

CERTIFICATE

of Product Conformity (QAL1)

Certificate No: 0000062062_02

Certified AMS: ZPA-CEMS for CO, NO, SO₂, CO₂ and O₂

Manufacturer: Fuji Electric France S.A.S.
46, rue Georges Besse
Z.I. du Brézet
F63039 Clermont-Ferrand Cedex 2
France

Test Institute: TÜV Rheinland Energy & Environment GmbH

**This is to certify that the AMS has been tested
and found to comply with the standards
EN 15267-1 (2009), EN 15267-2 (2023), EN 15267-3 (2007)
as well as EN 14181 (2014).**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 14 pages).
The present certificate replaces certificate 0000062062_01 dated 4 June 2020.



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000062062

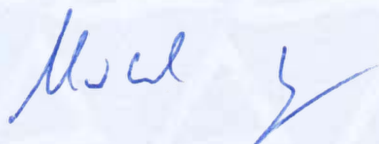
Publication in the German Federal Gazette
(BAnz) of 24 March 2020

German Environment Agency

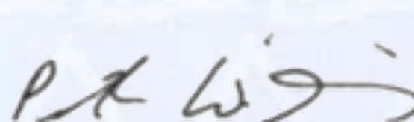
Dessau, 20 March 2025

This certificate will expire on:
23 March 2030

TÜV Rheinland Energy &
Environment GmbH
Cologne, 18 March 2025



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Test institute accredited to EN ISO/IEC 17025 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:	936/21239789/B dated 15 May 2019
Initial certification:	26 March 2019
Expiry date:	23 March 2030
Certificate:	Renewal (of previous certificate 0000062062_01 of 4 June 2020 valid until 23 March 2025)
Publication:	BAnz AT 24.03.2020 B7, chapter I No. 3.3

Approved application

The tested AMS is suitable for use at plants according to Directive 2010/75/EC, chapter III (combustion plants / 13th BImSchV:2017), Directive 2015/2193/EC (44th BImSchV:2022), plants according to the 27th BImSchV and TA Luft:2002. 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 month field test at a large combustion (hard coal firing) plant.

The AMS is approved for an ambient temperature range of +5 °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 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 emission limit values and oxygen concentration 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.

Note

The legal regulations mentioned correspond to the current state of legislation during certification. Each user should, if necessary, in consultation with the competent authority, ensure that this AMS meets the legal requirements for the intended use. In addition, it cannot be ruled out that legal regulations governing the use of a measuring device for emission monitoring may change during the lifetime of the certificate.

Basis of the certification

This certification is based on:

- Test report 936/21239789/B dated 15 May 2019 of 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 24.03.2020 B7, chapter I No. 3.3,
Announcement by UBA dated 24 February 2020:

AMS designation:

ZPA-CEMS for CO, NO, SO₂, CO₂ and O₂

Manufacturer:

Fuji Electric France S.A.S, Clermont-Ferrand, France

Field of application:

Modular AMS for measurement at plants according to the 13th BImSchV and TA Luft

Measuring ranges during the performance test:

Component	Certification range	supplementary measuring ranges		Unit
CO	0 – 375	0 – 625	0 – 2,500	mg/m ³
NO	0 – 268	0 – 670	0 – 2,680	mg/m ³
SO ₂	0 – 571	0 – 1,428	0 – 5,710	mg/m ³
CO ₂	0 – 20	-	-	Vol.-%
O ₂ para.	0 – 25	0 – 10	-	Vol.-%
O ₂ (ZrO ₂)	0 – 25	0 – 10	-	Vol.-%

Software version:

2.02g

Restrictions:

None

Notes:

1. The maintenance interval is four weeks.
2. There are two alternatives for measuring oxygen: the paramagnetic oxygen sensor (O₂ (para)) or the zirconium dioxide sensor (O₂ (ZrO₂)).
3. For measuring the components CO, NO, SO₂ and CO₂, the interval for automatic zero point adjustment must be set to 24 h. The option for automatic span point checks has not been activated during the field test.
4. The measuring system may be operated with a heated sampling probe and a M&C sample gas cooler (probe type SP2000-H, cooler type ECM).
5. The measuring system may be operated with a heated sampling probe and a JCT sample gas cooler (probe type JES-301-C, cooler type JCS-100).
6. The measuring system can be operated with a heated sampling probe and a Bühler sample gas cooler (probe type GAS 222.21, cooler type RC 1.2+).

7. The measuring system can be distributed with various combinations of measurement channels. The following table lists the AMS designation which indicates the relevant scope of measured components:

Designation			Combination of IR components
Without O ₂ measurement	With O ₂ measurement (ZrO ₂)	With O ₂ measurement (para)	
	ZPA-Yz	ZPA-Yp	O ₂
ZPA-B	ZPA-Bz	ZPA-Bp	CO
ZPA-Z	ZPA-Zz	ZPA-Zp	CO + SO ₂
ZPA-P	ZPA-Pz	ZPA-Pp	NO _w
ZPA-F	ZPA-Fz	ZPA-Fp	NO + SO ₂
ZPA-D	ZPA-Dz	ZPA-Dp	CO ₂
ZPA-G	ZPA-Gz	ZPA-Gp	CO + NO
ZPA-J	ZPA-Jz	ZPA-Jp	CO + CO ₂
ZPA-N	ZPA-Nz	ZPA-Np	CO + NO + SO ₂
ZPA-W	ZPA-Wz	ZPA-Wp	CO + NO + CO ₂
ZPA-Q	ZPA-Qz	ZPA-Qp	CO + NO + SO ₂ + CO ₂

8. Supplementary test (for the purpose of approving additional gas conditioning parts) as regards Federal Environment Agency notice of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter I number 2.1).

Test Institute:

TÜV Rheinland Energy GmbH, Cologne

Report No.: 936/21239789/B dated 15 May 2019

Certified product

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

The modular ZPA-CEMS measuring system is an extractive system and comprises the following components:

- **Measuring cabinet**

Manufacturer:	Schneider Electric,
Type:	SPACIAL SF NSYSF20860P
Dimensions:	1900 x 600 x 600 mm (without air conditioning)
Material:	Painted steel + insulation
Air conditioning:	Air conditioner with 1000 W

- **Sample probe**

Manufacturer:	M&C TechGroup Germany GmbH
Type:	SP2000-H with ceramic filter, heated to 180°C
Manufacturer: (optional)	JCT Analysentechnik GmbH
Type:	JES-301-C with ceramic filter, heated to 180°C
Manufacturer: (optional)	Bühler Technologies GmbH
Type:	GAS 222.21 with ceramic filter, heated to 180°C

- **Heated sample gas line**

Temperature:	180°C
Length:	21m in the laboratory test for both tested instruments 21 m for system 1 and 26 m for system 2 in the field (given the specific set-up).
Material:	PTFE

- **Compressor cooler**

Manufacturer:	M&C TechGroup Germany GmbH
Type:	ECM, due point 5°C
Condensate discharge:	via a peristaltic pump
Manufacturer: (optional)	JCT Analysentechnik GmbH
Type:	JCS-100, due point 5°C
Condensate discharge:	via a peristaltic pump
Manufacturer: (optional)	Bühler Technologies GmbH
Type:	RC 1.2+, due point 5°C
Condensate discharge:	via a peristaltic pump

- Sample gas pump and
- analyser modules.

The ZPA analyser itself measures the components CO, NO, SO₂ and CO₂ using NDIR. There are two alternatives for measuring O₂: either a paramagnetic measuring cell (sensor is installed in the enclosure of the ZPA analyser downstream of the optical benches) or a ZFK-7 zirconium dioxide sensor (sensor is installed upstream of the ZPA analyser enclosure).

Module configurations:

Designation			Combination of IR components
Without O ₂ measurement	With O ₂ measurement (ZrO ₂)	With O ₂ measurement (para)	
	ZPA-Yz	ZPA-Yp	O ₂
ZPA-B	ZPA-Bz	ZPA-Bp	CO
ZPA-Z	ZPA-Zz	ZPA-Zp	CO + SO ₂
ZPA-P	ZPA-Pz	ZPA-Pp	NO
ZPA-F	ZPA-Fz	ZPA-Fp	NO + SO ₂
ZPA-D	ZPA-Dz	ZPA-Dp	CO ₂
ZPA-G	ZPA-Gz	ZPA-Gp	CO + NO
ZPA-J	ZPA-Jz	ZPA-Jp	CO + CO ₂
ZPA-N	ZPA-Nz	ZPA-Np	CO + NO + SO ₂
ZPA-W	ZPA-Wz	ZPA-Wp	CO + NO + CO ₂
ZPA-Q	ZPA-Qz	ZPA-Qp	CO + NO + SO ₂ + CO ₂

The ZFK-7 sensor (ZrO₂) is connected to the ZPA analyser module such that the ZPA analyser module is used entirely for measured value output, operation and parameterisation of the ZFK-7.

Measured value output of the measuring system refers to dry gas under normal conditions.

The measuring system provides an option for automatic zero and span check and adjustment. This can be effected directly using (static) test gas application or via a probe when (dynamically) applying test gas.

Zero point adjustment during performance testing was performed every 24 h (6 min. purging duration) for the measured NDIR components. Synthetic air from a pressurised gas cylinder served as zero gas; it is also possible to use nitrogen or dry, clean compressed air/instrument air. Zero gas was provided to the measuring system via (static) application.

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 Energy & Environment 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 & Environment GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energy & Environment GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and its expiration is also accessible on the internet: qal1.de.

History of documents

Certification of ZPA-CEMS 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. 0000062062_00: 12 June 2019
Expiry date of the certificate: 25 March 2024
Test report: 936/21239789/A dated 21 September 2018
TÜV Rheinland Energy GmbH
Publication: BAnz AT 26.03.2019 B7, chapter I number 2.1
UBA announcement dated 27 February 2019

Supplementary testing according to EN 15267

Certificate No. 0000062062_01: 4 June 2020
Expiry date of the certificate: 23 March 2025
Test report: 936/21239789/B dated 15 May 2019
TÜV Rheinland Energy GmbH
Publication: BAnz AT 24.03.2020 B7, chapter I number 3.3
UBA announcement dated 24 February 2020

Renewal of certificates

Certificate No. 0000062062_02: 20 March 2025
Expiry date of the certificate: 23 March 2030

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

Measuring system

Manufacturer	Fuji Electric
AMS designation	ZPA-CEMS
Serial number of units under test	N7CO387 / N4C1455T
Measuring principle	NDIR

Test report

Test laboratory	936/21239789/A TÜV Rheinland
Date of report	2018-09-21

Measured component

Certification range	CO 0 - 375 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	4.10 mg/m ³
Sum of negative CS at span point	-2.40 mg/m ³
Maximum sum of cross-sensitivities	4.10 mg/m ³
Uncertainty of cross-sensitivity	u_i 2.367 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D 1.975 mg/m ³		3.901 (mg/m ³) ²
Lack of fit	u_{lof} -1.169 mg/m ³		1.367 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 1.588 mg/m ³		2.522 (mg/m ³) ²
Span drift from field test	$u_{d,s}$ 2.309 mg/m ³		5.331 (mg/m ³) ²
Influence of ambient temperature at span	u_t 1.400 mg/m ³		1.960 (mg/m ³) ²
Influence of supply voltage	u_v 1.429 mg/m ³		2.042 (mg/m ³) ²
Cross-sensitivity (interference)	u_i 2.367 mg/m ³		5.603 (mg/m ³) ²
Influence of sample gas flow	u_n -0.992 mg/m ³		0.984 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 3.031 mg/m ³		9.188 (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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 5.74 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 11.24 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 150 mg/m³ 7.49

Requirement of 2010/75/EU

U in % of the ELV 150 mg/m³ 10.00

Requirement of EN 15267-3

U in % of the ELV 150 mg/m³ 7.50

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

Measuring system

Manufacturer	Fuji Electric
AMS designation	ZPA-CEMS
Serial number of units under test	N7CO387 / N4C1455T
Measuring principle	NDIR

Test report

Test laboratory	TÜV Rheinland
Date of report	2018-09-21

Measured component

Certification range	CO	0 - 250 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	4.10 mg/m ³
Sum of negative CS at span point	-2.40 mg/m ³
Maximum sum of cross-sensitivities	4.10 mg/m ³
Uncertainty of cross-sensitivity	u_i 2.367 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	1.975 mg/m ³	3.901 (mg/m ³) ²
Lack of fit	u_{lof}	0.577 mg/m ³	0.333 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	1.588 mg/m ³	2.522 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	2.309 mg/m ³	5.331 (mg/m ³) ²
Influence of ambient temperature at span	u_t	1.400 mg/m ³	1.960 (mg/m ³) ²
Influence of supply voltage	u_v	1.429 mg/m ³	2.042 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	2.367 mg/m ³	5.603 (mg/m ³) ²
Influence of sample gas flow	u_n	-0.992 mg/m ³	0.984 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.021 mg/m ³	4.083 (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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 5.17 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 10.14 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 100 mg/m³ 10.1

Requirement of 2010/75/EU

U in % of the ELV 100 mg/m³ 10.0

Requirement of EN 15267-3

U in % of the ELV 100 mg/m³ 7.5

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

Measuring system

Manufacturer	Fuji Electric
AMS designation	ZPA-CEMS
Serial number of units under test	N7CO387 / N4C1455T
Measuring principle	NDIR

Test report

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

Measured component

Certification range	NO	0 - 268 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	2.63 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	2.63 mg/m ³
Sum of negative CS at span point	-1.69 mg/m ³
Maximum sum of cross-sensitivities	2.63 mg/m ³
Uncertainty of cross-sensitivity	u_i 1.516 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	2.153 mg/m ³	4.635 (mg/m ³) ²
Lack of fit	u_{lof}	0.573 mg/m ³	0.328 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	-1.393 mg/m ³	1.940 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	2.166 mg/m ³	4.692 (mg/m ³) ²
Influence of ambient temperature at span	u_t	2.343 mg/m ³	5.490 (mg/m ³) ²
Influence of supply voltage	u_v	1.164 mg/m ³	1.355 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	1.516 mg/m ³	2.298 (mg/m ³) ²
Influence of sample gas flow	u_n	-0.484 mg/m ³	0.234 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.166 mg/m ³	4.693 (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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 5.07 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 9.93 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 107.2 mg/m³ 9.3

Requirement of 2010/75/EU

U in % of the ELV 107.2 mg/m³ 20.0

Requirement of EN 15267-3

U in % of the ELV 107.2 mg/m³ 15.0

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

Measuring system

Manufacturer	Fuji Electric
AMS designation	ZPA-CEMS
Serial number of units under test	N7CO387 / N4C1455T
Measuring principle	NDIR

Test report

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

Measured component

Certification range	SO ₂	0 - 571 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	8.11 mg/m ³
Sum of negative CS at zero point	-5.14 mg/m ³
Sum of positive CS at span point	3.71 mg/m ³
Sum of negative CS at span point	-16.90 mg/m ³
Maximum sum of cross-sensitivities	-16.90 mg/m ³
Uncertainty of cross-sensitivity	u_i -9.758 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	4.538 mg/m ³	20.593 (mg/m ³) ²
Lack of fit	u_{lof}	0.593 mg/m ³	0.352 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	-3.956 mg/m ³	15.650 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	3.297 mg/m ³	10.870 (mg/m ³) ²
Influence of ambient temperature at span	u_t	5.009 mg/m ³	25.090 (mg/m ³) ²
Influence of supply voltage	u_v	2.031 mg/m ³	4.125 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-9.758 mg/m ³	95.219 (mg/m ³) ²
Influence of sample gas flow	u_n	-2.953 mg/m ³	8.720 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	4.615 mg/m ³	21.301 (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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	14.21 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	27.85 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 228.4 mg/m³	12.2
Requirement of EN 15267-3	U in % of the ELV 228.4 mg/m³	20.0
	U in % of the ELV 228.4 mg/m³	15.0

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

Measuring system

Manufacturer	Fuji Electric
AMS designation	ZPA-CEMS
Serial number of units under test	N7CO387 / N4C1455T
Measuring principle	NDIR

Test report

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

Measured component

Certification range	CO ₂	0 - 20 Vol.-%
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at span point	0.00	Vol.-%
Sum of negative CS at span point	-0.20	Vol.-%
Maximum sum of cross-sensitivities	-0.20	Vol.-%
Uncertainty of cross-sensitivity	u_i -0.115	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u^2
Standard deviation from paired measurements under field conditions *	u_D	0.102	Vol.-%	0.010 (Vol.-%) ²
Lack of fit	u_{lof}	0.087	Vol.-%	0.008 (Vol.-%) ²
Zero drift from field test	$u_{d,z}$	-0.058	Vol.-%	0.003 (Vol.-%) ²
Span drift from field test	$u_{d,s}$	0.300	Vol.-%	0.090 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.058	Vol.-%	0.003 (Vol.-%) ²
Influence of supply voltage	u_v	0.047	Vol.-%	0.002 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	-0.115	Vol.-%	0.013 (Vol.-%) ²
Influence of sample gas flow	u_n	-0.077	Vol.-%	0.006 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.162	Vol.-%	0.026 (Vol.-%) 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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.40	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.79	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 20 Vol.-%	3.9
Requirement of EN 15267-3	U in % of the range 20 Vol.-%	10.0 **
	U in % of the range 20 Vol.-%	7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10.0 % was used for this.

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

Measuring system

Manufacturer	Fuji Electric
AMS designation	ZPA-CEMS
Serial number of units under test	N7CO387 / N4C1455T
Measuring principle	paramagnetic

Test report

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

Measured component

Certification range	O ₂ (Para)
	0 - 25 Vol.-%

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at span point	0.00	Vol.-%
Sum of negative CS at span point	0.00	Vol.-%
Maximum sum of cross-sensitivities	0.00	Vol.-%
Uncertainty of cross-sensitivity	u_i	0.000 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u^2
Standard deviation from paired measurements under field conditions *	u_D	0.056	Vol.-%	0.003 (Vol.-%) ²
Lack of fit	u_{lof}	0.058	Vol.-%	0.003 (Vol.-%) ²
Zero drift from field test	$u_{d,z}$	0.092	Vol.-%	0.008 (Vol.-%) ²
Span drift from field test	$u_{d,s}$	-0.098	Vol.-%	0.010 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.015	Vol.-%	0.000 (Vol.-%) ²
Influence of supply voltage	u_v	0.026	Vol.-%	0.001 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	0.000	Vol.-%	0.000 (Vol.-%) ²
Influence of sample gas flow	u_n	-0.058	Vol.-%	0.003 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202	Vol.-%	0.041 (Vol.-%) 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)

$$u_c = \sqrt{\sum (u_{\max, j})^2} \quad 0.26 \text{ Vol.-%}$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1.96 \quad 0.52 \text{ Vol.-%}$$

Relative total expanded uncertainty

Requirement of 2010/75/EU

Requirement of EN 15267-3

U in % of the range 25 Vol.-%

U in % of the range 25 Vol.-%

U in % of the range 25 Vol.-%

2.1

10.0 **

7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.

A value of 10.0 % was used for this.

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

Measuring system

Manufacturer	Fuji Electric
AMS designation	ZPA-CEMS
Serial number of units under test	N4C13450+N4E0757 / N4C13460+N4E0758
Measuring principle	ZrO2

Test report

Test laboratory	936/21239789/A
Date of report	TÜV Rheinland
	2018-09-21

Measured component

Certification range	O ₂ (ZrO ₂)
	0 - 25 Vol.-%

Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at span point	0.24	Vol.-%
Sum of negative CS at span point	0.00	Vol.-%
Maximum sum of cross-sensitivities	0.24	Vol.-%
Uncertainty of cross-sensitivity	u_i	0.139 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u^2
Standard deviation from paired measurements under field conditions *	u_D	0.034	Vol.-%	0.001 (Vol.-%) ²
Lack of fit	u_{lof}	0.058	Vol.-%	0.003 (Vol.-%) ²
Zero drift from field test	$u_{d.z}$	0.017	Vol.-%	0.000 (Vol.-%) ²
Span drift from field test	$u_{d.s}$	0.115	Vol.-%	0.013 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.046	Vol.-%	0.002 (Vol.-%) ²
Influence of supply voltage	u_v	0.010	Vol.-%	0.000 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	0.139	Vol.-%	0.019 (Vol.-%) ²
Influence of sample gas flow	u_b	0.057	Vol.-%	0.003 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202	Vol.-%	0.041 (Vol.-%) 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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.29	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.57	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 25 Vol.-%	2.3
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
	U in % of the range 25 Vol.-%	7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10.0 % was used for this.