



# Your Bearing Solutions Provider



The Global Leader  
in High Performance Bearing Solutions



an EnPro Industries company

## Our strategic value drivers

- Customer solutions provider optimizing applications knowledge and industry expertise
- Industry leader in tribological and materials science
- Global footprint with local presence and delivery

## Partners in your success

For over 115 years, GGB Bearing Technology has stood for innovation, leadership and a collaborative approach to the world's most challenging bearing needs.

We work in concert with our customer partners to understand their unique application requirements and find bearing solutions for their individual needs. From the bottom of the ocean to the surface of Mars, our bearings and other specialty products represent the pinnacle of technical expertise and materials science.

Our passion for excellence and innovation is driven by more than just the technology that we advance. We're propelled by the knowledge that our solutions help ensure children arrive safely at school each day, that our bearings contribute to a greater understanding of the cosmos and that we're helping farmers feed the world. We're committed to providing innovative bearing solutions because we understand the connection between our bearings and the lives of people they affect.

## An EnPro Industries company

GGB is proud to be part of the EnPro Industries, Inc. family of companies. EnPro Industries, Inc. is a global manufacturer of critical safety and high performance products used in some of the most extreme environments on Earth (and Mars). From jet engines to nuclear power plants to pharmaceutical processing, EnPro's components and systems must perform flawlessly under extraordinary mechanical, chemical and environmental stress.

The EnPro Industries family of companies operates extensive R&D and manufacturing facilities throughout the world that work to continually develop new and innovative materials and technologies that drive further advances in the markets we support. EnPro Industries companies currently maintain manufacturing facilities in North and South America, Europe, and Asia, employing more than 5,000 people and supporting more than 50,000 customers in more than 100 countries around the world.





# The GGB advantage



## MAINTENANCE-FREE

GGB bearings are self-lubricating, making them ideal for applications requiring long bearing life without continuous maintenance, as well as under operating conditions with inadequate or no lubrication.



## LOW FRICTION, HIGH WEAR RESISTANCE

Low coefficients of friction eliminate the need for lubrication, while providing smooth operation, reducing wear and extending service life. Low friction also eliminates the effects of stick-slip or “stiction” during start up.



## ENVIRONMENTAL

Greaseless, lead-free GGB bearings comply with increasingly stringent environmental regulations such as the RoHS and WEEE directives restricting the use of hazardous substances in certain types of electrical and electronic equipment.



## LOWER SYSTEM COST

A slim, compact, one piece design offers significant space and weight reductions to simplify installation, lower system costs and minimize potential damage during installation.



## CUSTOMER SUPPORT

GGB’s flexible production platform and extensive supply network assure quick turnaround and timely deliveries. In addition, we offer technical, application and design support, so customers can identify the ideal bearing solution for even the most challenging applications.

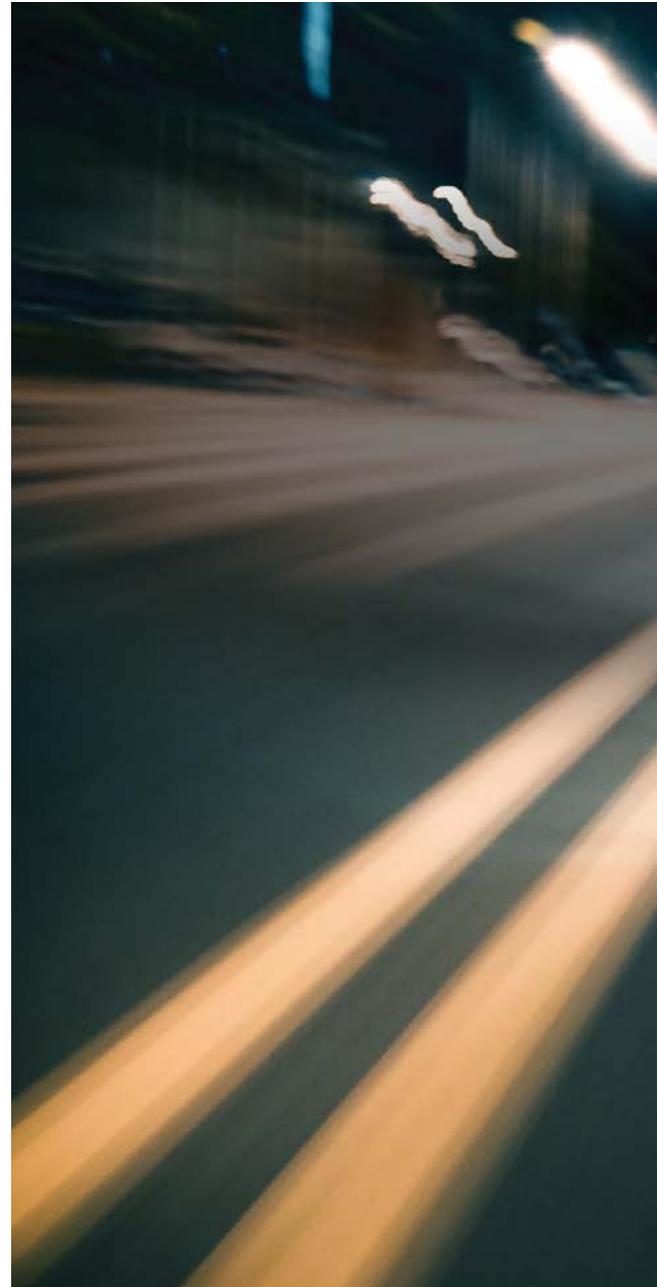


# Global solutions for every application

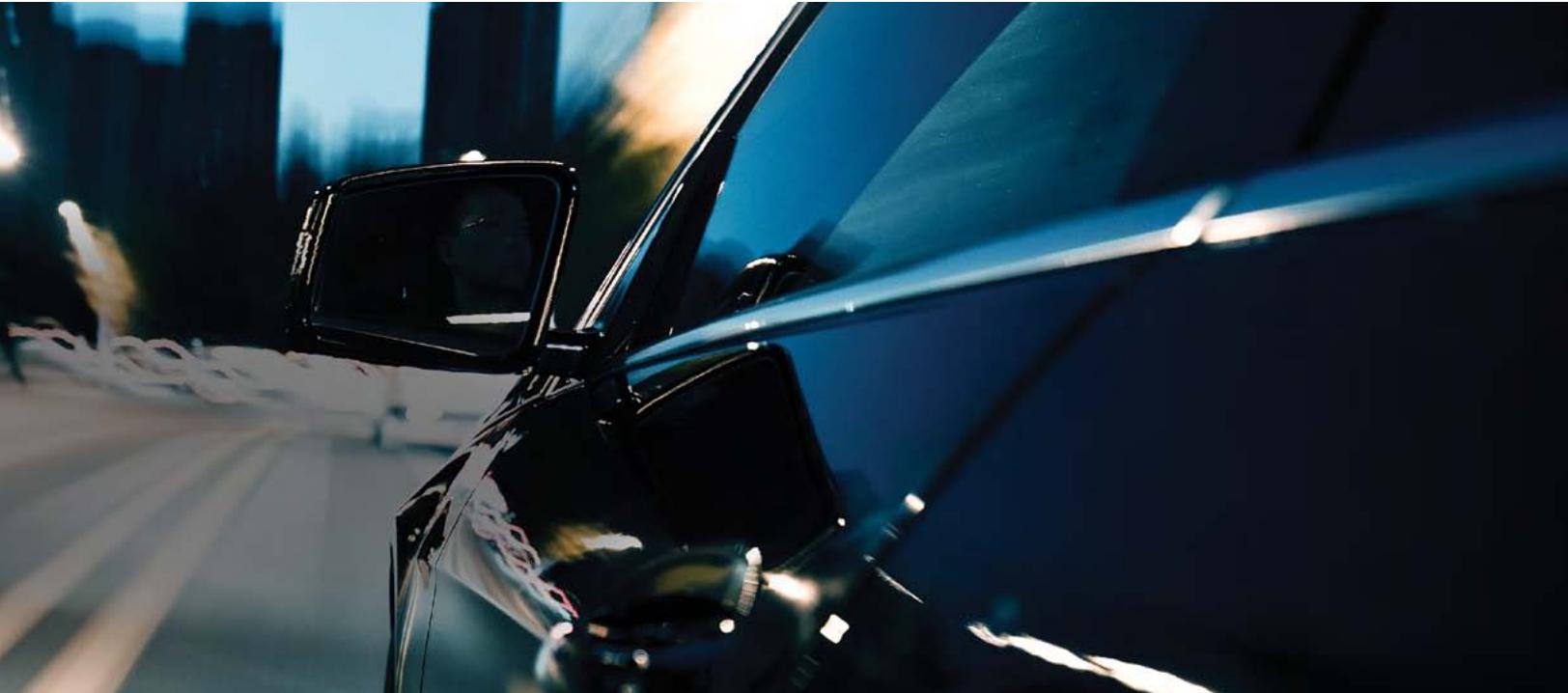
As a global supplier of innovative, reliable and effective bearing solutions, we operate manufacturing facilities globally that deliver responsive customer service and follow-up support, provide cutting edge research, and maintain development departments to address unique application demands and flexible production platforms that allow us to meet our customers' changing needs.

Whether you need five large bushings for a hydropower plant or 5 million bearings for a new car launch, we have the production capacity, technical expertise and materials science to meet your needs.

We don't just make products, we build partnerships. That's the GGB advantage.



The Global Leader  
in High Performance Bearing Solutions



# AUTOMOTIVE

## Driven by excellence

Bearing selection can be a critical component in automobile safety and comfort, impacting everything from the steering systems to the engine and transmission to the struts and shock absorbers. With so much riding on the bearings, automotive applications require solutions that are uniquely tailored to their intended uses as well as governmental regulations and manufacturing requirements. GGB is proud to offer over 50 unique bearing solutions for automotive applications, including our renowned DP11™, EP™ and DP4™ bearings. We also provide expert consultation to assist OEMs, Tier-1 and Tier-2 suppliers and aftermarket manufacturers in developing the ideal bearing solution for their specific application needs.

### AUTOMOTIVE APPLICATIONS

- Steering Systems: yoke support, steering column, gear pump bearings
- Transmissions: rear output shaft, main shaft and reverse idler bearings, clutches, pumps, solenoids, planetary gear sets, gear shifting forks
- Seats: seat recliner and height adjuster mechanisms
- Axles: driveline systems, kingpins
- Brake Systems
- Hinges: door, trunk and hood hinges, door checkers
- Engine Management: water and oil pumps, belt tensioners, pulley dampers
- Struts and Shock Absorbers

#### COMPONENT BEARING SOLUTIONS

See page 17 for a complete line of bearing solutions.



METAL-POLYMER



FIBER REINFORCED COMPOSITE BEARINGS



METALS & BIMETALS



# AEROSPACE

## New heights in bearing performance

For nearly 50 years, GGB has been providing the aerospace industry with high performance plain bearings to meet stringent demands for a higher level of safety and lighter weight. Certified to the AS 9100C quality standard, we fulfill the industry's quality management system requirements for the manufacture of metal-backed bearings and fiber reinforced composite bearings and washers, while offering full traceability as well as dimensional and material certification.

### AEROSPACE APPLICATIONS:

- Landing Gear Struts
- Wing Flap Actuators
- Hydraulic Fuel Pumps
- Flight Control Systems
- Electric Actuators
- Engines
- Aircraft Interiors:  
seat mechanisms, overhead  
baggage compartments,  
cargo bay floors, latches,  
hinges



**COMPONENT  
BEARING  
SOLUTIONS**

*See page 17 for a complete line of bearing solutions.*



METAL-POLYMER



FIBER REINFORCED COMPOSITE BEARINGS



METALS & BIMETALS

**CASE STUDY**

NASA's Jet Propulsion Laboratory turned to GGB for a bearing solution for a robotic drilling arm on its Curiosity Mars rover. The drilling arm operates under extreme temperature, debris and atmospheric conditions to obtain samples of Martian rock for analysis.

GGB selected three DU® metal-polymer bearing segments to serve as the primary suspension components for the drill spindle based on their high performance, self-lubricating properties and wear resistance in a wide range of loads, speeds and temperatures. Launched in 2011, the Curiosity is still advancing our understanding of the red planet.





**CASE STUDY**

A major manufacturer of construction and agriculture equipment was in the process of developing a new ripper attachment for its fleet of motor graders. The company's previous design used greased, steel-on-steel bearings and they were interested in the potential benefits of using a self-lubricating bearing.

Used for breaking up and mixing asphalt and aggregates, the ripper required bearings that could withstand severe impact and edge loading, debris exposure, temperature extremes and slow speed pivoting. GGB determined that the HSG™ fiber reinforced composite bearing would meet all of these requirements. Following an exhaustive proving grounds test, the HSG™ bearings showed minimal wear (<0.005") and very little damage from edge loading and misalignment. The company specified the bearings not only for the ripper, but for 36 total pivot joints throughout their motor graders.



**CONSTRUCTION  
& AGRICULTURE**

**COMPONENT BEARING SOLUTIONS**  
*See page 17 for a complete line of bearing solutions.*

		
METAL-POLYMER	FIBER REINFORCED COMPOSITE BEARINGS	METALS & BIMETALS



# CONSTRUCTION CULTURE

## Building a brighter future

GGB's metal-polymer and fiber reinforced composite bearings provide an extremely durable, greaseless and maintenance-free solution for a wide range of heavy equipment for the agricultural and construction industries, including tractors, backhoes, bulldozers, cranes and more.

In addition to outperforming traditional options, such as greased bronze, hardened steel and rolling-element bearings, GGB bearing solutions are cleaner and better resist the abrasive elements common to construction sites and farm fields.

### CONSTRUCTION AND AGRICULTURAL APPLICATIONS

- Linkage and Pivot Points
- Frame/Walking Beam Trunnion
- Suspension or Track Trunnions
- Critical Clearance Joints
- Hinges
- Pedals
- King Pins
- Articulating Joints
- Axle Trunnions
- Conveyors
- Dump Body Pivot
- Linkage Pins
- Rock Shaft
- Steering Cylinders



# ENERGY

## Powering the future

GGB offers industry-leading solutions for a wide range of energy and fluid power applications, including hydropower, wind, solar, nuclear, offshore, tidal and petrochemical. Whether your needs are for new construction or retrofits, our expertise, support and technological advancements deliver the solutions you need to reduce downtime, increase safety and improve efficiency.

For hydraulic fluid powered applications, our bearing solutions perform reliably under high loads and speeds while resisting cavitation and chemical attack.

### ENERGY APPLICATIONS:

- Turbines: servo-motors, operating ring sliding segments, linkages, wicket gates, guide vanes
- Pelton Turbines: injectors, deflectors
- Gates: intake gate sliding segments and rollers, spillway gates
- Ancillary Equipment: fish screens, trash rates
- Valves: ball and butterfly
- Hydraulic Pumps and Motors
- Fluid Power Applications
- Vane and Centrifugal Pump Drive Shafts
- Radial and Axial Piston Pump Shafts
- Gerotor and Radial Piston Motors



### CASE STUDY

Scheduled for completion in 2019, Brazil's Belo Monte hydroelectric dam will be the third largest in the world. During the planning phase, project leaders determined its wicket gates would need highly durable bearings that could withstand harsh, 24-hour operating conditions for many years. A tall order, but one that GGB was equipped to handle.

GGB recommended fiber reinforced composite HPM™ hydro bearings and HPF™ bearing segments for their excellent water and debris resistance, low friction and high load capacity. A simulation test of 30 years of continuous dry operation by a third party laboratory showed minimal evidence of operating stress and the bearings were approved for use in seven power generating units.

#### COMPONENT BEARING SOLUTIONS

See page 17 for a complete line of bearing solutions.



METAL-POLYMER



FIBER REINFORCED COMPOSITE BEARINGS



METALS & BIMETALS



# INDUSTRIAL

## Proving our mettle

Thanks to their durability, reliability, low friction, extended wear life and maintenance-free properties, GGB high performance bearings can be used in a vast number of general industrial and primary metal applications. Our innovative and technologically advanced bearing solutions comply with a broad range of environmental regulations and are supported by manufacturing facilities globally that provide quick turnaround for reduced downtime and inventory carrying costs.

### INDUSTRIAL APPLICATIONS

- Furniture
- Heat-Treating Units
- Industrial Solder Machines
- Injection Molding
- Machine Tools
- Multi-Ram Press Guides
- Power Tools
- Furnace Charging Cars
- Ladle Hangers
- Ladle Cover Manipulator
- Dummy Bar Chains
- Shears
- Charging Trolleys
- Conveyor Rollers
- Hyperbaric Filter



**COMPONENT BEARING SOLUTIONS**  
*See page 17 for a complete line of bearing solutions.*

 METAL-POLYMER	 ASSEMBLIES	 METALS & BIMETAL
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### CASE STUDY

Located in Newcastle, England, the Gateshead Millennium Bridge links the town of Gateshead and the city of Newcastle-upon-Tyne across the river Tyne and is the world's first bridge to pivot on four self-aligning bearings. Featuring a fixed and a floating bearing on either side of the river, the bridge presented a unique bearing challenge that GGB gladly accepted.

After in-depth consultations with the bridge designers, GGB determined that the DB™ maintenance-free bearings in bronze with graphite lubricant plugs and split stainless steel housings would meet the project's rigorous demands. Completed in 2001, the bridge continues to operate reliably and remains a popular tourist attraction.





# RECREATIONAL

## Taking recreation seriously

From all-terrain vehicles, bicycles, snowmobiles and mountain bike suspensions, to fishing equipment, ski bindings, recreational water craft, golf carts and many more, GGB has the experience and proven expertise in advanced materials to provide each customer with the ideal bearing solution for tomorrow's new challenges.

Our high performance bearings offer exceptional performance in nearly any environment — hot, wet, dirty, sandy or cold, our maintenance-free bearings provide durable, environmentally friendly and grease-free operation for a wide variety of recreational applications.

### RECREATIONAL APPLICATIONS:

- Electric Fishing Reels
- Elliptical Trainers for Cross-Country Skiing
- Drive Wheels in Electric Golf Caddies
- Golf Cart Front Suspensions
- Zip Line Pulleys
- Brake Systems and Bridge Supports for Mountain Gondolas
- Pleasure Craft Hatches and Rudders
- Multi-Gym Weight Stations
- Snowmobile Shock Absorbers
- Hang Glider Simulators
- ATV Towing Hitch Systems
- Cycling Equipment: shock absorbers, rear suspension arms, pedals, wheel hub, brake levers, motorbike starters, and accessories

#### COMPONENT BEARING SOLUTIONS

See page 17 for a complete line of bearing solutions.



METAL-POLYMER



FIBER REINFORCED COMPOSITE BEARINGS



ENGINEERED PLASTICS BEARINGS

# Going beyond compliance

Leading the way toward a safer and more sustainable world

Pursuing product quality and respecting the environment are crucial to our core values. As the global leader in high performance bearing solutions, GGB is certified to world-class standards including ISO 9001 for quality management systems, ISO/TS 16949 for international quality management specification for suppliers of automotive components, ISO 140001 for environmental management systems and OHSAS 18001, the Occupational Health and Safety Management standard.

GGB also takes the safety and health of its employees very seriously. At our manufacturing facilities, many procedures have been implemented to create a safe, injury-free workplace. Production plants have formed active committee-based safety programs providing employees with annual first-aid training, quarterly information exchange meetings, monthly safety inspections and continual monitoring of air quality.



## GGB values

Throughout our history, safety, excellence and respect have formed the foundational values for the entire GGB family. They are of paramount importance as we seek to maximize personal possibility, achieve excellence and establish open, creative work environments with the highest safety standards in the industry.

### SAFETY

GGB's deep-rooted culture of safety places a relentless focus on creating a secure, healthy work environment for all. A core value of GGB, safety is critically essential at all levels of business in order to achieve our goal of having the safest employees in the industry.

### EXCELLENCE

A world-class organization is built by fostering excellence throughout the company in all positions and functional areas. Our world-class manufacturing plants are certified in quality and excellence in the industry according to ISO 9001, ISO 14001, ISO 50001, OHSAS 18001, and ISO/TS 16949 allowing us to access the industry's best practices while aligning our quality management system with global standards.

### RESPECT

We believe that respect is consistent with the growth of individuals and groups. Our teams work together with mutual respect regardless of background, nationality or function, embracing the diversity of people and learning from one another.

# A long history of innovation

From our modest beginnings over 115 years ago, GGB grew through innovation and technical expertise to become the world's leading manufacturer of plain bearing solutions.

Findlay and Battle founded Findlay Motor Metals. The company was renamed to Glacier Antifriction Metal Company two years later.

1899



Began making plain bearings in response to increased demand for internal combustion engines.

1910s

Glacier licensed technology to a number of overseas bearing manufacturers. Licenses included: SIC (France), Garlock Bearings (USA).

Launched the marginally lubricated DX<sup>®</sup> metal-polymer product for greased applications.

Garlock Inc. is established as the U.S. bearing distributor for Glacier.

Introduced DU<sup>®</sup>, the world's first steel backed metal-polymer bearing product with bronze and PTFE lining offering excellent low friction and wear resistance performance. Introduced DU-B<sup>™</sup> with bronze backing for improved corrosion resistance.

1970s

1965

1958

1956



1974

Began continuous casting of the SICAL<sup>™</sup> range of aluminum alloys and high precision machining of bushing blocks in Dieuze, France.

1976

Glacier and Garlock Inc. established joint venture company Garlock Bearings Inc.

1978

Introduced fiber reinforced composite bearings in the USA, including GAR-MAX<sup>®</sup>.

1986

Launched HI-EX<sup>®</sup> metal-polymer product, designed for high temperature applications.



Introduced lead-free steel backed DP4<sup>™</sup> metal-polymer product for automotive shock absorbers and other hydraulic applications. Introduced DP4-B<sup>™</sup> with bronze backing for improved corrosion resistance.

1995

Launched new EP<sup>™</sup> engineered plastics bearings.

1996

Goodrich Corporation spun off its engineered industrial products division, creating EnPro Industries Inc., the new parent company of Glacier Garlock Bearings.

2002



Introduced lead-free DP31<sup>™</sup> metal-polymer product with improved performance under lubricated conditions. Acquired Saver North America, a producer of self-lubricating composite bearings. Glacier Garlock Bearings expanded business in Asia.

2003

Fiber reinforced composite bearings introduced to the European and Asian markets; GGB North America certified to AS9100C, the aerospace industry's standard for quality management systems.

Production facility opened in Suzhou, China; new DX<sup>®</sup>10 with DuraStrong<sup>™</sup> technology bearings won Frost & Sullivan's product innovation of the year award in the Class 7-8 truck bearings category.

Glacier Garlock Bearings changed name to GGB. Opened new manufacturing plant Sucany, Slovakia.

2004

Introduced SBC<sup>™</sup> (Sealed Bearing Cartridges) for off-highway equipment applications. Acquired Bohringer Kunststofftechnik GmbH, precision injection molder of high performance engineered plastics bearings.

2007

2009

2008

2010

Introduced lead-free DP10<sup>™</sup> and DP11<sup>™</sup> metal-polymer products for superior performance under marginally lubricated and dry running conditions.

2011

Acquired PI Bearing Technologies, a producer of PICAL<sup>™</sup> aluminum alloy bushing blocks for demanding fluid power applications. GGB plants certified to OHSAS 18001 for health and safety management systems.

2012

DTS10<sup>™</sup> machinable metal-polymer bearings are launched for the fluid power and compressor markets. GGB bearings land on Mars aboard NASA's Curiosity rover.

2013

Launched new self-lubricating metallic bearing product GGB-CSM<sup>™</sup> and GGB-CBM<sup>™</sup> as well as FLASH-CLICK<sup>®</sup> two-piece, double-flanged engineered plastics bearings.

Series of self-lubricating sintered bronze and sintered iron bearings introduced, including GGB-BP25<sup>™</sup>, GGB-FP20<sup>™</sup>, and GGB-SO16<sup>™</sup>. Three plants mark milestone anniversaries: 40 years for Heilbronn, Germany and Dieuze, France, and 10 years for Sucany, Slovakia.



Introduced HPMB<sup>™</sup> self-lubricating fiber reinforced composite bearings with machinable liner and GGB-SZ<sup>™</sup> lead-free bimetal bearings. The Thorofare, USA filament wound plant relocated to nearby, larger new facility.

2014

2015



# The highest standards in quality

Our world-class manufacturing plants in the United States, Brazil, China, Germany, France and Slovakia are certified in quality and excellence according to ISO 9001, TS 16949, ISO 14001, ISO 50001 and OHSAS 18001. This allows us to access the industry's best practices while aligning our management system with global standards.

For a complete listing of our certifications, please visit our website:

[www.ggbearings.com/en/company/certificates](http://www.ggbearings.com/en/company/certificates)



## A leader in research and development

As a leader in the advancement of tribological science and technology, GGB is continually innovating new materials and products that deliver improved performance, reliability and safety for our customers. Our research and development facilities are responsible for some of the most important innovations in the history of plain bearing technology, including the revolutionary DU® and DX® bearings, the fiber reinforced composite process that gave rise to lighter weight and corrosion resistant products like the GAR-MAX® line of bearings and, most recently, the technology that allowed for the creation of lead-free, environmentally friendly DP4™ and DP4-B™ bearings. It is through this ongoing investment in research and development that GGB will continue leading the industry in plain bearing solutions for the next 115 years.

# Our complete line of bearing solutions



## METAL-POLYMER BEARINGS

[ggbearings.com/en/category-product/metal-polymer](http://ggbearings.com/en/category-product/metal-polymer)

We manufacture metal-backed, PTFE-based (polytetrafluoroethylene) and thermoplastic-based polymer bearings that share a common structure consisting of a porous bronze sinter bonded into a metal backing. This bronze sinter layer is impregnated and overlaid with the filled PTFE or thermoplastic extruded tape liner.

The metal backing provides mechanical strength, while the bronze sinter layer provides a strong mechanical bond between the backing and the antifriction bearing lining. This construction promotes dimensional stability, improves thermal conductivity and offers exceptionally low friction.



## ENGINEERED PLASTICS BEARINGS

[ggbearings.com/en/category-product/solid-polymer](http://ggbearings.com/en/category-product/solid-polymer)

Our injection-molded engineered plastics bearings provide excellent wear resistance and low friction in both dry and lubricated operating conditions over a wide range of applications. The EP™ Series of engineered plastics bearings exhibits excellent dimensional stability, low coefficients of friction and thermal expansion, high compressive strength and creep resistance and good thermal conductivity.

We also manufacture acetal-based KA™ Glacetal thrust washers for light-duty applications, Multilube™ bearings that contain lubricants dispersed in the material and FLASH-CLICK® bearings for simply manual or automated installation without a pilot or assembly tools.



## FIBER REINFORCED COMPOSITE BEARINGS

[ggbearings.com/en/category-product/filament-wound](http://ggbearings.com/en/category-product/filament-wound)

This range of products typically consists of a fiber reinforced composite, fiberglass-impregnated, epoxy backing with a variety of low-friction, wear-resistant bearing linings. The reinforced composite structure of these materials supports high static and dynamic loads. Furthermore, the inert nature of the materials resists corrosive environments such as seawater and acidic environments.



## BUSHING BLOCKS AND THRUST PLATES

[ggbearings.com/en/category-product/bushing-blocks-and-thrust-plates](http://ggbearings.com/en/category-product/bushing-blocks-and-thrust-plates)

GGB's high precision bushing blocks and thrust plates are made from our proprietary aluminum alloys and provide good friction and wear resistance. They can be supplied with or without pre-installed GGB metal-polymer cylindrical bearings.



### METAL AND BIMETAL BEARINGS

[ggbearings.com/en/category-product/metals-and-bimetals](http://ggbearings.com/en/category-product/metals-and-bimetals)

We have a broad range of monometallic, bimetallic and sintered bronze bearings including our DB™ bearings, which are ideal for industrial applications on both land and under water. Our range of impregnated sintered bronze and iron bearings are intended for use in maintenance-free operations, under moderately high speeds and low loads. Designed for lubricated conditions, our mono- and bimetallic bearings are suitable for use in a wide range of operating conditions.



### ASSEMBLIES

[ggbearings.com/en/category-product/assemblies](http://ggbearings.com/en/category-product/assemblies)

We offer a variety of specialized housings and assemblies to complement our complete line of plain bearing solutions. UNI™, MINI™, and EXALIGN™ self-aligning bearing housings are designed to be used with our range of metal-polymer, fiber reinforced composite bearings, and metal and bimetal bearings.

What you need. Where you need it.  
**When you need it.**



GGB has manufacturing, sales, service and support locations around the globe. This vast network of resources and expertise enables us to respond promptly to your bearing needs wherever you do business.

### GLOBAL FOOTPRINT

[ggbearings.com/en/company/global-footprint](http://ggbearings.com/en/company/global-footprint)



an EnPro Industries company

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The Global Leader in High Performance Bearing Solutions



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