SCHOTT

Specification Physical and chemical properties	**PCP** **AF 32™**

AF 32™ D 0889 1

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).

The special composition of this substrate glass with fire-polished surfaces makes it suitable for a variety of applications:

- 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

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 ◊ 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**.

VX 0050/1e

Specification

Physical and chemical properties

PCP

AF 32™

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**	ν_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 mm, d = 1.1 mm (λ = 250 nm to 2000 nm)		see annex	
1.2.1.2	**$\tau(\lambda)$ - individual values in % (d = 0.5 mm, d = 1.1 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

VX 0050/1e

Specification

Physical and chemical properties

PCP
AF 32™

2. Thermal properties

2.1 Viscosities and corresponding temperatures

Designation	Viscosity lg η in dPas	Temperature ϑ in °C
Strain point	14.5	686
Annealing point	13.0	728
Softening point	7.6	969
Forming temperature	6.0	1090
Forming temperature	5.0	1187
Forming temperature	4.0	1309

2.2	**Transformation temperature *Tg* in °C**	715
2.3.	**Coefficient of thermal expansion α**	
2.3.1	**Coefficient of mean linear thermal expansion α (20 °C;300 °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**	
	ϑ = 89 °C	1.16

VX 0050/1e

Specification Physical and chemical properties		**PCP** **AF 32™**
3.	**Mechanical properties**	
3.1	**Density ρ in g/cm³** (annealed at 40 °C/h)	2.43
3.2	**Stress optical coefficient *C* in 1,02 · 10^{-12} m²/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/mm²**	74.8
3.5	**Poisson's ratio μ**	0.238
3.6	**Torsion modulus *G* in kN/mm²**	30.2
3.7	**Knoop hardness *HK* 0.1/20**	580

Specification

Physical and chemical properties

PCP
AF 32™

4. Chemical properties

4.1 Hydrolytic resistance acc. to DIN ISO 719

Hydrolytic class	HGB 1
Equivalent of alkali (Na_2O) 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/dm²	60

4.3 Alkali resistance acc. to DIN ISO 695

Class	A 3
Surface weight loss after 3 hours in mg/dm²	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

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

VX 0050/1e

Specification

Physical and chemical properties

PCP

AF 32™