

Rubert + Co. Ltd.  
UKAS Calibration Laboratory No. 4685  
**Calibration Certificate**  
Certificate No. 721915



Type of object: Roughness Specimen Type 529X with sinusoidal profile  
(ISO 5436 Type C)

Manufacturer: Rubert + Co. Ltd

Manufacturer's serial No: P16Z1D

Specimen condition: New

Customer: 5labs d.o.o.  
Legen 112  
2380 Slovenj Gradec  
Slovenia

Date of calibration: 14 October 2021

Date of certificate: 14 October 2021

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Individual with responsibility for this calibration Paul Rubert

This calibration certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service (UKAS). It provides traceability of measurement to the SI system of units, and/or to units of measurement realized at the National Physical Laboratory (NPL) or other recognised national metrology institutes. This certificate must not be reproduced other than in full, except with the prior written permission of Rubert + Co. Ltd.

## 1 Calibration Method

A Form Talysurf Series 2 contacting stylus instrument with laser pickup and diamond stylus of 60 degree conical shape was used for the measurements.

The instrument was first calibrated for height displacement on a certified reference standard with known uncertainty, in accordance with ISO 5436-1 and ISO 12179.

Depth of calibrating step: 2 403 nm +/- 3.4 nm  
Standard uncertainty of this (from certificate) 1.35 nm

## 2 Conditions and method of measurement

The measuring area of the roughness specimen was then measured for the required parameter values, at locations indicated on the Measuring Plan shown on page 3.

Parameter values were evaluated from the data profiles taken, using the details shown in the table of Measuring Conditions below. Unless otherwise stated, or requested by the customer, these conditions are in accordance with ISO 4288:1998. Parameters are evaluated in accordance with ISO 4287:2000.

Stylus tip size:	1.5 µm width	Datapoint spacing:	0.25 µm
Traverse speed:	30 mm/min	Number of measurements taken:	12
Cutoff Lc:	0.08 mm	Gauge range	6mm
Cutoff Ls:	1.25 µm	Filtering	Gaussian
Evaluation length Lt:	0.48 mm	Bandwidth (= Lc/Ls)	64:1

## 3 Policy on dealing with defects

The presence of a defect on the measuring area of any specimen which is to be calibrated can influence the measured values if that defect forms part of the measured profile data which is evaluated.

A deviation on a regular-profile specimen will count as a defect that must be corrected if both of the following are true: its magnitude is more than 100% of the prevailing p to v height, and its width is less than 25% of a wavelength of the profile. If the defect is wider than 25%, then the data should be discarded and the measurement repeated.

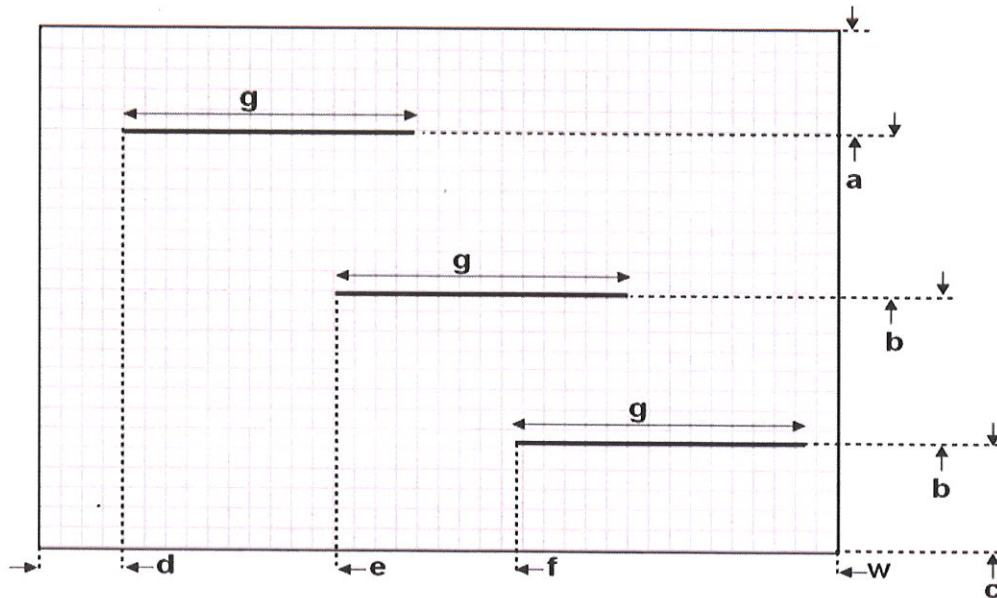
For this calibration on a specimen whose profile has a regular, repeating pattern, localised defects which are less wide than 25% of the period of the pattern, have been removed by smoothing at the software stage.

## 4 Environmental Conditions

The laboratory temperature was 20 ± 2 degrees Celsius.

## 5 Measuring Plan

The plan below shows the approximate location of the  $n = 12$  profiled evaluation lengths, in three lines of four each, with the start points and separations from the edges of the measuring area of the specimen shown in mm but NOT to scale.



a	b	c	d	e	f	g	w
5	8	5	4	15	27	2	38

## 6 Uncertainty of measurement

All uncertainty calculations are done in accordance with the procedure described in VDI/VDE 2602 *Surface measurement – Roughness measurements using stylus instruments – Part 4: Calibration and uncertainty of measurement* (September 2014). This document itself conforms to the requirements of ISO document *Guide to the Expression of Uncertainty in Measurement*.

In all cases the value obtained for combined standard uncertainty is then multiplied by a coverage factor  $k$ , which is taken to be 2 in order to give a confidence level of 95%, to give the expanded uncertainty.

The value given as the Expanded Uncertainty in the Summary of Results table in section 7 of this Certificate, is this evaluated uncertainty in case this exceeds the Laboratory's Calibration and Measurement Capability (CMC) as stated on our Schedule of Accreditation. The value in section 7 is the CMC otherwise. For details of our Schedule of Accreditation please visit

<http://www.rubert.co.uk/ukas-calibration-laboratory/>.

## 7 Measuring Results

Parameter	Mean of $n$ measured values	Expanded Uncertainty
Ra (nm)	100	14
Rz (nm)	375	27
Rt (nm)	398	40
Rmax (nm)	394	32

## 8 Comments

None

## 9 Certificate signed and dated

Signed . . . . . *Paul Rubert* . . . . .

Date . . . . . *14 October 2021* . . . . .

