Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000039319_02

Certified AMS:	MGS300 for CO, SO_2, NO, NO_2, HCl, HF, CH_4, CO_2, H_2O, N_2O and NH_3
Manufacturer:	MKS Instruments Inc. 651 Lowell Street, Methuen, MA 01844 USA
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

This is to certify that the AMS has been tested and found to comply with:

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 (see also the following pages).

The present certificate replaces Certificate No. 0000039319_01 of 29 April 2014

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000039319

Publication in the German Federal Gazette (BAnz.) of 5 August 2014

This certificate will expire on:
22 July 2018

German Federal Environment Agency
Dessau, 9 September 2014

i. A. Dr. Marcel Langner

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 8 September 2014

ppa. Dr. Peter Wilbring

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Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008.

Test report:	936/21208291/C of 20 March 2014
Initial certification:	23 July 2013
Expiry date:	22 July 2018
Publication:	BAnz AT 5 August 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, at waste incineration plants according to Directive 2010/75/EU, chapter IV 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 a laboratory test and a twelve-month field test at a municipal waste incinerator.

The AMS is approved for an ambient temperature range of +5 °C to +40 °C.

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 of 20 March 2014 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 5 August 2014 B11, chapter I, no. 4.3
  UBA announcement of 17 July 2014

AMS designation:
MGS300 for CO, SO_2, NO, NO_2, HCl, HF, CH_4, CO_2, H_2O, N_2O and NH_3

Manufacturer:
MKS Instruments Inc., Methuen, USA

Field of application:
For measurements at plants requiring official approval (e.g. Directive 2010/75/EU on industrial emissions, chapters III and IV)

Measuring ranges during the performance test:

Component	Certification range	Supplementary range		Unit
HF	0 - 3	0 - 10	-	mg/m^3
N_2O	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_2O	0 - 40	-	-	Vol.-%
CH_4	0 - 15	0 - 50	0 - 500	mg/m^3

Software versions:
MG2000: 7.2
MGS300 Control: 01.04

Restriction:
The requirement of Standard EN 15267-3 for protection provided by enclosures was not met during performance testing. The measuring system shall be installed protected from dust and precipitation.

Notes:
1. The maintenance interval is six months.
2. Supplementary testing (extension of the maintenance interval) to the announcement of the Federal Environmental Agency (UBA) of 27 February 2014 (Federal Gazette (BAnz) AT 01.04.2014 B12, chapter I, no. 3.3).

Test report:
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report no.: 936/21208291/C of 20 March 2014

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

The MGS300 is a multi-component gas analysing system for continuous monitoring of exhaust gases at industrial incineration plants. The gas to be measured is extracted with help of a sample gas probe from the stack. Then the gas is forwarded with a heated sample line to the heated analyser system.

For the spectral acquisition of the gas concentration a Fourier-transformed infrared spectrometer is used. The measurement device consists of the following main components:

- FTIR analyser MKS type MultiGas 2030D-29805
- System cabinet with control computer, control electronics, gas supply and data output modules
- heated sample probe type JES301HFTIR
- heated sample gas line with stainless steel tubing, length during the type approval 10 meters
- heated sample gas pump type JHSS
- MGS300 Control software (for the control of general analyser functions, valve- and temperature control, visualisation of measured values)
- MG2000 software (interferometer control and calculation of measured values)

Automatic background measurement

The analysers performs a daily automatic zero adjustment with nitrogen. This adjustment lasts about 10 minutes.

Consumable gases

During the field test the measurement device was operated with nitrogen for the background cycle, with compressed air for the ejector-pump and with conditioned compressed air (dew point app. -40 °C and hydrocarbon free) for the interferometer purge.

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 Energie und Umwelt 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 Energie und Umwelt GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energie und Umwelt 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 MGS300 for CO, SO_2, NO, NO_2, HCl, HF, CH_4, CO_2, H_2O, N_2O and NH_3 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. 0000039319: 20 August 2013

Expiry date of the certificate: 22 July 2018

Test report: 936/21208291/A of 26 March 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Publication: BAnz AT 23 July 2013 B4, chapter I, no. 3.2
UBA announcement of 3 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 of 3 September 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Publication: BAnz AT 1 April 2014 B12, chapter I, no. 3.3
UBA announcement of 27 February 2014

Supplementary testing according to EN 15267

Certificate no. 0000039319_02: 9 September 2014

Expiry date of the certificate: 22 July 2018

Test report: 936/21208291/C of 20 March 2014
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Publication: BAnz AT 5 August 2014 B11, chapter I, no. 4.3
UBA announcement of 17 July 2014

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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	2014-03-20
Measured component	CH_4
Certification range	0 - 15 mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.27	mg/m³	
Sum of negative CS at zero point	-0.12	mg/m³	
Sum of postive CS at span point	0.41	mg/m³	
Sum of negative CS at span point	-0.42	mg/m³	
Maximum sum of cross-sensitivities	-0.42	mg/m³	
Uncertainty of cross-sensitivity	-0.242	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	0.103	mg/m³	0.011	(mg/m³)²
Lack of fit	u_{lof}	-0.058	mg/m³	0.003	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.078	mg/m³	0.006	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.113	mg/m³	0.013	(mg/m³)²
Influence of ambient temperature at span	u_t	0.173	mg/m³	0.030	(mg/m³)²
Influence of supply voltage	u_v	0.074	mg/m³	0.005	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.242	mg/m³	0.059	(mg/m³)²
Influence of sample gas flow	u_p	-0.054	mg/m³	0.003	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121	mg/m³	0.015	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.38	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.75	mg/m³

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

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
The chosen value is recommended by the certification body.

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			936/21208291/C		
Test laboratory			TÜV Rheinland		
Date of report			2014-03-20		
Measured component			CO		
Certification range			0 - 75	mg/m³	
Evaluation of the cross-sensitivity (CS)					
(system with largest CS)					
Sum of positive CS at zero point			0.00	mg/m³	
Sum of negative CS at zero point			-2.12	mg/m³	
Sum of postive CS at span point			1.50	mg/m³	
Sum of negative CS at span point			-1.30	mg/m³	
Maximum sum of cross-sensitivities			-2.12	mg/m³	
Uncertainty of cross-sensitivity			-1.225	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.245	mg/m³	0.060	(mg/m³)²
Lack of fit	u_{lof}	0.312	mg/m³	0.097	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.260	mg/m³	0.068	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.346	mg/m³	0.120	(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	0.232	mg/m³	0.054	(mg/m³)²
Cross-sensitivity (interference)	u_i	-1.225	mg/m³	1.502	(mg/m³)²
Influence of sample gas flow	u_p	0.271	mg/m³	0.073	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.58	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.09	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**6.2**
Requirement of 2010/75/EU	**U in % of the ELV 50 mg/m³**	**10.0**
Requirement of EN 15267-3	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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	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 postive 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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.42	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.83	Vol.-%

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

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
The chosen value is recommended by the certification body.

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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	2014-03-20
Measured component	H_2O
Certification range	0 - 40 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	0.70	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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.69	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.35	Vol.-%

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

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
The chosen value is recommended by the certification body.

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		936/21208291/C	
Test laboratory		TÜV Rheinland	
Date of report		2014-03-20	
Measured component		HCl	
Certification range		0 - 15	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		0.51	mg/m³
Sum of negative CS at zero point		0.00	mg/m³
Sum of postive CS at span point		0.51	mg/m³
Sum of negative CS at span point		-0.21	mg/m³
Maximum sum of cross-sensitivities		0.51	mg/m³
Uncertainty of cross-sensitivity		0.294	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	0.102	mg/m³	0.010	(mg/m³)²
Lack of fit	u_{lof}	0.063	mg/m³	0.004	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.087	mg/m³	0.008	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.147	mg/m³	0.022	(mg/m³)²
Influence of ambient temperature at span	u_t	0.153	mg/m³	0.023	(mg/m³)²
Influence of supply voltage	u_v	0.083	mg/m³	0.007	(mg/m³)²
Cross-sensitivity (interference)	u_i	0.294	mg/m³	0.087	(mg/m³)²
Influence of sample gas flow	u_p	0.085	mg/m³	0.007	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121	mg/m³	0.015	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.43	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.84	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 10 mg/m³**	**8.4**
Requirement of 2010/75/EU	**U in % of the ELV 10 mg/m³**	**40.0**
Requirement of EN 15267-3	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		936/21208291/C	
Test laboratory		TÜV Rheinland	
Date of report		2014-03-20	
Measured component		HF	
Certification range		0 - 3	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		0.07	mg/m³
Sum of negative CS at zero point		-0.10	mg/m³
Sum of postive CS at span point		0.04	mg/m³
Sum of negative CS at span point		0.00	mg/m³
Maximum sum of cross-sensitivities		-0.10	mg/m³
Uncertainty of cross-sensitivity		-0.058	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	0.032	mg/m³	0.001	(mg/m³)²
Lack of fit	u_{lof}	0.017	mg/m³	0.000	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.016	mg/m³	0.000	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.024	mg/m³	0.001	(mg/m³)²
Influence of ambient temperature at span	u_t	0.058	mg/m³	0.003	(mg/m³)²
Influence of supply voltage	u_v	0.012	mg/m³	0.000	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.058	mg/m³	0.003	(mg/m³)²
Influence of sample gas flow	u_p	0.016	mg/m³	0.000	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.024	mg/m³	0.001	(mg/m³)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/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.19	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 1 mg/m³**	**19.4**
Requirement of 2010/75/EU	**U in % of the ELV 1 mg/m³**	**40.0**
Requirement of EN 15267-3	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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	2014-03-20
Measured component	N_2O
Certification range	0 - 50 mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.73	mg/m³
Sum of negative CS at zero point	0.00	mg/m³
Sum of postive CS at span point	1.50	mg/m³
Sum of negative CS at span point	-1.20	mg/m³
Maximum sum of cross-sensitivities	1.50	mg/m³
Uncertainty of cross-sensitivity	0.866	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.171	mg/m³	0.029	(mg/m³)²
Lack of fit	u_{lof}	0.237	mg/m³	0.056	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.087	mg/m³	0.008	(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	0.400	mg/m³	0.160	(mg/m³)²
Influence of supply voltage	u_v	0.185	mg/m³	0.034	(mg/m³)²
Cross-sensitivity (interference)	u_i	0.866	mg/m³	0.750	(mg/m³)²
Influence of sample gas flow	u_p	0.162	mg/m³	0.026	(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 span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.18	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.31	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**4.6**
Requirement of 2010/75/EU	**U in % of the ELV 50 mg/m³**	**20.0 ****
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	15.0

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
The chosen value is recommended by the certification body.

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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	2014-03-20
Measured component	NH_3
Certification range	0 - 10 mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.24	mg/m³	
Sum of negative CS at zero point	-0.31	mg/m³	
Sum of postive CS at span point	0.08	mg/m³	
Sum of negative CS at span point	-0.36	mg/m³	
Maximum sum of cross-sensitivities	-0.36	mg/m³	
Uncertainty of cross-sensitivity	-0.208	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	0.115	mg/m³	0.013	(mg/m³)²
Lack of fit	u_{lof}	0.035	mg/m³	0.001	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.075	mg/m³	0.006	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.069	mg/m³	0.005	(mg/m³)²
Influence of ambient temperature at span	u_t	0.153	mg/m³	0.023	(mg/m³)²
Influence of supply voltage	u_v	0.038	mg/m³	0.001	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.208	mg/m³	0.043	(mg/m³)²
Influence of sample gas flow	u_p	0.037	mg/m³	0.001	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.081	mg/m³	0.007	(mg/m³)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/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.62	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 10 mg/m³**	**6.2**
Requirement of 2010/75/EU	**U in % of the ELV 10 mg/m³**	**40.0 ****
Requirement of EN 15267-3	U in % of the ELV 10 mg/m³	30.0

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
The chosen value is recommended by the certification body.

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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	2014-03-20
Measured component	NO
Certification range	0 - 200 mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	1.64	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	-6.30	mg/m³
Maximum sum of cross-sensitivities	-6.30	mg/m³
Uncertainty of cross-sensitivity	-3.637	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.819	mg/m³	0.671	(mg/m³)²
Lack of fit	u_{lof}	0.635	mg/m³	0.403	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.231	mg/m³	0.053	(mg/m³)²
Span drift from field test	$u_{d,s}$	-1.155	mg/m³	1.334	(mg/m³)²
Influence of ambient temperature at span	u_t	1.249	mg/m³	1.560	(mg/m³)²
Influence of supply voltage	u_v	0.579	mg/m³	0.335	(mg/m³)²
Cross-sensitivity (interference)	u_i	-3.637	mg/m³	13.230	(mg/m³)²
Influence of sample gas flow	u_p	-0.818	mg/m³	0.669	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.617	mg/m³	2.613	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	4.57	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	8.95	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 131 mg/m³**	**6.8**
Requirement of 2010/75/EU	**U in % of the ELV 131 mg/m³**	**20.0**
Requirement of EN 15267-3	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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	2014-03-20
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	0.00	mg/m³
Sum of negative CS at zero point	0.00	mg/m³
Sum of postive CS at span point	0.50	mg/m³
Sum of negative CS at span point	-1.30	mg/m³
Maximum sum of cross-sensitivities	-1.30	mg/m³
Uncertainty of cross-sensitivity	-0.751	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.111	mg/m³	0.012	(mg/m³)²
Lack of fit	u_{lof}	0.289	mg/m³	0.084	(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	$u_{d,s}$	0.462	mg/m³	0.213	(mg/m³)²
Influence of ambient temperature at span	u_t	0.208	mg/m³	0.043	(mg/m³)²
Influence of supply voltage	u_v	0.242	mg/m³	0.059	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.751	mg/m³	0.563	(mg/m³)²
Influence of sample gas flow	u_p	0.235	mg/m³	0.055	(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 span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.10	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.15	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**4.3**
Requirement of 2010/75/EU	**U in % of the ELV 50 mg/m³**	**20.0**
Requirement of EN 15267-3	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	936/21208291/C
Test laboratory	TÜV Rheinland
Date of report	2014-03-20
Measured component	SO_2
Certification range	0 - 75 mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.71	mg/m³
Sum of negative CS at zero point	-1.76	mg/m³
Sum of postive CS at span point	1.79	mg/m³
Sum of negative CS at span point	-2.09	mg/m³
Maximum sum of cross-sensitivities	-2.09	mg/m³
Uncertainty of cross-sensitivity	-1.208	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.348	mg/m³	0.121	(mg/m³)²
Lack of fit	u_{lof}	0.346	mg/m³	0.120	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.346	mg/m³	0.120	(mg/m³)²
Span drift from field test	$u_{d,s}$	-0.606	mg/m³	0.367	(mg/m³)²
Influence of ambient temperature at span	u_t	0.643	mg/m³	0.413	(mg/m³)²
Influence of supply voltage	u_v	0.256	mg/m³	0.066	(mg/m³)²
Cross-sensitivity (interference)	u_i	-1.208	mg/m³	1.460	(mg/m³)²
Influence of sample gas flow	u_p	-0.352	mg/m³	0.124	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.78	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.48	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**7.0**
Requirement of 2010/75/EU	**U in % of the ELV 50 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	15.0