TEST REPORT

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

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

Client:
Energy Distribution 2015
1361 Rue Denison O,
Saint-Alphonse-de-Granby,
QC J0E 2A0

Model name:
Kazan Kazan GA, Kiara, Kiara GA

Attention: Rafaël Sanchez

TESTED BY:
Services Polytests Inc.
695-B Gaudette
St-jean-sur-Richelieu, QC, J3B 7S7

TEST DATES: February 26th and 27th 2019
REPORT DATE: March 9th 2019
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Project number: PI-20182

Tested:

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Verified by third party certifier (CSA):

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List of revision:

Revision 2 September 19th 2023:

- appendix 1 molecular weight updated to 29 for all runs
- Appendix 1 updated with data and preburn data
- Section 3.4 p.11 updated for runs Anomalies, Validity and appropriateness detail.
- Section 3.4 p.11 updated with comments about handling negative filters.
- Appendix 9 updated for more detailed fuel load
- Additional letter for TYPOs about mixing baffle in the original report.
- Table 2.6 p.8 updated for dual train precision in g/kg.
- All Calibration certificate are ISO 17025 (NIST traceable) in English appendix 3.
- Table 2.2 additional emission number in gr/Mj
- Appendix 1 additional information for negative filter weight rounded to zero emission rate

List of appendixes

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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: February 26th and 27th 2019
- Test methods used:
  - Particulate emissions: ASTM E2780-10; ASTM E2515-11 methods 28R as referred into 40 CFR Part 60 Subpart AAA & CSA B415.1-10
  - Efficiency: CSA B415.1-10

1.2 TEST UNIT INFORMATION

General

- Manufacturer: Energy Distribution
- Product type: non-catalytic single burn rate wood burning Stove
- Combustion system: non-catalytic, with post combustion
- Unit tested: Kazan
- Firebox Volume: 1.53cu.ft.

The firebox is made of cast iron. The unit uses primary and secondary air for combustion. None of the combustion air offer any control to the hand user.

The primary air intake is located at the top of the glass door. Secondary intake is at the back of the stove moving into a heat exchanger at the back of the firebox. There is no user control for both primary and secondary air.

The primary air is fed to the fire through a thin air wash at the top the glass door.

The same firebox will have different Esthetic for different model name listed below. For all drawings and Esthetic details and difference, refer to appendix 15:

1. Model tested with legs: Kazan
2. Alternative model: Kazan GA, Kiara, Kiara GA

1.3 RESULTS

Emission results obtained

- Average emission rate: 1.76 grams/hour
- Average efficiency: 63.4 %

Conformity: NSPS Phase 2020

1.4 PRETEST INFORMATION

Unit condition: The unit was received by carrier first week of December 2018. The 48hrs of aging is made by Polytests at single burn rate. (All data in Appendix 4).

Set up

- Venting system type: 6-inch flue
- System height from floor: 15 feet
- Particularities: top flue

Break in period

- Duration: the unit was pre burned by Services Polytests and run for at least 48 hours, adequate documentation of fuel additions, flue and unit temperatures recorded.
- Fuel: BC FIR between 19% and 25%

2 SUMMARY OF TEST RESULTS

2.1 EMISSIONS

Run Number	Test Date (AAA-MM-DD)	Burn Rate (kg/hr)	Emission Rate (g/hr)	Emission Rate (g/Mj)	Heating Efficiency (% Overall)	1st hour Emission Rate (g/hr)	CSA B415.1 CO emission Gr/hr
1	2019-02-26	1.97	1.38	0,055	64.5	1.97	108.85
2	2019-02-27	1.97	2.14	0,088	62.3	2.95	124.88

- Average emission: 0,072 g/MJ

2.2 AVERAGE CALCULATION

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	1,97	1,38	64,5	23 830	1,81
2	1,97	2,14	62,3	23 070	2,08
Weighted particulate emission average of 2 test runs: 1.76 grams per hour.					
Weighted average HHV efficiency of 2 test runs: 63.4 %.					
Average Co 1.95 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	78	79	29,382	29,323	29,4	25,3	0	0
2	72	75	29,294	29,560	26,5	23,1	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	11,48	21,10	2,7	10,68	6,552	21,15	19,5	2	1	10
2	11,36	23,47	2,6	10,77	6,609	20,11	19,5	2	1	10

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	122	294,48	565,73	23,728	22,521	1,70	1,70
2	124	286,91	562,42	22,926	21,823	2,80	2,70

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	1514,13	1595,28	2,73	2,89	2,74%	0,038
2	1551,84	1630,30	4,39	4,46	0,73%	0,016

2.7 GENERAL SUMMARY OF RESULTS

Run Number	Burn Rate (kg/hr)	Average Surface Temperature (F)	Change in surface Temperature (F)	Initial Draft (in. H^2O)	static pressure tunnel (in. H^2O)	Primary Air Setting	Run Time (min)
1	1,967	476,40	-111,0	0,06	0,200	single burn rate	122
2	1,968	459,04	-82,6	0,06	0,190	single burn rate	124

3 PROCESS DESCRIPTION

3.1 DISCUSSION

This stove as no optional fan, it is offer in 3 different esthetics refer to appendix 15 (Alternative Esthetic comparison) for all details. Single burn rate stove, no combustion air control.

3.2 UNIT DIMENSIONS

Baffle

- Location: between top of combustion chamber and hearth restriction 1 ¼ at the front
- Dimensions: refer appendix 6 page 31
- Material: Stainless steel.

Bricks

- None, firebox all made of cast iron and stainless steel, no refractory inside.

Flue gas exhaust

- Location: top flue.
- Dimensions: 6 in. diameter.
- Material: Steel 0.133 inches thick.

Gasket

- Location:
- Glass panel on the Door fiberglass, round 5mm diameter x 2.4m long

Overall unit dimension:

- Firebox dimensions: 24 3/8 wide X 9 5/8 depth X 9 ¼ high at the back and 13 ¼ high at the front
- Usable volume: 1.53 cuft
- Overall stove dimension: 25 ¼ wide X 14 ¼ depth X 32 height.

Convection fan:

- none

Catalyst: none

3.3 AIR SUPPLY SYSTEM

Description

This stove has a non-adjustable primary air above the glass door and a non-adjustable secondary air from the back of the stove. All details in appendix 6

- Primary air: window wash design into a cast iron piece located at the top of the glass door.
- Secondary air: baffle located at the top of the firebox.

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) sq. in.			OUTLET
Identification	Type	Imin	Imax	Controlled	(sq. in.)
APPENDIX 14 SHARED and PA	Primary	1.961	1.961	None	7.36
APPENDIX 14 SHARED and SA	Secondary	0.78	0.78	None	0.619
Appendix 14 TA	Pilot	None	None	None	None

* 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. Negative weights have been found on filter but not on probe or gaskets, negatives weights have been handled properly.

Run #1
This run was performed on February 26th 2019. It lasted 122 minutes and a 1.97 kg/hr burn rate was obtained & emission at 1.4gr/hr.

Run #2
This confirmation run was performed on February 27th 2017. It lasted 124 minutes and a 1.97 kg/hr burn rate was obtained & emission at 2.1 gr/hr.

- 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 at a point 15 feet from the tunnel entrance. The tunnel has two elbows in the system ahead of the sampling section. The sampling section is a continuous 15-foot section of 8-inch diameter pipe straight over its entire length. Tunnel velocity pressure is determined by a standard pitot tube located 48 inches from the beginning of the sampling section. Thermocouple is installed on the Pitot tube to measure the dry bulb temperature. MC is assumed, as allowed, to be 4%. Tunnel samplers are located 56 inches downstream of the Pitot tube and 16 inches upstream from the end of this section.

3.7 DRAWINGS

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

3.8 EMISSIONS EFFICIENCY TESTING EQUIPMENT LIST

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

4 SAMPLING METHODS

4.1 PARTICULATE SAMPLING

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

5 QUALITY ASSURANCE

5.1 INSTRUMENT CALIBRATION

5.1.1 GAS METERS

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

5.1.2 SCALES

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

5.1.3 GAS ANALYZERS

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

5.2 TEST METHOD PROCEDURES

5.2.1 LEAK CHECK PROCEDURES

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

5.2.2 TUNNEL VELOCITY FLOW MEASUREMENT

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

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

5.2.3 PM SAMPLING PROPORTIONALITY (ASTM E2515)

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

APPENDIX 1: Raw data, forms and results

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: PI 20182 Run: 1 Tech: M M Reviewer: DC

Finding 300LBS SIDAN FINE Full open
At 26LBS close Door
At 1.2LBS Insert preload
At 11.8LBS close Door
At 26LBS Insert load
At 2:30 close Door

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

PRE / POST CHECKS

Date: 2019-02-26 Manufacturer: Invicta Model: Kazan

Project #: PT 2018-2 Run: 1 Tech: MM Reviewer: DP

Moisture Meter Calibration Check:

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

Pre-Test Post-Test

Facility Conditions:

	Pre-Test	Post-Test
Air Velocity from less than 2 feet	0 (max50 Fpm)	0 (max50 Fpm)
Smoke Capture Check	ok	ok
Picture (4 sides)	ok	ok

Wood Heater Conditions:

Date Wood Heater Stack Cleaned	2019-02-26
Date Dilution Tunnel Cleaned	2019-02-26
Induced Draft Check (max 0.005 H2O)	ok
Traverse before ignition	ok
Flow Rate 140 cfm ±10%	ok

Temperature System:

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

Proportional Checks:

Thermocouple check	ok
Pitot Clean	ok
Pitot verification	ok

Sampling Train ID Numbers:

	Train 1st hour	Train 1	Train 2
Probe	001	20	31
Filter Front	312	863	865
Filter Back	313	864	866
Filter Thermocouple	12	11	12
Filter (<90°F)	ok	ok	ok

POLYTESTS
TESTING THROUGH YOUR REALITY

SAMPLING EQUIPMENT CHECK OUT

Date: 2019-02-26 Manufacturer: INVICTA Model: ICA2aN

Project #: PI2082 Run: 1 Tech: M M Reviewer: SC

Leakage Checks Tunnel Samplers

	System 1st hour		System 1		System 2	
Unplugged Flow Rate = .25cfm	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (max test)	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)
Vacuum (inches Hg.)	-15	-15	-15	-15	-15	-15
Final 1minute DGM (Liter)	858907.41	859660.87	858907.49	859624.26	809246.13	809938.68
Initial 1minute DGM (Liter)	858907.38	859620.86	858907.49	859624.94	809246.13	809938.68
Change © (Liter)	0.03	0.01	∅	0.02	∅	∅
Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56)						
Check OK	ok	ok	ok	ok	ok	ok

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	-5	-5
Rotometer Reading (mml/min.)	10	10
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	.4
Check OK (no change after 15 sec.)	ok	ok	ok	ok

POLYTESTS
TESTING THROUGH YOUR REALITY

PRE-TEST SCALE AUDIT

Date: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: PI 20182 Run: 1 Tech: MM Reviewer: DP

Scale Type	Audit		Measured Weight
	Equipment #	Weight	
Platform	EM-090	44 lbs, Class F	4,4 lbs
Wood	EM 090	44 lbs, Class F	44 lbs
Analytical	EM 128	100 mg, Class S	100mg
Analytical	EM-129	200 g, Class S	200g

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: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: pT 2018.2 Run: 1 Tech: MM Reviewer: SP

FOR TUNNELS < 12 in

Barometric pressure (P_{bar}) 99,5 (KPa.) Static pressure (P_q) 0,20 (inches w.c.)
Inside diameter: Port A _____ Port B ____.
Tunnel cross sectional area: .1963Ft^2
Pitot tube type: Standard

Traverse Point	Position (inches)			Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)
	6 po	7 po	8 po		
A- Centroid	3.00	3.50	4	0058	7412
B - Centroid	3.00	3.50	4	0057	7337
A-1	0.40	0.50	0.50	0047	7394
A-2	1.50	1.75	2	0058	7366
A-3	4.50	5.25	6	0045	7357
A-4	5.60	6.5	7.5	0045	7339
B-1	0.40	0.50	0.50	0046	7336
B-2	1.50	1.75	2	0066	7349
B-3	4.50	5.25	6	0056	7351
B-4	5.60	6.5	7.5	0050	7348
				AVERAGE	

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

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

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

POLYTESTS
TESTING THROUGH YOUR REALITY

CONTINUOUS ANALYZERS

Date: 2019-02-26 Manufacturer: INVICTA Model: IA29W

Project #: PT 2018L Run: 1 Tech: M M Reviewer: DP

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	0	0	1800	18000	1001	1,000
Tolerance CO		+/- 0.02		+/- 0.15		+/- 0.05
CO_2	0	0	2980	3,00	9,70	~~9,7~~ 10,00
Tolerance CO2		+/- 0.02		+/- 0.5		+/- 0.5
O_2 informative CSA B415 calculated value	na	na	na	na	na	na
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Limit	Span Drift	Limit	Cal. Drift	Limit	OK?	Not OK*
CO	0	17 99	1 000	6	0.02	601	0.15	0,001	0.05	✓	
CO_2	0	2,984	9,72	0	0.02	0,004	0.5	0,02	0.5	✓	

POLYTESTS
TESTING THROUGH YOUR REALITY

TEST DATA LOG

Date: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: pI 20182 Run: 1 Tech: MM Reviewer: PP

RAW DRY GAS METER READINGS

	System 1	System 2	Blanck
Final (Liter)	859619,94	809937,78 ~~809937~~ MM	757,11
Initial (Liter)	858907,99	809247,10	705,78

AMBIENT CONDITIONS

	Before	After
Barometer (kPa):	99,5	99,3
Dry Bulb (F):	72,86	78,80
Humidity (%):	29,4	25,3

Flow Meter

	Start	End
Flow meter reading	NA	NA

Flow Meter Verification

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

POLYTESTS
TESTING THROUGH YOUR REALITY

FUEL DATA

Date: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: PT-20182 Run: 1 Tech: S.B. Reviewer: DP

FUEL DESCRIPTION:

Type of wood:

PRE-TEST LOAD

Piece Size	Weight		Meter Moisture Content (% dry)*				
2 x 4 x 19 in.	2.404	lbs.	20.9	21.2	21.3	21.3	21.4
2 x 4 x 19 in.	2.572	lbs.	21.7	21.4	21.9	21.8	21.5
2 x 4 x 7 in.	1.092	lbs.	19.8	19.7	20.4	20.1	20.3
2 x 4 x 7 in.	1.070	lbs.	20.4	20.1	20.2	19.8	20
2 x 4 x 7 in.	1.056	lbs.	20.7	20.6	20.3	20.1	20.1
2 x 4 x 7 in.	1.140	lbs.	23.4	20.8	22.1	22.4	22.7
2 x 4 x 7 in.	1.086	lbs.	20.9	20.8	21.1	21.3	21
2 x 4 x 7 in.	1.058	lbs.	20.7	20.4	20.7	20.9	20.7
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					

TEST LOAD WEIGHT: ~~11.47~~ 11.48 S.B. lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

FUEL DATA

Date: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: PT-20182 Run: 1 Tech: S.B Reviewer: DO

FUEL DESCRIPTION:

Type of wood :

TEST LOAD

Piece Size	Weight		Meter Moisture Content (% dry)*				
1.5 x 3.5 x 19.5 in.	2.406	lbs.	21.8	21.7	21.4	21.2	20.1
1.5 x 3.5 x 19.5 in.	2.284	lbs.	21.9	21.8	21.8	22.5	22.7
3.5 x 3.5 x 19.5 in.	4.786	lbs.	20.8	20.9	20.4	21.1	20.9
x x in.		lbs.					
1.5 x .75 x 5 in.	0.112	lbs.			21.2		
1.5 x .75 x 5 in.	0.120	lbs.			19.8		
1.5 x .75 x 5 in.	0.116	lbs.			21.1		
1.5 x .75 x 5 in.	0.128	lbs.			21.1		
1.5 x .75 x 5 in.	0.134	lbs.			20.5		
1.5 x .75 x 5 in.	0.120	lbs.			19.9		
1.5 x .75 x 5 in.	0.118	lbs.			19.8		
1.5 x .75 x 5 in.	0.116	lbs.			20.7		
1.5 x .75 x 5 in.	0.122	lbs.			20.3		
1.5 x .75 x 5 in.	0.118	lbs.			19.7		
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					
x x in.		lbs.					

TEST LOAD WEIGHT: 10.68 lbs Min 20%: 2.136 Max 25%: 2.67

POLYTESTS
TESTING THROUGH YOUR REALITY

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2019 02- 25 Manufacturer: Invicta Model: Lazar

Project #: PT 20182 Run: 1 Tech: MM Reviewer: RD

		SYSTEM 1 – 1st hour				SYSTEM 1				
Pre-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Blanck
Date	Time	001	312	313	10	20	863	864	21	867
2019-02-25	17:00	61,0681	0,1270	0,1244	35,2740	108,8436	0,1222	0,1218	35,3892	0,1219
2019-02-26	9:00	61,0682	0,1271	0,1245	35,2739	108,8436	0,1222	0,1217	35,3893	0,1218

		SYSTEM 1 – 1st hour				SYSTEM 1				
Post-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Blanck
Date	Time	001	312	313	10	20	863	864	21	867
2019-02-26	15:00	61,0684	0,1277	0,1242	35,2760	108,8438	0,1222	0,1218	35,3905	0,1221
2019-03-04	8:00	61,0682	0,1273	0,1242	35,2753	108,8436	0,1222	0,1217	35,3899	0,1220
2019.03.05	8:00	61,0684	0,1273	0,1242	35,2753	108,8436	0,1222	0,1217	35,3899	0,1220

POLYTESTS
TESTING THROUGH YOUR REALITY

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2019-02-25 Manufacturer: Invicta Model: 1220

Project #: PI 20182 Run: 1 Tech: MM Reviewer: NP

		SYSTEM 2			
Pre-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets
Date	Time	31	865	866	32
2019-01-25	17:00	110,1276	0,1218	0,1223	~~35,27~~ 35,2471
2019-02-26	9:00	110,1277	0,1218	0,1223	35,2470

		SYSTEM 2			
Post-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets
Date	Time	31	865	866	32
2019-03-26	15:00	110,1278	0,1229	~~0,1214~~ 0,1222	35,2486
2019-03-04	8:00	110,1277	0,1227	0,1220	35,2483
2019-03-05	8:00	110,1277	0,1227	0,1220	35,2483

Paramètres

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

Code verrouillage:	INV

Description du test

Test standard	EPA	
Run #	1	
Date	26-02-2019	
Technicien	M.M	
Project #	PI 20182	

Description de l'unité

Manufacturier	INVICTA	
Modèle	KAZAN	
Combustion system	Non-Cat	
Appliance type	WOOD STOVE	
Firebox volume	1,53	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	4	
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):	1,010	Dimensionless
Equipment number (DGM #1):	EM 178	
Calibration Factor (DGM #2):	0,987	Dimensionless
Equipment number (DGM #2):	EM 179	
Calibration Factor (DGM #3):	0,996	
Equipment number (DGM #3):	EM 070	Dimensionless

Tunnel

Targeted tunnel flow rate	300	scfm
Tunnel diameter	8	in.
Molecular weight	29	May be assumed to be 28,78 (EPA) Si B-415 = 29
Pitot tube type	Standard	
Pitot tube coefficient	0,99	Dimensionless

Project nu.	PI 20182
Date	26-02-2019
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):	99,5	99,3
Barometer (in.Hg):	29,382339	29,32327896
Dry Bulb (F):	72,86	78,8
Humidity (%):	29,4	25,3
Air velocity (ft/min)	0	0

DGM #1	Final:	30357,192	cuft	Final:	859619,940	Liter
	Initial:	30332,050	cuft	Initial:	858907,990	Liter
DGM #2	Final:	28602,683	cuft	Final:	809937,780	Liter
	Initial:	28578,292	cuft	Initial:	809247,100	Liter
DGM room				Final:	757,780	cuft
				Initial:	705,780	cuft

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 230

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

Project nu.	PI 20182
Date	26-02-2019
Technicien	M.M

Preload data sheet

Test Load Weight:

Lower	Ideal	Upper
10,27	11,41	12,55

Load Volume: 0,3704 cu. ft

Loading Density: 7,042 lbs./ft3

Number of Spaces:

Spacer weight (lbs):

Load Density (wet): 30,991 lbs./ft3

Dry Wood Density: 25,591871

Piece Size (in): Thick	Wide	x Length	Weight lbs	Meter Moisture Content Dry Uncorrected %					Ave. MC x Weight	Volume Cubic Inches
2	4	19	2,404	20,9	21,2	21,3	21,3	21,4	51,01288	152,00
2	4	19	2,572	21,7	21,4	21,9	21,8	21,5	55,70952	152,00
2	4	7	1,092	19,8	19,7	20,4	20,1	20,3	21,90552	56,00
2	4	7	1,07	20,4	20,1	20,2	19,8	20	21,507	56,00
2	4	7	1,056	20,7	20,6	20,3	20,1	20,1	21,50016	56,00
2	4	7	1,14	23,4	22,8	22,1	22,4	22,7	25,8552	56,00
2	4	7	1,086	20,9	20,8	21,1	21,3	21	22,82772	56,00
2	4	7	1,058	20,4	20,4	20,7	20,9	20,7	21,81596	56,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
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										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
									SUM MC: 242,13396	

PreTest Load Weight: 11,48 lbs.

Dry Weight: 4,30 kg.

Average Moisture Content: %

Dry: 21,10

21,10

Must be 18-28

Wet: 17,42

must be 15,2-22

Project nu.	PI 20182
Date	26-02-2019
Technicien	M.M

FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

Lower	Ideal	Upper
10,3	11,4	12,6

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

Load Volume: 0,32 cu. ft — Loading Density: 6,6 lbs./ft3

Number of Spaces: 10 — Load Density (wet): 33,2 lbs./ft3

Spacer weight: lbs — Dry Wood Density: 27,4 lbs./ft3

Piece Size (in): Thick	Wide	Length	Weight lbs	Meter Moisture Content Dry Uncorrected %					Ave. MC x Weight	Volume Cubic Inches	Ave. MC %
1,5	3,5	19,5	2,41	21,80	21,70	21,40	21,20	20,10	51,10344	102,38	21,2
1,5	3,5	19,5	2,28	21,90	21,80	21,80	22,50	22,70	50,56776	102,38	22,1
3,5	3,5	19,5	4,79	20,80	20,90	20,40	21,10	20,90	99,64452	238,88	20,8
1,5	0,75	5	0,11			21,20			2,3744	5,63	21,2
1,5	0,75	5	0,12			19,80			2,376	5,63	19,8
1,5	0,75	5	0,12			21,10			2,4476	5,63	21,1
1,5	0,75	5	0,13			21,10			2,7008	5,63	21,1
1,5	0,75	5	0,13			20,50			2,747	5,63	20,5
1,5	0,75	5	0,12			19,90			2,388	5,63	19,9
1,5	0,75	5	0,12			19,80			2,3364	5,63	19,8
1,5	0,75	5	0,12			20,70			2,4012	5,63	20,7
1,5	0,75	5	0,12			20,30			2,4766	5,63	20,3
1,5	0,75	5	0,12			19,70			2,3246	5,63	19,7
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
								SUM MCx	225,88832		20,6 %

Test Load Weight: 10,68 lbs. — Dry Weight: 4,00 kg.

Average Moisture Content: %

Dry: 21,15 Dry(EPA) 21,15 — 21,15 — Wet: 17,46

Dry(B415 21,15 — Must be 19-25 — must be 15,2-22

Coal Bed Range: 2,1 lbs. to 2,7 lbs.

TEST CHARGE:

Coal bed weight: lbs.

Project nu.	PI 20182
Date	26-02-2019
Technicien	M.M

Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,2 in. H20
Barometer: 29,900 in. Hg

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

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

PITOT CONSTANT=
0,956

Pour un tunnel moins de 12", prendre 4 lectures

	TUNNEL VELOCITY	TUNNEL TEMP	SQUARE ROOT
	In. wc	°F	
A center	0,058	74,12	0,2408
B center	0,057	73,27	0,2387
A1	0,047	73,94	0,2168
A2	0,058	73,66	0,2408
A3	0,045	73,57	0,2121
A4	0,045	73,39	0,2121
B1	0,046	73,360	0,2145
B2	0,066	73,490	0,2569
B3	0,056	73,510	0,2366
B4	0,050	73,480	0,2236
AVERAGE	0,0528	73,5790	0,2293

Project nu.	PI 20182
Date	26-02-2019
Technicien	M.M

Filter set weight

	System 1 (g) 1st hour				System 1 (g)				System 2 (g)				Ambient blank (g)	Date	Heure
	probe	front	back	gasket	probe	front	back	gasket	probe	front	back	gasket	Filter		
Number	1	312	313	10	20	863	864	21	31	865	866	32	867		
Before (1)															
Before (2)															
Before (3)															
Before (4)															
Before (5)	61,0681	0,1270	0,1244	35,2740	108,8436	0,1222	0,1218	35,3892	110,1276	0,1218	0,1223	35,2471	0,1219	2019-01-25	17:00
Before (6)	61,0682	0,1271	0,1245	35,2739	108,8436	0,1222	0,1217	35,3893	110,1277	0,1218	0,1223	35,2470	0,1218	2019-02-26	09:00
After (1)	61,0684	0,1277	0,1242	35,2760	108,8438	0,1222	0,1218	35,3905	110,1278	0,1229	0,1222	35,2486	0,1221	2019-02-26	15:00
After (2)	61,0682	0,1273	0,1242	35,2753	108,8436	0,1222	0,1217	35,3899	110,1277	0,1227	0,1220	35,2483	0,1220	2019-03-04	08:00
After (3)	61,0682	0,1273	0,1242	35,2753	108,8436	0,1222	0,1217	35,3899	110,1277	0,1227	0,1220	35,2483	0,1220	2019-03-05	08:00
After (4)															
After (5)															
After (6)	61,0682	0,1273	0,1242	35,2753	108,8436	0,1222	0,1217	35,3899	110,1277	0,1227	0,1220	35,2483	0,1220	2019-03-05	08:00
Difference	0,0000	0,0002	-0,0003	0,0014	0,0000	0,0000	0,0000	0,0006	0,0000	0,0009	-0,0003	0,0013	0,0002		
Total (mg)		1,3				1,9				1,9			0,2		
Total ajusté (mg)		**1,10**				**1,70**				**1,70**					

Project nu.	PI 20182
Date	26-02-2019
Technicien	M.M

Filter set weight

	System 1 (g) 1st hour				System 1 (g)				System 2 (g)				Ambient blank (g)	Date	Heure
	probe	front	back	gasket	probe	front	back	gasket	probe	front	back	gasket	Filter		
Number	1	312	313	10	20	863	864	21	31	865	866	32	867		
Before (1)															
Before (2)															
Before (3)															
Before (4)															
Before (5)	61,0681	0,1270	0,1244	35,2740	108,8436	0,1222	0,1218	35,3892	110,1276	0,1218	0,1223	35,2471	0,1219	2019-01-25	17:00
Before (6)	61,0682	0,1271	0,1245	35,2739	108,8436	0,1222	0,1217	35,3893	110,1277	0,1218	0,1223	35,2470	0,1218	2019-02-26	09:00
After (1)	61,0684	0,1277	0,1242	35,2760	108,8438	0,1222	0,1218	35,3905	110,1278	0,1229	0,1222	35,2486	0,1221	2019-02-26	15:00
After (2)	61,0682	0,1273	0,1242	35,2753	108,8436	0,1222	0,1217	35,3899	110,1277	0,1227	0,1220	35,2483	0,1220	2019-03-04	08:00
After (3)	61,0682	0,1273	0,1242	35,2753	108,8436	0,1222	0,1217	35,3899	110,1277	0,1227	0,1220	35,2483	0,1220	2019-03-05	08:00
After (4)															
After (5)															
After (6)	61,0682	0,1273	0,1245	35,2753	108,8436	0,1222	0,1217	35,3899	110,1277	0,1227	0,1223	35,2483	0,1220	2019-03-05	08:00
Difference	0,0000	0,0002	0,0000	0,0014	0,0000	0,0000	0,0000	0,0006	0,0000	0,0009	0,0000	0,0013	0,0002		
Total (mg)		1,6				2,2				2,2			0,2		
Total ajusté (mg)		**1,40**				**2,00**				**2,00**					

Project nu.	PI 20182
Date	26-02-2019
Technicien	M.M

negative filter weight rounded to zero for demonstration emission rate 1,6gr/hr

*		*	*	*	*	*1	*2	*3	*4	*5	*6	*7	*8	Mass flow 1	DGM 1	DGM 1	Filter 1	Mass flow 2	DGM 2	DGM 2	Filter 2
Elapsed		Weight				Flue	Room	Tunnel	Unit	Unit	Unit	Unit	Unit	Reading	Inlet T	Outlet T	Temp	Reading	Inlet T	Outlet T	Temp
Time	Raw data row	Remaining	CO	CO_2	O_2	Gas	Temp	Dry Bulb	Top	Back	R.Side	L.Side	Bottom								
min		lbs	%	%	%	°F	°F	°F	°F	°F	°F	°F	°F	cuft/min	oF	oF	oF	cuft/min	oF	oF	oF
0,00	230,00	10,7	0,3	1,4	0,0	500,4	77,6	138,8	579,5	402,4	635,4	657,6	231,1	0,19	76,71	76,90	76,51	0,10	77,50	77,31	76,26
1,0	231,0	10,4	0,2	3,2	0,0	543,8	77,8	139,9	556,5	405,5	605,7	623,8	235,8	0,19	78,29	76,97	77,03	0,18	78,21	77,41	77,10
2,0	232,0	10,9	0,3	4,3	0,0	566,1	78,0	133,1	547,0	407,7	589,4	598,0	241,3	0,19	78,67	77,02	77,29	0,18	78,37	77,45	77,44
3,0	233,0	10,0	0,2	5,7	0,0	540,8	78,1	120,5	551,1	409,0	574,4	585,6	247,1	0,19	78,75	77,05	77,45	0,18	78,44	77,47	77,64
4,0	234,0	9,9	0,3	6,7	0,0	534,9	77,9	116,8	551,7	408,9	561,4	577,3	252,6	0,19	78,83	77,09	77,63	0,18	78,51	77,50	77,85
5,0	235,0	9,8	0,1	7,2	0,0	536,2	77,6	115,8	553,3	408,0	552,1	566,8	257,8	0,19	78,81	77,09	77,86	0,18	78,51	77,53	78,08
6,0	236,0	9,6	0,2	7,2	0,0	538,3	77,5	115,6	554,6	406,3	546,5	560,9	262,6	0,19	78,81	77,10	78,08	0,18	78,53	77,55	78,35
7,0	237,0	9,4	0,2	7,5	0,0	545,9	77,3	115,9	556,6	404,3	545,2	559,2	267,1	0,19	78,80	77,12	78,30	0,18	78,55	77,59	78,62
8,0	238,0	9,2	0,1	8,0	0,0	550,7	77,3	115,8	558,2	400,2	545,2	562,1	270,9	0,19	78,82	77,12	78,54	0,18	78,56	77,61	78,93
9,0	239,0	9,0	0,1	8,4	0,0	564,8	78,0	117,0	566,4	397,6	551,6	569,3	274,5	0,19	78,87	77,16	78,78	0,18	78,61	77,66	79,20
10,0	240,0	8,8	0,2	9,4	0,0	571,3	77,9	117,3	572,1	393,8	558,2	577,4	277,8	0,19	78,80	77,16	79,02	0,18	78,55	77,65	79,50
11,0	241,0	8,7	0,2	9,4	0,0	573,1	77,7	117,0	576,6	391,4	567,1	585,3	280,6	0,19	78,74	77,16	79,27	0,18	78,49	77,66	79,79
12,0	242,0	8,5	0,1	9,4	0,0	572,7	77,8	118,4	580,6	387,9	576,5	592,9	283,3	0,19	78,89	77,21	79,48	0,18	78,57	77,71	80,06
13,0	243,0	8,3	0,1	9,3	0,0	572,0	77,8	118,1	585,5	385,2	584,8	599,0	285,7	0,19	78,96	77,23	79,76	0,18	78,63	77,73	80,37
14,0	244,0	8,1	0,1	9,2	0,0	575,3	78,2	118,0	589,5	382,4	592,8	605,2	288,1	0,19	78,98	77,27	79,99	0,18	78,67	77,79	80,64
15,0	245,0	7,9	0,1	9,4	0,0	580,2	78,4	118,2	593,6	379,0	601,1	614,0	290,1	0,19	79,00	77,30	80,24	0,18	78,68	77,80	80,93
16,0	246,0	7,7	0,1	9,8	0,0	583,7	78,6	118,6	598,4	376,8	608,8	623,6	292,0	0,19	79,13	77,34	80,48	0,18	78,77	77,82	81,22
17,0	247,0	7,5	0,1	10,0	0,0	586,7	78,9	119,0	602,7	374,3	618,6	632,7	293,8	0,19	79,24	77,38	80,74	0,18	78,85	77,87	81,50
18,0	248,0	7,4	0,2	10,1	0,0	586,9	79,0	118,9	605,7	371,5	627,7	640,5	295,3	0,19	79,28	77,41	80,95	0,18	78,89	77,89	81,74
19,0	249,0	7,2	0,1	10,1	0,0	585,2	78,6	118,9	605,2	370,4	638,6	648,6	296,6	0,19	79,37	77,44	81,16	0,18	78,98	77,92	82,01
20,0	250,0	7,0	0,1	9,9	0,0	584,0	79,1	118,2	607,7	368,3	648,4	655,5	297,9	0,19	79,44	77,45	81,36	0,18	78,99	77,97	82,26
21,0	251,0	6,8	0,1	9,8	0,0	583,2	79,0	118,4	608,7	366,8	656,6	662,9	299,0	0,19	79,48	77,50	81,56	0,18	79,01	77,98	82,52
22,0	252,0	6,6	0,1	10,0	0,0	583,2	79,4	118,3	611,6	364,9	663,3	669,9	300,0	0,19	79,62	77,52	81,72	0,18	79,11	78,01	82,69
23,0	253,0	6,4	0,1	9,9	0,0	583,2	79,3	117,8	613,2	363,4	668,6	676,2	301,0	0,19	79,60	77,55	81,91	0,18	79,15	78,05	82,96
24,0	254,0	6,3	0,1	9,9	0,0	581,3	79,4	117,6	613,8	362,6	674,3	680,3	301,9	0,19	79,65	77,59	82,08	0,18	79,19	78,07	83,15
25,0	255,0	6,1	0,1	9,8	0,0	580,0	79,5	117,4	616,4	361,7	679,7	683,7	302,6	0,19	79,86	77,62	82,25	0,18	79,26	78,09	83,37
26,0	256,0	5,9	0,1	9,8	0,0	579,8	79,0	117,4	618,6	360,9	685,4	686,8	303,3	0,19	79,98	77,67	82,42	0,18	79,35	78,15	83,56
27,0	257,0	5,8	0,1	9,8	0,0	578,3	79,1	117,2	620,8	360,0	690,8	689,4	304,0	0,19	80,00	77,68	82,55	0,18	79,37	78,16	83,73
28,0	258,0	5,6	0,1	9,7	0,0	577,0	79,5	117,6	622,0	359,5	694,6	692,2	304,6	0,19	80,21	77,78	82,73	0,18	79,52	78,24	83,92
29,0	259,0	5,5	0,1	9,7	0,0	576,9	79,9	117,1	625,2	358,9	697,5	695,7	305,1	0,19	80,30	77,81	82,84	0,18	79,58	78,29	84,04
30,0	260,0	5,3	0,1	9,8	0,0	577,5	80,1	117,0	628,6	358,4	701,6	698,9	305,7	0,19	80,43	77,87	82,97	0,18	79,68	78,35	84,23
31,0	261,0	5,1	0,1	9,9	0,0	578,1	79,8	117,5	630,0	358,5	703,8	702,0	306,2	0,19	80,36	77,90	83,13	0,18	79,66	78,38	84,38
32,0	262,0	5,0	0,1	10,0	0,0	578,7	79,9	117,4	631,1	358,6	706,8	705,9	306,7	0,19	80,28	77,92	83,26	0,18	79,64	78,40	84,52
33,0	263,0	4,8	0,1	10,1	0,0	579,7	80,1	117,3	632,0	358,4	708,3	710,1	307,1	0,19	80,29	77,93	83,38	0,18	79,66	78,44	84,67
34,0	264,0	4,7	0,1	10,1	0,0	579,9	80,2	117,2	632,8	357,9	711,6	712,4	307,6	0,19	80,26	77,96	83,49	0,18	79,69	78,46	84,79
35,0	265,0	4,6	0,1	9,9	0,0	573,9	80,1	116,7	631,5	357,8	711,4	715,0	307,9	0,19	80,43	78,03	83,58	0,18	79,80	78,51	84,89
36,0	266,0	4,4	0,1	9,5	0,0	563,6	80,4	115,9	626,0	357,7	712,4	716,0	308,4	0,19	80,57	78,06	83,68	0,18	79,86	78,55	84,99
37,0	267,0	4,3	0,0	8,9	0,0	556,6	80,1	115,2	617,5	358,1	714,0	716,7	308,7	0,19	80,63	78,12	83,77	0,18	79,91	78,61	85,09
38,0	268,0	4,2	0,0	8,7	0,0	551,3	80,0	114,5	609,5	358,5	713,6	716,2	309,1	0,19	80,69	78,16	83,86	0,18	79,99	78,65	85,19
39,0	269,0	4,1	0,0	8,6	0,0	549,3	80,2	114,4	604,3	358,9	713,0	716,4	309,5	0,19	80,67	78,19	83,97	0,18	80,01	78,68	85,24
40,0	270,0	4,0	0,0	8,8	0,0	547,6	80,2	113,8	597,8	359,3	710,7	721,5	310,0	0,19	80,75	78,22	84,04	0,18	80,04	78,73	85,35
41,0	271,0	3,9	0,1	8,8	0,0	542,8	80,1	113,7	592,3	360,8	707,9	725,2	310,4	0,19	80,80	78,23	84,11	0,18	80,10	78,75	85,40
42,0	272,0	3,8	0,1	8,4	0,0	531,1	80,2	112,5	582,6	362,0	702,8	727,2	310,7	0,19	80,76	78,29	84,17	0,18	80,08	78,76	85,48
43,0	273,0	3,7	0,1	7,7	0,0	522,7	80,3	111,9	573,7	363,4	698,2	725,9	311,1	0,19	80,71	78,28	84,21	0,18	80,09	78,80	85,52
44,0	274,0	3,6	0,1	7,4	0,0	516,1	80,1	111,0	563,1	364,9	691,0	723,9	311,5	0,19	80,75	78,33	84,28	0,18	80,12	78,84	85,55
45,0	275,0	3,5	0,2	7,3	0,0	507,2	79,9	110,1	552,4	367,2	687,3	722,8	311,8	0,19	80,73	78,34	84,31	0,18	80,12	78,87	85,59
46,0	276,0	3,4	0,2	7,0	0,0	497,0	80,1	109,4	542,5	369,4	682,8	721,8	312,1	0,19	80,74	78,38	84,33	0,18	80,14	78,89	85,57
47,0	277,0	3,4	0,2	6,6	0,0	485,4	80,1	108,6	531,6	372,0	677,2	719,3	312,4	0,19	80,62	78,40	84,36	0,18	80,06	78,91	85,62
48,0	278,0	3,3	0,3	6,2	0,0	475,5	79,7	107,5	520,3	373,9	670,6	716,3	312,5	0,19	80,55	78,43	84,39	0,18	80,07	78,94	85,61
49,0	279,0	3,2	0,3	6,0	0,0	467,9	80,0	106,8	511,4	377,1	665,6	713,5	312,9	0,19	80,55	78,44	84,40	0,18	80,09	78,99	85,59
50,0	280,0	3,2	0,3	5,9	0,0	459,3	78,7	106,5	501,6	379,3	658,8	708,9	313,1	0,19	80,62	78,46	84,41	0,18	80,13	79,00	85,58
51,0	281,0	3,1	0,3	5,7	0,0	452,5	79,5	105,3	492,2	382,0	653,8	704,1	313,4	0,19	80,59	78,49	84,42	0,18	80,11	79,02	85,54
52,0	282,0	3,0	0,3	5,6	0,0	445,7	79,6	104,5	482,4	385,0	648,3	698,4	313,7	0,19	80,55	78,48	84,39	0,18	80,07	79,05	85,53
53,0	283,0	3,0	0,4	5,4	0,0	439,4	79,6	104,7	474,8	387,5	642,8	692,5	313,9	0,19	80,49	78,50	84,38	0,18	80,02	79,01	85,49
54,0	284,0	2,9	0,4	5,3	0,0	434,3	79,5	104,0	466,8	389,6	637,9	687,5	314,2	0,19	80,48	78,52	84,35	0,18	80,01	79,04	85,47
55,0	285,0	2,9	0,4	5,2	0,0	429,0	78,9	103,1	457,9	391,8	633,2	681,5	314,4	0,19	80,44	78,53	84,34	0,18	80,01	79,08	85,44
56,0	286,0	2,8	0,4	5,1	0,0	424,0	79,3	102,5	450,1	392,9	628,5	676,4	314,6	0,19	80,35	78,56	84,34	0,18	79,95	79,07	85,39
57,0	287,0	2,8	0,5	5,1	0,0	419,6	79,2	102,1	444,1	395,1	624,3	670,9	314,8	0,19	80,28	78,55	84,30	0,18	79,90	79,08	85,34
58,0	288,0	2,7	0,5	5,0	0,0	415,2	79,2	101,6	436,7	396,2	618,8	665,4	315,0	0,19	80,20	78,54	84,22	0,18	79,84	79,07	85,27
59,0	289,0	2,6	0,5	5,0	0,0	411,7	78,4	101,1	431,5	397,0	614,6	660,8	314,6	0,19	80,10	78,52	84,19	0,18	79,74	79,07	85,20
60,0	290,0	2,6	0,5	5,0	0,0	408,5	78,0	101,5	425,8	397,5	610,0	655,9	314,9	0,19	80,14	78,55	84,14	0,18	79,80	79,08	78,27
61,0	291,0	2,5	0,5	4,9	0,0	405,9	78,9	100,9	422,3	399,6	604,8	650,6	315,1	0,19	80,17	78,56	84,11	0,18	79,82	79,10	78,38
62,0	292,0	2,5	0,5	4,9	0,0	404,7	78,9	100,7	418,4	400,7	603,2	645,7	315,3	0,19	80,15	78,57	84,07	0,18	79,80	79,11	78,45
63,0	293,0	2,4	0,5	4,9	0,0	404,2	79,0	100,3	416,3	400,8	599,1	641,4	315,4	0,19	80,11	78,57	84,04	0,18	79,79	79,08	78,53
64,0	294,0	2,4	0,5	5,0	0,0	403,8	78,1	100,5	415,2	402,2	594,7	638,1	315,5	0,19	80,01	78,56	83,99	0,18	79,72	79,09	78,63
65,0	295,0	2,3	0,5	5,1	0,0	404,6	78,7	100,2	415,4	402,8	591,5	635,2	315,6	0,19	79,91	78,55	83,97	0,18	79,70	79,07	78,72
66,0	296,0	2,2	0,5	5,1	0,0	404,3	78,9	100,0	413,2	403,9	590,0	632,9	315,6	0,19	79,88	78,56	83,94	0,18	79,65	79,11	78,87
67,0	297,0	2,2	0,5	5,2	0,0	403,7	78,8	100,0	414,5	404,8	587,5	630,9	315,6	0,19	79,78	78,55	83,87	0,18	79,57	79,08	78,94
68,0	298,0	2,1	0,5	5,0	0,0	403,5	78,8	99,9	413,6	404,8	585,2	628,6	315,6	0,19	79,76	78,53	83,82	0,18	79,49	79,07	79,04
69,0	299,0	2,1	0,5	5,0	0,0	402,8	78,9	99,8	414,1	405,6	583,4	626,9	315,6	0,19	79,75	78,54	83,79	0,18	79,50	79,07	79,13
70,0	300,0	2,0	0,5	5,0	0,0	402,3	78,9	100,3	415,0	406,5	580,5	625,4	315,5	0,19	79,61	78,53	83,71	0,18	79,40	79,07	79,25
71,0	301,0	1,9	0,4	5,1	0,0	401,9	78,8	100,1	415,1	407,1	578,2	623,8	315,4	0,19	79,62	78,54	83,65	0,18	79,39	79,05	79,37
72,0	302,0	1,9	0,4	5,1	0,0	401,8	78,6	100,0	414,8	407,1	576,9	622,5	315,3	0,19	79,68	78,53	83,60	0,18	79,42	79,06	79,47
73,0	303,0	1,8	0,4	5,1	0,0	401,2	78,6	100,1	414,4	408,0	576,0	621,0	315,0	0,19	79,57	78,53	83,56	0,18	79,38	79,06	79,55
74,0	304,0	1,8	0,4	5,1	0,0	400,3	78,5	99,8	414,0	408,2	574,6	620,0	314,7	0,19	79,52	78,52	83,52	0,18	79,38	79,06	79,70
75,0	305,0	1,8	0,5	5,0	0,0	398,9	78,6	99,9	413,0	409,4	573,1	618,5	314,4	0,19	79,44	78,55	83,44	0,18	79,33	79,06	79,78
76,0	306,0	1,7	0,5	5,0	0,0	397,5	78,6	99,5	412,7	408,1	572,5	617,6	314,1	0,19	79,44	78,54	83,41	0,18	79,31	79,04	79,91
77,0	307,0	1,6	0,5	5,0	0,0	395,6	78,6	100,0	410,7	409,6	571,1	615,9	313,8	0,19	79,38	78,54	83,36	0,18	79,27	79,04	79,99
78,0	308,0	1,6	0,5	4,9	0,0	393,6	78,4	99,4	408,3	409,2	570,9	614,1	313,5	0,19	79,40	78,55	83,32	0,18	79,30	79,06	80,10
79,0	309,0	1,5	0,5	4,9	0,0	391,9	78,7	99,2	406,1	410,1	569,3	612,2	313,2	0,19	79,46	78,53	83,28	0,18	79,32	79,08	80,22
80,0	310,0	1,5	0,5	4,8	0,0	389,6	78,6	99,1	403,7	410,1	569,1	610,8	312,8	0,19	79,38	78,53	83,26	0,18	79,26	79,09	80,32
81,0	311,0	1,4	0,6	4,8	0,0	388,0	78,5	98,8	400,1	410,0	568,6	609,8	312,4	0,19	79,33	78,53	83,18	0,18	79,22	79,09	80,44
82,0	312,0	1,4	0,6	4,7	0,0	386,6	78,4	99,0	398,1	410,7	566,3	609,1	312,1	0,19	79,21	78,51	83,13	0,18	79,14	79,07	80,52
83,0	313,0	1,3	0,6	4,8	0,0	384,4	78,4	98,4	395,1	411,0	567,5	607,5	311,7	0,19	79,23	78,49	83,09	0,18	79,12	79,06	80,62
84,0	314,0	1,3	0,6	4,8	0,0	382,9	78,4	98,5	392,7	410,9	565,7	606,3	311,3	0,19	79,35	78,51	83,05	0,18	79,17	79,06	80,69
85,0	315,0	1,2	0,6	4,7	0,0	382,2	78,2	98,1	389,7	411,4	564,5	605,5	311,0	0,19	79,32	78,51	82,98	0,18	79,17	79,05	80,78
86,0	316,0	1,1	0,6	4,8	0,0	381,7	78,5	98,0	388,2	412,0	562,8	604,5	310,6	0,19	79,29	78,50	82,96	0,18	79,17	79,08	80,86
87,0	317,0	1,1	0,6	4,8	0,0	381,7	78,6	98,2	385,5	412,9	563,2	603,7	310,3	0,19	79,26	78,48	82,91	0,18	79,18	79,09	80,93

88,0	318,0	1,1	0,6	4,8	0,0	381,3	78,4	98,1	384,1	413,1	563,1	603,5	309,9	0,19	79,19	78,50	82,86	0,18	79,12	79,09	80,97
89,0	319,0	1,0	0,6	4,9	0,0	382,1	78,3	97,9	382,5	414,3	562,6	603,5	309,6	0,19	79,18	78,48	82,82	0,18	79,12	79,06	81,05
90,0	320,0	1,0	0,5	4,9	0,0	384,0	78,2	97,9	382,3	413,7	561,2	603,9	309,2	0,19	79,13	78,49	82,80	0,18	79,11	79,09	81,13
91,0	321,0	0,9	0,5	5,1	0,0	386,5	78,5	98,0	383,5	415,6	562,4	604,7	308,8	0,19	79,13	78,49	82,77	0,18	79,09	79,06	81,18
92,0	322,0	0,9	0,4	5,2	0,0	387,8	78,4	98,4	384,3	416,3	561,4	604,4	308,4	0,19	79,17	78,51	82,75	0,18	79,11	79,07	81,25
93,0	323,0	0,8	0,4	5,1	0,0	387,0	78,3	98,3	383,7	417,6	561,4	602,6	308,1	0,19	79,05	78,51	82,72	0,18	79,07	79,06	81,29
94,0	324,0	0,8	0,5	4,9	0,0	382,1	77,5	98,1	383,3	417,4	560,8	599,6	307,6	0,19	78,97	78,49	82,71	0,18	78,99	79,06	81,33
95,0	325,0	0,7	0,6	4,5	0,0	377,3	78,2	97,6	380,2	419,1	560,7	594,7	307,3	0,19	79,01	78,49	82,68	0,18	78,99	79,07	81,42
96,0	326,0	0,7	0,7	4,2	0,0	372,2	78,3	97,2	377,5	419,4	559,1	590,4	306,9	0,19	79,08	78,49	82,66	0,18	79,01	79,08	81,43
97,0	327,0	0,6	0,7	4,1	0,0	367,5	77,7	97,2	373,0	419,1	556,2	587,0	306,5	0,19	79,12	78,53	82,62	0,18	79,06	79,09	81,46
98,0	328,0	0,6	0,8	3,9	0,0	362,9	78,2	96,9	368,7	418,3	553,5	582,5	306,2	0,19	79,19	78,53	82,65	0,18	79,11	79,13	81,52
99,0	329,0	0,6	0,8	3,7	0,0	357,6	78,2	96,3	363,5	417,3	548,1	577,8	305,8	0,19	79,23	78,56	82,60	0,18	79,16	79,15	81,55
100,0	330,0	0,6	0,9	3,4	0,0	352,9	78,3	96,0	359,0	416,2	544,4	573,9	305,4	0,19	79,22	78,58	82,59	0,18	79,21	79,17	81,59
101,0	331,0	0,6	1,0	3,3	0,0	348,6	78,1	95,9	354,7	415,4	538,4	570,2	305,0	0,19	79,20	78,58	82,54	0,18	79,20	79,17	81,61
102,0	332,0	0,5	1,0	3,2	0,0	345,4	77,6	95,6	350,4	414,3	533,5	565,8	304,6	0,19	79,22	78,60	82,53	0,18	79,22	79,22	81,64
103,0	333,0	0,5	1,1	3,2	0,0	342,3	77,9	95,0	345,9	411,9	528,0	562,0	304,2	0,19	79,15	78,60	82,48	0,18	79,15	79,18	81,61
104,0	334,0	0,5	1,1	3,1	0,0	338,9	78,0	94,7	342,2	411,7	522,9	557,4	303,8	0,19	79,06	78,57	82,49	0,18	79,09	79,20	81,66
105,0	335,0	0,5	1,1	3,1	0,0	335,9	78,0	94,4	338,0	410,6	518,2	553,2	303,4	0,19	79,00	78,55	82,42	0,18	79,07	79,17	81,65
106,0	336,0	0,4	1,1	3,0	0,0	333,4	77,9	94,4	334,7	409,3	514,1	549,0	303,1	0,19	78,96	78,56	82,41	0,18	79,03	79,19	81,69
107,0	337,0	0,4	1,1	3,0	0,0	330,8	77,9	93,9	330,8	407,1	510,1	545,6	302,7	0,19	78,85	78,53	82,39	0,18	78,97	79,16	81,71
108,0	338,0	0,4	1,1	3,0	0,0	328,7	77,7	94,1	328,3	406,4	505,4	541,8	302,3	0,19	78,77	78,52	82,34	0,18	78,89	79,14	81,71
109,0	339,0	0,4	1,2	3,0	0,0	326,8	77,7	93,5	325,4	403,9	501,8	538,3	301,8	0,19	78,74	78,49	82,30	0,18	78,89	79,12	81,72
110,0	340,0	0,3	1,2	2,9	0,0	324,9	77,6	93,3	322,9	402,5	498,3	534,6	301,4	0,19	78,82	78,49	82,26	0,18	78,90	79,11	81,72
111,0	341,0	0,3	1,2	2,9	0,0	323,2	77,4	93,2	320,1	400,4	494,1	531,3	301,0	0,19	78,82	78,51	82,22	0,18	78,89	79,11	81,73
112,0	342,0	0,3	1,2	2,9	0,0	321,6	77,5	93,0	317,9	399,6	490,1	528,1	300,6	0,19	78,75	78,48	82,16	0,18	78,82	79,09	81,69
113,0	343,0	0,3	1,2	2,9	0,0	320,2	77,6	93,2	316,1	398,3	487,0	525,5	300,2	0,19	78,68	78,46	82,14	0,18	78,78	79,10	81,69
114,0	344,0	0,2	1,2	2,9	0,0	318,6	77,5	92,8	314,4	395,8	484,0	523,3	299,7	0,19	78,63	78,47	82,10	0,18	78,72	79,07	81,71
115,0	345,0	0,3	1,2	3,0	0,0	317,3	77,6	92,6	312,2	395,2	481,4	520,7	299,2	0,19	78,62	78,44	82,04	0,18	78,71	79,07	81,68
116,0	346,0	0,2	1,2	2,9	0,0	315,7	77,4	92,5	311,5	394,4	477,6	518,7	298,8	0,19	78,61	78,42	82,00	0,18	78,68	79,06	81,69
117,0	347,0	0,1	1,2	2,9	0,0	314,2	77,2	92,4	309,8	392,0	474,6	516,0	298,3	0,19	78,56	78,41	81,98	0,18	78,64	79,04	81,66
118,0	348,0	0,2	1,2	2,9	0,0	312,8	77,3	92,1	308,0	390,9	471,5	513,9	297,8	0,19	78,52	78,41	81,94	0,18	78,64	79,02	81,64
119,0	349,0	0,1	1,2	2,9	0,0	311,5	77,2	92,1	306,7	389,7	468,7	511,4	297,3	0,19	78,53	78,41	81,90	0,18	78,60	79,04	81,63
120,0	350,0	0,1	1,2	2,9	0,0	310,7	77,1	92,2	305,1	388,5	465,7	509,2	296,8	0,19	78,59	78,41	81,85	0,18	78,64	79,03	81,61
121,0	351,0	0,1	1,2	2,9	0,0	309,4	76,9	91,9	304,2	387,0	462,7	507,7	296,2	0,19	78,55	78,39	81,78	0,18	78,60	79,00	81,59
122,0	352,0	0,0	1,2	2,9	0,0	308,9	77,2	91,8	302,6	386,6	461,2	505,0	295,7	0,19	78,56	78,41	81,76	0,18	78,64	79,05	81,57

SFBA EPA EMISSION RESULTS

Test Duration: **122** min

PRESSURE FACTOR:	DGM 1	0,95351	
	DGM 2	0,95464	
	DGM 3	0,98104	
TEMPERATURE FACTORS	DGM 1	0,97988	
	DGM 2	0,97963	
	DGM 3	0,98029	
VOLUMES SAMPLED	DGM 1	23,728	SCft
	DGM 2	22,521	Scft
	DGM 3	49,797	SCft
TOTAL TUNNEL VOLUME :		35927	
SAMPLE RATIOS			
Sample Train 1:		1514,128	
Sample Train 2:		1595,278	
Paticulate concentration			
Sample Train 1		**0,000080**	g/dscf
Sample Train 2		**0,000084**	g/dscf
Room		**0,000004**	g/dscf
TOTAL EMISSIONS			
Sample Train 1		**2,73**	g
Sample Train 2		**2,89**	g
EMISSION RATES			
Sample Train 1		**1,34**	g/hr
Sample Train 2		**1,42**	g/hr
1st hour emission rate		**1,97**	g/hr

	Train 1	Train 2
Cs	8,008E-05	8,4367E-05

RESULTS

Average emission rate: 1,4 g/hr

Burn Rate : 1,967 Dry kg/hr

BAROMETRIC PRESSURE

Average:	29,352809	in Hg
Start:	29,382339	in Hg
End:	29,323279	in Hg

DGM CONTROLLER VALUES

DGM 1	Final:	30357,192	Cuft
	Initial:	30332,050	Cuft
DGM 2	Final:	28602,683	Cuft
	Initial:	28578,292	Cuft
DGM #3	Final:	757,780	Cuft
	Initial:	705,780	Cuft

TEMPERATURES

DGM 1	538,842	°R
DGM 2	538,981	°R

CALIBRATION FACTORS

DGM 1	1,0101
DGM 2	0,9873
DGM #3	0,9958

TUNNEL FLOW RATE: 294,481 Dscfm

PARTICULATE CATCH

Total Sample Train 1:	1,90	mg
Total Sample Train 2:	1,90	mg
Total Sample Train 1 1st hour:	1,30	mg

DEVIATION: 2,74%

Manufacturer: INVICTA
Model: KAZAN

Run: 1
Project #: PI 20182
Test Duration: 122 min

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

	HHV	LHV
Eff	64,47%	69,68%
Comb Eff	96,44%	96,44%
HT Eff	66,85%	72,25%
Output	25 122	kJ/h
Burn Rate	1,97	kg/h
Grams CO	221	g
Input	38 968	kJ/h
MC wet	17,46	

Ultimate CO_2
$CO_{2\text{-ult}}$ 19,64
F_0
1,060

Overall Heating Efficiency: 64,47%
Combustion Efficiency: 96,44%
Heat Transfer Efficiency: 66,85%

Heat Output: 23 830 Btu/h
Heat Input: 36 966 Btu/h
Burn Duration: 2,03 h
Burn Rate: 4,34 lb/h
Stack Temp: 448,8 Deg. F

Averages	0,47	6,01	2,40	20,51	14,26	231,80	25,90	92,6%	65,1%	60,5%
INPUT DATA			Oxygen Calculation			Input Data		Combust	Heat	Net
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO_2 [d]	Excess Air EA	Total O_2	Calc. % O_2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %
0,00	4,85	0,26	1,39	1093,5%	20,83	19,32	260,2	25,3	90,1%	-9,7%	-8,8%
1,00	4,70	0,21	3,21	473,2%	20,71	17,39	284,3	25,4	96,2%	38,8%	37,3%
2,00	4,97	0,28	4,32	327,0%	20,64	16,17	296,7	25,6	95,9%	49,1%	47,1%
3,00	4,52	0,25	5,67	231,6%	20,55	14,75	282,6	25,6	97,2%	59,6%	57,9%
4,00	4,47	0,26	6,74	180,9%	20,48	13,61	279,4	25,5	97,5%	64,2%	62,5%
5,00	4,43	0,14	7,20	167,6%	20,46	13,18	280,1	25,3	98,9%	65,5%	64,8%
6,00	4,34	0,17	7,16	168,2%	20,46	13,22	281,3	25,3	98,6%	65,3%	64,4%
7,00	4,25	0,16	7,54	155,4%	20,43	12,82	285,5	25,2	98,8%	66,0%	65,2%
8,00	4,16	0,09	8,04	141,5%	20,40	12,32	288,2	25,2	99,5%	67,0%	66,7%
9,00	4,07	0,10	8,44	130,2%	20,38	11,89	296,0	25,6	99,5%	67,3%	67,0%
10,00	3,98	0,15	9,37	106,2%	20,31	10,86	299,6	25,5	99,0%	69,0%	68,3%
11,00	3,94	0,19	9,37	105,4%	20,31	10,84	300,6	25,4	98,7%	68,9%	68,0%
12,00	3,84	0,12	9,43	105,8%	20,31	10,82	300,4	25,5	99,3%	69,0%	68,5%
13,00	3,75	0,11	9,27	109,5%	20,32	11,00	300,0	25,5	99,3%	68,7%	68,3%
14,00	3,66	0,12	9,21	110,6%	20,32	11,05	301,8	25,7	99,3%	68,5%	68,0%
15,00	3,57	0,12	9,36	107,3%	20,31	10,90	304,5	25,8	99,3%	68,6%	68,1%
16,00	3,48	0,13	9,78	98,1%	20,29	10,44	306,5	25,9	99,2%	69,2%	68,7%
17,00	3,39	0,14	9,97	94,3%	20,27	10,23	308,2	26,0	99,1%	69,4%	68,8%
18,00	3,34	0,15	10,11	91,4%	20,26	10,07	308,3	26,1	99,0%	69,7%	69,0%
19,00	3,26	0,13	10,10	92,0%	20,26	10,10	307,3	25,9	99,2%	69,7%	69,1%
20,00	3,16	0,13	9,93	95,1%	20,28	10,28	306,6	26,2	99,2%	69,5%	68,9%
21,00	3,07	0,14	9,82	97,3%	20,28	10,39	306,2	26,1	99,1%	69,3%	68,7%
22,00	2,98	0,12	9,95	95,0%	20,28	10,26	306,2	26,3	99,3%	69,6%	69,1%
23,00	2,89	0,14	9,90	95,7%	20,28	10,31	306,2	26,3	99,1%	69,5%	68,9%
24,00	2,85	0,14	9,85	96,6%	20,28	10,36	305,2	26,3	99,1%	69,5%	68,9%
25,00	2,75	0,15	9,82	97,1%	20,28	10,39	304,4	26,4	99,0%	69,5%	68,8%
26,00	2,67	0,13	9,77	98,5%	20,29	10,45	304,4	26,1	99,2%	69,4%	68,8%
27,00	2,62	0,12	9,82	97,6%	20,28	10,40	303,5	26,2	99,3%	69,5%	69,0%
28,00	2,53	0,12	9,73	99,2%	20,29	10,49	302,8	26,4	99,2%	69,5%	68,9%
29,00	2,49	0,13	9,72	99,5%	20,29	10,51	302,7	26,6	99,2%	69,5%	68,9%
30,00	2,39	0,11	9,84	97,5%	20,28	10,39	303,1	26,7	99,4%	69,6%	69,2%
31,00	2,30	0,12	9,87	96,6%	20,28	10,35	303,4	26,6	99,3%	69,7%	69,2%
32,00	2,26	0,14	9,98	94,1%	20,27	10,22	303,7	26,6	99,1%	69,8%	69,2%
33,00	2,17	0,13	10,08	92,3%	20,27	10,12	304,3	26,7	99,2%	70,0%	69,4%
34,00	2,13	0,15	10,06	92,4%	20,27	10,13	304,4	26,8	99,1%	69,9%	69,3%
35,00	2,07	0,13	9,90	95,9%	20,28	10,32	301,0	26,7	99,2%	69,9%	69,3%
36,00	1,99	0,08	9,46	105,9%	20,31	10,81	295,3	26,9	99,7%	69,6%	69,4%
37,00	1,94	0,05	8,91	119,4%	20,35	11,42	291,5	26,7	99,9%	68,8%	68,8%
38,00	1,90	0,04	8,70	124,9%	20,36	11,65	288,5	26,7	100,0%	68,6%	68,6%
39,00	1,85	0,05	8,63	126,4%	20,37	11,71	287,4	26,8	99,9%	68,6%	68,6%
40,00	1,81	0,04	8,76	123,1%	20,36	11,58	286,5	26,8	100,0%	69,0%	68,9%
41,00	1,77	0,10	8,82	120,3%	20,35	11,48	283,8	26,7	99,4%	69,3%	68,9%
42,00	1,71	0,10	8,39	131,3%	20,38	11,94	277,3	26,8	99,4%	68,9%	68,5%
43,00	1,67	0,08	7,72	151,9%	20,43	12,67	272,6	26,8	99,6%	67,8%	67,6%
44,00	1,62	0,12	7,41	160,7%	20,44	12,97	268,9	26,7	99,1%	67,3%	66,7%
45,00	1,58	0,18	7,29	163,1%	20,45	13,07	264,0	26,6	98,5%	67,5%	66,5%
46,00	1,54	0,23	6,97	173,1%	20,47	13,39	258,3	26,7	97,9%	67,1%	65,7%
47,00	1,54	0,24	6,57	188,3%	20,49	13,80	251,9	26,7	97,6%	66,6%	65,0%
48,00	1,49	0,27	6,17	204,8%	20,51	14,21	246,4	26,5	97,1%	65,9%	63,9%
49,00	1,45	0,29	6,01	211,9%	20,52	14,37	242,2	26,7	96,8%	65,8%	63,7%
50,00	1,44	0,30	5,88	217,8%	20,53	14,50	237,4	25,9	96,5%	65,8%	63,5%
51,00	1,39	0,33	5,68	226,9%	20,54	14,70	233,6	26,4	96,1%	65,5%	62,9%
52,00	1,35	0,35	5,56	232,4%	20,55	14,81	229,8	26,5	95,7%	65,5%	62,7%
53,00	1,35	0,37	5,41	239,8%	20,56	14,96	226,3	26,4	95,4%	65,4%	62,4%
54,00	1,31	0,38	5,33	243,7%	20,56	15,04	223,5	26,4	95,1%	65,4%	62,2%
55,00	1,31	0,40	5,22	249,5%	20,57	15,15	220,5	26,0	94,7%	65,2%	61,8%
56,00	1,26	0,43	5,14	253,0%	20,57	15,22	217,8	26,3	94,3%	65,3%	61,5%
57,00	1,26	0,45	5,05	256,7%	20,58	15,30	215,3	26,2	93,8%	65,2%	61,2%
58,00	1,22	0,47	5,02	257,7%	20,58	15,32	212,9	26,2	93,6%	65,4%	61,2%
59,00	1,17	0,48	4,99	259,0%	20,58	15,35	210,9	25,8	93,3%	65,4%	61,1%
60,00	1,17	0,48	4,99	259,1%	20,58	15,35	209,2	25,6	93,4%	65,7%	61,3%
61,00	1,13	0,50	4,94	261,2%	20,58	15,39	207,7	26,1	93,1%	65,7%	61,1%
62,00	1,13	0,51	4,94	260,7%	20,58	15,39	207,1	26,1	92,9%	65,8%	61,1%
63,00	1,08	0,52	4,89	263,2%	20,58	15,44	206,8	26,1	92,7%	65,6%	60,8%
64,00	1,08	0,51	4,95	259,6%	20,58	15,37	206,6	25,6	93,0%	65,9%	61,2%
65,00	1,03	0,49	5,10	251,5%	20,57	15,23	207,0	25,9	93,5%	66,5%	62,1%
66,00	0,99	0,47	5,14	250,1%	20,57	15,20	206,8	26,1	93,7%	66,6%	62,4%
67,00	0,99	0,46	5,18	248,0%	20,57	15,15	206,5	26,0	93,9%	66,9%	62,8%
68,00	0,94	0,47	5,04	256,6%	20,58	15,30	206,4	26,0	93,6%	66,3%	62,1%
69,00	0,94	0,47	5,02	257,4%	20,58	15,32	206,0	26,0	93,5%	66,3%	62,0%
70,00	0,90	0,46	5,04	257,5%	20,58	15,31	205,7	26,0	93,8%	66,4%	62,3%
71,00	0,85	0,45	5,05	257,0%	20,58	15,30	205,5	26,0	93,9%	66,5%	62,4%
72,00	0,85	0,45	5,06	256,9%	20,58	15,30	205,4	25,9	93,9%	66,5%	62,4%
73,00	0,81	0,45	5,07	256,1%	20,58	15,28	205,1	25,9	94,0%	66,6%	62,6%
74,00	0,81	0,45	5,05	257,1%	20,58	15,30	204,6	25,8	94,0%	66,6%	62,6%
75,00	0,81	0,46	5,04	257,4%	20,58	15,31	203,8	25,9	93,8%	66,6%	62,5%
76,00	0,77	0,46	5,00	259,8%	20,58	15,35	203,1	25,9	93,8%	66,6%	62,4%
77,00	0,72	0,48	4,97	260,3%	20,58	15,37	202,0	25,9	93,4%	66,6%	62,2%
78,00	0,72	0,50	4,91	263,0%	20,58	15,42	200,9	25,8	93,0%	66,4%	61,8%
79,00	0,67	0,53	4,86	264,6%	20,58	15,46	200,0	25,9	92,6%	66,4%	61,4%
80,00	0,67	0,54	4,84	265,3%	20,58	15,48	198,6	25,9	92,5%	66,5%	61,4%
81,00	0,62	0,55	4,79	267,3%	20,59	15,52	197,8	25,8	92,1%	66,4%	61,1%
82,00	0,62	0,57	4,75	269,6%	20,59	15,56	197,0	25,8	91,9%	66,2%	60,9%
83,00	0,58	0,57	4,79	266,5%	20,59	15,51	195,8	25,8	92,0%	66,6%	61,3%
84,00	0,58	0,57	4,77	267,8%	20,59	15,53	194,9	25,8	91,9%	66,6%	61,2%
85,00	0,54	0,57	4,75	269,4%	20,59	15,56	194,5	25,7	91,8%	66,6%	61,1%
86,00	0,49	0,57	4,76	268,3%	20,59	15,54	194,3	25,8	91,8%	66,7%	61,2%
87,00	0,49	0,58	4,78	266,9%	20,59	15,52	194,3	25,9	91,8%	66,8%	61,3%
88,00	0,49	0,57	4,81	265,3%	20,58	15,49	194,1	25,8	92,0%	66,9%	61,6%
89,00	0,45	0,55	4,87	262,0%	20,58	15,43	194,5	25,7	92,3%	67,1%	61,9%
90,00	0,45	0,52	4,93	260,6%	20,58	15,39	195,6	25,6	92,8%	67,2%	62,3%
91,00	0,40	0,47	5,07	254,1%	20,57	15,26	196,9	25,8	93,6%	67,6%	63,3%
92,00	0,40	0,43	5,15	251,9%	20,57	15,20	197,6	25,8	94,3%	67,8%	64,0%

93,00	0,36	0,41	5,14	253,7%	20,57	15,23	197,2	25,7	94,5%	67,8%	64,1%
94,00	0,36	0,45	4,89	267,6%	20,59	15,47	194,5	25,3	93,7%	67,2%	63,0%
95,00	0,31	0,57	4,52	286,2%	20,60	15,80	191,9	25,7	91,5%	65,9%	60,3%
96,00	0,31	0,66	4,24	301,4%	20,62	16,05	189,0	25,7	89,7%	64,9%	58,3%
97,00	0,27	0,70	4,08	310,7%	20,62	16,19	186,4	25,4	88,7%	64,5%	57,2%
98,00	0,26	0,75	3,93	319,6%	20,63	16,33	183,8	25,7	87,6%	64,1%	56,1%
99,00	0,26	0,82	3,73	331,3%	20,64	16,50	180,9	25,7	86,0%	63,4%	54,5%
100,00	0,26	0,94	3,43	349,4%	20,65	16,75	178,3	25,7	83,3%	61,9%	51,5%
101,00	0,26	1,00	3,29	358,3%	20,66	16,87	175,9	25,6	81,9%	61,2%	50,1%
102,00	0,22	1,03	3,23	361,5%	20,66	16,92	174,1	25,3	81,2%	61,1%	49,6%
103,00	0,22	1,05	3,16	366,4%	20,66	16,98	172,4	25,5	80,5%	60,9%	49,0%
104,00	0,22	1,08	3,13	366,7%	20,66	16,99	170,5	25,5	80,0%	61,0%	48,8%
105,00	0,22	1,10	3,09	369,6%	20,66	17,03	168,8	25,5	79,6%	61,0%	48,6%
106,00	0,17	1,11	3,03	374,4%	20,67	17,08	167,4	25,5	79,0%	60,8%	48,0%
107,00	0,17	1,13	3,00	375,7%	20,67	17,10	166,0	25,5	78,6%	60,8%	47,8%
108,00	0,17	1,14	2,97	377,9%	20,67	17,13	164,8	25,4	78,3%	60,8%	47,6%
109,00	0,17	1,15	2,97	377,1%	20,67	17,13	163,8	25,4	78,2%	61,0%	47,7%
110,00	0,13	1,15	2,95	378,7%	20,67	17,14	162,7	25,3	78,1%	61,0%	47,7%
111,00	0,13	1,16	2,94	379,1%	20,67	17,15	161,8	25,2	77,9%	61,1%	47,6%
112,00	0,13	1,17	2,94	378,3%	20,67	17,15	160,9	25,3	77,8%	61,3%	47,7%
113,00	0,13	1,17	2,92	380,2%	20,67	17,16	160,1	25,3	77,7%	61,3%	47,6%
114,00	0,08	1,18	2,95	376,5%	20,67	17,13	159,2	25,3	77,7%	61,7%	48,0%
115,00	0,13	1,17	2,95	376,0%	20,67	17,13	158,5	25,3	77,8%	61,9%	48,2%
116,00	0,08	1,17	2,95	377,5%	20,67	17,14	157,6	25,2	77,9%	62,0%	48,3%
117,00	0,04	1,17	2,92	379,8%	20,67	17,16	156,8	25,1	77,6%	62,0%	48,1%
118,00	0,08	1,18	2,87	385,7%	20,67	17,22	156,0	25,2	77,3%	61,7%	47,7%
119,00	0,04	1,17	2,88	384,1%	20,67	17,20	155,3	25,1	77,4%	62,0%	48,0%
120,00	0,04	1,18	2,87	385,7%	20,67	17,22	154,8	25,1	77,3%	61,9%	47,9%
121,00	0,04	1,17	2,88	385,7%	20,67	17,21	154,1	24,9	77,5%	62,1%	48,1%
122,00	0,00	1,18	2,89	382,5%	20,67	17,19	153,8	25,1	77,3%	62,3%	48,2%

DATA 2019-02-26 EPA PI 20182 RUN 1 SINGLE BURNRATE
unit preburn

Temps acquisition minutes	Flue temp °F	Room temp °F	scale lbs	Tunnel Velocity Pressure in. Wc	Flue draft Pressure in. Wc	Right °F	Back °F	bottom °F	Top °F	Left °F
0	71,51	71,35	2,97	0,0585	0,00	71,61	71,28	71,05	72,29	71,44
1	157,69	71,49	2,87	0,0595	0,00	72,93	71,33	71,08	84,41	75,28
2	278,81	71,57	2,67	0,0565	0,00	77,13	71,59	71,10	110,23	87,22
3	345,20	71,62	2,48	0,0573	0,00	93,36	71,95	71,17	153,22	110,61
4	408,97	71,69	2,27	0,0573	0,00	114,99	72,68	71,30	201,15	133,13
5	453,98	71,91	2,07	0,0567	0,00	136,98	73,95	71,40	249,15	157,62
6	492,29	72,10	1,88	0,0563	0,00	165,27	75,82	71,60	291,74	184,71
7	512,34	71,95	1,68	0,0551	0,00	195,58	78,32	71,78	328,53	214,25
8	493,13	72,40	1,59	0,0558	0,00	224,88	81,55	72,01	351,15	244,02
9	475,59	72,69	1,37	0,0558	0,00	251,01	85,16	72,29	363,41	263,89
10	456,57	72,76	1,27	0,0563	0,00	274,40	89,45	72,62	375,35	281,37
11	445,70	72,95	6,56	0,0558	0,00	298,14	94,20	72,97	380,62	294,72
12	463,57	72,91	12,34	0,0553	0,00	310,37	100,34	73,42	373,71	297,88
13	466,96	72,99	12,15	0,0555	0,00	335,12	105,99	74,03	370,97	307,98
14	517,08	73,29	11,86	0,0543	0,00	362,12	110,90	74,73	378,47	315,79
15	472,97	73,28	11,67	0,0555	0,00	373,52	116,21	75,51	384,53	323,45
16	447,51	73,25	11,54	0,0559	0,00	372,95	121,79	76,40	385,32	321,87
17	440,93	73,08	11,35	0,0558	0,00	374,93	127,02	77,36	386,02	316,57
18	446,93	72,90	11,26	0,0560	0,00	380,22	131,12	78,51	391,50	311,97
19	437,90	73,06	11,06	0,0558	0,00	384,28	134,68	79,65	395,34	310,58
20	444,12	73,19	10,97	0,0558	0,00	388,31	138,71	80,95	401,25	308,39
21	431,00	73,29	10,85	0,0560	0,00	393,66	142,75	82,34	402,34	304,44
22	436,54	73,05	10,65	0,0560	0,00	402,14	145,99	83,79	406,41	299,73
23	462,93	73,32	10,55	0,0558	0,00	418,27	149,13	85,39	418,02	296,52
24	484,68	73,42	10,36	0,0558	0,00	434,71	152,18	87,07	430,45	296,33
25	505,58	73,60	10,17	0,0560	0,00	447,10	154,93	88,92	452,00	299,84
26	521,79	73,48	9,96	0,0558	0,00	454,31	156,98	90,77	471,45	307,12
27	524,02	73,74	9,76	0,0560	0,00	459,89	159,94	92,81	485,26	315,67
28	518,01	73,90	9,66	0,0555	0,00	465,68	163,07	94,93	496,74	323,95
29	516,58	74,18	9,47	0,0560	0,00	470,34	165,21	97,10	505,62	330,37
30	518,29	74,32	9,25	0,0558	0,00	475,82	168,24	99,30	512,18	335,91
31	519,64	74,37	9,06	0,0559	0,00	481,96	171,26	101,56	519,59	340,69
32	529,37	74,50	8,86	0,0553	0,00	489,63	173,89	103,86	527,92	346,10
33	542,09	74,73	8,67	0,0558	0,00	498,13	176,95	106,20	537,66	353,36
34	549,20	74,85	8,46	0,0548	0,00	508,40	180,12	108,57	545,90	361,93
35	564,06	74,95	8,26	0,0551	0,00	516,81	183,78	111,01	551,04	378,34
36	570,00	75,34	8,07	0,0555	0,00	524,18	186,76	113,42	554,50	398,79
37	569,90	75,51	7,87	0,0548	0,00	532,31	191,35	115,91	558,82	419,43
38	572,29	75,62	7,66	0,0548	0,00	539,86	195,23	118,38	561,41	440,45
39	570,76	75,84	7,47	0,0548	0,00	546,95	199,10	120,78	564,36	461,94
40	572,83	76,00	7,27	0,0534	0,00	554,00	204,05	123,16	567,55	481,20
41	576,36	76,13	6,96	0,0548	0,00	562,65	209,10	125,45	572,99	498,02
42	575,31	76,42	6,86	0,0553	0,00	570,78	214,25	127,81	578,15	513,58
43	577,01	76,45	6,67	0,0554	0,00	580,63	220,65	130,35	582,38	527,84
44	578,35	76,28	6,48	0,0551	0,00	589,45	227,04	132,95	587,41	541,66
45	579,13	76,44	6,16	0,0541	0,00	600,41	233,63	135,60	590,60	555,69
46	579,49	76,71	5,97	0,0531	0,00	611,47	241,10	138,24	594,27	568,94
47	578,86	76,34	5,77	0,0543	0,00	621,70	248,38	140,91	597,17	582,17
48	580,61	76,61	5,58	0,0548	0,00	630,38	255,06	143,79	599,63	596,80
49	577,85	76,97	5,37	0,0548	0,00	638,33	262,50	146,75	601,15	610,00
50	578,23	77,28	5,17	0,0541	0,00	645,76	270,90	149,81	602,98	620,38
51	581,58	77,22	4,98	0,0548	0,00	653,14	278,26	153,03	604,17	629,70
52	582,53	76,47	4,78	0,0543	0,00	659,76	285,31	156,28	606,55	637,15
53	582,45	77,32	4,69	0,0551	0,00	665,46	292,38	159,74	607,41	644,07
54	582,00	77,14	4,47	0,0538	0,00	671,56	300,03	163,30	610,68	650,09
55	578,82	77,15	4,28	0,0531	0,00	677,02	307,58	167,02	612,72	656,12
56	572,56	77,41	4,18	0,0541	0,00	680,36	314,81	170,81	612,50	660,89
57	568,63	77,78	3,99	0,0543	0,00	682,16	322,94	174,71	613,38	666,09
58	567,17	77,81	3,77	0,0548	0,00	683,64	330,32	178,71	615,51	670,08
59	567,51	77,92	3,68	0,0543	0,00	685,11	337,76	182,78	615,48	673,89
60	564,01	77,99	3,48	0,0543	0,00	686,60	344,97	186,81	616,73	677,15
61	558,97	78,05	3,38	0,0546	0,00	688,23	352,40	190,99	615,52	680,87
62	563,54	77,42	3,19	0,0548	0,00	686,81	359,40	194,75	613,82	684,95
63	557,07	78,09	3,07	0,0551	0,00	682,97	365,97	199,21	613,17	682,37
64	548,60	77,80	2,98	0,0553	0,00	678,00	372,16	203,78	611,06	678,89
65	538,67	77,68	2,88	0,0555	0,00	672,53	378,21	208,40	609,13	675,80
66	531,72	78,24	2,78	0,0551	0,00	666,16	382,67	213,07	602,64	673,45
67	526,13	78,43	2,78	0,0551	0,00	659,63	388,87	217,81	597,18	669,46
68	521,32	78,07	2,68	0,0548	0,00	653,10	393,06	222,58	592,63	667,58
69	514,29	77,11	2,68	0,0548	0,00	645,98	398,11	227,32	586,46	664,31

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2019-01-23 Manufacturer: Invicta Model: KA-24

Project #: PT 2018 Run: 2 Tech: MM Reviewer: DP

Handling 300 LBS STAND FILE Full open
Δ1 26 LBS close Door
Δ1 12 LBS insert load
Δ1 118 LBS close Door
Δ1 24 LBS insert load
Δ1 2130 close Door

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

PRE / POST CHECKS

Date: 2019-01-27 Manufacturer: Invicta Model: ICA2AN

Project #: PT 20182 Run: 2 Tech: MM Reviewer: DD

Moisture Meter Calibration Check:

Equipment #	Time	12%	22%
EM 191	7h00	ok	ok

Pre-Test **Post-Test**

Facility Conditions:

	Pre-Test	Post-Test
Air Velocity from less than 2 feet	0 (max50 Fpm)	0 (max50 Fpm)
Smoke Capture Check	ok	ok
Picture (4 sides)	ok	ok

Wood Heater Conditions:

Date Wood Heater Stack Cleaned	2019-02-26 ~~2018-02-26~~
Date Dilution Tunnel Cleaned	2019-02-26
Induced Draft Check (max 0.005 H2O)	ok
Traverse before ignition	ok
Flow Rate 140 cfm ±10%	ok

Temperature System:

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

Proportional Checks:

Thermocouple check	ok
Pitot Clean	ok
Pitot verification	ok

Sampling Train ID Numbers:

	Train 1st hour	Train 1	Train 2
Probe	05	11	39
Filter Front	856	858	860
Filter Back	857	859	861
Filter Thermocouple	11	11	12
Filter (≤90°F)	ok	ok	ok

POLYTESTS
TESTING THROUGH YOUR REALITY

SAMPLING EQUIPMENT CHECK OUT

Date: 2019-02-27 Manufacturer: InVicta Model: KAZan

Project #: pt 20182 Run: 2 Tech: MM Reviewer: DD

Leakage Checks Tunnel Samplers

	System 1st hour		System 1		System 2	
Unplugged Flow Rate = .25cfm	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (max test)	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)	Pre-Test ASTM (-15) CSA B415 (-5)	Post-Test (Max test)
Vacuum (inches Hg.)	-15	-15	-15	-15	-15	-15
Final 1minute DGM (Liter)	859624,33	860305,13	859624,56	860305,22	809939,78	810604,82
Initial 1minute DGM (Liter)	859624,32	860305,10	859624,46	860305,22	809939,74	810604,82
Change © (Liter)	0,01	0,03	0,10	ø	0,04	ø
Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56)						
Check OK	ok	ok	ok	ok	ok	ok

Leakage Checks Flue Gas Sampler

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

Leakage Checks Pitot

Plugged Probe	Pre Test 3 H2o static	Pre Test 0.4-0.5 H2o velocity	Post Test 3 H2o Static	Post Test 0.4-0.5 H2o velocity
Vacuum (inches Hg.)	3	.4	3	.5
Check OK (no change after 15 sec.)	ok	ok	ok	ok

POLYTESTS
TESTING THROUGH YOUR REALITY

PRE-TEST SCALE AUDIT

Date: 2019-01-27 Manufacturer: InvictA Model: KAZAN

Project #: PJ 20182 Run: 2 Tech: MM Reviewer: DP

Scale Type	Audit		Measured Weight
	Equipment #	Weight	
Platform	EM-090	44 lbs, Class F	44 lbs
Wood	EM-090	44 lbs, Class F	44 lbs
Analytical	EM 128	100 mg, Class S	100 mg
Analytical	EM 129	200 g, Class S	200 g

LIMITS OF WEIGHT RANGES

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

Date: 2019-01-27 Manufacturer: INVICTA Model: KAZAN

Project #: PT 20182 Run: 2 Tech: MM Reviewer: DP

FOR TUNNELS < 12 in

Barometric pressure (P_{bar}) 95.2 (KPa.) Static pressure (P_q) 0.19 (inches w.c.)
Inside diameter: Port A _____ Port B _____.
Tunnel cross sectional area: .1963Ft^2
Pitot tube type: Standard

Traverse Point	Position (inches)			Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)
	6 po	7 po	8 po		
A- Centroid	3.00	3.50	4	0.055	90.01
B - Centroid	3.00	3.50	4	0.054	90.70
A-1	0.40	0.50	0.50	0.042	90.01
A-2	1.50	1.75	2	0.056	89.71
A-3	4.50	5.25	6	0.042	90.52
A-4	5.60	6.5	7.5	0.042	90.62
B-1	0.40	0.50	0.50	0.043	90.70
B-2	1.50	1.75	2	0.062	90.41
B-3	4.50	5.25	6	0.050	90.35
B-4	5.60	6.5	7.5	0.043	90.35
				AVERAGE	

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

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

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

POLYTESTS
TESTING THROUGH YOUR REALITY

CONTINUOUS ANALYZERS

Date: 2-19-02-27 Manufacturer: InnovA Model: KA2aN

Project #: pT 20182 Run: 2 Tech: MM Reviewer: DP

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	0	0	2973	3000	0991	1,000
Tolerance CO		+/- 0.02		+/- 0.15		+/- 0.05
CO_2	0	0	17 81	18,00	981	1,00
Tolerance CO2		+/- 0.02		+/- 0.5		+/- 0.5
O_2 informative CSA B415 calculated value	na	na	na	na	na	na
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Limit	Span Drift	Limit	Cal. Drift	Limit	OK?	Not OK*
CO	0	2981	0996	0	0.02	0,008	0.15	0,005	0.05	✓	
CO_2	0	17 86	9,78	0	0.02	0,05	0.5	0,03	0.5	✓	

POLYTESTS
TESTING THROUGH YOUR REALITY

TEST DATA LOG

Date: 2019-01-27 Manufacturer: INVICTA Model: KAZAN

Project #: PT 2182 Run: 2 Tech: MM Reviewer: DO

RAW DRY GAS METER READINGS

	System 1	System 2	Blanck
Final (Liter)	86030,16	81060,89	880,79
Initial (Liter)	85962,25	80994,60	847,29

AMBIENT CONDITIONS

	Before	After
Barometer (kPa):	99,2	100,1
Dry Bulb (F):	75,06	75,38
Humidity (%):	21,5	23,1

Flow Meter

	Start	End
Flow meter reading	N.A	NA

Flow Meter Verification

	Before	After
Flow meter Check (liters)	NA	NA
Scale Weight (Kg)	NA	NA

POLYTESTS
TESTING THROUGH YOUR REALITY

FUEL DATA

Date: 2019 01 27 Manufacturer: Invicta Model: Kazan

Project #: PI 20182 Run: 2 Tech: MT Reviewer: DS

FUEL DESCRIPTION:

Type of wood:

PRE-TEST LOAD

Piece Size	Weight	Meter Moisture Content (% dry)*				
2 x 4 x 15 7/8 in.	2.414 lbs.	21.8	22.3	22.2	22.8	22.1
2 x 4 x 15 7/8 in.	2.568 lbs.	23.7	24.1	24.5	23.8	24.4
2 x 4 x 7 in.	1.058 lbs.	22.9	23.8	24.1	24.1	24.0
2 x 4 x 7 in.	1.034 lbs.	22.8	22.8	22.9	22.6	21.9
2 x 4 x 7 in.	1.072 lbs.	22.9	23.7	23.4	23.3	23.4
2 x 4 x 7 in.	1.058 lbs.	24.3	24.1	24.1	23.8	23.9
2 x 4 x 7 in.	1.096 lbs.	24	24.1	23.9	24	23.8
2 x 4 x 7 in.	1.060 lbs.	24.1	24.5	24.3	24.4	24.4
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					

TEST LOAD WEIGHT: 11.36 lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

FUEL DATA

Date: 2019-02-27 Manufacturer: INVICTA Model: KAZAN

Project #: PI-20182 Run: 2 Tech: S.B. Reviewer: SP

FUEL DESCRIPTION:
Type of wood :

TEST LOAD

Piece Size	Weight	Meter Moisture Content (% dry)*				
1.5 x 3.5 x 19.5 in.	2.344 lbs.	20.6	20.3	20.1	19.9	20.4
1.5 x 3.5 x 19.5 in.	2.458 lbs.	20.1	19.6	20	19.3	19.8
3.5 x 3.5 x 19.5 in.	4.754 lbs.	21	19.1	20.8	20.1	19.9
x x in.	lbs.					
0.75 x 1.5 x 5 in.	0.124 lbs.			20.3		
0.75 x 1.5 x 5 in.	0.122 lbs.			19.2		
0.75 x 1.5 x 5 in.	0.126 lbs.			20.3		
0.75 x 1.5 x 5 in.	0.122 lbs.			21.6		
0.75 x 1.5 x 5 in.	0.116 lbs.			19.1		
0.75 x 1.5 x 5 in.	0.116 lbs.			21.4		
0.75 x 1.5 x 5 in.	0.118 lbs.			20.7		
0.75 x 1.5 x 5 in.	0.128 lbs.			20.4		
0.75 x 1.5 x 5 in.	0.126 lbs.			19.4		
0.75 x 1.5 x 5 in.	0.118 lbs.			19.8		
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					
x x in.	lbs.					

TEST LOAD WEIGHT: 10.77 lbs Min 20%: 2.154 Max 25%: 2.69

POLYTESTS
TESTING THROUGH YOUR REALITY

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2019-01-26 Manufacturer: Invicta Model: Kazan

Project #: pT 20182 Run: 2 Tech: MM Reviewer: DP

Pre-test Weight Record		SYSTEM 1 – 1st hour				SYSTEM 1				
		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Blanck
Date	Time	05	856	857	7	11	858	859	8	862
2019-01-26	17:30	61,5046	0,1230	0,1230	34,3281	93,7233	0,1227	0,1228	35,7981	0,1227
2019-01-27	8:00	61,5046	0,1229	0,1230	34,3282	93,7234	0,1227	0,1227	35,7982	0,1227

Post-test Weight Record		SYSTEM 1 – 1st hour				SYSTEM 1				
		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets	Blanck
Date	Time	05	856	857	7	11	858	859	8	862
2019-02-27	13:00	61,5048	0,1247	0,1226	34,3296	93,7237	0,1226	0,1223	35,8003	0,1228
2019-03-04	8:00	61,5047	0,1245	0,1226	34,3288	93,7235	0,1225	0,1223	35,7997	0,1228
2019-03-05	8:00	61,5047	0,1245	0,1226	34,3288	93,7235	0,1225	0,1223	35,7997	0,1228

POLYTESTS
TESTING THROUGH YOUR REALITY

DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: PI 20182 Run: 2 Tech: MM Reviewer: DP

		SYSTEM 2			
Pre-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets
Date	Time	39	860	861	38
2019-02-26	17:00	110 2781	0 1230	0 1263	35 4399
2019-02-27	8:00	110 2782	0 1229	0 1264	35 4398

		SYSTEM 2			
Post-test Weight Record		Probe & Housing Number	Front Filter Number	Back Filter Number	gaskets
Date	Time	39	860	861	38
2019-02-27	13:00	110 2785	0 1248	0 1256	35 4418
2019-03-04	8:00	110 2783	0 1247	0 1256	35 4415
2019-03-05	8:00	110 2783	0 1247	0 1256	35 4415

Paramètres

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

Code verrouillage:	INV

Description du test

Test standard	EPA	
Run #	2	
Date	27-02-2019	
Technicien	M.M	
Project #	PI 20182	

Description de l'unité

Manufacturier	INVICTA	
Modèle	KAZAN	
Combustion system	Non-Cat	
Appliance type	WOOD STOVE	
Firebox volume	1,53	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	4	
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):	1,010	Dimensionless
Equipment number (DGM #1):	EM 178	
Calibration Factor (DGM #2):	0,987	Dimensionless
Equipment number (DGM #2):	EM 179	
Calibration Factor (DGM #3):	0,996	
Equipment number (DGM #3):	EM 070	Dimensionless

Tunnel

Targeted tunnel flow rate	300	scfm
Tunnel diameter	8	in.
Molecular weight	29	May be assumed to be 28,78 (EPA) Si B-415 = 29
Pitot tube type	Standard	
Pitot tube coefficient	0,99	Dimensionless

Project nu.	PI 20182
Date	27-02-2019
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):	99,2	100,1
Barometer (in.Hg):	29,293749	29,55951887
Dry Bulb (F):	75,06	75,38
Humidity (%):	26,5	23,1
Air velocity (ft/min)	0	0

DGM #1	Final:	30381,355	cuft	Final:	860304,160	Liter
	Initial:	30357,274	cuft	Initial:	859622,250	Liter
DGM #2	Final:	28626,207	cuft	Final:	810603,890	Liter
	Initial:	28602,786	cuft	Initial:	809940,690	Liter

DGM room				Final:	880,790	cuft
				Initial:	847,290	cuft

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 121

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

Project nu.	PI 20182
Date	27-02-2019
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Preload data sheet

Test Load Weight:

Lower	Ideal	Upper
10,27	11,41	12,55

Load Volume: 0,3704 cu. ft

Loading Density: 6,969 lbs./ft3

Number of Spaces:

Spacer weight (lbs):

Load Density (wet): 30,672 lbs./ft3

Dry Wood Density: 24,841663

Piece Size (in): Thick	Wide	x Length	Weight lbs	Meter Moisture Content Dry Uncorrected %					Ave. MC x Weight	Volume Cubic Inches
2	4	19	2,414	21,8	22,3	22,2	22,8	22,1	53,68736	152,00
2	4	19	2,568	23,7	24,1	24,5	23,8	24,4	61,8888	152,00
2	4	7	1,058	22,9	23,8	24,1	24,1	24	25,15924	56,00
2	4	7	1,034	22,8	22,8	22,9	22,6	21,9	23,3684	56,00
2	4	7	1,072	22,9	23,7	23,4	23,3	23,4	25,02048	56,00
2	4	7	1,058	24,3	24,1	24,1	23,8	23,9	25,43432	56,00
2	4	7	1,096	24	24,1	23,9	24	23,8	26,26016	56,00
2	4	7	1,06	24,1	24,5	24,3	24,4	24,4	25,8004	56,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
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										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
										0,00
								SUM MC:	266,61916	

PreTest Load Weight: 11,36 lbs.

Dry Weight: 4,17 kg.

Average Moisture Content: %

Dry: 23,47

23,47
Must be 18-28

Wet: 19,01
must be 15,2-22

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FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

Lower	Ideal	Upper
10,3	11,4	12,6

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

Load Volume: 0,32 cu. ft

Loading Density: 6,6 lbs./ft3

Number of Spaces: 10

Spacer weight: lbs

Load Density (wet): 33,5 lbs./ft3

Dry Wood Density: 27,9 lbs./ft3

Piece Size (in): Thick	Wide	Length	Weight lbs	Meter Moisture Content Dry Uncorrected %					Ave. MC x Weight	Volume Cubic Inches	Ave. MC %
1,5	3,5	19,5	2,34	20,60	20,30	20,10	19,90	20,40	47,48944	102,38	20,3
1,5	3,5	19,5	2,46	20,10	19,60	20,00	19,30	19,80	48,57008	102,38	19,8
3,5	3,5	19,5	4,75	21,00	19,10	20,80	20,10	19,90	95,93572	238,88	20,2
1,5	0,75	5	0,12			20,30			2,5172	5,63	20,3
1,5	0,75	5	0,12			19,20			2,3424	5,63	19,2
1,5	0,75	5	0,13			20,30			2,5578	5,63	20,3
1,5	0,75	5	0,12			21,60			2,6352	5,63	21,6
1,5	0,75	5	0,12			19,10			2,2156	5,63	19,1
1,5	0,75	5	0,12			21,40			2,4824	5,63	21,4
1,5	0,75	5	0,12			20,70			2,4426	5,63	20,7
1,5	0,75	5	0,13			20,40			2,6112	5,63	20,4
1,5	0,75	5	0,13			19,40			2,4444	5,63	19,4
1,5	0,75	5	0,12			19,80			2,3364	5,63	19,8
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
										0,00	
								SUM MCx	216,58044		20,2 %

Test Load Weight: 10,77 lbs.

Dry Weight: 4,07 kg.

Average Moisture Content: %

Dry: 20,11 Dry(EPA) 20,11

Dry(B415 20,11

20,11
Must be 19-25

Wet: 16,74
must be 15,2-22

Coal Bed Range: 2,2 lbs. to 2,7 lbs.

TEST CHARGE:

Coal bed weight: 2,6 lbs.

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Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,19 in. H20
Barometer: 29,900 in. Hg

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

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

PITOT CONSTANT=
0,945

Pour un tunnel moins de 12", prendre 4 lectures

	TUNNEL VELOCITY	TUNNEL TEMP	SQUARE ROOT
	In. wc	°F	
A center	0,055	90,01	0,2345
B center	0,054	90,7	0,2324
A1	0,042	90,01	0,2049
A2	0,056	89,71	0,2366
A3	0,042	90,52	0,2049
A4	0,042	90,62	0,2049
B1	0,043	90,700	0,2074
B2	0,062	90,410	0,2490
B3	0,050	90,350	0,2236
B4	0,043	90,350	0,2074
AVERAGE	0,0489	90,3380	0,2206

Project nu.	PI 20182
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Filter set weight

	System 1 (g) 1st hour				System 1 (g)				System 2 (g)				Ambient blank (g)	Date	Heure
	probe	front	back	gasket	probe	front	back	gasket	probe	front	back	gasket	Filter		
Number	5	856	857	7	11	858	859	8	39	860	861	38	862		
Before (1)															
Before (2)															
Before (3)															
Before (4)															
Before (5)	61,5046	0,1230	0,1230	34,3281	93,7233	0,1227	0,1228	35,7981	110,2781	0,1230	0,1263	35,4399	0,1227	2019-02-26	17:00
Before (6)	61,5046	0,1229	0,1230	34,3282	93,7234	0,1227	0,1227	35,7982	110,2782	0,1229	0,1264	35,4398	0,1227	2019-02-27	08:00
After (1)	61,5048	0,1247	0,1226	34,3296	93,7237	0,1226	0,1223	35,8003	110,2785	0,1248	0,1256	35,4418	0,1228	2019-02-27	13:00
After (2)	61,5047	0,1245	0,1226	34,3288	93,7235	0,1225	0,1223	35,7997	110,2783	0,1247	0,1256	35,4415	0,1228		
After (3)															
After (4)															
After (5)															
After (6)	61,5047	0,1245	0,1226	34,3288	93,7235	0,1225	0,1223	35,7997	110,2783	0,1247	0,1256	35,4415	0,1228		
Difference	0,0001	0,0016	-0,0004	0,0006	0,0001	-0,0002	-0,0004	0,0015	0,0001	0,0018	-0,0008	0,0017	0,0001		
Total (mg)		1,9				2,9				2,8			0,1		
Total ajusté (mg)		**1,80**				**2,80**				**2,70**					

Project nu.	PI 20182
Date	27-02-2019
Technicien	M.M

Filter set weight

	System 1 (g) 1st hour				System 1 (g)				System 2 (g)				Ambient blank (g)	Date	Heure
	probe	front	back	gasket	probe	front	back	gasket	probe	front	back	gasket	Filter		
Number	5	856	857	7	11	858	859	8	39	860	861	38	862		
Before (1)															
Before (2)															
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Before (5)	61,5046	0,1230	0,1230	34,3281	93,7233	0,1227	0,1228	35,7981	110,2781	0,1230	0,1263	35,4399	0,1227	2019-02-26	17:00
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After (1)	61,5048	0,1247	0,1226	34,3296	93,7237	0,1226	0,1223	35,8003	110,2785	0,1248	0,1256	35,4418	0,1228	2019-02-27	13:00
After (2)	61,5047	0,1245	0,1226	34,3288	93,7235	0,1225	0,1223	35,7997	110,2783	0,1247	0,1256	35,4415	0,1228		
After (3)															
After (4)															
After (5)															
After (6)	61,5047	0,1245	0,1230	34,3282	93,7235	0,1227	0,1227	35,7993	110,2783	0,1247	0,1264	35,4407	0,1228		
Difference	0,0001	0,0016	0,0000	0,0000	0,0001	0,0000	0,0000	0,0011	0,0001	0,0018	0,0000	0,0009	0,0001		
Total (mg)		1,7				2,9				2,8			0,1		
Total ajusté (mg)		**1,60**				**2,80**				**2,70**					

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negative filter weight rounded to zero for démonstration emission rate 2,1g/hr

*		*	*	*	*	*1	*2	*3	*4	*5	*6	*7	*8	Mass flow 1	DGM 1	DGM 1	Filter 1	Mass flow 2	DGM 2	DGM 2	Filter 2	Tunnel Velo
Elapsed		Weight				Flue	Room	Tunnel	Unit	Unit	Unit	Unit	Unit	Reading	Inlet T	Outlet T	Temp	Reading	Inlet T	Outlet T	Temp	Pressure
Time	Raw data row	Remaining	CO	CO_2	O_2	Gas	Temp	Dry Bulb	Top	Back	R.Side	L.Side	Bottom									in wc
min		lbs	%	%	%	°F	°F	°F	°F	°F	°F	°F	°F	cuft/min	oF	oF	oF	cuft/min	oF	oF	oF	in wc
0,00	121,00	10,8	0,3	5,5	0,0	421,2	71,7	139,1	484,8	362,2	570,1	597,4	233,2	0,19	76,08	75,59	73,77	0,18	76,25	75,76	74,03	0,05
1,0	122,0	10,6	0,2	2,2	0,0	509,6	71,0	123,1	488,1	365,1	545,0	573,9	237,9	0,19	76,10	75,53	73,89	0,18	76,27	75,66	74,28	0,05
2,0	123,0	9,9	0,2	6,0	0,0	518,2	71,5	115,1	501,9	368,3	529,1	569,1	242,9	0,19	76,02	75,44	73,96	0,18	76,20	75,59	74,41	0,06
3,0	124,0	9,7	0,4	7,8	0,0	522,7	71,1	114,2	511,7	371,0	520,7	580,3	247,8	0,19	75,95	75,35	74,10	0,18	76,18	75,52	74,55	0,05
4,0	125,0	9,5	0,2	8,3	0,0	542,3	71,3	115,0	519,6	372,4	527,1	596,2	252,4	0,19	75,91	75,28	74,27	0,18	76,13	75,48	74,73	0,05
5,0	126,0	9,3	0,2	9,7	0,0	548,3	71,3	115,3	530,4	373,0	537,7	606,7	256,5	0,19	75,90	75,26	74,39	0,18	76,12	75,43	74,89	0,05
6,0	127,0	9,1	0,1	9,3	0,0	555,2	71,8	116,7	539,2	373,5	552,9	618,9	260,3	0,19	75,83	75,23	74,60	0,18	76,07	75,40	75,11	0,05
7,0	128,0	8,9	0,1	9,5	0,0	562,3	71,8	117,5	545,8	373,6	568,7	629,6	263,8	0,19	75,81	75,17	74,87	0,18	76,01	75,36	75,30	0,05
8,0	129,0	8,7	0,1	9,7	0,0	569,0	71,2	117,9	553,5	374,1	582,1	640,2	266,8	0,19	75,82	75,16	75,09	0,18	76,01	75,35	75,51	0,05
9,0	130,0	8,5	0,1	10,1	0,0	574,0	71,2	118,1	560,8	373,6	596,1	652,6	269,9	0,19	75,91	75,15	75,38	0,18	76,03	75,36	75,73	0,05
10,0	131,0	8,3	0,1	10,4	0,0	576,7	71,9	118,0	566,3	373,4	604,3	661,7	272,5	0,19	75,76	75,08	75,58	0,18	75,92	75,33	75,96	0,05
11,0	132,0	8,1	0,1	10,1	0,0	578,9	72,7	118,7	571,9	372,4	613,2	669,6	275,1	0,19	75,81	75,06	75,75	0,18	75,91	75,31	76,18	0,05
12,0	133,0	7,9	0,1	10,2	0,0	578,8	72,7	118,9	576,0	371,8	620,3	676,8	277,4	0,19	75,87	75,04	75,99	0,18	75,94	75,31	76,39	0,05
13,0	134,0	7,7	0,1	9,9	0,0	580,2	70,6	118,5	580,4	368,3	626,1	682,6	279,3	0,19	75,95	75,04	76,22	0,18	75,98	75,34	76,66	0,05
14,0	135,0	7,5	0,1	9,9	0,0	583,9	69,1	119,6	582,7	370,5	637,2	689,4	281,2	0,19	75,84	75,01	76,44	0,18	75,95	75,35	76,80	0,05
15,0	136,0	7,3	0,1	10,4	0,0	581,9	69,8	118,8	583,0	371,1	650,0	696,2	283,0	0,19	75,65	74,98	76,54	0,18	75,83	75,28	76,96	0,05
16,0	137,0	7,1	0,1	10,2	0,0	581,0	70,5	118,5	584,0	371,3	660,3	703,0	284,7	0,19	75,59	74,96	76,76	0,18	75,75	75,27	77,13	0,05
17,0	138,0	6,9	0,1	10,1	0,0	581,0	71,1	118,3	582,5	369,7	670,6	709,1	286,3	0,19	75,59	74,95	76,93	0,18	75,69	75,25	77,30	0,05
18,0	139,0	6,8	0,1	10,1	0,0	581,3	71,5	118,3	581,3	370,0	681,9	715,0	287,8	0,19	75,64	74,97	77,07	0,18	75,71	75,23	77,50	0,05
19,0	140,0	6,6	0,1	10,2	0,0	580,3	72,1	118,3	581,1	371,6	692,3	719,9	289,2	0,19	75,70	74,94	77,28	0,18	75,71	75,26	77,68	0,05
20,0	141,0	6,4	0,1	10,1	0,0	580,1	72,4	117,7	581,1	372,1	700,1	722,5	290,2	0,19	75,69	74,91	77,50	0,18	75,74	75,26	77,87	0,05
21,0	142,0	6,2	0,1	10,1	0,0	582,5	72,1	117,8	582,5	371,5	707,4	724,4	291,2	0,19	75,70	74,90	77,66	0,18	75,74	75,28	78,09	0,05
22,0	143,0	6,1	0,1	10,3	0,0	583,4	72,3	117,4	583,9	374,2	714,0	729,5	292,2	0,19	75,80	74,91	77,92	0,18	75,76	75,30	78,28	0,05
23,0	144,0	5,9	0,1	10,3	0,0	582,2	72,2	117,1	584,4	374,7	720,4	732,8	293,3	0,19	75,68	74,85	78,10	0,18	75,65	75,30	78,44	0,05
24,0	145,0	5,7	0,1	10,2	0,0	582,0	71,8	117,0	584,4	375,7	726,9	736,0	294,3	0,19	75,63	74,83	78,25	0,18	75,56	75,28	78,64	0,05
25,0	146,0	5,5	0,1	10,3	0,0	581,5	72,4	116,3	585,5	376,8	733,7	738,2	295,1	0,19	75,65	74,80	78,42	0,18	75,53	75,27	78,82	0,05
26,0	147,0	5,3	0,1	10,3	0,0	579,8	72,2	116,5	585,7	377,6	739,7	742,9	296,0	0,19	75,62	74,76	78,57	0,18	75,47	75,25	79,00	0,05
27,0	148,0	5,2	0,1	10,2	0,0	579,8	72,1	116,8	586,3	378,3	746,4	745,8	296,7	0,19	75,61	74,74	78,70	0,18	75,42	75,24	79,14	0,05
28,0	149,0	5,0	0,1	10,3	0,0	580,9	72,5	116,5	585,8	379,3	755,1	750,0	297,6	0,19	75,68	74,72	78,88	0,18	75,46	75,24	79,30	0,05
29,0	150,0	4,8	0,1	10,4	0,0	582,5	72,1	116,6	588,2	380,1	759,6	754,9	298,4	0,19	75,75	74,69	78,97	0,18	75,47	75,26	79,40	0,05
30,0	151,0	4,7	0,1	10,5	0,0	582,9	72,5	116,8	588,7	381,6	766,7	759,0	299,2	0,19	75,76	74,68	79,14	0,18	75,48	75,26	79,58	0,05
31,0	152,0	4,5	0,1	10,7	0,0	584,2	72,3	116,4	593,6	382,1	773,2	762,8	299,9	0,19	75,78	74,65	79,23	0,18	75,48	75,23	79,71	0,05
32,0	153,0	4,3	0,1	10,8	0,0	582,0	72,0	115,8	594,7	382,8	781,7	764,6	300,6	0,19	75,87	74,67	79,31	0,18	75,54	75,25	79,81	0,05
33,0	154,0	4,2	0,1	10,5	0,0	575,5	72,0	115,1	593,0	382,9	782,6	761,8	301,3	0,19	76,00	74,69	79,41	0,18	75,60	75,25	79,94	0,05
34,0	155,0	4,1	0,0	9,8	0,0	570,0	73,3	114,4	590,9	383,6	781,3	760,1	302,0	0,19	76,20	74,73	79,45	0,18	75,72	75,27	80,01	0,05
35,0	156,0	4,0	0,0	9,4	0,0	564,1	74,0	114,8	587,7	385,9	775,2	756,3	302,9	0,19	76,37	74,76	79,55	0,18	75,83	75,30	80,12	0,05
36,0	157,0	3,8	0,0	9,1	0,0	559,6	73,5	114,2	584,3	386,4	770,1	754,2	303,8	0,19	76,46	74,76	79,66	0,18	75,91	75,35	80,24	0,05
37,0	158,0	3,8	0,0	9,0	0,0	553,1	74,0	113,6	578,2	388,4	765,5	751,4	304,7	0,19	76,38	74,78	79,71	0,18	75,90	75,39	80,34	0,05
38,0	159,0	3,6	0,0	8,7	0,0	542,7	74,1	112,3	571,6	389,4	758,5	749,0	305,4	0,19	76,38	74,76	79,75	0,18	75,85	75,39	80,43	0,05
39,0	160,0	3,6	0,0	7,9	0,0	531,7	73,5	111,4	564,7	390,3	749,8	746,4	306,2	0,19	76,42	74,75	79,82	0,18	75,88	75,40	80,49	0,05
40,0	161,0	3,4	0,0	7,4	0,0	519,7	74,8	110,4	555,0	393,3	741,4	742,3	307,1	0,19	76,51	74,80	79,87	0,18	75,93	75,42	80,55	0,05
41,0	162,0	3,4	0,1	6,9	0,0	506,2	73,6	108,1	545,1	394,2	731,7	736,8	307,8	0,19	76,48	74,81	79,86	0,18	75,88	75,42	80,60	0,05
42,0	163,0	3,3	0,1	6,2	0,0	492,8	73,3	107,7	531,2	395,3	720,3	729,8	308,5	0,19	76,44	74,83	79,85	0,18	75,91	75,45	80,62	0,05
43,0	164,0	3,3	0,2	5,6	0,0	481,3	73,5	106,5	518,6	395,7	711,6	722,2	309,2	0,19	76,44	74,83	79,82	0,18	75,90	75,43	80,65	0,05
44,0	165,0	3,3	0,3	5,3	0,0	471,8	73,5	105,5	505,6	396,9	702,7	714,5	309,9	0,19	76,47	74,83	79,88	0,18	75,90	75,46	80,69	0,05
45,0	166,0	3,2	0,3	5,1	0,0	462,8	73,7	104,6	493,4	396,2	693,2	706,0	310,6	0,19	76,37	74,85	79,86	0,18	75,86	75,45	80,71	0,05
46,0	167,0	3,1	0,4	4,9	0,0	455,3	73,8	103,5	482,8	397,1	684,8	698,2	311,3	0,19	76,33	74,86	79,92	0,18	75,88	75,48	80,70	0,05
47,0	168,0	3,1	0,4	4,7	0,0	447,9	72,1	103,0	471,8	396,4	676,3	689,6	311,9	0,19	76,14	74,86	79,93	0,18	75,81	75,50	80,70	0,05
48,0	169,0	3,1	0,5	4,6	0,0	441,1	72,7	101,5	460,8	394,5	667,2	682,2	312,5	0,19	75,94	74,82	79,90	0,18	75,65	75,47	80,71	0,06
49,0	170,0	3,0	0,5	4,5	0,0	434,0	72,9	102,0	453,1	394,7	658,7	674,8	313,1	0,19	75,85	74,80	79,82	0,18	75,59	75,45	80,66	0,05
50,0	171,0	2,9	0,5	4,4	0,0	427,7	72,8	101,0	442,5	393,4	648,1	668,2	313,6	0,19	75,77	74,78	79,77	0,18	75,49	75,43	80,63	0,05
51,0	172,0	2,9	0,5	4,2	0,0	421,5	73,1	100,2	435,1	391,8	640,8	661,4	314,1	0,19	75,66	74,75	79,70	0,18	75,38	75,41	80,58	0,06
52,0	173,0	2,9	0,6	4,2	0,0	415,6	72,9	99,9	427,0	389,3	632,0	655,7	314,5	0,19	75,54	74,72	79,59	0,18	75,30	75,39	80,52	0,05
53,0	174,0	2,8	0,6	4,1	0,0	410,2	72,7	99,6	420,6	388,8	623,0	648,9	315,0	0,19	75,48	74,69	79,59	0,18	75,22	75,36	80,48	0,05
54,0	175,0	2,8	0,6	4,0	0,0	405,1	72,9	99,0	414,1	388,0	615,1	641,8	315,4	0,19	75,37	74,68	79,53	0,18	75,12	75,36	80,42	0,05
55,0	176,0	2,8	0,7	3,8	0,0	398,5	72,7	98,4	406,7	387,0	606,1	634,8	315,7	0,19	75,33	74,64	79,44	0,18	75,10	75,34	80,35	0,05
56,0	177,0	2,7	0,7	3,6	0,0	394,1	72,4	97,8	399,8	384,0	599,8	627,1	316,0	0,19	75,22	74,63	79,37	0,18	75,04	75,31	80,27	0,05
57,0	178,0	2,6	0,7	3,6	0,0	390,2	72,4	97,4	393,1	383,0	594,2	619,6	316,3	0,19	75,15	74,62	79,27	0,18	74,98	75,29	80,20	0,05
58,0	179,0	2,6	0,7	3,6	0,0	383,9	72,4	97,3	387,0	380,9	588,1	610,7	316,5	0,19	75,05	74,57	79,12	0,18	74,87	75,27	80,14	0,05
59,0	180,0	2,6	0,8	3,4	0,0	378,3	72,1	96,4	380,6	379,7	581,6	602,8	316,5	0,19	74,89	74,53	79,05	0,18	74,75	75,24	80,07	0,05
60,0	181,0	2,5	0,8	3,5	0,0	374,7	71,9	95,4	374,8	376,4	576,4	596,0	316,5	0,19	74,81	74,51	74,79	0,18	74,67	75,21	79,99	0,05
61,0	182,0	2,5	0,8	3,5	0,0	372,0	71,9	95,7	369,7	374,7	573,5	590,7	316,5	0,19	74,88	74,53	74,94	0,18	74,71	75,21	79,91	0,05
62,0	183,0	2,4	0,8	3,7	0,0	370,5	72,2	95,8	365,0	373,5	568,4	586,3	316,4	0,19	74,85	74,51	75,01	0,18	74,69	75,23	79,83	0,05
63,0	184,0	2,3	0,8	3,8	0,0	368,9	72,0	95,2	361,0	374,0	565,4	582,6	316,2	0,19	74,81	74,51	75,06	0,18	74,68	75,21	79,77	0,05
64,0	185,0	2,3	0,8	3,9	0,0	369,0	72,1	95,5	357,8	372,9	562,0	580,1	316,1	0,19	74,78	74,50	75,12	0,18	74,63	75,20	79,68	0,05
65,0	186,0	2,3	0,7	4,2	0,0	370,4	71,6	95,3	354,2	372,0	562,1	577,1	315,9	0,19	74,85	74,48	75,19	0,18	74,69	75,20	79,59	0,05
66,0	187,0	2,2	0,7	4,4	0,0	372,3	72,0	95,7	352,1	371,9	562,0	575,6	315,5	0,19	74,83	74,47	75,25	0,18	74,65	75,20	79,51	0,05
67,0	188,0	2,1	0,7	4,6	0,0	375,8	72,1	96,0	350,3	373,2	561,9	574,0	315,3	0,19	74,91	74,48	75,34	0,18	74,65	75,19	79,47	0,05
68,0	189,0	2,1	0,6	4,7	0,0	377,6	72,3	96,4	351,2	374,3	563,0	572,4	314,9	0,19	74,96	74,46	75,44	0,18	74,66	75,18	79,39	0,05
69,0	190,0	2,0	0,6	4,8	0,0	378,9	72,3	96,3	351,4	374,5	564,6	570,8	314,6	0,19	75,00	74,46	75,51	0,18	74,67	75,16	79,31	0,05
70,0	191,0	2,0	0,6	4,8	0,0	378,9	72,1	96,0	350,8	375,5	565,5	570,6	314,3	0,19	75,09	74,48	75,64	0,18	74,76	75,19	79,26	0,05
71,0	192,0	1,9	0,6	4,7	0,0	377,4	71,6	95,8	350,0	375,1	564,8	568,6	313,7	0,19	75,19	74,50	75,75	0,18	74,81	75,20	79,22	0,05
72,0	193,0	1,8	0,6	4,5	0,0	378,0	71,3	95,6	350,6	376,7	564,3	567,2	313,4	0,19	75,17	74,50	75,85	0,18	74,83	75,19	79,14	0,05
73,0	194,0	1,8	0,5	4,6	0,0	376,8	71,6	95,7	349,7	377,4	563,9	566,2	313,1	0,19	75,17	74,51	75,93	0,18	74,87	75,20	79,10	0,05
74,0	195,0	1,7	0,5	4,5	0,0	376,2	71,8	95,9	349,6	378,2	562,7	564,9	312,6	0,19	75,06	74,50	76,03	0,18	74,86	75,17	79,04	0,05
75,0	196,0	1,7	0,5	4,5	0,0	375,8	71,8	95,8	349,2	378,6	561,2	563,2	312,2	0,19	75,02	74,51	76,11	0,18	74,87	75,18	78,96	0,05
76,0	197,0	1,6	0,5	4,5	0,0	374,7	72,0	95,4	349,0	378,5	561,0	562,2	311,8	0,19	75,09	74,52	76,23	0,18	74,91	75,19	78,92	0,05
77,0	198,0	1,6	0,5	4,4	0,0	373,6	72,3	94,9	348,3	377,6	559,7	559,6	311,4	0,19	75,07	74,51	76,30	0,18	74,90	75,20	78,85	0,05
78,0	199,0	1,5	0,5	4,3	0,0	372,5	71,7	95,6	347,7	379,2	556,6	558,5	310,9	0,19	75,04	74,52	76,36	0,18	74,94	75,19	78,78	0,05
79,0	200,0	1,5	0,5	4,3	0,0	371,8	72,1	95,3	346,8	377,7	556,4	557,2	310,5	0,19	74,98	74,50	76,46	0,18	74,92	75,19	78,74	0,05
80,0	201,0	1,4	0,5	4,3	0,0	370,7	72,1	94,7	345,6	378,6	554,5	555,8	309,9	0,19	74,99	74,52	76,55	0,18	74,90	75,19	78,72	0,05
81,0	202,0	1,4	0,5	4,3	0,0	369,6	71,8	94,8	345,0	376,4	554,3	554,9	309,5	0,19	75,01	74,53	76,63	0,18	74,89	75,19	78,65	0,05
82,0	203,0	1,3	0,5	4,2	0,0	368,4	72,0	94,7	343,5	378,4	551,0	552,5	309,0	0,19	74,95	74,51	76,69	0,18	74,90	75,20	78,61	0,05
83,0	204,0	1,3	0,5	4,2	0,0	367,6	72,3	94,4	341,5	378,8	549,5	551,9	308,5	0,19	75,10	74,56	76,79	0,18	74,98	75,18	78,57	0,05
84,0	205,0	1,2	0,5	4,2	0,0	366,9	72,5	94,7	340,4	379,1	548,1	550,8	308,1	0,19	75,12	74,55	76,88	0,18	74,95	75,18	78,51	0,05
85,0	206,0	1,2	0,5	4,2	0,0	367,0	72,6	94,6	339,0	380,1	545,8	549,7	307,6	0,19	75,21	74,56	76,99	0,18	74,94	75,17	78,48	0,05
86,0	207,0	1,1	0,5	4,2	0,0	368,0	72,2	95,1	339,1	380,7	544,8	548,7	307,1	0,19	75,27	74,59	77,06	0,18	74,98	75,19	78,43	0,05
87,0	208,0	1,1	0,5	4,2	0,0	368,7	72,3	95,1	339,1	381,2	544,1	548,4	306,7	0,19	75,26	74,60	77,13	0,18	75,03	75,20	78,39	0,05
88,0	209,0	1,0	0,5	4,3	0,0	369,5	72,0	95,1	339,1	381,7	543,9	546,9	306,2	0,19	75,38	74,62	77,21	0,18	75,07	75,22	78,40	0,05

89,0	210,0	1,0	0,4	4,3	0,0	368,1	72,2	94,6	337,6	380,8	545,2	545,9	305,7	0,19	75,50	74,63	77,27	0,18	75,11	75,24	78,38	0,05
90,0	211,0	1,0	0,5	4,2	0,0	364,4	72,0	95,1	335,7	380,4	542,0	543,9	305,2	0,19	75,64	74,67	77,35	0,18	75,17	75,26	78,38	0,05
91,0	212,0	0,9	0,5	4,0	0,0	360,4	71,9	94,3	333,7	381,0	540,0	541,0	304,8	0,19	75,84	74,72	77,45	0,18	75,30	75,26	78,33	0,06
92,0	213,0	0,8	0,6	3,7	0,0	356,9	72,2	94,4	332,2	380,3	534,5	536,1	304,3	0,19	75,92	74,76	77,51	0,18	75,32	75,26	78,32	0,05
93,0	214,0	0,8	0,7	3,6	0,0	354,7	72,6	93,8	331,6	380,4	529,1	532,1	303,8	0,19	76,03	74,78	77,60	0,18	75,36	75,27	78,31	0,05
94,0	215,0	0,8	0,6	3,6	0,0	352,4	72,8	94,0	329,9	380,1	524,4	527,7	303,2	0,19	76,11	74,80	77,68	0,18	75,44	75,26	78,28	0,05
95,0	216,0	0,8	0,6	3,5	0,0	349,5	72,8	93,5	328,7	379,7	519,8	523,5	302,8	0,19	76,25	74,83	77,75	0,18	75,55	75,29	78,29	0,05
96,0	217,0	0,7	0,7	3,4	0,0	344,9	72,7	93,5	326,1	380,7	514,7	520,3	302,4	0,19	76,37	74,88	77,82	0,18	75,68	75,32	78,28	0,05
97,0	218,0	0,7	0,8	3,2	0,0	340,5	72,6	93,1	323,3	380,7	509,4	516,3	302,0	0,19	76,43	74,95	77,89	0,18	75,80	75,37	78,30	0,05
98,0	219,0	0,7	0,8	3,1	0,0	336,8	72,7	92,6	320,0	379,5	504,6	512,8	301,5	0,19	76,42	74,96	77,96	0,18	75,80	75,39	78,28	0,05
99,0	220,0	0,7	0,9	3,1	0,0	333,4	72,4	92,5	316,7	379,8	501,2	509,1	301,0	0,19	76,47	75,01	78,04	0,18	75,85	75,42	78,27	0,05
100,0	221,0	0,6	0,9	3,0	0,0	331,1	73,0	92,3	313,3	379,0	497,9	506,0	300,7	0,19	76,65	75,09	78,06	0,18	76,00	75,47	78,26	0,05
101,0	222,0	0,6	0,9	3,1	0,0	328,3	72,9	92,0	310,7	379,5	494,4	502,3	300,3	0,19	76,81	75,16	78,16	0,18	76,11	75,52	78,26	0,05
102,0	223,0	0,6	0,9	3,0	0,0	326,1	73,1	91,8	309,1	378,1	491,5	499,6	299,8	0,19	76,67	75,19	78,21	0,18	76,16	75,54	78,26	0,05
103,0	224,0	0,5	0,9	3,0	0,0	324,1	73,2	92,1	306,5	376,9	489,1	496,7	299,5	0,19	76,57	75,18	78,23	0,18	76,10	75,56	78,24	0,05
104,0	225,0	0,5	0,9	3,0	0,0	321,9	72,4	91,7	304,0	376,3	486,4	494,3	299,2	0,19	76,55	75,24	78,26	0,18	76,07	75,57	78,23	0,05
105,0	226,0	0,5	0,9	3,0	0,0	320,0	72,0	91,9	301,1	374,1	483,2	491,8	298,7	0,19	76,75	75,29	78,33	0,18	76,16	75,59	78,23	0,06
106,0	227,0	0,5	1,0	3,0	0,0	319,3	71,9	92,4	300,1	375,4	480,1	489,1	298,4	0,19	76,90	75,37	78,36	0,18	76,21	75,59	78,22	0,05
107,0	228,0	0,5	1,0	3,0	0,0	317,7	70,7	92,1	297,9	375,3	477,8	487,1	298,1	0,19	76,80	75,40	78,38	0,18	76,20	75,60	78,21	0,05
108,0	229,0	0,4	1,0	3,0	0,0	316,3	71,1	91,9	295,7	374,8	475,0	485,1	297,8	0,19	76,69	75,44	78,37	0,18	76,16	75,61	78,16	0,05
109,0	230,0	0,4	1,0	2,9	0,0	315,3	71,4	91,8	293,9	374,4	473,6	482,8	297,5	0,19	76,73	75,50	78,39	0,18	76,21	75,59	78,15	0,05
110,0	231,0	0,4	1,0	2,9	0,0	313,6	71,5	91,3	291,8	373,8	471,4	481,0	297,2	0,19	76,79	75,55	78,40	0,18	76,21	75,61	78,11	0,05
111,0	232,0	0,4	1,0	2,9	0,0	312,2	71,6	90,5	289,7	373,3	469,7	478,6	296,7	0,19	76,90	75,63	78,46	0,18	76,24	75,61	78,09	0,05
112,0	233,0	0,3	1,0	2,9	0,0	311,0	72,1	90,4	287,5	371,7	467,4	476,7	296,4	0,19	77,04	75,65	78,50	0,18	76,30	75,65	78,07	0,05
113,0	234,0	0,3	1,0	2,9	0,0	310,3	71,7	90,7	286,3	372,2	466,3	475,2	295,9	0,19	77,06	75,69	78,49	0,18	76,32	75,61	78,04	0,05
114,0	235,0	0,3	1,0	2,9	0,0	309,3	71,7	90,7	284,7	371,4	463,0	473,1	295,5	0,19	76,98	75,70	78,52	0,18	76,33	75,63	77,99	0,05
115,0	236,0	0,3	1,0	2,9	0,0	308,6	71,6	90,2	283,5	370,5	462,5	471,1	295,0	0,19	77,06	75,73	78,52	0,18	76,33	75,62	77,96	0,05
116,0	237,0	0,2	1,0	2,9	0,0	307,7	72,0	90,3	282,6	369,4	460,6	470,0	294,6	0,19	77,09	75,75	78,55	0,18	76,35	75,59	77,94	0,05
117,0	238,0	0,2	1,0	2,9	0,0	306,5	72,1	90,3	281,5	368,3	459,7	468,2	294,2	0,19	77,05	75,78	78,49	0,18	76,36	75,62	77,91	0,05
118,0	239,0	0,2	1,0	2,9	0,0	306,6	72,0	90,1	279,8	368,9	458,2	466,4	293,5	0,19	76,93	75,79	78,53	0,18	76,35	75,64	77,89	0,05
119,0	240,0	0,2	1,0	2,9	0,0	305,6	72,2	90,1	279,4	369,0	455,4	465,0	293,1	0,19	76,86	75,78	78,49	0,18	76,34	75,65	77,89	0,05
120,0	241,0	0,2	1,0	2,9	0,0	304,8	71,9	90,0	278,4	368,4	454,2	463,4	292,7	0,19	76,80	75,79	78,52	0,18	76,30	75,67	77,88	0,05
121,0	242,0	0,1	1,0	2,9	0,0	303,8	72,2	89,6	277,5	367,8	452,7	462,2	292,2	0,19	76,79	75,81	78,51	0,18	76,30	75,66	77,84	0,05
122,0	243,0	0,1	1,0	2,8	0,0	302,4	72,5	89,7	275,5	367,6	450,7	460,5	291,7	0,19	76,72	75,81	78,54	0,18	76,24	75,65	77,83	0,05
123,0	244,0	0,1	1,1	2,8	0,0	301,2	72,5	89,4	274,5	366,7	448,7	459,6	291,1	0,19	76,79	75,80	78,52	0,18	76,30	75,68	77,83	0,05
124,0	245,0	0,0	1,1	2,8	0,0	300,7	72,9	89,3	273,5	365,3	446,7	458,6	290,6	0,19	76,89	75,83	78,50	0,18	76,36	75,71	77,77	0,05

SFBA EPA EMISSION RESULTS

Test Duration: **124** min

PRESSURE FACTOR:	DGM 1	0,95574	
	DGM 2	0,95711	
	DGM 3	0,98351	
TEMPERATURE FACTORS	DGM 1	0,98617	
	DGM 2	0,98604	
	DGM 3	0,99207	
VOLUMES SAMPLED	DGM 1	22,926	SCft
	DGM 2	21,823	Scft
	DGM 3	32,548	SCft

TOTAL TUNNEL VOLUME : 35577

SAMPLE RATIOS

Sample Train 1:	1551,840
Sample Train 2:	1630,297

Paticulate concentration

Sample Train 1	**0,000126**	g/dscf
Sample Train 2	**0,000128**	g/dscf
Room	**0,000003**	g/dscf

TOTAL EMISSIONS

Sample Train 1	**4,39**	g
Sample Train 2	**4,46**	g

EMISSION RATES

Sample Train 1	**2,12**	g/hr
Sample Train 2	**2,16**	g/hr

1st hour emission rate **2,95** g/hr

	Train 1	Train 2
Cs	0,0001265	0,000128308

RESULTS

Average emission rate: 2,1 g/hr

Burn Rate : 1,968 Dry kg/hr

BAROMETRIC PRESSURE

Average:	29,426634	in Hg
Start:	29,293749	in Hg
End:	29,559519	in Hg

DGM CONTROLLER VALUES

DGM 1	Final:	30381,355	Cuft
	Initial:	30357,274	Cuft
DGM 2	Final:	28626,207	Cuft
	Initial:	28602,786	Cuft
DGM #3	Final:	880,790	Cuft
	Initial:	847,290	Cuft

TEMPERATURES

DGM 1	535,407	°R
DGM 2	535,477	°R

CALIBRATION FACTORS

DGM 1	1,0101
DGM 2	0,9873
DGM #3	0,9958

TUNNEL FLOW RATE: 286,913 Dscfm

PARTICULATE CATCH

Total Sample Train 1:	2,90	mg
Total Sample Train 2:	2,80	mg
Total Sample Train 1 1st hour:	1,90	mg

DEVIATION: 0,73%

Manufacturer: INVICTA
Model: KAZAN

Run: 2
Project #: PI 20182
Test Duration: 124 min

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

	HHV	LHV
Eff	62,35%	67,39%
Comb Eff	95,94%	95,94%
HT Eff	64,99%	70,24%
Output	24 320	kJ/h
Burn Rate	1,97	kg/h
Grams CO	258	g
Input	39 006	kJ/h
MC wet	16,74	

Ultimate CO_2
$CO_{2\text{-ult}}$ 19,64
F_0
1,060

Overall Heating Efficiency: 62,35%
Combustion Efficiency: 95,94%
Heat Transfer Efficiency: 64,99%

Heat Output: 23 070 Btu/h
Heat Input: 37 002 Btu/h
Burn Duration: 2,07 h
Burn Rate: 4,34 lb/h
Stack Temp: 430,6 Deg. F

Averages	0,50	5,68	2,68	20,53	14,61	221,40	22,34	91,5%	64,5%	59,3%
INPUT DATA			Oxygen Calculation			Input Data		Combust	Heat	Net
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO_2 [d]	Excess Air EA	Total O_2	Calc. % O_2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %
0,00	4,89	0,32	5,52	236,9%	20,56	14,88	216,2	22,1	96,2%	66,6%	64,1%
1,00	4,79	0,18	2,21	721,9%	20,78	18,48	265,3	21,7	95,9%	22,1%	21,2%
2,00	4,47	0,22	6,02	214,9%	20,53	14,40	270,1	21,9	97,7%	62,3%	60,9%
3,00	4,39	0,39	7,79	140,2%	20,40	12,42	272,6	21,7	96,4%	67,6%	65,2%
4,00	4,30	0,25	8,28	130,3%	20,38	11,97	283,5	21,8	98,0%	67,9%	66,5%
5,00	4,20	0,17	9,72	98,6%	20,29	10,48	286,8	21,9	98,9%	70,5%	69,7%
6,00	4,11	0,14	9,26	109,0%	20,32	10,99	290,7	22,1	99,1%	69,4%	68,7%
7,00	4,02	0,13	9,49	104,2%	20,30	10,75	294,6	22,1	99,2%	69,5%	68,9%
8,00	3,94	0,12	9,74	99,3%	20,29	10,49	298,4	21,8	99,3%	69,6%	69,2%
9,00	3,84	0,12	10,10	92,2%	20,27	10,10	301,1	21,8	99,3%	70,1%	69,6%
10,00	3,75	0,12	10,36	87,4%	20,25	9,82	302,6	22,2	99,3%	70,4%	69,9%
11,00	3,66	0,09	10,10	92,8%	20,27	10,12	303,9	22,6	99,6%	69,9%	69,6%
12,00	3,57	0,09	10,15	91,8%	20,26	10,07	303,8	22,6	99,5%	70,0%	69,7%
13,00	3,48	0,07	9,94	96,2%	20,28	10,30	304,5	21,4	99,7%	69,5%	69,3%
14,00	3,39	0,06	9,94	96,3%	20,28	10,30	306,6	20,6	99,8%	69,3%	69,2%
15,00	3,30	0,08	10,42	87,2%	20,25	9,79	305,5	21,0	99,6%	70,2%	70,0%
16,00	3,21	0,06	10,21	91,2%	20,26	10,02	305,0	21,4	99,8%	69,9%	69,8%
17,00	3,12	0,06	10,09	93,4%	20,27	10,14	305,0	21,7	99,8%	69,8%	69,6%
18,00	3,07	0,06	10,14	92,6%	20,27	10,09	305,2	21,9	99,8%	69,9%	69,7%
19,00	2,98	0,08	10,22	90,8%	20,26	10,00	304,6	22,3	99,7%	70,0%	69,8%
20,00	2,89	0,06	10,13	92,8%	20,27	10,11	304,5	22,4	99,8%	69,9%	69,8%
21,00	2,80	0,06	10,08	93,9%	20,27	10,17	305,8	22,3	99,8%	69,7%	69,6%
22,00	2,75	0,06	10,29	89,7%	20,26	9,94	306,3	22,4	99,8%	70,0%	69,9%
23,00	2,67	0,06	10,27	90,1%	20,26	9,95	305,7	22,3	99,8%	70,1%	69,9%
24,00	2,58	0,06	10,24	90,7%	20,26	9,99	305,6	22,1	99,8%	70,0%	69,9%
25,00	2,49	0,06	10,26	90,5%	20,26	9,97	305,3	22,4	99,8%	70,1%	69,9%
26,00	2,39	0,05	10,26	90,5%	20,26	9,97	304,3	22,3	99,8%	70,1%	70,0%
27,00	2,35	0,05	10,23	91,1%	20,26	10,01	304,3	22,3	99,8%	70,1%	70,0%
28,00	2,26	0,06	10,34	88,9%	20,25	9,89	304,9	22,5	99,8%	70,2%	70,1%
29,00	2,17	0,07	10,43	87,0%	20,25	9,78	305,8	22,3	99,7%	70,3%	70,1%
30,00	2,13	0,08	10,55	84,9%	20,24	9,65	306,1	22,5	99,6%	70,5%	70,2%
31,00	2,03	0,10	10,73	81,5%	20,23	9,45	306,8	22,4	99,5%	70,7%	70,3%
32,00	1,94	0,10	10,79	80,4%	20,22	9,38	305,6	22,2	99,5%	70,9%	70,5%
33,00	1,90	0,08	10,53	85,2%	20,24	9,67	301,9	22,2	99,6%	70,7%	70,5%
34,00	1,85	0,04	9,84	98,7%	20,29	10,43	298,9	23,0	99,9%	69,9%	69,8%
35,00	1,81	0,04	9,38	108,6%	20,32	10,92	295,6	23,3	100,0%	69,3%	69,3%
36,00	1,71	0,03	9,09	115,2%	20,34	11,23	293,1	23,1	100,0%	69,0%	69,0%
37,00	1,71	0,04	8,96	118,3%	20,35	11,37	289,5	23,4	100,0%	69,0%	69,0%
38,00	1,64	0,04	8,70	124,7%	20,36	11,64	283,7	23,4	100,0%	68,9%	68,9%
39,00	1,62	0,02	7,87	148,8%	20,42	12,54	277,6	23,1	100,2%	67,6%	67,7%
40,00	1,54	0,03	7,43	163,5%	20,45	13,01	270,9	23,8	100,2%	67,1%	67,2%
41,00	1,54	0,06	6,87	183,5%	20,48	13,59	263,4	23,1	99,8%	66,2%	66,0%
42,00	1,50	0,11	6,17	212,6%	20,53	14,30	256,0	23,0	99,2%	64,6%	64,1%
43,00	1,49	0,22	5,56	240,1%	20,56	14,89	249,6	23,1	97,6%	62,9%	61,4%
44,00	1,49	0,28	5,26	254,5%	20,57	15,17	244,3	23,1	96,6%	62,2%	60,1%
45,00	1,45	0,33	5,06	264,5%	20,58	15,36	239,3	23,1	95,7%	61,9%	59,2%
46,00	1,39	0,38	4,88	273,4%	20,59	15,52	235,2	23,2	94,8%	61,5%	58,3%
47,00	1,39	0,42	4,72	282,3%	20,60	15,67	231,1	22,3	94,0%	61,1%	57,5%
48,00	1,39	0,46	4,62	286,8%	20,60	15,76	227,3	22,6	93,3%	61,2%	57,1%
49,00	1,35	0,49	4,50	293,6%	20,61	15,86	223,4	22,7	92,7%	61,1%	56,6%
50,00	1,31	0,53	4,37	300,7%	20,62	15,98	219,8	22,6	91,8%	60,8%	55,8%
51,00	1,31	0,54	4,25	310,1%	20,62	16,10	216,4	22,8	91,5%	60,6%	55,5%
52,00	1,31	0,58	4,15	314,9%	20,63	16,18	213,1	22,7	90,7%	60,5%	54,9%
53,00	1,26	0,59	4,06	322,2%	20,63	16,28	210,1	22,6	90,3%	60,4%	54,6%
54,00	1,26	0,62	3,96	329,2%	20,64	16,37	207,3	22,7	89,7%	60,2%	54,0%
55,00	1,26	0,66	3,83	337,5%	20,64	16,48	203,6	22,6	88,8%	59,9%	53,2%
56,00	1,22	0,71	3,56	360,3%	20,66	16,75	201,2	22,4	87,2%	58,3%	50,9%
57,00	1,17	0,70	3,62	354,6%	20,65	16,68	199,0	22,4	87,5%	59,2%	51,8%
58,00	1,17	0,74	3,59	353,8%	20,65	16,69	195,5	22,4	86,9%	59,6%	51,8%
59,00	1,17	0,79	3,43	365,7%	20,66	16,84	192,4	22,3	85,6%	58,9%	50,4%
60,00	1,13	0,80	3,45	361,8%	20,66	16,81	190,4	22,2	85,4%	59,4%	50,7%
61,00	1,13	0,80	3,51	355,6%	20,66	16,74	188,9	22,2	85,7%	60,1%	51,5%
62,00	1,08	0,78	3,69	339,3%	20,64	16,56	188,0	22,3	86,5%	61,5%	53,2%
63,00	1,03	0,77	3,80	329,7%	20,64	16,45	187,1	22,2	86,9%	62,4%	54,2%
64,00	1,03	0,76	3,95	317,8%	20,63	16,31	187,2	22,3	87,6%	63,3%	55,4%
65,00	1,03	0,72	4,16	302,3%	20,62	16,10	188,0	22,0	88,6%	64,3%	57,0%
66,00	0,99	0,69	4,40	285,7%	20,60	15,86	189,0	22,2	89,5%	65,4%	58,5%
67,00	0,94	0,67	4,55	276,4%	20,60	15,71	191,0	22,3	90,2%	65,9%	59,4%
68,00	0,94	0,60	4,74	267,6%	20,59	15,54	192,0	22,4	91,4%	66,6%	60,9%
69,00	0,90	0,55	4,77	269,2%	20,59	15,54	192,7	22,4	92,1%	66,6%	61,4%
70,00	0,90	0,56	4,81	265,9%	20,59	15,50	192,7	22,3	92,1%	66,8%	61,5%
71,00	0,85	0,56	4,68	274,5%	20,59	15,63	191,9	22,0	91,9%	66,3%	60,9%
72,00	0,81	0,55	4,53	286,9%	20,60	15,80	192,2	21,8	91,8%	65,5%	60,2%
73,00	0,81	0,53	4,57	285,7%	20,60	15,77	191,6	22,0	92,2%	65,8%	60,7%
74,00	0,77	0,52	4,47	293,5%	20,61	15,88	191,2	22,1	92,2%	65,5%	60,4%
75,00	0,77	0,51	4,46	294,9%	20,61	15,89	191,0	22,1	92,2%	65,4%	60,4%
76,00	0,72	0,51	4,45	295,8%	20,61	15,90	190,4	22,2	92,3%	65,5%	60,5%
77,00	0,72	0,52	4,42	297,7%	20,61	15,93	189,8	22,4	92,1%	65,5%	60,3%
78,00	0,67	0,52	4,34	304,3%	20,62	16,02	189,2	22,1	92,0%	65,1%	59,8%
79,00	0,67	0,53	4,33	304,5%	20,62	16,03	188,8	22,3	91,8%	65,1%	59,8%
80,00	0,62	0,52	4,30	307,3%	20,62	16,06	188,2	22,3	91,9%	65,1%	59,8%
81,00	0,62	0,50	4,29	309,6%	20,62	16,08	187,6	22,1	92,1%	65,1%	60,0%
82,00	0,58	0,50	4,25	313,5%	20,63	16,13	186,9	22,2	92,1%	65,0%	59,9%
83,00	0,58	0,50	4,23	315,0%	20,63	16,15	186,4	22,4	92,0%	65,0%	59,8%
84,00	0,54	0,49	4,21	317,9%	20,63	16,18	186,1	22,5	92,2%	64,9%	59,8%
85,00	0,54	0,49	4,17	321,0%	20,63	16,21	186,1	22,5	92,1%	64,7%	59,6%
86,00	0,49	0,48	4,21	318,9%	20,63	16,18	186,6	22,4	92,3%	64,8%	59,9%
87,00	0,49	0,47	4,21	319,7%	20,63	16,19	187,1	22,4	92,5%	64,8%	59,9%
88,00	0,45	0,47	4,29	313,1%	20,63	16,10	187,5	22,2	92,7%	65,1%	60,4%
89,00	0,46	0,44	4,31	312,9%	20,63	16,09	186,7	22,3	93,1%	65,3%	60,8%
90,00	0,45	0,48	4,18	321,5%	20,63	16,21	184,7	22,2	92,3%	64,9%	59,9%
91,00	0,40	0,54	3,97	335,3%	20,64	16,40	182,5	22,2	90,9%	64,1%	58,3%
92,00	0,36	0,62	3,73	351,5%	20,65	16,61	180,5	22,4	89,1%	63,0%	56,2%

93,00	0,36	0,66	3,58	363,6%	20,66	16,75	179,3	22,5	88,2%	62,3%	54,9%
94,00	0,36	0,64	3,58	365,7%	20,66	16,76	178,0	22,6	88,4%	62,5%	55,2%
95,00	0,36	0,65	3,52	371,4%	20,66	16,82	176,4	22,7	88,1%	62,4%	55,0%
96,00	0,31	0,70	3,41	378,5%	20,67	16,91	173,8	22,6	87,0%	62,0%	53,9%
97,00	0,31	0,80	3,19	392,7%	20,68	17,09	171,4	22,6	84,5%	60,8%	51,4%
98,00	0,31	0,84	3,11	396,7%	20,68	17,15	169,3	22,6	83,6%	60,6%	50,7%
99,00	0,31	0,85	3,08	398,8%	20,68	17,17	167,4	22,4	83,3%	60,8%	50,6%
100,00	0,26	0,87	3,05	401,4%	20,68	17,20	166,2	22,8	82,8%	60,8%	50,3%
101,00	0,26	0,88	3,06	399,2%	20,68	17,19	164,6	22,7	82,7%	61,1%	50,6%
102,00	0,26	0,90	3,03	400,8%	20,68	17,21	163,4	22,8	82,3%	61,2%	50,3%
103,00	0,25	0,92	3,00	400,9%	20,68	17,22	162,3	22,9	81,9%	61,2%	50,1%
104,00	0,22	0,93	2,98	402,3%	20,68	17,24	161,1	22,5	81,6%	61,2%	50,0%
105,00	0,22	0,94	2,98	401,6%	20,68	17,24	160,0	22,2	81,4%	61,3%	49,9%
106,00	0,22	0,95	2,97	401,5%	20,68	17,24	159,6	22,1	81,2%	61,3%	49,8%
107,00	0,22	0,98	2,97	398,3%	20,68	17,23	158,7	21,5	80,8%	61,4%	49,6%
108,00	0,17	0,97	2,95	400,8%	20,68	17,24	157,9	21,7	80,8%	61,4%	49,6%
109,00	0,17	0,99	2,94	399,6%	20,68	17,24	157,4	21,9	80,4%	61,5%	49,5%
110,00	0,17	1,00	2,92	402,2%	20,68	17,27	156,4	21,9	80,2%	61,5%	49,3%
111,00	0,17	1,00	2,94	399,0%	20,68	17,24	155,7	22,0	80,3%	61,8%	49,6%
112,00	0,13	1,00	2,89	404,1%	20,68	17,29	155,0	22,3	80,0%	61,7%	49,4%
113,00	0,13	1,02	2,90	401,5%	20,68	17,27	154,6	22,1	79,8%	61,7%	49,3%
114,00	0,13	1,02	2,89	402,3%	20,68	17,28	154,0	22,0	79,7%	61,8%	49,2%
115,00	0,13	1,03	2,89	401,1%	20,68	17,28	153,7	22,0	79,5%	61,9%	49,2%
116,00	0,08	1,03	2,90	399,9%	20,68	17,27	153,2	22,2	79,7%	62,1%	49,5%
117,00	0,09	1,04	2,88	401,6%	20,68	17,28	152,5	22,3	79,4%	62,0%	49,3%
118,00	0,08	1,04	2,87	402,8%	20,68	17,29	152,6	22,2	79,3%	61,9%	49,1%
119,00	0,08	1,05	2,88	399,8%	20,68	17,27	152,0	22,3	79,3%	62,2%	49,3%
120,00	0,08	1,04	2,87	402,3%	20,68	17,29	151,5	22,2	79,4%	62,2%	49,3%
121,00	0,04	1,04	2,86	404,1%	20,68	17,31	151,0	22,4	79,3%	62,2%	49,3%
122,00	0,04	1,05	2,83	406,6%	20,68	17,33	150,2	22,5	79,0%	62,2%	49,1%
123,00	0,04	1,06	2,79	411,0%	20,69	17,37	149,6	22,5	78,7%	62,0%	48,8%
124,00	0,00	1,07	2,80	408,3%	20,68	17,35	149,3	22,7	78,6%	62,2%	48,8%

DATA 2019-02-27 EPA PI 20182 RUN 2 SINGLE BURNRATE
unit preburn

Temps	Flue	Room	scale	Tunnel Velocity	Flue draft	Right	Back	bottom	Top	Left
acquisition	temp	temp		Pressure	Pressure					
minutes	°F	°F	lbs	in. Wc	in. Wc	°F	°F	°F	°F	°F
0	71,02	66,69	3,18	0,0579	0,00	66,19	65,87	65,10	67,77	66,09
1	258,60	67,38	2,87	0,0576	0,00	91,19	66,09	65,13	80,67	74,12
2	339,28	67,61	2,67	0,0560	0,00	136,78	66,63	65,18	106,82	97,31
3	346,05	67,96	2,48	0,0560	0,00	157,09	67,17	65,25	136,76	123,29
4	398,31	68,40	2,26	0,0560	0,00	188,07	68,24	65,35	170,75	149,54
5	450,63	68,71	2,07	0,0558	0,00	227,63	70,10	65,53	209,42	180,27
6	467,16	69,15	1,78	0,0551	0,00	265,44	72,70	65,73	244,01	215,93
7	477,33	69,44	1,68	0,0555	0,00	298,60	76,07	65,97	276,66	248,33
8	480,88	69,69	1,47	0,0558	0,00	328,16	80,05	66,23	300,73	276,73
9	470,22	69,36	1,37	0,0551	0,00	352,74	84,39	66,52	318,88	298,47
10	456,94	69,42	1,27	0,0548	0,00	374,18	88,91	66,87	334,00	312,70
11	447,34	69,30	5,52	0,0563	0,00	394,40	93,74	67,21	346,53	322,26
12	454,05	69,70	11,86	0,0538	0,00	412,70	98,86	67,61	353,34	320,28
13	509,72	69,78	11,55	0,0534	0,00	451,60	103,31	68,18	352,31	317,69
14	453,84	69,73	11,45	0,0558	0,00	462,94	107,77	68,86	352,40	313,03
15	424,15	69,75	11,35	0,0553	0,00	459,78	112,55	69,61	351,04	305,00
16	423,16	69,34	11,26	0,0553	0,00	457,45	116,85	70,46	353,94	299,30
17	423,81	69,23	11,16	0,0563	0,00	454,65	120,69	71,43	357,09	294,40
18	408,78	69,40	11,06	0,0563	0,00	449,95	124,30	72,49	357,14	289,69
19	393,03	69,05	10,97	0,0560	0,00	446,39	127,37	73,66	353,55	285,70
20	389,86	69,25	10,85	0,0563	0,00	440,22	130,24	74,93	350,50	284,52
21	388,46	69,13	10,75	0,0558	0,00	433,92	133,49	76,35	350,58	285,35
22	389,54	69,16	10,65	0,0563	0,00	428,09	136,65	77,90	350,11	288,27
23	401,35	69,07	10,56	0,0563	0,00	423,18	139,79	79,52	352,06	295,15
24	413,60	69,42	10,36	0,0558	0,00	418,71	142,40	81,24	358,94	307,22
25	419,03	69,45	10,27	0,0563	0,00	413,51	144,99	83,08	369,72	318,91
26	421,90	69,92	10,17	0,0560	0,00	408,95	147,61	84,98	378,54	328,24
27	436,51	70,08	10,05	0,0555	0,00	406,71	150,62	86,92	389,18	336,97
28	460,33	70,29	9,86	0,0558	0,00	407,25	152,99	88,88	399,66	346,71
29	483,52	69,89	9,66	0,0558	0,00	412,60	155,86	90,89	409,07	356,22
30	490,20	70,10	9,56	0,0548	0,00	419,41	158,03	92,80	418,96	365,24
31	501,73	70,77	9,37	0,0548	0,00	427,06	160,90	94,66	429,57	375,35
32	521,47	70,78	9,16	0,0551	0,00	435,91	163,21	96,53	442,87	390,51
33	526,91	70,84	8,96	0,0556	0,00	447,87	165,60	98,50	454,46	407,86
34	522,29	70,86	8,86	0,0560	0,00	459,31	168,66	100,50	463,04	421,92
35	523,49	70,84	8,67	0,0553	0,00	470,04	171,57	102,50	471,68	432,53
36	525,85	71,06	8,46	0,0553	0,00	478,83	174,19	104,42	480,09	441,74
37	526,92	70,91	8,36	0,0555	0,00	487,11	177,30	106,31	488,79	450,62
38	530,78	70,76	8,17	0,0548	0,00	496,08	180,34	108,15	495,73	459,81
39	532,76	70,81	7,97	0,0558	0,00	505,14	182,72	109,94	502,72	468,55
40	535,98	70,72	7,87	0,0558	0,00	513,84	186,21	111,73	509,94	476,97
41	539,08	70,62	7,66	0,0553	0,00	520,80	189,69	113,56	517,96	485,56
42	541,04	70,74	7,47	0,0554	0,00	529,41	192,56	115,35	522,88	493,99
43	541,90	70,63	7,37	0,0555	0,00	535,09	195,71	117,27	528,43	502,23
44	546,65	70,71	7,18	0,0555	0,00	540,22	199,07	119,23	533,40	510,22
45	550,43	70,38	7,08	0,0551	0,00	546,35	202,42	121,16	537,55	518,61
46	552,32	70,66	6,86	0,0553	0,00	550,60	205,71	123,18	543,02	527,54
47	551,62	70,84	6,67	0,0553	0,00	555,20	208,92	125,34	542,18	538,45
48	543,74	70,92	6,47	0,0553	0,00	561,48	212,93	127,59	535,46	546,29
49	530,81	70,71	6,38	0,0560	0,00	561,68	216,59	129,98	528,55	553,60
50	526,94	70,33	6,28	0,0558	0,00	561,54	220,21	132,29	522,11	556,81
51	531,10	70,73	6,07	0,0551	0,00	562,33	224,26	134,35	520,56	562,49
52	534,15	70,96	5,87	0,0551	0,00	564,52	228,73	136,51	519,37	567,75
53	539,57	71,26	5,77	0,0505	0,00	568,33	232,16	138,69	519,32	573,96
54	539,47	70,42	5,68	0,0498	0,00	571,78	235,74	140,94	521,68	580,70
55	540,16	69,64	5,48	0,0510	0,00	576,50	240,94	143,20	522,60	588,26
56	545,07	70,82	5,36	0,0536	0,00	583,86	245,03	145,48	523,35	594,86
57	546,88	71,17	5,17	0,0560	0,00	593,01	249,50	147,92	525,80	603,49
58	547,81	71,19	4,98	0,0555	0,00	600,44	253,47	150,52	527,80	611,95
59	548,42	72,19	4,88	0,0555	0,00	607,26	258,33	153,13	530,65	618,17
60	551,79	70,90	4,78	0,0553	0,00	611,90	262,26	155,66	536,31	621,44
61	552,13	71,14	4,57	0,0553	0,00	617,40	267,18	158,24	539,02	625,35
62	552,05	71,60	4,47	0,0553	0,00	620,33	271,75	160,83	543,12	628,98
63	551,75	72,50	4,28	0,0548	0,00	623,88	276,33	163,50	547,01	631,79
64	552,78	72,73	4,18	0,0555	0,00	624,94	280,79	166,23	553,48	634,48
65	553,93	72,86	3,99	0,0553	0,00	627,85	285,44	168,97	558,50	637,43
66	550,69	73,14	3,89	0,0534	0,00	628,23	289,99	171,65	562,37	640,45
67	545,67	73,31	3,77	0,0531	0,00	629,32	294,78	174,33	567,26	643,28
68	539,51	73,39	3,59	0,0534	0,00	628,32	299,50	177,09	565,71	645,69
69	531,59	73,03	3,48	0,0538	0,00	627,47	303,99	179,98	561,59	649,24
70	523,44	73,11	3,48	0,0541	0,00	624,97	308,70	183,03	556,80	650,60
71	519,49	72,21	3,38	0,0541	0,00	622,50	312,73	186,16	553,03	650,54
72	513,29	72,14	3,29	0,0543	0,00	619,80	317,25	189,35	548,23	648,93
73	507,47	72,39	3,19	0,0543	0,00	617,93	322,27	192,77	542,81	645,18
74	499,77	71,98	3,07	0,0548	0,00	615,40	325,74	196,33	537,04	641,39
75	493,75	72,45	3,01	0,0555	0,00	612,72	330,32	200,12	531,40	638,63
76	489,36	72,35	2,97	0,0534	0,00	608,52	334,48	203,99	526,31	635,65
77	484,87	72,35	2,88	0,0541	0,00	603,99	338,68	208,10	521,57	631,84
78	481,07	72,20	2,88	0,0538	0,00	599,45	342,68	212,31	518,39	629,41
79	478,55	71,74	2,78	0,0543	0,00	596,47	346,51	216,62	514,87	625,80
80	476,52	71,58	2,78	0,0538	0,00	593,58	350,21	220,96	511,88	623,23
81	471,61	71,57	2,68	0,0548	0,00	592,65	354,54	225,48	506,16	620,92
82	462,96	71,44	2,59	0,0543	0,00	589,32	358,94	230,02	497,96	619,17

APPENDIX 2: Proportionality results

Average	Average	Average						Average
15,66	Inlet +	Inlet +						0,236
	Outlet	Outlet	Average	Average	#1	#2		
Tunnel	Temp.	Temp.	98,34	99,40	System 1	System 2		SQRT
Velocity	Meter 1	Meter 2	**Proportional Rates**		Vol.Std.	Vol.Std.		Delta-P
			PR1	**PR2**			Time	
Ft/Sec	Deg. R	Deg. R	**%**	**%**	(ft3)	(ft3)	min	(in H2O)2
16,003	536,8	537,4			0,187	0,095	0	0,2347939
16,077	537,6	537,8	101,92	102,90	0,186	0,135	1	0,2356572
15,927	537,8	537,9	101,52	102,77	0,186	0,174	2	0,2347944
15,858	537,9	538,0	99,95	101,12	0,186	0,175	3	0,236302
15,736	538,0	538,0	100,33	101,06	0,186	0,175	4	0,235226
15,794	538,0	538,0	99,65	100,63	0,187	0,174	5	0,2363019
15,863	538,0	538,0	99,11	100,08	0,186	0,175	6	0,237373
15,795	538,0	538,1	99,48	100,43	0,186	0,174	7	0,2363027
15,823	538,0	538,1	99,31	100,31	0,186	0,174	8	0,2367312
15,767	538,0	538,1	99,78	101,02	0,186	0,174	9	0,2356572
15,844	538,0	538,1	99,54	100,62	0,186	0,175	10	0,236731
15,810	538,0	538,1	99,52	100,79	0,186	0,175	11	0,2363024
15,858	538,1	538,1	99,52	100,79	0,186	0,175	12	0,2367305
15,825	538,1	538,2	99,67	100,98	0,186	0,175	13	0,236303
15,781	538,1	538,2	99,90	101,15	0,186	0,175	14	0,2356574
15,581	538,1	538,2	101,31	102,40	0,186	0,175	15	0,2326246
15,832	538,2	538,3	99,63	100,66	0,186	0,174	16	0,236303
15,620	538,3	538,4	101,05	101,92	0,186	0,174	17	0,2330603
15,836	538,3	538,4	99,77	100,92	0,186	0,174	18	0,236303
15,736	538,4	538,4	100,41	101,37	0,186	0,174	19	0,234795
15,610	538,4	538,5	101,12	102,22	0,186	0,174	20	0,2330605
15,858	538,5	538,5	99,37	100,66	0,186	0,175	21	0,236731
15,827	538,6	538,6	99,71	100,71	0,186	0,174	22	0,236303
15,676	538,6	538,6	100,30	101,61	0,186	0,174	23	0,2341459
15,718	538,6	538,6	100,06	101,21	0,186	0,174	24	0,2347986
15,589	538,7	538,7	100,97	102,05	0,186	0,174	25	0,2329107
15,815	538,8	538,7	99,31	100,52	0,186	0,174	26	0,236303
15,742	538,8	538,8	99,84	100,91	0,186	0,174	27	0,2352269
15,674	539,0	538,9	100,56	101,46	0,186	0,174	28	0,2341464
15,595	539,1	538,9	100,72	101,93	0,186	0,174	29	0,2330613
15,666	539,2	539,0	100,27	101,49	0,186	0,174	30	0,2341462
15,673	539,1	539,0	100,34	101,38	0,186	0,174	31	0,2341462
15,599	539,1	539,0	100,78	102,01	0,186	0,174	32	0,2330606
15,713	539,1	539,1	99,84	101,03	0,185	0,174	33	0,2347951
15,741	539,1	539,1	100,01	101,14	0,186	0,174	34	0,235228
15,662	539,2	539,2	100,34	101,34	0,186	0,174	35	0,234146
15,723	539,3	539,2	99,64	100,88	0,186	0,174	36	0,2352273
15,684	539,4	539,3	99,80	100,80	0,186	0,174	37	0,2347957
15,776	539,4	539,3	99,09	100,22	0,186	0,174	38	0,2363033
15,703	539,4	539,3	99,55	100,53	0,186	0,174	39	0,2352278
15,723	539,5	539,4	99,26	100,43	0,186	0,174	40	0,2356583
15,765	539,5	539,4	98,95	100,14	0,185	0,174	41	0,2363036
15,677	539,5	539,4	99,35	100,49	0,185	0,174	42	0,2352279
15,697	539,5	539,4	99,12	100,09	0,186	0,174	43	0,2356577
15,685	539,5	539,5	98,91	100,27	0,185	0,174	44	0,2356583
15,615	539,5	539,5	99,32	100,42	0,185	0,174	45	0,2347954
15,606	539,6	539,5	99,25	100,45	0,186	0,174	46	0,2347963
15,694	539,5	539,5	98,45	99,56	0,185	0,174	47	0,2363034
15,637	539,5	539,5	98,67	99,74	0,185	0,174	48	0,2356583
15,627	539,5	539,5	98,75	99,72	0,186	0,174	49	0,2356588
15,666	539,5	539,6	98,18	99,28	0,185	0,174	50	0,2363043
15,650	539,5	539,6	98,28	99,32	0,185	0,174	51	0,236304
15,639	539,5	539,6	98,05	99,32	0,185	0,174	52	0,2363044
15,712	539,5	539,5	97,79	98,63	0,185	0,174	53	0,2373746

15,631	539,5	539,5	98,13	99,20	0,186	0,174	54	0,2363043
15,618	539,5	539,5	98,11	99,02	0,186	0,174	55	0,2363039
15,610	539,5	539,5	98,12	98,97	0,186	0,174	56	0,2363043
15,704	539,4	539,5	97,34	98,46	0,186	0,174	57	0,237802
15,627	539,4	539,5	97,75	98,78	0,185	0,174	58	0,2367327
15,718	539,3	539,4	97,11	98,31	0,185	0,174	59	0,2382276
15,596	539,3	539,4	97,91	99,04	0,185	0,174	60	0,2363044
15,617	539,4	539,5	97,66	98,57	0,185	0,174	61	0,236726
15,656	539,4	539,5	97,27	98,59	0,185	0,174	62	0,2373744
15,608	539,3	539,4	97,68	98,70	0,185	0,174	63	0,2367325
15,653	539,3	539,4	97,44	98,35	0,186	0,174	64	0,2373745
15,650	539,2	539,4	97,22	98,36	0,185	0,174	65	0,2373743
15,674	539,2	539,4	97,17	98,29	0,185	0,174	66	0,2378025
15,646	539,2	539,3	97,35	98,34	0,185	0,174	67	0,237368
15,645	539,1	539,3	97,40	98,37	0,186	0,174	68	0,2373748
15,700	539,1	539,3	97,19	97,89	0,186	0,174	69	0,2382275
15,679	539,1	539,2	97,27	98,36	0,186	0,174	70	0,2378024
15,594	539,1	539,2	97,82	98,60	0,186	0,174	71	0,2365456
15,674	539,1	539,2	97,27	98,36	0,186	0,174	72	0,2378022
15,647	539,0	539,2	97,44	98,43	0,186	0,174	73	0,2373749
15,573	539,0	539,2	97,82	98,98	0,186	0,174	74	0,2363041
15,602	539,0	539,2	97,59	98,86	0,186	0,174	75	0,2367321
15,569	539,0	539,2	97,81	98,88	0,186	0,174	76	0,2363039
15,013	539,0	539,2	101,61	102,68	0,186	0,174	77	0,2277782
15,568	539,0	539,2	97,67	98,90	0,186	0,174	78	0,2363039
15,593	539,0	539,2	97,75	98,75	0,186	0,174	79	0,2367321
15,591	539,0	539,2	97,55	98,68	0,186	0,174	80	0,2367325
15,629	538,9	539,2	97,32	98,22	0,186	0,174	81	0,2373746
15,589	538,9	539,1	97,68	98,67	0,186	0,174	82	0,2367324
15,582	538,9	539,1	97,63	98,46	0,186	0,174	83	0,2367323
15,681	538,9	539,1	96,92	97,89	0,186	0,174	84	0,2382275
15,648	538,9	539,1	96,99	98,10	0,186	0,174	85	0,2378016
15,619	538,9	539,1	97,16	98,37	0,185	0,174	86	0,2373742
15,649	538,9	539,1	97,06	98,21	0,186	0,174	87	0,2378021
15,550	538,8	539,1	97,71	98,69	0,186	0,174	88	0,2363046
15,617	538,8	539,1	97,20	98,29	0,186	0,174	89	0,2373751
15,575	538,8	539,1	97,59	98,67	0,186	0,174	90	0,2367324
15,548	538,8	539,1	97,65	98,57	0,186	0,174	91	0,2363041
15,581	538,8	539,1	97,55	98,53	0,186	0,174	92	0,2367324
15,581	538,8	539,1	97,49	98,58	0,186	0,174	93	0,236732
15,620	538,7	539,0	97,29	98,32	0,186	0,174	94	0,2373743
15,543	538,7	539,0	97,58	98,73	0,186	0,174	95	0,2363046
15,537	538,8	539,0	97,52	98,68	0,185	0,174	96	0,2363042
15,635	538,8	539,1	97,05	98,05	0,186	0,174	97	0,2378022
15,603	538,9	539,1	97,11	98,05	0,186	0,174	98	0,2373744
15,594	538,9	539,2	97,11	98,05	0,186	0,174	99	0,2373743
15,618	538,9	539,2	96,91	97,98	0,186	0,174	100	0,2378024
15,644	538,9	539,2	96,62	97,81	0,186	0,174	101	0,2382275
15,779	538,9	539,2	95,85	96,99	0,186	0,174	102	0,240347
15,632	538,9	539,2	96,78	97,79	0,186	0,174	103	0,2382275
15,530	538,8	539,1	97,26	98,20	0,186	0,174	104	0,2367325
15,596	538,8	539,1	96,66	97,90	0,186	0,174	105	0,2378026
15,526	538,8	539,1	97,50	98,13	0,186	0,174	106	0,2367325
15,491	538,7	539,1	97,32	98,26	0,186	0,174	107	0,2363046
15,591	538,6	539,0	96,68	97,66	0,186	0,174	108	0,2378018
15,583	538,6	539,0	96,66	97,44	0,186	0,174	109	0,2378019
15,553	538,7	539,0	96,88	98,00	0,186	0,174	110	0,2373743
15,505	538,7	539,0	97,24	97,99	0,186	0,174	111	0,2366686
15,577	538,6	539,0	96,61	97,81	0,186	0,174	112	0,2378023
15,509	538,6	538,9	97,20	98,15	0,186	0,174	113	0,2367322
15,573	538,5	538,9	96,70	97,49	0,186	0,174	114	0,2378021

15,571	538,5	538,9	96,64	97,92	0,186	0,174	115	0,2378027
15,541	538,5	538,9	96,87	97,84	0,186	0,174	116	0,2373742
15,568	538,5	538,8	96,75	97,76	0,186	0,174	117	0,2378016
15,703	538,5	538,8	95,84	96,92	0,186	0,174	118	0,2399251
15,536	538,5	538,8	96,76	97,98	0,186	0,174	119	0,2373748
15,662	538,5	538,8	96,01	97,06	0,186	0,174	120	0,2392903
15,658	538,5	538,8	95,92	97,05	0,186	0,174	121	0,2392895
15,657	538,5	538,8	95,91	96,91	0,186	0,174	122	0,2392899

Average	Average	Average						Average
15,13	Inlet +	Inlet +						0,232
	Outlet	Outlet	Average	Average	#1	#2		
Tunnel	Temp.	Temp.	101,16	101,91	System 1	System 2		SQRT
Velocity	Meter 1	Meter 2	**Proportional Rates**		Vol.Std.	Vol.Std.		Delta-P
			PR1	**PR2**			Time	
Ft/Sec	Deg. R	Deg. R	**%**	**%**	(ft3)	(ft3)	min	(in H2O)2
15,605	535,8	536,0			0,183	0,172	0	0,2319671
15,468	535,8	536,0	102,42	103,21	0,183	0,172	1	0,2330567
15,476	535,7	535,9	101,04	101,94	0,183	0,172	2	0,2347914
15,421	535,7	535,8	101,28	101,98	0,183	0,172	3	0,2341421
15,332	535,6	535,8	102,23	102,66	0,183	0,171	4	0,2326213
15,263	535,6	535,8	102,58	103,36	0,183	0,172	5	0,2315286
15,382	535,5	535,7	101,96	102,73	0,183	0,172	6	0,2330564
15,322	535,5	535,7	102,75	103,28	0,183	0,172	7	0,2319662
15,399	535,5	535,7	102,21	102,95	0,183	0,172	8	0,2330567
15,372	535,5	535,7	102,33	102,99	0,183	0,172	9	0,2326202
15,197	535,4	535,6	103,56	104,29	0,183	0,172	10	0,2299909
15,308	535,4	535,6	102,97	103,70	0,183	0,172	11	0,2315285
15,311	535,5	535,6	102,93	103,86	0,183	0,172	12	0,2315287
15,335	535,5	535,7	102,75	103,63	0,183	0,172	13	0,2319671
15,349	535,4	535,6	102,92	103,55	0,183	0,172	14	0,2319667
15,335	535,3	535,6	102,88	103,45	0,183	0,172	15	0,2319264
15,335	535,3	535,5	102,70	103,49	0,183	0,172	16	0,2319665
15,331	535,3	535,5	102,72	103,35	0,183	0,172	17	0,2319667
15,404	535,3	535,5	102,24	103,01	0,183	0,172	18	0,2330564
15,274	535,3	535,5	103,18	103,88	0,183	0,172	19	0,23109
15,222	535,3	535,5	103,54	104,26	0,184	0,172	20	0,2304301
15,325	535,3	535,5	102,60	103,59	0,183	0,172	21	0,2319665
15,392	535,4	535,5	102,16	102,99	0,183	0,172	22	0,2330562
15,359	535,3	535,5	102,33	103,17	0,183	0,172	23	0,2326216
15,213	535,2	535,4	103,22	104,21	0,183	0,172	24	0,2304305
15,449	535,2	535,4	101,52	102,58	0,183	0,172	25	0,2341421
15,279	535,2	535,4	102,72	103,41	0,183	0,172	26	0,2315285
15,455	535,2	535,3	101,65	102,24	0,183	0,172	27	0,2341422
15,308	535,2	535,4	102,47	103,22	0,183	0,172	28	0,2319663
15,251	535,2	535,4	103,09	103,69	0,183	0,172	29	0,2310902
15,283	535,2	535,4	102,65	103,61	0,183	0,172	30	0,2315282
15,248	535,2	535,4	102,88	103,81	0,183	0,172	31	0,2310897
15,371	535,3	535,4	101,93	102,57	0,183	0,172	32	0,2330562
15,289	535,3	535,4	102,33	103,19	0,183	0,172	33	0,2319665
15,323	535,5	535,5	102,23	102,88	0,183	0,172	34	0,2326215
15,256	535,6	535,6	102,55	103,15	0,183	0,172	35	0,2315283
15,349	535,6	535,6	101,82	102,68	0,183	0,172	36	0,2330572
15,139	535,6	535,6	103,10	103,91	0,183	0,172	37	0,2299904
15,295	535,6	535,6	101,84	102,67	0,183	0,172	38	0,2326219
15,220	535,6	535,6	102,26	102,93	0,183	0,172	39	0,2316586
15,269	535,7	535,7	101,59	102,15	0,183	0,171	40	0,2326218
15,339	535,6	535,6	100,68	101,65	0,183	0,172	41	0,2341424
15,190	535,6	535,7	101,71	102,57	0,183	0,172	42	0,231958
15,317	535,6	535,7	100,78	101,28	0,183	0,172	43	0,2341426
15,103	535,7	535,7	102,06	102,52	0,183	0,171	44	0,2310908
15,092	535,6	535,7	101,67	102,69	0,183	0,172	45	0,2310908
15,135	535,6	535,7	101,34	101,98	0,183	0,172	46	0,2319665
15,269	535,5	535,7	100,39	101,18	0,183	0,172	47	0,234143
15,390	535,4	535,6	99,49	100,23	0,183	0,172	48	0,2362995
15,185	535,3	535,5	100,84	101,55	0,183	0,172	49	0,2330568
15,171	535,3	535,5	100,63	101,45	0,183	0,172	50	0,2330571
15,273	535,2	535,4	99,95	100,73	0,183	0,172	51	0,2347917
15,129	535,1	535,3	100,83	101,34	0,183	0,172	52	0,2326218
15,153	535,1	535,3	100,69	101,33	0,183	0,172	53	0,2330571

15,074	535,0	535,2	101,14	101,62	0,184	0,172	54	0,2319666
14,966	535,0	535,2	101,67	102,48	0,183	0,172	55	0,2304301
15,029	534,9	535,2	101,16	101,78	0,183	0,172	56	0,2315283
15,095	534,9	535,1	100,60	101,29	0,183	0,172	57	0,2326211
14,922	534,8	535,1	101,91	102,51	0,184	0,172	58	0,2299903
15,010	534,7	535,0	101,17	101,68	0,184	0,172	59	0,2315282
14,797	534,7	534,9	102,33	102,93	0,184	0,172	60	0,2284416
14,972	534,7	535,0	101,31	101,76	0,184	0,172	61	0,2310902
15,031	534,7	535,0	100,81	101,50	0,184	0,172	62	0,2319661
14,995	534,7	534,9	101,05	101,66	0,184	0,172	63	0,2315277
14,998	534,6	534,9	100,98	101,69	0,184	0,172	64	0,2315277
14,824	534,7	534,9	102,09	102,78	0,183	0,172	65	0,2288843
15,072	534,7	534,9	100,51	101,33	0,183	0,172	66	0,2326208
15,033	534,7	534,9	100,66	101,56	0,183	0,172	67	0,2319661
15,038	534,7	534,9	100,94	101,59	0,183	0,172	68	0,2319659
14,980	534,7	534,9	101,15	101,90	0,183	0,172	69	0,2310902
15,076	534,8	535,0	100,54	101,25	0,183	0,172	70	0,2326214
14,902	534,8	535,0	101,63	102,16	0,183	0,172	71	0,2299898
14,971	534,8	535,0	101,09	101,94	0,183	0,172	72	0,2310899
14,972	534,8	535,0	101,08	101,97	0,183	0,172	73	0,2310895
15,003	534,8	535,0	101,03	101,74	0,183	0,172	74	0,2315284
14,930	534,8	535,0	101,41	102,08	0,183	0,172	75	0,23043
14,996	534,8	535,1	100,90	101,64	0,183	0,172	76	0,2315277
15,089	534,8	535,0	100,19	101,09	0,183	0,172	77	0,2330565
15,028	534,8	535,1	100,84	101,62	0,183	0,172	78	0,2319664
14,967	534,7	535,1	101,08	101,78	0,183	0,172	79	0,2310897
15,058	534,8	535,0	100,35	101,10	0,183	0,172	80	0,2326216
15,060	534,8	535,0	100,34	101,00	0,183	0,172	81	0,2326208
15,016	534,7	535,0	100,57	101,43	0,183	0,172	82	0,2319662
15,011	534,8	535,1	100,50	101,24	0,183	0,172	83	0,2319664
15,086	534,8	535,1	100,10	100,81	0,183	0,172	84	0,2330563
15,014	534,9	535,1	100,65	101,50	0,183	0,172	85	0,2319656
14,993	534,9	535,1	100,63	101,62	0,183	0,172	86	0,2315267
14,993	534,9	535,1	100,83	101,50	0,183	0,172	87	0,2315278
14,893	535,0	535,1	101,56	102,32	0,183	0,172	88	0,22999
15,014	535,1	535,2	100,58	101,29	0,183	0,172	89	0,2319662
15,063	535,2	535,2	100,36	101,09	0,183	0,172	90	0,2326207
15,192	535,3	535,3	99,34	100,15	0,183	0,172	91	0,2347901
15,054	535,3	535,3	100,30	100,94	0,183	0,172	92	0,2326244
14,946	535,4	535,3	100,75	101,63	0,183	0,172	93	0,2310901
14,978	535,5	535,3	100,67	101,31	0,183	0,172	94	0,2315282
14,943	535,5	535,4	100,66	101,54	0,183	0,172	95	0,2310902
15,042	535,6	535,5	100,06	100,79	0,183	0,172	96	0,232622
14,994	535,7	535,6	100,35	101,28	0,183	0,172	97	0,2319666
15,128	535,7	535,6	99,54	100,12	0,183	0,172	98	0,2341421
14,930	535,7	535,6	100,54	101,33	0,183	0,172	99	0,2310911
14,955	535,9	535,7	100,49	101,14	0,183	0,171	100	0,231529
15,049	536,0	535,8	99,59	100,71	0,183	0,172	101	0,2330572
14,948	535,9	535,8	100,47	101,03	0,183	0,172	102	0,2315291
15,120	535,9	535,8	99,12	99,83	0,183	0,171	103	0,2341429
14,947	535,9	535,8	100,41	101,26	0,183	0,171	104	0,2315292
15,159	536,0	535,9	98,96	99,63	0,183	0,172	105	0,2347917
15,125	536,1	535,9	99,30	100,08	0,183	0,171	106	0,2341439
14,981	536,1	535,9	100,18	101,01	0,183	0,172	107	0,2319673
14,921	536,1	535,9	100,64	101,45	0,183	0,172	108	0,2310911
14,920	536,1	535,9	100,60	101,35	0,183	0,172	109	0,2310911
15,110	536,2	535,9	99,21	99,98	0,183	0,172	110	0,2341433
15,001	536,3	535,9	99,76	100,62	0,183	0,172	111	0,2326223
14,999	536,3	536,0	99,58	100,50	0,183	0,172	112	0,2326224
14,962	536,4	536,0	100,16	100,86	0,183	0,172	113	0,2319681
15,004	536,3	536,0	99,88	100,39	0,183	0,171	114	0,2326221

14,899	536,4	536,0	100,32	101,50	0,183	0,172	115	0,2310921
15,096	536,4	536,0	99,13	99,83	0,183	0,172	116	0,2341438
15,026	536,4	536,0	99,58	100,58	0,183	0,172	117	0,2330567
14,953	536,4	536,0	99,90	100,99	0,183	0,172	118	0,2319672
14,953	536,3	536,0	100,07	100,72	0,183	0,172	119	0,2319667
14,753	536,3	536,0	101,36	102,28	0,183	0,172	120	0,2288849
15,016	536,3	536,0	99,52	100,40	0,183	0,172	121	0,2330571
15,087	536,3	535,9	98,91	99,86	0,183	0,172	122	0,2341425
14,981	536,3	536,0	99,70	100,46	0,183	0,172	123	0,2325362
14,942	536,4	536,0	99,87	100,54	0,183	0,171	124	0,2319672

APPENDIX 3: Calibration data

4407 rue Charleroi, Montréal-Nord (Québec) H1H 1T6 Canada
TEL.: (514) 329-3242 / 1 888 774-6665
FAX : (514) 329-3750
info.canada@trescal.com

Certificat d'Étalonnage / Certificate of Calibration

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

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

CERTIFICAT No / Certificate No: **254067**

PROCÉDURE / Procedure :
TRESCAL - DELMHORST_MCS-1 REFERENCE STANDARD

aaaa - mm - jj
Date étalonnage/ Calibration Performed : 2018-12-19

Echéance/ Due Date : 2019-12-19

Type de résultat / *Results type* : **As-Found = As-Left**

Résultats d'essais / *Test results* : Conforme / In Tolerance

Conditions de mesure / Measurement conditions

TEMPÉRATURE / Temp. : **23.2°C**

HUMIDITÉ / Humidity : **28% RH**

Usage restreint/ *Restricted use* : ☐

Réparation effectuée / *Repair performed* : ☐

Ajustement effectué / *Adjustment performed* : ☐

ÉTALONS UTILISÉS/ Standards Used:

Identification	Manuf.	Model	Description	Ser. #	Etalonné/ Cal.	Echéance/ Due
PR0661	FLUKE	8508A	REFERENCE MULTIMETER	389272208	2018-07-27	2019-07-27

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

NOTES :

2019. 01. 07

Technicien :
Technician

V. KOSTADINOV

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

ACCREDITATION 17025 ISO/IEC

Trescal

Certificat d'Étalonnage
Certificate of Calibration

	254067
CLIENT / Customer :	SERVICES POLYTESTS INC.
DESCRIPTION / Description :	VÉRIFICATEUR D'HUMIDITÉ / MOISTURE METER
MANUFACTURIER / Manufacturer :	DELMHORST
MODÈLE / Model :	MCS-1 REFERENCE STANDARD

DESCRIPTION Description		LIMITES Limits	LECTURES Readings	LIMITES Limits
DOUGLAS-FIR @ 80°F	**Nominal**			**Déviation** ***Mohms***
12 %	120 MOhms		115.1	4.9
22 %	1.10 MOhms		1.099	0.001

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS KRC-CNRC CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-006 06/03/19

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

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

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

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Setra	**No. du certificat d'étalonnage:**	2019001131
No. Série:	2784759	**Dernière date d'étalonnage:**	27-Feb-19
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	27-Feb-20
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.0000 "H2O	0.000 "H2O	0.000 "H2O	0.000 "H2O	0.000 "H2O	0.25 "H2O	Vérification indicateur
0.2500 "H2O	0.250 "H2O	0.249 "H2O	-0.001 "H2O	0.249 "H2O	0.25 "H2O	Vérification indicateur
0.5000 "H2O	0.500 "H2O	0.500 "H2O	0.000 "H2O	0.500 "H2O	0.25 "H2O	Vérification indicateur
0.7500 "H2O	0.750 "H2O	0.750 "H2O	0.000 "H2O	0.750 "H2O	0.25 "H2O	Vérification indicateur
1.0000 "H2O	1.000 "H2O	0.998 "H2O	-0.002 "H2O	0.998 "H2O	0.25 "H2O	Vérification indicateur
0.0000 "H2O	0.0000 V.DC.	0.0003 V.DC.	+0.0003 V.DC.	0.0003 V.DC.	0.5 V.DC.	Vérification sortie analogique
0.2500 "H2O	2.5000 V.DC.	2.4714 V.DC.	-0.0286 V.DC.	2.4714 V.DC.	0.5 V.DC.	Vérification sortie analogique
0.5000 "H2O	5.0000 V.DC.	5.0177 V.DC.	0.0177 V.DC.	5.0177 V.DC.	0.5 V.DC.	Vérification sortie analogique
0.7500 "H2O	7.5000 V.DC.	7.5058 V.DC.	0.0058 V.DC.	7.5058 V.DC.	0.5 V.DC.	Vérification sortie analogique
1.0000 "H2O	10.0000 V.DC.	9.9982 V.DC.	-0.0018 V.DC.	9.9982 V.DC.	0.5 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 19 °C Humidité: 20 %RH

Type d'Étalonnage:

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	6 Mars 2019
Date du prochain Étalonnage:	6 Mars 2020
Date d'émission du certificat:	6 Mars 2019

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

2019-03-19

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

Martin Langlais - Technicien

5F09106

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-007 06/03/19

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

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

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

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Setra	**No. du certificat d'étalonnage:**	2019001131
No. Série:	2784759	**Dernière date d'étalonnage:**	27-Feb-19
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	27-Feb-20
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.0000 "H2O	0.0000 "H2O	0.0000 "H2O	0.0000 "H2O	0.0000 "H2O	0.25 "H2O	Vérification indicateur
0.0250 "H2O	0.0250 "H2O	0.0232 "H2O	-0.0018 "H2O	0.0254 "H2O	0.25 "H2O	Vérification indicateur
0.0500 "H2O	0.0500 "H2O	0.0466 "H2O	-0.0034 "H2O	0.0495 "H2O	0.25 "H2O	Vérification indicateur
0.0750 "H2O	0.0750 "H2O	0.0706 "H2O	-0.0044 "H2O	0.0746 "H2O	0.25 "H2O	Vérification indicateur
0.1000 "H2O	0.1000 "H2O	0.0940 "H2O	-0.0060 "H2O	0.0981 "H2O	0.25 "H2O	Vérification indicateur
0.0000 "H2O	0.0000 V.DC.	0.0011 V.DC.	+0.0011 V.DC.	0.0011 V.DC.	0.5 V.DC.	Vérification sortie analogique
0.0250 "H2O	2.5000 V.DC.	2.2890 V.DC.	-0.2110 V.DC.	2.5411 V.DC.	0.5 V.DC.	Vérification sortie analogique
0.0500 "H2O	5.0000 V.DC.	4.6505 V.DC.	-0.3495 V.DC.	4.9562 V.DC.	0.5 V.DC.	Vérification sortie analogique
0.0750 "H2O	7.5000 V.DC.	7.0448 V.DC.	-0.4552 V.DC.	7.4662 V.DC.	0.5 V.DC.	Vérification sortie analogique
0.1000 "H2O	10.0000 V.DC.	9.4216 V.DC.	-0.5784 V.DC.	9.8079 V.DC.	0.5 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 19 °C Humidité: 16 %RH

Type d'Étalonnage:

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	6 Mars 2019
Date du prochain Étalonnage:	6 Mars 2020
Date d'émission du certificat:	6 Mars 2019

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

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2019.03.19

Martin Langlais - Technicien

5F09106

DISPERSION
Laboratoire • Laboratory DIVISION - TRANSCAT CANADA

ACCREDITATION ISO 17025
CNN Portée Numéro 668

CERTIFICAT D'ÉTALONNAGE

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

Client :	Polytests	**No. du Certificat :**	**155-578412-181-1649**
Adresse :	695 B rue Gaudette Saint-Jean-sur-Richelieu, QC J3B7S7	**Date d'étalonnage :**	11-12-2018

Technicien:
Mossad, Osama

David Llorens, Responsable Qualité

DESCRIPTION DU SERVICE:

Modèle de Balance :	AR2140	**Méthode :**	ISO 17025
Manufacturier :	Ohaus	**Date d'approbation :**	11-12-2018
Numéro de Série :	M3658329010091	**Date prochain étalonnage :**	11-12-2019
Numéro d'identification :	EM-051	**accréditation CCN n. :**	668
Capacité :	210g	**Certification CLAS n. :**	2010-01
Résolution:	0.0001g		

Condition d'essai :	Temp °C:	27.1	Pression kPa:	99.81	Humidité %:	26.1

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

CETTE BALANCE RENCONTRE LES SPÉCIFICATIONS SUIVANTES:

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

NOTES:

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

2018-12-12

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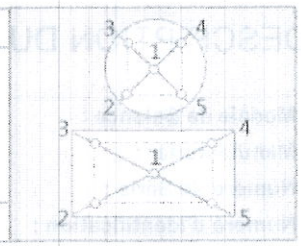
Client :	Polytests	**No. du Certificat :**	**155-578412-181-1649**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	Saint-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Modèle de Balance :**	AR2140
		Date d'étalonnage :	11-12-2018
Méthode :	ISO 17025	**Date du prochain étalonnage :**	11-12-2019

TEST D'EXCENTRICITÉ:

Poids Test: 100 g Tolérance 0.0004 g
(Note: Le Poids Test est taré au centre du plateau de pesée)

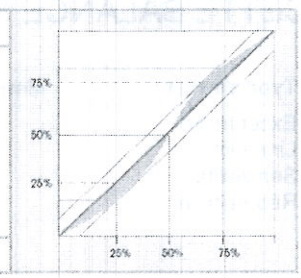
Position	Avant Ajustement	Après Ajustement
1: Centre:	0.0000 g	---
2: Avant Gauche:	0.0000 g	---
3: Arrière Gauche:	0.0000 g	---
4: Arrière Droit:	0.0000 g	---
5: Avant Droit:	0.0000 g	---
Résultats	0.0000 g	---
STATUT	**CONFORME**	**N/A**



TEST DE LINÉARITÉ:

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

Pré-Charge	Avant Ajustement	Après Ajustement
0.0000 g	50.0001 g	---
50.0000 g	50.0000 g	---
100.0000 g	50.0000 g	---
150.0000 g	50.0000 g	---
---	---	---
---	---	---
---	---	---
Résultats	**0.00007 g**	**---**
STATUT	**CONFORME**	**N/A**



TEST DE SENSIBILITÉ:

Valeur de masse conventionnelle: 200.0001 g Tolérance: 0.0004 g Résultats: 0.00% < 0.10%

	Avant Ajustement	Après Ajustement
Lecture:	200.0001 g	---
Résultats:	**0.0000 g**	**---**
STATUT	**CONFORME**	**N/A**

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

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CERTIFICAT D'ÉTALONNAGE

Client :	Polytests	**No. du Certificat :**	**155-578412-181-1649**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	Saint-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Modèle de Balance :**	AR2140
		Date d'étalonnage :	11-12-2018
Méthode :	ISO 17025	**Date du prochain étalonnage :**	11-12-2019

TEST DE RÉPÉTABILITÉ:

AVANT AJUSTEMENT:

Charge Utilisée:
100.0000 g

Tolérance:
0.00010 g

Résolution d'affichage:
0.0001 g

Moyenne:
100.00003 g

Écart-type:
0.00005 g

#	Vide	Chargé	Différence
1	0.0000 g	100.0001 g	100.0001 g
2	0.0000 g	100.0001 g	100.0001 g
3	0.0000 g	100.0001 g	100.0001 g
4	0.0000 g	100.0000 g	100.0000 g
5	0.0000 g	100.0000 g	100.0000 g
6	0.0000 g	100.0000 g	100.0000 g
7	0.0000 g	100.0000 g	100.0000 g
8	0.0000 g	100.0000 g	100.0000 g
9	0.0000 g	100.0000 g	100.0000 g
10	0.0000 g	100.0000 g	100.0000 g
		Statut :	CONFORME

APRÈS AJUSTEMENT:

Charge Utilisée:

Tolérance:
0.00010 g

Résolution d'affichage:
0.0001 g

Moyenne:

Écart-type:

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

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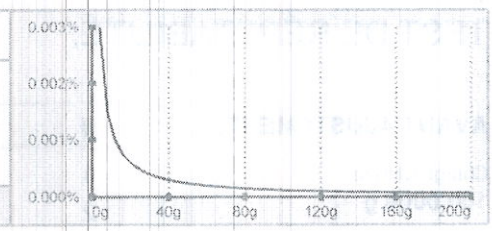
CERTIFICAT D'ÉTALONNAGE

INCERTITUDE AVANT AJUSTEMENT :

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

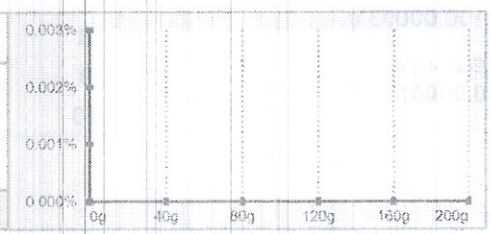
u(cr) =	Incertitude reliée à l'étalon utilisé
Sp =	Incertitude de l'écart-type
u(l) =	Incertitude associée à la linéarité
u(dr) =	Incertitude associée à résolution si Sp = 0
u(s) =	Incertitude liée à la sensibilité (span)

Valeur	Incertitude	Incertitude (%)
12.5000 g	0.00016 g	0.001284 %
25.0000 g	0.00016 g	0.000642 %
50.0000 g	0.00016 g	0.000322 %
100.0000 g	0.00016 g	0.000162 %
200.0000 g	0.00023 g	0.000113 %



INCERTITUDE APRÈS AJUSTEMENT :

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



NOTES :

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

CERTIFICAT D'ÉTALONNAGE

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RÉFÉRENCE

ENSEMBLE DE RÉFÉRENCE:

Référence	No de série	Fabricant	Date d'étalonnage
1mg-5kg	DK000A213	Dispersion	16-03-2018

INCERTITUDES:

Les incertitudes que nous retrouvons comprennent :

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

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

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

TRAÇABILITÉ

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

REMARQUES:

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CLAS
NRC CNRC
CLAS 2010-01

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CERTIFICAT D'ÉTALONNAGE

Client :	Polytests	**No. du Certificat :**	**152-4BB901-181**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Date d'étalonnage :**	09-01-2018

Technicien:
Simeonidis, Georgios

David Llorens, Responsable Qualité

DESCRIPTION DU SERVICE:

Description des masses :	ASTM E617	**Date d'approbation :**	09-01-2018
Classe de précision :	ASTM 6	**Date prochain étalonnage :**	09-01-2023
Densité :	7.95g/cm³	**Accrédtation CCN n. :**	668
Identification (si unique) :	EM-090	**Certification CLAS n. :**	2010-01

Condition d'essai :	Temp °C:	21.17	Pression kPa:	101.475	Humidité:	48.665

NOTES:

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

REMARQUES:

11 JAN. 2018

DISPERSION
Laboratoire • Laboratory DIVISION • TRANSCAT CANADA

CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

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Client :	Polytests	**No. du Certificat :**	**152-4BB901-181**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Classe d'exactitude :**	ASTM 6
		Date d'étalonnage :	09-01-2018
Masse :	2 kg	**Date du prochain étalonnage :**	09-01-2023

RÉSULTAT DE L'ÉTALONNAGE, MASSE CONVENTIONNELLE:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle	Masse conventionnelle après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
2 kg		EM-090	2.0001538 kg		200 mg	2.0 mg

S.P

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Client :	Polytests	**No. du Certificat :**	**152-4BB901-181**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Classe d'exactitude :**	ASTM 6
		Date d'étalonnage :	09-01-2018
Masse :	2 kg	**Date du prochain étalonnage :**	09-01-2023

RÉSULTAT DE L'ÉTALONNAGE DES POIDS, CORRECTIONS:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle Correction	Masse conventionnelle Correction après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
2 kg		EM-090	153.8 mg		200 mg	2.0 mg

CERTIFICAT D'ÉTALONNAGE

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BALANCES UTILISÉES

Pour l'étalonnage manuel :

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

Pour l'étalonnage automatisé :

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

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

INCERTITUDES:

Les incertitudes que nous retrouvons comprennent :

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

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

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

TRAÇABILITÉ

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RÉFÉRENCES UTILISÉES

Poids	No de série	Fabricant	Date d'étalonnage	Date due
20kg	69976	Troemner	30-05-2017	30-05-2018
5kg	129099	Mettler Toledo	02-09-2017	02-09-2018
5kg	96-0888-50-3	Denver Instrument Company	02-09-2017	02-09-2018
2kg	129098	Mettler Toledo	02-09-2017	02-09-2018
2kg	96-0888-50-3	Denver Instrument Company	02-09-2017	02-09-2018
300g	96-0888-50-2	Denver Instrument Company	02-09-2017	02-09-2018
1kg - 1mg	MT-01	Mettler Toledo	02-09-2017	02-09-2018

ÉTALONS CERTFIÉS PAR LE CNRC(**Référence NRC MS-2016-0021**)

Poids	No de série	Fabricant	Date d'étalonnage	Date due
100g	95170	Mettler Toledo	17-10-2016	17-10-2018
10kg	129100	Mettler Toledo	17-10-2016	17-10-2018
1kg	95171	Mettler Toledo	17-10-2016	17-10-2018

RÉFÉRENCES DE LA STATION ROBOTISÉE

Poids	No de série	Fabricant	Date d'étalonnage	Date due
1kg - 1mg	DK000A132	Laboratoire Dispersion	01-08-2017	01-08-2018

Rapport d'étalonnage No. CA0124-511-092818

Mettler Toledo
Service Business Unit Industrial
1900 Polaris Parkway
Columbus, Ohio 43240
1-800-METTLER

Accrédité par l'American Association for Laboratory Accreditation (A2LA)
CERT.CALIBRATION #1902.02

METTLER TOLEDO

ISO 9001 Registered
ANSI/NCSL Z540-1 Accrédité

Certificat d'étalonnage

Client

Société :	Services Polytests		
Adresse :	695-B Rue Gaudette		
Ville :	Saint-Jean-Sur-Richelieu	*État/Province :*	Quebec
Code postal :	J3B 7S7	Astea Customer ID:	301288671

Instrument

Constructeur :	RICE LAKE	*Modèle de terminal :*	IQ+355
Modèle :	4x4HP-10k	*# série du terminal:*	164851
No de série :	C18395	*# série de l'imprimant*	N/A
Capacité :	400 kg		N/A
Résolution :	0.05 kg	*Nbre de Divisions:*	8000
Classe :	III	*Procédure utilisée :*	NIST Handbook 44
No./ID d'inventaire:	EM114		
Procédure:	Le présent certificat est émis conformément aux conditions de certification accordées par l'A2LA, en vertu de la norme ISO/IEC 17025. A2LA a évalué la capacité de mesure du laboratoire et la traçabilité des normes nationales reconnues.		

Date de calibrage :	28-Sep-2018	*Date, prochaine Cal.*	30-Sep-2019
Signataire autorisé (A2LA) :	Pier-Hugues Riopel	*Signature:*	ELECTRONIC SIGNATURE

Étalons de travail

Retracabilité: Les poids de test utilisés se réfèrent au National Institute of Standards and Technology,

Jeu de poids no :	*Traçabilité NIST No.:*	*Classe ASTM/OIML*	*Date d'étalonnage :*	*Date proch. étalonnage*
160941929	4350-8126171	Temperature Kit	18-Nov-2016	18-Nov-2018
42273	M17-0562	M1	23-Jan-2018	23-Jan-2019
T101-T150 (20kg)	1412537	M1	19-Apr-2018	19-Apr-2019

2018-10-02

Version Logiciel : 4.6.4.2

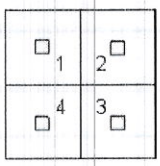
METTLER TOLEDO

Résultats de mesure

La température : 22 °C

Les conditions ambiantes ont été vérifiées afin d'assurer l'exactitude de l'étalonnage.

Test de variation



		Avant Réglage
Poids Appliqués	*Position*	*Valeur lue*
1: 100.00 kg	*Position 1*	100.05 kg
2: 100.00 kg	*Position 2*	100.05 kg
3: 100.00 kg	*Position 3*	99.95 kg
4: 100.00 kg	*Position 4*	99.95 kg
Erreur maximum :		0.10 kg
Max Erreur Admissible :		0.10 kg

Linéarité

	Avant réglage					
	Poids Appliqués	*Valeur lue*	*Erreur*		*Erreur admissible*	*Dans la Tolérance*
Zero 1	0.00 kg	0.00 kg	0.00 kg	0 d	1 d	YES
2	0.50 kg	0.50 kg	0.00 kg	0 d	1 d	YES
3	2.00 kg	2.00 kg	0.00 kg	0 d	1 d	YES
4	10.00 kg	10.05 kg	0.05 kg	1 d	1 d	YES
Max 5	100.00 kg	100.00 kg	0.00 kg	0 d	2 d	YES

☐ Méthode de substitution utilisée

Un réglage de la balance a été requis
Si non, les résultats "avant réglage" correspondent aux résultats tel que laissé.

☐ OUI ☑ NON

Répétabilité

Poids appliqués : 2.00 kg

	Chargé	*Vide*	*Différence*
1	2.00 kg	0.00 kg	2 kg
2	2.00 kg	0.00 kg	2 kg
3	2.00 kg	0.00 kg	2 kg
	Erreur maximale :	0.00 kg	0.0 d
	Tolérance :	0.05 kg	1 d

Incertitude

Mesure de l'incertitude = 0.029 kg

L'incertitude de mesure représente les incertitudes étendues selon un facteur de sécurité K=2 générant un niveau de confiance approximatif de 95 %. Des dispositions doivent être prises en matière d'environnement au lieu d'étalonnage, d'incertitude induite par l'article en étalonnage et d'effets indésirables causés par le transport du matériel d'étalonnage. Ces facteurs pourraient entraîner une incertitude plus grande que le CMC.

METTLER TOLEDO

Certificat de Pesée Minimale

Incertitude de mesure élargie

U = Uo
Ur1 = 0.03 kg

Exemple d'incertitudes élargies pour différentes valeurs de poids net :

Poids Net Affiché	*Incertitude de mesure élargie*	
0.4 kg	0.03 kg	7.25000 %
4 kg	0.03 kg	0.72500 %
40 kg	0.03 kg	0.07250 %
200 kg	0.03 kg	0.01450 %
400 kg	0.03 kg	0.00725 %

Explication sur le tableau de pesée minimale

Les valeurs du poids net affiché indiquées dans le tableau suivant sont les valeurs des pesées minimales. Pour ces valeurs, l'incertitude élargie de mesure, multipliée par un Facteur de Sécurité (1, 2, 3 ou 5) est inférieure ou égale à l'Erreur Relative R

Tableau des Pesées Minimales pour différentes Erreurs Relatives et différents Facteurs de Sécurité

	Facteur de Sécurité FS			
Erreur Relative Requise	*1x FS = 1*	*2x FS = 2*	*3x FS = 3*	*5x FS = 5*
0.1 %	29.00 kg	58.00 kg	87.00 kg	145.00 kg
0.2 %	14.50 kg	29.00 kg	43.50 kg	72.50 kg
0.5 %	5.80 kg	11.60 kg	17.40 kg	29.00 kg
1 %	2.90 kg	5.80 kg	8.70 kg	14.50 kg
2 %	1.45 kg	2.90 kg	4.35 kg	7.25 kg
5 %	0.58 kg	1.16 kg	1.74 kg	2.90 kg

Remarques sur les valeurs de pesée minimale du tableau ci-dessus :

1. "N/A" est indiqué dans le tableau quand aucune valeur appropriée n'a pu être calculée.
2. Pour les instrument à étendues et échelons multiples, les valeurs indiquées dans le tableau ci-dessus s'appliquent à la plus petite étendue de mesure.
3. METTLER TOLEDO ne peut être tenu pour responsable du choix retenu concernant la sélection de l'Erreur Relative Requise ou du Facteur de Sécurité.
4. Le client veille à ce que les paramètres de réglage restent identiques à ceux utilisés pour l'établissement de ce Constat de Vérification Standard.
5. Le client veille à ce que l'environnement demeure identique aux conditions de travail retenues pour l'établissement de ce Constat de Vérification Standard.

Remarques

None.

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS NRC·CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-126 06/03/19

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

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

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

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	**No. du certificat d'étalonnage:**	2019000879
No. Série:	7798010	**Dernière date d'étalonnage:**	7-Feb-19
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	7-Feb-20
Commentaire:			

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Crystal XP2i	**No. du certificat d'étalonnage:**	2018004512
No. Série:	258139	**Dernière date d'étalonnage:**	9-Jul-18
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	9-Jul-19
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	1 "Hg	Vérification indicateur
-7.50 "Hg	-7.50 "Hg	-7.61 "Hg	-0.11 "Hg	-7.61 "Hg	1 "Hg	Vérification indicateur
-15.00 "Hg	-15.00 "Hg	-15.25 "Hg	-0.25 "Hg	-15.25 "Hg	1 "Hg	Vérification indicateur
-22.50 "Hg	-22.50 "Hg	-22.88 "Hg	-0.38 "Hg	-22.88 "Hg	1 "Hg	Vérification indicateur
-28.00 "Hg	-28.00 "Hg	-28.48 "Hg	-0.48 "Hg	-28.48 "Hg	1 "Hg	Vérification indicateur
0.00 "Hg	10.0000 V.DC.	10.0625 V.DC.	+0.0625 V.DC.	10.0625 V.DC.	0.5 V.DC.	Vérification sortie analogique
-7.50 "Hg	8.0000 V.DC.	8.0413 V.DC.	+0.0413 V.DC.	8.0413 V.DC.	0.5 V.DC.	Vérification sortie analogique
-15.00 "Hg	6.0000 V.DC.	6.0055 V.DC.	+0.0055 V.DC.	6.0055 V.DC.	0.5 V.DC.	Vérification sortie analogique
-22.50 "Hg	4.0000 V.DC.	3.9621 V.DC.	-0.0379 V.DC.	3.9621 V.DC.	0.5 V.DC.	Vérification sortie analogique
-28.00 "Hg	2.5333 V.DC.	2.4497 V.DC.	-0.0836 V.DC.	2.4497 V.DC.	0.5 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 19 °C Humidité: 16 %RH

Type d'Étalonnage:

5F09106

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS NRC·CNRC CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN N°669

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CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-126 06/03/19

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

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

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

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	6 Mars 2019
Date du prochain Étalonnage:	6 Mars 2020
Date d'émission du certificat:	6 Mars 2019

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

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

Martin Langlais - Technicien

2019.03.19

5F09106

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
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CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-127 06/03/19

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

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

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

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Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	7-Feb-20
Commentaire:			

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Crystal XP2i	**No. du certificat d'étalonnage:**	2018004512
No. Série:	258139	**Dernière date d'étalonnage:**	9-Jul-18
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	9-Jul-19
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	0.00 "Hg	1 "Hg	Vérification indicateur
-7.50 "Hg	-7.50 "Hg	-7.49 "Hg	+0.01 "Hg	-7.49 "Hg	1 "Hg	Vérification indicateur
-15.00 "Hg	-15.00 "Hg	-14.84 "Hg	+0.16 "Hg	-14.84 "Hg	1 "Hg	Vérification indicateur
-22.50 "Hg	-22.50 "Hg	-22.57 "Hg	-0.07 "Hg	-22.57 "Hg	1 "Hg	Vérification indicateur
-28.00 "Hg	-28.00 "Hg	-27.86 "Hg	+0.14 "Hg	-27.86 "Hg	1 "Hg	Vérification indicateur
0.00 "Hg	10.0000 V.DC.	10.0152 V.DC.	+0.0152 V.DC.	10.0152 V.DC.	0.5 V.DC.	Vérification sortie analogique
-7.50 "Hg	8.0000 V.DC.	8.0359 V.DC.	+0.0359 V.DC.	8.0359 V.DC.	0.5 V.DC.	Vérification sortie analogique
-15.00 "Hg	6.0000 V.DC.	6.0757 V.DC.	+0.0757 V.DC.	6.0757 V.DC.	0.5 V.DC.	Vérification sortie analogique
-22.50 "Hg	4.0000 V.DC.	3.9980 V.DC.	-0.0020 V.DC.	3.9980 V.DC.	0.5 V.DC.	Vérification sortie analogique
-28.00 "Hg	2.5333 V.DC.	2.5845 V.DC.	+0.0512 V.DC.	2.5845 V.DC.	0.5 V.DC.	Vérification sortie analogique

Conditions Environnementales: Température: 19 °C Humidité: 16 %RH

Type d'Étalonnage:

2019-03-19

5F09106

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS 2010-02

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N°669

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CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-127 06/03/19

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

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

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

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	6 Mars 2019
Date du prochain Étalonnage:	6 Mars 2020
Date d'émission du certificat:	6 Mars 2019

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

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

Martin Langlais - Technicien

DISPERSION
Laboratoire • Laboratory DIVISION - TRANSCAT CANADA

CLAS
ARC·CNRC
CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

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

Client :	Polytests	**No. du Certificat :**	**152-4BB901-182**
Adresse :	695 B rue Gaudette St-Jean-sur-Richelieu, QC J3B7S7	**Date d'étalonnage :**	09-01-2018

Technicien:
Simeonidis, Georgios

David Llorens, Responsable Qualité

DESCRIPTION DU SERVICE:

Description des masses :	ASTM E617	**Date d'approbation :**	09-01-2018
Classe de précision :	ASTM 1	**Date prochain étalonnage :**	09-01-2023
Densité :	7.95g/cm³	**Accrédtation CCN n. :**	668
Identification (si unique) :	(items multiples)	**Certification CLAS n. :**	2010-01

Condition d'essai :	Temp °C:	21.265	Pression kPa:	101.565	Humidité:	49.58

NOTES:

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

REMARQUES:

11 JAN. 2018

DISPERSION
Laboratoire • Laboratory DIVISION • TRANSCAT CANADA

CLAS
NRC·CNRC
CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

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

Client :	Polytests	**No. du Certificat :**	**152-4BB901-182**
Adresse :	695 B rue Gaudette	**Accréditation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Classe d'exactitude :**	ASTM 1
		Date d'étalonnage :	09-01-2018
Masse :	100 mg - 200 g	**Date du prochain étalonnage :**	09-01-2023

RÉSULTAT DE L'ÉTALONNAGE, MASSE CONVENTIONNELLE:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle	Masse conventionnelle après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
100 mg	1000014200	EM-128	99.9993 mg		0.010 mg	0.002 mg
200 g	1000026013	EM-129	199.99962 g		0.50 mg	0.10 mg

D.P.

DISPERSION
Laboratoire • Laboratory DIVISION • TRANSCAT CANADA

CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

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

Client :	Polytests	**No. du Certificat :**	**152-4BB901-182**
Adresse :	695 B rue Gaudette	**Accrédtation CCN n. :**	668
	St-Jean-sur-Richelieu, QC	**Certification CLAS n. :**	2010-01
	J3B7S7	**Classe d'exactitude :**	ASTM 1
		Date d'étalonnage :	09-01-2018
Masse :	100 mg - 200 g	**Date du prochain étalonnage :**	09-01-2023

RÉSULTAT DE L'ÉTALONNAGE DES POIDS, CORRECTIONS:

Valeur Nominale	No de série	No d'inventaire	Masse conventionnelle Correction	Masse conventionnelle Correction après ajustement	Tolérance ± (mg)	Incertitudes ± (mg)
100 mg	1000014200	EM-128	-0.0007 mg		0.010 mg	0.002 mg
200 g	1000026013	EM-129	-0.38 mg		0.50 mg	0.10 mg

D.P.

CERTIFICAT D'ÉTALONNAGE

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

BALANCES UTILISÉES

Pour l'étalonnage manuel :

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

Pour l'étalonnage automatisé :

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

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

INCERTITUDES:

Les incertitudes que nous retrouvons comprennent :

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

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

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

TRAÇABILITÉ

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

B.P.

DISPERSION
Laboratoire • Laboratory DIVISION • TRANSCAT CANADA

CLAS
ARC CNRC
CLAS 2010-01

CERTIFICAT D'ÉTALONNAGE

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

RÉFÉRENCES UTILISÉES

Poids	No de série	Fabricant	Date d'étalonnage	Date due
20kg	69976	Troemner	30-05-2017	30-05-2018
5kg	129099	Mettler Toledo	02-09-2017	02-09-2018
5kg	96-0888-50-3	Denver Instrument Company	02-09-2017	02-09-2018
2kg	129098	Mettler Toledo	02-09-2017	02-09-2018
2kg	96-0888-50-3	Denver Instrument Company	02-09-2017	02-09-2018
300g	96-0888-50-2	Denver Instrument Company	02-09-2017	02-09-2018
1kg - 1mg	MT-01	Mettler Toledo	02-09-2017	02-09-2018

ÉTALONS CERTFIÉS PAR LE CNRC(**Référence NRC MS-2016-0021**)

Poids	No de série	Fabricant	Date d'étalonnage	Date due
100g	95170	Mettler Toledo	17-10-2016	17-10-2018
10kg	129100	Mettler Toledo	17-10-2016	17-10-2018
1kg	95171	Mettler Toledo	17-10-2016	17-10-2018

RÉFÉRENCES DE LA STATION ROBOTISÉE

Poids	No de série	Fabricant	Date d'étalonnage	Date due
1kg - 1mg	DK000A132	Laboratoire Dispersion	01-08-2017	01-08-2018

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
NRC·CNRC
CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-001 06/03/19

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

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

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

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	**No. du certificat d'étalonnage:**	2019000879
No. Série:	7798010	**Dernière date d'étalonnage:**	7-Feb-19
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	7-Feb-20
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
0.0 °C	0.0 °C	0.0 °C	0.0 °C	0.0 °C	1.0 °C	T1 typeJ
125.0 °C	125.0 °C	125.1 °C	+0.1 °C	125.1 °C	1.0 °C	T1 typeJ
250.0 °C	250.0 °C	250.1 °C	+0.1 °C	250.1 °C	1.0 °C	T1 typeJ
375.0 °C	375.0 °C	375.1 °C	+0.1 °C	375.1 °C	1.0 °C	T1 typeJ
500.0 °C	500.0 °C	500.1 °C	+0.1 °C	500.1 °C	1.0 °C	T1 typeJ
0.0 °C	0.0 °C	0.2 °C	+0.2 °C	0.2 °C	1.0 °C	T2 typeJ
125.0 °C	125.0 °C	125.1 °C	+0.1 °C	125.1 °C	1.0 °C	T2 typeJ
250.0 °C	250.0 °C	250.1 °C	+0.1 °C	250.1 °C	1.0 °C	T2 typeJ
375.0 °C	375.0 °C	375.1 °C	+0.1 °C	375.1 °C	1.0 °C	T2 typeJ
500.0 °C	500.0 °C	500.1 °C	+0.1 °C	500.1 °C	1.0 °C	T2 typeJ
0.0 °C	0.0 °C	0.2 °C	+0.2 °C	0.2 °C	1.0 °C	T1 typeK
125.0 °C	125.0 °C	125.2 °C	+0.2 °C	125.2 °C	1.0 °C	T1 typeK
250.0 °C	250.0 °C	250.1 °C	+0.1 °C	250.1 °C	1.0 °C	T1 typeK
375.0 °C	375.0 °C	375.2 °C	+0.2 °C	375.2 °C	1.0 °C	T1 typeK
500.0 °C	500.0 °C	500.1 °C	+0.1 °C	500.1 °C	1.0 °C	T1 typeK
0.0 °C	0.0 °C	0.2 °C	+0.2 °C	0.2 °C	1.0 °C	T2 typeK
125.0 °C	125.0 °C	125.2 °C	+0.2 °C	125.2 °C	1.0 °C	T2 typeK
250.0 °C	250.0 °C	250.2 °C	+0.2 °C	250.2 °C	1.0 °C	T2 typeK
375.0 °C	375.0 °C	375.2 °C	+0.2 °C	375.2 °C	1.0 °C	T2 typeK
500.0 °C	500.0 °C	500.2 °C	+0.2 °C	500.2 °C	1.0 °C	T2 typeK

Conditions Environnementales: Température: 19 °C Humidité: 16 %RH

Type d'Étalonnage:

5F09101

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS NRC·CNRC CLAS 2010-02

SCC Accredited LAB Accrédité CCN N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-001 06/03/19

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

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

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

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	6 Mars 2019
Date du prochain Étalonnage:	6 Mars 2020
Date d'émission du certificat:	6 Mars 2019

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

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

M L L

Martin Langlais - Technicien

2019-03-19

5F09101

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
NRC·CNRC
CLAS 2010-02

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-015 05/03/19

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

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

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

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	**No. du certificat d'étalonnage:**	2019000879
No. Série:	7798010	**Dernière date d'étalonnage:**	7-Feb-19
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	7-Feb-20
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
-190.0 °C	-190.0 °C	-190.7 °C	-0.7 °C	-190.7 °C	1.0 °C	Input#1TypeK
0.0 °C	0.0 °C	-0.3 °C	-0.3 °C	-0.3 °C	1.0 °C	Input#1TypeK
750.0 °C	750.0 °C	749.8 °C	-0.2 °C	749.8 °C	1.0 °C	Input#1TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#2 TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#3 TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#4 TypeK
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#5TypeK
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#6TypeK
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#7TypeK
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#8TypeK
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#9TypeK
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#10TypeJ
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#11TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#12TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#13 TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#14TypeJ
100.0 °C	100.0 °C	100.0 °C	0.0 °C	100.0 °C	1.0 °C	Input#15 TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#16TypeJ
100.0 °C	100.0 °C	100.0 °C	0.0 °C	100.0 °C	1.0 °C	Input#17TypeJ
100.0 °C	100.0 °C	99.9 °C	-0.1 °C	99.9 °C	1.0 °C	Input#18TypeJ
100.0 °C	100.0 °C	100.0 °C	0.0 °C	100.0 °C	1.0 °C	Input#19TypeJ
100.0 °C	100.0 °C	100.1 °C	+0.1 °C	100.1 °C	1.0 °C	Input#20TypeJ
12.000 mA	12.000 mA	12.003 mA	+0.003 mA	12.003 mA	1.00 mA	Input#21
12.000 mA	12.000 mA	12.003 mA	+0.003 mA	12.003 mA	1.00 mA	Input#22

Conditions Environnementales: Température: 19 °C Humidité: 20 %RH

5F09101

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS 2010-02

SCC Accredited LAB
LAB Accrédité CCN
N°669

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Tél: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-015 05/03/19

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

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

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

Type d'Étalonnage: Test avec EM-147

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	5 Mars 2019
Date du prochain Étalonnage:	5 Mars 2020
Date d'émission du certificat:	5 Mars 2019

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

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

Martin Langlais - Technicien

2019.03.09

5F09101

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005

CERTIFICAT D'ÉTALONNAGE # 9786

Date d'étalonnage : 2018-11-12
Date d'émission du certificat : 2018-11-12

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

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

CONFORMITÉ AU PROGRAMME DE QUALITÉ

Tous les étalonnages sont effectués conformément au manuel d'assurance qualité de Polycontrols qui est conforme à la norme ISO/IEC 17025 – 2005, à la norme ISO 9001 – 2015 ainsi qu'à tout autre exigences de qualité définies dans la description d'achat des clients.

TRAÇABILITÉ

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

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

APTITUDE EN MATIÈRE DE MESURE ET D'ÉTALONNAGE - CMC

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

SOMMAIRE DES CONDITIONS DE L'INSTRUMENT EN TEST

Conditions initiales	En bon état
Travail Effectué	Étalonnage de l'instrument
	Lectures Initiales = Lectures finales, aucun ajustement
Résultats	Lectures finales dans les tolérances
Remarques	Fréquence d'étalonnage aux 12 mois

Métrologiste

Responsable du laboratoire

2018-11-22

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS NRC·CNRC CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 9786

Numéro de série:	99A274209	Station de mesure:	3
Date d'étalonnage:	2018-11-12	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-130		

Instrument de mesure de référence utilisé pour l'étalonnage final

Description	Modèle	# Série	Traçabilité	Date dû
DHI molbloc (30 slpm)	3E4-VCR-V-Q	2403	1500237464	2019-04-26
DHI molbloc (100 slpm)	2E2-S	380	1500241926	2019-07-19
DHI molbox1	Molbox1	755	1500237197	2019-04-25
RTD Mist	M22	2208102	2018002234	2019-04-11
Module 44.5 PSI avec Baro 163671	Module 30	160659	2018002180	2019-04-12

Spécifications finales de l'appareil

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

Condition d'étalonnage

Gaz	Air
Température ambiante	21.5 °C
Pression ambiante	1026.07 mbar
Orientation	Verticale
Élastomère	Viton
Valve	Viton

Lectures finales

Débit du test ACFH	Instrument en test ft³	Valeurs mesurées Pression PSIA	Température °C	Référence ft³	Référence calculée ft³	Erreur calculée ft³	Tolérance acceptable ft³	TUR
39.5798	6.610	14.8845	21.17	6.674	6.590	0.020	0.066	2.97
70.0656	11.700	14.9044	21.05	11.845	11.677	0.023	0.117	>4
164.1928	27.340	15.0230	20.96	27.959	27.336	0.004	0.273	>4

Bernard Poirier
Métrologiste

B Poirier
Signature

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS 2009-02

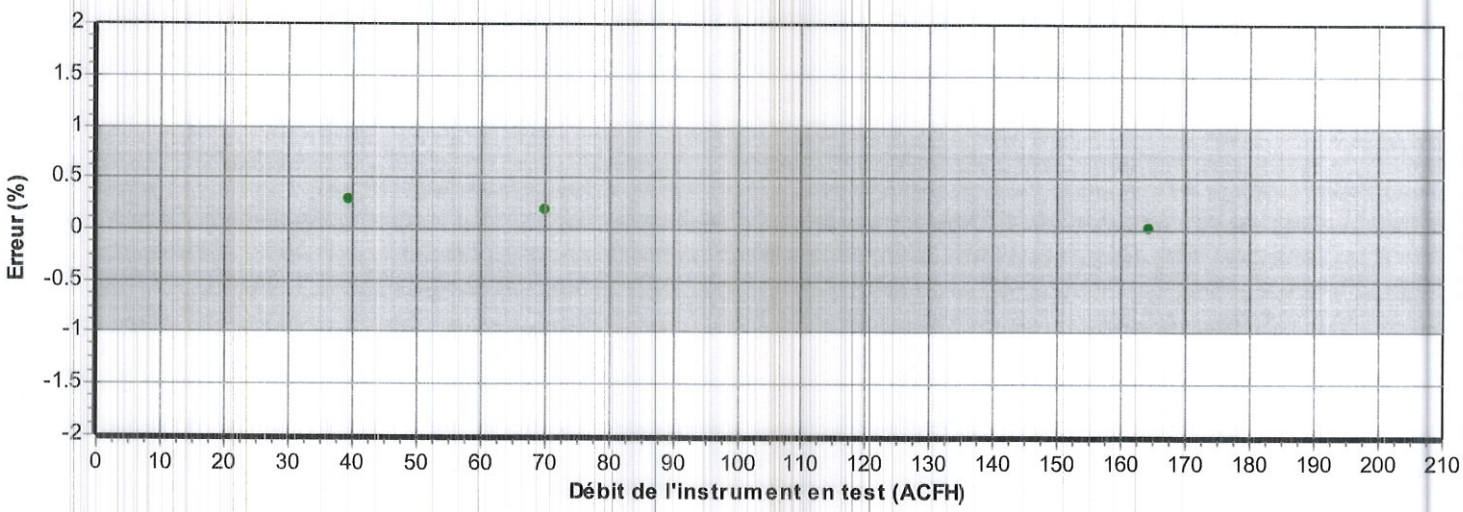
Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005

Certificat d'étalonnage # 9786

Numéro de série:	99A274209	Station de mesure:	3
Date d'étalonnage:	2018-11-12	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-130		

Résultats finaux



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

Bernard Poirier
Métrologiste

Signature

Instrumentation Saint-Laurent inc.
Accrédité ISO 17025

CLAS NRC-CNRC CLAS 2010-02

SCC Accredited LAB LAB Accrédité CCN N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-136 09/03/19

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

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

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

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Vaisala HMI14/HMP46	**No. du certificat d'étalonnage:**	2018002178
No. Série:	T1450150/T1940011	**Dernière date d'étalonnage:**	10-Apr-18
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	10-Apr-19
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
25.0 °C	25.0 °C	25.2 °C	+0.2 °C	25.2 °C	1.0 °C	
40.0 °C	40.0 °C	40.2 °C	+0.2 °C	40.2 °C	1.0 °C	
28.0 %RH	28.2 %RH	29.0 %RH	+0.8 %RH	29.0 %RH	-- %RH	
48.0 %RH	48.1 %RH	49.3 %RH	+1.2 %RH	49.3 %RH	-- %RH	
75.0 %RH	74.7 %RH	74.0 %RH	-0.7 %RH	74.0 %RH	-- %RH	

Conditions Environnementales: Température: 22 °C Humidité: 45 %RH

Type d'Étalonnage:

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	9 Mars 2019
Date du prochain Étalonnage:	9 Mars 2020
Date d'émission du certificat:	9 Mars 2019

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

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

Martin Langlais - Technicien

2019. 03. 19

CERTIFICATE OF NIST TRACEABLE CALIBRATION

Calibration Certificate No: 69804

Customer Information

Customer: Services Polytests, Inc.

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

Customer PO #: 100476

Calibration Procedure Information

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

Calibration Standards Information

Graftel ID	Manufacturer	Model #	Description	CAL Due
10086	Furness Controls	FC0332	DP Transmitter	6/6/2019
10100	Graftel	n/a	Temperature	10/29/2019
10171	Furness	FC0332-2W	0 - .4" H2O	11/10/2018
10187	Vaisala	PTB210	Barometric Pressure Gauge	11/22/2018
10157	HOBO	UX100-011	RH/Temp logger	11/10/2018

Sensor Information

Manufacturer: Omega Description: Anemometer Method Used: Pitot Tube

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

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

Serial #: 1015949

Comments: Calibration Date: 08/16/2018 | Note: Limited calibration range = 40 to 5000 fpm
Calibration Due: 08/16/2019

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

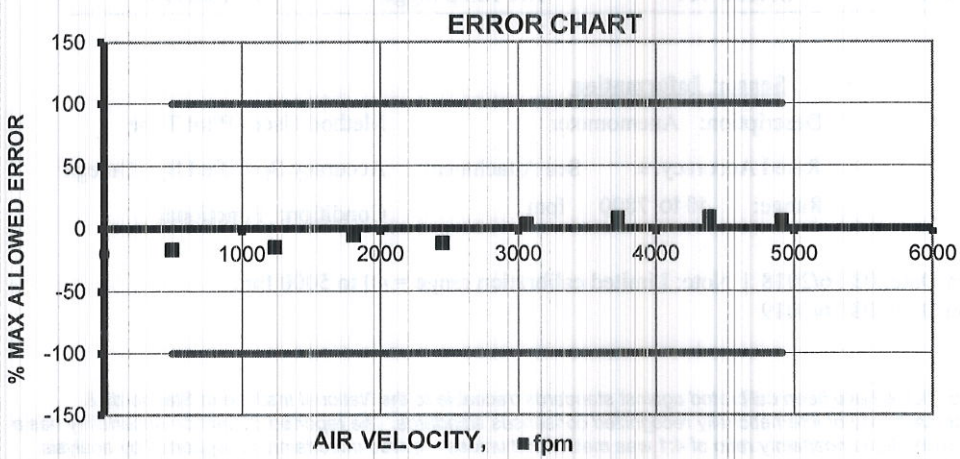
Performed By: _____ Date: 8/16/2018

Philip Davis
Calibration Technician

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

ATTACHMENT TO CALIBRATION CERTIFICATE 69804
AS FOUND/AS LEFT DATA

Reading From Standard,	Lower Limit of Meter Reading,	Measured Reading From Meter,	Upper Limit of Meter Reading,	Error,	Measurement Uncertainty,	STATUS
Actual Air Velocity						
fpm	fpm	fpm	fpm	fpm	fpm	
494	488	493	500	-1	2.47	Pass
1238	1225	1236	1251	-2	6.19	Pass
1805	1786	1804	1824	-1	9.03	Pass
2448	2423	2445	2473	-3	12.24	Pass
3063	3031	3064	3095	1	15.32	Pass
3724	3686	3727	3762	3	18.62	Pass
4388	4343	4392	4433	4	21.94	Pass
4911	4861	4914	4961	3	24.56	Pass



INSTRUMENT SPECIFICATIONS		
Test Fluid	Air	
Lower Range	40	fpm
Upper Range	7800	fpm
Rated Accuracy	1%Rding +1 digit	
LABORATORY AMBIENT CONDITIONS		
Pressure	14.36	psia
Humidity	56.22	% RH
Temperature	74.51	F

Flow - Humidity - Temperature - Pressure - Design - Consulting - Engineering

NIST Traceable Calibration Data Sheet

Graftel, LLC. 870 Cambridge Drive, Elk Grove Village, IL.60007
P. 847-364-2600 F. 847-364-2899

www.graftel.com

2018.08.27

Instrumentation
Saint•Laurent inc.
Accrédité ISO 17025

CLAS
NRC·CNRC
CLAS 2010-02

SCC Accredited LAB
LAB
Accrédité CCN
N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-154 05/03/19

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

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

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

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Fluke 744	**No. du certificat d'étalonnage:**	2019000879
No. Série:	7798010	**Dernière date d'étalonnage:**	7-Feb-19
Certificat fait par:	Alpha Controls	**Prochaine date d'étalonnage:**	7-Feb-20
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage	Incertitude Élargie	Commentaire
-17.000 mV	-17.000 mV	-17.011 mV	-0.011 mV	-17.011 mV	0.1 mV	Input#1
0.000 mV	0.000 mV	0.055 mV	+0.055 mV	0.055 mV	0.1 mV	Input#1
20.000 mV	20.000 mV	19.931 mV	-0.069 mV	19.931 mV	0.1 mV	Input#1
30.000 mV	30.000 mV	30.006 mV	+0.006 mV	30.006 mV	0.1 mV	Input#2
Input#3 Non-Conforme						
5.000 V.DC.	5.000 V.DC.	4.999 V.DC.	-0.001 V.DC.	4.999 V.DC.	0.1 V.DC.	Input#4
30.000 mV	30.000 mV	29.990 mV	-0.010 mV	29.990 mV	0.1 mV	Input#5
30.000 mV	30.000 mV	30.031 mV	+0.031 mV	30.031 mV	0.1 mV	Input#6
100.00 Ohms	100.00 Ohms	99.99 Ohms	-0.01 Ohms	99.99 Ohms	1.0 Ohms	Input#7
100.00 Ohms	100.00 Ohms	99.98 Ohms	-0.02 Ohms	99.98 Ohms	1.0 Ohms	Input#8
100.00 Ohms	100.00 Ohms	100.02 Ohms	+0.02 Ohms	100.02 Ohms	1.0 Ohms	Input#9
100.00 Ohms	100.00 Ohms	99.98 Ohms	-0.02 Ohms	99.98 Ohms	1.0 Ohms	Input#10
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#11TypeT
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#12TypeT
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#13 TypeJ
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#14TypeJ
100.0 °C	100.0 °C	99.8 °C	-0.2 °C	99.8 °C	1.0 °C	Input#15 TypeJ
100.0 °C	100.0 °C	99.7 °C	-0.3 °C	99.7 °C	1.0 °C	Input#16TypeJ
100.00 Ohms	100.00 Ohms	99.98 Ohms	-0.02 Ohms	99.98 Ohms	1.0 Ohms	Input#17
100.00 Ohms	100.00 Ohms	99.99 Ohms	-0.01 Ohms	99.99 Ohms	1.0 Ohms	Input#18
100.00 Ohms	100.00 Ohms	99.99 Ohms	-0.01 Ohms	99.99 Ohms	1.0 Ohms	Input#19
100.00 Ohms	100.00 Ohms	99.96 Ohms	-0.04 Ohms	99.96 Ohms	1.0 Ohms	Input#20
12.000 mA	12.000 mA	12.003 mA	+0.003 mA	12.003 mA	1.00 mA	Input#21
12.000 mA	12.000 mA	12.003 mA	+0.003 mA	12.003 mA	1.00 mA	Input#22

Conditions Environnementales: Température: 19 °C Humidité: 20 %RH

5F09101

Instrumentation Saint•Laurent inc.
Accrédité ISO 17025

CLAS NRC·CNRC CLAS 2010-02

SCC Accredited LAB LAB Accrédité CCN N°669

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-154 05/03/19

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

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

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

Type d'Étalonnage: Test avec EM-147

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

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	5 Mars 2019
Date du prochain Étalonnage:	5 Mars 2020
Date d'émission du certificat:	5 Mars 2019

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

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

M Langlais

Martin Langlais - Technicien

2019-03-19

5F09101

4407 rue Charleroi, Montréal-Nord (Québec) H1H 1T6 Canada
TEL.: (514) 329-3242 / 1 888 774-6665
FAX : (514) 329-3750
info.canada@trescal.com

Certificat d'Étalonnage / Certificate of Calibration

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

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

CERTIFICAT No / Certificate No: **254068**

PROCÉDURE / Procedure :
TRESCAL - EXTECH_365510

Date étalonnage/ Calibration Performed : 2018-12-20

Echéance/ Due Date : 2019-12-20

Type de résultat / *Results type* : **As-Found = As-Left**

Résultats d'essais / *Test results* : Conforme / In Tolerance

Conditions de mesure / Measurement conditions

TEMPÉRATURE / Temp. : **22°C**

HUMIDITÉ / Humidity : **23% RH**

Usage restreint/ *Restricted use* : ☐

Réparation effectuée / *Repair performed* : ☐

Ajustement effectué / *Adjustment performed* : ☐

ÉTALONS UTILISÉS/ Standards Used:

Identification	Manuf.	Model	Description	Ser. #	Etalonné/ Cal.	Echéance/ Due
PR0313	H-P	53132A	UNIVERSAL COUNTER	3546A03142	2018-07-03	2019-07-03
PR0392	AGILENT	33250A	FUNCTION/ARBITRARY WAVEFORM GENERATOR	MY40008014	2017-06-19	2019-06-19

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

NOTES :

2019-01-07

Technicien :
Technician

Y. MEFTAH

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

ACCREDITATION 17025 ISO/IEC

Réf : [illegible]

Trescal

Certificat d'Étalonnage
Certificate of Calibration

	254068
CLIENT / Customer :	SERVICES POLYTESTS INC.
DESCRIPTION / Description :	CHRONOMÈTRE / STOPWATCH TIMER
MANUFACTURIER / Manufacturer :	EXTECH
MODÈLE / Model :	365510

DESCRIPTION Description	LIMITES Limits	LECTURES Readings	LIMITES Limits
	Min		Max
Temps écoulé, chronomètre sous test / Elapsed time on test stopwatch		**Comptes / Counts** Chronomètre/timer 162060	

Minutes	Seconds	1/100 sec
27	0	60

Total au compteur / Reference timer: 162058.0 comptes/counts

(Δt) Deviation (1/100sec): 2.00

		Min	Readings	Max
Deviation Par jour/ Per day (%):	0.0012 %	*** Secondes**	Deviation 24hrs	*** Secondes**
Deviation Par jour/ Per day (sec):	**1.07 sec**	-3.00	**1.07**	3.00

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

Incertitude/ Uncertainty: ±37 ms

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

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

ACCREDITATION 17025 ISO/IEC

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS ARC·CNRC
CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

CERTIFICAT D'ÉTALONNAGE # 9799

Date d'étalonnage : 2018-11-14
Date d'émission du certificat : 2018-11-14

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

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

CONFORMITÉ AU PROGRAMME DE QUALITÉ

Tous les étalonnages sont effectués conformément au manuel d'assurance qualité de Polycontrols qui est conforme à la norme ISO/IEC 17025 – 2005, à la norme ISO 9001 – 2015 ainsi qu'à tout autre exigences de qualité définies dans la description d'achat des clients.

TRAÇABILITÉ

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

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

APTITUDE EN MATIÈRE DE MESURE ET D'ÉTALONNAGE - CMC

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

SOMMAIRE DES CONDITIONS DE L'INSTRUMENT EN TEST

Conditions initiales	En bon état
Travail Effectué	Étalonnage de l'instrument
Résultats	Lectures initiales hors tolérance
	Lectures finales dans les tolérances
Remarques	Valeur de l'instrument corrigée = Lecture de l'indicateur de l'instrument * 0.98 K facteur
	Fréquence d'étalonnage aux 12 mois

Carl Tessier-Duncan
Métrologiste

Responsable du laboratoire

2018. 11. 22

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS NRC·CNRC CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 9799

Numéro de série:	23544	Station de mesure:	4
Date d'étalonnage:	2018-11-14	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-178		

Instrument de mesure de référence utilisé pour l'étalonnage initial

Description	Modèle	# Série	Traçabilité	Date dû
DHI molbloc (30 slpm)	3E4-VCR-V-Q	2359	1500231794	2019-01-19
DHI molbox1+	Molbox1+	2089	1500241952	2019-07-24
RTD Mist	Mist	L00295	2017007605	2018-12-07
Module 44.5 PSI avec Baro 163671	Module 30	160659	2018002180	2019-04-12

Spécifications initiales de l'appareil

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

Condition d'étalonnage

Gaz	Air
Température ambiante	21 °C
Pression ambiante	1009.77 mbar
Orientation	Horizontale
Élastomère	Viton
Valve	

Lectures initiales

Débit du test ALH	Instrument en test L	Valeurs mesurées Pression PSIA	Température °C	Référence L	Référence calculée L	Erreur calculée L	Tolérance acceptable L	TUR
364.6385	61.8500	14.6522	21.55	60.4150	60.6869	1.1631	1.2137	>4
612.3148	104.0800	14.6557	21.47	101.7210	102.1249	1.9551	2.0425	>4
1628.8459	276.5500	14.6757	21.45	269.8463	270.5303	6.0197	5.4106	>4

Carl Tessier Dansereau
Métrologiste

Carl Tessier-Dansereau
Signature

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS NRC·CNRC CLAS 2009-02

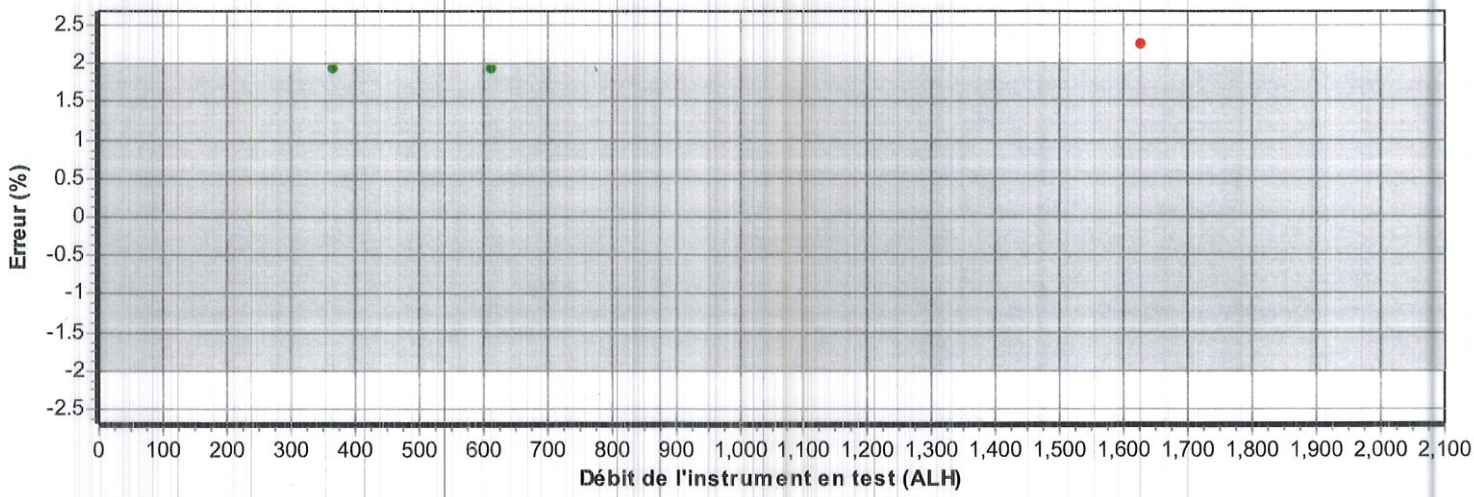
Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 9799

Numéro de série:	23544	Station de mesure:	4
Date d'étalonnage:	2018-11-14	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-178		

Résultats initiaux



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

Carl Tessier Dansereau
Métrologiste

Carl Tessier-Dansereau
Signature

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

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

Certificat d'étalonnage # 9799

Numéro de série:	23544	Station de mesure:	4
Date d'étalonnage:	2018-11-14	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-178		

Instrument de mesure de référence utilisé pour l'étalonnage final

Description	Modèle	# Série	Traçabilité	Date dû
DHI molbloc (30 slpm)	3E4-VCR-V-Q	2359	1500231794	2019-01-19
DHI molbox1+	Molbox1+	2089	1500241952	2019-07-24
RTD Mist	Mist	L00295	2017007605	2018-12-07
Module 44.5 PSI avec Baro 163671	Module 30	160659	2018002180	2019-04-12

Spécifications finales de l'appareil

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

Condition d'étalonnage

Gaz	Air
Température ambiante	21.5 °C
Pression ambiante	1025.86 mbar
Orientation	Horizontale
Élastomère	Viton
Valve	

Lectures finales

Débit du test ALH	Instrument en test L	Valeurs mesurées Pression PSIA	Température °C	Référence L	Référence calculée L	Erreur calculée L	Tolérance acceptable L	TUR
352.3959	58.5060	14.8906	21.27	59.3386	58.5953	-0.0893	1.1719	>4
614.6929	102.2940	14.9046	21.20	103.7453	102.3248	-0.0308	2.0465	>4
1597.3393	265.5408	14.9230	21.23	270.0182	266.0123	-0.4715	5.3202	>4

Fc. : 1.0100 7684

Carl Tessier Dansereau
Métrologiste

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CLAS 2009-02

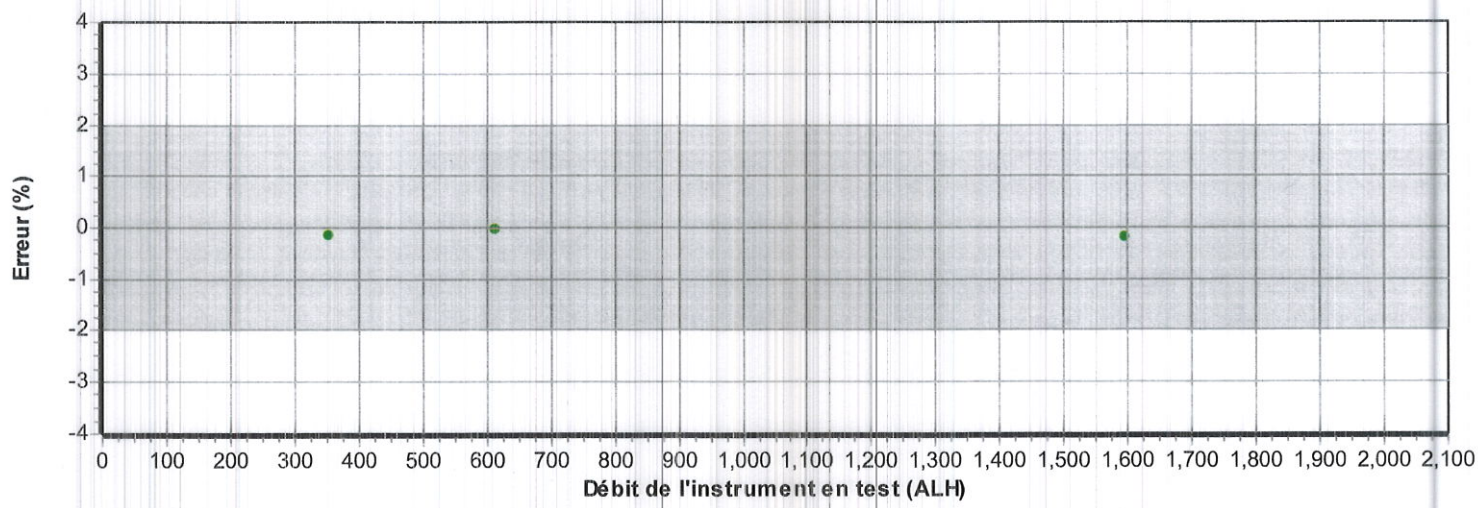
Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 9799

Numéro de série:	23544	Station de mesure:	4
Date d'étalonnage:	2018-11-14	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-178		

Résultats finaux



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Carl Tessier Dansereau
Métrologiste

Carl Tessier Dansereau
Signature

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CLAS NRC·CNRC
CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

CERTIFICAT D'ÉTALONNAGE # 9801

Date d'étalonnage : 2018-11-14
Date d'émission du certificat : 2018-11-14

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

Étalonnage d'un
Shinigawa DCDa-2c S/N : 23543

CONFORMITÉ AU PROGRAMME DE QUALITÉ

Tous les étalonnages sont effectués conformément au manuel d'assurance qualité de Polycontrols qui est conforme à la norme ISO/IEC 17025 – 2005, à la norme ISO 9001 – 2015 ainsi qu'à tout autre exigences de qualité définies dans la description d'achat des clients.

TRAÇABILITÉ

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

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

APTITUDE EN MATIÈRE DE MESURE ET D'ÉTALONNAGE - CMC

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

SOMMAIRE DES CONDITIONS DE L'INSTRUMENT EN TEST

Conditions initiales	En bon état
Travail Effectué	Lectures Initiales = Lectures finales, aucun ajustement Étalonnage de l'instrument
Résultats	Lectures initiales dans les tolérances
Remarques	Fréquence d'étalonnage aux 12 mois

Carl Tessier-Dansereau
Métrologiste

Responsable du laboratoire

2018-11-22

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS ARC·CNRC CLAS 2009-02

Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005 CERTIFICATION

Certificat d'étalonnage # 9801

Numéro de série:	23543	Station de mesure:	4
Date d'étalonnage:	2018-11-14	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-179		

Instrument de mesure de référence utilisé pour l'étalonnage final

Description	Modèle	# Série	Traçabilité	Date dû
DHI molbloc (30 slpm)	3E4-VCR-V-Q	2359	1500231794	2019-01-19
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Spécifications finales de l'appareil

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

Condition d'étalonnage

Gaz	Air
Température ambiante	21.5 °C
Pression ambiante	1027.25 mbar
Orientation	Horizontale
Élastomère	Viton
Valve	

Lectures finales

Débit du test ALH	Instrument en test L	Valeurs mesurées Pression PSIA	Température °C	Référence L	Référence calculée L	Erreur calculée L	Tolérance acceptable L	TUR
350.3144	59.1000	14.9078	21.31	59.1513	58.3496	0.7504	1.1670	>4
598.7895	101.1200	14.9160	21.26	101.1058	99.6653	1.4547	1.9933	>4
1605.3452	269.5100	14.9364	21.25	271.3957	267.1497	2.3603	5.3430	>4

Fe : 0,98730288

Carl Tessier Dansereau
Métrologiste

Carl Tessier-Dansereau
Signature

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS
ARC-CNRC
CLAS 2009-02

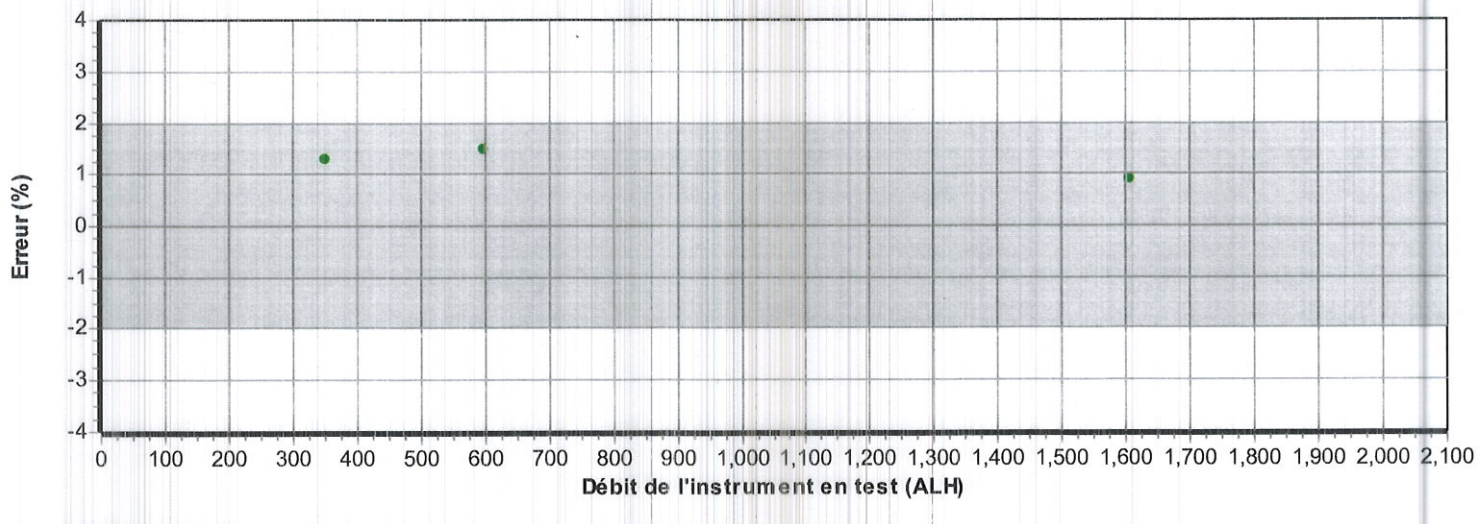
Conseil canadien des normes
Laboratoire accrédité
Portée d'accréditation 655

ISO/IEC 17025-2005
CERTIFICATION

Certificat d'étalonnage # 9801

Numéro de série:	23543	Station de mesure:	4
Date d'étalonnage:	2018-11-14	Procédure:	POS-CAL-005
Identification de l'instrument:	EM-179		

Résultats finaux



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Carl Tessier Dansereau
Métrologiste

Carl Tessier-Dansereau
Signature

EM-183

Airgas

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

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

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

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

ANALYTICAL RESULTS

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

Notes:

Approved for Release

Airgas

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

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

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

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

ANALYTICAL RESULTS

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

Approved for Release

Instrumentation Saint•Laurent inc.

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

CERTIFICAT D'ÉTALONNAGE

No.Certificat: CE-EM-224 06/03/19

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

SPÉCIFICATION DE CALIBRATION	
Procédure de service:	ISL-022
Précision requise:	+/- 1/32"
Fréquence d'étalonnage: (jours)	365

SPÉCIFICATION DE L'INSTRUMENT			
Type d'instrument:	Ruban à mesurer	**Type d'entrée:**	Mesure
Manufacturier:	Stanley	**Type de sortie:**	N/A
No. Model:	Leverlock 12'	**Type de mesure:**	Inch
No. Série:	N/A	**Gamme:**	0 à 12'
Emplacement:	Portable	**No. Machine:**	N/A

SPÉCIFICATION DE L'ÉTALON			
Étalon Utilisé:	Tape Mesure	**No. du certificat d'étalonnage:**	TA-47525320
No. Série:	17413592	**Dernière date d'étalonnage:**	23-Oct-17
Certificat fait par:	Starrett	**Prochaine date d'étalonnage:**	23-Oct-19
Commentaire:			

RÉSULTAT D'ÉTALONNAGE

Entrée Source	Valeur Donnée	Valeur Actuelle	Erreur de Déviation	Valeur après Étalonnage		Commentaire
1.00 "	1.00 "	1.00 "	0.00 "	1.00 "		
36.00 "	36.00 "	36.00 "	0.00 "	36.00 "		
72.00 "	72.00 "	72.00 "	0.00 "	72.00 "		
108.00 "	108.00 "	108.00 "	0.00 "	108.00 "		
132.00 "	132.00 "	132.00 "	0.00 "	132.00 "		

Conditions Environnementales: Température: 19 °C Humidité: 16 %RH

Commentaire:

Instrumentation St-Laurent Inc. Certifie que l'instrument ci-haut, rencontre ou excède les spécifications établies par le fabriquant. Les étalons utilisés pour effectuer l'étalonnage est retraçable au CNRC et/ou au NIST.

DATE D'ÉTALONNAGE / ÉMISSION DU CERTIFICAT	
Date d'Étalonnage:	6 Mars 2019
Date du prochain Étalonnage:	6 Mars 2020
Date d'émission du certificat:	6 Mars 2019

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

Martin Langlais - Technicien

2019.03.19

EM-303
EM-304

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

ACCREDITED A2LA Certificate No. 1750.01 Calibration

Cert. No.: 4199-10569957

Traceable® Certificate of Calibration for Dial Barometer

Manufactured for and distributed by : Control Company 12554 Galveston Rd B230, Webster, TX 77598

Instrument Identification:

Model: 4199, S/N: 192343395 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	22 Oct 2019	1000432773

Certificate Information:

Technician: 57 Procedure: CAL-33 Cal Date: 17 Jul 2019 Cal Due Date: 17 Jul 2021

Test Conditions: 64.68%RH 23.57°C 1017mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
mb/hPa	N.A.	N.A.		960.02	960	Y	955	965	0.62	>4:1
mb/hPa	N.A.	N.A.		985.80	986	Y	981	991	0.62	>4:1
mb/hPa	N.A.	N.A.		1014.51	1013	Y	1010	1020	0.62	>4:1

This certificate indicates Traceability to standards provided by (NIST) National Institute of Standards and Technology and/or a National Standards Laboratory.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement : (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ± U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min=As Left Nominal(Rounded) – Tolerance; Max= As Left Nominal(Rounded) + Tolerance;

Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Note :

Maintaining Accuracy:

In our opinion once calibrated your Dial Barometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Dial Barometer change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

Août 2019

CONTROL COMPANY 12554 Galveston RD Suite B230 Webster TX USA 77598
Phone 281 482-1714 Fax 281 482-9448 sales@control3.com www.control3.com

APPENDIX 4: Unit pre burn

time minutes	Flue temp °F	Room temp °F	Tunnel dry bulb °F	scale lbs	Right °F	Back °F	bottom °F	Top °F	Left °F
1	79,08	66,46	71,32	4,35	69,04	58,78	59,34	62,85	60,50
2	195,14	66,90	85,29	3,77	69,52	59,00	59,51	72,27	66,03
3	266,21	67,28	97,30	3,67	70,03	59,29	59,79	81,53	76,87
4	442,74	67,59	125,80	3,38	70,70	60,07	60,33	102,07	97,66
5	503,59	67,79	123,55	2,97	71,13	61,85	61,02	153,47	127,26
6	489,35	67,81	114,15	3,11	70,51	64,36	61,99	197,97	159,33
7	489,56	68,10	110,98	2,58	70,95	67,44	63,09	238,91	187,98
8	496,20	68,10	109,86	2,39	71,04	70,99	64,32	273,94	220,22
9	502,19	68,25	109,63	2,18	71,30	75,11	65,75	298,13	248,80
10	505,62	68,56	109,98	1,98	71,48	79,58	67,37	321,02	278,15
11	498,76	68,79	109,45	1,79	71,72	84,71	69,22	344,37	303,88
12	486,88	68,93	107,92	1,69	71,98	90,65	71,35	355,21	326,85
13	475,88	69,00	106,67	1,53	72,25	96,98	73,79	358,59	343,46
14	457,93	69,05	105,01	1,38	72,44	103,51	76,41	359,38	357,71
15	443,22	69,02	116,22	1,38	72,51	110,13	79,33	356,04	367,06
16	449,06	69,31	133,92	11,06	72,75	116,87	83,44	356,45	358,63
17	629,86	69,32	178,37	10,75	73,16	123,29	88,51	358,53	350,01
18	745,17	69,56	214,32	10,27	73,81	129,34	94,55	377,92	357,21
19	809,85	70,37	242,08	9,76	74,50	135,35	102,03	413,75	377,75
20	645,75	70,78	180,70	9,57	74,94	141,10	110,64	436,12	397,26
21	543,21	70,64	147,13	9,37	75,40	146,46	118,73	433,80	401,60
22	491,29	70,70	130,88	9,26	75,68	151,79	126,09	424,22	402,96
23	459,03	70,56	120,91	9,06	75,79	156,78	132,92	413,42	404,33
24	433,76	70,34	114,79	8,97	75,78	161,58	139,14	400,40	404,06
25	426,72	70,40	111,32	8,87	75,74	165,86	145,40	391,02	407,78
26	426,66	70,46	108,93	8,77	75,72	169,74	151,42	381,72	415,59
27	418,77	70,31	107,13	8,67	75,73	173,35	157,52	372,20	419,87
28	417,12	70,50	106,38	8,46	75,85	176,47	163,40	366,19	419,23
29	428,30	70,54	106,41	8,36	75,89	179,11	169,14	360,62	416,77
30	458,91	70,59	107,90	8,17	76,06	181,50	174,55	368,40	417,08
31	478,56	70,48	109,21	8,07	76,15	183,60	179,88	379,64	417,89
32	480,30	70,48	109,83	7,83	76,35	185,57	184,79	390,86	422,72
33	479,94	70,47	109,64	7,76	76,42	187,53	189,70	392,36	428,27
34	487,36	70,39	110,30	7,56	76,59	189,35	194,73	397,43	435,15
35	493,95	70,61	110,82	7,37	76,78	191,10	199,84	403,89	445,51
36	509,21	70,54	112,21	7,27	76,88	192,83	205,23	413,12	458,04
37	524,81	70,87	123,13	7,09	77,18	194,75	210,33	426,69	466,79
38	538,64	70,83	119,33	6,86	77,34	196,72	215,72	443,74	472,98
39	525,22	70,90	116,50	6,76	77,44	198,55	221,45	448,85	474,16
40	503,60	70,81	114,35	6,57	77,71	200,46	226,79	449,88	473,43
41	480,78	70,96	111,57	6,47	78,01	202,40	231,68	447,02	468,76
42	463,18	71,33	109,82	6,38	78,07	204,52	236,49	439,76	462,98
43	449,45	71,63	108,60	6,28	78,56	206,47	240,77	432,37	460,63
44	452,56	71,96	108,40	6,07	79,02	208,47	245,00	431,19	465,69
45	452,01	72,23	107,72	5,97	79,39	210,13	248,96	427,77	470,05
46	457,05	72,77	108,08	5,78	79,56	211,82	252,93	426,26	472,11
47	468,51	72,76	109,09	5,68	79,93	213,40	257,00	428,63	473,76
48	480,24	73,17	109,78	5,58	80,25	214,90	261,00	434,74	476,79
49	493,15	73,21	110,50	5,48	80,55	216,38	265,14	439,83	480,87
50	504,77	73,62	111,77	5,27	80,98	217,77	269,61	444,74	485,36
51	513,83	73,96	112,19	5,17	81,36	219,30	273,76	455,23	490,62
52	520,81	74,16	113,49	5,07	81,61	220,63	278,02	458,85	497,58
53	475,33	74,25	106,25	4,88	81,89	222,37	282,21	459,55	498,63
54	449,74	74,14	104,27	4,78	82,06	224,12	285,83	460,22	494,52
55	434,63	74,57	102,34	4,69	82,26	225,83	288,89	460,52	488,20
56	424,08	74,46	100,32	4,69	82,46	227,34	291,44	460,63	481,73
57	418,64	74,92	100,21	4,47	82,58	229,00	293,85	460,23	475,13
58	417,30	74,32	100,28	4,47	82,68	230,50	295,96	462,90	469,00
59	417,40	74,79	99,61	4,37	82,78	231,79	297,88	466,33	463,66
60	420,29	74,37	99,43	4,28	82,82	233,01	299,61	473,12	459,55
61	420,21	74,49	98,65	4,18	82,88	234,04	301,11	476,68	457,49
62	416,99	74,51	98,27	4,18	82,96	235,12	302,47	479,27	457,06
63	415,77	74,90	97,96	4,08	83,02	236,20	303,72	479,72	457,74
64	415,74	74,81	97,38	3,99	83,05	237,16	304,78	479,41	459,32
65	414,64	75,05	97,93	3,89	83,11	238,13	305,64	484,41	461,34
66	416,86	74,92	98,24	3,77	83,16	239,09	306,39	484,74	463,01
67	416,24	75,09	97,80	3,77	83,19	239,93	306,86	486,09	464,22
68	416,62	75,42	97,66	3,67	83,25	240,70	307,33	488,71	464,57
69	415,44	75,36	98,38	3,58	83,34	241,72	307,84	486,88	466,64
70	414,14	75,20	98,82	3,48	83,51	242,46	308,14	486,55	467,96
71	416,40	75,52	98,22	3,48	83,42	243,33	308,27	485,06	469,41
72	417,79	75,44	98,50	3,38	83,40	244,25	308,46	485,28	470,40
73	421,50	75,46	97,66	3,29	83,55	244,94	308,36	485,58	471,30
74	423,71	75,12	98,32	3,19	83,63	245,76	308,50	491,96	472,06
75	421,55	75,39	98,30	3,19	83,67	246,97	308,70	496,62	473,15
76	418,55	75,42	98,45	3,07	83,50	248,04	308,95	500,35	474,06
77	415,05	75,73	97,88	2,97	83,35	248,85	309,14	502,56	475,03
78	411,99	74,69	97,86	2,88	83,31	250,08	309,45	503,63	476,95
79	406,72	75,22	96,96	2,88	83,44	250,92	309,70	504,20	478,67
80	402,43	75,50	97,13	2,78	83,47	252,12	309,94	504,03	479,82
81	398,49	75,55	96,87	2,78	83,51	253,13	309,96	501,58	483,37
82	394,29	75,88	96,77	2,68	83,71	254,76	310,53	498,94	485,44
83	389,04	75,34	96,11	2,68	83,63	255,84	310,62	496,94	486,17
84	383,50	75,92	95,22	2,58	83,67	256,93	310,98	490,92	485,73
85	379,10	75,76	96,03	2,49	83,62	258,23	311,40	486,37	487,28
86	376,51	75,37	95,48	2,48	83,58	259,18	311,78	479,56	487,39
87	372,83	75,48	95,78	2,48	83,70	260,44	312,29	473,21	486,81
88	369,12	75,26	95,59	2,39	83,69	261,46	312,91	468,65	486,60
89	364,00	75,74	94,48	2,39	83,64	262,51	313,46	461,66	485,21
90	360,63	75,80	94,74	2,27	102,17	263,71	314,05	454,22	484,54
91	356,52	75,80	95,02	2,27	81,74	264,43	314,51	447,30	481,76
92	349,47	75,63	93,37	2,27	469,25	265,21	315,13	438,80	479,63
93	342,63	75,80	93,17	2,17	473,38	266,41	315,51	434,35	475,93
94	338,05	76,17	93,16	2,17	474,54	267,31	316,34	428,16	472,04
95	333,23	75,50	92,41	2,17	473,91	268,26	316,98	421,59	468,10
96	394,18	75,86	123,63	1,88	473,42	270,88	316,68	419,29	460,65
97	486,06	75,94	119,39	1,88	490,71	271,80	320,71	425,80	478,10
98	501,03	76,40	120,86	1,78	503,18	273,31	325,04	425,84	497,76
99	503,46	75,98	122,12	1,69	510,33	275,62	330,44	423,50	516,12
100	501,95	76,39	123,43	1,69	515,06	278,03	336,54	421,84	529,55
101	496,10	76,17	123,27	1,59	517,33	280,70	343,37	418,91	539,61
102	490,76	76,22	124,16	1,59	519,16	283,58	350,86	414,19	546,62
103	481,95	76,18	124,03	1,47	519,35	286,28	358,80	410,69	550,99
104	473,69	76,19	123,55	1,47	519,23	289,28	366,96	404,98	550,95

105	462,57	76,24	122,55	1,37	518,30	292,08	375,24	398,26	551,34
106	452,80	75,98	121,28	1,37	516,28	294,86	383,43	392,07	548,33
107	442,64	76,37	120,20	1,28	514,35	297,32	391,58	385,01	542,63
108	429,06	76,21	118,68	1,28	512,17	299,81	399,28	376,76	535,11
109	419,37	76,16	117,67	1,28	510,91	302,09	406,27	369,84	527,39
110	412,99	76,39	116,12	1,28	508,97	303,86	412,50	361,45	520,84
111	407,11	75,85	115,41	1,27	506,57	306,08	418,11	355,14	513,58
112	401,70	76,44	114,69	1,18	504,90	307,66	422,89	348,10	507,44
113	397,78	76,12	114,07	1,18	502,09	309,16	426,89	342,51	501,89
114	394,40	76,37	113,81	1,08	499,56	310,15	430,43	338,33	497,34
115	390,19	76,43	112,70	1,08	497,56	311,30	433,49	332,60	492,52
116	385,48	76,22	111,90	1,08	493,79	311,90	436,22	328,16	488,32
117	382,23	76,31	111,29	1,08	490,47	312,76	438,50	323,38	483,93
118	290,65	76,95	123,78	13,46	471,76	315,75	438,18	313,09	465,35
119	313,84	76,87	116,77	13,46	449,23	315,51	439,89	307,87	443,02
120	338,88	76,55	132,28	13,36	436,48	316,31	441,51	301,06	420,55
121	459,22	75,97	155,94	13,05	447,74	316,44	445,90	302,66	400,71
122	526,74	76,58	147,22	12,76	468,14	315,09	451,32	331,52	389,11
123	535,48	76,54	132,66	12,56	471,41	313,18	453,71	360,26	382,20
124	584,93	76,93	131,58	12,35	474,49	311,57	453,41	401,84	380,24
125	597,51	76,97	131,24	12,05	480,14	309,81	451,21	434,02	384,92
126	582,52	77,31	129,12	11,86	485,01	308,47	447,88	455,91	390,42
127	582,43	76,99	128,63	11,66	491,21	306,96	443,49	474,92	398,23
128	607,44	76,85	130,34	11,35	501,24	305,46	438,83	498,82	410,67
129	655,16	76,67	134,41	11,16	512,49	304,16	433,98	519,60	427,97
130	686,12	77,45	137,85	10,75	530,26	302,73	429,21	547,94	439,50
131	702,47	77,56	140,78	10,56	546,47	301,89	424,77	566,08	450,69
132	714,60	77,94	143,09	10,16	559,02	301,71	420,56	587,13	466,52
133	728,71	78,27	145,92	9,85	573,03	301,86	416,61	601,97	483,87
134	736,78	77,29	146,66	9,57	586,17	302,66	412,86	617,75	503,12
135	736,27	77,83	147,29	9,25	599,29	304,37	409,38	631,25	527,02
136	722,60	78,28	147,89	8,96	604,84	306,35	406,16	642,95	549,87
137	719,95	78,25	147,08	8,67	623,96	308,64	403,28	650,86	567,69
138	669,98	77,84	139,00	8,46	633,07	311,37	400,53	654,85	580,62
139	578,75	78,43	127,51	8,26	625,31	314,18	397,93	638,84	569,68
140	525,80	78,52	120,87	8,16	611,06	316,64	395,25	618,22	552,47
141	490,56	78,57	116,84	8,07	596,60	319,13	392,53	594,85	535,02
142	466,69	78,34	113,32	8,07	581,05	320,65	389,73	575,96	518,76
143	450,07	77,95	111,68	7,87	566,77	322,13	387,01	563,57	505,54
144	436,22	78,20	109,76	7,87	555,32	322,63	384,24	548,49	493,42
145	425,18	78,19	108,23	7,77	543,79	323,22	381,48	535,67	483,07
146	415,75	78,11	107,52	7,77	534,27	322,62	378,74	524,66	473,41
147	407,54	77,18	104,59	7,66	524,67	322,41	375,65	514,09	465,08
148	400,64	78,39	105,01	7,56	517,14	321,42	372,97	503,13	457,85
149	396,00	77,68	104,52	7,56	511,00	320,47	370,26	495,08	451,57
150	393,27	77,35	103,87	7,46	506,54	318,72	367,64	484,44	445,08
151	388,80	77,83	102,86	7,37	501,93	316,97	364,86	476,34	439,39
152	386,26	77,22	103,05	7,36	498,86	315,51	362,25	468,57	434,59
153	384,00	77,59	102,14	7,27	495,04	314,04	359,75	462,11	430,41
154	382,24	77,65	102,27	7,17	493,31	312,22	357,16	457,11	426,52
155	381,67	77,24	101,63	7,17	492,30	310,38	354,63	452,09	422,48
156	381,85	77,84	101,81	7,07	492,47	308,69	352,21	448,45	419,25
157	382,93	77,81	101,62	6,96	494,07	306,38	349,83	445,60	416,52
158	383,64	78,01	100,87	6,86	496,08	304,84	347,51	441,78	413,56
159	384,03	77,95	101,02	6,86	498,14	303,04	345,20	440,31	412,04
160	384,38	77,64	100,88	6,76	499,94	300,96	342,94	438,99	410,39
161	385,05	77,66	100,36	6,67	501,79	298,80	340,68	437,48	410,08
162	386,92	77,69	99,46	6,66	503,07	297,16	338,39	438,60	409,60
163	388,78	77,54	100,40	6,57	507,04	295,65	336,32	440,81	409,46
164	393,80	77,95	100,99	6,47	511,31	293,86	334,28	441,58	409,61
165	398,75	77,52	100,60	6,37	518,03	292,11	332,15	441,76	409,99
166	402,99	78,12	101,42	6,27	526,09	290,47	330,18	445,29	409,90
167	408,35	78,17	102,15	6,28	538,17	289,14	328,22	446,40	411,94
168	410,89	78,21	101,74	6,06	550,90	287,71	326,25	446,15	413,05
169	413,46	77,81	101,45	5,96	564,70	286,24	324,28	447,61	415,40
170	413,41	78,30	101,68	5,87	580,06	285,00	322,31	448,60	416,78
171	415,02	78,19	101,28	5,77	588,58	283,53	320,38	450,60	417,15
172	414,93	78,38	101,20	5,77	585,79	282,52	318,44	455,30	418,60
173	413,99	77,85	101,54	5,67	584,88	281,59	316,51	460,15	420,84
174	413,13	78,19	102,01	5,57	584,73	280,63	314,58	461,13	422,26
175	412,21	78,35	100,54	5,48	584,76	279,57	312,82	463,32	425,84
176	409,59	77,76	100,30	5,36	584,31	279,01	311,09	466,88	429,36
177	407,33	78,02	100,85	5,36	583,05	278,37	309,40	466,21	432,44
178	405,85	78,18	101,12	5,26	580,29	278,19	307,76	468,39	436,00
179	406,50	78,81	100,83	5,17	579,82	277,63	306,10	469,31	438,41
180	405,17	78,44	100,74	5,16	578,55	277,40	304,53	470,91	442,03
181	405,79	78,14	100,49	5,07	576,63	277,07	302,94	473,45	445,97
182	406,55	78,42	100,83	4,97	574,91	276,93	301,48	476,04	447,97
183	408,53	78,60	100,17	4,97	571,82	277,02	300,13	480,18	451,72
184	407,70	78,40	100,72	4,78	569,25	277,33	298,70	486,21	454,34
185	406,42	78,83	100,13	4,78	566,25	277,58	297,34	490,15	457,67
186	405,30	78,87	101,17	4,68	562,18	277,94	296,05	494,51	463,26
187	407,63	79,21	102,16	4,56	557,55	278,56	294,88	501,31	467,99
188	411,08	79,34	101,27	4,56	553,20	279,02	293,66	506,17	472,53
189	413,65	78,86	100,81	4,46	549,36	279,76	292,54	509,91	476,97
190	415,31	78,93	101,14	4,37	546,54	280,31	291,50	513,21	480,74
191	416,76	78,66	101,33	4,27	543,37	281,30	290,48	517,16	483,94
192	414,37	79,12	102,57	4,27	541,03	282,08	289,60	522,79	487,46
193	413,77	79,08	101,66	4,17	538,71	283,04	288,71	524,36	491,43
194	412,91	79,48	101,61	4,07	536,28	283,70	287,91	526,74	493,95
195	407,74	79,51	101,49	3,98	534,15	284,61	287,16	526,68	496,01
196	403,89	78,95	101,61	3,98	531,95	285,51	286,48	525,66	498,08
197	401,22	79,36	101,48	3,88	529,03	286,48	285,81	526,38	498,78
198	400,42	78,95	101,48	3,88	526,49	287,33	285,33	523,99	500,12
199	397,28	79,34	101,79	3,76	523,32	288,36	284,83	520,97	503,18
200	393,27	78,89	101,36	3,76	521,61	289,14	284,42	516,27	505,30
201	388,43	78,77	100,81	3,67	519,19	290,33	284,03	513,09	507,57
202	385,44	78,95	100,09	3,67	517,05	291,10	283,81	504,90	509,13
203	381,40	79,17	100,21	3,62	514,24	292,20	283,56	498,30	510,34
204	376,04	78,92	99,96	3,57	511,99	293,24	283,49	488,79	512,24
205	372,55	79,04	99,52	3,57	509,41	294,17	283,38	481,16	512,71
206	368,45	78,64	99,52	3,47	507,86	295,19	283,29	474,26	512,87
207	363,79	79,08	99,22	3,47	504,91	296,14	283,32	466,70	512,44
208	356,50	78,79	98,33	3,47	500,43	297,21	283,23	459,27	508,79
209	349,92	78,65	97,95	3,37	496,87	298,24	283,39	451,12	503,48
210	342,60	78,76	97,47	3,37	491,79	298,96	283,46	443,63	498,46
211	334,62	79,11	97,33	3,37	488,59	299,79	283,66	435,07	492,66

212	322,90	78,97	96,26	3,37	483,36	300,40	283,82	424,79	485,86
213	314,13	78,93	95,99	3,37	479,07	301,14	284,06	417,36	478,96
214	307,40	79,12	95,52	3,37	473,69	301,44	284,35	409,39	472,70
215	302,25	78,92	95,70	3,28	468,96	301,68	284,64	401,27	466,01
216	297,63	78,98	94,14	3,28	464,55	301,71	284,90	393,57	460,80
217	293,71	79,14	94,02	3,28	460,66	301,98	285,33	386,39	455,59
218	289,75	79,00	94,20	3,28	456,06	301,95	285,68	380,91	452,00
219	286,77	79,13	93,18	3,18	452,76	301,93	286,01	374,54	448,09
220	283,40	78,86	93,20	3,18	449,23	302,00	286,40	369,29	445,16
221	279,89	78,56	93,64	3,18	447,35	301,80	286,86	362,95	441,47
222	277,01	78,69	92,87	3,18	444,59	301,73	287,31	357,04	437,81
223	273,81	78,57	92,30	3,18	440,58	301,19	287,64	351,96	434,19
224	270,70	78,40	92,35	-0,01	437,59	301,09	288,09	348,42	431,56
225	266,79	78,87	112,83	10,64	423,40	303,05	287,49	340,59	417,19
226	287,82	79,04	120,10	10,36	407,48	303,38	289,30	334,50	397,04
227	303,46	78,98	113,05	10,26	399,81	302,05	292,23	326,13	382,13
228	305,46	78,72	111,80	10,26	389,95	299,74	295,18	319,89	370,59
229	392,22	78,63	115,96	9,95	388,03	297,95	298,06	328,23	359,80
230	454,45	78,80	115,26	9,85	390,23	294,70	300,75	358,08	359,31
231	455,04	78,45	113,74	9,66	389,17	291,93	302,71	378,45	361,57
232	514,08	78,98	118,35	9,46	391,55	288,97	304,03	401,62	364,58
233	525,85	78,96	118,67	9,15	397,18	286,21	304,74	422,41	372,59
234	424,55	78,84	108,86	9,07	396,93	283,84	305,08	413,44	373,04
235	384,88	78,96	104,75	9,05	393,70	282,02	305,21	406,80	370,80
236	361,83	78,97	102,39	8,96	390,62	280,25	305,11	401,58	368,51
237	344,60	78,92	100,51	8,86	387,40	278,65	304,84	393,95	365,21
238	329,34	78,95	99,02	8,76	384,52	277,24	304,51	383,22	361,59
239	320,07	78,84	98,06	8,66	381,73	275,92	304,04	374,68	358,09
240	313,79	78,68	96,71	8,66	379,82	274,49	303,49	367,13	355,01
241	313,49	78,61	96,58	8,57	378,64	273,01	302,89	366,34	352,56
242	319,30	78,50	96,62	8,45	377,98	271,30	302,11	370,73	350,25
243	324,14	78,44	96,24	8,35	377,43	270,17	301,31	374,20	348,49
244	329,37	78,43	96,90	8,25	377,65	268,71	300,59	377,34	346,68
245	330,48	78,31	96,88	8,16	378,57	267,43	299,77	374,55	344,97
246	327,50	78,33	96,85	8,15	378,48	266,12	298,92	370,68	343,13
247	319,82	78,50	96,69	8,06	378,27	264,95	298,06	364,95	342,52
248	320,42	78,47	96,11	7,97	378,67	263,80	297,16	356,38	340,71
249	327,32	78,50	96,45	7,87	380,06	262,51	296,30	355,43	339,57
250	338,64	78,69	96,92	7,77	383,16	261,15	295,28	355,95	338,16
251	346,97	78,91	97,52	7,65	387,78	259,93	294,30	357,58	337,46
252	353,46	79,04	98,37	7,55	392,38	258,89	293,34	361,70	337,67
253	353,69	79,03	97,99	7,46	396,69	257,63	292,30	367,64	337,42
254	351,22	79,03	97,86	7,36	400,84	256,49	291,31	374,92	338,20
255	355,37	79,00	98,12	7,26	404,69	255,83	290,33	384,32	339,30
256	359,23	78,89	98,79	7,17	409,16	255,17	289,33	391,11	340,62
257	360,10	79,02	98,25	7,07	413,28	254,53	288,20	395,89	341,57
258	360,41	78,55	97,51	6,85	416,47	253,82	286,57	402,66	341,73
259	363,79	78,77	98,08	6,76	420,19	253,73	285,86	407,59	344,08
260	378,58	78,67	99,12	6,66	423,09	253,59	284,94	412,18	347,13
261	393,38	78,70	99,93	6,56	426,39	253,24	284,06	418,02	351,17
262	405,86	79,04	101,11	6,37	429,64	253,20	283,23	426,00	356,33
263	421,01	79,11	102,23	6,27	432,47	252,92	282,38	433,06	361,19
264	435,71	79,05	103,15	6,06	434,52	253,02	281,54	442,90	366,59
265	441,19	79,21	103,49	5,96	436,83	253,42	280,62	452,74	373,05
266	435,37	79,47	103,76	5,86	439,67	253,66	279,84	458,15	378,72
267	417,04	79,42	103,06	5,77	442,00	254,22	279,11	461,19	384,39
268	406,94	79,26	102,28	5,67	443,87	254,55	278,43	458,59	389,57
269	401,22	79,28	102,25	5,57	446,63	255,68	277,77	456,39	393,67
270	396,39	79,30	102,19	5,48	448,62	256,40	277,08	454,38	398,34
271	393,65	79,26	101,86	5,36	450,45	257,27	276,42	454,41	402,64
272	391,58	79,42	101,73	5,26	453,31	258,16	275,72	455,24	407,29
273	389,83	79,62	101,91	5,16	455,68	259,20	275,10	457,45	411,77
274	388,13	78,57	100,98	5,07	457,24	260,12	274,49	457,09	416,88
275	387,23	79,11	101,02	4,97	458,60	260,71	273,88	456,43	421,23
276	386,28	79,60	100,26	4,87	460,35	261,44	273,04	454,00	426,19
277	383,52	79,16	100,76	4,77	462,94	262,02	272,49	452,76	430,06
278	383,01	79,18	100,59	4,78	465,40	263,27	271,89	452,11	433,47
279	380,18	79,79	100,71	4,68	468,44	263,60	271,21	450,50	435,74
280	377,24	79,59	100,02	4,56	470,66	264,31	270,64	447,72	437,72
281	376,87	78,83	99,92	4,46	469,86	265,26	270,04	445,29	439,15
282	376,52	79,08	99,42	4,37	474,75	266,21	269,40	442,72	440,62
283	374,87	79,38	99,50	4,27	476,51	266,75	268,71	442,57	441,74
284	373,31	79,33	99,67	4,27	478,66	267,80	268,12	440,68	443,66
285	374,36	79,32	99,07	4,17	480,64	268,35	267,49	438,25	445,22
286	374,13	79,05	99,49	4,07	481,77	269,30	266,96	438,67	446,91
287	373,23	78,75	99,43	3,98	484,09	270,14	266,38	437,00	448,28
288	376,98	79,25	99,19	3,98	484,72	271,03	265,86	437,15	450,07
289	378,27	79,26	99,39	3,88	486,07	272,10	265,26	436,54	451,84
290	378,80	79,47	99,90	3,88	487,41	272,80	264,73	434,19	454,05
291	378,69	79,33	100,06	3,76	488,54	273,46	264,23	434,47	456,59
292	374,56	79,44	99,58	3,67	488,69	274,19	263,72	431,47	459,13
293	371,63	78,86	99,45	3,57	488,09	274,89	263,17	428,64	460,24
294	369,00	79,23	99,27	3,57	487,60	275,31	262,69	426,29	462,77
295	365,34	79,24	99,35	3,48	486,07	276,04	262,24	425,55	465,28
296	361,91	78,92	99,15	3,47	484,69	276,45	261,77	424,04	469,23
297	360,64	79,07	99,45	3,37	483,86	277,16	261,28	422,17	473,03
298	357,56	79,21	98,87	3,37	482,30	277,77	260,85	420,45	476,85
299	355,03	78,90	99,08	3,28	481,70	278,48	260,31	418,11	479,43
300	352,44	78,92	98,45	3,18	480,35	278,97	259,84	415,13	481,90
301	351,56	79,53	98,07	3,18	479,67	279,57	259,41	415,91	482,36
302	349,51	79,59	98,58	3,06	478,34	280,02	259,05	416,28	482,48
303	347,72	79,48	98,46	3,06	477,99	280,72	258,69	415,86	482,20
304	347,18	79,73	97,87	3,04	477,14	281,48	258,25	413,53	481,83
305	345,35	80,13	97,52	2,96	476,81	282,01	257,81	412,14	481,47
306	343,76	79,89	98,07	2,87	476,53	282,53	257,53	412,81	482,10
307	342,59	79,70	97,34	2,77	475,30	283,22	257,11	409,64	481,30
308	340,59	79,54	97,24	2,77	474,71	284,00	256,73	409,35	481,82
309	339,38	79,98	97,86	2,77	473,99	284,69	256,53	409,56	481,62
310	337,66	79,81	98,01	2,77	473,27	285,27	256,36	408,87	480,96
311	337,13	79,88	97,44	2,67	472,68	285,89	256,06	405,89	480,81
312	336,43	80,02	97,87	2,67	472,38	286,55	255,88	405,42	479,92
313	334,64	80,11	97,40	2,58	471,28	287,20	255,74	403,72	479,97
314	331,42	79,77	97,04	2,58	470,39	288,17	255,38	402,06	478,55
315	328,02	80,04	97,35	2,58	469,67	289,17	255,26	400,90	477,18
316	326,56	80,17	96,94	2,57	469,06	290,25	255,19	400,48	475,51
317	324,52	80,27	97,13	2,48	468,05	291,48	255,07	397,67	474,40
318	322,88	80,32	96,57	2,48	466,84	292,79	254,89	395,37	471,85

319	323,80	79,91	97,42	2,38	466,38	293,95	254,86	394,33	470,00
320	323,06	79,61	96,47	2,37	464,82	295,00	254,70	391,87	467,26
321	322,98	80,40	97,35	2,26	464,52	296,60	254,65	390,75	465,26
322	322,68	80,13	96,76	2,26	463,39	297,59	254,60	388,20	463,09
323	322,33	80,01	97,06	2,17	462,54	298,56	254,59	387,30	460,95
324	322,28	79,76	97,37	2,17	461,60	299,51	254,65	387,55	458,87
325	322,39	79,61	97,37	2,17	460,78	300,38	254,68	386,92	456,49
326	324,34	80,17	96,98	2,07	459,57	301,30	254,54	385,48	453,48
327	326,73	80,36	97,49	2,07	459,70	302,02	254,62	386,31	452,48
328	329,64	79,48	97,55	1,97	459,22	302,84	254,63	387,98	451,03
329	333,41	79,74	97,51	1,97	458,93	303,36	254,61	389,50	450,50
330	337,04	79,97	96,91	1,91	458,49	303,68	254,48	391,65	449,37
331	339,62	80,31	97,48	1,88	458,98	304,25	254,42	394,41	449,23
332	344,48	80,22	98,36	1,78	459,57	304,51	254,49	398,45	449,78
333	345,40	79,69	98,40	1,78	460,05	304,93	254,55	400,31	450,81
334	346,41	80,12	98,65	1,68	460,24	305,07	254,55	400,80	451,21
335	346,92	79,71	98,60	1,68	460,70	305,48	254,58	401,95	450,84
336	346,79	80,65	98,36	1,68	460,46	305,59	254,61	401,17	450,28
337	342,72	80,64	98,80	1,58	461,33	305,64	254,60	401,48	450,14
338	335,61	80,45	98,83	1,58	460,83	306,15	254,59	402,75	449,50
339	328,80	79,93	98,57	1,51	461,32	306,84	254,64	401,16	448,60
340	327,38	80,42	97,70	1,47	462,83	307,68	254,62	397,17	446,28
341	322,82	80,62	97,38	1,47	465,13	308,43	254,58	392,21	444,32
342	318,09	80,70	97,02	1,47	441,92	309,23	254,63	387,37	442,08
343	314,19	80,52	97,22	1,40	469,39	310,02	254,60	381,20	440,33
344	310,45	80,88	97,21	1,37	471,61	310,91	254,61	376,87	438,17
345	306,21	80,27	97,20	1,37	473,95	311,90	254,60	373,83	436,96
346	301,51	80,16	96,51	1,27	473,95	312,82	254,56	368,60	435,65
347	296,64	80,79	96,83	1,27	473,94	314,02	254,63	365,75	434,24
348	292,70	80,63	96,76	1,27	473,01	314,93	254,65	361,11	432,99
349	288,49	80,65	96,41	1,27	471,51	316,02	254,67	357,50	430,88
350	285,26	80,82	95,60	1,27	469,52	316,95	254,63	352,27	428,77
351	281,71	81,80	95,50	1,17	468,81	317,93	254,65	348,66	427,85
352	278,48	81,68	95,28	1,17	466,68	318,93	254,64	345,02	426,02
353	275,48	80,98	95,47	1,17	463,35	319,72	254,67	340,44	425,29
354	272,84	80,85	95,49	1,17	463,59	320,40	254,69	337,54	423,39
355	270,50	81,42	95,21	1,17	461,21	321,34	254,66	333,93	421,83
356	268,67	80,92	94,99	1,17	460,44	321,58	254,63	330,36	420,34
357	266,30	81,41	94,59	1,08	459,18	322,04	254,59	326,66	419,20
358	263,92	80,64	94,28	1,08	457,26	322,58	254,66	323,20	418,03
359	261,77	81,21	94,10	1,08	455,59	322,68	254,61	320,85	416,24
360	259,77	81,10	94,12	0,98	454,43	323,06	254,59	317,88	414,78
361	257,46	81,67	94,36	0,98	452,74	323,19	254,61	315,21	414,30
362	256,18	81,43	94,28	0,98	451,38	323,25	254,62	312,98	413,06
363	254,83	81,62	94,13	0,98	450,33	323,43	254,64	310,24	411,74
364	253,16	80,94	93,91	0,88	448,77	323,57	254,65	308,49	410,78
365	251,63	80,98	93,85	0,88	447,40	323,52	254,62	305,19	409,19
366	250,71	81,59	93,68	0,98	446,41	323,60	254,52	303,55	407,65
367	249,40	81,76	94,25	0,88	445,51	323,37	254,60	300,76	407,14
368	248,27	81,15	93,86	0,88	444,21	323,16	254,63	299,82	405,71
369	247,59	81,02	93,99	0,88	442,93	322,89	254,64	297,81	404,55
370	246,01	80,84	94,10	0,88	441,58	322,46	254,66	295,32	403,71
371	244,84	81,23	93,55	0,79	440,06	321,90	254,60	293,06	401,78
372	243,43	81,80	93,32	0,79	438,72	321,77	254,62	292,55	401,16
373	242,48	81,25	93,55	0,79	437,22	321,23	254,56	290,81	400,19
374	241,50	81,65	93,58	0,79	435,96	320,68	254,51	289,18	398,71
375	240,85	81,43	93,29	0,79	434,67	320,02	254,46	287,21	397,31
376	239,84	81,68	93,36	0,71	433,48	319,59	254,38	285,62	396,20
377	238,55	81,13	93,33	0,67	431,84	318,71	254,39	283,79	395,48
378	237,73	81,37	93,52	0,67	430,73	318,22	254,38	282,22	394,27
379	236,68	81,25	93,27	0,67	429,38	317,39	254,35	280,58	393,22
380	236,18	81,93	93,29	0,67	428,25	316,66	254,33	278,59	392,10
381	235,05	81,33	93,18	0,57	426,98	316,08	254,29	276,88	390,86
382	234,22	81,74	93,10	0,57	425,50	315,23	254,21	275,23	389,58
383	233,40	81,26	93,16	0,67	423,59	314,24	254,10	273,97	388,58
384	232,14	81,15	93,18	0,57	421,97	313,46	254,05	272,36	387,56
385	231,18	81,31	93,14	0,57	420,69	312,52	254,02	271,35	386,30
386	230,64	82,14	92,93	0,57	418,86	311,69	253,80	269,55	384,70
387	230,15	82,00	93,52	0,52	417,90	310,81	253,75	269,79	385,38
388	228,60	81,24	93,09	0,57	418,15	309,90	253,69	268,13	389,22
389	227,63	81,96	92,85	0,47	417,10	309,05	253,60	267,04	392,00
390	226,75	81,85	93,06	0,47	415,73	308,40	253,53	266,47	394,47
391	225,76	81,45	92,98	0,47	414,64	307,68	253,52	264,91	396,53
392	225,44	81,33	92,91	0,47	413,16	307,07	253,57	263,93	398,51
393	224,81	81,46	93,00	0,47	412,29	306,43	253,57	263,11	399,30
394	224,64	81,61	92,89	0,38	410,68	305,83	253,61	262,52	400,18
395	224,01	81,98	93,08	0,38	409,33	305,45	253,65	262,56	401,01
396	223,28	82,06	92,58	0,38	407,78	304,88	253,48	261,04	400,37
397	222,87	82,23	92,80	0,38	406,14	304,60	253,44	261,41	401,29
398	222,70	82,31	93,32	0,38	404,95	304,42	253,41	260,75	401,05
399	222,69	81,34	92,92	0,28	403,41	304,34	253,46	259,64	401,28
400	222,24	82,05	93,05	0,28	402,79	304,13	253,51	259,25	401,82
401	221,87	82,48	93,28	0,28	401,48	303,71	253,58	260,10	402,58
402	221,89	82,00	93,14	0,28	400,91	303,56	253,58	257,89	403,48
403	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
404	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
405	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
406	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
407	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
408	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
409	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
410	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
411	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
412	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
413	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
414	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
415	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
416	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
417	221,85	82,14	93,00	0,28	399,78	303,02	253,65	256,55	403,97
418	221,85	82,14	93,00	0,00	399,78	303,02	253,65	256,55	403,97
419	80,20	78,72	79,44	3,07	78,24	77,41	77,25	79,26	77,96
420	110,89	78,53	79,45	2,97	80,36	77,40	77,30	82,57	78,45
421	236,18	78,83	79,59	2,77	90,38	77,57	77,50	94,90	82,67
422	442,15	78,96	80,38	2,40	113,50	78,19	77,87	129,41	101,64
423	447,42	79,03	150,92	2,17	179,63	79,79	78,44	169,76	135,60
424	428,40	79,22	136,80	1,98	193,01	82,11	79,16	212,21	162,96
425	443,48	79,42	134,66	1,77	213,93	84,73	79,93	245,37	192,50

426	449,07	79,45	133,64	1,57	236,63	87,85	80,76	277,80	228,34
427	455,48	79,47	134,11	1,47	263,37	91,22	81,74	306,31	261,88
428	450,08	79,66	132,76	1,28	291,99	95,01	82,93	323,44	287,70
429	507,34	79,66	194,74	6,88	333,71	98,99	84,45	330,92	306,29
430	426,28	79,97	168,60	11,98	340,18	103,60	86,91	327,44	307,69
431	421,13	79,87	153,45	11,78	339,77	108,20	89,49	328,13	303,14
432	438,09	79,78	149,12	11,58	341,71	112,62	91,72	334,80	304,09
433	547,26	80,06	165,48	11,38	352,91	116,78	93,75	363,03	310,49
434	527,28	79,90	157,79	11,08	362,22	121,07	95,94	386,11	323,14
435	482,03	79,85	147,26	10,88	360,99	125,21	97,94	402,97	327,02
436	473,12	79,96	143,28	10,78	358,21	129,18	99,80	415,16	332,19
437	474,82	80,38	141,99	10,68	356,65	133,13	101,50	420,46	339,55
438	475,72	80,65	140,92	10,48	357,49	136,95	103,23	427,18	339,24
439	487,25	80,18	141,86	10,28	361,95	140,71	104,88	432,61	338,66
440	487,47	80,66	141,01	10,18	371,28	144,45	106,45	448,03	340,01
441	492,96	80,67	140,08	10,08	382,76	148,15	108,02	459,49	343,33
442	511,59	80,99	141,33	9,88	393,31	151,76	109,71	470,50	351,08
443	540,15	80,83	144,51	9,68	404,29	155,35	111,51	482,08	362,47
444	573,76	81,10	148,82	9,48	417,89	158,90	113,32	497,74	376,44
445	584,51	80,98	151,67	9,28	433,93	162,52	115,26	511,37	393,61
446	588,31	80,80	153,15	9,08	451,14	166,25	117,27	523,95	409,15
447	583,63	80,92	153,17	8,88	466,45	169,97	119,28	535,10	416,68
448	570,89	80,92	151,81	8,68	484,79	173,84	121,35	542,24	420,36
449	566,08	81,79	151,37	8,48	499,81	177,79	123,48	546,01	424,37
450	587,33	81,72	154,17	8,28	511,25	181,89	125,51	550,34	432,11
451	600,10	81,87	156,61	8,08	520,64	186,28	127,77	554,24	444,53
452	608,32	82,01	158,13	7,88	528,52	191,13	130,10	558,88	460,79
453	612,77	82,12	158,47	7,58	536,46	196,57	132,60	561,65	477,34
454	612,35	81,46	159,09	7,38	544,52	202,73	135,37	565,64	492,78
455	611,20	82,06	159,17	7,18	553,11	209,38	138,32	568,54	505,47
456	608,57	81,59	159,21	6,97	562,18	216,68	141,59	575,62	518,53
457	610,25	82,48	158,55	6,78	573,04	224,15	145,11	577,87	532,29
458	590,29	82,83	156,64	6,58	583,76	231,55	148,84	575,26	551,90
459	580,47	81,93	154,31	6,38	594,71	238,51	152,76	571,54	569,63
460	576,21	83,24	153,20	6,19	604,64	244,90	156,84	567,30	583,49
461	570,74	83,40	151,77	6,08	613,49	251,00	160,93	565,53	594,27
462	567,01	83,33	150,75	5,88	621,22	256,77	165,23	563,39	602,66
463	565,30	83,22	151,25	5,78	628,54	262,37	169,66	560,49	608,75
464	564,58	83,07	151,08	5,57	635,44	268,08	174,24	560,98	613,35
465	567,33	83,50	150,81	5,38	642,26	273,81	178,87	560,82	618,25
466	569,97	83,64	151,45	5,28	648,42	279,56	183,76	559,22	622,92
467	575,87	83,86	151,42	5,08	654,25	285,35	188,75	559,65	627,18
468	581,06	83,81	152,21	4,87	659,49	291,16	193,83	564,52	634,43
469	583,77	84,27	151,33	4,68	665,21	297,03	198,91	566,39	640,80
470	585,92	84,14	152,02	4,58	670,57	302,97	204,03	568,59	648,40
471	586,25	84,23	151,61	4,37	675,31	308,57	209,24	571,27	655,33
472	587,24	84,34	151,03	4,17	681,37	314,18	214,64	572,07	661,28
473	588,96	83,37	151,30	4,08	687,12	320,15	220,13	575,16	668,15
474	586,74	84,27	151,91	3,88	693,27	325,16	225,60	576,43	673,89
475	586,79	84,49	151,16	3,67	699,78	330,62	231,17	576,34	680,95
476	586,88	84,14	150,71	3,57	704,74	335,72	236,64	578,61	685,91
477	585,06	84,33	149,91	3,44	707,18	340,71	242,07	580,31	688,81
478	579,52	84,68	149,77	3,28	703,72	345,47	247,46	584,13	693,97
479	572,70	84,92	162,98	3,18	695,29	351,23	253,01	582,64	696,95
480	561,09	84,57	151,19	3,07	686,06	355,58	259,06	580,65	698,90
481	548,17	84,97	147,29	2,97	678,59	359,77	265,06	582,34	697,54
482	537,33	84,92	144,82	2,87	671,39	364,07	271,08	577,71	694,48
483	529,92	84,24	142,91	2,77	663,50	368,24	277,25	573,99	688,70
484	525,01	84,34	141,33	2,77	656,41	372,76	283,78	571,40	682,22
485	519,61	84,46	139,82	2,68	650,42	377,09	290,35	563,05	673,84
486	512,94	84,36	138,98	2,58	644,61	381,84	297,02	550,33	665,91
487	468,55	85,04	194,30	10,00	624,01	389,11	303,40	532,95	643,16
488	482,81	84,31	155,06	9,78	591,56	391,64	311,37	535,03	610,14
489	488,79	85,16	146,53	9,68	565,73	391,61	317,15	528,55	587,60
490	502,12	84,19	145,25	9,58	546,43	390,03	321,55	525,64	573,75
491	514,88	84,26	144,23	9,48	534,21	387,53	325,13	523,65	568,10
492	523,66	83,96	145,48	9,28	524,20	383,56	328,17	529,57	563,09
493	532,15	84,60	145,49	9,14	517,22	379,65	330,76	532,43	561,01
494	532,04	84,96	145,88	8,98	513,69	375,01	333,00	538,62	558,83
495	548,23	84,61	146,86	8,88	513,37	370,42	334,63	545,95	556,28
496	564,99	83,84	148,70	8,68	516,16	365,66	336,39	555,48	564,35
497	567,75	84,68	150,92	8,48	519,26	361,09	337,79	559,34	574,93
498	563,98	84,58	150,27	8,28	522,13	356,72	339,12	564,80	580,74
499	560,09	83,92	149,29	8,18	524,78	352,47	340,14	565,07	581,67
500	563,41	83,97	150,24	7,98	527,62	348,21	341,11	569,56	583,31
501	567,95	84,51	150,45	7,88	531,93	344,56	342,10	571,70	588,81
502	573,70	84,42	150,71	7,68	536,77	340,94	342,93	574,67	592,73
503	575,79	84,34	151,57	7,48	541,53	337,53	343,82	579,40	599,74
504	577,95	84,83	151,70	7,28	547,36	334,61	344,62	581,18	608,16
505	580,05	85,04	151,87	7,18	552,36	331,60	345,47	584,34	616,42
506	583,24	84,98	152,50	6,97	557,58	328,99	346,15	586,30	623,10
507	584,50	84,85	152,90	6,81	564,07	326,70	346,86	588,53	629,92
508	586,49	84,89	153,69	6,68	570,76	324,74	347,54	591,93	636,84
509	589,78	85,20	153,27	6,48	578,18	322,81	348,14	594,95	642,68
510	591,38	85,29	153,75	6,35	585,66	321,20	348,79	596,61	649,75
511	591,67	84,48	153,98	6,18	593,73	319,82	349,46	597,42	656,15
512	595,56	85,45	153,95	5,98	601,36	318,80	350,16	598,73	663,05
513	595,44	85,13	153,57	5,88	609,41	317,66	350,76	600,52	667,36
514	596,13	85,53	153,64	5,67	625,05	316,97	351,36	600,15	674,54
515	592,91	85,74	153,08	5,48	638,04	316,43	351,79	601,01	681,32
516	590,27	85,45	152,95	5,38	649,95	316,18	352,26	600,13	687,06
517	589,10	85,54	152,36	5,18	658,95	316,10	352,60	601,08	691,39
518	588,32	85,99	152,22	5,08	666,33	316,05	353,09	601,46	695,09
519	589,06	85,90	152,72	4,87	671,40	316,04	353,53	601,91	699,06
520	586,76	85,96	152,56	4,78	676,65	316,66	353,88	602,92	702,14
521	583,66	86,08	151,66	4,68	681,51	317,05	354,21	601,89	705,65
522	581,53	86,14	151,43	4,48	687,07	317,58	354,64	600,33	709,81
523	579,18	85,93	151,34	4,37	693,44	318,27	354,97	597,98	716,13
524	575,56	85,91	150,76	4,23	698,28	318,98	355,31	595,46	718,96
525	571,31	86,15	150,34	4,17	700,41	319,79	355,71	590,91	721,74
526	569,71	86,09	149,98	4,02	701,06	320,79	356,26	587,27	724,38
527	560,25	85,93	148,76	3,88	702,45	321,65	356,90	581,51	728,02
528	554,55	86,21	148,09	3,78	700,58	322,76	357,52	576,57	726,30
529	548,97	86,77	146,62	3,67	697,32	323,89	358,02	572,19	726,31
530	540,36	85,91	144,77	3,57	693,66	325,35	358,48	563,17	724,70
531	528,70	86,15	144,15	3,50	690,15	326,57	358,90	552,14	721,66
532	521,06	86,08	142,44	3,47	686,88	328,05	359,26	540,62	716,17

533	512,65	86,39	140,43	3,38	683,11	329,62	359,60	528,55	711,35
534	505,35	86,41	139,19	3,28	679,73	331,29	359,88	515,97	708,16
535	499,14	86,30	138,90	3,18	675,78	332,87	360,18	504,36	706,19
536	493,61	86,05	137,08	3,18	672,25	334,54	360,59	494,78	704,87
537	487,81	86,10	136,57	3,07	667,54	335,92	360,99	486,55	702,22
538	481,53	86,19	135,10	2,97	662,80	337,49	361,39	478,23	700,75
539	473,74	85,78	134,55	2,97	655,64	338,76	361,60	468,30	698,34
540	466,43	85,72	133,07	2,87	649,83	340,04	362,11	461,92	694,57
541	459,25	83,74	132,27	2,87	641,93	340,91	362,48	455,35	690,93
542	451,51	85,47	131,30	2,77	634,78	341,67	362,87	446,92	684,90
543	444,56	85,61	130,15	2,77	626,76	342,39	363,31	440,25	677,38
544	437,28	85,42	129,65	2,68	619,17	343,21	363,70	433,98	667,58
545	430,95	84,82	128,80	2,68	610,23	343,58	364,12	431,47	656,85
546	425,83	85,11	128,52	2,58	602,13	344,00	364,62	423,88	647,99
547	420,19	85,31	127,74	2,58	594,89	344,34	365,03	417,72	638,06
548	416,05	85,24	126,99	2,58	587,87	344,55	365,47	412,75	630,46
549	410,94	85,08	126,36	2,47	581,84	344,80	365,99	407,67	622,29
550	405,75	85,01	125,58	2,47	575,58	344,81	366,46	402,59	613,91
551	400,73	85,27	124,68	2,37	569,99	344,86	366,98	396,89	605,86
552	396,62	85,26	124,04	2,37	564,49	344,65	367,50	392,67	598,40
553	392,18	85,08	123,77	2,37	558,65	344,63	368,12	386,82	591,03
554	388,69	84,98	123,09	2,27	553,28	344,23	368,72	382,78	584,56
555	381,11	85,02	122,12	2,27	547,01	344,18	369,33	377,81	575,23
556	375,55	84,85	121,40	2,24	541,10	343,94	369,98	372,36	565,81
557	371,27	85,03	120,80	2,17	535,79	343,78	370,65	366,66	558,53
558	367,25	84,95	119,87	2,17	530,52	343,54	371,30	362,99	551,69
559	363,76	85,05	119,33	2,07	525,75	343,43	372,06	357,69	545,50
560	361,15	84,76	119,11	2,07	521,04	343,41	372,77	355,60	539,17
561	357,55	84,53	118,45	2,07	516,88	343,21	373,49	350,92	534,13
562	355,11	84,84	118,00	1,98	512,79	343,12	374,15	347,23	529,12
563	352,61	84,71	117,63	1,98	509,12	342,89	374,87	342,59	524,15
564	350,64	84,51	117,37	1,98	505,24	342,71	375,60	339,94	520,72
565	348,10	84,60	116,80	1,87	502,15	342,62	376,29	336,85	516,10
566	346,00	84,40	116,27	1,87	499,20	342,53	376,86	333,59	512,10
567	343,46	84,71	115,98	1,87	496,28	342,32	377,46	329,90	508,19
568	341,13	84,18	115,56	1,77	493,88	341,90	377,96	327,12	505,28
569	338,79	84,64	115,30	1,77	492,00	341,73	378,27	324,48	502,88
570	336,83	84,29	115,12	1,68	490,01	341,80	378,35	320,99	498,97
571	335,59	84,49	114,54	1,67	488,59	341,59	378,14	319,13	495,33
572	333,95	84,30	113,52	1,67	487,53	341,64	377,77	315,39	491,14
573	332,55	84,10	113,62	1,57	486,31	341,96	377,21	314,28	487,62
574	331,70	84,36	113,49	1,57	485,29	342,22	376,71	312,54	484,28
575	330,20	84,07	113,32	1,57	483,76	342,98	376,16	308,86	481,15
576	329,37	83,87	113,25	1,47	482,44	343,53	375,57	307,82	478,19
577	328,78	84,03	112,96	1,37	481,64	344,42	374,93	306,73	476,25
578	327,70	84,18	112,91	1,37	480,40	345,31	374,38	305,11	474,05
579	326,99	84,38	113,04	1,37	479,16	346,22	373,76	303,39	472,07
580	326,20	84,31	112,80	1,28	478,16	347,18	373,16	300,80	470,54
581	325,70	84,14	112,87	1,27	477,66	347,97	372,58	299,78	468,07
582	325,39	84,08	112,60	1,17	476,63	349,19	371,99	298,23	467,11
583	323,44	84,22	112,61	1,17	475,62	350,24	371,41	297,99	465,52
584	323,15	84,27	112,40	1,12	474,20	351,17	370,87	296,28	464,38
585	327,02	84,18	112,65	1,07	475,15	352,34	370,32	295,37	464,39
586	328,46	83,81	112,62	1,07	477,10	353,01	369,73	295,57	466,68
587	331,60	83,65	113,12	0,97	479,20	353,97	369,15	296,17	467,91
588	335,26	84,03	113,21	0,97	482,13	354,63	368,57	296,37	470,85
589	338,64	83,92	113,66	0,87	485,61	355,70	367,98	297,89	473,00
590	344,00	84,07	113,94	0,87	489,32	356,68	367,41	299,55	476,34
591	349,36	83,96	114,91	0,77	493,17	357,59	366,83	303,07	478,61
592	356,35	83,91	115,60	0,77	497,85	358,72	366,23	306,53	482,46
593	365,20	84,08	116,54	0,67	502,74	359,85	365,76	311,31	486,26
594	372,75	83,86	117,35	0,57	507,96	361,17	365,23	315,95	490,74
595	376,98	84,22	117,84	0,57	512,46	362,58	364,81	320,89	495,90
596	379,30	84,20	118,11	0,47	516,95	364,31	364,32	324,64	500,06
597	378,80	84,17	117,18	0,47	519,71	365,93	363,86	328,02	503,57
598	376,47	83,59	117,06	0,37	520,26	367,51	363,60	329,90	505,34
599	370,57	84,38	116,59	0,37	518,78	369,65	363,36	327,83	505,92
600	362,48	84,28	116,25	0,27	516,96	371,25	363,06	323,48	504,82
601	353,28	84,27	115,49	0,27	513,23	372,84	362,76	320,08	502,97
602	347,07	84,11	114,51	0,27	510,14	374,16	362,51	316,91	498,42
603	341,36	84,11	113,86	0,27	504,81	375,40	362,26	313,94	493,25
604	336,61	84,13	113,29	0,27	500,48	376,02	362,00	310,53	489,18
605	333,15	83,86	113,08	0,17	495,36	376,38	361,78	308,50	483,75
606	330,07	83,58	112,47	0,17	491,55	376,69	361,48	306,07	480,03
607	327,02	84,18	112,20	0,17	486,73	376,70	361,34	301,67	475,65
608	324,59	83,82	111,20	0,17	483,34	376,56	361,04	299,29	472,10
609	321,68	84,08	110,74	0,07	479,43	376,25	360,84	296,04	468,43
610	319,17	84,14	110,31	0,15	476,09	376,11	360,61	293,62	464,74
611	316,99	84,07	109,90	0,07	473,23	375,73	360,21	290,84	460,97
612	314,85	83,90	109,45	0,07	469,77	375,34	359,99	289,05	458,46
613	313,39	83,21	109,18	0,07	467,24	374,71	359,71	286,92	455,31
614	311,50	83,52	109,13	0,07	464,25	374,24	359,30	284,77	451,45
615	310,17	83,36	109,05	0,07	461,64	373,92	358,96	282,91	449,17
616	308,23	83,67	108,89	0,07	460,11	373,52	358,54	280,53	445,71
617	307,14	83,73	108,74	0,07	457,15	372,91	358,09	280,13	443,82
618	75,54	74,99	75,67	2,97	75,53	74,84	75,04	75,73	75,22
619	99,72	74,99	78,29	2,87	78,69	74,91	75,10	78,83	75,96
620	159,17	75,01	87,09	2,77	88,47	75,04	75,15	88,92	77,46
621	261,02	75,00	108,19	2,57	112,68	75,32	75,29	107,22	80,42
622	305,86	75,20	107,02	2,37	135,63	75,90	75,47	133,28	90,07
623	311,04	75,07	102,23	2,21	144,97	76,61	75,70	158,15	103,50
624	353,79	75,08	106,48	2,07	154,38	77,35	75,92	192,75	118,80
625	384,30	75,09	110,64	1,88	170,37	78,19	76,18	224,20	136,82
626	422,45	75,53	116,39	1,77	188,59	79,19	76,48	263,34	154,29
627	427,60	75,41	118,85	1,59	209,33	80,35	76,87	295,13	169,80
628	477,13	75,61	135,01	1,37	239,36	81,74	77,29	326,30	192,06
629	472,46	75,49	130,80	1,27	261,64	83,51	77,77	351,90	214,38
630	496,40	75,78	154,73	1,61	288,38	85,63	78,34	369,21	234,66
631	405,53	75,76	189,62	11,88	325,38	88,01	79,10	351,10	235,89
632	431,73	76,04	168,09	11,68	334,52	90,95	80,12	342,05	233,82
633	414,92	76,14	148,41	11,58	344,66	93,74	81,37	333,75	231,98
634	369,56	76,23	129,70	11,48	346,10	96,49	82,75	320,64	228,72
635	397,45	75,83	127,21	11,30	351,42	98,99	84,16	320,58	226,17
636	425,16	76,03	127,62	11,18	361,01	101,44	85,62	330,57	225,91
637	439,02	75,67	128,56	11,08	369,69	103,74	87,08	338,65	227,05
638	431,82	75,90	126,77	10,88	381,84	106,03	88,57	343,27	229,15
639	457,47	76,30	129,29	10,78	392,82	108,33	90,18	356,05	231,54

640	466,86	76,14	130,56	10,58	403,63	110,65	91,94	369,53	236,08
641	444,88	76,06	128,35	10,47	413,55	113,07	93,79	372,37	239,92
642	425,06	75,98	126,26	10,42	427,65	115,53	95,79	365,13	242,29
643	415,33	76,76	124,18	10,38	443,79	118,00	97,89	359,36	243,68
644	399,08	76,38	121,64	10,28	456,08	120,46	100,09	350,53	244,42
645	377,84	76,50	118,76	10,28	461,29	122,83	102,45	343,33	244,46
646	359,77	76,73	115,88	10,18	458,50	125,31	104,81	336,13	243,62
647	346,36	76,49	113,92	10,08	451,78	127,75	107,23	327,45	242,67
648	336,40	76,03	112,30	10,08	445,40	130,10	109,61	319,36	241,08
649	361,59	76,50	122,40	9,98	444,30	132,29	111,91	318,33	238,22
650	401,02	76,74	129,51	9,88	456,81	134,36	114,07	322,31	237,81
651	461,82	76,58	140,40	9,68	473,15	136,40	116,36	336,16	241,25
652	530,83	76,93	154,23	9,58	492,24	138,38	118,66	364,20	251,65
653	475,96	77,01	137,72	9,38	505,55	140,61	120,82	378,03	266,33
654	451,65	76,92	132,58	9,28	504,63	143,20	122,88	386,68	277,62
655	445,68	76,15	130,58	9,17	498,69	145,73	124,99	398,49	287,98
656	451,52	76,37	130,13	9,07	491,37	148,33	126,96	412,42	297,23
657	457,67	76,89	130,50	8,89	484,03	150,84	128,72	428,00	306,59
658	462,86	76,64	130,99	8,78	477,42	153,39	130,43	439,06	314,94
659	469,60	76,91	131,97	8,68	472,55	155,78	132,04	447,34	325,30
660	468,33	77,09	132,05	8,51	468,73	158,16	133,52	452,10	340,43
661	451,55	76,87	129,82	8,37	464,80	160,33	134,97	455,59	351,73
662	439,88	77,39	127,99	8,37	459,89	162,64	136,28	450,05	356,83
663	427,92	76,94	126,12	8,28	455,98	164,74	137,55	443,07	361,53
664	420,73	76,69	124,86	8,18	452,91	166,74	138,74	436,87	363,81
665	413,54	77,00	123,62	8,08	452,30	168,69	139,89	429,98	362,61
666	409,83	77,18	122,93	7,98	454,87	170,53	140,99	420,77	358,65
667	408,34	76,91	122,32	7,87	461,67	172,16	142,04	414,57	357,85
668	401,61	76,95	121,30	7,87	468,87	173,68	143,09	404,44	356,38
669	393,94	77,23	119,87	7,77	474,85	175,18	143,99	394,51	353,40
670	387,42	77,65	118,81	7,67	479,66	176,54	144,82	385,00	349,85
671	382,62	77,10	117,55	7,62	484,02	177,80	145,64	376,02	347,37
672	378,81	77,58	117,02	7,58	489,27	179,14	146,64	368,67	344,58
673	374,28	77,39	116,36	7,48	492,55	180,29	147,51	360,86	341,73
674	370,66	77,54	115,76	7,44	495,18	181,26	148,27	353,64	338,27
675	385,35	77,29	117,18	7,38	498,81	182,24	149,11	354,51	337,21
676	401,28	77,41	119,05	7,28	505,19	183,13	149,85	357,81	339,93
677	421,87	77,63	121,73	7,07	513,38	184,16	150,73	364,54	346,54
678	444,62	77,48	124,57	6,97	523,96	185,21	151,58	375,70	354,62
679	464,27	77,96	127,78	6,88	536,89	186,49	152,42	388,92	364,66
680	476,40	77,61	129,94	6,68	548,37	187,99	153,26	402,45	374,99
681	488,61	77,93	132,09	6,57	560,49	189,63	154,14	415,28	387,84
682	499,47	78,03	133,76	6,37	572,54	191,58	155,02	429,00	401,14
683	516,78	77,73	136,05	6,18	584,77	193,73	155,97	441,97	418,34
684	526,69	77,90	137,86	6,08	596,89	196,24	156,91	452,90	438,48
685	526,53	78,16	138,30	5,87	605,08	198,78	157,90	460,29	457,39
686	523,14	78,24	138,46	5,77	609,19	201,44	158,97	469,53	472,58
687	519,34	78,21	138,15	5,67	611,01	204,37	160,02	479,40	488,98
688	515,09	78,42	137,61	5,57	611,05	207,31	161,19	489,32	503,14
689	511,89	78,42	136,95	5,38	612,39	210,48	162,40	497,67	512,71
690	512,39	79,03	136,93	5,28	613,77	213,69	163,65	503,20	522,63
691	514,17	78,90	137,34	5,17	612,81	216,87	164,89	509,55	532,31
692	514,31	79,24	137,30	4,97	612,20	220,50	166,27	514,45	542,15
693	511,06	79,35	136,84	4,87	610,80	223,98	167,64	517,42	550,94
694	509,52	79,01	136,12	4,78	608,33	227,75	169,17	519,36	559,36
695	506,77	78,86	135,80	4,68	605,44	231,43	170,75	522,70	567,50
696	505,49	79,38	135,34	4,57	602,47	235,23	172,46	522,94	578,21
697	507,21	79,47	135,45	4,47	598,23	238,98	174,11	526,25	588,31
698	508,97	79,14	135,60	4,37	592,18	242,95	176,02	529,18	596,90
699	507,88	79,60	135,29	4,27	587,94	246,88	178,15	532,69	603,68
700	504,63	79,17	135,08	4,17	583,14	250,76	180,17	534,01	609,51
701	503,59	79,12	134,88	4,08	578,12	254,80	182,59	535,08	614,68
702	502,56	78,88	134,46	3,98	574,25	258,97	184,72	536,16	618,14
703	503,27	79,21	134,22	3,87	569,68	262,97	187,35	538,16	620,82
704	502,68	79,30	134,06	3,91	567,06	267,26	189,76	536,77	624,63
705	501,87	79,59	132,20	3,78	562,93	271,29	192,43	526,53	635,75
706	500,48	79,09	140,58	3,57	554,51	275,73	195,09	514,77	638,80
707	484,40	79,30	133,58	3,47	548,15	279,21	198,12	504,76	634,52
708	484,67	79,52	131,85	3,38	540,92	282,18	201,45	497,34	631,44
709	481,58	79,57	130,27	3,28	535,69	285,15	204,68	489,16	641,24
710	472,29	79,57	128,89	3,27	529,46	287,59	208,16	483,60	648,37
711	463,61	79,00	127,43	3,17	523,07	289,89	211,59	477,20	650,10
712	459,25	79,34	126,13	3,07	517,18	292,09	215,02	472,16	650,54
713	453,88	78,72	125,24	3,04	510,68	294,15	218,51	466,51	650,89
714	450,03	79,42	124,88	2,97	504,74	296,08	222,10	459,51	651,00
715	446,28	79,35	124,15	2,87	499,40	298,21	225,59	454,18	649,99
716	441,97	79,81	123,10	2,77	494,08	300,16	229,21	447,75	649,00
717	438,65	79,60	122,89	2,77	490,18	301,98	232,91	441,51	648,12
718	433,49	79,31	122,14	2,67	486,44	304,15	236,64	435,62	646,23
719	430,38	79,15	121,25	2,67	481,47	306,02	240,25	431,54	643,63
720	427,65	78,65	121,15	2,57	478,81	307,95	243,98	427,76	641,31
721	431,66	79,52	162,07	10,35	466,24	312,53	246,66	419,61	623,79
722	412,87	79,60	131,50	10,08	449,58	313,53	251,38	411,97	600,91
723	406,99	78,98	128,59	10,08	433,68	313,63	255,67	405,90	574,91
724	409,80	79,12	124,49	9,98	421,89	313,01	259,83	400,82	556,47
725	428,73	78,95	124,73	9,88	412,37	311,41	263,33	401,25	540,35
726	444,28	79,03	125,70	9,77	405,58	309,19	266,60	408,60	531,22
727	438,79	79,23	124,73	9,68	400,96	306,63	269,32	404,46	525,79
728	434,49	78,80	124,50	9,58	397,47	304,02	271,76	404,05	521,72
729	432,19	79,11	123,91	9,48	392,14	301,14	273,65	400,75	520,03
730	445,44	79,10	125,20	9,38	390,08	298,18	275,55	413,39	514,45
731	452,37	78,99	125,99	9,18	388,80	295,02	277,17	421,50	512,66
732	451,34	79,00	126,07	9,13	390,35	292,00	278,59	421,87	512,99
733	453,61	78,98	126,53	8,98	391,06	289,03	279,92	419,90	516,84
734	453,46	79,17	126,72	8,88	391,87	286,24	281,16	420,41	522,36
735	455,50	79,05	127,02	8,78	391,77	283,63	282,04	419,72	524,40
736	459,92	78,44	127,11	8,68	391,36	281,04	283,07	422,16	525,22
737	459,95	79,23	127,41	8,58	390,93	278,51	284,11	422,30	528,43
738	455,84	79,05	126,78	8,47	390,83	276,37	284,95	422,27	529,64
739	452,59	79,03	126,21	8,28	390,35	274,23	285,71	422,06	530,75
740	452,01	78,71	126,20	8,18	390,12	272,24	286,53	421,88	534,04
741	456,81	78,79	126,64	8,08	391,08	270,31	287,24	425,88	538,47
742	457,17	78,99	126,98	7,98	395,35	268,52	287,90	427,67	541,85
743	460,58	78,97	127,27	7,88	402,63	266,82	288,55	428,24	543,16
744	464,64	79,02	127,70	7,77	411,37	265,29	289,13	428,39	545,38
745	463,11	79,08	127,88	7,67	419,15	263,80	289,71	429,23	549,71
746	465,86	78,85	127,02	7,48	428,40	262,27	290,12	428,60	556,14

747	479,23	78,90	128,28	7,38	441,29	261,57	290,57	434,36	566,80
748	491,93	78,91	129,59	7,28	453,98	261,00	291,03	441,45	580,09
749	494,60	79,25	130,14	7,07	464,99	260,58	291,35	450,12	592,11
750	492,79	79,08	130,26	6,97	472,39	260,27	291,75	456,02	601,58
751	489,90	79,71	129,80	6,88	482,20	260,12	292,14	460,46	611,87
752	489,92	79,66	129,80	6,68	494,07	260,22	292,38	466,63	622,62
753	490,87	79,64	129,54	6,57	503,76	260,17	292,61	471,99	630,65
754	491,99	79,47	129,59	6,47	512,12	260,31	292,83	475,63	637,44
755	492,65	79,50	129,47	6,37	519,53	260,39	292,96	479,47	642,18
756	493,40	79,67	129,80	6,18	527,05	260,80	293,09	483,07	647,60
757	495,84	79,23	129,90	6,08	533,57	260,94	292,97	485,09	648,32
758	492,55	79,95	129,46	5,98	541,27	261,38	293,24	483,93	655,63
759	484,89	79,09	128,47	5,87	546,50	261,53	293,24	480,37	658,58
760	475,73	79,97	127,49	5,74	550,85	262,33	293,48	471,40	660,89
761	468,43	79,84	126,32	5,63	553,62	262,62	293,74	463,30	662,76
762	461,01	79,98	125,39	5,57	553,78	262,96	294,01	455,80	664,28
763	455,02	79,99	124,43	5,48	552,25	263,35	294,36	449,24	666,07
764	448,21	79,29	123,72	5,38	549,53	263,56	294,75	441,74	664,92
765	443,71	79,85	123,05	5,38	547,50	263,84	295,22	436,04	663,05
766	437,63	79,99	121,88	5,28	545,07	264,17	295,75	430,92	659,45
767	433,55	79,91	121,34	5,15	541,07	264,43	296,13	427,61	654,06
768	429,93	79,47	120,82	5,07	537,48	264,54	296,78	423,43	651,73
769	429,51	79,51	120,54	4,97	533,11	264,79	297,08	420,67	650,27
770	425,73	79,71	119,88	4,87	531,51	264,90	297,60	416,13	648,40
771	424,73	79,64	119,51	4,87	528,70	265,28	297,98	415,26	641,06
772	423,15	79,69	119,00	4,78	526,29	265,53	298,20	414,28	632,14
773	423,20	79,73	119,12	4,68	524,34	265,86	298,40	414,10	623,85
774	422,52	79,79	119,16	4,68	522,07	266,40	298,48	413,58	617,42
775	420,69	79,63	118,96	4,57	519,61	266,78	298,51	413,52	610,43
776	420,29	79,83	118,80	4,47	515,33	267,22	298,53	411,70	605,99
777	421,49	79,82	118,98	4,37	510,49	267,77	298,48	410,29	602,79
778	423,24	79,54	118,88	4,37	506,03	268,34	298,50	410,16	601,97
779	424,04	79,81	119,21	4,27	502,61	268,81	298,46	408,94	601,73
780	425,32	79,72	119,23	4,17	499,58	269,18	298,41	408,85	605,01
781	426,20	79,76	119,19	4,11	497,49	269,86	298,39	408,19	607,77
782	426,76	79,55	118,59	4,08	494,24	270,24	298,11	407,44	610,55
783	426,59	79,30	118,91	3,97	492,14	270,48	298,16	405,96	616,89
784	424,55	79,75	118,71	3,87	491,55	271,16	298,20	404,88	620,71
785	423,58	80,04	118,68	3,77	490,87	271,61	298,29	404,94	622,51
786	422,19	79,84	118,19	3,77	489,82	271,93	298,29	403,88	622,85
787	419,59	79,90	117,96	3,67	488,76	272,35	298,29	402,85	623,35
788	416,87	80,06	117,29	3,57	486,66	272,62	298,08	401,24	621,01
789	414,46	80,23	117,31	3,57	486,19	273,03	297,92	398,77	619,54
790	408,90	80,01	116,55	3,47	486,21	273,47	297,80	397,16	615,38
791	404,31	80,10	116,11	3,47	485,28	273,56	297,62	393,73	608,64
792	400,69	80,08	115,56	3,38	485,91	273,99	297,45	389,57	601,22
793	398,00	79,78	114,91	3,33	486,65	274,30	297,39	385,96	593,45
794	393,28	79,60	114,99	3,27	487,00	274,50	297,20	380,54	587,82
795	389,39	79,64	114,38	3,27	489,32	274,68	297,10	375,26	582,28
796	384,71	79,66	113,51	3,17	495,06	274,77	297,01	370,13	574,52
797	378,69	79,36	112,97	3,17	498,98	274,89	297,00	365,22	568,11
798	373,20	79,49	112,39	3,07	501,57	275,18	296,94	359,93	561,62
799	369,93	79,74	111,82	3,07	503,67	275,27	296,95	355,17	555,44
800	367,22	79,70	111,29	2,97	506,66	275,33	297,05	350,28	550,69
801	363,88	79,69	110,97	2,97	507,27	275,56	297,10	346,93	545,63
802	359,59	80,01	110,27	2,87	508,62	275,77	297,20	342,86	542,45
803	355,69	79,82	109,68	2,87	508,34	276,00	297,54	339,32	536,32
804	353,49	79,89	109,40	2,87	508,29	276,04	297,87	336,29	533,49
805	351,79	79,84	109,33	2,77	508,99	276,32	298,19	333,01	529,84
806	348,86	79,60	108,87	2,77	508,62	276,37	298,54	329,77	526,13
807	345,15	79,35	108,63	2,67	507,29	276,74	298,90	326,04	521,92
808	341,12	79,34	108,26	2,67	503,88	277,42	299,25	323,36	517,84
809	337,49	79,57	107,60	2,67	501,51	277,62	299,71	319,66	514,13
810	333,52	79,66	107,14	2,57	498,35	278,10	300,09	316,96	510,21
811	330,10	79,01	106,44	2,57	493,13	278,50	300,36	315,35	506,20
812	326,95	79,54	106,28	2,57	490,71	278,93	300,81	311,47	502,54
813	324,12	79,79	105,88	2,53	486,88	279,42	301,21	308,87	498,93
814	319,41	79,89	105,18	2,47	481,44	279,98	301,56	306,65	495,62
815	315,76	79,72	104,66	2,44	473,64	280,56	302,01	303,76	490,98
816	312,59	79,66	104,15	2,37	466,43	281,34	302,36	301,62	487,43
817	309,99	79,67	103,78	2,37	460,21	281,53	302,80	299,55	483,28
818	306,93	79,70	103,61	2,37	453,67	281,99	303,18	296,72	478,96
819	304,12	79,63	103,18	2,27	447,58	282,44	303,50	294,53	474,88
820	302,05	79,32	102,70	2,37	441,17	282,99	303,54	292,57	469,79
821	299,96	79,55	102,42	2,27	435,79	283,30	304,04	290,83	466,77
822	297,82	79,36	102,16	2,27	431,83	283,69	304,30	288,81	462,89
823	296,01	79,16	102,12	2,27	427,11	284,33	304,47	286,09	458,96
824	294,84	79,39	101,82	2,27	423,50	284,97	304,63	284,44	456,52
825	292,96	79,35	101,65	2,17	419,91	285,44	304,74	282,87	452,76
826	290,45	79,21	101,54	2,17	416,00	285,93	304,68	279,98	449,28
827	288,26	79,26	100,86	2,16	411,89	286,06	304,84	278,80	446,74
828	285,75	79,31	100,59	2,07	407,95	286,40	304,76	276,70	444,17
829	284,30	79,21	100,43	2,07	404,67	286,32	304,73	274,71	440,81
830	294,41	79,38	107,01	2,07	400,99	286,63	304,12	273,18	438,73
831	299,86	79,25	104,41	1,97	398,84	286,47	304,24	272,57	441,04
832	302,59	79,04	104,39	1,97	398,39	286,38	304,57	272,24	443,41
833	305,11	79,22	104,51	1,87	398,79	286,50	304,91	270,35	446,48
834	305,80	79,12	104,42	1,87	398,16	286,45	305,15	269,16	448,26
835	306,74	79,24	104,10	1,84	398,50	286,27	305,44	268,39	452,05
836	308,80	78,99	104,75	1,77	397,00	286,54	305,54	267,91	453,80
837	310,44	79,10	104,54	1,77	396,29	287,11	305,72	266,73	455,74
838	311,45	79,31	105,10	1,67	396,74	287,15	305,96	266,34	456,66
839	310,10	79,34	105,01	1,67	396,58	287,40	306,12	265,92	456,72
840	311,15	79,25	104,89	1,67	396,80	287,41	306,25	265,69	453,86
841	314,76	79,09	105,40	1,67	397,15	287,87	306,34	264,82	453,25
842	319,20	78,79	105,93	1,57	396,41	288,51	306,37	263,68	452,21
843	321,19	79,07	106,00	1,57	397,67	288,65	306,39	264,28	451,03
844	322,34	79,06	106,14	1,47	399,62	288,74	306,46	265,25	450,20
845	322,79	79,30	106,38	1,47	400,50	288,98	306,62	265,21	448,96
846	321,82	79,25	106,27	1,37	401,42	289,06	306,73	265,65	447,64
847	320,62	79,30	106,40	1,37	402,15	289,38	306,87	266,83	445,83
848	319,26	79,23	106,27	1,37	402,59	289,42	306,98	267,59	444,85
849	320,68	79,10	106,52	1,27	403,11	289,50	307,12	268,37	443,09
850	322,04	79,21	106,61	1,27	403,60	289,79	307,16	268,45	442,56
851	323,64	78,79	106,77	1,17	404,21	290,12	307,13	269,74	441,74
852	326,31	78,56	106,78	1,17	404,28	290,91	307,13	269,81	441,17
853	328,28	78,22	106,61	1,17	405,14	291,56	307,10	270,85	440,34

854	329,75	78,30	106,90	1,07	406,32	292,43	307,09	272,24	439,71
855	330,25	78,35	107,21	0,97	407,78	293,57	307,13	273,71	440,20
856	331,48	78,61	107,37	0,97	409,37	294,76	307,30	274,65	441,50
857	331,75	78,28	107,49	0,87	411,94	295,73	307,43	275,40	439,74
858	330,71	78,54	107,60	0,87	415,21	297,12	307,62	275,63	439,39
859	331,25	78,63	107,78	0,87	419,00	298,27	307,77	275,75	438,69
860	333,44	79,01	107,80	0,77	423,13	299,77	307,99	275,74	438,24
861	333,87	79,05	107,82	0,77	428,02	300,67	308,16	276,14	436,08
862	334,70	79,11	107,96	0,67	432,76	301,86	308,25	276,20	433,67
863	335,17	79,30	107,92	0,67	437,09	303,02	308,31	276,15	433,58
864	334,92	79,28	108,12	0,67	441,00	304,27	308,28	275,70	432,17
865	335,12	79,25	108,10	0,57	444,21	305,40	308,21	275,35	432,36
866	335,19	79,42	108,22	0,57	447,25	306,29	308,07	275,17	431,41
867	336,58	79,38	108,32	0,57	449,93	307,33	307,95	275,19	430,23
868	336,77	79,29	108,47	0,47	452,42	308,14	307,80	275,47	429,36
869	336,85	79,19	108,61	0,47	455,02	308,85	307,61	275,56	427,86
870	337,10	79,49	108,60	0,47	456,78	309,72	307,37	275,21	427,63
871	335,19	79,54	108,09	0,37	458,97	310,39	307,06	275,31	426,52
872	331,72	79,55	107,76	0,37	459,81	310,90	306,82	275,42	426,17
873	328,36	79,54	107,41	0,37	458,44	311,91	306,40	274,34	425,59
874	325,64	79,73	107,11	0,37	456,54	312,43	306,12	273,46	424,47
875	322,52	79,54	106,94	0,27	453,88	312,78	305,75	271,87	422,14
876	317,09	79,69	106,32	0,27	450,83	313,43	305,38	271,01	421,52
877	311,74	79,67	105,95	0,27	446,63	314,01	304,97	269,85	419,41
878	307,84	79,63	105,25	0,17	441,49	314,50	304,55	267,35	417,66
879	303,87	79,73	104,66	0,17	437,33	314,82	304,20	265,93	415,36
880	300,78	79,69	104,35	0,17	433,09	315,19	303,77	264,47	414,16
881	299,17	79,63	104,17	0,17	429,21	315,54	303,36	262,79	411,22
882	297,06	79,70	103,94	0,17	425,48	315,93	302,99	260,44	410,60
883	295,07	79,71	103,86	0,07	422,21	316,12	302,57	259,16	408,24
884	293,59	79,43	103,43	0,07	418,80	316,53	302,24	257,40	406,57
885	292,25	79,36	103,13	0,17	414,57	317,20	301,94	255,18	405,26
886	291,13	79,42	102,92	0,07	412,14	317,41	301,58	253,63	404,45
887	289,52	79,40	102,68	0,07	409,55	318,17	301,30	252,34	402,62
888	288,56	79,33	102,66	0,07	407,57	318,49	301,01	250,76	400,29
889	287,65	79,30	102,32	0,07	404,98	319,12	300,74	249,78	399,89
890	286,20	79,46	102,15	0,07	403,32	319,50	300,45	248,68	398,40
891	285,31	79,50	102,01	0,07	401,54	319,94	300,16	247,67	396,65
892	284,43	79,16	101,83	0,07	399,43	320,30	299,76	246,21	394,79
893	283,82	78,82	101,42	0,00	397,11	320,64	299,37	244,32	392,82
894	74,75	73,81	77,90	2,97	72,41	71,57	71,71	72,96	72,27
895	116,77	73,85	83,97	2,87	73,64	71,61	71,71	76,23	79,26
896	162,84	73,89	92,43	2,68	77,67	71,68	71,78	84,15	86,65
897	180,20	73,88	86,27	2,67	85,52	71,98	71,81	97,97	98,76
898	225,26	73,95	89,45	2,57	94,73	72,32	71,89	116,34	108,63
899	253,56	73,96	92,25	2,56	104,83	72,80	71,97	128,41	121,50
900	296,10	74,03	97,17	2,37	115,42	73,51	72,08	145,27	145,85
901	341,81	74,18	103,12	2,17	127,30	74,44	72,19	167,10	179,19
902	378,00	74,25	108,79	2,07	142,00	75,74	72,34	194,35	215,51
903	389,76	74,40	111,98	1,87	160,80	77,32	72,53	217,75	246,37
904	408,96	74,36	115,78	1,77	178,02	79,21	72,69	238,13	272,87
905	400,68	74,32	116,13	1,67	194,65	81,40	72,96	251,80	292,47
906	396,76	74,51	116,52	1,57	209,37	83,79	73,24	261,27	307,67
907	396,39	74,68	117,12	1,47	221,85	86,40	73,57	267,09	324,37
908	396,33	74,65	117,67	1,37	230,84	89,16	73,93	271,53	343,30
909	410,93	74,87	119,55	1,27	236,26	92,15	74,30	278,00	367,82
910	416,13	74,77	136,50	1,47	240,54	95,38	74,85	285,67	387,48
911	412,84	74,87	182,41	11,68	247,74	98,95	75,42	289,44	385,24
912	392,95	75,11	156,19	11,58	255,51	102,80	76,26	290,04	382,16
913	368,85	75,08	138,60	11,48	258,09	106,17	77,27	286,25	374,35
914	360,28	75,25	137,15	11,38	257,79	109,17	78,41	281,52	363,32
915	383,40	75,18	155,98	11,28	268,49	111,82	79,78	281,54	352,87
916	371,25	75,29	139,78	11,18	286,81	114,28	81,36	280,55	343,93
917	323,08	75,22	122,17	11,08	281,19	116,54	83,13	272,93	335,92
918	308,77	75,26	116,02	11,08	273,21	118,63	85,00	268,32	329,98
919	304,33	75,37	112,68	11,08	264,93	120,47	86,82	261,88	328,58
920	325,45	75,41	113,49	10,88	257,54	122,15	88,68	261,26	332,81
921	344,13	75,32	114,46	10,88	251,86	123,61	90,53	266,97	331,29
922	374,39	75,26	117,90	10,78	247,89	124,96	92,36	283,63	330,50
923	394,86	75,49	120,40	10,68	245,77	126,24	94,17	297,31	331,83
924	413,91	75,75	122,80	10,47	245,65	127,62	95,99	307,66	336,08
925	429,81	75,66	125,44	10,38	247,19	128,99	97,88	321,21	344,50
926	445,72	75,56	128,14	10,18	251,43	130,17	99,80	338,12	355,49
927	469,45	75,52	132,24	10,08	256,35	131,30	101,73	356,21	368,49
928	496,80	75,57	136,22	9,98	261,61	132,48	103,66	371,44	384,90
929	528,39	75,63	141,34	9,77	268,52	133,70	105,56	388,09	405,94
930	511,69	75,68	141,21	9,67	275,51	135,00	107,56	401,00	427,11
931	491,91	75,79	139,88	9,48	281,29	136,36	109,54	408,05	442,19
932	481,44	76,09	138,51	9,38	287,20	137,84	111,58	408,74	450,50
933	472,70	76,15	137,15	9,28	291,70	139,37	113,54	405,52	453,33
934	461,85	76,16	135,35	9,17	294,27	140,88	115,47	399,19	454,22
935	460,44	76,25	135,05	9,07	295,91	142,44	117,49	397,94	456,66
936	459,20	76,50	134,81	8,88	296,72	143,94	119,53	400,41	459,12
937	459,35	76,44	134,55	8,78	297,22	145,52	121,56	404,59	462,61
938	465,49	76,33	134,86	8,68	297,42	147,15	123,67	407,52	467,03
939	472,21	76,46	136,09	8,58	298,74	148,61	125,71	416,21	473,48
940	474,58	76,59	136,58	8,47	300,68	150,15	127,80	423,59	481,00
941	481,29	76,68	137,52	8,37	303,40	151,74	129,87	432,85	488,84
942	498,80	76,73	139,75	8,18	307,17	153,33	131,92	444,58	498,67
943	522,75	76,56	143,06	7,98	313,52	155,03	133,88	452,93	513,54
944	557,27	76,80	148,04	7,77	322,42	156,73	135,76	462,55	532,89
945	574,75	76,83	152,13	7,58	334,96	158,63	137,74	474,56	552,67
946	580,37	77,05	153,93	7,48	349,32	160,68	139,52	485,75	571,14
947	573,26	77,39	154,63	7,28	362,89	162,76	141,34	492,81	587,20
948	565,65	77,53	154,13	7,17	375,59	165,16	143,08	499,99	601,37
949	559,78	77,68	153,12	6,97	386,12	167,73	144,82	503,87	613,37
950	559,53	77,75	152,88	6,78	394,81	170,44	146,56	507,10	622,45
951	574,32	77,79	154,25	6,58	405,57	173,18	148,19	512,72	629,79
952	589,62	78,14	156,14	6,47	419,07	176,18	149,94	522,69	637,02
953	594,40	77,95	156,90	6,27	431,95	179,29	151,62	529,98	643,09
954	592,43	78,53	157,42	6,08	444,29	182,45	153,51	538,15	651,09
955	588,74	78,26	157,69	5,98	455,96	185,99	155,49	545,16	658,70
956	577,26	78,46	156,43	5,77	473,53	189,60	157,51	547,31	667,17
957	553,05	78,53	153,49	5,67	489,73	193,41	159,63	535,26	669,81
958	528,51	78,80	149,99	5,57	499,09	197,41	161,70	521,27	665,72
959	508,12	78,74	146,83	5,48	502,32	201,46	163,74	508,35	656,94
960	508,14	78,95	155,94	5,38	497,35	206,00	165,40	499,97	639,91

961	547,45	78,77	153,19	5,17	501,55	210,02	167,36	507,01	635,99
962	575,06	79,22	155,26	5,07	506,77	214,08	169,35	517,49	638,30
963	586,35	79,40	157,36	4,87	511,19	218,71	171,51	526,95	642,91
964	600,85	79,35	158,82	4,68	516,64	223,49	173,77	537,11	648,74
965	602,82	79,28	159,72	4,58	522,51	229,14	176,19	544,19	654,43
966	605,55	79,25	159,87	4,37	532,17	235,08	178,76	552,30	660,25
967	600,93	79,41	159,79	4,27	541,65	241,57	181,52	560,57	664,74
968	601,90	79,39	159,92	4,08	553,52	248,34	184,45	564,24	668,76
969	600,52	79,82	159,74	3,87	570,09	255,70	187,59	566,81	672,32
970	596,50	79,74	159,24	3,77	583,58	263,22	190,91	568,20	675,13
971	594,34	79,91	158,47	3,57	592,66	270,93	194,44	569,51	678,23
972	594,34	80,04	158,70	3,47	601,41	278,44	198,15	569,92	681,72
973	592,08	80,05	158,14	3,28	606,53	286,56	202,12	571,32	685,95
974	590,86	80,24	157,59	3,28	610,84	294,69	206,09	572,38	688,30
975	588,44	80,41	156,73	3,07	612,37	302,88	210,47	574,16	691,09
976	584,49	80,42	156,36	2,97	614,52	311,50	214,86	576,38	691,30
977	579,24	80,63	155,34	2,87	616,64	319,78	219,36	579,80	687,13
978	574,79	81,04	154,10	2,77	617,29	328,75	224,09	582,80	682,38
979	569,17	80,85	152,77	2,68	619,81	337,24	228,91	583,13	674,85
980	561,07	80,41	151,53	2,58	622,04	345,57	233,99	578,88	668,06
981	516,31	81,31	216,65	10,40	619,01	356,52	238,27	558,43	643,20
982	528,53	81,26	168,57	10,16	604,29	361,08	244,20	550,19	611,07
983	530,64	81,37	158,71	9,98	590,51	363,96	249,88	537,71	587,28
984	539,26	81,26	156,33	9,88	583,23	364,25	255,17	533,42	570,40
985	566,00	81,39	157,66	9,68	583,07	363,39	260,04	536,87	559,12
986	574,22	81,22	158,01	9,58	582,10	361,23	264,58	541,87	556,74
987	601,87	81,34	161,09	9,28	578,91	358,40	268,75	551,40	561,92
988	623,95	81,83	164,00	9,18	577,92	354,88	272,65	559,83	572,98
989	630,65	81,79	166,27	8,98	581,32	351,45	276,18	570,97	583,49
990	628,62	81,99	166,46	8,78	586,24	347,53	279,58	575,13	594,78
991	624,90	82,12	166,23	8,58	589,01	343,78	282,85	580,80	605,15
992	619,58	81,90	165,50	8,38	587,63	340,45	285,84	585,79	614,94
993	621,36	81,75	165,70	8,28	586,50	337,20	288,54	589,47	623,13
994	626,91	82,07	165,99	8,08	587,68	333,52	291,32	592,91	630,71
995	625,64	82,41	166,61	7,88	588,29	330,52	293,86	593,10	634,44
996	620,20	81,95	166,35	7,67	591,81	327,53	296,27	595,27	641,35
997	616,38	82,14	166,03	7,54	597,11	324,91	298,49	593,46	645,89
998	610,60	82,44	164,71	7,38	599,47	322,38	300,63	589,79	652,26
999	605,90	82,94	164,11	7,18	601,41	320,18	302,72	588,76	659,37
1000	600,90	82,51	163,19	7,08	604,77	318,26	304,69	586,14	665,53
1001	598,69	82,48	162,65	6,88	607,16	316,71	306,62	585,78	671,35
1002	596,34	82,64	162,17	6,78	610,75	314,79	308,45	584,57	679,34
1003	594,34	82,88	161,89	6,58	613,46	313,50	310,23	582,63	687,66
1004	591,65	82,90	161,14	6,48	618,00	312,27	311,89	582,47	694,05
1005	589,26	83,07	160,66	6,27	622,70	310,99	313,57	583,07	698,97
1006	587,96	82,88	160,07	6,18	626,85	309,75	315,14	584,30	701,41
1007	586,08	83,24	159,65	6,08	630,55	308,76	316,61	582,06	701,74
1008	585,31	83,40	159,70	5,88	634,92	307,76	318,03	582,69	704,36
1009	583,45	83,16	159,07	5,78	638,30	307,11	319,38	580,43	707,57
1010	584,17	83,02	159,00	5,57	642,82	306,49	320,68	581,17	711,53
1011	584,63	82,78	159,02	5,48	648,01	305,51	321,89	580,02	714,28
1012	583,02	83,08	158,63	5,34	651,05	305,07	323,10	580,10	717,32
1013	580,96	83,09	157,99	5,18	653,32	304,99	324,27	580,98	720,23
1014	577,94	83,25	157,34	5,07	655,90	304,78	325,33	577,12	723,40
1015	570,19	83,54	156,44	4,97	660,65	304,81	326,43	571,61	726,12
1016	572,05	83,65	156,23	4,87	671,26	304,45	327,36	567,36	727,08
1017	572,11	83,13	156,02	4,68	679,04	304,75	328,40	560,32	728,68
1018	570,97	83,75	155,36	4,58	686,38	304,95	329,40	552,80	728,79
1019	564,43	83,97	154,95	4,48	690,40	305,76	330,40	546,93	728,90
1020	559,82	84,31	154,26	4,37	691,68	306,62	331,36	539,52	727,90
1021	552,55	84,44	153,43	4,27	693,03	307,54	332,44	533,20	725,10
1022	550,06	84,28	153,13	4,17	693,95	308,50	333,51	528,75	723,75
1023	547,09	84,53	152,31	4,08	693,72	309,38	334,64	522,78	721,79
1024	540,60	84,31	151,36	3,98	692,11	310,44	335,73	515,53	719,03
1025	533,66	84,71	149,85	3,88	688,65	311,60	336,82	510,46	713,96
1026	523,31	84,60	148,79	3,78	683,99	312,72	337,84	501,98	709,33
1027	514,00	84,48	146,85	3,77	678,46	313,33	338,82	490,71	702,92
1028	504,20	84,38	145,84	3,67	673,22	314,23	339,77	483,85	695,43
1029	493,34	84,39	144,05	3,57	667,16	315,28	340,63	474,59	686,34
1030	482,53	84,59	141,96	3,57	662,00	316,20	341,32	465,82	676,14
1031	471,79	84,76	140,72	3,47	654,80	316,60	342,08	457,35	665,27
1032	461,31	84,14	138,96	3,47	648,44	316,80	342,73	447,77	654,33
1033	452,83	84,19	137,90	3,38	641,23	317,07	343,27	440,18	645,50
1034	446,47	83,97	136,81	3,38	633,64	317,67	343,75	435,74	638,12
1035	441,39	84,07	135,45	3,28	628,01	317,54	344,15	426,81	629,48
1036	437,65	83,91	134,91	3,28	623,31	318,01	344,48	419,41	623,12
1037	431,98	83,93	133,94	3,18	618,67	318,53	344,82	414,33	617,05
1038	426,29	84,23	132,90	3,18	613,92	318,77	345,05	409,07	610,70
1039	420,79	84,15	132,19	3,07	608,75	319,15	345,27	402,97	605,34
1040	415,67	84,07	131,32	2,97	603,26	319,24	345,45	395,04	599,29
1041	410,15	83,99	130,43	2,97	597,90	319,57	345,59	389,67	593,42
1042	405,41	83,91	129,89	2,97	592,52	319,88	345,70	385,33	588,12
1043	400,74	83,68	129,08	2,87	586,77	319,88	345,71	380,09	582,54
1044	396,25	83,57	128,25	2,87	581,23	320,01	345,74	373,72	577,56
1045	391,88	83,37	127,69	2,78	575,61	319,89	345,77	368,86	572,44
1046	387,76	83,75	126,87	2,77	569,41	319,79	345,66	364,51	567,57
1047	383,75	83,68	125,86	2,77	561,73	319,24	345,65	360,06	562,94
1048	380,24	83,64	125,42	2,68	555,07	318,77	345,55	356,45	558,18
1049	377,15	83,39	124,69	2,68	548,40	318,21	345,37	352,31	554,27
1050	374,32	83,99	123,68	2,68	541,66	317,29	345,26	349,73	550,86
1051	372,05	84,03	123,45	2,57	535,81	316,41	345,00	347,56	547,57
1052	371,13	83,25	122,94	2,57	530,34	315,43	344,70	345,26	543,97
1053	369,81	83,84	122,75	2,47	525,34	314,71	344,44	341,46	540,47
1054	368,37	83,43	122,64	2,47	520,78	314,01	344,13	339,14	537,88
1055	366,96	83,18	122,66	2,43	517,14	313,45	343,79	336,67	534,59
1056	366,09	83,62	122,14	2,37	513,54	313,07	343,31	335,32	531,78
1057	366,07	83,64	121,76	2,37	511,03	312,16	342,93	334,01	529,15
1058	364,79	83,67	121,98	2,27	507,96	311,57	342,54	330,85	527,03
1059	364,27	82,72	121,54	2,27	505,23	311,04	342,10	329,80	524,88
1060	363,08	83,57	121,51	2,17	502,06	310,22	341,71	329,04	522,50
1061	363,21	83,78	121,40	2,17	500,02	309,64	341,26	325,90	521,10
1062	361,93	83,47	121,29	2,17	497,02	309,18	340,84	324,79	519,78
1063	361,74	83,01	121,27	2,07	494,68	308,83	340,37	323,53	518,19
1064	361,60	82,91	121,38	2,07	493,06	308,69	339,91	322,98	517,13
1065	363,89	82,86	121,63	2,07	491,21	308,44	339,36	322,57	516,58
1066	365,91	82,79	121,70	1,97	489,96	308,44	338,86	322,69	517,24
1067	370,99	82,89	122,17	1,87	489,53	308,90	338,36	328,42	518,24

1068	376,42	82,81	122,64	1,87	489,86	309,77	337,83	333,10	520,23
1069	379,23	82,96	123,08	1,77	491,14	310,56	337,31	335,60	521,37
1070	381,55	82,93	123,35	1,67	493,13	311,95	336,74	338,31	522,92
1071	383,02	83,05	123,42	1,67	496,31	313,80	336,16	339,40	524,60
1072	384,06	82,88	123,72	1,67	500,06	315,65	335,60	340,51	525,36
1073	385,89	83,28	123,67	1,57	503,11	317,12	335,09	341,79	527,22
1074	385,38	83,23	123,98	1,47	506,45	318,81	334,58	341,85	528,26
1075	386,30	82,85	123,94	1,47	509,42	320,37	334,10	341,30	528,65
1076	386,82	83,09	123,92	1,44	512,07	321,93	333,62	341,29	528,95
1077	386,40	83,12	124,08	1,37	513,94	323,46	333,18	341,14	530,11
1078	385,39	83,53	124,15	1,27	515,48	324,39	332,74	340,28	530,34
1079	385,71	83,48	124,01	1,27	517,00	325,56	332,30	339,75	530,48
1080	384,92	83,22	123,76	1,17	516,94	326,75	331,90	338,16	530,23
1081	384,16	83,51	123,53	1,17	517,46	327,56	331,53	337,56	530,20
1082	382,28	83,10	123,42	1,17	517,61	328,19	331,19	337,77	529,30
1083	381,22	83,70	122,92	1,07	517,92	328,97	330,82	335,32	528,07
1084	379,66	83,14	123,05	1,07	516,97	329,30	330,44	333,09	527,32
1085	379,07	83,31	122,95	0,97	515,96	329,70	330,10	333,54	525,55
1086	378,01	83,08	122,85	0,97	514,51	330,29	329,72	332,61	523,98
1087	376,83	84,00	122,50	0,87	513,25	330,64	329,42	332,73	523,26
1088	376,03	83,54	122,65	0,87	511,15	331,02	329,19	331,81	521,13
1089	374,74	83,74	122,48	0,83	508,68	331,40	328,90	330,45	520,51
1090	372,58	83,67	122,47	0,77	505,79	331,81	328,65	329,31	518,60
1091	369,90	83,47	122,30	0,77	502,61	332,18	328,44	328,75	516,60
1092	367,41	83,68	121,83	0,77	499,83	332,46	328,20	327,95	514,33
1093	365,42	83,45	121,60	0,67	497,72	332,51	328,04	325,97	512,10
1094	364,52	83,05	120,89	0,67	495,96	333,20	327,78	325,36	509,04
1095	363,46	83,51	120,89	0,57	493,54	333,05	327,72	324,75	507,89
1096	364,26	83,44	120,31	0,57	492,20	333,58	327,59	324,34	504,53
1097	363,03	83,72	120,34	0,57	491,33	333,91	327,51	323,61	502,55
1098	361,48	83,77	120,37	0,47	489,19	334,27	327,44	322,84	501,75
1099	358,53	83,73	120,25	0,47	487,03	334,80	327,42	320,71	500,11
1100	353,11	83,52	119,68	0,47	484,28	335,40	327,47	319,33	498,44
1101	344,97	82,97	118,29	0,37	481,48	335,68	327,50	315,43	494,45
1102	339,77	83,34	117,84	0,37	478,18	334,96	327,47	311,75	491,93
1103	335,68	83,34	117,17	0,37	475,19	334,25	327,54	307,75	487,63
1104	332,57	82,57	116,61	0,37	471,29	333,53	327,52	305,43	484,46
1105	330,58	83,13	116,41	0,37	468,05	332,87	327,54	301,61	482,27
1106	328,13	83,47	116,35	0,27	465,46	332,02	327,57	299,72	480,56
1107	326,30	83,70	115,97	0,27	462,70	331,21	327,57	297,56	477,84
1108	324,92	83,76	115,99	0,27	460,40	330,25	327,53	295,36	476,81
1109	324,15	83,87	115,64	0,27	458,57	329,67	327,48	293,96	475,03
1110	323,03	83,65	115,74	0,27	456,90	329,19	327,41	292,99	473,05
1111	323,39	83,79	115,64	0,17	455,67	329,03	327,33	292,21	471,63
1112	324,23	83,98	115,72	0,17	454,96	328,81	327,18	291,80	470,72
1113	323,78	83,94	115,60	0,17	453,99	328,98	327,04	291,08	469,65
1114	323,70	83,60	115,60	0,07	452,75	329,19	326,84	289,71	468,80
1115	323,76	83,90	115,65	0,07	451,84	329,73	326,62	289,57	467,99
1116	321,41	83,71	115,42	0,07	450,63	330,16	326,44	287,78	467,49
1117	318,48	83,78	115,11	0,07	448,78	330,70	326,24	285,29	467,56
1118	316,40	83,82	114,44	0,07	447,09	331,42	326,02	283,30	466,09
1119	314,11	83,76	113,96	0,00	444,83	331,39	325,79	281,32	464,59
1120	71,57	68,41	75,39	2,77	72,27	72,76	72,02	72,17	71,98
1121	87,20	68,24	77,09	2,77	73,81	72,72	72,00	73,78	72,34
1122	171,22	68,30	93,27	2,52	88,44	72,79	71,97	81,09	74,83
1123	253,36	67,99	97,54	2,37	116,31	73,17	71,98	109,59	86,99
1124	291,55	67,50	98,05	2,27	131,94	73,67	72,05	138,24	102,00
1125	330,34	67,49	102,27	2,08	147,59	74,38	72,14	166,31	117,08
1126	359,37	68,05	106,45	1,97	167,17	75,35	72,24	188,10	131,48
1127	376,85	68,46	109,60	1,81	190,56	76,73	72,42	209,99	149,08
1128	393,38	68,56	112,79	1,67	210,91	78,43	72,59	231,15	167,74
1129	411,55	67,77	116,43	1,57	234,20	80,58	72,80	252,72	186,83
1130	424,90	68,65	107,07	1,37	255,54	83,16	73,07	269,58	211,31
1131	428,25	68,27	88,59	1,27	275,71	86,36	73,36	281,95	237,36
1132	428,33	68,34	79,09	1,17	289,73	89,98	73,72	291,46	257,38
1133	421,46	68,51	117,26	1,07	300,47	94,02	74,15	296,94	275,25
1134	417,37	68,47	179,68	11,62	305,46	98,29	74,58	292,86	285,57
1135	423,77	68,48	171,64	11,38	306,97	102,55	75,26	290,02	295,44
1136	490,71	68,66	195,78	11,15	304,52	106,39	76,00	296,41	316,02
1137	417,95	68,64	149,27	10,98	299,68	109,96	76,92	296,99	341,46
1138	410,52	68,21	135,29	10,79	290,51	113,14	77,94	301,65	361,57
1139	427,91	68,61	132,05	10,68	282,70	115,98	79,01	306,05	378,83
1140	442,83	68,75	130,91	10,57	276,88	118,63	80,15	311,64	396,94
1141	462,92	68,21	131,88	10,38	272,92	121,18	81,41	318,93	410,42
1142	474,61	68,70	133,14	10,28	271,57	123,65	82,79	326,69	425,29
1143	472,15	68,54	132,36	10,08	271,85	126,04	84,26	334,11	440,19
1144	468,77	68,52	131,82	10,02	272,72	128,63	85,88	341,93	451,16
1145	462,56	68,34	130,62	9,87	273,25	131,28	87,70	354,21	458,41
1146	463,05	68,12	130,30	9,77	273,20	134,14	89,57	363,66	464,91
1147	471,64	67,85	131,37	9,68	272,53	136,95	91,56	373,19	470,81
1148	481,07	68,18	132,68	9,48	272,32	139,67	93,61	378,81	477,74
1149	486,80	68,36	133,63	9,38	274,09	142,44	95,69	388,46	485,25
1150	495,66	68,19	135,33	9,27	277,18	145,25	97,90	395,52	492,13
1151	521,69	67,83	139,07	9,07	281,61	148,04	99,97	407,67	501,20
1152	537,37	68,19	142,07	8,88	289,19	151,31	102,16	418,90	510,61
1153	553,43	68,37	144,78	8,67	298,61	154,80	104,51	428,93	519,91
1154	560,25	68,93	146,64	8,57	308,34	158,61	106,88	437,96	528,40
1155	562,84	68,80	147,78	8,37	317,65	162,88	109,38	448,10	536,31
1156	563,69	68,98	148,39	8,18	327,05	167,39	111,75	459,39	542,55
1157	562,76	68,95	148,45	7,97	338,15	171,91	114,04	469,03	547,53
1158	553,33	69,09	147,44	7,87	347,44	177,17	116,88	476,28	553,27
1159	548,90	69,03	146,76	7,67	353,23	182,09	119,49	482,25	557,98
1160	545,34	68,95	145,56	7,48	357,94	186,92	122,02	486,36	561,65
1161	545,00	69,28	145,46	7,38	362,70	191,90	124,59	491,00	565,99
1162	544,87	69,01	145,23	7,18	369,55	196,59	127,22	493,83	570,31
1163	547,01	68,74	145,85	6,97	374,96	201,34	129,80	498,40	575,21
1164	549,54	68,91	146,21	6,88	379,62	206,23	132,36	501,59	581,16
1165	550,91	69,04	146,32	6,78	384,00	211,10	135,05	505,02	587,42
1166	565,68	68,77	147,86	6,57	389,33	215,91	137,80	509,47	594,01
1167	584,23	69,17	150,19	6,37	397,03	221,06	140,57	513,32	601,69
1168	598,22	69,32	152,74	6,18	406,61	226,36	143,32	518,60	608,40
1169	613,33	69,39	155,57	5,97	420,19	231,64	146,20	524,66	616,46
1170	630,00	69,62	158,16	5,77	434,84	237,22	149,26	534,33	625,27
1171	626,37	70,04	158,79	5,57	448,42	243,12	152,39	542,39	634,40
1172	617,97	69,84	157,65	5,38	460,35	248,95	155,66	546,78	643,83
1173	611,84	69,44	156,83	5,27	473,54	254,84	159,05	548,39	651,82
1174	607,52	69,79	155,84	5,07	484,08	260,68	162,45	551,91	659,64

1175	604,01	69,40	154,91	4,87	494,68	266,24	166,00	554,06	665,35
1176	599,72	69,69	153,81	4,78	503,64	271,86	169,51	555,52	669,56
1177	601,00	69,88	153,82	4,57	511,95	277,24	173,03	555,74	673,30
1178	609,43	69,98	154,42	4,47	520,59	282,44	176,69	557,56	677,25
1179	613,61	69,75	154,45	4,27	530,88	287,89	180,57	563,48	679,11
1180	609,45	69,91	154,24	4,09	547,94	293,14	184,55	564,99	679,07
1181	600,37	69,58	152,68	3,97	568,60	298,33	188,47	560,42	676,20
1182	590,39	69,49	150,49	3,87	582,73	303,29	192,51	563,12	671,61
1183	584,01	69,87	149,15	3,67	593,04	308,33	196,77	563,75	665,89
1184	580,19	69,76	148,39	3,57	600,90	312,98	200,95	565,95	658,46
1185	578,18	69,94	147,34	3,47	606,35	317,59	205,29	568,13	652,63
1186	579,67	69,90	146,87	3,38	609,41	322,17	209,79	569,27	647,87
1187	587,56	69,61	147,93	3,27	613,30	326,86	214,17	567,24	643,51
1188	583,96	70,31	146,90	3,07	615,68	331,72	218,89	566,70	639,10
1189	576,10	69,69	146,47	2,97	618,73	336,33	223,67	564,72	634,79
1190	572,69	69,72	145,69	2,87	621,23	341,33	228,41	566,84	631,82
1191	571,71	70,15	145,09	2,77	626,24	346,30	233,23	565,82	627,73
1192	568,65	69,60	144,14	2,68	632,92	350,99	237,94	566,40	621,84
1193	562,95	69,84	143,46	10,25	638,57	355,82	242,52	562,47	616,89
1194	515,91	69,46	170,26	9,98	618,01	362,49	246,47	540,29	586,32
1195	512,98	69,58	150,33	9,88	605,44	363,80	251,40	527,30	553,95
1196	512,47	69,61	145,12	9,72	602,31	364,02	256,29	514,40	529,21
1197	524,18	69,34	144,20	9,58	605,67	362,56	260,59	505,90	508,50
1198	529,98	69,41	143,92	9,38	606,03	360,32	264,66	505,88	500,18
1199	557,52	69,35	146,93	9,17	597,95	357,13	268,62	512,94	485,52
1200	592,42	68,23	151,38	8,98	587,04	353,89	272,13	521,35	474,03
1201	621,06	68,84	155,78	8,78	577,04	350,52	275,28	531,64	467,59
1202	660,57	69,40	161,29	8,56	567,43	346,95	278,22	542,49	463,86
1203	687,40	69,63	166,98	8,28	557,00	343,47	281,04	555,30	467,37
1204	694,00	69,63	168,95	8,03	550,09	340,60	283,56	567,84	474,23
1205	728,23	69,86	175,25	7,77	548,74	337,39	286,10	581,00	478,47
1206	751,55	70,07	180,65	7,48	545,23	334,76	288,23	591,43	484,56
1207	750,49	69,65	182,45	7,17	544,35	332,52	290,34	602,34	489,79
1208	750,87	70,61	183,02	6,88	543,82	330,60	292,55	612,32	504,99
1209	749,34	69,60	183,85	6,65	543,59	328,78	294,58	620,67	517,18
1210	751,46	70,14	184,32	6,37	544,07	327,86	296,50	629,78	525,61
1211	747,28	70,66	184,02	6,08	546,42	327,16	298,45	638,35	533,93
1212	751,63	69,82	184,32	5,87	549,85	326,66	300,04	645,03	539,19
1213	753,37	70,55	185,15	5,57	555,79	326,75	301,64	651,22	548,87
1214	750,23	70,79	183,23	5,37	560,27	327,23	303,38	655,81	562,78
1215	750,74	70,36	184,02	5,07	567,32	327,92	304,88	658,20	578,58
1216	748,15	70,43	183,59	4,87	575,97	328,93	306,48	662,49	594,74
1217	748,64	70,89	183,00	4,68	584,68	330,39	308,11	664,77	608,93
1218	756,64	70,36	183,70	4,37	596,64	331,69	309,70	668,19	623,31
1219	760,47	71,16	184,54	4,17	609,38	333,48	311,29	672,53	637,39
1220	775,84	71,68	186,13	3,97	622,38	335,02	312,70	675,66	649,44
1221	782,35	72,06	186,68	3,67	635,56	337,07	314,16	678,59	661,15
1222	759,89	72,56	183,61	3,47	647,76	338,93	315,74	680,74	671,97
1223	740,02	72,58	181,33	3,27	658,15	341,35	317,31	680,05	681,80
1224	731,26	72,30	178,95	3,07	666,81	343,23	318,87	681,01	690,35
1225	730,64	72,68	178,06	2,87	674,08	345,44	320,45	678,75	698,64
1226	728,92	72,10	176,89	2,77	681,91	348,00	322,03	678,19	707,08
1227	731,30	71,02	177,00	2,57	688,66	350,20	323,36	677,48	714,02
1228	723,89	71,11	176,16	2,37	695,69	352,13	324,73	678,22	722,14
1229	711,80	70,95	173,34	2,17	702,02	354,79	326,23	674,01	730,80
1230	697,58	71,20	172,15	2,05	706,68	357,23	327,52	671,41	739,25
1231	683,43	72,00	169,64	1,87	713,13	359,28	328,89	664,31	743,44
1232	670,15	72,26	167,31	1,77	719,74	361,57	330,18	659,46	751,30
1233	649,72	72,25	163,55	1,58	723,13	364,31	331,24	651,68	754,87
1234	631,81	71,76	160,28	1,47	723,52	366,62	332,55	638,48	755,81
1235	613,55	71,14	157,16	1,47	721,72	369,78	333,83	624,38	754,92
1236	594,26	71,66	152,89	1,37	718,28	372,73	335,36	607,54	755,00
1237	575,12	71,81	149,42	1,28	713,23	376,29	336,85	592,53	752,89
1238	558,49	70,98	146,32	1,17	707,78	379,57	338,39	571,49	749,57
1239	543,17	71,10	143,55	1,17	699,89	383,34	340,10	553,66	743,85
1240	528,57	71,62	141,29	1,17	692,79	386,65	341,75	540,50	734,34
1241	516,22	72,62	139,28	1,17	684,21	389,61	343,30	526,78	723,26
1242	505,08	72,24	137,57	1,07	676,02	392,37	344,97	513,68	713,64
1243	495,56	72,80	135,90	1,07	668,11	395,28	346,34	498,83	702,57
1244	486,28	71,58	133,72	1,07	661,34	397,34	347,85	490,34	692,61
1245	478,08	70,93	131,84	0,97	655,09	398,57	349,05	476,16	682,44
1246	470,99	71,45	130,33	0,97	648,18	400,34	350,22	465,82	673,44
1247	464,54	71,26	128,84	0,92	641,94	401,30	351,77	456,34	665,82
1248	458,02	71,97	127,59	0,97	636,46	402,22	352,88	448,15	659,16
1249	452,19	70,89	126,48	0,87	632,24	403,01	353,97	438,01	652,74
1250	447,71	71,73	125,31	0,87	626,65	403,32	355,08	432,11	646,19
1251	447,63	70,51	124,72	0,77	622,48	403,31	356,21	425,79	649,95
1252	447,14	72,08	124,38	0,77	619,22	403,68	357,04	422,27	652,37
1253	445,21	71,46	124,11	0,70	616,55	403,15	357,99	419,11	655,41
1254	442,89	71,55	123,64	0,67	613,75	402,78	358,95	413,55	655,86
1255	440,16	70,40	123,27	0,67	611,61	402,26	359,93	410,27	656,64
1256	431,90	70,76	122,14	0,67	610,22	401,63	361,20	403,07	655,39
1257	424,94	70,37	121,06	0,57	608,10	400,68	362,80	396,20	650,95
1258	420,24	71,84	120,24	0,57	606,46	399,96	364,19	391,78	645,62
1259	415,98	70,98	119,40	0,57	603,50	398,69	365,72	386,27	639,64
1260	412,22	70,99	118,96	0,57	600,26	397,04	367,33	382,73	633,13
1261	409,11	70,45	118,10	0,47	597,09	396,05	368,77	375,81	628,49
1262	405,84	70,44	117,21	0,47	594,23	394,17	370,33	371,09	622,77
1263	402,05	70,96	116,21	0,47	591,00	392,27	371,76	367,48	618,22
1264	399,40	70,73	115,96	0,37	588,34	390,50	372,84	363,02	613,48
1265	396,83	71,18	115,60	0,37	585,45	388,94	374,10	358,84	608,69
1266	394,41	70,42	115,23	0,33	582,52	387,01	374,87	354,77	605,24
1267	392,45	70,86	114,66	0,32	579,67	385,29	376,34	351,32	600,96
1268	389,80	70,66	114,38	0,27	577,08	383,68	377,34	346,30	598,51
1269	387,95	70,52	113,88	0,27	574,09	382,00	378,13	343,89	593,74
1270	386,36	70,54	113,52	0,17	571,25	380,17	378,97	340,18	591,32
1271	383,94	70,25	112,94	0,18	569,05	378,55	379,62	338,22	588,55
1272	381,71	70,72	112,82	0,17	566,35	376,94	380,44	335,31	584,16
1273	380,23	70,86	112,59	0,17	564,46	375,43	381,04	332,60	580,91
1274	378,39	70,93	112,35	0,17	562,99	373,85	381,65	329,76	578,43
1275	375,85	70,38	111,97	0,07	560,68	371,97	382,41	327,35	575,07
1276	374,16	70,42	111,53	0,07	558,43	370,59	383,06	325,70	571,34
1277	372,00	70,23	111,42	0,07	556,12	368,78	383,77	322,59	566,48
1278	370,26	70,63	111,09	0,07	554,12	366,97	383,96	320,21	561,61
1279	369,30	70,43	110,77	0,07	552,12	365,08	384,47	318,22	559,37
1280	368,94	70,40	110,56	0,07	549,64	363,34	384,81	317,43	556,54
1281	366,54	70,43	110,21	0,00	547,89	361,55	385,05	313,64	554,07

1282	71,17	70,93	71,23	0,17	71,45	70,98	71,19	71,13	71,07
1283	72,38	71,07	71,24	2,87	71,63	70,99	71,20	71,52	71,21
1284	127,61	70,97	82,25	2,77	78,66	70,93	71,20	74,35	73,55
1285	172,09	71,08	94,03	2,67	98,61	70,99	71,33	78,06	77,49
1286	268,17	71,03	123,48	2,47	160,57	71,06	71,40	88,97	81,72
1287	229,48	71,16	94,26	2,46	169,04	71,38	71,54	103,64	89,60
1288	221,85	71,20	89,70	2,34	171,76	71,99	71,72	116,47	96,82
1289	251,20	71,10	91,61	2,24	177,67	72,79	71,90	132,97	106,85
1290	295,74	71,29	96,22	2,07	188,84	73,90	72,11	158,82	120,15
1291	366,34	71,28	105,22	1,97	203,86	75,50	72,34	195,06	135,06
1292	426,75	71,36	114,39	1,77	226,80	77,59	72,57	233,40	151,63
1293	440,34	71,45	118,71	1,67	254,39	80,17	72,88	263,97	171,87
1294	443,14	71,57	120,94	1,47	280,62	83,17	73,17	288,84	189,92
1295	440,63	71,67	121,63	1,37	294,23	86,51	73,55	305,36	210,12
1296	439,31	71,49	122,13	1,27	302,20	90,12	73,95	318,70	229,88
1297	459,83	71,72	138,68	1,17	312,83	93,85	74,40	332,42	247,68
1298	409,43	71,95	180,24	12,28	312,85	97,55	74,89	320,66	260,26
1299	454,34	72,10	199,15	11,98	318,39	101,42	75,48	313,17	278,96
1300	366,22	72,01	139,59	11,88	310,06	105,90	76,22	303,34	284,56
1301	334,31	71,94	123,66	11,87	298,87	109,80	77,09	293,35	284,38
1302	349,00	71,99	119,37	11,78	289,18	113,30	78,07	289,04	284,81
1303	371,27	72,07	118,61	11,68	282,51	116,43	79,05	292,63	285,70
1304	403,78	72,14	121,00	11,58	280,59	119,40	80,15	302,98	287,56
1305	425,53	72,18	123,11	11,38	284,53	122,24	81,30	315,02	290,38
1306	423,09	72,11	123,20	11,28	289,09	124,87	82,55	322,68	292,39
1307	413,09	72,21	121,89	11,17	289,67	127,62	83,87	327,79	295,81
1308	410,01	72,34	121,41	11,08	289,11	130,37	85,32	334,28	294,68
1309	428,58	72,32	123,75	10,98	290,51	133,03	86,84	338,10	291,61
1310	443,21	72,24	125,86	10,78	295,96	135,63	88,54	344,52	288,59
1311	461,24	72,55	128,77	10,68	304,38	138,13	90,35	351,40	286,29
1312	491,53	72,67	133,94	10,47	314,44	140,61	92,17	369,09	288,25
1313	493,59	72,88	134,89	10,38	323,53	143,15	94,24	386,95	292,72
1314	488,54	72,64	135,09	10,18	329,86	145,79	96,37	399,31	297,85
1315	511,24	72,83	138,82	10,07	336,73	148,47	98,59	415,02	304,65
1316	527,52	73,24	141,55	9,87	344,30	151,10	100,93	432,31	314,81
1317	524,16	73,34	141,89	9,68	351,24	153,56	103,25	444,16	323,82
1318	534,40	73,39	143,74	9,48	356,86	155,85	105,71	455,66	334,82
1319	550,55	73,50	146,14	9,28	361,34	157,96	108,13	469,70	348,82
1320	577,30	73,47	150,54	9,17	366,04	160,03	110,63	484,57	365,53
1321	604,58	73,77	155,16	8,88	376,22	162,26	113,07	498,99	380,86
1322	588,48	73,61	154,18	8,78	392,91	164,43	115,60	508,39	393,64
1323	587,27	73,93	154,81	8,58	406,05	166,64	118,14	519,60	406,80
1324	601,00	74,25	156,47	8,37	415,71	168,78	120,68	529,69	423,98
1325	609,70	74,28	158,33	8,18	424,55	171,02	123,29	535,62	442,92
1326	618,92	74,34	159,93	7,98	433,16	173,27	125,86	542,88	460,12
1327	632,64	74,65	162,94	7,77	443,84	175,81	128,55	553,60	475,42
1328	643,32	74,92	164,92	7,48	456,96	178,37	131,05	560,99	490,18
1329	649,99	75,18	166,74	7,28	469,77	181,32	133,82	571,21	505,61
1330	648,16	75,40	166,70	7,07	480,56	184,68	136,55	576,68	521,73
1331	643,41	75,52	166,46	6,88	490,01	188,14	139,30	579,65	534,40
1332	642,56	75,44	165,78	6,68	502,05	192,28	142,15	579,94	548,41
1333	647,20	75,32	167,02	6,47	515,51	196,57	145,20	584,06	558,80
1334	639,73	75,61	166,11	6,27	527,31	201,04	148,29	585,22	569,79
1335	635,33	75,86	165,60	6,18	537,32	205,73	151,47	583,55	578,37
1336	636,33	75,77	165,53	5,98	545,59	210,29	154,53	583,32	587,77
1337	637,73	75,86	164,87	5,77	553,83	215,34	157,75	587,48	595,47
1338	639,12	76,57	165,37	5,57	569,87	220,36	161,17	585,82	602,82
1339	636,61	76,59	165,10	5,38	589,44	225,59	164,72	585,12	610,47
1340	629,68	76,05	163,77	5,18	603,21	230,53	168,21	582,26	619,08
1341	625,75	76,71	163,18	5,07	615,62	235,47	171,60	578,34	629,41
1342	623,85	76,90	162,60	4,87	623,92	240,56	175,19	577,32	639,93
1343	622,30	77,23	161,81	4,71	631,78	245,77	178,69	574,06	646,45
1344	626,84	77,33	162,09	4,47	639,67	250,91	182,11	572,81	652,24
1345	623,30	77,19	161,61	4,37	647,36	255,97	185,50	572,22	657,39
1346	629,59	77,18	162,14	4,17	654,33	261,23	188,87	571,97	661,97
1347	632,18	77,51	162,30	4,08	661,56	266,95	192,25	573,34	667,06
1348	627,43	77,28	161,39	3,88	668,03	272,79	195,70	573,21	672,77
1349	624,64	77,11	160,95	3,67	671,08	279,50	199,29	572,93	677,51
1350	622,25	77,47	160,06	3,57	671,80	286,47	202,83	572,58	683,15
1351	618,82	77,58	159,35	3,47	672,71	293,91	206,65	571,94	688,73
1352	611,75	78,21	158,36	3,28	674,76	301,56	210,59	572,60	692,99
1353	603,45	77,12	156,36	3,17	674,23	309,39	214,39	572,42	695,71
1354	596,45	77,12	154,67	3,07	674,28	317,55	218,80	570,85	698,13
1355	590,91	77,24	153,19	2,87	674,40	325,72	223,04	565,35	699,40
1356	585,10	77,69	151,89	2,77	675,72	333,35	227,47	562,57	699,78
1357	578,85	78,10	150,27	2,68	677,50	340,91	231,78	557,50	701,16
1358	566,57	77,10	148,05	2,58	678,38	348,30	236,49	548,47	705,21
1359	515,84	78,81	199,98	10,28	656,78	357,95	240,29	529,22	678,38
1360	517,74	79,37	161,41	10,18	627,44	362,01	245,70	515,42	653,22
1361	529,45	78,34	154,68	9,98	612,08	363,78	251,22	506,66	640,51
1362	538,65	78,40	151,95	9,88	600,36	364,25	256,40	497,78	630,08
1363	571,45	78,57	154,25	9,68	589,27	363,57	260,99	504,80	617,64
1364	602,55	78,46	157,97	9,48	576,25	361,66	265,22	513,37	611,81
1365	630,78	78,10	160,96	9,28	565,33	358,94	269,01	527,98	606,71
1366	648,89	78,01	165,03	9,08	557,74	356,26	272,86	540,24	605,41
1367	659,62	78,32	167,40	8,88	553,07	352,97	275,99	551,71	604,69
1368	658,54	78,50	168,25	8,66	550,10	349,95	279,00	561,91	606,40
1369	658,29	78,56	168,21	8,37	548,39	347,07	281,61	570,23	609,17
1370	655,91	78,63	168,44	8,28	548,48	344,59	284,27	576,11	611,81
1371	653,46	78,64	168,12	8,08	548,97	342,24	286,71	582,45	614,33
1372	653,44	78,68	168,59	7,78	549,80	340,10	289,00	586,38	619,18
1373	651,25	78,68	168,30	7,58	551,82	338,28	291,00	591,27	627,94
1374	650,22	79,09	167,56	7,38	554,83	336,48	292,81	592,60	635,04
1375	649,21	79,37	167,39	7,28	558,62	335,15	294,57	594,84	640,71
1376	646,18	79,42	166,49	7,00	561,65	333,94	296,19	595,77	647,33
1377	645,95	78,45	166,00	6,88	564,38	332,80	297,59	597,55	653,82
1378	644,92	79,65	165,92	6,68	569,57	331,96	299,05	597,52	659,44
1379	644,78	79,20	165,51	6,48	575,95	331,65	300,27	598,72	665,92
1380	642,18	79,31	165,39	6,27	582,50	331,44	301,60	598,65	669,87
1381	639,54	79,03	164,34	6,18	590,14	330,96	302,40	596,10	676,71
1382	637,66	79,22	164,16	5,98	598,77	330,96	303,69	595,26	681,15
1383	636,35	78,58	163,45	5,77	604,96	330,62	304,38	596,21	684,95
1384	635,76	79,24	162,98	5,67	611,60	330,50	305,42	593,69	688,27
1385	635,03	79,16	163,01	5,48	617,44	330,14	305,95	593,33	691,13
1386	635,68	79,86	162,59	5,28	623,70	330,57	306,93	593,51	695,79
1387	631,89	79,07	161,85	5,18	630,30	330,65	307,49	593,10	698,67
1388	624,25	79,67	160,82	4,97	638,38	331,18	308,26	588,74	703,28

1389	616,82	79,48	159,51	4,87	644,51	331,96	308,87	585,86	705,07
1390	611,84	79,16	157,93	4,69	649,00	332,15	309,47	578,90	707,93
1391	606,10	79,84	157,08	4,58	655,70	332,94	310,08	572,44	712,34
1392	597,24	79,99	155,46	4,47	662,09	333,81	310,66	564,11	715,38
1393	585,74	79,79	153,32	4,37	664,94	334,42	310,96	556,23	715,54
1394	577,65	80,17	151,59	4,17	667,40	335,70	311,61	548,37	715,02
1395	571,68	79,92	150,28	4,08	667,55	336,91	311,96	542,19	713,24
1396	568,27	80,02	149,86	3,98	666,11	338,27	312,50	537,85	714,80
1397	567,23	79,67	149,30	3,78	664,97	339,93	313,24	533,65	713,48
1398	567,23	79,94	149,09	3,77	664,67	341,81	313,54	529,19	712,39
1399	565,82	80,55	148,27	3,57	663,39	343,73	314,16	524,32	711,88
1400	564,29	80,83	147,71	3,47	663,56	345,58	314,68	521,35	711,19
1401	562,18	80,42	147,17	3,38	662,54	347,51	315,20	518,39	710,09
1402	558,28	80,12	146,89	3,28	661,38	349,88	315,64	515,10	708,07
1403	553,85	79,50	146,09	3,17	662,22	351,94	316,14	512,42	705,07
1404	545,30	80,07	144,36	3,07	661,83	354,56	316,49	508,27	703,92
1405	535,68	80,53	142,70	3,07	662,21	356,93	317,06	503,66	701,15
1406	526,15	79,66	141,15	2,97	660,27	359,20	317,68	500,54	694,41
1407	516,74	79,02	139,72	2,87	658,21	361,19	318,15	494,52	687,61
1408	508,55	79,46	138,05	2,87	656,61	363,48	318,80	488,65	681,96
1409	501,42	80,09	136,59	2,77	654,98	365,37	319,46	480,57	676,27
1410	494,53	80,49	135,51	2,68	652,66	367,44	320,00	474,40	671,33
1411	488,57	79,93	134,43	2,61	649,15	369,02	320,78	467,56	664,46
1412	483,43	80,21	133,45	2,58	644,58	370,32	321,43	461,44	659,12
1413	478,47	80,01	132,60	2,47	639,60	371,74	322,14	454,80	652,88
1414	473,33	80,57	131,95	2,47	637,55	372,90	322,62	448,87	650,24
1415	469,51	80,30	131,32	2,37	633,89	373,84	323,19	442,65	645,43
1416	464,69	80,58	130,60	2,37	629,97	374,46	323,79	436,98	639,14
1417	461,65	80,08	129,76	2,27	626,38	375,38	324,42	431,88	634,61
1418	458,43	79,66	129,50	2,26	623,48	375,52	324,70	427,52	628,61
1419	454,52	79,45	128,46	2,24	618,94	376,16	325,45	423,63	627,82
1420	451,73	79,82	127,84	2,17	616,70	376,95	326,16	419,16	623,33
1421	449,71	79,85	127,52	2,07	614,30	377,57	326,76	414,77	621,41
1422	447,94	79,63	127,51	2,07	611,17	377,77	327,41	411,28	618,30
1423	446,31	79,53	127,07	1,98	608,64	377,97	328,05	408,60	616,56
1424	444,31	80,10	126,86	1,93	606,82	378,44	328,88	405,56	614,34
1425	442,76	79,55	126,53	1,87	604,59	378,24	329,37	400,97	611,24
1426	441,02	79,59	126,29	1,87	602,54	378,68	330,06	397,66	607,88
1427	440,17	79,72	126,32	1,77	600,41	378,72	330,76	394,99	607,60
1428	439,79	79,95	125,75	1,77	598,92	378,93	331,36	392,05	606,41
1429	438,78	79,99	125,52	1,67	597,35	378,60	332,07	389,62	604,82
1430	438,60	80,17	125,65	1,67	596,50	378,34	332,70	387,47	603,87
1431	437,99	80,09	125,50	1,57	595,88	378,17	333,47	384,94	602,17
1432	437,35	80,34	125,20	1,57	594,21	378,13	334,02	383,90	602,03
1433	437,08	80,06	125,38	1,47	592,66	377,59	334,77	381,35	600,94
1434	436,94	80,59	125,52	1,47	591,59	377,22	335,46	380,56	600,21
1435	437,70	79,94	125,54	1,37	590,07	376,88	335,98	381,13	599,27
1436	437,35	80,67	125,62	1,37	589,72	376,38	336,61	377,91	599,30
1437	438,08	80,73	125,75	1,28	590,17	375,73	337,16	376,35	600,30
1438	437,86	80,47	125,69	1,17	589,48	375,18	337,71	375,88	599,73
1439	438,77	80,53	125,93	1,17	588,66	374,38	338,20	375,31	600,35
1440	439,72	80,26	125,74	1,17	588,80	374,06	338,59	374,49	600,31
1441	440,25	80,71	125,89	1,07	589,45	373,45	338,84	374,21	601,10
1442	440,05	80,70	125,97	0,97	589,34	372,85	338,99	373,63	606,62
1443	439,36	80,86	125,91	0,97	590,22	372,23	339,24	372,58	618,88
1444	439,36	80,88	125,99	0,97	590,06	371,39	339,58	371,85	606,74
1445	439,14	80,66	125,85	0,87	588,58	370,76	339,88	371,90	599,45
1446	437,95	80,95	125,79	0,87	586,09	370,08	339,95	371,67	593,15
1447	435,58	80,88	125,47	0,77	584,87	369,51	340,09	370,75	587,88
1448	427,19	80,48	124,48	0,77	592,07	368,63	340,13	371,60	584,01
1449	421,84	80,76	123,79	0,76	596,21	367,91	340,04	371,50	580,34
1450	417,71	80,64	123,50	0,67	599,09	367,27	339,97	370,02	578,20
1451	413,76	80,41	122,86	0,67	600,19	366,30	339,92	367,29	575,18
1452	409,00	80,65	122,20	0,57	600,30	365,35	339,88	364,66	572,62
1453	405,53	80,59	121,77	0,57	598,30	364,24	339,85	363,30	571,23
1454	401,62	80,71	121,24	0,57	597,23	363,21	339,84	359,03	566,88
1455	396,13	80,08	120,23	0,47	593,71	362,14	339,73	355,36	563,66
1456	390,43	80,83	119,45	0,47	590,51	360,92	339,88	352,48	559,73
1457	383,67	80,61	118,75	0,38	585,31	359,61	340,10	346,47	556,22
1458	378,03	81,08	118,09	0,47	579,51	358,20	340,39	343,32	553,87
1459	373,48	80,97	117,34	0,37	574,24	356,79	340,75	339,09	549,06
1460	369,18	80,96	117,00	0,37	569,74	355,02	341,13	335,02	544,95
1461	366,35	80,47	116,11	0,37	564,63	353,30	341,58	331,56	542,18
1462	363,95	80,77	115,70	0,37	561,15	351,82	342,00	328,03	537,94
1463	360,32	80,80	115,21	0,27	556,03	350,04	342,56	324,81	534,89
1464	357,71	80,63	114,86	0,27	551,17	348,34	343,11	322,41	532,12
1465	355,83	80,84	114,64	0,27	547,41	346,56	343,69	317,92	528,55
1466	353,56	80,23	114,14	0,27	542,89	344,79	344,28	315,00	525,41
1467	351,29	80,64	113,66	0,19	540,14	343,20	344,86	311,92	521,06
1468	349,50	80,77	113,56	0,17	536,99	341,52	345,50	309,71	517,31
1469	347,66	80,67	113,12	0,17	534,43	339,71	346,09	307,75	514,44
1470	346,25	80,66	112,94	0,17	532,27	338,02	346,67	305,21	511,42
1471	345,12	80,75	112,98	0,11	530,14	336,27	347,34	302,65	509,47
1472	344,11	80,78	112,76	0,07	527,59	334,34	348,02	301,11	506,43
1473	343,18	80,61	112,70	0,07	526,44	332,65	348,67	299,46	503,65
1474	341,86	80,46	112,27	0,07	524,36	331,05	349,13	297,83	501,42
1475	340,84	79,89	112,04	0,07	521,08	329,59	349,47	296,21	498,89
1476	339,25	80,63	111,92	0,04	520,26	327,90	350,25	294,30	497,09
1477	339,08	80,14	111,86	0,04	517,17	326,52	350,92	293,74	496,69
1478	338,23	80,69	111,89	0,04	516,92	324,91	351,59	292,28	494,09
1479	337,95	80,81	111,71	0,04	515,61	323,47	352,24	290,84	491,39
1480	340,65	80,37	112,73	0,04	514,05	322,01	352,65	289,45	489,39
1481	389,15	80,58	172,74	0,04	511,71	323,23	350,54	294,23	485,02
1482	72,58	72,87	75,17	2,97	72,31	71,93	71,59	73,51	72,29
1483	97,66	73,13	78,36	2,88	72,91	71,92	71,59	75,76	72,76
1484	280,26	73,04	101,91	2,68	114,73	72,31	71,64	88,88	85,29
1485	325,83	73,29	100,30	2,49	185,45	73,20	71,83	117,99	114,08
1486	333,52	73,63	98,85	2,39	197,88	73,83	72,07	147,70	147,78
1487	362,02	73,56	102,16	2,18	210,81	75,14	72,32	186,02	181,83
1488	386,40	73,76	105,05	2,08	227,86	77,48	72,67	217,31	218,43
1489	383,07	73,91	105,46	1,88	251,11	80,20	73,10	236,93	249,52
1490	382,86	73,98	103,92	1,79	273,13	83,64	73,59	253,50	277,81
1491	372,35	74,15	101,93	1,69	288,77	87,66	74,14	263,27	302,78
1492	359,74	74,07	100,03	1,59	299,99	92,18	74,78	270,12	320,60
1493	356,16	74,24	98,96	1,55	312,03	96,99	75,54	275,34	334,64
1494	357,09	74,32	98,64	1,38	321,68	102,01	76,39	280,17	349,01
1495	354,94	74,10	98,39	1,28	329,64	107,20	77,40	283,82	363,69

1496	347,95	74,01	97,64	1,28	338,33	112,75	78,50	284,63	372,70
1497	388,31	74,21	124,51	9,90	346,59	118,98	79,73	289,27	380,51
1498	361,77	74,32	119,16	12,25	346,39	124,95	81,69	289,82	375,30
1499	530,69	74,13	146,32	11,87	376,39	131,25	83,91	305,02	381,71
1500	407,87	74,44	112,13	11,77	368,00	135,96	85,81	310,44	383,04
1501	359,95	74,40	104,08	11,67	357,24	140,60	87,68	310,77	376,65
1502	424,02	74,12	135,10	11,55	365,75	145,78	89,88	311,04	362,03
1503	527,95	74,39	136,82	11,26	406,30	150,31	91,73	336,06	362,82
1504	436,15	74,54	114,92	11,16	400,04	154,05	93,50	344,50	364,14
1505	421,18	74,26	110,51	11,07	387,40	157,67	95,41	353,98	368,43
1506	450,05	74,29	110,85	10,85	376,96	161,29	97,44	372,08	376,50
1507	469,13	74,54	111,97	10,65	370,75	164,94	99,59	396,60	389,77
1508	481,99	74,57	113,08	10,56	369,19	168,26	101,70	416,78	403,17
1509	487,62	74,65	113,45	10,37	372,46	171,66	103,86	436,63	415,43
1510	495,62	74,56	114,18	10,17	378,08	175,09	106,06	454,30	428,62
1511	508,43	74,69	115,13	9,95	385,48	178,52	108,32	475,00	442,43
1512	524,48	74,99	116,75	9,76	394,32	181,97	110,58	495,13	455,83
1513	539,34	74,70	118,68	9,57	405,60	185,73	113,02	513,05	470,44
1514	549,25	74,55	120,18	9,37	418,32	189,56	115,53	528,61	484,83
1515	556,32	74,80	121,43	9,16	431,47	193,42	118,13	544,09	497,00
1516	565,10	74,78	122,54	8,96	446,51	197,51	120,80	556,43	509,38
1517	566,02	74,61	122,56	8,77	461,29	201,50	123,60	568,80	521,45
1518	566,45	75,16	123,02	8,58	474,91	206,39	126,46	580,33	532,68
1519	568,18	75,03	123,13	8,36	486,89	211,23	129,46	589,27	544,83
1520	570,25	75,35	124,01	8,17	498,50	216,65	132,60	597,92	556,97
1521	573,31	75,18	123,62	7,87	508,77	221,76	135,79	605,93	567,68
1522	579,81	75,34	125,03	7,66	517,71	227,03	139,16	612,31	578,72
1523	580,44	75,55	125,43	7,54	526,82	232,33	142,63	617,53	588,27
1524	587,28	75,89	126,23	7,27	535,80	237,48	146,18	622,83	598,19
1525	592,03	76,08	127,05	7,08	546,35	243,59	149,89	626,00	609,35
1526	591,14	75,65	126,88	6,86	558,19	249,13	153,64	629,07	620,45
1527	590,21	75,68	126,68	6,67	570,96	255,22	157,48	631,08	630,09
1528	588,70	75,83	126,54	6,38	584,21	261,08	161,33	633,60	637,69
1529	586,24	76,44	126,78	6,28	603,69	266,64	165,43	634,37	643,53
1530	582,98	76,07	126,57	6,07	622,22	272,97	169,50	635,87	648,96
1531	582,23	76,45	126,40	5,79	636,96	279,35	173,73	638,28	653,58
1532	580,70	76,67	126,26	5,68	646,26	284,81	178,06	637,41	658,04
1533	581,24	76,85	127,07	5,48	655,50	291,42	182,51	638,01	662,95
1534	581,86	76,86	126,15	5,27	662,68	297,46	187,07	641,25	667,43
1535	582,60	76,99	126,64	5,07	668,19	303,81	191,78	640,88	672,23
1536	583,77	77,47	126,60	4,88	674,88	309,79	196,64	642,18	677,13
1537	584,29	77,59	126,82	4,69	681,07	316,09	201,65	641,30	682,54
1538	584,45	76,54	126,85	4,57	687,14	322,09	206,74	642,81	688,41
1539	583,27	77,80	127,18	4,28	694,73	328,24	211,95	645,09	694,58
1540	583,35	77,87	126,95	4,18	701,95	334,81	217,23	647,05	700,55
1541	581,84	78,09	127,13	3,99	709,43	341,13	222,57	647,94	705,13
1542	576,85	77,49	126,31	3,77	717,83	347,62	227,96	648,46	707,90
1543	573,38	76,99	125,59	3,67	724,38	353,30	233,30	648,70	710,85
1544	569,37	77,92	125,23	3,48	730,81	359,24	238,72	649,22	714,01
1545	550,58	76,96	123,22	3,38	746,35	365,90	244,23	640,55	726,99
1546	534,64	77,87	121,76	3,29	746,51	372,05	249,86	627,87	735,72
1547	522,36	77,72	120,37	3,19	739,28	377,69	255,32	612,75	741,23
1548	513,30	78,27	120,05	3,07	731,21	382,14	260,83	594,99	743,06
1549	507,51	78,28	118,48	2,98	725,57	386,70	266,25	581,09	744,17
1550	525,88	77,74	127,78	2,88	710,93	390,76	270,81	573,42	729,80
1551	522,51	77,70	120,50	2,78	701,57	394,29	276,54	572,84	718,24
1552	523,15	76,75	119,60	2,68	696,18	398,81	282,39	572,84	710,41
1553	528,89	77,10	126,02	3,05	694,20	403,20	287,97	572,47	703,33
1554	526,46	77,08	137,04	10,66	673,49	408,15	293,73	567,14	668,98
1555	569,05	77,75	129,25	10,37	660,08	411,74	300,48	574,58	644,54
1556	614,81	77,51	129,96	10,17	643,66	414,00	305,75	583,29	627,95
1557	661,02	77,33	133,82	9,88	627,78	414,33	310,24	599,93	612,27
1558	681,12	77,85	136,01	9,58	614,21	414,73	314,01	617,47	600,65
1559	683,47	78,53	137,06	9,37	603,81	413,47	317,47	635,28	593,23
1560	686,77	78,12	138,50	9,06	597,64	412,04	320,50	650,13	587,81
1561	693,49	78,07	139,82	8,77	594,06	410,64	323,25	663,62	587,17
1562	687,58	78,15	139,12	8,67	594,48	409,81	325,64	673,90	588,27
1563	679,60	78,65	139,11	8,36	594,26	408,64	327,97	683,39	588,90
1564	678,05	78,85	138,85	8,16	596,56	408,14	329,98	692,40	591,88
1565	672,31	78,79	139,09	7,88	600,77	407,68	332,00	700,95	598,72
1566	664,71	78,24	138,69	7,66	609,77	406,81	333,89	707,83	605,25
1567	659,41	78,74	137,92	7,37	619,21	406,81	335,59	711,71	618,01
1568	654,25	78,76	137,40	7,17	628,75	406,59	337,26	715,58	632,00
1569	648,60	79,39	136,59	6,96	637,59	407,19	338,93	716,90	644,36
1570	643,62	78,97	136,12	6,67	643,72	407,22	340,51	720,97	656,45
1571	637,72	79,00	135,21	6,47	650,80	407,96	342,03	722,21	666,96
1572	632,26	79,10	134,05	6,28	657,04	408,28	343,45	723,81	676,79
1573	626,07	79,02	133,19	5,97	664,04	409,74	344,81	725,05	685,36
1574	624,40	79,24	132,83	5,87	670,81	410,59	346,21	726,27	694,29
1575	620,58	79,61	131,84	5,68	676,52	411,93	347,40	725,15	702,26
1576	617,56	78,50	130,92	5,48	682,58	412,93	348,41	722,82	707,50
1577	618,48	78,12	131,85	5,27	690,63	414,78	349,76	724,78	716,45
1578	619,82	79,77	132,79	5,07	697,19	417,18	351,00	725,16	724,23
1579	624,72	80,40	131,85	4,78	706,03	418,54	352,26	726,31	731,51
1580	622,68	80,74	131,72	4,57	715,57	420,35	353,42	726,77	738,22
1581	615,53	79,10	131,50	4,47	724,70	422,99	354,49	725,60	745,21
1582	603,98	79,98	129,71	4,28	732,04	424,70	355,60	721,57	751,49
1583	590,47	79,42	128,33	4,08	739,40	427,29	356,69	710,62	755,76
1584	578,82	80,52	127,01	3,98	745,39	429,52	357,84	699,94	757,74
1585	569,60	80,44	125,14	3,89	750,85	431,97	358,83	688,95	757,64
1586	561,93	80,11	124,07	3,67	753,85	433,75	359,91	678,19	755,55
1587	554,25	79,50	123,68	3,57	755,62	436,81	360,88	664,61	754,25
1588	547,32	81,01	122,46	3,48	754,58	438,93	361,79	656,65	752,46
1589	541,94	79,60	121,19	3,38	753,49	440,28	362,65	649,44	748,66
1590	539,17	79,88	120,90	3,18	750,79	442,97	363,57	642,97	743,98
1591	535,64	80,37	119,24	3,07	745,20	444,96	363,89	638,30	736,78
1592	527,91	80,11	119,27	2,97	740,42	446,48	365,23	633,59	732,36
1593	518,67	80,58	119,00	2,87	735,55	449,60	366,04	626,97	727,34
1594	510,73	80,07	117,86	2,78	731,21	452,27	366,81	618,38	722,52
1595	503,41	81,28	115,99	2,68	726,75	454,85	367,46	609,90	718,15
1596	494,50	79,63	114,99	2,68	722,19	456,90	368,08	596,45	713,43
1597	486,76	81,02	114,25	2,48	717,52	459,03	368,88	585,10	709,87
1598	479,82	79,79	113,45	2,48	711,37	462,52	369,39	576,26	706,21
1599	472,89	79,76	112,81	2,39	706,12	464,64	370,05	565,90	701,68
1600	465,53	79,86	112,61	2,39	700,01	466,26	370,76	555,46	697,40
1601	459,85	80,67	111,69	2,27	693,63	468,07	371,44	546,32	693,05
1602	455,56	81,15	111,82	2,27	688,17	469,43	372,10	536,22	688,67

1603	450,77	80,28	111,20	2,17	683,39	470,51	372,49	528,64	685,05
1604	446,33	80,99	109,90	2,17	677,46	471,42	373,11	519,51	681,79
1605	442,09	80,31	110,06	2,07	673,85	471,84	373,70	512,77	679,03
1606	438,42	79,19	110,06	1,98	669,33	472,70	374,16	506,73	676,46
1607	434,90	80,24	109,10	1,88	665,17	473,57	374,46	501,09	674,18
1608	432,01	79,38	109,16	1,88	660,69	473,45	374,87	495,38	672,09
1609	429,20	80,85	108,18	1,78	657,04	473,68	375,24	488,23	669,75
1610	427,09	80,50	107,67	1,78	654,39	473,87	375,40	483,32	667,08
1611	424,16	79,56	107,80	1,71	651,76	474,53	375,82	478,27	665,85
1612	423,22	80,07	107,76	1,68	649,41	473,74	376,16	473,83	664,33
1613	421,21	80,17	107,77	1,59	647,81	474,45	376,41	469,90	663,60
1614	420,72	80,06	106,94	1,59	645,93	474,00	376,57	466,24	661,04
1615	418,87	80,81	107,01	1,47	644,20	473,97	376,84	462,36	659,31
1616	417,57	80,80	106,81	1,47	643,97	474,19	377,02	459,14	658,44
1617	416,94	79,94	106,84	1,37	642,59	473,83	377,13	456,64	657,85
1618	416,36	80,48	106,88	1,27	642,03	473,32	377,24	454,33	656,63
1619	416,88	81,13	106,53	1,27	641,53	473,08	377,38	450,69	655,03
1620	417,12	80,71	106,29	1,18	641,04	472,33	377,47	449,78	654,41
1621	418,21	79,80	106,64	1,08	641,16	472,16	377,54	447,71	653,70
1622	420,07	81,26	106,70	1,08	642,55	470,97	377,68	447,49	653,14
1623	421,80	80,76	106,72	1,08	643,27	471,32	377,70	446,92	652,88
1624	422,71	80,89	106,81	0,98	643,92	470,37	377,74	445,69	654,90
1625	421,94	79,85	106,95	0,88	649,09	469,98	377,82	445,08	665,89
1626	422,04	81,06	106,87	0,88	652,74	468,74	377,79	444,45	673,23
1627	423,35	79,65	106,61	0,79	655,34	467,22	378,01	445,13	679,73
1628	424,01	80,52	106,26	0,79	656,89	466,19	378,28	445,92	684,17
1629	422,96	81,29	106,40	0,67	653,98	464,26	378,66	447,97	687,37
1630	418,26	80,72	106,00	0,57	649,10	462,78	379,17	448,45	688,64
1631	409,83	81,04	105,68	0,57	643,21	461,38	379,74	444,65	684,78
1632	401,39	79,80	105,15	0,57	637,64	459,28	380,41	439,99	679,01
1633	394,37	80,25	104,49	0,48	630,79	457,85	381,16	434,14	672,58
1634	387,70	80,56	104,01	0,48	624,58	456,19	381,96	427,94	664,13
1635	382,22	79,26	103,75	0,48	618,49	453,59	382,91	421,30	656,45
1636	379,14	81,23	102,95	0,48	612,97	451,32	383,89	415,48	650,21
1637	374,66	80,25	102,61	0,38	607,81	449,58	384,86	408,27	644,31
1638	370,57	80,92	102,20	0,38	603,02	447,55	385,86	402,73	638,77
1639	366,94	79,75	101,54	0,38	598,83	445,56	386,94	396,58	634,37
1640	362,95	79,77	100,67	0,28	593,96	443,32	387,61	389,91	629,31
1641	359,72	80,60	100,81	0,28	590,00	440,22	389,02	385,64	625,55
1642	355,90	79,67	99,25	0,28	585,09	438,96	390,05	379,79	619,97
1643	352,73	79,58	99,08	0,18	580,78	436,65	391,03	374,65	615,34
1644	350,50	79,92	99,90	0,18	577,70	434,17	392,05	369,61	612,13
1645	347,36	79,38	99,17	0,18	573,88	432,38	393,15	365,96	609,24
1646	345,62	80,60	98,93	0,18	569,81	431,05	394,03	362,90	606,56
1647	343,48	80,09	99,20	0,18	567,48	428,63	395,04	358,28	603,69
1648	341,62	79,80	98,78	0,09	564,35	426,60	395,88	354,65	600,87
1649	340,40	79,49	98,33	0,08	561,66	424,57	396,78	352,03	598,48
1650	338,63	79,06	97,98	0,09	558,60	421,98	397,75	349,01	597,06
1651	336,67	79,58	98,42	0,08	556,01	419,67	398,62	345,83	594,24
1652	72,38	71,07	71,24	2,87	71,63	70,99	71,20	71,52	71,21
1653	127,61	70,97	82,25	2,77	78,66	70,93	71,20	74,35	73,55
1654	172,09	71,08	94,03	2,67	98,61	70,99	71,33	78,06	77,49
1655	268,17	71,03	123,48	2,47	160,57	71,06	71,40	88,97	81,72
1656	229,48	71,16	94,26	2,46	169,04	71,38	71,54	103,64	89,60
1657	221,85	71,20	89,70	2,34	171,76	71,99	71,72	116,47	96,82
1658	251,20	71,10	91,61	2,24	177,67	72,79	71,90	132,97	106,85
1659	295,74	71,29	96,22	2,07	188,84	73,90	72,11	158,82	120,15
1660	366,34	71,28	105,22	1,97	203,86	75,50	72,34	195,06	135,06
1661	426,75	71,36	114,39	1,77	226,80	77,59	72,57	233,40	151,63
1662	440,34	71,45	118,71	1,67	254,39	80,17	72,88	263,97	171,87
1663	443,14	71,57	120,94	1,47	280,62	83,17	73,17	288,84	189,92
1664	440,63	71,67	121,63	1,37	294,23	86,51	73,55	305,36	210,12
1665	439,31	71,49	122,13	1,27	302,20	90,12	73,95	318,70	229,88
1666	459,83	71,72	138,68	1,17	312,83	93,85	74,40	332,42	247,68
1667	409,43	71,95	180,24	12,28	312,85	97,55	74,89	320,66	260,26
1668	454,34	72,10	199,15	11,98	318,39	101,42	75,48	313,17	278,96
1669	366,22	72,01	139,59	11,88	310,06	105,90	76,22	303,34	284,56
1670	334,31	71,94	123,66	11,87	298,87	109,80	77,09	293,35	284,38
1671	349,00	71,99	119,37	11,78	289,18	113,30	78,07	289,04	284,81
1672	371,27	72,07	118,61	11,68	282,51	116,43	79,05	292,63	285,70
1673	403,78	72,14	121,00	11,58	280,59	119,40	80,15	302,98	287,56
1674	425,53	72,18	123,11	11,38	284,53	122,24	81,30	315,02	290,38
1675	423,09	72,11	123,20	11,28	289,09	124,87	82,55	322,68	292,39
1676	413,09	72,21	121,89	11,17	289,67	127,62	83,87	327,79	295,81
1677	410,01	72,34	121,41	11,08	289,11	130,37	85,32	334,28	294,68
1678	428,58	72,32	123,75	10,98	290,51	133,03	86,84	338,10	291,61
1679	443,21	72,24	125,86	10,78	295,96	135,63	88,54	344,52	288,59
1680	461,24	72,55	128,77	10,68	304,38	138,13	90,35	351,40	286,29
1681	491,53	72,67	133,94	10,47	314,44	140,61	92,17	369,09	288,25
1682	493,59	72,88	134,89	10,38	323,53	143,15	94,24	386,95	292,72
1683	488,54	72,64	135,09	10,18	329,86	145,79	96,37	399,31	297,85
1684	511,24	72,83	138,82	10,07	336,73	148,47	98,59	415,02	304,65
1685	527,52	73,24	141,55	9,87	344,30	151,10	100,93	432,31	314,81
1686	524,16	73,34	141,89	9,68	351,24	153,56	103,25	444,16	323,82
1687	534,40	73,39	143,74	9,48	356,86	155,85	105,71	455,66	334,82
1688	550,55	73,50	146,14	9,28	361,34	157,96	108,13	469,70	348,82
1689	577,30	73,47	150,54	9,17	366,04	160,03	110,63	484,57	365,53
1690	604,58	73,77	155,16	8,88	376,22	162,26	113,07	498,99	380,86
1691	588,48	73,61	154,18	8,78	392,91	164,43	115,60	508,39	393,64
1692	587,27	73,93	154,81	8,58	406,05	166,64	118,14	519,60	406,80
1693	601,00	74,25	156,47	8,37	415,71	168,78	120,68	529,69	423,98
1694	609,70	74,28	158,33	8,18	424,55	171,02	123,29	535,62	442,92
1695	618,92	74,34	159,93	7,98	433,16	173,27	125,86	542,88	460,12
1696	632,64	74,65	162,94	7,77	443,84	175,81	128,55	553,60	475,42
1697	643,32	74,92	164,92	7,48	456,96	178,37	131,05	560,99	490,18
1698	649,99	75,18	166,74	7,28	469,77	181,32	133,82	571,21	505,61
1699	648,16	75,40	166,70	7,07	480,56	184,68	136,55	576,68	521,73
1700	643,41	75,52	166,46	6,88	490,01	188,14	139,30	579,65	534,40
1701	642,56	75,44	165,78	6,68	502,05	192,28	142,15	579,94	548,41
1702	647,20	75,32	167,02	6,47	515,51	196,57	145,20	584,06	558,80
1703	639,73	75,61	166,11	6,27	527,31	201,04	148,29	585,22	569,79
1704	635,33	75,86	165,60	6,18	537,32	205,73	151,47	583,55	578,37
1705	636,33	75,77	165,53	5,98	545,59	210,29	154,53	583,32	587,77
1706	637,73	75,86	164,87	5,77	553,83	215,34	157,75	587,48	595,47
1707	639,12	76,57	165,37	5,57	569,87	220,36	161,17	585,82	602,82
1708	636,61	76,59	165,10	5,38	589,44	225,59	164,72	585,12	610,47
1709	629,68	76,05	163,77	5,18	603,21	230,53	168,21	582,26	619,08

1710	625,75	76,71	163,18	5,07	615,62	235,47	171,60	578,34	629,41
1711	623,85	76,90	162,60	4,87	623,92	240,56	175,19	577,32	639,93
1712	622,30	77,23	161,81	4,71	631,78	245,77	178,69	574,06	646,45
1713	626,84	77,33	162,09	4,47	639,67	250,91	182,11	572,81	652,24
1714	623,30	77,19	161,61	4,37	647,36	255,97	185,50	572,22	657,39
1715	629,59	77,18	162,14	4,17	654,33	261,23	188,87	571,97	661,97
1716	632,18	77,51	162,30	4,08	661,56	266,95	192,25	573,34	667,06
1717	627,43	77,28	161,39	3,88	668,03	272,79	195,70	573,21	672,77
1718	624,64	77,11	160,95	3,67	671,08	279,50	199,29	572,93	677,51
1719	622,25	77,47	160,06	3,57	671,80	286,47	202,83	572,58	683,15
1720	618,82	77,58	159,35	3,47	672,71	293,91	206,65	571,94	688,73
1721	611,75	78,21	158,36	3,28	674,76	301,56	210,59	572,60	692,99
1722	603,45	77,12	156,36	3,17	674,23	309,39	214,39	572,42	695,71
1723	596,45	77,12	154,67	3,07	674,28	317,55	218,80	570,85	698,13
1724	590,91	77,24	153,19	2,87	674,40	325,72	223,04	565,35	699,40
1725	585,10	77,69	151,89	2,77	675,72	333,35	227,47	562,57	699,78
1726	578,85	78,10	150,27	2,68	677,50	340,91	231,78	557,50	701,16
1727	566,57	77,10	148,05	2,58	678,38	348,30	236,49	548,47	705,21
1728	515,84	78,81	199,98	10,28	656,78	357,95	240,29	529,22	678,38
1729	517,74	79,37	161,41	10,18	627,44	362,01	245,70	515,42	653,22
1730	529,45	78,34	154,68	9,98	612,08	363,78	251,22	506,66	640,51
1731	538,65	78,40	151,95	9,88	600,36	364,25	256,40	497,78	630,08
1732	571,45	78,57	154,25	9,68	589,27	363,57	260,99	504,80	617,64
1733	602,55	78,46	157,97	9,48	576,25	361,66	265,22	513,37	611,81
1734	630,78	78,10	160,96	9,28	565,33	358,94	269,01	527,98	606,71
1735	648,89	78,01	165,03	9,08	557,74	356,26	272,86	540,24	605,41
1736	659,62	78,32	167,40	8,88	553,07	352,97	275,99	551,71	604,69
1737	658,54	78,50	168,25	8,66	550,10	349,95	279,00	561,91	606,40
1738	658,29	78,56	168,21	8,37	548,39	347,07	281,61	570,23	609,17
1739	655,91	78,63	168,44	8,28	548,48	344,59	284,27	576,11	611,81
1740	653,46	78,64	168,12	8,08	548,97	342,24	286,71	582,45	614,33
1741	653,44	78,68	168,59	7,78	549,80	340,10	289,00	586,38	619,18
1742	651,25	78,68	168,30	7,58	551,82	338,28	291,00	591,27	627,94
1743	650,22	79,09	167,56	7,38	554,83	336,48	292,81	592,60	635,04
1744	649,21	79,37	167,39	7,28	558,62	335,15	294,57	594,84	640,71
1745	646,18	79,42	166,49	7,00	561,65	333,94	296,19	595,77	647,33
1746	645,95	78,45	166,00	6,88	564,38	332,80	297,59	597,55	653,82
1747	644,92	79,65	165,92	6,68	569,57	331,96	299,05	597,52	659,44
1748	644,78	79,20	165,51	6,48	575,95	331,65	300,27	598,72	665,92
1749	642,18	79,31	165,39	6,27	582,50	331,44	301,60	598,65	669,87
1750	639,54	79,03	164,34	6,18	590,14	330,96	302,40	596,10	676,71
1751	637,66	79,22	164,16	5,98	598,77	330,96	303,69	595,26	681,15
1752	636,35	78,58	163,45	5,77	604,96	330,62	304,38	596,21	684,95
1753	635,76	79,24	162,98	5,67	611,60	330,50	305,42	593,69	688,27
1754	635,03	79,16	163,01	5,48	617,44	330,14	305,95	593,33	691,13
1755	635,68	79,86	162,59	5,28	623,70	330,57	306,93	593,51	695,79
1756	631,89	79,07	161,85	5,18	630,30	330,65	307,49	593,10	698,67
1757	624,25	79,67	160,82	4,97	638,38	331,18	308,26	588,74	703,28
1758	616,82	79,48	159,51	4,87	644,51	331,96	308,87	585,86	705,07
1759	611,84	79,16	157,93	4,69	649,00	332,15	309,47	578,90	707,93
1760	606,10	79,84	157,08	4,58	655,70	332,94	310,08	572,44	712,34
1761	597,24	79,99	155,46	4,47	662,09	333,81	310,66	564,11	715,38
1762	585,74	79,79	153,32	4,37	664,94	334,42	310,96	556,23	715,54
1763	577,65	80,17	151,59	4,17	667,40	335,70	311,61	548,37	715,02
1764	571,68	79,92	150,28	4,08	667,55	336,91	311,96	542,19	713,24
1765	568,27	80,02	149,86	3,98	666,11	338,27	312,50	537,85	714,80
1766	567,23	79,67	149,30	3,78	664,97	339,93	313,24	533,65	713,48
1767	567,23	79,94	149,09	3,77	664,67	341,81	313,54	529,19	712,39
1768	565,82	80,55	148,27	3,57	663,39	343,73	314,16	524,32	711,88
1769	564,29	80,83	147,71	3,47	663,56	345,58	314,68	521,35	711,19
1770	562,18	80,42	147,17	3,38	662,54	347,51	315,20	518,39	710,09
1771	558,28	80,12	146,89	3,28	661,38	349,88	315,64	515,10	708,07
1772	553,85	79,50	146,09	3,17	662,22	351,94	316,14	512,42	705,07
1773	545,30	80,07	144,36	3,07	661,83	354,56	316,49	508,27	703,92
1774	535,68	80,53	142,70	3,07	662,21	356,93	317,06	503,66	701,15
1775	526,15	79,66	141,15	2,97	660,27	359,20	317,68	500,54	694,41
1776	516,74	79,02	139,72	2,87	658,21	361,19	318,15	494,52	687,61
1777	508,55	79,46	138,05	2,87	656,61	363,48	318,80	488,65	681,96
1778	501,42	80,09	136,59	2,77	654,98	365,37	319,46	480,57	676,27
1779	494,53	80,49	135,51	2,68	652,66	367,44	320,00	474,40	671,33
1780	488,57	79,93	134,43	2,61	649,15	369,02	320,78	467,56	664,46
1781	483,43	80,21	133,45	2,58	644,58	370,32	321,43	461,44	659,12
1782	478,47	80,01	132,60	2,47	639,60	371,74	322,14	454,80	652,88
1783	473,33	80,57	131,95	2,47	637,55	372,90	322,62	448,87	650,24
1784	469,51	80,30	131,32	2,37	633,89	373,84	323,19	442,65	645,43
1785	464,69	80,58	130,60	2,37	629,97	374,46	323,79	436,98	639,14
1786	461,65	80,08	129,76	2,27	626,38	375,38	324,42	431,88	634,61
1787	458,43	79,66	129,50	2,26	623,48	375,52	324,70	427,52	628,61
1788	454,52	79,45	128,46	2,24	618,94	376,16	325,45	423,63	627,82
1789	451,73	79,82	127,84	2,17	616,70	376,95	326,16	419,16	623,33
1790	449,71	79,85	127,52	2,07	614,30	377,57	326,76	414,77	621,41
1791	447,94	79,63	127,51	2,07	611,17	377,77	327,41	411,28	618,30
1792	446,31	79,53	127,07	1,98	608,64	377,97	328,05	408,60	616,56
1793	444,31	80,10	126,86	1,93	606,82	378,44	328,88	405,56	614,34
1794	442,76	79,55	126,53	1,87	604,59	378,24	329,37	400,97	611,24
1795	441,02	79,59	126,29	1,87	602,54	378,68	330,06	397,66	607,88
1796	440,17	79,72	126,32	1,77	600,41	378,72	330,76	394,99	607,60
1797	439,79	79,95	125,75	1,77	598,92	378,93	331,36	392,05	606,41
1798	438,78	79,99	125,52	1,67	597,35	378,60	332,07	389,62	604,82
1799	438,60	80,17	125,65	1,67	596,50	378,34	332,70	387,47	603,87
1800	437,99	80,09	125,50	1,57	595,88	378,17	333,47	384,94	602,17
1801	437,35	80,34	125,20	1,57	594,21	378,13	334,02	383,90	602,03
1802	437,08	80,06	125,38	1,47	592,66	377,59	334,77	381,35	600,94
1803	436,94	80,59	125,52	1,47	591,59	377,22	335,46	380,56	600,21
1804	437,70	79,94	125,54	1,37	590,07	376,88	335,98	381,13	599,27
1805	437,35	80,67	125,62	1,37	589,72	376,38	336,61	377,91	599,30
1806	438,08	80,73	125,75	1,28	590,17	375,73	337,16	376,35	600,30
1807	437,86	80,47	125,69	1,17	589,48	375,18	337,71	375,88	599,73
1808	438,77	80,53	125,93	1,17	588,66	374,38	338,20	375,31	600,35
1809	439,72	80,26	125,74	1,17	588,80	374,06	338,59	374,49	600,31
1810	440,25	80,71	125,89	1,07	589,45	373,45	338,84	374,21	601,10
1811	440,05	80,70	125,97	0,97	589,34	372,85	338,99	373,63	606,62
1812	439,36	80,86	125,91	0,97	590,22	372,23	339,24	372,58	618,88
1813	439,36	80,88	125,99	0,97	590,06	371,39	339,58	371,85	606,74
1814	439,14	80,66	125,85	0,87	588,58	370,76	339,88	371,90	599,45
1815	437,95	80,95	125,79	0,87	586,09	370,08	339,95	371,67	593,15
1816	435,58	80,88	125,47	0,77	584,87	369,51	340,09	370,75	587,88

1817	427,19	80,48	124,48	0,77	592,07	368,63	340,13	371,60	584,01
1818	421,84	80,76	123,79	0,76	596,21	367,91	340,04	371,50	580,34
1819	417,71	80,64	123,50	0,67	599,09	367,27	339,97	370,02	578,20
1820	413,76	80,41	122,86	0,67	600,19	366,30	339,92	367,29	575,18
1821	409,00	80,65	122,20	0,57	600,30	365,35	339,88	364,66	572,62
1822	405,53	80,59	121,77	0,57	598,30	364,24	339,85	363,30	571,23
1823	401,62	80,71	121,24	0,57	597,23	363,21	339,84	359,03	566,88
1824	396,13	80,08	120,23	0,47	593,71	362,14	339,73	355,36	563,66
1825	390,43	80,83	119,45	0,47	590,51	360,92	339,88	352,48	559,73
1826	383,67	80,61	118,75	0,38	585,31	359,61	340,10	346,47	556,22
1827	378,03	81,08	118,09	0,47	579,51	358,20	340,39	343,32	553,87
1828	373,48	80,97	117,34	0,37	574,24	356,79	340,75	339,09	549,06
1829	369,18	80,96	117,00	0,37	569,74	355,02	341,13	335,02	544,95
1830	366,35	80,47	116,11	0,37	564,63	353,30	341,58	331,56	542,18
1831	363,95	80,77	115,70	0,37	561,15	351,82	342,00	328,03	537,94
1832	360,32	80,80	115,21	0,27	556,03	350,04	342,56	324,81	534,89
1833	357,71	80,63	114,86	0,27	551,17	348,34	343,11	322,41	532,12
1834	355,83	80,84	114,64	0,27	547,41	346,56	343,69	317,92	528,55
1835	353,56	80,23	114,14	0,27	542,89	344,79	344,28	315,00	525,41
1836	351,29	80,64	113,66	0,19	540,14	343,20	344,86	311,92	521,06
1837	349,50	80,77	113,56	0,17	536,99	341,52	345,50	309,71	517,31
1838	347,66	80,67	113,12	0,17	534,43	339,71	346,09	307,75	514,44
1839	346,25	80,66	112,94	0,17	532,27	338,02	346,67	305,21	511,42
1840	345,12	80,75	112,98	0,11	530,14	336,27	347,34	302,65	509,47
1841	344,11	80,78	112,76	0,07	527,59	334,34	348,02	301,11	506,43
1842	343,18	80,61	112,70	0,07	526,44	332,65	348,67	299,46	503,65
1843	341,86	80,46	112,27	0,07	524,36	331,05	349,13	297,83	501,42
1844	340,84	79,89	112,04	0,07	521,08	329,59	349,47	296,21	498,89
1845	339,25	80,63	111,92	0,04	520,26	327,90	350,25	294,30	497,09
1846	339,08	80,14	111,86	0,04	517,17	326,52	350,92	293,74	496,69
1847	338,23	80,69	111,89	0,04	516,92	324,91	351,59	292,28	494,09
1848	337,95	80,81	111,71	0,04	515,61	323,47	352,24	290,84	491,39
1849	340,65	80,37	112,73	0,04	514,05	322,01	352,65	289,45	489,39
1850	389,15	80,58	172,74	0,04	511,71	323,23	350,54	294,23	485,02
1851	71,30	68,82	71,11	2,98	69,52	69,16	69,25	70,25	69,33
1852	242,80	68,92	93,43	2,69	105,69	69,36	69,25	81,69	75,25
1853	339,64	69,25	98,30	2,49	178,75	69,82	69,28	118,24	90,96
1854	333,18	69,28	95,27	2,39	200,30	70,13	69,38	154,97	104,10
1855	369,13	69,39	98,72	2,18	234,13	70,70	69,54	199,28	118,59
1856	401,48	69,61	102,14	1,99	279,06	71,63	69,69	236,29	133,42
1857	425,06	69,72	105,77	1,79	322,61	72,97	69,91	270,19	152,00
1858	433,17	69,85	106,22	1,69	352,95	74,70	70,18	300,05	173,81
1859	427,93	70,10	105,30	1,48	381,25	76,78	70,50	320,26	199,09
1860	426,58	70,33	104,62	1,38	404,66	79,36	70,91	336,18	223,84
1861	421,26	70,39	103,51	1,29	421,01	82,55	71,40	345,93	249,50
1862	469,94	70,52	140,72	30,49	443,04	88,27	71,75	360,15	274,27
1863	461,95	70,81	146,48	12,26	434,92	95,80	72,67	360,73	297,87
1864	556,81	70,89	165,40	11,77	446,69	103,07	73,72	376,49	326,68
1865	440,07	70,97	123,41	11,68	435,80	108,15	74,83	373,77	339,96
1866	379,87	70,92	108,79	11,56	416,11	113,19	76,14	362,23	332,93
1867	361,66	70,82	102,62	11,56	398,81	117,94	77,60	351,64	325,43
1868	391,29	71,01	102,46	11,36	392,87	122,25	79,18	350,56	323,50
1869	422,16	70,82	103,75	11,27	392,03	125,07	80,75	364,32	321,94
1870	447,47	70,70	105,07	11,17	389,75	128,28	82,42	393,36	322,15
1871	457,23	70,69	105,69	10,97	389,70	130,74	84,08	415,09	325,69
1872	472,75	70,99	107,91	10,76	392,19	134,09	85,80	433,31	332,61
1873	483,79	70,89	109,31	10,56	397,03	137,49	87,56	448,76	341,81
1874	478,40	71,04	109,71	10,46	402,40	140,96	89,39	457,36	348,76
1875	474,40	71,01	108,76	10,27	407,24	144,46	91,20	467,20	352,54
1876	471,23	70,63	108,68	10,13	412,21	148,27	93,07	473,34	355,51
1877	476,43	70,75	109,11	9,96	428,14	152,08	94,99	478,96	358,33
1878	482,34	70,68	109,21	9,76	441,22	155,23	96,86	482,42	361,27
1879	490,12	70,61	109,81	9,67	451,17	158,20	98,77	485,52	366,07
1880	492,03	70,89	110,45	9,47	459,74	160,79	100,65	486,53	372,39
1881	504,07	70,95	110,93	9,26	467,33	163,32	102,52	490,04	380,46
1882	510,89	70,86	111,95	9,06	474,50	165,72	104,24	496,98	389,61
1883	522,45	71,00	113,09	8,97	482,20	169,52	106,16	506,19	400,93
1884	535,76	70,82	114,64	8,77	488,86	172,32	108,09	515,77	414,70
1885	544,74	70,76	115,44	8,46	496,27	174,64	109,99	526,91	429,07
1886	551,65	70,41	116,31	8,28	503,76	178,14	112,01	538,66	445,59
1887	549,25	71,04	116,50	8,17	512,56	181,82	114,05	549,59	458,51
1888	551,69	70,61	116,33	7,88	521,36	185,55	116,10	557,15	468,62
1889	550,71	71,33	117,32	7,78	528,66	189,37	118,13	564,09	479,27
1890	553,77	66,76	116,20	7,56	531,57	191,69	119,71	571,51	486,86
1891	559,21	69,12	116,90	7,37	541,79	196,37	121,78	578,36	495,64
1892	568,15	69,58	117,96	7,17	549,12	199,96	123,84	583,50	506,05
1893	577,61	70,28	120,53	6,96	559,42	204,64	126,20	593,09	516,78
1894	579,38	70,80	122,24	6,77	571,56	208,77	128,48	601,06	527,02
1895	577,68	71,37	123,50	6,57	583,47	213,26	130,92	607,63	537,09
1896	578,88	71,91	124,95	6,38	595,45	217,92	133,62	613,59	546,74
1897	579,13	72,46	125,42	6,16	607,03	222,69	136,41	619,92	556,77
1898	579,33	72,41	126,07	5,97	621,27	227,49	139,29	624,95	565,64
1899	578,35	72,36	127,02	5,78	633,17	232,40	142,15	633,24	577,10
1900	578,33	73,09	127,70	5,58	643,38	237,15	145,10	638,35	589,89
1901	582,08	73,63	127,48	5,48	652,13	242,47	148,20	641,44	600,94
1902	586,04	73,89	126,68	5,27	658,81	247,86	151,37	644,67	609,73
1903	587,24	73,99	126,99	5,08	665,90	252,77	154,33	649,64	616,42
1904	590,12	74,14	126,39	4,88	671,33	258,47	157,74	652,50	624,16
1905	590,82	73,98	126,03	4,69	678,78	264,06	161,10	657,70	631,03
1906	593,74	75,08	126,04	4,47	683,81	269,53	164,53	658,58	638,01
1907	596,87	74,37	124,27	4,38	687,91	274,70	167,87	661,03	642,20
1908	600,65	74,45	125,11	4,18	692,10	280,48	171,34	662,41	649,23
1909	602,12	73,99	124,83	3,99	695,35	286,13	175,13	666,77	653,96
1910	603,68	73,21	125,38	3,77	694,99	291,66	178,78	670,22	661,33
1911	601,65	74,72	125,08	3,67	697,01	297,33	183,13	675,66	666,95
1912	598,29	74,68	124,29	3,48	697,70	302,89	187,22	678,59	672,19
1913	590,81	74,57	123,44	3,38	698,46	308,20	191,78	680,10	676,76
1914	581,24	74,36	122,01	3,19	699,12	313,57	196,51	678,33	681,15
1915	576,67	75,22	121,66	3,07	698,57	319,29	201,33	677,96	684,59
1916	570,52	74,71	120,18	2,97	699,39	324,79	206,47	677,61	684,65
1917	563,53	74,50	119,08	2,88	698,95	330,90	211,49	673,83	687,28
1918	555,06	75,17	118,19	2,78	697,32	336,82	216,63	666,81	687,55
1919	545,94	75,06	116,59	2,68	695,46	342,29	221,90	657,63	686,87
1920	535,13	75,01	115,82	2,58	691,22	347,93	227,18	649,04	683,95
1921	500,49	74,84	150,04	10,85	663,73	354,15	231,66	624,00	661,84
1922	523,84	74,93	155,19	10,67	641,61	359,81	238,25	594,18	622,67
1923	500,13	74,89	127,36	10,56	614,30	363,63	244,51	578,01	595,79

1924	485,39	74,89	118,49	10,46	591,03	366,53	250,18	561,26	574,01
1925	484,52	74,76	115,72	10,35	576,73	368,07	255,55	552,58	561,45
1926	485,48	75,12	113,39	10,17	570,34	368,23	260,35	543,32	549,10
1927	483,81	74,97	112,31	10,05	566,62	368,82	264,69	535,61	541,70
1928	475,57	75,10	110,91	9,86	561,69	367,47	268,67	528,06	536,23
1929	472,43	75,55	109,81	9,76	555,30	366,94	272,03	521,18	527,95
1930	481,46	74,63	111,25	9,56	550,01	365,36	275,14	519,93	528,37
1931	487,40	75,64	111,18	9,47	552,04	363,57	277,76	519,09	532,87
1932	487,27	75,42	111,73	9,25	552,12	361,77	280,30	518,10	536,94
1933	488,29	75,27	110,88	9,16	553,47	359,84	282,33	518,46	538,01
1934	495,18	75,11	111,72	8,96	559,79	357,93	284,08	519,55	539,50
1935	497,24	75,21	111,23	8,87	567,67	355,80	285,83	526,36	537,06
1936	498,84	75,49	111,69	8,67	573,85	354,35	287,36	530,29	532,43
1937	506,18	75,20	112,45	8,46	580,44	352,04	288,44	536,13	531,11
1938	509,13	75,31	112,75	8,36	588,53	350,46	289,46	539,60	530,40
1939	518,21	75,50	113,57	8,16	596,31	347,94	290,30	542,56	538,05
1940	526,85	75,20	114,63	7,97	604,94	346,19	291,03	549,46	550,13
1941	532,03	74,84	114,86	7,78	613,76	343,91	291,70	553,46	561,63
1942	536,02	74,99	115,09	7,66	622,81	342,65	292,26	562,48	572,46
1943	542,55	75,39	115,41	7,46	632,39	342,36	292,80	570,04	583,72
1944	545,59	75,69	115,77	7,27	640,21	341,26	293,19	577,08	593,33
1945	550,26	75,65	116,45	7,07	646,77	340,11	293,64	582,79	602,76
1946	553,94	75,64	117,58	6,86	655,54	339,89	294,04	589,98	614,00
1947	557,23	75,33	117,50	6,66	666,30	339,88	294,61	596,23	623,63
1948	560,98	75,96	117,72	6,47	678,71	339,48	294,92	602,01	634,17
1949	563,78	75,32	118,54	6,28	689,26	339,11	295,19	606,90	643,13
1950	563,64	75,93	118,31	6,06	699,64	339,70	295,55	609,76	651,65
1951	564,77	77,00	118,49	5,97	709,05	340,19	295,86	613,72	659,07
1952	564,32	75,90	118,41	5,77	716,63	340,67	296,32	615,16	666,31
1953	564,52	76,09	118,28	5,58	725,20	341,92	296,76	619,47	673,65
1954	563,81	76,20	117,71	5,36	731,89	343,03	297,25	621,94	680,09
1955	562,06	76,50	117,76	5,17	736,91	344,31	297,65	624,43	686,12
1956	561,44	76,12	117,71	5,07	743,13	346,13	298,00	627,24	691,71
1957	560,06	76,13	117,53	4,88	748,73	347,35	298,43	627,34	699,50
1958	558,87	75,92	117,03	4,78	752,27	349,54	298,83	628,56	704,88
1959	554,61	76,78	116,86	4,56	755,04	351,56	299,45	624,66	709,06
1960	549,90	76,25	116,35	4,47	754,75	353,87	299,93	621,49	709,54
1961	544,01	76,35	115,40	4,37	753,45	356,21	300,28	615,03	706,88
1962	535,38	76,20	114,60	4,18	749,15	358,37	300,79	608,07	704,60
1963	526,79	76,47	113,78	4,08	743,50	360,24	301,20	599,39	698,20
1964	520,38	76,42	112,94	3,98	740,05	361,98	301,83	590,83	693,78
1965	511,98	76,61	111,82	3,88	734,02	363,67	302,39	581,10	688,10
1966	506,19	76,15	111,22	3,77	728,05	364,82	302,95	572,21	683,07
1967	500,14	76,33	110,97	3,67	722,04	366,31	303,44	562,09	679,31
1968	496,61	76,23	110,49	3,57	718,73	367,61	304,06	554,33	675,53
1969	492,86	76,79	110,01	3,57	713,80	368,31	304,64	546,51	672,33
1970	491,07	76,96	109,89	3,38	710,19	368,87	305,08	537,83	669,06
1971	489,30	77,07	109,50	3,38	706,39	370,03	305,65	530,31	666,07
1972	485,64	76,54	109,06	3,28	700,16	371,06	306,19	523,71	664,71
1973	482,16	76,34	108,67	3,18	694,84	371,73	306,53	516,01	664,03
1974	476,46	76,30	107,80	3,07	690,68	373,66	307,06	509,32	662,70
1975	466,70	76,80	107,08	2,97	684,93	375,09	307,61	501,98	659,93
1976	458,25	76,38	106,57	2,97	677,35	376,41	307,84	495,24	658,05
1977	451,37	76,75	105,92	2,87	670,73	378,81	308,43	486,19	656,41
1978	445,46	77,19	105,11	2,77	664,82	381,02	308,94	478,76	654,04
1979	440,11	76,45	104,55	2,77	658,54	383,49	309,33	472,46	653,06
1980	433,79	76,14	104,07	2,68	651,95	384,85	309,73	464,83	652,29
1981	428,62	76,56	103,42	2,58	645,42	387,96	310,31	460,41	649,44
1982	423,91	76,79	102,94	2,58	640,03	390,26	310,72	454,99	646,58
1983	418,84	76,89	102,18	2,48	634,64	392,49	311,16	450,16	642,07
1984	414,19	76,39	101,67	2,38	629,35	393,83	311,66	443,84	637,32
1985	409,01	76,85	101,23	2,38	623,26	395,97	312,19	438,02	630,59
1986	404,70	76,87	100,84	2,38	619,86	397,39	312,52	431,46	623,27
1987	400,09	75,85	100,31	2,27	615,40	398,38	313,05	425,48	616,39
1988	395,19	76,10	99,78	2,27	609,25	399,18	313,45	419,51	608,75
1989	391,38	76,56	99,33	2,17	603,97	399,79	313,89	414,51	602,11
1990	387,26	76,81	98,90	2,17	599,53	400,11	314,02	409,57	595,39
1991	384,19	75,62	98,71	2,07	595,85	400,43	314,37	405,47	590,50
1992	382,60	76,19	98,30	1,97	593,57	401,35	314,70	400,95	585,10
1993	381,08	76,01	98,21	1,97	591,37	400,39	314,98	396,58	580,80
1994	379,12	75,71	97,93	1,88	590,83	400,69	315,28	392,95	575,85
1995	377,50	75,86	97,57	1,88	590,91	401,31	315,55	390,20	572,34
1996	376,65	75,62	97,35	1,88	589,49	401,30	315,67	388,16	568,70
1997	375,64	75,24	97,10	1,78	587,48	401,21	315,97	385,25	564,24
1998	375,07	75,20	97,27	1,68	586,75	401,39	316,10	382,90	560,94
1999	375,37	75,27	97,00	1,68	589,10	401,80	316,18	381,32	558,89
2000	374,96	75,70	97,33	1,58	588,43	401,47	316,30	380,85	556,67
2001	374,24	75,59	97,01	1,47	589,30	402,08	316,27	379,25	554,31
2002	374,70	75,61	96,75	1,47	588,82	402,60	316,10	377,48	552,84
2003	374,72	75,28	96,55	1,47	587,02	403,07	316,07	375,77	550,72
2004	373,69	75,12	96,34	1,37	585,34	404,25	315,73	374,51	547,78
2005	374,26	75,50	96,49	1,27	582,34	404,29	315,29	373,22	546,00
2006	374,49	75,00	96,70	1,27	581,08	405,53	314,97	371,84	544,44
2007	376,11	75,39	96,62	1,27	579,13	406,92	314,61	372,14	543,37
2008	378,12	75,46	97,25	1,17	576,72	407,30	314,33	372,19	543,88
2009	379,79	75,23	96,68	1,08	576,50	408,93	314,05	371,69	542,85
2010	380,98	75,80	96,52	1,08	575,70	409,51	313,64	371,27	543,33
2011	382,62	75,82	96,49	0,98	575,55	411,32	313,07	372,81	543,11
2012	383,29	75,80	96,46	0,98	574,99	412,30	312,50	372,16	544,95
2013	382,89	75,22	96,75	0,88	574,84	413,95	311,99	372,38	546,52
2014	381,39	75,43	96,84	0,79	572,09	415,20	311,54	372,47	547,70
2015	380,45	75,87	96,70	0,79	569,08	417,23	311,25	373,40	549,65
2016	378,48	74,94	96,37	0,67	565,72	418,23	310,76	371,44	551,51
2017	376,03	75,59	96,10	0,67	564,48	419,84	310,22	370,91	552,21
2018	373,70	75,15	96,25	0,67	561,80	420,93	309,60	369,18	552,72
2019	371,23	75,61	96,10	0,57	560,52	422,52	309,07	368,21	552,88
2020	370,23	75,53	95,70	0,47	556,15	423,36	308,54	365,37	554,26
2021	367,95	75,04	95,57	0,47	555,12	424,39	308,11	364,50	554,50
2022	366,32	74,84	95,07	0,47	552,44	425,59	307,64	364,62	555,49
2023	362,43	74,97	94,61	0,38	548,90	426,93	307,07	361,84	557,04
2024	357,94	75,08	94,22	0,38	546,56	428,18	306,73	359,44	556,13
2025	350,92	74,63	93,84	0,38	541,52	429,00	306,37	354,71	553,23
2026	344,58	74,96	93,11	0,38	538,75	430,29	305,75	350,85	547,74
2027	339,13	74,93	93,05	0,28	532,82	430,43	305,16	345,46	542,62
2028	334,78	75,26	92,53	0,28	527,80	431,13	304,71	341,20	538,32
2029	330,78	74,90	92,14	0,28	522,55	431,54	304,31	336,71	534,03
2030	326,59	74,76	91,77	0,18	517,24	431,56	304,01	332,54	529,63

2031	322,53	74,69	91,45	0,18	512,06	430,56	303,59	328,86	524,07
2032	318,81	75,06	91,02	0,18	507,56	430,79	303,28	324,29	518,63
2033	315,53	74,78	90,73	0,18	502,79	430,12	302,89	320,53	514,24
2034	312,28	74,60	90,48	0,18	498,89	430,10	302,30	316,41	510,81
2035	309,67	74,69	90,20	0,08	493,91	429,05	302,05	312,69	506,88
2036	307,00	74,93	89,97	0,08	489,99	428,95	301,66	309,33	502,60
2037	304,47	74,73	89,66	0,08	485,21	427,77	301,20	305,48	499,24
2038	301,72	74,60	89,35	0,00	482,06	426,82	300,78	301,78	495,54
2039	71,07	70,76	75,76	2,87	69,56	68,73	68,63	70,59	69,83
2040	80,23	70,64	76,40	2,87	70,24	68,76	68,64	72,54	70,01
2041	279,38	70,50	102,63	2,67	113,87	69,05	68,65	93,84	76,48
2042	308,56	70,58	94,31	2,48	165,79	69,31	68,73	121,04	88,70
2043	321,02	70,75	93,10	2,38	202,34	69,53	68,82	145,57	102,60
2044	330,57	70,87	93,39	2,17	240,32	70,02	68,94	168,31	115,55
2045	344,10	70,88	94,47	2,07	273,08	70,74	69,12	192,43	127,37
2046	361,64	70,95	96,07	1,88	300,84	71,78	69,31	220,47	140,14
2047	386,00	70,87	98,33	1,78	328,76	73,15	69,56	251,76	153,71
2048	392,36	71,20	99,44	1,58	357,78	74,83	69,83	278,61	167,60
2049	391,63	71,32	99,64	1,47	381,73	76,70	70,22	298,50	182,91
2050	384,85	71,46	99,30	1,37	394,95	78,87	70,63	311,19	198,52
2051	374,98	71,66	98,54	1,27	402,20	81,40	71,11	317,04	212,89
2052	380,36	71,52	107,14	1,88	411,52	84,32	71,64	324,41	225,95
2053	395,80	71,67	130,01	12,66	427,52	87,87	72,43	323,52	225,69
2054	450,78	71,79	144,24	12,46	458,88	92,00	73,48	320,32	230,35
2055	443,26	72,18	129,61	12,25	478,50	95,72	74,38	321,63	236,67
2056	364,23	72,26	109,46	12,15	463,34	99,00	75,57	314,46	235,50
2057	334,88	72,29	102,60	12,05	446,72	102,29	76,98	308,21	231,83
2058	332,35	71,97	99,89	11,96	434,66	105,32	78,47	306,71	226,83
2059	341,80	72,16	98,95	11,86	426,47	108,13	80,02	309,01	222,89
2060	353,74	72,16	99,01	11,76	420,99	110,91	81,74	316,40	220,21
2061	360,83	72,20	99,07	11,55	415,41	113,22	83,47	320,92	220,15
2062	370,52	72,51	100,11	11,45	410,40	115,93	85,25	327,21	220,39
2063	384,40	72,30	100,70	11,35	404,70	118,21	87,05	335,21	222,21
2064	395,00	72,74	102,22	11,25	401,58	120,35	88,85	347,60	225,37
2065	397,38	72,71	102,36	11,16	400,73	122,61	90,77	360,30	227,88
2066	379,85	72,19	101,00	10,96	399,87	124,69	92,67	358,28	229,20
2067	373,34	72,94	101,11	10,84	404,89	126,66	94,61	355,06	230,98
2068	379,90	72,88	101,18	10,75	410,88	128,61	96,56	352,23	233,08
2069	392,83	72,93	102,46	10,65	421,06	130,89	98,53	352,20	237,46
2070	390,45	73,42	102,38	10,46	430,32	133,02	100,49	349,12	243,17
2071	396,48	73,09	102,60	10,36	437,39	134,68	102,25	347,07	251,67
2072	390,51	73,36	102,69	10,26	442,51	137,09	104,14	346,91	262,07
2073	385,41	72,91	101,97	10,17	445,46	139,24	105,96	345,45	272,07
2074	414,58	73,24	120,17	9,95	449,07	141,57	107,73	345,73	278,03
2075	457,28	73,55	115,53	9,76	460,07	143,93	109,52	364,28	293,00
2076	437,89	73,59	110,78	9,56	459,46	146,75	111,40	373,11	305,15
2077	454,43	72,83	110,38	9,47	459,77	148,59	113,13	382,47	318,56
2078	484,00	72,78	112,65	9,25	463,25	151,26	114,99	402,65	330,92
2079	498,68	73,03	114,20	9,06	469,36	153,99	116,84	424,83	341,58
2080	503,52	73,81	114,43	8,96	475,75	156,81	118,78	443,27	352,23
2081	506,97	74,03	114,97	8,76	482,14	159,08	120,67	458,64	363,10
2082	510,42	74,44	116,08	8,57	488,81	162,50	122,54	471,74	374,67
2083	513,96	74,20	116,06	8,36	494,18	165,14	124,33	483,54	389,16
2084	516,02	74,28	116,73	8,16	500,41	168,56	126,11	493,16	403,28
2085	521,21	74,23	117,18	8,06	507,37	171,70	128,02	508,67	417,11
2086	527,96	74,43	117,88	7,87	515,37	174,81	129,88	526,56	429,57
2087	534,54	74,98	118,85	7,65	524,69	177,98	131,86	540,93	441,21
2088	543,29	74,55	119,80	7,46	533,04	181,20	133,77	554,68	451,99
2089	542,41	74,82	119,59	7,27	543,91	184,83	135,67	564,88	466,83
2090	547,13	75,05	120,01	7,07	551,91	188,57	137,70	573,38	480,56
2091	552,30	75,14	121,13	6,86	564,86	192,22	139,79	582,60	493,08
2092	554,31	75,46	121,85	6,66	576,31	196,35	141,91	591,70	505,10
2093	554,78	75,10	122,08	6,47	586,42	201,03	144,14	598,70	519,05
2094	556,61	75,33	121,35	6,27	595,37	206,07	146,25	605,12	532,33
2095	553,78	75,18	121,20	6,16	605,17	211,22	148,58	606,55	544,76
2096	550,83	75,24	120,51	5,96	616,67	216,60	150,92	608,78	555,05
2097	550,18	75,54	120,86	5,77	625,83	222,37	153,33	609,70	564,13
2098	551,43	75,54	120,38	5,61	632,14	227,96	155,67	611,73	570,97
2099	554,25	75,73	119,77	5,48	636,98	233,50	158,11	614,31	575,57
2100	557,59	75,97	120,92	5,26	641,83	239,38	160,64	617,36	580,43
2101	560,07	76,18	121,03	5,07	644,77	245,02	163,22	619,55	584,10
2102	559,75	75,48	121,37	4,97	646,99	250,60	165,80	622,57	588,58
2103	557,89	75,23	121,20	4,78	648,05	256,32	168,37	625,53	594,94
2104	555,78	75,29	120,91	4,68	648,71	262,36	171,03	627,53	601,58
2105	554,60	75,22	121,13	4,47	648,21	267,90	173,85	629,93	607,68
2106	551,90	75,45	120,22	4,37	647,73	273,36	176,71	630,42	611,65
2107	551,24	76,56	120,60	4,18	645,11	279,04	179,64	632,31	617,22
2108	549,17	75,59	119,46	4,08	643,10	283,83	182,50	631,47	620,31
2109	548,62	76,05	120,05	3,98	642,17	288,51	185,41	631,71	624,31
2110	550,55	76,20	119,74	3,77	641,05	294,87	188,50	631,35	627,43
2111	551,34	75,85	119,58	3,67	642,47	299,87	191,82	631,67	631,12
2112	549,92	76,34	119,51	3,48	645,19	305,53	195,33	634,13	634,80
2113	548,35	76,61	119,38	3,38	647,28	310,19	199,01	634,94	638,49
2114	546,11	76,63	118,22	3,28	647,22	316,00	202,80	637,15	642,90
2115	542,01	76,10	117,81	3,18	649,87	321,11	206,82	639,13	646,50
2116	536,15	76,27	117,96	3,07	650,80	326,54	210,90	638,25	648,58
2117	530,54	77,02	118,14	2,97	650,80	332,56	215,27	638,73	650,96
2118	526,79	75,26	117,38	2,77	650,46	338,11	219,69	638,08	652,19
2119	522,83	76,96	116,26	2,69	650,77	343,98	224,10	636,42	652,65
2120	519,82	76,03	116,79	2,68	650,93	350,25	228,54	633,62	654,07
2121	515,48	76,59	115,94	2,58	650,02	356,37	232,99	632,48	652,79
2122	494,44	77,34	150,49	10,85	634,68	362,77	236,00	617,19	642,08
2123	572,57	77,36	149,13	10,56	618,57	368,01	241,20	593,08	610,31
2124	615,79	76,40	152,79	10,36	619,29	371,82	247,08	583,49	584,51
2125	578,30	75,98	137,03	10,17	624,13	372,74	252,92	583,80	572,01
2126	547,68	75,90	128,09	9,95	619,49	373,32	258,68	584,66	569,10
2127	536,92	75,64	124,73	9,83	612,27	372,20	264,05	582,40	565,53
2128	534,70	75,40	123,27	9,66	608,79	370,92	269,04	580,65	563,60
2129	531,81	75,94	121,05	9,47	605,94	370,35	273,68	579,20	563,56
2130	529,05	76,12	120,34	9,26	605,97	367,66	277,79	577,75	562,92
2131	531,53	75,49	120,22	9,06	608,85	365,60	281,44	578,63	567,06
2132	534,31	76,73	120,68	8,96	609,20	364,39	285,00	579,08	571,55
2133	550,39	76,64	121,61	8,77	612,43	361,75	288,17	586,08	577,77
2134	550,21	77,09	121,78	8,57	614,95	358,90	290,89	591,19	586,07
2135	550,52	77,76	121,16	8,36	621,32	357,13	293,41	592,57	591,79
2136	550,36	77,64	122,34	8,17	628,09	354,65	295,77	594,82	601,49
2137	549,32	77,53	122,87	7,97	635,70	353,49	297,92	595,65	607,90

2138	549,91	77,77	123,04	7,88	639,91	351,85	299,96	597,27	613,13
2139	549,36	76,92	121,63	7,62	644,99	350,18	301,99	598,20	617,09
2140	548,22	77,56	121,43	7,47	650,38	349,18	303,74	597,25	621,65
2141	546,43	78,39	120,94	7,27	656,38	347,29	305,37	597,13	627,08
2142	547,66	77,58	121,16	7,08	663,58	346,10	306,86	596,96	634,03
2143	549,45	78,15	120,11	6,96	671,07	344,24	308,31	597,32	641,38
2144	550,34	79,18	121,18	6,76	680,66	343,56	309,64	598,47	650,44
2145	552,09	78,44	121,47	6,57	690,53	342,52	311,00	599,55	660,17
2146	551,98	78,00	121,41	6,38	700,60	341,65	312,31	600,76	668,96
2147	550,85	78,52	121,67	6,16	709,10	341,33	313,69	603,71	674,39
2148	550,92	78,78	121,46	6,06	716,69	340,27	314,73	606,25	681,38
2149	549,99	78,65	120,59	5,87	721,95	339,38	315,70	605,23	687,23
2150	548,59	78,84	121,05	5,67	727,38	339,34	316,88	605,26	691,82
2151	546,62	79,25	120,47	5,58	731,47	339,18	317,93	604,26	697,08
2152	545,01	78,74	120,69	5,48	736,93	338,97	318,94	601,77	700,49
2153	545,84	79,16	120,69	5,27	740,77	339,25	319,83	601,18	704,64
2154	543,58	79,15	120,92	5,14	745,22	339,25	320,72	600,19	708,37
2155	541,06	78,42	120,06	4,97	749,24	339,40	321,68	598,28	712,45
2156	536,59	77,96	119,45	4,78	750,00	340,33	322,63	595,32	716,41
2157	531,69	79,49	119,02	4,68	749,44	339,78	323,45	590,19	719,48
2158	524,36	78,86	118,42	4,47	748,58	340,43	324,36	582,49	722,75
2159	515,35	80,12	117,52	4,41	745,61	341,05	325,13	575,01	727,05
2160	509,54	77,74	116,72	4,28	742,25	341,71	325,95	566,81	727,10
2161	502,78	79,69	115,59	4,27	737,72	342,53	326,66	557,08	726,75
2162	497,30	79,78	115,37	4,08	733,79	343,60	327,37	549,66	725,80
2163	492,35	79,39	114,95	3,98	726,60	344,34	328,11	543,27	719,56
2164	486,15	78,97	112,78	3,89	718,92	344,74	328,78	535,07	710,67
2165	480,15	79,33	112,78	3,77	711,42	345,71	329,56	529,79	704,86
2166	473,53	77,70	112,99	3,77	703,55	346,67	330,46	523,30	697,95
2167	467,89	78,64	111,79	3,67	695,75	347,92	331,28	516,31	691,29
2168	461,43	78,19	111,21	3,57	687,05	348,82	332,16	509,02	686,58
2169	455,31	79,16	110,39	3,48	679,70	349,63	333,03	501,94	678,72
2170	448,93	79,56	109,91	3,48	671,52	349,88	333,75	495,16	674,96
2171	443,75	78,16	109,30	3,38	664,51	350,08	334,42	489,04	670,07
2172	437,24	79,64	108,29	3,38	657,19	350,64	335,39	482,72	664,71
2173	433,53	77,24	108,64	3,28	649,35	351,33	336,22	476,77	658,45
2174	429,36	78,42	108,04	3,18	642,68	351,14	337,11	470,73	653,16
2175	425,66	78,03	107,77	3,07	635,59	351,75	338,14	465,48	648,37
2176	422,26	76,76	107,24	3,07	629,08	351,13	339,03	458,14	646,92
2177	418,84	77,56	106,94	2,97	623,53	351,85	340,08	453,42	645,07
2178	414,97	78,09	106,05	2,91	618,11	352,63	341,04	447,42	646,46
2179	411,40	79,76	106,23	2,87	613,50	352,92	341,94	441,56	645,84
2180	407,84	78,37	106,63	2,77	608,97	353,12	343,00	436,51	643,08
2181	404,34	79,63	105,42	2,68	603,86	353,24	343,73	430,28	642,64
2182	400,99	79,33	105,65	2,68	599,80	353,43	344,61	426,43	640,21
2183	398,35	76,46	104,38	2,58	594,52	353,53	345,15	420,75	638,58
2184	394,91	77,39	104,27	2,58	590,35	354,26	345,80	415,64	636,14
2185	392,30	78,61	103,76	2,48	585,34	354,71	346,53	411,97	634,24
2186	389,08	77,33	103,86	2,48	581,97	355,49	347,21	407,25	630,49
2187	385,84	77,96	102,95	2,38	578,45	355,67	347,77	402,53	625,95
2188	381,74	77,72	102,73	2,38	575,07	355,72	348,39	398,72	622,00
2189	378,03	79,41	102,42	2,27	571,07	356,62	348,89	394,51	616,13
2190	371,29	76,69	101,96	2,27	566,12	357,03	349,39	388,96	609,67
2191	365,54	76,93	101,34	2,17	561,23	357,39	349,78	384,49	601,18
2192	360,61	77,53	100,93	2,17	555,63	357,78	350,00	379,97	593,80
2193	356,10	76,94	100,37	2,07	551,81	357,46	350,06	374,82	584,40
2194	352,04	76,15	99,80	2,07	546,94	358,08	350,02	370,19	576,70
2195	348,62	76,36	99,51	2,03	542,69	357,76	349,78	365,15	568,12
2196	347,29	76,47	99,51	1,97	539,73	357,93	349,52	360,72	560,17
2197	346,26	76,69	99,01	1,97	538,11	357,42	349,26	356,06	553,07
2198	344,29	76,78	98,76	1,88	536,29	357,45	348,90	352,26	546,28
2199	342,60	76,83	98,24	1,88	535,68	356,95	348,32	348,80	539,35
2200	341,47	76,57	98,49	1,78	533,71	356,77	347,75	345,93	534,44
2201	341,11	75,29	98,56	1,78	533,16	356,62	347,11	342,65	528,83
2202	340,75	75,74	98,32	1,68	533,00	356,74	346,44	339,91	523,82
2203	340,40	75,92	98,27	1,59	532,51	356,56	345,61	337,51	519,65
2204	341,56	75,35	98,22	1,59	532,64	355,79	344,71	335,28	516,42
2205	342,94	76,32	98,46	1,59	532,39	355,97	343,85	333,28	515,44
2206	343,31	76,72	98,35	1,58	532,37	355,95	342,87	331,64	512,74
2207	343,75	76,50	98,41	1,47	532,04	355,80	341,87	330,45	510,39
2208	344,33	76,57	98,59	1,37	531,28	356,15	340,88	328,75	508,98
2209	343,88	76,59	98,63	1,37	530,21	356,12	339,86	328,02	506,47
2210	342,99	75,95	98,51	1,30	529,59	356,63	338,87	327,58	504,18
2211	343,45	76,46	98,66	1,27	528,97	356,75	337,80	327,00	502,76
2212	342,89	76,70	98,60	1,27	528,36	357,36	336,72	326,51	499,73
2213	342,82	76,27	98,58	1,27	527,51	357,72	335,66	325,94	497,28
2214	343,00	76,58	98,83	1,18	526,39	357,94	334,55	325,25	496,58
2215	342,65	76,59	98,75	1,08	525,57	358,66	333,46	325,01	494,95
2216	342,21	75,98	99,05	1,08	523,73	358,77	332,35	324,97	493,51
2217	341,28	76,05	98,72	0,98	522,15	359,66	331,23	324,91	491,44
2218	340,85	75,94	98,58	0,98	520,54	360,91	330,11	323,75	490,01
2219	340,59	76,64	98,26	0,98	517,78	361,62	328,92	324,53	487,92
2220	339,56	76,70	97,68	0,88	514,85	362,78	327,67	323,99	486,45
2221	338,96	76,07	97,87	0,88	512,40	363,87	326,54	323,43	485,20
2222	338,54	76,17	98,11	0,79	509,29	364,90	325,42	323,92	483,56
2223	337,28	76,85	97,88	0,79	506,73	366,67	324,33	323,47	482,25
2224	337,11	76,43	97,87	0,67	504,01	368,13	323,15	323,19	481,87
2225	336,45	76,39	97,68	0,67	502,64	369,31	322,02	323,02	479,94
2226	337,52	76,90	97,97	0,57	502,60	370,48	320,94	323,07	480,13
2227	338,74	76,74	97,68	0,57	502,72	371,27	319,72	323,82	479,99
2228	338,16	76,08	97,64	0,57	503,15	372,76	318,62	323,75	478,77
2229	336,24	76,18	97,51	0,48	502,28	373,13	317,50	322,79	480,48
2230	335,78	76,19	97,78	0,48	500,95	374,67	316,44	322,53	482,05
2231	335,25	76,80	97,60	0,38	500,36	376,04	315,41	321,05	482,87
2232	335,71	76,04	97,21	0,38	499,42	377,58	314,37	320,14	483,97
2233	335,60	76,43	97,56	0,28	497,62	378,57	313,32	320,15	486,18
2234	336,22	75,89	97,78	0,28	495,38	380,50	312,34	319,51	487,82
2235	336,41	76,51	96,84	0,28	493,86	381,31	311,22	319,38	489,24
2236	336,59	76,12	97,83	0,18	492,26	382,01	310,26	319,84	492,03
2237	336,55	75,85	97,41	0,18	490,46	384,16	309,32	318,86	493,64
2238	336,32	75,28	97,18	0,18	490,07	385,93	308,29	318,17	495,84
2239	334,03	75,36	97,09	0,09	488,76	386,58	307,28	316,95	498,97
2240	328,75	75,91	96,73	0,09	486,07	388,42	306,41	314,95	498,24
2241	320,92	76,69	96,30	0,02	482,46	388,79	305,49	312,22	495,68
2242	314,88	74,55	95,89	-0,01	479,42	389,51	304,55	308,64	491,63
2243	309,64	74,86	95,65	-0,01	476,35	390,20	303,69	305,87	486,74
2244	305,79	75,87	95,34	-0,01	473,10	391,10	302,75	302,15	482,03

2245	302,27	75,68	94,94	-0,01	470,36	392,22	301,94	298,93	477,72
2246	299,35	75,56	94,52	-0,01	467,90	392,98	301,15	295,50	472,52
2247	296,77	75,85	94,21	-0,01	465,08	393,57	300,34	292,38	468,68
2248	293,84	75,08	93,87	-0,01	462,91	393,99	299,54	288,85	463,40
2249	291,36	75,11	93,56	0,00	459,74	394,14	298,74	285,87	460,15
2250	69,74	70,25	72,39	2,98	69,45	68,95	68,82	70,11	69,39
2251	72,93	70,29	72,47	2,88	69,63	68,95	68,82	70,74	69,61
2252	200,04	70,21	88,91	2,69	89,34	69,21	68,87	82,13	75,40
2253	304,08	70,33	94,89	2,49	143,24	69,92	68,93	108,58	92,96
2254	295,17	70,28	89,80	2,40	168,85	70,30	69,07	135,57	106,06
2255	313,84	70,38	90,67	2,28	200,52	70,97	69,18	164,54	119,15
2256	332,84	70,43	92,13	2,08	231,49	71,97	69,39	194,82	135,01
2257	348,52	70,57	93,56	1,89	258,32	73,33	69,61	222,22	152,80
2258	359,41	70,70	95,05	1,79	277,02	75,15	69,84	245,64	175,34
2259	370,31	70,75	96,40	1,69	292,53	77,54	70,13	265,59	200,37
2260	386,54	70,88	98,38	1,48	311,10	80,73	70,47	286,77	223,59
2261	385,31	71,04	98,57	1,38	334,14	84,34	70,83	299,68	247,49
2262	377,96	71,24	98,20	1,28	349,26	88,43	71,25	306,93	271,76
2263	375,96	71,12	101,46	1,73	360,36	93,21	71,72	312,73	289,51
2264	403,23	71,22	131,49	13,43	380,61	99,04	72,33	315,76	298,32
2265	454,90	71,43	146,52	13,15	403,74	104,73	73,34	314,42	316,46
2266	516,22	71,75	162,64	12,86	425,50	110,45	74,46	317,15	337,81
2267	431,29	71,82	123,88	12,67	427,31	115,67	75,38	321,82	335,14
2268	381,16	72,00	110,98	12,57	415,91	120,75	76,51	321,87	323,85
2269	364,88	71,98	105,09	12,47	406,69	125,51	77,74	322,40	310,53
2270	351,75	71,97	101,27	12,36	398,47	129,70	78,99	319,25	298,50
2271	350,10	72,09	99,70	12,26	391,94	133,45	80,29	318,72	287,55
2272	360,86	72,10	99,78	12,16	391,36	136,91	81,65	322,02	278,00
2273	417,21	72,14	124,81	12,06	404,84	140,16	83,23	322,70	269,43
2274	465,37	72,18	131,54	11,87	445,05	143,14	84,90	326,70	261,90
2275	429,75	72,31	114,69	11,77	455,51	145,65	86,21	336,80	257,45
2276	421,67	72,16	110,06	11,55	451,15	147,82	87,77	346,38	255,10
2277	416,31	72,55	107,46	11,46	443,15	150,03	89,51	354,63	253,21
2278	407,83	72,40	105,70	11,36	435,52	152,04	91,35	359,85	252,87
2279	394,97	72,52	103,86	11,26	427,96	153,88	93,30	361,36	251,63
2280	389,76	72,63	103,23	11,17	422,17	155,62	95,34	361,51	250,18
2281	391,29	72,97	103,00	11,07	417,22	157,11	97,37	362,76	249,43
2282	399,67	72,76	103,38	10,86	413,75	158,83	99,53	366,95	249,38
2283	412,01	72,73	104,49	10,76	411,51	160,50	101,72	372,80	249,56
2284	436,15	72,99	106,76	10,56	412,92	162,01	103,91	389,01	252,01
2285	453,93	72,69	108,90	10,47	417,73	163,34	106,17	409,13	256,64
2286	465,12	72,89	110,20	10,27	427,53	165,11	108,42	425,75	262,93
2287	466,48	73,00	110,67	10,17	439,25	166,76	110,68	438,91	270,22
2288	458,23	73,01	110,19	9,96	450,19	168,22	112,88	445,35	276,58
2289	449,89	72,45	109,49	9,86	459,34	169,97	115,04	450,07	281,22
2290	441,17	72,59	108,59	9,76	465,75	171,76	117,21	450,53	283,72
2291	443,77	72,49	108,52	9,67	471,38	173,49	119,30	451,91	286,21
2292	461,36	73,20	109,78	9,39	477,43	175,20	121,34	454,94	290,07
2293	476,55	73,14	111,05	9,26	484,70	177,17	123,37	462,23	297,23
2294	491,83	73,45	113,34	9,16	497,43	178,87	125,39	479,84	309,15
2295	500,51	72,74	114,37	8,97	509,90	180,80	127,43	493,97	322,62
2296	505,29	72,66	114,89	8,77	522,20	183,06	129,44	506,91	335,06
2297	509,95	73,72	115,57	8,57	533,84	185,59	131,46	520,26	346,75
2298	516,14	73,79	116,63	8,36	546,05	188,36	133,48	531,07	359,07
2299	531,27	74,06	118,04	8,17	558,95	191,29	135,62	539,30	374,82
2300	534,60	74,45	119,15	7,97	569,72	194,95	137,71	546,73	400,10
2301	537,33	74,05	119,52	7,78	579,63	198,69	139,89	553,02	424,84
2302	541,10	73,96	119,88	7,56	589,93	203,29	142,03	561,21	445,14
2303	545,64	74,75	120,04	7,37	601,93	208,15	144,19	570,53	463,10
2304	549,35	74,21	121,12	7,08	612,76	213,29	146,37	576,82	479,08
2305	552,78	74,98	121,74	6,86	625,26	219,03	148,59	585,81	494,48
2306	554,15	75,20	122,05	6,67	636,85	224,97	150,80	592,41	508,99
2307	559,42	75,13	121,85	6,48	647,26	231,34	153,11	599,20	522,44
2308	559,46	75,08	121,94	6,28	658,32	237,82	155,42	605,15	533,06
2309	560,97	74,79	121,32	6,07	668,17	244,56	157,86	610,83	542,25
2310	560,88	75,15	121,13	5,87	677,71	251,19	160,31	614,93	550,41
2311	561,51	75,31	120,89	5,68	687,78	257,91	162,84	620,00	559,07
2312	560,54	75,58	120,80	5,48	696,38	264,97	165,42	623,10	566,47
2313	561,29	75,71	120,52	5,37	705,12	271,48	168,13	625,32	575,81
2314	560,76	74,76	121,70	5,17	709,11	278,39	170,87	627,69	584,70
2315	561,60	75,88	121,98	4,98	715,49	285,42	174,07	630,58	594,74
2316	561,18	75,02	122,25	4,78	718,82	292,42	177,19	632,01	605,66
2317	559,42	76,13	121,93	4,69	724,91	299,60	180,52	634,24	614,84
2318	556,97	76,15	121,45	4,47	730,72	306,43	183,83	634,41	623,63
2319	553,46	75,94	120,53	4,28	733,23	313,44	187,14	633,84	631,64
2320	549,60	75,47	120,53	4,08	733,10	320,45	190,75	632,47	640,29
2321	545,50	75,36	119,49	3,99	727,95	327,44	194,48	631,87	645,73
2322	541,60	76,69	118,74	3,87	720,90	334,40	198,43	631,16	651,40
2323	538,74	75,93	118,73	3,67	711,82	341,02	202,31	629,03	655,37
2324	536,93	76,41	117,69	3,58	706,15	348,12	206,56	630,65	658,91
2325	536,06	76,53	117,18	3,48	701,52	354,69	210,69	631,10	662,71
2326	533,79	76,80	117,12	3,29	698,19	362,20	215,13	630,99	666,02
2327	530,45	76,36	117,16	3,29	693,74	369,28	219,32	629,40	669,59
2328	527,77	77,14	116,55	3,07	690,47	376,71	223,74	628,58	672,57
2329	523,88	77,26	116,52	2,97	685,77	383,06	228,03	625,23	676,64
2330	518,41	76,63	115,72	2,88	683,53	390,19	232,45	620,37	677,00
2331	512,28	75,81	114,53	2,78	679,52	397,64	236,53	614,12	679,99
2332	504,00	76,62	114,80	2,68	675,65	404,97	241,23	607,99	682,60
2333	497,05	75,67	113,30	2,58	671,64	412,43	245,83	598,68	682,29
2334	474,65	77,69	146,36	11,26	648,27	419,64	248,89	581,40	661,81
2335	573,58	77,42	153,25	10,97	617,53	424,58	255,13	562,72	632,46
2336	657,26	76,44	159,48	10,66	601,26	427,60	262,30	564,49	617,57
2337	599,32	77,41	138,89	10,46	592,21	427,91	269,14	574,75	619,04
2338	587,95	77,65	133,18	10,27	582,52	428,02	275,51	588,97	616,55
2339	592,37	77,71	130,35	9,96	580,34	427,45	281,28	604,40	615,66
2340	600,11	77,35	130,57	9,76	585,36	425,31	286,33	616,14	615,84
2341	596,96	77,66	128,79	9,57	593,97	423,85	290,97	625,08	622,30
2342	600,94	77,57	128,39	9,26	596,72	421,17	294,90	634,10	628,40
2343	606,82	78,17	128,69	9,06	600,67	418,65	298,54	640,43	635,31
2344	609,22	78,06	129,27	8,87	609,16	415,68	301,65	648,67	641,00
2345	614,34	78,12	130,31	8,58	617,68	414,24	304,78	656,12	646,33
2346	614,79	77,31	130,66	8,36	626,30	413,38	307,64	662,87	652,58
2347	616,08	77,63	130,23	8,16	638,62	411,92	310,21	666,92	656,39
2348	616,66	78,34	130,38	7,97	652,38	410,89	312,60	672,73	661,73
2349	612,93	77,54	129,40	7,78	664,01	409,60	314,68	677,97	666,19
2350	610,54	78,08	129,35	7,47	673,35	408,81	316,55	680,57	671,09
2351	609,08	77,91	129,06	7,27	682,23	408,48	318,37	681,72	675,86

2352	606,58	77,82	128,99	7,08	691,90	408,65	320,16	681,85	681,26
2353	604,48	77,77	128,83	6,86	699,16	407,48	321,61	685,30	685,03
2354	599,74	77,67	128,06	6,67	710,69	408,10	323,26	684,20	688,60
2355	596,17	78,41	127,63	6,48	717,53	407,50	324,50	684,38	692,68
2356	592,31	78,45	126,78	6,28	722,64	407,14	325,76	683,09	696,29
2357	587,26	78,57	126,13	6,07	726,61	408,13	327,07	680,17	700,79
2358	584,82	77,98	125,92	5,97	732,01	407,80	328,28	679,52	706,10
2359	581,39	79,19	125,50	5,78	736,39	407,46	329,05	677,38	711,82
2360	579,26	79,12	124,75	5,60	739,78	407,89	330,11	674,49	714,81
2361	579,06	79,00	124,82	5,48	744,32	406,86	331,11	672,24	723,68
2362	580,39	78,58	124,34	5,27	748,23	408,23	331,85	671,18	727,27
2363	581,63	78,72	124,00	5,08	752,30	409,99	332,84	671,38	732,16
2364	582,17	78,81	124,58	4,98	753,78	411,15	333,68	671,19	738,94
2365	584,46	79,35	124,60	4,69	756,18	412,92	334,69	670,96	743,31
2366	582,76	79,58	124,69	4,57	761,75	414,77	335,48	670,44	747,43
2367	581,96	79,66	124,34	4,37	767,01	416,65	336,27	667,86	750,25
2368	576,31	79,42	123,91	4,28	770,80	419,17	337,19	665,85	754,77
2369	570,33	79,39	122,78	4,18	774,10	420,73	337,76	661,04	757,39
2370	564,93	79,94	122,37	3,99	776,79	423,71	338,58	657,55	754,94
2371	561,50	79,58	120,94	3,89	776,36	425,93	339,31	651,30	755,51
2372	557,76	79,30	120,58	3,77	775,71	427,58	340,20	647,40	753,43
2373	553,26	79,82	121,15	3,58	773,46	429,75	341,00	641,99	750,53
2374	546,44	80,03	119,50	3,58	772,30	431,90	341,86	635,89	748,40
2375	538,75	78,95	118,79	3,38	771,97	433,52	342,89	628,58	744,97
2376	529,76	80,22	117,97	3,28	771,51	434,82	343,79	618,41	740,16
2377	518,58	79,87	116,03	3,19	768,03	436,61	344,93	605,24	732,99
2378	507,77	79,27	114,88	3,07	762,53	437,77	345,71	593,10	726,82
2379	496,39	80,29	113,47	3,07	755,00	438,71	346,76	579,63	716,63
2380	486,84	79,43	112,64	2,97	747,99	440,12	347,75	568,91	709,86
2381	478,67	80,10	112,47	2,88	740,99	441,59	348,77	558,80	702,55
2382	471,54	79,31	111,69	2,78	733,78	441,53	349,75	547,94	694,91
2383	465,86	79,72	110,53	2,68	727,02	443,07	350,58	539,09	689,85
2384	460,81	78,72	110,75	2,68	721,17	442,68	351,85	529,66	683,00
2385	455,24	79,44	110,34	2,58	715,93	443,01	352,96	520,67	677,77
2386	450,58	79,89	110,62	2,49	710,55	442,98	353,84	513,58	672,35
2387	446,99	79,68	109,46	2,49	705,99	442,63	354,72	506,77	667,68
2388	445,24	79,67	109,40	2,39	700,98	442,68	355,72	501,12	663,87
2389	443,63	79,78	109,93	2,27	697,15	441,94	356,45	497,59	661,78
2390	439,16	80,53	109,50	2,27	692,54	442,13	357,23	493,75	658,98
2391	435,98	79,08	109,22	2,27	687,94	442,31	358,15	489,06	656,25
2392	432,00	79,95	108,17	2,17	682,44	442,58	358,60	483,98	653,42
2393	429,20	80,33	108,06	2,08	676,16	442,62	359,37	478,56	649,05
2394	426,81	79,13	107,69	2,08	670,43	442,59	359,86	474,25	646,50
2395	424,35	78,91	107,80	1,98	666,83	442,82	360,54	471,05	642,49
2396	422,08	79,23	106,79	1,88	662,23	443,26	361,08	466,35	639,32
2397	419,79	79,55	106,76	1,79	658,11	443,19	361,33	462,66	636,83
2398	417,80	79,41	106,61	1,78	654,30	443,84	361,66	459,16	633,70
2399	415,08	79,33	106,17	1,69	651,41	444,33	361,93	455,73	631,80
2400	413,21	79,55	105,72	1,69	648,96	444,60	362,00	451,56	629,75
2401	410,71	79,63	105,03	1,59	645,37	444,31	361,99	447,99	626,85
2402	409,22	80,06	105,34	1,59	642,18	444,69	361,85	444,61	624,42
2403	407,78	79,52	105,15	1,47	640,06	444,80	362,18	442,90	621,14
2404	406,25	79,23	105,30	1,38	637,53	444,85	362,37	439,72	619,92
2405	404,90	80,06	104,24	1,28	635,05	445,33	362,25	434,91	616,25
2406	402,95	79,90	104,02	1,28	631,98	445,08	362,32	432,98	615,16
2407	401,26	79,97	103,60	1,18	629,51	445,82	362,40	430,99	613,20
2408	400,35	79,97	103,73	1,18	627,17	446,17	362,45	428,99	611,47
2409	399,62	79,68	103,95	1,08	625,70	445,85	362,39	427,44	609,32
2410	398,77	79,78	103,39	1,08	624,43	446,44	362,41	425,67	607,48
2411	397,84	79,35	103,36	0,99	623,20	446,53	362,28	423,97	607,69
2412	396,57	79,76	103,37	0,99	621,48	446,56	362,18	422,23	607,45
2413	395,45	79,26	103,31	0,89	621,22	446,81	362,10	420,68	607,48
2414	394,58	79,25	103,12	0,79	619,98	446,84	361,81	419,20	604,65
2415	393,75	79,26	103,00	0,79	620,00	446,50	361,72	417,54	600,18
2416	393,08	78,91	102,81	0,67	620,02	446,20	361,67	416,83	595,95
2417	391,96	79,26	103,08	0,67	620,41	445,23	361,43	415,56	592,89
2418	392,25	79,09	102,98	0,58	621,02	444,55	361,19	416,14	590,23
2419	391,73	79,60	103,23	0,58	621,45	444,14	360,85	416,29	586,44
2420	390,74	79,45	102,66	0,58	619,55	443,02	360,49	415,17	583,86
2421	388,68	79,11	102,48	0,48	617,73	442,03	360,16	414,52	582,00
2422	385,78	79,56	101,79	0,48	615,78	441,98	359,70	414,25	577,73
2423	383,91	79,49	101,63	0,38	613,53	441,06	359,28	412,70	576,38
2424	380,69	79,18	101,80	0,38	610,45	439,52	358,83	409,28	575,71
2425	374,43	79,15	102,00	0,29	603,58	438,37	358,49	403,67	573,36
2426	367,94	79,13	101,41	0,28	596,29	436,62	357,80	395,66	567,98
2427	360,93	79,60	99,94	0,20	588,94	435,80	357,42	387,88	565,35
2428	354,83	79,82	98,88	0,28	581,66	433,10	356,90	380,12	558,07
2429	349,43	79,16	98,23	0,19	574,55	430,97	356,40	373,02	553,07
2430	345,03	79,62	97,66	0,19	567,64	427,64	355,91	366,59	548,44
2431	340,72	79,29	97,69	0,19	561,22	425,14	355,57	360,94	542,05
2432	336,82	79,47	97,63	0,19	555,49	421,85	355,13	355,42	538,42
2433	333,55	79,46	96,87	0,19	549,48	418,21	354,65	349,80	531,58
2434	330,54	79,52	96,43	0,09	544,74	415,25	354,26	344,83	526,76
2435	327,42	78,57	96,05	0,02	540,06	411,86	353,87	340,35	521,84
2436	324,28	79,10	95,65	0,09	534,90	408,17	353,43	335,55	517,05
2437	67,25	68,24	71,68	2,97	66,47	65,55	65,84	66,96	66,08
2438	148,55	68,34	83,11	2,87	74,84	65,71	65,86	73,40	74,67
2439	352,10	68,31	118,29	1,98	95,93	66,58	65,93	106,66	98,29
2440	351,32	68,46	98,01	2,39	115,58	67,13	66,03	152,60	121,44
2441	407,76	68,48	101,05	2,15	133,61	68,40	66,18	205,85	148,24
2442	450,49	68,58	105,02	1,88	158,84	70,50	66,36	255,21	176,51
2443	473,58	68,67	108,00	1,68	184,91	73,54	66,58	300,87	206,33
2444	482,18	68,80	109,37	1,47	211,88	77,51	66,83	343,71	236,26
2445	480,96	68,95	109,51	1,28	239,89	81,86	67,12	376,31	263,91
2446	454,60	69,24	130,44	12,76	266,99	87,15	67,49	387,65	276,76
2447	449,85	69,15	138,88	12,66	303,63	92,52	68,17	378,83	272,97
2448	548,87	69,46	167,16	12,15	348,59	97,59	68,96	389,12	278,35
2449	533,09	69,59	140,91	11,96	377,18	102,24	69,74	411,88	288,33
2450	476,70	69,66	122,76	11,76	382,98	107,23	70,62	412,21	289,20
2451	453,74	69,63	115,44	11,66	385,19	111,84	71,59	416,79	286,88
2452	415,79	69,92	108,82	11,55	377,43	116,42	72,62	415,48	282,80
2453	403,60	69,82	105,98	11,45	366,80	119,79	73,68	414,39	278,86
2454	408,07	69,94	104,84	11,36	357,58	122,99	74,73	422,32	276,75
2455	409,66	69,91	104,43	11,26	351,54	126,14	75,85	420,56	277,12
2456	431,17	69,99	106,32	11,06	349,34	129,25	76,95	428,25	279,33
2457	474,99	70,12	110,69	10,85	351,26	131,58	78,15	440,82	287,87
2458	516,20	70,24	115,20	10,66	357,80	134,46	79,29	460,32	303,67

2459	552,05	70,34	119,80	10,36	376,39	138,24	80,48	479,78	319,54
2460	567,40	70,43	122,68	10,05	396,88	142,60	81,71	500,63	335,82
2461	572,16	70,52	123,54	9,86	416,00	147,42	82,94	521,80	353,85
2462	567,40	70,48	123,31	9,66	433,45	152,48	84,27	539,51	371,56
2463	563,23	70,77	123,27	9,37	446,44	157,83	85,65	555,12	388,68
2464	557,68	70,77	122,32	9,25	452,55	162,52	87,03	568,15	408,55
2465	546,76	70,76	121,10	9,06	456,06	167,99	88,51	576,47	420,02
2466	540,45	70,85	120,40	8,86	457,62	172,47	90,01	581,61	427,20
2467	539,37	70,96	119,98	8,67	459,36	177,14	91,61	587,34	434,33
2468	540,31	71,03	119,89	8,45	461,60	181,50	93,26	591,45	442,45
2469	544,76	71,24	120,52	8,26	467,70	185,61	95,03	596,29	453,38
2470	549,91	71,45	121,09	8,07	476,40	189,96	96,78	599,78	466,43
2471	553,88	71,36	121,69	7,87	487,54	193,96	98,63	600,77	479,87
2472	557,93	71,49	122,12	7,66	498,77	198,41	100,57	602,06	494,07
2473	563,23	71,55	122,78	7,46	510,88	203,28	102,49	606,72	510,91
2474	570,10	71,95	123,60	7,27	523,97	208,50	104,49	609,12	528,66
2475	574,25	72,19	124,40	6,96	537,16	214,32	106,56	613,29	546,72
2476	577,50	71,93	125,01	6,76	550,97	220,54	108,67	614,33	563,23
2477	579,13	72,09	125,50	6,57	564,01	226,50	110,87	616,16	579,53
2478	579,47	72,25	125,31	6,38	575,47	231,94	113,17	619,83	595,57
2479	579,85	72,33	125,19	6,16	588,33	239,81	115,54	623,11	610,35
2480	577,57	72,45	125,35	5,87	600,60	246,86	117,99	625,83	623,06
2481	574,40	72,68	125,04	5,68	612,05	253,13	120,53	626,38	633,95
2482	574,23	73,14	125,29	5,58	622,12	260,83	123,32	629,72	645,22
2483	573,04	73,14	124,80	5,36	631,23	267,47	126,13	631,27	655,37
2484	572,07	73,38	124,95	5,17	639,74	274,95	129,07	634,24	665,43
2485	571,12	73,31	125,05	4,88	648,42	281,22	132,11	636,07	674,72
2486	569,20	73,69	123,98	4,78	655,57	288,57	135,18	636,35	683,21
2487	567,82	73,81	124,08	4,57	662,53	295,15	138,46	636,57	691,41
2488	567,07	73,84	123,54	4,37	669,27	301,85	141,72	638,72	698,84
2489	566,39	73,97	124,14	4,25	674,96	309,04	145,18	639,21	706,17
2490	565,49	74,32	124,35	4,08	680,71	316,24	148,68	638,76	713,23
2491	566,42	74,71	124,04	3,89	685,76	323,69	152,32	636,70	719,04
2492	568,16	74,90	124,04	3,67	691,22	330,76	156,12	635,98	725,41
2493	571,94	75,49	124,06	3,48	697,04	337,90	160,06	632,87	729,86
2494	574,10	75,15	124,38	3,38	702,08	345,04	164,15	633,65	735,36
2495	572,07	75,75	123,95	3,28	705,70	352,63	168,39	633,68	740,25
2496	566,65	75,79	122,92	3,07	707,13	358,30	172,77	635,31	743,62
2497	556,83	75,69	121,99	2,97	707,83	368,17	177,32	638,57	743,01
2498	546,24	75,34	120,46	2,87	708,46	374,39	181,82	637,41	735,31
2499	532,04	75,58	118,86	2,78	708,76	379,60	186,65	632,15	728,42
2500	517,96	75,81	117,48	2,68	708,58	389,07	191,62	622,86	721,73
2501	505,74	75,76	115,77	2,58	708,38	396,02	196,68	612,53	713,63
2502	476,83	76,41	146,71	18,42	688,50	400,32	200,70	596,26	689,81
2503	512,59	75,81	139,85	10,46	655,79	407,05	207,23	573,74	646,05
2504	512,73	75,98	128,33	10,27	629,34	408,53	214,57	566,59	612,37
2505	519,62	76,38	123,92	10,05	603,37	411,95	221,02	566,54	588,64
2506	533,09	76,13	122,84	9,86	597,52	410,68	227,01	571,21	573,74
2507	542,96	76,92	123,22	9,66	602,05	411,67	232,58	576,12	571,16
2508	550,67	76,84	123,37	9,47	608,09	410,16	237,79	582,30	563,82
2509	559,42	77,11	123,88	9,26	614,27	408,38	242,60	588,74	557,02
2510	559,73	77,31	124,11	9,06	625,07	405,08	247,06	596,12	559,58
2511	566,74	77,34	124,64	8,77	629,91	402,69	251,09	602,10	559,37
2512	571,15	76,99	125,24	8,67	636,86	400,91	254,89	607,05	559,73
2513	567,71	77,27	124,85	8,36	645,33	399,05	258,42	611,13	574,00
2514	564,45	76,83	125,02	8,17	656,61	397,55	261,73	612,89	587,33
2515	567,45	77,51	125,32	8,07	666,01	393,34	264,80	613,79	589,53
2516	570,83	77,06	125,51	7,78	674,22	392,85	267,61	617,61	589,46
2517	575,27	76,66	125,74	7,56	677,86	392,08	270,18	621,03	590,47
2518	573,47	76,51	125,51	7,37	684,41	390,19	272,62	623,75	600,74
2519	568,59	76,58	125,24	7,17	690,10	390,72	274,96	625,21	617,33
2520	566,71	76,47	124,20	6,96	697,15	386,95	277,16	623,75	629,57
2521	564,37	76,89	124,04	6,76	703,09	384,88	279,23	623,11	639,57
2522	564,11	77,07	123,35	6,57	707,94	382,10	281,03	623,31	646,67
2523	563,95	77,35	123,32	6,48	713,67	382,74	282,83	622,56	652,87
2524	561,81	76,93	123,12	6,17	719,03	382,53	284,60	619,43	659,63
2525	559,61	76,81	123,40	6,07	724,97	381,85	286,41	618,86	666,47
2526	556,86	76,53	122,58	5,87	729,38	381,69	288,15	615,27	672,60
2527	554,13	78,00	122,65	5,67	733,35	381,17	289,80	613,09	680,44
2528	552,74	79,37	122,33	5,58	737,36	381,98	291,25	612,83	687,20
2529	551,76	78,53	122,32	5,36	740,34	382,62	292,95	610,55	692,56
2530	550,45	79,84	122,65	5,17	742,63	382,16	294,55	611,21	697,60
2531	550,29	78,62	122,16	5,07	743,18	383,88	296,09	611,87	703,36
2532	550,92	80,63	122,33	4,98	744,91	382,09	297,61	613,61	707,38
2533	551,14	79,27	122,25	4,78	745,11	385,38	299,08	616,23	711,42
2534	552,79	79,22	122,05	4,57	746,34	383,51	300,52	617,73	715,96
2535	555,93	80,26	121,81	4,37	747,49	383,29	301,91	620,98	719,56
2536	558,45	79,34	121,48	4,27	749,98	383,78	303,18	622,86	722,98
2537	558,18	79,12	121,76	4,18	752,37	385,38	304,41	625,65	726,85
2538	558,05	78,80	121,23	3,98	753,33	386,13	305,74	626,00	729,79
2539	557,07	80,46	122,01	3,77	754,21	389,70	307,09	629,86	736,17
2540	550,98	82,05	121,22	3,67	756,54	388,76	308,54	628,39	739,91
2541	539,27	81,12	119,92	3,58	755,86	391,45	309,92	624,17	741,76
2542	526,90	78,98	118,34	3,48	752,28	391,82	311,25	611,23	743,84
2543	514,04	80,45	117,17	3,38	747,96	392,80	312,54	600,06	742,84
2544	501,67	81,49	115,85	3,28	742,16	393,72	313,75	585,22	738,85
2545	492,89	81,07	114,56	3,19	737,40	394,53	314,85	571,39	734,65
2546	484,95	81,06	113,94	3,12	730,82	397,08	316,04	560,47	728,50
2547	476,63	80,97	112,89	2,97	724,45	400,51	316,90	550,34	721,55
2548	468,67	80,27	112,34	2,97	718,32	403,35	317,77	540,77	715,74
2549	461,62	80,37	112,14	2,97	708,91	405,11	318,83	532,28	709,05
2550	455,07	81,16	110,99	2,78	703,89	409,36	319,70	522,98	703,35
2551	449,44	81,48	109,94	2,78	697,19	410,22	320,52	512,74	695,98
2552	443,94	78,84	109,82	2,68	691,46	413,76	321,03	504,97	689,34
2553	439,63	80,58	108,68	2,68	685,28	414,96	321,73	496,50	683,02
2554	434,46	80,32	108,18	2,58	681,35	418,44	322,31	488,60	677,59
2555	429,61	80,12	108,13	2,48	676,57	422,67	322,71	482,24	672,43
2556	425,34	80,96	107,81	2,48	672,66	421,80	323,40	475,46	667,00
2557	421,90	80,50	106,88	2,39	668,59	423,91	323,87	469,48	661,70
2558	417,65	80,37	106,96	2,39	664,65	426,41	324,34	462,39	658,22
2559	414,38	80,02	106,37	2,27	661,48	427,28	324,82	455,91	654,11
2560	410,61	79,47	105,85	2,17	657,49	425,70	325,20	449,14	649,53
2561	407,51	79,43	105,02	2,17	651,77	425,48	325,48	442,42	644,20
2562	404,43	80,73	105,28	2,07	645,62	428,05	325,74	438,72	639,73
2563	401,31	79,93	105,01	1,98	641,19	426,96	326,11	433,19	633,49
2564	399,53	79,81	104,18	1,98	637,39	426,79	326,41	427,84	629,19
2565	397,75	79,21	103,74	1,88	632,08	424,50	326,54	424,84	625,66

2566	396,36	78,93	103,47	1,88	629,48	422,10	326,68	419,31	622,55
2567	393,64	78,52	103,39	1,78	626,40	421,37	326,75	415,49	619,70
2568	392,00	79,49	103,28	1,68	624,69	421,34	326,93	413,37	617,63
2569	390,93	78,90	103,78	1,68	622,53	419,24	327,11	411,15	615,50
2570	389,43	79,78	103,10	1,68	621,64	418,00	327,35	407,79	615,00
2571	388,81	79,35	103,18	1,57	620,25	415,22	327,51	404,40	613,71
2572	386,63	79,56	102,81	1,47	618,03	413,10	327,54	402,70	611,37
2573	384,58	79,55	102,79	1,47	617,50	412,65	327,66	400,55	610,01
2574	383,03	80,61	102,54	1,47	615,33	408,84	327,77	398,31	608,86
2575	381,77	80,73	102,40	1,37	614,32	408,99	327,84	395,54	607,23
2576	380,82	80,77	102,28	1,28	612,67	406,81	327,95	392,91	604,44
2577	380,25	81,06	102,27	1,28	611,60	406,65	328,00	391,43	603,37
2578	379,71	79,89	101,85	1,28	609,11	403,87	328,10	389,66	601,49
2579	379,58	80,81	101,80	1,18	608,64	402,30	328,14	388,04	601,48
2580	380,36	79,96	101,76	1,18	607,63	402,80	328,16	387,44	600,84
2581	381,16	78,77	101,81	0,98	606,55	402,34	328,35	387,67	599,51
2582	382,48	78,69	102,15	0,98	606,37	402,89	328,51	388,89	599,74
2583	383,07	77,42	101,98	0,98	606,41	401,99	328,75	390,00	600,96
2584	382,91	78,17	101,95	0,88	606,56	400,63	329,03	389,50	599,30
2585	383,83	78,36	101,84	0,88	606,15	400,00	329,23	390,23	601,51
2586	383,62	78,80	102,14	0,79	604,44	400,04	329,39	390,29	602,87
2587	381,04	78,22	101,90	0,79	602,11	399,55	329,55	390,54	603,86
2588	378,95	78,31	101,46	0,67	598,30	399,38	329,66	390,80	603,86
2589	376,28	77,90	101,70	0,67	594,31	398,74	329,78	389,96	602,49
2590	373,48	78,35	101,19	0,57	589,97	397,78	329,96	386,70	599,52
2591	370,59	79,38	101,26	0,57	586,42	398,76	330,02	385,27	596,98
2592	365,99	78,57	100,83	0,57	582,85	396,65	330,06	381,06	592,86
2593	362,15	79,47	100,57	0,48	579,41	398,88	329,90	378,67	588,19
2594	358,90	80,30	100,48	0,48	576,40	397,32	329,90	374,68	584,11
2595	355,95	79,38	99,92	0,48	572,04	394,77	329,70	371,35	581,36
2596	353,50	79,47	99,86	0,48	569,03	395,67	329,61	367,93	578,11
2597	351,30	79,51	99,70	0,38	565,72	394,15	329,45	365,52	573,97
2598	348,85	79,11	99,77	0,38	562,59	395,75	329,38	362,82	570,01
2599	346,65	80,48	99,91	0,38	558,94	393,73	329,32	360,39	565,54
2600	344,52	80,38	99,38	0,31	555,44	392,35	329,24	357,83	561,70
2601	341,95	80,32	99,21	0,28	551,38	393,20	329,16	355,18	558,31
2602	340,39	81,14	99,22	0,28	548,73	392,61	329,15	352,14	554,33
2603	338,26	80,78	99,41	0,28	545,73	391,90	329,13	349,87	551,71
2604	337,02	80,63	99,51	0,28	543,16	391,61	329,11	347,31	548,83
2605	335,52	79,84	99,19	0,09	540,42	388,26	329,09	344,61	544,55
2606	334,23	79,64	99,10	0,18	538,21	388,03	328,97	341,72	541,46
2607	332,55	79,35	98,86	0,09	536,22	387,44	328,95	340,04	538,54
2608	330,93	78,88	98,67	0,09	534,64	386,19	328,98	337,47	535,49
2609	330,06	78,90	98,67	0,09	532,24	385,55	328,96	335,52	533,03
2610	328,53	78,11	98,45	0,00	530,92	384,07	328,94	332,94	529,83
2611	423,77	68,48	171,64	11,38	306,97	102,55	75,26	290,02	295,44
2612	490,71	68,66	195,78	11,15	304,52	106,39	76,00	296,41	316,02
2613	417,95	68,64	149,27	10,98	299,68	109,96	76,92	296,99	341,46
2614	410,52	68,21	135,29	10,79	290,51	113,14	77,94	301,65	361,57
2615	427,91	68,61	132,05	10,68	282,70	115,98	79,01	306,05	378,83
2616	442,83	68,75	130,91	10,57	276,88	118,63	80,15	311,64	396,94
2617	462,92	68,21	131,88	10,38	272,92	121,18	81,41	318,93	410,42
2618	474,61	68,70	133,14	10,28	271,57	123,65	82,79	326,69	425,29
2619	472,15	68,54	132,36	10,08	271,85	126,04	84,26	334,11	440,19
2620	468,77	68,52	131,82	10,02	272,72	128,63	85,88	341,93	451,16
2621	462,56	68,34	130,62	9,87	273,25	131,28	87,70	354,21	458,41
2622	463,05	68,12	130,30	9,77	273,20	134,14	89,57	363,66	464,91
2623	471,64	67,85	131,37	9,68	272,53	136,95	91,56	373,19	470,81
2624	481,07	68,18	132,68	9,48	272,32	139,67	93,61	378,81	477,74
2625	486,80	68,36	133,63	9,38	274,09	142,44	95,69	388,46	485,25
2626	495,66	68,19	135,33	9,27	277,18	145,25	97,90	395,52	492,13
2627	521,69	67,83	139,07	9,07	281,61	148,04	99,97	407,67	501,20
2628	537,37	68,19	142,07	8,88	289,19	151,31	102,16	418,90	510,61
2629	553,43	68,37	144,78	8,67	298,61	154,80	104,51	428,93	519,91
2630	560,25	68,93	146,64	8,57	308,34	158,61	106,88	437,96	528,40
2631	562,84	68,80	147,78	8,37	317,65	162,88	109,38	448,10	536,31
2632	563,69	68,98	148,39	8,18	327,05	167,39	111,75	459,39	542,55
2633	562,76	68,95	148,45	7,97	338,15	171,91	114,04	469,03	547,53
2634	553,33	69,09	147,44	7,87	347,44	177,17	116,88	476,28	553,27
2635	548,90	69,03	146,76	7,67	353,23	182,09	119,49	482,25	557,98
2636	545,34	68,95	145,56	7,48	357,94	186,92	122,02	486,36	561,65
2637	545,00	69,28	145,46	7,38	362,70	191,90	124,59	491,00	565,99
2638	544,87	69,01	145,23	7,18	369,55	196,59	127,22	493,83	570,31
2639	547,01	68,74	145,85	6,97	374,96	201,34	129,80	498,40	575,21
2640	549,54	68,91	146,21	6,88	379,62	206,23	132,36	501,59	581,16
2641	550,91	69,04	146,32	6,78	384,00	211,10	135,05	505,02	587,42
2642	565,68	68,77	147,86	6,57	389,33	215,91	137,80	509,47	594,01
2643	584,23	69,17	150,19	6,37	397,03	221,06	140,57	513,32	601,69
2644	598,22	69,32	152,74	6,18	406,61	226,36	143,32	518,60	608,40
2645	613,33	69,39	155,57	5,97	420,19	231,64	146,20	524,66	616,46
2646	630,00	69,62	158,16	5,77	434,84	237,22	149,26	534,33	625,27
2647	626,37	70,04	158,79	5,57	448,42	243,12	152,39	542,39	634,40
2648	617,97	69,84	157,65	5,38	460,35	248,95	155,66	546,78	643,83
2649	611,84	69,44	156,83	5,27	473,54	254,84	159,05	548,39	651,82
2650	607,52	69,79	155,84	5,07	484,08	260,68	162,45	551,91	659,64
2651	604,01	69,40	154,91	4,87	494,68	266,24	166,00	554,06	665,35
2652	599,72	69,69	153,81	4,78	503,64	271,86	169,51	555,52	669,56
2653	601,00	69,88	153,82	4,57	511,95	277,24	173,03	555,74	673,30
2654	609,43	69,98	154,42	4,47	520,59	282,44	176,69	557,56	677,25
2655	613,61	69,75	154,45	4,27	530,88	287,89	180,57	563,48	679,11
2656	609,45	69,91	154,24	4,09	547,94	293,14	184,55	564,99	679,07
2657	600,37	69,58	152,68	3,97	568,60	298,33	188,47	560,42	676,20
2658	590,39	69,49	150,49	3,87	582,73	303,29	192,51	563,12	671,61
2659	584,01	69,87	149,15	3,67	593,04	308,33	196,77	563,75	665,89
2660	580,19	69,76	148,39	3,57	600,90	312,98	200,95	565,95	658,46
2661	578,18	69,94	147,34	3,47	606,35	317,59	205,29	568,13	652,63
2662	579,67	69,90	146,87	3,38	609,41	322,17	209,79	569,27	647,87
2663	587,56	69,61	147,93	3,27	613,30	326,86	214,17	567,24	643,51
2664	583,96	70,31	146,90	3,07	615,68	331,72	218,89	566,70	639,10
2665	576,10	69,69	146,47	2,97	618,73	336,33	223,67	564,72	634,79
2666	572,69	69,72	145,69	2,87	621,23	341,33	228,41	566,84	631,82
2667	571,71	70,15	145,09	2,77	626,24	346,30	233,23	565,82	627,73
2668	568,65	69,60	144,14	2,68	632,92	350,99	237,94	566,40	621,84
2669	562,95	69,84	143,46	10,25	638,57	355,82	242,52	562,47	616,89
2670	515,91	69,46	170,26	9,98	618,01	362,49	246,47	540,29	586,32
2671	512,98	69,58	150,33	9,88	605,44	363,80	251,40	527,30	553,95
2672	512,47	69,61	145,12	9,72	602,31	364,02	256,29	514,40	529,21

2673	524,18	69,34	144,20	9,58	605,67	362,56	260,59	505,90	508,50
2674	529,98	69,41	143,92	9,38	606,03	360,32	264,66	505,88	500,18
2675	557,52	69,35	146,93	9,17	597,95	357,13	268,62	512,94	485,52
2676	592,42	68,23	151,38	8,98	587,04	353,89	272,13	521,35	474,03
2677	621,06	68,84	155,78	8,78	577,04	350,52	275,28	531,64	467,59
2678	660,57	69,40	161,29	8,56	567,43	346,95	278,22	542,49	463,86
2679	687,40	69,63	166,98	8,28	557,00	343,47	281,04	555,30	467,37
2680	694,00	69,63	168,95	8,03	550,09	340,60	283,56	567,84	474,23
2681	728,23	69,86	175,25	7,77	548,74	337,39	286,10	581,00	478,47
2682	751,55	70,07	180,65	7,48	545,23	334,76	288,23	591,43	484,56
2683	750,49	69,65	182,45	7,17	544,35	332,52	290,34	602,34	489,79
2684	750,87	70,61	183,02	6,88	543,82	330,60	292,55	612,32	504,99
2685	749,34	69,60	183,85	6,65	543,59	328,78	294,58	620,67	517,18
2686	751,46	70,14	184,32	6,37	544,07	327,86	296,50	629,78	525,61
2687	747,28	70,66	184,02	6,08	546,42	327,16	298,45	638,35	533,93
2688	751,63	69,82	184,32	5,87	549,85	326,66	300,04	645,03	539,19
2689	753,37	70,55	185,15	5,57	555,79	326,75	301,64	651,22	548,87
2690	750,23	70,79	183,23	5,37	560,27	327,23	303,38	655,81	562,78
2691	750,74	70,36	184,02	5,07	567,32	327,92	304,88	658,20	578,58
2692	748,15	70,43	183,59	4,87	575,97	328,93	306,48	662,49	594,74
2693	748,64	70,89	183,00	4,68	584,68	330,39	308,11	664,77	608,93
2694	756,64	70,36	183,70	4,37	596,64	331,69	309,70	668,19	623,31
2695	760,47	71,16	184,54	4,17	609,38	333,48	311,29	672,53	637,39
2696	775,84	71,68	186,13	3,97	622,38	335,02	312,70	675,66	649,44
2697	782,35	72,06	186,68	3,67	635,56	337,07	314,16	678,59	661,15
2698	759,89	72,56	183,61	3,47	647,76	338,93	315,74	680,74	671,97
2699	740,02	72,58	181,33	3,27	658,15	341,35	317,31	680,05	681,80
2700	731,26	72,30	178,95	3,07	666,81	343,23	318,87	681,01	690,35
2701	730,64	72,68	178,06	2,87	674,08	345,44	320,45	678,75	698,64
2702	728,92	72,10	176,89	2,77	681,91	348,00	322,03	678,19	707,08
2703	731,30	71,02	177,00	2,57	688,66	350,20	323,36	677,48	714,02
2704	723,89	71,11	176,16	2,37	695,69	352,13	324,73	678,22	722,14
2705	711,80	70,95	173,34	2,17	702,02	354,79	326,23	674,01	730,80
2706	697,58	71,20	172,15	2,05	706,68	357,23	327,52	671,41	739,25
2707	683,43	72,00	169,64	1,87	713,13	359,28	328,89	664,31	743,44
2708	670,15	72,26	167,31	1,77	719,74	361,57	330,18	659,46	751,30
2709	649,72	72,25	163,55	1,58	723,13	364,31	331,24	651,68	754,87
2710	631,81	71,76	160,28	1,47	723,52	366,62	332,55	638,48	755,81
2711	613,55	71,14	157,16	1,47	721,72	369,78	333,83	624,38	754,92
2712	594,26	71,66	152,89	1,37	718,28	372,73	335,36	607,54	755,00
2713	575,12	71,81	149,42	1,28	713,23	376,29	336,85	592,53	752,89
2714	558,49	70,98	146,32	1,17	707,78	379,57	338,39	571,49	749,57
2715	543,17	71,10	143,55	1,17	699,89	383,34	340,10	553,66	743,85
2716	528,57	71,62	141,29	1,17	692,79	386,65	341,75	540,50	734,34
2717	516,22	72,62	139,28	1,17	684,21	389,61	343,30	526,78	723,26
2718	505,08	72,24	137,57	1,07	676,02	392,37	344,97	513,68	713,64
2719	495,56	72,80	135,90	1,07	668,11	395,28	346,34	498,83	702,57
2720	486,28	71,58	133,72	1,07	661,34	397,34	347,85	490,34	692,61
2721	478,08	70,93	131,84	0,97	655,09	398,57	349,05	476,16	682,44
2722	470,99	71,45	130,33	0,97	648,18	400,34	350,22	465,82	673,44
2723	464,54	71,26	128,84	0,92	641,94	401,30	351,77	456,34	665,82
2724	458,02	71,97	127,59	0,97	636,46	402,22	352,88	448,15	659,16
2725	452,19	70,89	126,48	0,87	632,24	403,01	353,97	438,01	652,74
2726	447,71	71,73	125,31	0,87	626,65	403,32	355,08	432,11	646,19
2727	447,63	70,51	124,72	0,77	622,48	403,31	356,21	425,79	649,95
2728	447,14	72,08	124,38	0,77	619,22	403,68	357,04	422,27	652,37
2729	445,21	71,46	124,11	0,70	616,55	403,15	357,99	419,11	655,41
2730	442,89	71,55	123,64	0,67	613,75	402,78	358,95	413,55	655,86
2731	440,16	70,40	123,27	0,67	611,61	402,26	359,93	410,27	656,64
2732	431,90	70,76	122,14	0,67	610,22	401,63	361,20	403,07	655,39
2733	424,94	70,37	121,06	0,57	608,10	400,68	362,80	396,20	650,95
2734	420,24	71,84	120,24	0,57	606,46	399,96	364,19	391,78	645,62
2735	415,98	70,98	119,40	0,57	603,50	398,69	365,72	386,27	639,64
2736	412,22	70,99	118,96	0,57	600,26	397,04	367,33	382,73	633,13
2737	409,11	70,45	118,10	0,47	597,09	396,05	368,77	375,81	628,49
2738	405,84	70,44	117,21	0,47	594,23	394,17	370,33	371,09	622,77
2739	402,05	70,96	116,21	0,47	591,00	392,27	371,76	367,48	618,22
2740	399,40	70,73	115,96	0,37	588,34	390,50	372,84	363,02	613,48
2741	396,83	71,18	115,60	0,37	585,45	388,94	374,10	358,84	608,69
2742	394,41	70,42	115,23	0,33	582,52	387,01	374,87	354,77	605,24
2743	392,45	70,86	114,66	0,32	579,67	385,29	376,34	351,32	600,96
2744	389,80	70,66	114,38	0,27	577,08	383,68	377,34	346,30	598,51
2745	387,95	70,52	113,88	0,27	574,09	382,00	378,13	343,89	593,74
2746	386,36	70,54	113,52	0,17	571,25	380,17	378,97	340,18	591,32
2747	383,94	70,25	112,94	0,18	569,05	378,55	379,62	338,22	588,55
2748	381,71	70,72	112,82	0,17	566,35	376,94	380,44	335,31	584,16
2749	380,23	70,86	112,59	0,17	564,46	375,43	381,04	332,60	580,91
2750	378,39	70,93	112,35	0,17	562,99	373,85	381,65	329,76	578,43
2751	375,85	70,38	111,97	0,07	560,68	371,97	382,41	327,35	575,07
2752	374,16	70,42	111,53	0,07	558,43	370,59	383,06	325,70	571,34
2753	372,00	70,23	111,42	0,07	556,12	368,78	383,77	322,59	566,48
2754	370,26	70,63	111,09	0,07	554,12	366,97	383,96	320,21	561,61
2755	369,30	70,43	110,77	0,07	552,12	365,08	384,47	318,22	559,37
2756	368,94	70,40	110,56	0,07	549,64	363,34	384,81	317,43	556,54
2757	366,54	70,43	110,21	0,00	547,89	361,55	385,05	313,64	554,07
2758	71,17	70,93	71,23	0,17	71,45	70,98	71,19	71,13	71,07
2759	72,38	71,07	71,24	2,87	71,63	70,99	71,20	71,52	71,21
2760	127,61	70,97	82,25	2,77	78,66	70,93	71,20	74,35	73,55
2761	172,09	71,08	94,03	2,67	98,61	70,99	71,33	78,06	77,49
2762	268,17	71,03	123,48	2,47	160,57	71,06	71,40	88,97	81,72
2763	229,48	71,16	94,26	2,46	169,04	71,38	71,54	103,64	89,60
2764	221,85	71,20	89,70	2,34	171,76	71,99	71,72	116,47	96,82
2765	251,20	71,10	91,61	2,24	177,67	72,79	71,90	132,97	106,85
2766	494,44	77,34	150,49	10,85	634,68	362,77	236,00	617,19	642,08
2767	572,57	77,36	149,13	10,56	618,57	368,01	241,20	593,08	610,31
2768	615,79	76,40	152,79	10,36	619,29	371,82	247,08	583,49	584,51
2769	578,30	75,98	137,03	10,17	624,13	372,74	252,92	583,80	572,01
2770	547,68	75,90	128,09	9,95	619,49	373,32	258,68	584,66	569,10
2771	536,92	75,64	124,73	9,83	612,27	372,20	264,05	582,40	565,53
2772	534,70	75,40	123,27	9,66	608,79	370,92	269,04	580,65	563,60
2773	531,81	75,94	121,05	9,47	605,94	370,35	273,68	579,20	563,56
2774	529,05	76,12	120,34	9,26	605,97	367,66	277,79	577,75	562,92
2775	531,53	75,49	120,22	9,06	608,85	365,60	281,44	578,63	567,06
2776	534,31	76,73	120,68	8,96	609,20	364,39	285,00	579,08	571,55
2777	550,39	76,64	121,61	8,77	612,43	361,75	288,17	586,08	577,77
2778	550,21	77,09	121,78	8,57	614,95	358,90	290,89	591,19	586,07
2779	550,52	77,76	121,16	8,36	621,32	357,13	293,41	592,57	591,79

2780	550,36	77,64	122,34	8,17	628,09	354,65	295,77	594,82	601,49
2781	549,32	77,53	122,87	7,97	635,70	353,49	297,92	595,65	607,90
2782	549,91	77,77	123,04	7,88	639,91	351,85	299,96	597,27	613,13
2783	549,36	76,92	121,63	7,62	644,99	350,18	301,99	598,20	617,09
2784	548,22	77,56	121,43	7,47	650,38	349,18	303,74	597,25	621,65
2785	546,43	78,39	120,94	7,27	656,38	347,29	305,37	597,13	627,08
2786	547,66	77,58	121,16	7,08	663,58	346,10	306,86	596,96	634,03
2787	549,45	78,15	120,11	6,96	671,07	344,24	308,31	597,32	641,38
2788	550,34	79,18	121,18	6,76	680,66	343,56	309,64	598,47	650,44
2789	552,09	78,44	121,47	6,57	690,53	342,52	311,00	599,55	660,17
2790	551,98	78,00	121,41	6,38	700,60	341,65	312,31	600,76	668,96
2791	550,85	78,52	121,67	6,16	709,10	341,33	313,69	603,71	674,39
2792	550,92	78,78	121,46	6,06	716,69	340,27	314,73	606,25	681,38
2793	549,99	78,65	120,59	5,87	721,95	339,38	315,70	605,23	687,23
2794	548,59	78,84	121,05	5,67	727,38	339,34	316,88	605,26	691,82
2795	546,62	79,25	120,47	5,58	731,47	339,18	317,93	604,26	697,08
2796	545,01	78,74	120,69	5,48	736,93	338,97	318,94	601,77	700,49
2797	545,84	79,16	120,69	5,27	740,77	339,25	319,83	601,18	704,64
2798	543,58	79,15	120,92	5,14	745,22	339,25	320,72	600,19	708,37
2799	541,06	78,42	120,06	4,97	749,24	339,40	321,68	598,28	712,45
2800	536,59	77,96	119,45	4,78	750,00	340,33	322,63	595,32	716,41
2801	531,69	79,49	119,02	4,68	749,44	339,78	323,45	590,19	719,48
2802	524,36	78,86	118,42	4,47	748,58	340,43	324,36	582,49	722,75
2803	515,35	80,12	117,52	4,41	745,61	341,05	325,13	575,01	727,05
2804	509,54	77,74	116,72	4,28	742,25	341,71	325,95	566,81	727,10
2805	502,78	79,69	115,59	4,27	737,72	342,53	326,66	557,08	726,75
2806	497,30	79,78	115,37	4,08	733,79	343,60	327,37	549,66	725,80
2807	492,35	79,39	114,95	3,98	726,60	344,34	328,11	543,27	719,56
2808	486,15	78,97	112,78	3,89	718,92	344,74	328,78	535,07	710,67
2809	480,15	79,33	112,78	3,77	711,42	345,71	329,56	529,79	704,86
2810	473,53	77,70	112,99	3,77	703,55	346,67	330,46	523,30	697,95
2811	467,89	78,64	111,79	3,67	695,75	347,92	331,28	516,31	691,29
2812	461,43	78,19	111,21	3,57	687,05	348,82	332,16	509,02	686,58
2813	455,31	79,16	110,39	3,48	679,70	349,63	333,03	501,94	678,72
2814	448,93	79,56	109,91	3,48	671,52	349,88	333,75	495,16	674,96
2815	443,75	78,16	109,30	3,38	664,51	350,08	334,42	489,04	670,07
2816	437,24	79,64	108,29	3,38	657,19	350,64	335,39	482,72	664,71
2817	433,53	77,24	108,64	3,28	649,35	351,33	336,22	476,77	658,45
2818	429,36	78,42	108,04	3,18	642,68	351,14	337,11	470,73	653,16
2819	425,66	78,03	107,77	3,07	635,59	351,75	338,14	465,48	648,37
2820	422,26	76,76	107,24	3,07	629,08	351,13	339,03	458,14	646,92
2821	418,84	77,56	106,94	2,97	623,53	351,85	340,08	453,42	645,07
2822	414,97	78,09	106,05	2,91	618,11	352,63	341,04	447,42	646,46
2823	411,40	79,76	106,23	2,87	613,50	352,92	341,94	441,56	645,84
2824	407,84	78,37	106,63	2,77	608,97	353,12	343,00	436,51	643,08
2825	404,34	79,63	105,42	2,68	603,86	353,24	343,73	430,28	642,64
2826	400,99	79,33	105,65	2,68	599,80	353,43	344,61	426,43	640,21
2827	398,35	76,46	104,38	2,58	594,52	353,53	345,15	420,75	638,58
2828	394,91	77,39	104,27	2,58	590,35	354,26	345,80	415,64	636,14
2829	392,30	78,61	103,76	2,48	585,34	354,71	346,53	411,97	634,24
2830	389,08	77,33	103,86	2,48	581,97	355,49	347,21	407,25	630,49
2831	385,84	77,96	102,95	2,38	578,45	355,67	347,77	402,53	625,95
2832	381,74	77,72	102,73	2,38	575,07	355,72	348,39	398,72	622,00
2833	378,03	79,41	102,42	2,27	571,07	356,62	348,89	394,51	616,13
2834	371,29	76,69	101,96	2,27	566,12	357,03	349,39	388,96	609,67
2835	365,54	76,93	101,34	2,17	561,23	357,39	349,78	384,49	601,18
2836	360,61	77,53	100,93	2,17	555,63	357,78	350,00	379,97	593,80
2837	356,10	76,94	100,37	2,07	551,81	357,46	350,06	374,82	584,40
2838	352,04	76,15	99,80	2,07	546,94	358,08	350,02	370,19	576,70
2839	348,62	76,36	99,51	2,03	542,69	357,76	349,78	365,15	568,12
2840	347,29	76,47	99,51	1,97	539,73	357,93	349,52	360,72	560,17
2841	346,26	76,69	99,01	1,97	538,11	357,42	349,26	356,06	553,07
2842	344,29	76,78	98,76	1,88	536,29	357,45	348,90	352,26	546,28
2843	342,60	76,83	98,24	1,88	535,68	356,95	348,32	348,80	539,35
2844	341,47	76,57	98,49	1,78	533,71	356,77	347,75	345,93	534,44
2845	341,11	75,29	98,56	1,78	533,16	356,62	347,11	342,65	528,83
2846	340,75	75,74	98,32	1,68	533,00	356,74	346,44	339,91	523,82
2847	340,40	75,92	98,27	1,59	532,51	356,56	345,61	337,51	519,65
2848	341,56	75,35	98,22	1,59	532,64	355,79	344,71	335,28	516,42
2849	342,94	76,32	98,46	1,59	532,39	355,97	343,85	333,28	515,44
2850	343,31	76,72	98,35	1,58	532,37	355,95	342,87	331,64	512,74
2851	343,75	76,50	98,41	1,47	532,04	355,80	341,87	330,45	510,39
2852	344,33	76,57	98,59	1,37	531,28	356,15	340,88	328,75	508,98
2853	343,88	76,59	98,63	1,37	530,21	356,12	339,86	328,02	506,47
2854	342,99	75,95	98,51	1,30	529,59	356,63	338,87	327,58	504,18
2855	343,45	76,46	98,66	1,27	528,97	356,75	337,80	327,00	502,76
2856	342,89	76,70	98,60	1,27	528,36	357,36	336,72	326,51	499,73
2857	342,82	76,27	98,58	1,27	527,51	357,72	335,66	325,94	497,28
2858	343,00	76,58	98,83	1,18	526,39	357,94	334,55	325,25	496,58
2859	342,65	76,59	98,75	1,08	525,57	358,66	333,46	325,01	494,95
2860	342,21	75,98	99,05	1,08	523,73	358,77	332,35	324,97	493,51
2861	341,28	76,05	98,72	0,98	522,15	359,66	331,23	324,91	491,44
2862	340,85	75,94	98,58	0,98	520,54	360,91	330,11	323,75	490,01
2863	340,59	76,64	98,26	0,98	517,78	361,62	328,92	324,53	487,92
2864	339,56	76,70	97,68	0,88	514,85	362,78	327,67	323,99	486,45
2865	338,96	76,07	97,87	0,88	512,40	363,87	326,54	323,43	485,20
2866	338,54	76,17	98,11	0,79	509,29	364,90	325,42	323,92	483,56
2867	337,28	76,85	97,88	0,79	506,73	366,67	324,33	323,47	482,25
2868	337,11	76,43	97,87	0,67	504,01	368,13	323,15	323,19	481,87
2869	336,45	76,39	97,68	0,67	502,64	369,31	322,02	323,02	479,94
2870	337,52	76,90	97,97	0,57	502,60	370,48	320,94	323,07	480,13
2871	338,74	76,74	97,68	0,57	502,72	371,27	319,72	323,82	479,99
2872	338,16	76,08	97,64	0,57	503,15	372,76	318,62	323,75	478,77
2873	336,24	76,18	97,51	0,48	502,28	373,13	317,50	322,79	480,48
2874	335,78	76,19	97,78	0,48	500,95	374,67	316,44	322,53	482,05
2875	335,25	76,80	97,60	0,38	500,36	376,04	315,41	321,05	482,87
2876	335,71	76,04	97,21	0,38	499,42	377,58	314,37	320,14	483,97
2877	335,60	76,43	97,56	0,28	497,62	378,57	313,32	320,15	486,18
2878	336,22	75,89	97,78	0,28	495,38	380,50	312,34	319,51	487,82
2879	336,41	76,51	96,84	0,28	493,86	381,31	311,22	319,38	489,24
2880	336,59	76,12	97,83	0,18	492,26	382,01	310,26	319,84	492,03
2881	336,55	75,85	97,41	0,18	490,46	384,16	309,32	318,86	493,64
2882	336,32	75,28	97,18	0,18	490,07	385,93	308,29	318,17	495,84
2883	334,03	75,36	97,09	0,09	488,76	386,58	307,28	316,95	498,97
2884	328,75	75,91	96,73	0,09	486,07	388,42	306,41	314,95	498,24
2885	320,92	76,69	96,30	0,02	482,46	388,79	305,49	312,22	495,68
2886	314,88	74,55	95,89	-0,01	479,42	389,51	304,55	308,64	491,63

2887	309,64	74,86	95,65	-0,01	476,35	390,20	303,69	305,87	486,74
2888	305,79	75,87	95,34	-0,01	473,10	391,10	302,75	302,15	482,03
2889	302,27	75,68	94,94	-0,01	470,36	392,22	301,94	298,93	477,72
2890	299,35	75,56	94,52	-0,01	467,90	392,98	301,15	295,50	472,52
2891	296,77	75,85	94,21	-0,01	465,08	393,57	300,34	292,38	468,68
2892	293,84	75,08	93,87	-0,01	462,91	393,99	299,54	288,85	463,40
2893	291,36	75,11	93,56	0,00	459,74	394,14	298,74	285,87	460,15
2894	69,74	70,25	72,39	2,98	69,45	68,95	68,82	70,11	69,39
2895	72,93	70,29	72,47	2,88	69,63	68,95	68,82	70,74	69,61
2896	200,04	70,21	88,91	2,69	89,34	69,21	68,87	82,13	75,40
2897	304,08	70,33	94,89	2,49	143,24	69,92	68,93	108,58	92,96
2898	295,17	70,28	89,80	2,40	168,85	70,30	69,07	135,57	106,06
2899	313,84	70,38	90,67	2,28	200,52	70,97	69,18	164,54	119,15
2900	332,84	70,43	92,13	2,08	231,49	71,97	69,39	194,82	135,01
2901	348,52	70,57	93,56	1,89	258,32	73,33	69,61	222,22	152,80
2902	359,41	70,70	95,05	1,79	277,02	75,15	69,84	245,64	175,34
2903	370,31	70,75	96,40	1,69	292,53	77,54	70,13	265,59	200,37
2904	386,54	70,88	98,38	1,48	311,10	80,73	70,47	286,77	223,59
2905	385,31	71,04	98,57	1,38	334,14	84,34	70,83	299,68	247,49
2906	377,96	71,24	98,20	1,28	349,26	88,43	71,25	306,93	271,76
2907	375,96	71,12	101,46	1,73	360,36	93,21	71,72	312,73	289,51
2908	403,23	71,22	131,49	13,43	380,61	99,04	72,33	315,76	298,32
2909	454,90	71,43	146,52	13,15	403,74	104,73	73,34	314,42	316,46
2910	516,22	71,75	162,64	12,86	425,50	110,45	74,46	317,15	337,81
2911	431,29	71,82	123,88	12,67	427,31	115,67	75,38	321,82	335,14
2912	381,16	72,00	110,98	12,57	415,91	120,75	76,51	321,87	323,85
2913	364,88	71,98	105,09	12,47	406,69	125,51	77,74	322,40	310,53
2914	351,75	71,97	101,27	12,36	398,47	129,70	78,99	319,25	298,50
2915	350,10	72,09	99,70	12,26	391,94	133,45	80,29	318,72	287,55
2916	360,86	72,10	99,78	12,16	391,36	136,91	81,65	322,02	278,00
2917	417,21	72,14	124,81	12,06	404,84	140,16	83,23	322,70	269,43
2918	465,37	72,18	131,54	11,87	445,05	143,14	84,90	326,70	261,90
2919	429,75	72,31	114,69	11,77	455,51	145,65	86,21	336,80	257,45
2920	421,67	72,16	110,06	11,55	451,15	147,82	87,77	346,38	255,10
2921	416,31	72,55	107,46	11,46	443,15	150,03	89,51	354,63	253,21
2922	407,83	72,40	105,70	11,36	435,52	152,04	91,35	359,85	252,87
2923	394,97	72,52	103,86	11,26	427,96	153,88	93,30	361,36	251,63
2924	389,76	72,63	103,23	11,17	422,17	155,62	95,34	361,51	250,18
2925	391,29	72,97	103,00	11,07	417,22	157,11	97,37	362,76	249,43
2926	399,67	72,76	103,38	10,86	413,75	158,83	99,53	366,95	249,38
2927	412,01	72,73	104,49	10,76	411,51	160,50	101,72	372,80	249,56
2928	436,15	72,99	106,76	10,56	412,92	162,01	103,91	389,01	252,01
2929	453,93	72,69	108,90	10,47	417,73	163,34	106,17	409,13	256,64
2930	465,12	72,89	110,20	10,27	427,53	165,11	108,42	425,75	262,93
2931	466,48	73,00	110,67	10,17	439,25	166,76	110,68	438,91	270,22
2932	458,23	73,01	110,19	9,96	450,19	168,22	112,88	445,35	276,58
2933	449,89	72,45	109,49	9,86	459,34	169,97	115,04	450,07	281,22
2934	441,17	72,59	108,59	9,76	465,75	171,76	117,21	450,53	283,72
2935	443,77	72,49	108,52	9,67	471,38	173,49	119,30	451,91	286,21
2936	461,36	73,20	109,78	9,39	477,43	175,20	121,34	454,94	290,07
2937	476,55	73,14	111,05	9,26	484,70	177,17	123,37	462,23	297,23
2938	491,83	73,45	113,34	9,16	497,43	178,87	125,39	479,84	309,15
2939	500,51	72,74	114,37	8,97	509,90	180,80	127,43	493,97	322,62
2940	505,29	72,66	114,89	8,77	522,20	183,06	129,44	506,91	335,06
2941	509,95	73,72	115,57	8,57	533,84	185,59	131,46	520,26	346,75
2942	516,14	73,79	116,63	8,36	546,05	188,36	133,48	531,07	359,07
2943	531,27	74,06	118,04	8,17	558,95	191,29	135,62	539,30	374,82
2944	534,60	74,45	119,15	7,97	569,72	194,95	137,71	546,73	400,10
2945	537,33	74,05	119,52	7,78	579,63	198,69	139,89	553,02	424,84
2946	541,10	73,96	119,88	7,56	589,93	203,29	142,03	561,21	445,14
2947	545,64	74,75	120,04	7,37	601,93	208,15	144,19	570,53	463,10
2948	549,35	74,21	121,12	7,08	612,76	213,29	146,37	576,82	479,08
2949	552,78	74,98	121,74	6,86	625,26	219,03	148,59	585,81	494,48
2950	554,15	75,20	122,05	6,67	636,85	224,97	150,80	592,41	508,99
2951	559,42	75,13	121,85	6,48	647,26	231,34	153,11	599,20	522,44
2952	559,46	75,08	121,94	6,28	658,32	237,82	155,42	605,15	533,06
2953	560,97	74,79	121,32	6,07	668,17	244,56	157,86	610,83	542,25
2954	560,88	75,15	121,13	5,87	677,71	251,19	160,31	614,93	550,41
2955	561,51	75,31	120,89	5,68	687,78	257,91	162,84	620,00	559,07
2956	560,54	75,58	120,80	5,48	696,38	264,97	165,42	623,10	566,47
2957	561,29	75,71	120,52	5,37	705,12	271,48	168,13	625,32	575,81
2958	560,76	74,76	121,70	5,17	709,11	278,39	170,87	627,69	584,70
2959	561,60	75,88	121,98	4,98	715,49	285,42	174,07	630,58	594,74
2960	561,18	75,02	122,25	4,78	718,82	292,42	177,19	632,01	605,66
2961	559,42	76,13	121,93	4,69	724,91	299,60	180,52	634,24	614,84
2962	556,97	76,15	121,45	4,47	730,72	306,43	183,83	634,41	623,63
2963	553,46	75,94	120,53	4,28	733,23	313,44	187,14	633,84	631,64
2964	549,60	75,47	120,53	4,08	733,10	320,45	190,75	632,47	640,29
2965	545,50	75,36	119,49	3,99	727,95	327,44	194,48	631,87	645,73
2966	541,60	76,69	118,74	3,87	720,90	334,40	198,43	631,16	651,40
2967	538,74	75,93	118,73	3,67	711,82	341,02	202,31	629,03	655,37
2968	536,93	76,41	117,69	3,58	706,15	348,12	206,56	630,65	658,91
2969	536,06	76,53	117,18	3,48	701,52	354,69	210,69	631,10	662,71
2970	533,79	76,80	117,12	3,29	698,19	362,20	215,13	630,99	666,02
2971	530,45	76,36	117,16	3,29	693,74	369,28	219,32	629,40	669,59
2972	527,77	77,14	116,55	3,07	690,47	376,71	223,74	628,58	672,57
2973	523,88	77,26	116,52	2,97	685,77	383,06	228,03	625,23	676,64
2974	518,41	76,63	115,72	2,88	683,53	390,19	232,45	620,37	677,00
2975	512,28	75,81	114,53	2,78	679,52	397,64	236,53	614,12	679,99
2976	504,00	76,62	114,80	2,68	675,65	404,97	241,23	607,99	682,60
2977	497,05	75,67	113,30	2,58	671,64	412,43	245,83	598,68	682,29
2978	474,65	77,69	146,36	11,26	648,27	419,64	248,89	581,40	661,81
2979	573,58	77,42	153,25	10,97	617,53	424,58	255,13	562,72	632,46
2980	657,26	76,44	159,48	10,66	601,26	427,60	262,30	564,49	617,57
2981	599,32	77,41	138,89	10,46	592,21	427,91	269,14	574,75	619,04
2982	587,95	77,65	133,18	10,27	582,52	428,02	275,51	588,97	616,55
2983	592,37	77,71	130,35	9,96	580,34	427,45	281,28	604,40	615,66
2984	600,11	77,35	130,57	9,76	585,36	425,31	286,33	616,14	615,84
2985	596,96	77,66	128,79	9,57	593,97	423,85	290,97	625,08	622,30
2986	600,94	77,57	128,39	9,26	596,72	421,17	294,90	634,10	628,40
2987	606,82	78,17	128,69	9,06	600,67	418,65	298,54	640,43	635,31
2988	609,22	78,06	129,27	8,87	609,16	415,68	301,65	648,67	641,00
2989	614,34	78,12	130,31	8,58	617,68	414,24	304,78	656,12	646,33
2990	614,79	77,31	130,66	8,36	626,30	413,38	307,64	662,87	652,58
2991	616,08	77,63	130,23	8,16	638,62	411,92	310,21	666,92	656,39
2992	616,66	78,34	130,38	7,97	652,38	410,89	312,60	672,73	661,73
2993	612,93	77,54	129,40	7,78	664,01	409,60	314,68	677,97	666,19

2994	610,54	78,08	129,35	7,47	673,35	408,81	316,55	680,57	671,09
2995	609,08	77,91	129,06	7,27	682,23	408,48	318,37	681,72	675,86
2996	606,58	77,82	128,99	7,08	691,90	408,65	320,16	681,85	681,26
2997	604,48	77,77	128,83	6,86	699,16	407,48	321,61	685,30	685,03
2998	599,74	77,67	128,06	6,67	710,69	408,10	323,26	684,20	688,60
2999	596,17	78,41	127,63	6,48	717,53	407,50	324,50	684,38	692,68
3000	592,31	78,45	126,78	6,28	722,64	407,14	325,76	683,09	696,29
3001	587,26	78,57	126,13	6,07	726,61	408,13	327,07	680,17	700,79
3002	584,82	77,98	125,92	5,97	732,01	407,80	328,28	679,52	706,10

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

INVICTA FRANCE

Poêle bois de fonte
Cast iron wood stove

KAZAN
Référence 6104-44

KAZAN GA
Référence 6104-43

KIARA
Référence 6104-42

OWNER'S MANUAL

Installation and Operating Instructions

SAVE THIS OWNER'S MANUAL
FOR FUTURE REFERENCE

PLEASE READ THIS ENTIRE OWNER'S MANUAL BEFORE YOU INSTALL AND USE YOUR NEW INVICTA WOOD STOVE.

If this room heater is not properly installed, a house fire may result.
To reduce the risk of fire, follow the installation instructions.
Failure to follow these instructions can result in property damage, bodily injury, or even death.
Conforms to UL Std. 1482
Certified to ULC Std. S627

CONTACT LOCAL AUTHORITIES WITH JURISDICTION (BUILDING DEPARTMENT or FIRE OFFICIALS), ABOUT PERMITS REQUIRED, RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA.

C US Energy Verified

We recommend that our products be installed and serviced by professionals who are certified in the U.S. by NFI (National Fireplace Institute).
www.nficertified.org

Wood Energy Technology Transfer Inc. Certified

APC LES PROFESSIONNELS DU CHAUFFAGE D'APPOINT

California Prop 65

WARNING: This product can expose you to chemicals including glass wool fiber and carbon monoxide which are known to the State of California to cause cancer, birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

NOTES ON STOVE OPERATION AND EFFICIENCY

Rating:

You have purchased an Invicta stove tested to EPA Method 28R single burn rate stove 40 CFR Part 60 where applicable. This stove is certified to comply with the U.S. Environmental Protection Agency 2020 particulate emissions standard using crib wood. It is certified at 1.76gr/hr. emission rate and under specific test conditions has been shown to deliver heat at rates ranging from 23,070 to 23,830 Btu (output).

This wood heater has a manufacturer-set 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.

Please refer to the Warranty section of this manual for registration instructions. In case of warranty claims, please contact the point of original sale or the nearest authorized Invicta dealer. Our dealer network processes all warranty claims. Authorized Invicta dealers can be located at www.invictastoves.com.

This heater 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:** *Garbage, lawn clippings, material containing rubber (including tires), materials containing plastic, waste petroleum products paints or paint thinners, asphalt products, materials containing asbestos, construction or demolition debris, railroad ties, pressure treated wood, manure or animal remains, salt water driftwood or other previously salt water saturated materials, unseasoned wood, paper products, cardboard, plywood or particleboard.* This prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, sawdust, wax and similar substances for the purpose of starting a fire in an affected wood heater. Burning these materials may result in a release toxic fumes or render the heater ineffective and cause smoke.

Following the maintenance guidelines set forth in this manual will help insure the efficient use of your wood heater and minimize visible emissions. Having your stove inspected by a trained professional on a regular basis will greatly increase the potential for recognizing potential impacts to efficiency.

Proper draft is important to the efficient operation of your heater. Refer to the Normal Operation section of this manual for information regarding adequate draft. Both excessive and sub-minimum draft can affect the efficiency of your wood heater. Excessive draft can lead to over-consumption of fuel, lower overall heating capacity of the stove and potential over firing. Low draft can result in inefficient burns, low heat output, expulsion of smoke into the living area when stove doors are opened and an increased potential for build-up of flammable materials in the flue.

Efficiency:

Efficiency was measured and weighted using EPA Method 28R and CSA B415-10 methodology. A weighted average was used to calculate the overall efficiency using the higher heating value (HHV). The weighted average efficiency is 63,4% (HHV).

To maximize the efficiency of your wood stove, make sure it is sized properly for the space you plan to heat. An oversized stove will often be forced to burn at a lower and dirtier burn rate. Consult with your dealer for sizing and correctly placing the stove in your home. An incorrectly placed stove can greatly reduce efficiency. Maximizing the efficiency of your stove will heat your house quickly, burn cleaner and use less wood.

Refer to the Choosing Firewood section of this manual for appropriate fuel selection. Seasoned firewood is typically at or near 20% moisture content. This can be measured with any number of hand-held moisture meters available through your local hearth shop. Follow instructions included in the meter you purchase to measure fuel wood moisture content. Burn only dry, seasoned wood as using wet wood will greatly reduce your efficiency.

CO Emissions:

This Invicta series has the following CO emission rates by burn level: 1.76gr./min. Wet wood or unapproved fuel described above can greatly affect the emissions of a wood burning stove.

Smoke/Fire/CO Detectors:

It is highly recommended that smoke and CO detectors be installed throughout the heated space when a wood burning heater is installed. Be certain to install these devices not only in the area where the wood appliance is located, but also in bedrooms, hallways leading to other areas of the house and all common areas of the heated space. Check the batteries in these devices and assure operation by performing whatever test operations are recommended by the manufacturer.

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KAZAN GA RÉFÉRENCE 6104 43 31
KIARA RÉFÉRENCE 6104 42 33

INTRODUCTION

Thank you for purchasing an Invicta woodstove from Energy Distribution 2015. This stove will provide years of comfortable heat. This Invicta series offer you modern technology with the unique beauty and qualities of cast iron. We trust that you will appreciate the quality of this handcrafted product.

Your Invicta series woodstove burns efficiently, and produces a large amount of heat. However, you should not consider this stove as the primary heat source for your home.

Please read this manual in its entirety. Its purpose is to familiarize you with your stove's safe installation, proper break-in, operation and maintenance. It contains extremely important information so keep it handy and refer to it often.

A qualified heating technician may need this owner's manual as a reference when installing this stove in your home. There are national, state, and local building codes that direct the technician on how to install your stove. These codes stipulate the dimension of stovepipe and clearances to walls, ceilings, hearth, and other combustible surfaces. The codes exist to reduce the risk of fire. Failure to follow these instructions can result in fire, property damage, bodily injury, and even death.

Install the stove in a safe, open area, away from traffic flow, doors, and hallways. If possible, try to install the stove near an existing chimney and chimney connector. It is extremely important to install this stove with the proper clearance from combustible surfaces. You can purchase specific connector pipe and special wall coverings as specified by this manual and the NFPA 211 code to protect combustible surfaces. As a general rule, keep furniture, drapes, curtains, wood, paper, and other combustibles at least 36 inches (92 cm) away from the stove. Never install the stove in or near a storage location for gasoline, kerosene, charcoal lighter fluid or any other flammable liquids.

Install the stove in your central living area to allow heat to radiate naturally to distant rooms. Do not install your stove in a poorly insulated area. This is inefficient and would likely result in higher fuel usage.

- **SAFETY NOTICE :**

  AN IMPROPERLY INSTALLED STOVE CAN RESULT IN A HOUSE FIRE. FOR YOUR SAFETY, CAREFULLY FOLLOW THE INSTALLATION DIRECTIONS. CONTACT LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA.

The safety of your stove will depend on many factors, some of which include: distance to combustible objects, correct venting, and adequate chimney maintenance. Should you have any questions, do not hesitate to contact your dealer for additional information.

Contact your dealer for any necessary warranty service.

This Invicta series stove is warranted by:

Energy Distribution 2015
1361 Denison ouest
St-Alphonse, Qc J0E 2A0, Canada
www.Invictastoves.com

CODES

When you install your Invicta serie woodstove, it is imperative that you adhere to all Federal and local codes. Obtain these codes from either of the following sources:

American National Standards Institute, Inc. (ANSI)
1430 Broadway New
York, NY 10018
www.ansi.org

National Fire Protection Association, Inc. (NFPA)
Battery March Park Quincy,
MA 02269 www.nfpa.org

Do not install in a mobile home.

SAFETY INFORMATION

Read and understand this Owner's Manual thoroughly before installing and using this stove.

Make sure to install your stove:

- According to the manufacturer's recommendations
- In accordance with all applicable codes
- With the proper sized chimney

When using your stove, follow these safety precautions:

- **Never** modify this stove in any way.
- **Never** burn kiln dried, painted or treated wood in this stove.
- **DO NOT BURN GARBAGE. Never** burn garbage or trash, colored or glossy paper, solvents, plywood, artificial logs, cardboard, or driftwood, in this stove.
- **Never** burn coal in this stove.
- **DO NOT BURN FLAMMABLE FLUIDS.**
- **DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE. Never** use gasoline, kerosene, charcoal lighter fluid, or other flammable fluids to start or invigorate the fire. These fuels will cause dangerous burning conditions in the stove. Keep all such materials away from the stove.
- **Never** use a wood grate or other device to elevate the fire.
- **Never** allow logs in the firebox to hit the glass when the door is closed.
- **Never** slam the door or use the door to force wood in to the stove.
- **Never** over-fire your stove.
- **Never** put articles of clothing or candles on a hot stove.
- **Never** connect the stove to a flue used by another appliance.

Other safety guidelines :

- Keep all combustible items such as furniture, drapes, clothing, and other items, at least 36" (0.92 m) from the stove
- Install a smoke detector, preferably in an area away from your wood stove.
- Keep a fire extinguisher handy. We recommend the type rated "A B C."
- Dispose of ashes properly. (See page 22)
- Keep children and pets away from the stove when it is burning; they could be seriously injured by touching a hot stove.
- Clean your chimney system as needed.
- Outside combustion air may be required if:
  1. This solid-fuel-fired appliance does not draw steadily, smoke rollout occurs, fuel burns poorly, or back-drafts occur whether or not there is combustion present.
  2. Existing fuel-fired equipment in the house, such as fireplaces or other heating appliances, smell, do not operate properly, suffer smoke roll-out when opened, or back-draft whether or not there is combustion present.
  3. Opening a window slightly on a calm (windless) day alleviates any of the above symptoms.
  4. The house is equipped with a well-sealed vapor barrier and tight fitting windows and/or has any powered devices that exhaust house air.
  5. There is excessive condensation on windows in the winter.
  6. A ventilation system is installed in the house.

If these or other indications suggest that infiltration air is inadequate, additional combustion air should be provided from the outdoors. Outside combustion air can be provided to the appliance by using an optional air dispenser.

PERIODIC CHECKLIST

Perform each of these tasks at the specified intervals.

At the End of Every Week:

- Empty ashes from the firebox, sooner if the firebox is full.

At the Beginning of Every Other Month:

- Depending upon your use of the stove, visually inspect the chimney connector and chimney for creosote.
- Check door seals using the "dollar bill test." - When the stove is cool, shut the door on a dollar bill. If the bill pulls out without any resistance, then your stove's door is not sealing properly. To tighten the seal, adjust the door latch mechanism or change the door gasket.

At the End of Every Season:

- Dismantle the chimney connector and clean it thoroughly. Replace any pieces that show signs of rust or deterioration.
- Inspect and, if necessary, clean your chimney.
  Clean out the inside of the stove thoroughly.
- Inspect all door gasket material and replace if worn, frayed, cracked or extremely hard.

EMERGENCY PROCEDURES

If you have a stovepipe or chimney fire, follow these instructions:

1. If the fire is too threatening, leave the area and call the fire department immediately! If not, perform the next three steps.
2. Close the stovepipe damper (if present).
3. Keep the stove front door closed!

WARNING : DO NOT ATTEMPT TO PUT OUT A STOVEPIPE OR CHIMNEY FIRE BY THROWING WATER ONTO THE STOVE, STOVEPIPE, OR CHIMNEY. THE EXTREMELY HIGH TEMPERATURE OF SUCH FIRES CAN CAUSE INSTANTANEOUS STEAM AND SERIOUS BODILY HARM.

Once the chimney fire expires, let the fire in the stove die out completely. Inspect the stove, stovepipe, and chimney thoroughly for any sign of damage before firing the stove again. You must correct any damage before using your stove again.

Establish a routine for the fuel, wood burner and firing technique. Check daily for creosote build-up until experience shows how often you need to clean to be safe. Be aware that the hotter the fire the less creosote is deposited, and weekly cleaning may be necessary in mild weather even though monthly cleaning may be enough in the coldest months. Contact your local municipal or provincial fire authority for information on how to handle a chimney fire. Have a clearly understood plan to handle a chimney fire.

SPECIFICATIONS

Maximum Heat Output:

42,000 BTUs per hour of cordwood (based on independent laboratory test results).

Floor Size of Heated Area:

Up to a maximum of 1,500 square feet. Factors unique to your home can reduce the square footage the stove will heat. Home insulation value, number and efficiency of windows, floor plan, stove placement, quality of the fuel and other conditions may limit the heating ability of the stove.

Firebox Capacity:

1.53 cubic feet.

Maximum Log Length: Up to 22” (56cm).

Emissions: 1.76 g/hr.

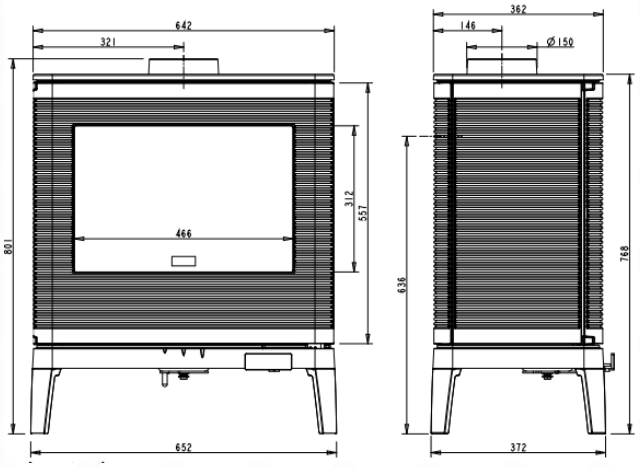
Burn Time: Up to **4**+ hrs.

Note: The amount and weight of wood contained per cubic foot of firebox volume can vary from 10 to 25 lbs. per cubic foot depending on type of wood, moisture content, packing density and other factors.

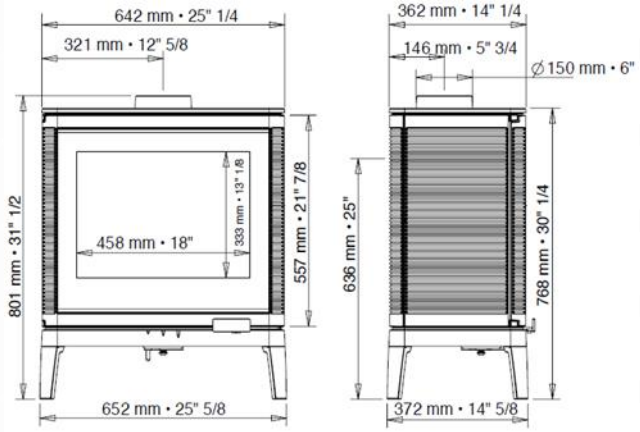
Stove Dimensions: (see drawing for exact dimension of each model)

Connector Size: **6**" (178 mm) diameter
Metal Chimney: **6**" (178 mm) inside diameter
Masonry Chimney: 6” (178 mm) inside diameter (round flue), 8” x 8” (203 x 203 mm) (square flue)

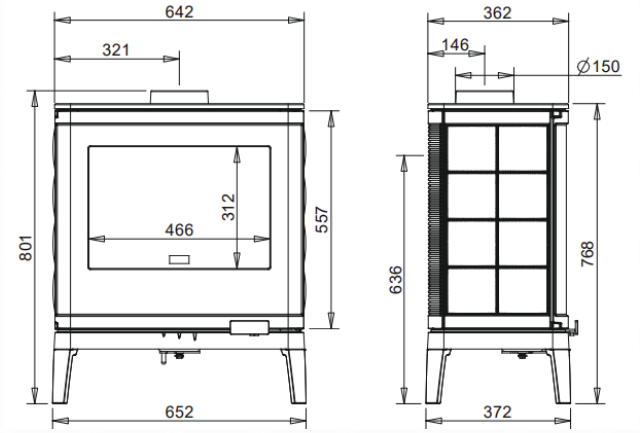
KAZAN 6104-44



KAZAN GA 6104-43



KIARA 6104-42



INSTALLATION

UNPACKING

Energy Distribution packages your Invicta series woodstove with the greatest care so that it ships safely. Under certain circumstances, however, damage may occur during transit and handling. When you receive the Invicta, carefully unpack and inspect the stove and all accompanying parts. Ensure that all parts are included inside the stove. If any parts are damaged or missing, please contact your authorized Invicta dealer immediately.

Be sure to remove the packaging material in the flue collar and above the baffle before installing the chimney.

PACK LIST

Invicta serie Kazan, Kazan GA, Kiara Woodstove Owner's Manual

The label is attached by a cable below the ashtray inside the stove.

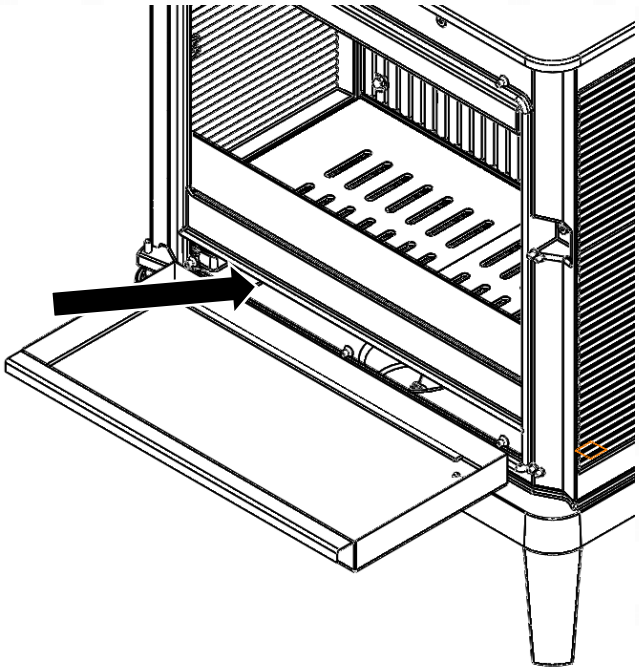


Figure 2 - Label Location

INSTALLING YOUR STOVE

Choose a place to install your Invicta woodstove. Consider the location of your stove for optimum heating efficiency. In general, it is better to place your stove in a main living area, rather than in a basement or other confined space.

Inspect this location to make sure that the stove and stovepipes will have the required clearance from combustible materials that are near the stove. Combustibles include walls, floor, ceiling, and chimney chase. You must carefully consider the clearances to all of these combustibles before actually connecting your stove.

If the floor is made of combustible material, then a non-combustible floor protector is required between the floor and the stove. An example of a non-combustible floor protector is a hearth constructed with a continuous layer of tile, brick, slate, glass or another non-combustible facing. There is no R-value requirement.

If you use a rear connector pipe, ensure it is listed with Underwriter's Laboratories. Check the listing of your pipe with UL for the correct clearances.

The diagrams in this manual represent typical installations, but are specific to the Security Chimney brand.

Clearances to NFPA Code 211 Protected Surfaces

You can reduce the clearances to combustible surfaces by using any National Fire Protection Agency (NFPA) approved wall protection system with additional approval of the regulatory authority having jurisdiction in your area. Please refer to NFPA Code 211 for specifications and complete details. You can obtain this information directly from the NFPA.

National Fire Protection Agency
Batterymarch Park
Quincy, MA 02269
1-800-344-3555
1-617-770-3000 www.nfpa.org

HEARTH REQUIREMENTS & FLOOR PROTECTION

Ensure you protect combustible flooring with a covering of non-combustible material. This Invicta series does not require an insulated hearth pad. The minimum floor protection must be met under the stove and extend beyond the stove as follows:

The minimum floor protection for US installations is 41'' ¼ x 36'' ¼
The minimum floor protection for installations in Canada is 41 ¼ x 40'' 1/4

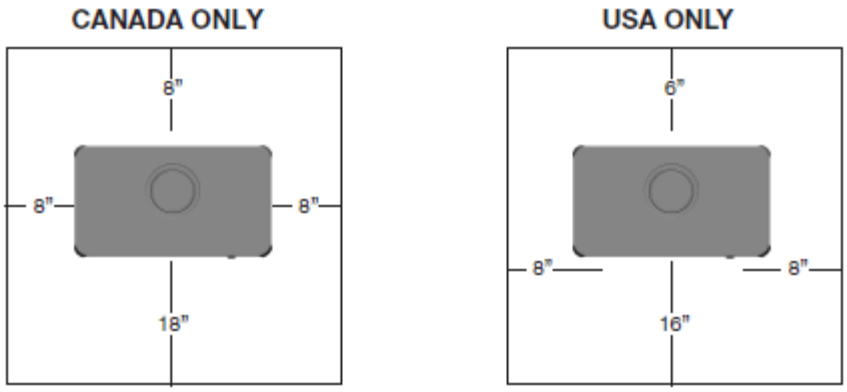


Figure 3 – Hearth Dimensions

COMBUSTIBLE SURFACE REQUIRED CLEARANCES

Note: *Dimensions shown in the following figures are from the body of the stove unless otherwise indicated.*

It is very important to follow minimum clearances for chimney connectors to combustibles such as walls and ceilings when installing the stove near combustible surfaces

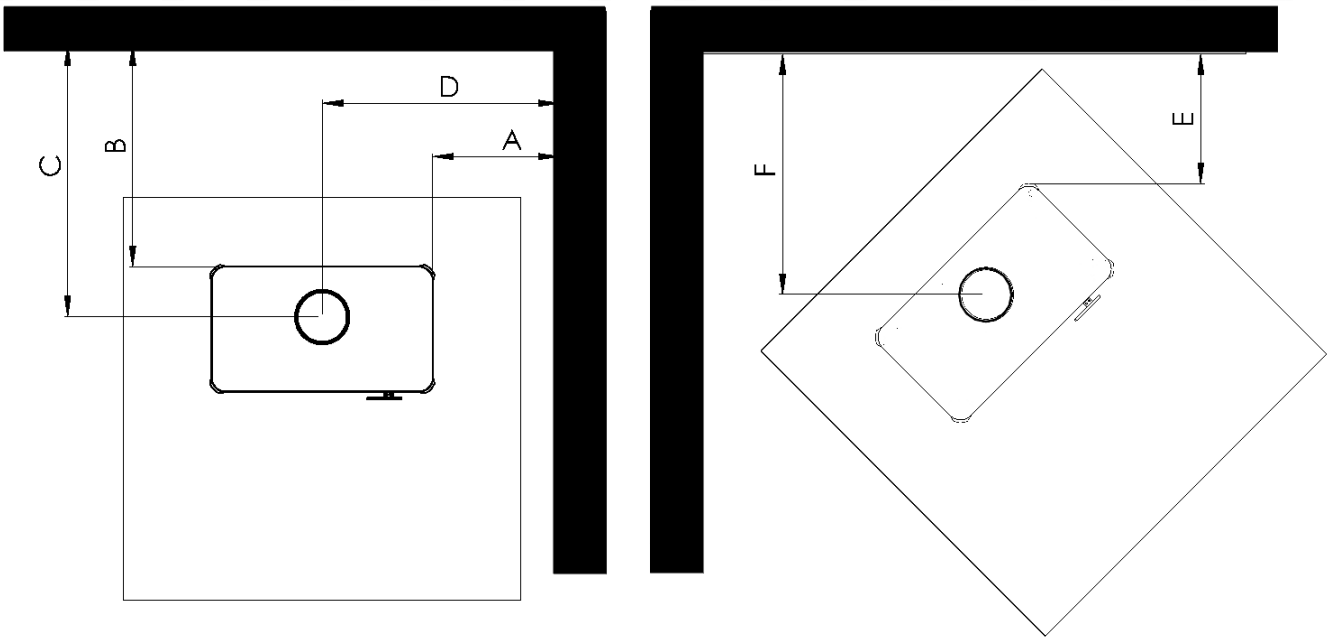


Figure 4 – Clearance to Combustibles

	Parallel				Corner	Corner
Clearances	A	B	C	D	E	F
Single wall Connector	20”-51cm	16”-41cm	21.5”-55cm	32.5”-83cm	15-38cm	27”-69cm
Double Wall Connector – Inc. Rear Heat Shield	22”-56cm	6”-15cm	11.5”-29cm	34.5”-88cm	15”-38cm	27”-69cm

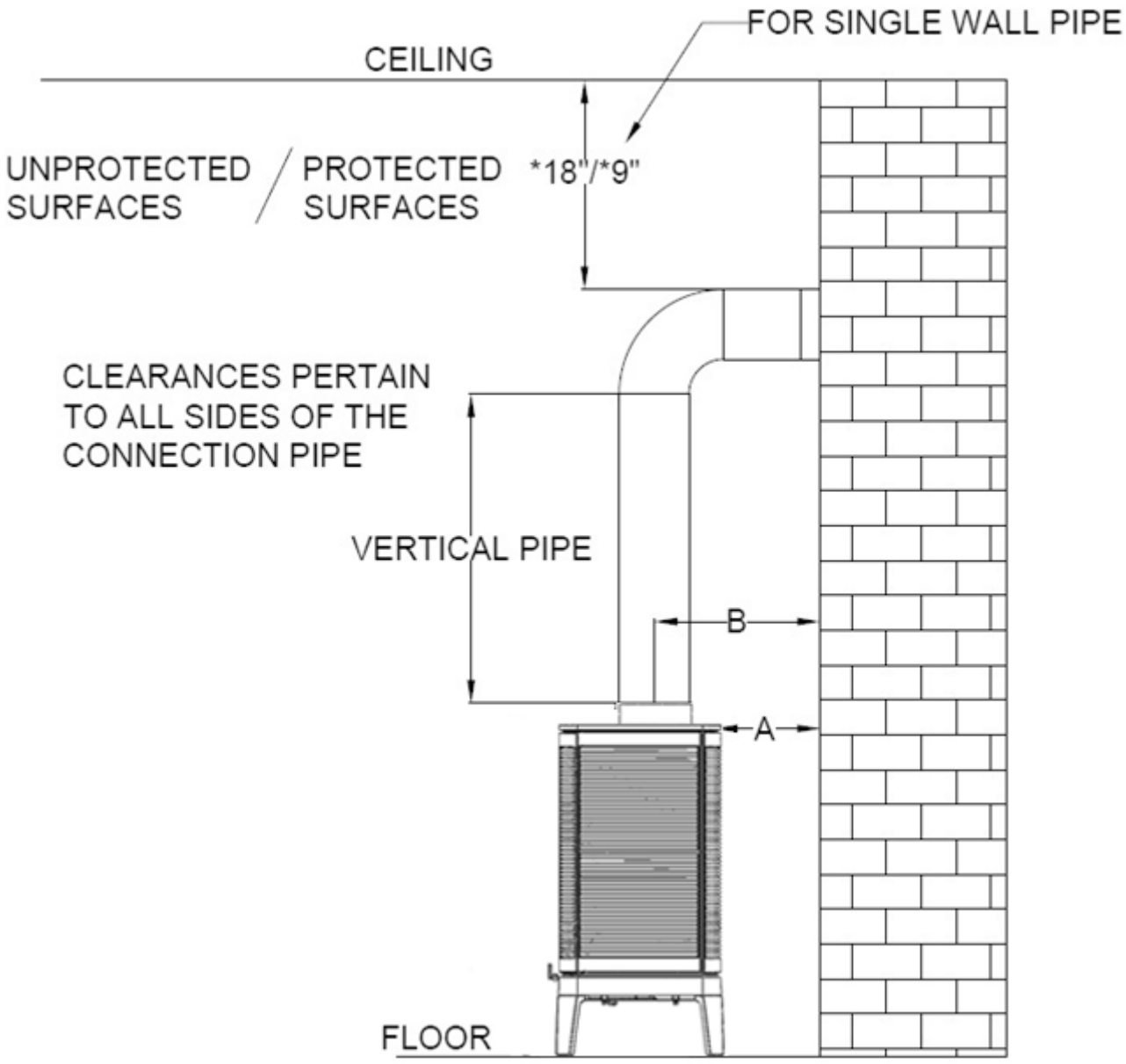
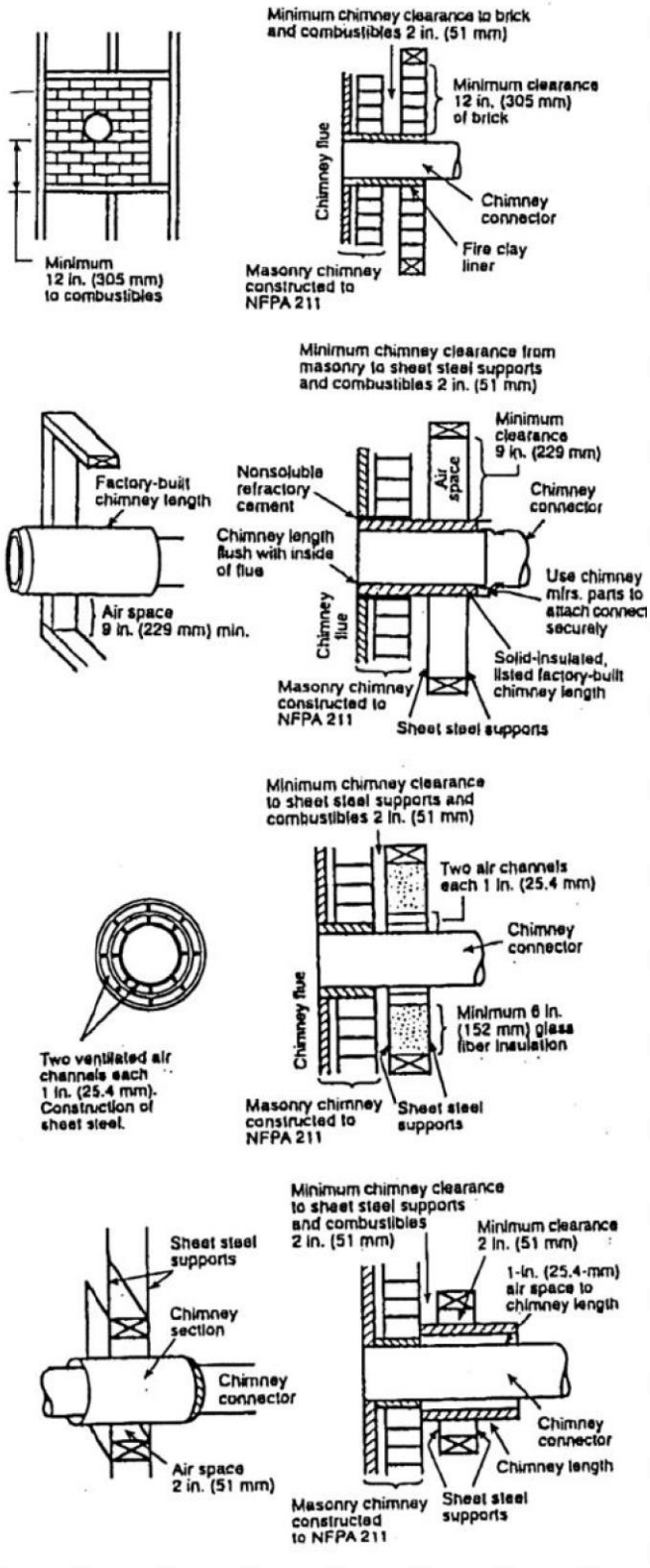


Figure 5 Chimney Connector Clearances

	Single Wall Pipe		Double Wall Pipe	
Through the wall top flue exit				**Inc. Rear Heat Shield**
A		16” (41cm)		6” (15 cm)
B		21.5” (55 cm)		11.5” (29cm)

***For double wall pipe clearance to ceiling, refer to pipe manufacturer specifications.**
See Parallel Clearance to Combustibles for clearances to the sides of the stove. Minimum ceiling height is 84’’.



CHIMNEY CONNECTOR SYSTEMS AND CLEARANCES FROM COMBUSTIBLE WALLS

FOR RESIDENTIAL HEATING APPLIANCES

A. Minimum 3.5in thick brick masonry all framed into combustible wall with a minimum of 12in. brick separation from clay liner to combustibles. The fire clay liner shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.

B. Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1in. or more of insulation with a minimum 9in. air space between the outer wall of the chimney length and combustibles.

C. Sheet steel chimney connector, minimum 24 gauge in thickness, with a ventilated thimble, minimum 24 gauge in thickness, having two 1in. air channels, separated from combustibles by a minimum of 6in of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge in thickness.

D. Solid insulated, listed factory-built chimney length with an inside diameter 2in. larger than the chimney connector and having 1in. or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24-gauge thickness, with a minimum 2in. air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12in. chimney section spaced 1in. away from connector using sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports securely fastened to wall surfaces of minimum 24-gauge thickness. Fasteners used to secure chimney

section shall not penetrate chimney flue liner.

OUTSIDE AIR SUPPLY

You can connect an outside air source as closed as possible to this stove using an optional air dispenser. The advantage of providing outside air directly to the stove is that the air used by the stove for combustion is taken from outside the residence rather than from within the room where the stove is located.

The outside air dispenser will allow to bring sufficient air intake to a minimum 3" (76 mm) diameter duct (supplied by others) * which leads to the outside of the house. When considering placement of the air dispenser from the outside of the house, keep in mind the need to avoid structural members of the house.

Locate the termination of the duct on the outside wall of the home in such a manner to avoid the possibility of obstruction by snow, leaves or other material. Screen the termination using ¼" x ¼" mesh rodent screen and cover it with a rain/wind proof hood (flex pipe, outside termination, mesh, and hood supplied by others) Contact your dealer for availability.

VENTING COMPONENTS & CONFIGURATION REQUIREMENTS

- **DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE USED BY ANOTHER APPLIANCE**

- Single wall connector that is at least 24 MSG or 25 MSG blued steel stovepipe.

- Double wall connector (Rear pipe) which is used with a listed, factory-built "Type HT" chimney or with a masonry chimney to reduce clearances, is available from several manufacturers, your dealer can help you choose. Some air insulated connector pipe models available are Simpson Dura Vent DVL and Metalbestos DS. Security, GSW, ICC and Ameritec also have acceptable Rear connector pipe.

- The chimney connector cannot pass through a floor or ceiling, nor any attic or roof space, closet or similar concealed space. Where venting requires passage through a wall or partition of combustible construction, the installation must conform to NFPA Code 211 or CAN/CSA - B365.

- Be sure to follow the manufacturer's instructions to maintain an effective vapor barrier at the location where the chimney of other component penetrates the exterior of the structure

- It is very important to follow minimum clearances for chimney connectors to combustibles such as walls and ceilings when installing the stove. Typical chimney connector clearances are outlined below. The single wall clearances are generic; the double wall clearances shown are specifically for Security brand and may vary with other brands. ***Check the specifications from the manufacturer of your connector.***

COMPONENTS OF A VENTING SYSTEM

The complete venting system consists of several components: chimney connector, wall thimble, wall pass-through, chimney, and liner. It is *absolutely necessary* that you install all of these components and maintain the clearances to combustibles discussed earlier to ensure a safe stove installation.

To protect against the possibility of a house fire, you *must properly install and constantly maintain the venting system in good condition. Be sure to inspect the chimney and chimney connector and keep it clean.* Upon inspection, immediately replace rusted, cracked, or broken components. Failure to follow these instructions and specified components or using make-shift compromises can result in fire, property damage, bodily injury, and even death.

- The *chimney connector* is the stovepipe from the woodstove to the chimney. The chimney connector stovepipe is 6" (152 mm) diameter, 24 MSG or 25 MSG blued steel connector pipe. *Do not use aluminum or galvanized steel pipe* - they cannot withstand the extreme temperatures of a wood fire.
- The *thimble* is a manufactured (or siteconstructed) device installed in combustible walls through which the chimney connector

passes to the chimney. It keeps the walls from igniting. You must use a wall thimble when installing a chimney connector through a combustible wall to the chimney.

- A *wall pass-through* (or chimney support package) also keeps the walls from igniting. You must use one when connecting through a wall or ceiling to a prefabricated chimney.

- Only install this stove to a *lined masonry chimney* or an *approved high temperature prefabricated residential* type building heating appliance chimney. *Do not* connect this stove to a chimney serving another appliance; you will compromise the safe operation of both the wood stove and the connected appliance.

- A *liner* is the UL 1777 or ULC S635 (for factory built fireplace or masonry) chimney.

You must connect your stove to a chimney comparable to those recommended in this manual. *Do not use stovepipe as a chimney*. Use stovepipe for freestanding installations only to connect the stove to a proper chimney.

- **WARNING: DO NOT CONNECT THIS APPLIANCE TO ANY AIR DISTRIBUTION DUCT OR SYSTEM.**

INSTALLING A VENTING SYSTEM

Attach stovepipe sections to the flue collar and to each other with the crimped end toward the stove. If creosote builds up, this allows the creosote to run into the stove and not on the outside of the stovepipe or onto the stove.
Secure all joints, including attaching the stovepipe to the stove's flue collar, with three sheet metal screws. Install #10 x 1/2" (3 mm x 13 mm) sheet metal screws into the holes pre-drilled in the flue collar. Disregarding the screws can cause joints to separate from the vibrations that result from a creosote chimney fire.

You can simplify connecting stovepipe by using additional accessories such as telescoping pipes, slip-connectors or clean-out tees. These accessories ease the periodic inspection of your chimney, as well as allow you to dismantle the stovepipe easily (without moving the stove).

Install the stove as close as practical to the chimney, while maintaining all proper clearances. Install stovepipe that is as short and as straight as possible.

Horizontal runs of stovepipe must always rise away from the stove at a minimum of 1/4" per foot (21mm/m).

We do not recommend long runs of stovepipe to increase heat dispersal. Longer lengths of stovepipe, or more connecting elbows, than necessary increase the chances of draft resistance and the accumulation of creosote buildup.

In general, you do not need to install a stovepipe damper with the Invicta series. Some installations, however, could benefit from a stovepipe damper, such as a tall chimney which can create a higher than normal draft. In such cases, a damper can help regulate the draft. The Invicta series requires a draft between 0.06" and 0.1" WC. For drafts above 0.1" WC, install a stovepipe damper. Check the draft at stove installation time.

Remember, the NFPA recommends minimum clearances for chimney connectors to combustibles such as walls and ceilings. Once the stove is installed at safe distances from these combustible surfaces, it is also important to maintain these connector clearances for the remainder of the installation.

CONNECTING THE STOVE TO A CHIMNEY

You can install your Invicta to a prefabricated metal chimney, or to a masonry chimney.

This room heater must be connected to (1) a listed Type HT (2100° F) chimney per UL 103 or ULC S629, or (2) a code-approved masonry chimney with a flue liner. The chimney size should not be less than the flue collar, or more than three times greater than the cross-sectional area of the flue collar.
We recommend installing a cleanout tee where possible to simplify chimney cleaning and maintenance.

Connecting to a Prefabricated Metal Chimney

There are two ways to install a prefabricated metal chimney:

- An *interior* installation where the chimney passes inside the residence through the ceiling and roof.

- An *exterior* installation where the chimney passes through the wall behind the stove then up the outside of the residence.

Whenever possible, choose an interior chimney. An interior chimney heats up quickly and retains its heat; thus promotes a better draft and discourages the formation of creosote. An exterior chimney does not

benefit from the warmth of the building, so it typically operates at lower flue temperatures than an interior chimney and may experience increased creosote accumulation.

When connecting the Invicta to a prefabricated metal chimney, you must follow, precisely, the manufacturer's installation instructions. Use only Type HT (2100° F), prefabricated metal chimneys listed per UL 103 or ULC S629 standards.

Ensure the size of the prefabricated chimney's flue is appropriate for the Invicta stove. This Invicta series requires a 6" (152 mm) inside diameter flue for new installations. A 6" diameter flue provides adequate draft and performance. An oversized flue contributes to creosote accumulation. (In this case, bigger is NOT better.)

When purchasing a prefabricated chimney to install with your stove, ensure you also purchase from the same manufacturer the wall pass-through (or ceiling support package), "T" section package, fire-stops (when needed), insulation shield, roof flashing, chimney cap, and any other required accessories. Follow the manufacturer's instructions when installing the chimney and accessories. In addition, ensure you maintain all manufacturers' recommendations for the proper clearances to the chimney.

Connection to a Masonry Chimney

Consider two primary elements when connecting your stove to a masonry chimney: the chimney itself and the thimble where the stovepipe connects to the chimney. **Use only code approved masonry chimneys containing a proper flue liner.**

Before connecting to a masonry chimney, hire a professional to examine the chimney for cracks, loose mortar, and other signs of deterioration and blockage. If the chimney needs repair, complete them before installing and using your stove. Do not install your stove until the chimney is safe for use.

Ensure the chimney's cleanout is complete and working properly. To avoid a loss of draft, the cleanout door must close completely and provide a tight seal. If the cleanout door leaks, the chimney will cool, your stove will perform poorly, and creosote can form.

Ensure the size of the chimney's flue is appropriate for this stove and that it is not too large. Use a masonry chimney with a maximum 6" Diameter or 8" x 8" (203 mm x 203 mm) tile size for best results. An oversized flue contributes to the accumulation of creosote.

Use the following checklist to ensure that your masonry chimney meets these minimum requirements:

MASONRY CHIMNEY WALL CONSTRUCTION :

- Mortared brick or modular block at least 4" (102 mm) thick – must use liner
- A mortared rubble or stone wall – must use liner

FLUE LINER OPTIONS :

- Tile - minimum wall thickness of 5/8" (16 mm), installed with refractory mortar, and with at least 1" (25 mm) air space around the liner
- Stainless steel - UL listed 6" diameter, insulated or wrapped liner, or the space around the liner filled with vermiculite or suitable material (these keep the liner warmer for better performance)
- Ensure any equivalent flue liner is a listed chimney liner system meeting type HT requirements or other approved material.

INTERIOR CHIMNEY REQUIREMENTS :

- Must have at least 2" (51 mm) clearance to combustible materials
- Must install fire stops at the spaces where the chimney passes through floors and/or ceiling
- Any insulation material must be at least 2" (51 mm) from the chimney

EXTERIOR CHIMNEY REQUIREMENTS :

- At least 1" (25 mm) clearance to combustible materials

CHIMNEY HEIGHT REQUIREMENTS (SEE *FIGURE 9*):

- At least 3 feet (0.9 m) higher than the highest part of the roof opening through which it passes.
- At least 2 feet (0.6 m) higher than any part of the roof within 10 feet (3 m) measured horizontally from the top of the chimney.

The recommended minimum chimney height is 15 feet (4.5 m) off the floor. The recommended maximum chimney height is 45 feet (13.5m). This Invicta series requires a draft between 0.06" and 0.1" water column. Ensure your chimney is long enough to provide the minimum draft, and use a damper if your installation has a required chimney height that provides too much draft.

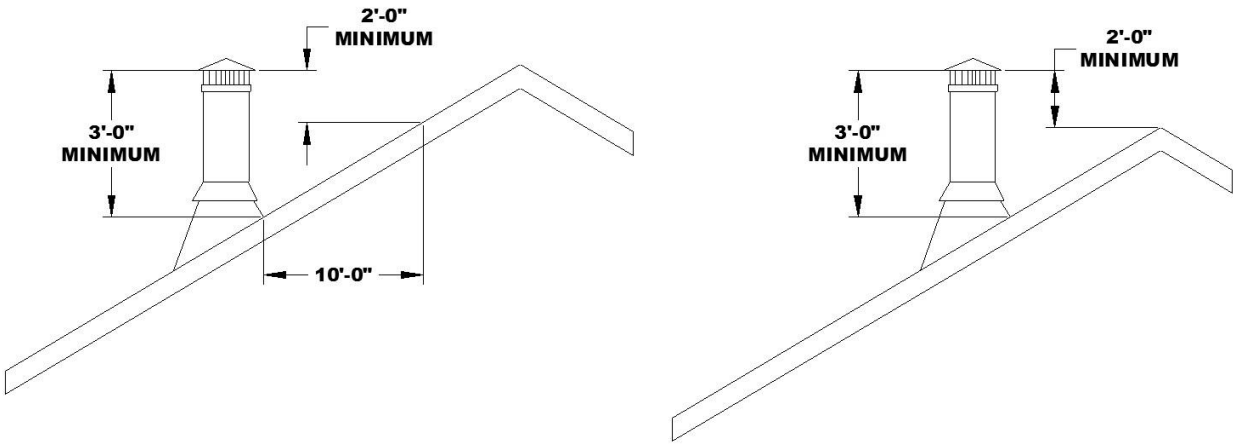
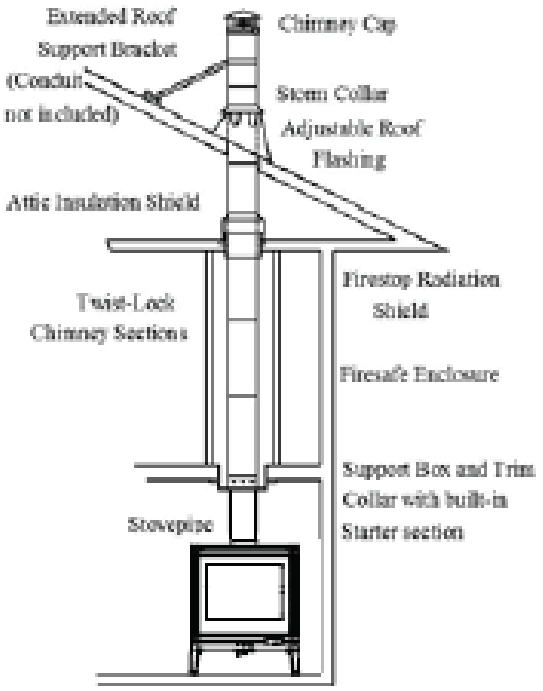
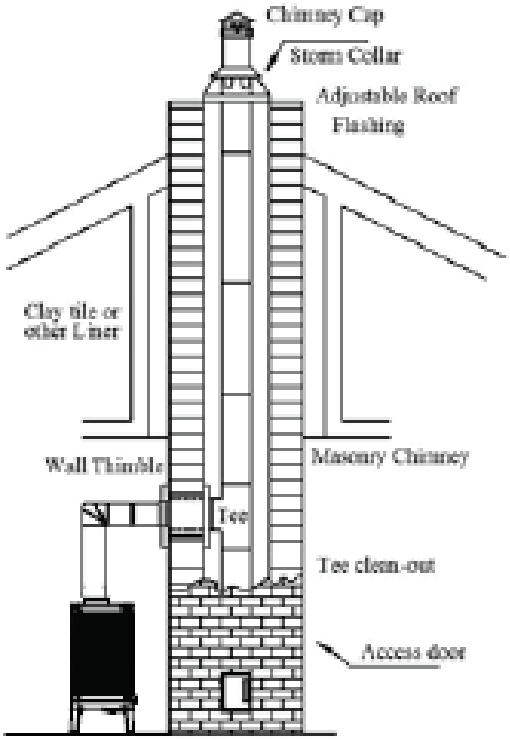


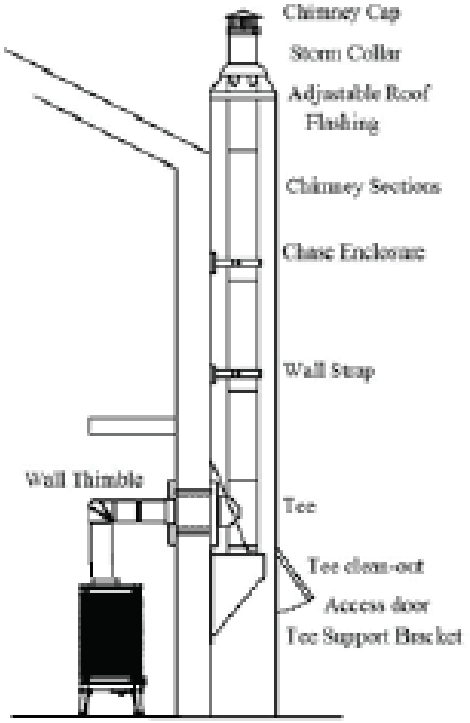
Figure 8 – Chimney Height Requirements



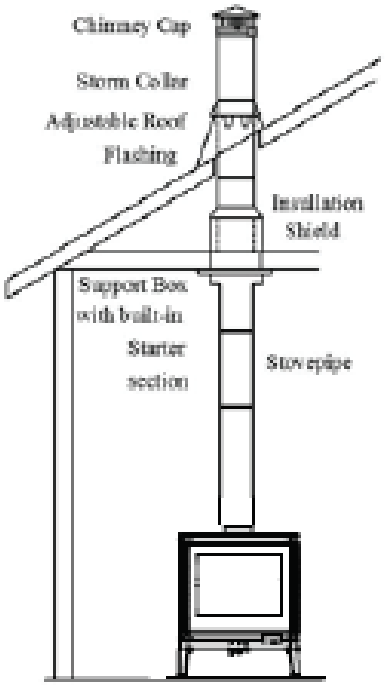
Two story house installation with attic.



Chimney pipe through Clay tile
or other Lined Masonry Chimney



Chimney through outer wall with enclosed chase.
Chimney is supported by Tee Support Bracket.



One story house installation with attic.
Chimney is supported by Ceiling.

Figure 9 – Typical Chimney Configurations

OPERATION

Once your INVICTA is installed, you are ready to light a fire.

Every installation, season's firewood, and operator's technique varies. Learn how to use your stove most efficiently for your installation. We can give you the basic principles, but only you can ensure maximizing the potential of your stove while also operating it safely.

- **WARNING : HOT WHILE IN OPERATION ! KEEP CHILDREN, PETS, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS.**

Read this entire chapter before lighting your first fire. It explains the controls and features of your wood stove, how to choose firewood, and how to use your stove on a daily basis.

OPENING THE DOOR

A glove is provided with your stove. Use it always when manipulating the door opening tool (cold hand). Always remove and place the cold hand away but close by the stove when not using it. Never let the cold hand hung in position to the stove. Burn may occur.

BURN RATE: This wood heater has a manufacturer pre-set 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.''

CHOOSING FIREWOOD

Burn only natural firewood (known as cordwood) in this INVICTA Wood Heater. This stove is not designed to burn other fuels.

- **CAUTION: DO NOT USE CHEMICALS OR FLAMMABLE FLUIDS TO START THE FIRE. DO NOT USE CHARCOAL, PELLETS, COAL, ARTIFICIAL LOGS OR ANY OTHER MATERIALS AS FUEL; THEY ARE NOT SAFE. DO NOT BURN GARBAGE OR FLAMMABLE FLUIDS.**
- **THE USE OF UNAUTHORIZED FUEL SUCH AS COAL COULD PRODUCE HIGH LEVELS OF CARBON DIOXIDE IN THE LIVING SPACE. AT HIGH LEVELS CARBON DIOXIDE COULD RESULT IN PERSONAL INJURY OR DEATH.**

The quality of your firewood directly affects heat output, duration of burn and performance of your stove. Softwoods generally burn hotter and faster, while hardwoods burn longer and produce better coals. Density and moisture content are two critical factors to consider when purchasing wood.

The following is a list of some wood species and their relative BTU (British Thermal Unit) content. The higher the BTU content, the longer the burn. Firewood with higher BTUs is generally ideal for a wood stove.

Burn untreated wood only. Other materials such as wood preservatives, metal foils, coal, plastic, garbage, sulphur, or oil may create creosote.

Wood Heat Value: Sorted By Btu Content

Common Name	Lb/ cord	MBTU/ cord
High		
Osage Orange (Hedge)	4,728	32.9
Hickory, Shagbark	4,327	27.7
Hop Hornbeam (Ironwood)	4,267	27.3
Beech, Blue (Ironwood)	3,890	26.8
Birch, Black	3,890	26.8
Locust, Black	3,890	26.8
Hickory, Bitternut	3,832	26.7
Locust, Honey	3,832	26.7
Apple	4,100	26.5
Mulberry	3,712	25.8
Oak, White	4,012	25.7
Medium High		
Beech, European	3,757	24
Maple, Sugar	3,757	24
Oak, Red	3,757	24
Ash, White	3,689	23.6
Birch, Yellow	3,689	23.6

Medium		
Juniper, Rocky Mtn	3,150	21.8
Elm, Red	3,112	21.6
Coffee tree, Kentucky	3.112	21.6
Hackberry	3,247	20.8
Tamarack	3,247	20.8
Birch, Gray	3,179	20.3
Birch, White (Paper)	3,179	20.3
Walnut, Black	3,192	20.2
Cherry	3,120	20
Ash, Green	2,880	19.9
Cherry, Black	2,880	19.9
Elm, American	3,052	19.5
Elm, White	3,052	19.5
Sycamore	2,808	19.5
Ash, Black	2,992	19.1
Maple, Red	2,924	18.7
Fir, Douglas	2,900	18.1
Medium Low		
Boxelder	2,797	17.9
Alder, Red	2,710	17.2
Pine, Jack	2,669	17.1
Pine, Norway (Red Pine)	2,669	17.1
Pine, Pitch	2,669	17.1
Catalpa	2,360	16.4
Hemlock	2,482	15.9
Spruce, Black	2,482	15.9
Pine, Ponderosa	2,380	15.2
Low		
Aspen, American	2,290	14.7
Butternut (Walnut, White)	2,100	14.5
Spruce	2,100	14.5
Willow	2,100	14.5
Fir, Balsam	2,236	14.3
Pine, White (Eastern, Western)	2,236	14.3
Fir, Concolor (White)	2,104	14.1
Basswood (Linden)	2,108	13.8
Buckeye, Ohio	1,984	13.8
Cottonwood	2,108	13.5
Cedar, White	1,913	12.2

Moisture content also plays a key role in the performance of your stove. Wood freshly cut from a living tree (green wood) contains a great deal of moisture. As you might expect, green wood burns poorly. You must season green wood before using it in your wood stove. To season green wood properly, split, stack, and allow it to air dry for a period of one year. Green wood may provide less than 2000 Btu per pound, whereas dry wood can provide up to 7000 Btu per pound.

Stack the firewood on skids or blocks to keep it off the ground, cover only the top of the stack. Plastic or tarps that cover the sides of the woodpile trap moisture and prevent the wood from drying. As for stacking, an old Vermonter said, "The spaces between the logs should be large enough for a mouse to get through, but not for the cat that's chasing it."

- **CAUTION: DO NOT STORE FIREWOOD WITHIN THE STOVE'S SPECIFIED CLEARANCES TO COMBUSTIBLE MATERIALS.**

BUILDING A FIRE

Once you understand the controls of your wood stove and have the appropriate firewood, you are ready to start a fire.

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

BREAKING IN YOUR WOOD STOVE

It is imperative that your stove is "broken in" gradually. Cast Iron must be "seasoned"; overfiring a new stove may cause cast iron to crack or may damage other stove parts. Natural moisture must be driven out slowly to minimize the “shock” to the cast iron of its first exposure to high firebox temperatures. In addition, the asbestos-free furnace cement must be cured slowly to ensure adequate sealing and bonding.

When you light your first fires, the woodstove will emit some smoke and fumes. This is normal “off gassing” of the paints and oils used when manufacturing the woodstove. If you find it necessary, open a few windows to vent your room. The smoke and fumes will usually subside after 10 to 20 minutes of operation. The odor and smoke will end once the stove is “cured”.

The first few fires of the season may produce other odors from impurities that exist in the area immediately surrounding the stove. Some potential impurities are cleaning solvents, paint solvents, cigarette smoke, and soot from scented candles, pet hair, dust, adhesives, a new carpet, and new textiles. These odors will dissipate over time. You can alleviate these odors by opening a few windows or otherwise creating additional ventilation around your stove. If any odor persists, contact your dealer or an authorized service technician.

If you adhere to the operating procedures in this manual, the steel and cast iron components of your stove will give you many years of trouble-free use.

Avoid the following conditions that can cause the glass, steel or cast iron pieces to break:

- Do not throw wood into the stove.
- Do not use the door as a lever to force wood into the stove.
- Do not load wood encrusted with ice into a burning stove - the thermal shock can cause damage.
- Do not use a manufactured log grate or otherwise support the fuel. Burn the fire directly on the floor of the firebox.

BUILDING A BREAK IN FIRE

1) Open the front door and place five or six double sheets of tightly twisted newspaper in the center of the firebox. Arrange kindling in a crisscross pattern over the newspaper. Kindling should be approximately ten pieces, 1/2" (13 mm) in diameter and 10" to 16" (254 mm to 457 mm) long.
2) Light the paper under the kindling. Leave the door slightly ajar momentarily until the kindling has started to burn and draft begins to pull.
3) Close the door and allow the fire to burn. Keep the door closed while the stove is in use.
4) KEEP A WATCHFUL EYE ON YOUR STOVE to maintain a steady fire. Your first fire should make the stove warm but **not hot to the touch**. Visible steam, or boiling moisture and hissing indicate the cast iron is too hot. At most, a few small chunks of wood should be added to the fire to reach safe break-in temperatures.
5) Once the stove is warm but **not hot to the touch,** allow the fire to die out completely.
6) Let the stove return to room temperature.

Your first fire and first fire each season thereafter should be built and maintained as outlined above. Your patience will be rewarded by a properly seasoned stove.

 NOTE : The cool flue gas temperatures present during the break-in procedure may cause rapid creosote build-up. The door glass may also get dirty. A good hot fire will clean it. We recommend a visual inspection (and cleaning if necessary) of your stovepipe and chimney once the break-in procedure is completed.

NORMAL OPERATION

BUILDING A FIRE FOR EVERYDAY USE

1) Open the front door and place five or six double sheets of tightly twisted newspaper in the center of the firebox. Arrange kindling in a tee-pee configuration over the newspaper. Use approximately 10 pieces of kindling, 1/2" (13 mm) in diameter and 10" to 16" (254 mm to 406 mm) long.
2) Light the paper under the kindling. Leave the front door slightly ajar momentarily until the kindling begins to burn and draft begins to pull (about 10 to 15 minutes).
3) Close the door and allow the fire to burn.
4) Once the kindling is burning, open the front door and add logs, small at first, to build the fire up. Ensure you keep the logs away from the glass in front in order for the air-wash system to work properly. Keep the front door closed while the stove is in use.

   CAUTION: DO NOT BUILD THE FIRE TOO CLOSE TO THE GLASS. KEEPING THE FIRE TOWARDS THE CENTER OF THE FIRE BOX WILL KEEP COALS FROM BUILDING UP AGAINST THE GLASS DURING RELOADING.
5) Once the fire is burning well, close the front door. Now the combustion is steady and your stove will be burning at its optimal efficiency.

Note: Always remember to use the cold handle before opening the front door. When opening the front door to reload or re-arrange logs, it is advisable to open the door just a crack, pause for a moment then open the door completely. This procedure allows the firebox to clear of smoke before the door is open fully. In addition, reloading on a bed of hot, red coals reduces smoking time and brings fresh fuel up to a

high temperature rapidly. During the refueling and rekindling of a cool fire, or a fire that has burned down to the charcoal phase, operate the stove with the door slightly crack for about 10 minutes to ensure that the fire is relighting faster. Once the fire as relight, door can be closed.

OVER-FIRE CAUTION

Over-firing means the stove is operating at temperatures above normal temperatures reached during High Burns outlined in the *BURN RATE* section. Carefully avoid over-firing, as it will damage the stove. Symptoms of chronic over-firing can include warped components, short burn times, a roaring sound in the stove or stovepipe, and discoloration of the stovepipe. A properly installed stove using fuel and following operating procedures as outlined in this manual should not over-fire.

Excessive draft, inappropriate fuel, and operator error can cause over-firing. Correct an over-fier situation as follows:

- **EXCESSIVE DRAFT:** Contact your local dealer to have a draft reading taken. Any draft in excess of 0.1 WC requires a damper in the stovepipe. Some installations may require more than one damper.
- **INAPPROPRIATE FUEL:** Do not burn coal; kiln dried lumber, wax logs, compressed wood, highly volatile fuels or combustibles, or anything other than natural cordwood.
- **OPERATOR ERROR:** Ensure all the gaskets are in good condition. Replace worn out or compressed gaskets. Only burn the stove with the firing and ash doors in the closed position.

If you suspect your stove is over-firing, discontinue use and contact your dealer immediately. **Damage caused by over-firing is not covered by your warranty**. Results of over-firing can include warped or burned out internal parts, cracked refractory panels, discolored or warped external parts, and damaged finish.

- **ANY SIGNS OF OVER-FIRING WILL VOID YOUR WARRANTY!**
- **THE FRONT DOOR MUST REMAIN CLOSED WHEN IN OPERATION**

REMOVAL AND DISPOSAL OF ASHES

You can leave a thin layer of ashes in the firebox if preferred. Allow fire to die down or go out completely. It is important to prevent ashes from building up around the front door opening or they will spill out, or they can pack into the gasket channel and prevent proper sealing. To remove ashes, use a fireplace shovel. Avoid removing large live coals by pushing them to the side and removing only the finer ash with a shovel.

Disposal of ashes - Ashes should be placed directly into a **metal** container with a tight fitting lid. Do not place any other items or trash into the metal container. Do not pour water into the container. Replace the container's lid and allow the ashes to cool. Never place the ash disposal container on a combustible surface or vinyl flooring, as the container could be **hot!**

Pending disposal, place the closed ash container on a non-combustible floor or on the ground outside, well away from all combustible materials, liquid fuels, or vehicles. Retain ashes in the closed container until all coals thoroughly cool.

If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled.

NEVER place ashes in wooden or plastic containers, in trashcans with other trash, or in paper or plastic bags, no matter how long the fire has been out. Coals within a bed of ashes can remain hot for several days once removed from the firebox.

MAINTENANCE

INSPECTION AND REPLACEMENT PROCEDURES

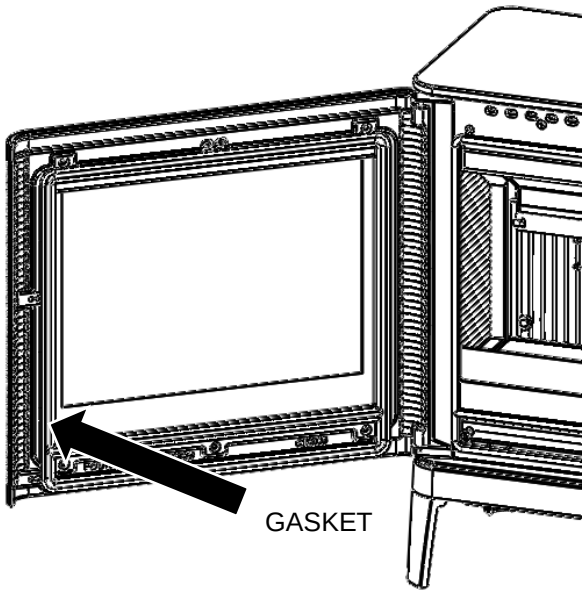
WARNING : THIS WOOD HEATER NEEDS PERIODIC INSPECTION AND REPLACEMENT FOR PROPER OPERATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH OPERATING INSTRUCTIONS IN THIS MANUAL

INSPECTING AND REMOVING/REPLACING THE BAFFLE

1. Allow the stove and ashes to fully cool.
2. Lift up on the right side baffle, and gently pull the left side baffle down and out of the stove.

3.Ensure that the baffle pieces are pushed together at the center joint.

CAUTION - Do not force the baffle pieces. Gently adjust the baffle orientation until each side can be removed freely from the stove.



GLASS REPLACEMENT PROCEDURES

WARNING : DO NOT OPERATE THIS APPLIANCE WITH THE GLASS PANEL REMOVED, CRACKED, OR BROKEN. DO NOT SUBJECT THE DOOR TO ABUSE, SUCH AS STRIKING OR SLAMMING SHUT. ONLY A QUALIFIED SERVICE PERSON SHOULD REPLACE THE GLASS PANEL.

1. Follow the instructions included with the replacement glass kit.

2. Remove the screws from the glass clips (use penetrating oil if necessary) – Set aside for reinstallation.
3. Carefully lift the damaged glass off the door and discard.
4. Remove any remaining glass and old gasket material.
5. Clean the screw holes and place a small amount of anti-seize compound in each one.
6. Install a new glass gasket in the glass gasket groove.
7. Place the new glass onto the door.
8. **Important! Center the glass** and ensure that the edges of the glass are parallel with the edges of the opening.
9. Check glass position again (centered, and parallel), then screw the glass retainer clips with the glass pads back on the door using a crisscross pattern. Tighten the screws no more than 1/8th of a turn after they seat. The glass will break at this point if not positioned correctly.
10. Apply a light film of anti-seize lubricant on the door's hinge pins if needed.
11. After 5 or 6 fires, check the glass retainer screws, and retighten if necessary. Use only 4mm x 329mm x 395mm Ceramic, or Neoceram glass. Contact your INVICTA dealer.

CREOSOTE FORMATION & REMOVAL

When wood burns slowly at low temperatures, it may produce tar and other organic vapors, which combine with expelled moisture to form creosote. These creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire, which may damage the chimney or even destroy the house. When burning wood, inspect the chimney connector and chimney at least once every two months during the heating season to determine if there is a creosote buildup.
If a creosote build-up occurs, inspect the stovepipe connector and chimney more often, at least monthly during the heating season to monitor the accumulation. If a creosote residue greater that 1/4" (6 mm) accumulates, remove it to reduce the risk of a chimney fire.

PREVENTION

Burn the stove with the door slightly crack for 15 - 20 minutes daily to burn out creosote deposits from within the stove and the venting system.

After reloading with wood, burn the stove with the door slightly crack for 15 to 20 minutes. This manner of operation ensures early engagement of the secondary combustion system that minimizes creosote buildup in the chimney.

If your glass always remains dirty, your wood is wet; therefore, there is a higher risk of creosote buildup.

Inspect the venting system at the stove connection *and* at the chimney top. Cooler surfaces tend to build creosote deposits faster, so it is important to check the chimney at the top (where it is coolest) as well as from the bottom near the stove. **CLEANING**

Remove accumulated creosote with a cleaning brush specifically designed for the type of chimney in use. We recommend you use a certified chimney sweep to perform this service. Contact your dealer for the name of a certified chimney sweep in your area (your dealer may be a certified sweep!).

We recommend that before each heating season you have the entire system professionally inspected, cleaned and repaired, if necessary.

GASKETS

Replace door gasket material every two to three seasons, or whenever it becomes deteriorated or loose, depending on stove use. If the door seal leaks, a new gasket will ensure a tight seal and improve stove performance.

We recommend you only use INVICTA replacement gaskets when you need to replace your door gasket. Contact your dealer for a gasket kit that includes instructions, and the gasket for your stove.

GLASS

The glass used in our stoves is actually not plain glass, but a tough, clear ceramic material capable of operating at temperatures up to 2300° F. Do not operate the stove with a broken door glass. Do not abuse the front door by striking or slamming.

When necessary, clean the glass. For the inside surface of the glass, we recommend using a damp paper towel dipped in gray ash. Rub the inside of the glass with a circular motion. When all the deposits are removed, clean up with window cleaner or with commercial stove glass cleaners, which are available from your local dealer. Use this type of cleaner for the outside surface as well. Never attempt to clean the glass while the fire is burning or while the glass is hot. Remove deposits by following the instructions provided with the cleaner. Wipe the cleaner off with a soft cloth, or black & white newsprint.

> **Important:** scratching or etching the glass will weaken the integrity of the glass. Do not use a razor blade, steel wool, or any other abrasive material to clean the glass. Use a cleaner specifically manufactured for woodstoves only.

The front door glass is a ceramic, thermal shock resistant glass, made specifically for use in woodstoves. Do not use any replacement glass other than the ceramic glass manufactured and supplied for use in this woodstove. Replacement glass is available through your local dealer.

Replace the door glass immediately if broken or chipped. Contact your local dealer for replacement glass. The glass kit includes instructions and everything needed for the repair. If you replace the glass yourself, wear work gloves and safety glasses.

TROUBLESHOOTING

COMMON ISSUES

Virtually all woodstove operators experience basic common problems at one time or another. Most are correctable and generally require only a minor adjustment of the stove, installation, or operating technique. In cases where weather conditions dramatically affect stove performance, the problems are typically temporary and solve themselves once the weather changes.

If you question whether your stove is producing adequate heat, the best way to troubleshoot the problem is to monitor the temperature of the stack no more than 12 inches (30 cm) above the flue collar. A 400° F (200° C) stovepipe confirms the stove is supplying sufficient heat. Keep in mind that your house itself will regulate room/house temperatures. How well the walls, floors and ceilings are insulated, the number and size of windows, the tightness of outside doors, and the construction or style of your house (vaulted ceilings or other open spaces which collect large percentages of heat, ceiling fans, etc.) all are determining factors of room temperature.

Your stove's performance is also dependent on its installation. One common cause of poor performance is an oversized chimney flue. Oversized chimney flues result in decreased draft, which prevents the smoke from rising out the chimney. Oversized flues are also more difficult to heat effectively, especially when burning a high efficiency stove. Cool flue temperatures inhibit the establishment of a strong draft (and encourage the accumulation of creosote). The lack of a strong draft will cause the fire to die down and may even force smoke to pour into the room.

If your chimney is the proper size and a strong draft is not easily established, there is the possibility that the chimney is too cold. Again, hot chimneys promote stronger drafts. Opening a window briefly in the room while lighting the stove may help.

Other draft guidelines are as follows:

An **"AIRTIGHT" HOUSE:** The air supply (infiltration) to the interior of the house may be inadequate if your home is super-insulated or especially well sealed. This phenomenon of air starvation within the building is exacerbated if exhaust fans, such as clothes dryers, bathroom fans or cook stove exhaust fans, are in operation within the home. Outfitting your stove with an optional outside air dispenser, which leads to the outside of the building, can correct this problem.

Tall Trees or Buildings: These obstructions, when located close to the top of the chimney can cause chronic or occasional downdrafts. When selecting a site for a new chimney, consider the placement of other objects near the proposed chimney location.

Wind Velocity: Generally, the stronger and steadier a wind, the stronger (better) the draft. However, "gusty" wind conditions can cause erratic downdrafts. For consistent problems, consider a high wind cap, such as the Vacu-Stack.

Barometric Pressure: Chimney drafts are typically sluggish on balmy, wet or muggy days (low barometric pressure). This is a weather-related phenomenon, which generally is self-correcting as the weather changes.

Briskness of Fire: The hotter the fire in your stove, the hotter your chimney and, therefore, the stronger the draft.

Breaks in the Venting System: An unsealed clean-out door at the bottom of the chimney, leaky stovepipe joints, a poor stovepipe-to-thimble connection, missing caps, or a leaky chimney all can cause inadequate draft.

Seasonal Factors: Early fall and late spring are generally difficult seasons in which to establish proper drafts. The colder the outside air is relative to room temperature, the stronger the draft.

OPERATING THE STOVE

As outlined above, there are days when a good draft is just not easy to establish. The causes are usually seasonal factors or a cold chimney. Try starting the fire by using small kindling and fuel to obtain a quick, hot fire. Tend the fire frequently with small fuel until the chimney is hot and the draft is well established. Sometimes, partially opening a first floor window briefly will help quickly get draft established.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTIONS
STOVE SMOKES	Operating Technique	Slightly crack the door one minute before fully opening doors.
	Cold Chimney or reverse draft	Preheat the chimney when first starting a fire. Briefly open a window in the room containing the stove.
	Blocked Chimney	Examine the chimney and stovepipe for blockage or creosote accumulations.
	Oversized Chimney	Reline the chimney to the appropriate diameter
	Undersized Chimney	Install a draft inducer or replace the chimney.
	Chimney Too Short	Lengthen the chimney.
	Air Infiltration into The Chimney	Seal chimney connections and openings. Check clean-out doors.
	Not burning proper fuel	Ensure cordwood is seasoned and dry.
	More Than One Appliance Connected to the Flue	Disconnect all other appliances and seal openings.
BACK-PUFFING OR GAS EXPLOSIONS	Operating Technique	Slightly crack door one minute before fully opening the door and keep it fully open for a few minutes after reloading.
	Chimney Down-draft	Install a chimney cap.
	Excessive Ash Build-up	Empty the ash pan more frequently. Increase efficiency of burns, and avoid using poor quality or green wood.
UNCONTROLLED OR SHORT BURN	Unsealed or Open Door	Close the door tightly or replace the gaskets. Air leakage around glass gasket – replace gasket
	Excessive Draft	Check the installation. Install stovepipe damper. Draft in excess of 0.1 wc should be corrected with a stovepipe damper(s)
	Extra Long Chimney	Shorten the chimney. Install stovepipe damper(s).
	Oversized Chimney	Reline the chimney to the proper diameter.
	High Winds or Hilltop Location:	Install a chimney cap.
INSUFFICIENT HEAT	Poor Quality, low Btu content, or Green Wood	Use only air-dried wood, preferably dried at least one year. Use a wood with a high Btu content if available.
	Cold Exterior Chimney	Reline or insulate the chimney.
	Leaky Stovepipe or Chimney	Check the installation. Replace with a pre-fabricated insulated chimney system or a properly sized masonry chimney.
	Too Much Heat Loss From House	Add insulation, use energy efficient windows, or caulk windows, and seal openings in home.
	Excessive Ash Build-up	Empty the ash pan more frequently. Increase efficiency of burns, and avoid using poor quality or green wood.
BLISTERING OF FINISH	Operating Technique	Do not over-fire the stove. Monitor stove temperatures. Use seasoned wood only.
	Excessive Draft	Check the DRAFT. A damper may be required. Operate the stove at a LOW BURN range.

SAFETY LABEL

CONTACT YOUR LOCAL BUILDING OFFICIALS ABOUT
RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA

Listed Room Heater. Solid Fuel Type

C US
Energy Verified

Conforms to UL STD 1482
Certied to ULC STD S627

Manufactured by:
Energy Distribution
1361, Denison
St-Alphonse-De-Granby,
Qc, Canada, J0E 2A0

MODEL NAME:
KAZAN 6104-44
KAZAN GA 6104-43
KIARA 6104-42
SERIAL NUMBER: [redacted]

CAUTION: HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING, AND FUNITURE AWAY. CONTACT MAY CAUSE SKIN BRUNS. SEE NAMEPLATE AND INSTRUCTIONS, INSPECT AND CLEAN CHUMNEY AND CONNECTOR FREQUENTLY, UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY.

WARNINGS

Do not use grade or elevate fire. Build wood fire directly on hearth. Do not overrfire. If the heater or chimney connector glows, you are overfiring
(See Operator's Manual)

OPERATE ONLY WITH DOORS CLOSED. DO NOT OBSTRUCT SPACE UNDER HEATER.
TYPE OF FUEL: CORD WOOD ONLY BURNING FUEL: OTHER THAN CORDWOOD MAY DAMAGE THE APPLIANCE

" PREVENT HOUSE FIRES"

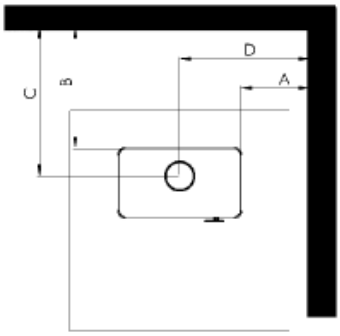
Install and use only in accordance with manufacturer's installation instructions and your local bulding codes.

CAUTION: Special methods are required when passing chimney through a wall or celling, refer to local buildind codes. Do not connect this unit to a chimney flue serving another appliance.

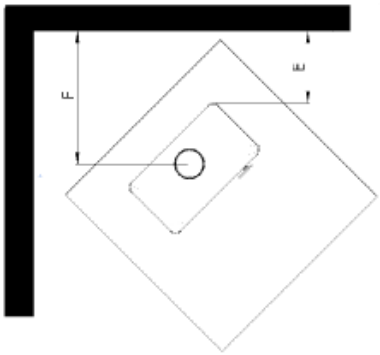
NOTE: Replace glass only with 4mm ceramic glass.

This wood heater needs perodic inspection and repair for proper operation. Consult the owner's manual for further information.
It's against Federal regulation to operate this wood heater in a manner in inconsistent with the operating instruction in the owner's manual.

Minimum Clearance to Combustible Materials*



Floor Protection*



When install on a combustible floor, non-combustible floor protection is required to cover the area beneath the heater, and extend at least 16" (in US) or 18" (in CAN) to the front and 8" beyond of the fuel loading and ash removal (in US) (Canada is 8" from the side of stove), the floor protection must extend under the flue connector and extend 2" beyond each side of pipe.

VENT REQUIREMENTS: 6" diameter. single wall, minimum 24 MSG blue steel connector with listed factory-built Type HT chimney or masonry chimney

	Parallel				Corner	Corner
Clearances	A	B	C	D	E	F
Single wall Connector	20"-51cm	16"-41cm	21.5"-55cm	32.5"-83cm	15"-38cm	27"-69cm
Double Wall Connector – Inc. Rear Heat Shield	22"-56cm	6"-15cm	11.5"-29cm	34.5"-88cm	15"-38cm	27"-69cm

*** Refer to the installation Manual for additional clearance information. Installation Instructions, and operating Instructions.**

CFR EPA Title 40, part 60, Subpart AAA
Particule emission: ASTM E2780-10; ASTM E2515-11 methods 28R
Efficiency: CSA B415.1-10 section 13.7

U.S. ENVIRONMENTAL PROTECTION AGENCY
Certified to comply with 2020 particulate emission standards for single burn rate heaters.
This single burn rate wood heater is no approved for use with flue damper

- average particulate emission rate
- 1.76 g/h and 0.072g/MJ (output);
- average efficiency 63.4%
- minimum heat output rate 23 070 btu/hr
- maximium heat output rate 23 830 btu/ht

Date of Manufacture

2021 2022 2023 2024 JAN FEV MAR APR MAY JUN JUL AOU SEP OCT NOV DEC

DO NOT REMOVE OR COVER THIS LABEL

WARRANTY

CONTRACTUAL GUARANTEE

DURATION The duration of our guarantee is10 years on the firebox body and 3 years for all casting component having direct contact with the fire like the ashes grid, the chenet and the baffle, counting from the date of delivery by the installer or the date of point of sale. The guarantee applies during this period to all defects of parts or of manufacture. We are only responsible for the free replacement of parts found defective, after verification by ourselves. If the replacement of these parts would prove too expensive, we reserve the right to replace the appliance, a decision we alone can make.

LEGAL GUARANTEE The provisions of this guarantee do not preclude the purchaser from benefiting from the legal guarantees on equipment, covering faults and defects, which apply in any event under the conditions of article 1641 and following of the civil code.

VALIDITY The purchaser designated hereunder, acknowledging having received the notice of installation and of use, agrees to conform to it for safety reasons.

This guarantee is only valid if the appliance is used according to the rules and recommendations stated on the Instructions for Installation and Use, supplied with the appliance.

The appliance must be installed at the address quoted on the certificate of guarantee.

The other components are guaranteed for 1 year, such as : latch, screws and bolts, springs, fans, printed circuits, switch, electric thimbles, wire, electric sheaths, etc...

EXCLUSION The glass is resistant to a temperature of 750°C, and the temperatures in the combustion chamber never reach this temperature, a breakage of glass cannot occur as a result of overheating. Therefore, the breakage of the glass, due to a bad manipulation on installation or the handling of the appliance, is not covered by the guarantee.

The joints are considered items which are subject to wear.

The fuel used and the control of the apparatus, being outside our control, the parts of the stove in direct contact with the ignited fuel, are not included in the cover of the guarantee, including : fireplate, fire grate, vent, log barrier. The cost of travelling, of transport, of workmanship, of packaging, of disassembly and the consequences of the immobilization of the appliance, resulting from the operations of the guarantee, are the sole responsibility of the customer.

Any disorder caused on any part of the installation, by mechanical or electrical parts which we have not supplied and which are prohibited by the texts governing heating appliances.
The damage caused by the use of any other fuel than wood.

Date of purchase (start of the guarantee) : .....

PURCHASER

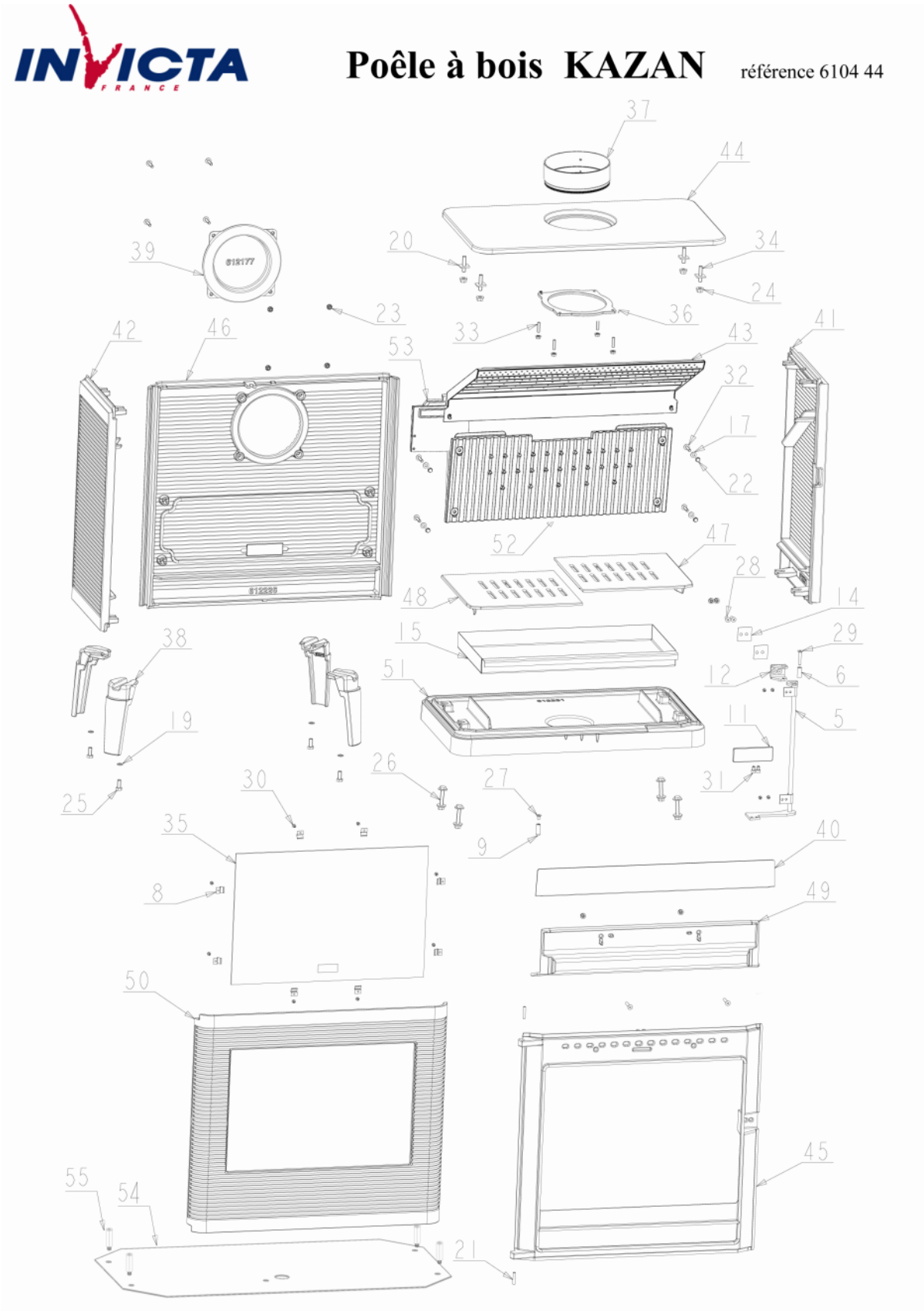
SURNAME : .....
First name : .....
Address : .....
Postal Code : ..... Town : ..... Country : .....

SUPPLIER

Designation of the appliance : .....

Reference : .....

ANNEX – PARTS


INVICTA FRANCE
Poêle à bois KAZAN
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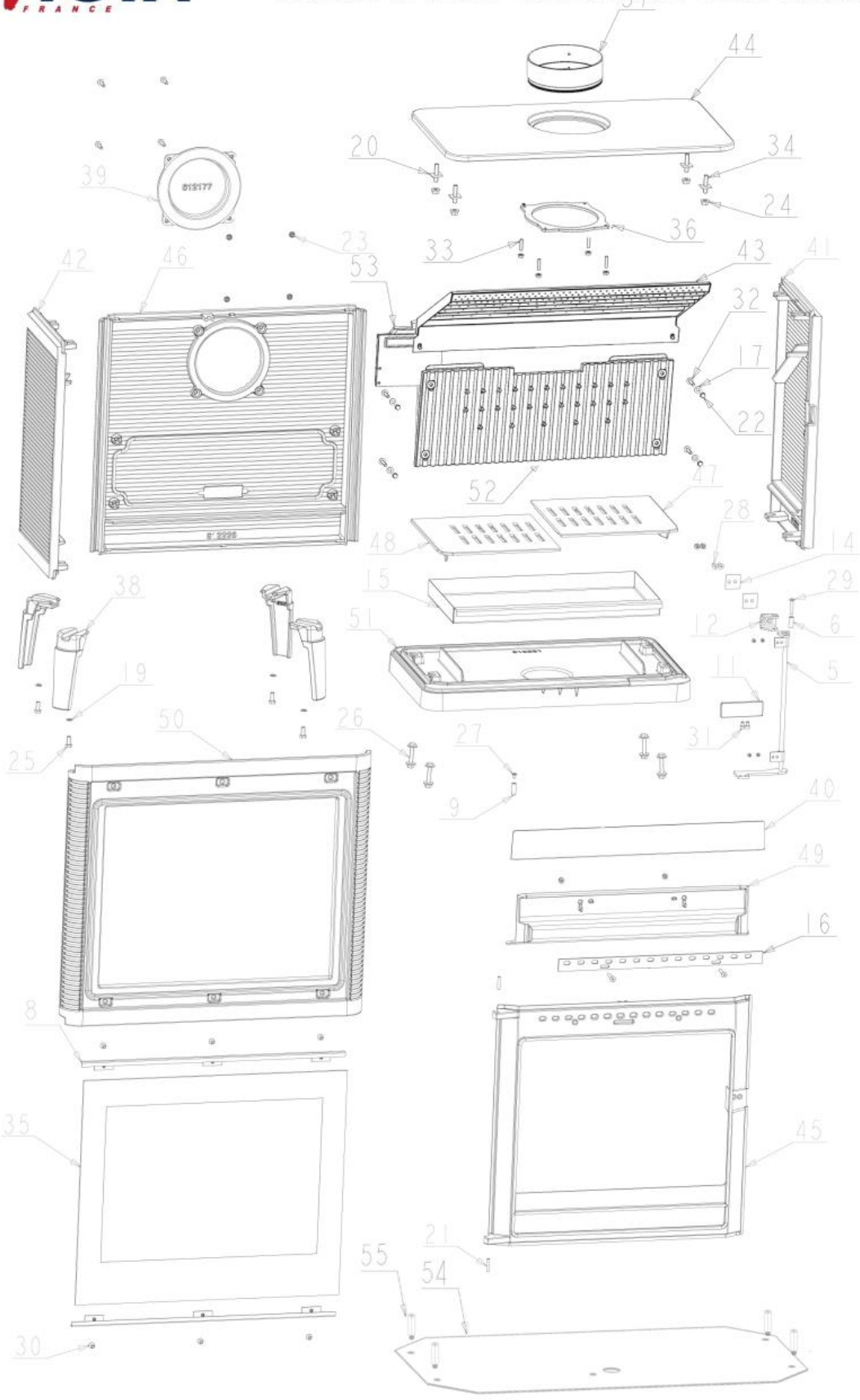
REP.	DESIGNATIONS	REFERENCES	QTE
1	JOINT THERMOCORDE PLAT 7x3	AI010080	1
2	JOINT THERMOCORDE Ø8	AI303008	1
3	JOINT THERMOCORDE Ø12	AI303012	1
4	MASTIC-REFRACTAIRE	AI501001	1
5	TRINGLE DE FERMETURE	AS610234	1
6	ENTRETOISE FERMETURE	AS610235	1
7	VIS LOQUET COSSU	AS618100	1
8	CLAMS	AS700180	8
9	BOUTON DE REGISTRE	AS750120	1
10	RESSORT REGISTRE PRIMAIRE FLAMEO/PHAROS	AS750125	1
11	POIGNEE	AS900109	1
12	EQUERRE DE FERMETURE	AT610441	1
13	TOLE REGISTRE	AT610443	1
14	CALE REGLAGE	AT610444	2
15	CENDRIER	AT610449	1
16	REGISTRE AIR VITRAGE	ED-RES-1001	1
17	RONDELLE M Ø6	AV4100060	4
18	RONDELLE L Ø8	AV4110080	10
19	RONDELLE A DENTS M8	AV4151080	4
20	CALE OBLIQUE Ø8 A 8%	AV4240080	4
21	GOUPILLE CANNELEE Ø6x30	AV6306300	2
22	ECROU BORGNE M6	AV7140060	4
23	ECROU A EMBASE M6	AV7220060	13
24	ECROU A EMBASE M8	AV7220080	8
25	VIS TETE HEXAGONALE M8x20	AV8408200	4
26	VIS TETE HEXAGONALE M8x50	AV8408500	4
27	VIS FHC M6x10	AV8636100	1
28	VIS FHC M6x20	AV8636200	2
29	VIS FHC M6x35	AV8636350	3
30	VIS M4x6	AV8644067	12
31	VIS CHC M6x10	AV8666100	2
32	VIS TBEHC M6x30	AV8696300	8
33	GOUJON CHC M6x25	AV8706250	4
34	GOUJON CHC M8x40	AV8708400	4
35	VITRAGE	AX610444	1
36	SUPPORT DE BUSE	ED-BVS-6001	1
37	BUSE	ED-BVS-6000	1
38	PIED	F612174U	4
39	TAMPON ARRIERE	F612177B	1
40	CHENET	F612220B	1
41	COTE DROIT	F612221B	1
42	COTE GAUCHE	F612222B	1
43	DEFLECTEUR	ED-CCD-1002	1
44	DESSUS	F612224U	1
45	FACADE	F612225B	1
46	FOND	F612226B	1
47	GRILLE DROITE	F612227B	1
48	GRILLE GAUCHE	F612228B	1
49	GUIDE D'AIR	F612229B	1
50	PORTE	F612230U	1
51	SOCLE	F612231U	1
52	TAQUE	ED-F612234B	1
53	Conduit d'air arrière	ED-CCDU-0001	1
54	Pare-Chaleur du dessous	ED-HSL-1002	1
55	Espaceurs pour pare-chaleur du dessous	ED-QST-M8-1.25-40-10	4

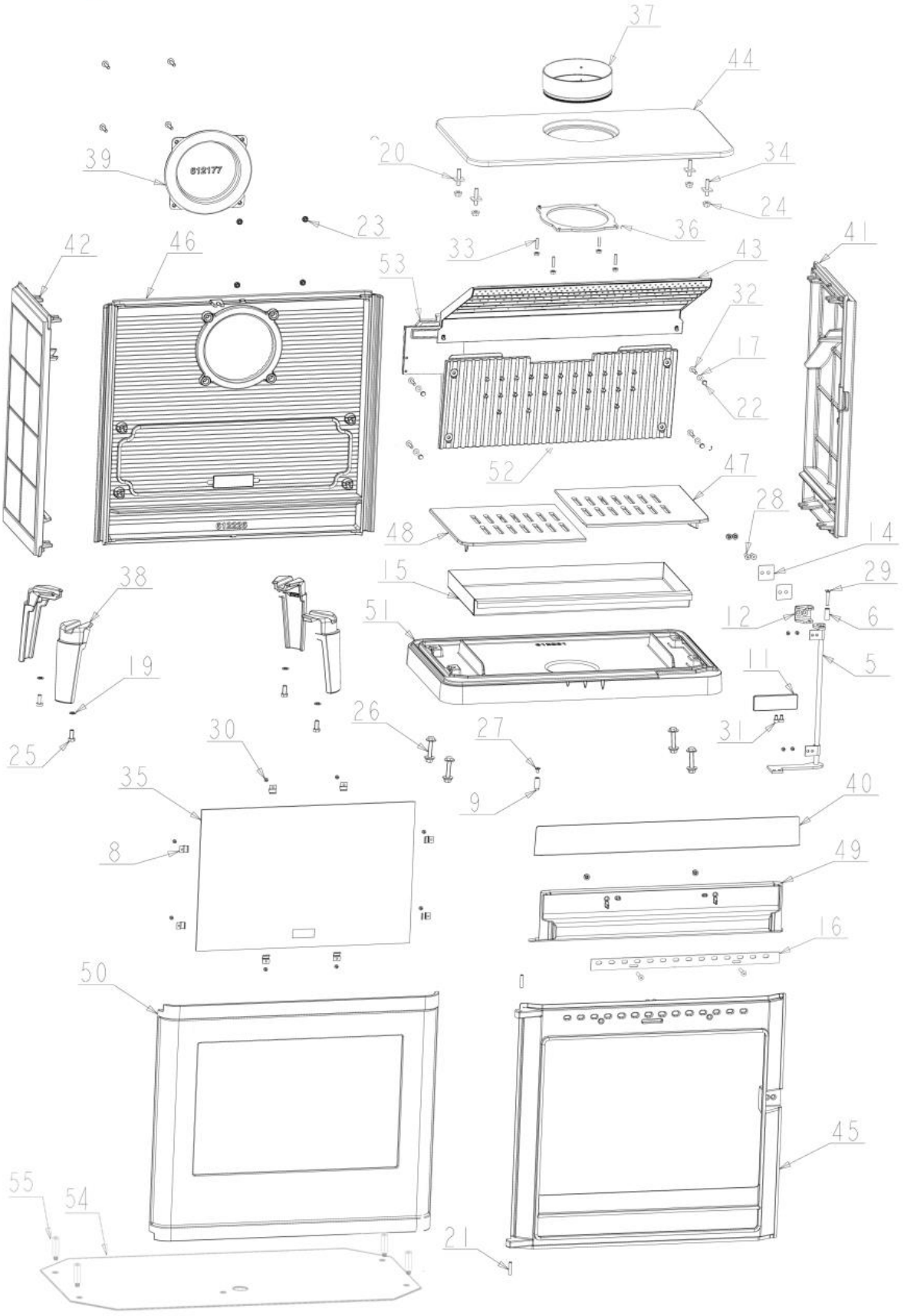
Poêle à bois KAZAN GA référence 6104 43



REP.	DESIGNATIONS	REFERENCES	QTE
1	JOINT THERMOCORDE VITRE Ø9 x 2.0 m	AI303009	1
2	JOINT THERMOCORDE FACADE/PORTE Ø12 x 2.5 m	AI303012	1
3	JOINT THERMOCORDE TAQUE Ø12 x 1.4 m	AI303012	1
4	MASTIC-REFRACTAIRE	AI501001	1
5	TRINGLE DE FERMETURE	AS610234	1
6	ENTRETOISE FERMETURE	AS610235	1
7	VIS LOQUET COSSU	AS618100	1
8	PRESSE VERRE	AT610463	2
9	BOUTON DE REGISTRE	AS750120	1
10	RESSORT REGISTRE PRIMAIRE FLAMEO/PHAROS	AS750125	1
11	POIGNEE	AS900109	1
12	EQUERRE DE FERMETURE	AT610441	1
13	TOLE REGISTRE	AT610443	1
14	CALE REGLAGE	AT610444	2
15	CENDRIER	AT610449	1
16	REGISTRE AIR VITRAGE	ED-RES-1001	1
17	RONDELLE M Ø6	AV4100060	4
18	RONDELLE L Ø8	AV4110080	10
19	RONDELLE A DENTS M8	AV4151080	4
20	CALE OBLIQUE Ø8 A 8%	AV4240080	4
21	GOUPILLE CANNELEE Ø6x30	AV6306300	2
22	ECROU BORGNE M6	AV7140060	4
23	ECROU A EMBASE M6	AV7220060	13
24	ECROU A EMBASE M8	AV7220080	8
25	VIS TETE HEXAGONALE M8x20	AV8408200	4
26	VIS TETE HEXAGONALE M8x50	AV8408500	4
27	VIS FHC M6x10	AV8636100	1
28	VIS FHC M6x20	AV8636200	2
29	VIS FHC M6x35	AV8636350	3
30	VIS FHC M5X10	AV8635100	6
31	VIS CHC M6x10	AV8666100	2
32	VIS TBEHC M6x30	AV8696300	8
33	GOUJON CHC M6x25	AV8706250	4
34	GOUJON CHC M8x40	AV8708400	4
35	VITRAGE	AX826104	1
36	SUPPORT DE BUSE	ED-BVS-6001	1
37	BUSE	ED-BVS-6000	1
38	PIED	F612174U	4
39	TAMPON ARRIERE	F612177B	1
40	CHENET	F612220B	1
41	COTE DROIT	F612221B	1
42	COTE GAUCHE	F612222B	1
43	DEFLECTEUR	ED-CCD-1002	1
44	DESSUS	F612224U	1
45	FACADE	F612225B	1
46	FOND	F612226B	1
47	GRILLE DROITE	F612227B	1
48	GRILLE GAUCHE	F612228B	1
49	GUIDE D'AIR	F612229B	1
50	PORTE	F612300U	1
51	SOCLE	F612231U	1
52	TAQUE	ED-F612234B	1
53	Conduit d'air arrière	ED-CCDU-0001	1
54	Pare-Chaleur du dessous	ED-HSL-1002	1
55	Espaceurs pour pare-chaleur du dessous	ED-QST-M8-1.25-40-10	4

Poêle à bois KIARA

Référence 6104 42



REP.	DESIGNATIONS	REFERENCES	QTE
1	JOINT THERMOCORDE PLAT VITRE 7 x 3 x 1.7 m	AI010080	1
2	JOINT THERMOCORDE FACADE/PORTE Ø12 x 2.5 m	AI303012	1
3	JOINT THERMOCORDE TAQUE Ø12 x 1.4 m	AI303012	1
4	MASTIC-REFRACTAIRE	AI501001	1
5	TRINGLE DE FERMETURE	AS610234	1
6	ENTRETOISE FERMETURE	AS610235	1
7	VIS LOQUET COSSU	AS618100	1
8	CLAMS	AS700180	8
9	BOUTON DE REGISTRE	AS750120	1
10	RESSORT REGISTRE PRIMAIRE FLAMEO/PHAROS	AS750125	1
11	POIGNEE	AS900109	1
12	EQUERRE DE FERMETURE	AT610441	1
13	TOLE REGISTRE	AT610443	1
14	CALE REGLAGE	AT610444	2
15	CENDRIER	AT610449	1
16	REGISTRE AIR VITRAGE	ED-RES-1001	1
17	RONDELLE M Ø6	AV4100060	4
18	RONDELLE L Ø8	AV4110080	10
19	RONDELLE A DENTS M8	AV4151080	4
20	RONDELLE L Ø8	AV4110080	4
21	GOUPILLE CANNELEE Ø6x30	AV6306300	2
22	ECROU BORGNE M6	AV7140060	4
23	ECROU A EMBASE M6	AV7220060	13
24	ECROU A EMBASE M8	AV7220080	8
25	VIS TETE HEXAGONALE M8x20	AV8408200	4
26	VIS TETE HEXAGONALE M8x50	AV8408500	4
27	VIS FHC M6x10	AV8636100	1
28	VIS FHC M6x20	AV8636200	2
29	VIS FHC M6x35	AV8636350	3
30	VIS M4x6	AV8644067	12
31	VIS CHC M6x10	AV8666100	2
32	VIS TBEHC INOX M6x30	AV8696300	8
33	GOUJON CHC M6x25	AV8706250	4
34	GOUJON CHC M8x40	AV8708400	4
35	VITRAGE	AX610444	1
36	SUPPORT DE BUSE	ED-BVS-6001	1
37	BUSE	ED-BVS-6000	1
38	PIED	F612174U	4
39	TAMPON ARRIERE	F612177B	1
40	CHENET	F612220B	1
41	COTE DROIT	F612303B	1
42	COTE GAUCHE	F612304B	1
43	DEFLECTEUR	ED-CCD-1002	1
44	DESSUS	F612224U	1
45	FACADE	F612225B	1
46	FOND	F612226B	1
47	GRILLE DROITE	F612227B	1
48	GRILLE GAUCHE	F612228B	1
49	GUIDE D'AIR	F612229B	1
50	PORTE	F612302U	1
51	SOCLE	F612231U	1
52	TAQUE	ED-F612234B	1
53	Conduit d’air arrière	ED-CCDU-0001	1
54	Pare-Chaleur du dessous	ED-HSL-1002	1
55	Espaceurs pour pare-chaleur du dessous	ED-QST-M8-1.25-40-10	4

INVICTA STOVE AND FIREPLACES ARE DESIGNED AND MANUFACTURED BY:
INVICTA GROUP SASU
785 520 180 R.C.S. SEDAN
Greffe du Tribunal de Commerce de SEDAN
Siège social
INVICTA GROUP SASU
ZI LA GRAVETTE
08350 DONCHERY
www.invicta.fr

Imported by / Importé par :
Energy distribution
1361 Denison
St-Alphonse, QC J0E 2A0 – Canada
1-877-257-2251
www.energydistribution.co
www.invictastoves.com

CONTACT YOUR LOCAL BUILDING OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA

Listed Room Heater. Solid Fuel Type

C US Energy Verified

Conforms to UL STD 1482
Certied to ULC STD S627

Manufactured by:
Energy Distribution
1361, Denison
St-Alphonse-De-Granby,
Qc, Canada, J0E 2A0

MODEL NAME:
KAZAN 6104-44
KAZAN GA 6104-43
KIARA 6104-42
SERIAL NUMBER: [redacted]

CAUTION: HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING, AND FUNITURE AWAY. CONTACT MAY CAUSE SKIN BRUNS. SEE NAMEPLATE AND INSTRUCTIONS, INSPECT AND CLEAN CHUMNEY AND CONNECTOR FREQUENTLY, UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY.

WARNINGS

Do not use grade or elevate fire. Build wood fire directly on hearth. Do not overrfire. If the heater or chimney connector glows, you are overfiring
(See Operator's Manual)

OPERATE ONLY WITH DOORS CLOSED. DO NOT OBSTRUCT SPACE UNDER HEATER.
TYPE OF FUEL: CORD WOOD ONLY BURNING FUEL: OTHER THAN CORDWOOD MAY DAMAGE THE APPLIANCE

" PREVENT HOUSE FIRES"

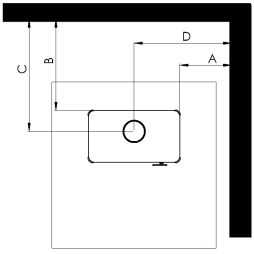
Install and use only in accordance with manufacturer's installation instructions and your local bulding codes.

CAUTION: Special methods are required when passing chimney through a wall or celling, refer to local buildind codes. Do not connect this unit to a chimney flue serving another appliance.

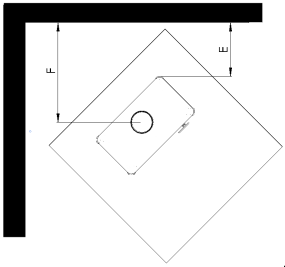
NOTE: Replace glass only with 4mm ceramic glass.

This wood heater needs perodic inspection and repair for proper operation. Consult the owner's manual for further information.
It's against Federal regulation to operate this wood heater in a manner in inconsistent with the operating instruction in the owner's manual.

Minimum Clearance to Combustible Materials*



Floor Protection*



When install on a combustible floor, non-combustible floor protection is required to cover the area beneath the heater, and extend at least 16" (in US) or 18" (in CAN) to the front and 8" beyond of the fuel loading and ash removal (in US) (Canada is 8" from the side of stove), the floor protection must extend under the flue connector and extend 2" beyond each side of pipe.

VENT REQUIREMENTS: 6" diameter. single wall, minimum 24 MSG blue steel connector with listed factory-built Type HT chimney or masonry chimney

	Parallel				Corner	Corner
Clearances	A	B	C	D	E	F
Single wall Connector	20"-51cm	16"-41cm	21.5"-55cm	32.5"-83cm	15"-38cm	27"-69cm
Double Wall Connector – Inc. Rear Heat Shield	22"-56cm	6"-15cm	11.5"-29cm	34.5"-88cm	15"-38cm	27"-69cm

*** Refer to the installation Manual for additional clearance information. Installation Instructions, and operating Instructions.**

CFR EPA Title 40, part 60, Subpart AAA
Particule emission: ASTM E2780-10; ASTM E2515-11 methods 28R
Efficiency: CSA B415.1-10 section 13.7

U.S. ENVIRONMENTAL PROTECTION AGENCY
Certified to comply with 2020 particulate emission standards for single burn rate heaters.
This single burn rate wood heater is no approved for use with flue damper

- average particulate emission rate
- 1.76 g/h and 0.072g/MJ (output);
- average efficiency 63.4%
- minimum heat output rate 23 070 btu/hr
- maximium heat output rate 23 830 btu/ht

Date of Manufacture

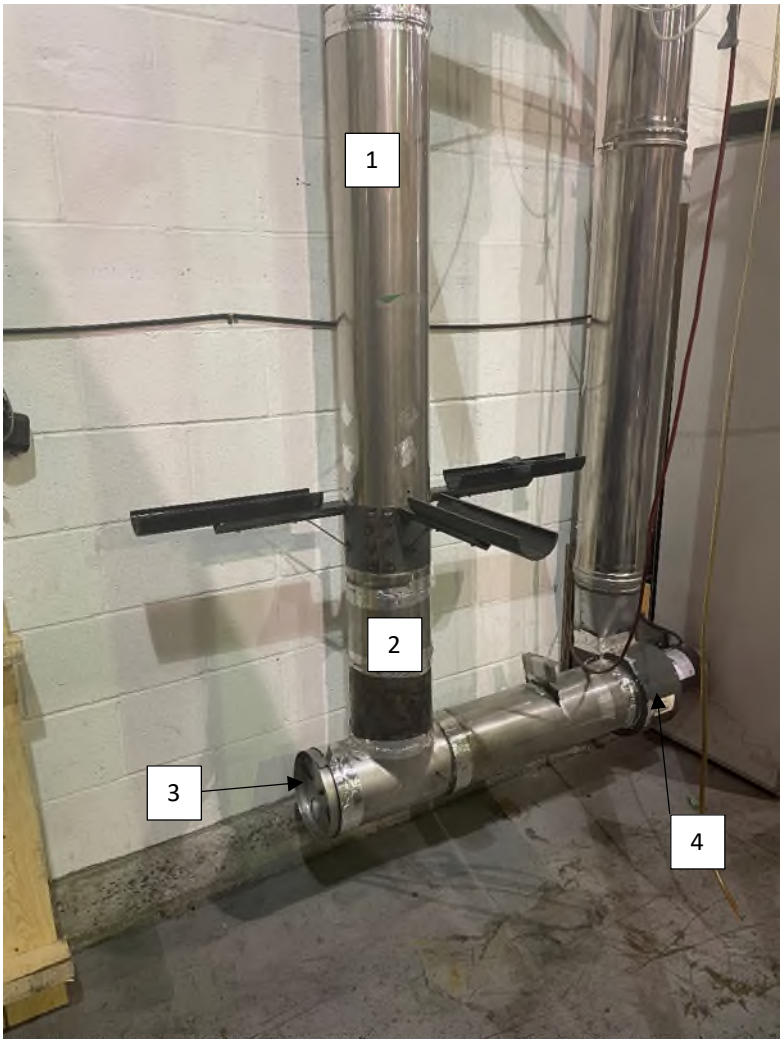
2021	2022	2023	2024	JAN	FEV	MAR	APR	MAY	JUN	JUL	AOU	SEP	OCT	NOV	DEC
■						■									

DO NOT REMOVE OR COVER THIS LABEL

APPENDIX 8: Photographs of test set up

Dilution picture Dia 8

Picture 1: Sampling system



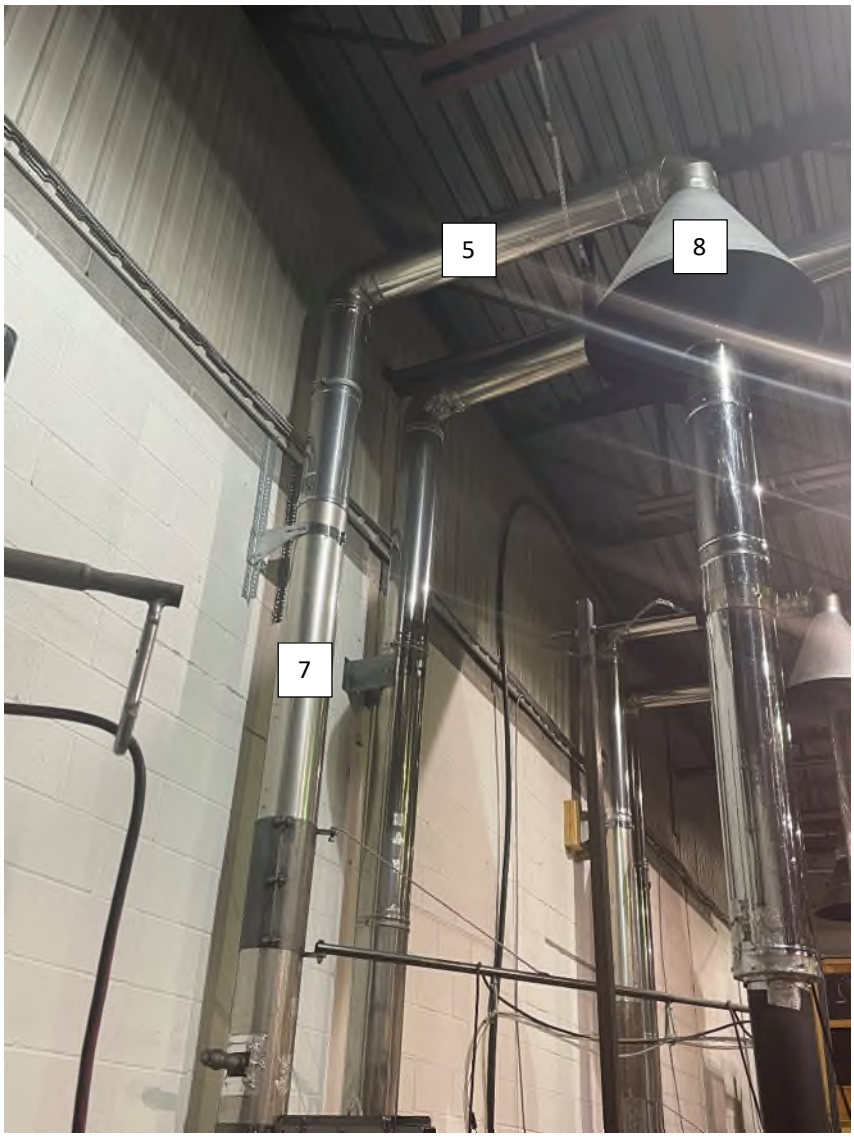
1 : 8 in dia Stainless steel pipe

2 : 16 in. Between sampling probe and lower elbow

3 : Air intake with damper to adjust flow rate

4 : Exhaust blower

Picture 2: Hood



5 : 8 in. dia. Stainless steel pipe

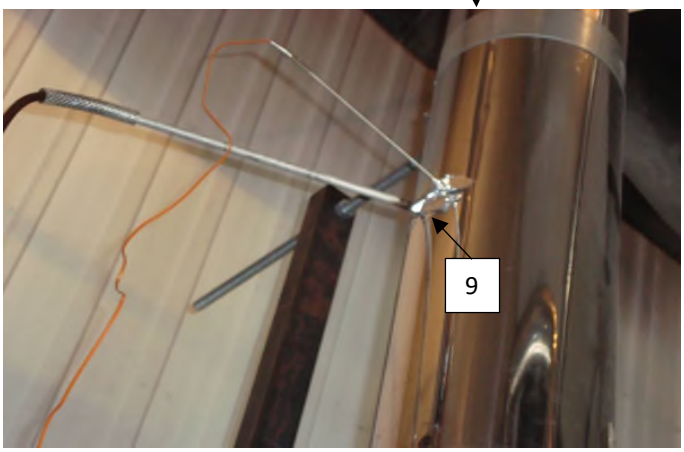
6 : na

7 : 10 feet long between velocity port and upper elbow

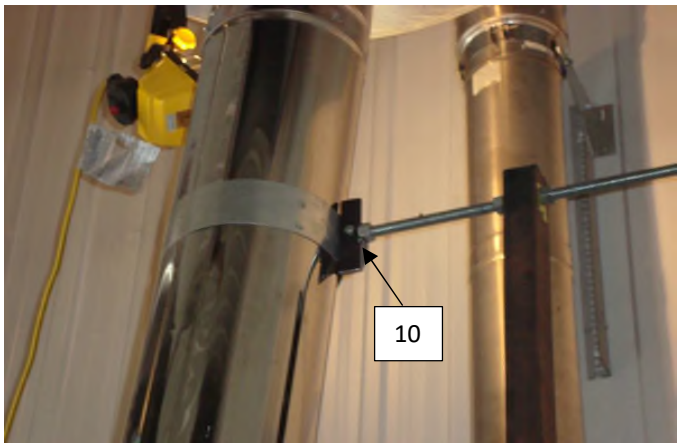
8 : 48 in. dia. Galvanized steel smoke captures hood

Picture 3: Stack sampling

Picture 3.1: Gas analysis and temperature probe



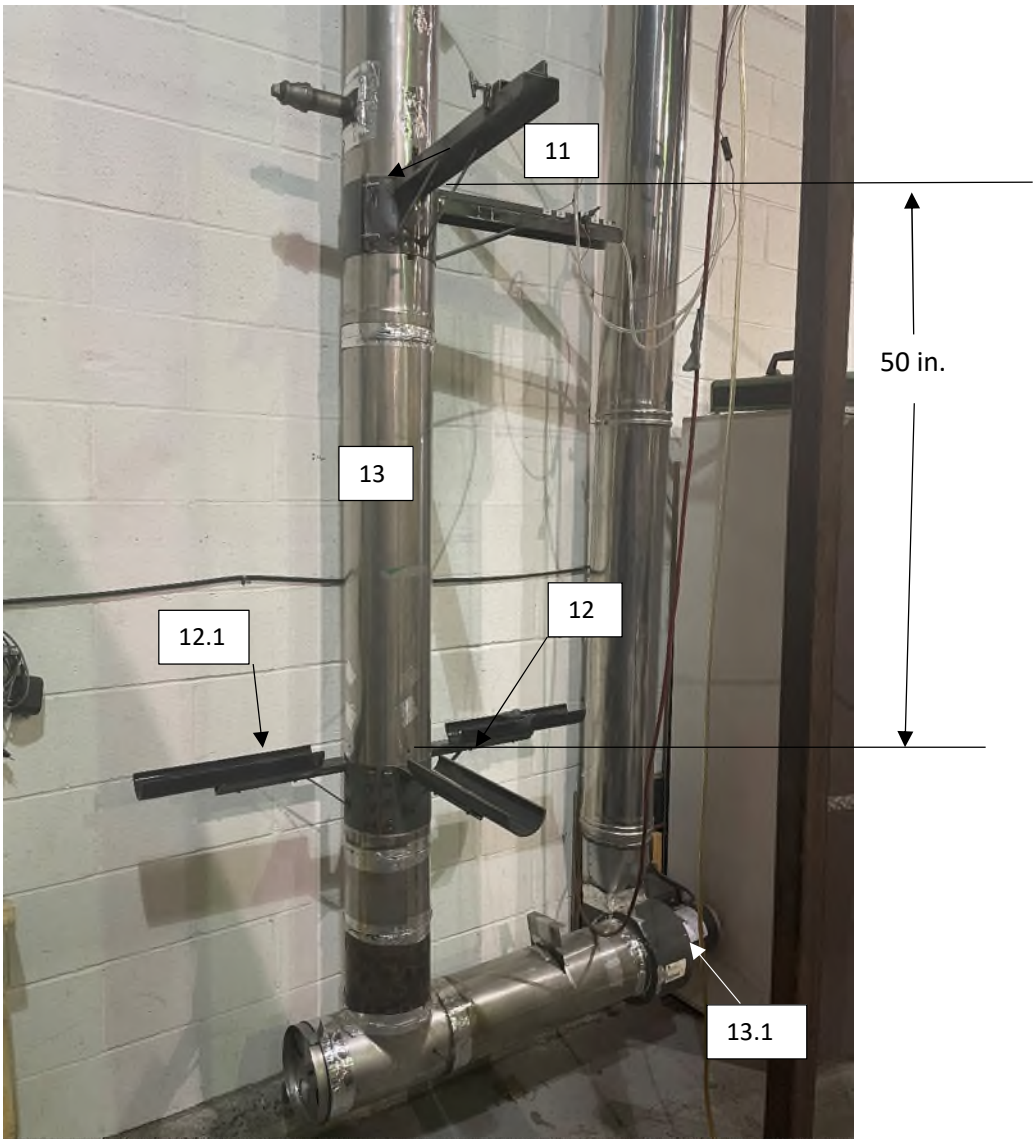
Picture 3.2: chimney support



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

10 : Exhaust system support bracket

Picture 4: Tunnel flow measurement and sampling probe



11: Velocity port

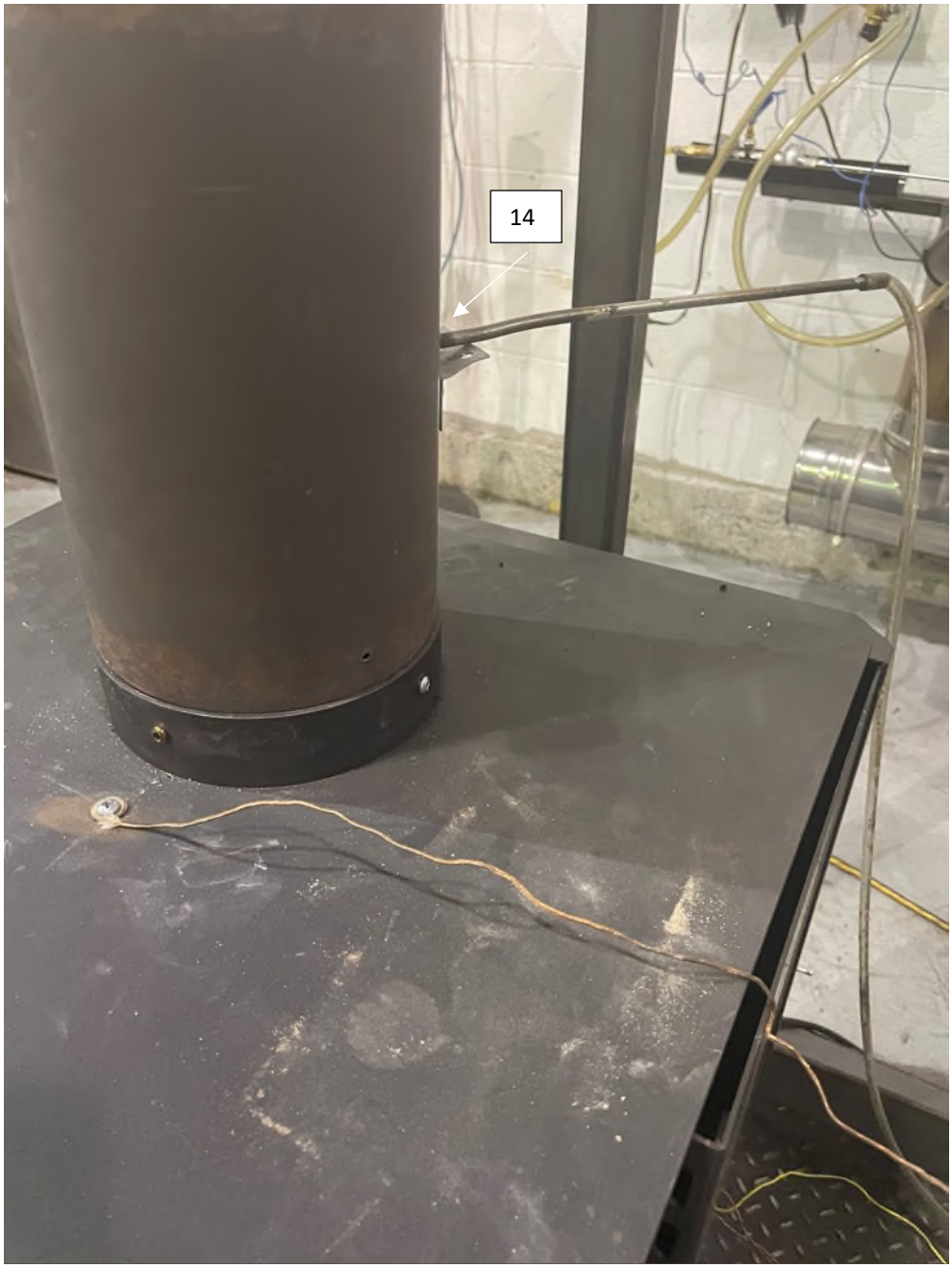
12: Sampling port, 2 sampling probes with 2x47 mm. dia.filter each.

12.1: Sampling port, sampling probes with 2x47 mm. dia.filter each., for first hour sampling

13:18 feet long dilution tunnel

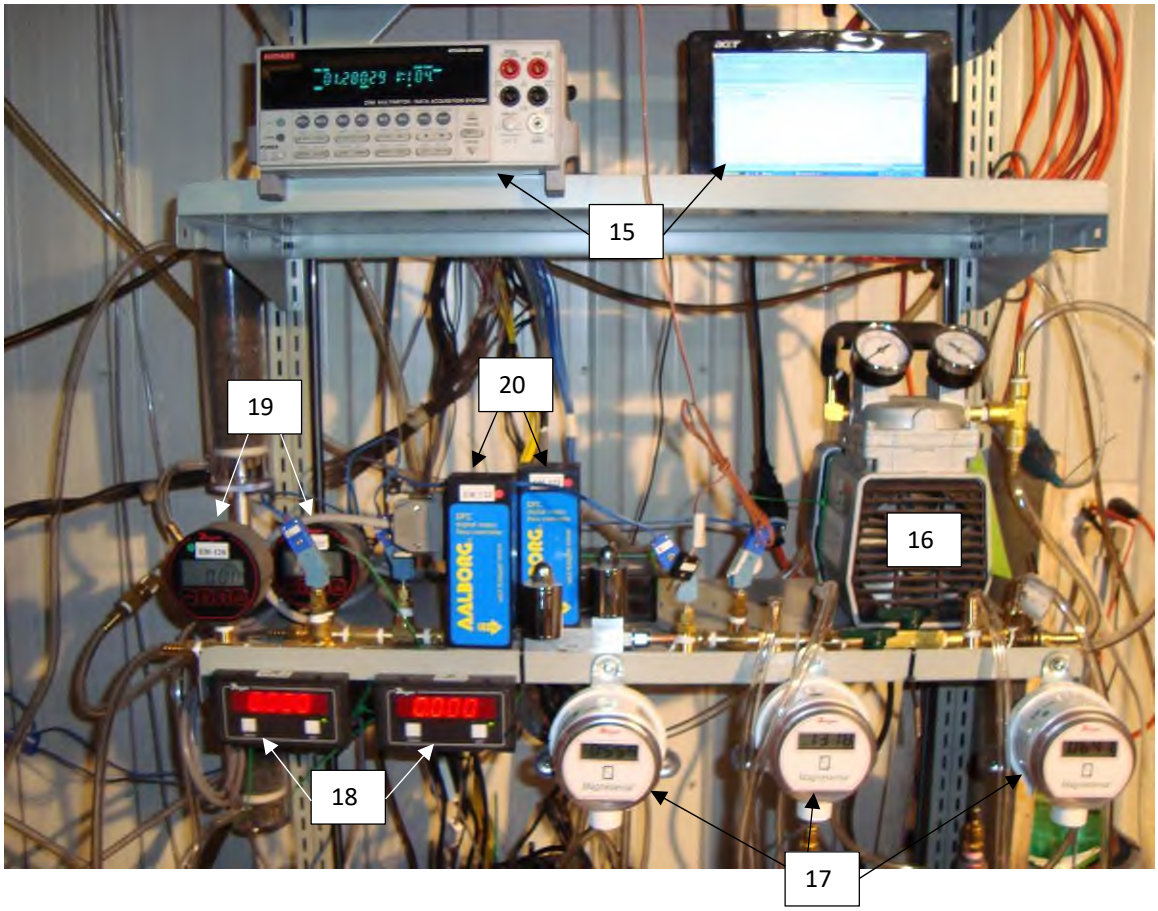
13.1: Extraction blower

Picture 5: Draft sampling



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

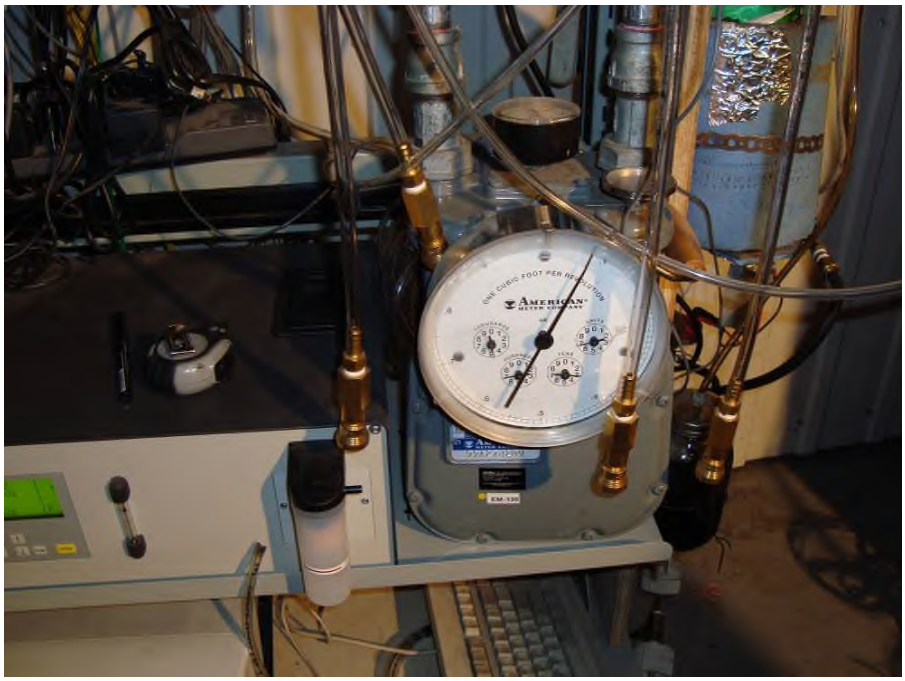
Picture 6: Equipments



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

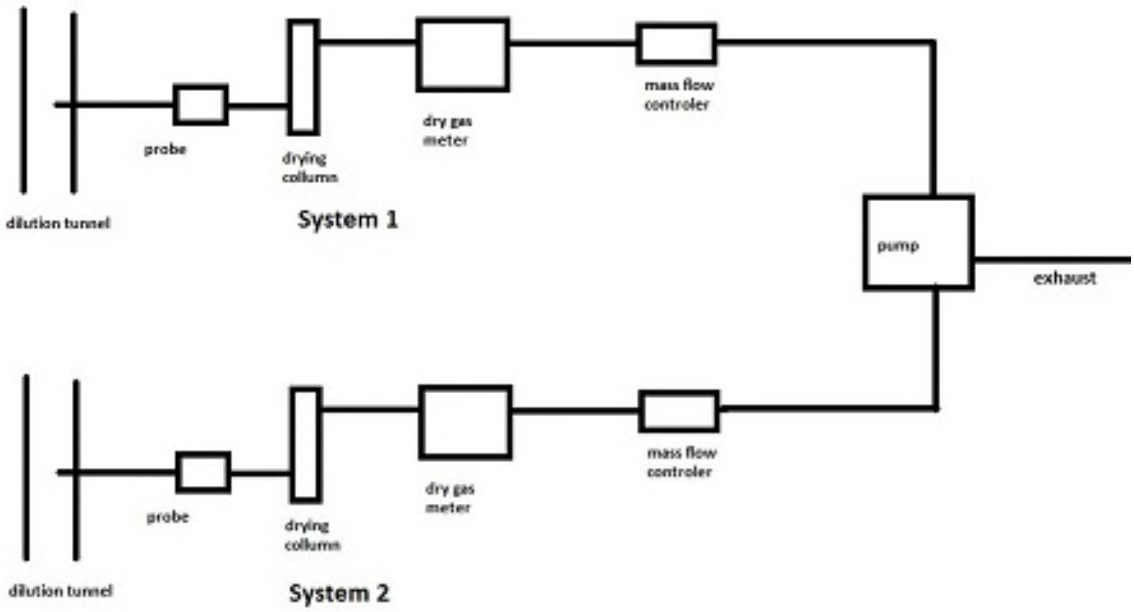
Picture 7: Gaz analyser

Picture 8: Reference dry gas meter



Picture 11: Dry gas meter

Picture 12: Dilution tunnel sample system



Picture 13: Dilution tunnel

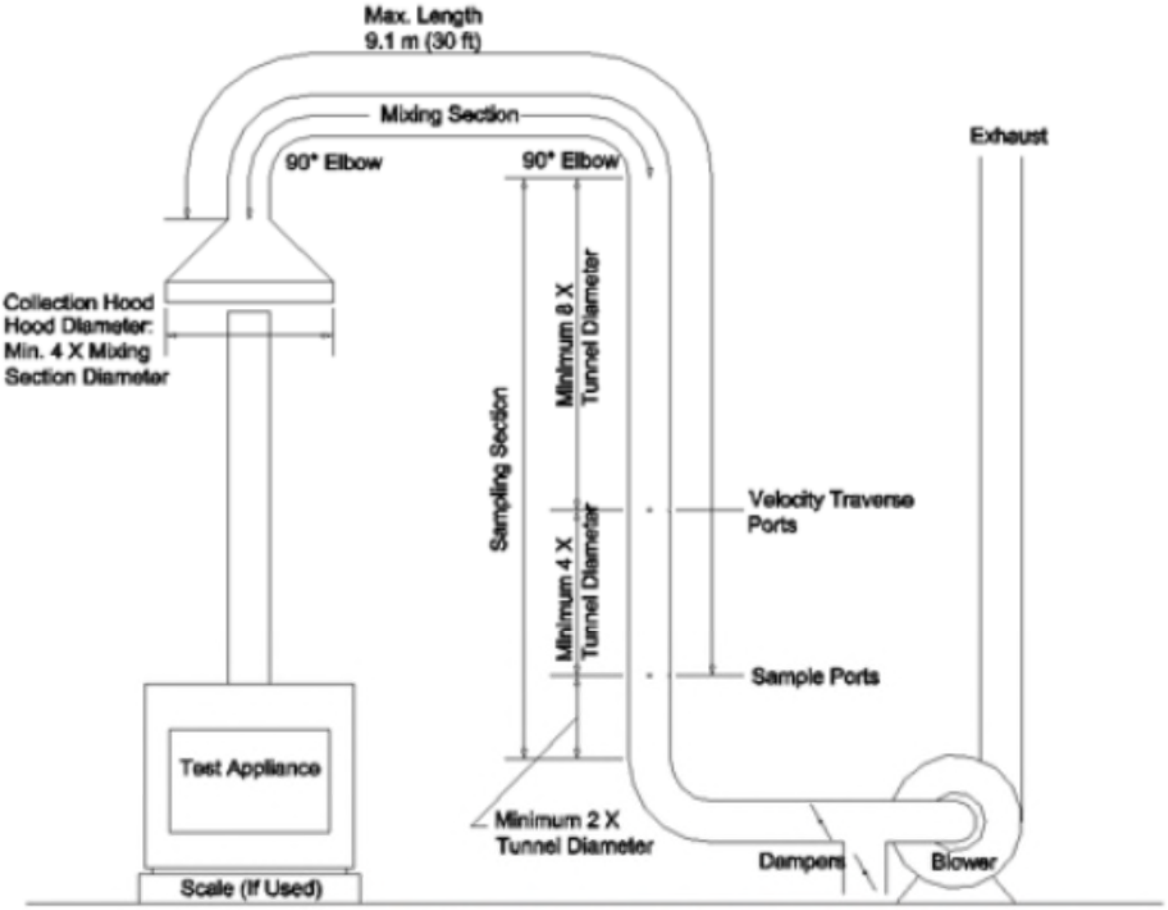


FIG. 3 Steel-Constructed Dilution Tunnel Apparatus

APPENDIX 9: Test load photographs

POLYTESTS
TESTING THROUGH YOUR REALITY

Run 1 February 26th 2019. Kazan stove

Testing load

Testing load

Side view

Load in stove

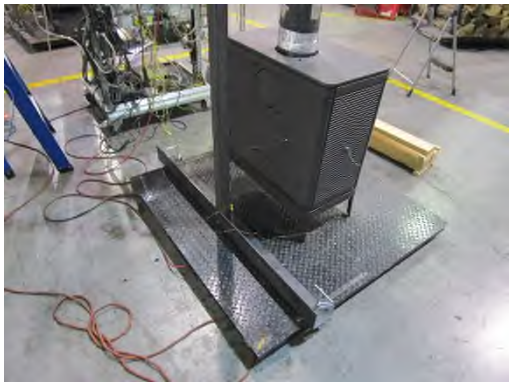
POLYTESTS
TESTING THROUGH YOUR REALITY

Run 2 February 27th 2017. Kazan Stove

Testing load

Testing load

Side and back view



Load in stove

APPENDIX 10: Laboratory Operating Procedures

POLYTESTS Services inc.

SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY OPERATING PROCEDURE

INTRODUCTION

This document provides a step by step guide for the technician conducting tests to EPA standard requirements. Procedures outlined here, when followed, will result in tests in conformance with EPA Methods 28R, ASTME2780, ASTME2515, ASTM E2618, Method 28WHH, Method 28 PTS, Method ALT-125, ASMTE 3053.

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

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

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

EPA METHODS

1. EPA METHODS 28R
2. ASTME2780
3. ASTME2515
4. ASTM E2618
5. METHOD 28WHH
6. METHOD 28 PTS
7. ALT-125
8. ASMTE 3053

I. APPLIANCE INSPECTION AND SET-UP

A. INCOMING INSPECTION

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

B. UNIT SET-UP

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

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

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

    Record catalyst temperature at 1-hour intervals or on chart recorder. Operating should continue until data shows at least fifty (50) hours of operation with catalyst temperature in excess of 500 degrees Fahrenheit (active range).

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

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

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.

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 tracable calibration gas bottles. Adjust flow meter if necessary at each instrument to required flow value.

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

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

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

3. Check for response time synchronization.

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

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

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

b) Place impingers in container and connect with "U TUBES". Grease carefully on bottom half of ball joint so that grease will not get into tubes.

c) Connect filter to first impinger and sample line to last impinger.

e. Leak check system as follows.

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

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

B. DILUTION TUNNEL SAMPLE TRAIN SET-UP

1. Filters and holders.

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

2. Leak checking.

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

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

d) Calculate leakage rate as follows.

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

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

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

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

e) Once leakage check is satisfactory, unplug probe and set flow to appropriate rate for test. This should be done in the minimum amount of time necessary and with the probes in ambient air. Do not insert probes in tunnel until the start of the test run. When flow is established, replug probes to prevent contamination.

III. TEST CONDUCT

A. FUEL LOAD

1. Determine optimum load weight by multiplying firebox volume in cubic feet by 7 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.

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 anomometer. Must be less than 50 ft/min.
4. Check all equipment for proper operation. Analyzers should be on and in sample mode. Computer should be loaded with test program and awaiting test start command.
5. Zero scale and start fire with uncolored newspaper and kindling representing 10 % of test load with the same type of fuel.
6. Once kindling is burning well after 5 minutes, add splitted pieces having a bottom surface around 4 sq. inches and representing 25% of test load weight. Operate at high fire for 15 minutes. Then adjust settings to intended test run levels as per the manufacturer's.
7. Following addition of pretest fuel load (splitted pieces), start computer for data logging.
8. All fuel additions, air intake settings and operational characteristics shall be noted with associated time stamp on form no. EPA-1-TP.

C. TEST RUN

1. Once the targeted test fuel bed weight is obtained, the test is to be started as follows:

   a) Insert the sample probes into the tunnel being careful not to hit sides of tunnel with probe tip.
   b) Check tunnel pitot tube for proper position. (Pitot should be carefully cleaned prior to each test.)
   c) Turn on probe sample systems and stack sampler.
   d) Open stove door, rake coals and load stove as follows: **TO BE DETERMINED**
   e) Close door or follow manufacturer's start-up procedures. (Five (5) minutes maximum time before all doors and controls must be set to final positions for duration of test. 15 minutes allowed for ALT-125 method))
   f) An alarm will sound an audible signal at the (10) minutes intervals. This signal a reading interval. You must verify at each interval that the following readings are correctly logged by the data acquisition system and make observations of any unusual or non-routine events that could occur.

      1) Rotometer readings.
      2) Tunnel pitot tube reading.
      (Zero regularly between readings)
      3) Gas meter readings.
      4) Temperature readings.
      5) Draft reading
      6) Test laod weight
      7) CO, CO_2 and O_2 readings
      8) Observations of any unusual or non-routine events.

   g) During the test, any condition approaching unacceptable limits will be noted. The filter probes and housings are installed in small holders just outside the tunnel. If the filter temperature gets too high, you will have to increase the water flow through the cooling unit until acceptable temperatures are obtained. In between readings, check on other equipment. Be sure dryers and filters are working and monitor impinger train for proper water and ice levels etc.

   h) When the fuel charge is consumed, it will signal end of test and shut down the sampling systems. When this occurs,

remove filter holder and probes from tunnel and impingers from sample line.

IV. POST TEST PROCEDURES

A. SAMPLE RECOVERY – FILTER TRAINS

1. Carefully clean outside of probes and filter housings with alcohol.
2. Disassemble filter holder and transfer filters to clean petri dish. Scrape gasket with scalpel and collect any loose material on filters.
3. Place probe and front half of first filter holders (still assembled) and filters in desiccator. Allow 24-hour desiccation before weighing.
4. Weigh probe filter holder units and filters at six (6) hour intervals until weight change between weighings 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}	10,68	lbs
θ	122	min
$\%M_W$	17,46	%

Calculation

BR	1,967	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	24,39	dcf
Y	0,9873	
P_{bar}	29,35	in Hg
ΔH	-0,7900	in Hg
T_m	539,0	R

Calculation

$V_{m(std)}$	22,51	dscf

Total amount of particulate matter collected (m_n)

Equation used

ASTM 2515, equation 12

$$m_n = F_1 + F_2 + \Delta PF$$

Nomenclature

m_n	Total amount of particulate matter collected, mg
F_1	Particulate matter collected on front filter, mg
F_2	Particulate matter collected on second filter, mg
ΔPF	Post-test weight gain of probe and filter holder assembly, mg

Sample calculation

Data

F_1	0,0009	g
F_2	0,000	g
ΔPF	0,001	g

Calculation

m_n	1,900	mg

Calculation based of train 2 data

Particulate concentration (C_S)

Equation used

ASTM 2515, equation 13

$$C_S = (0{,}001\ g/mg) \times \left(\frac{m_n}{V_{m\,(std)}}\right)$$

Nomenclature

C_S	Concentration of particulate matter in stack gas or dilution tunnel, dry basis, corrected to standard conditions, g/dsm^3 (g/dscf)
m_n	Total amount of particulate matter collected in the sampling train, mg
$V_{m(std)}$	Volume of gas sample measured corrected to dry standard conditions, dsm^3 (dscf)

Sample calculation

Data

m_n	1,900 mg
$V_{m(std)}$	22,51 dscf

Calculation

C_s	0,000084 g/dscf

Calculation based of train 2 data

Particulate concentration for room air (C_r)

Equation used

ASTM 2515, equation 14

$$C_r = (0{,}001\ g/mg) \times \left(\frac{m_r}{V_{mr\,(std)}}\right)$$

Nomenclature

C_r	Concentration of particulate matter in room air, dry basis, corrected to standard conditions, g/dsm^3 (g/dscf)
m_r	Total amount of particulate matter collected in the sampling train, mg
$V_{mr(std)}$	Volume of room air sample measured corrected to dry standard conditions, dsm^3 (dsc

Sample calculation

Data

m_r	0,200	mg
$V_{mr(std)}$	49,80	dscf

Calculation

C_r	0,000004	g/dscf

Calculation based of train 2 data

Adjustment factor for alternative pitot tube placement (FP)

Equation used

ASTM 2515, equation 1

$$F_P = \frac{V_{strav}}{V_{scent}}$$

Nomenclature

V_{strav}	Average gas velocity caclulated after the Pitot tube traverse
V_{scent}	Average gas velocity at the center of the dilution tunnel cacluated after the multi-point Pitot traverse
F_P	Adjustment factor for center of tunnel pitot tube placement

Sample calculation

Data

V_{strav}	0,229310016
V_{scent}	0,23978931

Calculation

F_P	0,956298

Average dilution tunnel gas velocity (V_S)

Equation used

ASTM 2515, equation 9

$$V_S = F_p K_P C_P \left(\sqrt{\Delta P}\right)_{avg} \sqrt{\frac{T_S}{P_S M_S}}$$

Nomenclature

V_S	Average dilution tunnel gas velocity, m/s (ft/s)
K_P	Pitot tube constant For the metric units: $34.97\ m/sec \left[\frac{\left(\frac{g}{g-mole}\right)(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$ For English units: $85.49\ ft/sec \left[\frac{\left(\frac{lb}{lb-mole}\right)(in\ Hg)}{(°R)(in\ H_2O)}\right]^{1/2}$
C_P	Pitot tube coefficient (use 0.99 for standard pitot tube, 0.84 may be used for S-type tubes constructed according to Method 2 specifications)
F_P	Pitot tube correction factor
$\left(\sqrt{\Delta P}\right)_{avg}$	Average square root of each individual velocity head (ΔP)
P_{bar}	Barometric pressure at measurement site, mm H_2O (in. H_2O)
P_g	Stack static pressure, mm Hg (in. Hg)
P_S	Absolute dilution tunnel static gas pressure, mm Hg (in. Hg), or $P_{bar} + P_g$
M_S	Molecular weight of dilution tunnel gas, wet basis, g/g-mole (lb/lb-mol) may be assumed to be 28.78 or 29 for CSA B415
t_S	Dilution tunnel temperature, °C (°F)
T_S	Absolute dilution tunnel temperature, °K (°R), or 273 + t_s for metric units, 460 + t_s for English units

Sample calculation

Data

K_P	85,49	
C_P	0,99	
F_P	0,956	
$\left(\sqrt{\Delta P}\right)_{avg}$	0,2364	in $H_20^{1/2}$
P_{bar}	29,35	in Hg
P_g	0,24	in H_20
P_S	29,37	in Hg
M_S	28,78	lb/lb-mol
t_S	105,73	F

T_S 565,73 R

Calculation

V_S 15,6532 ft/s

Average dilution tunnel gas flow rate (Qstd)

Equation used

ASTM 2515, equation 3

$$Q_{std} = 60(1 - B_{WS})V_S A\left(\frac{T_{std}}{T_S}\right)\left(\frac{P_S}{P_{std}}\right)$$

Nomenclature

Q_{std}	Total gas flow rate corrected to dry standard conditions, dsm^3/min (dscf/min)
60	Conversion factor minutes per hour
B_{WS}	Water vapour in the dilution tunnel stream, proportion by volume (may be assumed to be 2%)
V_S	Average dilution tunnel gas velocity, m/s (ft/s)
A	Cross-sectional area of dilution tunnel, m^2 (ft^2)
T_{std}	Standard absolute temperature, 293 °K (528°R)
T_S	Absolute average dilution tunnel temperature, °K (°R), or 273 + t_s for metric units, 460 + t_s for English units
t_S	Dilution tunnel temperature, °C (°F)
P_S	Absolute dilution tunnel static gas pressure, mm Hg (in. Hg), or P_{bar} + P_g
P_{bar}	Barometric pressure at measurement site, mm Hg (in. Hg)
P_g	Dilution tunnel static pressure, mm Hg (in. Hg)
P_{std}	Standard absolute pressure, 760 mm Hg (29.92 in. Hg)

Sample calculation

Data

B_{WS}	0,02	
V_S	15,653	
A	0,349	ft^2
T_{std}	528	R
T_S	565,73	R
P_S	29,370	in Hg
P_{std}	29,92	in Hg

Calculation

Q_{std}	294,34	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	0,000084	g/dscf
C_r	0,000004	g/dscf
Q_{std}	294,34	dscf/min

Calculation

E	0,02	g/min
E	1,42	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	0,000084	g/dscf
C_r	0,000004	g/dscf
Q_{std}	294,34	dscf/min
θ	122	min

Calculation

E	2,89	g

Calculation based on train 2 data.

Average gas velocity in dilution tunnel during each min interval, i, of the test run

Equation used

ASTM 2515, equation 10

$$v_{si} = F_p K_p C_p \sqrt{\Delta p_i} \sqrt{\frac{T_{si}}{P_s M_s}}$$

Nomenclature

v_{si}	Average gas velocity in dilution tunnel during each min interval, i of the test run m/sec (ft/sec)
F_P	Pitot tube correction factor
K_P	Pitot tube constant For the metric units: $34.97\ m/sec \left[\frac{\left(\frac{g}{g-mole}\right)(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$ For English units: $85.49\ ft/sec \left[\frac{\left(\frac{lb}{lb-mole}\right)(in\ Hg)}{(°R)(in\ H_2O)}\right]^{1/2}$
C_P	Pitot tube coefficient (use 0.99 for standard pitot tube, 0.84 may be used for S-type tubes constructed according to Method 2 specifications)
Δp_i	interval, i, of the test run
T_{Si}	Absolute average gas temperature in the dilution tunnel during the i^{th} minutes
P_S	Absolute dilution tunnel static gas pressure, mm Hg (in. Hg), or $P_{bar} + P_g$
M_S	Molecular weight of dilution tunnel gas, wet basis, g/g-mole (lb/lb-mol) may be assumed to be 28.78

Sample calculation

Data

i=1		**i=2**	
F_P	0,956	F_P	0,956
K_P	85,49	K_P	85,49
C_P	0,99	C_P	0,99
Δp_i	0,056 in H_20	Δp_i	0,055 in H_20
T_{Si}	599,9 R	T_{Si}	593,1 R
P_S	29,37 in Hg	P_S	29,37 in Hg
M_S	28,78 lb/lb-mol	M_S	28,78 lb/lb-mol

Calculation

i=1		**i=2**	
v_{si}	16,07 ft/sec	v_{si}	15,92 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	122	min	θ	122	min
θ_i	1	min	θ_i	1	min
V_m	23,73	dcf	V_m	22,52	dcf
$V_{mi(std)}$	0,191	cuft	$V_{mi(std)}$	0,1835	cuft
V_S	15,66	ft/sec	V_S	15,66	ft/sec
V_{Si}	16,077	ft/sec	V_{Si}	16,077	ft/sec
T_m	538,8	R	T_m	539,0	R
T_{mi}	537,63	R	T_{mi}	537,81	R
T_S	565,73	R	T_S	565,73	R
T_{Si}	599,9	R	T_{Si}	599,9	R

Calculation

train=1		**train=2**	
PR	101,9 %	PR	102,9 %

Filter face velocity check

Equation used

$$FV_{max} = \frac{V_{mL}}{1} \times \frac{1}{F_A}$$

Nomenclature

FV_{max}	Maximum filter face velocity during the test run, m/min (ft/min)
V_{mL}	Largest 1 minute interval metered gas volume value recorded during the test run, dm^3 (dcf)
F_A	Filter area exposed to gas sample during train operation, m2 (ft^2)

Sample calculation

Data

V_{mL}	0,175	dcf
F_A	0,0116	ft^2

Calculation

FV_{max}	15,07	ft/min

Dual train precision

Equation used

$$\frac{Train\ 1 - average\ train\ 1\ and\ train\ 2}{average\ train\ 1\ and\ train\ 2} \times 100 \leq 7.5\%$$

Nomenclature

Dual train precision	Deviation between emission's train 1 and 2
Train 1	Total emission for train 1
Train 2	Total emission for train 2

Sample calculation

Data

Train 1	2,73 g
Train 2	2,89 g

Calculation

Dual train precision	2,74 %

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
∆R	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

∆R	0,015 %
Span	5 %

Calculation

Drift	0,30 %

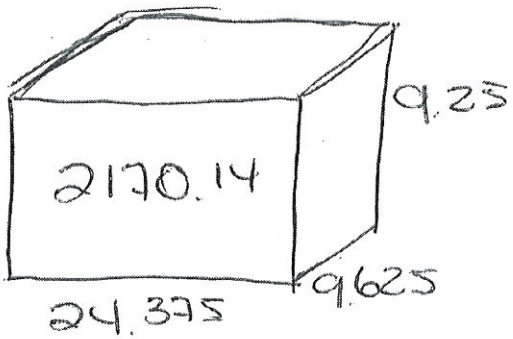
Calculated with CO concentration values.

APPENDIX 12: Volume calculations

POLYTESTS
UN SERVICE ADAPTÉ À VOTRE RÉALITÉ

Feuille de données vierge

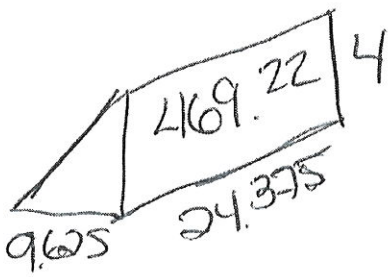
Tech : S.B.	Date : 18dec 2018	Projet : PI - 20182 Manufacturier : INVICTA (KAZAN)



$= 9.25 \times 9.625 \times 24.375$

$= 2170.14$

+



$= \frac{4 \times 9.625 \times 24.378}{2}$

$= 469$

$2639.36 / 1728 = 1,527$ cuft

USABLE VOLUME

APPENDIX 13: Operating instruction

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2019-02-26 Manufacturer: INVICTA Model: KAZAN

Project #: PI 20182 Run: 1 Tech: M M Reviewer: DP

Finding 300 LBS Stand Firm Full open
At 26 LBs close Door
At 1.2 LBs insert preload
At 11.8 LBS close Door
At 26 LBs insert load
At 2:30 close Door
TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

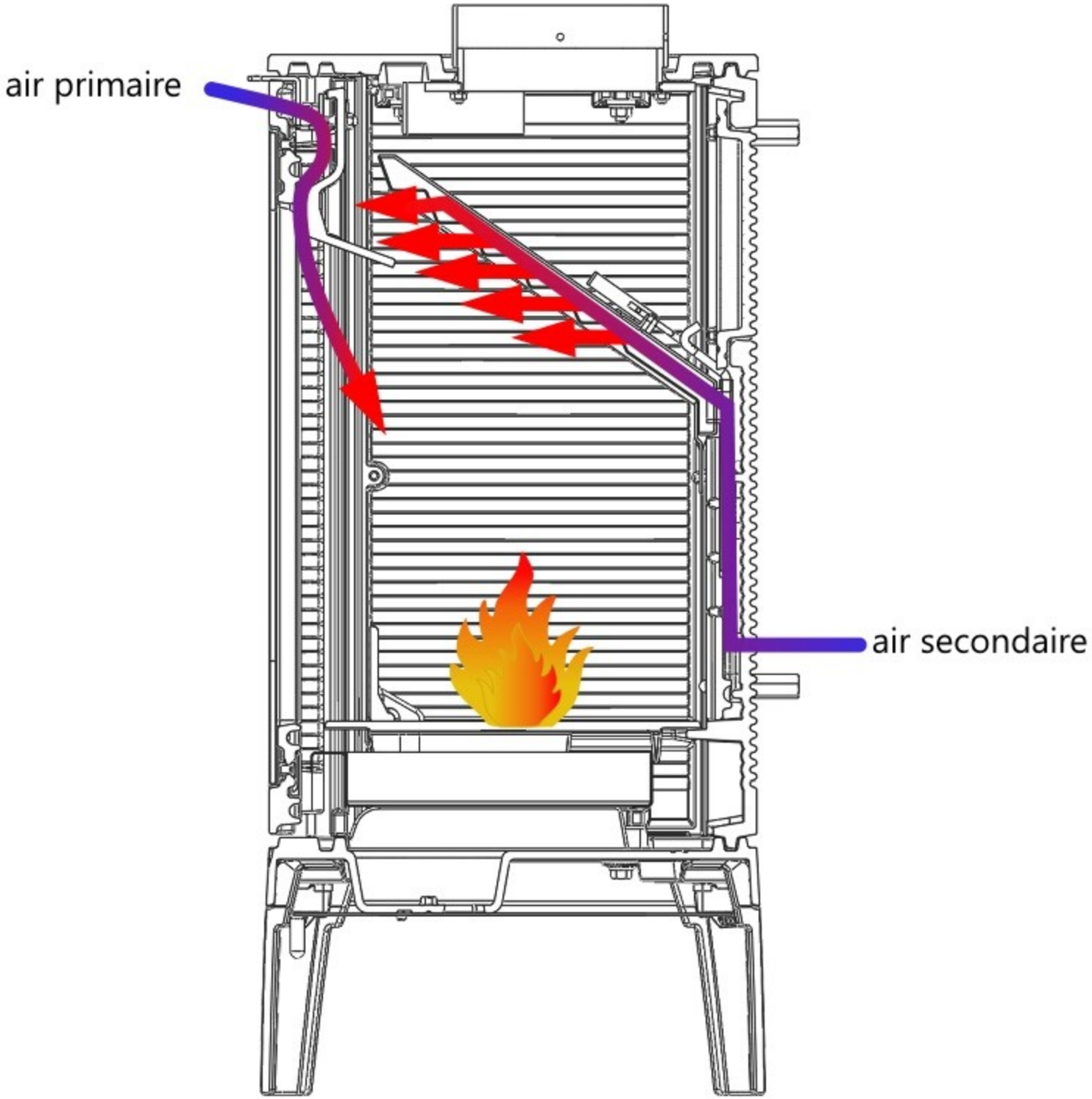
Date: 2019-01-23 Manufacturer: Invicta Model: KA-24

Project #: PT 2018 Run: 2 Tech: MM Reviewer: DP

Handling 300 LBS STAND FILE Full open
Δ1 26 LBS close Door
Δ1 12 LBS insert load
Δ1 118 LBS close Door
Δ1 24 LBS insert load
Δ1 2130 close Door

TEST LOAD CONFIGURATION

APPENDIX 14: Drawing Air flow pattern


air primaire
air secondaire

APPENDIX 15: Alternative Esthetic description

DECLINASION OF THE KAZAN, KAZAN GA, KIARA, KIARA GA

HERE'S THE DIFFERENCE BETWEEN ALL THE MODELS

KAZAN

KAZAN GA

it has a black glass door as oppose to a cast iron door of the Kazan.

KIARA

it has a different finish of the cast iron on the side of the stove compare to the KAZAN.

KIARA GA

it’s going to be the body of the Kiara but with the black glass front door of the Kazan GA.

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:
Energy distribution 2015 (Invicta group)

Appliance Type (Circle One):	Adjustable Burn Rate Wood Heater	Pellet Stove	Single Burn Rate Heater	Hydronic Heater	Forced Air Furnace	Other:
Hydronic Heater Type (Circle One):	Traditional	Full Storage	Partial Storage	Indoor/Outdoor	Other:	
Forced-Air Furnace Type (Circle One):	Small (less than 65,000 BTU/hr heat output)		Large (greater than 65,000 BTU/hr heat output)		Other:	
Fuel Type:	Crib	Pellet	Cordwood	Other:		

Model Name and Number:

Catalyst: Yes_____ No X

Mailing Address:

Street Address:

City:	**State:**	**ZIP Code:**
Phone:	**Fax:**	**Web Site:**

Address of Manufacturing Facility:

City:	**State**	**ZIP Code:**

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 RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

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- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

Phone: 450 741-3636	**E-mail: Dpower@polytests.com**	**Fax: NA**
City: St-jean-sur-richelieu	**State: Canada, Quebec**	**ZIP Code: J3B 7S7**

EPA APPROVED THIRD-PARTY CERTIFIER

Name and Title of Authorized Representative: **Ryan Beard**		
Company: **CSA Group**		
Phone: 416 747-32630	**E-mail:** **Ryan.beard@csagroup.org**	**Fax:** **416 401 6800**
City: **Toronto**	**State:** **On**	**ZIP Code:** **M9W 1R3**

COMPLIANCE TEST INFORMATION

Test Method(s):
Method 28; ASTME2515 ; ASTM E2780

Date(s) of Proposed Test:
February 26th 2019

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

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- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

DANIEL BEAUREGARD, V-P

Print Name and Title of Authorized Official

Signature

23/01/19

Date

Remarks:

v1

St-jean-sur-Richelieu, September 8th 2021

Att.: Rafael Sanchez, Steffan Johnson

Subject: TYPO, mixing baffle in template report

In our report template we forgot to remove the reference of the mixing baffle in the dilution tunnel in the description section 3.1 and in the drawing in appendix 8 for our report template. This TYPO will can be found in most of our EPA reports. In reality the mixing baffles has been removed from the tunnel in 2015 when the E.P.A. review the regulation and refer to the ASMTE2515 for sampling standard. Our Iso 17025 accreditor (IAS) has audited Polytests for the ASMT E2515 and other testing method in March 2015 and found the dilution tunnel compliant to the standard (no mixing baffle in place). Moreover, we have been audited every two years by the EPA proficiency testing and dilution tunnel have been dismantling and inspected by the auditor and no mixing baffle was in the dilution tunnels. In order to fix this issue, reports are updated to remove the TYPO and updated the drawing of the dilution tunnel in appendix 8.

Thank you
Best regards,

Danick Power
Polytests services inc.
695-B Gaudette
St-jean-sur-richelieu
J3B 7S7
Phone. : 450 741-3636
e-mail: infos@polytests.com

Regards
Marvin

Marvin Evans

Marvin Evans, LET, OBT1, G2
Technical Oversight Specialist,
Special Inspections / Field Evaluations – Fuel Burning Appliances
Certification - Oil and Solid Fuel Burning Appliances

178 Rexdale Blvd
Toronto, ON M9W 1R3
T 416 747 2342
C 437 996 5424
marvin.evans@csagroup.org
csagroup.org

International Accreditation Service, Inc.
3060 Saturn Street, Suite 100
Brea, CA 92821-1732 USA
tel: 562.364.8201
tel: 866.427.4422
fax: 562.699.8031
www.iasonline.org

IAS Laboratory Assessment Report

File or TL No.: File 2014-12-10

Laboratory Name: Services Polytests, Inc.

Laboratory Address: 695B Gaudette, St. Jean-sur-Richelieu, Quebec, J3B 7S7, Canada

Name and Title of Laboratory Contact: Gaetan Piedalue, P. Eng.; President

Name of Assessor: Douglas Sickles, P.E.

Date(s) of Assessment: March 16-20, 2015

Use this space to record names and titles of persons present at opening meeting:

Services Polytests : Gaetan Piedalue, P. Eng.; President ; Danick Power, VP, Operation Manager; Marie-Josee Brudeau, Quality Manager

IAS: Douglas Sickles, P.E.

Use this space to record names and titles of persons present at closing meeting:

Services Polytests : Gaetan Piedalue, P. Eng.; President ; Danick Power, VP, Operations Manager

IAS: Douglas Sickles, P.E.

Signature of Laboratory Representative:

Signature of Assessor:

Reviewer Comments:

Reviewed by:
Date:

Report	Date	Client	Product	Standards	Tested By:	Reviewer
P-1164	12-2012	ICC	Chimney Liner	ULC S640, UL 1777	Alain Lefebvre	Danick Power
P-1223	10-2014	ICC	Flexible Liner	ULC S640, UL 1777	Alain Lefebvre	Danick Power
P-1231	12-2014	ESIM	Automatically fed pellet/wood chip fired boiler	CSA B366.1 CSA B415.1 UL 2523 EPA Method 28 WHH ASTM 2515A	Maxime Martin	Danick Power
P-1246	11-2014	JA Roby	Wood Stove	UL 1482, ULC S627		Danick Power

TEST METHODS DEMONSTRATED AND REVIEWED:

Test methods demonstrated: (many tests shared between standards)

Test Standard/Method	Title
ANSI/UL 1482	Solid Fuel Type Room Heaters
CAN/ULC S627	Standard for Space Heaters for use with Solid Fuels
ASTM E1509	Standard Specification for Room Heaters, Pellet Fuel Burning type
CAN/CSA B366.1	Solid Fuel Fired Heating Appliances
CAN/CSA B415	Performance Testing of Solid Fuel Burning Heating Appliances
ASTM E2515	Determination of particulate matter collected by a dilution tunnel

Test methods that involved interviews and equipment review:

Test Standard/Method	Title
ULC S628	Fireplace Inserts
ANSI/UL 2523	Solid Fuel Fired Hydronic Heating Appliances, Water Heaters and Boilers
CAN/ULC S610	Standard for Factory Built Fireplaces
ANSI/UL 127	Factory Built Fireplaces
ANSI/UL 391	Solid Fuel and Combination Fuel Central and Supplementary Furnaces"
CAN/ULC S632	Standard for Heat Shields
ANSI/UL 1618	Wall protectors, floor protectors and hearth extensions
EPA 40 CFR Part 60, Subpart AAA, Method 28R	Certification and Auditing of Wood Heaters
EPA 40 CFR Part 60, Subpart QQQ, Method 28WHH	Measurement of Particulate Emissions and Heating Efficiency of Wood-Fired Hydronic Heating Appliances
E2558,E2618, E2779, E2780	Particulate Matter Emissions for Wood, heaters, Pellet heaters, Boilers, Wood Fireplaces
ULC S604	Standard for Factory-Built type A Chimneys
ULC S629	Standard for 650^{o}C Factory-Built Chimneys
UL 103	Factory-Built Chimneys for Residential type and Building Heating Appliances
ULC S640	Standard for Lining Systems for New Masonry Chimneys
ULC S641	Standard for Factory-Built Chimney connectors and wall pass-through assemblies
UL 1777	Chimney Liners
ULC S635	Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
CERTIFICATION OF CONFORMITY
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

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GENERAL INFORMATION

Manufacturer's Name: ENERGY DISTRIBUTION 2015 (INVICTA GROUP)

Heater Type (Circle One):	Adjustable Burn Rate Wood Heater	Pellet Stove	Single Burn Rate Heater	Hydronic Heater	Forced Air Furnace	Other:
Hydronic Heater Type (Circle One):	Traditional	Full Storage	Partial Storage	Indoor/Outdoor	Other:	
Forced-Air Furnace Type (Circle One):	Small (less than 65,000 BTU/hr heat output)		Large (greater than 65,000 BTU/hr heat output)		Other:	
Fuel Type:	Crib	Pellet	Cordwood	Other:		

Model Name and Number:

1. INVICTA GROUP: KAZAN
2. INVICTA GROUP: KAZAN GA
3. INVICTA GROUP: KIARA
3. INVICTA GROUP: KIARA GA

Catalyst: Yes_____ No__X___

Mailing Address: 1361 DENISON, ST-ALPHONSE, QC. J0E 2A0

Street Address: 1320 DENISON

City: ST-ALPHONSE	**State: QC**	**ZIP Code: J0E 2A0**
Phone: 1-877-257-2251	**Fax: NA**	**Web Site: WWW.ENERGYDISTRIBUTION.CO**

Address of Manufacturing Facility:

ZI LA GRAVETTE
Donchery, Ardennes 08350
France

City: Doncherry	**State Ardennes**	**ZIP Code: 08350**

EPA APPROVED THIRD PARTY CERTIFIER

Authorized Representative: Ryan Beard C.Tech

Company: CSA Group

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
CERTIFICATION OF CONFORMITY
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

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Phone: 1-416-747-2630	**E-mail: ryan.beard@csagroup.org**	**Fax: NA**
City: Toronto	**State: Ontario**	**ZIP Code: M9W 1R3**
Position: Certifier III		
Report Number: PI-20182	**Date of Tests: February 26 and 27, 2019**	**Date of Report: March 9, 2019**
Quality Assurance Plan included?: Yes ___X___ No_____	**Wood Heater/Hydronic Heater/Forced-Air Furnace Application Included: Yes ___X__ No_____**	**Remarks:**
Affected Source Data Summary		
Wood Burning Heater	**Hydronic Heater**	**Forced-Air Furnace**
Weighted particulate emission average of 2 test runs: 1.76 grams per hour	Maximum Output Rating:_NA_____ Weighted particulate emission average: X Lb/MMbtu output	Particulate emission average: X Lb/MMbtu output
Weighted average HHV efficiency of 2 test runs: 63.4%	Annual Efficiency Rating:____NA____	Overall thermal efficiency (HHV): X%
	Particle Emissions:_____NA_____	Overall Delivered Heat Efficiency: X%
AFFIRMATIONS		

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
CERTIFICATION OF CONFORMITY
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

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- **The above-named affected source has been tested by a laboratory qualified to test and report on the emissions of this type of product under 40 CFR Part 60, Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces (2015 Standards).**
- **The Test Report No. PI-20182, prepared by Danick Power, P.Eng, and dated March 9, 2019, has been reviewed by Ryan Beard, C.Tech, and was found to be complete and to have used the correct procedures in accordance to the 2015 NSPS Standards.**
- **The emissions levels measured in the Test Report and listed above comply with the relevant particulate matter limits established by the 2015 NSPS Standards.**
- **The model listed above was tested to ASTM E2780-10 ; ASTM E2515-11 methods 28R as referred into 40**
- **CFR Part 60 Subpart AAA for Particulate and CSA B415.1-10 for Efficiency.**
- **The permanent label and owner's manual meets the requirements of 40 CFR § 60.536 and/or § 60.5478.**
- **The above-named manufacturer, on the effective date of this certificate, was operating under a quality assurance plan, per 40 CFR § 60.533(m) and/or § 60.5475(m), that has been reviewed and approved by Ryan Beard, C.Tech**
- **The above-named manufacturer has contracted CSA Group to conduct regular (at least annual) unannounced audits of the manufacturing facility, affected source, and quality assurance plan pursuant to 40 CFR § 60.533(m) and/or § 60.5475(m).**

Ryan Beard, C.Tech – Certifier III

Print Name and Title

Signature of Authorized Third-Party Representative

April 17, 2019

Date

This is a certification of conformity to certify that the bearer has successfully completed the requirements pursuant to the 2015 NSPS Standards.

Third-party EPA approval expiration date: 2020

V1

Remarks:

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
2015 Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces Application
40 CFR PART 60 SUBPARTS AAA AND QQQQ

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Contents

Application for US EPA certification 2

Wood Burning Heaters 6

I. Test Method 28R for Certification and Auditing of Wood Heaters ..... **Erreur ! Signet non défini.**

A. *Summary Results – Adjustable Wood Burning Heaters* ..... **Erreur ! Signet non défini.**

B. Summary Results – Single Burn Rate Wood Burning Heaters 6

C. Summary Results – Pellet Heaters ..... **Erreur ! Signet non défini.**

Hydronic Heaters ..... **Erreur ! Signet non défini.**

II. Test Method 28WHH for Measurement of Particulate Emissions and Heating Efficiency of Wood-Fired Hydronic Heating Appliances **Erreur ! Signet non défini.**

Table 1A. Data Summary Part A ..... **Erreur ! Signet non défini.**

..... **Erreur ! Signet non défini.**

Table 1B. Data Summary Part B ..... **Erreur ! Signet non défini.**

Table 1C: Additional (Hangtag) Information ..... **Erreur ! Signet non défini.**

Table 2. Annual Weighting ..... **Erreur ! Signet non défini.**

III. Test Method 28WHH for Certification of Cord Wood-Fired Hydronic Heating Appliances With Partial Thermal Storage... **Erreur ! Signet non défini.**

Table 2A. Data Summary Part A ..... **Erreur ! Signet non défini.**

Table 2B. Data Summary Part B ..... **Erreur ! Signet non défini.**

Table 3C. Data Summary Part D ..... **Erreur ! Signet non défini.**

Forced-Air Furnaces ..... **Erreur ! Signet non défini.**

IV. Forced-Air Furnaces ..... **Erreur ! Signet non défini.**

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: ENERGY DISTRIBUTION 2015 (INVICTA GROUP)

Heater Type (Circle One):	Adjustable Burn Rate Wood Heater	Pellet Stove	Single Burn Rate Heater	Hydronic Heater	Forced Air Furnace	Other:
Hydronic Heater Type (Circle One):	Traditional	Full Storage	Partial Storage	Indoor/Outdoor	Other:	
Forced-Air Furnace Type (Circle One):	Small (less than 65,000 BTU/hr heat output)		Large (greater than 65,000 BTU/hr heat output)		Other:	
Fuel Tested:	Crib	Pellet	Cordwood	Wood Chips	Other:	

Test Method(s): Method 28	**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):

1. **INVICTA GROUP: KAZAN**
2. **INVICTA GROUP: KAZAN GA**
3. **INVICTA GROUP: KIARA**
4. **INVICTA GROUP: KIARA GA**

Physical Address (Street number and Address, not P.O. Box): 1320 DENISON	**Mailing Address: 1361 DENISON, ST-ALPHONSE, QC. J0E 2A0**

City:ST-ALPHONSE	**State: QC**	**ZIP Code: J0E 2A0**
Phone: 1-877-257-2251	**Email: INFO@ENERGYDISTRIBUTION.CO**	**Website: WWW.ENERGYDISTRIBUTION.CO**

EPA Submission Date of 30 day Notice: January 23rd 2019

MANUFACTURER'S AUTHORIZED REPRESENTATIVE INFORMATION

Name: DANIEL BEAUREGARD

Position/Title: V-P, SECRETARY

Address: 1320 DENISON

City: ST-ALPHONSE	**State:QC**	**ZIP Code:J0E 2A0**
Phone: 1-877-257-2251	**E-mail: DANIEL@ENERGYDISTRIBUTION.CO**	**Website: WWW.ENERGYDSITRIBUTION.CO**

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

Remarks:

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: Ryan Beard

Position/Title: C. Tech Certifier- Fuel group

Address: 178 Rexdale blvd,

City: Toronto	**State: ontario**	**ZIP Code: M9W 1R3**
Phone: 416-747-2630	**Email: ryan.beard@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.
The drawing have been put in attachement (p610443-poele_kazan-ga_asm-22fev2019-modification)

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.
See attachement (p610443-poele_kazan-ga_asm-22fev2019-modification) and (Assembly Kazan GA).

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.**
2 Report will be attach, CBI and NONE CBI

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).
2 Report will be attach, CBI and NONE CBI

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. **See attachement (Manual Kazan-GA-Kiara on page #46)**

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.**See attachment (IU - 14-0065 control qualité)**

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 seal the day after test were run and will be kept in our warehouse.**

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. **See attachment (IU-14-0065 control qualité) and (Manual Kazan-GA-Kiara). The owner's manual will be upload on our website when approbation is issue.**

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. **See page 3 on this document.**

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. **See page 3 on this document.**

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.
A copy of the test report will be upload on our website when certification will be issue.

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.
The certification is issue for: Energy Distribution 2015
Model Invicta Group: Kazan, Kazan GA, Kiara, Kiara GA

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.
No unit will be sold without certificate of compliance.

Print Name and Title: DANIEL BEAUREGARD, V-P/SECRETARY | **Date: 04/03/19**

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

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	1,967	1,38	64,5%	23 830	1,814
2	1,968	2,14	62,3	23 070	2,08
Weighted particulate emission average of 2 test runs: 1.76 grams per hour.					
Weighted average HHV efficiency of 2 test runs: 63.4 %.					
Average Co 1.95 gr/min					