Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000081150_00

Certified AMS:	Set CEM CERT II 7MB1957 for CO, NO, NO_2, NO_x, SO_2, O_2 and CO_2
Manufacturer:	Siemens AG 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).

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Regular Surveillance

www.tuv.com
ID 0000081150

Publication in the German Federal Gazette (BAnz) of 20 March 2023

This certificate will expire on: 19 March 2028

German Environment Agency
Dessau, 25 April 2023

TÜV Rheinland Energy GmbH
Cologne, 24 April 2023

Dr. Marcel Langner
Head of Section II 4.1

ppa. Dr. Peter Wilbring

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

TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Köln

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.

10/221 2.08

Test report:	936/21253799/A dated 05 August 2022
Initial certification:	20 March 2023
Expiry date:	19 March 2028
Publication:	BAnz AT 20.03.2023 B6, chapter I No. 3.3

Approved application
The tested AMS is suitable for use at plants according to Directive 2010/75/EC, chapter III (13th BImSchV:2021), chapter IV (17th BImSchV:2021), Directive 2015/2193/EC (44th BImSchV:2021), 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 six 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/A dated 05 August 2022 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 20.03.2023 B6, chapter I No. 3.3, Announcement by UBA dated 21 February 2023:

AMS designation:

SET CEM CERT II 7MB1957 for CO, NO, NO_2, NO_x, SO_2, CO_2 and O_2

Manufacturer:

Siemens AG, Karlsruhe, Deutschland

Field of application:

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

Measuring ranges during the performance test:

Component	Modul variant	Certification range	Additional ranges		Unit
	Ultramat23-7MB235a-0bcd6-3efg				
CO	a = 5; bc = (AG, AJ)[1]	0 - 50	0 - 1,250	0 - 3,000	mg/m³
	a = 7; (bc = (AG, AJ) [1] or ef = AA, (AG, AJ)[1])				
	a = 8; bc = BM, (AK, AS)[1]				
NOx	a = 7; (bc = PA, (PF, PG, PH, PU, PV, PW) [1] or ef = (PF, PG, PH, PU, PV, PW) [1]	0 - 50	0 – 2,000	-	mg/m³
	a = 8; bc = AS[1]				
NO	a = 5; bc = PA, (PF, PG, PH, PU, PV, PW) [1]	0 - 50	0 - 1,000	-	mg/m³
	a = 7; (bc = PA, (PF, PG, PH, PU, PV, PW) [1] or ef = (PF, PG, PH, PU, PV, PW)[1]				
	a = 8; bc = (AK, AS) [1]				
NO_2	a = 5; bc = NS	0 - 50	0 - 1,000	-	mg/m³
	a = 7,8; ef = NS				
SO_2	a = 5; bc = NS, (NF, NG, NH, NW) [1]	0 - 70	0 - 1,250	-	mg/m³
	a = 7; (bc = (NF, NG, NH, NW) [1] or ef = NS, (NF, NG, NH, NW) [1]				
	a = 8; ef = NS, (NF, NG, NH, NW) [1]				
CO_2	a = 5; bc = CP	0 - 25	-	-	Vol.-%
	a = 7; (bc = CP or ef = CP)				
	a = 8; bc = BM				
$O_{2\ electrochemical}$	a = 5,7,8; d = 1	0 - 25	-	-	Vol.-%

[1] additional range

Software versions:

ULTRAMAT 23-7MB2355 4.02.10
ULTRAMAT 23-7MB2357 4.02.10
ULTRAMAT 23-7MB2358 4.02.10
SIEMENS SIMATIC Set CEM CERT 7MB1957 Rev. 3.0.2

Restrictions:
None

Notes:
1. The modules of the ULTRAMAT 23 series are to be operated with an interval of 24 h for the automatic zero point adjustment.
2. The maintenance interval is three 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 with a fan unit.

Test report:
TÜV Rheinland Energy GmbH, Cologne
Report No.: 936/21253799/A dated 5 August 2022

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 oder 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:	EGK 2-19, 2 stage, dew point 3 °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: **qal1.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 05 August 2022
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 20.03.2023 B6, chapter I No. 3.3
Announcement by UBA dated 21 February 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		936/21253799/A	
Test laboratory		TÜV Rheinland	
Measured component		CO	
Certification range		0 - 50	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		0.23	mg/m³
Sum of negative CS at zero point		0.00	mg/m³
Sum of postive CS at span point		0.00	mg/m³
Sum of negative CS at span point		-0.30	mg/m³
Maximum sum of cross-sensitivities		-0.30	mg/m³
Uncertainty of cross-sensitivity	u_i	-0.173	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
	u_D	0.309	mg/m³	0.095	(mg/m³)²
Lack of fit	u_{lof}	-0.231	mg/m³	0.053	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.115	mg/m³	0.013	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.318	mg/m³	0.101	(mg/m³)²
Influence of ambient temperature at span	u_t	0.379	mg/m³	0.144	(mg/m³)²
Influence of supply voltage	u_v	0.107	mg/m³	0.011	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.173	mg/m³	0.030	(mg/m³)²
Influence of sample gas flow	u_p	0.196	mg/m³	0.038	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.404	mg/m³	0.163	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.81	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.58	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 33.3 mg/m³**	**4.7**
Requirement of 2010/75/EU	**U in % of the ELV 33.3 mg/m³**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 33.3 mg/m³	7.5

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

Measuring system			
Manufacturer		SIEMENS AG	
AMS designation		Set CEM CERT II 7MB1957	
Serial number of units under test		TÜV 1/TÜV 2	
Measuring principle		NDIR	
Test report		936/21253799/A	
Test laboratory		TÜV Rheinland	
Measured component		NO	
Certification range		0 - 50	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		1.19	mg/m³
Sum of negative CS at zero point		-0.97	mg/m³
Sum of postive CS at span point		1.10	mg/m³
Sum of negative CS at span point		-0.70	mg/m³
Maximum sum of cross-sensitivities		1.19	mg/m³
Uncertainty of cross-sensitivity	u_i	0.687	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
	u_D	0.643	mg/m³	0.413	(mg/m³)²
Lack of fit	u_{lof}	0.346	mg/m³	0.120	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.144	mg/m³	0.021	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.404	mg/m³	0.163	(mg/m³)²
Influence of ambient temperature at span	u_t	0.346	mg/m³	0.120	(mg/m³)²
Influence of supply voltage	u_v	0.156	mg/m³	0.024	(mg/m³)²
Cross-sensitivity (interference)	u_i	0.687	mg/m³	0.472	(mg/m³)²
Influence of sample gas flow	u_p	0.115	mg/m³	0.013	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.404	mg/m³	0.163	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.23	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.41	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 33.3 mg/m³**	**7.2**
Requirement of 2010/75/EU	**U in % of the ELV 33.3 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 33.3 mg/m³	15.0

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

Measuring system					
Manufacturer		SIEMENS AG			
AMS designation		Set CEM CERT II 7MB1957			
Serial number of units under test		TÜV 1/TÜV 2			
Measuring principle		UV Absorption			
Test report		936/21253799/A			
Test laboratory		TÜV Rheinland			
Measured component		NO_2			
Certification range		0 - 50	mg/m³		
Evaluation of the cross-sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point		0,68	mg/m³		
Sum of negative CS at zero point		0,00	mg/m³		
Sum of postive CS at span point		0,60	mg/m³		
Sum of negative CS at span point		-0,80	mg/m³		
Maximum sum of cross-sensitivities		-0,80	mg/m³		
Uncertainty of cross-sensitivity	u_i	-0,462	mg/m³		
Calculation of the combined standard uncertainty					
Tested parameter				u^2	
	u_D	0,468	mg/m³	0,219	(mg/m³)²
Lack of fit	u_{lof}	0,173	mg/m³	0,030	(mg/m³)²
Zero drift from field test	$u_{d.z}$	0,144	mg/m³	0,021	(mg/m³)²
Span drift from field test	$u_{d.s}$	0,404	mg/m³	0,163	(mg/m³)²
Influence of ambient temperature at span	u_t	0,321	mg/m³	0,103	(mg/m³)²
Influence of supply voltage	u_v	0,313	mg/m³	0,098	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0,462	mg/m³	0,213	(mg/m³)²
Influence of sample gas flow	u_p	0,115	mg/m³	0,013	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0,404	mg/m³	0,163	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1,01	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1,98	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 33,3 mg/m³**	**6,0**
Requirement of 2010/75/EU	**U in % of the ELV 33,3 mg/m³**	**20,0**
Requirement of EN 15267-3	U in % of the ELV 33,3 mg/m³	15,0

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

Measuring system					
Manufacturer			SIEMENS AG		
AMS designation			Set CEM CERT II 7MB1957		
Serial number of units under test			TÜV 1/TÜV 2		
Measuring principle			UV Absorption		
Test report			936/21253799/A		
Test laboratory			TÜV Rheinland		
Measured component			NOx		
Certification range			0 - 50 mg/m³		
Evaluation of the cross-sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point			1.65 mg/m³		
Sum of negative CS at zero point			-0.86 mg/m³		
Sum of postive CS at span point			0.00 mg/m³		
Sum of negative CS at span point			-0.70 mg/m³		
Maximum sum of cross-sensitivities			1.65 mg/m³		
Uncertainty of cross-sensitivity		u_i	0.953 mg/m³		
Calculation of the combined standard uncertainty					
Tested parameter				u^2	
		u_D	1.035 mg/m³	1.071	(mg/m³)²
Lack of fit		u_{lof}	0.173 mg/m³	0.030	(mg/m³)²
Zero drift from field test		$u_{d,z}$	-0.133 mg/m³	0.018	(mg/m³)²
Span drift from field test		$u_{d,s}$	0.442 mg/m³	0.195	(mg/m³)²
Influence of ambient temperature at span		u_t	0.586 mg/m³	0.343	(mg/m³)²
Influence of supply voltage		u_v	0.313 mg/m³	0.098	(mg/m³)²
Cross-sensitivity (interference)		u_i	0.953 mg/m³	0.908	(mg/m³)²
Influence of sample gas flow		u_p	-0.214 mg/m³	0.046	(mg/m³)²
Uncertainty of reference material at 70% of certification range		u_{rm}	0.404 mg/m³	0.163	(mg/m³)²
Combined standard uncertainty (u_C)		$u_c = \sqrt{\sum (u_{max,j})^2}$		1.69	mg/m³
Total expanded uncertainty		$U = u_c * k = u_c * 1.96$		3.32	mg/m³

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

Relative total expanded uncertainty	**U in % of the ELV 33.3 mg/m³**	**10.0**
Requirement of 2010/75/EU	**U in % of the ELV 33.3 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 33.3 mg/m³	15.0

Umwelt Bundesamt

Certificate:
0000081150_00 / 25 April 2023

TÜVRheinland®
Precisely Right.

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		936/21253799/A		
Test laboratory		TÜV Rheinland		
Measured component		SO_2		
Certification range		0 - 70 mg/m³		
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 postive 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	
	u_D	0,203 mg/m³	0,041	(mg/m³)²
Lack of fit	u_{lof}	-0,287 mg/m³	0,082	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0,323 mg/m³	0,104	(mg/m³)²
Span drift from field test	$u_{d,s}$	0,525 mg/m³	0,276	(mg/m³)²
Influence of ambient temperature at span	u_t	0,608 mg/m³	0,370	(mg/m³)²
Influence of supply voltage	u_v	0,176 mg/m³	0,031	(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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1,71	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3,35	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 46.6 mg/m³**	**7.2**
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

Certificate:
0000081150_00 / 25 April 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	936/21253799/A				
Test laboratory	TÜV Rheinland				
Measured component	CO_2				
Certification range	0 - 25	Vol.-%			
Evaluation of the cross-sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point		0,00	Vol.-%		
Sum of negative CS at zero point		0,00	Vol.-%		
Sum of postive 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	
	u_D	0,105	Vol.-%	0,011	(Vol.-%)²
Lack of fit	u_{lof}	0,058	Vol.-%	0,003	(Vol.-%)²
Zero drift from field test	$u_{d.z}$	0,014	Vol.-%	0,000	(Vol.-%)²
Span drift from field test	$u_{d.s}$	0,087	Vol.-%	0,008	(Vol.-%)²
Influence of ambient temperature at span	u_t	0,115	Vol.-%	0,013	(Vol.-%)²
Influence of supply voltage	u_v	0,000	Vol.-%	0,000	(Vol.-%)²
Cross-sensitivity (interference)	u_i	0,058	Vol.-%	0,003	(Vol.-%)²
Influence of sample gas flow	u_b	0,058	Vol.-%	0,003	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0,202	Vol.-%	0,041	(Vol.-%)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0,29	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0,56	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.3**
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/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		eletrochemical			
Test report		936/21253799/A			
Test laboratory		TÜV Rheinland			
Measured component		O_2			
Certification range		0 - 25	Vol.-%		
Evaluation of the cross-sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point		0.00	Vol.-%		
Sum of negative CS at zero point		-0.10	Vol.-%		
Sum of postive 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	
	u_D	0.038	Vol.-%	0.001	(Vol.-%)²
Lack of fit	u_{lof}	-0.058	Vol.-%	0.003	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.058	Vol.-%	0.003	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.087	Vol.-%	0.008	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.064	Vol.-%	0.004	(Vol.-%)²
Influence of supply voltage	u_v	0.021	Vol.-%	0.000	(Vol.-%)²
Cross-sensitivity (interference)	u_i	-0.058	Vol.-%	0.003	(Vol.-%)²
Influence of sample gas flow	u_p	0.006	Vol.-%	0.000	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202	Vol.-%	0.041	(Vol.-%)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.25	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.50	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/EC on industrial emissions does not define requirements for this component.
A value of 10.0 % was used instead.