TEST REPORT

TEST OF A PELLET STOVE FOR EMISSIONS AND EFFICIENCY

PER ASTM E2779-10 (Integrated run); ASTM E2515-11, methods 28R as referred into 40 CFR Part 60 Subpart AAA

Client:
AICO SPA (RAVELLI)
Via Consorzio Agrario, 3/D
Chiari, Italy

Model name: RV 120 TOUCH, ATENA V, VITORIA V

Attention: Rafaël Sanchez

TESTED BY:

Services Polytests inc.
695-B Gaudette
St-jean-sur-Richelieu, QC, J3B 7S7

TEST DATES:
Test date: May 12th 2017
REPORT DATE: May 19th 2017
Revision 1: March 7th 2022
Revision 2: April 13th 2022
Revision 3: July 5th 2022
Revision 4: August 9th 2022
Project number: PI-20145

Tested: written by:

Maxime Martin Danick Power, P. Eng

Verified by third party certifier (CSA):

SUMMARY

Revision 1 March 17th 2022

- Moisture in the tunnel assume change section 3.6
- Table 2.6 updated with deviation in g/Kg
- Appendix 1 molecular weight updated to 29 for all runs
- Appendix 1 updated with data and preburn data
- The section 3.4 p.9 updated for runs Anomalies, Validity and appropriateness detail.
- Updated Section 1.4 p.5 conditioning was done at Polytests Facility.
- Additional letter for TYPOs about mixing baffle in the original report.
- Table 2.1 additional emission number in gr/Mj

Revision 2 April 13th 2022

- Section 3.2, Additional Alternative components, all alternative components have same parameter. Auger motor, exhaust fan, pressure switch, safety temperature switch.

Revision 3 July 5th 2022

- Section 1.4 and 3.4 updated to mentioned ENplus program pellet have been used for aging and testing
- Appendix 8 updated with new picture and more detail on dilution tunnel
- Appendix 7 manual updated
- Appendix 13 operating instruction updated
- Section 3.4 updated to address negative filters weight.

Revision 4: August 9th 2022

- include negative filter weights with calculations both corrected to zero and uncorrected in appendix 1.

List of appendixes

1 INTRODUCTION

1.1 GENERAL

Laboratory

- Location: Services Polytests Inc., 695-B Gaudette St-jean-sur-Richelieu QC, Canada J3B 7S7
- Elevation: 100 feet above sea level

Test program

- Purpose: unit qualification NSPS 2020
- Test date: May 12th 2017
- Test methods used:
  - Particulate emissions: ASTM E2779-10 (Integrated run); ASTM E2515-11, methods 28R as referred into 40 CFR Part 60 Subpart AAA
  - Efficiency: CSA B415.1-10

1.2 TEST UNIT INFORMATION

General

- Manufacturer: AICO Spa
- Product type: Pellet stove
- Combustion system: blower
- Unit tested: RV 120 TOUCH

Particularities

- Included also other models, only Esthetic differences. All three stoves have the same combustion components, setting, and dimensions.
- Models included: ATENA V, VITORIA V. ref. appendix 6 for detail on

1.3 RESULTS

Emission results obtained

- Weighted average emission rate: 0.6grams/hour
- Efficiency 79.25 %

Conformity: NSPS Phase 2020

1.4 PRETEST INFORMATION

Unit condition: The unit was received by carrier on April 2017. The 50hrs of aging was done in week of May 1st 2017 at Polytests Facility prior to testing.

Set up

- Venting system type: pellet venting conduit 3inch. diameter
- System height from floor: 15 feet
- Particularities: none

Break in period

- Duration: the unit was received from the manufacturer and ran for at least 50 hours at 50% of the maximum burn rate with adequate documentation of fuel additions and flue and unit temperatures during the week of May 1st 2017 at Polytests facility.
- Fuel: wood pellet

2 SUMMARY OF TEST RESULTS

2.1 EMISSIONS

Run Number	Date	Setting	Burn Rate	Run Time (Min.)	Heat Output (Btu/hr)	1st Hour Emissions (g/hr)	Integrated Total (g/hr)	CO Emissions (g/hr)	Heating Efficiency (% HHV)
1	May 12th 2017	H	2.48	61	37 800	2.19	0.62	0.62	77.41
		M	1.22	120	18 500			3.56	78.81
		L	0.83	180	12 900			4.52	81.54
		Overall	1.23	361	18 821			2.80	79.25

- 0.047 gr/min overall Co emission rate
- 0.031 g/Mj emission / output

2.2 AVERAGE CALCULATION

NA : Pellet Stove tested as ASTM E2779 section 9.4.1 integrate test run

2.3 TEST FACILITY CONDITIONS

Run Number	Room Temperature		Barometric pressure		Relative humidity		Air Velocity	
	Before (F)	After (F)	Before (in.Hg)	After (in.Hg)	Before (%)	After (%)	Before (ft/min)	After (ft/min)
1	73	77	30,121	30,062	35	36,3	7	5

2.4 FUEL QUALITIES

Run Number	Pre-test Load			Test Load			
	Loading Weight Wet Basis (lbs)	Moisture Content Dry Basis (%)	Coal bed Weight (lbs)	Weight Wet Basis (lbs)	Density Wet Basis (lbs/cuft)	Moisture Content Dry Basis (%)	Piece Length (in.)
1	9.0	6.11	na	17.36	na	6.11	na

2.5 DILUTION TUNNEL FLOW RATE MEASUREMENTS AND SAMPLING DATA (ASTM E2515)

Average dilution tunnel measurements				Sample Data			
Run Number	Burn Rate (Min)	Volumetric Flow Rate (dscf/min)	Total Temperatures (°R)	Volume sampled (DSCF)		Particulate catch (mg)	
				1	2	1	2
1	361	175,65	554,27	63,730	62,608	3,80	3,60

2.6 DILUTION TUNNEL DUAL TRAIN PRECISION

Run Number	Sample Ratio		Total Emission (g)			
	Train 1	Train 2	Train 1	Train 2	% Deviation	Deviation g/Kg
1	994,97	1012,81	3,80	3,67	1,78%	0,018

3 PROCESS DESCRIPTION

3.1 DISCUSSION

The unit was received by carrier on April 2017 in good condition

3.2 UNIT DIMENSIONS

Baffle

- Location: top of the combustion chamber
- Dimensions: refer to appendix 6 drawings
- Material: Stainless Steel

Bricks

- Location: back and side of the combustion chamber
- Dimensions: back: 5 ½ wide X 15 ½ height; Sides: 7 wide X 15 ½ height
- Material: Vermiculite

Flue gas exhaust

- Location: back of the unit at 7 ½ from the bottom
- Dimensions: 2 ½ inch (inside diameter)
- Material: Steel

Overall unit dimension

- Overall dimension: 21 ½ depth X 21 wide X 45 ¾ height
- Firebox dimensions: 6 ½ depth X 5 ½ wide at the back X 12 wide at the front X 16 Height
- Burner dimension: 4 depth X 4 wide X 5 height

Gasket

- Refer to appendix 6 for all details

Auger motor

- Manufacturer: MELLOR ELECTRICS
- Model: SC9-100
- Spec.: certification file: E191425

alternative component:

- Manufacturer: Merkle Korff ind.
- Model: 4415up
- Spec.: certification file: E32533

Convection fan

- Manufacturer: ECOFIT
- Model: 2GDSu15

Exhaust fan

- Manufacturer: EBM-PAPST
- Model: M2E 068-BF

alternative component A:

- Manufacturer: EBM-PAPST
- Model: G2E152
- Spec.: certification file: E322940

alternative component B:

- Manufacturer: TRIAL SRL
- Model: YJ72-20E
- Spec.: certification file: E357840

Safety temperature switch

- Manufacturer: IMIT
- Model: LS1
- Spec.: certification file: E83222

alternative component:

- Manufacturer: Foshan Nanhai Tengya electrical Applliance Co.
- Model: WGS100-425-6112-20
- Spec.: certification file: E320875

Glass

- Dimension: 272 x 510 mm
- material: Ceramic glass
- Thickness: 5mm

3.3 AIR SUPPLY SYSTEM

Description

model	RV 120 TOUCH - VITTORIA V – ATENA V	
power	rpm blower	Auger motor (2 rpm)
1	1000	1.8 sec. ON / 5.4 sec. OFF
2	1270	2.7 sec. ON / 4.5 sec. OFF
3	1550	3.6 sec. ON / 3.6 sec. OFF
4	1820	4.6 sec. ON / 2.6 sec. OFF
5	2100	5.5 sec. ON / 1.7 sec. OFF

3.4 OPERATION DURING TEST

Run #1

This run was performed May 12th 2017. It lasted 361 minutes and as ASTM E 2779 section 9.4.1 integrate test run obtained at 1.23 kg/hr & emission at 0.62gr/hr. The pellet stove is preheated for 80 min. before the beginning of the test. For the first hour of the test the unit was set at power 5, then for the next 2 hours we set at power 2 to burn less than 50% of the maximum, and for the last portion of the test the pellet stove is set at power 1 for 3hours of minimum burn rate. Run have been found appropriate, no anomalies happened and have been validate and found compliant. Negative weight has been found on back filter du to sticking on gasket, these have been handled properly. No negative weight on probes or gaskets.

- Details: Refer to the front page of each test run data sheets found in appendix for the detailed test sequence showing air supply settings and adjustments, fuel bed adjustments and operational specifics of the test unit.

Test fuel

- Test fuel: wood pellet (model: Hotzpellets), ENplus program listed manufacturer.
- Description: The pellet for each test and pre-burn period was sent to Twin ports testing inc for test fuel calorific analysis. This laboratory is ISO/IEC 17025 recognize. For the test fuel property refer to test fuel analysis in the appendix 3 Calibration data.
- Handling and storage: keep all bags in the same room (at 20C ambient and 50% humidity) all wrap together to ensure the stability of the moisture.

3.5 START-UP OPERATION

The complete manufacturer's firing procedure of each burn rate category is fully described in appendix 13.

3.6 SAMPLING LOCATIONS

Particulate samples are collected from the dilution tunnel at a point 15 feet from the tunnel entrance. The tunnel has two elbows in the system ahead of the sampling section. The sampling section is a continuous 10 foot section of 6 inch diameter pipe straight over its entire length. Tunnel velocity pressure is determined by a standard pitot tube located 48 inches from the beginning of the sampling section. Thermocouple is installed on the pitot tube to measure the dry bulb temperature. MC is assumed, as allowed, to be 2%. Tunnel samplers are located 56 inches downstream of the pitot tube and 16 inches upstream from the end of this section.

3.7 DRAWINGS

Various drawings of the stack gas sampling train and of dilution tunnel system are found in Appendix 1.

3.8 EMISSIONS EFFICIENCY TESTING EQUIPMENT LIST

The complete test equipment list together with all corresponding calibration data can be found in Appendix 3.

4 SAMPLING METHODS

4.1 PARTICULATE SAMPLING

Particulates were sampled in strict accordance with ASTM E2515. This method uses two identical sampling systems with Gelman A/E 61631 binder free (or equivalent), 47 mm diameter filters. The dryers used in the sample systems are filled with "Drierite" before each test run.

5 QUALITY ASSURANCE

5.1 INSTRUMENT CALIBRATION

5.1.1 GAS METERS

At the conclusion of each test program the gas meters are verified using the reference dry gas meter. This process involves sampling the train operation for 1 cubic foot of volume. With readings made to .01 fr', the resolution is 1 %, giving an accuracy higher than the 2% required by the standard.

5.1.2 SCALES

Before each test program, the different scales used are checked with traceable calibration weights to ensure their accuracy.

5.1.3 GAS ANALYZERS

The continuous analyzers are zeroed and spanned before each test with NBS traceable gases. A mid-scale multi-component calibration gas is then analyzed (values are recorded). At the conclusion of a test, the instruments are checked again with zero, span and calibration gases (values are recorded only). The drift in each meter is then calculated and must not exceed 5% of the scale used for the test.

5.2 TEST METHOD PROCEDURES

5.2.1 LEAK CHECK PROCEDURES

Before and after each test, each sample train is tested for leaks. Leakage rates are measured and must not exceed 0.02 CFM or 4% of the sampling rate. Leak checks are performed checking the entire sampling train. Pre-test and post-test leak checks are conducted with a vacuum of 5 inches of mercury. Vacuum is monitored during each test and the highest vacuum reached is then used for the post test vacuum value. If leakage limits are not met, the test run is rejected. During these tests, the vacuum is typically less than 2 inches of mercury. Thus, leakage rates reported are expected to be much higher than actual leakage during the tests.

5.2.2 TUNNEL VELOCITY FLOW MEASUREMENT

The tunnel velocity is calculated from a center point pitot tube signal multiplied by an adjustment factor. This factor is determined by a traverse of the tunnel as prescribed in EPA Method 1. Final tunnel velocities and flow rates are calculated from EPA Method 2, Equation 6.9 and 6.10. (Tunnel cross sectional area is the average from both lines of traverse.)

Pitot tubes are cleaned before each test and leak checks are conducted after each test.

5.2.3 PM SAMPLING PROPORTIONALITY (ASTM E2515)

Proportionalities were calculated in accordance with ASTM E2515. The data and results are found in appendix.

APPENDIX 1: Raw data, forms and results

Paramètres

Tous les facteurs de corrections et autres paramètres qui peuvent être modifiés par l'utilisateur du fichier sont regroupés ici.

Code verrouillage:	RAV

Description du test

Test standard	EPA	
Run #	1	
Date	12-05-2017	
Technicien	m.m	
Project #	pi 20145	

Description de l'unité

Manufacturier	ravelli	
Modèle	RV 120	
Combustion system	Pellet	
Appliance type	pellet stove	
Firebox volume	na	cu ft.
Appliance weight empty	na	lbs
Appliance weight full	na	lbs

Paramètres du test

Logging time	1	min
Manufacturer's rated heat output	na	BTU/h Donnée fournie par le manfacturier
Targeted category		
Targeted output	na	BTU/h
Cp steel	na	BTU/lb-°F

Échantillonnage

Blank sampling rate	0,20	cuft/min
Internal probe diameter	0,18	in.
Calibration Factor (DGM #1):	0,987	Dimensionless
Equipment number (DGM #1):	EM-178	
Calibration Factor (DGM #2):	0,996	Dimensionless
Equipment number (DGM #2):	EM-179	
Calibration Factor (DGM #3):	0,986	
Equipment number (DGM #3):	EM-070	Dimensionless

Tunnel

Targeted tunnel flow rate	140	scfm
Tunnel diameter	6	in.
Molecular weight	29	May be assumed to be 29
Pitot tube type	Standard	
Pitot tube coefficient	0,99	Dimensionless

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Fuel data

Fuel type	Dimension	
Fuel specie	Other	
HHV	20294,0	kJ/kg
%C	50,47	
%H	6,08	
%O	42,31	
%Ash	0,29	
HHV	8725,0	Btu/lb
LHV	7631,0	Btu/lb

Default Fuel Values

	D. Fir	Oak/Maple
HHV	19 810	19 887
%C	48,73	50
%H	6,87	6,6
%O	43,9	42,9
%Ash	0,5	0,5
HHV (Btu/lb)	8519	8552
LHV (Btu/lb)	7451	7480

	Start	End
Barometer (kPa):	102	101,8
Barometer (in.Hg):	30,120589	30,061529
Dry Bulb (F):	71,42	76,82
Humidity (%):	35	36,3
Air velocity (ft/min)	7	5

DGM #1	Final:	####### cuft	Final:	507124,450	Liter
	Initial:	####### cuft	Initial:	505229,440	Liter
DGM #2	Final:	####### cuft	Final:	427926,060	Liter
	Initial:	####### cuft	Initial:	426083,560	Liter

DGM room		Final:	1071,620	cuft
		Initial:	990,910	cuft

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 114

Autres données à rentrer: dans preload data, load data, traverse et filter set weight

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Technicien	m.m

FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

Lower	Ideal	Upper
####	#####	#####

* For boilers, a loading density factor of 10 lb/ft3 is appliec

Load Volume: 0,00 cu. ft

Loading Density: #VALEUR! lbs./ft3

Number of Spaces:

Spacer weight: lbs

Load Density (wet): #DIV/0! lbs./ft3

Dry Wood Density: #DIV/0! lbs./ft3

Piece Size (in): Thick	Wide	: Length	Weight lbs	Meter Moisture Content Dry Uncorrected %					Ave. MC x Weight	Volume Cubic Inches	Ave. MC %
			17,36	6,11					106,0696	0,00	6,1
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
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										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
								SUM MCx	106,0696		6,1 %

Test Load Weight: 17,36 lbs.

Dry Weight: 7,42 kg.

Average Moisture Content: %

Dry: 6,11 Dry(EPA) 6,11

Dry(B415 6,11

6,11
Must be 19-25

Wet: 5,76
must be 15,2-22

Coal Bed Range: 3,5 lbs. to 4,3 lbs.

TEST CHARGE:

Coal bed weight: 42,58 lbs.

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Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,22 in. H20
Barometer: 29,900 in. Hg

Pour un tunnel de 12" et plus, prendre 6 lectures

	TUNNEL VELOCITY	TUNNEL TEMP	SQUARE ROOT
	In. wc	°F	
A center			0,0000
B center			0,0000
A1			0,0000
A2			0,0000
A3			0,0000
A4			0,0000
A5			0,0000
A6			0,0000
B1			0,0000
B2			0,0000
B3			0,0000
B4			0,0000
B5			0,0000
B6			0,0000
AVERAGE	#DIV/0!	#DIV/0!	0,0000

PITOT CONSTANT=
0,943

Pour un tunnel moins de 12", prendre 4 lectures

	TUNNEL VELOCITY	TUNNEL TEMP	SQUARE ROOT
	In. wc	°F	
A center	0,061	70.50	0,2470
B center	0,062	70,66	0,2490
A1	0,050	70,48	0,2236
A2	0,054	70,54	0,2324
A3	0,053	70,42	0,2302
A4	0,051	70,64	0,2258
B1	0,052	70,690	0,2280
B2	0,055	70,610	0,2345
B3	0,056	70,660	0,2366
B4	0,053	70,620	0,2302
AVERAGE	0,0547	63,5320	0,2337

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Filter set weight

	System 1 (g) 1st hour				System 1 (g)				System 2 (g)				Ambient blank (g)	Date	Heure
	probe	front	back	gasket	probe	front	back	gasket	probe	front	back	gasket	Filter		
Number	1	201	530	10	9	531	532	22	20	533	534	53	556		
Before (1)															
Before (2)															
Before (3)															
Before (4)															
Before (5)	61,4491	0,1285	0,1299	10,9072	61,3835	0,1291	0,1281	10,7872	108,8330	0,1281	0,1280	10,2509	0,1278	11/05/2017	18:30
Before (6)	61,4492	0,1286	0,1300	10,9071	61,3835	0,1290	0,1280	10,7872	108,8429	0,1282	0,1279	10,2508	0,1279	12/05/2017	08:30
After (1)	61,4495	0,1297	0,1297	10,9096	61,3841	0,1297	0,1274	10,7895	108,8438	0,1302	0,1277	10,2539	0,1280	12/05/2017	16:00
After (2)	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7886	108,8438	0,1302	0,1277	10,2518	0,1280	16/05/2017	08:00
After (3)	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7882	108,8438	0,1302	0,1277	10,2518	0,1280	17/05/2017	08:00
After (4)	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7882	108,8438	0,1302	0,1277	10,2518	0,1280	19/05/2017	08:00
After (5)															
After (6)	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7882	108,8438	0,1302	0,1277	10,2518	0,1280	19/05/2017	08:00
Difference	0,0002	0,0011	-0,0003	0,0012	0,0006	0,0007	-0,0006	0,0010	0,0009	0,0020	-0,0002	0,0010	0,0001		
Total (mg)		2,2				3,9				3,7			0,1		
Total ajusté (mg)		**2,10**				**3,80**				**3,60**					

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Technicien	M.M

Demonstration Purpose Only Not real Numbers negative mass adjusted to Zero

Filter set weight

	System 1 (g) 1st hour				System 1 (g)				System 2 (g)				Ambient blank (g)	Date	Heure
	probe	front	back	gasket	probe	front	back	gasket	probe	front	back	gasket	Filter		
Number	1	201	530	10	9	531	532	22	20	533	534	53	556		
Before (1)															
Before (2)															
Before (3)															
Before (4)															
Before (5)	61,4491	0,1285	0,1299	10,9072	61,3835	0,1291	0,1281	10,7872	108,8330	0,1281	0,1280	10,2509	0,1278	2017-05-11	18:30
Before (6)	61,4492	0,1286	0,1300	10,9071	61,3835	0,1290	0,1280	10,7872	108,8429	0,1282	0,1279	10,2508	0,1279	2017-05-12	08:30
After (1)	61,4495	0,1297	0,1297	10,9096	61,3841	0,1297	0,1274	10,7895	108,8438	0,1302	0,1277	10,2539	0,1280	2017-05-12	16:00
After (2)	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7886	108,8438	0,1302	0,1277	10,2518	0,1280	2017-05-16	08:00
After (3)	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7882	108,8438	0,1302	0,1277	10,2518	0,1280	2017-05-17	08:00
After (4)	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7882	108,8438	0,1302	0,1277	10,2518	0,1280	2017-05-19	08:00
After (5)															
After (6)	61,4494	0,1297	0,1300	10,9083	61,3841	0,1297	0,1280	10,7882	108,8438	0,1302	0,1279	10,2518	0,1280	2017-05-19	08:00
Difference	0,0002	0,0011	0,0000	0,0012	0,0006	0,0007	0,0000	0,0010	0,0009	0,0020	0,0000	0,0010	0,0001		
Total (mg)		2,5				4,8				3,9			0,1		
Total ajusté (mg)		**2,40**				**4,70**				**3,80**					

Project nu.	pi 20145
Date	12-05-2017
Technicien	M.M

SFBA EPA EMISSION RESULTS

Test Duration: **361** min

PRESSURE FACTOR:	DGM 1	0,97873	
	DGM 2	0,98035	
	DGM 3	1,00572	
TEMPERATURE FACTORS	DGM 1	0,98583	
	DGM 2	0,98544	
	DGM 3	0,98772	
VOLUMES SAMPLED	DGM 1	63,730	SCft
	DGM 2	62,608	Scft
	DGM 3	79,052	SCft

TOTAL TUNNEL VOLUME : 63410

SAMPLE RATIOS

Sample Train 1:	994,971
Sample Train 2:	1012,808

Paticulate concentration

Sample Train 1	**0,000061**	g/dscf
Sample Train 2	**0,000059**	g/dscf
Room	**0,000001**	g/dscf

TOTAL EMISSIONS

Sample Train 1	**3,80**	g
Sample Train 2	**3,67**	g

EMISSION RATES

Sample Train 1	**0,63**	g/hr
Sample Train 2	**0,61**	g/hr

1st hour emission rate **2,19** g/hr

	Train 1	Train 2
Cs	6,12E-05	5,90978E-05

RESULTS

Average emission rate: 0,62 g/hr

Burn Rate : 1,233 Dry kg/hr

BAROMETRIC PRESSURE

Average:	30,091059	in Hg
Start:	30,120589	in Hg
End:	30,061529	in Hg

DGM CONTROLLER VALUES

DGM 1	Final:	17908,931	Cuft
	Initial:	17842,010	Cuft
DGM 2	Final:	15112,067	Cuft
	Initial:	15046,999	Cuft
DGM #3	Final:	1071,620	Cuft
	Initial:	990,910	Cuft

TEMPERATURES

DGM 1	535,592	°R
DGM 2	535,803	°R

CALIBRATION FACTORS

DGM 1	0,9870
DGM 2	0,9960
DGM #3	0,9860

TUNNEL FLOW RATE: 175,651 Dscfm

PARTICULATE CATCH

Total Sample Train 1:	3,90	mg
Total Sample Train 2:	3,70	mg
Total Sample Train 1 1st hour:	2,20	mg

DEVIATION: 1,78%

data 2017-05-12 epa pi 20145 run 1 MODEL RV 120
preburn

Temps acquisition minutes	Flue temp °F	Room temp °F	scale lbs	Tunnel Velocity Pressure in. Wc
0	70,64	70,11	19,36	0,0618
1	84,28	70,10	19,36	0,0614
2	105,00	70,03	19,27	0,0621
3	121,37	70,02	19,01	0,0621
4	140,46	70,05	19,45	0,0619
5	153,95	70,01	19,36	0,0607
6	164,93	69,96	19,35	0,0611
7	175,22	69,95	19,26	0,0602
8	182,80	69,96	19,22	0,0604
9	189,62	70,02	19,17	0,0612
10	199,07	69,95	19,05	0,0614
11	209,98	70,11	18,95	0,0600
12	200,65	69,99	18,95	0,0612
13	206,45	70,05	18,85	0,0595
14	221,16	70,12	18,86	0,0604
15	245,02	70,16	18,75	0,0602
16	260,99	70,02	18,66	0,0595
17	269,86	70,75	18,57	0,0590
18	279,53	70,56	18,47	0,0583
19	292,17	70,53	18,37	0,0578
20	302,81	70,57	18,25	0,0590
21	310,48	70,57	18,16	0,0585
22	316,73	70,64	18,07	0,0580
23	323,39	70,72	17,86	0,0576
24	330,11	70,78	17,87	0,0583
25	332,85	70,82	17,76	0,0576
26	338,27	70,87	17,66	0,0564
27	342,86	70,91	17,58	0,0558
28	349,70	70,86	17,45	0,0568
29	354,92	71,03	17,35	0,0580
30	358,42	71,16	17,27	0,0588
31	360,94	71,16	17,08	0,0571
32	364,80	71,23	16,97	0,0560
33	366,53	71,24	16,95	0,0573
34	368,65	71,25	16,87	0,0558
35	372,34	71,37	16,78	0,0573
36	374,43	71,41	16,65	0,0571
37	377,12	71,37	16,56	0,0573
38	379,04	71,57	16,37	0,0580
39	382,33	71,69	16,37	0,0576
40	382,70	71,68	16,26	0,0560
41	384,46	71,76	16,08	0,0573
42	384,67	71,87	16,08	0,0583
43	387,31	71,88	15,94	0,0595
44	388,04	71,96	15,86	0,0592
45	391,09	72,06	15,71	0,0585
46	393,60	72,09	15,57	0,0602
47	394,98	72,31	15,57	0,0607
48	395,28	72,12	15,38	0,0600

49	397,06	72,17	15,28	0,0595
50	398,60	72,21	15,15	0,0600
51	398,15	72,28	15,06	0,0595
52	399,05	72,28	14,96	0,0602
53	398,38	72,29	14,96	0,0602
54	400,79	72,33	14,76	0,0604
55	402,79	72,45	14,67	0,0585
56	403,95	72,46	14,58	0,0595
57	403,95	72,50	14,58	0,0595
58	402,84	72,57	14,35	0,0604
59	403,30	72,57	14,27	0,0602
60	403,81	72,61	14,16	0,0600
61	404,62	72,68	14,08	0,0590
62	406,04	72,63	13,98	0,0586
63	407,01	72,61	13,88	0,0600
64	407,82	72,78	13,79	0,0595
65	407,70	72,87	13,68	0,0576
66	408,73	72,86	13,57	0,0600
67	410,71	72,85	13,47	0,0602
68	409,56	73,06	13,37	0,0602
69	409,54	72,53	13,27	0,0592
70	411,54	73,03	13,18	0,0585
71	411,04	73,10	13,08	0,0585
72	411,21	72,99	12,98	0,0595
73	410,56	73,07	12,88	0,0590
74	413,29	73,08	12,88	0,0578
75	412,46	73,15	17,87	0,0600
76	412,18	73,13	17,77	0,0600
77	411,53	73,39	17,67	0,0592
78	409,71	73,13	17,58	0,0607
79	409,39	73,10	17,46	0,0580

Average Stove Temperature:			#######				Min:	85,15
Moisture content of wood (wet basis):			0,00				Max:	112,23
		Average	0,01	5,75	#DIV/0!	266,54	74,57	92,09
*		*	*	*	*	*1	*2	*3
Elapsed		Weight				Flue	Room	Tunnel
Time	Raw data row	Remaining	CO	CO_2	O_2	Gas	Temp	Dry Bulb
min		lbs	%	%	%	°F	°F	°F
0,00	114,00	17,4	0,0	9,1	0,0	409,5	73,4	109,7
1,0	115,0	17,3	0,0	8,5	0,0	409,1	73,2	109,9
2,0	116,0	17,2	0,0	7,4	0,0	408,6	73,5	109,8
3,0	117,0	17,1	0,0	8,7	0,0	409,7	73,5	110,1
4,0	118,0	17,1	0,0	9,7	0,0	410,8	73,6	110,0
5,0	119,0	17,0	0,0	9,2	0,0	411,5	73,7	110,2
6,0	120,0	16,8	0,0	10,7	0,0	412,6	73,8	110,0
7,0	121,0	16,8	0,0	8,1	0,0	412,5	73,8	110,1
8,0	122,0	16,6	0,0	8,8	0,0	413,1	73,6	110,2
9,0	123,0	16,6	0,0	7,9	0,0	412,6	73,7	110,3
10,0	124,0	16,4	0,0	9,6	0,0	413,1	73,9	110,2
11,0	125,0	16,3	0,0	9,2	0,0	413,1	74,0	110,2
12,0	126,0	16,2	0,0	7,8	0,0	411,9	74,0	110,0
13,0	127,0	16,1	0,0	9,7	0,0	412,2	74,0	110,5
14,0	128,0	16,1	0,0	9,7	0,0	412,8	74,1	110,3
15,0	129,0	16,0	0,0	8,0	0,0	412,6	74,2	110,4
16,0	130,0	15,9	0,0	8,4	0,0	411,8	74,0	110,6
17,0	131,0	15,8	0,0	10,4	0,0	412,8	74,3	110,7
18,0	132,0	15,7	0,0	9,5	0,0	413,5	74,2	110,8
19,0	133,0	15,6	0,0	9,2	0,0	414,1	74,4	111,1
20,0	134,0	15,5	0,0	8,2	0,0	414,2	74,3	110,9
21,0	135,0	15,4	0,0	9,7	0,0	414,7	74,3	111,0
22,0	136,0	15,3	0,0	9,4	0,0	415,2	74,5	111,1
23,0	137,0	15,2	0,0	9,7	0,0	414,7	74,5	110,7
24,0	138,0	15,1	0,0	9,5	0,0	415,6	74,3	110,7
25,0	139,0	15,0	0,0	9,0	0,0	416,3	74,4	111,2
26,0	140,0	14,9	0,0	9,2	0,0	415,5	74,5	110,8
27,0	141,0	14,7	0,0	9,9	0,0	416,2	74,7	111,2
28,0	142,0	14,7	0,0	9,5	0,0	415,5	74,7	111,1
29,0	143,0	14,6	0,0	8,8	0,0	415,2	74,7	111,0
30,0	144,0	14,5	0,0	10,9	0,0	416,6	74,8	111,2
31,0	145,0	14,4	0,0	9,4	0,0	416,7	74,5	111,4
32,0	146,0	14,3	0,0	7,5	0,0	415,2	74,7	111,1
33,0	147,0	14,2	0,0	9,3	0,0	415,7	74,7	111,3
34,0	148,0	14,1	0,0	9,6	0,0	416,0	74,7	111,4
35,0	149,0	13,9	0,0	7,4	0,0	415,5	74,8	111,3
36,0	150,0	13,9	0,0	10,4	0,0	416,5	74,8	111,4
37,0	151,0	13,8	0,0	9,0	0,0	415,8	74,9	111,3
38,0	152,0	13,6	0,0	10,1	0,0	416,7	74,9	111,3
39,0	153,0	13,6	0,0	7,6	0,0	415,1	74,9	111,1
40,0	154,0	13,4	0,0	8,8	0,0	415,2	74,9	111,6
41,0	155,0	13,4	0,0	9,6	0,0	415,7	74,9	111,5
42,0	156,0	13,3	0,0	9,0	0,0	415,7	74,9	111,3
43,0	157,0	13,2	0,0	9,1	0,0	416,1	75,0	111,7
44,0	158,0	13,1	0,0	8,8	0,0	415,7	75,1	111,7
45,0	159,0	12,9	0,0	9,2	0,0	416,1	75,0	111,4
46,0	160,0	12,9	0,0	8,6	0,0	415,8	75,0	111,7
47,0	161,0	12,7	0,0	9,8	0,0	417,2	75,1	111,5
48,0	162,0	12,7	0,0	7,8	0,0	415,6	75,1	111,6
49,0	163,0	12,6	0,0	9,2	0,0	415,7	75,1	111,2
50,0	164,0	12,5	0,0	7,8	0,0	413,4	75,1	111,3
51,0	165,0	12,4	0,0	7,8	0,0	412,6	75,1	111,5
52,0	166,0	12,3	0,0	8,8	0,0	414,4	75,1	112,2
53,0	167,0	12,2	0,0	7,2	0,0	412,2	75,2	111,8
54,0	168,0	12,1	0,0	8,1	0,0	411,2	75,2	111,5
55,0	169,0	12,1	0,0	9,4	0,0	411,7	75,1	111,9
56,0	170,0	12,0	0,0	8,4	0,0	409,9	75,2	111,1
57,0	171,0	11,9	0,0	7,3	0,0	410,1	75,1	111,2
58,0	172,0	11,8	0,0	9,4	0,0	410,8	75,3	111,2
59,0	173,0	11,7	0,0	8,9	0,0	409,7	75,1	111,0
60,0	174,0	11,6	0,0	8,5	0,0	409,7	75,0	111,3
61,0	175,0	11,5	0,0	9,8	0,0	410,9	74,7	111,0
62,0	176,0	11,3	0,0	9,3	0,0	402,4	75,2	108,5
63,0	177,0	11,3	0,0	8,5	0,0	384,3	75,1	103,0
64,0	178,0	11,2	0,0	7,6	0,0	371,4	75,3	100,7
65,0	179,0	11,2	0,0	5,8	0,0	361,8	75,1	99,6

66,0	180,0	11,1	0,0	5,4	0,0	354,5	75,0	98,9
67,0	181,0	11,1	0,0	5,8	0,0	347,8	75,2	98,2
68,0	182,0	11,1	0,0	5,1	0,0	341,7	75,0	97,3
69,0	183,0	11,0	0,0	7,1	0,0	336,5	75,2	96,5
70,0	184,0	11,0	0,0	6,0	0,0	331,9	75,0	96,4
71,0	185,0	10,9	0,0	7,0	0,0	328,3	75,2	95,8
72,0	186,0	10,9	0,0	5,6	0,0	324,3	75,0	95,0
73,0	187,0	10,8	0,0	5,1	0,0	320,4	74,7	94,9
74,0	188,0	10,8	0,0	5,8	0,0	316,9	75,1	94,4
75,0	189,0	10,8	0,0	5,4	0,0	313,3	75,0	94,1
76,0	190,0	10,7	0,0	4,8	0,0	309,8	74,8	93,5
77,0	191,0	10,7	0,0	5,9	0,0	306,8	74,8	93,2
78,0	192,0	10,6	0,0	5,6	0,0	303,8	74,5	93,1
79,0	193,0	10,6	0,0	6,0	0,0	301,9	74,5	93,0
80,0	194,0	10,5	0,0	6,4	0,0	300,1	74,4	92,5
81,0	195,0	10,5	0,0	5,8	0,0	298,3	74,4	92,2
82,0	196,0	10,4	0,0	5,7	0,0	296,2	74,3	92,3
83,0	197,0	10,4	0,0	4,5	0,0	293,8	74,1	91,9
84,0	198,0	10,4	0,0	4,7	0,0	291,6	74,1	91,8
85,0	199,0	10,3	0,0	6,0	0,0	289,8	74,3	91,5
86,0	200,0	10,3	0,0	5,5	0,0	288,5	74,3	91,6
87,0	201,0	10,2	0,0	5,3	0,0	287,5	74,3	91,7
88,0	202,0	10,2	0,0	5,4	0,0	285,7	74,1	91,6
89,0	203,0	10,2	0,0	5,1	0,0	284,7	74,2	91,4
90,0	204,0	10,1	0,0	5,5	0,0	283,9	74,2	91,4
91,0	205,0	10,0	0,0	5,3	0,0	282,8	74,1	91,1
92,0	206,0	10,0	0,0	6,2	0,0	281,3	73,8	90,8
93,0	207,0	10,0	0,0	6,2	0,0	280,7	73,9	90,7
94,0	208,0	9,9	0,0	7,8	0,0	280,5	73,9	90,9
95,0	209,0	9,8	0,0	6,4	0,0	279,7	73,8	90,5
96,0	210,0	9,8	0,0	6,4	0,0	278,7	73,8	90,4
97,0	211,0	9,7	0,0	5,1	0,0	277,4	73,4	90,3
98,0	212,0	9,7	0,0	6,8	0,0	277,4	73,8	90,3
99,0	213,0	9,6	0,0	5,7	0,0	276,7	73,8	90,2
100,0	214,0	9,5	0,0	5,8	0,0	276,4	73,6	90,2
101,0	215,0	9,5	0,0	6,4	0,0	275,9	73,7	90,1
102,0	216,0	9,5	0,0	6,9	0,0	275,8	73,9	90,1
103,0	217,0	9,4	0,0	5,3	0,0	274,7	73,6	90,1
104,0	218,0	9,4	0,0	4,5	0,0	273,6	73,6	89,8
105,0	219,0	9,3	0,0	5,0	0,0	273,3	73,3	89,7
106,0	220,0	9,2	0,0	6,2	0,0	272,5	73,3	89,8
107,0	221,0	9,2	0,0	5,5	0,0	271,7	73,4	89,6
108,0	222,0	9,2	0,0	6,6	0,0	272,7	73,1	90,1
109,0	223,0	9,1	0,0	6,3	0,0	272,3	72,6	89,7
110,0	224,0	9,1	0,0	5,8	0,0	271,7	73,4	89,5
111,0	225,0	9,1	0,0	5,6	0,0	270,9	73,5	89,6
112,0	226,0	9,0	0,0	5,3	0,0	270,1	73,7	89,6
113,0	227,0	8,9	0,0	4,2	0,0	277,2	73,4	91,3
114,0	228,0	8,9	0,0	4,5	0,0	271,4	73,6	90,4
115,0	229,0	8,8	0,0	4,5	0,0	269,5	72,9	90,2
116,0	230,0	8,8	0,0	6,4	0,0	269,5	73,2	90,2
117,0	231,0	8,7	0,0	5,9	0,0	269,5	73,2	90,0
118,0	232,0	8,7	0,0	5,5	0,0	268,7	73,7	90,1
119,0	233,0	8,7	0,0	5,2	0,0	268,4	73,5	90,0
120,0	234,0	8,6	0,0	5,5	0,0	267,7	73,7	90,1
121,0	235,0	8,6	0,0	4,7	0,0	266,4	73,9	90,3
122,0	236,0	8,5	0,0	5,1	0,0	265,5	73,7	90,4
123,0	237,0	8,5	0,0	5,3	0,0	264,7	73,8	90,4
124,0	238,0	8,5	0,0	4,6	0,0	264,4	73,7	90,7
125,0	239,0	8,4	0,0	4,6	0,0	263,9	73,8	90,6
126,0	240,0	8,4	0,0	6,0	0,0	263,9	73,7	90,4
127,0	241,0	8,3	0,0	6,2	0,0	264,0	73,8	90,6
128,0	242,0	8,3	0,0	4,4	0,0	262,7	74,0	90,2
129,0	243,0	8,2	0,0	5,8	0,0	263,0	74,0	90,3
130,0	244,0	8,2	0,0	5,9	0,0	262,8	73,9	90,4
131,0	245,0	8,1	0,0	5,9	0,0	263,1	74,1	90,2
132,0	246,0	8,1	0,0	5,7	0,0	263,4	74,1	90,4
133,0	247,0	8,0	0,0	5,0	0,0	262,8	74,1	90,4
134,0	248,0	8,0	0,0	5,1	0,0	262,7	73,9	90,4
135,0	249,0	7,9	0,0	5,3	0,0	261,8	73,9	90,3
136,0	250,0	7,9	0,0	4,4	0,0	261,3	74,1	90,5
137,0	251,0	7,8	0,0	5,9	0,0	261,9	74,0	90,6
138,0	252,0	7,8	0,0	4,8	0,0	260,7	74,0	90,5

139,0	253,0	7,8	0,0	5,5	0,0	260,1	74,2	90,5
140,0	254,0	7,7	0,0	5,2	0,0	259,8	74,0	90,6
141,0	255,0	7,7	0,0	5,9	0,0	260,3	74,1	90,6
142,0	256,0	7,6	0,0	5,9	0,0	260,1	74,1	90,6
143,0	257,0	7,6	0,0	5,0	0,0	259,7	74,2	90,7
144,0	258,0	7,5	0,0	6,1	0,0	260,0	74,2	90,5
145,0	259,0	7,5	0,0	6,3	0,0	260,6	74,1	90,7
146,0	260,0	7,4	0,0	5,9	0,0	261,2	74,5	90,8
147,0	261,0	7,4	0,0	5,7	0,0	260,6	74,3	90,8
148,0	262,0	7,4	0,0	6,1	0,0	260,5	74,3	90,9
149,0	263,0	7,3	0,0	5,8	0,0	260,7	74,1	90,9
150,0	264,0	7,3	0,0	4,1	0,0	258,9	74,3	90,8
151,0	265,0	7,2	0,0	4,5	0,0	258,3	74,2	91,0
152,0	266,0	7,2	0,0	6,2	0,0	259,3	74,3	91,0
153,0	267,0	7,1	0,0	5,9	0,0	259,3	74,3	91,2
154,0	268,0	7,1	0,0	5,8	0,0	259,5	74,4	91,0
155,0	269,0	7,1	0,0	5,7	0,0	258,8	74,5	91,0
156,0	270,0	7,0	0,0	5,4	0,0	258,6	74,6	91,1
157,0	271,0	6,9	0,0	4,6	0,0	258,0	74,5	91,3
158,0	272,0	6,9	0,0	4,6	0,0	257,8	74,6	91,3
159,0	273,0	6,8	0,0	5,9	0,0	258,1	74,6	91,3
160,0	274,0	6,8	0,0	6,1	0,0	258,2	74,4	91,4
161,0	275,0	6,8	0,0	6,1	0,0	258,4	74,6	91,2
162,0	276,0	6,7	0,0	6,9	0,0	259,2	74,6	91,5
163,0	277,0	6,6	0,0	5,1	0,0	259,0	74,5	91,0
164,0	278,0	6,6	0,0	4,7	0,0	258,2	74,6	91,2
165,0	279,0	6,6	0,0	6,7	0,0	258,8	74,6	91,2
166,0	280,0	6,5	0,0	5,3	0,0	259,0	74,5	91,3
167,0	281,0	6,4	0,0	5,6	0,0	259,0	74,5	91,2
168,0	282,0	6,4	0,0	5,9	0,0	259,7	74,3	91,3
169,0	283,0	6,3	0,0	5,8	0,0	259,5	74,3	91,1
170,0	284,0	6,3	0,0	5,1	0,0	259,3	74,3	91,2
171,0	285,0	6,2	0,0	5,6	0,0	259,5	74,7	91,2
172,0	286,0	6,2	0,0	4,9	0,0	259,1	74,7	90,9
173,0	287,0	6,1	0,0	6,0	0,0	273,6	74,6	95,1
174,0	288,0	6,1	0,1	3,3	0,0	263,2	74,3	91,8
175,0	289,0	6,1	0,0	5,0	0,0	261,2	74,6	91,5
176,0	290,0	6,0	0,0	5,7	0,0	260,8	74,7	91,5
177,0	291,0	6,0	0,0	6,2	0,0	262,0	74,5	91,6
178,0	292,0	6,0	0,0	6,0	0,0	261,4	74,6	91,3
179,0	293,0	5,9	0,0	5,1	0,0	260,6	74,5	91,2
180,0	294,0	5,9	0,0	5,4	0,0	260,6	74,6	91,3
181,0	295,0	5,8	0,0	6,7	0,0	259,8	74,3	91,0
182,0	296,0	5,7	0,0	6,5	0,0	251,1	73,9	89,2
183,0	297,0	5,7	0,0	5,4	0,0	247,6	74,7	89,1
184,0	298,0	5,7	0,0	4,3	0,0	244,6	74,7	88,7
185,0	299,0	5,7	0,0	5,1	0,0	242,5	74,6	88,3
186,0	300,0	5,6	0,0	4,7	0,0	239,9	74,6	88,1
187,0	301,0	5,6	0,0	5,2	0,0	238,5	74,5	88,1
188,0	302,0	5,5	0,0	4,6	0,0	236,3	74,5	87,8
189,0	303,0	5,5	0,0	4,2	0,0	234,1	74,7	87,5
190,0	304,0	5,5	0,0	3,7	0,0	232,4	74,6	87,5
191,0	305,0	5,5	0,0	4,9	0,0	230,6	74,4	87,3
192,0	306,0	5,4	0,0	3,2	0,0	229,0	74,4	87,3
193,0	307,0	5,4	0,0	5,3	0,0	228,0	74,6	87,2
194,0	308,0	5,4	0,0	4,8	0,0	226,0	74,6	86,9
195,0	309,0	5,3	0,0	5,3	0,0	225,4	74,5	87,0
196,0	310,0	5,3	0,0	5,0	0,0	223,9	74,4	86,9
197,0	311,0	5,3	0,0	5,6	0,0	223,3	74,5	87,0
198,0	312,0	5,2	0,0	4,4	0,0	222,5	74,0	86,8
199,0	313,0	5,2	0,0	5,0	0,0	221,3	74,3	86,7
200,0	314,0	5,2	0,0	4,0	0,0	220,5	74,0	86,6
201,0	315,0	5,2	0,0	4,6	0,0	219,4	74,6	86,3
202,0	316,0	5,1	0,0	3,4	0,0	218,4	74,6	86,4
203,0	317,0	5,1	0,1	3,3	0,0	217,2	74,3	86,5
204,0	318,0	5,1	0,0	3,6	0,0	216,2	74,5	86,4
205,0	319,0	5,0	0,0	4,9	0,0	215,8	74,1	86,2
206,0	320,0	5,0	0,0	5,1	0,0	215,5	74,5	86,4
207,0	321,0	5,0	0,0	4,7	0,0	215,0	74,6	86,2
208,0	322,0	4,9	0,0	4,2	0,0	214,0	74,5	86,1
209,0	323,0	4,9	0,0	4,7	0,0	213,3	74,8	86,0
210,0	324,0	4,9	0,0	3,6	0,0	212,6	74,7	86,1
211,0	325,0	4,9	0,0	4,8	0,0	212,3	74,7	86,0

212,0	326,0	4,8	0,0	4,6	0,0	211,8	74,5	85,7
213,0	327,0	4,8	0,0	4,3	0,0	211,4	74,3	85,9
214,0	328,0	4,7	0,0	4,9	0,0	211,2	74,5	85,9
215,0	329,0	4,8	0,0	4,2	0,0	210,7	74,4	85,7
216,0	330,0	4,7	0,0	3,7	0,0	210,3	74,4	86,0
217,0	331,0	4,7	0,0	5,3	0,0	210,3	73,9	85,6
218,0	332,0	4,6	0,0	5,9	0,0	210,0	74,3	85,6
219,0	333,0	4,6	0,0	4,8	0,0	210,1	74,3	85,6
220,0	334,0	4,6	0,0	4,2	0,0	209,5	74,2	85,6
221,0	335,0	4,5	0,0	5,1	0,0	209,0	74,5	85,6
222,0	336,0	4,5	0,0	4,7	0,0	209,3	74,2	85,5
223,0	337,0	4,4	0,0	4,7	0,0	208,5	74,0	85,6
224,0	338,0	4,4	0,0	3,6	0,0	208,0	74,2	85,6
225,0	339,0	4,4	0,1	3,1	0,0	207,3	74,6	85,7
226,0	340,0	4,4	0,0	3,7	0,0	206,8	74,4	85,5
227,0	341,0	4,3	0,0	5,1	0,0	207,6	74,7	85,7
228,0	342,0	4,3	0,0	6,1	0,0	208,1	74,6	85,7
229,0	343,0	4,3	0,0	3,9	0,0	207,3	74,2	85,4
230,0	344,0	4,2	0,0	5,0	0,0	207,0	74,5	85,5
231,0	345,0	4,2	0,0	3,9	0,0	206,5	74,3	85,5
232,0	346,0	4,2	0,0	6,1	0,0	207,0	74,8	85,5
233,0	347,0	4,1	0,0	3,6	0,0	206,5	74,6	85,4
234,0	348,0	4,1	0,0	3,9	0,0	215,8	74,4	86,5
235,0	349,0	4,1	0,1	3,3	0,0	210,7	74,2	85,7
236,0	350,0	4,0	0,0	4,5	0,0	209,2	73,7	85,8
237,0	351,0	4,0	0,0	4,8	0,0	208,1	74,2	85,5
238,0	352,0	4,0	0,1	3,4	0,0	206,6	74,0	85,5
239,0	353,0	4,0	0,0	5,8	0,0	207,2	74,2	85,7
240,0	354,0	3,9	0,0	5,4	0,0	206,9	73,7	85,5
241,0	355,0	3,9	0,0	4,2	0,0	206,1	73,9	85,3
242,0	356,0	3,9	0,0	3,7	0,0	205,3	74,3	85,5
243,0	357,0	3,8	0,0	4,9	0,0	205,9	74,0	85,5
244,0	358,0	3,8	0,0	4,7	0,0	205,1	74,5	85,4
245,0	359,0	3,8	0,0	3,6	0,0	204,3	74,2	85,3
246,0	360,0	3,8	0,0	3,7	0,0	203,6	74,0	85,2
247,0	361,0	3,8	0,0	3,6	0,0	203,4	73,8	85,4
248,0	362,0	3,7	0,0	4,9	0,0	203,2	74,1	85,5
249,0	363,0	3,7	0,0	4,0	0,0	202,8	74,0	85,4
250,0	364,0	3,7	0,0	5,2	0,0	202,5	74,2	85,3
251,0	365,0	3,6	0,0	4,2	0,0	202,6	74,1	85,3
252,0	366,0	3,6	0,0	5,2	0,0	202,3	74,2	85,1
253,0	367,0	3,6	0,0	4,5	0,0	202,0	74,1	85,4
254,0	368,0	3,5	0,0	4,5	0,0	202,2	74,0	85,3
255,0	369,0	3,5	0,0	4,4	0,0	201,8	73,9	85,2
256,0	370,0	3,5	0,0	3,5	0,0	201,2	74,2	85,4
257,0	371,0	3,5	0,1	3,6	0,0	201,4	74,2	85,4
258,0	372,0	3,4	0,0	4,0	0,0	201,5	74,2	85,4
259,0	373,0	3,4	0,0	4,3	0,0	201,5	74,2	85,4
260,0	374,0	3,4	0,0	3,8	0,0	201,4	74,4	85,5
261,0	375,0	3,4	0,0	4,3	0,0	200,7	74,4	85,3
262,0	376,0	3,3	0,0	4,1	0,0	200,9	74,5	85,3
263,0	377,0	3,3	0,0	5,5	0,0	201,6	74,5	85,4
264,0	378,0	3,3	0,0	4,8	0,0	200,9	74,6	85,2
265,0	379,0	3,2	0,0	4,5	0,0	201,3	74,6	85,4
266,0	380,0	3,2	0,0	5,3	0,0	201,2	74,7	85,3
267,0	381,0	3,1	0,0	4,6	0,0	201,0	74,7	85,3
268,0	382,0	3,1	0,0	4,8	0,0	200,7	74,6	85,3
269,0	383,0	3,1	0,0	4,0	0,0	200,3	74,8	85,3
270,0	384,0	3,0	0,0	4,3	0,0	200,5	74,7	85,4
271,0	385,0	3,0	0,0	5,4	0,0	201,0	74,7	85,4
272,0	386,0	3,0	0,0	5,6	0,0	201,3	74,6	85,3
273,0	387,0	2,9	0,0	4,6	0,0	200,9	74,7	85,3
274,0	388,0	2,8	0,0	5,2	0,0	201,6	74,6	85,4
275,0	389,0	2,9	0,0	6,8	0,0	202,0	74,6	85,4
276,0	390,0	2,8	0,0	5,6	0,0	202,1	74,7	85,3
277,0	391,0	2,8	0,0	5,7	0,0	202,4	74,7	85,4
278,0	392,0	2,7	0,0	5,1	0,0	202,8	74,8	85,5
279,0	393,0	2,7	0,0	4,7	0,0	202,6	74,8	85,4
280,0	394,0	2,7	0,0	5,8	0,0	202,9	74,9	85,5
281,0	395,0	2,6	0,0	5,4	0,0	203,3	74,9	85,5
282,0	396,0	2,5	0,0	5,5	0,0	203,7	74,9	85,4
283,0	397,0	2,5	0,0	5,4	0,0	204,1	75,0	85,5
284,0	398,0	2,5	0,0	4,3	0,0	203,6	74,9	85,5

285,0	399,0	2,5	0,0	4,0	0,0	203,3	74,9	85,5
286,0	400,0	2,5	0,0	4,6	0,0	203,4	74,9	85,2
287,0	401,0	2,4	0,0	5,5	0,0	203,5	74,7	85,5
288,0	402,0	2,4	0,0	4,4	0,0	203,1	74,7	85,4
289,0	403,0	2,3	0,0	1,0	0,0	203,4	74,7	85,6
290,0	404,0	2,3	0,0	4,8	0,0	202,9	74,9	85,3
291,0	405,0	2,3	0,0	4,3	0,0	202,9	74,9	85,5
292,0	406,0	2,3	0,0	5,0	0,0	202,9	75,0	85,4
293,0	407,0	2,2	0,0	5,9	0,0	203,3	75,0	85,5
294,0	408,0	2,2	0,0	3,7	0,0	216,3	75,1	88,0
295,0	409,0	2,1	0,0	5,9	0,0	210,1	75,1	86,3
296,0	410,0	2,1	0,0	5,1	0,0	207,6	75,1	85,8
297,0	411,0	2,1	0,0	4,8	0,0	206,9	75,0	85,9
298,0	412,0	2,0	0,0	4,6	0,0	206,4	75,2	85,8
299,0	413,0	2,0	0,0	4,9	0,0	205,8	75,1	85,6
300,0	414,0	2,0	0,0	5,1	0,0	205,7	75,2	85,6
301,0	415,0	2,0	0,0	5,9	0,0	205,7	75,1	85,6
302,0	416,0	2,0	0,0	3,9	0,0	204,5	75,2	85,4
303,0	417,0	1,9	0,0	3,8	0,0	204,1	75,1	85,5
304,0	418,0	1,9	0,0	3,8	0,0	203,1	75,2	85,4
305,0	419,0	1,9	0,0	5,0	0,0	203,4	74,9	85,5
306,0	420,0	1,8	0,0	3,5	0,0	202,0	75,1	85,3
307,0	421,0	1,8	0,0	4,0	0,0	201,8	75,2	85,2
308,0	422,0	1,8	0,0	4,1	0,0	201,6	75,3	85,4
309,0	423,0	1,8	0,0	4,9	0,0	202,3	75,2	85,4
310,0	424,0	1,7	0,0	4,7	0,0	202,6	75,3	85,4
311,0	425,0	1,7	0,0	6,4	0,0	202,9	75,4	85,4
312,0	426,0	1,7	0,0	3,8	0,0	202,0	75,4	85,4
313,0	427,0	1,6	0,0	4,4	0,0	202,4	75,0	85,5
314,0	428,0	1,6	0,0	4,7	0,0	202,6	75,2	85,6
315,0	429,0	1,5	0,0	5,1	0,0	202,8	75,2	85,6
316,0	430,0	1,5	0,0	4,9	0,0	202,4	75,0	85,5
317,0	431,0	1,5	0,0	5,8	0,0	202,2	75,3	85,3
318,0	432,0	1,4	0,0	4,0	0,0	201,8	75,5	85,5
319,0	433,0	1,4	0,0	5,5	0,0	202,3	75,1	85,6
320,0	434,0	1,4	0,0	4,5	0,0	201,3	75,5	85,4
321,0	435,0	1,3	0,0	4,5	0,0	201,4	75,3	85,4
322,0	436,0	1,3	0,0	5,5	0,0	201,8	75,4	85,5
323,0	437,0	1,3	0,0	6,4	0,0	202,8	75,4	85,6
324,0	438,0	1,2	0,0	4,4	0,0	202,3	75,4	85,5
325,0	439,0	1,2	0,0	4,9	0,0	202,1	75,4	85,5
326,0	440,0	1,2	0,0	4,4	0,0	201,6	75,3	85,4
327,0	441,0	1,2	0,0	4,3	0,0	201,3	75,1	85,4
328,0	442,0	1,1	0,0	4,6	0,0	201,8	75,4	85,6
329,0	443,0	1,1	0,0	6,2	0,0	202,2	75,5	85,4
330,0	444,0	1,1	0,0	5,6	0,0	202,6	75,4	85,6
331,0	445,0	1,0	0,0	5,0	0,0	202,8	75,5	85,8
332,0	446,0	1,0	0,0	5,5	0,0	203,1	75,6	85,6
333,0	447,0	0,9	0,0	5,2	0,0	203,1	75,5	85,6
334,0	448,0	0,9	0,0	6,2	0,0	203,0	75,4	85,6
335,0	449,0	0,9	0,0	5,6	0,0	202,8	75,6	85,5
336,0	450,0	0,8	0,0	5,1	0,0	202,4	75,5	85,5
337,0	451,0	0,8	0,0	4,4	0,0	202,3	75,6	85,5
338,0	452,0	0,8	0,0	4,1	0,0	202,1	75,6	85,5
339,0	453,0	0,7	0,0	4,7	0,0	202,1	75,7	85,6
340,0	454,0	0,7	0,0	6,1	0,0	202,6	75,3	85,7
341,0	455,0	0,7	0,0	4,8	0,0	202,5	75,6	85,6
342,0	456,0	0,6	0,0	4,4	0,0	202,4	75,6	85,8
343,0	457,0	0,6	0,0	6,2	0,0	202,8	75,6	85,6
344,0	458,0	0,6	0,0	4,6	0,0	202,6	75,8	85,6
345,0	459,0	0,6	0,0	5,2	0,0	202,6	75,8	85,8
346,0	460,0	0,5	0,0	4,1	0,0	202,9	75,9	85,7
347,0	461,0	0,5	0,0	4,9	0,0	202,7	75,9	85,8
348,0	462,0	0,5	0,0	5,0	0,0	202,9	75,6	85,8
349,0	463,0	0,4	0,0	5,4	0,0	203,3	75,7	85,8
350,0	464,0	0,4	0,0	4,6	0,0	203,3	75,6	85,8
351,0	465,0	0,3	0,0	4,3	0,0	203,1	75,8	85,8
352,0	466,0	0,3	0,0	5,5	0,0	203,3	75,7	85,7
353,0	467,0	0,3	0,0	5,6	0,0	203,2	75,6	85,7
354,0	468,0	0,3	0,0	5,4	0,0	213,2	75,9	88,2
355,0	469,0	0,2	0,0	4,1	0,0	211,2	75,8	86,5
356,0	470,0	0,2	0,0	4,1	0,0	207,3	75,8	86,1
357,0	471,0	0,2	0,0	5,4	0,0	206,5	76,0	86,1

358,0	472,0	0,1	0,0	4,4	0,0	205,9	75,9	86,0
359,0	473,0	0,1	0,0	6,2	0,0	206,0	75,9	85,9
360,0	474,0	0,1	0,0	4,9	0,0	206,0	75,9	85,9
361,0	475,0	0,0	0,0	4,8	0,0	205,3	75,9	85,8

Manufacturer: ravelli
Model: RV 120

Run: 1
Project #: pi 20145
Test Duration: 361 min

Note: In the "Input data", "Calc. % O_2", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a]. [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses

	HHV	LHV
Eff	79,25%	84,72%
Comb Eff	99,50%	99,50%
HT Eff	79,65%	85,15%
Output	19 840	kJ/h
Burn Rate	1,23	kg/h
Grams CO	17	g
Input	25 036	kJ/h
MC wet	5,76	

Ultimate CO_2
$CO_{2\text{-ult}}$ 20,21
F_0
1,029

Overall Heating Efficiency: 79,25%
Combustion Efficiency: 99,50%
Heat Transfer Efficiency: 79,65%

Heat Output: 18 821 Btu/h
Heat Input: 23 749 Btu/h
Burn Duration: 6,02 h
Burn Rate: 2,72 lb/h
Stack Temp: 281,7 Deg. F

Averages	0,01	5,75	2,81	20,73	14,97	130,30	23,53	100,5%	79,9%	#DIV/0!
INPUT DATA			Oxygen Calculation			Input Data		Combust	Heat	Net
Elapsed	Weight	%	%	Excess	Total	Calc. %	Flue	Room	Eff	Transfer	Eff
Time	Remaining (kg)	CO [e]	CO_2 [d]	Air EA	O_2	O_2 [g]	Gas (ºC)	Temp (ºC)	%	%	%
0,00	7,88	0,00	9,13	121,5%	20,61	11,48	209,7	23,0	100,4%	78,5%	78,8%
1,00	7,83	0,00	8,49	138,1%	20,63	12,15	209,5	22,9	100,4%	77,6%	77,9%
2,00	7,79	0,00	7,40	173,1%	20,67	13,27	209,2	23,0	100,5%	75,7%	76,0%
3,00	7,75	0,00	8,74	131,3%	20,63	11,89	209,8	23,1	100,4%	78,0%	78,3%
4,00	7,74	0,00	9,74	107,5%	20,59	10,85	210,4	23,1	100,3%	79,3%	79,5%
5,00	7,70	0,00	9,16	120,6%	20,61	11,45	210,9	23,2	100,4%	78,5%	78,8%
6,00	7,61	0,00	10,75	88,1%	20,55	9,81	211,5	23,2	100,3%	80,3%	80,5%
7,00	7,61	0,00	8,09	149,9%	20,65	12,56	211,4	23,2	100,4%	76,8%	77,1%
8,00	7,51	0,00	8,80	129,7%	20,62	11,82	211,7	23,1	100,4%	77,9%	78,2%
9,00	7,51	0,00	7,92	155,0%	20,65	12,73	211,4	23,2	100,5%	76,5%	76,8%
10,00	7,43	0,00	9,64	109,7%	20,59	10,95	211,7	23,3	100,3%	79,1%	79,3%
11,00	7,38	0,00	9,21	119,4%	20,61	11,40	211,7	23,3	100,3%	78,5%	78,8%
12,00	7,34	0,00	7,81	158,8%	20,66	12,85	211,0	23,3	100,5%	76,3%	76,7%
13,00	7,29	0,00	9,66	109,3%	20,59	10,94	211,2	23,3	100,3%	79,1%	79,4%
14,00	7,30	0,00	9,71	108,3%	20,59	10,89	211,5	23,4	100,3%	79,2%	79,4%
15,00	7,25	0,00	8,02	151,9%	20,65	12,63	211,5	23,4	100,4%	76,7%	77,0%
16,00	7,20	0,00	8,35	141,9%	20,64	12,29	211,0	23,3	100,4%	77,3%	77,6%
17,00	7,15	0,00	10,45	93,4%	20,56	10,11	211,6	23,5	100,3%	80,0%	80,2%
18,00	7,11	0,00	9,47	113,3%	20,60	11,12	212,0	23,5	100,3%	78,9%	79,1%
19,00	7,07	0,00	9,19	119,8%	20,61	11,42	212,3	23,5	100,3%	78,5%	78,7%
20,00	7,02	0,00	8,17	147,4%	20,65	12,48	212,3	23,5	100,4%	76,9%	77,2%
21,00	6,98	0,00	9,66	109,3%	20,59	10,94	212,6	23,5	100,3%	79,0%	79,3%
22,00	6,93	0,00	9,39	115,2%	20,60	11,21	212,9	23,6	100,3%	78,7%	79,0%
23,00	6,88	0,00	9,72	107,8%	20,59	10,87	212,6	23,6	100,3%	79,1%	79,4%
24,00	6,84	0,00	9,51	112,6%	20,60	11,09	213,1	23,5	100,3%	78,8%	79,1%
25,00	6,79	0,00	9,03	123,8%	20,62	11,59	213,5	23,6	100,4%	78,1%	78,4%
26,00	6,75	0,00	9,19	119,8%	20,61	11,42	213,0	23,6	100,3%	78,4%	78,7%
27,00	6,66	0,00	9,92	103,8%	20,58	10,66	213,5	23,7	100,3%	79,3%	79,6%
28,00	6,66	0,00	9,50	112,7%	20,60	11,09	213,1	23,7	100,3%	78,8%	79,1%
29,00	6,62	0,00	8,80	129,7%	20,62	11,82	212,9	23,7	100,4%	77,9%	78,2%
30,00	6,57	0,00	10,88	85,7%	20,55	9,66	213,7	23,8	100,2%	80,3%	80,5%
31,00	6,51	0,00	9,41	114,8%	20,60	11,19	213,7	23,6	100,3%	78,7%	78,9%
32,00	6,48	0,00	7,49	169,9%	20,67	13,18	212,9	23,7	100,5%	75,6%	75,9%
33,00	6,42	0,00	9,28	117,8%	20,61	11,33	213,2	23,7	100,3%	78,5%	78,8%
34,00	6,38	0,00	9,64	109,7%	20,59	10,95	213,3	23,7	100,3%	79,0%	79,2%
35,00	6,29	0,00	7,36	174,4%	20,68	13,31	213,1	23,8	100,5%	75,3%	75,7%
36,00	6,29	0,00	10,42	94,1%	20,57	10,15	213,6	23,8	100,3%	79,9%	80,1%
37,00	6,25	0,00	8,96	125,5%	20,62	11,66	213,2	23,8	100,4%	78,1%	78,4%
38,00	6,16	0,00	10,07	100,7%	20,58	10,51	213,7	23,8	100,3%	79,5%	79,7%
39,00	6,15	0,00	7,63	164,9%	20,67	13,04	212,8	23,8	100,5%	75,9%	76,2%
40,00	6,07	0,00	8,80	129,7%	20,62	11,83	212,9	23,9	100,4%	77,9%	78,2%
41,00	6,06	0,00	9,62	110,0%	20,59	10,97	213,1	23,8	100,3%	79,0%	79,2%
42,00	6,02	0,00	9,00	124,6%	20,62	11,62	213,2	23,8	100,4%	78,1%	78,4%
43,00	5,98	0,00	9,10	122,2%	20,61	11,52	213,4	23,9	100,3%	78,3%	78,5%
44,00	5,93	0,00	8,78	130,1%	20,62	11,84	213,2	23,9	100,4%	77,8%	78,1%
45,00	5,85	0,00	9,19	119,8%	20,61	11,41	213,4	23,9	100,3%	78,4%	78,7%
46,00	5,84	0,00	8,55	136,3%	20,63	12,08	213,2	23,9	100,4%	77,5%	77,8%
47,00	5,75	0,00	9,84	105,4%	20,59	10,75	214,0	24,0	100,3%	79,2%	79,4%
48,00	5,75	0,01	7,84	157,6%	20,66	12,81	213,1	23,9	100,4%	76,3%	76,6%
49,00	5,71	0,00	9,24	118,6%	20,61	11,36	213,2	24,0	100,3%	78,5%	78,8%
50,00	5,66	0,00	7,84	157,6%	20,66	12,81	211,9	23,9	100,4%	76,4%	76,7%
51,00	5,62	0,00	7,76	160,4%	20,66	12,90	211,4	23,9	100,5%	76,3%	76,6%
52,00	5,57	0,00	8,82	129,0%	20,62	11,80	212,5	24,0	100,3%	78,0%	78,2%
53,00	5,53	0,01	7,16	181,9%	20,68	13,52	211,2	24,0	100,5%	75,1%	75,4%
54,00	5,48	0,00	8,11	149,3%	20,65	12,54	210,7	24,0	100,4%	77,0%	77,3%
55,00	5,48	0,00	9,39	115,3%	20,60	11,21	211,0	23,9	100,3%	78,9%	79,1%
56,00	5,43	0,00	8,37	141,5%	20,64	12,27	209,9	24,0	100,4%	77,5%	77,8%
57,00	5,39	0,01	7,31	176,1%	20,68	13,36	210,0	24,0	100,5%	75,5%	75,8%
58,00	5,35	0,00	9,38	115,5%	20,60	11,23	210,4	24,1	100,3%	78,9%	79,2%
59,00	5,30	0,00	8,91	126,7%	20,62	11,71	209,8	23,9	100,4%	78,3%	78,6%
60,00	5,26	0,00	8,52	137,1%	20,63	12,11	209,8	23,9	100,4%	77,7%	78,0%
61,00	5,21	0,00	9,79	106,5%	20,59	10,80	210,5	23,7	100,3%	79,4%	79,6%
62,00	5,12	0,00	9,26	118,3%	20,61	11,35	205,8	24,0	100,3%	79,1%	79,4%
63,00	5,11	0,00	8,52	137,3%	20,63	12,12	195,7	24,0	100,4%	78,9%	79,2%
64,00	5,07	0,00	7,56	167,3%	20,67	13,11	188,6	24,1	100,5%	78,0%	78,3%
65,00	5,07	0,01	5,81	246,7%	20,73	14,91	183,2	24,0	100,5%	74,6%	75,0%
66,00	5,03	0,02	5,45	269,8%	20,74	15,29	179,2	23,9	100,5%	74,0%	74,4%
67,00	5,03	0,01	5,76	250,2%	20,73	14,96	175,5	24,0	100,6%	75,4%	75,8%
68,00	5,02	0,02	5,08	296,9%	20,76	15,67	172,0	23,9	100,6%	73,6%	74,1%
69,00	4,98	0,01	7,08	185,1%	20,69	13,60	169,2	24,0	100,5%	78,9%	79,3%
70,00	4,98	0,01	6,01	235,8%	20,72	14,71	166,6	23,9	100,6%	77,0%	77,4%
71,00	4,94	0,01	6,99	189,1%	20,69	13,70	164,6	24,0	100,5%	79,2%	79,6%
72,00	4,94	0,01	5,61	259,7%	20,74	15,12	162,4	23,9	100,7%	76,5%	77,0%
73,00	4,89	0,02	5,12	293,2%	20,76	15,62	160,2	23,7	100,6%	75,3%	75,8%
74,00	4,89	0,01	5,85	245,1%	20,73	14,88	158,3	23,9	100,6%	77,5%	78,0%
75,00	4,90	0,01	5,39	274,3%	20,75	15,35	156,3	23,9	100,6%	76,6%	77,0%
76,00	4,85	0,02	4,82	317,7%	20,77	15,94	154,3	23,8	100,5%	75,1%	75,5%
77,00	4,85	0,01	5,95	239,4%	20,73	14,78	152,6	23,8	100,6%	78,4%	78,8%
78,00	4,80	0,01	5,55	263,4%	20,74	15,18	151,0	23,6	100,6%	77,6%	78,1%
79,00	4,80	0,01	5,98	237,5%	20,72	14,74	149,9	23,6	100,6%	78,7%	79,2%
80,00	4,75	0,00	6,42	214,5%	20,71	14,28	148,9	23,6	100,6%	79,7%	80,2%
81,00	4,75	0,01	5,81	247,3%	20,73	14,91	148,0	23,6	100,6%	78,6%	79,1%
82,00	4,71	0,01	5,68	255,1%	20,74	15,05	146,8	23,5	100,6%	78,4%	78,9%
83,00	4,71	0,03	4,47	349,0%	20,78	16,29	145,5	23,4	100,5%	75,1%	75,5%
84,00	4,71	0,02	4,67	331,1%	20,77	16,09	144,2	23,4	100,7%	75,9%	76,4%
85,00	4,67	0,01	5,98	237,5%	20,72	14,74	143,2	23,5	100,6%	79,5%	79,9%
86,00	4,66	0,01	5,55	263,3%	20,74	15,18	142,5	23,5	100,6%	78,6%	79,1%
87,00	4,62	0,02	5,26	283,4%	20,75	15,49	142,0	23,5	100,6%	78,0%	78,4%
88,00	4,62	0,01	5,42	272,2%	20,74	15,32	141,0	23,4	100,6%	78,5%	79,0%
89,00	4,62	0,02	5,11	294,4%	20,76	15,64	140,4	23,5	100,6%	77,8%	78,2%
90,00	4,57	0,02	5,55	263,2%	20,74	15,18	139,9	23,4	100,5%	78,9%	79,3%
91,00	4,53	0,01	5,32	278,9%	20,75	15,42	139,4	23,4	100,6%	78,4%	78,9%
92,00	4,53	0,01	6,18	226,8%	20,72	14,54	138,5	23,2	100,6%	80,3%	80,8%

93,00	4,53	0,01	6,24	223,4%	20,72	14,47	138,2	23,3	100,6%	80,5%	81,0%
94,00	4,49	0,00	7,76	160,4%	20,66	12,90	138,1	23,3	100,4%	82,7%	83,1%
95,00	4,44	0,01	6,36	217,6%	20,71	14,35	137,6	23,2	100,5%	80,8%	81,2%
96,00	4,44	0,00	6,37	216,9%	20,71	14,33	137,1	23,2	100,6%	80,8%	81,3%
97,00	4,39	0,02	5,12	293,2%	20,76	15,62	136,3	23,0	100,6%	78,3%	78,7%
98,00	4,39	0,01	6,79	197,3%	20,70	13,90	136,3	23,2	100,4%	81,6%	81,9%
99,00	4,35	0,01	5,66	256,3%	20,74	15,07	135,9	23,2	100,6%	79,6%	80,1%
100,00	4,30	0,01	5,76	250,1%	20,73	14,96	135,8	23,1	100,6%	79,8%	80,3%
101,00	4,30	0,01	6,37	216,7%	20,71	14,33	135,5	23,2	100,5%	81,0%	81,4%
102,00	4,30	0,00	6,93	191,4%	20,69	13,76	135,4	23,3	100,5%	81,9%	82,3%
103,00	4,26	0,02	5,30	280,2%	20,75	15,44	134,8	23,1	100,6%	78,9%	79,4%
104,00	4,26	0,04	4,54	342,0%	20,78	16,22	134,2	23,1	100,4%	76,9%	77,1%
105,00	4,21	0,01	4,96	306,4%	20,76	15,80	134,0	23,0	100,7%	78,1%	78,6%
106,00	4,17	0,01	6,18	226,9%	20,72	14,54	133,6	22,9	100,6%	80,8%	81,3%
107,00	4,17	0,01	5,47	269,0%	20,74	15,27	133,2	23,0	100,7%	79,5%	80,0%
108,00	4,17	0,01	6,57	207,3%	20,70	14,13	133,7	22,9	100,5%	81,5%	81,9%
109,00	4,13	0,00	6,31	220,3%	20,71	14,40	133,5	22,6	100,6%	81,0%	81,5%
110,00	4,12	0,01	5,82	246,7%	20,73	14,90	133,2	23,0	100,6%	80,2%	80,8%
111,00	4,13	0,01	5,61	259,4%	20,74	15,12	132,7	23,1	100,6%	79,9%	80,4%
112,00	4,08	0,02	5,29	280,6%	20,75	15,45	132,3	23,1	100,6%	79,2%	79,7%
113,00	4,03	0,02	4,20	378,0%	20,79	16,57	136,2	23,0	100,6%	75,4%	75,8%
114,00	4,03	0,02	4,51	346,4%	20,78	16,26	133,0	23,1	100,7%	76,9%	77,5%
115,00	3,98	0,04	4,54	341,2%	20,78	16,21	132,0	22,7	100,3%	77,2%	77,4%
116,00	3,98	0,01	6,44	213,5%	20,71	14,26	132,0	22,9	100,5%	81,4%	81,9%
117,00	3,96	0,01	5,88	243,3%	20,73	14,84	132,0	22,9	100,6%	80,5%	81,0%
118,00	3,94	0,01	5,49	267,8%	20,74	15,25	131,5	23,1	100,6%	79,7%	80,3%
119,00	3,94	0,01	5,16	290,7%	20,75	15,59	131,3	23,1	100,6%	79,0%	79,5%
120,00	3,89	0,01	5,49	267,4%	20,74	15,25	131,0	23,2	100,6%	79,8%	80,3%
121,00	3,89	0,01	4,70	328,6%	20,77	16,06	130,2	23,3	100,7%	78,0%	78,5%
122,00	3,85	0,01	5,09	295,8%	20,76	15,66	129,7	23,2	100,7%	79,1%	79,6%
123,00	3,85	0,02	5,26	282,7%	20,75	15,48	129,3	23,2	100,5%	79,5%	79,9%
124,00	3,85	0,03	4,64	332,8%	20,77	16,12	129,1	23,2	100,4%	77,9%	78,2%
125,00	3,81	0,02	4,64	333,7%	20,77	16,12	128,8	23,2	100,6%	78,0%	78,4%
126,00	3,80	0,01	5,98	237,5%	20,72	14,74	128,8	23,2	100,6%	81,0%	81,5%
127,00	3,76	0,01	6,19	225,9%	20,72	14,52	128,9	23,2	100,5%	81,4%	81,8%
128,00	3,77	0,03	4,37	359,9%	20,78	16,40	128,1	23,4	100,5%	77,2%	77,6%
129,00	3,71	0,02	5,78	248,3%	20,73	14,94	128,3	23,3	100,4%	80,7%	81,1%
130,00	3,71	0,01	5,90	242,0%	20,73	14,82	128,2	23,3	100,6%	81,0%	81,5%
131,00	3,66	0,02	5,91	240,9%	20,73	14,81	128,4	23,4	100,5%	81,0%	81,4%
132,00	3,66	0,01	5,75	251,0%	20,73	14,98	128,6	23,4	100,6%	80,7%	81,1%
133,00	3,62	0,01	5,01	302,7%	20,76	15,75	128,2	23,4	100,7%	79,1%	79,6%
134,00	3,62	0,02	5,11	294,3%	20,76	15,64	128,2	23,3	100,6%	79,3%	79,8%
135,00	3,58	0,01	5,27	282,8%	20,75	15,47	127,6	23,3	100,7%	79,8%	80,3%
136,00	3,58	0,02	4,42	355,2%	20,78	16,35	127,4	23,4	100,6%	77,5%	78,0%
137,00	3,53	0,02	5,86	243,4%	20,73	14,85	127,7	23,3	100,4%	81,0%	81,3%
138,00	3,53	0,03	4,77	321,5%	20,77	15,98	127,0	23,3	100,5%	78,6%	79,0%
139,00	3,54	0,01	5,52	265,3%	20,74	15,21	126,7	23,4	100,6%	80,4%	80,9%
140,00	3,49	0,02	5,17	289,3%	20,75	15,57	126,6	23,4	100,6%	79,7%	80,1%
141,00	3,49	0,01	5,86	243,9%	20,73	14,86	126,8	23,4	100,5%	81,1%	81,5%
142,00	3,44	0,01	5,86	244,3%	20,73	14,86	126,7	23,4	100,6%	81,1%	81,6%
143,00	3,44	0,02	5,03	300,4%	20,76	15,72	126,5	23,5	100,6%	79,4%	79,8%
144,00	3,40	0,01	6,14	228,6%	20,72	14,57	126,7	23,4	100,6%	81,6%	82,0%
145,00	3,40	0,01	6,27	221,5%	20,71	14,43	127,0	23,4	100,5%	81,8%	82,2%
146,00	3,35	0,01	5,91	241,4%	20,73	14,81	127,3	23,6	100,6%	81,1%	81,6%
147,00	3,34	0,01	5,66	256,1%	20,74	15,07	127,0	23,5	100,6%	80,7%	81,2%
148,00	3,35	0,01	6,11	230,2%	20,72	14,60	126,9	23,5	100,6%	81,5%	82,0%
149,00	3,30	0,01	5,83	246,1%	20,73	14,90	127,1	23,4	100,6%	81,0%	81,4%
150,00	3,30	0,02	4,09	391,3%	20,79	16,69	126,0	23,5	100,7%	76,6%	77,1%
151,00	3,26	0,03	4,54	342,1%	20,78	16,22	125,7	23,5	100,5%	78,1%	78,5%
152,00	3,26	0,01	6,24	223,5%	20,72	14,47	126,3	23,5	100,6%	81,8%	82,3%
153,00	3,22	0,01	5,88	243,1%	20,73	14,84	126,3	23,5	100,5%	81,2%	81,6%
154,00	3,21	0,01	5,80	248,2%	20,73	14,93	126,4	23,5	100,6%	81,0%	81,5%
155,00	3,21	0,01	5,72	253,2%	20,73	15,02	126,0	23,6	100,6%	80,9%	81,4%
156,00	3,17	0,01	5,37	275,6%	20,75	15,37	125,9	23,7	100,6%	80,2%	80,7%
157,00	3,14	0,03	4,65	332,6%	20,77	16,11	125,6	23,6	100,5%	78,5%	78,9%
158,00	3,12	0,02	4,63	334,1%	20,77	16,13	125,5	23,6	100,6%	78,5%	78,9%
159,00	3,08	0,01	5,93	240,4%	20,73	14,79	125,6	23,7	100,6%	81,4%	81,8%
160,00	3,08	0,01	6,12	229,6%	20,72	14,59	125,7	23,5	100,6%	81,7%	82,1%
161,00	3,08	0,01	6,06	233,3%	20,72	14,66	125,8	23,6	100,6%	81,6%	82,0%
162,00	3,04	0,00	6,90	192,8%	20,69	13,79	126,2	23,7	100,5%	82,8%	83,2%
163,00	2,98	0,01	5,14	292,4%	20,75	15,61	126,1	23,6	100,7%	79,7%	80,2%
164,00	2,98	0,05	4,74	321,9%	20,77	16,00	125,7	23,7	100,1%	78,7%	78,8%
165,00	2,99	0,01	6,65	203,4%	20,70	14,04	126,0	23,7	100,5%	82,4%	82,9%
166,00	2,94	0,01	5,29	281,4%	20,75	15,46	126,1	23,6	100,6%	80,0%	80,5%
167,00	2,89	0,01	5,55	263,5%	20,74	15,18	126,1	23,6	100,6%	80,6%	81,1%
168,00	2,89	0,01	5,94	239,6%	20,73	14,78	126,5	23,5	100,6%	81,3%	81,8%
169,00	2,85	0,01	5,79	248,4%	20,73	14,93	126,4	23,5	100,6%	81,0%	81,5%
170,00	2,85	0,01	5,06	299,0%	20,76	15,70	126,3	23,5	100,7%	79,5%	80,0%
171,00	2,81	0,01	5,65	257,3%	20,74	15,08	126,4	23,7	100,6%	80,8%	81,3%
172,00	2,81	0,01	4,88	313,6%	20,76	15,88	126,2	23,7	100,7%	79,0%	79,6%
173,00	2,77	0,01	6,01	235,5%	20,72	14,70	134,2	23,7	100,5%	80,6%	81,0%
174,00	2,77	0,06	3,31	501,0%	20,82	17,48	128,5	23,5	100,1%	72,6%	72,6%
175,00	2,76	0,03	4,99	302,9%	20,76	15,76	127,3	23,7	100,4%	79,2%	79,5%
176,00	2,72	0,01	5,73	251,8%	20,73	14,99	127,1	23,7	100,5%	80,8%	81,3%
177,00	2,72	0,01	6,23	224,3%	20,72	14,49	127,8	23,6	100,6%	81,6%	82,1%
178,00	2,72	0,01	6,00	236,7%	20,72	14,73	127,4	23,7	100,6%	81,3%	81,8%
179,00	2,68	0,02	5,11	294,4%	20,76	15,64	127,0	23,6	100,6%	79,5%	80,0%
180,00	2,68	0,02	5,37	275,3%	20,75	15,37	127,0	23,7	100,6%	80,1%	80,6%
181,00	2,62	0,00	6,65	203,6%	20,70	14,05	126,5	23,5	100,6%	82,4%	82,8%
182,00	2,58	0,00	6,53	209,4%	20,71	14,17	121,7	23,3	100,6%	82,7%	83,1%
183,00	2,58	0,01	5,37	275,7%	20,75	15,37	119,8	23,7	100,6%	81,0%	81,5%
184,00	2,58	0,03	4,34	362,3%	20,78	16,43	118,1	23,7	100,4%	78,7%	79,0%
185,00	2,58	0,02	5,11	294,3%	20,76	15,64	116,9	23,7	100,6%	80,8%	81,3%
186,00	2,54	0,02	4,65	332,3%	20,77	16,11	115,5	23,7	100,6%	79,9%	80,4%
187,00	2,54	0,02	5,22	285,8%	20,75	15,52	114,7	23,6	100,6%	81,3%	81,8%
188,00	2,49	0,03	4,63	333,9%	20,77	16,13	113,5	23,6	100,5%	80,1%	80,6%
189,00	2,49	0,03	4,19	379,6%	20,79	16,59	112,3	23,7	100,6%	79,1%	79,6%
190,00	2,49	0,03	3,73	437,2%	20,80	17,06	111,3	23,7	100,6%	77,7%	78,1%
191,00	2,49	0,03	4,85	314,6%	20,76	15,90	110,4	23,5	100,5%	81,1%	81,5%
192,00	2,45	0,05	3,23	516,7%	20,82	17,57	109,4	23,6	100,2%	75,9%	76,1%
193,00	2,45	0,02	5,28	280,8%	20,75	15,45	108,9	23,7	100,5%	82,2%	82,5%
194,00	2,44	0,02	4,79	319,9%	20,77	15,96	107,8	23,7	100,6%	81,3%	81,8%
195,00	2,40	0,02	5,27	282,2%	20,75	15,47	107,4	23,6	100,6%	82,3%	82,8%
196,00	2,40	0,01	4,96	306,4%	20,76	15,79	106,6	23,5	100,7%	81,8%	82,4%
197,00	2,40	0,01	5,58	261,2%	20,74	15,15	106,3	23,6	100,6%	83,0%	83,5%
198,00	2,36	0,02	4,44	352,8%	20,78	16,33	105,9	23,4	100,6%	80,7%	81,2%
199,00	2,36	0,01	4,99	303,6%	20,76	15,76	105,2	23,5	100,7%	82,1%	82,6%
200,00	2,36	0,04	4,00	400,5%	20,79	16,78	104,7	23,3	100,4%	79,6%	79,9%
201,00	2,35	0,02	4,55	342,1%	20,78	16,21	104,1	23,7	100,7%	81,3%	81,8%
202,00	2,31	0,03	3,39	490,5%	20,82	17,41	103,6	23,7	100,6%	77,7%	78,2%
203,00	2,31	0,05	3,27	509,1%	20,82	17,53	102,9	23,5	100,2%	77,3%	77,4%
204,00	2,32	0,04	3,59	457,4%	20,81	17,20	102,3	23,6	100,4%	78,7%	79,1%
205,00	2,26	0,02	4,91	309,8%	20,76	15,84	102,1	23,4	100,6%	82,3%	82,8%
206,00	2,26	0,01	5,08	297,3%	20,76	15,67	102,0	23,6	100,7%	82,6%	83,2%

207,00	2,26	0,02	4,65	333,0%	20,77	16,11	101,6	23,7	100,7%	81,8%	82,4%
208,00	2,22	0,02	4,21	377,2%	20,79	16,56	101,1	23,6	100,7%	80,9%	81,4%
209,00	2,22	0,02	4,75	324,2%	20,77	16,01	100,7	23,8	100,6%	82,2%	82,7%
210,00	2,22	0,03	3,64	449,9%	20,81	17,15	100,3	23,7	100,6%	79,3%	79,7%
211,00	2,22	0,02	4,83	317,2%	20,77	15,93	100,2	23,7	100,7%	82,4%	82,9%
212,00	2,18	0,02	4,60	337,3%	20,77	16,16	99,9	23,6	100,7%	82,0%	82,5%
213,00	2,17	0,04	4,28	368,1%	20,78	16,49	99,7	23,5	100,3%	81,2%	81,5%
214,00	2,13	0,02	4,90	310,7%	20,76	15,85	99,5	23,6	100,6%	82,6%	83,1%
215,00	2,17	0,04	4,18	379,4%	20,79	16,59	99,3	23,5	100,4%	81,0%	81,3%
216,00	2,13	0,04	3,66	445,5%	20,81	17,12	99,0	23,6	100,4%	79,6%	79,9%
217,00	2,13	0,01	5,32	279,0%	20,75	15,42	99,1	23,3	100,6%	83,4%	83,9%
218,00	2,09	0,01	5,86	244,4%	20,73	14,86	98,9	23,5	100,6%	84,2%	84,8%
219,00	2,08	0,02	4,85	315,4%	20,76	15,91	98,9	23,5	100,7%	82,6%	83,1%
220,00	2,08	0,03	4,17	381,6%	20,79	16,61	98,6	23,4	100,6%	81,1%	81,6%
221,00	2,04	0,02	5,11	294,5%	20,76	15,64	98,3	23,6	100,6%	83,2%	83,7%
222,00	2,04	0,02	4,71	327,7%	20,77	16,05	98,5	23,5	100,6%	82,4%	82,9%
223,00	2,00	0,02	4,75	323,7%	20,77	16,01	98,1	23,4	100,5%	82,5%	82,9%
224,00	2,00	0,04	3,58	457,4%	20,81	17,20	97,8	23,4	100,4%	79,5%	79,8%
225,00	1,99	0,06	3,10	540,8%	20,83	17,70	97,4	23,7	100,1%	77,7%	77,8%
226,00	2,00	0,04	3,69	441,6%	20,81	17,09	97,1	23,6	100,4%	80,0%	80,3%
227,00	1,94	0,02	5,06	298,3%	20,76	15,69	97,6	23,7	100,6%	83,2%	83,7%
228,00	1,94	0,01	6,11	230,3%	20,72	14,60	97,8	23,7	100,6%	84,7%	85,2%
229,00	1,94	0,03	3,92	411,4%	20,80	16,86	97,4	23,5	100,5%	80,6%	81,0%
230,00	1,90	0,03	4,99	302,8%	20,76	15,75	97,2	23,6	100,5%	83,1%	83,5%
231,00	1,90	0,02	3,88	417,4%	20,80	16,91	96,9	23,5	100,7%	80,6%	81,2%
232,00	1,90	0,01	6,12	230,1%	20,72	14,60	97,2	23,8	100,6%	84,8%	85,2%
233,00	1,85	0,03	3,57	461,1%	20,81	17,22	96,9	23,7	100,6%	79,6%	80,1%
234,00	1,85	0,03	3,93	410,9%	20,80	16,85	102,1	23,6	100,7%	79,9%	80,4%
235,00	1,86	0,06	3,29	502,6%	20,82	17,50	99,3	23,4	99,9%	78,1%	78,0%
236,00	1,81	0,02	4,54	342,7%	20,78	16,22	98,4	23,1	100,6%	82,0%	82,5%
237,00	1,83	0,02	4,78	321,4%	20,77	15,98	97,8	23,4	100,7%	82,6%	83,1%
238,00	1,81	0,05	3,39	487,1%	20,82	17,40	97,0	23,3	100,2%	78,9%	79,1%
239,00	1,81	0,01	5,85	245,0%	20,73	14,88	97,3	23,4	100,5%	84,4%	84,8%
240,00	1,77	0,01	5,37	275,9%	20,75	15,37	97,2	23,2	100,7%	83,7%	84,2%
241,00	1,76	0,03	4,23	375,0%	20,79	16,55	96,7	23,3	100,6%	81,5%	82,0%
242,00	1,76	0,04	3,67	444,3%	20,81	17,11	96,3	23,5	100,3%	80,1%	80,3%
243,00	1,73	0,02	4,93	308,2%	20,76	15,82	96,6	23,4	100,6%	83,0%	83,6%
244,00	1,72	0,01	4,70	329,3%	20,77	16,07	96,1	23,6	100,8%	82,7%	83,3%
245,00	1,72	0,03	3,56	462,1%	20,81	17,23	95,7	23,4	100,6%	79,8%	80,3%
246,00	1,72	0,03	3,72	438,7%	20,81	17,07	95,3	23,3	100,6%	80,3%	80,8%
247,00	1,73	0,04	3,56	461,3%	20,81	17,23	95,2	23,2	100,5%	79,8%	80,2%
248,00	1,68	0,01	4,88	313,4%	20,76	15,88	95,1	23,4	100,7%	83,1%	83,8%
249,00	1,68	0,02	4,03	398,7%	20,79	16,75	94,9	23,3	100,8%	81,3%	81,9%
250,00	1,68	0,01	5,19	289,0%	20,75	15,56	94,7	23,4	100,7%	83,7%	84,3%
251,00	1,63	0,02	4,23	374,9%	20,79	16,54	94,8	23,4	100,7%	81,8%	82,4%
252,00	1,63	0,01	5,20	287,6%	20,75	15,54	94,6	23,4	100,7%	83,8%	84,4%
253,00	1,63	0,03	4,55	341,1%	20,78	16,21	94,5	23,4	100,4%	82,6%	82,9%
254,00	1,58	0,03	4,52	344,5%	20,78	16,24	94,5	23,3	100,5%	82,5%	82,9%
255,00	1,58	0,02	4,39	358,3%	20,78	16,38	94,4	23,3	100,7%	82,3%	82,8%
256,00	1,58	0,04	3,47	475,8%	20,81	17,32	94,0	23,4	100,5%	79,8%	80,2%
257,00	1,58	0,06	3,64	445,4%	20,81	17,13	94,1	23,4	99,9%	80,3%	80,2%
258,00	1,54	0,03	4,02	399,5%	20,79	16,76	94,2	23,5	100,7%	81,4%	82,0%
259,00	1,54	0,02	4,26	372,1%	20,79	16,52	94,2	23,5	100,7%	82,0%	82,5%
260,00	1,54	0,04	3,83	422,5%	20,80	16,95	94,1	23,6	100,4%	80,9%	81,2%
261,00	1,54	0,03	4,25	372,2%	20,79	16,52	93,7	23,6	100,6%	82,1%	82,6%
262,00	1,49	0,02	4,13	386,0%	20,79	16,64	93,8	23,6	100,6%	81,8%	82,3%
263,00	1,49	0,01	5,53	264,9%	20,74	15,20	94,2	23,6	100,7%	84,3%	84,9%
264,00	1,49	0,02	4,85	315,5%	20,77	15,91	93,8	23,7	100,7%	83,3%	83,9%
265,00	1,45	0,03	4,53	342,9%	20,78	16,23	94,1	23,6	100,4%	82,6%	83,0%
266,00	1,45	0,01	5,26	283,6%	20,75	15,49	94,0	23,7	100,7%	84,0%	84,5%
267,00	1,40	0,01	4,57	341,1%	20,78	16,20	93,9	23,7	100,8%	82,8%	83,4%
268,00	1,41	0,02	4,81	318,9%	20,77	15,95	93,7	23,7	100,6%	83,2%	83,8%
269,00	1,41	0,02	3,99	404,4%	20,80	16,80	93,5	23,8	100,8%	81,5%	82,1%
270,00	1,36	0,02	4,33	364,8%	20,78	16,45	93,6	23,7	100,6%	82,3%	82,8%
271,00	1,36	0,01	5,43	271,2%	20,74	15,31	93,9	23,7	100,6%	84,2%	84,8%
272,00	1,36	0,01	5,65	257,3%	20,74	15,08	94,1	23,7	100,6%	84,5%	85,0%
273,00	1,32	0,01	4,60	338,2%	20,77	16,17	93,8	23,7	100,8%	82,8%	83,5%
274,00	1,27	0,01	5,22	286,0%	20,75	15,52	94,2	23,7	100,6%	83,9%	84,4%
275,00	1,31	0,00	6,77	198,4%	20,70	13,93	94,5	23,7	100,6%	85,7%	86,2%
276,00	1,27	0,01	5,60	260,4%	20,74	15,13	94,5	23,7	100,7%	84,4%	84,9%
277,00	1,27	0,01	5,66	256,5%	20,74	15,07	94,7	23,7	100,7%	84,5%	85,0%
278,00	1,22	0,01	5,11	295,1%	20,76	15,64	94,9	23,8	100,7%	83,6%	84,2%
279,00	1,22	0,01	4,73	326,1%	20,77	16,03	94,8	23,8	100,8%	83,0%	83,6%
280,00	1,20	0,01	5,83	246,1%	20,73	14,89	94,9	23,8	100,6%	84,7%	85,2%
281,00	1,18	0,01	5,38	274,8%	20,75	15,36	95,2	23,8	100,7%	84,0%	84,6%
282,00	1,13	0,01	5,50	266,9%	20,74	15,24	95,4	23,8	100,7%	84,2%	84,8%
283,00	1,13	0,01	5,39	274,2%	20,75	15,35	95,6	23,9	100,6%	84,0%	84,5%
284,00	1,13	0,02	4,34	363,7%	20,78	16,44	95,4	23,8	100,7%	82,1%	82,6%
285,00	1,13	0,03	3,98	403,9%	20,80	16,80	95,2	23,8	100,5%	81,2%	81,6%
286,00	1,13	0,02	4,61	335,8%	20,77	16,15	95,2	23,8	100,6%	82,7%	83,1%
287,00	1,09	0,01	5,53	264,7%	20,74	15,20	95,3	23,7	100,6%	84,2%	84,8%
288,00	1,08	0,02	4,36	362,3%	20,78	16,42	95,1	23,7	100,8%	82,1%	82,8%
289,00	1,04	0,02	1,05	1787,1%	20,90	19,84	95,2	23,7	103,6%	51,8%	53,6%
290,00	1,04	0,02	4,85	315,5%	20,77	15,91	94,9	23,8	100,7%	83,2%	83,7%
291,00	1,04	0,02	4,26	371,6%	20,79	16,51	95,0	23,9	100,7%	82,0%	82,5%
292,00	1,04	0,01	5,01	302,7%	20,76	15,74	95,0	23,9	100,8%	83,5%	84,1%
293,00	1,00	0,01	5,88	243,2%	20,73	14,84	95,1	23,9	100,6%	84,7%	85,2%
294,00	1,00	0,05	3,74	434,1%	20,80	17,04	102,4	24,0	100,3%	79,3%	79,5%
295,00	0,97	0,02	5,94	239,1%	20,73	14,77	98,9	24,0	100,5%	84,4%	84,8%
296,00	0,95	0,01	5,13	293,0%	20,76	15,62	97,6	24,0	100,7%	83,3%	83,9%
297,00	0,96	0,03	4,76	321,9%	20,77	15,99	97,1	23,9	100,4%	82,7%	83,1%
298,00	0,91	0,03	4,56	340,9%	20,78	16,20	96,9	24,0	100,5%	82,4%	82,8%
299,00	0,91	0,01	4,90	311,5%	20,76	15,86	96,5	23,9	100,7%	83,1%	83,6%
300,00	0,91	0,02	5,14	291,8%	20,75	15,60	96,5	24,0	100,6%	83,5%	84,0%
301,00	0,91	0,01	5,87	244,0%	20,73	14,86	96,5	23,9	100,6%	84,5%	85,0%
302,00	0,91	0,02	3,87	419,2%	20,80	16,92	95,8	24,0	100,8%	80,8%	81,5%
303,00	0,85	0,04	3,80	425,9%	20,80	16,98	95,6	23,9	100,3%	80,6%	80,9%
304,00	0,86	0,03	3,75	434,5%	20,80	17,04	95,0	24,0	100,6%	80,6%	81,1%
305,00	0,86	0,02	5,04	299,3%	20,76	15,71	95,2	23,8	100,5%	83,5%	83,9%
306,00	0,81	0,03	3,47	477,4%	20,81	17,33	94,4	24,0	100,7%	79,8%	80,4%
307,00	0,81	0,03	3,96	406,2%	20,80	16,82	94,3	24,0	100,6%	81,3%	81,8%
308,00	0,81	0,02	4,13	387,7%	20,79	16,66	94,2	24,1	100,8%	81,8%	82,4%
309,00	0,81	0,01	4,88	313,1%	20,76	15,88	94,6	24,0	100,7%	83,3%	83,9%
310,00	0,77	0,01	4,70	328,9%	20,77	16,07	94,8	24,0	100,7%	82,9%	83,5%
311,00	0,77	0,01	6,38	216,5%	20,71	14,33	94,9	24,1	100,5%	85,3%	85,8%
312,00	0,77	0,03	3,77	431,7%	20,80	17,02	94,4	24,1	100,5%	80,8%	81,2%
313,00	0,72	0,02	4,36	361,8%	20,78	16,42	94,7	23,9	100,7%	82,2%	82,8%
314,00	0,73	0,02	4,71	327,4%	20,77	16,05	94,8	24,0	100,7%	83,0%	83,5%
315,00	0,68	0,01	5,12	293,7%	20,76	15,63	94,9	24,0	100,7%	83,7%	84,2%
316,00	0,68	0,03	4,89	311,0%	20,76	15,86	94,7	23,9	100,5%	83,3%	83,7%
317,00	0,67	0,01	5,84	245,1%	20,73	14,88	94,5	24,1	100,6%	84,7%	85,2%
318,00	0,65	0,03	3,97	405,3%	20,80	16,81	94,3	24,1	100,7%	81,4%	81,9%
319,00	0,64	0,01	5,49	267,3%	20,74	15,25	94,6	24,0	100,6%	84,2%	84,7%
320,00	0,63	0,01	4,52	346,7%	20,78	16,26	94,1	24,2	100,9%	82,7%	83,4%

321,00	0,60	0,02	4,49	348,2%	20,78	16,28	94,1	24,1	100,7%	82,6%	83,2%
322,00	0,59	0,01	5,53	264,8%	20,74	15,20	94,3	24,1	100,7%	84,4%	85,0%
323,00	0,59	0,00	6,42	214,6%	20,71	14,29	94,9	24,1	100,6%	85,4%	85,9%
324,00	0,55	0,01	4,39	359,3%	20,78	16,39	94,6	24,1	100,8%	82,3%	83,0%
325,00	0,55	0,01	4,87	313,9%	20,76	15,89	94,5	24,1	100,7%	83,3%	83,9%
326,00	0,55	0,01	4,39	360,1%	20,78	16,39	94,2	24,1	100,9%	82,4%	83,1%
327,00	0,55	0,02	4,33	364,8%	20,78	16,44	94,1	24,0	100,8%	82,3%	82,9%
328,00	0,49	0,01	4,62	336,2%	20,77	16,15	94,3	24,1	100,7%	82,9%	83,5%
329,00	0,50	0,01	6,22	224,5%	20,72	14,49	94,6	24,2	100,6%	85,2%	85,7%
330,00	0,50	0,01	5,58	261,5%	20,74	15,15	94,8	24,1	100,7%	84,4%	84,9%
331,00	0,45	0,01	5,01	302,4%	20,76	15,74	94,9	24,2	100,7%	83,5%	84,1%
332,00	0,45	0,01	5,50	267,1%	20,74	15,24	95,0	24,2	100,7%	84,2%	84,8%
333,00	0,41	0,01	5,17	289,8%	20,75	15,57	95,0	24,1	100,7%	83,8%	84,3%
334,00	0,40	0,01	6,16	228,0%	20,72	14,56	95,0	24,1	100,6%	85,1%	85,6%
335,00	0,41	0,01	5,65	257,2%	20,74	15,08	94,9	24,2	100,6%	84,5%	85,0%
336,00	0,36	0,01	5,14	292,8%	20,75	15,61	94,7	24,2	100,8%	83,7%	84,4%
337,00	0,36	0,03	4,41	355,4%	20,78	16,35	94,6	24,2	100,5%	82,4%	82,8%
338,00	0,36	0,03	4,11	388,5%	20,79	16,67	94,5	24,2	100,6%	81,7%	82,2%
339,00	0,32	0,01	4,74	325,0%	20,77	16,02	94,5	24,3	100,8%	83,1%	83,7%
340,00	0,32	0,01	6,14	228,8%	20,72	14,57	94,8	24,0	100,6%	85,1%	85,6%
341,00	0,32	0,01	4,78	322,1%	20,77	15,98	94,7	24,2	100,9%	83,1%	83,8%
342,00	0,28	0,02	4,40	356,8%	20,78	16,37	94,7	24,2	100,7%	82,4%	82,9%
343,00	0,28	0,01	6,24	223,2%	20,72	14,47	94,9	24,2	100,5%	85,2%	85,6%
344,00	0,27	0,02	4,59	339,1%	20,77	16,18	94,8	24,4	100,7%	82,8%	83,3%
345,00	0,27	0,01	5,21	287,1%	20,75	15,54	94,8	24,3	100,7%	83,9%	84,4%
346,00	0,23	0,02	4,11	389,2%	20,79	16,67	94,9	24,4	100,7%	81,7%	82,2%
347,00	0,23	0,03	4,95	306,5%	20,76	15,80	94,8	24,4	100,5%	83,4%	83,8%
348,00	0,23	0,01	4,98	305,0%	20,76	15,77	95,0	24,2	100,8%	83,5%	84,1%
349,00	0,18	0,01	5,42	272,2%	20,74	15,32	95,2	24,3	100,7%	84,1%	84,7%
350,00	0,18	0,01	4,64	334,4%	20,77	16,13	95,2	24,2	100,7%	82,8%	83,4%
351,00	0,13	0,02	4,27	371,0%	20,79	16,50	95,0	24,3	100,8%	82,0%	82,7%
352,00	0,13	0,01	5,47	269,0%	20,74	15,27	95,2	24,3	100,7%	84,2%	84,8%
353,00	0,13	0,01	5,58	261,1%	20,74	15,15	95,1	24,2	100,6%	84,4%	84,8%
354,00	0,13	0,01	5,37	275,8%	20,75	15,37	100,7	24,4	100,7%	83,4%	83,9%
355,00	0,09	0,01	4,10	391,0%	20,79	16,68	99,5	24,3	100,9%	80,9%	81,6%
356,00	0,09	0,02	4,06	394,9%	20,79	16,72	97,4	24,3	100,8%	81,2%	81,8%
357,00	0,09	0,01	5,35	277,1%	20,75	15,39	96,9	24,5	100,7%	83,8%	84,4%
358,00	0,05	0,02	4,39	358,7%	20,78	16,38	96,6	24,4	100,7%	82,1%	82,7%
359,00	0,05	0,01	6,23	224,4%	20,72	14,49	96,7	24,4	100,6%	85,0%	#DIV/0!
360,00	0,05	0,01	4,90	311,8%	20,76	15,86	96,6	24,4	100,7%	83,1%	83,7%
361,00	0,00	0,02	4,77	321,6%	20,77	15,98	96,3	24,4	100,6%	82,9%	83,4%

Manufacturer: ravelli
Model: RV 120

Run: 1
Project #: pi 20145
Test Duration: 61 min

Note: In the "Input data", "Calc. % O_2", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a]. [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses

	HHV	LHV
Eff	77,41%	82,76%
Comb Eff	99,50%	99,50%
HT Eff	77,80%	83,17%
Output	38 776	kJ/h
Burn Rate	2,47	kg/h
Grams CO	1	g
Input	50 090	kJ/h
MC wet	5,76	

Ultimate CO_2
$CO_{2\text{-ult}}$ 20,21
F_0
1,032

Overall Heating Efficiency: 77,41%
Combustion Efficiency: 99,50%
Heat Transfer Efficiency: 77,80%

Heat Output: 36 783 Btu/h
Heat Input: 47 516 Btu/h
Burn Duration: 1,02 h
Burn Rate: 5,44 lb/h
Stack Temp: 413,7 Deg. F

Averages	0,00	8,95	1,28	20,62	11,66	212,03	23,63	100,4%	78,0%	78,3%
INPUT DATA			Oxygen Calculation			Input Data		Combust	Heat	Net
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO_2 [d]	Excess Air EA	Total O_2	Calc. % O_2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %
0,00	2,66	0,00	9,13	121,5%	20,61	11,48	209,7	23,0	100,4%	78,5%	78,8%
1,00	2,62	0,00	8,49	138,1%	20,63	12,15	209,5	22,9	100,4%	77,6%	77,9%
2,00	2,58	0,00	7,40	173,1%	20,67	13,27	209,2	23,0	100,5%	75,7%	76,0%
3,00	2,53	0,00	8,74	131,3%	20,63	11,89	209,8	23,1	100,4%	78,0%	78,3%
4,00	2,53	0,00	9,74	107,5%	20,59	10,85	210,4	23,1	100,3%	79,3%	79,5%
5,00	2,49	0,00	9,16	120,6%	20,61	11,45	210,9	23,2	100,4%	78,5%	78,8%
6,00	2,40	0,00	10,75	88,1%	20,55	9,81	211,5	23,2	100,3%	80,3%	80,5%
7,00	2,40	0,00	8,09	149,9%	20,65	12,56	211,4	23,2	100,4%	76,8%	77,1%
8,00	2,30	0,00	8,80	129,7%	20,62	11,82	211,7	23,1	100,4%	77,9%	78,2%
9,00	2,30	0,00	7,92	155,0%	20,65	12,73	211,4	23,2	100,5%	76,5%	76,8%
10,00	2,21	0,00	9,64	109,7%	20,59	10,95	211,7	23,3	100,3%	79,1%	79,3%
11,00	2,17	0,00	9,21	119,4%	20,61	11,40	211,7	23,3	100,3%	78,5%	78,8%
12,00	2,13	0,00	7,81	158,8%	20,66	12,85	211,0	23,3	100,5%	76,3%	76,7%
13,00	2,08	0,00	9,66	109,3%	20,59	10,94	211,2	23,3	100,3%	79,1%	79,4%
14,00	2,08	0,00	9,71	108,3%	20,59	10,89	211,5	23,4	100,3%	79,2%	79,4%
15,00	2,04	0,00	8,02	151,9%	20,65	12,63	211,5	23,4	100,4%	76,7%	77,0%
16,00	1,98	0,00	8,35	141,9%	20,64	12,29	211,0	23,3	100,4%	77,3%	77,6%
17,00	1,94	0,00	10,45	93,4%	20,56	10,11	211,6	23,5	100,3%	80,0%	80,2%
18,00	1,89	0,00	9,47	113,3%	20,60	11,12	212,0	23,5	100,3%	78,9%	79,1%
19,00	1,85	0,00	9,19	119,8%	20,61	11,42	212,3	23,5	100,3%	78,5%	78,7%
20,00	1,81	0,00	8,17	147,4%	20,65	12,48	212,3	23,5	100,4%	76,9%	77,2%
21,00	1,77	0,00	9,66	109,3%	20,59	10,94	212,6	23,5	100,3%	79,0%	79,3%
22,00	1,72	0,00	9,39	115,2%	20,60	11,21	212,9	23,6	100,3%	78,7%	79,0%
23,00	1,67	0,00	9,72	107,8%	20,59	10,87	212,6	23,6	100,3%	79,1%	79,4%
24,00	1,62	0,00	9,51	112,6%	20,60	11,09	213,1	23,5	100,3%	78,8%	79,1%
25,00	1,58	0,00	9,03	123,8%	20,62	11,59	213,5	23,6	100,4%	78,1%	78,4%
26,00	1,53	0,00	9,19	119,8%	20,61	11,42	213,0	23,6	100,3%	78,4%	78,7%
27,00	1,44	0,00	9,92	103,8%	20,58	10,66	213,5	23,7	100,3%	79,3%	79,6%
28,00	1,44	0,00	9,50	112,7%	20,60	11,09	213,1	23,7	100,3%	78,8%	79,1%
29,00	1,40	0,00	8,80	129,7%	20,62	11,82	212,9	23,7	100,4%	77,9%	78,2%
30,00	1,36	0,00	10,88	85,7%	20,55	9,66	213,7	23,8	100,2%	80,3%	80,5%
31,00	1,30	0,00	9,41	114,8%	20,60	11,19	213,7	23,6	100,3%	78,7%	78,9%
32,00	1,26	0,00	7,49	169,9%	20,67	13,18	212,9	23,7	100,5%	75,6%	75,9%
33,00	1,21	0,00	9,28	117,8%	20,61	11,33	213,2	23,7	100,3%	78,5%	78,8%
34,00	1,17	0,00	9,64	109,7%	20,59	10,95	213,3	23,7	100,3%	79,0%	79,2%
35,00	1,08	0,00	7,36	174,4%	20,68	13,31	213,1	23,8	100,5%	75,3%	75,7%
36,00	1,08	0,00	10,42	94,1%	20,57	10,15	213,6	23,8	100,3%	79,9%	80,1%
37,00	1,04	0,00	8,96	125,5%	20,62	11,66	213,2	23,8	100,4%	78,1%	78,4%
38,00	0,94	0,00	10,07	100,7%	20,58	10,51	213,7	23,8	100,3%	79,5%	79,7%
39,00	0,94	0,00	7,63	164,9%	20,67	13,04	212,8	23,8	100,5%	75,9%	76,2%
40,00	0,85	0,00	8,80	129,7%	20,62	11,83	212,9	23,9	100,4%	77,9%	78,2%
41,00	0,85	0,00	9,62	110,0%	20,59	10,97	213,1	23,8	100,3%	79,0%	79,2%
42,00	0,81	0,00	9,00	124,6%	20,62	11,62	213,2	23,8	100,4%	78,1%	78,4%
43,00	0,76	0,00	9,10	122,2%	20,61	11,52	213,4	23,9	100,3%	78,3%	78,5%
44,00	0,72	0,00	8,78	130,1%	20,62	11,84	213,2	23,9	100,4%	77,8%	78,1%
45,00	0,63	0,00	9,19	119,8%	20,61	11,41	213,4	23,9	100,3%	78,4%	78,7%
46,00	0,63	0,00	8,55	136,3%	20,63	12,08	213,2	23,9	100,4%	77,5%	77,8%
47,00	0,54	0,00	9,84	105,4%	20,59	10,75	214,0	24,0	100,3%	79,2%	79,4%
48,00	0,54	0,01	7,84	157,6%	20,66	12,81	213,1	23,9	100,4%	76,3%	76,6%
49,00	0,50	0,00	9,24	118,6%	20,61	11,36	213,2	24,0	100,3%	78,5%	78,8%
50,00	0,45	0,00	7,84	157,6%	20,66	12,81	211,9	23,9	100,4%	76,4%	76,7%
51,00	0,41	0,00	7,76	160,4%	20,66	12,90	211,4	23,9	100,5%	76,3%	76,6%
52,00	0,36	0,00	8,82	129,0%	20,62	11,80	212,5	24,0	100,3%	78,0%	78,2%
53,00	0,32	0,01	7,16	181,9%	20,68	13,52	211,2	24,0	100,5%	75,1%	75,4%
54,00	0,26	0,00	8,11	149,3%	20,65	12,54	210,7	24,0	100,4%	77,0%	77,3%
55,00	0,27	0,00	9,39	115,3%	20,60	11,21	211,0	23,9	100,3%	78,9%	79,1%
56,00	0,22	0,00	8,37	141,5%	20,64	12,27	209,9	24,0	100,4%	77,5%	77,8%
57,00	0,17	0,01	7,31	176,1%	20,68	13,36	210,0	24,0	100,5%	75,5%	75,8%
58,00	0,13	0,00	9,38	115,5%	20,60	11,23	210,4	24,1	100,3%	78,9%	79,2%
59,00	0,09	0,00	8,91	126,7%	20,62	11,71	209,8	23,9	100,4%	78,3%	78,6%
60,00	0,04	0,00	8,52	137,1%	20,63	12,11	209,8	23,9	100,4%	77,7%	78,0%
61,00	0,00	0,00	9,79	106,5%	20,59	10,80	210,5	23,7	100,3%	79,4%	79,6%

Manufacturer: ravelli
Model: RV 120

Run: 1
Project #: pi 20145
Test Duration: 120 min

Note: In the "Input data", "Calc. % O_2", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a]. [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses

	HHV	LHV
Eff	78,81%	84,25%
Comb Eff	99,50%	99,50%
HT Eff	79,20%	84,67%
Output	19 513	kJ/h
Burn Rate	1,22	kg/h
Grams CO	7	g
Input	24 760	kJ/h
MC wet	5,76	

Ultimate CO_2
$CO_{2\text{-ult}}$ 20,21
F_0
1,029

Overall Heating Efficiency: 78,81%
Combustion Efficiency: 99,50%
Heat Transfer Efficiency: 79,20%

Heat Output: 18 510 Btu/h
Heat Input: 23 488 Btu/h
Burn Duration: 2,00 h
Burn Rate: 2,69 lb/h
Stack Temp: 278,4 Deg. F

Averages	0,01	5,69	2,63	20,73	15,04	137,49	23,44	100,6%	79,3%	79,8%
INPUT DATA			Oxygen Calculation			Input Data		Combust	Heat	Net
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO_2 [d]	Excess Air EA	Total O_2	Calc. % O_2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %
0,00	2,59	0,00	9,79	106,5%	20,59	10,80	210,5	23,7	100,3%	79,4%	79,6%
1,00	2,49	0,00	9,26	118,3%	20,61	11,35	205,8	24,0	100,3%	79,1%	79,4%
2,00	2,49	0,00	8,52	137,3%	20,63	12,12	195,7	24,0	100,4%	78,9%	79,2%
3,00	2,45	0,00	7,56	167,3%	20,67	13,11	188,6	24,1	100,5%	78,0%	78,3%
4,00	2,45	0,01	5,81	246,7%	20,73	14,91	183,2	24,0	100,5%	74,6%	75,0%
5,00	2,40	0,02	5,45	269,8%	20,74	15,29	179,2	23,9	100,5%	74,0%	74,4%
6,00	2,40	0,01	5,76	250,2%	20,73	14,96	175,5	24,0	100,6%	75,4%	75,8%
7,00	2,40	0,02	5,08	296,9%	20,76	15,67	172,0	23,9	100,6%	73,6%	74,1%
8,00	2,36	0,01	7,08	185,1%	20,69	13,60	169,2	24,0	100,5%	78,9%	79,3%
9,00	2,36	0,01	6,01	235,8%	20,72	14,71	166,6	23,9	100,6%	77,0%	77,4%
10,00	2,31	0,01	6,99	189,1%	20,69	13,70	164,6	24,0	100,5%	79,2%	79,6%
11,00	2,31	0,01	5,61	259,7%	20,74	15,12	162,4	23,9	100,7%	76,5%	77,0%
12,00	2,27	0,02	5,12	293,2%	20,76	15,62	160,2	23,7	100,6%	75,3%	75,8%
13,00	2,27	0,01	5,85	245,1%	20,73	14,88	158,3	23,9	100,6%	77,5%	78,0%
14,00	2,27	0,01	5,39	274,3%	20,75	15,35	156,3	23,9	100,6%	76,6%	77,0%
15,00	2,23	0,02	4,82	317,7%	20,77	15,94	154,3	23,8	100,5%	75,1%	75,5%
16,00	2,22	0,01	5,95	239,4%	20,73	14,78	152,6	23,8	100,6%	78,4%	78,8%
17,00	2,18	0,01	5,55	263,4%	20,74	15,18	151,0	23,6	100,6%	77,6%	78,1%
18,00	2,18	0,01	5,98	237,5%	20,72	14,74	149,9	23,6	100,6%	78,7%	79,2%
19,00	2,12	0,00	6,42	214,5%	20,71	14,28	148,9	23,6	100,6%	79,7%	80,2%
20,00	2,13	0,01	5,81	247,3%	20,73	14,91	148,0	23,6	100,6%	78,6%	79,1%
21,00	2,09	0,01	5,68	255,1%	20,74	15,05	146,8	23,5	100,6%	78,4%	78,9%
22,00	2,09	0,03	4,47	349,0%	20,78	16,29	145,5	23,4	100,5%	75,1%	75,5%
23,00	2,08	0,02	4,67	331,1%	20,77	16,09	144,2	23,4	100,7%	75,9%	76,4%
24,00	2,04	0,01	5,98	237,5%	20,72	14,74	143,2	23,5	100,6%	79,5%	79,9%
25,00	2,04	0,01	5,55	263,3%	20,74	15,18	142,5	23,5	100,6%	78,6%	79,1%
26,00	1,99	0,02	5,26	283,4%	20,75	15,49	142,0	23,5	100,6%	78,0%	78,4%
27,00	2,00	0,01	5,42	272,2%	20,74	15,32	141,0	23,4	100,6%	78,5%	79,0%
28,00	1,99	0,02	5,11	294,4%	20,76	15,64	140,4	23,5	100,6%	77,8%	78,2%
29,00	1,95	0,02	5,55	263,2%	20,74	15,18	139,9	23,4	100,5%	78,9%	79,3%
30,00	1,91	0,01	5,32	278,9%	20,75	15,42	139,4	23,4	100,6%	78,4%	78,9%
31,00	1,90	0,01	6,18	226,8%	20,72	14,54	138,5	23,2	100,6%	80,3%	80,8%
32,00	1,90	0,01	6,24	223,4%	20,72	14,47	138,2	23,3	100,6%	80,5%	81,0%
33,00	1,86	0,00	7,76	160,4%	20,66	12,90	138,1	23,3	100,4%	82,7%	83,1%
34,00	1,81	0,01	6,36	217,6%	20,71	14,35	137,6	23,2	100,5%	80,8%	81,2%
35,00	1,82	0,00	6,37	216,9%	20,71	14,33	137,1	23,2	100,6%	80,8%	81,3%
36,00	1,77	0,02	5,12	293,2%	20,76	15,62	136,3	23,0	100,6%	78,3%	78,7%
37,00	1,77	0,01	6,79	197,3%	20,70	13,90	136,3	23,2	100,4%	81,6%	81,9%
38,00	1,72	0,01	5,66	256,3%	20,74	15,07	135,9	23,2	100,6%	79,6%	80,1%
39,00	1,68	0,01	5,76	250,1%	20,73	14,96	135,8	23,1	100,6%	79,8%	80,3%
40,00	1,68	0,01	6,37	216,7%	20,71	14,33	135,5	23,2	100,5%	81,0%	81,4%
41,00	1,67	0,00	6,93	191,4%	20,69	13,76	135,4	23,3	100,5%	81,9%	82,3%
42,00	1,63	0,02	5,30	280,2%	20,75	15,44	134,8	23,1	100,6%	78,9%	79,4%
43,00	1,63	0,04	4,54	342,0%	20,78	16,22	134,2	23,1	100,4%	76,9%	77,1%
44,00	1,59	0,01	4,96	306,4%	20,76	15,80	134,0	23,0	100,7%	78,1%	78,6%
45,00	1,54	0,01	6,18	226,9%	20,72	14,54	133,6	22,9	100,6%	80,8%	81,3%
46,00	1,55	0,01	5,47	269,0%	20,74	15,27	133,2	23,0	100,7%	79,5%	80,0%
47,00	1,54	0,01	6,57	207,3%	20,70	14,13	133,7	22,9	100,5%	81,5%	81,9%
48,00	1,50	0,00	6,31	220,3%	20,71	14,40	133,5	22,6	100,6%	81,0%	81,5%
49,00	1,50	0,01	5,82	246,7%	20,73	14,90	133,2	23,0	100,6%	80,2%	80,8%
50,00	1,50	0,01	5,61	259,4%	20,74	15,12	132,7	23,1	100,6%	79,9%	80,4%
51,00	1,46	0,02	5,29	280,6%	20,75	15,45	132,3	23,1	100,6%	79,2%	79,7%
52,00	1,40	0,02	4,20	378,0%	20,79	16,57	136,2	23,0	100,6%	75,4%	75,8%
53,00	1,40	0,02	4,51	346,4%	20,78	16,26	133,0	23,1	100,7%	76,9%	77,5%
54,00	1,36	0,04	4,54	341,2%	20,78	16,21	132,0	22,7	100,3%	77,2%	77,4%
55,00	1,36	0,01	6,44	213,5%	20,71	14,26	132,0	22,9	100,5%	81,4%	81,9%
56,00	1,33	0,01	5,88	243,3%	20,73	14,84	132,0	22,9	100,6%	80,5%	81,0%
57,00	1,31	0,01	5,49	267,8%	20,74	15,25	131,5	23,1	100,6%	79,7%	80,3%
58,00	1,31	0,01	5,16	290,7%	20,75	15,59	131,3	23,1	100,6%	79,0%	79,5%
59,00	1,27	0,01	5,49	267,4%	20,74	15,25	131,0	23,2	100,6%	79,8%	80,3%
60,00	1,27	0,01	4,70	328,6%	20,77	16,06	130,2	23,3	100,7%	78,0%	78,5%
61,00	1,22	0,01	5,09	295,8%	20,76	15,66	129,7	23,2	100,7%	79,1%	79,6%
62,00	1,22	0,02	5,26	282,7%	20,75	15,48	129,3	23,2	100,5%	79,5%	79,9%
63,00	1,23	0,03	4,64	332,8%	20,77	16,12	129,1	23,2	100,4%	77,9%	78,2%
64,00	1,18	0,02	4,64	333,7%	20,77	16,12	128,8	23,2	100,6%	78,0%	78,4%
65,00	1,18	0,01	5,98	237,5%	20,72	14,74	128,8	23,2	100,6%	81,0%	81,5%
66,00	1,14	0,01	6,19	225,9%	20,72	14,52	128,9	23,2	100,5%	81,4%	81,8%
67,00	1,14	0,03	4,37	359,9%	20,78	16,40	128,1	23,4	100,5%	77,2%	77,6%
68,00	1,08	0,02	5,78	248,3%	20,73	14,94	128,3	23,3	100,4%	80,7%	81,1%
69,00	1,09	0,01	5,90	242,0%	20,73	14,82	128,2	23,3	100,6%	81,0%	81,5%
70,00	1,04	0,02	5,91	240,9%	20,73	14,81	128,4	23,4	100,5%	81,0%	81,4%
71,00	1,03	0,01	5,75	251,0%	20,73	14,98	128,6	23,4	100,6%	80,7%	81,1%
72,00	1,00	0,01	5,01	302,7%	20,76	15,75	128,2	23,4	100,7%	79,1%	79,6%
73,00	1,00	0,02	5,11	294,3%	20,76	15,64	128,2	23,3	100,6%	79,3%	79,8%
74,00	0,95	0,01	5,27	282,8%	20,75	15,47	127,6	23,3	100,7%	79,8%	80,3%
75,00	0,95	0,02	4,42	355,2%	20,78	16,35	127,4	23,4	100,6%	77,5%	78,0%
76,00	0,91	0,02	5,86	243,4%	20,73	14,85	127,7	23,3	100,4%	81,0%	81,3%
77,00	0,91	0,03	4,77	321,5%	20,77	15,98	127,0	23,3	100,5%	78,6%	79,0%
78,00	0,91	0,01	5,52	265,3%	20,74	15,21	126,7	23,4	100,6%	80,4%	80,9%
79,00	0,87	0,02	5,17	289,3%	20,75	15,57	126,6	23,4	100,6%	79,7%	80,1%
80,00	0,86	0,01	5,86	243,9%	20,73	14,86	126,8	23,4	100,5%	81,1%	81,5%
81,00	0,82	0,01	5,86	244,3%	20,73	14,86	126,7	23,4	100,6%	81,1%	81,6%
82,00	0,82	0,02	5,03	300,4%	20,76	15,72	126,5	23,5	100,6%	79,4%	79,8%
83,00	0,78	0,01	6,14	228,6%	20,72	14,57	126,7	23,4	100,6%	81,6%	82,0%
84,00	0,77	0,01	6,27	221,5%	20,71	14,43	127,0	23,4	100,5%	81,8%	82,2%
85,00	0,72	0,01	5,91	241,4%	20,73	14,81	127,3	23,6	100,6%	81,1%	81,6%
86,00	0,72	0,01	5,66	256,1%	20,74	15,07	127,0	23,5	100,6%	80,7%	81,2%
87,00	0,72	0,01	6,11	230,2%	20,72	14,60	126,9	23,5	100,6%	81,5%	82,0%
88,00	0,68	0,01	5,83	246,1%	20,73	14,90	127,1	23,4	100,6%	81,0%	81,4%
89,00	0,68	0,02	4,09	391,3%	20,79	16,69	126,0	23,5	100,7%	76,6%	77,1%
90,00	0,63	0,03	4,54	342,1%	20,78	16,22	125,7	23,5	100,5%	78,1%	78,5%
91,00	0,64	0,01	6,24	223,5%	20,72	14,47	126,3	23,5	100,6%	81,8%	82,3%
92,00	0,59	0,01	5,88	243,1%	20,73	14,84	126,3	23,5	100,5%	81,2%	81,6%

93,00	0,59	0,01	5,80	248,2%	20,73	14,93	126,4	23,5	100,6%	81,0%	81,5%
94,00	0,59	0,01	5,72	253,2%	20,73	15,02	126,0	23,6	100,6%	80,9%	81,4%
95,00	0,54	0,01	5,37	275,6%	20,75	15,37	125,9	23,7	100,6%	80,2%	80,7%
96,00	0,52	0,03	4,65	332,6%	20,77	16,11	125,6	23,6	100,5%	78,5%	78,9%
97,00	0,50	0,02	4,63	334,1%	20,77	16,13	125,5	23,6	100,6%	78,5%	78,9%
98,00	0,46	0,01	5,93	240,4%	20,73	14,79	125,6	23,7	100,6%	81,4%	81,8%
99,00	0,45	0,01	6,12	229,6%	20,72	14,59	125,7	23,5	100,6%	81,7%	82,1%
100,00	0,46	0,01	6,06	233,3%	20,72	14,66	125,8	23,6	100,6%	81,6%	82,0%
101,00	0,42	0,00	6,90	192,8%	20,69	13,79	126,2	23,7	100,5%	82,8%	83,2%
102,00	0,36	0,01	5,14	292,4%	20,75	15,61	126,1	23,6	100,7%	79,7%	80,2%
103,00	0,36	0,05	4,74	321,9%	20,77	16,00	125,7	23,7	100,1%	78,7%	78,8%
104,00	0,36	0,01	6,65	203,4%	20,70	14,04	126,0	23,7	100,5%	82,4%	82,9%
105,00	0,31	0,01	5,29	281,4%	20,75	15,46	126,1	23,6	100,6%	80,0%	80,5%
106,00	0,27	0,01	5,55	263,5%	20,74	15,18	126,1	23,6	100,6%	80,6%	81,1%
107,00	0,27	0,01	5,94	239,6%	20,73	14,78	126,5	23,5	100,6%	81,3%	81,8%
108,00	0,23	0,01	5,79	248,4%	20,73	14,93	126,4	23,5	100,6%	81,0%	81,5%
109,00	0,23	0,01	5,06	299,0%	20,76	15,70	126,3	23,5	100,7%	79,5%	80,0%
110,00	0,18	0,01	5,65	257,3%	20,74	15,08	126,4	23,7	100,6%	80,8%	81,3%
111,00	0,18	0,01	4,88	313,6%	20,76	15,88	126,2	23,7	100,7%	79,0%	79,6%
112,00	0,14	0,01	6,01	235,5%	20,72	14,70	134,2	23,7	100,5%	80,6%	81,0%
113,00	0,15	0,06	3,31	501,0%	20,82	17,48	128,5	23,5	100,1%	72,6%	72,6%
114,00	0,14	0,03	4,99	302,9%	20,76	15,76	127,3	23,7	100,4%	79,2%	79,5%
115,00	0,10	0,01	5,73	251,8%	20,73	14,99	127,1	23,7	100,5%	80,8%	81,3%
116,00	0,10	0,01	6,23	224,3%	20,72	14,49	127,8	23,6	100,6%	81,6%	82,1%
117,00	0,10	0,01	6,00	236,7%	20,72	14,73	127,4	23,7	100,6%	81,3%	81,8%
118,00	0,05	0,02	5,11	294,4%	20,76	15,64	127,0	23,6	100,6%	79,5%	80,0%
119,00	0,05	0,02	5,37	275,3%	20,75	15,37	127,0	23,7	100,6%	80,1%	80,6%
120,00	0,00	0,00	6,65	203,6%	20,70	14,05	126,5	23,5	100,6%	82,4%	82,8%

Manufacturer: ravelli
Model: RV 120

Run: 1
Project #: pi 20145
Test Duration: 180 min

Note: In the "Input data", "Calc. % O_2", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a]. [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses

	HHV	LHV
Eff	81,54%	87,17%
Comb Eff	99,50%	99,50%
HT Eff	81,95%	87,61%
Output	13 642	kJ/h
Burn Rate	0,82	kg/h
Grams CO	14	g
Input	16 731	kJ/h
MC wet	5,76	

Ultimate CO_2
$CO_{2\text{-ult}}$ 20,21
F_0
1,028

Overall Heating Efficiency: 81,54%
Combustion Efficiency: 99,50%
Heat Transfer Efficiency: 81,95%

Heat Output: 12 941 Btu/h
Heat Input: 15 871 Btu/h
Burn Duration: 3,00 h
Burn Rate: 1,82 lb/h
Stack Temp: 208,0 Deg. F

Averages	0,02	4,73	3,43	20,77	16,03	97,93	23,79	100,6%	82,1%	#DIV/0!
INPUT DATA			Oxygen Calculation			Input Data		Combust	Heat	Net
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO_2 [d]	Excess Air EA	Total O_2	Calc. % O_2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %
0,00	2,62	0,00	6,65	203,6%	20,70	14,05	126,5	23,5	100,6%	82,4%	82,8%
1,00	2,58	0,00	6,53	209,4%	20,71	14,17	121,7	23,3	100,6%	82,7%	83,1%
2,00	2,58	0,01	5,37	275,7%	20,75	15,37	119,8	23,7	100,6%	81,0%	81,5%
3,00	2,58	0,03	4,34	362,3%	20,78	16,43	118,1	23,7	100,4%	78,7%	79,0%
4,00	2,58	0,02	5,11	294,3%	20,76	15,64	116,9	23,7	100,6%	80,8%	81,3%
5,00	2,54	0,02	4,65	332,3%	20,77	16,11	115,5	23,7	100,6%	79,9%	80,4%
6,00	2,54	0,02	5,22	285,8%	20,75	15,52	114,7	23,6	100,6%	81,3%	81,8%
7,00	2,49	0,03	4,63	333,9%	20,77	16,13	113,5	23,6	100,5%	80,1%	80,6%
8,00	2,49	0,03	4,19	379,6%	20,79	16,59	112,3	23,7	100,6%	79,1%	79,6%
9,00	2,49	0,03	3,73	437,2%	20,80	17,06	111,3	23,7	100,6%	77,7%	78,1%
10,00	2,49	0,03	4,85	314,6%	20,76	15,90	110,4	23,5	100,5%	81,1%	81,5%
11,00	2,45	0,05	3,23	516,7%	20,82	17,57	109,4	23,6	100,2%	75,9%	76,1%
12,00	2,45	0,02	5,28	280,8%	20,75	15,45	108,9	23,7	100,5%	82,2%	82,5%
13,00	2,44	0,02	4,79	319,9%	20,77	15,96	107,8	23,7	100,6%	81,3%	81,8%
14,00	2,40	0,02	5,27	282,2%	20,75	15,47	107,4	23,6	100,6%	82,3%	82,8%
15,00	2,40	0,01	4,96	306,4%	20,76	15,79	106,6	23,5	100,7%	81,8%	82,4%
16,00	2,40	0,01	5,58	261,2%	20,74	15,15	106,3	23,6	100,6%	83,0%	83,5%
17,00	2,36	0,02	4,44	352,8%	20,78	16,33	105,9	23,4	100,6%	80,7%	81,2%
18,00	2,36	0,01	4,99	303,6%	20,76	15,76	105,2	23,5	100,7%	82,1%	82,6%
19,00	2,36	0,04	4,00	400,5%	20,79	16,78	104,7	23,3	100,4%	79,6%	79,9%
20,00	2,35	0,02	4,55	342,1%	20,78	16,21	104,1	23,7	100,7%	81,3%	81,8%
21,00	2,31	0,03	3,39	490,5%	20,82	17,41	103,6	23,7	100,6%	77,7%	78,2%
22,00	2,31	0,05	3,27	509,1%	20,82	17,53	102,9	23,5	100,2%	77,3%	77,4%
23,00	2,32	0,04	3,59	457,4%	20,81	17,20	102,3	23,6	100,4%	78,7%	79,1%
24,00	2,26	0,02	4,91	309,8%	20,76	15,84	102,1	23,4	100,6%	82,3%	82,8%
25,00	2,26	0,01	5,08	297,3%	20,76	15,67	102,0	23,6	100,7%	82,6%	83,2%
26,00	2,26	0,02	4,65	333,0%	20,77	16,11	101,6	23,7	100,7%	81,8%	82,4%
27,00	2,22	0,02	4,21	377,2%	20,79	16,56	101,1	23,6	100,7%	80,9%	81,4%
28,00	2,22	0,02	4,75	324,2%	20,77	16,01	100,7	23,8	100,6%	82,2%	82,7%
29,00	2,22	0,03	3,64	449,9%	20,81	17,15	100,3	23,7	100,6%	79,3%	79,7%
30,00	2,22	0,02	4,83	317,2%	20,77	15,93	100,2	23,7	100,7%	82,4%	82,9%
31,00	2,18	0,02	4,60	337,3%	20,77	16,16	99,9	23,6	100,7%	82,0%	82,5%
32,00	2,17	0,04	4,28	368,1%	20,78	16,49	99,7	23,5	100,3%	81,2%	81,5%
33,00	2,13	0,02	4,90	310,7%	20,76	15,85	99,5	23,6	100,6%	82,6%	83,1%
34,00	2,17	0,04	4,18	379,4%	20,79	16,59	99,3	23,5	100,4%	81,0%	81,3%
35,00	2,13	0,04	3,66	445,5%	20,81	17,12	99,0	23,6	100,4%	79,6%	79,9%
36,00	2,13	0,01	5,32	279,0%	20,75	15,42	99,1	23,3	100,6%	83,4%	83,9%
37,00	2,09	0,01	5,86	244,4%	20,73	14,86	98,9	23,5	100,6%	84,2%	84,8%
38,00	2,08	0,02	4,85	315,4%	20,76	15,91	98,9	23,5	100,7%	82,6%	83,1%
39,00	2,08	0,03	4,17	381,6%	20,79	16,61	98,6	23,4	100,6%	81,1%	81,6%
40,00	2,04	0,02	5,11	294,5%	20,76	15,64	98,3	23,6	100,6%	83,2%	83,7%
41,00	2,04	0,02	4,71	327,7%	20,77	16,05	98,5	23,5	100,6%	82,4%	82,9%
42,00	2,00	0,02	4,75	323,7%	20,77	16,01	98,1	23,4	100,5%	82,5%	82,9%
43,00	2,00	0,04	3,58	457,4%	20,81	17,20	97,8	23,4	100,4%	79,5%	79,8%
44,00	1,99	0,06	3,10	540,8%	20,83	17,70	97,4	23,7	100,1%	77,7%	77,8%
45,00	2,00	0,04	3,69	441,6%	20,81	17,09	97,1	23,6	100,4%	80,0%	80,3%
46,00	1,94	0,02	5,06	298,3%	20,76	15,69	97,6	23,7	100,6%	83,2%	83,7%
47,00	1,94	0,01	6,11	230,3%	20,72	14,60	97,8	23,7	100,6%	84,7%	85,2%
48,00	1,94	0,03	3,92	411,4%	20,80	16,86	97,4	23,5	100,5%	80,6%	81,0%
49,00	1,90	0,03	4,99	302,8%	20,76	15,75	97,2	23,6	100,5%	83,1%	83,5%
50,00	1,90	0,02	3,88	417,4%	20,80	16,91	96,9	23,5	100,7%	80,6%	81,2%
51,00	1,90	0,01	6,12	230,1%	20,72	14,60	97,2	23,8	100,6%	84,8%	85,2%
52,00	1,85	0,03	3,57	461,1%	20,81	17,22	96,9	23,7	100,6%	79,6%	80,1%
53,00	1,85	0,03	3,93	410,9%	20,80	16,85	102,1	23,6	100,7%	79,9%	80,4%
54,00	1,86	0,06	3,29	502,6%	20,82	17,50	99,3	23,4	99,9%	78,1%	78,0%
55,00	1,81	0,02	4,54	342,7%	20,78	16,22	98,4	23,1	100,6%	82,0%	82,5%
56,00	1,83	0,02	4,78	321,4%	20,77	15,98	97,8	23,4	100,7%	82,6%	83,1%
57,00	1,81	0,05	3,39	487,1%	20,82	17,40	97,0	23,3	100,2%	78,9%	79,1%
58,00	1,81	0,01	5,85	245,0%	20,73	14,88	97,3	23,4	100,5%	84,4%	84,8%
59,00	1,77	0,01	5,37	275,9%	20,75	15,37	97,2	23,2	100,7%	83,7%	84,2%
60,00	1,76	0,03	4,23	375,0%	20,79	16,55	96,7	23,3	100,6%	81,5%	82,0%
61,00	1,76	0,04	3,67	444,3%	20,81	17,11	96,3	23,5	100,3%	80,1%	80,3%
62,00	1,73	0,02	4,93	308,2%	20,76	15,82	96,6	23,4	100,6%	83,0%	83,6%
63,00	1,72	0,01	4,70	329,3%	20,77	16,07	96,1	23,6	100,8%	82,7%	83,3%
64,00	1,72	0,03	3,56	462,1%	20,81	17,23	95,7	23,4	100,6%	79,8%	80,3%
65,00	1,72	0,03	3,72	438,7%	20,81	17,07	95,3	23,3	100,6%	80,3%	80,8%
66,00	1,73	0,04	3,56	461,3%	20,81	17,23	95,2	23,2	100,5%	79,8%	80,2%
67,00	1,68	0,01	4,88	313,4%	20,76	15,88	95,1	23,4	100,7%	83,1%	83,8%
68,00	1,68	0,02	4,03	398,7%	20,79	16,75	94,9	23,3	100,8%	81,3%	81,9%
69,00	1,68	0,01	5,19	289,0%	20,75	15,56	94,7	23,4	100,7%	83,7%	84,3%
70,00	1,63	0,02	4,23	374,9%	20,79	16,54	94,8	23,4	100,7%	81,8%	82,4%
71,00	1,63	0,01	5,20	287,6%	20,75	15,54	94,6	23,4	100,7%	83,8%	84,4%
72,00	1,63	0,03	4,55	341,1%	20,78	16,21	94,5	23,4	100,4%	82,6%	82,9%
73,00	1,58	0,03	4,52	344,5%	20,78	16,24	94,5	23,3	100,5%	82,5%	82,9%
74,00	1,58	0,02	4,39	358,3%	20,78	16,38	94,4	23,3	100,7%	82,3%	82,8%
75,00	1,58	0,04	3,47	475,8%	20,81	17,32	94,0	23,4	100,5%	79,8%	80,2%
76,00	1,58	0,06	3,64	445,4%	20,81	17,13	94,1	23,4	99,9%	80,3%	80,2%
77,00	1,54	0,03	4,02	399,5%	20,79	16,76	94,2	23,5	100,7%	81,4%	82,0%
78,00	1,54	0,02	4,26	372,1%	20,79	16,52	94,2	23,5	100,7%	82,0%	82,5%
79,00	1,54	0,04	3,83	422,5%	20,80	16,95	94,1	23,6	100,4%	80,9%	81,2%
80,00	1,54	0,03	4,25	372,2%	20,79	16,52	93,7	23,6	100,6%	82,1%	82,6%
81,00	1,49	0,02	4,13	386,0%	20,79	16,64	93,8	23,6	100,6%	81,8%	82,3%
82,00	1,49	0,01	5,53	264,9%	20,74	15,20	94,2	23,6	100,7%	84,3%	84,9%
83,00	1,49	0,02	4,85	315,5%	20,77	15,91	93,8	23,7	100,7%	83,3%	83,9%
84,00	1,45	0,03	4,53	342,9%	20,78	16,23	94,1	23,6	100,4%	82,6%	83,0%
85,00	1,45	0,01	5,26	283,6%	20,75	15,49	94,0	23,7	100,7%	84,0%	84,5%
86,00	1,40	0,01	4,57	341,1%	20,78	16,20	93,9	23,7	100,8%	82,8%	83,4%
87,00	1,41	0,02	4,81	318,9%	20,77	15,95	93,7	23,7	100,6%	83,2%	83,8%
88,00	1,41	0,02	3,99	404,4%	20,80	16,80	93,5	23,8	100,8%	81,5%	82,1%
89,00	1,36	0,02	4,33	364,8%	20,78	16,45	93,6	23,7	100,6%	82,3%	82,8%
90,00	1,36	0,01	5,43	271,2%	20,74	15,31	93,9	23,7	100,6%	84,2%	84,8%
91,00	1,36	0,01	5,65	257,3%	20,74	15,08	94,1	23,7	100,6%	84,5%	85,0%
92,00	1,32	0,01	4,60	338,2%	20,77	16,17	93,8	23,7	100,8%	82,8%	83,5%

93,00	1,27	0,01	5,22	286,0%	20,75	15,52	94,2	23,7	100,6%	83,9%	84,4%
94,00	1,31	0,00	6,77	198,4%	20,70	13,93	94,5	23,7	100,6%	85,7%	86,2%
95,00	1,27	0,01	5,60	260,4%	20,74	15,13	94,5	23,7	100,7%	84,4%	84,9%
96,00	1,27	0,01	5,66	256,5%	20,74	15,07	94,7	23,7	100,7%	84,5%	85,0%
97,00	1,22	0,01	5,11	295,1%	20,76	15,64	94,9	23,8	100,7%	83,6%	84,2%
98,00	1,22	0,01	4,73	326,1%	20,77	16,03	94,8	23,8	100,8%	83,0%	83,6%
99,00	1,20	0,01	5,83	246,1%	20,73	14,89	94,9	23,8	100,6%	84,7%	85,2%
100,00	1,18	0,01	5,38	274,8%	20,75	15,36	95,2	23,8	100,7%	84,0%	84,6%
101,00	1,13	0,01	5,50	266,9%	20,74	15,24	95,4	23,8	100,7%	84,2%	84,8%
102,00	1,13	0,01	5,39	274,2%	20,75	15,35	95,6	23,9	100,6%	84,0%	84,5%
103,00	1,13	0,02	4,34	363,7%	20,78	16,44	95,4	23,8	100,7%	82,1%	82,6%
104,00	1,13	0,03	3,98	403,9%	20,80	16,80	95,2	23,8	100,5%	81,2%	81,6%
105,00	1,13	0,02	4,61	335,8%	20,77	16,15	95,2	23,8	100,6%	82,7%	83,1%
106,00	1,09	0,01	5,53	264,7%	20,74	15,20	95,3	23,7	100,6%	84,2%	84,8%
107,00	1,08	0,02	4,36	362,3%	20,78	16,42	95,1	23,7	100,8%	82,1%	82,8%
108,00	1,04	0,02	1,05	1787,1%	20,90	19,84	95,2	23,7	103,6%	51,8%	53,6%
109,00	1,04	0,02	4,85	315,5%	20,77	15,91	94,9	23,8	100,7%	83,2%	83,7%
110,00	1,04	0,02	4,26	371,6%	20,79	16,51	95,0	23,9	100,7%	82,0%	82,5%
111,00	1,04	0,01	5,01	302,7%	20,76	15,74	95,0	23,9	100,8%	83,5%	84,1%
112,00	1,00	0,01	5,88	243,2%	20,73	14,84	95,1	23,9	100,6%	84,7%	85,2%
113,00	1,00	0,05	3,74	434,1%	20,80	17,04	102,4	24,0	100,3%	79,3%	79,5%
114,00	0,97	0,02	5,94	239,1%	20,73	14,77	98,9	24,0	100,5%	84,4%	84,8%
115,00	0,95	0,01	5,13	293,0%	20,76	15,62	97,6	24,0	100,7%	83,3%	83,9%
116,00	0,96	0,03	4,76	321,9%	20,77	15,99	97,1	23,9	100,4%	82,7%	83,1%
117,00	0,91	0,03	4,56	340,9%	20,78	16,20	96,9	24,0	100,5%	82,4%	82,8%
118,00	0,91	0,01	4,90	311,5%	20,76	15,86	96,5	23,9	100,7%	83,1%	83,6%
119,00	0,91	0,02	5,14	291,8%	20,75	15,60	96,5	24,0	100,6%	83,5%	84,0%
120,00	0,91	0,01	5,87	244,0%	20,73	14,86	96,5	23,9	100,6%	84,5%	85,0%
121,00	0,91	0,02	3,87	419,2%	20,80	16,92	95,8	24,0	100,8%	80,8%	81,5%
122,00	0,85	0,04	3,80	425,9%	20,80	16,98	95,6	23,9	100,3%	80,6%	80,9%
123,00	0,86	0,03	3,75	434,5%	20,80	17,04	95,0	24,0	100,6%	80,6%	81,1%
124,00	0,86	0,02	5,04	299,3%	20,76	15,71	95,2	23,8	100,5%	83,5%	83,9%
125,00	0,81	0,03	3,47	477,4%	20,81	17,33	94,4	24,0	100,7%	79,8%	80,4%
126,00	0,81	0,03	3,96	406,2%	20,80	16,82	94,3	24,0	100,6%	81,3%	81,8%
127,00	0,81	0,02	4,13	387,7%	20,79	16,66	94,2	24,1	100,8%	81,8%	82,4%
128,00	0,81	0,01	4,88	313,1%	20,76	15,88	94,6	24,0	100,7%	83,3%	83,9%
129,00	0,77	0,01	4,70	328,9%	20,77	16,07	94,8	24,0	100,7%	82,9%	83,5%
130,00	0,77	0,01	6,38	216,5%	20,71	14,33	94,9	24,1	100,5%	85,3%	85,8%
131,00	0,77	0,03	3,77	431,7%	20,80	17,02	94,4	24,1	100,5%	80,8%	81,2%
132,00	0,72	0,02	4,36	361,8%	20,78	16,42	94,7	23,9	100,7%	82,2%	82,8%
133,00	0,73	0,02	4,71	327,4%	20,77	16,05	94,8	24,0	100,7%	83,0%	83,5%
134,00	0,68	0,01	5,12	293,7%	20,76	15,63	94,9	24,0	100,7%	83,7%	84,2%
135,00	0,68	0,03	4,89	311,0%	20,76	15,86	94,7	23,9	100,5%	83,3%	83,7%
136,00	0,67	0,01	5,84	245,1%	20,73	14,88	94,5	24,1	100,6%	84,7%	85,2%
137,00	0,65	0,03	3,97	405,3%	20,80	16,81	94,3	24,1	100,7%	81,4%	81,9%
138,00	0,64	0,01	5,49	267,3%	20,74	15,25	94,6	24,0	100,6%	84,2%	84,7%
139,00	0,63	0,01	4,52	346,7%	20,78	16,26	94,1	24,2	100,9%	82,7%	83,4%
140,00	0,60	0,02	4,49	348,2%	20,78	16,28	94,1	24,1	100,7%	82,6%	83,2%
141,00	0,59	0,01	5,53	264,8%	20,74	15,20	94,3	24,1	100,7%	84,4%	85,0%
142,00	0,59	0,00	6,42	214,6%	20,71	14,29	94,9	24,1	100,6%	85,4%	85,9%
143,00	0,55	0,01	4,39	359,3%	20,78	16,39	94,6	24,1	100,8%	82,3%	83,0%
144,00	0,55	0,01	4,87	313,9%	20,76	15,89	94,5	24,1	100,7%	83,3%	83,9%
145,00	0,55	0,01	4,39	360,1%	20,78	16,39	94,2	24,1	100,9%	82,4%	83,1%
146,00	0,55	0,02	4,33	364,8%	20,78	16,44	94,1	24,0	100,8%	82,3%	82,9%
147,00	0,49	0,01	4,62	336,2%	20,77	16,15	94,3	24,1	100,7%	82,9%	83,5%
148,00	0,50	0,01	6,22	224,5%	20,72	14,49	94,6	24,2	100,6%	85,2%	85,7%
149,00	0,50	0,01	5,58	261,5%	20,74	15,15	94,8	24,1	100,7%	84,4%	84,9%
150,00	0,45	0,01	5,01	302,4%	20,76	15,74	94,9	24,2	100,7%	83,5%	84,1%
151,00	0,45	0,01	5,50	267,1%	20,74	15,24	95,0	24,2	100,7%	84,2%	84,8%
152,00	0,41	0,01	5,17	289,8%	20,75	15,57	95,0	24,1	100,7%	83,8%	84,3%
153,00	0,40	0,01	6,16	228,0%	20,72	14,56	95,0	24,1	100,6%	85,1%	85,6%
154,00	0,41	0,01	5,65	257,2%	20,74	15,08	94,9	24,2	100,6%	84,5%	85,0%
155,00	0,36	0,01	5,14	292,8%	20,75	15,61	94,7	24,2	100,8%	83,7%	84,4%
156,00	0,36	0,03	4,41	355,4%	20,78	16,35	94,6	24,2	100,5%	82,4%	82,8%
157,00	0,36	0,03	4,11	388,5%	20,79	16,67	94,5	24,2	100,6%	81,7%	82,2%
158,00	0,32	0,01	4,74	325,0%	20,77	16,02	94,5	24,3	100,8%	83,1%	83,7%
159,00	0,32	0,01	6,14	228,8%	20,72	14,57	94,8	24,0	100,6%	85,1%	85,6%
160,00	0,32	0,01	4,78	322,1%	20,77	15,98	94,7	24,2	100,9%	83,1%	83,8%
161,00	0,28	0,02	4,40	356,8%	20,78	16,37	94,7	24,2	100,7%	82,4%	82,9%
162,00	0,28	0,01	6,24	223,2%	20,72	14,47	94,9	24,2	100,5%	85,2%	85,6%
163,00	0,27	0,02	4,59	339,1%	20,77	16,18	94,8	24,4	100,7%	82,8%	83,3%
164,00	0,27	0,01	5,21	287,1%	20,75	15,54	94,8	24,3	100,7%	83,9%	84,4%
165,00	0,23	0,02	4,11	389,2%	20,79	16,67	94,9	24,4	100,7%	81,7%	82,2%
166,00	0,23	0,03	4,95	306,5%	20,76	15,80	94,8	24,4	100,5%	83,4%	83,8%
167,00	0,23	0,01	4,98	305,0%	20,76	15,77	95,0	24,2	100,8%	83,5%	84,1%
168,00	0,18	0,01	5,42	272,2%	20,74	15,32	95,2	24,3	100,7%	84,1%	84,7%
169,00	0,18	0,01	4,64	334,4%	20,77	16,13	95,2	24,2	100,7%	82,8%	83,4%
170,00	0,13	0,02	4,27	371,0%	20,79	16,50	95,0	24,3	100,8%	82,0%	82,7%
171,00	0,13	0,01	5,47	269,0%	20,74	15,27	95,2	24,3	100,7%	84,2%	84,8%
172,00	0,13	0,01	5,58	261,1%	20,74	15,15	95,1	24,2	100,6%	84,4%	84,8%
173,00	0,13	0,01	5,37	275,8%	20,75	15,37	100,7	24,4	100,7%	83,4%	83,9%
174,00	0,09	0,01	4,10	391,0%	20,79	16,68	99,5	24,3	100,9%	80,9%	81,6%
175,00	0,09	0,02	4,06	394,9%	20,79	16,72	97,4	24,3	100,8%	81,2%	81,8%
176,00	0,09	0,01	5,35	277,1%	20,75	15,39	96,9	24,5	100,7%	83,8%	84,4%
177,00	0,05	0,02	4,39	358,7%	20,78	16,38	96,6	24,4	100,7%	82,1%	82,7%
178,00	0,05	0,01	6,23	224,4%	20,72	14,49	96,7	24,4	100,6%	85,0%	#DIV/0!
179,00	0,05	0,01	4,90	311,8%	20,76	15,86	96,6	24,4	100,7%	83,1%	83,7%
180,00	0,00	0,02	4,77	321,6%	20,77	15,98	96,3	24,4	100,6%	82,9%	83,4%

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2017-05-12 Manufacturer: RAVelli Model: RV 120

Project #: ~~pI 20145~~ pI 20145 mm. Run: 1 Tech: M M Reviewer: DP

ligne 114 START test ~~mm~~ mm maximum (5) 60 mn

ligne 174 test medium (2) 120 mn

ligne 294 test low (1) 180 mn

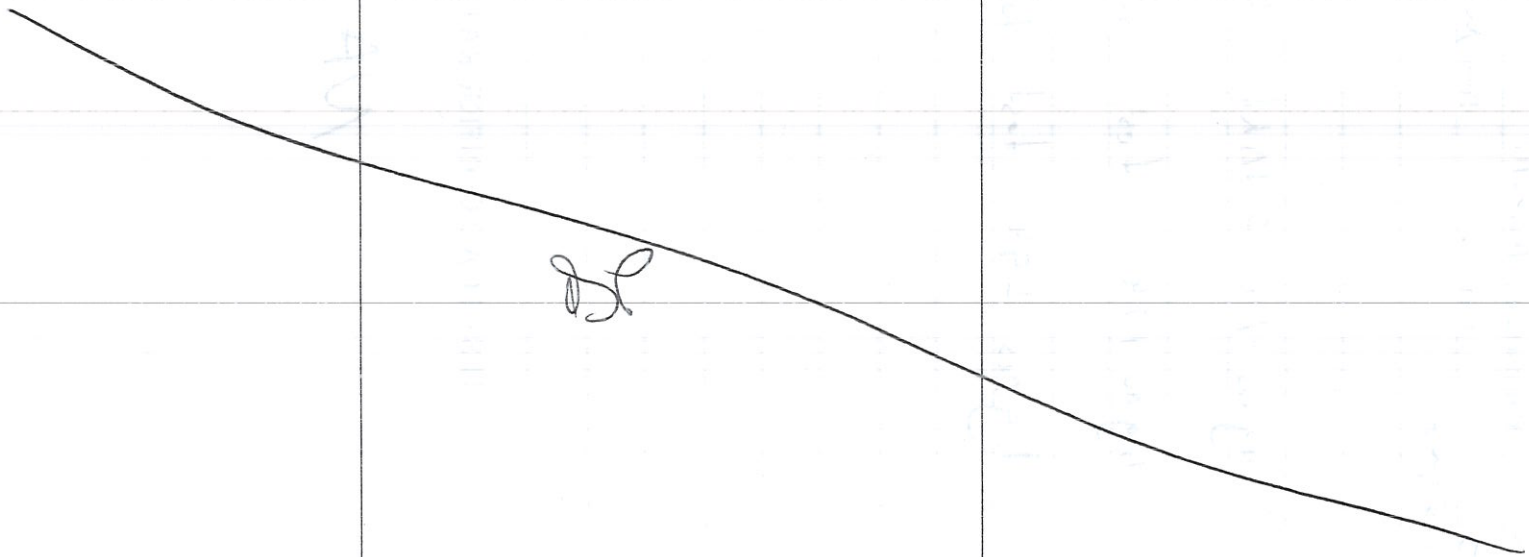
TEST LOAD CONFIGURATION

NA

POLYTESTS
TESTING THROUGH YOUR REALITY

Date:_____ Manufacturer:_____ Model:_____

Project #: _____ Run:_____ Tech:_____ Reviewer:_____

Side view	Front view	Top view
		

POLYTESTS
TESTING THROUGH YOUR REALITY

Date:_____ Manufacturer:_____ Model:_____

Project #: _____ Run:_____ Tech:_____ Reviewer:_____

	ADDITION		SUBSTRACTION	
	ft3	Volume	ft3	Volume
V measure				
V ashlip				
%				
V usable				

Usable Firebox:_____

Test load weight:_____ Minimum:_____ Maximum:_____

DP

Déviation:_____

POLYTESTS
TESTING THROUGH YOUR REALITY

PRE / POST CHECKS

Date: 2017-05-12 Manufacturer: I Model: PV 120

Project #: ~~PI 20145~~ PI 20145 M.M. Run: 1 Tech: Max Martin Reviewer: DO

Equipment #	Time	12%	22%
EM-191	7:00	ok	ok

Moisture Meter Calibration Check:

Pre-Test **Post-Test**

Facility Conditions:

	Pre-Test	Post-Test
Air Velocity from less than 2 feet (max50 Fpm)	7	5
Smoke Capture Check	ok	ok
Picture (4 sides)	ok	ok

Wood Heater Conditions:

Date Wood Heater Stack Cleaned	2017-05-12
Date Dilution Tunnel Cleaned	2017-05-12
Induced Draft Check (max 0.005 H2O)	ok
Traverse before ignition	ok
Flow Rate 140 cfm ±10%	ok

Temperature System:

Ambient (65°-90°F)	ok °F
Wood Heater Surface (±125°F)	ok °F

Proportional Checks:

Thermocouple check	ok
Pitot Clean	ok
Pitot verification	ok

Sampling Train ID Numbers:

	Train 1st hour	Train 1	Train 2
Probe	01	09	20
Filter Front	201	531	533
Filter Back	530	532	534
Filter Thermocouple	1	11	12
Filter (<90°F)	ok	ok	ok

POLYTESTS
TESTING THROUGH YOUR REALITY

SAMPLING EQUIPMENT CHECK OUT

Date: 2017-05-12 Manufacturer: Nadvell Model: NV 120

Project #: pI 20145 Run: 1 Tech: MM Reviewer: MP

Leakage Checks Tunnel Samplers

	System 1st hour		System 1		System 2	
Unplugged Flow Rate = .25cfm	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (max test)	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)
Vacuum (inches Hg.)	-15	-15	-15	-15	-15	-15
Final 1minute DGM (Liter)	502228,94	507125,21	505229,03	507125,31	426082,94	427926,84
Initial 1minute DGM (Liter)	505228,93	507125,21	505229,02	507125,30	426082,94	427926,84
Change © (Liter)	0,01	∅	0,01	0,01	∅	∅
Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56)						
Check OK	ok	ok	ok	ok	ok	ok

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	-5	-5
Rotometer Reading (mml/min.)	0	0
Flow Rate (lpm)	1.5	1.5
Allowable (.02 x Sample Rate)	30	30
Check OK	ok	ok

Leakage Checks Pitot

Plugged Probe	Pre Test 3 H2o static	Pre Test 0.4-0.5 H2o velocity	Post Test 3 H2o Static	Post Test 0.4-0.5 H2o velocity
Vacuum (inches Hg.)	3	0.4	3	.5
Check OK (no change after 15 sec.)	ok	ok	ok	ok

POLYTESTS
TESTING THROUGH YOUR REALITY

PRE-TEST SCALE AUDIT

Date: 2017-05-12 Manufacturer: Navell Model: RV120

Project #: pT 20145 Run: 1 Tech: M M Reviewer: DB

Scale Type	Audit		Measured Weight
	Equipment #	Weight	
Platform	EM-090	4.4 lbs, Class F	4.4 lbs
Wood	EM-090	4.4 lbs, Class F	4.4 lbs
Analytical	EM-128	100 mg, Class S	100 mg
Analytical	EM-129	200 g, Class S	200 g

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE: ..... 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE ..... 20%-80% of ideal test load weight, ± 0.1 lbs or 1%
WOOD SCALE ..... 20%-80% of ideal test load weight, ± 0.01 lbs or 1%

Date: 2017-05-12 Manufacturer: RAVelli Model: RV 120

Project #: PI 10145 Run: 1 Tech: MM Reviewer: DO

FOR TUNNELS < 12 in

Barometric pressure (P_{bar}) 102 (KPa.) Static pressure (P_q) 0,22 (inches w.c.)
Inside diameter: Port A _____ Port B ____.
Tunnel cross sectional area: .1963Ft^2
Pitot tube type: Standard

Traverse Point	Position (inches)			Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)
	6 po	7 po	8 po		
A- Centroid	3.00	3.50	4	0061	70,50
B - Centroid	3.00	3.50	4	0,062	70,66
A-1	0.40	0.50	0.50	0,050	70,48
A-2	1.50	1.75	2	0,054	70,54
A-3	4.50	5.25	6	0,053	70,42
A-4	5.60	6.5	7.5	0051	70,64
B-1	0.40	0.50	0.50	0,052	70,69
B-2	1.50	1.75	2	0,055	70,61
B-3	4.50	5.25	6	0056	70,66
B-4	5.60	6.5	7.5	0,053	70,62
				AVERAGE	

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{(T_s)_{avg}}{P_s M_s}}$$

Where,
C_p = pitot tube coefficient, dimension less = 0.99 for standard pitot.
Δ_p = manometer reading (inches H_2O)
T_s = average absolute dilution tunnel temperature (°F + 460)
P_s = absolute dilution tunnel gas pressure or $P_{bar} + P_{qg}$
P_q = static pressure $\frac{\text{in. } H_2O}{\{\ 13.6\ \}}$
M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured)
K_p = 85.49 pitot tube constant, (conversion factor for English units)

_$\Delta_p$avg. = average of the square roots of the velocity heads (Δ_p) measured at each traverse point.

POLYTESTS
TESTING THROUGH YOUR REALITY

CONTINUOUS ANALYZERS

Date: 2017-05-12 Manufacturer: Maulli Model: RV 120

Project #: pL 20145 Run: 1 Tech: MM Reviewer: DP

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	0	0	2.955	2.971	0.998	1.00
Tolerance CO		+/- 0.02		+/- 0.15		+/- 0.05
CO_2	0	0	17.91	17.81	9.77	10.00
Tolerance CO2		+/- 0.02		+/- 0.5		+/- 0.5
O_2 informative CSA B415 calculated value	na	na	na	na	na	na
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Limit	Span Drift	Limit	Cal. Drift	Limit	OK?	Not OK*
CO	9.00²	2.95²	1.00²	9.00²	0.02	9.003	0.15	9.004	0.05	✓	
CO_2	0	17.83	9.74	0	0.02	0.08	0.5	9.03	0.5	✓	
O_2	na	na	na	✓	na	✓	na	✓	na	✓	

POLYTESTS
TESTING THROUGH YOUR REALITY

TEST DATA LOG

Date: 2017-05-12 Manufacturer: Navelli Model: NV 120

Project #: PT 20145 Run: 1 Tech: MM Reviewer: DP

RAW DRY GAS METER READINGS

	System 1	System 2	Blanck
Final (Liter)	507124,95	427926,06	071,62
Initial (Liter)	505229,44	426083,56	990,91

AMBIENT CONDITIONS

	Before	After
Barometer (kPa):	102,0	101,8
Dry Bulb (F):	71,42	76,82
Humidity (%):	35	36,3

Flow Meter

	Start	End
Flow meter reading	N.A	N.A

Flow Meter Verification

	Before	After
Flow meter Check (liters)	N.A	N.A
Scale Weight (Kg)	N.A	N.A

POLYTESTS
TESTING THROUGH YOUR REALITY

FUEL DATA

Date:_____ Manufacturer:_____ Model:_____

Project #: _____ Run:_____ Tech:_____ Reviewer:_____

FUEL DESCRIPTION:

Type of wood:

PRE-TEST LOAD

Piece Size	Weight	Meter Moisture Content (% dry)*				
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.		N/A			
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					

TEST LOAD WEIGHT: _____ lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

FUEL DATA

Date:____________________ Manufacturer:____________________________ Model:______________________

Project #: ______________ Run:____________ Tech:________ Reviewer:____________

FUEL DESCRIPTION:
Type of wood :

TEST LOAD

Piece Size	Weight	Meter Moisture Content (% dry)*				
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.		N.A			
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					

TEST LOAD WEIGHT: ______________ lbs Min 20%:............. Max 25%:__________

POLYTESTS
TESTING THROUGH YOUR REALITY

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2017-05-11 Manufacturer: RAVEL Model: RV 120

Project #: pI 20145 Run: 1 Tech: MM Reviewer: DO

Pre-test Weight Record		SYSTEM 1 – 1st hour				SYSTEM 1				
		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Probe & Housing Number MM	Front Filter Number	Back Filter Number	gaskets	Blanck 556 MM
Date	Time	09	201	530	10	~~09~~ 04	531	532	22	~~576~~
2017-05-11	18:30	61,4491	0,1285	0,1299	10,9072	61,3835	0,1291	0,1281	10,7872	0,1278
2017-05-12	8:30	61,4492	0,1286	0,1300	10,9071	61,3835	0,1290	0,1280	10,7872	0,1279

Post-test Weight Record		SYSTEM 1 – 1st hour				SYSTEM 1				
		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Blanck
Date	Time	09	201	530	10	04	531	532	22	556
2017-05-12	16:00	61,4495	0,1297	0,1297	10,9096	61,3841	0,1297	0,1274	10,7895	0,1280
2017-05-16	8:00	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7886	0,1280
2017-05-17	8:00	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7882	0,1280
2017-05-19	8:00	61,4494	0,1297	0,1297	10,9083	61,3841	0,1297	0,1274	10,7882	0,1280

POLYTESTS
TESTING THROUGH YOUR REALITY

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2017-05-11 Manufacturer: RAVELL Model: RV 120

Project #: PJ 20 145 Run: 1 Tech: MM Reviewer: AP

		SYSTEM 2			
Pre-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets
Date	Time	20	533	534	53
2017-05-11	18:30	108 8430	0,1281	0,1280	10 2509
2017-05-12	8:30	108 8429	0,1282	0,1279	10 2508

		SYSTEM 2			
Post-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets
Date	Time	20	533	534	53
20170 5-12	16:00	108,8438	0,1302	0,1277	10,2539
2017-05-16	8:00	108 8438	0,1302	0,1277	10 2518
2017-05-17	8:00	108,8438	0,1302	0,1277	10,2518
201705-19	8:00	108,8438	0,1302	0,1277	10,2518

APPENDIX 2: Proportionality results

Average	Average	Average						Average
15,87	Inlet +	Inlet +						0,249
	Outlet	Outlet	Average	Average	#1	#2		
Tunnel	Temp.	Temp.	99,76	99,40	System 1	System 2		SQRT
Velocity	Meter 1	Meter 2	**Proportional Rates**		Vol.Std.	Vol.Std.		Delta-P
			PR1	**PR2**			Time	
Ft/Sec	Deg. R	Deg. R	**%**	**%**	(ft3)	(ft3)	min	(in H2O)2
15,746	533,4	533,5			0,174	0,172	0	0,243301
15,722	533,6	533,6	104,37	104,07	0,174	0,172	1	0,2428847
15,881	533,7	533,7	103,24	103,00	0,174	0,172	2	0,245378
15,751	533,7	533,8	104,20	103,87	0,174	0,172	3	0,2433022
15,952	533,7	533,8	102,87	102,43	0,174	0,171	4	0,2464107
15,794	533,8	533,8	104,15	103,47	0,174	0,171	5	0,2439266
15,790	533,8	533,9	103,86	103,46	0,174	0,171	6	0,2439271
15,657	533,8	533,9	104,80	104,43	0,174	0,171	7	0,2418377
15,919	533,8	533,9	103,20	102,66	0,174	0,171	8	0,2458663
15,755	533,9	534,0	104,16	104,11	0,174	0,172	9	0,2433016
15,794	533,9	534,0	104,08	103,13	0,174	0,171	10	0,2439269
15,955	533,9	534,1	102,95	102,38	0,174	0,171	11	0,2464109
15,751	534,0	534,1	104,12	103,44	0,174	0,171	12	0,2433017
15,985	534,0	534,2	102,76	102,37	0,174	0,171	13	0,2468225
15,869	534,1	534,2	103,54	103,02	0,174	0,171	14	0,2450659
15,891	534,1	534,2	103,23	102,97	0,174	0,171	15	0,2453791
15,732	534,1	534,3	104,35	103,92	0,173	0,171	16	0,242885
15,759	534,2	534,3	104,09	103,72	0,173	0,171	17	0,2433019
15,571	534,2	534,3	105,48	105,40	0,173	0,172	18	0,2403655
15,926	534,2	534,4	103,12	102,80	0,173	0,172	19	0,2457921
15,871	534,2	534,4	103,49	102,98	0,173	0,171	20	0,2449648
15,804	534,2	534,4	103,71	103,42	0,173	0,171	21	0,2439275
15,900	534,3	534,4	103,07	103,00	0,173	0,171	22	0,2453795
15,868	534,3	534,5	103,42	103,16	0,173	0,171	23	0,244965
15,922	534,3	534,5	103,02	102,59	0,173	0,171	24	0,2457925
15,875	534,3	534,5	103,30	103,22	0,173	0,171	25	0,2449651
15,802	534,4	534,6	103,72	103,47	0,173	0,171	26	0,2439275
15,672	534,4	534,6	104,72	104,26	0,173	0,171	27	0,2418386
15,874	534,5	534,6	103,34	103,26	0,173	0,171	28	0,2449656
15,765	534,5	534,7	104,06	103,73	0,173	0,171	29	0,2433022
15,994	534,6	534,7	102,52	102,17	0,173	0,171	30	0,2468222
15,971	534,6	534,8	102,88	102,52	0,173	0,171	31	0,2464111
15,739	534,6	534,8	104,19	103,90	0,173	0,171	32	0,2428857
15,903	534,6	534,8	103,06	102,97	0,173	0,171	33	0,2453797
15,770	534,7	534,8	104,16	103,87	0,173	0,171	34	0,2433026
15,769	534,7	534,9	104,07	104,01	0,173	0,171	35	0,2433029
15,743	534,7	534,9	104,42	104,12	0,173	0,171	36	0,2428864
15,877	534,7	534,9	103,25	102,82	0,173	0,171	37	0,2449814
15,769	534,7	534,9	104,13	103,70	0,173	0,171	38	0,2433032
15,928	534,7	534,9	102,86	102,70	0,173	0,171	39	0,2457928
15,880	534,7	534,9	103,34	103,02	0,173	0,171	40	0,2449659
16,066	534,7	535,0	102,19	101,80	0,173	0,171	41	0,2478494
15,903	534,8	535,0	103,49	103,09	0,173	0,171	42	0,24538
15,728	534,8	535,0	104,32	103,97	0,173	0,171	43	0,2425914
15,882	534,8	535,0	103,49	102,91	0,173	0,171	44	0,2449646
15,998	534,8	535,0	102,72	102,09	0,173	0,171	45	0,246823
15,747	534,8	535,0	104,46	103,85	0,173	0,171	46	0,2428866
15,906	534,9	535,1	103,39	103,08	0,174	0,171	47	0,2453799
15,677	534,9	535,1	104,68	104,16	0,173	0,171	48	0,2418351
15,875	534,9	535,1	103,36	102,91	0,173	0,171	49	0,2449656
15,903	534,9	535,1	103,22	103,06	0,173	0,171	50	0,2453804
16,040	535,0	535,2	102,45	102,30	0,173	0,172	51	0,2474388
15,889	535,0	535,2	103,54	102,86	0,173	0,171	52	0,2449656
15,937	535,1	535,3	103,11	102,86	0,173	0,171	53	0,2457927

15,676	535,1	535,3	104,79	104,45	0,173	0,171	54	0,2418393
15,938	535,1	535,3	103,29	102,92	0,173	0,171	55	0,2457929
15,900	535,1	535,3	103,23	103,16	0,173	0,172	56	0,2453786
15,995	535,2	535,4	102,42	102,10	0,173	0,171	57	0,2468237
15,751	535,2	535,4	104,33	103,63	0,173	0,171	58	0,2430627
15,670	535,2	535,4	104,60	104,16	0,173	0,171	59	0,241839
15,970	535,2	535,5	102,88	102,20	0,173	0,171	60	0,2464127
15,899	535,3	535,5	103,20	102,93	0,173	0,171	61	0,2453837
15,864	535,3	535,5	102,82	102,70	0,173	0,171	62	0,2453808
15,880	535,3	535,6	101,75	101,17	0,173	0,171	63	0,2468237
16,029	535,4	535,6	100,52	100,01	0,173	0,171	64	0,2496387
15,805	535,4	535,6	101,63	101,27	0,173	0,171	65	0,2464129
15,954	535,4	535,6	100,69	100,16	0,173	0,171	66	0,2488717
15,852	535,4	535,6	101,11	100,82	0,173	0,171	67	0,2474399
15,800	535,4	535,7	101,28	100,88	0,173	0,171	68	0,246824
15,945	535,4	535,7	100,25	99,80	0,173	0,171	69	0,2492788
15,825	535,4	535,7	100,87	100,41	0,173	0,171	70	0,2474396
15,973	535,4	535,7	99,95	99,52	0,173	0,171	71	0,2498887
15,881	535,5	535,7	100,36	99,98	0,173	0,171	72	0,2486172
15,922	535,5	535,7	99,98	99,66	0,173	0,171	73	0,2492788
15,889	535,5	535,8	100,08	99,69	0,173	0,171	74	0,2488716
15,950	535,5	535,7	99,70	99,32	0,173	0,171	75	0,2498886
15,940	535,4	535,7	99,55	99,19	0,173	0,171	76	0,2498889
15,897	535,4	535,7	100,02	99,47	0,173	0,171	77	0,2492784
16,002	535,4	535,7	99,13	98,88	0,173	0,171	78	0,250935
15,895	535,4	535,7	99,83	99,24	0,173	0,171	79	0,2492786
16,043	535,4	535,7	98,82	98,33	0,173	0,171	80	0,2517099
16,013	535,4	535,7	99,10	98,66	0,173	0,171	81	0,2513066
15,794	535,3	535,7	100,45	99,85	0,173	0,171	82	0,2478516
15,853	535,4	535,7	99,86	99,53	0,173	0,171	83	0,2488718
16,032	535,4	535,7	98,82	98,43	0,173	0,171	84	0,25171
16,066	535,4	535,7	98,51	98,28	0,173	0,171	85	0,2523138
15,978	535,3	535,6	99,04	98,55	0,173	0,171	86	0,2509022
15,876	535,3	535,6	99,58	99,61	0,173	0,171	87	0,249279
15,874	535,3	535,6	99,69	99,29	0,173	0,171	88	0,2492784
15,872	535,3	535,6	99,52	99,44	0,173	0,171	89	0,2492783
15,872	535,3	535,6	99,75	99,26	0,173	0,171	90	0,2492782
15,842	535,3	535,6	99,97	99,63	0,173	0,171	91	0,2488712
16,082	535,3	535,5	98,34	98,05	0,173	0,171	92	0,2527155
16,017	535,3	535,5	98,70	98,18	0,173	0,171	93	0,2517096
16,121	535,2	535,5	98,11	97,59	0,173	0,171	94	0,2533183
15,963	535,2	535,5	98,85	98,56	0,173	0,171	95	0,250902
15,896	535,2	535,5	99,47	99,22	0,173	0,171	96	0,2498884
15,804	535,2	535,5	99,93	99,84	0,173	0,171	97	0,2484631
16,049	535,1	535,4	98,48	98,05	0,173	0,171	98	0,2523133
15,957	535,1	535,4	99,07	98,71	0,173	0,171	99	0,2509018
15,855	535,1	535,4	99,72	99,33	0,173	0,171	100	0,2492785
15,853	535,1	535,4	99,59	99,36	0,173	0,171	101	0,2492804
15,828	535,1	535,3	99,86	99,53	0,173	0,171	102	0,2488708
16,008	535,1	535,3	98,82	98,44	0,173	0,171	103	0,2517094
15,977	535,1	535,3	98,69	98,50	0,173	0,171	104	0,2513064
16,002	535,0	535,3	98,52	98,18	0,173	0,171	105	0,2517101
15,731	535,1	535,3	100,27	99,98	0,173	0,171	106	0,2474388
15,795	535,0	535,2	99,79	99,72	0,173	0,171	107	0,2484629
16,071	535,0	535,2	98,20	98,04	0,173	0,171	108	0,2527158
15,795	535,0	535,2	100,04	99,66	0,173	0,171	109	0,2484625
15,754	535,0	535,2	100,30	99,87	0,173	0,171	110	0,2478482
15,975	535,0	535,2	98,87	98,43	0,173	0,171	111	0,2513061
15,885	535,0	535,2	99,35	99,05	0,173	0,171	112	0,2498877
15,648	535,1	535,2	101,15	100,70	0,173	0,171	113	0,2457934
15,832	535,1	535,2	99,79	99,49	0,173	0,171	114	0,2488707

16,009	535,1	535,3	98,87	98,29	0,173	0,171	115	0,2517091
15,764	535,1	535,2	100,26	100,00	0,173	0,171	116	0,2478498
15,826	535,2	535,3	99,79	99,30	0,173	0,171	117	0,248871
16,007	535,2	535,3	98,76	98,43	0,173	0,171	118	0,2517092
15,890	535,2	535,3	99,41	99,19	0,173	0,171	119	0,249889
15,853	535,2	535,4	99,56	99,10	0,173	0,171	120	0,2492781
15,739	535,3	535,4	100,35	100,03	0,173	0,171	121	0,2474389
15,857	535,3	535,4	99,60	99,41	0,173	0,171	122	0,2492784
15,857	535,4	535,5	99,48	99,30	0,173	0,171	123	0,2492784
15,836	535,4	535,5	99,79	99,41	0,173	0,171	124	0,2488717
15,705	535,4	535,6	100,73	100,15	0,173	0,171	125	0,2468349
15,832	535,5	535,6	99,74	99,45	0,173	0,171	126	0,2488716
15,860	535,5	535,6	99,53	99,30	0,173	0,171	127	0,2492776
15,698	535,5	535,7	100,52	100,35	0,173	0,171	128	0,2468238
15,960	535,6	535,7	98,71	98,85	0,173	0,171	129	0,250902
15,986	535,6	535,7	98,86	98,12	0,173	0,171	130	0,2513065
16,009	535,6	535,8	98,43	98,30	0,173	0,171	131	0,2517091
16,011	535,6	535,8	98,56	98,06	0,173	0,171	132	0,2516971
15,896	535,6	535,8	99,34	98,86	0,173	0,171	133	0,2498895
15,895	535,7	535,8	99,34	98,92	0,173	0,171	134	0,2498887
15,894	535,7	535,8	99,38	98,88	0,173	0,171	135	0,2498895
15,898	535,7	535,8	99,32	98,89	0,173	0,171	136	0,2498889
15,769	535,7	535,9	99,98	99,53	0,173	0,171	137	0,2478506
15,859	535,7	535,9	99,62	99,39	0,173	0,171	138	0,2492793
15,987	535,7	535,9	98,76	98,35	0,173	0,171	139	0,2513078
15,834	535,7	535,9	99,87	99,32	0,173	0,171	140	0,2488719
15,809	535,8	535,9	99,89	99,46	0,173	0,171	141	0,248464
16,015	535,8	536,0	98,60	98,77	0,173	0,171	142	0,2517099
15,810	535,8	535,9	99,95	99,39	0,173	0,171	143	0,2484632
15,962	535,8	536,0	98,96	98,51	0,173	0,171	144	0,2509029
15,861	535,8	536,0	99,49	99,09	0,173	0,171	145	0,2492797
15,811	535,8	536,0	99,92	99,63	0,173	0,171	146	0,248464
15,837	535,8	536,0	99,91	99,28	0,173	0,171	147	0,2488725
15,967	535,9	536,0	98,95	98,60	0,173	0,171	148	0,2509026
15,968	535,9	536,0	99,01	98,51	0,173	0,171	149	0,2509033
15,838	535,9	536,1	99,66	99,43	0,173	0,171	150	0,2488777
15,911	535,9	536,1	99,36	99,08	0,173	0,171	151	0,2499893
15,749	535,9	536,1	100,19	100,01	0,173	0,171	152	0,2474412
15,908	535,9	536,1	99,40	98,95	0,173	0,171	153	0,2498903
15,709	535,9	536,1	100,49	100,34	0,173	0,171	154	0,2468244
15,969	536,0	536,2	98,92	98,53	0,173	0,171	155	0,250903
15,750	536,0	536,2	100,46	99,77	0,173	0,171	156	0,2474408
15,909	536,1	536,3	99,46	98,95	0,173	0,171	157	0,2498897
15,871	536,1	536,3	99,56	99,36	0,173	0,171	158	0,2492804
15,973	536,2	536,3	98,99	98,58	0,173	0,171	159	0,2509042
15,911	536,2	536,4	99,34	98,88	0,173	0,171	160	0,2498903
15,843	536,2	536,4	99,74	99,48	0,173	0,171	161	0,2488735
15,912	536,2	536,4	99,24	99,24	0,173	0,171	162	0,2498901
15,906	536,2	536,4	99,28	98,94	0,173	0,171	163	0,2498906
15,997	536,2	536,5	98,89	98,61	0,173	0,171	164	0,2512798
15,868	536,2	536,5	99,63	99,32	0,173	0,171	165	0,2492799
15,910	536,2	536,5	99,43	99,05	0,173	0,171	166	0,2498983
15,870	536,2	536,5	99,61	99,06	0,173	0,171	167	0,2492805
15,845	536,3	536,5	99,87	99,24	0,173	0,170	168	0,2488738
15,867	536,3	536,5	99,52	99,17	0,173	0,171	169	0,249281
15,868	536,3	536,5	99,51	99,43	0,173	0,171	170	0,2492805
15,869	536,3	536,5	99,53	99,30	0,173	0,171	171	0,2492809
16,019	536,3	536,5	98,66	97,95	0,173	0,171	172	0,251712
15,833	536,3	536,5	100,38	100,24	0,173	0,171	173	0,2478522
15,773	536,3	536,5	100,28	99,70	0,173	0,171	174	0,2476421
15,821	536,2	536,5	99,99	99,73	0,173	0,171	175	0,2484656

15,783	536,3	536,5	100,07	99,60	0,173	0,171	176	0,247853
16,029	536,3	536,5	98,67	98,26	0,173	0,171	177	0,2517132
15,845	536,3	536,6	99,76	99,49	0,173	0,171	178	0,2488744
15,908	536,3	536,6	99,28	99,00	0,173	0,171	179	0,2498914
15,844	536,3	536,5	99,65	99,39	0,173	0,171	180	0,2488742
15,905	536,3	536,5	99,24	98,81	0,173	0,171	181	0,2498912
15,995	536,3	536,5	98,40	97,99	0,173	0,171	182	0,2517125
15,943	536,3	536,6	98,60	98,34	0,173	0,171	183	0,2509049
15,833	536,3	536,6	99,41	98,92	0,173	0,171	184	0,2492818
15,866	536,3	536,6	98,99	98,78	0,173	0,171	185	0,2498908
15,773	536,3	536,6	99,58	99,15	0,173	0,171	186	0,2484653
15,953	536,3	536,6	98,49	98,01	0,173	0,170	187	0,2513093
16,039	536,3	536,6	97,99	97,37	0,173	0,170	188	0,2527191
15,816	536,4	536,6	99,19	98,89	0,173	0,171	189	0,2492813
15,790	536,3	536,6	99,25	99,24	0,173	0,171	190	0,2488742
15,916	536,3	536,6	98,46	98,33	0,173	0,171	191	0,2509049
16,006	536,3	536,6	97,99	97,76	0,173	0,171	192	0,2523166
15,914	536,4	536,6	98,52	98,17	0,173	0,171	193	0,2509044
15,690	536,3	536,6	100,03	99,66	0,173	0,171	194	0,247442
15,938	536,3	536,6	98,53	97,84	0,173	0,171	195	0,2513088
15,961	536,3	536,6	98,28	97,77	0,173	0,170	196	0,2517116
15,782	536,3	536,6	99,20	98,80	0,173	0,170	197	0,2488736
15,806	536,3	536,6	99,03	98,69	0,173	0,170	198	0,2492807
15,557	536,4	536,6	100,74	100,43	0,173	0,171	199	0,2453835
15,777	536,4	536,6	99,14	98,60	0,173	0,170	200	0,2488746
15,952	536,4	536,6	98,26	97,75	0,173	0,170	201	0,2517075
15,928	536,4	536,6	98,32	97,82	0,173	0,170	202	0,2513093
15,775	536,4	536,7	99,30	98,91	0,173	0,171	203	0,2488745
15,929	536,4	536,7	98,36	97,85	0,173	0,171	204	0,2513093
15,836	536,4	536,7	98,93	98,45	0,173	0,171	205	0,2498913
15,839	536,5	536,7	98,86	98,65	0,173	0,171	206	0,249908
15,951	536,5	536,7	98,22	97,59	0,173	0,171	207	0,2517123
15,796	536,5	536,7	99,04	98,59	0,173	0,170	208	0,2492813
15,794	536,5	536,7	98,99	98,65	0,173	0,170	209	0,2492815
15,702	536,5	536,7	99,81	99,38	0,173	0,171	210	0,2478079
15,794	536,5	536,7	98,92	98,60	0,173	0,171	211	0,2492816
15,944	536,5	536,7	98,04	97,69	0,173	0,171	212	0,2517126
15,793	536,4	536,7	99,14	98,86	0,173	0,171	213	0,2492813
15,831	536,4	536,7	98,84	98,49	0,173	0,171	214	0,2498909
15,893	536,4	536,6	98,44	97,94	0,173	0,171	215	0,2509043
15,768	536,4	536,6	99,40	98,93	0,173	0,171	216	0,2488743
15,795	536,4	536,6	99,11	98,67	0,173	0,171	217	0,2493891
15,980	536,3	536,6	97,75	97,58	0,173	0,171	218	0,2523166
15,788	536,3	536,6	99,08	98,61	0,173	0,171	219	0,249281
15,916	536,3	536,5	98,21	97,98	0,173	0,171	220	0,2513092
15,891	536,3	536,5	98,52	98,11	0,173	0,171	221	0,2509043
15,873	536,3	536,5	98,52	98,13	0,173	0,171	222	0,2506424
15,916	536,3	536,5	98,33	97,91	0,173	0,171	223	0,2513091
15,827	536,3	536,5	98,75	98,29	0,173	0,171	224	0,2498906
15,828	536,3	536,5	98,78	98,58	0,173	0,171	225	0,2498905
15,915	536,3	536,5	98,15	97,84	0,173	0,171	226	0,2513085
15,944	536,3	536,6	98,24	97,77	0,173	0,171	227	0,2517123
16,007	536,3	536,6	97,68	97,55	0,173	0,171	228	0,2527194
15,914	536,3	536,6	98,26	98,06	0,173	0,171	229	0,2513091
15,916	536,3	536,6	98,27	97,74	0,173	0,171	230	0,2513092
15,941	536,4	536,6	98,06	98,03	0,173	0,171	231	0,2517119
15,761	536,4	536,7	99,31	98,79	0,173	0,171	232	0,2488738
15,824	536,4	536,7	98,68	98,42	0,173	0,171	233	0,2498911
15,904	536,4	536,7	98,38	98,12	0,173	0,171	234	0,2509047
15,918	536,4	536,6	98,39	97,88	0,173	0,171	235	0,2513093
16,009	536,4	536,6	97,66	97,17	0,173	0,170	236	0,2527189

15,819	536,3	536,6	98,82	98,43	0,173	0,170	237	0,2497899
15,787	536,3	536,6	98,97	98,44	0,173	0,170	238	0,2492811
15,892	536,3	536,6	98,35	97,90	0,173	0,170	239	0,2509046
15,890	536,3	536,5	98,42	97,90	0,173	0,170	240	0,2509042
15,822	536,3	536,5	98,69	98,57	0,173	0,171	241	0,2498906
15,979	536,3	536,5	97,96	97,28	0,173	0,171	242	0,2523153
15,889	536,3	536,5	98,31	97,98	0,173	0,170	243	0,2509038
15,913	536,3	536,5	98,26	98,00	0,173	0,171	244	0,2513094
15,906	536,3	536,5	98,16	97,89	0,173	0,171	245	0,2512088
15,822	536,3	536,5	98,76	98,33	0,173	0,171	246	0,2498934
15,939	536,3	536,5	97,98	97,67	0,173	0,171	247	0,2517036
15,825	536,3	536,6	98,77	98,36	0,173	0,171	248	0,24989
15,733	536,4	536,6	99,33	98,85	0,173	0,170	249	0,2484654
15,823	536,4	536,6	98,82	98,38	0,173	0,171	250	0,2498906
15,913	536,4	536,6	98,37	97,90	0,173	0,171	251	0,2513088
15,884	536,4	536,6	98,32	98,03	0,173	0,171	252	0,2509036
15,939	536,4	536,6	97,98	97,67	0,173	0,171	253	0,2517118
15,823	536,4	536,6	98,86	98,20	0,173	0,170	254	0,2498914
16,000	536,4	536,6	97,70	97,23	0,173	0,170	255	0,2527184
15,887	536,4	536,6	98,41	97,81	0,173	0,170	256	0,2509046
15,824	536,4	536,6	98,69	98,38	0,173	0,170	257	0,2498915
15,888	536,4	536,6	98,22	98,13	0,173	0,171	258	0,2509045
15,940	536,4	536,6	98,08	97,78	0,173	0,171	259	0,2517122
15,786	536,4	536,6	99,08	98,52	0,173	0,171	260	0,249281
15,976	536,4	536,6	97,56	97,36	0,173	0,170	261	0,2523167
15,941	536,4	536,6	98,26	97,57	0,173	0,170	262	0,2517509
15,785	536,5	536,7	99,02	98,79	0,173	0,171	263	0,2492811
15,666	536,5	536,7	99,75	99,38	0,173	0,171	264	0,247442
16,002	536,5	536,7	97,58	97,26	0,173	0,171	265	0,2527192
15,912	536,5	536,7	98,22	97,98	0,173	0,171	266	0,2513099
15,912	536,5	536,7	98,28	97,75	0,173	0,171	267	0,2513092
15,886	536,5	536,7	98,35	98,05	0,173	0,171	268	0,2509047
15,760	536,5	536,8	99,11	98,70	0,173	0,171	269	0,2488879
15,694	536,5	536,8	99,61	99,45	0,173	0,171	270	0,2478526
16,066	536,6	536,8	97,15	96,83	0,173	0,171	271	0,2537217
15,603	536,6	536,8	100,13	99,61	0,173	0,170	272	0,2464156
15,786	536,6	536,8	98,97	98,38	0,173	0,170	273	0,249319
15,670	536,6	536,9	99,72	99,20	0,173	0,170	274	0,247443
15,903	536,6	536,9	98,18	98,11	0,173	0,171	275	0,2511464
15,887	536,6	536,9	98,26	97,89	0,173	0,171	276	0,2509058
15,824	536,6	536,9	98,84	98,32	0,173	0,170	277	0,2498916
15,825	536,6	536,9	98,88	98,50	0,173	0,171	278	0,2498913
15,786	536,6	536,9	98,93	98,70	0,173	0,171	279	0,2492822
15,915	536,6	536,9	98,27	97,76	0,173	0,171	280	0,2513099
15,941	536,7	536,9	98,07	97,85	0,173	0,171	281	0,2517127
15,760	536,7	536,9	99,40	98,85	0,173	0,171	282	0,2488747
15,941	536,7	536,9	97,97	97,66	0,173	0,171	283	0,2517132
15,915	536,7	536,9	98,20	97,75	0,173	0,171	284	0,2513093
15,940	536,7	537,0	97,94	97,59	0,173	0,170	285	0,2517133
15,886	536,7	537,0	98,43	98,00	0,173	0,171	286	0,250905
15,915	536,8	537,0	98,07	97,61	0,173	0,170	287	0,2513086
15,940	536,8	537,0	98,01	97,84	0,173	0,171	288	0,2517127
15,788	536,8	537,0	98,85	98,67	0,173	0,171	289	0,2492817
16,040	536,8	537,0	97,40	96,91	0,173	0,170	290	0,2533213
15,825	536,8	537,0	98,73	98,38	0,173	0,170	291	0,2498917
16,002	536,8	537,0	97,45	97,45	0,173	0,171	292	0,2527193
15,915	536,8	537,1	98,04	97,89	0,172	0,171	293	0,2513096
15,978	536,8	537,1	98,27	97,73	0,173	0,170	294	0,2517131
15,681	536,8	537,1	99,70	99,48	0,173	0,170	295	0,2474427
15,739	536,8	537,1	99,32	98,89	0,173	0,171	296	0,2484675
15,767	536,9	537,1	99,24	98,78	0,173	0,170	297	0,2488743

15,919	536,9	537,1	98,21	97,76	0,173	0,170	298	0,2513106
15,917	536,9	537,1	98,07	97,78	0,173	0,170	299	0,2513103
15,789	536,9	537,1	99,06	98,68	0,173	0,171	300	0,2492819
15,980	536,9	537,1	97,71	97,60	0,173	0,171	301	0,2523173
15,914	536,9	537,1	98,15	97,61	0,173	0,171	302	0,25131
15,890	536,9	537,1	98,15	97,89	0,173	0,170	303	0,2509052
15,977	536,9	537,1	97,55	97,39	0,172	0,170	304	0,2523172
15,979	536,9	537,1	97,70	97,22	0,172	0,170	305	0,2523175
16,001	536,9	537,1	97,57	97,17	0,173	0,170	306	0,25272
15,912	536,9	537,1	98,12	97,66	0,173	0,170	307	0,2513107
15,785	536,9	537,1	98,87	98,57	0,173	0,170	308	0,2492819
15,785	537,0	537,2	98,87	98,50	0,173	0,170	309	0,2492819
15,914	537,0	537,2	98,25	98,13	0,173	0,171	310	0,2513104
15,734	537,0	537,2	99,29	98,92	0,173	0,171	311	0,2484678
15,824	537,0	537,2	98,71	98,36	0,173	0,171	312	0,2498918
15,915	537,0	537,2	98,09	98,09	0,173	0,171	313	0,2513102
15,891	537,0	537,2	98,43	97,88	0,173	0,171	314	0,2509054
15,788	537,0	537,2	98,85	98,50	0,173	0,170	315	0,2492817
15,735	537,0	537,2	99,19	99,02	0,173	0,171	316	0,2484663
15,784	537,0	537,3	98,86	98,50	0,173	0,171	317	0,2492818
15,889	537,0	537,3	98,19	98,02	0,173	0,171	318	0,2509045
15,941	537,0	537,3	98,04	97,54	0,173	0,170	319	0,2516995
15,786	537,1	537,3	98,88	98,59	0,173	0,170	320	0,2492822
15,760	537,1	537,3	99,14	98,80	0,173	0,171	321	0,2488745
15,787	537,1	537,3	98,89	98,48	0,173	0,170	322	0,2492822
15,789	537,1	537,4	98,98	98,40	0,173	0,170	323	0,2492826
15,808	537,1	537,4	98,74	98,50	0,173	0,170	324	0,2496284
15,979	537,2	537,4	97,75	97,32	0,173	0,170	325	0,2523172
15,889	537,2	537,4	98,34	97,75	0,173	0,170	326	0,2509053
15,889	537,2	537,4	98,30	97,96	0,173	0,170	327	0,2509054
15,789	537,2	537,4	98,81	98,62	0,173	0,171	328	0,2492823
16,041	537,2	537,4	97,50	97,04	0,173	0,171	329	0,2533219
15,737	537,2	537,4	99,25	98,99	0,173	0,171	330	0,2484662
15,894	537,3	537,5	98,35	98,05	0,173	0,171	331	0,2509071
15,827	537,3	537,5	98,66	98,43	0,173	0,171	332	0,2498927
15,917	537,3	537,5	98,20	97,73	0,173	0,171	333	0,2513109
15,789	537,3	537,5	98,82	98,58	0,173	0,170	334	0,249283
15,826	537,3	537,5	98,49	98,45	0,172	0,171	335	0,2498927
15,890	537,3	537,5	98,37	97,90	0,173	0,171	336	0,2509067
15,941	537,3	537,5	97,92	97,39	0,173	0,170	337	0,2517141
15,762	537,3	537,5	99,06	98,70	0,173	0,170	338	0,2488755
15,827	537,3	537,5	98,55	98,30	0,173	0,170	339	0,2498927
15,943	537,3	537,5	97,89	97,60	0,172	0,170	340	0,2517137
15,827	537,3	537,6	98,58	98,32	0,172	0,170	341	0,2498935
15,983	537,3	537,6	97,65	97,15	0,172	0,170	342	0,2523178
15,890	537,3	537,6	98,17	97,80	0,172	0,170	343	0,2509061
15,754	537,3	537,6	98,94	98,96	0,172	0,171	344	0,24873
15,739	537,4	537,6	99,24	98,77	0,172	0,170	345	0,2484669
15,919	537,4	537,6	97,97	97,65	0,172	0,170	346	0,2513108
15,739	537,4	537,6	99,12	98,97	0,172	0,170	347	0,2484674
15,830	537,4	537,6	98,72	98,03	0,173	0,170	348	0,2498931
15,766	537,4	537,6	99,05	98,46	0,173	0,170	349	0,2488757
15,983	537,4	537,6	97,59	97,42	0,172	0,170	350	0,252318
15,901	537,4	537,7	98,26	97,98	0,173	0,171	351	0,2510192
15,893	537,5	537,7	98,26	97,76	0,173	0,170	352	0,2509064
15,982	537,5	537,7	97,70	97,12	0,173	0,170	353	0,2523178
15,800	537,5	537,7	99,46	98,86	0,173	0,170	354	0,2488744
15,776	537,5	537,7	98,94	98,73	0,173	0,170	355	0,2488762
15,950	537,5	537,7	97,99	97,68	0,172	0,170	356	0,2517139
15,988	537,5	537,7	97,77	97,53	0,173	0,171	357	0,252318
15,948	537,5	537,7	97,90	97,46	0,173	0,170	358	0,2517138

15,922	537,5	537,7	98,30	98,00	0,173	0,170	359	0,2513108
15,793	537,5	537,7	98,90	98,77	0,173	0,171	360	0,2492828
15,766	537,5	537,7	99,18	98,84	0,173	0,171	361	0,2488758

APPENDIX 3: Calibration data

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS 2010-02

SCC Accredited LAB
Accrédité CCN LAB
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-001 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9101
Précision requise:	+\- 2.0°C
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Enregistreur	Type d'entrée:	Temp
Manufacturier:	Fluke	Type de sortie:	Digitale
No. Model:	52-II	Type de mesure:	Température
No. Série:	90630037	Gamme:	Divers
Emplacement:	N.A.	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.0 °C	0.0 °C	-0.1 °C	-0.1 °C	-0.1 °C	1.0 °C	T1 typeJ
125.0 °C	125.0 °C	124.9 °C	-0.1 °C	124.9 °C	1.0 °C	T1 typeJ
250.0 °C	250.0 °C	250.0 °C	0.0 °C	250.0 °C	1.0 °C	T1 typeJ
375.0 °C	375.0 °C	374.9 °C	-0.1 °C	374.9 °C	1.0 °C	T1 typeJ
500.0 °C	500.0 °C	500.0 °C	0.0 °C	500.0 °C	1.0 °C	T1 typeJ
0.0 °C	0.0 °C	0.0 °C	0.0 °C	0.0 °C	1.0 °C	T2 typeJ
125.0 °C	125.0 °C	125.0 °C	0.0 °C	125.0 °C	1.0 °C	T2 typeJ
250.0 °C	250.0 °C	250.0 °C	0.0 °C	250.0 °C	1.0 °C	T2 typeJ
375.0 °C	375.0 °C	374.9 °C	-0.1 °C	374.9 °C	1.0 °C	T2 typeJ
500.0 °C	500.0 °C	500.0 °C	0.0 °C	500.0 °C	1.0 °C	T2 typeJ
0.0 °C	0.0 °C	0.0 °C	0.0 °C	0.0 °C	1.0 °C	T1 typeK
125.0 °C	125.0 °C	125.0 °C	0.0 °C	125.0 °C	1.0 °C	T1 typeK
250.0 °C	250.0 °C	250.0 °C	0.0 °C	250.0 °C	1.0 °C	T1 typeK
375.0 °C	375.0 °C	375.0 °C	0.0 °C	375.0 °C	1.0 °C	T1 typeK
500.0 °C	500.0 °C	500.0 °C	0.0 °C	500.0 °C	1.0 °C	T1 typeK
0.0 °C	0.0 °C	0.0 °C	0.0 °C	0.0 °C	1.0 °C	T2 typeK
125.0 °C	125.0 °C	125.0 °C	0.0 °C	125.0 °C	1.0 °C	T2 typeK
250.0 °C	250.0 °C	250.0 °C	0.0 °C	250.0 °C	1.0 °C	T2 typeK
375.0 °C	375.0 °C	375.0 °C	0.0 °C	375.0 °C	1.0 °C	T2 typeK
500.0 °C	500.0 °C	500.0 °C	0.0 °C	500.0 °C	1.0 °C	T2 typeK

Conditions Environnementales: Température: 18 °C Humidité: 33 %RH

Type d'Étalonnage:

2017.03.16

5F09101

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-001 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9101
Précision requise:	+\- 2.0°C
Fréquence d'étalonnage: (jours)	365

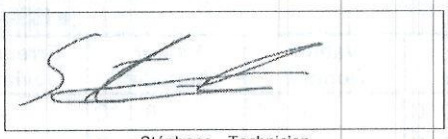
SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Enregistreur	**Type d'entrée:**	Temp
Manufacturier:	Fluke	**Type de sortie:**	Digitale
No. Model:	52-II	**Type de mesure:**	Température
No. Série:	90630037	**Gamme:**	Divers
Emplacement:	N.A.	**No. Machine:**	N.A.

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	27 Février 2017
Date du prochain Étalonnage:	27 Février 2018
Date d'émission du certificat:	27 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.



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Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
MRC-CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-006 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\-0.25"H2O
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Indicateur	Type d'entrée:	Pression
Manufacturier:	Dwyer	Type de sortie:	Digitale
No. Model:	MS-321-LCD	Type de mesure:	Pression
No. Série:	E47U020014	Gamme:	0-0.5"H2O
Emplacement:	N.A.	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Setra	No. du certificat d'étalonnage:	AC17021126
No. Série:	2784759	Dernière date d'étalonnage:	17-Feb-17
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	17-Feb-18
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.0000 "H2O	0.000 "H2O	-0.007 "H2O	-0.007 "H2O	-0.007 "H2O	0.25 "H2O	Vérification indicateur
0.2500 "H2O	0.250 "H2O	0.237 "H2O	-0.013 "H2O	0.237 "H2O	0.25 "H2O	Vérification indicateur
0.5000 "H2O	0.500 "H2O	0.493 "H2O	-0.007 "H2O	0.493 "H2O	0.25 "H2O	Vérification indicateur
0.7500 "H2O	0.750 "H2O	0.740 "H2O	-0.010 "H2O	0.740 "H2O	0.25 "H2O	Vérification indicateur
1.0000 "H2O	1.000 "H2O	0.989 "H2O	-0.011 "H2O	0.989 "H2O	0.25 "H2O	Vérification indicateur
0.0000 "H2O	0.0000 V.DC.	0.0003 V.DC.	+0.0003 V.DC.	0.0003 V.DC.	0.00 V.DC.	Vérification sortie analogique
0.2500 "H2O	2.5000 V.DC.	2.3571 V.DC.	-0.1429 V.DC.	2.3571 V.DC.	0.00 V.DC.	Vérification sortie analogique
0.5000 "H2O	5.0000 V.DC.	4.8491 V.DC.	-0.1509 V.DC.	4.8491 V.DC.	0.00 V.DC.	Vérification sortie analogique
0.7500 "H2O	7.5000 V.DC.	7.4099 V.DC.	-0.0901 V.DC.	7.4099 V.DC.	0.00 V.DC.	Vérification sortie analogique
1.0000 "H2O	10.0000 V.DC.	9.8836 V.DC.	-0.1164 V.DC.	9.8836 V.DC.	0.00 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 18 °C Humidité: 33 %RH

Type d'Étalonnage:

5F09106

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS NRC·CNRC CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-006 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\-0.25"H2O
Fréquence d'étalonnage: (jours)	365

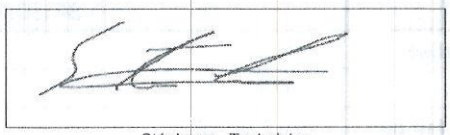
SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Indicateur	**Type d'entrée:**	Pression
Manufacturier:	Dwyer	**Type de sortie:**	Digitale
No. Model:	MS-321-LCD	**Type de mesure:**	Pression
No. Série:	E47U020014	**Gamme:**	0-0.5"H2O
Emplacement:	N.A.	**No. Machine:**	N.A.

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

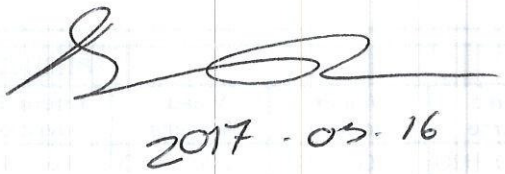
DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	27 Février 2017
Date du prochain Étalonnage:	27 Février 2018
Date d'émission du certificat:	27 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.



Stéphane - Technicien



2017 - 03 - 16

5F09106

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
ARC-CRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

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(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-007 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\- 0.25"H2O
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Indicateur	Type d'entrée:	Pression
Manufacturier:	Dwyer	Type de sortie:	Digitale
No. Model:	MS-321-LCD	Type de mesure:	Pression
No. Série:	E23S020111/12	Gamme:	0-0.5"H2O
Emplacement:	N.A.	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Setra	No. du certificat d'étalonnage:	AC17021126
No. Série:	2784759	Dernière date d'étalonnage:	17-Feb-17
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	17-Feb-18
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.0000 "H2O	0.0000 "H2O	0.0015 "H2O	+0.0015 "H2O	0.0015 "H2O	0.25 "H2O	Vérification indicateur
0.1500 "H2O	0.1500 "H2O	0.1484 "H2O	-0.0016 "H2O	0.1484 "H2O	0.25 "H2O	Vérification indicateur
0.2500 "H2O	0.2500 "H2O	0.2444 "H2O	-0.0056 "H2O	0.2444 "H2O	0.25 "H2O	Vérification indicateur
0.3500 "H2O	0.3500 "H2O	0.3528 "H2O	+0.0028 "H2O	0.3528 "H2O	0.25 "H2O	Vérification indicateur
0.5000 "H2O	0.5000 "H2O	0.5017 "H2O	+0.0017 "H2O	0.5017 "H2O	0.25 "H2O	Vérification indicateur
0.0000 "H2O	0.0000 V.DC.	0.0026 V.DC.	+0.0026 V.DC.	0.0026 V.DC.	0.01 V.DC.	Vérification sortie analogique
0.0250 "H2O	2.5000 V.DC.	2.8463 V.DC.	+0.3463 V.DC.	2.8463 V.DC.	0.01 V.DC.	Vérification sortie analogique
0.0500 "H2O	5.0000 V.DC.	5.2385 V.DC.	+0.2385 V.DC.	5.2385 V.DC.	0.01 V.DC.	Vérification sortie analogique
0.0750 "H2O	7.5000 V.DC.	7.5625 V.DC.	+0.0625 V.DC.	7.5625 V.DC.	0.01 V.DC.	Vérification sortie analogique
0.1000 "H2O	10.0000 V.DC.	9.9601 V.DC.	-0.0399 V.DC.	9.9601 V.DC.	0.01 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 18 °C Humidité: 33 %RH

Type d'Étalonnage:

5F09106

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS NRC-CRC CLAS 2010-02

SCC Accredited LAB LAB Accrédité CCN N°669

80 rue de la montagne
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Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-007 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\- 0.25"H2O
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Indicateur	**Type d'entrée:**	Pression
Manufacturier:	Dwyer	**Type de sortie:**	Digitale
No. Model:	MS-321-LCD	**Type de mesure:**	Pression
No. Série:	E23S020111/12	**Gamme:**	0-0.5"H2O
Emplacement:	N.A.	**No. Machine:**	N.A.

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	27 Février 2017
Date du prochain Étalonnage:	27 Février 2018
Date d'émission du certificat:	27 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.

Stéphane - Technicien

2017-03-16

5F09106

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
NRC·CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-015 28/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9101
Précision requise:	+\- 2°C
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Enregistreur	Type d'entrée:	Temp
Manufacturier:	Keithley	Type de sortie:	Digitale
No. Model:	7700	Type de mesure:	Température
No. Série:	1213648	Gamme:	Divers
Emplacement:	N/A	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
-190.0 °C	-190.0 °C	-190.7 °C	-0.7 °C	-190.7 °C	1.0 °C	Input#1TypeK
0.0 °C	0.0 °C	-0.3 °C	-0.3 °C	-0.3 °C	1.0 °C	Input#1TypeK
750.0 °C	750.0 °C	749.7 °C	-0.3 °C	749.7 °C	1.0 °C	Input#1TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#2 TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#3 TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#4 TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#5TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#6TypeK
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#7TypeK
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#8TypeK
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#9TypeK
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#10TypeJ
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#11TypeJ
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#12TypeJ
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#13 TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#14TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#15 TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#16TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#17TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#18TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#19TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#20TypeJ
12.000 mA	12.000 mA	12.002 mA	+0.002 mA	12.002 mA	1.00 mA	Input#21
12.000 mA	12.000 mA	12.002 mA	+0.002 mA	12.002 mA	1.00 mA	Input#22

Conditions Environnementales: Température: 18 °C Humidité: 34 %RH

5F09101

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
NRC·CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-015 28/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9101
Précision requise:	+\- 2°C
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Enregistreur	**Type d'entrée:**	Temp
Manufacturier:	Keithley	**Type de sortie:**	Digitale
No. Model:	7700	**Type de mesure:**	Température
No. Série:	1213648	**Gamme:**	Divers
Emplacement:	N/A	**No. Machine:**	N.A.
Type d'Étalonnage:	Test avec EM-047		

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	28 Février 2017
Date du prochain Étalonnage:	28 Février 2018
Date d'émission du certificat:	28 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.

Stéphane - Technicien

2017-03-16

5F09101

DISPERSION
Laboratoire • Laboratory DIVISION • TRANSCOT CANADA

CLAS
ARC·CRC
CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

Client :	Polytests	**No. du Certificat :**	**122-3A7009-161-1647**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Date d'étalonnage :**	22-09-2016

Technicien:
Auclair, François

David Llorens, Responsable Qualité

DESCRIPTION DU SERVICE:

Modèle de la Base :	4X4HP-10K	**Capacité :**	4000kg
Numéro de Série Base:	C25969	**Méthode:**	ISO 17025 / Class III
Modèle de Terminal:	420 plus 2A	**Résolution:**	0.05kg
Numéro de Série Terminal:	1407400034	**Date d'approbation :**	22-09-2016
Numéro d'identification :	EM-020-021	**Date prochain étalonnage :**	22-09-2017

Condition d'essai :	Temp °C:	21.7	Pression kPa:	101.9	Humidité %:	58.1

Note: Les conditions environnementales ne sont pas utilisées dans le calcul de l'incertitude.

CETTE BALANCE RENCONTRE LES SPÉCIFICATIONS SUIVANTES:

Type de test :	**Manufacturier**			
Excentricité:	Pré: ☑ Oui	☐ Non	Post: ☑ Oui	☐ Non
Linéarité:	☐ Oui	☑ Non	☑ Oui	☐ Non
Sensibilité:	☐ Oui	☑ Non	☑ Oui	☐ Non
Répétabilité:	☑ Oui	☐ Non	☑ Oui	☐ Non

NOTES:

Cette balance a été certifiée selon la procédure de travail PDL-09-MG-010 (certification de balance analytique et à plateau) et la et la procédure PDL-09-MG-012 (détermination des incertitudes de pesées). Nos étalons sont certifiés à chaque année.

2016.09.28

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www.dispersion.ca 1.866.390.5066

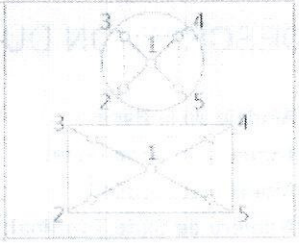
CERTIFICAT D'ÉTALONNAGE

Client :	Polytests	**No. du Certificat :**	**122-3A7009-161-1647**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Modèle de la Base :**	4X4HP-10K
		Date d'étalonnage :	22-09-2016
Méthode :	ISO 17025	**Date du prochain étalonnage :**	22-09-2017

TEST D'EXCENTRICITÉ:

Poids Test: 400 kg Tolérance 0.25 kg
(Note: Le Poids Test est taré au centre du plateau de pesée)

Position	Avant Ajustement	Après Ajustement
1: Centre:	0.00 kg	0.00 kg
2: Avant Gauche:	0.05 kg	0.05 kg
3: Arrière Gauche:	0.15 kg	0.15 kg
4: Arrière Droit:	0.15 kg	0.15 kg
5: Avant Droit:	0.25 kg	0.25 kg
Résultats	0.25 kg	0.25 kg
STATUT	**CONFORME**	**CONFORME**



TEST DE LINÉARITÉ:

Méthode: Accumulation Plage: 1200 kg Poids Test: 200 kg Tolérance: 0.15 kg

Pré-Charge	Avant Ajustement	Après Ajustement
0.00 kg	199.10 kg	199.95 kg
0.00 kg	398.30 kg	399.95 kg
0.00 kg	597.55 kg	599.95 kg
0.00 kg	796.85 kg	800.00 kg
0.00 kg	996.25 kg	1000.10 kg
0.00 kg	1195.55 kg	1200.10 kg
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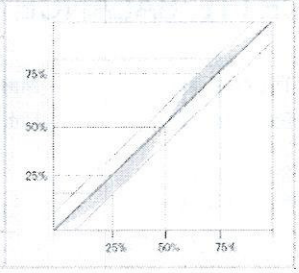
Résultats	**0.225 kg**	**0.100 kg**
STATUT	**NON-CONFORME**	**CONFORME**



TEST DE SENSIBILITÉ:

Valeur de masse conventionnelle: 1200.00 kg Tolérance: 0.25 kg

	Avant Ajustement	Après Ajustement
Lecture:	1195.60 kg	1200.10 kg
Résultats:	**4.40 kg**	**0.10 kg**
STATUT	**NON-CONFORME**	**CONFORME**

$$S = \frac{\Delta W}{\Delta m}$$

DISPERSION

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CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

Client :	Polytests	**No. du Certificat :**	**122-3A7009-161-1647**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Modèle de la Base :**	4X4HP-10K
		Date d'étalonnage :	22-09-2016
Méthode :	ISO 17025	**Date du prochain étalonnage :**	22-09-2017

TEST DE RÉPÉTABILITÉ:

on ne fait jamais de test avec plus de 1 DD

AVANT AJUSTEMENT:

Charge Utilisée: 160.00 kg

Tolérance: 0.150 kg

Résolution d'affichage: 0.05 kg

Moyenne: 160.090 kg

Écart-type: **0.032 kg**

#	Vide	Chargé	Différence
1	0.00 kg	160.10 kg	160.10 kg
2	0.00 kg	160.10 kg	160.10 kg
3	0.00 kg	160.10 kg	160.10 kg
4	0.00 kg	160.10 kg	160.10 kg
5	0.00 kg	160.10 kg	160.10 kg
6	0.00 kg	160.10 kg	160.10 kg
7	0.00 kg	160.10 kg	160.10 kg
8	0.00 kg	160.00 kg	160.00 kg
9	0.00 kg	160.10 kg	160.10 kg
10	0.00 kg	160.10 kg	160.10 kg

Statut : **CONFORME**

APRÈS AJUSTEMENT:

Charge Utilisée: 160.00 kg

Tolérance: 0.150 kg

Résolution d'affichage: 0.05 kg

Moyenne: 159.900 kg

Écart-type: **0.000 kg**

#	Vide	Chargé	Différence
1	0.00 kg	159.90 kg	159.90 kg
2	0.00 kg	159.90 kg	159.90 kg
3	0.00 kg	159.90 kg	159.90 kg
4	0.00 kg	159.90 kg	159.90 kg
5	0.00 kg	159.90 kg	159.90 kg
6	0.00 kg	159.90 kg	159.90 kg
7	0.00 kg	159.90 kg	159.90 kg
8	0.00 kg	159.90 kg	159.90 kg
9	0.00 kg	159.90 kg	159.90 kg
10	0.00 kg	159.90 kg	159.90 kg

Statut : **CONFORME**

2016-09-28

CERTIFICAT D'ÉTALONNAGE

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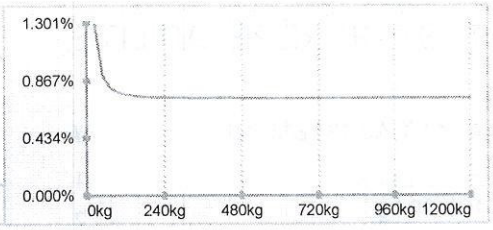
www.dispersion.ca 1.866.390.5066

INCERTITUDE AVANT AJUSTEMENT :

$$Uc = \sqrt{(u_{(cr)}{}^2 + s_p{}^2 + u_{(l)}{}^2 + u_{(dr)}{}^2 + u_{(s)}{}^2)}$$

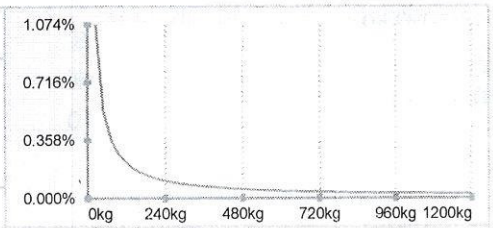
u(cr) = Incertitude reliée à l'étalon utilisé
Sp = Incertitude de l'écart-type
u(l) = Incertitude associée à la linéarité
u(dr) = Incertitude associée à résolution si Sp = 0
u(s) = Incertitude liée à la sensibilité (span)

Valeur	Incertitude	Incertitude (%)
75.00 kg	0.5535851 kg	0.738113 %
150.00 kg	1.1017969 kg	0.734531 %
300.00 kg	2.2008990 kg	0.733633 %
600.00 kg	4.4004496 kg	0.733408 %
1200.00 kg	8.812 kg	0.734310 %



INCERTITUDE APRÈS AJUSTEMENT :

Valeur	Incertitude	Incertitude (%)
75.00 kg	0.0641303 kg	0.085507 %
150.00 kg	0.0676864 kg	0.045124 %
300.00 kg	0.0803520 kg	0.026784 %
600.00 kg	0.1181374 kg	0.019690 %
1200.00 kg	0.2901435 kg	0.024179 %



NOTES :

De ces valeurs d'incertitudes, seule la valeur surlignée est calculée selon ISO17025:2005, les autres étant estimées jusqu'au résultat de l'incertitude minimale. Dans le calcul de cette l'incertitude, l'écart-type utilisé est de 0,577d (où d est la précision d'affichage de la balance) lorsque cet écart-type est plus inférieur à 0,577d.

DISPERSION
Laboratoire • Laboratory DIVISION - TRANSCAT CANADA

CLAS 2010-01

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

CERTIFICAT D'ÉTALONNAGE

RÉFÉRENCE

ENSEMBLE DE RÉFÉRENCE:

Référence	No de série	Fabricant	Date d'étalonnage
20kg	LT-PHM01	Poids & Mesure Canada	09-09-2015

INCERTITUDES:

Les incertitudes que nous retrouvons comprennent :

3. *L'incertitude associée à l'étalon utilisé.*
2. *L'incertitude associée à l'écart-type.*
1. *L'incertitude associée à l'opération de pesage.*
4. *L'incertitude associée à la résolution de l'appareil.*

L'incertitude de l'opération de pesage comprend la reproductibilité à long terme.

Les incertitudes précisées dans ce rapport sont des incertitudes élargies représentant un niveau de confiance d'approximativement 95 %, obtenu en multipliant ensemble l'incertitude-type composée par un facteur de couverture de k = 2. Pour de plus amples renseignements, veuillez consulter la publication GUM (Guide pour l'expression de l'incertitude de mesure, édition de 1995).

TRAÇABILITÉ

Le Service d'évaluation de laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et a certifié des capacités d'étalonnage spécifiques de ce laboratoire et leur traçabilité à des étalons nationaux de mesure reconnus et au Système international d'unités (SI). Ce certificat d'étalonnage est émis conformément aux conditions de certification accordées par CLAS et aux conditions d'accréditation accordées par le Conseil canadien des normes (CCN). Le CLAS pas plus que le CCN ne peut garantir l'exactitude des étalonnages individuels effectués par des laboratoires accrédités.

REMARQUES:

2016-09-28

Instrumentation Saint-Laurent inc.
Accrédité ISO 17025

CLAS NRC-CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-047 28/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9101
Précision requise:	+\-2°C
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Enregistreur	Type d'entrée:	Temp
Manufacturier:	Keithley	Type de sortie:	Digitale
No. Model:	2700	Type de mesure:	Température
No. Série:	1217093	Gamme:	Divers
Emplacement:	N.A.	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
Voir Commentaire						

Conditions Environnementales: Température: 18 °C Humidité: 32 %RH

Type d'Étalonnage: Data Acquisition system Conforme
Carte1: EM-154
Carte2: EM-015

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	28 Février 2017
Date du prochain Étalonnage:	28 Février 2018
Date d'émission du certificat:	28 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.

Stéphane - Technicien

2017.03.16

5F09101

DISPERSION
Laboratoire • Laboratory DIVISION - TRANSCAT CANADA

CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

Client :	Polytests	**No. du Certificat :**	**122-3A7009-161-1649**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Date d'étalonnage :**	22-09-2016

Technicien:
Auclair, François

David Llorens, Responsable Qualité

DESCRIPTION DU SERVICE:

Modèle de Balance :	AR2140	**Méthode :**	ISO 17025
Manufacturier :	Ohaus	**Date d'approbation :**	22-09-2016
Numéro de Série :	M3658329010091	**Date prochain étalonnage :**	22-09-2017
Numéro d'identification :	EM-051	**accréditation CCN n. :**	668
Capacité :	210g	**Certification CLAS n. :**	2010-01
Résolution:	0.0001g		

Condition d'essai :	Temp °C:	25.1	Pression kPa:	101.9	Humidité %:	45.5

Note: Les conditions environnementales ne sont pas utilisées dans le calcul de l'incertitude.

CETTE BALANCE RENCONTRE LES SPÉCIFICATIONS SUIVANTES:

Type de test :	**Manufacturier**
Excentricité:	☑ Oui ☐ Non
Linéarité:	☑ Oui ☐ Non
Sensibilité:	☑ Oui ☐ Non
Répétabilité:	☑ Oui ☐ Non

NOTES:

Cette balance a été certifiée selon la procédure de travail PDL-09-MG-010 (certification de balance analytique et à plateau) et la et la procédure PDL-09-MG-012 (détermination des incertitudes de pesées). Nos étalons sont certifiés à chaque année.

2016.09.28

DISPERSION

Laboratoire • Laboratory DIVISION - TRANSCAT CANADA

CLAS NRC-CNRC CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

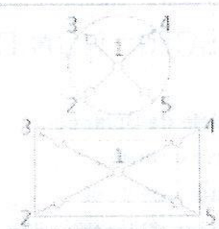
Client :	Polytests	**No. du Certificat :**	**122-3A7009-161-1649**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Modèle de Balance :**	AR2140
		Date d'étalonnage :	22-09-2016
Méthode :	ISO 17025	**Date du prochain étalonnage :**	22-09-2017

TEST D'EXCENTRICITÉ:

Poids Test: 100 g Tolérance 0.0004 g

(Note: Le Poids Test est taré au centre du plateau de pesée)

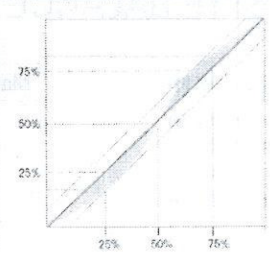
Position	Avant Ajustement	Après Ajustement
1: Centre:	0.0000 g	----
2: Avant Gauche:	0.0000 g	----
3: Arrière Gauche:	0.0000 g	----
4: Arrière Droit:	0.0000 g	----
5: Avant Droit:	0.0000 g	----
Résultats	0.0000 g	----
STATUT	**CONFORME**	**N/A**



TEST DE LINÉARITÉ:

Méthode: Substitution Plage: 210 g Poids Test: 50 g Tolérance: 0.0002 g

Pré-Charge	**Avant Ajustement**	**Après Ajustement**
0.0000 g	50.0002 g	----
50.0000 g	49.9998 g	----
100.0000 g	49.9998 g	----
150.0000 g	50.0002 g	----
----	----	----
----	----	----
----	----	----
Résultats	**0.00020 g**	----
STATUT	**CONFORME**	**N/A**



TEST DE SENSIBILITÉ:

Valeur de masse conventionnelle: 200.0000 g Tolérance: 0.0004 g

	Avant Ajustement	**Après Ajustement**
Lecture:	199.9998 g	----
Résultats:	**0.0002 g**	----
STATUT	**CONFORME**	**N/A**

$$S = \frac{\Delta W}{\Delta m}$$

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CERTIFICAT D'ÉTALONNAGE

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www.dispersion.ca 1.866.390.5066

Client :	Polytests	**No. du Certificat :**	**122-3A7009-161-1649**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Modèle de Balance :**	AR2140
		Date d'étalonnage :	22-09-2016
Méthode :	ISO 17025	**Date du prochain étalonnage :**	22-09-2017

TEST DE RÉPÉTABILITÉ:

AVANT AJUSTEMENT:

Charge Utilisée:
100.0000 g

Tolérance:
0.00010 g

Résolution d'affichage:
0.0001 g

Moyenne:
99.99979 g

Écart-type:
0.00006 g

#	Vide	Chargé	Différence
1	0.0000 g	99.9997 g	99.9997 g
2	0.0000 g	99.9998 g	99.9998 g
3	0.0000 g	99.9998 g	99.9998 g
4	0.0000 g	99.9997 g	99.9997 g
5	0.0000 g	99.9998 g	99.9998 g
6	0.0000 g	99.9998 g	99.9998 g
7	0.0000 g	99.9998 g	99.9998 g
8	0.0000 g	99.9999 g	99.9999 g
9	0.0000 g	99.9998 g	99.9998 g
10	0.0000 g	99.9998 g	99.9998 g
		Statut :	**CONFORME**

APRÈS AJUSTEMENT:

Charge Utilisée:

Tolérance:
0.00010 g

Résolution d'affichage:
0.0001 g

Moyenne:

Écart-type:

#	Vide	Chargé	Différence
1	---	---	---
2	---	---	---
3	---	---	---
4	---	---	---
5	---	---	---
6	---	---	---
7	---	---	---
8	---	---	---
9	---	---	---
10	---	---	---
		Statut :	**N/A**

2016-09-28

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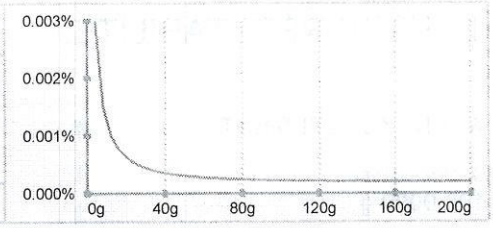
CERTIFICAT D'ÉTALONNAGE

INCERTITUDE AVANT AJUSTEMENT :

$$Uc = \sqrt{(u_{(cr)}{}^2 + s_p{}^2 + u_{(l)}{}^2 + u_{(dr)}{}^2 + u_{(s)}{}^2)}$$

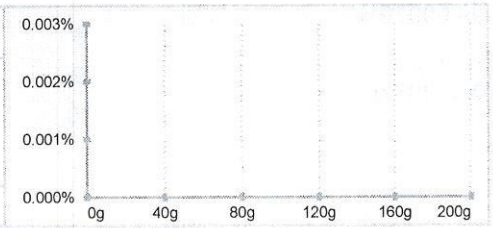
u(cr) = Incertitude reliée à l'étalon utilisé
Sp = Incertitude de l'écart-type
u(l) = Incertitude associée à la linéarité
u(dr) = Incertitude associée à résolution si Sp = 0
u(s) = Incertitude liée à la sensibilité (span)

Valeur	Incertitude	Incertitude (%)
12.5000 g	0.00016 g	0.001300 %
25.0000 g	0.00017 g	0.000673 %
50.0000 g	0.00019 g	0.000378 %
100.0000 g	0.00026 g	0.000256 %
200.0000 g	0.00059 g	0.000294 %



INCERTITUDE APRÈS AJUSTEMENT :

Valeur	Incertitude	Incertitude (%)
---	---	---
---	---	---
---	---	---
---	---	---



NOTES :

De ces valeurs d'incertitudes, seule la valeur surlignée est calculée selon ISO17025:2005, les autres étant estimées jusqu'au résultat de l'incertitude minimale. Dans le calcul de cette l'incertitude, l'écart-type utilisé est de 0,577d (où d est la précision d'affichage de la balance) lorsque cet écart-type est plus inférieur à 0,577d.

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RÉFÉRENCE

ENSEMBLE DE RÉFÉRENCE:

Référence	No de série	Fabricant	Date d'étalonnage
1mg - 5kg	DK000A161	Dispersion Laboratoire	29-08-2016

INCERTITUDES:

Les incertitudes que nous retrouvons comprennent :

3. *L'incertitude associée à l'étalon utilisé.*
2. *L'incertitude associée à l'écart-type.*
1. *L'incertitude associée à l'opération de pesage.*
4. *L'incertitude associée à la résolution de l'appareil.*

L'incertitude de l'opération de pesage comprend la reproductibilité à long terme.

Les incertitudes précisées dans ce rapport sont des incertitudes élargies représentant un niveau de confiance d'approximativement 95 %, obtenu en multipliant ensemble l'incertitude-type composée par un facteur de couverture de k = 2. Pour de plus amples renseignements, veuillez consulter la publication GUM (Guide pour l'expression de l'incertitude de mesure, édition de 1995).

TRAÇABILITÉ

Le Service d'évaluation de laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et a certifié des capacités d'étalonnage spécifiques de ce laboratoire et leur traçabilité à des étalons nationaux de mesure reconnus et au Système international d'unités (SI). Ce certificat d'étalonnage est émis conformément aux conditions de certification accordées par CLAS et aux conditions d'accréditation accordées par le Conseil canadien des normes (CCN). Le CLAS pas plus que le CCN ne peut garantir l'exactitude des étalonnages individuels effectués par des laboratoires accrédités.

REMARQUES:

2016-09-28

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CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
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Client :	Polytests	**No. du Certificat :**	**123-259410-142**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Date d'étalonnage :**	30-10-2014

Technicien :
Simard, Catherine

Technicienne Métrologie

Pierre Trépanier, Directeur laboratoire

DESCRIPTION DU SERVICE:

Description des masses :	ASTM E617	**Date d'approbation :**	03-11-2014
Classe de précision :	ASTM 6	**Date prochain étalonnage :**	03-11-2015
Densité :	7.95g/cm³	**Accrédtation CCN n. :**	668
Identification (si unique) :	EM-090	**Certification CLAS n. :**	2010-01

Condition d'essai :	Temp °C:	20.605	Pression kPa:	101.2	Humidité:	46.785

NOTES:

Pour l'étalonnage des masses, nous utilisons la procédure "Comparaison individuelle" PDL-09-MG-001 et la procédure "Détermination des incertitudes" PDL-09-MG-002. Le droit d'auteur du présent certificat appartient au laboratoire délivreur et doit être reproduit intégralement, à moins d'une autorisation écrite du laboratoire délivreur.

REMARQUES:

2014-11-05

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Client :	Polytests	**No. du Certificat :**	**123-259410-142**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Accrédtation CCN n. :**	668
		Certification CLAS n. :	2010-01
		Classe d'exactitude :	ASTM 6
		Date d'étalonnage :	30-10-2014
Masse :	2 kg	**Date du prochain étalonnage :**	03-11-2015

RÉSULTAT DE L'ÉTALONNAGE, MASSE CONVENTIONNELLE:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle	Masse conventionnelle après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
2 kg		EM-090	2.0001350 kg		200 mg	2.0 mg

S'applique seulement pour les masses qui ont été ajustées **Hors-tolérance pour la classe spécifiée**

2014-11-05

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Client :	Polytests	**No. du Certificat :**	**123-259410-142**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Accrédtation CCN n. :**	668
		Certification CLAS n. :	2010-01
		Classe d'exactitude :	ASTM 6
		Date d'étalonnage :	30-10-2014
Masse :	2 kg	**Date du prochain étalonnage :**	03-11-2015

RÉSULTAT DE L'ÉTALONNAGE DES POIDS, CORRECTIONS:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle Correction	Masse conventionnelle Correction après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
2 kg		EM-090	135.0 mg		200 mg	2.0 mg

S'applique seulement pour les masses qui ont été ajustées **Hors-tolérance pour la classe spécifiée**

2014-11-05

CERTIFICAT D'ÉTALONNAGE

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BALANCES UTILISÉES

Pour l'étalonnage manuel :

> 5 kg à 25 kg :	Mettler Toledo XP32003L, SNR 1123271214, max. 32100 g, d = 0.005 g
> 1 kg à 5 kg	Mettler Toledo PR5003, SNR 1115311634, max. 5100 g, d = 0.001 g
> 300 g à 2 kg :	Mettler Toledo XP2004S, SNR B131185222, max. 2100 g, d = 0.1 mg
> 100 g à 200 g :	Mettler Toledo AT201 SNR BA1115230146, max. 205 g, d = 0.01 mg
> 5 g à 100 g :	Mettler Toledo AX106 SNR 1127063924, max. 111 g, d = 1 µg
1 mg à 5 g :	Mettler UMX5, SNR 1121103055, max. 5.1 g, d = 0.1 µg

Pour l'étalonnage automatisé :

> 200 g à 1 kg :	Mettler Toledo AX1005 SNR 1127063210, max. 1109 g, d = 0.01 mg
> 5 g à 100 g :	Mettler Toledo AX106 SNR 1120143015, max. 111 g, d = 1 µg
1 mg à 5 g :	Mettler UMX5, SNR 1125140561, max. 5.1 g, d = 0.1 µg

Les balances sont vérifiées selon notre procédure de contrôle périodique PDL-11-MG-001.

INCERTITUDES:

Les incertitudes que nous retrouvons comprennent :

1. *L'incertitude associée à l'opération de pesage.*
2. *L'incertitude associée à la densité de l'air.*
3. *L'incertitude associée à l'étalon utilisé.*
4. *L'incertitude associée à la densité de la masse à être étalonnée.*

L'incertitude de l'opération de pesage comprend la reproductibilité à long terme.

Les incertitudes précisées dans ce rapport sont des incertitudes élargies représentant un niveau de confiance d'approximativement 95 %, obtenu en multipliant ensemble l'incertitude-type composée par un facteur de couverture de k = 2. Pour de plus amples renseignements, veuillez consulter la publication GUM (Guide pour l'expression de l'incertitude de mesure, édition de 1995).

TRAÇABILITÉ

Le Service d'évaluation de laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et a certifié des capacités d'étalonnage spécifiques de ce laboratoire et leur traçabilité à des étalons nationaux de mesure reconnus et au Système international d'unités (SI). Ce certificat d'étalonnage est émis conformément aux conditions de certification accordées par CLAS et aux conditions d'accréditation accordées par le Conseil canadien des normes (CCN). Le CLAS pas plus que le CCN ne peut garantir l'exactitude des étalonnages individuels effectués par des laboratoires accrédités.

2014-11-05

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CERTIFICAT D'ÉTALONNAGE

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RÉFÉRENCES UTILISÉES

Poids	No de série	Fabricant	Date d'étalonnage
20kg	69976	Troemner	18-03-2014
1kg - 1mg	MT-01	Mettler Toledo	04-09-2014
300g	96-0888-50-2	Denver Instrument Company	04-09-2014
2kg	96-0888-50-3	Denver Instrument Company	04-09-2014
2kg	129098	Mettler Toledo	04-09-2014
5kg	96-0888-50-3	Denver Instrument Company	04-09-2014
5kg	129099	Mettler Toledo	04-09-2014
10kg	129100	Mettler Toledo	14-08-2014

ÉTALONS CERTFIÉS PAR LE CNRC:

Poids	No de série	Fabricant	Date d'étalonnage
100g	95170	Mettler Toledo	19-08-2014
1kg	95171	Mettler Toledo	02-05-2014

RÉFÉRENCES DE LA STATION ROBOTISÉE:

Poids	No de série	Fabricant	Date d'étalonnage
1kg - 1mg	DK000A133	Laboratoire Dispersion	04-09-2014
1kg - 1mg	DK000A132	Laboratoire Dispersion	01-02-2013

2014-11-05

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS 2010-02

SCC Accredited LAB
Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-126 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\- 1"Hg
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Manomètre	Type d'entrée:	Pression
Manufacturier:	Dwyer	Type de sortie:	Digitale
No. Model:	DPG200	Type de mesure:	Pression
No. Série:	N.A.	Gamme:	0-28"Hg
Emplacement:	N.A.	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Crystal XP2i 300	No. du certificat d'étalonnage:	AC16061306
No. Série:	866756	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	1 "Hg	Vérification indicateur
-7.50 "Hg	-7.50 "Hg	-7.61 "Hg	-0.11 "Hg	-7.61 "Hg	1 "Hg	Vérification indicateur
-15.00 "Hg	-15.00 "Hg	-15.23 "Hg	-0.23 "Hg	-15.23 "Hg	1 "Hg	Vérification indicateur
-22.50 "Hg	-22.50 "Hg	-22.84 "Hg	-0.34 "Hg	-22.84 "Hg	1 "Hg	Vérification indicateur
-28.00 "Hg	-28.00 "Hg	-28.44 "Hg	-0.44 "Hg	-28.44 "Hg	1 "Hg	Vérification indicateur
0.00 "Hg	10.0000 V.DC.	10.0600 V.DC.	+0.0600 V.DC.	10.0600 V.DC.	0.01 V.DC.	Vérification sortie analogique
-7.50 "Hg	8.0000 V.DC.	8.0461 V.DC.	+0.0461 V.DC.	8.0461 V.DC.	0.01 V.DC.	Vérification sortie analogique
-15.00 "Hg	6.0000 V.DC.	6.0117 V.DC.	+0.0117 V.DC.	6.0117 V.DC.	0.01 V.DC.	Vérification sortie analogique
-22.50 "Hg	4.0000 V.DC.	3.9727 V.DC.	-0.0273 V.DC.	3.9727 V.DC.	0.01 V.DC.	Vérification sortie analogique
-28.00 "Hg	2.5333 V.DC.	2.4605 V.DC.	-0.0728 V.DC.	2.4605 V.DC.	0.01 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 18 °C Humidité: 33 %RH

Type d'Étalonnage:

2017-03-16

5F09106

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS
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CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-126 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\- 1"Hg
Fréquence d'étalonnage: (jours)	365

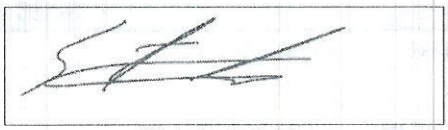
SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Manomètre	**Type d'entrée:**	Pression
Manufacturier:	Dwyer	**Type de sortie:**	Digitale
No. Model:	DPG200	**Type de mesure:**	Pression
No. Série:	N.A.	**Gamme:**	0-28"Hg
Emplacement:	N.A.	**No. Machine:**	N.A.

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	27 Février 2017
Date du prochain Étalonnage:	27 Février 2018
Date d'émission du certificat:	27 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.



Stéphane - Technicien

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Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

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CLAS 2010-02

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LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-127 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\- 1"Hg
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Manomètre	Type d'entrée:	Pression
Manufacturier:	Dwyer	Type de sortie:	Digitale
No. Model:	DPG200	Type de mesure:	Pression
No. Série:	N.A.	Gamme:	0-28"Hg
Emplacement:	N.A.	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Crystal XP2i 300	No. du certificat d'étalonnage:	AC16061306
No. Série:	866756	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	1 "Hg	Vérification indicateur
-7.50 "Hg	-7.50 "Hg	-7.53 "Hg	-0.03 "Hg	-7.53 "Hg	1 "Hg	Vérification indicateur
-15.00 "Hg	-15.00 "Hg	-15.03 "Hg	-0.03 "Hg	-15.03 "Hg	1 "Hg	Vérification indicateur
-22.50 "Hg	-22.50 "Hg	-22.56 "Hg	-0.06 "Hg	-22.56 "Hg	1 "Hg	Vérification indicateur
-28.00 "Hg	-28.00 "Hg	-28.08 "Hg	-0.08 "Hg	-28.08 "Hg	1 "Hg	Vérification indicateur
0.00 "Hg	10.0000 V.DC.	10.0101 V.DC.	+0.0101 V.DC.	10.0101 V.DC.	0.01 V.DC.	Vérification sortie analogique
-7.50 "Hg	8.0000 V.DC.	8.0232 V.DC.	+0.0232 V.DC.	8.0232 V.DC.	0.01 V.DC.	Vérification sortie analogique
-15.00 "Hg	6.0000 V.DC.	6.0216 V.DC.	+0.0216 V.DC.	6.0216 V.DC.	0.01 V.DC.	Vérification sortie analogique
-22.50 "Hg	4.0000 V.DC.	4.0059 V.DC.	+0.0059 V.DC.	4.0059 V.DC.	0.01 V.DC.	Vérification sortie analogique
-28.00 "Hg	2.5333 V.DC.	2.5208 V.DC.	-0.0125 V.DC.	2.5208 V.DC.	0.01 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 18 °C Humidité: 33 %RH

Type d'Étalonnage:

2017-03-16

5F09106

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
NRC·CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
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CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-127 27/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9106
Précision requise:	+\- 1"Hg
Fréquence d'étalonnage: (jours)	365

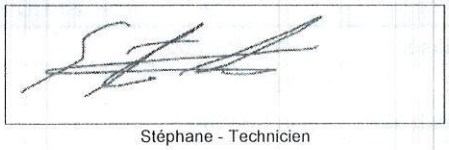
SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Manomètre	**Type d'entrée:**	Pression
Manufacturier:	Dwyer	**Type de sortie:**	Digitale
No. Model:	DPG200	**Type de mesure:**	Pression
No. Série:	N.A.	**Gamme:**	0-28"Hg
Emplacement:	N.A.	**No. Machine:**	N.A.

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	27 Février 2017
Date du prochain Étalonnage:	27 Février 2018
Date d'émission du certificat:	27 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.



Stéphane - Technicien

5F09106

DISPERSION
Laboratoire • Laboratory

CLAS
NRC·CNRC
CLAS 2010-01

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

CERTIFICAT D'ÉTALONNAGE

Client :	Polytests	**No. du Certificat :**	**900-259410-141**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Date d'étalonnage :**	03-11-2014

Technicien :
CB001,

Station d'étalonnage automatisée

Pierre Trépanier, Directeur laboratoire

DESCRIPTION DU SERVICE:

Description des masses :	ASTM E617	**Date d'approbation :**	03-11-2014
Classe de précision :	ASTM 1	**Date prochain étalonnage :**	03-11-2015
Densité :	7.95g/cm³	**Accrédtation CCN n. :**	668
Identification (si unique) :	(items multiples)	**Certification CLAS n. :**	2010-01

Condition d'essai :	Temp °C:	20.51	Pression kPa:	101.195	Humidité:	48.615

NOTES:

Pour l'étalonnage des masses, nous utilisons la procédure "Comparaison individuelle" PDL-09-MG-001 et la procédure "Détermination des incertitudes" PDL-09-MG-002. Le droit d'auteur du présent certificat appartient au laboratoire délivreur et doit être reproduit intégralement, à moins d'une autorisation écrite du laboratoire délivreur.

REMARQUES:

2014-11-05

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CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

Client :	Polytests	**No. du Certificat :**	**900-259410-141**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Classe d'exactitude :**	ASTM 1
		Date d'étalonnage :	03-11-2014
Masse :	100 mg - 200 g	**Date du prochain étalonnage :**	03-11-2015

RÉSULTAT DE L'ÉTALONNAGE, MASSE CONVENTIONNELLE:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle	Masse conventionnelle après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
100 mg	1000014200	EM-128	99.9996 mg		0.010 mg	0.002 mg
200 g	1000026013	EM-129	200.00023 g		0.50 mg	0.11 mg

S'applique seulement pour les masses qui ont été ajustées **Hors-tolérance pour la classe spécifiée**

2014-11-05

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CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

Client :	Polytests	**No. du Certificat :**	**900-259410-141**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Classe d'exactitude :**	ASTM 1
		Date d'étalonnage :	03-11-2014
Masse :	100 mg - 200 g	**Date du prochain étalonnage :**	03-11-2015

RÉSULTAT DE L'ÉTALONNAGE DES POIDS, CORRECTIONS:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle Correction	Masse conventionnelle Correction après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
100 mg	1000014200	EM-128	-0.0004 mg		0.010 mg	0.002 mg
200 g	1000026013	EM-129	0.23 mg		0.50 mg	0.11 mg

S'applique seulement pour les masses qui ont été ajustées **Hors-tolérance pour la classe spécifiée**

2014 - 11 - 05

CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

BALANCES UTILISÉES

Pour l'étalonnage manuel :

> 5 kg à 25 kg :	Mettler Toledo XP32003L, SNR 1123271214, max. 32100 g, d = 0.005 g
> 1 kg à 5 kg	Mettler Toledo PR5003, SNR 1115311634, max. 5100 g, d = 0.001 g
> 300 g à 2 kg :	Mettler Toledo XP2004S, SNR B131185222, max. 2100 g, d = 0.1 mg
> 100 g à 200 g :	Mettler Toledo AT201 SNR BA1115230146, max. 205 g, d = 0.01 mg
> 5 g à 100 g :	Mettler Toledo AX106 SNR 1127063924, max. 111 g, d = 1 µg
1 mg à 5 g :	Mettler UMX5, SNR 1121103055, max. 5.1 g, d = 0.1 µg

Pour l'étalonnage automatisé :

> 200 g à 1 kg :	Mettler Toledo AX1005 SNR 1127063210, max. 1109 g, d = 0.01 mg
> 5 g à 100 g :	Mettler Toledo AX106 SNR 1120143015, max. 111 g, d = 1 µg
1 mg à 5 g :	Mettler UMX5, SNR 1125140561, max. 5.1 g, d = 0.1 µg

Les balances sont vérifiées selon notre procédure de contrôle périodique PDL-11-MG-001.

INCERTITUDES:

Les incertitudes que nous retrouvons comprennent :

1. *L'incertitude associée à l'opération de pesage.*
2. *L'incertitude associée à la densité de l'air.*
3. *L'incertitude associée à l'étalon utilisé.*
4. *L'incertitude associée à la densité de la masse à être étalonnée.*

L'incertitude de l'opération de pesage comprend la reproductibilité à long terme.

Les incertitudes précisées dans ce rapport sont des incertitudes élargies représentant un niveau de confiance d'approximativement 95 %, obtenu en multipliant ensemble l'incertitude-type composée par un facteur de couverture de k = 2. Pour de plus amples renseignements, veuillez consulter la publication GUM (Guide pour l'expression de l'incertitude de mesure, édition de 1995).

TRAÇABILITÉ

Le Service d'évaluation de laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et a certifié des capacités d'étalonnage spécifiques de ce laboratoire et leur traçabilité à des étalons nationaux de mesure reconnus et au Système international d'unités (SI). Ce certificat d'étalonnage est émis conformément aux conditions de certification accordées par CLAS et aux conditions d'accréditation accordées par le Conseil canadien des normes (CCN). Le CLAS pas plus que le CCN ne peut garantir l'exactitude des étalonnages individuels effectués par des laboratoires accrédités.

2014 - 11 - 05

DISPERSION
Laboratoire • Laboratory

CLAS
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CERTIFICAT D'ÉTALONNAGE

108-86 Boulevard Des Entreprises, Boisbriand, Québec J7G 2T3
www.dispersion.ca 1.866.390.5066

RÉFÉRENCES UTILISÉES

Poids	No de série	Fabricant	Date d'étalonnage
20kg	69976	Troemner	18-03-2014
1kg - 1mg	MT-01	Mettler Toledo	04-09-2014
300g	96-0888-50-2	Denver Instrument Company	04-09-2014
2kg	96-0888-50-3	Denver Instrument Company	04-09-2014
2kg	129098	Mettler Toledo	04-09-2014
5kg	96-0888-50-3	Denver Instrument Company	04-09-2014
5kg	129099	Mettler Toledo	04-09-2014
10kg	129100	Mettler Toledo	14-08-2014

ÉTALONS CERTFIÉS PAR LE CNRC:

Poids	No de série	Fabricant	Date d'étalonnage
100g	95170	Mettler Toledo	19-08-2014
1kg	95171	Mettler Toledo	02-05-2014

RÉFÉRENCES DE LA STATION ROBOTISÉE:

Poids	No de série	Fabricant	Date d'étalonnage
1kg - 1mg	DK000A133	Laboratoire Dispersion	04-09-2014
1kg - 1mg	DK000A132	Laboratoire Dispersion	01-02-2013

2014 - 11 - 05

POLYCONTROLS

CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

CERTIFICAT D'ÉTALONNAGE # 6182

Date d'étalonnage : 2016/09/29
Date d'émission du certificat : 2016/09/29

Services Polytests
695 B Gaudette street
St-Jean-sur-Richelieu, Québec, Canada
J3B 7S7

Étalonnage d'un
Débitmètre volumétrique American Meter Company DTM-200A S/N : 99A274209

CONFORMITÉ AU PROGRAMME DE QUALITÉ

Tous les étalonnages sont effectués conformément au manuel d'assurance qualité de Polycontrols et sont conformes à la norme ISO/IEC 17025 – 2005, à la norme ISO 9001 – 2008 ainsi qu'à tout autre exigences de qualité définies dans la description d'achat des clients.

TRAÇABILITÉ

La traçabilité des étalons de débit au National Institute of Standards and Technology, NIST, est maintenue par les laboratoires de Fluke Corporation de Phoenix, Arizona et est conforme aux normes ISO/IEC 17025, AINSI/NCSL Z540-1-1994, ISO-10012-1, MIL-STD 45662A.

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.

APTITUDE EN MATIÈRE DE MESURE ET D'ÉTALONNAGE - CMC

Les références utilisées pour l'étalonnage de débit ont une incertitude de ±0.2% de la lecture pour les mesures entre 5 SCCM à 10 SLPM, ±0.3% de la lecture pour les mesures entre 10 SLPM à 30 SLPM, ±0.2% de la lecture pour les mesures entre 30 SLPM à 3000 SLPM, ±0.3% de la lecture pour les mesures supérieures à 3000 SLPM jusqu'à 6000 SLPM et ±0.5% pour les mesures inférieures à 5 SCCM jusqu'à concurrence de 1 SCCM, équivalent air ou azote. Les incertitudes exprimées sont élargies avec un facteur d'élargissement k = 2, et ce, pour un niveau de confiance d'environ 95 %, dans l'hypothèse d'une distribution normale. Le rapport d'incertitude des essais (RIE) de cet étalonnage respecte un ratio de 4:1 à moins d'indication contraire.

SOMMAIRE DES CONDITIONS DE L'INSTRUMENT EN TEST

Conditions initiales	En bon état
Travail Effectué	Étalonnage de l'instrument
	Aucun ajustement est requis
Résultats	Lectures finales dans les tolérances
Remarques	Fréquence d'étalonnage aux 12 mois

B Poirier
Métrologiste

Responsable du laboratoire

10 oct 2016

POLYCONTROLS

CLAS NRC·CNRC CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 6182

Numéro de série:	99A274209	Station de mesure:	3
Date d'étalonnage:	2016/09/29	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-130		

Instrument de mesure de référence utilisé pour l'étalonnage final

Description	Modèle	# Série	Traçabilité	Date dû
DHI molbloc (120 slpm)	2E2-S	237	1500192072	2016/12/12
DHI molbloc (30 slpm)	3E4-VCR-V-Q	2403	1500196118	2017/03/16
DHI molbox1	Molbox1	755	1500196141	2017/03/17
RTD Mist	M22	1871501	AC16031190-1871501	2017/04/20
Module 44.5 PSI avec Baro 163671	Module 30	160659	AC16041392-160659	2017/04/22

Spécifications finales de l'appareil

Gaz	Air
Température d'opération	
Pression à l'entrée	
Pression à la sortie	
Température de référence	
Pression de référence	
Étendue d'échelle	0-200 ACFH
Signaux Entrée/Sortie	-
Alimentation	
Tolérance ±1 %O.R.	

Condition d'étalonnage

Gaz	Air
Température ambiante	23 °C
Pression ambiante	1031 mbar
Orientation	Verticale
Élastomère	Viton
Valve	Viton

Lectures finales

Débit du test ACFH	Instrument en test ft3	Valeurs mesurées Pression PSIA	Température °C	Référence ft3	Référence calculée ft3	Erreur calculée ft3	Tolérance acceptable ft3	TUR
40.3549	6.810	14.993	23.46	6.874	6.792	0.018	0.068	2.91
71.3742	11.940	15.010	23.37	12.027	11.866	0.074	0.119	3.98
157.0952	26.230	15.098	23.39	26.681	26.173	0.057	0.262	>4

~~BA~~

Bernard Poirier
Métrologiste

Signature

10 oct 2016

POLYCONTROLS

CLAS 2009-02

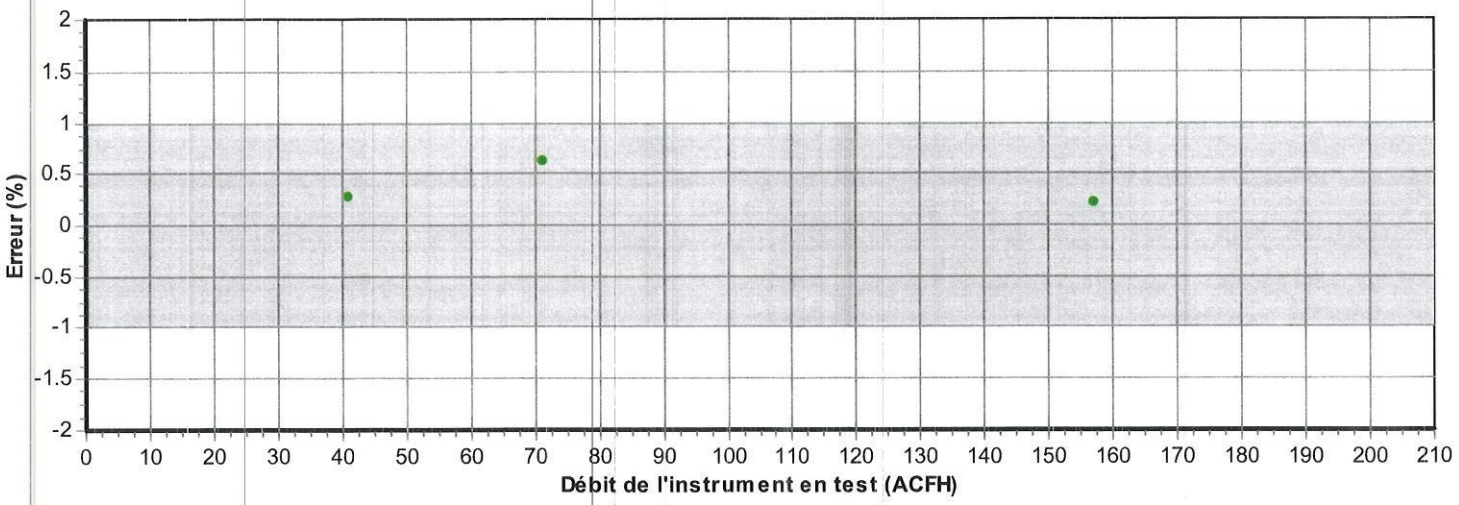
Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005

Certificat d'étalonnage # 6182

Numéro de série:	99A274209	Station de mesure:	3
Date d'étalonnage:	2016/09/29	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-130		

Résultats finaux



- La mesure (et son incertitude) se situe dans les tolérances
- La mesure (et son incertitude) se situe hors tolérance
- La mesure (et son incertitude) ne rencontre pas la marge de sécurité tel que spécifié dans le document G-8 de l'ILAC

cal. fact. 0,9974

10 oct 2016

Bernard Poirier
Métrologiste

Signature

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
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Tél: (450) 473-6169
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Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-136 01/03/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	ISL-004
Précision requise:	+\-2°C +\-3%RH
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Hygromètre	Type d'entrée:	Temp/%RH
Manufacturier:	Fluke	Type de sortie:	Digitale
No. Model:	971	Type de mesure:	Temp/humidité
No. Série:	10610850	Gamme:	5-95%RH -20a60°C
Emplacement:	N.A.	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Vaisala Portable 1	No. du certificat d'étalonnage:	AC16071314
No. Série:	U4840010/U4920031	Dernière date d'étalonnage:	21-Jul-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	21-Jul-17
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
25.0 °C	25.0 °C	25.2 °C	+0.2 °C	25.2 °C	1.0 °C	
40.0 °C	40.0 °C	40.2 °C	+0.2 °C	40.2 °C	1.0 °C	
33.0 %RH	33.0 %RH	32.9 %RH	-0.1 %RH	32.9 %RH	3.0 %RH	
50.0 %RH	50.0 %RH	50.6 %RH	+0.6 %RH	50.6 %RH	3.0 %RH	
80.0 %RH	80.0 %RH	80.9 %RH	+0.9 %RH	80.9 %RH	3.0 %RH	

Conditions Environnementales: Température: 22 °C Humidité: 35 %RH

Type d'Étalonnage:

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	1 Mars 2017
Date du prochain Étalonnage:	1 Mars 2018
Date d'émission du certificat:	1 Mars 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Numéro d'accréditation du CCN: # 669. Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.

Stéphane - Technicien

2017-03-16

CERTIFICATE OF NIST TRACEABLE CALIBRATION

Calibration Certificate No: 56849

Customer Information

Customer: Services Polytests, Inc.

Address : 695-B Gaudette
St-Jean-sur-richelieu
J3B 7S7

Customer PO #: 100396

LABORATORY ACCREDITATION BUREAU a division of A-S-B
ACCREDITED ISO/IEC 17025
Certificate # L2115-1 Calibration

Calibration Procedure Information

Procedure ID: GTP AIRVEL Revision #: 6 Revision Date: 1/6/2013

Calibration Standards Information

Graftel ID	Manufacturer	Model #	Description	CAL Due
10017	Hart Scientific/Burns	1502A/3925	Thermometer	9/7/2016
10086	Furness Controls	FC0332	DP Transmitter	6/6/2017
10100	Graftel	n/a	Temperature	10/29/2016
10155	HOBO	UX100-011	RH/Temp logger	11/17/2016
10171	Furness	FC0332-2W	0 - .4" H2O	11/10/2016
10187	Vaisala	PTB210	Barometric Pressure Gauge	12/6/2017

Sensor Information

Manufacturer: Omega
Description: Anemometer
Method Used: Pitot Tube

Model #: HHF143
Rated Accuracy: ± See Attachment
Accuracy Specified By: Omega

Instrument ID#: EM153
Range: 40 to 7800 fpm
Condition: Failed

Serial #: 1015949

Comments: Calibration Date: 08/12/2016
Failed Calibration

Pass bellow 5200 FPM
August 22nd 2016

The instruments(s) listed on this certificate have been calibrated against standards traceable to the National Institue of Standards && Technology (NIST) or compared to nationally or internationally recognized consensus standards. The reported calibration uncertainty has a confidence level of 95% (k=2). A calibration uncertainty ratio of 4:1 was maintained unless required uncertainty is supported by analysis. Graftel, LLC. Quality Assurance System complies with applicable requirements of ISO/IEC-17025-2005, ANSI/NCSL Z540-I-1994 and ISO 9001: 2008. All results contained within this certificate relate only to item(s) calibrated. This certificate shall not be reproduced except in full and with the written consent of Graftel, LLC. Acceptance Criteria per Simple Acceptance Rule: Measurement Uncertainty is not applied to the measured value when in/out of tolerance statement is made.

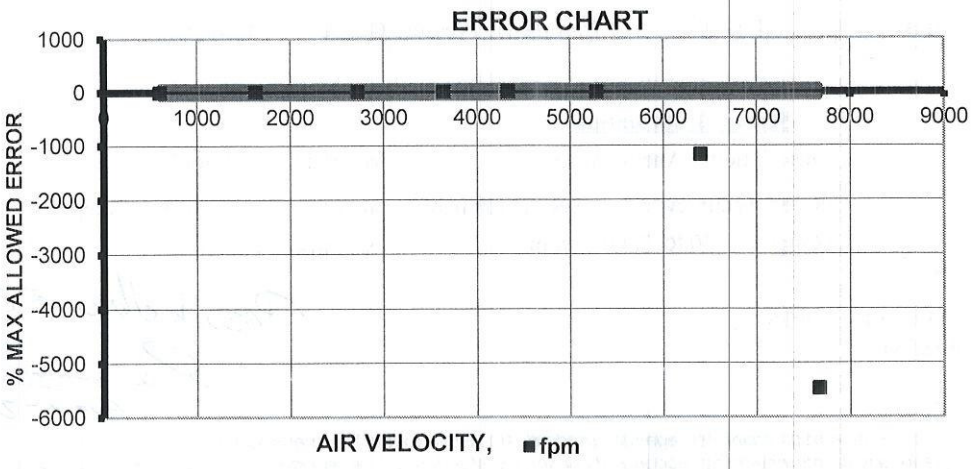
Performed By: _____ Date: 8/12/2016

J. Cortez
Calibration Technician

GRAFTEL, LLC. 870 Cambridge Drive, Elk Grove Village, IL 60007 847.364.2600
www.graftel.com

ATTACHMENT TO CALIBRATION CERTIFICATE 56849
AS FOUND/AS LEFT DATA

Reading From Standard,	Lower Limit of Meter Reading,	Measured Reading From Meter,	Upper Limit of Meter Reading,	Error,	Measurement Uncertainty,	STATUS
Actual Air Velocity						
fpm	fpm	fpm	fpm	fpm	fpm	
609	602	608	616	-1	3.05	Pass
1634	1617	1634	1651	0	8.17	Pass
2720	2692	2722	2748	2	13.60	Pass
3639	3602	3638	3676	-1	18.20	Pass
4333	4289	4334	4377	1	21.67	Pass
5285	5231	5282	5339	-3	26.43	Pass
6402	6337	5640	6467	-762	32.01	Fail
7669	7591	3416	7747	-4253	38.35	Fail



INSTRUMENT SPECIFICATIONS		
Test Fluid	Air	
Lower Range	40	fpm
Upper Range	7800	fpm
Rated Accuracy	+/- 1% reading +/-1 digit	
LABORATORY AMBIENT CONDITIONS		
Pressure	14.30	psia
Humidity	48.40	% RH
Temperature	78.83	F

Flow - Humidity - Temperature - Pressure - Design - Consulting - Engineering
NIST Traceable Calibration Data Sheet
Graftel, LLC. 870 Cambridge Drive, Elk Grove Village, IL 60007
P. 847-364-2600 F. 847-364-2899
www.graftel.com

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
NRC·CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-154 28/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9101
Précision requise:	+\- 2°C
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Enregistreur	Type d'entrée:	Temp
Manufacturier:	Keithley	Type de sortie:	Digitale
No. Model:	7700	Type de mesure:	Température
No. Série:	1306774	Gamme:	Divers
Emplacement:	N/A	No. Machine:	N.A.

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	No. du certificat d'étalonnage:	AC16061306
No. Série:	7798010	Dernière date d'étalonnage:	27-Jun-16
Certificat fait par:	Alpha Controls	Prochaine date d'étalonnage:	27-Jun-17
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
-17.000 mV	-17.000 mV	-16.948 mV	+0.052 mV	-16.948 mV	0.1 mV	Input#1
0.000 mV	0.000 mV	0.038 mV	+0.038 mV	0.038 mV	0.1 mV	Input#1
20.000 mV	20.000 mV	20.030 mV	+0.030 mV	20.030 mV	0.1 mV	Input#1
30.000 mV	30.000 mV	30.068 mV	+0.068 mV	30.068 mV	0.1 mV	Input#2
Input#3 Non-Conforme						
100.0 °C	100.0 °C	99.5 °C	-0.5 °C	99.5 °C	1.0 °C	Input#4 TypeJ
30.000 mV	30.000 mV	29.518 mV	-0.452 mV	29.518 mV	0.1 mV	Input#5
30.000 mV	30.000 mV	29.574 mV	-0.426 mV	29.574 mV	0.1 mV	Input#6
100.0 Ohms	100.0 Ohms	100.0 Ohms	0.0 Ohms	100.0 Ohms	1.0 Ohms	Input#7
100.0 Ohms	100.0 Ohms	100.0 Ohms	0.0 Ohms	100.0 Ohms	1.0 Ohms	Input#8
100.0 Ohms	100.0 Ohms	99.9 Ohms	-0.1 Ohms	99.9 Ohms	1.0 Ohms	Input#9
100.0 Ohms	100.0 Ohms	99.9 Ohms	-0.1 Ohms	99.9 Ohms	1.0 Ohms	Input#10
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#11TypeT
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#12TypeT
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#13 TypeJ
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#14TypeJ
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#15 TypeJ
100.0 °C	100.0 °C	99.6 °C	-0.4 °C	99.6 °C	1.0 °C	Input#16TypeJ
100.0 Ohms	100.0 Ohms	100.2 Ohms	+0.2 Ohms	100.2 Ohms	1.0 Ohms	Input#17
100.0 Ohms	100.0 Ohms	100.1 Ohms	+0.1 Ohms	100.1 Ohms	1.0 Ohms	Input#18
100.0 Ohms	100.0 Ohms	100.2 Ohms	+0.2 Ohms	100.2 Ohms	1.0 Ohms	Input#19
100.0 Ohms	100.0 Ohms	100.1 Ohms	+0.1 Ohms	100.1 Ohms	1.0 Ohms	Input#20
12.000 mA	12.000 mA	12.002 mA	+0.002 mA	12.002 mA	1.00 mA	Input#21
12.000 mA	12.000 mA	12.002 mA	+0.002 mA	12.002 mA	1.00 mA	Input#22

Conditions Environnementales: Température: 18 °C Humidité: 33 %RH

5F09101

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS NRC·CNRC CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN N°669

80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-154 28/02/17

CLIENT	
Compagnie:	Services Polytests Inc
Adresse:	695 B rue Gaudette
	St-Jean-sur-Richelieu, Québec, J3B 7S7

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	4IN9101
Précision requise:	+\- 2°C
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Enregistreur	Type d'entrée:	Temp
Manufacturier:	Keithley	Type de sortie:	Digitale
No. Model:	7700	Type de mesure:	Température
No. Série:	1306774	Gamme:	Divers
Emplacement:	N/A	No. Machine:	N.A.
Type d'Étalonnage:	Test avec EM-047		

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Le système qualité de l'entreprise est conforme aux exigences de la norme ISO 17025 et les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST. Le degré d'incertitude est basé sur un niveau de confiance=95%, K=2.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	28 Février 2017
Date du prochain Étalonnage:	28 Février 2018
Date d'émission du certificat:	28 Février 2017

CONFORMITÉ D'ÉTALONNAGE	Avant	Après
Conforme:	X	X
Non Conforme:		

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Stéphane - Technicien

2017-03-16

5F09101

PRIMO INSTRUMENT
4407, rue Charleroi, Montréal-Nord (Qc) Canada H1H 1T6
Tél. : 514 329-3242 • 1 888 774-6665
Fax : 514 329-3750 • 514 329-5869 (service)
Courriels : service@primoinc.com • ventes@primoinc.com
www.primoinc.com

17025 ISO/IEC

Certificat d'Étalonnage / Certificate of Calibration

CLIENT :
SERVICES POLYTESTS INC.
695-B GAUDETTE
ST-JEAN-SUR-RICHELIEU, QUEBEC

Description: CHRONOMÈTRE / STOPWATCH TIMER
Fabriquant/ Manufacturer: EXTECH
Modèle/ Model : 365510
No série / Serial no : 131636
 # Inventaire / Asset # : **EM-175**

CERTIFICAT No / Certificate No: **203849**

PROCÉDURE / Procedure :
PRIMO - EXTECH_365510

Certificat émis/ Certificate issued : yyyy-mm-dd **2017-01-25**

Echéance/ Due Date : **2018-01-25**

Type de résultat / *Results type* : **Tel que trouvé / As Found**

Résultats d'essais / *Test results* : **Ok Pass**

Conditions de mesure / Measurement conditions

TEMPÉRATURE / Temp. : **22°C**

HUMIDITÉ / Humidity : **30%RH**

Usage restreint/ *Restricted use* : ☐

Réparation effectuée / *Repair performed* : ☐

Ajustement effectué / *Adjustment performed* : ☐

ÉTALONS UTILISÉS/ Standards Used:

Identification	Fabricant / Manufacturer	Modèle / Model	Description	Ser. #	Echéance/ Due Date
PR0283	H-P	53131 A	FREQUENCY COUNTER	3736A24271	2017-05-31
PR0392	AGILENT	33250A	FUNCTION/ARBITRARY WAVEFORM GENERATOR	MY40008014	2017-05-25

Les spécifications mentionnées comme limites de tolérances d'essai sont celles établies par le manufacturier, sauf indication contraire.
Test tolerance limits are based on manufacturers specifications unless stated otherwise.

NOTES :

2017-01-31

Technicien :
Technician

H. AMRI

Le système qualité de la société est conforme aux exigences de la norme **ISO 17025** et les étalons utilisés pour le processus d'étalonnage sont retraçables au SI par l'entremise du CNRC et/ou du NIST.
*Our quality system complies with the requirements of **ISO 17025** and the standards used for the calibration are traceable to SI through NRC and/or NIST.*

PRIMO INSTRUMENT
4407, rue Charleroi, Montréal-Nord (Qc) Canada H1H 1T6
Tél. : 514 329-3242 • 1 888 774-6665
Fax : 514 329-3750 • 514 329-5869 (service)
Courriels : service@primoinc.com • ventes@primoinc.com
www.primoinc.com

Certificat d'Étalonnage
Certificate of Calibration

CERTIFICAT No / Certificate No :	203849
CLIENT / Customer :	SERVICES POLYTESTS INC.
DESCRIPTION / Description :	CHRONOMÈTRE / STOPWATCH TIMER
MANUFACTURIER / Manufacturer :	EXTECH
MODÈLE / Model :	365510

DESCRIPTION Description	LIMITES Limits	LECTURES Readings	LIMITES Limits
	Min		Max
Temps écoulé, chronomètre sous test / Elapsed time on test stopwatch		**Comptes / Counts** Chronomètre/timer	
Minutes: 27 / Seconds: 52 / 1/100 sec: 94		167294	
Total au compteur / Reference timer: 167293.7 comptes/counts			
(Δt) Deviation (1/100sec): 0.30			
Deviation Par jour/ Per day (%): 0.0002 %	*** Secondes**	Deviation 24hrs	*** Secondes**
Deviation Par jour/ Per day (sec): **0.15 sec**	-3.00	**0.15**	3.00

* Tolérances basées sur une déviation maximale de 3 sec/jour
* Tolerances based on a 3 sec/day maximum deviation

Incertitude/ Uncertainty: ±37 ms

Lorsque fournies dans le rapport, les incertitudes de mesure sont des incertitudes élargies représentant un niveau de confiance d'approximativement 95% , obtenu en multipliant l'incertitude-type composée par un facteur de couverture de k=2.

When supplied in the report, the measurement uncertainties are expanded uncertainties representing a confidence level of approximately 95% , obtain by multiplying the combined standard uncertainty by a coverage factor of k=2.

2017.01.31

POLYCONTROLS

CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005

CERTIFICAT D'ÉTALONNAGE # 6601

Date d'étalonnage : 2017-03-16
Date d'émission du certificat : 2017-03-16

Services Polytests
695 B Gaudette street
St-Jean-sur-Richelieu, Québec, Canada
J3B 7S7

Étalonnage d'un
Shinigawa DCDa-2c S/N : 23544

CONFORMITÉ AU PROGRAMME DE QUALITÉ

Tous les étalonnages sont effectués conformément au manuel d'assurance qualité de Polycontrols et sont conformes à la norme ISO/IEC 17025 – 2005, à la norme ISO 9001 – 2008 ainsi qu'à tout autre exigences de qualité définies dans la description d'achat des clients.

TRAÇABILITÉ

La traçabilité des étalons de débit au National Institute of Standards and Technology, NIST, est maintenue par les laboratoires de Fluke Corporation de Phoenix, Arizona et est conforme aux normes ISO/IEC 17025, AINSI/NCSL Z540-1-1994, ISO-10012-1, MIL-STD 45662A.

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.

APTITUDE EN MATIÈRE DE MESURE ET D'ÉTALONNAGE - CMC

Les références utilisées pour l'étalonnage de débit ont une incertitude de ±0.2% de la lecture pour les mesures entre 5 SCCM à 10 SLPM, ±0.3% de la lecture pour les mesures entre 10 SLPM à 30 SLPM, ±0.2% de la lecture pour les mesures entre 30 SLPM à 3000 SLPM, ±0.3% de la lecture pour les mesures supérieures à 3000 SLPM jusqu'à 6000 SLPM et ±0.5% pour les mesures inférieures à 5 SCCM jusqu'à concurrence de 1 SCCM, équivalent air ou azote. Les incertitudes exprimées sont élargies avec un facteur d'élargissement k = 2, et ce, pour un niveau de confiance d'environ 95 %, dans l'hypothèse d'une distribution normale incluant la résolution de l'instrument. Le rapport d'incertitude des essais (RIE) de cet étalonnage respecte un ratio de 4:1 à moins d'indication contraire.

SOMMAIRE DES CONDITIONS DE L'INSTRUMENT EN TEST

Conditions initiales	En bon état
Travail Effectué	Étalonnage de l'instrument
	Aucun ajustement est requis
Résultats	Lectures finales dans les tolérances
Remarques	Fréquence d'étalonnage aux 12 mois

Métrologiste

Responsable du laboratoire

POLYCONTROLS

CLAS NRC·CNRC CLAS 2009-02 — Conseil canadien des normes Laboratoire accrédité Portée d'accréditation 655 — ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 6601

Numéro de série:	23544	Station de mesure:	3
Date d'étalonnage:	2017-03-16	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-178		

Instrument de mesure de référence utilisé pour l'étalonnage final

Description	Modèle	# Série	Traçabilité	Date dû
DHI molbloc (30 slpm)	3E4-VCR-V-Q	2359	1500210394	2017-12-27
DHI molbox1	Molbox1	881	1500199423	2017-05-24
RTD Mist	M22	1871501	AC16031190-1871501	2017-04-20
Module 44.5 PSI avec Baro 163671	Module 30	160659	AC16041392-160659	2017-04-22

Spécifications finales de l'appareil

Gaz	Air
Température d'opération	
Pression à l'entrée	
Pression à la sortie	
Température de référence	
Pression de référence	
Étendue d'échelle	10-2000 ALH
Signaux Entrée/Sortie	-
Alimentation	
Tolérance	±2 %O.R.

Condition d'étalonnage

Gaz	Air
Température ambiante	21 °C
Pression ambiante	1008.76 mbar
Orientation	Horizontale
Élastomère	Viton
Valve	

Lectures finales

Débit du test ALH	Instrument en test L	Valeurs mesurées Pression PSIA	Température °C	Référence L	Référence calculée L	Erreur calculée L	Tolérance acceptable L	TUR
363.8231	61.3500	14.6394	20.97	60.3517	60.5567	0.7933	1.2111	>4
610.5164	102.7800	14.6439	20.93	101.3251	101.6238	1.1562	2.0325	>4
1642.7223	277.4000	14.6690	20.93	273.1258	273.4560	3.9440	5.4691	>4

Fact. cal : 0,987069

Bernard Poirier
Métrologiste

Signature

2017-03-21

POLYCONTROLS

CLAS NRC·CNRC CLAS 2009-02

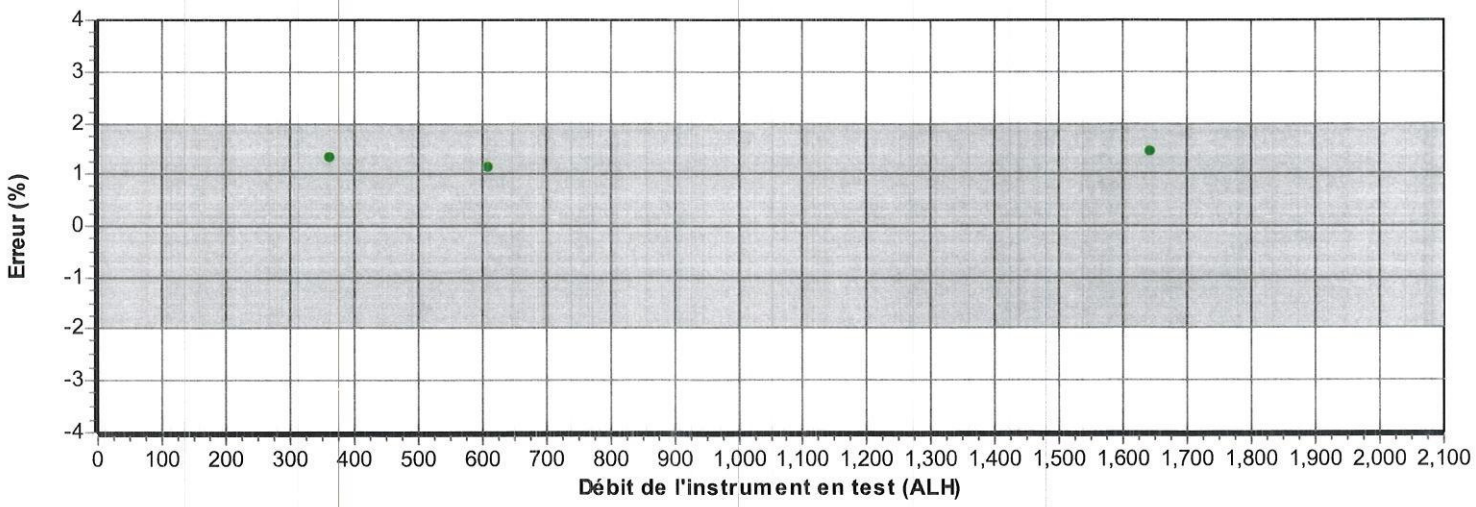
Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 6601

Numéro de série:	23544	Station de mesure:	3
Date d'étalonnage:	2017-03-16	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-178		

Résultats finaux



- La mesure (et son incertitude) se situe dans les tolérances
- La mesure (et son incertitude) se situe hors tolérance
- La mesure (et son incertitude) ne rencontre pas la marge de sécurité tel que spécifié dans le document G-8 de l'ILAC

Bernard Poirier
Métrologiste

Signature

POLYTESTS
TESTING THROUGH YOUR REALITY

Posttest dry gas meter calibration data

		Date : 2017-05-12	Barometric pressure: 100.8	Tech/Eng. Maxime Martin
Manufacturer. : Ravelli Model : RV 120 Touch	Calibration factor : 0.987069 DGM 1 : EM-178	Calibration factor : 0.9960177 DGM 2 : EM-179	Calibration factor 0.98640352 DGM 3 : EM-070	Calibration factor 0.9974 Standardized DGM : EM-130

Standard meter							Dry gas meter #1					
Trail #	Press drop	Final ft3	Initial ft3	Change ft3	Temp F	STD ft3	Final Liter	Initial Liter	Change ft3	Temp F	STD ft3	Cal Factor
1	0	703,5	702,5	1,000	75,1	0,984	507162,590	507133,430	1,030	81,68	1,0038	1,0199
2	0	704,5	703,5	1,000	75,4	0,984	507191,810	507162,590	1,032	81,86	1,0055	1,0223
3	0	705,5	704,5	1,000	75,9	0,983	507221,000	507191,810	1,031	82,04	1,0041	1,0218
Average calibration factor : 1.0213												

Previous cal factor	minus	Average cal factor	Divided by	Previous cal. factor	Multiplied * 100	Equals	Deviation percent Max5%
0.987069	-	1.0213	/	0.987069	*100	=	3.5 %

Standard meter							Dry gas meter #2					
Trail #	Press drop	Final ft3	Initial ft3	Change ft3	Temp F	STD ft3	Final Liter	Initial Liter	Change ft3	Temp F	STD ft3	Cal Factor
1	0	703,5	702,5	1,000	75,1	0,984	427964,45	427935,11	1,036	81,68	1,010	1,0262
2	0	704,5	703,5	1,000	75,4	0,984	427993,83	427964,45	1,038	82,22	1,010	1,0272
3	0	705,5	704,5	1,000	75,9	0,983	428023,16	427993,83	1,036	82,4	1,008	1,0260
Average calibration factor : 1.0265												

Previous cal factor	minus	Average cal factor	Divided by	Previous cal. factor	Multiplied * 100	Equals	Deviation percent Max5%
0.9960177	-	1.0265	/	0.9960177	*100	=	3.0 %

POLYTESTS TESTING THROUGH YOUR REALITY Posttest dry gas meter calibration data		Date : 2017-05-12	Barometric pressure: 100.8	Tech/Eng. Maxime Martin
Manufacturer. : Ravelli Model : RV 120 Touch	Calibration factor : 0.987069 DGM 1 : EM-178	Calibration factor : 0.9960177 DGM 2 : EM-179	Calibration factor 0.98640352 DGM 3 : EM-070	Calibration factor 0.9974 Standardized DGM : EM-130

Standard meter							Dry gas meter #3					
Trail #	Press drop	Final ft3	Initial ft3	Change ft3	Temp F	STD ft3	Final Liter	Initial Liter	Change ft3	Temp F	STD ft3	Cal Factor
1	0	703,5	702,5	1,000	75,1	0,984	73,03	71,99	1,040	75,100	1,026	1,0427
2	0	704,5	703,5	1,000	75,4	0,984	73,96	73,03	0,930	75,400	0,917	0,9324
3	0	705,5	704,5	1,000	75,9	0,983	75	73,96	1,040	75,900	1,025	1,0427
Average calibration factor : 1.0059												

Previous cal factor	minus	Average cal factor	Divided by	Previous cal. factor	Multiplied * 100	Equals	Deviation percent Max5%
0.98640352	-	1.0059	/	0.98640352	*100	=	1.97 %

POLYCONTROLS

CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005

CERTIFICAT D'ÉTALONNAGE # 6599

Date d'étalonnage : 2017-03-16
Date d'émission du certificat : 2017-03-16

Services Polytests
695 B Gaudette street
St-Jean-sur-Richelieu, Québec, Canada
J3B 7S7

Étalonnage d'un
American Meter Company AL 425 S/N : 5-7975

CONFORMITÉ AU PROGRAMME DE QUALITÉ

Tous les étalonnages sont effectués conformément au manuel d'assurance qualité de Polycontrols et sont conformes à la norme ISO/IEC 17025 – 2005, à la norme ISO 9001 – 2008 ainsi qu'à tout autre exigences de qualité définies dans la description d'achat des clients.

TRAÇABILITÉ

La traçabilité des étalons de débit au National Institute of Standards and Technology, NIST, est maintenue par les laboratoires de Fluke Corporation de Phoenix, Arizona et est conforme aux normes ISO/IEC 17025, AINSI/NCSL Z540-1-1994, ISO-10012-1, MIL-STD 45662A.

Le Service d'évaluation des laboratoires d'étalonnage (CLAS) du Conseil national de recherches du Canada (CNRC) a évalué et certifié la capacité d'étalonnage du laboratoire et la traçabilité au Système international d'unités (SI) ou à des étalons acceptables selon le CLAS. Le présent certificat d'étalonnage est délivré conformément aux conditions de certification du CLAS et aux conditions d'accréditation du Conseil canadien des normes (CCN). Le CLAS et le CCN ne garantissent pas l'exactitude des étalonnages individuels effectués par les laboratoires accrédités.

APTITUDE EN MATIÈRE DE MESURE ET D'ÉTALONNAGE - CMC

Les références utilisées pour l'étalonnage de débit ont une incertitude de ±0.2% de la lecture pour les mesures entre 5 SCCM à 10 SLPM, ±0.3% de la lecture pour les mesures entre 10 SLPM à 30 SLPM, ±0.2% de la lecture pour les mesures entre 30 SLPM à 3000 SLPM, ±0.3% de la lecture pour les mesures supérieures à 3000 SLPM jusqu'à 6000 SLPM et ±0.5% pour les mesures inférieures à 5 SCCM jusqu'à concurrence de 1 SCCM, équivalent air ou azote. Les incertitudes exprimées sont élargies avec un facteur d'élargissement k = 2, et ce, pour un niveau de confiance d'environ 95 %, dans l'hypothèse d'une distribution normale incluant la résolution de l'instrument. Le rapport d'incertitude des essais (RIE) de cet étalonnage respecte un ratio de 4:1 à moins d'indication contraire.

SOMMAIRE DES CONDITIONS DE L'INSTRUMENT EN TEST

Conditions initiales	En bon état
Travail Effectué	Étalonnage de l'instrument
	Aucun ajustement est requis
Résultats	Lectures finales dans les tolérances
Remarques	Fréquence d'étalonnage aux 12 mois

Métrologiste

Responsable du laboratoire

POLYCONTROLS

CLAS NRC·CNRC CLAS 2009-02

Conseil canadien des normes Laboratoire accrédité Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 6599

Numéro de série:	5-7975	Station de mesure:	3
Date d'étalonnage:	2017-03-16	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-070		

Instrument de mesure de référence utilisé pour l'étalonnage final

Description	Modèle	# Série	Traçabilité	Date dû
DHI molbloc (125 slpm)	2E2-S	254	1500196120	2017-03-17
DHI molbloc (250 slpm)	5E2-S	349	1500199133	2017-05-19
DHI molbox1	Molbox1	881	1500199423	2017-05-24
RTD Mist	M22	1871501	AC16031190-1871501	2017-04-20
Module 44.5 PSI avec Baro 163671	Module 30	160659	AC16041392-160659	2017-04-22

Spécifications finales de l'appareil

Gaz	Air
Température d'opération	
Pression à l'entrée	
Pression à la sortie	
Température de référence	
Pression de référence	
Étendue d'échelle	0-340 ACFH
Signaux Entrée/Sortie	-
Alimentation	
Tolérance	±1 %O.R.

Condition d'étalonnage

Gaz	Air
Température ambiante	21 °C
Pression ambiante	1008.24 mbar
Orientation	Horizontale
Élastomère	
Valve	

Lectures finales

Débit du test ACFH	Instrument en test ft³	Valeurs mesurées Pression PSIA	Température °C	Référence ft³	Référence calculée ft³	Erreur calculée ft³	Tolérance acceptable ft³	TUR
67.6014	11.300	14.6504	20.40	11.247	11.255	0.045	0.113	>4
118.8256	19.900	14.6979	20.41	19.830	19.780	0.120	0.198	>4
267.0264	44.490	14.9712	20.50	45.389	44.461	0.029	0.445	>4

Fact. corr. : 0,9960177

2017-03-21

Bernard Poirier
Métrologiste

Signature

POLYCONTROLS

CLAS NRC·CNRC CLAS 2009-02

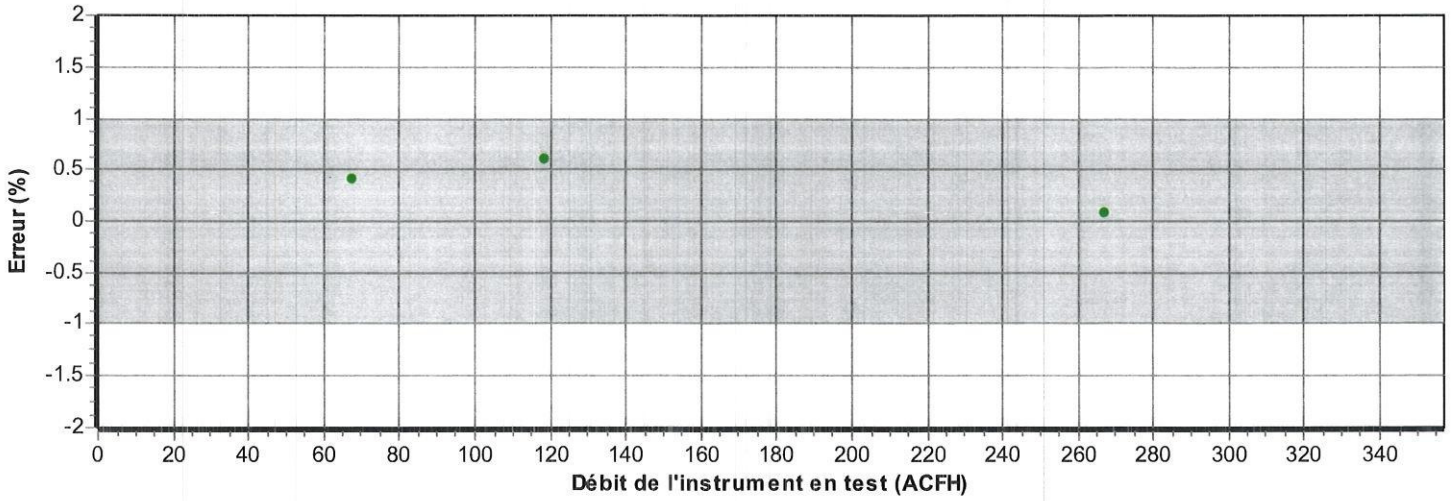
Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 6599

Numéro de série:	5-7975	Station de mesure:	3
Date d'étalonnage:	2017-03-16	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-070		

Résultats finaux



- La mesure (et son incertitude) se situe dans les tolérances
- La mesure (et son incertitude) se situe hors tolérance
- La mesure (et son incertitude) ne rencontre pas la marge de sécurité tel que spécifié dans le document G-8 de l'ILAC

Bernard Poirier
Métrologiste

Signature

EM-183

Airgas

Airgas USA, LLC
325 McCausland Court
Cheshire, CT 06410
(203) 250-6820
(203) 272-1584 (FAX)

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X04NI79C15A2VF3	Reference Number:	37-400238139-1
Cylinder Number:	SG9140147	Cylinder Volume:	151.0 CF
Laboratory:	ANE - Cheshire (SAP) - CT	Cylinder Pressure:	2015 PSIG
Analysis Date:	Aug 16, 2013	Valve Outlet:	590
Lot Number:	37-400238139-1		

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration (Mole %)	Analytical Uncertainty
CARBON MONOXIDE	1.000 %	1.031 %	+/- 2%
CARBON DIOXIDE	10.00 %	9.968 %	+/- 2%
OXYGEN	10.00 %	9.995 %	+/- 2%
NITROGEN	Balance		

Notes:

Approved for Release

PRIMO INSTRUMENT
4407, rue Charleroi, Montréal-Nord (Qc) Canada H1H 1T6
Tél. : 514 329-3242 • 1 888 774-6665
Fax : 514 329-3750 • 514 329-5869 (service)
Courriels : service@primoinc.com • ventes@primoinc.com
www.primoinc.com

17025 ISO/IEC

Certificat d'Étalonnage / Certificate of Calibration

CLIENT :
SERVICES POLYTESTS INC.
695-B GAUDETTE
ST-JEAN-SUR-RICHELIEU, QUEBEC

Description: VÉRIFICATEUR D'HUMIDITÉ / MOISTURE METER
Fabriquant/ Manufacturer: DELMHORST
Modèle/ Model : MCS-1 REFERENCE STANDARD
No série / Serial no : N/A
 # Inventaire / Asset # : **EM-191**

CERTIFICAT No / Certificate No: **202448**

PROCÉDURE / Procedure :
PRIMO - DELMHORST_MCS-1 REFERENCE STANDARD

Certificat émis/ Certificate issued : yyyy-mm-dd **2016-12-28**

Echéance/ Due Date : **2017-12-28**

Type de résultat / *Results type* : **Tel que trouvé / As Found**

Résultats d'essais / *Test results* : Ok Pass

Conditions de mesure / Measurement conditions

TEMPÉRATURE / Temp. : **22°C**

HUMIDITÉ / Humidity : **24%RH**

Usage restreint/ *Restricted use* : ☐

Réparation effectuée / *Repair performed* : ☐

Ajustement effectué / *Adjustment performed* : ☐

ÉTALONS UTILISÉS/ Standards Used:

Identification	Fabricant / Manufacturer	Modèle / Model	Description	Ser. #	Echéance/ Due Date
PR0133	H-P	3458A	MULTIMETER	2823A25866	2017-04-16

Les spécifications mentionnées comme limites de tolérances d'essai sont celles établies par le manufacturier, sauf indication contraire.
Test tolerance limits are based on manufacturers specifications unless stated otherwise.

NOTES :

2017-01-11

Technicien :
Technician A. GAUDETTE

Le système qualité de la société est conforme aux exigences de la norme **ISO 17025** et les étalons utilisés pour le processus d'étalonnage sont retraçables au SI par l'entremise du CNRC et/ou du NIST.
*Our quality system complies with the requirements of **ISO 17025** and the standards used for the calibration are traceable to SI through NRC and/or NIST.*

PRIMO INSTRUMENT
4407, rue Charleroi, Montréal-Nord (Qc) Canada H1H 1T6
Tél. : 514 329-3242 • 1 888 774-6665
Fax : 514 329-3750 • 514 329-5869 (service)
Courriels : service@primoinc.com • ventes@primoinc.com
www.primoinc.com

Certificat d'Étalonnage
Certificate of Calibration

CERTIFICAT No / Certificate No : **202448**

CLIENT / Customer : **SERVICES POLYTESTS INC.**

DESCRIPTION / Description : **VÉRIFICATEUR D'HUMIDITÉ / MOISTURE METER**

MANUFACTURIER / Manufacturer : **DELMHORST**

MODÈLE / Model : **MCS-1 REFERENCE STANDARD**

DESCRIPTION Description		LIMITES Limits	LECTURES Readings	LIMITES Limits
DOUGLAS-FIR @ 80°F	**Nominal**			**Déviation** ***Mohms***
12 %	120 MOhms		120.2	-0.2
22 %	1.10 MOhms		1.096	0.004

S:\CERTIFICAT\MANUFACTURIER\DELMHORST\MCS-1 REFERENCE STANDARD

FORME : REV. 2011-12-13

2017-07-11

Airgas

Airgas USA, LLC
325 McCausland Court
Cheshire, CT 06410
(203) 250-6820
(203) 272-1584 (FAX)

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X04NI77C15A0004	Reference Number:	37-400429255-1
Cylinder Number:	CC46789	Cylinder Volume:	144.0 CF
Laboratory:	ANE - Cheshire (SAP) - CT	Cylinder Pressure:	1862 PSIG
Analysis Date:	Sep 29, 2014	Valve Outlet:	350
Lot Number:	37-400429255-1		

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration (Mole %)	Analytical Uncertainty
OXYGEN	2.000 %	1.989 %	+/- 2%
CARBON MONOXIDE	3.000 %	2.971 %	+/- 2%
CARBON DIOXIDE	18.00 %	17.87 %	+/- 2%
NITROGEN	Balance		

Approved for Release

PRIMO INSTRUMENT
4407, rue Charleroi, Montréal-Nord (Qc) Canada H1H 1T6
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Fax : 514 329-3750 • 514 329-5869 (service)
Courriels : service@primoinc.com • ventes@primoinc.com
www.primoinc.com

17025 ISO/IEC

Certificat d'Étalonnage / Certificate of Calibration

CLIENT :
SERVICES POLYTESTS INC.
695-B GAUDETTE
ST-JEAN-SUR-RICHELIEU, QUEBEC

Description: RUBAN A MESURER / MEASURING TAPE
Fabriquant/ Manufacturer: STANLEY
Modèle/ Model : 12 ft
No série / Serial no : N/A
 # Inventaire / Asset # : **EM-224**

CERTIFICAT No / Certificate No: **202449**

PROCÉDURE / Procedure :
CAN / CGSB-39.22-94

yyyy-mm-dd
Certificat émis/ Certificate issued : 2016-12-28

Echéance/ Due Date : 2017-12-28

Type de résultat / *Results type* : **Tel que trouvé / As Found**

Résultats d'essais / *Test results* : Ok Pass

Conditions de mesure / Measurement conditions

TEMPÉRATURE / Temp. : **20.2°C**

HUMIDITÉ / Humidity : **32%RH**

Usage restreint/ *Restricted use* : ☐

Réparation effectuée / *Repair performed* : ☐

Ajustement effectué / *Adjustment performed* : ☐

ÉTALONS UTILISÉS/ Standards Used:

Identification	Fabricant / Manufacturer	Modèle / Model	Description	Ser. #	Echéance/ Due Date
PR0 10	STARRETT	SS8AAX	GAUGE BLOCK SET	111488.9	2018-03-16
PR0 17	MITUTOYO	516-902 GRADE 2	GAUGE BLOCK SET	106053	2017-02-17
PR0 26	NEWAGE IND.	0-4 mm	POCKET MAGNIFIER	N/A	2017-03-09
PR0 68	MITUTOYO	517-816	TABLE DE GRANITE	5053-471	2017-07-16

Les spécifications mentionnées comme limites de tolérances d'essai sont celles établies par le manufacturier, sauf indication contraire.
Test tolerance limits are based on manufacturers specifications unless stated otherwise.

NOTES :

2017-01-11

Technicien :
Technician
T. DUMONT

Le système qualité de la société est conforme aux exigences de la norme **ISO 17025** et les étalons utilisés pour le processus d'étalonnage sont retraçables au SI par l'entremise du CNRC et/ou du NIST.
*Our quality system complies with the requirements of **ISO 17025** and the standards used for the calibration are traceable to SI through NRC and/or NIST.*

PRIMO INSTRUMENT
4407, rue Charleroi, Montréal-Nord (Qc) Canada H1H 1T6
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Fax : 514 329-3750 • 514 329-5869 (service)
Courriels : service@primoinc.com • ventes@primoinc.com
www.primoinc.com

Certificat d'Étalonnage
Certificate of Calibration

CERTIFICAT No / Certificate No : **202449**

CLIENT / Customer : **SERVICES POLYTESTS INC.**

DESCRIPTION / Description : **RUBAN A MESURER / MEASURING TAPE**

MANUFACTURIER / Manufacturer : **STANLEY**

MODÈLE / Model : **12 ft**

DESCRIPTION Description		LIMITES Limits	LECTURES Readings	LIMITES Limits
EXACTITUDE ACCROCHE / PULL				
1 "		0.980	0.998	1.020
EXACTITUDE APPUYE / PUSH				
1 "		0.980	0.992	1.020
ZONE VÉRIFIÉE / TESTED ZONE	NOMINAL			
0-4 PIEDS / FT	48 PO / IN	47.976	48.004	48.024
4-8 PIEDS / FT	48 PO / IN	47.976	48.000	48.024
8-12 PIEDS / FT	48 PO / IN	47.976	47.998	48.024

S:\CERTIFICAT\MANUFACTURIER\STANLEY\12 ft

FORME : REV. 2011-12-02

2017-01-11

Twin Ports Testing, Inc.
1301 North 3rd Street
Superior, WI 54880
p: 715-392-7114
p: 800-373-2562
f: 715-392-7163
www.twinportstesting.com

Analytical Test Report

Report No: USR:W217-0066-01
Issue No: 1

Client: POLYTESTS
695-B Gaudette
St-jean-sur-richelieu, QB J3B 7S7
Attention: Danick Power

PO No: 100412

Signed: Katy Mickelson
Katy Mickelson
Senior Chemist
Date of Issue: 2/1/2017

Sample Details

Sample Log No:	W217-0066-01	**Sample Date:**	
Sample Designation:	Pellet Sample	**Sample Time:**	
Sample Recognized As:	Wood Pellets	**Arrival Date:**	1/23/2017

Test Results

	METHOD	UNITS	MOISTURE FREE	AS RECEIVED
Moisture Total	ASTM E871	wt. %		6.11
Ash	ASTM D1102	wt. %	0.29	0.27
Volatile Matter	ASTM D3175	wt. %		
Fixed Carbon by Difference	ASTM D3172	wt. %		
Sulfur	ASTM D4239	wt. %	0.011	0.011
SO_2	Calculated	lb/mmbtu		0.025
Net Cal. Value at Const. Pressure	ISO 1928	GJ/tonne	18.97	17.66
Net Cal. Value at Const. Pressure	ISO 1928	J/g	18972	17663
Gross Cal. Value at Const. Vol.	ASTM E711	J/g	20294	19054
Gross Cal. Value at Const. Vol.	ASTM E711	Btu/lb	8725	8192
Carbon	ASTM D5373	wt. %	50.47	47.38
Hydrogen*	ASTM D5373	wt. %	6.08	5.71
Nitrogen	ASTM D5373	wt. %	0.84	0.79
Oxygen*	ASTM D3176	wt. %	42.31	39.72
Chlorine	ASTM D6721	mg/kg		
Fluorine	ASTM D3761	mg/kg		
Mercury	ASTM D6722	mg/kg		
Bulk Density	ASTM E873	lbs/ft^3		
Fines (Less than 1/8")	TPT CH-P-06	wt.%		
Durability Index	Kansas State	PDI		
Sample Above 1.50"	TPT CH-P-06	wt.%		
Maximum Length (Single Pellet)	TPT CH-P-06	inch		
Diameter, Range	TPT CH-P-05	inch		to
Diameter, Average	TPT CH-P-05	inch		
Stated Bag Weight	TPT CH-P-01	lbs		
Actual Bag Weight	TPT CH-P-01	lbs		

*Note: As received values do not include hydrogen and oxygen in the total moisture.

Comments

APPENDIX 4: Unit pre burn

Temps acquisition de données	Flue temp °F	scale lbs	Tunnel Velocity Pressure in. Wc
0	238,60	21,98	0,0450
10	256,25	21,38	0,0450
20	269,23	20,78	0,0450
30	278,38	20,08	0,0450
40	286,07	19,58	0,0450
50	289,55	18,98	0,0450
60	288,37	18,38	0,0450
70	287,20	17,78	0,0450
80	288,35	17,28	0,0450
90	289,77	16,68	0,0450
100	290,91	15,98	0,0450
110	289,23	15,48	0,0450
120	263,16	14,98	0,0450
130	253,35	14,48	0,0450
140	247,80	14,08	0,0450
150	244,12	13,68	0,0450
160	241,11	13,18	0,0450
170	240,52	12,78	0,0450
180	240,65	12,28	0,0450
190	239,18	11,87	0,0450
200	239,06	11,37	0,0450
210	239,47	10,98	0,0450
220	238,24	10,47	0,0450
230	238,62	10,07	0,0450
240	238,44	9,68	0,0450
250	235,71	9,27	0,0450
260	235,01	8,78	0,0450
270	233,17	8,37	0,0450
280	233,94	7,97	0,0450
290	234,47	7,47	0,0450
300	235,00	7,07	0,0450
310	235,14	6,67	0,0450
320	236,13	6,17	0,0450
330	235,81	5,77	0,0450
340	235,71	5,27	0,0450
350	233,31	4,87	0,0450
360	Flue	weight	0,0450
370	170,24	52,96	0,0450
380	170,96	52,81	0,0450
390	169,38	52,61	0,0450
400	168,58	52,31	0,0450
410	Flue	weight	0,0450
420	164,42	51,40	0,0450
430	163,73	51,21	0,0450
440	166,56	50,90	0,0450
450	168,24	50,61	0,0450
460	165,77	50,41	0,0450
470	166,89	50,20	0,0450
480	167,71	50,01	0,0450
490	168,55	49,70	0,0450
500	168,42	49,40	0,0450
510	169,68	49,10	0,0450
520	169,87	48,80	0,0450
530	172,40	48,61	0,0450
540	170,35	48,40	0,0450
550	169,51	48,10	0,0450
560	169,03	47,80	0,0450
570	169,75	47,60	0,0450
580	169,24	47,30	0,0450
590	170,20	47,01	0,0450
600	167,85	46,84	0,0450
610	167,02	46,60	0,0450
620	168,55	46,30	0,0450
630	168,19	46,00	0,0450
640	169,45	45,80	0,0450
650	171,18	45,50	0,0450
660	169,85	45,30	0,0450
670	168,41	45,00	0,0450
680	168,20	44,70	0,0450
690	167,32	44,50	0,0450
700	169,11	44,20	0,0450
710	170,59	43,92	0,0450
720	169,05	43,70	0,0450
730	168,33	43,40	0,0450
740	167,40	43,14	0,0450
750	167,98	42,90	0,0450
760	169,02	42,60	0,0450
770	169,19	42,40	0,0450
780	166,95	42,10	0,0450
790	166,39	41,90	0,0450
800	165,55	41,60	0,0450
810	166,20	41,40	0,0450
820	167,62	41,09	0,0450
830	168,84	40,80	0,0450
840	167,34	40,60	0,0450
850	167,66	40,29	0,0450
860	166,13	39,99	0,0450
870	167,08	39,79	0,0450

880	166,30	39,50	0,0450
890	168,41	39,19	0,0450
900	166,48	38,99	0,0450
910	166,36	38,70	0,0450
920	165,29	38,49	0,0450
930	163,71	38,29	0,0450
940	164,44	37,99	0,0450
950	167,04	37,69	0,0450
960	165,59	37,49	0,0450
970	166,30	37,19	0,0450
980	178,14	37,09	0,0450
990	237,26	36,59	0,0450
1000	268,74	36,19	0,0450
1010	214,99	35,89	0,0450
1020	198,29	35,59	0,0450
1030	189,73	35,29	0,0450
1040	183,85	35,09	0,0450
1050	180,63	34,89	0,0450
1060	181,03	34,59	0,0450
1070	177,20	34,39	0,0450
1080	178,04	34,09	0,0450
1090	178,99	33,79	0,0450
1100	177,23	33,59	0,0450
1110	177,86	33,29	0,0450
1120	180,78	33,09	0,0450
1130	177,64	32,79	0,0450
1140	177,04	32,49	0,0450
1150	176,50	32,29	0,0450
1160	176,50	31,99	0,0450
1170	175,28	31,69	0,0450
1180	179,79	31,49	0,0450
1190	177,03	31,19	0,0450
1200	177,40	30,91	0,0450
1210	178,25	30,69	0,0450
1220	177,86	30,39	0,0450
1230	176,41	30,09	0,0450
1240	179,08	29,88	0,0450
1250	175,69	29,59	0,0450
1260	174,83	29,30	0,0450
1270	173,47	29,09	0,0450
1280	174,49	28,79	0,0450
1290	178,09	52,96	0,0450
1300	177,77	52,96	0,0450
1310	174,76	52,96	0,0450
1320	173,23	52,95	0,0450
1330	173,92	52,71	0,0450
1340	172,35	52,51	0,0450
1350	172,35	52,21	0,0450
1360	176,42	51,91	0,0450
1370	172,79	51,71	0,0450
1380	171,68	51,40	0,0450
1390	172,48	51,21	0,0450
1400	172,03	50,91	0,0450
1410	170,97	50,61	0,0450
1420	174,38	50,41	0,0450
1430	171,92	50,11	0,0450
1440	172,64	49,84	0,0450
1450	171,15	49,60	0,0450
1460	170,90	49,40	0,0450
1470	171,95	49,10	0,0450
1480	178,61	48,80	0,0450
1490	173,12	48,60	0,0450
1500	171,61	48,31	0,0450
1510	170,09	48,10	0,0450
1520	171,09	47,80	0,0450
1530	171,88	47,56	0,0450
1540	178,98	47,30	0,0450
1550	172,57	47,06	0,0450
1560	172,16	46,80	0,0450
1570	172,00	46,50	0,0450
1580	170,72	46,30	0,0450
1590	170,81	46,00	0,0450
1600	177,56	45,75	0,0450
1610	173,00	45,50	0,0450
1620	170,65	45,20	0,0450
1630	170,03	45,00	0,0450
1640	169,94	44,80	0,0450
1650	168,88	44,50	0,0450
1660	181,18	44,20	0,0450
1670	171,19	44,00	0,0450
1680	170,86	43,70	0,0450
1690	169,37	43,50	0,0450
1700	168,49	43,20	0,0450
1710	167,87	42,90	0,0450
1720	172,55	42,70	0,0450
1730	170,57	42,40	0,0450
1740	170,57	42,20	0,0450
1750	170,55	41,90	0,0450
1760	169,91	41,60	0,0450
1770	170,37	41,40	0,0450
1780	169,75	41,09	0,0450
1790	171,66	40,89	0,0450
1800	170,38	40,59	0,0450
1810	169,30	40,29	0,0450

1820	168,39	40,10	0,0450
1830	168,17	39,79	0,0450
1840	167,57	39,51	0,0450
1850	168,70	39,29	0,0450
1860	169,63	39,08	0,0450
1870	168,45	38,79	0,0450
1880	168,04	38,49	0,0450
1890	166,98	38,29	0,0450
1900	165,55	38,02	0,0450
1910	167,18	37,79	0,0450
1920	167,11	37,49	0,0450
1930	166,71	37,29	0,0450
1940	167,56	36,99	0,0450
1950	166,29	36,79	0,0450
1960	168,40	36,49	0,0450
1970	170,96	36,19	0,0450
1980	168,96	35,99	0,0450
1990	167,97	35,69	0,0450
2000	167,34	35,49	0,0450
2010	168,46	35,19	0,0450
2020	167,80	34,89	0,0450
2030	170,43	34,59	0,0450
2040	169,05	34,39	0,0450
2050	167,32	34,09	0,0450
2060	167,57	33,89	0,0450
2070	167,39	33,59	0,0450
2080	167,35	33,29	0,0450
2090	167,69	33,09	0,0450
2100	166,94	32,79	0,0450
2110	165,53	32,59	0,0450
2120	166,41	32,29	0,0450
2130	166,39	31,99	0,0450
2140	166,55	31,79	0,0450
2150	168,87	31,49	0,0450
2160	167,53	31,23	0,0450
2170	167,47	30,99	0,0450
2180	171,05	30,89	0,0450
2190	246,02	30,29	0,0450
2200	268,44	29,79	0,0450
2210	215,05	29,49	0,0450
2220	199,36	29,28	0,0450
2230	192,32	28,99	0,0450
2240	186,97	28,79	0,0450
2250	184,32	28,48	0,0450
2260	183,81	28,19	0,0450
2270	180,42	27,98	0,0450
2280	180,14	27,69	0,0450
2290	178,97	27,48	0,0450
2300	178,94	27,18	0,0450
2310	180,25	26,88	0,0450
2320	180,84	26,68	0,0450
2330	179,80	26,38	0,0450
2340	178,55	26,08	0,0450
2350	177,64	25,88	0,0450
2360	177,08	25,58	0,0450
2370	176,18	25,38	0,0450
2380	177,39	25,08	0,0450
2390	176,90	24,78	0,0450
2400	176,20	24,58	0,0450
2410	176,25	24,28	0,0450
2420	175,98	23,98	0,0450
2430	174,99	23,78	0,0450
2440	177,69	23,48	0,0450
2450	177,44	23,18	0,0450
2460	176,16	22,98	0,0450
2470	175,73	22,68	0,0450
2480	173,39	22,38	0,0450
2490	174,27	22,18	0,0450
2500	175,50	21,88	0,0450
2510	173,15	21,68	0,0450
2520	171,74	21,38	0,0450
2530	172,05	21,18	0,0450
2540	172,59	20,88	0,0450
2550	170,82	20,68	0,0450
2560	175,59	20,38	0,0450
2570	174,10	20,08	0,0450
2580	173,49	19,88	0,0450
2590	172,41	19,68	0,0450
2600	172,95	19,38	0,0450
2610	173,24	19,08	0,0450
2620	176,41	18,78	0,0450
2630	173,72	18,58	0,0450
2640	173,28	18,28	0,0450
2650	173,72	17,98	0,0450
2660	172,37	17,78	0,0450
2670	172,34	17,48	0,0450
2680	175,43	17,18	0,0450
2690	173,39	16,98	0,0450
2700	173,15	16,68	0,0450
2710	171,26	16,48	0,0450
2720	170,83	16,18	0,0450
2730	170,35	15,98	0,0450
2740	174,98	15,68	0,0450
2750	172,32	15,38	0,0450

2760	171,72	15,18	0,0450
2770	170,92	14,88	0,0450
2780	171,46	14,60	0,0450
2790	170,68	14,38	0,0450
2800	173,33	14,16	0,0450
2810	170,13	13,87	0,0450
2820	168,60	13,68	0,0450
2830	168,25	13,38	0,0450
2840	169,89	13,08	0,0450
2850	168,67	12,88	0,0450
2860	172,46	12,58	0,0450
2870	169,36	12,38	0,0450
2880	169,67	12,08	0,0450
2890	169,41	11,87	0,0450
2900	169,31	11,58	0,0450
2910	169,88	11,38	0,0450
2920	174,28	11,08	0,0450
2930	170,52	10,80	0,0450
2940	168,86	10,57	0,0450
2950	170,44	10,28	0,0450
2960	169,75	10,08	0,0450
2970	170,73	9,77	0,0450
2980	175,94	9,48	0,0450
2990	170,59	9,27	0,0450
3000	170,25	8,98	0,0450
3010	168,95	8,78	0,0450
3020	169,51	8,47	0,0450
3030	170,12	8,21	0,0450
3040	177,09	7,97	0,0450
3050	170,99	7,67	0,0450
3060	169,66	7,48	0,0450
3070	168,34	7,27	0,0450
3080	168,35	6,97	0,0450
3090	166,63	6,77	0,0450
3100	175,11	6,47	0,0450
3110	168,25	6,27	0,0450
3120	169,63	5,97	0,0450
3130	171,12	5,67	0,0450
3140	171,38	5,37	0,0450
3150	171,34	5,17	0,0450
3160	182,52	4,87	0,0450
3170	172,84	4,67	0,0450
3180	170,11	4,37	0,0450
3190	168,16	4,17	0,0450
3200	167,36	3,87	0,0450
3210	166,19	3,67	0,0450
3220	167,39	3,52	0,0450
3230	171,28	3,37	0,0450
3240	168,77	3,14	0,0450
3250	169,79	2,97	0,0450
3260	169,25	2,77	0,0450
3270	167,63	2,67	0,0450
3280	165,61	2,54	0,0450
3290	163,03	2,37	0,0450
3300	158,23	2,27	0,0450
3310	155,43	2,17	0,0450
3320	152,03	2,07	0,0450
3330	151,49	1,97	0,0450
3340	151,45	1,87	0,0450
3350	153,17	1,67	0,0450
3360	151,77	1,57	0,0450
3370	148,77	1,47	0,0450
3380	147,65	1,47	0,0450
3390	139,61	1,45	0,0450
3400	129,69	1,47	0,0450
3410	106,71	1,47	0,0450
3420	92,15	1,47	0,0450

APPENDIX 5: Participants

Danick Power ing.
v-p operation
Services Polytests inc.
450.741.3636
www.polytests.com

Maxime Martin
Technicien
Services Polytests inc.
450.741.3636
www.polytests.com

APPENDIX 6: Drawings and specifications

APPENDIX 7: Operator's manual

USE AND MAINTENANCE MANUAL

RAVELLI
il fuoco intelligente

Stoves with Touch Remote

Vittoria V - Atena V
RV 120 Touch

US
Energy Verified

SAVE THESE INSTRUCTIONS

Please read this entire manual before installation and use of this pellet fuel-burning room heater.
Failure to follow these instructions could result in property damage, bodily injury or even death.
Contact local building or fire officials about restrictions and installation inspection requirements in your area.
Contact local authorities to see if a permit must be obtained before installation.

ASTM E 1509-12 • UL 1482 - 11 • ULC S627-00 • Oregon Administration Rules 814-23-909 • Mobile Home Approved

Sommario

INTRODUCTION

Please read this manual carefully. It describes all the phases necessary for perfect functioning of the stove.

The regulations on installation and operation in this manual may differ from the regulations in force locally. In this case, the indications of the competent local authorities must always be followed. The drawings shown in this manual are indicative and not to scale.

Information

The packaging that we have used offers good protection against any damage due to transport. Always check the stove immediately after delivery: in the event of any damage, please inform your Ravelli dealer immediately.

Description of use and maintenance manual

With this use and maintenance manual, Ravelli wishes to provide the user with all the information on safety in using the stove, in order to avoid damage to persons or things or parts of the stove. Please read this manual carefully before use and any work on the product.

WARNINGS

Ravelli stoves are manufactured taking care even on the individual components in order to protect both the user and the installer from any accidents.
The authorized personnel, after any work on the product, should therefore always pay special attention to the electrical connections.
Installation must be performed by authorized personnel, who must give the purchaser a declaration of conformity of the appliance, and who will assume all responsibility for the final installation and consequent good functioning of the product installed. It is also necessary to take into consideration all the laws and national, regional, provincial and local regulations present in the country in which the appliance has been installed. In the event of failure to respect these precautions, Aico S.p.A. declines all responsibility.
This instruction manual is an integral part of the product: please make sure that it is always with the stove, including in the case of transfer to another owner or user, or transfer to another place. In the case of its damage or loss, please request another copy from the Technical service.
This stove must be used for the purpose for which it has been specifically manufactured. Do not use the appliance as an incinerator or in any way other than that for which it was designed. All contractual and tort responsibility of the manufacturer is excluded for damage caused to persons, animals or things, due to errors of installation, maintenance regulation or improper use. No other fuel except the pellets must be used. Do not use liquid fuels.
After having removed the packaging, please make sure that the contents are complete and intact.
All the electrical components that make up the stove must be replaced with original spare parts exclusively from an authorized technical assistance centre.
Maintenance of the stove must be performed at least once a year, planning it in time with the technical assistance centre.
Do not make any unauthorized modification to the appliance.

For safety reasons, please remember that:
- the stove must not be used by children or disabled people without assistance;
- do not touch the stove when barefoot or when any parts of the body are wet;
- the safety devices or adjustment devices must not be modified without the authorization or instructions of Ravelli.
The stove, especially the external surfaces, reaches very high temperatures when it is in operation; take care when touching it to avoid burns.

The stove has been designed to function in any climatic condition; in the event of particularly adverse conditions (wind, freezing), safety systems could switch off the stove.
If this occurs, contact the technical assistance and, in any case, do not disable the safety systems.

THANK YOU

Dear Customer,
We would like to thank you and congratulate you on the excellent choice you have made.
With the Ravelli stove, you will see that quality and economy can go hand in hand, offering excellent performances with limited consumption and being totally practical. Please find below some suggestions, which we would like to give you, to obtain the most from your stove and to fully enjoy all the advantages that it can give you.
Through this, we want to be close to our customers to offer the maximum technical support to all those who use our technology.

Aico S.p.A. thanks you for your confidence
and wishes you happy times in the company
of your pellet stove.

SAFETY INFORMATION

The stove must be installed and tested by specialized personnel instructed by the Ravelli. Please read this use and maintenance manual before installing and putting the stove into operation!
If you require further information, please contact your Ravelli dealer.

IMPORTANT
The place of installation of the stove must comply with local, national and Federal regulations.
The stove must be fuelled only with quality pellets with a diameter of 6 mm as described in the specific chapter.
The stove cannot operate with traditional wood
The stove must not be used as an incinerator. FIRE HAZARD!!!
Installation, the electrical connections, checking the functioning and maintenance must be performed by qualified and authorized personnel.
Improper installation or poor maintenance (not compliant with what is shown in the following manual) may cause damage to persons and things. In this condition, Ravelli is relieved of all civil or criminal responsibility.
Before connecting the stove electrically, the connection of the exhaust tubes must be completed (specifically for pellet stoves, not made from aluminium) with the flue.
The protection grille inside the pellet hopper must never be removed.
There must be sufficient circulation of air in the room where the stove is installed.
Never open the door of the stove whilst it is functioning. FIRE HAZARD!!!
The stove must not be used with the door open or with the glass broken. FIRE HAZARD!!!
When the stove is operating, the surfaces, the glass, the handle and the pipes become overheated: during functioning, these parts must only be touched with the adequate protection.
Do not light the stove without having first performed the daily inspection as described in the MAINTENANCE chapter of this manual.
Do not place any washing on the stove to dry. Keep clothes and similar at a suitable distance from the stove. FIRE HAZARD!!!
DO NOT INSTALL A FLUE DAMPER
DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE
Attachment and securement of the exhaust venting system to the product and to each adjoining section. All joints for connector pipe shall be required to be fastened with at least three screws. If vented horizontally, joints shall be made gaslight in a manner that shall be specified.
Perform regular inspection, maintenance, and cleaning of the chimney and chimney connector
Disposal of Ashes: Ashes should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a non-combustible floor or on the ground, well away from all combustible materials, and moved outdoors immediately. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled. Other waste shall not be placed in this container.
Caution against the storage or use of flammable liquids, as follows: Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or 'freshen up' a fire in this heater. Keep all such liquids well away from the heater while it is in use.
Creosote - Formation and Need for Removal
When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited this creosote makes an extremely hot fire
The exhaust venting system should be inspected at least once every two months during the heating season to determine if a creosote buildup has occurred.
If creosote has accumulated it should be removed to reduce the risk of a chimney fire.
Scrupulously follow the maintenance programme.
Do not switch off the stove by disconnecting the electricity mains supply.
Do not clean the stove until the structure and the ashes have cooled down completely.
Carry out all operations in maximum safety and tranquillity.
Coply with exhaust venting system termination requirements including location restrictions to air inlets, distances from windows, doors, and air inlets and distance to combustible materials.
Do not connect to or use in conjunction with any air distribution ductwork
Hot while in operation. Keep children, clothing and furniture away. Contact may cause skin burns.
The type of chimney shall be suitable for solid fuel and the chimney connector must be in good condition and kept clean.
Establish a routine for the fuel, pellet burner and fring technique. Check daily for creosote build-up until experience shows how often you need to clean to be safe. Be aware that the hotter the fire the less creosote is deposited and weekly cleaning may be necessary in mild weather even though monthly cleaning may be enough in the coldest months. Contact your local or fire authority for information on how to handle a chimney fire. Have a clearly understood plan to handle a chimney fire.
Keep firing and deashing doors closed and maintain all seals in good conditions.
Do not strike or slam shut the door, the glass can brake. The glass shall be cleaned only when cold, do not clean a hot glass. Use a dry cloth with normal glass detergent, do not use any abrasive cleaner.
The type of chimney shall be suitable for solid fuel and the chimney connector must be in good condition and kept clean.
When this room heater is not properly installed, a house fire may result. To reduce the risk of fire, follow the installation instructions. Contact local building or fire officials about restrictions and installation inspection requirements in your area.
This room heater must be connected to a chimney complying with the requirements for type HT chimneys in the standard UL 103 or a code-approved masonry chimney with a flue liner.

This wood heater needs periodic inspection and repair for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual. - This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.
This heater is designed to burn wood pellet only. DO NOT BURN ANY OTHER FUEL. Burning other materials may result in release of toxic fumes or render the heater ineffective and cause smoke.
Do not overfire. Attempts to achieve heat output rates that exceed heater design specifications can result in permanent damage to the heater.
Flues gases contain carbon monoxide (CO), it is recommended to install smoke monitors and CO monitors for areas that are expected to generated CO. Inspect the chimney to minimize visible emissions.
Soot and Flyash: Formation and Need for Removal—The products of combustion will contain small particles of flyash. The flyash will collect in the exhaust venting system and restrict the flow of the flue gases. Incomplete combustion, such as occurs during startup, shutdown, or incorrect operation of the room heater will lead to some soot formation which will collect in the exhaust venting system. The exhaust venting system should be inspected at least once every year to determine if cleaning is necessary.

GENERAL

The Stove must only operate in rooms. As it is controlled by an electronic board, combustion is completely automatic and controlled and the control unit regulates the ignition phase, 5 levels of power and the switching off phase, guaranteeing safe functioning. Most of the ashes produced by the combustion of the pellets fall into the collection drawer.
However, always check the fire pot every day, as not all pellets have high standards of quality and could leave residue that is difficult to remove.
The glass has a special air circulation for self-cleaning. However, a slight greyish film cannot be avoided after a few hours of functioning.
As already mentioned earlier, pellets with a diameter of 6 mm must be used with the stove.

Responsibility

Ravelli declines all responsibility, both civil and criminal, with the delivery of this manual, for any accidents deriving from partial or total failure to observe the instructions it contains,
Ravelli declines all responsibility deriving from the improper use of the stove, from its incorrect use by the user, by unauthorized modifications and/or repairs or from the use of spare parts which are not original.
The manufacturer declines all direct civil or criminal responsibility due to:

- poor maintenance
- failure to observe the instructions in the manual
- use not compliant with the safety instructions
- installation that is not compliant with the regulations in force in the country.
- installation by personnel who are not qualified or authorized
- modifications and repairs that are not authorized by the manufacturer
- use of spare parts that are not original
- exceptional events

Majolica finishes

Due to the special hand finish of the majolica surface imperfections such as shadowing my accour .Those are details that make every majolica one of its kind. As it is a delicate material, please handle with care whilst cleaning and avoid blows as sudden breakage may occur. Please also take care when loading the hopper (Ed.'s note; tank containing the pellets) with the bag of pellets: do not place it on the stove!

What are the wood pellets

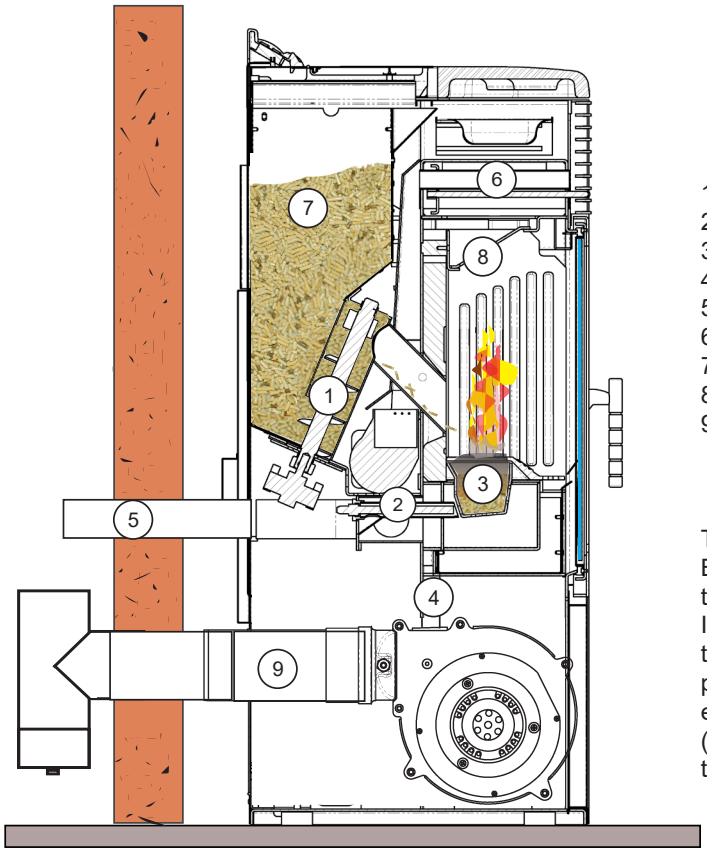
The wood pellets are made from sawdust and wood shavings produced in joiners' shops. The material used cannot contain any foreign substance such as glue, varnish or synthetic substances.
Subjecting it to high pressure, the wood is pressed through a plate with holes and due to the high pressure the sawdust is heated activating the natural binders of the wood. Thus, the pellets keep their shape even without the addition of bonding substances. The density of the wood pellet varies according to the type of wood and can be 1.5 – twice greater than that of natural wood.
The diameter of the cylindrical rods is 6 mm and their length can vary between 10 and 40 mm.
Their real weight is greather than 650 kg/m^3. Due to the low content of water (<10%) they have a high energy content.
The standards ISO 17225-2:2014 define the quality of the pellets:

Length: < 40 mm
Diameter: 6 mm approx.
Real weight: > 600 kg/m3
Lower heating value: ≥ 16,5 MJ/kg (≥ 7100 BTU/lb)
Residual humidity: < 10 %
Ashes: < 1.2 %
Specific weight: >1000 kg/m3

Do not put the bag of pellets on the ceramic parts during the loading operations.

The pellets must be transported and stored in a dry place. They swell on contact with damp, and cannot be used, They must always be protected from the damp both during transport and in storage. Do not place such fuel within the space heater installation clearances or within the space required for charging and ash removal.

The components of the stove



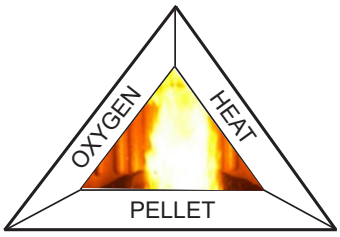
1) pellet loading auger
2) electrical igniter
3) combustion fire pot
4) tube for passage of smoke
5) air intake tube
6) stainless steel heat exchanger
7) pellet hopper
8) baffle
9) smoke exhaust tube

This drawing shows the internal parts of a pellet stove.
By filling the hopper (7), the pellets are loaded into the fire pot (3) through the loading auger (1).
Ignition is by means of the electrical igniter (2), which overheats the air from the special entrance (5) which on contact with the pellets will allow the development of the flame. At this point the exhaust smoke is deviated towards the stainless steel exchanger (6) and through the smoke extraction tube (4) it is released into the flue, through the connection with the smoke exhaust pipe. (9).

The combustion

The combustion is a chemical reaction between fuel and oxidizer. The result of this reaction is the heat.
The three elements that are required for the combustion are:

- Fuel (pellet)
- Oxidizer (oxygen available in the air)
- Ignition (heat of embers or electrical ignitor)



To get the combustion, the combustible and the carburant must be available in a correct proportion.

The reaction between combustible and carburant is made by an external starter. The start can be made by the hot reaction or by a sparkle.
The combustion is NOT CORRECT, the flame is too tight with too much incandescent pellet in the fire pot.
Adjust the Set pellet/air reducing the air percentage (from 0 up to -5); in the vent this is not enough to get a proper flame, increase the loading quantity of the pellet (from 0 up to +5) to reach the flame condition shown in picture 3.

Pic. 1

INCORRECT combustion, flame too drawn, in “blowtorch” style with a high quality of incandescent pellets coming out of the grate. Correct the pellet/air set by reducing the percentage of air (from 0 to -5); if not sufficient, also increase the percentage of falling pellets (from 0 to +5) to arrive to the condition in Figure 3.
If the changes made to the settings do not bring the stove to the right combustion conditions in Figure 3, contact the Technical Support Centre.

Pic. 2

INCORRECT combustion, “spring” flame in “wood stove” style with high quantity of pellets not burning on the grate. Firstly, check the door is closed and the ash pan. Secondly, correct the pellet/air set by increasing the percentage of air (from 0 to +5); if not sufficient, also reduce the percentage of falling pellets (from 0 to -5) to arrive to the condition in Figure 3.
If the changes made to the settings do not bring the stove to the right combustion conditions in Figure 3, contact the Technical Support Centre.

Pic. 3

The combustion IS CORRECT, full flame yellow/white and minimum quantity of pellet in the fire pot.
The combustion if fine and no ad.

The picture 3 show a flame done with a stove working at power P5.

Compliance status

This manual describes the installation and operation of the Ravelli, Vittoria V, Atena V and RV 120 Touch wood pellet heater. This heaters meet the 2020 U.S. Environmental Protection Agency's wood pellet emission limits for wood heaters sold after May 15th 2015. Under specific test conditions this heater has been shown to deliver heat at rates ranging from 12900 to 37000 Btu/hr.

	Emission Rate (g/hr)	Heating Efficiency (% Overall)	1st hour Emission Rate (g/hr)	CO emission gr/hr
Vittoria V	0.6	79.25%	2.19	2.8
Atena V	0.6	79.25%	2.19	2.8
RV 120 Touch	0.6	79.25%	2.19	2.8

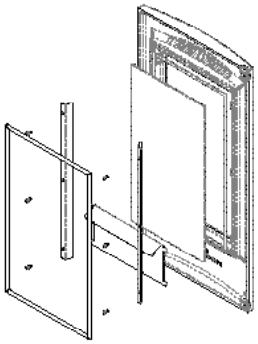
Spare parts

Use original spare parts only. Do not use any substitute material. Do not wait for the components to be worn before replacing them. Replace a worn component before it is completely broken to prevent any accidents caused by the sudden breakage of components, perform the periodic maintenance checks as described in the dedicated chapter. Removal of broken or damaged components shall be only done by authorized technical service.

Glass and gasket replacement

Use only ceramic type glass. To replace the glass the door needs to be disassembled according to the below drawing.

Vittoria V - Atena V - RV 120 Touch



Ceramic glass dimensions:
272 x 510 mm (10.71'' x 20.08'')
thickness 5mm (0.20'')

Glass ribbon trecotee gasket:
8 mm x 3 mm (0.31" x 0.12")
L1540 mm (60.63")

Door tricovet gasket:
diam. 10 mm (0.39")
L1680 mm (66.14")

SAFETY DEVICES

The stove is fitted with sophisticated safety systems so that, in the case of breakage of one of the individual parts or defects in the flue, no damage will be caused to the stove and the room in which it is installed. In any case, when a problem arises, the pellets stop falling immediately and the " switch off " phase is activated.
The corresponding alarm will be shown on the display. The details can be seen in chapter 9 "DESCRIPTION OF ALARMS".

TECHNICAL FEATURES

		Vittoria V	Atena V	RV 120 Touch
Height	Inch	45.7	45.8	45.8
Width	Inch	20.2	21.1	21.1
Depth	Inch	22.4	22.4	22.4
Weight	Lbs	420	420	400
Diameter of smoke exit tube	Inch	3.1	3.1	3.1
Min - max hourly consumption of pellets	Lbs/h	1.8 - 5.3	1.8 - 5.3	1.8 - 5.3
Supply	V - Hz	120 - 60	120 - 60	120 - 60
Hopper capacity	Lbs	50	50	50
Efficiency *	%	79.25	79.25	79.25
Smoke temperature min - max	°F	200 - 415	200 - 415	200 - 415

*overll heating efficiency is determined using higher heating value of the fuel.

The data shown above are indicative and not binding. Ravelli reserves the right to make any modifications for the purpose of improv-ing the performances of the product.

The stove is equipped with a combustion air control device that automatically sets the parameters for good combustion, optimising consumption of pellet and ensuring maximum efficiency.

Automatic cleaning system

The stove is equipped with atuomatic brazier cleaning system. This means that there is no need to carry out daily manual cleaning of the brazier or every time the stove is lit. The automatic cleaning system is activated every time the stove is lit and after 6 hours of continuous operation. The cleaning cycle, which involves shutting down, automatic cleaning and restarting the stove, takes about 10 minutes. During this period the heating is guaranteed by the heat accumulated by the appliance itself.
Note: the times indicated are those set by default by the Manufacturer.

POSITIONING, ASSEMBLY AND INSTALLATION

Environment of use

The positioning of the stove is decisive for a successful and equal heating of the room. Before deciding where to place the stove, the following must be taken into account:
- The stove must be installed on a floor with a sufficient carrying capacity. If the existing building does not meet this requisite, appropriate measures must be taken (i.e. load distribution plate).
- The combustion air cannot be obtained from a garage or from an area without ventilation or exchange of air, but from a free or external space
- The stove must not be installed in a bedroom, bathroom or shower, or where there is already another heating appliance without an autonomous air flow (chimney, stove etc.)
- A non-combustable Hearth board 6” from front of unit and 6” from the sides must be installed before unit is placed on the floor.
- Installation is better in a large and central room in the house to ensure maximum circulation of the heat;
- Connection to the main supply is recommended using a grounded outlet (if the cable supplied is not long enough to reach the nearest outlet, use an extension cord with a surge protector);
- The stove must be placed in a position that receives the necessary level of air for appropriate combustion of the pellets (at least 131.23 f^3/h must be available), in accordance with installation regulation and local legislations;
- All joints for connector pipe is required to be fastened with at least three screws.
- If vented horizontally joint should be siliconed with hi-temp. silicone and screwed so they are gas tight. (RTU 500 silicone)
- the chimney connector shall not pass through an attic or roof space, closet or similar conceald space, or a floor or ceiling. Where passage through a wal, or partition of combustible construction is desired, the installationshall conform to CAN/CSA-B365.

The stove must be installed and assembled by qualified personnel.
The room must be:
- Prepared for the environmental functioning conditions
- Prepared with an adequate system of evacuation of smoke
- Have a 120V 60 Hz electricity mains supply
- Do not connect this unit to a chimney flue serving another appliance
- Use only UL Listed Type L Vent or Pellet Vent 3” in. I.D. venting system to exhaust. Do not install flue damper in the exhaust system of this unit.
- The chimney connector and each other adjoining section must be firmly attached and secured to the stove.

Mobile Home Requirements

- Outside air is required
- The heater must be secured to the floor using lag bolts.
- The heater must be grounded to the chassis of the mobile home.
- Installation should be in accordance with the manufactured home.
- When outside air is required, system parts, such as vent sections, supports, spark arresters, rodent screens, etc. must be used.
- The space heater is to be connected to a factory built chimney conforming to CAN/ULC-S629.
- It is important to use all the specified components, do not use other components.
- Installation shall maintain an effective vapour barrier at the location where the chimney or other component penetrates to the exterior of the structure.
- Operating the space heater with open firing doors can cause serious injuries and health damages due to excaping flames or carbon monoxide generation inside the room.
- Adequate ventilation is required to avoid air starvation and icing which can determine an unhealthy indoor environment.
- Do not overfire.
- If the space heater is not correctly installed and operated it can interfere with smoke detectors.

Do not install in bedroom

The structural integrity of the mobile home floor, ceiling, walls, roof must be maintained.

Refer to HUD Requirements, CFR 3280, Part 24

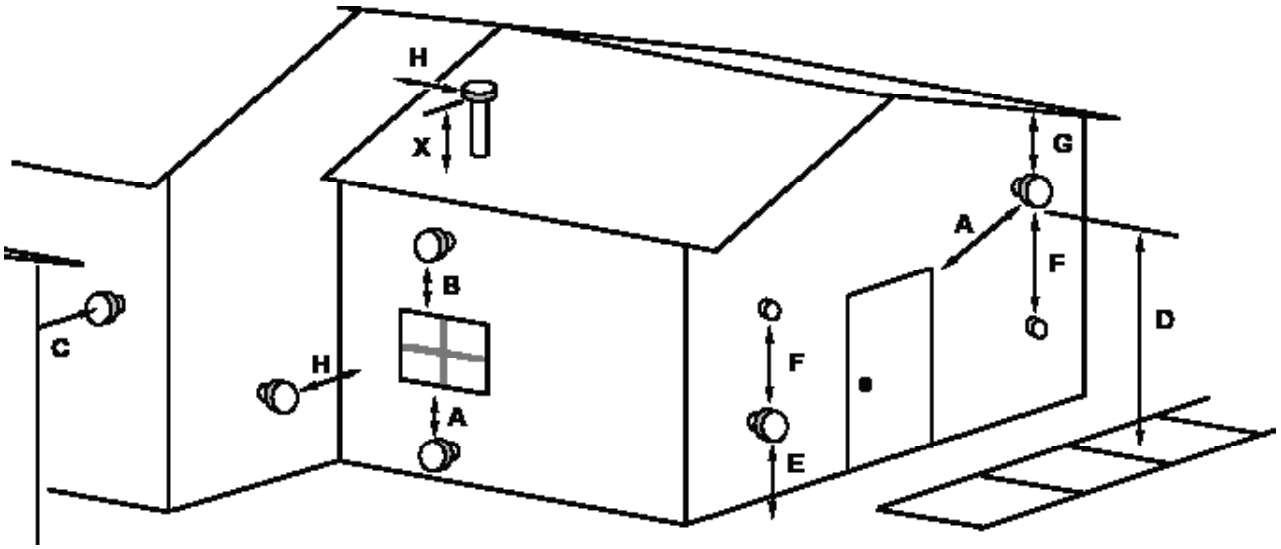
Install vent at clearances specified by the vent manufactures.

Measure clearances to the nearest edge of the exhaust hood.

Vent may not terminate in covered walkway or breezeway.

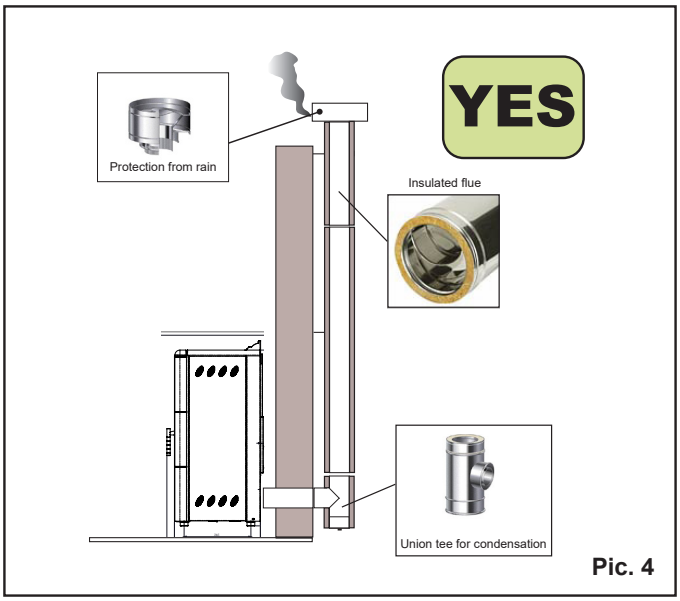
If venting horizontally, check your venting specifications for distance pipe should extrude from building.

Vent Termination Locations

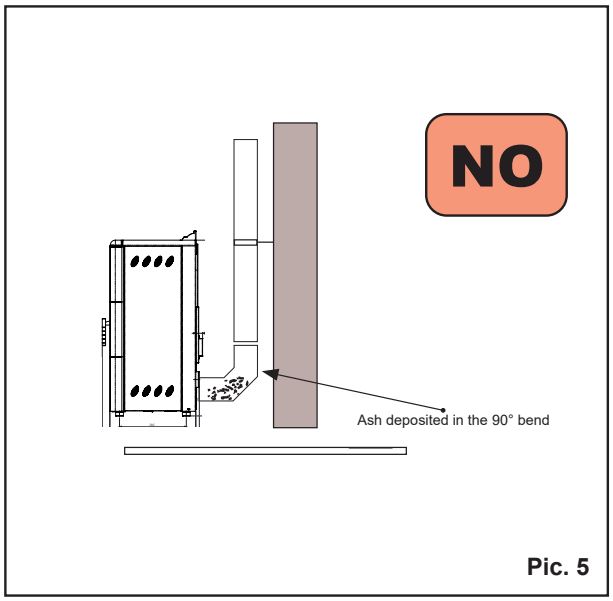


A) Minimum 4’ clearance below or beside any door or window that opens (with outside air installed, 1’ below or beside) Minimum 1’ clearance below or beside any window that does not open.
B) Minimum 1’ clearance above any door or window that opens
C) Minimum 2’ clearance from any adjacent building
D) Minimum 7’ clearance above any grade when adjacent to public walkways
E) Minimum 2’ clearance above any grass, plants, or other combustible materials
F) Minimum 3’ clearance from any forced air intake of any other appliance
G) Minimum 2’ clearance below eaves or overhangs
H) Minimum 1’ clearance horizontally from combustible wall
X) Must be a minimum of 2’ above the roof

Examples of installation

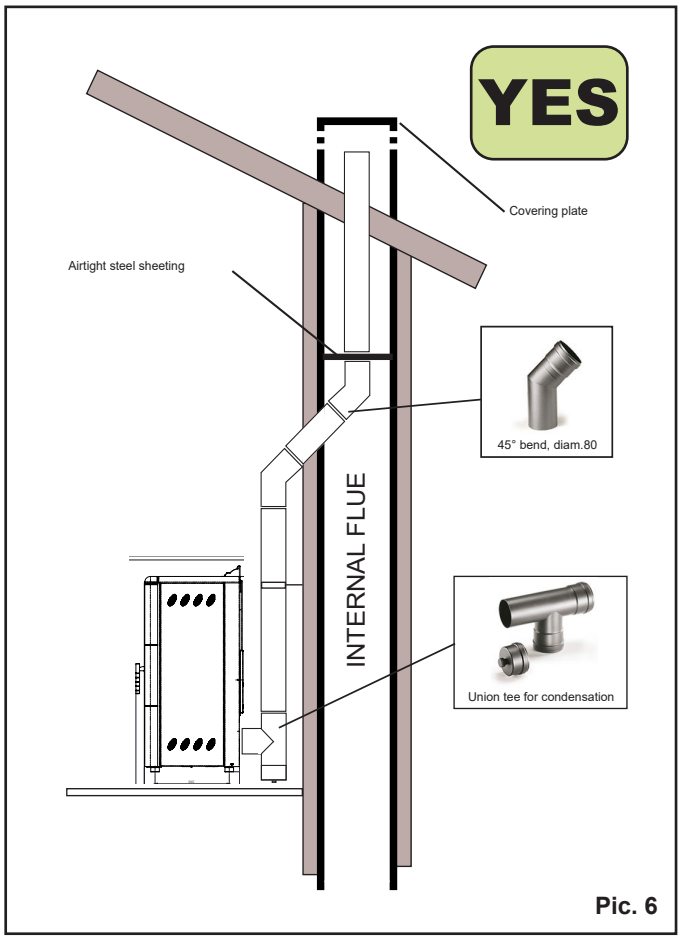


Pic. 4



Pic. 5

This type of installation (see Pic. 4) requires an insulated flue, as all the smoke pipe has been installed outside the house.
In the lower part of the flue, a union tee has been mounted with an inspection cap.
A 90° bend should not be installed as the first initial piece as the ashes would quickly obstruct the passage of smoke, causing problems for the draught of the flue. (See Pic. 5).



Pic. 6

This type of installation (se Pic. 6) does not require an insulated flue as the smoke tube has been assembled partly inside the house and partly inside an existing flue.
In the lower part of the flue a union tee has been installed with a peephole cap.
A 90° bend should not be installed as the first piece, as the ash would quickly block the passage of smoke, causing problems for the draught of the flue (See Pic. 5).
Please note the use of 2 45° bends, to guarantee that the ash falls in the union tee with a peephole.

Determining Size of Pipe to install

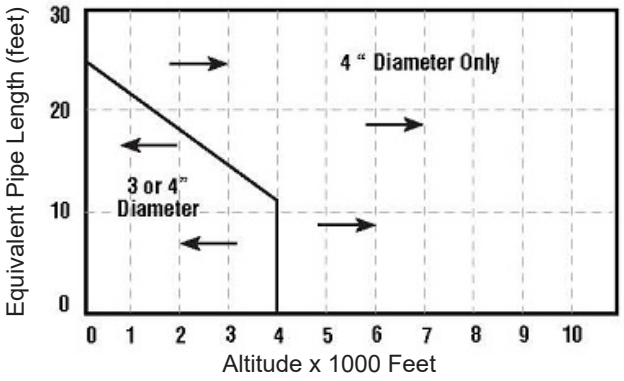
To determine the diameter of pipe to use (3"or 4"), you can use the following guidelines.

Fillout the installation chart (table 1), and calculate your total equivalent pipe length.
Then use the total equivalent pipe length and the altitude in the pipe selection chart. (Pic. 7) to determine if your installation requires 3" or 4" exhaust pipe.

Table 1 - Installation chart

Type of Pipe	# of Elbows or Feet of Pipe		Equivalent
90° Elbows/ Tee (A & G)		x	5 feet (1.5 m)
45° Elbows (C)		x	3 feet (1.0 m)
Horizontal (B & F)		x	1 feet (0.3 m)
Vertical (E)		x	0.5 feet (0.15 m)

Pic. 7 - Pipe Selection Chart



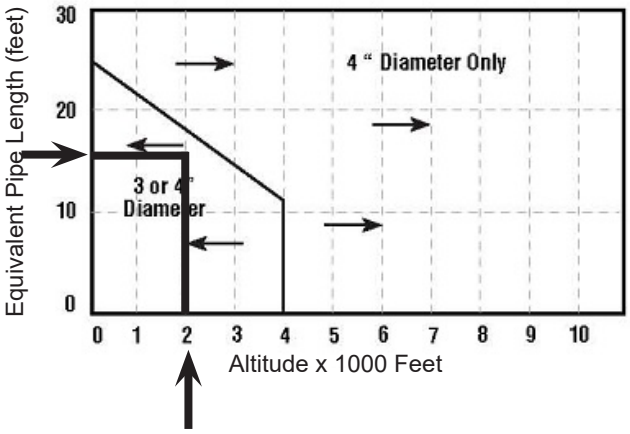
Sample installation chart

Type of Pipe	# of Elbows or Feet of Pipe		Equivalent	Total Equivalent
90° Elbows/ Tee (A & G)	2	x	5 feet (1.5 m)	10 feet (3.0 m)
45° Elbows (C)	1	x	3 feet (1.0 m)	3 feet (1.0 m)
Horizontal (B & F)	3	x	1 feet (0.3 m)	1 feet (1,0 m)
Vertical (E)	8	x	0.5 feet (0.15m)	1 feet (1,2 m)

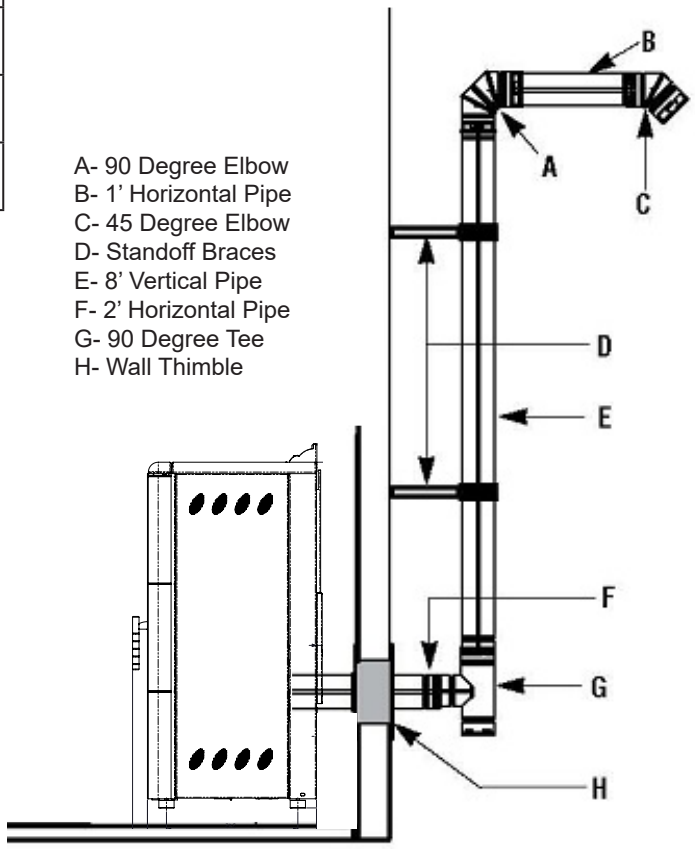
Table 2 - Sample chart for Pic. 8

Equivalent pipe lenght = (10 + 3 + 1 + 1) ft = 15 ft

If the stove is installed in a place with an altitude of 2000 ft, it is possible to use either a pipe of 3" or of 4", as you can see in the pipe selection chart below.



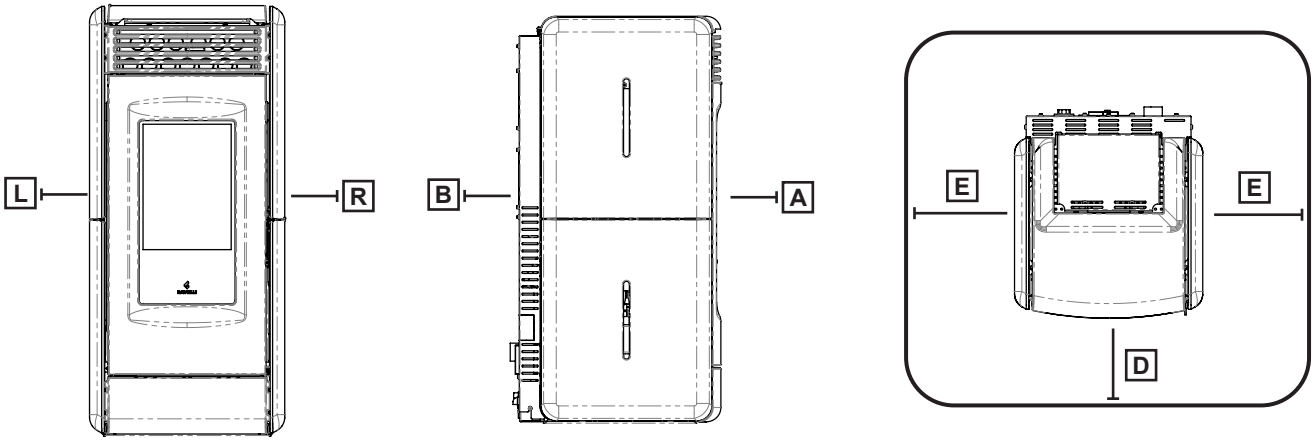
A- 90 Degree Elbow
B- 1' Horizontal Pipe
C- 45 Degree Elbow
D- Standoff Braces
E- 8' Vertical Pipe
F- 2' Horizontal Pipe
G- 90 Degree Tee
H- Wall Thimble



Pic. 8 - See sample installation chart

The vent pipe can be a minimum of 2 feet and a maximum of 45 feet long.

Minimum distance from combustible material



NOTE: Install vent at clearances specified by the vent manufactures.

Vittoria V, Atena V, RV 120 Touch				
	Unit of measurement	**Corner installation**	**Through the wall**	**Without outside air inlet**
Back wall to unit (B)	Inch / mm	2 / 51	2 / 51	4 / 102
Back wall to pipe	Inch / mm	2.75 / 70	N/A	1 / 25
Side wall to unit (L, R)	Inch / mm	2 / 51	2 / 51	2 / 51
Side wall to pipe	Inch / mm	2.75 / 70	11 / 280	11 / 280
Front to unit (A)	Inch / mm	40 / 1000	40 / 1000	40 / 1000
Ceiling from floor	Inch / mm	72 / 1830	72 / 1830	72 / 1830
Front (floor protection) (D)	Inch / mm	6 /152	6 / 152	6 / 152
Side (floor protection) (E)	Inch / mm	6 / 152	6 / 152	6 / 152

Floor: combustible floor;
Floor protection: 6 in in front and sides.
N.B. The floor protection must extend under the chimney connector and 2 inches (51 mm) beyond each side.

Standard horizontal installation configurations

1. Locate the proper position for the listed type “PL” wall thimble. Avoid cutting wall studs when installing your pipe. Use a saber saw or keyhole saw to cut the proper diameter hole through the wall to accommodate the wall thimble. Use extreme caution to avoid cutting into power lines within the wall of the home.
The hole size will depend on the brand of pellet vent that you are using. Install the wall thimble in the hole.

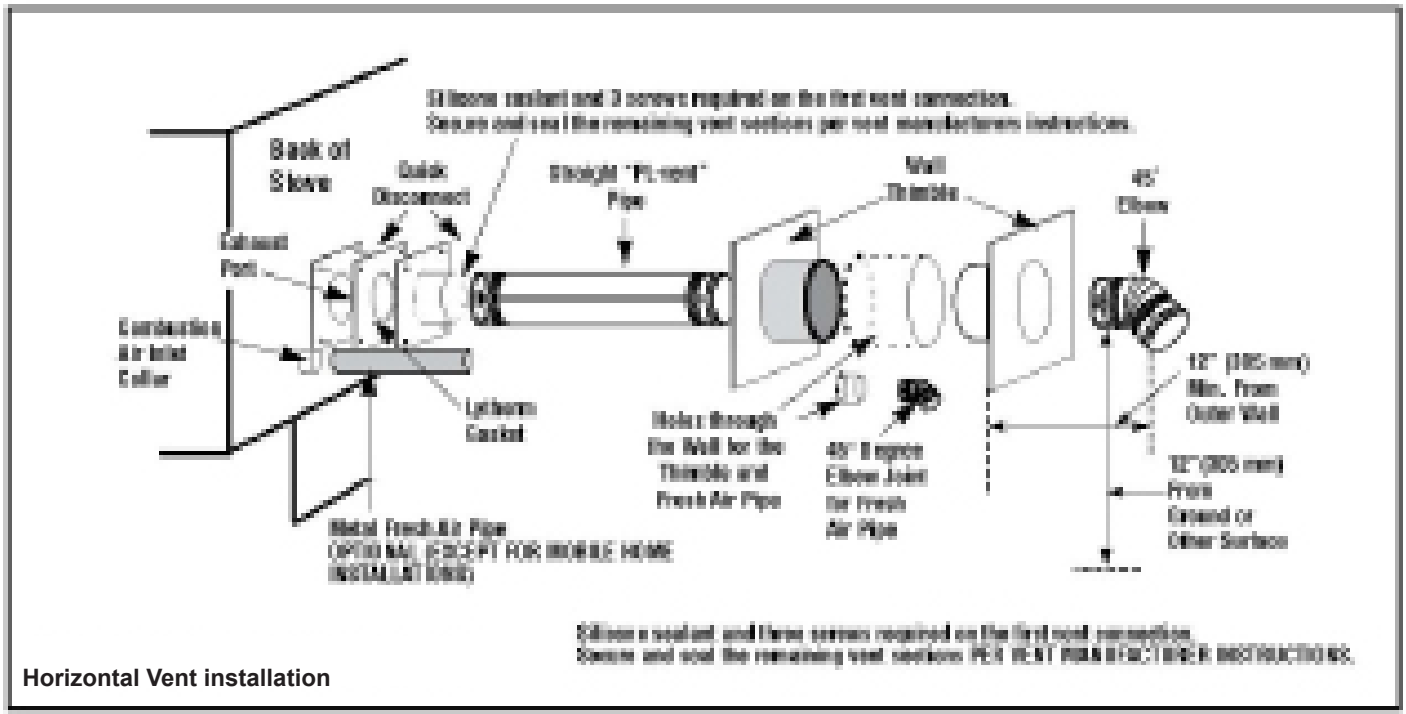
2. ALL INTERLOCKING PIPE CONNECTIONS WITH-IN THE ROOM MUST BE SEALED WITH HIGH TEMPERATURE RTV AND SECURED WITH A MINIMUM OF 3 FASTENERS PER CONNECTION. Position the stove approximately 12” (305 mm) from the wall on the floor pad. Push the “PL” pipe through the wall thimble. Squeeze a bead of high temperature silicone (RTV) sealer around the end of the machined portion of the 3” (76mm) pipe connector on the back of the stove. Firmly push on a section of “PL” pipe until inner pipe liner pushes into the bead of RTV sealer.

3. Push the stove with pipe attached towards the wall (the pipe will go through the wall thimble). Do not position the back of the stove closer than 2” (51mm) from the wall.

4. Install listed type “PL” 45 degree elbow with optional rodent screen or cap (recommended) on outside end of pipe. The rodent screen should be no less than 1/2” (13 mm) mesh and may clog with soot and ash if left unattended during the burn season.
NOTE: The end of the exhaust pipe must extend a minimum of 12” (305 mm) from the outside of the building.

5. If the installation includes a source of outside combustion air; cut a separate hole through the wall for the fresh air tube. Use a galvanized or stainless steel pipe for the duct. The minimum size for the duct shall be not less than 50% of the cross sectional flue area. Connect outside air pipe to air inlet on stove.
This tube must be terminated with a 45 degree elbow or hood.

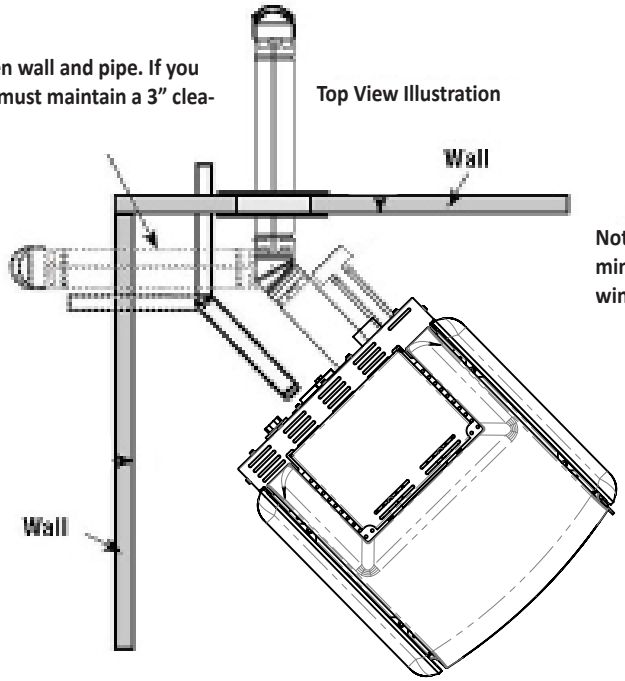
NOTES:
Combustion air may also be drawn from a vented crawl space under the home.
All joints for connector pipe are required to be fastened with at least three screws. If vented horizontally, joints shall be made gas-tight (air tight, sealed connection) in a manner as specified on this page (see instruction #2).
Install vent at clearances specified by the vent manufacturer.



Horizontal Vent installation

3" (75 mm) Minimum clearance between wall and pipe. If you vent to the furthest wall, the vent pipe must maintain a 3" clearance parallel to the other wall.

Top View Illustration

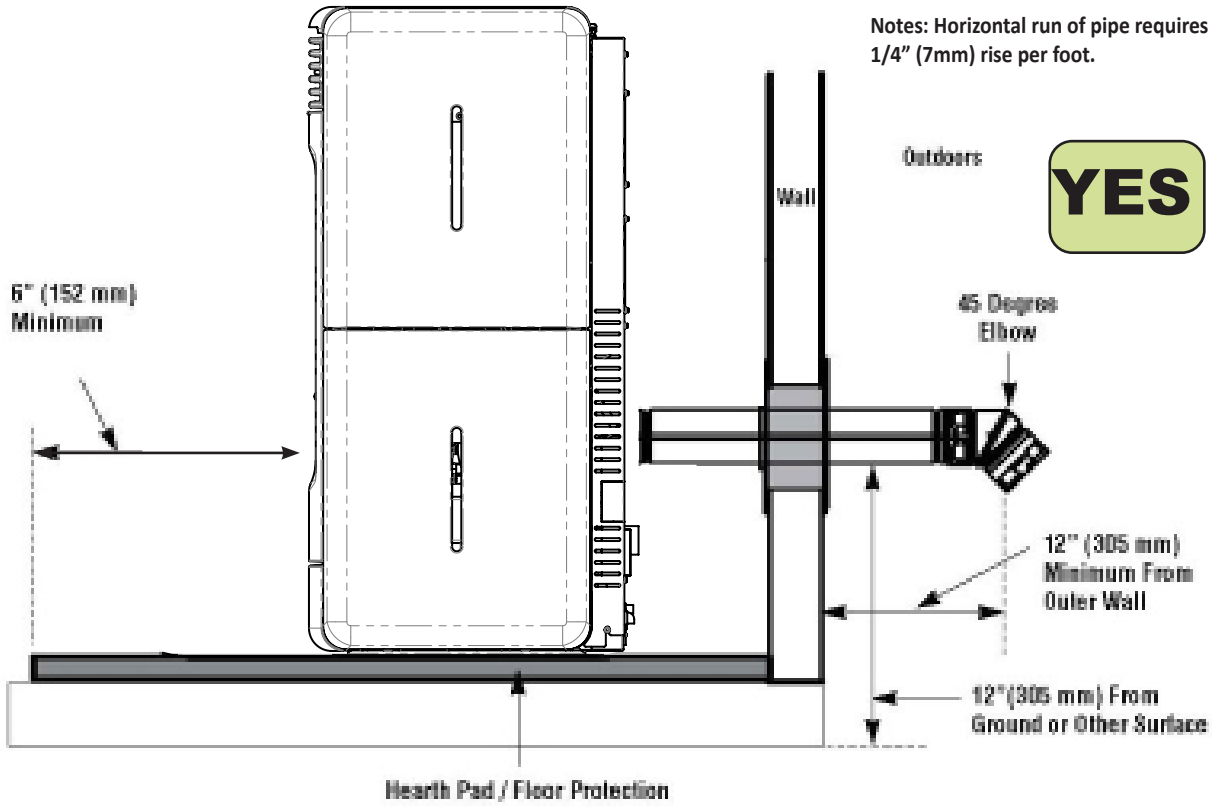


YES

Notes: It is not recommended to terminate exhaust vent on the prevailing wind side of the house

Corner Through the Wall

Notes: Horizontal run of pipe requires 1/4" (7mm) rise per foot.



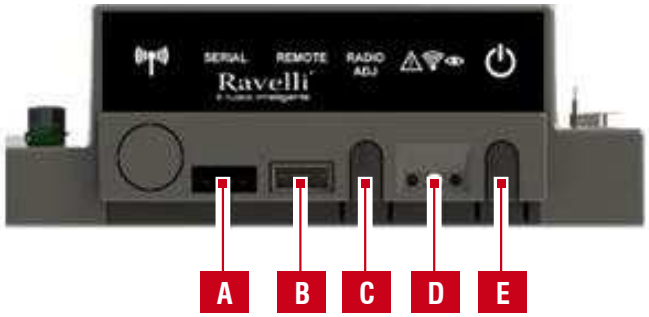
YES

Parallel Through the Wall

CONTROLS AND USE

Control panel description

The stove is controlled by an electronic card that allows fully automatic and controlled combustion. It allows to regulate the ignition phase, the power levels and the shutdown phase, guaranteeing safe operation. On the back of the stove there is a control panel that allows you to synchronise the electronic discharge with the remote control and turn the stove on/off.



A	Serial socket
B	Remote control cable connection socket
C	ADJ Radio: button to connect the remote control to the card
D	Signaling Led Red: active allergy Yellow: Awaiting communication with the remote control Green: Stove on
E	Stove on/off button

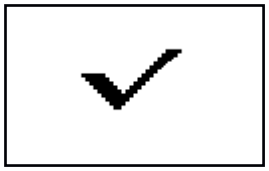
Radio touch remote control initialization

The remote control, after a first short screen showing the Ravelli logo, will list the languages available in the menu.
Select the desired language with the scroll buttons and confirm your selection with the confirmation button.

In order to operate correctly, the remote control should be interfaced with the electronic board installed inside the stove. For this reason, on display appears the following message:

If the remote control is used for the first time, select YES using the selection keys and confirm with the dedicated key. On the display of the remote control appears the following:

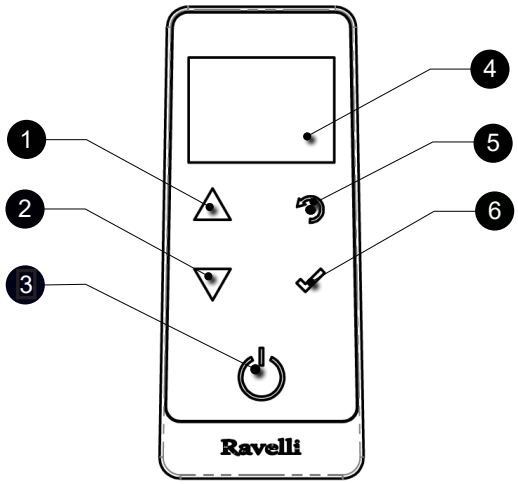
The flashing yellow LED indicates that the circuit board is waiting to receive the signal from the remote control.
By pressing the enter key on the remote control, the components start communicating with each other. A check sign on the display, accompanied by a sound signal, shows that the initialization of the remote control has been completed successfully.



In case of battery replacement, it is not necessary to perform the initialization procedure of the remote control. In this case, when the display will show the message “FIRST INSTALLATION ?”, select NO and press the dial key.

Description of the radio touch remote control

The remote control looks like the following picture:
The information below will familiarize you with the product and give you the best performance.



1	Increase button “UP” (selection key)
2	Decrease key “DOWN” (selection key)
3	ON/OFF or reset from “Sleep” mode key.
4	Display
5	Key for accessing the MENU and back
6	Confirmation key

In “Sleep” mode, the remote control screen is darkened, but radio communication with the stove is still active in order to reduce battery consumption.

How to insert the batteries in the remote control:
Remove the protective cover of the battery on the back of the remote control as shown in Figure A, and insert the 3 batteries (mini pen style battery AAA 1.5V) in the housing of the remote control and observe the poles. Install the battery protective cover as shown in figure B

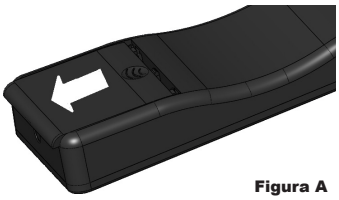
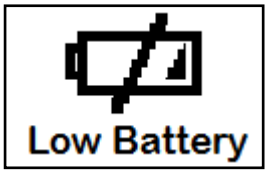


Figura A


Figura B

What happens if the batteries are empty
If the battery is discharged, within the “drop” is shown a symbol that indicates that the battery is empty, while maintaining active the features of your device.

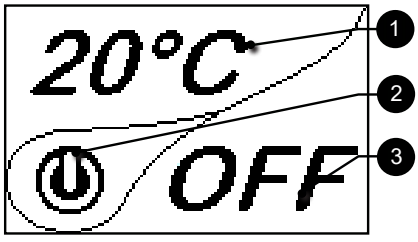
As soon as the level of the battery prevents the radio communication the remote control displays on full screen the picture of empty battery and all device functions are locked until the batteries are replaced.



If not in use for a long time, we recommend removing the batteries from the remote control.

Description of the display

The display of the remote control is described below (in “Home” mode):



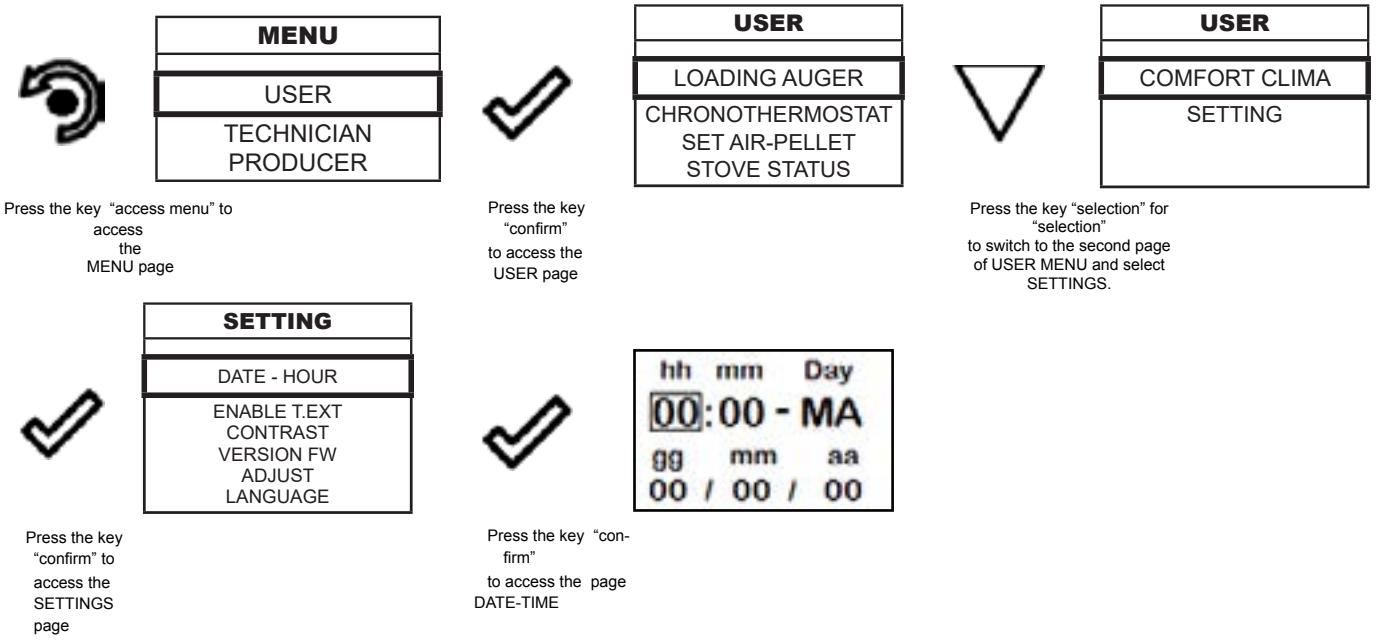
After 5 minutes of inactivity, the remote control display dims to “SLEEP” mode while maintaining the radio connection to the stove. A subsequent press of the ON/OFF key reactivates the display.

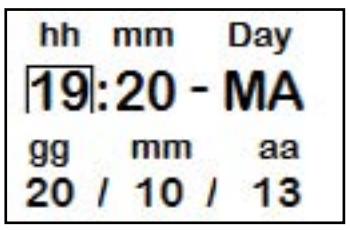
The first press of any key with active display turns on its backlight, not interpreting it as a command.

The display is subdivided into three parts:
1- It shows the current room temperature measured by the remote control. Moreover, if you press the DOWN scroll key you will display the temperature settings that can be changed using the two UP/DOWN keys. Any change made is confirmed automatically within 3 seconds from the change or by pressing the confirmation key. A sound signal indicates that the change has been confirme.

2- Icon indicating the status of the stove (see synthetic phase diagrams).
3- In the inactive phases (combined with the second part of the display) indicates the state of the stove. In the active phases, it indicates the operating power of the stove. In addition, by pressing the DOWN scroll button, you can display the power settings, that can be edited using the two scroll keys UP/DOWN: The confirmation of any change takes place automatically within 3 seconds from the change or by pressing the confirmation key. A sound signal indicates that the change has been confirmed.

Time and date setting
Below are given the steps for accessing the relative menu





Press the increase key to change every single value

Press the increase key to change every single value

Press “confirm” to confirm the settings and switch to the next value.

By pressing the key “back” for several times you will display the stand-by page.

PROCEDURES FOR USE

If the chimney catches fire you must call the fire brigade immediately.

Checks prior to start-up

You have read and perfectly understood the contents of this instructions manual.

Before lighting the stove, you must ensure that:
- the pellet tank is full;
- the combustion chamber is clean;
- the fire door and ash drawer seals are functioning properly;
- the electrical plug is connected correctly;
- all items that could burn (instructions, various adhesive labels) have been removed;
- the brazier, if removable, is correctly positioned in its housing.

During the first hours of use the paints used for the stove finish may release an unpleasant odour. You might also smell the typical odour of metal parts subject to high temperatures. Make sure sufficient air circulation is guaranteed in the room. These unavoidable inconveniences will disappear after the first hours of operation. To reduce your discomfort to a minimum, keep the stove on for a few hours on low power and in the beginning, do not overload it, avoiding intense heating-cooling cycles

At the initial start-up, the paint finishes drying and hardens. Accordingly, to avoid ruining it, we advise you not to touch the stove's painted surfaces at this time.

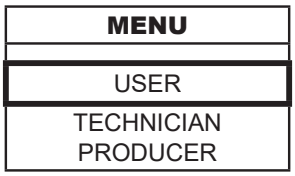
Auger loading

Before starting the stove for the first time, whenever the stove is in alarm "06 - Pellets finished", and in any case whenever the hopper has emptied completely, the initial feed screw loading is required. This phase serves to fill the pellet loading system so that, at the time of ignition, the correct pellet loading takes place in the brazier.In the event that the feed screw operations are not carried out, there may be stove ignition failures.

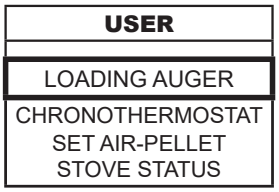
After loading the auger and before lighting the stove, always remember to empty the brazier and check that the brazier is clean. Never empty the brazier inside the hopper.

After each maintenance operation, make sure that the brazier is positioned correctly in its seat.

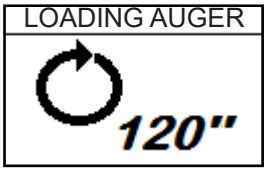
In models with self-cleaning brazier it is not necessary to remove the pellets in the brazier: the pellets loaded are sufficient for subsequent ignition.



Press the "menu access" button to access the MENU screen.



Press the "confirm" button to access the USER screen



Press the "confirm" button to activate feed screw rotation

Switching the appliance on and off

From the "Home" screen, it is possible to switch the stove on and off by keeping the ON / OFF button pressed on the device for a few seconds. An acoustic signal will warn you that the appliance has switched on or off. In case it is not possible using your remote control you can switch the appliance on / off using the appropriate button on the electronic board.

Do not switch off the heater by unplugging the plug from the wall socket.

The appearance of the "SET RDS" message indicates that the initial parameter testing and calibration procedure was not carried out correctly. This indication does not imply blocking the stove (see SIGNALING POP UP section).

Failed ignition

If the system does not detect the ignition of the flame within the preset time, operation will be blocked with the “No ignition” alarm. Before relighting the stove, check that there are pellets in the hopper, that the door and ash drawer compartment are closed, that there are no obstructions to the combustion air inlet system and above all that, in models without self-cleaning brazier, the brazier is empty, clean and correctly positioned. If the problem persists, it could be due to a technical problem (ignition plug, adjustments, etc ...), so please contact a Ravelli CAT.

The accumulation of unburned pellets in the brazier after a failed ignition must be removed before proceeding with a new ignition.

The brazier could be very hot: danger of burns!

Never empty the brazier inside the hopper.

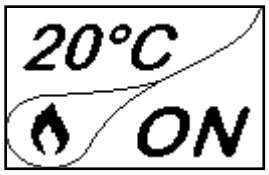
Setting operating temperature and power:

Set the two values following the indications given in the chapter “Description of the display”

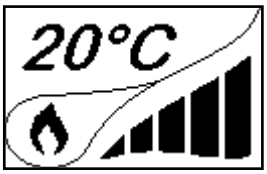
OPERATING PHASES OF THE APPLIANCE

Sequence of ignition phases

IGNITION - initial pellet loading phase;
FLAME LIGHT - flame stabilization phase and reduction of combustible inside the brazier;

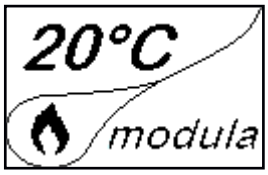


WORK - operation phase described in the dedicated chapter;



Modulation

During the work phase, the appliance should reach the room temperature set; when this condition is met, the stove switches to MODULATION mode in which fuel consumption is minimum.



If you wish to detect the ambient temperature by means of an external thermostat (optional), this must be connected to the appropriate connector on the rear side of the stove; and you will have to activate the reading in “SETTINGS - ENABLE THERMOSTAT.” On display appears the writing TON / TOFF based on thermostat request.

Connect an external thermostat with a simple dry contact, therefore, not powered, moreover, we recommend you use a thermostat with a minimum offset of 3°C if you ntend to use the comfort clima function.

Description of menu functions

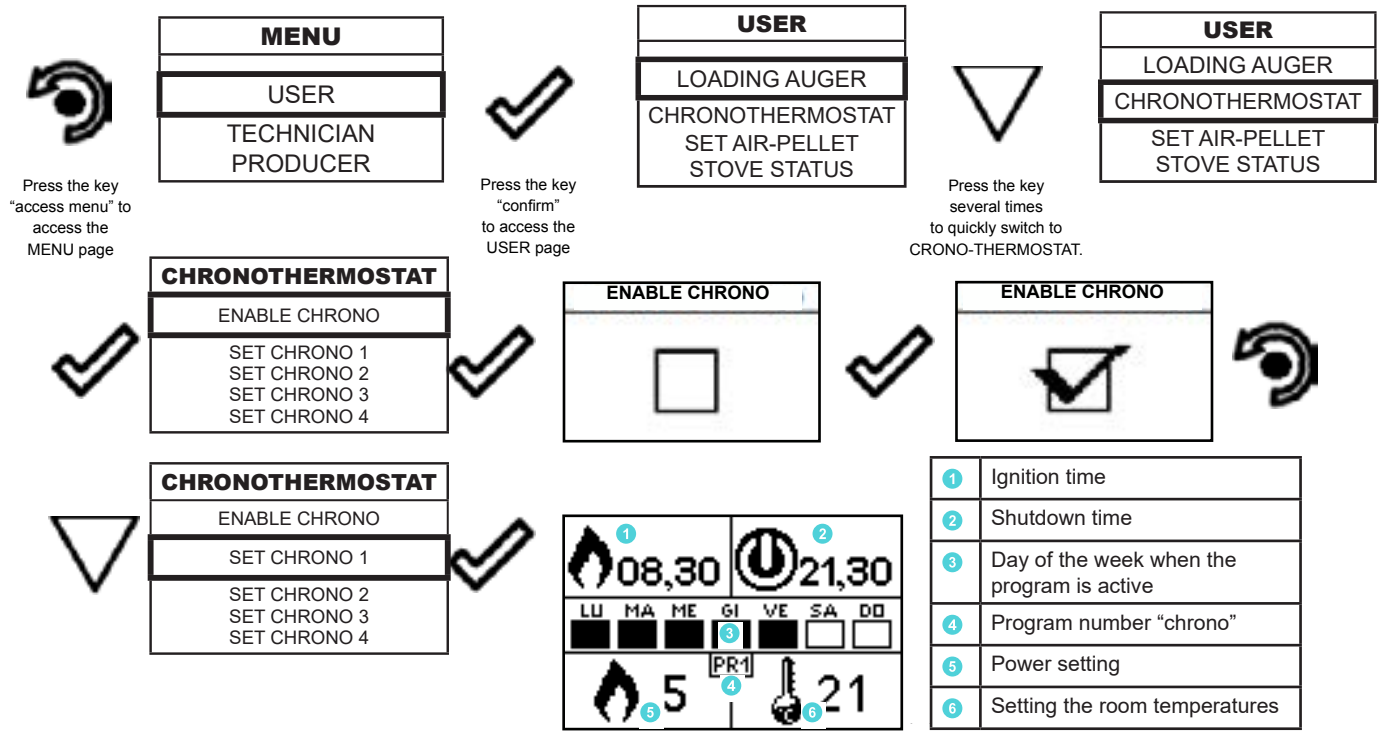
Press the key to access the MENU page

MENU
USER
TECHNICIAN PRODUCER

The TECHNICIAN and PRODUCER menus are password protected. Changing parameters within these menus could compromise the operation and safety of the stove. In this case the warranty will be invalidated.

Chronothermostat

With the Chrono-thermostat function you can program the automatic switch ON/OFF of the stove for each day of the week for each day of the week in 4 independent time intervals (SET CHRONO 1-2-3-4). Below are given the steps for accessing the relative menu starting from “Home” mode.



The exit key shows the CHRONO menu to set other variables related to the menu functions.

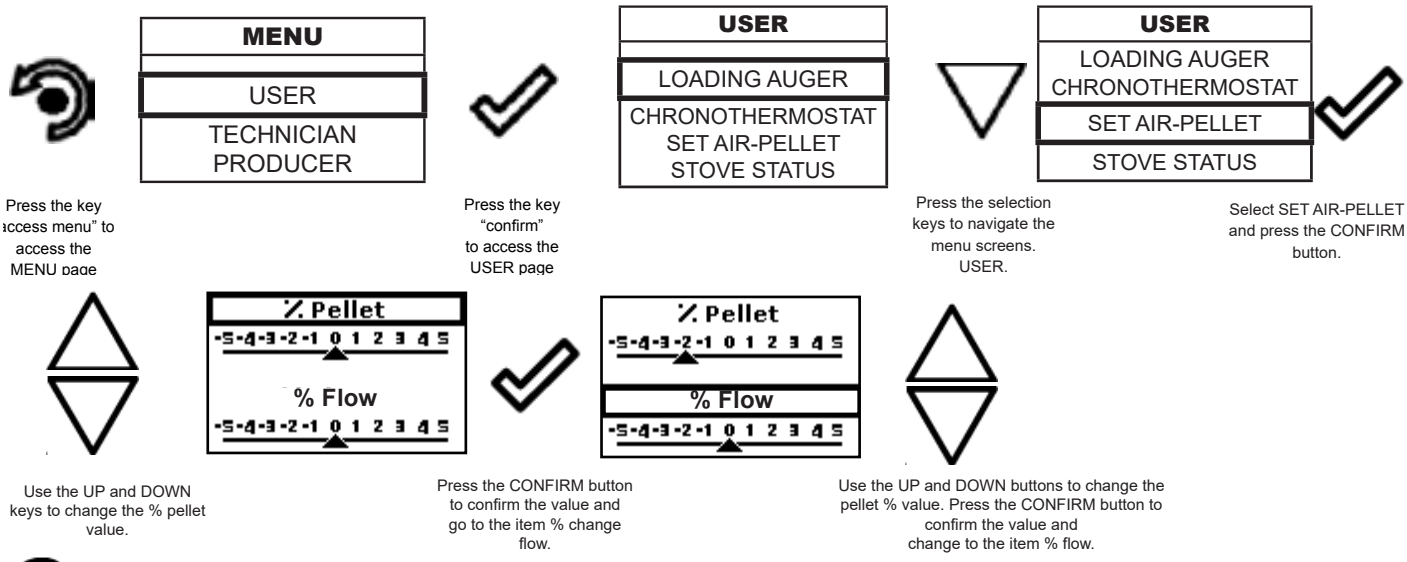
To exit the page and return to “Home” page, press the button repeatedly.

Set air - pellet

The setting of the PELLET-FLOW mixture allows to adjust the combustion by varying the quantity of pellets loaded in the brazier and/or the quantity of air. In fact, by its nature, pellets vary in grain size and composition: even bags of pellets of the same brand can have different characteristics.

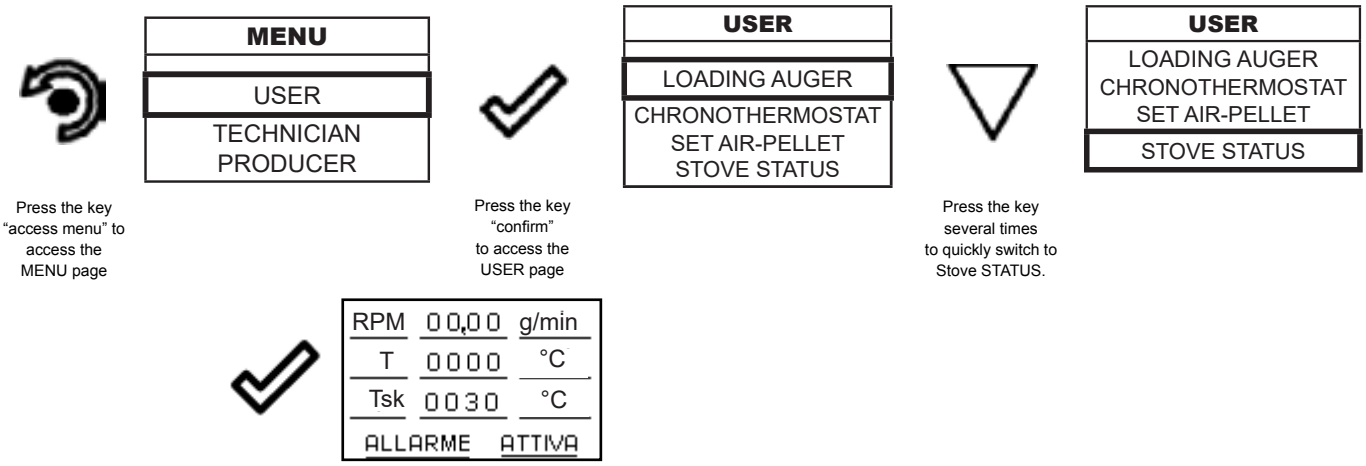
If combustion is not optimal, vary the flow parameter to adjust the combustion air. If air regulation alone is not sufficient, it may also be necessary to modify the pellet parameter.

Combustion regulation is an operation that requires a lot of experience. We recommend that you contact an Authorised Service Centre to calibrate the stove appropriately.



To exit the screen and return to the home screen, press the key repeatedly.

Stove status
Below are given the steps for accessing the relative menu starting from “Home” mode.



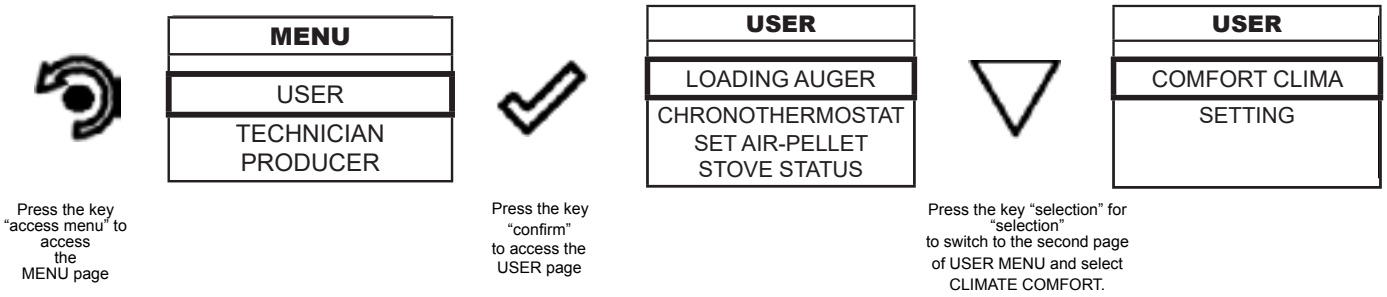
In this mode you can check the proper operation of the most important parameters of the appliance. Here is a list of real data of the stove useful for service during inspection.

- RDS current reading RDS (m/s)
- RPM current smoke extractor speed (rpm)
- T fumes temperture (°C)
- Indication of stove status
- SET set value RDS (m/s)
- Df cold probe temperture RDS (°C)
- Sk: electronic board temperature (°C

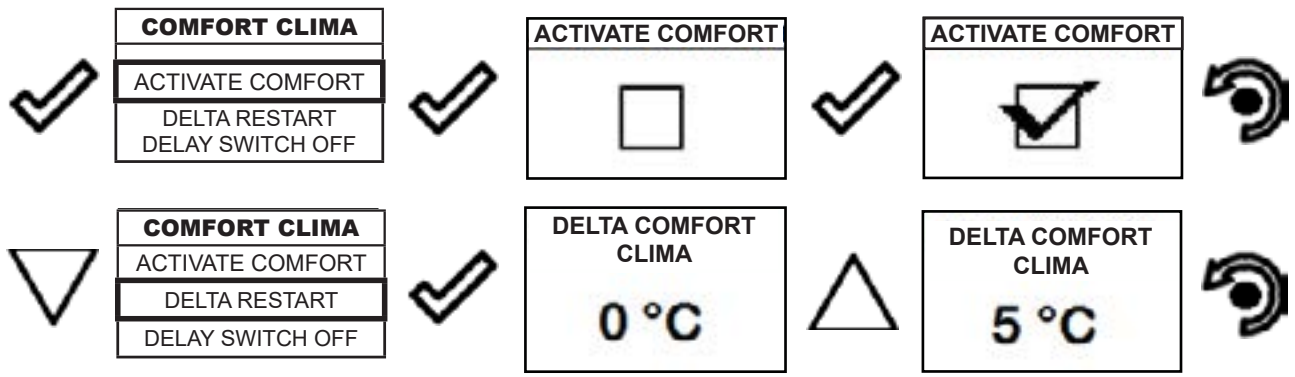
To exit the STOVE STATUS screen and return to the Home screen, press the key repeatedly.

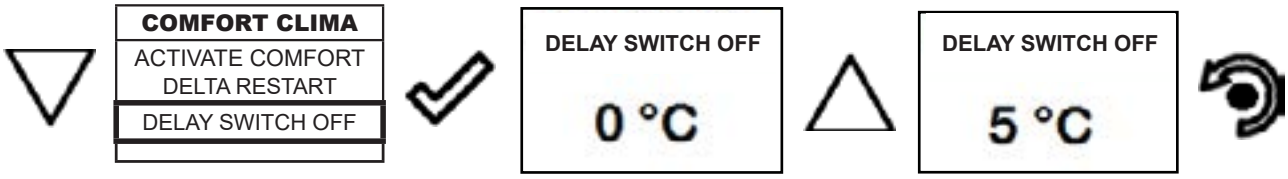
Comfort clima
The activation of this function enables the stove to reduce pellet consumption by activating the modulation phases, after the desired temperature has been reached. Subsequently, the stove checks that the temperature is maintained steady for a preset time (DELAY SWITCH OFF). If this condition is met, it automatically switches off, and on display appears the writing ECO.
The stove turns on again when the temperature drops below the set threshold (DELTA RESTART).

Below are given the steps for accessing the relative menu.



Once you have accessed the Comfort Clima menu, it is possible to operate on the 3 types of settings dedicated to the function:

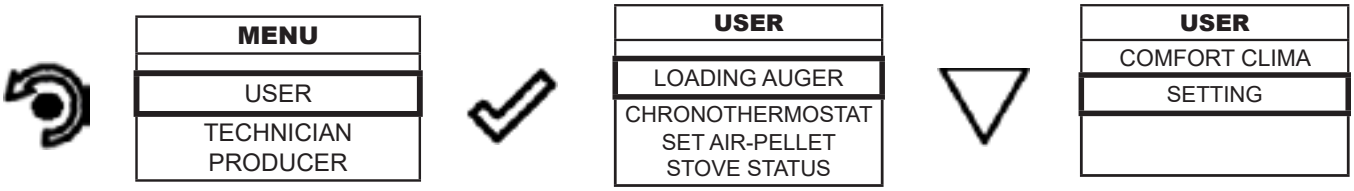




The first setting allows the activation of the COMFORT CLIMA function. This function is intended to ensure that the room tem perature set is maintained steady upon setting the maximum period of “X” minutes (SWITCH-OFF DELA Y: 5 MIN) before switch-ing to ECO STOP phase. The STOVE maintains this state until the temperature drops below the set value (DELTA COMFORT CLIMA: 5°C). For example, with the room temperature at 21 ° C, the stove switches of f when this temperature is reached and restarts when the temperature reaches 16°C (21°C - 5°C). You can also activate the function using an external thermostat, keeping in mind that this does not include the value of hysteresis.

Setting

Below are the steps to follow, starting from the Home screen, to access the Home menu.



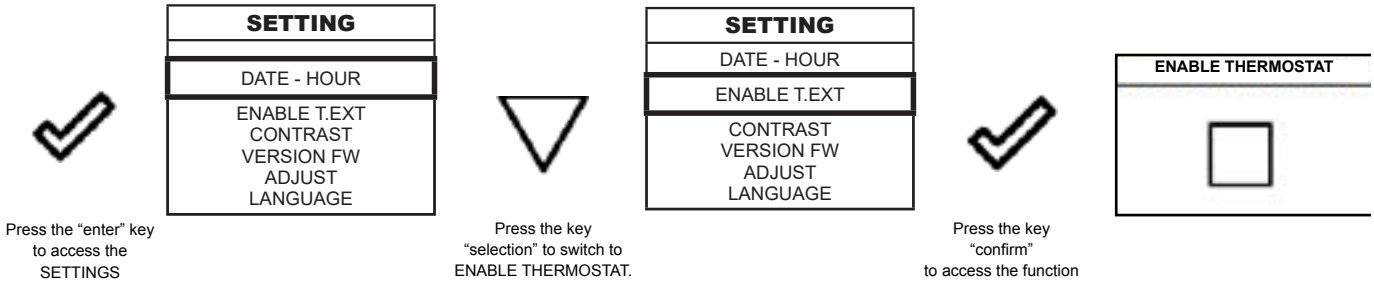
Press the key “access menu” to access the MENU page

Press the key “confirm” to access the USER page

Press the key “selection” for “selection” to switch to the second page of USER MENU and select SETTINGS.

After following the above procedure

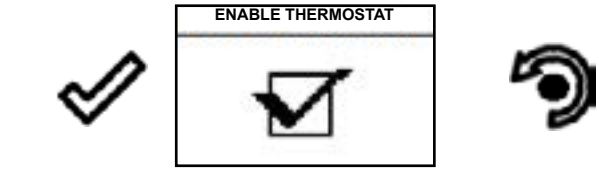
Settings > Enable thermostat



Press the “enter” key to access the SETTINGS

Press the key “selection” to switch to ENABLE THERMOSTAT.

Press the key “confirm” to access the function



Press the key “confirm” to enable the function.

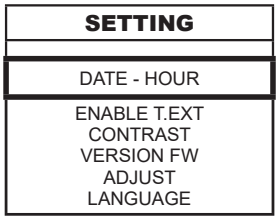
Press the key for several times to return to “STAND BY” page

In “Home” mode, instead of room temperature measured and settable, appears the line T ON if the room in which the thermostat is installed has not reached the temperature requested or the writing T OFF if the temperature in the room is reached.

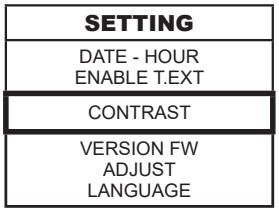
Settings > Contrast

With this function you can change the contrast setting to improve the display of your remote control. The contrast setting to improve the display of the remote control display.

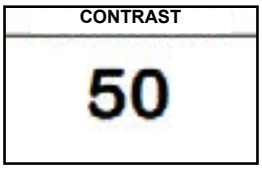
Press the key "confirm" to access the SETUP SETTINGS



Press the key "selection" to switch to the function CONTRAST.



Press the key "confirm" to access the function

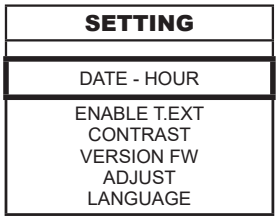


Use the UP/DOWN keys to change contrast setting and obtain a better visualisation of the information shown on the remote control set.
The value can vary from 0 to 100. 50 with respect to the standard value.

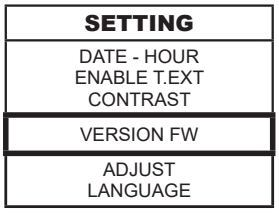
By pressing the following key you will confirm of data and switch to the page within SETTINGS menu.

Settings > Firmware version

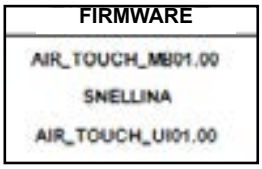
Press the "enter" key to access the SETTINGS



Press the key "selection" to switch to CONTRAST.



Press the key "confirm" to access the function

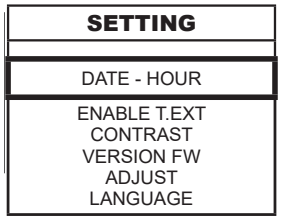


By pressing the button you will confirm the data and switch to the page within the SETTINGS menu.

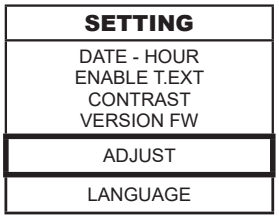
Settings > Adjust

The adjust function allows to modify the value read by the room probe inside the remote control, increasing or decreasing it by the set value (offset).
Make this adjustment carefully and only after having checked deviations from the actual room temperature with a reliable instrument!

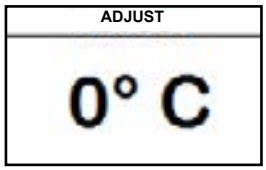
Press the key "confirm" to access the SETUP SETTINGS



Press the key "selection" to switch to the function VERSION FW.



Press the key "confirm" to access the function



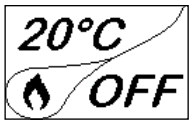
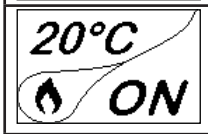
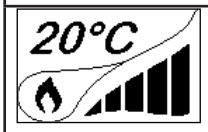
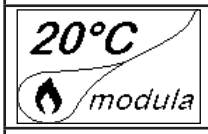
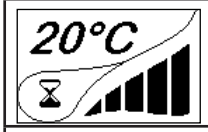
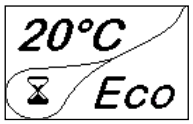
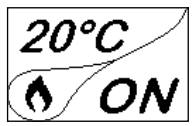
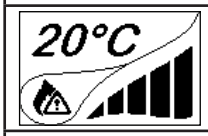
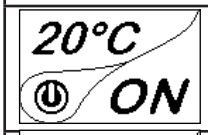
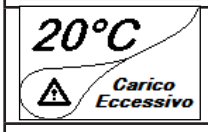
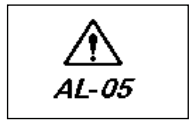
UP" and "DOWN" buttons The value can vary from -10°C to 10°C. The standard value is 0°C.

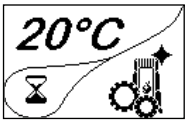
Pressing the following key allows you to confirm the data and move to the screen within the SETTINGS menu.

Settings > Language

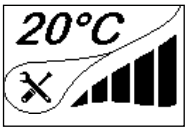
To access the next setting, follow the steps given above or simply remove and replace the batteries.
The device resets and prompts you again to select the language you want to set.

Stove phase general layout

	PHASE	DESCRIPTION
	**FINAL CLEANING**	The stove is in the switch off phase and the cooling phase has not been completed yet.
	**IGNITION**	The heater pre-heating phase has started and the pellets start to fall into the grate.
	**FLAME LIGHT**	The pellets ignite and take advantage of the heat in the intake air that passes through the incandescent heater tube.
	**WORK**	The stove has completed the switch on phase and runs at maximum set power
	**MODULATION**	The room temperature set has been reached.
	**FIRE POT CLEANING**	Fire pot cleaning phase is active (periodic function).
	**ECO STOP**	With Climate Comfort active, the stove switches to automatic switch-off mode when the room temperature set is reached (see the dedicated section).
	**WAITING START / RESTART**	Switch-on is requested but with the stove in cooling phase; once this condition is met, it restarts automatically.
	**IGNITION RESTART**	The HOT restart phase is activated. Functioning is similar to the SWITCH ON phase
	**HOT SMOKES**	The maximum fume temperature threshold has been reached. To facilitate cooling, the stove brings the capacity to a minimum with ventilation at power level 5, leading to a decrease in fume temperature.
	**OFF**	The stove is off
	**WAIT FOR PELLETS OUT OF**	When the switch-on request from ECO-STOP mode coincides with an automatic switch-off condition (from the TIMER), the stove turns on ensuring total cleaning of the fire pot before switching to FINAL CLEANING.
	**AUGER OVERFLOW**	CONDITION: when the pellet setting (set pellets +5) is near the continuous load condition. SOLUTION: Set the value back to 0.
	**ALARM (generic)**	The stove is in alarm state; refer to the troubleshooting chapter.

	**ANOMALY (general)**	The stove has detected an anomaly; refer to the troubleshooting chapter. By pressing the confirmation key, the problem is described.
	**AUTOMATIC CLEANING SYSTEM ACTIVE**	For models with automatic cleaning system it indicates the operating state of the same.

Warning Pop -Up

	ANOMALY	DESCRIPTION
	**SERVICE REQUEST**	The threshold value of set work hours has been reached. The symbol displayed remains active throughout the work phase. Non-routine maintenance is required on the stove.

Alarms (table with reference codes)

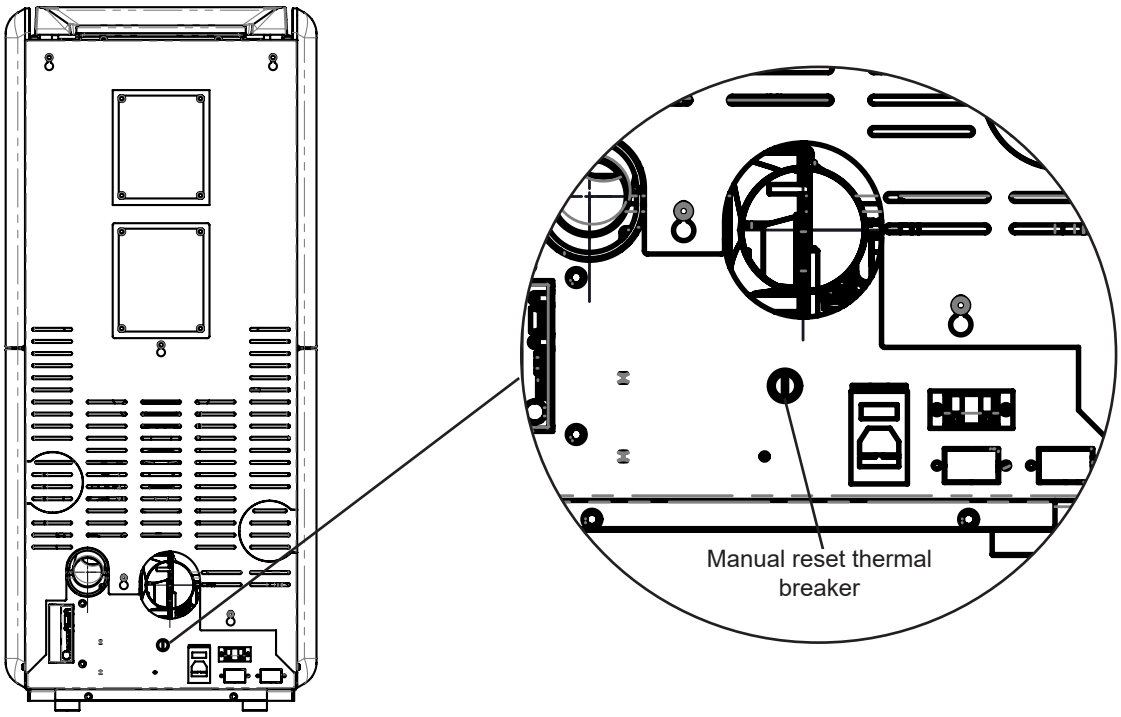
	TITLE	REASON	SOLUTION
AL 01	**BLACK OUT**	No voltage during work phase	Press the switch off key and switch on the stove again
			If the problem persists, contact the Support Service
AL 02	**SMOKE PROBE FAILURE**	The smoke probe is malfunctioning	Contact the Support Service
		The smoke probe is disconnected from the electronic board	Contact the Support Service
AL 03	**OVERTEMP. SMOKE**	Combustion in the fire pot is not optimal due to clogging or obstructions of internal stove ducts inside the stove	Switch off the stove, clean the fire pot and the tube bundle and adjust the combustion setting the Pellet/ Air values
			Contact the Support Service
			If the problem persists, contact the Support Service
AL 04	**FAN BROKEN**	Fume exhaust encoder is not working or is connected incorrectly	Contact the Support Service
		No power to fume extractor.	Contact the Support Service
		The fume extractor is blocked.	Contact the Support Service
AL 05	**NO IGNITION**	The pellet tank is empty.	Check for the presence of pellets in the container. Top up, if necessary.
		Pellet calibration and suction during switch on phase is incorrect.	Contact the Support Service
		The ignition coil is faulty or positioned incorrectly	Contact the Support Service
AL 06	**NO PELLET**	The pellet tank is empty.	Check for the presence of pellets in the container. Top up, if necessary.
		The gear motor is not loading pellets.	Empty the tank to see if there are any objects inside that may prevent proper operation of the auger.
		Not enough pellets loaded	Regulate pellets setting from “SET AIR/PELLETS”
			If the problem persists, contact the Support Service
AL 07	**THERMAL RESET**	The manual or automatic reset thermostat connected to the hopper has been triggered / Door, drawer or pellet door remained open	Wait for the stove to cool, reset the thermostat (if with manual reset) by pressing the button on the back of the stove
		Combustion in the fire pot is not optimal due to clogging or obstructions of internal stove ducts inside the stove	Switch off the stove, clean the fire pot and the tube bundle and adjust the combustion setting the Pellet/ Air values
			Contact the Support Service

AL 08	**DEPRESSION**	The flue is blocked.	Check the flue is free and clean
		The vacuum meter is faulty.	Check the mains voltage.
AL 12	**FUME EXHAUST SYSTEM**	The fume exhaust system has a loss of performance due to fan obstruction or voltage drop.	Check the mains voltage.
AL 14	**AUGER PHASE**	No cable connection to power the gear motor	Check the mains voltage.
AL 15	**AUGER TRIAC**	An internal part of the electronic board that controls the pellet auger is faulty.	Check the flue is free and clean
		Possible voltage drops or incorrect input voltage	Check the mains voltage.
AL 19	**CLEANER FAILURE**	The cleaner did not complete the movement and is not in the correct position	Reset the alarm and wait for the stove to switch to SHUTDOWN mode. Cut off and power again, the system reactivates the cleaner searching the correct position again.
			If the problem persists, contact the Support Service

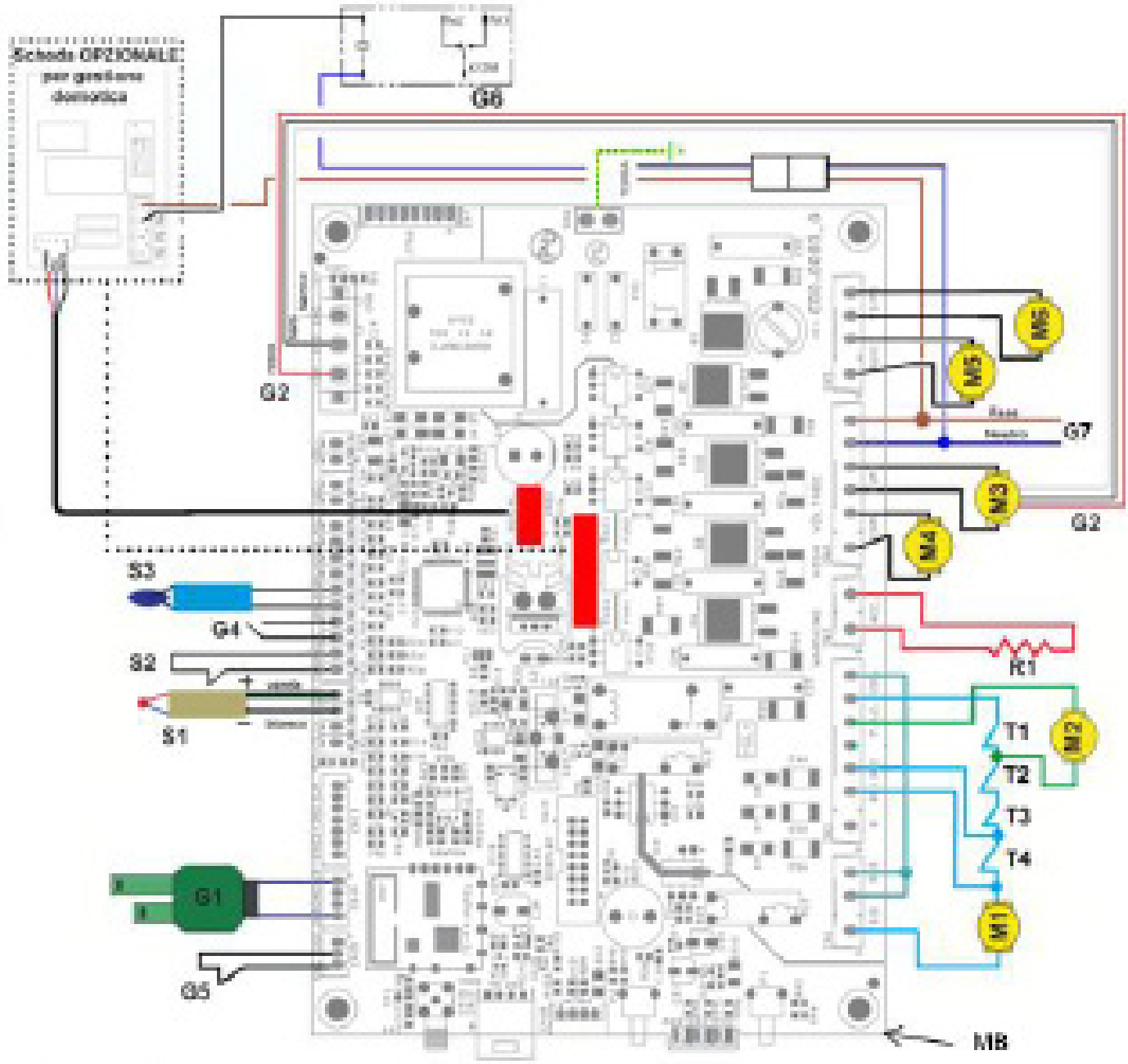
Thermal alarm with reset

In the case of alarm 07 THERMAL BREAKER below shows the location where to operate to reset the thermal switch with manual reset.

1) By pressing the button OK on the display the alarm can be reset.
2) Unscrew the protection cap and press the button to reset the thermostat alarm.
3) Try and repeat lighting after the cooling phase.



ELECTRICAL WIRING DIAGRAM



LEGEND:

MB- Motherboard
T1- Fire door contact
T2- Pellet hopper contact
T3- Pellet thermal safety
T4- Pressure switch

M1- Gearmotor
M2- Automatic cleaner
M3- Flue gas fan
M4- Front room fan
M5- Rear right room fan
(only for ducted stoves)
M6- Rear left room fan
(only for ducted stoves)

R1- Igniter

S1- Flame probe
S2- External thermostat
S3- Room probe (opt)

G2- Encoder reading revolutions suction
G3- RADIO Touch handheld remote control
G4- Automatic cleaner stroke counter
G5- Home automation management contact
G6- GAS ignition contact -
Home automation output alarm signalling (TRF 39)
G7- Power cord plug: main switch

G3

MAINTENANCE

Cleaning should be provided by the user

This wood heater needs periodic inspection and repair for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual.

Before any cleaning operation on the stove, implement the following precautions:
- switch off the stove and disconnect the power cord with the stove in “Switched OFF” state;
- make sure all the parts of the stove are cold;
- make sure the ash is completely cooled.

Please read carefully the following instructions to perform proper cleaning. Failure to comply with there instructions may lead to malfunctions of the stove.

Before carrying out any maintenance operation on the stove, please take the following precautions:
- Make sure that all the parts of the stove are cold
- Make sure that the ashes are completely extinguished
- Make sure that the general switch is in the zero position (off)
- Make sure that the plug is disconnected from the socket, thus avoiding accidental contacts.

Please follow the instructions for cleaning shown below carefully! Failure to observe them may lead to problems in the functioning of the stove AND FIRE HAZARD.

Cleaning the surfaces

To clean the surfaces on the painted metal parts, use a wet cloth in water or at the most, water and soap.

The use of aggressive detergents or diluents can damage the surfaces of the stove.

Cleaning the FIREX 600

All Ravelli products have a combustion chamber made with FIREX 600, a material based on vermiculite, the result of research and development by Ravelli. The main features of FIREX 600 are resistant to heat, its lightness and excellent insulating capacities, improving the combustion and performance of the stove.
During combustion, FIREX 600 turns white, due to an effect called PYROLYSIS, making the flame clear and shining. If the combustion is regulated in an optimal way, the FIREX 600 interior always remains clean and white.

The condition of FIREX 600 is therefore a thermometer to understand whether the combustion is good or not.
FIREX 600 LIGHT – GOOD COMBUSTION
FIREX 600 DARK – POOR COMBUSTION

Firex 600 does not require special maintenance, it only has to be dusted with a soft brush to remove the ash that is deposited during combustion.
Abrasive sponges to clean to most resistant waste should not be used as they could compromise the thickness of the FIREX600 panel, creating critical points of breakage.
The tube of the vacuum cleaner should not be used in direct contact with FIREX 600.
Wet cloths should not be used to clean FIREX 600.
FIREX 600 is resistant to heat but not to knocks; handle with care if moved.
FIREX 600 may show a slight abrasion after a few hours of functioning, this is perfectly normal as the flame creates microgrooves in the panel without compromising it.
The duration of FIREX 600 depends only on how maintenance is carried out.
The pellet stove is a generator of heat with a solid fuel and as such requires servicing by qualified personnel at least once a year at the start of the season. This maintenance has the purpose of ascertaining and ensuring the perfect efficiency of all the components.
We recommend you draw up an annual contract for maintenance of the product with your installer/dealer.

WARRANTY

Certificate of warranty

Ravelli thanks you for the trust granted with the purchase of one of its products and invites the purchaser to:

- read the installation, use and maintenance instructions for the product;
- read the warranty conditions contained below.

Warranty conditions

The warranty for the Customer is acknowledged by the Dealer under the terms of law.
The Dealer acknowledges the warranty only if the product has not been tampered with and only if it has been installed in accordance with the Manufacturer's instructions.
The limited warranty covers manufacturing material defects, as long as the product has not broken sue to an incorrect use, negligence, incorrect connection, tampering, installation errors.
The warranty becomes null and void even if only one requirement in this manual is not complied with.

The following are not covered by warranty:

- the combustion chamber refractory stones;
- the door glass;
- the gaskets;
- the paint job;
- the stainless steel or cast iron combustion grille;
- the resistance;
- the Majolica cladding;
- the aesthetic parts;
- any damages caused by unsuitable installation and/or use of the product and/or shortcomings on the part of the customer.

The use of poor quality pellet or any other unauthorised fuel may damage the product's components, cause its warranty to be voided and as a result eliminate the connected manufacturer liability.
It is therefore recommended to use good quality pellet that fulfils the requirements listed in the dedicated chapter.
All damages caused by transportation are not recognised, for this reason it is recommended to carefully check goods upon receipt, immediately warning the reseller of any damage.

Registration of warranty

To activate the warranty, it is necessary to register the product on the Guarantee Portal on the website www.ravelligroup.it, by entering your data and the purchase receipt.

Info and problems

Dealers authorised by Ravelli use a trained Technical Service Centre network to meet the Customer's requirements. For any information or request for assistance, please contact your Dealer or the Technical Service Centre.

RAVELLI
il fuoco intelligente

Aico S.p.A.

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Via Consorzio Agrario, 3 - 25032
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www.ravelligroup.it

MP0461 Rev.2 30/05/2022

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Atena V

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Date of production / *Date de production* : 03/2017

Electrical Rating / Service nominal électrique: 120VAC, 60Hz, 5amps

Serial number/
Numéro de série

Route power cord away from unit.do not route cord under or in front of appliance.

DANGER: Risk of Electric Shock. Disconnect power before servicing / *Risque de choc électrique. Débrancher l'alimentation électrique avant d'effectuer l'entretien ou la réparation*. **CAUTION /ATTENTION:** Moving parts may cause injury.Do not operate unit with external panels removed. Hot parts.Do not operate unit with external panels removedReplace glass only with ceramic glass original spare parts available from your dealer.To start set thermostat above room temperature, the stove will light automatically. To shutdown, set thermostat below room temperature. For further instructions refer to owner's manual./ *bouger les parties peut causer des blessures.Ne pas allumer l'appareil avec des habillages manquantes.Endroits chauds. Pour commencer, régler le thermostat au-dessus de la température ambiante, la poêle s'allumera automatiquement.Pour la éteindre, régler le thermostat au-dessous de la température de la chambre. Pour de plus amples informations se référer au manuel du propriétaire.* **OPERATE ONLY WITH DOORS CLOSED.** / ***FAIRE FONCTIONNER AVEC LES PORTES FERMÉES***. Never touch the door handle when the stove is running, you can burn your self. Do not obstruct the space beneath the heater / Ne jamais toucher la poignée de la porte quand le poêle est en marche, pour ne pas encourir de risque de brûlure. Ne pas obstruer l'espace en dessous de l'appareil de chauffage.

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When constructing floor protection for your pellet appliance, any part or materials used must be non-combustible.

For Use Only With Pelletized Wood Fuel. Do not use any other type of fuel than wood pellet. / Lors de la construction protection de plancher pour votre poêle à granulés, toutes les pièces et matériaux utilisés doivent être incombustibles. Utiliser uniquement avec du bois de chauffage en granules. Ne pas utiliser avec des types de carburants autres que le granulé de bois.

Refer to manufacturer's instructions and local codes for precautions required for passing chimney through a combustible wall or ceiling. Inspect and clean vent system frequently in accordance with manufacturer's instructions. / Se rapporter aux instructions du fabricant et aux codes locaux afin de prendre connaissance des précautions nécessaires pour faire passer la cheminée à travers un mur ou un plafond combustible. Inspecter et nettoyer fréquemment le réseau de tuyaux de ventilation conformément aux instructions du fabriquant.

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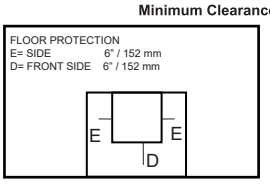
Minimum Clearances to combustible materials / Dégagement minimal pour les matériaux de combustion



R =RIGT SIDE / CÔTÉ DROIT 2"/ 51 mm
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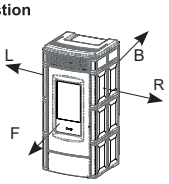
F =FRONT SIDE / CÔTÉ AVANT 39,4" /1000 mm



N.B. The floor protection must extrend under the chymney connector and 2 inches (50.8mm) beyond each side

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Vittoria V

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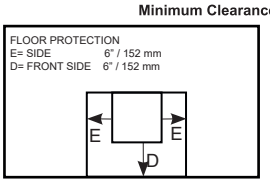

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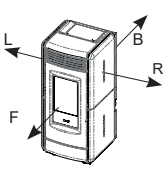

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RV 120 Touch

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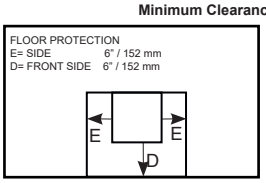
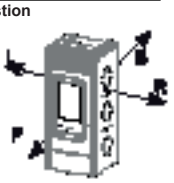
Use a 3 or 4inch(76-102mm) diametertype "L" or "PL" venting system./ *Utiliser un réseau de ventilation secondaire «L» ou «PL» d'un type de diamètre de 3 ou 4 pouces (76-102mm).*

Minimum Clearances to combustible materials / Dégagement minimal pour les matériaux de combustion



R =RIGT SIDE / CÔTÉ DROIT 2"/ 51 mm
L = LEFT SIDE / CÔTÉ GAUCHE 2"/ 51 mm
B =BACK SIDE / CÔTÉ ARRIÈRE 4"/ 102 mm (W/OUT OUTSIDE AIR KIT)
F =FRONT SIDE / CÔTÉ AVANT 39,4" /1000 mm



N.B. The floor protection must extrend under the chymney connector and 2 inches (50.8mm) beyond each side

U.S. ENVIROMENTAL PROTECTION AGENCY

Certified to comply with 2020 particulate emission standards using pellet wood.

Emission Rate (g/hr)	Heating Efficiency (% Overall)	1st hour Emission Rate (g/hr)	CO emission gr/hr
0.62	79.25%	2.19	2.8

Made in Italy DO NOT REMOVE THIS LABEL

APPENDIX 8: Photographs of test set up

Dilution picture Dia 6 no. EG-030

Polytests Services Inc. 695 B rue Gaudette,St-Jean-sur-Richelieu Québec, Canada, J3B 7S7

Velocity ports at 90 degrees and tunnel temperature sensor location

Particulate sample extraction ports located 48 inches under (requirement 4D=24 inches minimum) velocity ports and 16 inches above downstream Tee. (Requirement 2D=12 inches minimum)

Adjustable damper for flow adjustments

Extraction blower

Total length between hood and sampling port : 22 feet.

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60 inches horizontal run between two elbows. Mixing section, No mixing baffle. 6inches diameter pipe

Two 6 inches elbow with horizontal mixing section.

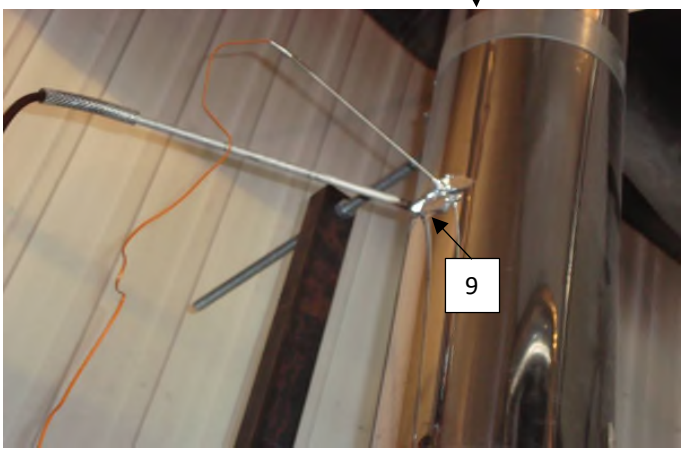
Hood diameter 32 (requirement 4D=24 inches minimum) inches and height of 24 inches (requirement 3D=18 inches minimum)

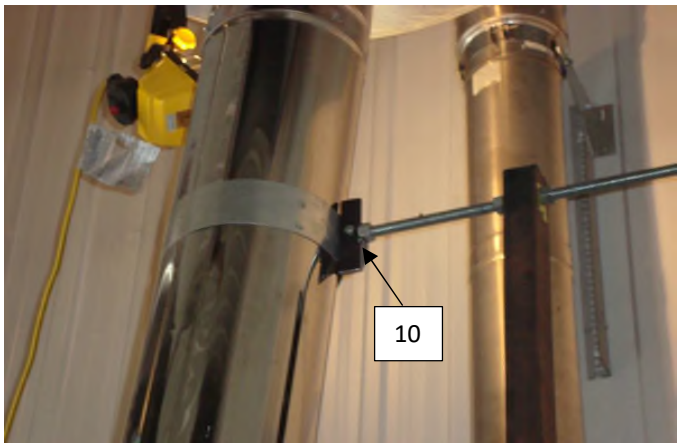
All pipe joints are sealed.

Stack sampling

Gas analysis and temperature probe

chimney support

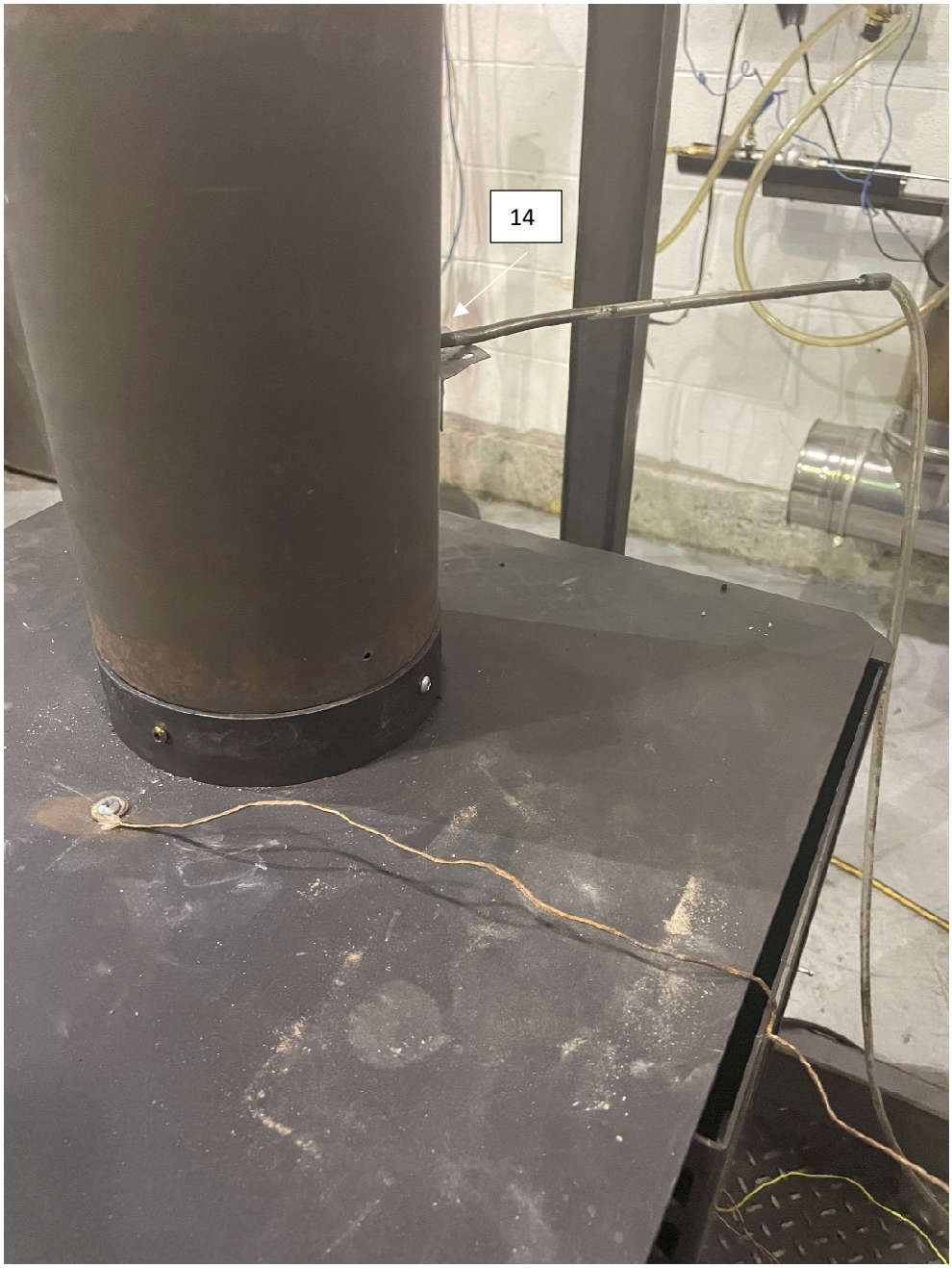




9 : Temperature and gas analyser sampling ports located 9 feet above platform

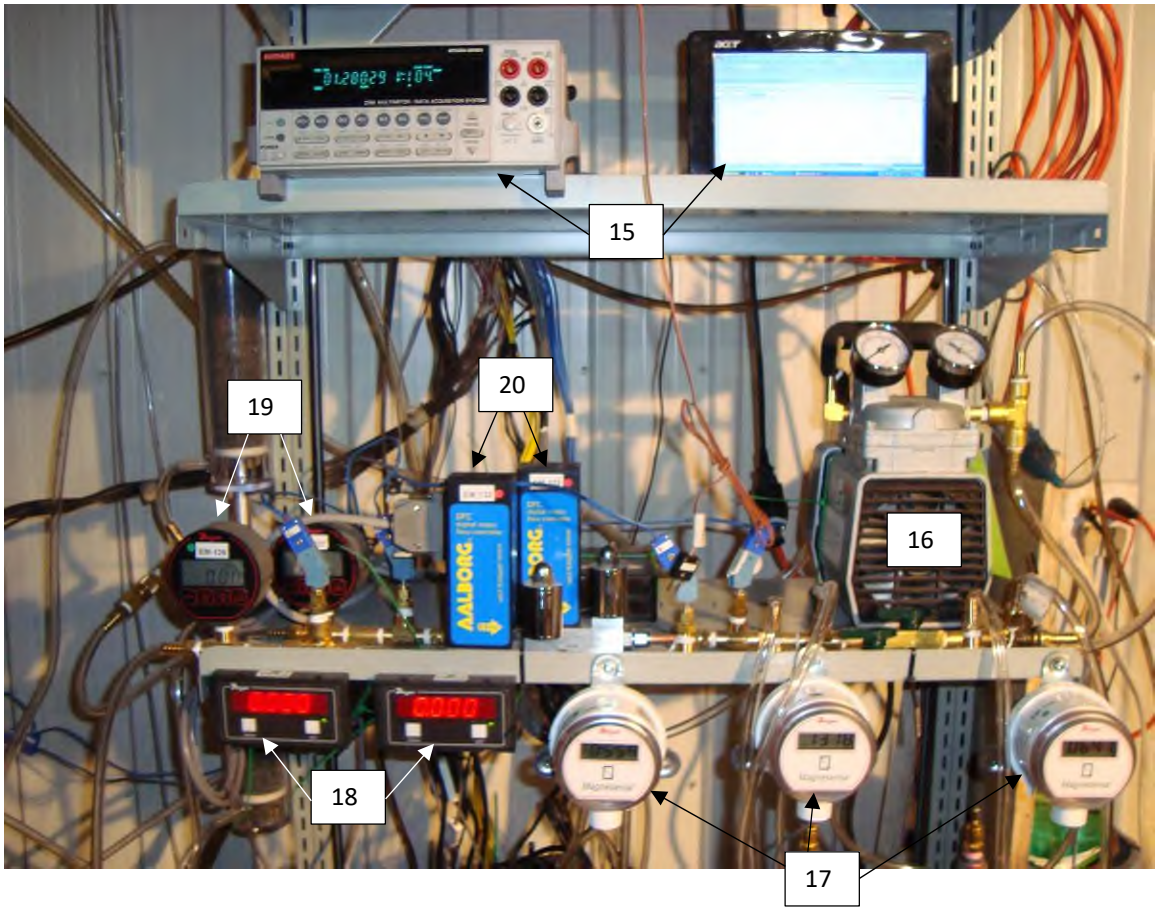
10 : Exhaust system support bracket

Draft sampling



14 : Draft sampling port located 6 in. from the flue outlet

Equipment's



15 : Acquisition system

16 : Vacuum pump

17 : Digital manometer

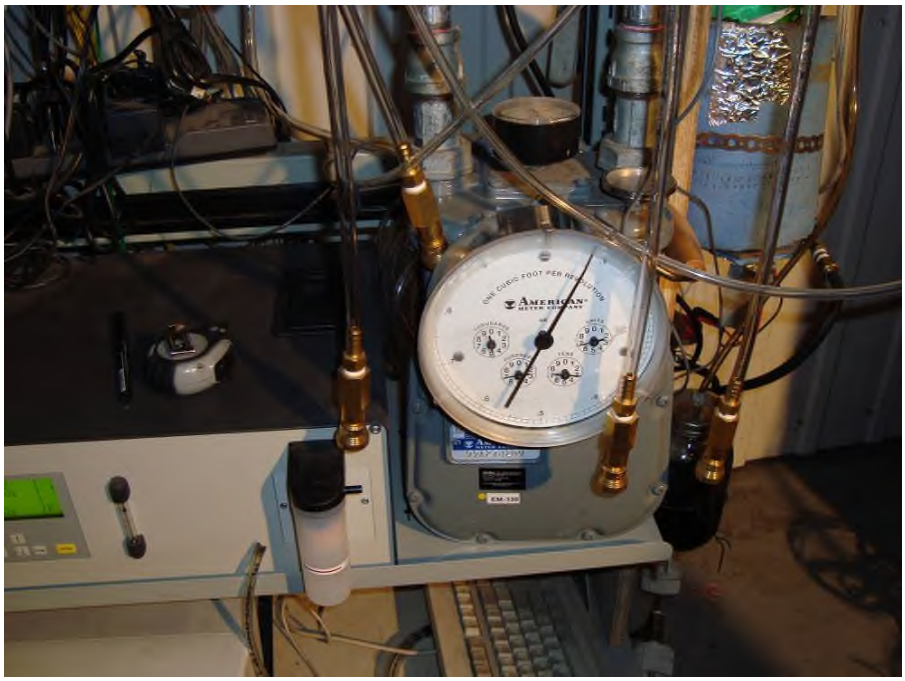
18 : Digital read out for mass flow meter

19 : Digital vacuum gage

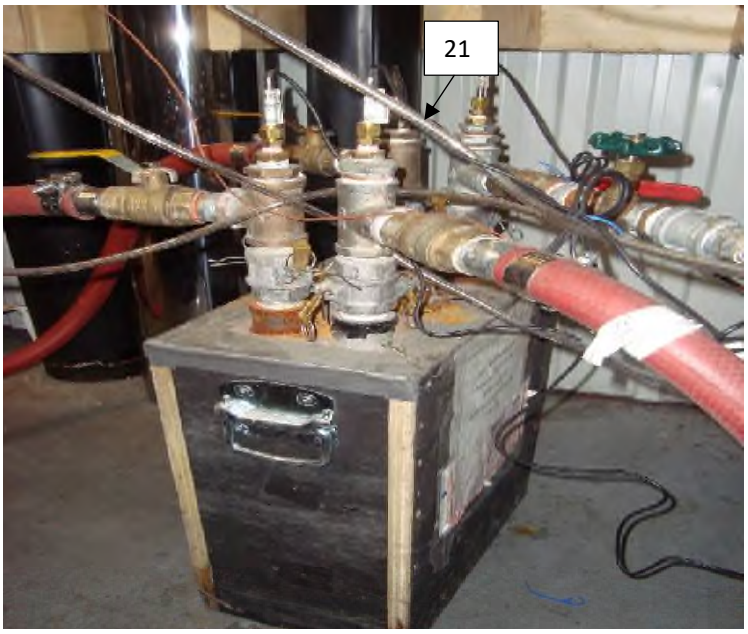
20 : Mass flow meter

Gaz analyser

Reference dry gas meter

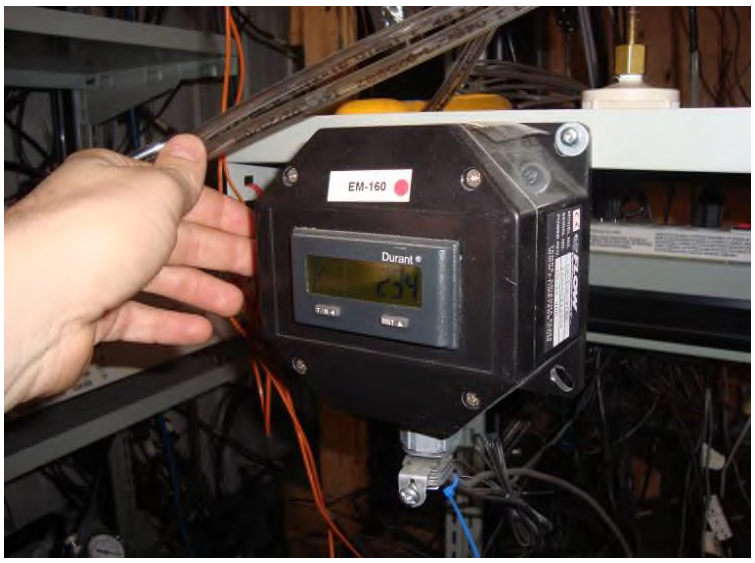


Heat exchanger only for boilers or hydronics



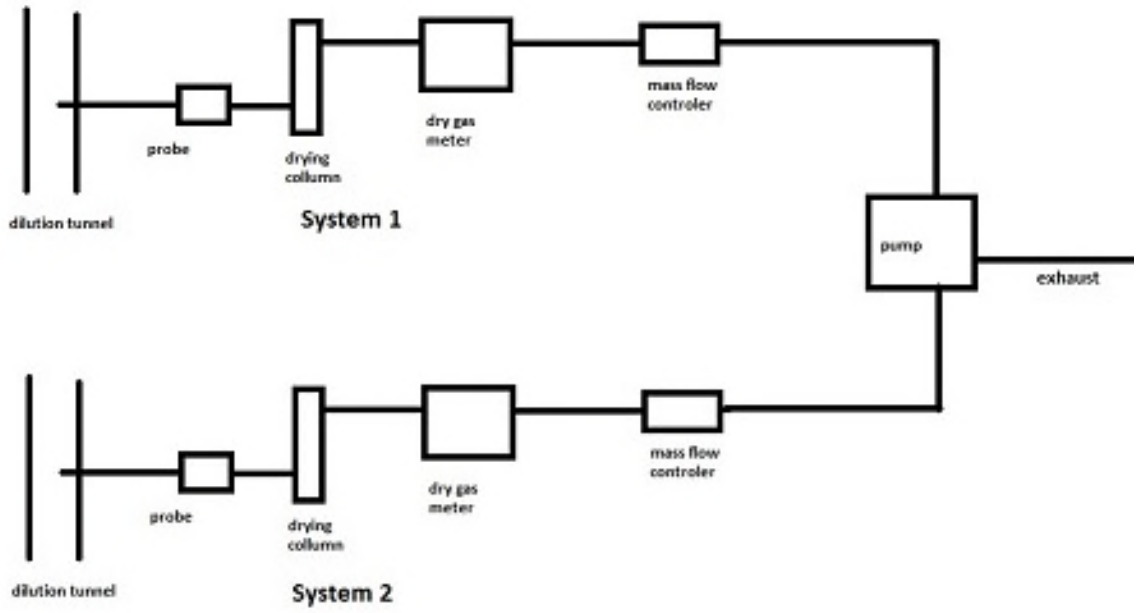
21 : PT 100 insertion probe

Water flow meter only for boilers or hydronics



Dry gas meter for train 1, train 2 and room filter.

Dilution tunnel sample system



Dilution tunnel

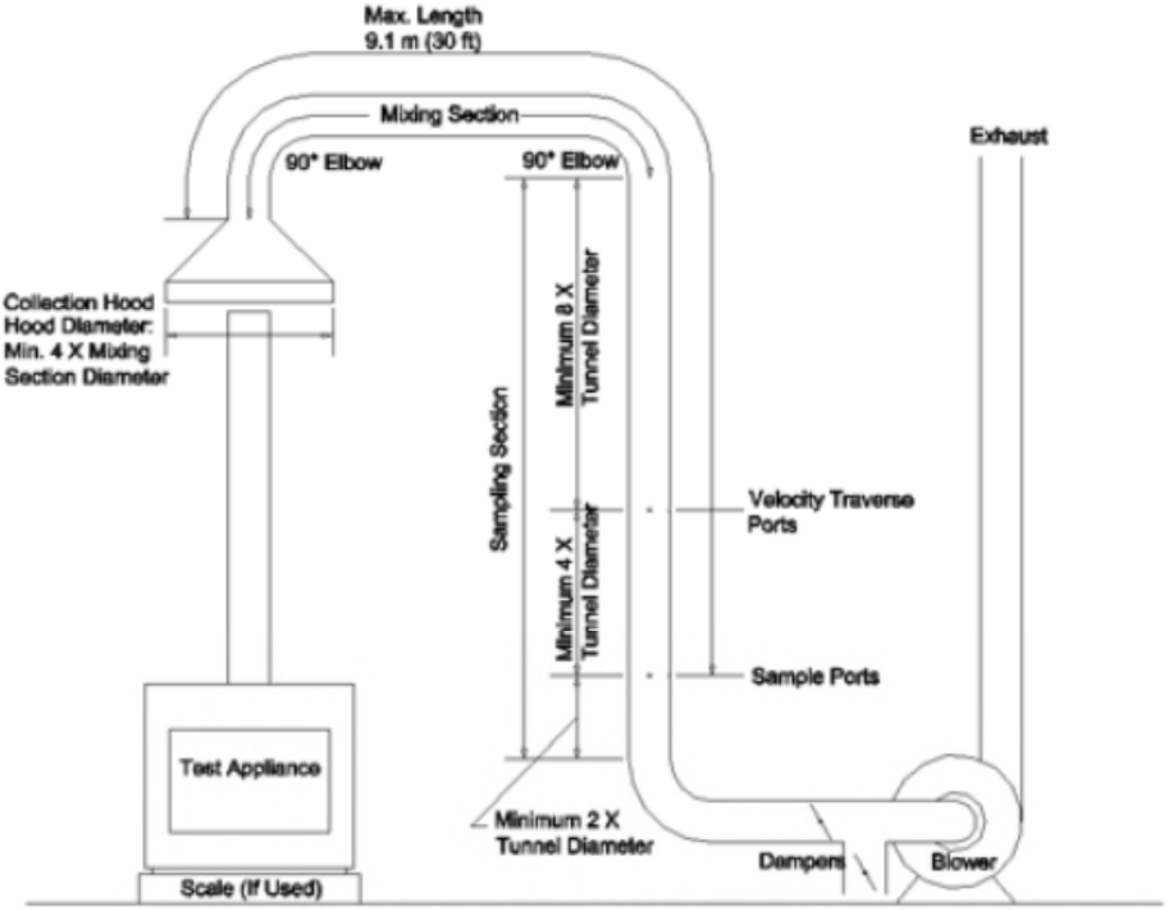


FIG. 3 Steel-Constructed Dilution Tunnel Apparatus

APPENDIX 9: Test load photographs

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Run 1

APPENDIX 10: Laboratory Operating Procedures

POLYTESTS Services inc.

SFBA EMISSIONS AND EFFICIENCY TESTING
LABORATORY OPERATING PROCEDURE

INTRODUCTION

This document provides a step by step guide for the technician conducting tests to EPA standard requirements. Procedures outlined here, when followed, will result in tests in conformance with EPA Methods 28R, ASTME2780, ASTME2515, ASTM E2618, Method 28WHH, Method 28 PTS.

The primary measurements to be made are particulate emissions rates. The technician's duties include the following steps.

1. Incoming inspection of test units.
2. Set-up of test units.
3. Preliminary testing to establish unit operating procedures and familiarity with operating controls.
4. Calibration of test equipment.
5. Set-up, checking and operation of sampling apparatus.
6. Conduct of tests including complete record keeping and data recording for non-automated functions.
7. Operation of hardware and software included in automatic data acquisition system.
8. Review and analysis of data at test completion to ensure test validity.

The technician running this test must be familiar with the following documents, which are to be kept in the laboratory at all, times.

EPA METHODS

1. EPA Methods 28R
2. ASTME2780
3. ASTME2515
4. ASTM E2618
5. Method 28WHH
6. Method 28 PTS

SFBA EMISSIONS AND EFFICIENCY TESTING
LABORATORY OPERATING PROCEDURE

I. APPLIANCE INSPECTION AND SET-UP

A. INCOMING INSPECTION

1. Check for completeness of unit including parts, accessories, installation and operating instructions, drawings and specifications etc. Note any discrepancies or missing parts or information.
2. Check for shipping damage. If damage has occurred, notify the laboratory manager. In some cases, repairs may be made, provided the manufacturer and laboratory manager concur that repairs will not affect the unit's performance. If damage is irrepairable, a new unit will need to be obtained.
3. Note whether unit is catalytic of non-catalytic.
4. Mark unit with manufacturer's name, model number, work order number and date received.
5. If unit is safety listed, note label data including listing agency and serial number. If unit is not listed, mark all data sheets "UNLISTED". Test results will not be released until unit passes safety tests without modification unless authorized by laboratory manager.

B. UNIT SET-UP

1. All new units must be operated for a breaking in period as follows.

    a) Non-catalytic units: Ten (48) hours at medium burn rate with Douglas Fir scrap or cordwood.
    b) Catalytic units: Fifty (50) hours at medium burn rate with Douglas Fir scrap or cordwood.

    During these break-in runs the unit may be connected to a lab chimney and fuel additions noted into the corresponding data acquisition file. For catalytic units, a thermocouple must be installed in the catalyst.

    Record catalyst temperature at 1-hour intervals or on chart recorder. Operating should continue until data shows at least fifty (50) hours of operation with catalyst temperature in excess of 800 degrees Fahrenheit (active range).

    For non-catalytic units a stack thermocouple should be installed and stack temperature recorded at 1-hour intervals. Fourthy-height (48) hours minimum burn time with a stack temperature of at least 250 degrees Fahrenheit is required.

2. Once break-in is completed, allow unit to cool. Clean unit thoroughly.

3. Unit is to be placed on scale for testing. Prior to proceeding with verification process, scale should be turned on and allowed to warm up for one (1) hour minimum. Zero scale and check calibration with standard weights. One (1) 1 kg weight and one (1) 2 kg weight are provided for this purpose. Use scale verification test form no. EPA-7-TP to record results. If scale fails to reproduce weights within tolerance, check with laboratory manager before proceeding.
4. If scale checks out, place unit on scale and align so chimney will be centered in hood.
5. Attach chimney connector and chimney. Be sure all joints are sealed below sampling points. Chimney and connector should be cleaned with a wire brush. Be sure chimney connector terminates and chimney starts at proper level above scale platform. Chimney must be supported from scale so that it does not touch test enclosure or hood walls.
6. Thermocouples should be attached to surfaces of unit prior to testing. EPA requires a thermocouple on the bottom of the firebox. This must be installed prior to putting the unit on the scale. In some cases, the required thermocouple locations will be inaccessible on finished units. These units should have thermocouples installed by the manufacturer during construction. Check with the laboratory manager if problems are encountered in proper thermocouple attachment.
7. Measure firebox dimensions and record on data forms nos. EPA-2-TP. Make a three dimensional sketch of the firebox including firebrick, baffles and obstructions. Calculate firebox volume in cubic feet with both addition and substraction methods using forms nos. EPA-3-TP and EPA-4-TP. See Section 6.2.4 of EPA Method 28 for details of firebox volume determination.
8. If unit is catalytically equipped, additional thermocouples must be installed upstream and downstream of catalyst. Thermocouples should also be placed in the primary and secondary combustion chambers of all units.
9. Plug thermocouples into data acquisition system jacks making a check of locations and jack numbers for each test on data form no. EPA-5-TP.
10. Note that inserts are tested as if they are freestanding stoves.
11. Dilution tunnel should be cleaned prior to each certification test series and at anytime a higher burn rate follows a lower test burn rate.

II. SAMPLING SYSTEM – SET-UP

A. GAS ANALYSIS

1. Instruments should be turned on and allowed to warm up for one (1) hour minimum.

SFBA EMISSIONS AND EFFICIENCY TESTING
LABORATORY OPERATING PROCEDURE

2. Calibrate analyzers as follows:

NOTE : Prior to proceeding with calibration, make sure to use NIST tracable calibration gas bottles. Adjust flow meter if necessary at each instrument to required flow value.

a) Using span gas, adjust span control to values specified on calibration gas label.
b) Using nitrogene, adjust zero controls to provide a 0.00 analyzer readout.

c) Repeat a) and b) until no further adjustment is required.
d) Check readout vs. calibration gases (2) labels.

The CO_2 and CO analyzers are "ZEROED" on nitrogen. The O_2 analyzer is spanned on air and set for 20.9%. It is zeroed on nitrogen as well.

3. Check for response time synchronization.

a) With no fire in unit, allow reading to stabilize (O_2 should be 20.93, CO and CO_2 should equal O).
b) Flow the calibration gas in the unit and start stop watch. Note the time required for each unit to reach .90 of the calibration gas bottle value. If all three analyzers reach this value within 15 seconds of each other, synchronization is adequate. If not, contact the laboratory manager. Synchronization is adjusted by internal instrument setting.

4. Set-up sample clean-up and water collection train as follows.

a) Load impingers as follows:
Impinger #1: 100 ml distilled water and 5 ml H_2SO_4
Impinger #2: 100 ml distilled water and 5 ml H_2SO_4
Impinger #3: Empty
Impinger #4: 200 – 300 grams silica gel (dry)

b) Place impingers in container and connect with "U TUBES". Grease carefully on bottom half of ball joint so that grease will not get into tubes.
c) Connect filter to first impinger and sample line to last impinger.

e. Leak check system as follows.

1) Plug probe.
2) Turn on sample system.
3) Observe sample flow rotometer and vacuum gauge. If necessary, use vacuum; adjust valve to set vacuum to the maximum inches Hg.
4) If the float in rotometer does not stabilize below 10 on scale, system must be resealed.
5) Repeat leak check procedure until satisfactory results are obtained.

f) Just prior to starting test, fill impinger container with water and ice and record ambiant conditions on data form no. EPA-8-TP.

B. DILUTION TUNNEL SAMPLE TRAIN SET-UP

1. Filters and holders.

a) Clean probes and filter holder front housings carefully and desiccate for at least 24 hours prior to use.
b) Filters should be numbered and filter and probe combinations labeled prior to use.
c) Weigh desiccated filters and probe-filter units on analytical balance. Record weights data form no. EPA-10-TP. Note that probe and front half of front filter are to be weighed as a unit.
d) Carefully assemble filter holder units and connect to sampling systems. Check “DRIERITE” columns for adequate dry absorbent (blue).

2. Leak checking.

a) Each sample system is to be checked for leakage prior to inserting probes in tunnel.
b) Plug probes and start samplers, adjust pump bypass valve to produce a vacuum reading of 5 inches Hg. (NOTE: During test, vacuum must not exceed 5 inches unless posttest leak check shows acceptable results.)

c) Allow vacuum indication to stabilize for two (2) minutes, then record time and dry gas (DGM_1) and (DGM_2) meter readings. Wait ten (10) minutes and record dry gas meter readings again (DGM_3, DGM_4). NOTE: If mark, system is leaking too much and all seals should be checked.

d) Calculate leakage rate as follows.

1) System 1: $\frac{(DGM_3 - DGM_1)}{10} = CFM_1$

2) System 2: $\frac{(DGM_4 - DGM_2)}{10} = CFM_2$

If CFM_1 or CFM_2 is greater than .02 CFM, leakage is unacceptable and system must be resealed.

If CFM_1 or CFM_2 is greater than 0.04 X sample rate, leakage is unacceptable. For most tests, the sample rate will be about 0.15 CFM, thus leakage rates in excess of 0.04 X 0.15 = 0.006 CFM are not acceptable. Record leakage rates on form no. EPA-5-TP

e) Once leakage check is satisfactory, unplug probe and set flow to appropriate rate for test. This should be done in the minimum amount of time necessary and with the probes in ambient air. Do not insert probes in tunnel until the start of the test run. When flow is established, replug probes to prevent contamination.

III. TEST CONDUCT

A. FUEL LOAD

1. Determine optimum load weight by multiplying firebox volume in cubic feet by 7. This is the load weight on an as-fired basis.
2. Determine piece size to obtain the requested load configuration and meet the test load weight criteria. The load should consist of the following: **TO BE DETERMINED**
3. Weigh out test load and adjust weight by shortening all pieces equally if necessary. Record individual piece load on form no. EPA-11-TP.

4. Measure and record moisture content of each fuel piece using Delmhorst moisture meter. Determine if fuel load moisture content is in required range. If not, construct new load using wood with required moisture content. All wood in the humidity chamber should be within range. Contact project manager if you cannot find suitable pieces. Record moisture of each individual piece load on form no. EPA-11-TP.

B. UNIT START-UP

1. Before lighting a fire, turn on dilution tunnel and set flow rate to 140 SCFM if burn rate is to be less than 3 kg/hr or to an appropriate rate from table provided in laboratory for higher burn rates. Record readings on data form no. EPA-9-TP.
2. Check draft imposed on cold stove with all inlets closed and a draft gauge in the chimney. If draft is greater than 0.005 inches water column, adjust tunnel to stack gap until draft is less than 0.005.
3. Check for ambient airflow around unit with hot wire anomometer. Must be less than 50 ft/min.
4. Check all equipment for proper operation. Analyzers should be on and in sample mode. Computer should be loaded with test program and awaiting test start command.
5. Zero scale and start fire with uncolored newspaper and kindling representing 10 % of test load with the same type of fuel.
6. Once kindling is burning well after 5 minutes, add splitted pieces having a bottom surface around 4 sq. inches and representing 25% of test load weight. Operate at high fire for 15 minutes. Then adjust settings to intended test run levels as per the manufacturer's.
7. Following addition of pretest fuel load (splitted pieces), start computer for data logging.

8. All fuel additions, air intake settings and operational characteristics shall be noted with associated time stamp on form no. EPA-1-TP.

C. TEST RUN

1. Once the targeted test fuel bed weight is obtained, the test is to be started as follows:

   a) Insert the sample probes into the tunnel being careful not to hit sides of tunnel with probe tip.
   b) Check tunnel pitot tube for proper position. (Pitot should be carefully cleaned prior to each test.)
   c) Turn on probe sample systems and stack sampler.
   d) Open stove door, rake coals and load stove as follows: **TO BE DETERMINED**
   e) Close door or follow manufacturer's start-up procedures. (Five (5) minutes maximum time before all doors and controls must be set to final positions for duration of test.)
   f) An alarm will sound an audible signal at the (10) minutes intervals. This signal a reading interval. You must verify at each interval that the following readings are correctly logged by the data acquisition system and make observations of any unusual or non routine events that could occur.

      1) Rotometer readings.
      2) Tunnel pitot tube reading.

      (Zero regularly between readings)

      3) Gas meter readings.
      4) Temperature readings.
      5) Draft reading
      6) Test laod weight
      7) CO, CO_2 and O_2 readings
      8) Observations of any unusual or non-routine events.

   g) During the test, any condition approaching unacceptable limits will be noted. The filter probes and housings are installed in small holders just outside the tunnel. If the filter temperature gets too high, you will have to increase the water flow through the cooling unit until acceptable temperatures are obtained. In between readings, check on

other equipment. Be sure dryers and filters are working and monitor impinger train for proper water and ice levels etc.

h) When the fuel charge is consumed, it will signal end of test and shut down the sampling systems. When this occurs, remove filter holder and probes from tunnel and impingers from sample line.

IV. POST TEST PROCEDURES

A. SAMPLE RECOVERY – FILTER TRAINS

1. Carefully clean outside of probes and filter housings with alcohol.
2. Disassemble filter holder and transfer filters to clean petri dish. Scrape gasket with scalpel and collect any loose material on filters.
3. Place probe and front half of first filter holders (still assembled) and filters in desiccator. Allow 24-hour desiccation before weighing.
4. Weigh probe filter holder units and filters at two (2) hour intervals until weight change between weighings is less than 0.5 mg. Record all weights taken on data form no. EPA-10-TP.

B. CALCULATION OF RESULTS

The computer program carries out all final calculations. When run, it will ask for data from forms used during the test. Enter data as called for.

GENERAL

This guide cannot cover every possible contingency, which may develop during a particular test program. Many questions, which may arise, can be answered by a complete understanding of the test standards and their intent. When in doubt on any detail, check with the laboratory manager and be sure you understand the procedures involved.

It is critical that all spaces on the data forms be properly filled in. Each test must be represented by a complete record of what was done and when.

APPENDIX 11: Sample calculations

Validation du fichier de calcul avec les équations provenant des normes:
ASTM E2515-11
ASTME2618

Dry burn rate (BR)

Equation used

B415.1, 13.4

$$BR = \left[\frac{60W_{WD}}{\theta}\right]\left[\frac{100 - \%M_W}{100}\right]$$

Nomenclature

BR	Dry wood burn rate, kg/hr (lb/hr)
W_{WD}	Total mass of wood burned (wet basis) during the test run, kg (lb)
θ	Total time of test run, minutes
$\%M_W$	Average moisture in test fuel charge, wet basis, %
	To convert from dry basis to wet basis: % moisture wet basis =

Sample calculation

Data

W_{WD}	17,36	lbs
θ	361	min
$\%M_W$	5,76	%

Calculation

BR	1,234	Dry kg/hr

Volume of gas sample corrected to dry standard conditions ($V_{m(std)}$)

Equation used

ASTM 2515, equation 6

$$V_{m\,(std)} = K_1 V_m Y \left[\frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m}\right]$$

Nomenclature

$V_{m\,(std)}$	Volume of gas sample , corrected to standard conditions, $dscm^3$ (dscf)
K_1	17.64 R/in Hg
V_m	Volume of gas sample
Y	DGM calibration factor
P_{bar}	Barometric pressure mmHg (in Hg)
ΔH	Average pressure at the outlet of the dry gas meter mm water (in. Water)
T_m	Absolute average dry gas meter temperature K (R)

Sample calculation

Data

V_m	65,07	dcf
Y	0,996	
P_{bar}	30,09	in Hg
ΔH	-0,7591	in Hg
T_m	535,8	R

Calculation

$V_{m(std)}$	62,58	dscf

Total amount of particulate matter collected (m_n)

Equation used

ASTM 2515, equation 12

$$m_n = F_1 + F_2 + \Delta PF$$

Nomenclature

m_n	Total amount of particulate matter collected, mg
F_1	Particulate matter collected on front filter, mg
F_2	Particulate matter collected on second filter, mg
ΔPF	Post-test weight gain of probe and filter holder assembly, mg

Sample calculation

Data

F_1	0,002 g
F_2	0,000 g
ΔPF	0,002 g

Calculation

m_n	3,700 mg

Calculation based of train 2 data

Particulate concentration (C_S)

Equation used

ASTM 2515, equation 13

$$C_S = (0{,}001\ g/mg) \times \left(\frac{m_n}{V_{m\,(std)}}\right)$$

Nomenclature

C_S	Concentration of particulate matter in stack gas or dilution tunnel, dry basis, corrected to standard conditions, g/dsm^3 (g/dscf)
m_n	Total amount of particulate matter collected in the sampling train, mg
$V_{m(std)}$	Volume of gas sample measured corrected to dry standard conditions, dsm^3 (dscf)

Sample calculation

Data

m_n	3,700	mg
$V_{m(std)}$	62,58	dscf

Calculation

C_s	0,000059	g/dscf

Calculation based of train 2 data

Particulate concentration for room air (C_r)

Equation used

ASTM 2515, equation 14

$$C_r = (0{,}001\ g/mg) \times \left(\frac{m_r}{V_{mr\,(std)}}\right)$$

Nomenclature

C_r	Concentration of particulate matter in room air, dry basis, corrected to standard conditions, g/dsm^3 (g/dscf)
m_r	Total amount of particulate matter collected in the sampling train, mg
$V_{mr(std)}$	Volume of room air sample measured corrected to dry standard conditions, dsm^3 (dsc

Sample calculation

Data

m_r	0,100 mg
$V_{mr(std)}$	79,05 dscf

Calculation

C_r	0,000001 g/dscf

Calculation based of train 2 data

Adjustment factor for alternative pitot tube placement (FP)

Equation used

ASTM 2515, equation 1

$$F_P = \frac{V_{strav}}{V_{scent}}$$

Nomenclature

V_{strav}	Average gas velocity caclulated after the Pitot tube traverse
V_{scent}	Average gas velocity at the center of the dilution tunnel cacluated after the multi-point Pitot traverse
F_P	Adjustment factor for center of tunnel pitot tube placement

Sample calculation

Data

V_{strav}	0,233743101
V_{scent}	0,247989886

Calculation

F_P	0,942551

Average dilution tunnel gas velocity (V_S)

Equation used

ASTM 2515, equation 9

$$V_S = F_p K_P C_P \left(\sqrt{\Delta P}\right)_{avg} \sqrt{\frac{T_S}{P_S M_S}}$$

Nomenclature

V_S	Average dilution tunnel gas velocity, m/s (ft/s)
K_P	Pitot tube constant For the metric units: $34.97\ m/sec \left[\frac{\left(\frac{g}{g-mole}\right)(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$ For English units: $85.49\ ft/sec \left[\frac{\left(\frac{lb}{lb-mole}\right)(in\ Hg)}{(°R)(in\ H_2O)}\right]^{1/2}$
C_P	Pitot tube coefficient (use 0.99 for standard pitot tube, 0.84 may be used for S-type tubes constructed according to Method 2 specifications)
F_P	Pitot tube correction factor
$\left(\sqrt{\Delta P}\right)_{avg}$	Average square root of each individual velocity head (ΔP)
P_{bar}	Barometric pressure at measurement site, mm H_2O (in. H_2O)
P_g	Stack static pressure, mm Hg (in. Hg)
P_S	Absolute dilution tunnel static gas pressure, mm Hg (in. Hg), or $P_{bar} + P_g$
M_S	Molecular weight of dilution tunnel gas, wet basis, g/g-mole (lb/lb-mol) may be assumed to be 28.78 or 29 for CSA B415
t_S	Dilution tunnel temperature, °C (°F)
T_S	Absolute dilution tunnel temperature, °K (°R), or 273 + t_s for metric units, 460 + t_s for English units

Sample calculation

Data

K_P	85,49	
C_P	0,99	
F_P	0,943	
$\left(\sqrt{\Delta P}\right)_{avg}$	0,2491	in $H_20^{1/2}$
P_{bar}	30,09	in Hg
P_g	0,25	in H_20
P_S	30,11	in Hg
M_S	28,78	lb/lb-mol
t_S	92,09	F

T_S 552,09 R

Calculation

V_S 15,8629 ft/s

Average dilution tunnel gas flow rate (Qstd)

Equation used

ASTM 2515, equation 3

$$Q_{std} = 60(1 - B_{WS})V_S A\left(\frac{T_{std}}{T_S}\right)\left(\frac{P_S}{P_{std}}\right)$$

Nomenclature

Q_{std}	Total gas flow rate corrected to dry standard conditions, dsm^3/min (dscf/min)
60	Conversion factor minutes per hour
B_{WS}	Water vapour in the dilution tunnel stream, proportion by volume (may be assumed to be 2%)
V_S	Average dilution tunnel gas velocity, m/s (ft/s)
A	Cross-sectional area of dilution tunnel, m^2 (ft^2)
T_{std}	Standard absolute temperature, 293 °K (528°R)
T_S	Absolute average dilution tunnel temperature, °K (°R), or 273 + t_s for metric units, 460 + t_s for English units
t_S	Dilution tunnel temperature, °C (°F)
P_S	Absolute dilution tunnel static gas pressure, mm Hg (in. Hg), or P_{bar} + P_g
P_{bar}	Barometric pressure at measurement site, mm Hg (in. Hg)
P_g	Dilution tunnel static pressure, mm Hg (in. Hg)
P_{std}	Standard absolute pressure, 760 mm Hg (29.92 in. Hg)

Sample calculation

Data

B_{WS}	0,02	
V_S	15,863	
A	0,196	ft^2
T_{std}	528	R
T_S	552,09	R
P_S	30,109	in Hg
P_{std}	29,92	in Hg

Calculation

Q_{std}	176,26	dscf/min

Particulate emission rate (E)

Equation used

$$E = (C_S - C_r)Q_{std}$$

Nomenclature

E	Particulate emission rate, g/hr
C_S	Concentration of particulate matter in stack gas or dilution tunnel gas, dry basis corrected to standard conditions, g/dscm^3 (g/dscf)
C_r	Concentration of particulate matter in room air, g/dscm^3 (g/dscf)
Q_{std}	Total gas flow rate, dry basis corrected to standard conditions, dsm^3/min (dscf/min)

Sample calculation

Data

C_S	0,000059	g/dscf
C_r	0,000001	g/dscf
Q_{std}	176,26	dscf/min

Calculation

E	0,01	g/min
E	0,61	g/h

Calculation based on train 2 data.

Total particulate emission rate (E_T)

Equation used

ASTM 2515, equation 15

$$E_T = (C_S - C_r)Q_{std}\theta$$

Nomenclature

E_T	Total particulate emission, g
C_S	Concentration of particulate matter in stack gas or dilution tunnel gas, dry basis corrected to standard conditions, g/dscm^3 (g/dscf)
C_r	Concentration of particulate matter in room air, g/dscm^3 (g/dscf)
Q_{std}	Total gas flow rate, dry basis corrected to standard conditions, dsm^3/min (dscf/min)
θ	Total sampling time, min

Sample calculation

Data

C_S	0,000059	g/dscf
C_r	0,000001	g/dscf
Q_{std}	176,26	dscf/min
θ	361	min

Calculation

E	3,68	g

Calculation based on train 2 data.

Average gas velocity in dilution tunnel during each min interval, i, of the test run

Equation used

ASTM 2515, equation 10

$$v_{si} = F_p K_p C_p \sqrt{\Delta p_i} \sqrt{\frac{T_{si}}{P_s M_s}}$$

Nomenclature

v_{si}	Average gas velocity in dilution tunnel during each min interval, i of the test run m/sec (ft/sec)
F_P	Pitot tube correction factor
K_P	Pitot tube constant For the metric units: $34.97\ m/sec \left[\frac{\left(\frac{g}{g-mole}\right)(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$ For English units: $85.49\ ft/sec \left[\frac{\left(\frac{lb}{lb-mole}\right)(in\ Hg)}{(°R)(in\ H_2O)}\right]^{1/2}$
C_P	Pitot tube coefficient (use 0.99 for standard pitot tube, 0.84 may be used for S-type tubes constructed according to Method 2 specifications)
Δp_i	interval, i, of the test run
T_{Si}	Absolute average gas temperature in the dilution tunnel during the i^{th} minutes
P_S	Absolute dilution tunnel static gas pressure, mm Hg (in. Hg), or $P_{bar} + P_g$
M_S	Molecular weight of dilution tunnel gas, wet basis, g/g-mole (lb/lb-mol) may be assumed to be 28.78

Sample calculation

Data

i=1		**i=2**	
F_P	0,943	F_P	0,943
K_P	85,49	K_P	85,49
C_P	0,99	C_P	0,99
Δp_i	0,059 in H_20	Δp_i	0,060 in H_20
T_{Si}	569,9 R	T_{Si}	569,8 R
P_S	30,11 in Hg	P_S	30,11 in Hg
M_S	28,78 lb/lb-mol	M_S	28,78 lb/lb-mol

Calculation

i=1		**i=2**	
v_{si}	15,71 ft/sec	v_{si}	15,87 ft/sec

Percent of proportional sampling rate (PR)

Equation used

B415, equation 13.1

$$PR = \left(\frac{\theta V_{mi(std)} V_S T_m T_{Si}}{\theta_i V_m V_{Si} T_{mi} T_S} \right) \times 100$$

Nomenclature

PR	Percent of proportional sampling rate (%)
θ	Total sampling time, min
θ_i	Time of interval, 1 min
V_m	Volume of gas sample measured by the DGM, dsm^3 (dscf)
$V_{mi(std)}$	Volume of gas sample measured by the digital mass flow controller during the i^{th} 1 minutes interval, dsm^3 (dscf)
V_S	Average gas velocity in the dilution tunnel, ft/min
V_{Si}	Average gas velocity in the dilution tunnel during the i^{th} 10 minutes interval, ft/min
T_m	Absolute average digital mass flow controller temperature, K (R)
T_{mi}	Absolute average digital mass flow controller temperature during the i^{th} 1 minutes
T_S	Absolute average gas temperature in the dilution tunnel, K (R)
T_{Si}	Absolute average gas temperature in the dilution tunnel during the i^{th} 1 minutes

Sample calculation

Data

train =1			train =2		
θ	361	min	θ	361	min
θ_i	1	min	θ_i	1	min
V_m	63,73	dcf	V_m	62,61	dcf
$V_{mi(std)}$	0,177	cuft	$V_{mi(std)}$	0,1732	cuft
V_S	15,87	ft/sec	V_S	15,87	ft/sec
V_{Si}	15,722	ft/sec	V_{Si}	15,722	ft/sec
T_m	535,6	R	T_m	535,8	R
T_{mi}	533,61	R	T_{mi}	533,62	R
T_S	552,09	R	T_S	552,09	R
T_{Si}	569,9	R	T_{Si}	569,9	R

Calculation

train=1		**train=2**	
PR	104,8 %	PR	104,5 %

Filter face velocity check

Equation used

$$FV_{max} = \frac{V_{mL}}{1} \times \frac{1}{F_A}$$

Nomenclature

FV_{max}	Maximum filter face velocity during the test run, m/min (ft/min)
V_{mL}	Largest 1 minute interval metered gas volume value recorded during the test run, dm^3 (dcf)
F_A	Filter area exposed to gas sample during train operation, m2 (ft^2)

Sample calculation

Data

V_{mL}	0,172	dcf
F_A	0,0116	ft^2

Calculation

FV_{max}	14,82	ft/min

Dual train precision

Equation used

$$\frac{Train\ 1 - average\ train\ 1\ and\ train\ 2}{average\ train\ 1\ and\ train\ 2} \times 100 \leq 7.5\%$$

Nomenclature

Dual train precision	Deviation between emission's train 1 and 2
Train 1	Total emission for train 1
Train 2	Total emission for train 2

Sample calculation

Data

Train 1	3,80 g
Train 2	3,67 g

Calculation

Dual train precision	1,78 %

Analyzer drift checks

Equation used

$$Drift = \frac{\Delta R}{span} \times 100$$

Nomenclature

Drift	The change in analyzer response to calibration gas over the duration of the test run
ΔR	The difference between the analyzer response at the end of the test run and the
Span	The upper limit of the instrument range, ppmv or %

Sample calculation

Data

ΔR	0,015	%
Span	5	%

Calculation

Drift	0,30	%

Calculated with CO concentration values.

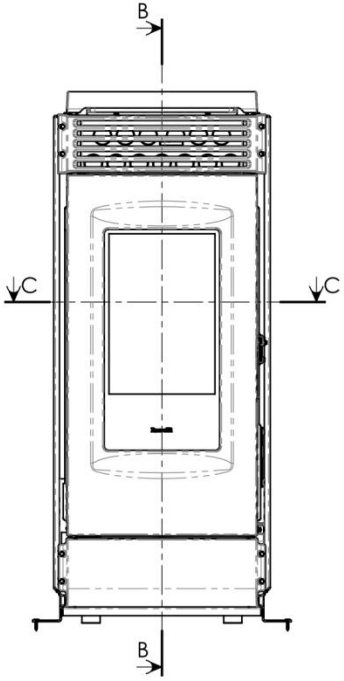
APPENDIX 12: Volume calculations

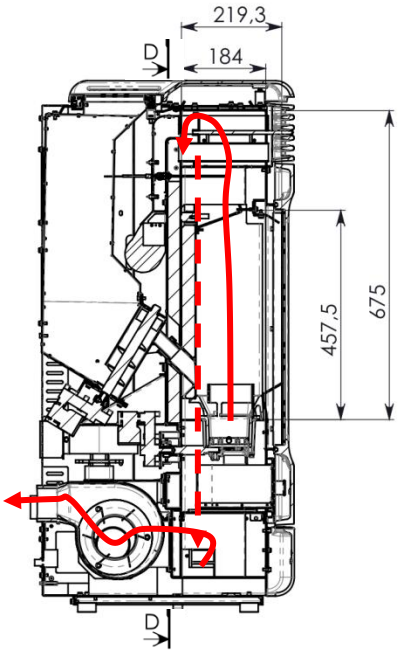
APPENDIX 13: Operating instruction

RV-120 operating instruction

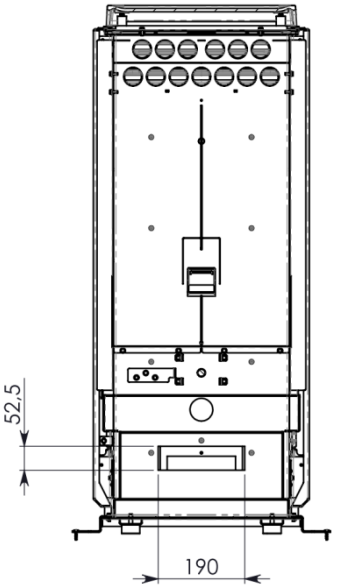
Pre-heat for at least one hours at maximum power,
Start the sampling (test start).
The first 60 minutes run at is maximum output (power 5),
Run for 120 minutes at less than 50% of the maximum burn rate (power2)
Run for 180 minutes at is minimum burn rate (power 1)

APPENDIX 14: Drawing Air flow pattern

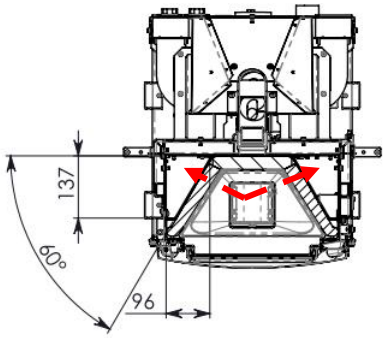




SEZIONE B-B



SEZIONE D-D



SEZIONE C-C

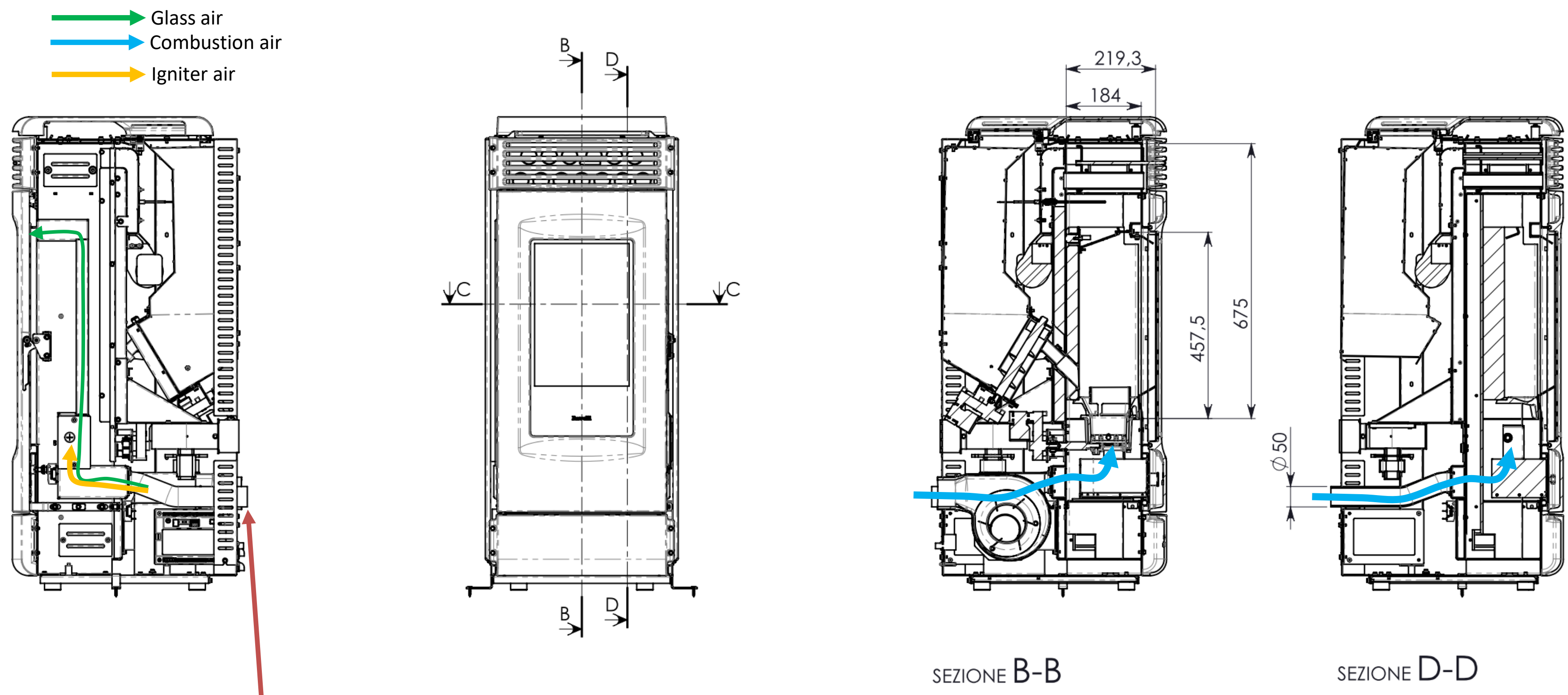
Mod.	DESCRIZIONE	Data	Dis.	Appr.
	MODIFICHE			

TOLLERANZE GENERALI PER QUOTE LINEARI, ANGOLARI, SMUSSI E RACCORDI, CLASSE FINE UNI EN 22768-1, DOVE NON INDICATE	MODIFICARE SOLO SU CAD CAD DRAWNING HANDLING ON CAD SYSTEM ONLY		
DENOMINAZIONE (DENOMINATION)	SCALA (SCALE) **1:10**	FORMATO (SCHEET) A3	MATRICE
COPLESSIVO STUFA	MATERIALE (MATERIAL)		
	TRATTAM. SUPERFICIALE		
	DIS. (DESIGNER) M.Tengatini	CONTR. (CHECKED) GH	
	DATA (DATE) **mercoledì 1 luglio 2015**	PESO Kg (WEIGHT) 94.353	
Ravelli il fuoco intelligente *Via Kupfer 25036 Palazzolo S/O - BRESCIA - ITALY*	N. DISEGNO (DRWG NR.) 029-00-001A-CE-2		MOD.

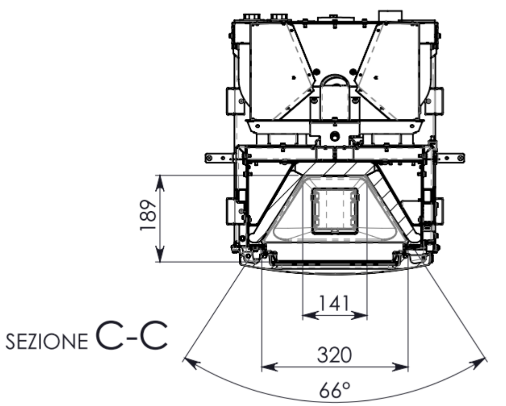
Posizione modello 3D: C:\Users\mtengatini\Desktop\CERTIFICAZIONE VITTORIA\

Posizione file di disegno: C:\Users\mtengatini\Desktop\CERTIFICAZIONE VITTORIA\

Ultimo salvataggio di: *mtengatini* - ***Data ultimo salvataggio:*** *giovedì 2 luglio 2015 08:44:34*



Unique air inlet:
- Combustion air
- Igniter air
- Glass air



Mod.	DESCRIZIONE	Data	Dis.	Appr.

MODIFICHE

TOLLERANZE GENERALI PER QUOTE LINEARI, ANGOLARI, SMUSSI E RACCORDI, CLASSE FINE UNI EN 22768-1, DOVE NON INDICATE

MODIFICARE SOLO SU CAD
CAD DRAWNING HANDLING ON CAD SYSTEM ONLY

DENOMINAZIONE (DENOMINATION)	SCALA (SCALE) 1:10	FORMATO (SCHEET) A3
	MATRICE	
COPLESSIVO STUFA	MATERIALE (MATERIAL)	
	TRATTAM. SUPERFICIALE	
	DIS. (DESIGNER) M.Tengatini	CONTR. (CHECKED) GH
	DATA (DATE) mercoledì 1 luglio 2015	PESO Kg (WEIGHT) 194.395
Ravelli il fuoco intelligente Via Kupfer 25036 Palazzolo S/O - BRESCIA - ITALY	N. DISEGNO (DRWG NR.) 029-00-001A-CE-2	MOD.

Posizione modello 3D: C:\Users\mtengatini\Desktop\CERTIFICAZIONE VITTORIA\

Posizione file di disegno: C:\Users\mtengatini\Desktop\CERTIFICAZIONE VITTORIA\

Ultimo salvataggio di: mtengatini - Data ultimo salvataggio: giovedì 2 luglio 2015 08:45:53

APPENDIX 15: WHA/ CoC/ 30-day notice/ others

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATIONFORM
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

Disclaimer: The statutory provisions and the EPA regulations described in this document contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. In the event of a discrepancy, please refer to 40 CFR PART 60 Subparts AAA AND QQQQ, Sections 60.533 and 60.5475. This document may be revised periodically without public notice. If you have additional questions, please contact Rafael Sanchez at 202-564-7028 or via email at sanchez.rafael@epa.gov.

- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

GENERALINFORMATION						
Manufacturer'sName: AICO SPA						
Appliance Type (Circle One):	Adjustable Burn Rate Wood Heater	Pellet Stove	Single Burn Rate Heater	Hydronic Heater	Forced Air Furnace	Other:
Hydronic Heater Type (Circle One):	Traditional	Full Storage	Partial Storage	Indoor/Outdoor	Other:	
Forced-Air Furnace Type (Circle One):	Small (less than 65,000 BTU/hr heat output)		Large (greater than 65,000 BTU/hr heat output)		Other:	
Fuel Type:	Crib	Pellet	Cordwood	Other:		
Model Name and Number: VITTORIA V; ATENA V; RV 120 TOUCH						
Catalyst: Yes_____ No__x_____						
MailingAddress: Via Kupfer 31						
Street Address: Via Kupfer 31						
City: Palazzolo s/O (BS)	**State:** ITALY	**ZIP Code:** 25036				
Phone: +39 030 7402939	**Fax:** +39 030 7302026	**Web Site:** http://usa.ravelligroup.it/				
Address of Manufacturing Facility: Via Kupfer 31						
City: Palazzolo s/O (BS)	**State** ITALY	**ZIP Code:** 25036				
EPA APPROVED TEST LABORATORY						
Name and Title of Authorized Representative: Danick Power						
Company: Polytests Services Inc.						

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATIONFORM
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

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- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

Phone: ***450.741.3636***	**E-mail:** dpower@polytests.com	**Fax:**
City: St-Jean-sur-Richelieu	**State:** Québec, CANADA	**ZIP Code:** J3B 7S7
EPA APPROVED THIRD-PARTY CERTIFIER		
Name and Title of Authorized Representative: Ken Martin		
Company: CSA Group		
Phone: (514) 428-2489	**E-mail:** ken.martin@csagroup.org	**Fax:**
City: Pointe-Claire (Montréal)	**State:** Québec, CANADA	**ZIP Code:** H9R 5E8
COMPLIANCE TEST INFORMATION		
Test Method(s): Method 28R		
Date(s) of Proposed Test: May 12th and after		
Testing Location: Polytests Services Inc. 695 B rue Gaudette, St-Jean-sur-Richelieu Québec, Canada, J3B 7S7		

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATIONFORM
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

Disclaimer: The statutory provisions and the EPA regulations described in this document contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. In the event of a discrepancy, please refer to 40 CFR PART 60 Subparts AAA AND QQQQ, Sections 60.533 and 60.5475. This document may be revised periodically without public notice. If you have additional questions, please contact Rafael Sanchez at 202-564-7028 or via email at sanchez.rafael@epa.gov.

- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

__Giovanni Scarlini, CEO_____
Print Name and Title of Authorized Official

_____
Signature

___2017-4-27_____
Date

Remarks:

v1

St-jean-sur-Richelieu, September 8th 2021

Att.: Rafael Sanchez, Steffan Johnson

Subject: TYPO, mixing baffle in template report

In our report template we forgot to remove the reference of the mixing baffle in the dilution tunnel in the description section 3.1 and in the drawing in appendix 8 for our report template. This TYPO will can be found in most of our EPA reports. In reality the mixing baffles has been removed from the tunnel in 2015 when the E.P.A. review the regulation and refer to the ASMTE2515 for sampling standard. Our Iso 17025 accreditor (IAS) has audited Polytests for the ASMT E2515 and other testing method in March 2015 and found the dilution tunnel compliant to the standard (no mixing baffle in place). Moreover, we have been audited every two years by the EPA proficiency testing and dilution tunnel have been dismantling and inspected by the auditor and no mixing baffle was in the dilution tunnels. In order to fix this issue, reports are updated to remove the TYPO and updated the drawing of the dilution tunnel in appendix 8.

Thank you
Best regards,

Danick Power
Polytests services inc.
695-B Gaudette
St-jean-sur-richelieu
J3B 7S7
Phone. : 450 741-3636
e-mail: infos@polytests.com

Regards
Marvin

Marvin Evans

Marvin Evans, LET, OBT1, G2
Technical Oversight Specialist,
Special Inspections / Field Evaluations – Fuel Burning Appliances
Certification - Oil and Solid Fuel Burning Appliances

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International Accreditation Service, Inc.
3060 Saturn Street, Suite 100
Brea, CA 92821-1732 USA
tel: 562.364.8201
tel: 866.427.4422
fax: 562.699.8031
www.iasonline.org

IAS Laboratory Assessment Report

File or TL No.: File 2014-12-10

Laboratory Name: Services Polytests, Inc.

Laboratory Address: 695B Gaudette, St. Jean-sur-Richelieu, Quebec, J3B 7S7, Canada

Name and Title of Laboratory Contact: Gaetan Piedalue, P. Eng.; President

Name of Assessor: Douglas Sickles, P.E.

Date(s) of Assessment: March 16-20, 2015

Use this space to record names and titles of persons present at opening meeting:

Services Polytests : Gaetan Piedalue, P. Eng.; President ; Danick Power, VP, Operation Manager; Marie-Josee Brudeau, Quality Manager

IAS: Douglas Sickles, P.E.

Use this space to record names and titles of persons present at closing meeting:

Services Polytests : Gaetan Piedalue, P. Eng.; President ; Danick Power, VP, Operations Manager

IAS: Douglas Sickles, P.E.

Signature of Laboratory Representative:

Signature of Assessor:

Reviewer Comments:

Reviewed by:
Date:

Report	Date	Client	Product	Standards	Tested By:	Reviewer
P-1164	12-2012	ICC	Chimney Liner	ULC S640, UL 1777	Alain Lefebvre	Danick Power
P-1223	10-2014	ICC	Flexible Liner	ULC S640, UL 1777	Alain Lefebvre	Danick Power
P-1231	12-2014	ESIM	Automatically fed pellet/wood chip fired boiler	CSA B366.1 CSA B415.1 UL 2523 EPA Method 28 WHH ASTM 2515A	Maxime Martin	Danick Power
P-1246	11-2014	JA Roby	Wood Stove	UL 1482, ULC S627		Danick Power

TEST METHODS DEMONSTRATED AND REVIEWED:

Test methods demonstrated: (many tests shared between standards)

Test Standard/Method	Title
ANSI/UL 1482	Solid Fuel Type Room Heaters
CAN/ULC S627	Standard for Space Heaters for use with Solid Fuels
ASTM E1509	Standard Specification for Room Heaters, Pellet Fuel Burning type
CAN/CSA B366.1	Solid Fuel Fired Heating Appliances
CAN/CSA B415	Performance Testing of Solid Fuel Burning Heating Appliances
ASTM E2515	Determination of particulate matter collected by a dilution tunnel

Test methods that involved interviews and equipment review:

Test Standard/Method	Title
ULC S628	Fireplace Inserts
ANSI/UL 2523	Solid Fuel Fired Hydronic Heating Appliances, Water Heaters and Boilers
CAN/ULC S610	Standard for Factory Built Fireplaces
ANSI/UL 127	Factory Built Fireplaces
ANSI/UL 391	Solid Fuel and Combination Fuel Central and Supplementary Furnaces"
CAN/ULC S632	Standard for Heat Shields
ANSI/UL 1618	Wall protectors, floor protectors and hearth extensions
EPA 40 CFR Part 60, Subpart AAA, Method 28R	Certification and Auditing of Wood Heaters
EPA 40 CFR Part 60, Subpart QQQ, Method 28WHH	Measurement of Particulate Emissions and Heating Efficiency of Wood-Fired Hydronic Heating Appliances
E2558,E2618, E2779, E2780	Particulate Matter Emissions for Wood, heaters, Pellet heaters, Boilers, Wood Fireplaces
ULC S604	Standard for Factory-Built type A Chimneys
ULC S629	Standard for 650^{o}C Factory-Built Chimneys
UL 103	Factory-Built Chimneys for Residential type and Building Heating Appliances
ULC S640	Standard for Lining Systems for New Masonry Chimneys
ULC S641	Standard for Factory-Built Chimney connectors and wall pass-through assemblies
UL 1777	Chimney Liners
ULC S635	Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents

Irregularities	**Regulatory Citation**	**Information Needed to Address Problems or Irregularities**	**Answers**
Missing or Incomplete Information - Instructions from the manufacturer to the laboratory on the operation of the device.	40 C.F.R. §60.534(h)	In the revised test report include all communication with the laboratory regarding the operation of the device. Any information provided must be consistent with the instructions provided in the Owner's Manual.	Appendix 13 updated to include manufacturer operating instrcution
Incomplete Information – Efficiency Sample Calculations.	40 C.F.R. §60.533(b)(5)	In the revised test report include the required sample efficiency calculations.	Already addressed in revision 1
Missing Information - Pellet Fuel Certification.	40 C.F.R. §60.532(e), 40 C.F.R. §60.533(b)(5)	In the revised test report include information documenting that the pellet fuel used was a quality certified fuel using either the Pellet Fuel Institute (PFI) program or the ENPlus program.	Section 1.4 and 3.4 updated to mentioned ENplus program pellet have been used for aging and testing
Incomplete Information – Discussion of Negative Filter Weights.	40 C.F.R. §60.533(b)(5)	In the revised test report include discussion of proper handling of negative filter weights with calculations both corrected to zero and uncorrected.	Section 3.4 updated to address negative filters weight.
Missing Information in Owner’s Manual.	40 C.F.R. §60.536(g)	In the revised test report include a revised Owner's Manual with: (1) Proper draft recommendations when operating the appliance; (2) Proper operation on low burn, and (3) How to get replacement parts.	Appendix 7 manual updated.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

June 28, 2022

Mr. Claudio Mezzalira
Research and Development Manager
Ravelli SRL
Via Kupfer 31
25036 Palazzolo sull'Oglio,
Brescia, Italy

Re: Request for Revised Certification Test Report to Address Documentation Problems or Irregularities – RV120 Touch, Atena V, and Vitoria V Models Pellet Heater; Certificate of Compliance Number 91-17

Dear Mr. Mezzalira:

The United States Environmental Protection Agency (EPA) has completed a post-certification review of your certification test report, dated May 19, 2017[1] and submitted in order to obtain a Certificate of Compliance for the above-referenced wood heater models. As discussed below, this review found problems or irregularities that remain in the revised test report documentation. EPA is requesting that you address these problems or irregularities by further revising the test report to include all required information pertaining to a valid certification test. If a revised test report is not submitted as requested and within the time allotted, EPA may at its discretion determine that the certification test was not valid, which would serve as the basis for revoking the Certificate of Compliance in accordance with the 2015 Wood Heater Rule at 40 C.F.R. §60.533(l).

The 2015 Wood Heater Rule authorizes EPA to issue a Certificate of Compliance upon a manufacturer submitting all required documentation pertaining to a valid certification test. Such documentation must include a complete test report providing information for all test runs, including raw data sheets, laboratory technician notes, calculations, and test results. In addition, the documentation must include the items specified in the applicable test methods. See 40 C.F.R. §60.533(b)(5). Upon subsequent review of the revised certification test report, however, EPA determined that certain required test report information continued to be missing and/or requires clarification. Therefore, EPA requests that you further revise the test report to include the following additional information to maintain the Certificate of Compliance for the above-referenced models.

1 Revised on March 7, 2022 and April 13, 2022.

Test Report Problems or Irregularities	Regulatory Citation	Information Needed to Address Problems or Irregularities
Missing or Incomplete Information - Instructions from the manufacturer to the laboratory on the operation of the device.	40 C.F.R. §60.534(h)	In the revised test report include all communication with the laboratory regarding the operation of the device. Any information provided must be consistent with the instructions provided in the Owner's Manual.
Incomplete Information – Efficiency Sample Calculations.	40 C.F.R. §60.533(b)(5)	In the revised test report include the required sample efficiency calculations.
Missing Information - Pellet Fuel Certification.	40 C.F.R. §60.532(e), 40 C.F.R. §60.533(b)(5)	In the revised test report include information documenting that the pellet fuel used was a quality certified fuel using either the Pellet Fuel Institute (PFI) program or the ENPlus program.
Incomplete Information – Discussion of Negative Filter Weights.	40 C.F.R. §60.533(b)(5)	In the revised test report include discussion of proper handling of negative filter weights with calculations both corrected to zero and uncorrected.
Missing Information in Owner's Manual.	40 C.F.R. §60.536(g)	In the revised test report include a revised Owner's Manual with: (1) Proper draft recommendations when operating the appliance; (2) Proper operation on low burn, and (3) How to get replacement parts.

We request that you submit both a revised confidential business information (CBI)[2] and non-CBI test report along with a revised Certification of Conformity to EPA within ten (10) business days of receipt of this letter to maintain the Certificate of Compliance for the above-referenced models. The revised test report (both CBI and non-CBI versions) and Certification of Conformity should be clearly identified as revised with a revision date provided. The revised test report and Certification of Conformity should include a summary table indicating what revisions have been made and where the revisions are located in the test report. Concurrently, you must post the revised non-CBI test report and Owner's Manual on your website and provide to EPA the web address where the report can be found.

Upon receipt, EPA will review the revised test report (CBI and non-CBI versions) to determine if the

[2] Manufacturers who claim that some of the information being submitted is CBI (e.g., design drawings and sensitive, detailed material specifications) must clearly mark the information. Note that emissions data cannot be claimed as CBI, including all information necessary either to determine emission rates in the format of the standard (e.g., g/hr, lb/mmBtu) or to determine whether the source complies with an applicable standard or limitation). See 40 CFR 2.301(a)(2) https://www.govinfo.gov/content/pkg/CFR-2013-title40-vol1/pdf/CFR-2013-title40-vol1-sec2-301.pdf.

revisions sufficiently address the identified problems or irregularities and verify that the non-CBI report has been posted on your website. Please submit the revised test report (both CBI and non-CBI versions) to WoodHeaterReports@epa.gov. The subject line of your email should be marked as "Wood Heater Test Report Requested Information."

Please note that we are in receipt of your March 29, 2022 request to renew your Certificate of Compliance for the above-referenced models. However, the request cannot be processed until the above-identified test report problems or irregularities have been sufficiently addressed and the revised non-CBI test report posted on your website.

This request has been coordinated with EPA's Office of Air Quality Planning and Standards and the Office of General Counsel. If you have any questions regarding this letter, please contact the Wood Heater Program at WoodHeaterReports@epa.gov.

Sincerely,

Elizabeth Vizard
Acting Director
Monitoring, Assistance, and Media Programs Division
Office of Compliance
Office of Enforcement and Compliance Assurance

cc:

Richard A. Wayland, OAQPS/AQAD
Steffan M. Johnson, OAQPS/MTG
Jacqueline Robles Werner, OC
Robert Scinta, OC/MAMPD
Scott Jordan, OGC
Danick Power, Services Polytests Inc.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
CERTIFICATION OF CONFORMITY
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

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GENERAL INFORMATION

Manufacturer's Name: AICO SPA (Ravelli)

Heater Type (Circle One):	Adjustable Burn Rate Wood Heater	Pellet Stove	Single Burn Rate Heater	Hydronic Heater	Forced Air Furnace	Other: Pellet Insert
Hydronic Heater Type (Circle One):	Traditional	Full Storage	Partial Storage	Indoor/Outdoor	Other:	
Forced-Air Furnace Type (Circle One):	Small (less than 65,000 BTU/hr heat output)		Large (greater than 65,000 BTU/hr heat output)		Other:	
Fuel Type:	Crib	Pellet	Cordwood	Other:		

Model Name and Number:
- RV 120 Touch, ATENA V, VITORIA V

Catalyst: No

Mailing Address: Via Consorzio Agrario, 3/D Chiari, Italy

Street Address: Via Consorzio Agrario

City: Chiari	**State:** Brescia	**ZIP Code:** 25032
Phone: + 39 030 74 02 939	**Fax:** N/A	**Web Site:** http://usa.ravelligroup.it/

Address of Manufacturing Facility:
Jotul Poland Sp z o.o.
ul. Ks. Jerzego Popiełuszki 17
Kąty Wrocławskie, Lower Silesian 55 080
Poland

City: Kąty Wrocławskie	**State:** Kąty Wrocławskie	**ZIP Code:** 55 080

EPA APPROVED THIRD PARTY CERTIFIER

Authorized Representative: Aaron Reesor

Company: CSA Group

Phone: 416 747-2652	**E-mail:** aaron.reesor@csagroup.org	**Fax:** N/A
City: Toronto	**State:** Ontario, Canada	**ZIP Code:** M9W 1R3

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
CERTIFICATION OF CONFORMITY
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

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Position: Certifier – Fuels Group

Report Number: Polytest Test Report: PI-20145	**Date of Tests:** May 12th 2017	**Date of Report:** REPORT DATE: May 19th 2017 Revision 1: March 7th, 2022 Revision 2: April 13th, 2022 Revision 3: July 5th 2022 Revision 4: August 9th 2022 Project number: PI-20145
Quality Assurance Plan included?: Yes	**Wood Heater/Hydronic Heater/Forced-Air Furnace Application Included:** NO	**Remarks:** N/A
Affected Source Data Summary		
Wood Burning Heater	**Hydronic Heater**	**Forced-Air Furnace**
Weighted particulate emission average of **1** test runs: **0.6** grams per hour	Maximum Output Rating:_____ Weighted particulate emission average: X Lb/MMbtu output	Particulate emission average: X Lb/MMbtu output
Weighted average HHV efficiency of **1** test runs: **79.25%**	Annual Efficiency Rating:_____	Overall thermal efficiency (HHV): X%
	Particle Emissions: _____	Overall Delivered Heat Efficiency: X%
AFFIRMATIONS		

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
CERTIFICATION OF CONFORMITY
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
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- **The above-named affected source has been tested by a laboratory qualified to test and report on the emissions of this type of product under 40 CFR Part 60, Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces (2015 Standards).**

- **The Test Report No. PI-20145, prepared by Danick Power and dated Aug 9th 2022, has been reviewed by Aaron Reesor and was found to be complete and to have used the correct procedures in accordance to the 2015 NSPS Standards.**

- **The emissions levels measured in the Test Report and listed above comply with the relevant particulate matter limits established by the 2015 NSPS Standards.**

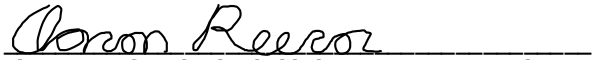
- **The model listed above was tested to Particulate emissions: ASTM E2779-10 (section 9.4.1 integrate test run); ASTM E2515-11 as referred into 40 CFR Part 60 Subpart AAA, CSA B415.1-10 (for efficiency only) (Test method(s)).**

- **The permanent label and owner's manual meets the requirements of 40 CFR § 60.536 and/or § 60.5478.**

- **The above-named manufacturer, on the effective date of this certificate, was operating under a quality assurance plan, per 40 CFR § 60.533(m) and/or § 60.5475(m), that has been reviewed and approved by Aaron Reesor.**

- **The above-named manufacturer has contracted CSA Group to conduct regular (at least annual) unannounced audits of the manufacturing facility, affected source, and quality assurance plan pursuant to 40 CFR § 60.533(m) and/or § 60.5475(m).**

Aaron Reesor – CSA Group – Certifier – Fuels Group
Print Name and Title



Signature of Authorized Third-Party Representative

August 9th 2022
Date

This is a certification of conformity to certify that the bearer has successfully completed the requirements pursuant to the 2015 NSPS Standards.

Third-party EPA approval expiration date: Aug 2027

V1

Remarks:

Revision 1 March 17th 2022

- Moisture in the tunnel assume change section 3.6
- Table 2.6 updated with deviation in g/Kg
- Appendix 1 molecular weight updated to 29 for all runs
- Appendix 1 updated with data and preburn data
- The section 3.4 p.9 updated for runs Anomalies, Validity and appropriateness detail.
- Updated Section 1.4 p.5 conditioning was done at Polytests Facility.
- Additional letter for TYPOs about mixing baffle in the original report.
- Table 2.1 additional emission number in gr/Mj

Revision 2 April 13th, 2022

- Section 3.2, Additional Alternative components, all alternative components have same parameter. Auger motor, exhaust fan, pressure switch, safety temperature switch.

Revision 3 July 5th 2022

- Section 1.4 and 3.4 updated to mentioned ENplus program pellet have been used for aging and
- testing
- Appendix 8 updated with new picture and more detail on dilution tunnel
- Appendix 7 manual updated
- Appendix 13 operating instruction updated
- Section 3.4 updated to address negative filters weight.

Revision 4: August 9th 2022

- include negative filter weights with calculations both corrected to zero and uncorrected in appendix 1.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
2015 Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces Application
40 CFR PART 60 SUBPARTS AAA AND QQQQ

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Contents

APPLICATION FOR A CERTIFICATE OF COMPLIANCE PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ

2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

GENERAL INFORMATION

Manufacturer'sName:AICO SPA

Heater Type (Circle One):	Adjustable Burn Rate Wood Heater	Pellet Stove	Single Burn Rate Heater	Hydronic Heater	Forced Air Furnace	Other:
Hydronic Heater Type (Circle One):	Traditional	Full Storage	Partial Storage	Indoor/Outdoor	Other:	
Forced-Air Furnace Type (Circle One):	Small (less than 65,000 BTU/hr heat output)		Large (greater than 65,000 BTU/hr heat output)		Other:	
Fuel Tested:	Crib	Pellet	Cordwood	Wood Chips	Other:	

Test Method(s): ASTM E2779-10 integrated run	**Catalyst: No**

Model Name and Design Number (The model name and design number must clearly distinguish one model from another. The name and design number cannot include the EPA symbol or logo or name or derivatives such as "EPA):

RV120 TOUCH, ATENA V, VITORIA V

Physical Address (Street number and Address, not P.O. Box): **Via Kupfer 31**	**Mailing Address:** **Via Kupfer 31**

City:Palazzolo s/O (BS)	**State: Italy**	**ZIP Code: 25036**
Phone: +39 030 7402939	**Email: g.scarlini@ravelligroup.it**	**Website: http://usa.ravelligroup.it/**

EPA Submission Date of 30 day Notice: yes

MANUFACTURER'S AUTHORIZED REPRESENTATIVE INFORMATION

Name: Giovanni Scarlini

Position/Title: CEO

Address: Via Kupfer 31

City:Palazzolo s/O (BS)	**State: Italy**	**ZIP Code: 25036**
Phone: +39 030 7402939	**E-mail: g.scarlini@ravelligroup.it**	**Website: http://usa.ravelligroup.it/**

Remarks:

APPLICATION FOR A CERTIFICATE OF COMPLIANCE PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ

2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

EPA-APPROVED TEST LABORATORY		
Name of Test Laboratory: Polytests Services Inc.		
Name of Person Authorized or Responsible for Conducting Compliance Test: Danick Power		
Position/Title: VP operation		
Address: 695-B Gaudette		
City: St-jean-sur-richelieu	**State:** Quebec	**ZIP Code:** J3B 7S7
Phone: 450 741-3636	**Email:** infos@polytests.com	**Website:** www.polytests.com
Remarks:		

EPA-Approved Third Party Certifier		
Name of Certifier Entity: CSA Group		
Name of Person Authorized or Responsible for Reviewing Test Report and/or Issuing Certification of Conformity: Ken Martin		
Position/Title: Certification project manager		
Address: 865 avenue Ellingham		
City: pointe-Claire	**State:** Quebec	**ZIP Code:** H9R 5E8
Phone: 514-428-2489	**Email:** Ken.martin@CSAgroup.org	**Website:** www.csagroup.org
Remarks:		

COMPLIANCE STATEMENTS AND ACKNOWLEDGEMENTS – SECTIONS 60.533(B) AND 60.5475(B)

INSTRUCTIONS: PLEASE READ THE BELOW STATEMENTS AND AFFIRMATIONS AND ADDRESS ACCORDINGLY.

FOR EMISSIONS DATA SUMMARY TABLES SEE ATTACHMENTS

1. Engineering Drawings Statement

Engineering drawings and specifications of components that may affect emissions (including specifications for each component listed in paragraphs (k)(2), (3) and (4) of 60.533(b) and 60.5475(b). Manufacturers may use assembly or design drawings that have been prepared for other purposes, but must designate on the drawings the dimensions of each component listed in paragraph (k) of this section. Manufacturers must identify tolerances of components listed in paragraph (k)(2) of 60.533(b) and 60.5475(b) that are different from those specified in that paragraph, and show that such tolerances cannot reasonably be anticipated to cause wood heaters in the model line to exceed the applicable emission limits. The drawings must identify how the emission-critical parts, such as air tubes and catalyst, can be readily inspected and replaced.

Dimensions are shown on the manufactured parts and assembly drawings. Overall tolerances are in line with 60.533(b) and are detailed in our Manufacturing Quality Assurance Manual.

2. Firebox Statement Requirement

A statement whether the firebox or any firebox component (including the materials listed in paragraph (k)(3) of 60.533(b) and 60.5475(b) will be composed of material different from the material used for the firebox or firebox component in the wood heater on which certification testing was performed, a description of any such differences and demonstration that any such differences may not reasonably be anticipated to adversely affect emissions or efficiency.

The materials used to build the prototype that was sent to Services Polytests for emission testing are the same that will be used for the production units.

3. CBI

Clear identification of any claimed confidential business information (CBI). Submit such information under separate cover to the EPA CBI Office; Attn: Residential Wood Heater Compliance Program Lead, 1200 Pennsylvania Ave., NW, Room 7138, MS:2227A, Washington, DC 20460. **Note that all emissions data, including all information necessary to determine emission rates in the format of the standard, cannot be claimed as CBI.**

A CBI and Non-CBI report will be provided separately

4. Valid Certification Statement

All documentation pertaining to a valid certification test, including the complete test report and, for all test runs: Raw data sheets, laboratory technician notes, calculations and test results. Documentation must include the items specified in the applicable test methods. Documentation must include discussion of each test run and its appropriateness and validity, and must include detailed discussion of all anomalies, whether all burn rate categories were achieved, any data not used in the calculations and, for any test runs not completed, the data collected during the test run and the reason(s) that the test run was not completed and why. The burn rate for the low burn rate category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer. The test report must include a summary table that clearly presents the individual and overall emission rates, efficiencies and heat outputs. Submit the test report and all associated required information, according to the procedures for electronic reporting specified in § 60.537(f) and 60.5475(f).

This has all been submitted as part of the report from Services Polytests Inc.

5. Warranties

A copy of the warranties for the model line, which must include a statement that the warranties are void if the unit is used to burn materials for which the unit is not certified by the EPA and void if not operated according to the owner's manual.

In the manual included in Polytests Report

6. Q/A Statement

A statement that the manufacturer will conduct a quality assurance program for the model line that satisfies the requirements of paragraph (m) of this section.

CSAis our Third Party Certifier. As such CSA will be coming unannounced to our facility to inspect the products under CSA listing four times per year, every year. QA plan is provide for review to CSA with the Polytests Report

7. Laboratory Sealing of Unit

A statement describing how the tested unit was sealed by the laboratory after the completion of certification testing and asserting that such unit will be stored by the manufacturer in the sealed state until 5 years after the certification test.

The unit has been appropriately sealed by Polytests Services and will be transferred back to AICO. It will then be kept, with the seal unbroken for at least 5 years

8. Statements that the wood heaters manufactured under this certificate will be—

(i) Similar in all material respects that would affect emissions as defined in § 60.531 to the wood heater submitted for certification testing, and labeled as prescribed in § 60.536 and 60.5478.

(ii) Accompanied by an owner's manual that meets the requirements in § 60.536 and 60.5478. In addition, a copy of the owner's manual must be submitted to the Administrator and be available to the public on the manufacturer's web site.

The materials used to build the prototype that was sent to Services Polytests for emission testing are the same that will be used for the production units.

It will be labelled as prescribed in § 60.536.

All units we produce are accompanied by the appropriate owner's/installation manual. All the owner's/installation manual are available on our web site once the unit become available for sale.

9. Third Party Certification Statement

A statement that the manufacturer has entered into contracts with an approved laboratory and an approved third-party certifier that satisfy the requirements of paragraph (f) of this section.

CSAwill be acting as our Third Party Certifier

10. Approved laboratory/third party Statement

A statement that the approved laboratory and approved third-party certifier are allowed to submit information on behalf of the manufacturer, including any claimed to be CBI.

Services Polytests Inc is hereby authorized to submit all information, including CBI, related to the emission testing that was conducted by Services Polytests, to allow us to get EPA certification for this unit.

CSA is hereby authorized to submit all information, including CBI, related to the emission testing that was conducted by Services Polytests, to allow us to get EPA certification for this unit.

11. Manufacturer's Website Certification Test Reports Availability Statement

A statement that the manufacturer will place a copy of the certification test report and summary on the manufacturer's web site available to the public within 30 days after the Administrator issues a certificate of compliance.

We will be adding, to our website, the public (non CBI) part of the certification report as soon as the unit becomes available for sale.

12. Transferability Acknowledgement Statement

A statement of acknowledgment that the certificate of compliance cannot be transferred to another manufacturer or model line without written approval by the Administrator.

We will not transfer the certificate of compliance to another manufacturer or model line without prior written approval by the Administrator

13. Statement about Selling Wood Heaters without an EPA Certificate

A statement acknowledging that it is unlawful to sell, distribute or offer to sell or distribute an affected wood heater without a valid certificate of compliance.

We recognize that it is unlawful to sell, distribute or offer to sell or distribute an affected wood heater without a valid certificate of compliance.

Print Name and Title: GIOVANNI SCARLINI, CEO **Date:** 23/5/2017

Signature of responsible representative of the manufacturer certifying the accuracy of the above statements:

The authorized or responsible party whose signature is above is certifying that the manufacturer has complied with and will continue to comply with all requirements of the 2015 NSPS for compliance certification and that the manufacturer remains responsible for compliance regardless of any error by the test laboratory or third-party certifier.

Attachments

Instructions: Please complete the section applicable to your certification request.You may substitute your own data tables in lieu of the ones shown below provided that all the information is captured.

A. SUMMARY RESULTS – PELLET HEATERS

Run Number	Date			Run Time (Min.)	Heat Output (Btu/hr)	1st Hour Emissions (g/hr)	Integrated Total(g/hr)	CO Emissions (g/hr)	Overall CO Emissions (g/hr)	Heating Efficiency (% HHV)	Overall Heating Efficiency(% HHV)
		Setting	BR								
1	May 12th 2017	H	2.41	61	37 800	2.19	0.62	0.62	2.8	77.41	79.25
		M	1.22	120	18 500			3.56		78.81	
		L	0.83	180	12 900			4.52		81.54	
		OA	1.23	361	18 821			2.8		79.25	