Desmopan® (TPU)

Product Range - Reference Data

Edition: 2004-09

Introduction

Desmopan® is Bayer MaterialScience's trade name for thermoplastic polyurethanes (TPU).

The Desmopan® range of grades has been adapted to the many special requirements imposed by Desmopan's broad range of applications. It takes in eight general-purpose lines, based on different raw material groups, and three series of special-purpose Desmopan® grades.

Overviews

- Nomenclature
- Property comparison of the Desmopan® grade series (for preliminary material selection)
- Overview of grades (arranged according to Shore hardness and raw material base)
- Short description of grades and reference value tables

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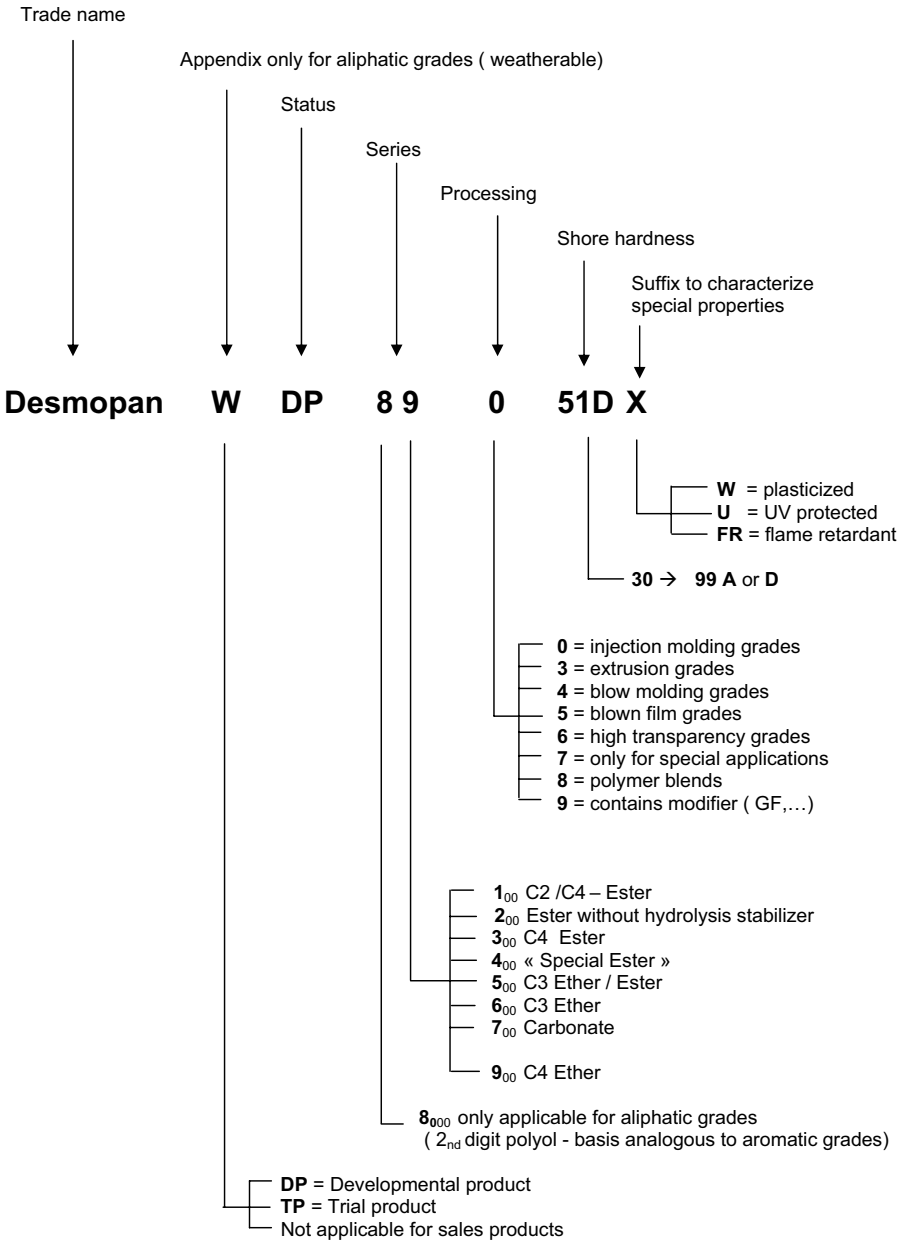
Nomenclature

Midway through 2003, we changed the nomenclature for our Desmopan® products. These changes were made in order to give the Desmopan® product range a more transparent structure. Nearly all the grades have been given a new name, with the exception of the sales products to date (three-character code), the full range of impact-modified ester grades, and a number of 300-series grades. These products can be recognized from the letters KA or KU. New developmental products have the letters DP in front of their code. The nomenclature for developmental and sales products has otherwise remained the same.

DESMOPAN ®

New Nomenclature



Desmopan® Product range

Raw material group	Ester				Ether/ Ester	C3-Ether	Carbonate	Aliphatics	C4-Ether	Impact mod. Ester	R - TPU
Series	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**W8000**	**900**		
Shore hardness 55 - 64A	DP 1060A DP 8060SGN										
65 - 79A			DP 3070A		5377A	DP 6065A			DP 9370A DP 9370AU		
80 - 84A		DP 2784A	DP 3380A DP 3080A	481	DP 5080A				DP 9380A		
85 - 89A	DP 1485A	DP 2586A DP 2786A	385 3385A 585 3485A KU 2-8785 DPS 032 DP 8785 S043 DP 3685AU	487	588	DP 6386A	786	W DP 89085A W DP 85085A KU 2-88586 W DP 85786A	9385 DP 9585A		
90 - 94A	192	DP 2590A DP 2792A	DP 3491A 392 DP 3690AU KU 2-8792A DP 8792 S043				790		DP 9392A DP 9392AU		
45 - 49D			KU 2-8795A DP 8795 S043 DP 3695AU 345	445		DP 6045D	795U	W DP 89043D	DP 9395A DP 9395AU DP 9095AU		
50 - 54D	150 DP 1350D		KU 2-8798A DP 8798 S043	453				W DP 89051D			
55 - 59D			355 356 DP 3059D 359					W DP 89056D	955U DP 9659DU	KU 2-8715 KA 8529	
60 - 64D			DP 3660DU	460					DP 9662DU	KA 8377	
65 - 69D			365						DP 9665DU KA 8333	KA 8410 KA 8417	
70 - 74D			372						DP 9873D		DP 3970D

see Disclaimer for developmental products

Bayer MaterialScience

Property comparison of the Desmopan® grade series

Series	Shore - hardness - range	Short description	Properties								
			Resistance to abrasion	Dynamic load bearing capacity	Heat deflection	Resistance to oil and grease	Resistance to hydrolysis	Resistance to hot air	Fastness to light (yellowing)	Resistance to microbial attack	Flexibility at low temperatures
100 / Ester	60A - 50D	Injection molding and extrusion grades with a high mechanical strength for articles exposed to wear	++	++	+	+	o	+	o	- x	+
200 / Ester	82A - 92A	Extrusion- ; injection molding and calandering-grades, may be used for food contact applications	++	++	0	+	-	+	0	-	+
300 / Ester	70A - 73D	Injection molding and extrusion grades, with a high mechanical strength, improved hydrolysis resistance and low-temperature flexibility	++	++	+	+	+	+	0	- x	+
400 / Ester	80A - 58D	Injection molding grades with a low compression set, a high heat deformation temperature and a good resistance to grease and oil	++	++	++	++	+	++	0	0 x	+
500 / Ether-Ester	77A - 92A	Injection molding and extrusion grades which combine the advantages of ether and ester grades in an eonomical manner	0/+	0	0	+	+	-	0	+	+
600 / Ether	65A - 45D	Injection molding and extrusion grades with very good resistance to hydrolysis and microbes but reduced mechanical properties	-	-	0	+	++	-	0	++	++
700 / Carbonate	88A - 43D	Injection molding and extrusion grades, resistant to microbes and hydrolysis, with low swelling in water	+	+	0	+/++ 1)	++	0	0	+	+
W8000 / Aliphatics	85A - 56D	Modifier, injection molding and slush molding grades which do not yellow under the action of UV light	+	0	0 / +	+	+/++ 1)	+ / - 1)	++	-/++ 1)	+/++ 1)
900 / Ether	70A - 73D	Injection molding and extrusion grades with very good resistance to microbes and hydrolysis; highly flexible at low temperatures	+	0	0	+	++	-	0	++	++
impact mod. Ester	57D - 66D	Special grades for shoe shells and similar applications with a high rigidity and good low -temperature impact strength	+	++	0	+	+	+	0	0	++

++ = very good; + = good; 0 = satisfactory; - = moderate; x = improves with increasing hardness; 1) depending on the grade

Series 100 ester grades

Injection molding, extrusion and blow molding grades with a high mechanical strength. In extrusion applications, there is no crystallization of the melt with grades in this series even when the extruder has been in service for a long period of time. Used primarily for articles subject to wear, such as castors, shoe heels, pneumatic hoses and bellows.

Desmopan®

DP 1060A Shore hardness: 60A; injection molding grade; free from plasticizer; grease and oil resistance; good wear resistance;
Application: rigid/flexible composites; shoe soles

DP 8060SGN Shore hardness: 61A; injection molding grade; good wear resistance; short cycle times;
Application: shoe soles

DP 1485A Shore hardness: 86A / 33D; extrusion and injection molding grade; suitable for extrusion blow molding; very broad processing range;
Application: bellows; hoses, unreinforced; profiles; engineering injection moldings

192 Shore hardness: 94A / 42D; injection molding grade; with high mechanical strength for articles subject to wear;
Application: shift lever balls; rollers; coupling elements; shoe heels

150 Shore hardness: 96A / 50D; injection molding grade; with high mechanical strength for articles subject to wear

DP 1350D Shore hardness: 96A / 50D; extrusion grade; good wear resistance; high melt stability;
Application: pneumatic hoses

Desmopan® (TPU)				**100 series, Ester grades**					
Typical Properties	**Test Conditions**	**Units**	**Standards**	**DP 1060A**	**DP 8060SGN**	**DP 1485A**	**192**	**150**	**DP 1350D**
Mechanical properties (23 °C/50 % r.h.)									
Shore hardness, method A		-	ISO 868	60	61	86	94	96	96
shore hardness, method D		-	ISO 868			33	42	50	50
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	15	22	46	50	50	50
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	850	900	630	520	420	420
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	2,9	3	5	9	15	15
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	15	5	9	18	31	31
Compression set	24 h; 70 °C	%	ISO 815	55		36	60	50	50
Compression set	72 h; 23 °C	%	ISO 815	30		11	25	25	25
Abrasion resistance	-	mm³	ISO 4649	60	100	19	30	30	30
Impact resilience	-	%	ISO 4662	55	51	46	30	30	30
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	33		78	100	120	120
Flexural modulus	2 mm/min	MPa	ISO 178					130	130
Thermal properties									
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	20		63	280	458	458
Torsional storage modulus	23 °C	MPa	ISO 6721-2	7		10	30	62	62
Torsional storage modulus	70 °C	MPa	ISO 6721-2	4		7	15	26	26
Other properties (23 °C)									
Density	-	kg/m³	ISO 1183	1198	1200	1216	1230	1240	1240
Glass fiber / glass bead / filler content	-	%	ISO 3451-1						
Molding conditions									
Injection molding-Melt temperature	-	°C	-	160 - 200	190 - 210	200 - 220	210 - 225	210 - 230	210 -230
Injection molding-Mold temperature	-	°C	-	20	20	20	20 - 40	20 - 40	
Extrusion-Melt temperature	-	°C	-			180 - 200			210 - 230

DP = Developmental product (see disclaimer for developmental products)

Series 200, ester grades

Blow molding and coating grades, may be used for food contact applications.

Our Ecology Department will be pleased to provide you with more information on the subject of "Food Contact":

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Desmopan®

DP 2784A Shore hardness: 82A / 33D; base material for batches

DP 2586A Shore hardness: 86A / 38D; extrusion and injection molding grade; Application: blown film

DP 2786A Shore hardness: 88A; calender coating grade; Application: fabric coating

DP 2590A Shore hardness: 92A; extrusion and injection molding grade; Application: blown film

DP 2792A Shore hardness: 93A / 50D; calender coating grade; Application: fabric coating

Desmopan® (TPU)				**200 series, Ester grades**				
Typical Properties	**Test Conditions**	**Units**	**Standards**	**DP 2784A**	**DP 2586A**	**DP 2786A**	**DP 2590A**	**DP 2792A**
Mechanical properties (23 °C/50 % r.h.)								
Shore hardness, method A		-	ISO 868	82	86	88	92	93
shore hardness, method D		-	ISO 868	33	38			50
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	25	45	33	45	43
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	500	500	590	500	520
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	4.0	5.6	6,4	10	10
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	10	12	11,2	30	20
Compression set	24 h; 70 °C	%	ISO 815			52		69
Compression set	72 h; 23 °C	%	ISO 815		23	17		26
Abrasion resistance	-	mm³	ISO 4649	30	32	86		70
Impact resilience	-	%	ISO 4662	45	46	37		29
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	50	71	69		
Flexural modulus	2 mm/min	MPa	ISO 178					
Thermal properties								
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	53	37	438	1860	318
Torsional storage modulus	23 °C	MPa	ISO 6721-2	13	12	40	74	24
Torsional storage modulus	70 °C	MPa	ISO 6721-2	5,2	8,3	19	29	11
Other properties (23 °C)								
Density	-	kg/m³	ISO 1183	1200	1190	1205	1205	1205
Glass fiber / glass bead / filler content	-	%	ISO 3451-1					
Molding conditions								
Injection molding-Melt temperature	-	°C	-	190 - 210	210 - 230	190 - 210	210 - 230	190 - 220
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	20	20	20 - 40
Extrusion-Melt temperature	-	°C	-		195 - 215		190 - 210	

DP = Developmental product (see disclaimer for developmental products)

Series 300, ester grades (1)

Injection molding and extrusion grades offering a high mechanical strength together with improved hydrolysis resistance and low-temperature flexibility. Low swelling values in oils, greases and solvents.

This is the series of grades used most frequently for extruded articles of all types, as well as for highly-stressed structural parts.

Desmopan®

DP 3070A Shore hardness: 70A; injection molding grade; plasticizer-free;
Application: engineering injection moldings; rigid/flexible composite systems

DP 3080A Shore hardness: 80A; injection molding grade; plasticizer-free;
Application: rigid/flexible composite systems; engineering parts

DP 3380A Shore hardness: 80A; extrusion grade; plasticizer-free;
Application: hoses, reinforced; profiles

385 E Shore hardness: 85A / 32D; extrusion and injection molding grade;
Application; hoses, unreinforced; screenpacks; engineering parts; rigid/flexible composite systems

585 Shore hardness 85A / 32D; injection molding grade; containing microbicidal agent;
Application: sport shoe soles

3385A Shore hardness: 85A / 33D; extrusion and injection molding type; good wear resistance; short cycle times;
Application: rigid/flexible composite systems; hoses, unreinforced; profiles; injection molding engineering parts

Desmopan® (TPU)				**300 series, Ester grades (1)**					
Typical Properties	**Test Conditions**	**Units**	**Standards**	**DP 3070A**	**DP 3080A**	**DP 3380A**	**385 E**	**585**	**3385A**
Mechanical properties (23 °C/50 % r.h.)									
Shore hardness, method A		-	ISO 868	70	80	80	85	85	85
shore hardness, method D		-	ISO 868				32	32	33
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	25	44	44	50	40	50
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	800	600	590	500	550	500
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	2,5	4,5	4,5	6.0	5.0	5
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	4,6	8,3	8,3	13	12	15
Compression set	24 h; 70 °C	%	ISO 815	52	42	42	50	55	42
Compression set	72 h; 23 °C	%	ISO 815	24	18	18	25	30	15
Abrasion resistance	-	mm³	ISO 4649	50	20	20	30	25	25
Impact resilience	-	%	ISO 4662	47	41	41	42	40	50
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	36	58	58	70	70	70
Flexural modulus	2 mm/min	MPa	ISO 178						17
Thermal properties									
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	11	95	95	32	68	
Torsional storage modulus	23 °C	MPa	ISO 6721-2	4	20	20	12	15	
Torsional storage modulus	70 °C	MPa	ISO 6721-2	2	13	13	8,7	9,9	
Other properties (23 °C)									
Density	-	kg/m³	ISO 1183	1148	1160	1160	1200	1200	1200
Glass fiber / glass bead / filler content	-	%	ISO 3451-1						
Molding conditions									
Injection molding-Melt temperature	-	°C	-	200 - 230	185 - 200	185 - 200	210 - 230	210 - 230	190 - 210
Injection molding-Mold temperature	-	°C	-	20	20 - 40	20	20 - 40	20 - 40	20
Extrusion-Melt temperature	-	°C	-			175 - 190	200 - 220		175 - 205

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Series 300, ester grades (2)

Injection molding and extrusion grades with high mechanical strength, improved hydrolysis resistance and low-temperature flexibility. Low swelling values in oils, greases and solvents.

This is the series of grades used most frequently for extruded articles of all types, as well as for highly-stressed structural parts.

Desmopan®

3485A Shore hardness: 85A / 33D; extrusion and injection molding grade; suitable for extrusion blow molding; with mold release agent; high melt stability;
Application: bellows; injection molding engineering parts

DP 3491A Shore hardness: 92A / 40D; extrusion and injection molding grade; suitable for extrusion blow molding; high melt stability;
Application: blow molding; profiles; injection molding engineering parts

392 Shore hardness: 92A / 40D; extrusion and injection molding grade;
Application: cogged belts: profiles; hoses, unreinforced

345 Shore hardness: 95A / 47D; injection molding grade; with high mechanical strength for articles subject to wear;
Application: injection molding engineering parts

355 Shore hardness 96A / 56D; injection molding grade;
Application: injection molding engineering parts

356 Shore hardness: 97A / 55D; injection molding grade
Application: engineering parts; ski-boot shells; heel patches

Desmopan® (TPU)				**300 series, Ester grades (2)**					
Typical Properties	**Test Conditions**	**Units**	**Standards**	**3485A**	**DP 3491A**	**392**	**345**	**355**	**356**
Mechanical properties (23 °C/50 % r. h.)									
shore hardness, method A		-	ISO 868	85	92	92	95	96	97
shore hardness, method D		-	ISO 868	33	40	40	47	56	55
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	50	50	45	52	60	60
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	500	500	450	450	430	400
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	5.0	8.0	9.0	12	15	19
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	15	20	22	27	35	40
Compression set	24 h; 70 °C	%	ISO 815	42	50	41	42	45	50
Compression set	72 h; 23 °C	%	ISO 815	15	20	25	25	30	30
Abrasion resistance	-	mm³	ISO 4649	25	25	25	30	35	35
Impact resilience	-	%	ISO 4662	50	36	33	35	35	35
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	70	100	80	100	130	130
Flexural modulus	2 mm/min	MPa	ISO 178	17			70	150	140
Thermal properties									
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	32	95	115	230	505	470
Torsional storage modulus	23 °C	MPa	ISO 6721-2	12	22	24	47	66	72
Torsional storage modulus	70 °C	MPa	ISO 6721-2	8,1	14	15	22	24	29
Other properties (23 °C)									
Density	-	kg/m³	ISO 1183	1200	1200	1210	1220	1200	1250
Glass fiber / glass bead / filler content	-	%	ISO 3451-1						
Molding conditions									
Injection molding-Melt temperature	-	°C	-	190 - 210	190 - 210	210 - 230	210 - 235	220 - 235	210 - 235
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	20 - 40	20 - 40	20 - 40	20 - 40
Extrusion-Melt temperature	-	°C	-	175 - 205	180 - 210	200-220			

DP = Developmental product (see disclaimer for developmental products)

Series 300, ester grades (3)

Injection molding and extrusion grades with high mechanical strength, improved hydrolysis resistance and low-temperature flexibility. Low swelling values in oils, greases and solvents.

This is the series of grades used most frequently for extruded articles of all types, as well as for highly-stressed structural parts.

Desmopan®

359 Shore hardness: 97A / 59D; injection molding grade; with high mechanical strength for articles subject to wear;
Application: injection molding engineering parts; roller tires; shoe heels; ski-boot shells

DP 3059D Shore hardness: 97A / 59D; injection molding grade; with mold release agent; excellent wear resistance; very short cycle times;
Application: heel patches; castors; shoe shells; injection molding engineering parts

365 Shore hardness: 98A / 65D; injection molding engineering parts;
Application; injection molding engineering parts; heel patches; sports shoe soles

372 Shore hardness: 98A / 73D; injection molding grade;
Application: injection molding engineering parts; gear socket balls for automotive sector

Desmopan® (TPU)				**300 series, Ester grades (3)**			
Typical Properties	**Test Conditions**	**Units**	**Standards**	**359**	**DP 3059D**	**365**	**372**
Mechanical properties (23 °C/50 % r.h.)							
Shore hardness, method A		-	ISO 868	97	97	98	98
shore hardness, method D		-	ISO 868	59	59	65	73
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	50	60	50	70
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	400		400	250
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	20	21	25	35
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	40	42	40	
Compression set	24 h; 70 °C	%	ISO 815	60	60	50	
Compression set	72 h; 23 °C	%	ISO 815	30	30	30	
Abrasion resistance	-	mm³	ISO 4649	35	18	30	30
Impact resilience	-	%	ISO 4662	35	35	40	42
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	160	120	180	220
Flexural modulus	2 mm/min	MPa	ISO 178	180	180	350	650
Thermal properties							
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	555	560	632	1000
Torsional storage modulus	23 °C	MPa	ISO 6721-2	105	115	160	354
Torsional storage modulus	70 °C	MPa	ISO 6721-2	38	42	52	68
Other properties (23 °C)							
Density	-	kg/m³	ISO 1183	1230	1230	1230	1240
Glass fiber / glass bead / filler content	-	%	ISO 3451-1				
Molding conditions							
Injection molding-Melt temperature	-	°C	-	220 - 240	200 - 230	220 - 245	220 - 245
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	20 - 40	20 - 40
Extrusion-Melt temperature	-	°C	-				

DP = Developmental product (see disclaimer for developmental products)

Series 300 ester grades (4) (sport shoe grades)

The 300 series grades listed below were developed for use in sport shoe soles. They have UV protection and fulfill the requirements of the leading sport shoe manufacturers. In addition to this, they are noted for their short cycle times, easy demolding and very good melt flowability when processed by injection molding. Long flow paths can thus be achieved with low wall thicknesses too.

Desmopan® (TPU)				**300 series, Ester grades (4)**			
Typical Properties	**Test Conditions**	**Units**	**Standards**	**KU 2-8785 DPS 032***	**KU 2-8792 A***	**KU 2-8795 A***	**KU 2-8798 A***
Mechanical properties (23 °C/50 % r. h.)							
Shore hardness, method A		-	ISO 868	85	91	94	94
shore hardness, method D		-	ISO 868	33	36	41	53
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	50	50	55	65
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	550	500	450	400
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	5	8.0	10	17
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	15	17	26	39
Compression set	24 h; 70 °C	%	ISO 815	42	50	40	45
Compression set	72 h; 23 °C	%	ISO 815	15	20	20	25
Abrasion resistance	-	mm³	ISO 4649	25	27	26	25
Impact resilience	-	%	ISO 4662	50	43	40	36
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	70	90	90	120
Flexural modulus	2 mm/min	MPa	ISO 178				100
Thermal properties							
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	39	90	157	390
Torsional storage modulus	23 °C	MPa	ISO 6721-2	11	19	27	62
Torsional storage modulus	70 °C	MPa	ISO 6721-2	7	12	16	27
Other properties (23 °C)							
Density	-	kg/m³	ISO 1183	1200	1200	1210	1220
Glass fiber / glass bead / filler content	-	%	ISO 3451-1				
Molding conditions							
Injection molding-Melt temperature	-	°C	-	200 - 220	190 - 210	190 - 210	195 - 215
Injection molding-Mold temperature	-	°C	-	20	20 - 40	20 - 40	20 - 40
Extrusion-Melt temperature	-	°C	-				

DP = Developmental product (see disclaimer for developmental products)
*) see disclaimer for developmental products

Series 300, ester grades (5) (sport shoe grades, reduced-wear)

These grades with the additional designation S043 are a further development of our sport shoe series of grades. In addition to the familiar good properties, such as UV stabilization, good flowability and short cycle times, these grades are noted for their considerably improved wear properties. They are used on parts subject to high wear. For coloring, it should be noted that these grades have a slightly milky natural color.

Desmopan® (TPU)				**300 series, Ester grades (5)**			
Typical Properties	**Test Conditions**	**Units**	**Standards**	**DP 8785A S043**	**DP 8792A S043**	**DP 8795A S043**	**DP 8798A S043**
Mechanical properties (23 °C/50 % r. h.)							
Shore hardness, method A		-	ISO 868	85	91	94	94
shore hardness, method D		-	ISO 868	33	40	41	53
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	45	50	50	65
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	500	500	450	400
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	5	7	10	17
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	14	17	24	39
Compression set	24 h; 70 °C	%	ISO 815	42	50	45	45
Compression set	72 h; 23 °C	%	ISO 815	15	20	21	25
Abrasion resistance	-	mm³	ISO 4649	18	18	17	15
Impact resilience	-	%	ISO 4662	50	43	40	36
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	70	80	90	120
Flexural modulus	2 mm/min	MPa	ISO 178				
Thermal properties							
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	39	115	185	374
Torsional storage modulus	23 °C	MPa	ISO 6721-2	11	19	29	67
Torsional storage modulus	70 °C	MPa	ISO 6721-2	7	12	16	28
Other properties (23 °C)							
Density	-	kg/m³	ISO 1183	1200	1200	1210	1220
Glass fiber / glass bead / filler content	-	%	ISO 3451-1				
Molding conditions							
Injection molding-Melt temperature	-	°C	-	190 - 210	190 - 210	190 - 220	200 - 230
Injection molding-Mold temperature	-	°C	-	20	20	20	25 - 40
Extrusion-Melt temperature	-	°C	-				

DP = Developmental product (see disclaimer for developmental products)

Series 300, ester grades (6) (transparent grades)

All the highly transparent grades listed here are hydrolysis-stabilized and have special UV protection. They can be used for clear, transparent injection moldings with a wall thickness of up to 6 mm. Hoses, flat film and profiles can be extruded from these grades.

Desmopan® (TPU)				300 series, Ester grades (6)			
Typical Properties	**Test Conditions**	**Units**	**Standards**	**DP 3685AU**	**DP 3690AU**	**DP 3695AU**	**DP 3660DU**
Mechanical properties (23 °C/50 % r. h.)							
Shore hardness, method A		-	ISO 868	86	93	96	98
shore hardness, method D		-	ISO 868	38	40	43	56
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	50	55	59	60
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	450	430	425	400
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	5	8	12	19
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	13	24	34	40
Compression set	24 h; 70 °C	%	ISO 815	36			
Compression set	72 h; 23 °C	%	ISO 815	13			
Abrasion resistance	-	mm³	ISO 4649	22	22	20	20
Impact resilience	-	%	ISO 4662	32	29	25	31
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	88	95	112	170
Flexural modulus	2 mm/min	MPa	ISO 178				110
Thermal properties							
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	190	848	1180	2380
Torsional storage modulus	23 °C	MPa	ISO 6721-2	13	54	69	267
Torsional storage modulus	70 °C	MPa	ISO 6721-2	6	30	33	77
Other properties (23 °C)							
Density	-	kg/m³	ISO 1183	1197	1211	1218	1229
Glass fiber / glass bead / filler content	-	%	ISO 3451-1				
Molding conditions							
Injection molding-Melt temperature	-	°C	-	215 -235	215 - 235	215 - 235	215 - 235
Injection molding-Mold temperature	-	°C	-	20	20 - 40	20 - 40	20 - 40
Extrusion-Melt temperature	-	°C	-	180 - 200	180 - 200	190 - 210	190 - 210

DP = Developmental product (see disclaimer for developmental products)

Series 400, ester grades

This series offers a number of special properties thanks to the use of special raw materials and ancillary materials. Compared with the 100 and 300 series of ester grades, the individual materials display improved:

- compression set
- elasticity
- heat resistance
- hydrolysis resistance
- oil/grease resistance
- microbe resistance

These injection molding grades are used first and foremost in functional engineering components for automotive, mechanical and plant engineering.

Desmopan®

481 Shore hardness: 80A / 30D; injection molding grade; plasticizer-free; grease and oil-resistant; low compression set; high elasticity; high heat resistance; easy-release; Application: rollers; seals; membranes; automotive engineering parts

487 Shore hardness: 86A / 34D; injection molding grade; grease and oil resistant; low compression set; high heat resistance; short cycle times; Application: automotive engineering parts; rollers; seals, membranes; damping elements

445 Shore hardness: 93A / 44D; injection molding grade; grease and oil resistant; high heat resistance; low compression set; Application: automotive engineering parts: injection molding engineering parts

453 Shore hardness: 97A / 52D; injection molding grade; grease and oil resistant; low compression set; good wear resistance; Application: injection molding engineering parts; automotive engineering parts

460 Shore hardness: 97A / 58D; injection molding grade; grease and oil resistant; low compression set; high heat resistance; high elasticity; short cycle times; Application: automotive engineering parts; engineering parts

Desmopan® (TPU)				**400 series, Ester grades**				
Typical Properties	**Test Conditions**	**Units**	**Standards**	**481**	**487**	**445**	**453**	**460**
Mechanical properties (23 °C/50 % r. h.)								
Shore hardness, method A		-	ISO 868	80	86	93	97	97
shore hardness, method D		-	ISO 868	30	34	44	52	58
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	30	35	38	38	35
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	600	500	500	475	350
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	5.0	6.0	8	17	21
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	9.0	14	20	29	33
Compression set	24 h; 70 °C	%	ISO 815	35	30	35	27	35
Compression set	72 h; 23 °C	%	ISO 815	22	15		15	25
Abrasion resistance	-	mm³	ISO 4649	25	20	25	32	40
Impact resilience	-	%	ISO 4662	48	45	35	30	35
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	45	70	95	180	150
Flexural modulus	2 mm/min	MPa	ISO 178					170
Thermal properties								
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	17	46	280	448	710
Torsional storage modulus	23 °C	MPa	ISO 6721-2	7,2	13	25	53	128
Torsional storage modulus	70 °C	MPa	ISO 6721-2	6,7	9,6	16	24	43
Other properties (23 °C)								
Density	-	kg/m³	ISO 1183	1200	1210	1220	1230	1220
Glass fiber / glass bead / filler content	-	%	ISO 3451-1					
Molding conditions								
Injection molding-Melt temperature	-	°C	-	225 - 235	230 - 240	210 - 235	220 - 240	235 - 245
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	20 - 40	20 - 40	20 - 40
Extrusion-Melt temperature	-	°C	-					

Series 500, ether/ester grades

Ether/ester grades that combine the advantages of both classes of raw material at low cost. These are used in applications subject to mechanical stressing with a simultaneous risk of damage through micro-organisms. Fields of application include extrusion coating, seals, technical injection moldings and watch straps.

Desmopan®

5377A Shore hardness: 77A / 28D; extrusion and injection molding grade; improved microbe resistance; improved hydrolysis resistance; Applications: cable sheathings; fabric coating; watch straps

DP 5080A Shore hardness: 80A / 29D; injection molding grade; improved microbe resistance; improved hydrolysis resistance;
Application: seals, membranes; rigid/flexible composite systems

588E Shore hardness: 88A / 33D; extrusion and injection molding grade; improved microbe resistance; improved hydrolysis resistance;
Application: cable sheathings; hoses, unreinforced; roof lining

Series 600, ether grades

The grades in the 600 series can be used as a lower-cost solution for applications that require the hydrolysis and microbe resistance of the 900 series but not such high-level mechanical properties. Potential applications include fire extinguisher hoses, shoe soles and rigid/flexible combinations.

Desmopan®

DP 6065A Shore hardness: 66A; injection molding grade; plasticizer-free; very good hydrolysis and microbe resistance; very short cycle times;
Application: rigid/flexible composite systems; shoe soles

DP 6386A Shore hardness: 85A; extrusion and injection molding grade; very good hydrolysis and microbe resistance; short cycle times;
Application: fire-extinguisher hoses; injection molding engineering parts; rigid/flexible composite systems

DP 6045D Shore hardness: 94A / 45D; injection molding grade; with special UV stabilizers;
very good resistance to hydrolysis and microbes; very short cycle times;
Application: injection molding engineering parts; animal identification tags

Desmopan® (TPU)				500 series, Ether/Ester grades			600 series, C3-Ether grades		
Typical Properties	**Test Conditions**	**Units**	**Standards**	5377A	DP 5080A	588 E	DP 6065A	DP 6386A	DP 6045D
Mechanical properties (23 °C/50 % r. h.)									
Shore hardness, method A		-	ISO 868	77	80	88	66	85	94
shore hardness, method D		-	ISO 868	28	29	33			45
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	26	28	35	17	24	27
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	740	650	600	850	725	391
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	4.0	4.0	6.0	2,7	6,8	13,5
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	7.0	9.0	11	6	11	23
Compression set	24 h; 70 °C	%	ISO 815	50	50	50	36	37	56
Compression set	72 h; 23 °C	%	ISO 815	20	20	25	16	17	18
Abrasion resistance	-	mm³	ISO 4649	80	70	60	150	90	90
Impact resilience	-	%	ISO 4662	45	45	36	50	43	39
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	40	55	55	26	40	50
Flexural modulus	2 mm/min	MPa	ISO 178					18	
Thermal properties									
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	20	20	39	42		455
Torsional storage modulus	23 °C	MPa	ISO 6721-2	6,7	7,5	11	15		155
Torsional storage modulus	70 °C	MPa	ISO 6721-2	5,1	5,6	7,9	12		91
Other properties (23 °C)									
Density	-	kg/m³	ISO 1183	1140	1140	1150	1084	1117	
Glass fiber / glass bead / filler content	-	%	ISO 3451-1						
Molding conditions									
Injection molding-Melt temperature	-	°C	-	180 - 200	190 - 210	210 - 230	190 - 210	215 - 230	200 - 220
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	20 - 40	20 -30	20	20 - 30
Extrusion-Melt temperature	-	°C	-	170 - 190		190 - 210		185 - 210	

DP = Developmental product (see disclaimer for developmental products)

Series 700, carbonate grades

The grades in this series have been specially developed for particular applications and have been successfully used in these applications for many years. They display good resistance to microbes and hydrolysis, experience less swelling in water than ether grades and offer a level of mechanical properties comparable to ester grades.

Applications include fire-extinguisher hoses, film, cogged belts, seals and animal identification tags.

Desmopan®

786 E Shore hardness: 88A / 33D; extrusion and injection molding grade; high mechanical strength; very good hydrolysis and microbe resistance; good low-temperature flexibility; Application: fire-extinguisher hoses; films; profiles; engineering parts

790 Shore hardness: 92A / 40D; extrusion and injection molding grade; good hydrolysis and microbe resistance; high mechanical strength; good low-temperature flexibility; Application: cogged belts; profiles; injection molding engineering parts

795 U Shore hardness: 94A / 43D; injection molding grade; with special UV stabilizers; good hydrolysis and microbe resistance; short cycle times; Application: animal identification tags

Desmopan® (TPU)				700 series, Carbonate grades		
Typical Properties	**Test Conditions**	**Units**	**Standards**	786 E	790	795 U
Mechanical properties (23 °C/50 % r. h.)						
Shore hardness, method A		-	ISO 868	88	92	94
shore hardness, method D		-	ISO 868	33	40	43
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	43	55	46
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	525	450	430
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	7.0	10	14
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	14	25	34
Compression set	24 h; 70 °C	%	ISO 815	55	50	42
Compression set	72 h; 23 °C	%	ISO 815	25	25	22
Abrasion resistance	-	mm³	ISO 4649	40	30	25
Impact resilience	-	%	ISO 4662	32	32	32
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	60	85	102
Flexural modulus	2 mm/min	MPa	ISO 178			72
Thermal properties						
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	120	200	450
Torsional storage modulus	23 °C	MPa	ISO 6721-2	15	22	48
Torsional storage modulus	70 °C	MPa	ISO 6721-2	9,3	12	19
Other properties (23 °C)						
Density	-	kg/m³	ISO 1183	1150	1210	1200
Glass fiber / glass bead / filler content	-	%	ISO 3451-1			
Molding conditions						
Injection molding-Melt temperature	-	°C	-	210 - 230	210 - 230	210 - 230
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	20 - 40
Extrusion-Melt temperature	-	°C	-	190 - 210	200 - 220	

Series W8000, aliphatic (1)

The new Desmopan® product line based on an aliphatic isocyanate. In addition to possessing the familiar properties of TPUs, these products do not yellow under the action of UV light. They additionally offer a particularly high resilience and "snappiness".

This is why these grades are particularly suitable for colored applications in automotive engineering and the sport and leisure sectors.

Desmopan®

W DP85085A Shore hardness: 85A; injection molding grade; improved microbe resistance; good low-temperature flexibility; improved hydrolysis resistance; Application: automotive interior applications

W DP 85786A Shore hardness: 90A; calender-coating grade; good low-temperature flexibility; high compression set; improved microbe resistance; improved hydrolysis resistance; Application: fabric coating

W DP 89085A Shore hardness: 86A; injection molding grade; very good hydrolysis and microbe resistance; good low-temperature flexibility; high compression set; low wear; for colored applications in the automotive, sports and leisure sectors

KU 2-88586* Shore hardness: 89A; special grade for slush processes; good low-temperature flexibility; high compression set; improved microbe resistance; improved hydrolysis resistance

Desmopan® (TPU)				W8000 series, Aliphatic grades (1)			
Typical Properties	**Test Conditions**	**Units**	**Standards**	**W DP85085A**	**W DP85786A**	**KU 2-88586***	**W DP 89085A**
Mechanical properties (23 °C/50 % r. h.)							
Shore hardness, method A		-	ISO 868	85	90	89	86
shore hardness, method D		-	ISO 868				
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	32	26	25	33
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	880	850	890	750
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	6.0	6,3	6.3	7
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	9.5	9,5	9.5	10
Compression set	24 h; 70 °C	%	ISO 815	42	43	43	
Compression set	72 h; 23 °C	%	ISO 815	18			
Abrasion resistance	-	mm³	ISO 4649	28	30	30	31
Impact resilience	-	%	ISO 4662	63	62	62	64
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	75	74	74	42
Flexural modulus	2 mm/min	MPa	ISO 178				33
Thermal properties							
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	62	67	67	150
Torsional storage modulus	23 °C	MPa	ISO 6721-2	22	22	22	30
Torsional storage modulus	70 °C	MPa	ISO 6721-2	15	15	15	40
Other properties (23 °C)							
Density	-	kg/m³	ISO 1183	1130	1130	1130	1080
Glass fiber / glass bead / filler content	-	%	ISO 3451-1				
Molding conditions							
Injection molding-Melt temperature	-	°C	-	180-210	170 - 190	170 - 190	200 - 220
Injection molding-Mold temperature	-	°C	-	20 - 40	20	20 -40	20 -40
Extrusion-Melt temperature	-	°C	-				

DP = Developmental product (see disclaimer for developmental products)

*) see disclaimer for developmental products

Series W8000, aliphatic (2)

The new Desmopan® product line based on an aliphatic isocyanate. In addition to possessing the familiar properties of TPUs, these products do not yellow under the action of UV light. The products in the following Table also have very good hydrolysis and microbe resistance, good low-level flexibility and low wear values. They additionally offer a particularly high resilience and "snappiness".

This is why these grades are particularly suitable for colored applications in automotive engineering and the sport and leisure sectors.

Desmopan® (TPU)				**W8000 series, Aliphatic grades (2)**		
Typical Properties	**Test Conditions**	**Units**	**Standards**	**W DP89043D**	**W DP89051D**	**W DP89056D**
Mechanical properties (23 °C/50 % r. h.)						
Shore hardness, method A		-	ISO 868	95	96	95
shore hardness, method D		-	ISO 868	43	51	56
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	39	48	43
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	717	550	320
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	12	17	20
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	18	23	43
Compression set	24 h; 70 °C	%	ISO 815	41	46	46
Compression set	72 h; 23 °C	%	ISO 815			
Abrasion resistance	-	mm³	ISO 4649	11	17	22
Impact resilience	-	%	ISO 4662	56	52	51
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	96	142	
Flexural modulus	2 mm/min	MPa	ISO 178	80	170	250
Thermal properties						
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	73	152	700
Torsional storage modulus	23 °C	MPa	ISO 6721-2	46	77	298
Torsional storage modulus	70 °C	MPa	ISO 6721-2	31	52	193
Other properties (23 °C)						
Density	-	kg/m³	ISO 1183	1080	1080	1110
Glass fiber / glass bead / filler content	-	%	ISO 3451-1			
Molding conditions						
Injection molding-Melt temperature	-	°C	-	210 - 230	230 - 250	240 - 260
Injection molding-Mold temperature	-	°C	-	40 - 60	40 - 60	40 - 60
Extrusion-Melt temperature	-	°C	-			

DP = Developmental product (see disclaimer for developmental products)

Series 900, ether grades (1)

Products offering very good hydrolysis and microbe resistance. Their excellent low-temperature flexibility constitutes a further characteristic feature. The 900 grade series is used inter alia in applications where good flexibility or impact strength is required at very low temperatures. Applications include cables, hoses, profiles, films and shoe shells.

Desmopan®

DP 9370A Shore hardness: 70A; extrusion and injection molding grade; good low-temperature flexibility; plasticizer-free; high moisture vapor transmission rate;
Application: roof lining; seals, membranes; films; rigid/flexible composite systems; sport shoe soles

DP 9370AU As for DP 9370A but with special UV stabilizers

DP 9380A Shore hardness: 82A / 31D; extrusion and injection molding grade; good low-temperature flexibility; complies with DIN VDE 0282-10;
Application: cable sheathings; hoses, unreinforced

9385 Shore hardness: 86A / 35D; extrusion and injection molding grade; good low-temperature flexibility; complies with DIN VDE 0282-10;
Application: cable sheathings; hoses, unreinforced

DP 9585A Shore hardness: 85A / 34D; extrusion and injection molding grade; good low-temperature flexibility;
Application: blown film; fabric coating; cable sheathings; profiles; engineering parts

DP 9392A Shore hardness: 92A / 42D; extrusion and injection molding grade;
good low-temperature flexibility;
Application: hoses, unreinforced; cable sheathings; profiles; engineering parts

DP 9392AU As for DP 9392A but with special UV stabilizers

DP 9095AU Shore hardness: 95A / 43D; injection molding grade; with special UV stabilizers;
good wear resistance, low tendency to warp;
short cycle times;
Application: animal identification tags

Desmopan® (TPU)				900 series, C4-Ether grades (1)					
Typical Properties	**Test Conditions**	**Units**	**Standards**	**DP 9370A / AU**	**DP 9380A**	**9385**	**DP 9585A**	**DP 9392A / AU**	**DP 9095AU**
Mechanical properties (23 °C/50 % r. h.)									
Shore hardness, method A		-	ISO 868	70	82	86	85	92	95
shore hardness, method D		-	ISO 868		31	35	34	42	43
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	25	40	48	40	50	65
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	800	500	600	630	500	370
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	2.4	5.0	6.0	6.0	8,5	18
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	4.3	9.0	13	10	17	30
Compression set	24 h; 70 °C	%	ISO 815	49	42	43	36	40	77
Compression set	72 h; 23 °C	%	ISO 815	22	25	25	28	20	30
Abrasion resistance	-	mm³	ISO 4649	69	20	25	84	20	18
Impact resilience	-	%	ISO 4662	63	50	40	45	32	33
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	39	50	65	60	85	129
Flexural modulus	2 mm/min	MPa	ISO 178						
Thermal properties									
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	37	14	29	31	104	275
Torsional storage modulus	23 °C	MPa	ISO 6721-2	4,5	8,3	12	12	22	40
Torsional storage modulus	70 °C	MPa	ISO 6721-2	3,2	6,3	7,9	7,8	13	19
Other properties (23 °C)									
Density	-	kg/m³	ISO 1183	1060	1110	1120	1110	1150	1149
Glass fiber / glass bead / filler content	-	%	ISO 3451-1						
Molding conditions									
Injection molding-Melt temperature	-	°C	-	190 - 210	205 - 225	205 - 225	205 - 225	210 - 230	200 - 220
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	20 - 40	20 - 40	20 - 40	20
Extrusion-Melt temperature	-	°C	-	175 - 215	195 - 215	195 - 215	180 - 210	195 - 215	200 - 220

DP = Developmental product (see disclaimer for developmental products)

Series 900, ether grades (2)

Products offering very good hydrolysis and microbe resistance. Their excellent low-temperature flexibility constitutes a further characteristic feature. The 900 grade series is used inter alia in applications where good flexibility or impact strength is required at very low temperatures. Applications include cables, hoses, profiles, films and shoe shells.

Desmopan®

DP 9395A Shore hardness: 95A / 46D; extrusion and injection molding grade;
good low-temperature flexibility;
Application: pneumatic hoses; cable sheathings; profiles, injection molding engineering parts

DP 9395AU As for DP 9395A but with special UV stabilizers

955 U Shore hardness: 97A / 55D; injection molding grade; with special UV stabilizers; very good low-temperature impact strength;
Application: ski-boot shells; hoses, unreinforced; injection molding engineering parts

DP 9659DU Shore hardness: 97A / 59D; extrusion and injection molding grade; with special UV stabilizers; transparent up to 6 mm wall thickness;
Application: ski-boot shells; hoses, unreinforced

DP 9662DU Shore hardness: 97A / 62D; extrusion and injection molding grade; with special UV stabilizers; transparent up to 6 mm wall thickness;
Application: ski-boot shells; hoses, unreinforced

DP 9665DU Shore hardness: 98A / 65D; extrusion and injection molding grade; with special UV stabilizers; transparent up to 6 mm wall thickness;
Application: ski-boot shells; hoses, unreinforced; pneumatic hoses

KA 8333* Shore hardness: 98A / 66D; injection molding grade; very good low-temperature impact strength;
Application: shoe soles; engineering parts

DP 9873D Shore hardness: 98A / 73D; injection molding grade; very good low-temperature impact strength;
Application: shoe soles; injection molding engineering parts

Desmopan® (TPU)				900 series, C4-Ether grades (2)						
Typical Properties	**Test Conditions**	**Units**	**Standards**	**DP 9395A / AU**	**955 U**	**DP 9659DU**	**DP 9662DU**	**DP 9665DU**	**KA 8333***	**DP 9873D**
Mechanical properties (23 °C/50 % r. h.)										
Shore hardness, method A		-	ISO 868	95	97	97	97	98	98	98
shore hardness, method D		-	ISO 868	46	55	59	62	65	66	73
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	50	55	60	55	55	55	55
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	450	400	400	350	350	325	310
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	13	20	22	28	26	29	35
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	27	35	40	49	55	45	50
Compression set	24 h; 70 °C	%	ISO 815	40	46					
Compression set	72 h; 23 °C	%	ISO 815	22						
Abrasion resistance	-	mm³	ISO 4649	30	40	20	20	19	30	
Impact resilience	-	%	ISO 4662		38	29	31	40	47	45
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	100	140	89	98	208	150	200
Flexural modulus	2 mm/min	MPa	ISO 178	55	170	180	220		530	910
Thermal properties										
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	209	330	1370	1270	1440	530	733
Torsional storage modulus	23 °C	MPa	ISO 6721-2	39	104	267	362	440	233	475
Torsional storage modulus	70 °C	MPa	ISO 6721-2	19	32	75	97	110	63	156
Other properties (23 °C)										
Density	-	kg/m³	ISO 1183	1150	1160	1160	1176	1175	1170	1190
Glass fiber / glass bead / filler content	-	%	ISO 3451-1							
Molding conditions										
Injection molding-Melt temperature	-	°C	-	210 -230	215 - 235	220 - 235	220 - 235	220 - 235	225 - 235	225 - 235
Injection molding-Mold temperature	-	°C	-	20 - 40	20 - 40	40 - 60	40 - 60	40 - 60	40 - 60	40 - 60
Extrusion-Melt temperature	-	°C	-	200 - 220	205 - 235	205 - 235	205 - 235			

DP = Developmental product (see disclaimer for developmental products)

*) see disclaimer for developmental products

Impact-modified ester grades

This series of grades was developed primarily for shoe shells and similar applications. Shoe shells or ski boots produced in these grades are lightweight and offer a high rigidity and elasticity with a very good low-temperature impact strength. The modified Desmopan® grades additionally display a high scratch and wear resistance.

Glass fiber reinforced grades

Injection moldings in glass fiber reinforced Desmopan® are characterized by a low shrinkage and a low coefficient of expansion. The coefficient of expansion in the direction of the glass fibers is of the same order of magnitude as for aluminum.

Field of application: exterior automotive engineering parts.

Parts in R-TPU display a high heat resistance, good low-temperature impact strength and sound insulation, good flowability and accurate reproduction of detail.

Molded parts can be printed and painted.

Desmopan® (TPU)				Impact modified, Ester grades					Glass fiber reinforced grades
Typical Properties	**Test Conditions**	**Units**	**Standards**	**KU 2-8715***	**KA 8529***	**KA 8377***	**KA 8410***	**KA 8417***	**DP 3970D**
Mechanical properties (23 °C/50 % r. h.)									
Shore hardness, method A		-	ISO 868	96	97	97	98	98	99
shore hardness, method D		-	ISO 868	57	59	62	64	66	70
Ultimate tensile strength	200 mm/min	MPa	i.A. ISO 527-1,-3	52	60	60	60	54	64
Elongation at break	200 mm/min	%	i.A. ISO 527-1,-3	470	410	390	380	360	25
Stress at 100 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	18	18	24	26	31	
Stress at 300 % strain	200 mm/min	MPa	i.A. ISO 527-1,-3	35	37	40	43	45	
Compression set	24 h; 70 °C	%	ISO 815		60				
Compression set	72 h; 23 °C	%	ISO 815		30				
Abrasion resistance	-	mm³	ISO 4649	25	30	30	30	30	
Impact resilience	-	%	ISO 4662	36	38	38			
Tear propagation resistance	500 mm/min	kN/m	ISO 34-1	130	140	160	150	190	
Flexural modulus	2 mm/min	MPa	ISO 178	175	240	330	440	510	1700
Thermal properties									
Torsional storage modulus	-20 °C	MPa	ISO 6721-2	542	600	760	824	895	2870
Torsional storage modulus	23 °C	MPa	ISO 6721-2	127	157	206	250	311	1450
Torsional storage modulus	70 °C	MPa	ISO 6721-2	46	57	64	77	93	765
Other properties (23 °C)									
Density	-	kg/m³	ISO 1183	1170	1200	1200	1200	1180	1376
Glass fiber / glass bead / filler content	-	%	ISO 3451-1						21
Molding conditions									
Injection molding-Melt temperature	-	°C	-	225 - 240	225 - 240	225 - 240	225 - 240	225 - 240	220 - 245
Injection molding-Mold temperature	-	°C	-	40 - 60	40 - 60	40 - 60	40 - 60	40 - 60	40 - 80
Extrusion-Melt temperature	-	°C	-						

DP = Developmental product (see disclaimer for developmental products)

*) see disclaimer for developmental products

Pretreatment of the granules

TPU absorbs moisture from the air. The extent and rate at which this happens depends on the raw material type, hardness and climate. To ensure trouble-free processing and avoid any loss of quality, we recommend drying to a moisture content of ≤ 0.05 %. If the granules are too moist, blisters or streaks can occur on the surface of the finished components. The extrudate is no longer smooth and glossy but foamy and gassy.

A frequent cause of defects is also the use of undried functional concentrates. These batches should be separately pre-dried and have a moisture content ≤ 0.05 %. Such levels can be reliably reached in conventional dry air and circulating air dryers.

Depending on the hardness, the recommended drying temperatures are between 80 and 110 °C, with drying times of 1 to 3 hours. Better drying can be achieved in a shorter time with dry air dryers.

Dried, hot granules should not be left to cool down in the open air. They must be stored in dry containers that can be re-sealed. The machine hopper must be kept covered.

Coloring

Apart from a few exceptions, Desmopan® is supplied solely in its natural color. This will be somewhere between transparent yellow and opaque white, depending on the grade in question.

Converters can easily color Desmopan® themselves. A simple and reliable means of doing this is by using pigment masterbatch with Desmopan® as the carrier material.

Pigment masterbatch based on polystyrene or SAN resin is suitable to a limited extent, while masterbatch based on polyethylene, polypropylene or PVC is not at all suitable. Desmopan® can similarly be colored with pigments and pastes. The standard quantities employed (depending on wall thickness and color density):

Pigment masterbatch	1.0 - 4%
Coloring pastes	0.5 - 1%
Pigments	0.2 - 0.5%

Particular care should be taken to ensure that the coloring agents employed are dry. Even the addition of just 1% moist pigment masterbatch can affect the surface and impair demolding behavior.

Food contact

Since there are different provisions governing food contact in a large number of countries, no general statement can be made here.

If you have any questions on this subject please contact:

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Occupational hygiene and environmental advice

Air extraction

Desmopan® can be machined and processed over a wide temperature range but, as with all natural and synthetic organic materials, it decomposes as of a certain temperature. The development of smoke signifies that decomposition is taking place.

Slow decomposition commences at approximately 240 °C, depending on the grade of Desmopan® involved. Further information may be obtained from our Safety Data Sheets.

We recommend efficient air extraction in all cases. This is particularly important for extrusion and welding, since, in the latter case in particular, it is impossible to achieve a controlled temperature profile.

Waste disposal

Providing that it is not contaminated with other substances, Desmopan® can essentially be dumped on municipal landfills. It does not constitute a hazard to water. If the material can no longer be recycled, then it is feasible and, indeed makes sense, for it to be incinerated in a waste incineration plant on account of its high calorific value.

Recycling

Molded parts in Desmopan® must be marked in accordance with DIN/ISO 11469 and ISO 11469 (see TI KU21159).

>TPU<

All Desmopan® grades can be remelted in a stable manner and can thus be reprocessed in the course of recycling (they should be pre-dried as a matter of principle).

Injection molding

Sprue and runner waste and other clean waste can be granulated and re-processed. The quantity of regrind added to virgin material should always be selected on the basis of the requirement profile specified for the parts. This will also show whether it is possible to use 100 % regrind. Unless the injection moldings are being used for inferior-quality applications, they must be tested to check that they meet the specified requirements.

Extrusion

Either process separately or add to injection molding grades.

DP / * This is a develomental product. Further information, including amended or supplementary data on hazards associated with its use, may be compiled in the future. For this reason no assurances are given as to type conformity, processability, long-term performance characteristics or other production or application parameters. Therefore, the purchaser/user uses the product entirely at his own risk without having been given any warranty or guarantee and agrees that the supplier shall not be liable for any damages, of whatever nature, arising out of such use.

Commercialization and continued supply of this material are not assured. Its supply may be discontinued at any time.

This information and our technical advice – whether verbal, in writing or by way of trials – are given in good faith but without warranty, and this also applies where proprietary rights of third parties are involved. Our advice does not release you from the obligation to verify the information currently provided - especially that contained in our safety data and technical information sheets - and to test our products as to their suitability for the intended processes and uses. The application, use and processing of our products and the products manufactured by you on the basis of our technical advice are beyond our control and, therefore, entirely your own responsibility. Our products are sold in accordance with the current version of our General Conditions of Sale and Delivery.

Unless specified to the contrary, the values given have been established on standardised test specimens at room temperature. The figures should be regarded as guide values only and not as binding minimum values. Kindly note that, under certain conditions, the properties can be affected to a considerable extent by the design of the mold/die, the processing conditions and the coloring.

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