

# Texin<sup>®</sup> 945DU

## Characterization

Texin 945DU resin is a polyether-based thermoplastic polyurethane with a Shore hardness of approximately 45D\*. It can be processed by injection molding, extrusion, or blow molding.

## Properties / Applications

Texin 945DU resin exhibits inherent resistance to hydrolysis as well as outstanding abrasion resistance, impact strength, toughness, and flexibility. In addition, this grade provides good clarity and is stabilized against degradation due to heat and UV exposure. Texin 945DU natural color resin is listed under NSF Standard 61 for use in potable water applications. Typical applications include boots, nonregulated animal identification tags, seals, pads, tubing, cable jacketing, sheet and profiles. As with any product, use of Texin 945DU resin in a given application must be tested (including field testing, etc.) 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 945DU resin must be thoroughly dried in a desiccant dehumidifying hopper dryer. Hopper inlet air temperature should be 190°–210°F (88°–99°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

General-purpose screws are satisfactory for use with Texin 945DU resin. 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 945DU 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            | 385°–400°F (196°–204°C)        |
| Barrel Temperature: Middle          | 390°–410°F (199°–210°C)        |
| Barrel Temperature: Front           | 390°–410°F (199°–210°C)        |
| Barrel Temperature: Nozzle          | 395°–415°F (202°–213°C)        |
| Melt Temperature                    | 395°–410°F (202°–210°C)        |
| Mold Temperature                    | 80°–120°F (27°–43°C)           |
| Injection Pressure                  | 8,000 - 15,000 psi             |
| Hold Pressure                       | 60 - 80% of Injection Pressure |
| Back Pressure                       | 800 psi max                    |
| Screw Speed                         | 40 - 80 rpm                    |
| Injection Speed                     | Slow to Moderate               |
| Cushion                             | 1/8 in max                     |
| Clamp                               | 3 - 5 ton/in <sup>2</sup>      |
| Timers (per 0.125-in cross section) |                                |
| Boost                               | 5 - 10 sec                     |
| 2nd Stage                           | 10- 30 sec                     |
| Cool                                | 30 - 50 sec                    |

## 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 945DU 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

|                     |                         |
|---------------------|-------------------------|
| Rear (Feed)         | 380°–400°F (193°–204°C) |
| Middle (Transition) | 385°–405°F (196°–207°C) |
| Front (Meter)       | 385°–405°F (196°–207°C) |
| Die                 | 385°–405°F (196°–207°C) |
| Melt                | 385°–405°F (196°–207°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.

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## 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<br>(Other) | Texin 945DU Resin<br>U.S. Units | Texin 945DU Resin<br>S.I. Units |
|--|-----------------------------|---------------------------------|---------------------------------|
| <b>General</b>   |                             |                                 |                                 |
| Specific Gravity                                       | D 792 (ISO 1183)            | 1.14                            | 1.14                            |
| Shore Hardness   | D 2240 (ISO 868)            | 45D                             | 45D                             |
| Taber Abrasion:<br>H-18, 1,000-g Load, 1,000<br>Cycles | D 3489 (ISO 4649)           | 60 mg Loss                      | 60 mg Loss                      |
| Bayshore Resilience                                    | D 2632                      | 35%                             | 35%                             |
| Mold Shrinkage,<br>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)             |
| <b>Mechanical</b>                                      |                             |                                 |                                 |
| Tensile Strength                                       | D 412 (ISO 37)              | 6,700 lb/in <sup>2</sup>        | 46.2 MPa                        |
| Tensile Stress at 50%<br>Elongation                    | D 412 (ISO 37)              | 1,400 lb/in <sup>2</sup>        | 9.7 MPa                         |
| Tensile Stress at 100%<br>Elongation                   | D 412 (ISO 37)              | 1,800 lb/in <sup>2</sup>        | 12.4 MPa                        |
| Tensile Stress at 300%<br>Elongation                   | D 412 (ISO 37)              | 4,000 lb/in <sup>2</sup>        | 27.6 MPa                        |
| Ultimate Elongation                                    | D 412 (ISO 37)              | 400%                            | 400%                            |
| Flexural Modulus:<br>158°F (70°C)                      | D 790 (ISO 178)             | 5,000 lb/in <sup>2</sup>        | 34.5 MPa                        |
| 73°F (23°C)  |                             | 15,000 lb/in <sup>2</sup>       | 103.4 MPa                       |
| Tear Strength, Die C                                   | D 624 (ISO 34)              | 725 lbf/in                      | 127 kN/m                        |

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

| Property                                       | ASTM Test Method<br>(Other) | Texin 945DU Resin<br>U.S. Units | Texin 945DU Resin<br>S.I. Units |
|--|-----------------------------|---------------------------------|---------------------------------|
| <b>Mechanical</b>                              |                             |                                 |                                 |
| Compression Set:                               | D 395-B (ISO 815)           |                                 |                                 |
| As molded [postcured] <sup>a</sup>             |                             | 75 [40]                         | 75 [40]                         |
| 22 Hours at 158°F (70°C)                       |                             | 22 [20]                         | 22 [20]                         |
| 22 Hours at 73°F (23°C)                        |                             |                                 |                                 |
| Compressive Load:                              | D 575                       |                                 |                                 |
| 2% Deflection                                  |                             | 130 lb/in <sup>2</sup>          | 0.9 MPa                         |
| 5% Deflection                                  |                             | 305 lb/in <sup>2</sup>          | 2.1 MPa                         |
| 10% Deflection                                 |                             | 550 lb/in <sup>2</sup>          | 3.8 MPa                         |
| 15% Deflection                                 |                             | 775 lb/in <sup>2</sup>          | 5.3 MPa                         |
| 20% Deflection                                 |                             | 1,000 lb/in <sup>2</sup>        | 6.9 MPa                         |
| 25% Deflection                                 |                             | 1,215 lb/in <sup>2</sup>        | 8.4 MPa                         |
| 50% Deflection                                 |                             | 3,125 lb/in <sup>2</sup>        | 21.5 MPa                        |
| <b>Thermal</b>                                 |                             |                                 |                                 |
| Low Temperature Brittle Point                  | D 746 (ISO 974)             | < -90°F                         | < -68°C                         |
| Glass Transition Temperature (T <sub>g</sub> ) | (DMA) <sup>b</sup>          | -40°F                           | -40°C                           |
| Vicat Softening Temperature Rate A             | D 1525 (ISO 306)            | 240°F                           | 116°C                           |

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

<sup>a</sup> Postcured for 16 hours at 230°F (110°C).

<sup>b</sup> DMA — Dynamic Mechanical Analysis.

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## Property Changes after Aging Texin 945DU Resin

| Property  | ASTM Test Method (Other) | 70 Hours | 7 Days | 14 Days | 21 Days |
|---|--------------------------|----------|--------|---------|---------|
| <b>Hot Air at 212°F (100°C)</b> D 573 (ISO 216)     |                          |          |        |         |         |
| Tensile Strength                                    |                          | 0%       | -4%    | -4%     | -8%     |
| Tensile Stress at 100% Elongation                   |                          | +7%      | +6%    | +6%     | +5%     |
| Tensile Stress at 300% Elongation                   |                          | +5%      | -1%    | -1%     | -3%     |
| Ultimate Elongation                                 |                          | +9%      | +14%   | +13%    | +17%    |
| Hardness, Shore D                                   |                          | -1       | 0      | -1      | 0       |
| <b>ASTM Oil #1 at 212°F (100°C)</b> D 471 (ISO 175) |                          |          |        |         |         |
| Tensile Strength                                    |                          | -4%      | -11%   | -11%    | -14%    |
| Tensile Stress at 100% Elongation                   |                          | +10%     | +4%    | +11%    | +5%     |
| Tensile Stress at 300% Elongation                   |                          | +8%      | -4%    | 0%      | -9%     |
| Ultimate Elongation                                 |                          | +11%     | +21%   | +20%    | +24%    |
| Hardness, Shore D                                   |                          | -1       | +2     | -1      | 0       |
| Volume  |                          | +1%      | -1%    | 0%      | 0%      |
| <b>ASTM Oil #3 at 212°F (100°C)</b> D 471 (ISO 175) |                          |          |        |         |         |
| Tensile Strength                                    |                          | +10%     | +9%    | +7%     | -9%     |
| Tensile Stress at 100% Elongation                   |                          | +2%      | -7%    | +2%     | -4%     |
| Tensile Stress at 300% Elongation                   |                          | -1%      | -10%   | -7%     | -15%    |
| Ultimate Elongation                                 |                          | +19%     | +32%   | +25%    | +30%    |
| Hardness, Shore D                                   |                          | -4       | -4     | -4      | -4      |
| Volume  |                          | +12%     | +13%   | +17%    | +16%    |

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## Property Changes after Aging Texin 945DU Resin (CONT'D.)

| Property                          | ASTM Test Method (Other) | 70 Hours | 7 Days | 14 Days | 21 Days |
|-----------------------------------|--------------------------|----------|--------|---------|---------|
| <b>Fuel A at 73°F (23°C)</b>      | D 471 (ISO 175)          |          |        |         |         |
| Tensile Strength                  |                          | +10%     | +4%    | +8%     | +7%     |
| Tensile Stress at 100% Elongation |                          | -2%      | +8%    | +1%     | -4%     |
| Tensile Stress at 300% Elongation |                          | -3%      | 0%     | -5%     | -8%     |
| Ultimate Elongation               |                          | +5%      | +1%    | +4%     | +6%     |
| Hardness, Shore D                 |                          | -1       | -1     | 0       | -1      |
| Volume                            |                          | +1%      | +2%    | +3%     | +3%     |
| <b>Fuel C at 73°F (23°C)</b>      | D 471 (ISO 175)          |          |        |         |         |
| Tensile Strength                  |                          | -25%     | -26%   | -28%    | -24%    |
| Tensile Stress at 100% Elongation |                          | -32%     | -28%   | -27%    | -27%    |
| Tensile Stress at 300% Elongation |                          | -33%     | -30%   | -30%    | -28%    |
| Ultimate Elongation               |                          | -5%      | -4%    | -6%     | -6%     |
| Hardness, Shore D                 |                          | -6       | -5     | -7      | -6      |
| Volume                            |                          | +30%     | +32%   | +33%    | +31%    |

*\* This table shows property changes for Texin 945DU 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.*





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**Note:**

***The purchaser/user agrees that Covestro LLC reserves the right to discontinue this product without prior notice.***

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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.

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Editor: Covestro LLC  
1 Covestro Circle  
Pittsburgh, Pennsylvania 15205  
United States  
[www.covestro.com](http://www.covestro.com)

**Contact:**  
TPU Single Point of Contact  
e-mail: [tpuinfo@covestro.com](mailto:tpuinfo@covestro.com)