

PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

Unheated PM₁₀ BAM-1020

manufactured by:

Met One Instruments, Inc

1600 NW Washington Blvd
Grants Pass
Oregon 97526
USA

has been assessed by Sira Certification Service
and for the conditions stated on this certificate complies with:

**Performance Standards for Continuous Ambient Air
Quality Monitoring Systems, Environment Agency, Version 10 dated June 2016**

Certification ranges:

PM₁₀ 0 to 1000µg/m³

Project number: 80056957
Certificate number: Sira MC100185/02
Initial certification: 24 December 2010
This certificate issued: 16 February 2021
Renewal date: 23 December 2025



Andrew Young
Environmental Team Manager

MCERTS is operated on behalf of the Environment Agency by

Sira Certification Service

Unit 6, Hawarden Industrial Park
Hawarden, Deeside, CH5 3US
Tel: +44 (0)1244 670 900



*The MCERTS certificate consists of this document in its entirety.
For conditions of use, please consider all the information within.
This certificate may only be reproduced in its entirety and without change
To authenticate the validity of this certificate please visit www.csagroupuk.org/mcerts*

Certificate contents

Approved site application	2
Basis of certification.....	2
Product certified	3
Certified performance	4
Description.....	8
General notes.....	9

Approved site application

Any potential user should ensure, in consultation with the manufacturer, that the monitoring system is suitable for the intended application. For general guidance on monitoring techniques refer to the Environment Agency technical guidance on monitoring, available at www.mcerts.net

On the basis of these tests this certificate is valid when the instrument is used for urban air quality monitoring and similar applications.

The PM₁₀ field test was conducted at four sites in the UK. The particulate loading at the test sites is representative of different types of areas including urban background, urban traffic, and suburban background locations. The testing took place in both winter and summer months.

The requirements according to the [Guide To The Demonstration Of Equivalence Of Ambient Air Monitoring Methods](#) (GDE 2010) are fulfilled for PM₁₀.

Basis of certification

This certification is based on the following test report(s) and on Sira's assessment and ongoing surveillance of the product and the manufacturing process:

Bureau Veritas	Bureau Veritas Report: AGG04003328/BV/AQ/DH/2658/V3, December 2010
TÜV Rheinland	TÜV-Report: 936/21205333/A dated December 06, 2006

Certificate number: Sira MC100185/02
This certificate issued: 16 February 2021

Product certified

The instrument tested was the Unheated BAM-1020 measuring system consisting of the following parts:

- USEPA design PM₁₀ sampling inlet. Sampling tube;
- BAM-1020 beta attenuation mass measuring system.
- Vacuum pump;

The operation of instrument versions other than the above is not covered by this certificate. Some of the other aspects of the application of the instrument have already been reviewed. These are:

- The standard filter tape used in the Met One BAM 1020 series of particulate monitors is made from glass fibre, which is commonly available. However, the filter tape used in the BAM 1020 series of instruments has critical and customised characteristics, and as such, all filter tapes should be obtained directly from Met One or from one of its authorised dealers. Met One has historically supplied a standard filter tape (product number 460130). This was employed in all the four field test programmes discussed in this certificate. Met One has more recently qualified one additional tape manufacturer (Whatman, Germany, product number 460180). Supporting evidence has been reviewed and considered to be satisfactory. This certificate requires the use of one of the designated filter tapes discussed.
- Newer instruments are installed with the application of a mass flow controller to ensure flow stability and compensation of changes due to filter loading.
- This certificate applies to all Unheated PM₁₀ BAM-1020 instruments with serial number D0001 onwards and fitted with Software Version 3236-02 2.5.0 onwards.

Certificate number: Sira MC100185/02
This certificate issued: 16 February 2021

Certified performance

The instrument was evaluated for use under the following environmental conditions:

Ambient Temperature Range: +5°C to +40°C

Laboratory tests

Test	Results	MCERTS specification requirement
Constancy of the sample volumetric flow	2.5%	To remain constant within $\pm 3\%$ of the rated value
Tightness of the sampling system	0.6% maximum	Leakage not to exceed 1% of the sampled volume
Maintenance interval	Four weeks Note 1 Note 2	\geq Two weeks

Certificate number: Sira MC100185/02
 This certificate issued: 16 February 2021

*This certificate may only be reproduced in its entirety and without change
 To authenticate the validity of this certificate please visit www.csagroupuk.org/mcerts*

Field tests

Field test data set, instrument numbers and site details	Uncorrected results	Results corrected for slope	MCERTS specification requirement
Between sampler/instrument uncertainty for the standard method PM₁₀ Full data set <30 µg/m ³ ≥30 µg/m ³	1.11 µg/m ³ 1.10 µg/m ³ 1.12 µg/m ³	No correction	≤ 2.0µg/m ³ Not specified Not specified
Between sampler instrument uncertainty for the candidate method Full data set <30 µg/m ³ ≥30 µg/m ³	2.06 µg/m ³ 1.69 µg/m ³ 2.67 µg/m ³	1.71 µg/m ³ 1.41 µg/m ³ 2.22 µg/m ³	≤2.5 µg/m ³ ≤2.5 µg/m ³ ≤2.5 µg/m ³
Expanded uncertainty calculated at 50 µg/m ³ for Instrument D1428 Full data set ≥30 µg/m ³ Individual sites Teddington Winter Teddington Summer Bristol Summer Bristol Winter	50.9% 48.4% 37.7% 44.1% 63.4% 56.7%	13.2% 13.1% 11.1% 8.9% 20.3% 16.7%	≤25% ≤25% ≤25% ≤25% ≤25% ≤25%
Expanded uncertainty calculated at 50 µg/m ³ for Instrument D1429 Full data set ≥30 µg/m ³ Individual sites Teddington Winter Teddington Summer Bristol Summer Bristol Winter	35.5% 32.7% 24.8% 21.9% 50.5% 42.5%	13.1% 16.6% 18.8% 19.3% 11.1% 14.1%	≤25% ≤25% ≤25% ≤25% ≤25% ≤25%

Certificate number: Sira MC100185/02
 This certificate issued: 16 February 2021

Field test data set, instrument numbers and site details	Uncorrected results	Results corrected for slope	MCERTS specification requirement
Expanded uncertainty calculated at 50 µg/m ³ for Instrument D1427		Note 3 Note 4	
Full data set	57.7%	16.0%	≤25%
≥30 µg/m ³	49.0%	9.4%	≤25%
Individual sites			
Birmingham Winter	53.9%	14.0%	≤25%
Birmingham Summer	50.2%	9.9%	≤25%
East Kilbride Summer	83.7%	34.9%	≤25%
East Kilbride Winter	90.4%	39.8%	≤25%
Expanded uncertainty calculated at 50 µg/m ³ for Instrument D1426			
Full data set	35.9%	11.5%	≤25%
≥30 µg/m ³	32.8%	11.2%	≤25%
Individual sites			
Birmingham Winter	32.2%	11.9%	≤25%
Birmingham Summer	36.5%	9.0%	≤25%
East Kilbride Summer	67.9%	22.5%	≤25%
East Kilbride Winter	80.7%	31.0%	≤25%

Note 1: Maintenance interval declared by the manufacturer

Note 2: The results of the flow tests, leak tests and maintenance intervals are taken from the TUV Rheinland Heated PM10 BAM 1020 Report. The BAM 1020 is manufactured using the same pneumatic train components regardless of whether the unit has the Smart Heater Option.

Note 3: The CM does not fulfil the relevant Data Quality Objective of EU Directive 2008/50/EC when used without correction of raw data, therefore the test results were also subjected to correction for the intercept, slope and both slope and intercept. Expanded uncertainties for the Candidate Method were calculated for both uncorrected datasets as well as data that have been adjusted for slope and/or intercept. **Slope correction of dividing by 1.2 (or multiplying by 0.833) is sufficient in order to make the Unheated PM₁₀ BAM-1020 equivalent.** It is not necessary to correct for intercept, but it is essential that thorough and frequent on-going QA/QC procedures are employed (as prescribed in CEN/TS16450) to quantify analyser baseline performance and ensure that the instrument specific baseline correction factor programmed in to the instrument is correctly monitored and maintained.

Certificate number: Sira MC100185/02
This certificate issued: 16 February 2021

Note 4: As the concentrations in East Kilbride were very low, an expanded uncertainty greater than 25% at this site is not considered to constitute sufficient evidence for a candidate instrument to be excluded. Rather, it reflects the problems associated with regression calculations where there is a significant scatter in data restricted to a narrow range.

Additional notes

- For the purposes of quality control the Unheated PM10 BAM-1020 should be calibrated on test sites at prescribed intervals against the gravimetric reference method EN 12341:2014, as given in the recommendations of the GDE 2010 and CEN/TS16450.
- The instruments tested were operated at the default measurement range of 0 to 1000 $\mu\text{g}/\text{m}^3$ for hourly averages. The maximum 24 hour average concentration recorded during the tests was 58.0 $\mu\text{g}/\text{m}^3$.

Certificate number: Sira MC100185/02
This certificate issued: 16 February 2021

Description

The Unheated PM₁₀ BAM-1020 Ambient Particulate Monitor is used to sample PM₁₀ by using a 16.7 l/min USEPA style PM₁₀ inlet.

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:

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

where:

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. During routine operation of the instrument this is checked hourly both on the clean filter prior to collection of the sample and using the built-in reference foil. The values obtained can be compared with any stability requirements (such as drift effects) relative to the values obtained during factory calibration.

One measurement cycle (incl. automatic check of the radiometric measurement) consists of the following steps (setting: measuring time for radiometry 4 min):

1. The initial count of the clean filter tape I_0 is performed at the beginning of the cycle for a period of four 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 50 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 four 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. Four 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.

Certificate number: Sira MC100185/02
This certificate issued: 16 February 2021

General notes

1. This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the standard(s) and performance criteria defined in this certificate. 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 system shall be subject to regular surveillance according to 'Regulations applicable to the holders of Sira certificates'.
2. The design of the product certified is held and maintained by TUV Rheinland for certificate No. Sira MC100185/02.
3. If a certified product is found not to comply, Sira should be notified immediately at the address shown on this certificate.
4. The certification marks that can be applied to the product or used in publicity material are defined in 'Regulations applicable to the holders of Sira certificates'.
5. This document remains the property of Sira and shall be returned if requested by Sira.

Certificate number: Sira MC100185/02
This certificate issued: 16 February 2021