

# CERTIFICATE

## of Product Conformity (QAL1)

Certificate No.: 0000040213

**Certified AMS:** Model 5014i Beta with PM<sub>2.5</sub>-pre-separator for particulate matter  
PM<sub>2.5</sub>

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

**Test Institute:** TÜV Rheinland Energie und Umwelt GmbH

**This is to certify that the AMS has been tested  
and found to comply with:**

**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  
(see also the following pages).

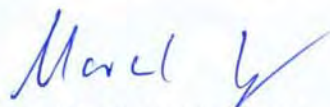


Suitability Tested  
Complying with  
2008/50/EC  
EN 15267  
Regular  
Surveillance

www.tuv.com  
ID 0000040213

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

German Federal Environment Agency  
Dessau, 29 April 2014



i. A. Dr. Marcel Langner

This certificate will expire on:  
31 March 2019

TÜV Rheinland Energie und Umwelt GmbH  
Cologne, 28 April 2014



ppa. Dr. Peter Wilbring

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Am Grauen Stein  
51105 Cologne

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

**Certificate:**  
0000040213 / 29 April 2014

**Test report:** 936/21209885/H of 20 September 2013  
**Initial certification:** 01 April 2014  
**Date of expiry:** 31 March 2019  
**Publication:** BAnz AT 01 April 2014 B12, chapter IV, No. 6.2

**Approved application**

The certified AMS is suitable for permanent monitoring of suspended particulate matter PM<sub>2.5</sub> 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 at 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 936/21209885/H of 20 September 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. 6.2)  
Announcement by UBA from 27 February 2014



**AMS designation:**

Model 5014i Beta with PM<sub>2.5</sub>-pre-separator for particulate matter PM<sub>2.5</sub>

**Manufacturer:**

Thermo Fisher Scientific, Franklin, USA

**Field of application:**

For permanent monitoring of suspended particulate matter PM<sub>2.5</sub> in ambient air (stationary operation).

**Measuring range during the performance test:**

Component	Certification range	Unit
PM <sub>2.5</sub>	0 - 1000	µg/m <sup>3</sup>

**Software version:**

V02.00.00.232+

**Restrictions:**

None

**Notes:**

1. The requirements of the Guide "Demonstration of Equivalence of Ambient Air Monitoring Methods" are fulfilled for the measuring component PM<sub>2.5</sub>.
2. The measuring system must be operated in a lockable measuring cabinet.
3. The measuring system must be regularly calibrated on location with the gravimetric PM<sub>2.5</sub> reference method according to 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 significantly high.
5. The performance test report can be viewed on the internet at [www.qal1.de](http://www.qal1.de).

**Test institute:**

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

### Certified product

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

The ambient air measuring device consists of the PM<sub>2.5</sub> 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 is based on the beat reduction measuring principle.

The particle sample passes through the PM<sub>2.5</sub> sampling head with a flow rate of 1 m<sup>3</sup>/h (=16.67 l/min) and flows via the heated sampling tube (DHS = dynamic heating system) to the actual model 5014i Beta measuring 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 fiberglass filter belt of the radiometric measuring system. The filter belt is located between the proportional detector and the <sup>14</sup>C beta emitter. The beta ray travels upwards through the filter belt and the accumulating dust layer. The intensity of the beta ray is reduced by the increasing dust load, which then leads to a reduced beta intensity that is measured by the proportional detector. The mass on the filter belt 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 shown on the display on 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 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 is presented on page 1 of this certificate.

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 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: **qal1.de**.

Certification of Model 5014i Beta with PM<sub>2,5</sub>-pre-separator for particulate matter PM<sub>2,5</sub> 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: 29. April 2014

Validity of the certificate: 31 March 2019

Test report: 936/21209885/H of 20 September 2013  
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Publication: BAnz AT 01 April 2014 B12, chapter IV, No. 6.2  
Announcement by UBA from 27 February 2014



**Calculation of overall uncertainty**

PM2.5 5014i Beta	28% ≥ 17 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W <sub>CM</sub> / %	n <sub>C-S</sub>	r <sup>2</sup>	Slope (b) +/- u <sub>b</sub>	Intercept (a) +/- u <sub>a</sub>	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 <sub>C-S</sub>	r <sup>2</sup>	Slope (b) +/- u <sub>b</sub>	Intercept (a) +/- u <sub>a</sub>	W <sub>CM</sub> / %	% ≥ 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 <sub>C-S</sub>	r <sup>2</sup>	Slope (b) +/- u <sub>b</sub>	Intercept (a) +/- u <sub>a</sub>	W <sub>CM</sub> / %	% ≥ 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 overall uncertainty, slope corrected**

PM2.5 5014i Beta Slope Corrected	28% ≥ 17 µg m-3	Orthogonal Regression				Between Instrument Uncertainties	
	W <sub>CM</sub> / %	n <sub>C-S</sub>	r <sup>2</sup>	Slope (b) +/- u <sub>b</sub>	Intercept (a) +/- u <sub>a</sub>	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 <sub>C-S</sub>	r <sup>2</sup>	Slope (b) +/- u <sub>b</sub>	Intercept (a) +/- u <sub>a</sub>	W <sub>CM</sub> / %	% ≥ 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 <sub>C-S</sub>	r <sup>2</sup>	Slope (b) +/- u <sub>b</sub>	Intercept (a) +/- u <sub>a</sub>	W <sub>CM</sub> / %	% ≥ 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

# CONFIRMATION

Notification: 0000040213\_00\_01\_rev1  
on changes according to EN 15267 regarding certificate 0000040213 dated 29 April 2014

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**Measuring system:** Model 5014i Beta with PM<sub>2.5</sub>-pre-separator for particulate matter PM<sub>2.5</sub>

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

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## German Federal Environmental Agency (UBA)

Announcement about the uniform practice in  
monitoring emissions and ambient air.

17 July 2014

Federal Gazette BAnz AT 05.08.2014 B11

V. Notifications to the uniform practice for the continuous monitoring of  
emissions and ambient air:

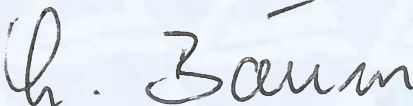
24 Notification as regards Federal Environmental Agency notices of 27 February 2014  
(Federal Gazette (BAnz) AT 01.04.2014 B12, chapter IV, no. 6.2)

The flow sensor and the vacuum sensor of the Model 5014i Beta measuring system with PM<sub>2.5</sub>-pre-separator for monitoring suspended particulate matter PM<sub>2.5</sub> 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 of TÜV Rheinland Energie und Umwelt GmbH of 29 March 2014

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TÜV Rheinland Energie und Umwelt GmbH  
Cologne, 8 September 2014

  
i. A. Dipl.-Ing. Guido Baum

  
i. A. Dipl. Ing. Carsten Röllig

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Am Grauen Stein  
51105 Cologne

Test institute accredited to EN ISO/IEC 17025:2005 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.



# CONFIRMATION

Notification: 0000040213\_00\_02\_rev1  
on changes according to EN 15267 regarding certificate 0000040213 dated 29 April 2014

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**Measuring system:** Modell 5014i Beta with PM<sub>2.5</sub>-pre-separator  
for particulate matter PM<sub>2.5</sub>

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

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## German Federal Environmental Agency (UBA)

Announcement about the uniform practice in  
monitoring emissions and ambient air.

25 February 2015

Federal Gazette BAnz AT 02 April 2015 B5

IV. Notifications to the uniform practice for the continuous monitoring of  
emission and ambient air:

23 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2014  
(Federal Gazette (BAnz) AT 01 April 2014 B12, chapter IV number 6.2) and of 17 July 2014  
(Federal Gazette (BAnz) AT 05 August 2014 B11, chapter V 24<sup>th</sup> notification)

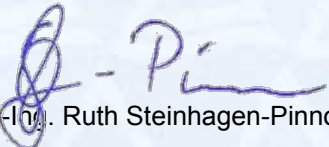
The current software version for the Model 5014i Beta measuring system with PM<sub>2.5</sub> pre-  
separator for the suspended particulate matter PM<sub>2.5</sub>, manufactured by Thermo Fisher Scientific,  
is:

V 02.02.05 (111578-00).

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

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TÜV Rheinland Energie und Umwelt GmbH  
Cologne, 30. April 2015

  
i. A. Dipl.-Ing. Ruth Steinhagen-Pinnow

  
i. A. Dipl. Ing. Carsten Röllig

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limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

# CONFIRMATION

Notification: 0000040213\_00\_03  
on changes according to EN 15267 regarding certificate 0000040213\_00 dated 29 April 2014

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**Measuring system:** 5014i Beta with PM<sub>2.5</sub>- pre-separator for floating-dust PM<sub>2.5</sub>  
**Manufacturer:** Thermo Fisher Scientific  
27, Forge Parkway  
Franklin, MA 02038  
USA

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**German Federal Environmental Agency (UBA)**

**Announcement about the uniform practice in  
monitoring emissions and ambient air  
dated 14 March 2016  
Federal Gazette: BAnz AT 14.03.2016 B7**

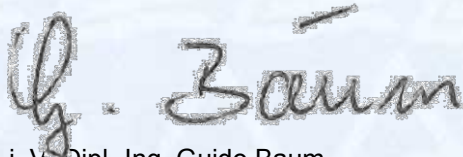
- V. **Notifications to the uniform practice for the continuous monitoring of  
emission and ambient air:**
- 16 **Notification as regards Federal Environment Agency (UBA) notices of  
27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 6.2) and of  
25 February 2015 (BAnz AT 02.04.2015 B5, chapter IV notification 23)**

The 5014i Beta measuring system with PM<sub>2.5</sub> pre-separator for suspended  
particulate matter PM<sub>2.5</sub> manufactured by Thermo Fisher Scientific can be  
operated with the vacuum pump type GAST 87R647-PDS-HV-913 also.

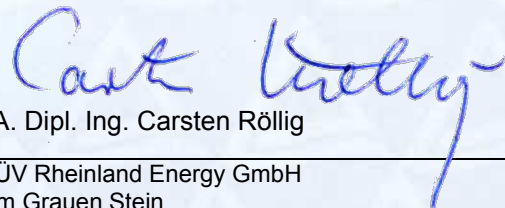
Statement of TÜV Rheinland Energie und Umwelt GmbH of 22 October 2015

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TÜV Rheinland Energy GmbH  
Cologne, 26 April 2016



i. V. Dipl.-Ing. Guido Baum



i. A. Dipl. Ing. Carsten Röllig

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