

Specification Physical and chemical properties	PCP D 0191
--	-----------------------------

CH-5555

D 0191

Colour: clear

Application: Special glass, in particular suitable for a rapid chemical toughening without problems.
The ideal material for moulds for the manufacture of plastic lenses.

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				
Physical and chemical properties		D 0191				
1. Optical properties						
1.1 Refractive indices (20 °C)						
Pretreatment of samples	n_g	1.5338				
[] Condition as supplied	$n_{F'}$	1.5296				
[x] annealed at 40 °C/h	n_F	1.5291				
	n_e	1.5251 ± 0.001				
	n_d	1.5230				
	n_D	1.5229				
	$n_{C'}$	1.5208				
	n_C	1.5204				
1.1.1 Abbe value						
	v_e	60.0 ± 0.6				
	v_d	60.2				
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 ($\lambda = 250$ 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	52				
	$\tau(\lambda)_{\max}$ for the λ - range 315 nm to 350 nm	87.5				
	τ_{380}	90.5				
	$\tau(\lambda)_{\min}$ for the λ - range 500 nm to 650 nm	◇				
1.2.1.3 Edge wavelength ($d = 2.0$ mm)						
	Edge wavelength λ_c ($\tau = 0.46$) in nm	312				
1.2.2 Luminous transmittance τ_v						
1.2.2.1 Luminous transmittance τ_{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
τ_{vD65} in %	◇	91.7	◇	◇	◇	◇
τ_{vA} in %	◇	◇	◇	◇	◇	◇
τ_{vC} in %	◇	◇	◇	◇	◇	◇

Specification		PCP D 0191	
Physical and chemical properties			
1.2.2.2	Scale number / Filter category		
	N for mean thickness $d =$ mm ($\tau_{vD65} =$ %)		◇
	N for mean thickness $d =$ mm ($\tau_{vD65} =$ %)		◇
	filter category for nominal transmittance $\tau_{vD65} = 91.7$ %		0
1.2.3	Special transmittance values in % ($d = 2.0$ mm)		
1.2.3.1	UV - transmittance		
		τ_{UVA}	81.8
		τ_{SUV}	◇
		τ_{SUVA}	76.8
		τ_{SUVB}	38.5
1.2.3.2	IR - transmittance	τ_{SIR}	92
1.2.3.3	Solar blue - light transmittance	τ_{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 d in mm for the visual colour comparison		90
1.3.2	Colorimetry		
	Chromaticity coordinates	x_{10}	0.314
		y_{10}	0.331
	Chromaticity coordinates (colour locus) are referred to the Standard Illuminant D_{65} according to CIE 10°-observer for the nominal transmittance $\tau_{vD65} = 91.7$ % (refer to 1.2.2.1)		
1.3.3	Signal light recognition		
	Relative visual attenuation coefficient (quotient) Q for signal light recognition referred to the nominal transmittance $\tau_{vD65} = 91.7$ % (refer to 1.2.2.1)	Q_{blue}	1.0
		Q_{green}	1.0
		Q_{yellow}	1.0
		Q_{red}	1.0
1.3.4	Yellowness index ($d = 10$ mm)		
		Y_i	1.1

Specification		PCP
Physical and chemical properties		D 0191
2.	Thermal properties	
2.1	Viscosities and corresponding temperatures	
	Designation	Viscosity lg η in dPas
		Temperature ϑ in °C
	Strain point	14.5
	Annealing point	13.0
	Softening point	7.6
	Forming temperature	6.0
	Forming temperature	5.0
	Forming temperature	4.0
2.2	Transformation temperature T_g in °C	488
2.3	Coefficient of mean linear thermal expansion $\alpha(20\text{ °C};300\text{ °C})$ in 10^{-6} K^{-1} (Static measurement)	8.4
2.4	Fuseability	◇
2.5	Mean specific heat capacity $c_p(20\text{ °C to }100\text{ °C})$ in $\text{J}/(\text{g} \cdot \text{K})$	◇

Specification		PCP D 0191
Physical and chemical properties		
3.	Mechanical properties	
3.1	Density ρ in g/cm ³ (annealed at 40 °C/h)	2.47
3.2	Stress optical coefficient C in $1.02 \cdot 10^{-12}$ m ² /N	2.48
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 ϑ in °C	380
	Processing time t in h	4
	Compressive stress D_s as birefringence in nm/cm	7000
	Penetration depth N_z up to neutral zone in μm	90
	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	◇
3.5	Poisson's ratio μ	◇
3.6	Torsion modulus G in kN/mm ²	◇
3.7	Knoop hardness HK 0.1/20	670

Specification		PCP
Physical and chemical properties		D 0191
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	60
4.2	Acid resistance acc. to DIN 12 116	
	Acid class	S 3
	Half surface weight loss after 6 hours in mg/dm ²	12
4.3	Alkali resistance acc. to DIN ISO 695	
	Class	A 2
	Surface weight loss after 3 hours in mg/dm ²	210
4.4	Hazardous Substances	
	EC-directive 2002/95/EC (RoHS-directive)	on request
5.	Electrical properties	disregarded
6.	Other properties	disregarded
7.	Annex (diagrams, curves)	

Form 0050/1e

Specification

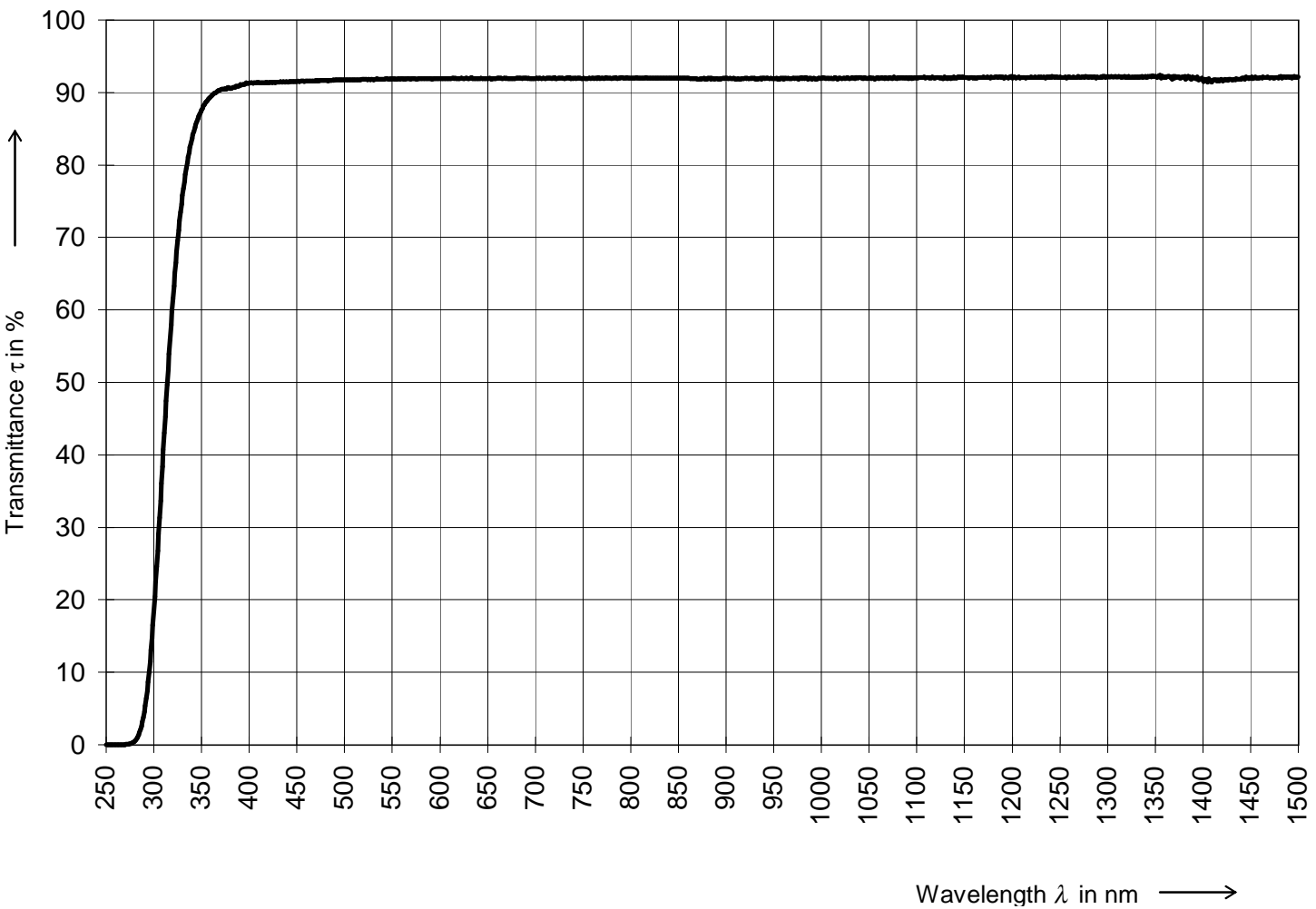
Physical and chemical properties

PCP

D 0191

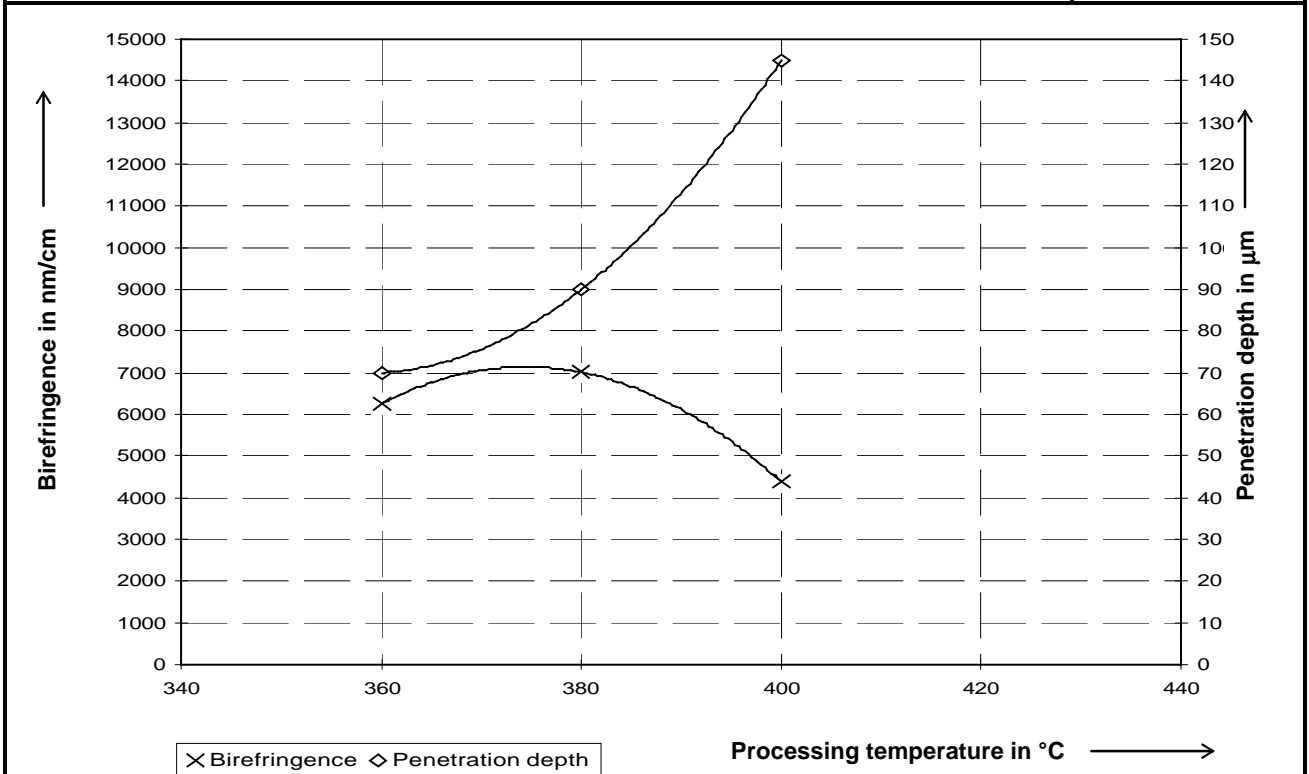
Spectral Transmittance

Type of Glass: CH-5555
Thickness: 2.00 mm



Annex 3.3.1

Specification		PCP	
Physical and chemical properties		D 0191	
Chemical toughening parameter			
Glass and chemical toughening parameters			
Transformation temperature	°C	488	
Glass thickness	mm	2	
Processing time	h	4	
Processing temperature	°C	380	
Salt bath (* weight percentages)	KNO ₃ in % *	59.5	
	NaNO ₃ in % *	40.0	
	SiO ₂ x H ₂ O in % *	0.5	
Chemical toughening results *			
Penetration depth	µm	90	
Birefringence	nm/cm	7000	
* measured across at a sample piece ground down to 0.3 mm ± 0.05 mm			
Ball drop test acc. FDA	% failed	not carried out	
Ball drop test acc. DIN	% failed	not carried out	



Form 0050/1e