 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>			WPS-300R-001
				29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020

## **1. Introduction.**

### **Purpose**

The purpose of this specification is to define the properties and quality requirements for QSIL PH300 quartz rods for various applications.

### **Scope**

This document applies to furnace cut and fine cut rods in the diameter range of 6 until 60 mm.

### **Glass Type**


PH300 glass is an undoped quartz glass, manufactured by electrically fusing high purity silica sand.

### **Lot identification**

The following information is given on each lot (see annex 1 for example):

- product code number (12 digit numeric code)
- campaign number
- lot number
- glass type
- main dimensions of the product (nominal vs. measured values)

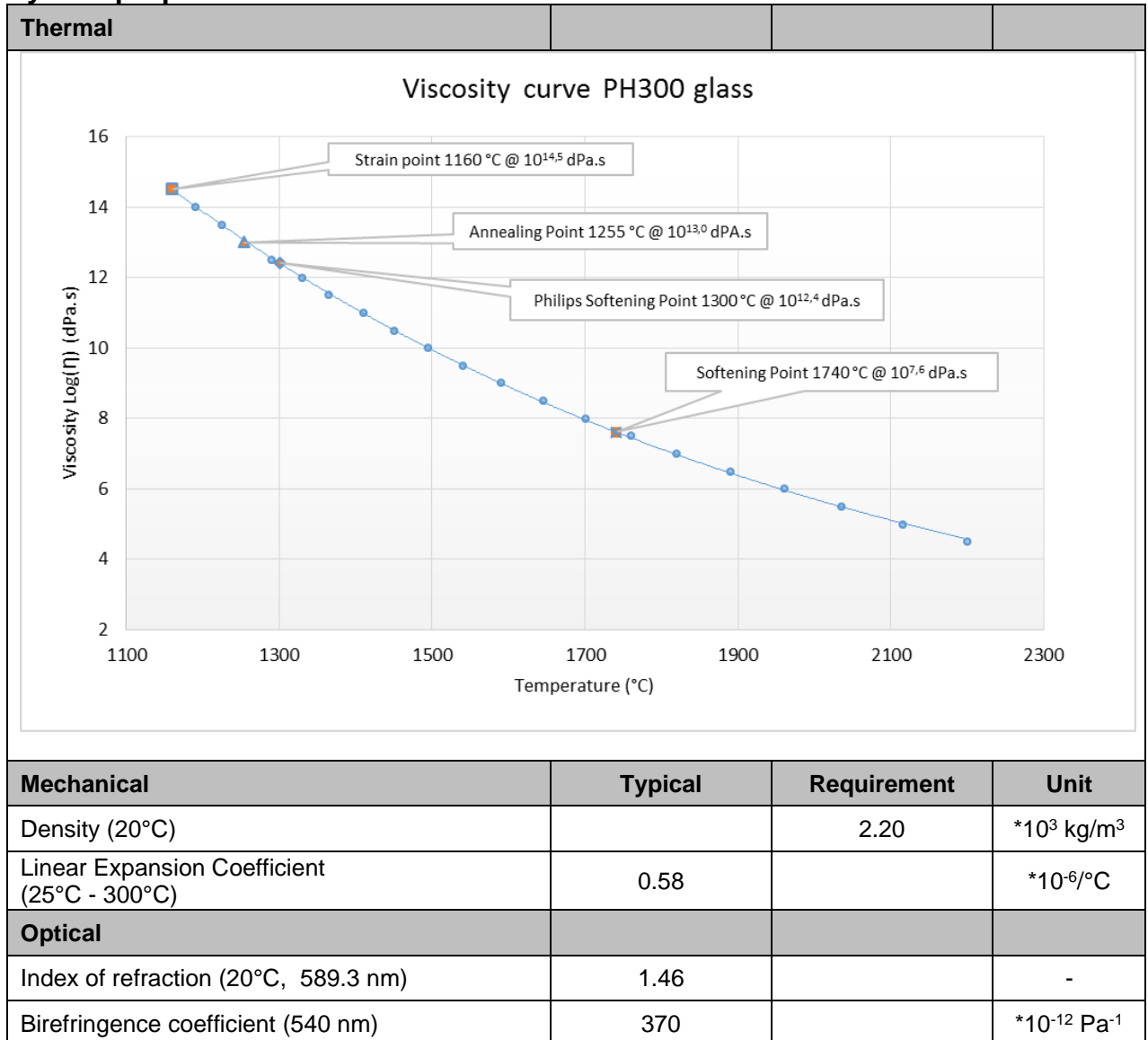
In case of a complaint the lot ID (12NC, campaign, lot) of each lot involved should be noted in the complaint announcement.


 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>			WPS-300R-001
				29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020

## 2. Product requirements.

The product specification consists of 3 paragraphs, being physical/chemical properties, dimensional requirements and visual requirements.

### Physical properties




 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>			WPS-300R-001
				29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020

## Chemical properties

Chemical Element	Typical	Requirement	Unit
Al	16.1		PPM
Ca	0.5		PPM
Cr	< 0.05		PPM
Cu	< 0.05		PPM
Fe	0.2		PPM
K	0.5		PPM
Li	0.7		PPM
Mg	0.01		PPM
Mn	0.01		PPM
Na	0.8		PPM
Ni	< 0.05		PPM
Ti	1.2		PPM
-OH (unbaked)	$\beta$ -OH ~150		PPM


Hydroxyl content (-OH)	Typical	Requirement	Unit
Rod dry (RD): For diameter range: diameter $\geq$ 6.0 – diameter $\leq$ 35.0 mm.		$\leq$ 35	PPM
Fiber dry (FD): For diameter range: diameter > 35.0 – diameter $\leq$ 45.0 mm.		$\leq$ 55	PPM
Big diameter dry (BD): For diameter range: diameter > 45.0 – diameter $\leq$ 60.0 mm.		$\leq$ 75	PPM

 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>			WPS-300R-001
				29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020

## Dimensional requirements

The rod dimensions are specified in the product drawing of each individual product. In table below the controls per parameter are specified. Sampling according to ISO 3951.

Parameter	AQL	Measuring method	Device
Outside diameter	1.0 %	Continuous diameter control towards nominal and sorting on USL and LSL.	In-line measuring OD device
Out of round (max diameter – min diameter)	1.0 %	Continuous measuring and sorting	Calculation In-line measuring data
<b>Furnace cut</b>			
Length	1.0%	Sample check, (Median & Range)	Off-line length measuring device
Bow	1.0%	Sample check	Off-line bow measuring device
<b>Saw cut</b>			
Length	1.0 %	Sample check, (Median & Range)	Off-line length measuring device


 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>				WPS-300R-001
					29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020	Pagina: 5 van 13

## Visual quality

The following requirements apply to furnace cut products.  
Sampling according to ISO 2859.

Class I, critical defect


Defect	AQL	Description and standard	Means
Crack		A linear surface crevice, not starting at the end of the rod.  <u>Acceptance limits:</u>  Any crack visible with the naked eye is not allowed.	TL light source with black background.
Contamination		Substances, not being SiO <sub>2</sub> , adhering to surface, which only can be removed by additional cleaning.  <u>Acceptance limits:</u>  Spots, (Length+Width)/2 > 10 mm, are not allowed  Spots, (Length+Width)/2 ≤ 10 mm, are allowed for a maximum of 10 particles per rod.	TL light source with black background.
Foreign material at the surface and in the rod		Foreign material (mostly metal particles).  <u>Acceptance limits:</u>  Particles, (Length+Width)/2 > 0.5 mm, are not allowed.  Particles, (Length+Width)/2 ≤ 0.5 mm, are allowed for a maximum of 5 particles per rod.	TL light source with black background.

 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>				WPS-300R-001
					29-09-2020
Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020	Pagina: 6 van 13	

Defect	AQL	Description and standard	Means
Open air lines		<p>An elongated void with a width of &gt; 0.1 mm wide and a length &gt; 0.1 mm, open to the quartz surface or just below the quartz surface with a thin membrane, which can be crushed easily with a fingernail or pencil.</p> <p><u>Acceptance limits:</u></p> <p>Any open air line longer the &gt; 0.1 mm and visible with the naked eye is not allowed.</p>	TL light source with black back-ground. Measuring magnifier 8x.
		<b>Total 0.4% (sum of class I defect)</b>	


Class II, major defect

Defect	AQL	Description and standard	Means
Discoloration		<p>Discoloration, mostly brown, of the rod.</p> <p><u>Acceptance limits:</u></p> <p>Internal discoloration grade <math>\leq 2</math> is acceptable. (Discoloration samples available on request).</p>	Laboratory testing on 10 cm of rod.
Colored Lines		<p>Sharp colored lines in the axial direction of the rod. (Black, Brown, Blue or White.)</p> <p><u>Acceptance limits:</u></p> <p>Sharp colored lines are acceptable.</p>	TL light source with black back-ground.
		<b>Total 1.0% (sum of class II defect)</b>	


 Quartz & Special Glass	Product specification PH300 Quartz rods				WPS-300R-001
					29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020	Pagina: 7 van 13

Class III, other defect


Defect	AQL	Description and standard	Means
Scratches		<p>A narrow line abrasion of the surface which is determined to have depth, as verified with a sharp object. Scratches can occur in the axial direction and in the radial direction.</p> <p><u>Acceptance limits:</u></p> <p><b>Axial scratches.</b></p> <p>Scratches with a width &gt; 0.2 mm are not allowed.</p> <p>Scratches with a width ≤ 0.2 mm and a length of &gt; 150 mm are not allowed.</p> <p>The sum of the length of all scratches with a width ≤ 0.2 mm and a length of ≤ 150 mm is max. 25% of rod length.</p> <p><b>Radial scratches.</b></p> <p>Scratches with a length &gt; ½ circumference are not allowed.</p> <p>Scratches with a length ≤ ½ circumference, max 3 allowed per product.</p>	<p>TL light source with black back-ground &amp; ruler.</p> <p>Tip of a sharp knife.</p>
Scuff marks		<p>Lines of abrasion of the surface which is determined <u>not</u> to have depth, as verified with a sharp object.</p> <p><u>Acceptance limits:</u></p> <p>Scuff marks with a width &gt; 15 mm and length &gt; 100 mm are not allowed.</p> <p>Maximum total surface area covered with scuff marks with a width ≤ 15 and length ≤ 100mm is 5%.</p>	<p>TL light source with black back-ground &amp; ruler.</p>

 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>				WPS-300R-001
					29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020	Pagina: 8 van 13

Defect	AQL	Description and standard	Means
Crystallization		<p>Spots where amorphous quartz is reverting into crystalline quartz.</p> <p><u>Acceptance limits:</u></p> <p>Not allowed is:</p> <p>Width <math>\leq</math> 0.1 mm and length <math>&gt;</math> 40 mm.  Width <math>\leq</math> 0.2 mm and length <math>&gt;</math> 20 mm.  Width <math>\leq</math> 0.4 mm and length <math>&gt;</math> 10 mm.  Width <math>\leq</math> 0.6 mm and length <math>&gt;</math> 5 mm.  Width <math>\leq</math> 0.8 mm and length <math>&gt;</math> 2.5 mm.  Width <math>\leq</math> 1.0 mm and length <math>&gt;</math> 1.0 mm.  Width <math>&gt;</math> 1.0 mm</p>	TL light source with black back-ground. Measuring magnifier 8x.
Closed airlines		<p>A closed airline is an elongated void, <math>&gt;</math> 0.1 mm wide and <math>&gt;</math> 2 mm length, fully enclosed in the quartz material.</p> <p><u>Acceptance limits:</u></p> <p>Closed air lines with a length <math>&gt;</math> 50 mm are not allowed.  Closed air lines with a width <math>&gt;</math> 3 mm are not allowed.  In a sample of 3 pcs the average airline length:  <math>\leq</math> 15 mm per meter for <math>\geq</math> 6 OD <math>&lt;</math> 25 mm  <math>\leq</math> 12 mm per meter for <math>\geq</math> 25 OD <math>\leq</math> 60 mm</p>	TL light source with black back-ground & ruler.
Air bubbles		<p>Round shaped voids, <math>&gt;</math> 0.2 mm and <math>\leq</math> 2.0 mm in diameter, fully enclosed in the quartz material.</p> <p><u>Acceptance limits:</u></p> <p>In a sample of 3 pcs the average amount of air bubbles is:</p> <p>For 6.0 mm <math>\leq</math> diameter <math>\leq</math> 40.0 mm  <math>\leq</math> 30 pcs per meter.</p> <p>For 40.0 mm <math>&lt;</math> diameter <math>\leq</math> 50.0 mm  <math>\leq</math> 45 pcs per meter.</p> <p>For 50.0 mm <math>&lt;</math> diameter <math>\leq</math> 60.0 mm  <math>\leq</math> 65 pcs per meter.</p>	TL light source with black back-ground & ruler.


 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>			WPS-300R-001
				29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020

Defect	AQL	Description and standard	Means
<b>Rod end defects (Furnace cut only)</b>			
Protrusions and intrusions.		Protrusions and intrusions are formed during furnace cutting of the rod.  <u>Acceptance limits:</u>  Sharp protrusions which have height of > 20 mm from the rod end are not allowed.  Sharp intrusions which have length of > 20 mm from the rod end mm are not allowed.	TL light source with black back-ground.
Cracks in ends of rod		A linear surface crevice starting at the end of the rod  <u>Acceptance limits:</u>  Cracks longer > 20 mm from the rod end are not allowed.	TL light source with black back-ground.
<b>Rod end defects (Saw cut only)</b>			
Protrusions and intrusions.		Protrusions and intrusions are formed during saw cutting of the rod.  <u>Acceptance limits:</u>  Protrusions are not allowed.  Intrusions which have length of > 10 mm or a depth > 2 mm from the rod end are not allowed.	TL light source with black back-ground & ruler.
		<b>Total 1.5% (sum of class III defect)</b>	

 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>			WPS-300R-001
				29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020

## Standard products

Standard rod dimensions		
Nominal diameter range	Tolerance (of nominal diameter)	Out of roundness (of nominal diameter)
Diameter $\geq 6.0$ mm and diameter $\leq 45.0$ mm	$\pm 1.5\%$	6.0 $\leq$ OD $\leq$ 10.0 mm: $< 1.5\%$ 10.0 $\leq$ OD $\leq$ 45 mm: $\leq 0.15$ mm
Diameter $> 45.0$ mm and diameter $\leq 60.0$ mm	$\pm 2.0\%$	45 $<$ OD $\leq$ 55 mm: $\leq 0.40$ mm 55 $<$ OD $\leq$ 60 mm: $\leq 0.50$ mm
Length (furnace cut)	Length ranges (mm)	Tolerance ( $\pm$ mm)
For diameter range $\geq 6.0$ mm and $< 18.0$ mm	900 – 1000	$\pm 10$ mm
	1150 – 1400	
	1550 – 1800	
For diameter range $\geq 18.0$ mm and $\leq 35.0$ mm	900 – 1050	
	1150 – 1450	
	1550 – 1800	
For diameter range $\geq 35.0$ mm and $\leq 55.0$ mm	900 – 1100	
	1150 – 1500	
	1550 – 1800	
For diameter range $> 55.0$ mm and $\leq 60.0$	900 – 1100	
	1150 – 1500	
	1550 – 1700	
Length (saw cut)	Length ranges (mm)	Tolerance ( $\pm$ mm)
For diameter range $\geq 6.0$ mm and $< 18.0$ mm	400 - 1750	$\pm 0.5$ mm
For diameter range $\geq 18.0$ mm and $\leq 45.0$ mm	400 - 1800	
For diameter range $> 45.0$ mm and $\leq 60.0$ mm	On request	$\pm 1.0$ mm
Bow	Maximum bow (mm/m)	
For diameter range $\geq 6.0$ mm and $< 14.0$ mm	$\leq 1.0$	
For diameter range $\geq 14.0$ mm and $\leq 45.0$ mm	$\leq 0.6$	
For diameter range $> 45.0$ mm and $\leq 60.0$ mm	$\leq 0.95$	
Multiple Bow / Snake	Maximum multiple bow (mm/200mm)	
For diameter range $\geq 18.0$ mm and $\leq 45.0$ mm	$\leq 0.12$	
For diameter range $> 45.0$ mm and $\leq 60.0$ mm	$\leq 0.32$	

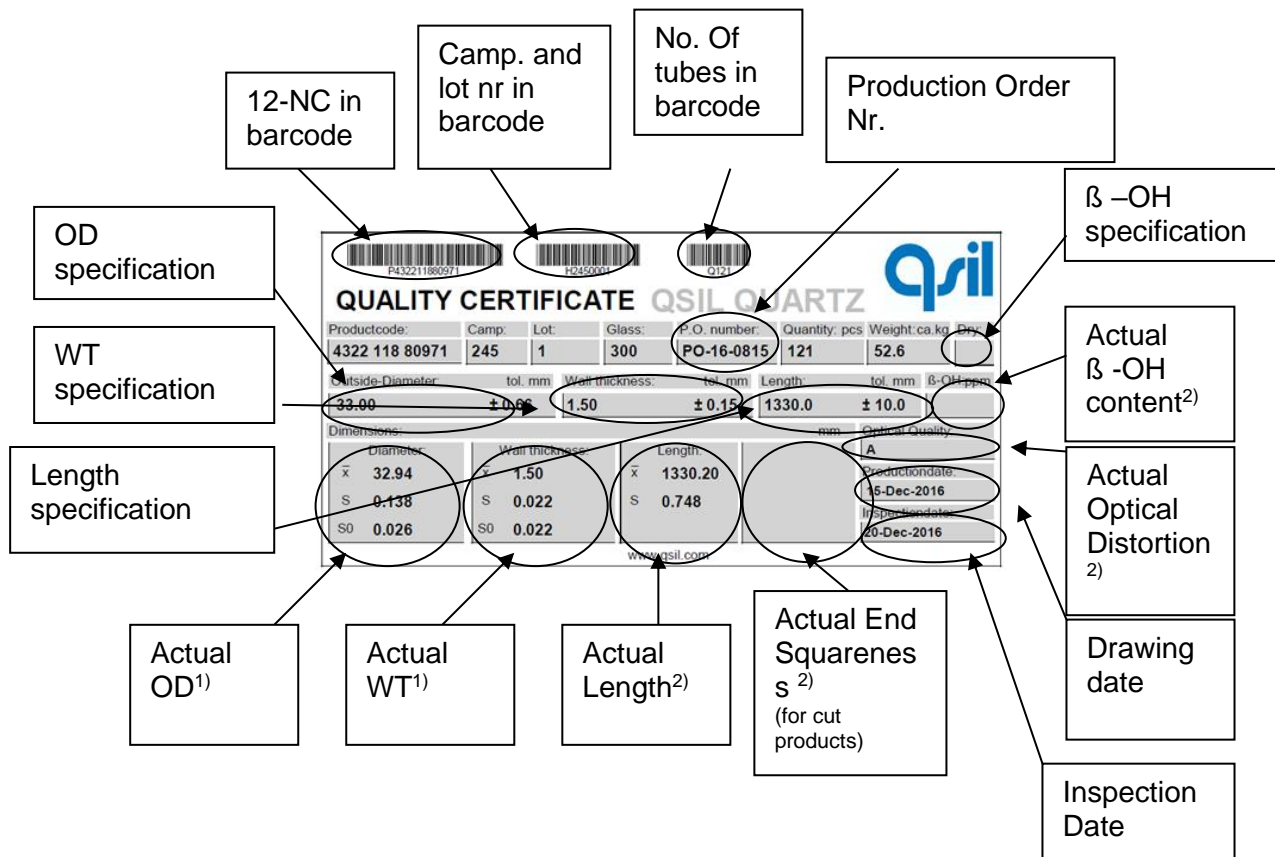
 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>				WPS-300R-001
					29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020	Pagina: 11 van 13

**Annex 1: example Certificate of Conformance**

1) By in-line measurements

X = average value  $OD_{NS,EW}$  respectively  $WT_{N,S,E,W}$  one measurement per individual tube  
S= standard deviation of OD respectively WT calculated over the length of the tube  
 $S_0$  = standard deviation of OD respectively WT calculated over the circumference of the tube

2) By off-line sampling measurements



 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>				WPS-300R-001
					29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020	Pagina: 12 van 13

## Annex 2: ROHS Certificate of Compliance

### QSIL Netherlands B.V.

H.M. Brouwerstraat 1  
9672 AG Winschoten  
The Netherlands



Number: **SW-LAB/RoHS/2019-2020**  
Date: 24-09-2019  
Company: QSIL Nederland B.V. Winschoten  
Request: RoHS Certificate of Compliance all products QSIL Netherlands

### RoHS Certificate of Compliance

QSIL Nederland hereby certifies that all our products are RoHS compliant with RoHS2 DIRECTIVE 2011/65/EU and RoHS3 Directive 2015/863.

Verification analysis are performed to establish of the following components: Pb, Cd, Hg, Cr6<sup>+</sup> and Br.

As XRF can only establish the Cr-total content, the actual Cr6<sup>+</sup> level will be less than the reported Cr-total content.

The Polybrominated biphenyls and Polybrominated diphenyl ethers (PBDE) will be measured as Br-total. (NEN 62321-3-1).

All the measurements were made on the XRF machine: Tiger S8 from Bruker.

#### The measured levels are in Percent by weight:

	Measurement date	Valid until	Pb	Cr-total	Br-total	Hg	Cd
<b>All QSIL Netherlands products</b>	19-9-2019	01-10-2020	<0,1	<0,1	<0,1	<0,1	<0,01

The maximum permitted concentrations are 0,1% or 1000 ppm except for cadmium which is limited to 0,01% or 100 ppm.


The substances: Bis(2-ethylhexyl)phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP) and Diisobutyl phthalate (DIBP), are tested by SGS.

These substances are not detected.

QSIL Netherlands B.V.

H.P.M. Huck  
Managing director  
CSO Qsil AG

A. Meijer-Hillenga  
Laboratory

 <b>Quartz &amp; Special Glass</b>	<b>Product specification PH300 Quartz rods</b>			WPS-300R-001
				29-09-2020
	Owner: Sales director	Peer: Operations mgr	Approver: Sales director	Datum: 29-09-2020

Version control
Change
13-02-2017 Change format QSIL
07-01-2019 Change header
10-02-2020 Added chemical composition - Update Rohs certificate – Update Certificate conformance
06-04-2020 Diameter range extended to OD 60 mm
15-04-2020 Layout adjusted (font type, re-arrangement of topics)
08-06-2020 Specification on striation removed
29-09-2020 Adjusted out of round specification for diameters > 45 mm