Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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0690

Accredited to ISO/IEC 17025:2017

Airflow Measurements Ltd

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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
AIR VELOCITY			
Calibration of Anemometers and Pitot Tubes by comparison	0.1 m/s to 1 m/s 1 m/s to 2 m/s 2 m/s to 10 m/s 10 m/s to 50 m/s	0.25 % + 0.15 m/s 0.25 % + 0.17 m/s 0.25 % + 0.20 m/s 0.25 % + 0.25 m/s	Usable wind tunnel diameter 100 mm. Calibrations by comparison with a master instrument within a characterised airstream. CMC above 30 m/s may. increase for UUT > 3" diameter
PRESSURE			Methods consistent with EURAMET CG17.
<u>Gas pressure (absolute)</u>			
Calibration of pressure indicating instruments and gauges	3.5 kPa to 131 kPa	0.0050 % + 10 Pa	NOTE: Absolute pressure calibration can be carried out using associated barometric pressure measurement. The uncertainty values given below will be increased by 11 Pa.
<u>Gas pressure (gauge)</u>			
Calibration of pressure indicating instruments and gauges	-95 kPa to 0 Pa 0 Pa to 2.5 kPa 2.5 kPa to 3.5 kPa 3.5 kPa to 200 kPa 200 kPa to 500 kPa 500 kPa to 4 MPa	50 Pa 0.050 % + 0.50 Pa 0.050 % + 1 Pa 0.010 % + 0.09 Pa 0.0050 % + 150 Pa 3 kPa	Calibration of devices with an electrical output may be undertaken
<u>Hydraulic pressure (gauge)</u>			
Calibration of pressure indicating instruments and gauges	0.7 MPa to 28 MPa	0.020 % + 1.7 kPa	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
ELECTRICAL CALIBRATION: Electrical values and uncertainties listed below are applicable for the calibration of both measuring instruments and for instruments with an output. The method used is by direct comparison against laboratory standards unless otherwise stated in the remarks column.			
DC VOLTAGE			
	0 V to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV	0.0050 % + 5.0 µV 0.010 % + 25 µV 0.0010 % + 250 µV 0.0025 % + 5.0 mV 0.0020 % + 4.0 mV	Direct measurement capability suitable for calibrating the outputs of devices submitted for calibration.
	0 V to 100 mV 100 mV to 1 V 1 V to 20 V 20 V to 200 V 200 V to 1 kV	0.0020 % + 5.0 µV 0.0010 % + 15 µV 0.0010 % + 120 µV 0.0010 % + 7.0 mV 0.0010 % + 24 mV	These are source values available for the calibration of measuring equipment.
DC RESISTANCE			
	0 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 2 kΩ 2 kΩ to 20 kΩ 20 kΩ to 200 kΩ 200 kΩ to 2 MΩ 2 MΩ to 20 MΩ	0.0050 % + 5.0 mΩ 0.0020 % + 5.0 mΩ 0.0020 % + 10 mΩ 0.0050 % + 100 mΩ 0.0010 % + 5.0 Ω 0.010 % + 15 Ω 0.050 % + 100 Ω	Direct measurement capability suitable for calibrating the outputs of devices submitted for calibration.
	100 µΩ 1 mΩ 5 mΩ 10 mΩ 100 mΩ 1 Ω	0.10 µΩ 0.31 µΩ 1.3 µΩ 1.0 µΩ 20 µΩ 430 µΩ	These are source values available for the calibration of measuring equipment using standard resistors
	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	0.016 % 0.0051 % 0.0027 % 0.0020 % 0.0020 % 0.016 % 0.0031 % 0.022 % 0.062 %	These are source values available for the calibration of measuring equipment using multi-function calibrator
DC CURRENT			
	0 A to 200 µA 200 µA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 1 A	0.010 % + 0.5 µA 0.010 % + 1.0 µA 0.0050 % + 2.0 µA 0.0050 % + 1.0 µA 0.0050 % + 500 µA	Direct measurement capability suitable for calibrating the outputs of devices submitted for calibration.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC CURRENT (continued)			
	0 A to 200 µA	0.0020 % + 25 nA	These are source values available for the calibration of measuring equipment.
	200 µA to 2 mA	0.0020 % + 100 nA	
	2 mA to 20 mA	0.0010 % + 5.0 µA	
	20 mA to 200 mA	0.0010 % + 10 µA	
	200 mA to 2 A	0.0050 % + 40 µA	
	2 A to 20 A	0.010 % + 600 µA	
	10 A to 100 A	0.080 % + 1.0 mA	For calibration of current clamps using a muilti turn coil.
	100 A to 1000 A	0.080 % + 1.0 mA	
AC VOLTAGE			
	45 Hz to 5 kHz:		
	5 mV to 200 mV	0.010 % + 200 µV	Direct measurement capability suitable for calibrating the outputs of devices submitted for calibration.
	200 mV to 2 V	0.020 % + 500 µV	
	2 V to 20 V	0.020 % + 5.0 mV	
	20 V to 200 V	0.010 % + 35 mV	
	200 V to 1000 V	0.075 % + 300 mV	
	45 Hz to 5 kHz:		
	1 mV to 200 mV	0.0050 % + 70 µV	These are source values available for the calibration of measuring equipment.
	200 mV to 2 V	0.010 % + 820 µV	
	10 V to 20 V	0.010 % + 12 mV	
	20 V to 200 V	0.010 % + 120 mV	
	200 V to 1000 V	0.010 % + 450 mV	
AC RESISTANCE	*At 50 Hz:*		Calibration of loop impedance meters.
	0 Ω to 0.3 Ω	0.10 % + 20 mΩ	
	0.3 Ω to 10 Ω	0.10 % + 25 mΩ	
	10 Ω to 100 Ω	0.20 % + 200 mΩ	
	100 Ω to 1 kΩ	0.30 % + 250 mΩ	
AC CURRENT			
	45 Hz to 5 kHz:		
	25 µA to 200 µA	0.35 % + 12 µA	Direct measurement capability suitable for calibrating the outputs of devices submitted for calibration.
	200 µA to 2 mA	0.35 % + 20 µA	
	2 mA to 20 mA	0.35 % + 30 µA	
	20 mA to 200 mA	0.35 % + 0.28 mA	
	100 mA to 1 A	0.35 % + 1.5 mA	
	45 Hz to 1 kHz:		
	25 µA to 200 µA	0.020 % + 500 nA	These are source values available for the calibration of measuring equipment.
	200 µA to 2 mA	0.015 % + 4.0 µA	
	2 mA to 20 mA	0.010 % + 40 µA	
	20 mA to 200 mA	0.015 % + 500 µA	
	200 mA to 2 A	0.015 % + 5.0 mA	
	2 A to 20 A	0.020 % + 15 mA	
	45 Hz to 400 Hz		
	10 A to 100 A	0.10 % + 15 mA	For calibration of current clamps.
	100 A to 1000 A	0.10 % + 120 mA	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RCD TRIP CURRENT	0 mA to 300 mA	0.30 % + 5.0 mA	
RCD TRIP TIME	0 s to 400 ms 400 ms to 1 s	0.30 % + 5.0 ms 0.30 % + 10 ms	
FREQUENCY	1 Hz to 100 kHz 100 kHz, 1 MHz, 5 MHz and 10 MHz	100 μHz 1.0 part in 10^7	
TIME INTERVAL	1 μs 5 μs 20 μs 500 μs 1 ms 5 ms 10 ms 50 ms 100 ms	0.020 μs 0.10 μs 0.10 μs 11 μs 0.020 ms 0.10 ms 0.20 ms 1.1 ms 2.1 ms	Repetitive signals suitable for calibrating oscilloscope time bases.
Elapsed time, single event			
Manually triggered devices Electronically triggered devices	0 s to 24 Hours 1 s to 24 hours	3.5 ppm + 2.0 ms 3.5 ppm	

ELECTRICAL CALIBRATION OF TEMPERATURE INDICATORS AND CALIBRATORS	Type	Range °C	Without Cold Junction Compensation	Including Cold Junction Compensation	Methods consistent with Euramet CG-11
Thermocouple indicators	T	-240 to -100	0.70 °C	0.80 °C	
		-100 to 0	0.70 °C	0.80 °C	
		0 to 400	0.60 °C	0.80 °C	
	K	-200 to -100	0.80 °C	0.90 °C	
		-100 to 0	0.70 °C	0.80 °C	
		0 to 1370	0.60 °C	0.80 °C	
	S	0 to 1700	0.80 °C	0.90 °C	
	R	-50 to 0	1.2 °C	1.3 °C	
		0 to 1700	0.70 °C	0.90 °C	
	N	-250 to 0	0.62 °C	0.80 °C	
		0 to 1300	0.60 °C	0.80 °C	
	J	-180 to 0	0.60 °C	0.80 °C	
		0 to 700	0.60 °C	0.80 °C	
	E	0 to 800	0.60 °C	0.80 °C	
	B	0 to 1800	0.80 °C	0.90 °C	
RTD indicators	Pt 100	-200 to +800	0.050 °C		
Reference junction compensation	15 °C to 25 °C		0.50 °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.