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# CERTIFICATE OF CALIBRATION

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Authorised Signatories:

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Signed:


Date of Issue: 18<sup>th</sup> July 2017

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Page 1 of 3

Customer Name and Address:

Scottish Government  
Water, Air, Soils and Flooding Division  
Environmental Quality Directorate  
Scottish Government  
Victoria Quay  
Edinburgh  
EH6 6QQ

Description:

Calibration factors for the City of Edinburgh Council's Currie, Glasgow Road, Gorgie Road, Queensferry Road, Salamander Street and St Johns Road air monitoring station's.

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response <sup>1</sup>	Uncertainties ppb	Calibration Factor <sup>2</sup>	Uncertainties %	Converter eff. (%) <sup>3</sup>
Currie 23 <sup>rd</sup> February 2017	NO <sub>x</sub>	1877	1.4	2.5	1.0193	3.5	96.0
	NO		2.7	2.8	1.0162	3.5	
Glasgow Road 10 <sup>th</sup> February 2017	NO <sub>x</sub>	M1780-	1.0	2.7	1.0456	3.5	100.7
	NO	M722	0.0	2.7	1.0386	3.5	
Gorgie Road 8 <sup>th</sup> February 2017	NO <sub>x</sub>	601915008	-1.2	2.7	1.3453	3.5	101.1
	NO		-0.2	2.6	1.2830	3.5	
Queensferry Road 20 <sup>th</sup> February 2017	NO <sub>x</sub>	4681833	-1.0	3.3	1.0088	7.3	96.9
	NO		-1.0	3.0	1.0088	7.3	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response <sup>1</sup>	Uncertainties ppb	Calibration Factor <sup>2</sup>	Uncertainties %	Converter eff. (%) <sup>3</sup>
Salamander Street 6 <sup>th</sup> February 2017	NO <sub>x</sub>	660B-292	1.0	2.6	1.1007	3.5	98.1
	NO		0.0	2.6	1.1012	3.5	
St Johns Road 10 <sup>th</sup> February 2017	NO <sub>x</sub>	108592	2.0	2.5	1.0268	3.5	95.3
	NO		0.0	2.7	1.0224	3.5	

Site / Date Test Carried Out	Species	Analyser Serial No.	Parameter	Specified Value	Measured Value	Deviation %	Uncertainty %
Currie 23 <sup>rd</sup> February 2017	TEOM PM <sub>10</sub>	140ab255 560503	Main Flow <sup>4</sup>	3.00	<b>2.86</b>	-4.8	2.25
			Aux Flow <sup>4</sup>	13.68	<b>13.11</b>	-4.2	2.25
			Total Flow	16.67	<b>15.97</b>	-4.2	2.25
			k <sub>0</sub> <sup>5</sup>	11566	11861	2.6	1.00
Glasgow Road 10 <sup>th</sup> February 2017	TEOM PM <sub>10</sub>	24376	Main Flow <sup>4</sup>	3.00	3.01	0.4	2.25
			Aux Flow <sup>4</sup>	13.67			2.25
			Total Flow	16.67	15.71	-5.8	2.25
			k <sub>0</sub> <sup>5</sup>	13952	14309	2.6	1.00
Salamander Street 6 <sup>th</sup> February 2017	TEOM PM <sub>10</sub>	22301	Main Flow <sup>4</sup>	2.94	2.93	-0.2	2.25
			Aux Flow <sup>4</sup>	13.45			2.25
			Total Flow	16.67	15.93	-4.4	2.25
			k <sub>0</sub> <sup>5</sup>	18010	18256	1.4	1.00
Queensferry Road 20 <sup>th</sup> February 2017	TEOM PM <sub>10</sub>	27492	Main Flow <sup>4</sup>	3.02	3.41	12.8	2.25
			Aux Flow <sup>4</sup>	13.67			2.25
			Total Flow	16.67	16.64	-0.2	2.25
			k <sub>0</sub> <sup>5</sup>	14045	14678	4.5	1.00

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NO<sub>x</sub> analysers only) by documented methods. The factors have been calculated using certified gas standards. The particulate analysers listed above have been tested for sample flow rates and k<sub>0</sub> (where appropriate) by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified. All results for gaseous species are given in ppb (parts per billion) mole fractions or ppm (parts per million) mole fractions.

<sup>1</sup>The zero response is the zero reading on the data logging system of the analyser when audit zero gas was introduced to the analysers under test.

<sup>2</sup>The calibration factor is the multiplying factor required to scale the reading on the data logging system of the analyser into reported concentration units (ppb for NO, NO<sub>x</sub>, SO<sub>2</sub>, O<sub>3</sub> and ppm for CO. Where 1 ppm = 1000 ppb). It should be used in conjunction with the zero response. A corrected concentration is calculated using the following equation:

**Concentration = F (Output - Zero Response)**

Where F = Calibration Factor provided on this certificate  
Output = Reading on the data logging system of the analyser  
Zero Response = Zero Response provided on this certificate

<sup>3</sup>Converter eff. is the measured efficiency of the NO<sub>2</sub> to NO converter within the oxides of nitrogen analyser under test.

<sup>4</sup>The measured main flow rate (where applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured aux flow rate (where applicable) is the flow rate through the bypass tubing of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are l.min<sup>-1</sup>. Where flow rates are highlighted in bold, it indicates that measurements were not made at the analyser sample inlet. These measurements therefore may not accurately reflect analyser performance in normal operation.

<sup>5</sup>The calculated k<sub>0</sub> value (TEOM analysers only) is the calculated k<sub>0</sub> spring constant based on tests undertaken with filters of known weight. The % deviation indicates the closeness of the calculated result to the manufacturer's specified k<sub>0</sub> value.

The calibration results shaded are those that fall out with our scope of accreditation, all other results on this certificate are not UKAS accredited, but have been included for completeness.