Schedule of Accreditation

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Accredited to ISO/IEC 17025:2017

ServiceCal Limited

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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			
DC RESISTANCE			
Generation			
Specific Values	0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	30 ppm 30 ppm 8.0 ppm 5.0 ppm 7.0 ppm 6.0 ppm 11 ppm 15 ppm 30 ppm 70 ppm 100 ppm	Using standard resistors in a 2-terminal or a 4-terminal configuration as appropriate to the resistance value.
	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	24.8 ppm 12.8 ppm 9.3 ppm 8.0 ppm 5.6 ppm 7.3ppm 8.9 ppm 26.8 ppm 87.7 ppm	Using multifunction calibrator in a 2-terminal or a 4-terminal configuration as appropriate to the resistance value.
Other Values	0 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 200 kΩ 200 kΩ to 2 MΩ 2 MΩ to 20 MΩ 20 MΩ to 200 MΩ 200 MΩ to 2 GΩ	30 ppm + 60 μΩ 20 ppm 15 ppm 30 ppm 70 ppm 650 ppm 0.65 %	By comparison with known resistance values.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC RESISTANCE (continued)			
Measurement			
Specific Values	0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	30 ppm 30 ppm 8.0 ppm 5.0 ppm 7.0 ppm 6.0 ppm 11 ppm 15 ppm 30 ppm 70 ppm 100 ppm	By comparison with known resistance values.
Other Values	0 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 200 kΩ 200 kΩ to 2 MΩ 2 MΩ to 20 MΩ 20 MΩ to 200 MΩ 200 MΩ to 2 GΩ	30 ppm + 60 μΩ 20 ppm 15 ppm 30 ppm 70 ppm 650 ppm 0.65 %	Using digital multimeter.
DC VOLTAGE			
Generation	0 mV to 220 mV 220 mV to 2.2 V 2.2 V to 22 V 22 V to 220 V 220 V to 1100 V	7 ppm + 0.50 μV 5 ppm + 0.80 μV 3.8 ppm 3.3 ppm 4.6 ppm	Using multifunction calibrator
Specific Values	100 mV 1 V 10 V 100 V 1 kV	7 ppm 3.8 ppm 3.6 ppm 3.8 ppm 4.6 ppm	
Measurement	100 μV to 200 mV 200 mV to 20 V 20 V to 1100 V	12 μV 8.0 ppm + 2.0 μV 15 ppm	Using digital multimeter.
DC CURRENT			
Generation	0 μA to 220 μA 220 μA to 2.2 mA 2.2 mA to 22 mA 22 mA to 220 mA 220 mA to 2.2 A 2.2 A to 20 A	15 ppm + 7.0 nA 15 ppm + 8.0 nA 10 ppm 30 ppm 40 ppm 550 ppm + 190 μA	Using multifunction calibrator
	20 A to 1000 A	610 ppm	For calibration of clamp-on ammeters and similar devices, using a multi-turn coil method.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC CURRENT (continued)			
Generation (continued)			Using multifunction calibrator.
Specific values	100 μA 1 mA 10 mA 100 mA 1 A 10 A	80 ppm 25 ppm 50 ppm 60 ppm 100 ppm 500 ppm	
Measurement	0 μA to 200 μA 200 μA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 2 A 10 A and 20 A	130 ppm + 9.0 nA 130 ppm + 90 nA 130 ppm 150 ppm 280 ppm 380 ppm	Using digital multimeter. Using digital multimeter and current shunt.
AC VOLTAGE			
Generation	2 mV to 200 V *10 Hz to 100 kHz* 200 V to 1 kV *55 Hz to 1 kHz*	 0.080 % + 50 μV 0.030 % + 50 μV	Using multifunction calibrator.
Specific values	*10 Hz to 100 kHz:* 2 mV 20 mV 100 mV 1 V 10 V 100 V *55 Hz to 1 kHz* 1000 V 100 mV *500 Hz* *1 kHz* *10 kHz* *50 kHz* 1 V *500 Hz* *1 kHz* *10 kHz* *50 kHz* 10 V *500 Hz* *1 kHz* *10 kHz* *50 kHz*	 0.15 % 0.04 % 0.025 % 0.017 % 0.017 % 0.017 % 0.015 % 0.008 % 0.008 % 0.008 % 0.008 % 0.012 % 0.012 % 0.012 % 0.012 % 0.012 % 0.012 % 0.012 % 0.012 %	Using multifunction calibrator.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC VOLTAGE (continued)			
Generation, Specific values (continued)	100 V		
	500 Hz	0.012 %	
	1 kHz	0.012 %	
	10 kHz	0.012 %	
	50 kHz	0.015 %	
	1000 V		
	500 Hz	0.015 %	
	1 kHz	0.015 %	
Measurement	20 mV to 200 mV		Using digital multimeter.
	20 Hz to 10 kHz	0.040 %	
	10 kHz to 100 kHz	0.15 %	
	200 mV to 200 V		
	20 Hz to 10 kHz	0.020 %	
	10 kHz to 100 kHz	0.15 %	
	200 V to 1000 V		
	55 Hz to 10 kHz	0.020 %	
	10 kHz to 30 kHz	0.15 %	
Specific values	*300 Hz, 1 kHz, 10 kHz*		
	100 mV	0.020 %	
	1 V, 10 V, 100 V, 1 kV	0.015 %	
	30 kHz		
	100 mV, 1 V, 10 V, 100 V, 1 kV	0.060 %	
AC CURRENT			
Generation	*55 Hz to 5 kHz*		Using multifunction calibrator.
	100 μA	0.031 %	
	1 mA	0.018 %	
	10 mA	0.018 %	
	100 mA	0.018 %	
	1 A	0.014 %	
	2 A to 20 A		
	30 Hz to 500 Hz	0.17 %	
	50 Hz		
	10 A to 1000 A	0.17 %	For calibration of clamp-on ammeters and similar devices, using a multi-turn coil method.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC CURRENT (continued)			
Measurement	*55 Hz to 5 kHz* 20 μA to 200 mA	 0.15 %	Using digital multimeter.
	55 Hz to 1 kHz 200 mA to 2 A	 0.25 %	
Specific values	*55 Hz, 300 Hz, 1.0 kHz* 100 μA, 1 mA, 10 mA, 100 mA 1 A	 0.050 % 0.10 %	
	50 Hz and 140 Hz 10 A and 20 A	 0.090 %	Using digital multimeter and current shunt.
FREQUENCY			
Measurement	0.1 Hz to 10 Hz 10 Hz to 1 GHz	1.0 in 10^6 2.0 in 10^9	Using frequency standard and divider.
Generation	0.1 Hz to 10 Hz 10 Hz to 1 GHz	1.0 in 10^6 2.0 in 10^9	Using frequency counter.
Mechanical Tachometer	60 rpm to 600 rpm 600 rpm to 3700 rpm	2.5 rpm 7.0 rpm	By comparison with optical tachometer.
Optical Tachometers	6 rpm 60 rpm 600 rpm 1500 rpm 3000 rpm 6000 rpm 15000 rpm 30000 rpm 60000 rpm	0.0070 rpm 0.0070 rpm 0.020 rpm 0.10 rpm 0.10 rpm 0.10 rpm 1.0 rpm 1.0 rpm 1.0 rpm	Using light pulses synchronised to frequencies that correspond to the stated rpm values.
CALIBRATION OF 16TH/17TH EDITION TEST EQUIPMENT			Using dedicated calibrator that covers all relevant functions.
Insulation Resistance	10 kΩ to 1 MΩ 1 MΩ to 5 MΩ 5 MΩ to 10 MΩ 10 MΩ to 30 MΩ 30 MΩ to 100 MΩ 100 MΩ to 500 MΩ 500 MΩ to 1 GΩ 1 GΩ to 2 GΩ	12 kΩ 170 kΩ 350 kΩ 1.0 MΩ 3.5 MΩ 18 MΩ 36 MΩ 130 MΩ	
Continuity Resistance	20 mΩ to 1 Ω 1 Ω to 2 Ω 2 Ω to 5 Ω 5 Ω to 10 Ω 10 Ω to 20 Ω 20 Ω to 50 Ω 50 Ω to 100 Ω 100 Ω to 1 kΩ	33 mΩ 44 mΩ 88 mΩ 150 mΩ 260 mΩ 610 mΩ 1.2 Ω 12 Ω	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
CALIBRATION OF 16TH/17TH EDITION TEST EQUIPMENT (continued)			
Continuity Resistance	20 mΩ to 1 Ω 1 Ω to 2 Ω 2 Ω to 5 Ω 5 Ω to 10 Ω 10 Ω to 20 Ω 20 Ω to 50 Ω 50 Ω to 100 Ω 100 Ω to 1 kΩ	33 mΩ 44 mΩ 88 mΩ 150 mΩ 260 mΩ 610 mΩ 1.2 Ω 12 Ω	
Continuity Current	200 mA	3.7 mA	
Insulation Voltage (DC)	50 V to 1000 V	13 V	
Loop Resistance *at 50 Hz*	0.22 Ω 0.33 Ω 0.5 Ω 1 Ω 5 Ω 10 Ω 100 Ω 1000 Ω	43 mΩ 43 mΩ 43 mΩ 44 mΩ 56 mΩ 80 mΩ 590 mΩ 5.8 Ω	
RCD Current *at 50 Hz*	10 mA 20 mA 30 mA 40 mA 50 mA 100 mA 150 mA 200 mA 300 mA 500 mA 1 A	1.9 mA 2.2 mA 2.6 mA 3.1 mA 3.6 mA 6.2 mA 9.1 mA 12 mA 18 mA 29 mA 58 mA	At 100 ms At 100 ms At 100 ms At 100 ms At 100 ms At 100 ms At 100 ms At 100 ms At 100 ms At 100 ms At 100 ms
RCD Current *at 50 Hz*	100 mA 1000 mA	2.2 mA 14 mA	At 1000 ms At 1000 ms
RCD Trip Time	20 ms 30 ms 40 ms 50 ms 100 ms 250 ms 500 ms 1000 ms	0.96 ms 0.96 ms 0.96 ms 0.96 ms 0.96 ms 0.96 ms 0.96 ms 0.96 ms	
Earth Bond Current	*At 50 Hz:* 100 mA 10 A 20 A	 22 mA 240 mA 420 mA	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
CALIBRATION OF 16TH/17TH EDITION TEST EQUIPMENT (continued)			
Earth Bond Resistance *at 50 Hz*	0 Ω to 10 Ω 10 Ω to 100 Ω	35 mΩ 590 mΩ	
Earth Leakage Current Test *at 50 Hz*	2.0 mA at 240 V 4.7 mA at 240 V 7.7 mA at 240 V	40 μA 85 μA 140 μA	
Flash Voltage Test *At 50 Hz*	1500 V (Class 1) 3000 V (Class 2)	170 V 260 V	
Flash Current Test *At 50 Hz*	1 mA at 1500 V (Class 1) 1 mA at 3000 V (Class 2)	63 μA 63 μA	
AC Voltage *At 50 Hz*	100 V to 400 V	4.5 V	
AC Line Voltage	225 V to 264 V	2.9 V	
Oscilloscope Calibration			
Amplitude	5 mV to 190 mV 190 mV to 190 V	0.89 % 0.30 %	Using signals of known peak to peak voltage.
Timebase	0.5 ms to 10 ms	0.50 %	Using time markers.
Bandwidth	50 kHz to 1.1 GHz 1.1 GHz to 3.2 GHz	4.5 % 5.2 %	50 Ω and 1 MΩ 50 Ω Only Results are normally reported in terms of the frequency at which the -3 dB points is reached, relative to a low frequency reference.
Temperature simulation			
Calibration of temperature indicators, recorders and similar instruments.	Type K -160 ºC to 0 ºC 0 ºC to 1300 ºC	 0.79 ºC 0.47 ºC	Using DC voltages corresponding to the equivalent temperature, with the internal cold junction enabled.
	Type K -160 ºC to 0.0 ºC 0.0 ºC to 1300 ºC	 0.73 ºC 0.36 ºC	Using DC voltages corresponding to the equivalent temperature, with the internal cold junction disabled.
Ambent Temperature Measurment	18 ºC to 22 ºC	0.15 ºC	Using mercury in glass thermometer; in support of cold junction calibration.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
PRESSURE			Methods consistent with EURAMET CG17.
<u>Hydraulic pressure (gauge)</u>			
Calibration of pressure indicating instruments and gauges	0 MPa to 10 MPa 10 MPa to 100 MPa 100 MPa to 400 MPa	0.0050 % + 3.5 kPa 0.010 % + 28 kPa 1.3 MPa	Calibration of pressure devices with an electrical output may be undertaken
<u>Gas pressure (gauge)</u>			
Calibration of pressure indicating instruments and gauges	-80 kPa to -100 Pa -100 Pa to 10 kPa 10 kPa to 0.50 MPa 0.5 MPa to 1.0 MPa 1.0 MPa to 2.0 MPa	85 Pa 40 Pa 85 Pa 150 Pa 300 Pa	Absolute pressure within these ranges can be generated and will attract an additional uncertainty of 72 Pa.
AIR VELOCITY			Comparison with reference anemometers in a characterised airstream.
Calibration of 25 to 100 mm Vane Anemometers	0.5 m/s to 2 m/s 2 m/s to 5 m/s 5 m/s to 15 m/s 15 m/s to 25 m/s	0.72 % + 0.090 m/s 0.80 % + 0.16 m/s 0.81 % + 0.25 m/s 0.90 % + 0.50 m/s	
Calibration of Thermal Anemometers by comparison	0.3 m/s to 2 m/s 2 m/s to 5 m/s 5 m/s to 15 m/s 15 m/s to 25 m/s	0.080 m/s 0.13 m/s 0.62 m/s 1.9 m/s	

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 $0.0036\ \%\cdot p + (0.12\cdot 10^{-6}\cdot p\cdot 10^{-6}) + 4.0$ 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.