

Ilmasil™ PE

Clear fused quartz tubes

Product standard and inspection criteria

Application

This standard is applicable to direct drawn tubes produced with Ilmasil™ PE base material

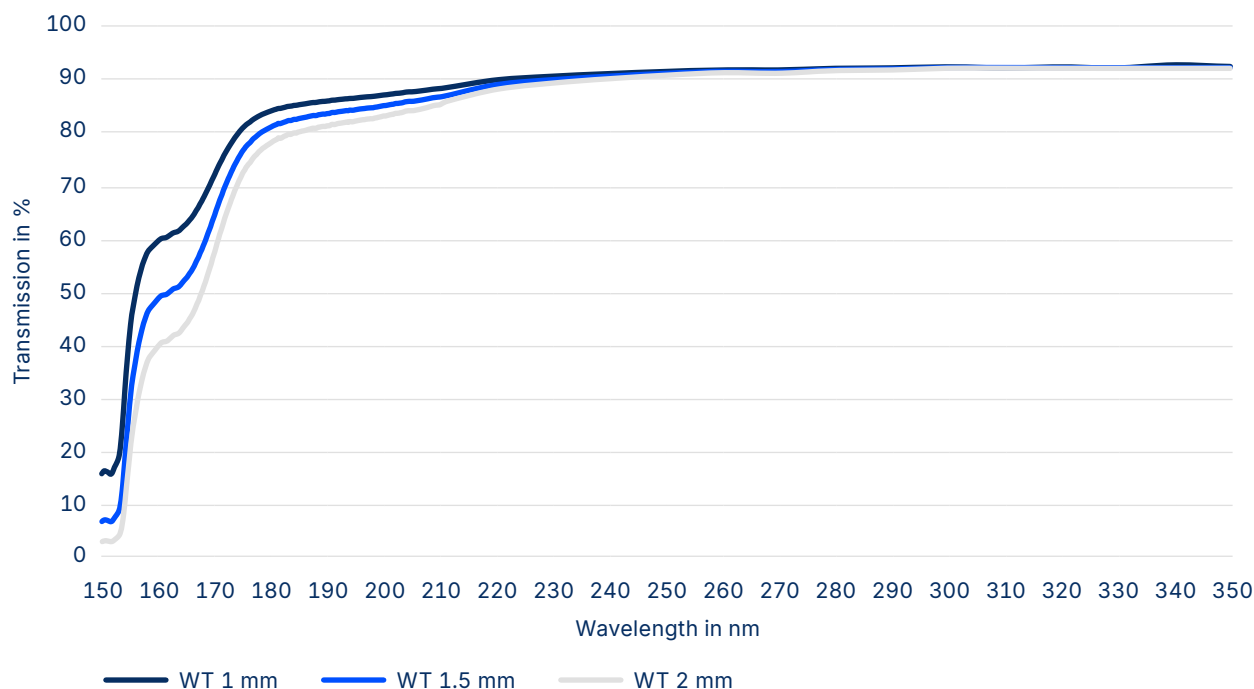
Optical properties

Transmission

Guaranteed values

Wavelength λ (nm)	185	200	250	254	360	400
Wall thickness 1 mm	$\geq 83 \%$	$\geq 84 \%$	$\geq 89 \%$	$\geq 90 \%$	$\geq 91 \%$	$\geq 91 \%$
Wall thickness 1.5 mm	$\geq 78 \%$	$\geq 82 \%$	$\geq 89 \%$	$\geq 90 \%$	$\geq 91 \%$	$\geq 91 \%$
Wall thickness 2 mm	$\geq 73 \%$	$\geq 80 \%$	$\geq 89 \%$	$\geq 90 \%$	$\geq 91 \%$	$\geq 91 \%$

Typical transmission for UV-range



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

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Hydroxyl content (OH-content)

Definition: degree of hydroxyl groups in the tube wall (excluding outer surface).
The typical content in Ilmasil™ PE fused quartz tubes is 55 ppm

Comment: 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.

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.

Bubbles

Enclosed bubbles

Definition: a spherical void, wholly within the tube wall

Limit: according to the following table

Tube outer diameter (OD)

Tube size	Length (mm)	Width (mm)	Max. number per 100 mm tube length (pieces)	Total length of all detected bubbles per 100 mm tube length (mm)
OD ≤ 40 mm WT ≤ 1 mm	> 5	max. 0.2	0	15 mm
	> 4 – 5		2	> 4 – 5 mm
	> 0.3 – 4		10	> 0.3 – 4 mm
OD ≤ 40 mm WT > 1 – 2 mm	> 5	max. 0.2	0	15 mm
	> 4 – 5		2	> 4 – 5 mm
	> 0.3 – 4		10	> 0.3 – 4 mm
OD ≤ 40 mm WT > 2 – 4 mm	> 5	max. 0.2	0	20 mm
	> 4 – 5		2	> 4 – 5 mm
	> 0.3 – 4		15	> 0.3 – 4 mm

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

Inspection: visual, scale magnifier

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Open bubbles

Definition: a void, open to the wall surface

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

Inspection: visual, scale magnifier

Bubble clusters

Definition: more than one bubble connected

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

Inspection: visual, scale magnifier

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

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

Surface defects

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

Scuff

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

Limit: not permitted

Inspection: visual, caliper

Waterspots, fingerprints, cutter dust

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

Limit: permitted to a minor degree

Inspection: visual

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Vapor

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

Limit: not permitted

Inspection: visual on a black background

Structure

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

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

Inspection: visual

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)

Surface adhesions

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

Limit: not permitted if any sharp edges

Inspection: visual, manually