

Application: This standard is applicable to direct drawn tubes produced with **ilmasil® PS** base material

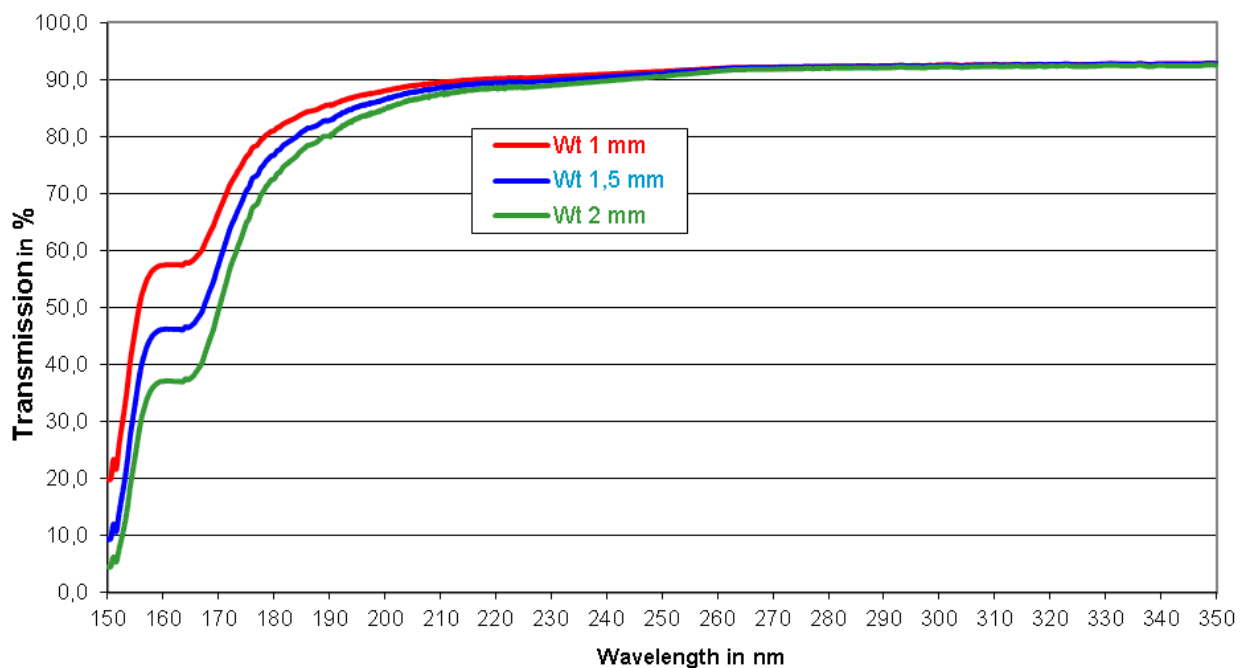
1 Optical Properties

1.1 Transmission

1.1.1 Guaranteed values

Wavelength λ [nm]	185	200	250	254	360	400
wallthickness 1 mm	$\geq 80\%$	$\geq 84\%$	$\geq 89\%$	$\geq 90\%$	$\geq 91\%$	$\geq 91\%$
wallthickness 1,5 mm	$\geq 75\%$	$\geq 82\%$	$\geq 89\%$	$\geq 90\%$	$\geq 91\%$	$\geq 91\%$
wallthickness 2 mm	$\geq 70\%$	$\geq 80\%$	$\geq 89\%$	$\geq 90\%$	$\geq 91\%$	$\geq 91\%$

1.1.2 Typical Transmission for UV-range



Remarking: All values are valid for measurement on a flat surface. Measurements on tube surface may vary depending on the tube diameter

2 Hydroxyl Content (OH-content)

Definition:	degree of hydroxyl groups in the tube wall (excluding outer surface) The typical content in ilmasil PS fused quartz tubes is 10 ppm
Limit:	max. 15 ppm
Remark:	After thermal treatment, a decrease of maximum 3 ppm is obtainable by tempering the material at 1000°C under vacuum for a period of 30 hours.

3 Visual Characteristics

The term “visual” is used for the inspection method where the tubing to be inspected at a distance of 0.3 – 0.6 m from the inspector, with a white/black background under general inspection illumination.

3.1 Bubbles

3.1.1 Enclosed Bubbles

Definition: a spherical void, wholly within the tube wall

Limit:

3.1.1.1 Tube outer diameter (OD) ≤ 40 mm and/or wallthickness (wt) ≤ 4 mm

	Bubble Length [mm]	Bubble Width [mm]	Max. number per 100 mm tube length [pcs]		Sum of length of all bubbles per 100 mm tube length [mm]
OD ≤ 40 mm; wt ≤ 1 mm	> 5 mm	Max 0.2	0		10 mm
	> 4 – 5 mm	Max 0.2	1	10	
	> 0.3 – 4 mm	Max 0.2			
OD ≤ 40 mm; wt > 1 – 2 mm	> 5 mm	Max 0.2	0		10 mm
	> 4 – 5 mm	Max 0.2	1	10	
	> 0.3 – 4 mm	Max 0.2			
OD ≤ 40 mm; wt > 2 - 4 mm	> 5 mm	Max 0.2	0		15 mm
	> 4 – 5 mm	Max 0.2	1	15	
	> 0.3 – 4 mm	Max 0.2			
Bubbles less than < 0.3 mm diameter are not counted.					
Bubble clusters: Judge the whole cluster to the limits of a single bubble; Bubble clusters > 5 mm are not permitted					

Tested by: visual, scale magnifier

3.1.1.2 Tube dimensions OD ≤ 40 mm und wt > 4 mm and Tube dimensions OD > 40 mm

Bubbles in length < 0.3 mm	are not counted
Bubbles in length > 5 mm	not permitted
Bubbles in width > 0.2 mm	not permitted
Total cross sections of all bubbles:	max. 30 mm ² /100cm ³ (as per DIN 58927)

Tested by: visual, scale magnifier

3.1.2 Open Bubbles

Definition: A void, open to the wall surface

Limit: None allowed on the ID or OD (visual detection limit: 0.1 mm)

Tested by: visual, scale magnifier

3.1.3 Bubble Clusters

Definition: More than one bubble connected

Limit: Judge the whole cluster to the limits of a single bubble

Tested by: visual, scale magnifier

3.2 Inclusions

Definition: included foreign particles (spots), visible by color difference

Limit: inclusions in diameter > 0.1 mm are not permitted


Inspection: visual, scale magnifier
for detection of white spots use a black background
for detection of black spots use a white background

3.3 Striation

Definition: transparent inclusions, causing apparent optical distortion

Limit: scattered colorless striations are permitted
Colored striations are not permitted

Inspection: visual on a crosswalk-background

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3.4 Surface defects

3.4.1 Scratches

Definition: a fine line abrasion on outer surface (line wider as 0.1 mm) visible by unaided eye with a black background

Limit: permitted if not perceptible with gloved fingers

Inspection: visual, manually, caliper, scale magnifier

3.4.2 Scuff

Definition: broad surface abrasion (groups of lines wider as 0.1 mm).

Limits: not permitted

Inspection: visual, caliper

3.4.3 Waterspots, Fingerprints, Cutter dust

Definition: removable surface deposits left by washing residue or finger touch

Limit: permitted to a minor degree

Inspection: visual

3.4.4 Vapor

Definition: a broad area or band of white haze on the inner or outer surface

Limits: not permitted

Inspection: visual on a black background

3.4.5 Structure

Definition: Optical distortion caused by marginal variations in the wall thickness

Limit: permitted if low-contrast appearance (comparison with limit sample)

Inspection: visual



3.4.6 Bubble Scars

Definition: Depressions on the surface caused by healed or collapsed bubbles

Limit: not permitted

Inspection: visual (inspection to be performed in axial direction)

3.4.7 Surface adhesions

Definition: non-colored quartz particles fused into the surface causing a protrusion

Limit: not permitted if any sharp edges

Inspection: visual, manually

4 Further applicable documents

S-101-05 Specification and Inspection Criteria for Tubes: Dimensional Characteristics

S-101-01-PS Material Standard: Clear Fused Quartz **ilmasil® PS**