Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

0716

Accredited to ISO/IEC 17025:2017

Tru-Cal Metrology Ltd

Issue No: 013 **Issue date**: 18 June 2020

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Calibration performed by the Organisations at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address Unit 1 Gorton Industrial Estate Froxmer Street Gorton Manchester M18 8EF	**Local contact** Mr R Desmond	Calibration	A

Site activities performed away from the locations listed above:

Location details		Activity	Location code
At customers premises	Mr R Desmond	Dimensional	B

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DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement (CMC) Capability Expressed as an Expanded Uncertainty (k=2)	Remarks	Location Code
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
LENGTH			2. Calibrations may be given in inch units where applicable.	
Gauge blocks Inch (Steel and Tungsten Carbide)	As BS 4311:2007 0 in to 0.4 in 0.4 in to 1in 2 in 3 in 4 in	(See notes) Class C 3.0 4.0 5.0 μ in. 6.0 7.0	**Comparison** **Class C** uncertainties apply to the measurement of length of gauges by comparison with grade K standards of length of a similar material.	A
Millimetre (Steel and Tungsten Carbide)	BS EN ISO 3650:1999 0 to 10 10 in to 25 30, 40, 50 60, 70, 75 80, 90, 100	 Class C 0.080 0.10 0.12 0.15 0.18	Class C uncertainties apply to new and used grade 0, 1 and 2 gauges to BS 4311:2007 and BS EN ISO 3650:1999.	
Plain plug gauge parallel, cylindrical setting standards and rollers	1 to 50 diameter 50 to 100 100 up to 150	0.8 on diameter 1.0 1.5	By comparison to length standards using a length measuring machine	A
Plain plug gauges (taper) parallel to 1 in 8 on diameter	0 to 100 diameter	3.0 on diameter	Using a length measuring machine	A
Plain ring gauges (parallel)	2 to 50 50 to 100 100 to 150 150 to 350	0.8 1.0 1.5 4.2	By comparison to master ring gauge using a length measuring machine	A
Plain ring gauges (taper) parallel to 1 in 8 on diameter	3 to 25 diameter 25 to 100	4.0 on diameter 12	Using a length measuring machine	A
Length gauges, flat and spherical ended	0 to 575	1.0 + (8.0 x length in m)	By comparison to length standards using a length measuring machine	A
Plain gap gauges (parallel)	2 to 125 125 to 150	3.0 4.0	By comparison to length standards	A
Feeler gauges	0.025 to 1	2.0	Calibration as BS 957:2008	A

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement (CMC) Capability Expressed as an Expanded Uncertainty (*k*=2)	Remarks	Location Code
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
LENGTH (cont'd)				
Screw plug gauges (parallel) including check and setting plugs	0 to 150 diameter	4.0 on pitch diameter See Note 3	3. Single start symmetrical thread forms only. By comparison length measuring machine and thread measuring cylinders	A
Screw plug gauges (taper)	0 to 150 diameter	5.0 on pitch diameter See Note 3	By comparison to length measuring machine and thread measuring cylinders	A
Screw ring gauges (parallel)	6 to 150 diameter	5.0	By comparison length standards using a length measuring machine	A
Screw ring gauges (taper)	6 to 150 diameter	6.0	By comparison length standards using a lengthmeasuring machine	A
Screw pitch	0.2 to 8	1.5	Using length measuring machine and a pitch attachment	A
Screw flank angle	0° to 52°	5.0 minutes of arc	By optical methods	A
Screw thread adjustable caliper gauges (parallel)	1 to 100 diameter	See Note 4	4. Functional test of size using setting plugs calibrated with a CMC of 4.0 µm	A
Parallels	5 to 50 x 100 x 400	2.5 to 5.0	Calibration as BS 906:Part 1:1972	A
Vee blocks	20 to 150	4.0 to 6.0	Calibration as BS 3731:1987	A
Receiver, position and profile gauges, jigs and fixtures See note 5	Maximum dimensions 0 to 400 x 700 x 600	Minimum per co-ordinate 3.0 + (20 x length in m)	5. Features and associated parts of these gauges can be measured to the uncertainties given for equivalent items listed in this schedule.	A

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement (CMC) Capability Expressed as an Expanded Uncertainty (k=2)	Remarks	Location Code
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
ANGLE			1. The uncertainty quoted is for the departure from flatness, straightness, parallelism or squareness, ie the distance separating the two parallel planes which just enclose the surface under consideration.	
Squares				
Blade type	0 to 600	5.0 On Squareness See Note 1	Calibration as BS 939:2007	A
Block type	0 to 600	7.0	Calibration as BS 939:2007	A
Spirit levels	5 seconds of arc to 60 minutes of arc nominal sensitivity	Mean sensitivity: 10% of nominal Minimum 0.50 seconds of arc	Calibration as BS 958:1968 or BS 3509:1962	A
Electronic indicating levels	0 minutes of arc to 20 minutes of arc	1.0 % range Minimum 0.50 seconds of arc	Using a small angle generator	A
Right angle and box angle plates	50 to 600	Squareness 6.0 Parallelism 3.0 See note 1	Calibration as BS 5535:1978	A
FORM			1. The uncertainty quoted is for the departure from flatness, straightness, parallelism or squareness, ie the distance separating the two parallel planes which just enclose the surface under consideration.	
Surface plates Granite and Cast iron	160 x 100 to 1600 x 1000	1.5 + (0.80 x diagonal in m) See Note 1	Calibration as BS 817:2008	A, B

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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement (CMC) Capability Expressed as an Expanded Uncertainty (*k*=2)	Remarks	Location Code
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
MEASURING INSTRUMENTS AND MACHINES				
Micrometers				A
External	0 to 600	Heads: 2.0	Calibration as BS 870:2008	
Internal	0 to 900	Setting and extension rods	Calibration as BS 959:2008	
Depth	0 to 300	1.0 + (8.0 x length in m)	Calibration as BS 6468:2008	
Height setting micrometer	0 to 300	Heads 1.50 between any two points Stepped column 2.5 Overall Performance 3.0	By comparison to length standards	A
Riser blocks for above	150 300	3.0 5.0	By comparison to length standards using a length measuring machine	A
Vernier type gauge including dial and digital				A
Caliper,	0 to 600		Calibration as BS 887:2008	
Height	0 to 600	Overall performance 10 + (30 x length in m)	Calibration as BS 1643:2008	
Depth	0 to 600		Calibration as BS 6365:2008	
Bevel protractor	0° to 360°	6 0 minutes of arc	Calibration as BS 1685:2008	A
Dial gauges and dial test indicators	0 to 50	1.5	Calibration as BS 907:2008 or BS 2795:1981	A
Comparators (external)	250 to 10 000 magnifications	1% of range Minimum 0.20	Calibration as BS 1054:1975	A
Profile projectors	10 to 100 magnification Linear 0 to 300 Angular 0° to 360°	125 at the screen 5.0 3.0 minutes of arc	By comparison to reference scales	A, B
Electronic microprocessor controlled height gauges	0 to 1000	7.0	By comparison to length standards	A, B
END				

Appendix - Calibration and Measurement Capabilities

Introduction

The definitive statement of the accreditation status of a calibration laboratory is the Accreditation Certificate and the associated Schedule of Accreditation. This Schedule of Accreditation is a critical document, as it defines the measurement capabilities, ranges and boundaries of the calibration activities for which the organisation holds accreditation.

Calibration and Measurement Capabilities (CMCs)

The capabilities provided by accredited calibration laboratories are described by the Calibration and Measurement Capability (CMC), which expresses the lowest uncertainty of measurement that can be achieved during a calibration. If a particular device under calibration itself contributes significantly to the uncertainty (for example, if it has limited resolution or exhibits significant non-repeatability) then the uncertainty quoted on a calibration certificate will be increased to account for such factors. The CIPM-ILAC definition of the CMC is as follows:

A CMC is a calibration and measurement capability available to customers under normal conditions:
(a) as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
(b) as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement.

The CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The CMC is calculated according to the procedures given in M3003 and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published CMC in certificates issued under its accreditation.

The CMC may be described using various methods in the Schedule of Accreditation:

As a single value that is valid throughout the range.
As an explicit function of the measurand or of a parameter (see below).
As a range of values. The range is stated such that the customer can make a reasonable estimate of the likely uncertainty at any point within the range.
As a matrix or table where the CMCs depend on the values of the measurand and a further quantity.
In graphical form, providing there is sufficient resolution on each axis to obtain at least two significant figures for the CMC.

Expression of CMCs - symbols and units

In general, only units of the SI and those units recognised for use with the SI are used to express the values of quantities and of the associated CMCs. Nevertheless, other commonly used units may be used where considered appropriate for the intended audience. For example, the term "ppm" (part per million) is frequently used by manufacturers of test and measurement equipment to specify the performance of their products. Terms like this may be used in Schedules of Accreditation where they are in common use and understood by the users of such equipment, providing their use does not introduce any ambiguity in the capability that is being described.

When the CMC is expressed as an explicit function of the measurand or of a parameter, this often comprises a relative term (e.g., percentage) and an absolute term, i.e. one expressed in the same units as those of the measurand. This form of expression is used to describe the capability that can be achieved over a range of values. Some examples are shown below. It should be noted that these expressions are *not* mathematical formulae but are instead written in a commonly used shorthand for expressing uncertainties - therefore, for purposes of clarity, an indication of how they are to be interpreted is also provided below.

DC voltage, 100 mV to 1 V: 0.0025 % + 5.0 µV

Over the range 100 mV to 1 V, the CMC is 0.0025 %·V + 5.0 µV, where V is the measured voltage.

Hydraulic pressure, 0.5 MPa to 140 MPa: 0.0036 % + 0.12 ppm/MPa + 4.0 Pa

Over the range 0.5 MPa to 140 MPa, the CMC is $0.0036\ \%\cdot p + (0.12\cdot 10^{-6}\cdot p\cdot 10^{-6}) + 4.0$ Pa, where p is the measured pressure in Pa.

It should be noted that the percentage symbol (%) simply represents the number 0.01. In cases where the CMC is stated only as a percentage, this is to be interpreted as meaning percentage of the measured value or indication.

Thus, for example, a CMC of 1.5 % means $1.5 \cdot 0.01 \cdot i$, where i is the instrument indication.