Ultradur® (PBT)

Product Range

Ultradur® in the web: www.ultradur.de

BASF
The Chemical Company

Ultradur® (PBT)

Ultradur® is BASF's trade name for its line of partially crystalline saturated polyesters. This line is based on polybutylene terephthalate and is employed in applications demanding a high performance level such as load bearing parts in different industrial sectors. Ultradur® is outstanding for its high rigidity and strength, very good dimensional stability, low water absorption and high resistance to many chemicals. Moreover, Ultradur® exhibits exceptional resistance to weathering and excellent heat aging behavior.

Ultradur® (PBT)

Overview Product Portfolio

Unreinforced grades	
B 2550	Easy-flowing grade for coating paper and board with high heat resistance, for example for packaging of frozen goods and ready-prepared meals. Also suitable for injection-molding applications with demands on the flowability and for the manufacture of fibers in the spinning process.
B 4500 B 4520	Medium-viscosity grade for manufacturing films, monofilaments, bristles and batches and for thin-walled profiles and pipes. The grade is also suitable for the manufacture of industrial functional parts in injection-molding.
B 6550 B 6550 L / LN	High-viscosity grades for the extrusion of loose buffer tubes for optical fibers and boards, semi-finished products for machining, profiles and pipes.

Unreinforced grades with good flowability	
B 4520 High Speed	Easy-flowing injection-molding grade for the manufacture of connectors and other industrial parts.

Reinforced grades	
B 4300 G2/G4/G6/G10	Injection-molding grades with 10% to 50% glass fibers, for industrial parts, rigid, tough and dimensionally stable, for example for thermostat parts, small-motor housings for vehicles, headlamp frames, cams, windshield wiper arms, plug-in connectors, housings, consoles, contact mounts and covers.
B 4040 G4/G6/G10	Injection-molding grades with 10% to 50% glass fibers for industrial parts with excellent surface quality, for example for door handles in vehicles, sunroof frames, oven door handles, toaster casings, exterior mirrors, rear screen wiper arms in vehicles and sunroof wind deflectors.
S 4090 G2/G4/G6	Low-warpage, easy-flowing injection-molding grades with 10% to 30% glass fibers for industrial parts with high dimensional stability requirements, for example for plug-in connectors and housings.
S 4090 GX/G4X/G6X	Low-warpage, easy-flowing injection-molding grades with very good processing properties, with 14% to 30% glass fibers, for industrial parts with high dimensional stability requirements, for example for internal applications for vehicles, plug-in connectors and housings.

Reinforced grades with excellent flowability	
B 4300 G2/G3/G4/G6 High Speed	Easy-flowing injection-molding grades with 10% to 30% glass fibers, for industrial parts, rigid, tough and dimensionally stable, for example for housings, consoles, plug-in connectors, contact carriers and covers.
B 4040 G6 High Speed	Easy-flowing injection-molding grade with 30% glass fibers for industrial parts with excellent surface quality, for example door handles in vehicles, sunroof frames, exterior mirrors and windshield wiper arms.
S 4090 G4/G6 High Speed	Low-warpage, easy-flowing injection-molding grades with 20% or 30% glass fibers for industrial parts with high dimensional stability requirements, for example for internal applications for vehicles, plug-in connectors and housings.

Reinforced grades with low warpage	
B 4300 K4/K6	Injection-molding grades with 20% to 30% glass beads for industrial parts with low warpage, for example precision parts for optical instruments, chassis, housings (including gas meter housings).
B 4300 M2/M5	Mineral-reinforced, impact-modified injection-molding grades for rigid parts with good surface quality and low warpage, for example central automotive door locks, housings and visible parts of domestic appliances.
B 4300 GM42	Mixed glass-fiber-reinforced and mineral-reinforced injection-molding grade with good surface quality and rigidity and with low warpage for parts such as housings and printed circuit boards.
S 4090 GM11/13	Injection-molding grades reinforced with 10% to 20% of glass fibers/minerals, for laminar parts with high dimensional stability requirements and low warpage, for example lids, ventilation grilles and housing covers.

Flame-retardant grades

B 4406 unreinforced/ G2/G4/G6	Flame-retardant injection-molding grades, unreinforced or with 10 % to 30 % glass fibers, for parts requiring enhanced flame-retardance, for example plug-in connectors and housings, coil formers and lighting components.
B 4441 G5	Halogen-free flame-retardant injection-molding grade with 25 % of glass fibers for parts requiring enhanced flame-retardance. Specially optimized for the filament requirements of IEC 60335 for increased tracking resistance, for example for plug-in connectors, switch parts and housings for domestic appliances.
B 4450 G5	Halogen-free flame-retardant injection-molding grade with 25 % glass fibers for parts requiring enhanced flame-retardance as well as maximum tracking resistance, for example for plug-in connectors, switch parts or housings for power electronics.
B 4450 G5 HR	Halogen-free flame-retardant injection-molding grade with 25 % glass fibers for parts requiring enhanced flame-retardance as well as maximum tracking resistance and additionally meeting the requirements in terms of hydrolysis stability.

Reinforced grades with outstanding hydrolysis resistance

B 4330 G3/G6 HR	Impact-modified injection-molding grade with 15 % or 30 % glass fibers, for industrial parts with increased demands on the hydrolysis stability, increased resistance to alkaline solutions and toughness, for example for housings and plug-in connectors in the engine compartment.
B 4300 G6 HR	Injection-molding grade with 30 % glass fibers, for industrial parts with increased demands on the hydrolysis stability, for example for housings and plug-in connectors in the engine compartment.

Reinforced grades with particularly high laser transparency for laser welding

LUX B 4300 G4/G6	Laser-weldable grades with 20 % or 30 % glass fibers; particularly high specified transparency for radiation in the near infrared area (800-1100 nm), e. g. of Nd:YAG or diode lasers.

Grades with special properties

LS	Laser-markable products; can be marked with a Nd:YAG laser (1064 nm).
LT	Laser-transparent grades with specified laser transparency; for radiation in the near infrared area (800-1100 nm), e. g. of Nd:YAG or diode lasers.
FC/FC Aqua®	Products suitable for use in drinking water and/or food contact. They meet the regulatory requirements for the corresponding areas of use.
PRO	Products which meet the regulatory requirements in particular in the area of medical devices, such as insulin pens or inhalers.

We also offer further products with special properties or for special applications. For more information on products with a special finish, please contact the Ultra-Infopoint.

Ultradur® Grades

Unreinforced grades

Typical values at 23 °C for uncolored products	Unit	Test method	B 2550
Product Features			
Symbol	–		PBT
Density	kg/m³	ISO 1183	1,300
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	
Flame retardant (F), Impact modifier (P)	–	–	
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	107
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.5
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.25
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	H, M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	45
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	
Melt temperature range, injection-molding	°C	–	245-270
Mold temperature range	°C	–	40-70
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	230-290
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	1.5/1.5
Melt temperature/mold temperature (for shrinkage test)	°C	–	260/60
Molding shrinkage, free, longitud./transvers.	%	ISO 2577, 294-4	1.6/1.9
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	HB
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	HB
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	+
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	2,500
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	57
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	3.7
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	35
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	1,100
Flexural strength	MPa	ISO 178	
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	250
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	4.1
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	130
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	65
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	165
Max. service temperature (short cycle operation)[3]	°C	–	200
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	120/140
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	130-160
Thermal conductivity	W (m · K)	DIN 52 612-1	0.27
Specific heat capacity	J (g · K)		1,500
Electrical properties			
Dielectric constant at 100 Hz/1 MHz	–	IEC 60250	3.3/3.3
Dissipation factor at 100 Hz/1 MHz	10^{-4}	IEC 60250	13/200
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{13}
Comparative tracking index CTI, test solution A	–	IEC 60112	500

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

Ultradur® Grades

... with good flowability:
B 4520 High Speed

B 4500	B 4520	B 6550	B 6550L	B 6550LN	B 4520 High Speed
PBT	PBT	PBT	PBT	PBT	PBT
1,300	1,300	1,300	1,300	1,300	1,300
130	130	160	160	160	115
n	n, c, sp, bk	n	n	n	n, bk
0.5	0.5	0.5	0.5	0.4	0.5
0.25	0.25	0.25	0.25	0.25	0.25
E, F, M	H, M	H, M	H, M	H, M	M
223	223	223	223	223	223
21	21	9.5	9.5	9.5	50
250-275	250-275	250-275	250-275	260-270	250-275
40-70	40-70	40-80	40-80	40-80	40-70
230-260		250-270	250-270	250-270	
230-250				250-270	
230-280					
230-280					
1.5/1.5	1.5/1.5	1.5/1.5	1.6/1.7	1.9/2.2	1.8/1.9
260/60	260/60	260/60	260/60	260/60	260/60
1.6/1.9	1.5/1.7	1.7/2.1			1.8/2.0
HB	HB	HB	HB	HB	
HB	HB	HB	HB	HB	
+	+	+	+	+	
2,500	2,500	2,400	2,500	2,600	2,200
55	55	54	55	56	53
3.7	3.7	3.5	3.5	3.5	3.5
>50	>50	>50	>50	>50	>50
1,200	1,200	1,100			
85	85	85	76		
NB	NB	NB	NB	NB	190
5.2	5.0	6.1	5.8	5.2	4
130	130	130			
65	55	55	55	55	55
165	165	135	135	135	130
200	200	200			200
120/140	120/140	120/140			
130-160	130-160	130-160	97-130	90-150	
0.27	0.27	0.27			
1,500	1,500	1,500			
3.3/3.3	3.4/3.3	3.3/3.3	3.4/3.2	3.4/3.2	
10/200	20/200	10/200	13/221	19/219	
10^{14}	10^{14}	10^{14}	10^{14}	10^{14}	
10^{13}	10^{13}	10^{13}	10^{13}	10^{13}	
550	550	600	600	475	

Ultradur® Grades

Reinforced grades

Typical values at 23 °C for uncolored products	Unit	Test method	B 4300 G2
Product Features			
Symbol	–		PBT
Density	kg/m³	ISO 1183	1,370
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	GF10
Flame retardant (F), Impact modifier (P)	–	–	
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	115
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n, c, sp, bk
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.4
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.2
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	16
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	
Melt temperature range, injection-molding	°C	–	250-275
Mold temperature range	°C	–	60-100
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	0.7/1.34
Melt temperature/mold temperature (for shrinkage test)	°C	–	260/80
Molding shrinkage, free, longitud. / transvers.	%	ISO 2577, 294-4	1.22/1.38
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	HB
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	HB
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	+
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	4,400
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	80*
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	4.5*
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	
Flexural strength	MPa	ISO 178	140
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	37
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	4.0
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	160*
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	200
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	220
Max. service temperature (short cycle operation)[3]	°C	–	210
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	40-50
Thermal conductivity	W (m · K)	DIN 52 612-1	0.23
Specific heat capacity	J (g · K)		1,700
Electrical properties			
Dielectric constant at 100 Hz/1 MHz	–	IEC 60250	3.6/3.6
Dissipation factor at 100 Hz/1 MHz	10^{-4}	IEC 60250	12/150
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{13}
Comparative tracking index CTI, test solution A	–	IEC 60112	300

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

B 4300 G4	B 4300 G6	B 4300 G10	B 4040 G4	B 4040 G6	B 4040 G10
PBT	PBT	PBT	(PBT+PET)	(PBT+PET)	(PBT+PET)
1,450	1,530	1,730	1,470	1,550	1,730
GF20	GF30	GF50	GF20	GF30	GF50
107	105	97	105	105	90
n, c, sp, bk	n, c, sp, bk	n, c, sp, bk	n, c, sp, bk	n, c, sp, bk	c, bk
0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.2	0.2	0.2	0.2	0.2
M	M	M	M	M	M
223	223	223	223	223	223
15	11	3.5			
			22	15	8.5
250-275	250-275	250-275	250-275	250-275	250-275
60-100	60-100	80-120	60-100	60-100	60-100
0.39/1.28	0.2/1.1	0.2/0.9	0.2/1.1	0.18/0.99	0.1/0.75
260/80	260/80	260/80	270/80	270/80	270/80
0.43/1.16	0.34/1.07		0.4/0.9	0.3/0.9	0.24/0.77
HB	HB	HB	HB	HB	HB
HB	HB	HB	HB	HB	HB
+	+	+	+	+	+
7,000	9,800	16,500	7,500	10,500	18,000
115*	137*	160*	120*	145*	170*
3.5*	3.0*	1.7*	2.8*	2.6*	1.6*
	7,500				
170	200		190		270
54	68	60	40	60	60
6.5	9.0	11	5.5	8	10
180*	190*	220*	190		
205	215	215	180	200	205
220	220	220	215	220	221
210	210	210	210	210	210
135/150	140/160	140/160		140/160	140/160
30-40	20-30	20-30	20-30	20-30	10-20
0.25	0.27	0.36			
1,600	1,500	1,400	1,700	1,600	1,600
3.7/3.7	4/3.8	4/4	3.7/3.5	4.0/3.8	4.7/4.5
12/150	25/170	12/150	14/180	16/170	20/150
10^{14}	10^{14}	10^{14}	10^{14}	10^{14}	10^{14}
10^{13}	10^{13}	10^{13}	10^{13}	10^{13}	10^{13}
300	375	425	300	250	225

Ultradur® Grades

Reinforced grades

Typical values at 23 °C for uncolored products	Unit	Test method	S 4090 G2
Product Features			
Symbol	–		(PBT + ASA)
Density	kg/m³	ISO 1183	1,310
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	GF10
Flame retardant (F), Impact modifier (P)	–	–	
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	105
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n, c, bk
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.4
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.2
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	35
Melt temperature range, injection-molding	°C	–	250-275
Mold temperature range	°C	–	60-100
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	0.46/0.85
Melt temperature/mold temperature (for shrinkage test)	°C	–	270/80
Molding shrinkage, free, longitud./transvers.	%	ISO 2577, 294-4	
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	HB
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	HB
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	+
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	4,500
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	75*
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	2.9*
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	3,300
Flexural strength	MPa	ISO 178	119
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	37
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	4
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	140*
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	105
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	190
Max. service temperature (short cycle operation)[3]	°C	–	170
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	110/140
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	55
Thermal conductivity	W (m · K)	DIN 52 612-1	0.27
Specific heat capacity	J (g · K)		1,500
Electrical properties			
Dielectric constant at 100 Hz/1 MHz	–	IEC 60250	3.6/3.4
Dissipation factor at 100 Hz/1 MHz	10^{-4}	IEC 60250	31/205
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{14}
Comparative tracking index CTI, test solution A	–	IEC 60112	375

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

S 4090 G4	S 4090 G6	S 4090 GX	S 4090 G4X	S 4090 G6X
(PBT+ASA)	(PBT+ASA)	(PBT+ASA)	(PBT+ASA)	(PBT+ASA)
1,390	1,470	1,330	1,390	1,470
GF20	GF30	GF14	GF20	GF30
105	105	110	104	104
n, c, bk	n, c, bk	n, bk	n, bk	n, bk
0.4	0.4	0.4	0.4	0.4
0.2	0.2	0.2	0.2	0.2
M	M	M	M	M
223	223	223	223	223
23	16	23	27	20
250-275	250-275	250-275	250-275	250-275
60-100	60-100	60-100	60-100	60-100
0.16/0.82	0.1/0.75	0.32/0.99	0.2/0.95	0.16/0.95
270/80	270/80	270/80	270/80	270/80
0.43/0.74	0.29/0.75	0.54/0.83	0.46/0.91	0.29/0.82
HB	HB			HB
HB	HB			HB
+	+	+	+	+
6,900	9,700	5,500	6,600	9,600
105*	125*	95*	100*	128*
2.4*	2.2*	3.2*	2.6*	2.5*
4,700	6,700			
151	183	140		190
50	58	52	49	61
5.5	7	7	5.5	7.5
153*	164*			
160	175	170	185	205
205	210	210	210	220
170	170	170	170	170
110/140	110/140			
40	30	52		30
0.28	0.29			
1,500	1,500			
3.7/3.6	3.8/3.7	3.6/3.4		3.9/3.7
30/190	30/180	39/208		46/202
10^{14}	10^{14}	10^{14}	10^{14}	10^{14}
10^{14}	10^{14}	10^{14}	10^{14}	10^{14}
450	500	375		425

Ultradur® Grades

Reinforced grades with excellent flowability

Typical values at 23 °C for uncolored products	Unit	Test method	B 4300 G2 High Speed
Product Features			
Symbol	–		PBT
Density	kg/m³	ISO 1183	1,370
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	GF10
Flame retardant (F), Impact modifier (P)	–	–	
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	105
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n, bk
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.4
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.2
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	28
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	
Melt temperature range, injection-molding	°C	–	250-275
Mold temperature range	°C	–	60-100
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	0.59 / 1.26
Melt temperature/mold temperature (for shrinkage test)	°C	–	260 / 80
Molding shrinkage, free, longitud. / transvers.	%	ISO 2577, 294-4	0.9 / 1.1
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	HB
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	HB
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	4,400
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	85*
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	3.9*
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	
Flexural strength	MPa	ISO 178	
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	25
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	3.5
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	165
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	210
Max. service temperature (short cycle operation)[3]	°C	–	210
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	
Thermal conductivity	W (m · K)	DIN 52 612-1	
Specific heat capacity	J (g · K)		
Electrical properties			
Dielectric constant at 100 Hz / 1 MHz	–	IEC 60250	3.6 / 3.6
Dissipation factor at 100 Hz / 1 MHz	10^{-4}	IEC 60250	12 / 150
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{13}
Comparative tracking index CTI, test solution A	–	IEC 60112	300

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

B 4300 G3 High Speed	B 4300 G4 High Speed	B 4300 G6 High Speed
PBT	PBT	PBT
1,410	1,450	1,530
GF15	GF20	GF30
100	100	90
n, bk	n, bk	n, bk
0.4	0.4	0.4
0.2	0.2	0.2
M	M	M
223	223	223
24	22	23
250-275	250-275	250-275
60-100	60-100	60-100
	0.3/1.33	0.27/1.1
	260/80	260/80
0.7/1.1	0.47/1.1	0.35/1.1
HB	HB	HB
HB	HB	HB
5,600	7,000	9,700
100*	115*	140*
3.7*	3.3*	2.7*
		210
30	45	60
5	6	7.5
185	195	200
215	220	220
210	210	210
		20-30
3.7/3.7	3.7/3.7	4/3.8
12/150	12/150	25/170
10^{14}	10^{14}	10^{14}
10^{13}	10^{13}	10^{13}
300	300	350

Ultradur® Grades

Reinforced grades with excellent flowability

Typical values at 23 °C for uncolored products	Unit	Test method	B 4040 G6 High Speed
Product Features			
Symbol	–		(PBT + PET)
Density	kg/m³	ISO 1183	1,560
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	GF30
Flame retardant (F), Impact modifier (P)	–	–	
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	85
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n, bk
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.4
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.2
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	33
Melt temperature range, injection-molding	°C	–	250-275
Mold temperature range	°C	–	60-100
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	0.14 / 0.88
Melt temperature/mold temperature (for shrinkage test)	°C	–	270 / 80
Molding shrinkage, free, longitud. / transvers.	%	ISO 2577, 294-4	0.31/1.03
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	HB
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	HB
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	10,500
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	140*
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	2.1*
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	
Flexural strength	MPa	ISO 178	
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	48
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	7.4
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	200
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	220
Max. service temperature (short cycle operation)[3]	°C	–	210
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	
Thermal conductivity	W (m · K)	DIN 52 612-1	
Specific heat capacity	J (g · K)		
Electrical properties			
Dielectric constant at 100 Hz / 1 MHz	–	IEC 60250	4/3.8
Dissipation factor at 100 Hz / 1 MHz	10^{-4}	IEC 60250	16/170
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{13}
Comparative tracking index CTI, test solution A	–	IEC 60112	250

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

S 4090 G4 High Speed	S 4090 G6 High Speed
(PBT + ASA)	(PBT + ASA)
1,390	1,480
GF20	GF30
105	92
n, bk	n, bk
0.4	0.4
0.2	0.2
M	M
223	223
35	22
250 - 275	250 - 275
60 - 100	60 - 100
0.17 / 0.8	
270 / 80	
0.4 / 0.8	0.27 / 0.80
HB	HB
HB	HB
6,900	9,600
100*	120*
2.4*	2.1*
43	50
5.5	7
180	187
210	215
170	170
3.7/3.6	
30 / 190	
10^{14}	
10^{14}	
325	325

Ultradur® Grades

Reinforced grades with low warpage

Typical values at 23 °C for uncolored products	Unit	Test method	B 4300 K4
Product Features			
Symbol	–		PBT
Density	kg/m³	ISO 1183	1,450
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	GB20
Flame retardant (F), Impact modifier (P)	–	–	
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	115
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n, c, sp, bk
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.4
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.2
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	16
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	
Melt temperature range, injection-molding	°C	–	250-275
Mold temperature range	°C	–	40-80
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	1.7 / 1.8
Melt temperature/mold temperature (for shrinkage test)	°C	–	260 / 60
Molding shrinkage, free, longitud. / transvers.	%	ISO 2577, 294-4	1.9 / 1.9
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	HB
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	HB
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	+
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	3,500
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	48*
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	6*
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	1,300
Flexural strength	MPa	ISO 178	100
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	35
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	3
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	150
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	70
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	170
Max. service temperature (short cycle operation)[3]	°C	–	200
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	120/130
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	80-90
Thermal conductivity	W (m · K)	DIN 52 612-1	0.27
Specific heat capacity	J (g · K)		1,600
Electrical properties			
Dielectric constant at 100 Hz / 1 MHz	–	IEC 60250	4 / 3.7
Dissipation factor at 100 Hz / 1 MHz	10^{-4}	IEC 60250	12/190
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{13}
Comparative tracking index CTI, test solution A	–	IEC 60112	250

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

B 4300 K6	B 4300 M2	B 4300 M5	B 4300 GM42	S 4090 GM11	S 4090 GM13
PBT	PBT-HI	PBT	PBT	(PBT+ASA)	(PBT+ASA)
1,530	1,360	1,510	1,550	1,290	1,370
GB30	M12,5	M25	GF20-M10	GF5-M5	GF7-M13
	P				
113	100	117	101	139	132
n, c, sp, bk	n, c, sp, bk	n, c, sp, bk	n, c, sp, bk	n	n
0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.2	0.2	0.2	0.2	0.2
M	M	M	M	M	M
223	223	223	223	223	223
9	11	14	17		
				10	10
250-275	250-275	250-275	250-275	250-275	250-275
40-80	40-60	40-80	60-90	60-100	60-100
1.7/1.7	1.7/1.9	1.74/1.78	0.5/1.3	0.6/0.9	0.47/0.73
260/60	260/60	250/60	260/60	270/80	270/80
		1.80/1.68		1.0/1.0	0.7/0.8
HB	HB	HB	HB		
HB	HB	HB	HB		
+	+	+	+		+
4,000	2,500	4,000	7,900	4,000	5,700
50*	40*	56*	105*	60*	70*
5*	12*	7.5*	2.7*	3.8*	3.1*
2,200	1,300	2,000	4,500		
				104	114
35	NB	100	45	40	34
3	6	4	4.5	4.9	3.9
165	105	170	195		
95	49	90	210	105	120
200	136	195	220	200	200
200	200	200	200	170	170
120/130	/100	120/130	120/130		
70-80	85-95	70-110	40		39
0.27	0.27				
1,500	1,700	1,500	1,500		
3.8/3.8	3.6/3.6	3.6/3.6	3.8/3.8		/4.1
12/190	12/150	12/150	12/150		/280
10^{14}	10^{14}	10^{14}	10^{14}		10^{13}
10^{13}	10^{13}	10^{13}	10^{13}		10^{14}
225	300	225	300		250

Ultradur® Grades

Flame-retardant grades

Typical values at 23 °C for uncolored products	Unit	Test method	B 4406
Product Features			
Symbol	–		PBT
Density	kg/m³	ISO 1183	1,450
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	
Flame retardant (F), Impact modifier (P)	–	–	F
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	123
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n, c, sp, bk
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.4
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.25
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	30
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	
Melt temperature range, injection-molding	°C	–	245-270
Mold temperature range	°C	–	40-70
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	1.5/1.5
Melt temperature/mold temperature (for shrinkage test)	°C	–	260 / 60
Molding shrinkage, free, longitud. / transvers.	%	ISO 2577, 294-4	
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	V-0
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	V-0
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	+
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	3,000
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	65
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	3.9
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	5.3
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	
Flexural strength	MPa	ISO 178	
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	50
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	4
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	120
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	60
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	170
Max. service temperature (short cycle operation)[3]	°C	–	200
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	110 / 135
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	50-60
Thermal conductivity	W (m · K)	DIN 52 612-1	0.27
Specific heat capacity	J (g · K)		1,500
Electrical properties			
Dielectric constant at 100 Hz / 1 MHz	–	IEC 60250	3.3 / 3.3
Dissipation factor at 100 Hz / 1 MHz	10^{-4}	IEC 60250	110/170
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{13}
Comparative tracking index CTI, test solution A	–	IEC 60112	250

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

B 4406 G2	B 4406 G4	B 4406 G6	B 4441 G5	B 4450 G5	B 4450 G5 HR
PBT	PBT	PBT	PBT	PBT	PBT
1,500	1,550	1,650	1,530	1,610	1,580
GF10	GF20	GF30	GF25	GF25	GF25
F	F	F	F	F	F
120	116	108	105	105	110
n, c, sp, bk	n, c, sp, bk	n, c, sp, bk	n, bk	n, bk	n, bk
0.4	0.4	0.4	0.4	0.4	0.4
0.2	0.2	0.2	0.2	0.2	0.2
M	M	M	M	M	M
223	223	223	223	223	223
15	11	8			
			15	20	7
250-275	250-275	250-275	260-280	260-280	260-280
60-100	60-100	60-100	60-100	60-100	60-100
0.6/1.3	0.3/1.2	0.2/1			
260/80	260/80	260/80	260/80	260/80	
			0.44/1.24	0.55/0.147	
V-0	V-0	V-0	V-0	V-0	V-0
V-0	V-0	V-0	V-0	V-2	V-2
+	+	+	+	+	+
5,500	8,200	11,300	9,800	9,500	8,400
95*	125*	145*	110*	105*	110*
3.3*	2.6*	2.3*	2.3*	2.4*	2.6*
		7,500			
			180	180	
30	48	60	45	42	50
6	9	10	7	5	6
	190*	220*			
190	200	205	210	210	208
215	220	220	220	220	222
210	210	210	210	210	210
120/130	120/130	125/150			
50	28-34	20-30	20	30	30
		0.32	0.27	0.28	
1,600	1,500	1,400	1,100	1,000	
3.5/3.5	3.8/3.6	3.9/3.9	/3.6	/3.8	/3.9
80/150	70/170	20/150	/137	/142	/150
10^{14}	10^{14}	10^{14}	10^{14}	10^{14}	10^{13}
10^{13}	10^{13}	10^{13}	10^{16}	10^{16}	$>10^{16}$
225	200	200	525	600	600

Ultradur® Grades

Reinforced grades with outstanding hydrolysis resistance

Typical values at 23 °C for uncolored products	Unit	Test method	B 4330 G3 HR
Product Features			
Symbol	–		PBT-I
Density	kg/m³	ISO 1183	1,390
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	GF15
Flame retardant (F), Impact modifier (P)	–	–	P
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	106
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	n, bk
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	0.4
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	0.2
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	M
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	29
Melt temperature range, injection-molding	°C	–	250-275
Mold temperature range	°C	–	60-100
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	
Melt temperature/mold temperature (for shrinkage test)	°C	–	
Molding shrinkage, free, longitud. / transvers.	%	ISO 2577, 294-4	0.9/1.15
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	5,300
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	100*
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	3.5*
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	
Flexural strength	MPa	ISO 178	160
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	62
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	10
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	200
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	220
Max. service temperature (short cycle operation)[3]	°C	–	210
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	30-60
Thermal conductivity	W (m · K)	DIN 52 612-1	
Specific heat capacity	J (g · K)		
Electrical properties			
Dielectric constant at 100 Hz/1 MHz	–	IEC 60250	
Dissipation factor at 100 Hz/1 MHz	10^{-4}	IEC 60250	
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{15}
Comparative tracking index CTI, test solution A	–	IEC 60112	600

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

B 4330 G6 HR	B 4300 G6 HR
PBT-I	PBT
1,490	1,510
GF30	GF30
P	
108	108
n, bk	n, bk
0.4	0.4
0.2	0.2
M	M
223	223
	5.5
250-280	250-275
60-100	60-100
0.5/1.1	0.45/1.3
HB	
HB	
8,500	8,700
120*	130*
3.4*	3.3*
190	
74	70
14	12
205	205
220	220
210	210
20-35	
10^{14}	
10^{15}	
400	

Ultradur® Grades

Reinforced grades with particularly high laser transparency for laser welding

Typical values at 23 °C for uncolored products	Unit	Test method	LUX B 4300 G4
Product Features			
Symbol	–		PBT
Density	kg/m³	ISO 1183	1,460
Reinforcing filler: Glass fiber (GF), Glass beads, (GB), Mineral (M)	%	–	GF20
Flame retardant (F), Impact modifier (P)	–	–	
Viscosity number, solution 0.005 g/ml phenol/1.2-dicholoro benzene (1:1)	cm³/g	ISO 1628	95
Colors: natural (n), colored (c), black (bk), special colors (sp)	–	–	
Water absorption, saturation in water at 23 °C	%	similar to ISO 62	
Moisture absorption, saturation in standard conditioning atmosphere 23 °C/50 % r. h.	%	similar to ISO 62	
Processing methods			
Injection molding (M), extrusion (E), film extrusion (F), coating (H)	–	–	
Melting temperature, DSC	°C	ISO 11357-1/-3	223
Melt volume rate MVR 250 / 2.16	cm³/10 min	ISO 1133	
Melt volume rate MVR 275 / 2.16	cm³/10 min	ISO 1133	7
Melt temperature range, injection-molding	°C	–	250-275
Mold temperature range	°C	–	60-100
Melt temperature range, pipe extrusion	°C	–	
Melt temperature range, semi-finished extrusion	°C	–	
Melt temperature range, cast-film extrusion	°C	–	
Melt temperature range, coating	°C	–	
Molding shrinkage, free, longitud./transvers. (plate with film gate 150 · 150 · 3 mm³)	%	–	
Melt temperature/mold temperature (for shrinkage test)	°C	–	
Molding shrinkage, free, longitud. / transvers.	%	ISO 2577, 294-4	0.75 / 1.25
Fire behavior			
Flammability according to UL-Standard at d = 1.6 mm thickness	class	IEC 60695-11-10	
Flammability according to UL-Standard at d = 0.8 mm thickness	class	IEC 60695-11-10	
Flammability of materials in cars at d ≥ 1 mm thickness[1]	–	FMVSS 302	
Mechanical properties			
Tensile modulus of elasticity	MPa	ISO 527-1/-2	7,300
Tensile stress at yield (v = 50 mm/min), stress at break* (v = 5 mm/min)	MPa	ISO 527-1/-2	125*
Strain at yield (v = 50 mm/min)	%	ISO 527-1/-2	
Strain at break (v = 50 mm/min), strain at break* (v = 5 mm/min)	%	ISO 527-1/-2	3.5*
Tensile creep modulus, 1000 h, elongation ≤ 0.5 %, +23 °C	MPa	ISO 899-1	
Flexural strength	MPa	ISO 178	195
Charpy impact strength (23 °C)[2]	kJ/m²	ISO 179/1eU	42
Charpy notched impact strength (23 °C)[2]	kJ/m²	ISO 179/1eA	6.8
Ball intendation hardness H 358 N/30 sec, H 961 N/30 sec*	MPa	ISO 2039-1	
Thermal properties			
Heat deflection temp. under 1.8 MPa (HDT/A)	°C	ISO 75-1/-2	198
Heat deflection temp. under 0.45 MPa (HDT/B)	°C	ISO 75-1/-2	220
Max. service temperature (short cycle operation)[3]	°C	–	210
Temperature index, at 50 % loss of tensile strength after 20,000 h/5,000 h	°C	IEC 60216-1	
Thermal coefficient of linear expansion, longitud. (23-80) °C	10^{-6}/K	ISO 11359-1/-2	25-40
Thermal conductivity	W (m · K)	DIN 52 612-1	
Specific heat capacity	J (g · K)		
Electrical properties			
Dielectric constant at 100 Hz / 1 MHz	–	IEC 60250	
Dissipation factor at 100 Hz / 1 MHz	10^{-4}	IEC 60250	
Volume resistivity	Ω · m	IEC 60093	10^{14}
Surface resistivity	Ω	IEC 60093	10^{15}
Comparative tracking index CTI, test solution A	–	IEC 60112	300

[1] + = passed
[2] NB = no break
[3] Typical values for parts required to withstand repeated exposure to this temperature for several hours over years of use, assuming appropriate shaping and processing for the material

LUX B 4300 G6
PBT
1,540
GF30
97
223
4.4
250-275
60-100
0.55 / 1.2
HB
HB
10,000
145*
3.1*
50
8.4
205
220
210
20-30
3.8 / 3.6
27/170
10^{14}
10^{15}
300

Nomenclature

Structure

The name of Ultradur® commercial products generally follows the scheme below:

Ultradur®	Subname	Technical ID	Suffixes	Color

Subnames

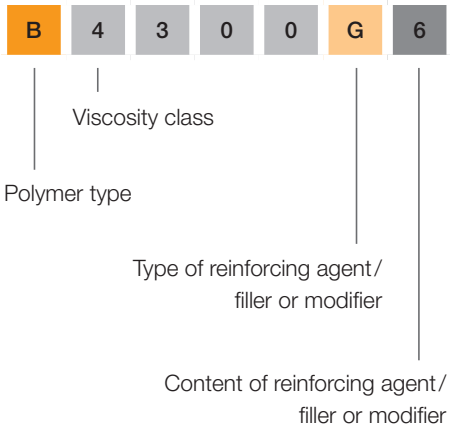
Subnames are optionally used in order to particularly emphasize a product feature that is characteristic of part of a range.

Examples of subnames:

LUX Particularly high transparency to the radiation from Nd:YAG lasers and lasers of a similar wavelength, e. g. diode lasers

Technical ID

The technical ID is made up of a series of letters and numbers which give hints about the polymer type, the melt viscosity and the finish with reinforcing agents, fillers or modifiers. The following classification scheme is found with most products:



Letters for identifying polymer types

B Polybutylene terephthalate (PBT) or polybutylene terephthalate + polyethylene terephthalate (PET)

S Polybutylene terephthalate + acrylonitrile styrene acrylate polymer (ASA)

Numbers for identifying viscosity classes

2 Low viscosity

4 Medium viscosity

6 High viscosity

Letters for identifying reinforcing agents, fillers, and modifiers

G Glass fibers

K Glass beads

M Minerals

Z Impact modifiers

GM Glass fibers in combination with minerals

Key numbers for describing the content of reinforcing agents, fillers, or modifiers

2 approx. 10 % by mass

3 approx. 15 % by mass

4 approx. 20 % by mass

6 approx. 30 % by mass

10 approx. 50 % by mass

12 approx. 60 % by mass

In the case of combinations of glass fibers with minerals, the respective contents are indicated by two numbers, e. g.

GM13 approx. 5 % by mass of glass fibers and approx. 15 % by mass of minerals

Suffixes

Suffixes are optionally used in order to indicate specific processing or application-related properties. They are frequently acronyms whose letters are derived from the English term.

Examples of suffixes:

Aqua®	Suitable for cold water applications
FC	Food Contact; meets specific regulatory requirements for applications in contact with food
High Speed	High flowability of the melt
HR	Hydrolysis Resistant, increased hydrolysis resistance
LS	Laser Sensitive, can be marked with Nd:YAG laser
LT	Laser Transparent, can be penetrated well with Nd:YAG lasers and lasers of a similar wavelength
PRO	Suitable for medical applications

Color

The color is generally made up of a color name and a color number.

Examples of colors:
Uncolored
Black 00110
Black 05110

For your notes

Selected Product Literature for Ultradur®:

- Ultradur® – Product Brochure
- Ultradur® LUX – PBT for Laser Welding
- Ultradur® HR – PBT for Hot-damp Environments
- Ultramid®, Ultradur® and Ultraform® – Resistance to Chemicals
- Engineering Plastics for Medical Solutions – Ultraform® PRO (POM) and Ultradur® PRO (PBT)
- From the Idea to Production – The Aqua® Plastics Portfolio for the Sanitary and Water Industries
- Ultramid® und Ultradur® – Engineering Plastics for Photovoltaic Mounting Systems
- Engineering Plastics for the E/E Industry – Standards and Ratings
- Engineering Plastics for the E/E Industry – Products, Applications, Typical Values
- Engineering Plastics for Automotive Electrics – Products, Applications, Typical Values

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (July 2013)

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