

CERTIFICATE

on Product Conformity (QAL1)

Number of Certificate: 0000036949

Certified AMS:	TEOM 1405-F Ambient Particulate Monitor with PM _{2,5} -pre-separator for particulate matter PM _{2,5}
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 on Demonstration of Equivalence of Ambient Air Monitoring Methods: 2010,
EN 15267-1: 2009, EN 15267-2: 2009**

Certification is awarded in respect of the conditions stated in this certificate
(also see the following pages).



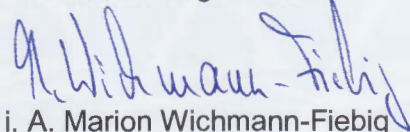
- Certified equivalent EN method
- Complying with 2008/50/EC
- TUV approved
- Annual inspection


Publication in the German Federal Gazette
(BAnz.) of 20 July 2012

The certificate is valid until:
19 July 2017

Umweltbundesamt
Dessau, 20 August 2012

TÜV Rheinland Energie und Umwelt GmbH
Köln, 17 August 2012


i. A. Marion Wichmann-Fiebig


ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / www.eco-tuv.com
teu@umwelt-tuv.de
Tel. +49 221 806-2756

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Köln

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

Test report:	936/21209885/C of 11 March 2012
First certification:	20 July 2012
Validity ends:	19 July 2017
Publication:	BAnz AT 20 July 2012 B11, chapter III, No. 1.1

Approved application

The certified AMS is suitable for continuous ambient air monitoring (stationary operation).

The suitability of the product for this application was assessed on the basis of a laboratory test and a field test for four different test sites or time periods respectively.

The AMS is approved for a temperature range of +8 °C to +25 °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/C of 11 March 2012 of TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Environmental Agency (UBA) as the relevant body
- the ongoing surveillance of the product and the manufacturing process
- publication in the German Federal Gazette: BAnz AT 20 July 2012 B11, chapter III, No. 1.1

AMS name:

TEOM 1405-F Ambient Particulate Monitor with PM_{2,5}-pre-separator for particulate matter PM_{2,5}

Manufacturer:

Thermo Fisher Scientific, Franklin, USA

Approval:

Continuous monitoring of suspended particulate matter PM_{2,5} fraction in ambient air (stationary operation)

Measuring ranges during the suitability test:

Component	Certification range	Unit
PM _{2,5}	0 – 1000	µg/m ³

Software version:

1.56

Restriction:

The permissible range of ambient temperature at the site of installation for the measuring system is 8 °C to 25 °C.

Remarks:

1. Requirements according to the guide "Demonstration of Equivalence of Ambient Air Monitoring Methods" were met for the component PM_{2,5}.
2. The measuring system shall be calibrated on site regularly using a gravimetric PM_{2,5}-reference method in accordance with DIN EN 14907.
3. The test report on the suitability test is available on the Internet: www.qal1.de.

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Köln
Report No.: 936/21209885/C of 11 March 2012

Certified product

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

The ambient air measuring system TEOM 1405-F Ambient Particulate Monitor is based on the measuring principle of oscillating micro weighing.

For the weighing principle, which is used in the TEOM mass transducer in the measuring system TEOM 1405-F Ambient Particulate Monitor, the change in mass determined with the sensor, results from the measurement of the change in frequency of the tapered element.

The particle sample passes the PM₁₀-pre-separator and the PM_{2.5} sharp cut cyclone with a flow rate of 16.67 l/min (=1 m³/h). Subsequently, the flow is directed over a flow-splitter and divided into two sub-flows – the PM_{2.5}-flow of 3 l/min and the bypass-flow of 13.67 l/min. The PM_{2.5}-flow is directed to the actual measuring system TEOM 1405-F via the FDMS-unit. There it is secreted to the respective TEOM-filter (constantly heated at 30 °C) and the secreted mass of particles is quantified.

To take into account non-volatile as well as volatile particulate during the measuring, the FDMS technology is used. The FDMS-unit is placed between the flow-splitter and the measuring device TEOM 1405-F in the so called FDMS-tower. The FDMS-unit compensated automatically the part of the semi-volatile particulate using a switching valve and two operation modi – the base mode and the reference mode.

Every six minutes the switching valve changes the sampling flow rate from base to reference mode. In the base mode the sampling is done on a straight way via a dryer directly to the mass measuring. In the reference mode the air flow is directed through a cooled filter after the dryer, to remove and restrain the non-volatile and volatile part of the particulate from the sample. During normal operation the temperature of the cooler is maintained at constantly 4 °C.

Based on the mass concentration measuring during the base- and reference-modi the FDMS-system updates every six minutes the 1h-average of the following results:

Base-MC	=	Particle concentration of the particle-loaded sampling flow.
Ref-MC	=	Particle concentration of the particle-free sampling flow after passing through the cooled filter.
MC	=	Base-MC adjusted for Ref-MC Base-mass-concentration (normally positive) reference-mass-concentration (negative, in case mass of the filter evaporates).

After the mass determination the sampling flows are directed over a mass flow rate regulator. To guarantee a constant sampling volume flow at the inlet, bearing in mind the ambient temperature and pressure, the volume flow control shall be operated in the mode „active/ actual“.

The tested measuring system consists of PM₁₀-sampling inlet, flow splitter, the respective sampling tubes, a tripod to support the sample, the measuring device TEOM 1405-F incl. FDMS-tower, the vacuum pump with its respective power supply cord and cables as well as adapters, the hole in the roof incl. a flange and a manual in German/English.

The measuring device is operated via touch screen at the front of the device. The user can retrieve data and instrument information, change parameters as well as perform tests and controls of the functionality of the measuring device.

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 given address 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 validity 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 Address: **qal1.de**.

Certification of TEOM 1405-F Ambient Particulate Monitor 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. 0000036949: 20 August 2012

Validity of the certificate: 19 July 2017

Test report: 936/21209885/C of 11 March 2012
TÜV Rheinland Energie und Umwelt GmbH, Köln

Publication: BAnz AT 20 July 2012 B11, chapter III, No. 1.1
Announcement by UBA from 06 July 2012

PM2.5 1405F FDMS	30.5% > 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	16.4	334	0.982	1.016 +/- 0.008	1.454 +/- 0.145	0.55	0.81
< 18 µg m-3	28.5	243	0.894	1.111 +/- 0.023	0.686 +/- 0.241	0.54	0.67
> 18 µg m-3	15.5	91	0.977	1.040 +/- 0.017	0.335 +/- 0.546	0.56	0.76

SN 20012	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	64	0.991	1.060 +/- 0.013	0.273 +/- 0.282	16.19	40.6
	Cologne Winter	71	0.984	1.045 +/- 0.016	0.815 +/- 0.404	18.15	59.2
	Bornheim Summer	84	0.971	1.068 +/- 0.020	1.309 +/- 0.289	24.28	19.0
	Teddington	125	0.971	0.948 +/- 0.014	2.491 +/- 0.228	11.71	15.2
Combined Datasets	< 18 µg m-3	252	0.888	1.136 +/- 0.024	0.518 +/- 0.246	32.31	4.4
	> 18 µg m-3	92	0.978	1.039 +/- 0.016	0.567 +/- 0.535	16.30	100.0
	All Data	344	0.981	1.023 +/- 0.008	1.446 +/- 0.147	17.69	29.9

SN 20121	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	64	0.991	1.041 +/- 0.012	1.157 +/- 0.270	17.85	40.6
	Cologne Winter	71	0.982	1.040 +/- 0.017	0.738 +/- 0.424	17.31	59.2
	Bornheim Summer	75	0.970	1.041 +/- 0.021	0.952 +/- 0.315	17.48	20.0
	Teddington	125	0.968	0.921 +/- 0.015	2.684 +/- 0.236	10.48	15.2
Combined Datasets	< 18 µg m-3	244	0.883	1.100 +/- 0.024	0.787 +/- 0.250	27.16	4.5
	> 18 µg m-3	91	0.973	1.041 +/- 0.018	0.135 +/- 0.594	15.63	100.0
	All Data	335	0.979	1.010 +/- 0.008	1.491 +/- 0.153	16.13	30.4