Specification D 263® T eco
Technical properties

Non-toleranced numerical values are reference values of a typical production quality.

General

D 263® T eco is a clear borosilicate glass that has high chemical resistance. It is available in a variety of thicknesses ranging from 0.05 mm to 1.1 mm. D 263® T eco borosilicate glass is available from stock in standard sheet sizes or can be cut into round or square shapes. Applications include use as cover glass, display glass, as coating or printed electronics substrate and as a replacement for plastic.

D 263® T eco is manufactured with eco-friendly refining agents instead of arsenic and antimony. This specification describes the technical (geometry/quality) and the physical and chemical properties for stock sheets and customized formats.

1. Stock sheets

Stock sheets defines glasses produced according to standard sizes and stored on stock. Stock sheet glasses feature the following properties:

- 100 % inspection for visual properties
- cut edges
- uncleaned
- stored with paper interleaves
- produced in campaigns

1.1 Formats of stock sheets

Upon request, SCHOTT also offers customized formats and shapes within the limits of production and processing capabilities listed below. Down-Draw glass types are produced with beads. Depending on thickness beads are cut off. All data are valid for the quality format.

Thickness	Maximum length	Maximum width
> 0.2 mm	510 mm ± 5 mm	430 mm $^{+10}_{0}$ mm
≤ 0.2 mm (Ultra-Thin Glass[1])	440 mm ± 5 mm	360 mm $^{+10}_{0}$ mm

[1] Ultra-Thin Glass is not available as rolled material (sheets only)

1.2 Geometrical properties of stock sheets

Thickness	Thickness tolerance (acc. to SEMI MF 1530 GBIR)	Total Thickness Variation (TTV) (acc. to SEMI MF 1530 GBIR)	Flatness (acc. to SEMI M1 GBINFER)
0.05 mm*	± 10 µm	≤ 15 µm	≤ 3000 µm
0.07 mm**	± 10 µm	≤ 15 µm	≤ 3000 µm
0.1 mm	± 10 µm	≤ 10 µm	≤ 1500 µm
0.145 mm to 0.175 mm	± 10 µm	≤ 10 µm	≤ 1500 µm
0.20 mm to 0.21 mm	± 15 µm	≤ 15 µm	≤ 200 µm
0.25 mm	± 15 µm	≤ 15 µm	≤ 150 µm
0.3 mm	± 15 µm	≤ 15 µm	≤ 150 µm
0.4 mm	± 15 µm	≤ 15 µm	≤ 150 µm
0.5 mm to 0.55 mm	± 15 µm	≤ 15 µm	≤ 150 µm
0.7 mm	± 20 µm	≤ 20 µm	≤ 250 µm
0.9 mm	± 25 µm	≤ 25 µm	≤ 250 µm
1.0 mm	± 30 µm	≤ 25 µm	≤ 250 µm
1.1 mm	± 30 µm	≤ 25 µm	≤ 250 µm

* standard Ultra-Thin Glass thickness
** availability on request

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1.3 Glass quality properties of stock sheets

Quality properties	Condition	Specification
Roughness	Ra	≤ 1 nm
Spot type defects (e.g. inclusions, bubbles, knots, particles, digs)	inline inspection	< 100 µm: ignore 100 µm to 200 µm: ≤ 4 pcs. > 200 µm: none
Linear defects (e.g. scratches)	**L:** length **W:** width	L < 25 mm and W < 20 µm: ignore L < 25 mm and W 20 µm to 50 µm: ≤ 3 pcs. L > 25 mm or W > 50 µm: none
Edge defects (e.g. chips, protrusions)		< 0.2 mm: ignore 0.2 mm to 1.0 mm: ≤ 3 pcs. > 1.0 mm: none
Cracks	visible	none
Contaminations	Inspection condition: light source ≤ 5 klux dark environment, duration 15s / pc., cleaned	Contaminations (e.g. glove marks, conveyor belt marks, paper marks, haze, cullet's, dust etc.) can be judged after a suitable cleaning process; cleaning recommendations or technical assistance on cleaning can be provided upon request. Contaminations on un-cleaned glasses will be ignored and are permissible without any size restriction.
Quality assurance	AQL according to ISO 2859	100 % in-process visual inspection SPC for geometrical properties AQL level will variegate depending on batch sizes, thickness and required quality level.

1.4 Packaging methods of stock sheets

Depending on size and thickness glasses are packed with paper interleaves in packs of 20 pcs. to 100 pcs. between cardboard covers. Packs will be shrunk in plastic foil to avoid environmental influences during transportation and storage. Each pack is identified by a waybill or a label which includes all required information to guarantee traceability. Packs will be packed in pallet boxes (made out of cardboard or wood) before they are shipped to customer.

2. Processed customized substrates

SCHOTT is offering different technologies to process thin glass as listed below:

- cutting
- seaming
- cleaning (dimensions: Min: 50 mm x 50 mm, Max: 300 mm x 300 mm, per Thickness > 200 µm)
- laser marking (thickness ≥ 0.3 mm only)

2.1 Cutting formats

Thickness	Format	Maximum size	Minimum size	Tolerance
≥ 0.05 mm to ≤ 0.07 mm	rectangular	440 mm x 360 mm	20 mm x 20 mm	± 0.5 mm
	round	Ø 300 mm	Ø 50 mm	± 0.5 mm
≥ 0.1 mm to ≤ 0.4 mm	rectangular	stock sheet minus 20 mm	1 mm x 1 mm	± 0.2 mm
	round	stock sheet minus 20 mm	Ø 20 mm	± 0.2 mm
≥ 0.5 mm to ≤ 1.1 mm	rectangular	stock sheet minus 20 mm	10 mm x 5 mm	± 0.2 mm
	round	stock sheet minus 20 mm	Ø 20 mm	± 0.5 mm

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2.2 Glass quality properties of substrates

Quality properties	Condition	Specification
Parallelism	thickness 0.05 mm to 0.07 mm	≤ 1.0 % (of max. edge)
	thickness 0.1 mm to 1.1 mm	≤ 0.5 % (of max. edge)
Squareness	thickness 0.05 mm to 0.07 mm	≤ 2.0 % (of max. edge)
	thickness 0.1 mm to 1.1 mm	≤ 1.0 % (of max. edge)
Spot type defects (e.g. inclusions, bubbles, knots, particles, digs)	max. edge format or Ø < 100 mm	< 0.1 mm: ignore ≥ 0.1 mm to ≤ 0.2 mm: ≤ 1 pc. > 0.2 mm: none
	100 mm to 300 mm	< 0.1 mm: ignore ≥ 0.1 mm to ≤ 0.2 mm: ≤ 2 pcs. > 0.2 mm: none
	> 300 mm	< 0.1 mm: ignore ≥ 0.1 mm to ≤ 0.2 mm: ≤ 3 pcs. > 0.2 mm: none
Linear defects (e.g. scratches)	**L:** length **W:** width max. edge format or Ø < 100 mm	L ≤ 25 mm and W ≤ 20 µm: ignore L ≤ 25 mm and W ≤ 20 to 50 µm: ≤ 1 pc. L > 25 mm or W > 50 µm: none
	100 mm to 300 mm	≤ 2 defects allowed (as defined for stock sheets)
	> 300 mm	≤ 3 defects allowed (as defined for stock sheets)
Edge defects (e.g. chips, protrusions)	thickness < 0.5 mm	< 0.1 mm: ignore < 0.5 mm: ≤ 2 pcs. per edge > 0.5 mm: none
	thickness > 0.5 mm to < 1.1 mm	< 0.2 mm: ignore < 1.0 mm: ≤ 2 pcs. per edge > 1.0 mm: none
Cracks	visible	none
Contaminations	Inspection condition: light source ≤ 5 klux dark environment, duration 15s / pc., cleaned	Contaminations (e.g. glove marks, conveyor belt marks, paper marks, haze, cullet's, dust etc.) can be judged after a suitable cleaning process; cleaning recommendations or technical assistance on cleaning can be provided upon request. Contaminations on un-cleaned glasses will be ignored and are permissible without any size restriction.
Quality assurance	AQL according to ISO 2859	100 % in-process inspection for cosmetic defects SPC for geometrical properties AQL level will variegate depending on batch sizes, thickness and required quality level.

2.3 Further processing capabilities

Processing properties	Condition	Specification
Cutting	shape	free shapes possible (depending on specific application)
Edge grinding (round shape only)	min. format max. format thickness	Ø 100 mm Ø 300 mm ≥ 0.2 mm
Cleaning	min. format max. format thickness	50 mm x 50 mm 300 mm x 300 mm ≥ 0.2 mm
Laser marking	thickness ≥ 0.3 mm	fonts: Arial, DOT, SEMI size: 1 mm to 5 mm

2.4 Packaging methods of substrates

Depending on size, thickness and processing status several packaging methods are available. Additionally packaging methods can be defined between customer and SCHOTT. Each pack is identified by a waybill or a label which includes all needed data to trace back all important information. Possible packing methods:

- glass stacks with paper interleaves
- stacks are packed between cardboard or plastic sheets on top and bottom
- wrapping of the stack with paper
- using cardboard or plastic boxes
- using trays
- clean room compatible packing methods are possible.

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Physical and chemical properties

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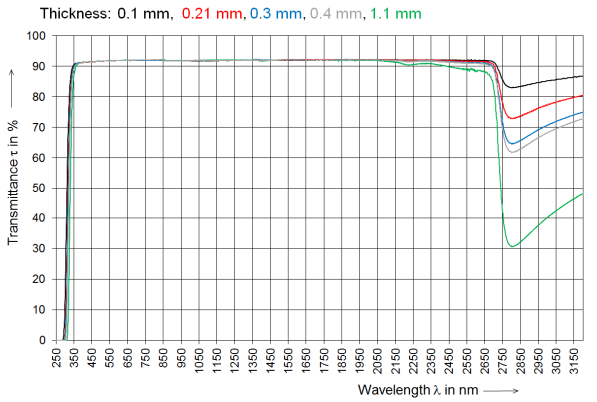
Optical properties		
Refractive indices	n_g	1.5354
Pretreatment of samples Condition as supplied ["as drawn"]	$n_{F'}$	1.5305
	n_F	1.5300
	n_e	1.5255 ± 0.0015
	n_d	1.5231
	n_D	1.5230
	$n_{C'}$	1.5209
	n_C	1.5204
Abbe value	v_e	55
Photoelastic constant	in (nm/cm)/MPa	34.7

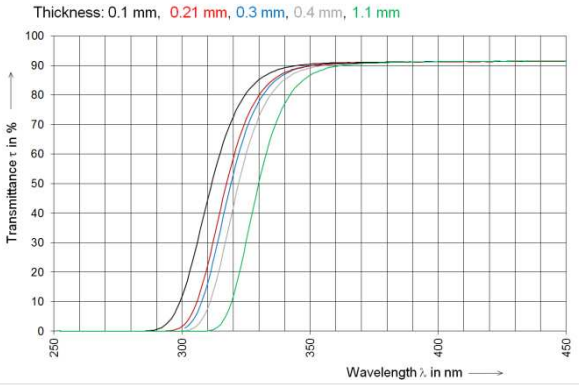
Thermal properties		
CTE (Coefficient of thermal expansion) α	in $10^{-6}\cdot K^{-1}$ (20 °C;300 °C)	7.2
Mean specific heat capacity c_p	in J/(g·K) (20 °C to 100 °C)	0.8
Transformation temperature T_g	in °C	557
Viscosities	Viscosity lg η in dPas	Temperature in °C
Strain point	14.5	529
Annealing point	13.0	557
Softening point	7.6	736

Mechanical properties		
Density ρ (annealed at 40 °C/h)	in g/cm³	2.51
Chemical toughening (d = 0.3 mm)	Temperature ϑ in °C	410
	Time t in h	4
	Compressive stress (CS) in MPa	320
	Depth of layer (DoL) in µm	18
Young's modulus E	in kN/mm²	72.9
Poisson's ratio μ		0.21
Torsion modulus G	in kN/mm²	30
Knoop hardness	HK 0.1/20	470
Vickers hardness	HV 0.2/25	510

Electrical properties		
Dielectric constant ε_r (at ϑ = 25 °C)	at 1 MHz	6.7
	at 1 GHz	6.4
	at 5 GHz	6.3
Dissipation factor tan δ (at ϑ = 25 °C)	at 1 MHz	$61\cdot10^{-4}$
	at 1 GHz	$74\cdot10^{-4}$
	at 5 GHz	$101\cdot10^{-4}$
Electric volume resistivity ρ_D	in Ω·cm alternate current 50 Hz	$1.6\cdot10^8$ (ϑ = 250 °C)
		$3.5\cdot10^6$ (ϑ = 350 °C)

Spectral transmittance (λ = 250 nm to 3200 nm and λ = 250 nm to 450 nm)





Transmittance values		
Thickness 0.3 mm	Wavelength	$\tau(\lambda)$ in %
	at 254 nm	< 0.1
	at 380 nm	91.2
	at 632.8 nm	92.0
	at 1064 nm	92.0
Edge wavelength λ_c (τ = 0.46)	Thickness in mm	Wavelength in nm
	0.10	308
	0.21	315
	0.30	318
	0,40	321
	1.10	329
Luminous transmittance	Thickness in mm	τ_{vD65} in %
	0.3	91.7 ± 0.3

Chemical properties		
Hydrolytic resistance (acc. to DIN ISO 719)	Class	HGB 1
	Equivalent of alkali per gram glass grains in µg/g	20
Acid resistance (acc. to DIN 12116)	Class	S 2
	Half surface weight loss after 6 hours in mg/dm²	1.4
Alkali resistance (acc. to DIN ISO 695)	Class	A 2
	Surface weight loss after 3 hours in mg/dm²	88