Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0054

Accredited to ISO/IEC 17025:2017

ITW Ltd trading as Avery Weigh-Tronix (Calibration Select Laboratory)

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Calibration Select **Foundry Lane** **Smethwick** **West Midlands** **B66 2LP**	**Contact: Mr A Fox** **Tel: +44 (0) 845 900 2244** **E-Mail: AFox@awtx-itw.com** **Website: www.calibrationselect.co.uk**

Calibration performed at the above address only

Electrical Calibration Electrical	Force Calibration Force	Pressure Calibration Pressure
Contact: Mr T Bates **Tel: +44 (0) 845 900 2244** **E-Mail: TBates@awtx-itw.com** **Website:** **calibrationselect.co.uk/calibration/electrical**	**Contact: Mr M Moran** **Tel: +44 (0) 121 568 1407** **Fax: +44 (0) 121 697 5407** **E-Mail: MMoran@awtx-itw.com** **Website:** **calibrationselect.co.uk/calibration/force**	**Contact: Mr T Bates** **Tel: +44 (0) 845 900 2244** **E-Mail: TBates@awtx-itw.com** **Website:** **calibrationselect.co.uk/calibration/pressure**
Temperature Calibration **Temperature**	**Torque Calibration** **Torque**	
Contact: Mr T Bates **Tel: +44 (0) 845 900 2244** **E-Mail: TBates@awtx-itw.com** **Website:** **calibrationselect.co.uk/calibration/temperature**	**Contact: Mr T Bates** **Tel: +44 (0) 845 900 2244** **E-Mail: TBates@awtx-itw.com** **Website:** **calibrationselect.co.uk/calibration/torque**	

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
FORCE			Calibrations can be performed in accordance with BS EN ISO 376:2011 and ASTM E74-18e1
Proving devices, load cells and other force-measuring devices in compression and tension modes	Machine No. 1		
	0.04 kN to 5 kN	0.0092 %	
	5 kN to 11 kN	0.0054 %	
	Machine No. 2		
	5.5 kN to 20 kN	0.0081 %	
	20 kN to 500 kN	0.0050 %	
Proving devices, load cells and other force-measuring devices in compression mode	Machine No. 3		
	2.2 N to 356 N	0.0050 %	
TEMPERATURE			
Temperature Indicators And probes	-45 °C to +140°C	0.15 °C	Calibration with a dry well source.
	140 °C to 650 °C	0.25 °C	
	Ice point (0 °C)	0.05 °C	
TORQUE			
Hand Torque Tools (Excluding torque screwdrivers)	BS EN ISO 6789-2:2017		
	0.3 N·m to 2500 N·m	1.0 %	Calibration results may also be given in units of lbf·in and lbf·ft. The uncertainty quoted is for both the application of the calibration torque and the characteristics of the device being calibrated.
	BS EN ISO 6789:2003 (Withdrawn)		
	0.3 N·m to 2500 N·m	1.5 %	
PRESSURE			Methods consistent with EURAMET CG17
Gas Pressure (Gauge) Calibration of pressure indicating instruments and gauges	-95 kPa to 0 Pa	40 Pa	Calibration of instruments with an electrical output may be undertaken
	0 Pa to 700 kPa	210 Pa	
	700 kPa to 2 MPa	340 Pa	
	2 MPa to 3.4 MPa	620 Pa	
	3.4 MPa to 6.9 MPa	2.1 kPa	
	6.9 MPa to 21 MPa	4.1 kPa	
Hydraulic Pressure (Gauge) Calibration of pressure indicating instruments and gauges.	0 MPa to 21 MPa	4.1 kPa	Absolute pressure calibration can be undertaken using gauge pressure ranges plus the ambient pressure with an additional uncertainty of 84 Pa
	21 MPa to 34 MPa	6.9 kPa	
	34 MPa to 138 MPa	59 kPa	
	138 MPa to 276 MPa	103 kPa	
	276 MPa to 414 MPa	200 kPa	

ELECTRICAL MEASUREMENTS: All values and uncertainties listed below are applicable for the calibration of both measurement instruments and for instruments with an output. the method used is by direct comparison unless otherwise stated in the remarks column.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RESISTANCE			
	0 Ω to 1 Ω	140 µΩ	
	1 Ω to 10 Ω	96 ppm + 30 µΩ	
	10 Ω to 30 Ω	110 ppm + 30 µΩ	
	30 Ω to 100 Ω	38 ppm	
	100 Ω to 300 Ω	40 ppm	
	300 Ω to 1 kΩ	34 ppm	
	1 kΩ to 3 kΩ	40 ppm	
	3 kΩ to 10 kΩ	39 ppm	
	10 kΩ to 30 kΩ	41 ppm	
	30 kΩ to 100 kΩ	40 ppm	
	100 kΩ to 300 kΩ	45 ppm	
	300 kΩ to 1 MΩ	80 ppm	
	1 MΩ to 3 MΩ	120 ppm	
	3 MΩ to 10 MΩ	260 ppm	
	10 MΩ to 30 MΩ	360 ppm	
	30 MΩ to 100 MΩ	670 ppm	
	100 MΩ to 300 MΩ	0.36 %	
	300 MΩ to 1 GΩ	1.8 %	
DC VOLTAGE			DC VOLTAGE
	0 V to 300 mV	32 ppm + 6.0 µV	
	300 mV to 3 V	23 ppm + 12 µV	
	3 V to 30 V	26 ppm + 120 µV	
	30 V to 300 V	35 ppm + 1.2 mV	
	300 V to 1.1 kV	32 ppm + 6.0 mV	
DC CURRENT			DC CURRENT
	0 A to 300 µA	200 ppm + 5.0 nA	
	300 µA to 3 mA	130 ppm	
	3 mA to 30 mA	140 ppm	
	30 mA to 300 mA	140 ppm	
	300 mA to 1 A	280 ppm	
	1 A to 3 A	530 ppm	
	3 A to 11 A	690 ppm	
	11 A to 20 A	0.15 %	

ELECTRICAL MEASUREMENTS: All values and uncertainties listed below are applicable for the calibration of both measurement instruments and for instruments with an output. the method used is by direct comparison unless otherwise stated in the remarks column.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC CURRENT HALL EFFECT			Using multi turn current coil for the calibration of current clamp meters.
	10 A to 100 A	0.16 %	
	100 A to 550 A	0.20 %	
	550 A to 1 kA	0.24 %	
AC VOLTAGE			AC VOLTAGE
	50 µV to 300 mV		
	45 Hz to 1 kHz	200 ppm + 37 µV	
	1 kHz to 10 kHz	210 ppm + 26 µV	
	300 mV to 3 V		
	45 Hz to 1 kHz	190 ppm + 140 µV	
	1 kHz to 10 kHz	200 ppm + 120 µV	
	3 V to 30 V		
	45 Hz to 1 kHz	240 ppm + 1.4 mV	
	1 kHz to 10 kHz	230 ppm + 1.2 mV	
	30 V to 300 V		
	45 Hz to 1 kHz	320 ppm + 14 mV	
	1 kHz to 10 kHz	330 ppm + 12 mV	
	300 V to 1.1 kV		
	45 Hz to 1 kHz	430 ppm + 71 mV	
	1 kHz to 10 kHz	430 ppm + 59 mV	
AC CURRENT			
	1 µA to 300 µA		
	45 Hz to 1 kHz	0.17 % + 24 nA	
	1 kHz to 5 kHz	0.41 % + 40 nA	
	300 µA to 3 mA		
	45 Hz to 1 kHz	0.12 % + 240 nA	
	1 kHz to 5 kHz	0.24 % + 240 nA	
	3 mA to 30 mA		
	45 Hz to 1 kHz	0.064 % + 2.4 µA	
	1 kHz to 5 kHz	0.10 % + 2.4 µA	
	30 mA to 300 mA		
	45 Hz to 1 kHz	0.52 % + 24 µA	
	1 kHz to 5 kHz	0.12 % + 24 µA	
	300 mA to 3 A		
	45 Hz to 1 kHz	0.088 % + 240 µA	
	1 kHz to 5 kHz	0.75 % + 370 µA	

ELECTRICAL MEASUREMENTS: All values and uncertainties listed below are applicable for the calibration of both measurement instruments and for instruments with an output. the method used is by direct comparison unless otherwise stated in the remarks column.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC CURRENT	3 A to 11 A		
	45 Hz to 1 kHz	0.15 %	
	1 kHz to 5 kHz	5.1 %	
	11 A to 20 A		
	45 Hz to 1 kHz	0.22 %	
	1 kHz to 5 kHz	5.3 %	
	3 A to 11 A		
	45 Hz to 1 kHz	0.15 %	
	1 kHz to 5 kHz	5.1 %	
	11 A to 20 A		
	45 Hz to 1 kHz	0.22 %	
	1 kHz to 5 kHz	5.3 %	
AC CURRENT HALL EFFECT			Using multi turn current coil for the calibration of current clamp meters
	10 A to 100 A		
	45 Hz to 400 Hz	0.25 %	
	100 A to 1000 A		
	45 Hz to 65 Hz	0.25 %	
FREQUENCY			
	10 mHz to 120 Hz	1.5 mHz	
	120 Hz to 1.2 kHz	100 mHz	
	1.2 kHz to 12 kHz	150 mHz	
	12 kHz to 120 kHz	1.5 Hz	
	120 kHz to 2 MHz	20 Hz	
CAPACITANCE			These are simulated values for the calibration of hand held type capacitance meters.
	0.19 nF to 0.4 nF	1.2 pF	
	0.4 nF to 1.1 nF	2.8 pF	
	1.1 nF to 11 nF	18 pF	
	11 nF to 110 nF	0.15 nF	
	0.11 µF to 1.1 µF	1.5 nF	
	1.1 µF to 11 µF	19 nF	
	11 µF to 110 µF	0.19 µF	
	0.11 mF to 1.1 mF	1.9 µF	
	1.1 mF to 11 mF	16 µF	
	11 mF to 110 mF	150 µF	

ELECTRICAL MEASUREMENTS: All values and uncertainties listed below are applicable for the calibration of both measurement instruments and for instruments with an output. the method used is by direct comparison unless otherwise stated in the remarks column.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
ELECTRICAL SIMULATION OF TEMPERATURE			For calibrators and displays.
PT 100 SIMULATION	-200 °C to 0 °C 0 °C to 850 °C	0.17 °C 0.12 °C	
THERMOCOUPLE SIMULATION			
Base metal thermocouples	-200 °C to 1600 °C	0.20 °C	Excluding reference junction compenstation
Noble metal thermocouples	-200 °C to 1760 °C	0.70 °C	
Base metal thermocouples	-200 °C to 1600 °C	0.40 °C	Including reference junction compenstation
Noble metal thermocouples	-200 °C to 1760 °C	1.1 °C	
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 %·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.