

www.leadglasspro.com

LGP Glass Specification



Radiation shielding glass protects against X-rays and gamma rays in the medical and technical field. In research works it also provides necessary safety screening.



Specification

Radiation shielding glass protects against X-rays and gamma rays in the medical and technical field. In research works it also provides necessary safety screening.

X-Ray Lead Glass is an extra dense flint glass. It has a high content of heavy metallic oxides, nearly 70 per cent by weight.

The lead oxide content alone is more than 65 per cent by weight. Therefore, a density of above 5.05 g/cm³ is reached, so that relatively small thicknesses fulfil all legal safety regulations. Radiation shielding glass RD 50[®] meets the requirements of DIN EN 61331-2:2016-09. The protective capacity of a radiation shielding glass for X-rays is indicated by the lead equivalent, either in relation of lead thickness to glass thickness in per cent or in mm Pb.



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

Physical and chemical properties



1. Optical properties			
1.1	Refractive index	n_D	1.79
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 $d = 5.0$ mm, $d = 10.0$ mm, $d = 20.0$ mm ($\lambda = 340$ nm to 800 nm)		see annex
1.2.1.2	$\tau(\lambda)$ - individual values in % ($d = 10$ mm)		
	τ at $\lambda = 550$ nm	τ_{550}	85
1.2.1.3	Edge wavelength ($d = 5.0$ mm)		
	Edge wavelength $\lambda_{c(\tau = 0.46)}$ in nm		397
1.2.2	Luminous transmittance τ_v as a function of thickness		
		Thickness in mm	τ_{vD65} in %
		5.0	85
		10.0	84.5
		20.0	83
2. Thermal properties			
2.1	Viscosities and corresponding temperatures		
	Designation	Viscosity lg η in dPas	Temperature ϑ in °C
	Strain point	14.5	444
	Annealing point	13.0	467
	Softening point	7.6	603
	Forming temperature	6.0	673
	Forming temperature	5.0	729
	Forming temperature	4.0	800
2.2	Transformation temperature T_g in °C		467
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)		7.4
2.4	Fuseability		disregarded
2.5	Mean specific heat capacity $c_p(20\text{ °C to } 100\text{ °C})$ in J/(g·K)		0.39
2.6	Thermal conductivity λ in W/(m·K) for 50 °C		0.62

Specification

Physical and chemical properties



3.	Mechanical properties	
3.1	Density ρ in g/cm ³ (Condition as supplied)	≥ 5.05
3.2	Stress optical coefficient C in 1.02 · 10 ⁻¹² m ² /N	0.78
3.3	Breaking strength	disregarded
3.4	Young's modulus E in kN/mm ²	56.6
3.5	Poisson's ratio μ	0.245
3.6	Torsion modulus G in kN/mm ²	22.7
3.7	Knoop hardness HK 0.1/20	360
4.0	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	24
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	A 3
	Surface weight loss after 3 hours in mg/dm ²	510
4.4	Hazardous Substances	
	EC-directive 2002/95/EC (RoHS-directive)	on request
5.0	Electrical properties	
		disregarded

Specification

Physical and chemical properties



6. Other properties								
6.1 Lead equivalent in % of glass thickness for different types of radiation								
6.1.1 X - radiation quality								
Minimum thickness in mm	5.0	7.0	8.5	10.0	11.5	16.0	20.0	
Thickness min. to thickness max. in mm	5.0 to 7.0	7.0 to 9.0	8.5 to 10.5	10.0 to 12.0	11.5 to 14.0	16.0 to 19.0	20.0 to 23.0	
Tube voltage in kV								
76*	31.2	31.3	30.9	30.8	30.2	◇	◇	
80	31.2	31.2	31.1	31.2	31.2	◇	◇	
100	30.6	30.8	31.0	31.3	31.5	31.5	31.5	
110	30.0	30.2	30.3	30.5	30.6	30.6	30.6	
150	30.1	30.3	30.5	30.8	30.9	30.9	30.9	
200	29.2	29.2	29.1	29.1	29.1	29.3	29.1	
250	28.7	28.7	28.8	28.9	29.0	29.5	29.5	
300	29.3	29.4	29.6	29.6	29.8	30.2	30.6	
350*	29.8	30.0	30.2	30.3	30.4	30.9	31.3	
400	30.5	30.8	30.9	31.1	31.3	31.7	32.1	
450*	30.9	31.2	31.4	31.6	31.8	32.3	32.7	
500*	31.2	31.6	31.8	32.0	32.2	32.7	33.2	
550*	31.7	32.1	32.3	32.6	32.8	33.3	33.7	
600*	32.0	32.5	32.7	33.0	33.2	33.7	34.2	
650*	32.2	32.8	33.1	33.3	33.6	34.1	34.6	
750*	32.7	33.3	33.7	34.0	34.2	34.8	35.2	
1000*	33.9	34.6	34.9	35.3	35.5	36.1	36.5	
* tube voltage not enclosed in DIN EN 61331-1								
Measuring and Test Procedures								
TÜV NORD EnSys Hannover GmbH & Co. KG (23.06.2009)						on request		

Specification

Physical and chemical properties



6.1.2	Radionuclide							
	Thickness min. to thickness max. in mm	5.0 to 7.0	7.0 to 9.0	8.5 to 10.5	10.0 to 12.0	11.5 to 14.0	16.0 to 19.0	20.0 to 23.0
	Nuclide							
	¹¹ C	37.2	37.2	37.2	37.2	37.2	37.2	37.2
	¹³ N	37.2	37.2	37.2	37.2	37.2	37.2	37.2
	¹⁵ O	37.2	37.2	37.2	37.2	37.2	37.2	37.2
	¹⁸ F	37.2	37.2	37.2	37.2	37.2	37.2	37.2
	²² Na	41.1	41.5	41.5	41.5	41.4	41.0	40.6
	⁵⁸ Co	40.7	40.5	40.4	40.3	40.3	40.1	39.9
	⁵⁹ Fe	44.7	44.6	44.5	44.4	44.3	44.2	44.2
	⁶⁰ Co	44.5	44.5	44.5	44.5	44.5	44.5	44.5
	⁶⁸ Ga	37.5	37.4	37.4	37.3	37.3	37.2	37.1
	⁸² Rb	38.0	37.9	37.8	37.7	37.7	37.5	37.5
	⁹⁹ Mo	44.1	45.9	45.5	44.8	44.2	42.9	42.2
	⁹⁹ Tcm	29.2	29.1	29.0	29.0	28.9	28.7	28.6
	¹²³ I	31.2	32.6	34.7	37.7	38.8	39.2	39.8
	¹²⁵ I	--*	--*	--*	--*	--*	--*	--*
	¹³¹ I	34.1	33.9	33.8	33.7	33.5	33.0	32.6
	¹³⁷ Cs	39.8	39.4	39.3	39.2	39.1	38.9	38.8
	¹⁹² Ir	32.1	33.8	34.4	34.7	34.9	34.7	34.3
* For the radionuclide ¹²⁵ I we have not been able to calculate a lead equivalent within the preset calculating time, because the glass shields the radiation too good.								
Measuring and Test Procedures								
TÜV NORD EnSys Hannover GmbH & Co. KG (23.06.2009)							on request	

Specification

Physical and chemical properties



6.1.3		Monoenergetic photon radiation						
Thickness min. to thickness max. in mm	5.0 to 7.0	7.0 to 9.0	8.5 to 10.5	10.0 to 12.0	11.5 to 14.0	16.0 to 19.0	20.0 to 23.0	
Energy in MeV								
0.5	36.9	37.0	37.0	37.0	37.0	37.0	37.0	
0.75	40.9	40.9	40.9	40.9	40.9	40.9	40.9	
1	43.0	43.0	43.0	43.0	43.0	43.1	43.1	
1.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	
2.5	43.4	43.4	43.4	43.4	43.4	43.5	43.5	
5	39.3	39.3	39.4	39.4	39.4	39.4	39.5	
7.5	37.4	37.5	37.5	37.6	37.6	37.7	37.8	
9	37.2	37.4	37.4	37.5	37.5	37.7	37.8	
Measuring and Test Procedures								
TÜV NORD EnSys Hannover GmbH & Co. KG (23.06.2009)						on request		
7.0		Annex						
		(diagrams, curves)						

Specification

Physical and chemical properties



Annex 1.2.1.1

