

# CERTIFICATE

## of Product Conformity (QAL1)

Certificate No.: 0000081150\_01

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

**Manufacturer:** Siemens  
Östliche Rheinbrückenstr. 50  
76187 Karlsruhe  
Germany

**Test Institute:** TÜV Rheinland Energy GmbH

**This is to certify that the AMS has been tested  
and found to comply with the standards  
EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2007)  
as well as EN 14181 (2014).**

Certification is awarded in respect of the conditions stated in this certificate  
(this certificate contains 13 pages).

The present certificate replaces certificate 0000081150\_00 dated 25 April 2023.



Suitability Tested  
EN 15267  
QAL1 Certified  
Regular  
Surveillance

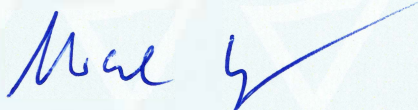
www.tuv.com  
ID 0000081150

Publication in the German Federal Gazette  
(BAnz) of 02 August 2023

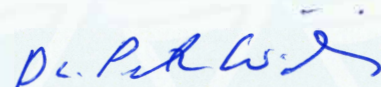
This certificate will expire on:  
01 August 2028

German Environment Agency  
Dessau, 05 September 2023

TÜV Rheinland Energy GmbH  
Cologne, 04 September 2023



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Test institute accredited to EN ISO/IEC 17025 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>	936/21253799/B dated 03 February 2023
<b>Initial certification:</b>	20 March 2023
<b>Expiry date:</b>	01 August 2028
<b>Publication:</b>	BAnz AT 02.08.2023 B7, chapter I No. 3.3

### **Approved application**

The tested AMS is suitable for use at plants according to Directive 2010/75/EC, chapter III (combustion plants / 13th BImSchV:2021), chapter IV (waste incineration plants / 17th BImSchV:2021), Directive 2015/2193/EC (44th BImSchV:2022), 30th BImSchV:2019, TA Luft:2021 and 27th BImSchV:2013. The measured ranges have been selected so as to ensure 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 a twelve month field test at a waste incineration plant.

The AMS is approved for an ambient temperature range of +5 ° 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 emission limit values and oxygen concentration 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.

### **Note:**

The legal regulations mentioned correspond to the current state of legislation during certification. Each user should, if necessary, in consultation with the competent authority, ensure that this AMS meets the legal requirements for the intended use. In addition, it cannot be ruled out that legal regulations governing the use of a measuring device for emission monitoring may change during the lifetime of the certificate.

### **Basis of the certification**

This certification is based on:

- Test report 936/21253799/B dated 03 February 2023 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 02.08.2023 B7, chapter I No. 3.3,  
Announcement by UBA dated 05 July 2023:

**AMS designation:**

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

**Manufacturer:**

Siemens AG, Karlsruhe, Germany

**Field of application:**

Modular measuring system for plants requiring official approval and plants according to the 27th BImSchV.

**Measuring ranges during the performance test:**

Component	Modul-Version	Certification range	Additional range		Unit
<b>Ultramat23-7MB235a-0bcd6-3efg</b>					
CO	a = 5; bc = (AG, AJ) <sup>1</sup>	0 - 50	0 - 1,250	0 - 3,000	mg/m <sup>3</sup>
	a = 7; (bc = (AG, AJ) <sup>1</sup> or ef=AA, (AG, AJ) <sup>1</sup> )				
	a = 8; bc = BM, (AK, AS) <sup>1</sup>				
NO <sub>x</sub>	a = 7; (bc = PA, (PF, PG, PH, PU, PV, PW) <sup>1</sup> or ef = (PF, PG, PH, PU, PV, PW) <sup>1</sup> )	0 - 50	0 - 2,000	-	mg/m <sup>3</sup>
	a = 8; bc = AS <sup>1</sup>				
NO	a = 5; bc = PA, (PF, PG, PH, PU, PV, PW) <sup>1</sup>	0 - 50	0 - 1,000	-	mg/m <sup>3</sup>
	a = 7; (bc = PA, (PF, PG, PH, PU, PV, PW) <sup>1</sup> oder ef = (PF, PG, PH, PU, PV, PW) <sup>1</sup> )				
	a = 8; bc = (AK, AS) <sup>1</sup>				
NO <sub>2</sub>	a = 5; bc = NS	0 - 50	0 - 1,000	-	mg/m <sup>3</sup>
	a = 7,8; ef = NS				
SO <sub>2</sub>	a = 5; bc = NS, (NF, NG, NH, NW) <sup>1</sup>	0 - 70	0 - 1,250	-	mg/m <sup>3</sup>
	a = 7; (bc = (NF, NG, NH, NW) <sup>1</sup> oder ef = NS, (NF, NG, NH, NW) <sup>1</sup> )				
	a = 8; ef = NS, (NF, NG, NH, NW) <sup>1</sup>				
CO <sub>2</sub>	a = 5; bc = CP	0 - 25	-	-	Vol.-%
	a = 7; (bc = CP oder ef = CP)				
	a = 8; bc = BM				
O <sub>2</sub> elektrochemical	a = 5,7,8; d = 1	0 - 25	-	-	Vol.-%

<sup>1</sup> Additional range

**Software versions:**

ULTRAMAT 23-7MB2355	4.02.12
ULTRAMAT 23-7MB2357	4.02.12
ULTRAMAT 23-7MB2358	4.02.12
SIEMENS SIMATIC Set CEM CERT 7MB1957 Rev.	3.0.3

**Restrictions:**

None

**Notes:**

1. The ULTRAMAT 23 series modules are to be operated with a 24 hour interval for automatic zero adjustment.
2. The maintenance interval is six months.
3. The modular measuring system Set CEM CERT II 7MB1957 includes a system cabinet with housing protection class IP40. The system cabinet can be equipped with an air-conditioning unit or a fan unit.
4. The measuring system has a digital interface for data transmission according to the guideline VDI 4201 Part 1 (general requirements), Part 3 (Modbus TCP/IP) and Part 4 (OPC).
5. Supplementary test (maintenance interval extension) with regard to the announcement of the Federal Environment Agency (UBA) of 21 February 2023 (BAnz AT 20.03.2023 B6, chapter I number 3.3).

**Test institute:**

TÜV Rheinland Energy GmbH, Cologne  
Report No.: 936/21253799/B dated 3 February 2023

### Certified product

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

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

Measuring cabinet	Set CEM CERT II 7MB1957 system cabinet
Probe	
Manufacturer:	Bühler Technologies GmbH
Typ:	GAS 222.20-Cal-twin incl. ceramic filter (length 100 cm), heated 180 °C
Heated sample gas line	
Temperature:	180 °C
Length:	50 m in the field, 10 m in the lab
Diameter (inner):	4 mm
Material:	PTFE
Compressor cooler	
Manufacturer:	Bühler Technologies GmbH
Type:	RC1.2, 2 stage, dew point 4 °C
Sample gas pump	
Manufacturer:	Bühler Technologies GmbH
Typ:	P 2.3
Analyser modules	
Manufacturer:	Siemens AG
Type:	Ultramat 23-7MB2355 Ultramat 23-7MB2357 Ultramat 23-7MB2358

The Set CEM CERT II 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.

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. 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 downstream of 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.



### **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 certification mark may be applied to the product or used in advertising materials 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).

### **History of documents**

Certification of Set CEM CERT II 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. 0000081150\_00: 25 April 2023  
Expiry date of the certificate: 19 March 2028  
Test report: 936/21253799/A dated 5 August 2022  
TÜV Rheinland Energy GmbH  
Publication: BAnz AT 20.03.2023 B6, chapter I number 3.3  
UBA announcement dated 21 February 2023

#### **Supplementary testing according to EN 15267**

Certificate No. 0000081150\_01: 05 September 2023  
Expiry date of the certificate: 01 August 2028  
Test report: 936/21253799/B dated 3 February 2023  
TÜV Rheinland Energy GmbH  
Publication: BAnz AT 02.08.2023 B7, chapter I number 3.3  
UBA announcement dated 5 July 2023

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

**Measuring system**

Manufacturer	SIEMENS AG
AMS designation	Set CEM CERT II 7MB1957
Serial number of units under test	TÜV 1/TÜV 2
Measuring principle	NDIR

**Test report**

Test laboratory	936/21253799/B TÜV Rheinland
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**Measured component**

Certification range	CO 0 - 50 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	0.23 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	-0.30 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	-0.30 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ -0.173 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Lack of fit	$u_D$ 0.309 mg/m <sup>3</sup>		0.095 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{lof}$ -0.231 mg/m <sup>3</sup>		0.053 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,z}$ 0.115 mg/m <sup>3</sup>		0.013 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_{d,s}$ 0.462 mg/m <sup>3</sup>		0.213 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_t$ 0.379 mg/m <sup>3</sup>		0.144 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_v$ 0.107 mg/m <sup>3</sup>		0.011 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_i$ -0.173 mg/m <sup>3</sup>		0.030 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_p$ 0.196 mg/m <sup>3</sup>		0.038 (mg/m <sup>3</sup> ) <sup>2</sup>
	$u_{rm}$ 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 ( $u_c$ )	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.87 mg/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.71 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

Requirement of 2010/75/EU	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>5.1</b>
Requirement of EN 15267-3	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>10.0</b>
	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>7.5</b>

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

**Measuring system**

Manufacturer	SIEMENS AG
AMS designation	Set CEM CERT II 7MB1957
Serial number of units under test	TÜV 1/TÜV 2
Measuring principle	NDIR

**Test report**

Test laboratory	936/21253799/B TÜV Rheinland
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**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	0.00 Vol.-%
Sum of negative CS at span point	-0.10 Vol.-%
Maximum sum of cross-sensitivities	0.10 Vol.-%
Uncertainty of cross-sensitivity	$u_i$ 0.058 Vol.-%

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Lack of fit	$u_D$ 0.105 Vol.-%		0.011 (Vol.-%) <sup>2</sup>
Zero drift from field test	$u_{lof}$ 0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Span drift from field test	$u_{d,z}$ 0.029 Vol.-%		0.001 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	$u_{d,s}$ 0.130 Vol.-%		0.017 (Vol.-%) <sup>2</sup>
Influence of supply voltage	$u_t$ 0.115 Vol.-%		0.013 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	$u_v$ 0.000 Vol.-%		0.000 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	$u_i$ 0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_b$ 0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
	$u_{rm}$ 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 ( $u_c$ )	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.30 Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.60 Vol.-%

**Relative total expanded uncertainty**

Requirement of 2010/75/EU	<b>U in % of the range 25 Vol.-%</b>	<b>2,4</b>
Requirement of EN 15267-3	<b>U in % of the range 25 Vol.-%</b>	<b>10,0 **</b>
	U in % of the range 25 Vol.-%	7,5

\*\* The EU-directive 2010/75/EC on industrial emissions does not define requirements for this component.  
A value of 10,0 % was used instead.



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

**Measuring system**

Manufacturer	SIEMENS AG
AMS designation	Set CEM CERT II 7MB1957
Serial number of units under test	TÜV 1/TÜV 2
Measuring principle	NDIR

**Test report**

Test laboratory	936/21253799/B TÜV Rheinland
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**Measured component**

Certification range	NO 0 - 50 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	1.19 mg/m <sup>3</sup>
Sum of negative CS at zero point	-0.97 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	-0.70 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	1.19 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ 0.687 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$
Lack of fit	$u_D$ 0.643 mg/m <sup>3</sup>	0.413 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{lof}$ 0.346 mg/m <sup>3</sup>	0.120 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,z}$ 0.173 mg/m <sup>3</sup>	0.030 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_{d,s}$ 0.635 mg/m <sup>3</sup>	0.403 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_t$ 0.346 mg/m <sup>3</sup>	0.120 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_v$ 0.156 mg/m <sup>3</sup>	0.024 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_i$ 0.687 mg/m <sup>3</sup>	0.472 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_p$ 0.115 mg/m <sup>3</sup>	0.013 (mg/m <sup>3</sup> ) <sup>2</sup>
	$u_{rm}$ 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 ( $u_c$ )	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.33 mg/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.60 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

Requirement of 2010/75/EU	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>7.8</b>
Requirement of EN 15267-3	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>20.0</b>
	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>15.0</b>

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

**Measuring system**

Manufacturer	SIEMENS AG
AMS designation	Set CEM CERT II 7MB1957
Serial number of units under test	TÜV 1/TÜV 2
Measuring principle	UV Absorption

**Test report**

Test laboratory	936/21253799/B TÜV Rheinland
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**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)

Sum of positive CS at zero point	0.68 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	0.60 mg/m <sup>3</sup>
Sum of negative CS at span point	-0.80 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	-0.80 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ -0.462 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$
Lack of fit	$u_D$ 0.468 mg/m <sup>3</sup>	0.219 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{l,of}$ 0.173 mg/m <sup>3</sup>	0.030 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,z}$ 0.144 mg/m <sup>3</sup>	0.021 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_{d,s}$ 0.508 mg/m <sup>3</sup>	0.258 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_t$ 0.321 mg/m <sup>3</sup>	0.103 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_i$ -0.462 mg/m <sup>3</sup>	0.213 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_n$ 0.115 mg/m <sup>3</sup>	0.013 (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 ( $u_c$ )	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.06 mg/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.07 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

<b>Requirement of 2010/75/EU</b>	<b>U in % of the ELV 33,3 mg/m<sup>3</sup></b>	<b>6,2</b>
Requirement of EN 15267-3	U in % of the ELV 33,3 mg/m <sup>3</sup>	20,0
	U in % of the ELV 33,3 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 II 7MB1957
Serial number of units under test	TÜV 1/TÜV 2
Measuring principle	calculated

**Test report**

Test laboratory	936/21253799/B TÜV Rheinland
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**Measured component**

Certification range	NOx 0 - 50 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	1.65 mg/m <sup>3</sup>
Sum of negative CS at zero point	-0.86 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	-0.70 mg/m <sup>3</sup>
Maximum sum of cross-sensitivities	1.65 mg/m <sup>3</sup>
Uncertainty of cross-sensitivity	$u_i$ 0.953 mg/m <sup>3</sup>

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Lack of fit	$u_D$ 1.035 mg/m <sup>3</sup>		1.071 (mg/m <sup>3</sup> ) <sup>2</sup>
Zero drift from field test	$u_{lof}$ 0.173 mg/m <sup>3</sup>		0.030 (mg/m <sup>3</sup> ) <sup>2</sup>
Span drift from field test	$u_{d,z}$ 0.177 mg/m <sup>3</sup>		0.031 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of ambient temperature at span	$u_{d,s}$ 0.574 mg/m <sup>3</sup>		0.329 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of supply voltage	$u_t$ 0.586 mg/m <sup>3</sup>		0.343 (mg/m <sup>3</sup> ) <sup>2</sup>
Cross-sensitivity (interference)	$u_v$ 0.313 mg/m <sup>3</sup>		0.098 (mg/m <sup>3</sup> ) <sup>2</sup>
Influence of sample gas flow	$u_i$ 0.953 mg/m <sup>3</sup>		0.908 (mg/m <sup>3</sup> ) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_p$ -0.214 mg/m <sup>3</sup>		0.046 (mg/m <sup>3</sup> ) <sup>2</sup>
	$u_{rm}$ 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 ( $u_c$ )	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.74 mg/m <sup>3</sup>
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.41 mg/m <sup>3</sup>

**Relative total expanded uncertainty**

Requirement of 2010/75/EU	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>10.2</b>
Requirement of EN 15267-3	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>20.0</b>
	<b>U in % of the ELV 33.3 mg/m<sup>3</sup></b>	<b>15.0</b>

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

**Measuring system**

Manufacturer	SIEMENS AG
AMS designation	Set CEM CERT II 7MB1957
Serial number of units under test	TÜV 1/TÜV 2
Measuring principle	elektrochemisch

**Test report**

Test laboratory	936/21253799/B TÜV Rheinland
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**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	-0.10 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	-0.10 Vol.-%
Uncertainty of cross-sensitivity	$u_i$ -0.058 Vol.-%

**Calculation of the combined standard uncertainty**

**Tested parameter**

			$u^2$
Lack of fit	$u_D$ 0.038 Vol.-%		0.001 (Vol.-%) <sup>2</sup>
Zero drift from field test	$u_{lof}$ -0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Span drift from field test	$u_{d,z}$ 0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Influence of ambient temperature at span	$u_{d,s}$ 0.104 Vol.-%		0.011 (Vol.-%) <sup>2</sup>
Influence of supply voltage	$u_t$ 0.064 Vol.-%		0.004 (Vol.-%) <sup>2</sup>
Cross-sensitivity (interference)	$u_v$ 0.021 Vol.-%		0.000 (Vol.-%) <sup>2</sup>
Influence of sample gas flow	$u_i$ -0.058 Vol.-%		0.003 (Vol.-%) <sup>2</sup>
Uncertainty of reference material at 70% of certification range	$u_b$ 0.006 Vol.-%		0.000 (Vol.-%) <sup>2</sup>
	$u_{rm}$ 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 ( $u_c$ )	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.26 Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.51 Vol.-%

**Relative total expanded uncertainty**

Requirement of 2010/75/EU	<b>U in % of the range 25 Vol.-%</b>	<b>2,0</b>
Requirement of EN 15267-3	<b>U in % of the range 25 Vol.-%</b>	<b>10,0 **</b>
	<b>U in % of the range 25 Vol.-%</b>	<b>7,5</b>

\*\* The EU-directive 2010/75/EC on industrial emissions does not define requirements for this component.  
A value of 10,0 % was used instead.



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

**Measuring system**

Manufacturer	SIEMENS AG
AMS designation	Set CEM CERT II 7MB1957
Serial number of units under test	TÜV 1/TÜV 2
Measuring principle	UV Absorption

**Test report**

Test laboratory	936/21253799/B TÜV Rheinland
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**Measured component**

Certification range	SO2 0 - 70 mg/m³
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**Evaluation of the cross-sensitivity (CS)**

(system with largest CS)

Sum of positive CS at zero point	0.54 mg/m³
Sum of negative CS at zero point	-0.61 mg/m³
Sum of positive CS at span point	2.20 mg/m³
Sum of negative CS at span point	-1.20 mg/m³
Maximum sum of cross-sensitivities	2.20 mg/m³
Uncertainty of cross-sensitivity	$u_i$ 1.269 mg/m³

**Calculation of the combined standard uncertainty**

**Tested parameter**

		$u^2$
Lack of fit	$u_D$ 0.203 mg/m³	0.041 (mg/m³)²
Zero drift from field test	$u_{d,cf}$ -0.287 mg/m³	0.082 (mg/m³)²
Span drift from field test	$u_{d,z}$ 0.323 mg/m³	0.104 (mg/m³)²
Influence of ambient temperature at span	$u_{d,s}$ 0.970 mg/m³	0.941 (mg/m³)²
Influence of supply voltage	$u_t$ 0.608 mg/m³	0.370 (mg/m³)²
Cross-sensitivity (interference)	$u_i$ 1.269 mg/m³	1.610 (mg/m³)²
Influence of sample gas flow	$u_n$ 0.289 mg/m³	0.084 (mg/m³)²
Uncertainty of reference material at 70% of certification range	$u_{rm}$ 0.566 mg/m³	0.320 (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 ( $u_c$ )

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 1.89 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 3.71 \text{ mg/m}^3$$

**Relative total expanded uncertainty**

**U in % of the ELV 46.6 mg/m³** **8.0**

**Requirement of 2010/75/EU**

**U in % of the ELV 46.6 mg/m³** **20.0**

Requirement of EN 15267-3

U in % of the ELV 46.6 mg/m³ 15.0