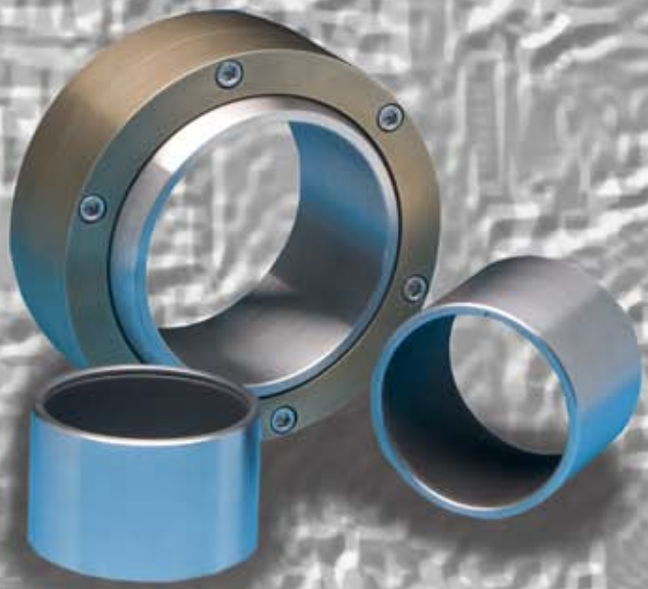
Heavy Duty

Lubron® TF

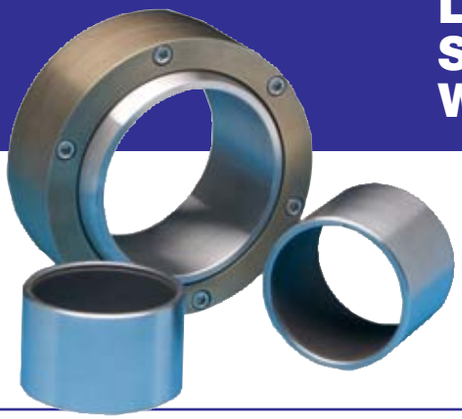
Self-Lubricating Woven PTFE Bearings



Lubron Bearing Systems

Bearings to move the world.

Lubron TF Self-Lubricating Woven PTFE Bearings



LUBRON® TF bearings are designed to provide the lowest possible coefficient of friction for moderate to high load applications. Consisting of woven PTFE fabric liners permanently bonded to metallic or composite substrates, LUBRON TF bearings are completely maintenance-free and can operate wet or dry.

LUBRON TF self-lubricating bearings have been performing flawlessly in a variety of rigorous operating conditions for more than 20 years. LUBRON TF bearings provide dependable maintenance-free service in applications where oil and grease lubrication is not desirable.

BENEFITS

LUBRON TF woven PTFE bearings feature the following advantages:

- Low coefficient of friction
- Extremely high load capacity
- High wear resistance
- Long service life
- Smaller bearing surface required
- Static loads up to 60 ksi
- Dynamic loads up to 30 ksi
- Minimal permanent set
- Tight running clearances
- No fretting or brinelling
- Excellent dimensional stability
- Wide temperature range
- Negligible water swell
- Simple installation
- No oil or grease lubrication

LUBRON TF bearings also have a unique mechanical locking system to prevent delamination, a common problem with many other types of bearing liner systems.

Lubron TF Self-Lubricating Woven PTFE Bearings

APPLICATIONS

- Aerospace & Defense
- Architectural & Structural
- Hydro Dam Gates & Water Control
- Industrial, Machinery & Heavy Equipment
- Power Generation

ADVANCED CONSTRUCTION

LUBRON TF's proprietary construction provides full support of the individual PTFE fibers and insures a rigid bond of the fabric to the bearing substrate, two basic requirements that DuPont specifies for the successful use of Teflon® as a bearing surface. In addition to having low tangential shear stress and high wear resistance, LUBRON TF's high strength adhesives and unique mechanical locking systems eliminate any possibility of delamination of the bearing liner during installation or actual service.

HIGH LOAD CAPACITY

LUBRON TF bearings are generally designed to accommodate static and dynamic loads from 1.5 ksi (10 N/mm^2) to 30 ksi (210 N/mm^2), and can withstand loads in excess of 60 ksi (420 N/mm^2) without cold flow. Cold flow is minimized by the effective entrapment of PTFE fibers and glass fibers with high strength bonding resins.

Teflon® is a registered tradmark of DuPont

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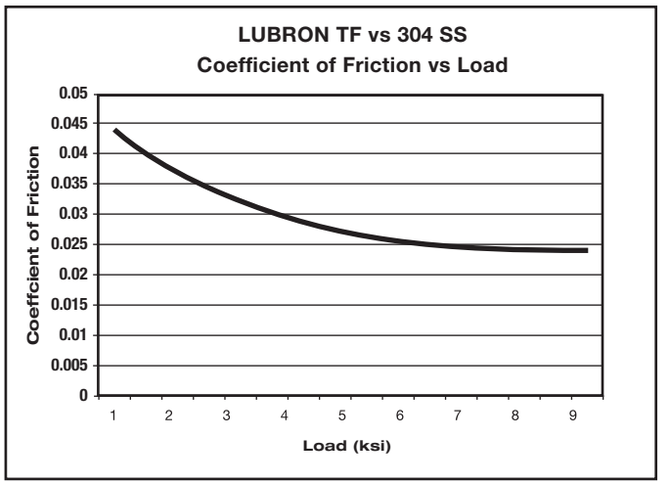
LOW FRICTION

The coefficient of friction for PTFE fibers is the lowest of all known fibers. Static coefficient of friction is only slightly higher than dynamic, minimizing stick-slip. LUBRON TF bearings typically have a coefficient of friction of less than 6%, depending on the load, velocity, temperature, type of movement, finish and hardness of the mating surface.

Coefficient of friction decreases as bearing loads increase. This characteristic allows using the smallest bearing sizes to obtain the least amount of friction.



LOW WEAR RATE

LUBRON TF bearings have a very low rate of wear, which is defined in terms of volumetric loss of material over time. Volumetric wear is approximately proportional to the unit load multiplied by the distance traveled, and is generally expressed as follows:

$W = KPVT$

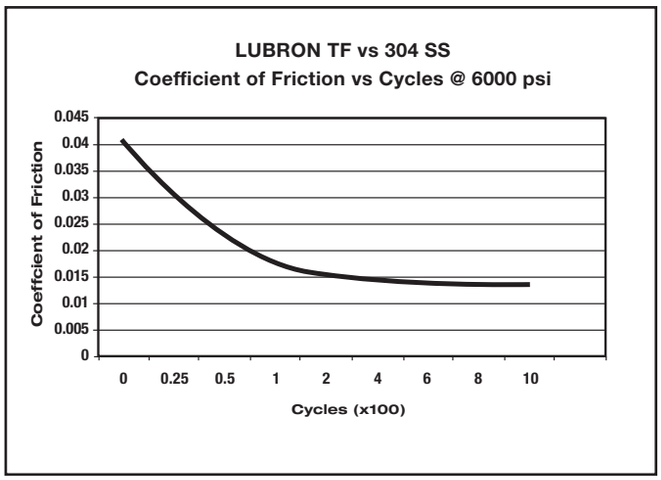
where W = wear depth, in (cm)

K = proportionality constant, in^3-min/ft-lb-hr (cm^3-min/m-kg-hr)

P = bearing pressure, psi (kg/cm^2)

V = surface velocity, ft/min (m/min)

T = elapsed time, hr



K values for LUBRON TF bearings have been derived from independent testing, and can be used to determine the amount of wear that will occur over a period of time. For most applications, a value of $K = 9.1 \times 10^{-10}$ in^3-min/ft-lb-hr is appropriate, which would be equivalent to 0.00045 inches of wear after 100,000 inches of travel at 3.5 ksi (24 Mpa).

Wear-in for LUBRON TF bearings generally takes place during the first few thousand cycles. During this period some PTFE is transferred to the mating surface. After this break-in, rate of wear will be considerably lower.

In actual applications, wear can be affected by a combination of many factors. By minimizing PV, deformation due to shaft misalignment, vibration and excessive heat, LUBRON TF bearings will achieve long service life.

Lubron TF Self-Lubricating Woven PTFE Bearings

PERFORMANCE CRITERIA

The overall performance of LUBRON TF bearings is directly influenced by a variety of operating factors which include bearing load, velocity, PV and temperature.

The following table list typical property values applicable for a broad range of conditions.

Properties	Value	
Maximum Static Pressure[1]	60 ksi	415 N/mm^2
Maximum Dynamic Pressure[1]	30 ksi	210 N/mm^2
Dynamic Pressure Design Limits for Optimum Life	2 ksi 10 ksi	15 N/mm^2 70 N/mm^2
Maximum Velocity (Loads < 100 psi)	600 ft/min	200 m/min
Maximum Velocity (Loads > 10 ksi)	30 ft/min	10 m/min
Maximum PV^2 (Continuous Operation)	60 ksi x ft/min	130 N/mm^2 x m/min
Maximum PV^2 (Intermittent Operation)	150 ksi x ft/min	325 N/mm^2 x m/min
Temperature Limits	- 200°F + 400°F	- 130°C + 200°C
Static Coefficient of Friction @ 3300 psi (Wet)	0.06	0.06
Static Coefficient of Friction @ 3300 psi (Dry)	0.07	0.07
Dynamic Coefficient of Friction @ 3300 psi (Wet)	0.05	0.05
Dynamic Coefficient of Friction @ 3300 psi (Dry)	0.06	0.06
Minimum Shear Strength (% of total radial load)	25	25
Maximum Swell in Water (% of wall thickness)	<0.1	<0.1

[1] Bonded to metal or composite of comparable strength.

[2] Wear rates will increase for elevated temperatures above 350°F. PV limits need to be decreased in order to prevent the bearing surface temperature from exceeding 300°F.

MATERIAL SELECTION

LUBRON TF bearings are typically furnished with bronze, aluminum or stainless steel substrates. The following table is intended to aid in the selection of a suitable substrate material for a specific application under consideration.

In many applications, the greatest economy and size reduction can be achieved by combining the high strength capability of LUBRON TF fabric liners with the high load capability of Alloy 863 Manganese Bronze.

Non-metallic LUBRON TF bearings are also available with filament wound fiberglass epoxy resin composite backings.

Alloy No.	Generic Description	ASTM Specification	Maximum Recommended Bearing Load
932	High Leaded Tin Bronze	B584-C93200	1500 psi 10.3 N/mm^2
954	Aluminum Bronze	B148-C95400	5000 psi 35 N/mm^2
863	Manganese Bronze	B584-C86300	10,000 psi 70 N/mm^2
304	Stainless Steel	A351-CF8	10,000 psi 70 N/mm^2
17-4	Stainless Steel	A747-CB7CU-1	20,000 psi 140 N/mm^2

SHAPES

LUBRON TF bearings are available in many different configurations depending on the application. Most common shapes include sleeve bearings, flange bearings, thrust bearings, spherical bearings and plates.

Bushings - One-piece sleeve bushings are used to accommodate all types of rotary and linear motion. Sleeve or journal bushings are employed when the shaft load is essentially perpendicular to the axis of the shaft (radial loads).

Washers - Washers are used to accommodate end thrust when the shaft load is in the direction of the axis of the shaft (thrust loads). Used alone or in conjunction with sleeve bushings, LUBRON TF washers can be lubricated on one or both sides.

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Flange Bushings - Flange bushings combine the features of sleeve bushings and washers into one unit. Flange bushings are used when the shaft load has both an axial and a perpendicular component. The flanges may be lubricated for thrust load applications, or provided without lubrication when required to function only as a spacer.

Spherical Bearings - Self-aligning spherical bearing assemblies are designed primarily to accommodate radial loads and some misalignment. Misalignment may be caused by structural or shaft deflections under load. LUBRON TF spherical bearings consist of an inner component (gimbal) with a cylindrical inside diameter for shaft rotation and a spherical convex outside diameter, and a one-piece or two-piece outer component (race) with a mating spherical concave inside diameter and a cylindrical concave outside diameter for mounting in a housing.

Stainless steel roller wheels are also available from Lubron Bearing Systems in combination with self-aligning spherical bearings.

Plates - Bearing plates are used to accommodate longitudinal and transverse movement under vertical and horizontal loads. LUBRON TF bearing plates are generally fastened with machine screws or retained with welded bars. Radial and spherical bearing plates are available to accomodate angular rotation.

SIZING

LUBRON TF bearings are finished machined to meet the exact requirements of each application, and are available in both inch and metric sizes. Nominal sizes for inside and outside diameters are dependent on the bearing load, shaft diameter, required wall thickness and size of the housing bore. Bearing length is usually determined by the amount of projected area required to accommodate the radial load, and can be calculated by dividing the shaft load by the desired bearing pressure multiplied by the inside diameter. Flange and washer thickness generally correspond to the bushing wall thickness.

Machining tolerances for most LUBRON TF bearings range from ±.001” (.025 mm) to ±.002” (.050 mm) for the inside diameters, and ±.0005” (.012 mm) to ±.001” (.025 mm) for the outside diameters.

As a general rule, close running fits are recommended for oscillating motion when minimum starting torque is less important than elimination of free play. For constant rotation, a free-running fit is normally recommended. A running clearance of 0.0015 inch per inch (0.038 mm per mm) of bore is usually satisfactory.

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The following iso-tolerance guide can be used for most heavy duty applications:

Shaft Diameter	≤3”Ø (≤75 mmØ)	e6
	>3”Ø (>75 mmØ)	d6
Inside Diameter	≤3”Ø (≤75 mmØ)	G8
	>3”Ø (>75 mmØ)	G8
Outside Diameter	≤3”Ø (≤75 mmØ)	r7
	>3”Ø (>75 mmØ)	r7
Housing Bore	≤3”Ø (≤75 mmØ)	H7
	>3”Ø (>75 mmØ)	H7

These recommended tolerances are for installed sizes. Allowance for shrinkage of the bushing inside diameter of at least 100% of the press or shrink fit interference must be made to insure adequate running clearance.

Tolerances for spherical bearings will vary depending on whether clearance or interference fit is required.

As running clearance and press fit tolerances vary with each application, contact Lubron Bearing Systems for specific design recommendations.

MATING SURFACES

For maximum wear resistance and service life, shafts should be corrosion resistant and polished to a surface finish not exceeding 32 microinch (0.8 micrometer). Austenitic (Types 304 & 316) and precipitation-hardened (17-4 PH) stainless steels are generally used for smaller diameters. For larger shaft sizes, stainless steel sleeves or weld overlay is recommended. Best performance is obtained with the hardest available mating surface.

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SEALS

LUBRON TF bearings will tolerate small amounts of debris, but reduced bearing life may result. Seals are recommended for applications subject to ingress of foreign debris and other contaminants. LUBRON TF bearings can be furnished with seals, or recommendations offered for their specification.

INSTALLATION

LUBRON TF bearings are supplied fully machined and ready for installation. Even though LUBRON TF bearings are very durable, care must be taken to ensure the lubricated bearing surface is not damaged during installation. The bearings may be hydraulically press fit into the housing, or shrunk fit with refrigeration or dry ice. If the use of liquid nitrogen is necessary, please contact Lubron Bearing Systems for instructions.

ENGINEERING SUPPORT

We offer a variety of engineering services from selection of bearing materials to in-house testing of prototype and full size bearings. Bearing design, AutoCAD® drawing preparation, testing, consulting and on-site engineering services are available upon request.

QUALITY ASSURANCE

All LUBRON TF bearings are manufactured and inspected in strict accordance with the requirements of ISO 9002. Every phase of manufacture is planned, performed, checked and certified in writing by Quality Control. Non-destructive testing is performed upon request by certified independent testing laboratories.

TESTING

Prototype and full size production testing can be performed in-house or by an independent testing laboratory to simulate load, movement, temperature, and other environmental conditions present during actual operations.

ORDERING INFORMATION

The following information is helpful in properly recommending the most suitable bearing for a specific application:

- Type of application
- Wet or dry environment
- Maximum operating load
- Minimum operating load
- Type of rotation
- Speed of rotation
- Size & tolerance of shaft diameter
- Size & tolerance of housing bore
- Shaft material & surface finish
- Seal requirement
- Testing requirement

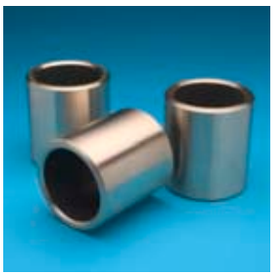
LUBRON Self-Lubricating Bearings for Heavy Duty Applications

LUBRON SL

LUBRON SL bearings are used extensively for moderate to heavy load industrial and structural applications. LUBRON SL bearings are permanently lubricated with graphite solid lubricants compounded and compressed into trepanned or circular recesses, and are available in a variety of bronze and Meehanite® bearing alloys. Most sizes are suitable for operating temperatures up to 1200ºF.

LUBRON TF

LUBRON TF bearings are constructed of woven PTFE fabric liners permanently bonded and mechanically locked to rigid bronze or stainless steel backings. Capable of very low friction and high wear resistance, LUBRON TF bearings offer exceptional performance for many heavy duty applications.



LUBRON TX

LUBRON TX bearings consists of synthetic fiber reinforced PTFE polyester materials capable of high loads and low friction. LUBRON TX bearings have excellent dimensional stability in water, and are ideally suited for many rigorous applications. LUBRON TX bearings can be machined on-site, and are a lower cost alternative to many other self-lubricating bearings.

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