Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0254

Accredited to ISO/IEC 17025:2017

Devonport Royal Dockyard Limited trading as Devonport Electrical and Nucleonic Calibration Facility

Issue No: 042 **Issue date:** 17 February 2023

Babcock International Group
PC1409, Devonport Royal Dockyard
Plymouth
Devon
PL1 4SG

Contact: Mr D Fisher
Tel: +44 (0)1752 323805
Fax: +44 (0)1752 566357
E-Mail: David.Fisher@babcockinternational.com

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 CALIBRATION			Electrical calibrations are as a comparison against a reference standard
DC Resistance			
Generation			
Specific Values	1 Ω	61 μΩ/Ω	
	10 Ω	58 μΩ/Ω	
	100 Ω	32 μΩ/Ω	
	1 kΩ	22 μΩ/Ω	
	10 kΩ	21 μΩ/Ω	
	100 kΩ	22 μΩ/Ω	
	1 MΩ	24 μΩ/Ω	
	10 MΩ	29 μΩ/Ω	
	100 MΩ	110 μΩ/Ω	
Measurement	0 Ω to 20 Ω	20 μΩ/Ω + 0.20 mΩ	
	20 Ω to 200 Ω	20 μΩ/Ω + 0.60 mΩ	
	200 Ω to 2 kΩ	20 μΩ/Ω + 0.60 mΩ	
	2 kΩ to 20 kΩ	15 μΩ/Ω + 7.0 mΩ	
	20 kΩ to 200 kΩ	15 μΩ/Ω + 65 mΩ	
	200 kΩ to 2 MΩ	25 μΩ/Ω + 1.5 Ω	
	2 MΩ to 20 MΩ	150 μΩ/Ω + 80 Ω	
	20 MΩ to 200 MΩ	200 μΩ/Ω + 9.0 kΩ	
	200 MΩ to 2 GΩ	500 μΩ/Ω + 1.0 MΩ	
	2 GΩ to 100 GΩ	2.0 %	
DC Voltage			
Generation	0 mV to 220 mV	13 μV/V + 2.0 μV	
	220 mV to 2.2 V	5.0 μV/V + 2.0 μV	
	2.2 V to 11 V	6.0 μV/V + 4.0 μV	
	11 V to 22 V	6.0 μV/V + 8.0 μV	
	22 V to 220 V	6.0 μV/V + 0.10 mV	
	220 V to 1100 V	6.0 μV/V + 0.60 mV	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
DC Voltage (continued)			
Measurement	0 mV to 200 mV	10 µV/V + 2.0 µV	
	200 mV to 2 V	10 µV/V + 2.0 µV	
	2 V to 20 V	10 µV/V + 3.0 µV	
	20 V to 200 V	10 µV/V + 40 µV	
	200 V to 1000 V	10 µV/V + 100 µV	
DC Current			
Generation	0 µA to 220 µA	52 µA/A + 10 nA	
	220 µA to 2.2 mA	15 µA/A + 10 nA	
	2.2 mA to 22 mA	30 µA/A + 100 nA	
	22 mA to 220 mA	37 µA/A + 1.0 µA	
	220 mA to 2.2 A	100 µA/A + 30 µA	
	2.2 A to 11 A	190 µA/A + 480 µA	
Measurement	0 µA to 200 µA	50 µA/A + 1.0 nA	
	200 µA to 2 mA	30 µA/A + 5.0 nA	
	2 mA to 20 mA	40 µA/A + 40 nA	
	20 mA to 200 mA	40 µA/A + 1.0 µA	
	200 mA to 1 A	52 µA/A + 10 µA	
	1 A to 10 A	50 µA/A	
AC Voltage			
Generation	*40 Hz to 20 kHz*		
	10 mV to 220 mV	56 µV/V + 10 µV	
	220 mV to 2.2 V	24 µV/V + 20 µV	
	2.2 V to 22 V	22 µV/V + 70 µV	
	22 V to 220 V	63 µV/V + 2.0 mV	
	220 V to 750 V	110 µV/V + 6.0 mV	
	750 V to 1100 V	270 µV/V + 11 mV	
	20 kHz to 50 kHz		
	10 mV to 220 mV	82 µV/V + 10 µV	
	220 mV to 2.2 V	27 µV/V + 80 µV	
	2.2 V to 22 V	22 µV/V + 200 µV	
	22 V to 220 V	91 µV/V + 4.0 mV	
	220 V to 750 V	270 µV/V + 11 mV	
	50 kHz to 100 kHz		
	10 mV to 220 mV	160 µV/V + 30 µV	
	220 mV to 2.2 V	56 µV/V + 80 µV	
	2.2 V to 22 V	52 µV/V + 400 µV	
	22 V to 220 V	200 µV/V + 10 mV	
	100 kHz to 1 MHz		
	220 mV to 2.2 V	0.17 % + 1.0 mV	
	2.2 V to 22 V	0.37 % + 9.0 mV	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
AC Voltage (continued)			
Measurement	*20 Hz to 10 kHz*		
	20 mV to 200 mV	270 μV/V + 4.0 μV	
	200 mV to 2 V	680 μV/V + 20 μV	
	2 V to 20 V	260 μV/V + 200 μV	
	20 V to 200 V	230 μV/V + 2.0 mV	
	10 kHz to 100 kHz		
	20 mV to 200 mV	690 μV/V + 20 μV	
	200 mV to 2 V	600 μV/V + 200 μV	
	2 V to 20 V	550 μV/V + 2.0 mV	
	20 V to 200 V	700 μV/V + 20 mV	
	55 Hz to 3 kHz		
	200 V to 1000 V	580 μV/V + 10 mV	
	3 kHz to 30 kHz		
	200 V to 1000 V	940 μV/V + 20 mV	
AC Current			
Generation	*50 Hz to 400 Hz*		
	10 μA to 200 μA	190 μA/A + 20 nA	
	0.2 mA to 2.2 mA	150 μA/A + 40 nA	
	2.2 mA to 22 mA	58 μA/A + 0.40 μA	
	22 mA to 220 mA	48 μA/A + 4.0 μA	
	220 mA to 2.2 A	110 μA/A + 40 μA	
	2.2 A to 11 A	190 μA/A + 170 μA	
	400 Hz to 1 kHz		
	10 μA to 200 μA	190 μA/A + 50 nA	
	0.2 mA to 2.2 mA	150 μA/A + 0.50 μA	
	2.2 mA to 22 mA	58 μA/A + 5.0 μA	
	22 mA to 220 mA	54 μA/A + 50 μA	
	220 mA to 2.2 A	110 μA/A + 100 μA	
	2.2 A to 11 A	250 μA/A + 380 μA	
	1 kHz to 5 kHz		
	10 μA to 200 μA	700 μA/A + 0.10 μA	
	0.2 mA to 2.2 mA	350 μA/A + 1.0 μA	
	2.2 mA to 22 mA	530 μA/A + 10 μA	
	22 mA to 220 mA	640 μA/A + 100 μA	
	220 mA to 2.2 A	410 μA/A + 200 μA	
	2.2 A to 11 A	390 μA/A + 750 μA	
	5 kHz to 10 kHz		
	10 μA to 200 μA	0.18 % + 0.10 μA	
	0.2 mA to 2.2 mA	0.12 % + 1.0 μA	
	2.2 mA to 22 mA	0.18 % + 10 μA	
	22 mA to 220 mA	0.22 % + 100 μA	
	220 mA to 2.2 A	0.090 % + 200 μA	
	2.2 A to 11 A	0.060 % + 750 μA	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
AC Current (continued)			
Measurement	*55 Hz to 1 kHz* 20 μA to 200 μA 200 μA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 1 A	 850 μA/A + 20 nA 850 μA/A + 200 nA 850 μA/A + 2.0 μA 800 μA/A + 20 μA 800 μA/A + 200 μA	
	1 kHz to 5 kHz 20 μA to 200 μA 200 μA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 1 A	 0.11 % + 20 nA 0.11 % + 200 nA 0.11 % + 2.0 μA 0.10 % + 20 μA 0.18 % + 400 μA	
Capacitance	*1 kHz* 100 pF to 1 μF	 0.070 %	 2 terminal measurements
Frequency			Averaged over 100 s
Generation			
Specific Values	100 kHz, 1 MHz, 5 MHz & 10 MHz	4.0 in 10^{12}	
	1 PPS	4.0 in 10^{11}	
Range values	1 Hz to 20 GHz	1.0 in 10^{11}	
Measurement	1 Hz to 20 GHz	1.0 in 10^{11} + 10 mHz	
Voltage Reflection Coefficient	*10 MHz to 18 GHz* 0 to 0.33	 0.040	The CMC applies to 7 mm 50 Ω coaxial line fitted with Type N connectors; for other connector types the quoted uncertainties may be increased. Results may also be quoted in terms of VSWR or Return Loss with the uncertainty being converted to the corresponding units.
RF Attenuation	*10 MHz to 1 GHz* 0 dB to 10dB 10 dB to 20 dB 20 dB to 30 dB 30 dB to 40 dB 40 dB to 50 dB 50 dB to 60 dB 60 dB to 70 dB 70 dB to 80 dB	 0.080 dB 0.10 dB 0.15 dB 0.18 dB 0.22 dB 0.25 dB 0.30 dB 0.35 dB	The CMCs apply to devices with input and output VSWR not exceeding 1.1: 1. For devices that exhibit higher values of VSWR the quoted uncertainties may be increased.

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
RF Power			
Specific value	*50 MHz* 1 mW	0.70 %	The CMC for measurement of 50MHz 1mW 50 Ω Reference sources with an output VSWR not exceeding 1.1 : 1, For devices that exhibit higher values of VSWR the quoted uncertainties may be increased.
Other values	-20 dBm to +20 dBm		
	10 MHz	2.5%	
	30 MHz	2.5%	
	50 MHz	2.3%	
	100 MHz	2.2%	
	200 MHz	2.2%	
	300 MHz	2.2%	
	400 MHz	2.2%	
	800 MHz	2.2%	
	1 GHz	2.2%	
	2 GHz	2.2%	
	4 GHz	2.2%	
	5 GHz	2.2%	The CMCs for RF Power (Diode Sensors) apply to the measurement of the output power of a 50 Ω source with an output VSWR not exceeding 1.5:1. For devices that exhibit higher values of VSWR the quoted uncertainties may be increased.
	6 GHz	2.2%	
	7 GHz	2.2%	
	8 GHz	2.5%	
	9 GHz	2.7%	
	10 GHz	2.5%	
	11 GHz	2.5%	
	12 GHz	2.5%	
	13 GHz	2.7%	
	14 GHz	3.0%	
	15 GHz	2.7%	
	16 GHz	2.7%	
	17 GHz	3.5%	
	18 GHz	4.5%	
	50 dBm to -20 dBm		
	10 MHz to 30 MHz	8.0 %	
	30 MHz to 8 GHz	3.5%	
	8 GHz to 18 GHz	4.5 %	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
RF Calibration Factor			
Nominal 1 mW	*10 MHz and 30 MHz*	1.6 %	The stated CMCs are for the measurement of RF Calibration Factor of power sensors in a 50 Ω coaxial system at a nominal level of 1 mW, with respect to a reference frequency of 50 MHz.
	100 MHz, 200 MHz, 300 MHz, 400 MHz, 800 MHz and 1000 MHz	1.4 %	
	2 GHz, 3 GHz and 4 GHz	1.7 %	
	5 GHz, 6 GHz, 7 GHz and 8 GHz	3.8 %	
	9 GHz, 10 GHz and 11 GHz	6.0 %	
	12 GHz, 13 GHz and 14 GHz	5.5 %	
	15 GHz, 16 GHz, 17 GHz and 18 GHz	5.3 %	
Nominal 1 μW	*10 MHz*	1.7 %	The stated CMCs are for the measurement of RF Calibration Factor of power sensors in a 50 Ω coaxial system at a nominal level of 1 μW, with respect to a reference frequency of 50 MHz.
	30 MHz, 100 MHz, 200 MHz, 300 MHz, 400 MHz, 800 MHz, 1 GHz, 2 GHz, 3 GHz and 4 GHz	1.5 %	
	5 GHz	1.6 %	
	6 GHz, 7 GHz and 8 GHz	3.0 %	
	9 GHz to 18 GHz	3.4 %	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
RADIOLOGICAL CALIBRATION			
Air Kerma Rate	^{137}Cs: 1.0 μGyh^{-1} to 1.2 Gyh^{-1}	4.0 %	Calibration of air kerma/air kerma rate monitors using air kerma rates to national standards through a secondary standard dosemeter
	^{60}Co: 360 μGyh^{-1} to 8.6 mGyh^{-1}	4.0 %	
	^{241}Am: 10.1 μGyh^{-1} to 2.0 mGyh^{-1}	4.0 %	
Ambient Dose Equivalent Rate	^{137}Cs: 1.21 μSvh^{-1} to 1.45 Svh^{-1}	4.0 %	Calibration of ambient dose equivalent/dose rate monitors using air kerma rates to national standards through a secondary standard dosemeter and using appropriate coefficients given in ISO Standards for H*(10).
	^{60}Co: 417 μSvh^{-1} to 9.8 mSvh^{-1}	4.0 %	
	^{241}Am: 17.6 μSvh^{-1} to 3.5 mSvh^{-1}	4.0 %	
Personal Dose Equivalent Rate	^{137}Cs: 1.21 μSvh^{-1} to 1.45 Svh^{-1}	4.0 %	Calibration of electronic personal dosemeters using air kerma rates to national standards through a secondary standard dosemeter, and using appropriate coefficients given in ISO Standards for Hp(10)
	^{60}Co: 414 μSvh^{-1} to 9.9 mSvh^{-1}	4.0 %	
	^{241}Am: 19.1 μSvh^{-1} to 3.8 mSvh^{-1}	4.0 %	
Surface Contamination			
Monitor Response:			
Alpha (α) Contamination	Alpha-emitting nuclides: ^{241}Am, ^{238}Pu, ^{238}U	5.0 % to 22 % depending upon monitor type	Calibration process is completed as per the guidance of GPG 14
Beta (β) Contamination	Beta-emitting nuclides: ^{90}Sr/^{90}Y, ^{36}Cl, ^{14}C, ^{60}Co, ^{137}Cs	5.0 % to 22 % depending upon monitor type	Calibration process is completed as per the guidance of GPG 14

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