

Specification

Physical and chemical properties

PCE - BK**D 0991****CH - W 0991****D 0991**

Colour: clear

Application: Special glass for moulds, in particular suitable for a rapid chemical toughening without problems.

The subsequent properties are based primarily upon the measuring results of the very latest standards and measuring methods, which are defined in corresponding "Measuring and Test Procedures". SCHOTT DESAG retains the right to change the data in keeping with the latest technical standards. Non-toleranced numerical values are reference values of an average production quality.

Values marked with \diamond do not apply to the type of glass or no values are available.

Requirements deviating from these specifications must be defined in writing in a **customer agreement**.

Date of release: 9 February 1999

Specification		PCE - BK	
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1.	Optical properties		
1.1	Refractive indices (20°C)		
	Pretreatment of samples	n_g	1.5343
	[x] Condition as supplied	n_F	1.5298
	[] annealed at 40°C/h	n_F	1.5293
		n_e	1.5251
		n_d	1.5229
		n_D	1.5228
		n_C	1.5205
		n_C	1.5201
1.1.1	Abbe value	n_e	56.5
		n_d	56.7
1.2	Transmittance data		
1.2.1	Spectral transmittance $t(I)$		
1.2.1.1	$t(I)$ - curve		
	Plot of spectral transmittance $t(I)$ for $d = 2.0$ mm ($I = 300$ nm - 1500 nm)	see annex	
1.2.1.2	$t(I)$ - individual values in % ($d = 2.0$ mm)		
	$t(I)_{\max}$ for the I - range 280 - 315 nm	49	
	$t(I)_{\max}$ for the I - range 315 - 350 nm	88	
	t_{380}	90	
	$t(I)_{\min}$ for the I - range 450 - 650 nm	◇	
	$t(I)_{\min}$ for the I - range 500 - 650 nm	◇	
1.2.1.3	Edge wavelength ($d = 2.0$ mm)		
	Edge wavelength $I_C (t = 0.46)$ in nm	314	
1.2.2	Luminous transmittance t_v		
1.2.2.1	Luminous transmittance t_{vD65} in % at nominal thickness	91.7*	
	$d = 2.0$ mm	* nominal transmittance	
	Luminous transmittance as a function of thickness		
	Thickness in mm	1.4	2.0
		3.0	4.0
		5.0	6.0
	t_{vD65} in %	91.7	91.7
		91.7	91.7
	t_{vA} in %	91.7	91.7
		91.7	91.7
	t_{vC} in %	91.7	91.7
		91.7	91.7

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1.2.2.2	Shade N / Filter category		
	<i>N</i> for mean thickness <i>d</i> = mm (<i>t</i> _{VD65} = %)		◇
	<i>N</i> for mean thickness <i>d</i> = mm (<i>t</i> _{VD65} = %)		◇
	filter category for nominal transmittance <i>t</i> _{VD65} = 91.7 %		0
1.2.3	Special transmittance values in % (<i>d</i> = 2.0 mm)		
1.2.3.1	UV - transmittance		
		<i>t</i> _{UVA}	82.2
		<i>t</i> _{SUV}	◇
		<i>t</i> _{SUVA}	77.2
		<i>t</i> _{SUVB}	31.6
1.2.3.2	IR - transmittance	<i>t</i> _{SIR}	92
1.2.3.3	Solar blue - light transmittance	<i>t</i> _{sb}	◇
1.3	Colour		
1.3.1	Visual evaluation		
	The visual evaluation of the admissible colour differences is to be made by using internal reference samples in transmission mode towards an from the backside illuminated opal screen with uniform luminance. Sample thickness <i>d</i> in mm for the visual colour comparison		90
1.3.2	Colorimetry		
	Chromaticity coordinates	<i>x</i> ₁₀	0.314
		<i>y</i> ₁₀	0.332
	Chromaticity coordinates (colour locus) are referred to the Standard Illuminant D ₆₅ according to CIE 10°-observer for the nominal transmittance <i>t</i> _{VD65} = 91.7 % (refer to 1.2.2.1)		
1.3.3	Signal recognition		
	Relative visual attenuation coefficient <i>Q</i> for signal lights referred to the nominal transmittance <i>t</i> _{VD65} = 91.7 % (refer to 1.2.2.1)	<i>Q</i> _{blue}	1.00
		<i>Q</i> _{green}	1.00
		<i>Q</i> _{yellow}	1.00
		<i>Q</i> _{red}	1.00
1.3.4	Yellowness index (<i>d</i> = 10 mm)		
		<i>Y</i> _i	1.0

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2. Thermal properties			
2.1 Viscosities and corresponding temperatures			
	Designation	Viscosity log <i>h</i> in dPas	Temperature <i>J</i> in °C
	Strain point	14.5	523
	Annealing point	13.0	556
	Softening point	7.6	754
	Forming temperature	6.0	862
	Forming temperature	5.0	953
	Forming temperature	4.0	1072
2.2	Transformation temperature <i>Tg</i> in °C		551
2.3	Coefficient of mean linear thermal expansion <i>a</i> (20°C-300°C) in 10 ⁻⁶ K ⁻¹ (Static measurement)		9.7
2.4	Fuseability		◇
2.5	Mean specific heat capacity <i>c_p</i>(20°C-100°C) in J/(g · K)		◇

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3.	Mechanical properties	
3.1	Density r in g/cm ³	2.61
3.2	Stress optical coefficient C in 1.02×10^{-12} m ² /N	3.30
3.3	Breaking strength A higher mechanical strength can be realized by chemical toughening according to the ion exchange procedure (refer to annex 3.3.1) or by thermal toughening.	
3.3.1	Chemical toughening	
	Processing temperature J in °C	440
	Processing time t in h	4
	Compressive stress D_s as birefringence in nm/cm	10750
	Penetration depth N_z up to neutral zone in µm	61
	Further information	see annex
3.3.2	Thermal toughening	
	Recommended minimum thickness d in mm for toughened safety glass lenses without corrective effect as per ball drop test (DIN EN 168)	2.5
3.4	Young's modulus E in kN/mm ²	69
3.5	Poisson's ratio m	0.227
3.6	Torsion modulus G in kN/mm ²	28
3.7	Knoop hardness HK_{100}	500

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4.	Chemical properties		
4.1	Hydrolytic resistance acc. to DIN ISO 719		
		Hydrolytic class	HGB 3
	Equivalent of alkali (Na ₂ O) per gram of glass grains in µg/g		84
4.2	Acid resistance acc. to DIN 12 116		
		Acid class	4
	Half surface weight loss after 6 hours in mg/dm ²		22.5
4.3	Alkali resistance acc. to DIN ISO 695		
		Class	A 3
	Surface weight loss after 3 hours in mg/dm ²		315
5.	Electrical properties		disregard
6.	Other properties		disregard
7.	Annex (diagrams, curves)		

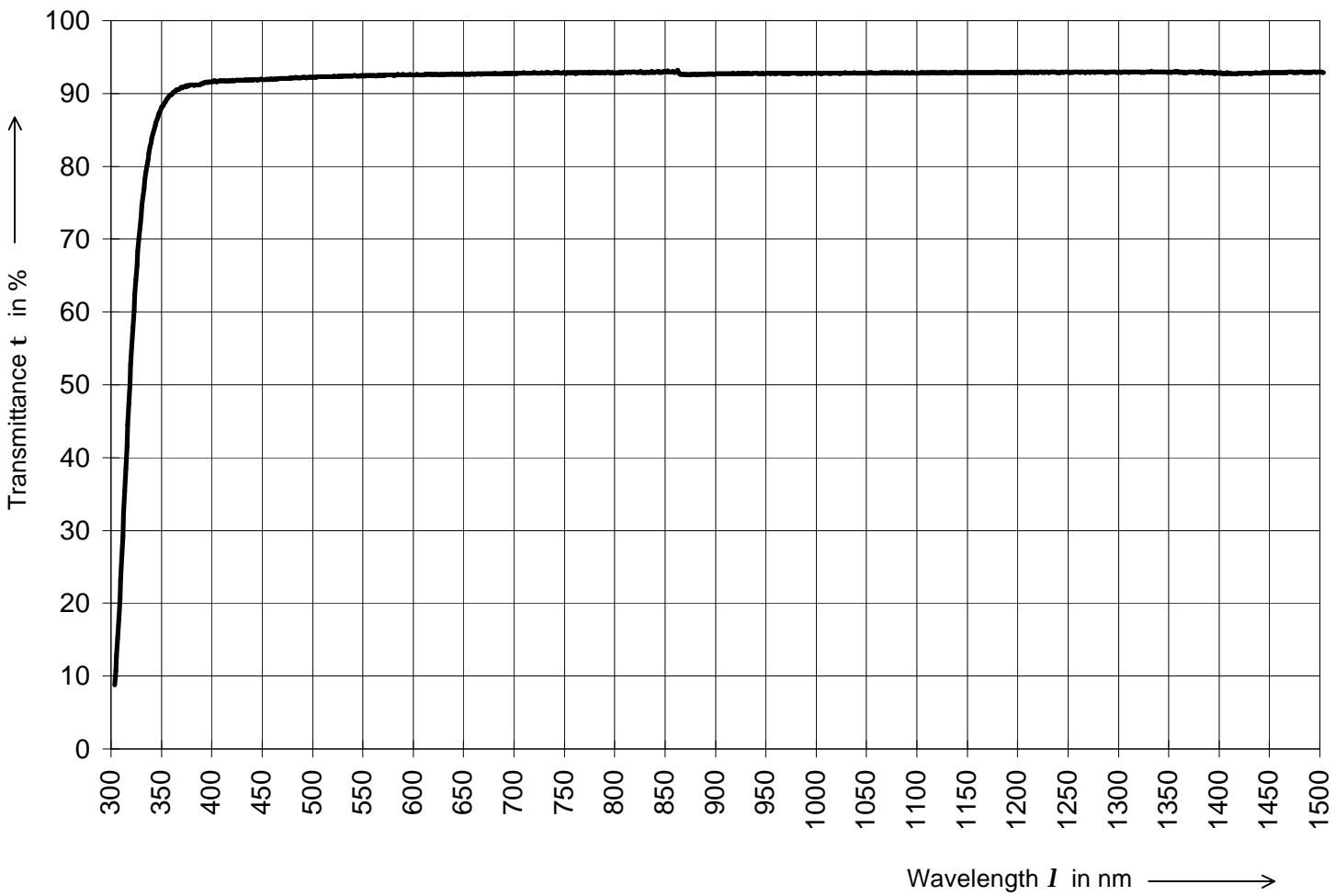
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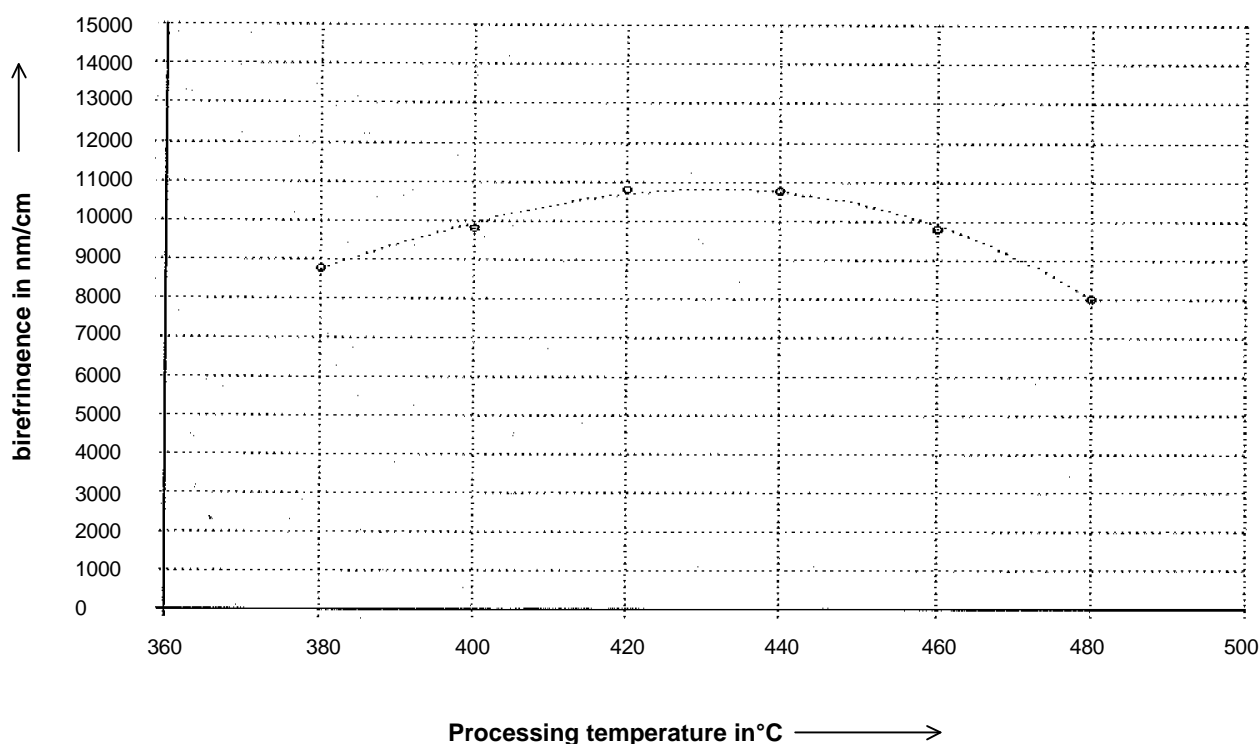
Spectral Transmittance

Type of Glass: CH - W 0991
Thickness: 2.00 mm



Annex 3.3.1

Specification		PCE - BK	
Physical and chemical properties		D 0991	
Chemical toughening parameter			
Glass and chemical toughening parameters			
Transformation temperature	°C	551	
Glass thickness	mm	2	
Processing time	h	4	
Processing temperature	°C	440	
Salt bath (* weight percentages)	KNO ₃ in % *	99.5	
	SiO ₂ x H ₂ O in % *	0.5	
Chemical toughening results *			
Penetration depth	µm	61	
Birefringence	nm/cm	10750	
* measured across at a sample piece ground down to 0.3 mm ± 0.05 mm			
Ball drop test acc. FDA	% failed	passed	
Ball drop test acc. DIN	% failed	passed	



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