

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000036948_04

Certified AMS: SM-4 for Hg

Manufacturer: Mercury Instruments GmbH IMT Innovative Meßtechnik GmbH
Liebigstraße 5 Am Forst 11
85757 Karlsfeld 92648 Vohenstrauß
Germany Germany

Test Institute: TÜV Rheinland Energy GmbH

**This is to certify that the AMS has been tested and certified
according to the standards**

**EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2007)
and EN 14181 (2004)**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 8 pages).



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000036948

Publication in the German Federal Gazette
(BAnz.) of 23 July 2013

This certificate will expire on:
19 July 2022

German Federal Environment Agency
Dessau, 18 July 2017

TÜV Rheinland Energy GmbH
Cologne, 17 July 2017

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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.

Certificate:
0000036948_04 / 18 July 2017

Test report: 936/21221608/A dated 20 March 2013
Initial certification: 20 July 2012
Expiry date: 19 July 2022
Certificate: renewal (previous certificate 0000036948_03 dated from 25 April 2016 with validity up to the 19 July 2017)
Publication: BAnz AT 23.07.2013 B4, chapter I, no. 1.1

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13. BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17. BImSchV), at plants according to the 27. BImSchV and other plants requiring official approval. The measured ranges have been selected considering the wide application range of the AMS.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a six-month field test at industrial plant for hazardous waste incineration, a one-month field test at a lignite-fired power plant (fluidized-bed firing) using secondary fuel and a one-month field test at a rotary kiln for lime production (fuels: lignite dust/natural gas and secondary fuel).

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 valid at the time of performance testing. As changes in legal regulations are possible, any potential user should ensure that this AMS is suitable for monitoring the limit value relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the installation at which it will be installed.

Basis of the certification

This certification is based on:

- test report 936/21221608/A dated 20 March 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 23.07.2013 B4, chapter I, no. 1.1,
Announcement by UBA from 3 July 2013:

AMS designation:

SM-4 for Hg

Manufacturer:

Mercury Instruments GmbH, Karlsfeld,
IMT Innovative Messtechnik GmbH, Moosbach

Field of application:

For measurements at plants requiring official approval and plants according to
27. BImSchV

Measuring ranges during the performance test:

| Component | Certification range | Supplementary ranges | | Unit |
|-----------|---------------------|----------------------|---------|-------------------|
| Hg | 0 - 30 | 0 - 45 | 0 - 100 | µg/m ³ |

Software version:

6.39

Restriction:

The requirement of the DIN EN 15267-3 for the response time was not met during the performance test.

Notes:

1. Wet gases shall be used for span point tests (QAL3). To this effect, the AMS is equipped with a test gas generator. An external test gas generator (type HOVACAL) may be used alternatively.
2. The maintenance interval is four weeks.
3. Every third day, the AMS performs an automatic span point correction.
4. The length of the test gas line was between 15 and 19.5 m.
5. A complementary test (approval of a smaller certification range) to notice of Federal Environmental Agency of 12 February 2013 (Federal Gazette: BAnz AT 05.03.2013 B10, chapter I no. 2.1).

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report No.: 936/21221608/A dated 20 March 2013

Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, chapter IV
notification 34,
Announcement by UBA from 25 February 2015:

**34 Notification as regards Federal Environment Agency (UBA) notice of
03 July 2013 (Federal Gazette BAnz AT 23.07.2013 B4, chapter I number 1.1)**

The SM-4 measuring system for Hg, manufactured by Mercury Instruments GmbH and IMT Innovative Messtechnik GmbH, can be equipped with a new probe housing, which permits the connection of an external vaporizer of a test gas generator.

The current software version of the SM-4 measuring system for Hg is now V 6.41.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 29 September 2014

Certified product

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

The SM-4 measuring system is an extractive instrument that measures total mercury, i. e. mercury, ionic mercury and mercury in its compounds.

An ejector pump, which is operated with compressed air, continually draws sample gas from the flue gas duct via a heated sampling probe (180°). Stack gas passes by a heated filter. Instrument air serves to dilute flue gas at a constant ratio. Subsequently, a partial stream of diluted gas is passed through a thermo catalytic converter. All mercury compounds are converted to elemental mercury. After its conversion, mercury in the diluted gas stream passes through a heated sample gas line and is led to the detector inside the analyser cabinet. Mercury concentration is determined by means of atomic absorption of UV radiation at a wavelength of 253.7 nm with amalgamation and a gold trap for capturing and separating the sample matrix.

The SM-4 measuring system consists of the following components:

- sampling conditioning system including a probe, filter, dilution system, a thermo catalytic reactor, a vaporizer for the test gas generator and a control unit
- a heated sample gas line with a bundle containing supply lines for sample gas as well as other transmission media for the probe and the sample gas generator (length of 15 m during the performance test)
- an analyser cabinet with a bypass pump, a detector, a control unit for a calibration gas generator
- the software version of the measuring system is 6.41
- the current version of the manual is V 5.4

The sampling system and the sample conditioning system of the SM-4 measuring system are directly mounted to the sampling probe. Sample gas is extracted from the stack at a low flow rate of 12 l/h and passed through the probe filter in order to remove dust particles from the sample gas. Subsequently, a critical nozzle is used to dilute the sample gas by a factor of 50. This serves to reduce the effects of cross-sensitivities and the concentration of interferences to tolerable levels. After purification and dilution, the sample gas is led through a thermo catalytic reactor. Inside the reactor, the entire mercury contained in the sample gas is converted to elemental mercury. Subsequently, the sample gas is transported to the analyser cabinet via the sampling probe line. The gas is transported via an ejector operated with compressed air, which is also located at the probe. The converter, ejector, critical nozzle and particle filter are installed in a heater with a temperature of 200°. The entire sample gas path of the measuring system is cleaned with purge air at each cycle (every 4 minutes).

Also integrated in the probe is a sample gas generator, which serves to feed test gas directly to the probe of the measuring system. The test gas generator continuously vaporises a solution containing Hg in a special vaporiser and mixes it with a specific carrier gas (purge air). This is then brought to the test item. Variation of the carrier gas flow rate, the liquid flow rate and the concentration of the solution allows for adjusting the concentration of the test gas. The carrier gas flow rate and the liquid flow rate are fixed and continuously monitored during the application of the test gas. Additionally, the probe control unit is installed at the measurement site near the probe. This control unit primarily contains temperature controllers.

The analyser cabinet contains the photometer in order to determine the Hg-concentration, together with the amalgamation unit, transmission media supply for the measuring system

and the control unit for the test gas generator as well as electronics and the instrument reading.

During cyclical operation, the SM-4 measuring system works with amalgamation steps. One cycle is made up of 6 steps. Each step is displayed clearly.

Sampling (90 s), Zeroing (12 s), heating of the gold trap (23 s), first of the gold trap (45 s including zero point), cleaning of the gold trap after the measurement (25 s), second cooling phase (45 s).

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 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.

This document as well as the certification mark remains property of TÜV Rheinland Energy 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 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.

Certification of SM-4 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. 0000036948: 20 August 2012
Expiry date of the certificate: 19 July 2017

Test report: 936/21213740/A of 26 March 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 20.07.2012 B11, chapter I, no. 2.1
Announcement by UBA from 06 July 2012

Supplementary testing according to EN 15267

Certificate No. 0000036948_01: 22 March 2013
Expiry date of the certificate: 19 July 2017

Test report: 936/21213740/B of 13 October 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 05.03.2013 B10, chapter I, no. 2.1
Announcement by UBA from 12 February 2013

Supplementary testing according to EN 15267

Certificate No. 0000036948_01: 20 August 2013
Expiry date of the certificate: 19 July 2017

Test report: 936/21221608/A of 20 March 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 23.07.2013 B4, chapter I, no. 1.1
Announcement by UBA from 03 July 2013

Notifications according to EN 15267

Statement of TÜV Rheinland Energie und Umwelt GmbH of 29 September 2014
Publication: BAnz AT 02.04.2015 B5, chapter IV notification 34
Announcement by UBA from 25 February 2015
(new software version and housing add-on)

Correction of certificate

Certificate No. 0000036948_03: 25 April 2016
Expiry date of the certificate: 19 July 2017
(Correction in product description)

Renewal of the certificate

Certificate No. 0000036948_04: 18 July 2017
Expiry date of the certificate: 19 July 2022

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

| | |
|-----------------------------------|--|
| Manufacturer | Mercury Instruments GmbH IMT Innovative Messtechnik GmbH |
| AMS designation | SM-4 |
| Serial number of units under test | 706 / 707 / 823 |
| Measuring principle | UV-Measurement with dilution, catalytic sample treatment and amalgamation |

Test report

| | |
|-----------------|---------------------------------|
| Test laboratory | 936/21221608/A TÜV Rheinland |
| Date of report | 2013-03-20 |

Measured component

| | |
|---------------------|--------------------|
| Certification range | Hg 0 - 30 µg/m³ |
|---------------------|--------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|-------------|
| Sum of positive CS at zero point | 1.16 µg/m³ |
| Sum of negative CS at zero point | 0.00 µg/m³ |
| Sum of positive CS at span point | 1.18 µg/m³ |
| Sum of negative CS at span point | -0.99 µg/m³ |
| Maximum sum of cross-sensitivities | 1.18 µg/m³ |
| Uncertainty of cross-sensitivity | 0.682 µg/m³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|--|-----------------------------------|-------------|----------------|
| Standard deviation from paired measurements under field conditions * | u_D | 0.394 µg/m³ | 0.155 (µg/m³)² |
| Lack of fit | u_{lof} | 0.173 µg/m³ | 0.030 (µg/m³)² |
| Zero drift from field test | $u_{d,z}$ | 0.208 µg/m³ | 0.043 (µg/m³)² |
| Span drift from field test | $u_{d,s}$ | 0.753 µg/m³ | 0.567 (µg/m³)² |
| Influence of ambient temperature at span | u_t | 0.557 µg/m³ | 0.310 (µg/m³)² |
| Influence of supply voltage | u_v | 0.225 µg/m³ | 0.051 (µg/m³)² |
| Cross-sensitivity (interference) | u_i | 0.682 µg/m³ | 0.466 (µg/m³)² |
| Influence of sample gas flow | u_p | 0.000 µg/m³ | 0.000 (µg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 0.242 µg/m³ | 0.059 (µg/m³)² |
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | | 1.30 µg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | | 2.54 µg/m³ |

Relative total expanded uncertainty

| | | |
|--|-----------------------------------|-------------|
| Requirement of 2000/76/EC and 2001/80/EC | U in % of the ELV 20 µg/m³ | 12.7 |
| Requirement of EN 15267-3 | U in % of the ELV 20 µg/m³ | 40.0 |
| | U in % of the ELV 20 µg/m³ | 30.0 |