Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000038507_02

AMS designation:	AS32M for nitrogen dioxide
Manufacturer:	Environnement S.A. 111, Boulevard Robespierre 78304 Poissy Cedex France
Test Laboratory:	TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested and certified according to the standards VDI 4202-1 (2010), VDI 4203-3 (2010), EN 14211 (2012), Guide to the demonstration of equivalence of ambient air monitoring methods (2010), EN 15267-1 (2009) and EN 15267-2 (2009).

Certification is awarded in respect of the conditions stated in this certificate (this certificate contains 10 pages).

TÜVRheinland® CERTIFIED

Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance

www.tuv.com
ID 0000038507

Publication in the German Federal Gazette (BAnz) of 01 April 2014

This certificate will expire on:
22 July 2023

German Federal Environment Agency
Dessau, 22 July 2018

Dr Marcel Langner
Head of Section II 4.1

TÜV Rheinland Energy GmbH
Cologne, 21 July 2018

ppa. Dr Peter Wilbring

www.umwelt-tuv.eu
tre@umwelt-tuv.eu
Phone: + 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.

Test Report:	936/21219819/B dated 9 September 2013
Initial certification:	23 July 2013
Expiry date:	22 July 2023
Certificate:	Renewal (of previous certificate 0000038507_01 dated 29 April 2014 valid until 22 July 2018)
Publication:	BAnz AT 01.04.2014 B12, chapter IV no. 4.2

Approved application
The certified AMS is suitable for continuous ambient air monitoring of nitrogen dioxide (stationary operation).

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

The AMS is approved for an ambient temperature range of 0 °C to +30 °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, in consultation with the manufacturer, 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 intended purpose.

Basis of the certification
This certification is based on:

- Test report no. 936/21219819/B dated 9 September 2013 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 01.04.2014 B12, chapter IV no. 4.2, UBA announcement dated 27 February 2014:

AMS designation:
AS32M for nitrogen dioxide

Manufacturer:
Environnement S.A., Poissy, France

Field of application:
For continuous ambient air monitoring of nitrogen dioxide (stationary operation)

Measuring range during performance testing:

Component	Certification range	Unit
Nitrogen dioxide	0–500	µg/m³

Software version:
3.6.a

Restrictions:
None

Notes:

1. The measuring system must be operated inside a lockable measurement container.
2. The test report on performance testing is available on the internet at www.qal1.de.
3. Equivalence with the reference method was demonstrated for the component NO_2 in accordance with the requirements of the “Demonstration of Equivalence of Ambient Air Monitoring Methods“.
4. Supplementary testing (demonstration of equivalence with the reference method) as regards Federal Environment Agency (UBA) notice of 03 July 2013 (BAnz AT 23.07.2013, chapter III number 1.1).

Test Laboratory:
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report no.: 936/21219819/B dated 9 September 2013

Publication in the German Federal Gazette: BAnz AT 26.08.2015 B4, chapter V notification 49, UBA announcement dated 22 July 2015:

49	**Notification as regards Federal Environment Agency (UBA) notice of 27 February 2014 (BAnz AT 01.04.2014 B12, chapter IV number 4.2)** The current software version of the AS32M measuring system for NO_2 manufactured by Environnement S.A. is: v1.05 (calculation process) v3.6.h (display process) To increase leak tightness, the diameter of the orifice was increased from 0.35 mm to 0.36 mm. Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 14 March 2015

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

The AS32M air quality monitor is a continuous nitrogen dioxide analyser. The measuring principle is based on direct UV absorption. The instrument was designed for continuous ambient air monitoring of nitrogen dioxide. The measuring principle of the AS32M is based on the CAPS technique (Cavity Attenuated Phase Shift Spectroscopy).
The sampling is performed by a pump mounted at the end of the fluid circuit through a Teflon tube connected to the rear panel of the analyser. An assembly of two 3-way solenoid valves enables the selection one of the three inlets of the analyser: “sample”, “zero air” or “span gas”. Protection against dust is ensured by a Teflon filter (PTFE) connected to the “sample” inlet.
A PERMA-PURE dryer is used to dry the sample gas. The dryer is made of two concentric tubes, the internal tube is made of a special water-permeable polymer. The molecules are transferred, through this tube, from the side where the water content is the highest to the side where it is the lowest. To ensure a lower partial pressure of water on the outside of the polymer tube, the tube periphery is placed under vacuum condition and rinsed by a portion of the flow rate leaving the tube.
After drying, the sampled gas passes through a dust filter (made of microfibers of borosilicate glass bound in PTFE) which holds 99.5% of the particles that have an aerodynamic diameter higher than 10 nm. This enables to avoid the optical interference generated by the light scattering induced by the particles whose diameter is higher than the emission wavelength (450 nm).

From here, the sampled gas is led into the optical cavity. The optical cavity is a stainless steel hollow cylinder, closed at each end by a semi-transparent mirror of high reflectivity. The luminous source placed upstream of the M1 inlet mirror of the cavity is an LED which emits light at 450 nm. A convergent lens placed between the LED and the M1 mirror focuses the beam of light. A phototube placed behind the M2 outlet mirror of the cavity detects the photons transmitted by this mirror. Between the M2 mirror and the detector, a convergent lens focuses the beam on the detector and a band-pass interference filter centred around 450 ± 10 nm enables to select the photons that have a wavelength between 440 and 460 nm.
The current software versions are: v1.05 (calculation process)
v3.6.h (display process)

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 AS32M 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. 0000038507: 20 August 2013
Expiry date of the certificate: 22 July 2018

Test report: 936/21219819/A dated 11 March 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 23.07.2013 B4, chapter III no. 1.1
UBA announcement dated 03 July 2013

Supplementary testing according to EN 15267

Certificate no. 0000038507_01: 29 April 2014
Expiry date of the certificate: 22 July 2018

Test report: 936/21219819/B dated 9 September 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 01.04.2014 B12, chapter IV no. 4.2
UBA announcement dated 27 February 2014

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 14 March 2015
Publication: BAnz AT 26.08.2015 B4, chapter V notification 49
UBA announcement dated 22 July 2015
(new software version, modification of the blind's diameter)

Renewal of the certificate

Certificate no. 0000038507_02: 22 July 2018
Expiry date of the certificate: 22 July 2023

Expanded uncertainty based on the results of the laboratory testing of system 1

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	$u_{r,lv}$	0.24	0.0574	
3	"lack of fit"	≤	4.0% of measured value	1.100	$u_{l,lv}$	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 H20 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				
		≤	9.6 µg/m³ (span)	4.100	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	-0.600	u_{av}	-0.69	0.4800	
18	Difference sample/calibration port	≤	1%	0.200	u_{Dsc}	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		5.1427	µg/m³
			expanded uncertainty		U_c		10.2855	µg/m³
			expanded uncertainty actual		$U_{c,rel}$		5.14	%
			expanded uncertainty required		$U_{req,rel.}$		15	%

Certificate:
0000038507_02 / 22 July 2018

TÜVRheinland®
Precisely Right.

Expanded uncertainty based on the results of the laboratory testing of Device 2

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	$u_{r,lv}$	0.30	0.0884	
3	"lack of fit"	≤	4.0% of measured value	1.500	$u_{l,lv}$	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 H20 at 21 mmol/mol	≤	9.6 µg/m³ (zero)	0.000	u_{H2O}	-1.44	2.0833	
		≤	9.6 µg/m³ (span)	0.000				
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				
		≤	9.6 µg/m³ (span)	2.700	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	2.700	u_{av}	3.12	9.7200	
18	Difference sample/calibration port	≤	1%	0.040	u_{Dsc}	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		5.4724	µg/m³
				expanded uncertainty	U_c		10.9449	µg/m³
				expanded uncertainty actual	$U_{c,rel}$		5.47	%
				expanded uncertainty required	$U_{req,rel.}$		15	%

Expanded uncertainty based on the results of the laboratory and field testing of system 1

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	$u_{l,lv}$	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 H20 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				
		≤	9.6 µg/m³ (span)	4.100	$u_{int,neg}$			
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	$u_{d,l,z}$	0.67	0.4485	
12	Long term drift at span level	≤	5.0% of certification range	1.810	$u_{d,l,lv}$	2.09	4.3681	
18	Difference sample/calibration port	≤	1%	0.200	u_{Dsc}	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	%

Expanded uncertainty based on the results of the laboratory and field testing of Device 2

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	$u_{l,lv}$	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 H20 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				
		≤	9.6 µg/m³ (span)	2.700	$u_{int,neg}$			
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	$u_{d,l,z}$	0.68	0.4563	
12	Long term drift at span level	≤	5.0% of certification range	1.730	$u_{d,l,lv}$	2.00	3.9905	
18	Difference sample/calibration port	≤	1%	0.040	u_{Dsc}	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	%