Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0461

Accredited to ISO/IEC 17025:2005

TMS Europe Ltd

Issue No: 048 **Issue date:** 07 August 2018

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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 Unit 10 Stretfield Mill Bradwell Hope Valley S33 9JT	**Local contact** Mr B Hanwell Tel: +44 (0)1433 620535 Fax: +44 (0)1433 621492 Email: sales@tmseurope.co.uk Website: www.tmseurope.co.uk	Electrical Time Humidity Pressure Temperature	P

Site activities performed away from the locations listed above:

Location details		Activity	Location code
The customers' 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	Contact as above	Electrical Time Pressure Temperature Humidity	S

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL CALIBRATION				
DC VOLTAGE				
Measurement and Generation	0 mV to 25 mV 25 mV to 50 mV 50 mV to 100 mV 100 mV to 10 V 10 V to 100 V 100 V to 1 kV	25 ppm + 1.0 μV 20 ppm + 1.0 μV 15 ppm + 1.0 μV 20 ppm + 50 μV 15 ppm + 1.4 mV 25 ppm + 7.0 mV		P
DC CURRENT				
Measurement	0 μA to 10 μA 10 μA to 100 μA 100 μA to 1 mA 1 mA to 10 mA 10 mA to 100 mA	45 ppm + 3.2 nA 45 ppm + 11 nA 45 ppm + 100 nA 40 ppm + 1.0 μA 39 ppm + 10 μA	Voltage and resistance method	P
	0 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 3 A	580 ppm + 3.0 μA 580 ppm + 14 μA 0.12 % + 190 μA 0.14 % + 0.74 mA	Using digital multimeter	
Generation	0 μA to 200 μA 200 μA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 2 A 2 A to 10 A 10 A to 20 A	0.012 % + 24 nA 0.0094 % + 140 nA 0.0094 % + 950 nA 0.011 % + 9.0 μA 0.050 % + 95 μA 0.035 % + 2.0 mA 0.035 % + 8.0 mA		P
DC RESISTANCE				
Measurement	1 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ	35 ppm + 15 mΩ 18 ppm + 1.3 mΩ 20 ppm + 6.0 Ω 50 ppm + 80 Ω 95 ppm + 3.0 kΩ	Including Generation	P
Generation	10.0 Ω 100 Ω 1.0 kΩ 10 kΩ 100 kΩ 1.0 MΩ 10 MΩ 100 MΩ	30 mΩ 33 mΩ 81 mΩ 610 mΩ 6.4 Ω 130 Ω 6.0 kΩ 130 kΩ		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE				
Measurement	*50 Hz to 200 Hz*			P
	100 μV to 100 mV	720 ppm + 120 μV		
	10 Hz to 20 kHz			
	100 mV to 1 V	710 ppm + 420 μV		
	1 V to 10 V	710 ppm + 6.0 mV		
	10 V to 100 V	710 ppm + 120 mV		
	100 V to 750 V	710 ppm + 570 mV		
Generation	1 mV to 200 mV			P
	40 Hz to 45 Hz	0.065 % + 60 μV		
	45 Hz to 1.0 kHz	0.033 % + 65 μV		
	1.0 kHz to 20 kHz	0.090 % + 250 μV		
	200 mV to 2.0 V			
	40 Hz to 45 Hz	0.060 % + 500 μV		
	45 Hz to 1.0 kHz	0.031 % + 500 μV		
	1.0 kHz to 2.0 kHz	0.35 % + 300 μV		
	2.0 kHz to 20 kHz	0.056 % + 650 μV		
	20 kHz to 50 kHz	0.20 % + 3.3 mV		
	2.0 V to 20 V			
	40 Hz to 45 Hz	0.060 % + 4.1 mV		
	45 Hz to 1 kHz	0.031 % + 4.3 mV		
	1 kHz to 2.0 kHz	0.035 % + 4.7 mV		
	2.0 kHz to 20 kHz	0.056 % + 6.2 mV		
	20 V to 200 V			
	40 Hz to 45 Hz	0.041 % + 35 mV		
	45 Hz to 1 kHz	0.040 % + 38 mV		
	1 kHz to 2.0 kHz	0.043 % + 29 mV		
	2.0 kHz to 20 kHz	0.083 % + 90 mV		
	200 V to 1000 V			
	40 Hz to 45 Hz	0.053 % + 170 mV		
	45 Hz to 1 kHz	0.037 % + 170 mV		
	1 kHz to 10 kHz	0.084 % + 500 mV		
AC CURRENT				
Generation	*40 Hz to 1.0 kHz*			P
	25 μA to 2.0 mA	0.060 % + 52 μA		
	2.0 mA to 20 mA	0.056 % + 56 μA		
	20 mA to 200 mA	0.061 % + 65 μA		
	200 mA to 2.0 A	0.072 % + 450 μA		
	1.0 A to 10 A			
	45 Hz to 200 Hz	0.15 % + 7.0 mA		
	200 Hz to 1.0 kHz	0.020 % + 9.0 mA		
	10 A to 20 A			
	40 Hz to 100 Hz	0.14 % + 14 mA		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
AC RESISTANCE				
Measurement	*At 25 Hz and 75 Hz* 0 Ω to 400 Ω	24 ppm + 100 μΩ		P
Calibration of 16th/17th Edition electrical testers				
Loop Resistance (Generation)	0 Ω to 10 Ω 10 Ω to100 Ω 100 Ω to 1.0 kΩ	0.056 % + 31 mΩ 0.050 % + 38 mΩ 0.050 % + 140 mΩ		
Capacitance	*At 1 kHz:* 10 nF, 20 nF, 50 nF, 100 nF and 1 μF	0.66 % + 420 pF		P
FREQUENCY				
Generation	10 Hz to 100 Hz 100 Hz to 10 MHz	170 ppm 24 ppm		P
Measurement	3.0 Hz to 30 Hz 30 Hz to 300 Hz 300 Hz to 3 kHz 3 kHz to 30 kHz 30 kHz to 300 kHz	5.0 mHz 10 mHz 35 mHz 0.35 Hz 5.0 Hz	Measured at 1.0 V	P
Temperature indicators, calibration by electrical simulation				
Base metal thermocouples	-200 °C to 0 °C 0 °C to 1370 °C	0.50 °C 0.30°C	Including cold junction compensation	P and S
Noble metal thermocouples	0 °C to 600 °C 600 °C to 1600 °C	0.50 °C 0.40 °C	Including cold junction compensation	P and S
Resistance thermometers (Pt100)	-200 °C to +800 °C	0.036 °C to 0.094 °C	For 4-wire measurements. The quoted uncertainties may be increased for 2-wire configurations.	P and S
TIME INTERVAL				
Mechanical and Electronic Timers	10 s to 24 hrs	0.0011 s/h + 0.052 s		P and S
Optical Tachometers	18 RPM to 180 RPM 180 RPM to 300 RPM 300 RPM to 3,000 RPM 3,000 RPM to 30,000 RPM 30,000 RPM to 90,000 RPM	0.21 RPM 1.1 RPM 1.1 RPM 3.6 RPM 21 RPM		P

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
HUMIDITY			Instruments with an electrical output can be calibrated	
Dew point	-20 °C to +30 °C 30 °C to 46 °C	0.23 °C 0.34 °C		P
Temperature probes in air	10 °C to 50 °C	0.049 °C		
Relative humidity	Example conditions	Corresponding to above dew-point and temperature uncertainties	Humidity limits: 11 %rh to 95 %rh at 10 °C 5 %rh to 95 %rh at 20 °C 5 %rh to 95 %rh at 35 °C 5 %rh to 85 %rh at 50 °C	
At 10 °C	11 % rh 50 % rh 95 % rh	0.40 % rh 0.84 % rh 1.5 % rh		
At 20 °C	5 % rh 50 % rh 95 % rh	0.40 % rh 0.80 % rh 1.4 % rh		
At 50 °C	5 % rh 50 % rh 95 % rh	0.40 % rh 1.0 % rh 1.5 % rh		
Temperature probes in air	10 °C to 50 °C	0.40 °C to 0.90 °C		S
Temperature measurement in air	10 °C to 50 °C	0.40 °C to 0.90 °C*	*An additional uncertainty component will normally be applicable owing to the thermal variations within the test environment	
Relative humidity probes and environmental controlled chambers inclusive of associated indicators controllers and recorders				
At 10 °C	10 %rh 50 %rh 90 %rh	2.3 %rh 3.1 %rh 4.1 %rh		
At 20 °C	10 %rh 50 %rh 90 %rh	1.3 %rh 1.8 %rh 2.3 %rh		
At 50 °C	10 %rh 50 %rh 90 %rh	1.4 %rh 2.3 %rh 3.0 %rh		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
PRESSURE				
Gauge gas pressure	-625 to 525 Pa	0.35% + 2.0 Pa	Instruments with an electrical output can be calibrated	P and S
	-95 kPa to -90 kPa -90 kPa to 2.0 MPa	35 ppm + 0.35 kPa 80 ppm + 30 Pa		P
	-80 kPa to 2.0 MPa	0.017 % + 0.4 kPa		S
Gauge gas absolute	10 kPa to 2.1 MPa	80 ppm + 30 Pa		P
	20 kPa to 2.1 MPa	0.031 % + 0.45 kPa	Achievable range may be reduced in the absence of a physical pressure port on the device.	S
Gauge hydraulic pressure	2 MPa to 70 MPa	0.030 % + 2.9 kPa		P and S
TEMPERATURE				
Resistance Thermometers	-196 °C -100 °C to -80 °C -80 °C to -40 °C -40 °C to 0 °C Ice point 0 °C Triple point of water (0.01 °C) 0 °C to 300 °C 300 °C to 650 °C	0.050 °C 0.18 °C 0.043 °C 0.024 °C 0.015 °C 0.0050 °C 0.022 °C 0.35 °C		P
Thermometers connected to suitable indicators	-196 °C -80 °C to 0 °C 0 °C to 300 °C 300 °C to 400 °C	0.20 °C 0.20 °C 0.10 °C 1.0 °C	Including instruments incorporated in customers Freezers, fridges, ovens chambers incubators and furnaces	S
Platinum thermocouples	0 °C to 300 °C 300 °C to 600 °C 600 °C to 1100 °C 1100 °C to 1600 °C	0.60 °C 0.85 °C 0.81 ºC 2.1 °C		P
Other thermocouples	-196 °C -80 °C to 0 °C 0 °C to 40 °C 40 °C to 300 °C 300 °C to 1100 °C 1100 °C to 1600 °C	0.25 °C 0.20 °C 0.11 °C 0.20 °C 0.84 °C 2.1 °C		P
Other thermocouples	-196 °C -80 °C to 0 °C 0 °C to 300 °C 300 °C to 1100 °C 1100 °C to 1600 °C	0.25 °C 0.20 °C 0.20 °C 1.0 °C 2.5 °C		S

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
TEMPERATURE (continued)				
Temperature Controlled Autoclaves, Chambers, Environmental Cabinets, Furnaces, Liquid Baths, Fridges/Refrigerators, Freezers, Incubators and Ovens	-80 °C to 0 °C 0 °C to 300 °C 300 °C to 1100 °C 1100 °C to 1600 °C	0.20 °C (PRTs) 0.50 °C (thermocouples) 0.10 °C (PRTs) 0.50 °C (thermocouples) 1.0 °C 2.5 °C	Single and multipoint time dependent temperature profiling, also referred to as spatial temperature surveying or mapping	P and S
Compensating and extension cables	-196 °C -80 °C to 250 °C	0.25 °C 0.25 °C		P and S
Mechanical Dial type and Electronic thermometers with sensors	Range as per sensor	As for sensor	Instruments with an electrical output can be calibrated	P and S
Metal block calibrators	-50 °C to 300 °C 300 °C to 1100 °C	0.16 °C 1.2 °C		P
Metal block calibrators	-50 °C to 300 °C 300 °C to 650 °C 650 °C to 1100 °C	0.20 °C 2.5 °C 4.0 °C		S
Radiation thermometers (pyrometers)	-30 °C to 25 °C 25 °C to 100 °C 100 °C to 200 °C 200 °C to 350 °C 350 °C to 480 °C 480 °C to 600 °C 600 °C to 1100 °C 1100 °C to 1300 °C 1300 °C to 1500 °C	1.0 °C 0.5 °C 0.6 °C 1.0 °C 1.4 °C 2.5 °C 3.0 °C 3.5 °C 5.0 °C	For an emissivity of 1.0. Other emissivities can be specified but will attract an additional uncertainty.	P

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, and an indication of how they are to be interpreted, are shown 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 %·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.