

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000038507

Certified AMS: AS32M for nitrogen dioxide

Manufacturer: Environnement S.A.
111, Boulevard Robespierre
78304 Poissy Cedex
France

Test Institute: TÜV Rheinland Energie und Umwelt GmbH

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

**VDI 4202-1: 2010, VDI 4203-3: 2010,
EN 14211: 2012, EN 15267-1: 2009 und EN 15267-2: 2009**

Certification is awarded in respect of the conditions stated in this certificate
(see also the following pages).

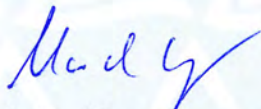


Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000038507

Publication in the German Federal Gazette
(BAnz.) of 23 July 2013

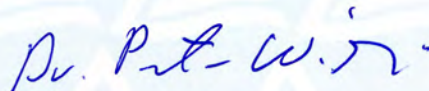
German Federal Environment Agency
Dessau, 20 August 2013



i. A. Dr. Marcel Langner

This certificate will expire on:
22 July 2018

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 19 August 2013



ppa. Dr. Peter Wilbring

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Am Grauen Stein
51105 Cologne

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

Certificate:
0000038507 / 20 August 2013

Test report: 936/21219819/A of 11 March 2013
Initial certification: 23 July 2013
Date of expiry: 22 July 2018
Publication: BAnz AT 23 July 2013 B4, chapter III, No. 1.1

Approved application

The tested AMS is suitable for stationary application as continuous measurement of nitrogen dioxide concentrations in ambient air (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three-month field test.

The AMS is approved for a temperature range of 0 °C bis 30 °C.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at which it will be installed.

Basis of the certification

This certification is based on:

- test report 936/21219819/A of 11 March 2013 of TÜV Rheinland Energie und Umwelt GmbH
- suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- the on-going surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz AT 23 July 2013 B4, chapter III, No. 1.1)

AMS designation:

AS32M for nitrogen dioxide

Manufacturer:

Environnement S. A., Poissy, France

Field of application:

Continuous measurement of nitrogen dioxide concentrations in ambient air (stationary operation)

Measuring range during the performance test:

Component	Certification range	Unit
Nitrogen dioxide	0 - 500	µg/m ³

Software version:

3.6.a

Restrictions:

None

Notes:

1. The measuring system shall be operated in a lockable measurement cabinet.
2. The performance test report is available online under www.qal1.de.

Test institute: TÜV Rheinland Energie und Umwelt GmbH, Cologne

Report No.: 936/21219819/A of 11 March 2013

Certified product

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

The ambient air monitoring system AS32M is a continuous nitrogen dioxide analyser. It operates on the basis of direct UV light absorption. The instrument was designed for the continuous measurement of nitrogen dioxide in ambient air. Its principle of measurement is based on CAPS technology (Cavity Attenuated Phase Shift Spectroscopy).

Sampling is carried out by means of a pump at the back end of the flow cycle, attached via a Teflon connection to the rear side of the measuring instrument. Two 3-way solenoid valves allow the selection of one of three analyser inlets: "Sample", "Zero air" or "Test gas". A Teflon filter (PTFE) at the sample gas inlet prevents dust from entering the instrument.

A PERMA-PURE dryer is used in order to dehumidify the sample gas. The permeation dryer employs two concentric tubes, the inner of which is made of a special water-permeable polymer. The water molecules are transported via this tube from the side with higher water content to the side with lower content. In order to guarantee a lower partial pressure of water outside the polymer tubes, their surroundings are exposed to vacuum and flushed with a portion of the waste gas.

After drying, the sample gas is directed through a dust filter (made of borosilicate glass microfiber, bound in PTFE). The filter retains 99.5 % of particles with an aerodynamic diameter of over 10 nm. This avoids optical interference caused by light scattered by particles with a larger diameter than the wavelength of the emission (450 nm).

The sample gas then reaches the optical resonator. It is a hollow cylinder made of stainless steel, sealed at both ends with a semi-transparent mirror with high reflectivity. The light source in front of the input mirror M1 of the resonator is a LED lamp, which emits light with a wavelength of 450 nm. The light beam is bundled by a converging lens between the LED lamp and the M1 mirror. The photons let through the resonator's M2 mirror are captured by a photo cell located behind the mirror. A converging lens between the M2 mirror and the detector focuses the beam toward the detector and an optical band-pass filter centred on 450 ± 10 nm rejects the photons with wavelength outside the range of 440 - 460 nm.

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 is presented on page 1 of this certificate.

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 the validity is also accessible on the internet: qal1.de.

Certification of AS32M for nitrogen dioxide 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. 0000038507: 20 August 2013

Expiration date of the certificate: 22 July 2018

Test report: 936/21219819/A of 11 March 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne

Publication: BAnz AT 23 July 2013 B4, chapter III, No. 1.1
Announcement by UBA from 03 July 2013

Calculation of overall uncertainty

Instrument:		Environnement AS32M		Serial.-No.		SN 1 (001)	
Component:		NO2		1h-limit value:		200 $\mu\text{g}/\text{m}^3$	
No.	Performance characteristic	Performance criteria	Result	Partial uncertainty		Square of uncertainty	
1	Repeatability at zero	$\leq 1.92 \mu\text{g}/\text{m}^3$	0.200	$u_{r,z}$	0.04	0.0014	
2	Repeatability at concentration ct	$\leq 5.76 \mu\text{g}/\text{m}^3$	1.300	$u_{r,lv}$	0.24	0.0574	
3	"lack of fit"	$\leq 4.0\%$ of measured value	1.100	$u_{l,lv}$	1.27	1.6133	
4	Sensitivity coefficient of sample gas pressure	$\leq 8.0 \mu\text{g}/\text{m}^3/\text{kPa}$	0.137	u_{gp}	0.95	0.8958	
5	Sensitivity coefficient of sample gas temperature	$\leq 5.76 \mu\text{g}/\text{m}^3/\text{K}$	0.072	u_{gt}	0.71	0.5049	
6	Sensitivity coefficient of surrounding temperature	$\leq 5.76 \mu\text{g}/\text{m}^3/\text{K}$	0.200	u_{st}	1.98	3.9184	
7	Sensitivity coefficient of electrical voltage	$\leq 0.57 \mu\text{g}/\text{m}^3/\text{V}$	0.034	u_v	0.67	0.4478	
8a	Interference of H2O at 21 mmol/mol	$\leq 9.6 \mu\text{g}/\text{m}^3$ (zero)	0.200	$u_{\text{H}_2\text{O}}$	-1.04	1.0800	
		$\leq 9.6 \mu\text{g}/\text{m}^3$ (span)	-1.800				
8b	Interference of CO2 at 500 $\mu\text{mol}/\text{mol}$	$\leq 9.6 \mu\text{g}/\text{m}^3$ (zero)	0.200	$u_{\text{int, pos}}$	3.64	13.2300	
		$\leq 9.6 \mu\text{g}/\text{m}^3$ (span)	2.200				
8c	Interference of NH3 at 200 nmol/mol	$\leq 9.6 \mu\text{g}/\text{m}^3$ (zero)	0.200	$u_{\text{int, neg}}$			
		$\leq 9.6 \mu\text{g}/\text{m}^3$ (span)	4.100				
9	Averaging effect	$\leq 7.0\%$ of measured value	-0.600	u_{av}	-0.69	0.4800	
18	Difference sample/calibration port	$\leq 1\%$	0.200	u_{Dsc}	0.40	0.1600	
21	Converter efficiency	≥ 98	---	u_{EC}	0.00	0.0000	
23	Uncertainty calibration gas	$\leq 3\%$	2.000	u_{cg}	2.00	4.0000	
combined standard uncertainty				u_c		5.1427	$\mu\text{g}/\text{m}^3$
expanded uncertainty				U_c		10.2855	$\mu\text{g}/\text{m}^3$
expanded uncertainty actual				$U_{c, \text{rel}}$		5.14	%
expanded uncertainty required				$U_{\text{req, rel}}$		15	%

Calculation of overall uncertainty

Instrument:		Environnement AS32M		Serial.-No.		SN 2 (002)	
Component:		NO2		1h-limit value:		200 $\mu\text{g}/\text{m}^3$	
No.	Performance characteristic	Performance criteria	Result	Partial uncertainty		Square of uncertainty	
1	Repeatability at zero	$\leq 1.92 \mu\text{g}/\text{m}^3$	0.100	$u_{r,z}$	0.02	0.0004	
2	Repeatability at concentration ct	$\leq 5.76 \mu\text{g}/\text{m}^3$	1.600	$u_{r,lv}$	0.30	0.0884	
3	"lack of fit"	$\leq 4.0\%$ of measured value	1.500	$u_{l,lv}$	1.73	3.0000	
4	Sensitivity coefficient of sample gas pressure	$\leq 8.0 \mu\text{g}/\text{m}^3/\text{kPa}$	0.119	u_{gp}	0.82	0.6759	
5	Sensitivity coefficient of sample gas temperature	$\leq 5.76 \mu\text{g}/\text{m}^3/\text{K}$	0.021	u_{gt}	0.21	0.0430	
6	Sensitivity coefficient of surrounding temperature	$\leq 5.76 \mu\text{g}/\text{m}^3/\text{K}$	0.170	u_{st}	1.68	2.8310	
7	Sensitivity coefficient of electrical voltage	$\leq 0.57 \mu\text{g}/\text{m}^3/\text{V}$	0.011	u_v	0.22	0.0471	
8a	Interference of H2O at 21 mmol/mol	$\leq 9.6 \mu\text{g}/\text{m}^3$ (zero)	0.000	$u_{\text{H}_2\text{O}}$	-1.44	2.0833	
		$\leq 9.6 \mu\text{g}/\text{m}^3$ (span)	0.000				
8b	Interference of CO2 at 500 $\mu\text{mol}/\text{mol}$	$\leq 9.6 \mu\text{g}/\text{m}^3$ (zero)	0.300	$u_{\text{int, pos}}$	2.71	7.3633	
		$\leq 9.6 \mu\text{g}/\text{m}^3$ (span)	2.000				
8c	Interference of NH3 at 200 nmol/mol	$\leq 9.6 \mu\text{g}/\text{m}^3$ (zero)	0.100	$u_{\text{int, neg}}$			
		$\leq 9.6 \mu\text{g}/\text{m}^3$ (span)	2.700				
9	Averaging effect	$\leq 7.0\%$ of measured value	2.700	u_{av}	3.12	9.7200	
18	Difference sample/calibration port	$\leq 1\%$	0.040	u_{Dsc}	0.08	0.0064	
21	Converter efficiency	≥ 98	---	u_{EC}	0.00	0.0000	
23	Uncertainty calibration gas	$\leq 3\%$	2.000	u_{cg}	2.00	4.0000	
combined standard uncertainty				u_c		5.4724	$\mu\text{g}/\text{m}^3$
expanded uncertainty				U_c		10.9449	$\mu\text{g}/\text{m}^3$
expanded uncertainty actual				$U_{c, \text{rel}}$		5.47	%
expanded uncertainty required				$U_{\text{req, rel}}$		15	%

Calculation of overall uncertainty

Instrument: Environnement AS32M		Serial.-No. SN 1 (001)				
Component: NO2		1h-limit value: 200		µg/m³		
No.	Performance characteristic	Performance criteria	Result	Partial uncertainty		Square of uncertainty
1	Repeatability at zero	≤ 1.92 µg/m³	0.200	U _{r,z}	0.04	0.0014
2	Repeatability at concentration ct	≤ 5.76 µg/m³	1.300	U _{r,lv}	not considered, because ur,lv = 0.23 < ur,f	-
3	"lack of fit"	≤ 4.0% of measured value	1.100	U _{lv}	1.27	1.6133
4	Sensitivity coefficient of sample gas pressure	≤ 8.0 µg/m³/kPa	0.137	U _{gp}	0.95	0.8958
5	Sensitivity coefficient of sample gas temperature	≤ 5.76 µg/m³/K	0.072	U _{gt}	0.71	0.5049
6	Sensitivity coefficient of surrounding temperature	≤ 5.76 µg/m³/K	0.200	U _{st}	1.98	3.9184
7	Sensitivity coefficient of electrical voltage	≤ 0.57 µg/m³/V	0.034	U _v	0.67	0.4478
8a	Interference of H2O at 21 mmol/mol	≤ 9.6 µg/m³ (zero)	0.200	U _{h2o}	-1.04	1.0800
		≤ 9.6 µg/m³ (span)	-1.800			
8b	Interference of CO2 at 500 µmol/mol	≤ 9.6 µg/m³ (zero)	0.200	U _{int,pos}	3.64	13.2300
		≤ 9.6 µg/m³ (span)	2.200			
8c	Interference of NH3 at 200 nmol/mol	≤ 9.6 µg/m³ (zero)	0.200	U _{int,neg}		
		≤ 9.6 µg/m³ (span)	4.100			
9	Averaging effect	≤ 7.0% of measured value	-0.600	U _{av}	-0.69	0.4800
10	Reproducibility under field conditions	≤ 5.0% of the average of 3 Mon.	1.770	U _{r,f}	3.54	12.5316
11	Long term drift at zero level	≤ 9.36 µg/m³	1.160	U _{gl,z}	0.67	0.4485
12	Long term drift at span level	≤ 5.0% of certification range	1.810	U _{gl,lv}	2.09	4.3681
18	Difference sample/calibration port	≤ 1%	0.200	U _{psc}	0.40	0.1600
21	Converter efficiency	≥ 98	---	U _{ec}	0.00	0.0000
23	Uncertainty calibration gas	≤ 3%	2.000	ucg	2.00	4.0000
combined standard uncertainty				u _c		7.4975 µg/m³
expanded uncertainty				U _c		14.9950 µg/m³
expanded uncertainty actual				U _{c,rel}		7.50 %
expanded uncertainty required				U _{req,rel}		15 %

Calculation of overall uncertainty

Instrument: Environnement AS32M		Serial.-No. SN 2 (002)				
Component: NO2		1h-limit value: 200		µg/m³		
No.	Performance characteristic	Performance criteria	Result	Partial uncertainty		Square of uncertainty
1	Repeatability at zero	≤ 1.92 µg/m³	0.100	U _{r,z}	0.02	0.0004
2	Repeatability at concentration ct	≤ 5.76 µg/m³	1.600	U _{r,lv}	not considered, because ur,lv = 0.29 < ur,f	-
3	"lack of fit"	≤ 4.0% of measured value	1.500	U _{lv}	1.73	3.0000
4	Sensitivity coefficient of sample gas pressure	≤ 8.0 µg/m³/kPa	0.119	U _{gp}	0.82	0.6759
5	Sensitivity coefficient of sample gas temperature	≤ 5.76 µg/m³/K	0.021	U _{gt}	0.21	0.0430
6	Sensitivity coefficient of surrounding temperature	≤ 5.76 µg/m³/K	0.170	U _{st}	1.68	2.8310
7	Sensitivity coefficient of electrical voltage	≤ 0.57 µg/m³/V	0.011	U _v	0.22	0.0471
8a	Interference of H2O at 21 mmol/mol	≤ 9.6 µg/m³ (zero)	0.200	U _{h2o}	-1.44	2.0833
		≤ 9.6 µg/m³ (span)	-2.500			
8b	Interference of CO2 at 500 µmol/mol	≤ 9.6 µg/m³ (zero)	0.300	U _{int,pos}	2.71	7.3633
		≤ 9.6 µg/m³ (span)	2.000			
8c	Interference of NH3 at 200 nmol/mol	≤ 9.6 µg/m³ (zero)	0.100	U _{int,neg}		
		≤ 9.6 µg/m³ (span)	2.700			
9	Averaging effect	≤ 7.0% of measured value	2.700	U _{av}	3.12	9.7200
10	Reproducibility under field conditions	≤ 5.0% of the average of 3 Mon.	1.770	U _{r,f}	3.54	12.5316
11	Long term drift at zero level	≤ 9.36 µg/m³	1.170	U _{gl,z}	0.68	0.4563
12	Long term drift at span level	≤ 5.0% of certification range	1.730	U _{gl,lv}	2.00	3.9905
18	Difference sample/calibration port	≤ 1%	0.040	U _{psc}	0.08	0.0064
21	Converter efficiency	≥ 98	---	U _{ec}	0.00	0.0000
23	Uncertainty calibration gas	≤ 3%	2.000	ucg	2.00	4.0000
combined standard uncertainty				u _c		7.6994 µg/m³
expanded uncertainty				U _c		15.3988 µg/m³
expanded uncertainty actual				U _{c,rel}		7.70 %
expanded uncertainty required				U _{req,rel}		15 %