

Pacific Marine & Industrial

Composite Bearing Product Manual



Pacific Marine & Industrial
P.O. Box 70520
Richmond, California, United States 94807

www.pacificmarine.net
info@pacificmarine.net

PH: 001-510-233-2310
FX: 001-510-233-2322

Composite Bearing Product Manual

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01.00 Composite Bearing Description

01.01 Materials of Construction

Composite bearings, both cylindrical and flat, are manufactured from synthetic polyester resins combined with fabric that adds strength and durability to the finished product. Combined with the resin is a lubricant that can be changed depending on the application. For marine and hydro bearings PTFE and molybdenum disulfide are commonly used. For industrial bearings graphite is commonly used. Changes can be made depending on the project requirements.

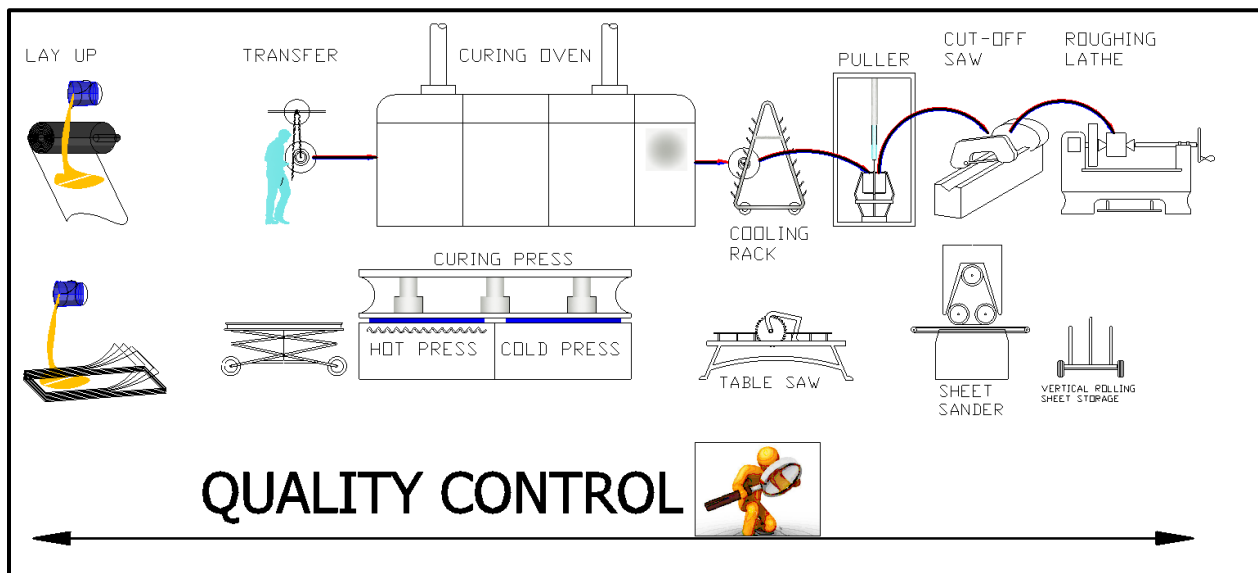
The material displays exceptional dimensional stability when immersed in water, acids and chemical solutions.

These bearings have excellent low friction qualities in wet conditions and provide very low conductivity and will not promote corrosion in unprotected steel housings and shafts.

01.02 Manufacturing Process

The manufacturing process for cylindrical bearings is by wrapping the materials on a mandrel to make the rough bearing followed by a machining process to finish the bearing. This means that bearings can be made of any inside diameter or outside diameter as needed. Sheet of material are also available.

Production time for a bearing, if needed, can be within a working day for an un-machined bearing. Quick delivery is possible if there are time constraints to the project.



01.03 Delivery Condition of the Bearing

Composite bearings can be shipped raw in un-machined condition on the inner diameter, outer diameter or both. Otherwise PM&I can finish machine the bearing to Marine or Industrial or as desired tolerances given the project and installation method. Water lubrication grooves can be machined into the ID of the bearing.

01.04 Common Bearing Uses

MARINE:

Propeller Shaft (Stern Tube and Strut) Bushings and Staves • Rudder Shaft Bushings • Shackle Bushings (Rope Termination Bushings) • Stabilizer Bearings
Deck Machinery Bearings • Steering Gear Bearings • Stern Roller Bearings • Crane Mast Bearings • Tugs and Workboats

HYDRO ELECTRIC GENERATION:

Turbine Main Guide Bearings • Wicket Gate Bearings • Linkage Bearings and Thrust Washers • Servo Motor Bearings • Valve Bearings • Spill Gate Trunnion Bearings • Fish Screen Bearings • Crane/Hoist Bearings • Eccentric Pin Bushings
• Control Gate Bushings and Wear Pads

INDUSTRIAL:

Amusement Park Rides / Water Rides • Fork Lifts and Scissor Lifts • Injection Molding • Assembly Lines • Off Road and Farm Equipment • Railway Applications • Steel Mills • Heavy Lifting Equipment • Process Machinery • Hydraulic Cylinder Wear Rings and Rod Ends • Recycling • Medical Equipment • Water Treatment Plants
• Oil Reclamation

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02.00 Product Images



Bearing Assortment



Bearing Assortment



Thrust Bearing



Fully Split Bearing



Propeller Shaft Bearings



Sheave Rollers

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03.00 Machining Instruction

As a general guide, methods used for brass, aluminum or lignum vitae will apply for PM&I composite bearings.

It is preferable to use tungsten carbide turning tools with cutting speeds of 20 feet (5 meters) per second.

Composite bearings materials must be machined dry without the use of coolant.

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04.00 Fitting Instruction

04.01 Bonding Method

The method of fixture will depend upon the design employed, however the key point to be emphasized is that in addition to traditional mechanical fixing, composite materials can be bonded to both itself and metallic substrates.

If the assembly is to exceed 60-70°C in temperature then interference fitting should be replaced with adhesive fitting.

Numerous adhesives are compatible and have been tested within our laboratory facilities.

Generally the most suitable adhesives are :

- * Epoxies
- * Acrylics
- * Cyanoacrylates
- * Polyurethanes

04.02 Press Fit Method: Hydraulic Press or Centre Pull Jacks

If a bearing is to be press fitted, installers should ensure that they have equipment available to deliver adequate force to press the bearing fully into the housing. The ease of fitting will vary dependent on the finish of the housing and this should be considered when calculating the force required. When press fitting a bearing, it is important that it is in line and square with the bore before the operation begins, an adequate chamfer on the housing will prevent shaving of the bush.

04.03 Freeze Fit Method

Freeze fitting using liquid nitrogen is a fast and efficient assembly method for a composite bearing. The thermal properties of the material allow a good clearance between the bearing and housing when frozen and the material does not become brittle at cryogenic temperatures.

Freeze fitting using dry ice and alcohol will only provide the required clearance when using very light interferences. As such it is rarely a viable method and will often require press fitting as well.

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05.00 Product Datasheets

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05.01 Composite Marine Bearings Datasheet

Composite Marine Bearings

PM&I Composite Marine Bearings are manufactured from synthetic polyester resins and fabric that adds strength and durability to the finished product. The material also displays exceptional dimensional stability when immersed in water, acids and chemical solutions. The lubricants in the Composite Marine Bearing material are PTFE and Molybdenum disulfide. While having excellent low friction qualities in wet conditions, these lubricants also provide very low conductivity and will not promote corrosion in unprotected steel housings and shafts.

Mechanical Properties	METRIC	IMPERIAL
Compressive Strength Normal to Laminate	345 N/mm²	50,000 lb./in²
Compressive Strength Parallel to Laminate	97 N/mm²	14,000 lb./in²
Shear Strength	80 N/mm²	11,603 lb./in²
Tensile Strength	55 N/mm²	8,000 lb./in²
Elastic Modulus Bending	.18 x 10⁴ N/mm²	26.11 x 10⁶ lb./in²
Elastic Modulus Tensile	.32 x 10⁴ N/mm²	46.41 x 10⁶ lb./in²
Hardness Rockwell M	100	100
Density	1.32 g/cm³	.047 lb/in³
Swell in Water (% wall thickness increase after one year submerged)	< 0.1%	< 0.1%
Static Coefficient of Friction (dry)	0.15	0.15

Thermal Properties

Linear Expansion Coefficients:

(20-100°C (per °C x 10⁻⁵) 86-212°F (per °F X 10⁻⁵))

Parallel To Laminate	5 – 6	2.7– 3.5
Normal To Laminate	9 – 10	5 – 6

The above values are typical

The information in this data sheet is based on many years of experience in the manufacture and application of composite bearings. However, unknown parameters and conditions may restrict general statements during usage. It is vital that Customers satisfy themselves as to the suitability of individual products through adequate testing. For this reason, and due to the wide range of applications we can accept no liability as to the suitability or correctness of our recommendations in individual cases. The application limits for pressure, temperature and speed given in this data sheet are maximum values and must be set correspondingly lower. For exceptional operating conditions, please contact us.

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05.02 Composite Hydro Bearings Datasheet

Composite Hydro Bearings

PM&I Composite Hydro Bearings are manufactured from synthetic polyester resins and fabric that adds strength and durability to the finished product. The material also displays exceptional dimensional stability when immersed in water, acids and chemical solutions. The lubricants in the Composite Hydro bearing material are PTFE and Molybdenum disulfide. While having excellent low friction qualities in wet conditions, these lubricants also provide very low conductivity and will not promote corrosion in unprotected steel housings and shafts.

Mechanical Properties	METRIC	IMPERIAL
Compressive Strength Normal to Laminate	345 N/mm²	50,000 lb./in²
Compressive Strength Parallel to Laminate	97 N/mm²	14,000 lb./in²
Shear Strength	80 N/mm²	11,603 lb./in²
Tensile Strength	55 N/mm²	8,000 lb./in²
Elastic Modulus Bending	.18 x 10⁴ N/mm²	26.11 x 10⁴ lb./in²
Elastic Modulus Tensile	.32 x 10⁴ N/mm²	46.41 x 10⁴ lb./in²
Hardness Rockwell M	100	100
Density	1.32 g/cm³	.047 lb/in³
Swell in Water (% wall thickness increase after one year submerged)	< 0.1%	< 0.1%
Static Coefficient of Friction (dry)	.05-.10	.05-.10

Thermal Properties

Linear Expansion Coefficients:

(20-100°C (per °C x 10⁻⁵) 86-212°F (per °F X 10⁻⁵))

Parallel To Laminate	5 – 6	2.7– 3.5
Normal To Laminate	9 – 10	5 – 6

The above values are typical

The information in this data sheet is based on many years of experience in the manufacture and application of composite bearings. However, unknown parameters and conditions may restrict general statements during usage. It is vital that Customers satisfy themselves as to the suitability of individual products through adequate testing. For this reason, and due to the wide range of applications we can accept no liability as to the suitability or correctness of our recommendations in individual cases. The application limits for pressure, temperature and speed given in this data sheet are maximum values and must be set correspondingly lower. For exceptional operating conditions, please contact us.

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05.03 Composite Industrial Bearings Data Sheet

Composite Industrial Bearings

PM&I Composite Industrial Bearings are manufactured from synthetic polyester resins and fabric that adds strength and durability to the finished product. The material also displays exceptional dimensional stability when immersed in water, acids and chemical solutions. Graphite is the lubricant used in the Composite Industrial bearing material offering very low friction values.

<u>Mechanical Properties</u>	<u>METRIC</u>	<u>IMPERIAL</u>
Compressive Strength Normal to Laminate	345 N/mm²	50,000 lb./in²
Compressive Strength Parallel to Laminate	97 N/mm²	14,000 lb./in²
Shear Strength	80 N/mm²	11,603 lb./in²
Tensile Strength	55 N/mm²	8,000 lb./in²
Elastic Modulus Bending	.18 x 10⁴ N/mm²	26.11 x 10⁴ lb./in²
Hardness Rockwell M	100	100
Density	1.32 g/cm³	.047 lb/in³
Swell in Water (% wall thickness increase after one year submerged)	< 0.1%	< 0.1%
Static Coefficient of Friction (dry) <small>(15 N/mm² at 1 meter/minute against 316 Stainless Steel)</small>	.13-.16	.13-.16

Thermal Properties

Linear Expansion Coefficients:

(20-100°C (per °C x 10⁻⁵) 86-212°F (per °F X 10⁻⁵)

Parallel To Laminate	5 – 6	2.7 – 3.5
Normal To Laminate	9 – 10	5 – 6

The above values are typical

The information in this data sheet is based on many years of experience in the manufacture and application of composite bearings. However, unknown parameters and conditions may restrict general statements during usage. It is vital that Customers satisfy themselves as to the suitability of individual products through adequate testing. For this reason, and due to the wide range of applications we can accept no liability as to the suitability or correctness of our recommendations in individual cases. The application limits for pressure, temperature and speed given in this data sheet are maximum values and must be set correspondingly lower. For exceptional operating conditions, please contact us.

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06.00 Composite Bearing Submerged Swell Testing

PM&I Composite Bearing Submerged Swell Testing

	Initial sizes (mm)			24 Hours			48 Hours			3 Months			6 Months			9 Months			12 Months		
Indust	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3
#1	37.24	37.25	37.16	37.21	37.24	37.15	37.20	37.25	37.16	37.23	37.26	37.16	37.24	37.26	37.17	37.24	37.27	37.17	37.24	37.26	37.17
#2	37.35	37.18	37.26	37.34	37.17	37.25	37.35	37.18	37.25	37.37	37.19	37.27	37.38	37.19	37.27	37.38	37.19	37.27	37.38	37.19	37.27
#3	37.37	37.16	37.24	37.33	37.16	37.23	37.34	37.16	37.24	37.37	37.18	37.24	37.38	37.18	37.25	37.38	37.18	37.25	37.38	37.18	37.24
#4	37.32	37.15	37.25	37.30	37.14	37.23	37.31	37.15	37.24	37.34	37.15	37.25	37.32	37.15	37.25	37.32	37.15	37.25	37.33	37.15	37.25
#5	37.22	37.15	37.19	37.22	37.15	37.19	37.22	37.15	37.20	37.24	37.15	37.21	37.25	37.15	37.21	37.24	37.15	37.21	37.24	37.15	37.21
Hydro	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3
#1	37.23	37.08	36.96	37.22	37.06	36.97	37.22	37.08	36.98	37.22	37.06	36.97	37.23	37.08	36.97	37.23	37.08	36.98	37.22	37.08	36.98
#2	37.19	36.98	37.04	37.20	36.96	37.03	37.19	36.98	37.04	37.20	36.98	37.04	37.20	36.97	37.04	37.20	36.98	37.04	37.20	36.98	37.04
#3	37.24	37.01	36.86	37.23	37.01	36.86	37.24	37.01	36.87	37.23	37.01	36.87	37.23	37.01	36.88	37.24	37.01	36.87	37.24	37.01	36.87
#4	37.20	36.95	37.05	37.17	36.94	37.06	37.18	36.96	37.05	37.19	36.96	37.05	37.19	36.96	37.07	37.19	36.96	37.05	37.19	36.96	37.05
#5	37.21	37.02	37.06	37.20	37.00	37.05	37.21	37.03	37.05	37.21	37.03	37.05	37.22	37.03	37.05	37.21	37.02	37.05	37.22	37.02	37.05
Marine	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3
#1	37.41	37.13	36.98	37.41	37.13	36.99	37.41	37.15	37.00	37.45	37.16	37.00	37.45	37.16	37.01	37.45	37.15	37.01	37.45	37.16	37.01
#2	37.37	37.15	36.99	37.37	37.15	37.00	37.37	37.16	37.00	37.42	37.17	37.01	37.43	37.17	37.01	37.43	37.17	37.01	37.43	37.17	37.01
#3	37.38	36.92	37.12	37.37	36.92	37.16	37.38	36.93	37.14	37.42	36.96	37.14	37.42	36.96	37.15	37.42	36.96	37.14	37.42	36.96	37.15
#4	37.32	37.17	37.00	37.32	37.17	37.00	37.32	37.17	37.01	37.36	37.17	37.01	37.36	37.18	37.01	37.36	37.17	37.01	37.36	37.17	37.01
#5	37.28	37.03	37.16	37.27	37.03	37.16	37.28	37.03	37.16	37.30	37.04	37.17	37.31	37.04	37.16	37.30	37.05	37.18	37.30	37.05	37.17
	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3	Msmt 1	Msmt 2	Msmt 3
#1																					
#2																					
#3																					
#4																					
#5																					

*All measurements done in metric

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