Self Lubricated Bearing & Wear Materials
Laminate Composites

www.cipcomposites.com
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Columbia Industrial Products (CIP) is a global manufacturer of custom composite bearing materials. CIP Composites™ offer the highest quality self lubricated bearing materials with exceptional mechanical and physical properties. Across the globe, customers turn to CIP when they require high performance composite products.

Location

CIP manufactures all materials in Eugene, Oregon USA. We are located just 100 miles south of the International Port of Portland, Oregon making marine and air shipments both cost effective and timely.

CIP’s Mission

We strive to be the dominant player for the diversified markets in which we design, manufacture, distribute and supply high quality, reliable laminate composite materials; to exceed our customer’s expectations by providing superior customer service and honest relationships with a high level of integrity.

To provide our experienced employees with the highest level of technical knowledge, skills and training necessary to provide superior products and services to our customers, suppliers and distributors.

Quality Statement

CIP is dedicated to providing the highest quality products with a focus on exceeding requirements. We strive for complete customer satisfaction through continuous improvement in service and quality.
Global Service

CIP Composites™ are available globally with local distribution in more than 10 countries.

CIP is the industry leader in responsiveness, with quick turn around times and top of the line technical support. Customers turn to CIP when time is critical and they need proven, reliable service.

Distribution Support

Distribution lines are strategically placed throughout the world to better support customers regionally. Our established distributors are highly reputable and well known in their industries. We work closely with our distributors in conjunction with customers to provide exceptional service and support of CIP Composites™.

Quick Lead Times

CIP is the industry leader providing both large and custom sizes with quick turn around times. Customers trust in CIP for fast response and short lead times.

Industry Edge

In addition to offering customers high quality composites, CIP continues to have the largest size capabilities, offering up to 60 inch (1524mm) diameter tubes and sheets up to 6 inches (152mm) thick.

We are continuously working on industry classifications, new product development and new applications.

One Group, 
One Location, 
Reaching Globally.
CIP Composites™ commonly replace bronze, brass, babbitt, nylon and wood bearings. In high load applications, CIP Composites™ replace other plastics that fail at high pressure. Ideal for high load, slow speed applications.

**Benefits**

**Advantages**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Advantages</th>
</tr>
</thead>
<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>
</tr>
<tr>
<td>Low Maintenance</td>
<td>Reduction or elimination of external lubrication systems</td>
</tr>
<tr>
<td>Wet or Dry Running</td>
<td>Dimensionally stable in salt or fresh water environments; dry and/or dirty environments</td>
</tr>
<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>
</tr>
<tr>
<td>Non-Metallic/Non- Conducting (non-graphite grades)</td>
<td>Resistant to chemical corrosion; electrical insulator</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>
</tbody>
</table>
Common Applications

- Butterfly valve bushings
- Bridge pivot wear pads
- Control gate bearings
- Fish screen bearings
- Miter gate bearings
- Operating ring wear pads
- Running blade adjuster bearings
- Screen bearings & wear pads
- Servo motor wear rings
- Trash rake bearings & wear pads
- Trunnion bushings
- Vertical shaft bearings
- Wicket gate bushings
- Wicket gate linkage bearings
- Wicket gate thrust washers

Hydro Power

- Rudder bearings
- Stern tube / strut bearings
- Fin stabilizer bearings
- Propeller shaft bushings
- Pintle bearings
- Side thruster bearings
- Slip way pads
- Guide strips
- Fairleads
- Sheave bushings
- Submersible ROV’s

Marine - Offshore

- Turbo drill head bearings
- Buoy anchor pin bearings
- Stinger rollers
- Tanker mooring systems
- Hydrodynamic excavators
- Windlass
- Jack lift bearings
- Drill string support pivots
- Fairleads
- Sheave bushings
- Chain guards
- Mooring buoy thrust segments
- Downhole oil tools

Oil & Gas

- Automotive lift & carry system bearings
- Amusement park plain bushings
- Dump bed pivot bearings
- Earth moving equipment
- Fire truck wear pads & bearings
- Forklift mast bearings
- Hydraulic cylinder wear rings
- Paper mill journal bearings
- Pump bearings
- Injection molding machines
- Kiln cart bearings

Various Industrial

- Automotive lift & carry system bearings
- Amusement park plain bushings
- Dump bed pivot bearings
- Earth moving equipment
- Fire truck wear pads & bearings
- Forklift mast bearings
- Hydraulic cylinder wear rings
- Paper mill journal bearings
- Pump bearings
- Injection molding machines
- Kiln cart bearings
CIP Composites™

Manufactured as tubes and sheets, then custom machined to a variety of finished products.

Manufacturing Capabilities

- **Wear Rings**
- **Wear Pads**
- **Flange Bearings**
- **Thrust Washers**
- **Sleeve Bearings**
  - Plain Bushings
  - Journal Bearings
- **Thermal & Electrical Isolators**

**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. Spherical bearings with stainless steel balls, threaded components and many other custom products can be fabricated.
Manufacturing Capabilities

Standard Shapes

Tubes
- Minimum Bore .............1/2 inches (12.7mm)
- 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
- Standard Widths ..........16” – 24” – 32” (406mm – 609mm – 812mm)
- Standard Lengths .............24” – 36” – 48” – 60”
  (609mm – 914mm – 1219mm – 1524mm)

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 the finished product. These efforts enable CIP to achieve the high level of efficiency that our markets and customers demand.

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.
CIP Composites™ are laminated polymer materials made by impregnating textiles with thermosetting resins. Solid lubricants are added to the resin to provide evenly dispersed lubrication throughout the material, inherently eliminating the need for external lubrication. CIP offers customers an array of different textile, lubricant and resin combinations. We determine the best combination based on application criteria and environment.

CIP Composites™ are represented by three (3) digits based on the chosen textile, lubricant and resin. For example: CIP151

Note: Enhancement A™ or Enhancement B™ are optional additives that increase the overall strength, reduce friction and wear. Available with all material grades, i.e. CIP151A.

<table>
<thead>
<tr>
<th>Textile</th>
<th>Lubricant</th>
<th>Resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Polyester</td>
<td>0 None</td>
<td>Light Pink 1 Standard Polyester</td>
</tr>
<tr>
<td>2 PTFE/Poly combination</td>
<td>1 Graphite</td>
<td>Grey 2 Marine</td>
</tr>
<tr>
<td>3 Nomex®</td>
<td>2 Moly (MoS₂)</td>
<td>Grey 3 High Temp Vinyl Ester</td>
</tr>
<tr>
<td>3 PTFE</td>
<td>Light Pink</td>
<td></td>
</tr>
<tr>
<td>4 Graphite &amp; PTFE</td>
<td>Grey</td>
<td></td>
</tr>
<tr>
<td>5 Moly &amp; PTFE</td>
<td>Grey</td>
<td></td>
</tr>
</tbody>
</table>

Left: Polyester
Middle: PTFE/Polyester
Right: Nomex®

Bottom: Raw tube surface; direct from oven
Middle: Rough turned surface
Top: Finished machined surface
<table>
<thead>
<tr>
<th>What’s it called?</th>
<th>What’s in it?</th>
<th>Where to use it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CIP Hydro™</strong></td>
<td>Polyester/PTFE Textile Proprietary Lubrication Polyester Resin</td>
<td>Ideal for situations requiring the lowest possible friction without grease. Developed for hydroelectric applications. Tested by Power Tech Labs</td>
</tr>
<tr>
<td><strong>CIP Marine™</strong></td>
<td>Polyester Textile Proprietary Lubrication Marine Resin</td>
<td>For marine environments, typically used as strut bearings and rudder bushings. Marine Class Type Approved</td>
</tr>
<tr>
<td><strong>CIP 151A</strong></td>
<td>Polyester Textile PTFE &amp; Moly Lubrication Polyester Resin Enhancement A™</td>
<td>Used in wet and/or dry situations offering excellent strengths; great option for low friction and wear rate.</td>
</tr>
<tr>
<td><strong>CIP 131</strong></td>
<td>Polyester Textile PTFE Lubrication Polyester Resin</td>
<td>For applications requiring PTFE only. Additional color options may be available.</td>
</tr>
<tr>
<td><strong>CIP 121</strong></td>
<td>Polyester Textile Moly Lubrication Polyester Resin</td>
<td>Used for general industrial applications in wet and/or dry environments.</td>
</tr>
<tr>
<td><strong>CIP 111</strong></td>
<td>Polyester Textile Graphite Lubrication Polyester Resin</td>
<td>Low friction without grease, used primarily in environments with no moisture present (dry).</td>
</tr>
<tr>
<td><strong>CIP 101</strong></td>
<td>Polyester Textile No Lubrication Polyester Resin</td>
<td>For static situations requiring high load capability and a light weight material; commonly used as electrical insulators.</td>
</tr>
<tr>
<td><strong>CIP 251A</strong></td>
<td>Polyester/PTFE Textile PTFE &amp; Moly Lubrication Polyester Resin Enhancement A™</td>
<td>For situations where low friction is critical, excellent for oscillating motion in wet or dry environments.</td>
</tr>
<tr>
<td><strong>CIP 333A</strong></td>
<td>Nomex® Textile PTFE Lubrication Vinyl Ester Resin Enhancement A™</td>
<td>For chemical/corrosive environments or high temperatures up to 400° F (204°C) when requiring low friction and high load capability.</td>
</tr>
</tbody>
</table>
Physical Properties

Tests performed on CIP100 Series sheet material.

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
CIP 251 ......................................................... 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 1 & 2 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 /Δ°F 6.3 x 10⁻⁵ /Δ°C
Parallel to Laminate ............................... 1.8 x 10⁻⁵ /Δ°F 3.2 x 10⁻⁵ /Δ°C

CIP 3 Resin
Operating Temperatures ......................... -40° to 400° F -40° to 204° C
Coefficient of Thermal Expansion .............. 68° to 400° F 20° to 204° C
Normal to Laminate ................................. 4.0 x 10⁻⁵ /Δ°F 7.2 x 10⁻⁵ /Δ°C
Parallel to Laminate ............................... 2.0 x 10⁻⁵ /Δ°F 3.6 x 10⁻⁵ /Δ°C
Electrical & Magnetic Materials

Certain grades of CIP Composites™ are excellent insulating materials and may be used in a number of different electrical applications. Non-graphite materials offer customers both a non-conducting and non-magnetic composite that does not build up static charges. **Note:** *If a magnetic material is desired, we can provide options with graphite filled composites.*

Thermal Properties

For operating temperatures exceeding Series 1 & 2 resin grades, use Series 3 for operating up to 400° F (204°C). Additionally, Series 3 (High Temp) resin offers better chemical resistance compared to Series 1 & 2.

As is common with all resin bonded textiles, CIP Composites™ are thermal insulators. Under normal circumstances frictional heat is removed via the mating metal surface. The removal of frictional heat may be improved, particularly in dry running applications, by using the housing for additional heat dissipation. The wall thickness of bearings should be kept to a minimum in order to improve heat conduction. However, in cases where shafts or housings are conducting heat to the bearing assembly, a lubricant may be necessary to aid in the removal of heat.

Although thermal expansion of CIP Composites™ are greater than that of most metal alloy bearings; it is consistent, predictable and less than many other plastics. Expansion must be taken into account for application operating in higher than ambient temperature. For applications where there will be a temperature change greater than 60° F (15°C), please consult with us for recommended running clearance.

Chemical Resistance

CIP Composites™ do not corrode and are unaffected by many solvents, inorganic solutions, fats and weak acids. It should be noted that water and chemical liquids often act as lubricants on the material. This may enhance the overall performance and therefore eliminate many of the problems commonly encountered with metal bearings. Composites are attacked by ketones, chlorinated solvents, strong alkalis, and hot strong oxidizing agents.
Machining

CIP Composites™ are readily machinable by conventional machining techniques. As a general guide they may be treated as bronze, but machined (dry) without coolant. CIP materials are non-toxic, although it is advisable to use adequate dust extraction when machining.

For turning, tungsten carbide-tipped tools should be used to obtain a fine finish. High speed steel tools can be used for machining where accuracy below 0.005 in. (0.12mm) is not required and for small quantity production.

Installation Methods

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. The amount of force can be suggested to make sure there is adequate power available.
**Freeze-Fit**
Bears 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 ambient 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 directly for more information.

**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 16 - 32 RMS (0.4 - 0.7 micro meters) 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.

**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.
Online

www.cipcomposites.com
www.cipmarine.com
www.ciphydro.com

Electronic Downloads

The Resources Page on the website has links for downloading: Engineering Manuals (general and marine), and all Brochures/Catalogs: translations can be found here as well.

Request For Quotation

Requests can be made on the website form directly, or by e-mail: sales@cipcomposites.com. Application Questions: found on the Resources page and submitted by e-mail for a new RFQ. This information helps CIP evaluate requests more efficiently and effectively.

Industry Certifications

CIP holds industry certifications such as Marine Type Approvals (American Bureau of Shipping: ABS). Certificates can be found on the Resources page of the website. If the desired certificate is not found, please contact CIP directly for more information.

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