

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000062065

AMS designation: DGA-X for NO and SO₂

Manufacturer: Dongwoo Optron Co., Ltd.
102-8, Hoean-Daero
Opo-Eup, Gwangju-Si
South Korea 12798

Test Laboratory: TÜV Rheinland Energy 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: 2014.

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 7 pages).



Suitability Tested
EN 15267
QAL1 Certified
Regular Surveillance

www.tuv.com
ID 0000062065

Publication in the German Federal Gazette
(BAnz) of 26 March 2019

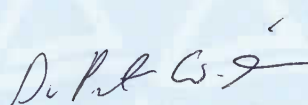
This certificate will expire on:
Cologne, 25 March 2024

German Federal Environment Agency
Dessau, 12 June 2019

TÜV Rheinland Energy GmbH
Cologne, 11 June 2019



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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:	936/21239654/A dated 9 October 2018
Initial certification:	26 March 2019
Expiry date:	25 March 2024
Publication:	BAnz AT 26.03.2019 B7, chapter I number 2.3

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 three-months field test at a waste incineration plant.

The AMS is approved for an ambient temperature range of -20 °C to +50 °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 936/21239654/A dated 9 October 2018 issued by TÜV Rheinland Energy GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz AT 26.03.2019 B7, chapter I number 2.3,
UBA announcement dated 27 February 2019

AMS designation:

DGA-X for NO and SO₂

Manufacturer:

Dongwoo Optron Co., Ltd., Gwangju-Si, South Korea

Field of application:

For plants requiring official approval

Measuring ranges during performance testing:

Component	Certification range	supplementary range	Unit
NO	0–100	0–1 000	mg/m ³
SO ₂	0–75	0–1 000	mg/m ³

Software version:

20000-8

Restrictions:

None

Notes:

1. The maintenance interval is four weeks.
2. The test cycle was deactivated during the determination of the maintenance interval.
3. The instrument version submitted to testing had an optical path length of 300 mm.
4. The AMS is suitable for velocities above 1 m/s.
5. Optical filters have to be deactivated.
6. Normalisation of measured signals referred to the operating status require the use of an external temperature sensor.
7. The output of measured values refers to the operating conditions without any moisture correction.

Test Report:

TÜV Rheinland Energy GmbH, Cologne
Report no.: 936/21239654/A dated 10 October 2018

Certified product

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

The DGA-X is an in-situ measuring system which continuously monitors gaseous components present in the waste gas of industrial plants. The AMS uses differential optical absorption spectroscopy as its measuring principle which relies on the absorption of specific frequencies or wavelengths of light by gaseous components. The certified AMS includes a main control unit (MU), an auto calibration unit (ACU), a probe and a purge air pump unit. The main control unit consists of a UV light source, a spectrometer a controller and an input/output control unit. The calibration unit includes a sliding table with a reflector (which modifies the UV light path) and a standard gas cell. The probe contains a purge air window, a reflector and a purge air tube at both ends of the measurement section, which is located in the middle. The probe is an integral part of the gas analyser. Depending on the size of the sensor, the former serves as reference for gas measurement calibration. The purge unit prevents the instrument and the probe from being contaminated. To this effect, fresh and filtered air is taken in through the purge unit.

The main control unit's display shows all current concentrations of measured components and status signals. The display is equipped with a touchscreen. The system provides a number of outputs for analogue and digital signals such as an RS Modbus.

Software version 20000-8 remained unchanged over the entire period of testing.

The AMS tested here comprises the following components:

- DGA-X gas analyser main control unit (MU),
- DGA-X gas analyser calibration unit (ACU),
- DGA-X gas analyser panel for gas control range,
- Purge unit (pump, filter, hose),
- DGA-X gas analyser probe (measurement path 300 mm),
- Flange, tube, and flange cover for mounting the probe,
- Manual in German and software version 20000-8.

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.

Document history

Certification of the DGA-X 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.0000062065 : 12 June 2019
Expiry date of the certificate: 25 March 2024
936/21239654/A dated 9 October 2018
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 26.03.2019 B7, chapter I number 2.3
UBA announcement dated 27 February 2019

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

Measuring system

Manufacturer	Dongwoo
AMS designation	DGA-X
Serial number of units under test	DGA-X-16-036-Nox/Sox / DGA-X-16-037-Nox/Sox
Measuring principle	DOAS

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-10

Measured component

Certification range	NO 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	0.00 mg/m ³
Sum of negative CS at span point	-1.60 mg/m ³
Maximum sum of cross-sensitivities	-1.60 mg/m ³
Uncertainty of cross-sensitivity	u_i -0.924 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}	0.098 mg/m ³	0.010 (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	$u_{d,s}$	1.501 mg/m ³	2.253 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.462 mg/m ³	0.213 (mg/m ³) ²
Influence of supply voltage	u_v	0.062 mg/m ³	0.004 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-0.924 mg/m ³	0.854 (mg/m ³) ²
Influence of sample gas pressure	u_p	0.104 mg/m ³	0.011 (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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.33 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	4.58 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 67 mg/m³	6.8
Requirement of EN 15267-3	U in % of the ELV 67 mg/m³	20.0
	U in % of the ELV 67 mg/m³	15.0

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

Measuring system

Manufacturer	Dongwoo
AMS designation	DGA-X
Serial number of units under test	DGA-X-16-036-Nox/Sox / DGA-X-16-037-Nox/Sox
Measuring principle	DOAS

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-10-10

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	0.00 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.40 mg/m ³
Sum of negative CS at span point	-0.50 mg/m ³
Maximum sum of cross-sensitivities	-0.50 mg/m ³
Uncertainty of cross-sensitivity	u _i -0.290 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}	-0.169 mg/m ³	0.029 (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}	0.953 mg/m ³	0.908 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.635 mg/m ³	0.403 (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	-0.290 mg/m ³	0.084 (mg/m ³) ²
Influence of sample gas pressure	u _p	0.212 mg/m ³	0.045 (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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.52 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.97 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 50 mg/m³	5.9
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