TriStar

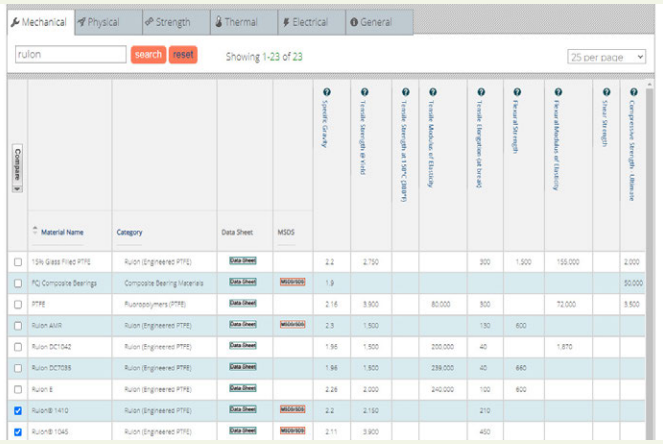
Engineered Plastic Solutions™

Custom Components

Engineering | Custom Fabrication | Manufacturing

Services

A partnership with TriStar will give you a competitive edge.



Material Data

Use our material database to filter and compare hundreds of the most popular high performance plastics in the industry based on specific characteristics.

Filter, compare and call on our engineering team to help you choose the right material and component geometry for your application.

Educational Seminars

We offer a series of training seminars on a variety of subjects relative to materials, component design and applications.

Custom seminars are available for your specific industry. Contact TriStar's technical department for more information.

Topic	Title
High Performance Materials	Pushing the Design Envelope of Plastics
Plane Bearing Technology	The Application of Self-Lubricating Materials in Bearings
Composites	Materials for Extreme Bearing Structural Applications
Fluoropolymers	Specific Overview of Fluoropolymers and their Applications

Analytical Services

We offer a complete array of surface analysis and materials characterization solutions by providing services that help companies get the critical information they need.

Our analytical techniques include:

- FTIR
- XPS
- AFM
- Goniometry
- Durometer [shore A shore D]
- Haze, Transmittance, Clarity [mainly transparent materials]
- Tensile Pull Testing [shear and T-peel]
- Compression Testing
- Flexural Testing

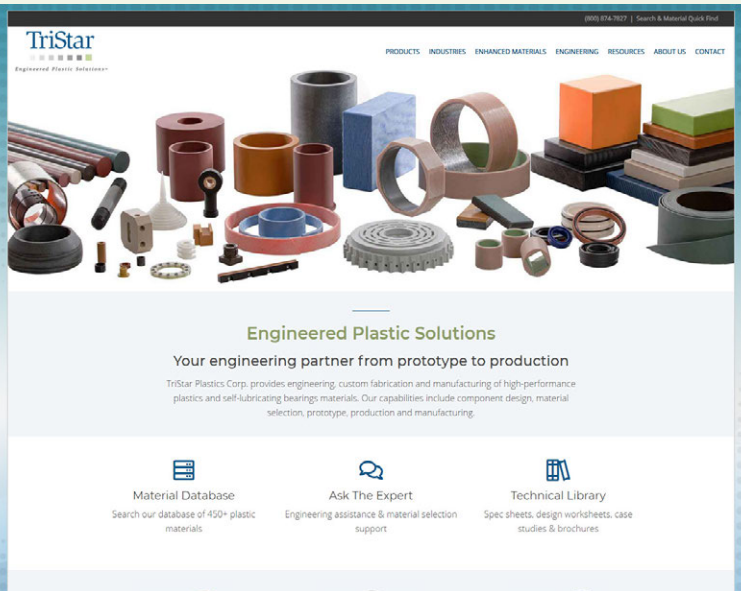
Enhanced Materials Division

From enhancing cell culture trays to bonding dissimilar materials, the scientists at TriStar's Enhanced Materials Division (EMD) can assist you in identifying problems and recommending solutions for your toughest surface issues.

Our expert technicians apply unique, dry, environmentally-friendly techniques to modify the surface of polymers, elastomers, and films in order to dramatically increase (or, if desired, decrease) the bond strength of adhesives, paint, markings, or specialty coatings.

Our services include:

- Plasma Treatment
- Asymmetric & Symmetric Filtration Membranes
- Specialized Primers & Coatings



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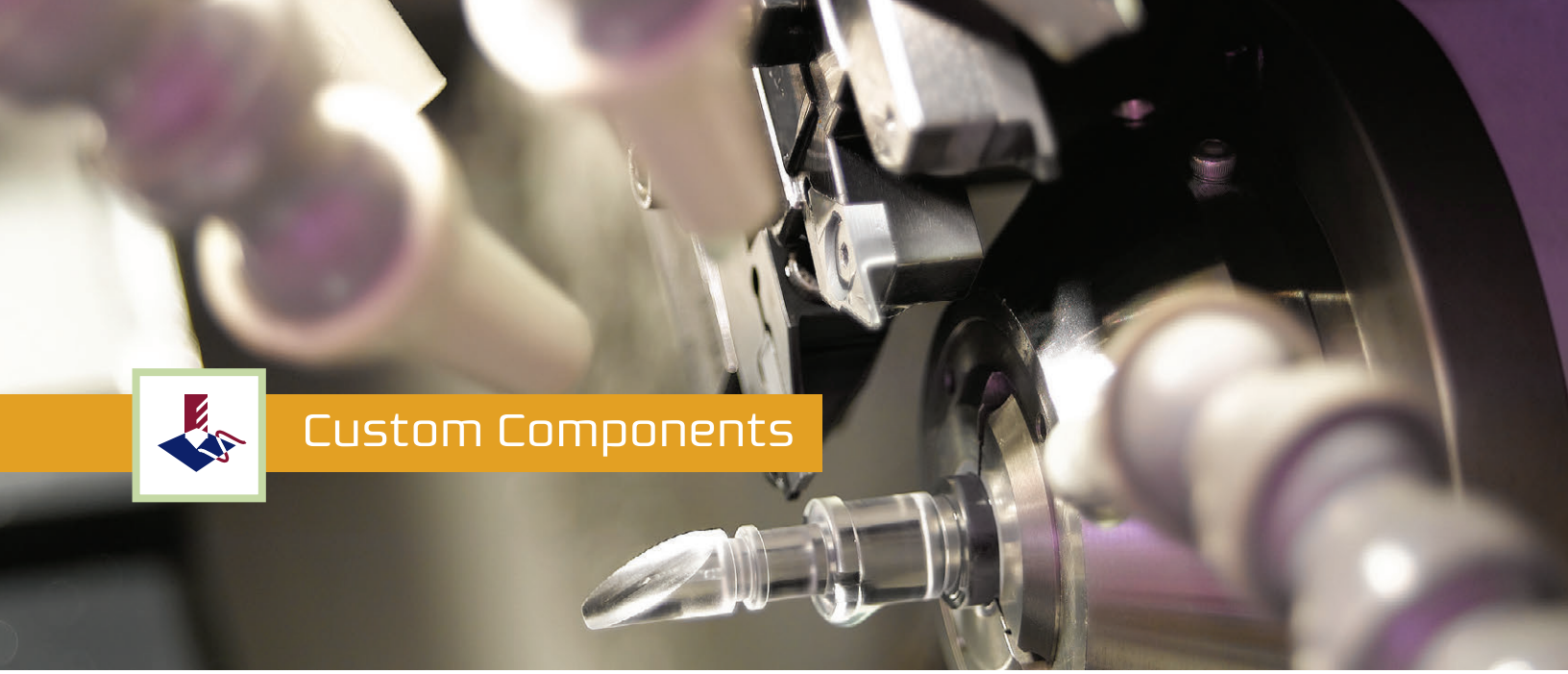
Our site has been praised by engineers and purchasing agents alike. We continually strive to make this site an indispensable engineering resource for your company.

- Engineering Tools
- Tech Talk Blog
- Material Database
- Web Store
- Ask the Expert
- On-line Brochures
- Product Videos
- Customer Portal

With our in-house technical and scientific staff we can resolve any challenge and help you find the right engineered plastic solution.



Custom Components

Our state-of-the-art fabrication facility features the latest in CNC machines – 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. By working as a team, our manufacturing engineers and machinists design the right tools for every job. 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

Custom Fabrication

- Design Assistance
- Prototype
- Only Machine Plastics

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Submit your CAD drawing at **www.tstar.com/quote-request** for an estimate.

Material Selection Process (MSP)

In all plastic component designs, material selection is critical. During the selection process, one should consider the following factors to ensure the best possible selection.

1 Temperature

All plastics are affected by ambient heat and have a maximum continuous service temperature. The maximum continuous service temperature is not a melting point, but is the highest temperature at which a material will retain physical integrity. *Important: Note that elevated temperatures affect material properties in a negative manner and should be carefully reviewed before use.*

2 Temperature Variation

All plastic materials have coefficients of thermal expansion. Measured in in/in/°F, plastic materials vary greatly not only from each other, but in some cases ten times that of metallic counter parts. As a result, we consider temperature variations. Components should be designed to meet required service temperature. Not doing so may result in premature failure.

3 Environmental Conditions

Always consider the following environmental conditions under which the material must operate:

- Contact with debris such as sand, grit or dust
- Contact with chemicals such as strong acids, bases and caustics
- Contact with water, constant spray or wash downs
- FDA or USDA compliance
- Thermal conductivity
- Radiation exposure
- Microwave exposure

4 Other Considerations

- Size and shape availability
- Material cost/economy
- Machinability
- Standard or custom runs
- Custom compounds

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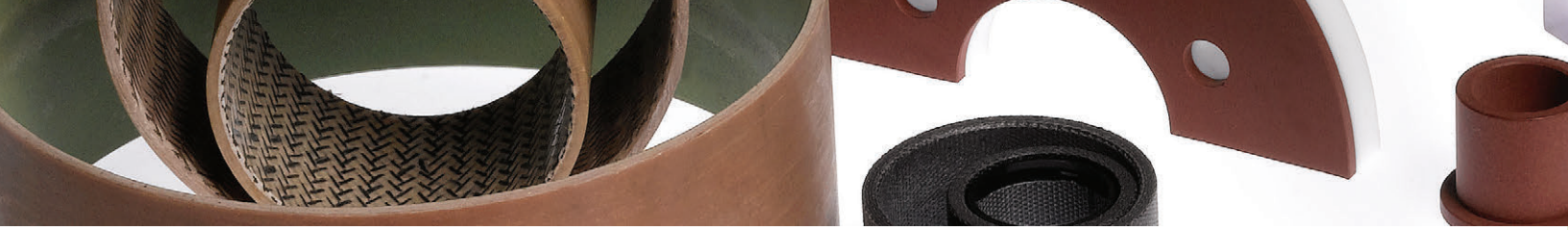
Visit our interactive online material database to research and compare various plastic materials. If you have questions regarding which materials are appropriate for your project, just reach out via our Ask the Expert page and our engineering team will assist you.

Plastic Material	Shape Availability Rod Dia	Sheet Thickness	Machinability Rating 1-10 1=Easy	Serv Temp Long/Short Degrees F	Characteristics / Attributes
ULTRACOMP UC200	Tubing	1/8 to 3	3	266/360	High Load / Impact-Vibration Resistant / Composite
ULTRACOMP UC300	Tubing	1/8 to 3	3	266/360	Lowest Friction / Chemical Resistant / High load
ULTRACOMP UC400	Tubing	1/8 to 3	3	266/360	Moly lubricant / Slow Rotary / Salt Water Applications
ULTRACOMP UC500	Tubing	1/8 to 3	3	266/360	Bearing Grade Blended Fiber / Bearing Grade Composite
ABS	3/16 to 8	1/4 to 4	1	140/210	General Purpose / Economical / Machinable / Moldable
ACETAL / DELRIN	1/8 to 12	.010 to 4	1	195	Machinable / Economical / Good Wear / FDA / USDA
ACETRON	1/4 to 6	1/4 to 2	1	180	Acetal / Machinable / Wear Resistance
ACRYLIC	1/16 to 6	1/32 to 3	5	140/200	Optically Clear / Colors / Machinable / Formable
CELAZOLE / PBI	1 to 4-3/4	3/8 to 2	8	650/1000	Highest Temp / Chemically Resistant / High PV
DELRIN AF	3/16 to 8	1/32 to 3	1	185/300	PTFE Filled Acetal / Low Friction / Brown
DELRIN 500CL	1/2 to 3	1/4 to 4	1	180/300	Chemically Lubricated Acetal / Low Friction
ERTALYTE / ERTALYTE TX*	3/16 to 8	1/4 to 4	1	210	PET I Bearing Grade* / Good Wear / FDA / White
FEP	1/16 to 6	.005 to3	3	400	Fluoropolymer / Excellent Chemical Resistance
FLUOROSINT 207* / 500	1/2 to 8-3/4	1/4 to 3	3	500	Family of Filled PTFE / High Thermal Stability / FDA*
HYDEX 4101 & 4101L*	1/2 to 6	3/8 to 4	1	220	PBT I PTFE Filled* / FDA-USDA / Low Friction / White
HYDEX FGA	1/2 to 4	3/8 to 2	1	185/300	Teflon Filled Delrin / FDA / USDA / Low Friction
HYDLAR ZF	1/4 to 5	1/4 to 2	5	230/300	Aramid Fiber Filled Nylon / Wear Resistant
KYNAR / PVDF	1/4 to 10	1/4 to 4	2	122/230	Fluoropolymer / Excellent Chemical Resistance
MICARTA C & L	1/32 to 10	1/32 to 8	8	257	Phenolic Resin / Cloth Fabric Matrix / Laminate
MICARTA G-10 & G-11*	1/32 to 5	.005 to 5	10	284/356	Epoxy I Silicone* / Woven Fiberglass Matrix / Laminate
MICARTA XXX	1/32 to 2	1/32 to 5	8	284	Phenolic Resin / Paper Matrix / Laminate
NORYL EN265	3/8 to 8	1/4 to 4	2	195/375	PPO & Styrene Alloy / Good Creep Resistance
NYLATRON	1/32 to 2	.010 to 4	1	200	Modified Nylon Type 66 / Cast Type 6 / Impact and wear
NYLON 66	1/32 to 6	.010 to 3	1	210	Economical / Good Wear / High Impact Strength
PCTFE / KEL-F	1/16 to 6	.005 to 2	3	400	Chemical Resistant / Heat Resistant / High Temp
PEEK	1/4 to 4	1/4 to 2-1/2	5	480	Autoclavable / Chemical & Steam Resistant
PFA / NEOFLON	1/16 to 3	.002 to 3	3	500	Chemical Resistant / Heat Resistant / High Temp
POLYCARBONATE	1/32 to 15	1/32 to 4	3	210/265	Good Machinability / Transparent / High Rigidity
POLYETHYLENE	1/32 to 18	.002 to 10	1	140/175	General Purpose / Economical / Chemical Resistant
POLYIMIDE / MELDIN	1 to 4-3/4	3/8 to 2	7	600	High Temp / Wear Resistance / High PV / Low Outgas
POLYPROPYLENE	1/4 to 16	.010 to 10	1	160/230	Chemically Resistant / Weldable / Economical
POLYSULFONE / UDEL	3/16 to 8	1/4 to 4	1	300/340	Autoclavable / Chemically Resistant / Heat Resistant
PVC / CPVC*	1/4 to 13-3/4	3/32 to 4	1	155	Weldable / Economical / Chemical Resistant / Hi Temp*
REXOLITE	1/16 to 9	1/32 to 6	3	212	Crosslinked Polystyrene / High Frequency Dielectric
RULON 123	3/16 to13	.010 to 2	3	550	Filled PTFE / FDA / USDA / High V / Inert / Black
RULON 142	N/A	.015 to 1/4	1	550	Slideways / Machine Ways / Expansion Supports
RULON 488	3/16 to12	.015 to 1	3	550	Filled PTFE / High V / Inert / Dryer Bearings / Green
RULON 641	3/16 to12	.015 to 1	3	550	Filled PTFE / FDA / USDA / High V / Inert / White
RULON J	3/16 to13	.010 to 4	3	550	Filled PTFE / Low Friction / Non Abrasive / Gold
RULON LR	3/16 to13	.010 to 4	5	550	Filled PTFE / Good Strength / High V / Inert / Maroon
TECHTRON / PPS	1/4 to 3	1/4 to 2	4	425	Chemical Resistant / High Temp / High Strength
TEFLON / GLASS FILLED	1/4 to 12	1/4 to 4	5	550	Filled PTFE / High V / High Temp / Chemical Resistant
TEFLON / EXT & MOLDED	1 to 38	.001 to 12	3	550	Unfilled Teflon / Inert / High Temp / Insulator / White
TEFLON/ FEP / TUBING	.034 to 12	N/A	N/A	550	Roll Covers / Spaghetti / Shrinkable / AWG Sizes
TEFZEL / ETFE	1/16 to 3-3/4	.030 to 3	3	300/350	Fluoropolymer / Excellent Chemical Resistance
TFM	1 to 12	.010 to 4	3	500	Fluoropolymer / Low Porosity / High Temperature
TORLON 4203 / 4301	3/32 to 2	3/16 to 1	5	500	High Temp / High Strength / Electrical & Bearing Grade
UHMW	1/4 to 10	.005 to 7	5	180	High Abrasion Resistance / Low Friction / FDA
UHMW / GLASS FILLED	1/2 to 4	1/16 to 2	3	180	Low Friction / Highest Abrasion Resistance
UHMW / OIL FILLED	1/4 to 8	1/8 to 2	3	180	Lowest Friction / High Abrasion Resistance
ULTEM 1000	1/32 to 8	.002 to 4	5	340	High Strength / Autoclavable / Chemical Resistance
ULTEM 2300	1/4 to 8	3/8 to 4	8	340	High Strength / Rigid / Autoclavable / Thermally Stable
VHMW	N/A	1/8 to 3/4	5	160	Good Abrasion Resistance / Low Friction / Economical



Plane Bearing Design (PBD)

In all plane bearing designs, material selection is critical. During the selection process, one should consider the following factors to ensure the best possible selection.

1 Bearing Load – P

P=LBS/(ID x LENGTH)

Measured in pounds per square inch (PSI), bearing pressure is calculated by disbursing the total load over the projected area (ID x LENGTH) of the bearing. This provides the average pressure (PSI) that the bearing must support. Note that all materials have a maximum P.

2 Relative Velocity – V

V = C x RPM

Measured in feet per minute (FPM), bearing velocity is calculated by first calculating the shaft circumference (C) in inches (C= Shaft Dia x 3.14 ÷ 12). Then by multiplying by the RPM of the shaft, this calculation gives the surface velocity in feet per minute (FPM) or V. Note that all materials have a maximum V.

3 System – PV

PV = P x V

System PV is measured in PSI x FPM, and is the product of P x V. System PV is a means of measuring the performance capabilities of a plastic material and is the result of multiplying the operating pressure by the surface velocity. *Important: Note that the maximum PV rating is not the maximum P x maximum V.*

4 Temperature

Materials used as self-lubricating plane bearings are always affected by ambient heat. All plastic materials have a maximum continuous service temperature. The maximum continuous service temperature is not a melting point, but is the highest temperature at which a material will retain enough physical integrity to allow it to continue to operate as a bearing. *Important: Note that elevated temperatures affect material properties in a negative manner and should be carefully reviewed before use.*

5 Temperature Variations

All plane-bearing materials have coefficients of thermal expansion. Measured in in/in/°F, plastic materials vary greatly not only from each other, but in some cases ten times that of their metallic counter parts. As a result, we must consider temperature variations. Bearings should be designed such that at service temperature, the bearing does not close down on the shaft. Failure to do so will result in additional frictional heat and/or total system freeze up.

6 Environmental Conditions

Always consider the following environmental conditions under which the bearing must operate:

- Contact with debris such as sand, grit or dust
- Contact with chemicals such as strong acids, bases and caustics
- Contact with water, constant spray or wash downs
- FDA or USDA compliance
- Shaft material, surface finish, and thermal conductivity

7 Hardware Conditions

Hardware Conditions are critical elements in optimizing wear life and frictional properties in bearing design.

- Shaft material
- Shaft surface finish – 12 to 16 RMS recommended
- Shaft treatments
- Housing design – finish and materials

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Use our online Linear Plane Bearing Engineering Worksheet to spec out your bearing. We have other worksheets available as well, including for flange bearings, structural shapes, and seals. Check them out!

Bearing Material	Max P Static psi	Max V No Load SFM dry	Max PV P x V Dry	Serv. Temp Continuous °F	Characteristics / Attributes
ULTRACOMP UC200	54,400	15	25,000	266	High Load / Impact-Vibration Resistant / Composite Bearing
ULTRACOMP UC300	45,000	100	15,000	266	Lowest Friction / High Load / Bearing Grade Composite
ULTRACOMP UC400	52,000	15	25,000	266	Moly lubricant / Slow Rotary / Salt Water Applications
ULTRACOMP UC500	50,000	30	25,000	266	Bearing Grade Blended Fiber / Bearing Grade Composite
CJ BEARING	35,000	150	25,000	300	PTFE Nomex-Lined Glass / Epoxy Shell / High Load
FCJ BEARING	20,000	500	20,000	300	Rulon Lined Glass / Epoxy Shell / High P
15% GRAPHITE 10% TFE POLYIMIDE	4,500	750	100,000	550	High PV / High Temp / Low Friction / Chemical Resistant
15% GRAPHITE FILLED POLYIMIDE	5,000	1,000	250,000	550	High PV / High Temp / Low Friction / Chemical Resistant
15% GRAPHITE FILLED PTFE	400	100	10,000	500	Filled PTFE / Low Friction / Economical
25% CARBON FILLED PTFE	1,000	400	10,000	500	Filled PTFE / Low Friction / Conductive
25% GLASS FILLED PTFE	1,000	350	10,000	550	Filled PTFE / High V / High Temp / Chemical Resistant
BEARING GRADE PPS	1,500	400	10,000	425	High Strength / Rigidity / Excellent Chemical Resistance
CARBON FIBER / PTFE FILLED PEEK	6,000	600	10,000	480	High PV / High Temp / Chemical Resistant / Thermally Stable
CARBON FIBER FILLED PEEK	6,000	600	50,000	480	High PV / High Temp / Thermally Stable / Conductive
CELAZOLE / PBI	1,000	150	37,500	650	Highest Temp / Chemical Resistant / Polybenzamidizole
DELRIN / HOMOPOLYMER	1,000	50	2,700	180	Acetal / Economical / Good Wear / FDA / USDA
DELRIN AF	1,000	100	11,000	180	PTFE Filled Acetal / Low Friction / Brown
DELRIN CL500	1,000	50	3,000	122	Chemically Lubricated Acetal / Low Friction
ERTALYTE	1,000	100	5,000	210	PET / Economical / Good Wear / FDA / USDA
FLUOROGOLD	1,000	400	10,000	500	Filled PTFE / Lowest Friction / High V / Chemical Resistant
FLUOROLOY A	1,000	400	7,500	500	Filled PTFE / Stability / Strength / High V / Low Friction
FLUOROLOY K	1,000	400	10,000	500	Filled PTFE / Stability / Seals / High V / Chemical Resistant
FLUOROSINT 207	750	400	7,500	500	Filled PTFE / Low Friction / FDA / Thermal Stability
FLUOROSINT 500	750	400	5,000	500	Filled PTFE / Most Thermally Stable in PTFE Family
FLUOROSINT HPV	1000	400	22,000	500	Filled PTFE / Low Friction / FDA / Thermal Stability
GLASS FILLED NYLON	350	40	3,000	225	Economical / Good Wear / High Impact
GLASS FILLED UHMW	1,000	50	1,500	180	Low Friction / Highest Abrasion Resistance
HYDEX 4101	1,000	100	6,000	245	PBT / Chemical Resistant / Economical / Good Wear
HYDEX 4101L	1,000	200	15,000	245	PTFE Filled PBT / FDA / USDA / Low Friction
HYDLAR FGA	1,000	100	12,400	180	PTFE Filled Acetal / Low Friction / FDA / USDA
HYDLAR ZF	1,500	100	8,000	230	Aramid Fiber Filled Nylon / Good Wear / FDA
MELDIN / POLYIMIDE	6,600	500	250,000	550	High PV / High Temp / Chemical Resistant
MELDIN 2021 / FILLED POLYIMIDE	6,000	1,000	300,000	550	Highest PV / Very High Temp / Lowest Friction
MELDIN 2030 / FILLED POLYIMIDE	3,000	750	100,000	550	High PV / High Temp / Low Friction / Chemical Resistant
MICARTA	27,500	15	5,000	250	Thermo-set / Rigid / High Strength / Electrical Insulator
NYLATRON GSM	300	60	3,000	200	MOs Filled Nylon Type 6 / Economical / Monocast
NYLATRON GSM BLUE & MC901	350	100	3,800	260	Oil & MOs Filled Nylon Type 6 / Monocast, Good Wear
NYLATRON NS/NSM	400	100	12,000	200	Solid Lubricant Filled Nylon Type 6
NYLON 66	300	60	2,700	210	Economical / Good Wear / High Impact
NYLON ST801	300	40	3,000	200	High Strength / Good Impact Strength
OIL FILLED UHMW	800	75	1,500	180	Low Friction / High Abrasion Resistance / FDA
PTFE	50	400	1,000	550	Unfilled Teflon / High Temp / Low Heat Transfer
RULON 142	1,000	400	10,000	500	Filled PTFE / Bondable / Machine Tool Ways / High Load
RULON 488	1,000	400	10,000	500	Filled PTFE / Economical / High V / Chemical Resistant
RULON 641	1,000	400	10,000	500	Filled PTFE / FDA / USDA / High V / Chemical Resistant
RULON DC7035	1,000	400	10,000	500	Filled PTFE / Conductive / High V / Chemical Resistant
RULON J	750	400	7,500	500	Filled PTFE / Low Friction / Non Abrasive / Chemical Resistant
RULON LR	1,000	400	10,000	500	Filled PTFE / Good Strength / High V / Chemical Resistant
RULON W2	1,000	400	10,000	500	Filled PTFE / Water Applications / High V / Chemical Resistant
TORLON 4301	1,000	900	50,000	500	High Temp / High Strength / Low Friction / Graphite Filled
UHMW	800	50	1,000	180	High Abrasion Resistance / Low Friction I FDA
ULTRALINER J	10,000	400	20,000	500	Filled PTFE w / Screen Reinforcement

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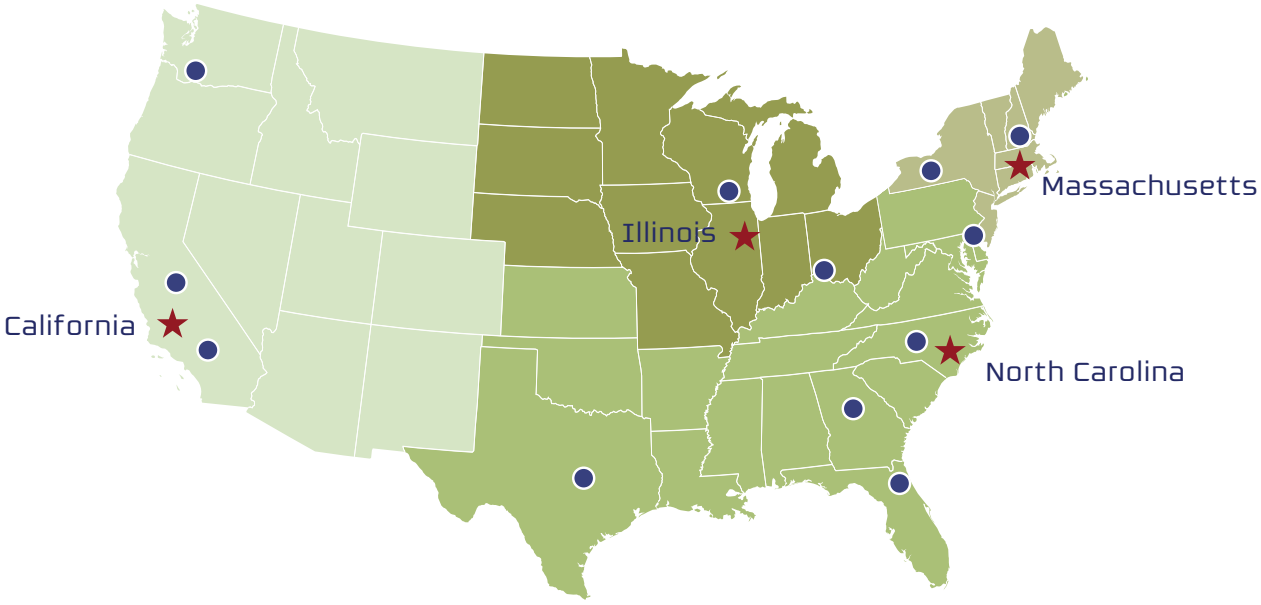
The Advantage is closer than you think.



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