

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040213_03

Certified AMS: Modell 5014i Beta with PM_{2,5}- pre-separator

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

Test Institute: TÜV Rheinland Energy & Environment 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 for Demonstration of Equivalence of Ambient Air Monitoring Methods (2010)
as well as EN 15267-1 (2009) and EN 15267-2 (2023).**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 10 pages).
The present certificate replaces certificate 0000040213_02 dated 1 July 2020.



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

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

German Environment Agency

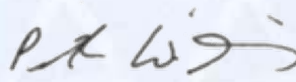
Dessau, 27 June 2025

This certificate will expire on:
30 June 2030

TÜV Rheinland Energy &
Environment GmbH
Cologne, 26 June 2025



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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 the certificate D-PL-11120-02-00.

Test report: 936/21209885/H dated 20 September 2013
Initial certification: 1 April 2014
Expiry date: 30 June 2030
Certificate: Renewal (of previous certificate 0000040213_02 of 1 July 2020 valid until 30 June 2025)
Publication: BAnz AT 01.04.2014 B12, chapter IV No. 6.2

Approved application

The tested AMS is suitable for continuous immission measurement of PM_{2,5} in stationary use.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test at four different locations with different time 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 that this AMS is suitable for monitoring the measured values relevant to the application.

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

Basis of the certification

This certification is based on:

- Test report 936/21209885/H dated 20 September 2013 of 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 No. 6.2,
Announcement by UBA 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 ranges during the performance test:

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.qal1.de.

Test institute: 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, Chap. V notification 24, Announcement by UBA dated 17 July 2014:

24 Notification as regards Federal Environmental Agency notices of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV, No. 6.2)

The flow sensor and the vacuum sensor of the Model 5014i Beta measuring system with PM_{2,5}-pre-separator for monitoring suspended particulate matter PM_{2,5} manufactured by Thermo Fisher Scientific will hereafter come with internal parylene coating. The corresponding sensor board will now be mounted vertically within the instrument.

Statement by TÜV Rheinland Energie und Umwelt GmbH of 29 March 2014

Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, Chap. IV notification 23, Announcement by UBA dated 25 February 2015:

23 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 17 July 2014 (BAnz AT 05.08.2014 B11 chapter V notification 24)

The current software version for the Model 5014i Beta measuring system with PM_{2,5} pre-separator for the suspended particulate matter PM_{2,5}, manufactured by Thermo Fisher Scientific, is:
V 02.02.05 (111578-00).

Statement by TÜV Rheinland Energie und Umwelt GmbH of 22 September 2014

Publication in the German Federal Gazette: BAnz AT 14.03.2016 B7, Chap. V notification 16, Announcement by UBA 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 notification 23)

The 5014i Beta measuring system with PM_{2,5} pre-separator for suspended particulate matter PM_{2,5} manufactured by Thermo Fisher Scientific can be operated with the vacuum pump type GAST 87R647-PDS-HV-913 also.

Statement by TÜV Rheinland Energie und Umwelt GmbH of 22 October 2015

Publication in the German Federal Gazette: BAnz AT 22.07.2019 B8, Chap. V notification 20,
Announcement by UBA 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 notification 16)**

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 by TÜV Rheinland Energy GmbH of 6 March 2019

Publication in the German Federal Gazette: BAnz AT 05.08.2021 B5, Chap. IV notification 4,
Announcement by UBA dated 29 June 2021:

**4 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 28 June 2019 (BAnz AT 22.07.2019 B8, chapter V notification 20)**

The measuring head of the ambient air monitoring system, Model 5014i Beta, with
PM_{2,5} pre-separator for PM_{2,5} suspended particulate matter manufactured by the
company Thermo Fisher Scientific was modified to increase operational safety with
regard to potential leakages.

The latest software version of the measuring system is:

V 03.00.01 (111578-00)

In addition to this revision number, the following interim version is also valid:

V 03.00.00 (111578-00)

Statement by TÜV Rheinland Energy GmbH dated 24 February 2021

Publication in the German Federal Gazette: BAnz AT 20.03.2023 B6, Chap. IV
notification 86, Announcement by UBA dated 21 February 2023:

**86 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 29 June 2021 (BAnz AT 05.08.2021 B5, chapter IV notification 4)**

The current software version of the measuring system Model 5014i Beta with PM_{2,5}
pre-separator for suspended particulate matter PM_{2,5} from Thermo Fisher Scientific
is:

V 03.00.05.268

Version V 03.00.03.261 can also be used.

Statement by TÜV Rheinland Energy GmbH dated 16 February 2022

Certified product

This certificate 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.

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 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 & Environment 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 certification mark may be applied to the product or used in advertising materials for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energy & Environment 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 & Environment GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and its expiration is also accessible on the internet: gal1.de.

History of documents

Certification of Modell 5014i Beta mit PM_{2,5}-Vorabscheider 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. 0000040213_00: 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
Publication: BAnz AT 01.04.2014 B12, chapter IV number 6.2
UBA announcement dated 27 February 2014

Notifications

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
(Hardware 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 changes)

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
(Hardware changes)

Renewal of certificates

Certificate No. 0000040213_01: 1 April 2019
Expiry date of the certificate: 30 June 2020

Notifications

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
(Hardware changes)

Renewal of certificates

Certificate No. 0000040213_02: 1 July 2020
Expiry date of the certificate: 30 June 2025

Notifications

Statement issued by TÜV Rheinland Energy GmbH dated 24 February 2021
Publication: BAnz AT 05.08.2021 B5, chapter IV notification 4
UBA announcement dated 29 June 2021
(Soft- and hardware change)

Statement issued by TÜV Rheinland Energy GmbH dated 16 February 2022
Publication: BAnz AT 20.03.2023 B6, chapter IV notification 86
UBA announcement dated 21 February 2023
(Software changes)

Renewal of certificates

Certificate No. 0000040213_03: 27 June 2025
Expiry date of the certificate: 30 June 2030

Calculation of total uncertainty

PM2.5 5014i Beta	28% $\geq 17 \mu\text{g m}^{-3}$	Orthogonal Regression				Between Instrument Uncertainties	
	$W_{CM} / \%$	n_{C-S}	r^2	Slope (b) $\pm u_b$		Intercept (a) $\pm u_a$	Reference Candidate
All Data	19.9	207	0.972	1.070	± 0.013	0.216 ± 0.220	0.61 1.24
< 18 $\mu\text{g m}^{-3}$	25.1	156	0.856	1.113	± 0.034	-0.058 ± 0.330	0.56 1.15
$\geq 18 \mu\text{g m}^{-3}$	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 $\mu\text{g m}^{-3}$	
		n_{C-S}	r^2	Slope (b) $\pm u_b$		Intercept (a) $\pm u_a$	$W_{CM} / \%$ % $\geq 17 \mu\text{g m}^{-3}$
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 $\mu\text{g m}^{-3}$	163	0.842	1.138	± 0.035	-0.383 ± 0.347	28.01 4.3
	$\geq 18 \mu\text{g m}^{-3}$	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 $\mu\text{g m}^{-3}$	
		n_{C-S}	r^2	Slope (b) $\pm u_b$		Intercept (a) $\pm u_a$	$W_{CM} / \%$ % $\geq 17 \mu\text{g m}^{-3}$
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 $\mu\text{g m}^{-3}$	168	0.810	1.125	± 0.038	-0.031 ± 0.367	28.37 4.8
	$\geq 18 \mu\text{g m}^{-3}$	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				Betw een 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