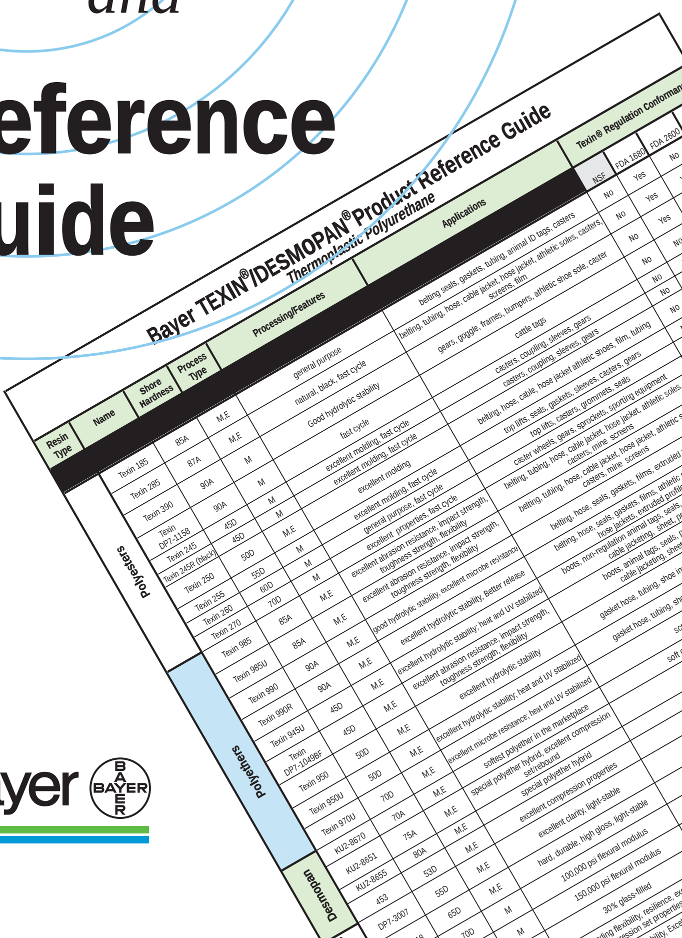
A *quick* Troubleshooting *and* Reference Guide



Bayer

What is Texin?

Texin is a thermoplastic polyurethane produced by Bayer Corporation in the United States since 1961.

What is Desmopan?

Desmopan is a thermoplastic polyurethane produced by Bayer AG in Germany. Desmopan grades are not direct equivalent grades of Texin grades, therefore the Texin and Desmopan product lines complement each other.

How are Texin/Desmopan grades produced?

Texin and Desmopan are produced primarily from three basic raw materials: polyester/polyether polyols, short chain diols, and diisocyanates. Some grades are blends of polyurethane with polycarbonate.

Are Texin/Desmopan grades rigid or flexible?

Some Texin/Desmopan grades are rigid, and some are flexible. The hardness range for Texin/Desmopan grades is approximately 65A to 70D. The Texin/Desmopan product line bridges the gap between thermoplastics such as rigid PVC and polypropylene, and rubbers such as nitrile rubber and EPDM.

What are key properties of Texin/Desmopan thermoplastic urethanes?

Texin/Desmopan grades possess a wide range of properties that make them suitable for many applications. Among the key physical properties of Texin/Desmopan grades are

- high tensile and tear strength
- excellent abrasion resistance
- high impact resistance and vibration dampening properties
- good hydrolytic and microbial resistance (polyether grades)
- excellent resistance to fuels, oils, ozone, and oxygen (polyester grades)
- high elasticity and resilience, as well as high load bearing capability and hardness
- good low temperature flexibility
- light stable (aliphatic grades)

How can Texin and Desmopan be processed?

Texin/Desmopan grades can be injection molded, extruded, slush (certain grades) molded, and blow molded.

In what applications are these products used?

Because Texin/Desmopan grades range from rubbery to stiff, the range of applications is varied. Typical applications are tubing, fire hose lining, animal ID tags, cable jacketing, hydraulic seals, mine screens, caster wheels, automotive gears, fuel and oil containment films, tarps, safety glass laminates, overmolded grips, and instrument panels.

What agency regulations are met with Texin grades?

Texin and Desmopan grades that meet FDA, NSF, and ISO medical regulations are shown in the attached Bayer Texin/Desmopan Product Reference Guide. Grades that meet UL requirements are shown below:

Texin 245 (natural) - HB @ 1.5mm

Texin 255 (natural and black) - HB @ 1.5mm

Texin 260 (natural) - HB @ 1.5mm

Texin 285 (natural and translucent) - HB @ 1.5mm and V-2 @ 3mm

Texin 4215 (natural) - HB @ 1.5mm

What is the shelf life of a Texin or Desmopan grade if containers remain sealed and are stored at normal conditions?

Texin and Desmopan grades have unlimited shelf lives if they are not exposed to high temperatures or humidity during storage.

What do Texin and Desmopan grade names tell me about the grades?

Both Texin and Desmopan standard (i.e. non-developmental) grades have 3 digit designations, except for Texin polyurethane/polycarbonate blends (4210 and 4215). The last two digits of three digit Texin/Desmopan grades (for example, Texin 285 and Desmopan 453) roughly indicate the Shore A or D hardness of the product. If the last two digits are greater than 75, they indicate a Shore A hardness; if less than 75, they indicate a Shore D hardness.

The first digit of a three digit Texin or Desmopan grade indicates whether the grade is polyester or polyether based. For a polyether based Texin grades the first digit is a “9” (for example, Texin 985), and if it is a polyester based grade the first digit is a “1”, “2”, “3”, or “4”.

How are developmental products identified?

Texin developmental products are identified with a “DP7” prefix, as in “DP7-1158”. Desmopan developmental products are preceded by the “KU2” prefix, as in “KU2-8651”.

What questions should I ask a customer if he is interested in selecting a Texin or Desmopan grade?

Typical questions to ask are:

- What 100% modulus value is required?
- What hardness is required?
- What is the intended use temperature?
- Is hydrolysis resistance important?
- Is microbial resistance important?
- Is the product intended for outdoor use?
- Is color stability important?
- Will there be chemical contact in the application? What type of chemicals?
- Will the product be under a compressive load?
- What is the intended life of the part?
- Will it be replacing a competitive thermoplastic urethane?
- How will it be processed?

How do I interpret the "compression set" property on Texin/Desmopan data sheets, and what is the significance of that property?

Compression set measures the residual deformation of a polymer after it has been compressively deformed for a specified time period and temperature. The compression set test compresses a test sample 25% for 22 hrs., usually at room temperature and at an elevated temperature. After the sample is removed from the test apparatus, the amount of residual deformation is measured. The lower the residual deformation, the lower the compression set value. The compression set property is relevant for applications such as seals where permanent deformation under compressive loads should be minimized, otherwise the part functionality is compromised.

Generally, how do some key properties differ between:

harder Texin/Desmopan grades and softer ones?

Harder Texin/Desmopan grades are stiffer, and have higher compression set values. Softer grades are flexible, and elongate more when stretched. Abrasion resistance is generally better in softer grades than in harder grades.

polyester based grades and polyether based grades?

Polyester grades, compared to polyether grades, have better heat stability, better cut resistance, and better inherent UV resistance. Polyether grades have excellent hydrolysis, fungal, and microbial resistance, and also better resistance to salt water stress cracking.

aromatic grades and aliphatic grades?

Aliphatic grades have better color stability than aromatic grades, therefore are better-suited for certain outdoor applications.

Should Texin/Desmopan grades be dried prior to processing?

Yes, Texin/Desmopan grades are hygroscopic and will degrade during processing if not adequately dried. Texin/Desmopan should be dried to a pellet moisture content of less than 0.03%, which requires a hopper dryer with inlet air of 160°F to 230°F (depending on the grade) and dew point at 0°F or lower. Refer to the Texin Injection Molding or Texin Extrusion Guides for additional information on drying conditions and equipment.

What is a simple test that can be used to determine if a Texin/Desmopan product is adequately dried?

It is important to use a dew point meter or a moisture analyzer to ensure that resin drying is adequate. However, if the melt stream has a lot of bubbles it generally means that the resin is wet.

What is a typical melt temperature for a Texin or Desmopan grade?

Melt temperatures for Texin/Desmopan grades range from about 350°F to 465°F. Control of melt temperature is more critical for TPU than some other thermoplastics; temperature controllers accurate to ±5°F are recommended.

What is a simple test that can be used to determine if a Texin/Desmopan product is at the correct melt temperature?

The most accurate way to check the melt temperature is with a pyrometer. But a crude way to determine if the melt temperature is correct is observe how the melt stream behaves when it forms a purge patty. If the purge initially forms a coil but ultimately becomes a smooth, then the melt temperature is normally in the correct range. If the purge never coils but immediately becomes smooth, then the melt temperature is too hot. If the purge remains in the shape of a coil, then the melt temperature is too cold.

How can degradation during processing be minimized?

Texin and Desmopan are shear sensitive, so it is important to minimize shear wherever possible when injection molding. A slow screw speed (40-60 rpm), slow injection speed, a low injection pressure (second stage set to 50% of first setting), low back pressure, and large gates all will help to minimize shear on the product.

What type of tooling considerations are important?

The most important consideration is gate size, which should be about 60% of the wall thickness. Refer to the Texin Injection Molding guide for more detailed information on tool design.

Can hot runner tools be used?

Yes, Texin/Desmopan grades can be successfully molded using insulated or hot runner systems. A diameter of at least 1 inch (2.54 mm) is suggested for insulated runners. The addition of cartridge heaters to the insulated runner block allows start-up without going through the procedure of removing the solidified runner.

The suggested diameter of hot runners is at least 0.50 in. (12.7 mm). The best results with hot runner molds have been obtained by using hot tips in the second plate. Consult the hot runner mold supplier's technical staff when selecting a system for Texin and Desmopan resin.

What type of tool surface is preferable for injection molding?

Thermoplastic urethanes stick to highly polished surfaces, so tool surfaces should be textured. A SP1 D2 finish (formerly SPE/SPI #4 or vapor hone) can be used, and it is important to impart the finish to all parts of the tool where the resin will solidify such as sprue bushings and runners.

What type of mold releases can be used with Texin/Desmopan?

Should they be necessary, non-silicone type mold releases, such as a dry fluorocarbon, are recommended. Silicone lubricants work well but generally leave a film on the parts for several shots after application, and may cause performance problems in electronic parts.

Can Texin/Desmopan be bonded to other thermoplastics in a co-injection molding process?

Yes, but it depends on the specific thermoplastic. Thermoplastic polyurethane bonds well to the following substrates in a co-injection process: ABS, polycarbonate, polycarbonate/ABS blends, rigid PVC, acrylic, and some copolyesters. Likewise, ABS, polycarbonate, and polycarbonate/ABS blends have been injection molded over thermoplastic urethane with good adhesion results. Polyolefins, polyesters, and polyamides generally do not bond well. Some tips on co-injection molding are:

- It is best if the substrate plastic has been freshly molded.
- The second material must be able to partially melt the substrate material.
- It is best to not use release versions of Texin (such as Texin 245R).
- Mechanical locks between the two plastics can further improve adhesion.
- Hot substrates and longer cooling cycles may aid adhesion.

Can Texin/Desmopan be colored?

Yes. The color concentrates should be based on either TPU or EVA, and must not contain any metal stearates because they degrade urethane. Polycarbonate based color concentrates can be used with the Texin/polycarbonate blends, 4210 and 4215. Some color concentrate suppliers are given below:

Clariant
Masterbatches Division
85 Holden Industrial Park
Holden, MA 01529
1-800-225-7490
508-829-6321
508-829-6322

A. Schulman Inc.
3550 West Market St.
Akron, OH 44333
1-800-662-3751
330-666-3751
(**Note:** For black concentrate Schulman's PolyBlak 3188 or 2973 are recommended.)

PolyOne Corporation
800 Satellite Blvd.
Suawanne, GA 30174-2878
1-800-551-7688

Is post curing of extruded or injection molded parts necessary or desirable?

After a thermoplastic urethane is molded or extruded, a certain period of time elapses before optimal physical properties are obtained as the chains align or "crystallize". If parts are stored for 2 to 3 weeks at ambient conditions after molding or extrusion, ultimate properties approaching those of elevated temperature curing will be achieved. However, if it is desirable to achieve ultimate physical properties immediately after fabrication, an elevated temperature cure - 8 to 16 hours at 230°F - can be used. Also, in order to achieve the best compression set properties, post curing is recommended. If parts are to be post cured, the curing process should be initiated within 8 hours after the part has been fabricated. A circulating air oven with temperature control of ±5°F is satisfactory for post-curing Texin and Desmopan parts.

What types of mold cleaners can be used?

CL-80/A produced by I. D. E. Processes (718-544-1177, in Kew Gardens, New York) is an effective mold cleaner for Texin/Desmopan processing.

Can Texin/Desmopan parts be painted?

It is best to color Texin/Desmopan parts via the use of color concentrates. However, if parts are to be painted, the following two paint companies can be contacted:

Jamison
72 South Kimball Street
P.O. Box 5197
Bradford, MA 01835
978-374-4731

Red Spot Paint and Varnish Co., Inc.
1107 E. Louisiana
Evansville, IN 47711
734-454-9200

Can printing inks be used on Texin/Desmopan parts?

Texin/Desmopan parts can be printed. Inks can be obtained from the following two companies:

Proell, Inc.
3820 Ohio Avenue, Suite 6
St. Charles, IL 60174
630-587-2300

Red Spot Paint & Varnish Co., Inc.
1107 E. Louisiana
Evansville, IN 47711
734-454-9200

What adhesives can be used on Texin/Desmopan parts?

The following two companies supply adhesives for thermoplastic urethanes:

Rohm and Haas
West Alexandria, Ohio
1-800-348-8846
937-839-5615
(Thixon is a recommended adhesive.)

Lord Corporation
Erie, PA
(814)-868-3611
(Tyrite is a recommended adhesive.)

Can Texin/Desmopan parts be solvent welded?

Yes. Solvents that can be used are tetrahydrofuran, dimethylformamide, dimethylacetamide, vinyl pyrollidone, normal methyl pyrollidone, and dimethylsulfoxide.

Can Texin/Desmopan be ultrasonically welded?

Harder Texin/Desmopan grades (such as Texin 255) and Texin/polycarbonate blends (4210 and 4215) can be welded satisfactorily. Softer grades, such as Texin 285, are difficult to weld because they dissipate too much energy.

Can Texin/Desmopan parts be machined?

Yes. The machining rate should be very slow, and the use of a coolant is recommended. Other machining guidelines are shown below:

Turning

			Shape of Tool			
Grade	**CuttingSpeed (ft./min.)**	**Feed (in./rev.)**	**A**	**B**	**V**	**Surface Roughness (microinches)**
Texin 285	1,000 - 1,650	0.004 - 0.008	12	53	25	50
Desmopan 453	330-500	0.004 - 0.008	12	53	25	10

Facing

The conditions for facing broad parts are the same as for turning. When thin discs are to be cut, it is advisable to use a cutting tool with a very acute blade (approximately 15° included angle) and hence, can be regarded as a knife. Coding should be used for facing operations with Texin.

Thread Cutting

Because of the relative softness of urethane elastomers, it is advisable to cut only coarse threads.

Milling

Surface qualities typical of those shown in “A” at left are obtained with a cutter made of high-speed cutting steel working at a peripheral speed of 600-1,300 ft./min. with a clearance of a=100° and ß=25°. In order to facilitate the removal of millings, the cutter should have a maximum of four flutes.

Boring

Normal tools are used at cutting speeds of 130 to 170 ft./min. and as slow a feed as possible (approximately 0.0004 - 0.0012 in./min.). A faster speed can be employed with harder materials. Holes of depths up to 1 inch can normally be made without the use of a coolant.

Grinding

Smooth surfaces are obtained with grinding wheels of carborundum with a fine grain size, medium hardness, and coarse texture. Grinding speeds are high (6,000 - 10, 000 ft./min., approximately 3,500 rpms). Cooling is recommended to avoid overheating.

Band Sawing

A hook-type tooth blade approximately 1/2 inch wide by 0.030 inch thick having four teeth per inch has given good results. Surface speeds of 200 ft./min. have been most satisfactory.

Bayer TEXIN®/DESMOPAN® Product Reference Guide

Type	Name	Hardness	Type	Processing/Features	Applications	Texin® Regulation Conformance			
						NSF	FDA 1680	FDA 2600	Medical
Polyesters	Texin 185	85A	M,E	general purpose	belting seals, gaskets, tubing, animal ID tags, casters	No	Yes	No	No
	Texin 285	87A	M,E	natural, black, fast cycle	belting, tubing, hose, cable jacket, hose jacket, athletic soles, casters, mine screens, film	No	Yes	Yes	No
	Texin 390	90A	M	Good hydrolytic stability	gears, goggle, frames, bumpers, athletic shoe sole, caster	No	Yes	No	No
	Texin DP7-1158	90A	M	fast cycle	cattle tags	No	No	No	No
	Texin 245	45D	M	excellent molding, fast cycle	casters, coupling, sleeves, gears	No	Yes	Yes	No
	Texin 245R (black)	45D	M	excellent molding, fast cycle	casters, coupling, sleeves, gears	No	Yes	Yes	No
	Texin 250	50D	M,E	excellent molding	belting, hose, cable, hose jacket athletic shoes, film, tubing	No	Yes	Yes	No
	Texin 255	55D	M	excellent molding, fast cycle	top lifts, seals, gaskets, sleeves, casters, gears	No	Yes	Yes	No
	Texin 260	60D	M	general purpose, fast cycle	top lifts, casters, grommets, seals	No	Yes	Yes	No
	Texin 270	70D	M	excellent properties, fast cycle	caster wheels, gears, sprockets, sporting equipment	No	Yes	Yes	No
Polyethers	Texin 985	85A	M,E	excellent abrasion resistance, impact strength, toughness strength, flexibility	belting, tubing, hose, cable jacket, hose jacket, athletic soles, casters, mine screens	Yes	Yes	Yes	Yes
	Texin 985U	85A	M,E	excellent abrasion resistance, impact strength, toughness strength, flexibility	belting, tubing, hose, cable jacket, hose jacket, athletic soles, casters, mine screens	Yes	No	No	No
	Texin 990	90A	M,E	good hydrolytic stability, excellent microbe resistance	belting, hose, seals, gaskets, films, extruded profiles	Yes	Yes	Yes	Yes
	Texin 990R	90A	M,E	excellent hydrolytic stability, Better release	belting, hose, seals, gaskets, films, athletic soles, hose jackets, extruded profiles	Yes	Yes	Yes	No
	Texin 945U	45D	M,E	excellent hydrolytic stability; heat and UV stabilized	boots, non-regulation animal tags, seals, pads, tubing, cable jacketing, sheet, profiles	Yes	No	No	No
	Texin DP7-1049BF	45D	M,E	excellent abrasion resistance, impact strength, toughness strength, flexibility	boots, animal tags, seals, pads, tubing, cable jacketing, sheet, profiles	No	Yes	Yes	No
	Texin 950	50D	M,E	excellent hydrolytic stability	gasket hose, tubing, shoe inserts, connectors, belting	Yes	Yes	Yes	Yes

	Texin 950U	50D	M,E	excellent hydrolytic stability; heat and UV stabilized	gasket hose, tubing, shoe inserts, connectors, belting	Yes	No	No	No
	Texin 970U	70D	M,E	excellent microbe resistance; heat and UV stabilized	screens, casters	No	No	No	No
Desmopan	KU2-8670	70A	M,E	softest polyether in the marketplace	soft over molding, very elastic	No	No	No	No
	KU2-8651	75A	M,E	special polyether hybrid, excellent compression set/rebound	over molding, gasket	No	Yes	No	No
	KU2-8655	80A	M,E	special polyether hybrid	over molding, gasket	No	No	No	No
	453	53D	M,E	excellent compression properties	casters, couplings, top lifts, sleeves, gears	No	No	No	No
Aliphatic Texin	DP7-3007	55D	M,E	excellent clarity, light-stable	automotive interior applications	No	No	No	No
	DP7-3018	65D	M,E	hard, durable, high gloss, light-stable	Light-stable cap layer	No	No	No	No
Specialty	Texin 4210	70D	M	100,000 psi flexural modulus	skate wheel hubs, boot support	No	No	No	Yes
	Texin 4215	75D	M	150,000 psi flexural modulus	skate wheel hubs, boot support	No	No	No	No
	Texin DP7-1172	75D	M	30% glass-filled	Metal replacement	No	No	No	No
Medical Texin	5275	75A	M,E	outstanding flexibility, resilience, excellent compression set properties	flexible tubing, film, catheters, connectors	No	No	No	Yes
	5286	86A	M,E	excellent hydrolytic stability, Excellent microbe resistance	flexible tubing, film, catheters, connectors, seals and gaskets	No	Yes	Yes	Yes
	5290	90A	M,E	excellent abrasion resistance, impact strength, toughness strength, flexibility	anesthetic connectors, seals, gaskets, flexible tubing, film, profiles, catheters	No	Yes	Yes	Yes
	5250	50D	M,E	excellent abrasion resistance, impact strength, toughness strength, flexibility	flexible tubing, film, catheters, connectors	No	Yes	Yes	Yes
	5265	65D	M,E	excellent hydrolytic stability, Excellent microbe resistance	flexible tubing, film, catheters, connectors	No	No	No	Yes
	5270	70D	M,E	outstanding tensile strength, high stiffness	connectors, bushings, housing, tubing, catheters,	No	No	No	Yes
	5370	70D	M,E	polyurethane/polycarbonate blend	tubing, catheters	No	No	No	Yes

Notes:

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