Schedule of Accreditation

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Accredited to ISO/IEC 17025:2017

Airbus Operations Ltd

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DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Electrical			
Electrical measurement and sourcing capabilities listed below follow the method of direct comparison against laboratory references or established ratio technique unless otherwise stated in the remarks column. This includes Time, Frequency and Temperature Simulation			
DC Voltage	0 mV to 200 mV	0.6 µV	
	200 mV to 2 V	5.3 ppm	
	2 V to 20 V	3.2 ppm	
	20 V to 200 V	3.1 ppm	
	200 V to 1 kV	4.7 ppm	
DC Resistance			
	0 Ω to 1 Ω	13 µΩ	
	1 Ω to 2 Ω	13 ppm	
	2 Ω to 20 Ω	8.3 ppm	
	20 Ω to 200 Ω	7.7 ppm	
	200 Ω to 2 kΩ	7.7 ppm	
	2 kΩ to 20 kΩ	7.7 ppm	
	20 kΩ to 200 kΩ	7.9 ppm	
	200 kΩ to 2 MΩ	9.6 ppm	
	2 MΩ to 20 MΩ	19 ppm	
	20 MΩ to 200 MΩ	110 ppm	
	200 MΩ to 2 GΩ	0.12 %	
	2 GΩ to 20 GΩ	0.42 %	
Current carrying resistors			
	1 mΩ at:-		
	3 A	0.33 µΩ	
	10 A	0.15 µΩ	
	20 A	0.76 µΩ	
	10 mΩ at:-		
	3 A	2.6 µΩ	
	10 A	1.4 µΩ	
	20 A	0.70 µΩ	
DC Current			
	0 µA to 20 µA	1.7 nA	
	20 µA to 200 µA	11 ppm	
	200 µA to 2 mA	11 ppm	
	2 mA to 20 mA	11 ppm	
	20 mA to 200 mA	41 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC Current (continued)	200 mA to 2 A	180 ppm	
	2 A to 20 A	410 ppm	
AC Voltage			
	2 mV to 200 mV		
	10Hz to 40Hz	150 ppm	
	40Hz to 100Hz	130 ppm	
	100Hz to 2kHz	120 ppm	
	2kHz to 10kHz	130 ppm	
	10kHz to 30kHz	350 ppm	
	30kHz to 100kHz	810 ppm	
	200 mV to 2 V		
	10Hz to 40Hz	110 ppm	
	40Hz to 100Hz	93 ppm	
	100Hz to 2kHz	73 ppm	
	2kHz to 10kHz	96 ppm	
	10kHz to 30kHz	220 ppm	
	30kHz to 100kHz	610 ppm	
	100 kHz to 300 kHz	0.40 %	
	300 kHz to 1 MHz	2.0 %	
	2 V to 20 V		
	10 Hz to 40 Hz	110 ppm	
	40 Hz to 100 Hz	93 ppm	
	100 Hz to 2 kHz	74 ppm	
	2 kHz to 10 kHz	96 ppm	
	10 kHz to 30 kHz	220 ppm	
	30 kHz to 100 kHz	610 ppm	
	100 kHz to 300 kHz	0.40 %	
	300 kHz to 1 MHz	2.0 %	
	20 V to 200 V		
	10Hz to 40Hz	120 ppm	
	40Hz to 100Hz	97 ppm	
	100Hz to 2kHz	76 ppm	
	2kHz to 10kHz	98 ppm	
	10kHz to 30kHz	220 ppm	
	30kHz to 100kHz	610 ppm	
	200 V to 1 kV		
	10Hz to 40Hz	110 ppm	
	40Hz to 30 kHz	250 ppm	
AC Current	*10 Hz to 10 kHz*		
	200 µA	110 nA	
	0.2 mA to 2 mA	370 ppm	
	2 mA to 20 mA	350 ppm	
	20 mA to 200 mA	360 ppm	
	200 mA to 2 A	830 ppm	
	2 A to 20 A	910 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC Voltage			
5700A system	0 mV to 200 mV	7.0 ppm + 0.70 µV	
	200 mV to 2 V	4.2 ppm + 1.3 µV	
	2 V to 11 V	4.2 ppm + 4.1 µV	
	11 V to 20 V	3.8 ppm + 8.1 µV	
	20 V to 200 V	4.2 ppm + 92 µV	
	200 V to 1 kV	4.8 ppm + 580 µV	
DC Resistance			
5700A system	0 Ω	50 µΩ	
	1 Ω	75 ppm	
	1.9 Ω	95 ppm	
	10 Ω	28 ppm	
	19 Ω	27 ppm	
	100 Ω	17 ppm	
	190 Ω	17 ppm	
	1 kΩ	13 ppm	
	1.9 kΩ	13 ppm	
	10 kΩ	12 ppm	
	19 kΩ	12 ppm	
	100 kΩ	14 ppm	
	190 kΩ	14 ppm	
	1 MΩ	20 ppm	
	1.9 MΩ	21 ppm	
	10 MΩ	40 ppm	
	19 MΩ	47 ppm	
	100 MΩ	110 ppm	
DC Current			
5700A system	0 µA to 200 µA	7.5 ppm + 1.8 nA	
	200 µA to 2 mA	26 ppm + 4.6 nA	
	2 mA to 20 mA	26 ppm + 92 nA	
	20 mA to 200 mA	33 ppm + 290 nA	
	200 mA to 2 A	48 ppm + 6.9 µA	
5520A system	2 A to 3 A	780 µA	
	3 A to 20 A	1.3 mA	
AC Voltage			
5700A system	5 µV to 2 mV		
	10 Hz to 20 Hz	550 ppm + 4.5 µV	
	20 Hz to 40 Hz	210 ppm + 4.5 µV	
	40 Hz to 20 kHz	110 ppm + 4.5 µV	
	20 kHz to 50 kHz	370 ppm + 4.5 µV	
	50 kHz to 100 kHz	850 ppm + 7.0 µV	
	100 kHz to 300 kHz	0.11 % + 13 µV	
	300 kHz to 500 kHz	0.17 % + 25 µV	
	500 kHz to 1 MHz	0.34 % + 25 µV	
	2 mV to 20 mV		
	10 Hz to 20 Hz	550 ppm + 5.0 µV	
	20 Hz to 40 Hz	210 ppm + 5.0 µV	
	40 Hz to 20 kHz	110 ppm + 5.0 µV	
	20 kHz to 50 kHz	370 ppm + 5.0 µV	
	50 kHz to 100 kHz	850 ppm + 7.0 µV	
	100 kHz to 300 kHz	0.11 % + 13 µV	
	300 kHz to 500 kHz	0.17 % + 25 µV	
	500 kHz to 1 MHz	0.34 % + 25 µV	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Voltage (continued) 5700A system	20 mV to 200 mV		
	10 Hz to 20 Hz	550 ppm + 13 µV	
	20 Hz to 40 Hz	210 ppm + 8.0 µV	
	40 Hz to 20 kHz	110 ppm + 8.0 µV	
	20 kHz to 50kHz	370 ppm + 8.0 µV	
	50 kHz to 100 kHz	850 ppm + 25 µV	
	100 kHz to 300 kHz	500 ppm + 25 µV	
	300 kHz to 500 kHz	0.13 % + 35 µV	
	500 kHz to 1 MHz	0.27 % + 80 µV	
	200 mV to 2 V		
	10 Hz to 20 Hz	550 ppm + 80 µV	
	20 Hz to 40 Hz	210 ppm + 25 µV	
	40 Hz to 20 kHz	110 ppm + 6.0 µV	
	20 kHz to 50 kHz	370 ppm + 16 µV	
	50 kHz to 100 kHz	850 ppm + 70 µV	
	100 kHz to 300 kHz	500 ppm + 130 µV	
	300 kHz to 500 kHz	0.13 % + 350 µV	
	500 kHz to 1 MHz	0.27 % + 850 µV	
	2 V to 20 V		
	10 Hz to 20 Hz	550 ppm + 800 µV	
	20 Hz to 40 Hz	160 ppm + 250 µV	
	40 Hz to 20 kHz	75 ppm + 60 µV	
	20 kHz to 50 kHz	120 ppm + 160 µV	
	50 kHz to 100 kHz	250 ppm + 350 µV	
	100 kHz to 300 kHz	500 ppm + 15 mV	
	300 kHz to 500 kHz	0.13 % + 4.3 mV	
	500 kHz to 1 MHz	0.27 % + 8.5 mV	
	20 V to 200 V		
	10 Hz to 20 Hz	550 ppm + 8.0 mV	
	20 Hz to 40 Hz	160 ppm + 3.0 mV	
	40 Hz to 20 kHz	80 ppm + 1.0 mV	
	20 kHz to 50 kHz	220 ppm + 4.0 mV	
	50 kHz to 100 kHz	500 ppm + 8.0 mV	
	100 kHz to 300 kHz	0.15 % + 90 mV	
	300 kHz to 500 kHz	0.47 % + 90 mV	
	500 kHz to 1 MHz	1.2 % + 190 mV	
	200 V to 1.1 kV		
	15 Hz to 50 Hz	400 ppm + 15 mV	
	50 Hz to 1 kHz	80 ppm + 4 mV	
AC Current 5700A sysyem	20 µA to 200 µA		
	55 Hz to 1 kHz	140 ppm+ 16 nA	
	1 kHz to 5 kHz	600 ppm + 40 nA	
	5 kHz to 10 kHz	0.16 % + 80 nA	
	200 µA to 2 mA		
	55 Hz to 1 kHz	140 ppm+ 35 nA	
	1 kHz to 5 kHz	600 ppm + 400 nA	
	5 kHz to 10 kHz	0.16 % + 800 nA	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC Current (continued) 5700A system	2 mA to 20 mA *55 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 20 mA to 200 mA *55 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz* 200 mA to 2.0 A *55 Hz to 1 kHz* *1 kHz to 5 kHz* *5 kHz to 10 kHz*	 140 ppm+ 350 nA 600 ppm + 4.0 µA 0.16 % + 8.0 µA 140 ppm+ 3.5 µA 600 ppm + 40 µA 0.16 % + 80 µA 650 ppm+ 35 µA 750 ppm + 80 µA 0.85 % + 160 µA	
5520A system	2 A to 3 A *45 Hz to 1 kHz* *1 kHz to 5 kHz* 3 A to 20 A *45 Hz to 1 kHz* *1 kHz to 5 kHz*	 1.2 mA 1.1 mA 23 mA 26 mA	
Capacitance	0.19 nF to 0.4 nF *10 Hz to 10 kHz* 0.4 nF to 1.1 nF *10 Hz to 10 kHz* 1.1 nF to 3.3 nF *10 Hz to 3 kHz* 3.3 nF to 11 nF *10 Hz to 1 kHz* 11 nF to 33 nF *10 Hz to 1 kHz* 33 nF to 110 nF *10 Hz to 1 kHz* 110 nF to 330 nF *10 Hz to 1 kHz* 330 nF to 1.1 µF *10 Hz to 600 Hz* 1.1 µF to 3.3 µF *10 Hz to 300 Hz* 3.3 µF to 11 µF *10 Hz to 150 Hz* 11 µF to 33 µF *10 Hz to 120 Hz* 33 µF to 110 µF *10 Hz to 80 Hz* 110 µF to 330 µF *DC to 50 Hz* 330 µF to 1.1 mF *DC to 20 Hz*	 8.9 pF 12 pF 19 pF 27 pF 136 pF 270 pF 810 pF 2.7 nF 8.1 nF 27 nF 120 nF 430 nF 1.3 uF 4.3 uF	These values are sourced by simulation.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Capacitance continued			
	1.1 mF to 3.3 mF		
	DC to 6 Hz	13 uF	
	3.3mF to 11 mF		
	DC to 2 Hz	43 uF	
	11 to 33 mF		
	DC to 0.6 Hz	200 uF	
	33 to 110 mF		
	DC to 0.2 Hz	930 uF	
AC Resistance			
	50 Hz to 1 kHz		
	0 Ω to 1 Ω	5 mΩ	
Spot frequency 1 kHz ± 10 Hz	5 mΩ to 1 Ω	0.31 %	Calibration of Aircraft loop test box.
AC Conductivity			
At a nominal 60 kHz			
0.8 % IACS to 15 % IACS	0.14 MS/m to 0.26 MS/m	1.4 % of value	Note; 58.0 MS/m = 100 % on the International Annealed Copper Scale
15 % IACS to 59.56% IACS	0.27 MS/m to 1.03 MS/m	0.85 % of value	
59.56 % IACS to 100 % IACS	1.03 MS/m to 58 MS/m	1.6 % of value	
Frequency			
	10 MHz reference	5 in 10^{10}	
	1 mHz to 1 GHz	1 in 10^{9}	
Time			
Repetitive events	10 ns to 103 s	1 ns	
Single shot	10 ns to 103 s	2 ns	
Mechanically triggered	100 ms to 103 s	50 ms	
Temperature Simulation			
Calibrators and displays Thermocouples Type:			Including reference junction compensation
K	-270 °C to -100 °C	0.23 °C	
	-100 °C to 120 °C	0.14 °C	
	120 °C to 1372 °C	0.28 °C	
T	-250 °C to -150 °C	0.43 °C	
	-150 °C to 0 °C	0.19 °C	
	0 °C to 400 °C	0.14 °C	
Calibrators and displays Thermocouples Type:			
J	-210 °C to -100 °C	0.19 °C	
	-100 °C to 150 °C	0.12 °C	
	150 °C to 1200 °C	0.16 °C	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Temperature Simulation continued			
Resistance thermometer (Pt 100)	-200 °C to 800 °C	0.070 °C	
Reference Junction Compensation	Nominal Ambient 20 °C to 21 °C	0.050 °C	
Force Measuring Devices			
Calibration of load cells (excluding proving devices) by force proving instruments in tension and compression	0.25 kN to 1200 kN	0.36 %	
Pressure			
All pressure calibrations performed by direct comparison to reference instruments Pressure devices with an electrical output can be calibrated.			Calibration of pressure indicating instruments and gauges
Hydraulic pressure (gauge)	600 kPa to 6 MPa 6 MPa to 120 MPa	$\sqrt{(0.020\,\%\,p)^2 + (180\ \mathrm{Pa})^2}$ $\sqrt{(0.014\,\%\,p)^2 + (180\ \mathrm{Pa})^2}$	p in Pa
Gas pressure (gauge)			Absolute pressure calibrations can be undertaken using associated barometric pressure measurement correction. The uncertainties quoted will be increased by 25 Pa
Calibration of pressure indicating instruments and gauges	-99 kPa to 0 0 Pa to 160 kPa 160 kPa to 7 MPa	25 Pa 25 Pa 500 Pa	
Gas pressure (absolute)			
Calibration of pressure indicating instruments and gauges	84 kPa to 115 kPa	25 Pa	
Temperature			
PRT (4 wire)	-90 °C to -40 °C -40 °C to 125 °C 125 °C to 250 °C 0.01 ˚C	0.15 °C 0.024 °C 0.022 °C 0.0055 ˚C	Using a metal block calibrator In silicon oil bath In silicon oil bath In Triple Point of Water Cell
Temperature sensors and indicators	-90 °C to -40 °C -40 °C to 125 °C 125 °C to 250 °C	0.15 °C 0.024 °C 0.022 °C	Using a metal block calibrator In silicon oil bath In silicon oil bath

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Temperature continued			
Thermocouples (base Metal)	-90 °C to -40 °C -40 °C to 125 °C 125 °C to 250 °C	0.50 °C 0.38 °C 0.42 °C	Using a metal block calibrator In silicon oil bath In silicon oil bath
Humidity			
Calibration of hygrometers and temperature in air	10 %rh to 95 %rh over a temperature range 5 °C to 50 °C	1.5% of value +0.2 %rh 0.20 °C	HygroGen Chamber
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.