

Specification Physical and chemical properties	PCP AF 32™		
<table border="0" style="width: 100%;"><tr><td style="width: 50%;">AF 32™</td><td style="width: 50%; text-align: right;">D 0889 1</td></tr></table> <p>The thin glass type AF 32™ is an aluminoborosilicate glass which is produced by the drown-draw method, enabling production in a very thin thickness range between 0.1mm and 1.1 mm. It is alkali-free in synthesis (however, contents of alkali oxide up to 0.2 weight percentages are possible by contamination of the raw materials and refractory material).</p> <p>The special composition of this substrate glass with fire-polished surfaces makes it suitable for a variety of applications:</p> <ul style="list-style-type: none">· Optical and electrical Sensors· LCD-Substrate· MEMS (Micro-Electro-Mechanical Systems)· Slides and Micro-Arrays· Wafer Level Chip Size Packaging· Microoptics on wafer level· High-temperature applications up to approx. 600 °C <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". 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.</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>		AF 32™	D 0889 1
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Specification		PCP AF 32™	
Physical and chemical properties			
1.	Optical properties		
1.1	Refractive indices		
	Pretreatment of samples	n_g	1.5200
	Condition as supplied	$n_{F'}$	1.5161
	["as drawn"]	n_F	1.5156
		n_e	1.5119
		n_d	1.5100
		n_D	1.5099
		$n_{C'}$	1.5079
		n_C	1.5075
1.1.1	Abbe value	v_e	62.4
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 $d = 0.5 \text{ mm}, d = 1.1 \text{ mm}$ ($\lambda = 250 \text{ nm}$ to 2000 nm)	see annex	
1.2.1.2	$\tau(\lambda)$ - individual values in % ($d = 0.5 \text{ mm}, d = 1.1 \text{ mm}$)	◇	
1.2.1.3	Edge wavelength		
	Thickness in mm	0.5	1.1
	Edge wavelength $\lambda_c (\tau = 0.46)$ in nm	268	295
1.2.2	Luminous transmittance τ_v		
1.2.2.1	Luminous transmittance as a function of thickness		
	Thickness in mm	0.5	1.1
	τ_{vD65} in %	92.0	91.9

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2.	Thermal properties	
2.1	Viscosities and corresponding temperatures	
	Designation	Viscosity $\lg \eta$ 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	715
2.3.	Coefficient of thermal expansion α	
2.3.1	Coefficient of mean linear thermal expansion $\alpha(20\text{ °C};300\text{ °C})$ in 10^{-6} K^{-1} (Static measurement)	3.2
2.4 - 2.5		disregard
2.6	Thermal conductivity λ in W/ (m·K) for the indicated temperature	
		$\vartheta = 89\text{ °C}$
		1.16

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3.	Mechanical properties	
3.1	Density ρ in g/cm ³ (annealed at 40 °C/h)	2.43
3.2	Stress optical coefficient C in $1,02 \cdot 10^{-12}$ m ² /N	3.1
3.3	Breaking strength	
3.3.1	Chemical toughening	
	A higher mechanical strength for chemical toughening according to the ion exchange procedure is not possible by alkali-free glasses.	
3.3.2	Thermal toughening	disregard
3.4	Young's modulus E in kN/mm ²	74.8
3.5	Poisson's ratio μ	0.238
3.6	Torsion modulus G in kN/mm ²	30.2
3.7	Knoop hardness HK 0.1/20	580

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Physical and chemical properties			
4.	Chemical properties		
4.1	Hydrolytic resistance acc. to DIN ISO 719		
		Hydrolytic class	HGB 1
	Equivalent of alkali (Na ₂ O) per gram of glass grains in µg/g		10
4.2	Acid resistance acc. to DIN 12116		
		Acid class	S 4
	Half surface weight loss after 6 hours in mg/dm ²		60
4.3	Alkali resistance acc. to DIN ISO 695		
		Class	A 3
	Surface weight loss after 3 hours in mg/dm ²		210
4.4	Hazardous Substances		
EC-directive 2002/95/EC (RoHS-directive)			
	Test Items	RoHS Limit in mg/kg	Value* in mg/kg
	Cadmium (Cd)	100	< Limit
	Lead (Pb)	1000	< Limit
	Mercury (Hg)	1000	< Limit
	Hexavalent chromium (Cr(VI))	1000	< Limit
	Polybrominated biphenyls (Sum of PBBs)	1000	< Limit
	Polybrominated diphenyl ethers (Sum of PBDEs)	1000	< Limit
* Test Report SGS INSTITUTE			

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Specification		PCP AF 32™
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5. Electrical properties		
5.1	Dielectric constant (Permittivity) ϵ_r at 1 MHz	5.1
5.2	Dissipation factor $\tan \delta$ at 1 MHz	$28 \cdot 10^{-4}$
5.3	Electric volume resistivity ρ_D in $\Omega \cdot \text{cm}$ at the specified temperatures	
5.3.1	ρ_D for alternating current	◇
5.3.2	ρ_D for direct current	
	$\vartheta = 250 \text{ }^\circ\text{C}$	$7.9 \cdot 10^{11}$
	$\vartheta = 350 \text{ }^\circ\text{C}$	$1.1 \cdot 10^{10}$
	$\vartheta = 500 \text{ }^\circ\text{C}$	$1.5 \cdot 10^8$
5.4	Temperature t_{k100} in $^\circ\text{C}$ for a specific electric volume resistivity of $10^8 \Omega \cdot \text{cm}$	518
6. Other properties		
6.1	Compaction	◇
7. Annex (diagrams, curves)		

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Annex 1.2.1.1

Specification

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