Polystone®
Thermoplastics

Polystone® G (HDPE)
Polystone® P (Polypropylene)
Competence. Performance. Confidence.

ISO 9001 Certified

RÖCHLING
Engineered Plastics

Understanding our customers needs

As part of the Röchling Haren Group, we are recognized worldwide as a leading manufacturer of extruded polyolefin sheets and rods. Persistent innovation with our product line and manufacturing capabilities keeps us at the forefront of technology, and most importantly, at the forefront of market demands, with a quality product and a competitive price.

Committed to quality, Röchling Engineered Plastics' Quality Management System is certified according to ISO 9001, making us the first and only UHMW, HDPE and PP stress-relieved products manufacturer with this accomplishment.

From food cutting boards to semiconductor wet benches, Polystone® G (HDPE) and Polystone® P (Polypropylene) performs the task, and performs it well.

Quality · Service · Dependability · Inventory

Range of Products
Physical Properties and Specifications

Physical properties			Polystone®				
Property	Units	ASTM Test	G (HDPE)	P (Polypropylene) Homopolymer	P (Polypropylene) Copolymer	P (Polypropylene) Rochling Grey Homopolymer	P (Polypropylene) Rochling Grey Copolymer
Density	gm/cm^3	D792	.95	.91	.91	.91	.91
Tensile strength at yield 73°F	psi	D638	3000	4700	3700	4700	3700
IZOD impact strength 73°F	ft. lb./in.	D256	3.1	1.0	8.0	1.0	8.0
Hardness 73°F	Shore	D785	67	72	68	72	68
Coefficient of linear thermal expansion	in./in./°F	D696	$5\text{-}6.5 \times 10^{-5}$	$5\text{-}6.5 \times 10^{-5}$	$5\text{-}6.5 \times 10^{-5}$	$5\text{-}6.5 \times 10^{-5}$	$5\text{-}6.5 \times 10^{-5}$
Continuous service temperature in air (max)	°F	–	180	180	180	239	230

Polystone® G (HDPE)
Polystone® P (Polypropylene)

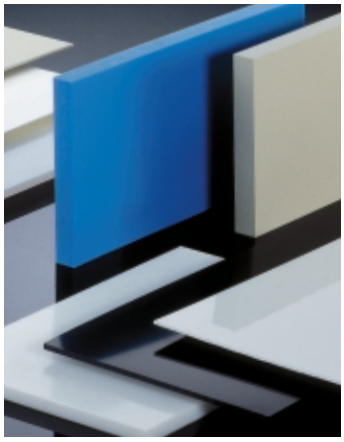
Sheets, extruded
1/16"- 1-1/2" x 48" x 96"
1/16"- 1-1/2" x 48" x 120"
1/16"- 1-1/2" x 60" x 120"
Sheets up to 120" wide available upon request

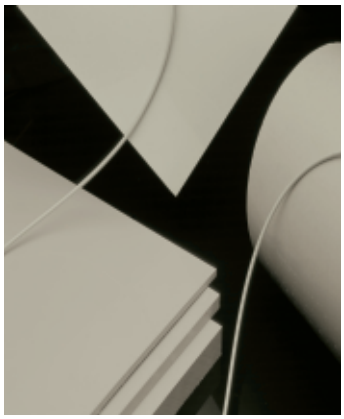
Sheets, pressed
1-3/4" - 4" x 48" x 96"
1-3/4" - 4" x 48" x 120"
1-3/4" - 4" x 96" x 240"
Sheets up to 8" thick available upon request

Rods
8mm (.31") - 350mm (13.78")

Welding Rods
3mm (.118") - 5mm (.197") diameter

Specifications and Approvals		
Polystone® G (HDPE)		
ASTM	D-1248	Polyethylene plastics molding and extrusion materials
FDA	Natural, and colors if requested	FDA Regulation Title 21 CFR 177.1520 Approved for direct contact with meat and poultry
Federal	L-P-390C	Plastic, molding and extrusion, polyethylene and copolymers
Military	MIL-P-23536 MIL-P-21922	Plastic sheets, virgin and borated polyethylene Plastic rods and tubes polyethylene
Polystone® P (Polypropylene)		
ASTM	D-4101	Propylene plastis injection and extrusion materials
FDA/USDA	Natural, and colors if requested	FDA Regulation Title 21 CFR 177.1520 Approved for direct contact with meat and poultry
Federal	L-P-394C	Plastic molding material (propylene plastics)
UL Rating	UL94 HB	If UL94-VO is required, Polystone® P Flame Retardant is manufactured from approved materials





The information listed herein is stated to the best of our knowledge and is intended to provide a general guideline for Polystone® and its uses. The values given are based on laboratory testing backed with global industry experience. All properties in this brochure have performed equal or better in laboratory testing. However, the data should not be considered as guaranteed specific properties. Suggested applications are provided for information only and are not specific recommendations.

Chemical Resistance
Machining and Welding Methods

Chemical resistance	Polystone® G	Polystone® P		Polystone® G	Polystone® P
Acetaldehyde	+	/	Glycerine	+	+
Acetic acid	+	+	Hydrochloric acid	+	+
Acetone	+	+	Hydrogen peroxide	30 +	30 +
Acrylonitrile	+	+	Hydrogen sulphide	+	+
Allyl alcohol	96 +	96 +	Lactic acid	+	+
Aluminum chloride	A +	A +	Magnesium chloride	A +	A +
Ammonia	A +	A +	Mercury	+	+
Ammonium chloride	A +	A +	Methanol	+	+
Aniline	+	+	Methyl ethyl ketone	+	+
Benzaldehyde	+	+	Methylene chloride	/	/
Benzene	/	/	Mineral oil	+	+
Benzyl alcohol	+	+	Motor oil	+	+
Bleach (Chlorine)	–	–	Nitric acid	50 /	50 /
Boric acid	A +	A +	Nitrobenzene	+	+
Butanol	+	+	Oleic acid	+	+
Butyl acetate	+	/	Ozone	/	/
Calcium chloride	+	+	Perchloric acid	50 +	20 +
Carbon disulphide	/	/	Petroleum	+	+
Carbon tetrachloride	/ M –	–	Phenol	+	+
Chlorine gas	/	–	Phosphoric acid	+	+
Chlorobenzene	/	/	Potassium chromate	40 +	40 +
Chloroform	/ M –	/ M –	Potassium hydroxide	30 +	30 +
Chromic acid	10 +	10 +	Potassium nitrate	A +	A +
Citric acid	+	+	Potassium permanganate	+	+
Cyclohexanol	+	+	Pyridine	+	/
Cyclohexanone	+	+	Sea water	+	+
Dekalin	+		Sodium carbonate	A +	A +
Dibutyl phthalate	+	+	Sodium chloride	50 +	50 +
Diesel fuel	+	+	Sodium hydroxide	A +	A +
Diethyl ether	+ to /	/	Sulphuric acid	80 +	80 +
Dioxane	+	/	Tallow	+	+
Ethanol	96 +	96 +	Tetrahydrofurane	+ to –	/
Ethyl acetate	+	+	Tetralin	+	–
Ethylene chloride	/	/	Thionyl chloride	–	–
Ethylene diamine	+	+	Toluene	/	/
Ferric chloride	A +	A +	Transformer oil	+	+
Fluorine	–	–	Trichlorethylene	+ to –	/
Formaldehyde	40 +	40 +	Urea, aqueous	33 +	33 +
Formic acid	+	+	Water	+	+
Furfurol	+		Zinc chloride	A +	A +

Values obtained at room temperature. Call for high or low temperature applications.
Number indicates concentration if < 100 %. M = Values may change under mechanical stress.
A = Aqueous solution.

\+ = Specimen is resistant .....Swelling < 3 % or weight loss < 0.5 %. Break elongation not significantly altered.
/ = Specimen has limited resistance.....Swelling 3-8 % or weight loss 0.5-5 % and/or break elongation decreased by < 50 %.
– = Specimen is not resistant .....Swelling > 8 % or weight loss > 5 % and/or break elongation decreased by > 50 %.

Recommended Machining and Welding Conditions

Polystone® G and P can be efficiently machined with all known tools used in wood and metal processing.

Sawing
Fast-running circular and band saws are suitable. Smooth surfaces can be achieved when the teeth are lightly set. Saw blades with teeth more than 5/8" apart are suggested. Especially with PP, fast chip removal is essential to prevent melting.

Milling
Fairly high feed rates and revolutions work best with attention to reduce heat generation. Suggested 9,000-12,000 rpm with a feed rate of 250-350 inches per minute.

Welding
Quality welds are achieved with the appropriate temperature setting and air pressure. The welding rod must be compatible, and along with the joint surfaces, both should be clean before starting.

Thermoforming
A controllable heating system is required that is designed to provide even heat to each point of the sheet. Typical heat time is 10 minutes per 1/8" sheet thickness.

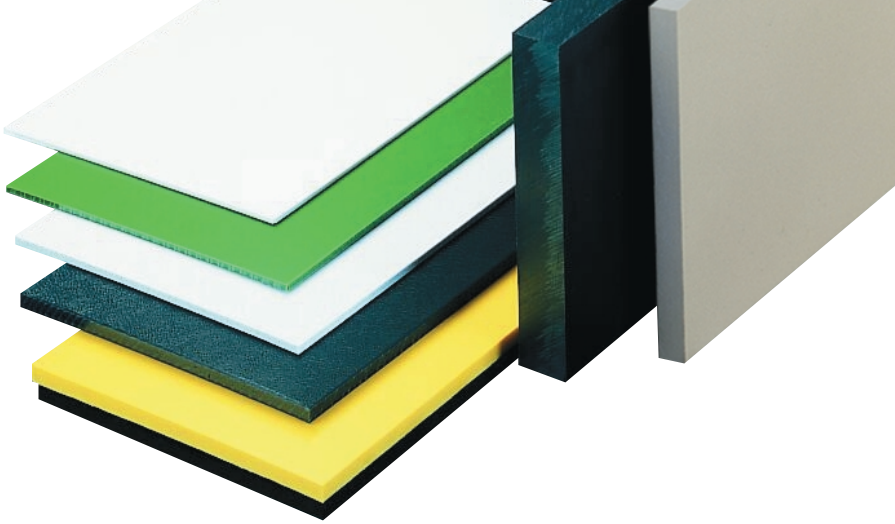
Polystone® G (HDPE)
Extrusion welding melt temperature: 395°F - 440° F
Hot gas welding temperature: 608°F
Thermoforming temperature range: 285°F - 300°F

Polystone® P (Polypropylene)
Extrusion welding melt temperature: 410°F - 460° F
Hot gas welding temperature: 590°F
Thermoforming temperature range: 320°F - 350°F

Polystone® sheets are easily cut and welded

Seams are routered to leave a smooth, clean joint

Polystone® G (HDPE)
Polystone® P (Polypropylene)



Polystone® G and P sheets are extruded with exceptionally close tolerances and, since they are always stress-relieved, you can be assured of the flatness. Our unique in-line trimming process produces a clean, square cut that does not require re-trimming.

Polystone® G:
- Outstanding impact resistance
- Easily fabricated and welded
- Operating temperature up to 180° F (82° C)
- FDA and USDA accepted
- Resistant to most acids and solvents

Polystone® P:
- Exceptional chemical resistance
- Easily fabricated, welded and formed
- Operating temperature up to 180° F (82° C), and up to 239° F (115° C) with heat stabilizers
- High impact resistance
- FDA and USDA accepted

Polystone® G Selection Table	Material Description	Standard Color
Natural	Standard high-density polyethylene, FDA/USDA accepted	Opaque white
Colors	Available in standard and custom colors	Assorted
Cut-Rite	Food preparation cutting boards, textured both sides	Natural and assorted
Play-Tec	Designed for playground structures, textured both sides, U.V. stabilized	Assorted solid and co-extruded
Marine-Tec	Designed for boat builders with a unique texture on both sides, U.V. stabilized	Assorted marine colors
Marine-Tec lite	Special foamed core reduces weight by as much as 20%	Assorted marine colors
Polystone	Bathroom partitions, textured both sides (available in HDPE or PP)	Assorted solid and granite
Pipe Grade	Special grade for the HDPE pipe market, U.V. stabilized	Black

Polystone® P Selection Table	Material Description	Standard Color
Natural Homopolymer	Standard polypropylene, FDA/USDA accepted	Opaque white
Natural Copolymer	Higher impact strength, especially in cold temperatures as low as –40° F	White
Colors	Available in standard and custom colors	Assorted
White	Designed for the semiconductor industry, with protective masking	Bright white
Röchling Grey	Operating temperature is increased up to 239°F	Grey-Tan
Flame Retardant	Manufactured from UL-94 V0 approved materials	White
Polystone	Bathroom partitions, textured both sides (available in HDPE or PP)	Assorted solid and granite
Foamlite	Extruded foam sheet with closed pores, textured scratch-resistant surface	Assorted

All grades are available in homopolymer and copolymer

Polystone® G (HDPE) defines dependability and versatility in a wide variety of industries

A polyethylene with outstanding impact resistance and tensile strength making it the perfect choice for a wide range of applications such as:

- tanks and vessels
- food cutting boards
- light-duty tank, chute and bin linings
- playground structures
- restroom partitions
- boat accessories

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1 *Polystone® G Natural tanks and tank linings*
2 *Cut-Rite cutting boards*
3 *Ski covers, doors, cabinetry and seat backs are fabricated from Marine-Tec and Marine-Tec Lite*
4 *Play-Tec is machined into various shapes and designs on commercial playground structures*
5 *Polystone restroom partitions*
6 *Polystone® G Pipe Grade fabricated into large manhole covers*

Polystone® P (Polypropylene) takes corrosion resistance to a new level

Best known for its outstanding chemical resistance, this polypropylene is easily fabricated, welded and machined for applications such as:

- structural tanks and linings
- plating barrels
- ducts and fume hoods
- semiconductor processing equipment
- orthotic and prosthetic devices
- pump and valve components

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7 *Polystone® P Natural chemical tanks*
8 *Laboratory equipment and cabinetry is fabricated from Polystone® P White*
9 *Large tanks over 80 foot long built with Polystone® P Copolymer*
10 *Polystone® P Natural Homopolymer plating barrel*
11 *Foot brace formed from Polystone® P Copolymer sheet*
12 *Polystone® P Röchling Grey extra-heat stabilized chemical tank*

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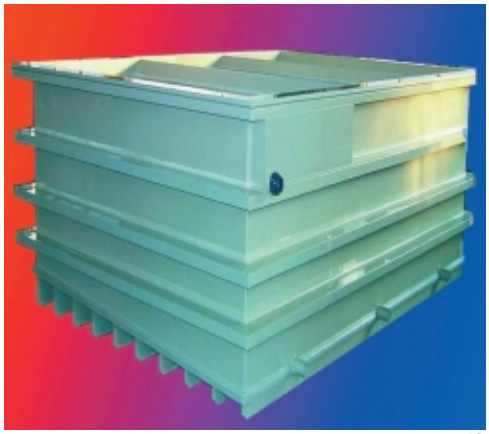

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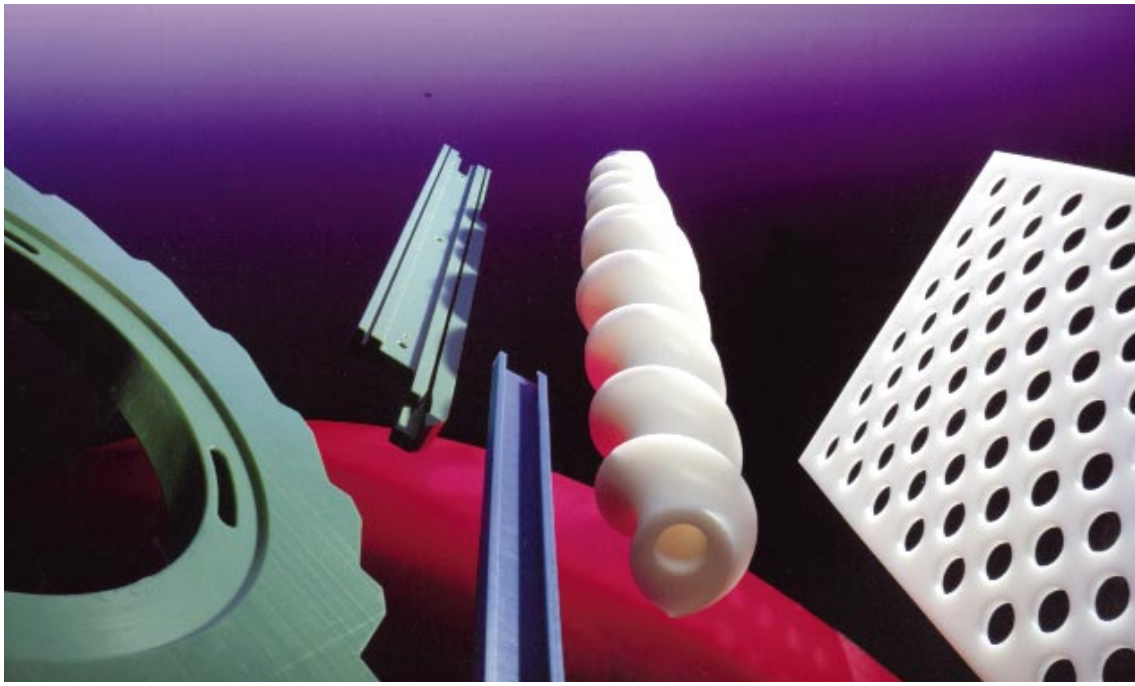
Polystone®
Thermoplastics

Polystone® M (UHMW-PE)
Setting the pace in today's industry



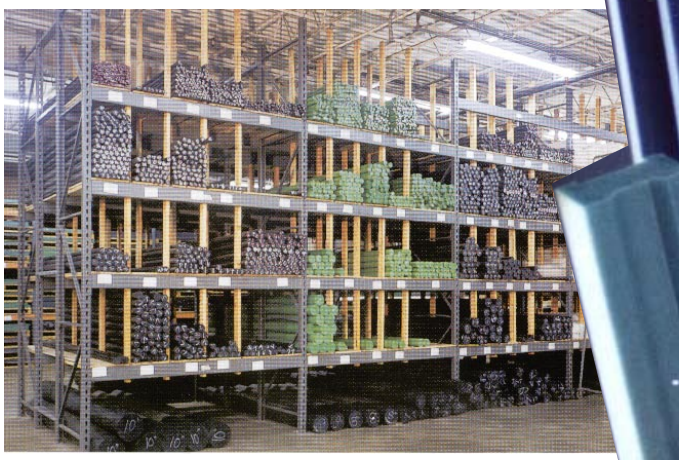
RÖCHLING
Engineered Plastics

The pursuit of customer satisfaction

„I can assist you in choosing the best Polystone® M for your application."

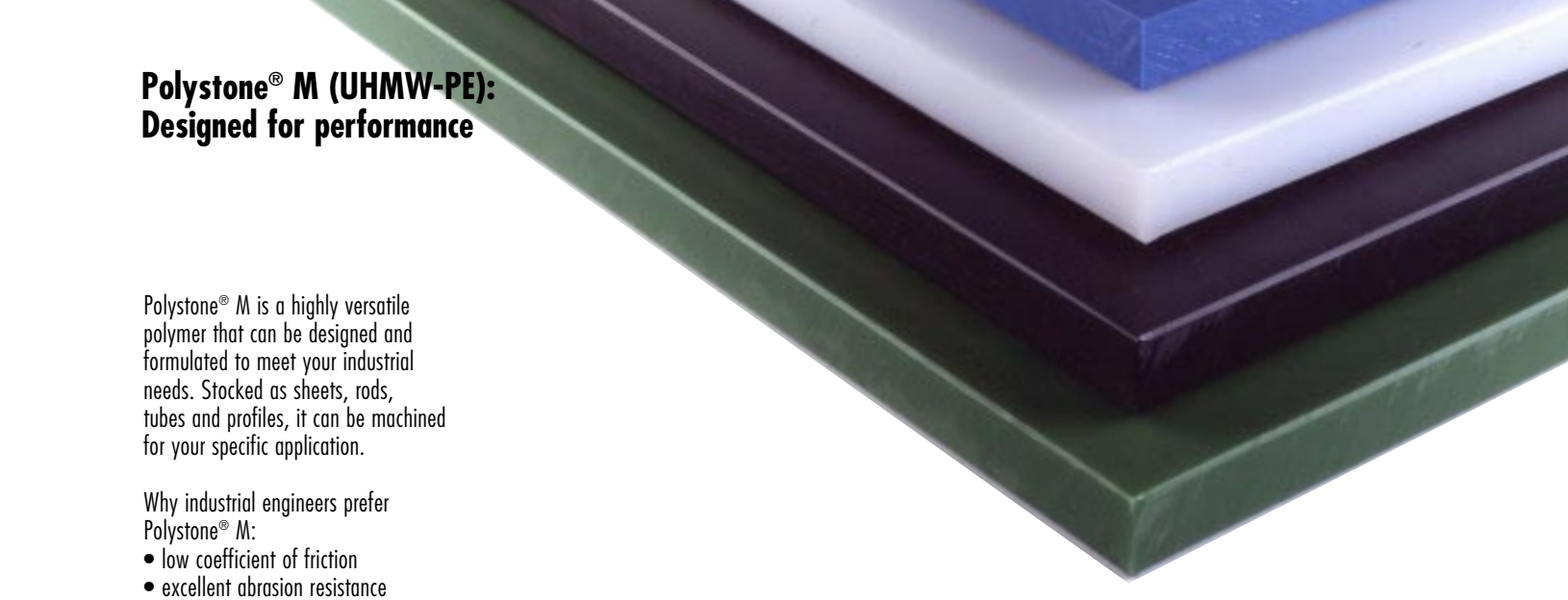
As a major manufacturer of Polystone® M (ultra-high molecular weight polyethylene), Röchling Engineered Plastics is among the world's leading suppliers to the conveying, material handling and packaging industries. Our sales and engineering teams work closely to provide you with the best solution to improve your business performance.

Quick to respond to the needs of our customers, we are constantly pursuing new and improved product designs and manufacturing techniques, allowing us to supply a state-of-the-art product at the most economical price. From conveyor wear parts to truck bedliners, Polystone® M keeps it moving.



Quality · Service · Dependability · Inventory

Polystone® M (UHMW-PE): Designed for performance



Polystone® M is a highly versatile polymer that can be designed and formulated to meet your industrial needs. Stocked as sheets, rods, tubes and profiles, it can be machined for your specific application.

Why industrial engineers prefer Polystone® M:

- low coefficient of friction
- excellent abrasion resistance
- high-impact strength (will not break or shatter)
- chemical resistance
- FDA and USDA accepted
- broad temperature range (-450° to + 180° F)
- little or no moisture absorption
- noise resistance
- easy to machine

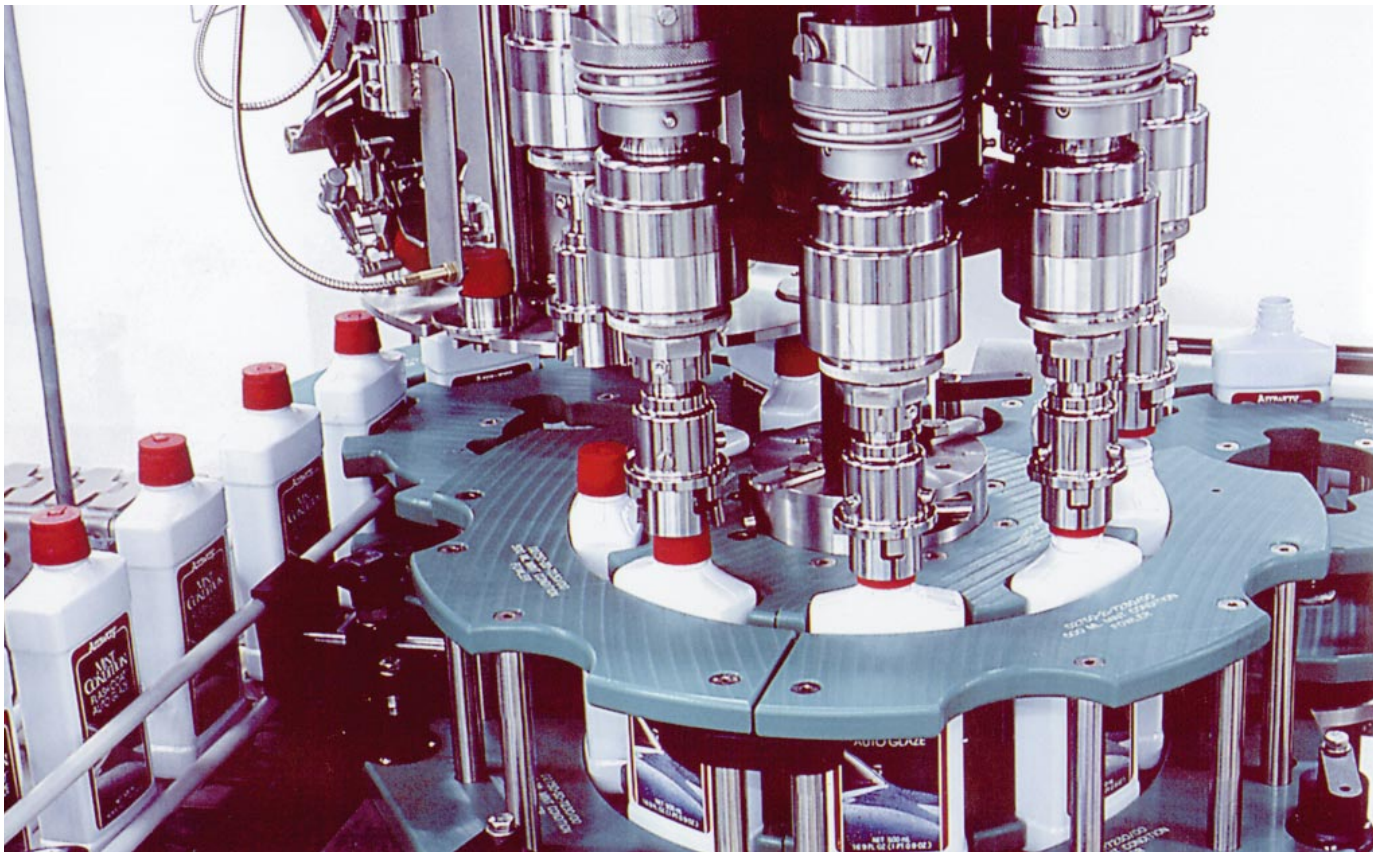
Polystone® M Selection Table	Material Description	Standard Color
Virgin Natural	Standard UHMW-PE, FDA/USDA approved	Opaque white
Virgin Colors	Available in standard and custom colors	Assorted
Reprocessed	Economical benefit in non-food applications	Black, Green
XL Crosslinked	Improved wear resistance and reduced thermal expansion	Grey
MPG Glass Filled	Superior wear resistance and dimensional stability	Blue
M-Slide	Dry lubricants to significantly reduce the coefficient of friction	Dark Grey
Oil Filled	Reduced coefficient of friction, FDA/USDA approved	Grey
U.V. Stabilized	Life can be extended up to 5 times in outdoor applications	Black
Anti-Static	Electrically conductive to reduce static build-up	Black
Rubber Backed	.060" rubber backing allows the use of adhesives	Opaque white
Flame Retardant	MSHA approved for underground mining	White

Other grades and colors available upon request

Polystone® M is extremely durable in the food and beverage, bottling and canning industries

The excellent abrasion and chemical resistance in addition to the ability to absorb noise makes it ideal for applications such as:

- star wheels and corner guides
- chain and belt guides
- idler sprockets
- guide rails and rollers
- bin and mixer linings



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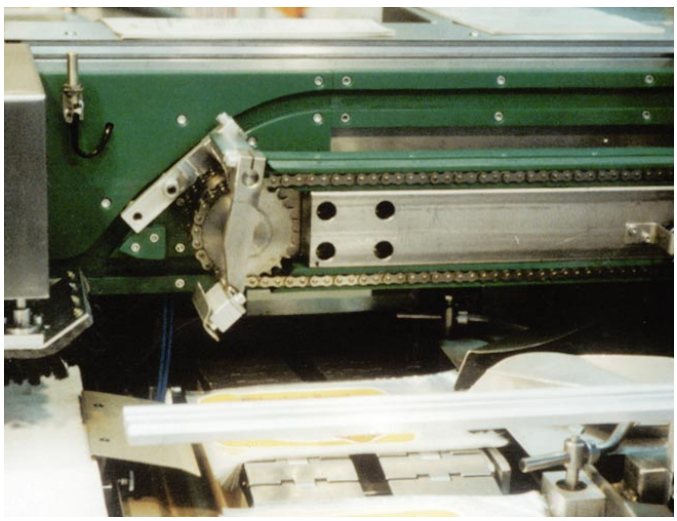

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1 *Polystone® M star wheels and guides on filling and capping machinery*
2 *Polystone® M chain guides and tracks on food packaging machinery*

Polystone® M resists abrasion in the conveying industry

Today's high speed conveyors demand surfaces with a low coefficient of friction combined with excellent impact and abrasion resistance. Polystone® M is ideal for the following applications:

- straight and curved tracks
- wear strips and guide rails
- rollers and roller sleeves
- gears and sprockets
- pillow blocks

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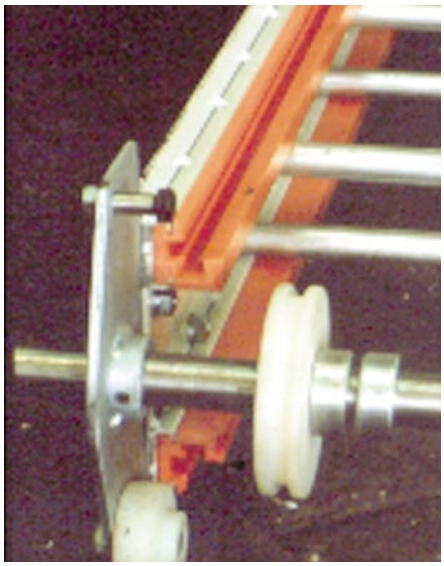

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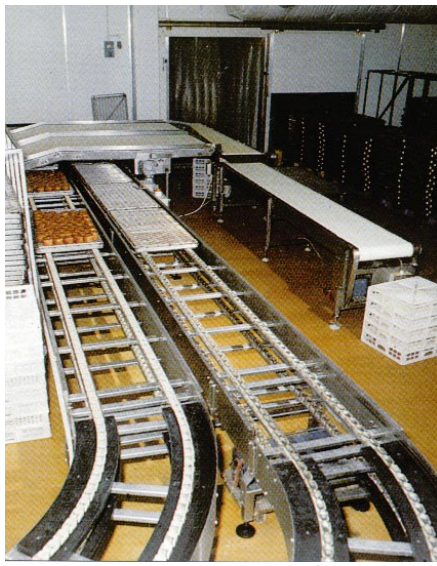

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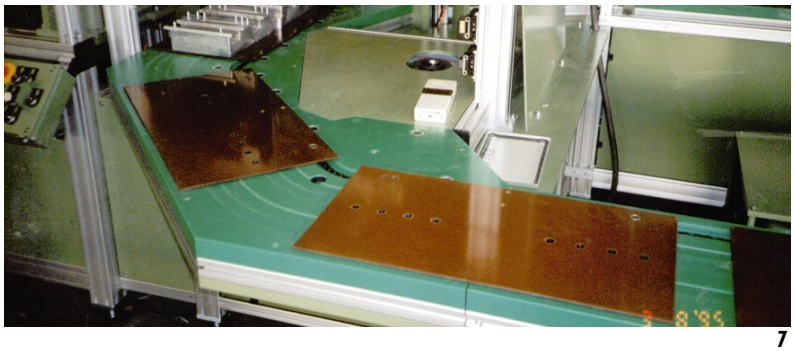

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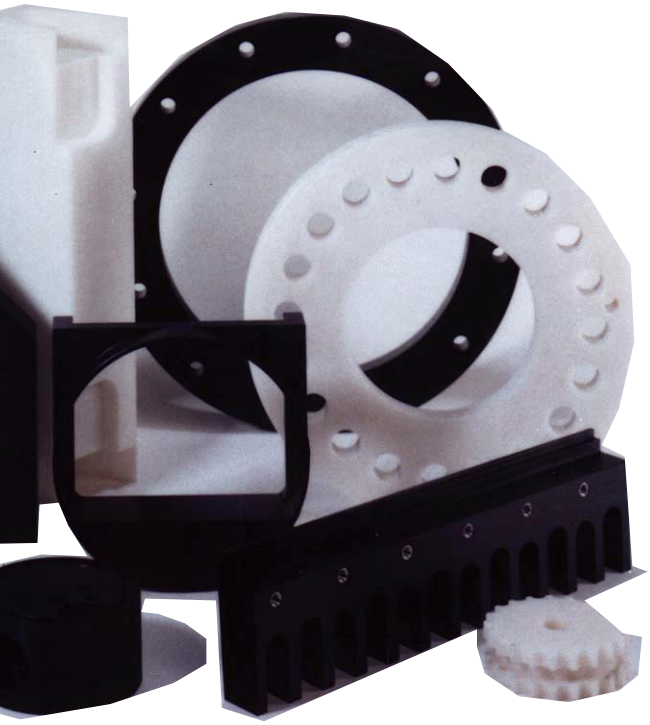

3 *Polystone® M machined and extruded chain tracks*
4 *Machined curve tracks and extruded profiles of Polystone® M*
5 *Polystone® M chain guide and roller*
6 *Polystone® M Oil Filled chain tensioner*
7 *Polystone® M guide rails*
8 *Car wash roller machined from Polystone® M Reprocessed*

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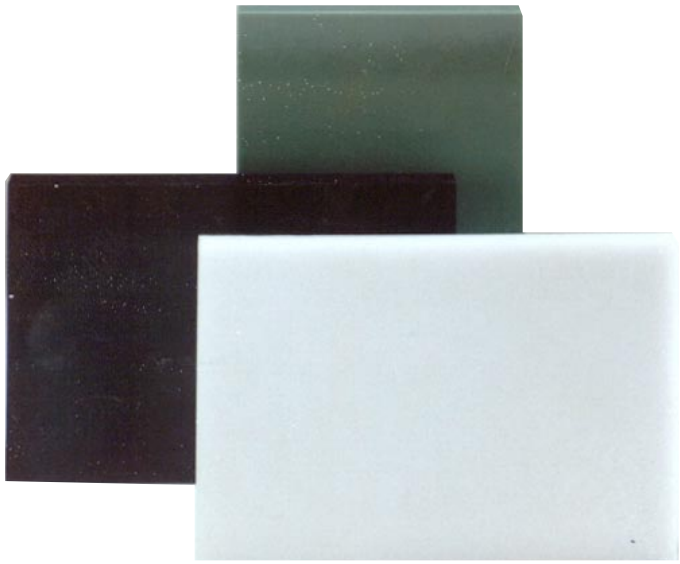
Polystone® M promotes flow in the material handling industry



Moving and conveying materials presents engineers with the challenge of finding a solution to abrasion and sticking problems. Polystone® M is the answer in applications such as:

- drag flights and paddles
- truck bedliners
- side rails and skirtboards
- dragline bucket liners

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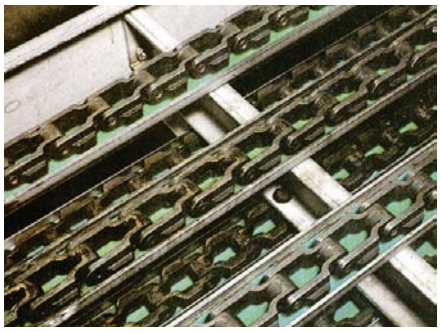

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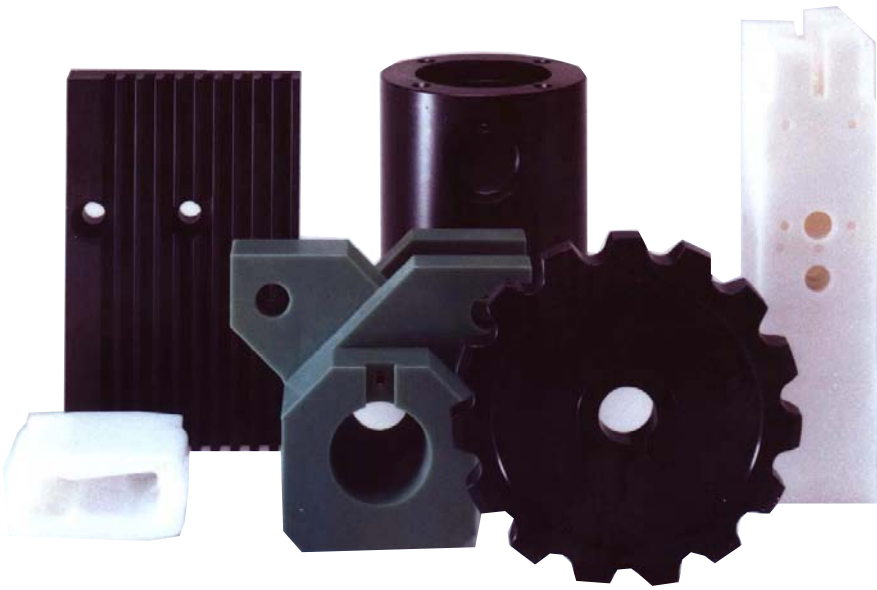
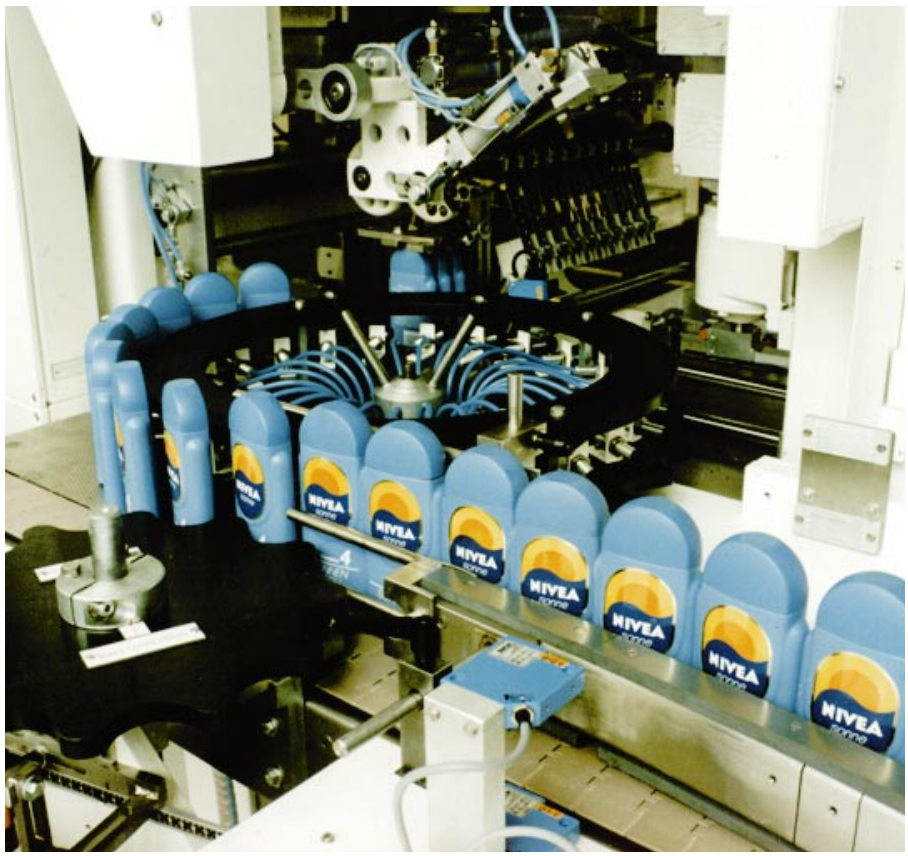
9 *Polystone® M U.V. Stabilized dock fenders*
10 *Chain wear plates made from Polystone® M Reprocessed*
11 *Polystone® M wear pads on an impact slider bed*
12 *A truck bedliner made of Polystone® M*

Polystone® M performs with remarkably low friction in the packaging industry

A polymer that is self-lubricating, non-marking and very easily machined while continuing to exhibit its exceptional abrasion resistance makes it extremely attractive in applications such as:

- bushings and bearings
- timing screws
- drive sprockets
- bumper and sorter push blocks
- wear strips and plates





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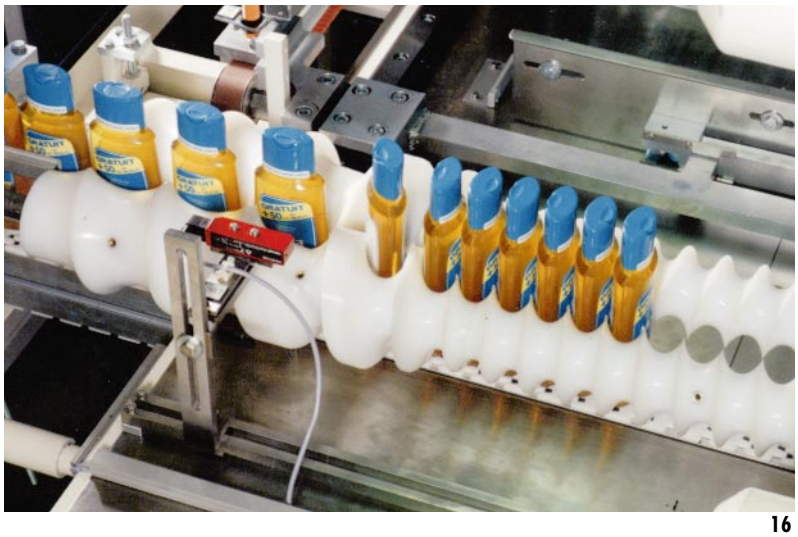
13 *Polystone® M star wheels and guides*
14 *Wear components machined from Polystone® M*
15 *A brewery makes use of Polystone® M wear strips and rollers*
16 *A timing screw machined from Polystone® M Natural*



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Chemical resistance
Machining methods

Chemical resistance	Polystone® M (UHMW-PE)		Polystone® M (UHMW-PE)
Acetaldehyde	+	Glycerine	+
Acetic acid	+	Hydrochloric acid	+
Acetone	+	Hydrogen peroxide	+
Acrylonitrile	+	Hydrogen sulphide	+
Allyl alcohol	96 +	Lactic acid	+
Aluminum chloride	A +	Magnesium chloride	A +
Ammonia	A +	Mercury	+
Ammonium chloride	A +	Methanol	+
Aniline	+	Methyl ethyl ketone	+
Benzaldehyde	+	Methylene chloride	/
Benzene	/	Mineral Oil	+
Benzyl alcohol	+	Nitric acid	+ to /
Bleach (Chlorine)	–	Nitrobenzene	+
Boric acid	A +	Oleic acid	+
Butanol	+	Ozone	/
Butyl acetate	+	Perchloric acid	50 +
Calcium chloride	+	Petroleum	+
Carbon disulphide	/	Phenol	+
Carbon tetrachloride	/ M –	Phosphoric acid	+
Chlorine gas	/	Potassium bichromate	40 +
Chlorobenzene	/	Potassium hydroxide	30 +
Chloroform	/ M –	Potassium nitrate	+
Chromic acid	10 +	Potassium permanganate	+
Citric acid	+	Pyridine	+
Cyclohexanol	+	Sea water	+
Cyclohexanone	+	Sodium carbonate	10 +
Dekalin	+	Sodium chloride	10 +
Dibutyl phthalate	+	Sodium hydroxide	60 +
Diesel oil	+	Sodium sulphite	
Diethyl ether	+ to /	Sulphuric acid	75 +
Dioxane	+	Tallow	+
Ethanol	96 +	Tetrahydrofurane	+ M –
Ethyl acetate	+	Tetralin	+
Ethylene chloride	/	Thionyl chloride	–
Ethylene diamine	+	Toluene	/
Ferric chloride	A +	Transformer oil	+
Fluorine	–	Trichlorethylene	+ M –
Formaldehyde	40 +	Urea, aqueous	33 +
Formic acid	+	Water	+
Furfurol	+	Zinc chloride	A +

Values obtained at room temperature. Call for high or low temperature applications.
Number indicates concentration if < 100 %. M = Values may change under mechanical stress.
A = Aqueous solution.

+ = Specimen is resistant .....Swelling < 3 % or weight loss < 0.5 %. Break elongation not significantly altered.
/ = Specimen has limited resistance.....Swelling 3-8 % or weight loss 0.5-5 % and/or break elongation decreased by < 50 %.
– = Specimen is not resistant .....Swelling > 8 % or weight loss > 5 % and/or break elongation decreased by > 50 %.

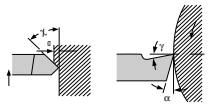
Recommended Machining Conditions

Polystone® M can be efficiently machined with equipment generally used for fabricating wood and metals. Sharp tools with wide-tooth spacing should be used for sufficient chip clearance and heat removal.

Sawing

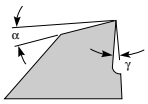
Cutting speed	3,000 - 13,000 ft/min
Feed	0.0008 - 0.0040 in/tooth
Rake angle in degrees	0 - 5 HM, 3 - 8 HSS
Clearance in degrees	10 -15 HM, 30 - 40 HSS
Tool material	Carbide Tip High speed tool steel (HSS)
Comments	pitch 0.20 - 0.40 in setting 0.03 - 0.04 in

Turning



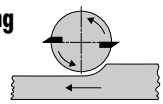
Cutting speed	600 - 1,300 ft/min
Feed	0.004 - 0.020 in/rev
Rake angle in degrees	0 - 15
Clearance in degrees	5 - 15
Tool material	HSS
Comments	depth of cut .020 - .250 in

Milling



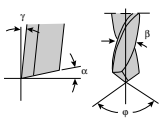
Cutting Speed	600 - 12,000 ft/min
Feed	0.010 - 0.030 in/rev
Rake angle in degrees	0 - 15
Clearance in degrees	5 - 15
Tool material	HSS
Comments	-----

Planing



Cutting speed	8,000 - 12,000 ft/min
Feed	0.012 - 0.030 in/rev
Rake angle in degrees	15 - 20
Clearance in degrees	15 - 30
Tool material	HSS, carbide Tip
Comments	-----

Drilling



Cutting speed	150 - 500 ft/min
Feed	0.004 - 0.012 in/rev
Rake angle in degrees	15 - 25
Clearance in degrees	10 - 12
Tool material	Hardened tool steel
Comments	rifling angle 20 - 30° angle of point 60 - 90°

Range of products
Physical properties and specifications

Physical properties			Polystone M® (UHMW-PE)			
Property	Units	ASTM Test	Natural	XL Cross linked	MPG Glass filled	Reprocessed
Density	gm/cm^3	D792	.930 - .936	.932	.96	.935
Tensile strength at yield 73°F	psi	D638	3100	2900	2700	3000
Elongation 73° F	%	D638	350	300	300	300
*Relative volumetric abrasion loss	*	*	100	85	75	90
Coefficient of friction 73°F on steel	–	–	Static .15 - .20 Dynamic .10 - .20	.15 - .20 .10 - .20	.15 - .20 .10 - .20	.17 - .20 .10 - .20
IZOD impact strength 73°F	KJ/m^2	D4020-96	125	125	110	96
Hardness 73°F	–	D785	Shore D 62 - 66	D 62 - 67	D 62 - 67	D 63 - 69
Melting point	°F	D789	275° - 280°	275° - 280°	275° - 280°	275° - 280°
Coefficient of linear thermal expansion	1/K	D696	2.0 x 10^{-4}	1.0 x 10^{-4}	1.0 x 10^{-4}	1.9 x 10^{-4}
Continuous service temperature in air (max)	°F	–	180	180	180	180
Volume resistivity	Ohm/cm	D257	>10^{15}	>10^{15}	>10^{15}	>10^{15}
Dielectric constant (10^3 Hz)	–	D150	2.3	2.3	2.3	–
Dielectric strength	KV/mm	D149	900	900	900	900

Specifications and Approvals		
ASTM	D-4020	UHMW-PE molding and extrusion materials
FDA	Natural, Oil-filled and if requested, Virgin Colors	Polystone® M (UHMW-PE) is in compliance with FDA regulations as listed in the Federal Register under the Food, Drug and Cosmetic Act of 1958, as amended for food contact use provided it is used unmodified and in accordance with good manufacturing practices.
USDA	Same as above	Polystone® M (UHMW-PE) has USDA approval for meat and poultry in food handling applications.
Federal	L-P-390C	Plastic, molding and extrusion material, polyethylene and copolymers (low, medium and high density)
Military	MIL-P-23536 MIL-P-21922	Plastic sheets, virgin and borated polyethylene Plastic rods and tubes polyethylene
OSHA		Polystone® M (UHMW-PE) is not considered hazardous, as defined by the OSHA Hazard Communications Standard 29 CFR 1910.1200

** Industry standard testing method using a slurry of 60 % aluminum oxide and 40 % water at a rotation speed of 1750 rpm for 2 hours. Results indicate the ability of each material, in relation to Natural (=100), to resist abrasion under typical UHMW-PE applications. A lower number indicates better abrasion resistance.*

The information listed herein is stated to the best of our knowledge and is intended to provide a general guideline for Polystone® M and its uses. The values given are based on laboratory testing backed with global industry experience. All properties in this brochure have performed equal or better in laboratory testing. However, the data should not be considered as guaranteed specific properties. Suggested applications are provided for information only and are not specific recommendations.

Polystone® M (UHMW-PE)

Sheets
1/32"- 7" x 48" x 120"
1/32"- 4" x 48" x 96"
Rods
1/4"- 10" diameter
Tubes
2"- 7-1/8" outside diameter
Profiles
Standard and custom