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Umwelt Bundes Amt
For our Environment

Certificate number: 1630664.2-ts

TÜV SÜD Industrie Service

CERTIFICATE

Of product conformity (QAL 1)

Certificate number: 1630664.2-ts

AMS	Set CEM CERT 7MB1957 monitoring CO, NO, SO_2 and O_2
Manufacturer	Siemens AG Östliche Rheinbrückenstraße 50 76187 Karlsruhe Germany
Test institute	TÜV SÜD Industrie Service GmbH

This is to certify that the AMS fulfils the requirements of the DIN EN 15267-1: 2009, DIN EN 15267-2: 2009, DIN EN 15267-3: 2008 and DIN EN 14181: 2004 standards.

This certificate replaces the certificate 1630664-ts dated 26th March 2013

DIN EN 15267 TÜV SÜD Eignungsprüfung gültig bis 03/2018 Produktion überwacht

Certificate No: 1630664.2-ts

Publication in the German Federal Gazette
dated 23rd July 2013

Certificate validity
until 4th March 2018

Umweltbundesamt
Dessau, 16th August 2013

p.p. Dr. Marcel Langner

TÜV SÜD Industrie Service GmbH
Testing laboratory Emission measurement/ calibration
Munich, 14th August 2013

Dr. Michael Waeber

TÜV®

Certification applies to the conditions listed in this certificate

Test report	1630664-2 from 15th March 2013
Initial certification	5th March 2013
Certificate validity until	4th March 2018 (5 years)
Publication	BAnz AT 23rd July 2013 B4, chapter I, No. 4.1

Approved application

The AMS tested is suitable for plants in compliance with TA-Luft. The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test of the modular measuring system Set CEM CERT 7MB1957 lasting over three months at a plant in compliance with the 17th BImSchV. The modular measuring system is authorised for the ambient temperature range from +5 °C to +40 °C.

The operator should consult the manufacturer to ensure that the AMS is suitable for the plant where it is being installed.

Certification basis

This certificate is based on:

- TÜV SÜD Industrie Service GmbH test report 1630664-2 from 15th March 2013
- suitability publication by the Umweltbundesamt as relevant body
- monitoring of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz AT 23rd July 2013 B4, chapter I, No. 4.1, UBA publication from 3rd July 2013).

AMS:	Set CEM CERT 7MB1957 monitoring CO, NO, SO_2 and O_2
Manufacturer:	Siemens AG, Karlsruhe
Suitability:	For plants in compliance with TA-Luft

Measurement ranges for the modular system Set CEM CERT 7 MB1957 in the suitability test:

Component	Module	Certification range	Additional measurement range
CO	Ultramat 23-7MB2358 – Z – T13	0 – 250 mg/m³	0 – 1250 mg/m³
	Ultramat 23-7MB2358 – Z – T23	0 – 250 mg/m³	0 – 1250 mg/m³
	Ultramat 23-7MB2358 – Z – T33	0 – 250 mg/m³	0 – 1250 mg/m³
NO	Ultramat 23-7MB2358 – Z – T13	0 – 400 mg/m³	0 – 2000 mg/m³
	Ultramat 23-7MB2358 – Z – T23	0 – 400 mg/m³	0 – 2000 mg/m³
	Ultramat 23-7MB2358 – Z – T33	0 – 400 mg/m³	0 – 2000 mg/m³
SO_2	Ultramat 23-7MB2358 – Z – T13	0 – 400 mg/m³	0 – 2000 mg/m³
	Ultramat 23-7MB2358 – Z – T23	0 – 400 mg/m³	0 – 2000 mg/m³
	Ultramat 23-7MB2358 – Z – T33	0 – 400 mg/m³	0 – 2000 mg/m³
$O_{2\ paramagnetic}$	Ultramat 23-7MB2358 – Z – T13	0 – 25 Vol.%	-
$O_{2\ electrochemical}$	Ultramat 23-7MB2358 – Z – T23	0 – 25 Vol.%	-

The suitability test of the modular system Set CEM CERT 7 MB1957 covers three modules that are each equipped to measure the following components:

Module	Component 1	Component 2	Component 3	Component 4
Ultramat 23-7MB2358 – Z – T13	CO	NO	SO_2	$O_{2\ paramagnetic}$
Ultramat 23-7MB2358 – Z – T23	CO	NO	SO_2	$O_{2\ electrochemical}$
Ultramat 23-7MB2358 – Z – T33	CO	NO	SO_2	-

Software versions:

Ultramat 23-7MB2358: 2.14.07
SPS: Set CEM CERT Rev. 1.0

Restrictions:

1. The minimum requirement of the correlation co-efficient for the calibration function R^2 could not be fulfilled for the component NO.
2. The requirement for total uncertainty in the suitability test according to DIN EN 15267-3 was not fulfilled for the components CO and NO and only partly fulfilled for the component SO_2.
3. In the case of the component CO monitoring is only possible from a limit value of 130 mg/m³ upwards. The AMS measurement range should be set according to the valid regulations.
4. The protection provided by enclosures class is only IP 20. If the operating conditions require a higher class the analysis modules shall be incorporated into an analysis cabinet with the relevant protection class.
5. The maintenance interval for the Ultramat 23-7MB2358 (-Z-T13, -Z-T23, -Z-T33) modules is three months. In the case of an extension of the Set CEM CERT 7MB1957 by adding additional modules the functionality of the respective compilation of the modules should be tested within the framework of the test for proper installation and the maintenance interval should be set.

Notes:

1. The AMS should be operated at an interval of 24 hours for automatic alignment.
2. The analyser should be operated with the activated thermo-AUTOCAL-function.
3. The modular measurement system Set CEM CERT 7MB1957 can alternatively be fitted with a measurement gas sampling probe from M&C TechGroup Germany GmbH and a measurement gas cooler from Bühler Technologies GmbH.
4. Supplementary test (alternative measurement gas sampling probe and measurement gas cooler) to the publication by the Umweltbundesamt from 12th February 2013 (BAnz AT 05.03.2013 B10, chapter I number 6.1).

Test report: TÜV SÜD Industrie Service GmbH, Munich
Report-No.: 1630664-2 from 15th March 2013

Certified product

The certificate applies to AMS that comply with the following description:

The entire tested modular AMS consists of the sample gas extraction probe, heated sample hose, a dual-level measurement gas cooler, a measurement gas feeder pump and the multi-component analyser Ultramat 23-7MB2358. The modular AMS measures CO, NO, SO_2 and O_2 according to the principle of non-dispersive-infrared-absorption (NDIR procedure). Either an electrochemical or paramagnetic oxygen measurement cell can be used to measure O_2.

To regulate measurement gas flow there is a measurement gas pipe with integrated gas recirculation between the first and second cooler level. In the cooler casing there is another fine filter for separating fine dust. After the measurement gas cooler the gas path separates into two pipe sections, each supplying one analyser module with measurement gas. In each of these pipe section currents there is a condensation filter directly before the analyser module, which closes the gas path on penetration of any humidity, to protect the analyser. To regulate zero / sample gas there is a three way valve between the first and second cooler level, which can be switched on to automatically align the analyser or can be time controlled using programmable logic controller (PLC).

The entire system is made up of the following components:

Probe
Manufacturer: Bühler Technologies GmbH, D - 40880 Ratingen
Type: GAS 222.20-Cal-twin with ceramic filter, length 100 cm, heated to 180 °C

Alternative Probe
Manufacturer: M&C TechGroup Germany GmbH, D - 40885 Ratingen
Type: SP2000-H with ceramic filter, length 100 cm, heated to 180 °C
Controller: M&C TechGroup Germany GmbH, D - 40885 Ratingen

Heated sampling hose	
Manufacturer:	Winkler GmbH, D-69126 Heidelberg
Heated temperature:	180 °C, 2 PTFE connections (ID: 4 mm), heated to 180 °C, length in the suitability test 35 m
Controller	
Manufacturer:	Siemens AG
Type:	SIRIUS, PT 100
Compressor cooler	
Manufacturer:	M&C TechGroup Germany GmbH, D - 40885 Ratingen
Type:	CSS V1-S, dew point at 3°C (2 gas paths)
Alternative compressor cooler	
Manufacturer:	Bühler Technologies GmbH, D-40880 Ratingen
Type:	EGK 2-19, dew point at 4°C (2 gas paths)
Measurement gas feeder pump	
Manufacturer:	Bühler Technologies GmbH, D-40880 Ratingen
Type:	P 2.3
Flow:	1-2 l/min
Analyser	Ultramat 23-7MB2358
	Software version 2.14.07
	Software version SPS Set CEM CERT Rev. 1.0

General comments

This certificate is based on the analyser tested. The manufacturer is responsible for the continuous compliance of the production to the DIN EN 15267 requirements. The manufacturer is obliged to maintain a tested quality management system to control the manufacture of the certified product. Regular monitoring must be conducted on both the product and the quality management systems.

Should the product from the current production series no longer comply with the certified product, the Environmental Service Department of TÜV SÜD Industrie Service GmbH, should be informed (Address see footnote).

The certification mark, which appears on the certified product or is used in advertising materials, is presented on page 1 of this certificate.

This document and the certification mark shall remain the property of TÜV SÜD Industrie Service GmbH.

Should the publication be revoked, this certificate will become invalid. This document must be returned when the period of validity has elapsed and at the request of TÜV SÜD Industrie Service GmbH and the certification mark may no longer be used.

The current version of the certificate and its validity can also be viewed on the internet page: **qal1.de**.

The certification of the modular measurement system Set CEM CERT 7MB1957 is based on the following documents and the regular continuous monitoring of the manufacturer's quality management system:

Initial certification to DIN EN 15267:

Certificate No. 1630664-ts	5th March 2013
Certificate validity until	4th March 2018 (5 years)

Test report: 1630664 from 15th September 2012,
TÜV SÜD Industrie Service GmbH
Publication: BAnz AT 05.03.2013 B10, chapter I No. 6.1
UBA publication from 12th February 2013

Supplementary test according to DIN EN 15267:

Certificate No. 1630664.2-ts	23rd July 2013
Certificate validity until	4th March 2018 (5 years)

Test report: 1630664-2 from 15th March 2013,
TÜV SÜD Industrie Service GmbH
BAnz AT 23.07.2013 B4, chapter I, No. 4.1
UBA publication from 3rd July 2013

Calculation of total uncertainty for QAL1 testing to DIN EN 14181 and DIN EN 15267-3

Total uncertainty for the measurement component CO in the measurement range 0-250 mg/m³ for modules 1/2

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	$u$lof	0,678	0,5
Zero point drift	ud,z	1,443	2,1
Span point drift	ud,s	1,443	2,1
Influence of ambient temperature at span point	ut	0,781	0,6
Influence of sample gas pressure	up	-	-
Influence of sample gas flow	uf	-0,217	0,0
Influence of voltage	uv	1,392	1,9
Cross-sensitivity	ui	5,340	28,5
Standard deviation from paired measurements or repeat standard deviation at span point *)	ur	1,656	2,7
Uncertainty of the test gas	$u$tg	2,021	4,1
Sum		-	42,6
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	6,5	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	12,8	mg/m³
Relative expanded uncertainty	U	9,8	%ELV
Demanded uncertainty (ELV 130 mg/m³) to DIN EN 15267-3		7,5	%ELV
Requirement concerning uncertainty fulfilled		no	

*) here: Standard deviation from paired measurements

Total uncertainty for the measurement component NO in the measurement range 0-400 mg/m³ for modules 1/2

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	$u$lof	-0,393	0,2
Zero point drift	ud,z	3,233	10,5
Span point drift	ud,s	3,695	13,7
Influence of ambient temperature at span point	ut	2,177	4,7
Influence of sample gas pressure	up	-	-
Influence of sample gas flow	uf	0,277	0,1
Influence of voltage	uv	1,688	2,8
Cross-sensitivity	ui	-8,083	65,3
Standard deviation from paired measurements or repeat standard deviation at span point *)	ur	1,750	3,1
Uncertainty of the test gas	$u$tg	3,236	10,5
Sum		-	110,8
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	10,5	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	20,6	mg/m³
Relative expanded uncertainty	U	15,8	%ELV
Demanded uncertainty (ELV 130,4 mg/m³) to DIN EN 15267-3		15,0	%ELV
Requirement concerning uncertainty fulfilled		no	

*) here: Standard deviation from paired measurements

Total uncertainty for the measurement component SO_2 in the measurement range 0-400 mg/m³ for modules 1/2

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	$u$lof	2,102	4,4
Zero point drift	ud,z	6,235	38,9
Span point drift	ud,s	4,85	23,5
Influence of ambient temperature at span point	ut	6,498	42,2
Influence of sample gas pressure	up	-	-
Influence of sample gas flow	uf	-2,215	4,9
Influence of voltage	uv	2,217	4,9
Cross-sensitivity	ui	-6,928	48,0
Standard deviation from paired measurements or repeat standard deviation at span point *)	ur	2,475	6,1
Uncertainty of the test gas	$u$tg	3,236	10,5
Sum		-	183,5
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	13,5	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	26,5	mg/m³
Relative expanded uncertainty	U	13,3	%ELV
Demanded uncertainty (ELV 200 mg/m³) to DIN EN 15267-3		15,0	%ELV
Requirement concerning uncertainty fulfilled		yes	

*) here: Standard deviation from paired measurements

Total uncertainty for the measurement component O_2 in the measurement range 0-25 Vol.-% (in version with paramagnetic oxygen measurement) for modules 1/2

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in Vol.%*	*Square sum of standard uncertainty in (Vol.%)²*
Lack-of-fit	$u$lof	0,017	0,00
Zero point drift	ud,z	-0,092	0,01
Span point drift	ud,s	-0,081	0,01
Influence of ambient temperature at span point	ut	0,044	0,00
Influence of sample gas pressure	up	-	-
Influence of sample gas flow	uf	-0,017	0,00
Influence of voltage	uv	0,051	0,00
Cross-sensitivity	ui	0,162	0,03
Standard deviation from paired measurements or repeat standard deviation at span point *)	ur	0,081	0,01
Uncertainty of the test gas	$u$tg	0,230	0,05
Sum		-	0,11
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,33	Vol.%
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	0,64	Vol.%
Relative expanded uncertainty	U	2,6	%
Demanded uncertainty (% from CR)		7,5	% from CR
Requirement concerning uncertainty fulfilled		yes	

*) here: Standard deviation from paired measurements

Total uncertainty for the measurement component CO in the measurement range 0-250 mg/m³ for modules 3/ 4

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	u_{lof}	0,678	0,5
Zero point drift	$u_{d,z}$	1,443	2,1
Span point drift	$u_{d,s}$	1,443	2,1
Influence of ambient temperature at span point	u_t	1,285	1,7
Influence of sample gas pressure	u_p	-	-
Influence of sample gas flow	u_f	-0,303	0,1
Influence of voltage	u_v	1,568	2,5
Cross-sensitivity	u_i	5,340	28,5
Standard deviation from paired measurements or repeat standard deviation at span point *)	u_r	1,656	2,7
Uncertainty of the test gas	u_{tg}	2,021	4,1
Sum		-	44,2
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	6,6	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	13,0	mg/m³
Relative expanded uncertainty	U	10,0	%ELV
Demanded uncertainty (ELV 130 mg/m³) to DIN EN 15267-3		7,5	%ELV
Requirement concerning uncertainty fulfilled		no	

*) here: Standard deviation from paired measurements

Total uncertainty for the measurement component NO in the measurement range 0-400 mg/m³ for modules 3/4

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	$u$lof	-0,393	0,2
Zero point drift	ud,z	3,233	10,5
Span point drift	ud,s	3,695	13,7
Influence of ambient temperature at span point	ut	1,712	2,9
Influence of sample gas pressure	up	-	-
Influence of sample gas flow	uf	0,531	0,3
Influence of voltage	uv	2,824	8,0
Cross-sensitivity	ui	-8,083	65,3
Standard deviation from paired measurements or repeat standard deviation at span point *)	ur	1,750	3,1
Uncertainty of the test gas	$u$tg	3,236	10,5
Sum		-	114,3
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	10,7	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	21,0	mg/m³
Relative expanded uncertainty	U	16,1	%ELV
Demanded uncertainty (ELV 130,4 mg/m³) to DIN EN 15267-3		15,0	%ELV
Requirement concerning uncertainty fulfilled		no	

*) here: Standard deviation from paired measurements

Total uncertainty for the measurement component SO_2 in the measurement range 0-400 mg/m³ for modules 3/4

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in mg/m³*	*Square sum of standard uncertainty in (mg/m³)²*
Lack-of-fit	$u$lof	2,102	4,4
Zero point drift	ud,z	6,235	38,9
Span point drift	ud,s	4,85	23,5
Influence of ambient temperature at span point	ut	9,96	99,2
Influence of sample gas pressure	up	-	-
Influence of sample gas flow	uf	-2,125	4,5
Influence of voltage	uv	2,564	6,6
Cross-sensitivity	ui	-6,928	48,0
Standard deviation from paired measurements or repeat standard deviation at span point *)	ur	2,475	6,1
Uncertainty of the test gas	$u$tg	3,236	10,5
Sum		-	241,7
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	15,5	mg/m³
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	30,5	mg/m³
Relative expanded uncertainty	U	15,2	%ELV
Demanded uncertainty (ELV 200 mg/m³) to DIN EN 15267-3		15,0	%ELV
Requirement concerning uncertainty fulfilled		no	

*) here: Standard deviation from paired measurements

Total uncertainty for the measurement component O_2 in the measurement range 0-25 Vol.-% (in version with electrochemical oxygen measurement) for modules 3/4

Performance characteristic	*Uncertainty*	*Value of standard uncertainty in Vol.%*	*Square sum of standard uncertainty in (Vol.%)²*
Lack-of-fit	$u$lof	0,035	0,00
Zero point drift	ud,z	0,167	0,03
Span point drift	ud,s	0,098	0,01
Influence of ambient temperature at span point	ut	0,021	0,00
Influence of sample gas pressure	up	-	-
Influence of sample gas flow	uf	-0,029	0,00
Influence of voltage	uv	0,009	0,00
Cross-sensitivity	ui	0,167	0,03
Standard deviation from paired measurements or repeat standard deviation at span point *)	ur	0,056	0,00
Uncertainty of the test gas	$u$tg	0,230	0,05
Sum		-	0,12
Combined standard uncertainty	$u_c = \sqrt{\sum (u_i)^2}$	0,35	Vol.%
Expanded uncertainty	$U_{0,95} = 1,96 \times u_c$	0,69	Vol.%
Relative expanded uncertainty	U	2,8	%
Demanded uncertainty (% from CR)		7,5	% from CR
Requirement concerning uncertainty fulfilled		yes	

*) here: Standard deviation from paired measurements