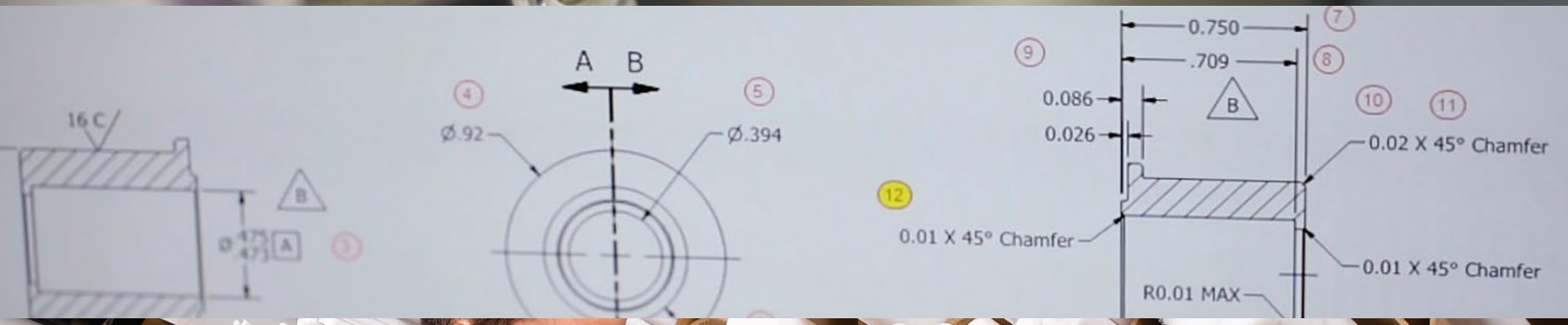
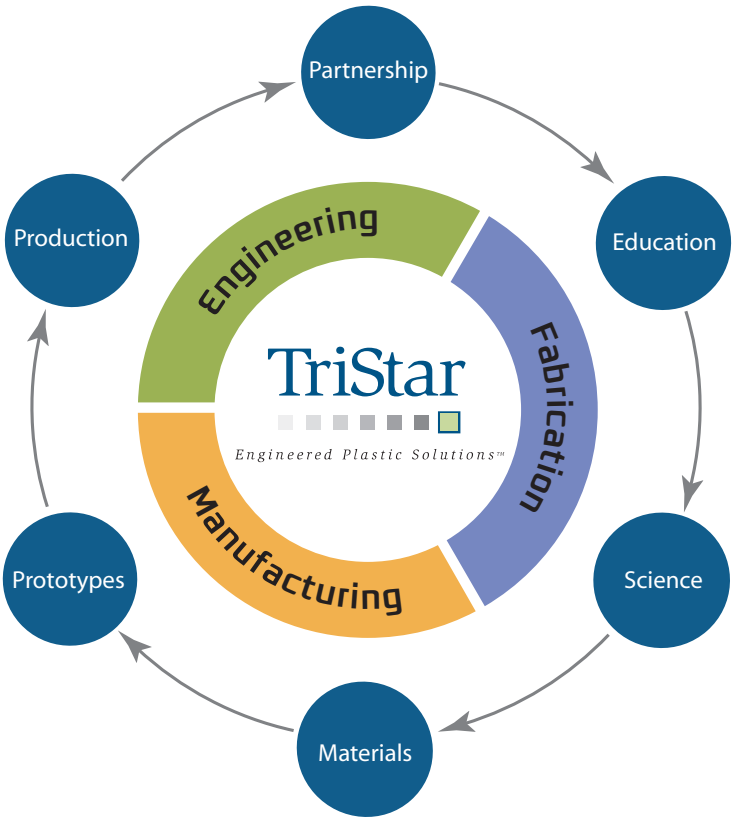
TriStar

Engineered Plastic Solutions™

The Advantage is Clear



Engineering | Custom Fabrication | Manufacturing



The TriStar Advantage

The TriStar Advantage is a comprehensive circle of services from education to engineering and prototype to production. Our engineering team can assist you to bring your ideas into full production.

Engineering

Our Business Development and Engineering teams are dedicated to assisting you choose the right material and component geometry for your application.

- Material Selection
- Material Testing
- Educational Seminars
- CAD/CAM Services

Fabrication

Our ISO 9001:2015 registered state-of-the-art fabrication facility features the latest in CNC equipment.

- Swiss Screw Machines
- CNC Turning
- CNC Milling
- Bonding

Manufacturing

Manufacturing bearings and bearing materials in-house allows us to offer custom blends and unique sizes.

- Custom Composite Bearings
- Prototype to Production
- Quick Turn Around
- Managed Inventory Programs

Your Online Advantage

Our web site has been designed to provide comprehensive technical education to help you choose the best material for your application.

- Material Database with 450 Materials
  - Full Property Filtering
  - Data and MSDS Sheets
- Extensive Video Library
  - Seminars
  - Product Education
- Downloadable Engineering Worksheets
  - Flange and Sleeve Bearings
  - Surface Modification
- Technical Library
  - Application and Product Spec Sheets
  - White Papers

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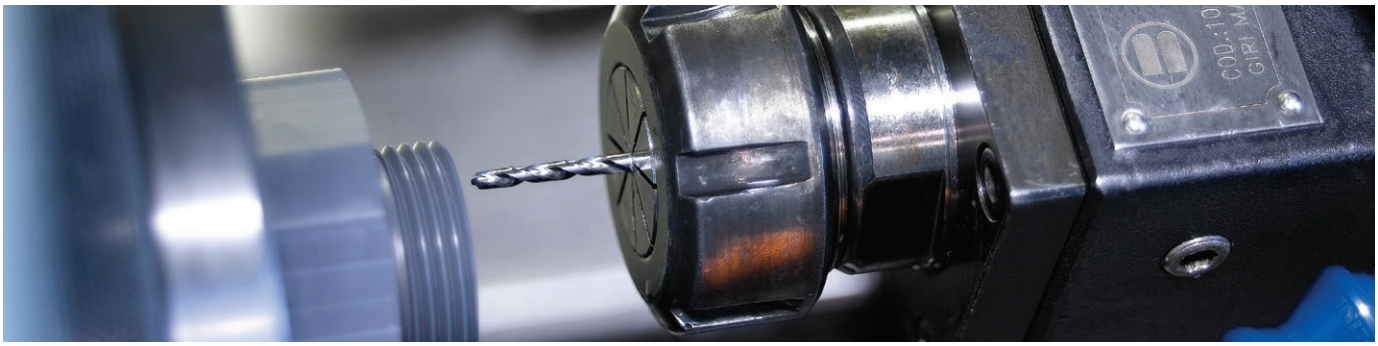


Fabrication

Our ISO 9001:2015 registered state-of-the-art fabrication facility features the latest in CNC equipment – from small diameter screw machines to large diameter CNC turning centers and large capacity CNC milling centers.

All of our machinists and quality control technicians are highly trained in the art of machining plastics, making sure your parts are right the first time, every time. We also fabricate all fixtures and tooling in-house to assure quality and to minimize lead-time.

At TriStar we are experts in machining plastics.

CNC Turning

- Live Mill Head Attachments
- 6-Axis
- Chucking Capacity up to 21"

CNC Milling

- Up to 36" x 81" Travel
- Rapid Tool Change
- CAD/CAM

Swiss Screw Machines

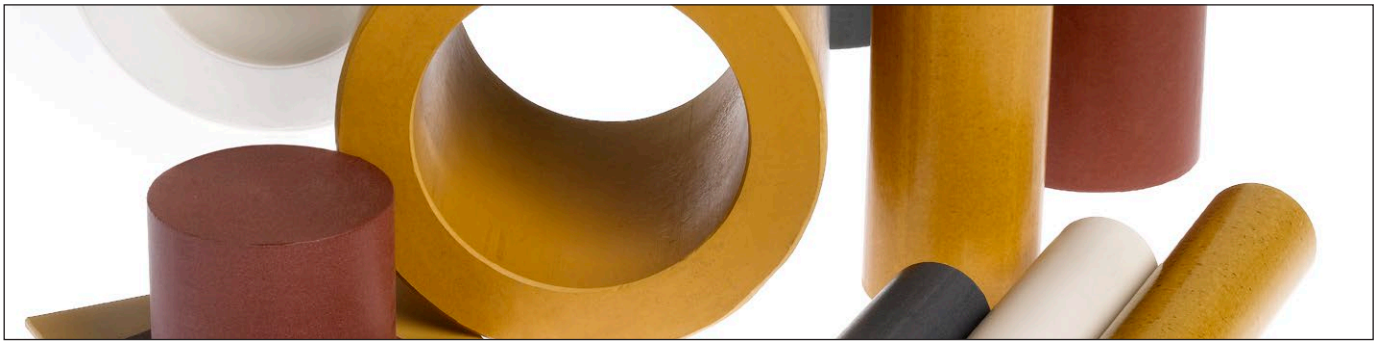
- High-Speed Turning
- Bar Capacity up to 1.25"
- Secondary Milling and Drilling

Custom Fabrication

- Engineering Assistance
- Prototyping
- Only Machine Plastics

Bonding

- Specialized Bonding Expertise
- State-of-the Art Plasma Facility
- Plasma Cleans Uniformly



Rulon®

Rulon composites are ideal for non-lubricated, high-load applications in a variety of climates and operating environments. Rulon composites exhibit a high load capacity similar to bronze, powdered metal and steel, and provide longer wear and extended operating life without the costs associated with lubrication.

Properties	Rulon LR	Rulon J	Rulon 641
Color	Maroon	Dull Gold	White
Max Load “P” (psi) Mpa	1,000/6.9	750/5.2	1,000/6.9
Max Speed “V” (fpm) m/s	400/2.0	400/2.0	400/2.0
Max “PV” (psi-fpm) (Mpa × m/s)	10,000/0.35	7,500/0.26	10,000/0.35
Mating Surface Steel and Stainless Steel	Rc35 and higher	Rb25 and higher, Aluminum	Rb25 and higher
Environment	Steam, Wet, Dry, Vacuum	Dry, vacuum	FDA compliant, steam, wet, dry, vacuum
Relative Rating (1=Low, 5=High) Coefficient of Friction Creep resistance Insulative property (Elec & Temp)	 4 4 Yes	 1 3 Yes	 1 4 Yes
Comments	Our standard Rulon bearing grade. High creep and abrasion resistance.	Lowest coefficient of friction of Rulon series. Excellent insulator.	Widely used in the food process industry.

Rulon LR

For continuous, non-lubricated service, Rulon LR sleeve bearings are capable of operating at PV values up to approximately 10,000 psi-fpm (0.35 Mpa × m/s).

Rulon J

RULON J is an all-polymeric reinforced PTFE compound that operates effectively against soft mating surfaces such as 316 stainless, aluminum, mild steel, and other plastics. It is ideally suited for start/stop applications where stick-slip must be eliminated.

Rulon 641

Rulon 641 uniquely incorporates the following features in one non-lubricated bearing: FDA-cleared materials, excellent load and wear characteristics, wide ranging temperature capability and naturally white color.

Composite Bearings

Composite bearings are a direct replacement for grease-lubricated bearings but have the added advantage of being self-lubricating and having superior wear properties compared to traditional bronze bearings of the same size.

Properties	CJ	FCJ	Ultracomp UC200
Shaft Material (recommended)	Steel	Alum / SS	Steel
Min. Shaft Hardness	Rc 35	Rc 25	Rc 35
Required Shaft Finish (RMS)	8-16	8-16	12-16
Max Pressure (static) - PSI	60,000	20,000	54,400
Max Pressure (dynamic) - PSI	30,000	20,000	25,000
Max Velocity (no load) Ft/Min	150	500	15
Max PV	25,000	20,000	25,000
Self-lubricating	Yes	Yes	Yes
Temperature Range (F°)	-320 to +300	-320 to +300	Cryo to +266
Coefficient of Friction (static / dynamic)	0.02 / .25	0.01 / .20	0.15 (Dynamic)
Water Absorption (ASTMD570)	< 0.5%	< 0.5%	0.01%
Corrosion Resistance	Excellent	Excellent	Excellent
Izod Impact Strength Notched	>14	>14	>20
Coefficient of Thermal Exp.	7 x 10-6	7 x 10-6	2.6-4.1 x 10-5

CJ

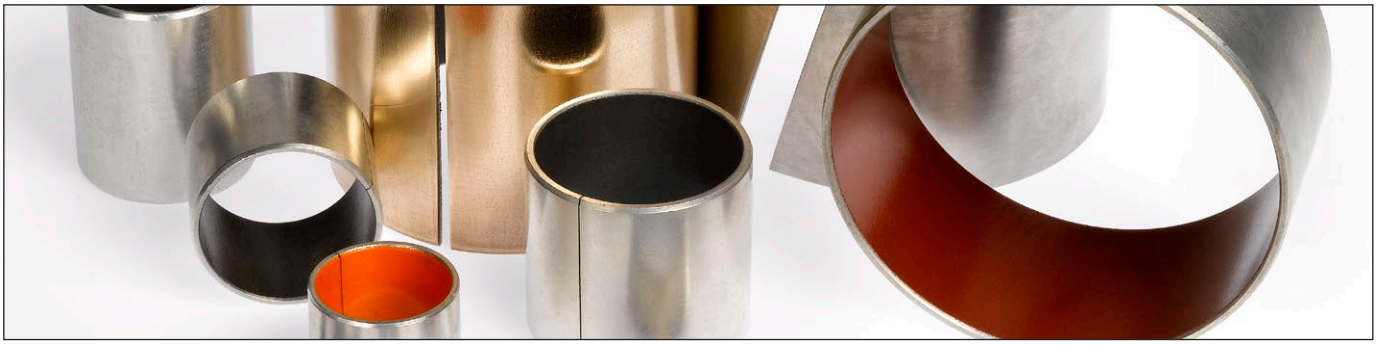
Excellent high load, higher speed reciprocating or oscillating applications. Excellent wear life and abrasion resistance. Thermal expansion very close to steel allows for tighter tunning tolerances. ID cannot be machined.

FCJ

Slightly lower load compared to CJ but considerably higher speed. Very low friction with the F liner as well as superior wear performance. Thermal expansion rate also also very low as with CJ for tight running tolerances. ID can be machined.

Ultracomp

Ultracomp bearing grade composites meet the rigorous needs of high load, low speed plane bearing applications. Ultracomp is produced using synthetic resins and reinforcing fibers with a series of internal lubricants. Therefore, it is an excellent choice for wet or dry, dirty or clean applications.

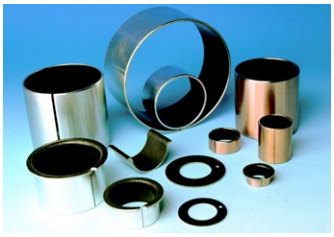


TriSteel™ Liner Materials

TriSteel is a metal backed system engineered for the most rigorous applications. TriSteel bearings utilize special polymer liners for self-lubrication and improved wear properties. Each material has a specific wear rate dependent on the speed, load, temperature, lubrication and hardware of the application. The metal backing supports liner materials made to withstand high loads, speeds and adverse environments.

Properties	Units	PT	AC	PE	PR
Maximum Static Load (P)	psi	36,000	36,000	40,000	36,000
Maximum Speed - Unlubricated (V)	fpm	1,000	*Consult with TriStar Engineering*		
Maximum PV Limits	psi/fpm	50,000	80,000	100,000	50,000
Impact Strength - Notched	ft-lbs/in.	>20	>20	>20	>20
Coefficient of Friction Dynamic - Dry		.08 - .12	.15 - .20	.15 - .20	.05-.10
Wear Factor	$Kx10^{-10}$	9	21	5	9
Operating Temperature					
Minimum	°F	-300	-40	-140	-300
Maximum - Continuous	°F	535	210	480	550
Coefficient of Thermal Expansion (x10-6)					
Parallel to Surface	in/in/°F	6	18	4.5	4.7
Thermal Conductivity	BTU/hr/ft2/°F/in	288	30	28	288
Water Absorption - 24 hour saturation	%	0	0.02	0.15	0.01
Liner Thickness	in	0.002	.018 - .020	.018 - .020	0.002

PT



Sintered porous bronze on metal substrate with PTFE calendared into the dynamic wear surface. High PV, self lubricating and long wear life. Commonly used in lift and tilt applications in construction, material handling, textile, hydraulic components, agriculture and forestry machinery.

AC

Sintered porous bronze on metal substrate with POM calendared into the dynamic wear surface. Requires boundary lubrication for optimum performance. High PV rating, low speeds. Commonly used in mining equipment, rolling mills, ski lifts and other applications where bronze bushings are utilized.

PE

Modified PEEK with self lubricating additives for applications where chemicals may be utilized. Excellent wear in both wet or dry applications. Available with a bronze substrate for use as chemical pump or valve bushings. Extra thick liner allows for slight modifications for shaft misalignment.

PR

No lead, enhanced PTFE liner with special fillers for dampening devices, hydraulic motors, automotive lift and pivot devices and linear motion equipment. A common use is for bicycle/motorcycle shock absorbers as piston and rod wear bearings. Exceptional wear properties in unlubricated service.

Enhanced Materials Division

Our **Enhanced Materials Division (EMD)** positions TriStar Plastics as the best resource to solve your demanding engineering challenges. From expert material selection guidance to material enhancements that improve and extend the performance of existing polymers and elastomers, we can help you find the best, most cost-effective way forward.

Surface Enhancements

Plasma

This technology utilizes highly-energetic gases to manipulate the surface of nearly any material. Highly effective in influencing adhesion, wettability, non-stick or inertness.

Coatings

Specialized coatings can be employed to Inhibit corrosion, enhance adhesion, and for non-stick or lubricious applications. Coatings can streamline manufacturing and enhance assembly performance.

Parylene

Parylene is the generic name used to describe a family of polymers based on polyxylene. It is a conformal coating applied in thin layers (a few mils/ fractions of mm) using a variety of methods.

Primers

Primers are compound mixtures that prepare surfaces for coating, paint, or adhesive. They are effective for rubber overmolding applications and improving material bonding and de-tack outcomes.

Engineering Services

Material I.D.

Rely on us to analyze components that you have on hand to see what they are made of. An example where this would be useful is if a part broke off a machine (or just wore out) and you need to know what it is so you can replace it with the same (or better) material.

Material Selection

We draw on many years of combined material engineering expertise to help you spec the best material for your projects. Regardless of your application, we can help you choose the right material for the operating conditions and desired service life.

Process Engineering

For companies that have overworked engineering departments or lack engineering resources altogether, we can become an extension and support resource to help implement new designs or develop better manufacturing processes.

Analysis/Testing

We offer expert advice and analysis on CAD design projects and our testing labs can help you evaluate processes and end results. Evaluation technologies employed include: Tribological testing, TGA, and DSC.

Innovative Product Offerings

Adhesives

Adhesives are substances that unify materials through millions of tiny interactions that result in massive macro-binding bulk properties. Our offerings include epoxies, urethanes, acrylics and special alloys of each of those types.

Primers

Primers are the link between material and adhesive. When a better bond is needed, the primer improves the bond between the material and the adhesive. We offer standard primer types and custom formulations to promote specific results.

Membranes

These are asymmetric and symmetric polyether sulfone membranes and glass membranes most often specified for water filtration applications. Common uses are for food processing and residential water treatment.

Specialized Materials

Our vast material engineering experience enables us to offer innovative materials that may not even have fully been brought to market yet. This helps us recommend materials for projects with very specific performance requirements.

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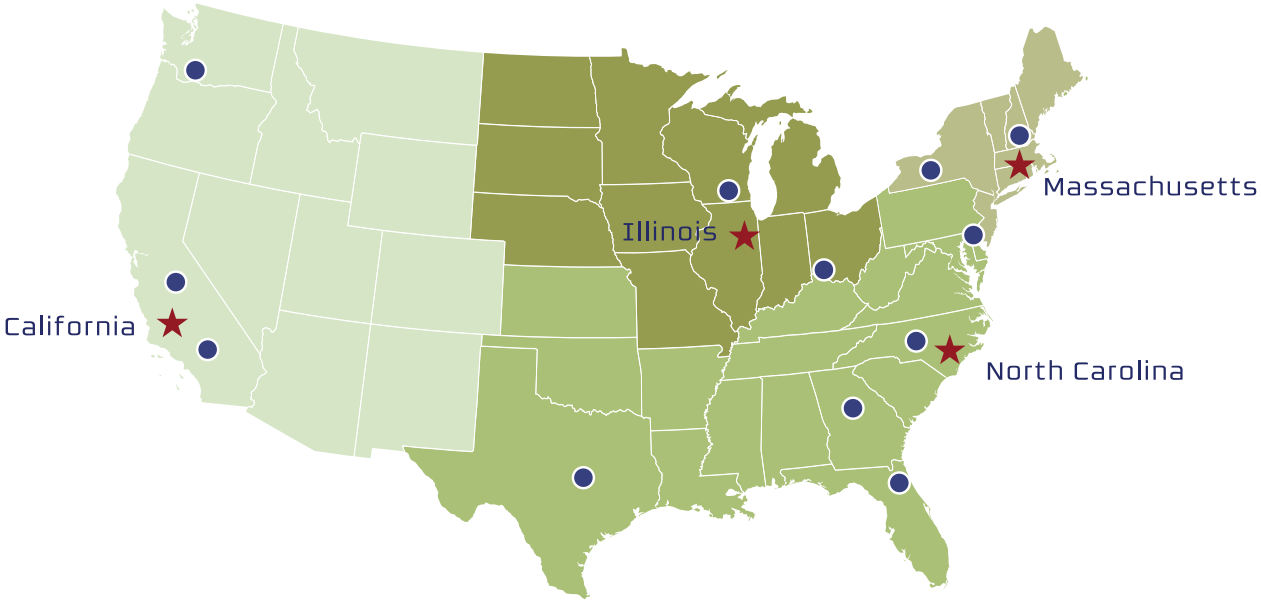

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