

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000053810_10

AMS designation: Set CEM CERT 7MB1957 for CO, NO, SO₂, CO₂, NO₂, NO_x and O₂

Manufacturer: Siemens AG
Östliche Rheinbrückenstraße 50
76187 Karlsruhe
Germany

Test Laboratory: 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 35 pages).



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000053810

Publication in the German Federal Gazette
(BAnz) of 31 July 2017

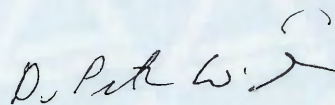
German Federal Environment Agency
Dessau, 05 March 2018



Dr. Marcel Langner
Head of Section II 4.1

This certificate will expire on:
04 March 2023

TÜV Rheinland Energy GmbH
Cologne, 04 March 2018



ppa. Dr. Peter Wilbring

www.umwelt-tuv.eu
tre@umwelt-tuv.eu
Phone: + 49 221 806-5200

TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Köln

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.

| | |
|-------------------------------|----------------------------------------------------------------------------------------------|
| Test Report: | 936/21230405/C dated 22 December 2016 |
| Initial certification: | 05 March 2013 |
| Expiry date: | 04 March 2023 |
| Certificate: | Renewal (of previous certificate 0000053810_09 dated 8 March 2017 valid until 04 March 2018) |
| Publication: | BAnz AT 31.07.2017 B12, chapter I number 3.1 |

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV), plants in compliance with TA Luft and plants according to the 27th BImSchV. Equipped with the SIPROCESS UV600-7MB2621 module the AMS is additionally suitable for waste incineration plants according to Directive 2010/75/EU, chapter IV (17th BImSchV) for monitoring the components NO, NO₂ and SO₂.

Finally, when equipped with the Ultramat 6, Ultramat 6-2K or Ultramat/Oxymant 6, the AMS is fit for use at plants according to EU Directive 2010/75/EU chapter IV (17th BImSchV) for monitoring components CO, NO and SO₂. The measured ranges have been selected so as to cater for as broad a field of application as possible.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and several field tests at various waste incinerators.

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 limit values and oxygen concentrations 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 936/21230405/C dated 22 December 2016 issued by TÜV Rheinland Energy 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 31.07.2017 B12, chapter I number 3.1, UBA announcement dated 13 July 2017:

AMS designation:

Set CEM CERT 7MB1957 for CO, NO, SO₂, CO₂, NO₂, NO_x and O₂

Manufacturer:

Siemens AG, Karlsruhe

Field of application:

Modular measuring system for plants according to the 13th and 27th BImSchV and for plants according to the TI Air

Measuring ranges during performance testing and maintenance interval determined:

| Component | Module version: | Certification range | Supplementary measuring range | | Unit | Maintenance interval |
|-----------------|-------------------------------------------|------------------------------------------|---------------------------------------------|--------------------------------------------|-------------------|----------------------|
| CO | Ultramat 23-7MB2355 - Z - T13 / T23 / T33 | 0-200 | 0-1250 | - | mg/m ³ | 12 months |
| | Ultramat 23-7MB2357 - Z - T13 / T23 / T33 | 0-200 | 0-1250 | - | mg/m ³ | 12 months |
| | Ultramat 23-7MB2358 - Z - T13 / T23 | 0-250 | 0-1250 | - | mg/m ³ | 6 months |
| | Ultramat 23-7MB2355 - Z - T14 / T24 / T34 | 0-1250 | 0-6000 | - | mg/m ³ | 12 months |
| | Ultramat 23-7MB2357 - Z - T14 / T24 / T34 | 0-1250 | 0-6000 | - | mg/m ³ | 12 months |
| | Ultramat 6 LR - Z + Y27 | 0-75 | 0-1250 | 0-3000 | mg/m ³ | 6 months |
| | Ultramat 6-2K LR - Z + Y27 + Y28 | 0-75 | 0-1250 | 0-3000 | mg/m ³ | 6 months |
| | Ultramat/Oxymat 6 LR - Z + Y27 + Y28 | 0-75 | 0-1250 | 0-3000 | mg/m ³ | 6 months |
| | Ultramat 6 HR - Z + Y27 | 0-1000 | 0-10000 | - | mg/m ³ | 6 months |
| | Ultramat 6-2K HR - Z + Y27 + Y28 | 0-1000 | 0-10000 | - | mg/m ³ | 6 months |
| | Ultramat/Oxymat 6 HR - Z + Y27 + Y28 | 0-1000 | 0-10000 | - | mg/m ³ | 6 months |
| | Ultramat 6-2K LR - HR - Z - Y27 + Y28 | 0-75 ³ 0-1000 ⁴ | 0-1250 ³ 0-10000 ⁴ | - | mg/m ³ | 6 months |
| NO _x | Ultramat 23-7MB2355 - Z - T13 / T23 / T33 | 0-150 ¹ 0-230 ² | 0-750 ¹ 0-1150 ² | 0-2000 ¹ 0-3067 ² | mg/m ³ | 12 months |
| | Ultramat 23-7MB2357 - Z - T13 / T23 / T33 | 0-150 ¹ 0-230 ² | 0-400 ¹ 0-613 ² | 0-2000 ¹ 0-3067 ² | mg/m ³ | 12 months |
| | Ultramat 23-7MB2358 - Z - T13 / T23 | 0-400 ¹ 0-613 ² | 0-2000 ¹ 0-3067 ² | - | mg/m ³ | 6 months |

| Component | Module version: | Certification range | Supplementary measuring range | | Unit | Maintenance interval |
|-----------------|-------------------------------------------|-------------------------------------------|---------------------------------------------|--------|-------------------|-----------------------------------------------------------------------------------------------|
| NO | SIPROCESS UV600-7MB2621 - Z - Y17 | 0-50 | 0-200 | 0-2000 | mg/m ³ | 2 weeks |
| | Ultramat 23-7MB2355 - Z - T14 / T24 / T34 | 0-600 | 0-3000 | - | mg/m ³ | 12 months |
| | Ultramat 23-7MB2357 - Z - T14 / T24 / T34 | 0-600 | 0-3000 | - | mg/m ³ | 12 months |
| | Ultramat 6 LR - Z + Y27 | 0-100 | 0-2000 | - | mg/m ³ | 6 months |
| | Ultramat 6-2K LR - Z + Y27 + Y 28 | 0-100 | 0-2000 | - | mg/m ³ | 6 months |
| | Ultramat/Oxymat 6 LR - Z + Y27 + Y28 | 0-100 | 0-2000 | - | mg/m ³ | 6 months |
| | Ultramat 6 HR - Z + Y27 | 0-1000 | 0-10000 | - | mg/m ³ | 6 months |
| | Ultramat 6-2K HR - Z + Y27 + Y 28 | 0-1000 | 0-10000 | - | mg/m ³ | 6 months |
| | Ultramat/Oxymat 6 HR - Z + Y27 + Y28 | 0-1000 | 0-10000 | - | mg/m ³ | 6 months |
| | Ultramat 6-2K LR - HR - Z - Y27 + Y28 | 0-100 ³ 0-1000 ⁴ | 0-2000 ³ 0-10000 ⁴ | - | mg/m ³ | 6 months |
| NO ₂ | SIPROCESS UV600-7MB2621 - Z - Y17 | 0-50 | 0-500 | - | mg/m ³ | 3 months provided that an adjustment with a calibration cell takes place weekly, else 2 weeks |
| SO ₂ | Ultramat 23-7MB2355 - Z - T13 / T23 / T33 | 0-400 | 0-2000 | 0-7000 | mg/m ³ | 12 months |
| | Ultramat 23-7MB2357 - Z - T13 / T23 / T33 | 0-400 | 0-2000 | 0-7000 | mg/m ³ | 12 months |
| | Ultramat 23-7MB2358 - Z - T13 / T23 | 0-400 | 0-2000 | 0-7000 | mg/m ³ | 6 months |
| | SIPROCESS UV600-7MB2621 - Z - Y17 | 0-75 | 0-130 | 0-2000 | mg/m ³ | 6 months provided that an adjustment with a calibration cell takes place weekly, else 2 weeks |
| | Ultramat 6 LR - Z + Y27 | 0-75 | 0-1500 | - | mg/m ³ | 6 months |
| | Ultramat 6-2K LR - Z + Y27 + Y 28 | 0-75 | 0-1500 | - | mg/m ³ | 6 months |
| | Ultramat/Oxymat 6 LR - Z + Y27 + Y28 | 0-75 | 0-1500 | - | mg/m ³ | 6 months |

| Component | Module version | Certification range | Supplementary measuring range | | Unit | Maintenance interval |
|----------------------------------|-------------------------------------------|---------------------|-------------------------------|---|--------|----------------------|
| CO ₂ | Ultramat 23-7MB2355 - Z - T13 / T23 / T33 | 0-25 | - | - | Vol.-% | 12 months |
| | Ultramat 23-7MB2357 - Z - T13 / T23 / T33 | 0-25 | - | - | Vol.-% | 12 months |
| O ₂ (paramagnetic) | Ultramat 23-7MB2355 - Z - T13 / T14 | 0-25 | - | - | Vol.-% | 12 months |
| | Ultramat 23-7MB2357 - Z - T13 / T14 | 0-25 | - | - | Vol.-% | 12 months |
| | Ultramat 23-7MB2358 - Z - T13 / T14 | 0-25 | - | - | Vol.-% | 6 months |
| | Oxymat 6 - Z + Y27 | 0-25 | 0-5 | - | Vol.-% | 6 months |
| | Ultramat / Oxymat 6 - Z + Y27 + Y28 | 0-25 | 0-5 | - | Vol.-% | 6 months |
| O ₂ (electrochemical) | Ultramat 23-7MB2355 - Z - T23 / T24 | 0-25 | 0-5 | - | Vol.-% | 12 months |
| | Ultramat 23-7MB2357 - Z - T23 / T24 | 0-25 | 0-5 | - | Vol.-% | 12 months |
| | Ultramat 23-7MB2358 - Z - T23 / T24 | 0-25 | 0-5 | - | Vol.-% | 6 months |

¹ expressed as NO

² expressed as NO₂

³ low measuring range

⁴ large measuring range

Software versions:

Ultramat 23-7MB2355 3.00.07
 Ultramat 23-7MB2357 3.00.07
 Ultramat 23-7MB2358 3.00.07
 Ultramat 6 4.8.5
 Ultramat 6-2K 4.8.5
 Oxymat 6 4.8.5
 Ultramat / Oxymat 6 4.8.5

SIEMENS SIMATIC Set CEM CERT 7MB1957 Rev. 1.0

SIPROCESS UV600-7MB2621

BCU: 9150883_3.003
 Gas module: 9137582_3.002
 UV-Module: 9139736_3.005

Restrictions:

1. For the component CO, the Ultramat 23-7MB2358 measuring system does not meet the requirements for measurement uncertainty stipulated in EN 15267.
2. For use with the Ultramat 23-7MB2355, Ultramat 23-7MB2357 and Ultramat 23-7MB2358, the system cabinet needs to be equipped with an air conditioning unit.

Notes:

1. When equipped with the SIPROCESS UV600-7MB2621 module for monitoring NO, NO₂ and SO₂ or with the Ultramat 6, Ultramat 6-2K, Ultramat/Oxymat 6 module for monitoring CO, NO and SO₂, the modular Set CEM CERT 7MB1957 system may also be used for applications according to IED, chapter IV (17th BImSchV).
2. Modules of the Ultramat 23 series need to be operated with a 24 h interval for automatic zero point adjustments. Modules of the Ultramat 6 series need to be operated with a one-week interval for automatic zero and span point adjustments.
3. For improved cross-sensitivity to CO₂ at the CO measurement channel, the Ultramat 23-7MB2355, Ultramat 23-7MB2357 and Ultramat 23-7MB2358 modules of the Set CEM CERT 7MB1957 series have been sold with a modified CO receiver since April 2014 which is clearly marked by serial number E4 and onwards in the middle section.
4. The Ultramat 23-7MB2355, Ultramat 23-7MB2357 and Ultramat 23-7MB2358 modules need to be operated with the Thermo-AUTOCAL feature activated.
5. The modular Set CEM CERT 7MB1957 measuring system may alternatively be equipped with a sampling probe (SP2000-H) manufactured by M&C TechGroup Germany GmbH and a sample gas cooler (EGK 2-19) manufactured by Bühler Technologies GmbH.
6. The sample gas cooler (EGK 2-19) manufactured by Bühler Technologies GmbH implemented in the modular CEM CERT 7MB1957 measuring system may be equipped with a PVDF or glass cooling element. In any case, a glass cooling element shall be used for the SIPROCESS UV600-7MB2621 module.
7. The modular Set CEM CERT 7MB1957 measuring system for determining NO_x is equipped with an NO_x type gas converter CG-2 manufactured by M&C Tech Group Germany GmbH.
8. When adding additional modules to the Set CEM CERT 7MB1957 measuring system, each combination of modules needs to be checked for functionality as part of testing proper installation and the maintenance interval has to be determined.
9. The Ultramat 6, Ultramat 6-2K, Ultramat/Oxymat 6 and Oxymat 6 modules need to be operated with weekly AUTO zero and AUTO span adjustments using test gases from pressurised gas bottles.
10. The Set CEM CERT 7MB1957 comes with a measuring cabinet with a degree of protection of IP40. The system cabinet can be equipped with an air conditioning unit or a ventilator unit.
11. Supplementary test (for the purpose the extension of the maintenance interval) as regards Federal Environment Agency notice dated 22 February 2017 (BAZ AT 15.03.2017 B6, chapter I number 4.1).

Test Report:

TÜV Rheinland Energy GmbH, Cologne
Report no.: 936/21230405/C dated 22 December 2016

Certified product

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

The complete modular Set CEM CERT 7MB1957 measuring system tested comprises a heated sampling probe, a heated sampling line, a two-stage sample gas cooler, the sample gas pump and a maximum of three measurement component analysers from the Ultramat 6, Ultramat 6 2-K, Oxymat 6, Ultramat/Oxymat 6, Ultramat 23-7MB2355, Ultramat 23-7MB2357, Ultramat 23-7MB2358 or SIPROCESS UV600-7MB2621.

The Set CEM CERT 7MB1957 comes with a measuring cabinet with a degree of protection of IP40. The system cabinet can be equipped with an air conditioning unit or a ventilator unit. For measuring CO, NO and SO₂ in the Ultramat 23 analysers, the modular measuring system uses the principle of non-dispersive infrared absorption (NDIR method). For measuring O₂, an electrochemical or a paramagnetic oxygen measuring cell may be used. The modular system for NO in the SIPROCESS UV600 uses the principle of gas filter correlation (GFC) and interference filter correlation (IFC) for NO₂ and SO₂ respectively.

A sample gas pump with integrated vapour recovery for the purpose of controlling sample gas flows is situated between the first and the second stage of cooling. A fine particle filter for dust separation is integrated in the cooler housing. Downstream of the sample gas cooler, the gas flow is divided into two to three partial flows to simultaneously supply analyser modules arranged in parallel with sample gas. Gas oversupply is led out via a bypass. A condensate filter is placed immediately upstream of each analyser modules which blocks the gas path in the event of moisture coming through in order to protect the analysers. In the Ultramat 23 measuring modules, a (heated) converter is placed upstream of the condensate filter for measuring NO_x. A three-way valve is placed in front of the pump which serves to feed zero gas for automatic zero gas adjustment (AutoCal) and is controlled via the SIMATIC.

A second three-way valve is installed behind the pump which, controlled by SIMATIC, is able to time the supply of zero/test gases for automatic adjustments of zero and span points. Test gases may alternatively be fed manually via a third three-way valve.

The modular measuring system comprises the following components:

| | | |
|---------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Measuring cabinet</u> | Set CEM CERT 7MB1957 system cabinet | |
| <u>Probe</u> | Manufacturer | Bühler Technologies GmbH |
| | Type | Gas 222.20-Cal-twin incl. ceramic filter |
| <u>alternative probe</u> | Manufacturer | M&C TechGroup Germany GmbH |
| | Type | SP2000-H incl. ceramic filter (length 100 cm), heated to 180 °C |
| <u>Heated sample gas line</u> | Temperature | 180 °C |
| | Length | 50 m in the field, 10 m in the lab |
| | Diameter | (inner):4 mm |
| | Material | PTFE |
| <u>Compressor cooler</u> | Manufacturer | M&C TechGroup Germany GmbH |
| | Type | CSS V1-S |
| <u>alternative cooler</u> | Manufacturer | Bühler Technologies GmbH |
| | Type | EGK 2-19, 2 stage, dew point 3 °C |
| <u>Sample gas pump</u> | Manufacturer | Bühler Technologies GmbH |
| | Type | P 2.3 |
| <u>NO_x converter</u> | Manufacturer | M&C TechGroup Germany GmbH |
| | Type | gas converter CG-2 |
| <u>Analyser module</u> | Manufacturer | Siemens AG |
| | Type | Ultramat 6 Ultramat 6 2-K Oxymat 6 Ultramat / Oxymat 6 Ultramat 23-7MB2355 Ultramat 23-7MB2357 Ultramat 23-7MB2358 SIPROCESS UV600 |

The current software versions are:

| | |
|---------------------|----------|
| Ultramat 23-7MB2355 | V3.00.07 |
| Ultramat 23-7MB2357 | V3.00.07 |
| Ultramat 23-7MB2358 | V3.00.07 |
| Ultramat 6 | 4.8.5 |
| Ultramat 6-2K | 4.8.5 |
| Oxymat 6 | 4.8.5 |
| Ultramat / Oxymat 6 | 4.8.5 |

SIEMENS SIMATIC

Set CEM CERT 7MB1957 Rev. 1.0

SIPROCESS UV600-7MB2621

BCU: 9150883_3.003
Gas module: 9137582_3.002
UV-Module: 9139736_3.005

The current manual versions are:

| | |
|------------------------------------------|----------------------------|
| Ultramat 23: | Issue 01/2015 |
| Ultramat 6 / Oxymat 6: | Issue 11/2005 |
| SiprocessUV600: | Issue 10/2013 |
| System description Set CEM CERT 7MB1957: | Issue of 06/07/2017 Rev. 7 |

General remarks

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 manufacturing process for 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 document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at qal1.de.

Certification of the Set CEM CERT 7MB1957 measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Initial certification according to EN 15267

Certificate no. 1630664-ts: 05 March 2013
Expiry date of the certificate: 04 March 2018

Test report 1630664 dated 15 September 2012,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 05.03.2013 B10, chapter I no. 6.1
UBA announcement dated 12 February 2013

Supplementary testing according to EN 15267

Certificate no. 1630664.2-ts: 23 July 2013
Expiry date of the certificate: 04 March 2018

Test report 1630664-2 dated 15 March 2013
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 23.07.2013 B4, chapter I number 4.1
UBA announcement dated 03 July 2013

Certificate no. 1630664.3-ts: 01 April 2014
Expiry date of the certificate: 04 March 2018

Test report 1630664-3 dated 18 December 2013
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 01.04.2014 B12, chapter I number 4.2
UBA announcement dated 27 February 2014

Certificate No. 1630664.4a-ts 05 August 2014
Expiry date of the certificate 04 March 2018

Test report 1630664-4a dated 28 February 2014,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 05.08.2014 B11, chapter I number 5.3
UBA announcement dated 17 July 2014

Certificate No. 1630664.4b-ts 05 August 2014
Expiry date of the certificate 04 March 2018

Test report 1630664-4b dated 28 February 2014,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 05.08.2014 B11, chapter I number 5.4
UBA announcement dated 17 July 2014

Certificate No. 1797266-ts 15 April 2015
Expiry date of the certificate 04 March 2018

Test report 1797266 dated 18 September 2014,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 02.04.2015 B5, chapter I number 4.1
UBA announcement dated 25 February 2015

Certificate No. 2219424-ts 08 September 2015
Expiry date of the certificate 04 March 2018

Test report 2219424 dated 20 March 2015,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 26.08.2015 B4, chapter I number 3.2
UBA announcement dated 22 July 2015

Certificate No. 2435071-ts 26 April 2016
Expiry date of the certificate 04 March 2018

Test report 2435071 dated 30 September 2015,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 14.03.2016 B7, chapter I number 5.1
UBA announcement dated 18 February 2016

Certificate No. 0000053810_08 25 April 2017
Expiry date of the certificate 04 March 2018

Test report: 936/21230405/A dated 31 August 2016
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 15.03.2017 B6, chapter I number 4.1
UBA announcement dated 22 February 2017

Certificate No. 0000053810_09 08 September 2017
Expiry date of the certificate 04 March 2018

Test report: 936/21230405/C dated 22 December 2016
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 31.07.2017 B12, chapter I number 3.1
UBA announcement dated 13 July 2017

Notifications in accordance with EN 15267

Statement issued by TÜV Süd Industrie Service GmbH dated 17 March 2013
Publication: BAnz AT 23.07.2013 B4, chapter V notification 26
UBA announcement dated 06 July 2013
(New software version)

Statement issued by TÜV Süd Industrie Service GmbH dated 19 March 2014
Publication: BAnz AT 05.08.2014 B11, chapter V notification 3
UBA announcement dated 17 July 2014
(New software version)

Statement issued by TÜV Süd Industrie Service GmbH dated 18 September 2015
Publication: BAnz AT 02.04.2015 B5, chapter IV notification 43
UBA announcement dated 25 February 2015
(New software version)

Statement issued by TÜV Süd Industrie Service GmbH dated 29 February 2016
Publication: BAnz AT 01.08.2016 B11, chapter V notification 29
UBA announcement dated 14 July 2016
(New software version)

Corrections in accordance with EN 15267

Correction issued by the Federal Environment Agency on 22 July 2015
Publication: BAnz AT 26.08.2015 B4, chapter IV correction 1 (missing second supplementary measuring range for NO_x of the Ultramat 23-7MB2357-Z-T13 module)
UBA announcement dated 22 July 2015

Statement issued by TÜV Süd Industrie Service GmbH dated 15 October 2015
Publication: BAnz AT 14.03.2016 B7, chapter IV correction 1 (second supplementary measuring range for CO of the Ultramat 23-7MB2357-Z-T13 module discarded)
UBA announcement dated 18 February 2016

Renewal of the certificate

Certificate no. 0000053810_10: 05 March 2018
Expiry date of the certificate: 04 March 2023

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 6 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------|
| Test laboratory | TÜV Rheinland |
| Date of report | 2016-08-31 |

Measured component

| | | |
|---------------------|----|--------------|
| Certification range | CO | 0 - 75 mg/m³ |
|---------------------|----|--------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|-------------------|
| Sum of positive CS at zero point | 0.32 mg/m³ |
| Sum of negative CS at zero point | -0.33 mg/m³ |
| Sum of positive CS at span point | 1.00 mg/m³ |
| Sum of negative CS at span point | -0.40 mg/m³ |
| Maximum sum of cross-sensitivities | 1.00 mg/m³ |
| Uncertainty of cross-sensitivity | u_i 0.576 mg/m³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|-----------|--------------|----------------|
| Standard deviation from paired measurements under field conditions * | u_D | 0.614 mg/m³ | 0.377 (mg/m³)² |
| Lack of fit | u_{lof} | 0.229 mg/m³ | 0.052 (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ | -0.650 mg/m³ | 0.423 (mg/m³)² |
| Span drift from field test | $u_{d,s}$ | 0.606 mg/m³ | 0.367 (mg/m³)² |
| Influence of ambient temperature at span | u_t | 0.924 mg/m³ | 0.854 (mg/m³)² |
| Influence of supply voltage | u_v | 0.082 mg/m³ | 0.007 (mg/m³)² |
| Cross-sensitivity (interference) | u_i | 0.576 mg/m³ | 0.332 (mg/m³)² |
| Influence of sample gas flow | u_p | -0.079 mg/m³ | 0.006 (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 0.606 mg/m³ | 0.368 (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 1.67 mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 3.27 mg/m³ |

Relative total expanded uncertainty

| | | |
|---------------------------|-----------------------------------|-------------|
| Requirement of 2010/75/EU | U in % of the ELV 50 mg/m³ | 6.5 |
| Requirement of EN 15267-3 | U in % of the ELV 50 mg/m³ | 10.0 |
| | U in % of the ELV 50 mg/m³ | 7.5 |

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 6 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------|
| Test laboratory | TÜV Rheinland |
| Date of report | 2016-08-31 |

Measured component

| | | |
|---------------------|----|----------------------------|
| Certification range | CO | 0 - 1000 mg/m ³ |
|---------------------|----|----------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|-------------------------------|
| Sum of positive CS at zero point | 0.00 mg/m ³ |
| Sum of negative CS at zero point | 0.00 mg/m ³ |
| Sum of positive CS at span point | 8.60 mg/m ³ |
| Sum of negative CS at span point | -4.20 mg/m ³ |
| Maximum sum of cross-sensitivities | 8.60 mg/m ³ |
| Uncertainty of cross-sensitivity | u_i 4.965 mg/m ³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 | |
|----------------------------------------------------------------------|-----------|---------------------------|---------|-----------------------------------|
| Standard deviation from paired measurements under field conditions * | u_D | 2.042 mg/m ³ | 4.170 | (mg/m ³) ² |
| Lack of fit | u_{lof} | -1.732 mg/m ³ | 3.000 | (mg/m ³) ² |
| Zero drift from field test | $u_{d,z}$ | 3.464 mg/m ³ | 11.999 | (mg/m ³) ² |
| Span drift from field test | $u_{d,s}$ | -13.279 mg/m ³ | 176.332 | (mg/m ³) ² |
| Influence of ambient temperature at span | u_t | 5.700 mg/m ³ | 32.490 | (mg/m ³) ² |
| Influence of supply voltage | u_v | 3.549 mg/m ³ | 12.595 | (mg/m ³) ² |
| Cross-sensitivity (interference) | u_i | 4.965 mg/m ³ | 24.651 | (mg/m ³) ² |
| Influence of sample gas flow | u_b | 0.842 mg/m ³ | 0.709 | (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 8.083 mg/m ³ | 65.333 | (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 18.20 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 35.67 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 500 mg/m³ 7.1

Requirement of 2010/75/EU

U in % of the ELV 500 mg/m³ 10.0

Requirement of EN 15267-3

U in % of the ELV 500 mg/m³ 7.5

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 23 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------------------------|
| Test laboratory | 936/21230405/A TÜV Rheinland |
| Date of report | 2016-08-31 |

Measured component

| | |
|---------------------|----------------------------------|
| Certification range | CO 0 - 1250 mg/m ³ |
|---------------------|----------------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|---------------------------------|
| Sum of positive CS at zero point | 0.00 mg/m ³ |
| Sum of negative CS at zero point | 0.00 mg/m ³ |
| Sum of positive CS at span point | 7.75 mg/m ³ |
| Sum of negative CS at span point | -23.38 mg/m ³ |
| Maximum sum of cross-sensitivities | -23.38 mg/m ³ |
| Uncertainty of cross-sensitivity | u_i -13.496 mg/m ³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|-----------|---------------------------|-------------------------------------------|
| Standard deviation from paired measurements under field conditions * | u_D | 2.228 mg/m ³ | 4.964 (mg/m ³) ² |
| Lack of fit | u_{lof} | 3.464 mg/m ³ | 11.999 (mg/m ³) ² |
| Zero drift from field test | $u_{d,z}$ | 3.608 mg/m ³ | 13.018 (mg/m ³) ² |
| Span drift from field test | $u_{d,s}$ | 7.939 mg/m ³ | 63.028 (mg/m ³) ² |
| Influence of ambient temperature at span | u_t | 8.609 mg/m ³ | 74.115 (mg/m ³) ² |
| Influence of supply voltage | u_v | 0.688 mg/m ³ | 0.473 (mg/m ³) ² |
| Cross-sensitivity (interference) | u_i | -13.496 mg/m ³ | 182.142 (mg/m ³) ² |
| Influence of sample gas flow | u_p | 0.000 mg/m ³ | 0.000 (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 10.104 mg/m ³ | 102.083 (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 21.26 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 41.66 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 600 mg/m³ 6.9

Requirement of 2010/75/EU

U in % of the ELV 600 mg/m³ 10.0

Requirement of EN 15267-3

U in % of the ELV 600 mg/m³ 7.5

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 6 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------------------------|
| Test laboratory | 936/21230405/A TÜV Rheinland |
| Date of report | 2016-08-31 |

Measured component

| | |
|---------------------|---------------------------------|
| Certification range | NO 0 - 100 mg/m ³ |
|---------------------|---------------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|-------------------------------|
| Sum of positive CS at zero point | 3.06 mg/m ³ |
| Sum of negative CS at zero point | 0.00 mg/m ³ |
| Sum of positive CS at span point | 3.20 mg/m ³ |
| Sum of negative CS at span point | -0.50 mg/m ³ |
| Maximum sum of cross-sensitivities | 3.20 mg/m ³ |
| Uncertainty of cross-sensitivity | u_i 1.848 mg/m ³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|------------------------------------|-------|-----------------------------------|
| Standard deviation from paired measurements under field conditions * | u_D 0.628 mg/m ³ | 0.394 | (mg/m ³) ² |
| Lack of fit | u_{lof} -0.924 mg/m ³ | 0.854 | (mg/m ³) ² |
| Zero drift from field test | $u_{d,z}$ 1.386 mg/m ³ | 1.921 | (mg/m ³) ² |
| Span drift from field test | $u_{d,s}$ 0.751 mg/m ³ | 0.564 | (mg/m ³) ² |
| Influence of ambient temperature at span | u_t 0.896 mg/m ³ | 0.803 | (mg/m ³) ² |
| Influence of supply voltage | u_v 0.582 mg/m ³ | 0.339 | (mg/m ³) ² |
| Cross-sensitivity (interference) | u_i 1.848 mg/m ³ | 3.415 | (mg/m ³) ² |
| Influence of sample gas flow | u_p -0.120 mg/m ³ | 0.014 | (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 0.808 mg/m ³ | 0.653 | (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|------------------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 2.99 mg/m ³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 5.87 mg/m ³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|----------------------------------------------|-------------|
| U in % of the ELV 40 mg/m³ | 14.7 |
| U in % of the ELV 40 mg/m³ | 20.0 |
| U in % of the ELV 40 mg/m ³ | 15.0 |

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

Measuring system

| | |
|-----------------------------------|------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 6 |
| Serial number of units under test | System 1 / System 3 / System2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------------------------|
| Test laboratory | 936/21230405/A TÜV Rheinland |
| Date of report | 2016-08-31 |

Measured component

| | |
|---------------------|----------------------------------|
| Certification range | NO 0 - 1000 mg/m ³ |
|---------------------|----------------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|---------------------------------|
| Sum of positive CS at zero point | 0.00 mg/m ³ |
| Sum of negative CS at zero point | 0.00 mg/m ³ |
| Sum of positive CS at span point | 0.00 mg/m ³ |
| Sum of negative CS at span point | -33.10 mg/m ³ |
| Maximum sum of cross-sensitivities | -33.10 mg/m ³ |
| Uncertainty of cross-sensitivity | u_i -19.110 mg/m ³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 | |
|----------------------------------------------------------------------|-----------|---------------------------|---------|-----------------------------------|
| Standard deviation from paired measurements under field conditions * | u_D | 5.941 mg/m ³ | 35.295 | (mg/m ³) ² |
| Lack of fit | u_{lof} | 4.041 mg/m ³ | 16.330 | (mg/m ³) ² |
| Zero drift from field test | $u_{d.z}$ | 5.774 mg/m ³ | 33.339 | (mg/m ³) ² |
| Span drift from field test | $u_{d.s}$ | 10.970 mg/m ³ | 120.341 | (mg/m ³) ² |
| Influence of ambient temperature at span | u_t | 6.275 mg/m ³ | 39.376 | (mg/m ³) ² |
| Influence of supply voltage | u_v | 1.851 mg/m ³ | 3.426 | (mg/m ³) ² |
| Cross-sensitivity (interference) | u_i | -19.110 mg/m ³ | 365.192 | (mg/m ³) ² |
| Influence of sample gas flow | u_b | -0.722 mg/m ³ | 0.521 | (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 8.083 mg/m ³ | 65.333 | (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max j})^2} \quad 26.06 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 51.08 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 500 mg/m³ 10.2

Requirement of 2010/75/EU

U in % of the ELV 500 mg/m³ 20.0

Requirement of EN 15267-3

U in % of the ELV 500 mg/m³ 15.0

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 23 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------------------------|
| Test laboratory | 936/21230405/C TÜV Rheinland |
| Date of report | 2016-12-22 |

Measured component

| | |
|---------------------|---------------------------------|
| Certification range | NO 0 - 600 mg/m ³ |
|---------------------|---------------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|--------------------------------|
| Sum of positive CS at zero point | 0.00 mg/m ³ |
| Sum of negative CS at zero point | 0.00 mg/m ³ |
| Sum of positive CS at span point | 0.00 mg/m ³ |
| Sum of negative CS at span point | -17.04 mg/m ³ |
| Maximum sum of cross-sensitivities | -17.04 mg/m ³ |
| Uncertainty of cross-sensitivity | u_i -9.838 mg/m ³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 | |
|----------------------------------------------------------------------|-----------|--------------------------|--------|-----------------------------------|
| Standard deviation from paired measurements under field conditions * | u_D | 2.338 mg/m ³ | 5.466 | (mg/m ³) ² |
| Lack of fit | u_{lof} | 1.732 mg/m ³ | 3.000 | (mg/m ³) ² |
| Zero drift from field test | $u_{d,z}$ | 4.850 mg/m ³ | 23.523 | (mg/m ³) ² |
| Span drift from field test | $u_{d,s}$ | 6.582 mg/m ³ | 43.323 | (mg/m ³) ² |
| Influence of ambient temperature at span | u_t | 3.005 mg/m ³ | 9.030 | (mg/m ³) ² |
| Influence of supply voltage | u_v | 1.787 mg/m ³ | 3.193 | (mg/m ³) ² |
| Cross-sensitivity (interference) | u_i | -9.838 mg/m ³ | 96.786 | (mg/m ³) ² |
| Influence of sample gas flow | u_p | 0.577 mg/m ³ | 0.333 | (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 4.850 mg/m ³ | 23.520 | (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|-------------------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 14.43 mg/m ³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 28.28 mg/m ³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|-----------------------------------------------|-------------|
| U in % of the ELV 200 mg/m³ | 14.1 |
| U in % of the ELV 200 mg/m³ | 20.0 |
| U in % of the ELV 200 mg/m ³ | 15.0 |

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 6 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------------------------|
| Test laboratory | 936/21230405/C TÜV Rheinland |
| Date of report | 2016-12-22 |

Measured component

| | |
|---------------------|---------------------------------------------|
| Certification range | SO ₂ 0 - 75 mg/m ³ |
|---------------------|---------------------------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|--------------------------------|
| Sum of positive CS at zero point | 1.99 mg/m ³ |
| Sum of negative CS at zero point | -0.84 mg/m ³ |
| Sum of positive CS at span point | 1.10 mg/m ³ |
| Sum of negative CS at span point | -2.80 mg/m ³ |
| Maximum sum of cross-sensitivities | -2.80 mg/m ³ |
| Uncertainty of cross-sensitivity | u_i -1.615 mg/m ³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|------------------------------------|-------|-----------------------------------|
| Standard deviation from paired measurements under field conditions * | u_D 1.066 mg/m ³ | 1.136 | (mg/m ³) ² |
| Lack of fit | u_{lof} -0.637 mg/m ³ | 0.406 | (mg/m ³) ² |
| Zero drift from field test | $u_{d,z}$ 0.953 mg/m ³ | 0.908 | (mg/m ³) ² |
| Span drift from field test | $u_{d,s}$ 0.996 mg/m ³ | 0.992 | (mg/m ³) ² |
| Influence of ambient temperature at span | u_t 1.277 mg/m ³ | 1.631 | (mg/m ³) ² |
| Influence of supply voltage | u_v 0.448 mg/m ³ | 0.201 | (mg/m ³) ² |
| Cross-sensitivity (interference) | u_i -1.615 mg/m ³ | 2.608 | (mg/m ³) ² |
| Influence of sample gas flow | u_p -0.135 mg/m ³ | 0.018 | (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 0.606 mg/m ³ | 0.368 | (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|------------------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 2.88 mg/m ³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 5.64 mg/m ³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|----------------------------------------------|-------------|
| U in % of the ELV 50 mg/m³ | 11.3 |
| U in % of the ELV 50 mg/m³ | 20.0 |
| U in % of the ELV 50 mg/m ³ | 15.0 |

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

Measuring system

| | |
|-----------------------------------|------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 23 |
| Serial number of units under test | System1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|---------------------------------|
| Test laboratory | 936/21230405/C TÜV Rheinland |
| Date of report | 2016-12-22 |

Measured component

| | |
|---------------------|----------------------------------|
| Certification range | CO ₂ 0 - 25 Vol.-% |
|---------------------|----------------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|---------------------|
| Sum of positive CS at zero point | 0.00 Vol.-% |
| Sum of negative CS at zero point | 0.00 Vol.-% |
| Sum of positive CS at span point | 0.10 Vol.-% |
| Sum of negative CS at span point | -0.30 Vol.-% |
| Maximum sum of cross-sensitivities | -0.30 Vol.-% |
| Uncertainty of cross-sensitivity | u_i -0.173 Vol.-% |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|-------------------------|--|-----------------------------|
| Standard deviation from paired measurements under field conditions * | u_D 0.740 Vol.-% | | 0.548 (Vol.-%) ² |
| Lack of fit | u_{lof} 0.058 Vol.-% | | 0.003 (Vol.-%) ² |
| Zero drift from field test | $u_{d,z}$ -0.289 Vol.-% | | 0.084 (Vol.-%) ² |
| Span drift from field test | $u_{d,s}$ -0.260 Vol.-% | | 0.068 (Vol.-%) ² |
| Influence of ambient temperature at span | u_t 0.289 Vol.-% | | 0.084 (Vol.-%) ² |
| Influence of supply voltage | u_v 0.062 Vol.-% | | 0.004 (Vol.-%) ² |
| Cross-sensitivity (interference) | u_i -0.173 Vol.-% | | 0.030 (Vol.-%) ² |
| Influence of sample gas flow | u_b 0.000 Vol.-% | | 0.000 (Vol.-%) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 0.202 Vol.-% | | 0.041 (Vol.-%) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|-------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 0.93 Vol.-% |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 1.82 Vol.-% |

Relative total expanded uncertainty

| | | |
|----------------------------------|--------------------------------------|------------|
| Requirement of 2010/75/EU | U in % of the range 25 Vol.-% | 7.3 |
| Requirement of EN 15267-3 | U in % of the range 25 Vol.-% | 10.0 ** |
| | U in % of the range 25 Vol.-% | 7.5 |

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.

A value of 10.0 % was used for this.

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Oxymat 6 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | paramagnetic |

Test report

| | |
|-----------------|----------------|
| Test laboratory | 936/21230405/C |
| Date of report | TÜV Rheinland |
| | 2016-12-22 |

Measured component

| | | |
|---------------------|----------------|---------------|
| Certification range | O ₂ | 0 - 25 Vol.-% |
|---------------------|----------------|---------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | | |
|------------------------------------|----------------|--------------|
| Sum of positive CS at zero point | 0.00 | Vol.-% |
| Sum of negative CS at zero point | 0.00 | Vol.-% |
| Sum of positive CS at span point | 0.00 | Vol.-% |
| Sum of negative CS at span point | 0.00 | Vol.-% |
| Maximum sum of cross-sensitivities | 0.00 | Vol.-% |
| Uncertainty of cross-sensitivity | u _i | 0.000 Vol.-% |

Calculation of the combined standard uncertainty

Tested parameter

| | | | | u ² |
|----------------------------------------------------------------------|------------------|--------|--------|-----------------------------|
| Standard deviation from paired measurements under field conditions * | u _D | 0.083 | Vol.-% | 0.007 (Vol.-%) ² |
| Lack of fit | u _{lof} | -0.012 | Vol.-% | 0.000 (Vol.-%) ² |
| Zero drift from field test | u _{d,z} | -0.035 | Vol.-% | 0.001 (Vol.-%) ² |
| Span drift from field test | u _{d,s} | -0.069 | Vol.-% | 0.005 (Vol.-%) ² |
| Influence of ambient temperature at span | u _t | 0.081 | Vol.-% | 0.007 (Vol.-%) ² |
| Influence of supply voltage | u _v | 0.055 | Vol.-% | 0.003 (Vol.-%) ² |
| Cross-sensitivity (interference) | u _i | 0.000 | Vol.-% | 0.000 (Vol.-%) ² |
| Influence of sample gas flow | u _b | 0.006 | Vol.-% | 0.000 (Vol.-%) ² |
| Uncertainty of reference material at 70% of certification range | u _{rm} | 0.202 | Vol.-% | 0.041 (Vol.-%) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 0.25 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.49 \text{ Vol.-%}$$

Relative total expanded uncertainty

U in % of the range 25 Vol.-% **2.0**

Requirement of 2010/75/EU

U in % of the range 25 Vol.-% **10.0 ****

Requirement of EN 15267-3

U in % of the range 25 Vol.-% **7.5**

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.

A value of 10.0 % was used for this.

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT Ultramat 23 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | electrochemic |

Test report

| | |
|-----------------|----------------|
| Test laboratory | 936/21230405/C |
| Date of report | TÜV Rheinland |
| | 2016-12-22 |

Measured component

| | | |
|---------------------|----------------|---------------|
| Certification range | O ₂ | 0 - 25 Vol.-% |
|---------------------|----------------|---------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | | |
|------------------------------------|----------------|--------------|
| Sum of positive CS at zero point | 0.00 | Vol.-% |
| Sum of negative CS at zero point | 0.00 | Vol.-% |
| Sum of positive CS at span point | 0.00 | Vol.-% |
| Sum of negative CS at span point | 0.00 | Vol.-% |
| Maximum sum of cross-sensitivities | 0.00 | Vol.-% |
| Uncertainty of cross-sensitivity | u _i | 0.000 Vol.-% |

Calculation of the combined standard uncertainty

Tested parameter

| | | | | u ² |
|-----------------------------------------------------------------|------------------|--------|--------|-----------------------------|
| Repeatability standard deviation at set point * | u _r | 0.050 | Vol.-% | 0.003 (Vol.-%) ² |
| Lack of fit | u _{lof} | 0.058 | Vol.-% | 0.003 (Vol.-%) ² |
| Zero drift from field test | u _{d,z} | -0.052 | Vol.-% | 0.003 (Vol.-%) ² |
| Span drift from field test | u _{d,s} | 0.081 | Vol.-% | 0.007 (Vol.-%) ² |
| Influence of ambient temperature at span | u _t | 0.116 | Vol.-% | 0.013 (Vol.-%) ² |
| Influence of supply voltage | u _v | 0.055 | Vol.-% | 0.003 (Vol.-%) ² |
| Cross-sensitivity (interference) | u _i | 0.000 | Vol.-% | 0.000 (Vol.-%) ² |
| Influence of sample gas flow | u _b | 0.006 | Vol.-% | 0.000 (Vol.-%) ² |
| Uncertainty of reference material at 70% of certification range | u _{rm} | 0.202 | Vol.-% | 0.041 (Vol.-%) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or
"Standard deviation from paired measurements under field conditions"

| | | | |
|-------------------------------------------------|-----------------------------------|------|--------|
| Combined standard uncertainty (u _c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 0.27 | Vol.-% |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 0.53 | Vol.-% |

Relative total expanded uncertainty

| | | |
|----------------------------------|--------------------------------------|------------|
| Requirement of 2010/75/EU | U in % of the range 25 Vol.-% | 2.1 |
| Requirement of EN 15267-3 | U in % of the range 25 Vol.-% | 10.0 ** |
| | U in % of the range 25 Vol.-% | 7.5 |

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10.0 % was used for this.

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

Measuring system

| | |
|-----------------------------------|------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 23 |
| Serial number of units under test | System1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/C |
| Date of report | TÜV Rheinland 2016-12-22 |

Measured component

| | | |
|---------------------|-----------------|---------------|
| Certification range | CO ₂ | 0 - 25 Vol.-% |
|---------------------|-----------------|---------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|---------------------|
| Sum of positive CS at zero point | 0.00 Vol.-% |
| Sum of negative CS at zero point | 0.00 Vol.-% |
| Sum of positive CS at span point | 0.10 Vol.-% |
| Sum of negative CS at span point | -0.30 Vol.-% |
| Maximum sum of cross-sensitivities | -0.30 Vol.-% |
| Uncertainty of cross-sensitivity | u_i -0.173 Vol.-% |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|-----------|---------------|-----------------------------|
| Standard deviation from paired measurements under field conditions * | u_D | 0.740 Vol.-% | 0.548 (Vol.-%) ² |
| Lack of fit | u_{lof} | 0.058 Vol.-% | 0.003 (Vol.-%) ² |
| Zero drift from field test | $u_{d,z}$ | -0.289 Vol.-% | 0.084 (Vol.-%) ² |
| Span drift from field test | $u_{d,s}$ | -0.260 Vol.-% | 0.068 (Vol.-%) ² |
| Influence of ambient temperature at span | u_t | 0.289 Vol.-% | 0.084 (Vol.-%) ² |
| Influence of supply voltage | u_v | 0.062 Vol.-% | 0.004 (Vol.-%) ² |
| Cross-sensitivity (interference) | u_i | -0.173 Vol.-% | 0.030 (Vol.-%) ² |
| Influence of sample gas flow | u_b | 0.000 Vol.-% | 0.000 (Vol.-%) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 0.202 Vol.-% | 0.041 (Vol.-%) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or
"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|-------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 0.93 Vol.-% |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 1.82 Vol.-% |

Relative total expanded uncertainty

| | | |
|----------------------------------|--------------------------------------|------------|
| Requirement of 2010/75/EU | U in % of the range 25 Vol.-% | 7.3 |
| Requirement of EN 15267-3 | U in % of the range 25 Vol.-% | 10.0 ** |
| | U in % of the range 25 Vol.-% | 7.5 |

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10.0 % was used for this.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------|
| Certification range | CO 0 - 200 mg/m³ |
|---------------------|---------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|-------------------|
| Uncertainty of cross-sensitivity | u_i 1.998 mg/m³ |
|----------------------------------|-------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|------------------------|-------|----------|
| Standard deviation from paired measurements under field conditions * | u_D 0.588 mg/m³ | 0.346 | (mg/m³)² |
| Lack of fit | u_{lof} -0.924 mg/m³ | 0.854 | (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ 1.848 mg/m³ | 3.415 | (mg/m³)² |
| Span drift from field test | $u_{d,s}$ -1.732 mg/m³ | 3.000 | (mg/m³)² |
| Influence of ambient temperature at span | u_t 0.493 mg/m³ | 0.243 | (mg/m³)² |
| Influence of supply voltage | u_v 0.484 mg/m³ | 0.234 | (mg/m³)² |
| Cross-sensitivity (interference) | u_i 1.998 mg/m³ | 3.992 | (mg/m³)² |
| Influence of sample gas flow | u_p -0.107 mg/m³ | 0.011 | (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 1.617 mg/m³ | 2.613 | (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | | |
|-----------------------------------------|-----------------------------------|------|-------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 3.84 | mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 7.52 | mg/m³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|------------------------------------|-------------|
| U in % of the ELV 100 mg/m³ | 7.5 |
| U in % of the ELV 100 mg/m³ | 10.0 |
| U in % of the ELV 100 mg/m³ | 7.5 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service GmbH account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------|
| Certification range | CO 0 - 250 mg/m³ |
|---------------------|---------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|-------------------|
| Uncertainty of cross-sensitivity | u_i 2.165 mg/m³ |
|----------------------------------|-------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|------------------------|--|----------------|
| Standard deviation from paired measurements under field conditions * | u_D 1.656 mg/m³ | | 2.742 (mg/m³)² |
| Lack of fit | u_{lof} -1.155 mg/m³ | | 1.334 (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ 1.443 mg/m³ | | 2.082 (mg/m³)² |
| Span drift from field test | $u_{d,s}$ 1.443 mg/m³ | | 2.082 (mg/m³)² |
| Influence of ambient temperature at span | u_t 1.277 mg/m³ | | 1.631 (mg/m³)² |
| Influence of supply voltage | u_v 1.392 mg/m³ | | 1.938 (mg/m³)² |
| Cross-sensitivity (interference) | u_i 2.165 mg/m³ | | 4.687 (mg/m³)² |
| Influence of sample gas flow | u_p -0.217 mg/m³ | | 0.047 (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 2.021 mg/m³ | | 4.083 (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 4.54 mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 8.90 mg/m³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|------------------------------------|-------------|
| U in % of the ELV 100 mg/m³ | 8.9 |
| U in % of the ELV 100 mg/m³ | 10.0 |
| U in % of the ELV 100 mg/m³ | 7.5 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------|
| Certification range | CO 0 - 250 mg/m³ |
|---------------------|---------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|-------------------|
| Uncertainty of cross-sensitivity | u_i 2.165 mg/m³ |
|----------------------------------|-------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | u^2 | |
|----------------------------------------------------------------------|------------------------|-------|----------|
| Standard deviation from paired measurements under field conditions * | u_D 1.656 mg/m³ | 2.742 | (mg/m³)² |
| Lack of fit | u_{lof} -1.155 mg/m³ | 1.334 | (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ 1.443 mg/m³ | 2.082 | (mg/m³)² |
| Span drift from field test | $u_{d,s}$ 1.443 mg/m³ | 2.082 | (mg/m³)² |
| Influence of ambient temperature at span | u_t 1.277 mg/m³ | 1.631 | (mg/m³)² |
| Influence of supply voltage | u_v 1.568 mg/m³ | 2.459 | (mg/m³)² |
| Cross-sensitivity (interference) | u_i 2.165 mg/m³ | 4.687 | (mg/m³)² |
| Influence of sample gas flow | u_p -0.303 mg/m³ | 0.092 | (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 2.021 mg/m³ | 4.083 | (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | | |
|-----------------------------------------|-----------------------------------|------|-------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 4.60 | mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 9.02 | mg/m³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|------------------------------------|-------------|
| U in % of the ELV 100 mg/m³ | 9.0 |
| U in % of the ELV 100 mg/m³ | 10.0 |
| U in % of the ELV 100 mg/m³ | 7.5 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------|
| Certification range | NO 0 - 150 mg/m³ |
|---------------------|---------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|--------------------|
| Uncertainty of cross-sensitivity | u_i -3.464 mg/m³ |
|----------------------------------|--------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|------------------------|--------|----------|
| Standard deviation from paired measurements under field conditions * | u_D 0.619 mg/m³ | 0.383 | (mg/m³)² |
| Lack of fit | u_{lof} 0.753 mg/m³ | 0.567 | (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ -1.212 mg/m³ | 1.469 | (mg/m³)² |
| Span drift from field test | $u_{d,s}$ 2.252 mg/m³ | 5.072 | (mg/m³)² |
| Influence of ambient temperature at span | u_t 0.833 mg/m³ | 0.694 | (mg/m³)² |
| Influence of supply voltage | u_v 1.108 mg/m³ | 1.228 | (mg/m³)² |
| Cross-sensitivity (interference) | u_i -3.464 mg/m³ | 11.999 | (mg/m³)² |
| Influence of sample gas flow | u_p 0.381 mg/m³ | 0.145 | (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 1.212 mg/m³ | 1.470 | (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | | |
|-----------------------------------------|-----------------------------------|------|-------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 4.80 | mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 9.41 | mg/m³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|-------------------------------------|-------------|
| U in % of the ELV 65,2 mg/m³ | 14.4 |
| U in % of the ELV 65,2 mg/m³ | 20.0 |
| U in % of the ELV 65,2 mg/m³ | 15.0 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------|
| Certification range | NO 0 - 400 mg/m³ |
|---------------------|---------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|--------------------|
| Uncertainty of cross-sensitivity | u_i -6.928 mg/m³ |
|----------------------------------|--------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | u^2 | |
|----------------------------------------------------------------------|------------------------|--------|----------|
| Standard deviation from paired measurements under field conditions * | u_D 1.750 mg/m³ | 3.063 | (mg/m³)² |
| Lack of fit | u_{lof} -1.155 mg/m³ | 1.334 | (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ 3.233 mg/m³ | 10.452 | (mg/m³)² |
| Span drift from field test | $u_{d,s}$ 3.695 mg/m³ | 13.653 | (mg/m³)² |
| Influence of ambient temperature at span | u_t 2.177 mg/m³ | 4.739 | (mg/m³)² |
| Influence of supply voltage | u_v 1.688 mg/m³ | 2.849 | (mg/m³)² |
| Cross-sensitivity (interference) | u_i -6.928 mg/m³ | 47.997 | (mg/m³)² |
| Influence of sample gas flow | u_p 0.277 mg/m³ | 0.077 | (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 3.233 mg/m³ | 10.453 | (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | | |
|-----------------------------------------|-----------------------------------|-------|-------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 9.73 | mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 19.07 | mg/m³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|--------------------------------------|-------------|
| U in % of the ELV 130,4 mg/m³ | 14.6 |
| U in % of the ELV 130,4 mg/m³ | 20.0 |
| U in % of the ELV 130,4 mg/m³ | 15.0 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------|
| Certification range | NO 0 - 400 mg/m³ |
|---------------------|---------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|--------------------|
| Uncertainty of cross-sensitivity | u_i -6.928 mg/m³ |
|----------------------------------|--------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|------------------------|--|-----------------|
| Standard deviation from paired measurements under field conditions * | u_D 1.750 mg/m³ | | 3.063 (mg/m³)² |
| Lack of fit | u_{lof} -1.155 mg/m³ | | 1.334 (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ 3.233 mg/m³ | | 10.452 (mg/m³)² |
| Span drift from field test | $u_{d,s}$ 3.695 mg/m³ | | 13.653 (mg/m³)² |
| Influence of ambient temperature at span | u_t 2.117 mg/m³ | | 4.482 (mg/m³)² |
| Influence of supply voltage | u_v 2.824 mg/m³ | | 7.975 (mg/m³)² |
| Cross-sensitivity (interference) | u_i -6.928 mg/m³ | | 47.997 (mg/m³)² |
| Influence of sample gas flow | u_p 0.531 mg/m³ | | 0.282 (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 3.233 mg/m³ | | 10.453 (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-----------------------------------------|-----------------------------------|-------------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 9.98 mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 19.57 mg/m³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|--------------------------------------|-------------|
| U in % of the ELV 130,4 mg/m³ | 15.0 |
| U in % of the ELV 130,4 mg/m³ | 20.0 |
| U in % of the ELV 130,4 mg/m³ | 15.0 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service GmbH account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|--------------------|
| Certification range | NO 0 - 50 mg/m³ |
|---------------------|--------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|-------------------|
| Uncertainty of cross-sensitivity | u_i 0.967 mg/m³ |
|----------------------------------|-------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u^2 |
|----------------------------------------------------------------------|------------------------|-------|----------|
| Standard deviation from paired measurements under field conditions * | u_D 0.350 mg/m³ | 0.123 | (mg/m³)² |
| Lack of fit | u_{lof} -0.289 mg/m³ | 0.084 | (mg/m³)² |
| Zero drift from field test | $u_{d,z}$ 0.866 mg/m³ | 0.750 | (mg/m³)² |
| Span drift from field test | $u_{d,s}$ -0.693 mg/m³ | 0.480 | (mg/m³)² |
| Influence of ambient temperature at span | u_t 0.624 mg/m³ | 0.389 | (mg/m³)² |
| Influence of supply voltage | u_v 0.096 mg/m³ | 0.009 | (mg/m³)² |
| Cross-sensitivity (interference) | u_i 0.967 mg/m³ | 0.935 | (mg/m³)² |
| Influence of sample gas flow | u_p -0.136 mg/m³ | 0.018 | (mg/m³)² |
| Uncertainty of reference material at 70% of certification range | u_{rm} 0.404 mg/m³ | 0.163 | (mg/m³)² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | | |
|-----------------------------------------|-----------------------------------|------|-------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 1.72 | mg/m³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 3.37 | mg/m³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|-------------------------------------|-------------|
| U in % of the ELV 32,6 mg/m³ | 10.3 |
| U in % of the ELV 32,6 mg/m³ | 20.0 |
| U in % of the ELV 32,6 mg/m³ | 15.0 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service GmbH account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|----------------------------------------------|
| Certification range | SO ₂ 0 - 400 mg/m ³ |
|---------------------|----------------------------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|----------------------------------|-----------------------------------------|
| Uncertainty of cross-sensitivity | u _i -6.928 mg/m ³ |
|----------------------------------|-----------------------------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u ² |
|----------------------------------------------------------------------|-------------------------------------------|------------------------------------------|----------------|
| Standard deviation from paired measurements under field conditions * | u _D 2.475 mg/m ³ | 6.126 (mg/m ³) ² | |
| Lack of fit | u _{lof} -2.309 mg/m ³ | 5.331 (mg/m ³) ² | |
| Zero drift from field test | u _{d,z} 6.235 mg/m ³ | 38.875 (mg/m ³) ² | |
| Span drift from field test | u _{d,s} 4.850 mg/m ³ | 23.523 (mg/m ³) ² | |
| Influence of ambient temperature at span | u _t 4.414 mg/m ³ | 19.483 (mg/m ³) ² | |
| Influence of supply voltage | u _v 2.217 mg/m ³ | 4.915 (mg/m ³) ² | |
| Cross-sensitivity (interference) | u _i -6.928 mg/m ³ | 47.997 (mg/m ³) ² | |
| Influence of sample gas flow | u _p -2.215 mg/m ³ | 4.906 (mg/m ³) ² | |
| Uncertainty of reference material at 70% of certification range | u _{rm} 3.233 mg/m ³ | 10.453 (mg/m ³) ² | |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-------------------------------------------------|------------------------------------------------|-------------------------|
| Combined standard uncertainty (u _c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 12.71 mg/m ³ |
| Total expanded uncertainty | U = u _c * k = u _c * 1.96 | 24.92 mg/m ³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|-----------------------------------------------|-------------|
| U in % of the ELV 200 mg/m³ | 12.5 |
| U in % of the ELV 200 mg/m³ | 20.0 |
| U in % of the ELV 200 mg/m ³ | 15.0 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service GmbH account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 3 / TÜV 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------------|
| | SO ₂ |
| Certification range | 0 - 400 mg/m ³ |

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | | |
|----------------------------------|----------------|--------------------------|
| Uncertainty of cross-sensitivity | u _i | -6.928 mg/m ³ |
|----------------------------------|----------------|--------------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u ² |
|----------------------------------------------------------------------|------------------|--------------------------|------------------------------------------|
| Standard deviation from paired measurements under field conditions * | u _D | 2.475 mg/m ³ | 6.126 (mg/m ³) ² |
| Lack of fit | u _{lof} | -2.309 mg/m ³ | 5.331 (mg/m ³) ² |
| Zero drift from field test | u _{d,z} | 6.235 mg/m ³ | 38.875 (mg/m ³) ² |
| Span drift from field test | u _{d,s} | 4.850 mg/m ³ | 23.523 (mg/m ³) ² |
| Influence of ambient temperature at span | u _t | 4.414 mg/m ³ | 19.483 (mg/m ³) ² |
| Influence of supply voltage | u _v | 2.564 mg/m ³ | 6.574 (mg/m ³) ² |
| Cross-sensitivity (interference) | u _i | -6.928 mg/m ³ | 47.997 (mg/m ³) ² |
| Influence of sample gas flow | u _p | -2.215 mg/m ³ | 4.906 (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u _{rm} | 3.233 mg/m ³ | 10.453 (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-------------------------------------------------|------------------------------------------------|-------------------------|
| Combined standard uncertainty (u _c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 12.78 mg/m ³ |
| Total expanded uncertainty | U = u _c * k = u _c * 1.96 | 25.04 mg/m ³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|-----------------------------------------------|-------------|
| U in % of the ELV 200 mg/m³ | 12.5 |
| U in % of the ELV 200 mg/m³ | 20.0 |
| U in % of the ELV 200 mg/m ³ | 15.0 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service GmbH account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-------------------------------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB1957 Ultramat 6 |
| Serial number of units under test | System 1 / System 3 / System 2 / System 4 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|----------------|
| Test laboratory | 936/21230405/C |
| Date of report | TÜV Rheinland |
| | 2016-12-22 |

Measured component

| | | |
|---------------------|-----------------|--------------------------|
| Certification range | SO ₂ | 0 - 75 mg/m ³ |
|---------------------|-----------------|--------------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | |
|------------------------------------|-----------------------------------------|
| Sum of positive CS at zero point | 1.99 mg/m ³ |
| Sum of negative CS at zero point | -0.84 mg/m ³ |
| Sum of positive CS at span point | 1.10 mg/m ³ |
| Sum of negative CS at span point | -2.80 mg/m ³ |
| Maximum sum of cross-sensitivities | -2.80 mg/m ³ |
| Uncertainty of cross-sensitivity | u _i -1.615 mg/m ³ |

Calculation of the combined standard uncertainty

Tested parameter

| | | | u ² |
|----------------------------------------------------------------------|-------------------------------------------|--|-----------------------------------------|
| Standard deviation from paired measurements under field conditions * | u _D 1.066 mg/m ³ | | 1.136 (mg/m ³) ² |
| Lack of fit | u _{lof} -0.637 mg/m ³ | | 0.406 (mg/m ³) ² |
| Zero drift from field test | u _{d,z} 0.953 mg/m ³ | | 0.908 (mg/m ³) ² |
| Span drift from field test | u _{d,s} 0.996 mg/m ³ | | 0.992 (mg/m ³) ² |
| Influence of ambient temperature at span | u _t 1.277 mg/m ³ | | 1.631 (mg/m ³) ² |
| Influence of supply voltage | u _v 0.448 mg/m ³ | | 0.201 (mg/m ³) ² |
| Cross-sensitivity (interference) | u _i -1.615 mg/m ³ | | 2.608 (mg/m ³) ² |
| Influence of sample gas flow | u _p -0.135 mg/m ³ | | 0.018 (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u _{rm} 0.606 mg/m ³ | | 0.368 (mg/m ³) ² |

* The larger value is used :
"Repeatability standard deviation at set point" or
"Standard deviation from paired measurements under field conditions"

| | | |
|-------------------------------------------------|------------------------------------|------------------------|
| Combined standard uncertainty (u _c) | $u_c = \sqrt{\sum (u_{max, j})^2}$ | 2.88 mg/m ³ |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 5.64 mg/m ³ |

Relative total expanded uncertainty

| | | |
|---------------------------|----------------------------------------------|-------------|
| Requirement of 2010/75/EU | U in % of the ELV 50 mg/m³ | 11.3 |
| Requirement of EN 15267-3 | U in % of the ELV 50 mg/m³ | 20.0 |
| | U in % of the ELV 50 mg/m³ | 15.0 |

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | NDIR |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|--------------------------|
| | NO ₂ |
| Certification range | 0 - 50 mg/m ³ |

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | | |
|----------------------------------|----------------|-------------------------|
| Uncertainty of cross-sensitivity | u _i | 1.065 mg/m ³ |
|----------------------------------|----------------|-------------------------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | u ² |
|----------------------------------------------------------------------|------------------|--------------------------|-----------------------------------------|
| Standard deviation from paired measurements under field conditions * | u _D | 0.372 mg/m ³ | 0.138 (mg/m ³) ² |
| Lack of fit | u _{lof} | 0.231 mg/m ³ | 0.053 (mg/m ³) ² |
| Zero drift from field test | u _{d,z} | 0.606 mg/m ³ | 0.367 (mg/m ³) ² |
| Span drift from field test | u _{d,s} | -0.808 mg/m ³ | 0.653 (mg/m ³) ² |
| Influence of ambient temperature at span | u _t | 0.643 mg/m ³ | 0.413 (mg/m ³) ² |
| Influence of supply voltage | u _v | 0.200 mg/m ³ | 0.040 (mg/m ³) ² |
| Cross-sensitivity (interference) | u _i | 1.065 mg/m ³ | 1.134 (mg/m ³) ² |
| Influence of sample gas flow | u _p | -0.075 mg/m ³ | 0.006 (mg/m ³) ² |
| Uncertainty of reference material at 70% of certification range | u _{rm} | 0.404 mg/m ³ | 0.163 (mg/m ³) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

| | | |
|-------------------------------------------------|------------------------------------------------|------------------------|
| Combined standard uncertainty (u _c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 1.72 mg/m ³ |
| Total expanded uncertainty | U = u _c * k = u _c * 1.96 | 3.38 mg/m ³ |

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

| | |
|----------------------------------------------|-------------|
| U in % of the ELV 50 mg/m³ | 6.8 |
| U in % of the ELV 50 mg/m³ | 20.0 |
| U in % of the ELV 50 mg/m ³ | 15.0 |

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service GmbH account for the data of the uncertainty calculation.

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

Measuring system

| | |
|-----------------------------------|-----------------------|
| Manufacturer | Siemens AG |
| AMS designation | Set CEM CERT 7MB 1957 |
| Serial number of units under test | TÜV 1 / TÜV 2 |
| Measuring principle | electrochemical |

Test report

| | |
|-----------------|-----------------------------|
| Test laboratory | 936/21230405/B |
| Date of report | TÜV Rheinland 2016-09-12 |

Measured component

| | |
|---------------------|---------------------|
| Certification range | O2 0 - 25 Vol.-% |
|---------------------|---------------------|

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

| | | | |
|----------------------------------|-------|-------|--------|
| Uncertainty of cross-sensitivity | u_i | 0.167 | Vol.-% |
|----------------------------------|-------|-------|--------|

Calculation of the combined standard uncertainty

Tested parameter

| | | | | u^2 | |
|----------------------------------------------------------------------|-----------|--------|--------|-------|-----------------------|
| Standard deviation from paired measurements under field conditions * | u_D | 0.056 | Vol.-% | 0.003 | (Vol.-%) ² |
| Lack of fit | u_{lof} | 0.058 | Vol.-% | 0.003 | (Vol.-%) ² |
| Zero drift from field test | $u_{d,z}$ | 0.167 | Vol.-% | 0.028 | (Vol.-%) ² |
| Span drift from field test | $u_{d,s}$ | 0.098 | Vol.-% | 0.010 | (Vol.-%) ² |
| Influence of ambient temperature at span | u_t | 0.040 | Vol.-% | 0.002 | (Vol.-%) ² |
| Influence of supply voltage | u_v | 0.009 | Vol.-% | 0.000 | (Vol.-%) ² |
| Cross-sensitivity (interference) | u_i | 0.167 | Vol.-% | 0.028 | (Vol.-%) ² |
| Influence of sample gas flow | u_b | -0.029 | Vol.-% | 0.001 | (Vol.-%) ² |
| Uncertainty of reference material at 70% of certification range | u_{rm} | 0.202 | Vol.-% | 0.041 | (Vol.-%) ² |

* The larger value is used :

"Repeatability standard deviation at set point" or
"Standard deviation from paired measurements under field conditions"

| | | | |
|-----------------------------------------|-----------------------------------|------|--------|
| Combined standard uncertainty (u_c) | $u_c = \sqrt{\sum (u_{max,j})^2}$ | 0.34 | Vol.-% |
| Total expanded uncertainty | $U = u_c * k = u_c * 1.96$ | 0.67 | Vol.-% |

Relative total expanded uncertainty

U in % of the range 25 Vol.-% **2.7**

Requirement of 2010/75/EU

U in % of the range 25 Vol.-% **25.0 ****

Requirement of EN 15267-3

U in % of the range 25 Vol.-% **7.5**

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.

A value of 25.0 % was used for this.

Test results from the test performed by TÜV Rheinland Energy GmbH and TÜV Süd Industrie Service GmbH account for the data of the uncertainty calculation.