


Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

 <p>UKAS CALIBRATION</p> <p>4353</p> <p>Accredited to ISO/IEC 17025:2017</p>	<h3>Alpha Electronics (Southern) Ltd</h3> <p>Issue No: 021 Issue date: 15 December 2020</p>	
	<p>Unit 6 Spectrum Business Estate Bircholt Road Parkwood Maidstone Kent ME15 9YP</p>	<p>Contact: Mr J Puttock Tel: +44 (0)1622 690187 Fax: +44 (0)1622 678827 E-Mail: john.puttock@alpha-electronics.com Website: www.alpha-electronics.com</p>
<p>Calibration performed at the above address only</p>		

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks
ELECTRICAL			
DC Voltage			Unless annotated otherwise electrical measurements are made by direct comparison with reference standards.
Generation	0 V to 200 mV 200 mV to 330 mV 330 mV to 1 V 1 V to 2. V 2 V to 3.3 V 3.3 V to 10 V 10 V to 20 V 20 V to 33 V 33 V to 100 V 100 V to 200 V 200 V to 330 V 330 V to 500 V 500 V to 1020 V 1 kV to 15 kV	69 ppm + 4.0 μ V 69 ppm + 5.0 μ V 58 ppm + 9.0 μ V 58 ppm + 13 μ V 58 ppm + 16 μ V 58 ppm + 91 μ V 58 ppm + 140 μ V 58 ppm + 190 μ V 64 ppm + 1.0 mV 64 ppm + 2.0 mV 64 ppm + 3.0 mV 64 ppm + 5.0 mV 64 ppm + 8.0 mV 0.30 % + 2.9 V	Values can be generated for the calibration of measuring instruments
Measurement	0 V to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV 1 kV to 15 kV	5.2 ppm + 0.13 μ V 3.2 ppm + 0.47 μ V 3.2 ppm + 4.8 μ V 4.7 ppm + 48 μ V 4.8 ppm + 0.48 mV 0.30 % + 2.9 V	Outputs of instruments can be measured to the stated uncertainties



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks
DC Current			
Generation	0 μ A to 200 μ A 200 μ A to 330 μ A 0.33 mA to 1 mA 1 mA to 2 mA 2 mA to 3.3 mA 3.3 mA to 10 mA 10 mA to 20 mA 20 mA to 33 mA 33 mA to 100 mA 100 mA to 200 mA 200 mA to 330 mA 0.33 A to 1 A 1 A to 2 A 2 A to 3.3 A 3.3 A to 10 A 10 A to 20 A	180 ppm + 250 nA 180 ppm + 26 nA 120 ppm + 63 nA 120 ppm + 76 nA 120 ppm + 95 nA 120 ppm + 390 nA 120 ppm + 580 nA 120 ppm + 810 nA 120 ppm + 4.0 μ A 120 ppm + 6.0 μ A 120 ppm + 8.0 μ A 440 ppm + 71 μ A 440 ppm + 120 μ A 440 ppm + 250 μ A 700 ppm + 1.0 mA 0.12% +3.0 mA	Values can be generated for the calibration of measuring instruments
Generation	20 A to 30 A 30 A to 100 A	350 ppm + 4.5 mA 0.095 % + 25 mA	
Generation	30 A to 500 A 500 A to 1000 A 1000 A to 1500 A	0.050 % + 0.50 A 0.050 % + 0.60 A 0.050 % + 1.5 A	For the calibration of clampmeters only
Measurement	0 A to 10 nA	0.58 % + 150 pA	Outputs of instruments can be measured to the stated uncertainties
	10 nA to 100 nA 100 nA to 1 μ A 1 μ A to 10 μ A 10 μ A to 100 μ A	0.21 % + 150 pA 0.023 % + 150 pA 0.035 % + 230 pA 8.0 ppm + 900 pA	
	100 μ A to 200 μ A 200 μ A to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 2 A 2 A to 20 A	11 ppm + 460 pA 11 ppm + 4.7 nA 11 ppm + 47 nA 39 ppm + 1.0 μ A 200 ppm + 19 μ A 450 ppm + 47 μ A	
	20 A to 30 A	570 ppm + 6.0 mA	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks
DC Resistance			
Sourcing			
Specific Values	100 $\mu\Omega$ 500 $\mu\Omega$ 1 m Ω 2 m Ω 4 m Ω	60 ppm 60 ppm 60 ppm 60 ppm 60 ppm	Shunts
	0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω	0.90 $\mu\Omega$ 0.80 $\mu\Omega$ 2.8 $\mu\Omega$ 26 $\mu\Omega$ 270 $\mu\Omega$ 2.8 m Ω 32 m Ω 310 m Ω	Standard Resistors
	1 M Ω 10 M Ω 100 M Ω 1 G Ω	31 Ω 410 Ω 54 k Ω 3.0 M Ω	
	400 $\mu\Omega$ 4 m Ω 40 m Ω 400 m Ω 4 Ω 40 Ω 400 Ω 4 k Ω 40 k Ω 400 k Ω	1.5 $\mu\Omega$ 10 $\mu\Omega$ 11 $\mu\Omega$ 100 $\mu\Omega$ 1.2 m Ω 10 m Ω 95 m Ω 250 m Ω 10 Ω 95 Ω	For the calibration of low resistance ohmmeters up to 10 A
Sourcing & Measurement Other Values	0 Ω to 2 Ω 2 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 2 k Ω 2 k Ω to 20 k Ω 20 k Ω to 200 k Ω 200 k Ω to 2 M Ω 2 M Ω to 20 M Ω	12 ppm + 4.7 $\mu\Omega$ 8.8ppm + 17 $\mu\Omega$ 8.7 ppm + 58 $\mu\Omega$ 9.1 ppm + 610 $\mu\Omega$ 9.1 ppm + 6.2 m Ω 8.6 ppm + 59 m Ω 11 ppm + 1.2 Ω 18 ppm + 120 Ω	



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Other Values Sourcing & Measurement	10 M Ω to 100 M Ω 100 M Ω to 1 G Ω 1 G Ω to 10 G Ω 10 G Ω to 100 G Ω 100 G Ω to 1 T Ω	0.082 % 0.15 % 0.30 % 0.65 % 0.70 %	For the measurement of insulation testers up to 5 kV
AC Voltage Generation	10 mV to 33 mV 10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	0.17 % + 23 μ V 0.12 % + 23 μ V 0.17 % + 23 μ V 0.23 % + 23 μ V 0.40 % + 38 μ V 1.16 % + 69 μ V	Values can be generated for the calibration of measuring instruments
	33 mV to 330 mV 10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	0.060 % + 25 μ V 0.030 % + 25 μ V 0.080 % + 25 μ V 0.12 % + 47 μ V 0.27 % + 200 μ V 0.58 % + 390 μ V	
	330 mV to 3.3 V 10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	0.060 % + 110 μ V 0.030 % + 110 μ V 0.080 % + 110 μ V 0.12 % + 110 μ V 0.27 % + 250 μ V 0.58 % + 1.10 mV	
	3.3 V to 33 V 10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.06 % + 1.6 mV 0.03 % + 1.1 mV 0.08 % + 1.1 mV 0.12 % + 1.1 mV 0.27 % + 2.5 mV	
	33 V to 330 V 45 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.06 % + 9.0 mV 0.10 % + 14 mV 0.14 % + 14 mV 0.28 % + 93 mV	
	330 V to 1020 V 45 Hz to 1 kHz 1 kHz to 10 kHz	0.060 % + 38 mV 0.10 % + 38 mV	
	50 Hz 1 kV to 15 kV	0.75 % + 9.2 V	



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Measurement	<i>10 Hz to 40 Hz</i> 0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV	0.015 % + 4.7 μ V 0.012 % + 140 μ V 0.012 % + 0.25 mV 0.012 % + 24 mV 0.029 % + 26 mV	Outputs of instruments can be measured to the stated uncertainties
	<i>40 Hz to 100 Hz</i> 0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV	0.015 % + 4.7 μ V 0.010 % + 26 μ V 0.009 % + 0.25 mV 0.010 % + 24 mV 0.028 % + 26 mV	
	<i>200 Hz to 2 kHz</i> 0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 100 V to 1 kV	0.013 % + 2.5 μ V 0.008 % + 26 μ V 0.008 % + 0.25 mV 0.008 % + 24 mV 0.028 % + 26 mV	
	<i>2 kHz to 10 kHz</i> 0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV	0.013 % + 4.7 μ V 0.010 % + 26 μ V 0.009 % + 0.25 mV 0.010 % + 24 mV 0.028 % + 26 mV	
	<i>10 kHz to 30 kHz</i> 0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 kV	0.035 % + 9.3 μ V 0.024 % + 48 μ V 0.023 % + 0.47 mV 0.023 % + 47 mV 0.14 % + 47 mV	
	<i>30 kHz to 100 kHz</i> 0 mV to 200 mV 200 mV to 2 V 1 V to 10 V	0.082 % + 12 μ V 0.058 % + 0.24 mV 0.058 % + 2.4 mV	
	<i>100 kHz to 300 kHz</i> 200 mV to 2 V 2 V to 20 V	0.35 % + 2.4 mV 0.35 % + 24 mV	
	<i>300 kHz to 1 MHz</i> 200 mV to 2 V 2 V to 20 V	1.2 % + 24 mV 1.2 % + 240 mV	
	<i>50 Hz</i> 1 kV to 15 kV	0.40 % + 60 V	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks
AC Current Generation	29 μ A to 330 μ A 10 Hz to 20 Hz 20 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz 0.33 mA to 3.3 mA 10 Hz to 20 Hz 20 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz 3.3 mA to 33 mA 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz 33 mA to 330 mA 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz 330 mA to 3 A 10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 3 A to 11 A 45 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz 11 A to 20 A 45 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz 20 A to 30 A 40 Hz to 100 Hz	0.23 % + 150 nA 0.17 % + 130 nA 0.35 % + 200 nA 0.92 % + 270 nA 1.90 % + 470 nA 0.23 % + 230 nA 0.14 % + 220 nA 0.23 % + 290 nA 0.58 % + 460 nA 1.20 % + 760 nA 0.21 % + 3.0 μ A 0.10 % + 3.0 μ A 0.05 % + 3.0 μ A 0.09 % + 3.0 μ A 0.23 % + 6.0 μ A 0.46 % + 7.0 μ A 0.21 % + 27 μ A 0.10 % + 26 μ A 0.05 % + 25 μ A 0.12 % + 60 μ A 0.23 % + 130 μ A 0.46 % + 240 μ A 0.21 % + 180 μ A 0.07 % + 180 μ A 0.69 % + 1.2 mA 2.90 % + 5.8 mA 0.07 % + 4.0 mA 0.12 % + 4.0 mA 3.50 % + 5.0 mA 0.14 % + 8.0 mA 0.17 % + 8.0 mA 3.50 % + 8.0 mA 0.05 % + 3.1 mA	Values can be generated for the calibration of measuring instruments
Generation	50 Hz 30 A to 500 A 500 A to 1500 A	0.070 % + 0.50 A 0.070 % + 1.0 A	For the calibration of clampmeters only



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Measurement	1 kHz 1 μH to 10 μH 10 μH to 100 μH 100 μH to 1mH 1 mH to 10 mH 10 mH to 100 mH 100 mH to 1 H 1 H to 10 H	0.14 % + 40 nH 0.12 % + 30 nH 0.12 % + 200 nH 0.12 % + 230 nH 0.12 % + 14 μH 0.12 % + 170 μH 0.23 % + 1.9 mH	Outputs of instruments can be measured to the stated uncertainties
AC Resistance	1 kHz 1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ	0.05 % + 0.7 mΩ 0.05 % + 5 mΩ 0.05 % + 45 mΩ 0.05 % + 0.63Ω	
Frequency	10 Hz to 3 GHz 10 s to 1 μs	0.044 ppm 1.0 ppm	
Phase Angle	50 Hz 0° to 360°	0.62°	
Optical Tachometers	60 rpm to 60000 rpm	60 ppm + 0.70 rpm	
IEE 16 TH /17 TH /18 TH EDITION TEST EQUIPMENT			
Insulation Resistance Up to 1 kV	10 kΩ to 20 kΩ 20 kΩ to 40 kΩ 40 kΩ to 80 kΩ 80 kΩ to 100 kΩ 100 kΩ to 200 kΩ 200 kΩ to 400 kΩ 400 kΩ to 800 kΩ 800 Ω to 1 MΩ 1 MΩ to 2 MΩ 2 MΩ to 4 MΩ 4 MΩ to 8 MΩ 8 MΩ to 10 MΩ 10 MΩ to 20 MΩ 20 MΩ to 40 MΩ 40 MΩ to 80 MΩ 80 MΩ to 100 MΩ 100 MΩ to 200 MΩ 200 MΩ to 400 MΩ 400 MΩ to 800 MΩ 800 MΩ to 1 GΩ 1 GΩ to 2 GΩ 2 GΩ to 4 GΩ 4 GΩ to 8 GΩ 8 GΩ to 10 GΩ 100 GΩ 1 TΩ	0.23 % + 0.51 Ω 0.23 % + 0.69 Ω 0.23 % + 1.1 Ω 0.35 % + 2.3 Ω 0.58 % + 5.0 Ω 0.23 % + 7.5 Ω 0.23 % + 12 Ω 0.23 % + 19 Ω 0.23 % + 140 Ω 0.35 % + 170 Ω 0.35 % + 240 Ω 0.35 % + 0.32 kΩ 0.58 % + 16 kΩ 0.58 % to 35 kΩ 0.58 % + 78 kΩ 0.58 % + 0.20 MΩ 0.58 % + 4.2 MΩ 0.58 % + 7.4 MΩ 1.2 % + 6.5 MΩ 1.2 % + 9.0 MΩ 1.2 % + 18 MΩ 1.2 % + 36 MΩ 1.2 % + 45 MΩ 1.2 % + 95 MΩ 3.5 % + 100 MΩ 3.5 % + 300 MΩ	Electrical calibrations are performed as a comparison against a reference standard



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Insulation Resistance DC Voltage	0 V to 1.5 kV (Pk)	1.2 % + 2.3 V	Actual values depend on the value of the local loop resistance
Insulation Test Voltage DC Voltage	50 V to 1.5 kV (Pk)	1.2 % + 2.3 V	
Insulation Test Current DC Current	0 mA to 9.9 mA	0.2 %	
Continuity Resistance	100 mΩ to 100 Ω	0.35 % + 12 mΩ	
	100 Ω to 1 kΩ	0.23 % + 23 mΩ	
	1 kΩ to 2 kΩ	0.23 % + 70 mΩ	
	2 kΩ to 4 kΩ	0.23 % + 100 mΩ	
	4 kΩ to 8 kΩ	0.23 % + 170 mΩ	
Continuity Current DC Current	8 kΩ to 10 kΩ	0.23 % + 200 mΩ	
	0 mA to 320 mA	1.5 % + 0.81 mA	
Loop Resistance	50 Hz		
	25 mΩ	6.7 mΩ	
	50 mΩ	6.7 mΩ	
	110 mΩ	6.7 mΩ	
	310 mΩ	8.8 mΩ	
	500 mΩ	9.8 mΩ	
	1 Ω	12 mΩ	
	1.8 Ω	21 mΩ	
	5 Ω	41 mΩ	
	10 Ω	70 mΩ	
	18 Ω	21 mΩ	
	50 Ω	41 mΩ	
	100 Ω	70 mΩ	
	180 Ω	120 mΩ	
	500 Ω	3.3 Ω	
1 kΩ	6.0 Ω		
1.8 kΩ	12 Ω		
RCD Current	10 mA to 30 mA	1.2 % + 0.01 mA	
	30 mA to 100 mA	1.2 % + 0.11 mA	
	100 mA to 150 mA	1.2 % + 0.05 mA	
	150 mA to 500 mA	1.2 % + 0.17 mA	
	500 mA to 3 A	1.2 % + 0.2 mA	
RCD Trip Times	10 ms – 50 ms	0.020 % + 0.31 ms	
	50 ms – 100 ms	0.020 % + 0.31 ms	
	100 ms – 500 ms	0.020 % + 0.35 ms	
	500 ms – 4.1 s	0.020 % + -0.58 ms	



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Ground Bond Resistance (Nominal)	<i>DC to 60 Hz</i>		
	25 mΩ	6.7 mΩ	
	50 mΩ	6.7 mΩ	
	110 mΩ	6.7 mΩ	
	310 mΩ	8.8 mΩ	
	500 mΩ	9.8 mΩ	
	1 Ω	12 mΩ	
	1.8 Ω	21 mΩ	
	5 Ω	41 mΩ	
	1 Ω	70 mΩ	
	1.8 Ω	21 mΩ	
	5 Ω	41 mΩ	
	10 Ω	70 mΩ	
	18 Ω	120 mΩ	
	50 Ω	350 mΩ	
	100 Ω	580 mΩ	
	180 Ω	2.0 Ω	
500 Ω	3.4 Ω		
1 kΩ	6.0 Ω		
1.8 kΩ	12 Ω		
Earth Bond Current	<i>DC to 60 Hz</i>		
	50 mA to 400 mA	1.8 % + 3.0 mA	
	400 mA to 3 A	1.8 % + 0.21 A	
	3 A to 10 A	1.8 % + 0.23 A	
	10 A to 20 A	1.8 % + 0.33 A	
20 A to 30 A	1.8 % + 0.84 A		
Earth Leakage	<i>DC to 60 Hz</i>		
	0.1 mA to 30 mA		
	Substitute	0.30 % + 5.0 μA	
	Passive	0.30 % + 5.0 μA	
Differential	0.30 % + 5.0 μA		
Active	0.30 % + 2.0 μA		
Flash Test Voltage	<i>50 Hz to 60 Hz</i> 0 V to 3.5 kV	0.75 % + 9.2 V	
Flash Leakage Current	<i>50 Hz to 60 Hz</i>		
	0 μA to 300 μA	2.0 %	
	300 μA to 3 mA	0.47 %	
3 mA to 30 mA	0.32 %		
DC Voltage	3 V to 30 V	0.37 %	
	30 V to 150 V	0.57 %	
	150 V to 600 V	0.29 %	
AC Voltage	<i>40 Hz to 400 Hz</i>		
	3 V to 30 V	0.37 %	
	30 V to 100 V	0.26 %	
	100 V to 150 V	0.57 %	
150 V to 600 V	0.29 %		



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Temperature indicators, calibration by electrical simulation			
Resistance Thermometer	-200 °C to +850 °C	0.010 °C	All thermocouple uncertainties listed include cold junction compensation
Thermocouple type B	600 °C to 800 °C	0.61 °C	
	800 °C to 1000 °C	0.48 °C	
	1000 °C to 1550 °C	0.42 °C	
	1550 °C to 1820 °C	0.45 °C	
Thermocouple type C	0 °C to 150 °C	0.41 °C	
	150 °C to 650 °C	0.36 °C	
	650 °C to 1000 °C	0.41 °C	
	1000 °C to 1800 °C	0.63 °C	
	1800 °C to 2316 °C	1.03 °C	
Temperature indicators, calibration by electrical simulation (cont'd)			
Thermocouple type E	-250 °C to -100 °C	0.61 °C	
	-100 °C to -25 °C	0.24 °C	
	-25 °C to +350 °C	0.22 °C	
	350 °C to 650 °C	0.24 °C	
	650 °C to 1000 °C	0.28 °C	
Thermocouple type J	-210 °C to -100 °C	0.36 °C	
	-100 °C to -30 °C	0.24 °C	
	-30 °C to +150 °C	0.22 °C	
	150 °C to 760 °C	0.25 °C	
	760 °C to 1200 °C	0.31 °C	
Thermocouple type K	-200 °C to -100 °C	0.41 °C	
	-100 °C to -25 °C	0.26 °C	
	-25 °C to +120 °C	0.24 °C	
	120 °C to 1000 °C	0.34 °C	
	1000 °C to 1372 °C	0.50 °C	
Thermocouple type N	-200 °C to -100 °C	0.49 °C	
	-100 °C to -25 °C	0.30 °C	
	-25 °C to +120 °C	0.27 °C	
	120 °C to 410 °C	0.26 °C	
	410 °C to 1300 °C	0.35 °C	
Thermocouple type R	0 °C to 250 °C	0.75 °C	
	250 °C to 400 °C	0.48 °C	
	400 °C to 1000 °C	0.45 °C	
	1000 °C to 1767 °C	0.52 °C	
Thermocouple type S	0 °C to 250 °C	0.64 °C	
	250 °C to 1000 °C	0.49 °C	
	1000 °C to 1400 °C	0.50 °C	
	1400 °C to 1767 °C	0.60 °C	



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Thermocouple type T	-200 °C to -150 °C -150 °C to 0 °C 0 °C to + 120 °C 120 °C to 400 °C	0.74 °C 0.32 °C 0.23 °C 0.21 °C	
TEMPERATURE Temperature indicators and recorders with sensors	-30 °C to 0 °C 0 °C to 30 °C 30 °C to 140 °C 140 °C to 230 °C 230 °C to 420 °C 420 °C to 650 °C	0.10 °C to 0.070 °C 0.070 °C 0.070 °C to 0.14 °C 0.24 °C to 0.36 °C 0.36 °C to 0.65 °C 0.65 °C to 1.0 °C	Calibration by comparison with Reference PRTs in dry block.
PRESSURE Gas Pressure (gauge) Calibration of pressure indicating instruments and gauges	-85 kPa to 0 kPa 0 kPa to 690 kPa 690 kPa to 2 MPa 3.7 kPa to 100 kPa 100 kPa to 700 kPa	56 Pa 0.40 kPa 1.8 kPa 0.034 kPa 111 ppm + 0.034 kPa	Methods consistent with EURAMET CG17 Calibration against digital pressure calibrator or controller. Calibration against deadweight tester Absolute pressures within these ranges can be generated which will attract the additional absolute pressure uncertainty quoted.
Gas Pressure (absolute) Calibration of pressure indicating instruments and gauges	55 kPa to 117 kPa	41 Pa	Calibration against digital pressure controller
Hydraulic Pressure (gauge) Calibration of pressure indicating instruments and gauges	0 kPa to 15 MPa 15 MPa to 70 MPa 0.6 MPa to 6 MPa 6 MPa to 30 MPa 30 MPa to 70 MPa	1.9 kPa 8.2 kPa to 8.7 kPa 16 ppm + 0.33 kPa 60 ppm + 1.4 kPa 43 ppm + 9.1 kPa	Calibration against digital pressure controller. Calibration against deadweight tester Absolute pressures within these ranges can be generated which will attract the additional absolute pressure uncertainty quoted.

END



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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 μ V

Over the range 100 mV to 1 V, the CMC is 0.0025 %·V + 5.0 μ V, 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 + (0.12·10⁻⁶· p ·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 · 0.01 · i , where i is the instrument indication.