

# **GAR-MAX<sup>®</sup>** **Self-lubricating** **Bearings**



**Technical Information**



*an EnPro Industries company*

# Introduction

GAR-MAX® is a dual-layer, composite bearing material that combines the mechanical strength of a filament-wound, fiberglass-impregnated epoxy backing and the excellent tribological properties of an anti-friction sliding layer. The high load-carrying capacity is the result of a special filament winding process. Reinforced PTFE filaments and high-

strength polymer fibres, embedded in epoxy resin compounded with graphite, form a strong, wear-resistant bearing surface. To meet the increased demand for GAR-MAX® bearings, we have expanded the production capacity of our U.S. plant. Please note our **new part numbers** and **modified clearances**.

## Structure of GAR-MAX®

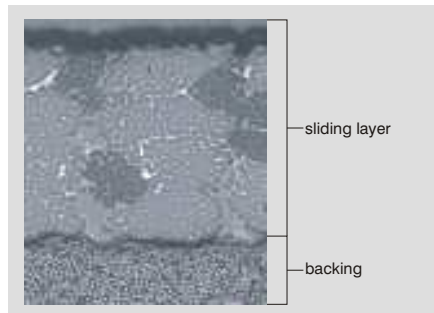
### Structure

#### Composite material Sliding Layer

Continuous wound PTFE and high-strength fibres encapsulated in an internally lubricated, high-temperature filled epoxy resin.

#### Backing

Continuous wound fiberglass encapsulated in a high temperature epoxy resin.



### Features

- High load capacity
- Excellent shock resistance
- Excellent contamination resistance
- Excellent misalignment tolerance
- Very good friction and wear properties
- Good chemical resistance

### Possible Applications

#### Industrial:

Steering linkages, hydraulic cylinder pivots, king pin bearings, boom lifts, scissor lifts, cranes, hoists, lift gates, backhoes, trenchers, skid steer loaders, front-end loaders, etc.

### Availability

#### Ex stock:

Cylindrical standard bushes

#### To order:

Non-standard lengths (short-term), non-standard wall thickness (on request)

Bearing properties		Units	Value
Maximum load $\bar{p}$	- static	MPa	210
	- dynamic		140
Maximum sliding speed U	- dry	m/s	0,13
Maximum $\bar{p}U$ factor	- dry	MPa x m/s	1,05
Maximum temperature $T_{max}$		°C	+160
Minimum temperature $T_{min}$		°C	-195
Coefficient of friction f	- dry	-	0,05 - 0,30
Shaft surface finish Ra*		µm	0,15 - 0,40
Shaft hardness*	- normal	HB	>350
	- for service life >2000 hours		>480

\*Alternative shaft hardnesses and shaft surface finish is possible, depending on the application. Please contact your local GGB representative.

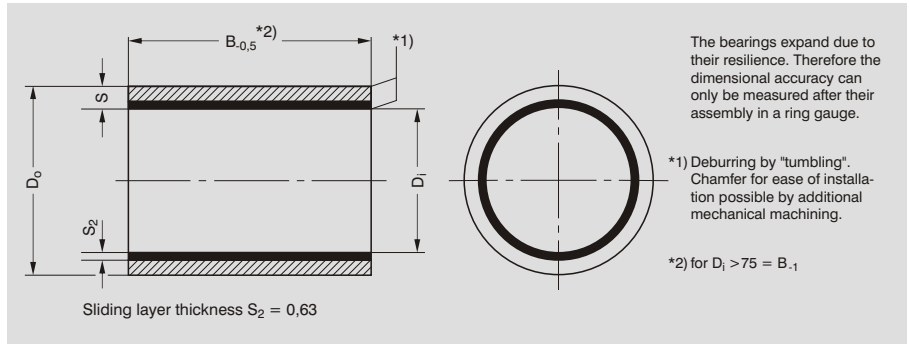


Cylindrical bushes

### Usage

dry	<b>very good</b>
oil lubricated	<b>fair</b>
grease lubricated	<b>fair</b>
water lubricated	<b>fair</b>
process fluid lubricated	<b>poor</b>

# Standard range cylindrical GAR-MAX® bushes



Dimensions [mm]

Order No.	Technical data						Installation tolerance
	Dimensions					Weight g	
GGB	Inner Ø D <sub>i</sub>	Outer Ø D <sub>o</sub>	Width B	Thick-ness S			
162015GM	16	20	15	2,0	3,8	H7/h8	0,020
162020GM	16	20	20	2,0	4,8		0,198
202415GM	20	24	15	2,0	4,1	H7/h8	0,020
202420GM	20	24	20	2,0	5,4		0,204
202425GM	20	24	25	2,0	6,8		
222620GM	22	26	20	2,0	6,5	H7/h8	0,020
222625GM	22	26	25	2,0	8,0		0,208
253020GM	25	30	20	2,5	8,1	H7/h8	0,020
253025GM	25	30	25	2,5	10,6		0,214
253030GM	25	30	30	2,5	12,1		
283422GM	28	34	22	3,0	12,0	H7/h8	0,020
303620GM	30	36	20	3,0	11,7		0,214
303630GM	30	36	30	3,0	17,4		
303636GM	30	36	36	3,0	21,0	H7/h8	0,025
303640GM	30	36	40	3,0	23,3		0,244
303650GM	30	36	50	3,0	29,1		
354130GM	35	41	30	3,0	20,1	H7/h8	0,025
354135GM	35	41	35	3,0	23,5		0,251
354140GM	35	41	40	3,0	26,8		
354150GM	35	41	50	3,0	33,5		
404820GM	40	48	20	4,0	20,7	H7/h8	0,025
404830GM	40	48	30	4,0	31,0		0,244
404840GM	40	48	40	4,0	41,4		
404850GM	40	48	50	4,0	51,7		
455330GM	45	53	30	4,0	34,5	H7/h8	0,025
455340GM	45	53	40	4,0	46,1		0,244
455345GM	45	53	45	4,0	51,8		
455350GM	45	53	50	4,0	57,5		
455360GM	45	53	60	4,0	69,1		
505830GM	50	58	30	4,0	38,1	H7/h8	0,025
505840GM	50	58	40	4,0	50,8		0,251
505850GM	50	58	50	4,0	63,4		
505860GM	50	58	60	4,0	76,1		
556330GM	55	63	30	4,0	41,6	H7/h8	0,025
556340GM	55	63	40	4,0	55,5		0,251
556360GM	55	63	60	4,0	83,2		
607030GM	60	70	30	5,0	57,3	H7/h8	0,025
607040GM	60	70	40	5,0	76,4		0,251
607045GM	60	70	45	5,0	85,9		
607050GM	60	70	50	5,0	95,4		
607060GM	60	70	60	5,0	114,6		
657550GM	65	75	50	5,0	102,8		

Production of special dimensions (e.g. other wall thicknesses, running layer thicknesses) are possible.

Order No.	Technical data						Installation tolerance
	Dimensions					Weight g	
GGB	Inner Ø D <sub>i</sub>	Outer Ø D <sub>o</sub>	Width B	Thick-ness S			
708040GM	70	80	40	5,0	86,7	H7/h8	0,030
708050GM	70	80	50	5,0	110,2		0,236
708055GM	70	80	55	5,0	121,3	H7/h8	0,040
708060GM	70	80	60	5,0	130,0		0,271
708070GM	70	80	70	5,0	154,2		
708080GM	70	80	80	5,0	173,4		
758550GM	75	85	50	5,0	117,5	H7/h8	0,040
758560GM	75	85	60	5,0	140,9		0,271
758570GM	75	85	70	5,0	164,5		
758580GM	75	85	80	5,0	187,9		
809050GM	80	90	50	5,0	124,8	H7/h8	0,040
809060GM	80	90	60	5,0	149,8		0,279
809070GM	80	90	70	5,0	174,7		
809080GM	80	90	80	5,0	199,7		
859560GM	85	95	60	5,0	158,6	H7/h8	0,040
859580GM	85	95	80	5,0	211,5		0,279
9010570GM	90	105	70	7,5	300,6		
10011580GM	100	115	80	7,5	378,8	H7/h8	0,040
100115100GM	100	115	100	7,5	473,5		0,304
100115120GM	100	115	120	7,5	568,2		
110125100GM	110	125	100	7,5	517,5	H7/h8	0,040
110125120GM	110	125	120	7,5	620,9		0,309
120135100GM	120	135	100	7,5	561,6	H7/h8	0,040
120135120GM	120	135	120	7,5	673,9		0,329

## Dimensions in free state

Inner Ø D <sub>i</sub>		Inner Ø D <sub>i</sub>	
16 - 25	+0,190 +0,110	>70 - 85	+0,265 +0,165
>25 - 40	+0,195 +0,115	>85 - 100	+0,275 +0,175
>40 - 50	+0,230 +0,130	>100 - 110	+0,300 +0,175
>50 - 65	+0,240 +0,140	>110 - 120	+0,305 +0,180
>65 - 70	+0,245 +0,145		

Outer Ø D <sub>o</sub>		Outer Ø D <sub>o</sub>	
>16 - 25	+0,090 +0,040	>70 - 85	+0,125 +0,075
>25 - 40	+0,095 +0,045	>85 - 100	+0,135 +0,085
>40 - 50	+0,105 +0,055	>100 - 110	+0,140 +0,090
>50 - 70	+0,115 +0,065	>110 - 120	+0,170 +0,100

## Additional filament-wound materials

### Multifil™ Tape Bearing Material



Tape

#### Structure

PTFE + Proprietary filler system

#### Features

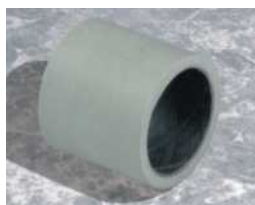
- Vibration-isolating
- Superior sliding bearing material which can be easily bonded to any clean, rigid substrate

**Industrial applications:** Machine tool ways, gibs and other sliding applications

#### Availability:

Tapes of 0,015 - 0,125 inches (0,38 - 3,2 mm) thickness by 12 inches (305 mm) width

### HSG™ Bearing Material



Cylindrical bushes

#### Structure

##### Composite material Sliding Layer

Continuous wound PTFE and high-strength fibres encapsulated in an internally lubricated, high temperature filled epoxy resin.

##### Backing

Continuous wound fiberglass encapsulated in a high temperature epoxy resin.

#### Features

- High static load capacity - twice as high as standard GAR-MAX®
- Excellent shock and misalignment resistance - better than standard GAR-MAX®
- Excellent contamination resistance
- Very good friction and wear properties
- Good chemical resistance

**Industrial applications:** Steering linkages, hydraulic cylinder pivots, king pin bearings, boom lifts, scissor lifts, cranes, hoists, lift gates, backhoes, trenchers, skid steer loaders, front end loaders, etc.

**Availability:** To order: cylindrical standard bushes and special parts

### GAR-FIL®- Bearing Material



Cylindrical bushes

#### Structure

##### Composite material Sliding Layer

Proprietary filled PTFE tape liner, 0,38 mm (0,015 inch) standard thickness, 0,76 mm (0,03 inch) on request.

##### Backing

Continuous wound fiberglass encapsulated in a high temperature epoxy resin.

#### Features

- High load capacity
- Good chemical resistance
- Machinable bearing surface
- High rotational speed capability
- Very good friction and wear properties
- Excellent contamination resistance

**Industrial applications:** Valves, scissor lifts, pulleys, toggle linkages, etc.

**Availability:** To order: cylindrical standard bushes

### MLG™ Bearing Material



Cylindrical bushes

#### Structure

##### Composite material Sliding layer

Continuous wound PTFE and high-strength fibers encapsulated in high temperature epoxy resin

##### Backing verbiage

Continuous wound fiberglass encapsulated in high temperature epoxy resin

#### Features

- Value engineered filament wound bearing for lighter duty applications
- High load capacity
- Good misalignment resistance
- Excellent shock resistance
- Good friction and wear properties
- Good chemical resistance

**Industrial applications:** Construction and earth moving equipment, conveyers, cranes, hoists, hydraulic cylinder pivots, etc.

**Availability:** To order: cylindrical bushes: ID Range: 12 to 150 mm, metric series; 0,5 to 6 inch, inch series. Special order bearing diameters to 500 mm (20 inches); flanged bushes, special parts

Bearing properties		Units	Value: GAR-MAX	Multifil	HSG	GAR-FIL	MLG
Maximum load $\bar{p}$	- static	MPa	210	70	415	140	210
	- dynamic	MPa	140	35	140	140	140
Maximum sliding speed U	- dry	m/s	0,13	2,5	0,13	2,5	0,13
Maximum $\bar{p}U$ factor	- dry	MPa x m/s	1,05	0,32	1,05	1,23	1,05
Maximum temperature $T_{max}$		°C	+160	+280	+160	+205	+160
Minimum temperature $T_{min}$		°C	-195	-200	-195	-195	-195
Shaft surface finish $Ra^*$		$\mu m$	0,15 - 0,40	0,2 - 0,4	0,2 - 0,8	0,4	0,4
Shaft hardness*	- normal - for service life >2000 hours	HB	>350	>200	>350	>200	>350
		HB	>480		>480		

\*Alternative shaft hardnesses and shaft surface finish is possible, depending on the application. Please contact your local GGB representative.

## Additional filament-wound materials

### HPF™ Bearing Material



Strips

#### Structure

**Composite material**  
**Sliding layer**  
 Proprietary filled PTFE tape liner  
**Backing**  
 Continuous woven fiberglass cloth laminate impregnated and cured with epoxy resin

#### Features

- Specifically developed for hydropower applications
- High load capacity
- Excellent shock and edge loading capacity
- Low friction, superior wear rating and bearing life
- Excellent corrosion resistance
- Dimensional stability low water absorption, no swelling
- Environmentally friendly

**Industrial applications:** Sliding segments, linkages, bearings

**Availability:** To order: plates in standard thicknesses of 6, 8, 10 mm; 0,24 - 0,3 - 0,39 inch

### HPM™ Bearing Material



Cylindrical bushes

#### Structure

**Composite material**  
**Sliding layer**  
 Continuous wound PTFE and high-strength fibers encapsulated in a self-lubricating, high temperature epoxy resin  
**Backing**  
 Continuous wound fiberglass encapsulated in a high temperature epoxy resin

#### Features

- Specifically developed for hydropower applications
- High load capacity
- Excellent shock and edge loading capacity
- Low friction, superior wear rating and bearing life
- Excellent corrosion resistance
- Dimensional stability low water absorption, no swelling
- Environmentally friendly

**Industrial applications:** Sliding segments, linkages, bearings

**Availability:** To order: cylindrical bushes up to 500 mm (20 inches)

### MEGALIFE® XT Bearing Material



Thrust washers

#### Structure

**Composite material**  
**Sliding layer**  
 Proprietary filled PTFE tape liner on both sides  
**Core**  
 Continuously woven layer of filament fiberglass encapsulated in a high temperature epoxy resin

#### Features

- Excellent shock resistance
- High load capacity
- Excellent misalignment resistance
- Excellent contamination resistance
- Good surface speed capability
- Very good friction and wear properties
- Good chemical resistance

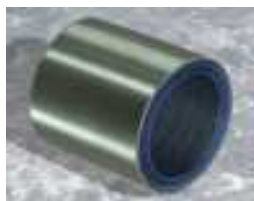
**Industrial applications:** Construction and earth moving equipment, gear and pulley spacers, steering links, valve actuator linkages, lifts, cranes, etc.

**Availability:** To order: thrust washers, standard sizes 12 x 24 mm to 75 x 115 mm and thicknesses of 1,5 - 2,0 - 3,0 mm; ½ x 1 inch to 3 x 4 ½ inches. For special sizes contact GGB.

### SBC™ GGB Sealed Bearing Cartridges



Cylindrical bushes



Cylindrical bushes with steel sleeves

#### Structure

**Composite material with sealing**  
 SBC bearings are available with GAR-MAX and HSG and are sealed to exclude contaminants. SBC are optionally available with a steel outer shell.

#### Features

- Self-lubricating
- High static load capability
- Excellent tolerance to shock loading and misalignment
- Contamination resistant
- Very good friction and wear properties
- Good chemical resistance
- Sealed to exclude contaminants therefore extended service life
- No grease required  
- therefore environmental friendly  
- cost savings by elimination of automated grease system and grease

**Industrial applications:** Steering linkages, hydraulic cylinder pivots, king pin bearings, boom lifts, scissor lifts, cranes, hoists, lift gates, backhoes, trenchers, skid steer loaders, front end loaders, etc.

**Availability:** To order: bushes, optionally available in a steel outer shell

Bearing properties	Units	Value HPF	Value HPM	Value MegalifeXT
Maximum load $\bar{p}$	- static	MPa	140	140
	- dynamic	MPa	140	140
Maximum sliding speed U	- dry	m/s	2,5	0,13
Maximum $\bar{p}U$ factor	- dry	MPa x m/s	1,23	1,23
Maximum temperature $T_{max}$		°C	+140	+160
Minimum temperature $T_{min}$		°C	-195	-195
Shaft surface finish $Ra^*$		$\mu m$	0,15 - 0,40	0,2 - 0,8
Shaft hardness*	- normal	HB	>350	>350
	- for service life >2000 hours	HB	>480	>480

\*Alternative shaft hardnesses and shaft surface finish is possible, depending on the application. Please contact your local GGB representative.

## Product Information

GGB gives an assurance that the products described in this document have no manufacturing errors or material deficiencies. The details set out in this document are registered to assist in assessing the material's suitability for the intended use. They have been developed from our own investigations as well as from generally accessible publications. They do not represent any assurance for the properties themselves.

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Products are subject to continual development. GGB retains the right to make specification amendments or improvements to the technical data without prior announcement.

Edition 2009 (This edition replaces earlier editions which hereby lose their validity).

## Declaration on lead contents of GGB products/compliance with EU law

Since July 1, 2006 it has been prohibited under Directive 2002/95/EC (restriction of the use of certain hazardous substances in electrical and electronic equipment; ROHS Directive) to put products on the market that contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). Certain applications listed in the annex to the ROHS Directive are exempted. A maximum concentration value of 0.01% by weight and per homogeneous material, for cadmium and of 0.1% by weight and per homogeneous material, for lead, mercury, hexavalent chromium, PBB and PBDE shall be tolerated.

According to Directive 2000/53/EC on end-of life vehicles, since July 1, 2003 it has been prohibited to put on the market materials and components that contain lead, mercury, cadmium or

Subject to technical alterations and improvements in the interest of technical progress. Dimensions are specified with tolerances in accordance with ISO and GGB company standards. The specified weights are approximate values. Errors and omissions are expected.

hexavalent chromium. Due to an exceptional provision, lead-containing bearing shells and bushes could still be put on the market up until July 1, 2008. This general exception expired on July 1, 2008. A maximum concentration value of up to 0.1% by weight and per homogeneous material, for lead, hexavalent chromium and mercury shall be tolerated.

All products of GGB in this brochure, with the exception of DU and DUB, satisfy these requirements of Directives 2002/95/EC (ROHS Directive) and 2000/53/EC (End-of-life Vehicle Directive).

All products manufactured by GGB are also compliant with REACH Regulation (EC) No. 1907/2006 of December 18, 2006.

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