Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

# CERTIFICATE

## of Product Conformity (QAL1)

**Certificate No.: 0000028754_03**

| | |
|---|---|
| **Certified AMS:** | APMA 370 for CO |
| **Manufacturer:** | HORIBA, Ltd.<br>2 Miyanohigashi<br>Kisshoin Minami-ku<br>Kyoto 610-8510<br>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 14626 (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).

TÜVRheinland® CERTIFIED

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

www.tuv.com
ID 0000028754

Publication in the German Federal Gazette (BAnz.) of 08 April 2006

This certificate will expire on:
25 January 2021

German Federal Environment Agency
Dessau, 21 January 2016

i. A. Dr. Marcel Langner

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 20 January 2016

ppa. Dr. Peter Wilbring


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|---|---|
| **www.umwelt-tuv.de** / **www.eco-tuv.com**<br>teu@umwelt-tuv.de<br>Tel. +49 221 806-5200 | TÜV Rheinland Energie und Umwelt GmbH<br>Am Grauen Stein<br>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.



10/2021 2.08

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| **Test report:** | 936/21204643/B of 05 January 2006 |
| **Initial certification:** | 26 January 2011 |
| **Certificate:** | renewal (previous certificate 0000028754_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. 2.1 |

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

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 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/B dated 05 January 2006 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH
- addenda 936/21204643/B1 of 27 July 2011 and 936/21222689/B 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. 2.1, UBA announcement from 21 February 2006:

**AMS name:**
APMA 370

**Manufacturer:**
HORIBA, Ltd., Kyoto 610 - 8510, Japan

**Distributor:**
HORIBA Europe GmbH, 42799 Leichlingen

**Approval:**
For continuous monitoring of CO (stationary operation).

**Measuring ranges during the performance test:**
CO 0 - 60 mg/m$^3$
0 - 100 mg/m$^3$

**Software version:**
Version P1000878001C

**Test report:**
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne
Report-No: 936/21204643/B of 05 January 2006

Publication in the German Federal Gazette: BAnz. 25 August 2009, No. 125, p. 2929, chapter III, notification 1, UBA announcement from 03 August 2009:

**1 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 APMA 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 5, UBA announcement from 10 January 2011:

**5 Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV No 2.1) and of 03 August 2009 (BAnz. p. 2929, chapter III, 1st notification)**

The APMA 370 measuring system by Horiba Ltd., Japan and Horiba Europe GmbH for component CO fulfils the requirements of EN 14626. Moreover, the production and quality management of the APMA 370 measuring system for component CO complies with the requirements of EN 15267.
The report of the suitability test is available on the internet at www.qal1.de.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 06 October 2010

Publication in the German Federal Gazette: BAnz. 02 March 2012, No. 36, p. 920, chapter V, notification 16, UBA announcement from 23 February 2012:

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| **16** | **Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV No 2.1) and of 10 January 2011 (BAnz. p. 294, chapter IV 5th notification)**<br><br>There is an addendum to the test report 936/21204643/B for the APMA 370 measuring system by Horiba Ltd., Japan and Horiba Europe GmbH for the component CO. The addendum has the report number 936/21204643/B1 and is an integral part of the test report 936/21204643/B after its publication and is also published on www.qal1.de.<br><br>Statement of TÜV Rheinland Energie und Umwelt GmbH of 03 November 2011 |

Publication in the German Federal Gazette: BAnz AT 05.03.2013 B10, chapter V, notification 7, UBA announcement from 12 February 2013:

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| **7** | **Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV, No. 2.1) and of 23 February 2012 (BAnz. p. 920, chapter V 16th notification)**<br><br>The APMA 370 measuring system for CO 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.<br><br>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 26, UBA announcement from 27 February 2014:

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| **26** | **Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV No 2.1) and of 12 February 2013 (BAnz AT 05.03.2013 B10, chapter V 7th notification)**<br><br>The measuring system APMA 370 for CO by Horiba Ltd., Japan and Horiba Europe GmbH fulfils the requirements of Standard EN 14626 (dated December 2012). An addendum that is an integral part of the test report 936/21222689/B can be viewed on the internet at www.qal1.de.<br><br>Statement of TÜV Rheinland Energie und Umwelt GmbH of 5 October 2013 |

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

The APMA 370 CO-Analyser operates based on the principle of non-dispersal infrared absorption. This measurement principle complies with the reference measuring method described in section 5.2 of Standard EN 14626 (2012). The attenuation of infrared light is measured after passing through the test cuvette. According to Lambert-Beer law, attenuation is a measure of the concentration of CO within the cuvette.

The APMA-370 measuring system uses the modulation effect of infrared absorption within the test gas itself if zero and test gas are led to the measuring cell at specific flow rates. The switch is made via a solenoid valve which is clocked at a frequency of 1 Hz. As long as the concentration of the measured component within the cell does not change, the output of the detector is practically zero. Thus, no zero drift occurs.

**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 APMA 370 for CO 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/B of 05 January 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, cologne
Publication: BAnz. 08 April 2006, No. 70, p. 2653, chapter IV, No. 2.1
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 1
Announcement by UBA from 03 August 2009 (Software changes and hardware extension)

**Initial certification according to EN 15267:**

Certificate No. 0000028754: 09 February 2011
Validity of the certificate: 25 January 2016
Test report: 936/21204643/B dated 05 January 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, cologne
Statement of TÜV Rheinland Energie und Umwelt GmbH of 6 October 2010
Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 5
Announcement by UBA from 10 January 2011

**Notifications according to EN 15267:**

Statement of TÜV Rheinland Energie und Umwelt GmbH of 3 November 2011
with Addendum 936/21204643/B1 from 27 July 2011
TÜV Rheinland Energie und Umwelt GmbH, cologne
Publication: BAnz. 02 March 2012, No. 36, p. 920, chapter V, notification 16
UBA announcement from 23 February 2012, (addition of an Addendum)
Certificate No. 0000028754_01: 16 March 2012
Validity of the certificate until: 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 7
Announcement by UBA from 12 February 2013, (hardware extension)

Statement of TÜV Rheinland Energie und Umwelt GmbH of 5 October 2013
with Addendum 936/21222689/B from 05 October 2013
TÜV Rheinland Energie und Umwelt GmbH, cologne
Publication: BAnz AT 01.04.2014 B12, chapter VI, notification 26
Announcement by UBA from 27 February 2014, (EN14626 (2012))
Certificate No. 0000028754_02: 29 April 2014
Validity of the certificate until: 25 January 2016

**Renewal of the certificate:**

Certificate No 0000028754_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: Horiba APMA 370 — Serial-No.: SN 10031

Measured component: CO — 8h-limit value: 8.62 µmol/mol

| No. | Performance characteristic | | Performance criterion | Result | Partial uncertainty | | Square of partial uncertainty | |
|---|---|---|---|---|---|---|---|---|
| 1 | Repeatability standard deviation at zero | ≤ | 0.3 µmol/mol | 0.035 | $u_{r,z}$ | 0.01 | 0.0001 | |
| 2 | Repeatability standard deviation at 8h-limit value | ≤ | 0.4 µmol/mol | 0.064 | $u_r$ | 0.00 | 0.0000 | |
| 3 | "lack of fit" at 8h-limit value | ≤ | 4.0% of measured value | 0.700 | $u_l$ | 0.03 | 0.0012 | |
| 4 | Sensitivity coefficient of sample gas pressure at 8h-limit value | ≤ | 0.7 µmol/mol/kPa | 0.006 | $u_{gp}$ | 0.02 | 0.0002 | |
| 5 | Sensitivity coefficient of sample gas temperature at 8h-limit value | ≤ | 0.3 µmol/mol/K | 0.005 | $u_{gt}$ | 0.01 | 0.0002 | |
| 6 | Sensitivity coefficient of surrounding temperature at 8h-limit value | ≤ | 0.3 µmol/mol/K | 0.077 | $u_{st}$ | 0.20 | 0.0398 | |
| 7 | Sensitivity coefficient of electrical voltage at 8h-limit value | ≤ | 0.3 µmol/mol/V | 0.006 | $u_V$ | 0.06 | 0.0030 | |
| 8a | Interferent $H_2O$ with 21 mmol/mol | ≤ | 1.0 µmol/mol (Zero) | 0.233 | $u_{H2O}$ | 0.02 | 0.0003 | |
| | | ≤ | 1.0 µmol/mol (Span) | -0.009 | | | | |
| 8b | Interferent $CO_2$ with 500 µmol/mol | ≤ | 0.5 µmol/mol (Zero) | 0.017 | $u_{int,pos}$ | 0.10 | 0.0105 | |
| | | ≤ | 0.5 µmol/mol (Span) | -0.164 | | | | |
| 8c | Interferent NO with 1 µmol/mol | ≤ | 0.5 µmol/mol (Zero) | -0.026 | or | | | |
| | | ≤ | 0.5 µmol/mol (Span) | -0.353 | | | | |
| 8d | Interferent $N_2O$ with 50 nmol/mol | ≤ | 0.5 µmol/mol (Zero) | 0.009 | $u_{int,neg}$ | | | |
| | | ≤ | 0.5 µmol/mol (Span) | -0.164 | | | | |
| 9 | Averaging effect | ≤ | 7.0% of measured value | 1.250 | $u_{av}$ | 0.06 | 0.0039 | |
| 18 | Difference sample/calibration port | ≤ | 1.0% | 0.000 | $u_{\Delta sc}$ | 0.00 | 0.0000 | |
| 21 | Uncertainty of test gas | ≤ | 3.0% | 2.000 | $u_{cg}$ | 0.09 | 0.0074 | |

| | | | |
|---|---|---|---|
| Combined standard uncertainty | $u_c$ | 0.2582 | µmol/mol |
| Expanded uncertainty | U | 0.5165 | µmol/mol |
| Relative expanded uncertainty | W | 5.99 | % |
| Maximum allowed expanded uncertainty | $W_{req}$ | 15 | % |

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

Measuring device: Horiba APMA 370 — Serial-No.: SN 10032

Measured component: CO — 8h-limit value: 8.62 µmol/mol

| No. | Performance characteristic | | Performance criterion | Result | Partial uncertainty | | Square of partial uncertainty | |
|---|---|---|---|---|---|---|---|---|
| 1 | Repeatability standard deviation at zero | | ≤ 0.3 µmol/mol | 0.028 | $u_{r,z}$ | 0.01 | 0.0000 | |
| 2 | Repeatability standard deviation at 8h-limit value | | ≤ 0.4 µmol/mol | 0.070 | $u_r$ | 0.00 | 0.0000 | |
| 3 | "lack of fit" at 8h-limit value | | ≤ 4.0% of measured value | 0.800 | $u_l$ | 0.04 | 0.0016 | |
| 4 | Sensitivity coefficient of sample gas pressure at 8h-limit value | | ≤ 0.7 µmol/mol/kPa | 0.009 | $u_{gp}$ | 0.02 | 0.0005 | |
| 5 | Sensitivity coefficient of sample gas temperature at 8h-limit value | | ≤ 0.3 µmol/mol/K | 0.004 | $u_{gt}$ | 0.01 | 0.0001 | |
| 6 | Sensitivity coefficient of surrounding temperature at 8h-limit value | | ≤ 0.3 µmol/mol/K | 0.067 | $u_{st}$ | 0.17 | 0.0304 | |
| 7 | Sensitivity coefficient of electrical voltage at 8h-limit value | | ≤ 0.3 µmol/mol/V | -0.007 | $u_V$ | -0.06 | 0.0041 | |
| 8a | Interferent $H_2O$ with 21 mmol/mol | | ≤ 1.0 µmol/mol (Zero) | 0.181 | $u_{H2O}$ | 0.01 | 0.0001 | |
| | | | ≤ 1.0 µmol/mol (Span) | -0.009 | | | | |
| 8b | Interferent $CO_2$ with 500 µmol/mol | | ≤ 0.5 µmol/mol (Zero) | 0.017 | $u_{int,pos}$ | | | |
| | | | ≤ 0.5 µmol/mol (Span) | -0.086 | | | | |
| 8c | Interferent NO with 1 µmol/mol | | ≤ 0.5 µmol/mol (Zero) | -0.009 | or | 0.01 | 0.0000 | |
| | | | ≤ 0.5 µmol/mol (Span) | 0.017 | | | | |
| 8d | Interferent $N_2O$ with 50 nmol/mol | | ≤ 0.5 µmol/mol (Zero) | 0.009 | $u_{int,neg}$ | | | |
| | | | ≤ 0.5 µmol/mol (Span) | -0.017 | | | | |
| 9 | Averaging effect | | ≤ 7.0% of measured value | -1.100 | $u_{av}$ | -0.05 | 0.0030 | |
| 18 | Difference sample/calibration port | | ≤ 1.0% | 0.000 | $u_{\Delta sc}$ | 0.00 | 0.0000 | |
| 21 | Uncertainty of test gas | | ≤ 3.0% | 2.000 | $u_{cg}$ | 0.09 | 0.0074 | |
| | | | | | Combined standard uncertainty | $u_c$ | 0.2176 | µmol/mol |
| | | | | | Expanded uncertainty | U | 0.4353 | µmol/mol |
| | | | | | Relative expanded uncertainty | W | 5.05 | % |
| | | | | | Maximum allowed expanded uncertainty | $W_{req}$ | 15 | % |

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

Measuring device: Horiba APMA 370 — Serial-No.: SN 10031

Measured component: CO — 8h-limit value: 8.62 µmol/mol

| No. | Performance characteristic | | Performance criterion | Result | Partial uncertainty | | Square of partial uncertainty |
|---|---|---|---|---|---|---|---|
| 1 | Repeatability standard deviation at zero | ≤ | 0.3 µmol/mol | 0.035 | $u_{r,z}$ | 0.01 | 0.0001 |
| 2 | Repeatability standard deviation at 8h-limit value | ≤ | 0.4 µmol/mol | 0.064 | $u_r$ | not considered, as ur = 0 < ur,f | - |
| 3 | "lack of fit" at 8h-limit value | ≤ | 4.0% of measured value | 0.700 | $u_l$ | 0.03 | 0.0012 |
| 4 | Sensitivity coefficient of sample gas pressure at 8h-limit value | ≤ | 0.7 µmol/mol/kPa | 0.006 | $u_{gp}$ | 0.02 | 0.0002 |
| 5 | Sensitivity coefficient of sample gas temperature at 8h-limit value | ≤ | 0.3 µmol/mol/K | 0.005 | $u_{gt}$ | 0.01 | 0.0002 |
| 6 | Sensitivity coefficient of surrounding temperature at 8h-limit value | ≤ | 0.3 µmol/mol/K | 0.077 | $u_{st}$ | 0.20 | 0.0398 |
| 7 | Sensitivity coefficient of electrical voltage at 8h-limit value | ≤ | 0.3 µmol/mol/V | 0.006 | $u_V$ | 0.06 | 0.0030 |
| 8a | Interferent $H_2O$ with 21 mmol/mol | ≤ | 1.0 µmol/mol (Zero) | -0.009 | $u_{H2O}$ | 0.02 | 0.0003 |
| | | ≤ | 1.0 µmol/mol (Span) | 0.233 | | | |
| 8b | Interferent $CO_2$ with 500 µmol/mol | ≤ | 0.5 µmol/mol (Zero) | 0.017 | $u_{int,pos}$ | 0.10 | 0.0105 |
| | | ≤ | 0.5 µmol/mol (Span) | -0.164 | | | |
| 8c | Interferent NO with 1 µmol/mol | ≤ | 0.5 µmol/mol (Zero) | -0.026 | or | | |
| | | ≤ | 0.5 µmol/mol (Span) | -0.353 | | | |
| 8d | Interferent $N_2O$ with 50 nmol/mol | ≤ | 0.5 µmol/mol (Zero) | 0.009 | $u_{int,neg}$ | | |
| | | ≤ | 0.5 µmol/mol (Span) | -0.164 | | | |
| 9 | Averaging effect | ≤ | 7.0% of measured value | 1.250 | $u_{av}$ | 0.06 | 0.0039 |
| 10 | Reproducibility standard deviation under field conditions | ≤ | 5.0% of average over 3 months | 3.420 | $u_{r,f}$ | 0.29 | 0.0869 |
| 11 | Long term drift at zero level | ≤ | 0.5 µmol/mol | -0.172 | $u_{d,l,z}$ | -0.10 | 0.0099 |
| 12 | Long term drift at span level | ≤ | 5.0% of max. of certification range | -1.750 | $u_{d,l,8h}$ | -0.09 | 0.0076 |
| 18 | Difference sample/calibration port | ≤ | 1.0% | 0.000 | $u_{\Delta sc}$ | 0.00 | 0.0000 |
| 21 | Uncertainty of test gas | ≤ | 3.0% | 2.000 | $u_{cg}$ | 0.09 | 0.0074 |

| | | |
|---|---|---|
| Combined standard uncertainty | $u_c$ | 0.4136 µmol/mol |
| Expanded uncertainty | U | 0.8271 µmol/mol |
| Relative expanded uncertainty | W | 9.60 % |
| Maximum allowed expanded uncertainty | $W_{req}$ | 15 % |

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

Measuring device: Horiba APMA 370 — Serial-No.: SN 10032

Measured component: CO — 8h-limit value: 8.62 µmol/mol

| No. | Performance characteristic | | Performance criterion | Result | Partial uncertainty | | Square of partial uncertainty | |
|---|---|---|---|---|---|---|---|---|
| 1 | Repeatability standard deviation at zero | ≤ | 0.3 µmol/mol | 0.028 | $u_{r,z}$ | 0.01 | 0.0000 | |
| 2 | Repeatability standard deviation at 8h-limit value | ≤ | 0.4 µmol/mol | 0.070 | $u_r$ | not considered, as ur = 0 < ur,f | - | |
| 3 | "lack of fit" at 8h-limit value | ≤ | 4.0% of measured value | 0.800 | $u_l$ | 0.04 | 0.0016 | |
| 4 | Sensitivity coefficient of sample gas pressure at 8h-limit value | ≤ | 0.7 µmol/mol/kPa | 0.009 | $u_{gp}$ | 0.02 | 0.0005 | |
| 5 | Sensitivity coefficient of sample gas temperature at 8h-limit value | ≤ | 0.3 µmol/mol/K | 0.004 | $u_{gt}$ | 0.01 | 0.0001 | |
| 6 | Sensitivity coefficient of surrounding temperature at 8h-limit value | ≤ | 0.3 µmol/mol/K | 0.067 | $u_{st}$ | 0.17 | 0.0304 | |
| 7 | Sensitivity coefficient of electrical voltage at 8h-limit value | ≤ | 0.3 µmol/mol/V | -0.007 | $u_v$ | -0.06 | 0.0041 | |
| 8a | Interferent $H_2O$ with 21 mmol/mol | ≤ | 1.0 µmol/mol (Zero) | -0.009 | $u_{H2O}$ | 0.01 | 0.0001 | |
| | | ≤ | 1.0 µmol/mol (Span) | 0.181 | | | | |
| 8b | Interferent $CO_2$ with 500 µmol/mol | ≤ | 0.5 µmol/mol (Zero) | 0.017 | $u_{int,pos}$ | or | 0.0000 | |
| | | ≤ | 0.5 µmol/mol (Span) | -0.086 | | | | |
| 8c | Interferent NO with 1 µmol/mol | ≤ | 0.5 µmol/mol (Zero) | -0.009 | | 0.01 | | |
| | | ≤ | 0.5 µmol/mol (Span) | 0.017 | | | | |
| 8d | Interferent $N_2O$ with 50 nmol/mol | ≤ | 0.5 µmol/mol (Zero) | 0.009 | $u_{int,neg}$ | | | |
| | | ≤ | 0.5 µmol/mol (Span) | -0.017 | | | | |
| 9 | Averaging effect | ≤ | 7.0% of measured value | -1.100 | $u_{av}$ | -0.05 | 0.0030 | |
| 10 | Reproducibility standard deviation under field conditions | ≤ | 5.0% of average over 3 months | 3.420 | $u_{r,f}$ | 0.29 | 0.0869 | |
| 11 | Long term drift at zero level | ≤ | 0.5 µmol/mol | -0.164 | $u_{d,l,z}$ | -0.09 | 0.0090 | |
| 12 | Long term drift at span level | ≤ | 5.0% of max. of certification range | -1.610 | $u_{d,l,8h}$ | -0.08 | 0.0064 | |
| 18 | Difference sample/calibration port | ≤ | 1.0% | 0.000 | $u_{\Delta sc}$ | 0.00 | 0.0000 | |
| 21 | Uncertainty of test gas | ≤ | 3.0% | 2.000 | $u_{cg}$ | 0.09 | 0.0074 | |

| | | | |
|---|---|---|---|
| Combined standard uncertainty | $u_c$ | 0.3869 | µmol/mol |
| Expanded uncertainty | U | 0.7737 | µmol/mol |
| Relative expanded uncertainty | W | 8.98 | % |
| Maximum allowed expanded uncertainty | $W_{req}$ | 15 | % |