

CERTIFICATE

on Product Conformity (QAL1)

Number of Certificate: 0000035016

Certified AMS: TEOM 1405F Ambient Particulate Monitor with PM₁₀ -pre-separator for particulate matter PM₁₀

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 12341: 1998;
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
(also see the following pages).



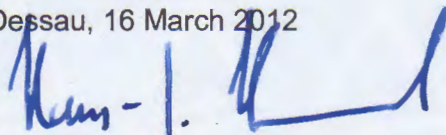
- Certified equivalent EN method
- Complying with 2008/50/EC
- TUV approved
- Annual inspection

Publication in the German Federal Gazette
(BAnz.) of 02 March 2012

The certificate is valid until:
01 March 2017

Umweltbundesamt
Dessau, 16 March 2012

TÜV Rheinland Energie und Umwelt GmbH
Köln, 15 March 2012


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51105 Köln

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

Test report:	936/21209885/B of 25 November 2011
First certification:	02 March 2012
Validity ends:	01 March 2017
Publication:	BAnz. 02 March 2012, No. 36, p. 920, chapter IV, 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/B dated 25 November 2011 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. 02 March 2012, No. 36, p. 920, chapter IV, No. 1.1, announcement by UBA from 23 February 2012)

AMS name:

TEOM 1405F Ambient Particulate Monitor with PM₁₀-pre-separator for particulate matter PM₁₀

Manufacturer:

Thermo Fisher Scientific, Franklin, USA

Field of application:

The AMS is approved for permanent monitoring of suspended particulate matter PM₁₀ in ambient air (stationary operation).

Measuring ranges during the suitability test:

Component	Certification range	Unit
PM ₁₀	0 – 1000	µg/m ³

Software version:

1.55

Restriction:

The allowed range of ambient temperature at the installation site is 8 °C to 25 °C.

Notes:

1. The requirements on the variation coefficient R² according standard EN 12341 were not met for the sites Teddington (Summer) and Bornheim (Summer).
2. The requirements according to guide "Demonstration of Equivalence of Ambient Air Monitoring Methods" are fulfilled for the measured component PM₁₀.
3. The measuring system is to be calibrated on site in regular intervals by application of the gravimetric PM₁₀ reference method according to EN 12341.
4. The test report on the suitability test is available on the internet under www.qal1.de.

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Köln
Report-No.: 936/21209885/B dated 25 November 2011

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 at 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 PM₁₀-flow of 3 l/min and the bypass-flow of 13.67 l/min. The PM₁₀-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 the 1h-average of the following results every six minutes:

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 for particulate matter PM₁₀ 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. 0000035016: 16 March 2012

Validity of the certificate: 01 March 2017

Test report: 936/21209885/B dated 25 November 2011
TÜV Rheinland Energie und Umwelt GmbH, Köln

Publication: BAnz. 02 March 2012, No. 36, p. 920, chapter IV, No. 1.1:
Announcement by UBA from 23 February 2012

PM10 1405F FDMS	23,3% > 28 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	8,4	215	0,973	0,994 +/- 0,011	0,395 +/- 0,291	0,48	1,09
< 30 µg m-3	12,0	169	0,882	1,055 +/- 0,028	-0,567 +/- 0,501	0,46	1,03
> 30 µg m-3	9,5	46	0,963	0,992 +/- 0,029	0,218 +/- 1,274	0,55	1,35
SN 20006	Dataset	Orthogonal Regression				Limit Value of 50 µg m-3	
		n _{c-s}	r ²	Slope (b) +/- u _b	Intercept (a) +/- u _a	W _{CM} / %	% > 28 µg m-3
Individual Datasets	Teddington Summer	42	0,895	1,112 +/- 0,057	0,055 +/- 0,883	23,71	2,4
	Cologne Winter	74	0,987	0,992 +/- 0,013	0,327 +/- 0,461	6,23	55,4
	Bornheim Summer	55	0,931	1,134 +/- 0,041	-2,097 +/- 0,750	20,10	3,6
	Teddington Winter	66	0,987	0,959 +/- 0,014	-1,549 +/- 0,337	15,22	16,7
Combined Datasets	< 30 µg m-3	186	0,860	1,069 +/- 0,029	-1,377 +/- 0,528	12,26	2,2
	> 30 µg m-3	51	0,966	0,986 +/- 0,026	-0,104 +/- 1,147	9,36	100,0
	All Data	237	0,970	0,994 +/- 0,011	-0,170 +/- 0,294	9,01	23,2
SN 20107	Dataset	Orthogonal Regression				Limit Value of 50 µg m-3	
		n _{c-s}	r ²	Slope (b) +/- u _b	Intercept (a) +/- u _a	W _{CM} / %	% > 28 µg m-3
Individual Datasets	Teddington Summer	57	0,927	1,065 +/- 0,039	0,807 +/- 0,605	17,19	1,8
	Cologne Winter	74	0,978	1,005 +/- 0,017	0,710 +/- 0,609	9,35	55,4
	Bornheim Summer	54	0,906	1,112 +/- 0,047	-0,860 +/- 0,859	21,03	3,7
	Teddington Winter	45	0,983	0,934 +/- 0,019	0,108 +/- 0,455	14,07	13,3
Combined Datasets	< 30 µg m-3	184	0,886	1,052 +/- 0,026	-0,062 +/- 0,467	13,06	2,2
	> 30 µg m-3	46	0,949	1,010 +/- 0,034	-0,139 +/- 1,526	11,60	100,0
	All Data	230	0,970	0,996 +/- 0,011	0,795 +/- 0,292	9,07	21,7