

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.



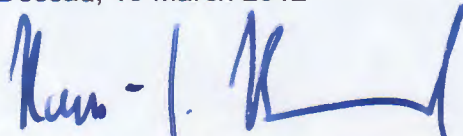
- Certified equivalent EN method
- Complying with 2008/50/EC
- TUV approved
- Annual inspection

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

The certificate is valid until:
01 August 2015

Umweltbundesamt
Dessau, 15 March 2012

TÜV Rheinland Energie und Umwelt GmbH
Köln, 16 March 2012



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Am Grauen Stein
51105 Köln

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

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)

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/m ³

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), PM₁₀-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 PM_{2.5} pre-separator of the company Met One Instruments, Inc. for the measured component PM_{2.5} 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:

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

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 loses 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**.

Certificate:
0000026912_02 / 16 March 2012

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

Initial certification according to EN 15267:

Certificate No 0000026912: 02 August 2010

Validity of the certificate: 01 August 2015

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

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

Update of certification according to EN 15267:

Certificate No 0000026912_01: 19 August 2011

Validity of the certificate: 01 August 2015

Certificate No 0000026912_02: 16 March 2011

Validity of the certificate: 01 August 2015

1st notification on changes to the certificate according to EN 15267:

Statement of TÜV Rheinland Energie und Umwelt GmbH, Köln from 25 September 2010

Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 18:
publication by UBA from 10 January 2011.

2nd notification on changes to the certificate according to EN 15267:

Statement of TÜV Rheinland Energie und Umwelt GmbH, Köln from 24 March 2011

Publication: BAnz. 29 July 2011, No. 113, p. 2725, chapter III, notification 11:
publication by UBA from 15 July 2011.

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 _{c-s}	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	0.971 +/- 0.025	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 _{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	1.822 +/- 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	35.6
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 _{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	14.66	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 +/- 0.952	19.03	100.0
	All Data	253	0.966	1.041 +/- 0.012	0.377 +/- 0.214	16.28	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.