


# Schedule of Accreditation

issued by

## United Kingdom Accreditation Service

21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

 <p><b>UKAS</b> CALIBRATION 0067</p> <p>Accredited to <b>ISO/IEC 17025:2005</b></p>	<p><b>Trescal Limited</b></p> <p>Issue No: 032    Issue date: 17 June 2011</p>	
	<p>Park Gate Close Bredbury Park Way Bredbury Stockport SK6 2SL</p>	<p>Contact: Mr Russell Hargreaves Tel: +44 (0)161 406 7878 Fax: +44 (0)161 406 7979 E-Mail: calibration.manchester@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><b>Address</b> Park Gate Close Bredbury Park Way Bredbury Stockport SK6 2SL</p>	<p><b>Local contact</b> Mr Russell Hargreaves</p>	<p>Dimensional Pressure Force Electrical</p>	<p>Main Laboratory (Lab)</p>

#### Site activities performed away from the locations listed above:

Location details	Activity	Location code
<p>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.</p>	<p>Dimensional</p>	<p>Site</p>



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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
<b>ELECTRICAL MEASUREMENTS</b>				
<b>DC RESISTANCE</b>				Lab
Specific Values	1 $\Omega$ 1 $\Omega$ 10 $\Omega$ 100 $\Omega$ 1 k $\Omega$ 10 k $\Omega$ 100 k $\Omega$ 1 M $\Omega$ 10 M $\Omega$ 100 M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$	63 ppm 66 ppm 12 ppm 6.0 ppm 6.0 ppm 6.0 ppm 6.0 ppm 8.0 ppm 25 ppm 79 ppm 1.0 %	Generation capability Measurement capability	
<b>AC RESISTANCE</b>				Lab
Generation and Measurement	At 50 Hz 2 m $\Omega$ to 50 m $\Omega$ 50 m $\Omega$ to 1 k $\Omega$	2.0 m $\Omega$ 0.15 %		
<b>DC VOLTAGE</b>				Lab
Generation	0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1100 V 1.1 kV to 10 kV	8.0 ppm + 1.0 $\mu$ V 7.0 ppm + 1.2 $\mu$ V 8.0 ppm + 8.0 $\mu$ V 8.0 ppm + 100 $\mu$ V 10 ppm + 600 $\mu$ V 0.16 %		
Measurement	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 kV  1 kV to 10 kV 10 kV to 40 kV	8.0 ppm + 1.0 $\mu$ V 7.0 ppm + 1.2 $\mu$ V 8.0 ppm + 8.0 $\mu$ V 8.0 ppm + 100 $\mu$ V 10 ppm + 600 $\mu$ V  0.16 % 0.025 % + 380 V		
<b>DC CURRENT</b>				Lab
Generation	0 $\mu$ A to 200 $\mu$ A 200 $\mu$ A to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 2 A 2 A to 20 A  20 A to 1000 A	45 ppm + 10 nA 46 ppm + 10 nA 46 ppm + 100 nA 43 ppm + 1.0 $\mu$ A 66 ppm + 30 $\mu$ A 180 ppm + 200 $\mu$ A  0.33 % + 50 mA	Simulation using a multi turn coil	



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DC CURRENT (cont'd)				
Measurement	0 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1A	45 ppm + 10 nA 46 ppm + 10 nA 46 ppm + 100 nA 43 ppm + 1.0 $\mu$ A 100 ppm + 30 $\mu$ A		Lab
AC VOLTAGE				
Generation Specific values at specific frequencies	100 mV 40 Hz 1 kHz 20 kHz 50 kHz 100 kHz 500 kHz 1 MHz	150 ppm 150 ppm 150 ppm 210 ppm 440 ppm 0.18 % 0.52 %		
	1 V 40 Hz 1 kHz 20 kHz 50 kHz 100 kHz 500 kHz 1 MHz	69 ppm 69 ppm 68 ppm 180 ppm 370 ppm 0.18 % 0.35 %		
	10 V 40 Hz 1 kHz 20 kHz 50 kHz 100 kHz 500 kHz 1 MHz	69 ppm 69 ppm 69 ppm 180 ppm 370 ppm 0.20 % 0.44 %		
	100 V 40 Hz 1 kHz 20 kHz 50 kHz 100 kHz	70 ppm 67 ppm 66 ppm 180 ppm 570 ppm		
	1 kV 55 Hz 1 kHz	120 ppm 110 ppm		
Other Values	2 mV to 20 mV 40 Hz to 20 kHz	160 ppm + 6.0 $\mu$ V		
	20 mV to 200 mV 40 Hz to 20 kHz	92 ppm + 10 $\mu$ V		



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AC VOLTAGE (cont'd)				
Other Values	200 mV to 2 V 40 Hz to 20 kHz	68 ppm + 7.0 $\mu$ V		
	2 V to 20 V 40 Hz to 20 kHz	66 ppm + 70 $\mu$ V		
	20 V to 200 V 40 Hz to 20 kHz	69 ppm + 1.0 mV		
	200 V to 1.1 kV 50 Hz to 1 kHz	80 ppm + 4.0 mV		
Levelled Sine wave Generation	600 mV 100 Hz to 300 MHz 300 MHz to 500 MHz	3.0 % 4.0 %	Terminated into 50 $\Omega$ ; suitable for oscilloscope bandwidth calibration.	
Measurement				
Specific values at specific frequencies	100 mV 40 Hz 1 kHz 20 kHz 50 kHz	150 ppm 150 ppm 150 ppm 210 ppm		
	1 V 40 Hz 1 kHz 20 kHz 50 kHz	70 ppm 70 ppm 69 ppm 180 ppm		
	10 V 40 Hz 1 kHz 20 kHz 50 kHz	70 ppm 70 ppm 70 ppm 180 ppm		
	100 V 40 Hz 1 kHz 20 kHz 50 kHz	71 ppm 68 ppm 67 ppm 180 ppm		
	1 kV 55 Hz 1 kHz	120 ppm 110 ppm		
Other Values	2 mV to 10 mV 40 Hz to 20 kHz	160 ppm + 6.0 $\mu$ V		
	10 mV to 100 mV 40 Hz to 20 kHz	92 ppm + 10 $\mu$ V		
	100 mV to 1 V 40 Hz to 20 kHz	68 ppm + 9.2 $\mu$ V		



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AC VOLTAGE (cont'd)				
Other Values (cont'd)	1 V to 10 V 40 Hz to 20 kHz	66 ppm + 92 $\mu$ V		
	10 V to 100 V 40 Hz to 20 kHz	69 ppm + 1.2 mV		
	100 V to 1 kV 50 Hz to 1 kHz	80 ppm + 7.2 mV		
High Voltage	At 50 Hz 1 kV to 5 kV 5 kV to 25 kV 25 kV to 40 kV	55 V 320 V 0.40 % + 380 V		
AC CURRENT				Lab
Generation	2 mA to 20 mA 40 Hz to 1 kHz 5 kHz	190 ppm + 0.40 $\mu$ A 840 ppm + 1.0 $\mu$ A		
	20 mA to 200 mA 40 Hz to 1 kHz 5 kHz	210 ppm + 4.0 $\mu$ A 840 ppm + 10 $\mu$ A		
	200 mA to 2 A 40 Hz to 1 kHz 5 kHz	0.10 % + 40 $\mu$ A 0.12 % + 140 $\mu$ A		
	2 A to 20 A 40 Hz to 400 Hz	410 ppm + 500 $\mu$ A		
	20 A to 200 A 50 Hz to 400 Hz	0.33 % + 110 mA	Simulation using a multi turn coil	
	200 A to 1000 A 50 Hz	0.33 % + 110 mA	Simulation using a multi turn coil	
Measurement	1 mA to 10 mA 40 Hz to 1 kHz 5 kHz	190 ppm + 400 nA 840 ppm + 1.0 $\mu$ A		
	10 mA to 100 mA 40 Hz to 1 kHz 5 kHz	210 ppm + 4.0 $\mu$ A 840 ppm + 10 $\mu$ A		
	100 mA to 1 A 40 Hz to 1 kHz 5 kHz	0.10 % + 40 $\mu$ A 0.12 % + 140 $\mu$ A		



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<b>CAPACITANCE</b>	100 Hz or 1 kHz 1 pF to 1000 pF 1 nF to 10 nF 10 nF to 100 nF 100 nF to 1 $\mu$ F 1 $\mu$ F to 10 $\mu$ F 10 $\mu$ F to 100 $\mu$ F	0.080 % + 0.033 pF 0.080 % + 0.33 pF 0.080 % + 3.3 pF 0.080 % + 33 pF 0.11 % + 330 pF 0.25 % + 3.3 nF		Lab
<b>FREQUENCY</b>				Lab
Generation Measurement	0.01 Hz to 560 MHz 0.01 Hz to 3 GHz	2.0 in $10^{10}$ 15 in $10^{10}$		
<b>ELAPSED TIME</b>	10 ms to 10 Days	3.0 in $10^8$ + 500 ns		Lab
<b>TEMPERATURE SIMULATION</b>				Lab
Thermocouple types			Including cold junction compensation	
R and S J, K, T and E J, K, T and E N	200 °C to 1760 °C -200 °C to -100 °C -100 °C to 1600 °C 0 °C and 1600 °C	0.70 °C 0.50 °C 0.30 °C 0.30 °C		
Cold junction measurement	18 °C to 22 °C	0.25 °C	In air	
<b>PRESSURE</b>				Lab
Gas pressure (gauge)				
Calibration of pressure indicating instruments and gauges	- 100 kPa to - 10 kPa - 10 kPa to 10 kPa 10 kPa to 100 kPa 100 kPa to 2.5 MPa 2.5 MPa to 7 MPa	0.015 % 20 Pa 0.013 % 0.015 % 4.3 kPa		
Gas pressure (absolute)				
Calibration of pressure indicating instruments and gauges	1.5 kPa to 75 kPa 75 kPa to 115 kPa 115 kPa to 200 kPa 200 kPa to 2.6 MPa 2.6 MPa to 7.1 MPa	0.015 % + 50 Pa 50 Pa 0.013 % + 50 Pa 0.015 % + 50 Pa 4.3 kPa		
Hydraulic pressure (gauge)				
Calibration of pressure indicating instruments and gauges	689 kPa to 5.6 MPa 6 MPa to 112 MPa	0.020 % 0.022 %		



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<p><b>PRESSURE</b> (cont'd)</p> <p>Hydraulic pressure (absolute)</p> <p>Calibration of pressure indicating instruments and gauges</p>	<p>789 kPa to 5.7 MPa 6.1 MPa to 112.1 MPa</p>	<p>0.020 % + 50 Pa 0.022 % + 50 Pa</p>		Lab
<p><b>FORCE</b></p> <p>Calibration of lever and push pull force measuring devices in tension and compression</p>	<p>0 to 1 200 N</p>	<p>0.1 %</p>	<p>The uncertainty stated is for the application of the calibration force and does not take into account the characteristics of the device being calibrated.</p>	Lab



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<b>DIMENSIONAL MEASUREMENTS</b>				
RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
<b>LENGTH</b>				<b>Lab</b>
Gauge blocks Inch (Steel and tungsten carbide)	BS 4311:Parts 1 and 3:1993  0 in to 0.4 in 0.4 in to 1 in 2 in 3 in 4 in	Class (see Remarks) C 3.0 4.0 5.0 6.0 7.0  (CMCs stated in $\mu$ inches)	<b>Class C</b> uncertainties apply to the measurement of length of gauges by comparison with grade K standards of length of similar materials. Class C uncertainties apply to grade 0, 1 and 2 gauges to BS 4311:2007 and BS EN ISO 3650:1999.  1. The uncertainty quoted is for the departure from flatness, straightness, parallelism or squareness, i.e. the distance separating the two parallel planes which just enclose the surface under consideration.	
Millimetre (Steel and tungsten carbide)	BS EN ISO 3650:1999 & BS 4311:Parts 1 and 3:1993  0 to 10 10 to 25 30, 40 and 50 60, 70 and 75 80, 90 and 100	Class (see Remarks) C 0.080 0.10 0.12 0.15 0.18		
Gauge block accessories	BS 4311-1: 2009 0.1 to 12.5	0.30	2. Single start, symmetrical thread forms only.	
Gauge block comparators	0 mm 100mm	0.050 + (0.50 x L in metres)	3. Single and multi-start symmetrical and asymmetrical thread forms.	
Length bars			4. Includes use of check plugs for screw rings from 1 mm to 14 mm diameter	
Workshop	BS 1790:1961, 0 in to 50 in	0.20 + (2.0 x length in m)	5. Functional test of size using setting plugs calibrated with a CMC of 3.0 $\mu$ m	
Grade 2	BS 5317:1976 0 to 1250	0.20 + (2.0 x length in m)		
Length bar accessories	BS 1790:1961 and BS 5317:1976	0.30		



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
LENGTH (cont'd)				Lab
Thread measuring cylinders	BS 5590:1978 and specials BS 3777: 1964 0.01 to 5	0.50		
Plain plug gauges (parallel) cylindrical setting standards and rollers	Diameter: 1 to 50 50 to 100 100 to 150 150 to 200 200 to 300	0.80 1.0 1.5 2.0 3.0		
Plain plug gauges (taper)	Diameter:			
Parallel to 1 in 8 on diameter	3 to 50 50 to 100	3.0 4.0		
1 in 8 to 1 in 3 on diameter	3 to 50 50 to 100	5.0 6.0		
Plain ring gauges (parallel) and setting standards	Diameter: 2 to 10 10 to 25 25 to 50 50 to 100 100 to 150 150 to 400	1.0 0.8 1.0 1.5 2.0 3.0		
Plain ring gauges (taper)	Diameter:			
Parallel to 1 in 8 on diameter	3 to 50 50 to 100 100 to 200	4.0 5.0 6.0		
1 in 8 to 1 in 3 on diameter	3 to 50 50 to 100 100 to 200	6.0 7.0 8.0		



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
LENGTH (cont'd)				Lab
Length gauges, flat and spherical ended	0 to 1200	1.0 + (5.0 x length in m)		
Plain gap gauges (parallel)	2 to 50 50 to 100 100 to 200 200 to 300 300 to 600	3.0 5.0 8.0 12 15		
Screw plug gauges (parallel) including check and setting plugs (see note 2)	Diameter:  1 to 100 100 to 150 150 to 300	CMC on pitch diameter:  3.0 4.0 6.0		
Screw plug gauges (taper) including check plugs (see note 2)	5 to 100 100 to 150	5.0 8.0		
Screw ring gauges (parallel) (see notes 2)	1 to 6 6 to 100 100 to 150 150 to 300 300 to 600	(see note 4) 5.0 6.0 8.0 12		
Screw ring gauges (taper)	6 to 150	7.0		
Screw pitch Screw flank angle	0.2 to 8 0° to 52°	1.5 5.0 minutes of arc		
Screw thread adjustable calliper gauges (parallel)	3 to 50 diameter	See note 5		
Parallels	BS 906:Part 1:1972 5 to 50 x 100 x 400	1.5 to 5		



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
LENGTH (cont'd)				Lab
Vee blocks	BS 3731:1987 20 to 150	2.5 to 5		
Receiver and position gauges, jigs and fixtures	Maximum dimensions 600 x 600 x 300	Minimum per coordinate 3.0 + (20 x length in m)		
Steel rules	BS 4372:1968 0 to 1000	5.0 + (10 x length in m)		
	DIN 866:1983 0 to 5000	5.0 + (10 x length in m)		
Precision scales (linear)	0 to 400	1.0 + (3.0 x length in m)		
Stage micrometers	0 to 10	0.50		
Tapes, measuring (pocket, precision and pi)	0 m to 5 m 5 m to 50 m	20 + (3.0 x L in metres) 300 + (10 x L in metres)		
Orifice Plates	BS EN ISO 5167-1:2003 0 to 500	5.0		
ANGLE				Lab
Squares (see note 1)				
Blade type	BS 939:2007 0 to 300 300 to 600 600 to 1000	CMC on squareness: 3.0 5.0 8.0		
Cylindrical	0 to 300 300 to 600 600 to 1000	2.0 4.0 6.0		
Block	0 to 300 300 to 600 600 to 1000	3.0 5.0 8.0		



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
ANGLE (cont'd)				Lab
Right angle and box angle plates. See note 1	BS 5535:1978 50 to 600	Squareness: 3.0 + (1.0 per 100 mm)  Parallelism: 1.0 + (1.0 per 100 mm)		
Sine bars and tables	BS 3064:1978 0 to 500 length	Linear dimensions: 1.0 + (10 x length in m) Overall performance: 3.0 seconds of arc		
Sine centres	0 to 500 length or between centres	Linear dimensions 1.0 + (10 x length in m) Overall performance 5.0 seconds of arc		
Compound sine tables	With tables or equivalent up to 500 length			
Spirit levels	BS 958:1968 and BS 3509:1962 5 seconds of arc to 60 minutes of arc nominal sensitivity	Mean sensitivity: 10 % of nominal Minimum 0.50 seconds of arc		
Electronic indicating levels	20 minutes of arc	1.0 % range Minimum 0.50 seconds of arc		
Clinometers	360 degrees	Mechanical instruments: 10 seconds of arc Optical instruments: 2.0 seconds of arc		Lab
FORM				Lab and Site
Toolmakers flats	BS 869:1978	0.50		
Surface plates				
Granite Cast iron	BS 817:1988 160 x 100 to 9 000 x 9 000	1.5 + (0.80 x length in m)		
Roundness	BS 3730:Part 2:1982			
External	0 to 350 diameter	0.050 on radius		
Internal	3 to 350 diameter	0.050 on radius		



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
FORM (cont'd)				Lab and Site
Straightedges				
Cast iron	BS 5204:Part 1:1975	1.0 + (2.0 x length in m)		
Steel	BS 5204:Part 2:1977			
Granite	0 to 6 000			
Tool makers	BS 852:1939	1.0		
Steel balls	1 to 25 diameter	0.50 on diameter		Lab
	25 to 50 diameter	0.80 on diameter		
MEASURING INSTRUMENTS AND MACHINES				
Micrometers				Lab and Site
Micrometers				
External	BS 870:2008	Heads: 2.0		
	0 to 600			
Internal	BS 959:2008	Setting and extension rods		
	0 to 900			
Depth	BS 6468:2008	1.0 + (8.0 x length in m)		
	0 to 300			
Micrometer heads	BS 1734:1951	1.0		
	0 to 50			
Bench micrometer	0 to 100	Overall performance 2.0		
Height setting micrometer	0 to 300	Heads 1.5 Stepped column 2.5 Overall performance 3.0		
Riser blocks for above	150	2.5		
	300	5.0		
Bore micrometer (three point) and Bore Gauges	0 to 150 diameter	5.0		
Vernier caliper, height and depth gauges	BS 887:2008	Overall performance		
	0 to 600	10 + (30 x length in m)		
	BS 1643:2008			
	0 to 600			
	BS 6365:2008			
	0 to 600			
Bevel protractors	BS 1685:2008	6 0 minutes of arc		
	0° to 360°			
Combination sets	0 mm to 600 mm	1.0 vernier division		



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES UNLESS OTHERWISE STATED				
<b>MEASURING INSTRUMENTS AND MACHINES (cont'd)</b>				
Dial gauges and dial test indicators	BS 907:2008 and BS 2795:1981 0 to 50	1.0		Lab and Site
Comparators (external)	BS 1054:1975 250 to 10 000 magnifications	1.0 % of range Minimum 0.20		
Horizontal comparator				
Horizontal measuring	0 to 100 length of scale	Minimum 0.30		
NPL type level comparator	MOY/SCMI/42 0 mm to 1000 mm	0.050 + (0.50 x L in metres)		Lab
Optical dividing heads				
Rotary tables	0 to 1000 capacity	<div style="border-left: 1px solid black; border-right: 1px solid black; padding: 2px;">           Linear dimensions            1.0 + (10 x length in m)            Overall angular performance            3.0 seconds of arc         </div>		Lab and Site
Inclinable tables	0 to 1000 capacity			
Inclinable rotary tables	0 to 1000 capacity			
Clinometers	0 degrees to 360 degrees	15 seconds of arc		
Bench centres	0 to 1000 between centres	Linear dimensions 1.0 + (10 x length in m)		
Thread diameter measuring	NPL Schedules MOY/SCMI/9 and MOY/SCMI/12 0 to 300	Overall performance 1.5		
Measuring machines, plain taper diameter	MOY/SCMI 16, 19 and 78 0 to 100 0 to 100 magnifications	1.5 (overall performance)		
Profile projectors	10 to 100 magnifications Linear 0 to 300 Angular 0° to 360° 10	Magnification 125 at screen Linear 5.0 Angular 3.0 mins of arc		



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MEASURING INSTRUMENTS AND MACHINES (cont'd)				Lab and Site
Microscopes, toolmakers	MOY/SCMI/02 0 to 150 x 150 mm	2.0 + 25/M with eye piece		
Linear scales associated with height and length measuring instruments using a laser interferometer	0 to 3000	0.15 + (1.5 x length in m)		
Feeler Gauges	BS 957:2008 0.025 to 1	3.0		
Electronic height gauges with microprocessor control	0 to 1000	1.0 + (5.0 x length in m)		
Cube moulds for concrete	BS EN 12390-1 2000 100 x 100 x 100 BS EN 196-1 2005 160 x 40 x 40	15		
Performance verification of co-ordinate measuring machines	ISO 10360-2 0 mm to 1900mm (longest diagonal using length bars)	1.5 + (1.2 x length in m)		Site
END				