



**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,
Marsaxlokk MXK 1220, Malta

QAL 2 REPORT ON AUTOMATED MEASURING SYSTEM INSTALLED FOR CONTINUOUS MONITORING OF EMISSIONS OF STACK 6A

performed on behalf of

SUN LAB GROUP Ltd


Area Technical Manager
C.A.D.A. snc
Dott. Giorgio Rocchia

December, 2017



INDEX

INDEX	1
1 INTRODUCTION	3
2 Reference	4
2.1 Normative Reference	4
2.2 Terms of Reference	4
3 DESCRIPTION OF THE PLANT	5
4 STANDARD REFERENCE METHOD (SRM)	7
5 AUTOMETED MEASURING SYSTEM (AMS)	9
6 FUNCTIONAL TEST	10
6.1 Test of linearity	12
7 CALIBRATION and VALIDATION OF THE AMS (QAL2)	14
7.1 Determination of the Calibration function	14
7.2 Test of Variability	16
8 ACCURACY INDEX ACCORDING TO LEGISLATIVE DECREE. 152/06 (IAR)	18
8.1 Determination of homogeneity of the Sampling Point	19
9 RESULTS	21
10 CONCLUSIONS and COMMENTS	23
11 ANNEX 1 – FUNCTIONAL TEST	24
12 ANNEX 2 – TEST LINEARITY RESULTS	27
12.1 Test Linearity of Carbon Monoxide	27
12.2 Test Linearity of Nitrogen Oxide	28
12.3 Test Linearity of Nitrogen Dioxide	29
12.4 Test Linearity of Sulfur Dioxide	30
12.5 Test Linearity of Oxygen	31
12.6 Test Linearity of Carbon Dioxide	32
12.7 Test Linearity of Ammonia	33
13 Annex 3 - Test Report	34
13.1 Determination of the velocity profile	34
13.2 Dust Report	36
13.3 Combustion gas report	38
13.4 Ammonia Report	41
14 ANNEX 4 - QAL2 REPORT	42
14.1 Carbon Monoxide - QAL2	42
14.2 Nitrogen Oxide - QAL2	44



14.3	Oxygen - QAL2	46
14.4	Carbon Dioxide – QAL2.....	48
14.5	DUST – QAL2.....	50
15	Annex 5 – IAR report.....	52
15.1	Water Vapour – IAR.....	52
15.2	Temperature – IAR	52
15.3	Pressure - IAR.....	53
15.4	Flow - IAR.....	53
16	Annex 6 – QAL1 Certified SRM Analyzer	54
17	Annex 7 – Dilution System calibration certificate	64
18	Annex 8 - Certificate of Accreditation to UNI CEI EN ISO / IEC 17025: 2005	67
19	Annex 9 - Certificates reference material.....	68



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 6A emissions at the Delimara Power Station, Marsaxlokk, Malta .

In this technical report, we describe the linearity test performed on AMS Stack 6A 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 6th, 7th and 8th November 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	
Address	Triq Belt il-Hazna Marsa, MRS II	
City	Marsa - Malta	
Location of Sampling	Delimara (MALTA)	
Emission Point	6A	
Responsible	Eng. David Griscti (D3 Power)	
Description of the plant	Power plant	
Process characteristics	Electricity production	
Source of emission	DE41 - DE42	
Majority fuel	Natural Gas	
GPS Coordinates (N - E)	35°49'57.93" N	14°33'29.19" E
Pollution abatement system	SCR/Denox	
Authorization decree	IPPC IP 0002/07/Gii	
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/Gii

Emission Limit Value		
Parameter	Unit of Measurement	Value
Dust	mg/Nm ³	5
Nitrogen Oxides	mg/Nm ³	55
Sulfur Dioxide	mg/Nm ³	10
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 “6A” 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 [cm]	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	
06/11/2017	08:00 - 24:00	DE 42	18,33 MW	50 %
07/11/2017	08:00 - 24:00	DE 42	14,66 MW	40 %
08/11/2017	08:00 - 24:00	DE 42	11,9 MW	33 %



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 6A.

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	<i>Alignment and cleanliness</i>	-	X	<i>Supplier/Manufacturer</i>
2	<i>Sampling system</i>	X	-	<i>Laboratory</i>
3	<i>Documentation and records</i>	X	X	<i>Plant operator</i>
4	<i>Functionality</i>	X	X	<i>Plant operator</i>
5	<i>Leak test</i>	X	-	<i>Laboratory</i>
6	<i>Zero and span check</i>	X	X	<i>Laboratory</i>
7	<i>Linearity</i>	X	-	<i>Laboratory</i>
8	<i>Interferences</i>	X	X	<i>Laboratory / Supplier / Installer</i>
9	<i>Zero and span drift (audit)</i>	X	X	<i>Plant operator</i>
10	<i>Response time</i>	X	X	<i>Laboratory</i>
11	<i>Report</i>	X	X	<i>Laboratory</i>

The functional test was carried out at 6th November 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.

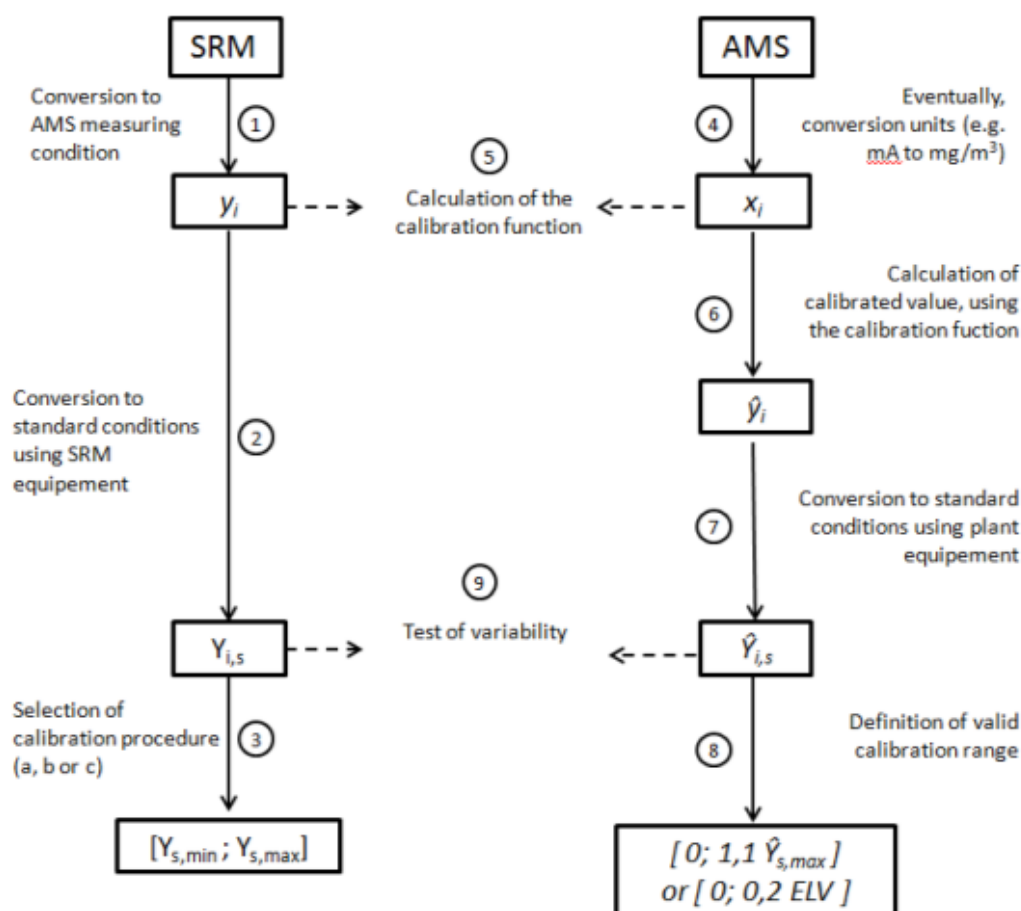
7 CALIBRATION and VALIDATION OF THE AMS (QAL2)

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 6A. Note that for ammonia and sulfur dioxide the QAL2 procedure is not applicable because the parameters concentration are below the detection limit (LOD) of the AMS. 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	0,441	0,000	0 - 4,21 [mg/Nm ³ rif O ₂]	Metodo B	30	27,79	5
Nitrogen Oxide (NO)	1,169	2,870	0 - 24,81 [mg/Nm ³ rif O ₂]	Metodo A	20	3,13	55
Carbon Monoxide (CO)	1,007	-1,663	0 - 22 [mg/Nm ³ rif O ₂]	Metodo C	10	0,62	110
Oxygen (O ₂)	1,124	0,000	0 - 14,54 [% Vol.]	Metodo B	10	3,74	/
Carbon Dioxide (CO ₂)	0,955	0,010	0 - 5,02 [% Vol.]	Metodo B	10	1,49	/

As regards carbon monoxide and nitrogen monoxide, the range of validity is lower than the emission limit value, carbon monoxide ELV is 110 mg/Nm³ and nitrogen monoxide ELV is 55 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)
Nitrogen Oxide (NO)	55	0 - 24,81 [mg/Nm ³ rif O ₂]	0	0,1	2,99	Positive
Carbon Monoxide (CO)	110	0 - 22 [mg/Nm ³ rif O ₂]	0	0	1,66	Positive



Table 13 - Span/ELV Verify

Span/ELV Verify (Rif. 6.5 - Calibration Function of the AMS and its validity EN 14181 : 2015)								
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)
Nitrogen Oxide (NO)	55	0 - 24,81 [mg/Nm3 rif O2]	61,56	59,58	10,96	20	11	Positive
Carbon Monoxide (CO)	110	0 - 22 [mg/Nm3 rif O2]	116,44	117	0,32	10	11	Positive

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

Table 14 - IAR Values

I _{AR} Water Vapour	I _{AR} Temperature	I _{AR} Pressure	I _{AR} Flow Rate
88,5	97,8	97,7	81,8



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 demonstrates 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 of AMS, 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 14/06/2017 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 14/06/2017 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 14/06/2017 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	0,1	291,1	290,2
				0,1		290,6
				0,1		290,4
NO	mg/Nm3	0	0,0	0,2	256,5	244,7
				0,1		246,8
				0,2		247,1
SO ₂	mg/Nm3	0	0,0	0,1	185,9	190,0
				0,0		192,0
				0,0		195,0
O ₂	% Vol	0	0,0	0,0	16,7	16,6
				0,1		16,7
				0,0		16,7
CO ₂	% Vol	0	0,0	0,1	20,0	20,0
				0,2		19,9
				0,1		20,0
NH ₃	mg/Nm3	0	0,0	0,0	23,9	21,0
				0,0		21,0
				0,0		21,5
NO ₂	mg/Nm3	0,1	0,1	0,1	83,7	83,3
				0,3		82,8
				0,2		82,8

Notes / Comments:
(*) Values recorded by linearity tests.



7	Linearity (*)				
Parameter	Full Scale set	Slope (B)	Intercept (A)	d _{c,rel} [%]	Results
CO	0 - 300 mg/Nm3	1,000	0,554	0,7	Positive
NO	0 - 300 mg/Nm3	0,970	1,054	1,0	Positive
SO ₂	0 - 2000 mg/Nm3	1,051	2,697	0,3	Positive
O ₂	0 - 21 %vol	0,990	-0,049	0,9	Positive
CO ₂	0 - 25 %vol	0,990	0,073	0,3	Positive
NH ₃	0 - 30 mg/Nm3	0,878	0,180	3,1	Positive
NO ₂	0 - 100 mg/Nm3	0,988	-0,001	2,0	Positive
Notes / Comments: (*) Test recordings are in Annex 2.					

8	Interferences	
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	Response time	
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	12,43	0,08	11,54	0,19	Positive
2	29	1	12,45		11,74		
3	59	1	12,65		11,95		
4	141	1	12,44		11,65		
5	171	1	12,55		11,52		
6	191	1	12,50		11,65		
7							
8							
9							
10							
11	9	2	12,48		11,12		
12	29	2	12,44		11,65		
13	59	2	12,55		11,62		
14	141	2	12,62		11,52		
15	171	2	12,63		11,66		
16	191	2	12,55		11,58		
17							
18							
19							
20							

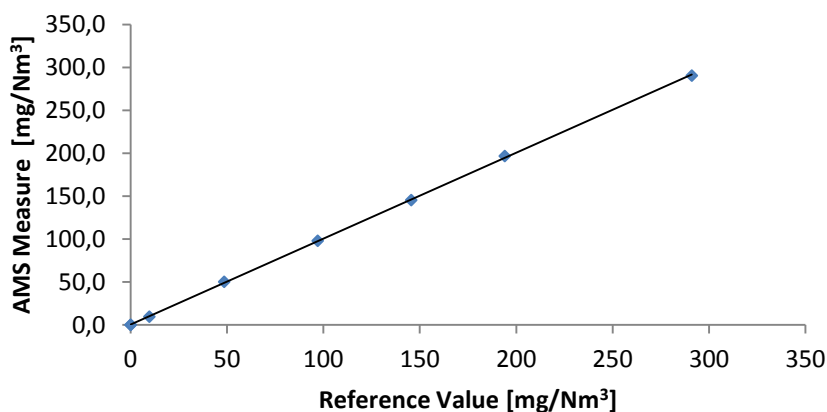


12 ANNEX 2 – TEST LINEARITY RESULTS

12.1 TEST LINEARITY OF CARBON MONOXIDE

Stack		6A		Data materials used					
Customer		D3 POWER GENERATION LIMITED		Cylinder Producer		SAPIO			
Parameter		CO		Serial/Certificate		MP9/1309			
Analyzer		SICK MCS 100 E		Concentration		233	ppm		
Full Scale set		0- 300	mg/Nm3	Expiration		01/08/2019			
Date measurements		06/11/2017		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	0,1	0	0,1	0,1	-0,49	-0,2	Positive
	1	9,7	9,5	9,6	9,7	9,6	-0,66	-0,2	Positive
	2	48,5	50,2	50,3	50,2	50,2	1,15	0,4	Positive
	3	97,0	98,0	98,0	98,0	98,0	0,39	0,1	Positive
	4	145,5	145,5	145,4	145,3	145,4	-0,73	-0,2	Positive
	5	194,0	197,0	195,9	197,3	196,7	2,07	0,7	Positive
	6	291,1	290,2	290,6	290,4	290,4	-1,31	-0,4	Positive
	0	0	0,2	0	0,2	0,1	-0,42	-0,1	Positive
		Y _z	98,2	A'	98,8	B	1,000	A	0,5540
	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



◆ Linearity Carbon Monoxide

$$y = 1,0003x + 0,554$$

$$R^2 = 0,9999$$



12.2 TEST LINEARITY OF NITROGEN OXIDE

Stack	6A		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	NO		Serial/Certificate	MP9/1309
Analyzer	SICK MCS 100 E		Concentration	230 ppm
Full Scale set	0- 300	mg/Nm ³	Expiration	01/08/2019
Date measurements	06/11/2017		Diluter	Beta CAP30RK

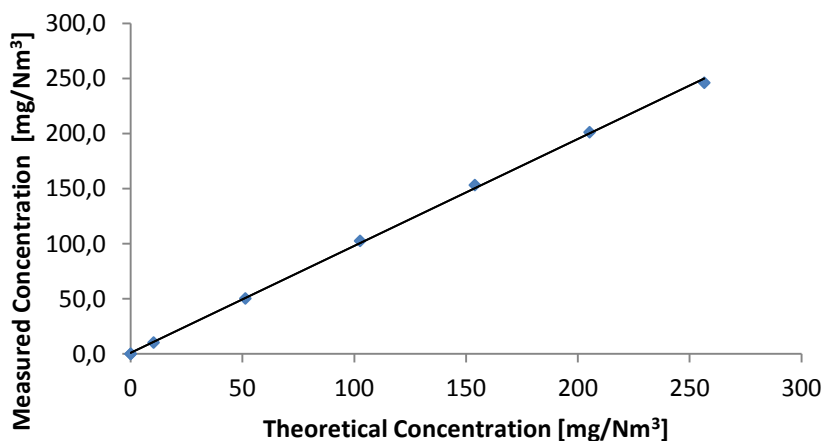
Measurements and calculations

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	0,1	0,2	0,2	-0,89	-0,3	Positive
	1	10,26	10,5	10,4	10,3	10,4	-0,60	-0,2	Positive
	2	51,3	50,1	50,8	50,4	50,4	-0,36	-0,1	Positive
	3	102,61	102,9	102,7	102,4	102,7	2,12	0,7	Positive
	4	153,92	153	152	155	153,3	3,04	1,0	Positive
	5	205,23	201,3	201,2	201,4	201,3	1,26	0,4	Positive
	6	256,53	244,7	246,8	247,1	246,2	-3,58	-1,2	Positive
	0	0	0,1	0,1	0	0,1	-0,99	-0,3	Positive
Y _z			97,5	A'	95,6	B	0,970	A	1,0541

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



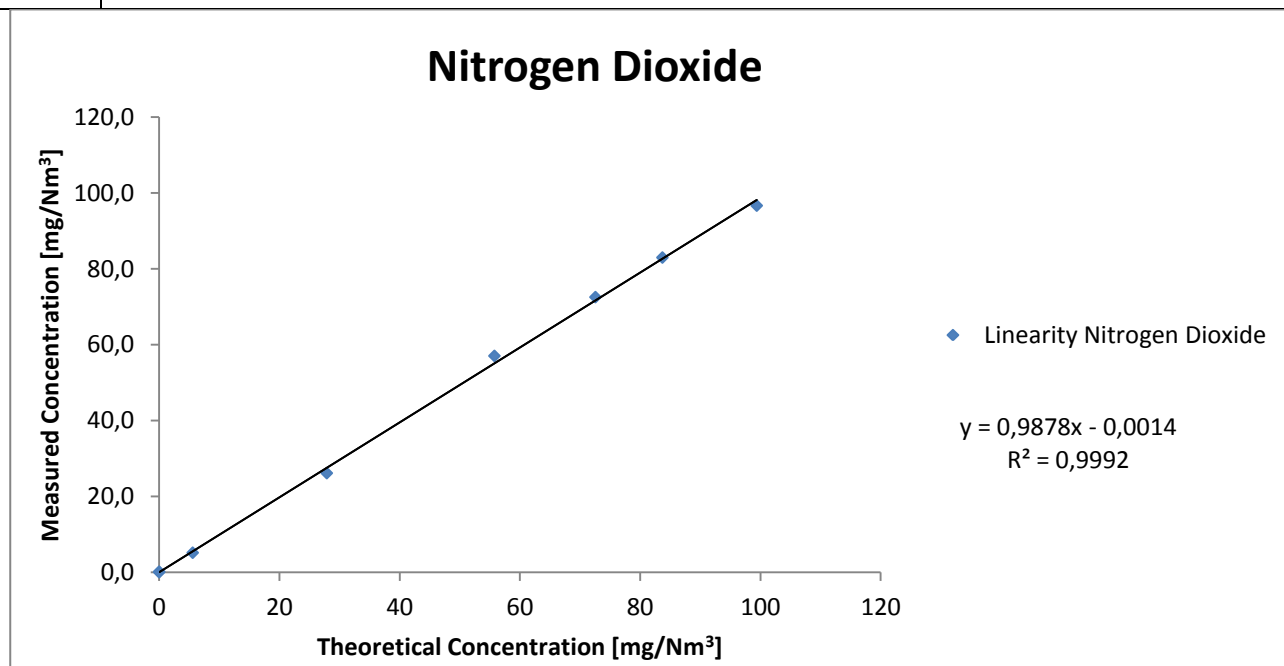
◆ Linearity Nitrogen monoxide

$$y = 0,9696x + 1,0541$$
$$R^2 = 0,9995$$



12.3 TEST LINEARITY OF NITROGEN DIOXIDE

Stack		6A		Data materials used					
Customer		D3 POWER GENERATION LIMITED		Cylinder Producer		SAPIO			
Parameter		NO ₂		Serial/Certificate		MP311905			
Analyzer		SICK MCS 100 E		Concentration		81,6 ppm			
Full Scale set		0- 100 mg/Nm3		Expiration		30/03/2018			
Date measurements		06/11/2017		Diluter		Beta CAP30RK			
Measurements and calculations									
NO2 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	0,1	0,1	0,3	0,2	0,17	0,2	Positive
	1	5,58	5,4	5,1	5	5,2	-0,34	-0,3	Positive
	2	27,88	26,1	26,2	26,1	26,1	-1,40	-1,4	Positive
	3	55,76	56,6	57	57,5	57,0	1,96	2,0	Positive
	4	72,56	72,43	72,51	72,63	72,5	0,85	0,9	Positive
	5	83,7	83,29	82,76	82,82	83,0	0,28	0,3	Positive
	6	99,39	96,2	96,3	97,4	96,6	-1,54	-1,5	Positive
	0	0	0,1	0	0	0,0	0,03	0,0	Positive
		Y _z	43,1	A'	42,6	B	0,988	A	-0,0014
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									





12.4 TEST LINEARITY OF SULFUR DIOXIDE

Stack	6A		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	SO ₂		Serial/Certificate	MP9/1309
Analyzer	SICK MCS 100 E		Concentration	65,1 ppm
Full Scale set	0- 2000	mg/Nm ³	Expiration	01/08/2019
Date measurements	06/11/2017		Diluter	Beta CAP30RK

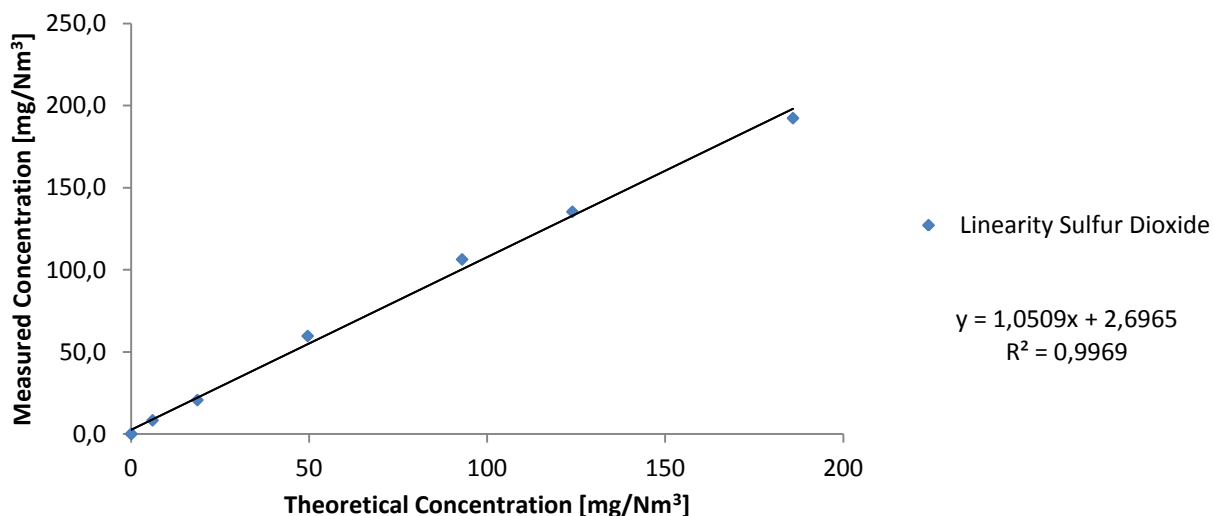
Measurements and calculations

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	0,1	0	0	0,0	-2,66	-0,1	Positive
	1	6,01	8	9	8	8,3	-0,68	0,0	Positive
	2	18,59	21	20	21	20,7	-1,57	-0,1	Positive
	3	49,57	60	59	60	59,7	4,88	0,2	Positive
	4	92,94	110	105	104	106,3	5,96	0,3	Positive
	5	123,92	134	137	135	135,3	2,41	0,1	Positive
	6	185,88	190	192	195	192,3	-5,71	-0,3	Positive
	0	0	0,1	0	0,1	0,1	-2,63	-0,1	Positive
		Y _z	59,6	A'	65,3	B	1,051	A	2,6965

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





12.5 TEST LINEARITY OF OXYGEN

Stack	6A		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	O ₂		Serial/Certificate	P33021
Analyzer	SICK MCS 100 E		Concentration	25,06 %vol
Full Scale set	0- 21	%vol	Expiration	30/03/2020
Date measurements	06/11/2017		Diluter	Beta CAP30RK

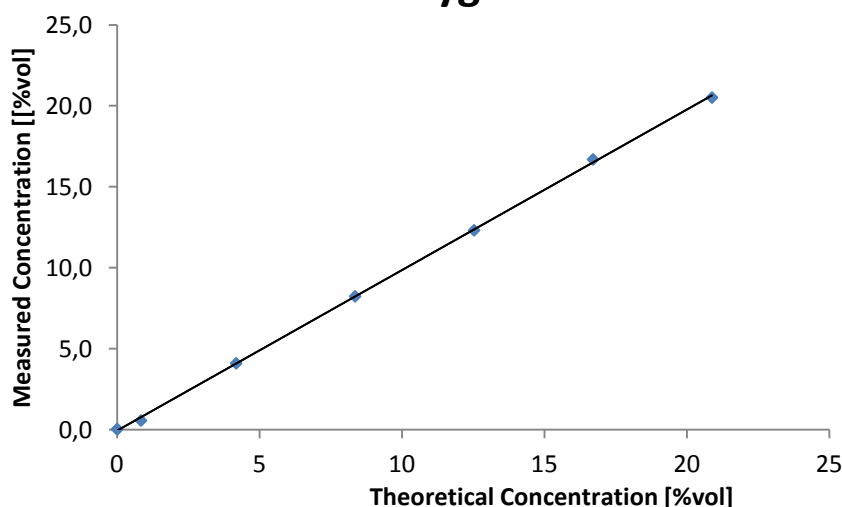
Measurements and calculations

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	0,1	0	0,0	0,08	0,4	Positive
	1	0,835	0,6	0,5	0,6	0,6	-0,21	-1,0	Positive
	2	4,177	4,2	4	4,1	4,1	0,01	0,1	Positive
	3	8,353	8,21	8,3	8,2	8,2	0,01	0,1	Positive
	4	12,53	12,33	12,31	12,3	12,3	-0,05	-0,2	Positive
	5	16,707	16,59	16,74	16,74	16,7	0,19	0,9	Positive
	6	20,883	20,53	20,48	20,52	20,5	-0,12	-0,6	Positive
	0	0	0	0	0,1	0,0	0,08	0,4	Positive
		Y _z	7,9	A'	7,8	B	0,990	A	-0,0494

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	6A		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	CO ₂		Serial/Certificate	MP9/1309
Analyzer	SICK MCS 100 E		Concentration	20,02 %vol
Full Scale set	0- 25	%vol	Expiration	01/08/2019
Date measurements	06/11/2017		Diluter	Beta CAP30RK

Measurements and calculations

%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	0,1	0,2	0,1	0,1	0,06	0,2	Positive
	1	2	2,01	2,02	2	2,0	-0,04	-0,2	Positive
	2	3,33	3,46	3,4	3,44	3,4	0,06	0,3	Positive
	3	5,33	5,3	5,31	5,35	5,3	-0,03	-0,1	Positive
	4	10,01	9,81	9,86	9,8	9,8	-0,16	-0,6	Positive
	5	16,68	16,55	16,65	16,59	16,6	0,01	0,0	Positive
	6	20,02	20	19,89	20,01	20,0	0,07	0,3	Positive
	0	0	0,3	0	0	0,1	0,03	0,1	Positive
	Y _z	7,2	A'	7,2	B	0,990	A	0,0733	



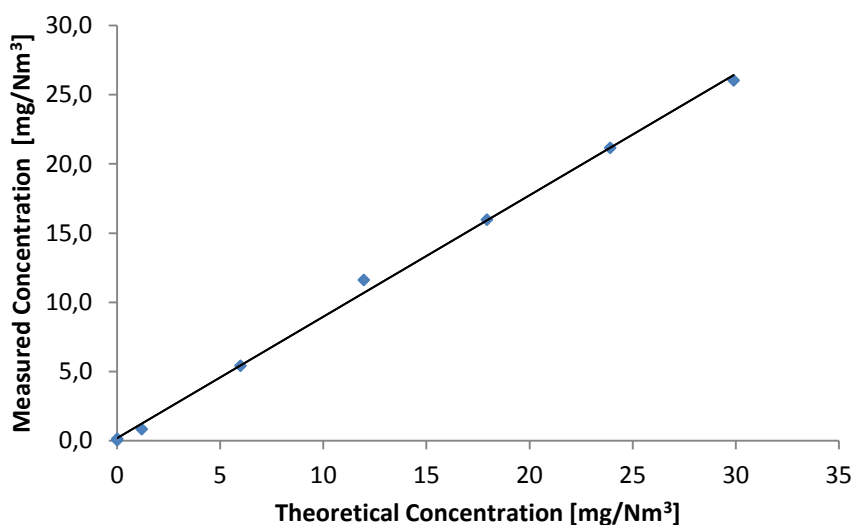
12.7 TEST LINEARITY OF AMMONIA

Stack	6A		Data materials used	
Customer	D3 POWER GENERATION LIMITED		Cylinder Producer	SAPIO
Parameter	NH ₃		Serial/Certificate	MP17107
Analyzer	SICK MCS 100 E		Concentration	47,3 ppm
Full Scale set	0- 30	mg/Nm ³	Expiration	31/12/2017
Date measurements	06/11/2017		Diluter	Beta CAP30RK

Measurements and calculations

NH ₃ 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	0,1	0	0,0	-0,15	-0,5	Positive
	1	1,19	1,1	0,8	0,6	0,8	-0,39	-1,3	Positive
	2	5,98	5,39	5,41	5,43	5,4	-0,02	-0,1	Positive
	3	11,96	11,59	11,61	11,63	11,6	0,94	3,1	Positive
	4	17,93	15,8	15,9	16,2	16,0	0,05	0,2	Positive
	5	23,91	20,95	21,02	21,5	21,2	0,00	0,0	Positive
	6	29,9	25,8	26,2	26,1	26,0	-0,38	-1,3	Positive
	0	0	0,2	0,2	0	0,1	-0,05	-0,2	Positive
		Y _z	11,4	A'	10,1	B	0,878	A	0,1797
Legend									
<p>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</p>									

Ammonia



$y = 0,8775x + 0,1797$
 $R^2 = 0,9983$



13 ANNEX 3 - TEST REPORT

13.1 DETERMINATION OF THE VELOCITY PROFILE

Report Campionamento / Determinazione del Profilo di Velocità							
Determinazione della Velocità e Portata				UNI EN ISO 16911-1:2013 Annex A			
Parametri Ausiliari							
Ossigeno (O ₂)				UNI EN 14789:2006			
Temperatura				UNI EN ISO 16911-1:2013 Annex A			
Pressione				UNI EN ISO 16911-1:2013 Annex A			
Vapor d'acqua				UNI EN 14790:2006			
Informazioni in merito alla strumentazione e supporti utilizzati per il campionamento ed analisi							
Strumentazione							
Misuratore di Velocità e Portata		DADO LAB	ST55AA20160199	DADO LAB - ST5 V8.5			
Analizzatore Gas		Horiba	MY25EG2X	Analizzatore Horiba PG-350E			
Tubo di Pitot		Zambelli	30435	k =0,8296; Type Pitot (S)			
Informazioni relative al Punto Emissivo							
Diametro del camino [m]		2,00	Altezza da terra [m]			40	
Superficie del camino [m ²]		3,14	Altezza da terra del punto di campionamento [m]			Verticale	
Diametri a monte del punto di campionamento		12,5	Diametri a valle del punto di campionamento			1	
Personale tecnico che ha eseguito il campionamento							
Dott. Giorgio Rocchia							
Determinazione del profilo di velocità						06/11/2017	
Punto	Diametro	Affondamento [cm]	Temperatura [°C]	Δpi [Pa]	Velocità [m/s]	Parametri Ausiliari	
1	1	9	365	335	29,3	Ossigeno [% vol]	12,5
2	1	29	364	344	29,6		
3	1	59	365	326	28,9		
4	1	141	365	325	28,8	Biossido di Carbonio [%vol]	4,8
5	1	171	365	334	29,2		
6	1	191	364	341	29,5		
7						Vapore Acqueo [% vol]	10,48
8							
9							
10						Densità - ρ (Kg/m ³)	1,305
11	2	9	363	321	28,6		
12	2	29	365	336	29,3		
13	2	59	362	336	29,3	Pressione Emissione [kPa]	102
14	2	141	363	333	29,1		
15	2	171	365	334	29,2		
16	2	191	365	330	29,1	Temperatura Ambiente [°C]	18
17							
18							
19						Pressione Ambiente [hPa]	1008
20							



Determinazione del profilo di velocità						07/11/2017	
Punto	Diametro	Affondamento [cm]	Temperatura [°C]	Δp_i [Pa]	Velocità [m/s]	Parametri Ausiliari	
1	1	9	153	67,5	10,73	Ossigeno [% vol]	11,9
2	1	29	152	68,4	10,79		
3	1	59	153	69,6	10,89		
4	1	141	154	72,4	11,12	Biossido di Carbonio [%vol]	4,6
5	1	171	152	70,1	10,92		
6	1	191	155	69,6	10,92		
7						Vapore Acqueo [% vol]	10,46
8							
9							
10						Densità - ρ (Kg/m ³)	1,303
11	2	9	152	71,5	11,03		
12	2	29	151	72	11,05		
13	2	59	155	72,6	11,15	Pressione Emissione [kPa]	102
14	2	141	153	72	11,08		
15	2	171	155	70,1	10,96		
16	2	191	153	69,2	10,86	Temperatura Ambiente [°C]	19
17							
18							
19						Pressione Ambiente [hPa]	1010
20							

Determinazione del profilo di velocità						08/11/2017	
Punto	Diametro	Affondamento [cm]	Temperatura [°C]	Δp_i [Pa]	Velocità [m/s]	Parametri Ausiliari	
1	1	9	141	43,44	8,50	Ossigeno [% vol]	12,8
2	1	29	142	42,1	8,38		
3	1	59	140	40,8	8,23		
4	1	141	140	40,6	8,21	Biossido di Carbonio [%vol]	4,3
5	1	171	139	41	8,24		
6	1	191	138	41,2	8,25		
7						Vapore Acqueo [% vol]	11,62
8							
9							
10						Densità - ρ (Kg/m ³)	1,302
11	2	9	140	42,1	8,36		
12	2	29	141	42,2	8,38		
13	2	59	139	39,4	8,08	Pressione Emissione [kPa]	102
14	2	141	138	40,1	8,14		
15	2	171	141	38,9	8,05		
16	2	191	140	40,1	8,16	Temperatura Ambiente [°C]	20
17							
18							
19						Pressione Ambiente [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			
Tubo di Pitot		Zambelli	30435	k = 0,8296; 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							
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		06/11/2017	/	FN01	0,00	0,06	0,881
2125827-001	Reply 1	06/11/2017 13:15	60	FN02	0,92	0,16	0,506
2125827-002	Reply 2	06/11/2017 14:38	60	FN03	3,43	0,16	1,633
2125827-003	Reply 3	06/11/2017 15:52	60	FN04	1,05	0,15	0,641
2125827-004	Reply 4	06/11/2017 17:06	60	FN05	1,06	0,11	0,607
2125827-005	Reply 5	06/11/2017 18:16	60	FN06	2,02	0,11	1,016
Method Blank		07/11/2017	/	FM91	0,00	0,05	0,883
2125827-006	Reply 6	07/11/2017 09:04	60	FM92	1,90	0,16	0,884
2125827-007	Reply 7	07/11/2017 10:21	60	FM93	2,26	0,14	0,894
2125827-008	Reply 8	07/11/2017 11:40	60	FM94	2,13	0,15	0,880
2125827-009	Reply 9	07/11/2017 12:47	60	FM95	2,05	0,14	0,874
2125827-010	Reply 10	07/11/2017 14:14	60	FM97	1,64	0,13	0,881
Method Blank		08/11/2017	/	FN07	0,00	0,05	0,662
2125827-011	Reply 11	08/11/2017 08:35	60	FN08	2,01	0,13	0,710
2125827-012	Reply 12	08/11/2017 09:35	60	FN09	1,40	0,11	0,700
2125827-013	Reply 13	08/11/2017 10:39	60	FN10	1,11	0,11	0,458
2125827-014	Reply 14	08/11/2017 11:48	60	FN11	2,48	0,11	0,716
2125827-015	Reply 15	08/11/2017 12:57	60	FN12	1,89	0,11	0,728

⁽¹⁾ The pressure, temperature and volume data related to the Method Blank are obtained from the average of the values of the 5 replies of the day.



Dust - Sampling and analysis Data							2
I.D. Sample	Stack Speed [m/s]	Temperature [°C] ⁽¹⁾	Pressure [kPa] ⁽¹⁾	H ₂ O [%v/v] ⁽¹⁾	O ₂ [%v/v] ⁽¹⁾	Dust Concentration [mg/Nm ³] ^{(1) (2)}	Dust Concentration correct with O ₂ [mg/Nm ³] ⁽¹⁾⁽³⁾
Method Blank	/	363,95	100,7	10,60	12,53	0,06	0,04
2125827-001	9,52	364,62	100,7	11,00	12,56	2,13	1,51
2125827-002	30,88	365,10	100,6	10,80	12,57	2,20	1,56
2125827-003	11,95	363,43	100,7	10,30	12,49	1,87	1,32
2125827-004	11,37	362,52	100,8	10,90	12,51	1,94	1,37
2125827-005	19,04	364,08	100,7	10,00	12,53	2,10	1,49
Method Blank	/	152,26	101,2	10,44	13,50	0,06	0,05
2125827-006	10,94	152,88	101,1	10,10	13,88	2,33	1,96
2125827-007	11,14	155,65	101,1	10,50	13,90	2,69	2,27
2125827-008	10,95	153,28	101,2	11,00	13,19	2,59	1,99
2125827-009	10,76	150,17	101,1	10,02	13,27	2,51	1,95
2125827-010	10,95	149,34	101,7	10,60	13,29	2,01	1,57
Method Blank	/	144,14	101,5	11,38	13,27	0,07	0,05
2125827-011	8,67	140,48	101,6	11,00	13,22	3,02	2,33
2125827-012	8,73	140,05	101,7	12,00	13,30	2,15	1,68
2125827-013	5,64	148,15	101,8	11,00	13,27	2,66	2,06
2125827-014	8,88	146,57	100,7	12,00	13,29	3,62	2,81
2125827-015	8,88	145,44	101,7	10,90	13,27	2,75	2,14
⁽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		06/11/2017	/			0,04	Positive
2125827-001	Reply 1	06/11/2017 13:15	60	0,2	Positive		
2125827-002	Reply 2	06/11/2017 14:38	60	-0,1	Positive		
2125827-003	Reply 3	06/11/2017 15:52	60	0,2	Positive		
2125827-004	Reply 4	06/11/2017 17:06	60	0	Positive		
2125827-005	Reply 5	06/11/2017 18:16	60	0	Positive		
Method Blank		07/11/2017	/			0,05	Positive
2125827-006	Reply 6	07/11/2017 09:04	60	0	Positive		
2125827-007	Reply 7	07/11/2017 10:21	60	0,1	Positive		
2125827-008	Reply 8	07/11/2017 11:40	60	0,1	Positive		
2125827-009	Reply 9	07/11/2017 12:47	60	0	Positive		
2125827-010	Reply 10	07/11/2017 14:14	60	0	Positive		
Method Blank		08/11/2017	/			0,05	Positive
2125827-011	Reply 11	08/11/2017 08:35	60	0	Positive		
2125827-012	Reply 12	08/11/2017 09:35	60	0	Positive		
2125827-013	Reply 13	08/11/2017 10:39	60	2,3	Positive		
2125827-014	Reply 14	08/11/2017 11:48	60	0	Positive		
2125827-015	Reply 15	08/11/2017 12:57	60	0	Positive		
⁽⁴⁾ Dust sampling must be done in isocinetics. The isocinetetic 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					
Determination of Nitrogen Oxide (NO) - Sampling and analysis Data					1
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Nitrogen Oxide (NO) - [mg/Nm3] (2)	Oxygen (O ₂) - [%vol] ⁽¹⁾
2125827-001	Reply 1	06/11/2017 16:51	60	37,60	12,56
2125827-002	Reply 2	06/11/2017 18:05	60	33,97	12,57
2125827-003	Reply 3	06/11/2017 19:15	60	33,54	12,49
2125827-004	Reply 4	06/11/2017 20:29	60	32,62	12,51
2125827-005	Reply 5	06/11/2017 21:29	60	31,10	12,53
2125827-006	Reply 6	07/11/2017 10:03	60	18,88	13,88
2125827-007	Reply 7	07/11/2017 11:20	60	18,42	13,90
2125827-008	Reply 8	07/11/2017 12:39	60	20,41	13,19
2125827-009	Reply 9	07/11/2017 13:46	60	21,64	13,27
2125827-010	Reply 10	07/11/2017 15:13	60	22,82	13,29
2125827-011	Reply 11	08/11/2017 09:34	60	25,93	13,22
2125827-012	Reply 12	08/11/2017 10:34	60	24,78	13,30
2125827-013	Reply 13	08/11/2017 11:38	60	24,16	13,27
2125827-014	Reply 14	08/11/2017 12:47	60	24,03	13,29
2125827-015	Reply 15	08/11/2017 13:56	60	24,25	13,27
Notes:					
(1) The oxygen value reported refers to the same measurement period of the parameter on which QAL2 (NO) is performed.					
(2) The Nitric Oxide (NO) 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⁾
2125827-001	Reply 1	06/11/2017 14:14	60	3,28	12,44
2125827-002	Reply 2	06/11/2017 15:37	60	2,98	12,49
2125827-003	Reply 3	06/11/2017 16:51	60	2,98	12,56
2125827-004	Reply 4	06/11/2017 18:05	60	2,91	12,57
2125827-005	Reply 5	06/11/2017 19:15	60	2,74	12,49
2125827-006	Reply 6	07/11/2017 10:03	60	0,11	13,88
2125827-007	Reply 7	07/11/2017 11:20	60	0,12	13,90
2125827-008	Reply 8	07/11/2017 12:39	60	0,11	13,19
2125827-009	Reply 9	07/11/2017 13:46	60	0,11	13,27
2125827-010	Reply 10	07/11/2017 15:13	60	0,11	13,29
2125827-011	Reply 11	08/11/2017 09:34	60	0,11	13,22
2125827-012	Reply 12	08/11/2017 10:34	60	0,11	13,30
2125827-013	Reply 13	08/11/2017 11:38	60	0,11	13,27
2125827-014	Reply 14	08/11/2017 12:47	60	0,11	13,29
2125827-015	Reply 15	08/11/2017 13:56	60	0,11	13,27
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⁾
2125827-001	Reply 1	06/11/2017 14:14	60	< 1	/
2125827-002	Reply 2	06/11/2017 15:37	60	< 1	/
2125827-003	Reply 3	06/11/2017 16:51	60	< 1	/
2125827-004	Reply 4	06/11/2017 18:05	60	< 1	/
2125827-005	Reply 5	06/11/2017 19:15	60	< 1	/
2125827-006	Reply 6	07/11/2017 10:03	60	< 1	/
2125827-007	Reply 7	07/11/2017 11:20	60	< 1	/
2125827-008	Reply 8	07/11/2017 12:39	60	< 1	/
2125827-009	Reply 9	07/11/2017 13:46	60	< 1	/
2125827-010	Reply 10	07/11/2017 15:13	60	< 1	/
2125827-011	Reply 11	08/11/2017 09:34	60	< 1	/
2125827-012	Reply 12	08/11/2017 10:34	60	< 1	/
2125827-013	Reply 13	08/11/2017 11:38	60	< 1	/
2125827-014	Reply 14	08/11/2017 12:47	60	< 1	/
2125827-015	Reply 15	08/11/2017 13:56	60	< 1	/
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				4
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Oxygen (O ₂) - [%vol] ⁽¹⁾
2125827-001	Reply 1	06/11/2017 14:14	60	12,44
2125827-002	Reply 2	06/11/2017 15:37	60	12,49
2125827-003	Reply 3	06/11/2017 16:51	60	12,56
2125827-004	Reply 4	06/11/2017 18:05	60	12,57
2125827-005	Reply 5	06/11/2017 19:15	60	12,49
2125827-006	Reply 6	07/11/2017 10:03	60	13,88
2125827-007	Reply 7	07/11/2017 11:20	60	13,90
2125827-008	Reply 8	07/11/2017 12:39	60	13,19
2125827-009	Reply 9	07/11/2017 13:46	60	13,27
2125827-010	Reply 10	07/11/2017 15:13	60	13,29
2125827-011	Reply 11	08/11/2017 09:34	60	13,22
2125827-012	Reply 12	08/11/2017 10:34	60	13,30
2125827-013	Reply 13	08/11/2017 11:38	60	13,27
2125827-014	Reply 14	08/11/2017 12:47	60	13,29
2125827-015	Reply 15	08/11/2017 13:56	60	13,27
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				5
I.D. Sample	Reply	Date and time of Start of the Sampling	Sampling duration [min]	Carbon Dioxide (CO ₂) - [%vol] ⁽¹⁾
2125827-001	Reply 1	06/11/2017 14:14	60	4,78
2125827-002	Reply 2	06/11/2017 15:37	60	4,73
2125827-003	Reply 3	06/11/2017 16:51	60	4,70
2125827-004	Reply 4	06/11/2017 18:05	60	4,70
2125827-005	Reply 5	06/11/2017 19:15	60	4,74
2125827-006	Reply 6	07/11/2017 10:03	60	3,92
2125827-007	Reply 7	07/11/2017 11:20	60	3,93
2125827-008	Reply 8	07/11/2017 12:39	60	4,26
2125827-009	Reply 9	07/11/2017 13:46	60	4,22
2125827-010	Reply 10	07/11/2017 15:13	60	4,23
2125827-011	Reply 11	08/11/2017 09:34	60	4,45
2125827-012	Reply 12	08/11/2017 10:34	60	4,41
2125827-013	Reply 13	08/11/2017 11:38	60	4,43
2125827-014	Reply 14	08/11/2017 12:47	60	4,42
2125827-015	Reply 15	08/11/2017 13:56	60	4,42
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 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		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							
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		06/11/2017	/	0,881	0,000	0,000	/
2125827-001	Reply 1	06/11/2017 13:15	60	0,506	0,000	0,000	< 0,1
2125827-002	Reply 2	06/11/2017 14:38	60	1,633	0,000	0,000	< 0,1
2125827-003	Reply 3	06/11/2017 15:52	60	0,641	0,000	0,000	< 0,1
2125827-004	Reply 4	06/11/2017 17:06	60	0,607	0,000	0,000	< 0,1
2125827-005	Reply 5	06/11/2017 18:16	60	1,016	0,000	0,000	< 0,1
Method Blank		07/11/2017	/	0,883	0,000	0,000	/
2125827-006	Reply 6	07/11/2017 09:04	60	0,884	0,000	0,000	< 0,1
2125827-007	Reply 7	07/11/2017 10:21	60	0,894	0,000	0,000	< 0,1
2125827-008	Reply 8	07/11/2017 11:40	60	0,880	0,000	0,000	< 0,1
2125827-009	Reply 9	07/11/2017 12:47	60	0,874	0,000	0,000	< 0,1
2125827-010	Reply 10	07/11/2017 14:14	60	0,881	0,000	0,000	< 0,1
Method Blank		08/11/2017	/	0,662	0,000	0,000	/
2125827-011	Reply 11	08/11/2017 08:35	60	0,710	0,000	0,000	< 0,1
2125827-012	Reply 12	08/11/2017 09:35	60	0,700	0,000	0,000	< 0,1
2125827-013	Reply 13	08/11/2017 10:39	60	0,458	0,000	0,000	< 0,1
2125827-014	Reply 14	08/11/2017 11:48	60	0,716	0,000	0,000	< 0,1
2125827-015	Reply 15	08/11/2017 12:57	60	0,728	0,000	0,000	< 0,1

⁽¹⁾ The pressure, temperature and volume data related to the Method Blank are obtained from the average of the values of the 5 replies of the day.



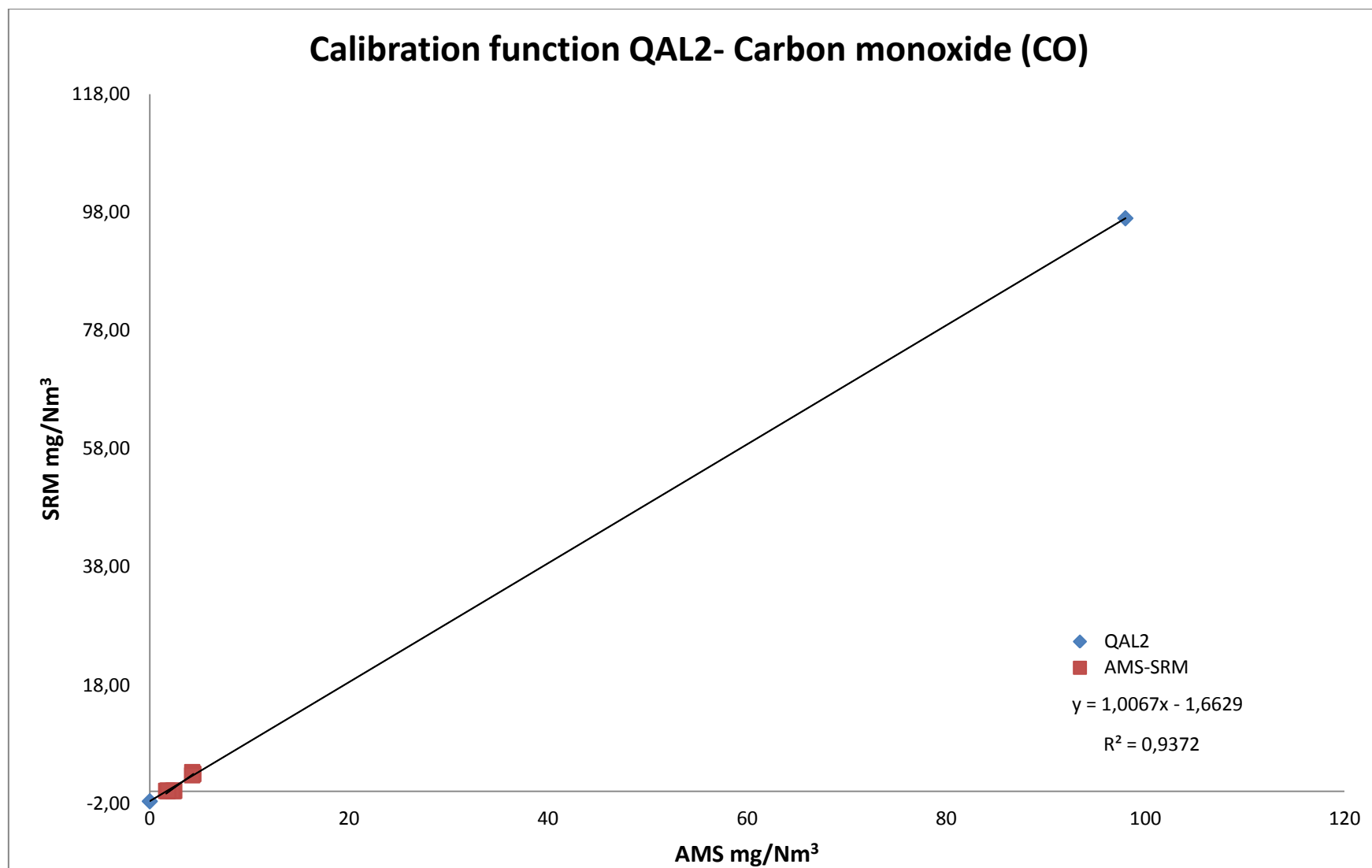


14 ANNEX 4 - QAL2 REPORT

14.1 CARBON MONOXIDE - QAL2

Parameter				CO			Emission Point			6A							
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 -d̄	(D _i -d̄) ²		
1	6/11/17 14:14	3,28	-3,37	12,44	2,30	4,26	11,52	-3,99	15,91	13,43	2,63	1,67	0,63	0,62	0,39		
2	6/11/17 15:37	2,98	-3,67	12,49	2,10	4,28	11,53	-3,97	15,75	14,57	2,65	1,68	0,42	0,41	0,16		
3	6/11/17 16:51	2,98	-3,67	12,56	2,12	4,37	11,58	-3,88	15,05	14,22	2,74	1,75	0,37	0,36	0,13		
4	6/11/17 18:05	2,91	-3,73	12,57	2,07	4,34	11,58	-3,92	15,34	14,62	2,70	1,72	0,35	0,34	0,11		
5	6/11/17 19:15	2,74	-3,91	12,49	1,93	4,26	11,53	-3,99	15,94	15,59	2,63	1,66	0,27	0,26	0,07		
6	7/11/17 10:03	0,11	-6,54	13,88	0,09	2,38	11,74	-5,88	34,52	38,39	0,73	0,47	-0,38	-0,39	0,15		
7	7/11/17 11:20	0,12	-6,53	13,90	0,10	2,45	11,74	-5,81	33,72	37,90	0,80	0,52	-0,42	-0,43	0,19		
8	7/11/17 12:39	0,11	-6,53	13,19	0,09	2,43	11,75	-5,82	33,89	38,03	0,79	0,51	-0,42	-0,44	0,19		
9	7/11/17 13:46	0,11	-6,54	13,27	0,08	2,40	11,75	-5,85	34,24	38,27	0,76	0,49	-0,41	-0,42	0,18		
10	7/11/17 15:13	0,11	-6,53	13,29	0,09	2,24	11,76	-6,01	36,13	39,28	0,60	0,39	-0,30	-0,31	0,10		
11	8/11/17 9:34	0,11	-6,54	13,22	0,08	1,65	11,56	-6,61	43,67	43,21	-0,01	0,00	0,09	0,07	0,01		
12	8/11/17 10:34	0,11	-6,54	13,30	0,08	1,75	11,63	-6,51	42,35	42,56	0,09	0,06	0,02	0,01	0,00		
13	8/11/17 11:38	0,11	-6,54	13,27	0,08	1,80	11,67	-6,45	41,65	42,20	0,15	0,10	-0,01	-0,03	0,00		
14	8/11/17 12:47	0,11	-6,54	13,29	0,08	1,78	11,68	-6,48	41,96	42,36	0,12	0,08	0,00	-0,01	0,00		
15	8/11/17 13:56	0,11	-6,54	13,27	0,08	1,82	11,66	-6,43	41,40	42,08	0,17	0,11	-0,03	-0,04	0,00		
16	zero	0,00	-6,65	15,00	0,00	0,10	15,00	-8,15	66,48	54,19	-1,56	-1,56					
17	span	97,00	90,35	15,00	97,00	98,00	15,00	89,75	8054,44	8108,98	96,99	96,99					
Average												0,01					
Sum									8582,44	8639,88			1,67				
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		110	Yaverage	6,65	x average	8,25	Z	/	Procedure for the determination of the calibration fuction								
15% ELV [mg/Nm3 rif O ₂]		16,5	m	1,007	i	-1,663	r	0,99971	Method C				Calibration Function				
Ys Max-Ys min		2,22	ŷs, max	1,75	Calibration Range				0 - 22 [mg/Nm3 rif O2]				Y= 1,007X - 1,663				
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 σ ₀ k _v)								
Standard Deviation of the difference D _i - (S ₀)		0,345643	Standard Deviation (σ ₀)		5,61	Experimental Confidence interval [%]		0,62	Positive								

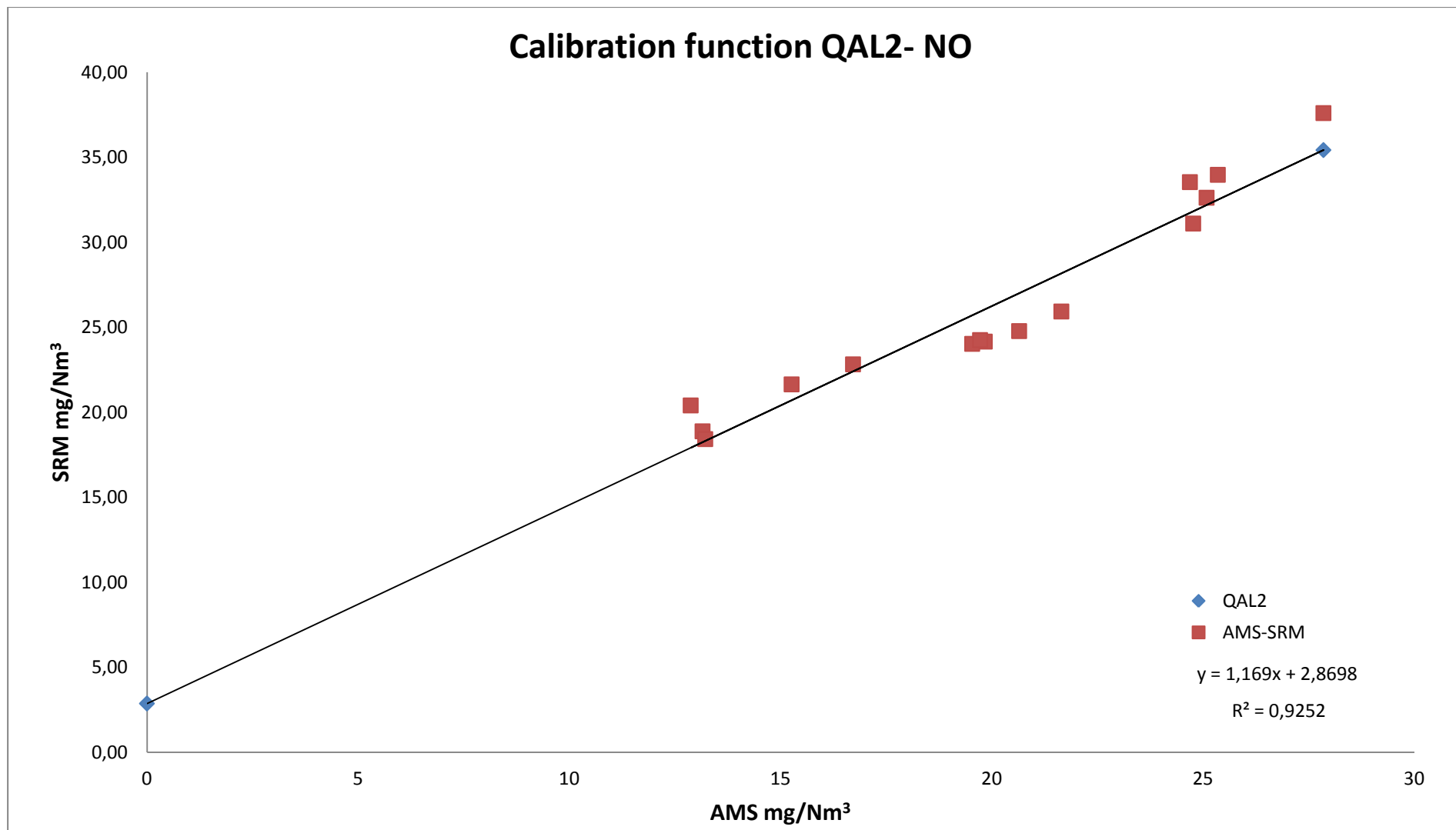
DR.21.25 Rev.0





14.2 NITROGEN OXIDE - QAL2

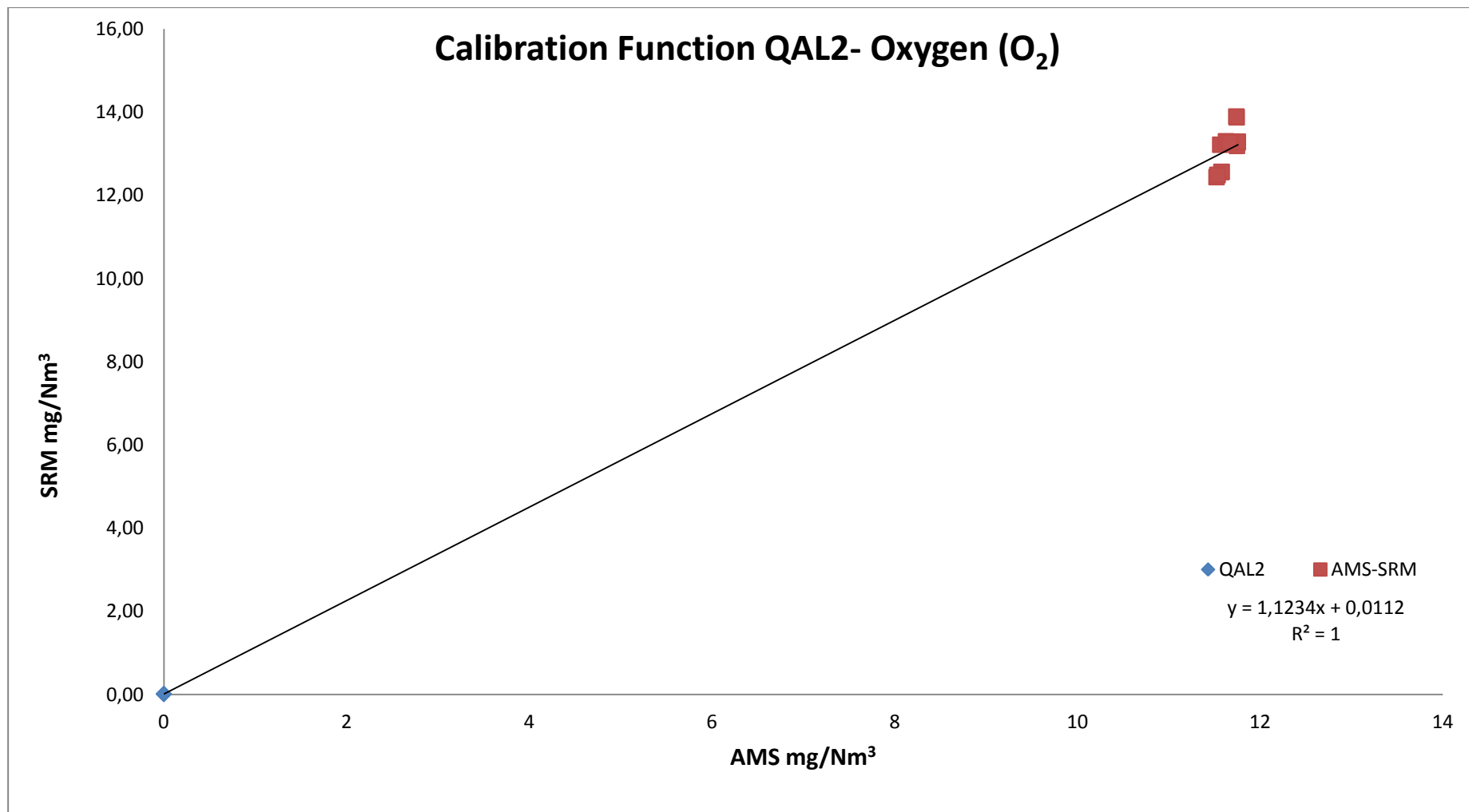
Parameter				NO		Emission Point			6A								
O2 rif %	15	SRM				AMS							Calculations				
N. Test	DATE/TIME	Y _i	Yi-Ym	O ₂	Y _{i,s}	X _i	O ₂	xi-xm	(xi-xm) ²	(xi-xm)*(Yi-Ym)	ŷ _i	ŷ _{i,s}	D _i = y _{i,s} -ŷ _{i,s}	D _i -đ	(D _i -đ) ²		
1	6/11/17 16:51	37,60	11,32	12,56	26,74	27,85	11,58	7,83	61,28	88,65	35,43	22,56	4,18	1,23	1,51		
2	6/11/17 18:05	33,97	7,69	12,57	24,17	25,35	11,58	5,33	28,38	40,99	32,51	20,70	3,47	0,51	0,26		
3	6/11/17 19:15	33,54	7,26	12,49	23,66	24,69	11,53	4,67	21,77	33,89	31,73	20,11	3,55	0,59	0,35		
4	6/11/17 20:29	32,62	6,35	12,51	23,05	25,09	11,57	5,06	25,62	32,12	32,19	20,49	2,56	-0,40	0,16		
5	6/11/17 21:29	31,10	4,83	12,53	22,02	24,77	11,58	4,74	22,51	22,90	31,82	20,26	1,76	-1,19	1,43		
6	7/11/17 10:03	18,88	-7,40	13,88	15,90	13,15	11,74	-6,87	47,20	50,82	18,25	11,83	4,08	1,12	1,26		
7	7/11/17 11:20	18,42	-7,85	13,90	15,56	13,22	11,74	-6,81	46,33	53,45	18,32	11,87	3,69	0,74	0,54		
8	7/11/17 12:39	20,41	-5,87	13,19	15,68	12,87	11,75	-7,15	51,14	42,00	17,92	11,62	4,06	1,10	1,22		
9	7/11/17 13:46	21,64	-4,63	13,27	16,79	15,26	11,75	-4,76	22,68	22,07	20,71	13,44	3,35	0,40	0,16		
10	7/11/17 15:13	22,82	-3,46	13,29	17,77	16,72	11,76	-3,31	10,94	11,43	22,41	14,55	3,22	0,27	0,07		
11	8/11/17 9:34	25,93	-0,35	13,22	20,00	21,65	11,56	1,62	2,64	-0,56	28,18	17,92	2,08	-0,88	0,77		
12	8/11/17 10:34	24,78	-1,50	13,30	19,31	20,65	11,63	0,62	0,39	-0,94	27,01	17,29	2,02	-0,93	0,87		
13	8/11/17 11:38	24,16	-2,12	13,27	18,75	19,83	11,67	-0,19	0,04	0,40	26,06	16,76	1,98	-0,97	0,94		
14	8/11/17 12:47	24,03	-2,25	13,29	18,70	19,54	11,68	-0,49	0,24	1,10	25,71	16,55	2,15	-0,80	0,64		
15	8/11/17 13:56	24,25	-2,03	13,27	18,83	19,72	11,66	-0,30	0,09	0,61	25,93	16,66	2,17	-0,78	0,61		
Average													2,96				
Sum									341,3	398,9					10,78		
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		55	Yaverage	26,28	x average	20,02	Z	//	Procedure for the determination of the calibration fuction								
15% ELV [mg/Nm3 rif O ₂]		8,25	m	1,169	i	2,870	r	0,962	Method A				Calibration Function				
Ys Max-Ys min		11,18	ŷs, max	22,56	Calibration Range				0 - 24,81 [mg/Nm3 rif O2]				Y= 1,168X + 2,869				
Test of Variability																	
Maximum permissible uncertainty (95% confidence interval)		20	Test value for variability (k _v)		0,9761	σ0k _v		5,478	Result of Variability Test (s _p ≤σ ₀ k _v)								
Standard Deviation of the difference D _j - (S ₀)		0,877595	Standard Deviation (σ ₀)		5,61	Experimental Confidence interval [%]		3,13	Positive								





14.3 OXYGEN - QAL2

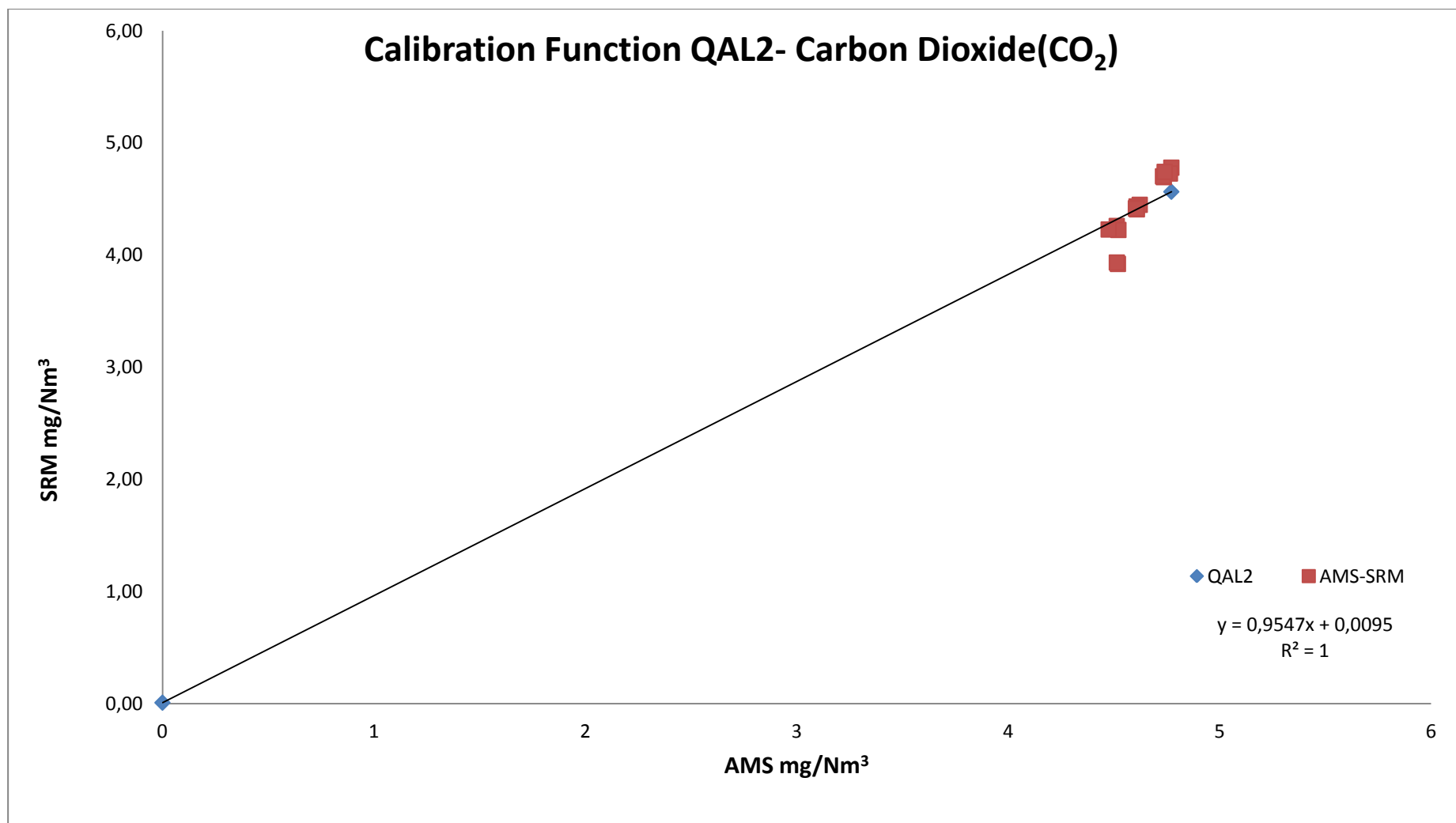
Parameter				O ₂		Emission Point			6A								
O2 rif %	15	SRM				AMS						Calculations					
N. Test	DATE/TIME	Y _i	Yi-Ym	O ₂	Y _{i,s}	x _i	O ₂	xi-xm	(xi-xm) ²	(xi-xm)*(Yi-Ym)	ŷ _i		D _i = y _{i,s} -ŷ _{i,s}	D _i -đ	(D _i -đ) ²		
1	6/11/17 14:14	12,44	-0,66			11,52		-0,12	0,02	0,08	12,96		-0,52	-0,52	0,27		
2	6/11/17 15:37	12,49	-0,61			11,53		-0,11	0,01	0,07	12,97		-0,48	-0,48	0,23		
3	6/11/17 16:51	12,56	-0,53			11,58		-0,07	0,00	0,04	13,02		-0,45	-0,45	0,21		
4	6/11/17 18:05	12,57	-0,53			11,58		-0,07	0,00	0,04	13,02		-0,45	-0,45	0,21		
5	6/11/17 19:15	12,49	-0,60			11,53		-0,11	0,01	0,07	12,97		-0,47	-0,47	0,23		
6	7/11/17 10:03	13,88	0,78			11,74		0,10	0,01	0,08	13,21		0,67	0,67	0,45		
7	7/11/17 11:20	13,90	0,80			11,74		0,09	0,01	0,08	13,20		0,70	0,70	0,48		
8	7/11/17 12:39	13,19	0,09			11,75		0,10	0,01	0,01	13,21		-0,02	-0,02	0,00		
9	7/11/17 13:46	13,27	0,17			11,75		0,11	0,01	0,02	13,22		0,05	0,05	0,00		
10	7/11/17 15:13	13,29	0,20			11,76		0,11	0,01	0,02	13,22		0,07	0,07	0,01		
11	8/11/17 9:34	13,22	0,12			11,56		-0,08	0,01	-0,01	13,00		0,22	0,22	0,05		
12	8/11/17 10:34	13,30	0,21			11,63		-0,02	0,00	0,00	13,07		0,23	0,23	0,05		
13	8/11/17 11:38	13,27	0,17			11,67		0,03	0,00	0,00	13,13		0,14	0,14	0,02		
14	8/11/17 12:47	13,29	0,20			11,68		0,03	0,00	0,01	13,13		0,16	0,16	0,03		
15	8/11/17 13:56	13,27	0,18			11,66		0,01	0,00	0,00	13,11		0,16	0,16	0,03		
Average													0,00				
Sum									0,11		0,49		2,25				
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		21	Yaverage	13,10	x average	11,65	Z	-0,01	Procedure for the determination of the calibration fuction								
15% ELV [mg/Nm3 rif O ₂]		3,15	m	1,123	i	0,011	r	0,82103616	Method B				Calibration Function				
Ys Max-Ys min		1,46	ŷs, max	13,22	Calibration Range				0 - 14,54 [% Vol.]				Y= 1,123X + 0,011				
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)		0,400674	Standard Deviation (σ ₀)		1,07	Experimental Confidence interval [%]		3,74	Positive								





14.4 CARBON DIOXIDE – QAL2

Parameter				CO ₂		Emission Point			6A								
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	6/11/17 14:14	4,78	0,36			4,77		0,15	0,02	0,05	4,57		0,21	0,21	0,05		
2	6/11/17 15:37	4,73	0,30			4,77		0,14	0,02	0,04	4,56		0,17	0,17	0,03		
3	6/11/17 16:51	4,70	0,27			4,74		0,11	0,01	0,03	4,53		0,16	0,16	0,03		
4	6/11/17 18:05	4,70	0,28			4,73		0,11	0,01	0,03	4,53		0,18	0,18	0,03		
5	6/11/17 19:15	4,74	0,32			4,74		0,12	0,01	0,04	4,54		0,21	0,21	0,04		
6	7/11/17 10:03	3,92	-0,50			4,52		-0,10	0,01	0,05	4,32		-0,40	-0,40	0,16		
7	7/11/17 11:20	3,93	-0,49			4,51		-0,11	0,01	0,05	4,32		-0,39	-0,39	0,15		
8	7/11/17 12:39	4,26	-0,16			4,51		-0,11	0,01	0,02	4,32		-0,06	-0,06	0,00		
9	7/11/17 13:46	4,22	-0,20			4,52		-0,10	0,01	0,02	4,33		-0,10	-0,10	0,01		
10	7/11/17 15:13	4,23	-0,19			4,48		-0,15	0,02	0,03	4,28		-0,05	-0,05	0,00		
11	8/11/17 9:34	4,45	0,03			4,62		0,00	0,00	0,00	4,42		0,03	0,03	0,00		
12	8/11/17 10:34	4,41	-0,01			4,61		-0,01	0,00	0,00	4,41		0,00	0,00	0,00		
13	8/11/17 11:38	4,43	0,01			4,61		-0,02	0,00	0,00	4,41		0,03	0,03	0,00		
14	8/11/17 12:47	4,42	-0,01			4,60		-0,02	0,00	0,00	4,41		0,01	0,01	0,00		
15	8/11/17 13:56	4,42	-0,01			4,61		-0,02	0,00	0,00	4,41		0,01	0,01	0,00		
Average													0,00				
Sum									0,15	0,37		0,50					
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		25	Yaverage	4,42	x average	4,62	Z	-0,01	Procedure for the determination of the calibration fuction								
15% ELV [mg/Nm3 rif O ₂]		3,75	m	0,955	i	0,010	r	0,92149966	Method B				Calibration Function				
Ys Max-Ys min		0,86	ŷs, max	4,57	Calibration Range				0 - 5,02 [% Vol.]				Y= 0,954X + 0,009				
Test of Variability																	
Maximum permissible uncertainty (95% confidence interval)		10	Test value for variability (kv)		0,9761	σ0kv		1,245	Result of Variability Test (s0≤σ0kv)								
Standard Deviation of the difference Di - (S0)		0,189675	Standard Deviation (σ0)		1,28	Experimental Confidence interval [%]		1,49	Positive								



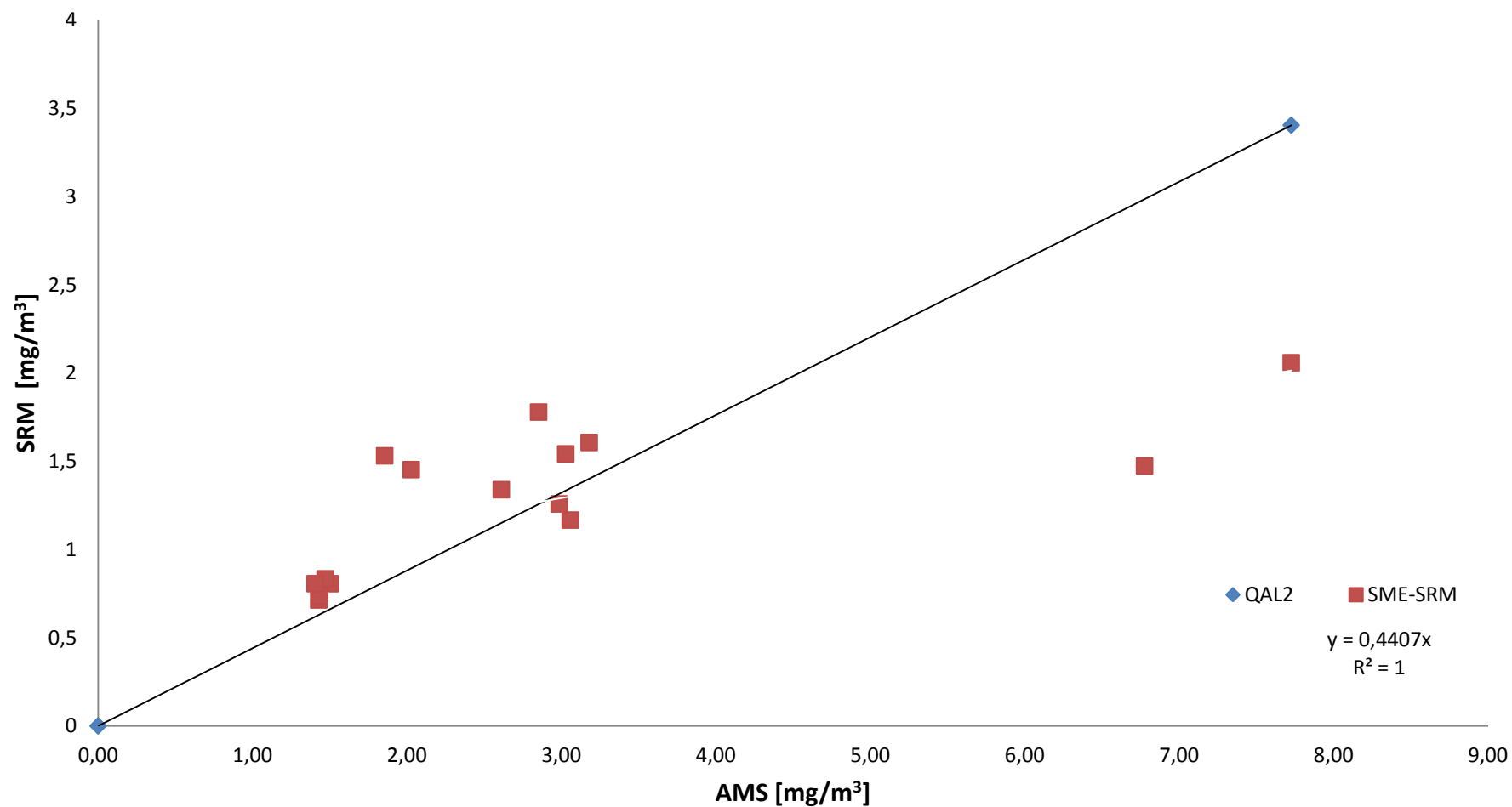


14.5 DUST – QAL2

Parameter									Dust		Emission Point					6A								
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 -đ	(D _i -đ)			
1	06/11/2017 14:14	0,81	12,56	364,62	100,65	11,00	-0,47	1,51	1,50	11,52	363,58	991,18	11,03	-1,39	1,92	0,65	0,66	1,12	0,39	0,09	0,01			
2	06/11/2017 15:37	0,83	12,57	365,10	100,62	10,80	-0,44	1,56	1,47	11,53	364,08	991,16	11,00	-1,42	2,01	0,62	0,65	1,10	0,46	0,16	0,03			
3	06/11/2017 16:51	0,71	12,49	363,43	100,65	10,30	-0,56	1,32	1,43	11,58	363,28	991,22	10,92	-1,46	2,13	0,82	0,63	1,07	0,24	-0,06	0,00			
4	06/11/2017 18:05	0,74	12,51	362,52	100,78	10,90	-0,54	1,37	1,43	11,58	362,44	991,28	10,90	-1,46	2,12	0,78	0,63	1,07	0,29	-0,01	0,00			
5	06/11/2017 19:15	0,81	12,53	364,08	100,73	10,00	-0,47	1,49	1,41	11,53	363,12	991,39	10,93	-1,48	2,20	0,69	0,62	1,05	0,44	0,14	0,02			
6	07/11/2017 10:03	1,34	13,88	152,88	101,09	10,10	0,07	1,96	2,61	11,74	152,33	992,07	10,09	-0,28	0,08	-0,02	1,15	1,32	0,64	0,34	0,11			
7	07/11/2017 11:20	1,53	13,90	155,65	101,14	10,50	0,26	2,27	1,86	11,74	155,31	992,12	10,06	-1,03	1,07	-0,27	0,82	0,94	1,33	1,03	1,05			
8	07/11/2017 12:39	1,47	13,19	153,28	101,23	11,00	0,20	1,99	6,78	11,75	152,87	992,08	10,10	3,89	15,11	0,78	2,99	3,43	-1,44	-1,75	3,05			
9	07/11/2017 13:46	1,45	13,27	150,17	101,08	10,02	0,18	1,95	2,03	11,75	149,81	992,03	10,16	-0,86	0,74	-0,15	0,89	1,02	0,93	0,62	0,39			
10	07/11/2017 15:13	1,17	13,29	149,30	101,70	10,60	-0,11	1,56	3,06	11,76	148,75	992,06	11,37	0,17	0,03	-0,02	1,35	1,56	0,01	-0,30	0,09			
11	08/11/2017 09:34	1,78	13,22	140,50	101,61	11,00	0,51	2,33	2,85	11,56	141,99	993,12	10,54	-0,04	0,00	-0,02	1,26	1,39	0,94	0,64	0,41			
12	08/11/2017 10:34	1,26	13,30	140,10	101,68	12,00	-0,02	1,68	2,99	11,63	146,77	993,16	10,43	0,10	0,01	0,00	1,32	1,47	0,20	-0,10	0,01			
13	08/11/2017 11:38	1,54	13,27	148,20	101,76	11,00	0,27	2,06	3,03	11,67	147,93	993,16	10,39	0,14	0,02	0,04	1,33	1,51	0,56	0,25	0,06			
14	08/11/2017 12:47	2,06	13,29	146,60	100,72	12,00	0,78	2,81	7,73	11,68	145,97	993,12	10,34	4,84	23,40	3,80	3,41	3,83	-1,01	-1,32	1,73			
15	08/11/2017 13:56	1,61	13,27	145,40	101,65	10,90	0,33	2,14	3,18	11,66	144,86	993,10	10,35	0,29	0,08	0,10	1,40	1,57	0,57	0,27	0,07			
Average																			0,30					
Sum															50,93	7,79					7,04			
Emission Limit Value - ELV [mg/Nm3 rif O ₂]		5	Yaverag e	1,27	x average	2,89	Z		Procedure for the determination of the calibration fuction						Calibration Function									
15% ELV [mg/Nm3 rif O ₂]		0,75	m	0,44	i	0,000 0	r	0,70	Method B						Y= 0,44X + 0									
Ys Max-Ys min		1,50	ŷs, max	3,83	Calibration Range				0 - 4,21 [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)		0,709	Standard Deviation (σ ₀)			0,77	Experimental Confidence interval [%]			27,79	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	6/11/17 14:14	11,0	11,0	0,0
2	6/11/17 15:37	10,8	11,0	0,2
3	7/11/17 10:03	10,1	10,1	0,0
4	7/11/17 11:20	10,5	10,1	0,4
5	8/11/17 10:34	12	10,4	2
Average		10,9	10,5	0,5
t student 0,95 (N-1)		2,78		
Standard Deviation (S _D)		0,65		
Confidence Interval (I _c)		0,80		
I.A.R		88,5		

15.2 TEMPERATURE – IAR

Parameter		Temperature		
N. Test	DATE/TIME	SRM [°C]	AMS [°C]	Absolute Differences (X _i)
1	6/11/17 14:14	365	364	1
2	6/11/17 15:37	365	364	1
3	7/11/17 10:03	153	152	1
4	7/11/17 11:20	156	155	0
5	8/11/17 10:34	140	147	7
Average		236	236	1,9
t student 0,95 (N-1)		2,78		
Dev. Standard (S _D)		2,70		
Intervallo di Confidenza (I _c)		3,35		
I.A.R		97,8		



15.3 PRESSURE - IAR

Parameter		Pressure		
N. Test	DATE/TIME	SRM [hPa]	AMS [hPa]	Absolute Differences (X _i)
1	6/11/17 14:14	1007	991	15
2	6/11/17 15:37	1006	991	15
3	7/11/17 10:03	1011	992	19
4	7/11/17 11:20	1011	992	19
5	8/11/17 10:34	1017	993	24
Average		1010	992	18
t student 0,95 (N-1)		2,78		
Standard Deviation (S _D)		3,51		
Confidence Interval (I _c)		4,36		
I.A.R		97,7		

15.4 FLOW - IAR

Parameter			Flow	
N. Test	DATE/TIME	SRM [Nm ³ /h]	AMS [Nm ³ /h]	Absolute Differences (X _i)
1	7/11/17 10:03	79121	92040	12919
2	7/11/17 11:20	80086	92245	12159
3	7/11/17 12:39	79228	92204	12976
4	7/11/17 13:46	78309	92211	13902
5	8/11/17 10:34	64916	76085	11169
Average		76332,16	88957,03	12625
t student 0,95 (N-1)		2,78		
Standard Deviation (S _D)		1021,92		
Confidence Interval (I _c)		1268,88		
I.A.R		81,8		



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.	
qal1.de	info@qal1.de
page 1 of 10	



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

qal1.de

info@qal1.de

page 5 of 10



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	Chemiluminescence

Test report

Test laboratory	21217817/A
Date of report	TÜV Rheinland 2012-10-08

Measured component

Certification range	NO _x as NO 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

		u^2
Standard deviation from paired measurements under field conditions *	u_D mg/m ³	0,797 (mg/m ³) ²
Lack of fit	u_{LOF} 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_b 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)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 4,38 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c \cdot k = u_c \cdot 1,96 \quad 8,59 \text{ mg/m}^3$$

Relative total expanded uncertainty

$$U \text{ in \% of the ELV } 131 \text{ mg/m}^3 \quad 6,6$$

Requirement of 2000/76/EC and 2001/80/EC

$$U \text{ in \% of the ELV } 131 \text{ mg/m}^3 \quad 20,0$$



Requirement of EN 15267-3

$$U \text{ in \% of the ELV } 131 \text{ mg/m}^3 \quad 15,0$$





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	NDIR	
Test report	21217617/A	
Test laboratory	TÜV Rheinland	
Date of report	2012-10-08	
Measured component	SO ₂	
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		u²
Standard deviation from paired measurements under field conditions *	u ₀ mg/m³	1.672 (mg/m³)²
Lack of fit	u _{lof} mg/m³	0.334 (mg/m³)²
Zero drift from field test	u _{zdr} mg/m³	3.881 (mg/m³)²
Span drift from field test	u _{sdr} mg/m³	4.713 (mg/m³)²
Influence of ambient temperature at span	u _t 1.752 mg/m³	3.070 (mg/m³)²
Influence of supply voltage	u _v 0.790 mg/m³	0.624 (mg/m³)²
Cross sensitivity (interference)	u _i mg/m³	2.258 (mg/m³)²
Influence of sample gas flow	u _p mg/m³	0.067 (mg/m³)²
Uncertainty of reference material at 70% of certification range	u _{rm} mg/m³	1.336 (mg/m³)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
qal1.de	info@qal1.de	page 7 of 10



	<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	NDIR	
Test report	21217617/A	
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_{zdr} mg/m ³	0.706 (mg/m ³) ²
Span drift from field test	u_{sdr} mg/m ³	0.456 (mg/m ³) ²
Influence of ambient temperature at span	u_t 0.866 mg/m ³	0.750 (mg/m ³) ²
Influence of supply voltage	u_v 0.286 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	$U = u_c \cdot k = u_c \cdot 1.96$	3.35 mg/m ³
Relative total expanded uncertainty	U in % of the ELV 50 mg/m³	6.7
Requirement of 2000/76/EC and 2001/80/EC	U in % of the ELV 50 mg/m³	10.0
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	7.5

qa11.de info@qa11.de page 6 of 10



	<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 _{ZD}	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.		
qal1.de	info@qal1.de	page 9 of 10



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.					
qal1.de		info@qal1.de		page 10 of 10	



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
DAK-17588-01-00

als Kalibrierlaboratorium im / as calibration laboratory in the

Deutschen Kalibrierdienst

DKD

Kalibrierschein
Calibration certificate

Kalibrierzeichen
Calibration mark

09830
D-K- 17588-01-00
2017-10

Gegenstand
Object

Gasteller

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, Italien

Auftragsnummer
Order No.

PK752

Anzahl der Seiten des Kalibrierscheines
Number of pages of the certificate

3

Datum der Kalibrierung
Date of calibration

04.10.2017

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverarbeitet werden. Auszüge oder Änderungen bedürfen der Genehmigung sowohl der Deutschen Akkreditierungsstelle GmbH 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 Deutsche Akkreditierungsstelle GmbH and the issuing laboratory. Calibration certificates without signature are not valid.

Datum
Date

04.10.2017

Leiter des Kalibrierlaboratoriums
Head of the calibration laboratory

Dr.rer.nat. Johannes Schubert

Bearbeiter
Person in charge

Dr. Marc Plüschau

Dr. Marc Plüschau

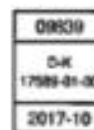
TetraTec Instruments GmbH · Gewerbestraße 8 · 71144 Steinbronn
Tel 07157/53870 · Fax 07157/538710 · www.tetratec.de · info@tetratec.de

File: CAL055133
DA9999 VQ350 R00



Calibration Laboratory of TetraTec Instruments GmbH

Seite 2 of 3
Page english version



1.) Calibration object: Gas Blender
Type: BetaCAP30 RK
Manufacturer: Bu.T.A. strumentazione
Serial-No.: 300229
Meas.range: ca. 3.990 sm³/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: 50MK10-6 50MJ10-14 50MJ10-13
Serial-No.: 752050-2 776810-N7 789090-S5
Meas.range: 3,3...65 ml/min 133...4100 ml/min 300...7300 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, 1300 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: $969,3 \pm 1,0$ hPa
room temperature: $23,0 \pm 1,0$ °C
atmospheric humidity: $39,9 \pm 5,0$ %r.F.

5.) Uncertainties of measurement

volume flow: 0,43% o.r. for $Q \geq 10$ l/h
0,38% 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.

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

File: CAL055133



Calibration Laboratory of TetraTec Instruments GmbH

Seite 3 of 3
Page english version

09839
D-K 17589-01-00
2017-10

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

$$\text{dev.} = c_i - c_s$$

unc.: uncertainty of c_i due to uncertainties of the measured flows

$$\text{unc.} = \sqrt{\left(\frac{\partial c}{\partial Q_1} \cdot uQ_1\right)^2 + \left(\frac{\partial c}{\partial Q_2} \cdot uQ_2\right)^2} \quad \text{resp.} \quad \text{unc.}(c=100\%)=0$$

All measurements were performed at an entrance pressure of the gas-blender of ca. 1300 hPa rel.

Step	$Q_{N,TG1}$	$Q_{N,TG0}$	$Q_{N,OUT}$	c_s	c_i	dev.	unc.
-	ml/min	ml/min	ml/min	%	%	%	%
0	0,00	3975,7	3975,7	0,00	0,00	0,00	0,00
1	137,64	3847,7	3985,4	3,33	3,45	0,12	0,02
2	272,18	3718,3	3990,5	6,67	6,82	0,15	0,04
4	543,07	3448,3	3991,4	13,33	13,61	0,27	0,07
8	1081,69	2910,2	3991,9	26,67	27,10	0,43	0,15
15	1989,6	2002,0	3991,6	50,00	49,85	-0,15	0,27
30	4005,4	0,0	4005,4	100,00	100,00	0,00	0,00

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

File: CAL055133



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 del Laboratorio 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.

SEDE LEGALE: VIA SAN MARCO 13, 20121 MILANO
UFFICIO OPERATIVO VIA SEPIATORE SANVITTORIO (VT) 05051, ORONZO (VT)
TELEFONO: 0435/981 / TELEFAX: 0435/981

CERTIFICATO DI ANALISI Certificate of analysis

6-38-05

CLIENTE: CHIMICA APPLICATA DEPURAZIONE ACQUE

Customer:

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

Address:

NUMERO ORDINE: 2726323
Order number:

CODICE RICORDO: PSM4377P
Code reminder:

PER RICORDO: [certificati analisi](#)
Numero verde: 800418110

MATRICOLO: MPN1386
Serial number:

CAPACITA' (litri): 20
Capacity (liters):

SCADENZA
PROVA IDRAULICA: 08/2019
Expiration hydraulic test:

CONTENUTO: MISCELA DI GAS
Content:

RECIPIENTE: BOMBOLA GRUPPO 5-UN11146
Vessel:

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

COMPONENTE Component	RICHIESTA Request	CONCENTRAZIONE (C) Concentration (C)	Incertezza Relativa (RC%) Relative Uncertainty (RC%)
ELUIRICO (O) CARBONIO	10.0 ± 1%	10.0 ± 1%	0.0%
OSSIGENO (O) CARBONIO	27.0 ppm	27.0 ppm	0.0%
OSSIGENO (O) AZOTO	27.0 ppm	27.0 ppm	0.0%
ANIDRIDE SOLFORICA	10.0 ppm	10.0 ppm	0.0%
OSSIGENO AZOTO TOTALE	-	27.0 ppm	0.0%

Completamento: AZOTO
Balance: Concentrazione (C) espressa in termini di: mol/m³
Concentration (C) espressa in termini di:

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

Ripetibilità: La lettura del ricettore di massa utilizzato per la preparazione della miscela è effettuata utilizzando masse certificate del centro di taratura LAT s.p.a.

Trazionalità: La lettura delle masse è eseguita in conformità alla procedura PT54 (EURAMET go-12 v. 4.0);
I certificati di rintracciamento delle masse utilizzate sono: LAT06 0642017, 0652017, 4010215, 5722015.

Note:

Non:

PRESSIONE DI RIMPIEMBIMENTO (bar) Filling pressure (bar):	150.0	RISCHI PER LA SALUTE: Health hazard:	NOGIVO
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:	08/2019

Data certificato: 01/06/2017
Certification date:

Numero certificato: 201705601
Certificate number:

Operatore: F. Giglio
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: 02.9574084

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, 20067, 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 ($\Delta C\%$) Relative Uncertainty ($\Delta C\%$)
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 ($\Delta C\%$) 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 E.V.)

SEDE LEGALE: VIA SAN MARINO 12, 20122, MILANO
UFFICIO OPERATIVO VIA SIVARIONE 5/A, 20122, CAPONAGO (MI)
TELEFONO: 02 87061 / TELEFAX: 02 8706162

CERTIFICATO DI ANALISI Certificate of analysis

CLIENTE: CHIMICA APPLICATA DEPURAZIONE ACQUE
Customer:

INDIRIZZO: VIA PIO LA TORRE 13 - AREA P.I.P. MENFI 92013 AG
Address:

NUMERO ORDINE: 3832384
Order number:

CODICE RICORDO: IP614R5YDFN
Code reminder:

PER RICORDO: ordini@sapiogroup.it
Numero verde: 800416118

MATRICOLA: MP17187
Serial number:

CAPACITA' (litri): 18
Capacity (liters):

SCADENZA
PROVA IDRAULICA: 03/2024
Expiration hydraulic test:

CONTENUTO: MISCELA DI GAS
Content:

RECIPIENTE: BOMBOLA GRUPPO S-UNIT1144
BOMX
Vessel:

METODO DI PREPARAZIONE: GRAMMETRICO SECONDO NORME ISO 8142 - ISO 8143
Method of preparation:

COMPONENTE Component	RICHESTA Request	CONCENTRAZIONE (C) Concentration (C)	Incertezza Relativa (IC%) Relative Uncertainty (IC%)
ARMONICA	98.0 ppm	97.3 ppm	0.8%
Completamento: AZOTO Addition:		Concentrazione (C) espressa in termini di: multipli Concentration (C) expressed in terms of:	

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

Ripetibilità: La taratura dei misuratori di massa utilizzato per la preparazione della miscela è effettuata utilizzando masse certificate del centro di taratura LAT n°066.
Ripetibilità: La taratura delle masse è eseguita in conformità alla procedura PT04 (EURAMET go-18 v. 4.0).
I certificati di riferimento delle masse utilizzate sono: LAT05 064/2017; 065/2017; 431/2015; 572/2015.

Note:
Note:

PRESSIONE DI RIEMPIMENTO (bar): Filling pressure (bar):	150	RISCHI PER LA SALUTE: Health hazard:	ASPIRANTE 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:	12/2017

Data certificato: 24/03/2017
Certification date:

Numero certificato: 201702042
Certificate number:

Operatore: M. BUCCHIA
Operator: