

# CERTIFICATE

## of Product Conformity (QAL1)

Certificate No.: 0000028756\_03

**Certified AMS:** APOA 370 for O<sub>3</sub>

**Manufacturer:** HORIBA, Ltd.  
2 Miyano Higashi  
Kisshoin Minami-ku  
Kyoto 610-8510  
Japan

**Test Institute:** TÜV Rheinland Energie und Umwelt GmbH

**This is to certify that the AMS has been tested and certified  
according to the standards**

**VDI 4202-1 (2002), VDI 4203-3 (2004), EN 14625 (2012),  
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).



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

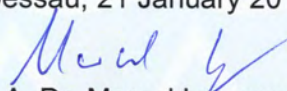
www.tuv.com  
ID 0000028756

Publication in the German Federal Gazette  
(BAnz.) of 26 January 2011

This certificate will expire on:  
25 January 2021

German Federal Environment Agency  
Dessau, 21 January 2016

TÜV Rheinland Energie und Umwelt GmbH  
Cologne, 20 January 2016

  
i. A. Dr. Marcel Langner

  
ppa. Dr. Peter Wilbring

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Am Grauen Stein  
51105 Cologne

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.

**Certificate:**  
0000028756\_03 / 21 January 2016

**Test report:** 936/21204643/A of 05 January 2006  
**Initial certification:** 26 January 2011  
**Certification:** renewal (previous certificate 0000028756\_02 of 29 April 2014  
valid until 25 January 2016)  
**Date of expiry:** 25 January 2021  
**Publication:** BAnz. 08 April 2006, No. 70, p. 2653, chapter IV, No. 3.1

#### **Approved application**

The certified AMS is approved for continuous monitoring of Ozone in ambient air (stationary operation). The suitability of the product for this application was assessed on the basis of a laboratory test and a 3 month field test

The AMS is approved for the temperature range of 0 °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 valid at the time of performance testing. As changes in legal regulations are possible, any potential user should ensure that this AMS is suitable for monitoring the limit value relevant to the application.

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 936/21204643/A of 05 January 2006 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
- addenda 936/21204643/A1 of 27 July 2011 and 936/21222689/A of 05 October 2013
- suitability announced by the German Environmental Agency (UBA) as the relevant body
- the ongoing surveillance of the product and the manufacturing process



Publication in the German Federal Gazette: BAnz. 08 April 2006, No. 70, p. 2653, chapter IV, No. 3.1  
Announcement by UBA from 21 February 2006:

**AMS name:**

APOA 370

**Manufacturer:**

HORIBA, Ltd., Kyoto 610-8510, Japan

**Distributor:**

HORIBA Europe GmbH, 42799 Leichlingen

**Approval:**

For continuous monitoring of Ozone in ambient air (stationary operation).

**Measuring ranges during the suitability test:**

O<sub>3</sub> 0 – 360 µg/m<sup>3</sup>  
0 – 500 µg/m<sup>3</sup>

**Software:**

Version P1000878001C

**Test institute:**

TÜV Immissionsschutz und Energiesysteme GmbH, Cologne  
TÜV Rheinland Group

**Test report:**

No. 936/21204643/A of 5 January 2006

Publication in the German Federal Gazette: BAnz. 25 August 2009, No. 125, p. 2929, chapter III,  
notification 3, Announcement by UBA from 3 August 2009:

**3 Notification on the announcement of the Federal Environment Agency of  
21 February 2006 (BAnz. p. 2655)**

The current software version of the ambient air measuring system APOA 370 of the company  
Horiba Europe GmbH is:

P1000878001J

As an option, the pump of the type GD-6 EH of the company Horiba can be used alongside  
the so far used measured gas pump type N 86 KNE of the company KNF.

Statement of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH  
of 31 March 2009

Publication in the German Federal Gazette: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 8, Announcement by UBA from 10 January 2011:

**8 Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV, No. 3.1) and of 3 August 2009 (BAnz. p. 2929, chapter III, 3<sup>rd</sup> notification)**

The APOA 370 measuring system by Horiba Ltd., Japan and Horiba Europe GmbH for component O<sub>3</sub> fulfils the requirements of EN 14625. Moreover, the production and quality management of the APOA 370 measuring system for component O<sub>3</sub> complies with the requirements of EN 15267.

The report of the suitability test is available on the internet at [www.qal1.de](http://www.qal1.de).

Statement of TÜV Rheinland Energie und Umwelt GmbH of 6 October 2010

Publication in the German Federal Gazette: BAnz. 02 March 2012, No. 36, p. 920, chapter V, notification 15, Announcement by UBA from 23 February 2012:

**15 Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV, No. 3.1) and of 10 January 2011 (BAnz. p. 294, chapter IV 8<sup>th</sup> notification)**

There is an addendum to the test report 936/21204643/A for the APOA 370 measuring system by Horiba Ltd., Japan and Horiba Europe GmbH for the component O<sub>3</sub>.

The addendum has the report number 936/21204643/A1 and is an integral part of the test report 936/21204643/A after its publication and is also published on [www.qal1.de](http://www.qal1.de).

Statement of TÜV Rheinland Energie und Umwelt GmbH of 3 November 2011

Publication in the German Federal Gazette: BAnz AT 05.03.2013 B10, chapter V, notification 9, Announcement by UBA from 12 February 2013:

**9 Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV, No. 3.1) and of 23 February 2012 (BAnz. p. 920, chapter V 15<sup>th</sup> notification)**

The APOA 370 measuring system for O<sub>3</sub> manufactured by Horiba Ltd., Japan and Horiba Europe GmbH can be optionally equipped with an additional calibration gas inlet. Calibration gas can be fed either before or after the sample gas filter by means of an additional three-way valve.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 11 October 2012

Publication in the German Federal Gazette: BAnz AT 01.04.2014 B12, chapter VI, notification 28, Announcement by UBA from 27 February 2014:

**28 Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV No 3.1) and of 12 February 2013 (BAnz AT 05.03.2013 B10, chapter V 9<sup>th</sup> notification)**

The measuring system APOA 370 for O<sub>3</sub> by Horiba Ltd., Japan and Horiba Europe GmbH fulfils the requirements of Standard DIN EN 14625 (dated December 2012). An addendum that is an integral part of the test report 936/21222689/A can be viewed on the internet at [www.qal1.de](http://www.qal1.de). In addition to use with the type D06T-24 PH housing ventilation by Nidec as used so far, the measuring system can also be fitted with a type 3412 NGV regulated ventilator by Papst.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 8 October 2013



**Certified product**

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

The ambient air measuring system APOA 370 is based on the measuring principle of UV-absorption. The measuring principle complies with the reference measuring principle stated in the Standard EN 14625 (2012) in section 5.2.

First the sample air passes a filter in the APOA 370, where coarse dirt particles are filtered out. Afterwards it is separated in two gas flows (measuring and reference gas). The analyzer contains a single cuvette. Via a 3 way magnetic valve measuring and reference gas are conducted to the cuvette. The reference gas is cleared of the ozone by a catalytic converter. The cuvette irradiated by monochromatic radiation, centered on 253.7 nm, from a stabilized low-pressure mercury (Hg) discharge lamp. The UV-radiation, which passes through the absorption cell, is measured by a sensitive photodiode and converted to a measurable electrical signal. The difference of the UV-Absorption of measuring and reference gas is a rate of the ozone concentration in the ambient air

**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 APOA 370 Ozone Analyzer is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

**First suitability test:**

Test report: 936/21204643/A of 5 January 2006,  
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne,  
Publication: BAnz. 08 April 2006, No. 70, p. 2653, chapter IV, No. 3.1,  
Announcement by UBA from 21 February 2006

**Notifications:**

Statement of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH of 31 March 2009,  
Publication: BAnz. 25 August 2009, No. 125, p. 2929, chapter III, notification 3,  
Announcement by UBA from 3 August 2009 (Software changes and hardware extension)

**Initial certification according to EN 15267:**

Certificate No. 0000028756: 09 February 2011  
Validity of the certificate: 25 January 2016  
Statement of TÜV Rheinland Energie und Umwelt GmbH of 6 October 2010,  
Test report: 936/21204643/A of 05 January 2006,  
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne,  
Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 8,  
Announcement by UBA from 10 January 2011

**Notification according to EN 15267:**

Statement of TÜV Rheinland Energie und Umwelt GmbH of 3 November 2011,  
with Addendum 936/21204643/A1 from 27 July 2011,  
Publication: BAnz. 02 March 2012, No. 36, p. 920, chapter V, notification 15,  
UBA announcement from 23 February 2012, (addition of an Addendum)  
Certificate No. 0000028756\_01: 16 March 2012  
Validity of the certificate: 25 January 2016

Statement of TÜV Rheinland Energie und Umwelt GmbH of 11 October 2012,  
Publication: BAnz AT 05.03.2013 B10, chapter V, notification 9,  
Announcement by UBA from 12 February 2013 (hardware extension)

Statement of TÜV Rheinland Energie und Umwelt GmbH of 8 October 2013,  
with Addendum to test report 936/21222689/A from 05 October 2013,  
Publication: BAnz AT 01.04.2014 B12, chapter VI, notification 28,  
Announcement by UBA from 27 February 2014, (EN14625 (2012) and hardware-addition),  
Certificate No. 0000028756\_02: 29 April 2014  
Validity of the certificate: 25 January 2016

**Renewal of the certificate:**

Certificate No : 0000028756\_03: 21 January 2016  
Validity of the certificate: 25 January 2021



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

| Measuring device:   |  | Serial-No.:                          |                        | 1h-alert threshold: |               | mmol/mol            |        |                               |  |
|---------------------|--|--------------------------------------|------------------------|---------------------|---------------|---------------------|--------|-------------------------------|--|
| Horiba APOA 370     |  | SN 10041                             |                        | 120                 |               |                     |        |                               |  |
| Measured component: |  | Performance criterion                |                        | Result              |               | Partial uncertainty |        | Square of partial uncertainty |  |
| No.                 | Performance characteristic   | ≤                                    | 1.0 nmol/mol           | 0.250               | $u_{r,z}$     | 0.06                | 0.0042 |                               |  |
| 1                   | Repeatability standard deviation at zero                                 | ≤                                    | 3.0 nmol/mol           | 0.140               | $u_{r,h}$     | 0.10                | 0.0107 |                               |  |
| 2                   | Repeatability standard deviation at 1h-alert threshold                   | ≤                                    | 4.0% of measured value | -1.100              | $u_{r,h}$     | -0.76               | 0.5808 |                               |  |
| 3                   | "lack of fit" at 1h-alert threshold                                      | ≤                                    | 2.0 nmol/mol/kPa       | 0.023               | $u_{gp}$      | 0.27                | 0.0755 |                               |  |
| 4                   | Sensitivity coefficient of sample gas pressure at 1h-alert threshold     | ≤                                    | 1.0 nmol/mol/K         | 0.090               | $u_{gt}$      | 1.15                | 1.3333 |                               |  |
| 5                   | Sensitivity coefficient of sample gas temperature at 1h-alert threshold  | ≤                                    | 1.0 nmol/mol/K         | 0.360               | $u_{st}$      | 1.56                | 2.4300 |                               |  |
| 6                   | Sensitivity coefficient of surrounding temperature at 1h-alert threshold | ≤                                    | 0.30 nmol/mol/V        | 0.000               | $u_v$         | 0.00                | 0.0000 |                               |  |
| 7                   | Sensitivity coefficient of electrical voltage at 1h-alert threshold      | ≤                                    | 10 nmol/mol (Zero)     | -0.100              | $u_{H2O}$     | 0.11                | 0.0120 |                               |  |
| 8a                  | Interferent H <sub>2</sub> O with 21 mmol/mol                            | ≤                                    | 10 nmol/mol (Span)     | 0.270               | $u_{int,pos}$ |                     |        |                               |  |
| 8b                  | Interferent Toluene with 0,5 µmol/mol                                    | ≤                                    | 5.0 nmol/mol (Zero)    | 0.070               | or            | 0.64                | 0.4146 |                               |  |
| 8c                  | Interferent Xylene with 0,5 µmol/mol                                     | ≤                                    | 5.0 nmol/mol (Span)    | 0.740               |               |                     |        |                               |  |
| 9                   | Averaging effect   | ≤                                    | 5.0 nmol/mol (Zero)    | 0.100               | $u_{int,neg}$ |                     |        |                               |  |
| 18                  | Difference sample/calibration port                                       | ≤                                    | 7.0% of measured value | 1.400               | $u_{dv}$      | 0.97                | 0.9408 |                               |  |
| 21                  | Uncertainty of test gas  | ≤                                    | 1.0%                   | 0.000               | $u_{sc}$      | 0.00                | 0.0000 |                               |  |
|                     |  | ≤                                    | 3.0%                   | 2.000               | $u_{cg}$      | 1.20                | 1.4400 |                               |  |
|                     |  | Combined standard uncertainty        |                        | $u_c$               |               |                     | 2.6911 | nmol/mol                      |  |
|                     |  | Expanded uncertainty                 |                        | U                   |               |                     | 5.3821 | nmol/mol                      |  |
|                     |  | Relative expanded uncertainty        |                        | W                   |               |                     | 4.49   | %                             |  |
|                     |  | Maximum allowed expanded uncertainty |                        | $W_{req}$           |               |                     | 15     | %                             |  |

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

| Measuring device:   |  | Serial-No.:                                    |                 | SN 10042                             |                               |
|---------------------|--|--|-----------------|--------------------------------------|-------------------------------|
| Measured component: |  | 1h-alert threshold:                            |                 | 120                                  |                               |
| Horiba APOA 370     |  | 1h-alert threshold:                            |                 | 120                                  |                               |
| O3                  |  | 1h-alert threshold:                            |                 | 120                                  |                               |
| No.                 | Performance characteristic   | Performance criterion                          | Result          | Partial uncertainty                  | Square of partial uncertainty |
| 1                   | Repeatability standard deviation at zero                                 | ≤ 1.0 nmol/mol                                 | 0.170           | u <sub>r,z</sub> 0.04                | 0.0020                        |
| 2                   | Repeatability standard deviation at 1h-alert threshold                   | ≤ 3.0 nmol/mol                                 | 0.135           | u <sub>r,lv</sub> 0.10               | 0.0103                        |
| 3                   | "lack of fit" at 1h-alert threshold                                      | ≤ 4.0% of measured value                       | -0.700          | u <sub>lv</sub> -0.48                | 0.2352                        |
| 4                   | Sensitivity coefficient of sample gas pressure at 1h-alert threshold     | ≤ 2.0 nmol/mol/kPa                             | 0.013           | u <sub>sp</sub> 0.16                 | 0.0253                        |
| 5                   | Sensitivity coefficient of sample gas temperature at 1h-alert threshold  | ≤ 1.0 nmol/mol/K                               | 0.100           | u <sub>gt</sub> 1.30                 | 1.6875                        |
| 6                   | Sensitivity coefficient of surrounding temperature at 1h-alert threshold | ≤ 1.0 nmol/mol/K                               | 0.390           | u <sub>st</sub> 1.69                 | 2.8519                        |
| 7                   | Sensitivity coefficient of electrical voltage at 1h-alert threshold      | ≤ 0.30 nmol/mol/V                              | 0.000           | u <sub>v</sub> 0.00                  | 0.0000                        |
| 8a                  | Interferent H <sub>2</sub> O with 21 mmol/mol                            | ≤ 10 nmol/mol (Zero)<br>≤ 10 nmol/mol (Span)   | -0.770<br>0.140 | u <sub>H2O</sub> -0.12               | 0.0149                        |
| 8b                  | Interferent Toluene with 0.5 µmol/mol                                    | ≤ 5.0 nmol/mol (Zero)<br>≤ 5.0 nmol/mol (Span) | 0.100<br>0.300  | u <sub>int,pos</sub><br>or           | 0.3388                        |
| 8c                  | Interferent Xylene with 0.5 µmol/mol                                     | ≤ 5.0 nmol/mol (Zero)<br>≤ 5.0 nmol/mol (Span) | 0.100<br>1.100  | u <sub>int,neg</sub>                 |                               |
| 9                   | Averaging effect   | ≤ 7.0% of measured value                       | -0.300          | u <sub>av</sub> -0.21                | 0.0432                        |
| 18                  | Difference sample/calibration port                                       | ≤ 1.0%   | 0.000           | u <sub>psc</sub> 0.00                | 0.0000                        |
| 21                  | Uncertainty of test gas  | ≤ 3.0%   | 2.000           | u <sub>cg</sub> 1.20                 | 1.4400                        |
|                     |  |  |                 | Combined standard uncertainty        | u <sub>c</sub> 2.5786         |
|                     |  |  |                 | Expanded uncertainty                 | U 5.1571                      |
|                     |  |  |                 | Relative expanded uncertainty        | W 4.30                        |
|                     |  |  |                 | Maximum allowed expanded uncertainty | W <sub>req</sub> 15           |



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

| Measuring device:                    |  | Serial-No.:                           |        | SN 10041             |   | nmol/mol         |        |
|--------------------------------------|--|---------------------------------------|--------|----------------------|---|------------------|--------|
| Measured component:                  |  | 1h-alert threshold:                   |        | 120                  |   |                  |        |
| No.                                  | Performance characteristic   | Performance criterion                 | Result | Partial uncertainty  | Square of partial uncertainty                                   |                  |        |
| 1                                    | Repeatability standard deviation at zero                                 | ≤ 1.0 nmol/mol                        | 0.250  | U <sub>r,z</sub>     | 0.06  | 0.0042           |        |
| 2                                    | Repeatability standard deviation at 1h-alert threshold                   | ≤ 3.0 nmol/mol                        | 0.140  | U <sub>r,h</sub>     | not considered, as<br>U <sub>r,h</sub> = 0.1 < U <sub>r,f</sub> | -                |        |
| 3                                    | "lack of fit" at 1h-alert threshold                                      | ≤ 4.0% of measured value              | -1.100 | U <sub>i,h</sub>     | -0.76   | 0.5808           |        |
| 4                                    | Sensitivity coefficient of sample gas pressure at 1h-alert threshold     | ≤ 2.0 nmol/mol/kPa                    | 0.023  | U <sub>sp</sub>      | 0.27  | 0.0755           |        |
| 5                                    | Sensitivity coefficient of sample gas temperature at 1h-alert threshold  | ≤ 1.0 nmol/mol/K                      | 0.090  | U <sub>gt</sub>      | 1.15  | 1.3333           |        |
| 6                                    | Sensitivity coefficient of surrounding temperature at 1h-alert threshold | ≤ 1.0 nmol/mol/K                      | 0.360  | U <sub>st</sub>      | 1.56  | 2.4300           |        |
| 7                                    | Sensitivity coefficient of electrical voltage at 1h-alert threshold      | ≤ 0.30 nmol/mol/V                     | 0.000  | U <sub>v</sub>       | 0.00  | 0.0000           |        |
| 8a                                   | Interferent H <sub>2</sub> O with 21 nmol/mol                            | ≤ 10 nmol/mol (Zero)                  | -0.100 | U <sub>H2O</sub>     | 0.11  | 0.0120           |        |
|                                      |  | ≤ 10 nmol/mol (Span)                  | 0.270  |                      |   |                  |        |
| 8b                                   | Interferent Toluene with 0.5 µmol/mol                                    | ≤ 5.0 nmol/mol (Zero)                 | 0.070  | U <sub>tol,pos</sub> |   |                  |        |
|                                      |  | ≤ 5.0 nmol/mol (Span)                 | 0.740  | or                   | 0.64  | 0.4146           |        |
| 8c                                   | Interferent Xylene with 0.5 µmol/mol                                     | ≤ 5.0 nmol/mol (Zero)                 | 0.100  | U <sub>int,neg</sub> |   |                  |        |
|                                      |  | ≤ 5.0 nmol/mol (Span)                 | 0.840  |                      |   |                  |        |
| 9                                    | Averaging effect   | ≤ 7.0% of measured value              | 1.400  | U <sub>av</sub>      | 0.97  | 0.9408           |        |
| 10                                   | Reproducibility standard deviation under field conditions                | ≤ 5.0% of average over 3 months       | 2.180  | U <sub>r,f</sub>     | 2.62  | 6.8435           |        |
| 11                                   | Long term drift at zero level  | ≤ 5.0 nmol/mol                        | -0.900 | U <sub>d,l,z</sub>   | -0.52   | 0.2700           |        |
| 12                                   | Long term drift at span level  | ≤ 5.0% of max. of certification range | -3.890 | U <sub>d,l,h</sub>   | -2.70   | 7.2634           |        |
| 18                                   | Difference sample/calibration port                                       | ≤ 1.0%                                | 0.000  | U <sub>ssc</sub>     | 0.00  | 0.0000           |        |
| 21                                   | Uncertainty of test gas  | ≤ 3.0%                                | 2.000  | U <sub>cg</sub>      | 1.20  | 1.4400           |        |
| Combined standard uncertainty        |  |                                       |        |                      |   | U <sub>c</sub>   | 4.6484 |
| Expanded uncertainty                 |  |                                       |        |                      |   | U                | 9.2969 |
| Relative expanded uncertainty        |  |                                       |        |                      |   | W                | 7.75   |
| Maximum allowed expanded uncertainty |  |                                       |        |                      |   | W <sub>req</sub> | 15     |

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

| Measuring device:                    |  | Serial-No.:                           |        | SN 10042                    |  | nmol/mol         |        |
|--------------------------------------|--|---------------------------------------|--------|-----------------------------|--|------------------|--------|
| Measured component:                  |  | 1h-alert threshold:                   |        | 120                         |  |                  |        |
| No.                                  | Performance characteristic   | Performance criterion                 | Result | Partial uncertainty         | Square of partial uncertainty                                |                  |        |
| 1                                    | Repeatability standard deviation at zero                                 | ≤ 1.0 nmol/mol                        | 0.170  | u <sub>r,z</sub>            | 0.04   | 0.0020           |        |
| 2                                    | Repeatability standard deviation at 1h-alert threshold                   | ≤ 3.0 nmol/mol                        | 0.135  | u <sub>r,h</sub>            | not considered, as u <sub>r,h</sub> = 0.1 < u <sub>r,f</sub> | -                |        |
| 3                                    | "lack of fit" at 1h-alert threshold                                      | ≤ 4.0% of measured value              | -0.700 | u <sub>l,h</sub>            | -0.48  | 0.2352           |        |
| 4                                    | Sensitivity coefficient of sample gas pressure at 1h-alert threshold     | ≤ 2.0 nmol/mol/kPa                    | 0.013  | u <sub>gp</sub>             | 0.16   | 0.0253           |        |
| 5                                    | Sensitivity coefficient of sample gas temperature at 1h-alert threshold  | ≤ 1.0 nmol/mol/K                      | 0.100  | u <sub>gt</sub>             | 1.30   | 1.6875           |        |
| 6                                    | Sensitivity coefficient of surrounding temperature at 1h-alert threshold | ≤ 1.0 nmol/mol/K                      | 0.390  | u <sub>st</sub>             | 1.69   | 2.8519           |        |
| 7                                    | Sensitivity coefficient of electrical voltage at 1h-alert threshold      | ≤ 0.30 nmol/mol/V                     | 0.000  | u <sub>v</sub>              | 0.00   | 0.0000           |        |
| 8a                                   | Interferent H <sub>2</sub> O with 21 nmol/mol                            | ≤ 10 nmol/mol (Zero)                  | -0.770 | u <sub>H<sub>2</sub>O</sub> | -0.12  | 0.0149           |        |
|                                      |  | ≤ 10 nmol/mol (Span)                  | 0.140  |                             |  |                  |        |
| 8b                                   | Interferent Toluene with 0.5 µmol/mol                                    | ≤ 5.0 nmol/mol (Zero)                 | 0.100  | u <sub>tol,pos</sub>        |  |                  |        |
|                                      |  | ≤ 5.0 nmol/mol (Span)                 | 0.300  | or                          |  |                  |        |
| 8c                                   | Interferent Xylene with 0.5 µmol/mol                                     | ≤ 5.0 nmol/mol (Zero)                 | 0.100  | u <sub>xt,neg</sub>         | 0.58   | 0.3388           |        |
|                                      |  | ≤ 5.0 nmol/mol (Span)                 | 1.100  |                             |  |                  |        |
| 9                                    | Averaging effect   | ≤ 7.0% of measured value              | -0.300 | u <sub>av</sub>             | -0.21  | 0.0432           |        |
| 10                                   | Reproducibility standard deviation under field conditions                | ≤ 5.0% of average over 3 months       | 2.180  | u <sub>r,f</sub>            | 2.62   | 6.8435           |        |
| 11                                   | Long term drift at zero level  | ≤ 5.0 nmol/mol                        | -1.100 | u <sub>gl,z</sub>           | -0.64  | 0.4033           |        |
| 12                                   | Long term drift at span level  | ≤ 5.0% of max. of certification range | -3.670 | u <sub>gl,h</sub>           | -2.54  | 6.4651           |        |
| 18                                   | Difference sample/calibration port                                       | ≤ 1.0%                                | 0.000  | u <sub>l,sc</sub>           | 0.00   | 0.0000           |        |
| 21                                   | Uncertainty of test gas  | ≤ 3.0%                                | 2.000  | u <sub>cg</sub>             | 1.20   | 1.4400           |        |
| Combined standard uncertainty        |  |                                       |        |                             |  | u <sub>c</sub>   | 4.5112 |
| Expanded uncertainty                 |  |                                       |        |                             |  | U                | 9.0223 |
| Relative expanded uncertainty        |  |                                       |        |                             |  | W                | 7.52   |
| Maximum allowed expanded uncertainty |  |                                       |        |                             |  | W <sub>req</sub> | 15     |