Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

23653

Accredited to ISO/IEC 17025:2017

Thorcal Ltd

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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
PRESSURE			
Hydraulic pressure (gauge)			Methods consistent with EURAMET CG17
Calibration of pressure indicating instruments and gauges	275 kPa to 690 kPa 690 kPa to 5.5 MPa 5.5 MPa to 110 MPa	0.012 % 0.010 % 0.0080 %	Calibration of pressure measuring devices with an electrical output may be undertaken. Calibration on other fluids up to 70 MPa can be undertaken with an additional uncertainty of 1.4 kPa added in quadrature
Gas pressure (gauge)			Absolute pressure calibrations may be undertaken by associated barometric pressure measurement with an additional uncertainty of 13 Pa added in quadrature.
Calibration of pressure indicating instruments and gauges	-100 kPa to -6.9 kPa -6.9 kPa to 0 Pa 0 Pa to 1.5 kPa 1.5 kPa to 2.5 kPa 2.5 kPa to 10 kPa 10 kPa to 12.15 MPa	0.0080 % 5.6 Pa 11 Pa Q [0.0060 %, 0.30 Pa] Q [0.0060 %, 0.15 Pa] 0.0075 %	
Gas pressure (absolute)			
Calibration of pressure indicating instruments and gauges	75 kPa to 115 kPa	10 Pa to 13 Pa	
TEMPERATURE			
Temperature indicators and or recorders with temperature sensors	-45 °C to 0 °C 0 °C to 75 °C 75 °C to 232 °C 232 °C to 420 °C 420 °C to 660 °C	0.13 °C 0.12 °C 0.24 °C 0.28 °C 0.42 °C	By comparison in a range of metal and liquid media baths
Metal Block Calibrators	-90 °C to 0 °C 0 °C to 125 °C 125 °C to 660°C	0.040 °C 0.030 °C 0.030 °C	Comparison to a reference PRT. Characterisation consistent with Euramet CG 13

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
TEMPERATURE (continued)			
Platinum Resistance Thermometers	-39 °C to 0 °C 0.01 °C 0 °C to 232 °C 232 °C to 420 °C 420 °C to 660 °C	0.10 °C 0.050 °C 0.26 °C 0.27 °C 0.43 °C	3 and 4 wire PRTs Output of the PRTs 4-20mA transmitters.
Thermocouple (Base metal)	-39 °C to 0 °C 0.01 °C 0 °C to 232 °C 232 °C to 420 °C 420 °C to 660 °C	0.30 °C 0.29 °C 0.47 °C 0.62 °C 0.92 °C	
ELECTRICAL			All electrical calibrations are performed as a comparison against a reference standard
DC VOLTAGE			
Generation	0 V to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1050 V	46 µV/V + 2.1 µV 46 µV/V + 31 µV 46 µV/V + 310 µV 47 µV/V + 3.7 mV 69 µV/V + 35 mV	For the calibration of measuring instruments
Measurement	0 to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V	9.2 µV/V + 1.6 µV 1.7 µV/V + 5.8 µV 1.5 µV/V + 53 µV 4.9 µV/V + 580 µV 47 µV/V + 5.8 mV	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
DC CURRENT			
Generation	0 A to 200 µA 200 µA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 2 A 2 A to 20 A	0.018 % + 30 nA 0.014 % + 87 nA 0.014 % + 640 nA 0.014 % + 11 uA 0.046 % + 200 uA 0.070 % + 10 mA	For the calibration of measuring instruments
Simulated Current	10 A to 100 A 100 A to 1100 A	0.001 % + 1.9 A 0.0085 % + 1.9 A	For the calibration of clamp meters, using multi-turn coil technique.
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 3 A	28 uA/A + 3.4 nA 20 uA/A + 21 nA 140 uA/A + 0.21 uA 63 uA/A + 2.4 uA 10 uA/A + 48 uA 0.15 % + 0.43 mA	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL (continued)			
AC VOLTAGE			
Generation	1 mV to 200 mV		For the calibration of measuring instruments
	40 Hz to 1 kHz	0.058% + 0.12 mV	
	1 kHz to 20 kHz	0.12 % + 0.18 mV	
	0 .2 V to 2 V		
	40 Hz to 1 kHz	0.046 % + 0.33 mV	
	1 kHz to 20 kHz	0.069 % + 0.60 mV	
	2 V to 20 V		
	40 Hz to 1 kHz	23 mV	
	1 kHz to 20 kHz	21mV	
	20 V to 200 V		
	40 Hz to 1 kHz	0.077% + 42 mV	
	200 V to 1000 V		
	40 Hz to 1 kHz	0.10 % + 14 mV	
Measurement	10 mV to 100 mV		Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
	10 Hz to 60 Hz	72 µV/V + 39 µV	
	60 Hz to 1 kHz	84 µV/V + 19 µV	
	1 kHz to 50 kHz	51 µV/V + 50 µV/V	
	100 mV to 1 V		
	10 Hz to 60 Hz	81 µV/V + 0.14 mV	
	60 Hz to 1 kHz	67 µV/V + 0.07 mV	
	1 kHz to 50 kHz	97 µV/V + 1.5 mV	
	1 V to 10 V		
	10 Hz to 60 Hz	70 µV/V + 1.2 mV	
	60 Hz to 1 kHz	68 µV/V + 0.62 mV	
	1 kHz to 100 kHz	82 µV/V + 1.9 mV	
	100 kHz to 1 MHz	0.17 % + 63 mV	
	10 V to 100 V		
	40 Hz to 1 kHz	25 µV/V + 12 mV	
	1 kHz to 10 kHz	27 µV/V + 5.6 mV	
	10 kHz to 50 kHz	170 µV/V + 5.2 mV	
	100 V to 700 V		
	40 Hz to 10 kHz	0.02 % + 50 mV	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL (continued)			
AC CURRENT			
Generation	0 A to 200 µA *40 Hz to 1 kHz*	0.081 % + 0.37 µA	For the calibration of measuring instruments
	200 µA to 2 mA *40 Hz to 1 kHz*	0.11 % + 0.88 µA	
	2 mA to 20 mA *40 Hz to 1 kHz*	0.081 % + 8.7 µA	
	20 mA to 200 mA *40 Hz to 1 kHz*	0.092 % + 87 µA	
	200 mA to 2 A *40 Hz to 500 Hz*	0.12 % + 1.6 mA	
	2 A to 20 A *40 Hz to 500 Hz*	0.23 % + 7.1 mA	
Measurement	0 µA to 100 µA *10 Hz to 1 kHz*	83 µA/A + 0.12 µA	Generation of these quantities with the same or similar CMCs may be undertaken over the same ranges by the use of a transfer method.
	100 µA to 1 mA *10 Hz to 1 kHz*	19 µA/A + 0.12 µA	
	1 mA to 10 mA *20 Hz to 1 kHz* *1 kHz to 5 kHz*	49 µA/A + 2.8 µA 75 µA/A + 5.4 µA	
	10 mA to 100 mA *10 Hz to 1 kHz*	46 µA + 28 µA	
	100 mA to 1 A *10 Hz to 1 kHz*	49 µA/A + 0.44 mA	
	1 A to 3 A	13 mA	
Simulated Current	10 A to 100 A *40 Hz to 1 kHz*	0.0014 % + 1.9 A	For the calibration of clamp meters, using multi-turn coil technique.
	100 A to 1100 A *40 Hz to 100 Hz*	0.016 % + 1.9 A	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL (continued)			
DC RESISTANCE			
FIXED RESISTANCE 2 WIRE or 4 WIRE			
Generation	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	13 mΩ 17 mΩ 79 mΩ 0.79 Ω 7.9 Ω 0.18 kΩ 12 kΩ 1.2 MΩ 110 MΩ	For the calibration of measuring instruments
Measurement	0 Ω to 10 Ω 0 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	29 μΩ/Ω + 3.5 mΩ 8.6 μΩ/Ω+ 3.6 mΩ 4.3 μΩ/Ω + 8.9 mΩ 1.9 μΩ/Ω + 77 mΩ 8.8 μΩ/Ω+ 1.2 Ω 37 μΩ/Ω + 24 Ω 8.9 μΩ/Ω + 0.45 kΩ 0.02 % + 36 kΩ 0.35 % + 1.1 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.
SIMULATED RESISTANCE	0 Ω to 400 Ω 400 Ω to 4000 Ω 4000 Ω to 40 kΩ	0.058 % + 0.58 Ω 0.027 % + 1.2 Ω 0.023 % + 5.9 Ω	For the calibration of measuring instruments

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Temperature indicators, calibration by electrical simulation			
Type J Thermocouple	-210 ºC to 50 ºC 50 ºC to 1200 ºC	0.37 ºC 0.29 ºC	Excluding internal reference junction (CJC)
Type K Thermocouple	-200 °C to 0 °C 0 °C to 1372 °C	0.44 °C 0.36 °C	
Type T Thermocouple	-200 °C to 100 °C 100 °C to 400 °C	0.42 °C 0.27 °C	
Type N Thermocouple	-200 °C to 0 °C 0°C to 600 °C 600 °C to 1300 °C	0.26 °C 0.29 °C 0.34 °C	
Type E Thermocouple	-200 °C to 0 °C 0 °C to 1000 °C	0.31 °C 0.27 °C	
Type R Thermocouple	-50 °C to 50 °C 50 °C to 250 °C 250 °C to 1768 °C	2.0 °C 0.87 °C 0.64°C	
Type S Thermocouple	-50 °C to 500 °C 500 °C to 1768 °C	1.5 °C 0.67 °C	
Type B Thermocouple	300 °C to 800 °C 800 °C to 1820 °C	2.0 °C 0.89 °C	
PT100	-39 °C to 0 °C 0 °C to 420 °C 420 °C to 660 °C	0.15 °C 0.30 °C 0.50 °C	2 and 4 wire measurements.
18th EDITION ELECTRICAL TEST EQUIPMENT			
CONTINUITY RESISTANCE	0 Ω to 1 Ω 1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ	0.29 % + 31 mΩ 0.29 % + 31 mΩ 0.29 % + 31 mΩ 0.29 % + 31 mΩ	For the calibration of Insulation Resistance Meters using a dedicated calibration system
CONTINUITY CURRENT	10 mA to 320 mA	1.5 % + 0.7 mA	
INSULATION RESISTANCE	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 1 GΩ to 10 GΩ	0.12 % + 0.20 Ω 0.12 % 1.2 % 1.2 % 1.4 % 6.5 %	

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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
18th EDITION ELECTRICAL TEST EQUIPMENT (continued)			
INSULATION TEST VOLTAGE	50 V to 1000 V	1.2 % + 0.93 V	
AC VOLTAGE OUTPUT	100 V to 200 V 200 V to 400 V *At 50 Hz*	0.23 % + 0.16 V 0.23 % + 0.15 V	
RCD CURRENT	*At 50 Hz* 20 ms to 190 ms 2 mA to 1 A 1 A to 3 A 190 ms to 5 s 2 mA to 1 A 1 A to 3 A	 5.8 % + 0.23 mA 5.8 % + 0.23 mA 1.4 % + 71 uA 1.4 % + 71 uA	For the calibration of RCD Testers using a dedicated calibration system
TRIP TIME	20 ms to 400 ms 400 ms to 5 s	0.95 ms 8.1 ms	
LOOP RESISTANCE	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ *At 50 Hz*	0.58 % + 41 mΩ 0.58 % + 45 mΩ 0.58 % + 54 mΩ	For the calibration of Earth Loop Testers using a dedicated calibration system
PAT TESTERS			
PAT EARTH BOND RESISTANCE *at 50 Hz*	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1000 Ω	0.58 % + 4.7 mΩ 0.58 % + 19 mΩ 0.58 % + 35 mΩ	For the calibration of Portable Appliance Testers using a dedicated calibration system
PAT EARTH BOND CURRENT *at 50 Hz*	0 mA to 500 mA 500 mA to 10 A 10 A to 30 A	1.7 % + 14 mA 1.7 % + 71 mA 1.7 % + 71 mA	
PAT INSULATION RESISTANCE	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 1 GΩ to 10 GΩ	0.12 % + 0.20 Ω 0.12 1.2 % 1.2 % 1.4 % 6.5 %	
PAT LEAKAGE CURRENT at 50 Hz	2.7 mA at 240 V 4.7 mA at 240 V 7.7 mA at 240 V	1.7 % + 9.6 µA 1.7 % + 9.6 µA 1.7 % + 9.6 µA	
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: $Q[a, b] = [a^2 + b^2]^{1/2}$