Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0604

Accredited to ISO/IEC 17025:2017

Young Calibration Limited

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Calibration performed by the Organisations at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address 5 Cecil Pashley Way Shoreham Airport Shoreham-by-Sea West Sussex BN43 5FF	**Local contact** Mr A Young	Pressure Electrical Temperature indicators - Electrical simulation Air velocity Air flow Water flow Hydrocarbon flow Temperature Humidity	Lab

Site activities performed away from the locations listed above:

Location details		Activity	Location code
The customer's site or premises must be suitable for the nature of the particular calibrations undertaken and will be the subject of contract review arrangements between the laboratory and the customer	**Local contact** Mr A Young	Pressure Electrical Temperature indicators - Electrical simulation Temperature Humidity	Site

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
FLOW				
Hydrocarbon oils				
Calibration of flow meters using gravimetric and reference meter methods				
Volume flow rate	0.5 l/min to 440 l/min	0.40 %	Calibrations are carried out with fluids within the viscosity range 5 to 20cSt at fluid temperatures of up to 60 °C Calibrations are carried out at pressures of up to 10 bar	Lab
Quantity of fluid passed	0.33 l to 361.7 l 361.7 l to 4 400 l (at flow rates of 0.5 l/min to 440 l/min)	0.40 % 1.0 %		
Mass flow rate	0.5 kg/min to 367.4 kg/min	0.40 %		
Mass of fluid passed	0.4 kg to 302 kg 302 kg to 3 674 kg (at flow rates of 0.5 kg/min to 367.4 kg/min)	0.40 % 1.0 %		
Water				
Calibration of flow meters using gravimetric and reference meter methods				
Volume flow rate	1.0 ml/hr to 2400 ml/hr 1.0 ml/hr to 2400 ml/hr	0.10 % + 0.0040 ml/hr 0.55 % + 0.36 ml/hr	Calibrations are carried out at pressures of up to 4 bar	Lab
	0.04 l/min to 1 000 l/min	0.15 %		
Quantity of fluid passed	0.25 l to 801.6 l 801.6 l to 7 000 l (at flow rates of 0.04 l/min to 1 000 l/min)	0.15 % 1.0 %		
Mass flow rate	1 g/hr to 2400 g/hr 1 g/hr to 2400 g/hr	0.10 % + 0.0040 g/hr 0.55 % + 0.36 g/hr		
	0.04 kg/min to 998 kg/min	0.15 %		
Mass of fluid passed	0.25 g to 800 kg 800 kg to 9 980 kg (at flow rates of 0.04 kg/min to 998 kg/min)	0.15% 1.0 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Gas			Calibration of flow meters with an electrical or pressure output can be undertaken	
Calibration of flow meters using Sonic nozzle method				
Volume flow rate	1 ml/min to 1 300 l/min	0.52 % + 0.3 ml/min	Calibrations are carried out at pressures of up to 8 bar	Lab
Quantity of gas passed	300 ml to 26 000 l (at flow rates of 1 ml/min to 1 300 l/min)	0.52 % + 0.3 ml		
Mass flow rate	0.001 2 g/min to 1.56 kg/min	0.52 % + 0.0003 g/min		
Mass of gas passed	0.36 g to 31.2 kg (at flow rates of 0.001 2 g/min to 1.56 kg/min)	0.52 % + 0.0003 g		
Calibration of flow meters using Turbine meter method				
Volume flow rate	10 l/s to 450 l/s	0.85 %	Calibrations are carried out at ambient conditions	
Quantity of gas passed	300 l to 540 kl (at flow rates of 10 l/s to 450 l/s)	0.85 %		
Mass flow rate	12 g/s to 0.54 kg/s	0.85 %		
Mass of gas passed	0.36 kg to 643 kg (at flow rates of 12 g/s to 0.54 kg/s)	0.85 %		
Calibration of flow meters using LDA method				
Volume flow rate	40 l/s to 1 250 l/s	0.70 % + 0.030 l/s	Calibrations are carried out at ambient conditions using a laser doppler anemometer	Lab
Quantity of gas passed	12 kl to 375 kl (at flow rates of 40 l/s to 1 250 l/s)	0.70 % + 9.0 l		
Mass flow rate	48 g/s to 1.488 kg/s	0.70 % + 0.036 g/s		
Mass of gas passed	14.28 kg to 1 785 kg (at flow rates of 48 g/s to 1.488 kg/s)	0.70 % + 11 g		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
AIR VELOCITY				
Pitot tubes	1.0 m/s to 80 m/s	0.15 % + 0.000 20 m/s	1) Calibrations are performed against a laser doppler anemometer, or a secondary standard where requested.	Lab
Thermal and ultrasonic anemometers	0.05 m/s to 80 m/s	0.16 % + 0.000 30 m/s		
Vane anemometers	0.1 m/s to 40 m/s	0.20 % + 0.001 m/s	2) Pitot tube uncertainty dependant on pitot differential pressure range	
Rotating cup anemometers	1.0 m/s to 21 m/s	0.23 %	3) Air velocity instruments up to 480 x 120 mm diameter (working area): uncertainty is dependent on design of instrument under test.	
PRESSURE			Methods consistent with EURAMET CG3 and CG17	
Gas pressure (absolute)				
Calibration of pressure indicating instruments and gauges	5 kPa to 130 kPa	22 Pa	Devices with an electrical output can also be calibrated.	Lab
Gas pressure (gauge)				
Calibration of pressure indicating instruments and gauges	- 90 kPa to 0 Pa 0 Pa to 2.5 kPa 2.5 kPa to 5 kPa 5 kPa to 6.9 kPa 6.9 kPa to 20 kPa 20 kPa to 270 kPa 270 kPa to 2.1 MPa 2.1 MPa to 3.5 MPa	120 Pa 0.047 % + 0.060 Pa 0.046 % + 0.31 Pa 9 Pa 16 Pa 0.029 % 0.023 % 1.1 kPa	Absolute pressure calibrations can be undertaken using gauge pressure generation and the associated barometric pressure with the additional absolute pressure uncertainty as listed	Lab
Hydraulic pressure (gauge)				
Calibration of pressure indicating instruments and gauge	0.55 MPa to 1 MPa 1 MPa to 41 MPa 41 MPa to 110 MPa	0.019 % + 90 Pa 0.013 % + 90 Pa 0.018 %		Lab
Gas pressure (absolute)				
Calibration of pressure indicating instruments and gauges	5.0 kPa to 130 kPa	22 Pa		Site
Gas pressure (gauge)				
Calibration of pressure indicating instruments and gauges	- 90 kPa to 0 Pa 0 Pa to 2.5 kPa 2.5 kPa to 5.0 kPa 5.0 kPa to 6.9 kPa 6.9 kPa to 34.4 kPa 34.4 kPa to 250 kPa 250 kPa to 2.1 MPa 2.1 MPa to 3.5 MPa	38 Pa 0.047 % + 0.060 Pa 0.046 % + 0.31 Pa 9 Pa 16 Pa 0.13 kPa 0.46 kPa 0.59 kPa		Site

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL			The method for all electrical measurements listed below is by direct comparison to laboratory standards unless otherwise described in the remarks column.	Lab and site
DC Voltage				
Generation	0 V to 330 mV	0.012 % + 6.0 µV		
	330 mV to 3.3 V	0.0070 % + 33 µV		
	3.3 V to 33 V	0.0070 % + 370 µV		
	33 V to 1000 V	0.0073 % + 29 mV		
Measurement	0 V to 100 mV	0.0047 % + 5.5 µV		
	100 mV to1 V	0.0034 % + 34 µV		
	1 V to 10 V	0.0033 % + 330 µV		
	10 V to 100 V	0.0048 % + 3.3 mV		
	100 V to 1000 V	0.0051 % + 31 mV		
Mains Voltage Measurement	200 V to 300 V	1.0 %		
Mains Voltage Frequency	Nominal 50 Hz	2.5 %		
DC Current				
Generation	0 mA to 33 mA	0.016 % + 0.35 µA		
	33 mA to 330 mA	0.017 % + 4.5 µA		
	330 mA to 2.2 A	0.041 % + 190 µA		
	2.2 A to 11 A	0.079 % + 460 µA		
DC Current (cont'd)				
Measurement	0 mA to 30 mA	0.017 % + 6.0 µA		
	0 mA to 100 mA	0.060 % + 7.5 µA		
	0 mA to 10A	0.21 % + 1.2 mA		
DC Resistance	0 Ω to 33 Ω	20 mΩ		
	33 Ω to 330 Ω	60 mΩ		
	330 Ω to 3.3 kΩ	500 mΩ		
	3.3 kΩ to 33 kΩ	5.0 Ω		
	33 kΩ to 110 kΩ	25 Ω		
	110 kΩ to 330 kΩ	60 Ω		
	330 kΩ to 3.3 MΩ	800 Ω		
	3.3M Ω to 11 MΩ	10 kΩ		
	11 MΩ to 33 MΩ	43 kΩ		
	33 MΩ to 110 MΩ	800 kΩ		
	110 MΩ to 330 MΩ	2.2 MΩ		
Measurement	0 Ω to 100 Ω	20 mΩ		
	100 Ω to 1 kΩ	150 mΩ		
	1 kΩ to 10 kΩ	1.5 Ω		
	10 kΩ to 100 kΩ	15 Ω		
	100 kΩ to 1 MΩ	140 Ω		
	1 MΩ to 10 MΩ	5.0 kΩ		
	10 MΩ to 100 MΩ	1.1 % + 23 kΩ		
	100 MΩ to 1 GΩ	3.2 % + 7.4 MΩ		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL (cont'd)				Lab and site
Frequency				
Spot values	1 MHz, 5 MHz and 10 MHz	0.12 ppm		
Ranges source and measure	0.5 Hz to 100 kHz	3.7 ppm	Frequency can be expressed in other units, for example RPM, at equivalent uncertainties.	
Source only	250 MHz to 1 GHz	0.13 ppm		
Elapsed time	50 ms to 1 day	0.13 % + 38 ms		
Electrical calibration of temperature indicators				
Ambient	15 °C to 30 °C	0.41 °C	For reporting reference junction temperature	
Base Metal Thermocouples	- 270 °C to 0 °C 0 °C to 1370 °C	0.67 °C 0.55 °C	Including reference junction compensation	
Noble Metal Thermocouples	- 50 °C to + 399 °C 400 °C to 1760 °C	0.96 °C 0.70 °C		
PRTs Generate resistance Pt 100	- 100 °C to 850 °C	0.43 °C		
Measure resistance Pt 100	- 100 °C to 850 °C	0.27 °C		
TEMPERATURE			By comparison with Reference thermometers	
Resistance thermometers and electronic probes with indicators	-40 °C to 20 °C 20 °C to 200 °C 0 °C	0.35 °C 0.059 °C 0.043 °C	In Liquid bath	Lab
Base metal thermocouples	-40 °C to 20 °C 20 °C to 200 °C	0.55 °C 0.70 °C		
Block Calibrators	-40 °C to 200 °C	0.045 °C		Lab and site
Liquid baths	-40 °C to 200 °C	0.045 °C	Single and multipoint time dependent temperature profiling, also referred to as spatial temperature surveying or mapping	
Air temperature	0 °C to 60 °C	0.19 °C	In air chamber	Lab

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
HUMIDITY			By comparison with chilled mirror hygrometer and reference thermometers	
Dew point	-32 °C to 60 °C	0.31 °C		Lab
Relative humidity	5 %rh to 20 %rh 20 %rh to 40 %rh 40 %rh to 60 %rh 60 %rh to 80 %rh 80 %rh to 95 %rh	0.20 %rh 0.31 %rh 0.70 %rh 1.4 %rh 1.9 %rh	Temperature range 0 °C to 60 °C	Lab
	5 %rh to 20 %rh 20 %rh to 40 %rh 40 %rh to 60 %rh 60 %rh to 80 %rh 80 %rh to 95 %rh	1.3 %rh 1.4 %rh 1.70 %rh 2.2 %rh 2.5 %rh	Temperature range 0 °C to 60 °C	Site
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.