Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

0401

Accredited to ISO/IEC 17025:2017

Ricardo-AEA Ltd
Trading as Ricardo Energy & Environment

Issue No: 035 **Issue date:** 22 December 2023

Ricardo-AEA
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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 Ludbridge Mill East Hendred Wantage OX12 8LN **Local contact** Stewart Eaton Tel: +44 (0)1235 753212 Email: stewart.eaton@ricardo.com	Certified Reference Gases for Air Quality Monitoring Environmental Air Quality Monitoring Instruments Local Office for Site Activities	Harwell
Address 18 Blythswood Square Glasgow G2 4AD **Local contact** Ms Susannah Telfer Tel: +44 (0)1235 753523 Email: susannah.telfer@ricardo.com	Environmental Air Quality Monitoring Instruments Local Office for Site Activities	Glasgow
Address First Floor, Bright Building,Pencroft Way, Manchester Science Park, Manchester M15 6GZ **Local contact** Tim Bevington Tel: +44 (0)1235 753125 Email: tim.bevington@ricardo.com	Environmental Air Quality Monitoring Instruments Local Office for Site Activities	Manchester

Site activities performed away from the locations listed above:

Location details	Activity	Location code
Air Quality Monitoring Stations	Environmental Air Quality Monitoring Instruments	Site
Client Premises	Particle Number Counting Calibration	Site

Calibration and Measurement Capability (CMC)

Measured Quantity Instrument or Gauge	Range	Expanded Meaurement Uncertainty (k = 2)	Remarks	Location Code
COMPRESSED GAS MIXTURES FOR AIR QUALITY MONITORING				Harwell
Carbon monoxide (CO) in air or nitrogen	2 µmol/mol to 5 µmol/mol 5 µmol/mol to 50 µmol/mol	4.5 % 2.0 %	Measurement comparison using reference gas mixture	
Nitric oxide (NO) in nitrogen	100 nmol/mol to 200 nmol/mol 2 nmol/mol to 1000 nmol/mol	3.5 % 3.0 %		
Nitrogen dioxide (NO_2) in air	100 nmol/mol to 200 nmol/mol 2 nmol/mol to 1000 nmol/mol	4.0 % 3.5 %		
Sulphur dioxide (SO_2) in air	100 nmol/mol to 200 nmol/mol 2 nmol/mol to 1000 nmol/mol	3.0 % 2.5 %		
ENVIRONMENTAL INSTRUMENTS FOR AIR QUALITY MONITORING				Harwell Glasgow Manchester
Ozone photometers	10 nmol/mol to 400 nmol/mol		Comparison against a reference photometer.	
Calibration factor		3.5 %		
Zero response		3.0 nmol/mol		
Particle Counters				
Airborne particle number concentration. Calibration factor for condensation particle counters CPC/PNC	Concentration range 10 cm^{-3} to 100,000 cm^{-3} 100,000 cm^{-3} to 1,000,000 cm^{-3} depending upon particle size	 6.2 % 5.7 %	Comparison against a traceable reference condensation particle counter at diameters from 10 nm to 200 nm	Harwell and Site
Particle Dilution Systems				
Particle Concentration Reduction Factor (PCRF) measurements of volatile particle removers (VPR)	Dilution factors of the system calibrated at particle diameters from 10 nm to 200 nm	6.3 %	Comparison of the particle concentration upstream and downstream of the dilution system.	Harwell and Site

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Measured Quantity Instrument or Gauge	Range	Expanded Meaurement Uncertainty (k = 2)	Remarks	Location Code
AIR QUALITY MONITORING STATIONS				Site
Carbon monoxide (CO) analysers	2.0 µmol/mol to 5 µmol/mol 5 µmol/mol to 50 µmol/mol	10 % 2.0 %	Comparison against reference gas mixture	
Zero response		0.20 µmol/mol		
Chemiluminescent analysers for nitric oxide and nitrogen dioxide (NO and NO_2)	50 nmol/mol to 2000 nmol/mol		Comparison against reference gas mixture	
Calibration factor		3.5 %		
Zero response		2.0 nmol/mol		
Chemiluminescent analysers NOx converter efficiency	90 % to 100 %	1.0 %	Reaction of NO with ozone	
Ultraviolet fluorescence analysers for sulphur dioxide (SO_2)	50 nmol/mol to 2000 nmol/mol		Comparison against reference gas mixture	
Calibration factor		2.5 %		
Zero response		2.0 nmol/mol		
Ultraviolet absorption analysers for ozone (O_3)			Comparison against reference photometer	
Calibration factor	0 nmol/mol to 100 nmol/mol 100 nmol/mol to 400 nmol/mol	3.0 nmol/mol 3.0 %		
Zero response		3 nmol/mol		
Determination of TEOM analyser spring constant (k_0)	4000 g/s^2 to 25000 g/s^2	1.0 %	Using weighed filters	
Determination of particle analyser flow rate	1 litre/min to 40 litre/min	2.2 %	By direct measurement of sampled air flow rate using reference meters	
Determination of Non Automatic hydrocarbon sampler flow rate	10 ml/min to 30 ml/min Flow difference of 0 ml/min to 20 ml/min	Q [1.3 %, 0.37 ml/min] Q [1.7 %, 0.002 ml/min]		
Determination of PAH sampler flow rate	500 L/min	1.1 %		
Determination of filter weight	Up to 200 mg	25 µg	By direct weighing	Harwell
Determination of 'deposit weight'	Up to 50 mg	35 µg	By calculated difference	

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 measurement uncertainty 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 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 measurement uncertainty is calculated according to the procedures given in the GUM 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 measurement uncertainty in certificates issued under its accreditation.

Expression of CMCs - symbols and units

It should be noted that the percentage symbol (%) represents the number 0.01. In cases where the measurement uncertainty is stated as a percentage, this is to be interpreted as meaning percentage of the measurand.
Thus, for example, a measurement uncertainty of 1.5 % means $1.5 \times 0.01 \times q$, where q is the quantity value.

The notation Q[a, b] stands for the root-sum-square of the terms between brackets: $Q[a, b] = [a^2 + b^2]^{1/2}$