Schedule of Accreditation

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Accredited to ISO/IEC 17025:2005

PASS (Portable Appliance Safety Services) 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
DC RESISTANCE			
Fixed value sources	0.1 Ω 0.2 Ω 0.3 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	5.8 mΩ 41 mΩ 41 mΩ 6.0 mΩ 8.2 mΩ 490 µΩ 4.8 mΩ 49 mΩ 980 mΩ 33 Ω 3.1 kΩ 210 kΩ 12 MΩ	
Measurement and generation	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	18 ppm + 65 µΩ 14 ppm + 650 µΩ 12 ppm + 1.6 mΩ 12 ppm + 8.1 mΩ 12 ppm + 250 mΩ 21 ppm + 6.7 Ω 67 ppm + 150 Ω 590 ppm + 5.0 kΩ 0.60 % + 270 kΩ	
DC VOLTAGE			
Generation	0 mV to 202 mV 202 mV to 1 V 1 V to 2.02 V 2.02 V to 10 V 10 V to 20.2 V 20.0 V to 100 V 100 V to 202 V 202 V to 1020 V	17 ppm + 2.5 µV 10 ppm + 3.6 µV 10 ppm + 7.6 µV 9.8 ppm + 43 µV 9.8 ppm + 72 µV 14 ppm + 430 µV 14 ppm + 720 µV 14 ppm + 2.8 mV	
Measurement	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V	6.2 ppm + 560 nV 5.2 ppm + 1.2 µV 5.3 ppm + 1.3 µV 7.3 ppm + 58 µV 18 ppm + 260 µV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC CURRENT			
Generation	0 µA to 202 µA	120 ppm + 12 nA	
	202 µA to 1 mA	58 ppm + 35 nA	
	1 mA to 2.02 mA	58 ppm + 49 nA	
	2.02m A to 10 mA	58 ppm + 230 nA	
	10 mA to 20.2 mA	58 ppm + 440 nA	
	20.2 mA to 100 mA	58 ppm + 2.3 µA	
	100 mA to 202 mA	58 ppm + 9.0 µA	
	202 mA to 1 A	150 ppm + 36 µA	
	1 A to 2.02 A	150 ppm + 100 µA	
	2.02 A to 10 A	350 ppm + 590 µA	
	10 A to 20.2 A	350 ppm + 760 µA	
	20.2 A to 30 A	580 ppm + 4.4 mA	
	20 A to 1500 A	0.26 % + 13 mA	Simulation with coil
Measurement	0 µA to 1 µA	27 ppm 1.2 nA	
	1 µA to 10 µA	25 ppm +1.2 nA	
	10 µA to 100 µA	25 ppm +1.6 nA	
	100 µA to 1 mA	25 ppm +9.4 nA	
	1 mA to 10 mA	25 ppm + 99 nA	
	10 mA to 100 mA	42 ppm + 870 nA	
	100 mA to 1 A	130 ppm + 21 µA	
	1 A to 3 A	0.23 % + 750 µA	
	3 A to 5 A	0.14 % + 2.6 mA	
	5 A to 10 A	0.27 % + 4.4 mA	
AC VOLTAGE			
Generation	20 mV to 202 mV		
	10 Hz to 44 Hz	920 ppm + 62 µV	
	45 Hz to 1 kHz	190 ppm + 62 µV	
	1 kHz to 20 kHz	230 ppm + 56 µV	
	20 kHz to 100 kHz	0.12 % + 84 µV	
	100 kHz to 500 kHz	0.46 % + 2.5 mV	
	202 mV to 2.02 V		
	10 Hz to 44 Hz	580 ppm + 320 µV	
	45 Hz to 1 kHz	180 ppm + 280 µV	
	1 kHz to 20 kHz	240 ppm + 450 µV	
	20 kHz to 100 kHz	750 ppm + 530 µV	
	2.02 V to 20.2 V		
	10 Hz to 44 Hz	580 ppm + 3.0 mV	
	45 Hz to 1 kHz	180 ppm + 2.7 mV	
	1 kHz to 20 kHz	240 ppm + 4.4 mV	
	20 kHz to 100 kHz	690 ppm + 5.3 mV	
	20.2 V to 202 V		
	30 Hz to 44 Hz	580 ppm + 33 mV	
	45 Hz to 1 kHz	170 ppm + 28 mV	
	1 kHz to 10 kHz	270 ppm + 30 mV	
	10 kHz to 40 kHz	350 ppm + 53 mV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Generation (cont'd)	202 V to 1020 V		
	30 Hz to 44 Hz	640 ppm + 250 mV	
	45 Hz to 1 kHz	230 ppm + 110 mV	
	1 kHz to 10 kHz	290 ppm + 200 mV	
Measurement	10 µV to 10 mV		
	1 kHz to 20 kHz	350 ppm + 5.8 µV	
	10 mV to 100 mV		
	40 Hz to 1 kHz	86 ppm + 5.6 µV	
	1 kHz to 20 kHz	160 ppm + 5.6 µV	
	100 mV to 1 V		
	20 Hz to 40 Hz	130 ppm + 63 µV	
	40 Hz to 1 kHz	86 ppm + 38 µV	
	1 kHz to 20 kHz	160 ppm + 43 µV	
	20 kHz to 50 kHz	350 ppm + 41 µV	
	50 kHz to 100 kHz	920 ppm + 42 µV	
	1 V to 10 V		
	20 Hz to 40 Hz	130 ppm + 730 µV	
	40 Hz to 1 kHz	86 ppm + 400 µV	
	1 kHz to 20 kHz	160 ppm + 400 µV	
	20 kHz to 50 kHz	350 ppm + 430 µV	
	50 kHz to 100 kHz	920 ppm + 400 µV	
	100 kHz to 300 kHz	0.35 % ppm + 1.2 mV	
	10 V to 100 V		
	20 Hz to 40 Hz	250 ppm + 6.7 mV	
	40 Hz to 1 kHz	240 ppm + 4.3 mV	
	1 kHz to 20 kHz	240 ppm + 4.3 mV	
	20 kHz to 50 kHz	410 ppm + 4.9 mV	
	100 V to 700 V		
	40 Hz to 1 kHz	460 ppm + 38 mV	
	1 kHz to 20 kHz	690 ppm + 38 mV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC CURRENT			
Generation	20 µA to 202 µA *40 Hz to 1 kHz*	580 ppm + 180 nA	
	202 µA to 2.02 mA *40 Hz to 1 kHz*	460 ppm + 460 nA	
	2.02 mA 20.2 mA *40 Hz to 1 kHz*	400 ppm + 4.6 µA	
	20.2 mA to 202 mA *40 Hz to 1 kHz*	400 ppm + 46 µA	
	202 mA to 2.02 A *40 Hz to 1 kHz*	460 ppm + 550 µA	
	2.02 A to 20 A *40 Hz to 100 Hz*	650 ppm + 6.0 mA	
	20 A to 30 A *40 Hz to 100 Hz*	650 ppm + 13 mA	
	20 A to 1500 A *40 Hz to 60 Hz*	0.26 % + 13 mA	Simulation using coil
Measurement	50 nA to 100 µA *100 Hz to 5 kHz*	700 ppm + 46 nA	
	100 µA to 1 mA *100 Hz to 5 kHz*	350 ppm + 280 nA	
	1 mA to 10 mA *10 Hz to 20 Hz* 20 Hz to 45 Hz 45 Hz to 5 kHz	0.46 % + 2.6 µA 0.17 % + 2.6 µA 350 ppm + 2.6 µA	
	10 mA to 100 mA *10 Hz to 20 Hz* 20 Hz to 45 Hz 45 Hz to 5 kHz	0.46 % + 26 µA 0.17 % + 26 µA 350 ppm + 26 µA	
	100 mA to 1 A *10 Hz to 20 Hz* 20 Hz to 45 Hz 45 Hz to 5 kHz	0.46 % + 280 µA 0.18 % + 280 µA 0.12 % + 280 µA	
	1 A to 3 A *10 Hz to 5 kHz*	0.27 % + 580 µA	
	3 A to 5 A *10 Hz to 5 kHz*	0.27 % + 11 mA	
	5 A to 10 A *10 Hz to 5 kHz*	0.29 % + 11 mA	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
CAPACITANCE			
	At 1 kHz:		
	1 nF	3.5 pF	
	10 nF	31 pF	
	20 nF	64 pF	
	50 nF	150 pF	
	100 nF	290 pF	
	1 µF	4.6 nF	
	10 µF	69 nF	
INDUCTANCE	*At 1 kHz:*		
	1 mH	5.9 µH	
	10 mH	58 µH	
	100 mH	580 µH	
	1 H	5.8 mH	
FREQUENCY			
	10 MHz reference	1.0 part in to 10^{12}	Frequency may also expressed time; $1/f$ for repetitive signals, in terms of seconds or other units such as RPM.
Measure and Generate			
	1 Hz to 30 MHz	1.5 parts in to 10^{12} + 0.60 µHz	
	30 MHz to 4 GHz	2.0 parts in to 10^{12}	
Rotatioal speed - Optical			
Measurement	10 RPM to 99.99 RPM	2.3 RPM	
	100 RPM to 999.9 RPM	2.4 RPM	
	1000 RPM to 99999 RPM	3.3 RPM	
Generation	60 RPM to 3000 RPM	0.12 RPM	
	3000 RPM to 60000 RPM	1.2 RPM	
TEMPERATURE SIMULATION			
PT 100	-200 ˚C to 800 ˚C	0.065 ˚C	
Ambient	17 ˚C to 23 ˚C	0.20 ˚C	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Temperature indicators and calibrators by electrical simulation, reference juncton compensation INCLUDED			
Base Thermocouples			
Type E	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1000 °C	0.22 °C 0.21 °C 0.22 °C	
Type J	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1200 °C	0.24 °C 0.21 °C 0.22 °C	
Type K	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1372 °C	0.27 °C 0.22 °C 0.24 °C	
Type N	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1300 °C	0.35 °C 0.24 °C 0.24 °C	
Type T	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 400 °C	0.27 °C 0.23 °C 0.21 °C	
Noble thermocouples			
Type B	600 °C to 1820 °C	0.52 °C	
Type R	-50 °C to 0 °C 0 °C to 400 °C 400 °C to 1767 °C	0.78 °C 0.57 °C 0.36 °C	
Type S	-50 °C to 0 °C 0 °C to 400 °C 400 °C to 1767 °C	0.65 °C 0.55 °C 0.40 °C	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Temperature indicators and calibrators by electrical simulation Reference junction compensation EXCLUDED			
Base Thermocouples			
Type E	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1000 °C	0.22 °C 0.19 °C 0.20 °C	
Type J	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1200 °C	0.24 °C 0.19 °C 0.20 °C	
Type K	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1372 °C	0.26 °C 0.21 °C 0.22 °C	
Type N	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 1300 °C	0.35 °C 0.22 °C 0.22 °C	
Type T	-200 °C to -100 °C -100 °C to 0 °C 0 °C to 400 °C	0.26 °C 0.21 °C 0.20 °C	
Noble thermocouples			
Type B	600 °C to 1820 °C	0.52 °C	
Type R	-50 °C to 0 °C 0 °C to 400 °C 400 °C to 1767 °C	0.77 °C 0.56 °C 0.35 °C	
Type S	-50 °C to 0 °C 0 °C to 400 °C 400 °C to 1767 °C	0.65 °C 0.55 °C 0.39 °C	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
EQUIPMENT FOR IEE 16TH / 17TH EDITION WIRING TESTING			
LOOP TESTERS			
	Nominal applied resistances		
AC Resistance at 50 Hz	0.05 Ω	4.7 mΩ	
	0.10 Ω	4.8 mΩ	
	0.21 Ω	4.9 mΩ	
	0.32 Ω	5.1 mΩ	
	0.5 Ω	5.6 mΩ	
	1 Ω	8.6 mΩ	
	5 Ω	31 mΩ	
	10 Ω	59 mΩ	
	100 Ω	580 mΩ	
	1 kΩ	5.9 Ω	
CONTINUITY TESTERS			
DC Resistance	20 mΩ	29 mΩ	
	200 mΩ to 2 Ω	29 mΩ	
	4 Ω	31 mΩ	
	6 Ω	34 mΩ	
	8 Ω	37 mΩ	
	10 Ω	41 mΩ	
	20 Ω	65 mΩ	
	100 Ω	290 mΩ	
	1 kΩ	2.9 Ω	
Continuity Current Measurement	10 mA	1.1 mA	
	100 mA	1.7 mA	
	200 mA	3.1 mA	
	300 mA	4.6 mA	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
INSULATION TESTERS			
DC Resistance	10 kΩ 20 kΩ 30 kΩ 40 kΩ 60 kΩ 100 kΩ 200 kΩ 400 kΩ 600 kΩ 1 MΩ 2 MΩ 3 MΩ 4 MΩ 5 MΩ 6 MΩ 7 MΩ 8 MΩ 9 MΩ 10 MΩ 20 MΩ 30 MΩ 40 MΩ 50 MΩ 60 MΩ 70 MΩ 80 MΩ 90 MΩ 100 MΩ 200 MΩ 400 MΩ 600 MΩ 800 MΩ 1 GΩ 10 GΩ	12 Ω 23 Ω 35 Ω 46 Ω 69 Ω 120 Ω 230 Ω 460 Ω 690 Ω 1.2 kΩ 2.3 kΩ 3.5 kΩ 4.6 kΩ 58 kΩ 69 kΩ 81 kΩ 92 kΩ 100 kΩ 120 kΩ 230 kΩ 350 kΩ 460 kΩ 580 kΩ 690 kΩ 810 kΩ 930 kΩ 1.0 MΩ 1.2 MΩ 2.8 MΩ 5.6 MΩ 8.5 MΩ 11 MΩ 14 MΩ 580 MΩ	
DC Voltage	50 V 100 V 150 V 200 V 250 V 500 V 1000 V	1.1 V 1.5 V 2.0 V 2.5 V 3.0 V 5.9 V 12 V	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
EARTH BOND TESTERS			
AC Resistance at 50 Hz	Nominal applied resistance		
	0.04 Ω	4.7 mΩ	
	0.1 Ω	4.8 mΩ	
	0.15 Ω	4.8 mΩ	
	0.27 Ω	5.0 mΩ	
	0.38 Ω	5.2 mΩ	
	0.55 Ω	5.8 mΩ	
	1 Ω	7.8 mΩ	
	5 Ω	30 mΩ	
	10 Ω	59 mΩ	
	100 Ω	580 mΩ	
	1 kΩ	5.8 Ω	
AC Current at 50 Hz	100 mA	7.3 mA	
	200 mA	7.9 mA	
	400 mA	9.9 mA	
	4 A	100 mA	
	8 A	160 mA	
	10 A	190 mA	
	20 A	440 mA	
LEAKAGE TESTERS			
DC Current	2 mA	36 µA	
	5 mA	82 µA	
	10 mA	130 µA	
RCD TESTERS			
RCD Trip Time	20 ms	680 µs	
	40 ms	680 µs	
	100 ms	680 µs	
	200 ms	680 µs	
	390 ms	680 µs	
	900 ms	8.1 ms	
RCD Trip Current at 50 Hz	10 mA	620 µA	
	30 mA	1.7 mA	
	90 mA	5.2 mA	
	100 mA	5.8 mA	
	110 mA	6.4 mA	
	150 mA	17 mA	
	300 mA	17 mA	
	1 A	58 mA	
	2 A	120 mA	
AC Voltage Source at 50 Hz	100 V	0.37 V	
	200 V	0.45 V	
	230 V	0.65 V	
	300 V	0.82 V	
	400 V	0.99 V	
Line Voltage Measurement	200 V to 260 V	2.4 V	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
PRESSURE			
Gas Pressure (Gauge)			
Calibration of pressure indicating instruments and gauges	-95 to -1.5 kPa 1.5 to 100 kPa 20 kPa to 2.5 MPa 0.70 MPa to 11.1 MPa	0.012 % 0.009 0 % 0.010 % 0.010 %	Absolute pressures can be generated within these gauge pressure ranges. This will attract an additional uncertainty of 20 Pa. Calibration of devices with an electrical output may be undertaken
Hydraulic Pressure (Gauge)			
Calibration of pressure indicating instruments and gauges	0.6 MPa to 8.0 MPa 6.0 MPa to 80 MPa	0.012 % 0.013 %	Calibration of devices with an electrical output may be undertaken
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, and an indication of how they are to be interpreted, are shown 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.