

<p>Specification Physical and chemical properties</p>	<p>PCE - BK D 6625</p>
<p>HC - PHOTOSOLAR^â DUNKELBRAUN D 6625</p> <p>Colour: darkbrown</p> <p>Application: High index glass sensitive to light for corrective lenses and sun glare filter; luminous transmittance range 87% (t_0) / 25% (t_1) or filter categories 0 / 2 respectively and UV - absorption</p> <p>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.</p> <p>Values marked with \diamond do not apply to the type of glass or no values are available.</p> <p>Requirements deviating from these specifications must be defined in writing in a customer agreement.</p> <p>Date of release: March 07, 00</p>	

Form 0050/6A

Specification		PCE - BK D 6625	
Physical and chemical properties			
1.	Optical properties		
1.1	Refractive indices (20°C)		
	Pretreatment of samples	n_g	1.6185
	[x] Condition as supplied	$n_{F'}$	1.6113
	[] annealed at 40°C/h	n_F	1.6104
		n_e	1.6040 ^{+0.0006} -0.0010
		n_d	1.6007
		n_D	1.6006
		$n_{C'}$	1.5972
		n_C	1.5965
1.1.1	Abbe value	n_e	42.8
		n_d	43.0
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 the light state $t_{0'}$ and dark state $t_{15'}$	see annex	
1.2.1.2	$t(I)$ - individual values in % ($d = 2.0$ mm)	$t_{0'}$	$t_{15'}$
	$t(I)_{\max}$ for the I - range 280 - 315 nm	< 0.003	< 0.003
	$t(I)_{\max}$ for the I - range 315 - 350 nm	2.5	2
	t_{380}	28	8
	$t(I)_{\min}$ for the I - range 450 - 650 nm	77	19
	$t(I)_{\min}$ for the I - range 500 - 650 nm	77	19
1.2.1.3	Edge wavelength ($d = 2.0$ mm)		
	Edge wavelength I_C ($t = 0,46$) in nm for $t_{0'}$	393	

Specification		PCE - BK						
Physical and chemical properties		D 6625						
1.2.2	Luminous transmittance t_v							
1.2.2.1	Luminous transmittance t_{vD65} or t_{vA} in % respectively under standard conditions ($d = 2.0$ mm)							
	Light state t_{vD65}	$t_{0'}(t_0)$	87 ± 1					
	Dark state	$t_{15'}(t_1)$	25 ± 2					
		$t_{R5'}$	-					
	Regeneration t_{vA}	$t_{R10'}$	63,5 ± 2					
		$t_{R30'}$	71 ± 2					
	Darkening-fading curve for 23 °C		78 ± 2					
			see annex					
	Luminous transmittance t_{vD65} in % in relationship to the thickness	$t_{0'}(t_0)$	$t_{15'}(t_1)$					
		2.0	87					
	Thickness in mm	3.0	25					
		4.0	86					
			19					
			16.5					
1.2.2.2	Shade N / Filter category ($d = 2.0$ mm)							
		N	5 - 1.1 < 2.5					
			$t_{0'}(t_0)$					
			$t_{15'}(t_1)$					
		Filter category	0					
			2					
1.2.2.3	Luminous transmittance dark state $t_{15'}$ in % in relationship to the sample temperature J in °C ($d = 2.0$ mm)							
		-	-	t_w	t_1	t_s		
	J	-10	-5	5	23	35		
	$t_{15'}$	50	59	16	25	39		
		◇	◇					
1.2.2.4	Luminous transmittance dark state $t_{15'}$ in % in relationship to the illuminance E in klx ($d = 2.0$ mm)							
		t_1	-	-	t_a	-		
	E	50	30	20	15	10		
	$t_{15'}$	25	31	37	41	47		
						5		
						58		
1.2.2.5	Luminous transmittance dark state $t_{15'}$ in % in relationship to the variation the excitation spectrum in dependance of the edge wavelength l_c of a sharp cut filter in nm ($d = 2.0$ mm)							
	l_c	328	353	369	389	410	433	454
	$t_{15'}$	25	26	27	30	34	44	57
								60
	Diagram							see annex

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Specification		PCE - BK	
Physical and chemical properties		D 6625	
1.2.3	Special transmittance values in % ($d = 2.0$ mm)		
1.2.3.1	UV - transmittance for t_{15}		
		t_{UVA}	2.2
		t_{SUV}	0.8
		t_{SUVA}	1.2
		t_{SUVB}	< 0.05
1.2.3.2	IR - transmittance	t_{SIR}	$\geq t_{vD65}$
1.2.3.3	Solar blue - light transmittance	t_{sb}	17.5
1.3	Colour		
1.3.1	Visual evaluation		
	The visual evaluation is made on the basis of a simultaneous comparison with internal limit samples.		
1.3.2	Colorimetry		
	Chromaticity coordinates	A x_{10}	0.362 ₉
		y_{10}	0.350 ₄
	Chromaticity coordinates (colour locus) are referred to the Standard Illuminant D ₆₅ according to CIE 10°-observer	B x_{10}	0.367 ₇
	for t_{15} (t_1) - for the time being they are only reference values	y_{10}	0.348 ₉
	($d = 2.0$ mm) in view of the relative calibration possibility	C x_{10}	0.370 ₉
	In case of verification, the measured values may additionally deviate by the measuring uncertainty of the used measuring devices.	y_{10}	0.354 ₁
	part of chromaticity coordinates	D x_{10}	0.366 ₀
		y_{10}	0.355 ₇
			see annex
1.3.3	Signal recognition		
	Relative visual attenuation coefficient Q	Q_{blue}	0.91
	for signal lights for t_{15} (t_1) ($d = 2.0$ mm)	Q_{green}	0.89
		Q_{yellow}	1.16
		Q_{red}	1.35
1.3.4	Yellowness index ($d = 10$ mm)		
		Y_i	\diamond

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Physical and chemical properties		D 6625	
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	516
	Annealing point	13.0	541
	Softening point	7.6	692
	Forming temperature	6.0	772
	Forming temperature	5.0	838
	Forming temperature	4.0	923
2.2	Transformation temperature <i>T_g</i> in °C		539
2.3	Coefficient of mean linear thermal expansion <i>a</i> (20°C-300°C) in 10 ⁻⁶ K ⁻¹ (Static measurement)		6.0
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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Physical and chemical properties		D 6625
3.	Mechanical properties	
3.1	Density r in g/cm³	2.74
3.2	Stress optical coefficient C in 1.02×10^{-12} m²/N	3.49
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). This toughening method may cause in slightly transmittance - and colourchange.	
3.3.1	Chemical toughening	
	Processing temperature J in °C	440
	Processing time t in h	16
	Compressive stress D_s as birefringence in nm/cm	2600
	Penetration depth Nz up to neutral zone in μm	51
	Further information	see annex
3.4	Young's modulus E in kN/mm²	78
3.5	Poisson's ratio m	0.229
3.6	Torsion modulus G in kN/mm²	32
3.7	Knoop hardness HK_{100}	◇

Specification		PCE - BK D 6625	
Physical and chemical properties			
4.	Chemical properties		
4.1	Hydrolytic resistance acc. to DIN ISO 719		
		Hydrolytic class	HGB 2
	Equivalent of alkali (Na ₂ O) per gram of glass grains in µg/g		42
4.2	Acid resistance acc. to DIN 12 116		
		Acid class	4
	Half surface weight loss after 6 hours in mg/dm ²		253
4.3	Alkali resistance acc. to DIN ISO 695		
		Class	A 2
	Surface weight loss after 3 hours in mg/dm ²		100
5.	Electrical properties	disregard	
6.	Other properties		
6.1	Anti-reflection processes		
	<p>During the anti-reflection process and burning in of the anti-reflection coatings respectively the luminous transmittance in the dark state may change.</p> <p>In annex 6.1 there is specified the deviation from the luminous transmittance dark state t_{15} for $d = 2.0$ mm as a function of various additional heat treatments, corresponding to typical anti-reflection processes in temperature/time behaviour.</p>		
	Diagram	see annex	
	<p>Additional heat treatment</p> <p>The sample is put on a kaolin plate (room temperature) and then placed in a box furnace, in which the treatment temperature is already existing.</p> <p>After the specified time, the sample and the kaolin plate are taken out and immediately put on a cold (room temperature) kaolin plate for rapid cooling.</p>		
7.	Annex (diagrams, curves)		

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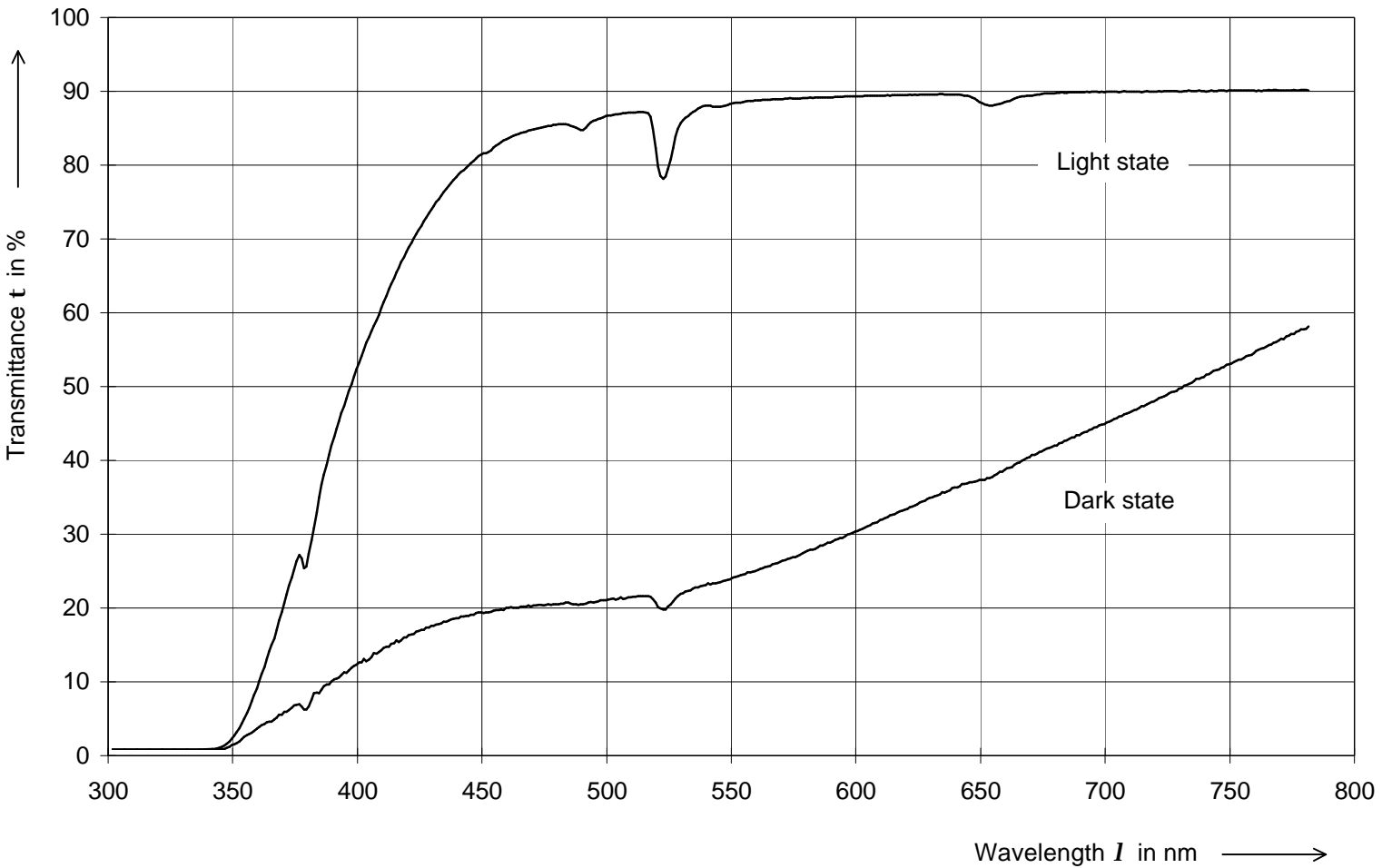
Specification

Physical and chemical properties

PCE - BK
D 6625

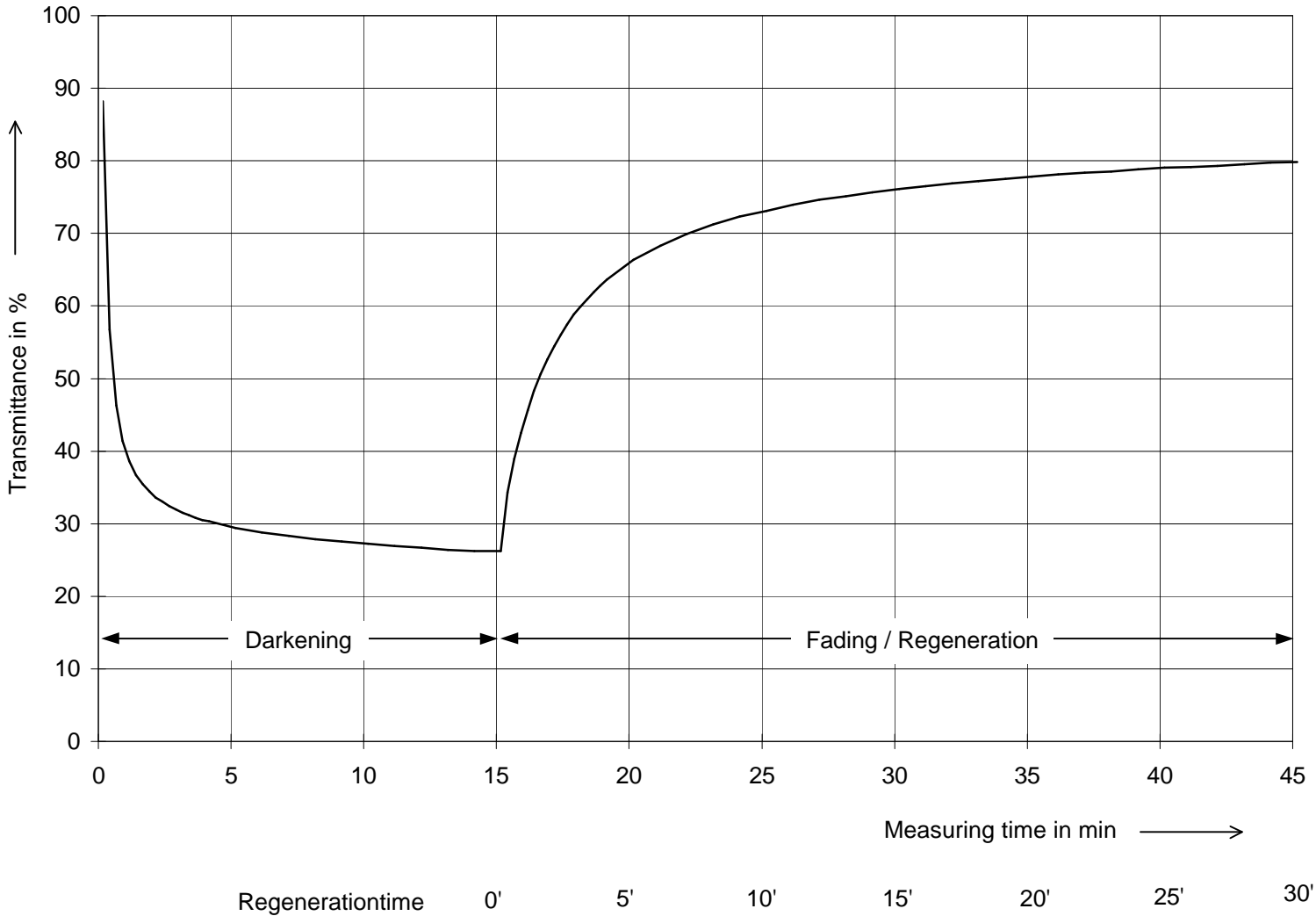
Spectral Transmittance

Type of Glass: HC - PHOTOSOLAR[®] DUNKELBRAUN
Thickness: 2 mm



Darkening - Fading - Curve

Type of Glass: HC - PHOTOSOLAR^â DUNKELBRAUN
Thickness: 2 mm



Specification

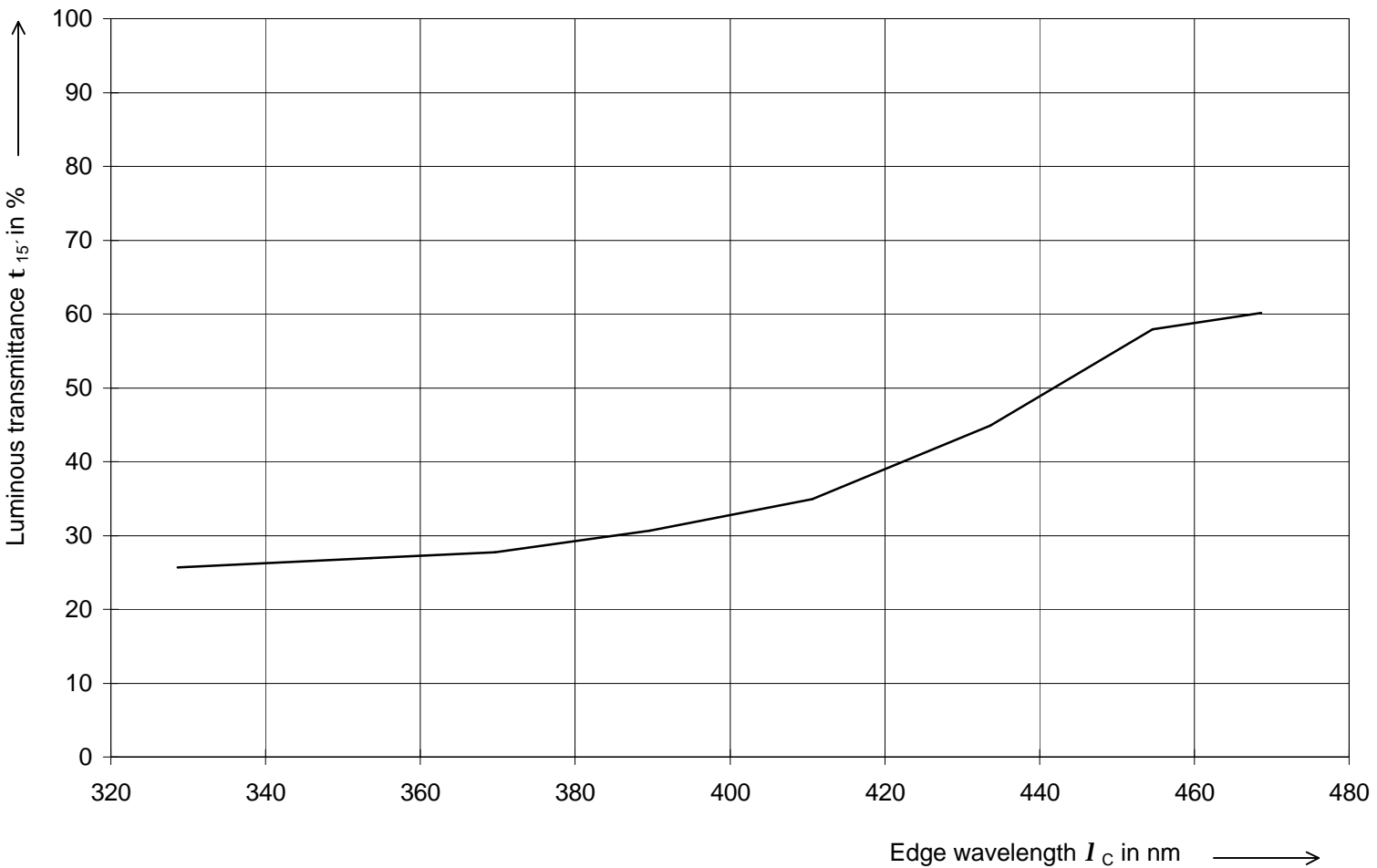
Physical and chemical properties

PCE - BK
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Luminous transmittance dark state in relationship to the variation the excitation spektrum (sharp cut filter)

Type of Glass: HC - PHOTOSOLAR^â DUNKELBRAUN

Thickness: 2 mm



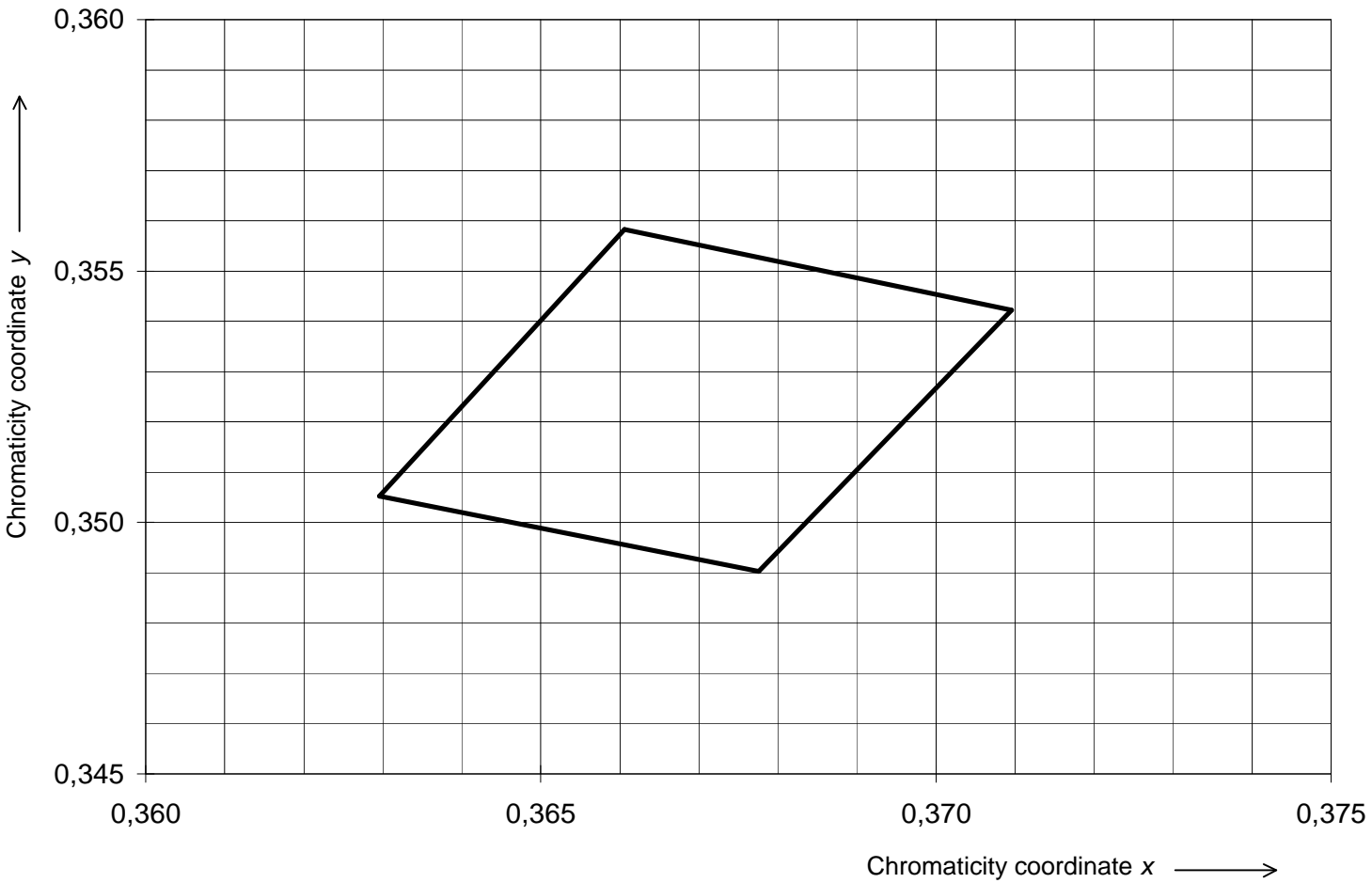
Specification

Physical and chemical properties

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Chromaticity Coordinates

Type of Glass: HC - PHOTOSOLAR[®] DUNKELBRAUN
Thickness: 2 mm



Annex 3.3.1

Specification		PCE - BK													
Physical and chemical properties		D 6625													
Chemical toughening parameter															
Glass and chemical toughening parameters															
Transformation temperature	°C	539													
Glass thickness	mm	2													
Processing time	h	16													
Processing temperature	°C	440													
Salt bath (* weight percentages)	NaNO ₃ in % *	40.0													
	KNO ₃ in % *	59.5													
	SiO ₂ x H ₂ O in % *	0.5													
Chemical toughening results *															
Penetration depth	µm	51													
Birefringence	nm/cm	2600													
* 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	not carried out													
<table border="1"> <caption>Birefringence vs Processing Temperature Data</caption> <thead> <tr> <th>Processing temperature (°C)</th> <th>Birefringence (nm/cm)</th> </tr> </thead> <tbody> <tr> <td>400</td> <td>2200</td> </tr> <tr> <td>420</td> <td>2400</td> </tr> <tr> <td>430</td> <td>2700</td> </tr> <tr> <td>450</td> <td>2600</td> </tr> <tr> <td>480</td> <td>1800</td> </tr> </tbody> </table>				Processing temperature (°C)	Birefringence (nm/cm)	400	2200	420	2400	430	2700	450	2600	480	1800
Processing temperature (°C)	Birefringence (nm/cm)														
400	2200														
420	2400														
430	2700														
450	2600														
480	1800														

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Specification

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Anti - reflection processes $D t_{15'} = f(J)$

Type of Glass: HC - PHOTOSOLAR^â DUNKELBRAUN
Thickness: 2 mm

