Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0389

Accredited to ISO/IEC 17025:2017

BAE Systems Marine Limited

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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			Methods consistent with EURAMET CG3 and CG17 Calibration of devics with an electrical output may also be undertaken
<u>Hydraulic pressure (gauge)</u>			
Determination of effective area of Dead Weight Testers	0.5 MPa to 140 MPa	0.0070 %	Using deadweight tester
Calibration of pressure indicating instruments and gauges, pressure relief valves and switches	0.5 MPa to 140 MPa 140 MPa to 450 MPa	0.0070 % 0.010 % + 0.24 x10^{-6}/MPa	Using deadweight tester
<u>Gas pressure (gauge)</u>			
Determination of effective area of Dead Weight Testers	3.5 kPa to 700 kPa 700 kPa to 7 MPa	0.0036 % 0.0030 %	Using deadweight tester
Calibration of pressure indicating instruments and gauges, pressure relief valves and switches	-90 kPa to +3.5 kPa 3.5 kPa to 700 kPa 700 kPa to 7 MPa 7 MPa to 20 MPa 20 MPa to 35 MPa 35 MPa to 70 MPa	27 Pa 0.0035 % 0.0035 % 25 kPa 35 kPa 60 kPa	Using pressure calibrator Using deadweight tester Using deadweight tester Using pressure calibrator Using pressure calibrator Using pressure calibrator
<u>Gas pressure (absolute)</u>			
Calibration of pressure indicating instruments and gauges.	3.5 kPa to 700 kPa 700 kPa to 7 MPa	0.0035 % + 1.3 Pa 0.0030 % + 1.3 Pa	Using deadweight tester

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
TEMPERATURE			
Resistance thermometers	-30 °C to 0 °C 0 °C to 50 °C 50 °C to 250 °C 250 °C to 300 °C	0.013 °C 0.020 °C 0.020 °C 0.040 °C	Calibration within liquid baths
	130 °C to 260 °C 260 °C to 520 °C 520 °C to 650 °C	0.80 °C 0.90 °C 0.90 °C	Calibration in a dry block
Thermocouples Base Metal	-30 °C to 300 °C 130 °C to 650 °C 650 °C to 1100 °C	0.16 °C 1.2 °C 4.4 °C	Calibration in liquid bath Calibration in a dry block
Electronic thermometers with sensors Analogue Digital	Range as per sensors	As for sensors plus Half scale division One least significant digit	
MASS			
Weights and Artefacts	Nominal value g	mg	
	0.001 0.002 0.005 0.01 0.02 0.05 0.1 0.2 0.5 1 2 5 10 20 50 100 200 500 1000 2000 5000 10 000 20 000 25 000 30 000	0.012 0.012 0.012 0.016 0.020 0.024 0.032 0.040 0.050 0.060 0.080 0.10 0.12 0.16 0.20 0.32 0.60 1.6 3.2 6.0 16 32 60 150 150	Intermediate values can be calibrated but at an appropriate uncertainty which may exceed the value interpolated from the next highest and lowest values. Substitution method

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
ELECTRICAL			Electrical calibrations are performed as a comparison against a reference standard unless otherwise stated
DC RESISTANCE			
Specific Values	1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ	1.7 μΩ/Ω 0.62 μΩ/Ω 0.53 μΩ/Ω 0.33 μΩ/Ω 0.17 μΩ/Ω 0.10 μΩ/Ω 0.42 μΩ/Ω 0.90 μΩ/Ω 1.2 μΩ/Ω	Decade values using the automated resistance bridge measurement system referenced to a standard resistor
	1 MΩ 10 MΩ 100 MΩ 1 GΩ	1.8 μΩ/Ω 5.1 μΩ/Ω 0.61 μΩ/Ω 3.0 μΩ/Ω	Electrical calibrations are performed as comparison against a reference standard using Build-up method
Other values	10 μΩ to 1 mΩ 1 mΩ to 10 mΩ 10 mΩ to 100 mΩ 100 mΩ to 1 Ω 1 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 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ	1.7 μΩ/Ω 0.62 μΩ/Ω 0.53 μΩ/Ω 0.33 μΩ/Ω 0.17 μΩ/Ω 0.10 μΩ/Ω 0.10 μΩ/Ω 0.42 μΩ/Ω 0.90 μΩ/Ω 1.2 μΩ/Ω 1.8 μΩ/Ω 5.1 μΩ/Ω	Resistors suitable for oil immersion can be calibrated at specified temperatures from 18 °C to 26 °C Resistors suitable for high current can be calibrated at test currents up to 100 A
DC VOLTAGE			Sourcing and measurement capability for the calibration of voltage instruments
Measurement Standard Cell Values	1.018 V	0.41 μV/V	
Specific Values	0.1 V 1 V 10 V 100 V 1000 V	1.5 μV/V 0.30 μV/V 0.26 μV/V 0.32 μV/V 0.60 μV/V	
Sourcing Specific Values	0.1 V 1 V 10 V 100 V 1000 V	1.5 μV/V 0.30 μV/V 95 nV/V 0.32 μV/V 0.60 μV/V	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Range Values	0 V to 1 mV	0.60 % + 0.10 μV	
	1 mV to 10 mV	4.0 μV/V + 1.2 μV	
	10 mV to 100 mV	4.0 μV/V + 1.2 μV	
	100 mV to 1 V	4.0 μV/V + 1.2 μV	
	1 V to 10 V	5.0 μV/V	
	10 V to 1100 V	10 μV/V	
	1 kV to 35 kV	0.045 %	
Values for Temperature simulation			
Measurement	10 mV	3.0 μV/V	
	10 mV to 50 mV	4.0 μV/V	
	50 mV to 100 mV	3.0 μV/V	
Generation	10 mV	3.0 μV/V	
	10 mV to 50 mV	4.0 μV/V	
	50 mV to 100 mV	3.0 μV/V	
DC CURRENT	1 μA to 10 μA	35 μA/A	Sourcing and measurement capability for the calibration of current instruments
	10 μA to 1 A	20 μA/A	
	1 A to 10 A	25 μA/A	
	10 A to 100 A	27 μA/A	
AC VOLTAGE			
Specific Values	0.3 V		For the calibration of voltage measuring and generating equipment.
	10 Hz, 20 Hz, 40 Hz, 300 Hz, 1 kHz, 10 kHz and 20 kHz	30 μV/V	
	50 kHz and 100 kHz	50 μV/V	
	300 kHz, 500 kHz and 1 MHz	0.075 %	
	1 V, 3 V, 10 V and 100 V		
	10 Hz, 20 Hz, 40 Hz, 300 Hz, 1 kHz, 10 kHz and 20 kHz	25 μV/V	
	50 kHz and 100 kHz	50 μV/V	
	30 V		
	10 Hz, 300 Hz, 1 kHz, 10 kHz and 20 kHz	25 μV/V	
	1 V and 10 V		
	300 kHz, 500 kHz and 1 MHz	0.071 %	
	3 V		
	500 kHz and 1 MHz	0.071 %	
	300 V and 1000 V		
	10 Hz, 20 Hz, 40 Hz, 300 Hz, 1 kHz, 10 kHz and 20 kHz	31 μV/V	
	300 V		
	50 kHz and 100 kHz	60 μV/V	
	700 V		
	20 kHz, 50 kHz and 100 kHz	0.075 %	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
AC VOLTAGE (Cont)			
Other values	1 mV to 10 mV		For the calibration of voltage measuring and generating equipment.
	50 Hz to 5 kHz	0.13 %	
	5 kHz to 20 kHz	1.1 %	
	10 mV to 31 mV		
	50 Hz to 5 kHz	0.017 %	
	5 kHz to 20 kHz	0.11 %	
	0.03 V to 0.1 V		
	10 Hz to 20 kHz	42 μV/V	
	20 kHz to 100 kHz	100 μV/V	
	100 kHz to 1 MHz	0.11 %	
	0.1 V to 30 V		
	10 Hz to 20 kHz	44 μV/V	
	20 kHz to 100 kHz	97 μV/V	
	0.1 V to 10 V		
	100 kHz to 1 MHz	0.11 %	
	30 V to 340 V		For the calibration of voltage measuring and generating equipment.
	10 Hz to 20 kHz	52 μV/V	
	20 kHz to 100 kHz	150 μV/V	
	340 V to 1100 V		
	10 Hz to 20 kHz	58 μV/V	
	340 V to 700 V		
	20 kHz to 100 kHz	0.075 %	
	500 V to 35 kV		
	50 kHz to 400 kHz	0.13 %	
AC CURRENT	100 μA to 400 mA		
	40 Hz to 1 kHz	130 μA/A	
	400 mA to 10 A		
	40 Hz to 1 kHz	190 μA/A	
CAPACITANCE	*At 100 Hz*		
	10 μF to 100 μF	0.36 %	By bridge measurement And transfer
	100 μF to 10 mF	0.40 %	
	At 1 kHz:		
	1 pF to 10 pF	0.20 % + 0.0020 pF	
	10 pF to 100 pF	0.030 %	
	100 pF to 100 nF	0.026 %	
	1 μF to 10 μF	0.12 %	
	At 10 kHz		
	1 nF to 1 μF	0.20 %	
	At 100 kHz		
	100 pF to 1 nF	0.38 %	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
FREQUENCY MEASUREMENT	0.001 Hz to 0.01 Hz 0.01 Hz to 100 kHz 100 kHz to 500 MHz	0.35 % 2.0 in 10^{11} + 35 μHz 3.0 to 5.0 parts in 10^{11}	
Specific Values	1 MHz, 5 MHz and10 MHz	1.6 parts in 10^{12}	For calibration of frequency standards
TIME INTERVAL	5 ms to 55 ms	0.34 %	
TEMPERATURE SIMULATION			
Type K thermocouples	-100 °C to 0 ºC	0.13 ºC	Devices fitted with an internal cold junction.
	0 °C to 1370 ºC	0.12 ºC	
PT 100	0 ºC	0.028 ºC	
ACCELEROMETRY			
ACCELERATION TRANSDUCERS			Calibration method is by direct comparison against laboratory references
Accelerometer Types: Piezo electric minimum sensitivity >1 pC/m/s^2 Integral electronic minimum sensitivity >1 mV/m/s^2			Transducer at 23ºC
All types with a nominal mass of up to 250 grams, a nominal Peak Acceleration of 0.98 ms^{-2} to 98 ms^{-2}	*5 Hz to 10 Hz* *10 Hz to 100 Hz* *100 Hz* *100 Hz to 920 Hz* *920 Hz to 5 kHz* *5 kHz to 10 kHz* *10 kHz to 15 kHz* *15 kHz to 20 kHz*	1.6 % 1.3 % 1.0 % 1.2 % 1.8 % 2.3 % 2.8 % 4.5 %	

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Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
LENGTH			
MEASURING INSTRUMENTS AND MACHINES			
Micrometers - External	0 mm to 25 mm 25 mm to 100 mm	1.4 µm 1.6 µm	Calibration as BS 870:2008 Heads, between any two points
Ancillary Measurements	Flatness Parallelism	0.70 µm 1.0 µm	
Calliper type gauges including dial and digital	ISO 13385-1:2019 Partial surface contact error (E) 0 m to 150 mm	1.2 µm	Calibration by comparison to length standards
	Shift error (S) – Internal measuring faces 20 mm to 50 mm	5.4 µm	The stated uncertainty has been calculated in accordance With ISO 14253-5 and relates to the test value uncertainty.
	Shift error (S) – Crossed knife-edge internal measuring faces 5 mm	5.4 µm	The uncertainty quoted Excludes contributions relating the instrument under test.
	Shift error (S) – Depth or step measuring faces <50 mm	4.6 µm	
	Line contact error 15 mm	2.7 µm	
Dial gauges and dial test indicators	0 mm to 50 mm	13 µm	Calibration as BS 2795:1981 BS 907: 2008
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: $Q[a, b] = [a^2 + b^2]^{1/2}$