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metrologie und akkreditierung schweiz

**Certificate of calibration****No. 113-3555***Object***1 ring gauge made of steel,  $\varnothing$  40 mm**

Identification: SIP 42919

*Order*

Calibration of diameter and roundness deviation

*Applicant***SIP, Société Genevoise d'Instruments de Physique**

19, rue Pré - de - la - Fontaine

CH-1217 Meyrin

*Traceability*

The reported measurement values are traceable to national standards and thus to internationally supported realizations of the SI-units.

*Date of calibration*

5 and 7 March 2002

*Marking*

metas-calibration label

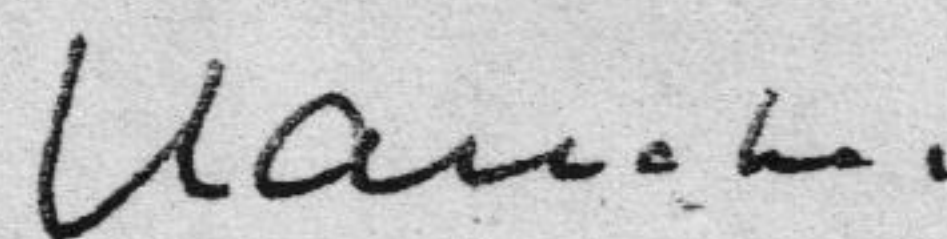
Wabern, 21 March 2002 Sp

For the measurements

Division of Mechanics, Radiation and Legal Metrology



Jürg Spiller



Dr. Bruno Vaucher, Deputy Director

**Mutual recognition**

This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

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metas

Lindenweg 50, CH-3003 Bern-Wabern

Telefon +41 31 32 33 111, Telefax +41 31 32 33 210

[www.metas.ch](http://www.metas.ch)

Bundesamt für Metrologie und Akkreditierung

Office fédéral de métrologie et d'accréditation

Ufficio federale di metrologia e di accreditamento

Swiss Federal Office of Metrology and Accreditation

Eidg. Justiz- und Polizeidepartement

Département fédéral de justice et police

Dipartimento federale di giustizia e polizia

Federal Department of Justice and Police



**Certificate of calibration****No. 113-3555****Extent of calibration**

The diameter and roundness deviation at three heights of the cylinder were measured.

**Measurement procedure and conditions**

The diameter of the ring gauge was calibrated on a length measurement machine using a laser interferometer and mechanical probing, according to the internal calibration procedure 11370K02.

Measurement probe: ruby sphere,  $\varnothing$  4 mm

Measurement force: extrapolated to zero

Measurement direction: between the reference marks, perpendicular to the cylinder axis

The roundness measurement was carried out on a form measurement machine.

Measurement probe: ruby sphere,  $\varnothing$  4 mm

Measurement force:  $< 0.05$  N

Filter: 2-50 upr, Gauss

The roundness deviation was measured according to ISO 6318. It is defined as the peak to valley deviation from the least squares (LS) circle fitted to the measured profile.

The ambient temperature during the measurements was  $(20 \pm 0.2)$  °C. The temperature of the ring gauge was 20.01 °C. The diameter results were corrected to the reference temperature of 20 °C assuming a linear coefficient of thermal expansion of  $11.5 \cdot 10^{-6}$  K<sup>-1</sup>.

**Measurement results**

Identification	Measurement position from mid height	Measured diameter	Roundness
SIP 42919	+7.0 mm	39.999'91 mm	0.05 $\mu$ m
	0	<b>39.999'83 mm</b>	<b>0.05 <math>\mu</math>m</b>
	-7.0 mm	39.999'81 mm	0.04 $\mu$ m

**Measurement uncertainty**

diameter:  $U = 0.10$   $\mu$ m

roundness:  $U = 0.10$   $\mu$ m

The reported uncertainty of measurement is stated as the combined standard uncertainty multiplied by a coverage factor  $k = 2$ . The measured value ( $y$ ) and the associated expanded uncertainty ( $U$ ) represent the interval ( $y \pm U$ ) which contains the value of the measured quantity with a probability of approximately 95%. The uncertainty was estimated following the guidelines of the ISO.

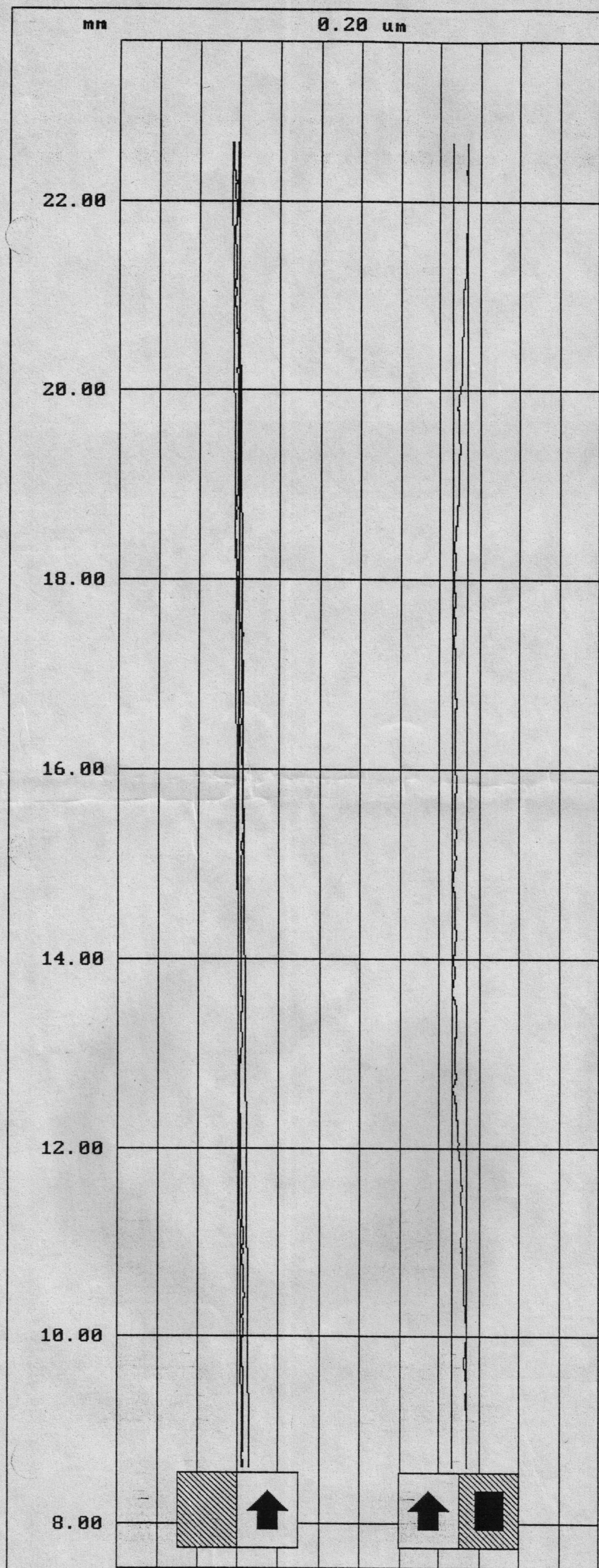
The measurement uncertainty contains contributions originating from the measurement standard, from the calibration method, from the environmental conditions and from the object being calibrated.

- Attachment: 4 form measurement protocols

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RTH TR300 V04.00 S0

metas, Bern-Wabern

MZ VERT PARALLELISM

Featurename	EAM
Measurement no.	04
Par.	0.06 um
P-U	0.03 um
Par Angle	-0.8 sec
Trav. Lth.	14.0 mm
Trav. Start	8.6 mm
Trav. End	22.6 mm
Spindle ang.	359.8 deg
Datum	EAM 03
Filter	0.80 mm
Profile	100.0 %
Meas. Mode	Vert. Up
Meas. date	
Meas. time	19:17:26

SIP

Ring gauge, SIP ; D = 40 mm

1217 Meyrin

Ident. No:42919