

1. General:

This product specification applies to optical and geometric properties of RSC tubes of Raesch Quarz (Germany) GmbH. RSC tubes are resized tubes which were previously produced in a single step drawing process.

2. Optical Characteristics:

Defects are just specified if they are detected with the unaided eye in front of a black or white background. The optical measuring instruments are scale magnifiers and caliper gauges.

2.1 Bubbles

There are three different types of bubbles:

- a) Enclosed bubbles are cavities completely surrounded by the wall and not tactile.
- b) Tactile bubbles are a raised area on the tube wall located directly above an enclosed cavity. Bubbles are tactile if they can be felt with a glove.
- c) Collapsed bubbles are not fully occluded cavities on the tube surface.

Limits for enclosed, tactile and collapsed bubbles:

width [mm]	max permissible length [mm]		max amount per 300mm tube section
	OD ≤ 300mm	OD > 300mm	
≤ 0.25	15	15	3
> 0.25 - ≤ 0.50	8	12	3
> 0.50 - ≤ 0.75	4	10	1
> 0.75 - ≤ 1.00	2	8	1
> 1.00 - ≤ 1.50	0	5	1
> 1.50	not permitted		

table 1

2.2 Contaminations

Contaminations are substances adhering to the tube surface which can be removed with suitable cleaning agents. This kind of contaminations is permitted.

2.3 Scratches

Scratches are fine surface defects caused by material removal. No inner surface scratches are permitted. On the outer surface they are only allowed if they are not palpable with a glove and their length does not exceed 150mm. The defected area should not exceed 2% of the tube surface.

2.4 Cracks

Cracks are clearly visible defects in the glass wall. Cracks are not permitted.

2.5 Discolorations

Discolorations are visible color differences of the tube caused by the production process. These are permitted if the glass properties are not negatively affected.

2.6 Stripes

Stripes are classified into drawing lines and striations.

Drawing lines are visible, not tactile inhomogeneities in the glass. A slight stripe forming is accepted. Striations are tactile peaks or pits on the tube surface. These are allowed if their height or depth does not exceed 0.05mm.

2.7 Orange Peel

Orange peel refers to a transparent surface defect. This is permissible if the font "ARIAL" size 10 points is clearly readable through both tube walls.

2.8 Machine Marks

Machine marks are surface defects (e.g. roller or chuck marks) caused by mechanical devices or tools during the resizing process. Chuck marks are permitted. Other machine marks are only allowed if their total length does not exceed 25mm per 1.000mm tube section.

2.9 Repairs

Repairs are polished areas in which optical defects (e.g. inclusions and scratches) have been fixed. The working surface should not exceed 500mm² per 600mm tube section.

2.10 Inclusions

Inclusions are foreign particles partially or completely enclosed in the tube.

Tactile inclusions on the inner tube surface are not permitted.

Inclusions with a size of smaller than 0.2mm are not considered. The limits of inclusions are shown in the table 2.

diameter [mm]	max permissible amount per 300 mm tube length		
	OD ≤ 300mm	OD > 300mm	OD > 600mm
≥ 0.20 - ≤ 0.40	3	5	up on request
> 0.40 - ≤ 0.70	1	2	
> 0.70 - ≤ 1.00	0	1	
> 1.00 - ≤ 2.00	0	1	
> 2.00	not permitted		

table 2

2.12 Devitrifications

Devitrifications are optical surface defects caused by recrystallization. The limits of devitrifications ≥ 0.2mm are shown in table 3.

diameter [mm]	max permissible amount per 300 mm tube length		
	OD ≤ 300mm	OD > 300mm	OD > 600mm
≥ 0.20 - ≤ 0.40	1	3	up on request
> 0.40 - ≤ 0.70	1	3	
> 0.70 - ≤ 1.00	1	1	
> 1.00 - ≤ 1,5	0	1	
> 1,5	not permitted		

table 3

2.13 Adhered Materials

Adhered materials are clear, transparent quartz particles on the tube surface. Sharp-edged particles are not allowed. Adhered materials exceeding 0.3mm are not allowed.

2.14 Pixel

Pixels are surface defects which are not caused by foreign material. Pixels with a diameter of smaller than 0.2mm are not considered. Pixels exceeding 1.0mm are not allowed. Further limits of pixels are shown in table 4.

diameter [mm]	max amount per 300mm tube section
> 0.20 - ≤ 0.40	10
> 0.40 - ≤ 0.70	5
> 0.70 - ≤ 1.5	2

table 4

3. Geometric Characteristics:

A tube is defined according to its outer (OD) or inner diameter (ID) as well as its wall thickness (WT) and its total length (L). The respective tolerances can be found in table 5.

The used measuring instruments are ultrasonic wall thickness gauges, calipers and dial gauges.

3.1 Ovality

Ovality defines the roundness of a tube and is calculated as follows:

$$\text{ovality in \%} = (\text{max OD} - \text{min OD}) / \text{nominal OD} \times 100\%$$

3.2 Siding (eccentric wall thickness distribution)

Siding describes the wall thickness differences of a tube and is calculated as follows:

$$\text{Siding in \%} = (\text{max WT} - \text{min WT}) / \text{nominal WT} \times 100\%$$

3.3 Bow

Bow describes the maximum deviation from a horizontal measuring axis. It is measured centrally over a length of 1.000mm.

3.4 Length

RSC tubes are only available as TC (Trim Cut). The standard length tolerance is +/- 3mm.

3.5 Waviness

The waviness defines dimensional variations of the wall thickness or the outside diameter caused by its production process. This dimensional characteristic is allowed within the tolerances shown in table 5.

Dimensional Characteristics:

OD [mm]	WT [mm]	standard tolerances		siding [%]	ovality [%]	bow [mm/m]
		OD [mm]	WT [mm]			
40-60	2.0-4.0	±1.0	±0.5	18	2	2.0
> 60 - 90	2.0-5.0	±1.2	±0.5			
> 90 - 150	2.5-6.0	±1.5	±0.5			
> 150 - 300	3.0-7.0	±2.0	±0.7			
> 300 - 450	4.0-8.0	±2.5	±0.8			
> 450 - 600	4.5-7.0	±3.0	±1.2			
> 600 - 1000	up on request					

table 5

4. OH content:

The nominal OH content of RSC tubes does not exceed 30 ppm (excluding surface).

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Applicable documents:

Material specifications
 General specification for cutting

Revision History		
Rev.	date	Description of Change
0	01.06.2019	<ul style="list-style-type: none"> new document
1	25.03.2020	<ul style="list-style-type: none"> table 5: OD> 150-300 change in WT