

Rheological Properties

Property		Symbol	Standard	Specimen (Dimensions in mm)	Unit	Supplementary Instructions	Test conditions
Melt volume-flow rate		MVR	ISO 1133	Material	cm ³ /10 min	Test conditions according to the relevant material standard	
Molding shrinkage	parallel (p)	S _{MP}	ISO 294-4 (Th.-plast) ISO 2577 (Th.-sets)	60 * 60 * 2	%		parallel to flow direction
	normal (n)	S _{MN}					normal to flow direction

Mechanical Properties

Tensile modulus		E _t	ISO 527-1 and -2	ISO 3167 injection molded: type A, machined: type B.	MPa	Determined in range 0,05-0,25% strain	1mm/min	
Yield stress		σ _Y						
Yield strain		ε _Y				%		50mm/min
Nominal strain at break		ε _{tB}					If Yield stress exists.	
Stress at 50% strain		σ ₅₀				MPa	If Yield stress does not exist.	
Stress at break		σ _B					If Yield stress and Stress at 50 % strain don't exist.	If Strain break <= 10%, 5mm/min If 10% < Strain at break <= 50%, 50mm/min
Strain at break		ε _B				%		
Stress at break (TPE)		S _B			MPa			
Strain at break (TPE)		e _{tB}			%	If strain at break is greater than 300%: indicate '>300'		
Stress at 10% strain		S ₁₀	ISO 527-1 and -2	ISO 527-1/1BA	MPa	If yield stress does not exist	200 mm/min	
Stress at 100% strain		S ₁₀₀						
Stress at 300% strain		S ₃₀₀						
Tensile creep modulus	1h	E _{tc1}	ISO 899-1		MPa	All strains <= 0.5%.	1h	
	1000h	E _{tc} 10 ³						1000h
Charpy impact strength	unnotched	a _{cU} +23	ISO 179/1eU	80 * 10 * 4	kJ/m ²	Using conventional impact pendulums and respecting their individual application ranges, that with the largest value of its potential energy possible shall be selected, see ISO 179 (Charpy), 8256 (tensile impact) and 13802 (pendulums). For instrumented Charpy tests see ISO 179-2 Notched: Reliable if Charpy impact strength shows "NB".	+23°C	
		a _{cU} -30					-30°C	
	notched	a _{cA} +23	ISO 179/1eA				+23°C	
		a _{cA} -30					-30°C	

Property		Symbol	Standard	Specimen (Dimensions in mm)	Unit	Supplementary Instructions	Test conditions
Tensile impact strength		a _{t1}	ISO 8256-1			Recommended if Charpy- notched impact strength shows "NB".	+23°C
Puncture impact properties	Max. Force	F _{M+23}	ISO 6603-2	60 * 60 * 2	N	Up to the deflection at which the force has dropped down to half the maximum force.	4,4m/s± 0,2m/s (***)
		F _{M-30}					
	Punct. Energy	W _{P+23}			J		
		W _{P-30}					
Compression set under constant strain	23°C	CS23	ISO 815	type B: plate Ø = 13 mm, d = 6.3 mm	%	Specimens may be stacked if initial thickness is smaller than 6.3 mm. Time of measurement after relief of compression 30 min ISO 815 refers to IRHD in order to define the strain to be applied. IRHD strain (%) 10 - 95 25 80 - 89 15 90 - 95 10 >95 not covered -> indicate: '*' Determination of IRHD acc. ISO 48	23°C, 25% strain, 22 -24 h
	70°C	CS70					70°C, 25% strain, 22 -24 h
	100°C	CS100					100°C, 25% strain, 22 -24 h
Tear strength		TearS	ISO 34-1	angle test specimen with nick	kN/m	Method B, procedure b. Loading in parallel direction, the cut (nick) is in the normal direction	500 mm/min
Abrasion resistance		AbrRes	ISO 4649		mm ³		
Shore A hardness (3s)		ShrA/3	ISO 868	≥ 6 * 25 * 25	-		Indenter Typ A, reading after 3s
Shore D hardness (15s)		ShrD/15					Indenter Typ D, reading after 15s

Footnotes:

(*) e: Edge wise blow according to ISO 179: 1993

(**) u: unnotched

(***) This bar may be taken from the central region of the multi- purpose- test specimen according to ISO 3167

Electrical Properties

Property		Symbol	Standard	Specimen (Dimensions in mm)	Unit	Supplementary Instructions	Test conditions	
Relative permittivity	100 Hz	ϵ_r 100	ISO 60250	60 * 60 * 2	-		100 Hz	
	1 MHz	ϵ_r 1M					1 MHz	
Dissipation factor	100 Hz	$\tan\delta$ 100				E-4		100 Hz
	1 MHz	$\tan\delta$ 1M						1 MHz
Volume resistivity		ρ_e	IEC 60093	60 * 60 * 2	Ω m	Use contact electrodes voltage 500V.		
Surface resistivity		σ_e		Plaque with thickness: 1.0mm +/- 0.1mm(*)	Ω	Use contact electrodes voltage 500V. Use contacting line electrodes, 50 mm long and with a gap of 5 mm, and a grounded contacting electrode at the back side of the plate.		
Electric strength		E_B 1	IEC 60243-1		kV/mm	Short- time test, voltagerate 2kV/s Immersion in transformer oil according to IEC 60296.		
Comparative tracking index		CTI	IEC 60112	≥ 15 * ≥ 15 * 4	-	Test liquid A		

Thermal Properties

Melting temperature		T_m	ISO 11357-1 and -3	Material	$^{\circ}\text{C}$	C 1 b)(DSC or DTA)	10 $^{\circ}\text{C}/\text{min}$
Glass transition temperature		T_g	ISO 11357-1 and -2				Method A (DSC or DTA) Only for amorphous, single-phase thermoplastics.
Temperature of deflection under load (flexural softening temperature)	T_f 1,8	ISO 75-1 and -2	80 * 10 * 4 or 110*10*4 (*)			For both rigid and less rigid materials	
	T_f 0,45						
	T_f 8,0						For rigid materials only
Vicat softening temperature		T_V 50/50	ISO 306	≥ 10 * 10 * 4 (**)			50 $^{\circ}\text{C}/\text{h}$; 50N
Coefficient of linear thermal expansion	Parallel (p)	α_p	ISO 11359-1 and -2	(**)	10 $^{-4}$. $^{\circ}\text{C}^{-1}$		23 $^{\circ}\text{C}$ - 55 $^{\circ}\text{C}$, Normal to the flow direction
	Normal (n)	α_n					23 $^{\circ}\text{C}$ - 55 $^{\circ}\text{C}$, Parallel to the flow direction

Property		Symbol	Standard		Specimen (Dimensions in mm)	Unit	Supplementary Instructions	Test conditions
Burning behavior	1.5 mm thick	B50/1.5	UL 94	IEC 60695-11-10	125 * 13 * 1.5	Class	Indicate class from the following sequence B50:HB, V-2, V-1, V-0 B500: N, 5VA or 5VB	
		B500/1.5			$\geq 150 * \geq 150 * 1.5$			
	-. mm thick	B50/-.-		IEC 60695-11-20	125 * 13 * -.-			
		B500/-.-			$\geq 150 * \geq 150 * -.-$			
Flammability by oxygen index		OI23	ISO 4589-1 and-2		80 * 10 * 4	%	Method A	

Footnotes:

(*) This bar may be taken from the central region of the multi- purpose- test specimen according to ISO 3167.

Test specimen	Loading direction	Span
80 mm x10 mm x 4 mm	flatwise	64 mm
110 mm x 10mm x 4 mm	edgewise	100mm

(**) can be taken from the central region of the multipurpose - test specimen according to ISO 3167

Electrical Properties

Relative permittivity	100 Hz	$\epsilon_r 100$	IEC 60250	60 * 60 * 2		-	
	1 MHz	$\epsilon_r 1M$					
Dissipation factor	100 Hz	$\tan\delta 100$					10^{-4}
	1 MHz	$\tan\delta 1M$					10^{-4}
Volume resistivity		ρ_e	IEC 60093		$\Omega \text{ m}$	Use contact electrodes voltage 500V	
Surface resistivity		σ_e			Ω	Use contact electrodes voltage 500V. Use contacting line electrodes, 50 mm long and with a gap of 5 mm, and a grounded contacting electrode at the back side of the plate	
Electric strength		$E_B 1$	IEC 60243-1	$\geq 60 * \geq 60 * 1$	kV/mm	Short- time test, voltagerate 2kV/s Immersion in transformer oil according to IEC 60296.	
Comparative tracking index		CTI	IEC 60112	$\geq 15 * \geq 15 * 4$	-	Test liquid A	

Other Properties

Property	Symbol	Standard	Specimen (Dimensions in mm)	Unit	Supplementary Instructions	Test conditions
Water absorption	W_W	ISO 62 and ISO 15512	Thickness ≥ 1	%	Saturation values	23°C immersion in water
Humidity absorption	W_H					
Density	ρ	ISO 1183	$\geq 10 * \geq 10 * 4 (*)$	kg/m^3		

(*) can be taken from the central region of the multipurpose - test specimen according to ISO 3167

Material Specific Properties

Viscosity number	VN	depending on material	material	cm^3/g	Test conditions according to the relevant material standard	
Indicative density	ρ_I	ISO 1872-1		kg/m^3	Applicable to PE only	
Luminous transmittance	τ_t	ISO 13468-1, -2	60 * 60 * 2	%	it is a matter of total transmission, the registration of non-diffuse and possibly diffuse parts of transmission from colorless transparent material	calculation for illuminant D65, CIE standard observer, alternatively C2°

Mechanical Properties (Film Grades)

Property		Symbol	Standard	Specimen (Dimensions in mm)	Unit	Supplementary Instructions	Test conditions
Stress at yield	parallel	S_{Yp}	ISO 527-1, -3	strip, 15 mm wide, clamping distance 100 mm	MPa	nominal strains only, relative to clamping distance	
	normal	S_{Yn}					
Strain at yield	parallel	e_{Yp}			%		
	normal	e_{Yn}					
Maximum stress	parallel	S_{Mp}			MPa		
	normal	S_{Mn}					
Maximum strain	parallel	e_{tBp}			%		
	normal	e_{tBn}					
Elmendorf tear resistance	parallel	F_{tp}	ISO 3167	rectangular (63,5 ± 0,5)mm x (75 ± 0,5)mm, cut perpendicular to longer edge, length of cut (20 ± 0,5)			work spent in tearing the speci- en shall be between 20% and 80% of the pendulum energy
	normal						
Trouser tear resistance	parallel			rectangular, 50mmx150 mm, cut perpendicular to shorter edge, length of cut (75 ± 1)mm, thickness d ≤1 mm			v=200 mm/min
	normal						

Optical Properties (Film Grades)

Property		Symbol	Standard	Specimen Dimensions in mm)	Unit
Gloss	20°	Gloss20	ISO 2813		-
	45°	Gloss45			
	60°	Gloss60			
Haze		Haze	ISO 14782	~ 50 * 50	%

Barrier Properties (Film Grades)

Water vapor transmission rate	23°C; 85% r.h.	WVTR2385	ISO 15106-1 and -2		g/(m ² *d)
Oxygen transmission rate	23°C, 0% r.h.	OTR23/0	ISO 15105-1 and -2		cm ³ /(m ² *d*bar)
	23°C, 85% r.h.	OTR23/85			
Carbon Dioxide transmission rate	23°C, 0% r.h.	CDTR23/0			
	23°C, 85% r.h.	CDTR23/85			