Makrolon® 2405

Polycarbonate

Covestro - Polycarbonates

Technical Data

Product Description			
MVR (300°C/1.2 kg) 19 cm³/10 min; general purpose; low viscosity; easy release; injection molding - melt temperature 280 - 320°C; available in transparent, translucent and opaque colors			
General			
Material Status	• Commercial: Active		
Literature [1]	• Technical Datasheet (English)		
UL Yellow Card [2]	• E41613-100441688		
Search for UL Yellow Card	• Covestro - Polycarbonates • Makrolon®		
Availability	• Africa & Middle East • Asia Pacific	• Europe • Latin America	• North America
Features	• General Purpose	• Good Mold Release	• Low Viscosity
Uses	• General Purpose		
RoHS Compliance	• RoHS Compliant		
Appearance	• Clear/Transparent • Colors Available	• Opaque • Translucent	
Processing Method	• Injection Molding		
Multi-Point Data	• Creep Modulus vs. Time (ISO 11403-1) • Isochronous Stress vs. Strain (ISO 11403-1) • Isothermal Stress vs. Strain (ISO 11403-1)	• Secant Modulus vs. Strain (ISO 11403-1) • Shear Modulus vs. Temperature (ISO 11403-1) • Specific Volume vs Temperature (ISO 11403-2)	• Viscosity vs. Shear Rate (ISO 11403-2)
ISO Shortname	• ISO 7391-PC,MR,(,,)-18-9		

Physical	Nominal Value (English)	Nominal Value (SI)	Test Method
Density (73°F (23°C))	1.20 g/cm³	1.20 g/cm³	ISO 1183
Apparent (Bulk) Density [4]	0.66 g/cm³	0.66 g/cm³	ISO 60
Melt Mass-Flow Rate (MFR) (300°C/1.2 kg)	20 g/10 min	20 g/10 min	ISO 1133
Melt Volume-Flow Rate (MVR) (300°C/1.2 kg)	19 cm³/10min	19 cm³/10min	ISO 1133
Molding Shrinkage			
Across Flow	0.50 to 0.70 %	0.50 to 0.70 %	ISO 2577
Flow	0.50 to 0.70 %	0.50 to 0.70 %	ISO 2577
Across Flow : 536°F (280°C), 0.0787 in (2.00 mm) [5]	0.70 %	0.70 %	ISO 294-4
Flow : 0.0787 in (2.00 mm) [5]	0.65 %	0.65 %	ISO 294-4
Water Absorption			ISO 62
Saturation, 73°F (23°C)	0.30 %	0.30 %	
Equilibrium, 73°F (23°C), 50% RH	0.12 %	0.12 %	

Mechanical	Nominal Value (English)	Nominal Value (SI)	Test Method
Tensile Modulus (73°F (23°C))	348000 psi	2400 MPa	ISO 527-1/1
Tensile Stress			ISO 527-2/50
Yield, 73°F (23°C)	9430 psi	65.0 MPa	
Break, 73°F (23°C)	9430 psi	65.0 MPa	
Tensile Strain			ISO 527-2/50
Yield, 73°F (23°C)	6.0 %	6.0 %	
Break, 73°F (23°C)	130 %	130 %	
Nominal Tensile Strain at Break			ISO 527-2/50
73°F (23°C)	> 50 %	> 50 %	
Tensile Creep Modulus			ISO 899-1
1 hr	319000 psi	2200 MPa	
1000 hr	276000 psi	1900 MPa	

Form No. TDS-35082-en

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

Mechanical	Nominal Value (English)	Nominal Value (SI)	Test Method
Flexural Modulus [6] (73°F (23°C))	341000 psi	2350 MPa	ISO 178
Flexural Stress [6]			ISO 178
73°F (23°C)	14100 psi	97.0 MPa	
3.5% Strain, 73°F (23°C)	10600 psi	73.0 MPa	
Flexural Strain at Flexural Strength [7]			ISO 178
73°F (23°C)	7.1 %	7.1 %	
Films	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Water Vapor Transmission Rate			ISO 15106-1
73°F (23°C), 85% RH, 3.9 mil (100 µm)	0.97 g/100 in²/24 hr	15 g/m²/24 hr	
Carbon Dioxide Permeability			ISO 2556
73°F (23°C), 1.0 mil (25.4 µm)	18900 cm³/m²/bar/24 hr	18900 cm³/m²/bar/24 hr	
Gas Permeation			ISO 2556
Carbon Dioxide : 3.9 mil (100.0 µm)	4000 cm³/m²/bar/24 hr	4000 cm³/m²/bar/24 hr	
Nitrogen : 1.0 mil (25.4 µm)	630 cm³/m²/bar/24 hr	630 cm³/m²/bar/24 hr	
Nitrogen : 3.9 mil (100.0 µm)	130 cm³/m²/bar/24 hr	130 cm³/m²/bar/24 hr	
Oxygen : 1.0 mil (25.4 µm)	3150 cm³/m²/bar/24 hr	3150 cm³/m²/bar/24 hr	
Oxygen : 3.9 mil (100.0 µm)	700 cm³/m²/bar/24 hr	700 cm³/m²/bar/24 hr	
Impact	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Charpy Notched Impact Strength [8]			ISO 179/1eA
-22°F (-30°C), Complete Break	6.7 ft·lb/in²	14 kJ/m²	
73°F (23°C), Partial Break	31 ft·lb/in²	65 kJ/m²	
Charpy Unnotched Impact Strength			ISO 179/1eU
-76°F (-60°C)	No Break	No Break	
-22°F (-30°C)	No Break	No Break	
73°F (23°C)	No Break	No Break	
Notched Izod Impact Strength [8]			ISO 180/A
-22°F (-30°C), Complete Break	7.1 ft·lb/in²	15 kJ/m²	
73°F (23°C), Partial Break	31 ft·lb/in²	65 kJ/m²	
Multi-Axial Instrumented Impact Energy			ISO 6603-2
-22°F (-30°C)	47.9 ft·lb	65.0 J	
73°F (23°C)	40.6 ft·lb	55.0 J	
Multi-Axial Instrumented Impact Peak Force			ISO 6603-2
-22°F (-30°C)	1350 lbf	6000 N	
73°F (23°C)	1150 lbf	5100 N	
Hardness	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Ball Indentation Hardness	16700 psi	115 MPa	ISO 2039-1
Thermal	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Deflection Temperature Under Load			
66 psi (0.45 MPa), Unannealed	279 °F	137 °C	ISO 75-2/B
264 psi (1.8 MPa), Unannealed	255 °F	124 °C	ISO 75-2/A
Glass Transition Temperature [9]	291 °F	144 °C	ISO 11357-2
Vicat Softening Temperature			
--	295 °F	146 °C	ISO 306/B120
--	293 °F	145 °C	ISO 306/B50
Ball Pressure Test (277°F (136°C))	Pass	Pass	IEC 60695-10-2
CLTE			ISO 11359-2
Flow : 73 to 131°F (23 to 55°C)	3.6E-5 in/in/°F	6.5E-5 cm/cm/°C	
Transverse : 73 to 131°F (23 to 55°C)	3.6E-5 in/in/°F	6.5E-5 cm/cm/°C	
Thermal Conductivity [10] (73°F (23°C))	1.4 Btu·in/hr/ft²/°F	0.20 W/m/K	ISO 8302
RTI Elec (0.06 in (1.5 mm))	257 °F	125 °C	UL 746B
RTI Imp (0.06 in (1.5 mm))	239 °F	115 °C	UL 746B
RTI Str (0.06 in (1.5 mm))	257 °F	125 °C	UL 746B

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

Electrical	Nominal Value (English)	Nominal Value (SI)	Test Method
Surface Resistivity	1.0E+16 ohms	1.0E+16 ohms	IEC 60093
Volume Resistivity (73°F (23°C))	1.0E+16 ohms·cm	1.0E+16 ohms·cm	IEC 60093
Electric Strength			IEC 60243-1
73°F (23°C), 0.0394 in (1.00 mm)	860 V/mil	34 kV/mm	
Relative Permittivity			IEC 60250
73°F (23°C), 100 Hz	3.10	3.10	
73°F (23°C), 1 MHz	3.00	3.00	
Dissipation Factor			IEC 60250
73°F (23°C), 100 Hz	5.0E-4	5.0E-4	
73°F (23°C), 1 MHz	9.0E-3	9.0E-3	
Comparative Tracking Index			IEC 60112
Solution A	250 V	250 V	
Solution B	125 V	125 V	
Flammability	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Flame Rating			UL 94
0.11 in (2.7 mm)	HB	HB	
0.014 in (0.36 mm)	V-2	V-2	
0.030 in (0.75 mm)	V-2	V-2	
Glow Wire Flammability Index			IEC 60695-2-12
0.030 in (0.75 mm)	1560 °F	850 °C	
0.06 in (1.5 mm)	1610 °F	875 °C	
0.12 in (3.0 mm)	1710 °F	930 °C	
Glow Wire Ignition Temperature			IEC 60695-2-13
0.030 in (0.75 mm)	1610 °F	875 °C	
0.04 in (1.0 mm)	1610 °F	875 °C	
0.06 in (1.5 mm)	1610 °F	875 °C	
0.12 in (3.0 mm)	1610 °F	875 °C	
Oxygen Index [11]	27 %	27 %	ISO 4589-2
Application of Flame from Small Burner [12]			DIN 53438-1, -3
78.7 mil (2.00 mm)	K1, F1	K1, F1	
Burning Rate [13] (> 39.4 mil (> 1.00 mm))	passed	passed	ISO 3795
Flash Ignition Temperature	896 °F	480 °C	ASTM D1929
Needle Flame Test			IEC 60695-11-5
59.1 mil (1.50 mm) [14]	5.0 sec	5.0 sec	
59.1 mil (1.50 mm) [15]	60.0 sec	60.0 sec	
78.7 mil (2.00 mm) [14]	5.0 sec	5.0 sec	
78.7 mil (2.00 mm) [15]	120.0 sec	120.0 sec	
0.12 in (3.00 mm) [14]	10.0 sec	10.0 sec	
0.12 in (3.00 mm) [15]	120.0 sec	120.0 sec	
Self Ignition Temperature	1022 °F	550 °C	ASTM D1929
Optical	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Refractive Index [16]	1.585	1.585	ISO 489
Light Transmittance			ISO 13468-2
39.37 mil (1000 µm)	89.0 %	89.0 %	
78.74 mil (2000 µm)	89.0 %	89.0 %	
118.1 mil (3000 µm)	88.0 %	88.0 %	
157.5 mil (4000 µm)	87.0 %	87.0 %	
Haze (118.1 mil (3000 µm))	< 0.800 %	< 0.800 %	ISO 14782
Additional Information	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Electrolytical Corrosion (73°F (23°C))	A1	A1	IEC 60426

Form No. TDS-35082-en

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

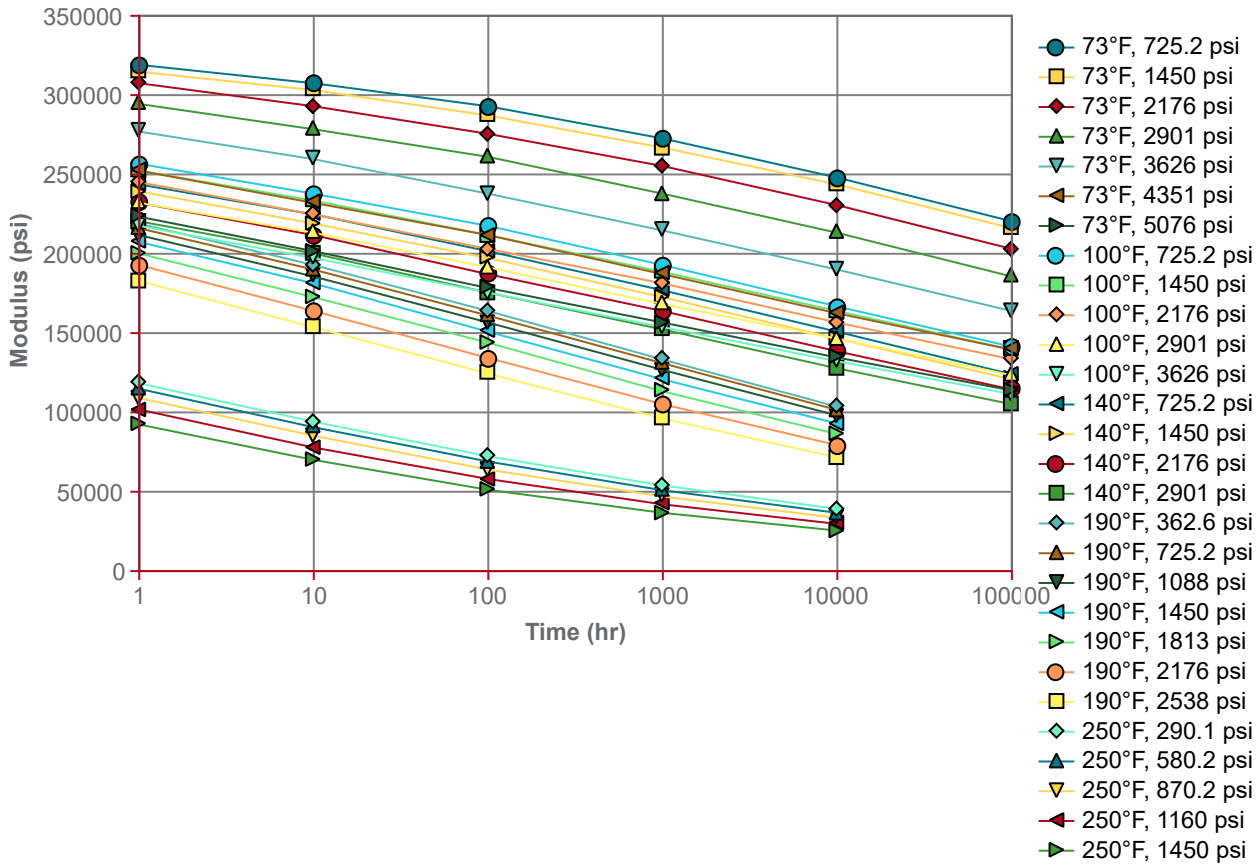
Injection	Nominal Value (English)	Nominal Value (SI)
Drying Temperature - Dry Air Dryer	248 °F	120 °C
Drying Time - Dry Air Dryer	2.0 to 3.0 hr	2.0 to 3.0 hr
Suggested Max Moisture	< 0.020 %	< 0.020 %
Suggested Shot Size	30 to 70 %	30 to 70 %
Rear Temperature	482 to 500 °F	250 to 260 °C
Middle Temperature	518 to 536 °F	270 to 280 °C
Front Temperature	536 to 554 °F	280 to 290 °C
Nozzle Temperature	554 to 572 °F	290 to 300 °C
Processing (Melt) Temp	536 to 608 °F	280 to 320 °C
Mold Temperature	176 to 248 °F	80 to 120 °C
Back Pressure	725 to 2180 psi	5.00 to 15.0 MPa
Vent Depth	9.8E-4 to 3.0E-3 in	0.025 to 0.075 mm

Injection Notes

Hold Pressure (% of Injection Pressure): 50 - 75%
Peripheral Screw Speed: 0.05 - 0.2 m/s
Standard Melt Temperature: 300°C

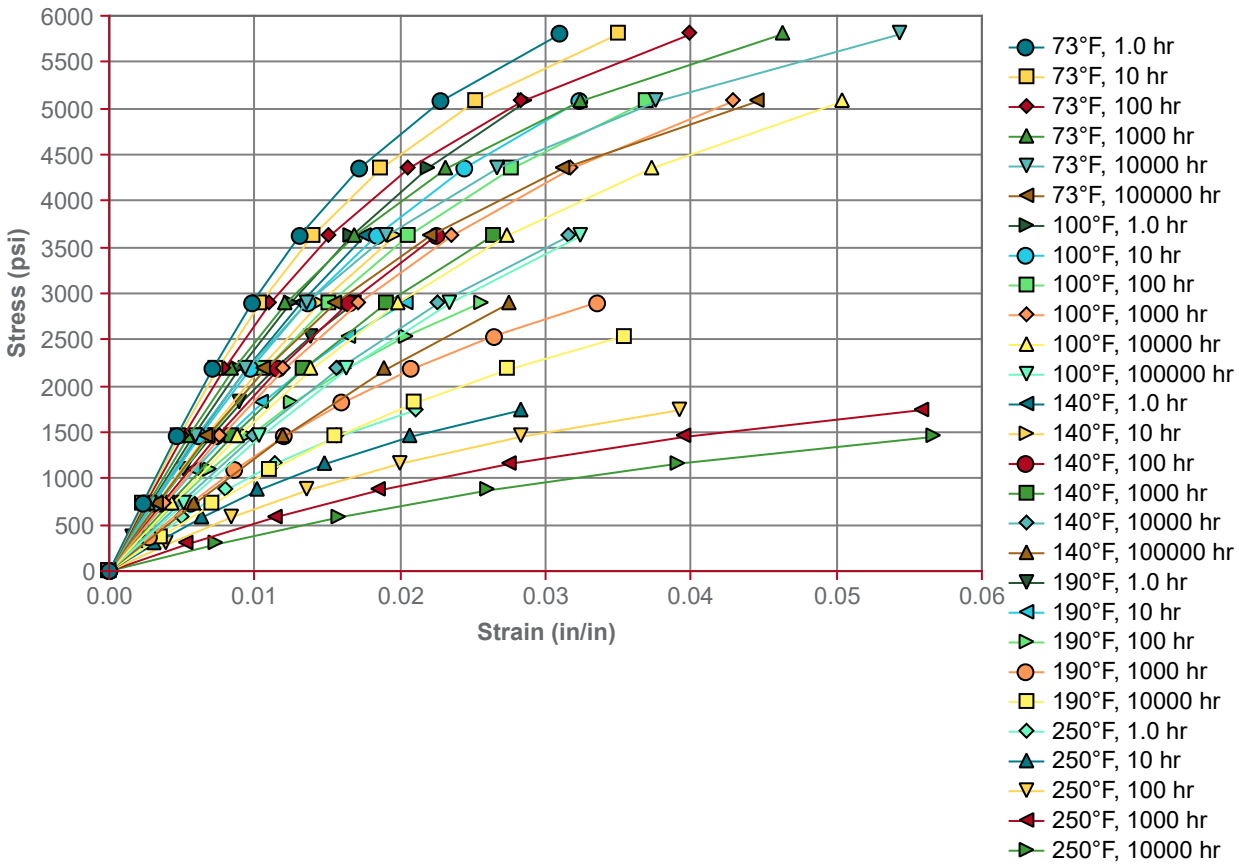
Form No. TDS-35082-en
Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

Creep Modulus vs. Time (ISO 11403-1)



Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

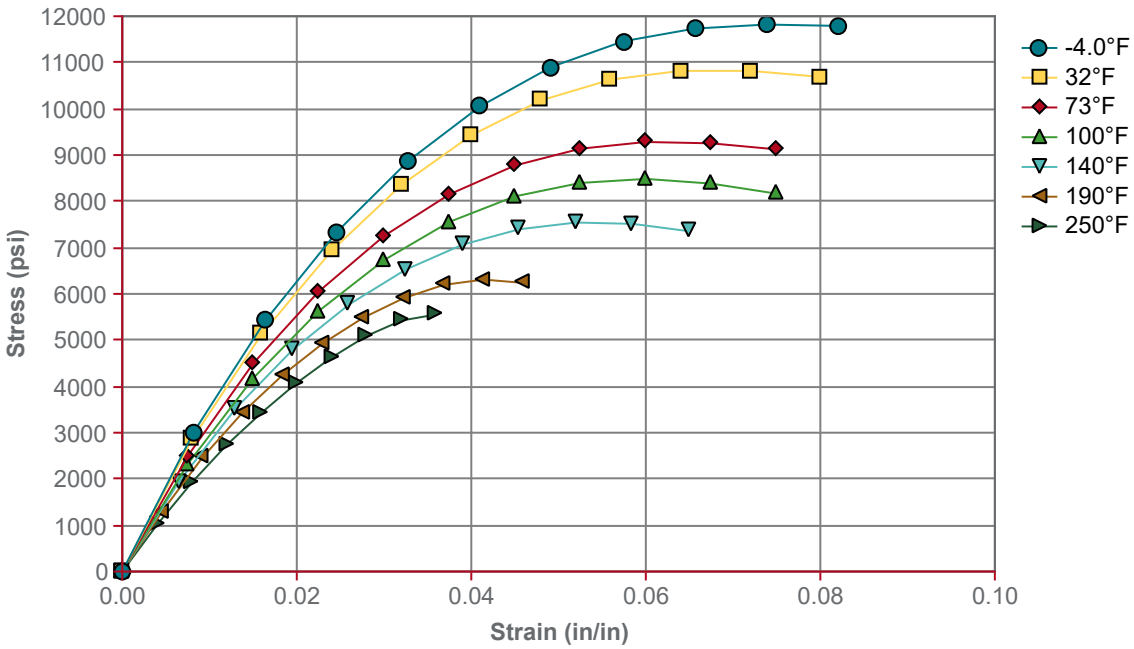
Isochronous Stress vs. Strain (ISO 11403-1)



Form No. TDS-35082-en

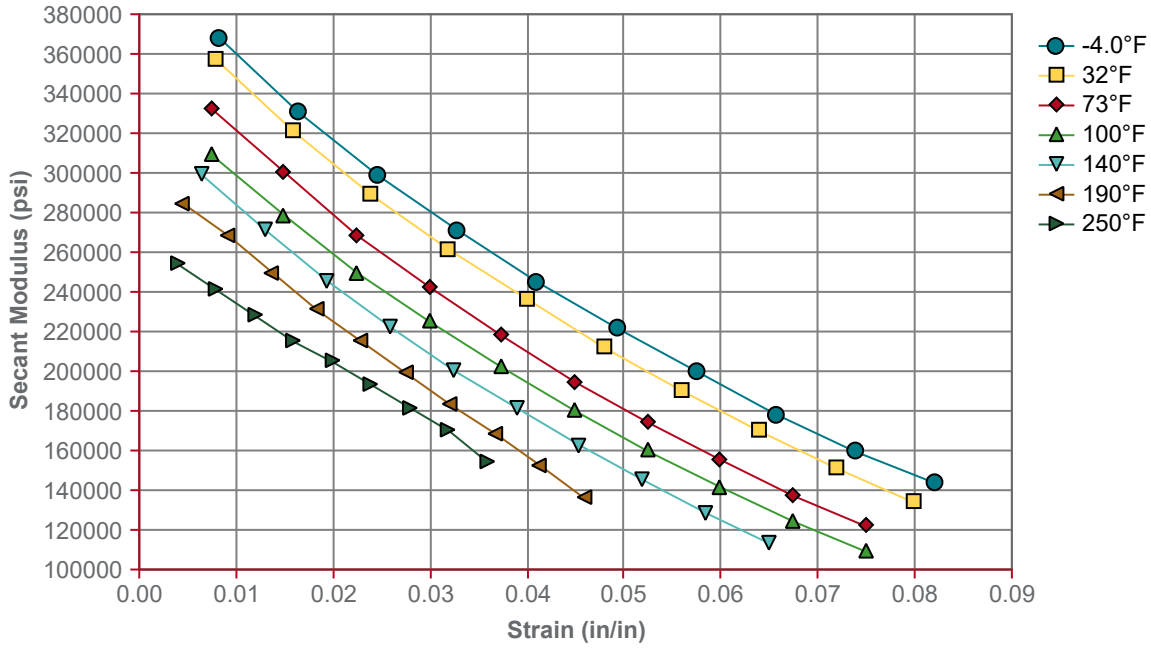
Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

Isothermal Stress vs. Strain (ISO 11403-1)



Form No. TDS-35082-en
Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

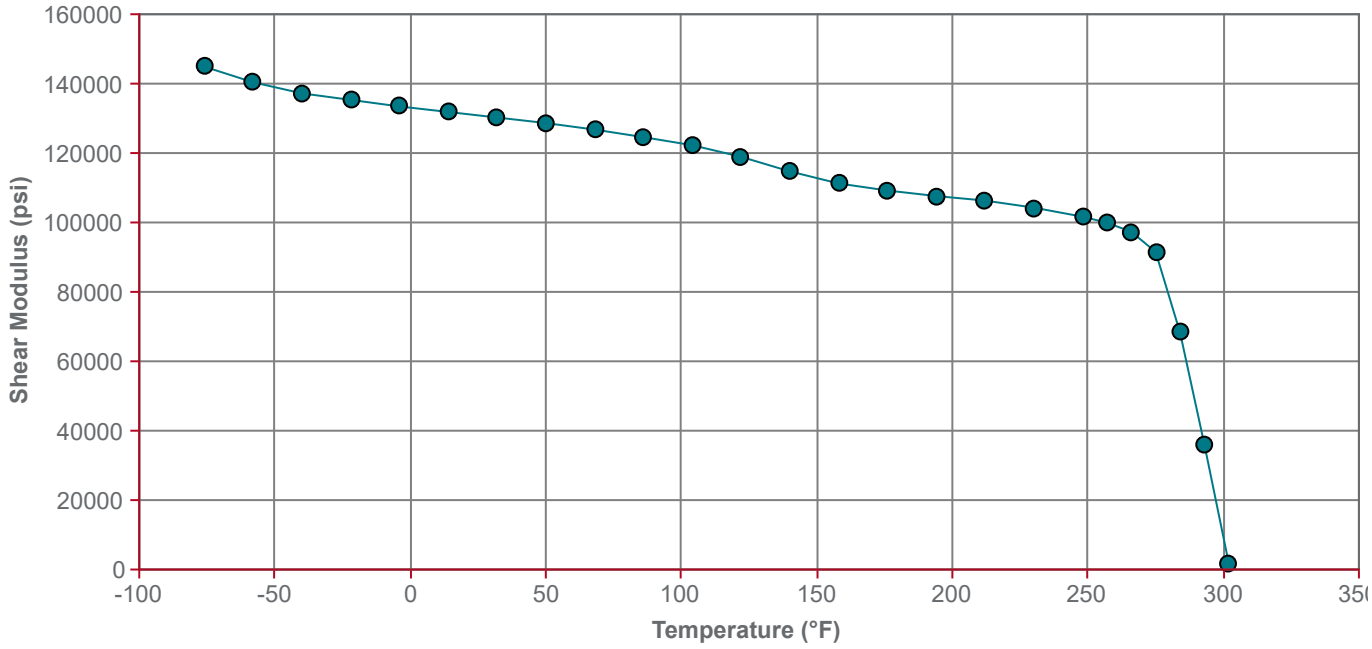
Secant Modulus vs. Strain (ISO 11403-1)



Form No. TDS-35082-en

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

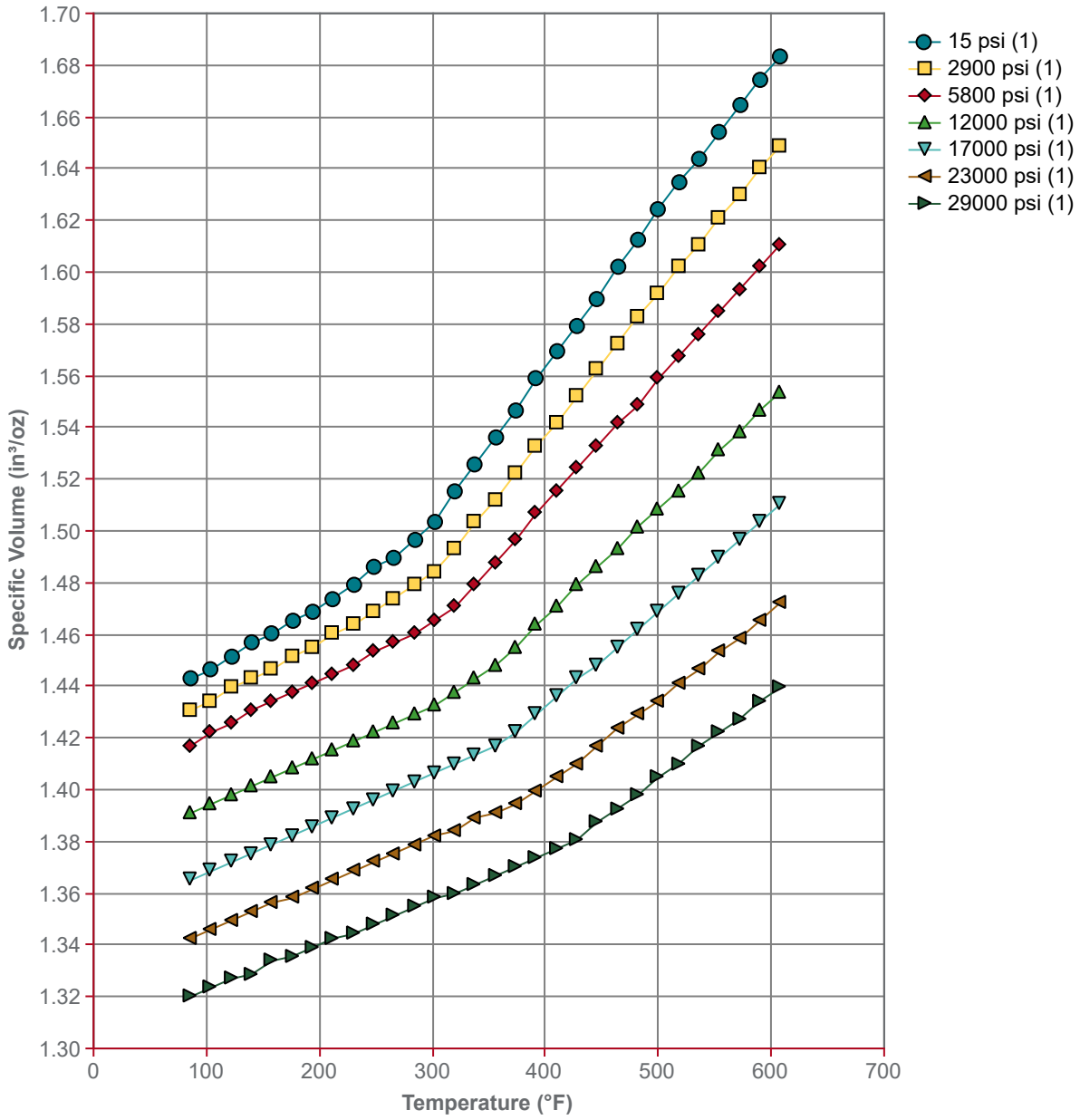
Shear Modulus vs. Temperature (ISO 11403-1)



Form No. TDS-35082-en

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

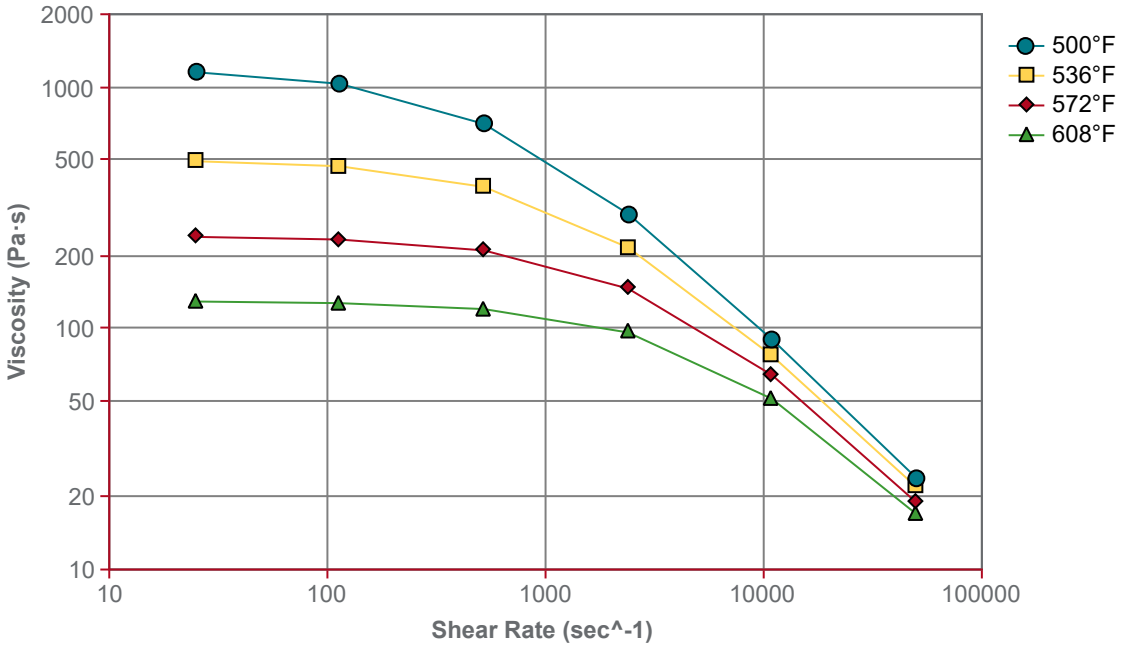
Specific Volume vs Temperature (ISO 11403-2)



Data Notes
(1) - Tested using Generic PC

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

Viscosity vs. Shear Rate (ISO 11403-2)



Form No. TDS-35082-en

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

Notes

[1] These links provide you with access to supplier literature. We work hard to keep them up to date; however you may find the most current literature from the supplier.

[2] A UL Yellow Card contains UL-verified flammability and electrical characteristics. UL Prospector continually works to link Yellow Cards to individual plastic materials in Prospector, however this list may not include all of the appropriate links. It is important that you verify the association between these Yellow Cards and the plastic material found in Prospector. For a complete listing of Yellow Cards, visit the UL Yellow Card Search.

[3] Typical properties: these are not to be construed as specifications.

[4] Pellets

[5] 60x60x2mm, 500 bar

[6] 0.079 in/min (2.0 mm/min)

[7] 2.0 mm/min

[8] 3 mm

[9] 10°C/min

[10] Across Flow

[11] Procedure A

[12] Method K and F

[13] US-FMVSS

[14] Method K

[15] Method F

[16] Method A

Form No. TDS-35082-en

Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021

Where to Buy

Supplier

Covestro - Polycarbonates
Leverkusen, Leverkusen Germany
Telephone: +49-214-6009-2000
Web: http://www.plastics.covestro.com/

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Document Created: Monday, February 27, 2023
Added to Prospector: November 2000
Last Updated: 10/28/2021