Hydro Industry
Self Lubricated Bearing & Wear Materials
Laminate Composites

www.cipcomposites.com
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CIP Composites™

CIP Composites™ are laminated polyester based materials with solid lubrication additives evenly dispersed throughout the material. Specific material grades are based on the combination of textile, resin and lubrication additive (PTFE, graphite and/or moly).

This combination of textile, resin and solid lubrication creates a self-lubricating bearing & wear material with low coefficients of friction and wear rates.

Primarily used in high load, low speed bearing & wear applications, CIP Composites™ eliminate external lubrication systems and are ideal for replacing bronze, wood and urethane materials.

Applications

- Hydro Power
- Locks & Dams
- Fish Ladders
**Benefits & Advantages**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Advantages</th>
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<tbody>
<tr>
<td>Self lubricated</td>
<td>Solid lubricants dispersed evenly throughout material</td>
</tr>
<tr>
<td>100% Bearing Material</td>
<td>Lubricated completely throughout the bearing; no fiberglass or metallic shell</td>
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<tr>
<td>Low Maintenance</td>
<td>Reduction or elimination of external lubrication systems</td>
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<tr>
<td>Wet or Dry Running</td>
<td>Dimensionally stable in salt or fresh water environments; dry and/or dirty environments</td>
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<tr>
<td>Low Coefficient of Friction</td>
<td>Elimination of stick-slip; better operating efficiency</td>
</tr>
<tr>
<td>Low Wear Rate</td>
<td>Extends operating life</td>
</tr>
<tr>
<td>High Edge Load / High Shock Load Capacities</td>
<td>Stable where side loading is anticipated; and where slight misalignment is present without damage or fracture</td>
</tr>
<tr>
<td>Low Thermal Expansion Rate</td>
<td>Dimensionally stable in high temperatures; predictable expansion</td>
</tr>
<tr>
<td>Negligible Water Swell</td>
<td>&lt;0.15% length/breadth/thickness</td>
</tr>
<tr>
<td>Easy to Machine</td>
<td>Machinable in place; does not contain toxic/harmful materials</td>
</tr>
<tr>
<td>Chemically Resistant</td>
<td>Stable in many chemical solutions</td>
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<tr>
<td>Non-Metallic</td>
<td>Resistant to chemical corrosion</td>
</tr>
<tr>
<td>Non-Conducting</td>
<td>Electrical insulator (non-graphite grades)</td>
</tr>
<tr>
<td>Light Weight</td>
<td>High strength - to - weight ratio</td>
</tr>
<tr>
<td>Easy Installation</td>
<td>Press, glue, freeze or fasten</td>
</tr>
<tr>
<td>Custom Manufactured</td>
<td>Made to your specifications</td>
</tr>
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**Discover the benefits... of composite bushings**

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**Replace Bronze & Graphite Plugged Bronze**

CIP Composites™ are ideal for replacing traditional bronze and graphite plugged bronze bushings. Metallic bearings require a consistent film of external lubrication for operation. CIP Composites™ can reduce or eliminate external lubrication systems with its self-lubricating properties.

Graphite plugged bronze bushings rely on full rotational movement to create an even lubrication layer. In slow oscillating applications, the lubrication layer may be uneven or non-existent and high friction or stick-slip can become a concern. CIP’s even distribution of lubrication additives allows for low dynamic and static coefficients of friction, eliminating stick-slip.
**Custom Products**

Custom components can be manufactured to customers’ drawings from all grades of CIP Composites™. Parts requiring hex, square or most irregular ID shapes can be produced. Sphericals with stainless steel balls, threaded components and many other special products can be fabricated.

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**Manufacturing Capabilities**

**Machining**

CIP offers a complete machine shop on location, including state of the art CNC machines. We provide live tooling functionality and 4th axis capability, along with a CNC router table for quick production of custom parts. We have an array of manual lathes which allows us to turn parts up to 54 inch (1371mm) diameter.

**Latest Technology**

CIP places high priority in the investment of quality machines, hardware and software to provide cutting edge technology for its workforce. This includes formal training, support services, and equipment maintenance to maximize the transfer of benefits to finished products and customers. These efforts enable CIP to achieve the high level of efficiency that our markets and customers demand.

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**Standard Shapes**

**Tubes**
- Minimum Bore ..........3/8 inches (9.5mm)
- Maximum Bore ..........60 inches (1524mm)
- Standard Lengths .........16” - 24” - 32”
  (406mm – 609mm – 812mm)

**Sheets**
- Minimum Thickness ......1/16 inches (1.6mm)
- Maximum Thickness ......6 inches (152.4mm)
- Standard Widths ............16” – 24” – 32” (406mm – 609mm – 812mm)
- Standard Lengths ............24” – 36” – 48” – 60”
  (609mm – 914mm – 1219mm – 1524mm)

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**Custom Products**

Custom components can be manufactured to customers’ drawings from all grades of CIP Composites™. Parts requiring hex, square or most irregular ID shapes can be produced. Sphericals with stainless steel balls, threaded components and many other special products can be fabricated.
Physical Properties

Compressive Strength (ASTM D695)
- Ultimate: 50,000 PSI (345 MPa)
- Yield: 15,000 PSI (103 MPa)
- Parallel: 13,500 PSI (93 MPa)
- Modulus: 500,000 PSI (3,447 MPa)

Tensile Strength (ASTM D638): 11,000 PSI (75 MPa)
Tensile Modulus of Elasticity (ASTM D638): 470,000 PSI (3,240 MPa)
Poisson’s Ratio (ASTM D3039-08): 0.231
Shear Strength (ASTM D2344): 12,000 PSI (82 MPa)
Flexural Modulus of Elasticity (ASTM D790): 260,000 PSI (1,793 MPa)
Hardness Rockwell M (ASTM D785): 100
Density (ASTM D792): 0.047 lbs/in³ (1.3g/cm³)
Water Swell (ASTM D570): <0.15%

Mechanical Properties

Coefficients of Friction
- CIP 121: 0.15 - 0.20
- CIP 151: 0.13 - 0.15
- CIPHydro™: 0.05 - 0.09

COF vary with application shaft material, surface finish, load, speed, environment and external lubrication.

Electrical Properties

Dielectric Strength (ASTM D149-97a): 200 volts / mil
Volume Resistivity (ASTM D257-07): 4.2x10¹⁵ ohm-cm

Thermal Properties

CIP 001 & 002 Resin
- Operating Temperatures: -40° to 200° F (-40° to 93° C)
- Coefficient of Thermal Expansion: 68° to 200° F (20° to 93° C)
- Normal to Laminate: 3.5 x 10⁻⁵ /°F (6.3 x 10⁻⁶ /°C)
- Parallel to Laminate: 1.8 x 10⁻⁵ /°F (3.2 x 10⁻⁶ /°C)

Note: Data should be used as reference. Consult with CIP directly to evaluate specific application requirements.

Common Materials

CIP Hydro™
Ideal for high load, oscillating applications where low friction is critical.
Commonly used:
- Wicket Gate Stem Bushings
- Spillway Trunnions
- Operating Ring Wear Pad

CIP151A
Ideal for high load applications with wet or dry operation where friction is less critical.
Commonly used:
- Navigation Lock Bushings
- Vertical Gates
- Sheave Bushings

CIPMarine™
Ideal for water lubricated bearings or completely submerged applications.
Commonly used:
- Main Guide Bearings
- Main Guide Staves

CIP131A
Ideal for less critical applications that operate in wet or dry conditions.
Commonly used:
- Sluice Gates
- Servomotor Cylinder Wear Rings
Installation Methods

Counter Surface
The counter surface finish of the mating operating component has a major effect on the performance of the composite. Surface finish should ideally be 32 RMS (0.7 µm) and HRC 40. Suitable materials for shafts, thrust faces, etc., would be hardened steels or stainless. All mating surface should be free from cutting edges and lubrication grooves or holes. **Note:** 

Hard chrome plated steel surfaces can cause high wear rates under certain conditions, and burnishing or other surface finish treatments should be considered as an alternative.

External Lubrication
CIP Composites™ can be used with external lubricants if desired. We can custom design bearings and wear pads with lubrication grooves for water, grease or oil. Although most lubricants will not harm CIP Composites™, we recommend the use of synthetics.

Bearings & Wear Pads
CIP Composite™ bearings can be designed for press-fit, freeze-fit or glue-in installation. Shoulders, bolt on rings, other rings, or keepers can be used to prevent the bearing from moving over time. Flat components such as wear pads can be retained by countersunk screws or metal inserts and located by keeper plates where high lateral or shearing loads are anticipated.

Press-Fit
Bearings should be fully supported over their loaded area, with uniform interference fit. A suitable lead-in chamfer should be provided in the housing and on the bearing diameter to assure proper start. We can suggest an estimated amount of force to make sure there is adequate power available.

Freeze-Fit
Bearings do not become brittle during the freezing process. Liquid nitrogen is the most efficient method; in some cases dry ice or refrigeration may be used. Once bearing is frozen, and outer diameter is smaller than housing, block or hold the bearing in place. As the bearing returns to normal temperature it will increase in size and the proper interference with the housing will be obtained.

Glue-In
CIP Composites™ inherently bond with adhesives exceptionally well. Bearings can be designed for glue-in installation with a minimum clearance of 0.005” (0.127mm). During installation, bearings should be retained on top and bottom. Wear pads can be retained with adhesives to many metallic surfaces. We can recommend adhesives. Contact us for more information.
On Site Engineering Support
The engineering staff on site provides technical assistance and application engineering services for our customers. Utilizing the most up-to-date software programs the engineers are able to provide valuable design support efficiently, and in formats used most common with the industry. Design prints, 3D models and visual renderings can all be shared and utilized to promote effective communication. CIP has developed a calculation program that quickly and consistently explains critical information to customers in a pdf format.

Resources Page Online
The CIP website (Resources Page) has links for downloading the CIP Engineering Manual and all Brochures/Catalogs (translations can be found here as well).

Request For Quotation
Quote requests can be made on the website form directly, or by email: sales@cipcomposites.com. Application Questions can be found on the Resources Page and submitted by email for a new RFQ. This information helps CIP evaluate requests more efficiently and effectively.

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