Texin® 970DU

Characterization	Texin 970DU resin is an aromatic polyether-based thermoplastic polyurethane with a Shore hardness of approximately 70D*. It can be processed by injection molding, extrusion, or blow molding.
Properties / Applications	Texin 970DU resin offers exhibits excellent tensile and tear properties, high stiffness characteristics, good resistance to fuels and oils, and inherent resistance to hydrolysis. It is stabilized against degradation due to heat and UV exposure. Typical applications include industrial screens and casters, bushings, housings, agricultural equipment components and marine equipment. As with any product, use of Texin 970DU resin in a given application must be tested (including but not limited to field testing) in advance by the user to determine suitability.
Storage	Texin thermoplastic polyurethane resins are hygroscopic and will absorb ambient moisture. The presence of moisture can adversely affect processing characteristics and the quality of parts. Therefore, the resins should remain in their sealed containers and be stored under cool and dry conditions until used. Storage temperature should not exceed 86°F (30°C). Unused resin from opened containers, or reground material that is not to be used immediately, should be stored in sealed containers.
Drying	Prior to processing, Texin 970DU resin must be thoroughly dried in a desiccant dehumidifying hopper dryer. Hopper inlet air temperature should be 200° –230°F (93° –110°C). To achieve the recommended moisture content of less than 0.03%, the inlet air dew point should be -20°F (-29°C) or lower. The hopper capacity should be sufficient to provide a minimum residence time of 4 hours. Additional information on drying procedures is available in the brochure - General Drying Guide.

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Injection Molding

Texin 970DU resin may be easily processed on commercially available equipment suitable for injection molding of thermoplastic polyurethane elastomers. The recommended screw length-to-diameter (L/D) ratio is 20:1 with a compression ratio of 2.5 –3:1. Screws with a compression ratio greater than 4:1 should be avoided. Recommended shot weight is 40 –80% of rated barrel capacity. To obtain good clarity in parts, Texin 970DU resin must be molded on tools with a highly polished chrome surface. Typical starting conditions are noted below. Actual processing conditions will depend on machine size, mold design, material residence time, etc.

Typical Injection Molding Conditions

Barrel Temperature: Rear	420°–440°F (216°–227°C)
Barrel Temperature: Middle	425°–445°F (218°–229°C)
Barrel Temperature: Front	425°–445°F (218°–229°C)
Barrel Temperature: Nozzle	430°–450°F (221°–232°C)
Melt Temperature	430°–450°F (221°–232°C)
Mold Temperature	85°–130°F (29°–54°C)
Injection Pressure	8,000 - 15,000 psi
Back Pressure	800 psi
Screw Speed	40 - 80 rpm
Injection Speed	Moderate
Cushion	1/8 - 1/4 in
Clamp	3 - 5 ton/in^2

Mold Shrinkage

Typical values for mold shrinkage are given below. For treatments such as postcuring, an additional 1 to 1.5 mil per inch should be added.

Cross Section	Mold Shrinkage*
Less than 1/8 inch	7 - 10 mils per inch
1/8 to 1/4 inch	10 - 15 mils per inch
Over 1/4 inch	15 - 20 mils per inch

Additional Injection Molding Information

Additional information on injection molding may be obtained by consulting the publication - Texin and Desmopan Thermoplastic Polyurethanes — A Processing Guide for Injection Molding and by contacting a Covestro technical service representative.

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Extrusion

Texin 970DU resin possesses a satisfactory melt strength and can be controlled over a wide range of temperature conditions to produce tubing, sheet, and extruded profiles. Typical starting conditions are noted below. Actual processing conditions vary and are dependent on size of extruders, extrusion rate, part geometry, etc.

Typical Temperature Profile for Extrusion

Die	420°–435°F (216°–224°C)
Zone 1 (Feed)	415°–430°F (213°–221°C)
Zone 2 (Transition)	420°–435°F (216°–224°C)
Zone 3 (Meter)	420°–435°F (216°–224°C)
Melt	420°–435°F (216°–224°C)

Additional Extrusion Information

The preferred screw design should have a compression ratio of 3:1 and should feature a long, gradual transition zone and a long meter zone. The recommended length- to-diameter (L/D) ratio is at least 24:1. Typical recommendations for 3:1 compression ratio screws on various sizes of 24:1 L/D extruders are given in the table below. Additional information on extrusion may be obtained by consulting the publication - Texin and Desmopan Thermoplastic Polyurethanes - A Processing Guide for Extrusion and by contacting a Covestro technical service representative.

Section	Number of Diameters	Depth ("h") in inches		
		2 1/2-in Extruder	3 1/2-in Extruder	4 1/2-in Extruder
Feed	5	0.375	0.450	0.525
Transition	7 - 13			
Meter	6 - 12	0.125	0.150	0.175

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Regrind Usage

Where end-use requirements permit, up to 20% Texin resin regrind may be used with virgin material, provided that the material is kept free of contamination and is properly dried (see section on Drying). Any regrind used must be generated from properly molded/extruded parts, sprues, runners, trimmings, and/or films. All regrind used must be clean, uncontaminated, and thoroughly blended with virgin resin prior to drying and processing. Under no circumstances should degraded, discolored, or contaminated material be used for regrind. Materials of this type should be properly discarded.

Improperly mixed and/or dried regrind may diminish the desired properties of Texin resin. It is critical that you test finished parts produced with any amount of regrind to ensure that your end-use performance requirements are fully met. Regulatory or testing organizations (e.g., Underwriter's Laboratories) may have specific requirements limiting the allowable amount of regrind. Because third party regrind generally does not have a traceable heat history or offer any assurance that proper temperatures, conditions, and/or materials were used in processing, extreme caution must be exercised in buying and using regrind from third parties.

The use of regrind material should be avoided entirely in those applications where resin properties equivalent to virgin material are required, including but not limited to color quality, impact strength, resin purity, and/or load-bearing performance.

Regulatory Compliance Information

Some of the end uses of the products described in this bulletin must comply with applicable regulations, such as FDA, NSF, USDA, and CPSC. If you have any questions on the regulatory status of these products, contact your Covestro representative or Regulatory Affairs Manager in Pittsburgh, PA.

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Typical Properties* for Natural Resin

Property	ASTM Test Method (Other)	Texin 970DU Resin U.S. Units	Texin 970DU Resin S.I. Units
General			
Specific Gravity	D 792 (ISO 1183)	1.18	1.18
Shore Hardness	D 2240 (ISO 868)	70D	70D
Taber Abrasion: H-18, 1,000-g Load, 1,000 Cycles	D 3489 (ISO 4649)	75 mg Loss	75 mg Loss
Bayshore Resilience	D 2632	50%	50%
Mold Shrinkage, 100-mil thickness	D 955 (ISO 2577)		
Flow Direction		0.008 in/in (mm/mm)	0.008 in/in (mm/mm)
Cross-Flow Direction		0.008 in/in (mm/mm)	0.008 in/in (mm/mm)
Mechanical			
Tensile Strength	D 412 (ISO 37)	6,900 lb/in^2	47.6 MPa
Tensile Stress at 50% Elongation	D 412 (ISO 37)	3,000 lb/in^2	20.7 MPa
Tensile Stress at 100% Elongation	D 412 (ISO 37)	3,700 lb/in^2	25.5 MPa
Tensile Stress at 300% Elongation	D 412 (ISO 37)	5,700 lb/in^2	39.3 MPa
Ultimate Elongation	D 412 (ISO 37)	320%	320%
Flexural Modulus:	D 790 (ISO 178)		
158°F (70°C)		17,000 lb/in^2	117 MPa
73°F (23°C)		78,000 lb/in^2	538 MPa
-22°F (-30°C)		293,000 lb/in^2	2,020 MPa
Tear Strength, Die C	D 624 (ISO 34)	1,100 lbf/in	193 kN/m
Compression Set:	D 395-B (ISO 815)		
As molded		90%	90%
22 Hours at 212°F (100°C)		75%	75%
22 Hours at 158°F (70°C)		40%	40%
22 Hours at 73°F (23°C)			
Post-cured[a]:		65%	65%
22 Hours at 212°F (100°C)		45%	45%
22 Hours at 158°F (70°C)		25%	25%
22 Hours at 73°F (23°C)			

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Typical Properties* for Natural Resin (CONT'D.)

Property	ASTM Test Method (Other)	Texin 970DU Resin U.S. Units	Texin 970DU Resin S.I. Units
Mechanical (cont'd.)			
Compressive Load:	D 575		
2% Deflection		150 lb/in^2	1.0 MPa
5% Deflection		800 lb/in^2	5.5 MPa
10% Deflection		1,900 lb/in^2	13.1 MPa
15% Deflection		2,400 lb/in^2	16.5 MPa
20% Deflection		2,800 lb/in^2	19.3 MPa
25% Deflection		3,300 lb/in^2	22.8 MPa
50% Deflection		7,000 lb/in^2	48.3 MPa
Thermal			
Deflection Temperature Under Load:	D 648 (ISO 75)		
264 psi		113°F	45°C
66 psi		155°F	68°C
Coefficient of Linear Thermal Expansion	D 696	6.4 E-05 in/in°F	11.5 E-05 mm/mm°C
Low Temperature Brittle Point	D 746 (ISO 974)	< -94°F	< -70°C
Glass Transition Temperature (Tg)	(DMA)[b]	32°F	0°C
Vicat Softening Temperature, Rate A	D 1525 (ISO 306)	284°F	140°C

**These items are provided as general information only. They are approximate values and are not part of the product specifications.*

a Postcured for 16 hours at 230°F (110°C).

b DMA — Dynamic Mechanical Analysis.

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Property Changes after Aging Texin 970DU Resin

Property	ASTM Test Method (Other)	70 Hours	7 Days	14 Days	21 Days
Hot Air at 257°F (125°C)	D 573 (ISO 216)				
Tensile Strength		0%	-17%	-24%	-32%
Tensile Stress at 100% Elongation		+6%	-8%	-10%	-15%
Tensile Stress at 300% Elongation		+4%	-16%	-19%	-25%
Ultimate Elongation		+12%	+33%	+33%	+17%
Hardness, Shore D		-2	-2	-2	-1
Hot Air at 212°F (100°C)	D 573 (ISO 216)				
Tensile Strength		-6%	-32%	-4%	-9%
Tensile Stress at 100% Elongation		-7%	+1%	+1%	-10%
Tensile Stress at 300% Elongation		-4%	+6%	-5%	-12%
Ultimate Elongation		+18%	+15%	+22%	+18%
Hardness, Shore D		-2	-3	-4	-5
ASTM Oil #1 at 212°F (100°C)	D 471 (ISO 175)				
Tensile Strength		+3%	+3%	+15%	+9%
Tensile Stress at 100% Elongation		+6%	+11%	+12%	+11%
Tensile Stress at 300% Elongation		+4%	+10%	+19%	+18%
Ultimate Elongation		+13%	+10%	-7%	-11%
Hardness, Shore D		0	+1	0	0
Volume		-1%	-1%	-2%	-2%
ASTM Oil #3 at 212°F (100°C)	D 471 (ISO 175)				
Tensile Strength		+6%	+9%	+14%	+5%
Tensile Stress at 100% Elongation		-1%	-70%	-2%	+2%
Tensile Stress at 300% Elongation		+2%	-4%	0%	+8%
Ultimate Elongation		+15%	+18%	-5%	-12%
Hardness, Shore D		+2	+1	0	+3
Volume		+3%	+5%	+4%	+5%

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Property Changes after Aging Texin 970DU Resin (CONT'D.)

Property	ASTM Test Method (Other)	70 Hours	7 Days	14 Days	21 Days
Fuel A at 73°F (23°C)	D 471 (ISO 175)				
Tensile Strength		+1%	-1%	+13%	+9%
Tensile Stress at 100% Elongation		-2%	-7%	-1%	-1%
Tensile Stress at 300% Elongation		+2%	+1%	+21%	+31%
Ultimate Elongation		+1%	-2%	-14%	-23%
Hardness, Shore D		+2	+2	+2	+1
Volume		0%	0%	0%	0%
Fuel C at 73°F (23°C)	D 471 (ISO 175)				
Tensile Strength		+5%	+2%	-12%	-10%
Tensile Stress at 100% Elongation		-31%	-34%	-45%	-46%
Tensile Stress at 300% Elongation		-10%	-12%	-23%	-15%
Ultimate Elongation		0%	-1%	-5%	-13%
Hardness, Shore D		-9	-10	-16	-11
Volume		+6%	+10%	+14%	+16%

** This table shows property changes for Texin 970DU resin after exposure to hot air, oil, and fuel. As is the case with any compatibility test, the results are dependent on variables, such as concentration, time, temperature, part design, and residual stresses, and should serve only as a guideline. It is imperative that production parts be evaluated under actual application conditions prior to commercial use.*

Humid Aging

Humid Aging at 100% RH	ASTM Test Method (Other)	248°F (120°C)	212°F (100°C)	158°F (70°C)
Tensile Half Life	D 471 (ISO 175)	48 Hours	42 Days	> 100 Weeks

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Health and Safety Information	Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling this product. Before working with this product, you must read and become familiar with the available information on its risks, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., safety data sheets and product labels. For further information contact your Covestro LLC representative or the Product Safety and Regulatory Affairs Department in Pittsburgh, PA.
Note	***The purchaser/user agrees that Covestro LLC reserves the right to discontinue this product without prior notice.***

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