

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000039319_03

AMS designation: MGS300 for CO, SO₂, NO, NO₂, HCl, HF, CH₄, CO₂, H₂O, N₂O and NH₃

Manufacturer: MKS Instruments Inc.
651 Lowell Street,
Methuen, MA 01844
USA

Test Laboratory: 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 17 pages).



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

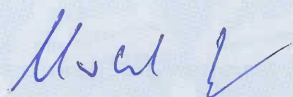
www.tuv.com
ID 0000039319

Publication in the German Federal Gazette
(BAnz) of 05 August 2014

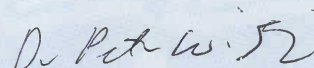
This certificate will expire on:
22 July 2023

German Federal Environment Agency
Dessau, 22 July 2018

TÜV Rheinland Energy GmbH
Cologne, 21 July 2018



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Test institute accredited to EN ISO/IEC 17025:2005 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

Test Report:	936/21208291/C dated 20 March 2014
Initial certification:	23 July 2013
Expiry date:	22 July 2023
Certificate:	Renewal (of previous certificate 0000039319_02 dated 09 September 2014 valid until 22 July 2018)
Publication:	BAnz AT 05.08.2014 B11, chapter I no. 4.3

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17th BImSchV), the 27th and 30th BImSchV and TA Luft. 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-months field test at a municipal waste incinerator.

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 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 limit values 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 936/21208291/C dated 20 March 2014 issued by 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 05.08.2014 B11, chapter I no. 4.3,
UBA announcement dated 17 July 2014:

AMS designation:

MGS300 für CO, SO₂, NO, NO₂, HCl, HF, CH₄, CO₂, H₂O, N₂O and NH₃

Manufacturer: MKS Instruments Inc., Methuen, USA

Field of application:

For plants requiring official approval and for plants according to the 27th BImSchV

Measuring ranges during performance testing:

Component	Certification range	Supplementary measuring ranges		Unit
HF	0–3	0–10	-	mg/m ₃
N ₂ O	0–50	0–100	0–500	mg/m ₃
CO	0–75	0–300	0–1500	mg/m ₃
SO ₂	0–75	0–300	0–2000	mg/m ₃
NO	0–200	0–400	0–1500	mg/m ₃
NO ₂	0–50	0–100	0–1000	mg/m ₃
HCl	0–15	0–90	0–200	mg/m ₃
NH ₃	0–10	0–75	-	mg/m ₃
CO ₂	0–25	-	-	vol.-%
H ₂ O	0–40	-	-	vol.-%
CH ₄	0–15	0–50	0–500	mg/m ₃

Software versions:

MG2000: 7.2 / MGS300 Control: 1.04

Restriction:

During performance testing in accordance with EN 15267-3, the requirement for the degree of protection provided by the enclosure was not fulfilled. The measuring system has to be installed in an environment sheltered from dust and precipitation.

Notes:

1. The maintenance interval is six months.
2. Supplementary testing (extension of the maintenance interval) as regards Federal Environment Agency (UBA) notice of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter I number 3.3).

Test Report: TÜV Rheinland Energie und Umwelt GmbH, Cologne

Report no.: 936/21208291/C dated 20 March 2014

Publication in the German Federal Gazette: BAnz AT 26.08.2015 B4, chapter V notification 20, UBA announcement dated 22 July 2015:

20 Notification as regards Federal Environment Agency notice of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter I no. 4.3)

The power supply and the pre-amplifier board of the MGS300 multi-component measuring system manufactured by MKS Instruments Inc. have been revised. The new version of the pre-amplifier board is 1040912-002. The component number of the power supply 1053932.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 25 March 2015

Certified product

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

The MGS300 is a multi-component gas analyser designed to continuously monitor flue gases emitted by industrial combustion plants. The gas to be measured is extracted from the flue gas duct with a sampling probe and then transported to the analyser system via a heated sample gas line. A Fourier transform infrared spectrometer (FTIR spectrometer) is used for spectral detection. The measuring system comprises the following main components:

- FTIR Analysator MKS Type MultiGas 2030D-29805
- System rack c/w control unit, control electronics, gas supply and data output modules
- heated sampling probe type JES301HFTIR
- heated sample gas line c/w stainless steel line, 10 m long during performance testing
- heated sample gas pump type JHSS
- MGS300 Control (to control general instrument functions, valve and temperature, visualisation of measured values)
- MG2000 software (to control the interferometer and the formation of measured values)

Automatic background measurement

The measuring system performs daily zero point adjustments using nitrogen. This takes approximately 10 minutes.

Fuel gases

As part of the field test, the measuring system was operated with nitrogen for the background measurement cycle, compressed air for the ejector pump and processed compressed air (dry dew point ~-40 °C and HC-free) for purging the interferometer.

The current software version is: MG2000: 7.2
 MGS300 Control: 1.04

General remarks

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 manufacturing process for 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. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at qal1.de.

Certification of the MGS300 measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Initial certification according to EN 15267

Certificate no. 0000039319: 20 August 2013
Expiry date of the certificate: 22 July 2018
Test report: 936/21208291/A dated 26 March 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 23.07.2013 B4, chapter I no. 3.2
UBA announcement dated 03 July 2013

Supplementary testing according to EN 15267

Certificate no. 0000039319_01: 29 April 2014
Expiry date of the certificate: 22 July 2018
Test report: 936/21208291/B dated 03 September 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 01.04.2014 B12, chapter I no. 3.3
UBA announcement dated 27 February 2014

Certificate no. 0000039319_02: 09 September 2014
Expiry date of the certificate: 22 July 2018
Test report: 936/21208291/C dated 20 March 2014
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 05.08.2014 B11, chapter I no. 4.3
UBA announcement dated 17 July 2014

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 25 March 2015
Publication: BAnz AT 26.08.2015 B4, chapter V notification 20
UBA announcement dated 22 July 2015
(revised power supply and pre-amplifier board)

Renewal of the certificate

Certificate no. 0000039319_03: 22 July 2018
Expiry date of the certificate: 22 July 2023

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

Measuring system

Manufacturer	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	TÜV Rheinland
Date of report	2014-03-20

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	0.27 mg/m ³
Sum of negative CS at zero point	-0.12 mg/m ³
Sum of positive CS at span point	0.41 mg/m ³
Sum of negative CS at span point	-0.42 mg/m ³
Maximum sum of cross-sensitivities	-0.42 mg/m ³
Uncertainty of cross-sensitivity	-0.242 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			U ²
Repeatability standard deviation at set point *	u _r	0.103 mg/m ³	0.011 (mg/m ³) ²
Lack of fit	u _{lof}	-0.058 mg/m ³	0.003 (mg/m ³) ²
Zero drift from field test	u _{d,z}	-0.078 mg/m ³	0.006 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.113 mg/m ³	0.013 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.173 mg/m ³	0.030 (mg/m ³) ²
Influence of supply voltage	u _v	0.074 mg/m ³	0.005 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	-0.242 mg/m ³	0.059 (mg/m ³) ²
Influence of sample gas flow	u _p	-0.054 mg/m ³	0.003 (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)	$u_c = \sqrt{\sum (u_{max, i})^2}$	0.38 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.75 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m³	7.5
Requirement of EN 15267-3	U in % of the ELV 10 mg/m ³	30.0 **
	U in % of the ELV 10 mg/m ³	22.5

** EU Directive 2010/75/EU does not define requirements for this component.
A value of 30.0 % was used instead.

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

Measuring system

Manufacturer	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

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	0.00 mg/m ³
Sum of negative CS at zero point	-2.12 mg/m ³
Sum of positive CS at span point	1.50 mg/m ³
Sum of negative CS at span point	-1.30 mg/m ³
Maximum sum of cross-sensitivities	-2.12 mg/m ³
Uncertainty of cross-sensitivity	-1.225 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.245 mg/m ³	0.060 (mg/m ³) ²
Lack of fit	u_{lof}	0.312 mg/m ³	0.097 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	0.260 mg/m ³	0.068 (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	0.379 mg/m ³	0.144 (mg/m ³) ²
Influence of supply voltage	u_v	0.232 mg/m ³	0.054 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-1.225 mg/m ³	1.502 (mg/m ³) ²
Influence of sample gas flow	u_p	0.271 mg/m ³	0.073 (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 span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max, i})^2}$	1.58 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.09 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 50 mg/m³	6.2
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	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

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 positive CS at span point	0.40	Vol.-%
Sum of negative CS at span point	-0.30	Vol.-%
Maximum sum of cross-sensitivities	0.40	Vol.-%
Uncertainty of cross-sensitivity	0.231	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.033	Vol.-%	0.001	(Vol.-%) ²
Lack of fit	u_{lof}	0.058	Vol.-%	0.003	(Vol.-%) ²
Zero drift from field test	$u_{d,z}$	0.014	Vol.-%	0.000	(Vol.-%) ²
Span drift from field test	$u_{d,s}$	0.159	Vol.-%	0.025	(Vol.-%) ²
Influence of ambient temperature at span	u_t	0.173	Vol.-%	0.030	(Vol.-%) ²
Influence of supply voltage	u_v	0.118	Vol.-%	0.014	(Vol.-%) ²
Cross-sensitivity (interference)	u_i	0.231	Vol.-%	0.053	(Vol.-%) ²
Influence of sample gas flow	u_p	-0.105	Vol.-%	0.011	(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 span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max, i})^2}$	0.42	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.83	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 25 Vol.-%	3.3
Requirement of EN 15267-3	U in % of the ELV 25 Vol.-%	10.0 **
	U in % of the ELV 25 Vol.-%	7.5

** EU Directive 2010/75/EU 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	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland 2014-03-20

Measured component

Certification range	H ₂ O	0 - 40 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	0.70 Vol.-%
Sum of negative CS at span point	-0.50 Vol.-%
Maximum sum of cross-sensitivities	0.70 Vol.-%
Uncertainty of cross-sensitivity	0.404 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.127 Vol.-%	0.016 (Vol.-%) ²
Lack of fit	u_{lof}	0.058 Vol.-%	0.003 (Vol.-%) ²
Zero drift from field test	$u_{d,z}$	-0.046 Vol.-%	0.002 (Vol.-%) ²
Span drift from field test	$u_{d,s}$	0.300 Vol.-%	0.090 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.265 Vol.-%	0.070 (Vol.-%) ²
Influence of supply voltage	u_v	0.127 Vol.-%	0.016 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	0.404 Vol.-%	0.163 (Vol.-%) ²
Influence of sample gas flow	u_p	0.077 Vol.-%	0.006 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.323 Vol.-%	0.105 (Vol.-%) 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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	0.69 Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.35 Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 40 Vol.-%	3.4
Requirement of EN 15267-3	U in % of the ELV 40 Vol.-%	10.0 **
	U in % of the ELV 40 Vol.-%	7.5

** EU Directive 2010/75/EU 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	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

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	0.51 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.51 mg/m ³
Sum of negative CS at span point	-0.21 mg/m ³
Maximum sum of cross-sensitivities	0.51 mg/m ³
Uncertainty of cross-sensitivity	0.294 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Repeatability standard deviation at set point *	u_r	0.102 mg/m ³	0.010 (mg/m ³) ²
Lack of fit	u_{lof}	0.063 mg/m ³	0.004 (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	$u_{d,s}$	0.147 mg/m ³	0.022 (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	0.083 mg/m ³	0.007 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	0.294 mg/m ³	0.087 (mg/m ³) ²
Influence of sample gas flow	u_p	0.085 mg/m ³	0.007 (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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	0.43 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.84 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m³	8.4
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	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

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	0.07 mg/m ³
Sum of negative CS at zero point	-0.10 mg/m ³
Sum of positive CS at span point	0.04 mg/m ³
Sum of negative CS at span point	0.00 mg/m ³
Maximum sum of cross-sensitivities	-0.10 mg/m ³
Uncertainty of cross-sensitivity	-0.058 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Repeatability standard deviation at set point *	u_r	0.032 mg/m ³	0.001 (mg/m ³) ²
Lack of fit	u_{lof}	0.017 mg/m ³	0.000 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	-0.016 mg/m ³	0.000 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	0.024 mg/m ³	0.001 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.058 mg/m ³	0.003 (mg/m ³) ²
Influence of supply voltage	u_v	0.012 mg/m ³	0.000 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-0.058 mg/m ³	0.003 (mg/m ³) ²
Influence of sample gas flow	u_p	0.016 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)	$u_c = \sqrt{\sum (u_{max, i})^2}$	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	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

Measured component

Certification range	N ₂ O	0 - 50 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.73 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	1.50 mg/m ³
Sum of negative CS at span point	-1.20 mg/m ³
Maximum sum of cross-sensitivities	1.50 mg/m ³
Uncertainty of cross-sensitivity	0.866 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.171 mg/m ³	0.029 (mg/m ³) ²
Lack of fit	u _{lof}	0.237 mg/m ³	0.056 (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}	0.404 mg/m ³	0.163 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.400 mg/m ³	0.160 (mg/m ³) ²
Influence of supply voltage	u _v	0.185 mg/m ³	0.034 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	0.866 mg/m ³	0.750 (mg/m ³) ²
Influence of sample gas flow	u _p	0.162 mg/m ³	0.026 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.404 mg/m ³	0.163 (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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	1.18 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.31 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 50 mg/m³	4.6
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

** EU Directive 2010/75/EU does not define requirements for this component.
A value of 20.0 % was used instead.

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

Measuring system

Manufacturer	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

Measured component

Certification range	NH ₃	0 - 10 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	-0.31 mg/m ³
Sum of positive CS at span point	0.08 mg/m ³
Sum of negative CS at span point	-0.36 mg/m ³
Maximum sum of cross-sensitivities	-0.36 mg/m ³
Uncertainty of cross-sensitivity	-0.208 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Repeatability standard deviation at set point *	u _r	0.115 mg/m ³	0.013 (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}	-0.075 mg/m ³	0.006 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.069 mg/m ³	0.005 (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	0.038 mg/m ³	0.001 (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	0.037 mg/m ³	0.001 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.081 mg/m ³	0.007 (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)	$u_c = \sqrt{\sum (u_{\max, j})^2}$	0.32 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.62 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m³	6.2
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

** EU Directive 2010/75/EU does not define requirements for this component.

A value of 40.0 % was used instead.

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

Measuring system

Manufacturer	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

Measured component

Certification range	NO	0 - 200 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.64 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	-6.30 mg/m ³
Maximum sum of cross-sensitivities	-6.30 mg/m ³
Uncertainty of cross-sensitivity	-3.637 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.819 mg/m ³	0.671 (mg/m ³) ²
Lack of fit	u_{lof}	0.635 mg/m ³	0.403 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	-0.231 mg/m ³	0.053 (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	1.249 mg/m ³	1.560 (mg/m ³) ²
Influence of supply voltage	u_v	0.579 mg/m ³	0.335 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-3.637 mg/m ³	13.230 (mg/m ³) ²
Influence of sample gas flow	u_p	-0.818 mg/m ³	0.669 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.617 mg/m ³	2.613 (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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	4.57 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	8.95 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 131 mg/m³	6.8
Requirement of EN 15267-3	U in % of the ELV 131 mg/m³	20.0
	U in % of the ELV 131 mg/m³	15.0

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

Measuring system

Manufacturer	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

Measured component

Certification range	NO ₂	0 - 50 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	0.50 mg/m ³
Sum of negative CS at span point	-1.30 mg/m ³
Maximum sum of cross-sensitivities	-1.30 mg/m ³
Uncertainty of cross-sensitivity	-0.751 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.111 mg/m ³	0.012 (mg/m ³) ²
Lack of fit	u _{lof}	0.289 mg/m ³	0.084 (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}	0.462 mg/m ³	0.213 (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	0.242 mg/m ³	0.059 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	-0.751 mg/m ³	0.563 (mg/m ³) ²
Influence of sample gas flow	u _p	0.235 mg/m ³	0.055 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.404 mg/m ³	0.163 (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)	$u_c = \sqrt{\sum (u_{max,i})^2}$	1.10 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.15 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 50 mg/m³	4.3
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	MKS Instruments Inc.
AMS designation	MGS300
Serial number of units under test	017151632 / 016842381
Measuring principle	FTIR

Test report

Test laboratory	936/21208291/C
Date of report	TÜV Rheinland
	2014-03-20

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	0.71 mg/m ³
Sum of negative CS at zero point	-1.76 mg/m ³
Sum of positive CS at span point	1.79 mg/m ³
Sum of negative CS at span point	-2.09 mg/m ³
Maximum sum of cross-sensitivities	-2.09 mg/m ³
Uncertainty of cross-sensitivity	-1.208 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.348 mg/m ³	0.121 (mg/m ³) ²
Lack of fit	u _{lof}	0.346 mg/m ³	0.120 (mg/m ³) ²
Zero drift from field test	u _{d,z}	-0.346 mg/m ³	0.120 (mg/m ³) ²
Span drift from field test	u _{d,s}	-0.606 mg/m ³	0.367 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.643 mg/m ³	0.413 (mg/m ³) ²
Influence of supply voltage	u _v	0.256 mg/m ³	0.066 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	-1.208 mg/m ³	1.460 (mg/m ³) ²
Influence of sample gas flow	u _p	-0.352 mg/m ³	0.124 (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 span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,i})^2}$	1.78 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.48 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the ELV 50 mg/m³	7.0
U in % of the ELV 50 mg/m³	20.0
U in % of the ELV 50 mg/m³	15.0