



**Chimica
Applicata
Depurazione
Acque S.n.c.**
di Filippo Giglio & C

**Area Matrici Aeriformi
-
Settore Emissioni
Convogliate**



LAB N° 0439

D3 POWER GENERATION LTD

Delimara Power Station Administration, Triq il Power House,
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QAL 2 REPORT ON AUTOMATED MEASURING SYSTEM INSTALLED FOR CONTINUOUS MONITORING OF EMISSIONS OF STACK 6C

performed on behalf of

SUN LAB GROUP Ltd


Area Technical Manager
C.A.D.A. snc
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1 INTRODUCTION

SUNLAB Ltd commissioned to CADA snc di F.Giglio & C. the calibration activities (QAL2) in accordance to the EN 14181:2015 on Automated Measuring System (AMS) installed for continuous monitoring of Stack 6C emissions at the Delimara Power Station, Marsaxlokk, Malta .

In this technical report, we describe the linearity test performed on AMS Stack 6C after change over to the methane conversion of the plant.

The report describes all the activities required by the technical standard EN 14181:2015 in particular:

- ⇒ The functional test (Annex A of EN 14181:2015),
- ⇒ Calibration function created on 15 parallel measurements.

The technical activity has been performed on 10th, 11th and 17th May 2017.



2 REFERENCE

2.1 NORMATIVE REFERENCE

- ⇒ EN 14181:2015: *"Automatic measurement systems quality Assurance"*;
- ⇒ Legislative Decree 3 April 2006 n. 152: *"Rules in enviroing matter"*;
- ⇒ Legislative Decree 11 May 2005 n. 133: *"Implementation of Direttive 200/76/CE, in waste incineration field"*;
- ⇒ Tecnical Guide for administrator of continuous monitoring systems for emissions in atmosphere *ISPRA 69/2011*;
- ⇒ Tecnical Guide for administrator of continuous monitoring systems for emissions in atmosphere *ISPRA 87/2013*;
- ⇒ Environmental Protection Agency Office of Environmental Enforcement (OEE) - Air Guidance Note on the Implementation of I.S. EN 14181 (AG3).
- ⇒ Method Implementation Document (MID 14181). *EN 14181: Stationary source emissions Quality assurance of automated measuring systems*. Environment Agency Version 3 April 2014.
- ⇒ Technical Guidance Note (Monitoring). *M20 Quality assurance of continuous emission monitoring systems - application of EN 14181 and BS EN 13284-2*. Environment Agency Version 3 June 2015.

2.2 TERMS OF REFERENCE

- ⇒ **AMS** (Automatic Measurement System): measurement system installed permanently in the place for emissions continuous monitoring;
- ⇒ **In-situ AMS**: AMS having the detection unit in the gas stream or in a part of it;
- ⇒ **Extractive AMS**: AMS having the detection unit physically separated from the gas stream by means a sampling system;
- ⇒ **SRM** (Standardized Reference Method): standardized and described method to define an air quality feature;
- ⇒ **ELV**: Emission Limit Value of a determined parameter.



3 DESCRIPTION OF THE PLANT

The phase 3 of the power electrical generation plant at the Delimara Power Station was been converted from HFO to natural gas, for all eight diesel engines. Four of these eight engines (1 to 4) will be capable of running only on natural gas (NG) as single fuel, whilst the remaining four (5 to 8) were been converted as dual fuel engines, running on natural gas as the main fuel or diesel in emergency situations.

From the 4 chimneys the exhaust gases of engines are transported into the atmosphere, each chimney taking up the exhaust gases of 2 engines and for continuous emission monitoring an AMS (Automatic Measurement System) is installed at each chimney.

Table 1 - Data Sheet of Customer

Data Sheet of Customer		
Company	D3 POWER GENERATION LIMITED LTD	
Adress	Enemalta Building, Triq Belt il-Hazna	
City	Marsa MRS 1571	
Location of Sampling	Delimara Power Station	
Emission Point	6C	
Responsible	David Griscti	
Description of the plant	Power plant	
Process characteristics	Electricity production	
Source of emission	Diesel Engines N°45 & 46	
Majority fuel	Natural Gas	
GPS Coordinates (N - E)	35°49'57.12"	14°33'27.87"
Pollution abatement system	SCR/Denox + DeSOx + Filter	
Authorization decree	IPPC IP 0002/07/Fii	
Reference Oxygen for Correction of Results	15 % Vol.	

The emission limits with Natural Gas Fuel are as follows.

Table 2 - Emission Limit Value - IPPC IP 0002/07/C

Emission Limit Value		
Parameter	Unit of Measurement	Value
Dust	mg/Nm ³	5
Nitrogen Oxides	mg/Nm ³	55
Sulfur Dioxide	mg/Nm ³	100
Carbon Monoxide	mg/Nm ³	110
Ammonia	mg/Nm ³	2,6
Note: All values shall be corrected to 273.15 K, 101,3 Pa, dry gas volume and to an Oxygen content of 15% vol.		



Below, Information of Emission Point “6C” and Sampling Security Information.

Table 3 - Information of Emission Point

Data Sheet of Emission Point	
Height of Stack [m]	65
Height of the ground of sampling point	25
Distance of perturbation upstream of sampling point	25
Distance of perturbation downstream of sampling point	25
Flow direction	Vertical
Direct outlet in Atmosphere	Yes
Diameter [m]	200
Stack Area [m ²]	3,14
Number of Sampling Lines (Access Ports)	2
Conformance of the Sampling Platform	
Sampling platform area > 5 m ² and support > 400 kg	Yes
Presence of artificial lighting	Yes
Appropriate electrical installation	Yes
Secure platform	Yes
Sampling platform conformance	Yes

During the parallel measurements the plant loads have been changed, this operation represents the normal plant conditions and increase the variability of data to implement the calibration.

Table 4 - Plant Load during the measurements

Plant Load during the measurements				
Fuel	Natural Gas	Other Fuel	/	
Day	Time	Source of emission	Load	
10/05/2017	07:30 - 22:30	Diesel Engine 45 & 46	32MW	100%
11/05/2017	07:30 - 22:30	Diesel Engine 45 & 46	26MW	80%
17/05/2017	07:30 - 22:30	Diesel Engine 45	16MW	50%



4 STANDARD REFERENCE METHOD (SRM)

Flow, dust and ammonia measurements are made directly to the chimney. The combustion gases are transported through a heated probe to the analyzer. The gases before being analyzed pass into a chiller that removes water.

Below is the SRM specification used for parallel measurements.

Table 5 - SRM Sampling and Analysis Method

Parameter	Method	Description of the method
Dust	UNI EN 13284-1:2003	Stationary source emissions. Determination of low range mass concentration of dust. Manual gravimetric method.
NH ₃	EPA CTM 027:1997	Procedure for collection and analysis of ammonia in stationary sources.
NO _x	UNI EN 14792:2006	Stationary source emissions. Determination of mass concentration of nitrogen oxides (NO _x). Reference method: Chemiluminescence.
SO ₂	ISO 11042-1:1996	Gas turbines - Exhaust gas emission - Part 1: Measurement and evaluation. Principle of Measurement: Non-dispersive infrared (NDIR).
CO	UNI EN 15058:2006	Stationary source emissions. Determination of the mass concentration of carbon monoxide (CO). Reference method: Non-dispersive infrared spectrometry.
CO ₂	ISO 11042-1:1996	Gas turbines - Exhaust gas emission - Part 1: Measurement and evaluation. Principle of Measurement: Non-dispersive infrared (NDIR).
O ₂	UNI EN 14789:2006	Determination of volume concentration of oxygen (O ₂). Reference method - Paramagnetism.
H ₂ O	UNI EN 14790:2006	Stationary source emissions. Determination of the water vapour in ducts.
Flow, Velocity	UNI EN 16911:2013 Annex A	Stationary source emissions. Manual and automatic determination of velocity and volume flow rate in ducts. Part 1: Manual reference method.
Temperature, Pressure	UNI EN 16911:2013 Annex A	



Below are the technical specifications of the instrumentation used during the sampling.

Table 6 - SRM Specification

Parameter	Manufacturer / Model	Measuring principle	Range of Measurement
Dust	Dado Lab - ST5	Sampling	Only Sampling
Flow, Velocity	Dado Lab - ST5	Differential Pressure	-100 ÷ 1000 Pa
Temperature	Dado Lab - ST5	Thermocouples - Type K	0 - 1200 °C
Pressure	Dado Lab - ST5	Static/Barometric Pressure	10 ÷ 105 kPa (1050 mBar)
NH ₃	Dado Lab - ST5	Sampling	
NOx	Horiba / PG - 350 E	CLD chemiluminescence	0-25/50/100/250/ 500/1000/2500 ppm
SO ₂	Horiba / PG - 350 E	ND-IR	0-50/100/200/500 ppm
CO	Horiba / PG - 350 E	ND-IR	0-60/100/200/500/1000 ppm
CO ₂	Horiba / PG - 350 E	ND-IR	0-10/20/30 %
O ₂	Horiba / PG - 350 E	Paramagnetic	0-/10/25 %
H ₂ O	Tecora - Ayrton	Sampling	Only Sampling

In Annex 6 and 7, QAL1 certificates of SRM and Dilution System.



5 AUTOMATED MEASURING SYSTEM (AMS)

AMS has been supplied by SICK and consists in an independent flue gas analyzer placed in a cabin at the base of the stack 6C.

Inside the cabin there are two types of instruments:

- ⇒ In situ analyzers, for measurement of dust, temperature, pressure;
- ⇒ extraction analyzers, for measurement of carbon monoxide (CO), Sulfur dioxide (SO₂), nitrogen monoxide (NO), nitrogen dioxide (NO₂), carbon dioxide (CO₂), ammonia (NH₃) and water vapor (H₂O).

The in situ analyzers, measure directly in the chimney the parameter or the physical characteristic of the flue gas. In particular, the concentration of the dust is measured with the Optical Extinction technique, temperature and pressure with heat resistance and electro pneumatic transducer system respectively.

Extract analyzers are connected to the AMS analysis-cabin through a heated line. Heated line brings the flue gas under the same sampling conditions of temperature, humidity and to avoid condensation along the sampling line. All parameters are measured by IR Non-Dispersive technique (NDIR), while oxygen is measured with zirconium oxides.

Table 7 - AUTOMATED MEASURING SYSTEM (AMS) FEATURES

Supplier	Certification	Analyzer	Measuring Principle	Parameter	Full-scale set
SICK	TÜV Technischer Überwachungsverein	SB 100	Optical - Extinction	Dust	0 - 200 mg/Nm ³
		MCS 100 E	ZrO ₂	O ₂	0 - 21 %
			IR Non-Dispersive (NDIR)	CO	0 - 300 mg/Nm ³
				CO ₂	0 - 25 %
				NO	0 - 300 mg/Nm ³
				NO ₂	0 - 100 mg/Nm ³
				SO ₂	0 - 2000 mg/Nm ³
				NH ₃	0 - 30 mg/Nm ³



6 FUNCTIONAL TEST

The functional tests are a mandatory requirement within EN 14181. Suitably trained personnel from either the test laboratory, process operator or AMS supplier may perform the functional tests. The functional test is intended to verify that the AMS is installed in accordance with the requirements of the industry standard.

The functional test has the aim to ensure:

- ⇒ AMS is installed at a representative sampling point,
- ⇒ AMS is working and in good condition,
- ⇒ AMS is maintained properly as required by the user manuals,
- ⇒ AMS has the same performance as stated in QAL 1 certificate.

In addition, the technical standard EN 14181: 2015 also provides for checks to be carried out during the operation of the analyzer. Among the most important are:

- ⇒ Zero and SPAN Test with Certified Gas (QAL3 Controls). These controls are the responsibility of the Plant operator,
- ⇒ Zero and Span Drift in time. These controls are the responsibility of the Plant operator.

The checks performed by certified laboratory in accordance with technical standard EN ISO / IEC 17025 are:

- ⇒ Verify the functionality of the entire system (Leak Test, Response Time),
- ⇒ Zero and SPAN test with certified material,
- ⇒ Linearity Checking.



Table 2 specifies the individual steps of the functional test of AMS to be performed during QAL2 and AST for extractive and in-situ AMS.

Table 8 - Functional Test Step

Functional Test to be performed during QAL2 / AST activities on AMS (EN 14181 : 2015 - Annex A)				
N.	Type of Verification	Extractive AMS	In-situ AMS	Responsibility
1	Alignment and cleanliness	-	X	Supplier/Manufacturer
2	Sampling system	X	-	Laboratory
3	Documentation and records	X	X	Plant operator
4	Functionality	X	X	Plant operator
5	Leak test	X	-	Laboratory
6	Zero and span check	X	X	Laboratory
7	Linearity	X	-	Laboratory
8	Interferences	X	X	Laboratory / Supplier / Installer
9	Zero and span drift (audit)	X	X	Plant operator
10	Response time	X	X	Laboratory
11	Report	X	X	Laboratory

The functional test was carried out at 8th May and the results are given in Annex N. 1 of the report.



6.1 TEST OF LINEARITY

Analyzers measurement linearity is tested in according to the UNI EN 14181:2015 Annex B - Test of Linearity. In this test procedure, a regression line is established between the instrument reading of the AMS (*x-values*) and the reference material values (*y-values*). The regression line is achieved at five different levels, including a zero concentrations. Different concentration levels have been obtained by means the use of a calibrated dilution system.

Concentration levels to realize the regression line at approximately 20%, 40%, 60% and 80% of a range which is at least the short-term ELV. For each levels concentration, at least three reading shall be made. The time period between the beginning each of the three readings were be separated by least four times the response time of the analyzer.

From measurement made it is determined the function linear regression:

$$x_i = A' + B(y_i - y_z) \quad (1)$$

The coefficient A' is obtained with the Formula (2):

$$A' = \frac{1}{n} \sum_{i=1}^n x_i \quad (2)$$

where

A' is the average value of the x-value, i.e. the average of the AMS instrument reading;

x_i is the individual AMS instrument reading;

n is the number of measuring point (at least 18, three for each levels).

The coefficient B is obtained with the Formula (3):

$$B = \frac{\sum_{i=1}^n x_i (y_i - y_z)}{\sum_{i=1}^n (y_i - y_z)^2} \quad (3)$$

y_z is the average of the y-values, i.e. the average of the reference material concentration;

y_i is the individual value of the reference material concentration.

Secondly the fuction in Formula (1) is converted to

$$x_i = A + B y_i \quad (3.1)$$



Through the calculation of A according to Formula (4)

$$A = A' - By_z \quad (4)$$

For each concentration level the average of AMS readings at one and the same concentration level c according to Formula (5):

$$\overline{x}_c = \frac{1}{m_c} \sum_{i=1}^{m_c} x_{c,i} \quad (5)$$

where

\overline{x}_c is the average x -value (AMS-reading) at concentration level c ;

$x_{c,i}$ is the individual x -value (AMS reading) at concentration level c ;

m_c is the number of repetitions at one and the same concentration level c .

Calculate the residual d_c of each average according to Formula (6)

$$d_c = \overline{x}_c - (A + Bc) \quad (6)$$

where

c is the concentration level.

Finally, convert d_c in concentration units to a relative unit $d_{c,rel}$ by dividing d_c by the upper limit c_u of the range used in the linearity test according to Formula (7):

$$d_{c,rel} = \frac{d_c}{c_u} 100\% \quad (7)$$

All residual shall pass this test in according to Formula (8):

$$d_{c,rel} < 5\% \quad (8)$$

The Linearity Test results are given in Annex N. 2 of the report.

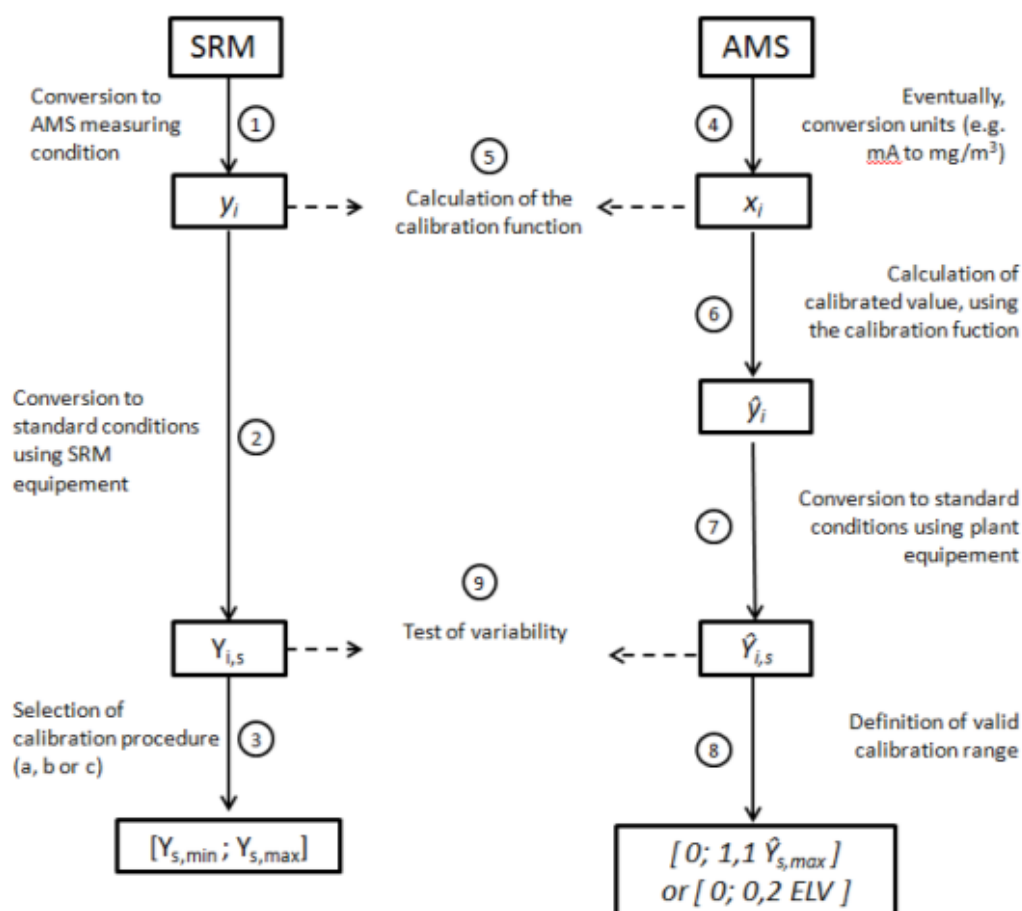
7 CALIBRATION and VALIDATION OF THE AMS (QAL2)

7.1 DETERMINATION OF THE CALIBRATION FUNCTION

The calibration of the AMS measurement should be performed on at least fifteen parallel measurements with an SRM distributed in a period of 6-8 hours for three days. The object of the parallel measurements was to calibrate and validate the AMS through an independent method (SRM). The tests were carried out over a period of three days in order to take measurements during different states of the system (for example changes of load).

Below it is shown flowchart that describes the steps of the calibration process.

Figure 1 - Flowchart of calibration process



The standard assumes that the calibration function is linear with a constant residual standard deviation. The calibration function is described by the following model.(See ISO 11095):



$$y_i = a + bx_i + \varepsilon_i \quad (9)$$

Where

- x_i is the result i^{th} of the AMS; i =from 1 to N; $N \geq 15$;
 y_i is the result i^{th} of the SRM; i =from 1 to N; $N \geq 15$;
 ε_i is the deviation between y_i and the expected value;
 a is the intercept of calibration function;
 b is the slope of the calibration function.

The following quantities shall be calculated, average value of the AMS (\bar{x}) and SRM (\bar{y}):

$$\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i \quad (10)$$

$$\bar{y} = \frac{1}{N} \sum_{i=1}^N y_i \quad (11)$$

Following, the difference between the highest and lowest measured SRM concentration at standard condition shall be calculated ($y_{s,max} - y_{s,min}$). Depending on the range of concentrations ($y_{s,max} - y_{s,min}$) reported during the measurement one has to choose the method of calculation of the calibration function.

Method a: if ($y_{s,max} - y_{s,min}$) \geq maximum permissible uncertainty.

The parameters of the calibration function shall be calculated according to Formula (12) and Formula (13):

$$\hat{b} = \frac{\sum_{i=1}^N (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^N (x_i - \bar{x})^2} \quad (12)$$

$$\hat{a} = \bar{y} - \hat{b}\bar{x} \quad (13)$$

Method b: if ($y_{s,max} - y_{s,min}$) $<$ maximum permissible uncertainty and $y_{s,min} \geq 15\%$ of Limit Emission Value (ELV). The parameters of the calibration function shall be calculated according to Formula (14) and Formula (15):



$$\hat{b} = \frac{\bar{y}}{\bar{x} - Z} \quad (14)$$

$$\hat{a} = -\hat{b}Z \quad (15)$$

Where

Z is the difference between the zero reading of the AMS and the zero.

Method c: if $(y_{s,max} - y_{s,min}) < \text{maximum permissible uncertainty}$ and $y_{s,min} < 15\%$ of Limit Emission Value (ELV). The function is constructed with the same formulas of *Method a* (12 - 13). In addition, two points "surrogate" of Zero and Span (*near the ELV*) are used using gaseous standards.

The calibration function is valid when the plant is operated within the valid calibration range. This valid calibration range is either the calibration range from zero to the maximum value $y_{s,max}$ of calibrated AMS measured value at standard conditions, determined the QAL2 procedure, plus an extension of 10% of $y_{s,max}$, or to 20% of ELV, whichever is greater.

7.2 TEST OF VARIABILITY

In order to validate the calibration function obtained in this way, will be executed the test of variability.

The data pairs (SRM and AMS calibrated) thus obtained are normalized and reported to the standard conditions of the plant using auxiliary measures supplied with measurement systems.

For the series of data are calculated:

$$D_i = y_{i,s} - \hat{y}_{i,s} \quad (16)$$

Where

$y_{i,s}$ is the result i^{th} of the SRM at standard conditions,

$\hat{y}_{i,s}$ is the result i^{th} of the AMS, calibrated at standard conditions,

Mean differences, Formula 17:



$$\bar{D} = \frac{1}{N} \sum_{i=1}^N D_i \quad (17)$$

Standard deviation of differences, Formula 18:

$$S_D = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (D_i - \bar{D})^2} \quad (18)$$

The AMS passes the variability test when:

$$S_D \leq \sigma_0 k_v \quad (16)$$

where

σ_0 is standard deviation derived from the range of confidence at 95%. In some EU Directive (EU 2010/75/CE) the uncertainty of the AMS measured values is expressed as half of the length of a 95% confidence interval as a percentage P of the emission value (ELV). Then, in order to convert this uncertainty to a standard deviation, the appropriate conversion factors is:

$$\sigma_0 = \frac{P \times ELV}{1,96} \quad (17)$$

the value of 1,96 represents the coverage factor of 95% of the confidence interval.

k_v is a value from χ^2 -test with a β -value of 50%. The k_v value depending on the number of tests conducted.

Table 9- k_v values

Number of parallel measurement	$k_v(N)$
15	0,9761
16	0,9777
17	0,9791
18	0,9803



8 ACCURACY INDEX ACCORDING TO LEGISLATIVE DECREE. 152/06 (IAR)

To verify that the analyzer correctly measures the auxiliary parameters, it has been used Accuracy Index (IAR). This index is reported on Italian Legislative Decree N. 152/2006 - Part V, Annex VI "Criteria for conformity assessment of the measured values to the emission limit values".

In this law the calculation of the IAR (accuracy relative index) was calculated according to the following formula:

$$IAR = 100 \times \left(1 - \frac{M + I_c}{M_r}\right) \quad (18)$$

where

- M It is the arithmetic average of N values X_i .
- X_i It represents the absolute value of the difference of the concentrations measured by the two measuring systems (stationary analyzer "AMS" and reference analyzer "SRM").
- M_r It represents the average of the values of the concentrations measured by the reference system (SRM).
- I_c It represents the absolute value of the confidence range calculated for the average of N values X_i namely.

$$I_c = t_n \frac{S}{\sqrt{N}} \quad (19)$$

where

- N number of measurements performed.
- S It represents the standard deviation of values X_i .
- t_n Represents the t Student calculated for the level of confidence of 95% and for (n) degrees of freedom equal to (N-1);



Table 10 - t Student values

N	t _n
3	4,303
4	3,182
5	2,776
6	2,571
7	2,447
8	2,365
9	2,306
10	2,262
11	2,229
12	2,201
13	2,179
14	2,16
15	2,145
16	2,131

The AMS system is considered verified if the value of the **IAR** is above **80%**. The result of IAR test are in Annex 5.

8.1 DETERMINATION OF HOMOGENEITY OF THE SAMPLING POINT

During the Accuracy test (IAR), the homogeneity testing of the sampling point is performed in according to Technical standard UNI EN 15259:2006, *paragraph 8.3 - Determination of homogeneity*. The procedure involves measuring one parameter, such as Oxygen (O₂) and its spatial and temporal variations shall be applied to determine the homogeneity. Below, the procedure:

- ⇒ determine the sampling points for the grid measurement;
- ⇒ install the probe of the measuring system for the grid measurement;
- ⇒ install the probe of an independent measuring system (reference measurement) at a fixed point in the measurement section;
- ⇒ adjust the sample flow in both systems in order to obtain equal response times;
- ⇒ perform a grid measurement and in parallel measurements at a fixed point in the measurement section, with a sampling time of at least four times the response time of the measuring system but not less than three minutes for each sampling point;



- ⇒ Record for each sampling point i the actual value $y_{i,grid}$ of the measurand in the grid and the value $y_{i,ref}$ of the reference measurement;
- ⇒ For each sample point i , determines the ratio r_i defined as follows:

$$r_i = \frac{y_{i,grid}}{y_{i,ref}} \quad (20)$$

- ⇒ average \bar{r} of the ratios r_i according to Equation (21):

$$\bar{r} = \frac{1}{N} \sum_{i=1}^N r_i \quad (21)$$

- ⇒ standard deviation s_{grid} of the grid measurements according to Equation (22):

$$s_{grid} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (y_{i,grid} - \bar{y}_{grid})^2} \quad (22)$$

- ⇒ standard deviation s_{ref} of the reference measurements according to Equation (23):

$$s_{ref} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (y_{i,ref} - \bar{y}_{ref})^2} \quad (23)$$

If $s_{grid} < s_{ref}$, the distribution of the gas in the measuring section can be considered homogeneous and sampling can therefore be performed in any point of the section occurred.

The result of Homogeneity of sampling point are in Annex 1.



9 RESULTS

Below a summary of the results obtained from the QAL2 test performed on the analyzer (AMS) installed on the stack 6C. Note that for ammonia and sulfur dioxide the QAL2 procedure is not applicable because the parameters concentration are below the detection limit (LOD).

In Annex 4, there are reports for single parameter.

Table 11 - Results of QAL2

Summary Report of QAL2							
Parameter	Slope	Intercept	Range of Validity	Procedure for the determination of the calibration function	Maximum permissible uncertainty (95% confidence interval)	Experimental Confidence interval [%]	Emission Limit Value (ELV)
Dust	0,569	0,000	0 - 4,33 [mg/Nm ³ rif O ₂]	Method B	30	28,87	5
Nitrogen Oxide (NO)	0,805	-3,093	0 - 73,13 [mg/Nm ³ rif O ₂]	Method A	20	7,32	55
Carbon Monoxide (CO)	0,992	-1,898	0 - 22 [mg/Nm ³ rif O ₂]	Method C	10	0,61	110
Oxygen (O ₂)	1,092	0,000	0 - 15,26 [% Vol.]	Method B	10	2,17	/
Carbon Dioxide (CO ₂)	1,044	0,010	0 - 5,37 [% Vol.]	Method B	10	0,72	/

As regards carbon monoxide, the range of validity is lower than the emission limit value - ELV (110 mg / Nm³), then the consideration of Chapter 6.5 "Calibration Function of the AMS and its validity" of the technical standard EN 14181 : 2015 are applied.

Table 12 - Zero Verify

Zero verify for single parameter (Rif. 6.5 - Calibration Function of the AMS and its validity EN 14181 : 2015)						
Parameter	Emission Limit Value (ELV)	Range of Validity	Reference Concentration (ZERO)	AMS Response	Deviation of the AMS calibrated value compared to the reference concentration	Result (Deviation < 10 % ELV)
Carbon Monoxide (CO)	110	0 - 22 [mg/Nm ³ rif O ₂]	0	0	1,90	Positive



Table 13 - Span/ELV Verify

Span/ELV Verify for single parameter (Rif. 6.5 - Calibration Function of the AMS and its validity EN 14181 : 2014)								
Parameter	Emission Limit Value (ELV)	Range of Validity	Reference Concentration (ELV - SPAN)	AMS Response	Deviation of the AMS calibrated value compared to the reference concentration	Maximum permissible uncertainty (95% confidence interval)	Maximum permissible uncertainty (95% confidence interval) at ELV	Result (Deviation < I.C. 95% - ELV)
Carbon Monoxide (CO)	110	0 - 22 [mg/Nm ³ rif O ₂]	115,4	111,2	7,00	10	11	Positive

Below a summary of the results obtained from the IAR test performed on the analyzer (AMS) installed on the stack 6C.

Table 14 - IAR Values

I _{AR} Water Vapour	I _{AR} Temperature	I _{AR} Pressure	I _{AR} Flow Rate
89,3	92,4	99,7	84,1



10 CONCLUSIONS AND COMMENTS

Taken note of analytical determinations performed on the gaseous effluents of the plant and the processing on the data carried out, it highlights the positive result of the procedure QAL2. The functional test performed showed the correct installation of the AMS system, the suitability of the installation site and the efficiency of the entire design.

The Ammonia and Sulfur Dioxide parameters are in concentrations below instrumental detection limits, so it has not been possible to construct the QAL2 calibration. However, the analyzer can still correctly record the two parameters, this is noted by the linearity test.

Auxiliary parameter analyzers respond positively to the accuracy test, this shows that they work properly.



11 ANNEX 1 – FUNCTIONAL TEST

1	ALIGNMENT AND CLEANLINESS (ONLY NON-EXTRACTIVE SYSTEM)	
	Type of Verification (visual)	Notes / Comments
a	Obstruction Optical path	The operator performs the necessary maintenance and checks. The operator on 31/03/2017 instructed its supplier (DG Tech) to carry out the checks provided for in the user manuals of the instrument. The visual checks required by EN 14181 were positive.
b	Cleaning of Optical Components	
c	Alignment	
d	Presence of Air Purge	

2	SAMPLING SYSTEM (ONLY EXTRACTIVE SYSTEM)			
	Type of Verification (visual)	State		
		Great	Sufficient	Inadequate
a	Sampling probe	X		
b	Calibration gas conditioning system	X		
c	Pumps	X		
d	Pneumatic connections	X		
e	Sample line	X		
f	Generators/current stabilizers	X		
g	Filters	X		
Notes / Comments: //				

3	DOCUMENTATIONS AND RECORDS		
	Type of Documents	Location	Reference
a	P & I of the AMS (Plan of the AMS pneumatic system)	Technical Office	David Griscti
b	Details of the performance testing and certification of the AMS	Technical Office	David Griscti
c	AMS user manual (Including the maintenance part)	Technical Office	David Griscti
d (*)	Logbooks with records of malfunctions and maintenance performed	Technical Office	David Griscti
e (*)	Service reports	Technical Office	David Griscti
f (*)	QAL3 Documentation	Technical Office	David Griscti
g	AMS management system procedure for maintenance, calibration and training	Not Informed	/
h	Training records	Not Informed	/
i	Maintenance schedules	Not Informed	/
l	Auditing plans and records	Not Informed	/
Notes / Comments: (*) D3 POWER GENERATION LIMITED has performed a functional test on 30/03/2017 by Danks Gasanalyse Teknik (DG TEK)			



4		SERVICEABILITY		
Type of Verification		State		
		Great	Sufficient	Inadequate
a	Safe and clean working environment with sufficient space and weather protection	X		
b	Easy and safe access to the ASM	X		
c (*)	Adequate supplies of reference material, tool and spare part		X	
Notes / Comments: (*) D3 POWER GENERATION LIMITED has performed a functional test on 30/03/2017 by Danks Gasanalyse Teknik (DG TEK)				

5		LEAK TEST (ONLY EXTRACTIVE SYSTEM)	
a	Description of the test		Result
	Checking for leaks in extractive systems shall be conducted by disconnecting the sampling line at the probe exit, plugging the line, and adjusting the vacuum to 50 kPa using the bypass valve. (rif. 7.1 Checking for leaks - ISO 10396:2007)		Positive

6	Zero and Spa check ⁽¹⁾					
Parameter	u.d.m.	Full Scale set	Reference Value ZERO	AMS Measure ZERO	Reference Value SPAN	AMS Measure SPAN
CO	mg/Nm3	0	0	0	288,57	292
				0,2		291
				0		292
NO	mg/Nm3	0	0	0,2	256,98	239
				0		244
				0		246
SO ₂	mg/Nm3	0	0	0	140,77	138
				0,3		137
				0,2		137
O ₂	% Vol	0	0	0	16,707	16,33
				0		16,45
				0		16,53
CO ₂	% Vol	0	0	0	16,78	16,7
				0,2		16,7
				0		16,7
NH ₃	mg/Nm3	0	0	0	17,93	17,46
				0,1		17,48
				0		17,54
NO ₂	mg/Nm3	0	0	0,1	83,73	82,5
				0		79,76
				0		79,8
Notes / Comments: (*) Values recorded by linearity tests.						



7	<i>Linearity (*)</i>				
Parameter	Full Scale set	Slope (B)	Intercept (A)	d _{c,rel} [%]	Results
CO	0 - 300 mg/Nm3	1,001	-1,081	1,3	Positive
NO	0 - 300 mg/Nm3	0,950	0,011	4,1	Positive
SO ₂	0 - 2000 mg/Nm3	0,955	-1,574	0,2	Positive
O ₂	0 - 21 %vol	0,986	0,019	0,4	Positive
CO ₂	0 - 25 %vol	0,988	-0,162	1,2	Positive
NH ₃	0 - 30 mg/Nm3	0,942	0,180	1,5	Positive
NO ₂	0 - 100 mg/Nm3	0,969	-0,416	4,7	Positive
Notes / Comments: (*) Test recordings are in Annex 2.					

8	<i>Interferences</i>	
	Type of Verification	Result
a	The same interference reported in the QAL1 certificate has been evaluated. Interferences are evaluated by DG Tech by placing different concentrations of water vapor.	Positive

9	<i>Response time</i>	
	Type of Verification (visual)	Result
a	Response times were verified by directly setting the reference gas in the AMS and comparing the timing with those stated in QAL1.	Positive

Determination of homogeneity of the Sampling Point (Rif. 8.3 Determination of homogeneity - UNI EN 15259:2006)							
Point	Grid Sampling	Diameter	O ₂ [% vol] SRM	S _{grid} O ₂ SRM	O ₂ [% vol] AMS	S _{grid} O ₂ AMS	Result
1	9	1	12,05	0,02	11,28	0,03	Positive
2	29	1	12,01		11,24		
3	59	1	12,01		11,24		
4	141	1	12,03		11,22		
5	171	1	12,00		11,24		
6	191	1	12,03		11,26		
7							
8							
9							
10							
11	9	2	12,04		11,30		
12	29	2	12,05		11,24		
13	59	2	12,02		11,23		
14	141	2	12,06		11,26		
15	171	2	12,01		11,19		
16	191	2	12,04		11,23		
17							
18							
19							
20							

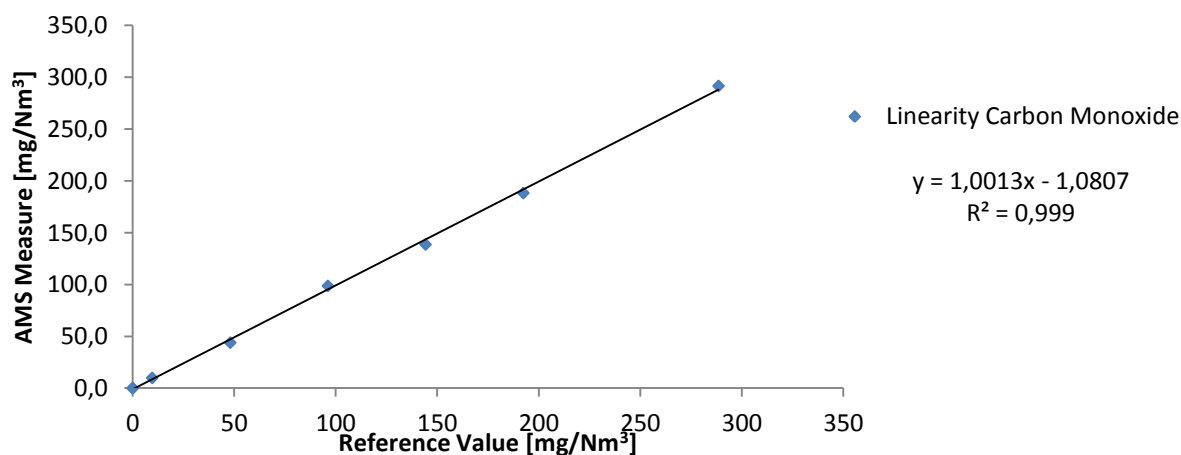


12 ANNEX 2 – TEST LINEARITY RESULTS

12.1 TEST LINEARITY OF CARBON MONOXIDE

Stack		6C		Data materials used					
Customer		D3 POWER GENERATION LIMITED		Cylinder Producer		SAPIO			
Parameter		CO		Serial/Certificate		P69313YDEN			
Analyzer		SICK MCS 100 E		Concentration		231	ppm		
Full Scale set		0- 300	mg/Nm3	Expiration		30/03/2019			
Date measurements		08/05/2017		Diluter		Beta CAP30RK			
Measurements and calculations									
CO mg/Nm3	Level	Reference Value (Y _i)	AMS Measure			X _c	Residual d _c	Relative Residual - % d _{c,rel}	Result
			Reply 1 (X _i)	Reply 2 (X _i)	Reply 3 (X _i)				
	0	0	0	0,2	0	0,1	1,15	0,4	Positive
	1	9,62	10,2	9,9	9,8	10,0	1,41	0,5	Positive
	2	48,09	44	44	43,9	44,0	-3,10	-1,0	Positive
	3	96,18	98,5	98,8	99	98,8	3,54	1,2	Positive
	4	144,28	140	137	139	138,7	-4,72	-1,6	Positive
	5	192,4	188	189	188	188,3	-3,23	-1,1	Positive
	6	288,57	292	291	292	291,7	3,81	1,3	Positive
	0	0	0,1	0,1	0	0,1	1,15	0,4	Positive
		Y _z	97,4	A'	96,4	B	1,001	A	-1,0807
	Legend								
Y _i : concentration of reference material; Xi: AMS measure corresponding to the Reference Material Concentration Level; Y _z : average concentration of reference material; A ': the mean value of the Instrument's readings (AMS); B: Linear regression line coefficient; A: Linear regression line intercept									

Carbon monoxide





12.2 TEST LINEARITY OF NITROGEN OXIDE

Stack	6C	Data materials used	
Customer	D3 POWER GENERATION LIMITED	Cylinder Producer	SAPIO
Parameter	NO	Serial/Certificate	P69313YDEN
Analyzer	SICK MCS 100 E	Concentration	288 ppm
Full Scale set	0- 300 mg/Nm ³	Expiration	30/03/2019
Date measurements	08/05/2017	Diluter	Beta CAP30RK

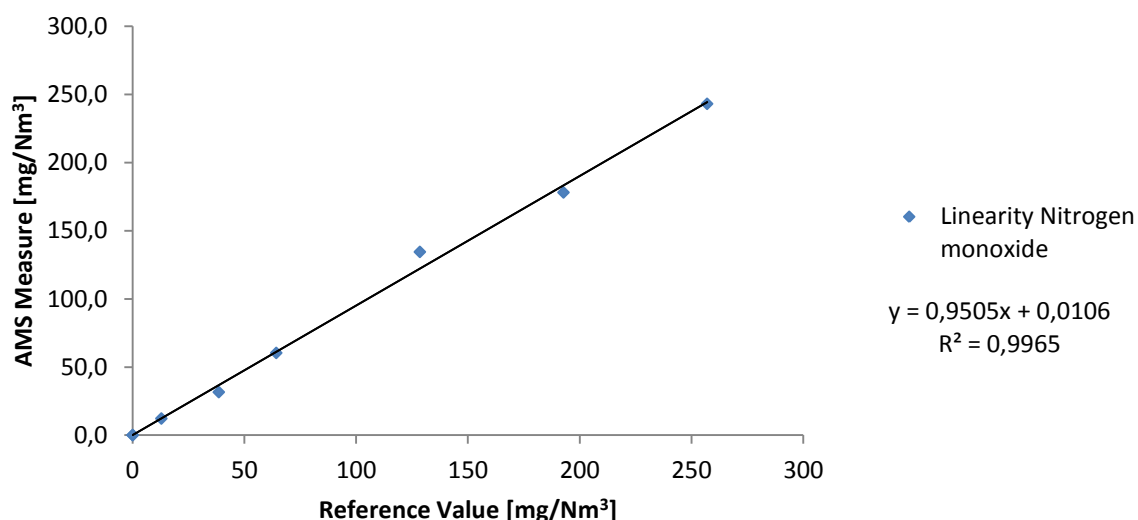
Measurements and calculations

NO mg/Nm ³	Level	Reference Value (Y _i)	AMS Measure			X _c	Residual d _c	Relative Residual - % d _{c,rel}	Result
			Reply 1 (X _i)	Reply 2 (X _i)	Reply 3 (X _i)				
	0	0	0,2	0	0	0,1	0,06	0,0	Positive
	1	12,84	12,3	12,2	12,1	12,2	-0,01	0,0	Positive
	2	38,54	31,6	31,5	31,6	31,6	-5,08	-1,7	Positive
	3	64,24	63,7	59,8	57,4	60,3	-0,77	-0,3	Positive
	4	128,49	133,2	134,8	135,2	134,4	12,26	4,1	Positive
	5	192,74	180	175	179	178,0	-5,21	-1,7	Positive
	6	256,98	239	244	246	243,0	-1,27	-0,4	Positive
	0	0	0,1	0	0	0,0	0,02	0,0	Positive
Y _z			86,7	A'	82,4	B	0,950	A	0,0106

Legend

Y_i: concentration of reference material;
X_i: AMS measure corresponding to the Reference Material Concentration Level;
Y_z: average concentration of reference material;
A': the mean value of the Instrument's readings (AMS);
B: Linear regression line coefficient;
A: Linear regression line intercept

Nitrogen monoxide





12.3 TEST LINEARITY OF NITROGEN DIOXIDE

Stack	6C		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	NO ₂		Serial/Certificate	P61YZ3YDFN
Analyzer	SICK MCS 100 E		Concentration	81,6 ppm
Full Scale set	0- 100	mg/Nm ³	Expiration	30/03/2018
Date measurements	08/05/2017		Diluter	Beta CAP30RK

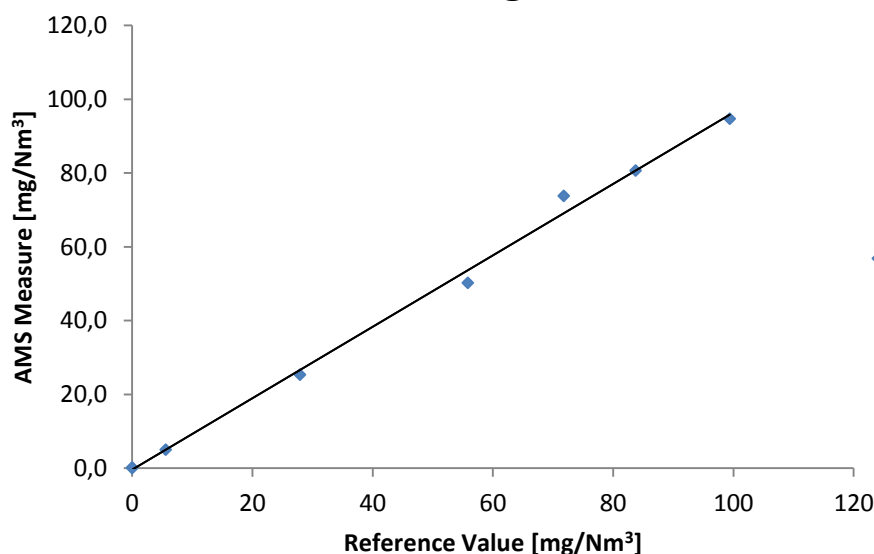
Measurements and calculations

NO ₂ mg/Nm ³	Level	Reference Value (Y _i)	AMS Measure			X _c	Residual d _c	Relative Residual - % d _{c,rel}	Result
			Reply 1 (X _i)	Reply 2 (X _i)	Reply 3 (X _i)				
	0	0	0,1	0	0	0,0	0,45	0,4	Positive
	1	5,58	4,98	5,1	5	5,0	0,04	0,0	Positive
	2	27,91	24,99	25,02	26,04	25,4	-1,27	-1,3	Positive
	3	55,82	50,28	50,33	50,12	50,2	-3,41	-3,4	Positive
	4	71,78	73,28	74,12	74,06	73,8	4,71	4,7	Positive
	5	83,73	82,5	79,76	79,8	80,7	0,00	0,0	Positive
	6	99,39	96,56	93,81	93,81	94,7	-1,13	-1,1	Positive
	0	0	0,2	0,2	0,2	0,2	0,62	0,6	Positive
		Y _z	43,0	A'	41,3	B	0,969	A	-0,4156

Legend

Y_i: concentration of reference material;
X_i: AMS measure corresponding to the Reference Material Concentration Level;
Y_z: average concentration of reference material;
A': the mean value of the Instrument's readings (AMS);
B: Linear regression line coefficient;
A: Linear regression line intercept

Nitrogen Dioxide



$$y = 0,9686x - 0,4156$$
$$R^2 = 0,9965$$



12.4 TEST LINEARITY OF SULFUR DIOXIDE

Stack	6C		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	SO ₂		Serial/Certificate	P69313YDEN
Analyzer	SICK MCS 100 E		Concentration	49,3 ppm
Full Scale set	0- 2000	mg/Nm ³	Expiration	30/03/2019
Date measurements	08/05/2017		Diluter	Beta CAP30RK

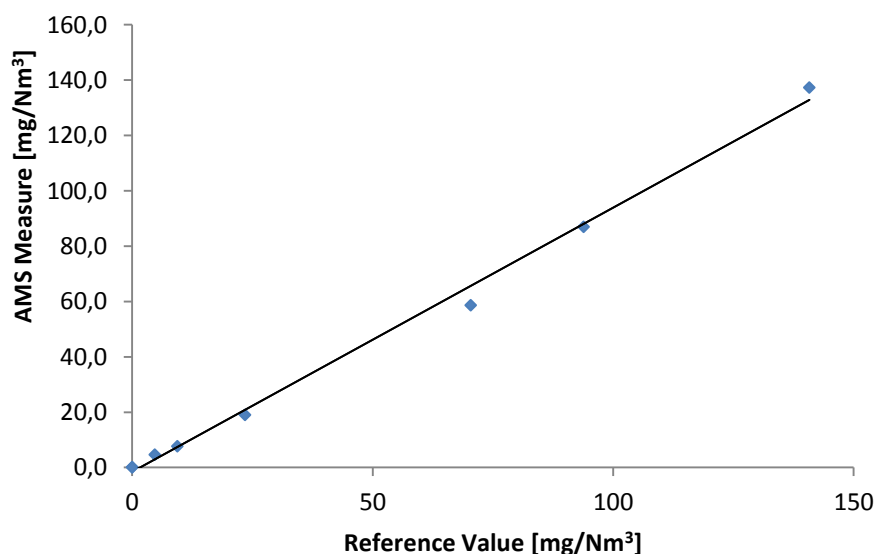
Measurements and calculations

SO ₂ mg/Nm ³	Level	Reference Value (Y _i)	AMS Measure			X _c	Residual d _c	Relative Residual - % d _{c,rel}	Result
			Reply 1 (X _i)	Reply 2 (X _i)	Reply 3 (X _i)				
	0	0	0	0,3	0,2	0,2	1,74	0,1	Positive
	1	4,7	5	4	5	4,7	1,75	0,1	Positive
	2	9,39	8	8,1	7	7,7	0,30	0,0	Positive
	3	23,46	19,2	19	18,9	19,0	-1,80	-0,1	Positive
	4	70,38	59	58	59	58,7	-6,99	-0,3	Positive
	5	93,85	87	88	86	87,0	-1,08	-0,1	Positive
	6	140,77	138	137	137	137,3	4,44	0,2	Positive
	0	0	0,1	0	0,1	0,1	1,64	0,1	Positive
		Y _z	42,8	A'	39,3	B	0,955	A	-1,5739

Legend

Y_i: concentration of reference material;
X_i: AMS measure corresponding to the Reference Material Concentration Level;
Y_z: average concentration of reference material;
A': the mean value of the Instrument's readings (AMS);
B: Linear regression line coefficient;
A: Linear regression line intercept

Sulfur dioxide



◆ Linearity Sulfur Dioxide

$$y = 0,9553x - 1,5739$$
$$R^2 = 0,9954$$



12.5 TEST LINEARITY OF OXYGEN

Stack	6C		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	O ₂		Serial/Certificate	P61LB2BDFN
Analyzer	SICK MCS 100 E		Concentration	25,06 %vol
Full Scale set	0- 21	%vol	Expiration	30/03/2020
Date measurements	08/05/2017		Diluter	Beta CAP30RK

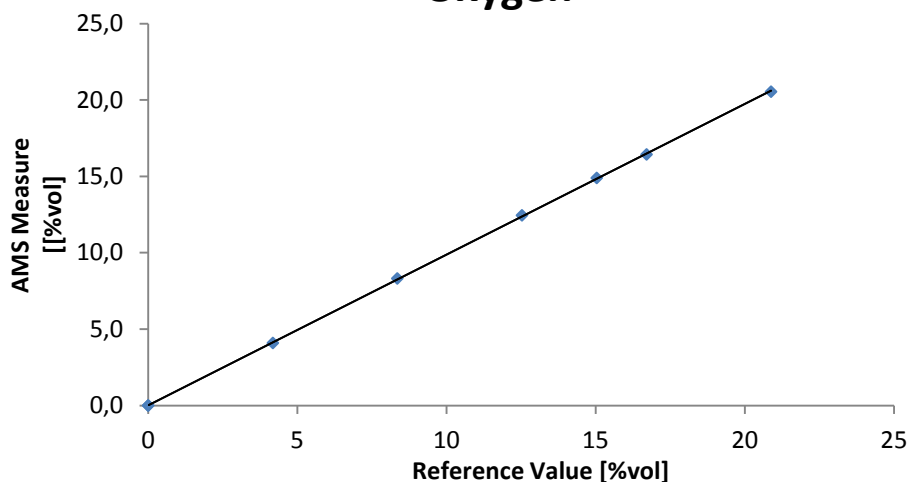
Measurements and calculations

O ₂ %vol	Level	Reference Value (Y _i)	AMS Measure			X _c	Residual d _c	Relative Residual - % d _{c,rel}	Result
			Reply 1 (X _i)	Reply 2 (X _i)	Reply 3 (X _i)				
	0	0	0	0	0	0,0	-0,02	-0,1	Positive
	1	4,18	3,92	4,18	4,18	4,1	-0,05	-0,2	Positive
	2	8,35	8,13	8,33	8,49	8,3	0,07	0,3	Positive
	3	12,53	12,36	12,45	12,54	12,5	0,08	0,4	Positive
	4	15,036	14,89	14,9	14,9	14,9	0,05	0,3	Positive
	5	16,707	16,33	16,45	16,53	16,4	-0,05	-0,3	Positive
	6	20,88	20,49	20,55	20,59	20,5	-0,06	-0,3	Positive
	0	0	0	0	0	0,0	-0,02	-0,1	Positive
		Y _z	9,7	A'	9,6	B	0,986	A	0,0190

Legend

Y_i: concentration of reference material;
X_i: AMS measure corresponding to the Reference Material Concentration Level;
Y_z: average concentration of reference material;
A': the mean value of the Instrument's readings (AMS);
B: Linear regression line coefficient;
A: Linear regression line intercept

Oxygen





12.6 TEST LINEARITY OF CARBON DIOXIDE

Stack	6C	Data materials used	
Customer	D3 POWER GENERATION LIMITED	Cylinder Producer	SAPIO
Parameter	CO ₂	Serial/Certificate	P69313YDEN
Analyzer	SICK MCS 100 E	Concentration	25,17 %vol
Full Scale set	0- 25 %vol	Expiration	30/03/2019
Date measurements	08/05/2017	Diluter	Beta CAP30RK

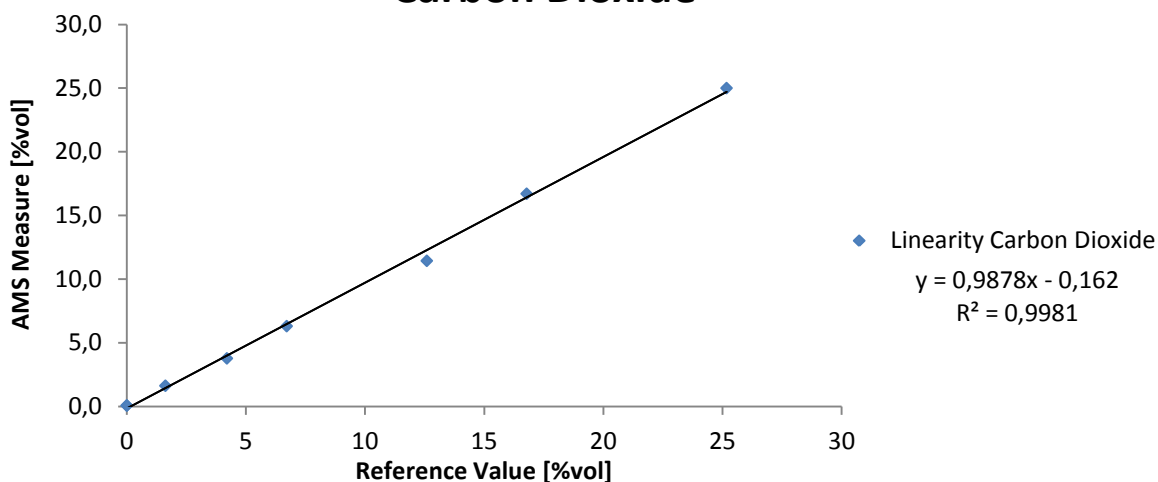
Measurements and calculations

CO ₂ %vol	Level	Reference Value (Y _i)	AMS Measure			X _c	Residual d _c	Relative Residual - % d _{c,rel}	Result
			Reply 1 (X _i)	Reply 2 (X _i)	Reply 3 (X _i)				
	0	0	0	0,2	0	0,1	0,23	0,9	Positive
	1	1,62	1,62	1,62	1,62	1,6	0,18	0,7	Positive
	2	4,2	3,77	3,77	3,77	3,8	-0,22	-0,9	Positive
	3	6,71	6,3	6,3	6,3	6,3	-0,17	-0,7	Positive
	4	12,59	11,5	11,4	11,4	11,4	-0,84	-3,4	Positive
	5	16,78	16,7	16,7	16,7	16,7	0,29	1,1	Positive
	6	25,17	25	25	25	25,0	0,30	1,2	Positive
	0	0	0,1	0,1	0	0,1	0,23	0,9	Positive
		Y _z	8,4	A'	8,1	B	0,988	A	-0,1620

Legend

Y_i: concentration of reference material;
X_i: AMS measure corresponding to the Reference Material Concentration Level;
Y_z: average concentration of reference material;
A': the mean value of the Instrument's readings (AMS);
B: Linear regression line coefficient;
A: Linear regression line intercept

Carbon Dioxide





12.7 TEST LINEARITY OF AMMONIA

Stack	6C		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	NH ₃		Serial/Certificate	P61AR3YDFN
Analyzer	SICK MCS 100 E		Concentration	47,3 ppm
Full Scale set	0- 30	mg/Nm ³	Expiration	30/09/2017
Date measurements	08/05/2017		Diluter	Beta CAP30RK

Measurements and calculations

g/Nm3	Level	Reference Value (Y _i)	AMS Measure			X _c	Residual d _c	Relative Residual - % d _{c,rel}	Result
			Reply 1 (X _i)	Reply 2 (X _i)	Reply 3 (X _i)				
	0	0	0	0,1	0	0,0	-0,15	-0,5	Positive
	1	2,39	2,94	2,72	2,7	2,8	0,36	1,2	Positive
	2	5,98	5,29	5,2	5,25	5,2	-0,57	-1,9	Positive
	3	11,96	11,89	11,92	11,85	11,9	0,44	1,5	Positive
	4	17,93	17,46	17,48	17,54	17,5	0,42	1,4	Positive
	5	23,92	22,59	22,89	22,97	22,8	0,10	0,3	Positive
	6	29,9	27,82	27,95	28	27,9	-0,43	-1,4	Positive
	0	0	0	0	0	0,0	-0,18	-0,6	Positive
	Y _c	11,5	A'	11,0	B	0,942	A	0,1798	



13 ANNEX 3 - TEST REPORT

13.1 DETERMINATION OF THE VELOCITY PROFILE

Sampling and Analysis Report - Velocity Profile							
Determination of Velocity				UNI EN ISO 16911-1:2013 Annex A			
Auxiliary Parameters							
Oxygen (O ₂)				UNI EN 14789:2006			
Temperature				UNI EN ISO 16911-1:2013 Annex A			
Pressure				UNI EN ISO 16911-1:2013 Annex A			
Water vapor				UNI EN 14790:2006			
Information on the instrumentation and materials used for sampling and analysis							
Instrumentation							
Speed and Flow Meter		DADO LAB	ST55AA20160199	DADO LAB - ST5 V8.5			
Gas Analyzer		Horiba	MY25EG2X	Analizzatore Horiba PG-350E			
Pitot Tube		Zambelli	91126	k =0,8304; Type Pitot (S)			
Emission Point Information							
Stack Diameter [m]		2,00	Height from Ground[m]			65	
Stack Surface [m ²]		3,14	Height from sampling point to the ground [m]			25	
Technical personnel who performed the sampling							
Dott. Giorgio Rocchia							
Ing. Calogero Romano							
Determination of the velocity profile							17/04/2017
Point	Diameter	Grid Sampling	Temperatura [°C]	Δpi [Pa]	Velocity [m/s]	Auxiliary Parameter	
1	1	9	165	258,9	21,3	Oxygen [% vol]	12,1
2	1	29	164	259,2	21,3		
3	1	59	165	257,1	21,3		
4	1	141	164	258,0	21,3	Carbon dioxide [%vol]	4,5
5	1	171	165	257,2	21,3		
6	1	191	164	256,0	21,2		
7						Water vapor [% vol]	8,30
8							
9							
10						Density - ρ (Kg/m ³)	1,302
11	2	9	165	257,0	21,2		
12	2	29	165	257,0	21,2		
13	2	59	165	258,1	21,3	Pressione Emissione [kPa]	101
14	2	141	165	257,2	21,3		
15	2	171	165	258,3	21,3		
16	2	191	164	258,0	21,3	Ambient Temperature [°C]	25
17							
18							
19						Ambient Pressure [hPa]	1011
20							



Determination of the velocity profile							11/05/2017	
Point	Diameter	Grid Sampling	Temperatura [°C]	Δpi [Pa]	Velocity [m/s]	Auxiliary Parameter		
1	1	9	163	242,0	20,2	Oxygen [% vol]	12,4	
2	1	29	164	249,1	20,6			
3	1	59	163	248,2	20,5			
4	1	141	163	247,0	20,4	Carbon dioxide [%vol]	4,1	
5	1	171	163	247,2	20,5			
6	1	191	163	247,3	20,5			
7						Water vapor [% vol]	0,93	
8								
9								
10						Density - ρ (Kg/m³)	1,300	
11	2	9	164	247,3	20,5			
12	2	29	164	247,4	20,5			
13	2	59	163	248,0	20,5	Pressione Emissione [kPa]	102	
14	2	141	162	248,5	20,5			
15	2	171	163	249,0	20,5			
16	2	191	161	249,0	20,5	Ambient Temperature [°C]	28	
17								
18								
19						Ambient Pressure [hPa]	1011	
20								
Determination of the velocity profile							17/05/2017	
Point	Diameter	Grid Sampling	Temperatura [°C]	Δpi [Pa]	Velocity [m/s]	Auxiliary Parameter		
1	1	9	163	87,8	12,2	Oxygen [% vol]	13,0	
2	1	29	163	88,0	12,2			
3	1	59	163	87,9	12,2			
4	1	141	164	88,6	12,2	Carbon dioxide [%vol]	4,3	
5	1	171	165	88,9	12,3			
6	1	191	166	88,0	12,2			
7						Water vapor [% vol]	0,92	
8								
9								
10						Density - ρ (Kg/m³)	1,303	
11	2	9	165	88,8	12,3			
12	2	29	166	89,1	12,3			
13	2	59	164	89,5	12,3	Pressione Emissione [kPa]	102	
14	2	141	163	89,6	12,3			
15	2	171	164	88,0	12,2			
16	2	191	162	88,6	12,2	Ambient Temperature [°C]	32	
17								
18								
19						Ambient Pressure [hPa]	102	
20								



13.2 DUST REPORT

Sampling and Analysis Report - Dust							
Dust				UNI EN 13284 - 1 : 2003			
Auxiliary Parameters							
Velocity and Flow				UNI EN ISO 16911-1:2013 Annex A			
Oxygen (O ₂)				UNI EN 14789:2006			
Temperature				UNI EN ISO 16911-1:2013 Annex A			
Pressure				UNI EN ISO 16911-1:2013 Annex A			
Water vapor				UNI EN 14790:2006			
Information on the instrumentation and materials used for sampling and analysis							
Instrumentation							
Isokinetic Sampler		DADO LAB	ST55AA20160199	DADO LAB - ST5 V8.5			
Gas Analyzer		Horiba	MY25EG2X	Analizzatore Horiba PG-350E			
Pitot Tube		Zambelli	91126	k =0,8304; Type Pitot (S)			
Sampling material							
Filter Material		Glass Fiber Filter		Diameter [mm]		47	
Filtration Temperature		Stack Temperature		Conditioning Temperature [° C]		180	
Technical personnel who performed the sampling							
Dott. Giorgio Rocchia							
Ing. Calogero Romano							
Dust - Sampling and analysis Data							1
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Filter Code	Dust mass on the filter [mg]	Dust mass in the Rinsing solution [mg]	Sampling Volume [Nm ³] ⁽¹⁾
Method Blank		10/05/2017	/	FE92	0,00	0,03	1,000
2123746-001	Reply 1	10/05/2017 13:59	60	FE93	1,18	0,03	0,753
2123746-002	Reply 2	10/05/2017 14:59	60	FE94	0,85	0,05	0,690
2123746-003	Reply 3	10/05/2017 15:59	60	FE95	1,02	0,05	1,287
2123746-004	Reply 4	10/05/2017 17:59	60	FE96	1,00	0,05	0,972
2123746-005	Reply 5	10/05/2017 18:59	60	FE97	1,01	0,06	0,991
Method Blank		11/05/2017	/	FE98	0,00	0,05	1,000
2123746-006	Reply 1	11/05/2017 09:59	60	FE99	0,72	0,05	1,168
2123746-007	Reply 2	11/05/2017 10:59	60	FF00	0,88	0,06	1,148
2123746-008	Reply 3	11/05/2017 11:59	60	FF01	0,90	0,03	1,226
2123746-009	Reply 4	11/05/2017 12:59	60	FF02	2,88	0,04	1,209
2123746-010	Reply 5	11/05/2017 13:59	60	FF03	0,90	0,04	1,156
Method Blank		17/05/2017	/	FF22	0,00	0,04	1,000
2123746-011	Reply 1	17/05/2017 14:59	60	FF23	1,23	0,04	0,997
2123746-012	Reply 2	17/05/2017 15:59	60	FF24	1,44	0,04	0,869
2123746-013	Reply 3	17/05/2017 16:59	60	FF25	0,55	0,04	0,995
2123746-014	Reply 4	17/05/2017 17:59	60	FF26	0,80	0,05	0,955
2123746-015	Reply 5	17/05/2017 18:59	60	FF27	1,09	0,05	0,998

⁽¹⁾ For Blanks of the method is considered a volume of 1 m³



Dust - Sampling and analysis Data							2
I.D. Sample	Stack Speed [m/s]	Temperature [°C]	Pressure [kPa]	H ₂ O [%v/v]	O ₂ [%v/v]	Dust Concentration [mg/Nm ³] ⁽²⁾	Dust Concentration correct with O ₂ [mg/Nm ³] ⁽³⁾
Method Blank	/	163,00	101,2	9,19	12,34	0,03	0,02
2123746-001	12,35	165,40	101,2	8,28	12,01	1,61	1,08
2123746-002	16,43	164,40	101,1	9,21	12,00	1,31	0,87
2123746-003	38,29	165,70	101,1	8,43	12,07	0,83	0,56
2123746-004	24,08	165,60	100,9	10,92	12,16	1,09	0,74
2123746-005	24,65	165,50	100,8	9,05	12,23	1,08	0,74
Method Blank	/	163,00	101,2	9,19	12,34	0,05	0,04
2123746-006	20,24	163,10	100,6	9,97	12,39	0,66	0,46
2123746-007	20,96	163,10	100,8	10,24	12,42	0,82	0,57
2123746-008	20,85	161,80	100,8	8,10	12,33	0,76	0,53
2123746-009	20,90	163,10	100,9	9,62	12,33	2,41	1,68
2123746-010	20,94	162,65	100,7	10,50	12,34	0,81	0,56
Method Blank	/	163,00	101,2	9,19	12,34	0,04	0,03
2123746-011	12,39	161,31	101,7	10,85	12,71	1,28	0,92
2123746-012	10,84	164,20	101,5	8,70	12,51	1,70	1,20
2123746-013	13,91	160,77	101,5	7,29	12,51	0,59	0,42
2123746-014	11,79	159,37	101,5	8,36	12,52	0,89	0,63
2123746-015	12,40	159,56	101,5	8,38	12,56	1,15	0,82
⁽²⁾ Dust Concentration (Wet).							
⁽³⁾ Dust Concentration (Dry), normalized for temperature and pressure and corrected for reference oxygen.							
Dust - Quality Control (QC)							3
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Iso rate [%] ⁽⁴⁾	Result	Dust Concentration correct with O ₂ [mg/Nm ³] - Blank	Result ⁽⁵⁾
Method Blank		10/05/2017	/			0,02	Positive
2123746-001	Reply 1	10/05/2017 13:59	60	-1,8	Positive		
2123746-002	Reply 2	10/05/2017 14:59	60	-3,7	Positive		
2123746-003	Reply 3	10/05/2017 15:59	60	-1,7	Positive		
2123746-004	Reply 4	10/05/2017 17:59	60	-0,1	Positive		
2123746-005	Reply 5	10/05/2017 18:59	60	-0,1	Positive		
Method Blank		11/05/2017	/			0,04	Positive
2123746-006	Reply 1	11/05/2017 09:59	60	-0,1	Positive		
2123746-007	Reply 2	11/05/2017 10:59	60	-3,2	Positive		
2123746-008	Reply 3	11/05/2017 11:59	60	-0,1	Positive		
2123746-009	Reply 4	11/05/2017 12:59	60	-1,5	Positive		
2123746-010	Reply 5	11/05/2017 13:59	60	-5	Positive		
Method Blank		17/05/2017	/			0,03	Positive
2123746-011	Reply 1	17/05/2017 14:59	60	0	Positive		
2123746-012	Reply 2	17/05/2017 15:59	60	0	Positive		
2123746-013	Reply 3	17/05/2017 16:59	60	0	Positive		
2123746-014	Reply 4	17/05/2017 17:59	60	0	Positive		
2123746-015	Reply 5	17/05/2017 18:59	60	0	Positive		
⁽⁴⁾ Dust sampling must be done in isocinetics. The isocinetic value must be within the Range -5% <G <+ 15%.							
⁽⁵⁾ Dust concentration in Method Blank must be less than 10% of the emission limit - ELV (paragraph 10.6 of UNI EN 13284-1: 2003 standard).							



13.3 COMBUSTION GAS REPORT

Nitrogen Oxides, Carbon Monoxide, Sulfur Dioxide, Oxygen and Carbon Dioxide - Sampling and Analysis Report					
Oxygen (O ₂)					UNI EN 14789:2017
Nitrogen Oxide (NO)					UNI EN 14792:2017
Carbon Monoxide (CO)					UNI EN 15058:2017
Sulfur Dioxide (SO ₂)					ISO 11042-1:1996
Carbon Dioxide (CO ₂)					ISO 11042-1:1996
Information on the instrumentation used for sampling and analysis					
Instrumentation					
Analizzatore Gas		Horiba		MY25EG2X	Analizzatore Horiba PG-350E
Technical personnel who performed the sampling					
Dott. Giorgio Rocchia					
Ing. Calogero Romano					
Determination of Nitrogen Oxides (NO_x) - Sampling and analysis Data					1
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Nitrogen Oxide (NO) - [mg/Nm ³] (2)	Oxygen (O ₂) - [%vol] ⁽¹⁾
2123746-001	Reply 1	10/05/2017 13:59	60	16,69	12,01
2123746-002	Reply 2	10/05/2017 14:59	60	17,37	12,00
2123746-003	Reply 3	10/05/2017 15:59	60	16,70	12,07
2123746-004	Reply 4	10/05/2017 18:59	60	11,98	12,23
2123746-005	Reply 5	10/05/2017 19:59	60	9,61	12,31
2123746-006	Reply 6	11/05/2017 09:59	60	6,59	12,39
2123746-007	Reply 7	11/05/2017 10:59	60	6,62	12,42
2123746-008	Reply 8	11/05/2017 17:59	60	6,64	12,93
2123746-009	Reply 9	11/05/2017 18:59	60	13,75	12,41
2123746-010	Reply 10	11/05/2017 19:59	60	12,71	12,33
2123746-011	Reply 11	17/05/2017 12:59	60	93,24	13,38
2123746-012	Reply 12	17/05/2017 14:59	60	30,74	12,71
2123746-013	Reply 13	17/05/2017 15:59	60	17,54	12,51
2123746-014	Reply 14	17/05/2017 16:59	60	17,33	12,51
2123746-015	Reply 15	17/05/2017 17:59	60	17,85	12,52
Notes:					
(1) The oxygen value reported refers to the same measurement period of the parameter on which QAL2 (NO _x) is performed.					
(2) The Nitric Oxide (NO _x) value is not corrected for the reference oxygen, is normalized by temperature and pressure and is expressed on a dry basis.					



Determination of Carbon Monoxide (CO) - Sampling and analysis Data					2
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Carbon Monoxide (CO) - [mg/Nm ³]	Oxygen (O ₂) - [%vol] ⁽¹⁾
2123746-001	Reply 1	10/05/2017 13:59	60	2,67	12,01
2123746-002	Reply 2	10/05/2017 14:59	60	2,81	12,00
2123746-003	Reply 3	10/05/2017 15:59	60	2,89	12,07
2123746-004	Reply 4	10/05/2017 18:59	60	3,30	12,23
2123746-005	Reply 5	10/05/2017 19:59	60	3,21	12,31
2123746-006	Reply 6	11/05/2017 11:59	60	1,68	12,33
2123746-007	Reply 7	11/05/2017 12:59	60	1,67	12,33
2123746-008	Reply 8	11/05/2017 13:59	60	1,55	12,34
2123746-009	Reply 9	11/05/2017 14:59	60	1,72	12,36
2123746-010	Reply 10	11/05/2017 15:59	60	1,56	13,02
2123746-011	Reply 11	17/05/2017 13:59	60	2,42	12,46
2123746-012	Reply 12	17/05/2017 14:59	60	2,28	12,71
2123746-013	Reply 13	17/05/2017 15:59	60	2,44	12,51
2123746-014	Reply 14	17/05/2017 16:59	60	2,37	12,51
2123746-015	Reply 15	17/05/2017 17:59	60	2,30	12,52
Notes: (1) The oxygen value reported refers to the same measurement period of the parameter on which QAL2 (CO) is performed. (2) The carbon monoxide (CO) value is not corrected for the reference oxygen, is normalized by temperature and pressure and is expressed on a dry basis.					

Determination of Sulfur Dioxide (SO ₂) - Sampling and analysis Data					3
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Sulfur Dioxide (SO ₂) - [mg/Nm ³]	Oxygen (O ₂) - [%vol] ⁽¹⁾
2123746-001	Reply 1	10/05/2017 13:59	60	< 1	12,01
2123746-002	Reply 2	10/05/2017 14:59	60	< 1	12,00
2123746-003	Reply 3	10/05/2017 15:59	60	< 1	12,07
2123746-004	Reply 4	10/05/2017 18:59	60	< 1	12,23
2123746-005	Reply 5	10/05/2017 19:59	60	< 1	12,31
2123746-006	Reply 6	11/05/2017 09:59	60	< 1	12,39
2123746-007	Reply 7	11/05/2017 10:59	60	< 1	12,42
2123746-008	Reply 8	11/05/2017 17:59	60	< 1	12,93
2123746-009	Reply 9	11/05/2017 18:59	60	< 1	12,41
2123746-010	Reply 10	11/05/2017 19:59	60	< 1	12,33
2123746-011	Reply 11	17/05/2017 12:59	60	< 1	13,38
2123746-012	Reply 12	17/05/2017 14:59	60	< 1	12,71
2123746-013	Reply 13	17/05/2017 15:59	60	< 1	12,51
2123746-014	Reply 14	17/05/2017 16:59	60	< 1	12,51
2123746-015	Reply 15	17/05/2017 17:59	60	< 1	12,52
Notes: (1) The oxygen value reported refers to the same measurement period of the parameter on which QAL2 (SO ₂) is performed. (2) The sulfur dioxide (SO ₂) value is not corrected for the reference oxygen, is normalized by temperature and pressure and is expressed on a dry basis.					



Determination of Oxygen (O ₂) - Sampling and analysis Data				3
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Oxygen (O ₂) - [%vol] ⁽¹⁾
2123746-001	Reply 1	10/05/2017 13:59	60	12,01
2123746-002	Reply 2	10/05/2017 14:59	60	12,00
2123746-003	Reply 3	10/05/2017 15:59	60	12,07
2123746-004	Reply 4	10/05/2017 18:59	60	12,23
2123746-005	Reply 5	10/05/2017 19:59	60	12,31
2123746-006	Reply 6	11/05/2017 09:59	60	12,39
2123746-007	Reply 7	11/05/2017 10:59	60	12,42
2123746-008	Reply 8	11/05/2017 17:59	60	12,93
2123746-009	Reply 9	11/05/2017 18:59	60	12,41
2123746-010	Reply 10	11/05/2017 19:59	60	12,33
2123746-011	Reply 11	17/05/2017 12:59	60	13,38
2123746-012	Reply 12	17/05/2017 14:59	60	12,71
2123746-013	Reply 13	17/05/2017 15:59	60	12,51
2123746-014	Reply 14	17/05/2017 16:59	60	12,51
2123746-015	Reply 15	17/05/2017 17:59	60	12,52
Notes: (1) The Oxygen value reported refers to the values used to construct the QAL2 calibration function.				

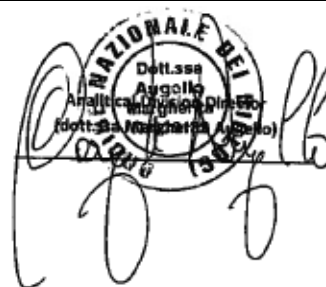
Determination of Carbon Dioxide (CO ₂) - Sampling and analysis Data				4
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Carbon Dioxide (CO ₂) - [%vol] ⁽¹⁾
2123746-001	Reply 1	10/05/2017 13:59	60	12,01
2123746-002	Reply 2	10/05/2017 14:59	60	12,01
2123746-003	Reply 3	10/05/2017 15:59	60	12,01
2123746-004	Reply 4	10/05/2017 18:59	60	12,01
2123746-005	Reply 5	10/05/2017 19:59	60	12,01
2123746-006	Reply 6	11/05/2017 09:59	60	12,01
2123746-007	Reply 7	11/05/2017 10:59	60	12,01
2123746-008	Reply 8	11/05/2017 17:59	60	12,01
2123746-009	Reply 9	11/05/2017 18:59	60	12,01
2123746-010	Reply 10	11/05/2017 19:59	60	12,01
2123746-011	Reply 11	17/05/2017 12:59	60	12,01
2123746-012	Reply 12	17/05/2017 14:59	60	12,01
2123746-013	Reply 13	17/05/2017 15:59	60	12,01
2123746-014	Reply 14	17/05/2017 16:59	60	12,01
2123746-015	Reply 15	17/05/2017 17:59	60	12,01
Notes: (1) The value of Carbon Dioxide reported refers to the values used to construct the QAL2 calibration function.				



13.4 AMMONIA REPORT

Sampling and Analysis Report - Ammonia							
Ammonia				EPA CTM 027:1997			
Auxiliary Parameter							
Velocity and Flow				UNI EN ISO 16911-1:2013 Annex A			
Oxygen (O ₂)				UNI EN 14789:2006			
Temperature				UNI EN ISO 16911-1:2013 Annex A			
Pressure				UNI EN ISO 16911-1:2013 Annex A			
Water vapor				UNI EN 14790:2006			
Information on the instrumentation and materials used for sampling and analysis							
Instrumentation							
Isokinetic Sampler		DADO LAB	ST55AA20160199	DADO LAB - ST5 V8.5			
Gas Analyzer		Horiba	MY25EG2X	Analizzatore Horiba PG-350E			
Pitot Tube		Zambelli	91126	k = 0,8304; Type Pitot (S)			
Sampling material							
Filter Material		Glass Fiber Filter		Absorption solution		H ₂ SO ₄ - 0,1 N	
Filtration Temperature		Stack Temperature		Conditioning Temperature [° C]		180	
Technical personnel who performed the sampling							
Dott. Giorgio Rocchia							
Ing. Calogero Romano							
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Sampling Volume [Nm ³] ⁽¹⁾	Impinger G1 [mg]	Impinger G2 [mg]	Concentration [mg/Nm ³]
Method Blank		10/05/2017	/	/	0,000	0,000	/
2123746-001	Reply 1	10/05/2017 13:59	60	0,753	0,000	0,000	0,00
2123746-002	Reply 2	10/05/2017 14:59	60	0,690	0,450	0,080	0,77
2123746-003	Reply 3	10/05/2017 15:59	60	1,287	0,230	0,120	0,27
2123746-004	Reply 4	10/05/2017 17:59	60	0,972	0,200	0,100	0,31
2123746-005	Reply 5	10/05/2017 18:59	60	0,991	0,130	0,110	0,24
Method Blank		11/05/2017	/	/	0,000	0,000	/
2123746-006	Reply 6	11/05/2017 09:59	60	1,168	0,060	0,000	0,05
2123746-007	Reply 7	11/05/2017 10:59	60	1,148	0,000	0,000	0,00
2123746-008	Reply 8	11/05/2017 11:59	60	1,226	0,000	0,000	0,00
2123746-009	Reply 9	11/05/2017 12:59	60	1,209	0,120	0,000	0,10
2123746-010	Reply 10	11/05/2017 13:59	60	1,156	0,000	0,000	0,00
Method Blank		17/05/2017	/	/	0,000	0,000	/
2123746-011	Reply 11	17/05/2017 14:59	60	0,997	0,170	0,000	0,17
2123746-012	Reply 12	17/05/2017 15:59	60	0,869	0,200	0,000	0,23
2123746-013	Reply 13	17/05/2017 16:59	60	0,995	0,110	0,000	0,11
2123746-014	Reply 14	17/05/2017 17:59	60	0,955	0,060	0,000	0,06
2123746-015	Reply 15	17/05/2017 18:59	60	0,998	0,110	0,000	0,11

⁽¹⁾ For Blanks of the method is considered a volume of 1 m³

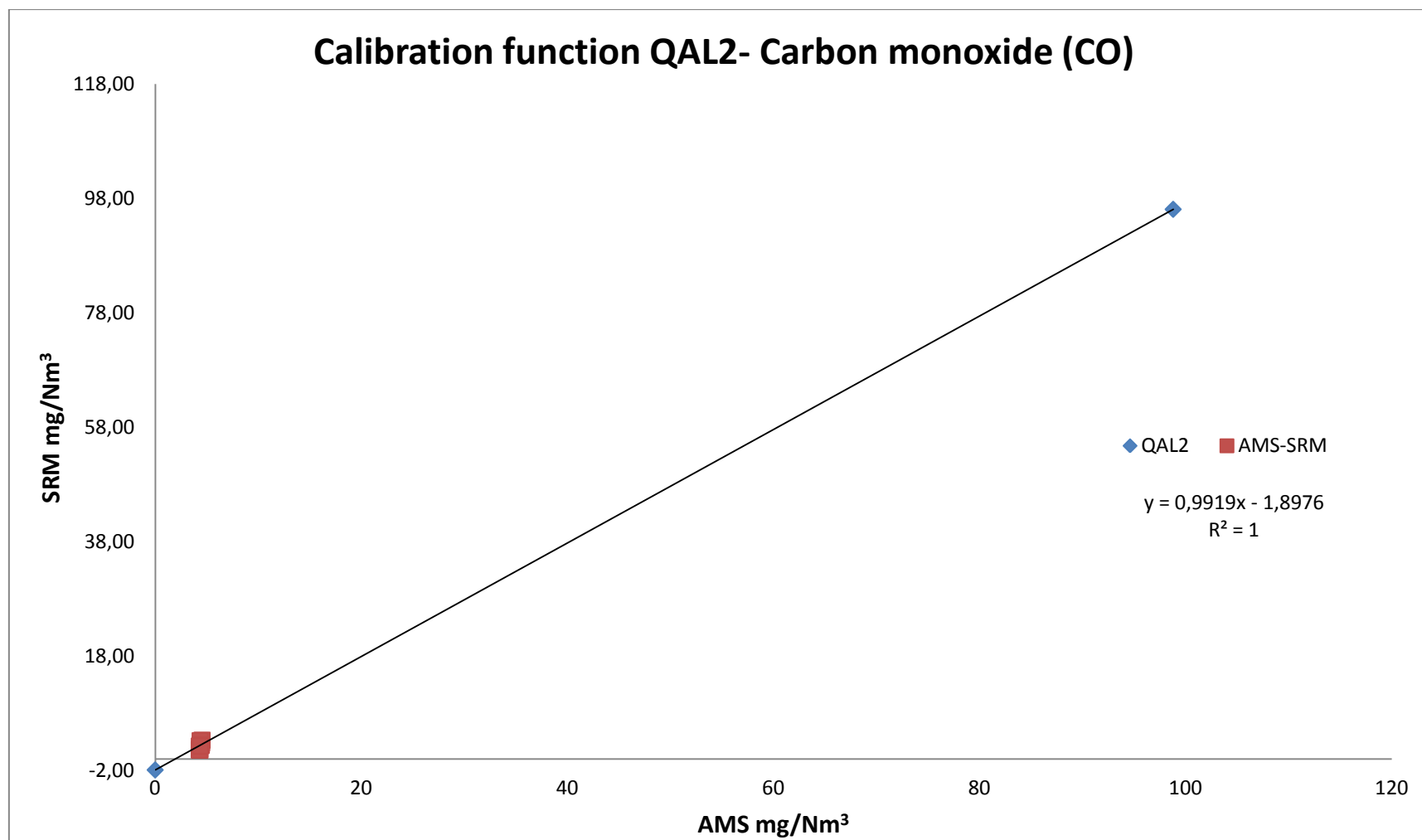




14 ANNEX 4 - QAL2 REPORT

14.1 CARBON MONOXIDE - QAL2

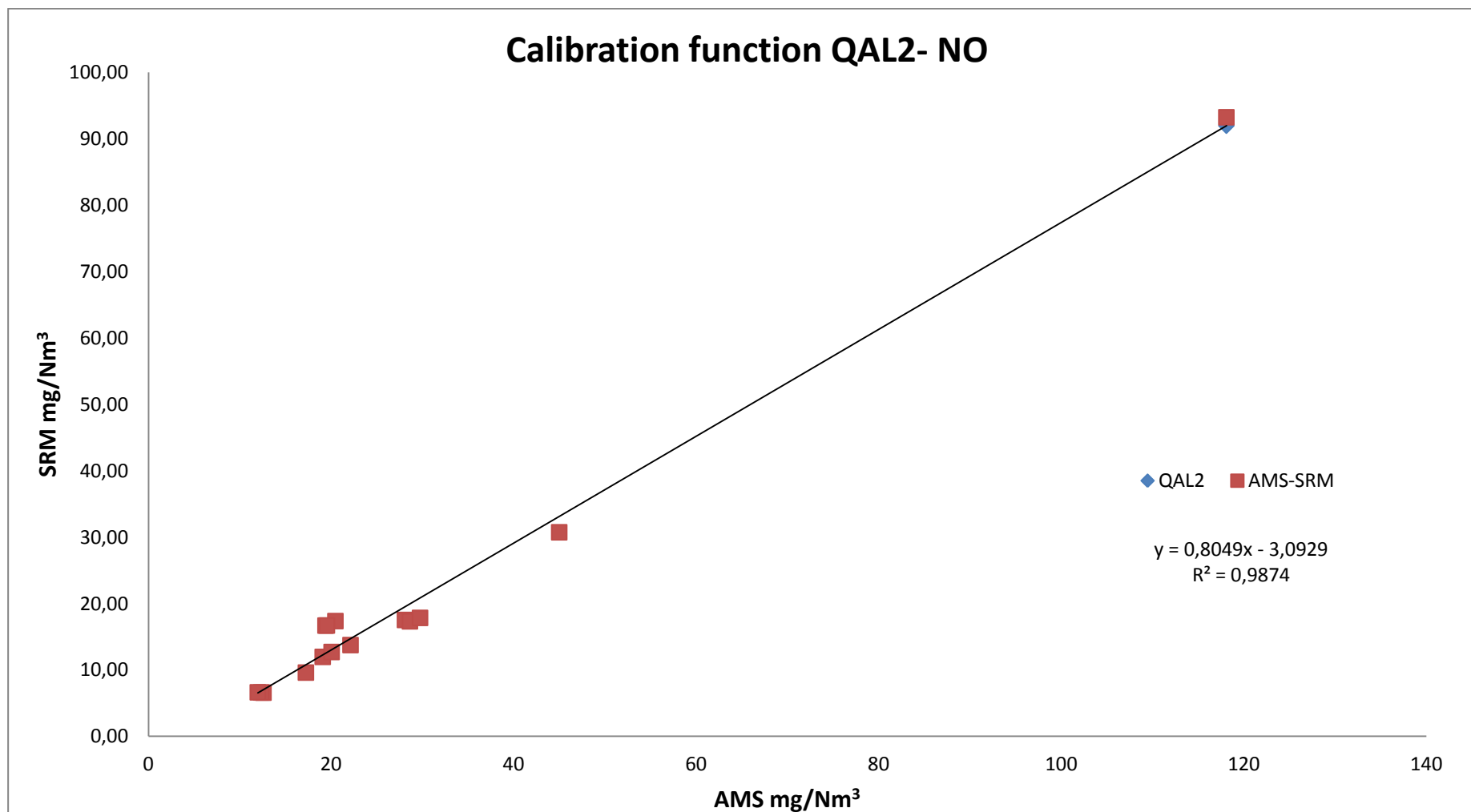
Parameter				CO		Emission Point			6C								
O ₂ rif %	15	SRM				AMS							Calculations				
N. Test	DATE/TIME	Y _i	Yi-Ym	O ₂	Y _{I,s}	x _i	O ₂	xi-xm	(xi-xm) ²	(xi-xm)*(Yi-Ym)	ŷ _i	ŷ _{I,s}	D _i = y _{i,s} -ŷ _{i,s}	D _i -đ	(D _i -đ) ²		
1	10/5/17 13:59	2,67	-5,04	12,01	1,78	4,43	11,24	-5,25	27,60	26,50	2,50	1,54	0,24	0,15	0,02		
2	10/5/17 14:59	2,81	-4,90	12,00	1,88	4,49	11,13	-5,19	26,97	25,43	2,56	1,55	0,32	0,22	0,05		
3	10/5/17 15:59	2,89	-4,82	12,07	1,94	4,49	11,11	-5,19	26,94	25,01	2,56	1,55	0,39	0,29	0,08		
4	10/5/17 18:59	3,30	-4,41	12,23	2,26	4,55	11,16	-5,14	26,38	22,64	2,61	1,59	0,66	0,57	0,32		
5	10/5/17 19:59	3,21	-4,50	12,31	2,22	4,37	11,24	-5,32	28,30	23,91	2,43	1,49	0,72	0,63	0,39		
6	11/5/17 11:59	1,68	-6,03	12,33	1,16	4,28	11,16	-5,41	29,26	32,61	2,34	1,43	-0,27	-0,36	0,13		
7	11/5/17 12:59	1,67	-6,04	12,33	1,15	4,28	11,14	-5,40	29,21	32,64	2,35	1,43	-0,27	-0,37	0,14		
8	11/5/17 13:59	1,55	-6,15	12,34	1,08	4,30	11,15	-5,38	28,99	33,14	2,37	1,44	-0,37	-0,46	0,21		
9	11/5/17 14:59	1,72	-5,99	12,36	1,19	4,33	11,15	-5,35	28,62	32,05	2,40	1,46	-0,27	-0,37	0,14		
10	11/5/17 15:59	1,56	-6,14	13,02	1,18	4,34	11,16	-5,35	28,59	32,85	2,41	1,47	-0,29	-0,39	0,15		
11	17/5/17 13:59	2,42	-5,29	12,46	1,70	4,48	11,51	-5,21	27,12	27,57	2,54	1,61	0,09	-0,01	0,00		
12	17/5/17 14:59	2,28	-5,43	12,71	1,65	4,29	11,75	-5,40	29,11	29,30	2,36	1,53	0,12	0,02	0,00		
13	17/5/17 15:59	2,44	-5,27	12,51	1,72	4,40	11,63	-5,28	27,88	27,82	2,47	1,58	0,14	0,05	0,00		
14	17/5/17 16:59	2,37	-5,34	12,51	1,68	4,35	11,60	-5,34	28,51	28,49	2,41	1,54	0,14	0,04	0,00		
15	17/5/17 17:59	2,30	-5,41	12,52	1,62	4,36	11,39	-5,32	28,30	28,80	2,43	1,52	0,11	0,01	0,00		
16	zero	0,00	-7,71	15,00	0,00	0,10	15,00	-9,58	91,87	73,89	-1,80	-1,80					
17	span	96,18	88,47	15,00	96,18	98,80	15,00	89,12	7941,50	7884,10	96,10	96,10					
Average												0,10					
Sum									8455,15	8386,75			1,64				
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		110	Yaverage	7,71	x average	9,68	Z	/	Procedure for the determination of the calibration fuction								
15% ELV [mg/Nm3 rif O ₂]		16,5	m	0,992	i	-1,898	r	0,99956	Method C				Calibration Function				
Ys Max-Ys min		1,18	ŷs, max	1,61	Calibration Range				0 - 22 [mg/Nm3 rif O2]				Y= 0,992X -1,897				
Test of Variability																	
Maximum permissible uncertainty (95% confidence interval)		10	Test value for variability (k _v)		0,9761	σ0kv		5,478	Result of Variability Test (s ₀ ≤σ0kv)								
Standard Deviation of the difference D _i - (S ₀)		0,342647	Standard Deviation (σ ₀)		5,61	Experimental Confidence interval [%]		0,61	Positive								





14.2 NITROGEN OXIDE - QAL2

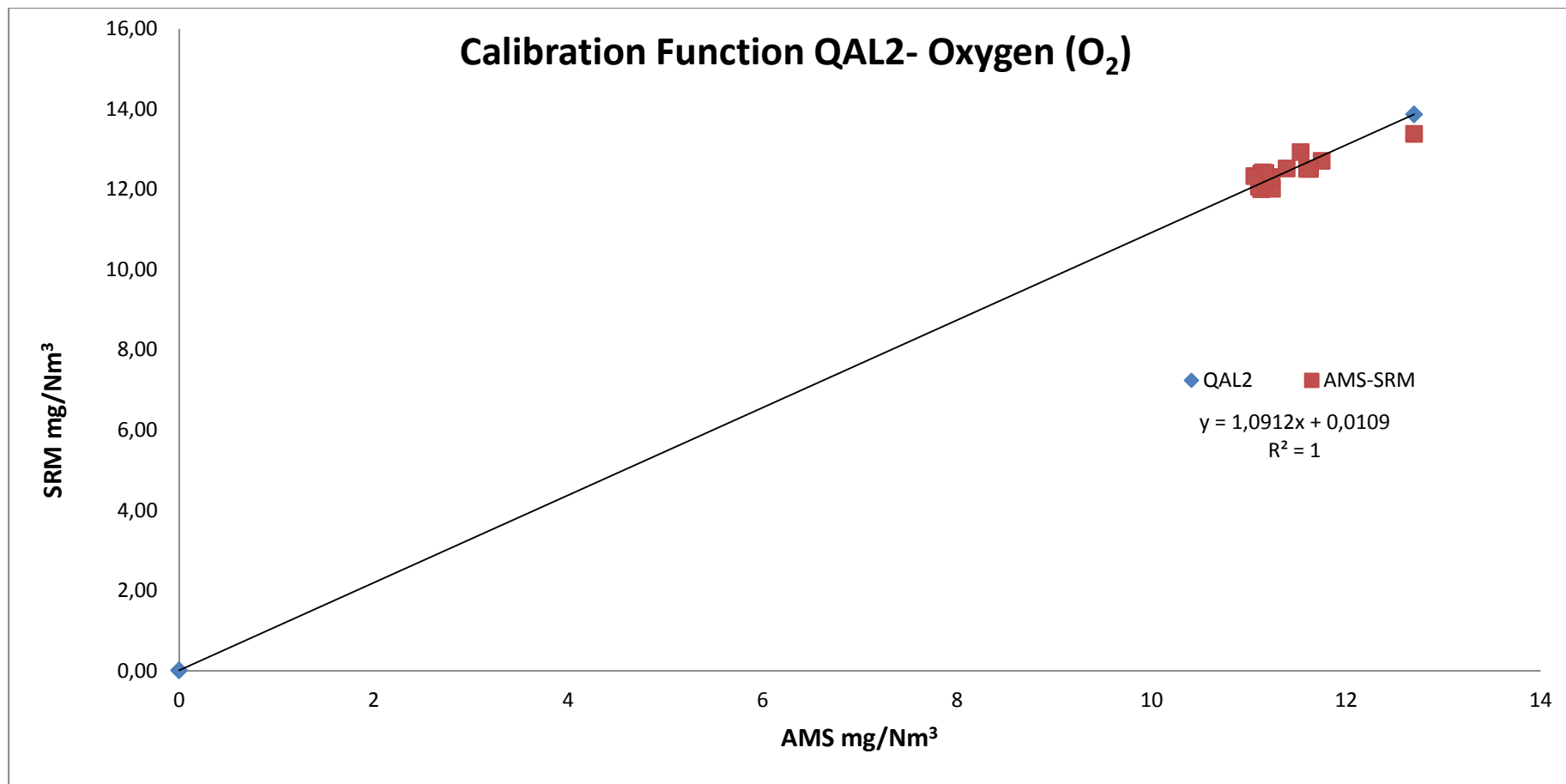
Parameter				NO			Emission Point			6C						
O2 rif %	15	SRM				AMS							Calculations			
N. Test	DATE/TIME	Y _i	Yi-Ym	O ₂	Y _{i,s}	x _i	O ₂	xi-xm	(xi-xm) ²	(xi-xm)*(Yi-Ym)	ŷ _i	ŷ _{i,s}	D _i = y _{i,s} -ŷ _{i,s}	D _i -đ	(D _i -đ) ²	
1	10/5/17 13:59	16,69	-3,00	12,01	11,15	19,40	11,24	-8,90	79,27	26,69	12,52	7,70	3,45	2,05	4,22	
2	10/5/17 14:59	17,37	-2,32	12,00	11,58	20,49	11,13	-7,82	61,11	18,15	13,40	8,14	3,44	2,05	4,19	
3	10/5/17 15:59	16,70	-2,99	12,07	11,22	19,55	11,11	-8,75	76,63	26,17	12,65	7,67	3,55	2,15	4,64	
4	10/5/17 18:59	11,98	-7,71	12,23	8,19	19,10	11,16	-9,21	84,82	71,05	12,28	7,49	0,70	-0,69	0,48	
5	10/5/17 19:59	9,61	-10,08	12,31	6,63	17,26	11,24	-11,05	122,12	111,37	10,80	6,63	0,00	-1,39	1,94	
6	11/5/17 9:59	6,59	-13,10	12,39	4,59	12,61	11,13	-15,70	246,43	205,71	7,06	4,29	0,30	-1,09	1,19	
7	11/5/17 10:59	6,62	-13,07	12,42	4,63	12,36	11,15	-15,95	254,43	208,55	6,85	4,17	0,46	-0,94	0,88	
8	11/5/17 17:59	6,64	-13,05	12,93	4,94	11,99	11,53	-16,32	266,35	213,01	6,55	4,15	0,78	-0,61	0,38	
9	11/5/17 18:59	13,75	-5,94	12,41	9,60	22,14	11,17	-6,16	37,99	36,59	14,73	8,99	0,61	-0,78	0,61	
10	11/5/17 19:59	12,71	-6,98	12,33	8,80	20,07	11,06	-8,23	67,76	57,43	13,07	7,88	0,92	-0,48	0,23	
11	17/5/17 12:59	93,24	73,55	13,38	73,44	118,10	12,70	89,79	8062,97	6604,22	91,97	66,48	6,95	5,56	30,90	
12	17/5/17 14:59	30,74	11,05	12,71	22,25	45,01	11,75	16,70	279,03	184,56	33,14	21,49	0,75	-0,64	0,41	
13	17/5/17 15:59	17,54	-2,15	12,51	12,40	28,11	11,63	-0,20	0,04	0,42	19,53	12,51	-0,11	-1,51	2,27	
14	17/5/17 16:59	17,33	-2,36	12,51	12,25	28,65	11,60	0,34	0,12	-0,81	19,97	12,75	-0,50	-1,89	3,58	
15	17/5/17 17:59	17,85	-1,84	12,52	12,63	29,76	11,39	1,45	2,11	-2,68	20,86	13,02	-0,40	-1,79	3,20	
Average													1,39			
Sum									9641,2	7760,4					59,11	
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		55	Yaverage	19,69	x average	28,31	Z	//	Procedure for the determination of the calibration fuction							
15% ELV [mg/Nm3 rif O ₂]		8,25	m	0,805	i	-3,093	r	0,994	Method A					Calibration Function		
Ys Max-Ys min		68,85	ŷs, max	66,48	Calibration Range				0 - 73,13 [mg/Nm3 rif O2]					Y= 0,805X -3,093		
Test of Variability																
Maximum permissible uncertainty (95% confidence interval)		20	Test value for variability (k _v)		0,9761	σ0kv		5,478	Result of Variability Test (s ₀ ≤σ ₀ k _v)							
Standard Deviation of the difference D _i - (S ₀)		2,054703	Standard Deviation (σ ₀)		5,61	Experimental Confidence interval [%]		7,32	Positive							





14.3 OXYGEN - QAL2

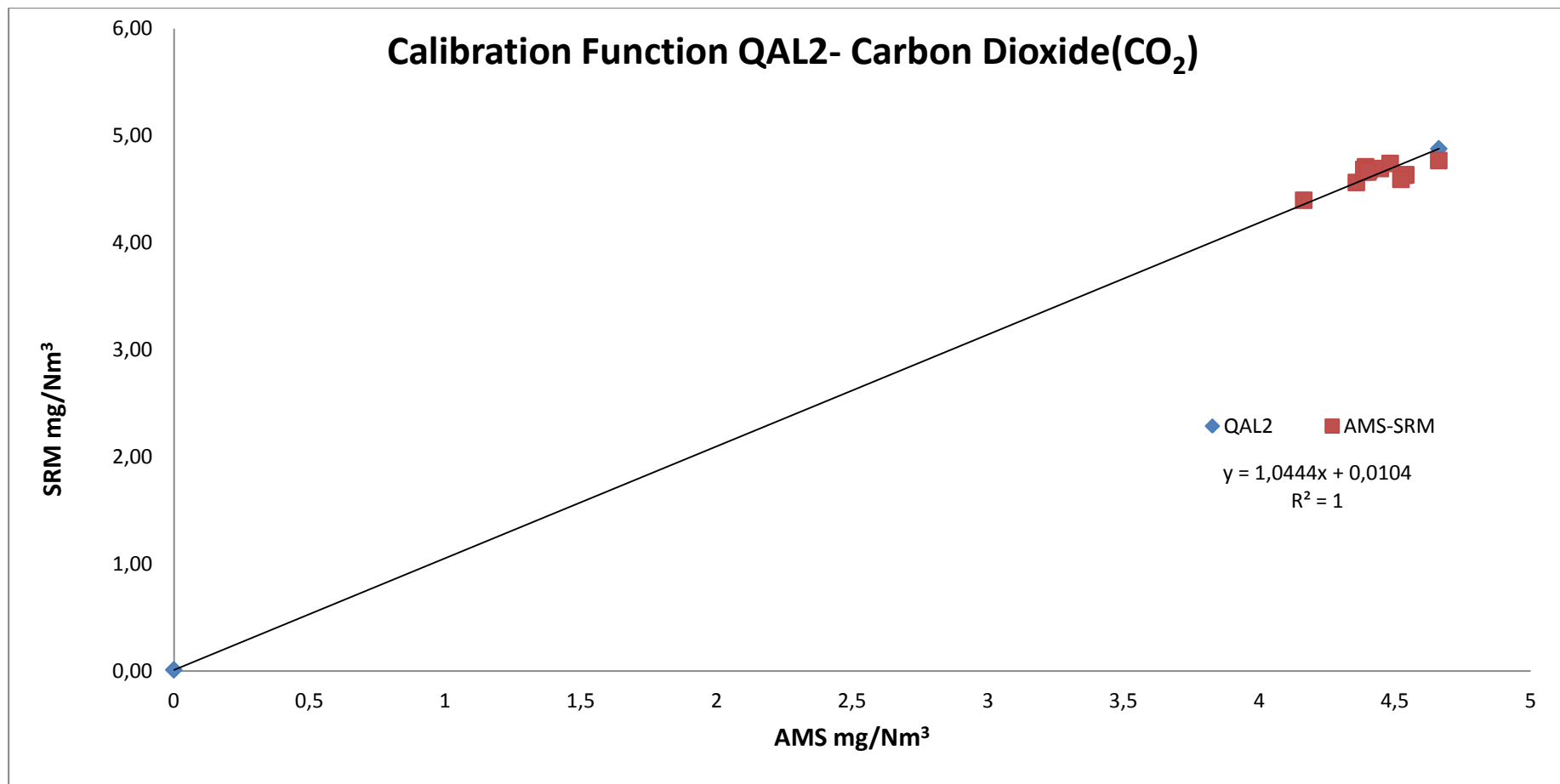
Parameter				O ₂		Emission Point			6C								
O2 rif %	15	SRM				AMS						Calculations					
N. Test	DATE/TIME	Y _i	Yi-Ym	O ₂	Y _{i,s}	x _i	O ₂	xi-xm	(xi-xm) ²	(xi-xm)*(Yi-Ym)	ŷ _i		D _i = y _{i,s} -ŷ _{i,s}	D _i -đ	(D _i -đ) ²		
1	10/5/17 13:59	12,01	-0,43			11,24		-0,16	0,03	0,07	12,27		-0,26	-0,26	0,07		
2	10/5/17 14:59	12,00	-0,45			11,13		-0,27	0,07	0,12	12,15		-0,15	-0,15	0,02		
3	10/5/17 15:59	12,07	-0,38			11,11		-0,29	0,09	0,11	12,13		-0,06	-0,06	0,00		
4	10/5/17 18:59	12,23	-0,22			11,16		-0,24	0,06	0,05	12,19		0,04	0,04	0,00		
5	10/5/17 19:59	12,31	-0,14			11,24		-0,16	0,03	0,02	12,27		0,04	0,04	0,00		
6	11/5/17 9:59	12,39	-0,06			11,13		-0,27	0,07	0,02	12,15		0,24	0,24	0,06		
7	11/5/17 10:59	12,42	-0,03			11,15		-0,25	0,06	0,01	12,17		0,25	0,25	0,06		
8	11/5/17 17:59	12,93	0,48			11,53		0,14	0,02	0,07	12,60		0,33	0,33	0,11		
9	11/5/17 18:59	12,41	-0,04			11,17		-0,23	0,05	0,01	12,20		0,21	0,21	0,04		
10	11/5/17 19:59	12,33	-0,12			11,06		-0,34	0,12	0,04	12,08		0,25	0,25	0,06		
11	17/5/17 12:59	13,38	0,93			12,70		1,30	1,69	1,22	13,87		-0,49	-0,49	0,24		
12	17/5/17 14:59	12,71	0,26			11,75		0,35	0,12	0,09	12,83		-0,12	-0,12	0,01		
13	17/5/17 15:59	12,51	0,06			11,63		0,23	0,05	0,01	12,70		-0,19	-0,19	0,04		
14	17/5/17 16:59	12,51	0,06			11,60		0,20	0,04	0,01	12,67		-0,16	-0,16	0,03		
15	17/5/17 17:59	12,52	0,07			11,39		-0,01	0,00	0,00	12,44		0,08	0,08	0,01		
Average												0,00					
Sum									2,50	1,85					0,75		
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		21	Yaverage	12,45	x average	11,40	Z	-0,01	Procedure for the determination of the calibration fuction								
15% ELV [mg/Nm3 rif O ₂]		3,15	m	1,091	i	0,011	r	0,86913519	Method B				Calibration Function				
Ys Max-Ys min		1,38	ŷs, max	13,87	Calibration Range				0 - 15,26 [mg/Nm3 rif O2]				Y= 1,091X + 0,01				
Test of Variability																	
Maximum permissible uncertainty (95% confidence interval)		10	Test value for variability (k _v)		0,9761	σ0kv		1,046	Result of Variability Test (s ₀ ≤σ ₀ k _v)								
Standard Deviation of the difference D _i - (S ₀)		0,231994	Standard Deviation (σ ₀)		1,07	Experimental Confidence interval [%]		2,17	Positive								





14.4 CARBON DIOXIDE – QAL2

Parameter				CO ₂		Emission Point			6C							
O2 rif %	15	SRM				AMS						Calculations				
N. Test	DATE/TIME	Y _i	Yi-Ym	O ₂	Y _{i,s}	x _i	O ₂	xi-xm	(xi-xm) ²	(xi-xm)*(Yi-Ym)	ŷ _i		D _i = y _{i,s} -ŷ _{i,s}	D _i -đ	(D _i -đ) ²	
1	10/5/17 13:59	4,64	-0,01			4,54		0,10	0,01	0,00	4,75		-0,11	-0,11	0,01	
2	10/5/17 14:59	4,64	-0,01			4,54		0,10	0,01	0,00	4,75		-0,12	-0,12	0,01	
3	10/5/17 15:59	4,63	-0,02			4,54		0,09	0,01	0,00	4,75		-0,12	-0,12	0,01	
4	10/5/17 18:59	4,59	-0,06			4,52		0,08	0,01	0,00	4,73		-0,14	-0,14	0,02	
5	10/5/17 19:59	4,56	-0,08			4,36		-0,08	0,01	0,01	4,56		0,00	0,00	0,00	
6	11/5/17 9:59	4,71	0,06			4,39		-0,05	0,00	0,00	4,60		0,11	0,11	0,01	
7	11/5/17 10:59	4,68	0,03			4,41		-0,04	0,00	0,00	4,61		0,07	0,07	0,01	
8	11/5/17 17:59	4,40	-0,25			4,16		-0,28	0,08	0,07	4,36		0,04	0,04	0,00	
9	11/5/17 18:59	4,69	0,05			4,45		0,01	0,00	0,00	4,65		0,04	0,04	0,00	
10	11/5/17 19:59	4,74	0,09			4,48		0,04	0,00	0,00	4,69		0,05	0,05	0,00	
11	17/5/17 12:59	4,77	0,12			4,66		0,22	0,05	0,03	4,88		-0,11	-0,11	0,01	
12	17/5/17 14:59	4,69	0,04			4,39		-0,06	0,00	0,00	4,59		0,10	0,10	0,01	
13	17/5/17 15:59	4,66	0,01			4,39		-0,05	0,00	0,00	4,59		0,07	0,07	0,01	
14	17/5/17 16:59	4,67	0,02			4,40		-0,04	0,00	0,00	4,60		0,06	0,06	0,00	
15	17/5/17 17:59	4,66	0,01			4,40		-0,04	0,00	0,00	4,61		0,06	0,06	0,00	
Average													0,00			
Sum									0,18	0,09					0,12	
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		25	Yaverage	4,65	x average	4,44	Z	-0,01	Procedure for the determination of the calibration fuction							
15% ELV [mg/Nm3 rif O ₂]		3,75	m	1,044	i	0,010	r	0,64762436	Method B				Calibration Function			
Ys Max-Ys min		0,37	ŷs, max	4,88	Calibration Range				0 - 5,37 [mg/Nm3 rif O ₂]				Y= 1,044X + 0,01			
Test of Variability																
Maximum permissible uncertainty (95% confidence interval)		10	Test value for variability (k _v)		0,9761	σ0kv		1,245	Result of Variability Test (s _p ≤σ ₀ k _v)							
Standard Deviation of the difference D _i - (S ₀)		0,09133	Standard Deviation (σ ₀)		1,28	Experimental Confidence interval [%]		0,72	Positive							



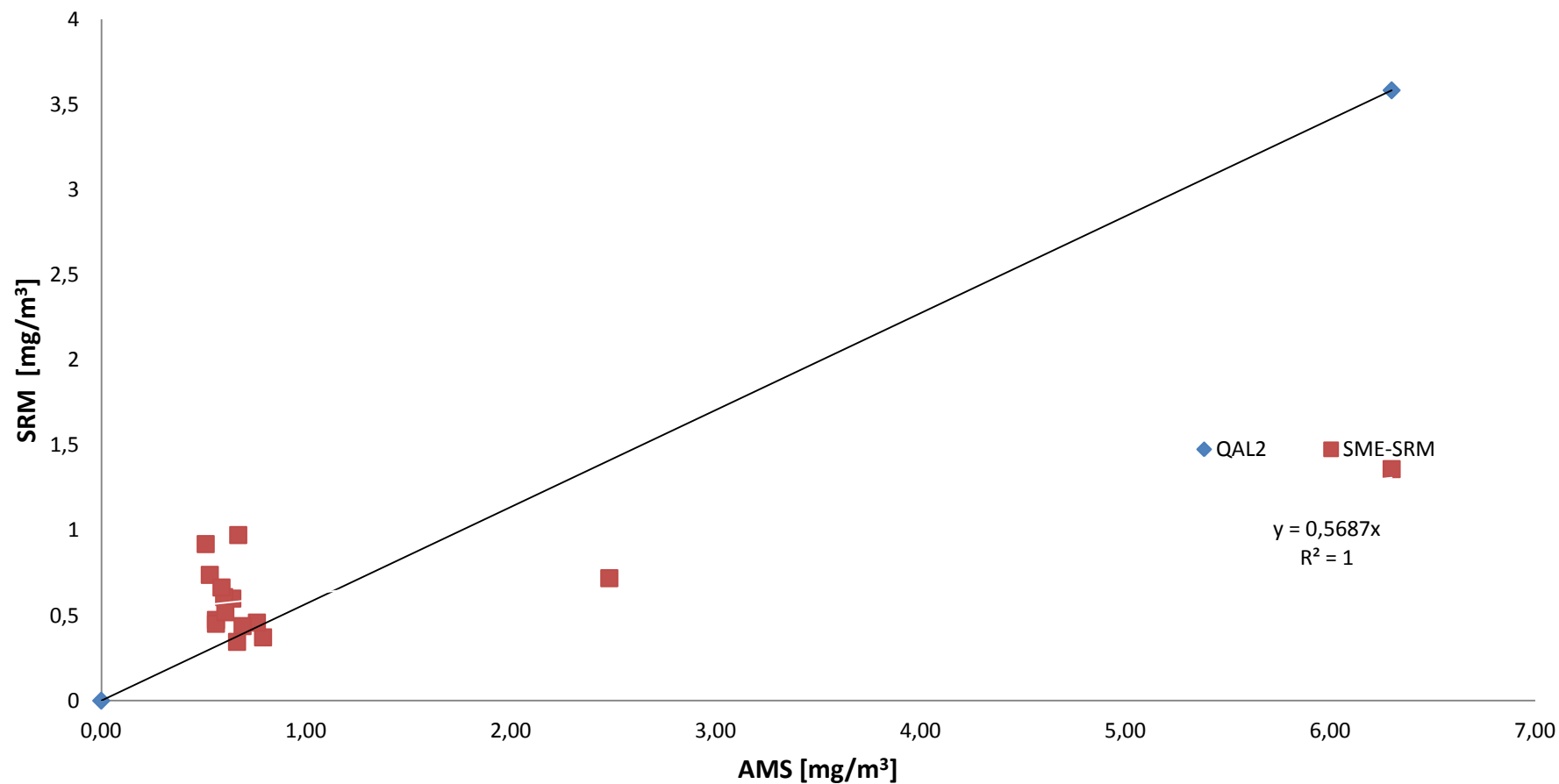


14.5 DUST – QAL2

Parameter								Dust		Emission Point					6C						
O ₂ rif. %	15	SRM							AMS										Calculations		
N. Test	DATE/TIME	Y _i [mg/m ³]	O ₂ [%vol]	T [°C]	P [KPa]	U [%]	Y _i -Y _m	Y _{i,s} [mg/Nm ³]	x _i [mg/m3]	O ₂ [%vol]	T [°C]	P [hPa]	U [%]	x _i -x _m	(x _i -x _m) ²	(x _i -x _m)* (Y _i -Y _m)	Ŷ _i [mg/m ³]	Ŷ _{i,s} [mg/Nm ³]	D _i = Y _{i,s} - Ŷ _{i,s}	D _i -d̄	(D _i - d̄) ²
1	10/05/2017 13:59	0,92	12,01	165,40	101,19	8,28	0,28	1,08	0,51	11,24	165,52	992,25	9,99	-0,62	0,38	-0,17	0,29	0,32	0,75	0,68	0,46
2	10/05/2017 14:59	0,74	12,00	164,40	101,05	9,21	0,10	0,87	0,53	11,13	165,32	992,12	10,03	-0,60	0,36	-0,06	0,30	0,33	0,54	0,47	0,22
3	10/05/2017 15:59	0,47	12,07	165,70	101,13	8,43	-0,17	0,56	0,56	11,11	165,14	991,97	10,05	-0,57	0,32	0,10	0,32	0,35	0,21	0,14	0,02
4	10/05/2017 17:59	0,60	12,16	165,60	100,86	10,92	-0,04	0,74	0,64	11,12	165,10	991,93	10,08	-0,49	0,24	0,02	0,36	0,40	0,33	0,26	0,07
5	10/05/2017 18:59	0,61	12,23	165,50	100,83	9,05	-0,03	0,74	0,60	11,16	165,19	991,87	10,08	-0,53	0,28	0,02	0,34	0,38	0,36	0,29	0,08
6	11/05/2017 09:59	0,37	12,39	163,10	100,63	9,97	-0,27	0,46	0,79	11,13	162,89	991,47	9,64	-0,34	0,12	0,09	0,45	0,49	-0,03	-0,10	0,01
7	11/05/2017 10:59	0,46	12,42	163,10	100,81	10,24	-0,18	0,57	0,76	11,15	162,79	991,61	9,62	-0,37	0,14	0,07	0,43	0,47	0,10	0,03	0,00
8	11/05/2017 11:59	0,44	12,33	161,80	100,83	8,10	-0,20	0,53	0,69	11,16	161,67	991,66	9,66	-0,44	0,19	0,09	0,39	0,43	0,10	0,03	0,00
9	11/05/2017 12:59	1,36	12,33	163,10	100,86	9,62	0,72	1,67	6,30	11,14	162,75	991,67	9,67	5,17	26,73	3,71	3,58	3,93	-2,26	-2,33	5,45
10	11/05/2017 13:59	0,45	12,34	162,70	100,70	10,50	-0,19	0,56	0,56	11,15	162,84	991,61	9,74	-0,57	0,32	0,11	0,32	0,35	0,21	0,14	0,02
11	17/05/2017 14:59	0,72	12,71	161,30	101,68	10,85	0,08	0,92	2,48	11,75	160,17	993,05	8,86	1,35	1,82	0,10	1,41	1,62	-0,70	-0,77	0,59
12	17/05/2017 15:59	0,97	12,51	164,20	101,53	8,70	0,33	1,20	0,67	11,63	158,88	993,03	9,43	-0,46	0,21	-0,15	0,38	0,43	0,77	0,70	0,49
13	17/05/2017 16:59	0,35	12,51	160,80	101,53	7,29	-0,30	0,42	0,66	11,60	158,35	992,95	9,39	-0,47	0,22	0,14	0,38	0,43	-0,01	-0,08	0,01
14	17/05/2017 17:59	0,52	12,52	159,40	101,54	8,36	-0,12	0,63	0,61	11,39	159,80	992,88	9,46	-0,52	0,27	0,06	0,34	0,38	0,25	0,18	0,03
15	17/05/2017 18:59	0,66	12,56	159,60	101,45	8,38	0,02	0,82	0,59	11,42	160,71	992,88	9,62	-0,54	0,29	-0,01	0,33	0,38	0,44	0,37	0,14
Average																			0,07		
Sum															31,91	4,11					7,59
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		5	Yaverage	0,64	x average	1,13	Z	/	Procedure for the determination of the calibration fuction						Calibration Function						
15% ELV [mg/Nm3 rif O ₂]		0,75	m	0,57	i	0,000	r	0,72	Method B						Y= 0,568X + 0						
Ys Max-Ys min		1,25	ŷs, max	3,93	Calibration Range				0 - 4,33 [mg/Nm3 rif O2]												
Test of Variability																					
Maximum permissible uncertainty (95% confidence interval)		30	Test value for variability (k _v)			0,9761	σ0kv			0,747	Result of Variability Test (s ₀ ≤σ ₀ k _v)										
Standard Deviation of the difference D _i - (S ₀)		0,736	Standard Deviation (σ ₀)			0,77	Experimental Confidence interval [%]			28,87	Positive										
Note: Method B was used to process the results in order to obtain a proper calibration function.																					



Calibration function QAL2- Dust





15 ANNEX 5 – IAR REPORT

15.1 WATER VAPOUR - IAR

Parameter		Water Vapour		
N. Test	DATE/TIME	SRM [%]	AMS [%]	Absolute Differences (X_i)
1	10/5/17 13:59	8,3	10,0	2
2	10/5/17 14:59	9,2	10,0	1
3	10/5/17 15:59	8,4	10,1	2
4	10/5/17 17:59	10,9	10,1	1
5	10/5/17 18:59	9	10	1
Average		9,2	10,0	1,2
t student 0,95 (N-1)		2,78		
Standard Deviation (S_D)		0,43		
Confidence Interval (I_c)		0,53		
I.A.R		81,1		

15.2 TEMPERATURE - IAR

Parameter		Temperature		
N. Test	DATE/TIME	SRM [°C]	AMS [°C]	Absolute Differences (X_i)
1	10/5/17 13:59	165	166	0
2	10/5/17 14:59	164	165	1
3	10/5/17 15:59	166	165	1
4	10/5/17 17:59	166	165	1
5	10/5/17 18:59	166	165	0
Average		165	165	0,5
t student 0,95 (N-1)		2,78		
Standard Deviation (S_D)		0,30		
Confidence Interval (I_c)		0,37		
I.A.R		99,5		



15.3 PRESSURE - IAR

Parameter		Pressure		
N. Test	DATE/TIME	SRM [hPa]	SME [hPa]	Absolute Differences (X _i)
1	10/5/17 13:59	1012	992	20
2	10/5/17 14:59	1011	992	18
3	10/5/17 15:59	1011	992	19
4	10/5/17 17:59	1009	992	17
5	10/5/17 18:59	1008	992	16
Average		1010	992	18
t student 0,95 (N-1)		2,78		
Standard Deviation (S _D)		1,49		
Confidence Interval (I _C)		1,84		
I.A.R		98,0		

15.4 FLOW - IAR

Parameter			Flow	
N. Test	DATE/TIME	SRM [Nm ³ /h]	AMS [Nm ³ /h]	Absolute Differences (X _i)
1	11/5/17 9:59	142301	163071	20770
2	11/5/17 10:59	147627	162805	15179
3	11/5/17 11:59	147320	162865	15545
4	11/5/17 12:59	147277	162835	15558
5	11/5/17 13:59	147477	163212	15735
Average		146400,43	162957,66	16557
t student 0,95 (N-1)		2,78		
Standard Deviation (S _D)		2363,57		
Confidence Interval (I _C)		2934,76		
I.A.R		86,7		



16 ANNEX 6 – QAL1 CERTIFIED SRM ANALYZER

	
<h1>CERTIFICATE</h1> <p>on Product Conformity (QAL1)</p>	
Certificate No.: 0000032301	
Certified AMS:	PG-350E for NO _x , SO ₂ , CO, CO ₂ and O ₂
Manufacturer:	HORIBA Europe GmbH Julius-Kronenberg-Str. 9 42799 Leichlingen Germany
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH
<p>This is to certify that the AMS has been tested and found to comply with:</p> <p>EN 15267-1: 2009, EN 15267-2: 2009, EN 15267-3: 2007 and EN 14181: 2004</p> <p>Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).</p>	
	
<ul style="list-style-type: none">• EN 15267-3 tested• QAL1 certified• TÜV approved• Annual inspection	
Publication in the German Federal Gazette (BAnz.) of 05 March 2013	This certificate will expire on: 04 March 2018
German Federal Environment Agency Dessau, 22 March 2013	TÜV Rheinland Energie und Umwelt GmbH Cologne, 21 March 2013
 i. A. Dr. Marcel Langner	 ppa. Dr. Peter Wilbring
www.umwelt-tuv.de / www.eco-tuv.com teu@umwelt-tuv.de Tel. +49 221 806-2756	TÜV Rheinland Energie und Umwelt GmbH Am Grauen Stein 51105 Cologne
Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008.	
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Certificate:
0000032301 / 22 March 2013



Test report: 936/21217617/A of 05 October 2012
Initial certification: 05 March 2013
Expiry date: 04 March 2018
Publication: BAnz AT 05 March 2013 B10, chapter I, No. 5.2

Approved application

The tested AMS is suitable for use at combustion plants according to EC Directive 2001/80/EC, at waste incineration plants according to EC directive 2000/76/EC and other plants requiring official approval. The measured ranges have been selected considering the wide application range of the AMS.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a sevenmonth field test at a waste incineration plant.

The AMS is approved for an ambient temperature range of +5 °C to +40 °C.

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

Basis of the certification

This certification is based on:

- test report 936/21217617/A of 05 October 2012 of 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 05 March 2013 B10, chapter I, No. 5.2



Certificate:
0000032301 / 22 March 2013



AMS designation:

PG-350E for NO_x, SO₂, CO, CO₂ and O₂

Manufacturer:

Horiba Europe GmbH, Leichlingen

Field of application:

Measurement at plants requiring official approval as well as plants within the scope of 2000/76/EC (waste incineration directive) and 2001/80/EC (large combustion plants directive)

Measuring ranges during the suitability test:

Components	Certification ranges	Supplementary ranges	Unit
NO _x	0 - 205 ¹⁾	0 - 2050 ²⁾	mg/m ³
SO ₂	0 - 143	0 - 1430	mg/m ³
CO	0 - 75	0 - 1250	mg/m ³
CO ₂	0 - 20	-	Vol.-%
O ₂	0 - 25	0 - 10	Vol.-%

¹⁾ as NO₂, this corresponds to apx 0 - 134 mg/m³ NO

²⁾ as NO₂, this corresponds to apx. 0 - 1340 mg/m³ NO

Software version:

P2000788001D / 1.11

Restrictions:

None

Notes:

1. The maintenance interval is four weeks.
2. The certification range for the component SO₂ is not suited to monitor the daily mean value at plants pursuant to 2000/76/EC.
3. The internal dryer should be by-passed for the test gas flow inside the PG-350E.
4. For measuring SO₂ the PD-100 permeation dryer manufactured by Horiba should be used.

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Köln
Report No.: 936/21217617/A dated 05 October 2012



Certificate:
0000032301 / 22 March 2013



Certified product

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

The PG-350E measuring system is a multi-channel gas analyser which uses different measuring principles according to the specific measured component. The following table lists the different measuring principles:

Measured component	Measuring principle
NO _x	Chemiluminescence
CO, SO ₂ , CO ₂	Non-dispersive absorption (NDIR) Infrared
O ₂	Paramagnetism

The HORIBA PG-350E measuring system is comprised of the main parts described below:

Sampling

Sampling probe: M&C Type PSP 4000-H/C

Heated sample gas filter Type SP-2K ceramic material, pore size 2µm

Sampling hose: M&C Type PSP-W 4M 4/6 (length for performance testing apx. 5 m)
(max. 120 °C)

Analyser

Horiba: PG-350E

Sample gas dryer

Horiba permeation dryer, type PD-100 with 100 permeation tubes

or


M&C Analysentechnik condensing dryer, type PSS-5

The measuring system may be operated with the PD-100 permeation dryer manufactured by Horiba or with the PSS-5 condensing dryer manufactured by M&C Analysentechnik.

Sample gas is led to the measuring system via a heated probe. The probe is equipped with an internal filter made of ceramic material with a pore size of 2µm. The sample gas is transported via a heated PTFE-line to a sample dryer before continuing via an unheated PTFE-line to the analyser. The pump is situated behind the measuring cell.


Integrating several measuring cells, the AMS performs simultaneous measurement of multiple components. The sample gas continuously flows through the respective measuring cell of the AMS.





Umwelt
Bundes
Amt
For our Environment

Certificate:
0000032301 / 22 March 2013



TÜVRheinland®
Precisely Right.

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.

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 its expiration is also accessible on the internet: qal1.de.

Certification of PG-350E for NO_x, SO₂, CO, CO₂ and O₂ 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. 0000032301: 22 March 2013
Expiry date of the certificate: 04 March 2018
Test report: 936/21217617/A dated 05 October 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 05 March 2013 B10, chapter I, No. 5.2
Announcement by UBA from 12 February 2013

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	<p align="center">Certificate: 0000032301 / 22 March 2013</p>	
<p align="center">Calculation of overall uncertainty according to EN 14181 and EN 15267-3</p>		
Measuring system		
Manufacturer	Horiba Europe GmbH	
Name of measuring system	PG-350E	
Serial number of the candidates	VC4DFKB0 / XL7LTUL1	
Measuring principle	Chemiluminescence	
Test report	21217817/A	
Test laboratory	TÜV Rheinland	
Date of report	2012-10-08	
Measured component	NO _x as NO	
Certification range	0 - 134 mg/m ³	
Evaluation of the cross sensitivity (CS) (system with largest CS)		
Sum of positive CS at zero point	0,84 mg/m ³	
Sum of negative CS at zero point	0,00 mg/m ³	
Sum of positive CS at reference point	0,00 mg/m ³	
Sum of negative CS at reference point	-0,70 mg/m ³	
Maximum sum of cross sensitivities	0,84 mg/m ³	
Uncertainty of cross sensitivity	0,487 mg/m ³	
Calculation of the combined standard uncertainty		
Tested parameter		u²
Standard deviation from paired measurements under field conditions *	u _D mg/m ³	0,797 (mg/m ³) ²
Lack of fit	u _{LF} mg/m ³	0,336 (mg/m ³) ²
Zero drift from field test	u _{0,z} mg/m ³	0,082 (mg/m ³) ²
Span drift from field test	u _{0,s} 2,035 mg/m ³	4,141 (mg/m ³) ²
Influence of ambient temperature at span	u _t 1,332 mg/m ³	1,774 (mg/m ³) ²
Influence of supply voltage	u _v 0,306 mg/m ³	0,094 (mg/m ³) ²
Cross sensitivity (interference)	u _i mg/m ³	0,238 (mg/m ³) ²
Influence of sample gas flow	u _g mg/m ³	0,013 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} mg/m ³	1,173 (mg/m ³) ²
Converter efficiency for AMS measuring NO _x	u _{CE} mg/m ³	10,583 (mg/m ³) ²
* The larger value is used: * Repeatability standard deviation at span* or * Standard deviation from paired measurements under field conditions"		
Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	4,38 mg/m ³
Total expanded uncertainty	$U = u_c \cdot k = u_c \cdot 1.96$	8,59 mg/m ³
Relative total expanded uncertainty	U in % of the ELV 131 mg/m ³	6.6
Requirement of 2000/76/EC and 2001/80/EC	U in % of the ELV 131 mg/m ³	20.0
Requirement of EN 15267-3	U in % of the ELV 131 mg/m ³	15.0

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

Measuring system

Manufacturer Horiba Europe GmbH
Name of measuring system PG-350E
Serial number of the candidates VC4DFKB9 / XL7LTUL1
Measuring principle NDIR

Test report

Test laboratory TÜV Rheinland
Date of report 2012-10-08

Measured component

SO₂
Certification range 0 - 143 mg/m³

Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point 0.54 mg/m³
Sum of negative CS at zero point -0.69 mg/m³
Sum of positive CS at reference point 0.70 mg/m³
Sum of negative CS at reference point -2.60 mg/m³
Maximum sum of cross sensitivities -2.60 mg/m³
Uncertainty of cross sensitivity -1.503 mg/m³

Calculation of the combined standard uncertainty

Tested parameter

		u ²
Standard deviation from paired measurements under field conditions *	u ₀ mg/m ³	1.672 (mg/m ³) ²
Lack of fit	u _{lof} mg/m ³	0.334 (mg/m ³) ²
Zero drift from field test	u _{zdr} mg/m ³	3.881 (mg/m ³) ²
Span drift from field test	u _{sdr} mg/m ³	4.713 (mg/m ³) ²
Influence of ambient temperature at span	u _t 1.752 mg/m ³	3.070 (mg/m ³) ²
Influence of supply voltage	u _v 0.790 mg/m ³	0.624 (mg/m ³) ²
Cross sensitivity (interference)	u _i mg/m ³	2.258 (mg/m ³) ²
Influence of sample gas flow	u _p mg/m ³	0.067 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} mg/m ³	1.336 (mg/m ³) ²

* The larger value is used:

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c) $u_c = \sqrt{\sum (u_{max,i})^2}$ 4.23 mg/m³
Total expanded uncertainty $U = u_c \cdot k = u_c \cdot 1.96$ 8.30 mg/m³



Relative total expanded uncertainty

U in % of the ELV 60 mg/m³ 13.8

Requirement of 2000/76/EC and 2001/80/EC U in % of the ELV 60 mg/m³ 20.0



Requirement of EN 15267-3 U in % of the ELV 60 mg/m³ 15.0



			
Certificate: 0000032301 / 22 March 2013			
Calculation of overall uncertainty according to EN 14181 and EN 15267-3			
Measuring system			
Manufacturer	Horiba Europe GmbH		
Name of measuring system	PG-350E		
Serial number of the candidates	VC4DFKB0 / XL7LTUL1		
Measuring principle	NDIR		
Test report			
Test laboratory	TÜV Rheinland		
Date of report	2012-10-08		
Measured component		CO	
Certification range	0 - 75 mg/m ³		
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 reference point	0.50 mg/m ³		
Sum of negative CS at reference point	-0.65 mg/m ³		
Maximum sum of cross sensitivities	-0.65 mg/m ³		
Uncertainty of cross sensitivity	-0.377 mg/m ³		
Calculation of the combined standard uncertainty			
Tested parameter			
Standard deviation from paired measurements under field conditions *	u_D	mg/m ³	0.356 (mg/m ³) ²
Lack of fit	u_{lof}	mg/m ³	0.070 (mg/m ³) ²
Zero drift from field test	u_{zdt}	mg/m ³	0.706 (mg/m ³) ²
Span drift from field test	u_{sdt}	-0.675 mg/m ³	0.456 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.868 mg/m ³	0.750 (mg/m ³) ²
Influence of supply voltage	u_v	0.288 mg/m ³	0.082 (mg/m ³) ²
Cross sensitivity (interference)	u_i	mg/m ³	0.142 (mg/m ³) ²
Influence of sample gas flow	u_p	mg/m ³	0.001 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	mg/m ³	0.368 (mg/m ³) ²
* The larger value is used: "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"			
Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max})^2}$		1.71 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$		3.35 mg/m ³
Relative total expanded uncertainty		U in % of the ELV 50 mg/m³	
Requirement of 2000/76/EC and 2001/80/EC		10.0	
Requirement of EN 15267-3		7.5	

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	<p align="center">Certificate: 0000032301 / 22 March 2013</p>	
<p align="center">Calculation of overall uncertainty according to EN 14181 and EN 15267-3</p>		
Measuring system		
Manufacturer	Horiba Europe GmbH	
Name of measuring system	PG-350E	
Serial number of the candidates	VC4DFKB9 / XL7LTUL1	
Measuring principle	NDIR	
Test report	21217617/A	
Test laboratory	TÜV Rheinland	
Date of report	2012-10-08	
Measured component	CO ₂	
Certification range	0 - 20 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 reference point	0.00	Vol.-%
Sum of negative CS at reference point	-0.11	Vol.-%
Maximum sum of cross sensitivities	-0.11	Vol.-%
Uncertainty of cross sensitivity	-0.064	Vol.-%
Calculation of the combined standard uncertainty		
Tested parameter		U²
Standard deviation from paired measurements under field conditions *	U _D	Vol.-% 0.000 (Vol.-%) ²
Lack of fit	U _{LOF}	Vol.-% 0.013 (Vol.-%) ²
Zero drift from field test	U _{0Z}	Vol.-% 0.071 (Vol.-%) ²
Span drift from field test	U _{SD}	0.238 Vol.-% 0.057 (Vol.-%) ²
Influence of ambient temperature at span	U _t	0.115 Vol.-% 0.013 (Vol.-%) ²
Influence of supply voltage	U _v	0.051 Vol.-% 0.003 (Vol.-%) ²
Cross sensitivity (interference)	U _i	Vol.-% 0.004 (Vol.-%) ²
Influence of sample gas flow	U _g	Vol.-% 0.000 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	U _{rm}	Vol.-% 0.026 (Vol.-%) ²
* The larger value is used : "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"		
Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,i})^2}$	0.43 Vol.-%
Total expanded uncertainty	$U = u_c \cdot k = u_c \cdot 1.96$	0.85 Vol.-%
Relative total expanded uncertainty	U in % of the range 20 Vol.-%	4.2
Requirement of 2000/76/EC and 2001/80/EC	U in % of the range 20 Vol.-%	10.0**
Requirement of EN 15267-3	U in % of the range 20 Vol.-%	7.5
** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given. The chosen value is recommended by the certification body.		
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Umwelt Bundes Amt For our Environment		Certificate: 0000032301 / 22 March 2013		TÜVRheinland® Precisely Right.	
Calculation of overall uncertainty according to EN 14181 and EN 15267-3					
Measuring system					
Manufacturer	Horiba Europe GmbH				
Name of measuring system	PG-350E				
Serial number of the candidates	VC4DFKB9 / XL7LTUL1				
Measuring principle	Paramagnetism				
Test report		21217617/A			
Test laboratory	TÜV Rheinland				
Date of report	2012-10-08				
Measured component		O ₂			
Certification range	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 reference point	0.00 Vol.-%				
Sum of negative CS at reference point	0.00 Vol.-%				
Maximum sum of cross sensitivities	0.00 Vol.-%				
Uncertainty of cross sensitivity	0.000 Vol.-%				
Calculation of the combined standard uncertainty					
Tested parameter		u²			
Standard deviation from paired measurements under field conditions *	u _D	Vol.-%	0.004	(Vol.-%) ²	
Lack of fit	u _{lof}	Vol.-%	0.000	(Vol.-%) ²	
Zero drift from field test	u _{dz}	Vol.-%	0.006	(Vol.-%) ²	
Span drift from field test	u _{ds}	0.092 Vol.-%	0.008	(Vol.-%) ²	
Influence of ambient temperature at span	u _t	0.064 Vol.-%	0.007	(Vol.-%) ²	
Influence of supply voltage	u _v	0.018 Vol.-%	0.000	(Vol.-%) ²	
Cross sensitivity (Interference)	u _i	Vol.-%	0.000	(Vol.-%) ²	
Influence of sample gas flow	u _g	Vol.-%	0.000	(Vol.-%) ²	
Uncertainty of reference material at 70% of certification range	u _{rm}	Vol.-%	0.041	(Vol.-%) ²	
* The larger value is used : "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"					
Combined standard uncertainty (u _c)		$u_c = \sqrt{\sum (u_{max,i})^2}$		0.26	Vol.-%
Total expanded uncertainty		$U = u_c \cdot k = u_c \cdot 1.96$		0.51	Vol.-%
Relative total expanded uncertainty					
Requirement of 2000/76/EC and 2001/80/EC	U in % of the range 25 Vol.-%	2.0			
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0**			
	U in % of the range 25 Vol.-%	7.5			
** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given. The chosen value is recommended by the certification body.					
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17 ANNEX 7 – DILUTION SYSTEM CALIBRATION CERTIFICATE

Kalibrierlaboratorium der TetraTec Instruments GmbH
Calibration Laboratory of TetraTec Instruments GmbH

TetraTec
Instruments

akkreditiert durch die / accredited by the

Deutsche Akkreditierungsstelle GmbH



Deutsche
Akkreditierungsstelle
D-K-17569-01-00

als Kalibrierlaboratorium im / as calibration laboratory in the

Deutschen Kalibrierdienst

DKD

Kalibrierschein
Calibration certificate

Kalibrierzeichen
Calibration mark

06013
D-K- 17569-01-00
2014-10

Gegenstand
Object
Gas Blender

Hersteller
Manufacturer
Be.T.A Strumentazione S.r.l

Typ
Type
BetaCAP30 RK

Fabrikat/Serien-Nr.
Serial number
300229

Auftraggeber
Customer
**Chimica Applicata Depurazione Acque
S.n.c
92013 Menfi, Italy**

Auftragsnummer
Order No.
PF790

Anzahl der Seiten des Kalibrierscheines
Number of pages of the certificate
3

Datum der Kalibrierung
Date of calibration
22.10.2014

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung sowohl der Deutschen Akkreditierungsstelle als auch des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.

This calibration certificate may not be reproduced other than in full except with the permission of both the German Accreditation Body GmbH and the Issuing laboratory. Calibration certificates without signature are not valid.

Datum
Date
22.10.2014

Leiter des Kalibrierlaboratoriums
Head of the calibration laboratory
Dr.rer.nat. Johannes Schubert

Bearbeiter
Person in charge
PTA Dominik Wörn

TetraTec Instruments GmbH · Gewerbestrasse 8 · 71144 Steinenbronn · Germany
Tel +497157/53870 · Fax +497157/538710 · www.tetratec.de · info@tetratec.de

File: CAL032528
DA0999 VQ300 R00



Calibration Laboratory of TetraTec Instruments GmbH

Seite 2 of 3
Page english version

06013
D-K 17589-01-00
2014-10

1.) Calibration object: Gas Blender
Type: BetaCAP30 RK
Manufacturer: Be.T.A. strumentazione
Serial-No.: 300229
Meas.range: ca. 3.091 sml/min air
at a relative pressure of ca. 1000 hPa
Standard conditions: standard volume flows are related to standard conditions
1013,25 hPa ; 293,15°K (20 °C) ; 0 % r.F.

2.) Calibration standards: Laminar Flow Element
Type: LDS-ES-05-10 50MJ10-14 50MJ10-12
Serial-No.: LDS-ES-05-10 2.3 776810-N7 752050-J13
Meas.range: 50...1350 ml/min 160...3500 ml/min 1000...12000 ml/min

3.) Calibration procedure:

Before the calibration the unit under test (uut) rested at least 6 hours in the laboratory for thermal accommodation.

calibration-medium: compressed air
calibration set-up: compressed air, 1000 hPa rel. - cal.standard 1 - unit under test -
calibration standard 2 - atmosphere

The calibration set-up was leak-proofed before the calibration.
To avoid running-in effects the uut was run at least 10 min. at max. flow before taking measurements. Measurements were taken not before 3 min after tuning the flow.

4.) Ambient conditions during calibration

atmospheric pressure: $964,5 \pm 1,0$ hPa
room temperature: $23,0 \pm 1,0$ °C
atmospheric humidity: $32,2 \pm 5,0$ %r.F.

5.) Uncertainties of measurement

volume flow: 0,65% o.r. for $Q \geq 10$ l/h
0,85% o.r. for $Q < 10$ l/h
absolute pressure: 0,10% o.r.

Given is the extended uncertainty, which is calculated from the standard uncertainty by multiplication with the extension factor $k = 2$. It was determined according to DKD-3 / EAL-R2. The value of the measured variable is in the corresponding interval of values with a probability of 95%.

The given uncertainties of values are composed of the uncertainties of the calibration procedure and that of the uut during calibration. A part for the long-term-instability of the uut is not included.

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File: CAL032528



Calibration Laboratory of TetraTec Instruments GmbH

Seite 3 of 3
Page english version

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2014-10

6.) results

Given values have the following meaning:

Step : selected divider-step
 $Q_{N,TG1}$: measured standard volume flow inlet gas to be diluted ("TG1")
 $Q_{N,OUT}$: measured standard volume flow diluted gas output ("OUT")
 $Q_{N,TG0}$: calculated standard volume flow diluting gas inlet ("TG0"), $Q_{N,TG0} = Q_{N,OUT} - Q_{N,TG1}$
 c_S : Concentration according to divider step (as displayed)
 c_I : Concentration calculated from flow values
 $c_I = 100\% \cdot Q_{N,TG1} / (Q_{N,TG0} + Q_{N,TG1})$
dev.: deviation calculated concentration against displayed value
dev. = $c_I - c_S$
unc.: uncertainty of c_I due to uncertainties of the measured flows
$$unc. = \sqrt{\left(\frac{\partial c}{\partial Q_1} \cdot uQ_1\right)^2 + \left(\frac{\partial c}{\partial Q_2} \cdot uQ_2\right)^2} \quad \text{resp.} \quad unc.(c=100\%)=0$$

All measurements were performed at an entrance pressure of the gas-blender of ca. 1000 hPa rel.

Step	$Q_{N,TG1}$ ml/min	$Q_{N,TG0}$ ml/min	$Q_{N,OUT}$ ml/min	c_S %	c_I %	dev. %	unc. %
0	0,00	3116,1	3116,1	0,00	0,00	0,00	0,00
1	106,82	3014,4	3121,2	3,33	3,42	0,09	0,04
2	210,99	2891,7	3102,7	6,67	6,80	0,13	0,06
4	421,33	2685,3	3106,6	13,33	13,56	0,23	0,12
8	837,74	2279,1	3116,8	26,67	26,88	0,21	0,25
15	1524,3	1534,0	3058,3	50,00	49,84	-0,16	0,46
30	3016,3	0,0	3016,3	100,00	100,00	0,00	0,00

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File: CAL032528



18 ANNEX 8 - CERTIFICATE OF ACCREDITATION TO UNI CEI EN ISO / IEC 17025: 2005



CERTIFICATO DI ACCREDITAMENTO Accreditation Certificate

Accreditamento n°
Accreditation n°

0439

Rev. 4

Si dichiara che
We declare that

**CHIMICA APPLICATA DEPURAZIONE ACQUE di
GIGLIO FILIPPO & C. Snc**

Sede:
Via Pio La Torre, 13 - AREA P.I.P. - 92013 Menfi AG

è conforme ai requisiti
della norma

UNI CEI EN ISO/IEC 17025:2005 "Requisiti generali per la competenza dei
Laboratori di prova e taratura"

meets the requirements
of the standard

EN ISO/IEC 17025:2005 "General Requirements for the Competence of Testing
and Calibration Laboratories" standard

quale

Laboratorio di Prova

as

Testing Laboratory

L'accreditamento attesta la competenza tecnica del Laboratorio relativamente allo scopo riportato nelle schede allegate al presente certificato. Le schede possono variare nel tempo. I requisiti gestionali della ISO/IEC 17025:2005 (sezione 4) sono scritti in un linguaggio idoneo all'attività dei Laboratori di Prova, sono conformi ai principi della ISO 9001:2008 ed allineati con i suoi requisiti applicabili.

Il presente certificato non è da ritenersi valido se non accompagnato dalle schede allegate e può essere sospeso o revocato in qualsiasi momento nel caso di inadempienza accertata da parte di ACCREDIA.

La validità dell'accreditamento può essere verificata sul sito WEB (www.accredia.it) o richiesta direttamente ai singoli Dipartimenti.

The accreditation certifies the technical competence of the laboratory limited to the scope detailed in the attached Enclosure. The scope may vary in the time. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in a language relevant to Testing Laboratories operations and meet the principles of ISO 9001:2008 and are aligned with its pertinent requirements.

The present certificate is valid only if associated to the annexed schedule, and can be suspended or withdrawn at any time in the event of non fulfilment as ascertained by ACCREDIA.

The in force status of the accreditation may be checked in the WEB site (www.accredia.it) or on direct request to appointed Department.

Data di 1ª emissione
1st issue date
2002-11-14

Data di modifica
Modification date
2015-02-17

Data di scadenza
Expiring date
2018-02-07

Il Direttore Generale
The General Director
(Dr. Filippo Trifiletti)

Il Direttore di Dipartimento
Department Director
(Dr.ssa Silvia Tramontin)

Il Presidente
The President
(Cav. del Lav. Federico Grazioli)



19 ANNEX 9 - CERTIFICATES REFERENCE MATERIAL



SAPIO PRODUZIONE IDROGENO OSSIGENO S.r.l.

SFIDE LEGALE: VIA SAN MAURIZIO 13, 20123, MILANO
UNICI OPERATIVI: VIA SENATORE SMOLETTA 27, 20057, CAPONAGO (MB)
TELEFONO: 02.857081 / TELEFAX: 02.85740842

CERTIFICATO DI ANALISI Certificate of analysis

638-04

CLIENTE: CHIMICA APPLICATA DEPURAZIONE ACQUE

Customer:

INDIRIZZO: VIA PIO LA TORRE 13 - AREA PIP MENFI 92013 AG

Address:

NUMERO ORDINE: 3632091
Order number

CODICE RIORDINO: P69313YDEN
Code reordering:

PER RIORDINO: ordini@sapio.it
Numero verde: 800416110

MATRICOLA: P35756
Serial number:

CAPACITA' (litri): 10
Capacity (liters):

SCADENZA
PROVA IDRAULICA: 01/2025
Expiration hydraulic test:

CONTENUTO: MISCELA DI GAS
Content:

RECIPIENTE: BOMBOLA GRUPPO 5-UNI1144
INOX
Vessel:

METODO DI PREPARAZIONE: GRAVIMETRICO SECONDO NORME ISO 6142 - ISO 6143
Method of preparation:

COMPONENTE Componente	RICHIESTA Request	CONCENTRAZIONE (C) Concentration (C)	incertezza Relativa (ΔC%) Relative Uncertainty (ΔC%)
BIOSSIDO DI CARBONIO	25,00 %	25,17 %	2,0%
OSSIDO DI CARBONIO	230 ppm	231 ppm	2,0%
OSSIDO DI AZOTO	300 ppm	298 ppm	2,0%
ANIDRIDE SOLFOROSA	50,0 ppm	49,3 ppm	2,0%
OSSIDI DI AZOTO TOTALI	-	297 ppm	2,0%

Complemento: AZOTO

Balance:

Concentrazione (C) espressa in termini di: mol/m³
Concentration (C) expressed in terms of:

L'incertezza relativa (ΔC%) riportata è espressa come incertezza estesa relativa con fattore di copertura k=2, corrispondente ad un livello di fiducia del 95% circa.

Riferibilità: La taratura del misuratore di massa utilizzato per la preparazione della miscela è effettuata utilizzando masse certificate dal centro di taratura LAT n°055;
Tracciabilità: la taratura delle masse è eseguita in conformità alla procedura PTS3;
I certificati di riferimento delle masse utilizzate sono:
LAT055 451/2015; 572/2015; 029/2015; 027/2015

Note:
Note:

PRESSIONE DI RIEMPIMENTO (bar): Filling pressure (bar):	120,0	RISCHI PER LA SALUTE: Health hazard:	NOCIVO
PRESSIONE MINIMA DI UTILIZZO (bar): Minimum pressure (bar):	12	PROPRIETÀ CHIMICO-FISICHE: Chemical and physical properties:	INERTE
TEMPERATURA DI STOCCAGGIO (°C): Storage temperature (°C):	0-40	DATA DI SCADENZA: Expiry date:	03/2019

Data certificato: 31/03/2017
Certification date:

Numero certificato: 201702238A
Certificate number:

Operatore: F. Padovani
Operator:



SAPIO PRODUZIONE IDROGENO OSSIGENO S.r.l.

SEDE LEGALE: VIA SAN MAURELIO 13, 20123, MILANO
UFFICIO OPERATIVO: VIA SENATORI SIMONE TTA 27, 20067, CAPONAGO (MB)
TELEFONO: 02.957051 / TELEFAX: 02.95740841

CERTIFICATO DI ANALISI
Certificate of analysis

C-39-01

CLIENTE: CHIMICA APPLICATA DEPURAZIONE ACQUE

Customer:

INDIRIZZO: VIA PIO LA TORRE 13 - AREA PIP - MENFI 92013 AG

Address:

NUMERO ORDINE: 3632354

Order number:

CODICE RIORDINO: P61YZ3YDFN

Code reordering:

PER RIORDINO: ordini@sapio.it

Numero verde: 800416110

MATRICOLA: MP31905

Serial number:

CAPACITA' (litri): 10

Capacity (liters):

SCADENZA

PROVA IDRAULICA: 07/2018

Expiration hydraulic test:

CONTENUTO: MISCELA DI GAS

Content:

RECIPIENTE: BOMBOLA GRUPPO 5-UNI11144

INOX

Vessel:

METODO DI PREPARAZIONE: GRAVIMETRICO SECONDO NORME ISO 6142 - ISO 6143

Method of preparation:

COMPONENTE Component	RICHIESTA Request	CONCENTRAZIONE (C) Concentration (C)	Incertezza Relativa (ΔC%) Relative Uncertainty (ΔC%)
OSSIDO DI AZOTO	80,0 ppm	81,31 ppm	2,0%

Complemento: AZOTO

Balance:

Concentrazione (C) espressa in termini di: mol/mol

Concentration (C) expressed in terms of:

L'incertezza relativa (ΔC%) riportata è espressa come incertezza estesa relativa con fattore di copertura $k=2$, corrispondente ad un livello di fiducia del 95% circa.

Riferibilità: La taratura del misuratore di massa utilizzato per la preparazione della miscela è effettuata utilizzando masse certificate dal centro di taratura LAT n°065;
Traceability: la taratura delle miscele è eseguita in conformità alla procedura PTSS3;
I certificati di riferimento delle masse utilizzate sono:
LAT055 451/2015; 572/2015; 028/2015; 027/2015

Note:

Note:

PRESSIONE DI RIEMPIMENTO (bar): Filling pressure (bar):	150	RISCHI PER LA SALUTE: Health hazards:	ASFISSIANTE SEMPLICE
PRESSIONE MINIMA DI UTILIZZO (bar): Minimum pressure (bar):	15	PROPRIETÀ CHIMICO-FISICHE: Chemical and physical properties:	INERTE
TEMPERATURA DI STOCCAGGIO (°C): Storage temperature (°C):	0-40	DATA DI SCADENZA: Expiry date:	03/2018

Data certificato: 23/03/2017

Certification date:

Numero certificato: 201702018

Certificate number:

Operatore: M. Bignardi

Operator:



SAPIO PRODUZIONE IDROGENO OSSIGENO S.r.l.

SEDE LEGALE: VIA SAN MAURILIO 13, 20153, MILANO
UFFICIO OPERATIVO: VIA SENATORE SMONETTA 27, 20867, CAPONAGO (MB)
TELEFONO: 02.867051 / TELEFAX: 02.86740842

CERTIFICATO DI ANALISI
Certificate of analysis

G18-02

CLIENTE: CHIMICA APPLICATA DEPURAZIONE ACQUE
Customer:
INDIRIZZO: VIA PIO LA TORRE 13 - AREA PIP - MENFI 92013 AG
Address:

NUMERO ORDINE: 3632354 CODICE RIORDINO: P61LB2BDFN
Order number Code reordering:

PER RIORDINO: ordini@sapio.it
Numero verde: 800416110

MATRICOLA: P33021 CAPACITA' (litri): 10
Serial number Capacity (liters):

SCADENZA
PROVA IDRAULICA: 02/2024
Expiration hydraulic test:

CONTENUTO: MISCELA DI GAS RECIPIENTE: BOMBOLA GRUPPO 2-UNIT1144
Content: Vessel:

METODO DI PREPARAZIONE: GRAVIMETRICO SECONDO NORME ISO 6142 - ISO 6143
Method of preparation:

COMPONENTE Component	RICHIESTA Request	CONCENTRAZIONE (C) Concentration (C)	incertezza Relativa (ΔC%) Relative Uncertainty (ΔC%)
OSSIGENO	25,00 %	25,06 %	2,0%

Complemento: AZOTO
Balance:

Concentrazione (C) espressa in termini di: mol/mol
Concentration (C) expressed in terms of:

L'incertezza relativa (ΔC%) riportata è espressa come incertezza estesa relativa con fattore di copertura $k=2$, corrispondente ad un livello di fiducia del 95% circa.

Riferibilità: La taratura del m suratore di massa utilizzato per la preparazione della miscela è effettuata utilizzando masse certificate dal centro di taratura LAT n°055.
Traceability: la taratura delle masse è eseguita in conformità alla procedura PTS3;
I certificati di riferimento delle masse utilizzate sono:
LAT055 451/2015; 572/2015; 028/2015; 027/2015

Note:
Note:

PRESSIONE DI RIEMPIMENTO (bar): Filling pressure (bar):	150,00	RISCHI PER LA SALUTE: Health hazards:	-
PRESSIONE MINIMA DI UTILIZZO (bar): Minimum pressure (bar):	15	PROPRIETA' CHIMICO-FISICHE: Chemical and physical properties:	COMBURENTE
TEMPERATURA DI STOCCAGGIO (°C): Storage temperature (°C):	0-40	DATA DI SCADENZA: Expiry date:	03/2020

Data certificato: 22/03/2017
Certification date:

Numero certificato: 201701957
Certificate number:

Operator: S. Manzoni
Operator:



SAPIO PRODUZIONE IDROGENO OSSIGENO S.r.l.

SEDE LEGALE: VIA SAN MAURILIO 13, 20123, MILANO
UFFICI OPERATIVI: VIA SENATORE SIMONE TTA 27, 20967, CAPONAGO (MB)
TELEFONO: 02.817051 / TELEFAX: 02.85740842

CERTIFICATO DI ANALISI
Certificate of analysis

630-02

CLIENTE: CHIMICA APPLICATA DEPURAZIONE ACQUE
Customer:
INDIRIZZO: VIA PIO LA TORRE 13 - AREA PIP MENFI 92013 AG
Address:

NUMERO ORDINE: 3633364
Order number:

CODICE RIORDINO: P61AR3YDFN
Code reordering:

PER RIORDINO: ordini@sapiog.it
Numero verde: 800416110

MATRICOLA: MP17107
Serial number:

CAPACITA' (litri): 10
Capacity (liters):

SCADENZA
PROVA IDRAULICA: 03/2024
Expiration hydraulic test:

CONTENUTO: MISCELA DI GAS
Content:
RECIPIENTE: BOMBOLA GRUPPO 5-UNI1144
Vessel:
INOX

METODO DI PREPARAZIONE: GRAVIMETRICO SECONDO NORME ISO 6142 - ISO 6143
Method of preparation:

COMPONENTE Component	RICHIESTA Request	CONCENTRAZIONE (C) Concentration (C)	Incertezza Relativa (ΔC%) Relative Uncertainty (ΔC%)
AMMONIACA	50.0 ppm	47.3 ppm	2.0%

Complemento: AZOTO Balance:	Concentrazione (C) espressa in termini di: mol/mo Concentration (C) expressed in terms of:
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L'incertezza relativa (ΔC%) riportata è espressa come incertezza estesa relativa con fattore di copertura k=2, corrispondente ad un livello di fiducia del 95% circa.

Riferibilità:
Traceability: La taratura del misuratore di massa utilizzato per la preparazione della miscela è effettuata utilizzando masse certificate dal centro di taratura LAT n° 055; la taratura delle masse è eseguita in conformità alle procedure PTSS; i certificati di riferimento delle masse utilizzate sono: LAT055 451/2015; 572/2015; 028/2015; 027/2015

Note:
Note:

PRESSIONE DI RIEMPIMENTO (bar): Filling pressure (bar):	150	RISCHI PER LA SALUTE: Health hazards:	ASPISSIANTE SEMPLICE
PRESSIONE MINIMA DI UTILIZZO (bar): Minimum pressure (bar):	15	PROPRIETA' CHIMICO-FISICHE: Chemical and physical properties:	INERTE
TEMPERATURA DI STOCCAGGIO (°C): Storage temperature (°C):	0-40	DATA DI SCADENZA: Expiry date:	09/2017

Data certificato: 24/03/2017
Certification date:

Numero certificato: 201702042
Certificate number:

Operatore: M. Gioschi
Operator: