Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040207_01

Certified AMS:	Spirant BAM 1100 with $PM_{2,5}$-pre-separator for particulate matter $PM_{2.5}$
Manufacturer:	Ecotech Pty Ltd. 1492 Ferntree Gully Road Knoxfield, VIC, 3180 Australia
Test Institute:	TÜV Rheinland Energy 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 14907: 2005,
Guide to the Demonstration of Equivalence of Ambient Air Monitoring Methods: 2010
EN 15267-1: 2009 and 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 0000040207 of 29 April 2014.

TÜVRheinland®
CERTIFIED

Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance

www.tuv.com
ID 0000040207

Publication in the German Federal Gazette (BAnz.) of 1 April 2014

This certificate will expire on:
30 June 2020

German Federal Environment Agency
Dessau, 1 April 2019

Dr. Marcel Langner
Head of Section II 4.1

TÜV Rheinland Energy GmbH
Cologne, 31 March 2019

ppa. Dr. Peter Wilbring

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TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Cologne

Certificate:
0000040207_01 / 1 April 2019

Test report:	936/21222754/A of 01 October 2013
Initial certification:	01 April 2014
Date of expiry:	30 June 2020
Publication:	BAnz AT 01 April 2014 B12, chapter IV, No. 6.1

Approved application
The certified AMS is suitable for permanent monitoring of suspended particulate matter $PM_{2,5}$ in ambient air (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test with four different test sites respectively time 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 936/21222754/A of 01 October 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 AT 01 April 2014 B12, chapter IV, No. 6.1)
  Announcement by UBA from 27 February 2014

AMS designation:
Spirant BAM 1100 with $PM_{2,5}$-pre-separator

Manufacturer:
Ecotech Pty Ltd., Knoxfield, Australia

Field of application:
For permanent monitoring of suspended particulate matter $PM_{2,5}$ in ambient air (stationary operation)

Measuring range during the performance test:

Component	Certification range	Unit
$PM_{2,5}$	0 - 1000	µg/m³

Software version:
Version 81237-05 V1.0.0

Restrictions:
None

Notes:

1. The requirements of the “Demonstration of Equivalence of Ambient Air Monitoring Methods” guideline (January 2010 version) are fulfilled for the measuring component $PM_{2,5}$.
2. The system must be fitted with the following options for the measurement of $PM_{2,5}$: sample heating (BX-830), PM_{10} sampling head (BX-802), $PM_{2,5}$ Sharp Cut Cyclone SCC (BX-807), combined pressure and temperature sensor (BX-596) or alternatively surrounding temperature sensor (BX-592).
3. The cycle time during the performance test was 1 h, i.e. automatic filter change was performed every hour. Each filter spot was sampled only once.
4. Sampling time within the cycle time is 42 min.
5. The measuring system must be operated in a lockable measuring container.
6. The measuring system must be regularly calibrated in-situ using the gravimetric $PM_{2,5}$ reference procedure according to DIN EN 14907.
7. The measuring system can optionally be operated with the BX-125 pump.
8. The performance test report can be viewed on the internet at www.qal1.de.

Test institute:
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report No.: 936/21222754/A of 1 October 2013

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

The Spirant BAM 1100 with $PM_{2,5}$ pre-separator is, with the exception of a modified front design and minor adjustments to the device software, absolutely identical to the BAM-1020 measuring system and was developed by MetOne Instruments, Inc. and completely manufactured by MetOne Instruments, Inc.

The Spirant BAM 1100 particulate monitoring system with $PM_{2,5}$ pre-separator consists of the BX-802 PM_{10} sampling head, the $PM_{2,5}$ Sharp Cut Cyclone SCC (BX-807), the sampling tube, the sample heater BX-830, the combined pressure and temperature sensor (BX-596) or alternatively the surrounding temperature sensor (BX-592), the vacuum pump BX-127 or optionally BX-125, the Spirant BAM 1100 measuring system (incl. fibreglass filter belt), the corresponding connection tubes and cables and adaptors, the roof duct incl flange, and the manual in German.

The measuring system works according to the principle of beta reduction.

The particle sample passes through the PM_{10} sampling head and the $PM_{2,5}$ Sharp Cut Cyclon SCC and at a flow rate of 1 m^3/h and travels to the actual Spirant BAM 1100 AMS via the sample tube.

During the performance test the measuring system was operated with the BX-830 sample heating device.

The particles reach the measuring system and are separated from the radiometric measurement on the fiberglass filter belt.

A measuring cycle (incl. automatic testing of radiometric measuring) is performed as follows (setting for $PM_{2,5}$: measuring time for radiometry 8 min):

1. The initial or empty measurement on the clean filter belt I_0 (Beta count rate at the beginning) is performed at the beginning of the cycle. It lasts 8 min.
2. The filter belt is transported forwards over a stretch of 4 dust feeding patches and is inserted underneath the sampling position. Sampling is performed on the filter patch where I_0 was determined previously. The particulated air is then sucked through this filter patch for a sampling time of 42 min.
3. At the same time an I_1 radiometric measurement lasting 8 min is performed for 4 particulated patches back on the filter belt. The measurement is performed to verify possible drift effects caused by changing external influences such as temperature and relative moisture. A third radiometric measurement, I_2, is performed at the same position with span foil having been inserted. Eight minutes before the end of the sampling time, another measurement is performed at the same position on the filter belt I_{1x}, allowing stability at zero point to be monitored using I_1 and I_{1x}.
4. After sampling the filter belt is reversed by 4 particulated patches and the occupied patch is measured radiometrically I_3. The concentration calculation forms the end of the measuring cycle.
5. The next cycle starts with step 1.

Radiometric mass determination is calibrated in the factory and tested hourly at the zero point (vacant filter patch) and span point (installed span foil) as part of internal system quality assurance. The measuring values at zero and span can be easily deduced from the data generated. These values can be compared with the stability requirements (drift) and the nominal value for span (factory settings).

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 Energy 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 Energy GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energy 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**.

Certification of Spirant BAM 1100 with $PM_{2,5}$ pre-separator for particulate matter $PM_{2,5}$ 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. 0000040207: 29 April 2014
Validity of the certificate: 31 March 2019

Test report: 936/21222754/A of 01 October 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 01 April 2014 B12, chapter IV, No. 6.1
Announcement by UBA from 27 February 2014

Renewal of the certificate according to EN 15267

Certificate No. 0000040207_01: 1 April 2019
Validity of the certificate: 30 June 2020

Calculation of overall uncertainty

$PM_{2.5}$ Spirant BAM 1100*	33.1% > 17 µg m-3	Orthogonal Regression				Betw een 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 equivalence testing has been performed in the basis test with the identical measuring devices BAM-1020 of the company Met One Instruments, Inc.

** The investigations for the measuring system Spirant BAM 1100 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.