



TEST REPORT

TEST OF A NON-CATALYTIC WOOD BURNING SINGLE BURN RATE STOVE FOR EMISSIONS AND EFFICIENCY

PER EPA METHODS 28R AND ASTM E2515 and ASTM E2780, MAY 2015

Client:

Spartherm

Maschweg 38 Melle 49324

Germany

Model Name: Spartherm M 700

Attention: Rafael Sanchez

TESTED BY:

Services Polytests inc.

695-B Gaudette

St-Jean-sur-Richelieu, QC, J3B 7S7

TEST DATES: April 8th and 9th 2024

REPORT DATE: April 16th 2024

Project number: PI-20302

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Tested:

Maxime Martin

written by:

Danick Power, P. Eng

Verified by third party certifier (CSA):

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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 dates: April 8th & 9th 2024
- Test methods used:
 - o Particulate emissions: ASTM E2780-10; ASTM E2515-11 methods 28R as referred into 40 CFR Part 60 Subpart AAA
 - o Efficiency: CSA B415.1-10

1.2 TEST UNIT INFORMATION

General

- Manufacturer: Spartherm
- Product type: non-catalytic single burn rate heater
- Combustion system: non-catalytic
- Unit tested: Spartherm M 700

Particularities

- Same firebox with same flue size and same air combustion control will be used to built an insert, aa free-standing wood stove and a zero-clearance wood fireplace. All three unit share the same design, exact same firebox, and no air control.
- Zero-clearance fireplace: Spartherm M 700 Z/C,
- Free standing stove: Spartherm M 700 Module
- Wood insert: Spartherm M 700 insert

1.3 RESULTS

Emission results obtained

- Average Emissions Rate: 1,7 g/hr
- Average Overall Efficiency: 66 %
- Average Emissions Rate CSA B415.1-22: 0.065 g/Mj

Conformity: NSPS Phase 2020, CSA B415.1-22

1.4 PRETEST INFORMATION

- Unit condition: The unit was received by carrier March 2024 in good condition. The 50hrs of aging was done at the lab. Fuel: BC FIR between 19% and 25%. (All data in Appendix 4).

Set up

- Venting system type: 6-inch steel pipe and insulated chimney
- System height from floor: 15 feet
- Particularities: none

2 SUMMARY OF TEST RESULTS

2.1 EMISSIONS

Run Number	Test Date (YY-MM-DD)	Emission Rate (g/hr)	Burn Rate (kg/hr)	1st hour Emission Rate (g/hr)	CSA B415.1 CO emission Gr/hr	CSA B415.1 emission Gr/Mj	Heat output (BTU/HR)	(OHE) % HHV
1	2024-04-08	1,88	1,960	2,86	56,61	0,07	24 269	65,88%
2	2024-04-09	1,52	1,995	1,87	67,17	0,06	24 906	66,43%

2.2 WEIGHTED AVERAGE CALCULATION

Test No.	Burn Rate (Kg/hr)	(E) Ave. Emission Rate g/hr	(OHE) % HHV	Heat Output (BTU/HR)	CSA B415.1 CO emission g/min
1	1,960	1,88	65,9%	24 269	0,9
2	1,995	1,52	66,4%	24 906	1,1
Weighted particulate emission average of 2 test runs: 1,7 grams per hour.					
Weighted average HHV efficiency of 2 test runs: 66 %.					
Average Co 1,0 gr/min					

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	71	75	29,766	29,796	28,6	26,9	0	0
2	72	74	29,707	29,737	29,1	30,1	0	0

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.)	Number of 2X4's	Number of 4x4's	Number of Spacers
1	11,91	19,82	2,6	10,71	6,780	19,96	17,5	2	1	12
2	11,61	19,74	2,6	10,39	6,575	20,11	17,5	2	1	12

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	124	350,56	563,59	21,531	22,569	1,90	2,10
2	118	353,12	564,80	20,392	21,352	1,40	1,60

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	2018,91	1926,04	3,79	3,99	2,56%	0,049
2	2043,37	1951,48	2,86	3,12	4,37%	0,067

2.7 GENERAL SUMMARY OF RESULTS

Run Number	Burn Rate (kg/hr)	Average Surface Temperature (F)	Change in surface Temperature (F)	Initial Draft (in. H2O)	static pressure tunnel (in. H2O) neg.	Primary Air Setting	Run Time (min)
1	1,960	388,73	-90,8	0,085	0,180	fix	124
2	1,995	388,16	-109,0	0,084	0,180	fix	118

3 PROCESS DESCRIPTION

3.1 DISCUSSION

The heater has been received in a good shape by a carrier in March 2024. Pre-burn was done at the lab with BC Fir crib at single setting burn rate for 50 hrs. The side walls of the combustion chamber are lined with Vermiculite. The air inlet is located at the back of the firebox. Post combustion is ensured by the secondary located at the top front of the firebox and tertiary air at the back of the firebox.

3.2 UNIT DIMENSIONS

Baffle

- Location: between top of combustion chamber and hearth
- Restriction: 1.5 X 21 inches at the front of unit
- Dimensions: covers the hearth area minus the restriction at front
- Material: Vermiculite 1 inch

Bricks

- Vermiculite lining bottom, back and side of the firebox.

Flue gas exhaust

- Location: top
- Dimensions: 6 in. diameter
- Material: Steel

Gasket

- Door: rope fiberglass
- Glass: rope fiberglass

Overall unit dimension

- Firebox dimensions: refer to appendix 12 for all detail and calculation of the usable volume
- Usable volume: 1.58 cuft
- Overall dimension: 26.188-inch-wide x 17.375-inch-deep x 22.625-inch-high

Convection fan

- none

Catalyst

- none

3.3 AIR SUPPLY SYSTEM

Description

- Tertiary air: window wash design with air intake at the back of unit
- Secondary air: secondary baffle design with air intake at the back of unit. Refer appendix 6 for drawing details

Characterization

The following table shows the inlet and outlet sections of each system. The air introduction system number is referred to on a set of drawings in Appendix 6.

AIR INTRODUCTION SYSTEM		INLET (1) cm2			OUTLET (cm2)
Identification	Type	Imin	Imax	Controlled	
A *	Primary	0	0	No	0
B *	Secondary (air wash and front holes)	15,9 (shared with tertiary)	15,9 (shared with tertiary)	No	43 + 4.9
C *	Tertiary (rear wall holes)	15,9 (shared with secondary)	15,9 (shared with secondary)	No	5.9

* This section would be filled by measuring and comparing with the manufacturer's drawings included in the test report.

Legend

Identification: Tag name referred to on drawings in Appendix 14, section airflow pattern

Type: Characterization of air intake

Imin: Minimum air intake of a particular air channel

Imax: Maximum air intake of a particular air channel

Controlled: Determines if a provision for air control is present

Outlet: Total air outlet of a particular air channel

3.4 OPERATION DURING TEST

All runs have been found appropriate, no anomalies happened and all runs below have been validate and found compliant.

Run #1

This run was performed on April 8th 2024. It lasted 124 minutes and a burn rate result at 1.96 kg/hr & emission at 1.88 gr/hr. The air inlet damper was fix at the single setting.

Run #2

This run was performed on April 9th 2024. It lasted 118 minutes and a burn rate result at 1.9 kg/hr & emission at 1.52 gr/hr. The air inlet damper was fix at the single setting.

- 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 cribs

- Type of wood: Douglas fir, grade c or better, 19 to 25% dry basis moisture content
- Description: for each test, description of the fuel crib is found on the front page of each test run data sheet together with photograph in appendix.

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. The tunnel has two elbows ahead of the sampling section. The sampling section is a continuous 8-inch diameter pipe straight over its entire length. Tunnel velocity pressure is determined by a standard pitot tube, 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 downstream of the pitot tube and upstream from the end of this section. All detail of dilution tunnel can be found in appendix 8.

3.7 DRAWINGS

Various drawings of the stack gas sampling train and of dilution tunnel system are found in Appendix 6.

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: SPA

Description du test

Test standard	EPA
Run #	1
Date	08-04-2024
Technicien	M.M
Project #	PI 20302

Description de l'unité

Manufacturier	SPARTHERM	
Modèle	700	
Combustion system	Non-Cat	
Appliance type	wood heater	
Firebox volume	1,58	cu ft.
Appliance weight empty	n.a	lbs
Appliance weight full	n.a	lbs

Paramètres du test

Logging time	1	min
Manufacturer's rated heat output	n.a	BTU/h Donnée fournie par le manfacturier
Targeted category	3	
Targeted output	n.a	BTU/h
Cp steel	n.a	BTU/lb-°F

Échantillonnage

Blank sampling rate	0,20	cuft/min
Internal probe diameter	0,18	in.
Calibration Factor (DGM #1):	0,986	
Equipment number (DGM #1):	EM-178	Dimensionless
Calibration Factor (DGM #2):	1,003	
Equipment number (DGM #2):	EM 318	Dimensionless
Calibration Factor (DGM #3):	0,984	
Equipment number (DGM #3):	EM 179	Dimensionless
Calibration Factor (DGM 1st Hr):	0,987	
Equipment number (DGM 1st Hr):	EM 130	Dimensionless

Tunnel

Targeted tunnel flow rate	350	scfm
Tunnel diameter	8	in.
Molecular weight	29	29 as per ASTM E2515
Pitot tube type	Standard	
Pitot tube coefficient	0,99	Dimensionless

Project nu. PI 20302
Date 08-04-2024
Technicien M.M

Fuel data

Fuel type	Dimension
Fuel specie	D. Fir
HHV	19810,0 kJ/kg
%C	48,7
%H	6,9
%O	43,9
%Ash	0,5
HHV	8519,2 Btu/lb
LHV	7451,0 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):	100,8	100,9
Barometer (in.Hg):	29,766229	29,79575878
Dry Bulb (F):	72,8	75,1
Humidity (%):	28,6	26,9
Air velocity (ft/min)	0	0

DGM #1st hour	Final:	589,510	cuft
	Initial:	577,530	cuft

DGM #1	Final:	33747,943	cuft
	Initial:	33725,122	cuft

DGM #2	Final:	24928,734	cuft
	Initial:	24905,031	cuft

DGM room	Final:	17280,611	cuft
	Initial:	17262,259	cuft

	Final:	589,510	cuft
	Initial:	577,530	cuft

	Final:	955635,300	Liter
	Initial:	954989,080	Liter

	Final:	705903,120	Liter
	Initial:	705231,920	Liter

	Final:	489332,400	Liter
	Initial:	488812,740	Liter

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

195

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

Project nu.	PI 20302
Date	08-04-2024
Technicien	M.M

Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,18 in. H2O
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=
0,953

Pour un tunnel moins de 12", prendre 4 lectures

	TUNNEL VELOCITY	TUNNEL TEMP	SQUARE ROOT
	In. wc	°F	
A center	0,075	67,57	0,2739
B center	0,075	67,6	0,2739
A1	0,062	67,57	0,2490
A2	0,070	67,58	0,2646
A3	0,073	67,58	0,2702
A4	0,061	67,62	0,2470
B1	0,061	67,6	0,2470
B2	0,071	67,7	0,2665
B3	0,072	67,7	0,2683
B4	0,062	67,7	0,2490
AVERAGE	0,0682	67,6110	0,2609

Project nu.	PI 20302
Date	08-04-2024
Technicien	M.M

Filter set weight

	System 1 (g) 1st hour			System 1 (g)			System 2 (g)			Ambient blank (g)	Date	Heure	Test end date & time
	probe	front/ Back	gasket	probe	front/ Back	gasket	probe	front/ Back	gasket	Filter			
Number	06	06-07	1	16	08-09	6	36	10-11	8	12			
Before (1)													
Before (2)													
Before (3)													
Before (4)													
Before (5)	61,3717	0,2685	3,2951	108,7510	0,2680	5,0371	107,7230	0,2645	4,1558	0,1317	2024-04-04	17:00	
Before (6)	61,3716	0,2686	3,2950	108,7511	0,2679	5,0370	107,7229	0,2646	4,1557	0,1318	2024-04-08	09:00	
After (1)	61,3717	0,2702	3,2965	108,7512	0,2686	5,0388	107,7231	0,2663	4,1573	0,1320	2024-04-08	14:30	2024-04-08 14:00
After (2)	61,3717	0,2700	3,2951	108,7512	0,2685	5,0383	107,7230	0,2662	4,1562	0,1319	2024-04-15	09:00	
After (3)	61,3717	0,2700	3,2951	108,7512	0,2685	5,0383	107,7230	0,2662	4,1562	0,1319	2024-04-16	10:00	
After (4)													
After (5)													
After (6)	61,3717	0,2700	3,2951	108,7512	0,2685	5,0383	107,7230	0,2662	4,1562	0,1319	2024-04-16	10:00	
Difference	0,0001	0,0014	0,0001	0,0001	0,0006	0,0013	0,0001	0,0016	0,0005	0,0001			
Total (mg)		1,6			2			2,2		0,1			
Total ajusté (mg)		1,50			1,90			2,10					

Project nu.

Date

Technicien

PI 20302

08-04-2024

M.M

Manufacturer: SPARTHERM
Model: 700

Run: 1
Project #: PI 20302
Test Duration: 124 min

Note: In the "Input data", "Calc. % O₂", "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

Overall Heating Efficiency: 65,88%
Combustion Efficiency: 98,34%
Heat Transfer Efficiency: 66,99%

	HHV	LHV
Eff	65,88%	71,20%
Comb Eff	98,34%	98,34%
HT Eff	66,99%	72,40%
Output	25 584	kJ/h
Burn Rate	1,96	kg/h
Grams CO	117	g
Input	38 836	kJ/h
MC wet	16,64	

Ultimate CO₂
CO_{2-ult} 19,64
F₀
1,061

Heat Output:	24 269 Btu/h
Heat Input:	36 840 Btu/h
Burn Duration:	2,07 h
Burn Rate:	4,32 lb/h
Stack Temp:	501,6 Deg. F

	Averages		0,32	7,52	1,80	20,42	12,74	260,81	22,38	0,96	0,67	0,64
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 (°C)	Room Temp (°C)	Eff %	Transfer %	Eff %	
0,00	4,86	0,13	3,03	521,9%	20,73	17,64	253,8	21,7	98,1%	41,6%	40,9%	
1,00	4,75	0,18	2,38	668,3%	20,77	18,31	278,3	21,6	96,1%	23,1%	22,1%	
2,00	4,62	0,16	6,12	212,6%	20,53	14,32	286,1	21,5	98,9%	60,9%	60,0%	
3,00	4,57	0,15	8,20	135,4%	20,39	12,12	293,1	21,5	98,9%	66,9%	66,1%	
4,00	4,48	0,08	9,35	108,3%	20,32	10,93	297,8	21,6	99,7%	69,0%	68,8%	
5,00	4,39	0,06	9,84	98,3%	20,29	10,41	301,4	21,6	99,8%	69,6%	69,5%	
6,00	4,35	0,05	10,14	92,7%	20,27	10,10	303,9	21,5	99,8%	69,9%	69,8%	
7,00	4,25	0,06	10,23	91,0%	20,26	10,00	308,3	21,7	99,8%	69,8%	69,7%	
8,00	4,16	0,06	11,05	76,7%	20,21	9,12	314,4	21,8	99,8%	70,6%	70,5%	
9,00	4,07	0,06	11,11	75,9%	20,20	9,07	317,7	21,8	99,8%	70,5%	70,3%	
10,00	4,03	0,06	11,24	73,9%	20,19	8,93	320,0	21,8	99,8%	70,5%	70,4%	
11,00	3,94	0,05	11,30	73,0%	20,19	8,86	322,1	21,8	99,9%	70,5%	70,4%	
12,00	3,85	0,05	11,15	75,3%	20,20	9,02	322,3	21,9	99,9%	70,3%	70,2%	
13,00	3,76	0,05	11,02	77,4%	20,21	9,16	322,4	21,9	99,9%	70,1%	70,0%	
14,00	3,71	0,05	10,99	77,9%	20,21	9,20	322,5	21,9	99,9%	70,0%	69,9%	
15,00	3,62	0,04	10,91	79,4%	20,22	9,29	322,9	21,9	99,9%	69,8%	69,8%	
16,00	3,53	0,04	11,03	77,4%	20,21	9,16	324,0	21,9	99,9%	70,0%	69,9%	
17,00	3,44	0,04	11,07	76,7%	20,21	9,11	324,5	21,8	99,9%	70,0%	69,9%	
18,00	3,35	0,05	11,22	74,3%	20,20	8,95	325,7	21,9	99,9%	70,1%	70,0%	
19,00	3,30	0,05	11,23	74,1%	20,20	8,94	326,4	22,0	99,9%	70,1%	70,0%	
20,00	3,21	0,05	11,35	72,3%	20,19	8,81	327,2	21,9	99,9%	70,2%	70,1%	
21,00	3,12	0,05	11,35	72,3%	20,19	8,81	328,4	22,1	99,9%	70,1%	70,0%	
22,00	3,06	0,05	11,25	73,8%	20,19	8,92	327,1	22,2	99,9%	70,1%	70,0%	
23,00	2,98	0,05	11,09	76,4%	20,20	9,09	325,7	22,3	99,9%	69,9%	69,9%	
24,00	2,89	0,04	11,04	77,2%	20,21	9,14	325,0	22,3	99,9%	69,9%	69,9%	
25,00	2,85	0,04	10,96	78,5%	20,21	9,23	324,4	22,4	99,9%	69,9%	69,8%	
26,00	2,76	0,04	10,99	78,0%	20,21	9,20	324,3	22,4	99,9%	69,9%	69,9%	
27,00	2,71	0,04	11,09	76,5%	20,21	9,09	324,7	22,4	99,9%	70,0%	70,0%	
28,00	2,62	0,04	11,12	76,0%	20,20	9,06	324,7	22,3	100,0%	70,1%	70,0%	
29,00	2,54	0,04	11,14	75,7%	20,20	9,04	324,9	22,5	99,9%	70,1%	70,1%	
30,00	2,48	0,04	11,17	75,3%	20,20	9,01	325,3	22,3	100,0%	70,1%	70,1%	
31,00	2,42	0,04	11,16	75,5%	20,20	9,03	325,3	22,5	100,0%	70,1%	70,1%	
32,00	2,35	0,04	11,19	74,9%	20,20	8,99	324,8	22,5	100,0%	70,2%	70,2%	
33,00	2,26	0,04	11,20	74,8%	20,20	8,98	325,5	22,5	100,0%	70,2%	70,1%	
34,00	2,21	0,04	11,27	73,7%	20,19	8,90	326,7	22,5	99,9%	70,2%	70,1%	
35,00	2,12	0,04	11,40	71,7%	20,18	8,77	327,0	22,4	99,9%	70,3%	70,3%	
36,00	2,08	0,04	11,52	69,9%	20,18	8,64	328,0	22,5	99,9%	70,4%	70,4%	
37,00	2,03	0,04	11,47	70,6%	20,18	8,69	327,1	22,6	99,9%	70,4%	70,4%	
38,00	1,94	0,04	10,98	78,3%	20,21	9,21	324,1	22,6	100,0%	69,9%	69,9%	
39,00	1,89	0,03	10,43	87,8%	20,25	9,80	320,6	22,4	100,0%	69,3%	69,3%	
40,00	1,85	0,03	10,17	92,7%	20,27	10,09	318,5	22,4	100,1%	69,0%	69,0%	
41,00	1,76	0,03	10,00	95,8%	20,28	10,26	316,4	22,5	100,1%	68,9%	68,9%	
42,00	1,71	0,03	9,94	97,0%	20,28	10,33	315,3	22,6	100,1%	68,8%	68,9%	
43,00	1,67	0,03	9,89	98,0%	20,29	10,38	313,6	22,6	100,1%	68,9%	68,9%	
44,00	1,62	0,03	9,74	101,2%	20,30	10,54	311,5	22,6	100,1%	68,8%	68,8%	
45,00	1,58	0,03	9,66	102,8%	20,30	10,63	310,0	22,6	100,1%	68,7%	68,8%	
46,00	1,53	0,02	9,59	104,3%	20,31	10,70	308,9	22,5	100,1%	68,7%	68,7%	
47,00	1,49	0,02	9,56	105,0%	20,31	10,74	307,7	22,5	100,1%	68,7%	68,8%	
48,00	1,44	0,02	9,52	105,8%	20,31	10,77	306,5	22,7	100,1%	68,7%	68,8%	
49,00	1,39	0,02	9,48	106,7%	20,31	10,82	305,3	22,5	100,1%	68,7%	68,8%	
50,00	1,35	0,02	9,41	108,2%	20,32	10,90	303,4	22,5	100,1%	68,7%	68,8%	
51,00	1,30	0,03	9,35	109,6%	20,32	10,96	301,3	22,6	100,1%	68,8%	68,9%	
52,00	1,26	0,03	9,07	115,9%	20,34	11,26	297,7	22,7	100,1%	68,5%	68,6%	
53,00	1,21	0,03	8,75	123,7%	20,36	11,59	294,3	22,4	100,1%	68,1%	68,2%	
54,00	1,17	0,03	8,49	130,3%	20,38	11,87	291,0	22,7	100,1%	67,9%	67,9%	
55,00	1,13	0,04	8,31	135,2%	20,39	12,06	287,2	22,6	100,0%	67,8%	67,8%	
56,00	1,12	0,04	8,03	143,2%	20,41	12,35	282,9	22,7	100,0%	67,5%	67,5%	
57,00	1,08	0,05	7,69	153,7%	20,43	12,71	278,0	22,7	99,9%	67,1%	67,0%	
58,00	1,06	0,07	7,38	163,8%	20,45	13,04	273,5	22,2	99,7%	66,6%	66,4%	
59,00	1,03	0,08	7,25	168,1%	20,46	13,17	269,5	22,1	99,6%	66,6%	66,3%	
60,00	0,99	0,10	6,97	178,0%	20,47	13,46	265,7	22,3	99,4%	66,2%	65,8%	
61,00	0,99	0,12	6,89	180,4%	20,48	13,53	262,7	22,3	99,1%	66,2%	65,6%	
62,00	0,94	0,14	6,82	182,2%	20,48	13,59	259,7	22,4	98,9%	66,3%	65,6%	
63,00	0,94	0,16	6,77	183,2%	20,48	13,63	257,2	22,5	98,6%	66,5%	65,5%	
64,00	0,90	0,18	6,68	186,3%	20,49	13,72	254,1	22,5	98,3%	66,5%	65,4%	
65,00	0,86	0,20	6,60	188,9%	20,49	13,79	251,7	22,5	98,1%	66,5%	65,2%	
66,00	0,85	0,21	6,57	189,7%	20,49	13,82	249,4	22,5	97,9%	66,5%	65,2%	
67,00	0,85	0,22	6,53	190,8%	20,49	13,85	247,2	22,5	97,8%	66,7%	65,2%	
68,00	0,80	0,23	6,51	191,4%	20,49	13,87	245,5	22,5	97,7%	66,8%	65,3%	
69,00	0,79	0,24	6,49	192,0%	20,50	13,89	243,8	22,5	97,6%	67,0%	65,4%	
70,00	0,76	0,25	6,46	193,0%	20,50	13,92	242,0	22,6	97,5%	67,0%	65,4%	
71,00	0,71	0,25	6,42	194,3%	20,50	13,95	241,0	22,5	97,4%	67,0%	65,3%	
72,00	0,71	0,25	6,47	192,1%	20,50	13,90	240,2	22,5	97,4%	67,3%	65,6%	
73,00	0,71	0,25	6,51	190,7%	20,49	13,86	239,5	22,5	97,5%	67,5%	65,7%	
74,00	0,67	0,25	6,52	190,2%	20,49	13,85	238,7	22,6	97,5%	67,6%	65,9%	
75,00	0,64	0,25	6,52	190,1%	20,49	13,85	237,9	22,6	97,5%	67,7%	66,0%	
76,00	0,62	0,25	6,52	190,0%	20,49	13,85	237,1	22,6	97,5%	67,8%	66,1%	
77,00	0,58	0,24	6,54	189,7%	20,49	13,83	237,3	22,6	97,6%	67,8%	66,2%	
78,00	0,58	0,23	6,54	190,0%	20,49	13,84	236,9	22,6	97,7%	67,8%	66,3%	
79,00	0,53	0,22	6,58	188,8%	20,49	13,80	236,9	22,6	97,8%	68,0%	66,5%	
80,00	0,53	0,22	6,61	187,5%	20,49	13,77	236,8	22,5	97,9%	68,1%	66,6%	
81,00	0,53	0,21	6,70	184,3%	20,48	13,68	237,5	22,5	98,0%	68,2%	66,9%	
82,00	0,49	0,20	6,86	178,1%	20,47	13,51	238,6	22,6	98,2%	68,6%	67,3%	
83,00	0,44	0,19	6,90	177,0%	20,47	13,48	238,5	22,6	98,2%	68,7%	67,5%	
84,00	0,44	0,21	6,73	183,0%	20,48	13,65	236,9	22,6	98,0%	68,4%	67,0%	
85,00	0,40	0,26	6,37	196,1%	20,50	14,00	235,3	22,6	97,3%	67,5%	65,7%	
86,00	0,40	0,32	5,88	216,7%	20,53	14,49	231,6	22,6	96,3%	66,3%	63,8%	
87,00	0,40	0,40	5,55	230,2%	20,55	14,80	227,4	22,6	95,1%	65,5%	62,3%	
88,00	0,40	0,47	5,32	239,1%	20,56	15,00	223,1	22,6	93,9%	65,1%	61,1%	
89,00	0,35	0,54	5,04	251,9%	20,57	15,26	219,1	22,6	92,6%	64,4%	59,6%	
90,00	0,35	0,59	4,82	263,0%	20,58	15,46	215,2	22,6	91,7%	63,9%	58,6%	
91,00	0,35	0,62	4,66	272,1%	20,59	15,62	212,0	22,6	91,0%	63,6%	57,8%	
92,00	0,30	0,65	4,59	274,4%	20,59	15,67	209,0	22,5	90,4%	63,6%	57,5%	

93,00	0,30	0,68	4,56	275,0%	20,59	15,69	206,7	22,5	90,0%	63,8%	57,4%
94,00	0,30	0,69	4,56	273,9%	20,59	15,69	204,8	22,6	89,8%	64,1%	57,5%
95,00	0,28	0,71	4,54	273,6%	20,59	15,69	203,0	22,6	89,5%	64,2%	57,5%
96,00	0,26	0,73	4,48	276,9%	20,60	15,75	201,2	22,5	89,1%	64,1%	57,2%
97,00	0,26	0,75	4,42	280,2%	20,60	15,81	199,8	22,2	88,8%	64,0%	56,8%
98,00	0,26	0,69	4,50	278,2%	20,60	15,75	199,4	22,5	89,7%	64,5%	57,9%
99,00	0,26	0,61	4,65	273,8%	20,59	15,64	199,2	22,6	91,2%	65,3%	59,5%
100,00	0,23	0,61	4,65	273,5%	20,59	15,64	198,4	22,6	91,1%	65,4%	59,6%
101,00	0,22	0,63	4,64	272,4%	20,59	15,63	197,3	22,6	90,8%	65,5%	59,5%
102,00	0,22	0,66	4,61	272,7%	20,59	15,65	196,3	22,6	90,3%	65,5%	59,1%
103,00	0,21	0,67	4,52	278,4%	20,60	15,74	194,6	22,6	90,0%	65,3%	58,8%
104,00	0,17	0,73	4,32	289,1%	20,61	15,92	192,5	22,6	88,9%	64,6%	57,4%
105,00	0,17	0,78	4,27	289,2%	20,61	15,95	191,1	22,6	88,0%	64,5%	56,8%
106,00	0,17	0,81	4,25	288,1%	20,61	15,95	190,0	22,6	87,5%	64,6%	56,5%
107,00	0,17	0,84	4,25	286,2%	20,60	15,94	188,8	22,6	87,1%	64,8%	56,4%
108,00	0,12	0,87	4,24	284,3%	20,60	15,92	187,9	22,6	86,8%	64,9%	56,3%
109,00	0,12	0,90	4,26	280,8%	20,60	15,89	186,8	22,6	86,4%	65,1%	56,3%
110,00	0,12	0,92	4,25	280,2%	20,60	15,89	185,7	22,7	86,1%	65,2%	56,2%
111,00	0,12	0,94	4,17	284,5%	20,60	15,96	184,2	22,6	85,6%	65,1%	55,7%
112,00	0,12	0,97	4,13	285,5%	20,60	15,99	183,3	22,6	85,1%	65,0%	55,3%
113,00	0,08	0,99	4,11	285,4%	20,60	16,00	182,5	22,5	84,8%	65,0%	55,1%
114,00	0,09	1,00	4,11	284,7%	20,60	15,99	181,7	22,6	84,7%	65,1%	55,1%
115,00	0,08	1,01	4,08	285,9%	20,60	16,02	181,0	22,5	84,4%	65,0%	54,9%
116,00	0,08	1,01	3,95	295,9%	20,61	16,16	179,7	22,5	84,0%	64,5%	54,2%
117,00	0,08	1,03	3,87	301,3%	20,62	16,23	178,7	22,4	83,6%	64,2%	53,7%
118,00	0,03	1,05	3,86	300,2%	20,62	16,23	177,8	22,4	83,3%	64,3%	53,6%
119,00	0,03	1,06	3,85	299,9%	20,62	16,23	176,9	22,5	83,1%	64,4%	53,5%
120,00	0,03	1,08	3,86	298,3%	20,61	16,22	176,1	22,6	82,9%	64,6%	53,5%
121,00	0,03	1,09	3,84	298,9%	20,61	16,23	175,4	22,6	82,7%	64,6%	53,4%
122,00	0,03	1,09	3,83	299,7%	20,62	16,24	175,1	22,5	82,7%	64,6%	53,4%
123,00	0,03	1,08	3,82	301,2%	20,62	16,26	174,4	22,4	82,7%	64,6%	53,4%
124,00	0,00	1,10	3,83	298,9%	20,61	16,24	173,8	22,5	82,5%	64,8%	53,5%

SFBA EPA EMISSION RESULTS

RESULTS

Average emission rate: 1,88 g/hr

Test Duration: 124 min

Burn Rate : 1,96 Dry kg/hr

PRESSURE FACTOR: DGM 1st hr 0,965
 DGM 1 0,966
 DGM 2 0,965
 DGM 3 0,995

BAROMETRIC PRESSURE

Average: 29,78099379 in Hg
 Start: 29,7662288 in Hg
 End: 29,79575878 in Hg

TEMPERATURE FACTORS DGM 1st hr 0,991
 DGM 1 0,991
 DGM 2 0,984
 DGM 3 0,992

DGM VALUES

DGM 1st hr Final: 589,510 Cuft
 Initial: 577,530 Cuft

VOLUMES SAMPLED DGM 1st hr 11,302 SCft
 DGM 1 21,531 SCft
 DGM 2 22,569 SCft
 DGM 3 17,832 SCft

DGM 1 Final: 33747,943 Cuft
 Initial: 33725,122 Cuft

DGM 2 Final: 24928,734 Cuft
 Initial: 24905,031 Cuft

TOTAL TUNNEL VOLUME : 43469

DGM #3 Final: 17280,611 Cuft
 Initial: 17262,259 Cuft

SAMPLE RATIOS

Sample Train 1st Hr: 1861,0
 Sample Train 1: 2018,9
 Sample Train 2: 1926,0

TEMPERATURES

DGM 1st hr 532,787 °R
 DGM 1 532,974 °R
 DGM 2 536,467 °R

Particulate concentration

Sample Train 1st Hr **0,000142** g/dscf
 Sample Train 1 **0,000093** g/dscf
 Sample Train 2 **0,000097** g/dscf
 Room **0,000006** g/dscf

CALIBRATION FACTORS

DGM 1st hr 0,9869
 DGM 1 0,9862
 DGM 2 1,0026
 DGM #3 0,9842

TOTAL EMISSIONS

Sample Train 1st Hr **2,86** g
 Sample Train 1 **3,79** g
 Sample Train 2 **3,99** g

TUNNEL FLOW RATE: 350,6 Dscfm

PARTICULATE CATCH

Total Sample Train 1: 2,00 mg
 Total Sample Train 2: 2,20 mg
 Total Sample Train 1 1st hour: 1,60 mg

EMISSION RATES

Sample Train 1st Hr **2,86** g/hr
 Sample Train 1 **1,84** g/hr
 Sample Train 2 **1,93** g/hr

DEVIATION: 2,56%

Cs Train 1 Train 2 Train 1st Hr
 9,289E-05 9,7478E-05 0,0001416

* Elapsed Time min	Raw data row	Weight Remaining lbs	* CO %	* CO ₂ %	*1 Room Temp °F	*2 Room Temp °F	*3 Tunnel Dry Bulb °F	*4 Unit Top °F	*5 Unit Back °F	*6 Unit R-Side °F	*7 Unit L-Side °F	*8 Unit Bottom °F	Mass flow Reading cuft/min	DGM 1st hour Inlet 1st hour °F	DGM 1st hour Inlet 1st hour °F	Filter Temp °F	DGM 1 Reading cuft/min	DGM 1 Inlet 1st hour °F	DGM 1 Outlet 1st hour °F	Filter 1 Temp °F	Mass flow 2 Reading cuft/min	DGM 2 Inlet 1st hour °F	DGM 2 Outlet 1st hour °F	Filter 2 Temp °F	Tunnel Velocity in wc	Flue draft in wc	Filter 1st hr in. Hg	Filter 1 in. Hg	Filter 2 in. Hg	Change in Surface Temp °F
0	195.00	10.7	0.1	3.0	488.9	71.1	143.4	719.1	216.7	410.1	424.6	315.4	0.19	71.1	71.7	86.8	0.18	71.4	70.8	87.5	0.18	71.3	71.1	83.2	0.08	0.07	-0.88	-0.88	-0.85	0.0
1	196.0	10.5	2.4	2.4	549.2	70.9	156.7	699.2	225.4	409.2	317.7	317.1	0.19	71.1	72.2	87.5	0.18	71.9	70.9	86.1	0.18	71.1	71.1	83.1	0.08	0.07	-0.87	-0.90	-0.85	-2.9
2	197.0	10.2	0.2	6.1	547.0	70.6	115.3	643.1	206.7	410.1	433.1	321.6	0.19	71.1	72.2	89.0	0.18	71.4	70.8	88.9	0.18	71.6	71.2	82.9	0.08	0.09	-0.86	-0.90	-0.84	-0.5
3	198.0	10.1	0.1	8.2	559.5	70.7	109.6	653.1	203.9	409.5	435.2	324.1	0.19	71.1	72.3	87.9	0.18	71.4	70.8	87.9	0.18	71.7	71.3	82.7	0.08	0.09	-0.85	-0.90	-0.85	-12.0
4	199.0	9.4	0.0	11.1	568.0	70.8	110.2	659.1	202.4	399.9	427.1	325.9	0.19	71.2	72.4	87.1	0.18	71.6	70.8	86.6	0.18	71.4	70.9	81.4	0.08	0.09	-0.84	-0.89	-0.84	-16.6
5	200.0	9.7	0.1	9.8	574.6	70.9	108.5	644.6	202.4	406.1	434.3	326.6	0.19	71.1	72.4	87.1	0.18	71.5	70.8	87.1	0.18	71.7	71.5	82.4	0.08	0.09	-0.85	-0.90	-0.85	-14.4
6	201.0	9.6	0.1	10.1	579.0	70.7	108.5	645.1	203.4	404.2	432.5	329.0	0.19	71.2	72.5	87.0	0.18	71.5	70.8	86.9	0.18	72.3	71.6	82.3	0.08	0.09	-0.85	-0.89	-0.85	-14.3
7	202.0	9.4	0.1	10.2	587.0	71.0	109.1	647.9	202.1	402.0	429.9	329.3	0.19	71.2	72.5	87.0	0.18	71.6	70.8	86.7	0.18	72.5	71.7	82.2	0.08	0.09	-0.85	-0.90	-0.85	-14.9
8	203.0	9.0	0.2	11.1	598.2	71.2	110.2	658.2	201.2	398.2	427.1	329.2	0.19	71.2	72.6	87.1	0.18	71.6	70.8	86.6	0.18	72.6	71.9	82.5	0.08	0.09	-0.86	-0.89	-0.85	-19.6
9	204.0	9.0	0.1	11.1	603.9	71.2	111.1	659.6	202.8	397.7	424.5	329.6	0.19	71.2	72.7	87.2	0.18	71.6	70.8	86.5	0.18	73.0	72.0	82.1	0.08	0.09	-0.86	-0.89	-0.85	-14.4
10	205.0	8.9	0.1	11.2	608.1	71.3	111.3	667.2	202.3	395.8	422.5	328.7	0.19	71.2	72.9	87.3	0.18	71.6	70.9	86.4	0.18	73.3	72.2	82.0	0.08	0.09	-0.85	-0.89	-0.85	-13.9
11	206.0	8.7	0.1	11.3	611.8	71.4	111.4	675.1	202.5	394.9	420.6	327.9	0.19	71.2	73.0	87.4	0.18	71.7	70.9	86.4	0.18	73.5	72.3	82.0	0.08	0.09	-0.86	-0.89	-0.85	-13.1
12	207.0	8.5	0.0	11.2	612.2	71.4	111.4	683.1	203.2	393.0	419.3	327.5	0.19	71.3	73.1	87.5	0.18	71.7	70.9	86.2	0.18	73.7	72.4	81.9	0.08	0.09	-0.86	-0.90	-0.85	-12.0
13	208.0	8.3	0.0	11.0	612.3	71.5	111.2	690.0	202.2	392.1	418.0	326.7	0.19	71.3	73.1	87.5	0.18	71.7	70.9	86.2	0.18	73.9	72.6	81.9	0.08	0.09	-0.86	-0.90	-0.85	-11.4
14	209.0	8.2	0.0	11.0	612.4	71.9	111.5	695.8	201.7	391.6	416.8	325.2	0.19	71.3	73.2	87.9	0.18	71.8	70.9	86.1	0.18	74.1	72.7	81.9	0.08	0.09	-0.86	-0.89	-0.85	-10.9
15	210.0	8.0	0.0	10.9	613.2	71.4	111.1	700.8	200.6	391.6	416.2	323.2	0.19	71.3	73.2	87.6	0.18	71.9	71.0	86.0	0.18	74.3	72.9	81.9	0.08	0.09	-0.86	-0.89	-0.86	-10.7
16	211.0	7.8	0.0	11.0	615.3	71.5	111.4	705.7	201.0	391.8	416.1	323.6	0.19	71.4	73.3	87.7	0.18	72.0	71.0	85.9	0.18	74.4	73.1	81.8	0.08	0.09	-0.86	-0.89	-0.85	-9.5
17	212.0	7.6	0.0	11.1	616.1	71.2	111.8	709.8	200.6	392.3	415.3	323.2	0.19	71.4	73.3	87.7	0.18	72.0	71.0	85.9	0.18	74.6	73.2	81.8	0.08	0.09	-0.87	-0.90	-0.86	-9.0
18	213.0	7.4	0.0	11.2	618.3	71.4	111.7	713.7	201.1	392.3	414.9	323.0	0.19	71.4	73.4	87.8	0.18	72.2	71.1	85.8	0.18	74.8	73.4	81.8	0.08	0.09	-0.87	-0.89	-0.85	-8.2
19	214.0	7.3	0.0	11.2	619.5	71.7	111.3	718.9	199.8	392.3	414.8	320.9	0.19	71.4	73.4	87.8	0.18	72.3	71.1	85.7	0.18	75.1	73.5	81.7	0.08	0.09	-0.88	-0.90	-0.86	-7.8
20	215.0	7.1	0.0	11.4	621.0	71.3	111.7	722.7	200.0	393.5	415.7	321.1	0.19	71.5	73.5	87.8	0.18	72.5	71.2	85.7	0.18	75.3	73.7	81.7	0.08	0.09	-0.87	-0.89	-0.86	-6.6
21	216.0	6.9	0.0	11.3	623.1	71.8	111.1	726.3	198.5	394.4	416.4	317.9	0.19	71.5	73.5	87.9	0.18	72.6	71.3	85.7	0.18	75.5	73.9	81.7	0.08	0.09	-0.87	-0.89	-0.87	-6.4
22	217.0	6.7	0.0	11.3	620.8	71.9	112.3	730.4	198.5	395.8	417.5	317.6	0.19	71.6	73.6	87.9	0.18	72.7	71.3	85.7	0.18	75.6	73.9	81.7	0.08	0.09	-0.87	-0.90	-0.86	-5.2
23	218.0	6.6	0.0	11.1	618.3	72.1	112.3	733.2	198.0	397.2	418.6	316.8	0.19	71.6	73.7	88.0	0.18	72.8	71.4	85.7	0.18	75.8	74.1	81.7	0.08	0.09	-0.87	-0.89	-0.86	-4.4
24	219.0	6.5	0.0	11.0	617.1	72.1	112.5	735.5	197.5	397.5	418.5	316.7	0.19	71.7	73.7	88.1	0.18	72.9	71.5	85.7	0.18	75.9	74.2	81.7	0.08	0.09	-0.87	-0.89	-0.87	-3.7
25	220.0	6.3	0.0	11.0	616.0	72.2	112.1	736.8	197.4	400.5	420.4	314.8	0.19	71.7	73.8	88.2	0.18	72.9	71.5	85.7	0.18	76.1	74.4	81.8	0.08	0.09	-0.88	-0.89	-0.87	-3.2
26	221.0	6.1	0.0	11.0	615.7	72.2	112.0	738.2	197.2	401.9	422.0	314.0	0.19	71.7	73.8	88.3	0.18	72.9	71.5	85.7	0.18	76.3	74.5	81.8	0.08	0.09	-0.89	-0.89	-0.88	-2.5
27	222.0	6.0	0.0	11.1	616.4	72.2	112.5	739.7	196.9	403.4	422.7	313.1	0.19	71.7	73.8	88.4	0.18	73.0	71.6	85.7	0.18	76.4	74.6	81.8	0.08	0.09	-0.89	-0.89	-0.87	-2.0
28	223.0	5.9	0.0	11.1	617.0	72.2	112.6	741.0	196.8	404.2	423.0	312.0	0.19	71.8	73.9	88.5	0.18	73.1	71.7	85.7	0.18	76.5	74.7	81.9	0.08	0.09	-0.90	-0.89	-0.88	-1.5
29	224.0	5.6	0.0	11.1	616.7	72.5	112.8	743.6	195.6	406.3	425.0	311.2	0.19	71.8	73.9	88.5	0.18	73.1	71.7	85.7	0.18	76.6	74.8	81.9	0.08	0.09	-0.90	-0.89	-0.88	-0.8
30	225.0	5.5	0.0	11.2	617.6	72.1	112.5	745.7	196.9	407.7	426.0	310.9	0.19	71.8	74.0	88.6	0.18	73.2	71.7	85.7	0.18	76.8	75.0	81.9	0.08	0.09	-0.91	-0.90	-0.88	0.3
31	226.0	5.5	0.0	11.2	618.2	72.2	112.5	748.2	196.5	408.2	427.4	310.0	0.19	71.9	74.1	88.7	0.18	73.3	71.8	85.7	0.18	77.0	75.2	81.9	0.08	0.09	-0.91	-0.89	-0.88	1.5
32	227.0	5.2	0.0	11.2	616.7	72.6	112.1	750.4	196.7	410.3	428.6	310.1	0.19	71.9	74.1	88.7	0.18	73.3	71.8	85.7	0.18	77.0	75.2	81.9	0.08	0.09	-0.92	-0.90	-0.89	2.1
33	228.0	5.0	0.0	11.2	617.9	72.5	112.2	752.4	196.2	411.6	429.7	308.7	0.19	71.9	74.1	88.7	0.18	73.3	71.8	85.7	0.18	77.1	75.3	82.0	0.08	0.09	-0.93	-0.90	-0.90	2.5
34	229.0	4.9	0.0	11.3	620.1	72.4	112.9	755.0	195.8	412.8	430.7	307.9	0.19	71.9	74.1	88.8	0.18	73.3	71.9	85.7	0.18	77.1	75.3	82.0	0.08	0.09	-0.93	-0.90	-0.90	3.3
35	230.0	4.7	0.0	11.3	620.2	72.7	113.2	757.2	195.8	413.8	431.6	307.2	0.19	72.0	74.2	88.9	0.18	73.4	72.0	85.8	0.18	77.2	75.4	82.0	0.08	0.09	-0.93	-0.90	-0.90	4.2
36	231.0	4.6	0.0	11.5	622.5	72.6	113.0	760.8	195.9	415.0	433.1	307.3	0.19	72.0	74.2	88.8	0.18	73.5	72.0	85.7	0.18	77.4	75.5	82.0	0.08	0.09	-0.94	-0.90	-0.90	5.2
37	232.0	4.5	0.0	11.5	620.7	72.7	113.2	763.9	196.3	416.4	433.9	306.7	0.19	72.0	74.3	88.9	0.18	73.5	72.0	85.7	0.18	77.4	75.6	82.0	0.08	0.09	-0.94	-0.90	-0.90	6.3
38	233.0	4.3	0.0	11.5	615.3	72.7	112.3	766.7	195.3	417.0	434.2	305.8	0.19	72.1	74.3	88.9	0.18	73.5	72.0	85.7	0.18	77.5	75.6	82.0	0.08	0.09	-0.95	-0.90	-0.90	7.5
39	234.0	4.2	0.0	10.4	609.1	72.3	111.6	759.4	195.4	419.0	436.0	305.5	0.19	72.1	74.4	88.9	0.18	73.4	72.1	85.7	0.18	77.6	75.7	82.1	0.08	0.09	-0.95	-0.90	-0.91	7.4
40	235.0	4.1	0.0	10.2	605.3	72.3	110.6	765.3	195.6	420.1	436.5	304.3	0.19	72.1	74.4	88.8	0.18	73.6	72.1	85.6	0.18	77.5	75.9	82.1	0.08	0.09	-0.96	-0.91	-0.91	7.2
41	236.0	4.0	0.0	9.9	604.9	72.7	110.6	767.7	195.6	421.6	437.6	304.2	0.19	72.2	74.5	88.9</														

115	310,0	0,2	1,0	4,1	357,8	72,5	91,3	413,2	214,0	365,1	371,6	313,9	0,00	72,5	72,4	83,5	0,18	74,3	73,6	82,9	0,18	78,8	76,5	81,3	0,08	0,06	-0,02	-0,87	-0,94	-81,6
116	311,0	0,2	1,0	4,0	355,5	72,5	91,3	410,5	213,5	363,8	371,3	314,4	0,00	72,5	72,4	83,3	0,18	74,3	73,7	82,8	0,18	78,9	76,5	81,2	0,08	0,06	-0,02	-0,88	-0,94	-82,5
117	312,0	0,2	1,0	3,9	353,7	72,4	91,2	408,0	213,3	362,3	370,2	314,5	0,00	72,5	72,4	83,0	0,18	74,2	73,7	83,4	0,18	78,9	76,6	81,1	0,08	0,06	-0,02	-0,87	-0,92	-83,5
118	313,0	0,1	1,0	3,9	352,1	72,3	90,9	405,3	212,3	361,0	368,5	314,2	0,00	72,5	72,4	82,7	0,18	74,2	73,7	86,4	0,18	78,9	76,6	81,0	0,08	0,06	-0,02	-0,88	-0,94	-84,9
119	314,0	0,1	1,1	3,9	350,4	72,5	90,9	402,9	211,2	359,6	368,2	314,3	0,00	72,5	72,4	82,4	0,18	74,2	73,7	87,2	0,18	78,8	76,5	82,8	0,08	0,06	-0,02	-0,88	-0,94	-85,9
120	315,0	0,1	1,1	3,9	348,9	72,6	90,8	400,5	211,0	358,5	367,4	314,2	0,00	72,5	72,4	82,2	0,18	74,2	73,7	87,0	0,18	78,9	76,6	85,0	0,08	0,06	-0,02	-0,89	-0,95	-86,8
121	316,0	0,1	1,1	3,8	347,7	72,6	90,6	398,1	210,2	357,5	366,4	313,5	0,00	72,5	72,4	81,9	0,18	74,2	73,7	86,7	0,18	78,9	76,6	85,4	0,08	0,06	-0,02	-0,88	-0,94	-88,0
122	317,0	0,1	1,1	3,8	347,2	72,5	90,4	395,8	210,0	356,5	365,6	312,7	0,00	72,5	72,4	81,7	0,18	74,2	73,7	86,4	0,18	78,9	76,6	85,2	0,08	0,06	-0,02	-0,88	-0,94	-89,1
123	318,0	0,1	1,1	3,8	345,9	72,4	90,4	393,4	209,2	355,3	363,8	313,2	0,00	72,5	72,4	81,5	0,18	74,2	73,7	86,1	0,18	78,9	76,6	85,1	0,08	0,06	-0,02	-0,88	-0,94	-90,2
124	319,0	0,0	1,1	3,8	344,9	72,6	90,7	391,1	209,0	354,2	363,3	314,5	0,00	72,5	72,4	82,4	0,18	74,3	73,8	85,8	0,18	79,0	76,6	84,9	0,08	0,06	-0,02	-0,87	-0,93	-90,8

Time acquisition minutes	Flue temp °F	Room temp °F	scale lbs	Right °F	Back °F	bottom °F	Top °F	Left °F
1	67,99	67,83	4,27	67,91	67,02	67,39	68,17	67,59
2	83,52	67,99	4,17	67,93	67,07	67,42	68,57	67,60
3	99,57	67,93	4,17	67,93	67,08	67,45	68,92	67,60
4	190,36	68,00	3,98	67,96	67,18	67,62	69,25	67,71
5	257,56	67,86	3,87	68,08	67,24	67,89	71,89	67,98
6	328,29	67,79	3,69	68,45	67,29	68,43	78,47	68,73
7	406,84	67,86	3,48	69,18	67,49	69,20	90,74	70,28
8	472,58	68,10	3,27	70,31	67,84	70,27	110,93	72,90
9	515,81	68,01	3,16	71,99	68,19	71,63	139,49	76,71
10	553,99	68,01	2,87	74,27	68,72	73,30	176,83	82,00
11	580,72	68,10	2,68	77,25	69,53	75,39	221,77	88,93
12	579,94	68,15	2,47	80,90	70,53	77,94	271,24	97,54
13	579,84	68,33	2,27	85,48	71,54	80,99	318,61	106,87
14	562,15	68,36	2,17	90,62	72,92	84,59	361,42	116,11
15	542,34	68,42	1,98	96,50	74,56	89,03	397,56	124,44
16	521,08	68,67	1,87	102,75	76,25	94,22	424,25	133,42
17	506,17	68,48	1,77	109,19	78,09	99,77	443,34	142,96
18	502,19	68,48	1,67	115,86	80,46	106,17	456,79	152,13
19	497,34	68,51	1,57	123,07	82,60	112,94	466,77	162,24
20	497,53	68,76	1,47	130,65	84,62	119,79	473,82	173,04
21	493,16	68,92	1,37	139,17	86,90	126,88	479,53	182,67
22	498,59	68,84	1,27	147,94	88,83	133,89	484,09	191,92
23	504,07	68,98	1,27	157,00	91,48	141,66	489,32	200,29
24	489,52	69,09	6,08	165,08	99,40	148,28	492,66	209,14
25	406,03	69,22	12,98	173,24	104,03	155,23	486,75	216,48
26	397,90	68,98	12,88	180,14	109,35	161,12	475,30	224,41
27	392,40	68,93	12,78	186,41	113,91	166,06	460,20	231,88
28	398,20	68,85	12,58	192,54	118,33	170,94	445,43	237,94
29	461,64	68,70	12,38	198,31	122,36	174,98	431,59	242,07
30	490,01	68,80	12,18	205,88	115,83	180,30	422,30	244,54
31	450,38	68,72	12,08	213,30	115,71	184,21	420,75	245,84
32	416,34	68,85	12,07	219,68	116,14	187,03	419,64	247,31
33	379,89	69,13	11,98	223,92	127,15	185,89	414,08	247,13
34	460,71	68,69	11,78	227,97	132,43	186,94	405,45	246,82
35	545,89	68,99	11,48	233,63	123,43	190,60	402,10	244,66
36	531,94	69,01	11,38	238,81	122,07	192,73	410,53	243,02
37	503,20	69,17	11,28	243,64	121,82	194,66	423,09	241,68
38	480,44	68,81	11,17	249,80	121,56	196,73	433,06	240,91
39	471,61	68,83	10,98	254,68	122,05	199,11	439,05	240,58
40	469,54	69,09	10,88	258,63	122,88	201,42	442,58	239,72
41	476,92	68,79	10,78	263,64	122,95	204,13	444,95	238,85
42	494,68	69,17	10,58	266,88	123,13	206,40	449,09	237,48
43	517,00	69,23	10,47	270,12	123,56	208,24	457,10	238,34
44	540,46	69,23	10,28	273,41	123,97	210,46	469,35	238,57
45	553,14	69,04	10,08	277,43	124,74	212,49	484,63	238,72
46	564,11	69,42	9,98	279,86	124,92	214,19	502,08	239,56
47	571,59	69,38	9,77	282,68	125,59	216,54	520,65	239,92
48	565,66	69,54	9,58	285,50	125,65	218,73	536,19	241,90
49	564,12	69,41	9,38	289,13	126,99	220,99	548,43	243,48
50	567,28	69,27	9,17	292,73	128,13	223,35	559,63	245,40
51	572,85	69,71	8,98	295,34	128,71	225,33	570,13	248,09
52	586,67	69,69	8,88	299,32	128,94	226,93	581,76	250,49
53	600,24	69,89	8,68	302,93	129,82	229,35	594,77	252,82
54	614,47	69,68	8,47	307,21	130,33	231,53	608,74	255,48
55	618,64	69,98	8,28	310,54	131,87	233,40	622,93	258,15
56	620,69	69,93	8,08	313,80	132,65	235,15	636,35	260,97
57	616,10	69,56	7,87	317,90	133,69	237,03	647,29	263,24
58	605,92	70,13	7,67	322,39	134,64	238,81	655,21	267,10
59	602,33	70,13	7,48	326,98	135,69	240,31	660,46	271,25
60	606,34	70,21	7,28	332,36	137,28	242,50	664,90	275,03
61	610,57	70,35	7,07	335,91	139,75	244,13	669,62	279,94
62	614,30	70,20	6,97	340,25	140,22	245,94	673,93	285,28
63	612,37	70,36	6,78	343,54	141,96	247,44	678,91	289,91
64	612,73	70,50	6,57	346,79	143,23	249,00	682,89	294,77
65	611,11	70,48	6,37	351,36	144,95	250,58	686,27	299,88
66	611,09	70,08	6,18	354,89	146,74	252,54	689,26	304,43
67	610,99	70,37	5,98	359,18	147,17	253,82	692,34	309,54
68	614,73	70,63	5,87	364,09	148,13	254,44	696,86	313,62

69	613,71	70,73	5,67	368,49	149,24	256,18	702,17	318,02
70	611,76	70,62	5,48	372,43	150,72	257,59	707,68	322,85
71	614,79	70,47	5,38	376,25	152,56	259,22	712,72	327,12
72	621,78	70,73	5,17	378,99	153,88	260,80	718,31	331,54
73	631,87	70,54	4,97	382,45	155,21	262,43	724,93	335,85
74	647,25	71,01	4,78	385,53	156,05	264,05	733,10	340,26
75	647,70	70,83	4,67	388,26	157,52	266,12	743,52	344,92
76	645,04	70,75	4,47	391,06	158,89	267,89	753,40	349,81
77	642,90	70,85	4,27	393,48	161,39	269,94	762,03	355,10
78	644,45	70,88	4,08	395,92	163,00	272,10	771,46	360,22
79	646,67	71,04	3,98	398,33	163,05	274,01	782,09	365,15
80	643,26	71,12	3,77	400,50	165,63	276,24	791,78	370,50
81	635,86	71,00	3,67	401,42	168,63	278,88	799,12	375,74
82	627,13	71,20	3,47	403,55	168,98	280,73	802,74	380,78
83	619,13	70,99	3,38	406,07	171,97	284,02	803,85	384,96
84	614,54	70,64	3,28	406,42	172,13	286,43	804,01	389,04
85	606,25	70,98	3,17	407,48	174,40	289,17	801,82	394,41
86	600,33	70,60	3,07	408,60	175,13	292,00	797,12	399,30
87	596,64	70,91	3,07	409,64	176,95	294,87	791,12	403,08
88	590,52	70,43	2,97	409,94	178,14	297,94	784,67	406,69
89	582,33	70,83	2,87	410,70	179,79	300,24	776,88	409,73
90	572,66	70,71	2,77	411,74	181,68	305,39	766,99	412,54
91	564,50	70,83	2,68	411,83	183,83	308,25	755,90	416,30
92	558,31	70,78	2,68	411,87	185,62	313,54	744,65	416,87
93	550,40	71,02	2,57	412,48	187,45	316,08	733,69	419,90



POLYTESTS

TESTING THROUGH YOUR REALITY

Date:

2024-04-08

Manufacturer:

SPANTHERM

Model:

700

Project #:

PI 20302

Run:

1

Tech:

MM

Reviewer:

AP

- Kindling 43 LBS START FIRE
- At 41 LBS close Door
- At 13 LBS insert prebld
- After 6 min close Door
- At 26 LBS insert load
- After 2 min close Door

TEST LOAD CONFIGURATION

Date: 2024-04-08

 Manufacturer: SPANTHERM
PRE / POST CHECKS

 Model: 700

 Project #: PI 20302

 Run: 1

 Tech: MM

 Reviewer: DP

Moisture Meter Calibration Check:

Equipment #	Time	12%	22%
EM-334	7:00	OK	OK

Pre-Test

Post-Test

Facility Conditions:

Air Velocity from less than 2 feet

Smoke Capture Check (tunnel velocity)

Picture.....

0 (max50 Fpm)	0 (max50 Fpm)
OK	NA
4 sides OK	OK

Wood Heater Conditions:

Date Wood Heater Stack Cleaned.....

Date Dilution Tunnel Cleaned.....

 Induced Draft Check (max 0.005 H₂O)

Traverse before ignition.....

2024-04-08
2024-04-08
OK
OK

Temperature System:

Ambient (65°-90°F)

OK	°F
----	----

Proportional Checks:

Thermocouple check.....

Pitot Clean.....

Pitot verification.....

Pictures for report.....

OK
OK
OK

Side	OK
Coal bed	OK
Load	OK
Load in stove	OK
Fuel adjustment	OK
	OK

Load Length 5/6 of firebox Length +/- 1 inch.....

Date: 20240408 Manufacturer: Spantherm Model: 700
Project #: QI 20302 Run: 1 Tech: MM Reviewer: Y

Leakage Checks Tunnel Samplers

	System 1 st hour		System 1		System 2		Ambient	
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)	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)
Vacuum (inches Hg.)	- 10	- 10	- 10	- 10	- 10	- 10	- 10	- 10
Final 1 minute DGM (Liter)	057744	058954	954986 91	955635 81	705229 46	705904 00	488813 65	489333 62
Initial 1 minute DGM (Liter)	057744	058954	954986 91	955635 80	705229 45	705904 00	488813 60	489333 62
Change (Liter)	0	0	0	0.01	0.01	0	0.05	0
Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56)								
Check OK	OK	OK	OK	OK	OK	OK	OK	OK



Date: 2024-04-08

Project #: PJ 20302

Manufacturer: Spantech

Run: 1

Tech: M.M

Model: 700

Reviewer: [Signature]

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre-Test	Post Test
Vacuum (inches Hg.)	-5	-5
Rotameter Reading (mm/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 0.4-0.5 H2O velocity
Vacuum (inches Hg.)	3	.4	.5
Check OK (no change after 15 sec.)	OK	OK	OK



Date: 2024-04-08
Project #: PI 20302

Manufacturer: Spantherm
Run: 1

Model: 700
Tech: MM
Reviewer: SP

Scale Type	Audit		Measured Weight
	Equipment #	Weight	
Platform	EM-090	44 lbs, Class F	44 lbs
Platform	EM-205	1000 Kg, Class F	1000 Kg
Wood	EM-090	440 lbs, Class F	440 lbs
Analytical	EM-335	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: 2024-04-08

 Manufacturer: Spantherm

 Model: 700

 Project #: 0120302

 Run: 1

 Tech: MR

 Reviewer: DO

FOR TUNNELS < 12 in

 Barometric pressure (P_{bar}) _____ (KPa.)

 Static pressure (P_q) _____ (inches w.c.)

Inside diameter: Port A _____ Port B _____

 Tunnel cross sectional area: .1963Ft²

Pitot tube type: Standard

Traverse Point	Position (inches)			Velocity Head Δp (inches H ₂ O)	Tunnel Temperature (°F)
Tunnel diameter	6 po	7 po	8 po		
A - Centroid	3.00	3.50	4	0.075	67.57
B - Centroid	3.00	3.50	4	0.075	67.60
A-1	0.40	0.50	0.50	0.062	67.57
A-2	1.50	1.75	2	0.070	67.58
A-3	4.50	5.25	6	0.073	67.58
A-4	5.60	6.5	7.5	0.061	67.62
B-1	0.40	0.50	0.50	0.061	67.60
B-2	1.50	1.75	2	0.071	67.66
B-3	4.50	5.25	6	0.072	67.66
B-4	5.60	6.5	7.5	0.062	67.67
				AVERAGE	

Date: _____ Manufacturer: _____ Model: _____
 Project #: _____ Run: _____ Tech: _____ Reviewer: _____

FOR TUNNELS 12 in

Barometric pressure (P_{bar}) _____ (KPa.) Static pressure (P_q) _____ (inches w.c.)
 Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature ($^{\circ}F$)
A Center	6		
B Center	6		
A-1	0.53		
A-2	1.75		
A-3	3.55		
A-4	8.45		
A-5	10.25		
A-6	11.47		
B-1	0.53		
B-2	1.75	N.A	
B-3	3.55		
B-4	8.45		
B-5	10.25		
B-6	11.47		

Date: 2024-04-08 Manufacturer: SpAtherm Model: 200
 Project #: PI 20302 Run: 1 Tech: MR Reviewer: SP

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	0	0	3039	3000	1018	1000
Tolerance CO	0	+/- 0.02	0.039	+/- 0.15	0.018	+/- 0.05
CO ₂	0	0	1795	1800	981	1000
Tolerance CO ₂	0	+/- 0.02	0.05	+/- 0.5	0.19	+/- 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	0	3041	1031	0	0.02	0.002	0.15	0.003	0.05	✓	
CO ₂	0	1797	984	0	0.02	0.02	0.5	0.03	0.5	✓	

Date: 2024-04-08

Project #: PI 20302

TEST DATA LOG

Manufacturer: SpAtherm

Run: 1

Tech: M.R.

Model: 700

Reviewer: [Signature]

RAW DRY GAS METER READINGS

Test	Final (Liter)	System 1 st hour	System 1	System 2	Blank
	Initial (Liter)				
		0589.51	95563530	705903.12	48933.40
		0577.53	954489.08	705231.92	488812.74

AMBIENT CONDITIONS

	Before	After
Barometer (kPa):	1008	1009
Dry Bulb (F):	72.8	75.1
Humidity (%):	28.6	26.9

FUEL DATA

 Date: 2024-04-08 Manufacturer: Spantherm Model: 700

 Project #: PI 20302 Run: 1 Tech: MM Reviewer: DO
FUEL DESCRIPTION:

Type of wood:

PRE-TEST LOAD

Piece Size	Weight	Meter Moisture Content (% dry) *				
1 1/2 x 3 1/2 x 15 in.	1 494 lbs.	203	204	203	202	201
1 1/2 x 3 1/2 x 15 in.	1 884 lbs.	199	196	193	194	198
1 1/2 x 3 1/2 x 15 in.	1 906 lbs.	200	193	194	201	203
1 1/2 x 3 1/2 x 25 in.	0 886 lbs.	203	201	203	202	202
1 1/2 x 3 1/2 x 25 in.	0 860 lbs.	191	193	192	192	193
1 1/2 x 3 1/2 x 25 in.	0 754 lbs.	201	20	200	201	202
1 1/2 x 3 1/2 x 25 in.	0 842 lbs.	193	194	193	193	196
1 1/2 x 3 1/2 x 25 in.	0 836 lbs.	202	201	200	200	201
1 1/2 x 3 1/2 x 25 in.	0 832 lbs.	191	192	192	194	196
1 1/2 x 3 1/2 x 25 in.	0 786 lbs.	200	20	20	201	200
1 1/2 x 3 1/2 x 25 in.	0 832 lbs.	199	200	200	201	202
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.					

 TEST LOAD WEIGHT: 11.91 lbs

FUEL DATA

Date: 2024-04-08 Manufacturer: SPANTHERM Model: 700
 Project #: pt 20302 Run: 1 Tech: MM Reviewer: DO

FUEL DESCRIPTION:

Type of wood:

TEST LOAD

Piece Size	Weight	Meter Moisture Content (% dry)*						
1 1/2 x 3 1/2 x 17 1/2 in.	1892 lbs.	196	194	194	196	192		
1 1/2 x 3 1/2 x 17 1/2 in.	1956 lbs.	199	196	195	193	193		
1 1/2 x 3 1/2 x 17 1/2 in.	5270 lbs.	201	200	197	210	209		
x x in.	lbs.							
1 1/2 x 3 1/2 x 5 in.	0122 lbs.			199				
1 1/2 x 3 1/2 x 5 in.	0148 lbs.			200				
1 1/2 x 3 1/2 x 5 in.	0120 lbs.			200				
1 1/2 x 3 1/2 x 5 in.	0152 lbs.			198				
1 1/2 x 3 1/2 x 5 in.	0118 lbs.			197				
1 1/2 x 3 1/2 x 5 in.	0128 lbs.			196				
1 1/2 x 3 1/2 x 5 in.	0152 lbs.			196				
1 1/2 x 3 1/2 x 5 in.	0132 lbs.			198				
1 1/2 x 3 1/2 x 5 in.	0144 lbs.			199				
1 1/2 x 3 1/2 x 5 in.	0126 lbs.			201				
1 1/2 x 3 1/2 x 5 in.	0140 lbs.			200				
1 1/2 x 3 1/2 x 5 in.	0112 lbs.			201				
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.							

TEST LOAD WEIGHT: 1067 lbs Min 20%: Max 25%:
1971



DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2024-04-06

Manufacturer: SpAtherm

Model: 700

Project #: 0126302

Run: 1

Tech: mm

Reviewer: AS

TEST FILTERS							
		SYSTEM 1 st hour			SYSTEM 1		
Pre-test Weight Record		Probe & Housing Number	Front & Back Filter Number	gaskets	Probe & Housing Number	Front & Back Filter Number	gaskets
Date	Time	06	06-07	1	16	08-09	6
2024 04-04	17:00	613717	02685	32951	1087510	02680	50371
2024 04-08	9:00	613716	02686	32950	1087511	02679	50370

TEST FILTERS							
Post-test Weight Record		SYSTEM 1 st hour			SYSTEM 1		
		Probe & Housing Number	Front & Back Filter Number	gaskets	Probe & Housing Number	Front & Back Filter Number	gaskets
Date	Time	06	06-07	1	16	08-09	6
2024-04-08	14:30	613717	02702	32965	1087512	02686	50388
2024-04-15	9:00	613717	02700	32951	1087512	02685	50383
2024-04-16	10:00	613717	02700	32951	1087512	02685	50383

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2024-04-04
Project #: PT 20302

Manufacturer: SPANTHER
Run: 1

Tech: M.N

Model: 700
Reviewer: 

TEST FILTERS						
SYSTEM 2				TEST FILTERS		
Pre-test Weight Record		Probe & Housing Number	Front & Back Filter Number	gaskets	Blank Filter	End test time and date
Date	Time					
2024-04-04	17100	36	10-11	8	12	
		107 7230	02645	41558	01317	
2024-04-08	9100	107 7229	02646	41557	01318	
SYSTEM 2				TEST FILTERS		
Post-test Weight Record		Probe & Housing Number	Front & Back Filter Number	gaskets	Blank Filter	End test time and date
Date	Time					
2024-04-08	14130	36	10-11	8	12	2024-04-08
		107 7231	02663	41573	01320	14100
2024-04-15	9100	107 7230	02662	41562	01319	
2024-04-16	10100	107 7230	02662	41562	01319	

Paramètres

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

Code verrouillage: SPA

Description du test

Test standard	EPA
Run #	2
Date	09-04-2024
Technicien	M.M
Project #	PI 20302

Description de l'unité

Manufacturier	SPARTHERM	
Modèle	700	
Combustion system	Non-Cat	
Appliance type	FIREPLACE	
Firebox volume	1,58	cu ft.
Appliance weight empty	n.a	lbs
Appliance weight full	n.a	lbs

Paramètres du test

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

Échantillonnage

Blank sampling rate	0,20	cuft/min
Internal probe diameter	0,18	in.
Calibration Factor (DGM #1):	0,986	
Equipment number (DGM #1):	EM 178	Dimensionless
Calibration Factor (DGM #2):	1,003	
Equipment number (DGM #2):	EM 318	Dimensionless
Calibration Factor (DGM #3):	0,984	
Equipment number (DGM #3):	EM 179	Dimensionless
Calibration Factor (DGM 1st Hr):	0,987	
Equipment number (DGM 1st Hr):	EM 130	Dimensionless

Tunnel

Targeted tunnel flow rate	350	scfm
Tunnel diameter	8	in.
Molecular weight	29	29 as per ASTM E2515
Pitot tube type	Standard	
Pitot tube coefficient	0,99	Dimensionless

Project nu. PI 20302
Date 09-04-2024
Technicien M.M

Fuel data

Fuel type	Dimension
Fuel specie	D. Fir
HHV	19810,0 kJ/kg
%C	48,7
%H	6,9
%O	43,9
%Ash	0,5
HHV	8519,2 Btu/lb
LHV	7451,0 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):	100,6	100,7
Barometer (in.Hg):	29,707169	29,73669881
Dry Bulb (F):	72,3	74,3
Humidity (%):	29,1	30,1
Air velocity (ft/min)	0	0

DGM #1st hour	Final:	601,880	cuft
	Initial:	589,840	cuft

Final:	601,880	cuft
Initial:	589,840	cuft

DGM #1	Final:	33769,704	cuft
	Initial:	33748,062	cuft

Final:	956251,500	Liter
Initial:	955638,680	Liter

DGM #2	Final:	24951,324	cuft
	Initial:	24928,853	cuft

Final:	706542,810	Liter
Initial:	705906,480	Liter

DGM room	Final:	17298,068	cuft
	Initial:	17280,692	cuft

Final:	489826,740	Liter
Initial:	489334,700	Liter

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

173

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

Project nu.	PI 20302
Date	09-04-2024
Technicien	M.M

Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,18 in. H2O
 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=
0,945

Pour un tunnel moins de 12", prendre 4 lectures

	TUNNEL VELOCITY	TUNNEL TEMP	SQUARE ROOT
	In. wc	°F	
A center	0,080	67,84	0,2828
B center	0,080	67,72	0,2828
A1	0,066	67,84	0,2569
A2	0,074	67,93	0,2720
A3	0,070	67,93	0,2646
A4	0,066	67,83	0,2569
B1	0,066	67,7	0,2569
B2	0,069	67,9	0,2627
B3	0,077	67,8	0,2775
B4	0,067	67,8	0,2588
AVERAGE	0,0715	67,8340	0,2672

Project nu.	PI 20302
Date	09-04-2024
Technicien	M.M

Filter set weight

System 1 (g) 1st hour			System 1 (g)			System 2 (g)			Ambient blank (g)	Date	Heure	Test end date & time
probe	front/ Back	gasket	probe	front/ Back	gasket	probe	front/ Back	gasket	Filter			
21	01-02	2	37	03-04	10	39	05-101	14	102			
Before (1)												
Before (2)												
Before (3)												
Before (4)												
Before (5)	108,7344	0,2614	5,0435	107,9750	0,2621	4,2217	110,2771	0,2584	5,0661	0,1232	2024-04-08 17:00	
Before (6)	108,7345	0,2613	5,0434	107,9749	0,2620	4,2216	110,2772	0,2585	5,0662	0,1233	2024-04-09 09:00	2024-04-09 13:15
After (1)	108,7347	0,2618	5,0451	107,9751	0,2621	4,2234	110,2774	0,2585	5,0678	0,1233	2024-04-09 13:45	
After (2)	108,7346	0,2617	5,0439	107,9749	0,2619	4,2231	110,2773	0,2585	5,0677	0,1233	2024-04-15 09:00	
After (3)	108,7346	0,2617	5,0439	107,9749	0,2620	4,2230	110,2773	0,2585	5,0677	0,1233	2024-04-16 10:00	
After (4)												
After (5)												
After (6)	108,7346	0,2617	5,0439	107,9749	0,2620	4,2230	110,2773	0,2585	5,0677	0,1233	2024-04-16 10:00	
Difference	0,0001	0,0004	0,0005	0,0000	0,0000	0,0014	0,0001	0,0000	0,0015	0,0000		
Total (mg)	1			1,4			1,6			0		
Total ajusté (mg)	1,00			1,40			1,60					

Project nu.

Date

Technicien

PI 20302

09-04-2024

M.M

Manufacturer: SPARTHERM
Model: 700

Run: 2
Project #: PI 20302
Test Duration: 118 min

Note: In the "Input data", "Calc. % O₂", "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

Overall Heating Efficiency: 66,43%
Combustion Efficiency: 97,95%
Heat Transfer Efficiency: 67,82%

	HHV	LHV
Eff	66,43%	71,79%
Comb Eff	97,95%	97,95%
HT Eff	67,82%	73,30%
Output	26 255	kJ/h
Burn Rate	2,00	kg/h
Grams CO	132	g
Input	39 526	kJ/h
MC wet	16,75	

Ultimate CO₂
CO_{2-ult} 19,64
F₀
1,061

Heat Output:	24 906 Btu/h
Heat Input:	37 494 Btu/h
Burn Duration:	1,97 h
Burn Rate:	4,40 lb/h
Stack Temp:	494,2 Deg. F

Averages		0,36	7,69	1,89	20,41	12,54	256,72	22,57	0,95	0,67	#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 (°C)	Room Temp (°C)	Eff %	Transfer %	Eff %
0,00	4,71	0,16	3,26	474,7%	20,71	17,38	249,5	22,3	97,6%	45,8%	44,7%
1,00	4,57	0,22	2,19	715,4%	20,78	18,48	266,4	22,0	94,7%	21,6%	20,5%
2,00	4,53	0,38	6,04	205,6%	20,52	14,28	277,1	22,1	95,6%	61,6%	58,9%
3,00	4,39	0,20	11,38	69,6%	20,18	8,69	318,9	22,0	98,7%	70,7%	69,8%
4,00	4,30	0,29	13,69	40,5%	20,02	6,18	333,1	22,0	98,4%	72,6%	71,4%
5,00	4,21	0,18	13,28	45,9%	20,05	6,68	338,3	22,0	99,0%	71,9%	71,2%
6,00	4,07	0,13	13,26	46,6%	20,06	6,73	341,3	22,1	99,3%	71,7%	71,2%
7,00	3,98	0,12	13,03	49,4%	20,07	6,98	341,9	22,2	99,4%	71,4%	71,0%
8,00	3,89	0,10	12,93	50,7%	20,08	7,10	343,2	22,3	99,5%	71,2%	70,9%
9,00	3,80	0,09	12,69	53,7%	20,10	7,36	343,4	22,2	99,6%	70,9%	70,6%
10,00	3,71	0,08	12,64	54,5%	20,10	7,42	343,4	22,2	99,7%	70,9%	70,6%
11,00	3,62	0,07	12,63	54,6%	20,10	7,43	344,4	22,4	99,7%	70,8%	70,6%
12,00	3,53	0,08	12,71	53,6%	20,10	7,35	344,9	22,4	99,6%	70,9%	70,6%
13,00	3,44	0,08	12,71	53,6%	20,10	7,34	346,1	22,4	99,6%	70,8%	70,6%
14,00	3,35	0,07	12,80	52,6%	20,09	7,25	347,7	22,6	99,7%	70,8%	70,6%
15,00	3,26	0,09	12,83	52,0%	20,09	7,21	348,4	22,7	99,6%	70,8%	70,5%
16,00	3,16	0,08	12,87	51,8%	20,09	7,18	349,6	22,5	99,7%	70,8%	70,5%
17,00	3,07	0,08	13,02	49,9%	20,07	7,02	351,4	22,6	99,6%	70,9%	70,6%
18,00	2,98	0,08	13,09	49,1%	20,07	6,94	352,4	22,7	99,6%	70,9%	70,6%
19,00	2,89	0,08	13,10	49,0%	20,07	6,93	352,7	22,7	99,6%	70,9%	70,6%
20,00	2,80	0,08	13,00	50,2%	20,08	7,04	352,1	22,8	99,6%	70,8%	70,6%
21,00	2,71	0,07	12,80	52,7%	20,09	7,26	350,5	22,9	99,7%	70,7%	70,5%
22,00	2,62	0,07	12,76	53,1%	20,09	7,30	347,5	22,9	99,7%	70,8%	70,6%
23,00	2,57	0,06	12,82	52,5%	20,09	7,24	347,2	22,9	99,7%	70,9%	70,7%
24,00	2,48	0,06	12,78	52,9%	20,09	7,28	346,2	22,9	99,8%	70,9%	70,7%
25,00	2,39	0,06	12,75	53,3%	20,09	7,31	345,4	22,8	99,8%	70,9%	70,8%
26,00	2,35	0,06	12,64	54,7%	20,10	7,43	343,9	22,6	99,8%	70,9%	70,7%
27,00	2,26	0,06	12,63	54,8%	20,10	7,44	343,6	23,0	99,8%	70,9%	70,7%
28,00	2,17	0,06	12,67	54,3%	20,10	7,40	343,4	23,0	99,8%	70,9%	70,8%
29,00	2,12	0,07	12,72	53,7%	20,10	7,35	343,1	22,8	99,7%	71,0%	70,8%
30,00	2,03	0,07	12,78	52,8%	20,09	7,27	343,0	22,8	99,7%	71,1%	70,9%
31,00	1,94	0,07	12,85	52,0%	20,09	7,20	342,6	23,0	99,7%	71,2%	71,0%
32,00	1,85	0,08	12,86	51,8%	20,09	7,19	341,1	22,8	99,7%	71,3%	71,1%
33,00	1,80	0,06	12,48	56,6%	20,11	7,60	337,1	22,9	99,7%	71,1%	70,9%
34,00	1,76	0,04	11,60	68,8%	20,17	8,55	328,8	22,9	99,9%	70,5%	70,4%
35,00	1,71	0,03	10,78	81,6%	20,23	9,43	319,3	22,8	100,0%	69,9%	69,9%
36,00	1,62	0,03	10,30	90,2%	20,26	9,95	314,0	23,1	100,1%	69,6%	69,6%
37,00	1,58	0,03	10,04	95,1%	20,28	10,22	310,4	23,2	100,1%	69,4%	69,4%
38,00	1,53	0,03	9,95	96,8%	20,28	10,31	307,9	23,2	100,1%	69,4%	69,5%
39,00	1,49	0,03	9,90	97,8%	20,28	10,37	306,3	23,2	100,1%	69,5%	69,5%
40,00	1,44	0,02	9,71	101,8%	20,30	10,57	304,2	23,2	100,1%	69,3%	69,3%
41,00	1,39	0,03	9,46	107,1%	20,31	10,84	301,7	23,0	100,1%	69,0%	69,1%
42,00	1,35	0,03	9,38	108,8%	20,32	10,92	299,8	23,2	100,1%	69,0%	69,1%
43,00	1,30	0,03	9,16	113,7%	20,33	11,16	296,5	23,1	100,1%	68,8%	68,9%
44,00	1,26	0,03	8,66	126,0%	20,37	11,69	291,5	23,0	100,1%	68,2%	68,2%
45,00	1,26	0,05	8,02	143,4%	20,41	12,36	285,6	23,0	99,9%	67,2%	67,2%
46,00	1,21	0,08	7,59	156,1%	20,43	12,80	279,9	22,9	99,6%	66,6%	66,4%
47,00	1,17	0,08	7,52	158,2%	20,44	12,87	275,7	22,7	99,6%	66,8%	66,5%
48,00	1,12	0,09	7,43	161,3%	20,44	12,97	271,0	22,8	99,5%	67,0%	66,7%
49,00	1,12	0,11	7,41	161,3%	20,44	12,98	267,3	22,9	99,3%	67,3%	66,9%
50,00	1,08	0,11	7,41	161,1%	20,44	12,98	264,2	22,8	99,3%	67,6%	67,1%
51,00	1,03	0,12	7,36	162,5%	20,45	13,02	260,7	22,6	99,2%	67,8%	67,2%
52,00	0,99	0,13	7,26	165,8%	20,45	13,12	257,6	22,8	99,1%	67,8%	67,2%
53,00	0,99	0,14	7,18	168,2%	20,46	13,20	254,7	22,8	98,9%	67,9%	67,2%
54,00	0,96	0,14	7,12	170,4%	20,46	13,27	252,0	22,8	98,9%	68,0%	67,2%
55,00	0,94	0,15	7,10	170,8%	20,46	13,28	249,7	22,8	98,8%	68,2%	67,3%
56,00	0,90	0,16	7,04	173,0%	20,46	13,35	247,3	22,8	98,7%	68,2%	67,3%
57,00	0,90	0,16	7,01	173,9%	20,47	13,38	245,0	22,7	98,6%	68,4%	67,4%
58,00	0,85	0,17	6,94	176,3%	20,47	13,44	242,7	22,8	98,6%	68,4%	67,4%
59,00	0,85	0,18	6,88	178,4%	20,47	13,51	240,7	22,8	98,4%	68,4%	67,3%
60,00	0,80	0,19	6,81	180,4%	20,48	13,57	238,8	22,6	98,2%	68,4%	67,2%
61,00	0,76	0,21	6,75	182,5%	20,48	13,63	237,1	22,2	98,1%	68,4%	67,0%
62,00	0,76	0,21	6,73	183,1%	20,48	13,65	235,4	22,6	98,0%	68,5%	67,2%
63,00	0,71	0,22	6,69	184,3%	20,48	13,68	234,0	22,5	97,9%	68,6%	67,1%
64,00	0,71	0,22	6,67	184,9%	20,48	13,70	232,6	22,6	97,9%	68,7%	67,2%
65,00	0,71	0,22	6,66	185,5%	20,49	13,72	231,6	22,4	97,8%	68,7%	67,2%
66,00	0,67	0,23	6,59	187,9%	20,49	13,78	230,5	22,3	97,7%	68,6%	67,0%
67,00	0,63	0,25	6,52	190,1%	20,49	13,85	229,3	22,4	97,5%	68,6%	66,8%
68,00	0,62	0,25	6,49	191,3%	20,49	13,88	227,8	22,5	97,4%	68,6%	66,9%
69,00	0,58	0,25	6,42	194,3%	20,50	13,95	226,5	22,5	97,4%	68,6%	66,8%
70,00	0,58	0,25	6,42	194,2%	20,50	13,95	225,4	22,5	97,4%	68,7%	66,9%
71,00	0,58	0,25	6,44	193,5%	20,50	13,93	224,7	22,5	97,4%	68,8%	67,0%
72,00	0,53	0,25	6,49	191,5%	20,50	13,88	224,1	22,5	97,5%	69,0%	67,3%
73,00	0,53	0,24	6,51	191,1%	20,49	13,87	223,5	22,5	97,6%	69,1%	67,4%
74,00	0,49	0,24	6,54	189,9%	20,49	13,83	228,2	22,5	97,6%	68,7%	67,1%
75,00	0,45	0,23	6,54	190,0%	20,49	13,84	229,6	22,5	97,7%	68,6%	67,0%
76,00	0,44	0,23	6,62	186,8%	20,49	13,75	229,9	22,5	97,8%	68,8%	67,3%
77,00	0,44	0,21	6,75	182,5%	20,48	13,63	231,0	22,5	98,1%	69,0%	67,7%
78,00	0,40	0,19	6,86	178,5%	20,47	13,52	231,8	22,4	98,3%	69,2%	68,0%
79,00	0,40	0,18	6,88	178,1%	20,47	13,50	232,4	22,5	98,4%	69,2%	68,1%
80,00	0,35	0,20	6,78	181,5%	20,48	13,60	231,2	22,5	98,2%	69,1%	67,8%
81,00	0,35	0,27	6,23	202,3%	20,51	14,15	229,1	22,6	97,1%	67,7%	65,7%
82,00	0,35	0,48	5,30	239,9%	20,56	15,02	221,4	22,6	93,8%	65,2%	61,2%
83,00	0,30	0,57	4,92	257,4%	20,58	15,37	215,6	22,5	92,0%	64,3%	59,2%
84,00	0,30	0,62	4,76	265,0%	20,58	15,52	211,4	22,5	91,1%	64,1%	58,4%
85,00	0,30	0,67	4,59	273,4%	20,59	15,67	208,2	22,5	90,2%	63,7%	57,5%
86,00	0,26	0,71	4,48	278,5%	20,60	15,76	205,1	22,5	89,5%	63,6%	56,9%
87,00	0,26	0,74	4,40	282,4%	20,60	15,83	202,0	22,5	88,8%	63,6%	56,5%
88,00	0,26	0,76	4,35	284,0%	20,60	15,87	199,6	22,4	88,5%	63,7%	56,4%
89,00	0,26	0,78	4,30	286,5%	20,60	15,91	197,4	22,5	88,1%	63,8%	56,2%
90,00	0,26	0,79	4,28	287,4%	20,61	15,93	195,8	22,4	87,9%	63,9%	56,1%
91,00	0,22	0,81	4,28	285,6%	20,60	15,92	193,9	22,4	87,6%	64,1%	56,2%
92,00	0,21	0,81	4,22	290,6%	20,61	15,99	192,2	22,4	87,4%	64,1%	56,0%

93,00	0,21	0,83	4,18	292,0%	20,61	16,01	190,7	22,5	87,1%	64,1%	55,8%
94,00	0,21	0,85	4,13	294,4%	20,61	16,06	188,4	22,4	86,7%	64,2%	55,6%
95,00	0,21	0,88	3,80	319,7%	20,63	16,39	186,0	22,4	85,4%	62,6%	53,5%
96,00	0,18	0,90	3,74	323,8%	20,63	16,45	184,0	22,4	84,9%	62,5%	53,1%
97,00	0,17	0,91	3,72	323,5%	20,63	16,45	182,5	22,4	84,6%	62,7%	53,1%
98,00	0,17	0,92	3,70	325,0%	20,63	16,47	180,8	22,4	84,4%	62,8%	53,0%
99,00	0,17	0,92	3,67	328,1%	20,64	16,51	179,2	22,4	84,4%	62,9%	53,1%
100,00	0,17	0,93	3,60	333,3%	20,64	16,57	177,9	22,4	84,0%	62,7%	52,6%
101,00	0,12	0,94	3,58	334,7%	20,64	16,59	176,3	22,3	83,9%	62,8%	52,7%
102,00	0,12	0,94	3,58	335,1%	20,64	16,60	175,3	22,3	83,8%	62,9%	52,7%
103,00	0,12	0,95	3,58	334,2%	20,64	16,59	174,2	22,3	83,7%	63,1%	52,8%
104,00	0,12	0,94	3,56	336,0%	20,64	16,61	173,0	22,4	83,7%	63,2%	52,9%
105,00	0,12	0,95	3,57	334,8%	20,64	16,60	172,0	22,4	83,6%	63,4%	53,0%
106,00	0,08	0,95	3,57	334,4%	20,64	16,60	171,1	22,3	83,6%	63,6%	53,2%
107,00	0,08	0,95	3,58	333,7%	20,64	16,59	170,3	22,3	83,6%	63,8%	53,3%
108,00	0,08	0,95	3,56	335,9%	20,64	16,61	169,6	22,4	83,6%	63,8%	53,3%
109,00	0,08	0,96	3,48	342,2%	20,65	16,69	168,7	22,4	83,1%	63,4%	52,7%
110,00	0,08	0,97	3,44	346,1%	20,65	16,73	167,5	22,4	82,9%	63,4%	52,6%
111,00	0,03	0,95	3,39	352,2%	20,65	16,79	166,9	22,3	82,9%	63,2%	52,4%
112,00	0,03	0,95	3,41	350,3%	20,65	16,76	166,2	22,3	83,1%	63,4%	52,7%
113,00	0,03	0,94	3,39	354,2%	20,65	16,80	165,7	22,3	83,1%	63,3%	52,7%
114,00	0,03	0,93	3,40	353,5%	20,65	16,79	165,0	22,2	83,3%	63,5%	52,9%
115,00	0,03	0,92	3,41	353,5%	20,65	16,78	164,6	22,2	83,5%	63,7%	53,2%
116,00	0,03	0,92	3,42	352,8%	20,65	16,77	164,0	22,2	83,6%	63,9%	#DIV/0!
117,00	0,03	0,92	3,44	351,2%	20,65	16,76	163,8	22,4	83,6%	64,0%	53,5%
118,00	0,00	0,91	3,45	350,5%	20,65	16,75	163,2	22,3	83,8%	64,2%	53,8%

SFBA EPA EMISSION RESULTS

RESULTS

Average emission rate: 1,52 g/hr

Test Duration: 118 min

Burn Rate : 1,99 Dry kg/hr

PRESSURE FACTOR: DGM 1st hr 0,963
 DGM 1 0,963
 DGM 2 0,962
 DGM 3 0,993

BAROMETRIC PRESSURE

Average: 29,72193381 in Hg
 Start: 29,70716882 in Hg
 End: 29,73669881 in Hg

TEMPERATURE FACTORS DGM 1st hr 0,990
 DGM 1 0,992
 DGM 2 0,985
 DGM 3 0,991

DGM VALUES

DGM 1st hr Final: 601,880 Cuft
 Initial: 589,840 Cuft

VOLUMES SAMPLED DGM 1st hr 11,332 SCft
 DGM 1 20,392 SCft
 DGM 2 21,352 SCft
 DGM 3 16,841 SCft

DGM 1 Final: 33769,704 Cuft
 Initial: 33748,062 Cuft

DGM 2 Final: 24951,324 Cuft
 Initial: 24928,853 Cuft

TOTAL TUNNEL VOLUME : 41668

DGM #3 Final: 17298,068 Cuft
 Initial: 17280,692 Cuft

SAMPLE RATIOS

Sample Train 1st Hr: 1869,7
 Sample Train 1: 2043,4
 Sample Train 2: 1951,5

TEMPERATURES

DGM 1st hr 533,128 °R
 DGM 1 532,251 °R
 DGM 2 536,074 °R

Particulate concentration

Sample Train 1st Hr 0,000088 g/dscf
 Sample Train 1 0,000069 g/dscf
 Sample Train 2 0,000075 g/dscf
 Room 0,000000 g/dscf

CALIBRATION FACTORS

DGM 1st hr 0,9869
 DGM 1 0,9862
 DGM 2 1,0026
 DGM #3 0,9842

TOTAL EMISSIONS

Sample Train 1st Hr 1,87 g
 Sample Train 1 2,86 g
 Sample Train 2 3,12 g

TUNNEL FLOW RATE: 353,1 Dscfm

PARTICULATE CATCH

Total Sample Train 1: 1,40 mg
 Total Sample Train 2: 1,60 mg
 Total Sample Train 1 1st hour: 1,00 mg

EMISSION RATES

Sample Train 1st Hr 1,87 g/hr
 Sample Train 1 1,45 g/hr
 Sample Train 2 1,59 g/hr

DEVIATION: 4,37%

Cs Train 1 Train 2 Train 1st Hr
 6,865E-05 7,4934E-05 8,824E-05

* Elapsed Time min	Raw data row	Weight Remaining lbs	* CO %	* CO ₂ %	*1 Room Temp °F	*2 Room Temp °F	*3 Turn Down Dry Bulb °F	*4 Unit Top °F	*5 Unit Back °F	*6 Unit R-Side °F	*7 Unit L-Side °F	*8 Unit Bottom °F	Mass flow Reading cuft/min	DGM 1st hour Inlet 1st hour °F	DGM 1st hour Inlet 1st hour °F	Filter 1st hour Inlet °F	DGM 1 Reading cuft/min	DGM 1 Inlet °F	DGM 1 Outlet °F	Filter 1 Inlet °F	Mass flow 2 Reading cuft/min	DGM 2 Inlet °F	DGM 2 Outlet °F	Filter 2 Inlet °F	Tunnel Velocity in wc	Flue draft Pressure in wc	Filter 1st hr in. Hg	Filter 1 in. Hg	Filter 2 in. Hg	Change in Sulf Temp
0	173.00	10.4	0.2	3.3	481.2	72.2	144.8	762.5	217.9	416.1	437.8	269.3	0.19	71.4	72.0	86.7	0.18	71.3	70.6	86.3	0.18	71.3	71.1	82.3	0.08	0.07	-0.88	-0.88	-0.88	0.0
1	174.0	10.1	2.2	4.5	481.5	72.2	144.8	762.5	217.9	416.1	437.8	269.3	0.19	71.7	72.4	87.1	0.18	71.2	70.6	86.7	0.18	71.2	71.1	82.3	0.08	0.07	-0.85	-0.89	-0.87	-0.5
2	175.0	10.0	0.4	6.0	530.8	71.8	115.2	698.4	204.0	417.1	442.2	275.1	0.19	71.5	72.5	87.2	0.18	71.4	70.6	87.6	0.18	71.6	71.2	82.1	0.08	0.09	-0.84	-0.89	-0.87	-13.3
3	176.0	9.7	0.2	11.4	606.1	71.6	116.6	682.1	201.4	416.5	442.7	276.9	0.19	71.5	72.5	86.9	0.18	71.3	70.6	87.2	0.18	71.7	71.3	81.9	0.08	0.10	-0.84	-0.91	-0.88	-16.8
4	177.0	9.3	0.1	13.1	631.6	71.6	117.6	694.7	201.4	416.5	442.7	276.9	0.19	71.5	72.5	86.9	0.18	71.3	70.6	87.2	0.18	71.7	71.3	81.9	0.08	0.10	-0.84	-0.91	-0.88	-16.8
5	178.0	9.3	0.2	13.3	640.9	71.6	116.5	686.9	200.6	416.8	443.1	281.6	0.19	71.5	72.8	86.8	0.18	71.3	70.6	87.0	0.18	72.0	71.4	81.7	0.08	0.10	-0.84	-0.90	-0.88	-16.8
6	179.0	9.0	0.1	13.3	646.3	71.9	117.7	698.2	201.1	410.5	435.0	283.4	0.19	71.6	72.9	86.8	0.18	71.4	70.6	87.0	0.18	72.2	71.5	81.5	0.08	0.10	-0.84	-0.90	-0.89	-15.0
7	180.0	8.8	0.1	13.0	647.5	71.9	117.8	710.3	201.7	408.4	431.5	284.9	0.19	71.6	73.0	86.9	0.18	71.4	70.6	87.1	0.18	72.4	71.7	81.5	0.08	0.10	-0.84	-0.90	-0.89	-13.3
8	181.0	8.6	0.1	12.9	649.7	72.0	117.6	722.1	201.7	408.4	431.5	284.9	0.19	71.6	73.1	86.8	0.18	71.4	70.6	87.1	0.18	72.5	71.8	81.5	0.08	0.10	-0.84	-0.91	-0.89	-11.7
9	182.0	8.4	0.1	12.7	650.1	72.0	117.2	732.8	202.7	404.3	428.0	287.4	0.19	71.6	73.3	86.8	0.18	71.5	70.6	87.2	0.18	72.9	72.0	81.5	0.08	0.10	-0.84	-0.90	-0.88	-9.6
10	183.0	8.2	0.1	12.6	650.1	72.0	116.7	742.1	203.4	403.0	426.2	287.9	0.19	71.7	73.4	86.7	0.18	71.6	70.7	87.1	0.18	73.1	72.1	81.5	0.08	0.10	-0.84	-0.90	-0.88	-9.2
11	184.0	8.0	0.1	12.6	651.9	72.4	117.9	750.3	203.5	402.4	425.4	288.3	0.19	71.7	73.5	86.8	0.18	71.6	70.7	87.2	0.18	73.3	72.2	81.5	0.08	0.10	-0.85	-0.90	-0.89	-6.7
12	185.0	7.8	0.1	12.7	652.7	72.4	117.9	757.6	203.5	402.2	424.3	289.1	0.19	71.8	73.5	86.8	0.18	71.6	70.7	87.3	0.18	73.5	72.4	81.4	0.08	0.10	-0.85	-0.89	-0.88	-5.3
13	186.0	7.6	0.1	12.7	655.0	72.4	117.9	764.4	204.1	401.9	423.8	289.0	0.19	71.7	73.6	86.8	0.18	71.7	70.7	87.4	0.18	73.7	72.5	81.4	0.08	0.10	-0.85	-0.90	-0.88	-4.1
14	187.0	7.4	0.1	12.8	657.8	72.6	118.2	770.9	203.4	402.2	424.0	289.7	0.19	71.8	73.7	86.9	0.18	71.8	70.8	87.5	0.18	74.0	72.7	81.5	0.08	0.10	-0.85	-0.90	-0.89	-2.8
15	188.0	7.2	0.1	12.8	659.1	72.8	118.7	777.4	203.1	402.8	424.6	288.9	0.19	71.9	73.8	86.9	0.18	71.9	70.8	87.6	0.18	74.2	72.8	81.5	0.08	0.10	-0.85	-0.90	-0.89	-1.3
16	189.0	7.0	0.1	12.9	661.4	72.4	119.1	783.5	203.1	403.6	424.9	289.9	0.19	71.9	73.9	87.0	0.18	71.9	70.8	87.7	0.18	74.4	72.9	81.5	0.08	0.10	-0.85	-0.89	-0.89	0.3
17	190.0	6.8	0.1	13.0	664.6	72.8	118.9	789.9	202.3	404.1	425.3	289.5	0.19	71.9	74.0	87.0	0.18	71.9	70.9	87.7	0.18	74.6	73.1	81.5	0.08	0.10	-0.85	-0.90	-0.89	1.5
18	191.0	6.6	0.1	13.1	666.4	72.8	120.0	796.3	202.5	405.1	425.5	289.6	0.19	72.0	74.0	87.1	0.18	71.9	70.9	87.9	0.18	74.7	73.2	81.6	0.08	0.10	-0.86	-0.90	-0.88	3.1
19	192.0	6.4	0.1	13.1	666.9	72.8	120.3	801.9	202.0	406.1	426.4	288.9	0.19	72.0	74.0	87.2	0.18	71.9	70.9	87.9	0.18	74.8	73.3	81.5	0.08	0.10	-0.86	-0.90	-0.89	4.4
20	193.0	6.2	0.1	13.0	665.7	73.1	119.7	807.5	201.4	407.3	427.2	289.1	0.19	72.0	74.1	87.2	0.18	72.0	70.9	88.0	0.18	75.0	73.5	81.7	0.08	0.10	-0.86	-0.90	-0.89	5.8
21	194.0	6.0	0.1	12.8	663.0	73.2	119.4	811.9	201.7	408.4	428.5	288.8	0.19	72.0	74.2	87.3	0.18	72.0	70.9	88.1	0.18	75.1	73.7	81.7	0.08	0.10	-0.86	-0.91	-0.90	7.2
22	195.0	5.8	0.1	12.8	657.6	73.2	119.6	814.9	202.2	409.8	430.1	289.4	0.19	72.1	74.2	87.3	0.18	72.1	71.0	88.1	0.18	75.3	73.8	81.8	0.08	0.10	-0.87	-0.90	-0.90	8.6
23	196.0	5.7	0.1	12.8	656.9	73.3	119.5	817.9	201.1	411.0	430.5	289.3	0.19	72.1	74.3	87.4	0.18	72.1	71.0	88.1	0.18	75.4	73.9	81.8	0.08	0.10	-0.88	-0.91	-0.90	9.3
24	197.0	5.5	0.1	12.8	655.2	73.3	119.5	815.9	200.2	412.3	431.3	289.1	0.19	72.1	74.3	87.4	0.18	72.1	71.0	88.2	0.18	75.5	74.0	81.9	0.08	0.10	-0.87	-0.91	-0.90	10.2
25	198.0	5.3	0.1	12.8	653.7	73.0	118.4	822.3	200.8	413.3	430.0	289.4	0.19	72.1	74.3	87.4	0.18	72.2	71.1	88.2	0.18	75.7	74.1	81.9	0.08	0.09	-0.88	-0.91	-0.90	11.1
26	199.0	5.2	0.1	12.6	651.1	72.8	118.6	823.2	201.1	414.7	434.3	289.7	0.19	72.2	74.4	87.4	0.18	72.4	71.2	88.2	0.18	75.8	74.2	81.9	0.08	0.10	-0.88	-0.91	-0.90	11.9
27	200.0	5.0	0.1	12.6	650.5	73.4	118.5	824.8	201.2	415.6	435.6	289.6	0.19	72.2	74.5	87.5	0.18	72.5	71.2	88.2	0.18	76.0	74.3	82.0	0.08	0.10	-0.89	-0.91	-0.90	12.7
28	201.0	4.8	0.1	12.6	650.8	73.7	118.7	826.2	200.8	416.8	436.7	289.8	0.19	72.2	74.5	87.5	0.18	72.5	71.3	88.3	0.18	76.1	74.5	82.1	0.08	0.10	-0.89	-0.91	-0.90	13.1
29	202.0	4.7	0.1	12.7	649.3	73.0	118.3	827.1	200.5	417.2	437.9	289.7	0.19	72.3	74.5	87.6	0.18	72.5	71.3	88.3	0.18	76.1	74.6	82.1	0.08	0.09	-0.89	-0.91	-0.92	13.8
30	203.0	4.5	0.1	12.8	649.3	73.0	118.1	828.6	201.2	418.0	439.3	290.1	0.19	72.3	74.5	87.6	0.18	72.6	71.4	88.3	0.18	76.2	74.7	82.2	0.08	0.10	-0.91	-0.91	-0.92	14.7
31	204.0	4.3	0.1	12.8	648.2	73.4	118.2	830.4	201.4	418.2	441.2	290.5	0.19	72.4	74.6	87.6	0.18	72.6	71.4	88.4	0.18	76.3	74.9	82.3	0.08	0.10	-0.92	-0.92	-0.93	15.6
32	205.0	4.1	0.1	12.9	646.0	73.0	117.9	832.2	200.2	420.8	442.3	290.1	0.19	72.4	74.6	87.6	0.18	72.8	71.5	88.4	0.18	76.5	75.0	82.3	0.08	0.10	-0.92	-0.92	-0.94	16.4
33	206.0	4.0	0.1	12.5	638.8	73.2	116.6	833.2	201.0	422.2	443.5	290.8	0.19	72.4	74.7	87.6	0.18	72.9	71.5	88.3	0.18	76.5	75.1	82.3	0.08	0.09	-0.93	-0.91	-0.93	17.4
34	207.0	3.9	0.0	11.6	623.9	73.3	116.7	831.9	200.9	423.5	445.1	290.7	0.19	72.5	74.7	87.6	0.18	73.0	71.6	88.3	0.18	76.7	75.2	82.3	0.08	0.09	-0.94	-0.93	-0.95	17.7
35	208.0	3.7	0.0	11.4	606.8	73.0	114.5	806.7	200.6	426.5	446.7	290.7	0.19	72.5	74.7	87.6	0.18	73.0	71.6	88.3	0.18	76.8	75.3	82.4	0.08	0.09	-0.94	-0.93	-0.95	18.0
36	209.0	3.6	0.0	10.8	597.2	73.5	114.9	820.7	201.6	426.0	447.1	290.7	0.19	72.5	74.8	87.4	0.18	73.1	71.7	88.1	0.18	76.9	75.4	82.4	0.08	0.09	-0.95	-0.93	-0.96	16.5
37	210.0	3.5	0.0	10.0	590.7	73.7	113.8	813.2	202.4	427.4	449.5	291.2	0.19	72.5	74.8	87.3	0.18	73.1	71.7	88.0	0.18	77.0	75.5	82.4	0.08	0.09	-0.95	-0.93	-0.94	16.0
38	211.0	3.3	0.0	9.0	583.6	73.8	113.3	806.7	203.6	428.6	450.7	291.6	0.19	72.6	74.9	87.3	0.18	73.1	71.7	87.9	0.18	77.1	75.6	82.4	0.08	0.09	-0.96	-0.93	-0.95	15.1
39	212.0	3.2	0.0	9.9	583.3	73.8	113.2	800.7	202.8	429.0	451.4	290.6	0.19	72.6	74.8	87.3	0.18	73.1	71.7	87.8	0.18	77.1	75.7	82.5	0.08	0.09	-0.96	-0.93	-0.95	14.4
40	213.0	3.2	0.0	9.7	579.6	73.7	112.9	795.3	202.4	429.8	451.9	291.1	0.19	72.6	74.8	87.2	0.18	73.1	71.8	87.8	0.18	77.1	75.8	82.5	0.08	0.09	-0.96	-0.93	-0.96	13.4
41	214.0	3.1	0.0	9.4	575.0	73.7	112.7	790.3	202.1	430.2	452.7	291.6	0.19	72.6	74.8	87.2														

115	288,0	0,1	0,9	3,4	328,3	72,0	88,5	373,6	213,9	345,7	344,6	298,7	0,00	71,6	71,6	83,8	0,18	73,0	72,8	86,2	0,18	78,2	76,2	83,0	0,08	0,06	-0,02	-0,90	-0,96	-105,4
116	289,0	0,1	0,9	3,4	327,3	72,0	88,6	371,1	213,3	343,9	343,1	298,8	0,00	71,6	71,6	83,5	0,18	73,1	72,9	85,8	0,18	78,2	76,2	82,7	0,08	0,06	-0,02	-0,90	-0,96	-106,6
117	290,0	0,1	0,9	3,4	326,8	72,2	88,4	368,8	213,3	342,3	341,8	297,9	0,00	71,6	71,6	83,2	0,18	73,2	72,9	85,5	0,18	78,2	76,2	82,5	0,08	0,06	-0,02	-0,90	-0,96	-107,9
118	291,0	0,0	0,9	3,5	325,8	72,2	88,6	366,6	213,2	340,5	340,0	298,0	0,00	71,6	71,6	82,9	0,18	73,4	72,9	85,1	0,18	78,2	76,2	82,3	0,08	0,06	-0,02	-0,90	-0,95	-109,0

Time acquisition minutes	Flue	scale	Right	Back	bottom	Top	Left
	temp						
	°F	lbs	°F	°F	°F	°F	°F
1	67,84	4,27	67,97	68,12	68,12	68,23	68,35
2	81,58	4,27	67,99	68,11	68,13	68,34	68,37
3	150,79	4,07	68,01	68,12	68,16	68,47	68,39
4	293,99	3,97	68,06	68,03	68,33	69,49	68,55
5	355,80	3,77	68,24	68,11	68,74	73,95	69,41
6	438,05	3,57	68,76	68,20	69,42	85,56	71,36
7	461,75	3,37	69,76	68,48	70,40	106,62	74,56
8	496,34	3,23	71,19	68,99	71,74	133,83	78,95
9	523,81	3,07	73,18	69,61	73,64	165,50	84,64
10	556,62	2,77	75,75	70,47	76,06	202,75	91,83
11	576,82	2,63	79,10	71,53	79,07	246,34	100,25
12	570,49	2,47	83,01	72,87	82,72	291,37	109,23
13	576,27	2,21	87,70	74,17	86,96	332,86	118,17
14	591,79	2,07	92,91	75,84	91,76	372,89	126,96
15	584,99	1,95	98,52	77,56	97,01	411,16	135,86
16	578,45	1,77	104,66	79,34	102,70	445,87	145,07
17	564,90	1,67	111,34	81,59	108,68	475,30	154,51
18	551,65	1,47	118,64	83,70	114,92	499,09	164,31
19	542,85	1,37	127,07	85,93	121,27	518,16	174,92
20	543,89	1,27	136,27	88,28	127,74	532,81	185,47
21	533,93	9,58	144,79	95,47	134,02	543,08	196,52
22	460,84	12,68	153,22	101,00	138,91	540,43	205,85
23	467,70	12,48	160,77	105,66	144,66	527,72	215,27
24	536,82	12,28	168,14	110,36	149,69	510,90	223,93
25	566,84	12,08	176,89	106,27	157,10	500,51	231,87
26	535,32	11,98	185,11	107,04	162,55	500,81	238,38
27	537,53	11,86	193,18	107,78	167,08	505,95	242,33
28	555,84	11,68	200,99	108,59	171,02	515,95	246,10
29	572,30	11,55	208,60	109,73	174,51	532,33	249,05
30	569,87	11,38	215,11	111,63	177,24	550,27	252,09
31	566,29	11,17	221,91	113,24	179,68	563,92	255,23
32	565,19	11,08	228,59	114,65	181,63	573,37	258,69
33	568,93	10,95	234,57	115,97	183,18	581,35	261,66
34	571,12	10,78	240,55	117,93	184,83	589,27	265,58
35	575,42	10,58	245,02	119,23	186,01	596,27	269,86
36	580,16	10,38	250,40	120,58	187,17	602,46	274,53
37	578,72	10,28	255,27	121,97	188,17	607,66	279,25
38	577,54	10,08	260,20	123,38	188,98	611,77	284,08
39	574,76	9,88	265,36	124,83	189,81	614,68	289,43
40	576,93	9,77	270,28	126,71	190,53	618,56	294,56
41	577,62	9,68	275,03	127,57	191,27	621,59	299,66
42	582,36	9,48	279,60	128,70	191,82	624,16	304,35
43	586,65	9,28	284,34	130,47	192,71	627,37	308,83
44	588,50	9,17	287,95	131,50	193,36	631,53	313,70
45	592,64	8,98	292,74	132,74	194,29	635,88	318,10
46	593,38	8,78	296,38	133,65	194,75	640,54	322,49
47	599,05	8,68	301,14	134,89	195,64	645,98	326,60
48	603,65	8,47	304,66	136,21	196,61	652,09	331,23
49	608,02	8,28	309,48	137,50	197,40	658,87	335,73
50	613,70	8,08	312,96	138,92	198,28	666,55	339,52
51	622,09	7,87	318,04	140,04	199,17	675,39	343,27
52	626,94	7,67	322,24	141,52	200,01	685,03	347,57
53	634,75	7,58	326,77	143,07	201,17	695,98	351,92
54	640,89	7,38	331,42	143,56	202,15	707,79	356,69
55	653,17	7,17	336,01	145,78	203,33	720,75	360,74
56	661,24	6,97	339,85	147,81	204,26	734,41	364,11
57	673,05	6,78	344,37	148,19	205,38	749,19	369,19
58	679,30	6,68	348,26	149,06	206,33	764,85	372,90
59	686,91	6,37	351,34	151,06	207,77	780,33	376,85
60	694,10	6,27	354,76	152,50	209,07	796,30	380,82
61	698,73	6,08	360,03	153,41	210,49	812,50	385,09
62	702,76	5,87	362,41	155,13	211,83	827,34	388,74
63	705,56	5,67	365,95	156,49	212,90	842,05	392,47
64	705,21	5,48	369,21	158,44	214,22	856,03	395,90

65	703,99	5,28	372,45	160,01	215,33	868,05	399,63
66	698,96	5,16	375,91	161,45	216,69	878,30	402,81
67	695,56	4,97	378,85	162,83	218,00	886,29	406,21
68	686,85	4,78	381,17	164,89	219,60	890,79	409,51
69	673,43	4,68	383,54	166,00	221,01	890,77	411,83
70	664,91	4,47	386,18	167,49	222,26	885,46	414,26
71	657,09	4,37	388,66	169,21	224,08	877,92	416,35
72	650,01	4,17	391,65	170,10	225,38	870,25	418,34
73	639,56	4,04	393,28	171,97	227,30	862,62	420,11
74	631,11	3,94	395,25	172,93	229,10	854,21	422,06
75	632,24	3,77	397,80	173,54	230,98	847,99	423,47
76	653,34	3,66	400,24	173,84	232,95	847,84	425,48
77	675,20	3,47	401,85	174,59	235,46	851,54	427,31
78	684,13	3,38	404,47	175,12	237,68	856,38	428,78
79	678,32	3,17	405,82	176,91	240,54	859,86	429,62
80	668,53	3,07	408,71	177,79	243,07	863,03	430,67
81	653,77	2,97	410,58	178,90	246,32	863,74	431,06
82	643,02	2,87	411,36	180,35	249,75	861,96	431,46
83	626,54	2,87	413,00	182,48	253,22	855,17	432,17
84	609,82	2,87	415,25	183,11	256,27	843,71	432,50
85	595,20	2,77	416,77	183,90	259,54	829,74	432,86
86	581,88	2,68	416,83	185,24	263,71	813,41	433,86
87	570,97	2,57	418,56	186,03	267,49	797,03	434,12
88	559,32	2,57	418,60	187,57	270,98	781,36	435,49



Reviewer: 

TEST LOAD CONFIGURATION

Date: 2024-04-09

 Manufacturer: Spartantherm
PRE / POST CHECKS

 Model: 700

 Project #: PI 20302

 Run: 2

 Tech: MM

 Reviewer: [Signature]

Moisture Meter Calibration Check:

Equipment #	Time	12%	22%
EM-334	7:00	ok	ok

Pre-Test

Post-Test

Facility Conditions:

Air Velocity from less than 2 feet

Smoke Capture Check (tunnel velocity)

Picture.....

0 (max50 Fpm)	0 (max50 Fpm)
ok	NA
4 sides ok	ok

Wood Heater Conditions:

Date Wood Heater Stack Cleaned.....

Date Dilution Tunnel Cleaned.....

Induced Draft Check (max 0.005 H2O)

Traverse before ignition.....

2024-04-08
2024-04-08
ok
ok

Temperature System:

Ambient (65°-90°F)

ok °F

Proportional Checks:

Thermocouple check.....

Pitot Clean.....

Pitot verification.....

Pictures for report.....

ok
ok
ok
Side
Coal bed
Load
Load in stove
Fuel adjustment

ok
ok
ok
ok
ok
ok
ok

Load Length 5/6 of firebox Length +/- 1 inch.....



Date: 2024-04-09

Project #: PB 20307

Leakage Checks Tunnel Samplers

Manufacturer: SPANTHER

Run: 2 Tech: AM

Model: 700

Reviewer: DO

	System 1 st hour			System 1			System 2			Ambient	
	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)		Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)
Unplugged Flow Rate = .25cfm	- 10	- 10		- 10	- 10		- 10	- 10		- 10	- 10
Vacuum (inches Hg.)											
Final 1 minute DGM (Liter)	0589 75	0601 98		955636 75	956251 94		705905 19	706543 68		489334 46	489827 82
Initial 1 minute DGM (Liter)	0589 75	0601 98		955636 71	956251 94		705905 19	706543 68		489334 45	489827 80
Change (Liter)	φ	φ		004	008		φ	φ		001	002
Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56)											
Check OK	OK	OK		OK	OK		OK	OK		OK	OK



Date: 2024-04-09

Project #: PI 20232

Run: 2

Manufacturer: SPANTHERM

Tech: MM

Model: 700

Reviewer: SP

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre-Test	Post Test
Vacuum (inches Hg.)	-5	-5
Rotameter Reading (mm/min.)	Ø	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	.4	3	.5
Check OK (no change after 15 sec.)	OK	OK	OK	OK



Date: 2024-04-09

Project #: PI 20302

Manufacturer: SPARKHERM

Run: 2

Tech: MM

Model: 700

Reviewer: [Signature]

Scale Type	Audit		Measured Weight
	Equipment #	Weight	
Platform	EM-090	44 lbs, Class F	44 lbs
Platform	EM-205	10.00 Kg, Class F	10.00 Kg
Wood	EM-090	440 lbs, Class F	440 lbs
Analytical	EM-335	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: 2024-04-09

 Manufacturer: SpAtherm

 Model: 700

 Project #: pt20302

 Run: 2

 Tech: MM

 Reviewer: DP

FOR TUNNELS < 12 in

 Barometric pressure (P_{bar}) _____ (KPa.)

 Static pressure (P_q) _____ (inches w.c.)

Inside diameter: Port A _____ Port B _____

 Tunnel cross sectional area: .1963Ft²

Pitot tube type: Standard

Traverse Point	Position (inches)			Velocity Head Δp (inches H ₂ O)	Tunnel Temperature (°F)
Tunnel diameter	6 po	7 po	8 po		
A- Centroid	3.00	3.50	4	0080	6784
B - Centroid	3.00	3.50	4	0080	6772
A-1	0.40	0.50	0.50	0066	6784
A-2	1.50	1.75	2	0074	6793
A-3	4.50	5.25	6	0070	6793
A-4	5.60	6.5	7.5	0066	6783
B-1	0.40	0.50	0.50	0066	6772
B-2	1.50	1.75	2	0069	6785
B-3	4.50	5.25	6	0077	6784
B-4	5.60	6.5	7.5	0067	6784
				AVERAGE	

Date: _____ Manufacturer: _____ Model: _____

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

FOR TUNNELS 12 in

 Barometric pressure (P_{bar}) _____ (KPa.) Static pressure (P_q) _____ (inches w.c.)

Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δp (inches H_2O)	Tunnel Temperature ($^{\circ}F$)
A Center	6		
B Center	6		
A-1	0.53		
A-2	1.75		
A-3	3.55		
A-4	8.45		
A-5	10.25		
A-6	11.47		
B-1	0.53		
B-2	1.75	N.A	
B-3	3.55		
B-4	8.45		
B-5	10.25		
B-6	11.47		

Date: 2023-04-09

 Manufacturer: SpAtherm

 Model: 700

 Project #: PJ 20302

 Run: 2

 Tech: MM

 Reviewer: BP
Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	0	0	3061	3000	1033	1000
Tolerance CO	6	+/- 0.02	0061	+/- 0.15	0033	+/- 0.05
CO ₂	0	0	1802	1800	986	1000
Tolerance CO ₂	0	+/- 0.02	002	+/- 0.5	014	+/- 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	0	3058	1025	6	0.02	003	0.15	0008	0.05	✓	
CO ₂	0	1801	980	6	0.02	001	0.5	006	0.5	✓	

Date: 2024.04.09

Project #: PJ 20302

RAW DRY GAS METER READINGS

TEST DATA LOG

Manufacturer: SPANtherm

Run: 2 Tech: MM

Model: 700

Reviewer: 

Test	System 1 st hour	System 1	System 2	Blank
	Final (Liter) 0601.88	956251.50	706542.81	489826.74
Initial (Liter) 0589.84	955638.68	705906 MM	705906.48	489334.70

AMBIENT CONDITIONS

	Before	After
Barometer (kPa):	100.6	100.7
Dry Bulb (F):	72.3	74.3
Humidity (%):	29.1	30.1

FUEL DATA

Date: 2024-04-09 Manufacturer: Spartherm Model: 700
 Project #: PT 20302 Run: 2 Tech: MM Reviewer: DD

FUEL DESCRIPTION:

Type of wood:

PRE-TEST LOAD

Piece Size			Weight	Meter Moisture Content (% dry) *				
1 1/2	x 3 1/2	x 15 in.	1646 lbs.	200	198	196	196	196
1 1/2	x 3 1/2	x 15 in.	1694 lbs.	193	194	193	194	194
1 1/2	x 3 1/2	x 15 in.	1594 lbs.	196	195	196	196	197
1 1/2	x 3 1/2	x 7 1/2 in.	0844 lbs.	192	191	193	194	195
1 1/2	x 3 1/2	x 7 1/2 in.	0842 lbs.	201	202	203	202	202
1 1/2	x 3 1/2	x 7 1/2 in.	0840 lbs.	200	201	198	197	198
1 1/2	x 3 1/2	x 7 1/2 in.	0826 lbs.	201	200	200	201	202
1 1/2	x 3 1/2	x 7 1/2 in.	0836 lbs.	203	202	204	203	202
1 1/2	x 3 1/2	x 7 1/2 in.	0808 lbs.	197	196	195	196	193
1 1/2	x 3 1/2	x 7 1/2 in.	0898 lbs.	194	193	194	194	193
1 1/2	x 3 1/2	x 7 1/2 in.	0782 lbs.	203	202	203	204	206
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.					

TEST LOAD WEIGHT: 1160 lbs

FUEL DATA

Date: 2024-04-09

Manufacturer: SpAtherm

Model: 700

Project #: PT 20302

Run: 2

Tech: MM

Reviewer: SP
FUEL DESCRIPTION:

Type of wood:

TEST LOAD

Piece Size			Weight		Meter Moisture Content (% dry)*			
1 1/2	X 3 1/2	X 17 1/2 in.	1	900 lbs.	191	192	192	192
1 1/2	X 3 1/2	X 17 1/2 in.	1	916 lbs.	195	196	195	194
3 1/2	X 3 1/2	X 17 1/2 in.	5	096 lbs.	201	208	207	207
	X 1 1/2	X 17 1/2 in.		lbs.				
1 1/2	X 3 1/4	X 5 in.	0	152 lbs.			203	
1 1/2	X 3 1/4	X 5 in.	0	134 lbs.			206	
1 1/2	X 3 1/2	X 5 in.	0	104 lbs.			204	
1 1/2	X 1 1/2	X 5 in.	0	124 lbs.			204	
1 1/2	X 3 1/4	X 5 in.	0	096 lbs.			205	
1 1/2	X 3 1/4	X 5 in.	0	114 lbs.			206	
1 1/2	X 3 1/4	X 5 in.	0	122 lbs.			205	
1 1/2	X 3 1/4	X 5 in.	0	128 lbs.			204	
1 1/2	X 3 1/4	X 5 in.	0	086 lbs.			208	
1 1/2	X 3 1/4	X 5 in.	0	128 lbs.			201	
1 1/2	X 3 1/4	X 5 in.	0	138 lbs.			206	
1 1/2	X 3 1/4	X 5 in.	0	140 lbs.			206	
	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.				

TEST LOAD WEIGHT: 1038 lbs Min 20%: Max 25%:

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2024-04-09 Project #: PT 20302 Manufacturer: SpAtherm Model: 700 Run: 2 Tech: MM Reviewer: SP

TEST FILTERS						
SYSTEM 1 st hour				SYSTEM 1		
Pre-test Weight Record		Probe & Housing Number	Front & Back Filter Number	gaskets	Probe & Housing Number	Front & Back Filter Number
Date	Time					
2024-04-08	17:30	108 7344	02614	50435	107 9750	02621
2024-04-09	9:00	108 7345	02613	50434	107 9749	02620

TEST FILTERS						
SYSTEM 1 st hour				SYSTEM 1		
Post-test Weight Record		Probe & Housing Number	Front & Back Filter Number	gaskets	Probe & Housing Number	Front & Back Filter Number
Date	Time					
2024-04-09	13:45	108 7347	02618	50451	107 9751	02621
2024-04-15	9:00	108 7346	02617	50439	107 9749	02619
2024-04-16	10:00	108 7346	02617	50439	107 9749	02620

Date: 2024-04-09

Project #: PJ 20302

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Manufacturer: SPANTHER

Run: 2

Tech: M.M

Model: 700

Reviewer: SD

TEST FILTERS						
SYSTEM 2						
Pre-test Weight Record		Probe & Housing Number	Front & Back Filter Number	gaskets	Blank Filter	
Date	Time					
2024-04-08	17:00	39	05-101	14	102	
		110 2771	02584	5 0661	0 1232	
2024-04-09	9:00	110 2772	02585	5 0662	0 1233	
TEST FILTERS						
SYSTEM 2						
Post-test Weight Record		Probe & Housing Number	Front & Back Filter Number	gaskets	Blank Filter	End test time and date
Date	Time					
2024-04-09	13:45	39	05-101	14	102	2024-04-09
		110 2774	02585	5 0678	0 1233	
2024-04-15	9:00	110 2773	02585	5 0677	0 1233	13:15
2024-04-16	10:00	110 2773	02585	5 0677	0 1233	

2024-04-09

13:15

APPENDIX 2: Proportionality results

Average	Average	Average	Average								Average
18,33	Inlet +	Inlet +	Inlet +								0,281
	Outlet	Outlet	Outlet	Average	Average	Average	#1st Hr	#1	#2		
Tunnel	Temp.	Temp.	Temp.	99,67	102,94	99,43	System 1st Hr	System 1	System 2		SQRT
Velocity	Meter 1st Hr	Meter 1	Meter 2	Proportional Rates			Vol.Std.	Vol.Std.	Vol.Std.		Delta-P
				PR1st hour	PR1	PR2				Time	
Ft/Sec	Deg. R	Deg. R	Deg. R	%	%	%	(ft3)	(ft3)	(ft3)	min	(in H2O)2
18,852	531,600	531,1	531,2				0,181	0,174	0,179	0	0,280
19,069	531,600	531,2	531,3	103,9	108,3	104,8	0,181	0,174	0,178	1	0,280
18,359	531,689	531,1	531,4	100,7	105,2	102,3	0,181	0,174	0,179	2	0,279
18,388	531,711	531,1	531,5	99,5	103,9	100,8	0,181	0,174	0,179	3	0,281
18,377	531,756	531,1	531,6	99,6	104,0	100,8	0,181	0,174	0,179	4	0,281
18,251	531,772	531,1	531,8	100,1	104,6	101,5	0,181	0,174	0,179	5	0,279
18,431	531,825	531,2	532,0	99,0	103,6	100,6	0,181	0,174	0,179	6	0,282
18,485	531,845	531,2	532,1	98,9	103,4	100,2	0,181	0,174	0,179	7	0,282
18,097	531,914	531,2	532,3	101,2	105,7	102,7	0,181	0,174	0,179	8	0,276
18,232	531,978	531,2	532,5	100,5	105,3	101,9	0,181	0,174	0,179	9	0,278
18,224	532,068	531,2	532,7	100,7	105,3	101,9	0,181	0,174	0,179	10	0,278
18,177	532,126	531,3	532,9	100,9	105,4	102,5	0,181	0,174	0,179	11	0,277
18,238	532,164	531,3	533,0	100,7	105,1	102,0	0,181	0,174	0,179	12	0,278
18,297	532,188	531,3	533,2	100,2	104,7	101,4	0,181	0,174	0,179	13	0,279
18,300	532,229	531,4	533,4	100,2	104,8	101,6	0,181	0,174	0,179	14	0,279
18,293	532,277	531,4	533,6	100,2	104,8	101,5	0,181	0,174	0,179	15	0,279
18,288	532,306	531,5	533,7	100,4	104,8	101,5	0,181	0,174	0,179	16	0,279
18,364	532,357	531,5	533,9	99,9	104,4	101,0	0,181	0,174	0,178	17	0,280
18,536	532,409	531,6	534,1	98,8	103,4	100,2	0,181	0,174	0,178	18	0,282
18,420	532,439	531,7	534,3	99,5	104,0	100,7	0,181	0,174	0,178	19	0,281
18,363	532,489	531,9	534,5	99,8	104,5	100,9	0,181	0,174	0,178	20	0,280
18,375	532,526	532,0	534,7	99,7	104,2	100,8	0,181	0,174	0,178	21	0,280
18,312	532,583	532,0	534,8	100,2	104,8	101,5	0,181	0,174	0,178	22	0,279
18,312	532,652	532,1	534,9	100,3	104,7	101,3	0,181	0,174	0,178	23	0,279
18,492	532,701	532,1	535,1	99,2	103,9	100,4	0,181	0,174	0,178	24	0,282
18,305	532,737	532,2	535,2	100,3	104,7	101,4	0,181	0,174	0,178	25	0,279
18,303	532,764	532,2	535,4	100,2	104,7	101,3	0,181	0,174	0,178	26	0,279
18,190	532,776	532,3	535,5	100,9	105,5	101,7	0,181	0,174	0,178	27	0,277
18,369	532,805	532,3	535,6	99,9	104,5	100,8	0,181	0,174	0,178	28	0,280
18,501	532,868	532,4	535,7	99,3	103,5	100,3	0,181	0,174	0,178	29	0,282
18,374	532,888	532,4	535,9	99,9	104,2	100,8	0,181	0,174	0,178	30	0,280
18,375	532,926	532,5	536,0	99,9	104,3	101,1	0,181	0,174	0,178	31	0,280
18,238	532,975	532,5	536,1	100,5	105,0	101,3	0,181	0,174	0,178	32	0,278
18,552	532,995	532,6	536,1	98,9	103,3	100,1	0,181	0,174	0,178	33	0,283
18,442	533,030	532,6	536,2	99,6	104,0	100,3	0,181	0,174	0,178	34	0,281
18,491	533,070	532,7	536,3	99,2	103,6	100,4	0,181	0,174	0,178	35	0,282
18,384	533,104	532,7	536,4	99,9	104,4	100,8	0,181	0,174	0,178	36	0,280
18,448	533,150	532,7	536,5	99,4	104,2	100,3	0,180	0,174	0,178	37	0,281
18,433	533,177	532,8	536,6	99,4	104,0	100,4	0,180	0,174	0,178	38	0,281
18,481	533,222	532,8	536,7	99,2	103,7	99,8	0,181	0,174	0,178	39	0,282
18,405	533,255	532,8	536,7	99,3	103,8	100,2	0,181	0,174	0,178	40	0,281
18,422	533,265	532,9	536,8	99,4	103,7	100,1	0,181	0,174	0,178	41	0,281
18,295	533,323	533,0	536,8	100,0	104,4	101,0	0,181	0,174	0,178	42	0,279
18,338	533,347	533,0	536,9	99,6	104,0	100,3	0,181	0,174	0,178	43	0,280
18,404	533,383	533,0	537,0	99,3	103,9	100,1	0,180	0,174	0,177	44	0,281
18,519	533,395	533,0	537,1	98,7	102,9	99,8	0,181	0,174	0,178	45	0,283
18,073	533,408	533,1	537,2	100,9	105,4	101,9	0,180	0,174	0,178	46	0,276
18,516	533,428	533,1	537,3	98,7	103,0	99,6	0,181	0,174	0,178	47	0,283
18,388	533,451	533,1	537,3	99,3	103,7	99,9	0,181	0,174	0,178	48	0,281
18,281	533,473	533,1	537,4	99,7	104,1	100,8	0,181	0,174	0,178	49	0,279
18,430	533,493	533,2	537,4	98,8	103,4	99,6	0,181	0,174	0,178	50	0,282
18,252	533,484	533,2	537,5	99,8	104,4	100,4	0,181	0,174	0,177	51	0,279
18,432	533,520	533,2	537,5	98,8	103,3	99,5	0,180	0,174	0,177	52	0,282
18,405	533,508	533,3	537,6	98,8	103,1	99,4	0,181	0,174	0,177	53	0,282
18,577	533,534	533,3	537,6	97,7	102,1	98,3	0,181	0,174	0,177	54	0,284
18,402	533,546	533,4	537,7	98,7	103,4	99,3	0,181	0,174	0,177	55	0,282
18,270	533,549	533,4	537,7	99,1	103,8	99,9	0,180	0,174	0,177	56	0,280
18,557	533,535	533,4	537,7	97,6	102,1	98,2	0,181	0,174	0,177	57	0,284
18,357	533,541	533,3	537,8	98,4	102,8	99,1	0,181	0,174	0,177	58	0,282
18,295	533,462	533,3	537,8	98,6	103,2	99,2	0,180	0,174	0,177	59	0,281
18,343	533,429	533,2	537,8	98,3	102,8	99,2	0,181	0,174	0,177	60	0,282
18,162	533,007	533,2	537,8	0,0	103,7	100,3	0,000	0,174	0,178	61	0,279
18,397	532,834	533,3	537,7	0,0	102,4	98,9	0,000	0,174	0,178	62	0,283
18,327	532,721	533,3	537,7	0,0	102,9	98,8	0,000	0,174	0,177	63	0,282
18,322	532,622	533,3	537,7	0,0	102,7	99,1	0,000	0,174	0,177	64	0,282
18,257	532,566	533,3	537,6	0,0	103,1	99,0	0,000	0,174	0,177	65	0,281
18,489	532,530	533,3	537,6	0,0	101,6	98,0	0,000	0,174	0,177	66	0,284
18,193	532,487	533,3	537,6	0,0	103,1	99,5	0,000	0,174	0,177	67	0,280
18,312	532,478	533,3	537,6	0,0	102,8	99,1	0,000	0,174	0,178	68	0,282
18,300	532,451	533,3	537,6	0,0	102,4	99,2	0,000	0,174	0,178	69	0,282
18,300	532,439	533,4	537,6	0,0	102,6	99,0	0,000	0,174	0,178	70	0,282
18,337	532,413	533,4	537,6	0,0	101,8	98,5	0,000	0,174	0,178	71	0,283
18,284	532,401	533,4	537,5	0,0	102,4	98,9	0,000	0,173	0,178	72	0,282
18,047	532,389	533,4	537,5	0,0	103,9	100,3	0,000	0,174	0,178	73	0,278
18,340	532,371	533,4	537,5	0,0	102,1	98,4	0,000	0,174	0,178	74	0,283
18,059	532,345	533,4	537,5	0,0	103,7	100,2	0,000	0,174	0,178	75	0,278
18,515	532,345	533,4	537,5	0,0	101,1	97,7	0,000	0,174	0,178	76	0,285
18,455	532,349	533,5	537,5	0,0	101,2	97,8	0,000	0,174	0,178	77	0,284
18,159	532,338	533,5	537,5	0,0	103,0	99,5	0,000	0,174	0,178	78	0,280

18,339	532,309	533,5	537,6	0,0	102,1	98,7	0,000	0,174	0,178	79	0,283
18,216	532,306	533,5	537,6	0,0	102,8	99,0	0,000	0,174	0,178	80	0,281
18,340	532,310	533,5	537,5	0,0	101,9	98,4	0,000	0,174	0,177	81	0,283
18,276	532,314	533,5	537,5	0,0	102,4	98,7	0,000	0,174	0,177	82	0,282
18,155	532,325	533,6	537,6	0,0	103,0	99,4	0,000	0,174	0,177	83	0,280
18,093	532,303	533,5	537,6	0,0	103,3	99,6	0,000	0,174	0,177	84	0,279
18,444	532,317	533,5	537,6	0,0	101,6	97,9	0,000	0,174	0,177	85	0,284
18,289	532,314	533,5	537,6	0,0	102,1	98,6	0,000	0,174	0,178	86	0,282
18,191	532,314	533,5	537,6	0,0	102,6	98,9	0,000	0,174	0,177	87	0,281
18,598	532,325	533,6	537,6	0,0	100,3	96,9	0,000	0,174	0,177	88	0,287
18,647	532,331	533,6	537,6	0,0	100,0	96,3	0,000	0,174	0,178	89	0,288
18,408	532,330	533,6	537,7	0,0	101,1	97,5	0,000	0,174	0,177	90	0,284
18,285	532,334	533,6	537,7	0,0	101,9	98,4	0,000	0,174	0,178	91	0,283
18,282	532,332	533,6	537,7	0,0	101,7	98,2	0,000	0,174	0,178	92	0,283
18,274	532,335	533,6	537,6	0,0	101,8	98,2	0,000	0,174	0,178	93	0,283
18,387	532,321	533,6	537,6	0,0	100,9	97,5	0,000	0,174	0,178	94	0,284
18,018	532,333	533,6	537,6	0,0	103,1	99,2	0,000	0,174	0,177	95	0,279
18,022	532,336	533,6	537,6	0,0	102,8	99,4	0,000	0,174	0,177	96	0,279
18,134	532,340	533,7	537,5	0,0	102,1	98,7	0,000	0,173	0,178	97	0,281
18,393	532,371	533,7	537,5	0,0	100,8	97,1	0,000	0,174	0,177	98	0,285
18,250	532,385	533,8	537,6	0,0	101,6	98,1	0,000	0,174	0,177	99	0,283
18,193	532,381	533,8	537,6	0,0	101,9	98,4	0,000	0,174	0,178	100	0,282
18,371	532,383	533,8	537,6	0,0	100,9	97,5	0,000	0,174	0,178	101	0,284
18,190	532,378	533,8	537,6	0,0	102,0	98,1	0,000	0,174	0,177	102	0,282
18,124	532,365	533,7	537,6	0,0	102,1	98,5	0,000	0,174	0,177	103	0,281
18,182	532,380	533,7	537,6	0,0	101,9	98,2	0,000	0,174	0,177	104	0,282
18,358	532,373	533,7	537,6	0,0	101,0	97,5	0,000	0,174	0,178	105	0,284
18,002	532,366	533,7	537,5	0,0	102,9	99,2	0,000	0,174	0,178	106	0,279
18,347	532,390	533,7	537,6	0,0	100,7	97,1	0,000	0,174	0,177	107	0,284
18,216	532,382	533,7	537,5	0,0	101,2	97,7	0,000	0,173	0,177	108	0,283
18,221	532,410	533,8	537,6	0,0	101,4	97,8	0,000	0,174	0,177	109	0,283
18,401	532,429	533,8	537,6	0,0	100,6	96,9	0,000	0,174	0,177	110	0,285
18,279	532,422	533,8	537,6	0,0	100,8	97,6	0,000	0,174	0,178	111	0,283
18,392	532,418	533,9	537,6	0,0	100,5	96,8	0,000	0,173	0,177	112	0,285
18,223	532,426	533,9	537,7	0,0	101,4	97,9	0,000	0,174	0,177	113	0,283
18,277	532,420	533,9	537,6	0,0	101,0	97,5	0,000	0,174	0,177	114	0,284
18,555	532,421	533,9	537,7	0,0	99,3	96,0	0,000	0,174	0,178	115	0,288
18,208	532,457	534,0	537,7	0,0	101,0	97,5	0,000	0,173	0,177	116	0,283
18,207	532,474	534,0	537,7	0,0	101,2	97,8	0,000	0,173	0,177	117	0,283
18,319	532,462	534,0	537,7	0,0	100,8	97,1	0,000	0,174	0,177	118	0,284
18,250	532,442	534,0	537,7	0,0	100,9	97,4	0,000	0,174	0,177	119	0,283
18,025	532,430	534,0	537,7	0,0	102,1	98,7	0,000	0,173	0,177	120	0,280
18,254	532,436	534,0	537,7	0,0	100,9	97,6	0,000	0,174	0,178	121	0,283
18,253	532,428	534,0	537,7	0,0	100,8	97,4	0,000	0,174	0,178	122	0,283
18,192	532,417	534,0	537,7	0,0	101,1	97,6	0,000	0,173	0,177	123	0,283
18,372	532,426	534,0	537,8	0,0	100,2	96,8	0,000	0,173	0,177	124	0,285

Average	Average	Average	Average								Average
18,54	Inlet +	Inlet +	Inlet +								0,286
	Outlet	Outlet	Outlet	Average	Average	Average	#1st Hr	#1	#2		
Tunnel	Temp.	Temp.	Temp.	99,55	103,39	99,98	System 1st Hr	System 1	System 2		SQRT
Velocity	Meter 1st Hr	Meter 1	Meter 2	Proportional Rates			Vol.Std.	Vol.Std.	Vol.Std.		Delta-P
				PR1st hour	PR1	PR2				Time	
Ft/Sec	Deg. R	Deg. R	Deg. R	%	%	%	(ft3)	(ft3)	(ft3)	min	(in H2O)2
18,929	531,921	531,0	531,2				0,181	0,174	0,178	0	0,283
19,270	531,921	531,0	531,3	103,3	108,4	105,5	0,181	0,174	0,178	1	0,285
18,519	531,995	531,0	531,4	100,3	105,7	102,5	0,180	0,174	0,179	2	0,283
18,658	532,037	531,0	531,5	99,9	104,9	102,1	0,180	0,174	0,179	3	0,285
18,665	532,078	531,0	531,6	99,9	105,1	102,3	0,180	0,174	0,179	4	0,285
18,801	532,159	530,9	531,7	99,2	104,4	101,4	0,181	0,174	0,179	5	0,287
18,619	532,214	531,0	531,9	100,3	105,6	102,8	0,181	0,174	0,179	6	0,284
18,322	532,281	531,0	532,0	102,0	107,3	104,2	0,181	0,174	0,179	7	0,280
18,676	532,373	531,0	532,2	100,1	105,4	102,2	0,181	0,174	0,179	8	0,285
18,669	532,461	531,1	532,4	100,0	105,0	102,3	0,181	0,174	0,179	9	0,285
18,543	532,531	531,1	532,6	100,5	105,8	102,7	0,181	0,174	0,179	10	0,283
18,914	532,587	531,1	532,7	98,7	104,0	100,8	0,180	0,174	0,178	11	0,289
18,738	532,640	531,2	532,9	99,5	105,0	101,8	0,180	0,174	0,178	12	0,286
18,739	532,656	531,2	533,1	99,7	104,9	102,0	0,180	0,174	0,179	13	0,286
18,685	532,749	531,3	533,3	100,0	105,3	102,1	0,181	0,174	0,178	14	0,285
18,515	532,844	531,3	533,5	100,9	106,3	103,0	0,180	0,174	0,178	15	0,283
18,699	532,912	531,4	533,7	100,0	105,1	102,2	0,180	0,174	0,178	16	0,285
18,499	532,950	531,4	533,8	100,9	106,4	103,2	0,180	0,174	0,178	17	0,282
18,704	532,984	531,4	533,9	100,2	105,4	102,1	0,180	0,174	0,178	18	0,285
18,660	532,996	531,4	534,1	100,3	105,7	102,5	0,180	0,174	0,178	19	0,284
18,650	533,055	531,4	534,2	100,3	105,9	102,4	0,180	0,174	0,178	20	0,284
18,528	533,098	531,5	534,4	100,9	106,3	102,9	0,180	0,174	0,178	21	0,283
18,707	533,141	531,5	534,5	100,0	105,4	102,0	0,180	0,174	0,178	22	0,285
18,765	533,172	531,6	534,6	99,7	105,0	101,6	0,180	0,174	0,178	23	0,286
18,644	533,187	531,6	534,8	100,3	105,6	102,2	0,180	0,174	0,178	24	0,284
18,688	533,241	531,7	534,9	99,8	105,3	101,7	0,180	0,174	0,178	25	0,285
18,668	533,296	531,8	535,0	100,0	105,2	102,1	0,180	0,174	0,178	26	0,285
18,690	533,364	531,8	535,1	99,9	105,3	101,8	0,180	0,174	0,178	27	0,285
18,695	533,400	531,9	535,3	100,0	105,2	101,9	0,180	0,174	0,178	28	0,285
18,568	533,407	531,9	535,4	100,5	105,6	102,4	0,180	0,174	0,178	29	0,283
18,743	533,429	532,0	535,5	99,6	104,8	101,4	0,180	0,174	0,178	30	0,286
18,744	533,467	532,1	535,6	99,5	104,6	101,3	0,180	0,174	0,178	31	0,286
18,739	533,504	532,1	535,7	99,4	104,8	101,4	0,180	0,174	0,178	32	0,286
18,662	533,554	532,2	535,8	99,8	104,8	101,3	0,180	0,174	0,177	33	0,285
18,366	533,595	532,3	535,9	101,3	106,6	103,3	0,180	0,174	0,177	34	0,281
18,620	533,617	532,3	536,1	99,5	104,8	101,5	0,180	0,174	0,178	35	0,285
18,277	533,658	532,4	536,2	101,5	106,8	103,3	0,180	0,174	0,178	36	0,280
18,730	533,660	532,4	536,3	98,7	103,9	100,6	0,180	0,174	0,178	37	0,287
18,668	533,676	532,4	536,3	99,1	104,5	100,8	0,180	0,174	0,177	38	0,286
18,711	533,688	532,4	536,4	98,8	103,9	100,6	0,180	0,174	0,177	39	0,287
18,364	533,704	532,4	536,4	100,6	105,9	102,1	0,180	0,174	0,177	40	0,282
18,584	533,701	532,4	536,5	99,2	104,4	101,0	0,180	0,174	0,177	41	0,285
18,482	533,690	532,5	536,6	99,9	105,2	101,6	0,180	0,174	0,177	42	0,284
18,906	533,687	532,5	536,7	97,4	102,4	99,1	0,180	0,174	0,177	43	0,291
18,905	533,669	532,5	536,8	97,3	102,4	99,0	0,180	0,174	0,177	44	0,291
18,371	533,615	532,4	536,9	100,0	105,0	101,7	0,180	0,173	0,177	45	0,283
18,520	533,558	532,5	536,9	99,0	104,2	100,9	0,180	0,174	0,178	46	0,285
18,515	533,525	532,5	536,9	98,9	104,1	100,6	0,180	0,174	0,178	47	0,285
18,653	533,487	532,5	536,9	97,9	103,0	99,5	0,180	0,173	0,177	48	0,288
18,267	533,470	532,5	536,9	100,0	105,2	101,7	0,180	0,173	0,177	49	0,282
18,595	533,464	532,5	537,0	98,1	103,1	99,8	0,180	0,173	0,177	50	0,287
18,583	533,437	532,6	537,0	98,1	103,3	99,7	0,180	0,174	0,177	51	0,287
18,406	533,412	532,6	537,0	99,0	104,3	100,7	0,180	0,174	0,177	52	0,284
18,573	533,388	532,6	537,1	98,0	102,9	99,6	0,180	0,174	0,177	53	0,287
18,621	533,403	532,7	537,1	97,6	102,8	99,3	0,180	0,173	0,177	54	0,288
18,648	533,386	532,7	537,2	97,3	102,3	99,0	0,180	0,174	0,177	55	0,289
18,484	533,370	532,7	537,2	98,2	103,2	99,9	0,180	0,173	0,177	56	0,286
18,254	533,340	532,7	537,3	99,4	104,6	101,1	0,180	0,174	0,177	57	0,283
18,535	533,340	532,7	537,3	97,9	102,8	99,2	0,180	0,173	0,177	58	0,287
18,532	533,329	532,7	537,4	97,8	102,9	99,5	0,180	0,173	0,177	59	0,287
18,694	533,356	532,7	537,5	96,9	102,1	98,3	0,180	0,174	0,177	60	0,290
18,571	532,927	532,6	537,4	0,0	102,5	98,9	0,000	0,174	0,177	61	0,288
18,743	532,638	532,6	537,4	0,0	101,6	97,8	0,000	0,174	0,177	62	0,291
18,564	532,460	532,6	537,3	0,0	102,6	98,9	0,000	0,174	0,177	63	0,288
18,561	532,355	532,5	537,3	0,0	102,3	98,7	0,000	0,174	0,177	64	0,288
18,365	532,254	532,5	537,3	0,0	103,5	100,0	0,000	0,174	0,177	65	0,285
18,549	532,170	532,4	537,2	0,0	102,3	98,7	0,000	0,174	0,177	66	0,288
18,435	532,081	532,4	537,2	0,0	102,9	99,3	0,000	0,174	0,177	67	0,286
18,601	532,015	532,4	537,2	0,0	102,1	98,5	0,000	0,174	0,177	68	0,289
18,547	531,957	532,3	537,2	0,0	102,3	98,7	0,000	0,174	0,177	69	0,288
18,368	531,916	532,3	537,2	0,0	103,4	99,8	0,000	0,174	0,177	70	0,285
18,677	531,871	532,3	537,2	0,0	101,7	98,0	0,000	0,174	0,177	71	0,290
18,645	531,810	532,3	537,1	0,0	101,7	98,2	0,000	0,174	0,177	72	0,290
18,705	531,767	532,3	537,1	0,0	101,2	97,5	0,000	0,173	0,177	73	0,291
18,587	531,733	532,3	537,1	0,0	101,8	98,3	0,000	0,173	0,177	74	0,289
18,482	531,697	532,3	537,1	0,0	102,5	99,0	0,000	0,173	0,177	75	0,287
18,360	531,682	532,3	537,1	0,0	103,1	99,7	0,000	0,173	0,177	76	0,285
18,589	531,670	532,4	537,1	0,0	102,2	98,5	0,000	0,174	0,177	77	0,289
18,449	531,662	532,4	537,2	0,0	102,9	99,1	0,000	0,174	0,177	78	0,287

18,363	531,657	532,4	537,2	0,0	103,3	99,7	0,000	0,174	0,177	79	0,285
18,420	531,651	532,4	537,2	0,0	102,9	99,3	0,000	0,174	0,177	80	0,286
18,526	531,657	532,5	537,2	0,0	102,2	98,4	0,000	0,174	0,177	81	0,288
18,508	531,629	532,5	537,2	0,0	102,2	98,6	0,000	0,174	0,177	82	0,288
18,329	531,639	532,5	537,2	0,0	102,8	99,3	0,000	0,173	0,177	83	0,285
18,494	531,619	532,5	537,1	0,0	102,0	98,7	0,000	0,173	0,177	84	0,288
18,433	531,624	532,5	537,2	0,0	102,5	98,6	0,000	0,174	0,177	85	0,287
18,366	531,634	532,6	537,2	0,0	102,7	99,0	0,000	0,174	0,177	86	0,286
18,557	531,619	532,5	537,2	0,0	101,4	98,0	0,000	0,174	0,177	87	0,289
18,406	531,610	532,5	537,2	0,0	102,3	98,7	0,000	0,174	0,177	88	0,287
18,630	531,578	532,6	537,1	0,0	100,8	97,5	0,000	0,174	0,177	89	0,291
18,172	531,586	532,6	537,2	0,0	103,4	99,9	0,000	0,173	0,177	90	0,283
18,224	531,580	532,6	537,2	0,0	103,0	99,5	0,000	0,174	0,177	91	0,284
18,457	531,581	532,6	537,2	0,0	101,7	98,1	0,000	0,174	0,177	92	0,288
18,332	531,597	532,6	537,2	0,0	102,4	98,8	0,000	0,174	0,177	93	0,286
18,609	531,612	532,6	537,2	0,0	100,6	97,1	0,000	0,173	0,177	94	0,291
18,584	531,613	532,7	537,2	0,0	100,7	97,3	0,000	0,173	0,177	95	0,290
18,317	531,602	532,7	537,2	0,0	102,2	98,6	0,000	0,173	0,177	96	0,286
18,313	531,610	532,7	537,2	0,0	102,3	99,0	0,000	0,174	0,177	97	0,286
18,634	531,592	532,7	537,2	0,0	100,5	97,0	0,000	0,174	0,177	98	0,291
18,246	531,595	532,7	537,2	0,0	102,3	98,9	0,000	0,173	0,177	99	0,285
18,358	531,595	532,7	537,2	0,0	101,9	98,1	0,000	0,173	0,177	100	0,287
18,356	531,604	532,8	537,2	0,0	101,9	98,5	0,000	0,174	0,177	101	0,287
18,290	531,599	532,8	537,2	0,0	102,0	98,6	0,000	0,174	0,177	102	0,286
18,455	531,589	532,8	537,2	0,0	101,2	97,7	0,000	0,174	0,177	103	0,289
18,570	531,597	532,9	537,2	0,0	100,4	97,1	0,000	0,173	0,177	104	0,291
18,289	531,587	532,8	537,2	0,0	102,1	98,5	0,000	0,173	0,177	105	0,286
18,566	531,575	532,8	537,2	0,0	100,6	97,0	0,000	0,174	0,177	106	0,291
18,450	531,564	532,9	537,2	0,0	100,9	97,7	0,000	0,173	0,177	107	0,289
18,452	531,558	532,9	537,2	0,0	101,3	97,8	0,000	0,173	0,177	108	0,289
18,452	531,575	532,9	537,2	0,0	101,1	97,9	0,000	0,174	0,177	109	0,289
18,281	531,563	532,9	537,2	0,0	102,0	98,4	0,000	0,173	0,177	110	0,286
18,389	531,553	532,9	537,2	0,0	101,4	98,1	0,000	0,173	0,177	111	0,288
18,561	531,553	532,9	537,2	0,0	100,5	96,8	0,000	0,174	0,177	112	0,291
18,167	531,546	532,9	537,2	0,0	102,6	99,3	0,000	0,174	0,177	113	0,285
18,381	531,552	532,9	537,2	0,0	101,2	97,8	0,000	0,173	0,177	114	0,288
18,199	531,556	532,9	537,2	0,0	102,3	98,6	0,000	0,173	0,177	115	0,285
18,597	531,588	533,0	537,2	0,0	100,0	96,7	0,000	0,173	0,177	116	0,291
18,254	531,617	533,1	537,2	0,0	101,9	98,7	0,000	0,173	0,177	117	0,286
18,201	531,644	533,2	537,2	0,0	102,2	98,9	0,000	0,173	0,177	118	0,285

APPENDIX 3: Calibration data

TEST DATA PACKAGE

CLIENT	Spartherm	PROJECT NUMBER	PI-20302
PRODUCT	Single burn rate Wood heater	SAMPLE ID#	QI-20477
MODEL	700		
STANDARDS	EPA, Method 28R, ASTM E2515-11,		

TEST EQUIPMENT

ITEM	EQUIPMENT TYPE	MANUFACTURER	EQUIPMENT #	CALIBRATION DUE DATE	COMPLIES WITH STANDARD REQUIREMENTS
1	Digital Manometer	Dwyer	EM-006	2024 May	Y
2	Digital Manometer	Dwyer	EM-249	2024 May	Y
3	Data acquisition System	Keithley	EM-147	2024 May	Y
4	analytical scale 200gr.	Ohaus	EM-051	2024 April	Y
5	Weight 2kg	N/A	EM-090	2027 MARS	Y
6	Pitot tube	Dwyer	EM-296	Verif. before use	Y
7	Scale 0-1000lbs Rough Deck	Rice lake	EM-114 / EM-137	2024 October	Y
8	Gas analyzer	Siemen's	EM-118	Verification before use	Y
9	Vacuum gauge	Dwyer	EM-126	2024 May	Y
10	Vacuum gauge	Dwyer	EM-127	2024 May	Y
11	Calibration weight 100mg	Troemer	EM-335	2027 March	y
12	Calibration weight 200g	Troemer	EM-129	2027 March	Y
13	Temperature humidity meter	Fluke	EM-136	2024 May	Y
14	Digital manometer	Dwyer	EM 313	2024 May	Y
15	Measuring tape	Stanley	EM-224	2024 May	Y
16	Chronometer	Extech	EM-175	2025 January	Y
17	Dry gas meter	Shinagawa	EM-178	2024 June	Y
18	Dry gas meter	Shinagawa	EM-179	2024 June	Y
19	Dry gas meter	Shinagawa	EM-318	2024 June	Y
20	Dry gas meter	Am. meter	EM-130	2024 June	Y
21	Calibration gas	Praxair	EM-336	2030	Y
22	Calibration gas	Praxair	EM-338	2030	Y
23	Thermometer	Fluke	EM-001	2024 May	Y
24	20 ch. card Thermocouple	Keithley	EM-015	2024 May	Y
25	20 ch. card Thermocouple	Keithley	EM-154	2024 May	Y
26	Barometer	Control company	EM 333	2024 June	Y
27	Vane anemometer	Omega	EM-153	2025 February	Y
28	Weight 10kg	N/A	EM-205	2026 MARS	Y
29	Calibration block	Delmhorst	EM-334	2025 January	Y
30	Vacuum gauge	Dwyer	EM-340	2024 May	y



**Instrumentation
Saint-Laurent** inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-001 2023-05-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9105
Address:	695 B rue Gaudette	Required Accuracy:	+/- 2.0°C
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Indicator	Input Type:	Temp
Manufacturer:	Fluke	Output Type:	Digitale
Model #:	52-II	Measurement Type:	Temperature
Serial #:	90630037	Range:	Divers
Location:	N.A.	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Fluke 744	Certification #:	2023003233
Serial #:	8180008	Certification Date:	2023-04-26
Certified by:	Alpha Controls	Next Certification:	2024-04-26
Comments:			



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CALIBRATION CERTIFICATE

Certificate #		CE-EM-001 2023-05-11				
Calibration Results						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
0.0 °C Compliant	0.0 °C T1 typeJ	0.0 °C	0.0 °C	0.0 °C	+/- 2.0 °C	± 0.2 °C
125.0 °C Compliant	125.0 °C T1 typeJ	125.0 °C	0.0 °C	125.0 °C	+/- 2.0 °C	± 0.2 °C
250.0 °C Compliant	250.0 °C T1 typeJ	250.0 °C	0.0 °C	250.0 °C	+/- 2.0 °C	± 0.2 °C
375.0 °C Compliant	375.0 °C T1 typeJ	375.0 °C	0.0 °C	375.0 °C	+/- 2.0 °C	± 0.2 °C
500.0 °C Compliant	500.0 °C T1 typeJ	500.0 °C	0.0 °C	500.0 °C	+/- 2.0 °C	± 0.2 °C
0.0 °C Compliant	0.0 °C T2 typeJ	0.0 °C	0.0 °C	0.0 °C	+/- 2 °C	± 0.2 °C
125.0 °C Compliant	125.0 °C T2 typeJ	125.0 °C	0.0 °C	125.0 °C	+/- 2 °C	± 0.2 °C
250.0 °C Compliant	250.0 °C T2 typeJ	250.0 °C	0.0 °C	250.0 °C	+/- 2.0 °C	± 0.2 °C
375.0 °C Compliant	375.0 °C T2 typeJ	375.0 °C	0.0 °C	375.0 °C	+/- 2.0 °C	± 0.2 °C
500.0 °C Compliant	500.0 °C T2 typeJ	500.0 °C	0.0 °C	500.0 °C	+/- 2.0 °C	± 0.2 °C
0.0 °C Compliant	0.0 °C T1 typeK	0.2 °C	+0.2 °C	0.2 °C	+/- 2.0 °C	± 0.3 °C
125.0 °C Compliant	125.0 °C T1 typeK	125.2 °C	+0.2 °C	125.2 °C	+/- 2.0 °C	± 0.3 °C
250.0 °C Compliant	250.0 °C T1 typeK	250.1 °C	+0.1 °C	250.1 °C	+/- 2.0 °C	± 0.3 °C
375.0 °C Compliant	375.0 °C T1 typeK	375.1 °C	+0.1 °C	375.1 °C	+/- 2.0 °C	± 0.3 °C
500.0 °C Compliant	500.0 °C T1 typeK	500.1 °C	+0.1 °C	500.1 °C	+/- 2.0 °C	± 0.3 °C
0.0 °C Compliant	0.0 °C T2 typeK	0.2 °C	+0.2 °C	0.2 °C	+/- 2.0 °C	± 0.3 °C
125.0 °C Compliant	125.0 °C T2 typeK	125.2 °C	+0.2 °C	125.2 °C	+/- 2.0 °C	± 0.3 °C
250.0 °C Compliant	250.0 °C T2 typeK	250.2 °C	+0.2 °C	250.2 °C	+/- 2.0 °C	± 0.3 °C
375.0 °C Compliant	375.0 °C T2 typeK	375.1 °C	+0.1 °C	375.1 °C	+/- 2.0 °C	± 0.3 °C

Version 1



Instrumentation
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St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-001 2023-05-11
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CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
500.0 °C	500.0 °C	500.0 °C	0.0 °C	500.0 °C	+/- 2.0 °C	± 0.3 °C
Compliant	T2 typeK					

Environmental Conditions:	Temperature: 21 °C	Humidity: 30 %RH
Comments:		

CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-05-11
Next Calibration:	2024-05-11
Certificate Date:	2023-05-11

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution k=2.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). SCC accreditation number: # 669. ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

M. Gingras

Marc Gingras - Technicien

[Signature]
May 17th 2023



Instrumentation
Saint-Laurent^{inc.}
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-006 2023-05-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9106
Address:	695 B rue Gaudette	Required Accuracy:	+/-0.25"H2O
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Indicator	Input Type:	Pression
Manufacturer:	Dwyer	Output Type:	Digitale
Model #:	MS-321-LCD	Measurement Type:	Pressure
Serial #:	E47U020014	Range:	0-0.5"H2O
Location:	N.A.	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Crystal XP2i 300	Certification #:	2022006892
Serial #:	258139	Certification Date:	2022-09-09
Certified by:	Alpha Controls	Next Certification:	2023-09-09
Comments:			
Calibrator:	Fluke 744	Certification #:	2023003233
Serial #:	8180008	Certification Date:	2023-04-26
Certified by:	Alpha Controls	Next Certification:	2024-04-26
Comments:			



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Phone: (450) 473-6169
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CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-006 2023-05-11					
CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
0.0000 "H2O Compliant	0.000 "H2O	-0.002 "H2O	-0.002 "H2O	-0.002 "H2O	+/-0.25 "H2O	± 0.5 "H2O
Verification of the indicator						
0.2500 "H2O Compliant	0.250 "H2O	0.244 "H2O	-0.006 "H2O	0.244 "H2O	+/-0.25 "H2O	± 0.5 "H2O
Verification of the indicator						
0.5000 "H2O Compliant	0.500 "H2O	0.495 "H2O	-0.005 "H2O	0.495 "H2O	+/-0.25 "H2O	± 0.5 "H2O
Verification of the indicator						
0.7500 "H2O Compliant	0.750 "H2O	0.750 "H2O	0.000 "H2O	0.750 "H2O	+/-0.25 "H2O	± 0.5 "H2O
Verification of the indicator						
1.0000 "H2O Compliant	1.000 "H2O	0.994 "H2O	-0.006 "H2O	0.994 "H2O	+/-0.25 "H2O	± 0.5 "H2O
Verification of the indicator						
0.7500 "H2O Compliant	0.7500	0.750	0.00	0.750	+/-0.25	± 0.5
Verification of the indicator						
0.5000 "H2O Compliant	0.5000	0.497	-0.003	0.497	+/-0.25	± 0.5
Verification of the indicator						
0.2500 "H2O Compliant	0.2500	0.246	-0.014	0.246	+/-0.25	± 0.5
Verification of the indicator						
0.0000 "H2O Compliant	0.0000	-0.002	-0.002	-0.002	+/-0.25	± 0.5
Verification of the indicator						
0.0000 "H2O Compliant	0.0000 V.DC.	0.0021 V.DC.	+0.0021 V.DC.	0.0021 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
0.2500 "H2O Compliant	2.5000 V.DC.	2.4300 V.DC.	-0.0700 V.DC.	2.4300 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
0.5000 "H2O Compliant	5.0000 V.DC.	4.9469 V.DC.	-0.0531 V.DC.	4.9469 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
0.7500 "H2O Compliant	7.5000 V.DC.	7.4356 V.DC.	-0.0644 V.DC.	7.4356 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
1.0000 "H2O Compliant	10.0000 V.DC.	9.9064 V.DC.	-0.0836 V.DC.	9.9064 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
0.7500 "H2O Compliant	7.5000 V.DC.	7.4359 V.DC.	-0.0641 V.DC.	7.4359 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
0.5000 "H2O Compliant	5.0000 V.DC.	4.9466 V.DC.	-0.0534 V.DC.	4.9466 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
0.2500 "H2O Compliant	2.5000 V.DC.	2.4304 V.DC.	-0.0696 V.DC.	2.4304 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
0.0000 "H2O Compliant	0.0000 V.DC.	0.0021 V.DC.	+0.0021 V.DC.	0.0021 V.DC.	+/-0.25 V.DC.	0.5 V.DC.
Verification of the analogic output						
Environmental Conditions:						
Temperature:		21 °C		Humidity:		30 %RH
Comments:						

Version 1



Instrumentation
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80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-006 2023-05-11
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CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-05-11
Next Calibration:	2024-05-11
Certificate Date:	2023-05-11

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution $k=2$.
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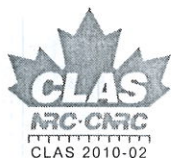
mg

Marc Gingras - Technicien

[Signature]
May 17th 2023



Instrumentation
Saint-Laurent^{inc.}
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80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-015/2 2023-12-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9101
Address:	695 B rue Gaudette	Required Accuracy:	+/- 4.0°F
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	181
INSTRUMENT SPECIFICATION			
Instrument Type:	Recorder	Input Type:	Temp
Manufacturer:	Keithley	Output Type:	Digitale
Model #:	7700	Measurement Type:	Temperature
Serial #:	1213648	Range:	Divers
Location:	N/A	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Fluke 744	Certification #:	AC00919
Serial #:	1693018	Certification Date:	2023-05-01
Certified by:	srp control systems ltd	Next Certification:	2024-04-29
Comments:			
Calibrator:	TCN-19	Certification #:	TCN-19
Serial #:	TCN-19	Certification Date:	2023-11-27
Certified by:	ISL	Next Certification:	2024-02-25
Comments:			



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80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
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CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-015/2 2023-12-11
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CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
662.0 °F	662.0 °F	663.1 °F	+1.1 °F	663.1 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 201 (Flue) en type "K" En Loop avec EM-015					
482.0 °F	482.0 °F	480.9 °F	-1.1 °F	480.9 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 202 (Right) en type "K" En Loop avec EM-015					
482.0 °F	482.0 °F	481.2 °F	-0.8 °F	481.2 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 203 (Back) en type "K" En Loop avec EM-015					
482.0 °F	482.0 °F	481.1 °F	-0.9 °F	481.1 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 204 (Bottom) en type "K" En Loop avec EM-015					
482.0 °F	482.0 °F	480.8 °F	-1.2 °F	480.8 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 205 (Top) en type "K" En Loop avec EM-015					
482.0 °F	482.0 °F	480.7 °F	-1.3 °F	480.7 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 206 (Left) en type "K" En Loop avec EM-015					
662.0 °F	662.0 °F	662.2 °F	+0.2 °F	662.2 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 207 (Catalyst) en type "K" En Loop avec EM-015					
77.0 °F	77.0 °F	76.6 °F	-0.4 °F	76.6 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 209 (DGM 1st HR IN) en type "J" En Loop avec EM-015					
77.0 °F	77.0 °F	76.9 °F	-0.1 °F	76.9 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 210 (DGM out 1st hr) en type "J" En Loop avec EM-015					
80.0 °F	80.0 °F	79.5 °F	-0.5 °F	79.5 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 211 (wetbulb tunnel) en type "J" En Loop avec EM-015					
77.0 °F	77.0 °F	76.8 °F	-0.2 °F	76.8 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 215 (DGM 1 In) en type "J" En Loop avec EM-015					
77.0 °F	77.0 °F	76.8 °F	-0.2 °F	76.8 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 216 (DGM 1 out) en type "J" En Loop avec EM-015					
77.0 °F	77.0 °F	76.8 °F	-0.2 °F	76.8 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 217 (DGM 2 In) en type "J" En Loop avec EM-015					
77.0 °F	77.0 °F	76.9 °F	-0.1 °F	76.9 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 218 (DGM 2 out) en type "J" En Loop avec EM-015					
85.0 °F	85.0 °F	84.9 °F	-0.1 °F	84.9 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 220 (Filter 1st Hour) en type "T" En Loop avec EM-015					

Environmental Conditions:	Temperature: 20 °C	Humidity: 29 %RH
Comments:		

CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-12-11
Next Calibration:	2024-06-11
Certificate Date:	2023-12-11

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		



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(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE # CE-EM-015/2 2023-12-11

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution $k=2$.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
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- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

mg

Marc Gingras - Technicien

[Signature]
2023. 12. 12

Mettler-Toledo Inc.
Service Division
1900 Polaris Parkway
Columbus, OH, 43240
1-800-METTLER



Accredited by the American Association
for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1788.01

ISO 17025 Accredited
ANSI/NCSL Z540-1 Accredited

Accuracy Calibration Certificate

Customer

Company: Services Polytests
Address: 695-B Rue Gaudette
City: Saint-Jean-Sur-Richelieu Contact: Danick Power
Zip / Postal: J3B 7S7
State / Province: Quebec

Weighing Device

Manufacturer: Ohaus Instrument Type: Weighing Instrument
Model: AR2140 Asset Number: EM-051
Serial No.: M3658329010091 Terminal Model: NA
Building: N/A Terminal Serial No.: NA
Floor: N/A Terminal Asset No.: NA
Room: N/A

Range	Max. Capacity	Readability (d)
1	210 g	0.0001 g

Procedure

Calibration Guideline: ASTM E898 - 20
METTLER TOLEDO Work Instruction: 30260953

This calibration certificate including procedures and uncertainty estimation also complies with EURAMET cg-18 v 4.0.

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Left calibration with an external weight. As Left 200g

	Temperature		Humidity	
As Found	Start: 20.3 °C	End: 21.5 °C	Start: 44.5 %	End: 42.9 %
As Left	Start: 21.8 °C	End: 22.0 °C	Start: 41.3 %	End: 40.2 %

Environmental conditions have been verified to ensure the accuracy of the calibration.

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

As Found Calibration Date: 30-10-2023
As Left Calibration Date: 30-10-2023
Issue Date: 30-10-2023
Requested Next Calibration Date: 31-10-2024

Authorized A2LA Signatory:

Wali Ariane

Oct. 31 2023

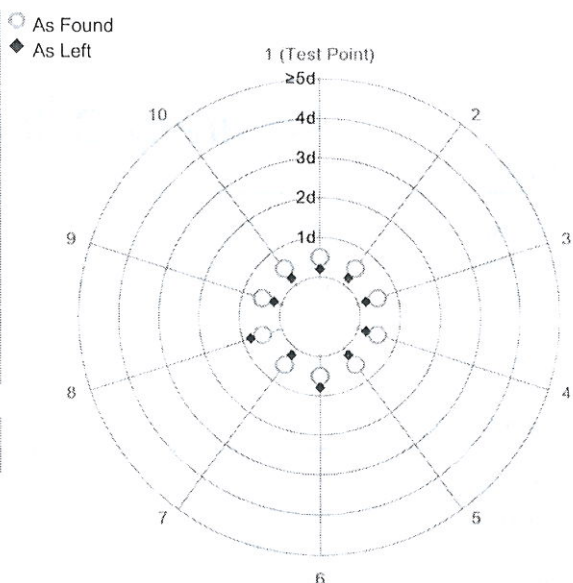
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9998 g	99.9999 g
2	99.9998 g	99.9999 g
3	99.9998 g	99.9999 g
4	99.9999 g	99.9999 g
5	99.9998 g	99.9999 g
6	99.9999 g	100.0000 g
7	99.9998 g	99.9999 g
8	99.9999 g	100.0000 g
9	99.9999 g	99.9999 g
10	99.9999 g	99.9999 g

Standard Deviation	0.00005 g	0.00004 g
--------------------	-----------	-----------



The "d" in the graph represents the readability of the range/interval in which the test was performed.

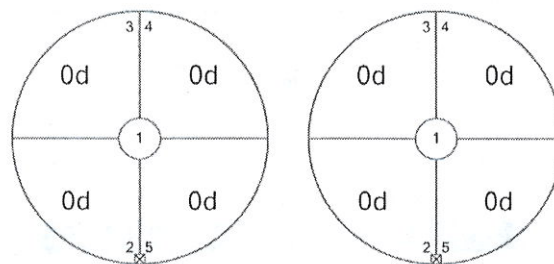
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	0.0000 g	0.0000 g
2	0.0000 g	0.0000 g
3	0.0000 g	0.0000 g
4	0.0000 g	0.0000 g
5	0.0000 g	0.0000 g

Maximum Deviation	0.0000 g	0.0000 g
-------------------	----------	----------



As Found

As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

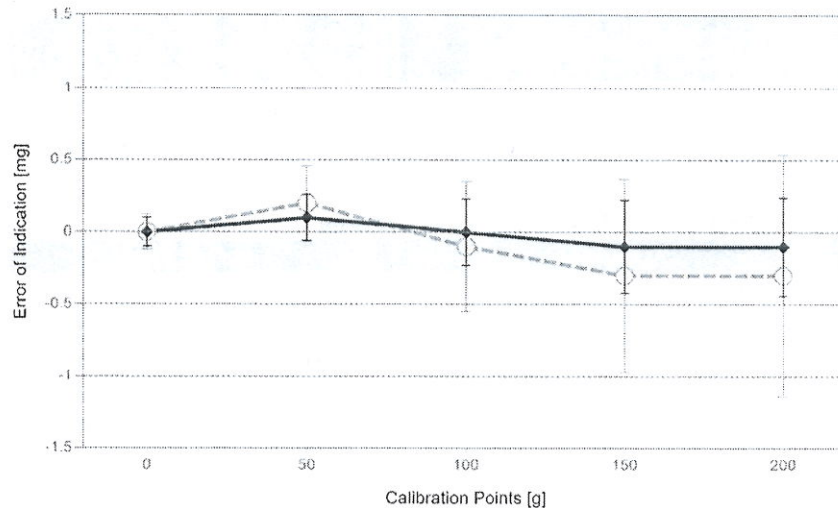
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.12 mg	2
2	50.0000 g	50.0002 g	0.0002 g	0.26 mg	2
3	99.9999 g	99.9998 g	-0.0001 g	0.45 mg	2
4	149.9999 g	149.9996 g	-0.0003 g	0.67 mg	2
5	200.0002 g	199.9999 g	-0.0003 g	0.84 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
2	50.0000 g	50.0001 g	0.0001 g	0.16 mg	2
3	99.9999 g	99.9999 g	0.0000 g	0.23 mg	2
4	149.9999 g	149.9998 g	-0.0001 g	0.32 mg	2
5	200.0002 g	200.0001 g	-0.0001 g	0.34 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to ASTM E898 and EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	381	Date of Issue:	11-08-2023
Certificate Number:	220705189	Calibration Due Date:	31-08-2024

Remarks

Balance Cleaned and Calibrated.

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 4 K

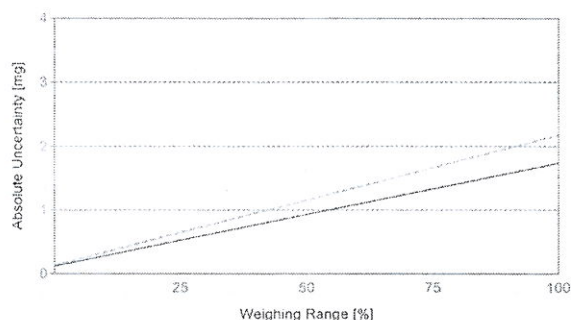
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	210 g	$U_1 = 0.13 \text{ mg} + 0.00974 \text{ mg/g} \cdot R$	$U_1 = 0.12 \text{ mg} + 0.00772 \text{ mg/g} \cdot R$

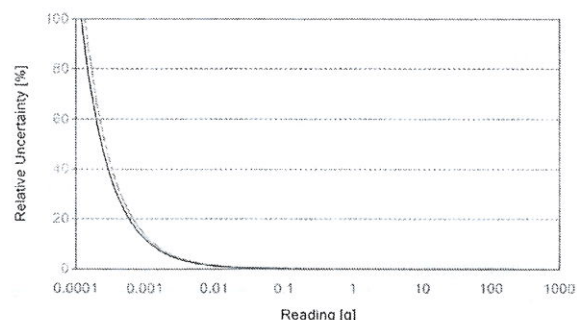
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0210 g	0.13 mg	0.62%	0.12 mg	0.57%
0.2100 g	0.13 mg	0.063%	0.12 mg	0.058%
2.1000 g	0.15 mg	0.0072%	0.14 mg	0.0065%
21.0000 g	0.33 mg	0.0016%	0.28 mg	0.0013%
210.0000 g	2.2 mg	0.0010%	1.7 mg	0.00083%



As Found



As Left

Custom Tolerance Assessment

Assessment done without considering measurement uncertainty.

One or more of the measurements from the attached calibration certificate were assessed against customer-defined tolerances.

	As Found	As Left
Overall	✓	✓
Repeatability	✓	✓
Eccentricity	✓	✓
Error of Indication	✓	✓

Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9998 g	99.9999 g
2	99.9998 g	99.9999 g
3	99.9998 g	99.9999 g
4	99.9999 g	99.9999 g
5	99.9998 g	99.9999 g
6	99.9999 g	100.0000 g
7	99.9998 g	99.9999 g
8	99.9999 g	100.0000 g
9	99.9999 g	99.9999 g
10	99.9999 g	99.9999 g

Standard Deviation	0.00005 g	0.00004 g
Tolerance	0.00010 g ✓	0.00010 g ✓

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	0.0000 g	0.0000 g
2	0.0000 g	0.0000 g
3	0.0000 g	0.0000 g
4	0.0000 g	0.0000 g
5	0.0000 g	0.0000 g

Maximum Deviation	0.0000 g	0.0000 g
Tolerance	0.0003 g ✓	0.0003 g ✓

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Tolerance	
1	0.0000 g	0.0000 g	0.0000 g	0.0001 g	✓
2	50.0000 g	50.0002 g	0.0002 g	0.0002 g	✓
3	99.9999 g	99.9998 g	-0.0001 g	0.0004 g	✓
4	149.9999 g	149.9996 g	-0.0003 g	0.0006 g	✓
5	200.0002 g	199.9999 g	-0.0003 g	0.0004 g	✓

As Left

	Reference Value	Indication	Error of Indication	Tolerance	
1	0.0000 g	0.0000 g	0.0000 g	0.0001 g	✓
2	50.0000 g	50.0001 g	0.0001 g	0.0002 g	✓
3	99.9999 g	99.9999 g	0.0000 g	0.0004 g	✓
4	149.9999 g	149.9998 g	-0.0001 g	0.0006 g	✓
5	200.0002 g	200.0001 g	-0.0001 g	0.0004 g	✓

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-223
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	Calibration date :	04-03-2022

Technician:
Coutu, Daniel

David Llorens

David Llorens, Quality Manager

SERVICE DESCRIPTION:

Masses description :	ASTM E617	Date approved :	04-03-2022
Precision class :	ASTM 6	Next Calibration :	04-03-2027
Density :	7.95g/cm ³	CCN accreditation # :	668
Identification (if unique) :	EM-090	CLAS Certification # :	2010-01

Test conditions :	Temp °C: 21.05	kPa Pressure: 102.3	Humidity: 49.4
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NOTES:

For weight calibration, we use the procedure "Comparaison individuelle" PDL-09-MG-001 and the procedure "Détermination des incertitudes" PDL-09-MG-002. This certificate cannot be copied without written approval from Dispersion Laboratory. The results presented in these pages relate only to objects subjected to calibration.

REMARKS:

March 2022

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-223
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	CCN Accreditation # :	668
		CLAS Certification # :	2010-01
		Precision class :	ASTM 6
		Calibration date :	04-03-2022
Mass :	2 kg	Follow-up date :	04-03-2027

CALIBRATION RESULTS, CONVENTIONAL MASS:

[illegible]

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-223
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	CCN Accreditation # :	668
		CLAS Certification # :	2010-01
		Precision class :	ASTM 6
		Calibration date :	04-03-2022
Mass :	2 kg	Follow-up date :	04-03-2027

CALIBRATION RESULTS, CORRECTIONS:

[illegible]

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

Our balances are periodically verified, according to our PDL-11-MG-001 control procedure.

UNCERTAINTIES:

The following uncertainties exist :

1. *Uncertainty associated with the weighting process.*
2. *Uncertainty associated with air density.*
3. *Uncertainty associated with the measurement standard.*
4. *Uncertainty associated with the density of the mass being calibrated.*

The uncertainty of the weighing process includes long-term reproducibility.

Uncertainties specified in this report are expanded uncertainties representing a confidence level of approximately 95% obtained by multiplying the combined standard uncertainty by a coverage factor of $k = 2$. For more detailed information refer to the GUM (Guide to the Expression of Uncertainty in Measurement, 1995 Edition)

TRACEABILITY

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and their traceability to recognized national measurement standards and to the International System of Units (SI). This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither the CLAS nor the SCC guarantees the accuracy of individual calibration by accredited laboratories.

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

USED REFERENCES

Item	Serial #	Manufacturer	Calibration date	Due date
300g Labo	96-0888-50-2	Denver Instrument Company	01-10-2020	31-03-2022
1kg-1mg Labo	MT-01	Mettler Toledo	01-10-2020	31-03-2022
2kg Labo	96-0888-50-3	Denver Instrument Company	01-10-2020	31-03-2022
1kg Labo	96-088850-1	Denver Instrument Company	01-10-2020	31-03-2022
5kg Labo	129099	Mettler Toledo	01-10-2020	31-03-2022
10kg Labo	DI000G991	Dispersion	23-03-2021	31-03-2022
20kg Labo	69976	Mettler Toledo	06-10-2021	31-10-2022
1 mg-10kg	4000028011	Troemner	15-10-2021	31-10-2022
2kg Labo	129098	Mettler Toledo	01-10-2020	31-03-2022

ENVIRONMENTAL CONDITIONS

Item	Serial #	Manufacturer	Calibration date	Due date
THE004	107080	Control Company	04-03-2021	31-03-2022

Mettler-Toledo Inc.
Service Division
1900 Polaris Parkway
Columbus, OH 43240
1-800-METTLER

METTLER TOLEDO



Accredited by the American Association
for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1902.01

ISO 17025 Registered
ANSI/NCSL Z540-1 Accredited

Certificat de Calibration de Précision

Accuracy Calibration Certificate

Client

Compagnie: Services Polytests
Adresse: 695-B Rue Gaudette
Ville: Saint-Jean-Sur-Richelieu Contact: Danick Power
Zip/Code Postal: J3B 7S7
État/Province: Quebec

Weighing Device

Manufacturier: RICE LAKE Type d'Instrument: Weighing Instrument
Modèle: 4X4HP-10K # Outil: EM-114 EM-137
No. Série: C18395 Modèle Indicateur: IQ+355
Building: N/D Terminal Serial No.: 164851
Floor: N/D Terminal Asset No.: N/D
Room: N/D

Plage	Capacité Max	Lisibilité (d)
1	400 kg	0.05 kg

Procedure

Instruction de Calibration: ASTM E898 - 20
Instruction de travail METTLER TOLEDO: 30260953

This calibration certificate including procedures and uncertainty estimation also complies with EURAMET cg-18 v 4.0.

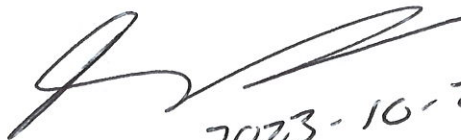
Ce certificat de calibration contient des mesures pour la calibration Tel que Trouvé. Aucune calibration Tel que Laissé n'a été effectuée puisque l'appareil n'a pas été modifié suite à la calibration Tel que Trouvé. Par conséquent, les résultats Tel que Laissé correspondent aux résultats Tel que Trouvé.

The calibration was agreed with the user below the maximum capacity of the balance.

Tel que Trouvé	Temperature		Environmental conditions have been verified to ensure the accuracy of the calibration.
	Start: 20.0 °C	End: 21.0 °C	

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

Date calibration Tel que Trouvé: 10-10-2023 Authorized A2LA Signatory: 
Date calibration Tel que Laissé: N/D
Date d'Émission: 10-10-2023
Requested Next Calibration Date: 31-10-2024
Stephane Poisson


2023-10-23

Résultats de Mesure

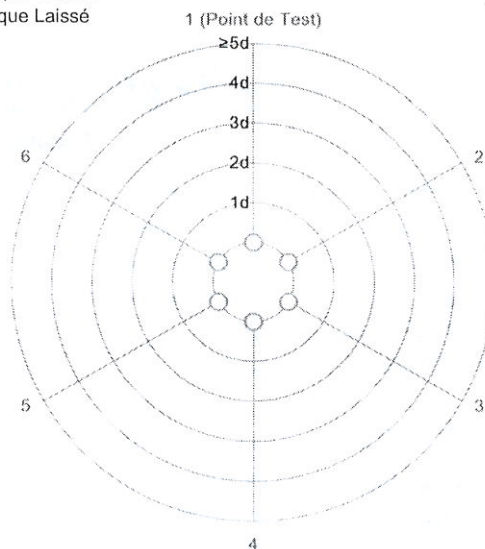
Répétabilité

Charge de Test: 70 kg

	Tel que Trouvé	Tel que Laisse
1	70.00 kg	N/D
2	70.00 kg	N/D
3	70.00 kg	N/D
4	70.00 kg	N/D
5	70.00 kg	N/D
6	70.00 kg	N/D

Écart Type	0.000 kg	N/D
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- Tel que Trouvé
◆ Tel que Laisse



The "d" in the graph represents the readability of the range/interval in which the test was performed.

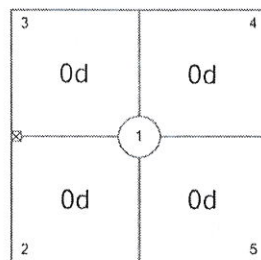
The results of this graph are based upon the absolute values of the differences from the mean value.

Excentricité

Charge de Test: 50 kg

Position	Tel que Trouvé	Tel que Laisse
1	50.00 kg	N/D
2	50.00 kg	N/D
3	50.00 kg	N/D
4	50.00 kg	N/D
5	50.00 kg	N/D

Déviati on Maximale	0.00 kg	N/A
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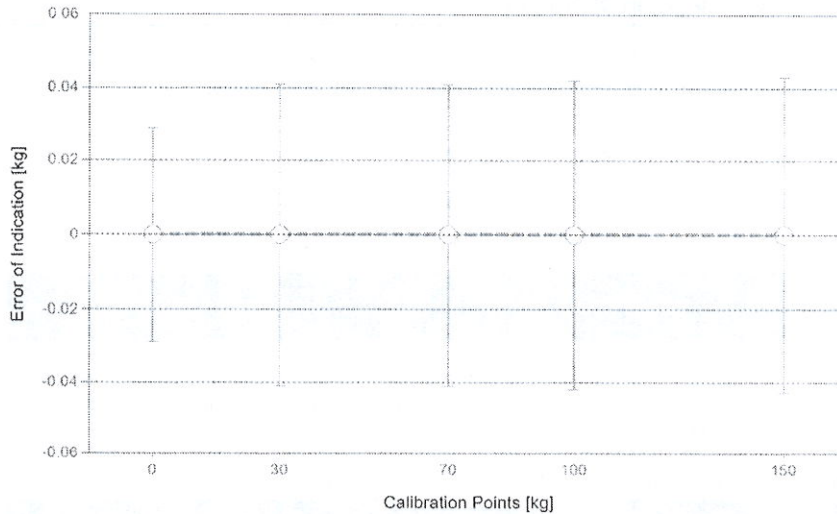
Tel que Trouvé

The "d" in the graph represents the readability of the range/interval in which the test was performed.

Erreur d'indication

Tel que Trouvé

	Reference Value	Indication	Erreur d'Indication	Incertitude Élargie	k
1	0 kg	0.00 kg	0.00 kg	0.029 kg	2
2	30 kg	30.00 kg	0.00 kg	0.041 kg	2
3	70 kg	70.00 kg	0.00 kg	0.041 kg	2
4	100 kg	100.00 kg	0.00 kg	0.042 kg	2
5	150 kg	150.00 kg	0.00 kg	0.043 kg	2
6	0 kg	0.00 kg	0.00 kg	0.029 kg	2



○ Tel que Trouvé

◆ Tel que Laissez

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to ASTM E898 and EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.
Les résultats présents dans ce certificat sont applicables uniquement aux équipements étalonnés.

Test Equipment

Tous les poids utilisés pour le contrôle métrologique sont retraçables aux étalons Nationaux et Internationaux. Les poids ont été calibrés et certifiés par un laboratoire de calibration accrédité.

Jeu de Poids 1: OIML M1

Weight Set Number:	M	Date d'Émission:	15-05-2023
# Certificat:	1400958	Date de Calibration Due:	15-05-2024

Jeu de Poids 2: OIML M1

Weight Set Number:	BE10	Date d'Émission:	11-08-2023
# Certificat:	M23-0320	Date de Calibration Due:	11-08-2024

Remarques

N/D

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Incertitude de Mesure du dispositif de pesage en opération

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Coefficient de température pour l'évaluation de l'incertitude de mesure en opération: $10.0 \cdot 10^{-6} / K$

Plage d'opération sur le site pour l'évaluation de l'incertitude de mesure en opération: 21 K

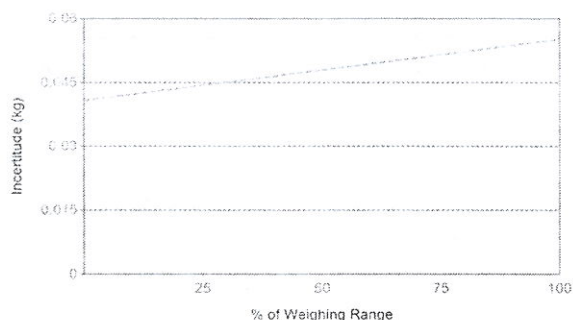
Linéarisation de l'Équation d'Incertitude

Plage			Tel que Trouvé	Tel que Laissé
	d	Max		
1	0.05 kg	150 kg	$U_1 = 41 \text{ g} + 0.0958 \text{ g/kg} \cdot R$	N/A

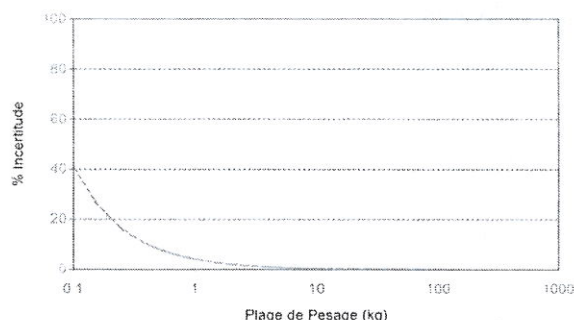
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Indication Net	Tel que Trouvé		Tel que Laissé	
1.50 kg	0.041 kg	2.7%	N/A	N/A
15.00 kg	0.042 kg	0.28%	N/A	N/A
30.00 kg	0.044 kg	0.15%	N/A	N/A
75.00 kg	0.048 kg	0.064%	N/A	N/A
150.00 kg	0.055 kg	0.037%	N/A	N/A



Tel que Trouvé



Tel que Laissé

Handbook 44 Tolerance Assessment(Entretien)

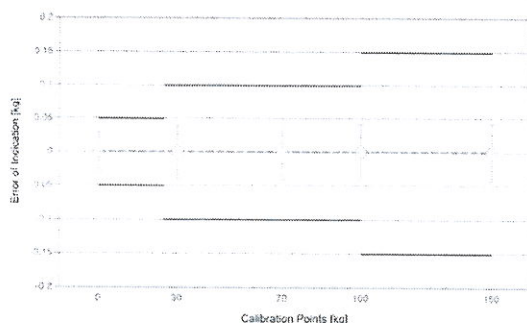
Assessment done without considering measurement uncertainty.

Les mesures du certificat de calibration joint ont été évaluées selon les tolérances définies par NIST HB44.

Tel que Trouvé  Tel que Laissé N/D  = Passed
Global  N/D  = Failed

Weighing Device

Range	Max. Capacity	Readability (d)	Verification Scale Interval (e)	Class
1	400 kg	0.05 kg	0.05 kg	III



Tolerances according to NIST Handbook 44

Test Load		Tolérance
From	To	
0.00 kg	0.00 kg	0.0125 kg
0.05 kg	25.00 kg	0.05 kg
25.05 kg	100.00 kg	0.1 kg
100.05 kg	150.00 kg	0.15 kg

☐ Tel que Trouvé

☒ Tel que Laissé

— Tolérance

Eccentricity and Repeatability

Test	Test Load	Tolérance	As Found		As Left	
			Max. Error / Range	Result	Max. Error / Range	Result
Excentricité (Maximum Error)	50 kg	0.10 kg	0.00 kg	✓	N/D	N/D
Excentricité (Plage)	50 kg	0.1 kg	0.00 kg	✓	N/D	N/D
Répétabilité (Maximum Error)	70 kg	0.1 kg	0.00 kg	✓	N/D	N/D
Répétabilité (Plage)	70 kg	0.10 kg	0.00 kg	✓	N/D	N/D

Max. Error: Maximum of the absolute values of the individual errors.

Range: Difference between largest and smallest measurement value.

Error of Indication

	Reference Value	Tolérance	As Found		As Left	
			Error of Indication	Result	Error of Indication	Result
1	0 kg	0.05 kg	0.00 kg	✓	N/D	N/D
2	30 kg	0.10 kg	0.00 kg	✓	N/D	N/D
3	70 kg	0.10 kg	0.00 kg	✓	N/D	N/D
4	100 kg	0.10 kg	0.00 kg	✓	N/D	N/D
5	150 kg	0.15 kg	0.00 kg	✓	N/D	N/D
6	0 kg	0.05 kg	0.00 kg	✓	N/D	N/D



**Instrumentation
Saint-Laurent** inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-126 2023-05-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9106
Address:	695 B rue Gaudette	Required Accuracy:	+/- 1"Hg
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Pressure Gauge	Input Type:	Pression
Manufacturer:	Dwyer	Output Type:	Digitale
Model #:	DPG200	Measurement Type:	Pressure
Serial #:	N.A.	Range:	0-28"Hg
Location:	N.A.	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Crystal XP2i 300	Certification #:	2022006892
Serial #:	258139	Certification Date:	2022-09-09
Certified by:	Alpha Controls	Next Certification:	2023-09-09
Comments:			
Calibrator:	Fluke 744	Certification #:	2023003233
Serial #:	8180008	Certification Date:	2023-04-26
Certified by:	Alpha Controls	Next Certification:	2024-04-26
Comments:			



**Instrumentation
Saint-Laurent** inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-126 2023-05-11					
CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
0.00 "Hg Compliant	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-7.50 "Hg Compliant	-7.50 "Hg	-7.61 "Hg	-0.11 "Hg	-7.61 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-15.00 "Hg Compliant	-15.00 "Hg	-15.24 "Hg	-0.24 "Hg	-15.24 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-22.50 "Hg Compliant	-22.50 "Hg	-22.87 "Hg	-0.13 "Hg	-22.87 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-28.00 "Hg Compliant	-28.00 "Hg	-28.40 "Hg	-0.40 "Hg	-28.40 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-22.50 "Hg Compliant	-22.50 "Hg	-22.87 "Hg	0.00 "Hg	-22.87 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-15.00 "Hg Compliant	-15.00 "Hg	-15.24 "Hg	-0.24 "Hg	-15.24 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-7.50 "Hg Compliant	-7.50 "Hg	-7.61 "Hg	-0.11 "Hg	-7.61 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
-7.50 "Hg Compliant	-7.50 "Hg	-7.61 "Hg	-0.11 "Hg	-7.61 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
0.00 "Hg Compliant	10.0000 V.DC.	10.0454 V.DC.	+0.0454 V.DC.	10.0778 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-7.50 "Hg Compliant	8.0000 V.DC.	8.0336 V.DC.	+0.0336 V.DC.	8.0447 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-15.00 "Hg Compliant	6.0000 V.DC.	6.0028 V.DC.	+0.0028 V.DC.	6.0069 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-22.50 "Hg Compliant	4.0000 V.DC.	3.9675 V.DC.	-0.0325 V.DC.	3.9596 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-28.00 "Hg Compliant	2.5333 V.DC.	2.5445 V.DC.	+0.0112 V.DC.	2.4444 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-22.50 "Hg Compliant	4.0000 V.DC.	3.9678 V.DC.	-0.0322 V.DC.	3.9678 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-22.50 "Hg Compliant	4.0000 V.DC.	3.9678 V.DC.	-0.0322 V.DC.	3.9678 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-22.50 "Hg Compliant	4.0000 V.DC.	3.9678 V.DC.	-0.0322 V.DC.	3.9678 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
-22.50 "Hg Compliant	4.0000 V.DC.	3.9678 V.DC.	-0.0322 V.DC.	3.9678 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Environmental Conditions: Temperature: 21 °C Humidity: 30 %RH Comments:						

Version 1



Instrumentation
Saint-Laurent inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE # CE-EM-126 2023-05-11

CALIBRATION DATE/ISSUANCE OF CERTIFICATE

Calibration Date:	2023-05-11
Next Calibration:	2024-05-11
Certificate Date:	2023-05-11

CALIBRATION CONFORMITY

	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution $k=2$.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). SCC accreditation number: # 669. ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

Marc Gingras - Technicien

MAY 17th 2023



Instrumentation
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Certified ISO 17025



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St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
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CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-127 2023-05-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9106
Address:	695 B rue Gaudette	Required Accuracy:	+/- 1"Hg
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Pressure Gauge	Input Type:	Pression
Manufacturer:	Dwyer	Output Type:	Digitale
Model #:	DPG200	Measurement Type:	Pressure
Serial #:	N.A.	Range:	0-28"Hg
Location:	N.A.	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Crystal XP2i 300	Certification #:	2022006892
Serial #:	258139	Certification Date:	2022-09-09
Certified by:	Alpha Controls	Next Certification:	2023-09-09
Comments:			
Calibrator:	Fluke 744	Certification #:	2023003233
Serial #:	8180008	Certification Date:	2023-04-26
Certified by:	Alpha Controls	Next Certification:	2024-04-26
Comments:			



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(Québec), J0N 1M0
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CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-127 2023-05-11				
CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	+/-1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
-7.50 "Hg	-7.50 "Hg	-7.50 "Hg	0.00 "Hg	-7.50 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
-15.00 "Hg	-15.00 "Hg	-15.00 "Hg	0.00 "Hg	-15.00 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
-22.50 "Hg	-22.50 "Hg	-22.53 "Hg	-0.03 "Hg	-22.53 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
-28.00 "Hg	-28.00 "Hg	-28.04 "Hg	-0.04 "Hg	-28.04 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
-22.50 "Hg	-22.50 "Hg	-22.53 "Hg	-0.03 "Hg	-22.53 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
-15.00 "Hg	-15.00 "Hg	-15.00 "Hg	0.00 "Hg	-15.00 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
-7.50 "Hg	-7.50 "Hg	-7.50 "Hg	0.00 "Hg	-7.50 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	+/- 1.0 "Hg	± 0.5 "Hg
Compliant	Verification of the indicator					
0.00 "Hg	10.0000 V.DC.	10.066 V.DC.	+0.0066 V.DC.	10.0066 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
-7.50 "Hg	8.0000 V.DC.	8.0210 V.DC.	+0.0210 V.DC.	8.0210 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
-15.00 "Hg	6.0000 V.DC.	6.0141 V.DC.	+0.0141 V.DC.	6.0141 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
-22.50 "Hg	4.0000 V.DC.	4.0133 V.DC.	+0.0133 V.DC.	4.0133 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
-28.00 "Hg	2.5333 V.DC.	2.5256 V.DC.	-0.0173 V.DC.	2.5160 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
-22.50 "Hg	-22.50 V.DC.	4.0136 V.DC.	+0.136 V.DC.	4.0136 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
-15.00 "Hg	-15.00 V.DC.	6.0144 V.DC.	+0.0144 V.DC.	6.0144 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
-7.50 "Hg	-7.50 V.DC.	8.0208 V.DC.	+0.208 V.DC.	8.0208 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
0.00 "Hg	0.00 V.DC.	10.068 V.DC.	+0.68 V.DC.	10.068 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Compliant	Verification of the analogic output					
Environmental Conditions:						
		Temperature: 21 °C		Humidity: 30 %RH		
Comments:						

Version 1



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CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-127 2023-05-11
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CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-05-11
Next Calibration:	2024-05-11
Certificate Date:	2023-05-11

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution $k=2$.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). SCC accreditation number: # 669. ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

Marc Gingras - Technicien

May 17th 2023

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-221
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	Calibration date :	04-03-2022

Technician:
Coutu, Daniel

David Llorens

David Llorens, Quality Manager

SERVICE DESCRIPTION:

Masses description :	ASTM E617	Date approved :	04-03-2022
Precision class :	ASTM 1	Next Calibration :	04-03-2027
Density :	7.95g/cm ³	CCN accreditation # :	668
Identification (if unique) :	1000026013	CLAS Certification # :	2010-01

Test conditions :	Temp °C:	21.05	kPa Pressure:	102.3	Humidity:	49.4
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NOTES:

For weight calibration, we use the procedure "Comparaison individuelle" PDL-09-MG-001 and the procedure "Détermination des incertitudes" PDL-09-MG-002. This certificate cannot be copied without written approval from Dispersion Laboratory. The results presented in these pages relate only to objects subjected to calibration.

REMARKS:

March 2022

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-221
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	CCN Accreditation # :	668
		CLAS Certification # :	2010-01
		Precision class :	ASTM 1
		Calibration date :	04-03-2022
Mass :	200 g	Follow-up date :	04-03-2027

CALIBRATION RESULTS, CONVENTIONAL MASS:

[illegible]

*Applicable only for adjusted masses **Falls outside of the specified class

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

Our balances are periodically verified, according to our PDL-11-MG-001 control procedure.

UNCERTAINTIES:

The following uncertainties exist :

1. *Uncertainty associated with the weighting process.*
2. *Uncertainty associated with air density.*
3. *Uncertainty associated with the measurement standard.*
4. *Uncertainty associated with the density of the mass being calibrated.*

The uncertainty of the weighing process includes long-term reproducibility.

Uncertainties specified in this report are expanded uncertainties representing a confidence level of approximately 95% obtained by multiplying the combined standard uncertainty by a coverage factor of $k = 2$. For more detailed information refer to the GUM (Guide to the Expression of Uncertainty in Measurement, 1995 Edition)

TRACEABILITY

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and their traceability to recognized national measurement standards and to the International System of Units (SI). This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither the CLAS nor the SCC guarantees the accuracy of individual calibration by accredited laboratories.

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

USED REFERENCES

Item	Serial #	Manufacturer	Calibration date	Due date
300g Labo	96-0888-50-2	Denver Instrument Company	01-10-2020	31-03-2022
1kg-1mg Labo	MT-01	Mettler Toledo	01-10-2020	31-03-2022
2kg Labo	96-0888-50-3	Denver Instrument Company	01-10-2020	31-03-2022
1kg Labo	96-088850-1	Denver Instrument Company	01-10-2020	31-03-2022
5kg Labo	129099	Mettler Toledo	01-10-2020	31-03-2022
10kg Labo	DI000G991	Dispersion	23-03-2021	31-03-2022
20kg Labo	69976	Mettler Toledo	06-10-2021	31-10-2022
1 mg-10kg	4000028011	Troemner	15-10-2021	31-10-2022
2kg Labo	129098	Mettler Toledo	01-10-2020	31-03-2022

ENVIRONMENTAL CONDITIONS

Item	Serial #	Manufacturer	Calibration date	Due date
THE004	107080	Control Company	04-03-2021	31-03-2022



POLYCONTROLS



CALIBRATION CERTIFICATE # 22190

Calibration date : 2023-12-21

Certificate issued : 2023-12-21

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

Calibration of

Positive displacement flow meter American Meter Company DTM-200A S/N : 99A274209

QUALITY PROGRAM CONFORMANCE

All calibrations are performed in accordance with Polycontrols Laboratory Quality Assurance Manual and conform to ISO/IEC 17025: 2017, ISO 9001 – 2015 and/or other quality requirements defined in customers purchase descriptions. The results are strictly valid for the device under test or calibration. If applicable, the decision rule is described in the certificate.

TRACEABILITY

The traceability for flow standard to the National Institute of Standards and Technology, NIST, is maintained by Fluke Corporation of Phoenix, Arizona and conform to ISO/IEC 17025, ANSI/NCSL Z540-1-1994, ISO-10012-1 and MIL-STD 45662A.

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and traceability to the International System of Units (SI) or to standards acceptable to the CLAS program. This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither CLAS nor SCC guarantee the accuracy of individual calibrations by accredited laboratories.

CALIBRATION OF MEASURING AND TEST EQUIPMENT

For calibration measurement capability, please refer to the Canadian Calibration Network web page at the National Research Council of Canada. This laboratory is accredited by the Standards Council of Canada as part of the Calibration Laboratory Assessment Service (CLAS) program and is listed at nrc.canada.ca.

This document forms part of the Certificate of Accreditation issued by the Standards Council of Canada (SCC). The original version is available in the Directory of Accredited Laboratories on the SCC website at www.scc.ca.

CONDITION SUMMARY OF THE DEVICE UNDER TEST

Initial conditions	In good condition
Work done	Calibration of the instrument
Results	Initial readings in tolerance-conditional
	Final readings in tolerance
Remarks	Calibration frequency every 6 months

Louis-Philippe Tremblay
Metrologist

Laboratory Manager

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3650, Matte blvd. (Unit A-1), Brossard (Quebec), Canada, J4Y 2Z2
Tel: (450) 444-3600 Fax: (450) 444-1088 www.polycontrols.com

Calibration certificate # 22190

Serial Number:	99A274209	Test stand:	3
Calibration Date:	2023-12-21	Procedure:	POS-CAL-005
Instrument ID:	EM-130	Decision rule:	Method #3

Standard equipment used for initial calibration

Description	Model	Serial #	Traceability	Due date
Fluke molbloc_120 slpm	2E2-S	237	1500349857	2024-03-02
Fluke molbloc_30 slpm	3E4-VCR-V-Q	2403	1500358529	2024-07-24
Fluke molbox1	Molbox1	881	1500363193	2024-10-08
RTD Mist	M22	3061002	2023005392	2024-06-29
Module 44.5 PSI avec Baro 163671	Module 30	160659	2023003753	2024-05-18

Initial specifications of the device under test
Calibration conditions

Gas	Air	Gas	Air
Operation temperature	20 °C	Ambient temperature	21.8 °C
Inlet pressure		Ambient pressure	1027.5 mbar
Outlet pressure		Orientation	Vertical
Reference temperature		Seals	Viton
Reference pressure		Valve	Viton
Range	0-200 ACFH		
Input/Output Signals	-		
Supply			
Accuracy	±2 %O.R.		

Initial readings

Test Flow ACFH	Device under test ft³	Measured values			Calculated Reference ft³	Calculated Error ft³	Acceptable Error ft³	Uncertainty k = 2 ft³	TUR
		Pressure PSIA	Temperature °C	Reference ft³					
10.2641	3.400	15.0214	21.49	3.488	3.417	-0.017	0.068	0.013	>4
120.0714	19.610	14.9818	21.48	20.353	19.990	-0.380	0.400	0.049	>4
194.1599	32.355	15.0998	21.44	33.115	32.265	0.090	0.645	0.079	>4



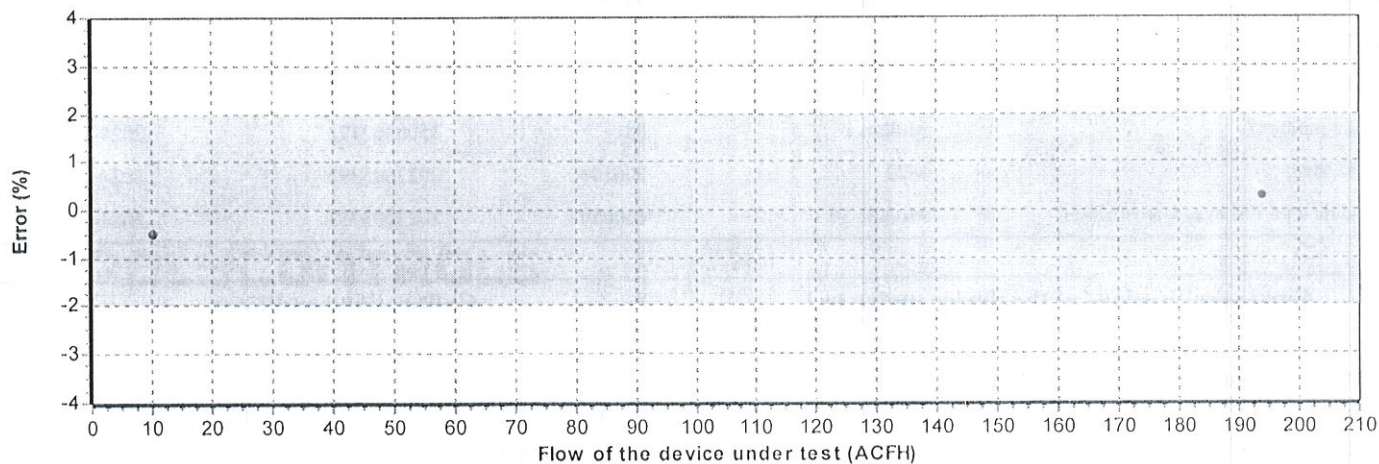
POLYCONTROLS



Calibration certificate # 22190

Serial Number:	99A274209	Test stand:	3
Calibration Date:	2023-12-21	Procedure:	POS-CAL-005
Instrument ID:	EM-130	Decision rule:	Method #3

Initial results



See the appendix for the guideline of decision rule

Calibration certificate # 22190

Serial Number:	99A274209	Test stand:	3
Calibration Date:	2023-12-21	Procedure:	POS-CAL-005
Instrument ID:	EM-130	Decision rule:	Method #3

Standard equipment used for final calibration

Description	Model	Serial #	Traceability	Due date
Fluke molbloc_120 slpm	2E2-S	237	1500349857	2024-03-02
Fluke molbloc_30 slpm	3E4-VCR-V-Q	2403	1500358529	2024-07-24
Fluke molbox I	Molbox I	881	1500363193	2024-10-08
RTD Mist	M22	3061002	2023005392	2024-06-29
Module 44.5 PSI avec Baro 163671	Module 30	160659	2023003753	2024-05-18

Final specifications of the device under test
Calibration conditions

Gas	Air	Gas	Air
Operation temperature	20 °C	Ambient temperature	21.74 °C
Inlet pressure		Ambient pressure	1036.36 mbar
Outlet pressure		Orientation	Vertical
Reference temperature		Seals	Viton
Reference pressure		Valve	Viton
Range	0-200 ACFH		
Input/Output Signals	-		
Supply			
Accuracy	±2 %O.R.		

Final readings

Test Flow ACFH	Device under test ft³	Measured values			Calculated Reference ft³	Calculated Error ft³	Acceptable Error ft³	Uncertainty k = 2 ft³	TUR
		Pressure PSIA	Temperature °C	Reference ft³					
10.2561	3.460	15.0375	21.51	3.4891	3.4145	0.046	0.068	0.0113	>4
116.0284	19.210	15.1207	21.84	19.8287	19.3192	-0.109	0.386	0.0474	>4
192.7459	32.565	15.2322	21.62	33.2070	32.0937	0.471	0.642	0.1065	>4



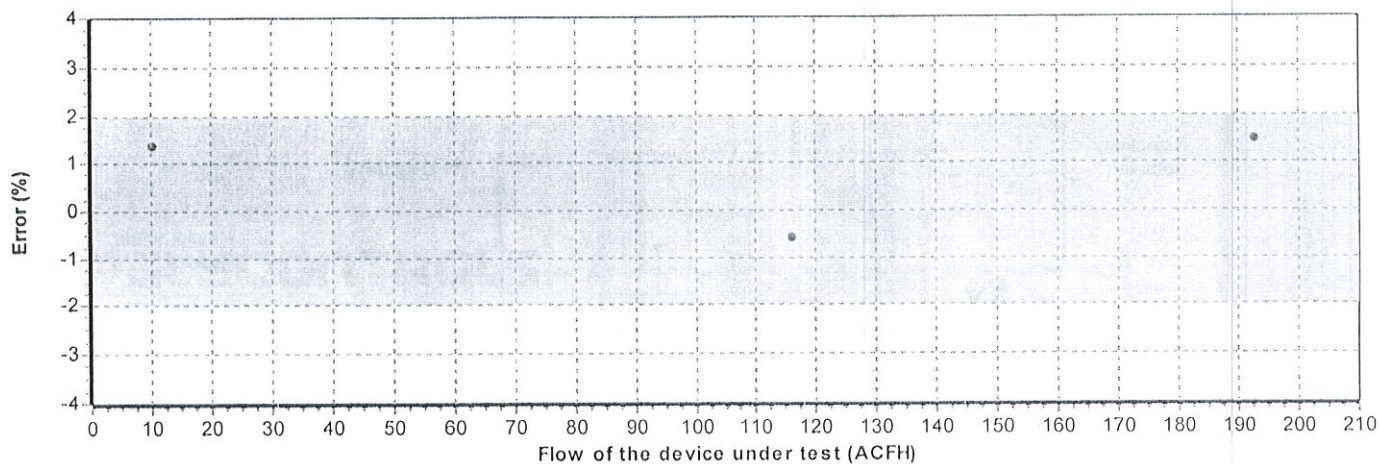
POLYCONTROLS



Calibration certificate # 22190

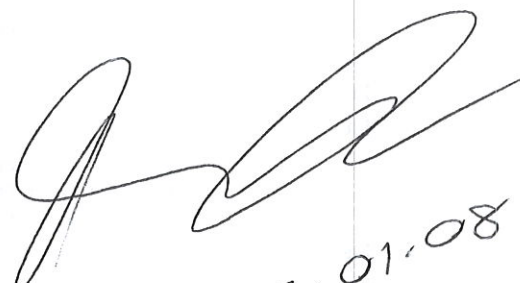
Serial Number:	99A274209	Test stand:	3
Calibration Date:	2023-12-21	Procedure:	POS-CAL-005
Instrument ID:	EM-130	Decision rule:	Method #3

Final results



See the appendix for the guideline of decision rule

cal fact.: 0.9868497


2023-01-08

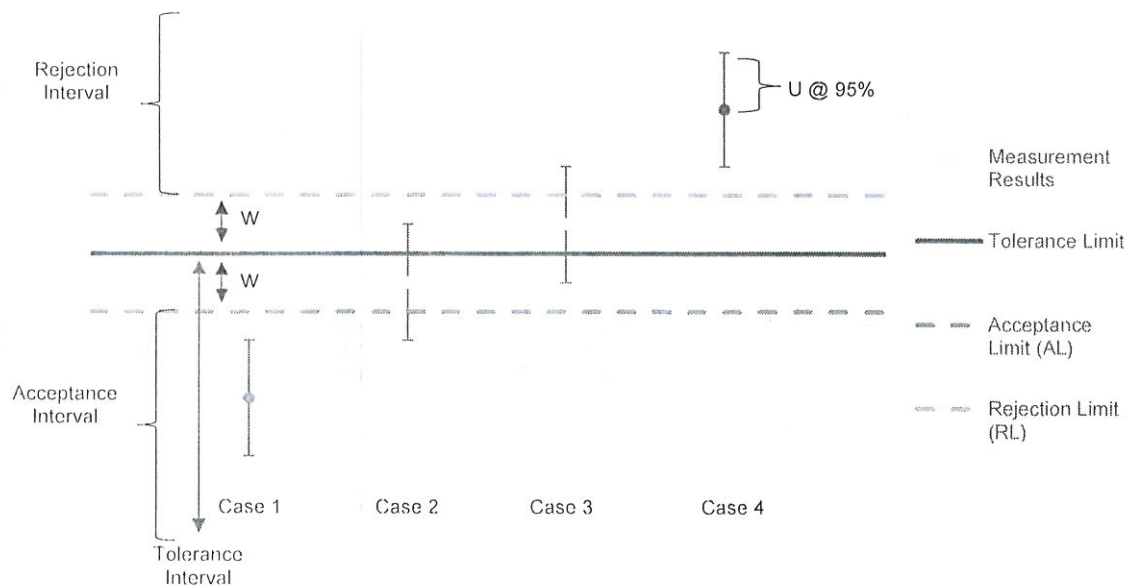


Appendix for the decision rule

Method #3 Non-binary Statement with Guard Band, uncertainty directly taken into account

This decision rule uses a guard band to define the acceptance and rejection interval. The acceptance limit is defined by the following mathematical formula $AL = TL - w$ and the rejection limit $RL = TL + w$, where $w = rU$. The multiple r that is multiplied by the expanded measurement uncertainty U can be defined following ILAC G8: 2019 table 1 section 5.2. The expanded measurement uncertainty U has a 95% coverage probability ($k = 2$). Non-binary statement with guard band exists when the result is limited to four choices: pass, conditional pass, conditional fail, and fail.

Statements of conformity are reported as:



Graphical representation of a Non-Binary Statement with a Guard Band

Case 1 – Below acceptance limit AL

Status: In tolerance

- The result is inside the acceptance interval. However, assuming a normal distribution, the risk that the result is outside the tolerance limit could be up to 2.5%. Uncertainty is directly taken into account. *Green*.

Case 2 – Below tolerance limit TL, greater than acceptance limit AL

Status: In tolerance-Conditional

- The result is outside the acceptance interval but below tolerance limit. However, the observed value is inside the guard band $w = TL - AL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 3 – Greater than tolerance limit, below rejection limit RL

Status: Out of tolerance-Conditional

- The result is greater than tolerance limit but outside the rejection interval. However, the observed value is inside the guard band $w = RL - TL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 4 – Greater than rejection limit RL

Status: Out of tolerance

- The result is inside the rejection interval. Uncertainty is directly taken into account. *Red*.

Fox Valley Metrology
 3114 Medalist Drive
 Oshkosh, WI 54902
 (920) 426-5894 • Fax (920) 426-8120
<https://www.FoxValleyMetrology.com>

CERTIFICATE OF CALIBRATION



Certificate No. ACT-1272

CERTIFICATION NUMBER C0003-33124-690 FOR Polytests Services Inc. 695 B rue Gaudette St-Jean-sur-Richelieu, QC, Canada J3B 7S7 TEST INSTRUMENT Thermohygrometer MAKE Fluke MODEL 971 RANGE -4 to 100°F/ 5 to 95%RH CUSTOMER LOCATION CONDITION RECEIVED In Tolerance CONDITION RETURNED In Tolerance CALIBRATED BY Rodney Kalata FORM REVIEWED BY M.T. CALIBRATION LOCATION FVM ENVIRONMENT 70.7°F, 38.6%RH, 29.19inHg CALIBRATION DATE 01/03/2024 RECALIBRATION DUE 01/03/2025		IDENTIFICATION EM-136 SERIAL NUMBER 10610860 PURCHASE ORDER # 100595 PROCEDURES FOLLOWED EL-033A rev. 0 STANDARDS USED <table border="1"> <thead> <tr> <th>INSTRUMENT</th> <th>SERIAL NUMBER</th> <th>TRACE NUMBER</th> <th>NEXT CAL.</th> </tr> </thead> <tbody> <tr> <td>FVS-275E</td> <td>16783134</td> <td>CN121-17281-690</td> <td>05/31/2024</td> </tr> <tr> <td>FVS-471</td> <td>1012820</td> <td>CN269-63374-744</td> <td>10/31/2024</td> </tr> </tbody> </table>	INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL.	FVS-275E	16783134	CN121-17281-690	05/31/2024	FVS-471	1012820	CN269-63374-744	10/31/2024
INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL.											
FVS-275E	16783134	CN121-17281-690	05/31/2024											
FVS-471	1012820	CN269-63374-744	10/31/2024											

CALIBRATION RESULTS

* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
Temperature	(°F)	(°F)	(°F)	(°F)	(°F)	
	60.0	59.0	61.0	59.8	59.8	3.6E-1
	70.0	69.0	71.0	69.4	69.4	3.6E-1
Humidity	(RH)	(RH)	(RH)	(RH)	(RH)	
	25.0	22.5	27.5	27.4	27.4	9.0E-1
	50.0	47.5	52.5	50.2	50.2	9.0E-1
	75.0	72.5	77.5	72.7	72.7	9.0E-1

[Signature]
 JAN 25, 2024

■ This certificate shall not be altered in any form or reproduced, except in full, without prior written approval from originating lab. These results relate only to the item(s) calibrated. Form Revision 8: 08/19/2021
 ■ Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of (k=2). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.
 ■ The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006. Other standards listed upon request.



**Instrumentation
Saint-Laurent** inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-147 2023-05-10	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9101
Address:	695 B rue Gaudette	Required Accuracy:	+/- 2.0C
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Recorder	Input Type:	Divers
Manufacturer:	Keithley	Output Type:	Digital
Model #:	2700	Measurement Type:	Temperature
Serial #:	1349443	Range:	Divers
Location:	N.A.	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Fluke 744	Certification #:	2023003233
Serial #:	8180008	Certification Date:	2023-04-26
Certified by:	Alpha Controls	Next Certification:	2024-04-26
Comments:			



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Saint-Laurent** inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-147 2023-05-10
----------------------	-----------------------------

CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
EntrySource	GivenValue	ActualValue	Deviation	Post Calib	Tolerance	Incertitude
Conformity	Voir Commentaire					

Environmental Conditions:	Temperature: 21 °C	Humidity: 28 %RH
Comments:	Data Acquisition system Conforme	
	Les 2 slot de l'enregistreur ont été vérifié.	

CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-05-10
Next Calibration:	2024-05-10
Certificate Date:	2023-05-10

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution k=2.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). SCC accreditation number: # 669. ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

me

Marc Gingras - Technicien

[Signature]
May 17th 2023



CERTIFICATE OF NIST TRACEABLE CALIBRATION

Calibration Certificate No: 113178

Customer Information

Customer: Services Polytests

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

Customer PO #: 100597



Calibration Procedure Information

Procedure ID: Calibration of Air Velocity Meters

Revision #: 7

Calibration Standards Information

Graftel ID	Model #	Description	CAL Due
10187	PTB210	Vaisala Ambient Pressure	11/6/2024
10100		Graftel Temperature	10/17/2025
10171	FC0332-2W	Furness DeltaP Meter, 0 to 0.4"H2O	11/6/2024
10086	FC0332	Furness Controls DeltaP Meter, 0 to 4"H2O	11/6/2024
T1830459	VAISALA / H MW95D	Vaisala Temp/RH Logger, Velocity Lab	6/13/2024
1A01JMGKP36		Graftel Barometric Pressure, Tank Farm	1/12/2025
10129	1502A/5628	Hart Scientific PRT, Temperature	6/28/2024

Calibrated Device Information

Manufacturer: Omega

Description: Anemometer

Method Used: Pitot Tube

Model #: HHF143

Rated Accuracy: See Attachments

Accuracy Specified By: Omega

Instrument ID: EM153

Range: 40 - 7800 fpm

Condition: Functional

Serial #: 1015949

Calibration Date: 02/09/2024

Calibration Due: 02/09/2025

Comments: *Limited Calibration Range: 40 - 5000

The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). 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 Quality Assurance System complies with applicable requirements of ISO/IEC-17025-2017, ANSI/NCSL Z540-1-1994 and ISO 9001. 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. Acceptance Criteria per Simple Acceptance Rule: Measurement Uncertainty is not applied to the measured value when in/out of tolerance statement is made.

Luis Marquez

Performed By
Luis Marquez
Calibration Technician
02/09/2024

Joselito Zosa

Approved/Issued By
Joselito Zosa
Lab Manager
02/12/2024

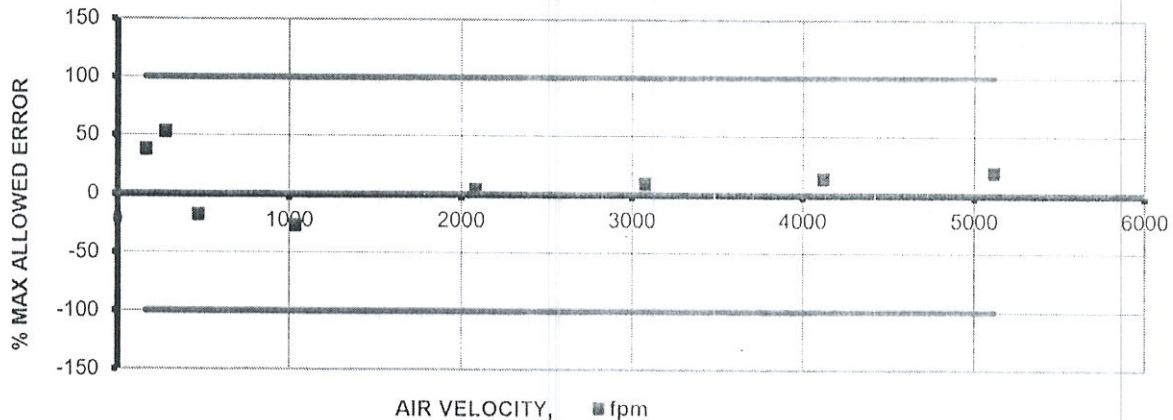
ATTACHMENT TO CALIBRATION CERTIFICATE 113178

AS FOUND / AS LEFT DATA

Page 2 of 2

Reading From Standard,	Lower Limit of Meter Reading,	Measured Reading From Meter,	Upper Limit of Meter Reading,	Error,	Measurement Uncertainty (k=2)	CMC (k=2)	STATUS
Actual Air Velocity							
fpm	fpm	fpm	fpm	fpm	fpm	fpm	STATUS
165	162	166	168	1	4	4	Pass
279	275	281	283	2	6	6	Pass
471	465	470	477	-1	8	8	Pass
1035	1024	1032	1046	-3	15	15	Pass
2083	2061	2084	2105	1	29	29	Pass
3076	3044	3079	3108	3	42	42	Pass
4120	4078	4126	4162	6	56	56	Pass
5115	5063	5125	5167	10	68	68	Pass

ERROR CHART



Instrument Specifications

Test Fluid:	Air
Lower Velocity Range:	40 fpm
Upper Velocity Range:	7800 fpm
Velocity Resolution:	1
Velocity Accuracy:	1 % Reading + 1 digit

Laboratory Ambient Conditions

Pressure:	14.23	psia
Humidity:	38.85	%RH
Temperature:	69.44	°F

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GRAFTEL
An  Company

WWW.GRAFTEL.COM

NIST Traceable Calibration Data Sheet

95 CHANCELLOR DRIVE, ROSELLE, ILLINOIS 60172

PHONE: (847) 364-2600

[Signature]
2024-02-19



Instrumentation
Saint-Laurent inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-154/2 2023-12-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9101
Address:	695 B rue Gaudette	Required Accuracy:	+/- 4.0°F
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	181
INSTRUMENT SPECIFICATION			
Instrument Type:	Recorder	Input Type:	Temp
Manufacturer:	Keithley	Output Type:	Digitale
Model #:	7700	Measurement Type:	Temperature
Serial #:	1306774	Range:	Divers
Location:	N/A	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Fluke 744	Certification #:	AC00919
Serial #:	1693018	Certification Date:	2023-05-01
Certified by:	srp control systems ltd	Next Certification:	2024-04-29
Comments:			
Calibrator:	TCN-19	Certification #:	TCN-19
Serial #:	TCN-19	Certification Date:	2023-11-27
Certified by:	ISL	Next Certification:	2024-02-25
Comments:			



**Instrumentation
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80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE # CE-EM-154/2 2023-12-11

CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
85.0 °F	85.0 °F	84.5 °F	-0.5 °F	84.5 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 111 (Filter 1) en type "T" En Loop avec EM-154					
85.0 °F	85.0 °F	84.4 °F	-0.6 °F	84.4 °F	+/- 4.0 °F	+/- 0.5 °F
Compliant	ID. No. 112 (Filter 2) en type "T" En Loop avec EM-154					
125.0 °F	125.0 °F	124.5 °F	-0.5 °F	124.5 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 113 (Tunnel) en type "J" En Loop avec EM-154					
70.0 °F	70.0 °F	70.1 °F	+0.1 °F	70.1 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 114 (Room) en type "J" En Loop avec EM-154					
100.0 °F	100.0 °F	99.5 °F	-0.5 °F	99.5 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 115 (Dry bulb tunnel) en type "J" En Loop avec EM-154					
70.0 °F	70.0 °F	69.8 °F	-0.2 °F	69.8 °F	+/- 4.0 °F	+/- 0.4 °F
Compliant	ID. No. 116 (Analyzer gaz) en type "J" En Loop avec EM-154					

Environmental Conditions:	Temperature: 20 °C	Humidity: 29 %RH
Comments:		

CALIBRATION DATE/ISSUANCE OF CERTIFICATE		CALIBRATION CONFORMITY		
Calibration Date:	2023-12-11	Compliant:	Before	After
Next Calibration:	2024-06-11		X	X
Certificate Date:	2023-12-11	Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution k=2.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

mg

Marc Gingras - Technicien

[Signature]
2023-12-11

Fox Valley Metrology

3114 Medalist Drive

Oshkosh, WI 54902

(920) 426-5894 • Fax (920) 426-8120

<https://www.FoxValleyMetrology.com>

CERTIFICATE OF CALIBRATION



Certificate No. ACT-1272

CERTIFICATION NUMBER C0009-68479-540	IDENTIFICATION EM-175												
FOR Polytests Services Inc. 695 B rue Gaudette St-Jean-sur-Richelieu, QC, Canada J3B 7S7	SERIAL NUMBER												
TEST INSTRUMENT Stopwatch	PURCHASE ORDER # 100595												
MAKE Extech Instruments	PROCEDURES FOLLOWED												
MODEL 365510	EL-019B rev. 0												
CUSTOMER LOCATION	STANDARDS USED												
CONDITION RECEIVED In Tolerance	<table border="1"><thead><tr><th>INSTRUMENT</th><th>SERIAL NUMBER</th><th>TRACE NUMBER</th><th>NEXT CAL</th></tr></thead><tbody><tr><td>FVS-275E</td><td>16783134</td><td>CN121-17281-690</td><td>05/31/2024</td></tr><tr><td>FVS-896F</td><td>N/A</td><td>CN159-71319-540</td><td>06/30/2024</td></tr></tbody></table>	INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL	FVS-275E	16783134	CN121-17281-690	05/31/2024	FVS-896F	N/A	CN159-71319-540	06/30/2024
INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL										
FVS-275E	16783134	CN121-17281-690	05/31/2024										
FVS-896F	N/A	CN159-71319-540	06/30/2024										
CONDITION RETURNED In Tolerance													
CALIBRATED BY Brock Pecore													
FORM REVIEWED BY M.T.													
CALIBRATION LOCATION FVM													
ENVIRONMENT 71.6°F, 40.3%RH, 28.34inHg													
CALIBRATION DATE 01/09/2024													
RECALIBRATION DUE 01/09/2025													

CALIBRATION RESULTS

* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
Time Interval	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
1 minute	60.00	59.50	60.50	59.94	59.94	6.0E-3
	60.00	59.50	60.50	59.96	59.96	6.0E-3
5 minute	300.00	299.50	300.50	299.98	299.98	6.0E-3
	300.00	299.50	300.50	299.96	299.96	6.0E-3

[Signature]
JAN 25, 2024

- This certificate shall not be altered in any form or reproduced, except in full, without prior written approval from originating lab. These results relate only to the item(s) calibrated. Form Revision 8: 08/19/2021
- Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of (k=2). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.
- The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006. Other standards listed upon request.



POLYCONTROLS



CALIBRATION CERTIFICATE # 22188

Calibration date : 2023-12-20

Certificate issued : 2023-12-21

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

Calibration of
Positive displacement flow meter Shinigawa DCDa-2c S/N : 23544

QUALITY PROGRAM CONFORMANCE

All calibrations are performed in accordance with Polycontrols Laboratory Quality Assurance Manual and conform to ISO/IEC 17025: 2017, ISO 9001 – 2015 and/or other quality requirements defined in customers purchase descriptions. The results are strictly valid for the device under test or calibration. If applicable, the decision rule is described in the certificate.

TRACEABILITY

The traceability for flow standard to the National Institute of Standards and Technology, NIST, is maintained by Fluke Corporation of Phoenix, Arizona and conform to ISO/IEC 17025, ANSI/NCSL Z540-1-1994, ISO-10012-1 and MIL-STD 45662A.

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and traceability to the International System of Units (SI) or to standards acceptable to the CLAS program. This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither CLAS nor SCC guarantee the accuracy of individual calibrations by accredited laboratories.

CALIBRATION OF MEASURING AND TEST EQUIPMENT

For calibration measurement capability, please refer to the Canadian Calibration Network web page at the National Research Council of Canada. This laboratory is accredited by the Standards Council of Canada as part of the Calibration Laboratory Assessment Service (CLAS) program and is listed at nrc.canada.ca.

This document forms part of the Certificate of Accreditation issued by the Standards Council of Canada (SCC). The original version is available in the Directory of Accredited Laboratories on the SCC website at www.scc.ca.

CONDITION SUMMARY OF THE DEVICE UNDER TEST

Initial conditions	In good condition
Work done	Initial readings = Final readings, no adjustment Calibration of the instrument
Results	Final readings in tolerance
Remarks	Calibration frequency every 6 months Tolerance modified per end user request

Louis-Philippe Tremblay
Metrologist

Laboratory Manager

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3650, Matte blvd. (Unit A-1), Brossard (Quebec), Canada, J4Y 2Z2
Tel: (450) 444-3600 Fax: (450) 444-1088 www.polycontrols.com



POLYCONTROLS



Calibration certificate # 22188

Serial Number:	23544	Test stand:	3
Calibration Date:	2023-12-20	Procedure:	POS-CAL-005
Instrument ID:	EM-178	Decision rule:	Method #3

Standard equipment used for final calibration

Description	Model	Serial #	Traceability	Due date
Fluke molbloc_120 slpm	2E2-S	237	1500349857	2024-03-02
Fluke molbloc_30 slpm	3E4-VCR-V-Q	2403	1500358529	2024-07-24
Fluke molbox I	Molbox I	881	1500363193	2024-10-08
RTD Mist	M22	3061002	2023005392	2024-06-29
Module 44.5 PSI avec Baro 163671	Module 30	160659	2023003753	2024-05-18

Final specifications of the device under test

Calibration conditions

Gas	Air	Gas	Air
Operation temperature		Ambient temperature	21.93 °C
Inlet pressure		Ambient pressure	1026.35 mbar
Outlet pressure		Orientation	Horizontal
Reference temperature		Seals	Viton
Reference pressure		Valve	
Range	10-2000 ALH		
Input/Output Signals	-		
Supply			
Accuracy	±2 %O.R.		

Final readings

Test Flow ALH	Device under test L	Pressure PSIA	Measured values Temperature °C	Reference L	Calculated Reference L	Calculated Error L	Acceptable Error L	Uncertainty k = 2 L	TUR
324.7552	54.810	14.8976	21.72	50.750	54.056	0.754	1.081	0.179	>4
1292.9193	218.020	14.9083	21.67	202.310	215.297	2.723	4.306	0.715	>4
2117.6956	358.140	14.9266	21.63	331.710	352.535	5.605	7.051	0.865	>4



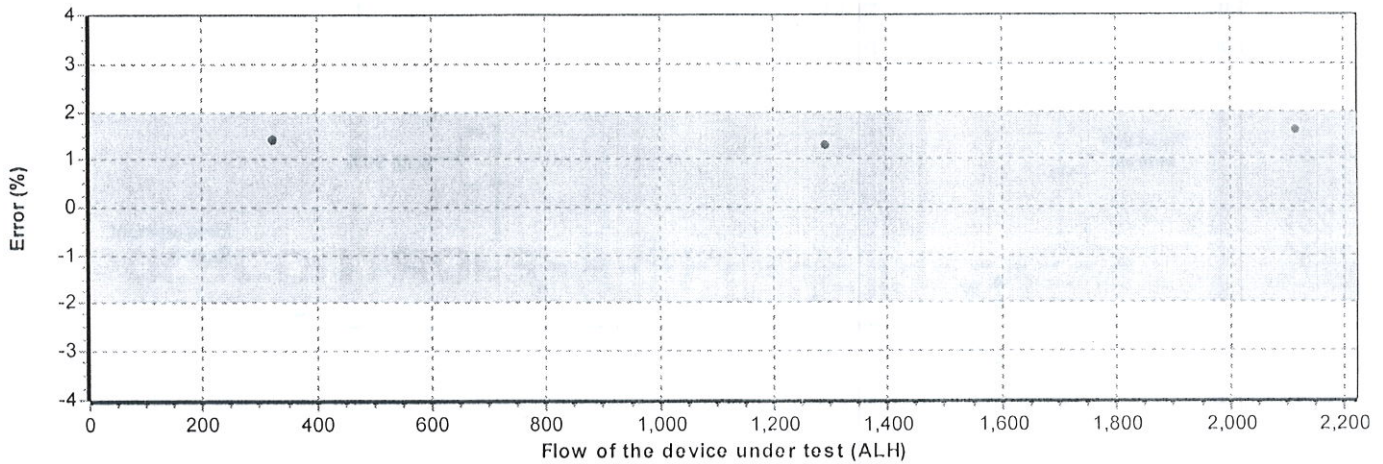
POLYCONTROLS



Calibration certificate # 22188

Serial Number:	23544	Test stand:	3
Calibration Date:	2023-12-20	Procedure:	POS-CAL-005
Instrument ID:	EM-178	Decision rule:	Method #3

Final results



See the appendix for the guideline of decision rule

CAL. Fact: 0,986243386

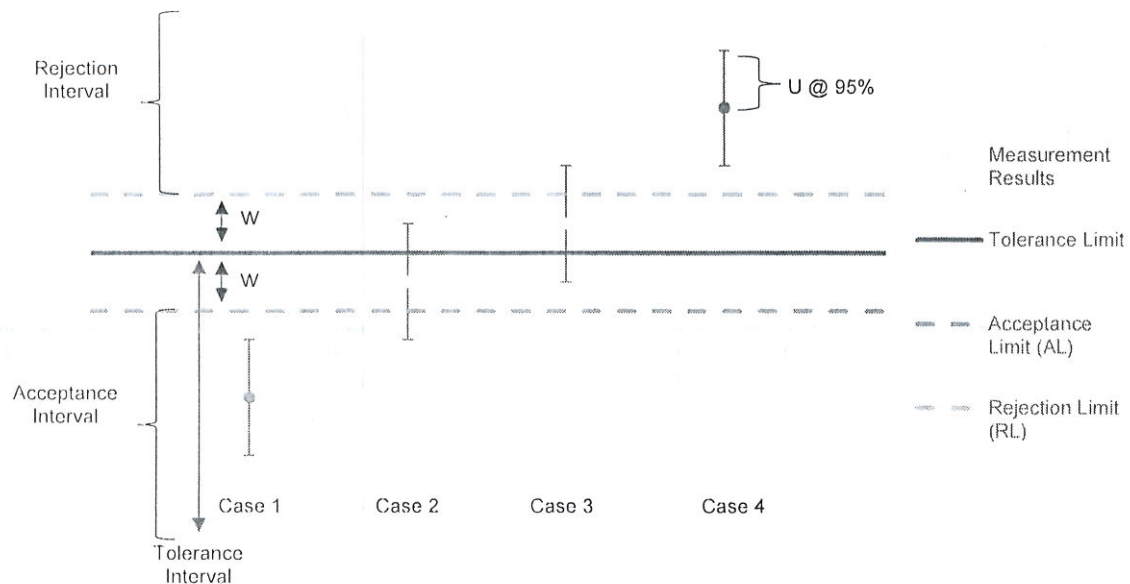
2023-01-08

Appendix for the decision rule

Method #3 Non-binary Statement with Guard Band, uncertainty directly taken into account

This decision rule uses a guard band to define the acceptance and rejection interval. The acceptance limit is defined by the following mathematical formula $AL = TL - w$ and the rejection limit $RL = TL + w$, where $w = rU$. The multiple r that is multiplied by the expanded measurement uncertainty U can be defined following ILAC G8: 2019 table 1 section 5.2. The expanded measurement uncertainty U has a 95% coverage probability ($k = 2$). Non-binary statement with guard band exists when the result is limited to four choices: pass, conditional pass, conditional fail, and fail.

Statements of conformity are reported as:



Graphical representation of a Non-Binary Statement with a Guard Band

Case 1 – Below acceptance limit AL

Status: In tolerance

- The result is inside the acceptance interval. However, assuming a normal distribution, the risk that the result is outside the tolerance limit could be up to 2.5%. Uncertainty is directly taken into account. *Green*.

Case 2 – Below tolerance limit TL, greater than acceptance limit AL

Status: In tolerance-Conditional

- The result is outside the acceptance interval but below tolerance limit. However, the observed value is inside the guard band $w = TL - AL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 3 – Greater than tolerance limit, below rejection limit RL

Status: Out of tolerance-Conditional

- The result is greater than tolerance limit but outside the rejection interval. However, the observed value is inside the guard band $w = RL - TL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 4 – Greater than rejection limit RL

Status: Out of tolerance

- The result is inside the rejection interval. Uncertainty is directly taken into account. *Red*.

CALIBRATION CERTIFICATE # 22186

Calibration date : 2023-12-20

Certificate issued : 2023-12-20

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

Calibration of
Positive displacement flow meter Shinigawa DCDa-2c S/N : 23543

QUALITY PROGRAM CONFORMANCE

All calibrations are performed in accordance with Polycontrols Laboratory Quality Assurance Manual and conform to ISO/IEC 17025: 2017, ISO 9001 – 2015 and/or other quality requirements defined in customers purchase descriptions. The results are strictly valid for the device under test or calibration. If applicable, the decision rule is described in the certificate.

TRACEABILITY

The traceability for flow standard to the National Institute of Standards and Technology, NIST, is maintained by Fluke Corporation of Phoenix, Arizona and conform to ISO/IEC 17025, ANSI/NCSL Z540-1-1994, ISO-10012-1 and MIL-STD 45662A.

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and traceability to the International System of Units (SI) or to standards acceptable to the CLAS program. This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither CLAS nor SCC guarantee the accuracy of individual calibrations by accredited laboratories.

CALIBRATION OF MEASURING AND TEST EQUIPMENT

For calibration measurement capability, please refer to the Canadian Calibration Network web page at the National Research Council of Canada. This laboratory is accredited by the Standards Council of Canada as part of the Calibration Laboratory Assessment Service (CLAS) program and is listed at nrc.canada.ca.

This document forms part of the Certificate of Accreditation issued by the Standards Council of Canada (SCC). The original version is available in the Directory of Accredited Laboratories on the SCC website at www.scc.ca.

CONDITION SUMMARY OF THE DEVICE UNDER TEST

Initial conditions	In good condition
Work done	Initial readings = Final readings, no adjustment Calibration of the instrument
Results	Final readings in tolerance
Remarks	Calibration frequency every 6 months Tolerance modified per end user request


Louis-Philippe Tremblay
Metrologist


Laboratory Manager

Calibration certificate # 22186

Serial Number:	23543	Test stand:	3
Calibration Date:	2023-12-20	Procedure:	POS-CAL-005
Instrument ID:	EM-179	Decision rule:	Method #3

Standard equipment used for final calibration

Description	Model	Serial #	Traceability	Due date
Fluke molbloc_120 slpm	2E2-S	237	1500349857	2024-03-02
Fluke molbloc_30 slpm	3E4-VCR-V-Q	2403	1500358529	2024-07-24
Fluke molbox I	Molbox I	881	1500363193	2024-10-08
RTD Mist	M22	3061002	2023005392	2024-06-29
Module 44.5 PSI avec Baro 163671	Module 30	160659	2023003753	2024-05-18

Final specifications of the device under test
Calibration conditions

Gas	Air	Gas	Air
Operation temperature		Ambient temperature	21.97 °C
Inlet pressure		Ambient pressure	1026.93 mbar
Outlet pressure		Orientation	Horizontal
Reference temperature		Seals	Viton
Reference pressure		Valve	
Range	10-2000 ALH		
Input/Output Signals	-		
Supply			
Accuracy	±2 %O.R.		

Final readings

Test Flow ALH	Device under test L	Measured values			Calculated Reference L	Calculated Error L	Acceptable Error L	Uncertainty k = 2 L	TUR
		Pressure PSIA	Temperature °C	Reference L					
308.6398	52.195	14.8948	21.71	48.2200	51.3690	0.826	1.027	0.1705	>4
1283.1975	216.986	14.9055	21.82	200.9900	214.0457	2.940	4.281	0.7106	>4
2129.4296	358.670	14.9284	21.86	334.0700	355.2704	3.400	7.105	0.8718	>4



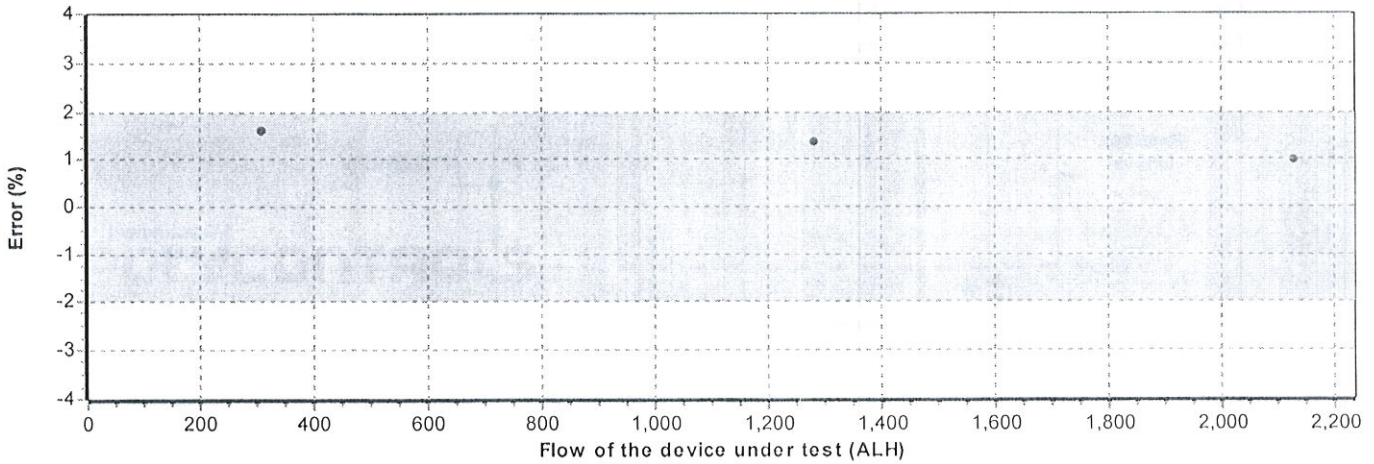
POLYCONTROLS



Calibration certificate # 22186

Serial Number:	23543	Test stand:	3
Calibration Date:	2023-12-20	Procedure:	POS-CAL-005
Instrument ID:	EM-179	Decision rule:	Method #3

Final results



See the appendix for the guideline of decision rule

Cal fact. : 0,9841747

2023-01-08

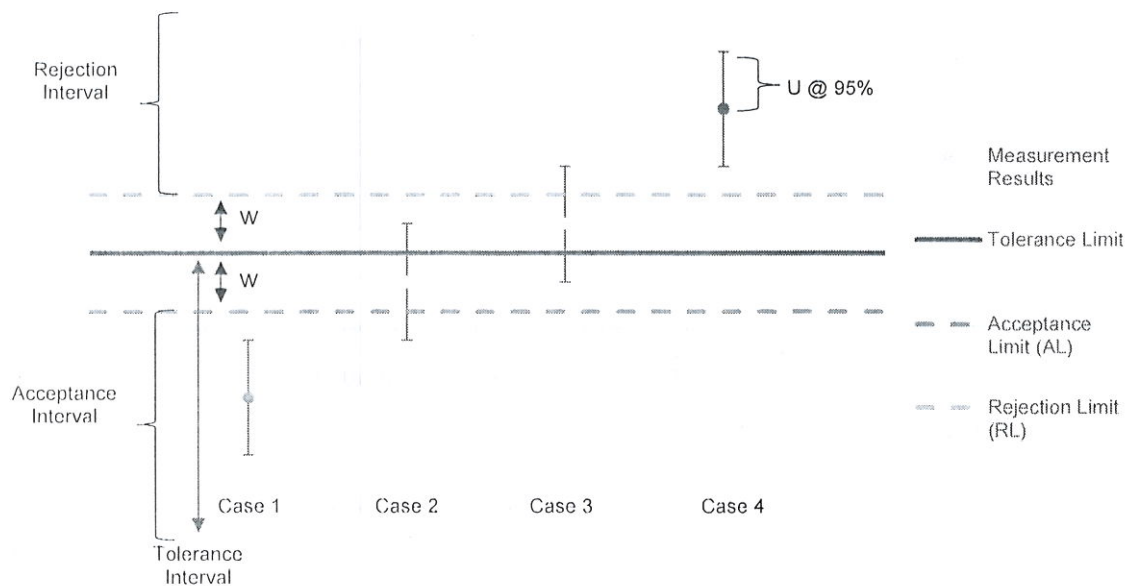


Appendix for the decision rule

Method #3 Non-binary Statement with Guard Band, uncertainty directly taken into account

This decision rule uses a guard band to define the acceptance and rejection interval. The acceptance limit is defined by the following mathematical formula $AL = TL - w$ and the rejection limit $RL = TL + w$, where $w = rU$. The multiple r that is multiplied by the expanded measurement uncertainty U can be defined following ILAC G8: 2019 table 1 section 5.2. The expanded measurement uncertainty U has a 95% coverage probability ($k = 2$). Non-binary statement with guard band exists when the result is limited to four choices: pass, conditional pass, conditional fail, and fail.

Statements of conformity are reported as:



Graphical representation of a Non-Binary Statement with a Guard Band

Case 1 – Below acceptance limit AL

Status: In tolerance

- The result is inside the acceptance interval. However, assuming a normal distribution, the risk that the result is outside the tolerance limit could be up to 2.5%. Uncertainty is directly taken into account. *Green*.

Case 2 – Below tolerance limit TL, greater than acceptance limit AL

Status: In tolerance-Conditional

- The result is outside the acceptance interval but below tolerance limit. However, the observed value is inside the guard band $w = TL - AL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 3 – Greater than tolerance limit, below rejection limit RL

Status: Out of tolerance-Conditional

- The result is greater than tolerance limit but outside the rejection interval. However, the observed value is inside the guard band $w = RL - TL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 4 – Greater than rejection limit RL

Status: Out of tolerance

- The result is inside the rejection interval. Uncertainty is directly taken into account. *Red*.

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-222
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	Calibration date :	04-03-2022

Technician:
Coutu, Daniel

David Llorens

David Llorens, Quality Manager

SERVICE DESCRIPTION:

Masses description :	NIST F	Date approved :	14-03-2022
Precision class :	NIST F	Next Calibration :	04-03-2026
Density :	7.7g/cm ³	CCN accreditation # :	668
Identification (if unique) :	DI000D532	CLAS Certification # :	2010-01

Test conditions :	Temp °C: 21.05	kPa Pressure: 102.3	Humidity: 49.4
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NOTES:

For weight calibration, we use the procedure "Comparaison individuelle" PDL-09-MG-001 and the procedure "Détermination des incertitudes" PDL-09-MG-002. This certificate cannot be copied without written approval from Dispersion Laboratory. The results presented in these pages relate only to objects subjected to calibration.

REMARKS:

March 2022
page 1 of 5

CALIBRATION CERTIFICATE

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www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-222
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	CCN Accreditation # :	668
		CLAS Certification # :	2010-01
		Precision class :	NIST F
		Calibration date :	04-03-2022
Mass :	10 kg	Follow-up date :	04-03-2026

CALIBRATION RESULTS, CONVENTIONAL MASS:

[illegible]

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

Our balances are periodically verified, according to our PDL-11-MG-001 control procedure.

UNCERTAINTIES:

The following uncertainties exist :

1. *Uncertainty associated with the weighting process.*
2. *Uncertainty associated with air density.*
3. *Uncertainty associated with the measurement standard.*
4. *Uncertainty associated with the density of the mass being calibrated.*

The uncertainty of the weighing process includes long-term reproducibility.

Uncertainties specified in this report are expanded uncertainties representing a confidence level of approximately 95% obtained by multiplying the combined standard uncertainty by a coverage factor of $k = 2$. For more detailed information refer to the GUM (Guide to the Expression of Uncertainty in Measurement, 1995 Edition)

TRACEABILITY

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and their traceability to recognized national measurement standards and to the International System of Units (SI). This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither the CLAS nor the SCC guarantees the accuracy of individual calibration by accredited laboratories.

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

USED REFERENCES

Item	Serial #	Manufacturer	Calibration date	Due date
300g Labo	96-0888-50-2	Denver Instrument Company	01-10-2020	31-03-2022
1kg-1mg Labo	MT-01	Mettler Toledo	01-10-2020	31-03-2022
2kg Labo	96-0888-50-3	Denver Instrument Company	01-10-2020	31-03-2022
1kg Labo	96-088850-1	Denver Instrument Company	01-10-2020	31-03-2022
5kg Labo	129099	Mettler Toledo	01-10-2020	31-03-2022
10kg Labo	DI000G991	Dispersion	23-03-2021	31-03-2022
20kg Labo	69976	Mettler Toledo	06-10-2021	31-10-2022
1 mg-10kg	4000028011	Troemner	15-10-2021	31-10-2022
2kg Labo	129098	Mettler Toledo	01-10-2020	31-03-2022

ENVIRONMENTAL CONDITIONS

Item	Serial #	Manufacturer	Calibration date	Due date
THE004	107080	Control Company	04-03-2021	31-03-2022



Instrumentation
Saint-Laurent inc.
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-224 2023-05-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	ISL-022
Address:	695 B rue Gaudette	Required Accuracy:	+/- 1/32"
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Ruban à mesurer	Input Type:	Mesure
Manufacturer:	Stanley	Output Type:	N/A
Model #:	Leverlock 12'	Measurement Type:	Inch
Serial #:	N/A	Range:	0 à 12'
Location:	Portable	Version:	Machine: N/A
CALIBRATORS SPECIFICATION			
Calibrator:	tape a mesurer	Certification #:	TB-13356500
Serial #:	23036922	Certification Date:	2023-01-19
Certified by:	Starrett	Next Certification:	2024-01-19
Comments:			



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Saint-Laurent^{inc.}**
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-224 2023-05-11
----------------------	-----------------------------

CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
1.00 "	1.00 "	1.00 "	0.00 "	1.00 "	+/- 1/32 "	... "
Compliant						
36.00 "	36.00 "	36.00 "	0.00 "	36.00 "	+/- 1/32 "	... "
Compliant						
72.00 "	72.00 "	72.00 "	0.00 "	72.00 "	+/- 1/32 "	... "
Compliant						
108.00 "	108.00 "	108.00 "	0.00 "	108.00 "	+/- 1/32 "	... "
Compliant						
132.00 "	132.00 "	132.00 "	0.00 "	132.00 "	+/- 1/32 "	... "
Compliant						

Environmental Conditions:	Temperature: 21 °C	Humidity: 30 %RH
Comments:		

CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-05-11
Next Calibration:	2024-05-11
Certificate Date:	2023-05-11

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution k=2.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). SCC accreditation number: # 669. ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

mg

Marc Gingras - Technicien

May 17th 2023



Instrumentation
Saint-Laurent inc.
Certified ISO 17025



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St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
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CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-249 2023-05-11		
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9106
Address:	695 B rue Gaudette	Required Accuracy:	+/- 0.25 "H2O
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Indicator	Input Type:	Pression
Manufacturer:	Dwyer	Output Type:	Voltage
Model #:	MS-321-LCD	Measurement Type:	Pressure
Serial #:	N/A	Range:	0 à 0.10 "H2O
Location:	Banc de test	Version:	Machine: N/A
CALIBRATORS SPECIFICATION			
Calibrator:	Crystal XP2i 300	Certification #:	2022006892
Serial #:	258139	Certification Date:	2022-09-09
Certified by:	Alpha Controls	Next Certification:	2023-09-09
Comments:			
Calibrator:	Fluke 744	Certification #:	2023003233
Serial #:	8180008	Certification Date:	2023-04-26
Certified by:	Alpha Controls	Next Certification:	2024-04-26
Comments:			



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St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
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CALIBRATION CERTIFICATE

Certificate #		CE-EM-249 2023-05-11				
		Calibration Results				
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
0.0000 "H2O Compliant	0.0000 "H2O Verification of the indicator	0.0000 "H2O	0.0000 "H2O	0.0000 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0250 "H2O Compliant	0.0250 "H2O Verification of the indicator	0.0239 "H2O	-0.0011 "H2O	0.0239 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0500 "H2O Compliant	0.0500 "H2O Verification of the indicator	0.0485 "H2O	-0.0015 "H2O	0.0485 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0750 "H2O Compliant	0.0750 "H2O Verification of the indicator	0.0732 "H2O	-0.0068 "H2O	0.0732 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.1000 "H2O Compliant	0.1000 "H2O Verification of the indicator	0.09575 "H2O	-0.0025 "H2O	0.09575 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0750 "H2O Compliant	0.0750 "H2O Verification of the indicator	0.0735 "H2O	-0.0065 "H2O	0.0735 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0500 "H2O Compliant	0.0500 "H2O Verification of the indicator	0.0482 "H2O	-0.0018 "H2O	0.0482 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0250 "H2O Compliant	0.0250 "H2O Verification of the indicator	0.0236 "H2O	-0.0014 "H2O	0.0236 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0000 "H2O Compliant	0.0000 "H2O Verification of the indicator	0.0000 "H2O	0.0000 "H2O	0.0000 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
0.0000 "H2O Compliant	0.0000 V.DC. Verification of the analogic output	0.0021 V.DC.	+0.0021 V.DC.	0.0021 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.0250 "H2O Compliant	2.5000 V.DC. Verification of the analogic output	2.4048 V.DC.	-0.1852 V.DC.	2.4048 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.0500 "H2O Compliant	5.0000 V.DC. Verification of the analogic output	4.8450 V.DC.	-0.1550 V.DC.	4.8450 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.0750 "H2O Compliant	7.5000 V.DC. Verification of the analogic output	7.3538 V.DC.	-0.1462 V.DC.	7.3538 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.1000 "H2O Compliant	10.0000 V.DC. Verification of the analogic output	9.7318 V.DC.	-0.2682 V.DC.	9.7318 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.0750 "H2O Compliant	0.00 V.DC. Verification of the analogic output	7.3535 V.DC.	-0.1465 V.DC.	7.3535 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.0500 "H2O Compliant	0.00 V.DC. Verification of the analogic output	4.8453 V.DC.	-0.1547 V.DC.	4.8453 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.0250 "H2O Compliant	0.00 V.DC. Verification of the analogic output	2.4051 V.DC.	-0.1849 V.DC.	2.4051 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
0.0000 "H2O Compliant	0.00 V.DC. Verification of the analogic output	0.0021 V.DC.	+0.0021 V.DC.	0.00 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
Environmental Conditions:		Temperature: 21 °C		Humidity: 30 %RH		
Comments:						

Version 1



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80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-249 2023-05-11									
CALIBRATION DATE/ISSUANCE OF CERTIFICATE										
Calibration Date:	2023-05-11									
Next Calibration:	2024-05-11									
Certificate Date:	2023-05-11									
CALIBRATION CONFORMITY										
	<table border="1"><thead><tr><th></th><th>Before</th><th>After</th></tr></thead><tbody><tr><td>Compliant:</td><td>X</td><td>X</td></tr><tr><td>Non Compliant:</td><td></td><td></td></tr></tbody></table>		Before	After	Compliant:	X	X	Non Compliant:		
	Before	After								
Compliant:	X	X								
Non Compliant:										

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution $k=2$.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

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mg

Marc Gingras - Technicien

May 17th 2023
[Signature]



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Saint-Laurent_{inc.}
Certified ISO 17025



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St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-313 2023-05-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9106
Address:	695 B rue Gaudette	Required Accuracy:	+/- 0.25"H2O
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Indicator	Input Type:	Pression
Manufacturer:	Dwyer	Output Type:	Voltage
Model #:	MS-321-LCD	Measurement Type:	Pressure
Serial #:	N.A.	Range:	0 a 0.1 inchh20
Location:	N.A.	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Crystal XP2i 300	Certification #:	2022006892
Serial #:	258139	Certification Date:	2022-09-09
Certified by:	Alpha Controls	Next Certification:	2023-09-09
Comments:			
Calibrator:	Fluke 744	Certification #:	2023003233
Serial #:	8180008	Certification Date:	2023-04-26
Certified by:	Alpha Controls	Next Certification:	2024-04-26
Comments:			



**Instrumentation
Saint-Laurent**
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80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
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CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-313 2023-05-11
----------------------	-----------------------------

CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
0.0000 "H2O Compliant	0.0000 "H2O	-0.0005 "H2O	-0.0005 "H2O	-0.0005 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0250 "H2O Compliant	0.0250 "H2O	0.0225 "H2O	-0.0025 "H2O	0.0225 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0500 "H2O Compliant	0.0500 "H2O	0.0475 "H2O	-0.0125 "H2O	0.0475 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0750 "H2O Compliant	0.0750 "H2O	0.0712 "H2O	-0.0038 "H2O	0.0712 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.1000 "H2O Compliant	0.1000 "H2O	0.0980 "H2O	-0.0020 "H2O	0.0980 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0750 "H2O Compliant	0.0750 "H2O	0.0715 "H2O	-0.0035 "H2O	0.0715 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0500 "H2O Compliant	0.0500 "H2O	0.0473 "H2O	-0.0127 "H2O	0.0473 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0250 "H2O Compliant	0.0250 "H2O	0.0228 "H2O	-0.0022 "H2O	0.0228 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0000 "H2O Compliant	0.0000 "H2O	-0.0004 "H2O	-0.0004 "H2O	-0.0004 "H2O	+/- 0.25 "H2O	± 0.10 "H2O
	Verification of the indicator					
0.0000 "H2O Compliant	0.0000 V.DC.	0.0054 V.DC.	+0.0054 V.DC.	0.0054 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.0250 "H2O Compliant	2.5000 V.DC.	2.4534 V.DC.	-0.0466 V.DC.	2.4534 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.0500 "H2O Compliant	5.0000 V.DC.	4.8196 V.DC.	-0.1804 V.DC.	4.8196 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.0750 "H2O Compliant	7.5000 V.DC.	7.0051 V.DC.	+0.0051 V.DC.	7.0051 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.1000 "H2O Compliant	10.0000 V.DC.	10.1084 V.DC.	+0.1084 V.DC.	10.1084 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.0750 "H2O Compliant	0.00 V.DC.	7.0050 V.DC.	+0.0050 V.DC.	7.0050 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.0500 "H2O Compliant	0.00 V.DC.	4.8193 V.DC.	-0.1807 V.DC.	4.8193 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.0250 "H2O Compliant	0.00 V.DC.	2.4536 V.DC.	-0.0464 V.DC.	2.4536 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					
0.0000 "H2O Compliant	0.00 V.DC.	0.0056 V.DC.	+0.0056 V.DC.	0.0056 V.DC.	+/- 0.5 V.DC.	0.5 V.DC.
	Verification of the analogic output					

Environmental Conditions: Temperature: 21 °C Humidity: 30 %RH

Comments:

Version 1



Instrumentation
Saint-Laurent^{inc.}
Certified ISO 17025



80 rue de la montagne
St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-313 2023-05-11
----------------------	-----------------------------

CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-05-11
Next Calibration:	2024-05-11
Certificate Date:	2023-05-11

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution $k=2$.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). SCC accreditation number: # 669. ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

Marc Gingras - Technicien

May 17th 2023

CALIBRATION CERTIFICATE # 22189

Calibration date : 2023-12-20

Certificate issued : 2023-12-20

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

Calibration of
Positive displacement flow meter Shinigawa DCSDa-2C S/N : S8020

QUALITY PROGRAM CONFORMANCE

All calibrations are performed in accordance with Polycontrols Laboratory Quality Assurance Manual and conform to ISO/IEC 17025: 2017, ISO 9001 – 2015 and/or other quality requirements defined in customers purchase descriptions. The results are strictly valid for the device under test or calibration. If applicable, the decision rule is described in the certificate.

TRACEABILITY

The traceability for flow standard to the National Institute of Standards and Technology, NIST, is maintained by Fluke Corporation of Phoenix, Arizona and conform to ISO/IEC 17025, ANSI/NCSL Z540-1-1994, ISO-10012-1 and MIL-STD 45662A.

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and traceability to the International System of Units (SI) or to standards acceptable to the CLAS program. This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither CLAS nor SCC guarantee the accuracy of individual calibrations by accredited laboratories.

CALIBRATION OF MEASURING AND TEST EQUIPMENT

For calibration measurement capability, please refer to the Canadian Calibration Network web page at the National Research Council of Canada. This laboratory is accredited by the Standards Council of Canada as part of the Calibration Laboratory Assessment Service (CLAS) program and is listed at nrc.canada.ca.

This document forms part of the Certificate of Accreditation issued by the Standards Council of Canada (SCC). The original version is available in the Directory of Accredited Laboratories on the SCC website at www.scc.ca.

CONDITION SUMMARY OF THE DEVICE UNDER TEST

Initial conditions	In good condition
Work done	Initial readings = Final readings, no adjustment Calibration of the instrument
Results	Final readings in tolerance
Remarks	Calibration frequency every 6 months Tolerance modified per end user request



Louis-Philippe Tremblay
Metrologist



Laboratory Manager

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3650, Matte blvd. (Unit A-1), Brossard (Quebec), Canada, J4Y 2Z2
Tel: (450) 444-3600 Fax: (450) 444-1088 www.polycontrols.com

Calibration certificate # 22189

Serial Number:	S8020	Test stand:	3
Calibration Date:	2023-12-20	Procedure:	POS-CAL-005
Instrument ID:	EM 318	Decision rule:	Method #3

Standard equipment used for final calibration

Description	Model	Serial #	Traceability	Due date
Fluke molbloc_120 slpm	2E2-S	237	1500349857	2024-03-02
Fluke molbloc_30 slpm	3E4-VCR-V-Q	2403	1500358529	2024-07-24
Fluke molbox I	Molbox I	881	1500363193	2024-10-08
RTD Mist	M22	3061002	2023005392	2024-06-29
Module 44.5 PSI avec Baro 163671	Module 30	160659	2023003753	2024-05-18

Final specifications of the device under test
Calibration conditions

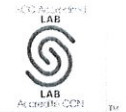
Gas	Air	Gas	Air
Operation temperature		Ambient temperature	21.88 °C
Inlet pressure		Ambient pressure	1026.55 mbar
Outlet pressure		Orientation	
Reference temperature		Seals	
Reference pressure		Valve	
Range	10-2000 ALH		
Input/Output Signals	-		
Supply			
Accuracy	±2 %O.R.		

Final readings

Test Flow ALH	Device under test L	Measured values			Calculated Reference L	Calculated Error L	Acceptable Error L	Uncertainty k = 2 L	TUR
		Pressure PSIA	Temperature °C	Reference L					
303.0177	50.300	14.8998	21.68	47.3600	50.4322	-0.132	1.009	0.1674	>4
1250.5764	204.895	14.8978	21.63	195.5300	208.2060	-3.311	4.164	0.6910	>4
2137.8284	351.770	14.8944	21.57	334.2800	355.9596	-4.190	7.119	0.8729	>4



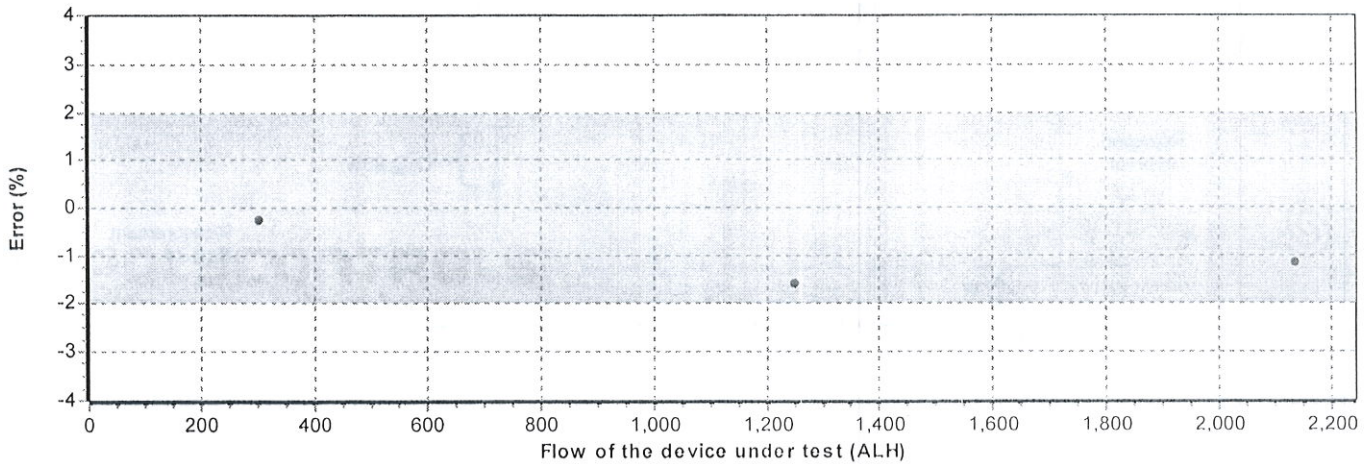
POLYCONTROLS



Calibration certificate # 22189

Serial Number:	S8020	Test stand:	3
Calibration Date:	2023-12-20	Procedure:	POS-CAL-005
Instrument ID:	EM 318	Decision rule:	Method #3

Final results



See the appendix for the guideline of decision rule

Cal Pack: 1,00262823

[Signature]

2023.01.08

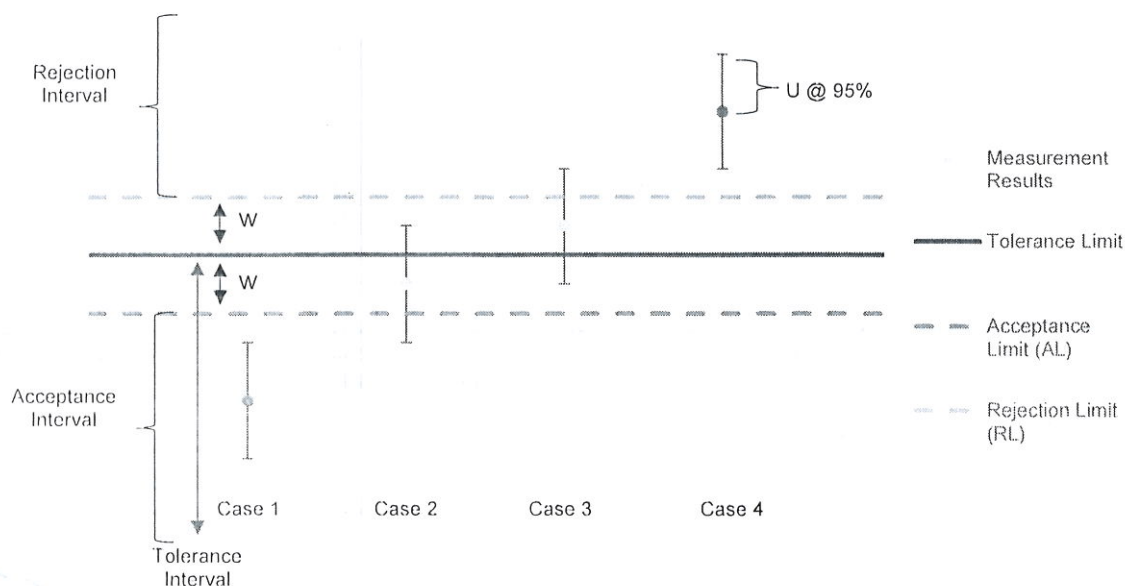


Appendix for the decision rule

Method #3 Non-binary Statement with Guard Band, uncertainty directly taken into account

This decision rule uses a guard band to define the acceptance and rejection interval. The acceptance limit is defined by the following mathematical formula $AL = TL - w$ and the rejection limit $RL = TL + w$, where $w = rU$. The multiple r that is multiplied by the expanded measurement uncertainty U can be defined following ILAC G8: 2019 table 1 section 5.2. The expanded measurement uncertainty U has a 95% coverage probability ($k = 2$). Non-binary statement with guard band exists when the result is limited to four choices: pass, conditional pass, conditional fail, and fail.

Statements of conformity are reported as:



Graphical representation of a Non-Binary Statement with a Guard Band

Case 1 – Below acceptance limit AL

Status: In tolerance

- The result is inside the acceptance interval. However, assuming a normal distribution, the risk that the result is outside the tolerance limit could be up to 2.5%. Uncertainty is directly taken into account. *Green*.

Case 2 – Below tolerance limit TL, greater than acceptance limit AL

Status: In tolerance-Conditional

- The result is outside the acceptance interval but below tolerance limit. However, the observed value is inside the guard band $w = TL - AL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 3 – Greater than tolerance limit, below rejection limit RL

Status: Out of tolerance-Conditional

- The result is greater than tolerance limit but outside the rejection interval. However, the observed value is inside the guard band $w = RL - TL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 4 – Greater than rejection limit RL

Status: Out of tolerance

- The result is inside the rejection interval. Uncertainty is directly taken into account. *Red*.



CERTIFICATE OF CALIBRATION



Certificate Number: 2023010474-Rev_1

Page 1 of 2

Manufacturer: Control Company
Model: 4199
Description: Barometer
Serial: 210758578
ID: EM 333
Customer: SERVICES POLYTESTS
695-B GUADETTE
ST-JEAN-SUR-RICHELIEU QC
J3B 7S7

RMA: AC23121571
Workorder: 2023010474
Barcode: AL00042136-P
Received Conditions: Out of Tolerance
Calibration Date: 28-Dec-2023
Calibration Due: 28-Jun-2024
Temperature: 22.39°C
Humidity: 35.7%RH

STATEMENT OF UNCERTAINTY: The reported expanded uncertainty of measurement is stated as the standard measurement uncertainty multiplied by the coverage factor $K = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95 percent. Alpha Controls & Instrumentation Inc. certifies this instrument was calibrated on the date shown using standards traceable to NIST/NRC or accepted intrinsic standards and in compliance with ISO/IEC-17025:2017 and ANSI/NCSL Z540-1.

Any statement of compliance is made without taking measurement uncertainty into account and is based on UUT performance against required tolerance only. The customer must ensure equipment calibrated meets the intended use.

Tolerance is based on manufacturer specification if not stated otherwise. Calibration results relate to items calibrated only.

This certificate shall not be reproduced except in full without written approval of Alpha Controls and Instrumentation Inc.

Functional tests are not covered by our scope of accreditation.

STANDARDS USED

Description	Model	ID	Cal Date	Due Date
Pressure Controller/Calibrator	DH Instruments PPC3	PRE-CAL-04	27-Jun-2023	30-Jun-2024
Reference Pressure Monitor	Fluke RPM4	PRE-MTR-04	27-Jun-2023	30-Jun-2024

Notes: Adjusted trim pots.

Rev1 - corrected As Found readings (SP/2024-01-10)

Performed by:

Farid Bazhdanzadeh

Technician

(digitally signed on 28-Dec-2023 10:43 am)

QA Reviewed by:

Slava Peciurov

Lab Manager

(digitally signed on 29-Dec-2023 9:31 am)

Quality Management System is assessed and registered by Intertek as conforming to the requirements of ISO9001

Alpha Controls & Instrumentation Inc., Suite 6, 361 Steelcase Road West, Markham, Ontario L3R 3V8 www.alphacontrols.com (800) 567-8686

Procedure: Pressure/Vacuum: CAL VER /DHI PPC3 (2.3.A)

FOUND (Fail)

Test Description	True Value	Test Results	Tolerance	Lower Limit	Upper Limit	Status	Uncertainty
------------------	------------	--------------	-----------	-------------	-------------	--------	-------------

PRESSURE TEST

MEASUREMENT UNITS: mmHg a

740.947	740.9	746	± 1.0	740	742	Fail	5.8e-001
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Procedure: Pressure/Vacuum: CAL VER /DHI PPC3 (2.3.A)

LEFT (Pass)

Test Description	True Value	Test Results	Tolerance	Lower Limit	Upper Limit	Status	Uncertainty
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PRESSURE TEST

MEASUREMENT UNITS: mmHg a

740.951	741.0	741	± 1.0	740	742	Pass	5.8e-001
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END OF CERTIFICATE


2023-01-10

Fox Valley Metrology
3114 Medalist Drive
Oshkosh, WI 54902
(920) 426-5894 • Fax (920) 426-8120
<https://www.FoxValleyMetrology.com>

CERTIFICATE OF
CALIBRATION



Certificate No. ACT-1272

CERTIFICATION NUMBER C0009-67871-540	IDENTIFICATION EM-334												
FOR Polytests Services Inc. 695 B rue Gaudette St-Jean-sur-Richelieu, QC, Canada J3B 7S7	SERIAL NUMBER 												
TEST INSTRUMENT Resistance Fixture	PURCHASE ORDER # 100595												
MAKE Delmhorst Instrument Co.	PROCEDURES FOLLOWED												
MODEL MCS-1	EL-010A rev. 0												
RANGE (1.1M to 120M) ohms													
CUSTOMER LOCATION	STANDARDS USED												
	<table><tr><th>INSTRUMENT</th><th>SERIAL NUMBER</th><th>TRACE NUMBER</th><th>NEXT CAL.</th></tr><tr><td>FVS-275E</td><td>16783134</td><td>CN121-17281-690</td><td>05/31/2024</td></tr><tr><td>FVS-982</td><td>618182363</td><td>CN219-47031-524</td><td>07/14/2024</td></tr></table>	INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL.	FVS-275E	16783134	CN121-17281-690	05/31/2024	FVS-982	618182363	CN219-47031-524	07/14/2024
INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL.										
FVS-275E	16783134	CN121-17281-690	05/31/2024										
FVS-982	618182363	CN219-47031-524	07/14/2024										
CONDITION RECEIVED In Tolerance													
CONDITION RETURNED In Tolerance													
CALIBRATED BY Brock Pecore													
FORM REVIEWED BY M.T.													
CALIBRATION LOCATION FVM													
ENVIRONMENT 71.4°F, 40.7%RH, 28.34inHg													
CALIBRATION DATE 01/09/2024													
RECALIBRATION DUE 01/09/2025													

CALIBRATION RESULTS

* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
Resistance	(Mohm)	(Mohm)	(Mohm)	(Mohm)	(Mohm)	(Mohm)
12% 'Pad'	120.00	119.76	120.24	119.91	119.91	6.0E-3
22% 'Pad'	1.100	1.078	1.122	1.097	1.097	6.0E-4


JAN 25, 2024

■ This certificate shall not be altered in any form or reproduced, except in full, without prior written approval from originating lab. These results relate only to the item(s) calibrated. Form Revision 8: 08/19/2021

■ Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of (k=2). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.

■ The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006. Other standards listed upon request.

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-225
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	Calibration date :	14-03-2022

Technician:
Coutu, Daniel

David L. Lorenson

David Llorens, Quality Manager

SERVICE DESCRIPTION:

Masses description :	ASTM E617	Date approved :	14-03-2022
Precision class :	ASTM 1	Next Calibration :	14-03-2027
Density :	7.96g/cm³	CCN accreditation # :	668
Identification (if unique) :	DI000J378	CLAS Certification # :	2010-01

Test conditions :	Temp °C:	21.16	kPa Pressure:	100.64	Humidity:	47.97
--------------------------	----------	-------	---------------	--------	-----------	-------

NOTES:

For weight calibration, we use the procedure "Comparaison individuelle" PDL-09-MG-001 and the procedure "Détermination des incertitudes" PDL-09-MG-002. This certificate cannot be copied without written approval from Dispersion Laboratory. The results presented in these pages relate only to objects subjected to calibration.n

REMARKS:

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March 2022 page 1 of 5

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

Client :	Polytests	Certificate Number :	157-77C603-225
Address :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	CCN Accreditation # :	668
		CLAS Certification # :	2010-01
		Precision class :	ASTM 1
		Calibration date :	14-03-2022
Mass :	100 mg	Follow-up date :	14-03-2027

CALIBRATION RESULTS, CONVENTIONAL MASS:

[illegible]

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

Our balances are periodically verified, according to our PDL-11-MG-001 control procedure.

UNCERTAINTIES:

The following uncertainties exist :

1. *Uncertainty associated with the weighting process.*
2. *Uncertainty associated with air density.*
3. *Uncertainty associated with the measurement standard.*
4. *Uncertainty associated with the density of the mass being calibrated.*

The uncertainty of the weighing process includes long-term reproducibility.

Uncertainties specified in this report are expanded uncertainties representing a confidence level of approximately 95% obtained by multiplying the combined standard uncertainty by a coverage factor of $k = 2$. For more detailed information refer to the GUM (Guide to the Expression of Uncertainty in Measurement, 1995 Edition)

TRACEABILITY

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and their traceability to recognized national measurement standards and to the International System of Units (SI). This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither the CLAS nor the SCC guarantees the accuracy of individual calibration by accredited laboratories.

CALIBRATION CERTIFICATE

9900 Chemin de la Côte-de-Liesse, Montréal, QC H8T 1A1
www.dispersion.ca 1.866.390.5066

USED REFERENCES

Item	Serial #	Manufacturer	Calibration date	Due date
300g Labo	96-0888-50-2	Denver Instrument Company	01-10-2020	31-03-2022
1kg-1mg Labo	MT-01	Mettler Toledo	01-10-2020	31-03-2022
2kg Labo	96-0888-50-3	Denver Instrument Company	01-10-2020	31-03-2022
1kg Labo	96-088850-1	Denver Instrument Company	01-10-2020	31-03-2022
5kg Labo	129099	Mettler Toledo	01-10-2020	31-03-2022
10kg Labo	DI000G991	Dispersion	23-03-2021	31-03-2022
20kg Labo	69976	Mettler Toledo	06-10-2021	31-10-2022
1 mg-10kg	4000028011	Troemner	15-10-2021	31-10-2022
2kg Labo	129098	Mettler Toledo	01-10-2020	31-03-2022

ENVIRONMENTAL CONDITIONS

Item	Serial #	Manufacturer	Calibration date	Due date
THE004	107080	Control Company	04-03-2021	31-03-2022

CERTIFICATE OF ANALYSIS

Grade of Product: PRIMARY STANDARD

Customer:	AIR LIQUIDE CANADA	Reference Number:	160-402375016-1
Part Number:	X04NI77P15A0003	Cylinder Volume:	153.0 CF
Cylinder Number:	EB0118140	Cylinder Pressure:	2016 PSIG
Laboratory:	124 - Plumsteadville - PA	Valve Outlet:	350
Analysis Date:	Mar 07, 2022		
Lot Number:	160-402375016-1		

Expiration Date: Mar 07, 2030

Primary Standard Gas Mixtures are traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
OXYGEN	2.000 %	2.005 %	+/- 0.02%
CARBON MONOXIDE	3.000 %	3.000 %	+/- 0.02%
CARBON DIOXIDE	18.00 %	18.00 %	+/- 0.02%
NITROGEN	Balance		

Notes: GROSS WEIGHT: 29.581 KG

NET WEIGHT: 5.442 KG

P/N A1336386

PO#89404761



EM-336

[Signature]
JUN 2022

[Signature]
Approved for Release



CERTIFICATE OF ANALYSIS

Customer: SERVICES POLYTESTS INC., (S2232)
695B, GAUDETTE
ST-JEAN SUR RICHELIEU QC
J3B 7S7

Analysis Date: 3/4/2022 9:44:18AM
Product code: A1334811
Grade: PRIMARY
Size: 44
CGA #: 590

Servitrex barcode No: T2H6H8N
Work order number: 1607008
Pressure: 1450 psig
Volume: 4.7M3
Expiry date: 03/04/2025

COMPONENTS	NOMINAL CONCENTRATION	ANALYSIS RESULTS
CARBON DIOXIDE	10.0000 % Molar	10.00 % Molar
CARBON MONOXIDE	1.0000 % Molar	1.002 % Molar
OXYGEN	10.0000 % Molar	10.00 % Molar
NITROGEN	BALANCE	BALANCE

Analysis performed by:

Tobi Erinle
TOBI ERINLE - LAB TECHNICIAN

Verified by:

AD

This Air Liquide Canada mixture is traceable to NIST

METHOD OF ANALYSIS:

Method of analysis is based on principles of gas chromatography and as documented in Air Liquide Canada operating procedure, where applicable, FID, TCD, PDHID, FT-IR, FPD, NO/NOx and SO2 chemiluminescence, hygrometer, and electrochemical cells and paramagnetic cell. Detectors were used in conjunction with packed or capillary columns calibrated flow meters and dilution calibrated system.

ANALYTICAL ACCURACY:

Quality	Concentration	Blend Tolerance	AA
PRIMARY	5%-50%	+/-1%	+/-1%
	0.5%-5%	+/-2%	
	1ppm-0.5%	+/-5%	
CERTIFIED	5%-50%	+/-5%	+/-2%
	0.5%-5%	+/-10%	+/-2%
	1ppm-0.5%	+/-20%	+/-5%
UNANALYZE	5%-50%	+/-10%	
	<5%	+/-20%	

EM-338

[Signature]
June 2022

This mixture was certified by a combination of weight and analysis (depending on component) using scales certified against weights traceable to the Institute for National Measurement Standards (INMS) of the National Research Council of Canada (NRCC), Report # W-021221-13857 (MTL) and CA3033-022-050621-ACC (Calgary) or calibration standards prepared in that manner.

How to contact us & order



E-mail within your region:

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specgas.qc@airliquide.com

specgas.on@airliquide.com
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specgas.pacific@airliquide.com



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Instrumentation
Saint-Laurent^{inc.}
Certified ISO 17025



80 rue de la montagne
St-Joseph du-lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
info@instrumentationsaintlaurent.com

CALIBRATION CERTIFICATE

CERTIFICATE #		CE-EM-340 2023-05-11	
CLIENT		CALIBRATION SPECIFICATION	
Company:	Services Polytests Inc	Service Procedure:	4IN9106
Address:	695 B rue Gaudette	Required Accuracy:	+/- 1.0 inHg
	St-Jean-sur-Richelieu, Québec, J3B 7S7	Calibration Frequency:(days)	365
INSTRUMENT SPECIFICATION			
Instrument Type:	Pressure Gauge	Input Type:	Pression
Manufacturer:	Dwyer	Output Type:	Digitale
Model #:	DPG200	Measurement Type:	Pressure
Serial #:	S799031-0001	Range:	-29.93 to 0 inHg
Location:	N.A.	Version:	Machine: N.A.
CALIBRATORS SPECIFICATION			
Calibrator:	Crystal XP2i 300	Certification #:	2022006892
Serial #:	258139	Certification Date:	2022-09-09
Certified by:	Alpha Controls	Next Certification:	2023-09-09
Comments:			
Calibrator:	Fluke 744	Certification #:	2022006829
Serial #:	7798010	Certification Date:	2022-09-15
Certified by:	Alpha Controls	Next Certification:	2023-09-15
Comments:			



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CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-340 2023-05-11
----------------------	-----------------------------

CALIBRATION RESULTS						
Entry Source	Given Value	Actual Value	Deviation Error	After Calib Value	Accuracy	Uncertainty
Conformity	Comment					
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
-7.50 "Hg	-7.50 "Hg	-7.52 "Hg	-0.02 "Hg	-7.52 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
-15.00 "Hg	-15.00 "Hg	-15.03 "Hg	-0.03 "Hg	-15.03 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
-22.50 "Hg	-22.50 "Hg	-22.53 "Hg	-0.03 "Hg	-22.53 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
-28.00 "Hg	-28.00 "Hg	-28.05 "Hg	-0.05 "Hg	-28.05 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
-22.50 "Hg	-22.50 "Hg	-22.53 "Hg	-0.03 "Hg	-22.53 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
-15.00 "Hg	-15.00 "Hg	-15.02 "Hg	-0.02 "Hg	-15.02 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
-7.50 "Hg	-7.50 "Hg	-7.52 "Hg	-0.02 "Hg	-7.52 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	+/- 1.0 "Hg	+/- 0.5 "Hg
Compliant	Verification of the indicator					
0.00 "Hg	20.00 mA	20.00 mA	0.00 mA	20.00 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
-7.50 "Hg	15.99 mA	15.99 mA	0.00 mA	15.99 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
-15.00 "Hg	11.98 mA	11.97 mA	-0.01 mA	11.97 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
-22.50 "Hg	7.97 mA	7.91 mA	-0.06 mA	7.91 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
-28.00 "Hg	5.03 mA	5.00 mA	-0.03 mA	5.00 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
-22.50 "Hg	-22.50 mA	7.91 mA	-0.06 mA	7.91 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
-15.00 "Hg	-15.00 mA	11.97 mA	-0.01 mA	11.97 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
-7.50 "Hg	-7.50 mA	15.99 mA	0.00 mA	15.99 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					
0.00 "Hg	0.00 mA	20.00 mA	0.00 mA	20.00 mA	+/- 0.5 mA	+/- 0.0045 mA
Compliant	Verification of the analogic output					

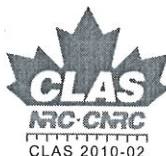
Environmental Conditions: Temperature: 21 °C Humidity: 30 %RH

Comments:

Version 1



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Certified ISO 17025



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CALIBRATION CERTIFICATE

CERTIFICATE #	CE-EM-340 2023-05-11
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CALIBRATION DATE/ISSUANCE OF CERTIFICATE	
Calibration Date:	2023-05-11
Next Calibration:	2024-05-11
Certificate Date:	2023-05-11

CALIBRATION CONFORMITY		
	Before	After
Compliant:	X	X
Non Compliant:		

- Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
- Reported uncertainties represent a 95 % of confidence level assuming a normal distribution $k=2$.
- The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
- The results presented in this certificate relate only to objects subject to calibration.
- It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
- The date format used in this certificate is: YYYY-MM-DD.

Assessment Service Calibration Laboratory (ASCL) of the National Research Council of Canada (NRC) has assessed and certified calibration laboratory's ability and traceability to the International System of Units (SI) or to standards acceptable according to ASCL. This calibration certificate is issued in accordance with the terms of ASCL certification and accreditation requirements of the Standards Council of Canada (SCC). SCC accreditation number: # 669. ASCL and SCC does not guarantee the accuracy of individual calibrations by accredited laboratories.

mg

Marc Gingras - Technicien

[Signature]
May 17th 2023

APPENDIX 4: Unit pre burn

Time acquisition	Flue	scale	Right	Back	bottom	Top	Left	number of pieces	moisture content % dry basis
	temp								
minutes	°F	lbs	°F	°F	°F	°F	°F		
1	70,7	4,3	70,7	70,2	70,3	70,9	70,5	3	19-20-21
2	87,1	4,2	70,7	70,1	70,3	71,0	70,5		
3	96,7	5,2	70,7	70,1	70,4	71,2	70,5		
4	124,1	4,2	70,7	70,2	70,7	71,7	70,6		
5	227,3	4,0	70,8	70,2	71,1	72,5	70,9		
6	362,8	3,9	70,8	70,2	71,5	74,6	71,5		
7	406,7	3,7	71,1	70,3	72,1	79,8	72,7		
8	400,7	3,5	71,6	70,4	72,7	91,6	75,2		
9	434,6	3,4	72,6	70,7	73,7	109,2	78,7		
10	465,7	3,3	73,9	71,0	75,1	132,5	82,9		
11	485,1	3,1	75,7	71,5	77,3	159,3	87,5		
12	511,4	2,9	77,8	72,1	80,3	187,6	92,6		
13	538,4	2,7	80,3	72,8	84,1	219,0	98,4		
14	555,5	2,6	83,2	73,7	88,7	252,3	105,1		
15	582,1	2,4	86,7	74,7	93,7	288,0	112,3		
16	614,3	2,2	90,5	75,8	99,2	328,2	119,9		
17	611,7	2,0	95,0	77,1	104,9	370,9	128,0		
18	600,6	1,8	100,2	78,6	110,9	410,8	136,7		
19	591,9	1,7	106,1	80,2	117,2	443,9	145,9		
20	584,5	1,5	112,6	82,1	123,5	472,5	155,4		
21	570,7	1,4	119,1	84,0	129,7	497,4	164,9	4	20-21-22-19
22	555,0	1,3	126,2	86,3	135,6	517,7	174,2		
23	521,2	8,9	133,4	93,4	141,4	529,7	184,3		
24	416,4	12,9	142,8	95,3	147,8	526,2	193,5		
25	392,2	12,9	151,6	96,6	154,5	513,7	202,9		
26	360,1	12,9	160,1	98,6	160,4	497,0	211,3		
27	311,6	12,9	166,4	106,3	163,2	479,3	218,5		
28	292,0	12,9	172,1	111,7	166,4	459,9	225,3		
29	313,9	12,8	176,7	116,1	169,1	440,2	230,5		
30	331,4	12,7	180,2	120,5	171,1	420,3	233,4		
31	382,6	12,6	182,8	123,7	172,7	403,1	234,8		
32	426,8	12,4	185,1	122,0	174,6	389,2	235,2		
33	391,7	12,4	187,7	117,9	177,1	378,9	234,5		
34	331,2	12,8	188,9	119,3	178,6	370,1	234,4		
35	271,0	12,3	188,5	127,9	176,5	360,9	234,5		
36	286,9	12,3	188,1	131,5	176,6	350,9	234,9		
37	350,3	12,1	189,1	123,8	179,1	340,7	234,5		
38	422,7	12,1	187,4	132,3	177,7	332,8	233,0		
39	490,3	11,9	186,1	135,3	177,8	327,7	231,7		
40	572,3	11,6	184,8	137,3	178,0	327,3	230,4		
41	611,5	11,3	184,6	126,9	180,9	336,0	230,3		
42	553,5	11,1	184,2	123,7	182,6	354,3	231,0		
43	528,8	11,0	184,4	122,7	184,5	376,6	232,8		
44	488,2	10,8	184,7	121,9	186,4	396,3	235,1		
45	428,0	10,8	185,2	122,4	188,4	407,4	238,4		
46	403,6	10,6	186,5	122,6	190,6	409,8	241,7		
47	384,3	10,6	188,2	123,3	192,6	406,9	246,0		
48	373,3	10,5	189,0	123,5	194,9	401,5	249,1		
49	374,9	10,4	191,1	123,5	196,9	394,9	252,4		
50	367,0	10,3	192,6	124,3	199,7	388,1	255,2		
51	366,5	10,2	193,9	125,0	202,3	381,3	258,1		
52	401,3	10,0	195,7	125,3	204,8	376,3	260,2		
53	429,0	9,9	197,3	125,0	207,8	374,3	262,3		
54	462,1	9,8	198,5	124,7	210,6	376,3	263,3		
55	502,3	9,6	199,9	124,8	213,3	384,3	265,7		
56	531,6	9,5	201,2	124,6	216,6	398,4	267,5		
57	543,4	9,3	202,9	124,3	219,1	417,4	270,7		
58	551,9	9,1	204,6	125,1	222,6	440,0	274,5		
59	562,5	8,9	206,3	125,1	225,3	465,0	278,1		
60	569,0	8,7	208,5	125,8	228,3	489,4	282,8		
61	582,4	8,5	210,8	126,1	230,3	511,8	288,1		
62	576,2	8,3	214,1	127,2	233,2	531,3	293,7		
63	568,6	8,1	217,4	127,9	235,9	547,5	299,4		
64	567,6	7,9	221,2	128,4	237,7	560,3	305,7		
65	575,8	7,8	225,9	129,5	239,8	571,1	311,7		
66	574,9	7,6	231,4	130,4	241,7	581,1	317,5		
67	583,5	7,4	237,3	132,4	243,6	590,0	323,4		
68	586,0	7,2	243,4	133,2	245,0	598,5	329,1		
69	585,3	7,0	249,5	134,4	246,4	606,6	334,6		
70	599,9	6,8	255,8	135,3	248,2	616,3	339,8		
71	595,7	6,7	262,2	136,9	249,6	625,5	345,0		
72	590,1	6,5	268,3	138,6	251,0	633,3	349,8		
73	589,8	6,4	274,5	139,6	252,3	639,5	354,5		
74	597,0	6,2	281,2	140,5	253,6	644,8	358,9		
75	596,6	6,0	287,1	142,2	255,1	650,2	363,4		
76	596,9	5,8	292,8	143,8	256,4	655,3	367,3		
77	598,7	5,6	298,7	145,4	258,2	660,3	371,8		
78	603,5	5,5	303,5	146,9	259,6	665,7	375,8		

79	602,7	5,3	309,9	148,5	261,4	671,1	379,9
80	602,2	5,1	315,2	149,6	261,7	675,8	383,2
81	604,5	5,0	320,5	151,1	262,6	680,6	387,1
82	606,0	4,8	325,7	153,0	265,0	685,3	390,9
83	607,9	4,6	330,8	154,2	267,1	690,5	393,9
84	609,5	4,5	335,1	155,7	267,9	696,4	396,7
85	606,2	4,3	339,7	157,6	270,3	702,4	399,8
86	603,4	4,2	344,4	159,1	271,8	706,9	403,7
87	601,8	4,0	347,9	160,6	273,8	710,8	406,7
88	597,0	3,9	353,9	162,7	275,4	713,6	409,8
89	592,2	3,7	358,6	164,1	277,3	715,3	412,8
90	614,9	3,6	363,0	164,5	278,8	718,4	414,5
91	649,3	3,4	366,6	165,9	281,0	728,7	417,0
92	664,3	3,3	370,0	167,1	282,5	742,7	419,2
93	666,3	3,2	372,8	168,8	284,9	756,5	421,4
94	664,8	3,1	375,9	169,0	285,9	769,2	422,3
95	651,5	2,9	379,3	170,2	288,7	779,0	422,9
96	632,7	2,8	382,6	172,3	291,3	785,7	423,9
97	613,8	2,8	384,7	173,5	294,5	787,6	424,2
98	599,0	2,7	387,3	175,1	297,0	784,5	424,2
99	585,3	9,9	388,9	205,5	303,9	727,2	428,0
100	585,3	9,8	395,0	194,1	312,1	706,1	428,2
101	613,3	9,6	396,9	191,7	315,5	695,0	427,9
102	632,3	9,4	398,6	190,9	318,5	693,3	424,2
103	637,6	9,2	398,3	191,2	320,6	697,4	420,4
104	638,1	9,0	399,1	193,3	323,0	704,3	417,3
105	640,9	8,7	399,9	194,0	324,6	711,9	414,2
106	642,9	8,6	399,9	193,4	325,0	719,5	412,2
107	644,2	8,4	400,5	194,6	326,5	727,6	411,0
108	642,2	8,2	399,7	194,9	327,0	734,9	410,0
109	639,4	8,0	401,5	196,2	327,8	740,5	409,6
110	636,5	7,8	401,1	196,0	327,8	744,7	410,0
111	634,1	7,6	401,2	197,3	328,0	747,8	410,3
112	635,3	7,5	402,8	197,6	328,1	750,2	411,4
113	635,0	7,2	403,6	197,3	327,9	752,4	412,4
114	636,2	7,1	405,6	197,6	328,1	754,8	413,0
115	636,3	6,9	405,0	197,9	327,0	757,3	414,2
116	636,3	6,7	405,2	199,2	327,5	759,9	415,5
117	635,5	6,6	406,6	199,0	326,9	762,1	417,0
118	633,7	6,4	408,6	199,3	327,1	764,0	417,7
119	631,6	6,2	408,3	198,4	326,8	765,4	420,0
120	629,4	6,1	408,9	198,9	326,5	766,3	421,0
121	628,1	5,9	410,5	198,0	326,0	766,8	423,0
122	628,4	5,7	412,1	199,5	325,7	766,9	425,0
123	628,8	5,6	413,0	198,8	325,6	767,0	426,6
124	627,9	5,4	414,0	199,8	325,5	767,4	428,0
125	627,6	5,3	415,4	199,3	325,0	767,7	428,8
126	626,9	5,1	418,1	200,0	324,9	767,7	428,9
127	627,8	5,0	418,1	199,3	324,5	767,9	431,2
128	629,2	4,8	419,1	199,2	323,7	768,8	432,4
129	630,1	4,7	421,4	200,6	324,1	770,1	432,8
130	632,7	4,5	421,4	199,8	323,5	772,7	434,8
131	632,8	4,4	421,1	198,8	323,5	776,1	436,5
132	627,1	4,3	422,0	199,6	322,8	778,9	437,9
133	620,0	4,1	424,6	200,1	323,4	779,9	439,2
134	611,3	4,0	424,0	199,7	323,2	778,5	440,6
135	606,9	3,9	425,1	198,9	323,3	775,5	441,8
136	601,8	3,8	425,4	200,3	323,6	771,9	443,1
137	596,5	3,6	427,1	201,9	324,0	767,9	444,2
138	593,8	3,5	425,7	202,2	323,9	764,0	444,8
139	589,4	3,4	427,3	201,6	323,8	759,6	445,2
140	587,8	3,4	426,2	201,7	323,7	755,4	446,0
141	586,5	3,2	427,1	201,3	323,6	751,7	446,4
142	584,5	3,1	428,5	202,3	323,6	748,0	446,1
143	579,3	3,0	430,0	201,7	323,5	744,3	445,5
144	572,4	3,0	429,1	201,8	323,8	740,5	446,6
145	561,6	2,9	430,2	202,0	323,5	735,2	446,1
146	550,7	2,8	429,9	202,7	323,4	728,3	447,0
147	542,5	2,7	428,3	204,0	324,1	720,0	447,7
148	536,0	2,6	429,8	203,6	324,2	711,2	445,9
149	529,8	2,6	429,4	203,1	323,0	702,0	445,1
150	525,5	2,6	430,3	203,0	323,9	693,3	445,5
151	520,1	2,4	428,9	203,4	324,0	684,7	444,5
152	515,6	2,4	426,4	202,9	323,8	676,2	443,8
153	511,3	2,3	426,4	203,1	323,8	668,2	443,5
154	505,7	2,3	425,7	204,2	323,8	660,3	442,4
155	500,3	2,2	424,6	203,4	323,9	651,9	441,2
156	496,2	2,1	424,1	203,9	323,5	644,1	440,4
157	493,1	2,1	423,3	204,7	323,4	636,5	439,3
158	488,9	2,0	421,4	204,2	323,6	629,4	437,9
159	484,7	2,0	419,8	205,1	323,3	622,7	436,6
160	480,7	2,0	419,8	205,7	323,5	615,8	435,4
161	477,3	1,9	419,6	207,4	323,3	609,1	434,2

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19-20-21-19

162	473,9	1,8	418,0	207,1	323,2	602,8	433,1
163	470,2	1,8	416,2	206,7	322,9	596,6	431,7
164	467,5	1,7	415,3	207,1	323,0	590,5	430,4
165	464,8	1,7	415,0	209,4	323,2	584,6	428,6
166	462,0	1,6	413,8	210,3	322,8	578,8	427,3
167	459,8	1,6	412,6	210,4	323,0	573,6	425,7
168	458,2	1,5	410,4	210,6	322,6	568,3	423,3
169	455,9	1,5	407,5	211,2	323,2	563,7	423,2
170	452,3	1,4	408,9	212,2	323,3	558,9	420,2
171	448,9	1,4	407,7	211,8	323,0	554,3	419,5
172	446,1	1,4	404,6	212,3	323,3	550,2	418,3
173	444,1	1,3	405,1	213,4	322,8	545,7	416,3
174	442,6	1,2	403,6	214,1	323,1	541,5	415,2
175	440,6	1,2	401,7	214,4	322,8	537,2	413,2
176	438,8	1,2	400,4	214,4	323,3	533,1	410,4
177	437,8	1,1	399,0	215,5	323,0	529,7	409,6
178	437,5	1,1	398,1	214,5	323,4	526,3	408,8
179	435,2	1,1	396,2	215,6	322,8	523,1	407,2
180	433,9	1,0	395,0	214,7	323,0	520,2	406,3
181	432,2	1,0	392,7	215,6	323,0	517,1	403,5
182	430,6	0,9	393,4	216,4	322,4	514,3	401,7
183	428,2	0,9	391,4	216,4	322,8	511,8	399,6
184	426,0	0,9	391,1	217,4	322,7	508,7	397,8
185	421,3	0,8	389,6	216,4	322,2	505,4	397,7
186	414,0	0,8	388,1	216,1	322,0	501,7	395,8
187	404,6	0,8	387,3	217,2	322,1	497,3	394,8
188	397,5	0,7	384,5	217,6	322,1	492,0	393,9
189	392,0	0,7	382,8	217,9	322,2	486,3	392,0
190	386,2	0,7	380,3	219,7	322,2	480,1	389,9
191	381,5	0,7	381,6	219,5	322,0	473,9	387,4
192	377,1	0,7	378,3	218,3	321,6	467,9	386,9
193	374,0	0,7	377,3	219,2	320,8	461,7	384,6
194	370,0	0,6	375,5	219,1	320,6	455,8	383,6
195	366,9	0,6	372,7	219,0	320,4	450,1	380,6
196	364,3	0,6	371,7	219,3	319,5	444,7	378,5
197	362,2	0,6	369,9	220,2	319,2	439,3	377,4
198	359,3	0,6	368,5	219,6	319,0	434,5	374,0
199	356,6	0,5	366,8	220,3	318,6	429,7	371,2
200	354,2	0,5	365,0	220,6	317,5	425,0	370,1
201	351,7	0,5	363,5	220,5	316,7	420,6	367,1
202	349,4	0,5	360,6	220,7	316,5	416,3	364,7
203	347,3	0,5	358,1	220,0	315,9	412,2	363,6
204	345,6	0,4	357,5	220,4	315,6	408,3	361,3
205	344,1	0,4	355,1	220,8	314,8	404,5	359,7
206	342,5	0,4	354,6	221,1	314,6	401,0	356,7
207	340,6	0,4	353,1	221,4	313,9	397,7	355,2
208	339,5	0,4	350,0	220,8	312,7	394,3	354,7
209	338,5	0,4	348,7	220,5	312,2	391,4	353,0
210	336,8	0,3	345,8	219,9	311,7	388,4	350,7
211	335,9	0,3	345,4	219,6	311,0	385,6	350,0
212	334,8	0,3	343,1	219,9	310,3	383,1	347,9
213	333,7	0,3	342,5	220,2	309,1	380,5	346,0
214	332,9	0,3	340,8	219,8	308,8	378,3	344,5
215	332,3	0,3	340,0	219,7	308,3	376,4	342,2
216	332,5	0,2	337,3	218,7	307,7	374,0	340,8
217	331,9	0,2	335,9	217,9	307,0	372,4	339,0
218	331,2	0,2	334,7	218,8	306,6	370,3	337,3
219	331,5	0,2	333,6	217,2	306,0	368,7	336,0
220	331,0	0,2	332,4	219,0	305,2	367,3	334,6
221	331,2	0,1	330,9	217,8	304,7	366,0	333,5
222	328,9	0,1	329,2	219,0	304,2	364,6	332,3
223	327,4	0,1	329,1	217,4	303,4	363,1	330,6
224	326,5	0,0	327,8	217,1	303,2	361,6	329,7
225	69,2	4,2	67,9	67,8	67,7	68,2	67,9
226	77,0	4,2	67,9	67,8	67,7	68,2	67,9
227	119,9	4,1	67,9	67,8	67,7	68,3	67,9
228	272,7	3,9	67,9	67,8	67,7	69,1	67,9
229	369,6	3,7	68,2	67,7	67,9	72,1	68,0
230	347,9	3,6	69,7	67,8	68,1	78,7	68,4
231	386,9	3,5	72,5	68,0	68,6	89,6	69,3
232	415,6	3,3	76,4	68,2	69,3	105,7	70,6
233	473,6	3,2	81,3	68,6	70,4	126,4	72,2
234	527,6	3,0	86,8	69,1	71,9	152,8	74,2
235	582,7	2,8	93,1	69,7	73,8	186,7	76,7
236	594,8	2,6	99,6	70,5	76,2	226,9	79,7
237	590,2	2,5	106,3	71,4	78,9	269,2	83,1
238	616,7	2,3	112,9	72,4	82,1	311,5	87,1
239	615,0	2,1	119,8	73,9	85,9	351,6	91,5
240	630,5	2,0	127,3	75,4	90,3	385,2	96,2
241	623,0	1,8	135,1	77,3	95,3	415,7	101,9
242	633,8	1,7	143,0	79,3	100,7	442,3	108,6
243	640,4	1,5	151,6	81,7	106,3	466,9	115,9
244	644,1	1,4	160,3	84,1	112,9	489,5	123,9

245	650,8	2,0	168,0	89,2	120,0	511,3	132,6	4	19-19-20-22
246	537,4	9,0	175,7	96,9	127,4	527,2	142,7		
247	463,4	12,4	181,5	102,6	135,9	524,5	153,0		
248	484,3	12,2	188,6	99,9	146,0	515,3	163,4		
249	499,7	12,1	194,7	101,6	155,0	504,9	172,5		
250	571,9	11,9	200,8	103,2	163,4	497,1	180,7		
251	630,1	11,7	205,5	105,0	170,9	499,6	187,7		
252	608,2	11,5	209,3	106,9	178,1	509,4	194,1		
253	574,5	11,4	212,2	109,2	184,2	518,5	200,4		
254	577,3	11,2	215,1	111,2	189,4	524,0	206,6		
255	607,6	11,1	216,8	113,2	193,0	529,3	212,3		
256	647,6	10,9	218,6	115,1	195,0	538,0	217,8		
257	656,7	10,6	219,3	116,6	196,2	552,8	223,2		
258	664,9	10,4	220,6	118,4	197,8	570,2	228,8		
259	663,6	10,2	222,4	119,8	199,4	588,5	234,5		
260	685,1	10,0	223,3	121,4	200,9	605,3	240,1		
261	712,5	9,8	225,1	122,6	202,6	622,7	246,1		
262	727,8	9,6	226,9	125,0	205,5	642,0	252,2		
263	720,4	9,4	228,2	126,3	208,9	661,2	258,7		
264	717,5	9,2	229,6	127,0	212,3	678,5	265,5		
265	705,5	8,9	231,3	128,7	215,6	692,4	272,4		
266	697,7	8,8	233,6	130,0	219,0	702,4	279,5		
267	694,3	8,5	236,3	131,5	222,4	709,6	286,4		
268	693,7	8,4	240,0	133,3	225,7	715,2	293,4		
269	704,6	8,2	243,1	135,0	229,4	720,5	300,4		
270	714,6	8,0	247,8	136,2	232,9	727,4	307,3		
271	720,8	7,7	251,9	137,3	236,5	735,9	313,8		
272	733,1	7,5	256,6	139,0	240,4	745,3	320,4		
273	741,6	7,3	261,9	140,4	244,2	755,6	326,9		
274	745,7	7,1	266,9	141,8	247,9	765,8	333,4		
275	740,5	6,9	272,7	143,9	251,8	775,8	339,5		
276	731,1	6,8	279,0	145,5	255,5	784,6	345,9		
277	722,3	6,6	284,5	147,0	258,4	791,4	351,5		
278	717,0	6,4	290,9	149,0	263,0	795,7	357,8		
279	714,9	6,3	296,0	150,2	266,9	798,3	363,8		
280	713,6	6,1	301,9	152,7	270,9	800,0	369,4		
281	712,2	6,0	307,3	154,5	274,7	801,4	374,3		
282	711,3	5,8	313,0	156,0	278,4	802,8	378,9		
283	714,9	5,7	318,0	158,1	282,4	804,4	383,2		
284	715,9	5,5	322,9	159,2	286,7	806,0	387,0		
285	715,6	5,4	327,8	161,4	290,5	807,8	390,7		
286	717,0	5,2	333,9	162,8	294,1	809,0	393,3		
287	719,6	5,0	337,1	164,0	297,8	810,8	396,0		
288	719,7	4,9	342,6	164,9	300,9	812,0	398,5		
289	719,3	4,8	346,8	166,7	304,0	813,2	400,4		
290	719,1	4,6	351,3	167,9	307,6	814,4	402,3		
291	717,2	4,5	355,3	170,0	312,4	815,8	404,4		
292	715,9	4,3	358,5	171,7	316,2	817,2	405,3		
293	713,7	4,2	362,8	173,6	318,9	818,3	405,9		
294	708,5	4,0	367,1	174,9	323,3	818,8	407,2		
295	703,4	3,9	370,4	176,7	325,9	817,8	408,1		
296	697,3	3,8	374,5	178,7	329,8	816,3	408,7		
297	687,1	3,7	378,7	180,7	333,3	813,8	409,6		
298	669,6	3,6	382,3	181,5	335,7	808,8	410,4		
299	649,5	3,5	384,9	183,3	340,1	801,2	410,5		
300	638,1	3,4	388,3	184,9	343,6	792,5	411,0		
301	630,9	3,3	390,9	186,2	346,5	784,8	411,2		
302	622,5	3,3	393,7	187,9	349,8	777,0	411,5		
303	611,4	3,2	395,9	189,4	352,6	767,3	410,6		
304	601,7	3,1	398,5	192,9	356,2	756,8	411,0		
305	592,0	3,0	401,1	193,3	359,5	745,9	411,0		
306	581,1	3,0	402,9	194,3	362,7	734,8	411,0		
307	569,3	2,9	404,6	196,7	365,6	722,7	411,7		
308	555,4	2,8	406,0	197,5	368,9	709,8	412,1		
309	540,3	2,8	408,0	198,6	371,5	695,7	411,6		
310	526,2	2,7	409,0	199,7	375,0	680,3	410,9		
311	514,6	2,7	410,6	201,9	377,5	664,5	411,6		
312	499,3	2,7	411,8	202,7	379,5	648,2	411,7		
313	487,5	2,6	412,6	204,8	382,7	631,8	411,3		
314	477,9	2,6	412,5	205,3	385,1	615,8	411,0		
315	469,2	2,5	412,0	207,5	388,1	600,6	410,0		
316	416,6	7,7	411,7	232,2	386,8	586,2	410,5	3	19-19-20
317	392,7	9,9	406,1	243,4	382,8	563,6	411,8		
318	411,3	9,8	403,4	251,5	382,8	541,2	410,8		
319	449,3	9,6	404,9	230,1	388,9	523,0	411,6		
320	441,8	9,5	403,1	225,7	390,4	507,7	409,3		
321	484,4	9,4	400,4	222,3	390,9	495,8	405,7		
322	532,9	9,2	396,0	220,7	391,2	491,0	401,8		
323	567,7	8,9	393,7	217,6	392,0	493,7	396,8		
324	579,1	8,7	389,1	215,9	391,8	503,2	392,1		
325	606,0	8,5	385,8	216,5	391,3	516,8	387,8		
326	617,2	8,3	383,2	214,4	390,7	534,4	384,0		
327	622,7	8,1	381,1	213,2	389,6	553,4	381,1		

328	623,4	7,9	380,4	212,9	388,5	572,3	378,8
329	624,3	7,7	378,8	213,4	387,2	589,5	377,6
330	626,5	7,5	380,1	212,1	385,1	604,8	376,0
331	630,9	7,4	379,3	212,5	384,0	618,8	377,1
332	630,0	7,2	379,2	212,1	382,8	631,0	377,6
333	630,0	7,0	379,3	210,8	380,8	641,7	377,5
334	633,2	6,9	380,9	209,1	379,5	651,2	379,4
335	635,3	6,7	381,8	208,0	377,8	659,9	381,6
336	638,8	6,5	383,4	208,2	376,4	668,4	383,8
337	641,5	6,4	383,6	207,8	375,0	676,2	386,0
338	643,0	6,2	384,8	206,5	373,4	683,9	388,4
339	645,2	6,0	387,2	207,9	371,8	691,3	390,7
340	647,0	5,9	388,6	205,6	370,4	698,6	392,8
341	646,9	5,7	390,5	206,0	369,0	705,5	395,3
342	647,3	5,6	392,4	206,0	367,7	711,8	397,6
343	646,9	5,4	394,1	205,3	366,2	717,4	399,5
344	647,7	5,3	396,4	207,3	365,1	722,5	401,9
345	649,4	5,1	397,7	205,0	363,4	727,6	403,7
346	652,7	5,0	399,0	206,3	362,7	732,5	406,7
347	654,2	4,8	400,2	205,6	361,5	737,6	409,1
348	655,9	4,7	402,4	205,2	360,5	743,1	411,2
349	657,8	4,6	404,9	204,1	359,7	748,8	413,2
350	658,5	4,4	405,6	205,2	358,8	754,2	415,9
351	659,2	4,3	408,4	205,1	358,1	759,7	418,0
352	678,3	4,1	409,7	205,5	357,4	766,4	420,2
353	686,7	4,0	411,5	205,7	356,9	775,7	423,0
354	678,6	3,8	413,1	206,4	356,5	784,3	425,8
355	666,5	3,7	416,7	205,4	356,1	790,1	428,5
356	655,3	3,6	418,0	204,7	355,9	792,6	430,6
357	647,7	3,5	421,1	205,8	355,5	792,2	432,9
358	642,8	3,4	423,1	206,1	355,6	790,4	434,0
359	636,5	3,3	424,9	207,1	355,4	787,4	435,5
360	631,3	3,2	425,9	206,9	355,3	783,0	436,6
361	625,7	3,1	426,8	207,8	354,9	777,8	437,4
362	620,1	3,0	427,4	208,4	355,0	772,3	436,4
363	612,8	2,9	428,8	208,8	355,1	766,4	437,1
364	605,7	2,8	428,7	208,5	355,4	759,8	437,1
365	594,7	2,7	428,1	210,5	355,1	751,6	437,4
366	581,4	2,6	428,5	212,6	355,1	741,2	436,6
367	568,7	2,5	429,9	211,5	355,6	729,3	436,2
368	556,3	2,4	428,9	210,8	355,7	716,1	436,4
369	548,6	2,4	428,4	212,9	355,6	703,0	436,3
370	541,8	2,3	428,4	213,2	356,0	690,3	435,9
371	535,4	2,2	428,6	212,8	356,0	678,3	435,2
372	529,6	2,2	427,6	214,0	356,1	666,8	434,6
373	523,1	2,1	427,2	214,1	356,3	655,8	432,7
374	518,0	2,0	425,3	215,3	355,4	645,2	432,5
375	512,3	2,0	425,9	216,4	356,3	635,4	429,8
376	508,7	1,9	423,8	216,7	356,2	626,0	429,2
377	504,7	1,8	421,8	216,8	356,4	617,3	428,2
378	501,1	1,8	420,9	217,0	356,4	609,2	427,5
379	497,6	1,7	420,0	218,4	356,3	601,9	426,0
380	494,6	1,6	418,2	218,7	356,4	594,8	425,1
381	491,5	1,6	418,0	219,9	356,3	588,3	423,8
382	489,2	1,5	416,3	218,7	356,1	582,3	421,9
383	486,6	1,5	415,5	220,5	356,1	576,4	420,9
384	484,2	1,4	413,1	219,4	356,2	571,1	419,0
385	482,3	1,3	412,1	220,4	355,9	566,0	417,6
386	479,6	1,3	410,8	220,7	355,9	561,1	416,8
387	477,4	1,2	409,5	220,6	355,6	556,6	414,6
388	475,7	1,2	408,0	221,6	355,6	552,3	413,6
389	474,3	1,1	406,5	221,5	355,1	548,1	411,4
390	473,2	1,0	404,4	221,9	355,0	544,2	410,7
391	472,5	1,0	403,8	221,8	354,5	540,5	408,7
392	471,2	0,9	403,0	221,8	354,0	537,2	407,2
393	471,4	0,9	400,6	222,6	353,4	534,1	407,2
394	471,4	0,8	399,3	222,9	353,4	531,1	405,0
395	470,4	0,8	397,4	221,6	353,2	528,6	404,1
396	470,8	0,7	396,3	222,7	352,9	526,6	403,1
397	470,9	0,7	395,4	222,9	352,7	525,0	401,5
398	472,4	0,6	393,5	221,5	352,5	523,6	399,8
399	472,2	0,6	392,4	220,9	352,1	522,8	398,5
400	470,7	0,5	391,3	223,0	352,1	522,1	396,8
401	466,4	0,5	390,2	224,5	351,7	521,6	396,1
402	458,1	0,4	389,5	223,7	351,6	520,1	394,6
403	449,4	0,4	388,0	223,2	351,4	517,2	394,2
404	438,9	0,4	386,5	224,4	351,1	513,1	392,7
405	432,2	0,3	386,1	223,6	350,8	507,7	391,0
406	426,1	0,3	384,5	224,9	350,3	501,3	389,1
407	421,7	0,3	383,7	226,1	350,0	495,3	388,5
408	417,2	0,3	382,1	227,2	349,9	489,1	388,0
409	414,0	0,2	381,9	226,6	349,6	483,1	385,7
410	410,7	0,2	380,1	224,0	349,5	477,3	385,5

411	407,2	0,2	378,2	226,0	349,2	471,7	384,2		
412	404,7	0,1	376,8	226,2	348,7	466,5	381,6		
413	402,1	0,1	377,3	225,2	348,8	461,5	379,9		
414	399,8	0,1	376,1	223,6	349,2	456,7	379,7		
415	397,2	0,0	376,4	225,0	349,0	452,2	378,5		
416	71,7	4,2	70,2	70,3	70,4	71,3	71,1	3	19-22-21
417	99,6	4,0	70,3	70,3	70,4	71,9	71,1		
418	168,9	4,0	70,3	70,4	70,4	72,3	71,1		
419	317,9	3,7	70,4	70,4	70,5	73,5	71,2		
420	406,1	3,5	71,1	70,6	70,5	77,5	71,4		
421	479,7	3,3	72,8	70,7	70,6	88,7	71,9		
422	490,2	3,1	75,6	71,0	70,8	108,1	72,9		
423	505,8	2,9	79,5	71,6	71,2	133,4	74,4		
424	537,1	2,7	84,8	72,4	71,9	163,8	76,4		
425	576,2	2,5	91,6	73,4	73,1	201,5	79,2		
426	604,0	2,3	99,9	74,7	74,9	244,6	82,6		
427	606,5	2,1	109,1	76,2	77,2	290,2	87,1		
428	609,9	1,9	118,5	78,0	80,2	335,3	93,0		
429	612,4	1,8	127,3	80,2	83,7	379,5	100,2		
430	610,0	1,6	136,1	82,3	87,8	422,3	108,4		
431	595,2	5,7	146,1	85,3	92,4	460,5	116,8		
432	591,3	1,5	157,3	87,4	97,5	493,4	124,7		
433	578,8	1,4	168,5	89,9	102,9	519,4	132,5		
434	555,3	1,3	179,6	92,5	108,4	536,0	140,7		
435	541,2	1,3	190,3	95,4	114,3	544,9	149,5		
436	530,4	1,4	200,4	99,5	120,2	547,9	158,3		
437	429,8	13,0	211,9	110,6	125,5	542,9	167,2	4	20-20-21-22
438	402,9	12,9	221,7	107,7	132,3	529,1	176,6		
439	393,1	12,7	231,3	109,9	139,1	511,4	185,2		
440	372,6	12,8	240,4	111,7	145,4	492,7	193,1		
441	332,2	12,7	246,9	120,0	149,5	472,4	198,5		
442	341,3	12,7	251,7	118,8	155,1	453,9	204,9		
443	324,4	12,6	256,1	119,6	159,6	436,3	209,7		
444	305,5	12,6	257,7	121,8	163,4	419,6	212,7		
445	291,3	12,6	258,3	123,7	166,4	403,7	214,9		
446	280,2	12,5	258,8	125,0	168,9	388,7	216,4		
447	271,8	12,5	258,2	126,5	170,8	374,7	217,5		
448	274,9	12,4	256,7	127,2	172,9	361,6	217,2		
449	282,6	12,4	254,9	127,9	174,4	349,5	217,1		
450	282,2	12,3	253,0	128,3	175,9	338,7	216,4		
451	274,2	12,3	251,2	129,5	177,1	328,9	215,5		
452	273,0	12,2	248,6	129,4	178,2	319,8	214,2		
453	288,7	12,2	246,1	129,2	179,1	311,6	212,6		
454	311,1	12,1	243,6	128,9	179,9	304,5	210,9		
455	304,8	11,7	240,7	128,7	180,1	298,7	209,2		
456	297,1	11,9	237,9	129,2	180,8	293,7	208,1		
457	334,6	11,8	235,1	128,1	181,8	289,2	206,4		
458	366,5	11,8	232,2	127,1	182,4	286,6	204,5		
459	391,3	11,7	229,8	126,1	182,7	286,9	202,8		
460	436,3	11,5	227,7	125,3	183,2	290,3	201,0		
461	465,9	11,4	225,9	124,5	183,3	299,1	199,4		
462	461,1	11,2	224,9	124,0	183,5	311,6	197,9		
463	464,8	11,1	224,8	123,9	183,7	324,3	196,7		
464	469,5	11,0	225,1	123,5	183,7	336,0	195,6		
465	476,9	10,9	226,0	123,0	183,9	347,3	194,8		
466	531,5	10,7	227,5	122,4	184,0	360,7	194,0		
467	565,8	10,5	229,4	122,0	184,3	379,8	193,6		
468	583,2	10,4	231,8	121,8	184,5	404,5	193,7		
469	586,8	10,2	234,8	121,7	184,8	431,6	193,5		
470	569,3	10,0	238,7	122,0	185,1	456,8	193,9		
471	560,1	9,9	243,1	122,6	185,6	475,7	195,2		
472	563,2	9,8	248,0	122,7	186,3	490,5	196,1		
473	564,6	9,6	253,0	123,0	187,1	502,8	197,6		
474	585,5	9,5	258,2	123,1	187,9	514,2	199,1		
475	613,4	9,3	263,7	123,5	188,9	529,7	201,1		
476	618,8	9,1	269,3	124,1	189,8	546,5	202,7		
477	619,5	9,0	274,8	124,4	190,9	562,0	204,8		
478	619,0	8,8	280,9	125,6	192,5	576,3	207,2		
479	620,8	8,6	286,9	126,2	194,3	588,8	209,2		
480	624,6	8,4	292,8	127,0	196,3	601,2	212,3		
481	635,9	8,3	298,7	128,4	198,6	613,2	215,5		
482	653,1	8,1	304,7	129,2	201,1	627,5	219,4		
483	646,6	7,9	310,3	130,1	203,5	641,4	223,4		
484	644,7	7,7	316,2	131,4	206,0	653,7	227,4		
485	661,6	7,6	321,7	132,8	208,7	664,7	232,7		
486	666,9	7,4	327,2	134,0	211,8	676,2	238,0		
487	674,9	7,2	332,1	135,6	214,8	688,3	243,4		
488	675,2	7,1	337,2	137,2	218,1	700,5	250,1		
489	696,8	6,9	341,9	138,1	221,3	713,3	255,1		
490	697,1	6,7	346,3	139,6	224,7	726,5	261,1		
491	700,2	6,5	350,6	141,4	228,4	738,8	268,2		
492	704,2	6,3	354,4	142,6	231,7	750,2	274,0		
493	707,2	6,2	358,2	144,4	235,4	761,2	280,9		

494	704,4	6,0	361,8	146,3	239,1	770,9	287,1
495	706,2	5,9	364,4	148,2	242,7	779,6	293,7
496	706,8	5,7	366,2	149,6	245,8	787,1	300,0
497	707,4	5,5	370,2	151,3	250,1	793,8	306,2
498	705,4	5,4	372,8	153,6	254,0	799,7	312,4
499	705,8	5,2	375,9	155,2	258,1	805,0	318,5
500	703,1	5,1	378,1	156,9	261,9	810,0	324,0
501	701,6	4,9	380,3	159,2	265,7	814,4	329,7
502	700,0	4,7	381,6	160,3	269,7	818,4	336,3
503	698,2	4,6	384,2	162,5	273,9	821,9	341,7
504	694,4	4,5	385,9	164,6	278,2	824,8	346,9
505	693,6	4,3	388,5	165,8	282,0	827,4	352,0
506	690,6	4,2	390,5	168,1	286,2	829,7	356,8
507	688,8	4,0	392,3	169,4	290,2	832,1	362,0
508	686,9	3,9	393,6	171,7	294,7	834,4	367,0
509	682,0	3,8	395,3	174,1	299,0	836,1	371,6
510	679,3	3,7	397,2	174,9	302,8	837,8	376,0
511	677,2	3,6	398,7	176,9	307,2	838,6	380,7
512	671,0	3,5	398,8	179,5	310,9	837,3	384,5
513	657,4	3,4	401,3	181,1	315,3	832,6	388,2
514	645,1	3,3	402,3	182,1	318,9	824,9	391,5
515	633,6	3,2	403,5	183,8	323,4	816,2	394,4
516	620,4	3,2	404,7	185,7	327,3	806,7	396,8
517	605,8	3,1	404,9	187,7	331,1	796,5	399,3
518	588,1	3,0	406,8	189,6	334,6	784,2	401,1
519	566,3	3,0	407,0	190,8	338,7	768,5	403,4
520	548,5	3,0	407,2	192,7	343,0	749,4	404,8
521	533,7	2,9	407,3	194,6	347,1	728,8	406,4
522	519,2	2,9	407,8	196,2	351,0	708,2	407,8
523	507,5	2,8	408,3	197,6	355,1	687,9	408,1
524	498,2	2,8	408,1	199,1	358,9	669,1	408,6
525	489,9	2,7	407,9	201,3	363,1	651,3	408,8
526	482,7	2,7	408,0	203,1	366,9	635,2	408,8
527	476,6	2,7	407,1	204,5	370,8	620,5	408,2
528	469,4	2,6	406,8	205,2	373,8	607,0	407,9
529	458,1	2,6	405,7	207,0	377,6	594,1	407,2
530	449,6	2,5	405,1	208,2	380,6	582,0	406,7
531	442,5	2,5	403,9	209,8	383,5	570,1	406,1
532	436,4	2,5	403,0	211,1	386,8	559,0	404,9
533	416,2	2,5	402,8	230,8	386,4	548,1	404,3
534	374,9	10,1	402,1	245,3	383,1	531,1	399,2
535	397,3	10,0	400,9	236,6	385,6	513,7	399,1
536	441,5	9,9	400,2	224,0	389,5	500,3	398,4
537	481,3	9,7	397,5	221,9	391,1	492,9	395,6
538	504,5	9,5	393,9	219,7	391,7	491,4	393,1
539	540,9	9,3	390,0	217,3	391,9	494,6	389,3
540	576,9	9,1	385,6	215,3	391,5	504,8	385,3
541	594,0	8,8	381,2	213,1	390,9	521,8	382,5
542	602,9	8,6	377,8	213,1	389,8	541,9	379,2
543	613,0	8,4	375,4	212,5	388,3	562,5	377,2
544	625,9	8,2	373,8	211,6	386,7	583,7	375,8
545	631,4	8,0	373,1	211,0	385,4	605,3	374,8
546	633,5	7,8	372,8	210,5	383,9	625,3	374,3
547	638,3	7,6	373,3	210,0	382,1	643,5	374,2
548	640,1	7,4	374,3	208,0	381,0	659,5	374,3
549	643,8	7,3	376,0	207,9	379,4	673,4	374,8
550	646,9	7,1	378,1	207,7	378,1	686,4	376,3
551	646,2	6,9	380,3	207,5	376,7	698,4	377,2
552	646,2	6,7	382,7	206,8	375,5	708,6	379,2
553	645,4	6,5	385,4	206,3	374,1	717,5	381,8
554	645,1	6,4	388,2	207,0	373,0	725,0	383,8
555	644,6	6,2	391,1	206,2	371,5	731,9	385,9
556	644,3	6,0	394,0	205,3	370,9	738,1	388,4
557	643,4	5,9	397,0	205,5	370,0	743,5	390,6
558	642,3	5,7	399,7	205,7	369,1	748,1	392,7
559	641,9	5,6	401,7	204,6	368,2	751,9	396,2
560	642,3	5,4	405,3	204,4	367,8	755,7	397,4
561	641,8	5,3	407,6	205,1	366,0	759,0	399,4
562	637,0	5,1	410,7	204,5	366,7	760,5	401,7
563	631,6	5,0	412,5	205,3	366,1	759,9	403,7
564	628,7	4,8	415,1	204,6	365,4	757,9	405,3
565	629,6	4,7	417,4	205,0	365,5	756,5	407,6
566	630,4	4,6	419,6	204,8	365,1	756,0	409,3
567	633,3	4,4	421,1	204,0	365,3	756,4	411,4
568	650,2	4,3	423,5	204,5	365,2	760,0	413,4
569	648,0	4,1	425,2	204,2	365,1	766,4	414,9
570	638,8	4,0	426,9	204,8	365,2	771,8	417,7
571	632,5	3,9	428,6	204,6	365,3	774,4	419,6
572	625,6	3,8	430,2	205,4	365,4	774,7	421,1
573	620,7	3,7	431,6	205,6	365,3	773,3	423,0
574	615,1	3,6	432,2	205,5	365,8	771,0	425,1
575	610,2	3,5	433,7	205,2	365,9	767,6	426,1
576	605,8	3,4	435,1	205,8	365,7	763,3	427,3

577	603,5	3,2	434,9	206,9	366,3	759,2	428,2
578	599,5	3,1	435,3	207,2	366,6	754,7	428,2
579	598,3	3,0	435,1	207,8	366,9	750,3	429,8
580	598,0	2,9	435,6	209,0	367,2	747,0	429,9
581	594,6	2,8	435,4	209,6	367,4	744,1	429,5
582	585,5	2,7	435,5	210,1	367,8	741,0	430,4
583	572,4	2,6	435,4	211,4	367,9	735,7	430,0
584	559,1	2,6	435,1	211,4	368,5	726,7	430,2
585	546,4	2,5	434,2	213,2	368,5	715,0	429,5
586	536,5	2,4	433,8	212,8	368,6	702,0	428,6
587	527,8	2,3	432,4	214,7	369,1	689,1	429,3
588	520,8	2,3	433,0	215,8	369,8	676,3	428,3
589	514,6	2,2	431,7	216,6	370,3	664,3	428,0
590	508,9	2,1	431,0	217,7	370,2	653,1	426,7
591	503,8	2,1	429,1	217,9	370,9	642,6	426,3
592	499,6	2,0	429,3	219,0	370,3	632,6	426,2
593	494,7	1,9	428,7	220,7	371,6	623,4	425,0
594	491,0	1,9	427,5	221,5	371,9	614,7	423,0
595	486,9	1,8	425,9	221,3	373,0	606,7	422,3
596	483,3	1,7	425,0	222,9	373,4	599,0	421,5
597	479,9	1,7	423,2	223,1	374,4	591,9	420,8
598	476,9	1,6	422,3	223,7	375,3	585,0	419,3
599	474,3	1,6	421,5	224,6	375,9	578,5	418,0
600	472,2	1,5	420,9	223,7	376,5	572,5	417,0
601	470,3	1,4	419,4	225,7	376,8	567,1	415,8
602	468,3	1,4	418,1	224,7	377,7	562,1	415,3
603	466,3	1,3	416,5	225,1	378,6	557,4	414,4
604	464,7	1,3	415,2	226,3	379,2	553,2	413,2
605	463,8	1,2	414,2	226,3	379,8	549,3	412,5
606	462,3	1,2	413,0	227,0	380,4	545,7	410,9
607	461,7	1,1	412,2	226,0	381,1	542,0	409,7
608	461,3	1,0	411,3	227,3	381,5	538,9	408,9
609	461,0	1,0	409,8	227,6	381,9	536,1	407,2
610	460,4	0,9	408,8	227,4	382,1	533,6	406,4
611	460,8	0,9	407,9	226,6	382,3	531,5	405,2
612	460,6	0,8	406,6	226,9	382,9	529,7	403,9
613	462,5	0,8	405,9	227,2	382,9	528,3	402,2
614	464,0	0,7	405,0	227,2	382,9	527,7	401,3
615	462,0	0,7	404,2	227,4	383,2	527,6	401,5
616	455,5	0,6	403,3	228,2	383,0	526,9	399,6
617	447,3	0,6	402,4	227,1	383,4	525,2	398,1
618	442,2	0,6	401,5	228,5	383,5	522,1	397,1
619	437,6	0,5	400,8	228,4	383,6	518,0	396,8
620	429,9	0,5	400,0	229,6	384,2	513,6	396,5
621	420,9	0,5	398,9	229,4	384,1	508,4	394,8
622	413,7	0,4	398,2	230,3	384,4	502,0	393,9
623	408,2	0,4	396,6	229,6	384,8	495,3	393,3
624	403,7	0,4	395,9	229,2	384,4	488,6	392,1
625	400,0	0,3	394,9	231,5	385,0	481,8	391,7
626	396,4	0,3	395,0	231,1	384,8	475,3	389,8
627	393,5	0,3	394,2	229,1	385,2	469,2	388,6
628	390,8	0,3	392,0	230,0	385,5	463,3	388,0
629	388,1	0,2	390,0	229,0	385,8	457,9	387,0
630	386,2	0,2	388,8	228,7	385,9	452,8	385,1
631	383,6	0,2	386,0	230,3	386,6	448,2	384,2
632	381,4	0,1	385,3	227,6	386,9	443,7	382,3
633	380,1	0,1	383,1	230,6	386,5	439,4	381,9
634	378,1	0,1	380,9	228,6	387,7	435,5	380,4
635	376,8	0,0	379,1	225,4	388,1	431,7	379,0
636	428,9	12,2	171,3	102,2	185,8	522,9	206,3
637	378,6	12,1	177,2	107,6	192,1	509,4	215,2
638	382,4	12,0	182,6	112,5	197,7	492,0	224,3
639	374,6	11,9	189,1	109,4	206,0	473,3	232,9
640	364,2	11,8	194,7	109,9	212,8	455,9	240,0
641	369,6	11,7	199,4	111,0	217,9	440,2	244,3
642	408,7	11,6	203,4	112,2	222,0	427,9	247,7
643	451,2	11,5	206,6	113,0	225,2	420,8	249,0
644	484,3	11,3	208,5	114,7	227,3	419,4	249,4
645	473,9	11,2	210,5	116,4	229,0	421,9	249,2
646	473,3	11,1	211,7	118,2	230,1	423,8	249,0
647	481,6	10,9	212,6	119,3	230,7	425,2	248,0
648	524,9	10,7	213,5	120,0	231,2	428,6	246,3
649	546,8	10,6	213,9	121,6	231,7	438,9	244,8
650	553,6	10,4	214,7	123,0	232,0	454,1	243,7
651	558,6	10,2	215,1	125,1	232,3	470,3	243,0
652	551,8	10,1	216,3	125,9	232,7	485,2	243,0
653	544,9	9,9	216,8	128,4	233,1	497,0	243,7
654	548,0	9,8	217,9	129,0	233,7	505,8	245,3
655	570,2	9,6	219,1	130,3	234,5	514,0	246,9
656	589,8	9,4	219,8	131,4	235,6	524,7	249,0
657	614,9	9,2	221,5	132,1	236,8	537,7	251,1
658	656,3	9,0	222,9	132,9	238,5	554,4	253,6
659	670,3	8,8	224,3	133,6	240,1	575,2	255,9

660	649,0	8,6	226,6	135,8	241,8	596,4	258,3
661	684,4	8,3	228,5	136,9	243,4	614,8	260,9
662	695,4	8,1	231,6	138,5	245,2	634,1	263,9
663	700,0	7,9	235,2	140,3	247,2	653,3	267,6
664	706,2	7,7	239,0	141,3	249,4	672,3	271,5
665	710,4	7,4	243,6	143,0	251,6	690,5	275,8
666	715,3	7,2	248,5	144,8	254,0	707,5	280,4
667	719,4	7,0	253,8	146,6	256,5	723,7	285,2
668	723,0	6,8	259,9	147,6	259,2	738,9	290,0
669	726,6	6,6	265,9	149,3	262,1	752,7	295,3
670	730,7	6,4	272,4	151,1	265,2	765,1	300,4
671	732,2	6,2	278,8	152,1	268,3	776,4	305,7
672	732,3	6,0	285,2	154,0	271,6	786,8	311,0
673	732,3	5,8	291,7	156,3	274,8	796,3	316,3
674	730,0	5,6	297,8	157,4	278,0	805,5	321,9
675	726,9	5,4	304,6	159,1	281,4	814,3	327,2
676	725,3	5,2	310,4	161,0	284,9	822,0	332,6
677	722,7	5,0	316,8	162,2	288,4	829,0	337,8
678	719,1	4,8	322,8	163,9	292,0	835,7	343,3
679	716,0	4,7	328,7	165,7	295,5	841,4	348,7
680	711,3	4,5	334,5	167,3	299,2	846,3	354,0
681	708,3	4,3	339,9	168,7	302,9	850,7	359,0
682	711,2	4,2	346,2	170,3	305,6	855,0	364,1
683	709,8	4,1	352,4	171,9	310,2	859,1	368,6
684	705,2	3,9	357,8	173,6	314,0	863,3	373,8
685	690,7	3,8	362,6	176,0	317,9	865,2	378,3
686	667,2	3,7	367,8	177,7	321,7	864,2	382,3
687	649,4	3,6	372,2	179,3	325,7	859,3	387,1
688	631,7	3,6	376,2	181,1	329,4	851,8	390,5
689	613,4	3,5	381,1	182,7	333,3	842,1	394,0
690	597,4	3,4	384,4	184,9	337,2	830,2	397,3
691	582,1	3,4	387,4	186,7	340,6	815,7	399,9
692	564,2	3,4	390,7	188,0	344,6	799,1	402,9
693	545,1	3,3	393,2	191,7	348,7	779,7	404,7
694	529,9	3,3	396,1	192,9	352,3	759,1	406,5
695	518,0	3,2	398,6	196,4	356,6	738,2	407,7
696	506,4	3,2	400,6	197,6	360,7	718,2	408,6
697	496,0	3,1	401,4	200,7	364,4	699,2	409,8
698	486,2	3,1	403,2	201,9	368,5	680,9	410,6
699	474,8	3,1	404,4	204,6	372,6	663,6	410,8
700	465,4	3,0	404,8	207,7	376,5	646,8	410,5
701	457,4	3,0	404,9	208,5	380,6	630,7	410,1
702	450,2	2,9	404,7	210,4	384,8	615,5	409,3
703	444,4	2,9	404,4	212,0	389,0	601,4	409,4
704	438,8	2,8	404,0	214,0	393,1	588,3	408,7
705	433,8	2,8	403,3	215,8	397,2	575,9	406,3
706	428,5	2,7	402,5	217,0	401,2	564,6	406,2
707	424,1	2,7	401,1	218,6	405,1	554,0	404,8
708	420,9	2,7	399,9	218,1	408,5	544,3	404,0
709	418,2	2,6	398,6	219,5	412,4	535,3	403,1
710	414,9	2,6	397,3	221,1	415,7	526,9	401,1
711	411,8	2,5	395,6	221,7	419,0	519,3	400,2
712	409,3	2,2	394,4	224,2	421,3	512,2	398,1
713	351,9	10,2	390,3	253,8	414,1	504,3	398,7
714	363,5	10,8	387,6	263,8	410,7	492,2	397,5
715	386,0	9,8	389,4	238,3	421,5	478,1	397,0
716	394,9	9,6	388,2	232,3	423,9	466,2	396,1
717	438,9	9,5	386,6	228,2	424,7	457,8	394,3
718	503,3	9,3	382,7	225,5	426,9	456,1	388,9
719	554,8	9,0	379,6	223,6	427,2	463,4	385,0
720	565,0	8,8	375,5	221,6	426,7	478,5	380,8
721	587,4	8,6	371,2	219,7	426,4	498,0	377,7
722	604,9	8,3	369,3	219,2	424,3	521,5	374,7
723	608,8	8,1	367,6	217,7	423,8	546,1	374,3
724	618,4	7,9	364,9	217,4	422,4	570,4	373,3
725	624,9	7,7	363,1	218,0	420,9	593,8	374,1
726	631,2	7,5	363,0	217,6	419,0	616,0	374,3
727	632,2	7,3	363,2	215,7	417,4	636,3	376,7
728	634,7	7,1	365,3	215,9	415,6	654,6	379,0
729	636,0	6,9	366,7	216,3	413,7	671,0	381,3
730	635,6	6,8	369,4	215,7	412,1	685,4	383,2
731	636,7	6,6	371,8	215,8	410,4	698,3	386,2
732	634,9	6,4	374,7	214,5	408,8	709,4	389,0
733	636,9	6,2	376,0	215,5	407,0	719,4	392,1
734	635,4	6,1	379,2	217,1	405,5	727,8	394,5
735	633,5	5,9	382,6	215,7	403,6	735,3	397,5
736	633,3	5,8	386,7	215,0	402,4	742,0	401,2
737	633,3	5,6	389,9	216,0	400,9	747,5	404,0
738	631,8	5,5	392,3	215,5	399,7	752,4	406,7
739	631,4	5,3	395,9	215,3	398,3	757,1	409,1
740	631,3	5,2	397,7	215,2	397,2	761,2	413,2
741	628,6	5,0	400,9	215,0	395,8	764,7	415,7
742	628,1	4,9	403,5	214,9	394,8	767,7	418,5

743	628,1	4,7	405,8	216,6	393,5	770,1	420,8
744	628,9	4,6	407,8	215,8	392,4	771,9	423,5
745	629,1	4,4	411,4	216,8	391,2	774,0	425,4
746	629,7	4,3	414,1	217,5	390,7	776,3	427,9
747	630,6	4,1	415,4	216,7	390,0	779,1	430,5
748	630,6	4,0	417,7	217,3	389,3	781,8	432,6
749	636,8	3,9	420,1	217,5	388,4	785,8	434,7
750	638,6	3,7	422,2	217,5	387,9	790,9	436,5
751	636,9	3,6	424,7	217,8	387,8	796,1	438,0
752	632,1	3,4	426,4	218,3	387,3	800,2	440,1
753	629,0	3,3	429,5	219,4	386,6	802,9	442,7
754	623,2	3,2	432,2	217,8	386,7	803,3	445,2
755	614,7	3,1	434,6	219,3	387,0	800,8	446,5
756	608,8	3,0	436,5	221,4	386,9	796,4	446,7
757	602,4	2,9	438,3	221,4	386,6	791,2	448,4
758	594,1	2,8	440,5	220,7	386,7	785,4	450,9
759	577,6	2,7	441,9	221,3	386,7	777,3	451,0
760	561,5	2,6	442,2	223,5	386,8	766,2	451,6
761	546,1	2,6	443,9	223,7	387,2	752,8	451,6
762	534,3	2,5	444,0	225,8	387,3	738,4	452,1
763	524,3	2,4	444,2	225,0	387,5	723,2	452,1
764	516,3	2,4	444,2	226,7	387,7	708,4	452,3
765	508,2	2,3	443,9	228,4	388,0	694,5	451,0
766	501,0	2,2	442,7	228,6	388,1	681,3	450,9
767	494,7	2,1	441,5	229,5	388,4	668,5	450,5
768	488,7	2,1	439,9	230,4	388,4	656,6	449,8
769	483,3	2,0	438,9	229,8	388,1	645,2	448,8
770	477,8	2,0	438,6	231,8	388,9	634,5	446,0
771	472,6	1,9	436,7	233,1	389,4	624,2	444,6
772	468,5	1,8	434,5	233,7	389,6	614,6	442,0
773	465,1	1,8	432,9	234,1	389,6	605,6	441,2
774	461,9	1,7	430,7	234,1	389,8	597,2	440,0
775	459,1	1,7	429,1	233,7	390,0	589,0	437,9
776	456,5	1,6	427,4	233,7	389,1	581,7	436,3
777	454,2	1,6	427,0	234,5	390,2	574,8	435,4
778	451,9	1,5	424,1	234,5	390,7	568,4	434,2
779	450,3	1,4	421,6	234,7	391,2	562,6	430,8
780	448,6	1,4	420,0	236,2	391,5	557,3	428,7
781	447,3	1,3	418,0	235,4	391,8	552,6	427,5
782	445,7	1,3	415,3	235,6	392,0	548,3	425,4
783	444,6	1,2	414,4	237,1	392,2	544,1	423,0
784	442,9	1,2	411,5	236,6	391,7	540,6	420,7
785	442,3	1,1	410,8	237,7	391,8	537,1	420,1
786	441,4	1,0	409,9	238,3	392,1	534,0	418,7
787	440,9	1,0	407,3	238,1	392,2	531,2	416,9
788	439,7	0,9	406,3	238,0	392,3	528,7	415,4
789	438,2	0,9	404,6	238,1	392,2	526,6	414,0
790	435,7	0,9	402,6	239,1	391,8	524,9	412,9
791	430,8	0,8	401,6	236,9	391,8	523,1	413,5
792	427,0	0,8	400,5	237,5	391,6	520,8	412,0
793	422,0	0,7	398,1	237,3	391,5	518,1	410,3
794	416,8	0,7	397,5	238,9	391,2	514,7	408,6
795	414,2	0,7	396,6	238,7	390,8	511,1	407,7
796	410,1	0,6	395,0	239,5	390,6	507,2	406,4
797	407,2	0,6	395,2	239,4	390,8	503,5	404,3
798	404,1	0,5	392,3	239,4	390,2	499,6	402,5
799	401,9	0,5	391,5	239,6	390,4	495,8	402,6
800	399,8	0,5	390,4	240,1	390,2	492,1	401,5
801	397,7	0,5	388,9	239,4	390,1	488,5	400,8
802	395,2	0,4	388,3	239,1	390,2	485,0	400,2
803	393,1	0,4	387,7	240,4	390,1	481,5	398,5
804	391,0	0,4	386,3	241,2	390,3	478,4	397,5
805	389,6	0,3	385,3	240,9	390,3	475,1	397,0
806	387,1	0,3	383,8	240,7	390,2	472,0	396,3
807	385,0	0,3	383,1	240,9	390,3	468,8	395,3
808	383,1	0,2	382,0	240,7	390,3	466,0	394,8
809	381,0	0,2	380,9	241,0	390,4	463,0	393,7
810	379,5	0,2	379,4	240,7	390,4	460,1	392,9
811	378,3	0,2	378,4	241,6	390,6	457,4	391,9
812	377,5	0,1	377,1	240,5	390,3	454,7	391,0
813	377,2	0,1	376,4	239,8	390,2	452,2	391,2
814	376,4	0,1	376,1	238,8	390,5	449,8	390,6
815	375,8	0,0	375,3	239,4	390,6	447,4	389,7
816	393,8	11,8	151,2	109,1	173,8	448,9	222,9
817	379,5	11,7	155,3	113,3	180,4	439,6	232,1
818	407,0	11,5	159,4	112,0	188,1	427,9	240,5
819	349,8	11,5	163,1	116,0	194,0	415,4	248,7
820	334,9	11,4	166,1	121,8	196,9	402,2	254,9
821	381,2	11,3	170,1	116,0	203,5	389,6	259,4
822	369,0	11,2	173,5	116,5	207,6	378,9	261,6
823	379,4	11,1	176,8	116,6	211,0	369,2	262,6
824	426,2	11,0	180,0	116,8	213,9	361,6	262,4
825	491,4	10,8	183,0	117,5	216,2	358,4	261,8

826	508,4	10,7	185,7	117,6	218,2	361,6	260,8
827	523,4	10,5	188,2	118,0	219,8	369,1	259,2
828	522,7	10,4	191,0	118,8	221,3	379,7	257,6
829	538,2	10,2	193,7	119,6	222,5	391,0	255,5
830	543,4	10,1	197,0	120,2	223,6	403,7	253,7
831	533,2	10,0	200,9	120,7	224,7	416,6	251,6
832	523,6	9,9	204,9	121,4	225,9	426,4	249,9
833	521,7	9,7	209,0	122,3	227,2	433,3	248,5
834	526,8	9,6	213,5	122,8	228,6	438,7	247,2
835	529,7	9,5	218,3	123,5	230,1	443,9	245,8
836	540,3	9,3	223,1	124,2	231,9	449,0	244,5
837	570,0	9,2	227,8	124,4	233,9	455,5	243,4
838	646,9	9,0	233,0	124,7	236,0	470,0	242,2
839	666,5	8,8	237,9	125,1	237,9	492,5	240,5
840	657,7	8,6	243,2	125,9	240,1	517,9	239,8
841	645,3	8,4	248,4	126,4	242,3	539,8	239,4
842	656,4	8,2	253,9	127,7	244,7	558,1	240,1
843	659,4	8,0	259,4	129,1	247,1	575,9	241,8
844	661,4	7,8	265,4	129,2	249,9	591,3	243,9
845	660,9	7,7	271,2	130,8	252,6	605,6	246,4
846	658,8	7,5	277,0	132,3	255,4	617,1	249,5
847	676,0	7,3	282,7	133,8	258,4	627,5	253,1
848	680,3	7,1	288,5	135,2	261,3	639,3	256,9
849	673,0	6,9	294,5	136,4	264,4	652,0	260,9
850	671,0	6,8	300,3	138,3	267,5	663,0	265,7
851	674,5	6,6	305,7	140,0	270,4	673,3	270,8
852	674,2	6,4	312,0	141,1	274,0	683,2	276,3
853	680,4	6,3	316,9	142,5	277,2	692,5	281,8
854	683,8	6,1	322,4	144,1	280,5	701,7	287,4
855	683,8	6,0	327,1	146,1	283,9	711,1	293,0
856	683,9	5,8	332,1	147,2	287,0	719,4	298,7
857	681,0	5,7	336,6	148,6	290,3	726,9	304,7
858	678,3	5,5	341,0	150,4	293,4	732,7	310,0
859	674,2	5,4	344,7	152,1	296,5	737,1	315,7
860	676,3	5,2	348,5	153,6	299,7	740,7	321,2
861	676,1	5,1	351,7	155,2	302,6	744,1	326,5
862	674,2	5,0	355,1	156,9	305,7	747,1	331,7
863	675,2	4,8	358,0	158,1	308,7	750,2	337,0
864	675,9	4,7	360,8	159,6	311,4	753,0	342,3
865	675,7	4,6	363,7	161,9	314,1	755,6	347,1
866	677,4	4,4	366,4	162,9	316,9	758,6	352,3
867	678,2	4,3	368,9	164,6	319,7	762,1	356,7
868	678,3	4,2	370,9	167,0	322,6	765,8	361,3
869	677,3	4,0	373,4	168,4	325,6	770,3	366,0
870	675,5	3,9	375,7	170,2	328,5	774,2	370,4
871	670,7	3,8	377,6	172,0	331,3	778,5	374,6
872	664,1	3,7	379,3	173,8	334,1	781,2	378,8
873	658,0	3,6	381,3	175,5	337,0	781,7	382,6
874	643,1	3,5	383,1	177,9	339,8	779,6	385,4
875	630,1	3,4	384,9	179,8	343,1	775,6	389,8
876	623,0	3,4	387,0	181,3	346,6	769,4	393,3
877	617,8	3,3	388,0	183,6	349,5	762,8	396,1
878	615,3	3,2	389,2	184,4	353,3	756,0	398,8
879	607,9	3,1	390,3	186,5	356,9	750,8	401,0
880	601,1	3,1	391,4	188,8	360,4	744,2	402,7
881	593,0	3,0	392,0	190,1	364,1	736,3	404,6
882	583,5	2,9	392,6	191,7	367,7	727,6	405,6
883	574,2	2,9	392,9	194,2	371,5	718,2	407,3
884	561,0	2,8	392,8	195,2	375,0	707,9	407,7
885	540,8	2,8	393,7	197,7	378,9	695,8	409,0
886	521,5	2,8	394,0	200,4	382,7	681,1	410,1
887	508,1	2,7	393,9	200,1	386,4	665,1	410,8
888	497,3	2,7	393,9	202,2	389,8	648,9	411,5
889	487,3	2,6	394,2	204,1	393,4	633,3	412,0
890	476,9	2,6	393,9	206,4	396,2	618,3	411,9
891	468,5	2,6	394,3	207,0	400,0	603,7	412,2
892	461,3	2,5	394,1	208,9	403,3	589,7	411,9
893	455,6	2,5	393,6	209,6	406,5	576,7	411,5
894	449,9	2,4	392,6	211,4	409,5	564,4	410,8
895	376,2	10,1	392,6	231,6	409,5	552,3	412,0
896	379,8	10,1	392,4	221,0	414,0	536,2	414,0
897	371,2	10,0	392,0	223,1	415,2	519,1	414,1
898	353,6	10,0	385,6	246,2	407,9	498,0	411,3
899	379,5	9,8	386,5	231,3	413,8	480,9	409,2
900	383,7	9,7	382,3	227,8	414,7	465,8	405,9
901	385,8	9,6	377,1	225,4	414,4	452,6	403,2
902	396,7	9,5	372,5	224,2	413,6	441,6	399,4
903	448,4	9,3	367,8	221,8	412,4	433,8	394,5
904	475,6	9,1	363,7	218,6	410,8	430,5	388,2
905	491,5	9,0	359,2	218,0	409,5	431,5	383,0
906	514,2	8,8	354,4	217,4	407,2	435,9	378,0
907	542,1	8,6	350,6	214,6	405,8	444,3	373,6
908	554,5	8,4	346,9	212,0	404,0	456,4	370,0

909	567,0	8,3	342,8	212,4	402,0	471,5	366,5
910	577,1	8,1	340,7	211,2	400,1	488,2	364,7
911	585,1	7,9	340,6	209,6	398,3	505,5	363,5
912	595,9	7,7	339,5	209,2	396,5	523,1	362,3
913	603,7	7,6	339,9	206,2	394,8	540,7	361,9
914	606,6	7,4	339,6	207,5	393,2	557,6	362,0
915	610,4	7,2	341,3	205,6	391,7	573,2	362,9
916	614,0	7,1	342,9	204,3	390,1	587,7	364,2
917	618,8	6,9	344,8	204,9	388,9	601,2	366,2
918	622,7	6,7	347,6	201,4	387,5	614,1	368,2
919	626,6	6,6	349,9	203,9	386,2	626,5	369,7
920	630,2	6,4	353,4	202,2	385,1	638,0	372,2
921	636,2	6,3	356,1	201,7	383,7	649,0	374,6
922	637,8	6,1	359,4	200,4	383,0	659,7	377,8
923	639,9	6,0	362,9	201,6	382,0	669,8	380,6
924	643,8	5,8	366,3	201,9	381,2	679,3	383,4
925	646,6	5,7	369,6	201,8	380,4	688,8	386,1
926	647,0	5,5	373,2	200,8	379,6	697,8	388,6
927	651,7	5,4	376,5	201,5	378,9	706,5	391,5
928	655,8	5,2	380,0	200,8	378,4	715,2	393,7
929	660,4	5,1	383,2	201,4	377,8	723,9	396,6
930	662,5	4,9	386,6	200,4	377,4	732,7	398,3
931	664,0	4,8	389,5	200,8	376,8	741,1	401,4
932	660,1	4,6	393,0	200,9	376,5	748,7	403,7
933	657,3	4,5	396,2	201,8	376,4	754,6	405,9
934	653,7	4,4	399,2	202,3	376,4	759,0	408,3
935	653,8	4,2	402,5	201,2	376,4	761,3	410,7
936	656,2	4,1	405,5	202,2	376,5	762,8	412,6
937	645,8	4,0	408,7	202,8	376,6	765,4	414,5
938	628,4	3,9	411,6	203,0	376,8	765,7	416,6
939	618,2	3,8	414,2	203,9	376,9	763,0	418,5
940	613,7	3,7	416,3	204,5	376,8	758,2	418,9
941	610,8	3,6	418,6	204,4	377,0	753,3	420,6
942	608,4	3,5	420,4	205,0	377,1	749,3	421,7
943	606,8	3,4	421,7	205,3	377,2	746,0	422,3
944	605,7	3,2	423,1	204,1	377,3	742,9	422,9
945	608,3	3,1	424,2	205,2	377,2	739,9	422,6
946	609,4	3,0	424,7	207,0	377,2	738,2	423,0
947	608,6	2,9	425,3	207,6	377,3	737,5	422,3
948	597,2	2,8	425,6	207,2	377,2	736,6	422,2
949	578,6	2,8	425,2	207,7	377,2	732,2	421,5
950	561,8	2,7	425,8	207,8	377,2	722,3	421,6
951	552,7	2,6	426,1	209,0	377,2	710,0	421,4
952	544,3	2,5	426,1	209,1	377,2	697,5	420,8
953	536,6	2,5	425,6	210,8	377,1	685,1	420,1
954	529,7	2,4	425,7	211,5	377,2	672,7	419,8
955	522,6	2,3	425,0	211,3	377,2	660,8	419,1
956	516,3	2,3	424,5	212,2	377,2	649,5	418,0
957	511,0	2,2	423,5	214,0	377,0	638,7	416,5
958	505,4	2,1	422,5	215,5	376,9	628,5	415,2
959	499,2	2,1	421,7	214,3	376,9	618,1	414,8
960	494,4	2,0	421,0	214,5	377,1	608,5	413,9
961	488,7	1,9	420,2	216,0	377,0	599,2	411,6
962	484,6	1,9	419,5	218,1	376,9	590,3	410,1
963	480,6	1,8	418,3	219,3	376,7	581,9	409,8
964	477,5	1,8	417,1	218,9	376,9	573,8	408,3
965	472,6	1,7	415,8	218,6	376,7	566,4	406,2
966	465,5	1,7	414,3	218,8	376,7	559,2	403,6
967	460,6	1,6	413,7	220,0	376,7	552,0	402,7
968	459,0	1,5	411,4	221,5	376,7	545,0	401,5
969	458,0	1,5	410,4	222,3	376,5	538,8	400,2
970	454,5	1,4	409,2	223,7	376,6	533,1	399,1
971	451,7	1,4	407,8	223,2	376,5	527,7	397,2
972	449,7	1,3	406,0	223,7	376,6	522,2	396,1
973	447,9	1,3	404,3	224,9	376,4	516,8	393,5
974	446,1	1,2	402,8	225,5	376,5	512,1	392,4
975	444,7	1,2	401,0	225,0	376,5	507,7	390,3
976	443,7	1,1	399,0	225,9	376,4	503,7	389,5
977	442,2	1,1	397,4	224,5	376,3	499,9	387,0
978	441,2	1,0	395,8	226,5	376,2	496,4	386,5
979	440,5	1,0	394,2	226,7	376,2	493,2	385,2
980	440,0	0,9	392,7	225,7	376,3	490,2	384,4
981	439,6	0,9	391,6	226,6	376,1	487,6	381,8
982	439,3	0,8	389,7	226,8	376,1	485,5	381,1
983	439,5	0,8	388,0	226,9	376,0	483,5	379,3
984	439,3	0,7	386,7	227,3	375,8	481,7	378,8
985	438,2	0,7	385,4	227,1	375,8	480,0	377,9
986	437,0	0,6	384,5	227,4	375,7	478,7	377,3
987	434,8	0,6	383,0	227,2	375,7	477,5	374,8
988	432,5	0,6	381,5	227,6	375,6	476,2	374,2
989	431,5	0,5	380,2	226,6	375,5	474,7	373,2
990	426,0	0,5	378,5	228,8	375,1	472,8	372,3
991	424,3	0,5	377,7	227,8	374,9	470,4	371,7

992	418,6	0,4	376,6	227,9	375,0	467,3	370,4		
993	414,1	0,4	375,2	227,7	375,1	463,9	369,9		
994	411,5	0,4	374,1	228,2	374,8	460,3	368,7		
995	407,9	0,3	372,6	228,0	374,7	456,6	367,7		
996	405,5	0,3	371,3	227,4	374,7	452,9	366,7		
997	403,4	0,3	370,0	227,2	374,7	449,3	365,6		
998	400,7	0,2	369,0	228,5	374,5	445,9	363,7		
999	398,8	0,2	368,0	227,9	374,6	442,7	363,7		
1000	397,0	0,2	367,2	227,7	374,6	439,4	362,4		
1001	395,5	0,2	366,3	228,3	374,4	436,2	360,2		
1002	393,6	0,1	365,8	228,3	374,6	433,3	359,4		
1003	391,3	0,1	365,1	228,2	374,6	430,6	359,7		
1004	388,8	0,1	364,7	227,6	374,7	427,5	358,7		
1005	387,0	0,0	364,1	229,2	374,7	425,1	357,0		
1006	678,1	6,4	285,7	144,7	312,0	647,0	308,1	3	20-20-21
1007	666,5	6,3	292,8	147,1	314,5	658,6	314,6		
1008	705,4	6,1	300,1	148,4	317,0	670,7	321,6		
1009	717,3	5,9	306,9	149,9	319,4	686,6	327,9		
1010	716,7	5,8	313,5	151,1	322,0	704,5	334,1		
1011	725,3	5,6	319,5	153,9	324,6	721,9	339,9		
1012	733,2	5,5	326,3	154,8	327,7	738,9	346,2		
1013	736,5	5,3	332,0	157,5	331,1	754,7	351,9		
1014	746,1	5,1	337,9	159,1	334,5	768,8	357,2		
1015	747,4	5,0	343,1	161,0	338,2	781,0	362,4		
1016	747,5	4,8	348,4	162,2	342,2	791,7	367,8		
1017	746,8	4,7	353,4	164,6	346,2	801,0	372,1		
1018	739,4	4,6	358,3	167,2	350,4	809,2	376,7		
1019	729,5	4,4	362,9	168,5	354,7	816,0	380,6		
1020	720,2	4,3	367,2	171,3	359,2	821,5	384,7		
1021	713,2	4,2	371,6	173,1	363,6	825,5	388,0		
1022	704,8	4,1	375,8	174,6	368,1	828,3	391,3		
1023	693,2	4,0	379,4	177,1	372,7	829,9	393,8		
1024	678,3	3,9	383,5	179,8	377,5	829,6	396,3		
1025	660,1	3,9	386,5	182,0	382,5	826,8	399,1		
1026	644,3	3,8	389,4	183,9	387,5	820,7	401,6		
1027	622,5	3,8	391,8	186,0	392,7	810,2	403,6		
1028	602,4	3,7	394,2	188,4	397,8	794,5	404,4		
1029	585,2	3,7	396,7	189,7	403,7	775,3	406,8		
1030	568,3	3,6	397,6	192,8	409,1	754,1	407,7		
1031	552,6	3,6	399,9	194,9	414,8	732,3	408,6		
1032	538,1	3,5	400,5	197,5	420,0	710,8	408,9		
1033	523,6	3,5	402,0	200,5	425,4	689,9	409,6		
1034	514,1	3,4	402,4	201,6	430,5	669,6	409,9		
1035	505,9	3,4	401,6	204,4	435,3	650,7	409,7		
1036	497,9	3,4	402,1	205,6	440,4	633,2	409,5		
1037	489,8	3,3	402,4	207,0	445,2	617,2	408,9		
1038	481,3	3,3	401,4	210,1	449,4	602,7	407,2		
1039	475,7	3,2	400,8	212,0	453,8	589,3	406,2		
1040	470,5	3,2	401,1	213,4	458,1	576,6	405,1		
1041	466,0	3,1	401,1	213,9	462,4	565,1	403,9		
1042	461,0	3,1	400,0	215,4	466,3	554,5	402,0		
1043	457,4	3,1	399,3	216,9	469,9	544,5	400,7		
1044	453,8	3,0	397,7	217,9	473,3	535,2	400,0		
1045	450,6	3,0	397,2	218,8	476,8	526,8	398,7		
1046	448,1	2,9	395,8	220,8	479,7	519,2	396,9		
1047	444,9	2,9	394,6	220,7	482,5	511,7	395,4		
1048	442,3	2,8	392,7	221,1	485,0	505,0	394,0		
1049	439,1	2,8	392,3	220,8	487,6	498,7	392,3		
1050	436,9	2,8	391,5	223,7	490,0	492,9	391,4		
1051	434,0	2,7	390,7	226,5	491,9	487,5	389,0		
1052	431,3	2,7	389,3	226,9	493,8	482,4	387,3		
1053	429,6	2,6	388,0	227,4	495,7	477,7	386,8		
1054	427,4	2,6	383,9	227,0	496,8	472,9	384,7		
1055	425,9	2,6	382,9	227,9	498,4	468,7	383,3		
1056	421,5	2,5	383,6	228,3	499,5	464,4	381,3		
1057	416,2	2,5	383,1	230,6	500,6	460,3	379,1		
1058	412,5	2,5	380,4	232,9	501,2	455,8	377,0		
1059	410,4	2,4	380,2	231,3	502,1	451,4	375,8		
1060	408,8	2,4	379,3	230,6	502,9	447,0	374,5		
1061	407,1	2,4	377,2	229,7	504,0	442,9	372,8		
1062	405,4	2,4	376,5	230,4	503,6	438,9	371,4		
1063	403,2	2,3	374,6	230,7	504,8	435,0	370,0		
1064	401,1	2,3	374,9	231,7	506,0	431,4	367,9		
1065	384,2	9,7	373,2	245,7	502,5	427,9	367,1	3	19-19-20
1066	336,7	9,7	373,2	240,4	503,3	422,7	367,3		
1067	321,8	9,7	370,5	264,3	494,3	413,3	366,1		
1068	313,5	9,6	370,7	252,4	498,7	404,0	365,7		
1069	313,5	9,5	368,4	249,6	499,4	393,3	363,8		
1070	314,7	9,5	364,7	247,9	497,2	382,9	361,3		
1071	311,0	9,4	362,4	245,8	493,7	373,4	356,6		
1072	312,3	9,4	358,5	244,6	492,1	364,5	352,5		
1073	327,7	9,3	353,0	241,2	488,8	356,6	348,4		
1074	345,4	9,2	349,7	239,6	485,6	350,1	343,4		

1075	342,1	9,1	345,0	237,1	481,6	345,3	338,8
1076	353,7	9,1	340,9	237,4	477,9	341,1	333,1
1077	411,7	8,9	336,4	231,4	474,1	338,7	327,4
1078	458,5	8,8	332,3	229,1	470,4	339,1	321,6
1079	501,7	8,6	327,8	226,1	466,7	343,5	317,4
1080	521,6	8,4	324,4	223,0	462,9	352,2	312,3
1081	521,3	8,3	322,2	222,8	459,2	364,1	307,8
1082	516,3	8,1	318,5	219,5	455,1	377,8	304,2
1083	524,3	8,0	317,5	218,8	451,4	391,4	301,3
1084	554,0	7,8	316,2	213,8	447,9	405,7	298,7
1085	564,5	7,7	315,1	214,0	444,5	421,8	296,6
1086	576,3	7,5	316,3	211,9	441,5	438,7	294,8
1087	595,2	7,3	315,9	208,1	438,6	456,7	294,0
1088	607,5	7,1	317,5	208,9	436,1	476,1	294,2
1089	608,3	6,9	318,2	205,9	433,0	495,9	295,2
1090	610,6	6,8	321,3	203,6	431,6	514,8	296,9
1091	610,7	6,6	323,2	202,8	429,4	532,4	299,2
1092	612,0	6,5	326,3	204,3	428,6	548,2	303,1
1093	612,9	6,3	329,3	201,8	427,3	562,4	306,1
1094	612,5	6,1	334,7	202,1	426,5	575,1	309,8
1095	614,6	6,0	337,1	203,9	425,7	586,3	314,0
1096	614,4	5,9	341,9	203,6	424,7	595,9	318,6
1097	616,3	5,7	344,0	202,6	423,7	605,0	322,4
1098	616,5	5,6	349,4	201,3	423,3	613,0	326,5
1099	618,2	5,4	352,6	200,8	422,9	620,2	331,6
1100	619,9	5,3	355,8	201,0	422,6	627,0	336,4
1101	622,0	5,2	359,2	200,3	422,0	633,9	340,7
1102	623,8	5,0	363,4	202,7	422,1	640,4	344,9
1103	627,6	4,9	368,2	204,6	422,2	646,8	349,8
1104	631,9	4,7	372,8	204,1	422,3	653,4	353,9
1105	632,5	4,6	376,6	205,1	422,4	660,3	358,1
1106	631,6	4,5	380,6	203,9	422,5	666,5	362,5
1107	632,9	4,3	382,0	200,9	422,3	672,8	366,2
1108	632,9	4,2	385,7	203,7	423,4	678,8	370,3
1109	634,0	4,1	390,8	203,8	423,8	684,1	374,6
1110	636,4	4,0	394,0	203,2	424,7	689,6	378,6
1111	637,0	3,8	398,0	204,7	425,7	695,7	382,3
1112	631,5	3,7	400,5	204,5	426,2	702,2	385,8
1113	623,7	3,6	403,2	206,0	427,3	707,6	389,5
1114	613,0	3,5	405,7	206,7	428,3	710,4	392,7
1115	604,5	3,4	407,6	206,1	429,0	710,7	396,1
1116	595,7	3,3	408,0	205,9	429,3	708,4	399,3
1117	586,8	3,2	411,7	208,3	430,8	704,2	401,5
1118	576,3	3,2	412,4	210,1	431,7	698,1	404,2
1119	568,4	3,1	413,3	209,2	432,5	690,4	406,4
1120	559,5	3,0	414,8	210,7	433,0	681,4	408,7
1121	552,5	2,9	415,1	214,2	434,2	672,1	409,2
1122	546,4	2,9	414,2	212,4	435,1	663,3	410,7
1123	538,8	2,8	414,2	214,4	435,7	654,1	412,3
1124	528,6	2,7	415,8	216,4	436,3	644,5	413,0
1125	521,0	2,7	417,2	215,8	437,1	634,2	413,7
1126	514,7	2,6	416,9	218,6	437,5	623,9	413,7
1127	509,2	2,5	414,6	218,1	436,9	613,7	413,9
1128	504,1	2,5	415,1	218,4	437,5	604,3	412,8
1129	500,2	2,4	413,2	218,2	437,1	595,0	413,0
1130	495,0	2,4	411,3	218,7	437,3	586,4	412,9
1131	491,3	2,3	411,1	220,3	437,2	578,1	411,9
1132	487,7	2,2	410,8	221,5	437,6	570,3	410,8
1133	483,9	2,2	411,7	223,8	438,0	562,8	409,8
1134	479,9	2,1	409,0	224,1	438,2	555,9	408,4
1135	478,0	2,1	408,1	224,6	438,4	549,2	406,9
1136	474,5	2,0	407,1	225,0	438,8	542,8	405,6
1137	472,8	2,0	404,8	229,4	439,0	536,9	404,7
1138	471,0	1,9	404,1	228,3	439,1	531,5	403,0
1139	468,8	1,8	403,5	229,2	439,2	526,3	400,4
1140	466,6	1,8	401,0	230,1	439,3	521,6	398,4
1141	464,9	1,7	400,4	230,9	439,1	517,2	397,9
1142	464,5	1,7	398,9	232,9	439,5	513,0	396,0
1143	462,7	1,6	396,5	230,8	439,7	509,0	395,8
1144	461,5	1,6	396,3	231,7	439,9	505,5	394,5
1145	460,4	1,5	394,3	233,2	440,1	502,4	393,0
1146	459,8	1,5	392,2	232,5	440,2	499,2	391,2
1147	458,2	1,4	392,0	231,5	440,0	496,2	389,6
1148	457,2	1,4	390,2	233,6	440,2	493,7	388,9
1149	456,4	1,3	387,7	235,2	440,5	491,4	387,0
1150	452,1	1,3	387,8	233,1	440,9	488,8	386,2
1151	449,2	1,2	387,9	232,1	440,8	485,9	385,9
1152	448,3	1,2	387,5	234,9	440,9	482,7	384,6
1153	446,5	1,1	387,2	235,8	440,8	479,6	384,3
1154	446,2	1,1	386,6	233,7	441,3	476,8	382,8
1155	445,3	1,0	385,1	234,8	441,3	474,1	381,1
1156	444,5	1,0	382,5	235,9	441,1	471,5	380,1
1157	443,2	0,9	381,2	233,6	441,0	469,2	378,9

1158	440,2	0,9	380,5	235,1	441,1	467,4	377,6		
1159	437,0	0,9	377,8	236,0	440,5	465,4	376,8		
1160	430,4	0,8	378,0	234,9	440,4	463,3	374,9		
1161	424,7	0,8	377,9	235,8	440,3	460,5	375,0		
1162	420,5	0,8	375,6	238,6	440,0	457,5	374,8		
1163	417,1	0,7	376,3	235,1	439,4	454,0	372,7		
1164	414,5	0,7	372,8	236,3	439,1	450,6	371,8		
1165	412,1	0,7	372,3	236,7	438,2	447,2	370,5		
1166	410,5	0,6	372,1	238,1	437,5	443,8	370,1		
1167	407,7	0,6	371,1	238,0	436,9	440,5	368,4		
1168	405,4	0,6	369,3	239,3	436,2	437,2	367,8		
1169	400,7	0,5	369,4	236,5	435,4	433,9	366,4		
1170	397,6	0,5	366,1	236,2	434,9	430,6	366,1		
1171	394,3	0,5	365,5	236,7	434,0	427,1	363,1		
1172	391,2	0,5	364,5	236,9	433,0	423,7	361,7		
1173	388,9	0,4	364,6	236,9	432,2	420,4	360,7		
1174	385,7	0,4	362,5	237,6	431,3	416,9	360,7		
1175	384,1	0,4	361,4	237,2	430,6	413,7	358,1		
1176	382,7	0,4	361,3	238,2	429,9	410,5	358,4		
1177	381,4	0,3	358,9	236,6	428,7	407,3	357,0		
1178	380,0	0,3	357,4	236,2	427,6	404,4	355,4		
1179	379,3	0,3	356,9	236,2	426,5	401,6	353,3		
1180	378,1	0,3	355,1	236,3	425,3	398,9	354,3		
1181	377,3	0,2	354,1	237,3	425,1	396,5	354,1		
1182	376,5	0,2	352,8	234,7	424,2	394,1	352,2		
1183	375,6	0,2	351,8	232,8	423,5	391,9	349,6		
1184	375,0	0,1	351,8	233,7	421,8	389,8	349,2		
1185	373,2	0,1	349,8	233,2	421,1	388,0	349,0		
1186	371,8	0,1	348,5	233,8	420,3	385,9	347,0		
1187	370,7	0,1	346,9	233,3	420,2	384,0	346,2		
1188	369,8	0,0	346,5	232,6	420,0	382,3	345,2		
1189	146,8	5,6	201,3	159,8	247,8	179,7	191,1	3	19-20-20
1190	157,7	5,6	199,0	162,8	244,0	177,3	188,3		
1191	192,2	5,5	197,2	160,8	240,9	175,2	185,5		
1192	194,1	5,5	195,1	153,6	242,0	173,3	184,0		
1193	207,9	5,4	192,6	150,0	241,2	172,4	182,1		
1194	223,1	5,4	190,6	146,9	240,1	172,3	179,9		
1195	214,0	5,4	188,8	145,7	239,2	173,1	178,8		
1196	205,2	5,4	187,2	145,2	238,3	174,2	177,0		
1197	199,7	5,3	185,9	143,9	237,8	175,5	175,5		
1198	195,7	5,3	185,2	143,0	237,1	176,7	174,3		
1199	195,7	5,3	184,1	141,9	237,0	177,6	173,2		
1200	198,6	5,3	183,1	140,5	236,7	178,4	172,1		
1201	199,2	5,2	182,3	139,3	236,4	179,2	171,1		
1202	202,5	5,2	181,2	138,3	236,4	180,0	170,3		
1203	205,8	5,1	180,7	137,1	236,0	180,9	169,0		
1204	208,1	5,1	179,8	136,9	235,8	181,8	168,3		
1205	205,3	5,1	179,0	135,9	235,2	182,6	167,0		
1206	205,7	5,0	178,2	135,0	235,7	183,1	166,0		
1207	214,2	5,0	177,1	133,8	235,4	183,6	165,9		
1208	221,2	4,9	176,5	132,6	235,1	184,3	164,8		
1209	239,3	4,8	175,8	131,4	234,8	185,2	164,5		
1210	257,6	4,7	175,3	129,9	234,4	186,8	164,1		
1211	296,6	4,6	174,4	128,4	234,1	189,6	164,0		
1212	339,3	4,5	174,1	127,0	234,0	194,3	163,8		
1213	391,7	4,3	174,1	124,9	233,5	202,9	164,1		
1214	416,9	4,1	173,6	124,3	233,2	216,1	165,0		
1215	441,0	4,0	173,9	123,6	233,0	232,8	166,8		
1216	501,2	3,8	174,4	122,8	232,6	253,7	169,3		
1217	521,1	3,6	174,9	122,3	232,1	280,8	172,5		
1218	530,7	3,5	176,0	122,8	232,3	310,6	176,4		
1219	545,3	3,3	177,1	123,0	232,5	342,7	180,9		
1220	559,4	3,1	179,4	123,0	232,4	376,5	186,1		
1221	569,0	2,9	181,8	122,8	233,0	411,9	191,6		
1222	572,4	2,8	184,6	123,7	233,7	446,0	197,7		
1223	573,2	2,6	187,9	125,1	234,8	477,3	203,8		
1224	569,5	2,4	191,8	126,3	236,0	505,1	210,3		
1225	565,9	2,3	196,6	127,7	237,3	528,9	216,8		
1226	561,1	2,1	201,4	128,9	238,6	548,2	223,6		
1227	558,7	2,0	206,2	130,3	240,0	563,2	230,0		
1228	555,4	1,9	211,4	131,7	241,7	574,5	236,4		
1229	553,0	1,7	216,4	133,2	243,7	583,2	242,8		
1230	551,0	1,6	221,7	134,6	245,6	590,3	248,8		
1231	549,5	1,5	227,1	136,8	247,3	596,4	254,7		
1232	546,5	1,4	232,8	138,1	249,2	601,4	260,3		
1233	544,0	1,2	237,4	140,0	251,2	605,0	265,8		
1234	542,1	1,1	243,8	142,3	253,7	607,7	270,5		
1235	541,8	1,0	249,5	145,1	256,0	610,1	276,0		
1236	543,0	0,9	254,0	145,9	257,6	612,4	280,7		
1237	543,5	0,8	258,0	146,5	258,4	614,6	285,4		
1238	544,0	0,7	263,2	148,4	260,6	617,3	289,5		
1239	542,5	0,6	268,9	151,5	263,5	619,4	293,6		
1240	491,9	13,4	328,4	182,7	297,9	492,3	339,7	3	19 19 19

1241	512,8	13,2	326,4	181,7	297,6	492,6	338,3
1242	522,1	13,1	324,6	181,9	298,6	498,5	335,9
1243	550,9	12,9	321,5	182,9	298,3	508,2	335,7
1244	554,4	12,7	318,7	182,7	298,5	521,5	335,3
1245	547,9	12,5	316,9	182,4	298,6	535,9	334,0
1246	543,6	12,4	314,5	182,3	299,0	547,8	335,7
1247	544,0	12,2	312,8	182,5	299,0	557,1	336,6
1248	545,7	12,1	310,8	182,4	299,3	564,8	337,2
1249	549,2	11,9	310,6	181,8	299,7	571,6	337,3
1250	555,1	11,8	309,4	181,7	300,2	578,8	338,7
1251	570,9	11,6	308,8	183,1	300,8	586,2	339,4
1252	578,8	11,4	308,4	181,4	301,2	595,7	341,1
1253	572,0	11,2	308,5	183,0	301,6	605,3	342,1
1254	563,6	11,1	308,8	181,2	302,5	613,4	344,3
1255	559,2	11,0	308,2	182,1	303,0	618,6	346,4
1256	556,4	10,8	310,5	181,3	303,9	622,3	347,2
1257	554,3	10,7	311,4	181,8	304,6	624,9	351,0
1258	553,5	10,5	312,9	185,0	305,5	627,0	351,3
1259	552,9	10,4	313,5	182,2	306,1	628,4	353,2
1260	551,6	10,3	314,4	183,1	307,0	629,9	355,1
1261	550,2	10,1	316,5	184,6	307,8	631,2	357,3
1262	548,1	10,0	317,6	184,6	308,8	632,5	359,2
1263	546,6	10,1	318,6	188,4	309,7	633,0	361,7
1264	550,0	17,8	321,0	189,1	310,6	630,5	363,7
1265	551,4	17,6	322,0	187,3	311,5	627,0	366,0
1266	559,0	17,4	322,5	185,9	312,4	624,8	370,2
1267	568,0	17,2	322,8	185,7	313,2	623,0	371,7
1268	584,5	17,0	323,4	184,9	314,0	623,0	372,2
1269	611,1	16,8	323,7	185,0	314,5	626,8	370,8
1270	650,3	16,5	324,9	187,0	314,2	635,4	366,0
1271	666,5	16,2	324,2	184,1	314,0	648,8	365,7
1272	674,5	16,0	324,2	184,8	314,9	664,2	362,2
1273	668,9	15,7	324,4	184,8	315,0	679,8	361,5
1274	671,4	15,5	325,2	184,9	314,3	693,8	359,7
1275	676,4	15,3	326,2	185,8	314,7	707,6	359,9
1276	682,1	15,0	326,1	185,7	314,4	721,7	360,5
1277	682,2	14,8	328,6	186,8	314,3	736,2	360,3
1278	681,4	14,5	329,3	187,6	314,4	748,7	362,1
1279	680,4	14,3	332,4	187,5	314,3	759,6	364,3
1280	673,5	14,1	333,6	188,1	314,3	768,4	366,3
1281	667,0	13,8	337,7	189,0	314,2	774,3	368,9
1282	664,4	13,6	340,3	190,0	314,4	779,3	371,6
1283	658,2	13,4	344,2	188,8	314,4	783,4	374,5
1284	652,6	13,2	348,5	189,2	314,7	785,1	377,7
1285	648,2	13,1	352,0	189,3	315,1	785,5	381,0
1286	647,1	12,8	355,6	189,7	315,5	785,5	383,8
1287	646,0	12,7	359,8	190,2	316,3	785,8	386,8
1288	644,7	12,4	363,8	191,7	317,1	786,1	389,6
1289	642,7	12,2	366,7	191,4	317,9	786,7	392,1
1290	641,6	12,1	370,6	191,7	318,6	787,1	394,9
1291	640,4	11,9	374,2	190,9	319,5	787,5	397,0
1292	639,2	11,7	377,6	192,1	320,5	788,1	399,2
1293	638,8	11,5	381,1	192,5	321,6	788,2	402,0
1294	637,5	11,3	384,8	193,4	322,7	788,6	403,8
1295	637,8	11,1	387,9	193,7	323,6	789,7	406,0
1296	636,4	11,0	391,0	194,3	324,6	790,9	408,3
1297	633,3	10,8	393,6	195,1	325,6	792,1	410,3
1298	631,5	10,6	396,5	195,4	326,7	792,6	412,5
1299	630,2	10,5	399,5	195,1	327,4	793,0	414,6
1300	628,7	10,3	401,8	195,6	328,6	793,3	416,2
1301	626,1	10,1	404,1	196,5	329,4	793,5	418,0
1302	625,2	10,0	406,3	196,7	330,3	793,2	419,9
1303	622,7	9,8	408,5	198,6	331,0	792,4	421,8
1304	620,7	9,6	410,6	197,8	332,0	791,2	423,8
1305	618,9	9,5	412,5	199,6	332,7	789,9	425,2
1306	617,6	9,4	414,5	199,1	333,6	788,2	426,6
1307	615,5	9,2	415,9	200,0	334,2	786,5	428,3
1308	614,0	9,1	416,8	200,5	335,0	784,6	429,5
1309	612,2	9,0	418,6	200,7	335,8	782,7	430,6
1310	611,4	8,8	419,1	200,9	336,9	781,4	431,8
1311	610,1	8,7	419,9	202,1	337,7	780,1	432,7
1312	608,4	8,5	421,4	202,2	338,5	779,0	433,5
1313	607,9	8,4	422,4	202,7	339,3	778,0	434,5
1314	606,4	8,3	424,1	202,8	340,1	777,1	435,6
1315	603,9	8,2	424,5	203,1	340,8	776,2	436,0
1316	600,8	8,1	425,4	204,6	341,9	774,4	436,6
1317	595,0	7,9	426,7	205,0	342,6	772,5	437,5
1318	588,2	7,9	427,5	206,0	343,5	769,5	438,1
1319	579,1	7,7	428,8	205,2	344,0	765,0	438,3
1320	569,8	7,7	428,5	206,3	345,0	758,8	438,9
1321	561,0	7,6	429,8	206,8	345,8	751,0	439,4
1322	550,9	7,5	430,3	207,4	346,7	741,7	440,0
1323	541,0	7,5	430,3	208,8	347,9	730,1	440,5

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1324	530,1	7,4	430,5	208,5	348,9	717,6	440,6
1325	519,1	7,4	430,4	209,2	350,1	704,3	440,5
1326	510,4	7,3	430,9	210,1	351,4	690,6	440,8
1327	503,2	7,3	430,7	210,6	352,5	677,1	441,0
1328	496,4	7,2	430,9	209,8	353,7	664,0	441,2
1329	490,0	7,2	429,9	211,2	354,7	651,8	440,5
1330	484,0	7,2	428,3	211,0	355,8	639,9	439,8
1331	478,4	7,1	427,1	210,9	356,7	628,8	438,9
1332	472,9	7,1	427,0	211,9	357,9	618,3	438,1
1333	468,2	7,0	425,6	211,4	358,4	608,4	437,2
1334	464,0	7,0	424,9	211,6	359,5	598,8	435,7
1335	459,4	6,9	422,4	212,0	360,2	589,7	433,9
1336	455,6	7,0	421,7	212,7	361,6	581,0	432,7
1337	452,6	6,9	420,5	212,5	362,5	573,2	431,0
1338	449,5	6,9	419,3	212,7	363,4	565,7	430,1
1339	446,7	6,8	417,2	212,5	364,4	558,8	428,8
1340	443,9	6,8	416,4	213,2	365,8	552,2	427,5
1341	440,2	6,8	415,0	213,5	366,6	546,0	426,4
1342	438,1	6,8	413,9	213,2	367,6	540,1	425,3
1343	435,4	6,7	412,0	213,1	369,0	534,5	424,1
1344	433,7	6,7	410,9	213,8	369,9	529,2	423,2
1345	432,2	6,7	409,7	213,3	370,9	524,5	421,9
1346	429,3	6,6	408,9	214,2	372,1	519,8	420,8
1347	422,7	6,6	407,5	214,0	373,1	515,4	419,4
1348	417,1	6,5	405,5	213,9	374,1	511,0	418,6
1349	412,9	6,5	404,6	214,9	375,4	506,3	417,5
1350	409,3	6,5	403,4	214,8	375,7	501,8	416,6
1351	406,2	6,5	402,6	215,2	377,4	497,4	415,6
1352	403,5	6,5	402,4	215,7	378,5	492,9	414,7
1353	400,9	6,4	400,1	216,2	379,4	488,5	413,8
1354	398,4	6,4	398,6	215,7	380,8	484,1	413,1
1355	396,6	6,4	398,2	216,1	381,6	480,2	411,1
1356	395,0	6,3	396,0	215,9	382,4	476,5	410,2
1357	393,6	6,3	394,5	216,2	383,4	473,1	409,4
1358	391,7	6,3	393,1	216,5	384,4	469,9	407,6
1359	389,0	6,3	391,6	217,0	385,8	466,3	406,5
1360	387,0	6,3	390,5	217,2	386,3	463,3	405,5
1361	384,0	6,2	390,1	216,9	386,8	459,7	404,2
1362	381,4	6,2	388,0	216,9	387,3	456,4	403,6
1363	380,3	6,2	386,9	217,6	388,8	453,3	402,2
1364	378,5	6,2	385,3	217,1	389,6	450,2	401,3
1365	377,4	6,2	383,7	217,1	390,4	447,5	400,3
1366	376,3	6,1	384,2	217,1	391,2	444,9	399,5
1367	374,8	6,1	382,0	217,1	392,0	442,5	398,6
1368	373,2	6,1	381,8	217,3	392,3	440,0	396,9
1369	372,5	6,1	379,9	216,9	392,7	437,9	396,3
1370	371,9	6,0	380,0	216,7	393,8	435,8	395,5
1371	371,1	6,0	378,0	216,6	394,4	433,7	394,3
1372	370,7	6,0	378,3	216,7	394,5	431,5	393,5
1373	370,2	6,0	376,2	215,8	395,3	429,8	393,0
1374	369,5	5,9	376,0	215,6	396,2	427,8	392,3
1375	369,5	5,9	374,2	214,7	396,4	426,1	391,0
1376	368,2	5,9	373,3	215,2	397,0	424,7	390,5
1377	367,0	5,9	373,0	214,3	397,3	423,5	390,2
1378	366,4	5,8	372,1	213,7	397,8	422,6	389,4
1379	365,9	5,8	371,6	214,0	397,9	421,6	388,8
1380	365,2	5,8	371,6	214,1	398,4	420,8	388,2
1381	364,5	5,8	371,3	213,2	398,7	419,9	387,4
1382	363,8	5,7	372,7	213,0	398,6	419,1	386,9
1383	361,9	5,7	370,6	212,4	399,0	418,5	386,0
1384	360,6	5,7	371,4	212,4	398,9	417,6	385,5
1385	359,3	5,7	370,3	211,9	398,8	416,5	384,8
1386	358,4	5,6	371,2	211,7	399,2	415,4	384,4
1387	356,3	5,6	370,5	211,5	399,5	414,0	383,6
1388	355,2	5,6	371,0	211,8	399,5	412,6	382,7
1389	354,0	5,6	369,9	211,1	399,8	411,4	382,1
1390	352,5	5,5	370,5	210,7	399,5	409,9	381,6
1391	351,3	5,5	370,6	211,9	399,7	408,3	380,7
1392	349,6	5,5	369,5	210,2	399,4	406,8	380,5
1393	347,8	5,5	369,4	210,7	399,6	405,2	379,6
1394	346,9	5,5	368,6	211,1	399,5	403,5	379,2
1395	345,3	5,5	368,3	210,6	399,5	401,9	378,3
1396	344,2	5,4	367,2	210,5	399,6	400,3	377,7
1397	343,3	5,4	366,6	209,7	399,4	398,5	376,7
1398	342,2	5,4	366,2	209,3	399,3	396,8	375,7
1399	341,3	5,4	365,5	209,1	399,2	395,4	374,5
1400	340,6	5,4	364,6	209,0	399,1	393,7	373,7
1401	339,9	5,3	364,0	209,1	399,2	392,1	372,8
1402	339,3	5,3	363,0	208,2	399,0	390,7	371,5
1403	338,6	5,3	362,1	208,7	399,3	389,1	370,1
1404	338,1	5,2	361,5	208,3	399,2	387,6	369,5
1405	337,6	5,2	359,7	207,9	398,8	386,3	368,3
1406	336,8	5,2	359,1	207,2	398,7	385,1	366,8

1407	336,4	5,2	357,9	207,2	398,6	383,7	366,1
1408	335,5	5,2	357,6	206,8	398,4	382,5	365,1
1409	335,0	5,1	355,9	206,0	398,6	381,4	363,4
1410	334,2	5,1	354,5	206,5	398,6	380,2	362,1
1411	333,7	5,1	355,0	205,7	398,5	378,8	361,3
1412	333,5	5,1	353,8	205,5	398,3	377,8	360,1
1413	332,9	5,0	353,4	205,5	398,9	376,8	359,5
1414	332,2	5,1	352,1	205,9	398,5	375,7	358,5
1415	331,4	5,1	351,0	205,0	398,5	374,5	357,1
1416	330,7	5,0	350,1	204,5	398,3	373,4	356,6
1417	330,6	5,0	349,1	204,2	398,5	372,6	355,5
1418	329,5	5,0	349,2	204,5	398,6	371,5	354,6
1419	329,2	5,0	347,3	204,2	398,6	370,5	353,4
1420	328,5	5,0	347,0	204,5	398,6	369,4	352,7
1421	328,3	4,9	345,3	202,7	398,3	368,4	351,7
1422	327,7	4,9	345,3	203,3	398,6	367,6	351,1
1423	327,1	4,9	343,5	202,8	398,9	366,6	349,9
1424	326,6	4,9	343,9	202,8	398,9	365,4	349,4
1425	325,8	4,9	342,1	201,9	398,8	364,6	348,3
1426	323,1	4,8	340,9	202,6	398,8	363,7	347,7
1427	320,7	4,8	340,8	201,6	398,7	362,4	347,0
1428	319,4	4,8	340,1	202,0	398,8	361,5	346,3
1429	318,3	4,8	338,7	202,5	398,3	360,2	345,4
1430	316,9	4,8	338,2	202,1	398,2	358,9	344,6
1431	315,7	4,8	338,9	202,2	398,5	357,6	343,7
1432	314,3	4,8	336,9	200,9	397,2	356,3	342,9
1433	313,0	4,7	337,0	200,5	396,8	354,9	342,1
1434	312,3	4,7	336,2	201,5	396,3	353,6	341,2
1435	311,2	4,7	334,8	201,3	395,6	352,1	340,1
1436	309,7	4,7	333,8	200,9	394,6	350,7	339,1
1437	308,7	4,7	333,4	201,0	394,1	349,1	338,1
1438	307,7	4,7	331,4	200,0	393,3	347,8	337,0
1439	306,7	4,6	330,8	199,5	392,6	346,4	335,8
1440	306,1	4,7	329,0	199,3	392,3	345,1	334,8
1441	305,5	4,6	328,6	199,2	391,6	343,7	333,5
1442	304,4	4,6	327,6	198,5	391,1	342,6	333,1
1443	303,5	4,6	326,5	198,6	390,3	341,2	332,0
1444	302,3	4,5	326,8	198,9	390,3	339,9	330,1
1445	301,1	4,5	325,1	198,1	389,4	338,6	329,2
1446	299,9	4,5	322,9	197,2	388,4	337,4	328,6
1447	298,9	4,6	323,0	196,8	388,1	336,0	327,4
1448	297,5	4,5	320,6	196,8	387,2	334,8	326,2
1449	296,9	4,5	320,7	195,7	386,2	333,2	325,0
1450	295,8	4,5	319,9	196,4	385,7	331,8	324,2
1451	295,0	4,4	319,0	195,6	385,5	330,6	323,2
1452	293,9	4,4	317,1	194,2	384,5	329,2	322,1
1453	292,8	4,4	316,4	194,2	383,7	327,9	321,0
1454	292,5	4,4	315,3	194,7	383,2	326,6	320,0
1455	291,3	4,4	314,0	194,1	382,4	325,2	319,3
1456	290,8	4,4	313,2	193,3	381,9	324,0	318,0
1457	290,0	4,3	312,9	193,0	381,5	322,7	316,7
1458	289,4	4,4	311,1	192,7	380,5	321,5	315,8
1459	288,6	4,4	310,0	191,4	379,8	320,3	314,5
1460	287,9	4,3	309,5	192,8	379,5	319,2	313,1
1461	286,9	4,3	308,0	192,8	378,9	318,4	311,8
1462	286,0	4,3	308,3	191,3	378,0	317,1	311,3
1463	285,1	4,3	306,2	190,1	377,2	316,1	310,1
1464	284,0	4,3	305,2	190,7	376,6	314,8	309,2
1465	283,0	4,3	304,0	189,7	375,7	313,5	307,7
1466	282,0	4,2	303,1	189,8	374,9	312,6	306,7
1467	281,5	4,2	303,3	189,2	374,5	311,4	305,8
1468	280,5	4,2	301,9	189,0	373,8	310,3	304,9
1469	279,5	4,2	300,8	188,4	373,0	309,1	303,6
1470	278,8	4,2	300,0	188,8	372,5	308,1	302,7
1471	277,7	4,2	299,5	187,8	371,4	306,9	301,7
1472	276,9	4,2	298,5	187,6	370,5	305,6	300,4
1473	276,1	4,2	297,8	187,6	369,9	304,5	299,5
1474	274,9	4,1	296,9	186,6	369,2	303,3	298,4
1475	273,9	4,1	296,4	186,4	368,9	302,2	297,2
1476	273,0	4,1	295,5	185,9	368,2	301,0	296,0
1477	271,6	4,1	294,2	186,1	367,1	299,8	294,8
1478	271,0	4,1	293,3	185,5	366,3	298,7	294,1
1479	270,2	4,1	292,5	185,4	365,9	297,5	293,2
1480	269,5	4,1	290,9	184,7	365,4	296,2	291,8
1481	268,3	4,1	289,6	184,7	364,5	295,0	290,5
1482	267,6	4,1	288,7	184,1	364,0	293,9	289,7
1483	266,6	4,1	288,0	184,1	363,1	292,7	288,5
1484	265,8	4,0	286,3	183,2	362,6	291,5	287,1
1485	264,7	4,0	285,1	183,3	362,0	290,4	286,1
1486	264,0	4,0	285,0	183,3	361,9	289,2	284,9
1487	263,0	4,0	283,7	182,8	361,1	288,0	284,0
1488	262,6	4,0	283,2	182,9	360,6	286,9	283,0
1489	261,9	4,0	282,0	182,9	360,1	285,7	282,2

1490	261,0	4,0	280,8	182,4	359,5	284,5	281,2	3	19-20-20
1491	260,3	4,0	279,7	181,4	358,8	283,4	280,4		
1492	259,7	4,0	278,6	181,5	358,2	282,3	279,4		
1493	258,9	3,9	277,4	181,3	357,9	281,3	278,2		
1494	314,0	6,9	305,5	240,8	296,2	315,6	309,7		
1495	315,8	6,8	304,4	228,0	299,8	313,9	310,0		
1496	313,4	6,7	303,1	221,5	302,0	312,1	309,8		
1497	314,1	6,6	303,8	218,0	303,8	310,7	309,1		
1498	306,3	6,6	303,8	215,3	304,9	309,3	308,6		
1499	300,7	6,5	302,3	213,1	306,2	307,7	307,2		
1500	305,6	6,4	303,2	210,1	306,6	306,3	306,6		
1501	314,2	6,3	303,0	208,1	307,0	305,2	305,5		
1502	308,4	6,3	301,7	206,4	308,5	304,5	304,3		
1503	304,5	6,2	303,0	205,0	309,5	303,8	302,9		
1504	303,9	6,1	302,1	202,6	309,1	303,1	301,5		
1505	303,5	6,1	299,9	201,6	310,0	302,5	299,8		
1506	297,6	6,1	300,6	201,0	311,1	301,7	298,4		
1507	298,5	6,0	299,4	198,9	310,9	300,8	296,4		
1508	300,7	5,9	298,3	197,0	310,6	299,8	295,0		
1509	307,7	5,8	298,6	195,5	311,6	298,8	293,2		
1510	379,2	5,7	298,1	190,8	311,8	299,3	291,0		
1511	480,5	5,5	296,4	187,5	312,2	308,1	288,1		
1512	521,5	5,3	295,9	185,1	313,1	329,8	285,8		
1513	539,4	5,1	296,0	183,3	312,4	361,2	284,1		
1514	541,9	4,9	296,8	182,3	313,9	397,5	283,7		
1515	542,0	4,8	297,9	181,2	314,2	431,9	283,1		
1516	542,3	4,6	300,7	180,9	314,9	462,4	282,7		
1517	544,3	4,5	302,0	179,8	314,8	488,4	283,8		
1518	545,1	4,3	303,7	178,2	313,8	510,8	285,3		
1519	546,9	4,2	308,1	178,5	314,9	530,6	287,0		
1520	546,7	4,0	311,4	179,3	315,0	547,2	289,2		
1521	545,4	3,9	315,0	179,9	315,5	561,4	292,3		
1522	545,3	3,7	318,5	179,0	315,9	573,8	295,6		
1523	543,6	3,6	321,3	178,4	315,4	583,6	299,5		
1524	541,7	3,5	325,3	178,1	315,9	592,4	303,0		
1525	539,7	3,4	327,6	177,6	316,1	599,0	307,4		
1526	538,9	3,3	331,0	178,9	316,4	605,2	311,0		
1527	537,6	3,1	335,2	179,0	317,2	610,0	315,2		
1528	536,1	3,0	340,1	179,8	318,0	614,5	318,5		
1529	533,7	2,9	343,0	180,0	318,0	617,5	322,1		
1530	532,1	2,8	346,1	180,8	319,1	619,2	325,3		
1531	532,0	2,7	349,7	182,1	320,5	620,0	327,9		
1532	530,8	2,6	353,1	182,9	321,1	620,7	331,4		
1533	529,2	2,5	355,7	183,7	321,9	621,3	333,4		
1534	527,6	2,3	359,5	184,1	322,6	621,4	337,1		
1535	525,9	2,2	360,5	185,6	323,4	621,4	340,2		
1536	523,9	2,2	362,7	186,0	324,6	621,4	343,8		
1537	522,0	2,1	366,4	187,2	325,2	621,0	346,1		
1538	519,8	2,0	367,9	187,8	325,8	620,1	348,7		
1539	517,3	1,9	369,2	189,2	326,9	618,8	351,7		
1540	515,0	1,8	372,0	189,4	327,5	617,7	353,4		
1541	513,0	1,7	373,0	191,0	328,4	616,3	356,3		
1542	511,4	1,6	374,8	191,2	329,1	614,6	358,4		
1543	510,3	1,5	376,6	191,9	330,0	613,4	360,1		
1544	508,9	1,4	377,2	193,3	330,7	611,5	362,5		
1545	507,4	1,4	379,9	193,1	331,7	611,0	362,8		
1546	504,1	1,3	380,9	194,0	331,8	609,6	365,1		
1547	498,3	1,2	380,7	195,3	332,9	608,1	367,1		
1548	491,7	1,1	382,5	195,3	333,8	605,7	368,2		
1549	486,4	1,1	384,2	196,9	334,0	602,0	369,1		
1550	481,5	1,0	383,9	197,3	335,2	597,5	371,2		
1551	477,8	1,0	384,9	198,3	336,0	592,6	372,1		
1552	473,7	0,9	385,1	198,7	336,7	587,4	372,9		
1553	469,9	0,9	385,3	199,4	337,6	582,3	373,2		
1554	466,6	0,8	385,2	200,1	337,9	576,8	374,0		
1555	463,8	0,8	385,8	200,4	338,7	571,8	375,6		
1556	460,6	0,7	386,0	201,1	339,5	566,9	376,3		
1557	457,0	0,7	386,3	203,0	340,6	562,0	376,1		
1558	453,5	0,7	385,1	202,5	341,0	557,2	376,0		
1559	453,9	0,6	385,7	202,9	341,9	552,1	375,9		
1560	443,9	9,5	385,1	219,3	340,4	548,2	376,1	3	19-20-21
1561	410,6	9,4	386,1	208,0	343,8	540,5	376,1		
1562	409,3	9,3	384,3	206,9	344,0	528,8	376,4		
1563	431,4	9,2	383,9	207,0	345,1	518,1	376,2		
1564	444,5	9,0	383,7	206,1	345,0	510,8	375,8		
1565	481,1	8,9	380,1	205,0	345,2	507,5	374,9		
1566	494,5	8,7	377,9	204,1	344,9	508,7	372,7		
1567	506,7	8,6	375,5	203,8	344,8	513,1	370,4		
1568	515,6	8,4	374,8	204,2	344,0	519,1	367,8		
1569	544,3	8,2	371,5	203,4	343,1	526,3	364,5		
1570	559,0	8,0	370,2	202,6	342,6	537,0	360,9		
1571	559,5	7,8	369,7	202,2	341,8	549,7	357,7		
1572	560,3	7,7	368,7	202,3	340,6	562,9	354,8		

1573	562,3	7,5	368,6	202,0	339,7	575,2	353,5
1574	564,1	7,4	370,0	201,3	338,5	587,3	352,4
1575	568,4	7,2	370,2	201,7	337,9	598,8	352,2
1576	571,3	7,0	372,3	200,6	336,7	609,1	351,7
1577	577,0	6,8	373,8	200,3	335,7	618,5	351,8
1578	580,1	6,7	375,2	200,2	334,9	628,5	352,2
1579	579,9	6,5	377,1	200,8	334,8	637,8	352,7
1580	580,3	6,3	379,3	199,8	333,7	646,2	353,8
1581	580,7	6,2	380,4	200,3	333,1	654,2	354,4
1582	582,5	6,0	382,6	199,5	332,4	661,0	355,6
1583	583,2	5,8	385,2	199,6	332,0	667,6	357,6
1584	582,7	5,7	386,4	199,2	331,3	673,6	359,7
1585	583,5	5,6	388,6	199,3	330,9	679,3	360,8
1586	585,8	5,5	390,6	199,1	330,6	684,5	362,0
1587	585,7	5,3	392,4	199,9	330,4	690,1	364,2
1588	585,7	5,1	394,7	199,5	330,2	694,9	364,5
1589	586,4	5,0	395,7	199,9	329,9	699,5	365,9
1590	585,2	4,8	397,9	199,7	329,6	703,7	368,3
1591	584,1	4,7	400,0	200,7	328,6	707,0	370,7
1592	581,7	4,6	401,2	200,4	329,5	709,6	371,5
1593	579,1	4,4	403,1	201,1	329,0	711,2	373,0
1594	578,2	4,3	405,0	201,4	328,9	711,7	374,7
1595	575,7	4,2	407,3	201,5	328,7	711,9	375,5
1596	574,3	4,1	409,0	201,0	328,6	712,0	377,6
1597	571,9	3,9	410,1	202,0	329,2	711,8	377,3
1598	569,9	3,8	412,0	201,4	327,8	711,0	378,7
1599	567,2	3,7	413,4	202,4	328,6	709,8	379,1
1600	565,1	3,6	414,8	202,7	328,4	708,5	380,7
1601	563,2	3,5	416,0	202,8	328,8	707,3	380,5
1602	561,3	3,4	417,5	203,9	329,0	705,6	382,6
1603	558,3	3,3	418,8	203,1	328,5	703,8	384,9
1604	555,3	3,1	418,3	204,2	328,8	701,8	385,8
1605	552,2	3,0	419,7	204,4	329,1	699,3	386,9
1606	549,0	2,9	419,9	205,1	327,9	696,7	388,8
1607	546,0	2,9	422,5	204,8	329,6	694,3	387,7
1608	542,7	2,7	423,5	205,7	329,9	691,2	389,6
1609	538,4	2,7	423,4	206,1	330,4	688,1	390,2
1610	534,2	2,6	422,9	205,6	330,0	685,1	390,2
1611	528,5	2,5	423,0	207,0	330,1	680,8	391,5
1612	522,3	2,4	422,4	207,6	330,6	675,2	392,3
1613	517,0	2,4	423,0	207,8	330,7	668,6	392,8
1614	512,9	2,3	422,7	208,4	331,1	661,7	393,8
1615	509,3	2,2	422,3	209,1	331,2	654,8	394,6
1616	506,4	2,1	421,4	209,1	331,6	648,0	394,2
1617	503,8	2,1	421,7	209,6	332,0	642,0	394,4
1618	501,4	2,0	420,4	209,7	332,1	636,3	394,7
1619	498,2	1,9	419,6	211,3	332,2	631,1	394,7
1620	495,2	1,9	419,7	211,0	332,5	626,4	393,8
1621	491,6	1,9	419,4	211,5	332,8	621,5	393,1
1622	487,0	1,8	419,7	212,3	332,4	616,2	393,9
1623	482,6	1,7	418,4	212,1	333,0	610,4	392,9
1624	478,3	1,7	418,3	213,2	333,4	604,3	394,0
1625	474,3	1,6	415,7	212,4	332,6	598,1	394,4
1626	470,1	1,6	415,2	213,7	333,5	591,6	393,3
1627	464,1	1,6	413,8	213,7	333,8	585,2	393,8
1628	457,1	1,5	414,3	214,8	334,6	578,4	392,6
1629	450,2	1,5	412,6	215,1	333,7	571,4	393,9
1630	443,4	1,5	411,3	215,1	334,2	564,0	393,0
1631	433,7	1,5	411,5	215,1	334,3	556,5	392,5
1632	425,9	1,4	410,0	216,7	335,4	548,3	390,4
1633	420,2	1,4	408,5	216,3	334,5	540,0	390,2
1634	414,6	1,4	406,6	216,7	335,6	531,9	389,6
1635	409,4	1,4	405,4	217,2	335,6	524,2	388,9
1636	404,9	1,3	404,0	217,0	335,7	517,2	387,2
1637	400,3	1,3	403,9	217,5	336,1	510,3	386,6
1638	395,7	1,3	402,1	217,7	337,0	503,5	385,7
1639	390,9	1,3	400,1	218,2	337,0	497,0	383,5
1640	386,9	1,3	398,6	217,4	337,2	490,7	383,0
1641	383,3	1,2	397,6	217,5	337,7	484,7	382,8
1642	380,7	1,2	395,4	217,2	337,8	479,1	382,0
1643	377,9	1,2	392,5	217,3	338,5	473,8	380,1
1644	374,5	1,2	390,1	217,0	338,4	468,5	379,3
1645	372,5	1,2	389,4	218,3	338,8	463,6	377,6
1646	370,5	1,1	388,1	217,1	338,9	458,9	376,4
1647	368,7	1,1	385,6	216,7	339,0	454,5	374,7
1648	366,5	1,1	383,7	217,0	338,7	450,2	375,5
1649	364,9	1,1	383,0	216,3	338,3	446,3	374,7
1650	362,5	1,0	380,4	215,7	338,6	442,7	374,1
1651	361,2	1,0	378,4	215,2	338,6	439,0	373,6
1652	359,8	1,0	377,4	215,7	339,4	435,8	371,0
1653	358,4	1,0	375,7	215,6	339,4	432,6	370,7
1654	356,9	1,0	373,2	213,9	338,9	429,5	369,8
1655	355,2	1,0	371,3	213,7	338,8	426,6	369,8

1656	354,0	0,9	370,5	213,3	339,1	423,7	367,3
1657	351,5	0,9	369,9	212,9	338,2	421,1	367,5
1658	349,0	0,9	368,7	213,4	339,3	418,7	365,5
1659	347,1	0,9	366,4	212,4	338,9	416,2	366,3
1660	345,6	0,8	366,2	212,0	338,7	413,2	364,9
1661	344,0	0,8	365,0	211,1	338,5	410,7	364,4
1662	342,4	0,8	364,5	212,1	338,7	408,3	363,2
1663	340,6	0,8	362,1	210,6	338,3	405,8	362,2
1664	339,6	0,8	361,1	209,7	338,4	403,3	360,3
1665	338,8	0,8	359,7	209,7	338,3	401,1	360,4
1666	337,6	0,8	357,7	209,3	338,4	398,9	360,7
1667	336,4	0,7	356,1	209,6	338,3	396,7	360,1
1668	335,4	0,7	354,1	208,5	338,1	394,7	359,7
1669	333,6	0,7	353,7	208,5	338,2	392,6	357,6
1670	332,5	0,7	352,2	207,6	337,8	390,6	357,1
1671	331,3	0,6	352,5	207,6	337,4	388,5	356,5
1672	330,0	0,6	350,6	207,2	337,5	386,5	355,0
1673	329,1	0,6	349,8	206,5	337,3	384,5	353,9
1674	327,8	0,6	350,0	206,6	337,0	382,6	353,1
1675	326,5	0,6	349,8	206,3	337,3	380,9	351,5
1676	325,0	0,6	346,1	206,3	336,2	379,2	350,7
1677	324,3	0,5	345,3	205,5	336,3	377,4	349,6
1678	322,8	0,5	344,8	205,8	336,3	375,4	347,9
1679	321,4	0,5	343,1	204,3	335,2	373,8	347,2
1680	320,3	0,5	341,5	204,4	335,3	372,1	346,6
1681	319,6	0,5	340,2	203,6	334,9	370,4	345,9
1682	318,9	0,5	340,2	202,9	332,7	368,8	345,2
1683	317,7	0,4	340,1	203,4	334,3	367,1	342,9
1684	316,5	0,4	338,8	202,5	333,4	365,3	342,7
1685	315,7	0,4	336,6	202,7	333,6	363,7	341,1
1686	314,9	0,4	336,1	202,2	333,2	362,3	341,3
1687	313,7	0,4	334,3	202,1	332,8	360,9	339,5
1688	312,8	0,4	333,8	201,3	332,2	359,3	339,1
1689	312,1	0,4	333,3	201,4	332,4	357,9	336,9
1690	311,1	0,3	332,1	201,3	332,4	356,4	335,9
1691	310,3	0,3	330,0	200,6	330,8	355,0	335,6
1692	309,8	0,3	329,4	199,7	330,9	353,6	335,0
1693	309,1	0,3	327,1	199,3	330,4	352,2	334,1
1694	308,5	0,3	328,6	199,2	330,3	351,0	332,8
1695	307,8	0,2	325,9	199,3	329,8	349,8	332,6
1696	306,8	0,2	325,8	199,3	329,0	348,4	332,2
1697	306,5	0,2	323,6	198,2	329,1	347,3	330,0
1698	305,5	0,2	324,2	197,7	328,1	346,1	329,2
1699	304,6	0,2	322,2	198,2	328,1	344,7	328,5
1700	304,1	0,1	321,5	197,8	328,0	343,6	326,1
1701	303,0	0,1	320,4	197,2	327,6	342,6	325,8
1702	302,7	0,1	318,1	196,4	327,1	341,4	324,6
1703	302,1	0,1	316,9	196,2	326,2	340,2	325,0
1704	301,1	0,1	315,8	196,0	326,0	339,0	324,2
1705	300,6	0,1	314,8	196,0	325,8	338,0	323,6
1706	281,3	13,5	315,9	200,8	323,5	337,0	323,8
1707	274,8	13,4	314,9	198,5	324,5	333,9	323,7
1708	269,3	13,4	313,3	198,0	324,2	329,7	322,4
1709	264,5	13,4	311,8	198,6	324,0	325,1	320,8
1710	260,3	13,4	309,2	197,9	323,4	319,9	319,0
1711	256,3	13,3	308,7	197,2	323,6	314,7	315,8
1712	253,0	13,3	306,6	198,0	322,4	309,6	313,8
1713	250,2	13,2	303,1	197,7	321,3	304,4	311,1
1714	248,2	13,1	300,5	197,2	320,4	299,5	308,3
1715	246,3	13,1	297,8	196,7	319,3	294,7	305,0
1716	244,5	13,1	295,3	196,0	318,1	290,1	301,5
1717	243,3	13,0	292,6	195,2	316,8	285,7	298,5
1718	242,2	13,0	290,1	194,4	315,5	281,7	295,1
1719	241,1	12,9	287,8	193,9	314,2	277,8	291,4
1720	240,1	12,8	287,0	195,2	313,4	274,2	287,6
1721	239,4	12,8	284,6	193,6	312,5	270,8	284,0
1722	238,5	12,7	281,8	192,5	310,6	267,4	280,2
1723	237,6	12,7	279,2	191,2	308,2	264,5	276,7
1724	237,0	12,6	277,6	191,7	307,7	261,6	273,9
1725	236,4	12,6	275,4	190,9	306,2	259,1	270,8
1726	236,0	12,5	272,9	189,7	304,1	256,6	268,5
1727	235,7	12,4	270,5	189,2	302,5	254,3	265,7
1728	235,5	12,4	268,8	189,2	301,3	252,1	263,1
1729	235,0	12,3	265,5	186,1	298,5	250,3	260,5
1730	234,7	12,3	264,6	185,9	297,4	248,4	258,1
1731	234,5	12,2	262,8	185,5	296,8	246,6	256,2
1732	234,2	12,1	261,6	184,4	295,2	245,0	254,1
1733	234,4	12,1	260,6	184,6	294,4	243,6	253,1
1734	234,3	12,0	258,9	184,0	293,0	242,2	251,1
1735	234,1	11,9	257,6	184,1	291,8	240,8	249,3
1736	234,1	11,9	255,5	181,7	289,4	239,7	248,1
1737	234,1	11,8	254,4	181,3	289,0	238,6	247,2
1738	234,2	11,8	253,5	181,3	288,0	237,6	246,0

1739	234,3	11,7	252,6	181,1	286,9	236,7	244,3
1740	234,6	11,6	251,8	180,7	285,8	236,0	243,3
1741	235,1	11,6	250,9	179,5	284,8	235,2	242,9
1742	235,2	11,5	249,5	179,3	283,8	234,5	242,3
1743	235,7	11,4	248,5	179,1	282,5	233,8	241,1
1744	236,0	11,4	248,2	178,0	281,8	233,4	240,3
1745	236,4	11,3	247,6	178,3	281,0	232,9	240,0
1746	236,9	11,2	246,8	177,5	280,1	232,6	240,3
1747	237,2	11,1	246,2	177,0	279,2	232,1	239,8
1748	237,5	11,1	245,6	177,4	278,3	231,8	239,3
1749	237,7	11,0	244,7	176,5	277,4	231,6	238,9
1750	237,6	10,9	243,9	175,9	276,1	231,3	238,2
1751	237,6	10,9	243,8	175,5	275,5	231,1	237,9
1752	237,8	10,8	243,7	175,4	275,0	230,9	238,2
1753	237,8	10,7	242,9	174,8	273,7	230,8	237,5
1754	237,9	10,6	242,2	172,6	272,3	230,6	237,6
1755	238,5	10,6	241,2	172,3	271,7	230,5	237,2
1756	238,7	10,5	241,2	171,7	270,9	230,4	237,2
1757	239,3	10,4	241,1	171,9	270,1	230,3	237,6
1758	240,0	10,4	241,1	171,4	269,5	230,3	237,8
1759	240,6	10,4	241,1	171,2	269,0	230,3	237,9
1760	241,2	10,3	240,4	170,9	268,7	230,4	238,2
1761	242,0	10,2	240,6	171,3	268,5	230,5	239,1
1762	242,7	10,1	239,9	170,7	268,0	230,8	239,8
1763	243,6	10,0	239,8	170,2	267,7	230,9	239,9
1764	244,4	10,0	239,5	169,8	267,4	231,3	240,1
1765	245,3	9,9	239,3	169,6	266,9	231,7	240,9
1766	246,6	9,8	239,0	169,7	266,6	232,0	241,2
1767	247,5	9,7	238,6	169,5	266,6	232,4	241,6
1768	248,3	9,7	238,5	169,0	266,3	232,9	242,3
1769	249,3	9,6	238,0	168,9	266,1	233,5	242,8
1770	250,3	9,5	237,9	168,8	265,7	234,0	243,6
1771	251,1	9,4	237,7	168,8	265,6	234,6	244,3
1772	251,9	9,4	237,7	168,6	265,5	235,2	245,0
1773	252,8	9,3	237,3	168,4	265,3	235,9	245,7
1774	252,9	9,2	237,1	168,9	265,1	236,5	246,2
1775	253,4	9,1	236,9	168,8	265,1	237,2	247,0
1776	253,8	9,0	237,1	168,4	264,8	237,8	247,8
1777	254,3	9,0	236,7	168,5	264,5	238,4	248,2
1778	255,0	8,9	236,7	168,4	264,1	239,1	249,0
1779	255,2	8,8	236,3	168,5	264,2	239,6	249,6
1780	256,0	8,8	236,1	168,3	263,8	240,1	249,8
1781	256,5	8,7	235,9	168,5	263,8	240,7	249,9
1782	257,2	8,6	235,9	168,5	263,4	241,1	249,9
1783	257,7	8,5	235,5	168,7	263,3	241,7	250,4
1784	271,9	8,4	235,8	167,3	262,9	242,4	250,4
1785	412,3	8,2	235,7	163,5	262,7	247,3	250,0
1786	518,5	8,0	235,4	161,4	262,3	264,0	249,6
1787	579,2	7,7	235,2	160,4	261,7	293,5	250,0
1788	594,2	7,5	235,5	160,1	261,4	332,2	251,7
1789	593,5	7,3	236,7	160,0	261,2	374,8	254,7
1790	601,6	7,1	239,7	160,4	260,6	417,4	258,7
1791	610,9	6,9	242,9	160,7	260,6	460,9	263,9
1792	608,3	6,7	247,2	161,9	260,6	503,2	269,3
1793	601,9	6,5	251,7	162,3	260,7	540,1	275,5
1794	593,6	6,4	257,3	163,1	260,8	570,5	281,8
1795	586,4	6,2	262,9	164,2	261,2	593,4	288,4
1796	581,0	6,0	269,1	165,5	261,6	610,3	295,0
1797	575,1	5,9	275,4	166,6	262,1	622,2	301,4
1798	569,3	5,8	281,6	167,7	263,0	630,5	307,7
1799	563,2	5,6	288,2	168,7	263,6	636,0	313,5
1800	558,7	5,4	293,8	169,7	264,5	639,0	319,2
1801	553,8	5,4	299,8	170,9	265,3	640,6	324,9
1802	549,8	5,3	305,2	172,1	266,1	640,8	330,1
1803	545,0	5,1	309,9	173,5	267,0	640,0	335,0
1804	540,3	5,0	314,9	174,6	267,8	638,4	339,3
1805	536,4	4,9	319,0	175,6	268,7	635,8	343,9
1806	532,8	4,7	323,3	176,5	269,4	632,4	347,7
1807	530,5	4,7	326,9	177,6	270,4	629,2	351,4
1808	527,7	4,5	330,5	179,1	271,2	625,9	354,7
1809	526,0	4,4	333,8	180,3	272,0	622,8	357,7
1810	523,8	4,3	336,4	181,4	272,8	620,2	360,6
1811	522,0	4,2	338,8	182,1	273,4	617,4	363,2
1812	520,4	4,1	341,4	182,8	274,3	614,9	365,7
1813	519,7	4,0	343,5	183,9	275,0	612,1	368,1
1814	518,6	3,9	345,3	184,9	275,9	610,3	369,9
1815	517,4	3,8	348,5	185,5	276,5	608,7	372,1
1816	516,5	3,7	349,3	186,2	277,3	606,8	373,8
1817	515,4	3,6	351,3	186,9	278,0	604,8	375,3
1818	514,5	3,6	352,6	188,0	278,7	603,5	376,6
1819	514,8	3,5	353,5	188,8	279,4	602,3	378,4
1820	515,4	3,3	354,8	189,2	280,2	601,1	379,6
1821	516,0	3,3	356,0	189,9	280,5	600,6	380,4

1822	514,1	3,1	356,6	191,0	281,4	600,4	381,3
1823	512,1	3,0	358,0	191,4	282,1	599,8	383,0
1824	511,4	3,0	359,0	192,1	282,9	599,1	384,2
1825	510,7	2,9	359,7	192,9	283,6	598,1	385,1
1826	510,7	2,8	360,8	193,3	284,3	597,2	386,5
1827	510,2	2,7	361,7	193,7	284,9	596,5	387,1
1828	510,9	2,6	362,1	195,1	285,6	596,0	387,4
1829	511,4	2,6	362,9	195,1	286,4	596,4	388,2
1830	512,1	2,5	363,7	195,6	286,7	596,6	388,6
1831	511,9	2,4	364,6	195,9	287,4	597,4	388,9
1832	510,0	2,3	364,7	196,9	287,8	598,4	388,9
1833	504,8	2,3	365,5	197,7	288,5	598,6	389,1
1834	499,4	2,2	365,8	197,5	289,0	597,7	389,6
1835	494,7	2,1	365,8	198,3	289,4	595,3	389,4
1836	491,8	2,1	366,4	198,9	289,9	592,3	389,4
1837	489,8	2,0	366,7	199,6	290,1	588,9	389,6
1838	485,8	2,0	366,6	199,6	290,6	585,5	389,4
1839	481,6	1,9	367,2	200,0	291,0	581,5	390,0
1840	474,4	1,9	367,4	200,8	291,2	576,6	389,3
1841	465,9	1,8	367,1	201,6	291,5	571,0	388,3
1842	459,2	1,8	367,2	201,8	291,9	564,6	388,3
1843	453,4	1,8	366,8	202,7	292,1	557,8	387,0
1844	449,4	1,7	366,7	202,7	292,2	551,1	386,7
1845	445,9	1,7	365,7	203,2	292,5	544,3	385,3
1846	442,9	1,6	365,9	203,4	292,7	538,0	384,7
1847	439,7	1,6	364,9	203,6	292,9	532,3	383,4
1848	435,7	1,6	364,1	204,1	292,9	526,9	382,4
1849	432,4	1,5	363,2	204,5	293,0	521,8	380,9
1850	428,8	1,5	362,6	204,4	293,1	516,7	379,8
1851	425,4	1,5	362,0	204,5	293,2	511,6	378,5
1852	422,4	1,4	361,0	204,6	293,2	506,6	377,2
1853	419,3	1,4	361,1	204,6	293,2	501,8	375,5
1854	416,7	1,4	359,8	205,1	293,1	496,9	374,2
1855	414,1	1,4	360,1	204,9	293,4	492,3	372,9
1856	409,8	1,3	358,7	205,3	293,4	487,7	371,3
1857	402,6	1,3	358,0	205,0	293,4	482,9	369,8
1858	394,2	1,3	357,8	205,4	293,5	477,7	368,6
1859	387,0	1,3	357,9	205,8	293,4	471,9	366,6
1860	381,5	1,3	356,9	206,1	293,5	465,9	365,1
1861	377,2	1,3	356,5	206,3	293,5	459,8	364,0
1862	373,2	1,2	355,4	205,3	293,3	453,6	362,8
1863	369,5	1,2	354,9	205,7	293,6	447,6	360,8
1864	366,2	1,2	353,6	206,0	293,8	441,9	359,5
1865	362,8	1,1	353,1	205,8	293,6	436,2	358,1
1866	360,0	1,1	351,7	206,1	293,5	430,9	355,8
1867	357,1	1,1	351,3	206,3	293,5	425,8	354,5
1868	354,7	1,1	350,1	206,0	293,6	421,0	353,2
1869	352,0	1,1	349,0	205,8	293,4	416,3	351,6
1870	349,5	1,1	347,7	205,2	293,4	411,8	349,8
1871	347,0	1,0	347,3	205,2	293,0	407,4	348,0
1872	345,0	1,1	345,6	205,1	293,4	403,4	346,4
1873	343,2	1,1	344,7	205,1	293,2	399,5	345,2
1874	341,5	1,0	343,4	204,8	293,0	395,8	343,6
1875	340,4	1,0	342,3	204,5	293,1	392,4	341,9
1876	339,1	1,0	341,7	204,3	292,9	389,1	340,5
1877	338,1	0,9	340,1	204,0	292,8	386,1	338,9
1878	336,9	0,9	338,9	203,4	292,6	383,1	337,5
1879	336,0	0,9	338,2	203,3	292,6	380,4	335,8
1880	334,9	0,9	336,7	202,5	292,4	377,9	334,8
1881	333,7	0,9	335,9	202,8	292,4	375,5	332,9
1882	332,3	0,9	334,6	202,4	292,3	373,2	331,8
1883	331,1	0,9	333,6	202,1	291,7	370,9	330,7
1884	329,6	0,8	332,6	201,9	292,0	368,9	329,0
1885	328,2	0,8	331,4	201,7	291,6	366,9	328,4
1886	326,2	0,8	330,4	201,4	291,4	364,8	327,0
1887	324,7	0,8	329,2	201,2	291,5	362,6	325,8
1888	322,7	0,8	328,3	201,0	291,4	360,5	324,4
1889	321,3	0,8	327,0	200,4	291,2	358,6	323,3
1890	319,9	0,7	325,9	200,1	290,9	356,4	322,3
1891	318,7	0,7	324,9	200,0	291,0	354,6	321,1
1892	317,2	0,7	323,8	199,8	291,0	352,5	320,0
1893	315,6	0,7	322,8	199,5	290,8	350,5	319,1
1894	313,1	0,7	321,8	199,2	290,8	348,5	318,2
1895	311,7	0,7	320,5	199,5	290,7	346,8	316,9
1896	310,1	0,6	319,4	198,8	290,5	345,1	315,4
1897	309,0	0,7	318,4	198,5	290,4	343,5	314,6
1898	307,8	0,6	317,2	198,0	290,4	341,6	313,4
1899	306,6	0,6	316,1	197,7	290,2	340,0	312,6
1900	305,2	0,6	314,9	197,4	290,2	338,3	311,7
1901	304,4	0,6	313,8	197,3	290,1	336,5	311,2
1902	303,1	0,6	312,7	197,0	289,8	335,1	310,9
1903	302,1	0,6	311,8	197,0	289,8	333,5	310,2
1904	300,9	0,5	310,5	196,1	289,8	332,0	309,7

1905	300,0	0,5	309,6	196,2	289,5	330,4	308,6
1906	299,0	0,5	308,5	195,9	289,6	328,8	308,5
1907	297,8	0,5	307,1	195,3	289,6	327,4	308,3
1908	296,9	0,5	306,0	195,1	289,5	325,8	307,9
1909	295,7	0,5	305,0	194,8	289,8	324,6	307,5
1910	295,0	0,4	303,8	194,5	289,3	323,0	307,3
1911	294,3	0,4	302,7	193,7	289,4	321,7	306,6
1912	293,4	0,4	301,7	193,5	289,4	320,4	306,3
1913	292,5	0,5	300,4	193,2	289,6	319,2	305,5
1914	290,9	0,4	299,6	192,4	289,3	317,8	305,3
1915	290,2	0,4	298,4	192,7	289,4	316,4	304,8
1916	289,2	0,4	297,7	191,9	289,2	315,2	304,4
1917	288,0	0,3	296,4	191,8	289,3	313,8	304,0
1918	287,3	0,4	295,4	191,6	289,3	312,5	303,4
1919	286,2	0,4	294,5	190,9	289,4	311,3	303,2
1920	285,2	0,3	293,4	190,9	289,3	310,1	302,6
1921	284,2	0,3	292,3	190,6	289,3	308,8	302,0
1922	283,5	0,3	291,4	190,6	289,0	307,8	301,5
1923	282,8	0,3	290,5	189,5	289,0	306,5	300,8
1924	281,9	0,3	289,4	189,1	289,1	305,2	300,2
1925	280,8	0,2	288,4	188,6	288,8	304,0	299,7
1926	280,3	0,2	287,4	188,8	288,9	302,9	299,0
1927	279,3	0,2	286,6	188,8	289,0	301,9	298,4
1928	278,4	0,2	285,7	188,2	288,8	300,8	297,6
1929	277,8	0,2	284,8	187,7	288,8	299,7	296,7
1930	276,5	0,2	284,0	187,1	288,7	298,8	295,9
1931	275,4	0,2	283,1	187,4	288,7	297,9	295,3
1932	274,2	0,2	282,4	186,5	288,5	296,7	294,4
1933	273,5	0,2	281,6	186,3	288,5	295,8	293,8
1934	272,6	0,1	280,9	186,0	288,4	294,8	293,0
1935	271,4	0,1	280,1	185,8	288,2	293,7	292,2
1936	270,4	0,1	279,4	185,1	288,2	292,8	291,6
1937	269,7	0,1	278,7	185,4	288,2	291,7	290,6
1938	269,1	0,1	277,8	184,6	288,1	290,7	290,1
1939	268,1	0,1	277,2	184,0	287,9	289,7	289,1
1940	267,7	0,1	276,6	183,8	287,7	288,8	288,1
1941	266,9	0,1	275,7	183,6	287,6	287,9	287,6
1942	169,7	7,7	72,4	71,1	72,1	79,9	72,2
1943	172,8	7,7	73,0	71,1	72,2	84,2	72,8
1944	171,8	7,6	73,9	71,1	72,5	88,7	73,5
1945	177,1	7,6	75,0	71,2	72,9	93,1	74,4
1946	175,2	7,5	76,2	71,3	73,4	97,3	75,4
1947	181,8	7,4	77,5	71,4	74,2	101,5	76,4
1948	196,5	7,3	78,9	71,6	75,1	105,5	77,6
1949	206,9	7,3	80,4	71,9	76,2	109,8	79,0
1950	216,9	7,2	82,0	72,0	77,4	114,5	80,7
1951	220,8	7,1	83,7	72,3	78,9	119,3	82,7
1952	222,7	7,1	85,5	72,7	80,6	124,2	84,9
1953	232,8	7,0	87,3	73,0	82,5	129,0	87,4
1954	258,6	6,9	89,2	73,4	84,5	133,8	90,1
1955	267,4	6,8	91,1	73,8	86,6	139,3	92,9
1956	278,0	6,7	93,0	74,2	88,8	145,5	96,0
1957	302,0	6,6	95,1	74,9	91,4	152,4	99,5
1958	379,8	6,4	97,1	75,3	93,9	161,4	103,1
1959	408,1	6,3	99,3	75,7	96,4	175,5	106,8
1960	386,7	6,2	101,6	76,6	99,0	193,1	111,5
1961	366,0	6,1	104,1	77,5	101,7	209,7	116,6
1962	333,6	6,1	106,7	78,5	104,6	223,1	122,3
1963	312,1	6,0	109,2	79,6	107,4	232,5	128,2
1964	289,3	6,0	111,0	82,7	109,8	238,5	134,0
1965	330,9	5,8	113,3	82,9	112,5	242,3	139,9
1966	335,2	5,7	115,6	83,5	115,5	245,2	145,5
1967	343,4	5,7	118,1	84,5	118,7	248,7	151,1
1968	328,1	5,6	121,0	85,8	121,3	252,7	156,3
1969	301,1	5,5	124,2	87,2	124,5	255,7	161,5
1970	282,5	5,5	127,2	90,3	126,6	257,0	166,1
1971	299,4	5,4	129,4	94,2	128,5	255,9	169,7
1972	330,3	8,4	131,9	98,0	130,8	254,3	174,0
1973	336,9	8,3	134,1	100,1	132,5	252,5	177,9
1974	370,8	8,1	136,5	102,4	135,0	250,5	180,4
1975	411,8	7,9	139,2	104,6	137,0	250,3	183,9
1976	423,5	7,7	143,1	99,6	140,1	252,8	186,2
1977	430,9	7,5	147,9	98,8	143,4	260,0	187,4
1978	440,0	7,4	153,1	98,9	146,8	271,4	188,7
1979	448,5	7,2	158,4	99,4	149,8	285,1	189,5
1980	476,9	7,0	163,7	99,9	152,9	301,1	190,4
1981	507,0	6,8	169,0	100,9	156,2	320,8	190,9
1982	533,9	6,6	174,4	101,6	159,1	345,7	191,2
1983	562,4	6,5	179,6	102,4	162,0	374,2	191,6
1984	603,3	6,2	185,1	103,5	164,9	407,0	192,0
1985	634,4	5,9	190,7	104,6	167,5	444,4	192,2
1986	648,1	5,6	196,8	106,1	170,1	481,9	192,8
1987	650,9	5,4	203,2	108,1	172,6	517,6	194,7

1988	651,3	5,1	210,0	109,9	175,0	550,7	197,6
1989	655,3	4,9	216,9	111,8	177,5	580,9	201,9
1990	658,6	4,7	223,9	113,8	180,0	608,8	207,3
1991	662,9	4,4	230,9	115,5	182,5	633,4	213,6
1992	663,6	4,2	238,2	118,1	185,3	656,4	221,0
1993	662,0	4,0	245,5	120,6	188,2	676,4	228,8
1994	658,6	3,8	252,9	122,8	191,1	694,1	237,3
1995	651,2	3,6	260,4	124,7	194,2	710,1	246,0
1996	638,3	3,4	267,7	127,8	197,4	722,7	254,6
1997	627,6	3,2	274,3	129,3	200,0	731,5	263,6
1998	612,5	3,1	281,4	133,3	204,0	736,5	272,3
1999	596,1	3,0	288,2	136,4	207,5	736,6	281,0
2000	582,9	2,8	294,6	137,8	210,5	732,7	289,3
2001	570,5	2,7	300,3	140,9	213,4	726,4	297,0
2002	560,7	2,6	306,0	144,0	217,4	717,9	304,6
2003	552,5	2,5	311,3	146,7	221,1	708,6	310,9
2004	543,7	2,4	316,1	147,6	224,3	699,1	316,6
2005	534,2	2,3	320,6	150,4	227,7	689,4	321,9
2006	525,2	2,2	324,1	153,2	231,4	679,0	327,1
2007	517,4	2,2	327,9	155,6	235,0	667,9	331,4
2008	510,6	2,1	331,2	157,6	238,3	656,8	335,3
2009	504,4	2,0	334,2	159,9	242,0	646,4	338,9
2010	499,0	1,9	336,8	161,9	245,4	636,5	342,1
2011	494,3	1,8	339,1	163,0	247,8	626,9	344,9
2012	490,0	1,7	341,5	164,6	251,7	618,2	345,6
2013	484,9	1,7	343,4	167,3	255,0	610,1	348,5
2014	480,4	1,6	344,3	169,0	258,2	602,0	351,0
2015	475,5	1,5	345,9	171,2	261,3	594,4	352,2
2016	472,0	1,4	346,7	172,0	263,9	587,1	354,0
2017	469,3	1,4	347,9	173,7	267,2	580,1	355,3
2018	466,3	1,3	348,4	175,8	270,6	573,6	357,1
2019	462,5	1,3	348,8	175,7	273,2	567,1	356,6
2020	458,1	1,2	350,1	177,9	276,3	561,2	357,4
2021	453,4	1,1	350,6	179,0	279,3	555,2	358,1
2022	448,9	1,1	351,2	180,4	282,3	549,2	359,7
2023	446,0	1,0	351,6	181,3	284,7	543,3	359,9
2024	443,3	1,0	352,8	182,1	288,0	537,9	358,7
2025	440,5	0,9	353,8	184,2	290,7	532,1	359,3
2026	438,6	0,9	353,6	185,1	293,6	526,8	359,8
2027	436,7	0,8	354,1	185,3	296,1	522,0	360,5
2028	436,5	0,8	354,3	186,7	298,7	517,7	360,6
2029	436,1	0,7	354,5	187,1	299,9	513,9	361,0
2030	434,8	0,6	354,5	188,3	302,7	510,2	359,8
2031	429,3	0,6	354,1	188,0	305,4	506,5	358,9
2032	425,2	0,6	354,9	189,4	308,0	502,8	357,4
2033	422,0	0,5	355,2	190,8	310,6	498,4	357,6
2034	419,8	0,5	355,1	190,9	312,7	494,1	357,0
2035	417,5	0,5	355,3	192,2	314,9	489,8	355,9
2036	415,0	0,4	355,0	193,1	317,2	485,5	355,6
2037	413,0	0,4	354,7	192,9	319,2	481,5	353,3
2038	411,4	0,3	354,7	192,8	320,9	477,6	352,6
2039	408,3	0,3	355,0	194,5	322,9	473,9	350,8
2040	406,3	0,3	354,6	194,8	324,8	470,7	350,5
2041	403,4	0,2	355,0	194,2	326,6	467,5	348,5
2042	401,6	0,2	354,6	195,5	328,1	464,5	347,9
2043	400,8	0,1	354,6	195,4	330,1	461,9	347,5
2044	400,2	0,9	354,1	198,4	330,3	459,2	346,1
2045	378,4	7,5	355,3	201,2	333,8	454,9	345,5
2046	415,8	7,4	355,3	196,9	336,2	449,5	343,8
2047	457,3	7,2	354,6	195,3	338,6	447,9	342,0
2048	478,9	7,1	353,8	194,8	339,5	451,5	340,6
2049	507,8	6,9	352,8	194,1	340,7	460,1	339,1
2050	542,2	6,7	352,8	193,0	341,6	475,5	335,4
2051	561,0	6,5	351,7	192,5	342,0	495,6	332,3
2052	571,3	6,3	350,8	191,7	342,0	518,5	328,7
2053	581,8	6,1	350,6	191,6	341,9	541,2	324,7
2054	584,5	5,9	351,3	191,4	341,3	562,7	323,4
2055	589,8	5,7	350,9	191,9	340,7	583,1	322,9
2056	602,2	5,5	350,6	192,0	340,5	602,6	323,2
2057	606,0	5,3	350,9	191,5	339,6	621,4	323,2
2058	610,0	5,1	352,0	190,5	338,2	638,9	324,1
2059	611,0	5,0	353,2	191,1	338,2	655,0	325,6
2060	612,4	4,8	354,3	190,9	337,6	669,3	326,2
2061	605,3	4,6	356,3	191,7	335,0	681,3	329,0
2062	596,0	4,4	358,5	194,0	336,3	690,3	331,6
2063	587,6	4,3	358,5	191,8	335,5	695,4	335,7
2064	580,1	4,2	360,9	192,9	335,6	697,5	337,0
2065	572,3	4,1	362,0	192,9	334,8	697,0	340,0
2066	566,5	3,9	364,9	194,9	335,3	695,2	341,5
2067	561,2	3,8	366,3	194,8	335,1	692,6	344,7
2068	558,1	3,7	368,6	195,8	334,9	689,7	345,4
2069	551,9	3,5	369,6	195,2	334,5	686,6	348,5
2070	544,8	3,4	371,3	196,0	333,1	683,1	350,7

2071	533,9	3,3	374,4	198,2	334,3	677,9	352,7		
2072	524,0	3,2	375,6	198,5	332,9	670,3	354,3		
2073	516,5	3,1	378,5	200,4	334,2	661,3	355,8		
2074	510,0	3,1	379,7	200,1	334,0	652,0	356,9		
2075	504,8	3,0	381,3	201,9	334,0	642,6	357,8		
2076	500,3	2,9	381,3	201,1	333,8	633,8	358,9		
2077	497,2	2,8	382,1	202,2	333,1	625,5	359,2		
2078	494,0	2,7	383,4	202,6	333,3	617,6	359,7		
2079	491,5	2,7	384,6	203,2	332,8	610,7	358,5		
2080	488,8	2,6	384,6	203,3	332,4	604,3	359,9		
2081	486,9	2,5	384,8	204,2	332,6	598,6	359,9		
2082	484,8	2,4	386,3	204,7	331,7	593,1	359,8		
2083	482,8	2,4	386,6	204,1	332,4	588,1	359,3		
2084	481,5	2,3	387,3	205,7	332,2	583,6	358,5		
2085	478,7	2,2	387,9	206,7	332,8	579,6	358,4		
2086	474,4	2,2	386,6	205,5	331,8	575,5	358,6		
2087	471,7	2,1	387,0	204,7	332,1	571,6	356,9		
2088	469,6	2,0	387,7	205,5	331,6	567,4	356,7		
2089	467,9	1,9	389,0	206,4	331,9	563,7	356,5		
2090	465,5	1,9	387,3	205,8	331,0	560,2	356,6		
2091	461,0	1,8	387,7	206,4	331,1	557,0	355,1		
2092	455,9	1,8	388,7	206,3	331,2	552,6	354,1		
2093	452,3	1,7	387,7	206,4	330,8	548,0	354,8		
2094	449,2	1,7	387,0	206,5	331,1	543,1	354,9		
2095	445,4	1,6	386,9	206,3	331,2	538,2	354,5		
2096	441,7	1,5	387,2	207,0	330,8	533,5	355,0		
2097	438,1	1,5	386,4	207,4	331,2	528,8	353,9		
2098	435,3	1,4	386,7	208,5	331,9	524,2	353,7		
2099	432,9	1,4	386,0	207,0	331,5	519,8	354,0		
2100	430,1	1,4	386,0	208,3	332,3	515,7	353,6		
2101	427,6	1,3	385,1	208,2	332,7	511,5	353,6		
2102	424,8	1,3	383,5	208,3	332,8	507,5	353,8		
2103	421,8	1,2	383,3	207,4	332,6	503,6	354,2		
2104	420,3	1,2	382,4	207,9	333,7	500,1	353,1		
2105	418,6	1,2	382,8	208,1	333,7	496,4	353,0		
2106	416,8	1,1	381,2	207,1	333,8	493,3	353,3		
2107	415,5	1,0	380,8	207,9	334,1	490,1	353,4		
2108	413,6	1,0	380,0	207,2	334,6	487,3	353,1		
2109	411,6	1,0	380,0	206,8	335,0	484,6	351,9		
2110	409,8	0,9	379,1	206,5	335,4	482,4	351,9		
2111	408,6	0,9	378,1	207,0	336,2	479,9	351,0		
2112	407,3	0,8	378,0	207,7	336,2	477,6	350,5		
2113	405,9	0,8	377,5	207,1	336,7	475,4	350,2		
2114	404,8	0,7	376,6	207,1	336,7	473,3	350,4		
2115	403,8	0,8	377,3	207,0	337,6	471,2	348,7		
2116	403,0	0,7	376,6	206,7	337,6	469,7	349,1		
2117	402,8	0,7	376,6	207,1	338,3	467,8	348,6		
2118	402,6	0,6	376,3	206,7	338,8	466,1	348,9		
2119	402,9	0,5	375,7	205,8	339,1	464,6	348,8		
2120	403,9	0,5	375,8	207,0	339,2	463,4	348,2		
2121	405,8	0,5	375,4	206,2	339,4	462,6	347,9		
2122	408,1	0,5	375,1	205,5	339,8	462,0	347,4		
2123	407,7	0,4	374,6	205,2	339,9	462,1	347,1		
2124	403,8	0,4	375,5	206,1	339,9	462,0	346,3		
2125	396,1	0,4	375,7	207,7	340,6	461,4	346,2		
2126	387,2	0,3	374,7	207,3	340,9	459,6	346,3		
2127	380,6	0,3	374,7	206,7	340,5	457,1	344,7		
2128	376,0	0,3	374,8	207,2	341,5	453,3	345,9		
2129	372,5	0,3	374,0	206,9	341,8	449,6	346,3		
2130	368,9	0,2	373,0	207,0	341,8	445,5	346,2		
2131	366,1	0,2	371,9	207,1	342,3	441,6	346,0		
2132	362,8	0,2	370,9	207,1	342,3	437,6	345,7		
2133	359,3	0,2	370,1	206,7	342,5	433,5	345,2		
2134	356,3	0,2	368,9	207,7	342,5	429,4	344,7		
2135	353,5	0,2	368,7	206,7	342,6	425,3	343,0		
2136	351,1	0,1	367,5	207,2	342,3	421,5	342,3		
2137	348,1	0,1	366,3	206,5	342,4	417,8	341,0		
2138	345,8	0,1	364,6	206,6	343,0	414,0	341,2		
2139	344,0	0,1	363,9	206,7	342,7	410,2	340,2		
2140	341,7	0,1	362,9	206,7	343,1	406,7	339,0		
2141	351,4	0,1	359,1	224,9	335,7	400,5	337,1		
2142	349,2	0,1	355,9	231,6	333,4	393,1	335,2		
2143	93,4	3,4	69,5	68,7	69,3	70,2	69,6	2	19-19
2144	151,1	3,2	69,5	68,7	69,4	70,5	69,7		
2145	236,3	3,2	69,6	68,8	69,7	71,5	69,9		
2146	362,5	3,0	69,6	68,9	70,3	74,4	70,6		
2147	359,9	2,8	69,9	69,0	71,3	80,5	72,1		
2148	339,5	2,7	70,4	69,4	73,0	88,3	74,8		
2149	317,3	2,6	71,2	70,0	75,4	99,1	78,4		
2150	327,0	2,5	72,3	70,3	78,8	111,3	82,4		
2151	319,0	9,6	73,8	71,0	82,9	124,3	86,6	2	20 -20
2152	300,5	9,5	75,5	72,0	87,9	136,5	91,2		
2153	273,1	9,5	77,0	73,7	93,5	146,9	96,0		

2154	320,8	9,2	78,5	75,4	99,0	155,6	100,6
2155	333,8	9,2	80,4	75,8	104,3	163,3	104,8
2156	293,6	9,2	82,4	76,8	109,7	170,4	109,2
2157	273,3	9,2	84,5	78,4	115,1	176,3	113,8
2158	367,9	9,0	86,3	81,5	119,9	180,3	118,5
2159	515,6	8,7	89,5	81,9	124,0	185,0	122,8
2160	408,1	8,7	94,8	82,0	128,3	194,8	127,0
2161	390,0	8,6	101,1	82,7	132,7	207,8	131,9
2162	369,1	8,5	107,4	83,8	136,9	221,3	136,3
2163	354,0	8,4	113,4	84,9	140,5	233,2	140,9
2164	363,6	8,4	119,3	85,8	144,4	243,1	144,7
2165	352,2	8,3	124,7	87,0	147,2	251,8	147,7
2166	361,2	8,2	130,0	88,0	150,3	258,7	150,8
2167	363,3	8,2	135,1	89,0	153,3	264,6	154,6
2168	413,0	8,0	140,1	89,8	156,0	271,5	157,9
2169	445,4	7,9	145,0	90,6	158,4	282,3	160,7
2170	464,1	7,8	150,3	91,3	161,0	297,7	163,1
2171	481,6	7,6	155,6	92,1	163,0	316,7	164,9
2172	489,7	7,5	161,3	92,9	165,8	338,4	168,0
2173	497,3	7,3	167,2	93,9	168,2	359,7	170,3
2174	503,7	7,2	173,4	95,1	170,9	380,8	173,8
2175	518,0	7,0	179,7	96,1	173,1	401,9	177,2
2176	514,5	6,9	186,2	97,3	175,8	423,4	180,5
2177	511,5	6,8	192,7	98,4	178,5	442,6	183,8
2178	514,7	6,6	199,4	100,0	180,2	459,0	186,4
2179	523,6	6,5	206,1	101,2	182,8	474,4	190,5
2180	531,3	6,3	212,9	102,6	184,9	489,6	194,1
2181	528,9	6,1	219,6	104,3	187,9	504,1	197,8
2182	529,5	6,0	226,3	105,9	190,0	516,7	202,0
2183	530,1	5,9	232,6	107,6	192,7	528,6	206,5
2184	527,9	5,8	239,0	109,3	195,1	538,6	210,8
2185	528,0	5,7	245,1	111,1	196,9	547,3	215,5
2186	528,4	5,5	250,7	112,9	199,4	554,6	219,8
2187	525,3	5,4	256,4	114,8	201,8	561,2	224,1
2188	524,0	5,3	261,5	116,5	204,2	566,1	228,2
2189	522,7	5,2	266,7	118,3	206,7	570,1	232,1
2190	520,9	5,1	271,6	120,1	209,2	572,5	235,6
2191	519,3	4,9	276,1	122,0	211,9	574,7	239,8
2192	517,1	4,8	280,5	123,8	214,4	576,2	243,5
2193	515,9	4,7	284,5	125,5	216,9	577,1	246,7
2194	514,8	4,6	288,3	127,3	219,2	577,0	250,1
2195	513,0	4,5	292,1	128,8	221,2	576,5	253,4
2196	510,8	4,4	295,7	130,5	223,3	575,6	256,6
2197	509,2	4,3	299,2	132,2	226,3	574,2	259,6
2198	507,9	4,2	302,5	133,8	230,1	573,1	261,8
2199	506,9	4,1	305,9	135,6	232,7	572,2	263,8
2200	505,2	4,0	308,8	137,4	234,7	571,0	266,4
2201	502,0	3,9	311,5	138,9	237,7	570,4	269,6
2202	498,5	3,8	313,9	140,5	239,9	569,2	271,7
2203	496,7	3,8	316,4	142,2	242,5	567,7	274,1
2204	493,0	3,6	318,6	143,8	244,8	565,8	276,2
2205	488,9	3,6	320,6	145,4	247,6	563,3	278,1
2206	486,1	3,5	322,5	146,9	250,6	560,2	280,1
2207	481,2	3,3	324,4	148,3	253,3	556,2	281,3
2208	478,4	3,3	326,0	149,8	255,3	552,0	283,0
2209	475,7	3,3	327,3	151,1	257,6	548,0	284,2
2210	472,5	3,1	328,5	152,5	260,4	543,9	284,8
2211	469,2	3,1	329,2	153,6	262,7	539,9	285,4
2212	466,0	3,0	330,4	155,1	265,5	535,9	287,9
2213	462,3	3,0	331,3	156,2	268,1	532,2	289,6
2214	458,7	2,9	332,0	157,7	270,3	528,1	291,6
2215	454,7	2,8	332,6	159,1	274,4	524,1	292,4
2216	451,8	2,7	333,4	160,2	276,3	519,8	294,2
2217	447,9	2,6	333,9	161,3	278,4	515,4	295,7
2218	444,4	2,6	334,4	162,5	281,4	511,3	298,2
2219	441,2	2,5	334,7	163,6	282,4	507,1	300,7
2220	438,5	2,5	334,9	164,5	286,0	502,8	301,1
2221	436,2	2,4	335,5	165,8	287,4	498,7	303,6
2222	433,3	2,3	335,4	166,7	290,8	494,9	303,0
2223	430,8	2,3	335,7	167,7	292,4	491,1	305,4
2224	429,1	2,3	335,5	168,7	296,7	487,5	306,2
2225	427,0	2,2	335,7	169,9	298,3	484,0	305,8
2226	425,3	2,2	335,8	170,8	301,3	480,8	306,4
2227	423,9	2,1	335,7	171,4	301,7	477,9	307,4
2228	423,9	2,1	335,1	172,2	303,9	475,2	311,1
2229	423,4	2,0	335,3	173,2	306,7	472,7	309,9
2230	423,3	1,9	334,9	173,7	308,5	470,6	311,8
2231	423,9	1,9	334,7	174,1	310,8	468,9	312,1
2232	423,2	1,8	334,6	174,6	314,5	467,7	312,2
2233	423,1	1,8	334,5	175,6	315,8	466,5	312,1
2234	420,0	1,7	334,4	176,2	316,6	465,1	314,8
2235	412,1	1,7	334,0	177,0	319,4	463,6	314,0
2236	402,0	1,6	334,1	177,8	321,5	461,0	314,3

2237	394,5	1,6	334,2	178,8	324,7	457,4	314,4
2238	388,1	1,6	333,9	179,5	326,6	453,3	315,3
2239	383,3	1,5	333,4	180,5	329,6	448,8	315,1
2240	379,2	1,5	333,1	181,4	332,4	444,2	314,6
2241	374,7	1,5	332,8	181,7	332,6	439,5	317,6
2242	366,2	1,5	332,2	182,5	335,4	434,6	316,0
2243	353,4	1,5	331,6	183,7	338,7	429,1	315,6
2244	343,8	1,5	330,8	184,4	340,0	422,6	316,3
2245	337,1	1,4	329,9	185,2	343,6	415,8	313,9
2246	331,2	1,4	329,6	185,9	345,7	408,9	312,4
2247	328,0	1,4	328,8	186,5	346,5	402,0	313,2
2248	324,5	1,4	327,7	186,8	348,8	395,3	310,3
2249	321,5	1,4	326,7	187,1	349,9	389,1	310,9
2250	318,3	1,4	325,2	187,2	352,2	383,0	309,2
2251	316,0	1,4	324,1	187,6	354,3	377,5	306,4
2252	314,0	1,4	323,3	187,8	356,4	372,3	304,9
2253	312,5	1,3	322,4	187,6	355,6	367,4	304,4
2254	311,4	1,3	320,8	187,8	358,0	362,8	304,4
2255	310,4	1,3	319,5	187,5	360,9	358,6	300,7
2256	309,1	1,3	318,0	187,5	360,8	354,8	300,6
2257	308,5	1,2	316,9	187,4	363,9	351,2	296,6
2258	308,1	1,2	316,1	187,1	364,9	348,0	295,5
2259	306,9	1,2	314,8	187,2	365,3	345,0	294,8
2260	305,4	1,2	313,7	186,7	366,0	342,2	294,3
2261	304,5	1,2	312,6	186,4	369,7	339,6	291,4
2262	303,6	1,2	312,2	186,5	368,7	337,2	292,8
2263	268,9	8,1	312,3	194,2	370,6	334,9	291,2
2264	280,3	8,1	307,4	206,3	368,4	327,7	290,1
2265	277,2	8,0	304,6	211,4	368,3	320,8	287,3
2266	276,3	8,0	302,1	214,9	366,8	313,9	286,7
2267	273,0	7,9	299,7	215,6	366,9	307,5	284,7
2268	290,2	7,8	296,4	218,8	366,4	300,6	283,8
2269	296,4	7,7	293,3	220,6	365,2	294,7	281,8
2270	293,8	7,7	290,1	221,8	364,7	288,8	278,6
2271	293,5	7,6	287,3	222,7	363,3	283,4	277,7
2272	304,6	7,5	283,9	223,5	362,3	278,6	273,6
2273	342,6	7,4	280,7	223,9	361,0	273,9	271,3
2274	332,0	7,3	280,5	200,9	364,3	272,2	269,4
2275	307,8	7,1	278,0	195,7	363,8	272,0	267,4
2276	298,3	7,1	276,0	192,4	363,4	272,5	265,9
2277	293,5	7,0	274,5	189,9	363,6	273,3	264,5
2278	284,4	6,9	273,4	188,4	361,9	274,1	262,8
2279	280,6	6,9	272,1	187,2	361,3	274,5	261,6
2280	281,0	6,8	271,1	185,7	360,2	274,9	260,1
2281	292,1	6,7	270,3	184,3	360,0	275,4	259,6
2282	304,6	6,7	269,8	182,7	360,5	276,6	258,1
2283	341,3	6,6	269,3	180,5	358,1	279,0	257,5
2284	378,9	6,5	268,3	178,4	357,1	285,4	257,7
2285	392,4	6,4	267,4	177,3	356,9	296,1	256,2
2286	403,5	6,2	266,9	175,9	356,5	308,8	255,0
2287	418,9	6,1	266,3	175,1	356,1	322,4	255,2
2288	418,9	6,0	267,2	174,4	355,3	335,8	255,6
2289	417,5	6,0	267,3	173,8	355,0	347,8	255,9
2290	416,1	5,8	268,0	173,8	353,9	358,4	258,4
2291	418,4	5,7	268,6	173,1	354,8	367,7	257,7
2292	423,0	5,6	269,5	173,0	354,3	376,4	259,0
2293	430,8	5,6	270,2	173,4	354,1	384,9	259,6
2294	434,1	5,4	272,0	172,9	354,5	393,9	261,4
2295	441,9	5,3	273,1	173,1	354,3	402,6	263,0
2296	448,6	5,2	274,6	172,7	352,8	411,5	266,7
2297	456,1	5,2	276,1	172,5	353,8	421,2	268,5
2298	462,5	5,0	278,2	172,6	352,7	430,9	270,0
2299	462,7	4,9	279,8	172,8	352,9	440,7	272,7
2300	453,3	4,9	281,5	172,8	353,5	448,8	273,4
2301	448,0	4,8	283,4	173,7	355,1	454,8	275,6
2302	445,5	4,7	285,5	174,4	355,0	459,0	277,1
2303	441,8	4,5	287,6	174,9	356,2	462,1	278,6
2304	426,9	4,5	290,4	176,2	358,8	463,0	279,9
2305	405,9	4,5	292,5	177,0	357,4	461,7	285,1
2306	390,6	4,4	294,0	178,3	359,3	457,8	285,7
2307	399,6	4,3	295,2	186,4	358,2	449,9	287,6
2308	420,0	4,3	297,7	181,6	360,2	444,3	290,9
2309	427,5	4,2	299,8	181,2	360,2	440,4	292,0
2310	431,6	4,1	300,9	180,9	361,2	438,7	291,7
2311	434,5	3,9	302,1	181,3	362,4	438,4	292,4
2312	437,6	3,9	304,1	181,5	362,9	439,1	294,3
2313	439,5	3,8	306,5	181,8	364,2	440,7	294,5
2314	441,7	3,7	308,5	181,9	364,7	443,1	295,6
2315	443,2	3,6	310,0	182,2	362,3	445,6	298,7
2316	444,7	3,5	311,8	182,3	365,3	448,3	297,8
2317	444,8	3,5	314,1	182,1	361,3	451,3	299,4
2318	444,8	3,4	316,5	182,3	363,3	454,4	300,7
2319	445,5	3,3	318,7	182,3	365,6	457,2	298,7

2320	444,6	3,2	320,4	182,6	366,5	459,7	301,3
2321	443,9	3,1	322,5	183,0	367,8	461,9	299,8
2322	442,3	3,0	325,2	183,6	369,3	463,6	300,0
2323	441,1	3,0	327,7	183,4	369,1	465,1	300,3
2324	439,9	2,9	329,6	184,0	369,6	466,2	300,9
2325	437,8	2,8	331,6	184,3	370,6	467,0	300,7
2326	436,6	2,8	333,3	184,3	371,7	467,2	300,1
2327	434,8	2,7	335,3	184,4	372,6	467,2	300,4
2328	432,5	2,7	336,9	184,7	373,2	466,8	300,9
2329	431,3	2,6	338,3	185,0	374,0	466,3	301,0
2330	428,2	2,5	339,7	185,1	374,1	465,5	302,0
2331	426,1	2,4	341,1	185,8	375,6	464,5	303,1
2332	424,4	2,3	342,3	185,6	376,3	463,2	304,3
2333	422,7	2,4	343,4	185,8	377,1	461,9	303,2
2334	421,4	2,3	344,6	186,3	377,9	460,4	303,5
2335	421,3	2,2	345,5	186,2	379,2	459,0	304,7
2336	422,2	2,2	346,0	186,3	379,5	457,7	306,4
2337	423,8	2,1	346,5	186,3	380,3	456,9	306,2
2338	425,9	2,0	347,6	186,0	381,3	456,5	305,8
2339	429,7	2,0	348,6	186,4	383,1	456,8	305,9
2340	424,0	1,9	349,2	186,4	384,7	457,6	305,4
2341	414,1	1,8	349,8	186,8	385,4	457,5	305,9
2342	402,7	1,8	350,4	187,4	386,9	456,0	306,2
2343	388,3	1,8	351,0	187,9	388,0	453,0	306,5
2344	374,1	1,8	351,8	188,4	388,2	448,7	307,2
2345	364,9	1,8	352,2	189,1	388,6	443,2	307,3
2346	359,3	1,7	352,5	189,4	388,7	437,0	307,3
2347	355,9	1,7	352,4	189,7	389,1	430,6	306,8
2348	355,3	1,7	352,1	190,0	388,4	424,2	306,9
2349	353,1	1,6	351,6	190,0	388,3	418,5	307,2
2350	349,5	1,6	351,0	190,2	387,7	413,0	306,6
2351	346,9	1,5	350,3	190,2	387,5	407,7	306,6
2352	346,0	1,5	349,7	190,4	386,8	402,8	306,0
2353	343,2	1,5	348,5	190,3	386,6	398,3	305,5
2354	335,3	1,5	347,6	190,6	386,0	394,0	304,1
2355	325,7	1,5	346,7	191,2	385,3	389,5	303,6
2356	318,8	1,5	345,9	191,3	384,9	384,9	303,1
2357	313,9	1,5	344,6	190,9	384,8	379,9	302,1
2358	309,8	1,5	343,0	191,4	383,8	375,0	300,8
2359	306,3	1,4	341,6	191,1	384,1	370,1	300,4
2360	303,0	1,4	340,3	190,8	383,4	365,1	299,2
2361	300,0	1,4	338,7	190,6	382,7	360,2	297,8
2362	297,7	1,4	337,0	190,6	382,8	355,6	296,5
2363	295,3	1,4	334,8	190,0	382,8	351,2	295,4
2364	292,8	1,4	333,0	190,0	381,8	347,1	293,8
2365	290,8	1,4	331,2	189,8	381,1	343,1	293,4
2366	289,2	1,4	329,2	189,0	380,8	339,3	291,5
2367	287,5	1,3	327,4	188,7	380,7	335,8	290,5
2368	286,1	1,4	325,2	188,3	380,8	332,4	288,4
2369	284,5	1,3	323,5	187,7	380,8	329,1	286,6
2370	282,7	1,4	321,4	187,1	380,5	326,0	286,1
2371	281,1	1,3	319,7	186,8	379,9	323,1	284,4
2372	279,7	1,3	317,6	186,2	379,0	320,3	283,0
2373	278,5	1,3	315,4	185,8	379,2	317,6	281,0
2374	277,5	1,3	313,9	185,3	378,8	315,2	279,7
2375	276,2	1,2	312,4	184,7	378,2	312,7	278,5
2376	274,8	1,2	310,4	184,2	378,6	310,4	277,0
2377	274,1	1,3	308,9	183,5	378,6	308,2	275,5
2378	273,0	1,2	307,4	183,2	378,1	306,1	273,9
2379	272,0	1,2	305,9	182,7	378,2	304,2	272,7
2380	270,8	1,2	304,2	182,8	377,6	302,3	272,1
2381	269,8	1,2	302,8	182,2	378,5	300,5	272,2
2382	269,0	1,2	300,9	181,2	379,0	298,6	272,3
2383	268,4	1,2	299,3	180,5	378,6	296,9	270,3
2384	267,6	1,2	297,4	180,3	375,2	295,2	270,9
2385	266,2	1,2	295,1	180,1	375,9	293,6	270,9
2386	265,5	1,1	294,1	179,1	375,9	292,1	271,0
2387	265,3	1,1	292,8	176,5	372,9	290,6	269,7
2388	264,4	1,2	292,2	175,5	371,7	288,9	268,7
2389	263,6	1,1	291,4	173,9	373,8	287,5	266,6
2390	262,2	1,1	290,1	174,3	375,3	286,1	263,9
2391	261,6	1,1	288,8	174,2	376,5	284,8	263,6
2392	260,9	1,1	287,2	173,7	374,8	283,6	264,6
2393	260,7	1,1	285,9	173,3	376,8	282,5	262,9
2394	260,4	1,1	284,7	172,7	376,6	281,5	262,5
2395	259,8	1,1	283,5	172,4	376,8	280,5	261,5
2396	259,3	1,2	282,2	175,5	377,2	279,6	259,7
2397	243,2	8,8	279,3	189,1	374,0	276,9	259,1
2398	248,1	8,7	276,7	193,1	371,6	273,2	259,4
2399	245,5	8,6	274,9	193,1	372,6	269,3	256,0
2400	252,3	8,4	271,8	196,6	370,0	264,8	253,6
2401	248,4	8,4	269,4	198,5	368,1	259,6	253,0
2402	317,8	8,3	267,0	199,7	365,8	255,4	250,1

2403	361,6	8,2	264,0	200,5	364,0	251,4	247,4
2404	419,9	8,0	261,3	201,0	361,5	249,9	244,5
2405	473,3	7,7	258,9	201,3	359,4	250,0	242,2
2406	444,6	7,6	258,6	182,5	362,5	255,4	241,3
2407	356,3	7,5	258,1	177,4	361,3	263,8	240,0
2408	325,6	7,4	257,9	174,7	361,6	270,7	238,6
2409	325,2	7,3	258,0	172,2	360,5	275,3	238,3
2410	338,8	7,2	259,3	170,2	359,1	279,0	238,6
2411	355,5	7,1	259,9	168,6	359,4	283,1	238,1
2412	377,8	7,0	260,3	166,5	358,3	288,4	237,9
2413	397,1	7,0	261,0	165,2	355,9	296,2	238,5
2414	408,6	6,9	261,4	164,4	356,6	306,3	239,5
2415	418,2	6,7	261,9	163,6	355,5	317,8	240,0
2416	424,1	6,6	262,3	163,0	355,0	330,1	240,2
2417	424,6	6,5	262,7	162,6	354,1	342,2	241,1
2418	455,4	6,4	263,1	161,5	352,8	354,8	243,9
2419	492,8	6,2	263,7	160,5	352,2	371,1	246,0
2420	499,4	6,1	265,1	160,2	351,5	391,6	248,0
2421	494,3	5,9	266,6	160,0	351,4	413,1	249,3
2422	492,3	5,8	268,6	160,2	351,8	432,1	251,4
2423	490,8	5,7	271,3	160,1	350,1	448,2	256,3
2424	487,7	5,6	274,0	160,1	349,9	462,0	259,8
2425	483,5	5,5	277,0	160,4	348,4	473,0	264,2
2426	479,6	5,4	280,5	160,6	349,3	481,6	268,1
2427	475,4	5,2	283,8	160,9	347,9	488,2	270,2
2428	473,4	5,1	287,4	161,5	347,7	492,6	275,1
2429	471,2	5,0	290,7	162,2	348,3	495,9	278,5
2430	469,9	4,9	293,9	163,1	350,7	498,5	280,2
2431	469,4	4,8	296,5	164,0	349,8	500,3	285,9
2432	468,9	4,7	299,1	164,6	350,6	502,3	288,0
2433	468,6	4,6	302,2	165,9	353,0	503,8	290,7
2434	468,8	4,5	304,7	166,7	351,7	505,4	292,7
2435	468,2	4,4	307,3	168,1	353,6	506,9	295,2
2436	467,3	4,3	310,0	169,3	355,0	508,5	297,7
2437	466,7	4,2	312,3	170,3	355,0	509,5	299,6
2438	465,6	4,1	314,6	171,4	353,8	510,9	303,6
2439	463,0	4,1	316,7	172,6	355,1	511,3	304,7
2440	460,7	4,0	318,7	173,4	356,0	511,5	308,0
2441	458,9	3,9	321,0	174,9	356,9	511,7	310,2
2442	455,2	3,8	323,2	175,6	357,3	510,8	313,5
2443	453,2	3,7	324,9	176,5	357,5	509,9	315,5
2444	449,1	3,7	326,3	177,6	358,9	508,7	316,9
2445	447,2	3,6	328,1	178,6	360,5	506,6	316,6
2446	444,8	3,5	329,6	180,3	360,4	504,8	318,9
2447	442,7	3,4	330,8	180,7	360,5	502,7	321,4
2448	440,8	3,4	332,1	181,8	361,1	500,6	322,9
2449	438,6	3,3	333,2	182,4	361,9	498,2	323,9
2450	436,5	3,3	334,2	183,3	362,6	496,0	325,3
2451	435,2	3,2	335,2	184,2	362,9	493,9	326,1
2452	433,6	3,1	336,1	184,6	364,0	491,6	327,4
2453	431,8	3,0	336,8	185,7	364,5	489,5	328,6
2454	431,0	3,0	337,3	186,6	365,6	487,5	329,4
2455	429,4	2,9	338,2	187,2	366,6	485,2	327,8
2456	427,9	2,9	338,9	188,3	367,2	483,4	326,8
2457	427,0	2,8	339,5	189,0	367,2	481,4	331,1
2458	427,0	2,8	339,7	189,1	367,9	479,4	331,5
2459	426,6	2,7	340,0	189,6	367,8	477,6	332,0
2460	427,3	2,6	340,3	190,0	369,1	476,4	330,0
2461	425,4	2,6	340,5	190,7	370,1	475,1	329,8
2462	420,8	2,5	340,7	191,7	370,6	474,2	330,6
2463	416,9	2,5	340,7	192,1	371,6	472,7	331,1
2464	414,1	2,4	340,8	192,7	372,5	470,7	331,8
2465	411,0	2,3	341,0	193,1	372,3	468,7	330,8
2466	408,8	2,3	342,0	193,7	372,0	466,3	334,0
2467	407,0	2,2	343,1	194,3	373,4	463,8	334,1
2468	404,4	2,2	343,3	194,5	374,0	461,5	334,6
2469	399,5	2,1	343,4	195,5	373,7	458,9	334,8
2470	393,2	2,1	343,2	195,9	375,9	455,8	333,1
2471	386,5	2,1	343,9	196,8	376,3	452,1	332,6
2472	377,3	8,7	339,4	217,9	372,0	445,1	332,1
2473	372,9	8,6	336,5	226,1	372,1	434,7	333,2
2474	384,4	8,5	333,2	231,7	370,9	422,5	332,0
2475	374,8	8,4	330,5	235,9	370,6	410,9	332,4
2476	379,9	8,2	331,5	222,3	372,8	401,0	332,7
2477	368,0	8,2	331,1	212,9	375,4	393,9	331,4
2478	361,5	8,0	330,1	209,4	377,1	388,0	327,4
2479	364,8	7,9	328,4	206,7	375,9	383,5	328,3
2480	370,7	7,8	327,1	204,8	376,6	380,7	324,4
2481	385,9	7,7	326,7	202,8	375,8	378,8	323,1
2482	407,7	7,6	325,6	200,9	377,5	379,1	320,1
2483	417,8	7,5	324,3	199,1	376,7	382,4	317,8
2484	422,2	7,4	323,4	198,4	376,4	388,0	316,9
2485	418,3	7,3	322,9	196,9	373,5	394,3	317,5

2486	411,2	7,2	322,5	196,2	372,8	400,2	315,0
2487	399,9	7,1	322,8	195,8	370,2	404,6	315,2
2488	389,7	7,0	322,5	195,1	370,5	406,9	314,3
2489	383,3	6,9	322,4	194,7	371,1	407,4	310,6
2490	379,1	6,9	322,4	194,4	369,2	406,5	312,6
2491	373,5	6,8	322,0	194,1	370,2	405,1	308,6
2492	369,5	6,8	322,6	193,6	369,8	402,8	307,6
2493	365,8	6,7	322,7	193,4	369,1	400,1	307,1
2494	361,9	6,6	322,9	193,2	368,7	397,3	307,5
2495	359,4	6,6	322,7	193,1	367,7	394,4	306,0
2496	356,9	6,5	322,6	192,7	367,0	391,3	305,3
2497	352,6	6,4	322,2	192,5	366,2	388,5	306,5
2498	348,7	6,4	321,5	192,2	366,3	385,3	304,4
2499	345,2	6,3	321,2	192,2	365,7	382,1	303,6
2500	342,7	6,3	320,7	191,9	365,0	378,8	302,4
2501	339,9	6,2	320,3	191,7	364,4	375,6	301,4
2502	338,2	6,1	319,7	191,3	363,7	372,4	300,6
2503	336,3	6,1	319,2	191,3	363,5	369,2	300,0
2504	335,0	6,0	318,3	191,0	363,2	366,1	299,3
2505	333,4	5,9	317,8	190,8	362,2	363,2	300,0
2506	331,5	5,9	316,3	190,4	361,6	360,5	300,2
2507	329,6	5,8	314,9	190,0	361,4	357,9	299,8
2508	327,9	5,8	313,8	189,5	361,5	355,5	297,7
2509	328,0	5,7	312,8	189,4	361,1	353,2	296,9
2510	327,5	5,7	312,2	189,0	360,9	350,9	297,1
2511	328,5	5,6	311,5	188,5	360,1	349,1	296,0
2512	329,3	5,6	310,7	188,3	358,8	347,3	296,9
2513	330,4	5,5	310,1	187,8	358,0	345,9	296,9
2514	343,0	5,5	310,0	186,5	355,6	344,9	295,6
2515	361,5	5,4	309,3	185,1	358,4	345,1	295,8
2516	383,0	5,3	308,3	183,9	358,3	347,2	293,1
2517	408,4	5,2	307,6	182,4	357,2	351,6	292,7
2518	427,6	5,1	307,4	181,6	356,1	359,4	292,4
2519	431,1	5,0	307,1	180,9	357,2	369,2	292,1
2520	426,7	5,0	307,3	180,6	356,1	379,6	291,1
2521	420,7	5,0	307,8	180,1	354,0	388,5	292,9
2522	414,5	4,8	308,4	180,0	353,8	395,5	292,7
2523	408,0	4,8	308,5	180,0	353,2	400,5	294,6
2524	400,4	4,7	309,9	180,2	355,3	403,7	295,2
2525	394,6	4,7	310,4	180,0	355,5	405,7	296,5
2526	387,8	4,6	311,0	180,4	357,0	406,7	298,5
2527	381,6	4,6	311,6	180,9	355,3	406,5	299,9
2528	371,5	4,5	312,1	181,3	356,9	405,6	300,2
2529	361,7	4,5	312,6	182,0	356,8	403,7	302,5
2530	351,8	4,4	313,3	182,7	355,5	401,0	304,2
2531	342,9	4,3	314,2	183,5	356,8	397,3	303,6
2532	336,8	4,3	314,5	184,0	356,1	393,0	305,7
2533	332,9	4,3	314,0	184,2	357,0	388,5	306,4
2534	329,9	4,2	313,9	184,6	357,0	383,6	306,3
2535	327,8	4,1	313,8	185,3	357,5	378,9	305,7
2536	324,9	4,1	313,9	185,1	356,9	374,3	305,4
2537	322,8	4,1	313,8	184,9	357,4	369,7	304,4
2538	320,4	4,1	313,2	185,0	357,6	365,6	302,8
2539	318,3	4,0	312,8	185,0	358,3	361,5	301,5
2540	316,3	4,0	312,2	185,1	358,3	357,8	300,7
2541	319,4	3,9	311,8	184,7	357,0	354,2	300,7
2542	316,5	3,8	311,2	184,9	356,6	351,0	298,8
2543	310,9	3,8	311,3	184,7	358,4	348,2	297,5
2544	308,0	3,8	310,8	184,5	356,0	345,3	297,1
2545	305,2	3,8	310,3	184,6	357,8	342,4	295,7
2546	303,2	3,7	310,0	184,7	358,1	339,8	293,9
2547	301,6	3,6	309,1	184,6	357,2	336,9	294,1
2548	299,8	3,6	308,5	184,5	357,7	334,3	292,2
2549	298,7	3,6	307,8	184,2	356,0	331,7	291,2
2550	297,5	3,5	306,9	184,1	357,4	329,3	290,8
2551	288,0	9,2	304,0	196,0	355,9	326,4	290,5
2552	319,1	9,1	300,6	204,5	353,7	321,3	289,0
2553	330,1	9,0	298,6	209,3	353,2	317,2	286,1
2554	420,3	8,8	295,3	212,1	351,9	310,7	286,2
2555	435,6	8,7	293,0	214,5	349,0	306,0	284,2
2556	437,9	8,5	289,8	216,4	349,3	304,5	281,1
2557	469,5	8,4	286,3	218,0	347,9	303,8	281,9
2558	494,7	8,2	283,5	219,8	345,7	304,5	278,1
2559	499,1	7,9	281,8	204,3	347,4	306,8	277,8
2560	476,2	7,7	280,5	193,5	347,5	315,0	278,8
2561	474,5	7,6	279,3	188,6	346,7	327,9	278,7
2562	474,6	7,5	277,8	185,6	344,1	343,5	281,8
2563	475,0	7,4	276,3	183,7	345,2	359,7	283,7
2564	471,9	7,2	275,5	182,7	345,8	375,9	286,8
2565	499,7	7,0	274,6	181,2	345,9	390,9	288,8
2566	514,9	6,9	273,5	180,4	343,7	407,0	293,2
2567	512,8	6,7	273,4	180,0	343,5	423,5	294,7
2568	512,1	6,6	273,7	179,7	344,0	440,5	299,5

2569	515,0	6,4	274,3	179,3	341,5	456,2	302,7
2570	522,7	6,3	275,5	179,6	343,1	471,7	305,5
2571	526,6	6,2	277,0	179,2	343,2	486,9	308,9
2572	546,3	6,0	279,2	179,4	341,5	501,2	311,7
2573	552,7	5,9	281,5	179,3	342,5	516,8	314,8
2574	551,6	5,7	283,9	179,8	343,3	532,3	317,9
2575	551,4	5,6	286,9	180,0	342,4	546,6	319,0
2576	551,1	5,4	290,7	180,3	342,7	559,7	323,4
2577	550,9	5,3	294,7	180,7	340,9	571,6	326,9
2578	548,9	5,2	298,6	181,3	344,2	581,9	328,0
2579	546,8	5,0	303,0	182,1	344,9	590,7	330,9
2580	544,7	4,9	307,3	183,1	345,5	598,2	333,6
2581	541,3	4,8	312,2	183,9	345,9	604,2	336,7
2582	537,6	4,7	316,6	184,6	344,7	609,0	340,3
2583	531,2	4,5	321,3	185,3	346,9	612,0	341,1
2584	526,9	4,5	326,2	186,1	347,0	613,2	342,8
2585	526,0	8,7	330,7	188,4	348,0	611,7	349,3
2586	537,0	8,6	334,9	188,5	348,9	610,7	351,1
2587	538,9	8,5	338,6	189,2	352,6	611,6	352,3
2588	536,1	8,3	341,7	189,9	353,7	612,5	353,2
2589	529,8	8,2	344,6	191,6	354,3	612,4	354,1
2590	530,8	8,0	347,1	192,5	356,3	611,4	354,0
2591	534,9	7,9	347,7	193,3	356,4	611,2	357,2
2592	537,9	7,7	348,3	193,9	357,6	613,2	357,9
2593	539,6	7,6	349,4	194,4	357,7	615,3	358,1
2594	541,0	7,5	349,5	195,3	357,7	617,8	359,4
2595	541,6	7,4	350,0	195,4	357,5	620,0	361,1
2596	541,3	7,2	350,1	196,2	359,4	622,4	362,2
2597	543,4	7,1	349,6	196,5	359,8	624,3	364,8
2598	544,1	7,0	349,7	196,5	359,9	626,6	364,6
2599	545,5	6,8	349,2	196,9	359,0	629,5	365,4
2600	547,8	6,7	349,5	196,9	360,4	632,7	365,8
2601	550,0	6,6	349,6	197,6	361,6	636,0	365,8
2602	550,6	6,4	350,5	198,2	362,5	639,6	364,2
2603	553,1	6,3	352,2	198,9	363,3	643,3	365,5
2604	553,3	6,2	353,1	198,9	362,9	647,2	366,7
2605	554,1	6,1	354,5	199,1	364,2	650,5	368,5
2606	553,4	5,9	355,9	200,0	364,4	653,7	368,9
2607	555,6	5,8	357,4	199,8	364,2	656,3	371,2
2608	558,4	5,7	358,5	200,7	364,4	659,4	369,7
2609	560,5	5,5	360,3	200,6	364,6	663,1	372,6
2610	554,9	5,4	361,6	201,0	364,8	666,9	374,8
2611	548,8	5,4	363,1	201,5	364,8	669,6	377,5
2612	544,3	5,2	365,7	201,7	365,7	669,7	380,1
2613	536,9	5,2	368,1	202,3	366,7	668,1	381,4
2614	529,8	5,1	370,1	202,9	368,9	664,8	381,4
2615	522,5	4,9	372,3	203,7	368,1	660,7	385,3
2616	510,3	4,9	373,6	204,1	370,3	655,2	387,0
2617	498,6	4,8	376,1	205,2	371,2	646,9	388,0
2618	489,8	4,8	378,2	206,0	372,1	637,6	388,2
2619	481,7	4,7	379,8	206,4	373,0	627,7	388,9
2620	474,6	4,7	381,3	207,3	372,3	617,4	391,2
2621	468,6	4,6	381,9	208,5	373,9	607,2	392,1
2622	462,7	4,6	383,0	209,8	375,0	597,0	391,7
2623	457,5	4,5	384,0	210,6	374,9	587,3	390,5
2624	452,4	4,4	384,7	211,4	375,2	578,1	390,9
2625	447,6	4,4	385,3	212,3	375,7	569,2	391,9
2626	442,6	4,4	385,3	212,8	376,3	561,2	392,6
2627	438,2	4,3	385,7	213,9	377,0	553,5	391,2
2628	434,1	4,3	385,6	214,5	376,9	546,2	390,6
2629	430,8	4,2	385,2	215,0	377,3	539,0	391,1
2630	428,4	4,1	385,0	215,4	377,7	532,4	388,0
2631	427,2	4,1	384,6	215,9	378,4	526,5	386,3
2632	424,0	4,0	383,7	216,0	378,3	521,1	384,6
2633	419,9	4,0	383,7	217,0	377,7	516,2	385,9
2634	417,8	4,0	383,2	217,3	377,6	510,8	385,1
2635	414,5	4,0	382,4	217,3	377,4	506,1	384,5
2636	413,7	3,9	381,5	217,7	378,2	501,4	385,1
2637	410,9	3,8	380,8	218,1	378,0	496,7	384,1
2638	408,2	3,7	380,0	218,4	378,3	492,4	383,2
2639	405,5	3,7	379,2	218,4	378,2	488,0	380,8
2640	404,4	3,7	378,5	218,6	378,4	483,9	381,1
2641	401,0	3,6	377,7	219,1	378,3	479,9	379,9
2642	398,2	3,6	377,0	218,7	378,3	475,9	378,6
2643	396,1	3,6	376,0	218,8	378,2	471,8	378,0
2644	391,6	3,5	375,2	219,0	378,0	467,9	376,1
2645	389,4	3,5	374,1	218,9	378,0	464,0	376,5
2646	387,9	3,4	372,9	218,9	378,4	460,2	375,2
2647	384,1	3,4	371,7	219,0	378,7	456,6	374,3
2648	381,8	3,4	370,7	219,2	378,1	453,1	372,0
2649	378,8	3,3	369,7	218,7	377,8	449,6	371,5
2650	376,7	3,3	368,5	218,7	377,4	446,0	371,7
2651	374,9	3,3	366,8	218,6	377,9	442,6	371,2

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2652	372,2	3,2	365,8	218,4	377,5	439,3	370,5
2653	370,3	3,2	364,9	218,2	377,9	436,0	370,2
2654	368,5	3,2	363,4	218,2	377,4	432,8	368,4
2655	368,3	3,1	363,1	217,7	376,8	429,5	367,3
2656	366,9	3,1	362,0	217,3	376,8	426,6	366,8
2657	366,8	3,0	360,9	216,8	377,1	423,9	366,0
2658	362,5	3,0	360,1	216,5	376,3	421,5	364,3
2659	360,3	3,0	359,2	216,6	375,9	418,7	363,0
2660	359,0	3,0	358,6	216,2	375,8	416,3	361,4
2661	362,1	2,9	357,1	215,9	375,9	413,5	359,6
2662	365,2	2,9	356,1	215,3	375,6	411,5	356,7
2663	367,4	2,9	355,4	215,2	374,7	409,8	355,2
2664	367,8	2,8	354,5	214,5	374,3	408,6	353,5
2665	368,3	2,8	353,9	214,8	374,5	407,7	354,2
2666	368,3	2,8	353,5	213,8	374,2	407,1	353,1
2667	367,7	2,7	352,6	213,9	374,0	406,7	352,1
2668	367,1	2,7	351,9	213,2	373,8	406,3	350,4
2669	366,2	2,6	351,8	213,3	373,3	405,9	350,1
2670	364,6	2,6	350,8	212,8	373,7	405,4	348,6
2671	362,9	2,6	350,6	212,2	372,8	404,5	348,2
2672	361,4	2,6	349,7	211,5	373,0	403,7	349,9
2673	359,0	2,6	349,1	212,2	372,9	402,6	348,8
2674	358,1	2,5	348,4	211,2	371,7	401,4	347,4
2675	358,2	2,5	348,1	211,6	372,2	400,3	347,4
2676	358,3	2,4	347,4	210,8	372,0	399,0	347,4
2677	363,0	2,4	347,1	210,2	371,6	398,0	346,4
2678	361,5	2,4	346,7	209,6	371,2	397,2	345,4
2679	356,5	2,3	346,5	209,9	371,0	396,5	343,7
2680	352,7	2,3	346,4	210,1	371,1	395,9	344,4
2681	349,8	2,3	346,2	209,0	370,2	394,8	343,8
2682	347,6	2,3	346,5	208,7	370,8	394,0	343,8
2683	345,2	2,3	346,5	208,1	370,7	392,9	343,6
2684	342,9	2,2	346,5	208,3	370,3	391,7	342,1
2685	340,8	2,2	346,6	208,0	370,2	390,0	341,7
2686	338,5	2,2	346,9	207,6	370,2	388,5	341,2
2687	336,6	2,2	347,0	207,2	370,8	386,8	340,9
2688	334,0	2,2	347,1	207,0	370,7	385,2	340,4
2689	332,4	2,1	347,3	206,3	370,2	383,5	338,7
2690	330,7	2,2	347,3	206,4	370,5	381,8	337,5
2691	328,8	2,1	347,1	205,9	370,7	379,9	337,8
2692	327,4	2,1	346,4	205,6	370,9	378,2	337,3
2693	326,2	2,1	345,9	205,4	370,6	376,5	335,6
2694	325,1	2,0	346,1	204,5	370,5	374,8	335,5
2695	322,9	2,0	345,5	203,7	370,5	373,1	335,4
2696	321,1	2,0	345,4	203,4	369,6	371,6	334,0
2697	319,0	2,0	345,3	203,0	369,9	369,5	333,2
2698	317,4	2,0	344,8	202,7	369,6	367,8	331,1
2699	316,1	2,0	344,2	202,8	369,8	366,0	331,6
2700	315,6	2,0	343,3	202,7	369,5	364,3	331,3
2701	312,5	2,0	343,3	202,1	368,7	362,5	330,5
2702	310,7	1,9	342,8	201,8	368,3	360,8	328,8
2703	308,7	1,9	342,1	201,2	367,9	358,9	328,4
2704	307,2	1,9	341,2	200,4	367,9	356,9	327,9
2705	305,3	1,9	340,2	200,3	367,2	355,0	326,7
2706	304,0	1,9	339,1	200,4	367,2	353,1	325,9
2707	302,4	1,9	338,6	199,9	366,4	351,3	324,2
2708	301,4	1,8	338,3	199,0	365,8	349,2	323,1
2709	300,2	1,8	337,0	199,1	365,4	347,2	321,8
2710	299,2	1,8	336,5	198,0	364,3	345,4	320,9
2711	298,2	1,8	335,4	197,9	363,8	343,5	319,9
2712	297,3	1,8	334,8	197,6	362,5	341,6	317,9
2713	295,8	1,8	334,3	197,2	362,3	340,0	317,1
2714	294,6	1,8	333,1	197,0	361,5	338,1	315,4
2715	293,6	1,8	332,3	196,9	360,4	336,4	313,6
2716	292,3	1,8	331,5	196,0	358,9	334,6	311,2
2717	291,1	1,7	330,9	195,4	358,3	332,8	309,8
2718	289,9	1,7	330,2	195,1	357,8	331,1	309,7
2719	289,5	1,7	329,2	194,5	357,2	329,4	308,6
2720	288,1	1,7	328,3	194,5	355,7	327,7	306,1
2721	287,1	1,7	327,5	194,0	355,5	326,0	304,6
2722	286,2	1,7	326,5	193,7	354,5	324,2	303,3
2723	285,3	1,7	325,7	192,9	352,9	322,6	301,7
2724	284,4	1,6	324,9	192,3	352,2	320,9	300,8
2725	283,5	1,6	323,7	192,2	351,7	319,3	299,3
2726	282,4	1,6	322,8	191,6	350,6	317,6	297,6
2727	281,0	1,6	321,2	191,1	350,0	316,1	296,0
2728	279,8	1,6	319,9	190,3	349,2	314,6	295,6
2729	279,1	1,6	318,2	190,2	348,4	313,1	294,1
2730	278,6	1,6	317,3	189,9	347,5	311,5	292,3
2731	277,7	1,6	316,2	189,2	346,4	310,2	290,5
2732	276,8	1,6	315,1	189,2	345,4	308,7	289,4
2733	275,5	1,6	313,8	188,6	344,7	307,3	288,4
2734	274,6	1,6	312,7	188,4	343,7	305,9	286,5

2735	273,4	1,5	311,5	187,7	342,4	304,5	285,3
2736	272,7	1,5	310,7	188,0	341,8	303,1	283,9
2737	271,5	1,5	309,6	187,5	340,4	301,7	282,9
2738	269,8	1,5	308,9	186,7	339,2	300,3	281,7
2739	267,9	1,5	307,7	186,6	338,7	299,0	280,3
2740	266,2	1,5	306,9	185,9	338,0	297,6	278,7
2741	264,9	1,4	306,1	185,5	337,4	296,1	276,9
2742	263,0	1,5	305,2	185,6	336,2	294,5	276,4
2743	262,1	1,4	304,2	183,9	335,4	293,1	275,0
2744	260,7	1,4	303,0	183,7	334,5	291,5	274,3
2745	259,3	1,4	301,4	184,3	333,6	289,9	272,8
2746	258,1	1,4	300,5	183,4	332,2	288,3	271,9
2747	257,0	1,4	299,4	183,7	331,4	286,7	270,0
2748	256,1	1,4	298,6	182,8	330,5	285,2	269,0
2749	254,5	1,4	297,3	182,4	329,5	283,7	267,1
2750	253,6	1,4	295,9	182,1	328,6	282,1	266,2
2751	252,2	1,4	294,4	181,2	328,0	280,5	265,6
2752	251,4	1,4	293,5	180,2	326,9	278,8	264,4
2753	250,0	1,4	291,8	180,4	326,0	277,4	262,0
2754	248,5	1,4	291,0	179,8	325,1	275,8	260,9
2755	247,2	1,4	289,9	179,2	324,3	274,3	260,2
2756	246,3	1,3	288,4	179,1	323,1	272,7	258,8
2757	244,9	1,4	287,4	179,0	322,2	271,2	257,9
2758	243,6	1,3	286,0	178,0	321,1	269,7	256,2
2759	242,5	1,3	284,2	178,2	320,3	268,1	254,6
2760	241,1	1,3	283,3	177,0	319,2	266,6	253,2
2761	240,3	1,3	281,7	176,8	318,2	265,1	251,5
2762	239,1	1,3	280,3	175,7	317,3	263,6	250,6
2763	238,2	1,3	279,5	175,6	315,8	262,2	250,0
2764	237,1	1,3	278,5	175,3	314,4	260,7	248,5
2765	236,0	1,3	277,0	175,5	314,3	259,3	246,7
2766	234,7	1,3	275,7	174,9	313,3	257,8	245,6
2767	233,9	1,2	274,6	173,6	312,0	256,5	244,8
2768	232,4	1,3	273,3	174,1	311,2	255,0	243,2
2769	231,6	1,3	272,4	173,7	310,2	253,6	241,5
2770	230,4	1,3	270,8	172,9	309,1	252,2	240,2
2771	229,5	1,3	270,3	172,4	308,2	250,9	239,4
2772	228,3	1,3	268,9	171,2	306,9	249,5	238,2
2773	227,4	1,2	268,4	171,6	306,2	248,1	236,7
2774	226,4	1,3	267,0	170,5	305,2	246,8	235,4
2775	225,5	1,2	266,3	170,6	304,2	245,5	233,6
2776	224,5	1,2	264,8	169,3	303,3	244,3	233,1
2777	223,2	1,2	263,6	168,8	302,3	243,0	231,9
2778	222,2	1,2	262,1	168,9	301,8	241,8	230,4
2779	221,6	1,2	260,5	169,0	300,9	240,5	229,5
2780	220,5	1,2	259,5	168,3	299,7	239,3	228,6
2781	219,4	1,2	258,3	167,6	299,1	238,2	227,2
2782	218,7	1,2	257,3	167,3	297,8	237,0	227,1
2783	217,3	1,2	256,0	166,6	297,0	235,8	226,2
2784	217,0	1,2	255,2	167,0	296,1	234,6	224,8
2785	216,3	1,2	253,7	166,3	295,2	233,4	223,5
2786	215,9	1,2	253,2	165,5	294,3	232,3	222,7
2787	215,2	1,2	252,3	164,9	293,3	231,2	221,8
2788	214,6	1,1	251,1	164,4	292,4	230,1	220,4
2789	213,8	1,1	250,4	164,6	291,7	229,1	218,9
2790	213,2	1,1	249,3	163,0	290,9	228,1	218,8
2791	212,5	1,1	248,5	162,9	290,1	227,1	217,1
2792	212,1	1,1	247,1	162,8	289,3	226,2	216,0
2793	211,4	1,1	246,0	162,1	288,4	225,2	214,9
2794	210,7	1,1	245,1	162,2	287,8	224,2	213,6
2795	209,9	1,1	245,1	160,5	287,3	223,3	213,0
2796	208,9	1,1	243,8	161,0	286,6	222,5	211,9
2797	207,6	1,1	243,2	160,1	285,8	221,6	210,8
2798	206,5	1,1	242,3	159,8	285,1	220,7	209,7
2799	205,0	1,1	241,3	160,0	284,4	219,9	208,9
2800	203,8	1,1	240,5	159,0	283,8	219,0	208,1
2801	202,4	1,1	239,3	158,9	282,8	218,1	207,1
2802	201,4	1,1	238,3	157,9	282,4	217,0	206,7
2803	200,2	1,1	237,7	157,7	281,9	216,2	205,6
2804	77,8	2,3	68,1	67,5	67,7	69,2	68,2
2805	94,8	2,2	68,1	67,5	67,7	69,1	68,2
2806	109,4	2,2	68,2	67,5	67,8	69,4	68,3
2807	115,8	2,2	68,3	67,6	67,8	70,5	68,4
2808	142,3	2,1	68,6	67,6	67,8	72,2	68,8
2809	216,7	2,0	69,1	67,6	67,9	75,3	69,5
2810	258,0	1,9	69,7	67,3	68,0	81,0	70,6
2811	287,2	1,8	70,6	67,5	68,2	89,4	72,2
2812	327,7	1,7	71,8	67,7	68,5	100,1	74,4
2813	344,0	1,6	73,3	68,0	68,8	114,0	77,3
2814	351,6	1,5	75,1	68,5	69,3	129,8	81,0
2815	376,9	1,4	77,2	69,0	69,9	146,3	85,4
2816	406,4	1,3	79,6	69,6	70,7	164,7	90,5
2817	426,6	1,1	82,4	70,4	71,8	186,3	96,4

2818	462,2	1,0	85,5	71,4	73,2	211,6	102,6	2	20-20
2819	466,0	0,9	88,9	72,5	74,8	240,1	109,2		
2820	466,0	1,0	92,7	73,8	76,9	267,7	115,9		
2821	418,9	6,2	96,8	75,7	79,3	291,1	123,1		
2822	372,9	6,1	101,6	77,4	82,1	305,6	130,7		
2823	383,3	6,0	106,4	79,4	84,9	314,0	138,7		
2824	400,0	5,9	111,1	81,1	88,1	321,7	146,0		
2825	435,9	5,7	115,6	83,0	91,1	329,8	152,6		
2826	449,7	5,6	120,1	84,7	94,1	337,0	157,8		
2827	481,2	5,4	124,4	86,3	97,1	344,9	162,3		
2828	519,4	5,2	128,7	88,0	99,8	358,3	166,7		
2829	524,4	5,0	132,8	89,7	102,5	376,7	171,4		
2830	521,2	4,9	136,9	91,5	105,0	396,0	176,7		
2831	522,0	4,8	141,1	93,2	107,4	414,9	182,7		
2832	524,5	4,6	145,2	95,1	109,6	432,3	189,4		
2833	550,3	4,4	149,4	96,9	112,2	451,3	196,5		
2834	554,4	4,3	153,8	98,6	114,8	472,8	202,6		
2835	554,1	4,1	158,2	100,6	117,6	494,4	211,0		
2836	554,0	3,9	162,7	102,5	120,7	513,7	216,6		
2837	556,9	3,8	167,5	104,3	123,4	531,1	223,6		
2838	556,1	3,6	172,5	106,3	126,9	545,9	230,4		
2839	550,8	3,5	177,4	108,2	129,6	558,2	238,0		
2840	545,9	3,3	182,6	110,3	133,3	567,9	243,5		
2841	544,4	3,2	187,9	112,2	135,9	575,5	251,9		
2842	538,7	3,1	193,2	114,6	139,5	581,5	257,9		
2843	529,2	3,0	198,6	116,6	143,1	585,2	263,8		
2844	519,2	2,9	204,0	118,9	147,8	586,5	268,5		
2845	511,8	2,8	209,4	120,9	151,8	585,5	273,2		
2846	504,9	2,7	214,6	122,9	155,2	582,9	280,3		
2847	498,7	2,6	219,7	124,9	159,3	578,5	283,5		
2848	493,6	2,5	224,8	127,2	163,3	573,4	285,7		
2849	488,8	2,4	229,5	129,1	166,7	567,8	290,4		
2850	484,8	2,3	234,5	131,1	169,4	562,0	294,5		
2851	481,1	2,3	238,9	132,9	173,4	556,8	297,2		
2852	477,3	2,1	243,1	134,6	177,3	551,6	298,1		
2853	474,3	2,1	247,4	136,3	180,1	546,7	302,0		
2854	472,1	2,0	251,7	138,0	183,3	542,1	302,7		
2855	468,4	1,9	255,5	139,7	186,5	537,7	303,5		
2856	466,5	1,8	259,1	141,3	189,0	533,7	305,4		
2857	465,0	1,8	262,6	143,0	191,5	530,0	308,2		
2858	462,3	1,7	265,9	144,6	193,3	526,9	312,4		
2859	460,2	1,6	268,8	145,9	197,0	523,3	311,4		
2860	457,1	1,6	271,6	147,3	200,2	519,8	312,3		
2861	454,0	1,5	274,6	148,6	202,9	516,8	313,9		
2862	451,4	1,4	277,0	150,3	205,3	513,9	316,4		
2863	449,4	1,3	279,5	151,8	208,5	510,4	315,2		
2864	447,0	1,3	281,1	153,3	211,4	507,3	317,6		
2865	444,8	1,2	283,4	154,7	215,0	504,2	318,2		
2866	443,6	1,2	285,3	155,8	218,3	501,4	318,1		
2867	442,7	1,1	287,4	157,1	221,5	499,0	319,5		
2868	442,5	1,0	288,9	158,1	224,8	496,4	319,3		
2869	441,9	1,0	291,0	159,2	228,7	494,4	319,0		
2870	441,9	0,9	292,8	160,3	231,6	492,8	320,2		
2871	443,7	0,8	294,1	161,0	234,6	491,2	320,5		
2872	443,9	0,8	294,9	162,0	238,0	490,8	321,7		
2873	445,7	0,8	296,7	162,8	239,9	490,5	320,4		
2874	446,9	0,7	297,8	164,0	242,9	490,8	320,6		
2875	449,8	0,6	298,7	164,9	245,6	491,6	320,5		
2876	450,4	0,5	300,2	165,7	248,1	494,2	321,5		
2877	441,1	0,5	301,7	166,4	249,8	496,4	324,0		
2878	421,8	0,5	302,5	167,4	252,4	496,1	326,9		
2879	400,3	0,4	303,9	168,8	256,4	493,0	323,4		
2880	361,8	0,3	304,8	178,0	257,3	485,9	324,8		
2881	347,0	6,9	306,6	175,3	260,9	476,3	326,2	3	19-19-20
2882	339,5	6,8	308,1	175,4	263,4	464,1	325,8		
2883	333,0	6,7	308,5	175,8	266,1	451,5	326,9		
2884	326,3	6,7	307,9	176,8	269,6	439,0	324,8		
2885	318,5	6,6	308,2	178,2	271,2	426,9	322,8		
2886	311,8	6,5	307,9	178,8	272,7	415,0	321,5		
2887	310,0	6,4	306,9	179,6	273,7	403,7	319,2		
2888	310,9	6,4	305,7	179,7	274,8	393,4	316,4		
2889	325,4	6,3	303,2	179,6	275,9	384,2	313,2		
2890	325,3	6,2	300,1	179,0	276,2	376,7	310,7		
2891	319,1	6,2	298,1	178,8	276,9	370,0	306,9		
2892	320,3	6,0	295,8	178,5	277,4	363,9	303,6		
2893	337,2	5,9	293,6	177,4	276,9	358,2	300,2		
2894	371,4	5,9	290,6	175,4	278,3	353,9	296,5		
2895	412,3	5,7	287,8	173,7	278,8	352,9	292,6		
2896	434,5	5,6	285,7	172,1	278,0	356,0	289,5		
2897	449,0	5,5	283,4	171,0	278,0	363,4	287,5		
2898	470,7	5,3	281,3	169,8	276,4	374,7	285,3		
2899	484,3	5,1	279,5	168,5	278,5	390,3	284,4		
2900	487,2	5,0	278,5	167,4	278,6	407,1	283,4		

2901	491,2	4,9	278,1	166,1	278,0	423,9	284,6
2902	492,6	4,7	278,2	167,2	279,1	439,5	285,2
2903	488,4	4,6	277,3	165,4	279,4	452,7	286,9
2904	484,4	4,5	276,6	165,5	280,0	462,8	288,0
2905	483,6	4,5	277,2	165,5	279,9	471,0	291,6
2906	484,4	4,3	278,3	165,2	280,7	477,6	294,3
2907	483,5	4,2	279,6	165,1	281,0	483,8	298,0
2908	482,9	4,1	281,0	165,5	282,6	489,5	299,2
2909	480,2	4,0	281,8	165,7	283,2	494,2	304,3
2910	479,9	3,9	283,2	165,9	284,8	498,2	306,0
2911	479,1	3,8	283,7	166,3	285,0	501,6	308,8
2912	479,7	3,7	285,0	166,6	286,6	504,7	310,3
2913	482,3	3,6	286,3	167,0	288,0	508,0	313,5
2914	482,1	3,5	287,6	167,1	288,1	510,9	316,6
2915	478,7	3,5	288,5	167,6	289,8	513,2	319,7
2916	474,6	3,3	289,6	168,4	290,9	515,0	321,1
2917	470,1	3,4	290,5	169,1	291,3	515,8	324,3
2918	466,4	3,2	291,3	169,4	293,1	515,9	327,5
2919	463,7	3,1	292,3	170,2	296,0	515,6	328,3
2920	461,3	3,0	292,7	171,2	296,8	515,1	329,9
2921	460,1	3,0	292,1	171,7	298,7	514,3	331,9
2922	459,0	2,8	293,7	172,2	299,2	512,8	332,9
2923	458,3	2,8	295,2	173,4	300,9	510,9	333,7
2924	457,9	2,7	296,4	174,0	302,7	509,5	336,9
2925	456,4	2,6	296,8	174,5	303,6	507,8	338,6
2926	455,6	2,6	297,2	175,3	304,6	506,0	340,4
2927	455,5	2,5	298,5	176,3	305,7	504,7	341,8
2928	454,7	2,4	299,4	176,5	307,2	503,8	343,1
2929	453,4	2,3	299,7	177,4	308,4	502,8	344,6
2930	452,1	2,3	301,3	177,8	310,1	501,9	345,3
2931	450,9	2,2	301,8	178,8	311,5	500,9	346,5
2932	449,3	2,2	302,9	179,3	312,6	499,9	347,4
2933	447,9	2,1	303,3	179,8	313,5	498,8	348,0
2934	446,0	2,0	304,0	180,2	314,9	497,7	348,5
2935	444,8	1,9	304,6	181,0	316,2	496,5	349,3
2936	444,3	1,9	305,1	181,2	317,1	495,2	349,9
2937	442,5	1,8	305,5	181,7	318,1	494,0	350,3
2938	441,7	1,7	306,4	182,3	319,2	492,8	350,8
2939	441,5	1,7	307,3	182,3	320,8	491,6	352,0
2940	440,9	1,7	308,2	182,6	321,5	490,6	351,5
2941	440,8	1,6	308,3	183,1	322,7	489,7	352,4
2942	440,5	1,5	308,5	183,9	323,6	489,2	353,2
2943	437,2	1,5	309,8	184,0	323,1	488,7	353,7
2944	429,2	1,4	311,3	184,0	324,5	487,8	354,6
2945	422,9	1,4	312,5	183,2	322,1	486,2	354,9
2946	419,2	1,4	313,8	182,7	321,4	483,6	356,6
2947	415,8	1,3	314,8	181,5	323,1	480,7	353,7
2948	412,9	1,3	315,3	181,2	323,2	477,6	354,6
2949	411,3	1,2	315,8	181,1	322,6	474,5	354,1
2950	409,3	1,2	316,3	180,9	325,1	471,3	353,5
2951	408,2	1,1	316,4	180,6	323,8	468,5	354,4
2952	406,0	1,1	316,9	180,5	325,0	465,6	353,3
2953	403,2	1,1	317,7	180,2	328,1	463,0	350,7
2954	399,5	1,0	317,9	180,5	327,2	460,4	351,3
2955	394,3	1,0	318,0	180,5	327,4	457,2	350,3
2956	389,4	1,0	317,7	180,7	327,0	453,3	350,4
2957	355,1	8,4	317,4	188,4	328,2	448,8	350,0
2958	347,1	8,3	317,8	184,1	329,1	441,2	350,0
2959	351,0	8,2	317,9	183,2	329,8	432,4	350,2
2960	357,3	8,1	317,6	182,8	330,1	423,6	348,5
2961	353,1	8,0	316,7	182,2	330,8	415,7	347,8
2962	337,4	7,9	316,1	182,9	331,5	407,7	345,6
2963	331,5	7,8	315,2	182,9	333,1	399,6	342,2
2964	326,1	7,7	313,5	183,3	332,0	391,9	340,6
2965	333,8	7,6	311,8	182,2	333,0	384,3	337,1
2966	360,0	7,6	310,4	181,3	330,2	377,8	335,9
2967	440,3	7,4	308,6	178,7	330,0	376,2	331,1
2968	485,3	7,2	307,1	176,7	329,5	384,0	328,1
2969	491,1	7,1	305,1	175,4	328,6	399,5	325,2
2970	486,3	6,9	303,5	174,8	327,2	417,3	323,9
2971	485,9	6,8	302,2	173,7	327,2	433,8	321,3
2972	493,2	6,7	300,8	172,7	325,0	448,8	319,4
2973	506,1	6,5	300,8	171,5	325,5	462,7	319,6
2974	525,6	6,4	300,7	171,5	324,0	478,3	320,4
2975	528,8	6,2	301,0	174,9	327,5	495,8	316,6
2976	530,6	6,0	300,8	173,4	328,0	512,8	317,0
2977	532,4	5,9	301,5	171,9	325,3	528,3	319,3
2978	534,0	5,8	302,8	171,3	324,5	542,7	321,2
2979	534,6	5,6	304,8	170,9	321,6	555,7	325,1
2980	533,5	5,5	306,7	170,8	322,1	567,1	327,9
2981	531,2	5,4	308,3	170,9	324,4	577,0	329,3
2982	529,2	5,2	310,4	170,8	320,4	584,8	332,8
2983	526,7	5,1	312,8	171,0	318,8	591,3	334,9

2984	524,5	5,0	315,0	171,0	317,7	596,0	338,1
2985	522,3	4,9	317,2	171,1	317,0	599,3	341,4
2986	518,7	4,7	319,6	171,3	318,7	601,9	342,4
2987	515,6	4,7	321,7	171,9	316,1	603,6	345,9
2988	512,6	4,5	323,6	172,8	319,9	604,2	347,9
2989	508,9	4,4	324,4	173,7	320,9	604,0	349,0
2990	507,4	4,3	326,5	174,2	320,6	602,5	350,4
2991	504,0	4,2	328,5	175,0	318,8	600,9	352,3
2992	501,5	4,1	330,0	175,2	317,0	598,9	354,7
2993	500,5	4,0	331,5	175,3	316,0	597,1	356,6
2994	499,0	4,0	332,8	175,6	315,6	595,1	359,0
2995	496,7	3,8	334,2	176,1	316,4	593,0	359,7
2996	495,4	3,8	335,2	176,5	317,7	590,9	358,5
2997	494,2	3,6	337,4	177,6	316,5	588,9	361,3
2998	492,7	3,6	338,9	177,9	316,4	586,6	362,9
2999	489,9	3,4	340,2	179,6	317,5	584,7	361,8
3000	486,9	3,4	341,5	178,8	317,5	581,8	362,6
3001	483,8	3,3	342,9	179,9	318,4	578,9	363,9
3002	481,2	3,2	344,1	180,2	317,3	575,6	364,5
3003	480,0	3,2	344,6	180,9	316,4	573,0	366,4
3004	478,0	3,1	345,5	181,6	316,4	569,7	368,0
3005	476,8	3,0	345,7	182,0	317,8	566,9	366,2
3006	474,6	2,9	346,6	182,8	316,4	564,2	367,5
3007	472,8	2,8	347,4	182,8	318,7	561,1	367,9
3008	470,8	2,8	348,3	183,7	315,6	558,4	368,0
3009	469,0	2,7	349,2	183,5	318,1	555,6	367,4
3010	466,9	2,6	350,1	184,8	320,5	552,9	367,5
3011	465,6	2,6	350,3	185,0	317,3	549,9	367,6
3012	464,2	2,5	350,7	185,5	319,2	547,3	368,6
3013	463,1	2,4	351,1	186,3	316,4	544,8	367,4
3014	462,2	2,4	352,0	187,5	320,0	542,5	364,6
3015	461,8	2,3	352,2	188,2	322,6	540,6	363,7
3016	462,2	2,2	352,5	189,2	322,5	538,5	364,9
3017	463,4	2,1	353,1	189,9	322,5	537,2	365,7
3018	467,2	2,1	353,9	190,4	323,9	537,3	365,4
3019	469,8	2,0	354,0	191,5	324,7	537,9	365,2
3020	466,0	1,9	354,4	192,1	324,9	539,3	364,5
3021	458,9	1,9	354,5	192,7	321,2	540,4	364,2
3022	449,9	1,9	355,0	193,2	324,6	539,1	363,1
3023	442,5	1,8	355,7	194,5	325,2	536,4	363,8
3024	437,3	1,7	355,6	195,2	325,0	532,1	363,3
3025	433,6	1,7	356,3	195,7	325,7	526,7	364,6
3026	429,6	1,6	356,9	196,3	326,3	521,7	364,4
3027	425,6	1,6	357,1	197,3	327,3	516,5	364,6
3028	408,9	2,5	356,0	213,7	324,7	511,5	364,8
3029	361,0	12,8	356,9	213,2	326,1	503,2	367,4
3030	377,2	12,7	357,1	207,2	327,7	489,2	367,4
3031	409,8	12,4	357,1	204,7	327,3	475,9	369,3
3032	417,5	12,2	356,5	204,1	329,0	465,6	367,3
3033	405,8	12,1	355,1	204,2	328,4	457,1	364,0
3034	394,0	12,0	352,9	204,1	328,2	448,9	361,6
3035	382,0	11,9	351,3	204,5	328,1	441,2	359,5
3036	365,9	11,8	348,2	204,9	328,0	432,8	357,8
3037	355,8	11,7	345,4	205,3	326,7	424,7	354,7
3038	355,2	11,4	342,3	204,7	326,7	416,4	353,1
3039	354,8	11,4	337,2	206,9	327,1	408,6	349,4
3040	362,1	11,2	332,0	205,1	326,6	401,0	346,6
3041	419,3	11,1	329,1	201,9	325,8	395,7	347,1
3042	480,6	10,8	326,3	199,9	324,3	395,6	344,7
3043	505,6	10,6	323,3	198,0	323,0	404,1	343,6
3044	510,1	10,6	319,2	197,0	322,3	419,4	343,9
3045	512,8	10,4	317,4	195,9	321,6	437,7	343,5
3046	515,7	10,2	314,7	195,0	320,1	453,9	344,7
3047	514,9	10,0	311,7	194,5	318,8	466,9	346,6
3048	511,4	9,9	309,6	193,6	317,9	477,4	348,2
3049	511,8	9,7	307,5	193,2	317,5	485,9	350,8
3050	513,1	9,6	306,5	193,0	316,4	493,8	352,6
3051	514,3	9,4	304,6	192,7	315,8	500,6	355,8
3052	516,9	9,2	304,3	192,7	315,2	507,5	357,8
3053	526,3	9,1	303,8	192,0	314,0	514,9	360,4
3054	536,0	8,9	303,5	191,3	313,4	523,5	363,0
3055	540,8	8,8	302,8	191,4	313,2	534,5	366,1
3056	547,4	8,6	303,1	191,3	312,4	547,5	369,0
3057	552,7	8,4	302,3	191,6	312,1	561,1	371,8
3058	552,5	8,3	303,2	191,3	311,6	573,8	374,5
3059	550,9	8,1	303,5	191,7	311,1	584,3	377,2
3060	547,5	8,0	304,9	191,3	310,8	593,3	379,4
3061	544,4	7,8	306,8	191,7	310,2	599,4	382,0
3062	542,3	7,7	308,3	191,9	309,9	604,5	384,5
3063	540,1	7,5	309,9	192,1	309,6	607,6	387,0
3064	538,1	7,4	311,7	192,4	308,8	609,2	388,7
3065	532,7	7,2	314,9	192,5	309,0	610,7	391,6
3066	529,1	7,1	316,7	192,8	309,0	611,3	393,6

3067	527,0	7,0	318,7	193,0	308,8	611,2	395,4
3068	525,3	6,9	321,9	193,1	309,3	610,8	397,0
3069	524,6	6,8	324,3	193,5	309,1	610,5	398,3
3070	524,4	6,6	326,9	193,5	309,9	610,2	399,8
3071	521,7	6,5	329,3	194,2	309,7	609,3	401,0
3072	520,2	6,4	331,2	194,3	309,7	608,1	402,2
3073	518,1	6,2	333,5	194,4	310,3	606,9	403,1
3074	516,2	6,1	335,9	194,4	310,3	605,4	403,8
3075	514,7	6,0	338,7	195,1	310,9	604,1	404,7
3076	519,4	5,9	340,6	194,9	311,4	602,9	405,3
3077	521,2	5,7	343,9	194,8	311,1	603,5	405,6
3078	521,8	5,6	346,4	195,5	311,7	605,0	406,3
3079	522,5	5,5	348,6	195,4	311,9	606,9	406,9
3080	522,7	5,4	350,5	195,5	312,6	608,9	407,5
3081	521,9	5,3	352,6	196,4	312,7	610,9	407,9
3082	520,5	5,2	355,4	196,5	312,7	612,5	408,1
3083	518,3	5,1	357,7	196,8	313,6	613,0	408,7
3084	515,6	5,0	359,7	196,6	313,8	613,2	409,2
3085	513,4	4,9	361,4	197,1	314,1	612,7	409,8
3086	510,2	4,8	363,3	197,4	314,7	611,7	410,3
3087	507,0	4,7	365,5	197,3	315,2	610,4	410,9
3088	505,3	4,6	367,3	198,0	315,5	608,6	411,5
3089	502,6	4,5	369,5	198,1	315,7	606,7	411,7
3090	500,1	4,4	371,0	198,3	316,4	604,7	412,4
3091	498,7	4,3	372,8	198,6	317,4	602,5	412,7
3092	498,1	4,2	374,3	198,3	317,1	600,4	413,1
3093	497,0	4,1	375,7	199,0	317,7	598,6	413,2
3094	495,5	4,0	376,9	199,6	318,4	597,0	413,4
3095	494,3	4,0	378,0	199,5	318,8	595,2	413,7
3096	493,6	3,9	379,0	200,5	319,1	593,3	413,5
3097	494,1	3,8	380,3	200,4	319,9	592,1	413,9
3098	495,8	3,7	380,9	200,7	320,9	591,0	414,2
3099	496,6	3,6	381,4	200,4	320,8	590,8	414,3
3100	496,2	3,5	382,2	200,7	321,5	590,9	414,7
3101	493,1	3,4	383,0	201,0	322,0	591,0	415,1
3102	486,1	3,3	384,0	201,2	322,5	590,6	415,9
3103	479,1	3,3	385,1	201,4	323,0	588,6	416,4
3104	474,2	3,3	385,7	202,2	322,9	585,8	417,2
3105	469,7	3,2	386,2	201,9	323,5	582,1	418,1
3106	466,0	3,2	386,5	202,4	324,2	577,6	418,3
3107	461,4	3,0	386,4	203,1	324,6	573,1	419,1
3108	458,4	3,0	386,7	203,2	325,8	568,5	419,7
3109	455,3	2,9	386,9	203,3	326,1	563,8	420,3
3110	451,8	2,9	386,9	204,1	326,7	559,4	420,3
3111	448,9	2,9	387,0	204,4	327,2	555,0	420,5
3112	446,7	2,8	386,8	204,4	327,9	550,5	420,3
3113	443,8	2,8	386,2	205,0	328,6	546,0	419,7
3114	441,7	2,7	386,0	204,9	328,9	542,0	419,2
3115	439,4	2,7	386,1	205,0	329,8	538,0	418,4
3116	437,0	2,6	386,2	205,4	329,5	534,3	416,7
3117	433,6	2,6	385,5	205,8	330,6	531,0	416,7
3118	430,6	2,5	385,0	205,5	331,2	527,1	416,2
3119	428,7	2,5	384,6	205,8	331,1	523,4	414,1
3120	424,1	2,4	384,3	206,2	331,9	519,7	413,5
3121	416,6	2,4	383,5	206,2	332,4	515,6	413,4
3122	408,7	2,4	383,1	206,9	332,3	511,0	411,5
3123	403,7	2,4	382,2	207,0	332,7	505,6	410,7
3124	399,3	2,4	381,0	207,4	333,5	500,3	409,2
3125	395,4	2,3	379,4	207,9	334,0	494,4	408,1
3126	392,0	2,3	379,0	207,6	334,4	489,3	407,1
3127	388,5	2,3	378,2	207,6	335,1	483,5	405,6
3128	385,2	2,3	376,7	207,8	335,5	478,6	404,4
3129	382,0	2,3	376,3	207,5	336,0	473,6	402,8
3130	378,6	2,2	375,0	207,9	336,0	468,7	400,7
3131	375,4	2,2	374,0	207,9	335,6	463,8	398,0
3132	373,4	2,2	373,4	208,3	336,5	459,0	396,6
3133	370,8	2,1	371,9	207,2	336,7	454,4	395,5
3134	367,7	2,1	370,5	207,8	337,3	450,0	393,7
3135	365,8	2,1	369,0	207,4	337,5	445,6	391,1
3136	363,8	2,1	367,5	207,5	338,1	441,5	390,0
3137	361,9	2,1	366,0	207,0	338,5	437,3	388,1
3138	359,7	2,1	364,3	207,0	338,5	433,7	387,5
3139	358,1	2,0	363,6	207,0	338,7	430,2	385,8
3140	356,1	2,0	363,0	207,0	338,7	426,6	382,8
3141	352,8	2,0	360,6	206,4	339,4	423,4	381,2
3142	350,4	2,0	360,0	206,5	339,0	420,1	379,7
3143	348,5	2,0	359,0	206,1	339,3	416,8	377,6
3144	346,5	1,9	358,3	206,5	339,1	413,4	375,6
3145	344,9	2,0	356,2	206,1	339,4	410,4	374,1
3146	343,0	1,9	355,3	206,1	339,6	407,3	372,3
3147	341,0	1,9	354,4	205,7	339,4	404,3	370,4
3148	339,8	1,9	353,4	205,4	339,1	401,5	368,9
3149	338,8	1,9	351,4	205,1	339,5	398,8	367,4

3150	337,2	1,8	350,5	204,6	339,8	396,2	365,9
3151	334,8	1,8	349,1	204,3	339,7	393,6	365,0
3152	332,8	1,8	347,4	203,8	339,3	390,9	363,2
3153	330,5	1,8	345,7	203,6	339,7	388,6	361,4
3154	329,1	1,8	344,7	203,6	339,7	386,4	360,1
3155	327,2	1,7	342,5	204,0	339,5	384,0	358,1
3156	325,0	1,7	342,0	203,3	339,7	381,5	357,5
3157	323,4	1,7	341,3	202,9	339,3	379,1	355,6
3158	321,4	1,7	339,5	202,0	339,1	376,5	354,2
3159	319,6	1,7	338,6	201,8	339,1	374,1	352,5
3160	318,2	1,6	336,8	202,2	338,2	371,6	350,9
3161	316,3	1,7	336,0	201,7	338,4	369,2	349,7
3162	315,2	1,6	334,9	201,1	338,5	366,6	348,8
3163	313,7	1,6	334,2	200,8	338,1	364,5	347,1
3164	312,2	1,6	333,2	200,7	337,9	362,2	346,1
3165	310,8	1,6	331,5	199,6	336,7	359,9	344,5
3166	309,4	1,6	330,3	199,4	337,1	357,6	342,7
3167	308,6	1,6	328,2	199,6	336,2	355,5	341,4
3168	307,6	1,6	327,4	199,0	336,4	353,4	340,3
3169	306,3	1,5	326,2	198,1	336,3	351,2	339,4
3170	305,2	1,5	325,2	197,9	335,6	349,1	337,3
3171	304,7	1,5	323,9	197,5	335,3	347,2	336,2
3172	303,7	1,5	322,5	196,9	334,8	345,3	334,8
3173	302,7	1,5	321,1	196,0	334,2	343,4	333,5
3174	301,8	1,5	320,4	195,7	334,0	341,6	332,2
3175	301,1	1,4	319,3	195,4	333,7	340,0	330,7
3176	299,5	1,4	318,6	195,7	333,4	338,3	329,0
3177	299,1	1,4	317,4	194,8	332,7	336,5	328,2
3178	298,4	1,4	316,1	194,1	332,7	334,9	327,4
3179	297,5	1,3	314,2	193,7	332,5	333,4	325,6
3180	297,1	1,4	313,2	193,0	331,9	331,9	324,8
3181	296,7	1,3	312,4	192,1	331,8	330,7	322,9
3182	296,4	1,3	311,1	191,6	331,0	329,3	321,7
3183	296,4	1,3	309,8	191,4	330,4	328,2	320,6
3184	296,6	1,3	309,1	190,6	330,3	327,0	319,7
3185	296,7	1,3	308,4	190,7	329,7	326,2	319,0
3186	295,9	1,3	307,1	189,6	329,0	325,2	317,5
3187	295,7	1,2	306,0	189,8	329,4	324,4	317,4
3188	295,9	1,2	304,7	189,0	328,7	323,4	316,1
3189	295,0	1,2	303,8	188,5	328,2	322,7	315,1
3190	294,9	1,2	303,5	187,5	328,3	322,0	314,5
3191	294,5	1,2	301,9	187,2	328,0	321,3	313,8
3192	293,5	1,2	301,1	187,6	327,1	320,5	313,0
3193	292,5	1,2	300,2	186,4	326,6	320,0	312,2
3194	292,1	1,2	299,1	186,1	326,7	319,5	312,6
3195	291,3	1,1	298,2	185,5	326,5	319,0	311,8
3196	290,6	1,1	297,3	185,3	326,2	318,6	310,8
3197	289,8	1,1	296,5	184,8	326,3	318,0	311,2
3198	288,9	1,1	296,0	184,7	325,6	317,5	310,5
3199	288,1	1,1	295,0	184,3	325,2	316,9	309,5
3200	287,3	1,1	293,4	183,8	324,8	316,3	308,6
3201	286,4	1,1	293,0	183,8	324,5	315,7	308,0
3202	286,1	1,1	292,6	183,4	324,0	315,0	308,0
3203	283,6	1,0	291,3	182,7	324,2	314,2	307,6
3204	282,8	1,0	290,0	182,4	323,5	313,5	306,7
3205	281,1	1,0	289,0	182,3	323,0	312,5	305,7
3206	280,0	1,0	287,9	182,0	322,9	311,7	305,0
3207	278,9	1,0	286,6	181,6	322,2	310,6	304,1
3208	277,7	0,9	285,7	181,4	321,8	309,6	303,6
3209	277,1	0,9	284,0	181,0	321,5	308,6	302,7
3210	276,3	0,9	283,4	180,5	321,4	307,5	302,2
3211	275,4	1,0	282,7	180,4	320,8	306,4	301,1
3212	274,6	0,9	282,2	180,1	320,5	305,2	300,3
3213	273,6	0,9	281,0	179,9	319,7	304,2	299,4
3214	272,7	0,9	280,2	179,4	319,2	303,2	298,6
3215	271,8	0,9	279,0	179,2	318,9	302,1	297,6
3216	271,6	0,8	278,2	179,2	318,0	300,9	296,7
3217	270,8	0,9	277,5	178,9	317,5	300,0	295,7
3218	269,7	0,8	277,0	178,4	317,3	298,7	294,7
3219	268,4	0,9	276,2	178,2	316,7	297,8	294,2
3220	268,1	0,8	274,8	178,0	316,2	296,9	293,5
3221	267,5	0,8	273,6	177,8	315,8	295,8	292,3
3222	266,6	0,8	272,6	177,5	315,3	294,7	291,8
3223	265,9	0,8	272,1	176,9	314,3	293,5	290,7
3224	265,3	0,8	271,1	176,9	314,0	292,5	289,9
3225	264,1	0,8	270,3	176,6	313,5	291,4	288,9
3226	263,4	0,7	269,3	176,2	313,1	290,3	287,8
3227	262,8	0,7	268,2	175,8	312,9	289,2	286,7
3228	261,8	0,8	268,3	175,4	311,8	288,1	285,7
3229	261,1	0,7	268,2	175,3	311,6	286,9	284,9
3230	260,1	0,7	266,6	175,0	311,0	285,7	283,9
3231	259,2	0,7	267,1	174,5	310,5	284,6	282,7
3232	257,9	0,7	266,0	174,2	309,8	283,5	281,7

3233	257,1	0,7	264,8	174,0	309,3	282,3	281,0
3234	256,2	0,7	265,2	173,5	308,8	281,1	280,0
3235	255,4	0,6	264,2	173,1	308,2	279,9	279,2
3236	254,6	0,6	263,2	172,8	307,6	278,6	278,0
3237	253,4	0,6	262,8	172,4	307,1	277,6	276,9
3238	252,4	0,7	262,3	172,2	306,4	276,3	276,2
3239	251,5	0,6	261,7	171,8	305,8	275,2	275,1
3240	250,5	0,6	260,5	171,9	305,3	274,0	274,1
3241	249,6	0,6	259,8	171,3	304,9	272,8	273,4
3242	248,5	0,6	258,2	171,0	304,1	271,7	272,6
3243	247,7	0,6	258,0	170,8	303,4	270,4	271,6
3244	246,6	0,6	257,7	170,4	303,5	269,4	270,7
3245	245,6	0,5	255,7	170,0	302,8	268,1	269,7
3246	244,7	0,5	255,3	169,6	302,5	267,0	268,9
3247	243,7	0,5	253,8	169,3	301,9	265,9	267,7
3248	242,4	0,5	253,7	168,9	301,2	264,7	266,9
3249	241,3	0,5	253,2	168,3	301,1	263,5	265,8
3250	240,3	0,6	252,7	168,3	300,2	262,3	264,7
3251	239,2	0,5	251,2	167,9	299,3	261,0	264,0
3252	238,7	0,5	251,2	167,4	298,8	259,8	262,8
3253	237,3	0,5	250,6	167,1	298,4	258,6	261,8
3254	236,6	0,6	249,4	166,8	297,8	257,4	261,0
3255	235,4	0,5	248,6	166,3	297,3	256,2	259,9
3256	234,6	0,5	247,6	166,0	296,7	255,1	259,0
3257	233,7	0,5	247,0	165,8	296,0	254,0	257,8
3258	232,8	0,5	246,0	165,3	295,8	252,7	257,0
3259	231,8	0,4	244,0	164,8	295,2	251,5	256,2

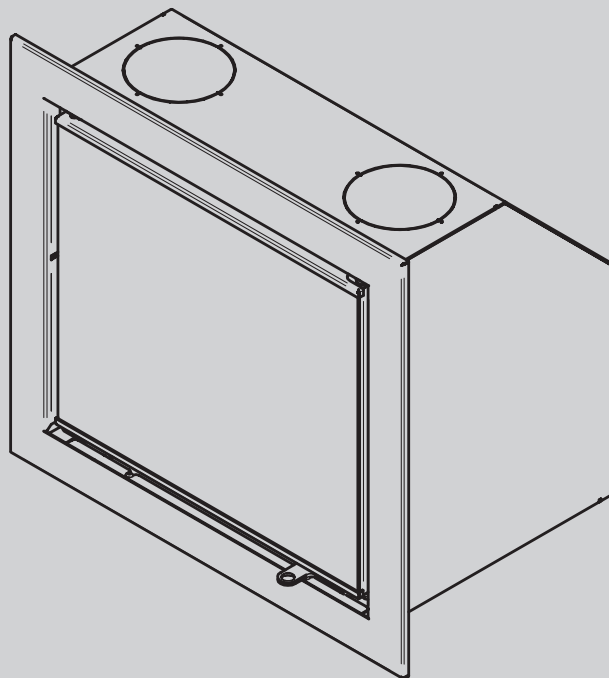
APPENDIX 5: Participants

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



Installation and Operating Instructions

MASONRY INSERT-700

The Spartherm wood insert have been tested and certified by CSA based on the following standards: UL 127 / ULCS628. EPA : U.S.ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 emissionstandards using Crib wood.



Spartherm Feuerungstechnik GmbH
Maschweg 38 · 49324 Melle
Phone +49 5422 94 41-0
www.spartherm.com

Save this manual and keep it in a safe place that it is easy to refer to it.

INTRODUCTION AND UNIT DESCRIPTION SPARTHERM INSERT-700 RANGE.

PLEASE READ THIS ENTIRE MANUAL BEFORE YOU INSTALL YOUR INSERT-700.

PLEASE READ THE MANUAL FOR OPERATING INSTRUCTIONS AND HOW TO BURN THE FIRE THAT YOU HAVE A CLEAN AND EFFICIENT FIRE.

FAILURE TO FOLLOW INSTRUCTIONS MAY RESULT IN PROPERTY DAMAGE, BODILY INJURY, OR EVEN DEATH.

Save this manual and keep it in a safe place that it is easy to refer to it.

"DO NOT INSTALL IN A MOBILE HOME"

WARNING: DO NOT OVERFIRE.

IF THE STOVE TOP OR CHIMNEY OR CONNECTOR GLOW RED, YOU ARE OVERFIRING!
THIS IS DANGEROUS AND WILL VOID THE WARRANTY.

This insert 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 range of inserts/stoves/zero clearance inserts have been tested by...

POLYTEST –
Polytests Services Inc.
695 B rue Gaudette,
St-Jean-sur-Richelieu
Québec, Canada, J3B 7S7
450.741.3636
www.polytests.com

AND ARE LISTED TO UL1482-2011 AND ULCS628-93.

THEY ARE ALSO EPA CERTIFIED – U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using CRIB WOOD. 700 insert 1.7 g/hr WARRANTY.

PLEASE REFER TO WARRANTY CONDITIONS IN THE MANUAL.

"U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using crib wood.

SAFETY INFORMATION



WARNING

IF THE INFORMATION IN THESE INSTRUCTIONS IS NOT FOLLOWED EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR DEATH. IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE INJURY OR PROPERTY DAMAGE, BODILY INJURY OR EVEN DEATH. PLEASE READ ENTIRE MANUAL BEFORE YOU INSTALL AND USE YOUR APPLIANCE. THIS APPLIANCE HAS NOT BEEN TESTED WITH AN UNVENTED GAS LOG SET. TO REDUCE RISK OF FIRE OR INJURY, DO NOT INSTALL AN UNVENTED GAS LOG SET INTO THE APPLIANCE..

- This appliance can be very hot when burning.
- Combustible materials such as firewood, wet clothing, etc. placed too close can catch fire.
- Children and pets must be kept from touching the appliance when it is hot.
- The chimney must be sound and free of cracks. Before installing this unit, contact the local building or fire authority and follow their guidelines.
- Operate only with the door tightly closed.
- Do not use an elevated grate or otherwise raise the fire.
- At least 14 square inches (90,3 square centimeters) of outside air must be admitted to the room or directly to the unit through a 5" (127 mm) diameter pipe. Failure to provide this may starve other fuel burning appliances from an adequate air supply.
- Make sure not to create negative pressure in the installation room, e.g. by means of an exhaust fan or similar mechanical blower, as this could affect

the combustion of the wood insert or increase the possibility of smoke leakage.

- This appliance is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or to green or freshly cut hardwoods.
- Do not burn green or freshly cut wood.
- Do not start a fire with chemicals or fluids such as gasoline, engine oil, etc.
- Do not burn treated wood, coal, charcoal, colored paper, cardboard, solvents or garbage.
- Do not let the appliance become hot enough for any part to glow red.
- KEEP THE STOVE TOP TEMPERATURE BELOW 700°F (371°C). Attempts to achieve heat output rates that exceed design specifications can result in steel distortion and damage.



WARNING

**HOT GLASS WILL CAUSE BURNS.
DO NOT TOUCH GLASS UNTIL COOLED.
NEVER ALLOW CHILDREN TO TOUCH GLASS.**

NOTICE

DO NOT DISCARD THIS MANUAL

- IMPORTANT OPERATING AND MAINTENANCE INSTRUCTIONS INCLUDED.
- READ, UNDERSTAND AND FOLLOW THESE INSTRUCTIONS FOR SAFE INSTALLATION AND OPERATION.
- LEAVE THIS MANUAL WITH PARTY RESPONSIBLE FOR USE AND OPERATION.

Safe Wood-Burning Practices

When using your wood burning appliance, follow these guidelines for safe operation:

Keep flammable items, like curtains, furniture, newspapers, and books, away from your appliance.

Only use newspaper, dry kindling and all-natural or organic fire starters. Never start a fire with gasoline, kerosene, or charcoal starter.

Do not burn wet or green (unseasoned) wood.

Many wax and sawdust logs are made for open hearth wood insert only. Check your wood stove or wood insert operating instructions before using artificial logs.

If you use manufactured logs, choose those made from 100 percent compressed sawdust.

Build hot fires. For most appliances, a smoldering fire is not safe or efficient.

Keep the doors of your wood-burning appliance closed unless loading or stoking the live fire. Harmful chemicals, like carbon monoxide, can be released into your home.

Regularly remove ashes into a covered, metal container. Store the container outdoors on a nonflammable surface.

Keep a fire extinguisher handy.

Do not burn:

1. Garbage
 2. Lawn clippings or yard waste
 3. Materials containing rubber, including tires
 4. Materials containing plastic
 5. Waste petroleum products, paints or paint thinners, or asphalt products
 6. Materials containing asbestos
 7. Construction or demolition debris
 8. Railroad ties or pressure-treated wood
 9. Manure or animal remains
 10. Salt water driftwood or other previously salt water saturated materials
 11. Unseasoned wood
 12. Paper products, cardboard, plywood, or particleboard.
- The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater. Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke.

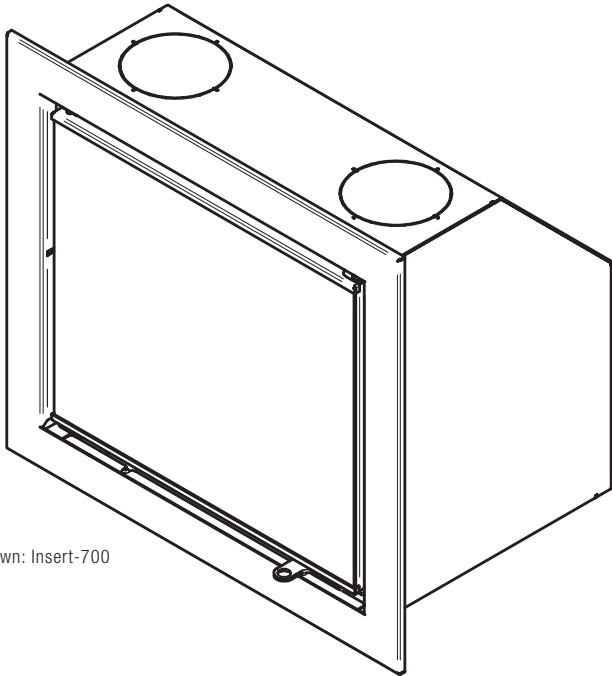
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SPECIFICATIONS MASONRY INSERT-700:

	Spartherm Masonry Insert-700
Weight of Insert	275 lbs (124.5 kg)
Insert exterior: Width/depth/height (inches)	W 26 5/16" D 17 5/16" H23 5/8"
Recommended amount of wood when fueling (lbs/kg) wood: 2-3 logs of wood of app. 18-21" / 46-53 cm	2,1 kg/hr
Intermittent operation:	
Single wall connector stove pipe:	6"/153 mm
Chimney pipe - class A. UL-103 HT:	6"/153 mm
Optimal thermal output:	25,000 BTU/hr
Min. /Max. output (kW):	25,000 BTU/hr
Tested EPA emission particulate rate:	1.7 g/hr

1. INSTALLATION OVERVIEW



Example shown: Insert-700

2. INTRODUCTION



The Spartherm masonry insert have been tested and certified by CSA based on the following standards: UL 127 / ULCS628. EPA : U.S.ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 emission standards using Crib wood. Before installing your Spartherm masonry insert, PLEASE NOTE: THE LOCAL AUTHORITY HAVING JURISDICTION (MUNICIPAL BUILDING DEPARTMENT, FIRE PREVENTION BUREAU, ETC) SHOULD BE CONSULTED BEFORE INSTALLATION TO DETERMINE THE NEED TO OBTAIN A PERMIT. Please read this manual carefully before installing or using your masonry insert. Incorrect installation may result in fire. To reduce the risk of fire, follow the installation instructions. Failure to do so may result in property damage, bodily injury or even death. Keep this manual handy so you can refer to it whenever necessary.



WARNING

- THIS APPLIANCE IS HOT WHEN OPERATED AND CAN CAUSE SEVERE BURNS IF CONTACTED.
- ANY CHANGES OR ALTERATIONS TO THIS APPLIANCE OR ITS CONTROLS CAN BE DANGEROUS AND IS PROHIBITED:
- Do not operate appliance before reading and understanding operating instructions. Failure to operate appliance according to operating instructions could cause fire or injury.
- Before installing this appliance, contact the local building or fire authority and follow their guidelines.
- This appliance must be installed by a qualified installer.
- Do not use a wood insert or other product not specified for use with this wood insert.
- Risk of burns. The appliance should be turned off and cooled before servicing.
- Do not operate without fully assembling all components.
- Risk of cuts and abrasions. Wear protective gloves and safety glasses during installation. Sheet metal edges may be sharp.
- Children and adults should be alerted to the hazards of high surface temperature and should stay away to avoid burns or clothing ignition.
- Young children should be carefully supervised when they are in the same room as the appliance. Toddlers, young children and others may be susceptible to accidental contact burns. A physical barrier is recommended if there are at risk individuals in the house. To restrict access to an appliance or stove, install an adjustable safety gate to keep toddlers, young children and other at risk individuals out of the room and away from hot surfaces.
- Clothing or other flammable material must not be placed on or near the appliance. Objects placed in front of the appliance must be kept a minimum of 48" (1220 mm) away from the front face of the appliance.
- Due to high temperatures, the appliance should be located out of traffic and away from furniture and draperies.
- Ensure you have incorporated adequate safety measure to protect infants/toddlers from touching hot surfaces.
- Even after the appliance is out, the glass and/or screen will remain hot for an extended period of time.
- Check with your local hearth specialty dealer for safety screens and hearth guards to protect children from hot surfaces. These screens and guards must be fastened to the floor.
- Any safety screen or guard removed for servicing must be replaced prior to operating the appliance.
- Under no circumstances should this appliance be modified.
- This appliance must not be connected to a chimney flue pipe servicing a separate solid fuel burning appliance.
- Do not operate the appliance with glass door removed, cracked or broken. Replacement of the glass should be done by a licensed or qualified service person.
- Do not strike or slam shut the appliance glass door.
- Only doors / optional fronts certified with the unit are to be installed on the appliance.
- Keep the packaging material out of reach of children and dispose of the material in a safe manner. As with all plastic bags, these are not toys and should be kept away from children and infants.
- If the appliance is not properly installed, a house fire may result. Do not expose the appliance to the elements (e.g. rain, etc.) and keep the appliance dry at all times. Wet insulation will produce an odour when the appliance is used.
- The chimney must be sound and free of cracks. Clean your chimney a minimum of twice a year and as required.
- Do not start a fire with chemicals or fluids such as gasoline, engine oil, etc.
- Your appliance requires periodic maintenance and cleaning. Failure to maintain your appliance may lead to smoke spillage in your home.
- Lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or too green or freshly cut hardwoods. Burning wet unseasoned wood can cause excessive creosote accumulation. When this is ignited it can cause a chimney fire that may result in a serious house fire.
- This appliance is designed to burn natural wood only. Do not burn treated wood, coal, charcoal, coloured paper, cardboard, solvents or garbage.
- Burn wood directly on the refractory bricks. Do not elevate grate or otherwise raise the fire.
- Do not store wood within appliance installation clearances or within the space required for re-fueling and ash removal.
- Ashes must be disposed in a metal container with a tight lid and placed on a non-combustible surface well away from the home or structure until completely cool.
- Ensure clearances to combustibles are maintained when building a mantel or shelves above the appliance. Elevated temperatures on the wall or in the air above the appliance can cause melting, discoloration or damage to decorations, a T.V. or other electronic components.
- Do not install this wood insert in a factory- built wood insert unless certified with the wood insert.

2.1 EXAMPLE OF IDENTIFICATION PLATE

Safety Information

Listed by / Manufactured by:
Spartherm Feuerungstechnik GmbH
Maschweg 38
GER - 49324 Melle, Germany
info@spartherm.com



Solid Fuel Room Heater – For Use with Solid Wood Fuel only
Tested to Standards: UL-1482-11, ULC-S628 M93
U.S. Environment Protection Agency: Certified to comply with 2020
Particulate emission standards using crib wood: emission rate 1.7 g/hr
Model: Spartherm Cassette 700 Insert
Date of Manufacture
Month/Year: 05/2024
Serial Number M 700 Insert - 001

Informations Sur La Sécurité

Listée par / Fabriqué par:
Spartherm Feuerungstechnik GmbH
Maschweg 38
GER - 49324 Melle, Germany
info@spartherm.com



Appareil de Chauffage à combustion solides
Tested to Normes: UL-1482-11, ULC-S628 M93
U.S. Environment Protection Agency: Certified to comply with 2020
Particulate emission standards using crib wood: emission rate 1.7 g/hr
Model: Spartherm Cassette 700 Insert
Date de Fabrication:
Mois/Année: 05/2024
No de Serie: M 700 Insert - 001

TO PREVENT HOUSE FIRES:

Contact local building or fire officials about restrictions and installation inspection in your area. Install and use only in accordance with manufacturer's installation and operating instructions and local codes. In the absence of any local codes, installation must meet minimum requirements of NFPA 211 in the USA, and B365 in Canada. Refer to manufacturer's instructions and local codes for precautions required for passing a chimney through a combustible wall or ceiling. Inspect and clean chimney system frequently in accordance with manufacturer's instruction. Do not connect this insert to a chimney flue serving another appliance. Do not use grate or elevate fire. Build wood fire directly on hearth. This fireplace insert must be installed with a continuous chimney liner of 6 or 7 inches diameter extending from the fireplace insert to the top of the chimney. The chimney liner must conform to the Class 3 requirements of CAN/ULC-S635, Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents, or CAN/ULC-S640, Standard for Lining Systems for New Masonry Chimneys.

TO PREVENT CREOSOTE FIRES:

Inspect and clean chimney frequently - under certain conditions of use, creosote buildup may occur rapidly. Do not use fuels other than firewood.

CAUTION:

Only operate the wood heater with the doors fully closed. Replace glass only with original 4 mm Robax ceramic glass. Areas of the fireplace incorporating warm or cold air ducts shall be enclosed in accordance with the manufacturer's installation instructions. If provided with a hearth extension, the hearth extension must be installed according to the installation instructions! Air is needed for fireplace operation! At least 14 square inches (90.3 square centimeters) of outside air must be admitted to the room or directly to the unit through a 4" (101.6mm) diameter pipe. Failure to provide this may starve other fuel burning appliances from an adequate air supply. Do not obstruct air inlet and outlet in any case. Components used with fireplace must be listed. See manual. Do not use a fireplace insert or other products not specified for use with this product.

CAUTION:

Gas logs shall be certified for the application. This unit is not designed to burn with a log set.

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

POUR EVITER LES INCENDIES DOMESTIQUES:

Inspection dans votre région. Installez et utilisez uniquement conformément aux instructions d'installation et d'utilisation du fabricant et aux codes locaux. En l'absence de codes locaux, l'installation doit répondre aux exigences minimales de NFPA 211 aux États-Unis et de B365 au Canada. Reportez-vous aux instructions du fabricant et aux codes locaux pour connaître les précautions nécessaires pour faire passer une cheminée à travers un mur ou un plafond combustible. Inspectez et nettoyez fréquemment le système de cheminée conformément aux instructions du fabricant. Ne raccordez pas cet insert à un conduit de cheminée desservant un autre appareil. Ne pas utiliser de grille ou élever le feu. Faites du feu de bois directement sur le foyer. Cet insert de foyer doit être installé avec une doublure de cheminée continue de 6 ou 7 pouces de diamètre s'étendant de l'insert de cheminée jusqu'au sommet de la cheminée. Le revêtement de cheminée doit être conforme aux exigences de classe 3 de CAN / ULC-S635. Norme pour les systèmes de revêtement pour maçonnerie existante ou cheminées et événements construits en usine, ou CAN / ULC-S640. Norme pour les systèmes de revêtement pour les nouvelles cheminées de maçonnerie.

POUR EVITER LES FEUX DE CREOSOTE :

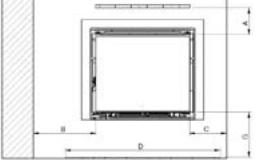
Inspectez et nettoyez la cheminée régulièrement - Sous certaines condition d'emploi, la creosote peut s'accumuler rapidement. Ne pas utiliser d'autres combustibles que le bois.

ATTENTION:

N'utilisez le poêle que lorsque les portes sont complètement fermées. Remplacer la vitre uniquement avec du verre Robax céramique de 4 mm. Il faut que les zones du foyer vitré qui portent les canaux d'alimentation d'air chaud et froid soient conformes à l'instruction de montage du fabricant. L'approvisionnement en revêtement fait de matériaux ininflammables devant l'ouverture du foyer vitré doit être installé conforme à l'instruction de montage du fabricant. L'aération suffisante pour l'utilisation du foyer est nécessaire! Dans l'emplacement du foyer vitré il faut assurer au moins 14 pouces carré (90,3 centimètres carré) de l'air de dehors ou il faut assurer l'alimentation en air de combustion directe au foyer vitré par une tube d'un diamètre de 4 pouces carré (101,6mm). Un manque d'air d'appoint pourrait priver les autres appareils de combustion d'une alimentation d'air adéquate. Ne pas obstruer les entrées et sorties d'air en aucun cas. Les composantes utilisées dans l'appareil doivent être répertoriées. Voir manuel. N'utilisez pas d'insert de cheminée ou autres produits qui ne sont pas autorisés pour l'usage de ce produit.

ATTENTION:

Ce poêle à bois n'est pas conçu pour brûler avec un bûche à gaz. Ce foyer vitré à bois doit être entretenu et réparé à intervalles réguliers pour assurer un fonctionnement correct. Veuillez consulter s.v.p. pour de plus amples informations les instructions du fabricant. Il est contraire aux dispositions de l'autorité d'exploiter ce foyer vitré à bois incompatible au manuel du fabricant.



Floor protection for Canada: 18" (457 mm) from unit to front of floor protector.

Protection de sol pour Canada: 18" (457 mm) de l'avant de l'appareil au bord de la protection.

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS

A. 7.25" / 184 mm
B. 15" / 381 mm
C. 15" / 381 mm
D. Unit width and add 8" / 203 mm on each side
E. 8" / 203 mm on each side
F. For USA: 16" / 406 mm For Canada 18" / 457 mm
G. 9.25" / 235 mm

IN FRONT OF UNIT

Recommend amount of wood: 2.1 kg/hr
Min. / Max. output (kW) 25.000 BTU/hr

* Not Tested - NFPA Guidelines in the USA, CAN/CSA B365-M91 in Canada. Floor protection must be minimum 3/8-inch non-combustible material extending beneath the stove, and to the front and sides from door opening and to the rear as indicated.

ÉCARTEMENT MINIMUM AUX MATERIAUX COMBUSTIBLES

A. 7.25" / 184 mm
B. 15" / 381 mm
C. 15" / 381 mm
D. Unité largeur et ajouter 8" / 203 mm de chaque côté
E. 8" / 203 mm de chaque côté
F. Pour les USA: 16" / 406 mm Pour le Canada 18" / 457 mm
G. 9.25" / 235 mm

DEVANT L'APPAREIL

Quantité de bois recommandée: 2.1 kg/hr
Min. / Max. sortie (kW): 25.000 BTU/hr

* Non testé - Exigences NFPA aux États-Unis, CAN/CSA B365-M91 au Canada. La protection de sol doit avoir une épaisseur de 3/8 pouces (1 cm), être d'un matériau non combustible et être placée devant et à côté de la porte ainsi qu'à l'arrière, comme indiqué.

CAUTION:

HOT WHILE IN OPERATION. DO NOT TOUCH.
KEEP CHILDREN AND CLOTHING AWAY.
CONTACT MAY CAUSE SKIN BURNS. SEE NAME PLATE AND INSTRUCTIONS. KEEP FURNISHINGS AND OTHER COMBUSTIBLE MATERIALS A CONSIDERABLE DISTANCE AWAY FROM THE APPLIANCE.
NOT SUITABLE FOR BIBLE HOME INSTALLATION.
DO NOT OVERFIRE - IF HEATER OR CHIMNEY CONNECTOR GLOWS, YOU ARE OVERFIRING.



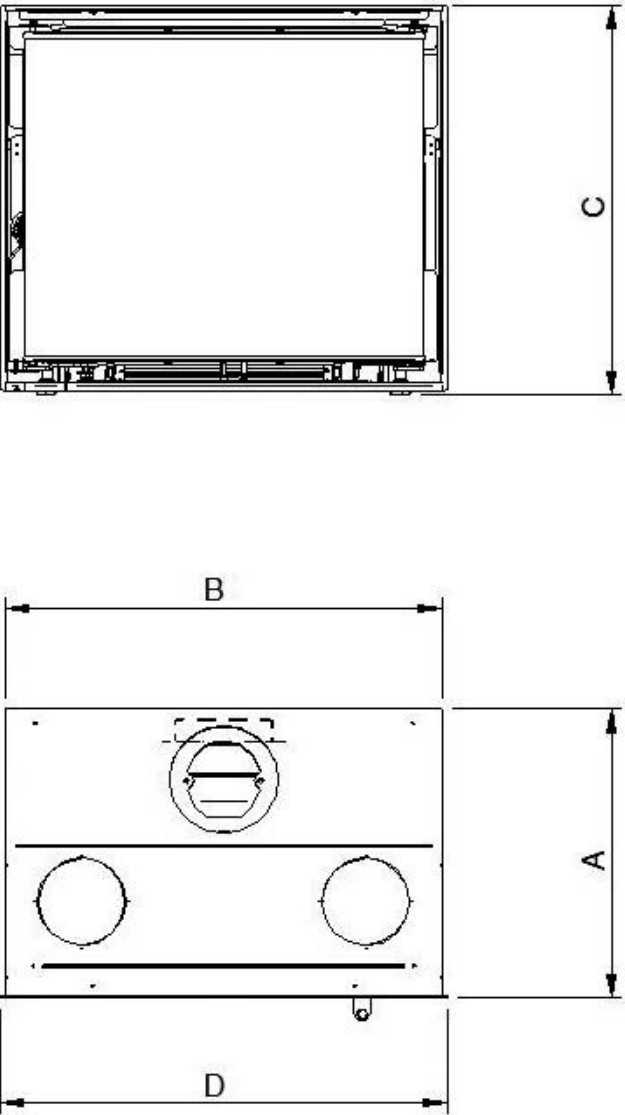
ATTENTION:

CHAUD PENDANT LE FONCTIONNEMENT - NE PAS TOUCHER.
TENIR ÉLOIGNÉS LES ENFANTS ET LES VÊTEMENTS - LE CONTACT PEU CAUSER DES BRULURES. CONSERVEZ LA PLAQUE D'IMMATRICULATION ET LES INSTRUCTIONS.
TENIR LES FOURNITURES ET AUTRES MATIERES COMBUSTIBLES À DISTANCE DE L'APPAREIL.
NE PAS INSTALLER DANS UNE MAISON MOBILE.
EVITER DE SURCHAUFFER - SI LE FEU OU LA CHEMINÉE DEVIENT ROUGE, VOUS SURCHAUFFEZ.

DO NOT REMOVE THIS LABEL

NE PAS ENLEVER CETTE ETIQUETTE

2.2 DIMENSIONS



	Insert-700
A	17 5/16" / 440 mm
B	26 1/4" / 666 mm
C	23 5/8" / 594 mm
D	26 5/16" / 682 mm

AVAILABLE FRAME FINISHES
60 MM - 2 3/8"
80 MM - 3 1/8"
100 MM - 3 15/16"

Example shown: 700

6

2.3 SPECIFICATION

Conversion Factors

	Fire chamber volume	Output	Efficiency*	Chimney type	Unit weight	ideal fuel size
Insert-700	1,58 ft ³	25,000 BTU/hr	66 %	6"	pounds	21"

Inches to millimeters (mm): 1" = 25.4 mm

British Thermal Unit BTU/h to Watt: 1 BTU/hr = 0.293 Watt

Kilogramm to Pound: 1kg = 2.205 lb

Cubicmeter to cubicfeet:

$$1\text{m}^3 = 35.314\text{ ft}^3$$

2.4 GENERAL INSTRUCTIONS



WARNING

THIS APPLIANCE HAS NOT BEEN TESTED WITH ANY VENTED OR UNVENTED GAS LOG SET: TO REDUCE RISK OF FIRE OR PREVENT INJURY, DO NOT INSTALL A VENTED OR UNVENTED GAS LOG SET INTO THE APPLIANCE.

CAUTION:

These masonry inserts are not certified for gas log sets.

DO NOT CONNECT THIS APPLIANCE TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.

THIS APPLIANCE AND THE COMPONENTS ARE DESIGNED TO BE INSTALLED AND OPERATED AS A SYSTEM. ANY ALTERATION TO OR SUBSTITUTION FOR ITEMS IN THIS SYSTEM, UNLESS ALLOWED BY THESE INSTALLATION INSTRUCTIONS, WILL VOID THE LISTING AND MAY VOID THE PRODUCT WARRANTY. IT MAY ALSO CREATE A HAZARDOUS INSTALLATION. READ THROUGH THESE INSTRUCTIONS THOROUGHLY BEFORE STARTING YOUR INSTALLATION AND FOLLOW THEM CAREFULLY THROUGHOUT YOUR PROJECT.

- Before beginning your installation, consult with your local building code agency or fire officials and insurance representative to ensure compliance.
- Non-toxic smoke will be emitted during the paint curing process, to help dissipate the smoke open a window near the appliance.
- Remove any dust or debris off the top of the appliance before firing the appliance as the paint will become soft as the appliance heats up and will harden as the appliance cures. To cure the paint on your appliance burn your appliance moderately hot during the first few fires.
- To keep the gasket from sticking to the appliance as the paint is curing, periodically open the door every 5-10 minutes.

2.5 GENERAL INFORMATION

- The chimney vent system used on your wood burning appliance should be designed with the

least amount of restriction possible to enable the exhaust products to easily flow through it. Chimney vent systems that are too short or too long (refer to point "4.3 Chimney liner installation") can also have an adverse affect on the flow of exhaust through it. The wood burning appliance and chimney vent system also require a sufficient supply of combustion air not only to support the combustion in the combustion chamber but to replace the exhaust leaving it so it can flow freely up through the vent system and out into the atmosphere. It is the correct balance of combustion air and the chimney vent system that will ensure the appliance provides you with its optimum performance.

- Be sure to provide sufficient combustion air. There are many other appliances in your home competing for air such as a kitchen range hood, forced air heating devices or a bathroom exhaust fan.

Expansion / contraction noises during heating up and cooling down cycles are normal and to be expected.

After extended periods of non-operation such as following a vacation or a warm weather season, the appliance may emit a slight odour for a few hours. This is caused by dust particles on the firebox burning off. Open a window to sufficiently ventilate the room.

CALIFORNIA PROP 65 WARNING:

Use of this product may produce smoke which contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

If you experience smoking problems, you may need to open a door, a window or otherwise provide some method of supplying combustion air to the appliance.

**NATIONAL
FIREPLACE
INSTITUTE**



CERTIFIED

www.nficertified.org

We suggest that our woodburning hearth products be installed and serviced by professionals who are certified in the U.S. by the National Fireplace Institute® (NFI) as NFI Woodburning Specialists or who are certified in Canada by Wood Energy Technical Training (WETT).

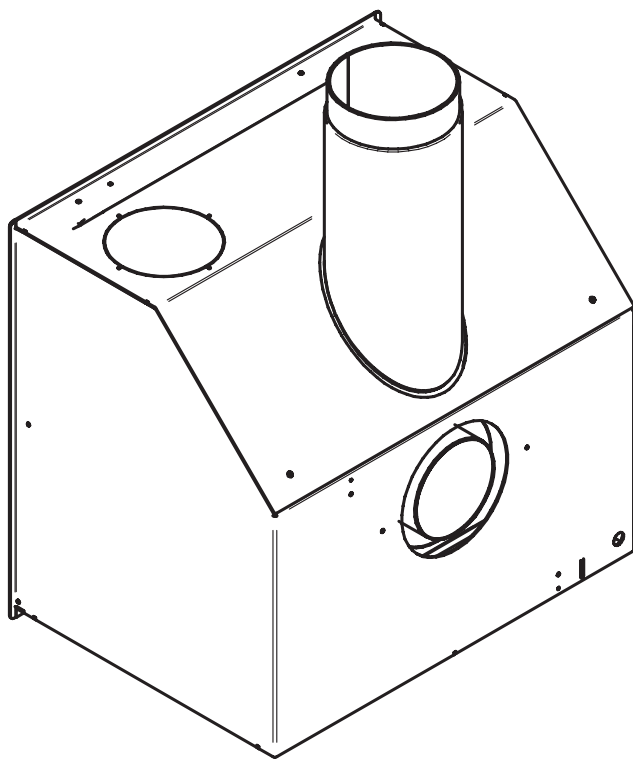


**Wood Energy
Technical Training**
www.wettinc.ca

2.6 COMBUSTION AIR

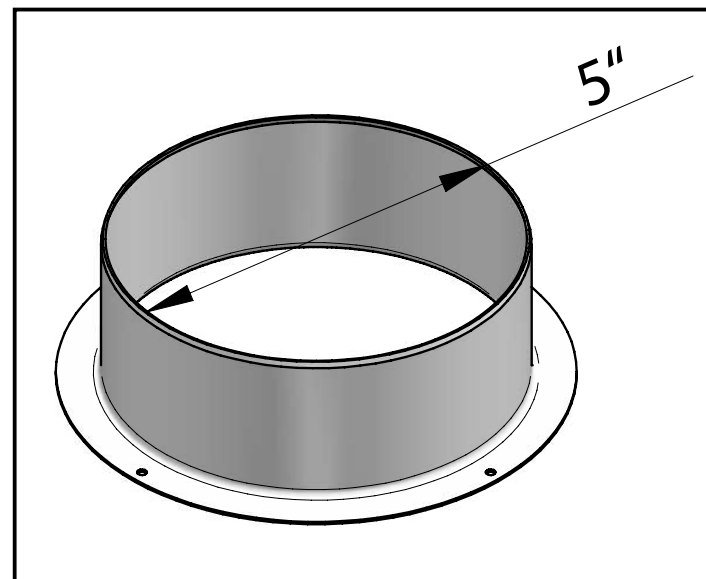
When mounting the air system ensure that the air control system provides fresh air from the outside.

Masonry Insert-700 combustion air intake



2.6.1 CONNECTION DIRECTLY TO THE UNIT

To connect the separate combustion air directly to the unit you need to have the right separate combustion air connector Ø 5". Fix the connector directly to the unit. It can be oriented to the left side, right side or to the back.



Grills

The combustion air ducts will be protected at the outside by a grill. The free passage section of those grills is at least equivalent to the section of the air inlet. Please note that the infiltration of water and the effect of the wind can damage the system.

CLOSURE VALVE

If you decide to connect separate combustion air it is recommended to install a closure valve to prevent condensate formation and to prevent the room from becoming cold while the stove is not in use. It should ideally be located as close as possible to the outside wall. It can be controlled from inside if it is not too far from the stove (cable length = 47").



PLEASE NOTE: COMBUSTION AIR INTAKE REQUIREMENTS.

It is recommended that the 5" Combustion air intake duct is installed in a correct manner.

Please find the following information. Outside Air- ducts must... - Be protected on the outside by a grill where the free passage section of these grills is at least equivalent to the section of the air inlet.

Please note that the infiltration of wind, weather, snow and water can effect or damage the air combustion system.

- Ideally be fitted with a butterfly valve so that it can manually, be used to close the cold air from entering the firebox.

Please note that the butterfly valve has to be 100% open or 100% closed and should not be used to adjust burn rate!

Try to keep the butterfly valve as close to the outside wall as possible.

-The air-duct should be insulated and the distance from the wood insert to the outside should be as short as possible.

For 5" air duct please refer to the maximum lengths and elbows

Number of 90 degree elbows

4' = 4 elbows

8' = 4 elbows

10' = 2 elbows

12' = 0 elbow

If you exceed these guidelines, you must compensate by using a larger diameter and/or a smoother duct. Careful not to crush the duct!

It should ideally be located as close as possible to the outside wall.

-If it is not possible to bring in combustion air to the wood insert please insure that there is sufficient air to feed the wood insert in the room –please note that this is not ideal.

Please contact your dealer who offers suitable parts for air inlet ducts (pipes and damper).

Make sure that the wire mesh is mounted at the combustion air inlet.

3. INSTALLATION PLANNING

Clean all ashes out of the inside of the existing wood insert opening. Make sure that the chimney and wood insert are free of cracks, loose mortar, creosote deposits, blockage or other signs of deterioration. If necessary, have any repair work done by a qualified professional before installing the insert.

Do NOT remove bricks or mortar from the wood insert. In case of an outside air inlet or ash dump, fill with rockwool insulation. Adhere to minimum clearances as illustrated.



WARNING

WEAR GLOVES AND SAFETY GLASSES FOR PROTECTION. CAREFULLY FOLLOW THE INSTRUCTIONS FOR ASSEMBLY OF THE PIPE AND OTHER PARTS NEEDED TO INSTALL THE APPLIANCE. FAILURE TO DO SO MAY RESULT IN A FIRE, ESPECIALLY IF COMBUSTIBLES ARE TOO CLOSE TO THE APPLIANCE OR CHIMNEY AND AIR SPACES ARE BLOCKED, PREVENTING THE FREE MOVEMENT OF COOLING AIR. DO NOT DRAW OUTSIDE AIR FROM GARAGE SPACES. EXHAUST PRODUCTS OF GASOLINE ENGINES ARE HAZARDOUS. DO NOT INSTALL OUTSIDE AIR DUCTS SUCH THAT THE AIR MAY BE DRAWN FROM ATTIC SPACES, BASEMENTS OR ABOVE THE ROOFING WHERE OTHER HEATING APPLIANCES OR FANS AND CHIMNEYS EXHAUST UTILIZE AIR. THESE PRECAUTIONS WILL REDUCE THE POSSIBILITY OF APPLIANCE SMOKING OR AIR FLOW REVERSAL. THE OUTSIDE AIR INLET MUST REMAIN CLEAR OF LEAVES, DEBRIS ICE AND/OR SNOW OR ANY OTHER OBSTACLES. IT MUST BE UNRESTRICTED WHILE APPLIANCE IS IN USE TO PREVENT ROOM AIR STARVATION WHICH CAN CAUSE SMOKE SPILLAGE AND AN INABILITY TO MAINTAIN A FIRE. SMOKE SPILLAGE CAN ALSO SET OFF SMOKE ALARMS. NEGATIVE PRESSURE WITHIN YOUR HOME MAY INADVERTENTLY AFFECT YOUR APPLIANCE. TO PREVENT CONTACT WITH SAGGING OR LOOSE INSULATION, THE APPLIANCE MUST NOT BE INSTALLED AGAINST VAPOUR BARRIERS OR EXPOSED INSULATION. LOCALIZED OVERHEATING COULD OCCUR AND A FIRE COULD RESULT. DO NOT USE MAKESHIFT COMPROMISES DURING

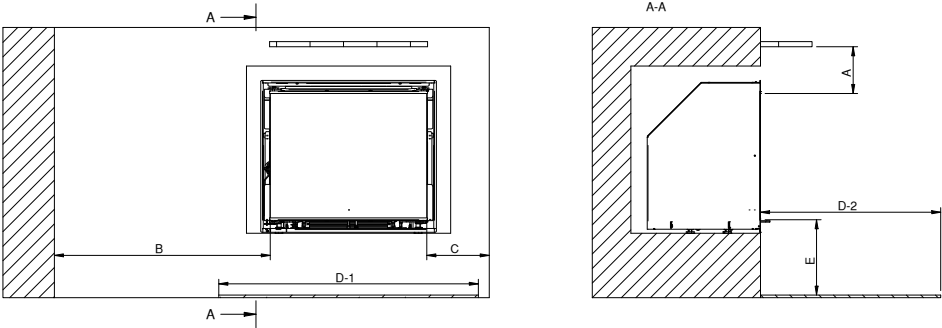
INSTALLATION. DO NOT BLOCK OR RESTRICT AIR, GRILLE OR LOUVRE OPENINGS. DO NOT ADD A HOOD. KEEP HAND TOOLS IN GOOD CONDITION; SHARPEN CUTTING EDGES AND MAKE SURE TOOL HANDLES ARE SECURE. ALWAYS MAINTAIN THE MINIMUM AIR SPACE REQUIRED TO THE ENCLOSURE TO PREVENT FIRES. DO NOT PACK REQUIRED AIR SPACES WITH INSULATION OR OTHER MATERIALS. COMBUSTION AIR INLET DUCTS ARE NOT TO TERMINATE IN ATTIC SPACES OR CRAWL SPACES.

3.1 MINIMUM CLEARANCES TO COMBUSTIBLES

DO NOT PLACE ANY COMBUSTIBLE MATERIALS (FURNITURE, FIREWOOD, ETC.) WITHIN 48" (1220 mm) IN FRONT AND ON THE SIDES OF THE Insert.

COMBUSTIBLE MATERIALS CAN NOT PROTRUDE ONTO THE METAL PARTS OF THE UNIT, THEY MUST BE COVERED WITH NON COMBUSTIBLE MATERIALS.

Clearance requirements to combustible surfaces



A	Combustible mantle to top of glass
B	Sidewall to insert
C	Side facing
D-1	Hearth extension, width
D-2	Hearth extension, depth

	Canada	USA
A	7 1/4" for 8" thickness	7 1/4" for 8" thickness
B	15"	15"
C	15"	15"
D-1	unit width and add 8" on each side	unit width and add 6" on each side
D-2	18"	16"
E	9 1/4" from the floor to the bottom of the glass or 4 1/2" with R value 2,957	9 1/4" from the floor to the bottom of the glass or 6 1/2" with R value 2,957

Informations to D-1/D-2:
The floor in front of the wood insert requires thermal protection. This protection must be non-combustible. Also this floor protector must be listed to UL 1618 ember protection or in Canada CSA-B365.
Do NOT install in a mobile home

Distance to furniture
The recommend minimum distance from stove to furniture is 48 inches. Note that some furniture is more easily affected by heat and may need to be moved to greater distance. This is your responsibility.
In addition other combustible materials, away from the stove. In general, a distance of 48 inches must be maintained between the stove and moveable combustible item such as drying clothes, newspapers, firewood etc. Failure to meet the required clearances can endanger property and personal safety.

3.2 PLACEMENT

Make sure there is enough space for the wood heater. If the masonry inserts is fitted with a frame (which conceals the contours of the recess) an additional tolerance of 1/4" can be set when the recess is made.
The wood heater must be able to expand freely. The brick-work or decorative materials must not enter into contact with the wood heater under any circumstances; leave a gap of at 1/4".

4. INSTALLATION

4.1 HEARTH EXTENSION

**WARNING**

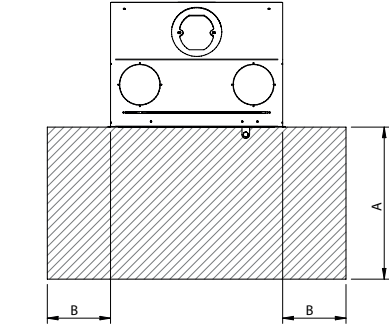
INSTALL THE HEARTH EXTENSION ONLY AS ILLUSTRATED!

A 18" x 8" (457 mm x 203 mm) for Canada or 16" x 6" (406 mm x 152 mm) for USA minimum hearth extension made of non combustible material is required. To prevent any burning embers falling between the fireplace and the hearth extension from coming into contact with the floor, insert a metal sheet under the front of the wood insert. This sheet must extend 4" (100 mm) on both sides of the wood insert and 2" (50 mm) in front. You can also prevent embers from falling in the joint between the wood insert and the hearth extension by filling it with mortar grout.

The non combustible material that is used must be UL 1618 ember protection or in Canada CSA-B365.

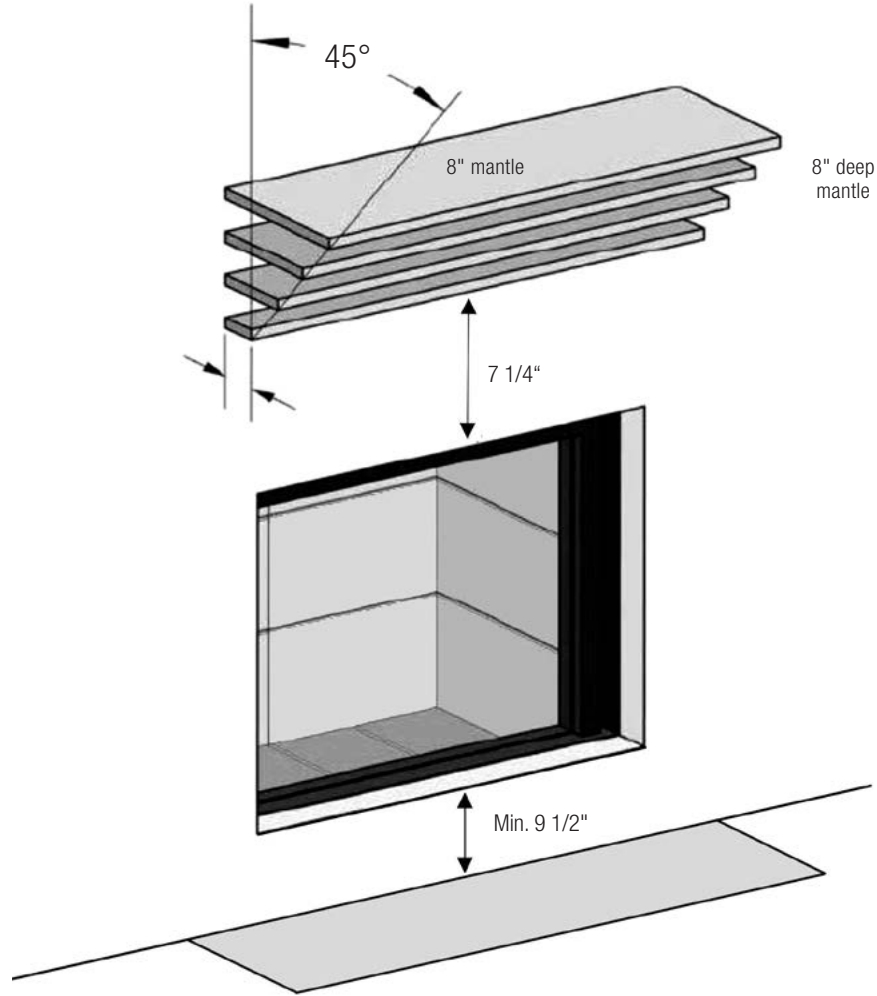
Distance from bottom of the glass to the floor 9 1/2" to the bottom of the glass or 4 1/2" -with R value 2,957 (Canada) or 6,1/2" - with R value 2,957 (USA).

4.1.1 700



	M 700
A	18 inches (Canada) 16 inches (USA)
B	Canada: 8" on each side USA: 6" on each side

4.2 DISTANCE COMBUSTIBLE MANTLE



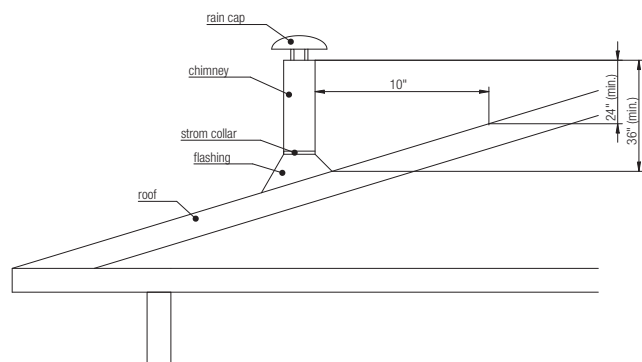
4.3 CHIMNEY LINER INSTALLATION

This wood insert is designed and approved for installation with the following brands of chimney liner measuring 6 and 7" (152 and 178 mm) in diameter.

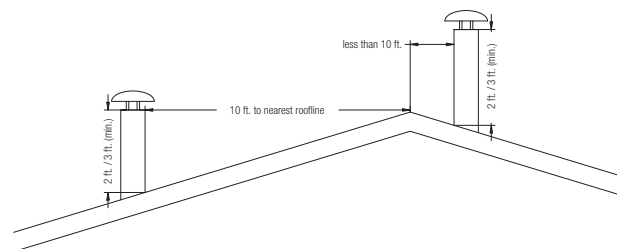
4.3.1 LISTED CHIMNEYS

This appliance must be installed with a listed 6 and 7" chimney liner system approved under the following standards:
The chimney liner must conform to the Class 3 requirements of CAN/ULC-S635, Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents, or CAN/ULC-S640, Standard for Lining Systems for New Masonry Chimneys and be installed in accordance with the manufacturer's installation instructions.

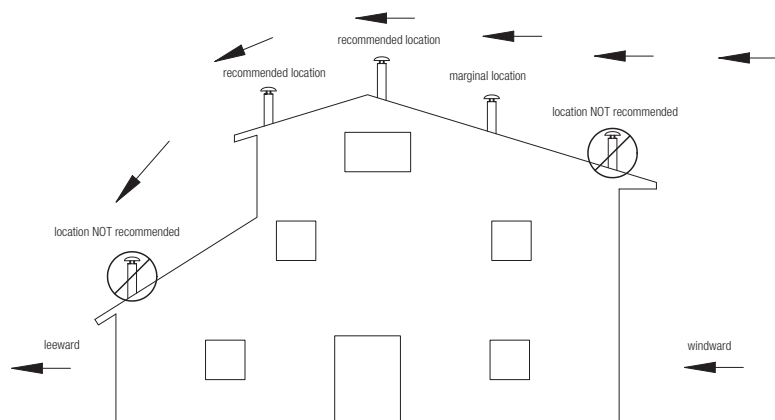
4.3.2 EXAMPLES OF TYPICAL INSTALLATIONS



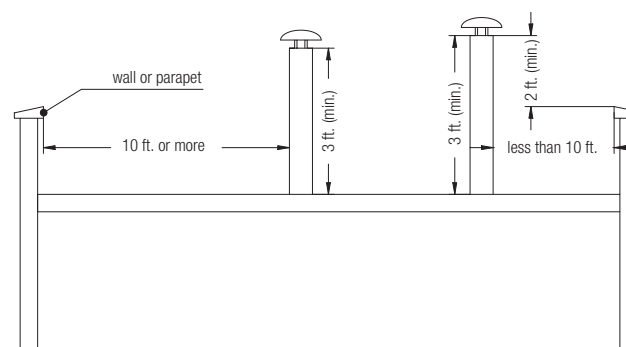
minimum chimney height



pitched roof



multi level roofs



flat roof

This appliance must be installed with a listed 6" (150 mm) or 7" (178 mm) chimney system approved under the following standards: The chimney liner must conform to the Class 3 requirements of CAN/ULC-S635, Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents, or CAN/ULC-S640, Standard for Lining Systems for New Masonry Chimneys and be installed in accordance with the manufacturer's installation instructions.

This fireplace insert is designed to be installed into a masonry fireplace. The masonry fireplace is to be constructed in accordance to N.F.P.A. 211 (Latest Edition), Standards of Chimney, Fireplaces, Vents and Solid-Fuel-Burning Appliances and Equipment or applicable National, Provincial, State or local codes. The installation shall conform to CAN/CSA-B365, Installation Code for Solid-Fuel-Burning Appliances and Equipment.

The combustible floor in front of the fireplace insert must be protected from hot embers by a non-combustible material extending 16" (USA) and 18" (Canada) on the fuel loading side and 8" to the other sides.

Heat protection is required in front of the insert when it is installed less than 9 1/4" above a combustible floor, measured vertically from the combustible floor to the bottom of the glass. The distance from the combustible floor to the bottom of the glass can be reduced to 4 1/2" (Canada) 6 1/2" (USA) when the hearth protection used, has an R value of 2.957

If this insert is not properly installed, a house fire may result. For your safety, follow the installation directions. Consult your local Fire or Building officials about restrictions and installation inspection requirements in your area.

4.4 MASONRY

4.4.1 TYPICAL EXISTING MASONRY

WARNING

DO NOT CONNECT THIS APPLIANCE TO A CHIMNEY FLUE SERVING ANOTHER FIREPLACE. DO NOT CONNECT TO ANY AIR DISTRIBUTION DUCT OR SYSTEM.

You can install your masonry inserts using your existing masonry chimney liner. To do so, follow the guidelines below. If you are using a masonry chimney, it is important that it be built in compliance with the specifications of the Building Code in your region. It must normally be lined with refractory bricks, metal or clay tiles sealed together with fire cement. (Round flues are the most efficient).

Remove the wood insert damper or fasten it permanently open. We recommend the following method of sealing off the damper area around the liner:

Measure the throat of the wood insert and mark this shape on a piece of 24 gauge sheet metal (flue cover); cut a six-inch (6 3/4" / 171 mm) hole to lie directly below the wood insert flue opening. Allow two inches of material for a flange on all sides and cut to these measurements. Bend down the flanges. If you have never done this before, it might be a good idea to make a cardboard pattern and test it first. Fasten this flue cover in position as high as possible with two masonry screws per side through the flanges into the wood insert.

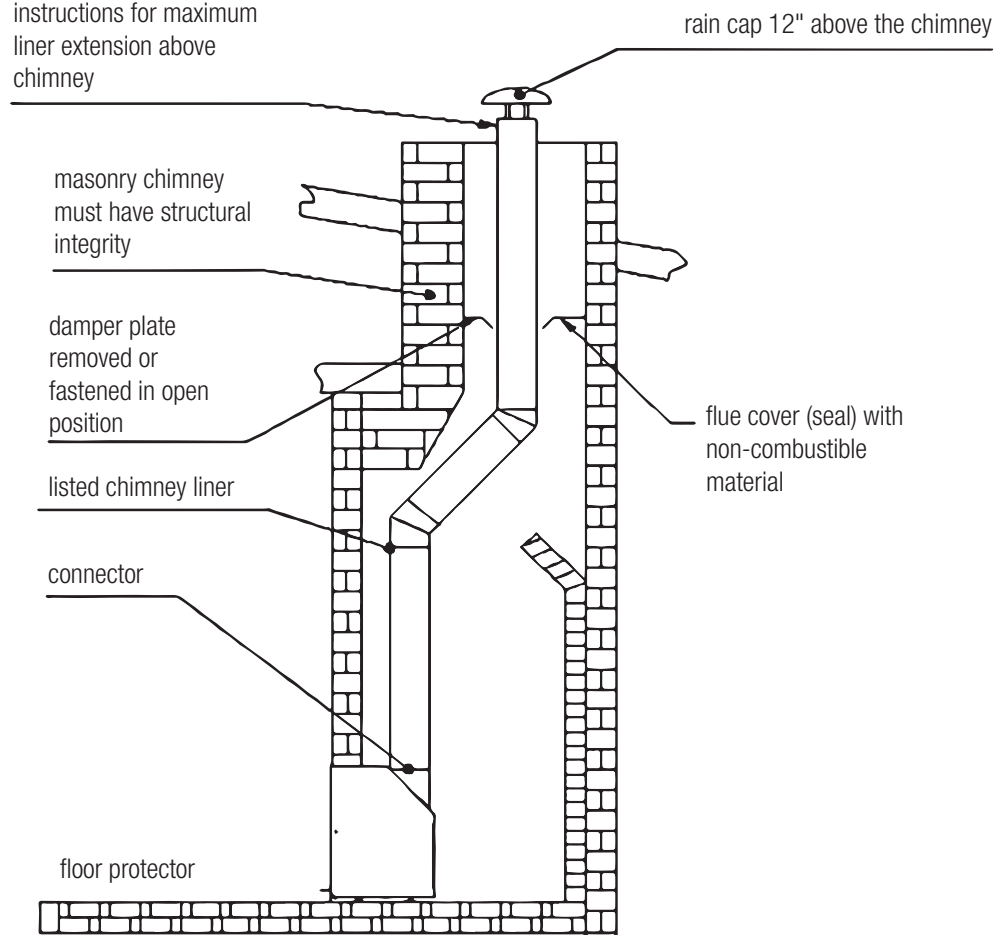
In Canada: Install only flexible or solid chimney liner from the top of the chimney to the insert flue collar. Attach a stainless steel liner connector or elbow to the liner and insert onto the flue collar. Fasten with three screws. Secure the top of the liner to the chimney cap using a liner support and chimney flashing. Cap the top of the chimney liner assembly using an approved rain cap.

In the United States: While it is not required, it is recommended that a chimney liner be installed that is continuous from the insert to the top of the chimney, particularly when the insert is installed in a basement. For this type of connection, use the "In Canada" installation instructions above.

If a continuous liner is not installed, a "direct flue connection" must be made. The direct flue connection requires a non-combustible connector that extends from the insert into the chimney flue liner and also the installed flue cover to be sealed below the entry point of the connector to prevent dilution of combustion products in the chimney flue with air from inside the house. Cap the top of the chimney using an approved rain cap.

THIS UNIT IS NOT TESTED TO BE BUILT INTO A FACTORY BUILT FIREPLACE.

follow manufactures's instructions for maximum liner extension above chimney



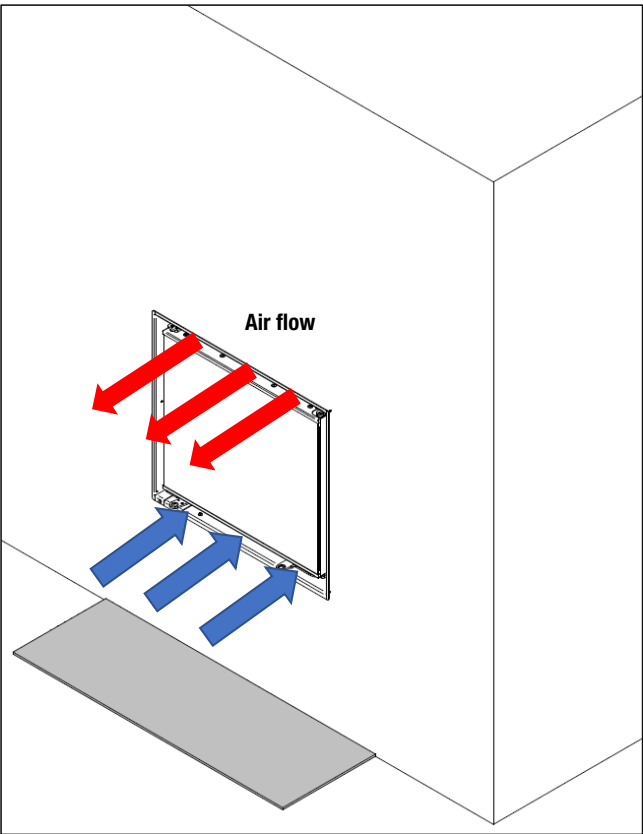
4.5 CONVECTION

Circulation of convection air

The convection air enters into the wood insert via the inlet at the bottom of the wood insert. The hot air for convection comes out of the wood insert via the front outlet.

Circulation of convection air

The convection air enters into the fireplace via the inlet at the bottom of the fireplace. The hot air for convection comes out of the fireplace via the front outlet.



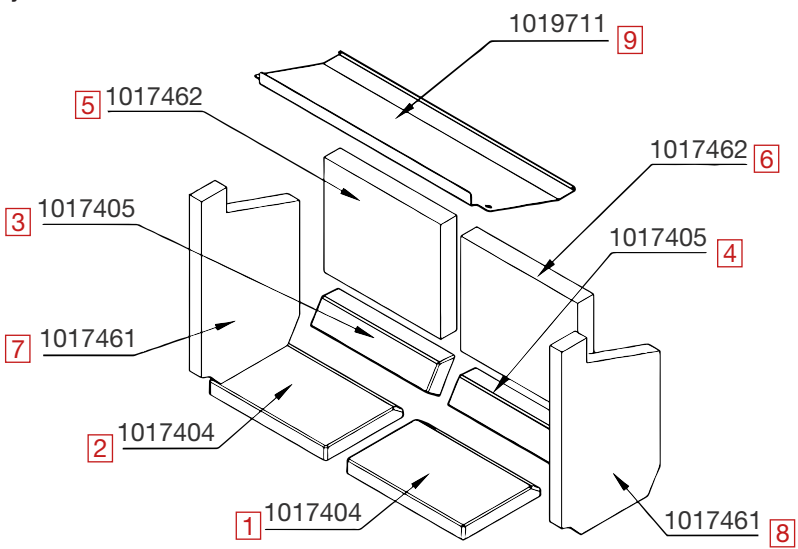
5. FINISHING

5.1 BRICKS AND BAFFLES
INSTALLATION

**WARNING**

OPERATION OF THE APPLIANCE WITHOUT THE BAFFLES CAN RESULT IN EXCESSIVE TEMPERATURES THAT COULD DAMAGE THE APPLIANCE, CHIMNEY AND THE SURROUNDING ENCLOSURE.
NOTE: DO NOT OPERATE IF BAFFLE AND MANIFOLD SHIELD ARE NOT IN POSITION.

Masonry Insert-700



article designation	assembly sequence	art. no.	quantity	price group
individual bricks				
base brick, front	1+2	1017404	2	D
side wall brick	7+8	1017461	2	B
base brick, rear	3+4	1017405	2	C
rear wall brick	5+6	1017462	2	D
baffle plate	9	1019711	1	D
complete set (without baffle plate)				
set bottom	—	1017639	4	price list
wall set	—	1047758	4	price list

Attention: Surcharge according to price list when ordering in eboris 1300 - black

5.2 DOOR REMOVAL / INSTALLATION

WARNING

BURNING YOUR APPLIANCE WITH THE DOORS OPEN OR AJAR CREATES A FIRE HAZARD THAT MAY RESULT IN A HOUSE AND/OR CHIMNEY FIRE.

DO NOT STRIKE OR SLAM DOOR.

NEVER REMOVE THE DOOR WHEN THE APPLIANCE IS HOT.

Please follow the following steps to dismantle / install the firebox door. Take care when carrying out these tasks as otherwise damage to the casing / door cannot be ruled out. We recommend protecting the casing / metal plates with an overlay.

Dismantling:

1. Use a screwdriver or a similar tool to remove the safety clasp on the stop-per side (hinge side) of the door.
2. Swing the door open. Then tighten the Allen screw on the lower hinge with a 3 mm Allen key.
3. Take hold of the door at the bottom. Raise the door a little with a light lifting movement so that the lower pin of the hinge is exposed.
4. In this position, pull the door a little forward at the bottom.



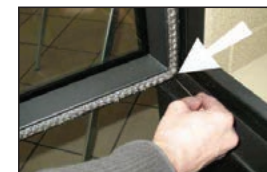
5. Now allow the door to drop down a little so that it comes away from the upper guidance pin and can be removed.

The door is now free and can be carefully placed to one side.



INSTALLATION: Installation is carried out in the reverse order:

1. Firstly guide the door in a slightly inclined position onto the fixture for the hinge side of the door. In the process, support the door from below so that the fireplace casing is not scratched.
2. Then swing the door inwards and set the lower pin into the lower fixture. To ensure the hexagonal socket can slide into the fixture, move the door a little (swivel the door).
3. Loosen the hexagonal socket on the lower hinge with a 3 mm Allen key.
4. Close the door and then push the safety clasp back onto the pin.



6. OPERATION

WARNING

ALWAYS OPERATE THIS APPLIANCE WITH THE DOOR CLOSED AND LATCHED EXCEPT DURING START UP AND RE-FUELING. ALWAYS WEAR GLOVES TO PREVENT INJURY. DO NOT LEAVE THE FIRE UNATTENDED WHEN THE DOOR IS UNLATCHED AS UNSTABLE WOOD COULD FALL OUT OF THE FIRE CHAMBER CREATING A FIRE HAZARD TO YOUR HOME.

PLEASE USE THE GLOVE THAT IS SUPPLIED WHEN OPERATING THE INSERT.

NEVER EVER LEAVE CHILDREN UNATTENDED WHEN THERE IS A FIRE BURNING IN THE APPLIANCE.

NEVER USE GASOLINE, GASOLINE-TYPE LANTERN FUEL, KEROSENE, CHARCOAL LIGHTER FLUID, OR SIMILAR LIQUIDS TO START OR 'FRESHEN UP' A FIRE IN THIS APPLIANCE. KEEP ALL SUCH LIQUIDS WELL AWAY FROM THE APPLIANCE WHILE IT IS IN USE.

OBJECTS PLACED IN FRONT OF THE APPLIANCE SHOULD BE KEPT A MINIMUM OF 48" FROM THE FRONT FACE.

ANY MODIFICATION OF THE APPLIANCE THAT HAS NOT BEEN APPROVED IN WRITING BY THE TESTING AUTHORITY IS CONSIDERED BREACHING CSA B365 (CANADA) AND ANSI NFPA 211 (USA).

HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. WEAR SUITABLE GLOVES TO OPERATE YOUR APPLIANCE.

NEVER OPERATE THE STOVE WITH THE GRATE COVER REMOVED.

DO NOT POKE OR STIR THE LOGS WHILE THEY ARE BURNING. USE ONLY FIRELOGS THAT HAVE BEEN EVALUATED FOR THE APPLICATION IN WOOD INSERT AND REFER TO FIRELOG WARNINGS AND CAUTION MARKINGS ON PACKAGING PRIOR TO USE.



WARNING

AVOID BURN RISK. REMOVE OPERATIONAL TOOL AFTER USE!!!



WARNING

PLEASE USE THE GLOVE THAT IS SUPPLIED WHEN OPERATING THE INSERT!

Your Spartherm product is designed with the most advanced technology. The appliance is extremely airtight. It has an exclusive direct outside air supply (optional kit), a safety feature designed to prevent spillage, and to keep your house free of carbon monoxide, in case of a down drafting chimney or an internal negative pressure.

The first fire(s) in your appliance will be difficult to get going and keep going with little amount of heat being generated. This is a result of the moisture being driven out of the fire brick. Allow 30 hours of hot fires (temperatures in excess of 500°F / 260°C - 600°F / 316°C) before your appliance will perform normally. During the break-in period (the first 2 or 3 fires) create only small, hot fires using kindling; this will allow the firebrick to cure. Do not be alarmed if small hairline cracks develop in the firebrick.

This is a normal occurrence and does not pose a safety hazard. The paint may also smell for the first few fires as it cures and it is recommended to open a door or window to alleviate the smell.

To start, a brisk fire is required. Place loosely crumpled paper on the floor of the appliance and cover with dry kindling. Light the paper and leave the door slightly ajar (one inch) until all kindling is burning. To maintain a brisk fire, a hot coal bed must be established and maintained.

Slowly add larger wood (2x4 size pieces). Lay the pieces lengthwise from side to side in the hot coal bed with a shallow trench between, so that the primary air can flow directly into this trench and ignite the fuel above. When the fire seems to be at its peak, medium sized logs may be added. Once these logs have caught fire, carefully close the door. (Closing the door too quickly after refueling will reduce the firebox temperature and result in an unsatisfactory burn.) Remember it is more efficient to burn

medium sized wood, briskly, and refuel frequently than to load the appliance with large logs that result in a smoldering, inefficient fire and dirty glass. As soon as the door is closed, you will observe a change in the flame pattern. The flames will get smaller and lazier because less oxygen is getting into the combustion chamber. The flames, however, are more efficient. The flames will remain lazy but become larger again as soon as the refractory bricks have been heated thoroughly and the chimney becomes heated and provides a good draft. At this point, the roaring fire that you see when the door is opened is wastefully drawing heated room air up the chimney -- certainly not desirable. Always operate with the door fully closed once the medium sized logs have caught fire.

You can now add larger pieces of wood and operate the appliance normally. Once the appliance is entirely hot, it will burn very efficiently with little smoke from the chimney. There will be a bed of orange coals in the firebox and secondary flames flickering just below the top firebrick. You can safely fill the firebox with wood up to the air inlet on the backside of the firebox or, if not present, up to 50% of the fireboxes backside height and will get best burns if you keep the appliance pipe temperatures between 250°F (120°C) and 450°F (270°C). A surface thermometer placed on the front top will help regulate this.

Without an appliance thermometer, you are working blindly and have no idea of how the appliance is operating! An appliance thermometer offers a guide to performance.

Can't get the fire going?

Use more kindling and paper. Assuming the chimney and vent are sized correctly and there is sufficient combustion air, the lack of sufficiently dry quantities of small kindling is the problem. Thumb size is a good gauge for small kindling diameter.

Can't get heat out of the appliance?

One of two things may have happened. The appliance door may have been closed prematurely and the appliance itself has not reached optimum temperature. Reopen the door and to re-establish a brisk fire. The other problem may have been wet wood. The typical symptom is sizzling wood and moisture being driven from the wood.

COMBUSTION AIR

Spartherm Insert has a pre-set combustion air setting.

Air Wash system: This combustion air is designed to keep the glass clean and to feed the fire with combustion air to burn.

Secondary Air system: This air is used to burn off the gases that are released when the fire burns. The secondary air is also linked to the Pre-set combustion air setting.

Operating instruction for single burn rate Method 28R.

- Start the fire with approximately 4,3 lbs. of kindling.
- Keep the door slightly open for a good ignition.
- At around 4,1 lbs the door can be closed between 2-6 minutes.
- Once you have a good hot coal bed rake the coals and insert wood load.
- Keep the door slightly open until the wood is burning well between 2-6 minutes.
- Close the door.



WARNING

HOT GLASS – WILL CAUSE BURNS.

DO NOT TOUCH GLASS UNTIL COOLED

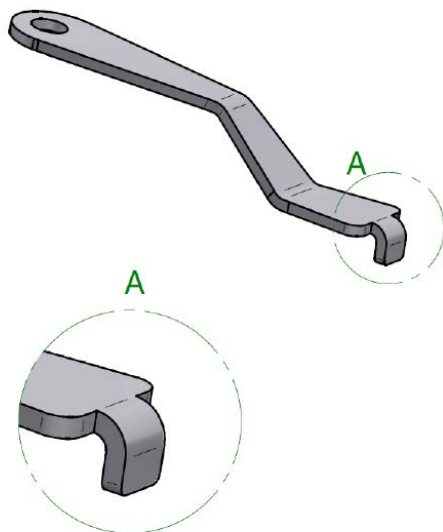
NEVER!!! ALLOW CHILDREN TO TOUCH THE GLASS.

PLEASE NOTE.

The tool that has been provided is for the operation of the air control lever and for opening and closing the masonry insert door.

WARNING!

If this tool is not used there is a risk of BURNS.



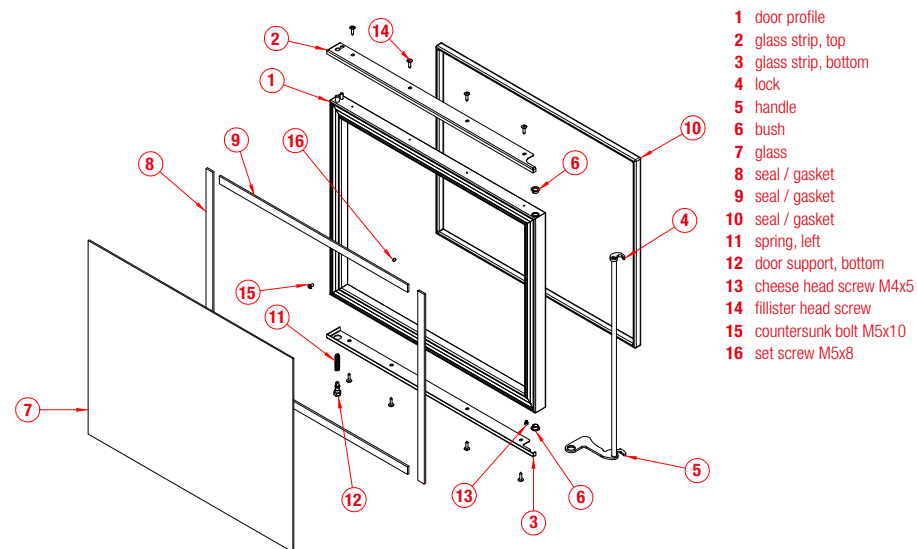
WARNING

The combustion-air damper should NOT be altered for increased firing for any reason!

DOOR ASSEMBLY - SPARE PARTS.

ROBAX 4 MM CERAMIC GLASS.

USE ONLY AS PER MANUFACTURERS STANDARD AND SPARE PARTS.



Pos.	name	quantity	SAP
1	door profile	1	–
2	glass strip, top	1	–
3	glass strip, bottom	1	–
4	lock	1	–
5	handle	1	–
6	bush	2	–
7	glass	1	–
8	seal / gasket	2	–
9	seal / gasket	2	–
10	seal / gasket	1	–
11	spring, left	1	–
12	door support, bottom	1	–
13	cheese head screw M4x5	1	–
14	fillister head screw	8	–
15	countersunk bolt M5x10	1	–
16	set screw M5x8	1	–

6.1 FIRE EXTINGUISHERS / SMOKE DETECTORS

All homes with a solid fuel burning appliance should have at least one fire extinguisher in a central location, known to all, and at least one smoke detector in the room containing the appliance. If it sounds an alarm, correct the cause but do not de-activate or relocate the smoke detector.

6.2 FUEL



WARNING

THIS APPLIANCE IS DESIGNED TO BURN NATURAL WOOD ONLY. DO NOT BURN TREATED WOOD, COAL, CHARCOAL, COLOURED PAPER, CARDBOARD, SOLVENTS OR GARBAGE. THIS APPLIANCE HAS NOT BEEN TESTED WITH AN UNVENTED GAS LOG SET. TO REDUCE RISK OF FIRE OR INJURY, DO NOT INSTALL AN UNVENTED GAS LOG SET INTO THE APPLIANCE.

HIGHER EFFICIENCIES AND LOWER EMISSIONS GENERALLY RESULT WHEN BURNING AIR DRIED SEASONED HARDWOODS, AS COMPARED TO SOFTWOODS OR TOO GREEN OR FRESHLY CUT HARDWOODS. DO NOT BURN GREEN OR FRESHLY CUT WOOD.

BURNING WET UNSEASONED WOOD CAN CAUSE EXCESSIVE CREOSOTE ACCUMULATION. WHEN IGNITED IT CAN CAUSE A CHIMNEY FIRE THAT MAY RESULT IN A SERIOUS HOUSE FIRE.

DO NOT STORE FUEL WITHIN THE CLEARANCE TO COMBUSTIBLES, OR IN THE SPACE REQUIRED FOR RE-FUELING AND ASH REMOVAL.

When loading the appliance, ensure that the upper fibre baffles are not forced out of position. For maximum efficiency, when the appliance is thoroughly hot, load it fully to the line of air inlet nozzles at the backside of the firebox or, if not present, to 50% of the fireboxes backside height. The whiteness of the bricks and the cleanliness of the glass are good indicators of your operating efficiency. Not

enough heat is produced when only a few pieces of wood are burned or the wood may not burn completely. Fuel for the appliance must not be stored closer than the required clearances to combustibles (heat sensitive material).

NEVER STORE WOOD IN THE ASH PAN COMPARTMENT (IF APPLICABLE).

NOTE: WHEN LOADING THE APPLIANCE, ENSURE TO KEEP FUEL BACK FROM THE GLASS. IF COALS ARE TO ACCUMULATE ON THE FRONT LIP, THERE IS A CHANCE THEY WILL FALL OUT WHEN THE DOOR IS OPENED.

Burn only dry, clean unpainted wood that has been seasoned. It produces more heat and less soot or creosote. Freshly cut wood contains about 50% moisture while after proper seasoning only about 20% of the water remains. As wood is burned, this water boils off consuming energy that should be used in heating. The wetter the wood, the less heat is given off and the more creosote is produced. Dry firewood has cracks in the end of the grain. Both hardwood and softwood burn equally well in this appliance but hardwood is denser, will weigh more per cord and burn a little slower and longer.

Firewood should be split, stacked in a manner that air can get to all parts of it and covered in early spring to be ready for burning that fall. Dry firewood has cracks in the end grain.

Cut the wood so that it will fit horizontally, front to back, making for easier loading and less of a likelihood that the wood will roll onto the glass.

Manufactured firelogs made by compressing 100% natural

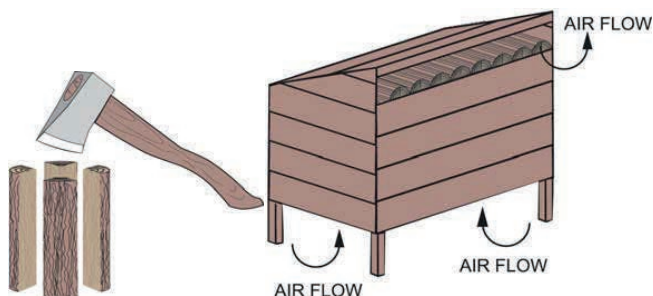
wood fibre can be safely used as fuel. Do not use manufactured firelogs if they contain additives such as paraffin, wax, binders etc. Never burn more than two manufactured firelogs at a time.

Do's

- Build a hot fire.
- Use only dry wood.
- Several pieces of medium sized wood are better than a few big pieces.
- Clean chimney regularly.
- Refuel frequently using medium sized wood.

Don't's

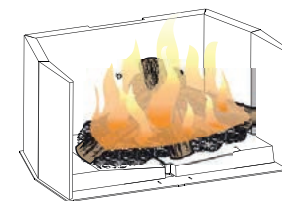
- Take ash out immediately. Let it accumulate to a depth of at least one inch. A good ash layer provides for a longer lasting and better burning fire.
- Burn wet wood
- Close the door too soon or damper down too quickly. Burn one large log rather than two or three smaller, more reasonably sized logs.
- Burn at continually "low setting", if glass door is constantly blackened. This means the Firebox temperature is too low and energy is wasted by incomplete combustion.



6.3 LIGHTING A FIRE

Lighting the fire in your masonry insert is very easy if you follow the instructions given below:

1. A fire may only be started in the masonry insert when the firebox lining has been correctly installed.
2. Turn off any air extraction ventilation (kitchen, bathroom, WC etc.). This will avoid low pressure building up in the installation room that can affect the extraction of flue gases from the wood insert.
3. Place chopped wood into the middle of the firebox using the funeral pyre method (use softwood).
Caution: The height of the wood pile must not exceed the lower marking on the deflector plate!
4. Place standard firelighter cubes on top of the wood pyre to help start the fire. (paper is not recommended because it burns too quickly and causes ash to circulate).
5. Never use methylated spirits, petrol, oil or other easily combustible liquids.
6. Light the fire using the firelighter cubes and, if required, leave the firebox door open by approx. 3-5 cm. The fire should now light, burning brightly and intensively.
7. When the kindling wood is burning well, add smaller hardwood logs or larger softwood logs using the funeral pyre method and close the door.



8. When the wooden logs are burning well, the door can be closed.
9. You can find out more about the correct volume of wood to add to the fire in the section "Volume of wood to add per hour".
10. When the wood has been completely burnt and only embers are remaining from the initial wood added to the fire, new wood can now be added as required (hardwood is ideal).

11. Always open the firebox door slowly. This will ensure that you avoid sudden low pressure in the firebox and prevent exhaust gases leaking into the living room.

12. This will prevent any possible smoke leakage through the opened door when adding new wood during the ember phase.

13. Never consistently add more wood than the recommended amount .

Caution: The height of the wood pile must not exceed the lower marking on the deflector plate!

6.3.1 FLASH FIRE

A flash fire is a small fire burned quickly when you don't need much heat. After your kindling has "caught", load at least 3 pieces of wood, stacked loosely. Open the door upward with 1 1/2 inches for 3 minutes if required.

6.3.2 EXTENDED FIRE

Load your larger pieces of wood compactly, packed close enough to prevent the flames from penetrating it completely.

DO NOT OVERFIRE THE APPLIANCE!
OVERFIRING CAN OCCUR BY:

A. Burning large amounts of smaller wood pieces such as furniture scraps, skids or treated wood.

B. Operating the appliance with a poor gasket seal on the main door.

C. Overfilling your appliance. Go by the following specifications:

Appliance	Wood consumed per hour
Insert-700	2.1 kg/hr

6.3.3 SMOKING

A properly installed appliance should not smoke. If yours does, check the following:

Has the chimney had time to get hot?

Is the smoke passage blocked anywhere in the appliance, chimney connector or chimney?

Is the room too airtight and the air intake not connected to

the outside? Try with a window partly open.

Is the smoke flow impeded by a too long horizontal pipe or too many bends?

Is it a weak draft perhaps caused by a leaky chimney, a cold outside chimney, a too large diameter of a chimney, a too short chimney, or a chimney too close to trees or a higher roof?

Has a direct flue connection been used rather than a chimney liner continuous from cap to appliance flue collar.

7. MAINTENANCE



WARNING

APPLIANCE MAY BE HOT, DO NOT SERVICE UNTIL APPLIANCE HAS COOLED. DO NOT USE ABRASIVE CLEANERS.

Check your chimney and chimney connector for creosote and soot buildup weekly until a safe frequency for cleaning is established.

If accumulation is excessive, disconnect the appliance and clean both the chimney and the appliance. You may want to call a professional chimney sweep to clean them. Both have to be cleaned at least once a year or as often as necessary.

Remove baffle plates and clean above them once a year. Replace any broken bricks.

7.1 ASH REMOVAL PROCEDURES



WARNING

IMPROPER DISPOSAL OF ASHES RESULTS IN FIRES. DO NOT DISCARD ASHES IN CARDBOARD BOXES. DUMP IN BACK YARDS, OR STORE IN GARAGES.

IF USING A VACUUM TO CLEAN UP ASHES, BE SURE

THE ASHES ARE ENTIRELY COOLED. USING A VACUUM TO CLEAN UP WARM ASHES COULD CAUSE A FIRE INSIDE THE VACUUM.

Allow the ashes in your firebox to accumulate to a depth of two or three inches; they tend to burn themselves up. When the fire has burned down and cooled, remove any excess ashes but leave an ash bed approximately 1" (25mm) deep on the firebox bottom to help maintain a hot charcoal bed.

Shovel some ashes out through the door into a metal container with a tight fitting lid. Leave an ash bed approximately 1" (25 mm) deep on the firebox bottom to help maintain a hot charcoal bed. Remove the container immediately as you have placed the hot ashes into the container. Keep the closed container on a noncombustible floor or ground, well away from all combustible materials. The ashes should be retained in the closed container until all cinders have thoroughly cooled. Cold wood ashes can be used on the garden or in the compost.

7.2 CREOSOTE FORMATION AND REMOVAL

When wood is burned too slow, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cooler 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 chimney connector and chimney 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.

7.3 RUNAWAY OR CHIMNEY FIRE



WARNING

A CHIMNEY FIRE CAN PERMANENTLY DAMAGE YOUR CHIMNEY SYSTEM. THIS DAMAGE CAN ONLY BE REPAIRED

BY REPLACING THE DAMAGED COMPONENT PARTS. CHIMNEY FIRES ARE NOT COVERED BY THE WARRANTY.

CAUSES:

- Using incorrect fuel, or small fuel pieces which would normally be used as kindling.
- Leaving the door ajar too long and creating extreme temperatures as the air rushes in the open door.
- Improperly installed or worn gaskets.
- Creosote build up in chimney.

SOLUTIONS:

- Do not burn treated or processed wood, coal, charcoal, coloured paper or cardboard. Do not burn green or freshly cut wood.
- Be careful not to overfire the appliance by leaving the door open too long after the initial start-up. A thermometer on the chimney connector and/or appliance top helps.
- Replace worn, dried out (inflexible) gaskets.
- Have chimney regularly cleaned.

IN CASE OF A CHIMNEY FIRE:

- Have a well understood plan for evacuation and a place outside for everyone to meet. Prepare to evacuate to ensure everyone's safety.
- Close air control on appliance.
- Call local fire department. Have a fire extinguisher handy. Contact local authorities for further information on how to handle a chimney fire.
- After the chimney fire is out, clean and inspect the chimney or chimney liner for stress and cracks prior to lighting another fire. Also check combustibles around the chimney and the roof.

7.4 CHIMNEY CLEANING

Both the chimney and the appliance must be inspected and cleaned at least once a year.

For serious wood burners, chimney cleaning must be done as needed to avoid chimney fires; the venting systems for

controlled combustion appliances may need cleaning as often as once a month. These rates, however, depend on the burning habits of the individual operating the appliance. For example, it is possible to clog a solid fuel appliance chimney in a few days if slow, smoldering fires are burned and the chimney is cold. NOTE: Appliances burned consistently without hot fires may result in significant creosote accumulations in the chimney.

Certain items and considerations are important in chimney cleaning:

- Proper tools should be used, including a brush specifically designed for chimney cleaning.
- The chimney connector and dampers as well as the chimney should be cleaned.
- The appliance's firebox and baffle system should be cleaned if needed.
- The chimney should be inspected and repairs made if needed, preferably by a qualified chimney sweep or mason.

7.5 GLASS REPLACEMENT

WARNING

DO NOT USE SUBSTITUTE MATERIALS

GLASS MAY BE HOT, DO NOT TOUCH GLASS UNTIL COOLED.

CARE MUST BE TAKEN WHEN REMOVING AND DISPOSING OF ANY BROKEN DOOR GLASS OR DAMAGED COMPONENTS. BE SURE TO VACUUM UP ANY BROKEN GLASS FROM INSIDE THE APPLIANCE BEFORE OPERATION.

DO NOT STRIKE, SLAM OR SCRATCH GLASS. DO NOT OPERATE APPLIANCE WITH GLASS REMOVED, CRACKED, BROKEN OR SCRATCHED.

Installation:

Remove the door from the stove and remove the glass retainer. Position the 4 mm ceramic Schott Robax glass in the door, make sure that the glass gasket will properly seal

your unit, and replace the retainer, it should rest on the gasket not the glass. Tighten securely, but do not wrench down on the glass as this may cause the glass to break. Replacement Glass Part as for unit.

7.6 CARE OF GLASS

If the glass is not kept clean permanent discolouration and / or blemishes may result. Normally a hot fire will clean the glass. The most common reasons for dirty glass include: not using sufficient fuel to get the appliance thoroughly hot, using green or wet wood, closing the draft so far that there is insufficient air for complete combustion. If it is necessary to clean the glass, buff lightly with a clean dry cloth and non-abrasive cleaner.

DO NOT CLEAN GLASS WHEN HOT! Clean the glass after the first 10 hours of operation with a suitable stove glass cleaner. Thereafter clean as required.

The glass is very strong but do not let burning fuel rest or fall against it and always close the door gently. NEVER FORCE IT SHUT!

If the glass should ever crack or break while the fire is burning, do not open the door until the fire is out and do not operate the appliance again until the glass has been replaced, available from your authorized dealer. DO NOT USE SUBSTITUTE MATERIALS.

WARNING

**HOT GLASS WILL CAUSE BURNS.
DO NOT TOUCH GLASS UNTIL COOLED. NEVER
ALLOW CHILDREN TO TOUCH GLASS.**

7.7 CLEANING THE GLASS CERAMIC SHEET

WARNING

THE GLASS CERAMIC SHEET MAY ONLY BE CLEANED WHEN COLD (wood insert NOT BURNING AND COOLED DOWN; NO HOT ASH IN THE FIRE CHAMBER).

WARNING

All Spartherm inserts are supplied with Robax glass in the door. Robax is a ceramic glass.

Do not use substitute glass and order replacement glass from Spartherm through your dealer.

7.8 CARE OF PLATED PARTS

If the appliance is equipped with plated parts, you must clean fingerprints or other marks from the plated surfaces before operating the appliance for the first time. Use a glass cleaner or vinegar and towel to clean. If not cleaned properly before operating for the first time, the marks can cause permanent blemishes on the plating. After the plating is cured, the fingerprints and oils will not affect the finish and little maintenance is required, just wipe clean as needed. Prolonged high temperature burning with the door ajar may cause discolouration on plated parts.

NOTE: The protective wrap on plated parts is best removed when the assembly is at room temperature but this can be improved if the assembly is warmed, using a hair dryer or similar heat source.

8. REPLACEMENTS

Contact your dealer or the factory for questions concerning prices and policies on replacement parts. Normally all parts can be ordered through your authorized dealer / distributor. FOR WARRANTY REPLACEMENT PARTS, A PHOTOCOPY OF THE ORIGINAL INVOICE WILL BE REQUIRED TO HONOUR THE CLAIM. When ordering replacement parts always give the following information:

Model & Serial Number of appliance
Installation date of appliance
Part number
Description of part
Finish

IDENTIFIES ITEMS WHICH ARE NOT ILLUSTRATED. FOR FURTHER INFORMATION, CONTACT YOUR AUTHORIZED DEALER.

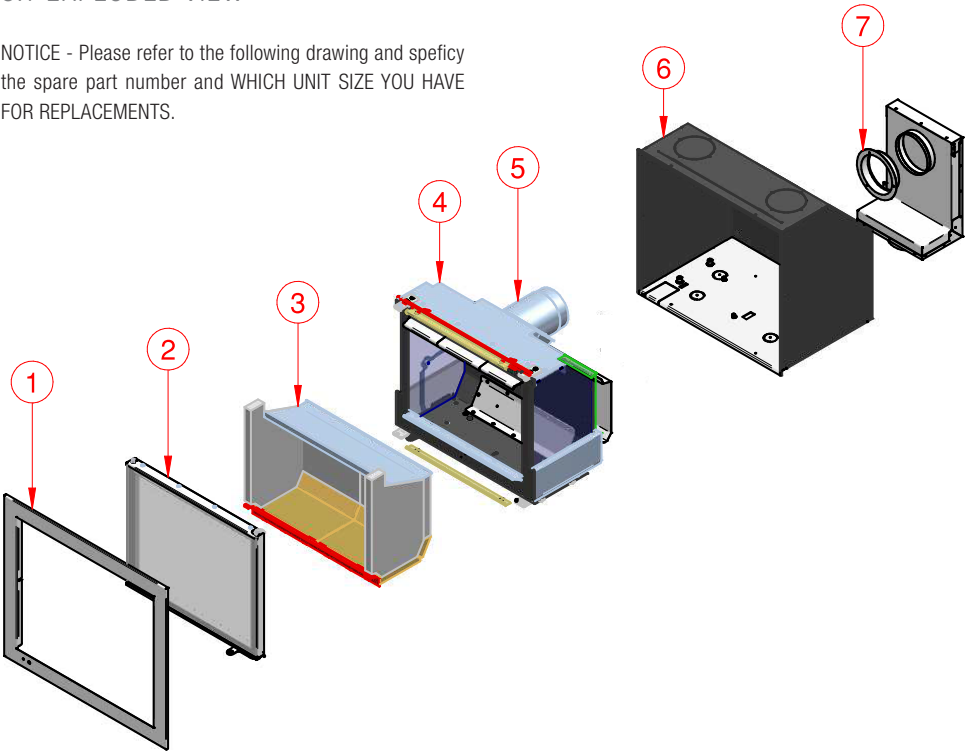
For refractory bricks and baffle plates replacement see chapter „5.1 Bricks and baffles installation“ on page 14.

WARNING

FAILURE TO POSITION THE PARTS IN ACCORDANCE WITH THIS MANUAL OR FAILURE TO USE ONLY PARTS SPECIFICALLY APPROVED WITH THIS APPLIANCE MAY RESULT IN PROPERTY DAMAGE OR PERSONAL INJURY.

8.1 EXPLODED VIEW

NOTICE - Please refer to the following drawing and specify the spare part number and WHICH UNIT SIZE YOU HAVE FOR REPLACEMENTS.



1	Frame
2	Firebox door with ceramic glass
3	Firebox lining
4	Firebox
5	Exhaust gas sockets, rotatable (vertically or horizontally)
6	Convection air jacket
7	Combustion air sockets, outlet to rear

SPARTHERM ACCESSORIES

Masonry Insert Description Part	
Spartherm Insert-700 1065254	Optional Combustion Air Appliance Connector
Required Accessories 700 Frame 2 3/8" 1017412	
700 Frame 3 1/8" 1017420	5" Butterfly Valve
700 Frame 4" 1017429	

9. TROUBLESHOOTING



WARNING

APPLIANCE MAY BE HOT, DO NOT SERVICE UNTIL APPLIANCE HAS COOLED.

DO NOT USE ABRASIVE CLEANERS.

Problem	Solution
Can't get the fire started.	• Not enough kindling / paper? Add more. • Not enough air? Open the door 2" until the fire burns-max 6 seconds. Also ensure that the air opening is not obstructed. • Cold air blockage? Burn a piece of paper to establish a draft. • Use dry seasoned wood. • Flue blockage? Inspect chimney.
Smokes when door is open.	• Cold air blockage? Burn a piece of paper to establish a draft. • Insufficient draft? Add more pipe. • Let air stabilize before opening door. • Ensure baffles are positioned correctly. • Negative pressure? Open a window near the appliance.
Appliance emits odour.	• Paint curing. See "2.4 General instructions" section.
Stove doesn't burn hot enough.	• Wood is too wet. • Insufficient draft? Add more pipe. • Not enough air? Also ensure that the air opening is not obstructed.
Wood burns too fast.	• Check door gasket for adequate seal. • Wood may be extremely dry.
Dirty glass.	• Burn hotter, smaller fires. Use well seasoned wood.

10. GENERAL WARRANTY TERMS AND CONDITIONS

10.1 GENERAL INFORMATION

This quality manufactured product is state of the art. The materials used were meticulously selected and are constantly checked, as is our entire production process.

Setting up or installing this product requires specialized knowledge. Our products may therefore only be installed and commissioned by specialized firms and in compliance with statutory regulations as amended.

10.2 WARRANTY PERIOD

The General Warranty Terms and Conditions apply only within the USA and Canada. The warranty period and scope of the warranty in accordance with these terms and conditions shall apply apart from the statutory guarantee, which remains unaffected.

Spartherm Feuerungstechnik GmbH gives a 5-year warranty on:
Basic body wood insert

Spartherm Feuerungstechnik GmbH gives a 24-month warranty on elevating mechanisms, operating devices such as handles, adjustment levers, shock absorbers, electronic and electrical components such as exhausters, governors, original spare parts, all purchased parts and safety devices.

Spartherm Feuerungstechnik GmbH gives a 6-month warranty on wearing parts around the fire, such as refractory bricks, vermiculite, fire grates, seals and glass ceramics.

10.3 REQUIREMENT OF EFFECTIVENESS FOR THE WARRANTY

The warranty period starts on the date of delivery to the dealer / intermediary. This must be verified from a document such as an invoice with the dealer / intermediary's confirmation of delivery. The warranty certificate relating to the product must be produced by the claimant when making a warranty claim.

If such proof is not produced Spartherm Feuerungstechnik GmbH shall not be obliged to honour the warranty.

10.4 WARRANTY EXCLUSIONS

The warranty does not cover:

- wear and tear to the product
- Refractory bricks/ vermiculite:

These are natural products subjected to expansion and contraction during the heating process. This may create cracks. For as long as the linings remain in position in the fire chamber and do not break up, they remain fully functional.

- the Surfaces:

Discoloration of the enamel or galvanized surfaces caused by thermal stress or overload.

- the elevating mechanism:

If the installation instructions are not correctly followed, resulting in overheating of the pulleys and bearings.

- the seals:

Reduced sealing due to thermal stress and hardening.

- the ceramic glass:

Soiling caused by soot or burnt-in residues of burnt materials as well as visibly changed colour or other aspects due to thermal stress.

- improper transport and/or incorrect storage
- improper handling of fragile components such as glass and ceramics
- improper handling and/or use
- lack of maintenance
- incorrect installation or connection of the unit
- Non-observance of the installation and operating instructions
- technical modifications to alter the unit by third parties

- installation that does not comply with industry practice on installation instructions

10.5 NOTE

Your specialist dealer/contractor will gladly advise and assist you in matters not covered by our warranty terms and conditions and undertakings. We particularly advise you to have your wood insert/stove serviced regularly by a stove fitter.

Technical data subject to change errors and omissions excepted.

11. SERVICE HISTORY

Appliance Service History

This heater must be serviced annually depending on usage.

[illegible]

SPARTHERM

THE GLOBAL BRAND FOR YOUR LIVING ROOM

Your specialist dealer



Spartherm Feuerungstechnik GmbH · Maschweg 38 · 49324 Melle
Phone +49 5422 94 41-0 · www.spartherm.com

Safety Information

Listed by / Manufactured by:
Spartherm Feuerungstechnik GmbH
Maschweg 38
GER – 49324 Melle, Germany
info@spartherm.com



Solid Fuel Room Heater – For Use with Solid Wood Fuel only
Tested to Standards: UL-1482-11, ULC-S628 M93
U.S. Environment Protection Agency: Certified to comply with 2020
Particulate emission standards using crib wood: emission rate 1.7 g/hr
Model: Spartherm Cassette 700 Insert
Date of Manufacture
Month/Year: 05/2024
Serial Number M 700 Insert - 001

Informations Sur La Sécurité

Listée par / Fabriqué par:
Spartherm Feuerungstechnik GmbH
Maschweg 38
GER – 49324 Melle, Germany
info@spartherm.com



Appareil de Chauffage à combustion solides
Tested aux Normes: UL-1482-11, ULC-S628 M93,
U.S. Environment Protection Agency: Certified to comply with 2020
Particulate emission standards using crib wood: emission rate 1.7 g/hr
Model: Spartherm Cassette 700 Insert
Date de Fabrication:
Mois/Année: 05/2024
No de Serie: M 700 Insert - 001

TO PREVENT HOUSE FIRES:

Contact local building or fire officials about restrictions and installation inspection in your area. Install and use only in accordance with manufacturer's installation and operating instructions and local codes. In the absence of any local codes, installation must meet minimum requirements of NFPA 211 in the USA, and B365 in Canada. Refer to manufacturer's instructions and local codes for precautions required for passing a chimney through a combustible wall or ceiling. Inspect and clean chimney system frequently in accordance with manufacturer's instruction. Do not connect this insert to a chimney flue serving another appliance. Do not use grate or elevate fire. Build wood fire directly on hearth. This fireplace insert must be installed with a continuous chimney liner of 6 or 7 inches diameter extending from the fireplace insert to the top of the chimney. The chimney liner must conform to the Class 3 requirements of CAN/ULC-S635, Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents, or CAN/ULC-S640, Standard for Lining Systems for New Masonry Chimneys.

TO PREVENT CREOSOTE FIRES:

Inspect and clean chimney frequently - under certain conditions of use, creosote buildup may occur rapidly. Do not use fuels other than firewood.

CAUTION: Only operate the wood heater with the doors fully closed. Replace glass only with original 4 mm Robax ceramic glass. Areas of the fireplace incorporating warm or cold air ducts shall be enclosed in accordance with the manufacturer's installation instructions. If provided with a hearth extension, the hearth extension must be installed according to the installation instructions! Air is needed for fireplace operation! At least 14 square inches (90.3 square centimeters) of outside air must be admitted to the room or directly to the unit through a 4" (101.6mm) diameter pipe. Failure to provide this may starve other fuel burning appliances from an adequate air supply. Do not obstruct air inlet and outlet in any case. Components used with fireplace must be listed. See manual. Do not use a fireplace insert or other products not specified for use with this product.

CAUTION: Gas logs shall be certified for the application. This unit is not designed to burn with a log set.

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

POUR EVITER LES INCENDIES DOMESTIQUES:

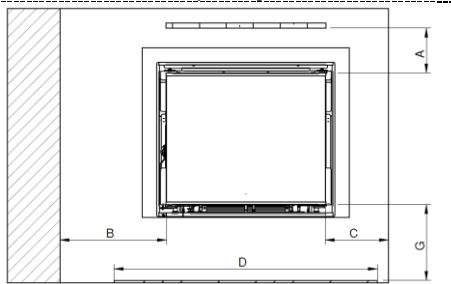
Inspection dans votre région. Installez et utilisez uniquement conformément aux instructions d'installation et d'utilisation du fabricant et aux codes locaux. En l'absence de codes locaux, l'installation doit répondre aux exigences minimales de NFPA 211 aux États-Unis et de B365 au Canada. Reportez-vous aux instructions du fabricant et aux codes locaux pour connaître les précautions nécessaires pour faire passer une cheminée à travers un mur ou un plafond combustible. Inspectez et nettoyez fréquemment le système de cheminée conformément aux instructions du fabricant. Ne raccordez pas cet insert à un conduit de cheminée desservant un autre appareil. Ne pas utiliser de grille ou élever le feu. Faites du feu de bois directement sur le foyer. Cet insert de foyer doit être installé avec une doublure de cheminée continue de 6 ou 7 pouces de diamètre s'étendant de l'insert de cheminée jusqu'au sommet de la cheminée. Le revêtement de cheminée doit être conforme aux exigences de classe 3 de CAN / ULC-S635, Norme pour les systèmes de revêtement pour maçonnerie existante ou cheminées et événements construits en usine, ou CAN / ULC-S640, Norme pour les systèmes de revêtement pour les nouvelles cheminées de maçonnerie.

POUR EVITER LES FEUX DE CREOSOTE :

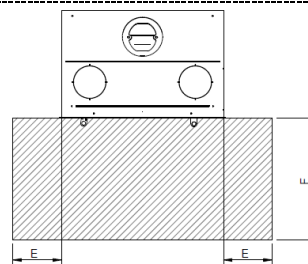
Inspectez et nettoyez la cheminée régulièrement - Sous certaines condition d'emploi, la creosote peut s'accumuler rapidement. Ne pas utiliser d'autres combustibles que le bois.

ATTENTION: N'utilisez le poêle que lorsque les portes sont complètement fermées. Remplacer la vitre uniquement avec du verre Robax céramique de 4 mm. Il faut que les zones du foyer vitré qui portent les canaux d'alimentation d'air chaud et froid soient conformes à l'instruction de montage du fabricant. L'approvisionnement en revêtement fait de matériaux ininflammables devant l'ouverture du foyer vitré doit être installé conforme à l'instruction de montage du fabricant. L'aération suffisante pour l'utilisation du foyer est nécessaire! Dans l'emplacement du foyer vitré il faut assurer au moins 14 pouces carée (90,3 centimètres carée) de l'air de dehors ou il faut assurer l'alimentation en air de combustion directe au foyer vitré par une tube d'un diamètre de 4 pouces carée (101,6mm). Un manque d'air d'appoint pourrait priver les autres appareils de combustion d'une alimentation d'air adéquate. Ne pas obstruer les entrées et sorties d'air en aucun cas. Les composantes utilisées dans l'appareil doivent être répertoriées. Voir manuel. N'utilisez pas d'insert de cheminée ou autres produits qui ne sont pas autorisés pour l'usage de ce produit.

ATTENTION: Ce poêle à bois n'est pas conçu pour brûler avec un bûche à gaz. Ce foyer vitré à bois doit être entretenu et réparé à intervalles réguliers pour assurer un fonctionnement correct. Veuillez consulter s.v.p. pour de plus amples informations les instructions du fabricant. Il est contraire aux dispositions de l'autorité d'exploiter ce foyer vitré à bois incompatible au manuel du fabricant.



Floor protection for Canada: 18" (457mm) from unit to front of floor protector.



Protection de sol pour Canada: 18" (457 mm) de l'avant de l'appareil au bord de la protection.

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS

- A. 7.25" / 184mm
- B. 15" / 381mm
- C. 15" / 381mm
- D. Unit width and add 8" / 203mm on each side
- E. 8" / 203mm on each side
- F. For USA: 16" / 406mm For Canada 18" / 457mm
- G. 9.25" / 235mm

IN FRONT OF UNIT

Recommend amount of wood: 2,1 kg/hr
Min. / Max. output (kW): 25,000 BTU/hr

* **Not Tested** - NFPA Guidelines in the USA, CAN/CSA B365-M91 in Canada. Floor protection must be minimum 3/8-inch non-combustible material extending beneath the stove, and to the front and sides from door opening and to the rear as indicated.

ECARTEMENT MINIMUM AUX MATERIAUX COMBUSTIBLES

- A. 7.25" / 184mm
- B. 15" / 381mm
- C. 15" / 381mm
- D. Unité largeur et ajouter 8" / 203mm de chaque côté
- E. 8" / 203mm de chaque côté
- F. Pour les USA: 16" / 406mm Pour le Canada 18" / 457mm
- G. 9.25" / 235mm

DEVANT L'APPAREIL

Quantité de bois recommandée: 2,1 kg/hr
Min. / Max. sortie (kW): 25,000 BTU/hr

* **Non testé** - Exigences NFPA aux États-Unis, CAN/CSA B365-M91 au Canada. La protection de sol doit avoir une épaisseur de 3/8 pouces (1 cm), être d'un matériau non combustible et être placée devant et à côté de la porte ainsi qu'à l'arrière, comme indiqué.

CAUTION:

HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN AND CLOTHING AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAME PLATE AND INSTRUCTIONS. KEEP FURNISHINGS AND OTHER COMBUSTIBLE MATERIALS A CONSIDERABLE DISTANCE AWAY FROM THE APPLIANCE. NOT SUITABLE FOR MOBILE HOME INSTALLATION. DO NOT OVERFIRE - IF HEATER OR CHIMNEY CONNECTOR GLOWS, YOU ARE OVERFIRING.



ATTENTION:

CHAUD PENDANT LE FONCTIONNEMENT - NE PAS TOUCHER. TENIR ÉLOIGNÉS LES ENFANTS ET LES VÊTEMENTS - LE CONTACT PEU CAUSER DES BRULURES. CONSULTEZ LA PLAQUE D'IMMATRICULATION ET LES INSTRUCTIONS. TENIR LES FOURNITURES ET AUTRES MATIERES COMBUSTIBLES À DISTANCE DE L'APPAREIL. NE PAS INSTALLER DANS UNE MAISON MOBILE. EVITER DE SURCHAUFFER - SI LE FEU OU LA CHEMINÉE DEVIENT ROUGE, VOUS SURCHAUFFEZ.

DO NOT REMOVE THIS LABEL

NE PAS ENLEVER CETTE ETIQUETTE

APPENDIX 8: Photographs of test set up

Dilution picture Dia 8 no. EG-029

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 $4D=32$ inches minimum) velocity ports and 18 inches above downstream Tee. (Requirement $2D=16$ inches minimum)

Adjustable damper for flow adjustments

Extraction blower



Last elbow from
horizontal run

8 inches diameter
stainless steel pipe

Velocity ports located 138
inches downstream of the
last elbow (requirement
 $8D=64$ inches minimum)
and 48 inches upstream of
the sampling ports
(requirement $4D=32$
inches minimum)

Total length between hood and sampling port: 23 feet.



Two 8 inches elbow with horizontal mixing section.

60 inches horizontal run between two elbows. Mixing section, No mixing baffle. 8 inches diameter pipe

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

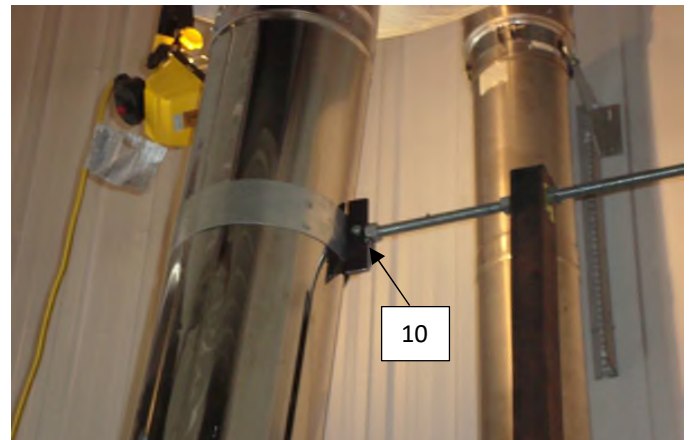
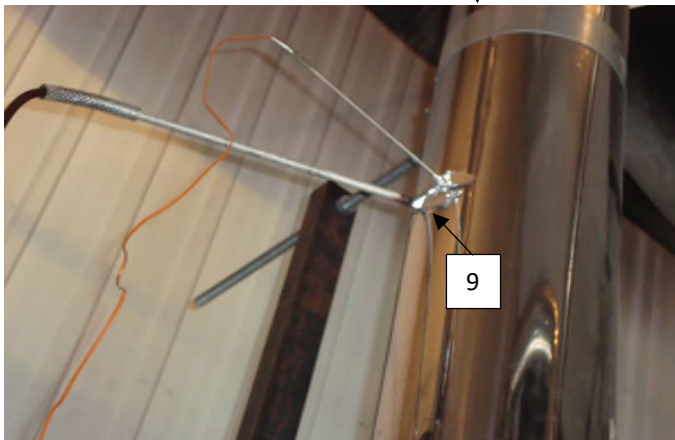
All pipe joints are sealed.

Stack sampling



Gas analysis and temperature probe

chimney support



9

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

10

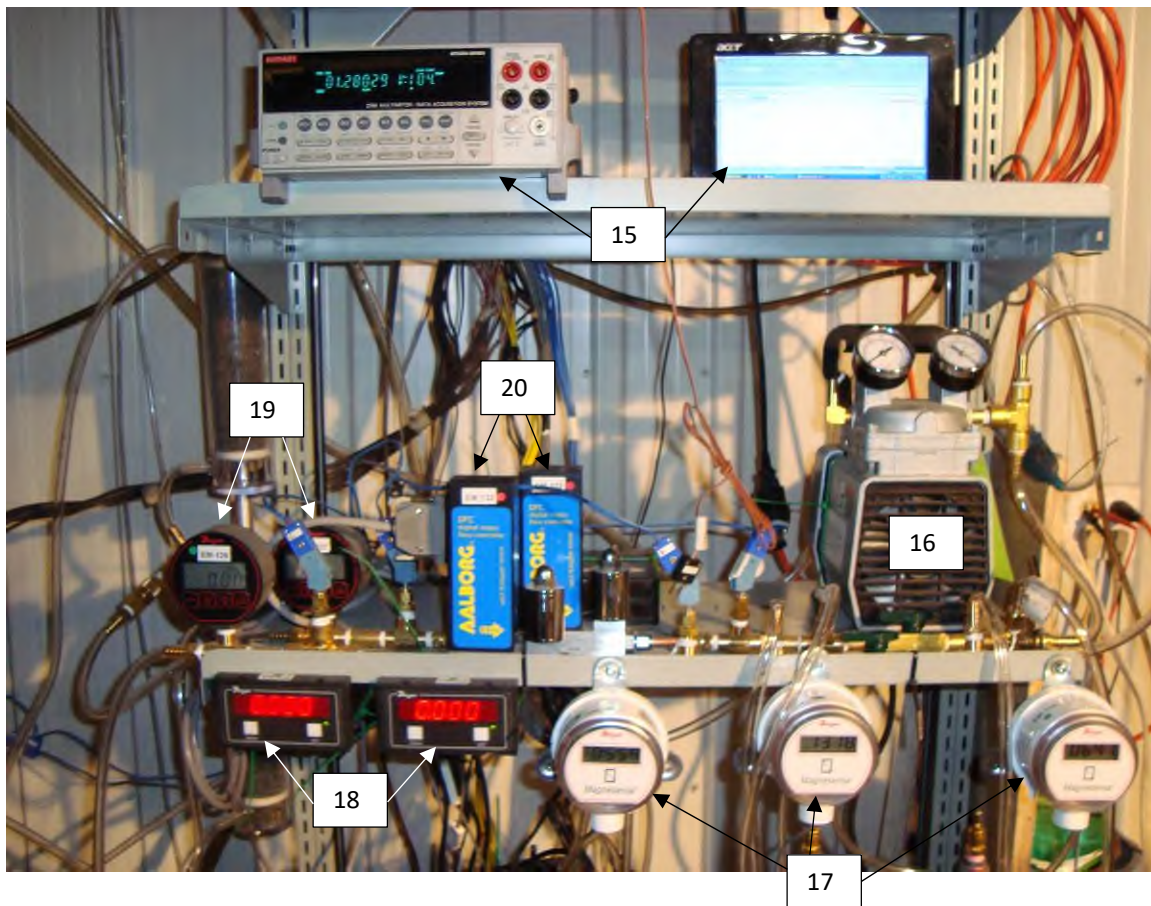
 : Exhaust system support bracket

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

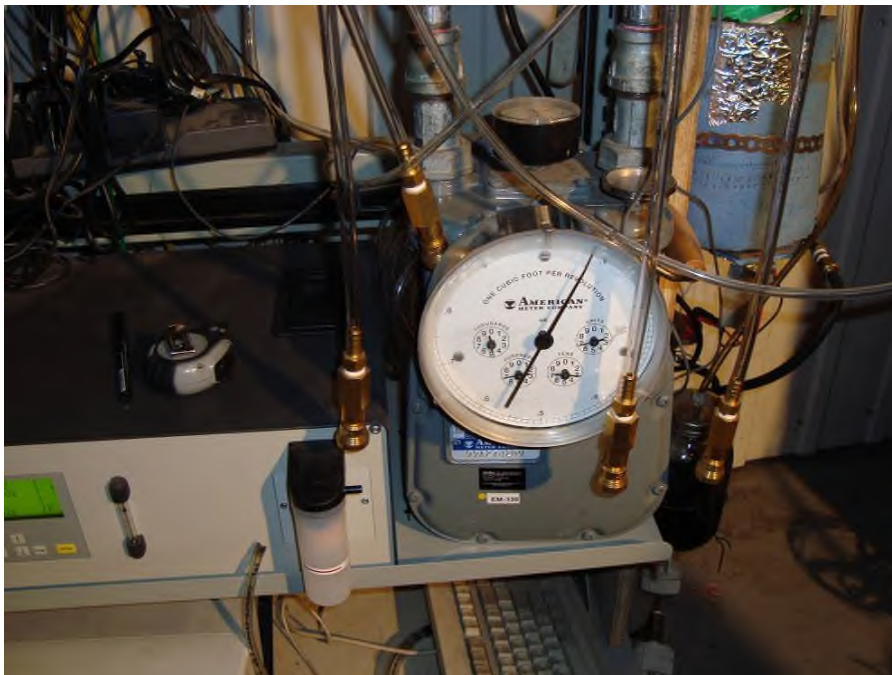
19 : Digital vacuum gage

20 : Mass flow meter

Gaz analyser



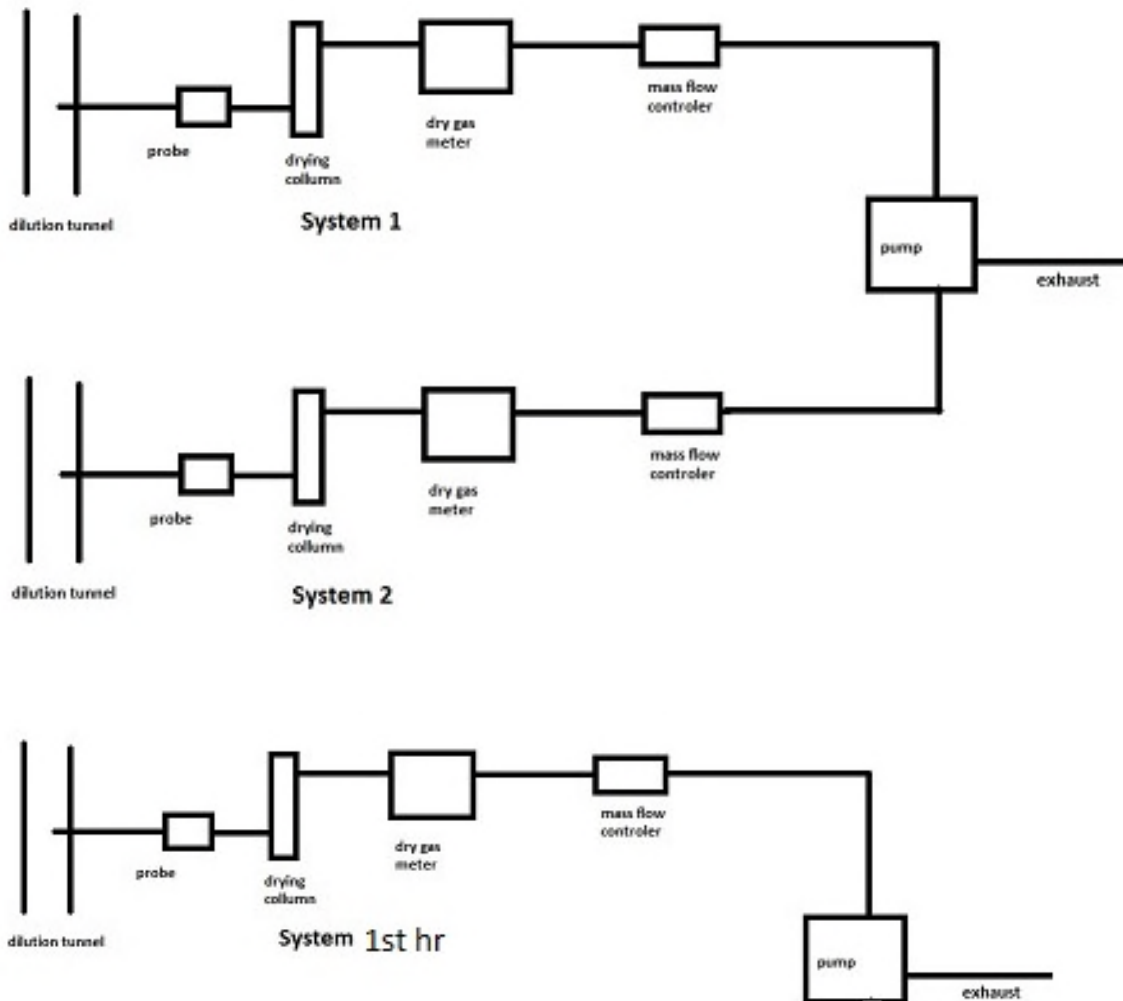
Reference dry gas meter



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



Dilution tunnel sample system



Dilution tunnel

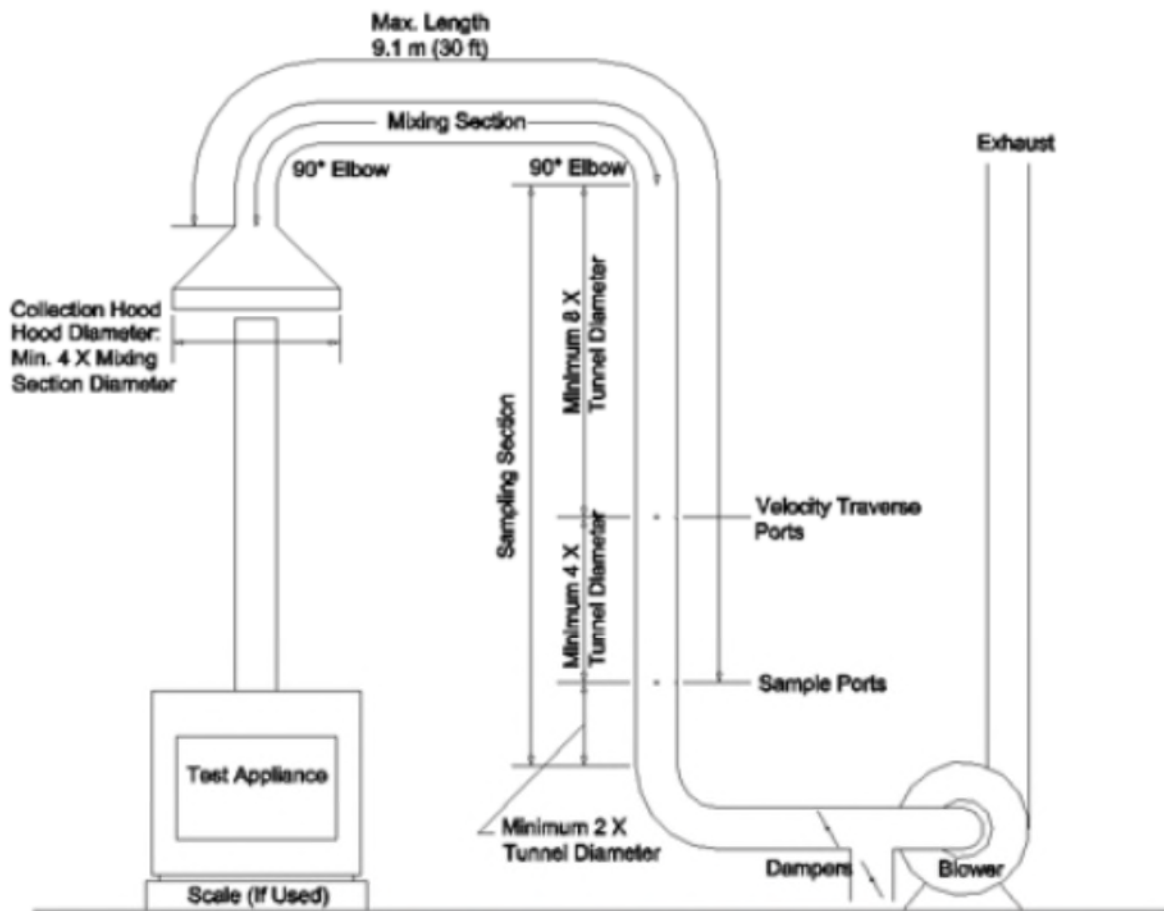


FIG. 3 Steel-Constructed Dilution Tunnel Apparatus

APPENDIX 9: Test load photographs

Front view stove setup



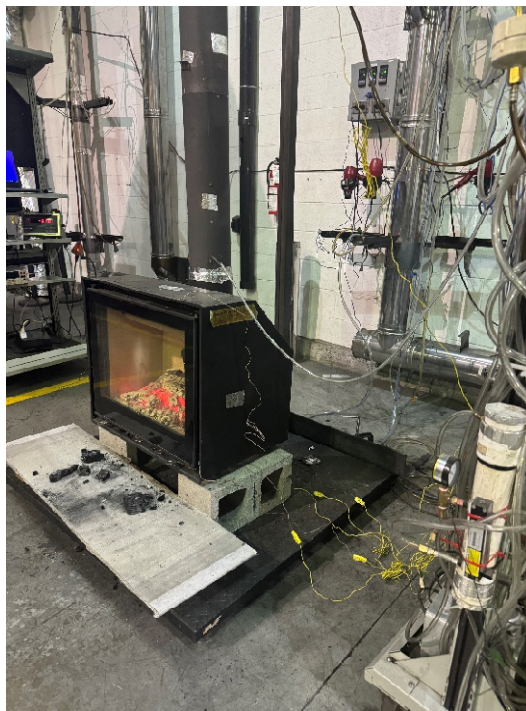
Left side view of the Stove



Back side view of the stove



Right side view of the stove



Run 1 April 8th 2024

Testing load



Preburn load



Charcoal / coal bed for load

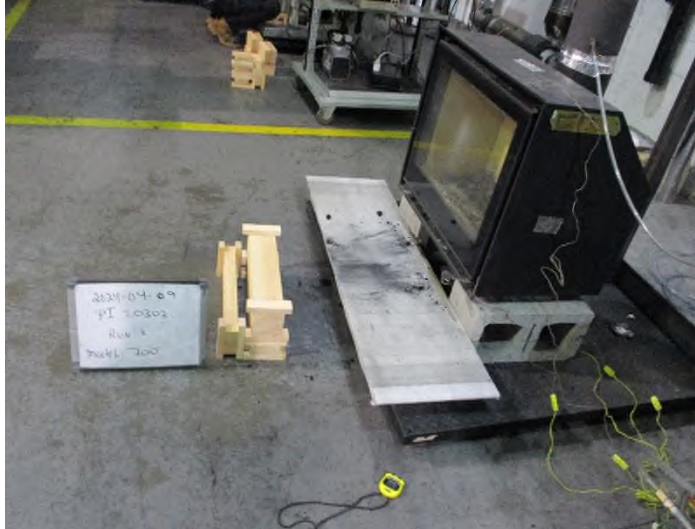


Load in stove



Run 2 April 9th 2024

Testing load



Preburn load



Charcoal / coal bed for load



Load in stove



APPENDIX 10: Laboratory Operating Procedures

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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, ASTM E2780, ASTM E2515, ASTM E2618, Method 28WHH, Method 28 PTS, Method ALT-125, ASTM E3053, ALT-134, ASTM E2779

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. ASTM E2780
3. ASTM E2515
4. ASTM E2618
5. METHOD 28WHH
6. METHOD 28 PTS
7. ALT-125
8. ASTM E3053
9. ALT-134
10. ASTM E2779

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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 irreparable, a new unit will need to be obtained.
3. Note whether unit is catalytic or 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) Fifty (50) hours at medium burn rate with Douglas Fir scrap or cordwood. Between 18% and 25% MC.

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 500 degrees Fahrenheit (active range).

For non-catalytic units a stack thermocouple should be installed and stack temperature recorded at 1-hour intervals. 50 hours minimum burn time with a stack temperature of at least 250 degrees Fahrenheit is required.

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

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2. 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.
3. If scale checks out, place unit on scale and align so chimney will be centered in hood.
4. 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.
5. 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.
6. 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 subtraction 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.
7. 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.
8. 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.
9. Note that inserts are tested as if they are freestanding stoves.
10. Dilution tunnel should be cleaned prior to each certification test series and at anytime a higher burn rate follows a lower test burn rate.

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SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY OPERATING PROCEDURE

II. SAMPLING SYSTEM – SET-UP

A. GAS ANALYSIS

1. Instruments should be turned on and allowed to warm up for one (1) hour minimum.
2. Calibrate analyzers as follows:

NOTE: Prior to proceeding with calibration, make sure to use NIST traceable 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 CO₂ and CO analyzers are “ZEROED” on nitrogen. The O₂ 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 (O₂ should be 20.93, CO and CO₂ should equal 0).
 - 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 H₂SO₄
Impinger #2: 100 ml distilled water and 5 ml H₂SO₄
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.

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SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY OPERATING PROCEDURE

- 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 ambient 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 48 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 10 inches Hg. (NOTE: During test, vacuum must not exceed 10 inches unless posttest leak check shows acceptable results.)
 - c) Allow vacuum indication to stabilize for two (2) minutes, then record time and dry gas (DGM₁) and (DGM₂) meter readings. Wait ten (10) minutes and record dry gas meter readings again (DGM₃, DGM₄).

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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 $0.04 \times \text{sample rate}$, leakage is unacceptable. For most tests, the sample rate will be about 0.15 CFM, thus leakage rates in excess of $0.04 \times 0.15 = 0.006$ 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 or (10 and 12 for cordwood method). 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.

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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 tunnel velocity to 500ft/min 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 anemometer. 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 manufacturers.
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.

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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. 15 minutes or 15% of lad burned allowed for ALT-125 method))
- f) An alarm will sound an audible signal at the (10) minutes intervals. This signals 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 load weight
- 7) CO, CO₂ and O₂ 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,

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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 48-hour desiccation before weighing.
4. Weigh probe filter holder units and filters at six (6) hour intervals minimum until weight change between weightings is less than 0.2 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}	10,712 lbs
θ	124 min
$\%M_W$	16,64 %

Calculation

BR	1,960 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	23,70 dcf
Y	1,00263
P_{bar}	29,78 in Hg
ΔH	-0,9114 in Hg
T_m	536,5 R

Calculation

$V_{m(std)}$	22,56 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

$F_1 + F_2$ Particulate matter collected on filters, mg

ΔPF Post-test weight gain of probe and filter holder assembly, mg

Sample calculation

Data

$F_1 + F_2$ 0,0016 g

ΔPF 0,001 g

Calculation

m_n 2,200 mg

Calculation based of train 2 data

Particulate concentration (C_s)

Equation used

ASTM 2515, equation 13

$$C_s = (0,001 \text{ g/mg}) \times \left(\frac{m_n}{V_{m(\text{std})}} \right)$$

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
$V_{m(\text{std})}$	Volume of gas sample measured corrected to dry standard conditions, dsm ³ (dscf)

Sample calculation

Data

m_n	2,200 mg
$V_{m(\text{std})}$	22,56 dscf

Calculation

C_s	0,000098 g/dscf
Calculation based of train 2 data	

Particulate concentration for room air (C_r)

Equation used

ASTM 2515, equation 14

$$C_r = (0,001 \text{ g/mg}) \times \left(\frac{m_r}{V_{mr(std)}} \right)$$

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 (dscf)

Sample calculation

Data

m_r	0,100 mg
$V_{mr(std)}$	17,83 dscf

Calculation

C_r	0,000006 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 cacluated 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}	0,260922876
V_{scent}	0,273861279

Calculation

F_P	0,952756
-------	----------

Average dilution tunnel gas velocity (V_s)

Equation used

ASTM 2515, equation 9

$$V_s = F_p K_p C_p (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_s}{P_s M_s}}$$

Nomenclature

V_s	Average dilution tunnel gas velocity, m/s (ft/s)
K_p	Pitot tube constant For the metric units: $34.97 \text{ m/sec} \left[\frac{(\frac{g}{g-mole})(mm \text{ Hg})}{(^{\circ}K)(mm \text{ H}_2\text{O})} \right]^{1/2}$ For English units: $85.49 \text{ ft/sec} \left[\frac{(\frac{lb}{lb-mole})(in \text{ Hg})}{(^{\circ}R)(in \text{ H}_2\text{O})} \right]^{1/2}$
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
$(\sqrt{\Delta P})_{avg}$	Average square root of each individual velocity head (ΔP)
P_{bar}	Barometric pressure at measurement site, mm H ₂ O (in. H ₂ O)
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, $^{\circ}C$ ($^{\circ}F$)
T_s	Absolute dilution tunnel temperature, $^{\circ}K$ ($^{\circ}R$), 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	0,953
$(\sqrt{\Delta P})_{avg}$	0,2813 in H ₂ O ^{1/2}
P_{bar}	29,78 in Hg
P_g	0,28 in H ₂ O
P_s	29,80 in Hg
M_s	29 lb/lb-mol
t_s	103,59 F
T_s	563,59 R

Calculation

V_s	18,3196 ft/s
-------	--------------

Average dilution tunnel gas flow rate (Q_{std})

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	18,320
A	0,349 ft^2
T_{std}	528 R
T_s	563,59 R
P_s	29,802 in Hg
P_{std}	29,92 in Hg

Calculation

Q_{std}	350,87 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	0,000098 g/dscf
C _r	0,000006 g/dscf
Q _{std}	350,87 dscf/min

Calculation

E	0,03 g/min
E	1,93 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	0,000098 g/dscf
C_r	0,000006 g/dscf
Q_{std}	350,87 dscf/min
θ	124 min

Calculation

E 4,00 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

	Average gas velocity in dilution tunnel during each min interval, i of the test run
v_{si}	m/sec (ft/sec)
F_p	Pitot tube correction factor
K_p	Pitot tube constant
	For the metric units: $34.97 \text{ m/sec} \left[\frac{(\frac{g}{g\text{-mole}})(\text{mm Hg})}{(^{\circ}\text{K})(\text{mm H}_2\text{O})} \right]^{1/2}$
	For English units: $85.49 \text{ ft/sec} \left[\frac{(\frac{\text{lb}}{\text{lb-mole}})(\text{in Hg})}{(^{\circ}\text{R})(\text{in H}_2\text{O})} \right]^{1/2}$
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 $P_{\text{bar}} + P_g$
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	0,953	F_p	0,953
K_p	85,49	K_p	85,49
C_p	0,99	C_p	0,99
Δp_i	0,078 in H ₂ O	Δp_i	0,078 in H ₂ O
T_{si}	616,6 R	T_{si}	575,3 R
P_s	29,80 in Hg	P_s	29,80 in Hg
M_s	29 lb/lb-mol	M_s	29 lb/lb-mol

Calculation

i=1		i=2	
v_{si}	19,06 ft/sec	v_{si}	18,35 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	124	min	θ	124	min
θ_i	1	min	θ_i	1	min
V_m	21,53	dcf	V_m	22,57	dcf
$V_{mi(std)}$	0,178	cuft	$V_{mi(std)}$	0,1797	cuft
V_S	18,33	ft/sec	V_S	18,33	ft/sec
V_{Si}	19,069	ft/sec	V_{Si}	19,069	ft/sec
T_m	533,0	R	T_m	536,5	R
T_{mi}	531,17	R	T_{mi}	531,30	R
T_S	563,59	R	T_S	563,59	R
T_{Si}	616,6	R	T_{Si}	616,6	R

Calculation

train=1		train=2	
PR	108,3 %	PR	104,8 %

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, m ² (ft ²)

Sample calculation

Data

V_{mL}	0,179 dcf
F_A	0,0116 ft ²

Calculation

FV_{max}	15,44 ft/min
------------	--------------

Dual train precision

Equation used

$$\frac{\text{Train 1} - \text{average train 1 and train 2}}{\text{average train 1 and train 2}} \times 100 \leq 7.5\%$$

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	3,79 g
Train 2	3,99 g

Calculation

Dual train precision	2,56 %
----------------------	--------

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

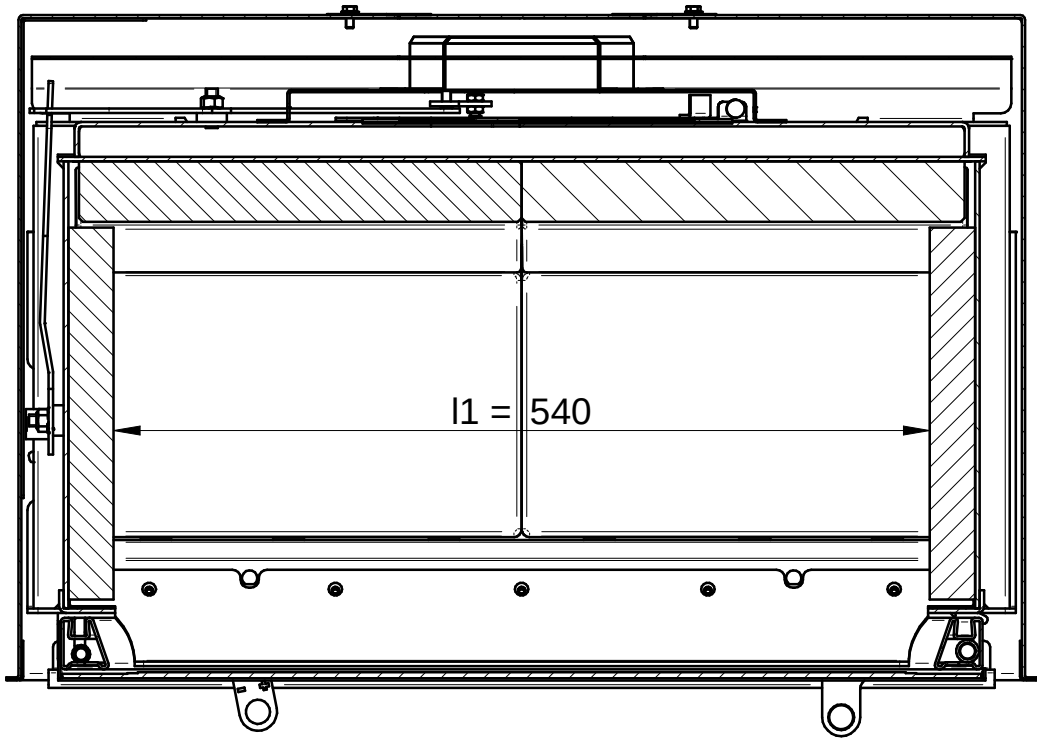
ΔR	0,015 %
Span	5 %

Calculation

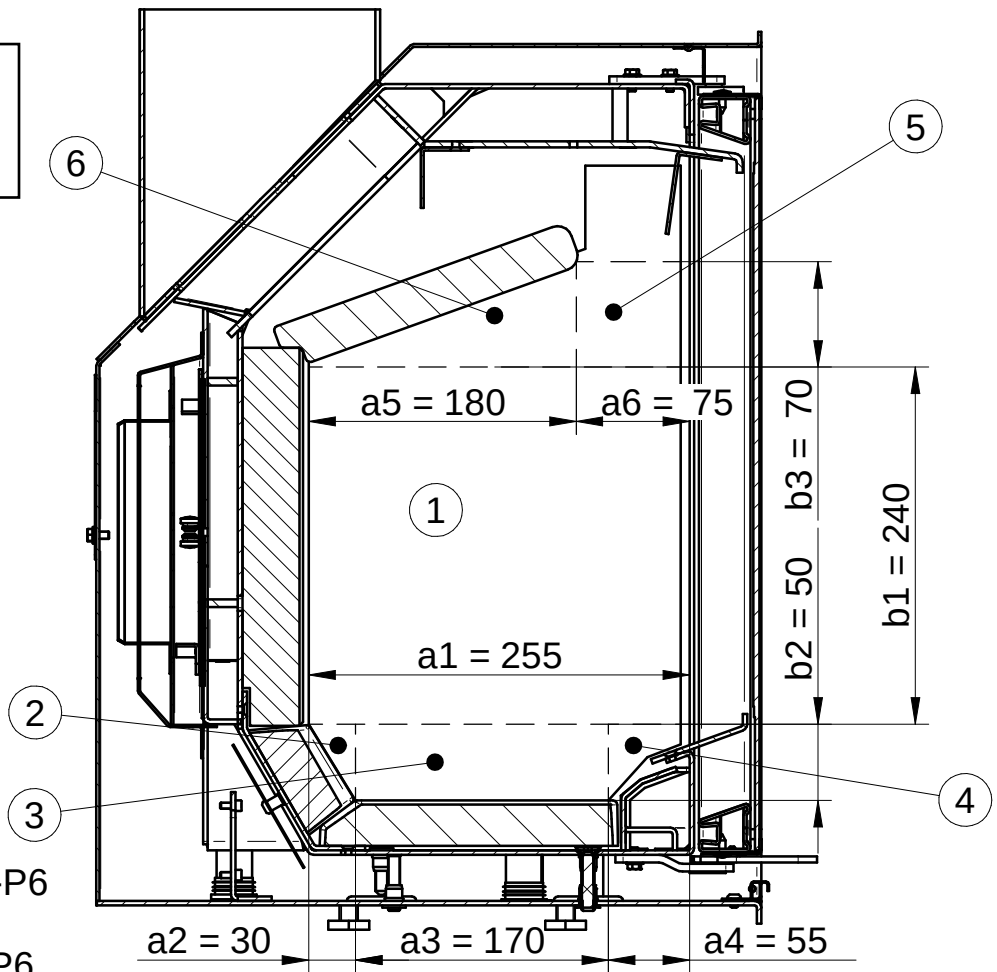
Drift	0,30 %
-------	--------

Calculated with CO concentration values.

APPENDIX 12: Volume calculations



Usable and overall volume are the same



Spartherm-700 M-INSERT-P6
Spartherm-700 M-ZC-P6
Spartherm-700 M-Module-P6

				No. of substitute character:				Designation: combustion chamber volume				 SPARTHERM® THE FIRE COMPANY Maschweg 38; D-49324 Melle tel. 0 54 22/94 410; fax 0 54 22/94 41 14	
				Substituted by:									
				Material:				Assembly:					
					Name		Date	Kassette - series					
				Drawn:			28.05.2024	Product:					
				Tested:				Spartherm-700 M-P6					
No	Modifications		Name	Date	Gen.:			Drawing-No.: 29-2023-740-030.025					
Filename.: KAMINKASSETTEN 700.asm					Scale	Format:	Page: 1	Mass:					
Dft - Filename.: 29-2023-740-030.026 Spartherm-700 M P6_combustion chamber volume						A4	of: 2						
Dxf - Filename.:													

				No. of substitute character:				Designation: combustion chamber volume				 SPARTHERM[®] THE FIRE COMPANY Maschweg 38;D-49324 Melle tel. 0 54 22/94 410; fax 0 54 22/94 41 14							
				Substituted by:												Assembly: Kassette - series			
				Material:															
					Name			Date			Product: Spartherm-700 M-P6								
								28.05.2024											
				Drawn:				Drawing-No.: 29-2023-740-030.025											
				Tested:															
No	Modifications			Name			Date												
Filename.: KAMINKASSETTEN 700.asm																			
Dft - Filename.: 29-2023-740-030.026 Spartherm-700 M P6_combustion chamber volume								Scale		Format: A4		Page: 2 of: 2		Mass:					
Dxf - Filename.:																			

APPENDIX 13: Operating instruction



Spartherm Feuerungstechnik GmbH, Maschweg 38, 49324 Melle

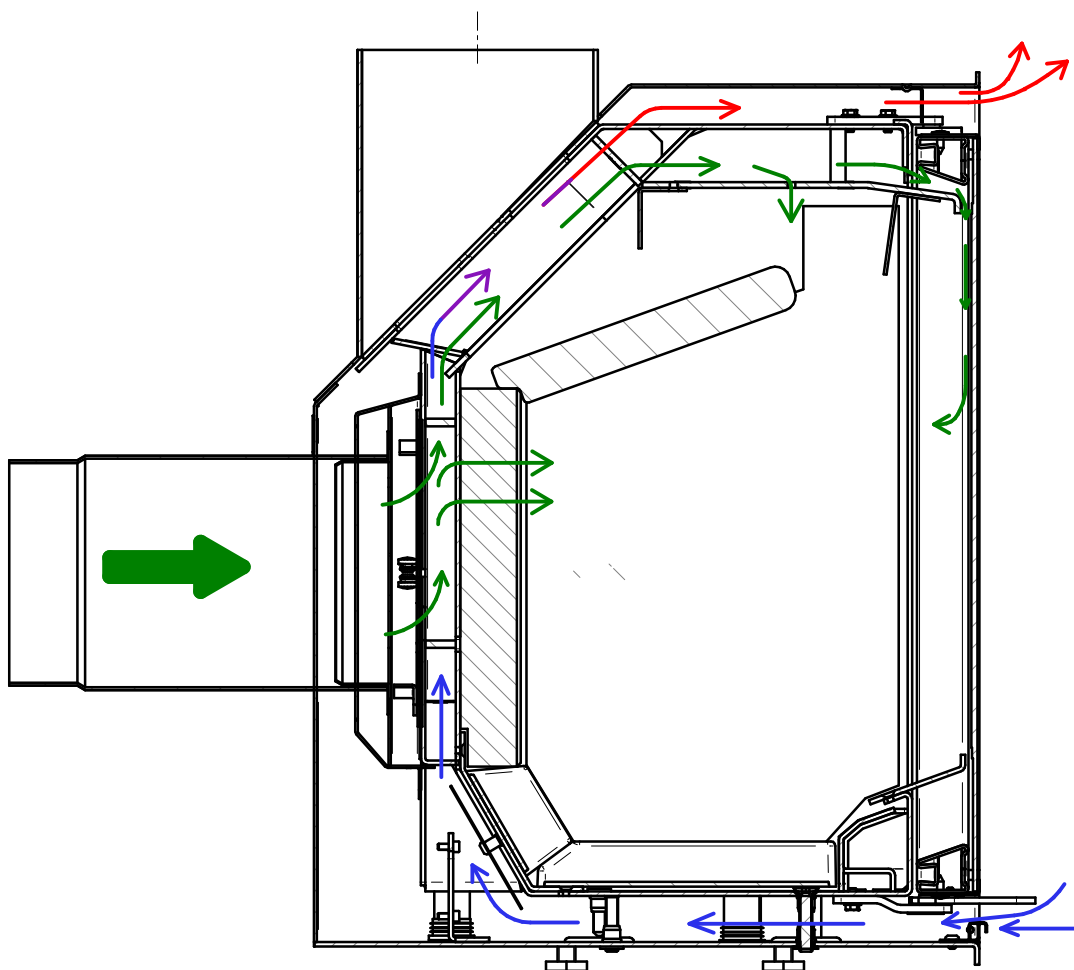
Operating instruction for single burn rate Method 28R

- Start the fire with approximately 4.3 lbs. of kindling.
- Keep the door slightly open for a good ignition
- Around 4.1lbs the door can be closed
- Close to 1.2lbs insert preload and keep the door slightly open for a good ignition
- After 6 min close the door
- At 2.6lbs rake coal and insert load
- Keep the door slightly open for 2 minutes
- close the door.

APPENDIX 14: Drawing Air flow pattern

section A-A

detail air flow pattern



green: combustion air
blue: cold convection air
red: hot convection air

				No. of substitute character:			Designation: Drawings Assembly: Kassette - series Product: Spartherm-700 M-INSERT-P6 Drawing-No.: 29-2019-740-030.021	 Maschweg 38; D-49324 Melle tel. 0 54 22/94 410; fax 0 54 22/94 41 14	
				Substituted by:					
				Material: main material: DC01 (1.0330) DIN EN 10130					
					Name	Date			
No	Modifications	Name	Date	Drawn:	J.Bartsch	11.07.2019			
Filename.: KAMINKASSETTEN_700.asm				Tested:					
Dft - Filename.: Spartherm-700 M-INSERT-P6.dft				Gen.:					
Dxf - Filename.:				Scale	Format: A4	Page: 16 of: 16	Mass:		

APPENDIX 15: 30 days notice, WHA, Others

700

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATION FORM
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.

GENERAL INFORMATION

Manufacturer's Name:

Appliance Type
(Circle One):

Single Burn
Rate Heater

Hydronic Heater
Type (Circle
One):

Forced-Air
Furnace Type
(Circle One):

Fuel Type:

Crib

Model Name and Number:
Spartherm M 700

Catalyst: Yes _____ No ☒ X _____

Mailing Address:
Maschweg 38 Melle 49324 Germany

Street Address:
Maschweg 38 Melle 49324 Germany

City: Melle

State: Lower Saxony

ZIP Code: 49324

Phone: +4915222644162

Fax: n/a

Web Site: www.spartherm.com

Address of Manufacturing Facility:
Maschweg 38

City: Melle

State Lower Saxony

ZIP Code: 49324

EPA APPROVED TEST LABORATORY

Name and Title of Authorized Representative: Danick Power

Company: Services Polytests inc.

**U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATION FORM
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW
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- ▶ 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: NA
City: St-jean-sur-richelieu	State: Canada, Quebec	ZIP Code: J3B 7S7
EPA APPROVED THIRD-PARTY CERTIFIER		
Name and Title of Authorized Representative: Bill Bellamy, Certifier 2 – HOCO Appliances		
Company: CSA		
Phone: 18667974272	E-mail: bill.bellamy@csagroup.org	Fax:
City: Toronto	State: ONTARIO	ZIP Code: M9W 1R3
COMPLIANCE TEST INFORMATION		
Test Method(s): Method 28R, SINGLE BURN RATE		
Date(s) of Proposed Test: WEEK OF APRIL 08/04/2024		
Testing Location: Polytests Services Inc. 695 B rue Gaudette, St-Jean-sur-Richelieu Québec, Canada, J3B 7S7 450.741.3636		

**U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATION FORM
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.

M.F. AUMANN -INTERNATIONAL SALES

Print Name and Title of Authorized Official

Signature

08/03/2024

Date

Remarks:

v1

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

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(b), 60.5475(b), and Appendix A-8. 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.

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Weighted average Final results	Error! Bookmark not defined.

**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's Name: Spartherm

Heater Type (Circle One):			Single Burn Rate Heater		
Hydronic Heater Type (Circle One):					
Forced-Air Furnace Type (Circle One):					
Fuel Tested:	Crib				

Test Method(s): Method 288; AMSTE2780 ; ASTME2515 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): Spartherm M 700 Z/C, Spartherm M 700 Module, Spartherm M 700 Insert

Physical Address (Street number and Address, not P.O. Box): Spartherm M 700 Z/C, Spartherm M 700 Module, Spartherm M 700 Insert
38 Maschwitz Melle

Mailing Address:

38 Maschwitz Melle
Germany

City: Melle State: Lower Saxony ZIP Code: 49324

Phone: +49 15222 644162 M. Humann @ Spartherm GmbH Website: www.spartherm.com

EPA Submission Date of 30 day Notice:

MANUFACTURER'S AUTHORIZED REPRESENTATIVE INFORMATION

Name: Markus Humann
Position/Title: International Sales
Address: 38 Maschwitz Melle
City: Melle State: Lower Saxony ZIP Code: 49324
Phone: +49 15222 644162 M. Humann @ Spartherm GmbH Website: www.spartherm.com

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, Canada

ZIP Code: J3B 7S7

Phone: 450 741-3636

Email: dpower@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:
Bill Bellamy

Position/Title: Project Manager
Certifier II – HOCO Appliances

Address: 178 Rexdale Boulevard,

City: Toronto

State: Ontario

ZIP Code: M9W 1R3

Phone: T 705 331 5450

Email:
bill.bellamy@csagroup.org

Website: 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.

All components include dimensions and production tolerances which meet or exceed the prescribed requirements and facilitate inspection. Replacement procedures are clearly documented in service kits.

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.

No – the firebox and any firebox component will not be made of different materials than what was used in the certification testing.

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.**

CBI was sent to EPA Testing Laboratory Polytest INC.

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).

Yes all requirements in the above section is covered as per the requirements in the test report.

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.

All warranty data is included in the manual and includes the necessary statements as per this section.

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.

Yes, included with the report is on quality assurance inspection program.

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 sealed at the testing facility by the technicians performing the test. There is metal banding encasing the unit preventing the door from being opened and modifications made. The unit is clearly permanently labeled as the EPA test unit.

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.

Yes, the wood heater manufactured will be of similar material to the wood heater tested. Each unit will be accompanied by its owner's manual and will be available on the websites.

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.

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.

Yes, both the approved laboratory and third party certifier have been given permission to submit information on behalf

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 place a copy of the certification test and summary on the websites within 30 days of the certificate.

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 acknowledge that the certificate of compliance cannot be transferred to another manufacturer or model line without notification and 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 acknowledge that we cannot sell, distribute or offer to sell the wood heater without a valid certificate of compliance.

Print Name and Title:

M. F. Humann


Date:

2/15/2024.

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.

WOOD BURNING HEATERS

I. Test Method 28R for Certification and Auditing of Wood Heaters

A. *SUMMARY RESULTS – SINGLE BURN RATE WOOD BURNING HEATERS*

Test No.	Burn Rate (Kg/hr)	(E) Ave. Emission Rate g/hr	(OHE) %	Heat Output (BTU/HR)	CSA B415.1 CO emission g/min
1	1,960	1,88	65,9%	24 269	0,9
2	1,995	1,52	66,4%	24 906	1,1
Weighted particulate emission average of 2 test runs: 1,7 grams per hour.					
Weighted average HHV efficiency of 2 test runs: 66 %.					
Average Co 1,0 gr/min					