


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>0394</p> <p>Accredited to ISO/IEC 17025:2005</p>	<h3>Trescal EMS – Rolls Royce</h3> <p>Issue No: 050 Issue date: 22 May 2018</p>	
	<p>Trescal EMS Unit 2, Riverside Road Pride Park Derby DE24 8HY</p>	<p>Contact: Kyle Angus Tel: +44 (0) 1942 761226 Fax: +44 (0) 2476 623626 E-Mail: kyle.angus@trescal.com Website: www.trescal.com</p>
<p>Calibration performed by the Organisations at the locations specified below</p>		

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details	Activity	Location code
<p>Address (Pride Park) Trescal EMS Unit 2, Riverside Road Pride Park Derby DE24 8HY</p> <p>Local contact Richard Parker Tel: +44 (0) 1332 238102 Email: richard.parker@trescal.com</p>	<p>Dimensional Electrical Humidity Temperature Torque</p>	Pride Park
<p>Address (Ansty) Trescal EMS – Rolls Royce Standards Room Building 6 Ansty Coventry CV7 9JR</p> <p>Local contact David Williams Tel: +44 (0) 2476 623625 Fax: +44 (0) 2476 623626 Email: David.williams2@rolls-royce.com</p>	<p>Torque Pressure</p>	Ansty
<p>Address (Inchinnan) Trescal EMS – Rolls Royce Inchinnan Drive Inchinnan Renfrewshire PA4 9AF</p> <p>Local contact Graham Maxwell Tel: +44 (0) 141 626 8540 Email: graham.maxwell@rolls-royce.com</p>	<p>Dimensional Torque</p>	Inchinnan
<p>Address (Washington) Trescal EMS – Rolls Royce Calibration Laboratory Radial Park Road Washington Tyne and Wear NE38 9DA</p> <p>Local contact Per Watson / Steve Jones Tel: +44 (0) 191 297 3023 Email: Per.watson@trescal.com</p>	<p>Dimensional Torque</p>	Washington



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Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address (Bristol) Trescal EMS – Rolls Royce Metrology Laboratory (EW6/7) PO Box 3 Filton Bristol BS34 7QE	Local contact Mr M Viney / Ms T Cogan Tel: +44 (0) 117 979 6099 Fax: +44 (0) 117 979 5038 Email: michael.viney@rolls-royce.com	Fuel Flow Torque	Bristol

Site activities performed away from the locations listed above:

All Rolls Royce sites: The 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 Per Watson / Richard Ireland Tel: +44 (0) 2476 623625 Fax: +44 (0) 2476 623626 Email: Per.watson@trescal.com	Form Electrical	Site
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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	Location Code	
LENGTH				Pride Park	
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED					
Thread measuring cylinders	BS3777:1964 and BS 5590:1978 and specials 0.1 to 5.0 diameter	0.50 on diameter	<p>NOTES</p> <p>1 In addition to all items in the first column, other similar items, including parts of measuring instruments and machines, may be calibrated in accordance with the stated CMCs. Where the item or part calibrated is of lower quality due to wear, errors in geometry or form, or poor surface texture, or where any other factor adversely affects the measurement capability, greater uncertainties will be quoted.</p> <p>2 The uncertainty quoted is for the departure from flatness, straightness, or squareness, i.e. the distance separating the two parallel planes which just enclose the surface under consideration.</p> <p>3 All linear calibrations may be given in inch units.</p> <p>4 Single start symmetrical thread forms only.</p> <p>5 Single start symmetrical thread forms only.</p>		
Plain plug gauges (parallel), cylindrical setting standards, gear measuring cylinders and rollers	1 to 50 diameter 50 to 100 100 to 150 150 to 200 200 to 300	0.50 0.80 1.0 1.2 1.6			on diameter
Plain ring gauges (parallel) and setting standards	CCP 2.3.2, issue 11 1 to 50 diameter 50 to 100 diameter 100 to 150 diameter 150 to 200 diameter	0.80 1.2 1.8 2.5			on diameter
Length gauges, flat and spherical ended	0 m to 3 m	1.0 + (5.0 x length in m)			
Length bars					
Inspection and workshop grades 1 and 2	BS 1790:1961 BS 5317:1976	0.45 + (1.1 x length in m)			
Plain gap gauges (parallel)	BS 969:2008 0.5 to 100 100 to 200 200 to 300	3.0 5.0 8.0			
Screw plug gauges (parallel) including check and setting plugs See Note 5	1 to 100 diameter 100 to 300 diameter	2.5 5.0			On pitch diameter
Screw ring gauges (parallel) See Note 4	5 to 75 diameter 100 to 150 diameter 150 to 300 diameter	4.0 5.0 8.0			
Screw pitch	0.2 to 8	1.5			
Screw flank angle	0° to 50°	5.0 minutes of arc			
Parallels	BS 906:Parts 1 and 2:1992 5 to (50 x 100 x 400)	1.5 to 5.0			



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
LENGTH (continued)				Pride Park
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
Gauge blocks		Class (see note)	Note	
Inch (Steel)	BS 4311-1:2007 0 in to 0.4 in 0.4 in to 1 in Size 2 in 3 in 4 in	C 3.0 μ in 4.0 μ in 5.0 μ in 6.0 μ in 7.0 μ in	Class C uncertainties apply to the measurement of length of gauges by comparison with grade K standards of length of a similar material. Class C uncertainties apply to new and used grade 0, 1 and 2 gauges to BS EN ISO 3650:1999 and BS 4311-1:2007	
Millimetre (Steel)	BS EN ISO 3650:1999 0 to 10 10 to 25 Size 30, 40, 50 60, 70, 75 80, 90, 100	C 0.080 0.10 0.12 0.15 0.18		
Vee blocks	BS 3731:1987 20 to 150 diameter, Vee capacity	2.5 to 5.0		
Receiver, position and profile gauges, jigs, fixtures	1500 x 750 x 750	From first principles: Dependant on size and features Minimum per co- ordinate: 3.0 + (10 x length in m)		
	1500 x 3200 x 1100	Using CMM: Dependant on size and features Minimum per co- ordinate: 5.0 + (10 x length in m)		
ANGLE				
Squares				
Blade type	BS 939:2007, CCP 2.4.17 issue 10 50 to 300 300 to 600	3.0 5.0		
Cylindrical	BS 939:2007, CCP 2.4.17 issue 10 75 to 300 300 to 600	2.0 On squareness 4.0 See Note 2		



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ANGLE (continued)				Pride Park	
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED					
Block	BS 939:2007 50 to 300 300 to 600	3.0 5.0			
Angle gauges	NPL type Other types	2.0 seconds of arc 3.0 seconds of arc			
Sine centres	100 to 500 length or between centres	Linear dimensions: 1.0+ (10 x length in m) Overall performance			
Compound sine tables	100 to 500 length	5.0 seconds of arc			
FORM					
Straightedges Cast iron Steel Granite	BS 5204:Part 1:1975 0 m to 2m	1.0 + (2.0 x length in m) See Note 2			
Roundness External Internal	BS 3730:Part 2:1982 0 to 350 diameter 3 to 350 diameter	0.050 on radius 0.050 on radius			
Steel balls	1 to 25 diameter	0.50 on diameter			
MEASURING INSTRUMENTS AND MACHINES					
Micrometers					
External	BS 870:2008, CCP 2.4.1 issue 12				
Internal	0 to 600	Heads: 2.0			
Depth	BS 959:2008 0 to 300 BS 6468:2008 0 to 300	Setting and Extension rods: 1.0 + (5.0 x length in m)			
Micrometer heads	BS 1734:1951; 0 to 100	1.0			
Bench micrometer	0 to 100	Overall performance 1.0			
Height setting micrometer	0 to 300	Heads 1.0 Stepped column 1.6 Overall performance 2.0			
Riser Blocks	150 300	1.0 2.0			



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MEASURING INSTRUMENTS AND MACHINES (continued)				Pride Park
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
Height gauges - (Simple) including vernier, dial and digital types	BS EN ISO 13225:2012 0 to 300	4.0		
Vernier gauges				
Caliper Height	BS 887:2008 BS 1643:2008 0 to 1200	Overall performance: 10 + (30 x length in m)		
Depth	BS 6365:2008 0 to 600			
Dial gauges and dial test indicators	BS 907:2008 and BS 2795:1981 0 to 50	1.0		
Dividing heads		Linear dimensions 1.0 + (10 x length in m)		
Rotary tables	100 to 750 capacity	Overall angular performance 3.0 seconds of arc		
Spirit levels	BS 958:1968 and BS 3509:1962 Nominal sensitivity 5 seconds of arc to 60 minutes of arc	Mean sensitivity: 10 % of nominal; minimum 0.50 seconds of arc		
Clinometers	0° to 360°	10 seconds of arc		
Levels, electronic	0 seconds of arc to 10 minutes of arc	1.0 % of range minimum 0.50 seconds of arc	The quoted uncertainty will be particularly dependent on the sensitivity of the device	
Orifice plates	BS EN ISO 5167-2:2003 (and similar devices) Bore d diameter 1.0 mm to 1 m	4.0 + (6.0 x length in m)		
TORQUE				
Hand torque tools	To BS EN ISO 6789:2003 (withdrawn and superseded) CCP 3.6.6 Issue6 0.25 N·m to 1000 N·m	1.0 %	The quoted uncertainty will be particularly dependent on the repeatability of the unit under test.	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code		
ELECTRICAL MEASUREMENTS						
DC VOLTAGE						
Measurement	Up to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1 000 V	6.5 ppm + 1.3 μ V 5.1 ppm 6.1 ppm 9.4 ppm 9.6 ppm	The stated CMCs are for a four-terminal configuration and may be increased if a two-terminal configuration is necessary.	Pride Park		
Generation	0 mV to 2 mV 2 mV to 20 mV 20 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1100 V	1.3 μ V 1.3 μ V 1.3 μ V 2.8 ppm + 0.90 μ V 2.2 ppm + 2.5 μ V 3.2 ppm + 39 μ V 5.6ppm + 0.39 mV				
DC RESISTANCE						
Measurement	0 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 200 k Ω 200 k Ω to 2 M Ω 2 M Ω to 20 M Ω 20 M Ω to 200 M Ω 200 M Ω to 2 G Ω	30 ppm + 20 $\mu\Omega$ 13 ppm 14 ppm 24 ppm 55 ppm 450 ppm 0.50%				
Generation						
Four terminal configuration	10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω	5.7 ppm 3.9 ppm 3.6 ppm 3.2 ppm 4.5 ppm 10 ppm 19 ppm 65 ppm				
Two terminal configuration	0 Ω , 10 Ω and 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω	10 m Ω 79 ppm 8.3 ppm 4.5 ppm 10 ppm 19 ppm 65 ppm				



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
DC CURRENT				Pride Park
Measurement	10 μ A to 200 μ A 200 μ A to 200 mA 200 mA to 2 A	100 ppm 100 ppm 170 ppm		
Generation	10 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	22 ppm + 1.6 nA 15 ppm + 7.8 nA 15 ppm + 78 nA 15 ppm + 0.78 μ A 26 ppm + 16 μ A		
AC VOLTAGE				
Measurement	10 mV to 200 mV 10 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz	390 ppm 640 ppm 0.17%		
	200 mV to 2 V 10 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz	190 ppm 270 ppm 870 ppm		
	2 V to 20 V 10 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz	180 ppm 270 ppm 870 ppm		
	20 V to 200 V 10 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz	190 ppm 270 ppm 870 ppm		
	200 V to 300 V 40 Hz to 10 kHz 10 kHz to 30 kHz	250 ppm 390 ppm		
	300 V to 1 kV 40 Hz to 10 kHz 10 kHz to 30 kHz	0.11 % 0.12 %		
	200 V to 1 kV 30 kHz to 50 kHz	0.20 %		



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AC VOLTAGE (continued)				Pride Park
Generation	1 mV to 2 mV 20 Hz to 100 kHz	0.74% + 4.2 μ V		
	2 mV to 20 mV 20 Hz to 100 kHz	0.032% + 4.2 μ V		
	20 mV to 200 mV 20 Hz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	130 ppm + 7.0 μ V 0.044% 0.17% 0.83%		
	200 mV to 2 V 10 Hz to 20 Hz 20 Hz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	310 ppm 89 ppm 180 ppm 0.13 % 0.52%		
	2 V to 20 V 10 Hz to 20 Hz 20 Hz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	290 ppm 73 ppm 240 ppm 0.12% 0.52%		
	20 V to 200 V 10 Hz to 20 Hz 20 Hz to 50 kHz 50 kHz to 100 kHz	220 ppm 100 ppm 200 ppm		
	200 V to 1 kV 45 Hz to 33 kHz	130 ppm		
AC CURRENT				
Measurement	40 Hz to 1 kHz: 10 μ A to 200 μ A 200 μ A to 200 mA 200 mA to 2 A	370 ppm + 16 nA 840 ppm 660 ppm + 310 μ A		
Generation	40 Hz to 1 kHz: 10 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	90 ppm + 7.8 nA 85 ppm + 78 nA 85 ppm + 0.78 μ A 110 ppm + 7.8 μ A 370 ppm + 78 μ A		



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FREQUENCY				Pride Park
Specific Values	1 MHz and 10 MHz	1.2 parts in 10^9	For calibrating oscillators	
Other Values	0.1 Hz to 1 Hz 1 Hz to 10 Hz 10 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 60 MHz 60 MHz to 100 MHz 100 MHz to 150 MHz 150 MHz to 500 MHz	1.5 parts in 10^3 1.5 parts in 10^4 1.5 parts in 10^5 1.5 parts in 10^6 1.5 parts in 10^7 1.7 parts in 10^8 3.9 parts in 10^9 2.5 parts in 10^9 1.2 parts in 10^9 2.4 parts in 10^9 1.4 parts in 10^9	Measurement capability only above 60 MHz	
ELAPSED TIME				
Stop watches (mechanical and electronic)	± 0.5 s error / 24 hours ± 2.0 s error / 24 hours 10 s to 24 hours	0.062 s 0.090 s 0.41 s	Time reference measurement per 24 hour period per 24 hour period Real time measurement	
TEMPERATURE SIMULATION				
Temperature indicators and simulators (thermocouple type), calibration by electrical simulation				
Base metal thermocouples	Type J, -210 °C to 0 °C Type J, 0 °C to 1200 °C Type K, -270 °C to -200 °C Type K, -200 °C to 0 °C Type K, 0 °C to 1370 °C Type N, -270 °C to -200 °C Type N, -200 °C to 0 °C Type N, 0 °C to 1300 °C Type T, -270 °C to -200 °C Type T, -200 °C to 0 °C Type T, 0 °C to 400 °C	0.064 °C 0.018 °C 0.23 °C 0.070 °C 0.022 °C 0.62 °C 0.084 °C 0.027 °C 0.19 °C 0.070 °C 0.020 °C	excluding cold junction compensation excluding cold junction compensation excluding cold junction compensation excluding cold junction compensation	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
Temperature indicators and simulators (thermocouple type), calibration by electrical simulation (continued)				Pride Park
Cold junction compensation	At ambient temperature of 20 °C ± 2.0 °C	0.13 °C		
Base metal thermocouples	Type J, -210 °C to 0 °C	0.14 °C	including cold junction compensation	
	Type J, 0 °C to 1200 °C	0.13 °C		
	Type K, -270 °C to -200 °C	0.24 °C		
Base metal thermocouples	Type K, -200 °C to 0 °C	0.15 °C	including cold junction compensation	
	Type K, 0 °C to 1370 °C	0.13 °C		
	Type N, -270 °C to -200 °C	0.53 °C		
Base metal thermocouples	Type N, -200 °C to 0 °C	0.15 °C	including cold junction compensation	
	Type N, 0 °C to 1300 °C	0.13 °C		
	Type T, -270 °C to -200 °C	0.21 °C		
Base metal thermocouples	Type T, -200 °C to 0 °C	0.15 °C	including cold junction compensation	
	Type T, 0 °C to 400 °C	0.13 °C		
	Noble metal thermocouples	-50 °C to 0 °C		
Noble metal thermocouples	0 °C to 250 °C	0.17 °C	excluding cold junction compensation	
	250 °C to 1760 °C	0.089 °C		
Cold junction compensation	At ambient temperature of 20 °C ± 2 °C	0.17 °C		
Temperature indicators and simulators (thermocouple type), calibration by electrical simulation				
Noble metal thermocouples	-50 °C to 0 °C	0.24 °C	including cold junction compensation	
	0 °C to 250 °C	0.22 °C		
	250 °C to 1760 °C	0.18 °C		
PRT simulation (Pt 100)	-200 °C to 0 °C	0.017 °C		
	0 °C to 100 °C	0.018 °C		
	100 °C to 400 °C	0.020 °C		
	400 °C to 630 °C	0.023 °C		
	630 °C to 850 °C	0.026 °C		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
TEMPERATURE				
Thermocouples				
Base metal	-20 °C to +200 °C	0.45 °C		Pride Park
Noble metal	-20 °C to 200 °C	0.92 °C		
Resistance thermometers	-20 °C to +200 °C	0.070 °C		
Electronic thermometers with sensors; analogue or digital	Ranges as per sensor	As per sensor type		
HUMIDITY				
Dew point	-10 °C to 0 °C 0 °C to 20 °C	0.12 °C dp 0.10 °C dp		Ansty
Relative Humidity	5 %rh to 95 %rh	2.0 %rh	At air temperature 5 °C to 60 °C	
Air Temperature	5 °C to 60 °C	0.4 °C		
PRESSURE				
Hydraulic pressure (Gauge)				Ansty
Pressure indicating instruments and gauges	600 kPa to 120 MPa	0.010 %	Calibration of pressure measuring devices with an electrical output may be undertaken.	
Pneumatic pressure (Gauge)				
Pressure indicating instruments and gauges	3.70 kPa to 3.5 MPa	0.010 %		
Pneumatic pressure (Absolute)				Ansty
Pressure indicating instruments and gauges	3.70 kPa to 3.5 MPa 75 kPa to 120 kPa	0.010 % + 5.0 Pa 17 Pa		



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TORQUE Hand torque tools	To BS EN ISO 6789:2003 (withdrawn and superseded), CCP 3.6.6 issue 6 0.2 N•m to 1000 N•m	1.0 %	The quoted uncertainty will be particularly dependent on the repeatability of the unit under test.	Ansvy
LENGTH				Inchinan
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
Thread measuring cylinders	BS3777:1964 and BS 5590:1978 and specials 0.1 to 5.0 diameter	0.50 on diameter		Inchinan
Plain plug gauges (parallel), cylindrical setting standards, gear measuring cylinders and rollers	1 to 50 diameter 50 to 100 diameter 100 to 150 diameter	0.50 } 0.80 } 1.0 } on diameter		
Plain ring gauges (parallel) and setting standards	CCP 2.3.2 1 to 50 diameter 50 to 100 diameter 100 to 150 diameter	0.80 } 1.2 } 1.8 } on diameter		
Length gauges, flat and spherical ended	0 m to 1 m	1.0 + (5.0 x length in m)		
Plain gap gauges (parallel)	BS 969:2008 0.5 to 100 100 to 200	3.0 5.0		
Screw plug gauges (parallel) excluding check and setting plugs	1 to 100 diameter	2.5 on pitch diameter	See Note 4	
Parallels	BS 906:Parts 1 and 2:1992 5 to (50 x 100 x 400)	1.5 to 5.0, dependant on size and grade		



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
FORM				Inchman
Surface plates Granite Cast iron	BS 817:2008 160 x 100 to 4 m x 4 m	1.5 + (0.80 x diagonal in m) See Note 2		
Straightedges Cast iron Steel Granite	BS 5204:Part 1:1975 0 m to 2 m	1 .0 + (2.0 x length in m) See Note 2		
MEASURING INSTRUMENTS AND MACHINES				
LENGTH				
Micrometers External	BS 870:2008 , CCP 2.4.1 0 to 300	Heads: 2.0 Setting and Extension rods: 1.0 + (5.0 x length in m)		
Internal	BS 959:2008 0 to 300			
Depth	BS 6468:2008 0 to 300			
Micrometer heads	BS 1734:1951 0 to 100	1.0		
Bench micrometer	0 to 100	Overall performance 1.0		
Height setting micrometer	0 to 300	Heads 1.0 Stepped column 1.6 Overall performance 2.0		
Riser Blocks for above	150 300	1.0 2.0		
Vernier gauges Caliper	BS 887:2008 0 to 300	Overall performance: 10 + (30 x length in m)		
Height	BS 1643:2008 0 to 300			
Depth	BS 6365:2008 0 to 300			



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MEASURING INSTRUMENTS AND MACHINES (continued) LENGTH (continued)				Inchman
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
Dial gauges and dial test indicators	BS 907:2008 and BS 2795:1981 0 to 50	1.0	The quoted uncertainty will be particularly dependent on the repeatability of the unit under test	
Dividing heads / Rotary tables	0 to 750 capacity	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> Linear dimensions $1.0 + (10 \times \text{length in m})$ Overall angular performance 3 seconds of arc </div>		
TORQUE Hand torque tools	To BS EN ISO 6789:2003 (withdrawn and superseded) and CCP 3.6.6 issue 6 0.136 N•m to 677.91 N•m	1.0 %		
LENGTH				Washington
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
Micrometers External	BS 870:2008 and CCP 2.4.1; 0 to 600	Heads: 2.0 Extension rods: 1.0 + (5.0 x length in m)		
Internal Depth	BS 959:2008; 0 to 150 BS 6468:2008; 0 to 150			
Vernier gauges Caliper Depth	BS 887:2008; 0 to 600 BS 6365:2008; 0 to 150	Overall performance: $10 + (30 \times \text{length in m})$		
Dial gauges and dial test indicators	BS 907:2008 and BS 2795:1981 0 to 50	1.5		



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Trescal EMS - Rolls Royce
Issue No: 050 Issue date: 22 May 2018

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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
TORQUE Hand torque tools	To BS EN ISO 6789:2003 (withdrawn and superseded) and CCP 3.6.6 issue 6 0.1 N•m to 1000 N•m	1.0 %	The quoted uncertainty will be particularly dependent on the repeatability of the unit under test	Washington
FUEL FLOW Flow rate - volume Flow rate - mass	5 l/hr to 27000 l/hr 4 kg/hr to 21330 kg/hr	0.10 % 0.20 %	Calibration fluid AVTUR (Aviation fuel)	Bristol
TORQUE Hand torque tools	To BS EN ISO 6789:2003 (withdrawn and superseded) and CCP 3.6.6 issue 6 0.1 N•m to 1000 N•m	1.0 %	The quoted uncertainty will be particularly dependent on the repeatability of the unit under test	Bristol
FORM				
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				Site
Surface plates Granite Cast iron	As BS 817:2008 160 x 100 to 4 m x 4 m	1.5 + (0.80 x diagonal in m) See Note 2		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
ELECTRICAL				
Temperature indicators and simulators (thermocouple type), calibration by electrical simulation:			Internal Reference junction enabled. Ambient temperature range 18 °C to 22°C (controlled customer environment).	
Base metal thermocouple types	Type J, -210 °C to 0 °C Type J, 0 °C to 1200 °C	0.36 °C 0.28 °C		Site
	Type K, -270 °C to -200 °C Type K, -200 °C to 0 °C Type K, 0 °C to 1000 °C Type K, 1000 °C to 1370 °C	4.6 °C 0.37 °C 0.29 °C 0.27 °C		
	Type N, -270 °C to -200 °C Type N, -200 °C to -100 °C Type N, -100 °C to 0 °C Type N, 0 °C to 800 °C Type N, 800 °C to 1300 °C	1.9 °C 0.49 °C 0.34 °C 0.26 °C 0.24 °C		
	Type T, -270 °C to -200 °C Type T, -200 °C to 0 °C Type T, 0 °C to 400 °C	0.81 °C 0.36 °C 0.26 °C		
Noble metal thermocouple types	Type R, -50 °C to 0 °C Type R, 0 °C to 150 °C Type R, 150 °C to 400 °C Type R, 400 °C to 1768 °C	0.91 °C 0.71 °C 0.51 °C 0.62 °C		
	Type S, -50 °C to 0 °C Type S, 0 °C to 100 °C Type S, 100 °C to 300 °C Type S, 300 °C to 1768 °C	0.80 °C 0.66 °C 0.55 °C 0.48 °C		
RTD Pt100	Up to 0 °C Up to 0 °C	0.072 °C 0.042 % + 0.072 °C	Ambient temperature range 18 °C to 28 °C -10 °C to +50 °C	
	0°C to 850 °C 0°C to 850 °C	0.029 % + 0.075 °C 0.051 % + 0.075 °C	18 °C to 28 °C -10 °C to +50 °C	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code	
DC Voltage	0 V to 150 mV 0 V to 150 mV	0.023 % + 5.0 μ V 0.048 % + 5.0 μ V	Ambient temperature range 18 °C to 28 °C -10 °C to +50 °C	Site	
	0.15 V to 0.25 V 0.15 V to 0.25 V	0.023 % + 8.4 μ V 0.048 % + 8.4 μ V	18 °C to 28 °C -10 °C to +50 °C		
	0.25 V to 1 V 0.25 V to 1 V	0.023 % + 12 μ V 0.048 % + 12 μ V	18 °C to 28 °C -10 °C to +50 °C		
	1 V to 25 V 1 V to 25 V	0.023 % + 0.65 mV 0.048 % + 0.65 mV	18 °C to 28 °C -10 °C to +50 °C		
	25 V to 60 V 25 V to 60 V	0.023 % + 1.2 mV 0.048 % + 1.2 mV	18 °C to 28 °C -10 °C to +50 °C		
DC Current	0 to 25 mA 0 to 25 mA	0.025 % + 1.7 μ A 0.049 % + 1.7 μ A	18 °C to 28 °C -10 °C to +50 °C		
	25 mA to 100 mA 25 mA to 100 mA	0.025 % + 2.0 μ A 0.049 % + 2.0 μ A	18 °C to 28 °C -10 °C to +50 °C		
DC Resistance	0 Ω to 250 Ω 0 Ω to 250 Ω	0.023 % + 4.3 m Ω 0.048 % + 4.3 m Ω	18 °C to 28 °C -10 °C to +50 °C		
	250 Ω to 2650 Ω 250 Ω to 2650 Ω	0.023 % + 11 m Ω 0.048 % + 11 m Ω	18 °C to 28 °C -10 °C to +50 °C		
	2650 Ω to 4000 Ω 2650 Ω to 4000 Ω	0.023 % + 100 m Ω 0.048 % + 100 m Ω	18 °C to 28 °C -10 °C to +50 °C		
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, and an indication of how they are to be interpreted, are shown 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 % \cdot 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 % \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.