Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

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Accredited to ISO/IEC 17025: 2017

Newtons4th 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
CALIBRATION OF AC POWER ANALYSERS			With the exception of calorimetric measurements, the AC Power Analyser capabilities are achieved by a phantom load technique, whereby independent signals (voltage or current) are applied to each channel of the power analyser. The phase and amplitude of these signals, and of their harmonics, are varied to produce the required stimulus. Suitably modulated signals are used for flicker measurements.
Voltage sine amplitude	1 V to 23 V *16 Hz to 45 Hz* *45 Hz to 65 Hz* *65 Hz to 850 Hz*	 90 μV/V + 0.20 mV 79 μV/V + 0.20 mV 90 μV/V + 0.20 mV	
	23 V to 45 V *16 Hz to 45 Hz* *45 Hz to 65 Hz* *65 Hz to 850 Hz*	 86 μV/V + 0.40 mV 74 μV/V + 0.40 mV 86 μV/V + 0.40 mV	
	45 V to 90 V *16 Hz to 45 Hz* *45 Hz to 65 Hz* *65 Hz to 850 Hz*	 85 μV/V + 0.80 mV 73 μV/V + 0.80 mV 85 μV/V + 0.80 mV	
	90 V to 180 V *16 Hz to 45 Hz* *45 Hz to 65 Hz* *65 Hz to 850 Hz*	 90 μV/V + 1.6 mV 80 μV/V + 1.6 mV 90 μV/V + 1.6 mV	
	180 V to 215 V *16 Hz to 850 Hz* *45 Hz to 65 Hz* *65 Hz to 850 Hz*	 87 μV/V + 3.2 mV 87 μV/V + 3.2 mV 87 μV/V + 3.2 mV	
	215 V to 246 V *16 Hz to 45 Hz* *45 Hz to 65 Hz* *65 Hz to 850 Hz*	 87 μV/V + 3.2 mV 75 μV/V + 3.2 mV 87 μV/V + 3.2 mV	
	246 V to 360 V *16 Hz to 850 Hz* *45 Hz to 65 Hz* *65 Hz to 850 Hz*	 87 μV/V + 3.2 mV 87 μV/V + 3.2 mV 87 μV/V + 3.2 mV	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Voltage sine amplitude (continued)	360 V to 425 V		
	16 Hz to 45 Hz	86 μV/V + 5.8 mV	
	45 Hz to 65 Hz	85 μV/V + 5.8 mV	
	65 Hz to 850 Hz	86 μV/V + 5.8 mV	
	425 V to 490 V		
	16 Hz to 45 Hz	86 μV/V + 5.8 mV	
	45 Hz to 65 Hz	75 μV/V+ 5.8 mV	
	65 Hz to 850 Hz	86 μV/V + 5.8 mV	
	490 V to 650 V		
	16 Hz to 45 Hz	86 μV/V + 5.8 mV	
	45 Hz to 65 Hz	85 μV/V + 5.8 mV	
	65 Hz to 850 Hz	86 μV/V + 5.8 mV	
	650 V to 1008 V		
	16 Hz to 45 Hz	90 μV/V + 10 mV	
	45 Hz to 65 Hz	90 μV/V + 10 mV	
	65 Hz to 850 Hz	90 μV/V + 10 mV	
Voltage harmonic amplitude	0 V to 6.9 V Total rms 1 V to 23 V		
	16 Hz to 850 Hz	600 μV/V + 1.0 mV	
	850 Hz to 6 kHz	1300 μV/V + 1.0 mV	
	0 V to 13.5 V Total rms 23 V to 45 V		
	16 Hz to 850 Hz	600 μV/V + 2.0 mV	
	850 Hz to 6 kHz	1300 μV/V + 2.0 mV	
	0 V to 27 V Total rms 45 V to 90 V		
	16 Hz to 850 Hz	600 μV/V + 2.2 mV	
	850 Hz to 6 kHz	1300 μV/V + 2.2 mV	
	0 V to 54 V Total rms 90 V to 180 V		
	16 Hz to 850 Hz	600 μV/V + 4.4 mV	
	850 Hz to 6 kHz	1300 μV/V + 4.4 mV	
	0 V to 108 V Total rms 180 V to 360 V		
	16 Hz to 850 Hz	600 μV/V + 12 mV	
	850 Hz to 6 kHz	1300 μV/V + 12 mV	
	0 V to 195 V Total rms 360 V to 650 V		
	16 Hz to 850 Hz	600 μV/V + 22 mV	
	850 Hz to 6 kHz	1300 μV/V + 22 mV	
	0 V to 302 V Total rms 650 V to 1008 V		
	16 Hz to 850 Hz	600 μV/V + 33 mV	
	850 Hz to 6 kHz	1300 μV/V + 33 mV	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Current sine amplitude	100 mA to 250 mA		
	16 Hz to 45 Hz	110 µA/A + 5.0 µA	
	45 Hz to 65 Hz	100 µA/A + 2.5 µA	
	65 Hz to 850 Hz	110 µA/A + 5.0 µA	
	250 mA to 500 mA		
	16 Hz to 45 Hz	85 µA/A + 10 µA	
	45 Hz to 65 Hz	75 µA/A + 5.0 µA	
	65 Hz to 850 Hz	85 µA/A + 10 µA	
	0.5 A to 1 A		
	16 Hz to 45 Hz	89 µA/A + 20 µA	
	45 Hz to 65 Hz	80 µA/A + 10 µA	
	65 Hz to 850 Hz	89 µA/A + 20 µA	
	1 A to 2 A		
	16 Hz to 45 Hz	89 µA/A + 40 µA	
	45 Hz to 65 Hz	80 µA/A + 20 µA	
	65 Hz to 850 Hz	89 µA/A + 40 µA	
	2 A to 5 A		
	16 Hz to 45 Hz	88 µA/A + 100 µA	
	45 Hz to 65 Hz	78 µA/A + 50 µA	
	65 Hz to 850 Hz	88 µA/A + 100 µA	
	5 A to 10 A		
	16 Hz to 45 Hz	92 µA/A + 200 µA	
	45 Hz to 65 Hz	82 µA/A + 100 µA	
	65 Hz to 850 Hz	92 µA/A + 200 µA	
	10 A to 21 A		
	16 Hz to 45 Hz	95 µA/A + 400 µA	
	45 Hz to 65 Hz	82 µA/A + 200 µA	
	65 Hz to 850 Hz	95 µA/A + 400 µA	
	21 A to 48 A		
	16 Hz to 45 Hz	140 µA/A + 1.0 mA	
	45 Hz to 65 Hz	93 µA/A + 0.50 mA	
	65 Hz to 850 Hz	140 µA/A + 1.0 mA	
Current harmonic amplitude	Harmonic 0 A to 75 mA Total rms 100 mA to 250 mA		
	16 Hz to 850 Hz	610 µA/A + 5.0 µA	
	850 Hz to 6 kHz	1800 µA/A + 5.0 µA	
	Harmonic 0 A to 150 mA Total rms 250 mA to 500 mA		
	16 Hz to 850 Hz	610 µA/A + 10 µA	
	850 Hz to 6 kHz	1800 µA/A + 10 µA	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Current harmonic amplitude (continued)	Harmonic 0 A to 300 mA Total rms 500 mA to 1 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 610 µA/A + 20 µA 1800 µA/A + 20 µA	
	Harmonic 0 A to 600 mA Total rms 1 A to 2 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 610 µA/A + 40 µA 1800 µA/A + 40 µA	
	Harmonic 0 mA to 1.5 A Total rms 2 A to 5 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 610 µA/A + 100 µA 1800 µA/A + 100 µA	
	Harmonic 0 A to 3 A Total rms 5 A to 10 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 610 µA/A + 200 µA 1800 µA/A + 200 µA	
	Harmonic 0 A to 6 A Total rms 10 A to 21 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 610 µA/A + 400 µA 1800 p µA/A + 400 µA	
	Harmonic 0 A to 15 A Total rms 21 A to 50 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 610 µA/A + 1.0 mA 1800 µA/A + 1.0 mA	
Current to voltage phase angle	-180° to +180° *16 Hz to 45 Hz* *45 Hz to 65 Hz* *65 Hz to 69 Hz* *69 Hz to 180 Hz* *180 Hz to 450 Hz* *450 Hz to 850 Hz*	 3.1 m° 2.4 m° 3.2 m° 7.1 m° 18 m° 33 m°	
Apparent power (VA product)	100 mVA to 48.4 kVA *16 Hz to 850 Hz*	 The RSS summation of the uncertainties for voltage and current.	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
AC Power	Harmonic 0 W to 48.4 kW *16 Hz to 850 Hz*	The RSS summation of the uncertainties for voltage, current and cos(φ).	For power factors between 0 and unity, leading or lagging. The uncertainties at low power factors may be stated in absolute terms or as a fraction of the VA product. NOTE: For typical input voltages of 115 V and 230 V, the minimum power at unity p.f. is 5.5 W and 11 W respectively. Lower powers for these voltages can be obtained by using lower power factors.
Current harmonic amplitude to IEC61000-4-7	Harmonic 0 A to 75 mA Total rms 100 mA to 250 mA *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 0.16 % + 5.0 µA 0.47 % + 5.0 µA	
	Harmonic 0 A to 150 mA Total rms 250 mA to 500 mA *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 0.16 % + 10 µA 0.47 % + 10 µA	
	Harmonic 0 A to 300 mA Total rms 500 mA to 1 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 0.16 % + 20 µA 0.47 % + 20 µA	
	Harmonic 0 A to 600 mA Total rms 1 A to 2 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 0.16 % + 40 µA 0.47 % + 40 µA	
	Harmonic 0 mA to 1.5 A Total rms 2 A to 5 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 0.16 % + 100 µA 0.47 % + 100 µA	
	Harmonic 0 A to 3 A Total rms 5 A to 10 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 0.16 % + 200 µA 0.47 % + 200 µA	
	Harmonic 0 A to 6 A Total rms 10 A to 21 A *16 Hz to 850 Hz* *850 Hz to 6 kHz*	 0.16 % + 400 µA 0.47 % + 400 µA	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Flicker to IEC61000-4-15	Pinst (sinusoidal modulation) Pinst (rectangular modulation) f_{mod} 0.5 Hz to 30 Hz f_{mod} 30.5Hz f_{mod} 31 Hz to 33.33 Hz Pst	0.36 % 0.39 % 1.0 % 0.39 % 0.25 %	
	d_c and d_{max} 0 % to 5 %	0.015 % of steady state	With respect to a nominal steady state of 100 V to 230 V at 50 Hz.
	T_{max}	Half cycle count	This is a counting function and therefore there is no associated uncertainty. The results may also be reported as time corresponding to the nominal frequency (1/2f).
	Frequency changes Distorted voltage with multiple zero crossings Harmonics with sidebands Phase jumps Rectangular changes with duty cycle	1.5 % 1.1 % 1.3 % 1.0 % 1.0 %	
CALIBRATION OF IMPEDANCE NETWORKS	*16 Hz to 850 Hz:*		Impedances are derived from the voltage and current signals described in Page 1.
Resistance	33 mΩ to 400 Ω	0.48 % to 0.10 %	Phase angle 0° to ±85°
Reactance	33 mΩ to 400 Ω	0.48 % to 0.10 %	Phase angle ±5° to ±90°

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: $Q[a, b] = [a^2 + b^2]^{1/2}$