UHMW Mechanical Properties

Comparison of dynamic coefficient of friction on polished steel

PROPERTY	ASTM TEST	UNITS METRIC (U.S)	.030"	.060"	.125"
Density	D792	gm/cc	0.93	0.93	0.93
Tensile Strength @ Yield	D638	MPa(psi)	23(3300)	20(2964)	22(3227)
Tensile Strength @ Break	D638	MPa(psi)	53(7740)	49(7056)	44(6373)
Elongation @ Break	D638	%	460	463	466
Youngs "E" Modulus	D638	MPa(psi x 105)	725(1.05)	731(1.06)	672(0.97)
Izod Impact Strength (23°C)	D256(1)	J/m(ft-lb/in notch)			
Izod Impact Strength (-40°C)	D256(1)	J/m(ft-lb/in notch)			
Hardness Shore "D"	D2240	-	65	65	65
Abrasion Resistance					
Water Absorbtion	D570	%	Nil	Nil	Nil
Relative Solution Viscosity	D4020	dl/gm	2.3 - 3.5	2.3 - 3.5	2.3 - 3.5
COEFFICIENT OF FRICTION					
Static			0.16	0.16	0.16
Dynamic			0.14	0.13	0.14

(1) Izod Impact Strength: Samples have two(15o +/- 1/2o) notches on opposite sides to a depth of 5mm.

PROPERTY	DRY	WATER	OIL
UHMW-PE	.10-.22	.05-.10	.05-.08
NYLON 6	.15-.40	.14-.19	.02-.11
NYLON 6/6	.15-.40	.14-.19	.02-.11
NYLON/MoS2	.12-.20	.10-.12	.08-.10
PTFE	.04-.25	.04-.08	.04-.05
ACETAL COPOLYMER	.15-.35	.10-.20	.05-.10

THERMAL PROPERTIES

PROPERTY	ASTM TEST	UNITS METRIC (U.S)	.030"	.060"	.125"
Crystalline Melting Range	Polarizing	°C(°F)	136(276)	134(273)	134(273)
Crystallinity	D3417-96	%	48	47	50
COEFFICIENT OF LINEAR EXPANSION					
20 - 100°C	D696	TBD	TBD	TBD	TBD
-20 to -100°C	D696	TBD	TBD	TBD	TBD

ELECTRICAL PROPERTIES

PROPERTY	ASTM TEST	UNITS METRIC (U.S)	.030"	.060"	.125"
Volume Resistivity	D357	Ohms/cm	5.9544x10^7	1.4516x10^7	>2.000x10^13
Dielectric Strength	D150	KV/cm (V/mil)	*	*	142
Dielectric Constant	D150		2.481	2.454	2.542
Surface Resistivity 1% Carbon Black	D257	Ohms	10^3	10^3	10^3
Static Decay 1% Carbon Black		Seconds	<.01	<.01	<.01
DISSIPATION FACTOR					
At 50Hz	D150		0.0594	0.0213	0.0082
At 10KHz	D150		0.1085	0.0690	0.0022
At 5MHz	D150		0.1035	0.2340	0.0034

* No reading could be taken due to material thickness.

UHMW Frequently Asked Questions:

1) What is UHMW-PE?

UHMW Polyethylene is a Linear Polymer with a molecular weight in the range of 3,100,000 to 6,000,000. Therefore, UHMW-PE has a molecular weight average 10 times that of conventional high density polyethylene resin.

2) What are the benefits of UHMW-PE?

The high molecular weight is what gives UHMW-PE a unique combination of high impact strength, low co-efficient of friction and abrasion resistance that outwears carbon steel 10 to 1 making it more suitable for many applications where lower molecular weight grades fail.

3) Where is UHMW used?

UHMW is a self-lubricating material which exhibits excellent wear and abrasion properties in addition to extremely high impact strength. Markets which would utilize these attributes would be snowboard bottoms, material handling, packaging, food processing and automotive just to name a few.

4) What are my installation options for UHMW?

Professional Plastics offers two methods of adhering - the use of pressure sensitive systems (peel and stick) and “Treated For Bonding” allowing UHMW-PE to be bonded using epoxy systems or contact cements. The traditional method of mechanical fastening can also be used if preferred.

5) What is the temperature range of UHMW?

UHMW-PE can operate continuously up to 180 degrees F and intermittently at 220 F with custom formulations available to enhance the temperature range up to 300 F. UHMW-PE can perform without degradation at cryogenic temperatures (-452 F).

6) Is UHMW USDA and FDA approved?

Yes, UHMW-PE is FDA and USDA approved for use in food processing and medical applications.

7) Is UHMW UV stable?

In its natural state, UHMW-PE is not UV stable, but formulations are available to provide UV stability in natural, black or any custom color.

8) Is UHMW available in a conductive or anti-static form?

Professional Plastics can offer virtually all of their gauges in conductive or anti-static forms making it ideal for use in electronics or semi-conductor applications

9) In what form is UHMW-PE available?

Professional Plastics can supply UHMW-PE from .003” through .125” thick in continuous coil from 1/4”up to 24” wide in roll form, cut to length pieces and in stamped parts.

10) What colors are available?

While natural (milky white) and black are standard stock colors, UHMW-PE can be produced in any color in the Pantone library.

11) Are there any high performance blends that can be added to UHMW-PE?

The factory R & D department has done extensive research on numerous additives that can enhance a variety of properties of UHMW-PE thereby providing customized products to meet customer requirements.

SPECIFICATIONS & APPROVAL FOR USE OF Hostalen GUR UHMW Polymer

STANDARD UHMW ROLL SPECIFICATIONS

COLORS	STANDARD UHMW ROLL LENGTH	STANDARD ROLL TOLERANCE	STANDARD THICKNESS TOLERANCE
Natural and Black (Conductive available in selected gauges). Custom colors can be produced with a 400 lb. minimum.	Roll lengths on tapes from 003" - .030" are available in standard 18 yd.(54") and 36 yd.(108") lengths. All other gauges come in standard 50" and 100" coils. Other lengths are available by request.	+/- .030" on width (tighter tolerances are available by request)	+/- 10% (tighter tolerances available by request)

ASTM	D4020 UHMW-PE	Molding and Extrusion Materials
	F-648 UHMW-PE	Powder and Fabricated Forms for Surgical Implants
FDA		Hostalen is in compliance with FDA regulations as listed in 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.
FEDERAL L-P-390C		Plastic, Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density)
MILITARY	MIL-B-17901	Bearing Components, Bonded Synthetic Rubber, Water Lubricated
	MIL-P-23536	Plastic Sheets, Virgin and Borated Polyethylene
NSF		To obtain NSF approval, a manufacturer must submit a unit which contains Hostalen GUR (e.g. a component in a refrigerator or drinking fountain)
OSHA		Hostalen is not considered hazardous as defined by the OSHA Hazard Communication Standard 29 CFR 1910.1200
UL		There is no current listing for Hostalen GUR. However, previous UL-94 testing resulted in a V-2 rating for unmodified GUR and a V-0 rating with sufficient flame retardant additives. Standard 29 CFR 1910.1200
USDA		Hostalen has a USDA approval for meat and poultry in food handling applications.

Rubber based adhesive systems typically offer the highest adhesion and shear properties in comparison to acrylic or silicone. They are best used in ambient, indoor applications as rubber adhesives are susceptible to UV and elevated temperatures. Since

rubber adhesives are very aggressive, they will work with a wide variety of substrates and satisfy most adhesion requirements.

Silicone based adhesive systems are primarily used for application requiring very high temperature resistence or for applications where the adhesive will be bonding to a silicone filled material. These sysems typically do not possess high adhesion and would only be recommended for thin films where thermal expansion or shear will not not be an issue. Silicone adhesives are also high priced which may exclude them from competitive situations.

Acrylic based adhesive systems are more versatile than rubber based systems and provide a host of attributes such as UV stability, higher temperature performance and good to excellent chemical resistence. While rubber based adhesives have a higher initial bond, the acylics go through a 24 hour cure cycle or “wet-out” period where over time, the bond continues to improve. Acylic systems are usually a little higher cost but offer longer life than rubber adhesives.

ADHESIVE PROPERTIES for UHMW

Adhesion, 180i Peel	2 mil	(0.05 mm)	Polyester Support
	U.S. POUNDS FORCE PER INCH WIDTH	METRIC NEWTONS PER METER	
Substrate: Stainless Steel *(Applied One Minute)*	175	1975	
LOOP TACK			
Substrate: Stainless Steel	288	3135	
STATIC SHEAR			
Temperature	Area	Load	Minutes to Failure
72iF(22iC)	1"(6.5cm2)	5.5 lbs(2.5kg)	>10,000
FEATURES	BENEFITS	STORAGE, SHELF LIFE & TEMP. INFO	SURFACE PREPARATION
Polypropylene Carrier	Stability in Processing	One year when stored at 70i F(21i C)	It is essential, as with all pressure-sensitive tapes, that the surface to which the tape is applied be clean, dry, and free of grease and oil.
Specially Formulated Adhesive	Combines high tack and adhesion with excellent shear	• Minimum Application Temperature: 50i F(10i C) • Maximum Continuous Operating Temperature: 120i F(49i C) • Maximum Intermittent Operating Temperature: 175i F(79i C)	