Schedule of Accreditation
issued by
United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

0783

Accredited to ISO/IEC 17025:2005

CET Structures Ltd. trading as CET Calibration

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Calibration performed at the above address only

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (*k* = 2)	Remarks
ELECTRICAL MEASUREMENTS			
DC VOLTAGE			
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	12 ppm + 0.9 µV 9.0 ppm 10 ppm 13 ppm 13 ppm	
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 ppm + 4.0 µV 58 ppm + 6.0 µV 58 ppm + 60 µV 67 ppm 65 ppm	
DC CURRENT			
Measurement	0 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	160 ppm + 24 nA 190 ppm 190 ppm 190 ppm 300 ppm 65 ppm	
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 ppm + 60 nA 120 ppm + 0.40 µA 120 ppm + 5.0 µA 350 ppm + 60 µA 700 ppm + 0.46 mA	

Calibration performed at main address only

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (*k* = 2)	Remarks
ELECTRICAL MEASUREMENTS (continued)			
DC RESISTANCE			
Measurement	0 Ω to 10 Ω	18 ppm + 180 μΩ	
	10 Ω to 100 Ω	16 ppm	
	100 Ω to 1 kΩ	14 ppm	
	1 kΩ to 10 kΩ	13 ppm	
	10 kΩ to 100 kΩ	14 ppm	
	100 kΩ to 1 MΩ	20 ppm	
	1 MΩ to 10 MΩ	43 ppm	
	10 MΩ to 100 MΩ	450 ppm	
	100 MΩ to 1 GΩ	2.1 %	
Generation			
Specific Values			
Decade Values	1 mΩ	75 ppm	
	10 mΩ	59 ppm	
	100 mΩ	63 ppm	
	1 Ω	63 ppm	
	10 MΩ	1.2 %	At 100 V, 500 V and 1000 V
	100 MΩ	1.3 %	At 100 V, 500 V and 1000 V
	1 GΩ	2.6 %	At 100 V, 500 V and 1000 V
	10 GΩ	1.0 %	At 100 V and 500 V
	100 GΩ	1.2 %	At 100 V and 500 V
	1 TΩ	1.7 %	At 100 V and 500 V
Decade and non-decade values	10 MΩ	23 ppm	
	20 MΩ	46 ppm	
	30 MΩ	69 ppm	
	40 MΩ	92 ppm	
	50 MΩ	120 ppm	
	60 MΩ	140 ppm	
	70 MΩ	160 ppm	
	80 MΩ	190 ppm	
	90 MΩ	210 ppm	
	100 MΩ	230 ppm	
	110 MΩ	250 ppm	
Other values	1 Ω to 10 Ω	580 ppm	
	10 Ω to 100 Ω	120 ppm	
	100 Ω to 1 kΩ	120 ppm	
	1 kΩ to 10 kΩ	120 ppm	
	10 kΩ to 100 kΩ	120 ppm	
	100 kΩ to 1 MΩ	150 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
ELECTRICAL MEASUREMENTS (continued)			
AC VOLTAGE			
Measurement	2 mV to 100 mV		
	20 Hz to 10 kHz	61 ppm + 16 µV	
	10 kHz to 30 kHz	67 ppm + 27 µV	
	30 kHz to 100 kHz	67 ppm + 61 µV	
	100 mV to 1 V		
	20 Hz to 10 kHz	170 ppm	
	10 kHz to 30 kHz	280 ppm	
	30 kHz to 100 kHz	710 ppm	
	100 kHz to 300 kHz	0.47 %	
	300 kHz to 1 MHz	2.3 %	
	1 V to 10 V		
	20 Hz to 10 kHz	170 ppm	
	10 kHz to 30 kHz	280 ppm	
	30 kHz to 100 kHz	710 ppm	
	100 kHz to 300 kHz	0.47 %	
	300 kHz to 1 MHz	2.3 %	
	10 V to 100 V		
	20 Hz to 10 kHz	170 ppm	
	10 kHz to 30 kHz	280 ppm	
	30 kHz to 100 kHz	710 ppm	
	100 V to 500 V		
	50 Hz to 10 kHz	160 ppm	
	10 kHz to 30 kHz	280 ppm	
	500 V to 1000 V		
	50 Hz to 10 kHz	210 ppm	
	10 kHz to 30 kHz	310 ppm	
Generation	1 mV to 330 mV		
	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
ELECTRICAL MEASUREMENTS (continued)			
AC CURRENT			
Measurement	2 μA to 100 μA *50 Hz to 5 kHz*	630 ppm + 0.13 μA	
	100 μA to 1 mA *50 Hz to 5 kHz*	640 ppm	
	1 mA to 10 mA *50 Hz to 5 kHz*	610 ppm	
	10 mA to 100 mA *50 Hz to 5 kHz*	610 ppm	
	100 mA to 1 A *50 Hz to 1 kHz* *1 kHz to 5 kHz*	 0.12 % 0.35 %	
	1 A to 20 A 50 Hz to 5 kHz	0.10 %	
Generation	30 μA to 3.3 mA *10 Hz to 5 kHz*	0.23 %	
	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%	

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

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
ELECTRICAL TEMPERATURE SIMULATION (continued)			
Cold Junction Compensation	At ambient temperature of 23°C ± 2°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 0.120°C 0.130°C 0.150°C 0.270°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
DIMENSIONAL MEASUREMENTS			
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED			
LENGTH			NOTES
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	In addition to these items, other similar items, including parts of measuring instruments and machines, may be calibrated in accordance with the stated CMCs. 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.
Plain ring gauges (parallel)	2 to 10 diameter 10 to 50 diameter 50 to 100 diameter 100 to 200 diameter	1.5 on diameter 1.5 on diameter 2.0 on diameter 2.4 on diameter	
Length gauge, flat and spherical ended (excluding length bars)	0 to 1200	1.0 + (8.0 x length in m)	
Plain gap gauges (parallel)	BS 969:2008 2 to 100 100 to 200 200 to 300	 3.0 5.0 8.0	
Feeler gauges	BS 957:2008 0.020 to 1	 2.0	
Paint thickness setting foils	0.020 to 1	2.0	
Parallels	BS 906:Part 1:1972 up to 5 to 50 x 100 x 400	Dependent on size and grade From 2.0 to 5.0	
Rule – steel	BS 4372:1968 0 to 1000 1000 to 2000	 5.0 + (50 x length in m) 10 + (50 x length in m)	
ANGLE			
Squares			
Blade type	BS 939:2007 50 to 300 300 to 600	 3.0 5.0 On squareness	The CMCs 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.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (*k* = 2)	Remarks
DIMENSIONAL MEASUREMENTS (continued)			
Right angle and box angle plates	BS 5535:1978 50 to 600	Squareness: 3.0 + (1.0 per 100 mm) Parallelism 1.0 + (1.0 per 100 mm)	The CMCs 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.
Bevel protractors	BS 1685:2008 0° to 360°	7.5 min of arc	
MEASURING INSTRUMENTS AND MACHINES			
Micrometers External	As BS 870:2008 (and above) 0 to 1000	Heads: 2.0	
Internal	As BS 959:2008 0 to 900	Setting and extension rods 1.0 + (8.0 x length in m)	
Depth	As BS 6468:2008 0 to 300		
Vernier caliper, height and depth gauges	BS 887:2008 (and above) 0 to 1200 BS 1643:2008 0 to 1000 BS 6365:2008 0 to 600	Overall performance 10 + (30 x length in m)	
Dial gauges and dial test indicators	BS 907:2008 and BS 2795:1981 0 to 50	1.0	
Electronic indicators	0 to 5	Lever type 1.0	
	0 to 50	Linear type 0.7	

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, and an indication of how they are to be interpreted, are shown 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 %$\cdot V$ + 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 %$\cdot p$ + $(0.12\cdot10^{-6}\cdot p\cdot10^{-6})$ + 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.

END