



# Fritex<sup>®</sup> Design Guide

## 2025





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# Who is Technymon

The company behind Fritex® composite and textile self lubricated bushing solutions.

## Overview

Technymon is considered a **pioneer in composite and multilayer sliding bearings** due to its **long-standing history of innovation**, deep technical expertise, and advanced manufacturing capabilities that date back to its **founding in 1975**. Starting as a small family-owned company specialized in multilayer metal-polymer sliding bearings, Technymon established itself in **Bergamo, Italy**—within the renowned **“PTFE Valley,”** a global hub for fluoropolymer and advanced bearing materials. This environment fostered continual investment in research, product development, and mastery of cutting-edge composite materials.

Today Technymon operates manufacturing facilities in **Italy, USA** and in **India** and counts as its customers, some of the world's largest and most demanding customers in all areas.

# 1975

Year Founded

## In summary

Technymon's pioneering heritage stems from nearly five decades of dedication to multilayer metal-polymer bearing development, leadership in composite materials innovation, broad application expertise, and a global presence that ensures cutting-edge sliding bearing solutions are available to industries worldwide.

## Several key factors contribute to Technymon's pioneering status:

- **Broad and Tailored Product Range:** Technymon produces a wide spectrum of sliding bearings, from simple metal-polymer composites to specialized multilayer designs suited for high-load, high-temperature, and harsh environmental applications. Their products include solutions for automotive, industrial machinery, hydraulics, oil & gas, agriculture, mining, and renewable energy sectors.
- **Global Manufacturing and Engineering Footprint:** With operations spanning Italy, the USA, and India, Technymon combines Italian engineering excellence and innovation with international manufacturing capacity and localized customer support, enabling them to serve diverse industries worldwide reliably.
- **Continuous Research and Customer Collaboration:** Through sustained investment and close partnerships with customers, Technymon has refined bearing materials, advanced shapes and geometries, and improved tribological performance to meet increasingly demanding application needs.
- **Proven Performance and Versatility:** Their composite and multilayer sliding bearings deliver high static and dynamic load capacities, excellent corrosion resistance, maintenance-free operation, and performance stability under extreme temperatures and chemical exposures. This positions Technymon at the forefront of sliding bearing technology.

# Fritex® Composite Bearings

Discover the product

Technymon's Fritex® composite bearings are solutions based on **multilayer composite and fabric solutions**, engineered to thrive in environments where traditional sliding bearing materials face limitations. These applications are not defined by a single performance parameter like temperature or speed, but rather by complex operating conditions where thermal fluctuations, dynamic loads, vibration, corrosion, or lack of lubrication can compromise conventional designs.

One such challenge is thermal shock and rapid cycling—common in machinery where components ramp from idle to high-speed rotation in milliseconds. This scenario is typical in high-performance drive systems, clutches, or actuation arms, where bearings must accommodate rapid changes in friction and heat. In these environments, thermal expansion mismatches between materials often lead to premature wear or seizing. Fritex®'s Bushings and Bearings, whether Fiberwound or Metal backed are designed to offer dimensional stability and controlled expansion within the ranges specified of usage, significantly reducing the likelihood of seizure or delamination even under extreme conditions.

In mobile equipment such as agricultural implements or construction machinery, or in valves and actuators used in Oil and Gas industry, exposure to dirt, moisture, and fluctuating mechanical stress presents another layer of difficulty.



Conventional greased metallic bushings often fail due to contamination and wear. Fritex® bearings, with their **self-lubricating inner surface** and **hydrophobic composite body**, eliminates the need for lubrication while resisting abrasion, ensuring **extended service life** in remote or maintenance-constrained locations.

In sectors like rail, marine, or energy generation, composite bearings are valued for their ability to **maintain performance under long-duration static and dynamic loading**, particularly in submerged or salt-laden environments. Whether used in pivot joints of bogies, rudder bearings, or turbine blade hubs, Fritex® bearings combine **low-friction operation with corrosion immunity**—factors critical to both safety and reliability.

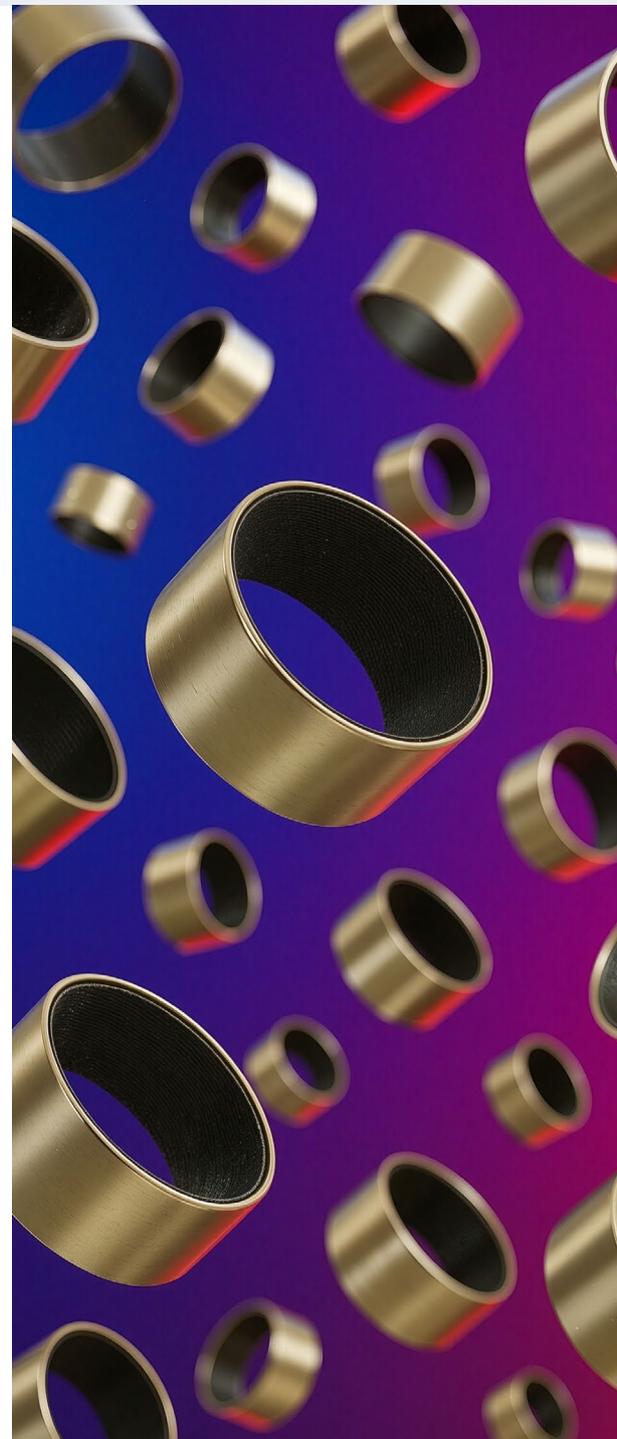
Ultimately, Fritex® bearings are not defined by a single advantage, but by their ability to **balance strength, friction control, thermal tolerance, and chemical resistance in one unified design**. Their adaptability across form factors—sleeves, flanges, washers, and custom geometries—further broadens their utility across industries. From robotic actuators to hydraulic pivots, Fritex® composite bushings extend uptime, minimize lubrication needs, and operate reliably where others falter.

# Why Choose **Fritex® Composite Bearings** Over Rolling Element Bearings

Our advanced composite bearing technology delivers performance far beyond that of traditional rolling element bearings — especially when subjected to high or shock loads.

## Key Performance Advantages

- **Lightweight, Compact Design** – Bearings can often be made over 50% lighter and slimmer than conventional options without compromising strength.
- **Superior Static Load Capacity** – For the same size, our composite bearings can handle over three times the static load capacity of an equivalent needle bearing.
- **Maintenance-Free Operation** – No grease or oil required, eliminating the risk of lubrication failure and shaft damage.
- **Consistent, Predictable Performance** – Utilizes a self-lubricating PTFE film transfer method rather than relying on mechanical rolling elements, ensuring stable performance throughout the bearing's life.
- **Exceptional in Dirty or Harsh Environments** – Operates reliably without costly integrated seals required by rolling element bearings to survive contaminated conditions.



# Following are the types of Fritex® Bearings manufactured by us

## Composite Filament Wound (FW)

**A-Series** = moderate strength

**B-Series** = high strength (typically Static Load  $\geq 200$  N/mm<sup>2</sup>)



## Cylindrical Radial Bearings (CR) - Metal-Backed with Woven Sliding Layer

**CRA SERIES = ARAMID FIBER WITH PTFE COATING**

**CRA A = PTFE + POLYESTER FILAMENT**

**Sliding Layer:** PTFE Fabric impreg. Polyester Fibres.

**Thickness:** 250  $\mu$ m

**Colour:** black/gray

**CRA B = PTFE + GLASS FILAMENT**

**Sliding Layer:** PTFE Fabric with Glass Fibres.

**Thickness:** 400  $\mu$ m

**Colour:** black/gray

**CRA C = PTFE + ARAMID**

**Sliding Layer:** PTFE Fabric with Aramid Fibres.

**Thickness:** 300 to 400  $\mu$ m

**Colour:** black/gray



## Summary Applications of Fritex® Composite Bearings

| Product Family | Construction  | Typical Applications  | Benefits in Application  |
|----------------|---|---|--|
| FW A-Series    | Fiber-wound epoxy resin body, PTFE fabric liner                                       | <ul style="list-style-type: none"> <li>• Agricultural machinery pivots and linkages</li> <li>• Industrial valves and actuators</li> <li>• Light construction equipment arms</li> <li>• - Packaging machinery</li> </ul>   | <ul style="list-style-type: none"> <li>• Primary Strengths: Excellent corrosion resistance, light weight, self-lubricating, maintenance free and tolerant of misalignment.</li> <li>• Load Type: Moderate radial and oscillating loads.</li> <li>• Smooth low-friction motion</li> </ul>   |
| FW B-Series    | High fiber-volume epoxy wound body (high strength), PTFE fabric liner                 | <ul style="list-style-type: none"> <li>• Hydraulic cylinder pivots</li> <li>• Mining and earthmoving booms</li> <li>• Offshore winch drums</li> <li>• Marine crane pivots</li> </ul>  | <ul style="list-style-type: none"> <li>• High static and dynamic load capacity</li> <li>• Resistant to impact and edge loading</li> <li>• Maintenance-free</li> <li>• Good in dirty/wet environments</li> </ul>  |
| CR-Series      | Carbon steel, stainless steel, bronze, or Inconel backing with PTFE-based woven liner | <ul style="list-style-type: none"> <li>• Aerospace flight controls</li> <li>• Oil &amp; gas subsea actuators</li> <li>• Earthmoving bucket and boom pivots</li> <li>• Rail bogies and brake linkages</li> <li>• Offshore cranes</li> <li>• Marine deck equipment</li> <li>• Industrial robotics</li> <li>• Defense turrets and elevation systems</li> </ul> | <ul style="list-style-type: none"> <li>• High load capacity with thin-wall design</li> <li>• Maintenance-free in oscillating motion</li> <li>• Corrosion and temperature resistance (material-dependent)</li> <li>• Easy press-fit installation</li> <li>• Low wear on mating shafts</li> <li>• Clean operation (no grease leakage)</li> </ul> |



# Mechanical and Physical Properties

All values are typical and may vary depending on material grade, operating environment, and custom design options.

## Mechanical Properties Table

| Property                                   | Fritex® FW A-Series | Fritex® FW B-Series | Fritex® CR-Series         |
|--|---------------------|---------------------|---------------------------|
| Static Load Capacity (N/mm <sup>2</sup> )  | 100–200             | 210–400+            | 250–450 <sup>+1</sup>     |
| Dynamic Load Capacity (N/mm <sup>2</sup> ) | 60–130              | 140–200             | 140–250 <sup>1</sup>      |
| Compressive Strength (N/mm <sup>2</sup> )  | ~350                | 400–600             | 450–700 <sup>1</sup>      |
| Max Sliding Speed (dry, m/s)               | 0.1–0.2             | 0.1–0.15            | 0.25–2.0 <sup>2</sup>     |
| Max PV Value (MPa×m/s)                     | 0.9–1.2             | 1.5+                | 2.5 <sup>+2</sup>         |
| Temperature Range (°C)                     | -60 to 130          | -195 to 160         | -195 to 250 <sup>+3</sup> |

## Physical Properties Table

| Property                      | Fritex® FW A-Series | Fritex® FW B-Series | Fritex® CR-Series         |
|-------------------------------|---------------------|---------------------|---------------------------|
| Coefficient of Friction (dry) | 0.05–0.18           | 0.03–0.16           | 0.03–0.15 <sup>2</sup>    |
| Coefficient of Friction (wet) | 0.08–0.20           | 0.04–0.18           | 0.04–0.16 <sup>2</sup>    |
| Water Absorption (24h, %)     | <0.3                | <0.2                | Negligible (<0.1)         |
| Specific Gravity              | 1.6–1.9             | 1.8–2.1             | 2.5–8.0 <sup>4</sup>      |
| Thermal Expansion (µm/m/°C)   | 15–20               | 10–15               | 10–14 (liner), <2 (shell) |
| Chemical Resistance           | Excellent           | Excellent           | Excellent <sup>5</sup>    |

### Footnotes:

1. CR-Series load ratings vary with shell material — carbon steel, stainless steel, bronze, or Inconel.
2. Values depend on lubrication conditions, liner composition, and mating shaft finish.
3. High-temperature performance achievable with specific liner and shell combinations.
4. Shell density varies significantly between steel, bronze, and Inconel options.
5. Chemical resistance is determined by both liner and shell material compatibility with the working environment.
6. The values listed under “Static Load (N/mm<sup>2</sup>)” are not raw compressive strength of the material, but rather the maximum recommended surface pressure for real-world use. These are engineered limits, factoring in:
  - Long-term deformation (creep)
  - Safety factors
  - Application dynamics
  - Fiber-resin structure behavior

So while compressive strength (e.g., tested in lab on a cube or cylinder) may be higher, the listed static load rating is more conservative — and relevant for design.

# What Are Composite Filament-Wound Epoxy (FW) - Impregnated Bushings and Bearings?

Fritex® FW A and B series bearings are part of a class of **advanced tribological components** known as composite filament-wound epoxy-impregnated bushings and bearings. These parts are engineered to operate under conditions where conventional lubrication is impractical or impossible. Built for **strength, durability, and minimal maintenance**, they offer exceptional performance in dynamic environments.

The outstanding performance of Fritex® composite bearings is fundamentally rooted in their **engineered microstructure**. Unlike homogeneous materials such as metals or monolithic plastics, filament-wound composites are formed by layering distinct material phases in a controlled, anisotropic configuration—designed to optimize strength, durability, and friction behavior. This leads to highly oriented fiber structures that yield exceptional strength in both radial and axial directions. The resulting bearing **can support significant loads while maintaining low friction and minimal wear**. This matrix not only binds the fibers but also distributes load and isolates them from environmental degradation. Microscopic voids are minimized through precise winding and impregnation techniques, ensuring consistency and long-term durability.

## Multi-functional structure:

### Outer Layer

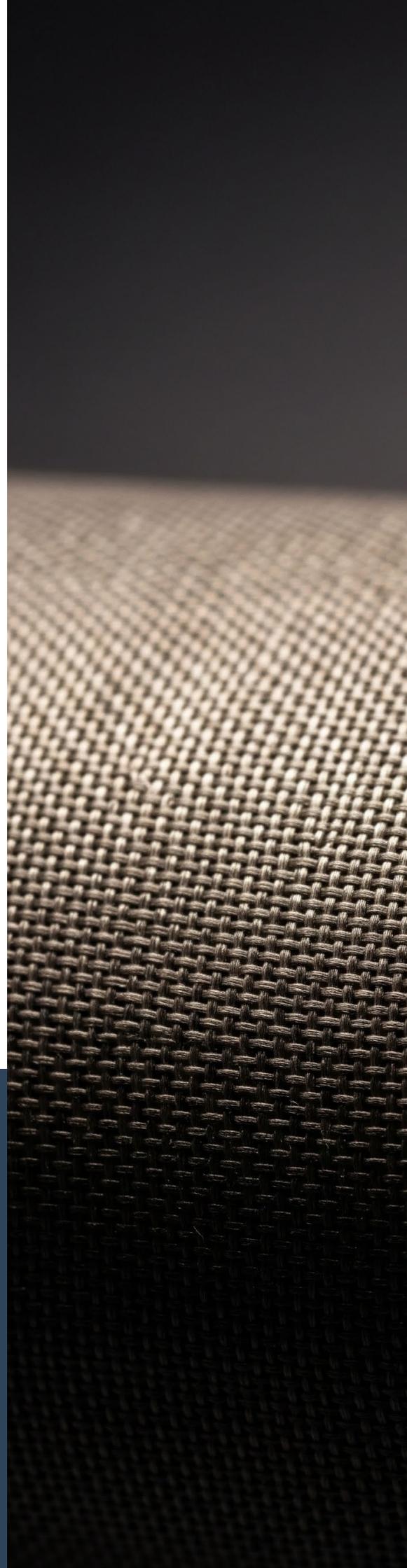
Provides structural integrity and impact resistance.

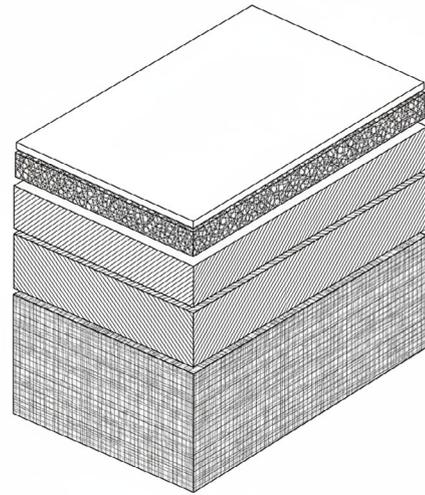
### Middle Layer

Manages load transfer via oriented fibers.

### Inner Layer

Ensures smooth, low-friction contact.





At their core, these bearings are constructed using **continuous or woven fiberglass or synthetic fiber reinforcement**, impregnated with a **thermosetting epoxy resin system**. The resin acts as the matrix, binding the fiber structure and giving it shape, chemical resistance, and mechanical integrity. In many designs, the inner bearing surface is enhanced with PTFE (Polytetrafluoroethylene) or graphite-based linings to reduce friction and ensure self-lubricating properties.

On the working surface—typically the inner diameter (ID)—a thin layer of self-lubricating liner is applied. This is often a woven PTFE or PTFE-graphite blend, designed to interact with the shaft under sliding conditions. This liner reduces friction and wear, eliminating the need for external lubrication. It is chemically bonded or mechanically integrated with the composite substrate to ensure it doesn't peel under shear stress.

**400** N/mm<sup>2</sup>  
Static Load Capacity

**-195°C / +160°C**  
Temperature Range

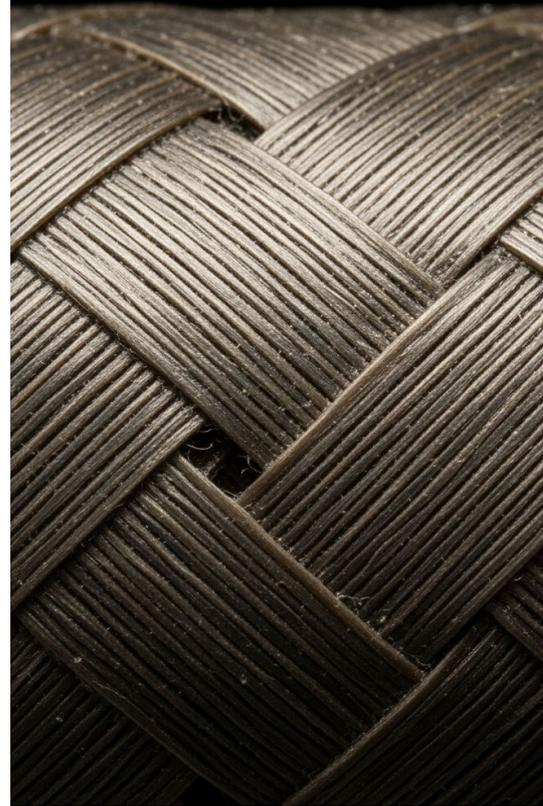
**0.03 - 0.18**  
Coefficient of Friction (dry)

**< 0.3%**  
Water Absorption (24h)

This laminated, fiber-reinforced architecture is what gives Fritex® FW bearings their characteristic resilience—**withstanding high loads, extreme temperatures, and aggressive environments** while maintaining shape and performance.

# Benefits of Fritex® - Filament Wound (FW) Composite Bearings

Composite filament-wound bearings provide numerous advantages over traditional metallic or plastic bushings:



## Maintenance-Free Operation



They are self-lubricating, eliminating the need for grease fittings, re-lubrication schedules, or oil baths.

## High Load Capacity



Engineered to handle static loads up to 400–600 N/mm<sup>2</sup> and dynamic loads over 200 N/mm<sup>2</sup> in some B-series designs.

## Corrosion Resistance



Ideal for marine, offshore, and chemical environments thanks to inert epoxy and PTFE components.

## Wide Temperature Operating Range



Some materials remain dimensionally stable from -195°C to +160°C or more.

## Weight Reduction



Significantly lighter than bronze or steel alternatives, beneficial for mobile and weight-sensitive applications.

## Adaptability



Can be designed in a variety of formats — cylindrical bushings, flanged bushings, washers, or custom profiles.

## Vibration & Noise Dampening



Natural damping properties reduce NVH (Noise, Vibration, Harshness), ideal for industrial automation and transportation.

## Application table

| Industry                | Common Applications                      | Recommended Series | Benefits                                       |
|-------------------------|--|--------------------|--|
| Hydraulics              | Piston/rod guides, cylinder eyes         | B-Series           | High pressure, no lubrication, wear resistance |
| Marine & Offshore       | Rudders, propeller shafts, deck gear     | B-Series           | Corrosion resistance, water lubrication        |
| Railway                 | Bogies, couplers, link arms              | A/B-Series         | Fire-safe grades, vibration damping            |
| Construction Machinery  | Bucket pivots, joints, articulating arms | B-Series           | Handles impact, dirt, and heavy load           |
| Agriculture             | Implements, control linkages             | A-Series           | Shock/vibration resistance, self-lubricating   |
| Dams & Water Infra      | Gate bearings, flood control arms        | A-Series           | Submerged service, corrosion resistance        |
| Automation & Robotics   | Bearings for arms, guides, tooling heads | A-Series           | Precise motion, low noise, maintenance-free    |
| Renewable Energy        | Wind blade hubs, hydro vane control      | B-Series           | Long service life, high static load            |
| Mining & Heavy Vehicles | Dumpers, cranes, rotary drills           | B-Series           | Shock load tolerance, no greasing required     |

# Why B-Series Has Higher Strength

Despite Similar Construction

| Property                 | A-Series (Standard)               | B-Series (High Strength)   |
|--------------------------|-----------------------------------|--|
| Resin type               | General-purpose epoxy or phenolic | High-performance or modified epoxy systems                       |
| Cross-linking density    | Moderate                          | Higher (tighter, more durable matrix)                            |
| Fillers                  | Minimal or basic                  | Reinforced with solid lubricants or tougheners                   |
| Heat resistance          | ~120°C                            | Often up to 160–200°C  |
| Fiber Type and Weave     | Standard Blends                   | High strength Fibers   |
| Fiber volume fraction    | Lower                             | Higher   |
| Winding Pattern          | Bidirectional                     | Precision wound for maximum axial / radial loads                 |
| Curing & Post-Processing |                                   | Higher pressures/temperatures; receive resin impregnation cycles |

## Results:

- Higher load-bearing and thermal capacity.
- Improving Mechanical Integrity.
- Reduce Porosity.
- Better load transfer, and better resistance to deformation.

## Summary

# What Sets B-Series Apart

| Attribute            | A-Series                   | B-Series                                  |
|----------------------|----------------------------|---|
| Target load class    | Moderate                   | Heavy-duty                                |
| Resin matrix         | Standard epoxy/phenolic    | Modified/high-load epoxy                  |
| Fiber density        | Medium                     | High                                      |
| Static load rating   | ~150–200 N/mm <sup>2</sup> | ≥200 N/mm <sup>2</sup> (often up to 400+) |
| Application examples | Valves, light bushings     | Marine shafts, hydraulic cylinders        |

## Why Fiber Density Matters in Bearings

### 1. More fibers = higher strength and stiffness

- Fibers carry most of the load in a composite.
- Higher density usually means better load-bearing and wear resistance, but may become brittle or harder to impregnate with resin.

### 2. Lower fibers = better damping, more resin-rich surface

- Can absorb more shock or vibration.
- May result in smoother surface finishes or easier machining.
- Weaker, but easier to process and better for low-load or flexible parts.

#### Summary:

This difference is one of the main reasons B-Series products withstand higher loads even if the materials look similar.

#### Comperitors:

**Fritex® FW A Series** competes with: Polygon PolyLube Fiber & Glass Tape Series, Polygon MRP (lower range), GGB GAR-FIL, GGB HPM/HPMB.

**Fritex® FW B Series** competes with: Polygon MRP/MRP-SL, Polygon PolyLube HT, GGB GAR-MAX, GGB HSG, GGB HPMB.

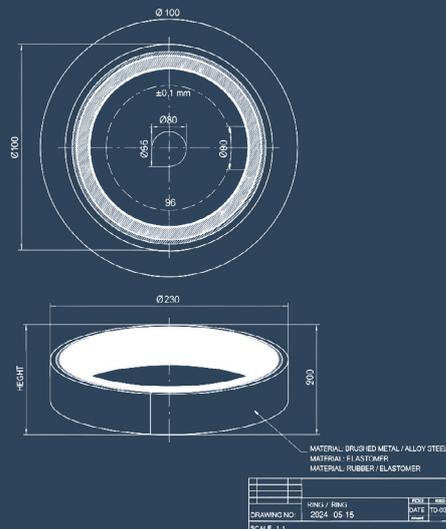
# What are Fritex® Heavy-Duty Metal-Backed Bearings (CR Series)

Fritex® CR-Series bearings are high-performance, self-lubricating, split-seam metal-backed bushings, allowing press-fit installation into housings and precise dimensional control. They are designed to provide dependable service in pivot and linkage points across a wide range of industries. These bearings are an ideal alternative to conventional greased bushings, eliminating the need for frequent maintenance and offering excellent dry-running capabilities.

These bushings are built with:

- A robust metallic outer shell
- A bonded composite sliding layer, formed by curing PTFE fabric or PTFE-based tape directly onto the backing material

These products are available in both inch and metric sizes and come in various wall thicknesses — from thin-wall versions that directly replace 1/16" standard bushings to heavy-wall styles that serve as robust drop-in replacements for bronze bushings. The fabric liner bonded to the inner diameter ensures low friction, wear resistance, and stability under high pressure and oscillating motion.





### Summary of Benefits:

- **Ideal for temperature extremes and dynamic loads**
- **Maintenance-Free Performance**  
CR-Series bearings use dry-lubricated, PTFE-based composite liners, eliminating continuous greasing, simplifying maintenance, reducing downtime, and suiting remote or sealed applications.
- **Low Friction Under Load**  
Engineered fabric or PTFE-tape liners perform under high pressure and oscillating motion, ideal for linkages and pivots where stick-slip or galling must be avoided.
- **Reliable in Any Environment**  
Suitable for industrial and corrosive conditions, including marine, offshore, and chemical.
- **Versatile Mounting Options**  
The split-seam design allows easy installation into standard bores without complex retention. Washers and thrust plates support axial loads.
- **Clean, Eco-Friendly Design**  
No grease or leakage ensures suitability for cleanrooms and environmentally sensitive applications while reducing ecological impact.

# Features & Advantages

## Metal shell

High mechanical strength, press-fit capability, precision metal shell - typically steel, stainless steel, or bronze.

- Optional surface treatments or machining to meet clearance, oil groove, or chamfer requirements.
- Customized Grease grooves or dry-running options.
- Customized Chamfers, flanges, or split designs.
- Custom ID/OD/lengths in inch or metric size.

## Composite sliding surface

Self-lubricating, low wear, adapted fabrics to meet specific demanding applications, quiet operation.

## PTFE Fabric Liners

- Application-matched friction, machinability, reinforced with aramid, glass, carbon, or polyester fibers for high wear and load resistance temperature, and load control.
- Suitable for dry or lubricated operation.

## Machinable PTFE composite tapes

Low thickness (from 0.16mm thick) Offering low-friction, formable interfaces with tight tolerance compatibility ideal for tight fits from 0.25 mm.

## Custom friction layers

Depending on application temperature, lubrication condition, or sealing environment.

## Thin-wall designs

Compact, weight-efficient solutions

# Application Areas for Fritex® CR Series

These heavy-duty bushings are used in industries where extreme conditions, frequent shock, and continuous motion demand a bearing that is durable, low-maintenance, and thermally stable.



## Oil & Gas

In oil and gas operations, bushings face abrasive particulates, pressure cycling, and saltwater exposure. Fritex® CR Series metal-backed bearings, when lined with corrosion-resistant composite materials, deliver unmatched endurance.

- Downhole tool components
- Valve actuators and hydraulic connections
- Riser articulation joints
- Subsea and platform loading systems



## Earthmoving & Construction Equipment

With their high load-bearing capacity and resistance to dirt and impact, these bushings are ideal for equipment subjected to dynamic shock loads and continuous vibration.

- Bucket and arm pivots
- Swing gear interfaces
- Telescopic joint assemblies
- Hydraulic cylinder mounts



## Aerospace and Defense

Low friction, consistent performance across wide temperature bands, and lightweight thin-wall construction make Fritex® bushings suitable for critical aerospace assemblies.

- Flight control linkages
- Landing gear torque arms
- Missile deployment systems



## Marine & Offshore Platforms

These environments demand high corrosion resistance, long life in submerged conditions, and low-friction interfaces. Fritex® bushings perform reliably in submerged or saltwater-exposed joints.

- Crane slewing bearings
- Mooring hinge points
- Gangway and winch assemblies



## Industrial Machinery & Automation

In high-cycle equipment, low-friction fabric-lined bushings reduce wear, improve repeatability, and eliminate the need for constant lubrication.

- Press linkages
- Packaging machines
- Automated tooling

| Parameter                        | Value / Tolerance   |
|----------------------------------|---|
| Metal Body Material Options      | Deep Draw Steel (DC04), 316 SS (standard), Inconel® 625, Inconel® 718, Monel® 400, Hastalloy® C or B, CuSN8, CuSn6 (Bronze) |
| Housing Bore Diameter            | +0.002 in, -0.000 in  |
| Shaft Diameter                   | +0.000 in, -0.002 in  |
| Bearing Thickness                | +/- 0.002 in  |
| Bearing Length                   | -0.000 in, -0.030 in  |
| Minimum Radial Bearing Clearance | 0.002 in  |
| Maximum Bearing Load             | 60,000 psi  |
| Temperature Limit                | 400°F up to 30 ksi<br>350°F from 30–60 ksi  |
| Maximum Diameter                 | 8 in  |
| Maximum Length                   | 8 in  |
| Velocity Range                   | 0–50 FPM  |
| Coefficient of Friction          | 0.05–0.10   |
| Standard Thickness Options (in.) | 0.027, 0.031, 0.033, 0.039, 0.045, 0.050, 0.057, 0.062, 0.075, 0.090  |

Available as bushings, washers, thrust plates, even custom washers—ideal for wash-down, ring joint use, or hydraulic flanges.

## Competitors

Fritex® CR-Series stands toe-to-toe with RBC Fiberglide® CJ bearings by offering:

- Dual metal backing materials
- Equivalent static/dynamic load ratings (250–400 MPa static; ~180 MPa dynamic)
- Similar operating temperature and friction parameters
- Equivalent form factors (cylindrical, thin-wall, heavy-wall, washers)





**FRITEX**<sup>®</sup>  
FIBER-REINFORCED BEARINGS  
by Technymon<sup>®</sup>

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