Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0295

Accredited to ISO/IEC 17025:2017

Haven Automation Limited

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Calibration performed at the above address only

Calibration and Measurement Capability (CMC)

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL			
DC Resistance			
Measurement	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 20 MΩ to 200 MΩ 200 MΩ to 1 GΩ	25 μΩ/Ω + 70 μΩ 15 μΩ/Ω 10 μΩ/Ω 12 μΩ/Ω 20 μΩ/Ω 25 μΩ/Ω 0.010 % 0.020 % + 15 kΩ 0.060 % + 0.60 MΩ	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
Generation	0 Ω to 40 Ω 40 Ω to 400 Ω 400 Ω to 4 kΩ 4 kΩ to 40 kΩ 40 kΩ to 400 kΩ 400 kΩ to 4 MΩ 4 MΩ to 40 MΩ 40 MΩ to 400 MΩ	0.018 % + 100 μΩ 0.0085 % 0.0055 % 0.0075 % 0.0095 % 0.012 % 0.030 % 0.024 %	Using multi-function calibrator.
DC Voltage			
Measurement	0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV 1 kV to 5 kV	1.5 μV 10 μV/V 8.0 μV/V 10 μV/V 15 μV/V 1.2 %	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
Generation	0 mV to 320 mV 320 mV to 3.2 V 3.2 V to 32 V 32 V to 320 V 320 V to 1050 V	0.0045 % + 2.5 μV 0.0060 % 0.0070 % 0.0090 % 0.0060 %	Using multi-function calibrator.

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL (continued)			
DC Current			
Measurement	0 μA to 200 μA 0.2 mA to 20 mA 20 mA to 200 mA 200 mA to 2 A	0.0065 % + 10 nA 0.0055 % + 10 nA 0.0080 % 0.015 %	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
Generation	0 μA to 320 μA 320 μA to 3.2 mA 3.2 mA to 32 mA 32 mA to 320 mA 320 mA to 3 A 3 A to 10 A	0.012 % + 6.0 nA 0.021 % 0.026 % 0.040 % 0.040 % 0.042 %	Using multi-function calibrator.
AC Voltage			
Generation	*40 Hz to 30 kHz* 32 mV to 320 mV 320 mV to 320 V *40 Hz to 10 kHz* 320 V to 750 V 750 V to 1050 V	 0.040 % 0.050 % 0.040 % 0.050 %	Using multi-function calibrator.
Measurement	*40 Hz to 30 kHz* 200 mV to 2 V 2 V to 20 V 20 V to 200 V *40 Hz to 10 kHz* 20 mV to 200 mV 200 V to 1000 V *50 Hz* 1 kV to 5 kV	 0.030 % 0.030 % 0.028 % 59 μV 0.040 % 1.8 %	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
AC Current			
Generation	32 μA to 320 mA *10 Hz to 110 Hz* *110 Hz to 3 kHz* 320 mA to 3 A *40 Hz to 110 Hz* *110 Hz to 3 kHz* 3 A to 10 A *40 Hz to 110 Hz* *110 Hz to 3 kHz*	 0.045 % 0.070 % 0.060 % 0.080 % 0.080 % 0.080 %	Using multi-function calibrator.

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL (continued)			
AC Current (continued)			
Measurement	*40 Hz to 1 kHz* 100 μA to 200 μA 0.2 mA to 2 mA 2 mA to 20 m A 20 mA to 200 mA *55 Hz to 300 Hz* 200 mA to 500 mA 500 mA to 2 A	 0.035 μA 0.030 % + 0.25 μA 0.030 % + 2.5 μA 0.030 % + 25 μA 0.25 % 0.10 %	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
AC Resistance	*At 50 Hz* 0.05 Ω and 0.1 Ω 0.2 Ω, 0.5 Ω, 1 Ω, 5 Ω, 10 Ω, 50 Ω, 100 Ω, 500 Ω and 1 kΩ	 0.40 % 0.30 %	For the calibration of the earth bond function on Portable Appliance Testers.
Capacitance			
Generation	1 nF to 4 nF 4 nF to 40 nF 40 nF to 400 nF 400 nF to 4 μF 4 μF to 40 μF 40 μF to 400 μF 400 μF to 4 mF 4 mF to 30 mF	0.30 % 0.20 % 0.20 % 0.20 % 0.20 % 0.20 % 0.35 % 0.35 %	
Frequency			
Generation	0.5 Hz to 200 kHz	0.0012 % + 0.010 Hz	
Temperature indicators, calibration by electrical simulation			
Base metal thermocouple	-50 °C to +1320 °C	0.30 °C	Including cold junction compensation
Noble metal thermocouple	-50 °C to +1800 °C	0.70 °C	Including cold junction compensation
Resistance thermometer (Pt 100)	-200 °C to 0 °C 0 °C to 250 °C 250 °C to 800 °C	0.0020 °C to 0.012 °C 0.012 °C to 0.025 °C 0.025 °C to 0.030 °C	
Cold junction compensation	21 °C to 25 °C	0.15 °C	Lab ambient temperature

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL (continued)			
Temperature simulators, calibration by electrical simulation			
Base metal thermocouple	-50 °C to +1320 °C	0.35 °C	Including cold junction compensation
Noble metal thermocouple	-50 °C to +1800 °C	0.90 °C	Including cold junction compensation
Resistance thermometer (Pt 100)	-200 °C to 0 °C 0 °C to 250 °C 250 °C to 800 °C	0.0020 °C to 0.012 °C 0.012 °C to 0.025 °C 0.025 °C to 0.030 °C	
Cold junction compensation	21 °C to 25 °C	0.15 °C	Lab ambient temperature
PRESSURE			Methods consistent with EURAMET CG17
<u>Hydraulic pressure (gauge)</u>			1 Calibrations may be undertaken expressed in other units of pressure as required.
Calibration of pressure indicating instruments and gauges	552 kPa to 4.8 MPa 5.1 MPa to 110 MPa	0.0090 % + 0.15 kPa 0.010 %	2 Calibration of pressure measuring devices with an electrical output may be undertaken.
<u>Gas pressure (gauge)</u>			
Calibration of pressure indicating instruments and gauges	-90 kPa to -2.5 kPa 1.5 kPa to 2.5 kPa 2.5 kPa to 100 kPa 100 kPa to 690 kPa 690 kPa to 3.5 MPa	0.011 % 0.032 % 0.011 % 0.0060 % 0.0080 %	
TEMPERATURE			
Resistance Thermometers	-50 °C to 0 °C 0 °C 0 °C to 230 °C 230 °C to 420 °C 420 °C to 650 °C	0.070 °C 0.060 °C 0.10 °C 0.10 °C 0.10 °C	Calibration performed within Liquid Baths
Thermocouples			
Base metal (Type J, K, T & N)	-50 °C to +650 °C	0.42 °C	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
TEMPERATURE (continued)			
Electronic thermometers with sensors		As for sensor type	
Temperature loggers with integral probes	-50 °C to 0 °C 0 °C to 150 °C	0.070 °C 0.10 °C	
Metal Block calibrators	-50 °C to +300 °C 300 °C to 650 °C	0.20 °C 0.35 °C	Method consistent with Euramet CG13
Liquid Baths	-40 °C to +250 °C	0.20 °C	
Furnaces and ovens	50 °C to 600 °C	3.0 °C	Single or Multipoint monitoring probes. Time dependent temperature profiling, also referred to as spatial temperature surveying or mapping
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 measurement uncertainty 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 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 measurement uncertainty is calculated according to the procedures given in the GUM 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 measurement uncertainty in certificates issued under its accreditation.

Expression of CMCs - symbols and units

It should be noted that the percentage symbol (%) represents the number 0.01. In cases where the measurement uncertainty is stated as a percentage, this is to be interpreted as meaning percentage of the measurand.
Thus, for example, a measurement uncertainty of 1.5 % means $1.5 \times 0.01 \times q$, where q is the quantity value.

The notation Q[a, b] stands for the root-sum-square of the terms between brackets: $Q[a, b] = [a^2 + b^2]^{1/2}$