

# CERTIFICATE

## of Product Conformity (QAL1)

Certificate No.: 0000053810\_08

**Certified AMS:** Set CEM CERT 7MB1957 for CO, NO, SO<sub>2</sub>, CO<sub>2</sub>, NO<sub>2</sub>, NO<sub>x</sub> and O<sub>2</sub>

**Manufacturer:** Siemens AG  
Östliche Rheinbrückenstraße 50  
76187 Karlsruhe  
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 32 pages).

The present certificate replaces certificate 2435071-ts of 14 March 2016



Suitability Tested  
EN 15267  
QAL1 Certified  
Regular  
Surveillance

www.tuv.com  
ID 0000053810

Publication in the German Federal Gazette  
(BAnz.) of 15 March 2017

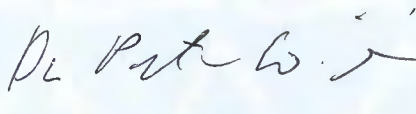
German Federal Environment Agency  
Dessau, 25 April 2017



Dr. Marcel Langner  
Head of Section II 4.1

This certificate will expire on:  
04 March 2018

TÜV Rheinland Energy GmbH  
Cologne, 24 April 2017



ppa. Dr. Peter Wilbring

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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.

<b>Test report:</b>	936/21230405/A dated 31 August 2016
<b>Initial certification:</b>	05 March 2013
<b>Expiry date:</b>	04 March 2018
<b>Publication:</b>	BAnz AT 15.03.2017 B6, chapter I no. 4.1

### Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13. BImSchV), plants in compliance with TA Luft and plants according to the 27. BImSchV. Equipped with the SIRPROCESS UV600-7MB2621 module the AMS is additionally suitable for waste incineration plants according to Directive 2010/75/EU, chapter IV (17. BImSchV) for monitoring the components NO, NO<sub>2</sub> and SO<sub>2</sub>. 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 several field tests at different waste incineration plants.

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 936/21230405/A dated 31 August 2016 of 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 15.03.2017 B6, chapter I no. 4.1,  
Announcement by UBA of 22 February 2017:

**AMS designation:**

Set CEM CERT 7MB1957 for CO, NO, SO<sub>2</sub>, CO<sub>2</sub>, NO<sub>2</sub>, NO<sub>x</sub> and O<sub>2</sub>

**Manufacturer:**

Siemens AG, Karlsruhe

**Field of application:**

Modular measuring system for plants requiring official approval and plants according to 27<sup>th</sup> BImSchV

**Measuring ranges during the performance test:**

Com- ponent	Module option	Certification range	Supplementary meas- urement ranges		Unit
CO	Ultramat 23-7MB2355 - Z - T13 / T23 / T33	0 - 200	0 - 1250	-	mg/m <sup>3</sup>
	Ultramat 23-7MB2357 - Z - T13 / T23 / T33	0 - 200	0 - 1250	-	mg/m <sup>3</sup>
	Ultramat 23-7MB2358 - Z - T13 / T23	0 - 250	0 - 1250	-	mg/m <sup>3</sup>
	Ultramat 23-7MB2355 - Z - T14 / T24 / T34	0 - 1250	0 - 6000	-	mg/m <sup>3</sup>
	Ultramat 23-7MB2357 - Z - T14 / T24 / T34	0 - 1250	0 - 6000	-	mg/m <sup>3</sup>
	Ultramat 6 LR - Z + Y27	0 - 75	0 - 1250	0 - 3000	mg/m <sup>3</sup>
	Ultramat 6-2K LR - Z + Y27 + Y 28	0 - 75	0 - 1250	0 - 3000	mg/m <sup>3</sup>
	Ultramat/Oxymat 6 LR - Z + Y27 + Y28	0 - 75	0 - 1250	0 - 3000	mg/m <sup>3</sup>
	Ultramat 6 HR - Z + Y27	0 - 1000	0 - 10000	-	mg/m <sup>3</sup>
	Ultramat 6-2K HR - Z + Y27 + Y 28	0 - 1000	0 - 10000	-	mg/m <sup>3</sup>
	Ultramat/Oxymat 6 HR - Z + Y27 + Y28	0 - 1000	0 - 10000	-	mg/m <sup>3</sup>
NO <sub>x</sub>	Ultramat 23-7MB2355 - Z - T13 / T23 / T33	0 - 150 <sup>1</sup> 0 - 230 <sup>2</sup>	0 - 750 <sup>1</sup> 0 - 1150 <sup>2</sup>	0 - 2000 <sup>1</sup> 0 - 3067 <sup>2</sup>	mg/m <sup>3</sup>
	Ultramat 23-7MB2357 - Z - T13 / T23 / T33	0 - 150 <sup>1</sup> 0 - 230 <sup>2</sup>	0 - 400 <sup>1</sup> 0 - 613 <sup>2</sup>	0 - 2000 <sup>1</sup> 0 - 3067 <sup>2</sup>	mg/m <sup>3</sup>
	Ultramat 23-7MB2358 - Z - T13 / T23	0 - 400 <sup>1</sup> 0 - 613 <sup>2</sup>	0 - 2000 <sup>1</sup> 0 - 3067 <sup>2</sup>	-	mg/m <sup>3</sup>
NO	SIPROCESS UV600-7MB2621 - Z - Y17	0 - 50	0 - 200	0 - 2000	mg/m <sup>3</sup>
	Ultramat 23-7MB2355 - Z - T14 / T24 / T34	0 - 600	0 - 3000	-	mg/m <sup>3</sup>
	Ultramat 23-7MB2357 - Z - T14 / T24 / T34	0 - 600	0 - 3000	-	mg/m <sup>3</sup>
	Ultramat 6 LR - Z + Y27	0 - 100	0 - 2000	-	mg/m <sup>3</sup>
	Ultramat 6-2K LR - Z + Y27 + Y 28	0 - 100	0 - 2000	-	mg/m <sup>3</sup>
	Ultramat/Oxymat 6 LR - Z + Y27 + Y28	0 - 100	0 - 2000	-	mg/m <sup>3</sup>
	Ultramat 6 HR - Z + Y27	0 - 1000	0 - 10000	-	mg/m <sup>3</sup>
	Ultramat 6-2K HR - Z + Y27 + Y 28	0 - 1000	0 - 10000	-	mg/m <sup>3</sup>
	Ultramat/Oxymat 6 HR - Z + Y27 + Y28	0 - 1000	0 - 10000	-	mg/m <sup>3</sup>
	Ultramat 6-2K LR - HR - Z - Y27 + Y28	0 - 100 <sup>3</sup> 0 - 1000 <sup>4</sup>	0 - 2000 <sup>3</sup> 0 - 10000 <sup>4</sup>	-	mg/m <sup>3</sup>
NO <sub>2</sub>	SIPROCESS UV600-7MB2621 - Z - Y17	0 - 50	0 - 500	-	mg/m <sup>3</sup>
SO <sub>2</sub>	Ultramat 23-7MB2355 - Z - T13 / T23 / T33	0 - 400	0 - 2000	0 - 7000	mg/m <sup>3</sup>
	Ultramat 23-7MB2357 - Z - T13 / T23 / T33	0 - 400	0 - 2000	0 - 7000	mg/m <sup>3</sup>
	Ultramat 23-7MB2358 - Z - T13 / T23	0 - 400	0 - 2000	0 - 7000	mg/m <sup>3</sup>
	SIPROCESS UV600-7MB2621 - Z - Y17	0 - 75	0 - 130	0 - 2000	mg/m <sup>3</sup>
	Ultramat 6 LR - Z + Y27	0 - 75	0 - 1500	-	mg/m <sup>3</sup>
	Ultramat 6-2K LR - Z + Y27 + Y 28	0 - 75	0 - 1500	-	mg/m <sup>3</sup>
	Ultramat/Oxymat 6 LR - Z + Y27 + Y28	0 - 75	0 - 1500	-	mg/m <sup>3</sup>

Component	Module option	Certification range	Supplementary measurement ranges		Unit
CO <sub>2</sub>	Ultramat 23-7MB2355 - Z - T13 / T23 / T33	0 - 25	-	-	Vol.-%
	Ultramat 23-7MB2357 - Z - T13 / T23 / T33	0 - 25	-	-	Vol.-%
O <sub>2</sub> (para.)	Ultramat 23-7MB2355 - Z - T13	0 - 25	-	-	Vol.-%
	Ultramat 23-7MB2357 - Z - T13	0 - 25	-	-	Vol.-%
	Ultramat 23-7MB2358 - Z - T13	0 - 25	-	-	Vol.-%
	Oxymat 6 - Z + Y27	0 - 25	0 - 5	-	Vol.-%
	Ultramat / Oxymat 6 - Z + Y27 + Y28	0 - 25	0 - 5	-	Vol.-%
O <sub>2</sub> (e.chem)	Ultramat 23-7MB2355 - Z - T23	0 - 25	0 - 5	-	Vol.-%
	Ultramat 23-7MB2357 - Z - T23	0 - 25	0 - 5	-	Vol.-%
	Ultramat 23-7MB2358 - Z - T23	0 - 25	0 - 5	-	Vol.-%

- 1 stated as NO                      2 stated as NO<sub>2</sub>  
3 low range                            3 high range

#### Software version:

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  
Gasmodul:                    9137582\_3.002  
UV-Module:                   9139736\_3.003

#### 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. The modular Set CEM CERT 7MB1957 measuring system can also be used for monitoring the components NO, NO<sub>2</sub> and SO<sub>2</sub> when equipped with the SIPROCESS UV600-7MB2621 or the components CO, NO and SO<sub>2</sub> at plants according to 17. BImSchV when equipped with the Ultramat 6, Ultramat 6-2K, Ultramat/Oxymat 6 module.
2. Modules of the Ultramat 23 series need to be operated with a 24h 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 CO<sub>2</sub> 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 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 (SP200-H) manufactured by M&C TechGroup Germany GmbH and a sample gas cooler (EGK 2-19) manufactured by Bühler Technologies GmbH.
6. The modular CEM CERT 7MB1957 measuring system may alternatively be equipped with a sample gas cooler (EGK 2-19) with a PVDF or glass cooling element manufactured by Bühler Technologies GmbH. 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<sub>x</sub> is equipped with a NO<sub>x</sub>-converter, type gas converter CG-2, converter manufactured by M&C Tech Group Germany GmbH.
8. The maintenance interval for the Ultramat 23-7MB2358 module is six months. 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 maintenance interval of the Ultramat 23-7MB2357 and Ultramat 23-7MB2355 modules is twelve months. 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.
10. The maintenance interval of the SIPROCESS UV600-7MB2621 is two weeks. The maintenance interval of the module can be extended six months for the component SO<sub>2</sub> and three months for the component NO<sub>2</sub> by way of weekly checks using the internal calibration cell. 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.
11. The maintenance interval for the Ultramat 6, Ultramat 6-2K, Ultramat/Oxymat 6 and Oxymat 6 is three months. 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.
12. 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.
13. 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.
14. Supplementary test (for the purpose of approving additional measuring modules, addition of a system cabinet, introduction of technical changes and the extension of the maintenance interval) as regards Federal Environmental Agency (UBA) notice dated 18 February 2016 (BAnz AT 14.03.2016 B7, chapter I number 5.1 as well as chapter IV correction 1) and dated 14 July 2016 (BAnz AT 01.08.2016 B11, chapter V notification 29).

**Test report:**

TÜV Rheinland Energy GmbH, Cologne  
Report No.: 936/21230405/A dated 31 August 2016

### Certified product

This certificate 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. For measuring CO, NO and SO<sub>2</sub>, the modular measuring system uses the principle of non-dispersive infrared absorption (NDIR method). For measuring O<sub>2</sub>, 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 NO<sub>2</sub> and SO<sub>2</sub> 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. 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>	Hersteller	M&C TechGroup Germany GmbH
	Typ	SP2000H incl. ceramic filter (length 100 cm), heated to 180 °C
<u>heated sample gas line</u>	Manufacturer	Winkler GmbH
	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<sub>x</sub> converter</u>	Manufacturer	M&C TechGroup Germany GmbH
	Type	gas converter CG-2
<u>analyser module</u>	Manufacturer	Siemens AG, Karlsruhe
	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	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
Gasmodul:	9137582_3.002
UV-Module:	9139736_3.003

The current versions of the operation manuals are:

Ultramat 23:	Version 01/2015
Ultramat 6 / Oxymat 6:	Version 11/2005
SiprocessUV600:	Version 10/2013
System description Set CEM CERT 7MB1957:	version dated 6 July 2017 Rev. 7

### **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\*\*](http://gal1.de).

Certification of Set CEM CERT 7MB1957 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. 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  
Announcement by UBA from 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 no. 4.1  
Announcement by UBA from 3 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 8 12, chapter I no. 4.2  
Announcement by UBA from 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 March 2014,  
TÜV SÜD Industrie Service GmbH  
Publication: BAnz AT 05.08.2014 B1 1, chapter I no. 5.3  
Announcement by UBA from 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 March 2014,  
TÜV SÜD Industrie Service GmbH  
Publication: BAnz AT 05.08.2014 B11, chapter I no. 5.4  
Announcement by UBA from 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 no. 4.1  
Announcement by UBA from 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 no. 3.2  
Announcement by UBA from 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 no. 5.1  
Announcement by UBA from 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 no. 4.1  
Announcement by UBA from 22 February 2017

### **Notifications**

Statement of TÜV Süd Industrie Service GmbH of 17 March 2013  
Publication in the German Federal Gazette: BAnz AT 23.07.2013 B4, chapter V  
notification 26  
Announcement by UBA from 03 July 2013  
(software changes)

Statement of TÜV Süd Industrie Service GmbH of 19 March 2014  
Publication in the German Federal Gazette: BAnz AT 05.08.2014 B11, chapter V  
notification 3  
Announcement by UBA from 17 July 2014  
(software changes)

Statement of TÜV Süd Industrie Service GmbH of 18 September 2015  
Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, chapter IV  
notification 43  
Announcement by UBA from 25 February 2015  
(software changes)

### **Corrections**

Correction of the Umweltbundesamt of 22 July 2015  
Publication in the German Federal Gazette: BAnz AT 26.08.2015 B4, chapter IV  
correction 1 (missing second additional measurement range for NO<sub>x</sub> for the Ultramat 23-  
7MB2357-Z-T13 module)  
Announcement by UBA from 22 July 2015

Statement of TÜV Süd Industrie Service GmbH of 15 October 2015  
Publication in the German Federal Gazette: BAnz AT 14.03.2016 B7, chapter IV  
correction 1 (second additional measurement range for CO for the Ultramat 23-7MB2357-Z-  
T13 module deleted)  
Announcement by UBA from 18 February 2016



**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	CO 0 - 75 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Sum of positive CS at zero point	0.32 mg/m <sup>3</sup>
Sum of negative CS at zero point	-0.33 mg/m <sup>3</sup>
Sum of positive CS at span point	1.00 mg/m <sup>3</sup>
Sum of negative CS at span point	-0.40 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	1.00 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ 0.576 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Standard deviation from paired measurements under field conditions *	$u_D$ 0.614 mg/m <sup>3</sup>		0.377 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$ 0.229 mg/m <sup>3</sup>		0.052 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$ -0.650 mg/m <sup>3</sup>		0.423 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$ 0.606 mg/m <sup>3</sup>		0.367 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$ 0.924 mg/m <sup>3</sup>		0.854 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$ 0.082 mg/m <sup>3</sup>		0.007 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ 0.576 mg/m <sup>3</sup>		0.332 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_p$ -0.079 mg/m <sup>3</sup>		0.006 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 0.606 mg/m <sup>3</sup>		0.368 (mg/m <sup>3</sup> ) <sup>2</sup>

\* 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/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.27 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 50 mg/m<sup>3</sup></b>	<b>6.5</b>
<b>U in % of the ELV 50 mg/m<sup>3</sup></b>	<b>10.0</b>
U in % of the ELV 50 mg/m <sup>3</sup>	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	CO 0 - 1000 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

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

**Calculation of the combined standard uncertainty**

**Tested parameter**

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

\* 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/m<sup>3</sup> 7.1**

**Requirement of 2010/75/EU**

**U in % of the ELV 500 mg/m<sup>3</sup> 10.0**

**Requirement of EN 15267-3**

**U in % of the ELV 500 mg/m<sup>3</sup> 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	TÜV Rheinland
Date of report	2016-08-31

**Measured component**

Certification range	CO	0 - 1250 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

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

**Calculation of the combined standard uncertainty**

**Tested parameter**

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

\* 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/m<sup>3</sup> 6.9**

**Requirement of 2010/75/EU**

**U in % of the ELV 600 mg/m<sup>3</sup> 10.0**

**Requirement of EN 15267-3**

**U in % of the ELV 600 mg/m<sup>3</sup> 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 <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

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

**Calculation of the combined standard uncertainty**

**Tested parameter**

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

\* 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 <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	5.87 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 40 mg/m<sup>3</sup></b>	<b>14.7</b>
<b>U in % of the ELV 40 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 40 mg/m <sup>3</sup>	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 <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

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

**Calculation of the combined standard uncertainty**

**Tested parameter**

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

\* 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/m<sup>3</sup> 10.2**

**Requirement of 2010/75/EU**

**U in % of the ELV 500 mg/m<sup>3</sup> 20.0**

**Requirement of EN 15267-3**

**U in % of the ELV 500 mg/m<sup>3</sup> 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/A TÜV Rheinland
Date of report	2016-08-31

**Measured component**

Certification range	NO 0 - 600 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

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

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$	
Standard deviation from paired measurements under field conditions *	$u_D$	2.338 mg/m <sup>3</sup>	5.466	(mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$	1.732 mg/m <sup>3</sup>	3.000	(mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$	3.811 mg/m <sup>3</sup>	14.524	(mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$	6.582 mg/m <sup>3</sup>	43.323	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	3.005 mg/m <sup>3</sup>	9.030	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$	1.787 mg/m <sup>3</sup>	3.193	(mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	-9.838 mg/m <sup>3</sup>	96.786	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_p$	0.577 mg/m <sup>3</sup>	0.333	(mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	4.850 mg/m <sup>3</sup>	23.520	(mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty ( $u_c$ )	$u_c = \sqrt{\sum (u_{max,j})^2}$	14.11 mg/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	27.66 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 200 mg/m<sup>3</sup></b>	<b>13.8</b>
<b>U in % of the ELV 200 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 200 mg/m <sup>3</sup>	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/A
Date of report	TÜV Rheinland
	2016-08-31

**Measured component**

	SO <sub>2</sub>
Certification range	0 - 75 mg/m <sup>3</sup>

**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Sum of positive CS at zero point	1.99 mg/m <sup>3</sup>
Sum of negative CS at zero point	-0.84 mg/m <sup>3</sup>
Sum of positive CS at span point	1.10 mg/m <sup>3</sup>
Sum of negative CS at span point	-2.80 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	-2.80 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	u <sub>i</sub> -1.615 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

			u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub>	1.066 mg/m <sup>3</sup>	1.136 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	u <sub>lof</sub>	-0.637 mg/m <sup>3</sup>	0.406 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub>	0.953 mg/m <sup>3</sup>	0.908 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub>	0.996 mg/m <sup>3</sup>	0.992 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub>	1.277 mg/m <sup>3</sup>	1.631 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub>	0.448 mg/m <sup>3</sup>	0.201 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub>	-1.615 mg/m <sup>3</sup>	2.608 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	u <sub>p</sub>	-0.135 mg/m <sup>3</sup>	0.018 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub>	0.606 mg/m <sup>3</sup>	0.368 (mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

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

**Relative total expanded uncertainty**

<b>Requirement of 2010/75/EU</b>	<b>U in % of the ELV 50 mg/m<sup>3</sup></b>	<b>11.3</b>
Requirement of EN 15267-3	U in % of the ELV 50 mg/m <sup>3</sup>	20.0
	U in % of the ELV 50 mg/m <sup>3</sup>	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 Oxymat 6
Serial number of units under test	System 1 / System 3 / System 2 / System 4
Measuring principle	paramagnetic

**Test report**

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

**Measured component**

Certification range	O <sub>2</sub>	0 - 25 Vol.-%
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**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 <sub>i</sub>	0.000 Vol.-%

**Calculation of the combined standard uncertainty**

**Tested parameter**

				u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub>	0.083	Vol.-%	0.007 (Vol.-%) <sup>2</sup>
Lack of fit	u <sub>lof</sub>	-0.012	Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub>	-0.035	Vol.-%	0.001 (Vol.-%) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub>	-0.069	Vol.-%	0.005 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub>	0.081	Vol.-%	0.007 (Vol.-%) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub>	0.055	Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub>	0.000	Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	u <sub>b</sub>	0.006	Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub>	0.202	Vol.-%	0.041 (Vol.-%) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u<sub>c</sub>)

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

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	TÜV Rheinland
Date of report	2016-08-31

**Measured component**

Certification range	O <sub>2</sub> 0 - 25 Vol.-%
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**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 <sub>i</sub> 0.000 Vol.-%

**Calculation of the combined standard uncertainty**

**Tested parameter**

				u <sup>2</sup>
Repeatability standard deviation at set point *	u <sub>r</sub>	0.050 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Lack of fit	u <sub>lof</sub>	0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub>	-0.052 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub>	0.081 Vol.-%		0.007 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub>	0.116 Vol.-%		0.013 (Vol.-%) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub>	0.055 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub>	0.000 Vol.-%		0.000 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	u <sub>b</sub>	0.006 Vol.-%		0.000 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub>	0.202 Vol.-%		0.041 (Vol.-%) <sup>2</sup>

\* The larger value is used :

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

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

**Relative total expanded uncertainty**

<b>Requirement of 2010/75/EU</b>	<b>U in % of the range 25 Vol.-%</b>	<b>2.1</b>
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
		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	TÜV Rheinland
Date of report	2016-08-31

**Measured component**

Certification range	CO <sub>2</sub>	0 - 25 Vol.-%
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**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.-%) <sup>2</sup>
Lack of fit	$u_{lof}$	0.058 Vol.-%	0.003 (Vol.-%) <sup>2</sup>
Zero drift from field test	$u_{d,z}$	-0.289 Vol.-%	0.084 (Vol.-%) <sup>2</sup>
Span drift from field test	$u_{d,s}$	-0.260 Vol.-%	0.068 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	0.289 Vol.-%	0.084 (Vol.-%) <sup>2</sup>
Influence of supply voltage	$u_v$	0.062 Vol.-%	0.004 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	-0.173 Vol.-%	0.030 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	$u_b$	0.000 Vol.-%	0.000 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	0.202 Vol.-%	0.041 (Vol.-%) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty ( $u_c$ )

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 0.93 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 1.82 \text{ Vol.-%}$$

**Relative total expanded uncertainty**

**U in % of the range 25 Vol.-%** **7.3**

**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 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/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	$u_i$ 1.998 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$
Standard deviation from paired measurements under field conditions *	$u_D$ 0.588 mg/m <sup>3</sup>	0.346 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$ -0.924 mg/m <sup>3</sup>	0.854 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$ 1.848 mg/m <sup>3</sup>	3.415 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$ -1.732 mg/m <sup>3</sup>	3.000 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$ 0.493 mg/m <sup>3</sup>	0.243 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$ 0.484 mg/m <sup>3</sup>	0.234 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ 1.998 mg/m <sup>3</sup>	3.992 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_p$ -0.107 mg/m <sup>3</sup>	0.011 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 1.617 mg/m <sup>3</sup>	2.613 (mg/m <sup>3</sup> ) <sup>2</sup>

\* 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/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	7.52 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 100 mg/m<sup>3</sup></b>	<b>7.5</b>
<b>U in % of the ELV 100 mg/m<sup>3</sup></b>	<b>10.0</b>
U in % of the ELV 100 mg/m <sup>3</sup>	7.5

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.

**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/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	$u_i$ 2.165 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$	
Standard deviation from paired measurements under field conditions *	$u_D$ 1.656 mg/m <sup>3</sup>	2.742	(mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$ -1.155 mg/m <sup>3</sup>	1.334	(mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$ 1.443 mg/m <sup>3</sup>	2.082	(mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$ 1.443 mg/m <sup>3</sup>	2.082	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$ 1.277 mg/m <sup>3</sup>	1.631	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$ 1.392 mg/m <sup>3</sup>	1.938	(mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ 2.165 mg/m <sup>3</sup>	4.687	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_p$ -0.217 mg/m <sup>3</sup>	0.047	(mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 2.021 mg/m <sup>3</sup>	4.083	(mg/m <sup>3</sup> ) <sup>2</sup>

\* 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/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	8.90	mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 100 mg/m<sup>3</sup></b>	<b>8.9</b>
<b>U in % of the ELV 100 mg/m<sup>3</sup></b>	<b>10.0</b>
U in % of the ELV 100 mg/m <sup>3</sup>	7.5

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.



**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**

Certification range	CO 0 - 250 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	$u_i$ 2.165 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$
Standard deviation from paired measurements under field conditions *	$u_D$ 1.656 mg/m <sup>3</sup>	2.742 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$ -1.155 mg/m <sup>3</sup>	1.334 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$ 1.443 mg/m <sup>3</sup>	2.082 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$ 1.443 mg/m <sup>3</sup>	2.082 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$ 1.277 mg/m <sup>3</sup>	1.631 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$ 1.568 mg/m <sup>3</sup>	2.459 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ 2.165 mg/m <sup>3</sup>	4.687 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_p$ -0.303 mg/m <sup>3</sup>	0.092 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 2.021 mg/m <sup>3</sup>	4.083 (mg/m <sup>3</sup> ) <sup>2</sup>

\* 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/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	9.02 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 100 mg/m<sup>3</sup></b>	<b>9.0</b>
<b>U in % of the ELV 100 mg/m<sup>3</sup></b>	<b>10.0</b>
U in % of the ELV 100 mg/m <sup>3</sup>	7.5

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.

**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/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	$u_i$ -3.464 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$	
Standard deviation from paired measurements under field conditions *	$u_D$ 0.619 mg/m <sup>3</sup>	0.383	(mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$ 0.753 mg/m <sup>3</sup>	0.567	(mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$ -1.212 mg/m <sup>3</sup>	1.469	(mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$ 2.252 mg/m <sup>3</sup>	5.072	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$ 0.833 mg/m <sup>3</sup>	0.694	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$ 1.108 mg/m <sup>3</sup>	1.228	(mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ -3.464 mg/m <sup>3</sup>	11.999	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_p$ 0.381 mg/m <sup>3</sup>	0.145	(mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 1.212 mg/m <sup>3</sup>	1.470	(mg/m <sup>3</sup> ) <sup>2</sup>

\* 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/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	9.41	mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 65,2 mg/m<sup>3</sup></b>	<b>14.4</b>
<b>U in % of the ELV 65,2 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 65,2 mg/m <sup>3</sup>	15.0

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.



**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/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	$u_i$ -6.928 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$	
Standard deviation from paired measurements under field conditions *	$u_D$ 1.750 mg/m <sup>3</sup>	3.063	(mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$ -1.155 mg/m <sup>3</sup>	1.334	(mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$ 3.233 mg/m <sup>3</sup>	10.452	(mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$ 3.695 mg/m <sup>3</sup>	13.653	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$ 2.177 mg/m <sup>3</sup>	4.739	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$ 1.688 mg/m <sup>3</sup>	2.849	(mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ -6.928 mg/m <sup>3</sup>	47.997	(mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_b$ 0.277 mg/m <sup>3</sup>	0.077	(mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 3.233 mg/m <sup>3</sup>	10.453	(mg/m <sup>3</sup> ) <sup>2</sup>

\* 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/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	19.07	mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 130,4 mg/m<sup>3</sup></b>	<b>14.6</b>
<b>U in % of the ELV 130,4 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 130,4 mg/m <sup>3</sup>	15.0

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.

**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**

Certification range	NO 0 - 400 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	$u_i$ -6.928 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Standard deviation from paired measurements under field conditions *	$u_D$ 1.750 mg/m <sup>3</sup>		3.063 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$ -1.155 mg/m <sup>3</sup>		1.334 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$ 3.233 mg/m <sup>3</sup>		10.452 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$ 3.695 mg/m <sup>3</sup>		13.653 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$ 2.117 mg/m <sup>3</sup>		4.482 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$ 2.824 mg/m <sup>3</sup>		7.975 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ -6.928 mg/m <sup>3</sup>		47.997 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_b$ 0.531 mg/m <sup>3</sup>		0.282 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 3.233 mg/m <sup>3</sup>		10.453 (mg/m <sup>3</sup> ) <sup>2</sup>

\* 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/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	19.57 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 130,4 mg/m<sup>3</sup></b>	<b>15.0</b>
<b>U in % of the ELV 130,4 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 130,4 mg/m <sup>3</sup>	15.0

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.



**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 TÜV Rheinland
Date of report	2016-09-12

**Measured component**

	NO
Certification range	0 - 50 mg/m <sup>3</sup>

**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	$u_i$	0.967 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Standard deviation from paired measurements under field conditions *	$u_D$	0.350 mg/m <sup>3</sup>	0.123 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	$u_{lof}$	-0.289 mg/m <sup>3</sup>	0.084 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{d,z}$	0.866 mg/m <sup>3</sup>	0.750 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,s}$	-0.693 mg/m <sup>3</sup>	0.480 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_t$	0.624 mg/m <sup>3</sup>	0.389 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_v$	0.096 mg/m <sup>3</sup>	0.009 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$	0.967 mg/m <sup>3</sup>	0.935 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_p$	-0.136 mg/m <sup>3</sup>	0.018 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_{rm}$	0.404 mg/m <sup>3</sup>	0.163 (mg/m <sup>3</sup> ) <sup>2</sup>

\* 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 <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.37 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 32,6 mg/m<sup>3</sup></b>	<b>10.3</b>
<b>U in % of the ELV 32,6 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 32,6 mg/m <sup>3</sup>	15.0

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.

**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 <sub>2</sub> 0 - 400 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	u <sub>i</sub> -6.928 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

		u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub> 2.475 mg/m <sup>3</sup>	6.126 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	u <sub>lof</sub> -2.309 mg/m <sup>3</sup>	5.331 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub> 6.235 mg/m <sup>3</sup>	38.875 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub> 4.850 mg/m <sup>3</sup>	23.523 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub> 4.414 mg/m <sup>3</sup>	19.483 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub> 2.217 mg/m <sup>3</sup>	4.915 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub> -6.928 mg/m <sup>3</sup>	47.997 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	u <sub>p</sub> -2.215 mg/m <sup>3</sup>	4.906 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub> 3.233 mg/m <sup>3</sup>	10.453 (mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

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

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 200 mg/m<sup>3</sup></b>	<b>12.5</b>
<b>U in % of the ELV 200 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 200 mg/m <sup>3</sup>	15.0

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.



**Berechnung der Gesamtunsicherheit nach DIN EN 14181 und DIN EN 15267-3**

**Messeinrichtung**

Hersteller	Siemens AG
Bezeichnung der Messeinrichtung	Set CEM CERT 7MB 1957
Seriennummer der Prüflinge	TÜV 3 / TÜV 4
Messprinzip	NDIR

**Prüfbericht**

Prüfinstitut	936/21230405/B
Berichtsdatum	TÜV Rheinland
	12.09.2016

**Messkomponente**

Zertifizierungsbereich ZB	SO <sub>2</sub>	0 - 400 mg/m <sup>3</sup>
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**Bewertung der Querempfindlichkeiten (QE)**

(System mit größter QE)

Messunsicherheit der Querempfindlichkeit	u <sub>i</sub>	-6.928 mg/m <sup>3</sup>
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**Berechnung der erweiterten Messunsicherheit**

**Prüfgröße**

		u <sup>2</sup>	
Standardabweichung aus Doppelbestimmungen *	u <sub>D</sub>	2.475 mg/m <sup>3</sup>	6.126 (mg/m <sup>3</sup> ) <sup>2</sup>
Linearität / Lack-of-fit	u <sub>lof</sub>	-2.309 mg/m <sup>3</sup>	5.331 (mg/m <sup>3</sup> ) <sup>2</sup>
Nullpunktdrift aus Feldtest	u <sub>d,z</sub>	6.235 mg/m <sup>3</sup>	38.875 (mg/m <sup>3</sup> ) <sup>2</sup>
Referenzpunktdrift aus Feldtest	u <sub>d,s</sub>	4.850 mg/m <sup>3</sup>	23.523 (mg/m <sup>3</sup> ) <sup>2</sup>
Einfluss der Umgebungstemperatur am Referenzpunkt	u <sub>t</sub>	4.414 mg/m <sup>3</sup>	19.483 (mg/m <sup>3</sup> ) <sup>2</sup>
Einfluss der Netzspannung	u <sub>v</sub>	2.564 mg/m <sup>3</sup>	6.574 (mg/m <sup>3</sup> ) <sup>2</sup>
Querempfindlichkeit	u <sub>i</sub>	-6.928 mg/m <sup>3</sup>	47.997 (mg/m <sup>3</sup> ) <sup>2</sup>
Einfluss des Probengasvolumenstrom	u <sub>b</sub>	-2.215 mg/m <sup>3</sup>	4.906 (mg/m <sup>3</sup> ) <sup>2</sup>
Unsicherheit des Referenzmaterials bei 70% des ZB	u <sub>rm</sub>	3.233 mg/m <sup>3</sup>	10.453 (mg/m <sup>3</sup> ) <sup>2</sup>

\* Der größere der Werte wird verwendet:

"Wiederholstandardabweichung am Referenzpunkt" oder

"Standardabweichung aus Doppelbestimmungen"

Kombinierte Standardunsicherheit (u <sub>c</sub> )	$u_c = \sqrt{\sum (u_{max,j})^2}$	12.78 mg/m <sup>3</sup>
Erweiterte Unsicherheit	U = u <sub>c</sub> * k = u <sub>c</sub> * 1,96	25.04 mg/m <sup>3</sup>

**Relative erweiterte Messunsicherheit**

**Anforderung nach 2010/75/EU**

Anforderung nach DIN EN 15267-3

<b>U in % vom Grenzwert 200 mg/m<sup>3</sup></b>	<b>12.5</b>
<b>U in % vom Grenzwert 200 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % vom Grenzwert 200 mg/m <sup>3</sup>	15.0

Die Daten der Unsicherheitsberechnung setzen sich zusammen aus Prüfergebnissen aus Prüfungen der TÜV Rheinland Energy GmbH und aus Prüfungen der TÜV Süd Industrie Service GmbH.

**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**

	SO <sub>2</sub>
Certification range	0 - 75 mg/m <sup>3</sup>

**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	u <sub>i</sub>	1.589 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

			u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub>	0.586 mg/m <sup>3</sup>	0.343 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	u <sub>lof</sub>	0.403 mg/m <sup>3</sup>	0.162 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub>	-1.212 mg/m <sup>3</sup>	1.469 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub>	-1.256 mg/m <sup>3</sup>	1.578 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub>	0.900 mg/m <sup>3</sup>	0.810 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub>	0.179 mg/m <sup>3</sup>	0.032 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub>	1.589 mg/m <sup>3</sup>	2.525 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	u <sub>p</sub>	-0.264 mg/m <sup>3</sup>	0.070 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub>	0.606 mg/m <sup>3</sup>	0.368 (mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u <sub>c</sub> )	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.71 mg/m <sup>3</sup>
Total expanded uncertainty	U = u <sub>c</sub> * k = u <sub>c</sub> * 1.96	5.32 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 50 mg/m<sup>3</sup></b>	<b>10.6</b>
<b>U in % of the ELV 50 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 50 mg/m <sup>3</sup>	15.0

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.



**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 <sub>2</sub> 0 - 50 mg/m <sup>3</sup>
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	u <sub>i</sub> 1.065 mg/m <sup>3</sup>
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**Calculation of the combined standard uncertainty**

**Tested parameter**

		u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub> 0.372 mg/m <sup>3</sup>	0.138 (mg/m <sup>3</sup> ) <sup>2</sup>
Lack of fit	u <sub>lof</sub> 0.231 mg/m <sup>3</sup>	0.053 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub> 0.606 mg/m <sup>3</sup>	0.367 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub> -0.808 mg/m <sup>3</sup>	0.653 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub> 0.643 mg/m <sup>3</sup>	0.413 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub> 0.200 mg/m <sup>3</sup>	0.040 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub> 1.065 mg/m <sup>3</sup>	1.134 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	u <sub>p</sub> -0.075 mg/m <sup>3</sup>	0.006 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub> 0.404 mg/m <sup>3</sup>	0.163 (mg/m <sup>3</sup> ) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

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

**Relative total expanded uncertainty**

**Requirement of 2010/75/EU**

Requirement of EN 15267-3

<b>U in % of the ELV 50 mg/m<sup>3</sup></b>	<b>6.8</b>
<b>U in % of the ELV 50 mg/m<sup>3</sup></b>	<b>20.0</b>
U in % of the ELV 50 mg/m <sup>3</sup>	15.0

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.

**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	O <sub>2</sub> 0 - 25 Vol.-%
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Uncertainty of cross-sensitivity	u <sub>i</sub> 0.167 Vol.-%
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**Calculation of the combined standard uncertainty**

**Tested parameter**

				u <sup>2</sup>
Standard deviation from paired measurements under field conditions *	u <sub>D</sub>	0.056 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Lack of fit	u <sub>lof</sub>	0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Zero drift from field test	u <sub>d,z</sub>	0.167 Vol.-%		0.028 (Vol.-%) <sup>2</sup>
Span drift from field test	u <sub>d,s</sub>	0.098 Vol.-%		0.010 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	u <sub>t</sub>	0.072 Vol.-%		0.005 (Vol.-%) <sup>2</sup>
Influence of supply voltage	u <sub>v</sub>	0.009 Vol.-%		0.000 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	u <sub>i</sub>	0.167 Vol.-%		0.028 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	u <sub>b</sub>	-0.029 Vol.-%		0.001 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	u <sub>rm</sub>	0.202 Vol.-%		0.041 (Vol.-%) <sup>2</sup>

\* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u <sub>c</sub> )	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.34 Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.68 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.-% 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.

The data of this calculation of overall uncertainty consists of results from tests of the TÜV Rheinland Energy GmbH and tests of the TÜV Süd Industrie Service GmbH.

**[Ende des Zertifikat -Bereichs,  
QAL1 Arbeitsblätter vor dieser Textmarke einfügen,  
diese Textmarke nicht löschen da sie für die Seitennummerierung gebraucht wird ]**