Calculation of overall uncertainty (device 2)

Measuring device:	Siemens APT M200/7M	Serial-No:	SN1 (1253)	
Measured component:	NO	Ref.-conc. value:	104.6	nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	$x \leq$ 1.0 nmol/mol	0.240	$u_{r,z}$	0.22	0.0485
2	Repeatability standard deviation at reference value	$x \leq$ 3.0 nmol/mol	1.550	$u_{r,r}$	not considered, as $\sqrt{2}\,u_{r,r} \cdot k = 0.05 < u_{cf}$	-
3	Lack of fit at 1/2 span value	$x \leq$ 4.0% of measured value	-0.500	u_{lof}	-0.30	0.1313
4	Sensitivity coefficient of sample gas pressure at reference value	$x \leq$ 5.0 nmol/mol/kPa	0.140	u_{cp}	1.29	1.6658
5	Sensitivity coefficient of sample gas temperature at reference value	$x \leq$ 3.0 nmol/mol/K	0.043	u_{ct}	0.10	0.0100
6	Sensitivity coefficient of ambient temperature at reference value	$x \leq$ 3.0 nmol/mol/K	0.520	u_{at}	1.25	1.5117
7	Sensitivity coefficient of supply voltage at reference value	$x \leq$ 0.20 nmol/mol/V	0.010	u_v	0.04	0.0013
8a	Interferent H_2O vol.-2% (humidity)	$x \leq$ 10 nmol/mol (Zero)	3.300	$u_{int,H2O}$	1.43	2.0510
		$x \leq$ 10 nmol/mol (Span)	-3.300			
8b	Interferent CO_2 vol.-6% (purge gas)	$x \leq$ 6.0 nmol/mol (Zero)	0.300	$u_{int,CO2}$	0.83	0.3915
		$x \leq$ 6.0 nmol/mol (Span)	0.700			
8c	Interferent NH_3 vol.-300 ppm (purge gas)	$x \leq$ 6.0 nmol/mol (Zero)	35.700	$u_{int,NH3}$		
		$x \leq$ 6.0 nmol/mol (Span)	<0.700			
9	Ageing effect	$x \leq$ 7.0% of measured value	0.800	u_{ag}	0.48	0.2334
10	Repeatability standard deviation under field conditions	$x \leq$ 8.0% of average over 3 months	1.770	u_{rf}	1.85	3.4278
11	Long term drift at zero level	$x \leq$ 10 nmol/mol	0.400	u_{dz}	0.23	0.0533
12	Long term drift at span level	$x \leq$ 5.0% of max. of calibration range	1.030	u_{dm}	0.62	0.3869
13	Difference sample/calibration port	$x \leq$ 1%	0.000	u_{dcp}	0.00	0.0000
21	Converter efficiency	$x \geq$ 95	98.000	u_{cv}	2.09	4.3765
23	Uniformity of test gas	$x \leq$ 2%	2.000	u_{tg}	1.05	1.0941

Combined standard uncertainty	u_c	3.9556	nmol/mol
Expanded uncertainty	U	7.9117	nmol/mol
Relative expanded uncertainty	W	7.56	%
Maximum allowed expanded uncertainty	W_{max}	15	%

Measuring device:	Siemens APT M200/7M	Serial-No:	SN2 (1257)	
Measured component:	NO	Ref.-conc. value:	104.6	nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	$x \leq$ 1.0 nmol/mol	0.340	$u_{r,z}$	0.19	0.0376
2	Repeatability standard deviation at reference value	$x \leq$ 3.0 nmol/mol	1.350	$u_{r,r}$	not considered, as $\sqrt{2}\,u_{r,r} \cdot k = 0.05 < u_{cf}$	-
3	Lack of fit at 1/2 span value	$x \leq$ 4.0% of measured value	-0.200	u_{lof}	-0.12	0.0146
4	Sensitivity coefficient of sample gas pressure at reference value	$x \leq$ 5.0 nmol/mol/kPa	0.060	u_{cp}	0.55	0.3003
5	Sensitivity coefficient of sample gas temperature at reference value	$x \leq$ 3.0 nmol/mol/K	0.030	u_{ct}	0.09	0.0068
6	Sensitivity coefficient of ambient temperature at reference value	$x \leq$ 3.0 nmol/mol/K	0.160	u_{at}	0.47	0.2170
7	Sensitivity coefficient of supply voltage at reference value	$x \leq$ 0.20 nmol/mol/V	0.030	u_v	0.11	0.0111
8a	Interferent H_2O vol.-2% (humidity)	$x \leq$ 10 nmol/mol (Zero)	1.900	$u_{int,H2O}$	0.19	0.0339
		$x \leq$ 10 nmol/mol (Span)	-0.700			
8b	Interferent CO_2 vol.-6% (purge gas)	$x \leq$ 6.0 nmol/mol (Zero)	0.700	$u_{int,CO2}$	0.58	0.4659
		$x \leq$ 6.0 nmol/mol (Span)	1.300			
8c	Interferent NH_3 vol.-300 ppm (purge gas)	$x \leq$ 6.0 nmol/mol (Zero)	0.000	$u_{int,NH3}$		
		$x \leq$ 6.0 nmol/mol (Span)	0.700			
9	Ageing effect	$x \leq$ 7.0% of measured value	1.000	u_{ag}	0.60	0.3647
10	Repeatability standard deviation under field conditions	$x \leq$ 8.0% of average over 3 months	1.770	u_{rf}	1.85	3.4278
11	Long term drift at zero level	$x \leq$ 10 nmol/mol	-0.540	u_{dz}	-0.31	0.0962
12	Long term drift at span level	$x \leq$ 5.0% of max. of calibration range	-0.940	u_{dm}	0.57	0.3251
13	Difference sample/calibration port	$x \leq$ 1%	0.000	u_{dcp}	0.00	0.0000
21	Converter efficiency	$x \geq$ 95	98.000	u_{cv}	1.89	3.5449
23	Uniformity of test gas	$x \leq$ 2%	2.000	u_{tg}	1.05	1.0941

Combined standard uncertainty	u_c	3.1815	nmol/mol
Expanded uncertainty	U	6.3630	nmol/mol
Relative expanded uncertainty	W	6.08	%
Maximum allowed expanded uncertainty	W_{max}	15	%

Umwelt Bundes Amt
For our Environment

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CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000038503_01

Certified AMS: 300E / T300 for CO

Manufacturer: Teledyne Advanced Pollution Instrumentation
9480 Carroll Park Drive
San Diego
CA 92121-5201
USA

Test Institute: TÜV Rheinland Energie und Umwelt GmbH

This is to certify that the AMS has been tested and found to comply with:

VDI 4202-1: 2002, VDI 4203-2: 2004, EN 14626: 2012, EN 15267-1: 2009, EN 15267-2: 2009

Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).

The present certificate replaces Certificate No. 0000038503 of 22 March 2013

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Product
See Website
www.qal1.de
ID 0000038503

Publication in the German Federal Gazette (BAnz.) of 29 October 2005

This certificate will expire on: 04 March 2018

German Federal Environment Agency
Dessau, 20 August 2013

i. A. Dr. Marcel Langner

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 19 August 2013

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / www.eco-tuv.com
teu@umwelt-tuv.de
Tel. +49 221 806-5200

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Cologne

Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008.

qal1.de
info@qal1.de

Umwelt Bundes Amt
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Certificate: 0000038503_01 / 20 August 2013

Test report: 936/21207124/B1_DE of 22 August 2007
Addendum 936/21219874/C of 31 October 2012
Addendum 936/21221556/C of 16 March 2013

Initial certification: 06 March 2013

Date of expiry: 04 March 2018

Publication: BAnz AT 23 July 2013 B4, chapter V, notification 17

Approved application
The certified AMS is suitable for continuous ambient air monitoring of CO (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three-month field test.

The AMS is approved for the temperature range of +5 °C to +40 °C.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at which it will be installed.

Basis of the certification
This certification is based on:

- test report 936/21207124/B1_DE of 22 August 2007 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, addendum 936/21219874/C of 31 October 2012 of TÜV Rheinland Energie und Umwelt GmbH and addendum 936/21221556/C of 16 March 2013 of TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- the on-going surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz. 29 October 2005, p. 15700, chapter IV, No. 2.1)
- publication in the German Federal Gazette (BAnz. 20 April 2007, p. 4139, chapter IV, notification 7)
- publication in the German Federal Gazette (BAnz. 26 January 2011, p. 294, chapter IV, notification 23 and 24)
- publication in the German Federal Gazette (BAnz AT 05 March 2013 B10, chapter V, notification 5)
- publication in the German Federal Gazette (BAnz AT 23 July 2013 B4, chapter V, notification 17)

AMS designation:
Model 300E for CO

Manufacturer:
Teledyne Advanced Pollution Instrumentation, San Diego, USA / EAS GmbH, Brunn, Austria

Field of application:
For continuous ambient air monitoring of CO (stationary operation)

Measuring ranges during the performance test:
CO: 0 - 60 mg/m³
0 - 100 mg/m³

Software version:
Version F.3b

Test report:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne
TÜV Rheinland Group, Cologne
Report No.: 936/21201601/B of 10 July 2005

7 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700)

The measuring systems Modell 300E for CO and Modell 400E for ozone of the of the company Teledyne Instruments, San Diego, USA will not by distributed anymore in future – as mentioned in the publication – by the company MLU-Monitoring für Leben und Umwelt Ges.m.b.H. in A-2340 Mödling, Austria, but only by the company EAS Enviret Analytical Systems Ges.m.b.H., Brunn, Austria.

Opinion stated by TÜV Rheinland Immissionsschutz und Energiesysteme GmbH of 14 December 2007

23 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 2.11) and of 12 April 2007 (BAnz. p. 4139, chapter IV, notification 7)

The current software version of the ambient air measuring system Modell 300E (=M300E) for CO of the company Teledyne Advanced Pollution Instrumentation is:
L_8 with Library Version 6.3

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 29 September 2010

24 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 2.1) and of 12 April 2007 (BAnz. p. 4139, chapter IV, notification 7)

The measuring system Modell 300E for CO of the company Teledyne Advanced Pollution Instrumentation is manufactured in the old design Modell 300E as well as in the new design Model T300. The new design differs from the old design only by a new display, a new front plate and extended possibilities for communication.

The current name of the new design of the measuring system is:

Model T300

The current software version of the new design of the measuring system is:

1.0.0 bld 54 with Library Version 7.0.0 bld 57

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 29 September 2010

5 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV, No. 2.1) and of 10 January 2011 (BAnz. p. 294, chapter IV, 23th and 24th notification)

The measuring system M300E respectively T300 for CO of the company Teledyne Advanced Pollution Instrumentation fulfils the requirements of EN 14626 (issue July 2005). Furthermore the manufacturing and the quality management of the measuring system M300E respectively T300 for CO fulfill the requirements of EN 15267.

The test report on the type approval with the report no. 936/21207124/B1_DE as well as an addendum to the test report with the report no. 936/21219874/C are available on available on the internet at www.qal1.de.

The current software version of the measuring system M300E is:

M.0 with Library Version 6.4

The current software version of the measuring system T300 is:

1.0.4 with Library Version 7.0.3

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 11 October 2012

17 Notification on announcements of the Federal Environmental Agency of 25 July 2005 (BAnz. p. 15700, chapter IV, no. 2.1) and of 12 February 2013 (BAnz. AT of 5 March 2013, chapter V, 5th notification)

The M300E / T300 measuring system for CO manufactured by Teledyne Advanced Pollution Instrumentation fulfils the requirements of Standard EN 14626 (December 2012). An addendum as integral part of test report no. 936/21221556/C is available online at www.qal1.de.

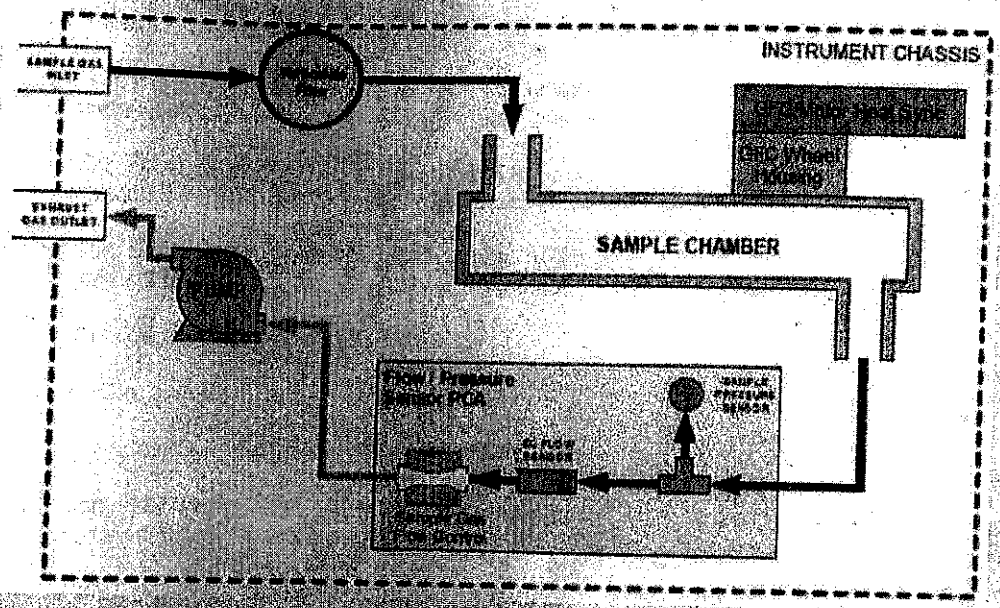
The new designation of the M300E measuring system for CO is 300E.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 16 March 2013

Certified product
This certificate applies to automated measurement systems conforming to the following description:

The measuring principle of the measuring system 300E respectively T300 is based on the determination of the IR-absorption caused by the gas to be measured in the respective ranges of wave lengths characteristic for this and thus complies with the reference method described in the standard EN 14626.

The schematic set-up / flow diagram of the measuring system 300E respectively T300 is as follows:



General notes
This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energie und Umwelt GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This can be applied to the product or used in publicity material for the certified product is presented on page 1 of this certificate.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energie und Umwelt GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and the validity is also accessible on the internet: **qal1.de**.

Umwelt Bundes Amt
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Certificate:
0000038503_01 / 20 August 2013

Certification of 300E / T300 for CO is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Basic test:

Test report: 936/21201601/B dated 10 July 2005
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: BAnz 29 October 2005, No. 206, p. 15700, chapter IV, No. 2.1
Announcement by UBA from 25 July 2005

Notification:

Publication: BAnz 20 April 2007, No. 75, p. 4139, chapter IV, notification 7
Announcement by UBA from 12 April 2007 *(name change)*

Publication: BAnz 26 January 2011, No. 14, p. 294, chapter IV, notification 23 and notification 24
Announcement by UBA from 10 January 2011 *(software change + design)*

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 5
Announcement by UBA from 12 February 2013 *(standard change)*

Initial certification according to EN 15267:

Certificate No. 0000038503: 22 March 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21207124/B1_DE dated 22 August 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21219874/C dated 31 October 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Statement of TÜV Rheinland Energie und Umwelt GmbH from 11 October 2012

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 5
Announcement by UBA from 12 February 2013

Supplementary testing according to EN 15267:

Certificate No. 0000038503_01: 20 August 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21207124/B1_DE of 22 August 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21219874/C of 31 October 2012 of TÜV Rheinland Energie und Umwelt GmbH
Addendum: 936/21221556/C of 16 March 2013 of TÜV Rheinland Energie und Umwelt GmbH

Publication: BAnz AT 23 July 2013 B4, chapter V, notification 17
Announcement by UBA from 08 July 2013

Calculation of overall uncertainty (device 1)

Measuring device:	Teledyne API M300E / T300				Serial number:	SN 370	
Measured component:	CO				8h-Limit value:	8.62	µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 µmol/mol	0.100	$u_{r,z}$	0.02	0.0006	
2	Repeatability standard deviation at 8h-limit value	≤ 3.0 µmol/mol	0.100	u_r	0.02	0.0006	
3	Lack of fit at 8h-limit value	≤ 4.0% of meas. value	0.300	u_l	0.01	0.0002	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.150	u_{cp}	0.16	0.0252	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.010	u_{ct}	0.02	0.0006	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.030	u_{et}	0.07	0.0056	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_v	0.00	0.0000	
8a	Interferent H_2O with 2 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.160	$u_{int,a}$	-0.11	0.0114	
		≤ 1.0 µmol/mol (Span)	-0.140				
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.030	$u_{int,b}$	0.07	0.0043	
		≤ 0.5 µmol/mol (Span)	0.100				
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.010	or			
		≤ 0.5 µmol/mol (Span)	0.020				
8d	Interferent N_2O with 50 nmol/mol	≤ 0.5 µmol/mol (Zero)	-0.030	$u_{int,d}$			
		≤ 0.5 µmol/mol (Span)	-0.026				
9	Averaging effect	≤ 7.0% of meas. value	0.600	u_{av}	0.04	0.0016	
18	Difference sample/calibration port	≤ 1%	-0.020	u_{dcp}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	2.000	u_{tg}	0.09	0.0074	

Combined standard uncertainty	u_c	0.2396	µmol/mol
Expanded uncertainty	U	0.4793	µmol/mol
Relative expanded uncertainty	W	5.56	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Measuring device:	Teledyne API M300E / T300				Serial number:	SN 370	
Measured component:	CO				8h-Limit value:	8.62	µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 µmol/mol	0.100	$u_{r,z}$	0.02	0.0006	
2	Repeatability standard deviation at 8h-limit value	≤ 3.0 µmol/mol	0.100	u_r	not considered, as $u_r = 0.02 < u_{r,z}$	-	
3	Lack of fit at 8h-limit value	≤ 4.0% of meas. value	0.300	u_l	0.01	0.0002	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.150	u_{cp}	0.16	0.0252	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.010	u_{ct}	0.02	0.0006	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.030	u_{et}	0.07	0.0056	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.000	u_v	0.00	0.0000	
8a	Interferent H_2O with 2 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.140	$u_{int,a}$	-0.11	0.0114	
		≤ 1.0 µmol/mol (Span)	-0.160				
8b	Interferent CO_2 with 500 µmol/mol	≤ 0.5 µmol/mol (Zero)	-0.030	$u_{int,b}$	0.07	0.0043	
		≤ 0.5 µmol/mol (Span)	0.100				
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.010	or			
		≤ 0.5 µmol/mol (Span)	0.020				
8d	Interferent N_2O with 50 nmol/mol	≤ 0.5 µmol/mol (Zero)	0.030	$u_{int,d}$			
		≤ 0.5 µmol/mol (Span)	-0.026				
9	Averaging effect	≤ 7.0% of meas. value	0.600	u_{av}	0.04	0.0016	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of 3 month average	3.470	$u_{r,f}$	0.20	0.0395	
11	Long term drift at zero level	≤ 0.5 µmol/mol	0.340	$u_{d,z}$	0.20	0.0395	
12	Long term drift at 8h-limit value	≤ 5.0% of max. of conf. range	-2.120	$u_{d,8h}$	-0.12	0.0133	
18	Difference sample/calibration port	≤ 1%	-0.020	u_{dcp}	0.00	0.0000	
21	Uncertainty of test gas	≤ 3%	2.000	u_{tg}	0.09	0.0074	

Combined standard uncertainty	u_c	0.4462	µmol/mol
Expanded uncertainty	U	0.8904	µmol/mol
Relative expanded uncertainty	W	10.33	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Calculation of overall uncertainty (device 2)

Measuring device: Teledyne API M300E / T300 — Serial number: SN 512 / 1385
Measured component: CO — 8h-Limit value: 8.62 µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 µmol/mol	0.100	$u_{c,z}$	0.02	0.0006	
2	Repeatability standard deviation at 8h-limit value	≤ 3.0 µmol/mol	0.000	u_r	0.00	0.0000	
3	Lack of fit at 8h-limit value	≤ 4.0% of meas. value	1.200	u_l	0.06	0.0036	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.180	u_{sp}	0.19	0.0362	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.010	u_{st}	0.02	0.0006	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.030	u_{at}	0.07	0.0056	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.010	u_V	0.03	0.0011	
8a	Interferent H_2O with 21 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.040	u_{H2O}	-0.07	0.0056	
		≤ 1.0 µmol/mol (Span)	-0.110				
8b	Interferent CO_2 with 400 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.010	$u_{int,pos}$	0.05	0.0020	
		≤ 0.5 µmol/mol (Span)	0.070				
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.030	or			
		≤ 0.5 µmol/mol (Span)	0.010				
8d	Interferent N_2O with 50 nmol/mol	≤ 0.5 µmol/mol (Zero)	0.020	$u_{int,neg}$			
		≤ 0.5 µmol/mol (Span)	-0.020				
9	Aftereffect	≤ 7.0% of meas. value	-0.700	u_{ae}	-0.03	0.0012	
10	Difference sample/calibration port	≤ 1%	-0.050	u_{cal}	0.00	0.0000	
11	Uncertainty of test gas	≤ 3%	2.000	u_{tg}	0.08	0.0074	
				Combined standard uncertainty	u_c	0.2529	µmol/mol
				Expanded uncertainty	U	0.5058	µmol/mol
				Relative expanded uncertainty	W	5.87	%
				Maximum allowed expanded uncertainty	W_{req}	15	%

Measuring device: Teledyne API M300E / T300 — Serial number: SN 512 / 1385
Measured component: CO — 8h-Limit value: 8.62 µmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤ 1.0 µmol/mol	0.100	$u_{c,z}$	0.02	0.0006	
2	Repeatability standard deviation at 8h-limit value	≤ 3.0 µmol/mol	0.005	u_r	not considered, as $u_r \leq u_{r,t}$		
3	Lack of fit at 8h-limit value	≤ 4.0% of meas. value	1.200	u_l	0.06	0.0036	
4	Sensitivity coefficient of sample gas pressure at 8h-limit value	≤ 0.7 µmol/mol/kPa	0.180	u_{sp}	0.19	0.0362	
5	Sensitivity coefficient of sample gas temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.010	u_{st}	0.02	0.0006	
6	Sensitivity coefficient of surrounding temperature at 8h-limit value	≤ 0.3 µmol/mol/K	0.030	u_{at}	0.07	0.0056	
7	Sensitivity coefficient of electrical voltage at 8h-limit value	≤ 0.3 µmol/mol/V	0.010	u_V	0.03	0.0011	
8a	Interferent H_2O with 21 mmol/mol	≤ 1.0 µmol/mol (Zero)	-0.110	u_{H2O}	-0.07	0.0056	
		≤ 1.0 µmol/mol (Span)	-0.040				
8b	Interferent CO_2 with 400 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.010	$u_{int,pos}$	0.05	0.0020	
		≤ 0.5 µmol/mol (Span)	0.070				
8c	Interferent NO with 1 µmol/mol	≤ 0.5 µmol/mol (Zero)	0.030	or			
		≤ 0.5 µmol/mol (Span)	0.010				
8d	Interferent N_2O with 50 nmol/mol	≤ 0.5 µmol/mol (Zero)	0.020	$u_{int,neg}$			
		≤ 0.5 µmol/mol (Span)	-0.020				
9	Aftereffect	≤ 7.0% of meas. value	-0.700	u_{ae}	-0.03	0.0012	
10	Reproducibility standard deviation unpaired readings	≤ 5.0% (3 month average)	5.470	u_{cm}	0.39	0.0895	
11	Long term drift at 8h-limit value	≤ 0.8 µmol/mol	0.710	u_{drift}	0.41	0.1680	
12	Long term drift at 8h-limit value	≤ 5.0% of max. of cert. range	4.960	u_{drift}	-0.29	0.0609	
13	Difference sample/calibration port	≤ 1%	-0.050	u_{cal}	0.00	0.0000	
14	Uncertainty of test gas	≤ 3%	2.000	u_{tg}	0.08	0.0074	
				Combined standard uncertainty	u_c	0.9184	µmol/mol
				Expanded uncertainty	U	1.2368	µmol/mol
				Relative expanded uncertainty	W	14.35	%
				Maximum allowed expanded uncertainty	W_{req}	15	%

Umwelt Bundes Amt
For our Environment

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CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000038504_01

Certified AMS: 400E / T400 for O_3

Manufacturer: Teledyne Advanced Pollution Instrumentation
9480 Carroll Park Drive
San Diego
CA 92121-5201
USA

Test Institute: TÜV Rheinland Energie und Umwelt GmbH

This is to certify that the AMS has been tested and found to comply with:

VDI 4202-1: 2002, VDI 4203-2: 2004, EN 14625: 2012, EN 15267-1: 2009, EN 15267-2: 2009

Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).

The present certificate replaces Certificate No. 0000038504 of 22 March 2013

TÜVRheinland® CERTIFIED
Suitability Tested
EN 15267
QAL1 Certified
Hanover
Surveillance
www.tuv.com
ID 0000038504

Publication in the German Federal Gazette (BAnz.) of 29 October 2005

This certificate will expire on:
04 March 2018

German Federal Environment Agency
Dessau, 20 August 2013

i. A. Dr. Marcel Langner

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 19 August 2013

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / www.eco-tuv.com
teu@umwelt-tuv.de
Tel. +49 221 806-5200

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Cologne

Umwelt Bundes Amt
for our Environment

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Certificate:
0000038504_01 / 20 August 2013

Test report: 936/21207124/A1_DE of 22 August 2007
Addendum 936/21219874/D of 11 October 2012
Addendum 936/21221556/D of 16 March 2013

Initial certification: 05 March 2013

Date of expiry: 04 March 2018

Publication: BAnz AT 23 July 2013 B4, chapter V, notification 18

Approved application
The certified AMS is suitable for continuous ambient air monitoring of O_3 (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a more than three-month field test.

The AMS is approved for the temperature range of +5 °C to +40 °C.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at which it will be installed.

Basis of the certification
This certification is based on:

- test report 936/21207124/A1_DE of 22 August 2007 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, addendum 936/21219874/D of 11 October 2012 of TÜV Rheinland Energie und Umwelt GmbH and addendum 936/21221556/D of 16 March 2013 of TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- the on-going surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz. 29 October 2005, p. 15700, chapter IV, No. 3.1)
- publication in the German Federal Gazette (BAnz. 20 April 2007, p. 4139, chapter IV, notification 7)
- publication in the German Federal Gazette (BAnz. 26 January 2011, p. 294, chapter IV, notification 25 and 26)
- publication in the German Federal Gazette (BAnz AT 05 March 2013 B10, chapter V, notification 6)
- publication in the German Federal Gazette (BAnz AT 23 July 2013 B4, chapter V, notification 18)

AMS designation:
Model 400E for O_3

Manufacturer:
Teledyne Advanced Pollution Instrumentation, San Diego, USA / EAS GmbH, Brunn, Austria

Field of application:
For continuous ambient air monitoring of ozone (stationary operation)

Measuring ranges during the performance test:
O_3: 0 - 360 µg/m³
0 - 500 µg/m³

Software:
Version C.3

Restrictions:
In case of SO_2 concentrations greater than 150 µg/m³, the requirements on the cross-sensitivity are not completely fulfilled anymore.

Test institute:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne
TÜV Rheinland Group, Cologne
Report No.: 936/21201601/A dated 10 July 2005

7 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700)

The measuring systems Modell 300E for CO and Modell 400E for ozone of the of the company Teledyne Instruments, San Diego, USA will not by distributed anymore in future – as mentioned in the publication - by the company MLU-Monitoring für Leben und Umwelt Ges.m.b.H. in A-2340 Mödling, Austria, but only by the company EAS Envimet Analytical Systems Ges.m.b.H., Brunn, Austria.

Opinion stated by TÜV Rheinland Immissionsschutz und Energiesysteme GmbH of 14 December 2006

25 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 3.1) and of 12 April 2007 (BAnz. p. 4139, chapter IV, notification 7)

The current software version of the ambient air measuring system Modell 400E (=M400E) for O_3 of the company Teledyne Advanced Pollution Instrumentation is:

E.3 with Library Version 6.3

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 29 September 2010

26 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 3.1) and of 12 April 2007 (BAnz. p. 4139, chapter IV, notification 7)

The measuring system Modell 400E for O_3 of the company Teledyne Advanced Pollution Instrumentation is manufactured in the old design Modell 400E as well as in the new design Model T400. The new design differs from the old design only by a new display, a new front plate and extended possibilities for communication.

The current name of the new design of the measuring system is:

Model T400

The current software version of the new design of the measuring system is:

1.0.0 bld 54 with Library Version 7.0.0 bld 57

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 29 September 2010

6 Notification as regards Federal Environmental Agency notices of 25 July 2005 (BAnz. p. 15700, chapter IV No. 3.1) and of 10 January 2011 (BAnz. p. 294, chapter IV, 25th and 26th notification)

The measuring system M400E respectively T400 for O_3 of the company Teledyne Advanced Pollution Instrumentation fulfills the requirements of EN 14625 (issue July 2005). Furthermore the manufacturing and the quality management of the measuring system M400E respectively T400 for O_3 fulfill the requirements of EN 15267.

The test report on the type approval with the report no. 936/21207124/A1_DE as well as an addendum to the test report with the report no. 936/21219874/D are available on available on the internet at www.qal1.de.

The current software version of the measuring system M400E is:

E.5 with Library Version 6.4

The current software version of the measuring system T400 is:

1.0.4 with Library Version 7.0.3

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 11 October 2012

18 Notification on announcements of the Federal Environmental Agency of 25 July 2005 (BAnz. p. 15700, chapter IV, no. 3.1) and of 12 February 2013 (BAnz. AT of 5 March 2013 B10, chapter V, 6th notification)

The M400E / T400 measuring system for O_3 manufactured by Teledyne Advanced Pollution Instrumentation fulfils the requirements of Standard EN 14625 (December 2012). An addendum as integral part of test report no. 936/21221556/D is available online at www.qal1.de.

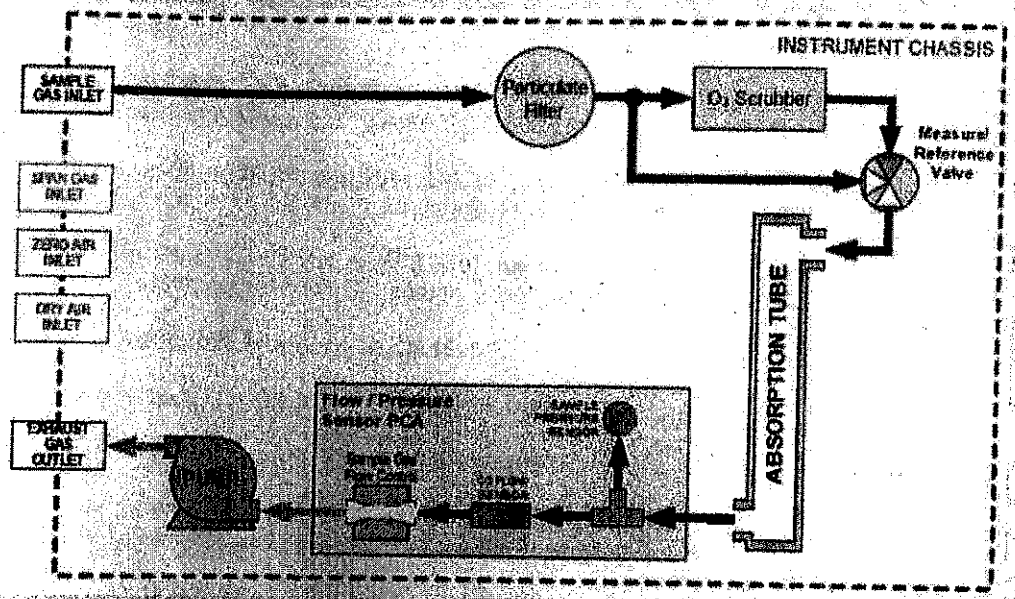
The new designation of the M400E measuring system for O_3 is 400E.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 16 March 2013

Certified product
This certificate applies to automated measurement systems conforming to the following description:

The measuring principle of the measuring system 400E respectively T400 is based on the determination of light absorption caused by the gas to be measured in the respective ranges of wave lengths characteristic for this gas, which is for ozone in the UV-range at a wave length of 253.7 nm and thus complies with the reference method described in the standard EN 14625.

The schematic set-up / flow diagram of the measuring system 400E respectively T400 (with optional zero- and span gas port) is as follows:



General notes
This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energie und Umwelt GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This can be applied to the product or used in publicity material for the certified product is presented on page 1 of this certificate.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energie und Umwelt GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and the validity is also accessible on the internet: **qal1.de**.

Certificate:
0000038504_01 / 20 August 2013

Certification of 400E / T400 for O_3 is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Basic test:

Test report: 936/21201601/A dated 10 July 2005
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: BAnz. 29 October 2005, No. 206, p. 15700, chapter IV, No. 3.1
Announcement by UBA from 25 July 2005

Notification:

Publication: BAnz. 20 April 2007, No. 75, p. 4139, chapter IV, notification 7
Announcement by UBA from 12 April 2007 *(name change)*

Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 25 and notification 26
Announcement by UBA from 10 January 2011 *(software change + design)*

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 6
Announcement by UBA from 12 February 2013 *(standard change)*

Initial certification according to EN 15267:

Certificate No. 0000038504: 22 March 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21207124/A1_DE dated 22 August 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21219874/D dated 11 October 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Statement of TÜV Rheinland Energie und Umwelt GmbH from 11 October 2012

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 6
Announcement by UBA from 12 February 2013

Supplementary testing according to EN 15267:

Certificate No. 0000038504_01: 20 August 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21207124/A1_DE of 22 August 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21219874/D of 11 October 2012 of TÜV Rheinland Energie und Umwelt GmbH
Addendum: 936/21221556/D of 16 March 2013 of TÜV Rheinland Energie und Umwelt GmbH

Publication: BAnz AT 23 July 2013 B4, chapter V, notification 18
Announcement by UBA from 03 July 2013

Calculation of overall uncertainty (device 1)

Measuring device:	Teledyne API M400E / T400					Serial number:	SN 309	
Measured component:	O3					1h-Alert threshold:	120	nmol/mol

No.	Performance characteristic	Performance criterion		Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.500	$u_{r,0}$	0.13	0.0166
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.100	$u_{r,h}$	0.26	0.0830
3	Lack of fit at 1h-limit value	≤	4.0% of meas. value	0.700	$u_{l,h}$	0.48	0.2352
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	2.0 nmol/mol/kPa	0.380	u_{sp}	1.12	1.2518
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.010	u_{sT}	0.11	0.0120
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.060	u_{sT1}	0.22	0.0479
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.020	u_{sV}	0.26	0.0652
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.800	u_{H2O}	-1.49	2.2271
		≤	10 nmol/mol (Span)	-2.000			
8b	Interferent Toluene with 0.5 µmol/mol	≤	5.0 nmol/mol (Zero)	0.400	$u_{tol,pos}$ or $u_{tol,neg}$	1.85	3.4133
		≤	5.0 nmol/mol (Span)	1.500			
8c	Interferent Xylene with 0.5 µmol/mol	≤	5.0 nmol/mol (Zero)	0.200			
		≤	5.0 nmol/mol (Span)	1.700			
9	Averaging effect	≤	7.0% of meas. value	2.600	u_{av}	1.80	3.2448
10	Difference sample/calibration port	≤	1%	0.000	u_{cal}	0.00	0.0000
11	Uncertainty of test gas	≤	3%	2.000	u_g	1.20	1.4400

Combined standard uncertainty	u_c	3.4695	nmol/mol
Expended uncertainty	U	6.9390	nmol/mol
Relative expanded uncertainty	W	5.78	%
Maximum allowed expanded uncertainty	W_{max}	15	%

Measuring device:	Teledyne API M400E / T400					Serial number:	SN 309	
Measured component:	O3					1h-Alert threshold:	120	nmol/mol

No.	Performance characteristic	Performance criterion		Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.500	$u_{r,0}$	0.13	0.0169
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.100	$u_{r,h}$	not considered, as $u_{r,h} = 0.26 < u_{l,f}$	-
3	Lack of fit at 1h-limit value	≤	4.0% of meas. value	0.700	$u_{l,h}$	0.48	0.2352
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	2.0 nmol/mol/kPa	0.380	u_{sp}	1.12	1.2518
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.010	u_{sT}	0.11	0.0120
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	1.0 nmol/mol/K	0.060	u_{sT1}	0.22	0.0479
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.020	u_{sV}	0.26	0.0652
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.800	u_{H2O}	-1.49	2.2271
		≤	10 nmol/mol (Span)	-2.000			
8b	Interferent Toluene with 0.5 µmol/mol	≤	5.0 nmol/mol (Zero)	0.400	$u_{tol,pos}$ or $u_{tol,neg}$	1.85	3.4133
		≤	5.0 nmol/mol (Span)	1.500			
8c	Interferent Xylene with 0.5 µmol/mol	≤	5.0 nmol/mol (Zero)	0.200			
		≤	5.0 nmol/mol (Span)	1.700			
9	Averaging effect	≤	7.0% of meas. value	2.600	u_{av}	1.80	3.2448
10	Reproducibility standard deviation under field conditions	≤	6.0% of 3 month average	2.690	u_r	3.23	10.4209
11	Long term drift at zero level	≤	5.0 nmol/mol	0.900	$u_{d,0}$	0.52	0.2700
12	Long term drift at 1h-limit value	≤	5.0% of max. of cert. range	3.700	$u_{d,h}$	2.56	6.5712
13	Difference sample/calibration port	≤	1%	0.000	u_{cal}	0.00	0.0000
14	Uncertainty of test gas	≤	3%	2.000	u_g	1.20	1.4400

Combined standard uncertainty	u_c	5.4051	nmol/mol
Expanded uncertainty	U	10.8103	nmol/mol
Relative expanded uncertainty	W	9.01	%
Maximum allowed expanded uncertainty	W_{max}	15	%

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Certificate:
0000038504_01 / 20 August 2013

Calculation of overall uncertainty (device 2)

Measuring device: Teledyne API M400E / T400 — Serial number: SN 308

Measured component: O3 — 1h-Alert threshold: 120 nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.700	$u_{r,z}$	0.19	0.0354
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1.100	$u_{r,h}$	0.30	0.0910
3	Lack of fit* at 1h-limit value	≤ 4.0% of meas. value	0.100	$u_{l,f}$	0.07	0.0048
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.160	u_{gp}	0.44	0.1951
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.030	u_{gt}	0.33	0.1077
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.040	u_{at}	0.15	0.0213
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	u_{av}	0.26	0.0652
8a	Interferent H_2O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.900	u_{H2O}	-1.34	1.8040
		≤ 10 nmol/mol (Span)	-1.800			
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.100	$u_{tol,pos}$ or $u_{tol,neg}$	1.21	1.4700
		≤ 5.0 nmol/mol (Span)	1.200			
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.300			
		≤ 5.0 nmol/mol (Span)	0.900			
9	Averaging effect	≤ 7.0% of meas. value	3.500	u_{av}	2.42	5.8800
10	Difference sample/calibration port	≤ 1%	0.000	u_{Dsc}	0.00	0.0000
21	Uncertainty of test gas	≤ 3%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	3.3336	nmol/mol
Expanded uncertainty	U	6.6676	nmol/mol
Relative expanded uncertainty	W	5.56	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Measuring device: Teledyne API M400E / T400 — Serial number: SN 308

Measured component: O3 — 1h-Alert threshold: 120 nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.700	$u_{r,z}$	0.19	0.0354
2	Repeatability standard deviation at 1h-limit value	≤ 3.0 nmol/mol	1.100	$u_{r,h}$	not considered, as $u_{r,h} = 0.3 < u_{r,f}$	*
3	Lack of fit* at 1h-limit value	≤ 4.0% of meas. value	0.100	$u_{l,f}$	0.07	0.0048
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤ 2.0 nmol/mol/kPa	0.160	u_{gp}	0.44	0.1951
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.030	u_{gt}	0.33	0.1077
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤ 1.0 nmol/mol/K	0.040	u_{at}	0.15	0.0213
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤ 0.30 nmol/mol/V	0.020	u_{av}	0.26	0.0652
8a	Interferent H_2O with 21 mmol/mol	≤ 10 nmol/mol (Zero)	-0.900	u_{H2O}	-1.34	1.8040
		≤ 10 nmol/mol (Span)	-1.800			
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.100	$u_{tol,pos}$ or $u_{tol,neg}$	1.21	1.4700
		≤ 5.0 nmol/mol (Span)	1.200			
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.300			
		≤ 5.0 nmol/mol (Span)	0.900			
9	Averaging effect	≤ 7.0% of meas. value	3.500	u_{av}	2.42	5.8800
10	Reproducibility standard deviation under field conditions	≤ 5.0% of 3 month average	2.880	$u_{r,f}$	3.23	10.4200
11	Long term drift at zero level	≤ 5.0 nmol/mol	0.500	$u_{d,z}$	-0.29	0.0833
12	Long term drift at 1h-limit value	≤ 5.0% of max. of conf. range	-3.700	$u_{d,h}$	-2.66	6.57.12
16	Difference sample/calibration port	≤ 1%	0.000	u_{Dsc}	0.00	0.0000
21	Uncertainty of test gas	≤ 3%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	5.3007	nmol/mol
Expanded uncertainty	U	10.6015	nmol/mol
Relative expanded uncertainty	W	8.83	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Wakendorf II, 07. November 2014

Manufacturer's Declaration

We, **Lumex-Marketing LLC** with our offices at 70, bld.2, Obukhovskoy Oborony pr., St.Petersburg, Russia, 192029
and
Lumex Analytics GmbH with our office at Naher Str. 8, 24558 Wakendorf II, Germany
hereby jointly declare:

the

LUMEX Ambient Air Mercury Monitor RA 915AM

is in agreement with the requirements of the European directive 2004/107/EC related to mercury measurement in the ambient air. The operation principle of RA-915AM is based on Atomic Absorption spectrometry.

Nikolay Ivanov

Lumex Analytics GmbH
Managing Director

LUMEX Analytics GmbH
Naher Straße 8
D-24558 Wakendorf II
Tel.: +49 -4535 - 297756
e-mail: info@lumexanalytics.de

Wakendorf II, 03. March 2014

Manufacturer's Declaration

We, **Lumex-Marketing LLC** with our offices at 70, bld.2, Obukhovskoy Oborony pr., St.Petersburg, Russia, 192029
and
Lumex Analytics GmbH with our office at Naher Str. 8, 24558 Wakendorf II, Germany
hereby jointly declare:

the

LUMEX Ambient Air Mercury Monitor RA 915AM

meets all the requirements of the European Norm EN15852:2010 "Ambient air quality- Standard method for the determination of total gaseous mercury."
This was verified by an extensive field trial, which provided the basis for the establishment of the norm. The results of the field trial are quoted in Annex C of the norm.

Nikolay Ivanov

Lumex Analytics GmbH
Managing Director

LUMEX Analytics GmbH
Naher Straße 8
D-24558 Wakendorf II
Tel.: +49 -4535 - 297756
e-mail: info@lumexanalytics.de

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CONFIRMATION

about Product Conformity (QAL1)

Approved AMS: BAM-1020 with $PM_{2.5}$ pre-separator for suspended particulate matter $PM_{2.5}$

Manufacturer: Met One Instruments, Inc.
1600 Washington Blvd
Grants Pass, Oregon 97526,
USA

Test Institute: TÜV Rheinland Immissionsschutz und Energiesysteme GmbH

We confirm that the AMS has been tested and found to comply with:

VDI 4202-1: 2002, VDI 4203-3: 2004, EN 14907: 2005, Guide to Demonstration of Equivalence of Ambient Air Monitoring Methods: 2009, EN 15267-1: 2009, EN 15267-2: 2009

The approval of the measuring equipment under the above mentioned conditions was authorized from the relevant body (LAI).

This confirmation is valid up to the official announcement in the federal gazette, but not more than 6 months from issuing.
(see also the following pages).

www.tuv.com
TÜVRheinland
ID 0000026912

- Certified equivalent EN method
- Complying with 2008/50/EC
- TÜV approved
- Annual Inspection

The confirmation is valid until: 2010-10-31

TÜV Rheinland Immissionsschutz
und Energiesysteme GmbH

Köln, 2010-05-28

i. A. Dipl.-Ing. K. Pletscher

i. A. Dipl.-Chem. M. Kenpa

www.umwelt-tuv.de / www.eco-tuv.com
e@umwelt-tuv.de
el. +49 - 221 - 806 - 2275

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
Am Grauen Stein
51105 Köln

Confirmation:
0000026912 / 2010-05-28

TÜVRheinland®
Precisely Right.

Test report: 936/21209919/A of 2010-03-26
First certification: After publication in the German Federal Gazet
Run of validity until: 2010-10-31

Approved application:
The AMS is approved for permanent monitoring of suspended particulate matter $PM_{2.5}$ in ambient air(stationary operation). The suitability of the product for this application was assessed on the basis of a laboratory test and a field test at four different test sites respectively time periods. The AMS is approved for the temperature range from +5°C to +40°C.

Any potential user should ensure, in consultation with the manufacturer that this AMS is suitable for the ambient air application on which it will be installed.

Basis of the confirmation:
This confirmation is based on the test report 936/21209919/A of 2010-03-26 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH and on the decision of approval by the relevant body (German Umweltbundesamt):

AMS name:
BAM-1020 with $PM_{2.5}$ pre-separator for suspended particulate matter $PM_{2.5}$

Manufacturer:
Met One Instruments, Inc., Grants Pass, USA

Approval:
For permanent monitoring of suspended particulate matter $PM_{2.5}$ in ambient air(stationary operation).

Measuring ranges during the suitability test:

Component	Certification range	Supplementary range	Unit
$PM_{2.5}$	0 – 1,000	-	µg/m³

Software version:
Version 3236-07 5.0.10

Restrictions:
During the check of the tightness of the sampling system within the scope of the suitability test, values of 1,8 % and 2,4 % have been determined. According to the minimum requirement, the leak rate shall not be greater than 1 % of the sample flow rate.

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Remarks:

1. The requirements according to guide "Demonstration of Equivalence of Ambient Air Monitoring Methods" are fulfilled for the measured component $PM_{2.5}$.
2. For the recordation of $PM_{2.5}$, the system has to be equipped with the following options: Sample heater (BX-830), PM_{10}-sampling inlet (BX-802), $PM_{2.5}$ Sharp Cut Cyclone SCC (BX-807), combined pressure and temperature sensor (BX-596) respectively as an alternative ambient temperature sensor (BX-592).
3. The cycle time duringthe suitability test was 1 h, i.e. an automatic filter change has been performed every hour. Each filter spot has been used one time.
4. The sampling time within the cycle time is 42 min.
5. The measuring system has to be operated in a lockable measuring cabinet.
6. The measuring system is to be calibrated on site in regular intervals by application of the gravimetric $PM_{2.5}$ reference method according to EN 14907.
7. The identical measuring system is also distributed by the company Horiba Europe GmbH, 61440 Oberursel, Germany under the name APDA-371 with $PM_{2.5}$ pre-separator.

Test report:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne
Report-No.: 936/21209919/A of 2010-03-26

Approved product
This confirmation applies to automated measurement systems confirming to the following description:

The ambient air measuring system BAM-1020 is based on the measuring principle of beta-attenuation.

The principle of the radiometric determination of mass is based on the physical law of attenuation of beta-rays when passing a thin layer of material. There is the following relationship:

$$c\left(\frac{\mu g}{m^3}\right) = \frac{10^6 \, A(cm^2)}{Q\left(\frac{l}{min}\right) \Delta t(min) \mu\left(\frac{cm^2}{g}\right)} \ln\left(\frac{I_0}{I}\right)$$

with:

c	particle-mass concentration	A	sampling area for particles (filter spot)
Q	sampling flow rate	Δt	sampling time
μ	mass absorption coefficient	I_0	beta count rate at the beginning (clean)
I	beta count at the end (collect)		

The radiometric determination of mass is calibrated in the factory and is checked within the scope of internal quality assurance hourly at the zero point (clean filter spot) and at the reference point (built-in reference foil) during operation. With the help of the generated data, measured values at zero and reference point can be easily affiliated. They can be compared with any stability requirements (drift effects) respectively with the nominal value for the reference foil (factory setting).

One measurement cycle (incl. automatic check of the radiometric measurement) consists of the following steps (setting: measuring time for radiometry 8 min):

1. The initial count of the clean filter tape I_0 is performed at the beginning of the cycle for a period of eight minutes,
2. The filter tape is advanced four windows and the sampling (vacuum pumping) begins on the spot in which I_0 was just measured. Air is drawn through this spot on the filter tape for approximately 42 minutes.
3. At the same time the second count I_1 occurs (at a point on the tape 4 windows back) for a period of eight minutes. The purpose of the measurement is to perform the verification for instrument drift caused by varying external parameters such as temperature and relative humidity. A third count I_2 occurs with the reference membrane extended over the same place on the tape. Eight minutes before the end of sampling time, another count I_{1x} occurs on the same point of the tape. With the help of I_1 and I_{1x}, the stability at the zero point can be monitored.
4. After sampling, the filter tape is moved back four windows to measure the beta ray absorption through the section that has collected dust (I_s). Finally the concentration calculation is performed to complete the cycle.
5. The next cycle begins with step 1

The measuring system BAM-1020 with PM_{10} pre-separator is already suitability-tested and published. The measuring system, which is approved with this confirmation is equipped with a $PM_{2.5}$ pre-separator.

PERRY JOHNSON REGISTRARS, INC.

Certificate of Registration

Perry Johnson Registrars, Inc. has assessed the Quality Management System of:

Met One Instruments, Inc.

Headquarters: 200 NE Greenfield, Grants Pass, OR 97526 United States
1600 Washington Boulevard, Grants Pass, OR 97526 United States

Hereinafter called the Organization, and has declared that
the Organization is in conformance with:

ISO 9001:2000

This certification is applicable to the following scope of supply:

**Design, Manufacture, Sale and Service of
Environmental Monitoring Instruments and Systems**

If this scope shall be maintained by the Organization, surveillance reviews shall be performed at the
[illegible] address(es) listed above. This Registration is subject to the system rules governing the
maintenance of registration, and the Organization hereby agrees to comply with the requirements duly and
properly with the said rules.

RR

Nancy Colasuonno
Vice President, Operations
Perry Johnson Registrars, Inc. (PJR)
755 Ethergreen, Suite 1500
Plymouth, Michigan 48170
(734) 559-4888

UKAS QUALITY MANAGEMENT 0054

PERRY JOHNSON REGISTRARS, INC.

The validity of this certificate is dependent upon surveillance audits.

Issue Date: November 14, 2006

Expiration Date: November 13, 2009

Certificate No: C2006-03060

MET-ONE INSTRUMENTS, INC.

REPROCESSING THE UK EQUIVALENCE TRIALS PM_{10} UNHEATED MET-ONE

RAM DATA AS PER THE JANUARY 2010 VERSION OF THE GDE

SG01352617/BVAQ/DH/2652

AUGUST 2010

BUREAU VERITAS

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DOCUMENT CONTROL SHEET

Issue/Revision	Issue 1			
Remarks	Draft for Comment			
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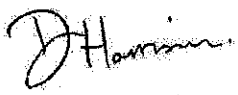
Signature				
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Signature				
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Bureau Veritas UK Limited
Great Guildford House
30 Great Guildford Street
London SE1 0ES

Telephone: +44 (0) 207 902 6100
Fax:: +44 (0) 027 902 6149
Registered in England 1758622
www.bureauveritas.co.uk

Registered Office
Great Guildford House
30 Great Guildford Street
London SE1 0ES

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Executive Summary

The UK equivalence trials data have been reprocessed as per the January 2010 version of The Guide for Demonstration of Equivalence (GDE). This report is intended to used as an addendum to the previously published "UK Equivalence Programme for Monitoring of Particulate Matter, Bureau Veritas report number: BV/AQ/AD202209/DH/2396.

The recommendations of the previous analysis were tested and proven to still be valid.

Candidate Instrument	PM Size Fraction	Manufacturer	Equivalence Criteria Met?	Correction Required
BAM	PM_{10}	Met-One	Meets equivalence criteria after application of a slope correction factor.	If flow reported at standard conditions: $BAM_{Corrected} = \frac{BAM}{1.211}$ If flow corrected to ambient conditions: $BAM_{Ambient\ Corrected} = \frac{BAM_{Ambient}}{1.273}$

It is policy within the UK that when using a PM_{10} Met-One BAM at ambient conditions, that the concentrations are divided by 1.2 rather than 1.211. This approach was also proven to be valid.

1 Introduction

Between 2004 and 2006 a comprehensive series of tests were undertaken on behalf of Defra. The PM_{10} Partisol 2025, TEOM, FDMS B, Opsis SM200 and Met-One BAM, along with the $PM_{2.5}$ FDMS were all tested at the following locations against the PM_{10} KFG and $PM_{2.5}$ Leckel reference methods operating with Emfab filters:

Site Name	Location	Site Classification	Local Site Operator	Winter Dates	Summer Dates
Teddington	52°25' 28.32" N 0°20' 43.66" W 13 m ASL	Suburban	NPL	14th November 2004 to 21st March 2005	22nd March 2005 to 25th July 2005
Birmingham	52°27' 19.60" N 1°55' 44.07" W 144 m ASL	Urban Background	University of Birmingham	28th November 2004 to 22nd March 2005	23rd March 2005 to 22nd July 2005
East Kilbride	55°45' 19.50" N 4°10' 08.50" W 180 m ASL	Suburban	netcen	13th October 2005 to 12th January 2006	1st August 2005 to 12th October 2005
Bristol	51°26' 57.63" N 2°35' 04.66" W 10 m ASL	Roadside	Bristol City Council	13th October 2005 to 19th January 2006	10th August 2005 to 12th October 2005

The results were processed as per the then most up to date version of the The Guide for Demonstration of Equivalence (GDE) from November 2005, and after publication, the use of these instruments within the UK was approved by the European Commission.

The Leckel and KFG listed above are the reference instruments. The candidate instruments listed above have previously been compared to the reference methods based on the November 2005 version of The GDE, and have been reported to Defra but not published or approved by the Commission.

Herein the results from all of these studies are reassessed using the January 2010 version of the GDE. This is heavily revised relative to the November 2005 version, but essentially identical to a version published in July 2009.

2 Methodology

The January 2010 version of the GDE requires that only 2.5 % of datapairs may be identified as outliers and removed from the reference method in order to account for errors due to weighing filters. None may be removed from the candidate. The following criteria must then be met:

1. Of the full dataset at least 20% of the results obtained using the standard method shall be greater than 70% of the current annual limit value, *i.e.*: 28 µg m^{-3} for PM_{10} and currently 17.5 µg m^{-3} for $PM_{2.5}$.
2. The intra instrument uncertainty of the candidate must be less than 2.5 µg m^{-3} for all data and for two sub datasets corresponding to all the data split greater than or equal to and lower than 30 µg m^{-3} or 18 µg m^{-3} for PM_{10} and $PM_{2.5}$ respectively.
3. The intra instrument uncertainty of the reference method must be less than 2.0 µg m^{-3}.
4. The expanded uncertainty (W_{CM}) is calculated at 50 µg m^{-3} for PM_{10} and 30 µg m^{-3} for $PM_{2.5}$ for each individual candidate instrument against the average results of the reference method. For each of the following permutations, the expanded uncertainty must be less than 25 %:
   - Full dataset;
   - Datasets representing PM concentrations greater than or equal to 30 µg m^{-3} for PM_{10}, or concentrations greater than or equal to 18 µg m^{-3} for $PM_{2.5}$, provided that the subset contains 40 or more valid data pairs;
   - Datasets for each individual site.
5. Preconditions for acceptance of the full dataset are that: the slope b is insignificantly different from 1: $|b-1| \leq 2.u(b)$, and the intercept a is insignificantly different from 0: $|a| \leq 2.u(a)$. If these preconditions are not met, the candidate method may be calibrated using the values obtained for slope and/or intercept of al paired instruments together.

While the mathematics required to calculate the orthogonal regression and expanded uncertainties are unchanged since November 2005, the rules of application are different. Most notably:

- Previously the number of data-pair outliers to be removed from the reference method was not specified. We had taken the decision to remove up to 3 data-pairs from each field study out of the typically 50 to 70 that were collected. In line with the new Guidance, up to 1 data-pair was removed if there were fewer than 60 available, and up to 2 were removed if more than 60 were available. As with the original UK Equivalence Report, only paired reference method data were used in the orthogonal regression and expanded uncertainty calculations.
- Previously we had removed data-pairs from candidate instruments that required the manual handling of filters.
- Previously, the expanded uncertainty of the candidate method was required to be less than 2.5 µg m^{-3} rather than 2.0 µg m^{-3}.
- Previously the limit values at which the expanded uncertainties were to be calculated were not specified. We had previously calculated PM_{10} at 18, 40 and 50 µg m^{-3}; and $PM_{2.5}$ at 12, 20, 25 and 35 µg m^{-3}. Particularly at the low Scottish limits, most instruments failed, and the specification of 50 µg m^{-3} for PM_{10} and 30 µg m^{-3} for $PM_{2.5}$ serve to greatly clarify the situation.
- Previously the average of the paired candidate data were used in the orthogonal regression and expanded uncertainty calculations, whereas these are calculated for individual candidate instruments in the January 2010 version of the GDE. It is therefore expected that at the expanded uncertainty will be higher for at least one of the 2 candidate instruments than it was for the average.
- Previously, the acceptance for the full dataset was set that 20 % of the data must be greater than half the limit value, though as the limit value was not specified this led to a lot of permutations, namely: PM_{10} at 9, 20 and 25 µg m^{-3}; and $PM_{2.5}$ at 6, 10, 12.5 and 17.5 µg m^{-3}. By setting the concentration at which 20 % of the data should be greater than as 28 µg/m^3 for PM_{10} and 17 µg/m^3 for $PM_{2.5}$., the situation is greatly simplified, however, as concentrations

have typically been low in the UK over recent years, it makes it more likely that these criteria will not be met.

Below is an example of the results obtained for the reanalysis, namely of the $PM_{2.5}$ Smart Heated Met-One BAM from the subsequent MCERTS/TÜV equivalence project. The text within the cells is shaded green or red if it passes or fails key criteria. In this example, cells are also shaded corresponding to which of the 6 criteria they relate to in the above list of the requirements of the January 2010 version of the GDE.

$PM_{2.5}$ Smart Heated BAM	33.1% > 17 µg m^{-3}	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	$n_{C\&S}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Data	[illegible]	248	0.967	[illegible]	[illegible]	0.33	[illegible]
< 18 µg m-3	[illegible]	174	0.889	0.971 +/- 0.025	1.066 +/- 0.267	0.34	[illegible]
> 18 µg m-3	[illegible]	74	0.926	1.031 +/- 0.033	-0.066 +/- 0.919	0.30	[illegible]

KEY
- Criterion 1
- Criterion 2
- Criterion 3
- Criterion 4
- Criterion 5
- Other

SN 17010	Dataset	Orthogonal Regression				Limit Value of 30 µg m^{-3}	
		$n_{C\&S}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 17 µg m^{-3}
Individual Datasets	Teddington Summer	78	0.931	0.994 +/- 0.030	1.622 +/- 0.372	17.11	19.2
	Cologne Winter	75	0.957	0.980 +/- 0.024	0.960 +/- 0.512	12.79	56.0
	Bornheim Summer	53	0.941	1.052 +/- 0.036	-0.962 +/- 0.527	11.61	20.8
	Teddington Winter	45	0.991	0.970 +/- 0.014	-0.182 +/- 0.300	10.28	35.6
Combined Datasets	< 18 µg m^{-3}	175	0.649	0.955 +/- 0.028	1.137 +/- 0.306	11.46	4.6
	> 18 µg m^{-3}	76	0.907	0.984 +/- 0.035	0.584 +/- 0.975	16.02	100.0
	All Data	251	0.957	0.969 +/- [illegible]	0.989 +/- [illegible]	12.90	33.5

SN 17011	Dataset	Orthogonal Regression				Limit Value of 30 µg m^{-3}	
		$n_{C\&S}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 17 µg m^{-3}
Individual Datasets	Teddington Summer	78	0.955	1.016 +/- 0.025	1.018 +/- 0.308	14.56	19.2
	Cologne Winter	75	0.977	1.061 +/- 0.019	0.430 +/- 0.405	17.91	56.0
	Bornheim Summer	57	0.901	1.134 +/- 0.048	-1.498 +/- 0.727	23.91	21.1
	Teddington Winter	43	0.992	0.991 +/- 0.014	0.630 +/- 0.293	7.41	32.6
Combined Datasets	< 18 µg m^{-3}	178	0.881	1.021 +/- 0.026	0.634 +/- 0.286	13.44	4.5
	> 18 µg m^{-3}	75	0.929	1.092 +/- 0.034	-1.108 +/- 0.952	19.03	100.0
	All Data	253	0.986	1.041 +/- [illegible]	0.377 +/- [illegible]	16.26	32.8

While there is no specific requirement for any of the individual datasets to have greater than 40 datapoints (other than those greater than 30 µg m^{-3} or 18 µg m^{-3} for PM_{10} and $PM_{2.5}$ respectively), it is implied in the text of the GDE, and so these cells are shaded yellow as part of criterion 5. In line with the original UK Equivalence Report, the text within the cells is shaded orange if there are between 30 and 40 datapoints, as an 'n' of 30 is normally considered sufficient for statistical analysis.

The January 2010 version of the GDE is ambiguous with respect to which slope and intercept should be used to correct a candidate should it fail the test for equivalence. After communication with Theo Hafkenscheid, it was decided that the requirement of the November 2005 version of the GDE are still valid, and that the slope and intercept from the orthogonal regression of all the paired data should be used. These are shaded gold and marked 'other' in the key on the above diagram.

There is also no longer a requirement that the paired candidate data be tested for equivalence. However, the results from this analysis are included in the tables and are also shaded gold and marked 'other' in the key on the above diagram. These expanded uncertainties most closely represent what those found using the November 2005 version of the GDE, yet differ in that only up to 2.5 % of outliers were removed, and the calculations were performed at limit values of 50 µg m^{-3} or 30 µg m^{-3} for PM_{10} and $PM_{2.5}$ respectively.

Very slightly different expanded uncertainties can be calculated based upon whether the expanded uncertainty of the reference method data includes those days when the candidate been assessed was not running. These days were included in the original UK Equivalence Report and are also included in the results presented herein.

3 Reanalysis of Results

The PM_{10} unheated Met-One BAM was included in the original equivalence trials, and no further comparison data have been collected since. The standard UK configuration of the instrument dose not measure ambient temperature and pressure and therefore does not correct the data to ambient conditions. A version that does correct to ambient conditions is available, and to simulate this, the data were subsequently corrected to ambient based on temperature and pressure measured by other collocated instruments. The BAM was compared to the reference method both with and without correction to ambient conditions.

Figure 6 in the Appendix shows the comparison of the unheated BAM without correction to ambient conditions. As with the previous analysis in the original equivalence report, all datasets significantly overestimate the reference method. The previous report recommended the data be divided by 1.211. The slope of all the paired data in the current study is actually 1.210, and is slightly different as fewer outliers were PM_{10} deleted from the reference method in line with the July 2009 version of the GDE. It is policy within the UK to divide the unheated PM_{10} BAM by 1.2, and this comparison is shown in Figure 1. When following the 5 criteria in turn:

1. Fewer than 20 % of the data are greater than 28 µg m^{-3}; however, greater than 20 5 of the miimum number of datapoints were greater than 28 µg m^{-3}.
2. The intra instrument uncertainty of the candidate is less than 2.5 µg m^{-3}.
3. The intra instrument uncertainty of the candidate is less than 2.0 µg m^{-3}.
4. The majority of the expanded uncertainties are below 25 %. However, some of the East Kilbride Winter datasets are greater than 25 %.

In accordance with the original Equivalence Report, as the concentrations in East Kilbride were very low, a high expanded uncertainty at this site was not considered sufficient evidence for a candidate instrument to be excluded. Rather, it reflects the problems associated with regression calculations where there is significant scatter on data that are restricted to within a narrow range.

5. Some of the intercepts and slopes of the 'All Data' comparisons of the individual instruments are significant.

As the data have already been corrected, it is not possible to correct the data further, and the PM_{10} unheated BAM should continue to be corrected by dividing by 1.2.

The ambient corrected BAM data also significantly overestimate the reference method. In the original Equivalence Report, these data were corrected by dividing by 1.273, and the results of this comparison are shown in Figure 2. Considering the 5 criteria, the results are exactly as for the non ambient corrected BAM after dividing by 1.2. As such, it is recommended that the ambient corrected BAM data are still divided by 1.273.

Appendix of Graphs and Tables of comparisons against the reference method.

Figure 1. Analysis of the PM_{10} BAM.

PM_{10} BAM 1020	16.3% > 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Data	45.3	405	0.942	1.210 +/- 0.014	0.414 +/- 0.313	1.11	2.06
< 30 µg m-3	71.7	344	0.843	1.396 +/- 0.029	-2.132 +/- 0.465	1.10	1.69
> 30 µg m-3	40.1	61	0.855	1.194 +/- 0.058	-0.255 +/- 2.413	1.12	2.67

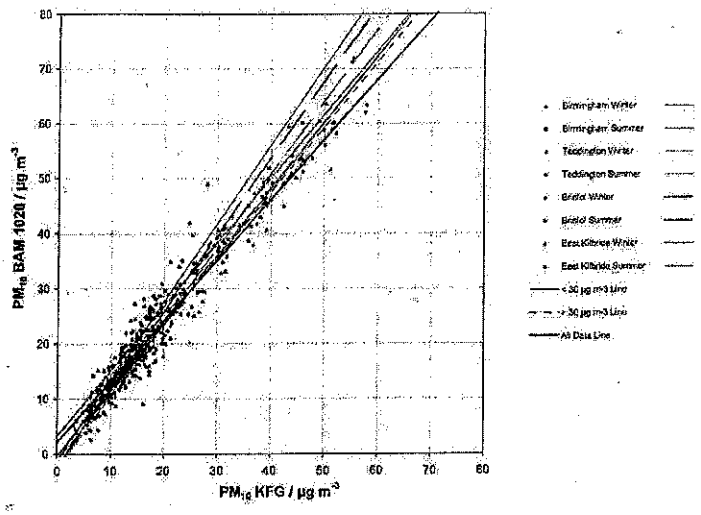
SND1428	Dataset	Orthogonal Regression				Limit Value of 50 µg m^3	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^3
Individual Datasets	Teddington Winter	49	0.941	1.153 +/- 0.041	1.267 +/- 1.100	37.66	34.7
	Teddington Summer	58	0.951	1.155 +/- 0.034	2.963 +/- 0.761	44.11	15.5
	Bristol Summer	53	0.966	1.373 +/- 0.035	-3.001 +/- 0.887	63.35	22.6
	Bristol Winter	51	0.935	1.199 +/- 0.043	3.833 +/- 1.082	56.73	23.5
Combined Datasets	> 30 µg m^3	47	0.857	1.257 +/- 0.070	-1.306 +/- 2.854	48.41	100.0
	All Data	211	0.935	1.218 +/- 0.021	1.338 +/- 0.530	50.91	23.7

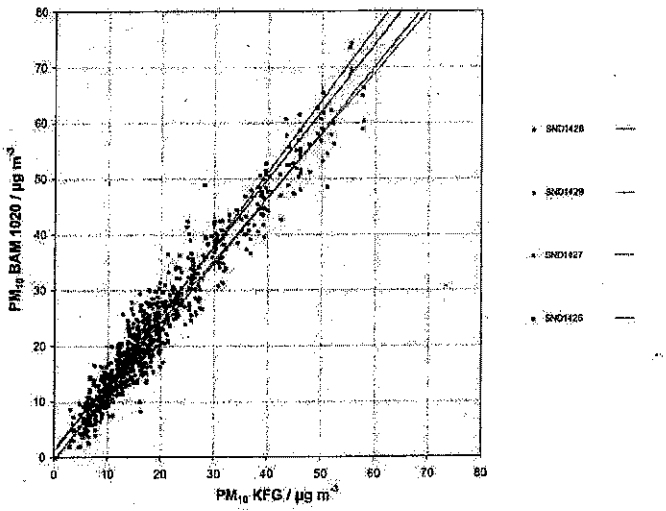
SND1429	Dataset	Orthogonal Regression				Limit Value of 50 µg m^3	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^3
Individual Datasets	Teddington Winter	49	0.930	1.045 +/- 0.040	3.166 +/- 1.089	24.84	34.7
	Teddington Summer	56	0.945	1.014 +/- 0.032	4.236 +/- 0.729	21.89	16.1
	Bristol Summer	51	0.967	1.294 +/- 0.033	-2.312 +/- 0.837	50.52	21.6
	Bristol Winter	51	0.898	1.135 +/- 0.052	3.062 +/- 1.290	42.54	23.5
Combined Datasets	> 30 µg m^3	46	0.801	1.125 +/- 0.075	0.938 +/- 3.075	32.71	100.0
	All Data	207	0.925	1.123 +/- 0.021	2.068 +/- 0.533	35.46	23.7

SND1427	Dataset	Orthogonal Regression				Limit Value of 50 µg m^3	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^3
Individual Datasets	Birmingham Winter	59	0.932	1.262 +/- 0.043	-0.011 +/- 1.000	53.90	18.6
	Birmingham Summer	56	0.967	1.239 +/- 0.031	0.467 +/- 0.596	50.19	8.9
	East Kilbride Summer	46	0.888	1.464 +/- 0.072	-2.379 +/- 0.808	83.73	0.0
	East Kilbride Winter	45	0.839	1.505 +/- 0.089	-2.890 +/- 1.041	90.41	2.2
Combined Datasets	> 30 µg m^3	15	0.927	1.252 +/- 0.093	-0.553 +/- 3.889	48.98	100.0
	All Data	206	0.943	1.297 +/- 0.021	-0.668 +/- 0.380	57.71	8.3

SND1426	Dataset	Orthogonal Regression				Limit Value of 50 µg m^3	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^3
Individual Datasets	Birmingham Winter	59	0.945	1.195 +/- 0.037	-2.114 +/- 0.850	32.15	18.6
	Birmingham Summer	54	0.953	1.192 +/- 0.036	-0.781 +/- 0.707	36.47	9.3
	East Kilbride Summer	46	0.924	1.395 +/- 0.057	-2.860 +/- 0.640	67.89	0.0
	East Kilbride Winter	39	0.766	1.393 +/- 0.106	0.152 +/- 1.256	80.71	2.6
Combined Datasets	> 30 µg m^3	15	0.906	1.246 +/- 0.105	-4.523 +/- 4.383	32.84	100.0
	All Data	198	0.922	1.177 +/- 0.023	-0.340 +/- 0.417	35.91	8.6

Figure 1 Continued. Analysis of the PM_{10} BAM.





Met-One
Reprocessing the UK Equivalence Trials PM_{10} Unheated
Met-One BAM Data as per the January 2010 version of the GDE

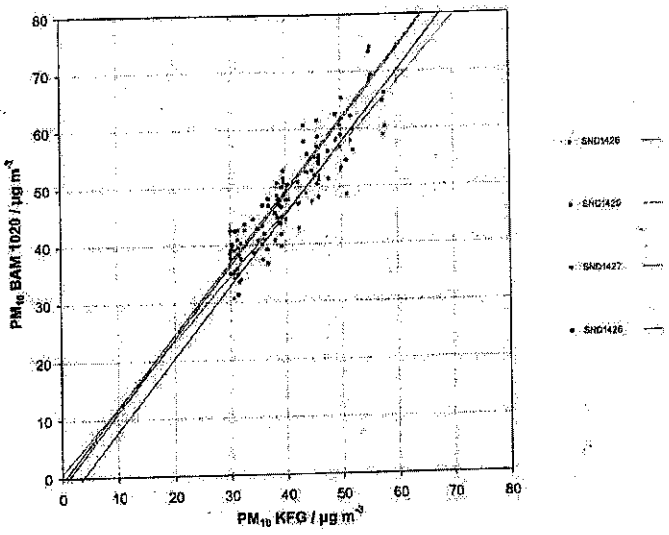


Figure 2. Analysis of the PM_{10} BAM after dividing by 1.2.

PM_{10} BAM 1020 corrected by dividing by 1.2	16.3% > 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Data	10.4	405	0.942	1.003 +/- 0.012	0.447 +/- 0.261	1.11	1.71
< 30 µg m-3	25.2	344	0.843	1.146 +/- 0.024	-1.513 +/- 0.387	1.10	1.41
> 30 µg m-3	11.5	61	0.855	0.980 +/- 0.049	0.379 +/- 2.011	1.12	2.22

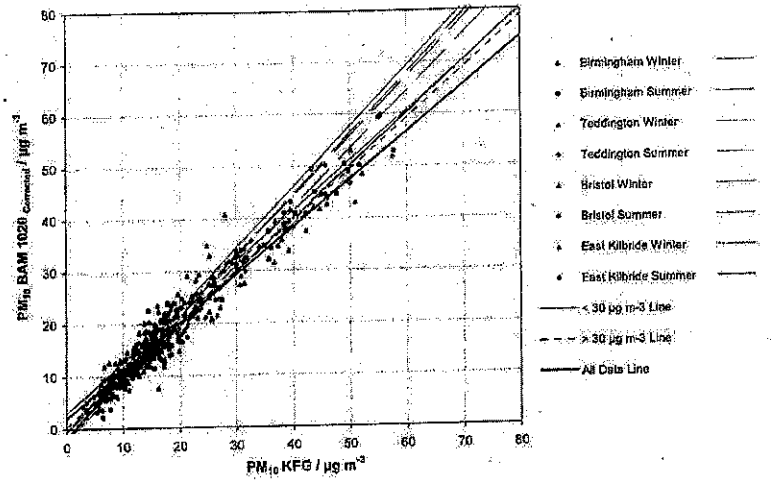
SND1428	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Teddington Winter	49	0.941	0.955 +/- 0.034	1.188 +/- 0.917	11.05	34.7
	Teddington Summer	58	0.951	0.958 +/- 0.028	2.556 +/- 0.634	8.88	16.5
	Bristol Summer	53	0.966	1.141 +/- 0.029	-2.423 +/- 0.739	20.29	22.6
	Bristol Winter	51	0.935	0.993 +/- 0.036	3.331 +/- 0.902	16.65	23.5
Combined Datasets	> 30 µg m^{-3}	47	0.867	1.032 +/- 0.058	-0.468 +/- 2.378	13.10	100.0
	All Data	211	0.935	1.010 +/- 0.018	1.253 +/- 0.442	13.17	23.7

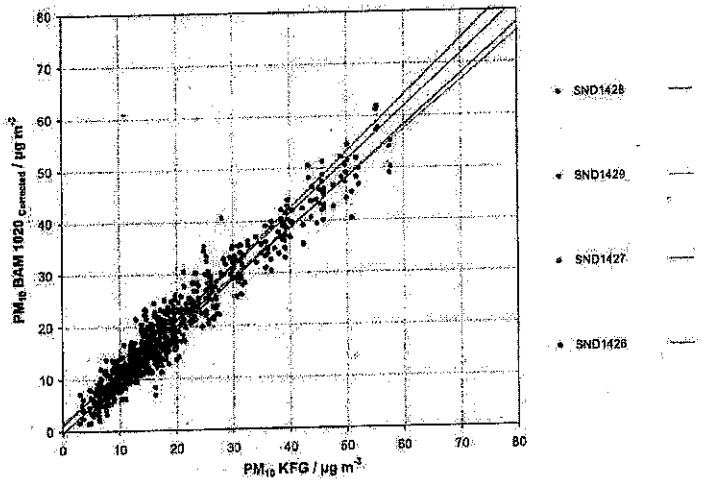
SND1429	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Teddington Winter	49	0.930	0.865 +/- 0.034	2.782 +/- 0.907	18.79	34.7
	Teddington Summer	56	0.945	0.840 +/- 0.027	3.616 +/- 0.608	19.25	16.1
	Bristol Summer	51	0.867	1.075 +/- 0.028	-1.854 +/- 0.697	11.05	21.6
	Bristol Winter	51	0.898	0.936 +/- 0.043	2.764 +/- 1.075	14.06	23.5
Combined Datasets	> 30 µg m^{-3}	46	0.801	0.918 +/- 0.062	1.582 +/- 2.562	16.57	100.0
	All Data	207	0.925	0.929 +/- 0.018	1.874 +/- 0.444	13.05	23.7

SND1427	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Birmingham Winter	59	0.932	1.045 +/- 0.036	0.131 +/- 0.833	14.03	18.6
	Birmingham Summer	56	0.967	1.029 +/- 0.025	0.442 +/- 0.496	9.91	8.9
	East Kilbride Summer	46	0.888	1.207 +/- 0.060	-1.857 +/- 0.674	34.92	0.0
	East Kilbride Winter	45	0.839	1.235 +/- 0.074	-2.213 +/- 0.868	39.81	2.2
Combined Datasets	> 30 µg m^{-3}	15	0.927	1.036 +/- 0.078	-0.165 +/- 3.241	9.41	100.0
	All Data	206	0.943	1.075 +/- 0.018	-0.472 +/- 0.316	15.95	8.3

SND1426	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Birmingham Winter	59	0.945	0.991 +/- 0.031	-1.656 +/- 0.709	11.88	18.6
	Birmingham Summer	54	0.953	0.989 +/- 0.030	-0.576 +/- 0.589	8.98	9.3
	East Kilbride Summer	46	0.924	1.154 +/- 0.048	-2.303 +/- 0.533	22.49	0.0
	East Kilbride Winter	39	0.766	1.133 +/- 0.089	0.421 +/- 1.046	31.01	2.6
Combined Datasets	> 30 µg m^{-3}	15	0.906	1.029 +/- 0.087	-3.384 +/- 3.652	11.22	100.0
	All Data	188	0.922	0.973 +/- 0.019	-0.173 +/- 0.347	11.54	8.6

Figure 2 Continued. Analysis of the PM_{10} BAM after dividing by 1.2.





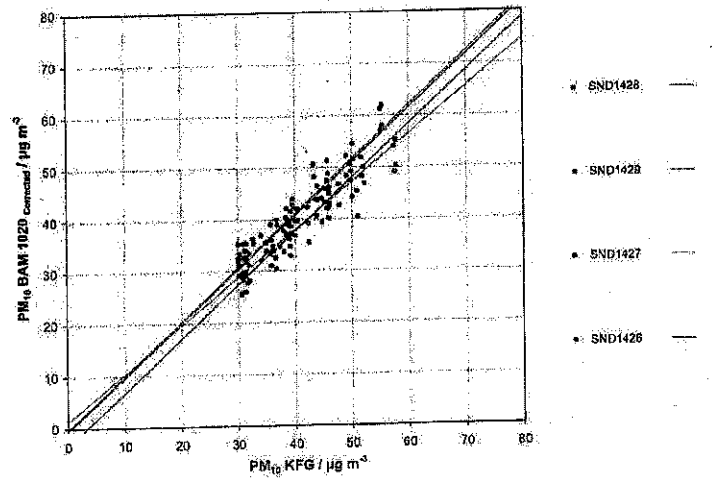


Figure 3. Analysis of the PM_{10} BAM Ambient after dividing by 1.273.

PM_{10} BAM 1020 Ambient corrected by dividing by 1.273	16.3% > 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Data	9.3	405	0.950	0.994 +/- 0.011	0.288 +/- 0.242	1.11	1.69
< 30 µg m-3	20.0	344	0.866	1.117 +/- 0.023	-1.411 +/- 0.363	1.10	1.38
> 30 µg m-3	11.1	61	0.678	0.933 +/- 0.043	1.994 +/- 1.762	1.12	2.21

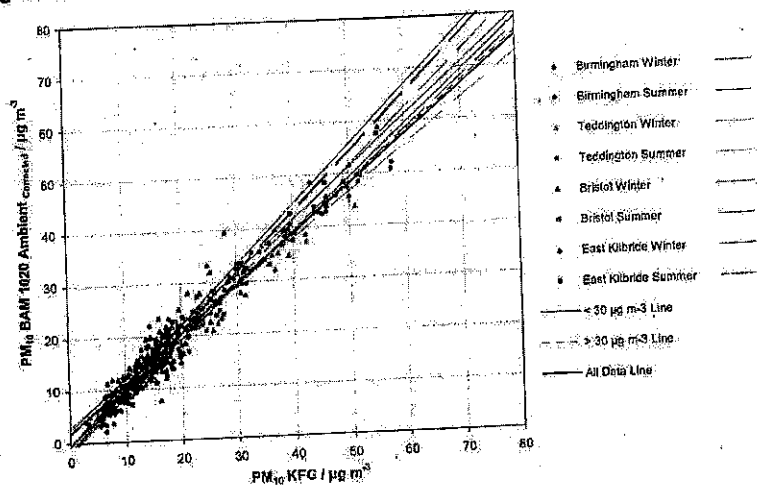
SND1428	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Teddington Winter	49	0.948	0.975 +/- 0.032	0.932 +/- 0.873	9.71	34.7
	Teddington Summer	56	0.954	0.933 +/- 0.027	2.609 +/- 0.597	6.58	15.5
	Bristol Summer	53	0.964	1.103 +/- 0.029	-2.245 +/- 0.739	14.35	22.6
	Bristol Winter	51	0.856	1.009 +/- 0.030	2.700 +/- 0.756	15.99	23.5
Combined Datasets	> 30 µg m^{-3}	47	0.882	0.998 +/- 0.051	0.712 +/- 2.092	10.97	100.0
	All Data	211	0.944	1.004 +/- 0.016	1.067 +/- 0.408	11.44	23.7

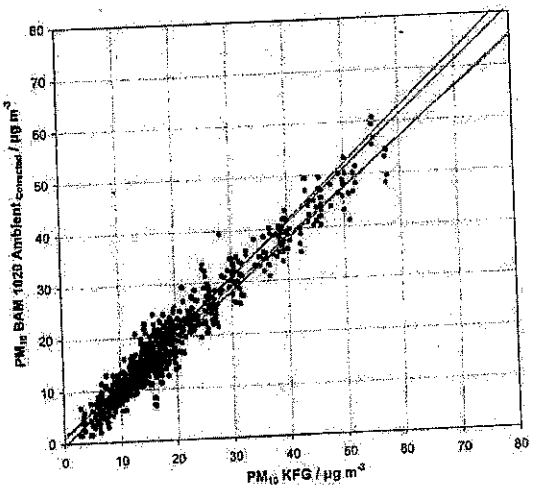
SND1429	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Teddington Winter	49	0.938	0.884 +/- 0.032	2.544 +/- 0.868	16.22	34.7
	Teddington Summer	56	0.951	0.816 +/- 0.025	3.648 +/- 0.562	23.10	16.1
	Bristol Summer	51	0.965	1.040 +/- 0.028	-1.694 +/- 0.698	8.02	21.6
	Bristol Winter	51	0.925	0.948 +/- 0.037	2.239 +/- 0.931	12.14	23.5
Combined Datasets	> 30 µg m^{-3}	46	0.831	0.880 +/- 0.055	2.939 +/- 2.271	16.82	100.0
	All Data	207	0.936	0.924 +/- 0.016	1.697 +/- 0.411	13.25	23.7

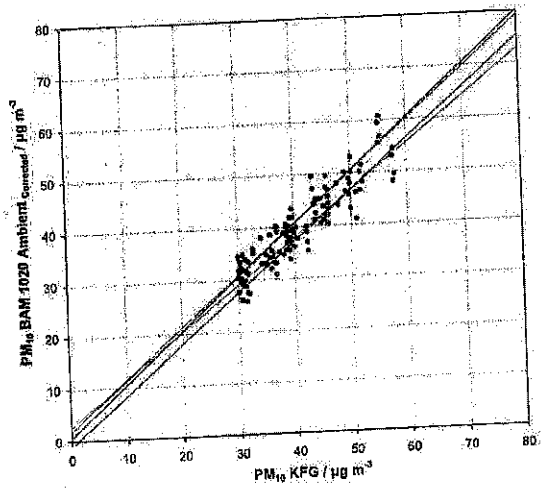
SND1427	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Birmingham Winter	59	0.938	1.030 +/- 0.034	0.227 +/- 0.782	11.72	18.6
	Birmingham Summer	56	0.971	0.997 +/- 0.023	0.387 +/- 0.450	5.54	8.9
	East Kilbride Summer	46	0.886	1.155 +/- 0.056	-1.708 +/- 0.651	25.27	0.0
	East Kilbride Winter	45	0.857	1.196 +/- 0.068	-2.056 +/- 0.794	32.61	2.2
Combined Datasets	> 30 µg m^{-3}	15	0.921	0.970 +/- 0.076	1.899 +/- 3.156	6.55	100.0
	All Data	206	0.948	1.055 +/- 0.017	-0.528 +/- 0.296	12.14	8.3

SND1426	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{o-s}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Birmingham Winter	59	0.951	0.976 +/- 0.029	-1.539 +/- 0.660	13.27	18.6
	Birmingham Summer	54	0.957	0.958 +/- 0.028	-0.597 +/- 0.546	12.92	9.3
	East Kilbride Summer	46	0.919	1.106 +/- 0.047	-2.176 +/- 0.528	14.18	0.0
	East Kilbride Winter	39	0.795	1.086 +/- 0.080	0.584 +/- 0.947	22.69	2.6
Combined Datasets	> 30 µg m^{-3}	15	0.914	0.959 +/- 0.078	-1.105 +/- 3.257	14.37	100.0
	All Data	198	0.930	0.953 +/- 0.018	-0.218 +/- 0.322	13.63	8.6

Figure 3 Continued. Analysis of the PM_{10} BAM Ambient after dividing by 1.273.







Umwelt Bundes Amt
For our Environment

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CERTIFICATE

about Product Conformity (QAL1)

Number of Certificate: 0000026912_02

Certified AMS:	BAM 1020 with $PM_{2.5}$-pre-separator
Manufacturer:	Met One Instruments, Inc. 1600 Washington Blvd. Grants Pass, Oregon 97526 USA
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

This is certifying that the AMS has been tested and found to comply with:

VDI 4202-1: 2002, VDI 4203-3: 2004, EN 14907: 2005, Guide to the Demonstration of Equivalence of Ambient Air Monitoring Methods: 2010, EN 15267-1: 2009, EN 15267-2: 2009

Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).
The present certificate replaces the Certificate 0000026912_01 of 19 August 2011.

www.tuv.com ID: 0000026912 TÜVRheinland

- Certified equivalent EN method
- Complying with 2008/50/EC
- TUV approved
- Annual inspection

Publication in the German Federal Gazette (BAnz.) of 28 July 2010

The certificate is valid until: 01 August 2015

Umweltbundesamt
Dessau, 15 March 2012

i. A. Dr. Hans-Joachim Hummel

TÜV Rheinland Energie und Umwelt GmbH
Köln, 16 March 2012

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / www.eco-tuv.com
teu@umwelt-tuv.de
Tel. +49 221 806-2756

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Köln

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Certificate:
0000026912_02 / 16 March 2012

Test report:	936/21209919/A of 26 March 2010
First certification:	28 July 2010
Validity ends:	01 August 2015
Publication:	BAnz. 28 July 2010, No. 111, p. 2597,chapter II, No. 1.1

Approved application
The AMS is approved for permanent monitoring of suspended particulate matter $PM_{2.5}$ in ambient air (stationary operation). The suitability of the product for this application was assessed on the basis of a laboratory test and a field test at four different test sites respectively time periods. The AMS is approved for the temperature range from +5 °C to +40 °C.

Any potential user should ensure, in consultation with the manufacturer that this AMS is suitable for the ambient air application on which it will be installed.

Basis of the certification
This certification is based on:

- the test report 936/21209919/A dated 26 March 2010 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
- the declaration of suitability by the German Umweltbundesamt as relevant body
- the publication in the German Federal Gazette BAnz. 28 July 2010, No. 111, p. 2597, chapter II, No. 1.1, UBA publication from 12 July 2010
- the ongoing surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 18, UBA publication from 10 January 2011)
- publication in the German Federal Gazette (BAnz. 29 July 2011, No. 113, p. 2725, chapter III, notification 11, UBA publication from 15 July 2011)

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Certificate:
0000026912_02 / 16 March 2012

AMS name:
BAM-1020 with $PM_{2.5}$ pre-separator

Manufacturer:
Met One Instruments, Inc., Grants Pass, USA

Approval:
For permanent monitoring of suspended particulate matter $PM_{2.5}$ in ambient air (stationary operation).

Measuring ranges during the suitability test:

Component	Certification range	Supplementary range	Unit
$PM_{2.5}$	0 – 1,000	-	µg/m³

Software version:
Version 3236-07 5.0.10

Restriction:
None

Remarks:
1. The requirements according to guide "Demonstration of Equivalence of Ambient Air Monitoring Methods" are fulfilled for the measured component $PM_{2.5}$.
2. For the recordation of $PM_{2.5}$, the system has to be equipped with the following options: Sample heater (BX-830), PM_{10}-sampling inlet (BX-802), $PM_{2.5}$ Sharp Cut Cyclone SCC (BX-807), combined pressure and temperature sensor (BX-596) respectively as an alternative ambient temperature sensor (BX-592).
3. The cycle time during the suitability test was 1 h, i.e. an automatic filter change has been performed every hour. Each filter spot has been used one time.
4. The sampling time within the cycle time is 42 min.
5. The measuring system has to be operated in a lockable measuring cabinet.
6. The measuring system is to be calibrated on site in regular intervals by application of the gravimetric $PM_{2.5}$ reference method according to EN 14907.
7. The identical measuring system is also distributed by the company Horiba Europe GmbH, 61440 Oberursel, Germany under the name APDA-371 with $PM_{2.5}$ pre-separator.

Test report:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Köln
Report-No.: 936/21209919/A of 26 March 2010

18 Notification on announcements of the Federal Environment Agency of 12 July 2010 (BAnz. p. 2597, chapter II, No. 1.1)
The requirements on the tightness of the sampling system for the measurement system BAM 1020 with $PM_{2.5}$ pre-separator of Met One Instruments are fulfilled after the re-evaluation.
The requirements according to guideline „Demonstration of Equivalence of Ambient Air Monitoring Method Version January 2010 are fulfilled.
Statement of TÜV Rheinland Energie und Umwelt GmbH 25 September 2010

11 Notification on announcements of the Federal Environment Agency of 12 July 2010 (BAnz. p. 2597, chapter II, No. 1.1) and of 10 January 2011 (BAnz. p. 294, chapter IV, 18th notification)
As an option the measuring system BAM-1020 with PM2.5 pre-separator of the company Met One Instruments, Inc. for the measured component PM2.5 can be operated with the pump BX-125.
As an option the measuring system can be equipped with a Touch Screen Display (Option BX-970).
The current firmware version is:
3236-77 V5.1.0
The firmware version of the measuring system without the option BX-970 Touch Screen Display remains 3236-07 5.0.10.
Statement of TÜV Rheinland Energie und Umwelt GmbH 24 March 2011

Certified product
This certificate applies to automated measurement systems confirming to the following description:

The ambient air measuring system BAM-1020 is based on the measuring principle of beta-attenuation. The principle of the radiometric determination of mass is based on the physical law of attenuation of beta-rays when passing a thin layer of material. There is the following relationship:

$$c\left(\frac{\mu g}{m^3}\right) = \frac{10^6\, A(cm^2)}{Q\left(\frac{l}{min}\right)\Delta t(min)\mu\left(\frac{cm^2}{g}\right)} \ln\left(\frac{I_0}{I}\right)$$

with:

C	particle-mass concentration	A	sampling area for particles (filter spot)
Q	sampling flow rate	Δt	sampling time
μ	mass absorption coefficient	I_0	beta count rate at the beginning (clean)
I	beta count at the end (collect)		

The radiometric determination of mass is calibrated in the factory and is checked within the scope of internal quality assurance hourly at the zero point (clean filter spot) and at the reference point (built-in reference foil) during operation. With the help of the generated data, measured values at zero and reference point can be easily affiliated. They can be compared with any stability requirements (drift effects) respectively with the nominal value for the reference foil (factory setting).

One measurement cycle (incl. automatic check of the radiometric measurement) consists of the following steps (setting: measuring time for radiometry 8 min):

1. The initial count of the clean filter tape I_0 is performed at the beginning of the cycle for a period of eight minutes.
2. The filter tape is advanced four windows and the sampling (vacuum pumping) begins on the spot in which I_0 was just measured. Air is drawn through this spot on the filter tape for approximately 42 minutes.
3. At the same time the second count I_1 occurs (at a point on the tape 4 windows back) for a period of eight minutes. The purpose of the measurement is to perform the verification for instrument drift caused by varying external parameters such as temperature and relative humidity. A third count I_2 occurs with the reference membrane extended over the same place on the tape. Eight minutes before the end of sampling time, another count I_{1x} occurs on the same point of the tape. With the help of I_1 and I_{1x}, the stability at the zero point can be monitored.
4. After sampling, the filter tape is moved back four windows to measure the beta ray absorption through the section that has collected dust (I_3). Finally the concentration calculation is performed to complete the cycle.
5. The next cycle begins with step 1.

The measuring system BAM-1020 with PM_{10} pre-separator is already suitability-tested and published. The measuring system, which is certified with this certificate, is equipped with a $PM_{2.5}$ pre-separator.

General notes

This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energie und Umwelt GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This can be applied to the product or used in publicity material for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate looses its validity. After the expiration of the validity of the certificate and on requests of the TÜV Rheinland Energie und Umwelt GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and the validity is also accessible on the internet Address: qal1.de.

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Certificate:
0000026912_02 / 16 March 2012

ertification of BAM 1020 with $PM_{2.5}$ pre-separator is based on the documents listed below and the egular, continuous monitoring of the Quality Management System of the manufacturer:

itial certification according to EN 15267:

ertificate No 0000026912: 02 August 2010

alidity of the certificate: 01 August 2015

est report: 936/21209919/A of 26 March 2010,
UV Rheinland Immissionsschutz und Energiesysteme GmbH, Köln,

ublication: BAnz. 28 July 2010, No. 111, p. 2597, chapter II, No. 1.1,
ublication by UBA from 12 July 2011.

pdate of certification according to EN 15267:

ertificate No 0000026912_01: 19 August 2011

alidity of the certificate: 01 August 2015

ertificate No 0000026912_02: 16 March 2011

alidity of the certificate: 01 August 2015

notification on changes to the certificate according to EN 15267:
tatement of TÜV Rheinland Energie und Umwelt GmbH, Köln from 25 September 2010
ublication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 18:
ublication by UBA from 10 January 2011.

nd notification on changes to the certificate according to EN 15267:
tatement of TÜV Rheinland Energie und Umwelt GmbH, Köln from 24 March 2011
ublication: BAnz. 29 July 2011, No. 113, p. 2725, chapter III, notification 11:
ublication by UBA from 15 July 2011.

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Certificate:
0000026912_02 / 16 March 2012

Results of the equivalence testing for the demonstration of equivalence according to the EC-Guide of July 2009*

$PM_{2.5}$ Smart Heated BAM	33.1% > 17 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	n_{CS}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Data	12.6	248	0.967	1.000 +/- 0.012	0.764 +/- 0.204	0.33	1.38
< 18 µg m-3	9.8	174	0.889	0.571 +/- 0.029	1.066 +/- 0.267	0.34	1.05
> 18 µg m-3	15.9	74	0.926	1.031 +/- 0.033	-0.068 +/- 0.919	0.30	1.57

SN 17010	Dataset	Orthogonal Regression				Limit Value of 30 µg m^{-3}	
		n_{CS}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 17 µg m^{-3}
Individual Datasets	Teddington Summer	78	0.931	0.994 +/- 0.030	1.822 +/- 0.372	17.11	19.2
	Cologne Winter	75	0.957	0.980 +/- 0.024	0.960 +/- 0.512	12.79	56.0
	Bornheim Summer	53	0.941	1.052 +/- 0.036	-0.962 +/- 0.527	11.61	20.8
	Teddington Winter	45	0.991	0.970 +/- 0.014	-0.182 +/- 0.300	10.28	85.6
Combined Datasets	< 18 µg m^{-3}	175	0.849	0.955 +/- 0.028	1.137 +/- 0.306	11.46	4.6
	> 18 µg m^{-3}	76	0.907	0.984 +/- 0.035	0.584 +/- 0.975	16.02	100.0
	All Data	251	0.957	0.969 +/- 0.013	0.989 +/- 0.226	12.90	33.5

SN 17011	Dataset	Orthogonal Regression				Limit Value of 30 µg m^{-3}	
		n_{CS}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 17 µg m^{-3}
Individual Datasets	Teddington Summer	78	0.955	1.016 +/- 0.025	1.018 +/- 0.308	14.66	19.2
	Cologne Winter	75	0.977	1.061 +/- 0.019	0.430 +/- 0.405	17.91	56.0
	Bornheim Summer	57	0.901	1.134 +/- 0.048	-1.498 +/- 0.727	23.91	21.1
	Teddington Winter	43	0.992	0.991 +/- 0.014	0.630 +/- 0.293	7.41	32.6
Combined Datasets	< 18 µg m^{-3}	178	0.881	1.021 +/- 0.026	0.634 +/- 0.286	13.44	4.5
	> 18 µg m^{-3}	75	0.929	1.092 +/- 0.034	-1.108 +/- 0.962	19.03	100.0
	All Data	253	0.966	1.041 +/- 0.012	0.977 +/- 0.214	16.26	32.8

* The investigations for the measuring system Met One BAM-1020 with $PM_{2.5}$ pre-separator have been performed on basis of the version of July 2009 of the EC-Guide. In the meanwhile there have been again some modifications on the Guide and a new version has been published in January 2010. The made modifications are purely of cosmetic kind and do not lead to any changes in the equivalence test itself. Hence an equivalence test according to the Guide in version of January 2010 leads to exactly identical results as an equivalence test according to the Guide in version of July 2009.

info@qal1.de
qal1.de

Umwelt Bundes Amt
(for our Environment)

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CERTIFICATE

on Product Conformity (QAL1)

Certificate No.: 0000037055

Certified AMS:	BAM-1020 with PM_{10}-pre-separator
Manufacturer:	Met One Instruments, Inc. 1600 Washington Blvd. Grants Pass Oregon 97526 USA
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

This is to certify that the AMS has been tested and found to comply with:

VDI 4202-1: 2002, VDI 4203-3: 2004, EN 12341: 1998, Guide to the Demonstration of Equivalence of Ambient Air Monitoring Methods: 2010, EN 15267-1: 2009, EN 15267-2: 2009

Certification is awarded in respect of the conditions stated in this certificate (also see the following pages).

www.tuv.com ID 0000037055 TÜVRheinland

- Certified equivalent EN method
- Complying with 2008/50/EC
- TÜV approved
- Annual inspection

Publication in the German Federal Gazette (Bundesanz.) of 05 March 2013

The certificate will expire on: 04 March 2018

German Federal Environment Agency
Dessau, 22 March 2013

Dr. Marcel Langner

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 21 March 2013

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / www.eco-tuv.com
umwelt-tuv.de
+49 221 806-2756

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Cologne

Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008

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Confirmation:
0000037055 / 22 March 2013

Test report:	936/21205333/A of 06 December 2006 Addendum 936/21220762/A of 04 October 2012
Initial certification:	05 March 2013
Date of expiry:	04 March 2018
Publication:	BAnz AT 05 March 2013 B10, chapter V, notification 2

Approved application
The certified AMS is suitable for permanent monitoring of suspended particulate matter PM_{10} in ambient air (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test, a field test (type approval) performed at three different test sites on three different periods as well as an equivalence testing carried out at seven different test sites on seven different periods.

The AMS is approved for a temperature range of +5 °C to +40 °C.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at which it will be installed.

Basis of the certification
This certification is based on:

- test report 936/21205333/A of 06 December 2006 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH and addendum 936/21220762/A of 04 October 2012 by TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- the on-going surveillance of the product and the manufacturing process
- publication in the German Federal Gazette: BAnz. 20 April 2007, No. 75, p. 4139, chapter III, No. 1.2
- publication in the German Federal Gazette: BAnz. 25 August 2009, No. 125, p. 2929, chapter III, notification 6
- publication in the German Federal Gazette: BAnz. 12 February 2010, No. 24, p. 552, chapter IV, notification 10 und 11
- publication in the German Federal Gazette: BAnz. 28 July 2010, No. 111, p. 2597, chapter III, notification 2
- publication in the German Federal Gazette: BAnz. 29 July 2011, No. 113, p. 2725, chapter III, notification 12
- publication in the German Federal Gazette: BAnz AT 20 July 2012 B11, chapter IV, notification 6
- publication in the German Federal Gazette: BAnz AT 05 March 2013 B10, chapter V, notification 2

Confirmation:
0000037055 / 22 March 2013

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AMS designation:
BAM-1020 with PM_{10}-pre-separator

Manufacturer:
Met One Instruments, Inc., Grants Pass, USA

Field of application:
Continuous ambient air monitoring of the PM_{10}-fraction in suspended particulate matter (stationary operation)

Measuring range during performance test:
Particulate matter PM_{10}: 0 - 1,000 mg/m³ = 0 - 1000 µg/m³

Software version:
3236-02 3.2.1b

Restrictions:
None

Notes:

1. For recording PM_{10} the system shall be equipped with the following options: Sample heater (BX-830), Sampling inlet (BX-802), Ambient temperature sensor (BX-592) and Ambient pressure sensor (BX-594).
2. The heater shall be used only in operating mode, as has been used during the type approval test.
3. The flow rate control shall be in actual volume related to ambient conditions (Operating mode, ACTUAL).
4. During the complete type approval test, the measuring system has been operated with the sample heater BX-830.
5. During the type approval test, the cycle time was 1 h, i.e. an automatic filter change was done each hour. Each filter spot has been sampled on only once.
6. The measuring system shall be operated in a lockable measuring cabinet.
7. The measuring system is to be calibrated on site at regular intervals by using the gravimetric PM_{10} reference method according to EN 12341.

Test Institute:
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne,
TÜV Rheinland Group
Report No.: 936/21205333/A dated 6 December 2006

6 Notification as regards Federal Environmental Agency notice of 12 April 2007 (BAnz. p. 4139)

The current firmware version of the ambient air measuring system BAM-1020 of the company Met One Instruments, Inc. is:

Version 3236-02 5.0.2

Remark No.1 has to be changed as follows:

1. For recording PM_{10} the system has to be equipped at minimum with the following options: Sample heater (BX-830), Sampling inlet (BX-802) and Ambient temperature sensor (BX-592).

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 30 March 2009

10 Notification as regards Federal Environmental Agency notices of 12 April 2007 (BAnz. p. 4139) and of 3 August 2009 (Federal Gazette [BAnz.] p. 2935)

The current firmware version of the ambient air measuring system BAM-1020 of the company Met One Instruments, Inc. is:

Version 3236-07 V5.0.5

Remark No. 1 is replaced by:

1. For recording PM_{10} the system has to be equipped at minimum with the following options: Sample heater (BX-830), Sampling inlet (BX-802) and Ambient temperature sensor (BX-592) respectively combined pressure and temperature sensor (BX-596).

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 9 October 2009

11 Notification as regards Federal Environmental Agency notices of 12 April 2007 (BAnz. p. 4139) and of 3 August 2009 (BAnz. p. 2935)

The identical measuring system BAM-1020 of the company Met One Instruments, Inc (TÜV report-No. 936/21205333A of 6 December 2006) is also distributed by the company Horiba Europe GmbH, 61440 Oberursel, Germany under the name APDA-371.

The current firmware version of the ambient air measuring system APDA-371 is:

Version 3236-07 V5.0.5

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 9 October 2009

2 Notification as regards Federal Environmental Agency notices of 12 April 2007 (BAnz. p. 4139) and of 25 January 2010 (BAnz. p. 555)

The current firmware version of the ambient air measuring system BAM-1020 with PM_{10} pre-separator of the company Met One Instruments, Inc. is:

Version 3236-07 V5.0.10

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 16 March 2010

2 Notification as regards Federal Environmental Agency notices of 12 April 2007 (BAnz. p. 4139, chapter III, No. 1.2) and of 12 July 2010 (BAnz. p. 2597, chapter III, 2th notification)

As an option, the measuring system BAM-1020 with PM_{10}-pre-separator of the company Met One Instruments, Inc for the measured component PM_{10} can be operated with the pump BX-125.

As an option the measuring system can be equipped with a Touch Screen Display (Option BX-970). The current firmware version is:

3236-77 V5.1.0

The firmware version of the measuring system without the option BX-970 Touch Screen Display remains 3236-07 5.0.10.

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 24 March 2011

5 Notification as regards Federal Environmental Agency notices of 12 April 2007 (BAnz. p. 4139, chapter III, No. 1.2) and of 15 July 2011 (BAnz. p. 2725, chapter III, 12th notification)

The measuring system BAM-1020 with PM_{10}-pre-separator for the component suspended particulate matter PM_{10}-fraction manufactured by Met One Instruments, Inc. is equipped with a re-designed back plate in order to make room for extended interfaces (i.e. the optional BX-965 reporting unit).

The current firmware version of the AMS is:

3236-07 5.0.15

The current firmware version of the AMS with touch screen display (option BX-970) is:

3236-77 V5.1.2

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 21 March 2012

2 Notification as regards Federal Environmental Agency notices of 12 April 2007 (BAnz. p. 4139, chapter III, No. 1.2) and of 6 July 2012 (BAnz AT 20.07.2012 B11, chapter IV, 6th notification)

The measuring system BAM-1020 with PM_{10}-pre-separator of the company Met One Instruments, Inc for the measured component PM_{10} fulfills the requirements of EN 12341 (issue March 1998) as well as of the Guide „Demonstration of Equivalence of Ambient Air Monitoring Methods" in its version of January 2010. Furthermore the manufacturing and the quality management of the measuring system BAM-1020 PM_{10} pre-separator fulfills the requirements of EN 15267.

The test report on the type approval test with the report number 936/21205333/A as well as an addendum to the test report with the report number 936/21220762/A are available on the internet www.qal1.de.

Opinion stated by TÜV Rheinland Energie und Umwelt GmbH of 4 October 2012

Confirmation:
0000037055 / 22 March 2013

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Certified product
This certificate applies to automated measurement systems conforming to the following description:

The measuring system BAM-1020 with PM_{10} pre-separator consists of the PM_{10}-sampling inlet BX-802, the sampling tube, the sample heater BX-830, the ambient temperature sensor BX-592 (incl. radiation protection shield) or the combined pressure and temperature sensor BX-596, the vacuum pump BX-127 or as an option BX-125, the measuring instrument BAM-1020 (incl. glass fiber filter tape), the respective connecting tubes and lines as well as adapters, the roof flange as well as the manual in English / German language.

The ambient air measuring system BAM-1020 is based on the measuring principle of beta-attenuation.

The particle sample passes the PM10-sampling inlet with a flow rate of 1 m³/h and arrives via the sampling tube at the measuring instrument BAM-1020.

Within the scope of the test work, the measuring system was operated with the sample heater BX-830.

The particles arrive at the measuring instrument and will be separated at the glass fiber filter tape for the radiometric measurement.

During the suitability test work, a cycle time of 60 min with a time need of 4 min for the radiometric measurement was set.

Therefore the cycle time consists of 2 x 4 min for the radiometric measurement (I_0 & I_s) as well as approximately 1-2 min for filter tape movements. Thus the effective sampling time is around 50 min.

Furthermore, the measuring system allows an extension of the measuring time to 6 or 8 min in order to increase the precision of the radiometric measurement. The effective sampling time is then decreased to 46 respectively 42 min.

The radiometric determination of mass is calibrated in the factory and is checked within the scope of internal quality assurance hourly at the zero point (clean filter spot) and at the reference point (built-in reference foil) during operation. With the help of the generated data, measured values at zero and reference point can be easily affiliated. They can be compared with any stability requirements (drift effects) respectively with the nominal value for the reference foil (factory setting).

General notes
This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energie und Umwelt GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This can be applied to the product or used in publicity material for the certified product is presented on page 1 of this certificate.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energie und Umwelt GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and the validity is also accessible on the internet: **qal1.de.**

Confirmation:
0000037055 / 22 March 2013

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Certification of BAM-1020 with PM_{10}-pre-separator is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Basic test:

Test report: 936/21205333/A dated 06 December 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: BAnz. 20 April 2007, No. 75, p. 4139, chapter III, No. 1.2
Announcement by UBA from 12 April 2007

Notification:

Publication: BAnz. 25 August 2009, No. 125, p. 2929, chapter III, notification 6
Announcement by UBA from 03 August 2009

Publication: BAnz. 12 February 2010, No. 24, p. 552, chapter IV, notification 10 and 11
Announcement by UBA from 25 January 2010

Publication: BAnz. 28 July 2010, No. 111, p. 2597, chapter III, notification 2
Announcement by UBA from 12 July 2010

Publication: BAnz. 29 July 2011, No. 113, p. 2725, chapter III, notification 12
Announcement by UBA from 15 July 2011

Publication: BAnz AT 20 July 2012 B11, chapter IV, notification 6
Announcement by UBA from 06 July 2012

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 2
Announcement by UBA from 12 February 2013

Initial certification according to EN 15267:

Certificate No. 0000037055: 22 March 2013

Expiration date of the certificate: 04 March 2018

Test report: 936/21205333/A dated 06 December 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Addendum: 936/21220762/A dated 04 October 2012
TÜV Rheinland Energie und Umwelt GmbH, Köln

Statement of TÜV Rheinland Energie und Umwelt GmbH from 04 October 2012

Publication: BAnz AT 05 March 2013 B10, chapter V, notification 2
Announcement by UBA from 12 February 2013

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0000037055 / 22 March 2013

PM_{10} Smart BAM 1020	35.3% > 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Paired Data	16.0	320	0.962	1.034 +/- 0.009	0.843 +/- 0.290	0.67	1.22
< 30 µg m-3	24.7	215	0.826	1.119 +/- 0.032	-0.446 +/- 0.557	0.53	1.09
> 30 µg m-3	17.7	105	0.971	1.042 +/- 0.017	0.141 +/- 1.031	0.91	1.49

4294	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Cologne, Parking Lot	29	0.960	0.948 +/- 0.038	2.202 +/- 0.950	10.13	34.5
	Titz - Rödingen	37	0.962	1.058 +/- 0.035	0.376 +/- 0.782	14.75	18.9
	Cologne, Frankfurter Str.	28	0.963	1.025 +/- 0.039	-1.293 +/- 1.083	8.07	42.9
Combined Datasets	< 30 µg m³	68	0.814	1.040 +/- 0.055	0.162 +/- 0.961	12.56	4.4
	> 30 µg m³	26	0.897	0.904 +/- 0.063	1.810 +/- 2.438	9.75	100.0
	All Data	94	0.953	0.987 +/- 0.022	1.048 +/- 0.563	9.16	35.8

4295	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Cologne, Parking Lot	29	0.970	0.990 +/- 0.033	2.661 +/- 0.862	12.53	34.5
	Titz - Rödingen	37	0.961	1.056 +/- 0.035	1.260 +/- 0.765	17.52	18.9
	Cologne, Frankfurter Str.	26	0.969	1.021 +/- 0.035	-0.154 +/- 0.994	8.10	42.6
Combined Datasets	< 30 µg m³	68	0.830	1.056 +/- 0.053	0.035 +/- 0.952	17.24	4.4
	> 30 µg m³	26	0.929	1.025 +/- 0.056	0.713 +/- 2.181	11.49	100.0
	All Data	94	0.960	1.004 +/- 0.021	1.735 +/- 0.528	11.41	30.9

Austria1	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Graz	45	0.969	1.025 +/- 0.027	-0.202 +/- 1.848	20.89	82.2
	Steyregg	45	0.824	1.049 +/- 0.067	-1.750 +/- 1.392	9.31	8.9
Combined Datasets	< 30 µg m³	50	0.644	1.339 +/- 0.109	-6.789 +/- 2.135	42.75	2.0
	> 30 µg m³	40	0.950	1.057 +/- 0.034	-2.826 +/- 2.431	18.58	100.0
	All Data	90	0.983	1.030 +/- 0.015	-1.204 +/- 0.729	15.95	45.6

Austria2	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Graz	45	0.966	1.033 +/- 0.029	1.048 +/- 1.992	26.05	82.2
	Steyregg	45	0.793	1.035 +/- 0.072	-1.668 +/- 1.489	9.56	8.9
Combined Datasets	< 30 µg m³	50	0.557	1.492 +/- 0.130	-9.462 +/- 2.545	62.86	2.0
	> 30 µg m³	40	0.956	1.084 +/- 0.037	-2.296 +/- 2.635	22.65	100.0
	All Data	90	0.980	1.079 +/- 0.018	-1.702 +/- 0.818	19.84	45.6

J7860	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	59	0.906	1.172 +/- 0.047	1.204 +/- 0.839	40.46	6.8
	> 30 µg m³	39	0.974	1.002 +/- 0.027	3.154 +/- 1.548	17.67	100.0
	All Data (Tusimice)	97	0.984	0.999 +/- 0.013	3.739 +/- 0.402	16.45	43.3

J7863	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	58	0.913	1.158 +/- 0.045	0.159 +/- 0.812	33.73	6.9
	> 30 µg m³	38	0.976	1.032 +/- 0.025	1.946 +/- 1.450	17.68	100.0
	All Data (Tusimice)	96	0.987	1.035 +/- 0.012	2.035 +/- 0.461	16.18	43.8

17011	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	39	0.960	1.039 +/- 0.034	0.032 +/- 0.458	11.13	0.0
	> 30 µg m³	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.949	1.162 +/- 0.042	-0.786 +/- 0.602	29.69	2.5

17022	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	39	0.958	1.051 +/- 0.035	0.603 +/- 0.477	13.45	0.0
	> 30 µg m³	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.963	1.110 +/- 0.034	-0.050 +/- 0.486	22.28	2.5

Confirmation:
0000037055 / 22 March 2013

PM_{10} Smart BAM 1020 Intercept Corrected	35.3% > 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Paired Data	14.2	320	0.962	1.034 +/- 0.008	0.000 +/- 0.290	0.67	1.22
< 30 µg m-3	21.7	216	0.826	1.119 +/- 0.032	-1.268 +/- 0.557	0.53	1.09
> 30 µg m-3	16.3	105	0.971	1.042 +/- 0.017	-0.701 +/- 1.031	0.91	1.49

4294	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Cologne, Parking Lot	29	0.960	0.948 +/- 0.036	1.359 +/- 0.050	11.22	34.5
	Titz - Rödingen	37	0.992	1.055 +/- 0.035	-0.486 +/- 0.762	11.91	16.9
	Cologne, Frankfurter Str.	28	0.963	1.025 +/- 0.039	-2.136 +/- 1.083	8.92	42.9
Combined Datasets	< 30 µg m³	68	0.814	1.040 +/- 0.055	-0.680 +/- 0.981	10.58	4.4
	> 30 µg m³	26	0.897	0.954 +/- 0.063	0.967 +/- 2.438	10.36	100.0
	All Data	94	0.953	0.987 +/- 0.022	0.206 +/- 0.663	9.30	35.3

4295	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Cologne, Parking Lot	29	0.970	0.990 +/- 0.033	1.639 +/- 0.662	10.54	34.5
	Titz - Rödingen	37	0.981	1.056 +/- 0.035	0.417 +/- 0.765	14.52	16.9
	Cologne, Frankfurter Str.	28	0.969	1.021 +/- 0.035	-0.996 +/- 0.994	7.82	42.9
Combined Datasets	< 30 µg m³	68	0.830	1.066 +/- 0.053	0.092 +/- 0.952	14.49	4.4
	> 30 µg m³	26	0.929	1.025 +/- 0.056	-0.129 +/- 2.151	9.57	100.0
	All Data	94	0.960	1.004 +/- 0.021	0.692 +/- 0.528	9.63	30.9

Austria1	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Graz	45	0.969	1.025 +/- 0.027	-1.045 +/- 1.848	20.50	82.2
	Steyregg	45	0.824	1.049 +/- 0.067	-2.503 +/- 1.392	8.95	6.9
Combined Datasets	< 30 µg m³	50	0.644	1.339 +/- 0.109	-7.631 +/- 2.135	39.58	2.0
	> 30 µg m³	40	0.960	1.057 +/- 0.034	-3.668 +/- 2.431	19.86	100.0
	All Data	90	0.983	1.039 +/- 0.015	-2.137 +/- 0.720	15.78	45.6

Austria2	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Graz	45	0.966	1.033 +/- 0.029	1.106 +/- 1.062	24.39	82.2
	Steyregg	45	0.793	1.035 +/- 0.072	-2.511 +/- 1.489	10.09	6.9
Combined Datasets	< 30 µg m³	50	0.557	1.492 +/- 0.150	-10.304 +/- 2.545	59.83	2.0
	> 30 µg m³	40	0.956	1.084 +/- 0.037	-3.136 +/- 2.635	21.77	100.0
	All Data	90	0.980	1.070 +/- 0.016	-2.544 +/- 0.816	18.61	45.6

J7860	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	59	0.906	1.172 +/- 0.047	0.361 +/- 0.639	37.23	6.8
	> 30 µg m³	38	0.974	1.002 +/- 0.027	2.311 +/- 1.548	15.38	100.0
	All Data (Tusimice)	97	0.984	0.999 +/- 0.013	2.886 +/- 0.492	15.92	43.3

J7863	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	59	0.913	1.158 +/- 0.045	-0.694 +/- 0.812	30.54	6.8
	> 30 µg m³	38	0.978	1.032 +/- 0.025	1.105 +/- 1.450	15.50	100.0
	All Data (Tusimice)	96	0.987	1.035 +/- 0.012	1.193 +/- 0.461	15.54	43.8

17011	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	39	0.980	1.039 +/- 0.034	-0.210 +/- 0.458	8.21	0.0
	> 30 µg m³	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.949	1.162 +/- 0.042	-1.608 +/- 0.602	20.73	2.5

17022	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{c,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	39	0.968	1.051 +/- 0.035	-0.240 +/- 0.477	10.40	0.0
	> 30 µg m³	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.963	1.110 +/- 0.034	-0.893 +/- 0.488	19.05	2.5

Confirmation:
0000037055 / 22 March 2013

PM_{10} Smart BAM 1020 Slope Corrected	35.3% > 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Paired Data	12.5	320	0.982	1.000 +/- 0.008	0.824 +/- 0.280	0.67	1.18
< 30 µg m-3	17.9	215	0.826	1.079 +/- 0.031	-0.372 +/- 0.538	0.53	1.06
> 30 µg m-3	14.9	105	0.971	1.007 +/- 0.017	0.164 +/- 0.997	0.91	1.44

4294	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Cologne, Parking Lot	29	0.960	0.917 +/- 0.035	2.144 +/- 0.918	12.72	34.5
	Tdz - Rödingen	37	0.962	1.023 +/- 0.034	0.378 +/- 0.756	9.03	18.9
	Cologne, Frankfurter Str.	28	0.963	0.990 +/- 0.037	-1.235 +/- 1.048	10.44	42.9
Combined Datasets	< 30 µg m³	68	0.814	1.003 +/- 0.063	0.219 +/- 0.949	8.67	4.4
	> 30 µg m³	26	0.897	0.931 +/- 0.061	1.815 +/- 2.358	11.57	100.0
	All Data	94	0.953	0.954 +/- 0.022	1.032 +/- 0.645	10.23	35.3

4295	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Cologne, Parking Lot	29	0.970	0.957 +/- 0.032	2.605 +/- 0.834	9.04	34.6
	Tdz - Rödingen	37	0.961	1.021 +/- 0.034	1.233 +/- 0.760	11.24	18.9
	Cologne, Frankfurter Str.	28	0.969	0.988 +/- 0.034	-0.155 +/- 0.962	7.70	42.9
Combined Datasets	< 30 µg m³	66	0.830	1.018 +/- 0.052	0.961 +/- 0.921	11.33	4.4
	> 30 µg m³	26	0.929	0.990 +/- 0.054	0.737 +/- 2.060	8.24	100.0
	All Data	94	0.960	0.971 +/- 0.020	1.693 +/- 0.610	8.28	30.9

Austria1	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Graz	45	0.969	0.991 +/- 0.027	-0.164 +/- 1.787	19.86	82.2
	Steyregg	45	0.824	1.012 +/- 0.065	-1.624 +/- 1.347	9.63	8.9
Combined Datasets	< 30 µg m³	50	0.644	1.285 +/- 0.105	-8.378 +/- 2.085	34.09	2.0
	> 30 µg m³	40	0.960	1.022 +/- 0.033	-2.687 +/- 2.351	20.01	100.0
	All Data	90	0.983	1.005 +/- 0.014	-1.240 +/- 0.705	18.79	45.6

Austria2	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Individual Datasets	Graz	45	0.966	0.999 +/- 0.028	1.920 +/- 1.898	22.33	82.2
	Steyregg	45	0.793	0.997 +/- 0.069	-1.531 +/- 1.441	11.48	8.9
Combined Datasets	< 30 µg m³	50	0.557	1.429 +/- 0.128	-8.879 +/- 2.462	52.84	2.0
	> 30 µg m³	40	0.958	1.048 +/- 0.036	-2.107 +/- 2.549	20.66	100.0
	All Data	90	0.980	1.043 +/- 0.016	-1.691 +/- 0.761	17.32	45.6

J7860	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	59	0.906	1.131 +/- 0.046	1.105 +/- 0.812	32.66	6.8
	> 30 µg m³	38	0.974	0.969 +/- 0.025	3.074 +/- 1.498	13.09	100.0
	All Data (Tusimice)	97	0.984	0.968 +/- 0.012	3.625 +/- 0.478	13.28	43.3

J7983	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	58	0.913	1.110 +/- 0.044	0.182 +/- 0.786	26.26	6.9
	> 30 µg m³	38	0.978	0.998 +/- 0.025	1.804 +/- 1.403	12.97	100.0
	All Data (Tusimice)	96	0.997	1.001 +/- 0.012	1.975 +/- 0.446	12.77	43.8

17011	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	39	0.960	1.004 +/- 0.033	0.620 +/- 0.443	5.53	0.0
	> 30 µg m³	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.949	1.123 +/- 0.041	-0.728 +/- 0.583	22.58	2.5

17022	Dataset	Orthogonal Regression				Limit Value of 50 µg m³	
		$n_{D,s}$	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m³
Combined Datasets	< 30 µg m³	39	0.958	1.016 +/- 0.034	0.502 +/- 0.481	7.27	0.0
	> 30 µg m³	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.963	1.073 +/- 0.033	-0.040 +/- 0.473	15.26	2.5

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Confirmation:
0000037055 / 22 March 2013

PM_{10} Smart BAM 1020 Slope and Intercept Corrected	35.3% > 28 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W_{CM} / %	n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	Reference	Candidate
All Paired Data	12.1	320	0.882	1.000 +/- 0.008	0.009 +/- 0.269	0.67	1.18
< 30 µg m-3	15.5	215	0.826	1.079 +/- 0.031	-1.187 +/- 0.539	0.53	1.06
> 30 µg m-3	14.9	105	0.971	1.007 +/- 0.017	-0.651 +/- 0.997	0.91	1.44

4294	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Cologne, Parking Lot	29	0.960	0.917 +/- 0.035	1.329 +/- 0.919	15.05	34.5
	Titz - Rödingen	37	0.952	1.023 +/- 0.034	-0.437 +/- 0.758	7.33	18.9
	Cologne, Frankfurter Str.	28	0.903	0.900 +/- 0.037	-2.090 +/- 1.048	12.87	42.9
Combined Datasets	< 30 µg m^{-3}	66	0.814	1.003 +/- 0.055	-0.596 +/- 0.949	9.11	4.4
	> 30 µg m^{-3}	26	0.897	0.931 +/- 0.061	1.000 +/- 2.356	13.74	100.0
	All Data	94	0.953	0.954 +/- 0.022	0.217 +/- 0.545	12.26	35.3

4295	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Cologne, Parking Lot	29	0.970	0.957 +/- 0.032	1.790 +/- 0.834	9.04	34.5
	Titz - Rödingen	37	0.961	1.021 +/- 0.024	0.416 +/- 0.760	6.01	18.9
	Cologne, Frankfurter Str.	28	0.969	0.968 +/- 0.034	-0.950 +/- 0.962	9.54	42.9
Combined Datasets	< 30 µg m^{-3}	66	0.830	1.018 +/- 0.052	0.146 +/- 0.921	8.59	4.4
	> 30 µg m^{-3}	26	0.929	0.990 +/- 0.064	-0.078 +/- 2.080	8.65	100.0
	All Data	94	0.960	0.971 +/- 0.020	0.878 +/- 0.510	8.65	30.9

Austria1	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Graz	45	0.909	0.991 +/- 0.027	-0.979 +/- 1.767	20.64	82.2
	Steyregg	45	0.824	1.012 +/- 0.065	-2.439 +/- 1.347	11.48	8.9
Combined Datasets	< 30 µg m^{-3}	50	0.644	1.285 +/- 0.105	-7.193 +/- 2.065	31.13	2.0
	> 30 µg m^{-3}	40	0.960	1.022 +/- 0.033	-3.502 +/- 2.351	21.30	100.0
	All Data	90	0.883	1.005 +/- 0.014	-2.055 +/- 0.705	18.64	45.6

Austria2	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Individual Datasets	Graz	45	0.966	0.998 +/- 0.028	1.105 +/- 1.898	21.51	82.2
	Steyregg	45	0.793	0.997 +/- 0.069	-2.346 +/- 1.441	13.60	8.9
Combined Datasets	< 30 µg m^{-3}	50	0.557	1.429 +/- 0.126	-9.894 +/- 2.462	49.78	2.0
	> 30 µg m^{-3}	40	0.956	1.048 +/- 0.038	-2.082 +/- 2.549	20.80	100.0
	All Data	90	0.930	1.043 +/- 0.016	-2.446 +/- 0.791	17.28	45.6

J7860	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Combined Datasets	< 30 µg m^{-3}	59	0.906	1.131 +/- 0.048	0.360 +/- 0.612	29.59	6.8
	> 30 µg m^{-3}	38	0.974	0.999 +/- 0.026	2.259 +/- 1.488	11.07	100.0
	All Data (Tusimice)	97	0.964	0.966 +/- 0.012	2.810 +/- 0.470	11.73	43.3

J7863	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Combined Datasets	< 30 µg m^{-3}	58	0.913	1.119 +/- 0.044	-0.633 +/- 0.786	23.28	6.8
	> 30 µg m^{-3}	38	0.978	0.998 +/- 0.025	1.089 +/- 1.403	11.54	100.0
	All Data (Tusimice)	96	0.967	1.001 +/- 0.012	1.160 +/- 0.446	11.08	43.6

17011	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Combined Datasets	< 30 µg m^{-3}	39	0.960	1.004 +/- 0.033	-0.195 +/- 0.443	4.89	0.0
	> 30 µg m^{-3}	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.949	1.123 +/- 0.041	-1.543 +/- 0.563	19.51	2.5

17022	Dataset	Orthogonal Regression				Limit Value of 50 µg m^{-3}	
		n_{Cal}	r^2	Slope (b) +/- u_b	Intercept (a) +/- u_a	W_{CM} / %	% > 28 µg m^{-3}
Combined Datasets	< 30 µg m^{-3}	39	0.958	1.016 +/- 0.034	-0.223 +/- 0.461	5.30	0.0
	> 30 µg m^{-3}	1		+/-	+/-		100.0
	All Data (Teddington)	40	0.883	1.073 +/- 0.033	-0.855 +/- 0.473	12.29	2.5

info@qal1.de
qal1.de

Umwelt Bundesamt

LUBW

CERTIFICATE

On Product Conformity (QAL1)

Number of Certificate: LUBW001430001

Certified AMS:	GC 955 version 601 (PID-Detector)
Manufacturer:	Synspec B. V. De Delmten 1 9747 AV Groningen The Netherlands
Test Institute:	LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg

This is to certify that the automated measuring system (AMS) has been tested and found to comply with:

E EN 14662-3: 2013, EN 15267-1: 2009, EN 15267-2: 2009
VDI-Richtlinie 4202 Blatt 1: 2010, VDI-Richtlinie 4203 Blatt 3: 2010

Certification is awarded in respect of the conditions stated in this certificate (See also the following pages).

Publication in the German Federal Gazette (BAnz.) of 05 August 2014

Umweltbundesamt
Dessau, 24. September 2014

i. A. Dr. Marcel Langner

This certificate is valid until:
04 August 2019

LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg
Karlsruhe, 19. September 2014

Werner Altkofer

www.lubw.baden-wuerttemberg.de
poststelle@lubw.bwl.de
Tel. +49-721-5600-3201

LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg
Großoberfeld 3

	76136 Karlsruhe
Accreditation according to EN ISO/IEC 17025:2005	

Test report:	143-04/13 of 11 June 2014
First certification:	13 August 2014
Validity ends:	04 August 2019
Publication:	BAnz AT 05 August 2014 B11, chapter III, No. 1.1

Approved application

The certified AMS is suitable for continuous ambient air monitoring of benzene (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three months field test at a traffic related location.

The AMS is approved for a temperature range of 0°C to 30°C.

Any potential user should ensure in consultation with the manufacturer, that the AMS is suitable for the planned application site.

Basis of the certification

This certification is based on:

- test report 143-04/13 dated 11 June 2014
- suitability announced by the German Environmental Agency (UBA) as the relevant body
- the ongoing surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz. AT 05 August 2014 B11, chapter III, No. 1.1, announcement by UBA from 17 July 2014)

Umwelt Bundesamt

Certificate:
LUBW001430001 / 19.09.2014

LUBW

AMS name:
Gaschromatograph GC 955 version 601 BTX type PID for benzene

Manufacturer:
Synspec B. V., Groningen (the Netherlands)

Approval:
Continuous ambient air monitoring of benzene concentration (stationary operation)

Measuring ranges during the suitability test:

component	*certificated range*	*measure unit*
benzene	0 - 50	µg/m³

Software version: 5.7.2

Restriction:
1. The AMS does not have a living zero.
2. The AMS shows a negative result for benzene under the influence of tetrachloromethane.

Remarks:
None

Test Institute:
Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg (LUBW), Karlsruhe
Report-No.: 143-04/13 of 11 June 2014

Certified product:

This certificate applies to automated measurement systems confirming to the following description:

The gaschromatograph GC 955 version 601 (type PID) is an analyser for the continuous measurement of benzene, toluene, ethylbenzene, m/p- and o-xylene in ambient air with enriching sampling, thermal desorption and subsequent gas chromatographic separation.

The tested AMS is assembled in 19 inch housing with the following technical data:

Housing 19 inch	
Height:	5 rack units (= 23,2 cm)
Depth:	37,2 cm
Weight:	17,4 kg
Voltage and gas supply:	
Voltage:	230 V AC; 1, 3 -2, 6 A
Energy consumption:	2,16 kWh
Carrier gas:	Nitrogen N_2 5.0
Gas connection:	Swagelok, 1/8 inch
Detector:	PID – Photo Ionization Detector (10,6 eV)
Sampling system:	
Column type:	CP 70003; (Synspec SY-1)
Analytical column:	Length: 13 m
Stripper column:	Length: 2 m
Preconcentration system:	Tenax GR (manufacturer: Synspec)
10-way-valve:	DV 22-2110 (manufacturer: Vici)
Measuring cell volume:	50 µl
Sample volume:	4 piston strokes a 23,33 ml per cycle
Communication:	
Interfaces:	4 analogue out 0 – 10 V oder 0(4) – 20 mA, 4 analogue in 0 – 10 V, 7 digital-outputs (TTL), 4 digital-inputs (TTL) Ethernet, 3 x RS232, 2 x USB, VGA
Protocols:	ASCII-terminal, Gesytec, ARIES, J-Bus, Profibus or Mod-Bus

General notes:

This certificate is based upon the equipment, which was tested. The manufacturer is responsible for ensuring, that on-going production complies with the requirements of the EN 15267. The manufacturer is obligated, to maintain an approved quality management system for the controlling of the manufacture of the certified product. Both the product and the quality management system shall be subject to regular surveillance.

If a product of the current production does not correspond with the certified product, the Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg is to be informed at the given address on page 1.

This document remains property of the Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg. With revocation of the publication the certificate loses its validity. After the expiration of the validity of the certificate and on requests of the Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg this document shall be returned and the certificate shall no longer be used.

The relevant version of this certificate and the validity is also accessible on the internet address: **www.qal1.de**.

Umwelt Bundesamt

Certificate:
LUBW001430001 / xx.xx.2014

LUBW

Results of the laboratory and field tests of the Synspec GC 955 version 601 (PID) according to E EN 14662-3

Paragraph	Performance characteristics	Symbol	Performance criterion	results		benzene-conc. $c_{benzene}$ [µg/m³]	uncertainty u [µg/m³]	
8.4.3	Short term drift at span value (12 h)	$D_{s,s}$	≤ 2,0 µg/m³	GC 2770:	- 0,94 [µg/m³]	37,5	-	
				GC 2771:	- 1,25 [µg/m³]	37,5	-	
8.4.4	Repeatability at the annual limit value	$s_{r,c(l)}$	≤ 0,25 µg/m³	GC 2770:	0,05 [µg/m³]	5,2	u_r	0,016
				GC 2771:	0,04 [µg/m³]	5,2	u_r	0,012
8.4.5	"Lack of fit", largest residual	r_{max}	≤ 5 %	GC 2770:	1,7 [%]	2,4	u_l	0,05
				GC 2771:	4,2 [%]	2,4	u_l	0,12
8.4.6	Sensitivity coefficient for the influence of the sample gas pressure	b_{gp}	≤ 0,10 (µg/m³)/kPa	GC 2770:	0,09 [(µg/m³)/kPa]	37,4	u_{gp}	0,19
				GC 2771:	0,06 [(µg/m³)/kPa]	37,4	u_{gp}	0,13
8.4.7	Sensitivity coefficient for the influence of the surrounding temperature	b_{st}	≤ 0,08 (µg/m³)/K	GC 2770:	0,07 [(µg/m³)/K]	36,0	u_{st}	0,16
				GC 2771:	0,01 [(µg/m³)/K]	36,0	u_{st}	0,04
8.4.8	Sensitivity coefficient for the influence of the electrical voltage	b_V	≤ 0,08 (µg/m³)/V	GC 2770:	< 0,01 [(µg/m³)/V]	37,4	u_V	0,02
				GC 2771:	< 0,01 [(µg/m³)/V]	37,4	u_V	< 0,02
8.4.9.2	Influence of the interference from relative humidity	b_{H2O}	≤ 0,015 (µg/m³)/(mmol/mol)	GC 2770:	-0,014 [(µg/m³)/(mmol/mol)]	5,5	u_{H2O}	-0,18
				GC 2771:	-0,010 [(µg/m³)/(mmol/mol)]	5,5	u_{H2O}	-0,13
8.4.10	Carry over (Memory effect)	c_m	≤ 1,0 µg/m³	GC 2770:	0,79 [µg/m³]	44,2	u_m	0,05
				GC 2771:	0,94 [µg/m³]	44,2	u_m	0,06
8.5.4	Long term drift	$D_{l,s}$	≤ 10 %	GC 2770:	-7,7 [%]	37,3	$u_{d,l,te}$	-0,22
				GC 2771:	-8,8 [%]	37,3	$u_{d,l,te}$	-0,25
8.5.5	Reproducibility standard deviation	$s_{r,t}$	≤ 0,25 µg/m³	GC 2770:	0,10 [µg/m³]	-	$u_{r,t}$	0,10
				GC 2771:				
8.5.6	Maintenance interval		> 14 Tage	GC 2770:	28 Tage	-	-	
				GC 2771:	28 Tage	-	-	
8.5.7	Availability	A	> 90%	GC 2770:	99,96 [%]	-	-	
				GC 2771:	99,99 [%]	-	-	

Calculation of the uncertainty according to E EN 14662-3:

uncertainty for the laboratory tests:

Paragraph	Performance characteristics	Symbol	Performance criterion	Results	
8.6 / Annex E	combined standard uncertainty	u_c	-	GC 2770:	0,32 [µg/m³]
				GC 2771:	0,24 [µg/m³]
8.6 / Annex E	relative expanded uncertainty	W	< 25 %	GC 2770:	13,0 [%]
				GC 2771:	9,7 [%]

uncertainty for the laboratory and field tests:

Paragraph	Performance characteristics	Symbol	Performance criterion	Results	
8.6 / Annex E	combined standard uncertainty	u_c	-	GC 2770:	0,41 [µg/m³]
				GC 2771:	0,37 [µg/m³]
8.6 / Annex E	relative expanded uncertainty	W	< 25 %	GC 2770:	16,3 [%]
				GC 2771:	14,6 [%]