



**PROFTECH**  
SPÓŁKA Z O.O.



AB 994

*Research laboratory  
accredited by PCA, Nr AB  
994*

Scopes of accreditation:

- concentration and mass measurements of flow of fine particles
- measurements of concentration and mass flow of SO<sub>2</sub>, NO<sub>x</sub>, CO
- concentration measurements of CO<sub>2</sub>, O<sub>2</sub>
- concentration and mass flow measurements of OWO
- sampling for mass concentration determination of PCDD/PDF and dioxin type PCB
- sampling for concentration determination of (As; Cd; Cr; Co; Cu; Mn; Ni; Pb; Sb; Ti; V)
- sampling for concentration determination of Hg
- sampling and determination of concentration and mass flow of HCl
- sampling and determination of concentration and mass flow of HF
- sampling for determining the concentration of individual gaseous organic compounds
- calibration of Automated Monitoring systems,
- QAL2 procedure
- annual performance test of Automated Monitoring Systems, AST procedure
- noise measurement from machinery, installations and industrial plants

Chorzów, September 18<sup>th</sup> 2020  
Our ref. No.: PW/30/09/20

### Report No PW/30/09/20

**on concentration measurements of dioxins and furans emitted into environment from flue gas channel located at UAB KAUNO KOGENERACINĖ JĖGAINĖ, Veterinarų g. 19, Biruliškių k., LT-54469 Kauno raj., Lithuania.**

Client name and address:

**UAB KAUNO KOGENERACINĖ  
JĖGAINĖ,**  
Veterinarų g. 19, Biruliškių k.,  
LT-54469 Kauno raj.

Developed by:

mgr Grzegorz Bortel

Calculation and data transfer checked by:

inż. Dariusz Guja

Verified by:

inż. Dariusz Guja

**DYREKTOR**

Dariusz Guja

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**Test Report No PW/30/09/20****1. PURPOSE AND SCOPE OF THE REPORT**

Purpose of executed measurements was to determine the concentration and emission of dioxins and furans emitted to environment from flue gas channel located at at UAB KAUNO KOGENERACINĖ JĖGAINĖ, Veterinarų g. 19, Biruliškių k., LT-54469 Kauno raj., Lithuania.

*Measurements range:*

- PCDD/DF emission and concentration.

The measurements were carried out in accordance with the sampling plan and the described sampling methods.

Operating parameters of the technological installation was obtained from the customer's representative.

**2. BASIS OF MEASUREMENTS EXECUTION**

The measurements were taken according to the Contract No 2020-KKJ-05 dated March 31<sup>st</sup> 2020, our reference number PP/15/03/20.

**3. MEASUREMENT TEAM**

The measurements taken on August 26<sup>th</sup> 2020 were executed by the following team:

- Dariusz Guja                      manager - measurement team leader,
- Grzegorz Bortel                specialist,

**4. MEASUREMENT RESULTS SUMMARY**

Below are presented measurement results summary, full measurement results are presented in chapter no 6, at page 8.

Concentration of the substance in the gas in the conventional conditions O2 ref. 11%	PCDDF	ng/m3	<b>0,002</b>
Emission limits	PCDDF	ng/m3	<b>0,1</b>
Transgerssion	PCDDF	ng/m3	<b>-</b>

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**5. DESCRIPTION OF THE MEASUREMENT METHOD****Measurement of the gas volumetric flow**

The flow rate was determined according to ISO Standard PN-EN ISO 16911-1:2013 „Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 1: Manual reference method". Gravimetric dust monitor type Megasystem APIS X-1 and type "S" Pitot tube were used for the measurements. Measurement is accredited.

Accreditation range: differential pressure: > 5 Pa

**Measurement O<sub>2</sub> content**

The concentration of O<sub>2</sub> was determined using gas analyzer HORIBA PG-350 EHR equipped with testing probe 2000 mm long. The measurements were taken according to the procedure described in measurement unit as well as to Polish Standard PN-EN 14789:2006 "Stationary source emissions - Determination of volume concentration of oxygen O<sub>2</sub> - Reference method - Paramagnetism". Measurement is accredited.

Accreditation range: O<sub>2</sub> content: 3-21%

**Measurement CO<sub>2</sub> content**

The concentration of CO<sub>2</sub> was determined using gas analyzer HORIBA PG-350 EHR equipped with testing probe 2000 mm long. The measurements were taken according to the procedure described in measurement unit as well as to Polish Standard PN-ISO 10396:2001 "Stationary Source Emissions - Sampling For The Automated Determination Of Gas Concentrations ". Measurement is accredited.

Accreditation range: CO<sub>2</sub> content: 0,1-20%

**Measurement moisture content**

Moisture content was determined using condensation-absorption method. The measurements were taken according to Polish Standard PN-EN 14790:2017. Measurement is accredited.

Accreditation range: H<sub>2</sub>O content: 29-250 g/m<sup>3</sup>

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**PCDD+PCDF sampling and determination**

PCDD/DF samples were taken according to the requirements of Polish Standard PN-EN 1948-1:2006 „ Stationary source emissions - Determination of mass concentration of PCDDs/PCDFs and dioxin-type PCBs - Part 1: Sampling of PCDDs/PCDFs”.

*The three stages of PCDD/DF concentration and emission determination:*

**Stage I - sampling**

For the determination of mass concentration of PCDD/DF proper sampling plays important role that affects following stages of the testing. The sampling were performed by means of the filtration and condensation method using PCDD/DF sampling system conformed to European Standard PN-EN 1948-1:2006.

The following page shows the schematic diagram of the sampling system.

**Stage II - laboratory analysis**

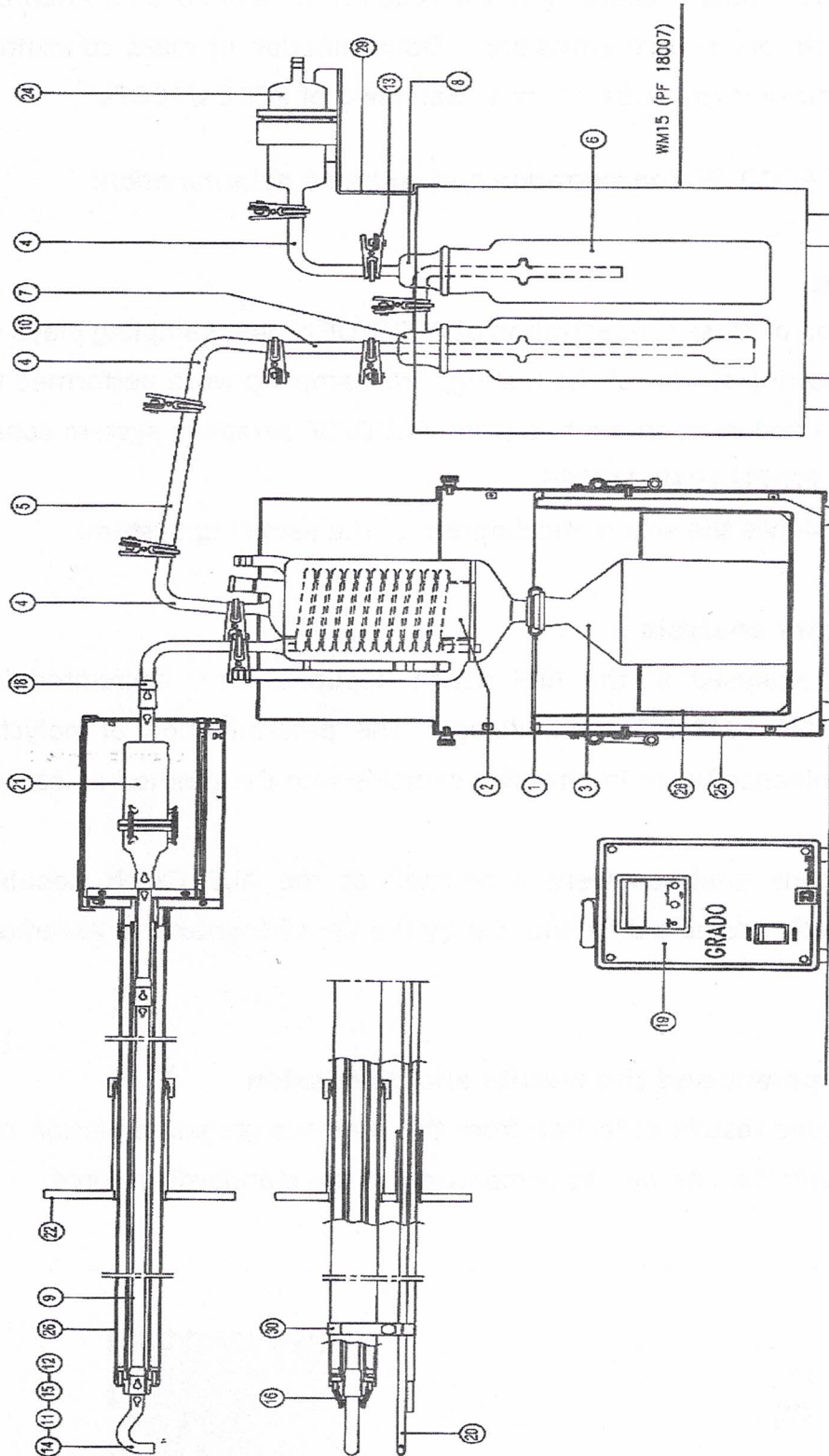
The samples were analysed at the ALS Czech Republic, s.r.o accredited laboratory following the CSN EN 1948-2,3 methodology: The determination of polychlorinated dibenzo-p-dioxine, dibenzofurans in emission samples with the method of isotop dillution using HRGC/HRMS.

The dioxin and furans analyses were conducted at the ALS Czech Republic, s.r.o. Laboratory, specifically accredited for the test by the Český Institut Pro Akreditaci, o.p.s. , Nr L 1163.

**Stage III - development and the results and discussion**

The last stage includes results collection from the previous stages, emission calculation and PCDD/DF concentration as well as comparison to the standards in force.

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- Opis:
- 1. ferrule
  - 2. cooler
  - 3. condensation pot
  - 4,18. aspiration path - elbows
  - 5,10. aspiration path - tubes
  - 6-8. scrubbers
  - 9. aspiration path - probe tube
  - 11,12,14,15. - aspiration endings
  - 13. clamp
  - 16. holding springs
  - 17. aspiration controller
  - 19. temperature controller
  - 20. Pitot tube „S” - type
  - 21. filter casing
  - 22. yoke
  - 23. heated probe
  - 24. gas dryer
  - 25. cooler casing
  - 26. cooler coil
  - 28. cooler coil
  - 29,30. support

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**6. MEASUREMENT RESULTS**

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- 1) Plant or unit name: **Combined Heat and Power Plant**
- 2) Flue gases cleaning unit: **bag filters, activate carbon, hydrated lime, scrubber**
- 3) Emission source load during measurements: **~93,4 MW**
- 4) Fuel type or material mass flow in process: **85% municipal waste, 15% non – hazardous industrial waste / waste code: 19 02 03;**
- 5) Location of sampling and measurements: **in duct, after flue gases cleaning unit**

Measurement reference number		26-08-01		X	X		
Date of measurement		26.08.2020					
Measurement time range		09:35-15:39					
Scope of test		Unit	Results	Uncertainty +/-	Method		
Meteorological conditions	Atmospheric pressure		hPa	995,9	X		
	Air temperature		oC	21			
Cross-section	Diameter		m	2,00			
	Area		m2	3,14			
The parameters of gas in line	Temperature		oC	60	1,650	PN-Z-04030-7:1994	
	Static pressure		Pa	118	1,160		
	Differential pressure		Pa	181	1,650		
	Gas moistness grade X		kg/kg	0,150	0,003		
	Average velocity		m/s	16,3	1,0		
	Chemical composition	O2		%	7,4	0,4	PN-EN 14789:2006
		CO2		%	11,6	0,6	PN-ISO 10396:2001
	Wet gas density during testing		kg/m3	0,997	X	PN-EN 14790:2006	
	Gas density in normal conditions		kg/m3 N	1,237		PN-EN 14790:2006	
	Gas density in conventional conditions		kg/m3 U	1,346		PN-EN 14790:2006	
Concentration in the gas at measurement conditions	PCDDF*		ng/m3	0,002	0,001	PN-EN 1948:2006	
Concentration in the gas at normal conditions	PCDDF*		ng/m3	0,002	0,001	PN-EN 1948:2006	
Concentration of the substance in the gas in the conventional conditions	PCDDF*		ng/m3	0,002	0,001	PN-EN 1948:2006	
Concentration of the substance in the gas in the conventional conditions O2 ref. 11%	PCDDF*		ng/m3	0,002	0,001	PN-EN 1948:2006	
Gas volume flow	measurement conditions		m3/h	184142	23096	PN-EN ISO 16911-1:2013	
	normal conditions		m3N/h	148412	18630		
	conventional conditions		m3U/h	120084	15785		
	conventional conditions O2 ref. 11%		m3U/h	163314	24547		
The emission obtained by measuring	PCDDF*		ng/h	288,20	96,10	PN-EN 1948:2006	
Emission limits	PCDDF*		ng/m3	0,1	X	X	
Transgresssion	PCDDF*		ng/m3	-			

\*- the results obtained from the subcontractor ( accredited )

**Test Report No PW/30/09/20**Notes:

Normal conditions designate the temperature of 273 K and pressure of 101,3kPa, defining normal cubic meter m<sup>3</sup>N. The conventional conditions designate the temperature of 273K, pressure of 101,3 kPa and dry gases (steam contents less than 5 g/kg of flue gas), defining conventional cubic meter, m<sup>3</sup>U

The specified expanded uncertainty comes from standard uncertainty multiplied by expansion coefficient k = 2, which provides 95% level of confidence for normal distribution. Uncertainty takes into account the sampling and analysis.

Registry of samples delivered to the laboratory: P/23/08/20, P/24/08/20  
Date of delivery to the laboratory: 27.08.2020  
Date of analysis: 27.08 - 10.09.2020

**Field blanks:**

ID/ number of sample	Type of substance	The criterion of the blank [ng/m <sup>3</sup> ] 11%O <sub>2</sub>	The value of the blank [ng/m <sup>3</sup> ] 11% O <sub>2</sub>	Result [+/-]
P/24/08/20	PCDD/DF	0,01	0,001	+

Work parameters of measurement system:**PCDD/DF (PN-EN 1948:2006):**

sampling method: condensation - adsorption method  
filter parameters: 19 x 90 mm, filter efficiency: 99,998 %  
sampling train: 2 measurement axis  
oxygen reference : 11 %  
time of dioxins and furans measurement: 09:35 – 15:39 (364,1 min)  
nozzle diameter: 6 mm  
probe temperature: 120 °C  
scrubbers temperature: 4 °C  
aspired gas volume: 7,125 m<sup>3</sup>  
average sampling flow: 19,6 l/min  
isokinetic ratio: 97,7 %  
leak test: + / +  
gas meter temperature: 23 °C  
gas meter pressure: 0 bar  
spiking pattern: filter surface  
absorption solution: 100 ml H<sub>2</sub>O dest. + 50 ml 2-etoksyetanol  
recovery: 55 % <sup>13</sup>C<sub>12</sub>-1,2,3,7,8-PECDF, />50%/  
52 % <sup>13</sup>C<sub>12</sub>-1,2,3,7,8,9-HxCDF, />50%/  
52 % <sup>13</sup>C<sub>12</sub>-1,2,3,4,7,8,9 HpCDF. />50%/  
TEQ sample mass: 0,016 ng

**H<sub>2</sub>O (PN-EN 14790:2017)**

sampling train: 2 measurement axis  
sampling equipment: titanium sampling train  
heated probe 2,0 m long  
sampling pump: PT-01  
cartridge: K/11/06/20  
number of samplings: 1  
sampling time: 32 min  
sampling volume: 2,0 l/min  
H<sub>2</sub>O mass: 11,67 g  
absorption efficiency: 96,2 %

**Test Report No PW/30/09/20****7. MEASUREMENT DEVICES**

Name of measuring device		X1- Apis
Type of measuring device		Isokinetic sampler S/N 0142
Certificate	Calibration No	824-2373/19 824-2374/19 824-2372/19 824-2375/19 G-106/20-66/20
Issued by		INTROL Sp. z o.o. KATOWICE ZAP BESTWINKA
Date of issue the certificate of calibration		27.08.2019 28.08.2019 11.03.2020
Expiration date of the certificate of calibration		-

Name of measuring device		HORIBA
Type of measuring device		PG-350E-HR
Certificate	Calibration No	63/1/AW/18
Issued by		Laboserwis Sp. z o.o. Katowice
Date of issue the certificate of calibration		13.03.2018
Expiration date of the certificate of calibration		-

Name of measuring device		Sampler
Type of measuring device		PT-01
Certificate	Calibration No	851-2463/19 786-2245/19 G-360/19-224/19 R-286/16-186/16
Issued by		INTROL Sp. z o.o. KATOWICE ZAP BESTWINKA
Date of issue the certificate of calibration		29.08.2019 12.08.2019 08.08.2019
Expiration date of the certificate of calibration		-

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**7. ANALYSIS RESULTS**



Attachment no. 1 to the Certificate of Analysis for work order PR2083382

Sample: P/23/08/20

Measurement results PCDD/Fs:

Sample: P/23/08/20		Final extract [µl]: 60			
		Injection volume [µl]: 4			
		Acquisition date [d.m.y h:m]: 3.9.20 0:34			
2,3,7,8-PCDD/Fs	Result [ng/sample]	Limit of Detection [ng/sample]	Limit of Quantification [ng/sample]	I-TEF <sub>s</sub>	I-TEQ Upperbound [ng/sample]
2,3,7,8-TCDD	< 0.0039	0.0039	0.0078	1	0.0039
1,2,3,7,8-PeCDD	< 0.0053	0.0053	0.011	0.5	0.0027
1,2,3,4,7,8-HxCDD	< 0.0075	0.0075	0.015	0.1	0.00075
1,2,3,6,7,8-HxCDD	< 0.0075	0.0075	0.015	0.1	0.00075
1,2,3,7,8,9-HxCDD	< 0.0075	0.0075	0.015	0.1	0.00075
1,2,3,4,6,7,8-HpCDD	< 0.017	0.017	0.034	0.01	0.00017
OCDD	< 0.026	0.026	0.052	0.001	0.000026
2,3,7,8-TCDF	< 0.0089	0.0045	0.0089	0.1	0.00089
1,2,3,7,8-PeCDF	< 0.0056	0.0056	0.011	0.05	0.00028
2,3,4,7,8-PeCDF	< 0.0056	0.0056	0.011	0.5	0.0028
1,2,3,4,7,8-HxCDF	< 0.0075	0.0075	0.015	0.1	0.00075
1,2,3,6,7,8-HxCDF	< 0.0075	0.0075	0.015	0.1	0.00075
1,2,3,7,8,9-HxCDF	< 0.0075	0.0075	0.015	0.1	0.00075
2,3,4,6,7,8-HpCDF	< 0.0075	0.0075	0.015	0.1	0.00075
1,2,3,4,6,7,8-HpCDF	< 0.011	0.011	0.022	0.01	0.00011
1,2,3,4,7,8,9-HpCDF	< 0.011	0.011	0.022	0.01	0.00011
OCDF	< 0.023	0.023	0.047	0.001	0.000023
I-TEQ from quantified 2,3,7,8-PCDD/Fs - "Lowerbound"					0
I-TEQ from 2,3,7,8-PCDD/Fs - "Mediumbound"					0.0081
Maximum possible I-TEQ - "Upperbound"					0.016
PCDDs	Result [ng/sample]	PCDFs	Result [ng/sample]		
Tetra-CDDs	< 0.085	Tetra-CDFs	< 0.23		
Penta-CDDs	< 0.075	Penta-CDFs	< 0.21		
Hexa-CDDs	< 0.075	Hexa-CDFs	< 0.12		
Hepta-CDDs	< 0.034	Hepta-CDFs	< 0.045		
OCDD	< 0.026	OCDF	< 0.023		

I-TEF according to NATO.

Limits of quantification are defined as double of the detection limits.

The limit of detection is defined as the amount of analyte producing a signal with S/N<sub>2</sub>3.

The value of the detection limit is mentioned as the actual value at the acquisition date.

Measurement uncertainty is expressed as a double (k=2) relative standard deviation (RSD%), and corresponds to 95% confidence interval.

Estimation of uncertainty of each 2,3,7,8-PCDD/F congener is 30% and total I-TEQ is 20%.

These values were ensured by analyzes of certified reference material under conditions of internal reproducibility.

Results marked with "<" are below limit of detection or quantification.

"Lowerbound" and "Upperbound" are levels defined in Regulation 2017/644 and EN 1948-4.

"Mediumbound" is levels defined in Regulation 2017/644.

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**Attachment no. 1 to the Certificate of Analysis for work order PR2083382**

Sample: P/23/08/20

Standards recovery:

Sample:		P/23/08/20			
		Final extract [µl]:	60		
		Injection volume [µl]:	4		
		Acquisition date [d.m.y h:m]:	3.9.20 0:34		
Extraction standard	Recovery [%]	Acceptable range [%]		Accept. rec. with respect to	
		Basic	Extended	basic range	extended range
PCDD <sub>2</sub>					
13C12 - 2,3,7,8-TCDD	95	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,7,8-PeCDD	75	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDD	93	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDD	95	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDD	48	40 - 130	20 - 150	YES	-
13C12 - OCDD	44	40 - 130	20 - 150	YES	-
PCDF <sub>5</sub>					
13C12 - 2,3,7,8-TCDF	95	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,7,8-PeCDF	76	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDF	92	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDF	87	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,6,7,8-HxCDF	87	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDF	54	40 - 130	20 - 150	YES	-
13C12 - OCDF	43	40 - 130	20 - 150	YES	-
Sampling standard	Recovery [%]	Acceptable range [%]		Rec. in range?	
13C12-1,2,3,7,8-PeCDF	55	> 50		YES	
13C12-1,2,3,7,8,9-HxCDF	52	> 50		YES	
13C12-1,2,3,4,7,8,9-HpCDF	52	> 50		YES	

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## 9. CERTIFICATE OF ACCREDITATION

POLSKIE CENTRUM AKREDYTACJI  
POLISH CENTRE FOR ACCREDITATIONSygnatariusz EA MLA  
EA MLA SignatoryCERTYFIKAT AKREDYTACJI  
LABORATORIUM BADAWCZEGO  
ACCREDITATION CERTIFICATE OF TESTING LABORATORY  
Nr AB 994

Potwierdza się, że: / This is to confirm that:

„PROFTECH” Sp. z o.o.  
ul. Kurta Aldera 44, 41-506 Chorzówspełnia wymagania normy PN-EN ISO/IEC 17025:2018-02  
meets requirements of the PN-EN ISO/IEC 17025:2018-02 standardAkredytowana działalność jest określona w Zakresie Akredytacji Nr AB 994  
Accredited activity is defined in the Scope of Accreditation No AB 994Akredytacja pozostaje w mocy pod warunkiem przestrzegania  
wymagań jednostki akredytującej określonych w kontrakcie Nr AB 994  
This accreditation remains in force provided the Laboratory observes  
the requirements of Accreditation Body defined in the Contract No AB 994Akredytacji udzielono dnia 30.01.2009 r.  
Accreditation was granted on 30.01.2009DYREKTOR  
POLSKIEGO CENTRUM AKREDYTACJI  
LUCYNA OLBORSKA

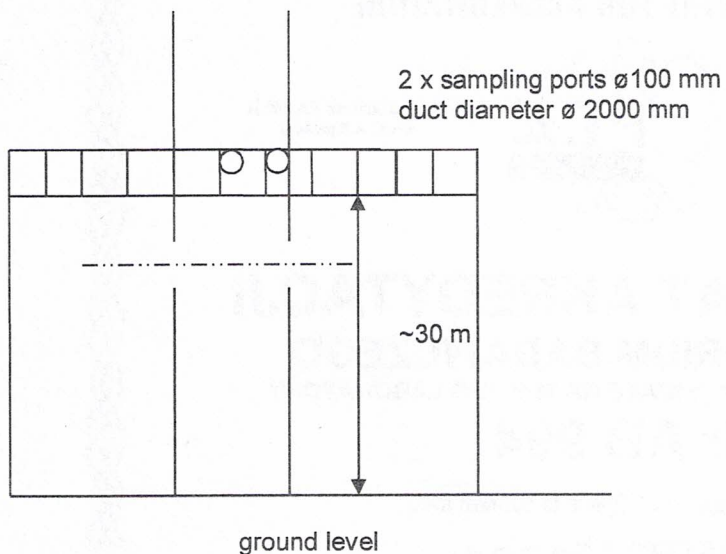
Warszawa, dnia 9 grudnia 2019 roku


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**10. MEASUREMENT PLANE SCHEME**



Approved by  
  
DYREKTOR  
.....  
Name and Signature *Dariusz Guja*

END OF REPORT