



# CIP Composites™

Catalog



**HYDRO POWER**



**MARINE**



**OIL & GAS**



**INDUSTRIAL**

**LAMINATE COMPOSITE MATERIALS  
CIP BEARINGS & WEAR PADS**

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# Columbia Industrial Products

**Established in 1998**, 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.

## **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 Assurance**

Our state of the art manufacturing facility is ISO compliant which allows us to consistently produce exceptional materials. Annual audits are performed by multiple organization on a regular basis.

Our materials are produced by highly trained personnel with over 100 years of combined history in manufacturing composites and industry experience.

## **Quick Lead Times**

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

We are continuously improving our processes to exceed our customer's demands.

## Global Service

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

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



## Markets and Applications

CIP is experienced and well known in a number of markets and continues to expand available products.

CIP has in depth knowledge of many applications over a wide range of industries. We pride ourselves in working closely with customers to understand the details of their application and offer solutions.

## Industry Edge

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

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

## Markets Served

- Industrial
- Oil & Gas
- Marine
- Hydro

## Standard Products

- Bearings/Bushings
- Thrust Washers
- Wear Pads
- Wear Rings



# Benefits

**CIP Composites™** commonly replace bronze, brass, babbitt and wood bearings. In high load applications, CIP Composites™ replaces other plastics that fail at high pressure. Ideally in high load, slow speed applications.

## **Sleeve Bearings/Plain Bushings - Thrust Washers Wear Pads - Wear Rings**

### **BENEFITS**

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

# Common Applications



Hydro	Marine
<ul style="list-style-type: none"> <li>Butterfly valve bushings</li> <li>Bridge pivot wear pads</li> <li>Control gate bearings</li> <li>Fish screen bearings</li> <li>Miter gate bearings</li> <li>Operating ring wear pads</li> <li>Running blade adjuster bearings</li> <li>Screen bearings &amp; wear pads</li> <li>Servo motor wear rings</li> <li>Trash rake bearings &amp; wear pads</li> <li>Trunnion bushings</li> <li>Vertical shaft bearings</li> <li>Wicket gate bushings</li> <li>Wicket gate linkage bearings</li> <li>Wicket gate thrust washers</li> </ul>	<ul style="list-style-type: none"> <li>Rudder bearings</li> <li>Stern tube / strut bearings</li> <li>Fin stabilizer bearings</li> <li>Propeller shaft bushings</li> <li>Pintle bearings</li> <li>Side thruster bearings</li> <li>Slip way pads</li> <li>Guide strips</li> <li>Fairleads</li> <li>Sheave bushings</li> <li>Submersible ROV's</li> </ul>
Oil & Gas	Various Industrial
<ul style="list-style-type: none"> <li>Turbo drill head bearings</li> <li>Buoy anchor pin bearings</li> <li>Stinger rollers</li> <li>Tanker mooring systems</li> <li>Hydrodynamic excavators</li> <li>Windlass</li> <li>Jack lift bearings</li> <li>Drill string support pivots</li> <li>Fairleads</li> <li>Sheave bushings</li> <li>Chain guards</li> <li>Mooring buoy thrust segments</li> <li>Downhole oil tools</li> </ul>	<ul style="list-style-type: none"> <li>Automotive lift &amp; carry system bearings</li> <li>Amusement park plain bushings</li> <li>Dump bed pivot bearings</li> <li>Earth moving equipment</li> <li>Fire truck wear pads &amp; bearings</li> <li>Forklift mast bearings</li> <li>Hydraulic cylinder wear rings</li> <li>Paper mill journal bearings</li> <li>Pump bearings</li> <li>Injection molding machines</li> <li>Kiln cart bearings</li> </ul>





# Manufacturing Capabilities

**CIP Composites™** are manufactured as tubes and sheets then custom machined to a variety of different finished products.



**Sleeve Bearings**  
*Plain Bushings*  
*Journal Bearings*



**Flange Bearings**



**Thrust Washers**



**Wear Rings**



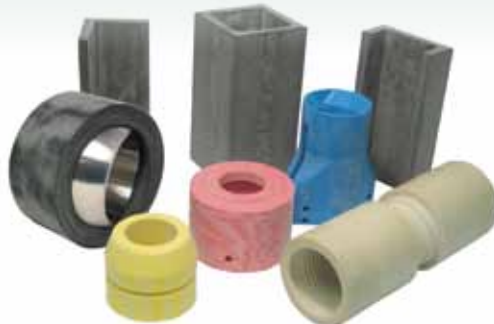
**Thermal & Electrical Isolators**



**Wear Pads**

## 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.



# Manufacturing Capabilities



## Standard Shapes

### Tubes

Minimum Bore .....3/8" (9.5mm)

Maximum Bore.....60" (1524mm)

Standard Lengths.....16" - 24" - 32" (406mm – 609mm – 812mm)

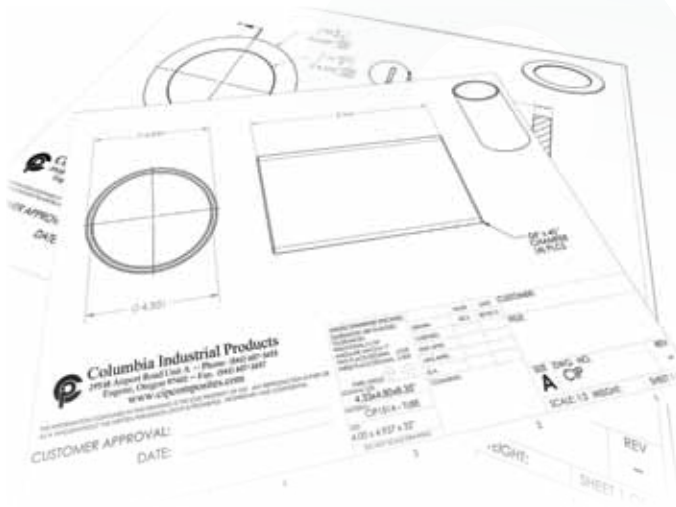
### Sheets

Minimum Thickness .....1/16" (1.6mm)

Maximum Thickness.....2" normal – special order up to 6"

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" (1371mm) diameter.





# CIP Composites™

**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 and environment.

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

**CIP X X X**

Textile		Lubricant			Resin	
<b>100</b>	Polyester	<b>000</b>	None	Electrical insulators	<b>001</b>	Standard
<b>200</b>	Poly/PFTE combination	<b>010</b>	Graphite	Dry conditions	<b>002</b>	Marine
<b>300</b>	Nomex®	<b>020</b>	Moly (MoS2)	Wet or dry conditions	<b>003</b>	High Temp
		<b>030</b>	PTFE	Wet or dry conditions needing lower friction than moly		
		<b>040</b>	Graphite & PTFE	Dry conditions needing lower friction		
		<b>050</b>	Moly & PTFE	Wet or dry conditions needing lower friction		
		<b>000A</b>	Enhancement A™	Increases strength and lower friction		
		<b>000B</b>	Enhancement B™	Reduces stick slip and noise in slow oscillating applications		

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



**Bottom:** Raw tube surface, direct from oven  
**Middle:** Rough turned surface  
**Top:** Finished machined surface

# Common Materials



<b>CIP Hydro™</b>	Polyester/PTFE Textile Proprietary Lubrication Polyester Resin	Ideal for situations requiring the lowest possible friction without grease. Targeted for hydroelectric applications. Tested by Power Tech Labs
<b>CIP Marine™</b>	Polyester Textile Proprietary Lubrication Marine Resin	For wet environments typically used as strut bearings and rudder bushings. Marine Type Approved
<b>CIP 151A</b>	Polyester Textile PTFE & Moly Lubrication Polyester Resin Enhancement A™	Used in wet and dry situations, offers additional strengths, low friction.
<b>CIP 131</b>	Polyester Textile PTFE Lubrication Polyester Resin	For less critical situations requiring wet or dry operation.
<b>CIP 121</b>	Polyester Textile Moly Lubrication Polyester Resin	Low friction and negligible water swell, this is ideal when moisture may be present (wet).
<b>CIP 111</b>	Polyester Textile Graphite Lubrication Polyester Resin	Low friction without grease used primarily in environments with no moisture (dry) present.
<b>CIP 101</b>	Polyester Textile No Lubrication Polyester Resin	For static situations requiring high loads such as electrical insulators.
<b>CIP 251A</b>	Polyester/PTFE Textile PTFE & Moly Lubrication Polyester Resin Enhancement A™	For situations where low friction is critical, possibly oscillating motion in wet or dry environments.
<b>CIP 333A</b>	Nomex® Textile PTFE Lubrication Vinyl Ester Resin Enhancement A™	For chemicals/corrosive environments or high temperatures up to 400° F (204°C) and still requiring low friction and high loads.



# Properties

## 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..... 100
Density (ASTM D792).....	0.047 lbs/in <sup>3</sup> ..... 1.3g/cm <sup>3</sup>
Water Swell (ASTM D570).....	<0.15%

## Mechanical Properties

Coefficients of Friction	Dry dynamic
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).....	4.2x10 <sup>15</sup> 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 <sup>-5</sup> /Δ°F	6.3 x 10 <sup>-5</sup> /Δ°C
Parallel to Laminate.....	1.8 x 10 <sup>-5</sup> /Δ°F	3.2 x 10 <sup>-5</sup> /Δ°C

### CIP 003 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 <sup>-5</sup> /Δ°F	7.2 x 10 <sup>-5</sup> /Δ°C
Parallel to Laminate .....	2.0 x 10 <sup>-5</sup> /Δ°F	3.6 x 10 <sup>-5</sup> /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 composites that do not build up static charges.

If a magnetic material is desired, we can provide options of graphite filled composites.

## Thermal Properties

For operating temperatures exceeding 001 & 002 resin grades, use Series 003 for operating up to 400° F (204°C). Series 003 is available with the same textile and solid lubricants as the standard grades.

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, enhancing frictional performance and thereby eliminating the problems commonly encountered with metal bearings. Composites are attacked by ketones, chlorinated solvents, strong alkalis, and hot strong oxidizing agents.

## Chemical Resistance

	20° C 68° F	49° C 120° F
Acetic Acid 15/100%	S/U	L/U
Acetone 15/100%	S/U	L/U
Alcohol Ethyl 15/100%	S/S	S/S
Aluminium Sulphate	S	S
Ammonia Liquid	U	U
Ammonia Aqueous	U	U
Ammonium Carbonate	S	L
Ammonium Nitrate	S	S
Benzene	S	L
Bleach Liquors	S	L
Calcium Chloride	S	S
Calcium Hydroxide	U	U
Carbon Tetrachloride	S	S
Chlorine Water	S	L
Creosote	S	S
Citric Acid	S	S
Ethylene Glycol	S	S
Fatty Acids	S	S
Hydrochloric Acid	S	S
Hydrofluoric Acid	U	U
Maleic Acid	S	S
Naphtha	S	S
Nitric Acid 15/100%	S/U	S/U
Oxalic Acid	S	S
Phosphoric Acid	S	S
Phthalic Anhydride	S	S
Potassium Hydroxide	U	U
Sodium Carbonate 25/100%	S/L	S/U
Sodium Chloride	S	S
Sodium Hydroxide	U	U
Sodium Nitrate	S	S
Sodium Nitrite	S	S
Sulphuric Acid 50/100%	S/U	S/U
Trichlorethylene	U	U

S = Satisfactory;  
L = Satisfactory for limited service  
U = Unsatisfactory

"Satisfactory" means that the material retains 50% or more of its original dry strength after immersion for at least six months. Tested on CIP 100 Series sheet material.



# Machining & Installation

## Machining

CIP Composites™ are readily machinable by conventional machining techniques and, as a general guide, may be treated as bronze, but should be machined dry without coolant. Our 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" (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. Amount of force will be suggested 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 the housing. 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.

## 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 micro meters) and HRC 40. Suitable materials for shafts, thrust faces, etc., would be hardened steels or stainless. Hard chrome plated steel surfaces cause high wear rates under certain conditions, and burnishing or other surface finish treatments should be considered as an alternative. The main criteria is that the 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 do recommend the use of synthetics.



# Company Support

## One group, one location reaching globally

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Exceptional service is achieved with our engineering, designing, sales and production under one roof. Together we provide years of experience and a high level of industry and application knowledge. From sales to logistics, customers turn to us for superior service and support.

## Quality

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We take pride in our high standards which provide customers with a proven quality assurance system. Our quality assurance is ISO compliant with all raw products being made in USA and ISO compliant/certified. Our customers can be sure they will be receiving top of the line composite materials produced by highly trained and experienced personnel.

## Distribution Support

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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*<sup>™</sup>.

## Location

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



Although the utmost care is taken to ensure the accuracy of data supplied and advice or opinions given by the Company and to maintain the highest possible quality of the Company's products and the materials used therein, the supply of such data, the giving of such advice or opinions and the sale of the Company's products are subject to the condition that in no circumstances is the Company to be under any liability for any injury, expense, loss or damage whatsoever arising or alleged to arise directly or indirectly as a result of the adoption of data supplied or advice or opinions given or the use to the Company's products except in so far as the Company's conditions of sale expressly otherwise provided.



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