Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0649

Accredited to ISO/IEC 17025:2017

Paragon Scientific Ltd

Issue No: 044 **Issue date:** 17 May 2019

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Calibration performed at the above address only

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address 6 Prenton Way North Cheshire Trading Estate Prenton Wirral CH43 3DU	**Local contact** Dr J Roberts	Calibration: Optical Viscosity Density Flash point Acid Number Base Number Sulfur Content pH Measurement	Prenton

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
OPTICAL				
Sucrose solutions for use as refractive index calibration standards	Sucrose in water wt/wt 0 % to 60 %	0.011 % wt/wt	Equivalent to 0 °Brix to 60 °Brix	
	Corresponding to refractive index values of 1.332986 to 1.441928	0.000016 to 0.000025	Calculated from ICUMSA Specification and Standard SPS-3 (2000)	
Refractive Index				
Calibration liquids	1.33 to 1.65	0.00007	Measurement at 15, 20, 25 and 30 °C Using a refractometer.	
VISCOSITY				
Capillary Viscometer Calibration				
Viscosity Constant •C•	•C• (mm^2s^{-1})s^{-1}			
Master viscometers – Ubbelohde	0.001 0.002 0.005 0.01 0.03 0.08 0.2 0.5 1.2 3 8 20 22	0.050 % 0.050 % 0.080 % 0.10 % 0.12 % 0.14 % 0.16 % 0.18 % 0.19 % 0.21 % 0.22 % 0.24 % 0.24 %	Calibrated to ASTM 2162	**Prenton**
Viscosity Constant •C•	•C• (mm^2s^{-1})s^{-1}			
Reference viscometers, Ubbelohde suspended level	0.001 0.003 0.005 0.01 0.03 0.05 0.1 0.3 0.5 1 3 5 10 30 100	0.13 % 0.13 % 0.13 % 0.14 % 0.16 % 0.16 % 0.17 % 0.19 % 0.20 % 0.22 % 0.23 % 0.23 % 0.24 % 0.27 % 0.27 %	Calibrated to ASTM D446 in direct comparison with master viscometers calibrated to ASTM D2162	

Measured Quantity Instrument or Gauge	Range		Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)		Remarks	Location Code
VISCOSITY (continued)						Prenton
Viscosity Constant •C•	•C• $(mm^2s^{-1})s^{-1}$					
Working viscometers						
	(a)	(b)	(a)	(b)		
(a) Direct flow - suspended level	0.001	0.002	0.17 %	0.25 %	Calibrated to ASTM D446 using viscosity standards calibrated to ASTM D2162	
	0.003	0.004	0.17 %	0.25 %		
(b) Reverse flow	0.005	0.008	0.17 %	0.25 %		
	0.01	0.015	0.17 %	0.26 %		
	0.03	0.035	0.18 %	0.28 %		
	0.05	0.1	0.21 %	0.29 %		
	0.1	0.25	0.22 %	0.31 %		
	0.3	0.5	0.25 %	0.33 %		
	0.5	1.2	0.26 %	0.34 %		
	1	2.5	0.28 %	0.35 %		
	3	8	0.30 %	0.38 %		
	5	20	0.31 %	0.40 %		
	10	30	0.33 %	0.40 %		
	30		0.35 %			
	50		0.36 %			
	(a)	(b)	(a)	(b)		
(a) Direct flow - suspended level					Calibrated to ASTM D 446 using viscosity standards calibrated / traceable to ASTM D 2162	
	100	100	0.48 %	0.52 %		
(b) Reverse flow		300		0.52 %		
Viscosity Measurement						
Kinematic and Dynamic Viscosity 15 °C to 100 °C	mm^2s^{-1}		Kinematic	Dynamic	Viscosity reference standards calibrated to ASTM D2162	
	0.3 to 7.4		0.070 %	0.070 %		
	7.4 to 10		0.090 %	0.090 %		
	10 to 30		0.12 %	0.12 %	Viscosity values at intermediate temperatures can be determined in accordance with ASTM D341	
	30 to 72		0.14 %	0.14 %		
	72 to 180		0.15 %	0.15 %		
	180 to 520		0.17 %	0.17 %		
	520 to 1000		0.19 %	0.19 %		
	1000 to 2700		0.20 %	0.20 %		
	2700 to 8000		0.22 %	0.22 %		
	8000 to 82 500		0.23 %	0.23 %	Viscosity index can be calculated in accordance with ASTM D2270	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)		Remarks	Location Code
VISCOSITY (continued) Viscosity Measurement (continued)					Prenton
Kinematic and Dynamic Viscosity 20 °C to 100 °C	mm^2s^{-1}	Kinematic	Dynamic	Viscosity reference standards calibrated to ASTM D445	
	0.3 to 3	0.29 %	0.29 %		
	3 to 10	0.30 %	0.30 %		
	10 to 50	0.32 %	0.32 %	Viscosity values at intermediate temperatures can be determined in accordance with ASTM D341	
	50 to 100	0.33 %	0.33 %		
	100 to 500	0.35 %	0.35 %		
	500 to 1000	0.36 %	0.36 %		
	1000 to 5000	0.37 %	0.37 %		
	5000 to 10000	0.38 %	0.38 %		
	10000 to 125 000	0.40 %	0.40 %	Viscosity index can be calculated in accordance with ASTM D2270	
Kinematic and Dynamic Viscosity 20 °C to -40 °C	mm^2s^{-1}	Kinematic	Dynamic	Viscosity reference standards calibrated to ASTM D445	
	0.6 to 2	0.38 %	0.38 %		
	2 to 8	0.39 %	0.39 %		
	8 to 200	0.40 %	0.40 %	For use with, but not limited to low temperature viscosity and ASTM D5293	
	200 to 400	0.41 %	0.41 %		
	400 to 800	0.42 %	0.42 %		
	800 to 2000	0.43 %	0.43 %		
	2000 to 4000	0.46 %	0.46 %	Viscosity values at intermediate temperatures can be determined in accordance with ASTM D341	
	4000 to 8000	0.47 %	0.47 %		
	8000 to 40000	0.49 %	0.49 %		
	40000 to 200 000	0.59 %	0.59 %		
Kinematic and Dynamic Viscosity 100 °C to 150 °C	mm^2s^{-1}	Kinematic	Dynamic	Viscosity reference standards calibrated to ASTM D445	
	0.3 to 4	0.32 %	0.32 %		
	4 to 8	0.33 %	0.33 %		
	8 to 80	0.34 %	0.34 %	Viscosity values at intermediate temperatures can be determined in accordance with ASTM D341	
	80 to 200	0.35 %	0.35 %		
	200 to 400	0.36 %	0.36 %		
	400 to 1000	0.37 %	0.37 %		
Kinematic and Dynamic Viscosity 20 °C to 150 °C	mm^2s^{-1}	Kinematic	Dynamic	Viscosity Silicon oil reference standards calibrated to ASTM D445	
	2 to 8	0.40 %	0.40 %		
	8 to 80	0.41 %	0.41 %		
	80 to 400	0.42 %	0.42 %		
	400 to 800	0.43 %	0.43 %		
	800 to 4000	0.44 %	0.44 %		
	4000 to 8000	0.45 %	0.45 %		
	8000 to 125 000	0.46 %	0.46 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
DENSITY				Prenton
Liquids -40 °C to 150 °C	0.60 g/ml to 1.65 g/ml	0.010 %	Calibrated to ASTM D1480	
15 °C, 20 °C & 25 °C	0.60 g/ml to 1.65 g/ml	0.027 %	Calibrated to ASTM D4052	
FLASH POINT				
Pensky-Martens Closed Cup Flash Point	40 °C to 370 °C	0.50 °C	Flash point standards calibrated to ASTM D93 Procedures A & B	
Cleveland Open Cup Flash Point	79 °C to 400 °C	1.5 °C	Flash point standards calibrated to ASTM D92	
Total Acid Number (TAN)	0.1 to 150 mg KOH/g	1.1%	Calibrated to ASTM D664 in a matrix of Base Oil	
Total Base Number (TBN)	1 to 300 mg KOH/g	1.3%	Calibrated to ASTM D2896 in a matrix of Base Oil	
Sulfur content	<0.1 ug/g to 5.00%m/m	1.0%	Calibration by inhouse method based on ASTM D2622	
pH MEASURMENT				
pH of Buffer Solutions	4 to 10 pH units at temperatures of 20°C and 25°C.	0.01 to 0.02 pH units	Calibration procedure based on ASTM E70	

Flexible Scope

The laboratory is accredited to ISO/IEC17025:2017 for calibration activities in accordance with the standards highlighted in the schedule. This may also include new versions of existing accredited standard test methods to be introduced in accordance with documented in-house procedure QA018, providing that:

(1) The method or standard does not introduce new principles of measurement.

(2) The method or standard does not require measurements to be made outside the parametric boundaries defined within the standard specifications already accredited and detailed within this Schedule of Accreditation.

Information about flexible scopes of accreditation is available in UKAS document LAB39 and EA document EA-2/05.

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.