Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

UKAS CALIBRATION **0783** **Accredited to ISO/IEC 17025:2017**	**Construction Testing Solutions Limited** **Trading as Calibration Testing Solutions** **Issue No:** 022 **Issue date:** 08 October 2021	
	M1 Commerce Park **Markham Lane** **Duckmanton** **Chesterfield** **S44 5HS**	**Contact: Luke Todd** **Tel: +44 (0)1246 828318** **Fax: +44 (0)1246 828319** **E-Mail: luke.todd@calibrationtesting.co.uk**
Calibration performed by the Organisation at the locations specified		

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address M1 Commerce Park Markham Lane Duckmanton Chesterfield S44 5HS	**Local contact** Luke Todd	Electrical Dimensional	P P

Site activities performed away from the locations listed above:

Location details	Activity	Location code
Customers’ sites or premises The customer’s sites or premises must be suitable for the nature of the particular calibrations undertaken and will be subject of contract review arrangements between the laboratory and the customer	MASS Weighing machines (non-automatic)	S

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DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (*k* = 2)	Remarks	Location Code
ELECTRICAL MEASUREMENTS				
DC VOLTAGE				P
Measurement	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V	4.5 part per 10^6 + 0.47 µV 3.3 part per 10^6 3.2 part per 10^6 4.8 part per 10^6 4.9 part per 10^6	Using digital multimeter with 10 MΩ input resistance.	
	10 V to 100 V 100 V to 1000 V	12 ppm 31 ppm	Using digital multimeter with 1 MΩ input resistance.	
Generation	0 mV to 330 mV 330 mV to 3.3 V 3.3 V to 33 V 33 V to 330 V 330 V to 1020 V	70 part per 10^6 + 4.0 µV 58 part per 10^6 + 6.0 µV 58 part per 10^6 + 60 µV 67 part per 10^6 65 part per 10^6	Using multifunction calibrator	
DC CURRENT				P
Measurement	0 µA to 10 µA 10 µA to 100 µA 100 µA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 20 A 10 A to 30 A	33 part per 10^6 + 20 nA 17 part per 10^6 16 part per 10^6 21 part per 10^6 78 part per 10^6 270 part per 10^6 290 part per 10^6 810 part per 10^6	Using digital multimeter	
Generation	0 mA to 3.3 mA 3.3 mA to 33 mA 33 mA to 330 mA 330 mA to 2.2 A 2.2 A to 11 A	150 part per 10^6 + 60 nA 120 part per 10^6 + 0.40 µA 120 part per 10^6 + 5.0 µA 350 part per 10^6 + 60 µA 700 part per 10^6 + 0.46 mA	Using multifunction calibrator	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL MEASUREMENTS (continued)				
DC RESISTANCE				P
Measurement	0 Ω to 1 Ω 1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	12 part per 10^6 + 26 μΩ 14 part per 10^6 11 part per 10^6 11 part per 10^6 11 part per 10^6 12 part per 10^6 14 part per 10^6 34 part per 10^6 250 part per 10^6 0.27 %	Using digital multimeter	
	0 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ 1 GΩ to 10 GΩ	20 part per 10^6 + 15 Ω 92 part per 10^6 380 part per 10^6 0.27 %	At 200 V At 200 V At 200 V At 200 V	
Generation				
Specific Values				
Decade Values	1 mΩ 10 mΩ 100 mΩ 1 Ω 10 MΩ 100 MΩ 1 GΩ 10 GΩ	75 part per 10^6 59 part per 10^6 63 part per 10^6 63 part per 10^6 1.2 % 1.3 % 2.6 % 1.0 %	Known resistance values for application to resistance measuring instruments At 100 V, 500 V and 1000 V At 100 V, 500 V and 1000 V At 100 V, 500 V and 1000 V At 100 V and 500 V	
Decade and non-decade values	10 MΩ 20 MΩ 30 MΩ 40 MΩ 50 MΩ 60 MΩ 70 MΩ 80 MΩ 90 MΩ 100 MΩ 110 MΩ	23 part per 10^6 46 part per 10^6 69 part per 10^6 92 part per 10^6 120 part per 10^6 140 part per 10^6 160 part per 10^6 190 part per 10^6 210 part per 10^6 230 part per 10^6 250 part per 10^6	Known resistance values for application to resistance measuring instruments	
Other values	1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ	580 part per 10^6 120 part per 10^6 120 part per 10^6 120 part per 10^6 120 part per 10^6 150 part per 10^6	Known resistance values for application to resistance measuring instruments	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL MEASUREMENTS (continued)				
AC VOLTAGE				P
Measurement	10 mV to 100 mV		Using digital multimeter	
	10 Hz to 10 kHz	150 part per 10^6		
	10 kHz to 30 kHz	270 part per 10^6		
	30 kHz to 100 kHz	620 part per 10^6		
	100 kHz to 300 kHz	0.25 %		
	300 kHz to 1 MHz	1.3 %		
	100 mV to 1 V			
	10 Hz to 10 kHz	140 part per 10^6		
	10 kHz to 30 kHz	270 part per 10^6		
	30 kHz to 100 kHz	620 part per 10^6		
	100 kHz to 300 kHz	0.25 %		
	300 kHz to 1 MHz	1.2 %		
	1 V to 10 V			
	10 Hz to 10 kHz	140 part per 10^6		
	10 kHz to 30 kHz	270 part per 10^6		
	30 kHz to 100 kHz	620 part per 10^6		
	100 kHz to 300 kHz	0.25 %		
	300 kHz to 1 MHz	1.2 %		
	10 V to 100 V			
	20 Hz to 10 kHz	130 part per 10^6		
	10 kHz to 30 kHz	270 part per 10^6		
	30 kHz to 100 kHz	680 part per 10^6		
	100 V to 1000 V			
	40 Hz to 10 kHz	130 part per 10^6		
	10 kHz to 30 kHz	270 part per 10^6		
Generation	1 mV to 330 mV		Using multifunction calibrator	
	45 Hz to 10 kHz	0.10 %		
	10 kHz to 50 kHz	0.21 %		
	330 mV to 3.3 V			
	45 Hz to 10 kHz	0.036 %		
	10 kHz to 50 kHz	0.039 %		
	3.3 V to 33 V			
	45 Hz to 10 kHz	0.046 %		
	10 kHz to 50 kHz	0.22 %		
	33 V to 330 V			
	45 Hz to 20 kHz	0.10 %		
	330 V to 1100 V			
	45 Hz to 1 kHz	0.058 %		
	1 kHz to 20 kHz	0.23 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (*k* = 2)	Remarks	Location Code
ELECTRICAL MEASUREMENTS (continued)				
AC CURRENT				P
Measurement	1μA to 10 μA *10 Hz to 10 kHz*	 0.24 % + 4.0 nA	Using digital multimeter	
	10 μA to 100 μA *10 Hz to 2 kHz* *2 kHz to 10 kHz* *10 kHz to 30 kHz*	 340 part per 10^6 620 part per 10^6 870 part per 10^6		
	100 μA to 1 mA *10 Hz to 2 kHz* *2 kHz to 10 kHz* *10 kHz to 30 kHz*	 330 part per 10^6 620 part per 10^6 860 part per 10^6		
	1 mA to 10 mA *10 Hz to 2 kHz* *2 kHz to 10 kHz* *10 kHz to 30 kHz*	 330 part per 10^6 620 part per 10^6 860 part per 10^6		
	10 mA to 100 mA *10 Hz to 2 kHz* *2 kHz to 10 kHz* *10 kHz to 30 kHz*	 330 part per 10^6 610 part per 10^6 860 part per 10^6		
	100 mA to 1 A *10 Hz to 2 kHz* *2 kHz to 10 kHz*	 370 part per 10^6 650 part per 10^6		
	1 A to 10 A *10 Hz to 10 kHz*	 980 part per 10^6		
	10 A to 30 A *10 Hz to 1 kHz*	 0.11 %		
Generation	30 μA to 3.3 mA *10 Hz to 5 kHz*	 0.23 %	Using multifunction calibrator	
	3.3 mA to 33 mA *10 Hz to 5 kHz*	 0.23 %		
	33 mA to 330 mA *10 Hz to 5 kHz*	 0.23 %		
	330 mA to 2.2 A *10 Hz to 1 kHz* *1 kHz to 5 kHz*	 0.23 % 0.87 %		
	2.2 A to 11 A *45 Hz to 500 Hz* *500 Hz to 1 kHz*	 0.12 % 0.38 %		

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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL TEMPERATURE SIMULATION				P
Temperature Indicators and Simulators (t/c Types) calibration by Electrical Simulation				
Base Metal Thermocouples	Type K -200°C to -100°C Type K -100°C to -25°C Type K -25°C to +120°C Type K 120°C to 1000°C Type K 1000°C to 1372°C	0.40 °C 0.24 °C 0.22 °C 0.32 °C 0.48 °C	Including Cold Junction Compensation	
	Type J -210°C to -100°C Type J -100°C to -30°C Type J -30°C to +150°C Type J 150°C to 760°C Type J 760°C to 1200°C	0.33 °C 0.22 °C 0.20 °C 0.23 °C 0.29 °C	Including Cold Junction Compensation	
	Type N -200°C to -100°C Type N -100°C to -25°C Type N -25°C to +120°C Type N 120°C to 410°C Type N 410°C to 1300°C	0.14 °C 0.12 °C 0.11 °C 0.11 °C 0.11 °C	Including Cold Junction Compensation	
	Type T -250°C to -150°C Type T -150°C to 0°C Type T 0°C to 120°C Type T 120°C to 400°C	0.74 °C 0.30 °C 0.22 °C 0.20 °C	Including Cold Junction Compensation	
Nobel Metal Thermocouples	Type B 600°C to 800°C Type B 800°C to 1000°C Type B 1000°C to 1550°C Type B 1550°C to 1820°C	0.59 °C 0.23 °C 0.21 °C 0.22 °C	Including Cold Junction Compensation	
	Type R 0°C to 250°C Type R 250°C to 400°C Type R 400°C to 1000°C Type R 1000°C to 1767°C	0.68 °C 0.42 °C 0.40 °C 0.48 °C	Including Cold Junction Compensation	
	Type S 0°C to 250°C Type S 250°C to 1000°C Type S 1000°C to 1400°C Type S 1400°C to 1767°C	0.56 °C 0.44 °C 0.44 °C 0.55 °C	Including Cold Junction Compensation	
	Type E -250°C to -100°C Type E -100°C to -25°C Type E -25°C to +350°C Type E 350°C to 650°C Type E 650°C to 1000°C	0.59 °C 0.22 °C 0.20 °C 0.22 °C 0.70 °C	Including Cold Junction Compensation	

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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL TEMPERATURE SIMULATION (continued)				P
Cold Junction Compensation	At ambient temperature of 21 °C ± 3 °C	0.20 °C		
Temperature Indicators and Simulators (PT100 Types) calibration by Electrical Simulation				
PT 100 Indicators	-200°C to 0°C 0°C to 100°C 100°C to 300°C 300°C to 400°C 400°C to 630°C 630°C to 800°C	0.077 °C 0.095 °C 0.12 °C 0.13 °C 0.15 °C 0.27 °C		
PT 100 Simulators	-200 °C to 0 °C 0 °C to 560 °C 560 °C to 850 °C	0.053 °C 0.050 °C 0.072 °C		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (*k* = 2)	Remarks	Location Code
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				

DIMENSIONAL MEASUREMENTS

NOTES
In addition to these items, other similar items, including parts of measuring instruments and machines, may be calibrated in accordance with the stated best measurement uncertainty capability. Where the item or part calibrated is of lower quality due to wear, errors in geometry or form, or poor surface texture, or where any other factor adversely affects the measurement capability, greater uncertainties may be quoted.

All linear calibrations may be given in inch units.

Measured Quantity Instrument or Gauge	Range	CMC	Remarks	Location Code
LENGTH				P
Plain plug gauges (parallel)	1 to 50 diameter 50 to 100 diameter 100 to 200 diameter	1.0 on diameter 1.0 on diameter 1.5 on diameter	Comparison to end standards using a length measuring machine	
Plain ring gauges (parallel)	2 to 10 diameter 10 to 50 diameter 50 to 100 diameter 100 to 200 diameter	2.0 on diameter 2.0 on diameter 2.0 on diameter 2.4 on diameter	Comparison to master setting rings using a length measuring machine	
Length gauge, flat and spherical ended (excluding length bars)	0 to 1200	1.0 + (8.0 x length in m)	Comparison to end standards	
Plain gap gauges (parallel)	2 to 100 100 to 200 200 to 300	3.0 5.0 8.0	BS 969:2008 Comparison to end standards	
Feeler gauges	0.020 to 1	2.0	BS 957:2008 Comparison to end standards using a length measuring machine	
Paint thickness setting foils	0.020 to 1	2.0	Comparison to end standards using a length measuring machine	
Parallels	up to 5 to 50 x 100 x 400	Dependent on size and grade From 2.0 to 5.0	BS 906:Part 1:1972 Comparison to datum surfaces and end standards	
Rule – steel	0 to 1000 1000 to 2000	5.0 + (50 x length in m) 10 + (50 x length in m)	BS 4372:1968 Using a length measuring machine with microscope	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
DIMENSIONAL MEASUREMENTS (continued)				P
Thread measuring cylinders	0.1 to 5	0.5	As BS 3777, BS 5590 and specials. Comparison to end standards using a length measuring machine	
Screw plug gauges (parallel) including check and setting plugs	1 to 100 diameter 100 to 200 diameter	3.0 5.0	Single start symmetrical thread gauges only Comparison to cylindrical setting standards and thread measuring cylinders using a length measuring machine	
Screw ring gauges (parallel)	3 to 100 diameter 100 to 150 diameter	4.0 6.0	Single start symmetrical thread gauges only Comparison to master setting ring using a length measuring machine and T-shape ball probe method	
Screw pitch	0.2 to 8	1.5	Using a length measuring machine and pitch attachment	
Screw flank angle	0° to 52°	5.0 minutes of arc	Mechanical and optical comparison	
ANGLE NOTE The best measurement uncertainty capabilities are for the departure from flatness, straightness, or squareness, i.e. the distance separating the two parallel planes which just enclose the surface under consideration.				P
Squares Blade type	50 to 300 300 to 600	3.0 On squareness 5.0 On squareness	BS 939:2007 Comparison to cylindrical square and datum surfaces	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (*k* = 2)	Remarks	Location Code
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
DIMENSIONAL MEASUREMENTS (continued)				
MEASURING INSTRUMENTS AND MACHINES				P
Micrometers			Comparison to end standards and optical parallels	
External	0 to 1000	Heads 2.0 between any two points	As BS 870:2008 (and above)	
Internal	0 to 900	Setting and extension rods	As BS 959:2008	
Depth	0 to 300	1.0 + (8.0 x length in m)	As BS 6468:2008	
Vernier, dial and digital gauges			Comparison to end standards	
Calliper	0 to 1200	Overall performance 10 + (30 x length in m)	BS 887:2008 (and above)	
Height	0 to 1000	Overall performance 10 + (30 x length in m)	BS 1643:2008	
Depth	0 to 600	Overall performance 10 + (30 x length in m)	BS 6365:2008	
Dial gauges and dial test indicators	0 to 50	1.0	BS 907:2008 and BS 2795:1981 Comparison to length measuring machine and end standards	
Electronic indicators				
Lever type	0 to 5	1.0	Comparison to length measuring machine and end standards	
Linear type	0 to 50	0.7	Comparison to length measuring machine and end standards	

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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
MASS				
NON-AUTOMATIC WEIGHING MACHINES Digital	200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 50 kg 100 kg	0.031 mg 0.038 mg 0.046 mg 0.061 mg 0.077 mg 0.09 mg 0.12 mg 0.16 mg 0.27 mg 0.54 mg 1.4 mg 2.7 mg 15.0 mg 39 mg 0.76 g 1.5 g 3.8 g 7.7 g	Note 1 Weights are available in OIML class: E2 1 mg to 2 kg. max grouped load 11 kg. F1 1 kg to 5 kg. Max grouped load 8 kg. M1 5 kg to 10 kg. Max grouped load 100 kg Note 2. Other loads within the overall listed range may also be used. Note 3.Method based on the requirements of Euramet guide cg-18	S
END				

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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.

<u>DC voltage, 100 mV to 1 V</u>: 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.

<u>Hydraulic pressure, 0.5 MPa to 140 MPa</u>: 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.