

Report for the Periodic Monitoring of Emissions to Atmosphere

Stack Emissions Test Report Commissioned by: Environmental Monitoring Solutions Ltd

Holmfirth Dryers Ltd Tumbler

Permit No: N/A
Installation: Holmfirth
Monitoring Dates: 21st June 2022
Site Address: Ribblesden Dye Works, Dunford Rd, Holmfirth, HD9 2DP

Report Number: ES-0911 Version: 1 Visit: 1 in 2022
Date of Report: 21st July 2022
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MCERTS No: MM 06 701 MCERTS Level: 2 (TE1,TE2,TE4)

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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Environmental Monitoring Solutions Ltd to carry out emissions monitoring at Holmfirth Dryers Ltd, to determine the compliance of Tumbler as part of the the Part A permit application process. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	Tumbler
Total Particulate Matter	✓
Carbon Monoxide	✓
Oxides of Nitrogen (as NO ₂)	✓
Total VOC	✓
Oxygen	✓
Volumetric Flow	✓
Water Vapour	✓

Special requirements: none

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Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

Substance	Limit (mg/m ³)	Concentration			Reference Conditions	Mass Emission			Sampling Date	Sampling Times
		Result (mg/m ³)	Measurement Uncertainty (MU) +/-	Limit (g/hr)		Result (g/hr)	Measurement Uncertainty (MU) +/-			
Total Particulate Matter	R1	-	1.4	0.18	273k, 101.3kPa, Wet Gas	-	11.6	1.6	21/06/2022	09:50-10:50
Water Vapour	R1	-	3.3%	-	273K, 101.3kPa	-	-	-	21/06/2022	09:50-10:50
Carbon Monoxide	R1	-	70.3	6.4	273k, 101.3kPa, Wet Gas	-	586	60.3	21/06/2022	09:50-10:50
Oxides of Nitrogen (as NO ₂)	R1	-	1.8	1.1	273k, 101.3kPa, Wet Gas	-	14.7	8.8	21/06/2022	09:50-10:50
Total VOC	R1	-	76.6	9.0	273k, 101.3kPa, Wet Gas	-	638	81.1	21/06/2022	09:50-10:50
Oxygen	R1	-	19.8%	0.24	273k, 101.3kPa, Wet Gas	-	-	-	21/06/2022	09:50-10:50
Volumetric Flow	R1	-	8,330 m ³ /h	397	273k, 101.3kPa, Wet Gas	-	-	-	21/06/2022	09:10-09:18

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Tumbler
Continuous or Batch Process	Continuous
Operating Status	Normal
Feedstock	Cloth
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	None
Abatement System Status	-
Process Fuel	Natural Gas
Plume Appearance	None

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	Run 1	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr K Wells	Team Leader	2 (TE1,TE2,TE4)	MM 06 701
Mr C Welsh	Technician	Trainee	MM 20 1692

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Carbon Monoxide	BS EN 15058	ETC-SE-10 (a/b)	Yes	NDIR by Horiba PG-250 or PG350E			
Oxides of Nitrogen	BS EN 14792	ETC-SE-10 (a/b)	Yes	Chemiluminescence by Horiba PG-250 or Horiba PG-350			
Oxygen	BS EN 14789	ETC-SE-10 (a/b)	Yes	Dry Zirconia Cell by Horiba PG-250 or Dry Paramagnetic by Horiba PG-350E			
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

RPS Laboratories Ltd (RPS) - Accreditation Number: 0605 | Marchwood Scientific Services - Accreditation Number: 1668 | Olfasense - Accreditation Number: 2430

Equipment Checklist

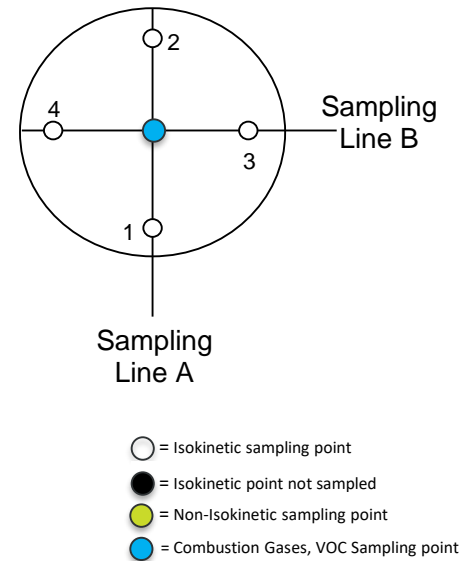
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.1	Horiba PG-250	-	Tape Measure	ETC-S17.05
Box Thermocouples	ETC-S2.10a	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S3.32	Horiba PG-350	ETC-S12.01	Stopwatch	ETC-S10.14
Box Thermocouple Out	ETC-S3.33	JCT JCC Cooler	-	Barometer	ETC-SMet office
Control Box Timer	ETC-S10.14	MAK10 Cooler	-	Digital Manometer	ETC-S24.04
Umbilical	ETC-S2.10b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.04
Oven Box	ETC-S9.06	M&C PSS Gas Preparation	ETC-S3.41b	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.12	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S1.12	SK-Thermo FID	ETC-S13.07	5m Heated Line	-
Stack Thermocouple (2)	ETC-S1.36	Bernath 3006 FID	-	10m Heated Line	ETC-S5.08
S-Type Pitot (1)	ETC-S4629	Testo 350XL	-	20m Heated Line	-
S-Type Pitot (2)	-	M&C PSP 4000	ETC-S7.08	30m Heated Line	-
L-Type Pitot	-	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.02	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.02a	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.02b	-	-	Sample Temperature Logger	-

Appendix 2: Tumbler Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.64
Width	m	-
Area	m ²	0.32
Port Depth	cm	8.0
Orientation of Stack / Duct	-	Horizontal
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	4 / 4
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Permanent
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	No
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	No
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	N/A
Fall Prevention	Platform has adequate drainage to prevent accumulation of free-standing water	N/A
	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Access	Gaps between handrails not >0,5m	N/A
	Platform has vertical base boards (approx. 0.25m high)	N/A
	Access to sampling ports unhindered by obstructions	N/A
	Easy & safe access and egress available	No

Sampling Location / Platform Recommendations

All sampling platforms should be designed in accordance with the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259.

Water Vapour Measurements

Parameter	Value	Unit
Sampling Date	21/06/2022	-
Start Time	09:50	-
End Time	10:50	-
Barometric Pressure	1019	mbar

Parameter	Value	Unit
Stack Temperature	63.0	°C
Corrected Volume	762.9	L
Collected Mass	20.8	g
Stack Gas Water Vapour Content	3.3	% v/v

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m ²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.64	0.32	1019	17.0	19.8	0.20	5.7	28.2	0.846

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH ₂ O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	9.3	0.54	0.54	0.54	0.54	8.6	61.0	9
	A2	54.7	0.62	0.62	0.62	0.62	9.2	61.0	7

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH ₂ O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	9.3	0.52	0.52	0.52	0.52	8.4	61.0	7
	B2	54.7	0.58	0.58	0.58	0.58	8.9	61.0	6

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow Actual	Stack Gas Volume Flow @ STP Wet	Stack Gas Volume Flow @ REF Conditions
Value	8.75	1.1:1	61.0	334	10131	8330	8330
Units	m/s	-	°C	K	m ³ /hr	Nm ³ /hr	Nm ³ /hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.1	-
Gas Meter Coefficient	0.994	-
Pitot Coefficient	0.846	-
Stack Gas Molecular Weight	28.5	g/mole
Static Pressure in Stack	-4.3	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.08	mm
Average Gas Meter Temperature	26.0	°C
Average Stack Temperature	62.4	°C
Average Stack Velocity	8.99	m/s
Isokineticity	102.5	%
Total Sampling Time	60	min
Gas Meter Difference	836.0	L
Corrected Gas Meter Volume	830.6	L
Mean Sampling Rate	13.8	L/min

Date	Operators
21/06/2022	KW/CW

Parameter	Before	After	Unit
Barometric Pressure	1019	1019	mbar
Ambient Temperature	16.0	18.0	°C
Leak Check	0.04	-	L/min
Time	09:50	10:50	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.763	Nm ³
Gas Meter Volume (REF)	0.789	Nm ³
Stack Gas Water Vapour Content	3.3	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	1.4	mg/Nm ³
TPM Mass Emissions (REF)	11.61	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Probe Wash Mass (mg)
Blank	<0.25
1	0.9

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank	47-2467	47mm GFA	0.06	<0.25	0.31
1	47-2470	47mm GFA	0.2	0.9	1.1

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1272.4	1405.7	1377.3	1481.2	20.8
	After	1276.8	1409.5	1383.6	1487.5	

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m ³
Overall Blank Value (OBV)	0.39	mg/m ³
OBV <10% of ELV	-	-

Date of Analysis	30/06/2022
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

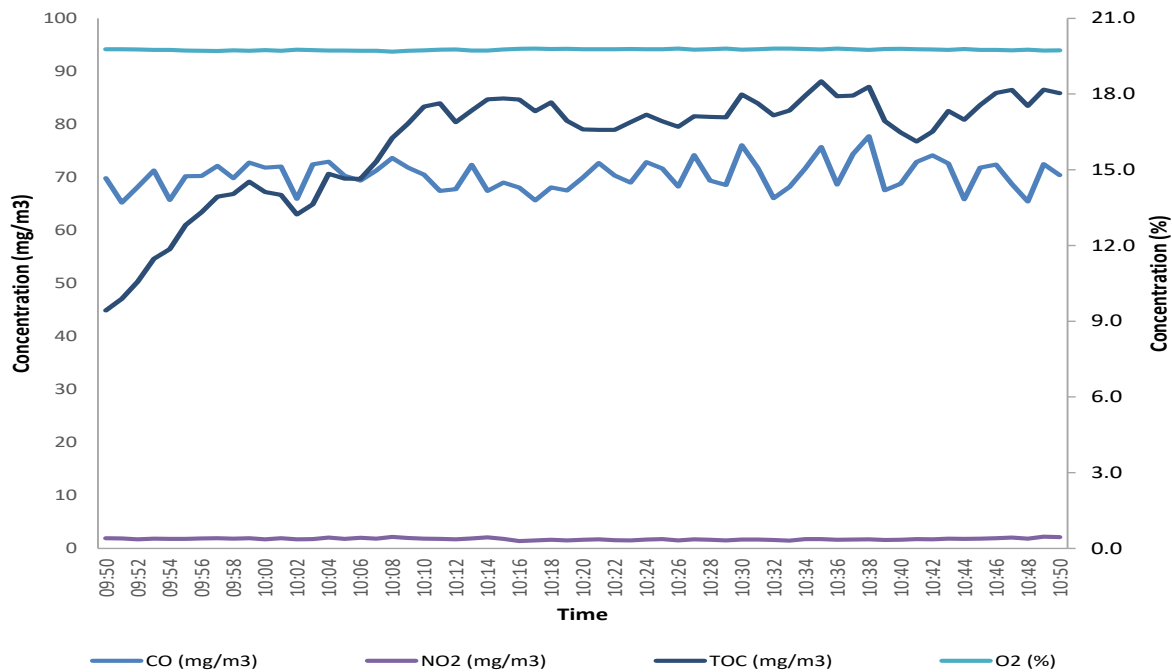
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
21/06/2022	KW/CW	ETC-S12.01	ETC-S13.07

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift	Span Drift	Drift Acceptable
					Zero	Span	Zero	Span			
Carbon Monoxide	160.81ppm	200ppm	22	160.8	0.20	160.8	0.00	156.4	0.00	-2.7	Yes
Nitrogen Monoxide	201.66ppm	250ppm	28	201.7	0.10	201.7	-0.10	201.8	-0.05	0.10	Yes
Propane	804.62ppm	1000ppm	16	804	0.02	802.3	0.50	802.1	0.06	-0.30	Yes
Oxygen	21.23%	25%	24	21.23	0.01	21.23	0.00	21.23	0.00	0.00	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Carbon Monoxide	1	70.3	77.7	65.2	mg/m ³	-	-
Oxides of Nitrogen (as NO ₂)	1	1.77	2.22	1.36	mg/m ³	NO _x as NO ₂	-
Total VOC	1	76.6	88.1	44.9	mg/m ³	VOC as C	-
Oxygen	1	19.75	19.80	19.68	%	-	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m ³
Mean Sampling Rate	13.8	L/min
Leak Rate	0.04	L/min
Barometric Pressure	1019	mbar
Average Stack Temperature	62	°C
Sampled Stack Gas Volume	836.0	L

Parameter	Value	Unit
Mean Emission Concentration	1.39	mg/m ³
Monitoring Duration	60	min
Console ID	8.1	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	-	0.09	mg	-	0.09	0.01
Leak Rate	Rect	<2% of sampling rate	0.28	0.04	L/min	0.29	0.002	0.00001
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.0004	0.0000001
Gasmeter Volume	Std	<2%	16.7	3.1	L	0.37	0.005	0.00003
Temperature	Std	1% of value	3.4	0.24	°C	0.38	0.005	0.00003
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.001	0.000002
Total								0.01
Combined Standard Uncertainty [(sum u²)^{0.5}]								0.09
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								12.8
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.18

Uncertainty of Carbon Monoxide by Horiba Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m ³
Reading	56.3	ppm
Span Gas Certified Value	160.8	ppm
Range	200	ppm

Cal Gas
CO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	0.20	Rectangular	1.7	0.12	0.01
Span Drift (ppm)	4.4	Rectangular	1.7	2.5	6.5
Linearity (% of value)	1.1	Rectangular	1.7	0.36	0.13
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.20	0.04
Interference (% of value)	-0.48	Rectangular	1.7	-0.16	0.02
Standard deviation of repeatability at zero point (% of range)	0.10	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.40	0.16
Total					6.9
Combined Standard Uncertainty [(sum u²)^{0.5}]					2.6
Expanded Total Uncertainty (ppm) (95% confidence)					5.1
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					9.1
Expanded Total Uncertainty (mg/m³) (95% confidence)					6.4

Uncertainty of Oxides of Nitrogen by Horiba gas Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m ³
Reading	0.9	ppm
Span Gas Certified Value	201.7	ppm
Range	250	ppm

Cal Gas
NO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	0.10	Rectangular	1.7	0.06	0.003
Span Drift (ppm)	-0.10	Rectangular	1.7	-0.06	0.003
Linearity (% of value)	0.63	Rectangular	1.7	0.003	0.00001
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.003	0.00001
Interference (% of value)	0.63	Rectangular	1.7	0.003	0.00001
Standard deviation of repeatability at zero point (% of range)	0.00	Rectangular	-	0.00	0.00
Standard deviation of repeatability at span point (% of range)	0.10	Rectangular	-	0.25	0.06
Total					0.07
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.26
Expanded Total Uncertainty (ppm) (95% confidence)					0.52
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					59.9
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.1

Uncertainty of Total VOC by SK - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m ³
Reading	47.6	ppm
Span Gas Certified Value	804.6	ppm
Range	1000	ppm

Cal Gas
C ₃ H ₈

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.48	Rectangular	1.7	-0.28	0.08
Span Drift (ppm)	0.20	Rectangular	1.7	0.12	0.01
Linearity (% of value)	0.40	Rectangular	1.7	0.11	0.01
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.17	0.03
Noise (ppm)	0.10	Rectangular	1.7	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.7	0.28	0.08
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	2.0	4.0
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	2.0	4.0
Total					8.2
Combined Standard Uncertainty [(sum u²)^{0.5}]					2.9
Expanded Total Uncertainty (ppm) (95% confidence)					5.6
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					11.8
Expanded Total Uncertainty (mg/m³) (95% confidence)					9.0

Uncertainty of Oxygen by Horiba Analyser

Parameter	Value	Unit
Reading	19.75	%
Span Gas Certified Value	21.23	%
Range	25	%

Cal Gas
O ₂

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (%vol)	0.05	Rectangular	1.7	0.03	0.001
Span Drift (%vol)	0.00	Rectangular	1.7	0.00	0.00
Linearity (% of value)	0.82	Rectangular	1.7	0.09	0.01
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.07	0.00
Interference (% of value)	0.00	Rectangular	1.7	0.00	0.00
Standard deviation of repeatability at zero point (% of range)	0.02	Rectangular	-	0.01	0.00003
Standard deviation of repeatability at span point (% of range)	0.02	Rectangular	-	0.01	0.00003
Total					0.01
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.12
Expanded Total Uncertainty (%) (95% confidence)					0.24
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					1.2

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	10131	L/min

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.01	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.00004	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.01	-
Standard Uncertainty - Mean Velocity	0.07	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.13	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	1.5	%
Standard Uncertainty - Volumetric Flow Rate	246	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	483	m ³ /hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.8	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.