

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040213_02

AMS designation: Model 5014i Beta with PM_{2.5} pre-separator for particulate matter PM_{2.5}

Manufacturer: Thermo Fisher Scientific
27, Forge Parkway
Franklin, MA 02038
USA

Test Laboratory: TÜV Rheinland Energy GmbH

**This is to certify that the AMS has been tested
and found to comply with the standards:
VDI 4202-1 (2010), VDI 4203-3 (2010), 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
(this certificate contains 9 pages).
The present certificate replaces certificate 0000040213_01 of 01 April 2019.



Suitability Tested
Equivalent to
2008/50/EC
EN 15267
Regular Surveillance
www.tuv.com
ID 0000040213

Publication in the German Federal Gazette
(BAnz) of 01 April 2014

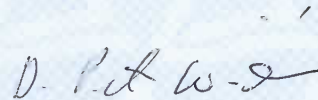
German Federal Environment Agency
Dessau, 01 July 2020



Dr. Marcel Langner
Head of Section II 4.1

This certificate will expire on:
30 June 2025

TÜV Rheinland Energy GmbH
Cologne, 30 June 2020



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Test institute accredited to EN ISO/IEC 17025 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to certificate D-PL-11120-02-00.

Test Report:	936/21209885/H dated 20 September 2013
Initial certification:	01 April 2014
Expiry date:	30 June 2025
Certificate:	Renewal (of previous certificate 0000040213_01 dated 01 April 2019 valid until 30 June 2020)
Publication:	BAnz AT 01.04.2014 B12, chapter IV number 6.2

Approved application

The tested AMS is suitable for continuous ambient air monitoring of suspended particulate matter, PM_{2.5} fraction (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test performed at four different sites and/or different periods.

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

The notification of suitability of the AMS, performance testing and the uncertainty calculation have been effected on the basis of the regulations applicable at the time of testing. As changes in legal provisions are possible, any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for monitoring the AMS readings relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended purpose.

Basis of the certification

This certification is based on:

- Test report no. 936/21209885/H dated 20 September 2013 issued by TÜV Rheinland Energie und Umwelt GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz AT 01.04.2014 B12, chapter IV number 6.2, UBA announcement dated 27 February 2014:

AMS designation:

Model 5014i Beta with PM_{2.5} pre-separator for particulate matter PM_{2.5}

Manufacturer:

Thermo Fisher Scientific, Franklin, USA

Field of application:

For continuous ambient air monitoring of suspended particulate matter, PM_{2.5} (stationary operation)

Measuring range during performance testing:

Component	Certification range	Unit
PM _{2.5}	0–1 000	µg/m ³

Software version:

V02.00.00.232+

Restrictions:

None

Notes:

1. The measuring system complies with the requirements of the guide to “Demonstration of Equivalence of Ambient Air Monitoring Methods” for the component PM_{2.5}.
2. The measuring system must be operated inside a lockable measurement container.
3. The instrument must be calibrated on-site regularly using a gravimetric PM_{2.5} reference method in accordance with EN 14907.
4. It is recommended to operate the measuring system with the threshold for the relative humidity being 58%, especially at sites where the ratio of volatiles in suspended particulate matter is particularly high.
5. The test report on performance testing is available on the internet at www.gal1.de.

Test Report:

TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report no.: 936/21209885/H dated 20 September 2013

Publication in the German Federal Gazette: BAnz AT 05.08.2014 B11, chapter V notification 24, UBA announcement dated 17 July 2014:

24 Notification as regards Federal Environment Agency (UBA) notice of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 6.2)

The flow and vacuum sensor of the Model 5014i Beta measuring system with PM_{2.5} pre-separator manufactured by Thermo Fisher Scientific will be equipped with an inner parylene coating in the future. The associated sensor plate is positioned vertically inside the instrument.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 29 March 2014

Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, chapter IV notification 23, UBA announcement dated 25 February 2015:

23 Notification as regards Federal Environment Notices (UBA) of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 6.2) and of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter V 24th notification)

The latest software version of the of the model 5014i Beta with PM_{2.5} pre-separator for suspended particulate matter PM_{2.5} manufactured by Thermo Fisher Scientific is: V 02.02.05 (111578-00).

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 22 September 2014

Publication in the German Federal Gazette: BAnz AT 14.03.2016 B7, chapter V notification 16, UBA announcement dated 18 February 2016:

16 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 6.2) and of 25 February 2015 (BAnz AT 02.04.2015 B5, chapter IV 23rd notification)

The model 5014i Beta with PM_{2.5} pre-separator for particulate matter PM_{2.5} manufactured by Thermo Fisher Scientific can also be operated with the GAST 87R647-PDS-HV-913 vacuum pump.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 22 October 2015

Publication in the German Federal Gazette: BAnz AT 22.07.2019 B8, chapter V notification 20, UBA announcement dated 28 June 2019:

20 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 6.2) and of 18 February 2016 (BAnz AT 14.03.2016 B7, chapter V 16th notification)

Instead of the MOLON MOTOR & COILCORP engine type CHM-2401-1M, a TEPUMOTOR type TP-77 engine can be used for the model 5014i Beta measuring system with PM_{2.5} pre-separator, for suspended particulate matter PM_{2.5} fraction, manufactured by Thermo Fisher Scientific.

Statement issued by TÜV Rheinland Energy GmbH dated 6 March 2019

Certified product

This certification applies to automated measurement systems conforming to the following description:

The ambient air measuring system consists of the PM_{2.5} sampling head, the heated sampling tube (dynamic heating system DHS), the (optional) extension tube, the ambient air sensor (incl. radiation protection shield), the vacuum pump, the central unit 5014i incl. fiberglass filter belt, the respective corresponding connection lines, cables and adapters, the roof duct incl. flange and the manual in German.

The model 5014i Beta ambient air measuring system uses beta attenuation as its measuring principle.

The particle sample passes through the PM_{2.5} sampling head at a flow rate of 1 m³/h (=16.67 l/min) and flows to the actual model 5014i Beta measuring system via the heated sampling tube (DHS = dynamic heating system).

The 5014i measuring system housing is located directly beneath the heated tube – the fine dust passes from the sampling tube into the radial tube above the radiometric assembly.

The particles are then separated on the fibre glass filter tape of the radiometric measuring system. The filter tape is located between the proportional detector and the ¹⁴C beta emitter. The beta ray travels upwards through the filter tape and the accumulating dust layer. The increasing dust load attenuates the beta ray intensity, which in turn reduces the beta intensity measured by the proportional detector. The mass on the filter tape is calculated from the continuous integrated count rate.

In order to maintain the sample flow at its nominal value the flow and the regulation of the proportional valve are measured continuously.

The PM concentrations are displayed at the front of the measuring system as PM (=radiometric measurement values). The measurement values can be provided as data in a variety of output forms (analogue, digital, Ethernet).

General remarks

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 manufacturing process for 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 document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at qal1.de.

Document history

Certification of the Model 5014i Beta with PM_{2.5} pre-separator is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Initial certification according to EN 15267

Certificate no. 0000040213: 29 April 2014
Expiry date of the certificate: 31 March 2019
Test report: 936/21209885/H dated 20 September 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 01.04.2014 B12, chapter IV number 6.2
UBA announcement dated 27 February 2014

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 29 March 2014
Publication: BAnz AT 05.08.2014 B11, chapter V notification 24
UBA announcement dated 17 July 2014
(Design changes)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 22 September 2014
Publication: BAnz AT 02.04.2015 B5, chapter IV notification 23
UBA announcement dated 25 February 2015
(software updates)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 22 October 2015
Publication: BAnz AT 14.03.2016 B7, chapter V notification 16
UBA announcement dated 18 February 2016
(Design changes)

Renewal of the certificate

Certificate no. 0000040213_01: 01 April 2019
Expiry date of the certificate: 30 June 2020

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energy GmbH dated 6 March 2019
Publication: BAnz AT 22.07.2019 B8, chapter V notification 20
UBA announcement dated 28 June 2019
(Design changes)

Renewal of the certificate

Certificate no. 0000040213_02: 01 July 2020
Expiry date of the certificate: 30 June 2025

Calculation of total uncertainty

PM2.5 5014i Beta	28% ≥ 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	19.9	207	0.972	1.070 +/- 0.013	0.216 +/- 0.220	0.61	1.24
< 18 µg m-3	25.1	156	0.856	1.113 +/- 0.034	-0.058 +/- 0.330	0.56	1.15
≥ 18 µg m-3	20.6	51	0.965	1.100 +/- 0.029	-0.952 +/- 0.902	0.76	1.69

SN1	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	Bornheim Winter	41	0.979	1.090 +/- 0.025	-0.155 +/- 0.620	21.28	56.1
	Cologne Winter	41	0.976	1.083 +/- 0.027	0.331 +/- 0.602	22.45	53.7
	Bornheim Summer	78	0.940	1.078 +/- 0.030	0.247 +/- 0.422	22.61	15.4
	Teddington Summer	55	0.834	1.023 +/- 0.057	0.028 +/- 0.487	13.12	3.6
Combined Datasets	< 18 µg m-3	163	0.842	1.138 +/- 0.035	-0.383 +/- 0.347	28.01	4.3
	≥ 18 µg m-3	52	0.963	1.118 +/- 0.030	-1.220 +/- 0.928	22.50	100.0
	All Data	215	0.969	1.089 +/- 0.013	-0.062 +/- 0.229	22.01	27.4

SN2	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	Bornheim Winter	41	0.969	1.110 +/- 0.031	-0.584 +/- 0.768	24.45	56.1
	Cologne Winter	43	0.971	1.046 +/- 0.028	1.333 +/- 0.615	22.24	53.5
	Bornheim Summer	70	0.941	0.923 +/- 0.027	1.735 +/- 0.387	13.46	15.7
	Teddington Summer	65	0.787	0.982 +/- 0.057	0.613 +/- 0.483	12.50	3.1
Combined Datasets	< 18 µg m-3	168	0.810	1.125 +/- 0.038	-0.031 +/- 0.367	28.37	4.8
	≥ 18 µg m-3	51	0.951	1.099 +/- 0.035	-1.296 +/- 1.076	21.92	100.0
	All Data	219	0.960	1.056 +/- 0.014	0.430 +/- 0.247	20.38	26.9

Calculation of the total uncertainty, corrected by the slope

PM2.5 5014i Beta Slope Corrected	28% ≥ 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	12.0	207	0.972	0.999 +/- 0.012	0.215 +/- 0.205	0.61	1.16
< 18 µg m-3	13.1	156	0.856	1.035 +/- 0.032	-0.005 +/- 0.309	0.56	1.07
≥ 18 µg m-3	14.6	51	0.965	1.026 +/- 0.027	-0.855 +/- 0.843	0.76	1.58

SN1	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	Bornheim Winter	41	0.979	1.018 +/- 0.023	-0.130 +/- 0.580	12.30	56.1
	Cologne Winter	41	0.976	1.011 +/- 0.025	0.325 +/- 0.563	12.47	53.7
	Bornheim Summer	78	0.940	1.005 +/- 0.028	0.254 +/- 0.394	14.12	15.4
	Teddington Summer	55	0.834	0.950 +/- 0.053	0.071 +/- 0.455	14.99	3.6
Combined Datasets	< 18 µg m-3	163	0.842	1.057 +/- 0.033	-0.301 +/- 0.325	15.20	4.3
	≥ 18 µg m-3	52	0.963	1.044 +/- 0.028	-1.102 +/- 0.867	15.36	100.0
	All Data	215	0.969	1.017 +/- 0.012	-0.043 +/- 0.214	13.05	27.4

SN2	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	Bornheim Winter	41	0.969	1.036 +/- 0.029	-0.522 +/- 0.717	15.84	56.1
	Cologne Winter	43	0.971	0.977 +/- 0.026	1.265 +/- 0.575	12.81	53.5
	Bornheim Summer	70	0.941	0.860 +/- 0.026	1.641 +/- 0.362	20.89	15.7
	Teddington Summer	65	0.787	0.910 +/- 0.053	0.631 +/- 0.451	18.17	3.1
Combined Datasets	< 18 µg m-3	168	0.810	1.044 +/- 0.035	0.040 +/- 0.343	15.74	4.8
	≥ 18 µg m-3	51	0.951	1.025 +/- 0.033	-1.160 +/- 1.005	17.88	100.0
	All Data	219	0.960	0.985 +/- 0.013	0.420 +/- 0.230	13.92	26.9