Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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0246

Accredited to ISO/IEC 17025:2017

Defence Electronics & Components Agency

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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			All electrical calibrations are performed as a comparison against a reference standard unless otherwise stated
FREQUENCY			
Specific Values	100 kHz 1 MHz 5 MHz 10 MHz	2.3 in 10^{12} 2.3 in 10^{12} 2.3 in 10^{12} 2.3 in 10^{12}	For the calibration of Frequency equipment, timers / counters
RESISTANCE	0 Ω to 2 Ω 2 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 2 kΩ 2 kΩ to 20 kΩ 20 kΩ to 200 kΩ 200 kΩ to 2 MΩ 2 MΩ to 20 MΩ 20 MΩ to 200 MΩ	18 ppm + 1.0 μΩ 11 ppm + 7.0 μΩ 10 ppm + 43 μΩ 10 ppm + 200 μΩ 10 ppm + 2.0 mΩ 10 ppm + 20 mΩ 12 ppm + 200 mΩ 27 ppm + 4.0 Ω 210 ppm + 200 Ω	For measurement of instrument outputs
DC/LF MULTIFUNCTION TRANSFER STANDARD SYSTEM			
DC RESISTANCE	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	12 ppm 10 ppm 7.5 ppm 5.8 ppm 9.9 ppm 17 ppm 67 ppm 250 ppm	Sourcing resistance for measuring instruments
DC VOLTAGE	100 mV 1 V 10 V 19 V 100 V 1000 V	11 ppm 4.5 ppm 4.3 ppm 4.3 ppm 7.0 ppm 6.1 ppm	Sourcing and measurement capability for the calibration of voltage instruments

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC/LF MULTIFUNCTION TRANSFER STANDARD SYSTEM (cont'd)			
DC CURRENT	100 μA 1 mA 10 mA 100 mA 1 A 10 A	39 ppm 35 ppm 30 ppm 36 ppm 51 ppm 73 ppm	Sourcing and measurement capability for the calibration of current instruments
AC VOLTAGE	1 mV *20 Hz* *30 Hz* *40 Hz* *55 Hz* *300 Hz* *1 kHz* *10 kHz* *20 kHz* *30 kHz* *50 kHz* *100 kHz* 10 mV *20 Hz* *30 Hz* *40 Hz* *55 Hz* *300 Hz* *1 kHz* *10 kHz* *20 kHz* *30 kHz* *50 kHz* *100 kHz* 100 mV *20 Hz* *30 Hz* *40 Hz* *55 Hz* *300 Hz* *1 kHz* *10 kHz* *20 kHz* *30 kHz* *50 kHz* *100 kHz*	 0.21 % 0.21 % 0.21 % 0.22 % 0.21 % 0.21 % 0.21 % 0.21 % 0.21 % 0.21 % 0.32 % 320 ppm 310 ppm 310 ppm 310 ppm 300 ppm 310 ppm 300 ppm 310 ppm 360 ppm 340 ppm 530 ppm 130 ppm 120 ppm 130 ppm 160 ppm 120 ppm 110 ppm 110 ppm 130 ppm 180 ppm 190 ppm 370 ppm	Sourcing and measurement capability for the calibration of voltage instruments

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC VOLTAGE (cont'd)	1 V		
	10 Hz	49 ppm	
	20 Hz	51 ppm	
	30 Hz	46 ppm	
	40 Hz	41 ppm	
	55 Hz	41 ppm	
	300 Hz	39 ppm	
	1 kHz	45 ppm	
	10 kHz	41 ppm	
	20 kHz	40 ppm	
	30 kHz	40 ppm	
	50 kHz	47 ppm	
	100 kHz	78 ppm	
	300 kHz	180 ppm	
	500 kHz	470 ppm	
	1 MHz	0.16 %	
	10 V		
	10 Hz	55 ppm	
	20 Hz	48 ppm	
	30 Hz	53 ppm	
	40 Hz	41 ppm	
	55 Hz	40 ppm	
	300 Hz	40 ppm	
	1 kHz	45 ppm	
	19 V		
	1 kHz	39 ppm	
	10 kHz	36 ppm	
	20 kHz	38 ppm	
	30 kHz	46 ppm	
	50 kHz	57 ppm	
	100 kHz	91 ppm	
	300 kHz	160 ppm	
	500 kHz	710 ppm	
	1 MHz	0.14 %	
	100 V		
	10 Hz	55 ppm	
	20 Hz	51 ppm	
	30 Hz	50 ppm	
	40 Hz	52 ppm	
	55 Hz	48 ppm	
	300 Hz	44 ppm	
	1 kHz	42 ppm	
	10 kHz	43 ppm	
	20 kHz	44 ppm	
	30 kHz	45 ppm	
	50 kHz	51 ppm	
	100 kHz	100 ppm	
	700 V		
	50 kHz	190 ppm	
	100 kHz	480 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC VOLTAGE (cont'd)	1000 V		
	40 Hz	53 ppm	
	55 Hz	51 ppm	
	300 Hz	52 ppm	
	1 kHz	49 ppm	
	10 kHz	60 ppm	
	20 kHz	63 ppm	
	30 kHz	89 ppm	
AC CURRENT	100 μA		Sourcing and measurement capability for the calibration of current instruments
	10 Hz	190 ppm	
	20 Hz	190 ppm	
	30 Hz	180 ppm	
	40 Hz	180 ppm	
	55 Hz	190 ppm	
	300 Hz	180 ppm	
	1 kHz	170 ppm	
	5 kHz	390 ppm	
	1 mA		
	10 Hz	140 ppm	
	20 Hz	150 ppm	
	30 Hz	130 ppm	
	40 Hz	110 ppm	
	55 Hz	110 ppm	
	300 Hz	110 ppm	
	1 kHz	110 ppm	
	5 kHz	170 ppm	
	10 mA		
	10 Hz	140 ppm	
	20 Hz	130 ppm	
	30 Hz	120 ppm	
	40 Hz	110 ppm	
	55 Hz	110 ppm	
	300 Hz	110 ppm	
	1 kHz	110 ppm	
	5 kHz	170 ppm	
	100 mA		
	10 Hz	140 ppm	
	20 Hz	130 ppm	
	30 Hz	130 ppm	
	40 Hz	110 ppm	
	55 Hz	110 ppm	
	300 Hz	110 ppm	
	1 kHz	110 ppm	
	5 kHz	170 ppm	
	1 A		
	10 Hz	180 ppm	
	20 Hz	180 ppm	
	30 Hz	170 ppm	
	40 Hz	140 ppm	
	55 Hz	140 ppm	
	300 Hz	130 ppm	
	1 kHz	180 ppm	
	5 kHz	300 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC CURRENT (cont'd)	10 A		
	10 Hz	370 ppm	
	20 Hz	380 ppm	
	30 Hz	380 ppm	
	40 Hz	360 ppm	
	55 Hz	360 ppm	
	300 Hz	370 ppm	
	1 kHz	390 ppm	
	5 kHz	640 ppm	
	10 kHz	0.12 %	
DC/LF AUTOMATED CALIBRATION SYSTEM			
DC VOLTAGE	0 mV to 200 mV	10 ppm + 0.60 μV	Sourcing and measurement capability for the calibration of voltage instruments
	200 mV to 2 V	6.5 ppm + 1.7 μV	
	2 V to 20 V	4.5 ppm + 5.2 μV	
	20 V to 200 V	6.5 ppm + 130 μV	
	200 V to 1000 V	9.0 ppm + 0.58 mV	
DC CURRENT	0 μA to 200 μA	120 ppm + 2.0 nA	Sourcing and measurement capability for the calibration of current instruments
	200 μA to 2 mA	50 ppm + 12 nA	
	2 mA to 20 mA	50 ppm + 120 nA	
	20 mA to 200 mA	50 ppm + 1.2 μA	
	200 mA to 2 A	120 ppm + 24 μA	
DC RESISTANCE	0 Ω	10 mΩ (2-wire configuration)	The zero uncertainty for 4-wire configurations will be lower than that for 2-wire configurations and will largely depend on the resolution of the instrument being calibrated.
	10 Ω	35 ppm	
	100 Ω	15 ppm	
	1 kΩ	15 ppm	
	10 kΩ	15 ppm	
	100 kΩ	16 ppm	
	1 MΩ	35 ppm	
	10 MΩ	65 ppm	
	100 MΩ	250 ppm	
AC VOLTAGE	2 mV to 200 mV		Sourcing and measurement capability for the calibration of voltage instruments
	20 Hz to 500 Hz	190 ppm + 11 μV	
	500 Hz to 1 kHz	140 ppm + 11 μV	
	1 kHz to 20 kHz	150 ppm + 11 μV	
	20 kHz to 40 kHz	400 ppm + 11 μV	
	40 kHz to 100 kHz	530 ppm + 11 μV	
	200 mV to 2 V		
	20 Hz to 300 Hz	110 ppm + 47 μV	
	300 Hz to 500 Hz	65 ppm + 47 μV	
	500 Hz to 30 kHz	55 ppm + 47 μV	
	30 kHz to 40 kHz	100 ppm + 47 μV	
	40 kHz to 100 kHz	110 ppm + 47 μV	
	2 V to 20 V		
	20 Hz to 300 Hz	110 ppm + 0.47 mV	
	300 Hz to 500 Hz	65 ppm + 0.47 mV	
	500 Hz to 30 kHz	55 ppm + 0.47 mV	
	30 kHz to 100 kHz	100 ppm + 0.47 mV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC VOLTAGE (cont'd)	20 V to 200 V		
	20 Hz to 300 Hz	130 ppm + 4.7 mV	
	300 Hz to 1 kHz	76 ppm + 4.7 mV	
	1 kHz to 20 kHz	76 ppm + 4.7 mV	
	20 kHz to 30 kHz	78 ppm + 4.7 mV	
	30 kHz to 40 kHz	150 ppm + 4.7 mV	
	40 kHz to 100 kHz	160 ppm + 4.7 mV	
	200 V to 1000 V		
	500 Hz to 1 kHz	130 ppm + 47 mV	
	1 kHz to 20 kHz	170 ppm + 47 mV	
	20 kHz to 30 kHz	180 ppm + 47 mV	
AC CURRENT	2 μA to 200 μA		Sourcing and measurement capability for the calibration of voltage instruments
	500 Hz	210 ppm + 12 nA	
	200 μA to 2 mA		
	500 Hz	160 ppm + 120 nA	
	2 mA to 20 mA		
	500 Hz	160 ppm + 1.2 μA	
	20 mA to 200 mA		
	40 Hz to 500 Hz	160 ppm + 12 μA	
	500 Hz to 5 kHz	280 ppm + 12 μA	
	200 mA to 2 A		
	40 Hz to 500 Hz	370 ppm + 120 μA	
	500 Hz to 5 kHz	570 ppm + 120 μA	
PRESSURE			Methods consistent with EURAMET CG17.
Gas pressure (absolute)			
Calibration of pressure measuring instruments and gauges	3.5 kPa to 175 kPa	50 ppm + 2 Pa	Calibration against a deadweight tester standard
	175 kPa to 700 kPa	46 ppm + 2 Pa	
Gas pressure (gauge)			
Calibration of pressure measuring instruments and gauges	-95 kPa to 0 kPa	70 Pa	Calibration against a deadweight tester standard
	3.5 kPa to 175 kPa	43 ppm	
	175 kPa to 700 kPa	43 ppm	
	700 kPa to 3.5 MPa	57 ppm	
Hydraulic pressure (gauge)			
Calibration of pressure measuring instruments and gauges	0.35 MPa to 0.69 MPa	108 ppm	Calibration against a deadweight tester standard
	0.69 MPa to 6.9 MPa	85 ppm	
	6.9 MPa to 69 MPa	58 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
FORCE			
Calibration of push strength testers in compression	5 N to 500 N	0.33% of applied force	Calibrated using alignment guides
TEMPERATURE			
Temperature Indicators and/or recorders with temperature sensors	5 °C to 60 °C 60 °C to 120 °C	0.045 °C 0.064 °C	Calibration against a reference standard
ROTATIONAL SPEED			
Optical Tachometers	45 RPM to 1000 RPM 1000 RPM to 100,000 RPM	110 ppm + 0.050 RPM 110 ppm + 0.50 RPM	Calibration against a reference standard
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.