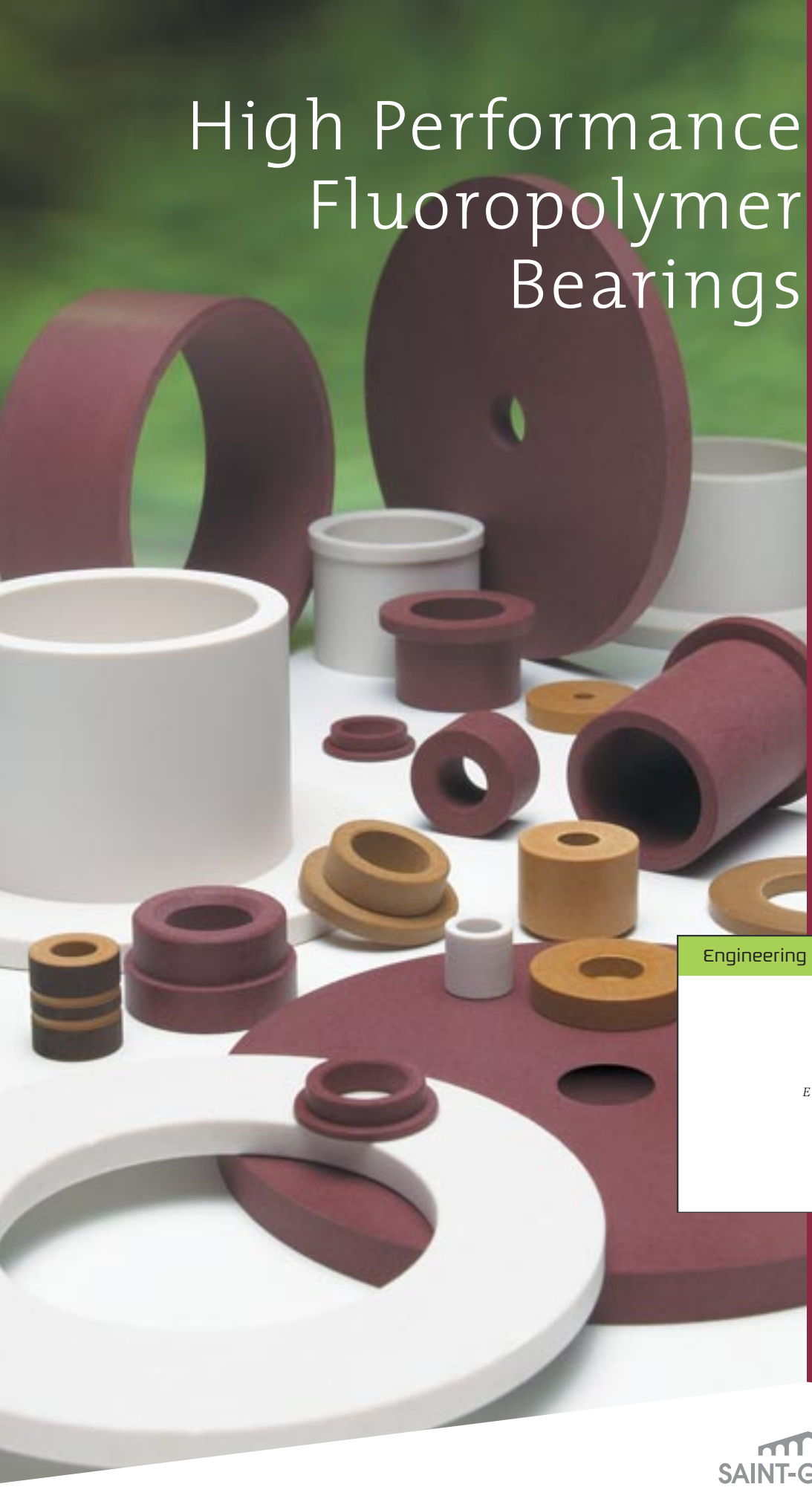
High Performance Fluoropolymer Bearings



RULON®

Long-wearing, maintenance-free bearing materials

- Self-lubricating design
- Low coefficient of friction
- Temperature resistant
- Dimensionally stable in fluids
- Chemically resistant
- Flexible material design
- Low weight/high strength ratio

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PERFORMANCE PLASTICS

Saint-Gobain

Rulon® Fluoropolymer Bearings

An Overview

Saint-Gobain Performance Plastics manufactures many different grades of composite bearing materials with distinct properties to accommodate a broad range of applications and industries. Our most popular grades are RULON® LR, RULON® J and RULON® 641.

RULON® Materials Outperform Metals

RULON® composites are ideal for non-lubricated, high-load applications in a variety of climates and operating environments, exhibit a high load capacity similar to bronze, powdered metal and steel, and provide longer wear and extended operating life without the costs associated with lubrication. RULON® materials also do not rust like metal components, so you can use them in environments where traditional metals corrode and fail. You will find Saint-Gobain Performance Plastics bearing materials in heavy-duty agricultural, automotive, construction, industrial, marine, railway, and material handling equipment.

RULON® components are rigid enough to support heavy loads, yet compliant enough to tolerate moderate amounts of shaft misalignment without highly stressing the ends of the bearings.

RULON® Fluoropolymers Outperform Polyamide

As a rule, polyamide is strictly limited to relatively light load applications and cannot compete with RULON® or metal materials in high load situations. Polyamide bearings are not as dimensionally stable as RULON® materials either, due to as much as 9% moisture absorption. The near-zero absorption rate of RULON® materials means there is negligible swelling and degradation of properties. It also enables tighter running clearances which increase the available bearing area and reduce the ingress of foreign particles which can become embedded and abrade the counterface material over time.

FEATURES	BENEFITS
Self-lubricating design	Provides maintenance-free operation and eliminates the need for costly and messy greasing systems.
Low coefficient of friction	Reduces wear and extends operating life and increases the efficiency of the equipment
Temperature resistant	Operates flawlessly in temperatures ranging from cryogenic levels to a high of 550°F (288°C)
Dimensionally stable in fluids (water, corrosive liquids, and chemical solutions)	Absorption rates are negligible, providing near zero swell
Chemically resistant	Compatible with a wide range of lubricants and media.
Flexible material design	Suitable for press fit, freeze fit, epoxy bonding, as well as conventional mechanical retention.
Low weight	Accommodates lightweight construction.

Cover photo: RULON® LR, RULON® J, and RULON® 641

Saint-Gobain is a worldwide group whose history spans more than three centuries. Created in 1665 in France, Saint-Gobain launched its first industrial Department with the production of mirrors, which adorn the famous Hall of Mirrors at Versailles.

Expansion beyond French borders began in the middle of the 19th century. An international pioneer, Saint-Gobain established a glass factory in Germany in 1857, another in Italy in 1889 and one in Belgium in 1904. The group moved toward the New World in 1937 with the opening of a plant in Brazil.

Early Diversification

Strongly established in flat glass production, Saint-Gobain began looking toward other activities at the beginning of the 20th century. The company entered the papermaking business in 1925, and the insulation business in 1936. The 1970 addition of the company Pont-á-Mousson, the world leader in cast iron pipes, reinforced Saint-Gobain's position in the construction market.

Throughout the 1970's and 80's the Saint-Gobain Group continued to pursue both internal and external growth, which culminated with the 1990 acquisition of Norton Company, one of the world's leading abrasives and ceramics manufacturers.

Norton Performance Plastics in turn acquired Furon Company and created the new Saint-Gobain Performance Plastics, combining decades of experience and leadership in metal-backed and polymer bearings and components.

The Rulon® trademark had been acquired by Furon in the purchase of Dixon Industries Corporation, founded in 1876 by Ezra Dixon, specializing in self-lubricating bearings for the then emerging textile industry in the northeastern United States.

RULON® J

Table of Contents

Materials Selection Guide

RULON® 641

Grade	AR	LR	J	641	W2	123	488	957	XL	F	142	945	1045	1337	1410	1439
Color	Maroon	Maroon	Gold	White	Black	Black	Turq.	Green	Tan	Green	Turq.	Black	Gold	Tan	Gold	White
Max Load "P" (psi) MPa	1,000 (6.9)	1,000 (6.9)	750 (5.2)	1,000 (6.9)	1,000 (6.9)	1,000 (6.9)	1,000 (6.9)	1,000 (6.9)	1,200 (8.3)	1,000 (6.9)	1,000 (6.9)	1,000 (6.9)	1,000 (6.9)	1,000 (6.9)	750 (5.2)	1,000 (6.9)
Max Speed "V" (fpm) m/s	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)	400 (2.0)
Max "PV" (psi-fpm) (MPa • m/s)	10,000 0.35	10,000 0.35	7,500 0.26	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	10,000 0.35	7,500 0.26	10,000 0.35
Rb 25 & higher			X	X	X	X	X	X	X	X			X	X	X	X
Rc 35 & higher	X	X									X	X				
Painted metal and porcelain							X	X								
Aluminum			X						X							
FDA compliant				X		X								X		X
Steam	X	X		X	X	X	X	X	X		X	X		X	X	X
Wet	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vacuum	X	X	X	X			X	X	X	X	X		X	X	X	X
Coefficient of friction	4	4	1	1	2	2	3	2	1	2	2	5	1	1	1	3
Creep resistance	3	4	3	4	4	4	4	4	4	4	5	5	2	2	2	4
Insulative prop.	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES

Slightly softer than Rulon LR. Good creep resistance.

Our Standard RULON® bearing grade. High Creep and Abrasion resistance.

Lowest Coefficient of Friction of Rulon series. Excellent insulator.

Widely used in the food process industry.

Very good operation in wet environments.

Good thermal and electrostatic dissipation.

Hot and dry applications. Excellent abrasion resistance.

Low friction/wear against coated metal or porcelain surfaces.

The best RULON® against aluminum surfaces.

Standard tape liner material for Rulon composite bearings.

Extensively used in machine tool guide ways.

Extremely low deformation under load, and high impact resistance.

FDA compliant; Excellent chemical resistance.

A standard material for compressor piston flip seals.

A standard material for compressor piston flip seals.

Ideal for submerged applications.

The list above is only a partial list of available formulations of RULON.® PV data may be exceeded based on specific application requirements. Ask to speak to a Saint-Gobain Performance Plastics Application Engineer. RATINGS above are relative within RULON® family ONLY. For RULON® materials, coefficient of friction decreases with increasing load, and wear decreases with increasing surface hardness. For PTFE based materials, wear in steam and wet environments is higher than in dry environments. Saint-Gobain Performance Plastics offers enhanced Rulon grades which minimize this effect. Most RULON® products have excellent chemical compatibility. Data available upon request.

Rulon® LR, J and 641 Bearings

Design Criteria
In choosing the appropriate RULON® bearing, the critical parameters of the application must first be determined. Bearing load, speed, PV, environment, mating surface, duty cycle, etc., all play an integral part in this choice. The more important criteria are described here, and their values are listed in the "Material Selection Guide".

Bearing Pressure
Bearing pressure is measured in pounds per square inch (psi) (MPa). It is calculated by distributing the total load in pounds (N) that the bearing is carrying by the projected area (I.D. x length in inches) (mm) of the bearing. This gives the average pressure that the bearing must support. Elevated temperatures reduce load capacity; lower temperatures generally increase static load capacity.

Bearing Speed
Bearing speed is determined by first calculating the circumference of the shaft in feet (meters), then multiplying by the RPM of the shaft. This gives the sliding or surface velocity of the bearing in surface feet per minute (SFM) (m/min – divide by 60 to get m/s). Lubrication or liquid cooling can extend these limits significantly.

Bearing PV
The third parameter is the product of operating pressure and surface velocity, defined as P = psi (MPa) x V = ft/min (m/sec) = PV. It is, in effect, a measure of the work the bearing is doing. While it is not the final answer, PV is an invaluable general guide in matching bearing to application.

Additional Considerations
Shaft hardness and finish: The various RULON® bearings are designed to operate against surfaces that have minimum hardness and finish requirements. These minimum values should be followed since each bearing's published dynamic properties and predicted wear rate are based on this system.

Friction and wear: RULON® bearings utilize custom compounds of PTFE. Like PTFE, they exhibit very low friction at low speeds, and low friction at high loads. These properties are diametrically opposed to most other materials and give RULON® bearings their smooth start/stop characteristics. They eliminate most stick-slip problems (*Figure 1*).

RULON® LR

RULON® J

An Overview

Wear rate: RULON® bearings are self-lubricating because a small quantity of RULON® or PTFE material is transferred to the mating surface during startup. After initial break-in, the wear rate levels out. This phenomenon is why bearing finishes in the 63 to 125 RMS range (1.6 to 3.2 µm Ra) can be tolerated. Under recommended conditions, long bearing life is possible. Contamination, insufficient shaft hardness, coarse shaft finish, corrosion, etc., accelerate wear because the shaft/bearing cannot properly break-in under these conditions (*Figure 2*).

Performance Considerations

RULON® materials are capable of operating at PV values up to approximately 10,000 lb. ft./inch^2 x min (0.35 MPa x m/s). Wear rates as a function of time can be greatly affected by the load and speed combinations. Therefore, higher PV values can be used where necessary for intermittent or short time duty. Lubricants or cooling fluids also permit higher PV values, primarily from speed, while generally decreasing wear.

Load

RULON® materials are generally limited to 1,000 psi (6.9 MPa). However, actual deformation is a function of the wall thickness used, temperature and load. Thinning the material so that cold flow will be minimized can increase the load-bearing capacity of most RULON® materials. Bonding the material will also increase its load-carrying ability – in some cases up to 5,000 psi (34.5 MPa). For higher loads, please contact our District Sales Manager so that arrangements can be made to discuss with an Applications Engineer.

Speed

While dry operation of RULON® materials is generally limited to 400 surface feet per minute (2.0 meters per second), under low-load conditions, higher speeds are possible with lubricants or liquid coolants. Silicone oils are not recommended as they interfere with the normal operation of RULON® bearings.

Friction

A rapid decrease in friction can be observed as load increases for most RULON® materials. Since start-up friction is extremely low, stick-slip is virtually eliminated. This makes RULON® materials the ideal choice for oscillating or start-stop applications. When fully lubricated with oil, RULON® materials exhibit a coefficient of friction in the .05 to .08 range typically obtained with lubricated metal bearings. In the event of lubrication failure, RULON® materials increase time to catastrophic failure, allowing time to replace bearings or components before significant damage occurs to critical metal components.

RULON® 641

FIGURE 1: TYPICAL WEAR BEHAVIOR FOR RULON® BEARINGS

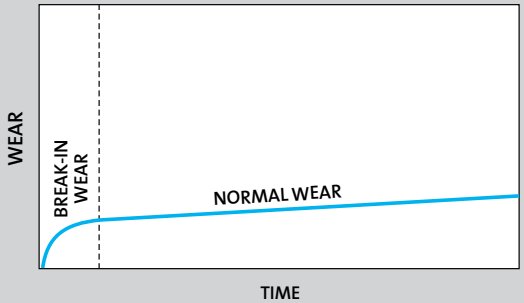
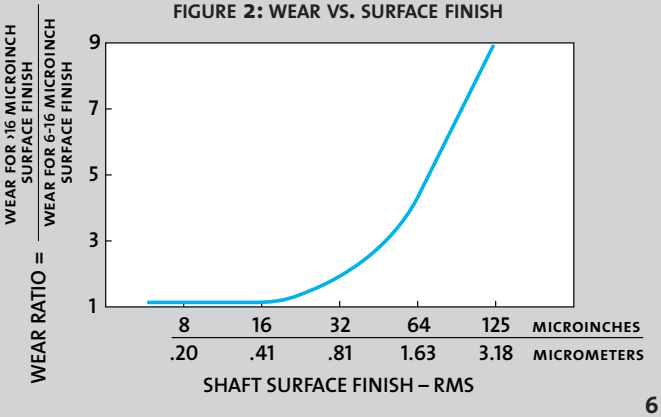


FIGURE 2: WEAR VS. SURFACE FINISH



Rulon® LR Bearings

For continuous, non-lubricated service, RULON® LR sleeve bearings are capable of operating at PV values up to approximately 10,000 lb. ft./inch^2 x min (0.35 MPa x m/s). *Figure 3* shows wear rates as a function of time at various PV values.

Load
RULON® bearings are generally limited to 1,000 psi (6.9 MPa). However, actual deformation is a function of wall thickness, temperature and load (*Figure 4*). Because the thickness of the RULON® sleeve affects deformation under load, load limits can be increased by using thin wall bearings or bonding in place.

Speed
RULON® LR bearings are generally limited to 400 ft/min (2.0 m/s) under dry, low-load operation. Higher speeds are possible with lubricants or liquid coolants.

Friction
Friction decreases rapidly with increase in load (*Figure 5*). *Figure 6* shows the effect of surface velocity on friction.

Mating Surfaces
Performance is optimized when the hardest possible running surface is used. Mild steel is acceptable. Softer shafts such as stainless steel or aluminum are not recommended. Special RULON® materials – such as RULON® J (see page 9) – are available for this type of service.

Surface Finish
Best performance is achieved with a surface finish in the 8 to 16 RMS range (0.2 to 0.4 µm Ra). However, acceptable performance can be obtained with finishes up to 32 mircroinches (0.8 µm Ra).

FIGURE 3: RADIAL WEAR VS. TIME

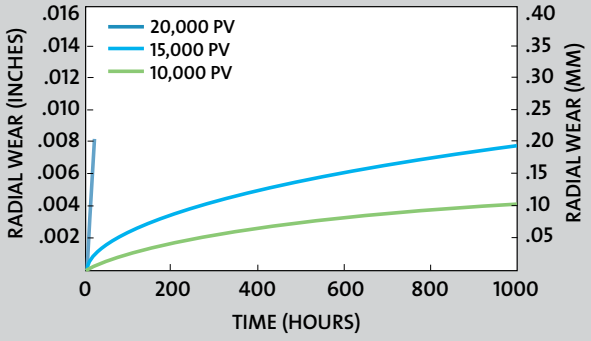
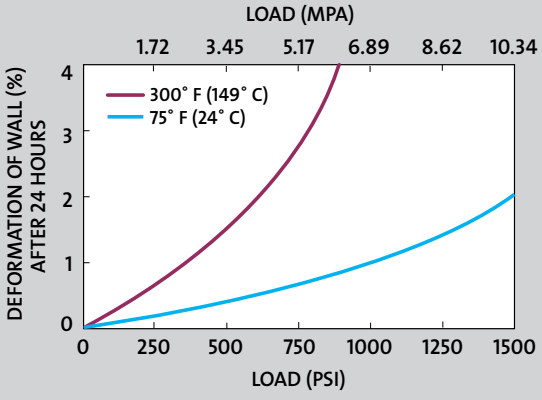


FIGURE 4: DEFORMATION VS. LOAD (RULON® LR)



Bearing Failure
At elevated temperatures and heavy load, RULON® LR bearings will not shatter, but will merely deform. This limits sudden breakdowns and possible damage to other components.

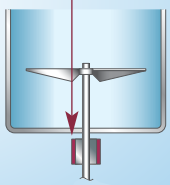
Corrosion resistance
RULON® LR material is practically inert to all acids, bases and solvents.

Typical Applications
For bearings in:
- Dryer oven conveyors
- Vacuum metalizing equipment
- Photographic processing equipment
- Hydraulic actuators
- Machine tool ways and gib slides

Application Case Story
Rulon® LR was selected for this application because of its lubricity and ability to withstand abrasion.

The blender is used to incorporate pumice to a hand soap mixture. Occasionally, the pumice does infiltrate the bearing area, exacerbating the wear. The Rulon® LR bushing rides on a stainless steel expendable sleeve that is pressed onto a smaller diameter shaft. When the sleeve wears excessively, it and the bushing are replaced.

RULON® LR BUSHING



HIGH SPEED
INSDUSTRIAL BLENDER

FIGURE 5: COEFFICIENT OF FRICTION VS. LOAD

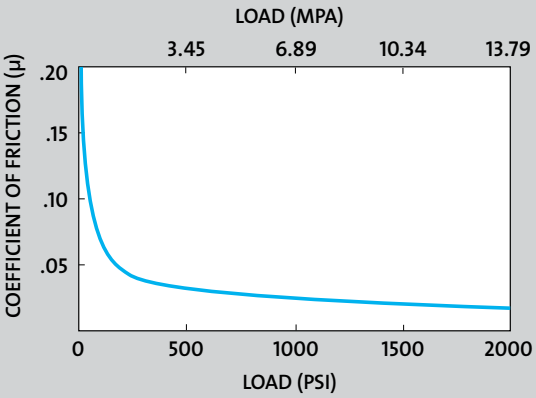
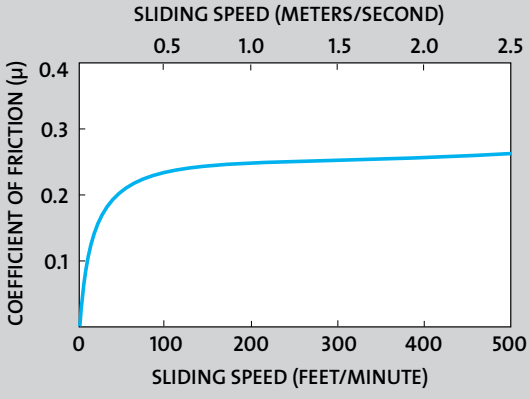


FIGURE 6: COEFFICIENT OF FRICTION VS. SPEED



Rulon® J Bearings

RULON® J is an all-polymeric reinforced PTFE compound that operates satisfactorily against soft mating surfaces such as 316 stainless, aluminum, mild steel, and frequently, other plastics. The unique "shaft kindliness" of RULON® J is in addition to the expected attributes of low friction and wear, self-lubrication and long life.

In fact, RULON® J has the lowest coefficient of friction of any available reinforced PTFE. This makes it ideally suited for start/stop applications where stick-slip must be eliminated.

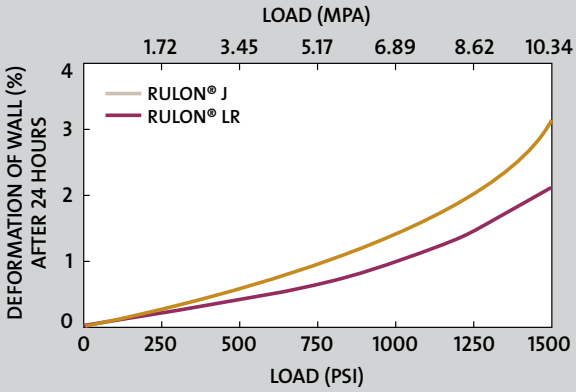
RULON® J bearings are designed to be dimensionally interchangeable with RULON® LR bearings and standard porous bronze and cast bronze bearings.

RULON® J has slightly less load capacity than RULON® LR (see *Figure 7)*. It also has a different thermal expansion. Bearing clearances are the same for both RULON® LR and RULON® J bearings.

Thermal Expansion for RULON LR and J Bearings

Like most plastic material, RULON® compounds have a higher coefficient of thermal expansion than metals. This expansion is shown in *Figures 8* and *9*, which provide data for unconfined bearings.

FIGURE 7: DEFORMATION VS. LOAD



Bearings confined in the proper housing are only able to grow radially. Typically, one-third of the differential growth (between bearing O.D. and housing) results in compression of the RULON® material, and two-thirds results in close-in or reduction of the bearing I.D.

Standard RULON® LR and RULON® J stock bearings are designed with sufficient clearance to operate between -70°F (-57°C) and +200°F (+93°C) without altering the standard bearing sizes. For ambient temperatures above +200° F (+93°C), additional clearance should be provided. Other design options are available for high temperature service. Contact your local District Sales Manager to seek design assistance.

Typical Applications:
For bearings in:
- Plain paper copiers
- Medical equipment
- Anemometers
- Printer heads

Application Case Story
Piston Arm Wear Pads – Compressor Industry: Bonded Rulon® J slide pads replaced lubricated bronze on reciprocating piston guides for production compressors. Low friction and long, un-lubricated wear life were critical to the performance of the compressor. Rulon® J is also utilized as the piston cup on wobble style compressors.

FIGURE 8: THERMAL EXPANSION OF RULON® LR VS. TEMP

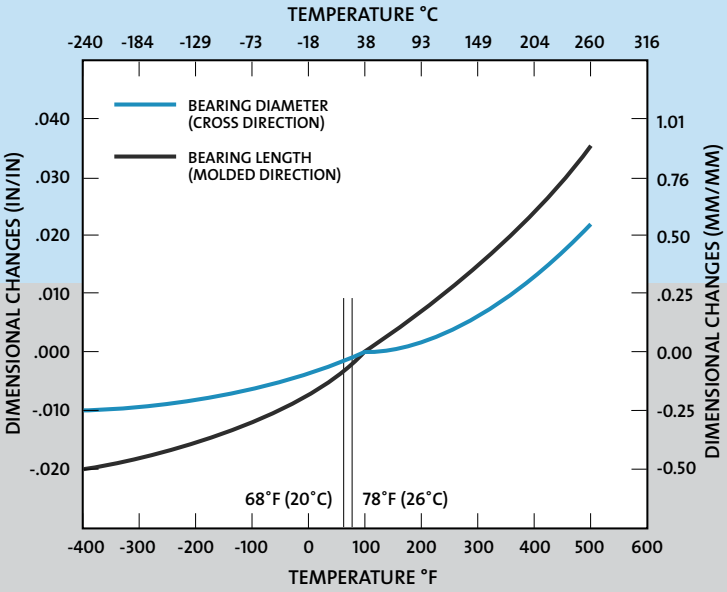
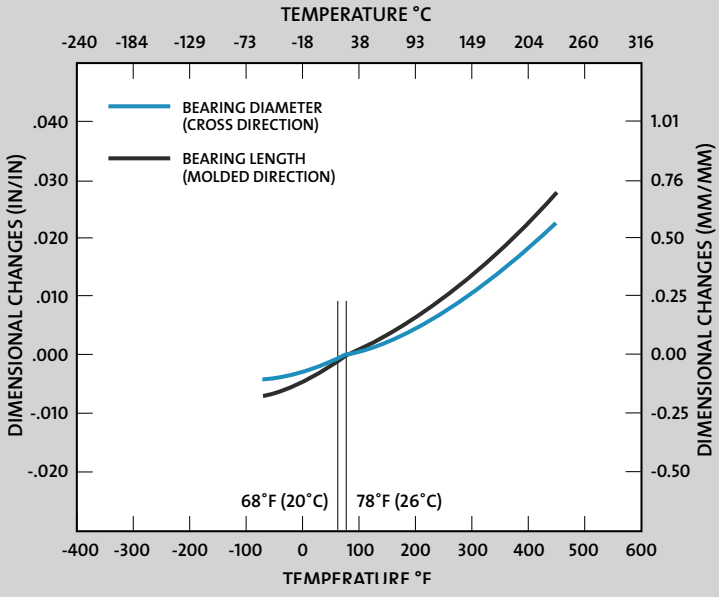


FIGURE 9: THERMAL EXPANSION OF RULON® J VS. TEMP



Rulon® 641 Bearings

The RULON® 641 bearing overcomes the chronic problems that plague other food and drug contact bearings. For the first time ever, design engineers can have the following features in one non-lubricated bearing: FDA-cleared materials, excellent load and wear characteristics, wide ranging temperature capability and naturally white color.

Wear Characteristics

RULON® 641 offers excellent, continuous non-lubricated service at 10,000 lb. ft./inch^2 x min (0.35 MPa x m/s) PV and higher. *Figure 10* shows wear rates of RULON® 641 as a function of time at various PV values. For comparison, virgin PTFE at 5,000 lb. ft./inch^2 x min (0.175 MPa x m/s) PV is also shown. The mating surface is 316 stainless steel.

Mating Surfaces

RULON® 641 is compatible with mild steel, 303 and 316 stainless steel mating surfaces. Harder materials are also acceptable.

Temperature

RULON® 641 bearings can operate at temperatures ranging from -400°F (-240°C) to +550°F (+288°C). Additional clearance is required for higher temperatures due to thermal expansion effects.

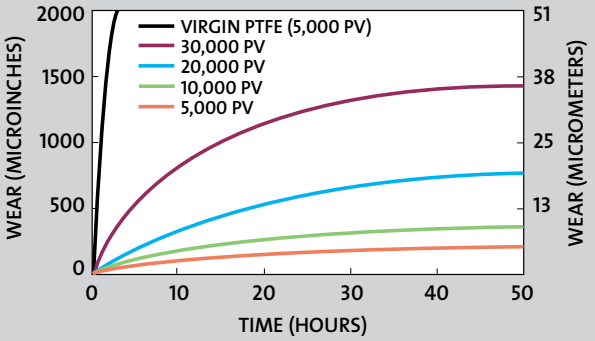
Speed

RULON® 641 bearings are capable of speeds up to 400 feet per minute (2.0 meters per second) under dry, low-load operation.

Friction

Friction decreases rapidly with increasing load. Since friction at start-up and very slow speeds is extremely low, stick-slip is virtually non-existent with RULON® 641 bearings. This makes them ideal for oscillating or start/stop applications.

FIGURE 10: WEAR VS. TIME AT VARIOUS PV'S (RULON® 641)



Load Capacity
RULON® 641 bearings are generally limited to 1,000 psi (6.9 MPa) at room temperature. However, actual deformation is a function of wall thickness, temperature and load.

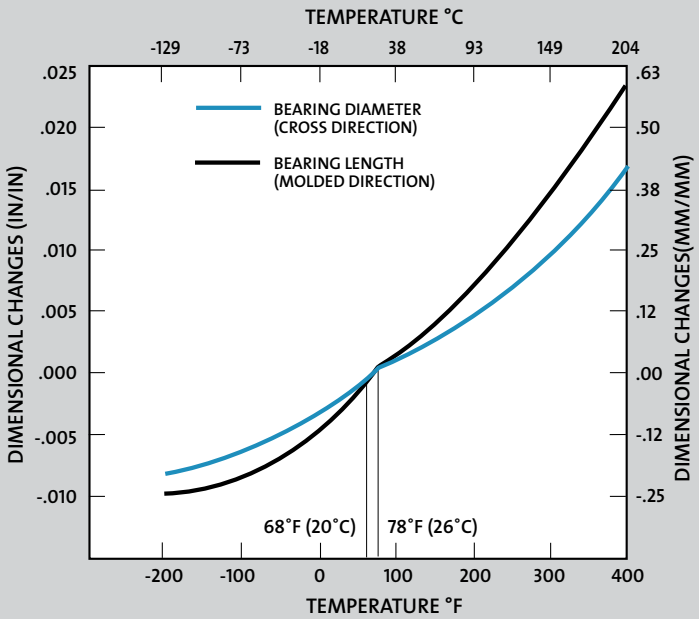
Corrosion Resistance
RULON® 641 is unaffected by all common acids, bases and solvents.

Thermal Expansion
Like most plastic materials, RULON® 641 has a higher coefficient of thermal expansion than most metals. *Figure 11* shows data for unconfined RULON® 641 bearings. Generally, I.D. close-in after being press fit into the housing is two-thirds of the total O.D. interference and should be taken into consideration during design.

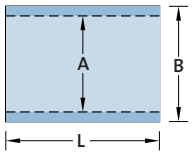
Typical Applications
Since all the components of RULON® 641 are FDA-cleared and non-toxic, RULON® 641 bearings are perfect for use in machinery and equipment in the following applications:
- Food process machinery
- Food and drug conveyors
- Prepared meat products
- Frozen foods
- Animal and marine fats and oils
- Medicinal and pharmaceutical preparations

Application Case Story
In small conveyor grills, Rulon® 641 bearings located on the drive and idle rollers support the stainless conveyor belt. With cooking temperatures above 400°F (204°C) for 12-18 hours per day, Rulon® 641 bearings are subjected to difficult operating environments without lubrication. Traditional ball bearings and sintered metal bearings do not hold up in these environments for long and can produce a very annoying squeak.

FIGURE **11:** THERMAL EXPANSION OF RULON® **641**



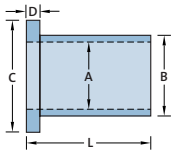
Standard Sizes for Rulon® LR, J & 641 Bearings



SLEEVE BEARINGS

NOMINAL I.D. x O.D.	I.D. -000",+002" (A)	O.D. -000",+002" (B)	RECOMMENDED HOUSING BORE	PRESS FIT	RECOMMENDED SHAFT SIZE	LENGTH ± .005" (L)	RULON® LR PART NUMBER	RULON® J PART NUMBER	RULON® 641 PART NUMBER
1/8 x 1/4	.129	.251	.250/.249	.004/.001	.1250/.1240	1/4	DRS-0204-2	DRJS-0204-2	
						3/8	DRS-0204-3	DRJS-0204-3	
3/16 x 5/16	.191	.313	.312/.311	.004/.001	.1875/.1865	1/4	DRS-0305-2	DRJS-0305-2	
						3/8	DRS-0305-3	DRJS-0305-3	
						1/2	DRS-0305-4	DRJS-0305-4	
1/4 x 3/8	.254	.376	.375/.374	.004/.001	.2500/.2490	1/4	DRS-0406-2	DRJS-0406-2	DR6S-0406-2
						3/8	DRS-0406-3	DRJS-0406-3	DR6S-0406-3
						1/2	DRS-0406-4	DRJS-0406-4	
5/16 x 1/2	.316	.501	.500/.499	.004/.001	.3125/.3115	3/8	DRS-0508-3	DRJS-0508-3	
						1/2	DRS-0508-4	DRJS-0508-4	
3/8 x 9/16	.379	.563	.562/.561	.004/.001	.3750/.3740	3/8	DRS-0609-3	DRJS-0609-3	DR6S-0609-3
						1/2	DRS-0609-4	DRJS-0609-4	
						3/4	DRS-0609-6	DRJS-0609-6	
7/16 x 5/8	.441	.626	.625/.624	.004/.001	.4375/.4365	3/8	DRS-0710-3	DRJS-0710-3	
						1/2	DRS-0710-4	DRJS-0710-4	
						3/4	DRS-0710-6	DRJS-0710-6	
1/2 x 3/4	.504	.751	.750/.749	.004/.001	.5000/.4990	1/2	DRS-0812-4	DRJS-0812-4	DR6S-0812-4
						3/4	DRS-0812-6	DRJS-0812-6	
						1	DRS-0812-8	DRJS-0812-8	
9/16 x 13/16	.567	.813	.812/.811	.004/.001	.5625/.5615	1/2	DRS-0913-4	DRJS-0913-4	
						3/4	DRS-0913-6	DRJS-0913-6	
						1	DRS-0913-8	DRJS-0913-8	
5/8 x 7/8	.630	.876	.875/.874	.004/.001	.6250/.6240	5/8	DRS-1014-5	DRJS-1014-5	DR6S-1014-5
						3/4	DRS-1014-6	DRJS-1014-6	
						1	DRS-1014-8	DRJS-1014-8	DR6S-1014-8
11/16 x 15/16	.693	.938	.937/.936	.004/.001	.6875/.6865	3/4	DRS-1115-6	DRJS-1115-6	
3/4 x 1	.755	1.001	1.000/.999	.004/.001	.7500/.7490	1/2	DRS-1216-4	DRJS-1216-4	
						3/4	DRS-1216-6	DRJS-1216-6	DR6S-1216-6
						1	DRS-1216-8	DRJS-1216-8	
						1-1/2	DRS-1216-12	DRJS-1216-12	DR6S-1216-12
7/8 x 1-1/8	.880	1.126	1.125/1.124	.004/.001	.8750/.8740	3/4	DRS-1418-6	DRJS-1418-6	
						1	DRS-1418-8	DRJS-1418-8	
1 x 1-1/4	1.005	1.251	1.250/1.249	.004/.001	1.000/.9990	3/4	DRS-1620-6	DRJS-1620-6	
						1	DRS-1620-8	DRJS-1620-8	DR6S-1620-8
						1 -1/2	DRS-1620-12	DRJS-1620-12	DR6S-1620-12
1-1/8 x 1- 3/8	1.130	1.376	1.375/1.374	.004/.001	1.125/1.124	3/4	DRS-1822-6	DRJS-1822-6	
						1	DRS-1822-8	DRJS-1822-8	
						1 -1/2	DRS-1822-12	DRJS-1822-12	
1-1/4 x 1 -1/2	1.255	1.501	1.500/1.499	.004/.001	1.250/1.249	3/4	DRS-2024-6	DRJS-2024-6	
						1	DRS-2024-8	DRJS-2024-8	
						1 -1/2	DRS-2024-12	DRJS-2024-12	
						2	DRS-2024-16	DRJS-2024-16	DR6S-2024-16
1-3/8 x 1- 5/8	1.380	1.626	1.625/1.624	.004/.001	1.375/1.374	1	DRS-2226-8	DRJS-2226-8	
						1 -1/2	DRS-2226-12	DRJS-2226-12	
1-1/2 x 1- 3/4	1.506	1.751	1.750/1.749	.004/.001	1.500/1.499	1	DRS-2428-8	DRJS-2428-8	
						1-1/2	DRS-2428-12	DRJS-2428-12	
						2	DRS-2428-16	DRJS-2428-16	DR6S-2428-16
1- 5/8 x 1- 7/8	1.631	1.876	1.875/1.874	.004/.001	1.625/1.6235	1-3/4	DRS-2630-14		
1 -3/4 x 2	1.756	2.001	2.000/1.999	.004/.001	1.750/1.7485	1-3/4	DRS-2832-14		
1- 7/8 x 2 -1/8	1.881	2.126	2.125/2.124	.004/.001	1.875/1.8735	2	DRS-3034-16		
2 x 2- 1/4	2.006	2.251	2.250/2.247	.006/.001	2.000/1.9985	2	DRS-3236-16*		
						2-1/2	DRS-3236-20*		
2 -1/4 x 2- 1/2	2.259	2.502	2.500/2.497	.008/.002	2.250/2.2485	2-1/2	DRS-3640-20*		
2 -1/2 x 2 -3/4	2.510	2.752	2.750/2.747	.008/.002	2.500/2.498	2-1/2	DRS-4044-20*		
2 -3/4 x 3	2.760	3.002	3.000/2.997	.008/.002	2.750/2.748	3	DRS-4448-24*		
3 x 3 -1/4	3.011	3.252	3.250/3.247	.008/.002	3.000/2.998	3	DRS-4852-24*		

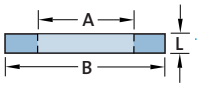
* I.D. AND O.D. -.000 + .003



FLANGE BEARINGS

NOMINAL I.D. x O.D.	I.D. -000", +002" (A)	O.D. -000", +002" (B)	RECOMMENDED HOUSING BORE	PRESS FIT	RECOMMENDED SHAFT SIZE	FLANGE DIA ± .005" (C)	FLANGE THK ± .003" (D)	LENGTH ± .005" (L)	RULON® LR PART NUMBER	RULON® J PART NUMBER	RULON® 641 PART NUMBER
3/16 x 5/16	.191	.313	.312/.311	.004/.001	.1875/.1865	.437	1/16	1/4	DRF-0305-2	DRJF-0305-2	
								1/2	DRF-0305-4	DRJF-0305-4	
1/4 x 3/8	.254	.376	.375/.374	.004/.001	.2500/.2490	.500	1/16	3/8	DRF-0406-3	DRJF-0406-3	
								1/2	DRF-0406-4	DRJF-0406-4	DR6F-0406-4
3/8 x 5/8	.379	.626	.625/.624	.004/.001	.3750/.3740	.875	1/8	1/2	DRF-0610-4	DRJF-0610-4	DR6F-0610-4
								3/4	DRF-0610-6	DRJF-0610-6	
1/2 x 3/4	.504	.751	.750/.749	.004/.001	.5000/.4990	1.000	1/8	1/2	DRF-0812-4	DRJF-0812-4	
								3/4	DRF-0812-6	DRJF-0812-6	
								1	DRF-0812-8	DRJF-0812-8	DR6F-0812-8
5/8 x 7/8	.630	.876	.875/.874	.004/.001	.6250/.6240	1.000	1/8	3/4	DRF-1014-6	DRJF-1014-6	
								1	DRF-1014-8	DRJF-1014-8	DR6F-1014-8
3/4 x 1	.755	1.001	1.000/.999	.004/.001	.7500/.7490	1.250	1/8	1	DRF-1216-8	DRJF-1216-8	DR6F-1216-8
1 x 1-1/4	1.005	1.251	1.250/1.249	.004/.001	1.0000/.9990	1.500	1/8	1-1/2	DRF-1620-12	DRJF-1620-12	DR6F-1620-12
1-1/4 x 1-1/2	1.255	1.501	1.500/1.499	.004/.001	1.2500/1.2490	1.750	1/8	2	DRF-2024-16	DRJF-2024-16	DR6F-2024-16
1-1/2 x 1-3/4	1.506	1.751	1.750/1.749	.004/.001	1.5000/1.4990	2.000	1/8	2	DRF-2428-16	DRJF-2428-16	DR6F-2428-16
1-3/4 x 2	1.756	2.001	2.000/1.999	.005/.001	1.750/1.749	2.250	1/8	3	DRF-2832-24*		
2 x 2-1/4	2.006	2.251	2.250/2.249	.005/.001	2.000/1.999	2.500	1/8	3	DRF-3236-24*		

* I.D. AND O.D. -.000 + .003



THRUST BEARINGS

NOMINAL I.D. x O.D.	I.D. -000", +005" (A)	O.D. +000", -003" (B)	THICKNESS ± .003" (L)	RULON® LR PART NUMBER	RULON® J PART NUMBER	RULON® 641 PART NUMBER
1/4 x 5/8	.254	.625	.060	DRT-0410-2	DRJT-0410-2	DR6T-0410-2
3/8 x 3/4	.379	.750	.060	DRT-0612-2	DRJT-0612-2	DR6T-0612-2
1/2 x 1	.504	1.000	.060	DRT-0816-2	DRJT-0816-2	DR6T-0816-2
3/4 x 1-3/8	.755	1.375	1/8	DRT-1222-4*	DRJT-1222-4*	DR6T-1222-4*
1 x 2	1.005	2.000	1/8	DRT-1632-4*	DRJT-1632-4*	DR6T-1632-4*
1-1/2 x 3	1.506	3.000	1/8	DRT-2448-4*	DRJT-2448-4*	DR6T-2448-4*

* I.D. AND O.D. -.000 + .006

SELF-READING PART NUMBERING SYSTEM

The first two characters of the composite part number are constant and stand for Rulon® LR. The third character is the material code that corresponds to the desired material. If no code is listed, then the material is always Rulon® LR. The type follows next and they are; (S) sleeve, (F) flange, and (T) thrust bearing.

Aside from the available listed sizes on the previous tables, all listed standard bearing sizes can be requested in these materials. These are special request items subject to special pricing and delivery.

D R 7 S – 1 6 2 0 – 8 =

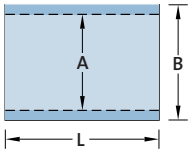
- D R 7 S: BEARING TYPE
- 1 6: I.D. (IN 1/16" INCREMENTS)
- 2 0: O.D. (IN 1/16" INCREMENTS)
- 8: BEARING LENGTH (IN 1/8" INCREMENTS)

RULON® 1337 SLEEVE BEARING
NOMINAL I.D. 1"
NOMINAL O.D. 1.25"
LENGTH 1"

RULON® MATERIAL CODES

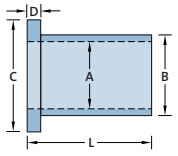
RULON®:	J	641	W2	123	488	957	XL	F	142	945	1045	1337	1410	1439	AR
CODE:	J	6	W	1	4	9	x	F	z	5	0	7	3	8	A

Standard Metric Sizes for Rulon® Bearings



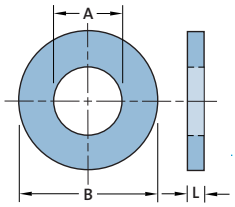
SLEEVE BEARINGS - ALL DIMENSIONS IN MILLIMETERS

NOMINAL I.D. x O.D.	I.D. (A)	O.D. (B)	RECOMMENDED HOUSING BORE	LENGTH (L)	PART NUMBER
3x6	3.21/3.16	6.09/6.04	6.0/5.98	5.0/4.8	MRS0306-5
4x7	4.21/4.16	7.09/7.04	7.0/6.98	6.0/5.8	MRS0407-6
5x8	5.21/5.16	8.09/8.04	8.0/7.98	6.0/5.8	MRS0508-6
6x9	6.21/6.16	9.09/9.04	9.0/8.98	8.0/7.8	MRS0609-8
7x11	7.23/7.18	11.10/11.05	11.0/10.98	8.0/7.8	MRS0711-8
8x12	8.23/8.18	12.10/12.05	12.0/11.98	8.0/7.8	MRS0812-8
9x13	9.23/9.18	13.10/13.05	13.0/12.98	10.0/9.75	MRS0913-10
10x14	10.24/10.19	14.10/14.05	14.0/13.98	10.0/9.75	MRS1014-10
12x16	12.24/12.19	16.10/16.05	16.0/15.98	10.0/9.75	MRS1216-10
15x21	15.27/15.20	21.10/21.05	21.0/20.98	15.0/14.75	MRS1521-15
17x23	17.27/17.20	23.10/23.05	23.0/22.98	15.0/14.75	MRS1723-15
20x26	20.33/20.21	26.11/26.06	26.0/25.98	20.0/19.75	MRS2026-20
22x28	22.33/22.21	28.11/28.06	28.0/27.98	20.0/19.75	MRS2228-20
25x31	25.33/25.21	31.11/31.06	31.0/30.98	25.0/24.75	MRS2531-25
28x34	28.33/28.21	34.11/34.06	34.0/33.98	30.0/29.75	MRS2834-30
30x36	30.33/30.22	36.11/36.06	36.0/35.98	30.0/29.75	MRS3036-30
32x40	32.38/32.22	40.11/40.06	40.0/39.98	30.0/29.75	MRS3240-30
35x43	35.38/35.22	43.11/43.06	43.0/42.98	35.0/34.75	MRS3543-35
40x48	40.38/40.22	48.11/48.06	48.0/47.98	40.0/39.75	MRS4048-40
45x53	45.39/45.20	53.11/53.06	53.0/52.7	50.0/49.75	MRS4553-50
50x60	50.39/50.24	60.11/60.06	60.0/59.7	50.0/49.75	MRS5060-50



FLANGE BEARINGS - ALL DIMENSIONS IN MILLIMETERS

NOMINAL I.D. x O.D.	I.D. (A)	O.D. (B)	FLANGE DIAMETER (C)	FLANGE THICKNESS (D)	RECOMMENDED HOUSING BORE	LENGTH (L)	PART NUMBER
3x6	3.21/3.16	6.09/6.04	9	1.55/1.50	6.0/5.98	5.0/4.8	MRF0306-5
4x7	4.21/4.16	7.09/7.04	9	1.55/1.50	7.0/6.98	6.0/5.8	MRF0407-6
5x8	5.21/5.16	8.09/8.04	11	1.55/1.50	8.0/7.98	8.0/7.8	MRF0508-8
6x9	6.21/6.16	9.09/9.04	12	1.55/1.50	9.0/8.98	8.0/7.8	MRF0609-8
7x11	7.23/7.18	11.10/11.05	15	2.05/2.00	11.0/10.98	10.0/9.8	MRF0711-10
8x12	8.23/8.18	12.10/12.05	16	2.05/2.00	12.0/11.98	10.0/9.8	MRF0812-10
9x13	9.23/9.18	13.10/13.05	17	2.05/2.00	13.0/12.98	10.0/9.75	MRF0913-10
10x14	10.24/10.19	14.10/14.05	18	2.05/2.00	14.0/13.98	15.0/14.75	MRF1014-15
12x16	12.24/12.19	16.10/16.05	20	2.05/2.00	16.0/15.98	15.0/14.75	MRF1216-15
15x21	15.27/15.20	21.10/21.05	27	3.05/3.00	21.0/20.98	20.0/19.75	MRF1521-20
17x23	17.27/17.20	23.10/23.05	29	3.05/3.00	23.0/22.98	20.0/19.75	MRF1723-20
20x26	20.33/20.21	26.11/26.06	32	3.05/3.00	26.0/25.98	25.0/24.75	MRF2026-25
22x28	22.33/22.21	28.11/28.06	34	3.05/3.00	28.0/27.98	25.0/24.75	MRF2228-25
25x31	25.33/25.21	31.11/31.06	37	3.05/3.00	31.0/30.98	30.0/29.75	MRF2531-30
28x34	28.33/28.21	34.11/34.06	40	3.05/3.00	34.0/33.98	30.0/29.75	MRF2834-30
30x36	30.33/30.22	36.11/36.06	42	3.05/3.00	36.0/35.98	35.0/34.75	MRF3036-35
32x40	32.38/32.22	40.11/40.06	48	4.05/4.00	40.0/39.98	35.0/34.75	MRF3240-35
35x43	35.38/35.22	43.11/43.06	51	4.05/4.00	43.0/42.98	40.0/39.75	MRF3543-40
40x48	40.38/40.22	48.11/48.06	56	4.05/4.00	48.0/47.98	45.0/44.75	MRF4048-45
45x53	45.39/45.23	53.11/53.06	61	4.05/4.00	53.0/52.97	50.0/49.75	MRF4553-50
50x60	50.39/50.24	60.11/60.06	70	5.05/5.00	60.0/59.97	60.0/59.75	MRF5060-60



THRUST BEARINGS - ALL DIMENSIONS IN MILLIMETERS

NOMINAL I.D. x O.D.	I.D., +0.00, -0.25 (A)	O.D., +0.00, -0.25 (B)	THICKNESS ±0.06 (L)	PART NUMBER
6x13	6.2	12.8	0.8	MRT0613
7x15	7.2	14.8	0.8	MRT0715
8x15	8.2	14.8	0.8	MRT0815
9x20	9.2	19.8	0.8	MRT0920
10x20	10.2	19.8	0.8	MRT1020
12x25	12.2	24.7	0.8	MRT1225
15x30	15.3	29.7	0.8	MRT1530
17x35	17.3	34.6	0.8	MRT1735
20x40	20.4	39.6	0.8	MRT2040
22x45	22.4	44.5	0.8	MRT2245
25x50	25.4	49.5	0.8	MRT2550
28x55	28.4	54.4	0.8	MRT2855
30x60	30.4	59.4	0.8	MRT3060
32x60	32.4	59.4	0.8	MRT3260
35x65	35.6	64.3	0.8	MRT3565
40x70	40.6	69.3	0.8	MRT4070
45x75	45.6	74.2	0.8	MRT4575
50x80	50.8	79.2	0.8	MRT5080

SELF-READING PART NUMBERING SYSTEM

MRS – 0812 – 8 =

- MRS: RULON® METRIC
- 08: I.D. (IN MM INCREMENTS)
- 12: O.D. (IN MM INCREMENTS)
- 8: BEARING LENGTH (IN MM INCREMENTS)

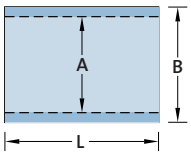
RULON® LR SLEEVE BEARING
NOMINAL I.D. 8MM
NOMINAL O.D. 12MM
LENGTH 8MM

RULON® MATERIAL CODES

RULON®:	J	641	W2	123	488	957	XL	F	142	945	1045	1337	1410	1439	AR
CODE:	J	6	W	1	4	9	X	F	Z	5	0	7	3	8	A

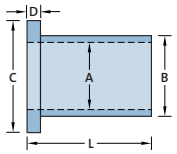
New Metric Sizes for Rulon® Bearings

All dimensions are based on temperature up to max 120°C and for hardware tolerance H7 and h7 according to DIN1850 BL6.



SLEEVE BEARINGS - ALL DIMENSIONS IN MILLIMETERS

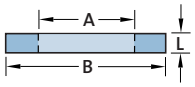
INSIDE DIAMETER ID (A)			*OUTSIDE DIAMETER OD (B)*			*LENGTH (L)*			
NOMINAL	*TOLERANCES*		*NOMINAL*	*TOLERANCES*		*NOMINAL*	*TOLERANCES*		*PART*
SIZE	*MIN*	*MAX*	*SIZE*	*MIN*	*MAX*	*SIZE*	*MIN*	*MAX*	*NUMBER*
3	0.15	0.20	6	0.06	0.11	5	-0.25	0.00	MRS030-060-05
4	0.15	0.20	7	0.06	0.11	6	-0.25	0.00	MRS040-070-06
5	0.15	0.20	8	0.06	0.11	6	-0.25	0.00	MRS050-080-06
6	0.15	0.20	9	0.06	0.11	8	-0.25	0.00	MRS060-090-08
7	0.17	0.22	11	0.07	0.12	8	-0.25	0.00	MRS070-110-08
8	0.17	0.22	12	0.07	0.12	8	-0.25	0.00	MRS080-120-08
9	0.17	0.22	13	0.07	0.12	10	-0.25	0.00	MRS090-130-10
10	0.17	0.22	14	0.07	0.12	10	-0.25	0.00	MRS100-140-10
12	0.18	0.23	16	0.07	0.12	10	-0.25	0.00	MRS120-160-10
15	0.20	0.25	21	0.08	0.13	15	-0.25	0.00	MRS150-210-15
16	0.20	0.25	22	0.08	0.13	15	-0.25	0.00	MRS160-220-15
17	0.20	0.25	23	0.08	0.13	15	-0.25	0.00	MRS170-230-15
18	0.20	0.25	24	0.08	0.13	20	-0.25	0.00	MRS180-240-20
20	0.20	0.25	26	0.08	0.13	20	-0.25	0.00	MRS200-260-20
22	0.20	0.25	28	0.08	0.13	20	-0.25	0.00	MRS220-280-20
25	0.21	0.26	31	0.09	0.14	25	-0.25	0.00	MRS250-310-25
25	0.22	0.27	32	0.09	0.14	30	-0.25	0.00	MRS250-320-30
28	0.21	0.26	34	0.09	0.14	30	-0.25	0.00	MRS280-340-30
28	0.23	0.28	36	0.09	0.14	30	-0.25	0.00	MRS280-360-30
30	0.21	0.28	36	0.09	0.14	30	-0.25	0.00	MRS300-360-30
30	0.23	0.28	38	0.09	0.14	30	-0.25	0.00	MRS300-380-30
32	0.23	0.28	40	0.09	0.14	30	-0.25	0.00	MRS320-400-30
35	0.23	0.28	43	0.09	0.14	35	-0.25	0.00	MRS350-430-35
35	0.25	0.30	45	0.09	0.14	40	-0.25	0.00	MRS350-450-40
40	0.23	0.28	48	0.09	0.14	40	-0.25	0.00	MRS400-480-40
40	0.25	0.30	50	0.09	0.14	40	-0.25	0.00	MRS400-500-40
45	0.24	0.29	53	0.10	0.15	50	-0.25	0.00	MRS450-530-50
45	0.26	0.31	55	0.10	0.15	40	-0.25	0.00	MRS450-550-40
50	0.26	0.31	60	0.10	0.15	50	-0.25	0.00	MRS500-600-50



FLANGE BEARINGS - ALL DIMENSIONS IN MILLIMETERS

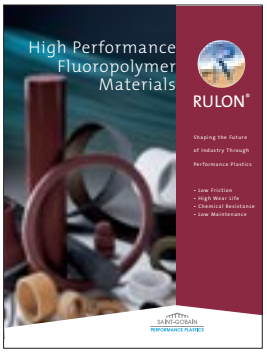
INSIDE DIAMETER ID (A)			OUTSIDE DIAMETER OD (B)			FLANGE DIAMETER FD (C)			LENGTH (L)			FLANGE THICKNESS FT (D)			
NOMINAL	TOLERANCES		NOMINAL	TOLERANCES		NOMINAL	TOLERANCES		NOMINAL	TOLERANCES		NOMINAL	TOLERANCES		PART
SIZE	MIN	MAX	SIZE	MIN	MAX	SIZE	MIN	MAX	SIZE	MIN	MAX	SIZE	MIN	MAX	NUMBER
3	0.15	0.20	6	0.06	0.11	9	-0.10	0.10	5	-0.25	0.00	1.5	0.00	0.50	MRF030-060-05
4	0.15	0.20	7	0.06	0.11	9	-0.10	0.10	6	-0.25	0.00	1.5	0.00	0.50	MRF040-070-06
5	0.15	0.20	8	0.06	0.11	11	-0.10	0.10	8	-0.25	0.00	1.5	0.00	0.50	MRF050-080-08
6	0.15	0.20	9	0.06	0.11	12	-0.10	0.10	8	-0.25	0.00	2	0.00	0.50	MRF060-090-08
7	0.17	0.22	11	0.07	0.12	16	-0.10	0.10	10	-0.25	0.00	2	0.00	0.50	MRF070-110-10
8	0.17	0.22	12	0.07	0.12	16	-0.10	0.10	10	-0.25	0.00	2	0.00	0.50	MRF080-120-10
9	0.17	0.22	13	0.07	0.12	17	-0.10	0.10	10	-0.25	0.00	2	0.00	0.50	MRF090-130-10
10	0.17	0.22	14	0.07	0.12	18	-0.10	0.10	15	-0.25	0.00	2	0.00	0.50	MRF100-140-15
12	0.18	0.22	16	0.07	0.12	20	-0.10	0.10	15	-0.25	0.00	2	0.00	0.50	MRF120-160-15
15	0.20	0.25	21	0.08	0.13	27	-0.10	0.10	20	-0.25	0.00	3	0.00	0.50	MRF150-210-20
16	0.20	0.25	22	0.08	0.13	28	-0.10	0.10	20	-0.25	0.00	3	0.00	0.50	MRF160-220-20
17	0.20	0.25	23	0.08	0.13	29	-0.10	0.10	20	-0.25	0.00	3	0.00	0.50	MRF170-230-20
18	0.20	0.25	24	0.08	0.13	30	-0.10	0.10	20	-0.25	0.00	3	0.00	0.50	MRF180-240-20
20	0.20	0.25	26	0.08	0.13	32	-0.10	0.10	25	-0.25	0.00	3	0.00	0.50	MRF200-260-25
22	0.20	0.25	28	0.08	0.13	34	-0.10	0.10	25	-0.25	0.00	3	0.00	0.50	MRF220-280-25
25	0.21	0.26	31	0.09	0.14	37	-0.10	0.10	30	-0.25	0.00	3	0.00	0.50	MRF250-310-30
25	0.22	0.27	32	0.09	0.14	38	-0.10	0.10	30	-0.25	0.00	4	0.00	0.50	MRF250-320-30
28	0.21	0.26	34	0.09	0.14	40	-0.10	0.10	30	-0.25	0.00	3	0.00	0.50	MRF280-340-30
28	0.23	0.28	36	0.09	0.14	42	-0.10	0.10	30	-0.25	0.00	4	0.00	0.50	MRF280-360-30
30	0.21	0.26	36	0.09	0.14	42	-0.10	0.10	35	-0.25	0.00	3	0.00	0.50	MRF300-360-35
30	0.23	0.28	38	0.09	0.14	44	-0.10	0.10	30	-0.25	0.00	4	0.00	0.50	MRF300-380-30
32	0.23	0.28	40	0.09	0.14	48	-0.10	0.10	35	-0.25	0.00	4	0.00	0.50	MRF320-400-35
35	0.23	0.28	43	0.09	0.14	51	-0.10	0.10	40	-0.25	0.00	4	0.00	0.50	MRF350-430-40
35	0.25	0.30	45	0.09	0.14	50	-0.10	0.10	40	-0.25	0.00	5	0.00	0.50	MRF350-450-40
40	0.23	0.28	48	0.09	0.14	56	-0.10	0.10	45	-0.25	0.00	4	0.00	0.50	MRF400-480-45
40	0.25	0.30	50	0.09	0.14	56	-0.10	0.10	40	-0.25	0.00	5	0.00	0.50	MRF400-500-40
45	0.24	0.29	53	0.10	0.15	61	-0.10	0.10	50	-0.25	0.00	4	0.00	0.50	MRF450-530-50
45	0.26	0.31	55	0.10	0.15	63	-0.10	0.10	40	-0.25	0.00	5	0.00	0.50	MRF450-550-40
50	0.26	0.31	60	0.10	0.15	70	-0.10	0.10	50	-0.25	0.00	5	0.00	0.50	MRF500-600-50

THRUST BEARINGS - ALL DIMENSIONS IN MILLIMETERS



INSIDE DIAMETER ID (A)			OUTSIDE DIAMETER OD (B)			RECOMMENDED HOUSING BORE (L)		
NOMINAL SIZE	TOLERANCES MIN	MAX	NOMINAL SIZE	TOLERANCES MIN	MAX	LENGTH	TOLERANCE	PART NUMBER
6x13	6.2	0.25	12.8	-0.25	12.8	0.8	±0.06	MRT060-130-08
7x15	7.2	0.25	14.8	-0.25	14.8	0.8	±0.06	MRT070-150-08
8x15	8.2	0.25	14.8	-0.25	14.8	0.8	±0.06	MRT080-150-08
9x20	9.2	0.25	19.8	-0.25	19.8	0.8	±0.06	MRT090-200-08
10x20	10.2	0.25	19.8	-0.25	19.8	0.8	±0.06	MRT100-200-08
12x25	12.2	0.25	24.7	-0.25	24.7	0.8	±0.06	MRT120-250-08
15x30	15.3	0.25	29.7	-0.25	29.7	0.8	±0.06	MRT150-300-08
17x35	17.3	0.25	34.6	-0.25	34.6	0.8	±0.06	MRT170-350-08
20x40	20.4	0.25	39.6	-0.25	39.6	0.8	±0.06	MRT200-400-08
20x70	20.4	0.25	69.2	-0.25	69.2	0.8	±0.06	MRT200-700-08
22x45	22.4	0.25	44.5	-0.25	44.5	0.8	±0.06	MRT220-450-08
25x50	25.4	0.25	49.5	-0.25	49.5	0.8	±0.06	MRT250-500-08
28x55	28.4	0.25	54.4	-0.25	54.4	0.8	±0.06	MRT280-550-08
30x60	30.4	0.25	59.4	-0.25	59.4	0.8	±0.06	MRT300-600-08
32x60	32.4	0.25	59.4	-0.25	59.4	0.8	±0.06	MRT320-600-08
35x65	35.6	0.25	64.3	-0.25	64.3	0.8	±0.06	MRT350-650-08
40x70	40.6	0.25	69.3	-0.25	69.3	0.8	±0.06	MRT400-700-08
45x75	45.6	0.25	74.2	-0.25	74.2	0.8	±0.06	MRT450-750-08
50x80	50.8	0.25	79.2	-0.25	79.2	0.8	±0.06	MRT500-800-08

Other Saint-Gobain Performance Plastics Catalogs



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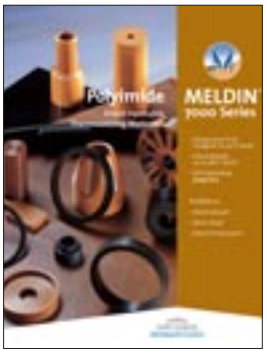

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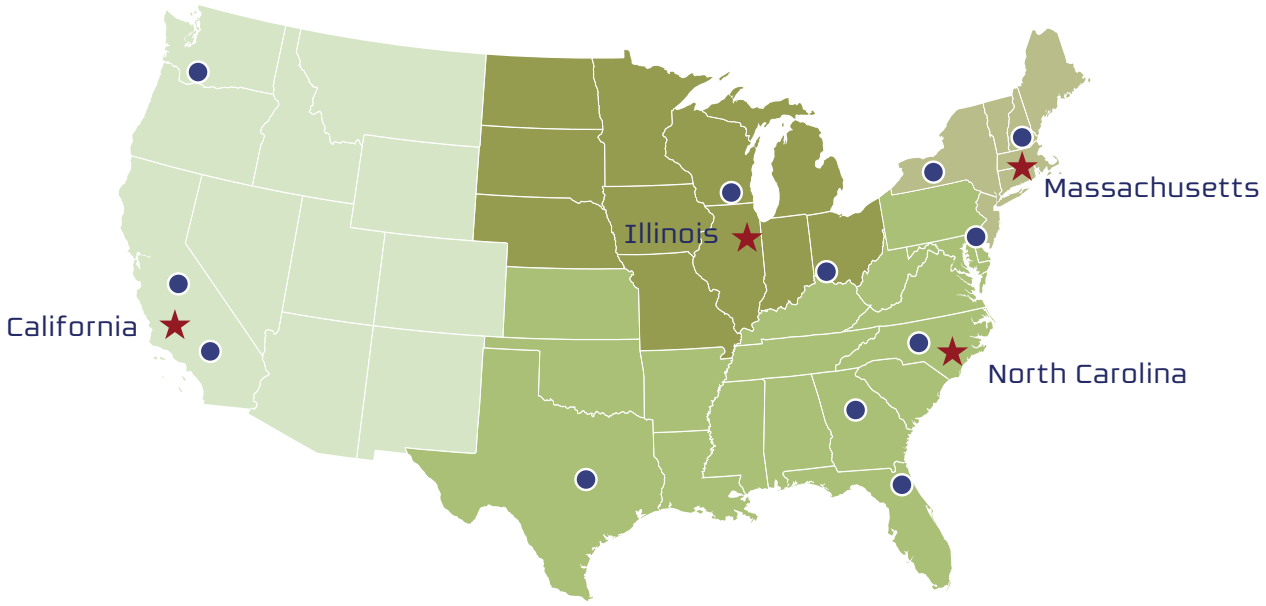

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