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Office of Climate, Licensing & Resource Use
PO Box 3000
Johnstown Castle Estate
County Wexford

05 Jan 2018

IPC Reg. No: PO465-02
Re:Request for Information according to Reg. 10(2)(b)(ii) of EPA(IPC) (Licensing) Regulations 2013 - Emissions Assessment A2-1 – A2-4 Rubber Fume, A2-5 Gleitmo Fume

Dear Mr. Clabby,

I am enclosing the requested information on Emissions Assessment for all emissions to atmosphere on site. In addition, enclosed also are the emissions Tables E.1(ii)(iii) for existing emission points A2-1 – A2-4 Rubber Fume and for the proposed emission point A2-5 Gleitmo Coating Fume.
The surveys and assessment was carried out by TMS Environment Ltd on our behalf.
I have also included updated data on energy usage and site activities since the original appplication was submitted in 2014.

We declare that the content of the electronic files on the accompanying CD-ROM is a true copy of the original form.

Please find enclosed the following documents for review:

1 signed original, 1 copy

- Requested Information
- Attachments – appendices supporting air emission assessments
- 2 electronic copies of all files on CD-ROM

Yours sincerely,

Anna Garvey
Environmental Manager
G. Bruss GmbH DICHTUNGSTECHNIK
Finisklin Road,
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Contents

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ASSESSMENT OF EMISSIONS TO ATMOSPHERE

For

G BRUSS GMBH
Finisklin Road,
Sligo

Licence Reg. P0465-01

Report Ref 23888-2
20 December 2017

1.0 INTRODUCTION AND SCOPE

This report presents an assessment of emissions to atmosphere in response to a request for information from the EPA dated 29th June 2016. The request for information included the following information relevant to this report:

(i) Carry out monitoring and analysis of emissions to atmosphere for relevant substances as listed in the EPA BAT Guidance Note for the Manufacture of Organic Chemicals;
(ii) Complete Tables E1(i) to E1(ii) for emission points A2-1 to A2-4;
(iii) Provide an analysis based on conservative modelling to indicate whether there is a possibility of breach of relevant air quality standards for particulates.

This report collates the relevant information gathered to respond to this element of the request for information.

2.0 MATERIALS IN USE

A range of materials is in use at the facility in the relevant production areas. A full list of the materials together with details of the associated emission points is provided in Appendix I. One of those materials listed in Appendix I (Bruss Number 07781, containing lead monoxide) is no longer in use and is therefore not considered further in this assessment. The MSDS Information for each of the materials is presented in Appendix II.

These materials were reviewed and Table 1 presents a summary of the relevant characteristics specifically expressed in terms of the potential substances that could be present in emissions to atmosphere and grouped according to the list of Emission Limit Values that are stated in the BAT Guidance Note for Manufacture of Organic Chemicals. It is clear from the review that the only substances for which Emission Limit Values are specified in the BAT Guidance Note are particulates (expressed as total particulates) and organic substances not specifically classified (expressed as Total Organic Carbon).

3.0 EMISSIONS MONITORING

Monitoring of emissions to atmosphere from emission points A2-01, A2-02, A2-03 and A2-04 was carried out in January 2017; the monitoring report is presented in Appendix III and has been submitted to the Agency. Monitoring was carried our pre- and post abatement. There is no separate emissions point prior to abatement so the pre-abatement monitoring was carried out by switching of the Electrostatic Precipitator; this meant that simultaneous monitoring could not be carried out and some runs had higher post-abatement than pre-abatement results for some parameters. It is also noted that although the analysis of rubber fume was carried out on the sample collected and gravimetrically analysed for total particulate, for some runs the rubber fume result was higher than that recorded for particulate matter. This is most likely due to measurement uncertainty in the analysis method for rubber fume.

The results showed that no Class I or Class II organic substances were detected and therefore all organic substances are classified under the heading Total Organic Carbon (TOC). The most notable feature of all of the TOC results is that extremely low mass emission rates were measured – the highest value recorded in any of the runs after abatement was 0.04kg/hour. The highest result pre-abatement was just 0.2 kg/hour. The ELV specified in the BAT Guidance Note is 50mg/m^3 at a mass flow rate of 500g/hour (0.5kg/hour). None of the measurement results, even prior to abatement, exceeded the mass flow threshold at which an ELV would apply. And none of the measurement results exceeded the ELV that would apply if the mass flow threshold had been exceeded.

The total particulate results are compared with the BAT Guidance Note ELV of 20mg/m^3 at a mass flow rate of 200g/hour (0.2kg/hour). None of the measurement results exceeded the mass flow threshold and therefore an ELV would not apply. The measured mass emission rates were orders of magnitude lower than the mass flow threshold in the BAT Guidance Note. There is no limit that would be specifically applied to rubber fume so the measurement results are compared with the result for total particulate matter. Again all of the measurement results were below the mass flow threshold at which an ELV would apply. This is entirely consistent with expectations considering the nature of the materials and the process.

The data acquired during the surveys was used to complete the Tables E1(i) to E1(II) for the Licence Review Application. In each case, it has been proposed that the maximum emission rate that would arise is less than the mass flow threshold at which an ELV would apply.

4.0 ASSESSMENT OF PARTICULATE EMISSIONS

The Agency requested that an analysis based on conservative modelling to indicate whether there is a possibility of breach of relevant air quality standards for particulates would be provided. As noted above the results of all measurements for particulates were significantly lower than the mass flow rate at which an ELV would apply. This indicates that the rate of the emissions is insignificant.

There is no ambient air quality standard for total particulate matter but there is a standard for fine particulate matter as PM_{10} and there will be an air quality standard in 2020 for $PM_{2.5}$. Even if all of the particulate matter was fine particulate matter as PM_{10}, the level of emission is so low that it is deemed to be insignificant and that there is no potential for breach of the air quality standard. The Agency Guidance in respect to significance of emissions when determining whether a Technical Amendment or a Licence Review would be required considers that emissions that are less than 30% of a relevant mass flow threshold are considered insignificant. The measured emission rate for this application is significantly lower than this assessment threshold and this supports our assessment that the emissions are insignificant.

Table 1 Assessment of the potential presence of substances in emissions which would have an Emission Limit Value

Parameter	**Presence in any materials in use**
Carcinogenic Substances Class I	None of the listed substances are present in any of the materials listed in Appendix I
Carcinogenic Substances Class II	None of the listed substances are present in any of the materials listed in Appendix I
Carcinogenic Substances Class III	None of the listed substances are present in any of the materials listed in Appendix I. Although butadiene rubbers (NBR and HNBR) are in use, 1,3-Butadiene is a gas and none of the free monomer is found in the product.
Organic Substances Class I	None of the listed substances are present in any of the materials listed in Appendix I
Organics Substances Class II	None of the listed substances are present in any of the materials listed in Appendix I
Total Organic Carbon (TOC)	There are a number of waxes and oils present which could contribute to a TOC reading in the emissions.
Mercaptans	Not present in any of the materials listed in Appendix I
Amines	Not present in any of the materials listed in Appendix I
Trimethylamine	Not present in any of the materials listed in Appendix I
Phenols, cresols and xylols	Not present in any of the materials listed in Appendix I
Toluene di-isocyanate	Not present in any of the materials listed in Appendix I
Substances with Photochemical Ozone Potential (R59)	Not present in any of the materials listed in Appendix I
Vaporous or gaseous Inorganic substances Class I	None of the listed substances are present in any of the materials listed in Appendix I
Vaporous or gaseous Inorganic substances Class II	None of the listed substances are present in any of the materials listed in Appendix I
Vaporous or gaseous Inorganic substances Class III	None of the listed substances are present in any of the materials listed in Appendix I
Vaporous or gaseous Inorganic substances Class IV	None of the listed substances are present in any of the materials listed in Appendix I
Inorganic Dust Particles Class I	None of the listed substances are present in any of the materials listed in Appendix I
Inorganic Dust Particles Class II	None of the listed substances are present in any of the materials listed in Appendix I
Inorganic Dust Particles Class III	None of the listed substances are present in any of the materials listed in Appendix I
Total particulates	There could be some particulate matter in the form of rubber fume present in the emissions

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Anna Garvey
G Bruss GmbH
Finisklin Road,
Sligo

Re: Licence Reg. P0465-01 Assessment of emissions for Emission Point A2-05

3 January 2018

Dear Anna

Emissions to Atmosphere from emission point A2-05 ae projected to occur for no more than 4 hours per day, 100 days per year ie 400 hours per year. This is a very limited period of operation and means that the overall emission rate of any substances from this emission point is low. The assessment of emission was considered for the main substances of potential interest – organic carbon, expressed as TOC, and organic tin (as di butyl tin). The following rationale is presented for assessment of significance of the emissions.

1. There was no organic tin detected in any of the emissions surveys (pre or post-abatement) and the data presented in Tables E therefore represents potential maxima for hourly emission rates. The maximum hourly mass emission rate is less than 20% of the BAT ELV and therefore the emission is insignificant and there is no potential for breach of an air quality standard as a result of the emission especially when the very limited operational hours are considered.

2. Organic substances expressed as TOC were detected and an upper estimate of 600mg/m^3 is considered for the emission which equates to 0.4kg/hour mass emission maximum. Since the process only operates for 400 hours per year, 4 hours per day, the average hourly emission rate per day is 0.067kg/hour and on an annual basis the average hourly emission rate is 0.0046kg/hour. These potential emission rates are significantly lower than the BAT threshold of 0.5 kg/hour. There is no Air Quality Standard for TOC specifically against which to assess the significance of the emissions so any assessment will be made against the annual air quality standard for some substance. Therefore it is reasonable to consider the annual average emission rate when assessing the significance of the emissions. The annual average mass emission rate is less than 1% of the BAT threshold. It is therefore concluded that the emissions are insignificant and that no breach of air quality standards would occur as a result of the emission.

The level of emission is so low that it is deemed to be insignificant and that there is no potential for breach of the air quality standards. The Agency Guidance in respect to significance of emissions when determining whether a Technical Amendment or a Licence Review would be required considers that emissions that are less than 30% of a relevant mass flow threshold are considered insignificant. As noted above, mass emission rates are significantly lower than this assessment threshold and this supports our assessment that the emissions are insignificant . We conclude that dispersion modelling is not required as there is no likelihood of a breach of an air quality standard given the low mass emission rate and infrequent operation hours for this activity.

Yours sincerely

Imelda Shanahan

Dr Imelda Shanahan

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-1
Source of Emission:	Rubber Tempering Ovens – Rubber Fume Stack
Location:	Business Unit 3
Grid Ref. (12 digit, 6E,6N):	168395E, 336310N
Vent Details Diameter: Height above Ground(m):	350 mm 9.5
Date of commencement:	2001 (2014 change roof location < 100m)

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	36000Nm^3/d	Maximum/day	36000Nm^3/d
Maximum rate/hour	1500Nm^3/h	Min efflux velocity	4$m.sec^{-1}$
(ii) Other factors			
Temperature	40°C(max)	40 °C(min)	40°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. Dry ☐ dry. _____%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 250 day/yr

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-2
Source of Emission:	Rubber Tempering Ovens – Rubber Fume Stack
Location:	Business Unit 2
Grid Ref. (12 digit, 6E,6N):	168437E,
Vent Details Diameter: Height above Ground(m):	350 mm 9.5
Date of commencement:	2001

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	36000Nm^3/d	Maximum/day	36000Nm^3/d
Maximum rate/hour	1500Nm^3/h	Min efflux velocity	4$m.sec^{-1}$
(ii) Other factors			
Temperature	40ºC(max)	20 ºC(min)	40ºC(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ☐ dry. _____%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 250 day/yr

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-3
Source of Emission:	Rubber Tempering Ovens – Rubber Fume Stack
Location:	Business Unit 2
Grid Ref. (12 digit, 6E,6N):	168463E, 336311N
Vent Details Diameter: Height above Ground(m):	500mm 9.5
Date of commencement:	2001

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	72000Nm^3/d	Maximum/day	72000Nm^3/d
Maximum rate/hour	2700Nm^3/h	Min efflux velocity	4$m.sec^{-1}$
(ii) Other factors			
Temperature	40ºC(max)	20 ºC(min)	20ºC(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. Dry ☐ dry. _____ $\%O_2$			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 250 day/yr

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-4
Source of Emission:	Rubber Tempering Ovens – Rubber Fume Stack
Location:	Business Unit 1
Grid Ref. (12 digit, 6E,6N):	168440E, 336341N
Vent Details Diameter: Height above Ground(m):	250mm 9.5
Date of commencement:	2001

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	64800Nm^3/d	Maximum/day	64800Nm^3/d
Maximum rate/hour	2500Nm^3/h	Min efflux velocity	7$m.sec^{-1}$
(ii) Other factors			
Temperature	40°C(max)	20 °C(min)	30°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. Dry ☐ dry. _____$\%O_2$			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 250 day/yr

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	Proposed A2-5
Source of Emission:	'Gleitmo' Coating Proess – Fume Stack
Location:	Business Unit 2
Grid Ref. (12 digit, 6E,6N):	168443E, 336321N
Vent Details Diameter: Height above Ground(m):	500mm 9.5
Date of commencement:	2014

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	2000Nm^3/d	Maximum/day	5000Nm^3/d
Maximum rate/hour	1000Nm^3/h	Min efflux velocity	2$m.sec^{-1}$
(ii) Other factors			
Temperature	30ºC(max)	30 ºC(min)	30ºC(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. Dry ☐ dry. _____%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 2 hr/day 50 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-1***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
Particulate	5	20	0.0075	0.2	Electrostatic Precipitator	3	3	0.0075	0.375	45	2250
Total Organic Carbon	20	50	0.03	0.5		20	50	0.03	0.5	180	3000

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-2***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
Particulate	5	20	0.0075	0.2	Electrostatic Precipitator	5	20	0.0075	0.375	45	2250
Total Organic Carbon	20	50	0.03	0.5		20	50	0.03	0.5	180	3000

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-3***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
Particulate	5	20	0.015	0.2	Electrostatic Precipitator	5	20	0.015	0.75	90	4500
Total Organic Carbon	20	50	0.06	0.5		20	50	0.06	0.5	360	3000

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-4***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
Particulate	5	20	0.0135	0.2	Electrostatic Precipitator	5	20	0.0135	0.675	81	4050
Total Organic Carbon	20	50	0.054	0.5		20	50	0.054	0.5	324	3000

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	Proposed A2-5
Source of Emission:	'Gleitmo' Coating Proess – Fume Stack
Location:	BRUSS Business Unit 2 Rear Roof Space
Grid Ref. (12 digit, 6E,6N):	168443E, 336321N
Vent Details Diameter: Height above Ground(m):	500mm 9.5
Date of commencement:	2014

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	4000Nm^3/d	Maximum/day	24000Nm^3/d
Maximum rate/hour	1000Nm^3/h	Min efflux velocity	2m.sec^{-1}
(ii) Other factors			
Temperature	30ºC(max)	15 ºC(min)	20 ºC(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ☐ dry. _____%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 3.8 hr/day 100 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-5***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
TOC	1900	2300	1.24	1.5	Activated Carbon	400	600	0.26	0.39	104	156
Di butyl tin	< 1.4	< 1.4	< 0.001	< 0.001		< 1.4	< 1.4	< 0.001	< 0.001	0.4	0.4

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0°C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.

G.BRUSS GmbH, DICHTUNGSTECHNIK, Finisklin Road, Sligo
Tel: (071) 9156300 Fax: (071) 9169352

Dated: 04.01.2018

Regulation 10(2)(b)(ii) of EPA (Integrated Pollution Control)(Licencing) Regulations 2013
Request for supporting Information under Regulation 9 0f the regulations.

Energy Consumption
BRUSS energy consumption 2014 – 2017 is presented in **Table 1** below.
Comparison is made with 2012 consumption to demonstrate how efficiencies have been maintained or improved upon. As noted in the application form Section G, BRUSS undertook an energy efficiency project starting 2012 and achieved an initial reduction of 20.4% (per 1,000pcs produced). Efficiencies were gained through retrofit of inverter drive motors on moulding machines and a change to energy efficient space heating and lighting.

Table 1 below shows reasonable performance in maintaining efficiencies when it is taken into account that the period between 2015 and 2017 saw significant remodelling works in the production area and moulding machine investment.

In 2016 – 2017, BRUSS invested in 5 off high output MAPLAN injection moulding machines, 2 of which replaced older high energy consuming machines. The company is now operating with 3 additional moulding machines compared to the 2012 levels.

A further energy project commenced in quarter 4 of 2017. BRUSS is currently installing continuous energy monitoring on all of its production equipment, starting with moulding. The aim of this project is to provide real-time data by machine, thus enabling improved scheduling of production activities from moulding to finishing processes and so reduce inadvertent wastages in energy.

Year	Annual KWh	Efficiencies gained compared to 2012 baseline (%)
2017	7698167	+12.8
2016	7692344	+12.8
2015	7673451	+13.1
2014	7488266	+15.1
2012	8825565	Baseline

Table 1 BRUSS annual energy consumption data in KWh

Site Activity Updates

Fuel Oils

In quarter 1 of 2017, BRUSS decommissioned the remaining fuel Oil standby tank used to supply an emergency generator for the site in the case of power outage. Alternative contracts are now in place with a mobile generator provider to cover emergency situations. The use of fuel oil on site has been eliminated.

Hazardous Substances

In 2018, BRUSS intends to phase out the use of Korro 60-90 (Boric Acid in solution <1%). Annual usage is currently 400litres as stated in Item 9 of Reg 10 Request , dated 17.07.2017.
The product is used as a corrosion inhibitor at mould cleaning process. BRUSS intends to replace the current process with an air-dried finish, eliminating the need for the use of anti-corrosive in rinsing water.

In 2017, BRUSS phased out the use of raw material: 07781 FKM (Fluorocarbon Rubber) which contained Lead monoxide at (<3 % ref IMDS data Appendix II) . Production with this material ceased in November 2017.

Anna Garvey
Env. Manager

ATTACHMENTS

Contents

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ATTACHMENT 1.B	**ITEM 1 A2-1 – A2-4 EMISSION ASSESSMENT REPORT** APPENDIX II MDS DATA BRUSS PRODUCT BY MATERIAL TYPE
ATTACHMENT 1.C	**ITEM 1 A2-1 – A2-4 EMISSION ASSESSMENT REPORT** APPENDIX III AIR EMISSION SURVEY A2-1-A204RUBBER FUME

ATTACHMENT 1.A

- ITEM 1 : A2-1 – A2-4 EMISSION ASSESSMENT REPORT

  APPENDIX I LIST OF BRUSS MATERIAL TYPES

23888-2 Appendix I List of Materials In Use

BRUSS	Elastomer Rubber Compound List	Rev : 00 DATE: 25.07.2016

Elastomer Rubber Compound - Homogenous Type	Chemical Description	Abbreviation (ASTM 1418)	Other Trade Names / Abbreviations	BRUSS Compound No.	Percentage Production (%)	Associated Emission Point [2]
Nitrile	Acrylonitrile-butadiene rubber	NBR	Buna-No	01736 01722 01723	**4.0**	A2-4
Hydrogenated Nitrile	Hydrogenated Acrylonitrile-butadiene rubber	HNBR	HNBR	14750 14615 14617	**5.2**	A2-1
Ethylene Propylene	Ethylene Propylene Diene Rubber	EPDM	EP, EPT, EPR	09611 09617 09716 09613	**17.8**	A2-3
Fluorocarbon	Fluorocarbon Rubber	FKM	Viton ®, Fluorel ® [1]	07770 07730 07795 07781 07709 07694 07712	**15.0**	A2-4
Polyacrylate	Polyacrylate Rubber	ACM	ACM	05532 05501 05730 05740 05640	**26.3**	A2-1,2,3,

BRUSS	Elastomer Rubber Compound List	Rev : 00 DATE: 25.07.2016

Elastomer Rubber Compound - Homogenous Type	Chemical Description	Abbreviation (ASTM 1418)	Other Trade Names / Abbreviations	BRUSS Compound No.	Percentage Production (%)	Associated Emission Point [2]
Ethylene Acrylic	Ethylene Acrylic Rubber	AEM	Vamac ® [1]	W 1150 11888 11721 11727 11827 11825 11621 11622	**28.0**	A2-1,2,3,

Table 1 Rubber and Elastomer Products Overwiew (www.professionalplastics.com)

Note 1 Viton ® and Vamac ® are registered trademarks of E.I.du Pont de Nemours. Fluorel ® is a registered trademark of Dyneon LLC

Note 2 Associated emission points reflect current production schedules. Configuration of rubber types at emission points is subject to change according to needs of the business.

ATTACHMENT 1.B

- ITEM 1 : A2-1 – A2-4 EMISSION ASSESSMENT REPORT

  APPENDIX II MDS DATA BRUSS PRODUCT BY MATERIAL TYPE

Attachment removed on foot of a request from Licensee in May 2024.

ATTACHMENT 1.C

- ITEM 1 : A2-1 – A2-4 EMISSION ASSESSMENT REPORT

  APPENDIX III AIR EMISSION SURVEY A2-1-A204RUBBER FUME

Appendix III

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ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 1507

CONFIDENTIAL REPORT

ANNUAL AIR EMISSIONS SURVEY 2017

AT
G BRUSS GMBH
Finisklin Road,
Sligo

Licence Reg. P0465-01
TMS Environment Ref. 23888 Rev 2.0

Commencement Date: 11 January 2017 **Completion Date:** 13 April 2017
Revision Date: 20 December 2017

Reporting	**Site Personnel**	**Analysts**
Enda Flood	Enda Flood	Sarah Kearney
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Approved by: **Date:** 20 December 2017

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EXECUTIVE SUMMARY

This Air Emissions report presents results of emissions monitoring from emission point A2-01, A2-02, A2-03 &, A2-04 at G Bruss GmbH, Finisklin Road, Sligo, County Sligo. Monitoring has been conducted to satisfy the customer's requirements in respect of the following parameters, having regard to relevant substances listed in Table 6.1 of the Agency's "BAT Guidance Note for Manufacturing of Organic Chemicals"

Monitoring Scope	***Annual Rubber Fume Emissions Monitoring 2017***
Emission Point	***Parameter***
A2-1, A2-2, A2-3 & A2-4	• Carcinogenic substances listed as Class I, II or III • Organic substances listed as Class I or Class II • Total Organic Carbon as Carbon (TOC as C) • Mercaptans • Amines (Total) • Trimethylamine • Phenols, Cresols and xylols • Toluene di-idocyante • Organic Substances with Photochemical Ozone Potential (R59) • Vaporous or Gaseous Inorganic Substances listed as Class I, II III or IV • Inorganic Dust Particles Class I, II or III • Total Particulates • Rubber Fume • Velocity and Temperature • Moisture

Measurements were completed during a two day site visit on 11 & 12 January 2017. Details of the monitoring methods employed, Standard Reference Methods used and Guidance Notes consulted are presented in Section 4.0 of this report together with information on the equipment used and the monitoring personnel.

Prior to the site visit a review of all products used in the drying ovens was undertaken to identify which substances would be present in the emission streams, and the monitoring and analysis techniques to be used to report the concentration of these substances.

Monitoring for Total Particulate was carried out at each emission point, with subsequent analysis to determine the Rubber Fume composition of the total particulate. Additionally, at each emission point, monitoring of speciated Volatile Organic Compounds (VOC's) and Total Organic Carbon as Carbon (TOC as C) was also completed.

Monitoring at each location occurred at a location post the Electro Static Precipitators (ESP) abatement unit in each of the vents. To monitor "pre abatement" conditions, monitoring were

carried out at the same locations, however the ESP systems were turned off, details of the ESP units are included in Table 2-1.

The results for all of the measurement parameters reported are compared with the Licence Limit Values specified in the customer's IPPC Licence. With respect to this it can be seen that results for Rubber fume are below the Licence Limit Values specified in the BAT Guidance Note for all Stacks monitored.

All compounds identified, where applicable have been classified in to a category based on the BAT Guidance Note for the Manufacture of Organic Chemical, and have been compared to the emission limits as specified in Table 6.1 BAT Associated Levels of Emissions to Air, in addition to this, all Volatile Organic Compounds, identified have also been compared to TA Luft (Technical Instructions on the Air Quality Control), in accordance with BAT guidelines, as monitoring has been conducted at an existing facility.

1.0 Scope

This Air Emissions report presents results of emissions monitoring from emission point A2-01 to A2-04 at G Bruss GmbH, Finisklin Road, Sligo, County Sligo.

Based on the review of the MSDS's monitoring has been conducted to satisfy the customer's requirements in respect of the following parameters:

Table 1-1Scope of Monitoring Survey

Reporting period		***Annual 2017***	
EMISSION POINT	***PARAMETER***	***SAMPLING METHOD AND MEDIUM & ANALYSIS METHODOLOGY***	***STANDARD REFERENCE METHOD***
A2-1 to A2-4	Total Particulate Rubber Fume/ Lead (*Inorganic Dust Particle Class II*)	Isokinetic, Filter & rinse / Gravimetric analysis with cyclohexane extraction	EN 13284-1:2002
	Speciated VOC's (*organic substances Class I & Class II*)	Non-isokinetic / Charcoal tube absorption / Analysis by solvent desorption followed by GC-MS or GC-FID	CEN/TS 13649:2014
	Organics TOC	*In situ* FID analyser	EN 12619:2013
	Temperature, Pressure, Velocity, Flow	Pitot tube coupled with pressure measurement device or anemometer, and temperature measurement device	EN/ISO 16911-1:2013

2.0 Survey protocol

2.1 Protocol

TMS Environment Ltd personnel conducted the monitoring survey on 11 & 12 January 2017. Emissions to atmosphere from the Emission Points A2-01, A2-02, A2-03 and A2-04 were monitored during the visit.

Particulate monitoring was conducted isokinetically with filters gravimetrically analysed to determine the concentration of total particulate matter found at each emission point, with the rubber fume concentration of the total particulate subsequently analysed via extraction with cyclohexane.

Lead particulate monitoring was conducted isokinetically with filters analysed by ICP to determine the concentration of total lead particulate matter found on filters at specific emission points.

Speciated VOC's were monitored by adsorption via charcoal sorbent tubes, flow rates through these tube was approximately 500ml/min. Tubes were subsequently sent for sub-contract analysis.

TOC as C analysis was completed *in-situ* via FID analysis, with results logged on site.

The survey was completed in order to meet the requirements of the company's IPPC Licence (Reg. No. P0465-01) for particulate matter and rubber fume concentrations, while VOC's, TOC as C and Lead particulate matter were monitored to collect information on the process on site with respect to the Client's application under Regulation 9 of the IPC Regulations 2013.

A Site Specific Protocol was prepared in accordance with EPA Air Guidance Note AG1 and CEN/TS 15675:2007 after a site review has been conducted with site personnel. A site risk assessment was completed prior to commencement of any monitoring to confirm that the monitoring could be carried out in a safe manner. All necessary PPE was worn at all times on site.

Relevant Process conditions during the survey are summarized below.

Table 2-1: Operational information during testing

Emission monitoring point	Date and time	Details	Products in Use in Drying Ovens	Abatement system
A2-01 Pre Abatement	12 January 2017 13:06 – 13:36	Normal operation	141617 HNBR, 14615 HNBR, 05640 ACM 05532 ACM	ESP 08
A2-01 Post Abatement	12 January 2017 12:27 – 12:57	Normal operation – ESP off		ESP 08
A2-02 Pre Abatement	12 January 2017 15:34 – 16:04	Normal operation	05730 ACM 11721 AEM 05532 ACM 11827 AEM	ESP 02
A2-02 Post Abatement	12 January 2017 14:52 – 15:22	Normal operation – ESP off		ESP 02
A2-03 Pre Abatement	12 January 2017 10:40 – 11:10	Normal operation	W1150 AEM 11888 AEM 11825 AEM	ESP04
A2-03 Post Abatement	12 January 2017 09:59 – 10:29	Normal operation – ESP off		ESP04
A2-04 Pre Abatement	11 January 2017 15:16 – 15:46	Normal operation	07781 FKM 05730 ACM 07770 FKM 11827 AEM	ESP 03
A2-04 Post Abatement	11 January 2017 16:00 – 16:30	Normal operation – ESP off		ESP 03

3.0 Monitoring Results

The results of the air emission monitoring reported in this document are presented in tables below. Where parameters have been classified according to Table 6.1 of The Agency's *'BAT Guidance Note for the Manufacture of Organic Chemicals'*, the sum of the total class is provided in Section 3, with individual compounds detailed Appendix I. Methods used are defined by Standard Operating Procedures (SOP), each SOP has a unique number, details regarding each SOP are given in Part 2 of this report.

3.1 Results for A2-01- Pre Abatement, 12 Jan 2017, 13:06-13:36

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	20	< 1.5	±0.19	mg/m^3	2.13×10^{-03}	Yes
Rubber Fume	20	0.8	±0.10	mg/m^3	1.10×10^{-03}	Yes
TOC as C	N/S	20.3	±3.98	mg/m^3	0.03	N/A
Volume Flow	N/S	1,393	±81	Nm^3/hr	-	N/A

3.2 Results for A2-01- Post Abatement, 12 Jan 2017, 12:27 – 12:57

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	20	< 1.5	±0.19	mg/m^3	$<2.09 \times 10^{-3}$	Yes
Rubber Fume	20	0.7	±0.09	mg/m^3	1.01×10^{-03}	Yes
TOC as C	N/S	11.4	±2.24	mg/m^3	0.02	N/A
Volume Flow	N/S	1,426	±83	Nm^3/hr	-	N/A

3.3 Results for A2-02- Pre Abatement, 12 Jan 2017, 15:34 – 16:04

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	20	< 0.4	±0.05	mg/m^3	$< 4.79 \times 10^{-03}$	Yes
Rubber Fume	20	3.4	±0.44	mg/m^3	4.48×10^{-03}	Yes
TOC as C	N/S	34.6	±6.77	mg/m^3	0.05	N/A
Volume Flow	N/S	1,309	±76	Nm^3/hr	-	N/A

3.4 Results for A2-02- Post Abatement, 12 Jan 2017, 14:52-15:22

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	20	2.1	±0.27	mg/m^3	2.66×10^{-03}	Yes
Rubber Fume	20	1.3	±0.16	mg/m^3	1.62×10^{-03}	Yes
TOC as C	N/S	28.7	±5.63	mg/m^3	0.04	N/A
Volume Flow	N/S	1,259	±73	Nm^3/hr	-	N/A

3.5 Results for A2-03- Pre Abatement, 12 Jan 2017, 10:40-11:10

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	20	< 1.3	±0.17	mg/m^3	$< 3.56 \times 10^{-03}$	Yes
Rubber Fume	20	4.4	±0.56	mg/m^3	0.01	Yes
TOC as C	N/S	7.0	±1.36	mg/m^3	0.02	N/A
Volume Flow	N/S	2,656	±154	Nm^3/hr	-	N/A

3.6 Results for A2-03 - Post Abatement, 12 Jan 2017, 09:59-10:29

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	20	< 1.5	±0.19	mg/m^3	$< 3.50 \times 10^{-03}$	Yes
Rubber Fume	20	0.7	±0.08	mg/m^3	1.58×10^{-03}	Yes
TOC as C	N/S	10.2	±1.99	mg/m^3	0.02	N/A
Volume Flow	N/S	2,400	±139	Nm^3/hr	-	N/A

3.7 Results for A2-04- Pre Abatement, 11 Jan 2017, 15:16 – 15:46

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	N/S	3.1	±0.39	mg/m^3	7.17×10^{-03}	Yes
Rubber Fume	20	1.5	±0.20	mg/m^3	3.53×10^{-03}	Yes
TOC as C	N/S	3.09	±0.60	mg/m^3	7.14×10^{-03}	N/A
Volume Flow	N/S	2,313	±134	Nm^3/hr	-	N/A

3.8 Results for A2-04- Post Abatement, 11 Jan 2017, 16:00 – 16:30

Parameter	Emission limit value	Emission results	Uncertainty	Units	Mass Emission kg/hr	Compliance
Total Particulate	N/S	< 7.5	±0.95	mg/m^3	$< 2.24 \times 10^{-03}$	Yes
Rubber Fume	20	22.4	±2.85	mg/m^3	6.73×10^{-03}	Yes
TOC as C	N/S	2.60	±0.50	mg/m^3	7.59×10^{-04}	N/A
Volume Flow	N/S	301	±17	Nm^3/hr	-	N/A

3.9 Reference Conditions for emission point A2-01 – A2-04

Reference Conditions for concentrations and volume flow as expressed as:

Temperature, K	Pressure, kPa	Oxygen %	Moisture %
273	101.3	N/A	Dry

4.0 Supporting Information

4.1 Monitoring team information

Name	Function	Qualification
Enda Flood	Environmental Scientist	• PgC Green Tech (2010) UCD Dublin • BAgSc (2008) UCD Dublin
Tim Hurley	Environmental Scientist	• Bsc (Hons) Chem, (2008) UCC • MSc (Merit) GeoChem, (2009) University of Leeds

4.2 Substance(s) monitored, SOP's and Standard Methods

Substance Monitored	SOP	Standard Method	Analysis by	Accreditation Range mg/m^3	ISO 17025 Accreditation Status	Analysis Date
Total Particulate	QP-SITE-2010	EN 13248-1 ISO 9096:2003	TMS	0.1-50 20-1,000	A	16 Jan 2017
Total Particulate (Rinse)	QP-SITE-2010	EN 13248-1 ISO 9096:2003	SAL	0.1-50 20-1,000	A	24 Jan – 02 Feb 2017
Rubber Fume	QP-SITE-2010	EN 13248-1	TMS	0.1-50 20-1,000	C	02 Feb 2017
Lead	QP-SITE-2017	EN 14358: 2004	SAL	0.005-50	B	24 Jan – 02 Feb 2017
Speciated VOC's	QP-SITE-2016	EN 13649: 2002	SAL	0.5-2,000	D	24 Jan – 02 Feb 2017
TOC as C	QP-SITE-2025	EN 12619	TMS	0.6-6,200	A	11 & 12 Jan 2017
Moisture	QP-SITE-2020	EN 14790:2005	TMS	2-40%	A	11 & 12 Jan 2017
Velocity & Temp	QP-SITE-2006 QP-SITE2027	EN 13284-1:2002/ EN/ISO 16911-1:2013	TMS	2.8-25m/s 0.13-40m/s 0-1,200^{o}C	A	11 & 12 Jan 2017

Note 1: ISO 17025 Accreditation Status: **A** – TMS accredited for Monitoring and Analysis, , **B** – TMS accredited for Monitoring, Subcontract Lab accredited for Analysis, **C** - TMS accredited for Monitoring, non-accredited analysis by TMS, **D** - TMS not accredited for Monitoring, as non-accredited analysis preformed by subcontract lab.

4.3 Equipment used and Quality checks

Equipment	Equipment ID	Quality Check
Tecora G4 Isokinetic sampler	M-S-E-1-1	Annual Calibration
Ratfisch FID	M-S-E-4-1	On-site per and post calibration check
Balance Scales	M-S-E-13-1	On Site Eccentricity check

4.4 Reporting results

4.4.1 Expression of test results

All test results are expressed to one decimal place lower than the Emission Limit Value (ELV), while uncertainty of measurement results are expressed to two decimal places lower than the ELV, e.g. where an ELV of 50mg/m^3 applies, the reported result shall be reported to the first decimal place e.g. 6.6mg/m^3 with the uncertainty of measurement reported to two decimal places, e.g. ±0.12mg/m^3.

4.4.2 Reporting results less than the detection limit

If a single result is reported as being less than the limit of detection, the measurement result is expressed using a less than "<" sign, e.g. <0.005 mg/Nm^3. Where a number of parameter results, found to be less than the limit of detection, are expressed as an overall parameter, these results are calculated as per Section 3.3, Method 3 (Half the Limit of Detection) of the EPA *BREF Guidance on the General Principles of Monitoring*. This percentage method provides an estimation of the value of the measurement. It is reported without the less than "<" sign, e.g. 0.05 mg/Nm^3.

4.4.3 Uncertainty calculation

An estimation of the uncertainty of measurement is attached to all measurements. Measurement uncertainties are based on calibration data and laboratory repeatability experiments. All uncertainties are given at a 95% confidence, based on applying a coverage factor of k=2 to the combined uncertainties for each measurement. The uncertainty of measurement associated with emissions monitoring are provided in the Table below.

Table 4-1: Uncertainty of Measurement

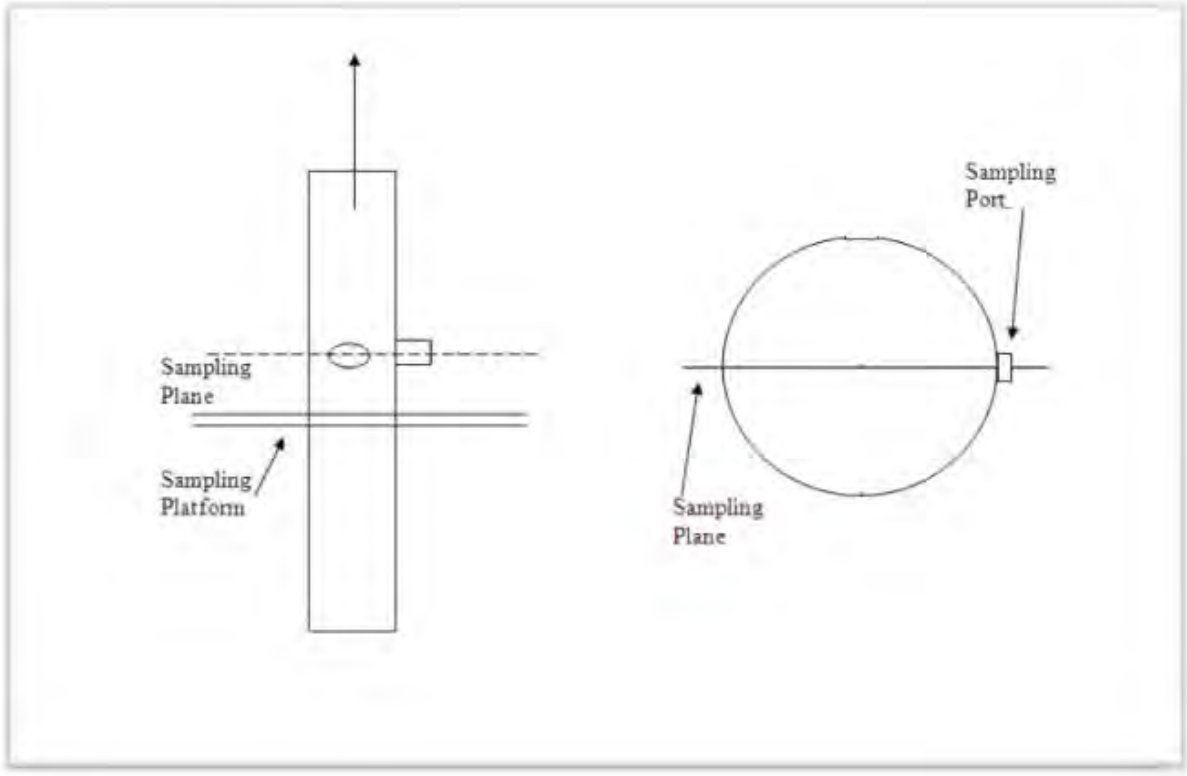
PARAMETER	SOURCE OF UNCERTAINTY	ESTIMATE OF UNCERTAINTY %	COMBINED UNCERTAINTY %	EXPANDED UNCERTAINTY % (95% Confidence Limit)
Rubber Fume	Flow/ADM Manometer	1.73	6.38	12.75%
	Lancom Analyser	3.46		
	Temperature/Lancom Analyser	0.29		
	Leak check**	0.00		
	Moisture	0.58		
	Isokinetic uncertainty	0.50		
	Analytical/Lab	5.00		
Speciated VOC's	Velocity	1.15	4.24	8.48%
	CSA	1.00		
	Pressure	0.58		
	Temperature	0.29		
	Analysis	5.00		
TOC as C	Lancom Analyser	3.46	4.28	8.56%
	Temperature/Lancom Analyser	0.29		
	FID	2.50		
Metals (Lead)	Lancom Analyser	6	7.24	14.48%
	Temperature/Lancom Analyser	0.5		
	Leak check**	2		
	Moisture	1		
	Isokinetic uncertainty	0.2		
	Analytical/Lab	12		
Volume Flow	Velocity	1.15	2.90	5.81%
	Stack Temperature	0.29		
	Stack Pressure	0.58		
	O_2	0.58		
	CSA	1.00		

ANNUAL AIR EMISSIONS
SURVEY 2017
G BRUSS GmBH
APPENDIX I
EMISSION POINT DETAILS

Licence Reg. P0465-01
TMS Environment Ref. 23888 Rev 2.0

Appendix 1: Emission Point A2-01, A2-02, A2-03, A2-04

Appendix1:1 – Stack Diagram



Stack Reference	A2-01	A2-02	A2-03	A2-04
Stack Diameter [m^2]	0.35	0.35	0.50	0.35
Stack Cross Sectional Area [m^3]	0.10	0.10	0.20	0.10
Number of Ports	2	2	2	1
Number of sampling planes	2	2	2	1
Number of Sampling points per line	1	1	1	1
Power supply available	110 supply	110 supply	110 supply	110 supply
Shelter at platform	Yes	Yes	Yes	Yes

Appendix 1:2 - Stack Measurements: VOC monitoring – A2-1 Pre Abatement

Reference method		EN 13649	
Sampling date		12 January 2017	
Sampling time		13:06-13:36	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.013	
Average flue gas temp temperature [^oC]		39.7	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	0.9
Temperature [K]	273	Temperature [K]	313
Pressure [kPa]	101.3	Pressure [kPa]	100.2
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:3 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-1 Pre Abatement

Reference method		EN 13284	
Sampling date		12 January 2017	
Sampling time		13:06-13:36	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		7.83	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.20	
Average flue gas velocity [m/s]		4.70	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		39.7	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	0.9
Temperature [K]	273	Temperature [K]	313
Pressure [kPa]	101.3	Pressure [kPa]	100.2
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:4 - Stack Measurements: TOC Monitoring - A2-1 Pre Abatement

Reference method	EN 12619
Sampling date	12 January 2017
Sampling time	13:06-13:36
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.35
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	4.70
Average flue gas temp temperature [^{o}C]	39.7

Sampling conditions

Conditions	**Reference**	**Sampling plane**
Moisture	Dry	0.9
Temperature [K]	273	313
Pressure [kPa]	101.3	100.2
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

Appendix 1:5 - Stack Measurements: VOC monitoring - A2-1 Post Abatement

Reference method		EN 13649	
Sampling date		12 January 2017	
Sampling time		12:27-12:57	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.013	
Average flue gas temp temperature [^oC]		37.8	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	0.64
Temperature [K]	273	Temperature [K]	311
Pressure [kPa]	101.3	Pressure [kPa]	100.8
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:6 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-1 Post Abatement

Reference method		EN 13284	
Sampling date		12 January 2017	
Sampling time		12:27-12:57	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		8.10	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.21	
Average flue gas velocity [m/s]		4.74	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		37.8	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	0.64
Temperature [K]	273	Temperature [K]	311
Pressure [kPa]	101.3	Pressure [kPa]	100.8
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:7 - Stack Measurements: TOC Monitoring - A2-1 Post Abatement

Reference method	EN 12619
Sampling date	12 January 2017
Sampling time	12:27-12:57
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.35
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	4.74
Average flue gas temp temperature [^{o}C]	37.8

Sampling conditions

Conditions	**Reference**	**Sampling plane**
Moisture	Dry	0.64
Temperature [K]	273	311
Pressure [kPa]	101.3	100.8
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

Appendix 1:8 - Stack Measurements: VOC monitoring - A2-2 Pre Abatement

Reference method		EN 13649	
Sampling date		12 January 2017	
Sampling time		15:34-16:04	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.014	
Average flue gas temp temperature [^oC]		39.6	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	0.72
Temperature [K]	273	Temperature [K]	313
Pressure [kPa]	101.3	Pressure [kPa]	100.6
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:9 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-2 Pre Abatement

Reference method		EN 13284	
Sampling date		12 January 2017	
Sampling time		15:34-16:04	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		30.37	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.85	
Average flue gas velocity [m/s]		4.39	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		39.6	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	0.72
Temperature [K]	273	Temperature [K]	313
Pressure [kPa]	101.3	Pressure [kPa]	100.6
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:10 - Stack Measurements: TOC Monitoring - A2-2 Pre Abatement

Reference method	EN 12619
Sampling date	12 January 2017
Sampling time	15:34-16:04
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.35
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	4.39
Average flue gas temp temperature [^{o}C]	39.6

Sampling conditions

Conditions	**Reference**	**Sampling plane**
Moisture	Dry	0.72
Temperature [K]	273	313
Pressure [kPa]	101.3	100.6
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

Appendix 1:11 - Stack Measurements: VOC monitoring - A2-2 Post Abatement

Reference method		EN 13649	
Sampling date		12 January 2017	
Sampling time		14:52-15:22	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.014	
Average flue gas temp temperature [^oC]		39.8	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	1.88
Temperature [K]	273	Temperature [K]	313
Pressure [kPa]	101.3	Pressure [kPa]	100.0
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:12 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-2 Post Abatement

Reference method		EN 13284	
Sampling date		12 January 2017	
Sampling time		14:52-15:22	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		8.80	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.25	
Average flue gas velocity [m/s]		4.30	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		39.8	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	1.88
Temperature [K]	273	Temperature [K]	313
Pressure [kPa]	101.3	Pressure [kPa]	100.0
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:13 - Stack Measurements: TOC Monitoring - A2-2 Post Abatement

Reference method	EN 12619
Sampling date	12 January 2017
Sampling time	14:52-15:22
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.35
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	4.30
Average flue gas temp temperature [^{o}C]	39.8

Sampling conditions

Conditions	Reference	Sampling plane
Moisture	Dry	1.88
Temperature [K]	273	313
Pressure [kPa]	101.3	100.0
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

Appendix 1:14 - Stack Measurements: VOC monitoring - A2-3 Pre Abatement

Reference method		EN 13649	
Sampling date		12 January 2017	
Sampling time		14:52-15:22	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.014	
Average flue gas temp temperature [^oC]		34.6	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	1.10
Temperature [K]	273	Temperature [K]	308
Pressure [kPa]	101.3	Pressure [kPa]	100.4
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:15 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-3 Pre Abatement

Reference method		EN 13284	
Sampling date		12 January 2017	
Sampling time		14:52-15:22	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		8.37	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.23	
Average flue gas velocity [m/s]		4.32	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		34.6	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	1.10
Temperature [K]	273	Temperature [K]	308
Pressure [kPa]	101.3	Pressure [kPa]	100.4
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:16 - Stack Measurements: TOC Monitoring - A2-3 Pre Abatement

Reference method	EN 12619
Sampling date	12 January 2017
Sampling time	14:52-15:22
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.5
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	4.32
Average flue gas temp temperature [^{o}C]	34.6

Sampling conditions

Conditions	**Reference**	**Sampling plane**
Moisture	Dry	1.10
Temperature [K]	273	308
Pressure [kPa]	101.3	100.4
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

Appendix 1:17 - Stack Measurements: VOC monitoring - A2-3 Post Abatement

Reference method		EN 13649	
Sampling date		12 January 2017	
Sampling time		09:59-10:29	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.014	
Average flue gas temp temperature [^oC]		16.7	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	0.80
Temperature [K]	273	Temperature [K]	290
Pressure [kPa]	101.3	Pressure [kPa]	101.4
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:18 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-3 Post Abatement

Reference method		EN 13284	
Sampling date		12 January 2017	
Sampling time		09:59-10:29	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		7.57	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.21	
Average flue gas velocity [m/s]		3.63	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		16.7	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	0.80
Temperature [K]	273	Temperature [K]	290
Pressure [kPa]	101.3	Pressure [kPa]	101.4
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:19 - Stack Measurements: TOC Monitoring - A2-3 Post Abatement

Reference method	EN 12619
Sampling date	12 January 2017
Sampling time	09:59-10:29
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.5
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	3.63
Average flue gas temp temperature [^{o}C]	16.7

Sampling conditions

Conditions	Reference	Sampling plane
Moisture	Dry	0.80
Temperature [K]	273	290
Pressure [kPa]	101.3	101.4
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

Appendix 1:20 - Stack Measurements: VOC monitoring - A2-4 Pre Abatement

Reference method		EN 13649	
Sampling date		12 January 2017	
Sampling time		15:16-15:46	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.014	
Average flue gas temp temperature [^oC]		33.1	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	1.09
Temperature [K]	273	Temperature [K]	306
Pressure [kPa]	101.3	Pressure [kPa]	101.2
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:21 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-4 Pre Abatement

Reference method		EN 13284	
Sampling date		12 January 2017	
Sampling time		15:16-15:46	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		13.9	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.39	
Average flue gas velocity [m/s]		7.58	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		33.1	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	1.09
Temperature [K]	273	Temperature [K]	306
Pressure [kPa]	101.3	Pressure [kPa]	101.2
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:22 - Stack Measurements: TOC Monitoring - A2-4 Pre Abatement

Reference method	EN 12619
Sampling date	12 January 2017
Sampling time	15:16-15:46
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.35
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	7.58
Average flue gas temp temperature [^{o}C]	33.1

Sampling conditions

Conditions	Reference	Sampling plane
Moisture	Dry	1.09
Temperature [K]	273	306
Pressure [kPa]	101.3	101.2
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

Appendix 1:23 - Stack Measurements: VOC monitoring - A2-4 Post Abatement

Reference method		EN 13649	
Sampling date		11 January 2017	
Sampling time		16:00-16:30	
Sampling technique			
Flue gas sampling system		SKC pump with Tygon tubing and low flow tube holder	
Oxygen measurement technique		FGA	
Material			
Sampling material		Charcoal tubes	
Sampling conditions			
Average sampling flow rate [l/min]		0.5 per tube	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.014	
Average flue gas temp temperature [^oC]		35.3	
Reference conditions		**Actual conditions**	
Moisture [%]	Dry	Moisture [%]	0.0
Temperature [K]	273	Temperature [K]	308
Pressure [kPa]	101.3	Pressure [kPa]	101.4
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		N/A	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:24 - Stack Measurements: Particulate & Rubber Fume Monitoring - A2-4 Post Abatement

Reference method		EN 13284	
Sampling date		11 January 2017	
Sampling time		16:00-16:30	
Sampling technique			
Flue gas sampling system		Isokinetic in stack filtration system	
Oxygen measurement technique		Flue Gas Analyser	
Material			
Sampling probe material		Titanium	
Filter material		Titanium	
Sampling conditions			
Probe temperature [^{o}C]		120	
Filtration temperature [^{o}C]		120	
Average sampling flow rate [l/min]		1.47	
Total sampling time [min]		30	
Sampled volume of the dry gas at STP [m^3]		0.04	
Average flue gas velocity [m/s]		0.98	
Nozzle diameter [mm]		7	
Ratio of highest to lowest velocity		< 1:3	
Swirl test result		Pass	
Initial leak test result [% of expected sampling flow rate]		0	
Final leak test result [% of average sampling flow rate]		0	
Average flue gas temp temperature [^{o}C]		35.3	
Reference conditions		**Actual conditions**	
Moisture [%]	N/A	Moisture [%]	0.0
Temperature [K]	273	Temperature [K]	308
Pressure [kPa]	101.3	Pressure [kPa]	101.4
Oxygen [%]	N/A	Oxygen [%]	N/A
Deviation from isokinetic conditions [%]		0.2	
Deviation from reference method		There was no deviation from reference method.	

Appendix 1:25 - Stack Measurements: TOC Monitoring - A2-4 Post Abatement

Reference method	EN 12619
Sampling date	11 January 2017
Sampling time	16:00-16:30
Sampling technique	
TOC	Flame ionisation detection
Material	
Sampling probe material	SS, PTFE
Fuel	Hydrogen
Span calibration gas	Propane 90.0 ppm
Zero calibration gas	Ambient air after passing charcoal filter
Span gas drift [% of the range]	<2
Zero gas drift [% of the range]	<2
Sampling conditions	
Duct diameter [m]	0.35
Number of sampling ports	2
Number of sampling lines	Single point sampling
Heated line temperature [^{o}C]	180
Number of sampling points per line	1
Average flue gas velocity [m/s]	0.98
Average flue gas temp temperature [^{o}C]	35.3

Sampling conditions

Conditions	**Reference**	**Sampling plane**
Moisture	Dry	0.0
Temperature [K]	273	308
Pressure [kPa]	101.3	101.4
Oxygen [%]	N/A	N/A

Deviation from reference method

There was no deviation from reference method

ANNUAL AIR EMISSIONS
SURVEY 2017
G BRUSS GmBH
APPENDIX II
MONITORING EQUIPMENT CALIBRATION CERTIFICATES

Licence Reg. P0465-01
TMS Environment Ref. 23888 Rev 2.0

M-S-E-1-1 29 MAR 2016

Temperature - *Temperature (°C)*

Campo di misura ingresso Termocoppie - Thermocouple input *Range* : 0 + 1200 °C
Campo di misura sonda Pt100 - Pt100 sensor *Range* : - 20 +80 °C

	Riferimento *Reference*	DUT	Dmax (°C)	Accett. *Accept.*	Emax (%)
TC Fumes	100	99.3	0.7	1%fs ±0.2 °C	0.06
	600	600.4	-0.4	1%fs ±0.2 °C	0.03
TC Aux1	100	99	1	1%fs ±0.2 °C	0.08
	600	599.9	0.1	1%fs ±0.2 °C	0.01
TC Aux2	100	99.1	0.9	1%fs ±0.2 °C	0.08
	600	600.1	-0.1	1%fs ±0.2 °C	0.01
TC Probe	100	99.3	0.7	1%fs ±0.2 °C	0.06
	600	600.4	-0.4	1%fs ±0.2 °C	0.03
TC Box	100	99.4	0.6	1%fs ±0.2 °C	0.05
	600	600.4	-0.4	1%fs ±0.2 °C	0.03
DGM Pt100	23.71	23.62	0.09	1%fs ±0.2 °C	0.09

Verifica misura del Volume - *Volume Measure Verifying*

Flusso di Taratura - *Reference Flow rate : 15 l/min [4 mc/h pump] - 30 l/min [8mc/h pump]*
Ref DGM Volume riferimento alle condizioni attuali - *Reference volume @ actual condition*
G4 Volume Volume attuale indicato dallo strumento - *Instrument volume reading @ actual condition*

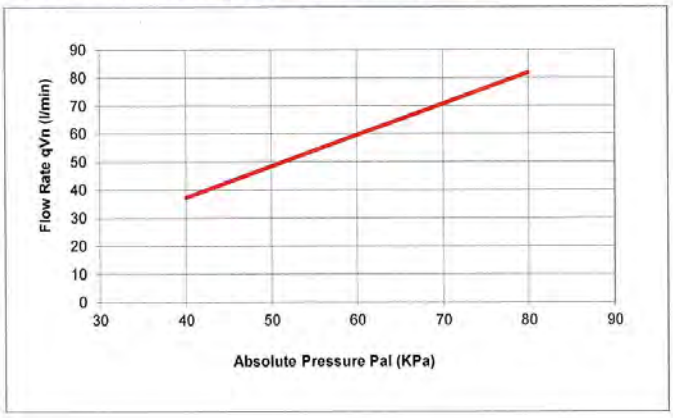
Ref DGM ini	Ref DGM fin	Ref DGM corr.	Ref Volume (@actual)	DUT (@actual)	Dmax (l)	Emax (%)	Accett. *Accept.*
172309.8	172789.4	1.005	482.00	484.241	2.2	0.47	± 2 %

Misura Portata - Flow rate measure

Flusso di Taratura - Reference Flow rate : 15 - 30 l/min [4 mc/h pump] ; 30 - 40 l/min [8 mc/h pump]

Point	Riferimento *Reference*	DUT	Dmax (l/min)	Accett. *Accept.*	Emax (%)
1	21.06	21.89	-0.83	±2 %	1.38
2	41.27	41.77	-0.5	±2 %	0.83

Curva caratteristica Pompa - *Pump performance curve*



Pal (KPa)	qVn (l/min)
79.9	81.82
40.05	37.35

M-S-E-1-1 29 MAR 2016

tecora
A DIVISION OF OMNISENSE TECHNOLOGIES

Rapporto di taratura
Calibration report N° R-11420244P

Strumento - *Instrument:* **Isostack G4**
Firmware version : **1.9.2000**
Destinatario - *Customer* :

Costruttore - Constructor : **TCR Tecora**
S.N.: **11420244P**

Il presente verbale di taratura non è utilizzabile per misure fiscali. Rappresenta la registrazione delle prove eseguite durante il collaudo dello strumento, in accordo ai requisiti qualitativi previsti dal nostro sistema di qualità.

Condizioni ambientali della prova - *Ambient condition*

Temp. - *Temperature* (°C) : **21.6**

Pressione - *Pressure* (KPa) : **99.8**

Riferimenti utilizzati - *Reference used*

Temperatura - *Temperature* :	Eurotron Mod. Microcal 10	S.N. 29454	TCR std 28S
Pressione - *Pressure* :	Eurotron Mod. Microcal P2	S.N. 59S	TCR std 59S
Pressione - *Pressure* :	Tecora Flowcal Air	S.N. 1043008FC	TCR std 56S
Flusso - *Flowrate* :	BGI Deltacal	S.N. 237	TCR std 43S
Volume - *Volume* :	Itron G4 Gallus	S.N. 0314A111213738	TCR std 67S
Rischi elettrici - *Electr. Risk* :	Fulltest HT 4050	S.N. 01021626	TCR std 39S

Pressione assoluta Pitot - Pitot *Absolute pressure*

Campo di misura - *Range* : 0 - 105 KPa
Dmax = Deviazione massima della misura - *Max reading deviation*
E max = Max errore di indicazione percentuale sul campo di misura - *Max full range percent indication error (%)*
DUT = Strumento in prova = Device under test

Point	Riferimento *Reference*	DUT	Dmax (kPa)	Accett. *Accept.*	Emax (%)
1	89.95	90	-0.05	1% ±0.1kPa	0.05
2	50.03	50	0.03	1% ±0.1kPa	0.03

Pressione assoluta CV - DGM *Absolute pressure*

Campo di misura - *Range* : 0 - 105 KPa

Point	Riferimento *Reference*	DUT	Dmax (kPa)	Accett. *Accept.*	Emax (%)
1	89.97	90	-0.03	1% ±0.1kPa	0.03
2	49.98	50	-0.02	1% ±0.1kPa	0.02

Pressione differenziale Pitot - Pitot *Differential pressure*

Campo di misura - *Range* : 0 - 2500 Pa

Point	Riferimento *Reference*	DUT	Dmax (Pa)	Accett. *Accept.*	Emax (%)
1	50.8	51	-0.2	1%fs ±2Pa	0.01
2	500.3	500	0.3	1%fs ±2Pa	0.01

Pressione differenziale OM - OM *Differential pressure*

Campo di misura - *Range* : 0 - 10000 Pa

Point	Riferimento *Reference*	DUT	Dmax (Pa)	Accett. *Accept.*	Emax (%)
1	1000.6	1000	0.6	1%fs ±10Pa	0.01

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Rischi. Elett. - Electr. Risk : Fulltest HT 4050 S.N. 01021626 TCR std 39S

Verifica rischi elettrici - *Electrical risk verifying*

In accordo alle norme CEI EN 61010-1 e CEI EN 60601-1 - In accordance to norms CEI EN 61010-1 and CEI EN 60601-1

Test	Valore-*Value*	Accett. - *Accept.*
Corrente di dispersione - *leakage current*	4.3	< 15 mA
Resistenza di isolamento - *Insulation resistance*	O.R.	> 0.2 MΩ
Resistenza equipotenziale - *Continuity resistance*	0.101	< 0.2 Ω

Data - *Date :* 25/03/2016 Eseguito da - *Tested by:* Pasquini C.