

# Cell Cast Acrylic Solutions for Aerospace

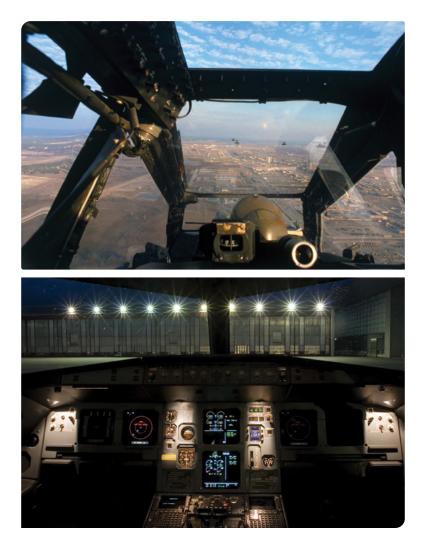


# Delivering aircraft transparencies for the demanding aerospace industry.

Polycast<sup>®</sup> cell cast acrylic has been manufactured and trusted by the aerospace industry for over 40 years. We offer different formulations designed to address the specific performance needs of various aircraft transparencies. That includes optical clarity and sheet cleanliness, unrivaled in the industry.

We consistently surpass stringent industry standards and demands, including the strict quality levels required by Military Material Specifications. Today, in supplying the Polycast® brand of materials, we are the principal supplier to the United States aerospace industry of acrylic sheet meeting U.S. Military Material Specifications MIL-PRF-5425, MIL-PRF-8184, and MIL-PRF-25690.

A comprehensive and experienced team of Spartech material engineers, technicians and sales & service representatives is available to help you determine the best Polycast<sup>®</sup> acrylic solution for your needs.



# **OUR AEROSPACE SOLUTIONS**

**POLY A** is our standard unshrunk acrylic. It is manufactured to a visual and optical aircraft specification **(ASTM D-4802)** and is available in clear as well as transparent colors. Common applications are non-critical glazing for commercial helicopters and sport planes.

Our **AIRCRAFT QUALITY** grade conforms to ASTM-D4802 and AMS-L-P-391, but is manufactured and inspected to the highest optical quality standards of Aerospace mil specs.

**POLY 900** is a lightly-cross linked material formulated to meet British specifications DTD-5592.

**POLY II** is our heat-resistant, preshrunk, clear and colored acrylic sheet formulated to meet military specification **MIL-PRF-5425**. We are qualified to furnish sheets in thicknesses 0.060"–1.000" to meet this specification.

POLY 76 is a crosslinked, preshrunk acrylic with excellent resistance to crazing, solvent attacks and dimensional change. As one of the few materials approved by the U.S. Military for use as stretched panels (MIL-PRF-25690), Poly 76 has numerous sophisticated applications for both military and commercial aircraft. It is also available in transparent colors. Poly 76 meets or exceeds all requirements of MIL-PRF-8184, Type I and II and Class 1. **POLY 84** is a uniquely formulated, crosslinked, preshrunk acrylic. With lower water absorption, it is specifically designed to provide superior craze and solvent resistance for today's changing environment. Poly 84 also meets or exceeds **MIL-PRF-8184, Type I and II, Class 1 and 2**. It is ideal for monolithic windscreens, outer laminates and canopies. Also available in transparent colors.

**POLY 2000** is produced to a military specification covering stretched acrylic sheet specially designed from **MIL-PRF-81 84** base material. It offers enhanced craze properties and increased crack resistance. It meets or exceeds all requirements of **MIL-PRF-25690**.

**Common Applications include:** fixed wing transparencies, helicopter bubbles, wing tip lenses, edge-lit display panels.

**POLYCAST SolarControl**<sup>®</sup> is a custom cell cast acrylic sheet that blocks out significant amounts of near-Infrared radiation while maintaining high visible light transmission. This acrylic solution offers full UV protection for pilots and aircraft interiors without sacrificing acrylic's superior light transmission qualities. Our aircraft-quality monolithic glazing material can be manufactured to MIL-PRF 5425, 8184 and 25690; DTD-5592; L-P-391; ASTM D-4802 and other specifications. It is available in a wide range of colors and/or light transmissions, including night vision compatibility.

# POLY II UVA MIL-PRF-5425

Produ	ct Dimensions			Thickness <sup>2</sup>													
Inches	Metric (mm)	Tolerance Class <sup>1</sup>	.060" 1.6 mm	.080" 2.1 mm	.100" 2.6 mm	.125" 3.2 mm	.150" 3.9 mm	.175" 4.8 mm	.220" 5.6 mm	.250" 6.4 mm	.312" 8.0 mm	.375" 9.6 mm	.500" 12.7 mm	.625" 15.9 mm	.750" 19.1 mm	.875" 22.3 mm	1.000" 25.4 mm
36 × 48	914.40 × 1219.2	Α	•	•						•		٠		•	•		
36 × 60	914.40 × 1524.0	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 × 72	914.40 × 1828.8	*	0	0	0	0	•	0	•	0	0	0	•	0	•	0	0
40 × 50	1016.00 × 1270.0	А												0	0	0	0
48 × 48	1219.20 × 1219.2	*						•		•		٠	•	•	•		
48 × 60	1219.20 × 1524.0	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48 × 72	1219.20 × 1828.8	В	•	•				•		•		٠	•	•	•		
48 × 96	1219.20 × 2438.4	В															
60 × 72	1524.00 × 1828.8	В								•		٠		0	•	0	0
60 × 96	1524.00 × 2438.4	C												0	0	0	0
72 × 72	1828.80 × 1828.8	C						•	•	•		•	•	•	•	•	•
72 × 96	1828.80 × 2438.4	С								٠	•	٠		0	0	0	0
<b>D</b> 1 11 11																	

Poly II UVT available upon request.

# POLY 76 MIL-PRF-8184, Type I and II, Class 1 POLY 84 MIL-PRF-8184, Type I and II, Class 2

Produ	uct Dimensions						Thickness <sup>2</sup> (inches/mm)							
Inches	Metric (mm)	Tolerance Class <sup>1</sup>	.060" 1.6 mm	.080/ 2.1 mm	.100" 2.6 mm	.125" 3.2 mm	.150" 3.9 mm	.187" 4.8 mm	.220" 5.6 mm	.250" 6.4 mm	.312" 8.0 mm	.375" 9.6 mm	.500" 12.8 mm	.625" 15.9 mm & Up
36 × 48	914.40 × 1219.2	А						•						0
36 × 60	914.40 × 1524.0	*	0	0	0	0	0	0	0	0	0	0	0	0
36 × 72	914.40 × 1828.8	*	0	0	0	0	•	0	0	0	0	0	0	0
40  imes 50	1016.00 × 1270.0	А	0	0	•		•	•	•		0	•	0	0
48 × 48	1219.20 × 1219.2	*					•	٠	0		0	0	0	0
48 × 60	1219.20 × 1524.0	*	0	0	0		•	•	0		0	0	0	0
48 × 72	1219.20 × 1828.8	В	•	•	•			•						
48 × 96	1219.20 × 2438.4	В						٠						
60 × 72	1524.00 × 1828.8	В					•	•	0			0	0	0
60 × 96	1524.00 × 2438.4	С					•	٠	0			0	0	0
72 × 72	1828.80 × 1828.8	С					•	•	0					
72 × 96	1828.80 × 2438.4	С				0	0		0		0	0	0	0

### CLEAR

- Standard Items: Standard items may be ordered in standard packages (cases and pallets).
- Non-Standard Items: Contact Polycast® Customer Service for availability.

#### COLOR

Poly 76 & Poly 84 are available in most colors, manufactured in accordance with MIL-PRF-8184 insofar as the specification is applicable.

POLY II is available in most colors, manufactured in accordance with MIL-PRF-5425 insofar as the specification is applicable. Please contact Customer Service for further information.

#### <sup>1</sup> Refer to tolerance table on page 6.

<sup>2</sup> Intermediate thicknesses are available with special ordering requirements.

Available with cutdowns from larger sizes. Tolerance of larger size prevails.

# SPECIFICATIONS BY PRODUCT, RANKED BY PERFORMANCE

PRODUCT	PRODUCT DESCRIPTION	USA	EUROPEAN EQUIVALENT SPECIFICATION
POLY A	As Cast	ASTM 4802, AMS-L-P-391	EN 4364, WL5.1412
POLY II	As Cast, Pre-Shrunk	MIL-PRF 5425	EN 4364, WL5.1412
POLY 900	Crosslinked, As Cast		DTD 5592, EN4365, meets and exceeds requirements of WL 5.1415.2, LN 9130 and DIN 65321
POLY 76	Crosslinked, As Cast, Pre-Shrunk	MIL-PRF 8184 (Class 1)	EN4365, WL5.1415
POLY 84	Crosslinked, As Cast, Lower Water Absorption, Pre-Shrunk	MIL-PRF 8184 (Class 2)	EN4365, WL5.1415
POLY 2000 (POLY 20001, POLY 20002)	Crosslinked and Stretched, Pre-Shrunk	MIL-PRF 25690	EN4366, WL5.1416

Customers may inquire about other specifications not listed, such as France AIR 9106 and Russia GOST 10667-90

TYPICAL PROPERTIES			POLYCAST POLY A	POLY 900 DTD-5592	POLY II MIL-PRF-542
MECHANICAL	TEST METHOD	UNIT			
Specific Gravity	ASTM D-792	-	1.19	1.19	1.19
Fensile Strength	ASTM D-638				
Tensile Strength, at Break Elongation, at Break		psi %	11,250 5	11,250 5	11,250 5
Modulus of Elasticity		psi	450,000	450,000	450,000
Flexural Strength	ASTM D-790				
Rupture Modulus of Elasticity		psi psi	15,250 450,000	15,250 450,000	15,250 450,000
Compressive Strength	ASTM D-695	pai	430,000	+30,000	+30,000
Yield		psi	18,000	18,000	18,000
Modulus of Elasticity		psi	440,000	440,000	440,000
Compressive Deformation (Under Load) 4,000 psi 112F, 24 hr.	ASTM D-621	%	0.75	0.75	0.75
4,000 psi 112r, 24 m. Shear Strength	ASTM D-732	psi	9,000	9,000	9,000
mpact Strength	ASTM D-752	μsi	5,000	3,000	3,000
Izod Milled Notch		ft-lbs/in	.375*	_	_
Rockwell Hardness	ASTM D-785	-	M98*	M98*	M98*
Barcol Hardness	ASTM D-2583	-	50*	50*	50*
Residual Shrinkage	ASTM D-4802				
Internal Strain)		%	2.2	2.2	<1
OPTICAL	TEST METHOD	UNIT	1.40	1.40	1.40
Refractive Index	ASTM D-542	0/	1.49	1.49	1.49
uminous Transmittance Haze	ASTM D-1003	%	92 <0.5	92 <0.5	92 <0.5
Yellowness Index	ASTM D-1925		0.5		
After Accelerated Weathering					
Luminous Transmittance Haze	ASTM G-155	%	92	92	92
1120		,	<0.5	<0.5	<0.5
Effect of Accelerated Weathering on Appearance –	ASTM G-155	_	none	none	none
Crazing, Discoloration, Warping Ultraviolet Transmission @ 320nm		0/			
Ditraviolet Transmission @ 320nm Craze Resistance	MIL-PRF	%	0	0	0
DRY IPA		psi	2,000	2,100	2,100
Lacquer Thinner			1,000	1,350	1,100
Sulfuric Acid			NA	NA	
WET IPA Lacquer Thinner			500 NA	1,460 1,200	1,000 NA
Sulfuric Acid			NA	NA	
THERMAL	TEST METHOD	UNIT			
lot Forming Temperature		°F	320*	320*	320*
Deflection Temperature Under Load (Heat Distortion	ASTM D-648	°F	202*	220*	015*
emperature)	264 psi	°F	203* 180	230* 180	215*
Max. Recommended Continuous Service Temperature	_	1	100	100	100
Coefficient of Linear Thermal Expansion	ASTM D-696	in/in/°F	0.000042	0.000042	0.000042
Coefficient of Thermal Conductivity	Cenco-Fitch	BTU/ (hr) (Ft²) (°F/in)	1.3	1.3	1.3
Thermal Relaxation					
@ 230°F @ 293°F	MIL-PRF-25690 MIL-PRF-25690	%	_	-	
Vater Absorption		/0			
Long-Term	MIL-PRF-8184	%	.65	.65	.65
24-Hour Immersion	ASTM-D570	%	0.2*	0.2*	0.2*
lammability (Burning Rate) UL94HB	ASTM D-635	in/min °F	1.2*	1.2*	1.2*
Self-ignition Temperature	ASTM D-1929 DuPont 900		830* 0.35	- 0.35	830 0.35
Specific Heat @ 77°F	(Therm. An. Cal.)	BTU/(lb) (°F)	0.30	0.30	0.35
Smoke Density	ASTM D-2843	%	27*	-	27*
Crack Propagation (Received at STD Conditions)	MIL-PRF-25690	lbs/in 3/2	_	_	_

\* Values vary by thickness. Values shown are for 0.250" thickness.

TYPICAL PROPERTIES			POLY 76 MIL-PRF-8184	POLY 84 MIL- PRF-8184	POLY 20001 MIL-PRF-25690 CLASS 1 POLY 76	POLY 20002 MIL-PRF-25690 CLASS 2 POLY 84
MECHANICAL	TEST METHOD	UNIT				
Specific Gravity	ASTM D-792	-	1.19	1.19	1.19	1.19
Tensile Strength	ASTM D-638		44.050	44.050	10.400	10 100
Tensile Strength, at Break Elongation, at Break		psi %	11,250 5	11,250 5	12,100	12,100
Modulus of Elasticity		psi	450,000	450,000		
Flexural Strength	ASTM D-790		15.050	15.050		
Rupture Modulus of Elasticity		psi psi	15,250 450,000	15,250 450,000		-
Compressive Strength	ASTM D-695					
Yield Modulus of Elasticity		psi	18,000 440,000	18,000 440,000		-
Compressive Deformation (Under Load)	ASTM D-621	psi	440,000	440,000	_	_
4,000 psi 112F, 24 hr.	A311VI D-021	%	0.75	0.75	_	_
Shear Strength	ASTM D-732	psi	9,000	9,000	3,700	3,700
Impact Strength	ASTM D-256					
Izod Milled Notch		ft-lbs/in	-	-	-	-
Rockwell Hardness	ASTM D-785	-	M98*	M98*		
Barcol Hardness	ASTM D-2583	-	50*	50*		
Residual Shrinkage (Internal Strain)	ASTM D-4802	%	<1	<1	_	_
OPTICAL	TEST METHOD	UNIT				
Refractive Index	ASTM D-542		1.49	1.49	1.49	1.49
Luminous Transmittance	ASTM D-342	%	92	92	91	91
Haze		70	<0.5	<0.75	<1.5	<1.5
Yellowness Index	ASTM D-1925					
After Accelerated Weathering Luminous Transmittance	ASTM G-155	%	91	91	90	90
Haze		70	<0.75	<0.75	<3.0	<3.0
Effect of Accelerated Weathering on Appearance – Crazing, Discoloration, Warping	ASTM G-155	-	none	none	-	-
Ultraviolet Transmission @ 320nm		%	0	0	0	0
Craze Resistance	MIL-PRF	psi				
DRY IPA			3,100	3,225	3,700	4,300
Lacquer Thinner Sulfuric Acid			3,150 1,285	3,030 1,550	3,300	3,600
WET IPA			2,440	2,775	2,750	3,600
Lacquer Thinner Sulfuric Acid			2,450 500	2,700 1,020	2,650	3,600
THERMAL	TEST METHOD	UNIT	300	1,020		
Hot Forming Temperature		°F	320*	320*	218*	218*
Deflection Temperature Under Load (Heat Distortion Temperature)	ASTM D-648 264 psi	۴	235*	225*	_	
Max. Recommended Continuous Service Temperature	-	°F	180	180	-	_
Coefficient of Linear Thermal Expansion	ASTM D-696	in/in/°F	0.000042	0.000042	0.000042	0.000042
Coefficient of Thermal Conductivity	Cenco-Fitch	BTU/ (hr) (Ft <sup>2</sup> ) (°F/in)	1.3	1.3	1.3	1.3
Thermal Relaxation						
@ 230°F @ 293°F	MIL-PRF-25690 MIL-PRF-25690	% %	-	-	3.3 45	3.3 45
Water Absorption		0/	26	16	26	1.6
Long-Term 24-Hour Immersion	MIL-PRF-8184 ASTM-D570	%	2.6 0.2*	1.6 0.2*	2.6 0.2*	1.6 0.2*
Flammability (Burning Rate) UL94HB	ASTM D-635	in/min	0.8*	0.8*	-	-
Self-ignition Temperature	ASTM D-1929	°F	-	-	-	-
Specific Heat @ 77°F	DuPont 900 (Therm. An. Cal.)	BTU/(lb) (°F)	0.35	0.35	0.35	0.35
Smoke Density	ASTM D-2843	%	-	-	-	-
Crack Propagation (Received at STD Conditions)	MIL-PRF-25690	lbs/in 3/2	-	-	2,900	2,900

	TOLERANCES FOR POLY II*, POLY 76 AND POLY 84 as per MIL-SPEC									
Standard	l Thickness <sup>1</sup>	Cla	ss A	Cla	iss B	Class C				
Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters			
0.060	1.524	±0.012	±0.305	±0.020	±0.508					
0.080	2.032	±0.012	±0.305	±0.020	±0.508					
0.100	2.540	±0.012	±0.305	±0.020	±0.508					
0.125	3.175	±0.015	±0.381	±0.020	±0.508	±0.030	±0.762			
0.150	3.810	±0.017	±0.432	±0.020	±0.508	±0.030	±0.762			
0.187	4.750	±0.020	±0.508	±0.023	±0.584	±0.030	±0.762			
0.220	5.588	±0.023	±0.584	±0.025	±0.635	±0.030	±0.762			
0.250	6.350	±0.025	±0.635	±0.030	±0.762	±0.035	±0.889			
0.312	7.925	±0.030	±0.762	±0.035	±0.889	±0.040	±1.016			
0.375	9.525	±0.035	±0.889	±0.040	±1.016	±0.045	±1.143			
0.500	12.700	±0.040	±1.016	±0.045	±1.143	±0.050	±1.270			
0.625	15.875	±0.050	±1.270	±0.050	±1.270	±0.060	±1.524			
0.750	19.050	±0.050	±1.270	±0.050	±1.270	±0.065	±1.651			
0.875	22.225	±0.050	±1.270	±0.050	±1.270	±0.070	±1.778			
1.000	25.400	±0.050	±1.270	±0.050	±1.270	±0.075	±1.905			
1.250	31.750	±0.063	±1.600	±0.063	±1.600	±0.094	±2.388			
1.500	38.100	±0.075	±1.905	±0.075	±1.905	±0.112	±2.845			
2.000	50.800	±0.100	±2.540	±0.100	±2.540	±0.131	±3.327			
2.250	57.150	±0.113	±2.870	±0.113	±2.870	±0.168	±4.267			
2.500	63.500	±0.126	±3.200	±0.126	±3.200	±0.180	±4.572			
3.000	76.200	±0.146	±3.708	±0.146	±3.708	±0.204	±5.182			
3.500	88.900	±0.150	±4.039	±0.159	±4.039	±0.219	±5.563			

\*We are qualified to furnish sheets in the entire range of thicknesses between 0.060" – 1.000" to meet this specification. Intermediate thicknesses are available.

POLY 9 Thickness ar	00 nd Sheet Sizes	5								
Thickness	Tolerance	36 x 48"	40 x 50"	48 x 72"	48 x 96"	60" x 72"	60" x 96"	72" x 72"	72" x 96"	
.060" / 1.50 mm	.048/.072"	٠	٠	•	_	_	_	_	_	<ul> <li>Standard</li> <li>Items: Standard</li> </ul>
.080" / 2.0 mm	.165/.095"	•	٠	•	_	_	_	_	_	items may
.100" / 2.50 mm	.082/.118"	•	٠	•	•		_	_	_	be ordered
.118" / 3.0 mm	.098/.138"	•	٠	•	•	—	_	_	_	in standard
.125" / 3.20 mm	.105/.145"	•	٠	•	•	•	•	0	•	packages (cases and
.138" / 3.50 mm	.116/.159"	•	٠	•	•	•	•	0	•	pallets).
.150" / 3.80 mm	.127/.173"	•	٠	•	•	•	•	0	•	Non-Standard
.157" / 4.0 mm	.133/.181"	•	٠	•	•	•	•	•	•	Items: Contact
.187" / 4.70 mm	.161/.213"	•	٠	•	•	•	•	•	•	Polycast® Customer
.197" / 5.0 mm	.169/.225"	•	٠	•	•	•	•	0	•	Service for
.220" / 5.60 mm	.191/.249"	•	٠	•	•	•	•	0	•	availability.
.236" / 6.0 mm	.208/.264"	•	٠	•	•	•	•	0	•	
.250" / 6.40 mm	.220/.280"	•	٠	•	•	•	•	0	•	Tolerances interpreted
.315" / 8.0 mm	.280/.350"	•	٠	•	•	•	•	•	•	from Fig. 2 of
.375" / 9.50 mm	.337/.413"	•	٠	•	•	•	•	•	•	DTD-5592A.
.394" / 10.0 mm	.355/.433"	•	•	•	•	•	•	•	•	
.472" / 12.70 mm	.429/.514"	•	•	•	•	•	•	•	•	
.50" / 12.70 mm	.455/.545"	•	•	•	•	•	•	0	•	
.512" / 13.0 mm	.466/.558"	•	•	•	•	•	•	0	•	
.591" / 15.0 mm	.544/.638"	•	٠	•	•	•	•	0	•	
.625" / 15.90 mm	.575/.675"	•	٠	•	•	•	•	•	•	
.709" / 18.0 mm	.659/.759"	•	٠	•	•	•	•	•	•	
.750" / 19.0 mm	.697/.803"	٠	٠	•	•	•	•	•	•	
.787" / 20.0 mm	.736/.838"	•	•	•	•	•	•	•	•	]
.875" / 22.20 mm	.822/.928"	•	•	•	•	0	•	•	•	]
.984" / 25.0 mm	.930/1.038"	•	٠	•	•	0	•	0	•	

# POLYCAST<sup>®</sup> POLY 2000 STRETCHED ACRYLIC SHEET (MIL P 25690)

# **KEY ATTRIBUTES**

- Largest sheet yields lower unit costs
- Superior optical quality
- Available in standard thicknesses

## MANUFACTURING PERFORMANCE

- Offer tighter tolerances than standard mil spec (+/- .020" < .250"; >.250" +/- 10%), upon request
- Flexibility and consistency
- Control from cell casting to stretching

# SERVICE

- Parts cut to your size and shape configurations
- Cradle to grave options
- Inventory levels exacted to your specifications
- Technical expertise and superior customer support

# **APPLICATIONS**

Military, commercial and general aviation glazing for fixed and rotary wing:

- Aircraft cockpit windows
- Aircraft canopies
- Windscreens
- Cabin windows
- Outer laminates

PROPERTY	REQUIREMENT	TYPICAL VALUE		
Angular Deviation*	7 minutes (more than 2" from edge)	1–3 min.		
Optical Distortion*	< 14 minute of arc over any 6″	3 min./6″		
Luminous Transmittance Before Weathering After Weathering	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	92.0 91.0 90.0 89.0 90.0 88.0 87.0		
Haze*: Before Weathering After Weathering	3% max. 4% max.	< 1.5 < 3.0		
Long Term Water Absorption (Class 2)	≤ 2.90%	2.79 – 2.85%		
Crack Propagation Received @ STD Conditions	Individual value: 2,300 lbs/in <sup>3/2</sup> Average value: 2,700 lbs/in <sup>3/2</sup>	2,600 – 3,000 2,700 – 3,100		
As Received @ –17.8C	Individual value: 1,150 lbs/in <sup>3/2</sup> Average value: 1,250 lbs/in <sup>3/2</sup>	1,200 — 1,500 1,300 — 1,600		
After Weathering @ STD Conditions	Individual value: 2,100 lbs/in <sup>3/2</sup> Average value: 2,300 lbs/in <sup>3/2</sup>	2,500 3,000		
Thermal Relaxation @ 110C @ 145C	10.0% max. 37.5% min.	1.6 - 5.0% 40.0 - 50.0%		
Tensile Strength	Individual value: 10,000 psi Average value: 10,500 psi	11,300 – 12,700 11,300 – 12,900		
Shear Strength	3,000 psi	3,200 – 4,200		
Craze Resistance Dry IPA a) Class 1 b) Class 2	3,000 psi 3,000 psi	3,700 – no craze 4,300 – no craze		
Dry Laquer Thinner a) Class 1 b) Class 2 Wet IPA	2,500 psi 2,500 psi	3,300 – no craze 3,400 – 3,800		
a) Class 1 b) Class 2	2,000 psi 2,500 psi	2,400 - 3,000 3,100 - 4,100		
Wet Laquer Thinner a) Class 1 b) Class 2	1,750 psi 2,000 psi	2, 200 – 3,100 2, 700 – 3,300		
Dimension Stability	0.2% max. after natural weathering	0.11		

\*Special optical requirements will be considered.

We are a leading plastics manufacturer that leverages our knowledge of materials, processing, and application development to deliver the highest level of value to our customers.



69 Southfield Ave., Stamford, CT 06902 800-243-9002 Fax: 800-955-0053 or 573-335-5661



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