

CERTIFICATE

of Product Conformity (QAL1)

Certificate number: 0000001013_04

Certified AMS: CEMS II e for CO, NO, NO₂, N₂O, SO₂, HCl, HF, NH₃,
CO₂, H₂O, O₂, CH₄ and CH₂O

Manufacturer: Gaset Technologies Oy
Pultitie 8A1
00880 Helsinki
Finland

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 19 pages).

The present certificate replaces certificate 0000001013_03 of 22 July 2016



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000001013

Publication in the German Federal Gazette
(BAnz.) of 1 August 2016

German Federal Environment Agency
Dessau, 19 August 2016



Dr. Marcel Langner
Head of Section II 4.1

This certificate will expire on:
28 July 2021

TÜV Rheinland Energy GmbH
Cologne, 18 August 2016



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 17025:2005 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.

Certificate:
0000001013_04 / 19 August 2016

Test report: 936/21225866/B of 23 February 2016
Initial certification: 29 July 2011
Expiry date: 28 July 2021
Publication: BAnz AT 01.08.2016 B11, chapter I number 3.1

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13. BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17. BImSchV) and other plants requiring official approval. 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 several laboratory tests and of three field tests over each three months. For the maintenance interval extension a further field test was carried out over ten months. The field tests occurred at two 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 936/21225866/B of 23 February 2016 of TÜV Rheinland Energie und Umwelt 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 01.08.2016 B11, chapter I number 3.1,
Announcement by UBA from 14 July 2016:

AMS designation:

CEMS II e for CO, NO, NO₂, N₂O, SO₂, HCl, HF, NH₃, CO₂, H₂O, O₂, CH₄ and CH₂O

Manufacturer: Gaset Technologies Oy, Helsinki, Finland

Field of application: For measurements at plants requiring official approval

Measuring ranges during the suitability test:

Component	Certification range	Supplementary measurement ranges		Unit
CO	0 – 75	0 – 300	0 – 1500	mg/m ³
NO	0 – 150	0 – 600	0 – 2000	mg/m ³
NO ₂	0 – 200	0 – 500	-	mg/m ³
N ₂ O	0 – 100	0 – 500	-	mg/m ³
SO ₂	0 – 75	0 – 300	0 – 1500	mg/m ³
HCl	0 – 15	0 – 90	-	mg/m ³
HF	0 – 3	0 – 10	-	mg/m ³
NH ₃	0 – 15	0 – 50	-	mg/m ³
O ₂	0 – 25	-	-	Vol.-%
CO ₂	0 – 25	-	-	Vol.-%
H ₂ O	0 – 30	0 – 40	-	Vol.-%
CH ₄	0 – 15	0 – 50	0 – 150	mg/m ³
CH ₂ O	0 – 20	0 – 30	0 – 90	mg/m ³

Software version:

Calcmet: 12.18 with evaluation module 4.42.2 and
OXITEC Ver. 1.50 np

Restrictions: None

Notes:

1. The maintenance interval is three month.
2. During test with HF, HCl, NH₃ and CH₂O wet test gases shall be used.
3. The sample probe should be cleansed after plant failure.
4. The measurement cabinet is available as variant A (air conditioner unit on top of the measurement cabinet) and variant B (air conditioner unit on the back of the measurement cabinet).
5. For measurement of the component O₂ (optional) the analyser OXITEC 500E SME 5 from the company ENOTEC GmbH, Marienheide, Germany is integrated.
6. Supplementary testing (extension of maintenance interval, extension of components CH₄ and CH₂O, changing of certification range for the component NO, measuring of all components (without O₂) with one FTIR analyzer (Gaset CX-4000)) for notification of the German Federal Environment Agency (UBA) of 3 July 2013 (BAnz AT 23.07.2013 B4, chapter I number 3.1) and of 25 February 2015 (BAnz AT 02.04.2015 B5, chapter IV Notification 33).

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report No.: 936/21225866/B of 23 February 2016

Certified product

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

The measuring equipment CEMS II e consist of the following parts:

1) Sampling system

- Sampling probe: SP2000H of the manufactured by M & C, heated to 180 °C, with PTFE-filter: 2 µm,
- Heated line: 180 °C with 4 mm Teflon tube, 25 m length, (standard 5 to 30 m)
- Pump: heated to 180 °C, with Teflon membrane

2) Analysers

- FTIR: Gaset CX-4000, cell temperature: 180 °C, cell with optical path length: 5 m, IR-Source: SiC
- O₂: ZrO₂ measuring cell OXITEC 500E SME 5 in the 19"-module (optional) manufactured by ENOTEC with the software OXITEC Ver. 1.50 np

3) Computer

Standard industrial PC with Windows 7 Ultimate 32bit.
To analyse the Gaset CEMS spectra, the calculated spectra are transmitted to a PC via RS232 interface for further processing. The PC also controls and monitors sampling and gaseous analyte flow of the analysers.

4) Software

Evaluation software Calcmnet version 12.18 with analysis module 4.42.2

5) Measuring cabinet

Air-conditioning adjusted to approx. 30 °C,
Sampling pump, control units, analysers, interface boards for analogue and digital input and output and computer.

The measurement cabinet is available as version
A (dimensions: 212x61x70 cm, air conditioner unit on top of the measurement cabinet) and
B (dimensions: 210x61x113 cm, air conditioner unit on the back of the measurement cabinet).
In both versions it is possible to integrate in addition to the FTIR the OXITEC 500E SME 5 O₂ analyser manufactured by Enotec. All other components are identical.

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: qal1.de.

Certification of CEMS II e is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Initial test:

Baseline report 936/21200448/A dated 07 July 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: Federal Gazette (BAnz.) of 14 October 2006, No. 194, p. 6715
Notification of the Federal Environmental Agency on 12 September 2006

Supplementary test

Supplementary test report 936/21203240/B dated 03 September 2007
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne

Publication: Federal Gazette (BAnz.) of 07 March 2008, No. 38, p. 901
Notification of the Federal Environmental Agency of 14 February 2008
(Additional component: O₂)

Notifications:

Statement of TÜV Rheinland Immissionsschutz und Energiesysteme of 14 December 2006
Publication: Federal Gazette BAnz. 20 April 2007, No. 75, p. 4139
Notification of the Federal Environmental Agency of 12 April 2007
(enclosure variants)

Statement of TÜV Rheinland Energie und Umwelt GmbH of 29 March 2011
Publication: Federal Gazette BAnz. 29 July 2011, No. 133, p. 2725
Notification of the Federal Environmental Agency of 15 July 2011
(changes in software version)

Initial certification according to EN 15267

Certificate No. 0000001013: 19 August 2011
Expiry date of the certificate: 28 July 2016

Test report: 936/21210692/A of 30 March 2011
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz. 29 July 2011, No. 113, p. 2725, chapter I, No. 4.1
Announcement by UBA from 15 July 2011

Supplementary testing according to EN 15267

Certificate No. 0000001013_01: 20 August 2012
Expiry date of the certificate: 28 July 2016

Test report: 936/21218384/A of 16 March 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 20.07.2012 B11, chapter 1, No. 3.1
Announcement by UBA from 06 July 2012

Certificate No. 0000001013_02: 20 August 2013
Expiry date of the certificate: 28 July 2016

Test report: 936/21220683/A of 27 March 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 23.07.2013 B4, chapter I, No. 3.1
Announcement by UBA from 03 July 2013

Notifications according to EN 15267

Statement of TÜV Rheinland Energie und Umwelt GmbH of 30 September 2013
Publication in the German Federal Gazette: BAnz AT 01.04.2014 B12, chapter VI notification 12
Announcement by UBA from 27 February 2014
(software changes)

Statement of TÜV Rheinland Energie und Umwelt GmbH of 01 October 2014
Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, chapter IV notification 33
Announcement by UBA from 03 July 2013
(hardware changes)

Renewal of the certificate

Certificate No. 0000001013_03: 22 July 2016
Expiry date of the certificate: 28 July 2021

Supplementary testing according to EN 15267

Certificate No. 0000001013_04: 19 August 2016
Expiry date of the certificate: 28 July 2021

Test report: 936/21225866/B of 23 February 2016
TÜV Rheinland Energie und Umwelt GmbH, Cologne,
Publication: BAnz AT 01.08.2016 B11, chapter I number 3.1
Announcement by UBA from 14 July 2016

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

Measuring system

Manufacturer	Gasmet Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	CO	0 - 75 mg/m ³
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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 ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	1.90 mg/m ³
Sum of negative CS at span point	-1.00 mg/m ³
Maximum sum of cross-sensitivities	1.90 mg/m ³
Uncertainty of cross-sensitivity	u_i 1.096 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.478 mg/m ³	0.228 (mg/m ³) ²
Lack of fit	u_{lof}	0.554 mg/m ³	0.307 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	0.000 mg/m ³	0.000 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	0.693 mg/m ³	0.480 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.208 mg/m ³	0.043 (mg/m ³) ²
Influence of supply voltage	u_v	0.298 mg/m ³	0.089 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	1.096 mg/m ³	1.200 (mg/m ³) ²
Influence of sample gas flow	u_p	0.117 mg/m ³	0.014 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606 mg/m ³	0.368 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	1.65 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.24 mg/m ³

Relative total expanded uncertainty

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

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	NO	0 - 150 mg/m ³
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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 ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.00 mg/m ³
Sum of negative CS at span point	-2.60 mg/m ³
Maximum sum of cross-sensitivities	-2.60 mg/m ³
Uncertainty of cross-sensitivity	u_i -1.498 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D 0.360 mg/m ³		0.130 (mg/m ³) ²
Lack of fit	u_{lof} 0.580 mg/m ³		0.336 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 0.087 mg/m ³		0.008 (mg/m ³) ²
Span drift from field test	$u_{d,s}$ 1.645 mg/m ³		2.706 (mg/m ³) ²
Influence of ambient temperature at span	u_t 0.709 mg/m ³		0.503 (mg/m ³) ²
Influence of supply voltage	u_v 0.379 mg/m ³		0.144 (mg/m ³) ²
Cross-sensitivity (interference)	u_i -1.498 mg/m ³		2.244 (mg/m ³) ²
Influence of sample gas flow	u_p -0.577 mg/m ³		0.333 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 1.212 mg/m ³		1.470 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max, j})^2} \quad 2.81 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 5.50 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the ELV 98 mg/m³ **5.6**

U in % of the ELV 98 mg/m³ **20.0**

U in % of the ELV 98 mg/m³ 15.0

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	NO ₂	0 - 150 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.66 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	7.90 mg/m ³
Sum of negative CS at span point	-1.60 mg/m ³
Maximum sum of cross-sensitivities	7.90 mg/m ³
Uncertainty of cross-sensitivity	u _i 4.561 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

		u ²
Standard deviation from paired measurements under field conditions *	u _D 1.200 mg/m ³	1.440 (mg/m ³) ²
Lack of fit	u _{lof} -0.520 mg/m ³	0.270 (mg/m ³) ²
Zero drift from field test	u _{d,z} 0.115 mg/m ³	0.013 (mg/m ³) ²
Span drift from field test	u _{d,s} -1.155 mg/m ³	1.334 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.529 mg/m ³	0.280 (mg/m ³) ²
Influence of supply voltage	u _v 0.571 mg/m ³	0.326 (mg/m ³) ²
Cross-sensitivity (interference)	u _i 4.561 mg/m ³	20.803 (mg/m ³) ²
Influence of sample gas flow	u _p -0.313 mg/m ³	0.098 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 1.212 mg/m ³	1.470 (mg/m ³) ²

* The larger value is used :

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	5.10 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	10.00 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 150 mg/m³	6.7
Requirement of EN 15267-3	U in % of the ELV 150 mg/m³	20.0
	U in % of the ELV 150 mg/m³	15.0

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	N ₂ O	0 - 100 mg/m ³
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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 ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	3.20 mg/m ³
Sum of negative CS at span point	-0.80 mg/m ³
Maximum sum of cross-sensitivities	3.20 mg/m ³
Uncertainty of cross-sensitivity	u _i 1.848 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.630 mg/m ³	0.397 (mg/m ³) ²
Lack of fit	u _{lof}	-0.231 mg/m ³	0.053 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.000 mg/m ³	0.000 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.346 mg/m ³	0.120 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.252 mg/m ³	0.064 (mg/m ³) ²
Influence of supply voltage	u _v	0.314 mg/m ³	0.099 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	1.848 mg/m ³	3.413 (mg/m ³) ²
Influence of sample gas flow	u _p	-0.120 mg/m ³	0.014 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.808 mg/m ³	0.653 (mg/m ³) ²

* The larger value is used :

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max, i})^2}$	2.19 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	4.30 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 100 mg/m³	4.3
Requirement of EN 15267-3	U in % of the range 100 mg/m³	20.0 **
	U in % of the range 100 mg/m ³	15.0

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component..
A value of 20.0 % was used for this.

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	SO ₂	0 - 75 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.24 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	2.30 mg/m ³
Sum of negative CS at span point	-2.90 mg/m ³
Maximum sum of cross-sensitivities	-2.90 mg/m ³
Uncertainty of cross-sensitivity	u _i -1.676 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u _i	u _i	u ²
Repeatability standard deviation at set point *	u _r 0.357 mg/m ³		0.127 (mg/m ³) ²
Lack of fit	u _{lof} -0.316 mg/m ³		0.100 (mg/m ³) ²
Zero drift from field test	u _{d,z} 0.043 mg/m ³		0.002 (mg/m ³) ²
Span drift from field test	u _{d,s} 0.996 mg/m ³		0.992 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.557 mg/m ³		0.310 (mg/m ³) ²
Influence of supply voltage	u _v 0.898 mg/m ³		0.806 (mg/m ³) ²
Cross-sensitivity (interference)	u _i -1.676 mg/m ³		2.808 (mg/m ³) ²
Influence of sample gas flow	u _p 0.226 mg/m ³		0.051 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.606 mg/m ³		0.368 (mg/m ³) ²

* The larger value is used :

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max, i})^2}$	2.36 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	4.62 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 50 mg/m³	9.2
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	20.0
	U in % of the ELV 50 mg/m³	15.0

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	HCl	0 - 15 mg/m ³
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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 ³
Sum of negative CS at zero point	-0.06 mg/m ³
Sum of positive CS at span point	0.60 mg/m ³
Sum of negative CS at span point	-0.10 mg/m ³
Maximum sum of cross-sensitivities	0.60 mg/m ³
Uncertainty of cross-sensitivity	u_i 0.346 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D 0.209 mg/m ³		0.044 (mg/m ³) ²
Lack of fit	u_{lof} 0.173 mg/m ³		0.030 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 0.000 mg/m ³		0.000 (mg/m ³) ²
Span drift from field test	$u_{d,s}$ 0.208 mg/m ³		0.043 (mg/m ³) ²
Influence of ambient temperature at span	u_t 0.265 mg/m ³		0.070 (mg/m ³) ²
Influence of supply voltage	u_v 0.091 mg/m ³		0.008 (mg/m ³) ²
Cross-sensitivity (interference)	u_i 0.346 mg/m ³		0.120 (mg/m ³) ²
Influence of sample gas flow	u_p -0.045 mg/m ³		0.002 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 0.121 mg/m ³		0.015 (mg/m ³) ²

* The larger value is used :

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

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	0.58 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.13 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m³	11.3
Requirement of EN 15267-3	U in % of the ELV 10 mg/m³	40.0
	U in % of the ELV 10 mg/m³	30.0

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	HF	0 - 3 mg/m ³
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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 ³
Sum of negative CS at zero point	0.04 mg/m ³
Sum of positive CS at span point	0.12 mg/m ³
Sum of negative CS at span point	-0.09 mg/m ³
Maximum sum of cross-sensitivities	0.12 mg/m ³
Uncertainty of cross-sensitivity	u_i 0.068 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.010 mg/m ³	0.000 (mg/m ³) ²
Lack of fit	u_{lof}	0.032 mg/m ³	0.001 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	0.002 mg/m ³	0.000 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	-0.040 mg/m ³	0.002 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.040 mg/m ³	0.002 (mg/m ³) ²
Influence of supply voltage	u_v	0.016 mg/m ³	0.000 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	0.068 mg/m ³	0.005 (mg/m ³) ²
Influence of sample gas flow	u_p	-0.006 mg/m ³	0.000 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.024 mg/m ³	0.001 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	0.10 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.19 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 1 mg/m³	19.4
Requirement of EN 15267-3	U in % of the ELV 1 mg/m³	40.0
	U in % of the ELV 1 mg/m³	30.0

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	NH ₃	0 - 15 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.06 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.30 mg/m ³
Sum of negative CS at span point	-0.60 mg/m ³
Maximum sum of cross-sensitivities	-0.60 mg/m ³
Uncertainty of cross-sensitivity	u _i -0.346 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.074 mg/m ³	0.005 (mg/m ³) ²
Lack of fit	u _{lof}	-0.139 mg/m ³	0.019 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.000 mg/m ³	0.000 (mg/m ³) ²
Span drift from field test	u _{d,s}	-0.199 mg/m ³	0.040 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.115 mg/m ³	0.013 (mg/m ³) ²
Influence of supply voltage	u _v	0.091 mg/m ³	0.008 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	-0.346 mg/m ³	0.120 (mg/m ³) ²
Influence of sample gas flow	u _p	0.061 mg/m ³	0.004 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.121 mg/m ³	0.015 (mg/m ³) ²

* The larger value is used :

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

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	0.47 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.93 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m³	9.3
Requirement of EN 15267-3	U in % of the ELV 10 mg/m³	40.0
	U in % of the ELV 10 mg/m³	30.0

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	Zirconium dioxide

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	O ₂	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 _i	0.000 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u ²
Standard deviation from paired measurements under field conditions *	u _D	0.047	Vol.-%	0.002 (Vol.-%) ²
Lack of fit	u _{lof}	-0.104	Vol.-%	0.011 (Vol.-%) ²
Zero drift from field test	u _{d,z}	0.064	Vol.-%	0.004 (Vol.-%) ²
Span drift from field test	u _{d,s}	-0.098	Vol.-%	0.010 (Vol.-%) ²
Influence of ambient temperature at span	u _t	0.165	Vol.-%	0.027 (Vol.-%) ²
Influence of supply voltage	u _v	0.015	Vol.-%	0.000 (Vol.-%) ²
Cross-sensitivity (interference)	u _i	0.000	Vol.-%	0.000 (Vol.-%) ²
Influence of sample gas flow	u _p	-0.012	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)	$u_c = \sqrt{\sum (u_{max, i})^2}$	0.31	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.60	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 25 Vol.-%	2.4
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
	U in % of the range 25 Vol.-%	7.5

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

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	CO ₂	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	-0.90	Vol.-%
Maximum sum of cross-sensitivities	-0.90	Vol.-%
Uncertainty of cross-sensitivity	u _i	-0.520 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u ²
Standard deviation from paired measurements under field conditions *	u _D	0.100	Vol.-%	0.010 (Vol.-%) ²
Lack of fit	u _{lof}	0.115	Vol.-%	0.013 (Vol.-%) ²
Zero drift from field test	u _{d,z}	0.000	Vol.-%	0.000 (Vol.-%) ²
Span drift from field test	u _{d,s}	-0.130	Vol.-%	0.017 (Vol.-%) ²
Influence of ambient temperature at span	u _t	0.231	Vol.-%	0.053 (Vol.-%) ²
Influence of supply voltage	u _v	0.099	Vol.-%	0.010 (Vol.-%) ²
Cross-sensitivity (interference)	u _i	-0.520	Vol.-%	0.270 (Vol.-%) ²
Influence of sample gas flow	u _p	0.060	Vol.-%	0.004 (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)	$u_c = \sqrt{\sum (u_{max, j})^2}$	0.65	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.27	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 25 Vol.-%	5.1
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
	U in % of the range 25 Vol.-%	7.5

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

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	305 / 306 / 14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	H ₂ O	0 - 30 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	1.10	Vol.-%
Sum of negative CS at span point	-0.10	Vol.-%
Maximum sum of cross-sensitivities	1.10	Vol.-%
Uncertainty of cross-sensitivity	u_i	0.632 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u^2
Standard deviation from paired measurements under field conditions *	u_D	0.292	Vol.-%	0.085 (Vol.-%) ²
Lack of fit	u_{lof}	0.230	Vol.-%	0.053 (Vol.-%) ²
Zero drift from field test	$u_{d,z}$	0.000	Vol.-%	0.000 (Vol.-%) ²
Span drift from field test	$u_{d,s}$	-0.329	Vol.-%	0.108 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.231	Vol.-%	0.053 (Vol.-%) ²
Influence of supply voltage	u_v	0.262	Vol.-%	0.069 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	0.632	Vol.-%	0.400 (Vol.-%) ²
Influence of sample gas flow	u_p	0.112	Vol.-%	0.013 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.242	Vol.-%	0.059 (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)	$u_c = \sqrt{\sum (u_{max, i})^2}$	0.92	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.80	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 30 Vol.-%	6.0
Requirement of EN 15267-3	U in % of the range 30 Vol.-%	10.0 **
	U in % of the range 30 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	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland
	2016-02-23

Measured component

Certification range	CH ₄	0 - 15 mg/m ³
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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 ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.08 mg/m ³
Sum of negative CS at span point	-0.38 mg/m ³
Maximum sum of cross-sensitivities	-0.38 mg/m ³
Uncertainty of cross-sensitivity	u_i -0.217 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.034 mg/m ³	0.001 (mg/m ³) ²
Lack of fit	u_{lof}	0.035 mg/m ³	0.001 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	0.000 mg/m ³	0.000 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	0.156 mg/m ³	0.024 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.057 mg/m ³	0.003 (mg/m ³) ²
Influence of supply voltage	u_v	0.026 mg/m ³	0.001 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-0.217 mg/m ³	0.047 (mg/m ³) ²
Influence of sample gas flow	u_p	-0.069 mg/m ³	0.005 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121 mg/m ³	0.015 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max, i})^2}$	0.31 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.61 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 15 mg/m³	4.1
Requirement of EN 15267-3	U in % of the range 15 mg/m³	30.0 **
	U in % of the range 15 mg/m ³	22.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component..
A value of 30.0 % was used for this.

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

Measuring system

Manufacturer	Gaset Technologies Oy
AMS designation	CEMS II e
Serial number of units under test	14433 / 14434
Measuring principle	FTIR

Test report

Test laboratory	936/21225866/B
Date of report	TÜV Rheinland 2016-02-23

Measured component

Certification range	CH ₂ O 0 - 20 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.16 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.36 mg/m ³
Sum of negative CS at span point	-0.19 mg/m ³
Maximum sum of cross-sensitivities	0.36 mg/m ³
Uncertainty of cross-sensitivity	u_i 0.208 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D 0.038 mg/m ³		0.001 (mg/m ³) ²
Lack of fit	u_{lof} -0.104 mg/m ³		0.011 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 0.000 mg/m ³		0.000 (mg/m ³) ²
Span drift from field test	$u_{d,s}$ -0.242 mg/m ³		0.059 (mg/m ³) ²
Influence of ambient temperature at span	u_t 0.153 mg/m ³		0.023 (mg/m ³) ²
Influence of supply voltage	u_v 0.047 mg/m ³		0.002 (mg/m ³) ²
Cross-sensitivity (interference)	u_i 0.208 mg/m ³		0.043 (mg/m ³) ²
Influence of sample gas flow	u_p -0.051 mg/m ³		0.003 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 0.162 mg/m ³		0.026 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max, j})^2} \quad 0.41 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.80 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

U in % of the range 20 mg/m³

4.0

Requirement of EN 15267-3

U in % of the range 20 mg/m³

30.0 **

U in % of the range 20 mg/m³

22.5

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

A value of 30.0 % was used for this.