

<b>Specification</b>		<b>PCE - BK</b>
Physical and chemical properties		<b>D 1511</b>
<b>Grau 1511</b>		<b>D 1511</b>
Colour:	grey	
Application:	dark tinted sunglare filter with IR- and high UV-absorption filter category 3 acc. to DIN EN 1836	
<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 <math>\diamond</math> 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 <b>customer agreement</b>.</p>		
<b>Date of release:</b>	<b>13 March 2000</b>	

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<b>Specification</b>		<b>PCE - BK D 1511</b>		
Physical and chemical properties				
<b>1.2.2.2</b>	<b>Shade N / Filter category</b>			
	<i>N</i> for mean thickness <i>d</i> = 1.9 mm ( <i>t</i> <sub>VD65</sub> = 12.6 %)	6 - 3.1		
	<i>N</i> for mean thickness <i>d</i> = 2.8 mm ( <i>t</i> <sub>VD65</sub> = 4.7 %)	6 - 4.1		
	filter category for nominal transmittance <i>t</i> <sub>VD65</sub> = 11.0 %	3		
<p><b>This "very dark" sunglare filter acc. to DIN EN 172 for <i>N</i> = 6 - 3.1 not recommended for driving and for <i>N</i> = 6 - 4.1 (extremely dark) not suitable for driving</b></p> <p><b>Reaching filter category 4 acc. DIN EN 1836 this sunglare filter not suitable for driving and road use.</b></p>				
<b>1.2.3</b>	<b>Special transmittance values in % (<i>d</i> = 2.0 mm)</b>			
<b>1.2.3.1</b>	<b>UV - transmittance</b>	<i>t</i> <sub>UVA</sub>	0.2	
		<i>t</i> <sub>SUV</sub>	< 0.5	
		<i>t</i> <sub>SUVA</sub>	< 0.5	
		<i>t</i> <sub>SUVB</sub>	< 0.05	
		<b>1.2.3.2</b>	<b>IR - transmittance</b>	<i>t</i> <sub>SIR</sub>
<b>1.2.3.3</b>	<b>Solar blue - light transmittance</b>	<i>t</i> <sub>sb</sub>	9.3	
<b>1.3</b>	<b>Colour</b>			
<b>1.3.1</b>	<b>Visual evaluation</b>	◇		
<b>1.3.2</b>	<b>Colorimetry</b>	Chromaticity coordinates	A <i>x</i> <sub>10</sub>	0.311 <sub>0</sub>
			<i>y</i> <sub>10</sub>	0.360 <sub>0</sub>
	Chromaticity coordinates (colour locus) are referred to the Standard Illuminant D <sub>65</sub> according CIE 10°-observer for the nominal transmittance <i>t</i> <sub>VD65</sub> = 11.0 % (refer to 1.2.2.1)	B <i>x</i> <sub>10</sub>	0.317 <sub>0</sub>	
		<i>y</i> <sub>10</sub>	0.360 <sub>0</sub>	
		C <i>x</i> <sub>10</sub>	0.317 <sub>0</sub>	
	In case of verification, the measured values may additionally deviate by the measuring uncertainty of the used measuring devices.	<i>y</i> <sub>10</sub>	0.366 <sub>0</sub>	
		D <i>x</i> <sub>10</sub>	0.311 <sub>0</sub>	
		<i>y</i> <sub>10</sub>	0.366 <sub>0</sub>	
part of chromaticity coordinates			see annex	
<b>1.3.3</b>	<b>Signal recognition</b>	Relative visual attenuation coefficient <i>Q</i>	<i>Q</i> <sub>blue</sub>	1.03
		for signal lights referred to the	<i>Q</i> <sub>green</sub>	1.04
		nominal transmittance <i>t</i> <sub>VD65</sub> = 11.0 %	<i>Q</i> <sub>yellow</sub>	0.95
		(refer to 1.2.2.1)	<i>Q</i> <sub>red</sub>	0.82
<b>1.3.4</b>	<b>Yellowness index (<i>d</i> = 10 mm)</b>	<i>Y</i> <sub>i</sub>	◇	

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<b>Specification</b>		<b>PCE - BK D 1511</b>	
Physical and chemical properties			
<b>2. Thermal properties</b>			
<b>2.1 Viscosities and corresponding temperatures</b>			
	Designation	Viscosity log <i>h</i> in dPas	Temperature <i>J</i> in °C
	Strain point	14.5	445
	Annealing point	13.0	476
	Softening point	7.6	667
	Forming temperature	6.0	777
	Forming temperature	5.0	874
	Forming temperature	4.0	1006
<b>2.2</b>	<b>Transformation temperature <i>Tg</i> in °C</b>		480
<b>2.3</b>	<b>Coefficient of mean linear thermal expansion</b> <i>a</i> (20°C-300°C) in 10 <sup>-6</sup> K <sup>-1</sup> (Static measurement)		10.0
<b>2.4</b>	<b>Fuseability</b>		◇
<b>2.5</b>	<b>Mean specific heat capacity <i>c<sub>p</sub></i>(20°C-100°C) in J/(g · K)</b>		◇

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<b>Specification</b>		<b>PCE - BK D 1511</b>
Physical and chemical properties		
<b>3.</b>	<b>Mechanical properties</b>	
<b>3.1</b>	<b>Density <math>r</math> in g/cm<sup>3</sup> (annealed at 40°C/h)</b>	2.55
<b>3.2</b>	<b>Stress optical coefficient <math>C</math> in <math>1.02 \times 10^{-12}</math> m<sup>2</sup>/N</b>	◇
<b>3.3</b>	<b>Breaking strength</b> 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. Both toughening methods may cause in slightly transmittance - and colourchange.	
<b>3.3.1</b>	<b>Chemical toughening</b>	
	Processing temperature $J$ in °C	380
	Processing time $t$ in h	16
	Compressive stress $D_s$ as birefringence in nm/cm	7300
	Penetration depth $N_z$ up to neutral zone in µm	55
	Further information	see annex
<b>3.3.2</b>	<b>Thermal toughening</b>	
	Recommended minimum thickness $d$ in mm for toughened safety glass lenses without corrective effect as per ball drop test (DIN EN 168)	2.5
<b>3.4</b>	<b>Young´s modulus <math>E</math> in kN/mm<sup>2</sup></b>	◇
<b>3.5</b>	<b>Poisson´s ratio <math>m</math></b>	◇
<b>3.6</b>	<b>Torsion modulus <math>G</math> in kN/mm<sup>2</sup></b>	◇
<b>3.7</b>	<b>Knoop hardness <math>HK_{100}</math></b>	499

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Physical and chemical properties		<b>D 1511</b>	
<b>4. Chemical properties</b>			
<b>4.1 Hydrolytic resistance acc. to DIN ISO 719</b>			
		Hydrolytic class	HGB 4
		Equivalent of alkali (Na <sub>2</sub> O) per gram of glass grains in µg/g	422
<b>4.2 Acid resistance acc. to DIN 12 116</b>			
		Acid class	3
		Half surface weight loss after 6 hours in mg/dm <sup>2</sup>	1.7
<b>4.3 Alkali resistance acc. to DIN ISO 695</b>			
		Class	A 2
		Surface weight loss after 3 hours in mg/dm <sup>2</sup>	99
<b>5. Electrical properties</b>			
		disregard	
<b>6. Other properties</b>			
		disregard	
<b>7. Annex (diagrams, curves)</b>			

Annex 1.2.1.1

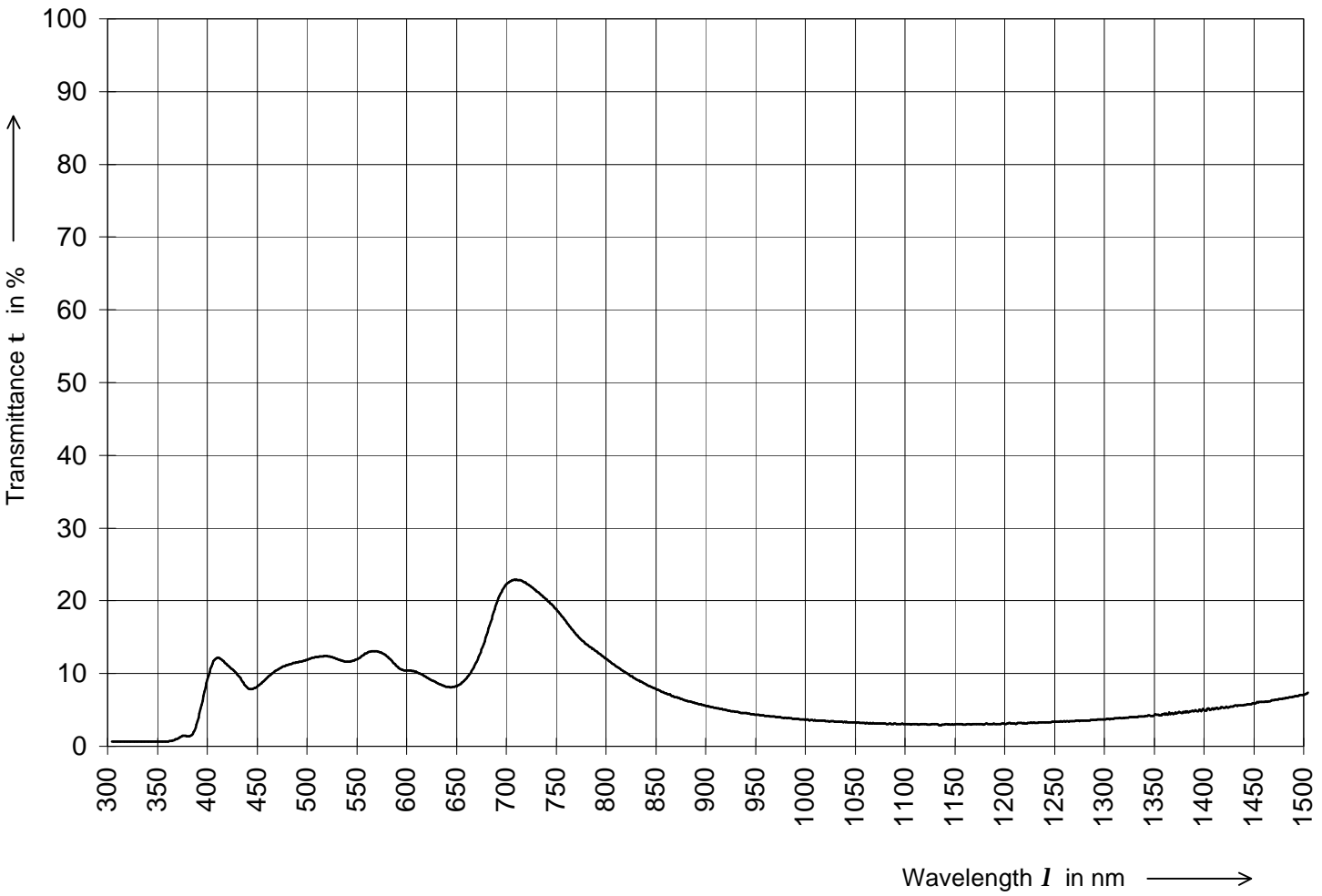
### Specification

Physical and chemical properties

PCE - BK  
D 1511

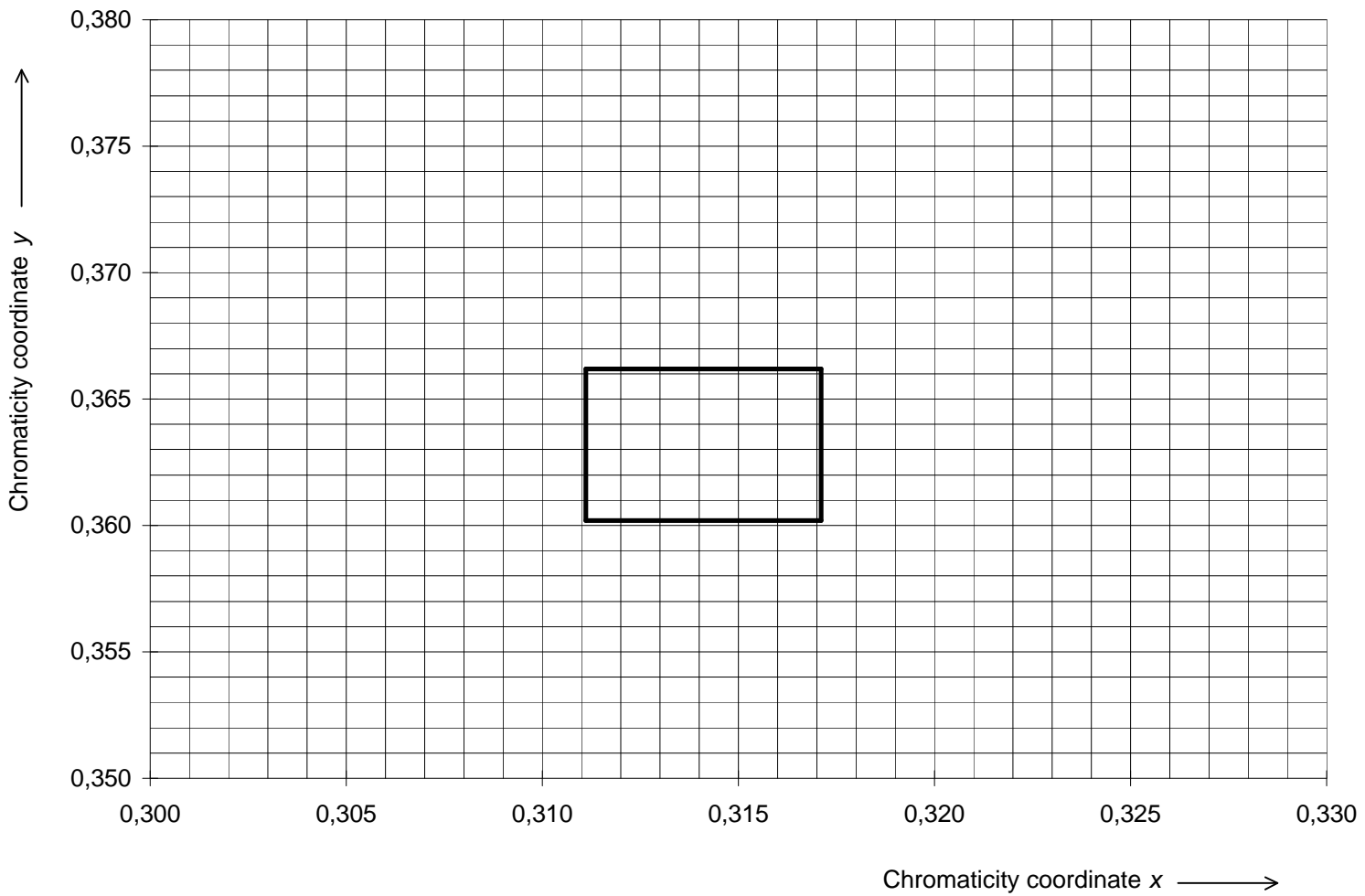
## Spectral Transmittance

Type of Glass: **Grau 1511**  
Thickness: 2.00 mm



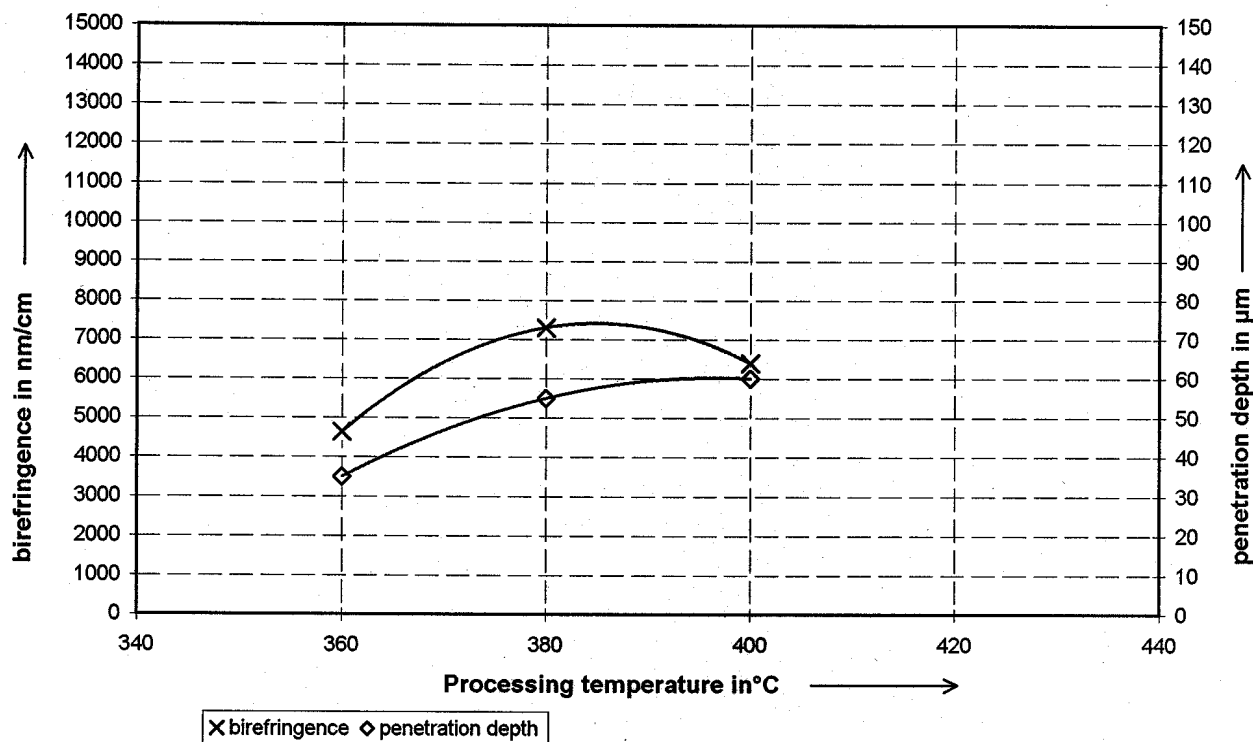
# Chromaticity Coordinates

**Type of Glass: Grau 1511**  
Thickness: 2.0 mm



Annex 3.3.1

<b>Specification</b>		<b>PCE - BK</b>	
Physical and chemical properties		<b>D 1511</b>	
<b>Chemical toughening parameter</b>			
<b>Glass and chemical toughening parameters</b>			
Transformation temperature	°C	480	
Glass thickness	mm	2	
Processing time	h	16	
Processing temperature	°C	380	
Salt bath (* weight percentages)	KNO <sub>3</sub> in % *	99.5	
	SiO <sub>2</sub> x H <sub>2</sub> O in % *	0.5	
<b>Chemical toughening results *</b>			
Penetration depth	μm	55	
Birefringence	nm/cm	7300	
* measured across at a sample piece ground down to 0.3 mm ± 0.05 mm			
<b>Ball drop test acc. FDA</b>		% failed	not carried out
<b>Ball drop test acc. DIN</b>		% failed	not carried out



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