

Specification	PCP
Physical and chemical properties	D 1219

- p r o v i s i o n a l -

S 4994

D 1219

Colour: grey

Application: medium tinted sunglare filter
with high UV- absorption
filter category 2 acc. to DIN EN 1836
(for $\tau_v < 18\%$ filter category 3)

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".

We retain 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**.

Specification		PCP D 1219				
Physical and chemical properties						
1. Optical properties						
1.1 Refractive indices (20 °C)						
Pretreatment of samples	n_g	1.5364				
[x] Condition as supplied	$n_{F'}$	1.5311				
[] annealed at 40 °C/h	n_F	1.5305				
	n_e	1.5256				
	n_d	1.5231				
	n_D	1.5230 ± 0.0015				
	$n_{C'}$	1.5205				
	n_C	1.5200				
1.1.1 Abbe value						
	v_e	49.4				
	v_D	49.7				
1.2 Transmittance data						
1.2.1 Spectral transmittance $\tau(\lambda)$						
1.2.1.1 $\tau(\lambda)$ - curve						
Plot of spectral transmittance $\tau(\lambda)$ for $d = 2.0$ mm ($\lambda = 300$ nm to 1500 nm)		see annex				
1.2.1.2 $\tau(\lambda)$ - individual values in % ($d = 2.0$ mm)						
	$\tau(\lambda)_{\max}$ for the λ - range 280 nm to 315 nm	< 0.001				
	$\tau(\lambda)_{\max}$ for the λ - range 315 nm to 350 nm	< 0.001				
	τ_{380}	≤ 1.0				
	$\tau(\lambda)_{\min}$ for the λ - range 500 nm to 650 nm	15				
1.2.1.3 Edge wavelength ($d = 2.0$ mm)						
	Edge wavelength λ_c ($\tau = 0.46$) in nm	◇				
1.2.2 Luminous transmittance τ_v						
1.2.2.1 Luminous transmittance τ_{vD65} in % at nominal thickness			19.5 *			
$d = 2.0$ 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
τ_{vD65} in %	◇	19.5	◇	◇	◇	◇
τ_{vA} in %	◇	19.3	◇	◇	◇	◇
τ_{vC} in %	◇	19.5	◇	◇	◇	◇

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1.2.2.2	Scale number/ Filter category		
	<i>N</i> for mean thickness <i>d</i> = 1.8 mm ($\tau_{VD65} = 22.8\%$)		5 - 2.5
	<i>N</i> for mean thickness <i>d</i> = 2.6 mm ($\tau_{VD65} = 12.6\%$)		5 - 3.1
	filter category for nominal transmittance $\tau_{VD65} = 19.5\%$		2
1.2.3	Special transmittance values in % (<i>d</i> = 2.0 mm)		
1.2.3.1	UV - transmittance		
		τ_{UVA}	0.2
		τ_{SUV}	0.1
		τ_{SUVA}	0.1
		τ_{SUVB}	< 0.1
1.2.3.2	IR - transmittance	τ_{SIR}	28.1
1.2.3.3	Solar blue - light transmittance	τ_{sb}	16.6
1.3	Colour		
1.3.1	Visual evaluation		◇
1.3.2	Colorimetry		
	Chromaticity coordinates	x_{10}	0.318
		y_{10}	0.357
	Chromaticity coordinates (colour locus) are referred to the Standard Illuminant D_{65} according CIE 10°-observer for the nominal transmittance $\tau_{VD65} = 19.5\%$ (refer to 1.2.2.1)		
	Colour-difference formula ΔE refer 6.1		
1.3.3	Signal light recognition		
	Relative visual attenuation coefficient (quotient) <i>Q</i>	Q_{blue}	1.0
	for signal light recognition referred to the	Q_{green}	1.0
	nominal transmittance $\tau_{VD65} = 19.5\%$	Q_{yellow}	1.0
	(refer to 1.2.2.1)	Q_{red}	0.9
1.3.4	Yellowness index (<i>d</i> = 10 mm)		
		Y_i	◇

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2. Thermal properties			
2.1 Viscosities and corresponding temperatures			
Designation	Viscosity lg η in dPas	Temperature ϑ in °C	
Strain point	14.5	466	
Annealing point	13.0	493	
Softening point	7.6	693	
Forming temperature	6.0	◇	
Forming temperature	5.0	◇	
Forming temperature	4.0	1048	
2.2 Transformation temperature T_g in °C		485	
2.3 Coefficient of mean linear thermal expansion $\alpha(20\text{ °C};300\text{ °C})$ in 10^{-6} K^{-1} (static measurement)		9.8	
2.4 Fuseability		◇	
2.5 Mean specific heat capacity $c_p(20\text{ °C to }100\text{ °C})$ in $\text{J}/(\text{g} \cdot \text{K})$		◇	

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3.	Mechanical properties	
3.1	Density ρ in g/cm ³	2.54
3.2	Stress optical coefficient C in $1.02 \cdot 10^{-12}$ m ² /N	◇
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. Both toughening methods may cause in slightly transmittance - and colourchange.	
3.3.1	Chemical toughening *	
	* Salt bath: 99.5 % KNO ₃ , and 0.5 % H ₂ SiO ₃ (% = Weight percentages)	
	Processing temperature ϑ in °C	◇
	Processing time t in h	◇
	Compressive stress D_s as birefringence in nm/cm	◇
	Penetration depth Nz up to neutral zone in μ m	◇
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	◇
3.5	Poisson´s ratio μ	◇
3.6	Torsion modulus G in kN/mm ²	◇
3.7	Knoop hardness HK 0.1/20	◇

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4.	Chemical properties	
4.1	Hydrolytic resistance acc. to DIN ISO 719	
	Hydrolytic class	◇
	Equivalent of alkali (Na ₂ O) per gram of glass grains in µg/g	◇
4.2	Acid resistance acc. to DIN 12 116	
	Acid class	◇
	Half surface weight loss after 6 hours in mg/dm ²	◇
4.3	Alkali resistance acc. to DIN ISO 695	
	Class	◇
	Surface weight loss after 3 hours in mg/dm ²	◇
4.4	Hazardous Substances	
	EC-directive 2002/95/EC (RoHS-directive)	on request

Form 0050/1e

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5.	Electrical properties	disregard
6. Other properties		
6.1 Colour-difference formula according to Color Science Concepts + Methods Wyszecki + Stiles John Wiley		
Referred to the Standard Illuminant C according to CIE 2°-observer		
$\Delta E = [(19.5-Y)^2(0.93)^2 + (-5.5-a)^2 + (4.5-b)^2]^{1/2}$		ΔE max. 0.95
<p>According to Hunter calculation: Hunter (1948,1958) Hunter L, a_L, b_L system</p> $L = 10Y^{1/2}$ $a_L = \frac{17.5(1.02X - Y)}{Y^{1/2}}$ $b_L = \frac{7.0(Y - 0.847Z)}{Y^{1/2}}$ <p>$X, Y, Z = 1931 =$ CIE tristimulus values (taken in percent) The total difference between two colours given in the L, a_L, b_L system is defined as</p> $\Delta E = [(\Delta L)^2 + (\Delta a_L)^2 + (\Delta b_L)^2]^{1/2}$		
diagram		see annex
7. Annex (diagrams, curves)		

Annex 1.2.1.1

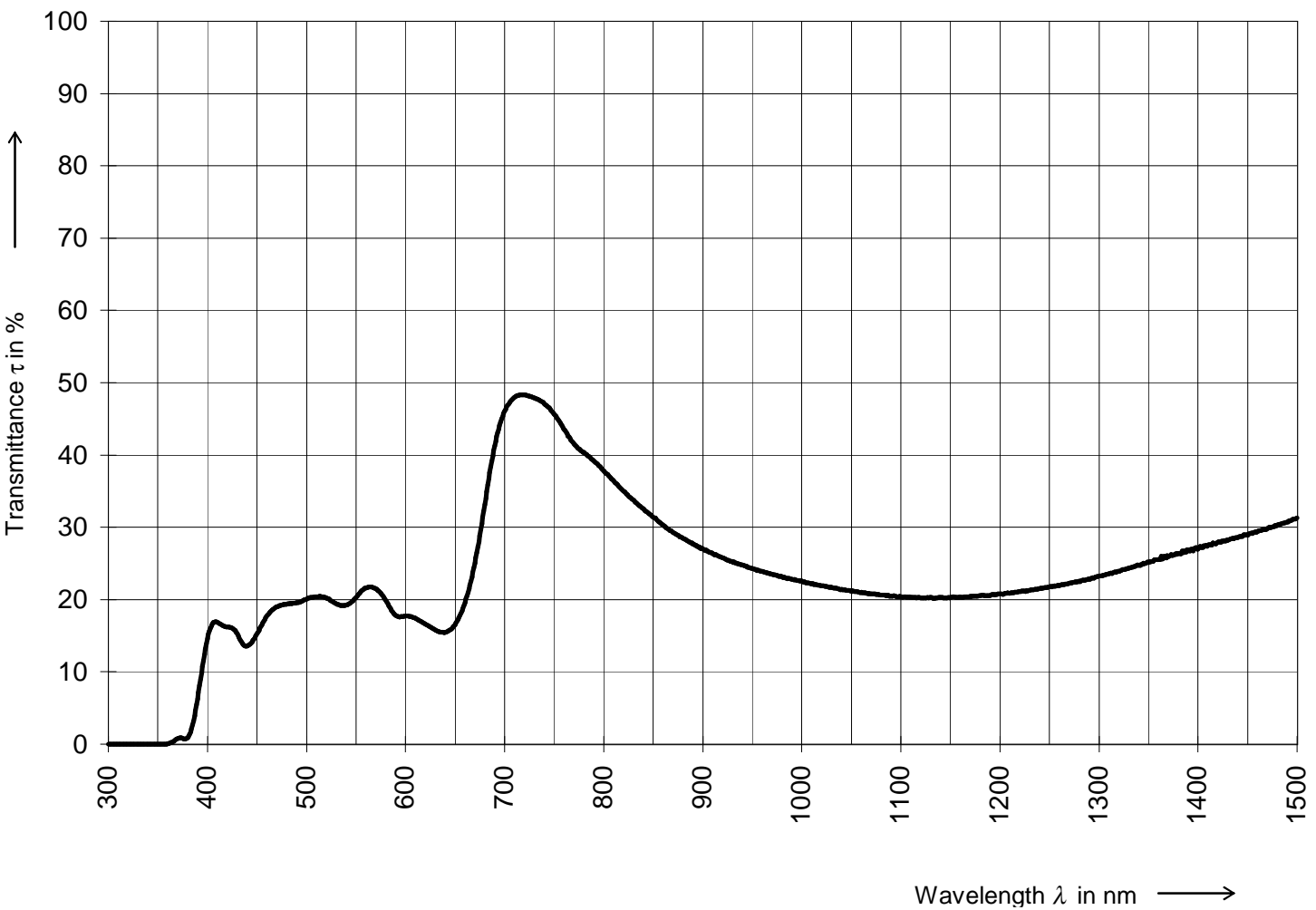
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Spectral Transmittance

Type of Glass: S 4994
Thickness: 2,0 mm



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Colour difference ΔE acc. to Hunter

Type of Glass: S 4994

Thickness: 2.0 mm

