



CATALOG & ENGINEERING MANUAL



LAMINATE COMPOSITE MATERIAL CIP BEARINGS & WEAR PADS

CIP Composites

Columbia Industrial Products

29538 Airport Rd. • Unit A • Eugene, Oregon 97402

Phone: 541-607-3655 • Fax: 541-607-3657 • Toll Free: 888-999-1835

www.cipcomposites.com



LAMINATE COMPOSITES

CIP COMPOSITE material is a laminated polymer material made by impregnating fabric with thermosetting resins. The physical and mechanical properties of all grades of CIP make them excellent bearing materials. CIP composites offer design engineers an attractive, cost effective alternative to the traditional materials used throughout industry for bearings, wear pads and other components. CIP is only 1/6 the weight of steel, easily machined, has good dimensional stability and contains no harmful or toxic materials.

ADVANTAGES OF USING CIP COMPOSITES

- Low maintenance, allows for reduction or elimination of wet lubrication.
- Excellent electrical insulation and non-magnetic series are available.
- Excellent dimensional stability in water, corrosive fluids, and chemical solutions.
- High load capacity and shock load resistant.
- Excellent mechanical strength.
- Long life, wear resistant.
- Non-abrasive to mating surfaces (no abrasive fillers/ calcium carbonate.)

APPLICATIONS

- Automobile Molding Presses
- Automotive lift & carry systems
- Amusement Ride Bearings
- Dump Bed Pivot Bearing
- Earth Moving Equipment
- Fire Truck Wear Pads & Bearings
- Forklift Mast Bearing
- Hydraulic Cylinder Wear Rings
- Agriculture Hay Bale Stackers
- Paper Mill Journal Bearings
- Pump Bearings
- Babbitt Replacements
- Injection Molding Machines
- Lumber Sorting Equipment
- Mooring Buoy Thrust Segments
- Down Hole Oil Tools
- Submersible ROV's
- Rudder Bearings
- Stern Tube Bearings
- Marine Stern Roller Bearing
- Stave Bearings
- Marine Fairleads
- Fin Stabilizer Bearings
- Hydro Trash Rake Bearings
- Hydro Wicket Gate Bearings
- Hydro Operating Ring Thrust Segments
- Bridge Pivot Wear Pads



CIP WEAR RINGS



CIP THRUST WASHERS



100 SERIES TEXTILE

Medium weave fabric with excellent mechanical strength.

200 SERIES TEXTILE

Medium weave fabric(100 series) cross-woven with PTFE for a low coefficient of friction. (Wrapped with series 100 material for walls over 1/4 inch.(6.35mm))

300 SERIES TEXTILE

High temperature fabric that can operate into the 400° (204° C) range while maintaining it's high compressive strength.

400 SERIES TEXTILE

Medium weave fabric (100 series) cross woven with a PTFE textile for a low coefficient of friction in thin wall bearings. No additional series wrap used.

SOLID LUBRICANTS

All above series of CIP Composites are available with solid lubricants incorporated. These can be graphite, MOS², or PTFE evenly dispersed throughout the material. These materials are recommended for use where other forms of lubricants are undesirable, erratic or nonexistent. These solid lubricants can substantially improve performance where maintenance of wet lubrication films is difficult.

ADVANCED PERFORMANCE

CIP COMPOSITES (Example: 101A or 101B)

CIP's Advanced Performance material incorporates an additive that strengthens the resin to enhance physical and mechanical properties, including strength, machinability and reduction of coefficient of friction. Dry lubricants (graphite, moly, PTFE) may be used with this additive. Advanced Performance Plus combines this additive with a lubricating enhancer.

CIP Material Codes

Fabric

	Series
Polyester	= 1
Poly & PTFE	= 2
Nomex	= 3
PTFE	= 4

Additive

None	= 0
Graphite	= 1
Moly	= 2
PTFE	= 3
G & P	= 4
M & P	= 5

Resin

Standard	= 1
Marine	= 2
High Temp	= 3
Advanced Performance	= A
Advanced Performance Plus	= B

Example: Polyester cloth, moly lubrication additive, polyester resin and Advanced Performance A = Series 121A



PHYSICAL PROPERTIES

Series 100 TEXTILE *All tests performed on sheet material (only).*

Compressive strength

Perpendicular to Laminate	35,000 PSI	241 N/mm ²
Perpendicular to Laminate (Breaking)	50,000 PSI	358 N/mm ²
Compressive strength (parallel) to Laminate.....	13,500 PSI	93 N/mm ²

Tensile strength..... 10,000 PSI..... 69 N/mm²

Tensile Modulus of Elasticity 470,000 PSI..... 3,240 N/mm²

Shear Strength 12,000 PSI..... 83 N/mm²

Flexural Modulus of Elasticity 260,000 PSI..... 1,930 N/mm²

Hardness Rockwell M 100..... 100

Density045 #/cu in..... 1.2g/cm³

Water Absorption..... <.1%

Dry applications are best suited for high load, high impact, linear or slow rotational movement.

Please consult with Technical Services for all applications.



CIP WEAR PADS

Standard Shapes

Tubes

Minimum Bore3/8" (9.5mm)

Maximum Bore.....54" (1371mm)

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

Custom sizes available upon request

Sheets

Minimum Thickness1/16" (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)

Custom sizes available upon request

SPECIAL PRODUCTS

Special components can be manufactured to customers drawings from all grades of CIP. In addition to special wear pads and bearings, spherical bearings can be manufactured in CIP to solve misalignment problems. Spherical bearing with metallic and CIP materials combined can also be produced. Parts requiring hex, square or irregular ID shapes can be produced from mandrels made with the appropriate configuration. Please contact Columbia Industrial Product's Technical Service department for special applications.



CIP TUBES & SHEETS



MACHINING

CIP composite is readily machinable by conventional machining techniques and, as a general guide, may be treated as bronze, but should be machined dry without coolant.

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 .005" (.12mm) is not required and for small quantity production.

CIP composites are completely non-toxic. It is advisable to use adequate dust extraction when machining CIP composites.

CIP WEAR PADS

CIP material is ideal for most wear pad applications. Its high compressive strength, dimensional stability and lubricity offer superior performance when compared to PTFE, UHMW, Cast Nylon or traditional Phenolics.

CIP can be provided from 1/16 to 3" (1.5mm to 76mm) thick. Material can be bonded to metal substrates or completely machined from sheet to your specifications. We invite you to submit your wear pad applications for consideration.

INSTALLATION OF CIP BEARINGS

CIP 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 drawing or pressing-in methods should be used. Hammer blows should be avoided. It is recommended that bearings be retained by shoulders whenever possible. CIP bearings close in between 90-100% of their interference fit. Flat components such as wear pads can be retained by countersunk screws and located by keeper plates where high lateral or shearing loads are anticipated. CIP material can also be bonded using two-part epoxy resin adhesives, but manufacturers recommendations must be strictly followed, particularly with reference to pre-treatment of the surfaces. Loctite grade 648, Permabond F246, or Hysol EA 9309.3NA are suggested adhesives. Where possible, contaminating or corroding liquids should be excluded from the bearing interface, unless they are being used as lubricants. Sealing will also help retain lubricants.

MATING SURFACE

The surface finish of the mating component has a major effect on the performance of the bearing. Surface roughness should ideally be 32 RMS (0.7Ra). 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. Journals or thrust faces should be free of lubrication grooves or holes.

GRADE	LUBRICATION				
	NONE	WATER	SOLUBLE OIL	GREASE	OIL
Series 100	.18-.25	.01	.019	.013	.02
CIP 121	.18	.01	.019	.013	.02
CIP 151	.14	.01	.013	.013	.013
Series 200	.05-.09	.01	.013	.013	.013

For Use In Rotary Application Only

Conditions: Standard CIP grades running against stainless steel mating surface. This data was generated by testing at these specifications.

Bearing pressure: 2,000 PSI (13.7 N/mm²)
 Surface speed: 90 SFM (v = 4.5 m/s)

Insulation Resistance (Megohms)
 BSS.2782 (Pt. 2)..... 2,000

Electrical Strength at 194° F (90° C)
 BSS.2782 (Pt.2) Flatwise (Volts/mil) 210
 Edgewise (kv/inch - kv/mm)..... 47 (1.85kv/mm)

Power Factor (1 M/c per sec)..... 0.021
 Permittivity (1 M/c per sec) 3.1

ELECTRICAL AND MAGNETIC PROPERTIES

Certain grades of CIP material are excellent insulating materials and may be used in many electrical applications. As bearings and thrust washers CIP material is suitable for use in dynamos, electric motors, generators, etc. As flat laminate, it can be used in heavy switchgear, transformers, insulating chassis and as general construction material. Sliprings and other current transfer devices can also be manufactured from CIP. CIP is non-magnetic and does not build-up static charges. These properties may often be exploited to advantage where interference with magnetic or electrical fields or accumulation of static electricity must be avoided.



CIP CURVED WEAR PADS



THERMAL PROPERTIES

Standard Series 100 & 200

Operating Temperature Range -40° - 200°F (40 - 113°C)
Coefficient of Thermal Expansion @ 68°F - 200°F (20° - 93°C)
Normal to Laminate 6.7×10^{-5} in/in/°F (1.7×10^{-3} mm)
Parallel to Laminate 3.8×10^{-5} in/in/°F (9.6×10^{-4} mm)

Series 300

Operating Temperature Range -40° - 400°F (40 - 204°C)
Coefficient of Thermal Expansion @ 68°F - 400°F (20° - 400°C)
Normal to Laminate 3×10^{-5} in/in/°F (1.7×10^{-3} mm)
Parallel to Laminate 1.6×10^{-5} in/in/°F (9.6×10^{-4} mm)

For operating temperatures exceeding Series 100 & 200 grades, use Series 300 to 400° F (204°C) with a compressive strength of 35,000 PSI (241 MPA). Series 300 is available with the same solid lubricants as the standard grades.

As is common with all resin bonded fabrics CIP has a low thermal conductivity. Under normal circumstances frictional heat is removed via the mating metal surface. However, in cases where shafts or housings are conducting heat to the bearing assembly, the lubricant must be sufficient to remove both frictional and conducted heat.

The removal of frictional heat may be improved, particularly in dry running applications, by using the housing as the main heat conductor. The wall thickness of bearings should be kept to a minimum in order to improve heat dissipation.

Thermal expansion of CIP material is greater than that of most metal alloy bearings and the characteristic must be taken into account in designs for higher temperature applications.

For applications where there will be a temperature change of > 60° F (15°C), please consult with Columbia Industrial Products for correct running clearance.



CIP SPECIAL BEARINGS

CHEMICAL & CORROSION RESISTANCE



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

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

This table refers in particular to Series 100 CIP. CIP does not corrode and is 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 by metal bearings.

Composites are attacked by ketones, chlorinated solvents, strong alkalis, hot strong oxidizing agents.

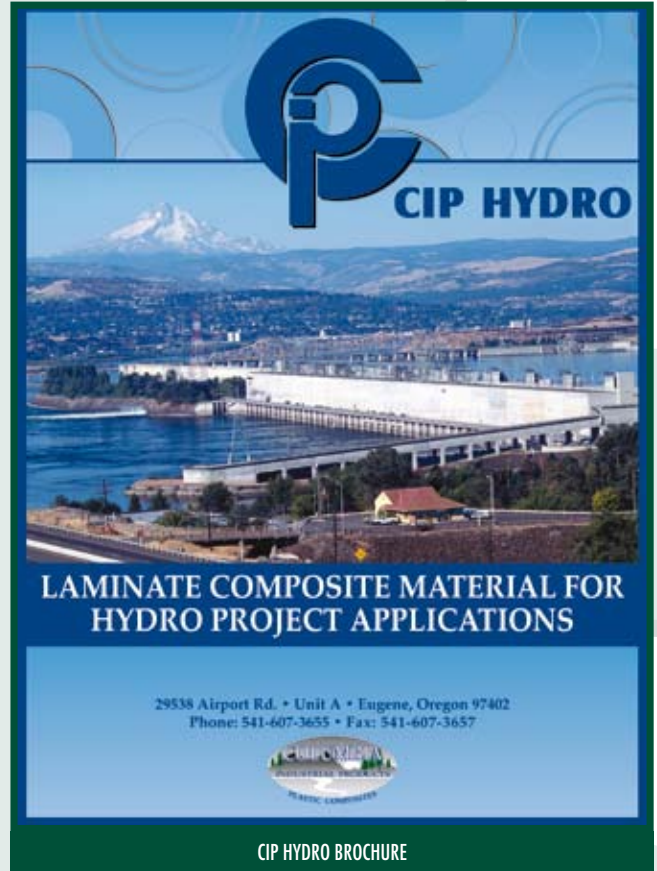
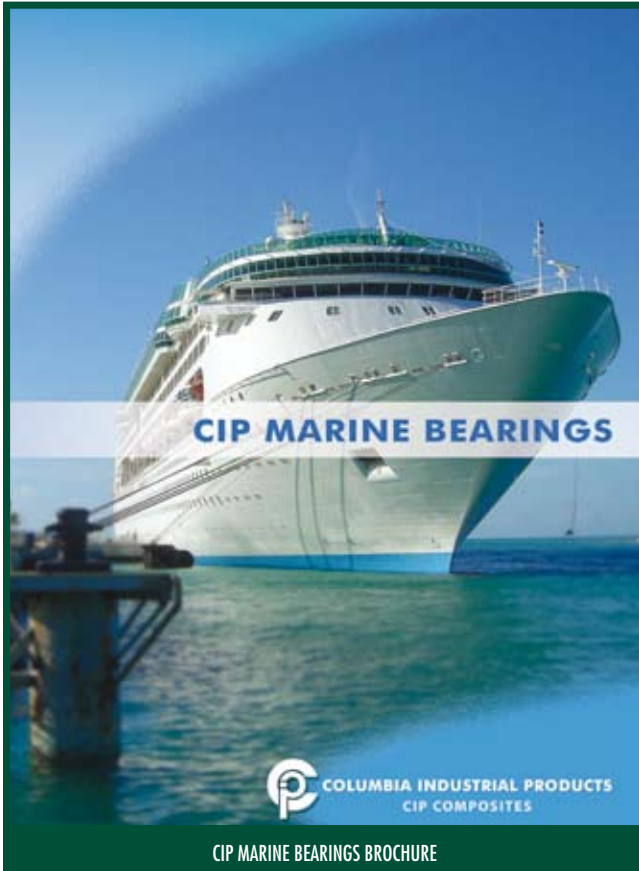
For acidic and alkaline applications, refer to Columbia Industrial Products for recommendations.

“Satisfactory” means that the material retains 50% or over of its original dry strength after immersion for at least six months.

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LITERATURE





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29538 Airport Rd. • Unit A

Eugene, Oregon 97402

Phone: 541-607-3655

Fax: 541-607-3657

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