TEST REPORT

TEST OF A WOOD HEATER FOR EMISSIONS AND EFFICIENCY

PER EPA METHODS 28R AND ASTME2515 and ASTME2780 and CSAB415.1, MAY 2015

Client:

**Hearthstone QHHP**

317 Stafford ave.

Morrisville, Vt 05661

Model name: Lincoln 8060

Attention: Rafaël Sanchez

TESTED BY:

Services Polytests Inc.

695-B Gaudette

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

TEST DATES: June 27th to July 27st 2022

REPORT DATE: August 1st 2022

Revision1: April 1st 2025

Project number: PI-20272

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Tested: written by:

Maxime Martin Danick Power, P. Eng

Verified by third party certifier (PFS):

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Revision1 (April 1st 2025):

- Additional names update detail section 1.2
- Appendix 6 additional drawings for new models
- Appenidx 7 additional manual pages and label for new names
- Static pressure subtracting from barometric pressure update table 2.6 & 2.7 & appendix 1
- Tunnel Velocity added table 2.5

# List of appendixes

APPENDIX 1: Raw data, forms and results

APPENDIX 2: Proportionality results

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APPENDIX 8: Photographs of test set up

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APPENDIX 13: Operating instruction

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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

- Test dates: June 27th to July 27st 2022
- Test methods used:
    - Particulate emissions: ASTM E2780-10; ASTM E2515-11 methods 28R as referred into 40 CFR Part 60 Subpart AAA; CSA B 415.1-22
    - Efficiency: CSA B415.1-22

## 1.2 TEST UNIT INFORMATION

General

- Manufacturer: Hearthstone
- Product type: Hybrid wood stove
- Combustion system: catalytic, with pre combustion
- Unit tested: Lincoln 8060
- Option: The alternative Catalyst can be installed in this stove as it meets the requirement emission rate range from the WDS-146.
- Additional names: Green Mountain 20 & Dorset
- description: Green Mountain 20 and Dorset will be identical to our already approved models listed on Certification Letter Number 335-22 in all functional aspects of the appliance, but will have a different aesthetic applied exclusively to the outer cast iron body.

## 1.3 RESULTS

Emission results obtained

- Average emission rate: 1.1 grams/hour

Conformity: NSPS Phase 2020 with crib wood and CSAB415.1-22

## 1.4 PRETEST INFORMATION

Unit condition: The unit was received by carrier on June 15th 2022. The 50hrs of aging was done by the laboratory at medium heat draw, during week prior to testing (all data in Appendix 4). The 50hrs aging for the alternative catalyst have been done after the first four tests and prior to confirmation test with the alternative catalyst.

Set up

- Venting system type: 6-inch diameter insulated chimney
- System height from floor: 15 feet
- Particularities: After the four tests the catalysts have been changes for the 50 hrs aging of the second (alternative) catalyst. Following the 50 hrs aging on the alternative catalyst a minimum and a maximum test have been done on the stove for catalyst equivalency (WDS-146- in appendix 15).

Break in period

- Duration: the unit was pre burned by Polytests and run for at least 50 hours for each catalyst, adequate documentation of fuel additions, flue and unit temperatures and fuel moisture recorded. All details in Appendix 4.
- Fuel: Red Oak cordwood between 19% and 25%

# 2 SUMMARY OF TEST RESULTS

## 2.1 EMISSIONS

| Run Number | Test Date (YR-MM-DD) | Emission Rate (g/hr) | Burn Rate (kg/hr) | 1st hour Emission Rate (g/hr) | CSA B415.1 CO emission Gr/hr | CSA B415.1 emission Gr/Mj |
|---|---|---|---|---|---|---|
| 1 | 2022-06-27 | 0,84 | 0,987 | 2,251 | 38,696 | 0,055 |
| 2 | 2022-06-28 | 1,50 | 1,070 | 3,032 | 18,243 | 0,090 |
| 3 | 2022-06-29 | 1,14 | 1,474 | 1,539 | 69,026 | 0,053 |
| 4 | 2022-06-30 | 1,17 | 1,396 | 0,549 | 17,297 | 0,055 |
| 5 | 2022-07-25 | 1,16 | 1,416 | 2,049 | 16,712 | 0,054 |
| 6 | 2022-07-26 | 0,84 | 0,970 | 1,498 | 17,888 | 0,056 |

## 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 | 0,987 | 0,84 | 79,4% | 14 545 | 0,645 |
| 2 | 1,07 | 1,50 | 80,5% | 15 776 | 0,304 |
| 4 | 1,40 | 1,17 | 78,0% | 20 305 | 0,288 |
| 3 | 1,47 | 1,14 | 75,7% | 20 507 | 1,150 |
| **Weighted particulate emission average of 4 test runs: 1.1 grams per hour.** | | | | | |
| **Weighted average HHV efficiency of 4 test runs: 79 %.** | | | | | |
| **Average Co 0.60 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 | 79 | 79 | 29,619 | 29,678 | 56,9 | 36,8 | 0 | 0 |
| 2 | 77 | 78 | 29,943 | 29,943 | 51,2 | 33,6 | 0 | 0 |
| 3 | 79 | 83 | 29,973 | 29,973 | 44,9 | 33,9 | 0 | 0 |
| 4 | 74 | 79 | 30,062 | 30,002 | 46,6 | 40,1 | 0 | 0 |
| 5 | 80 | 85 | 29,530 | 29,530 | 44,6 | 37 | 0 | 0 |
| 6 | 78 | 82 | 29,766 | 29,796 | 55,4 | 40,3 | 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 | 13,97 | 19,74 | 1,5 | 6,96 | 6,964 | 20,73 | 15 | 4 | 0 | 12 |
| 2 | 14,68 | 20,35 | 1,8 | 7,06 | 7,060 | 20,54 | 15 | 4 | 0 | 12 |
| 3 | 14,38 | 20,61 | 1,6 | 7,03 | 7,028 | 20,17 | 15 | 4 | 0 | 12 |
| 4 | 13,83 | 20,17 | 1,6 | 7,03 | 7,032 | 20,22 | 15 | 4 | 0 | 12 |
| 5 | 14,74 | 20,38 | 1,6 | 7,08 | 7,078 | 20,41 | 15 | 4 | 0 | 12 |
| 6 | 14,58 | 20,39 | 1,7 | 6,94 | 6,942 | 20,22 | 15 | 4 | 0 | 12 |

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

| Average dilution tunnel measurements | | | | Sample Data | | | |
|---|---|---|---|---|---|---|---|
| Run Number | Burn Rate (Min) | Tunnel Velocity (ft/min) | Total Temperatures (°R) | Volume sampled (DSCF) | | Particulate catch (mg) | |
| | | | | 1 | 2 | 1 | 2 |
| 1 | 159 | 1060 | 545,81 | 29,471 | 28,852 | 1,20 | 1,20 |
| 2 | 149 | 1068 | 547,28 | 27,752 | 26,921 | 2,00 | 1,90 |
| 3 | 108 | 990 | 559,49 | 20,245 | 19,670 | 1,20 | 1,20 |
| 4 | 114 | 1000 | 556,81 | 20,312 | 20,788 | 1,20 | 1,30 |
| 5 | 113 | 1076 | 555,08 | 20,976 | 21,108 | 1,20 | 1,20 |
| 6 | 162 | 1061 | 548,63 | 30,091 | 30,332 | 1,30 | 1,20 |

## 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 | 1873,45 | 1913,65 | 2,21 | 2,26 | 1,17% | 0,020 |
| 2 | 1892,41 | 1950,82 | 3,75 | 3,68 | 0,98% | 0,027 |
| 3 | 1707,64 | 1757,55 | 2,01 | 2,08 | 1,59% | 0,025 |
| 4 | 1826,81 | 1784,96 | 2,17 | 2,29 | 2,78% | 0,047 |
| 5 | 1860,33 | 1848,75 | 2,18 | 2,17 | 0,35% | 0,006 |
| 6 | 1870,04 | 1855,16 | 2,38 | 2,18 | 4,53% | 0,079 |

## 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 | 0,987 | 435,04 | -59,8 | 0,061 | -0,190 | lowest setting | 159 |
| 2 | 1,070 | 436,45 | -44,9 | 0,062 | -0,190 | lowest setting | 149 |
| 3 | 1,474 | 493,95 | -19,5 | 0,063 | -0,160 | maximum opening | 108 |
| 4 | 1,396 | 480,26 | -22,1 | 0,059 | -0,170 | maximum opening | 114 |
| 5 | 1,416 | 478,37 | -21,0 | 0,064 | -0,200 | maximum opening | 113 |
| 6 | 0,970 | 431,76 | -57,9 | 0,054 | -0,180 | lowest setting | 162 |

# 3 PROCESS DESCRIPTION

## 3.1 DISCUSSION

The unit was delivered by the client and received in a good condition. Four runs have been done for weighted average without any convection fan. Two more runs have been done with the alternative catalyst for equivalency, one at the maximum burn rate and a second at minimum burn rate.

## 3.2 UNIT DIMENSIONS

Baffle

- Location: between top of combustion chamber and hearth
- Restriction: 2X (2.0-inch X 2.625 inch) at the front of the unit
- Dimensions: cover the hearth area minus the restriction at the front
- Material: Gemcolite ½ inch thick.

Bricks

- All stove made from soapstone; bottom made from cast Iron with lining of soapstone in the firebox

Flue gas exhaust

- Location: top flue
- Dimensions: 6 in. diameter
- Material: Cast Iron

Gasket

- For all details refer to appendix 6

Overall unit dimension

- Overall dimensions: 14-inch-wide x 24 ¾ inch deep x 30 ½ inch high
- Usable volume: 1.0 cuft
- Firebox volume details refer to appendix 12 Volume calculation

Convection fan

- None

Catalyst (appendix 6 for details):

- Applied Ceramics – P/N WF-4150001076
- Cell density: 50 CPSI
- Material: 16 Ga SS430 or 304

Alternative Catalyst:

- Applied Ceramics – P/N WF-415000106
- Cell density: 50 CPSI
- Material: 16 Ga SS430 or 304

## 3.3 AIR SUPPLY SYSTEM

Description

- Primary air: Window wash design in cast iron channel fully gasketed on the top front and bottom back of the combustion chamber. Air intake on the rear bottom of the unit (if facing door of stove)
- Secondary air: secondary tube design with air intake coming from the bottom rear of unit, then up through a steel riser tube to the secondary air baffle at the back

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. | | | | |
|---|---|---|---|---|---|---|
| Identification | Type | Imin | Imax | Controlled | Location | OUTLET (sq. in.) |
| APPENDIX 14 | Primary | 0,40 | 2,37 | Yes | Lower rear, Primary delivery | 0,49 |
| APPENDIX 14 | | | | Yes | Air wash, primary delivery | 2,06 |
| Appendix 14 TA | Secondary | 0,36 | 0,62 | Yes | Secondary air, baffle delivery | 1,25 |

* 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. test fuel spacers with a length of 4 inches (4" x 1.5" x .75") instead of typical 5 inches, with no other changes to the crib load specifications have been used due to the narrow width of the firebox, approval letter from the EPA can be found in appendix 15. For run 1 to 4 filters have been weighted in pair with the gasket to reduce weighting error propagation, for other runs filters are weighted in pair and the gaskets separately.

Run #1
This run was performed on June 27th 2022. It lasted 159 minutes and a 0.987 kg/hr burn rate was obtained & emission at 0.84 gr/hr. Air inlet damper was set at the minimum (Lowest possible) setting. No convection fan was used during the test

Run #2
This run was performed on June 28th 2022. It lasted 149 minutes and a 1.07 kg/hr burn rate was obtained & emission at 1.5 gr/hr. Air inlet damper was set at the minimum (Lowest possible) setting. No convection fan was used during the test

Run #3
This run was performed on June 29th 2022. It lasted 108 minutes and a 1.47 kg/hr burn rate was obtained & emission at 1.14 gr/hr. Air inlet damper was set at the maximum setting. No convection fan was used during the test

Run #4
This run was performed on June 30th 2022. It lasted 114 minutes and a 1.40 kg/hr burn rate was obtained & emission at 1.17 gr/hr. Air inlet damper was set at the maximum setting. No convection fan was used during the test

Run #5
Following change of catalyst and an aging of 50hrs on this second catalyst. This run was performed on July 25th 2022. It lasted 113 minutes and a 1.41 kg/hr burn rate was obtained & emission at 1.16 gr/hr. Air inlet was set at the maximum opening. This run at the maximum setting meets the catalyst equivalency requirement (WDS-146 enclosed in appendix 15), with less than 0.5gr/hr above to the original catalyst run #3 emission result(1.14gr/hr). No convection fan was used during the test. During this run, negative weight has been found on back filter but none on probe and gasket, those were handled properly

Run #6
This run was performed on July 26th 2022. It lasted 162 minutes and a 0.97 kg/hr burn rate was obtained & emission at 0.84 gr/hr. Air inlet was set at the minimum (Lowest possible) setting. This run at the lowest setting meets the catalyst equivalency requirement (WDS-146 enclosed in appendix 15). No convection fan was used during the test

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

Test fuel cribs

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

### 3.5 START-UP OPERATION

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

### 3.6 SAMPLING LOCATIONS

Particulate samples are collected from the dilution tunnel. The tunnel has two elbows ahead of the sampling section. The sampling section is a continuous 8-inch diameter pipe straight over its entire length. Tunnel velocity pressure is determined by a standard pitot tube, thermocouple is installed on the pitot tube to measure the dry bulb temperature. MC is assumed, as allowed, to be 2%. Tunnel samplers are located downstream of the pitot tube and upstream from the end of this section. All detail of dilution tunnel can be found in appendix 8.

### 3.7 DRAWINGS

Various drawings of the stack gas sampling train and of dilution tunnel system are found in Appendix 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 NIST 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 10 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: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 1 Tech: MM Reviewer: NP

- loading 2.8LBS START 1st int
- by pass open
- Door open
- At 2.5LBS close Door
- At 11LBS insert 1st preload
- close Door immediatly
- At 12LBS insert second preload
- close Door immediatly
- At 33LBS close air inlet and close by pass
- At 15LBS rack coal Bed

After 2 min insert load and open air inlet

At 5 min close air inlet to lowest setting

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE / POST CHECKS

Date: 2022-06-27 Manufacturer: Hearthstove Model: 8260

Project #: PT 20272 Run: 1 Tech: MM Reviewer: AP

Moisture Meter Calibration Check:

| Equipment # | Time | 12% | 22% |
|---|---|---|---|
| EM-334 | 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 (tunnel velocity) | ok | NA |
| Picture (4 sides) | ok | ok |

**Wood Heater Conditions:**

| | |
|---|---|
| Date Wood Heater Stack Cleaned | 2022-06-27 |
| Date Dilution Tunnel Cleaned | 2022-06-27 |
| Induced Draft Check (max 0.005 H2O) | ok |
| Traverse before ignition | ok |

**Temperature System:**

| | |
|---|---|
| Ambient (65°-90°F) | ok °F |

**Proportional Checks:**

| | | |
|---|---|---|
| Thermocouple check | ok | |
| Pitot Clean | ok | |
| Pitot verification | ok | |
| Pictures for report | Side | ok |
| | Coal bed | ok |
| | Load | ok |
| | Load in stove | ok |
| | Fuel adjustment | ok |
| Load Length approximately 5/6 of firebox Lenght | | ok |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 1 Tech: MM Reviewer: SP

## Leakage Checks Tunnel Samplers

| | System 1st hour | | System 1 | | System 2 | |
|---|---|---|---|---|---|---|
| | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) |
| Unplugged Flow Rate = .25cfm | | | | | | |
| Vacuum (inches Hg.) | -10 | | -10 | | -10 | |
| Final 1minute DGM (Liter) | 655543.62 | 656425.31 | 655543.80 | 656425.44 | 403.402.56 | 404268.56 |
| Initial 1minute DGM (Liter) | 655543.58 | 656425.31 | 655543.78 | 656425.41 | 403.402.52 | 404268.56 |
| Change (Liter) | 0.04 | 0 | 0.02 NSM | 0.03 | 0.02 | 0 |
| Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56) | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Check OK | OK | OK | OK | OK | OK | OK |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 1 Tech: MM Reviewer: DP

## 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 | .5 | 3 | .4 |
| Check OK (no change after 15 sec.) | Ok | Ok | Ok | Ok |

## Scales checks

| Scale Type | Audit | | Measured Weight |
|---|---|---|---|
| | Equipment # | Weight | |
| Platform | EM-090 | 44 lbs, Class F | lbs |
| Platform | EM-205 | 1000 ~~lbs~~ kg, Class F | 1000 ~~lbs~~ kg |
| Wood | EM-090 | 440 lbs, Class F | 440 lbs |
| Analytical | EM-335 | 100 mg, Class S | 100 mg |
| Analytical | EM-129 | 200 g, Class S | 200 g |

## LIMITS OF WEIGHT RANGES

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

POLYTESTS
TESTING THROUGH YOUR REALITY

# CONTINUOUS ANALYZERS

Date: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 1 Tech: MM Reviewer: DP

FOR TUNNELS < 12 in

Barometric pressure ($P_{bar}$) 103 (KPa.) Static pressure ($P_q$) 0.19 (inches w.c.)
Inside diameter: Port A _____ Port B ____.
Tunnel cross sectional area: .1963$Ft^2$
Pitot tube type: Standard

| Traverse Point | Position (inches) | | | Velocity Head $\Delta_p$ (inches $H_2O$) | Tunnel Temperature (°F) |
|---|---|---|---|---|---|
| | 6 po | 7 po | 8 po | | |
| A- Centroid | 3.00 | 3.50 | 4 | 0.069 | 77.52 |
| B - Centroid | 3.00 | 3.50 | 4 | 0.069 | 77.55 |
| A-1 | 0.40 | 0.50 | 0.50 | 0.055 | 77.52 |
| A-2 | 1.50 | 1.75 | 2 | 0.065 | 77.51 |
| A-3 | 4.50 | 5.25 | 6 | 0.064 | 77.52 |
| A-4 | 5.60 | 6.5 | 7.5 | 0.056 | 77.52 |
| B-1 | 0.40 | 0.50 | 0.50 | 0.055 | 77.55 |
| B-2 | 1.50 | 1.75 | 2 | 0.065 | 77.59 |
| B-3 | 4.50 | 5.25 | 6 | 0.074 | 77.59 |
| B-4 | 5.60 | 6.5 | 7.5 | 0.055 | 77.55 |
| | | | | 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.
$\Delta_p$ = 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 ($\Delta_p$) measured at each traverse point.

# CONTINUOUS ANALYZERS

Date: 2022-06-27 Manufacturer: Heathstone Model: 8060

Project #: PT 20272 Run: 1 Tech: MR Reviewer: SP

Pre-Test (Adjust and Record)

| | ZERO | | SPAN | | CAL. (Record Only) | |
|---|---|---|---|---|---|---|
| CO | 0 | 0 | 3015 | 3000 | 1,010 | 1,000 |
| Tolerance CO | 0 | +/- 0.02 | 0015 | +/- 0.15 | 0010 | +/- 0.05 |
| $CO_2$ | 0 | 0 | 17 93 | 1800 | 9 74 | 10 00 |
| Tolerance CO2 | 0 | +/- 0.02 | 007 | +/- 0.5 | 026 | +/- 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 | 3009 | 1006 | 0 | 0.02 | 0,006 | 0.15 | 0,004 | 0.05 | ✓ | |
| $CO_2$ | 0 | 17 98 | 980 | 0 | 0.02 | 005 | 0.5 | 006 | 0.5 | ✓ | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# TEST DATA LOG

Date: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 1 Tech: MM Reviewer: DP

## RAW DRY GAS METER READINGS

| | System 1 | System 2 | Blanck |
|---|---|---|---|
| Final (Liter) | 656 424, 45 | 404 267, 18 | 390 000, 40 |
| Initial (Liter) | 655 544, 33 | 403 402, 38 | ~~389~~ 389 285, 70 |

## AMBIENT CONDITIONS

| | Before | After |
|---|---|---|
| Barometer (kPa): | 100,3 | 100,5 |
| Dry Bulb (F): | 78,8 | 79,1 |
| Humidity (%): | 56,9 | 36,8 |

## Flow Meter

| | Start | End |
|---|---|---|
| Flow meter reading | N.A | N.A |

## Flow Meter Verification

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

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 1 Tech: MS Reviewer: DP

## FUEL DESCRIPTION:

Type of wood:

## PRE-TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 14 in. | 1 122 lbs. | 19.4 | 19.3 | 19.4 | 19.6 | 19.3 |
| 1 1/2 x 3 1/2 x 14 in. | 1 380 lbs. | 19.6 | 19.5 | 19.5 | 19.5 | 19.4 |
| 1 1/2 x 3 1/2 x 14 in. | 1154 lbs. | 20 | 20.0 | 19.5 | 19.3 | 19.4 |
| 1 1/2 x 3 1/2 x 7 in. | 0834 lbs. | 20.0 | 20.0 | 19.8 | 19.3 | 19.8 |
| 1 1/2 x 3 1/2 x 7 in. | 0 846 lbs. | 19.1 | 19.2 | 19.4 | 19.4 | 19.3 |
| 1 1/2 x 3 1/2 x 7 in. | 0 846 lbs. | 19.2 | 19.2 | 19.3 | 19.4 | 19.3 |
| 1 1/2 x 3 1/2 x 7 in. | 0 848 lbs. | 19.6 | 19.4 | 19.3 | 19.4 | 19.4 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3 1/2 x 14 in. | 1092 lbs. | 20.1 | 20.1 | 20.0 | 19.9 | 19.8 |
| 1 1/2 x 3 1/2 x 14 in. | 1336 lbs. | 19.8 | 19.6 | 19.7 | 19.7 | 19.8 |
| 1 1/2 x 3 1/2 x 14 in. | 1204 lbs. | 19.6 | ~~20.0~~ 20.0 MC | 20.3 | 20.2 | 20.1 |
| 1 1/2 x 3 1/2 x 7 in. | 0840 lbs. | 20.0 | 20.1 | 20.1 | 20.1 | 20.2 |
| 1 1/2 x 3 1/2 x 7 in. | 0834 lbs. | 19.9 | 19.8 | 19.9 | 19.8 | 19.8 |
| 1 1/2 x 3 1/2 x 7 in. | 0 826 lbs. | 19.9 | 20.0 | 20.0 | 20.3 | 20.4 |
| 1 1/2 x 3 1/2 x 7 in. | 0812 lbs. | 20.1 | 20.3 | 20.4 | 20.4 | 20.3 |
| 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:** 6 946 + 7028 lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 1 Tech: MM Reviewer: BP

## FUEL DESCRIPTION:

Type of wood :

## TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 15 in. | 1 518 lbs. | 21 | 21 4 | 21 3 | 21 4 | 21 3 |
| 1 1/2 x 3 1/2 x 15 in. | 1 53 lbs. | 21 5 | 22 1 | 22 0 | 21 8 | 21 3 |
| 1 1/2 x 3 1/2 x 15 in. | 1 386 lbs. | 21 9 | 21 3 | 21 4 | 21 3 | 21 2 |
| 1 1/2 x 3 1/2 x 15 in. | 1 304 lbs. | 19 1 | 19 4 | 19 3 | 19 6 | 19 4 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3 1/2 x 4 in. | 0 112 lbs. | | | 19 6 | | |
| 1 1/2 x 3 1/2 x 4 in. | 0 122 lbs. | | | 19 3 | | |
| 1 1/2 x 3 1/2 x 4 in. | 0 104 lbs. | | | 19 8 | | |
| 1 1/2 x 3/4 x 4 in. | 0 106 lbs. | | | 19 8 | | |
| 1 1/2 x 3/4 x 4 in. | 0 108 lbs. | | | 19 1 | | |
| 1 1/2 x 3/4 x 4 in. | 0 092 lbs. | | | 19 2 | | |
| 1 1/2 x 3/4 x 4 in. | 0 078 lbs. | | | 19 1 | | |
| 1 1/2 x 3/4 x 4 in. | 0 096 lbs. | | | 19 3 | | |
| 1 1/2 x 3/4 x 4 in. | 0 112 lbs. | | | 19 2 | | |
| 1 1/2 x 3/4 x 4 in. | 0 092 lbs. | | | 19 4 | | |
| 1 1/2 x 3/4 x 4 in. | 0 090 lbs. | | | 19 6 | | |
| 1 1/2 x 3/4 x 4 in. | 0 114 lbs. | | | 19 5 | | |
| 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**: 6 98 lbs Min 20%: 1 40 Max 25%: 1 75

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-23 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 1 Tech: MM Reviewer: DP

| | | 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 | 19 | 302 | ~~303~~ 303 | 25 | 32 | 304 | 305 | 34 | 308 |
| 2022-06-23 | 17:00 | 109,0900 | | 35 2080 | | 110 1783 | | 34 5082 | | 0 1286 |
| 2022-06-27 | 10:00 | 109,0899 | | 35 2081 | | 110,1783 | | 34 5082 | | 0 1287 |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | | 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 | 19 | 302 | 303 | 25 | 32 | 304 | 305 | 34 | 308 |
| 2022-06-27 | 16:00 | 109,0906 | | 35 2099 | | 110 1788 | | 34 5094 | | 0 1289 |
| 2022-07-07 | 8:00 | 109,0900 | | 35 2092 | | 110,1783 | | 34 5083 | | 0 1288 |
| 2022-07-08 | 8:00 | 109,0900 | | 35 2092 | | 110 1783 | | 34 5083 | | 0 1288 |
| | | | | | | | | | | |
| | | | | | | | | | | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-23 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 1 Tech: MM Reviewer:

| Pre-test Weight Record | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 39 | 306 | 307 | 38 |
| 2022-06-23 | 12:00 | 110 2778 | | 35 8541 | |
| 2022-06-27 | 10:00 | 110 2777 | | 35 8540 | |
| | | | | | |
| | | | | | |

| Post-test Weight Record | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 39 | 306 | 307 | 38 |
| 2022-06-27 | 16:00 | 110 2779 | | 35 8556 | |
| 2022-07-07 | 8:00 | 110 2778 | | 35 8552 | |
| 2022-07-08 | 8:00 | 110 2778 | | 35 8552 | |
| | | | | | |
| | | | | | |

# Paramètres

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

| | |
|---|---|
| Code verrouillage: | HEA |

## Description du test

| | | |
|---|---|---|
| Test standard | EPA | |
| Run # | 1 | |
| Date | 27-06-2022 | |
| Technicien | M.M | |
| Project # | PI 20272 | |

## Description de l'unité

| | | |
|---|---|---|
| Manufacturier | HEARTHSTONE | |
| Modèle | 8060 | |
| Combustion system | Non-Cat | |
| Appliance type | WOOD SYOVE | |
| Firebox volume | 1 | 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 | 1 | |
| 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): | 1,007 | Dimensionless |
| Equipment number (DGM #1): | EM 178 | |
| Calibration Factor (DGM #2): | 1,005 | Dimensionless |
| Equipment number (DGM #2): | EM 318 | |
| Calibration Factor (DGM #3): | 0,988 | |
| Equipment number (DGM #3): | EM 179 | Dimensionless |

## Tunnel

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 27-06-2022 |
| **Technicien** | M.M |

## Fuel data

| | | |
|---|---|---|
| Fuel type | Dimension | |
| Fuel specie | D. Fir | |
| HHV | 19810,0 | kJ/kg |
| %C | 48,7 | |
| %H | 6,9 | |
| %O | 43,9 | |
| %Ash | 0,5 | |
| HHV | 8519,2 | Btu/lb |
| LHV | 7451,0 | Btu/lb |

**Default Fuel Values**

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

| | Start | End |
|---|---|---|
| Barometer (kPa): | 100,3 | 100,5 |
| Barometer (in.Hg): | 29,618579 | 29,67763883 |
| Dry Bulb (F): | 78,8 | 79,1 |
| Humidity (%): | 56,9 | 36,8 |
| Air velocity (ft/min) | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DGM #1 | Final: | 23181,411 | cuft | Final: | 656424,450 | Liter |
| | Initial: | 23150,330 | cuft | Initial: | 655544,330 | Liter |
| | | | | | | |
| DGM #2 | Final: | 14276,561 | cuft | Final: | 404267,180 | Liter |
| | Initial: | 14246,021 | cuft | Initial: | 403402,380 | Liter |
| | | | | | | |
| DGM room | Final: | 13772,734 | cuft | Final: | 390000,400 | Liter |
| | Initial: | 13747,495 | cuft | Initial: | 389285,700 | Liter |

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 252

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 27-06-2022 |
| **Technicien** | M.M |

## Preload data sheet

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,30 | 7,00 | 7,70 |

Load Volume: 0,4253 cu. ft

Loading Density: 13,974 lbs./ft3

Number of Spaces:

Spacer weight (lbs):

Load Density (wet): 32,853 lbs./ft3

Dry Wood Density: 27,437098

| Piece Size (in): Thick | Wide | x Length | Weight lbs | Meter Moisture Content Dry Uncorrected % | | | | | Ave. MC x Weight | Volume Cubic Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 3,5 | 14 | 1,122 | 19,4 | 19,3 | 19,4 | 19,6 | 19,3 | 21,7668 | 73,50 |
| 1,5 | 3,5 | 14 | 1,38 | 19,6 | 19,5 | 19,5 | 19,5 | 19,4 | 26,91 | 73,50 |
| 1,5 | 3,5 | 14 | 1,154 | 20 | 20 | 19,9 | 19,3 | 19,4 | 22,75688 | 73,50 |
| 1,5 | 3,5 | 7 | 0,834 | 20 | 20 | 19,8 | 19,3 | 19,8 | 16,49652 | 36,75 |
| 1,5 | 3,5 | 7 | 0,846 | 19,1 | 19,2 | 19,4 | 19,4 | 19,3 | 16,31088 | 36,75 |
| 1,5 | 3,5 | 7 | 0,846 | 19,2 | 19,2 | 19,3 | 19,4 | 19,3 | 16,31088 | 36,75 |
| 1,5 | 3,5 | 7 | 0,848 | 19,6 | 19,4 | 19,3 | 19,4 | 19,4 | 16,46816 | 36,75 |
| | | | | | | | | | | 0,00 |
| 1,5 | 3,5 | 14 | 1,092 | 20,1 | 20,1 | 20 | 19,9 | 19,8 | 21,81816 | 73,50 |
| 1,5 | 3,5 | 14 | 1,336 | 19,8 | 19,6 | 19,7 | 19,7 | 19,8 | 26,34592 | 73,50 |
| 1,5 | 3,5 | 14 | 1,204 | 19,6 | 20 | 20,3 | 20,2 | 20,1 | 24,12816 | 73,50 |
| 1,5 | 3,5 | 7 | 0,84 | 20 | 20,1 | 20,1 | 20,1 | 20,2 | 16,884 | 36,75 |
| 1,5 | 3,5 | 7 | 0,834 | 19,9 | 19,8 | 19,9 | 19,8 | 19,8 | 16,54656 | 36,75 |
| 1,5 | 3,5 | 7 | 0,826 | 19,9 | 20 | 20 | 20,3 | 20,4 | 16,61912 | 36,75 |
| 1,5 | 3,5 | 7 | 0,812 | 20,1 | 20,3 | 20,4 | 20,4 | 20,3 | 16,4836 | 36,75 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00

## FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,3 | 7,0 | 7,7 |

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

Load Volume: 0,18 cu. ft

Loading Density: 7,0 lbs./ft3

Number of Spaces: 12

Spacer weight: lbs

Load Density (wet): 31,5 lbs./ft3

Dry Wood Density: 26,1 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 | 15 | 1,52 | 21,10 | 21,40 | 21,30 | 21,40 | 21,30 | 32,3334 | 78,75 | 21,3 |
| 1,5 | 3,5 | 15 | 1,53 | 21,50 | 22,10 | 22,00 | 21,80 | 21,30 | 33,2622 | 78,75 | 21,7 |
| 1,5 | 3,5 | 15 | 1,39 | 21,90 | 21,30 | 21,40 | 21,30 | 21,20 | 29,68812 | 78,75 | 21,4 |
| 1,5 | 3,5 | 15 | 1,30 | 19,10 | 19,40 | 19,30 | 19,60 | 19,40 | 25,24544 | 78,75 | 19,4 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 0,75 | 4 | 0,11 | | | 19,60 | | | 2,1952 | 4,50 | 19,6 |
| 1,5 | 0,75 | 4 | 0,12 | | | 19,30 | | | 2,3546 | 4,50 | 19,3 |
| 1,5 | 0,75 | 4 | 0,10 | | | 19,80 | | | 2,0592 | 4,50 | 19,8 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,80 | | | 2,0988 | 4,50 | 19,8 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,10 | | | 2,0628 | 4,50 | 19,1 |
| 1,5 | 0,75 | 4 | 0,09 | | | 19,20 | | | 1,7664 | 4,50 | 19,2 |
| 1,5 | 0,75 | 4 | 0,08 | | | 19,10 | | | 1,4898 | 4,50 | 19,1 |
| 1,5 | 0,75 | 4 | 0,10 | | | 19,30 | | | 1,8528 | 4,50 | 19,3 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,20 | | | 2,1504 | 4,50 | 19,2 |
| 1,5 | 0,75 | 4 | 0,09 | | | 19,40 | | | 1,7848 | 4,50 | 19,4 |
| 1,5 | 0,75 | 4 | 0,09 | | | 19,60 | | | 1,764 | 4,50 | 19,6 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,50 | | | 2,223 | 4,50 | 19,5 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 |

# Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,19 in. H20 Absolute value
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=**
0,952

**Pour un tunnel moins de 12", prendre 4 lectures**

| | TUNNEL VELOCITY | TUNNEL TEMP | SQUARE ROOT |
|---|---|---|---|
| | In. wc | °F | |
| A center | 0,069 | 77,52 | 0,2627 |
| B center | 0,069 | 77,55 | 0,2627 |
| A1 | 0,055 | 77,52 | 0,2345 |
| A2 | 0,065 | 77,51 | 0,2550 |
| A3 | 0,064 | 77,52 | 0,2530 |
| A4 | 0,056 | 77,52 | 0,2366 |
| | | | |
| B1 | 0,055 | 77,550 | 0,2345 |
| B2 | 0,065 | 77,590 | 0,2550 |
| B3 | 0,074 | 77,590 | 0,2720 |
| B4 | 0,055 | 77,550 | 0,2345 |
| AVERAGE | 0,0627 | 77,5420 | 0,2500 |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 27-06-2022 |
| **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 | 19 | 302 | 303 | 25 | 32 | 304 | 305 | 34 | 39 | 306 | 307 | 38 | 308 | | |
| Before (1) | | | | | | | | | | | | | | | |
| Before (2) | | | | | | | | | | | | | | | |
| Before (3) | | | | | | | | | | | | | | | |
| Before (4) | | | | | | | | | | | | | | | |
| Before (5) | 109,0900 | | 35,2080 | | 110,1783 | | 34,5082 | | 110,2778 | | 35,8541 | | 0,1286 | 2022-06-23 | 17:00 |
| Before (6) | 109,0899 | | 35,2081 | | 110,1783 | | 34,5082 | | 110,2777 | | 35,8540 | | 0,1287 | 2022-06-27 | 10:00 |
| After (1) | 109,0906 | | 35,2099 | | 110,1788 | | 34,5094 | | 110,2779 | | 35,8556 | | 0,1289 | 2022-06-27 | 16:00 |
| After (2) | 109,0900 | | 35,2092 | | 110,1783 | | 34,5083 | | 110,2778 | | 35,8552 | | 0,1288 | 2022-07-07 | 08:00 |
| After (3) | 109,0900 | | 35,2092 | | 110,1783 | | 34,5083 | | 110,2778 | | 35,8552 | | 0,1288 | 2022-07-08 | 08:00 |
| After (4) | | | | | | | | | | | | | | | |
| After (5) | | | | | | | | | | | | | | | |
| After (6) | 109,0900 | | 35,2092 | | 110,1783 | | 34,5083 | | 110,2778 | | 35,8552 | | 0,1288 | 2022-07-08 | 08:00 |
| Difference | 0,0001 | 0,0000 | 0,0011 | 0,0000 | 0,0000 | 0,0000 | 0,0001 | 0,0000 | 0,0001 | 0,0000 | 0,0012 | 0,0000 | 0,0001 | | |
| Total (mg) | | 1,2 | | | | 1,3 | | | | 1,3 | | | 0,1 | | |
| Total ajusté (mg) | | **1,10** | | | | **1,20** | | | | **1,20** | | | | | |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 27-06-2022 |
| **Technicien** | M.M |

SFBA EPA EMISSION RESULTS

**Test Duration:** **159** min

| | | | |
|---|---|---|---|
| PRESSURE FACTOR: | DGM 1 | 0,96288 | |
| | DGM 2 | 0,96829 | |
| | DGM 3 | 0,99091 | |
| TEMPERATURE FACTORS | DGM 1 | 0,97832 | |
| | DGM 2 | 0,97036 | |
| | DGM 3 | 0,97914 | |
| VOLUMES SAMPLED | DGM 1 | 29,471 | SCft |
| | DGM 2 | 28,852 | Scft |
| | DGM 3 | 24,199 | SCft |

TOTAL TUNNEL VOLUME : 55212

SAMPLE RATIOS

| | |
|---|---|
| Sample Train 1: | 1873,450 |
| Sample Train 2: | 1913,646 |

Paticulate concentration

| | | |
|---|---|---|
| Sample Train 1 | **0,000044** | g/dscf |
| Sample Train 2 | **0,000045** | g/dscf |
| Room | **0,000004** | g/dscf |

TOTAL EMISSIONS

| | | |
|---|---|---|
| Sample Train 1 | **2,21** | g |
| Sample Train 2 | **2,26** | g |

EMISSION RATES

| | | |
|---|---|---|
| Sample Train 1 | **0,83** | g/hr |
| Sample Train 2 | **0,85** | g/hr |

1st hour emission rate **2,25** g/hr

| | Train 1 | Train 2 |
|---|---|---|
| Cs | 4,411E-05 | 4,5058E-05 |

RESULTS

**Average emission rate:** 0,84 g/hr

Burn Rate : 0,987 Dry kg/hr

BAROMETRIC PRESSURE

| | | |
|---|---|---|
| Average: | 29,64810884 | in Hg |
| Start: | 29,61857885 | in Hg |
| End: | 29,67763883 | in Hg |

DGM CONTROLLER VALUES

| | | | |
|---|---|---|---|
| DGM 1 | Final: | 23181,411 | Cuft |
| | Initial: | 23150,330 | Cuft |
| DGM 2 | Final: | 14276,561 | Cuft |
| | Initial: | 14246,021 | Cuft |
| DGM #3 | Final: | 13772,734 | Cuft |
| | Initial: | 13747,495 | Cuft |

TEMPERATURES

| | | |
|---|---|---|
| DGM 1 | 539,702 | °R |
| DGM 2 | 544,128 | °R |

CALIBRATION FACTORS

| | |
|---|---|
| DGM 1 | 1,0066 |
| DGM 2 | 1,0054 |
| DGM #3 | 0,9882 |

TUNNEL FLOW RATE: 347,243 Dscfm

PARTICULATE CATCH

| | | |
|---|---|---|
| Total Sample Train 1: | 1,30 | mg |
| Total Sample Train 2: | 1,30 | mg |
| Total Sample Train 1 1st hour: | 1,20 | mg |

DEVIATION: 1,17%

| | | Average | 0,33 | 10,59 | #DIV/0! | 286,31 | 79,25 | 85,81 | 434,71 | 344,96 | 548,12 | 511,96 | 335,43 | 704,33 | 0,19 | 79,80 | 79,60 | 84,09 | 0,18 | 83,98 | 84,28 | 85,30 | 0,08 | 0,05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * | | * | * | * | * | *1 | *2 | *3 | *4 | *5 | *6 | *7 | *8 | *9 | Mass flow 1 | DGM 1 | DGM 1 | Filter 1 | Mass flow 2 | DGM 2 | DGM 2 | Filter 2 | Tunnel Velo | Flue draft |
| Elapsed | | Weight | | | | Flue | Room | Tunnel | Unit | Unit | Unit | Unit | Unit | Catalyst | Reading | Inlet T | Outlet T | Temp | Reading | Inlet T | Outlet T | Temp | Pressure | Pressure |
| Time | Raw data row | Remaining | CO | $CO_2$ | $O_2$ | Gas | Temp | Dry Bulb | Top | Back | R.Side | L.Side | Bottom | | | | | | | | | | in wc | in wc |
| min | | lbs | % | % | % | °F | °F | °F | °F | °F | °F | °F | °F | °F | cuft/min | oF | oF | oF | cuft/min | oF | oF | oF | in wc | in wc |
| 0,00 | 252,00 | 6,9 | 0,1 | 2,9 | 0,0 | 283,2 | 79,3 | 91,4 | 372,7 | 320,8 | 578,2 | 560,3 | 438,8 | 456,8 | 0,18 | 78,98 | 79,01 | 87,71 | 0,18 | 79,64 | 80,44 | 84,45 | 0,07 | 0,05 |
| 1,0 | 253,0 | 6,9 | 0,4 | 4,0 | 0,0 | 286,9 | 79,1 | 88,5 | 367,8 | 316,3 | 570,9 | 554,2 | 437,9 | 648,6 | 0,18 | 78,89 | 79,00 | 87,24 | 0,18 | 79,68 | 80,50 | 84,20 | 0,07 | 0,06 |
| 2,0 | 254,0 | 6,8 | 0,1 | 5,7 | 0,0 | 305,5 | 79,0 | 88,1 | 365,2 | 311,7 | 561,9 | 544,1 | 436,4 | 676,8 | 0,18 | 78,92 | 79,01 | 86,81 | 0,18 | 79,81 | 80,62 | 84,01 | 0,08 | 0,06 |
| 3,0 | 255,0 | 6,8 | 0,1 | 6,4 | 0,0 | 314,7 | 79,3 | 88,3 | 363,9 | 311,5 | 552,7 | 534,3 | 435,4 | 681,0 | 0,18 | 78,95 | 79,01 | 86,52 | 0,18 | 79,93 | 80,70 | 83,90 | 0,08 | 0,06 |
| 4,0 | 256,0 | 6,7 | 0,1 | 6,6 | 0,0 | 318,7 | 78,9 | 88,9 | 364,5 | 309,6 | 542,1 | 523,3 | 433,4 | 673,5 | 0,18 | 78,94 | 79,02 | 86,32 | 0,18 | 80,10 | 80,78 | 83,84 | 0,07 | 0,06 |
| 5,0 | 257,0 | 6,6 | 0,1 | 10,3 | 0,0 | 307,4 | 79,0 | 87,4 | 369,9 | 314,5 | 532,6 | 513,7 | 431,7 | 691,1 | 0,19 | 79,05 | 79,04 | 86,00 | 0,18 | 80,28 | 80,88 | 83,72 | 0,08 | 0,06 |
| 6,0 | 258,0 | 6,5 | 0,1 | 12,0 | 0,0 | 301,3 | 79,1 | 87,0 | 376,8 | 317,3 | 523,4 | 504,0 | 429,6 | 687,2 | 0,19 | 79,11 | 79,05 | 85,70 | 0,18 | 80,50 | 80,97 | 83,60 | 0,08 | 0,06 |
| 7,0 | 259,0 | 6,5 | 0,0 | 10,0 | 0,0 | 292,4 | 79,1 | 86,5 | 381,3 | 320,5 | 516,1 | 495,3 | 427,5 | 670,3 | 0,19 | 79,14 | 79,06 | 85,43 | 0,18 | 80,68 | 81,05 | 83,50 | 0,07 | 0,06 |
| 8,0 | 260,0 | 6,4 | 0,0 | 7,4 | 0,0 | 286,3 | 78,9 | 85,8 | 381,4 | 323,2 | 507,1 | 485,9 | 425,0 | 667,6 | 0,19 | 79,13 | 79,05 | 85,12 | 0,18 | 80,79 | 81,10 | 83,33 | 0,07 | 0,06 |
| 9,0 | 261,0 | 6,3 | 0,0 | 6,5 | 0,0 | 281,9 | 78,9 | 85,8 | 379,9 | 324,0 | 500,2 | 478,2 | 422,7 | 647,3 | 0,19 | 79,18 | 79,08 | 84,87 | 0,18 | 80,99 | 81,21 | 84,79 | 0,07 | 0,05 |
| 10,0 | 262,0 | 6,3 | 0,0 | 7,7 | 0,0 | 277,7 | 79,0 | 86,1 | 379,9 | 326,1 | 493,2 | 471,8 | 420,5 | 632,4 | 0,18 | 79,23 | 79,07 | 84,70 | 0,18 | 81,17 | 81,32 | 87,93 | 0,08 | 0,06 |
| 11,0 | 263,0 | 6,2 | 0,0 | 9,6 | 0,0 | 278,0 | 78,9 | 86,1 | 382,2 | 327,5 | 487,1 | 464,5 | 417,8 | 638,9 | 0,18 | 79,23 | 79,09 | 84,47 | 0,18 | 81,36 | 81,40 | 88,12 | 0,08 | 0,06 |
| 12,0 | 264,0 | 6,2 | 0,0 | 10,9 | 0,0 | 280,7 | 78,9 | 86,3 | 386,9 | 328,2 | 482,2 | 458,1 | 415,2 | 655,6 | 0,18 | 79,19 | 79,07 | 84,26 | 0,18 | 81,49 | 81,46 | 87,80 | 0,08 | 0,06 |
| 13,0 | 265,0 | 6,1 | 0,0 | 11,4 | 0,0 | 285,9 | 78,8 | 86,6 | 391,9 | 329,8 | 476,8 | 450,7 | 412,6 | 682,0 | 0,19 | 79,19 | 79,09 | 84,06 | 0,18 | 81,66 | 81,56 | 87,44 | 0,08 | 0,06 |
| 14,0 | 266,0 | 6,0 | 0,0 | 12,3 | 0,0 | 291,6 | 78,8 | 86,7 | 398,7 | 330,4 | 473,0 | 445,2 | 409,9 | 698,2 | 0,19 | 79,18 | 79,08 | 83,88 | 0,18 | 81,78 | 81,61 | 87,14 | 0,08 | 0,06 |
| 15,0 | 267,0 | 5,9 | 0,0 | 12,4 | 0,0 | 295,7 | 78,8 | 86,4 | 406,4 | 332,7 | 469,7 | 441,4 | 407,3 | 707,7 | 0,19 | 79,20 | 79,08 | 83,68 | 0,18 | 81,91 | 81,67 | 86,81 | 0,08 | 0,06 |
| 16,0 | 268,0 | 5,9 | 0,0 | 11,9 | 0,0 | 296,6 | 79,0 | 86,5 | 412,1 | 335,4 | 467,5 | 440,3 | 405,1 | 710,6 | 0,19 | 79,25 | 79,09 | 83,52 | 0,18 | 82,07 | 81,80 | 86,56 | 0,07 | 0,06 |
| 17,0 | 269,0 | 5,8 | 0,0 | 11,3 | 0,0 | 296,8 | 78,9 | 86,4 | 417,0 | 337,1 | 464,6 | 439,2 | 402,7 | 716,5 | 0,19 | 79,30 | 79,11 | 83,44 | 0,18 | 82,26 | 81,94 | 86,37 | 0,08 | 0,06 |
| 18,0 | 270,0 | 5,7 | 0,0 | 11,1 | 0,0 | 296,7 | 78,9 | 86,5 | 420,4 | 339,1 | 463,6 | 439,0 | 400,2 | 708,0 | 0,19 | 79,28 | 79,11 | 83,27 | 0,18 | 82,34 | 82,03 | 86,12 | 0,07 | 0,06 |
| 19,0 | 271,0 | 5,6 | 0,1 | 10,9 | 0,0 | 299,2 | 79,1 | 87,4 | 423,2 | 342,3 | 461,5 | 437,8 | 397,9 | 725,0 | 0,19 | 79,36 | 79,14 | 83,21 | 0,18 | 82,53 | 82,15 | 85,97 | 0,08 | 0,06 |
| 20,0 | 272,0 | 5,5 | 0,1 | 11,1 | 0,0 | 301,0 | 79,1 | 86,7 | 425,6 | 344,3 | 460,4 | 436,2 | 395,6 | 735,6 | 0,19 | 79,40 | 79,15 | 83,12 | 0,18 | 82,64 | 82,24 | 85,77 | 0,07 | 0,06 |
| 21,0 | 273,0 | 5,5 | 0,1 | 11,1 | 0,0 | 301,7 | 79,0 | 87,4 | 427,4 | 345,8 | 458,8 | 434,3 | 393,1 | 739,7 | 0,19 | 79,38 | 79,16 | 83,07 | 0,18 | 82,75 | 82,33 | 85,57 | 0,07 | 0,06 |
| 22,0 | 274,0 | 5,4 | 0,1 | 11,2 | 0,0 | 304,8 | 79,1 | 87,8 | 430,7 | 349,2 | 457,8 | 433,3 | 390,8 | 761,7 | 0,19 | 79,45 | 79,18 | 83,02 | 0,18 | 82,89 | 82,44 | 85,49 | 0,08 | 0,06 |
| 23,0 | 275,0 | 5,3 | 0,1 | 11,6 | 0,0 | 308,9 | 79,2 | 87,8 | 433,7 | 351,1 | 455,5 | 432,0 | 388,4 | 773,0 | 0,19 | 79,68 | 79,25 | 83,01 | 0,18 | 83,14 | 82,58 | 85,43 | 0,07 | 0,06 |
| 24,0 | 276,0 | 5,2 | 0,1 | 12,2 | 0,0 | 314,9 | 79,0 | 87,2 | 437,9 | 351,2 | 455,1 | 430,2 | 385,8 | 774,9 | 0,19 | 79,68 | 79,25 | 82,95 | 0,18 | 83,20 | 82,65 | 85,27 | 0,07 | 0,06 |
| 25,0 | 277,0 | 5,1 | 0,2 | 13,8 | 0,0 | 320,3 | 78,8 | 86,8 | 444,4 | 353,7 | 454,9 | 430,2 | 383,5 | 761,8 | 0,19 | 79,63 | 79,29 | 82,83 | 0,18 | 83,26 | 82,73 | 85,12 | 0,08 | 0,06 |
| 26,0 | 278,0 | 5,0 | 0,1 | 13,5 | 0,0 | 323,2 | 79,0 | 86,6 | 449,4 | 354,4 | 456,8 | 430,6 | 381,2 | 757,7 | 0,19 | 79,69 | 79,30 | 82,68 | 0,18 | 83,34 | 82,84 | 84,90 | 0,08 | 0,06 |
| 27,0 | 279,0 | 4,9 | 0,5 | 13,8 | 0,0 | 328,9 | 79,1 | 88,3 | 453,9 | 358,7 | 459,5 | 432,0 | 379,2 | 779,9 | 0,19 | 79,65 | 79,30 | 82,70 | 0,18 | 83,37 | 82,90 | 84,81 | 0,07 | 0,07 |
| 28,0 | 280,0 | 4,8 | 0,6 | 13,7 | 0,0 | 333,1 | 79,2 | 88,2 | 457,6 | 360,9 | 462,0 | 433,6 | 377,0 | 778,8 | 0,19 | 79,71 | 79,35 | 82,69 | 0,18 | 83,55 | 83,03 | 84,72 | 0,08 | 0,06 |
| 29,0 | 281,0 | 4,7 | 0,4 | 13,4 | 0,0 | 335,2 | 79,2 | 87,8 | 462,4 | 359,8 | 466,2 | 434,5 | 374,9 | 780,8 | 0,19 | 79,71 | 79,35 | 82,65 | 0,18 | 83,68 | 83,17 | 84,64 | 0,08 | 0,06 |
| 30,0 | 282,0 | 4,7 | 0,1 | 13,0 | 0,0 | 332,8 | 79,0 | 87,1 | 467,4 | 359,0 | 470,2 | 435,9 | 372,6 | 765,1 | 0,19 | 79,66 | 79,37 | 82,55 | 0,18 | 83,68 | 83,19 | 84,42 | 0,07 | 0,06 |
| 31,0 | 283,0 | 4,6 | 0,0 | 13,0 | 0,0 | 330,3 | 79,1 | 86,8 | 471,5 | 358,5 | 472,5 | 437,4 | 370,5 | 757,8 | 0,19 | 79,63 | 79,34 | 82,44 | 0,18 | 83,66 | 83,23 | 84,21 | 0,07 | 0,07 |
| 32,0 | 284,0 | 4,5 | 0,1 | 13,4 | 0,0 | 331,1 | 79,2 | 86,8 | 475,1 | 360,2 | 475,8 | 439,8 | 368,4 | 771,0 | 0,19 | 79,61 | 79,36 | 82,38 | 0,18 | 83,68 | 83,25 | 84,09 | 0,07 | 0,06 |
| 33,0 | 285,0 | 4,4 | 0,2 | 13,6 | 0,0 | 332,4 | 79,2 | 88,2 | 478,3 | 361,9 | 478,4 | 441,5 | 366,5 | 777,1 | 0,19 | 79,65 | 79,37 | 82,42 | 0,18 | 83,71 | 83,31 | 84,08 | 0,08 | 0,06 |
| 34,0 | 286,0 | 4,3 | 0,5 | 13,9 | 0,0 | 334,3 | 79,1 | 89,0 | 480,6 | 363,6 | 478,4 | 443,4 | 364,4 | 789,3 | 0,19 | 79,64 | 79,34 | 82,46 | 0,18 | 83,79 | 83,37 | 84,04 | 0,07 | 0,07 |
| 35,0 | 287,0 | 4,2 | 0,8 | 14,0 | 0,0 | 337,8 | 79,3 | 87,7 | 482,8 | 364,4 | 483,5 | 445,7 | 362,5 | 798,5 | 0,18 | 79,82 | 79,41 | 82,38 | 0,18 | 83,99 | 83,47 | 83,92 | 0,07 | 0,06 |
| 36,0 | 288,0 | 4,1 | 1,2 | 13,9 | 0,0 | 340,6 | 79,2 | 87,9 | 485,9 | 363,2 | 485,6 | 446,4 | 360,5 | 803,7 | 0,19 | 79,77 | 79,41 | 82,37 | 0,18 | 83,98 | 83,51 | 83,84 | 0,08 | 0,07 |
| 37,0 | 289,0 | 4,0 | 1,5 | 14,0 | 0,0 | 341,8 | 79,0 | 87,3 | 488,8 | 362,6 | 487,8 | 447,5 | 358,5 | 809,0 | 0,19 | 79,68 | 79,40 | 82,31 | 0,18 | 83,95 | 83,49 | 83,72 | 0,08 | 0,07 |
| 38,0 | 290,0 | 3,9 | 1,7 | 14,1 | 0,0 | 343,7 | 79,0 | 88,1 | 492,2 | 365,1 | 489,1 | 448,6 | 356,7 | 827,2 | 0,19 | 79,61 | 79,40 | 82,27 | 0,18 | 83,93 | 83,52 | 83,66 | 0,07 | 0,07 |
| 39,0 | 291,0 | 3,8 | 2,5 | 14,4 | 0,0 | 343,6 | 79,3 | 89,0 | 496,0 | 367,7 | 491,0 | 451,1 | 355,0 | 837,8 | 0,19 | 79,69 | 79,40 | 82,33 | 0,18 | 83,99 | 83,60 | 83,64 | 0,08 | 0,06 |
| 40,0 | 292,0 | 3,7 | 2,4 | 14,5 | 0,0 | 343,5 | 79,5 | 88,4 | 500,0 | 367,1 | 495,2 | 453,4 | 353,2 | 841,7 | 0,19 | 79,80 | 79,41 | 83,89 | 0,18 | 84,11 | 83,69 | 83,70 | 0,08 | 0,07 |
| 41,0 | 293,0 | 3,6 | 2,5 | 14,3 | 0,0 | 343,4 | 79,4 | 88,4 | 504,2 | 371,0 | 497,3 | 455,2 | 351,6 | 845,2 | 0,19 | 79,84 | 79,47 | 86,32 | 0,18 | 84,19 | 83,82 | 83,67 | 0,07 | 0,07 |
| 42,0 | 294,0 | 3,5 | 2,6 | 14,4 | 0,0 | 342,3 | 79,4 | 90,2 | 507,6 | 372,9 | 500,5 | 458,4 | 350,1 | 844,1 | 0,19 | 79,91 | 79,50 | 86,61 | 0,18 | 84,33 | 83,97 | 83,74 | 0,07 | 0,07 |
| 43,0 | 295,0 | 3,3 | 2,6 | 14,4 | 0,0 | 341,0 | 79,5 | 90,0 | 510,1 | 374,9 | 503,3 | 461,1 | 348,6 | 846,8 | 0,19 | 79,99 | 79,52 | 86,45 | 0,18 | 84,41 | 84,07 | 83,70 | 0,08 | 0,06 |
| 44,0 | 296,0 | 3,3 | 2,4 | 14,4 | 0,0 | 340,9 | 79,3 | 88,9 | 513,2 | 375,4 | 507,1 | 463,7 | 347,1 | 848,6 | 0,19 | 79,86 | 79,54 | 86,22 | 0,18 | 84,44 | 84,17 | 83,62 | 0,08 | 0,06 |
| 45,0 | 297,0 | 3,2 | 2,3 | 14,5 | 0,0 | 342,0 | 79,3 | 88,7 | 515,9 | 376,5 | 510,4 | 466,8 | 345,5 | 849,1 | 0,19 | 79,82 | 79,55 | 86,05 | 0,18 | 84,48 | 84,27 | 83,57 | 0,08 | 0,07 |
| 46,0 | 298,0 | 3,1 | 2,1 | 14,6 | 0,0 | 341,7 | 79,3 | 89,1 | 518,3 | 380,0 | 514,0 | 469,5 | 344,1 | 846,6 | 0,19 | 79,74 | 79,53 | 85,88 | 0,18 | 84,45 | 84,39 | 83,52 | 0,08 | 0,06 |
| 47,0 | 299,0 | 3,0 | 2,0 | 14,7 | 0,0 | 340,9 | 78,9 | 87,4 | 520,5 | 379,7 | 517,4 | 472,8 | 342,6 | 845,3 | 0,19 | 79,74 | 79,52 | 85,64 | 0,18 | 84,44 | 84,44 | 83,43 | 0,07 | 0,06 |
| 48,0 | 300,0 | 2,9 | 1,8 | 14,6 | 0,0 | 339,7 | 79,3 | 87,3 | 522,1 | 382,7 | 521,0 | 476,0 | 341,3 | 843,5 | 0,19 | 79,73 | 79,53 | 85,50 | 0,18 | 84,44 | 84,51 | 83,38 | 0,08 | 0,07 |
| 49,0 | 301,0 | 2,8 | 1,6 | 14,6 | 0,0 | 338,5 | 79,1 | 86,7 | 524,2 | 383,0 | 523,2 | 479,3 | 339,7 | 837,2 | 0,19 | 79,66 | 79,52 | 85,30 | 0,18 | 84,39 | 84,48 | 84,89 | 0,07 | 0,06 |
| 50,0 | 302,0 | 2,7 | 1,7 | 14,5 | 0,0 | 336,3 | 79,4 | 88,1 | 526,5 | 387,2 | 526,6 | 481,9 | 338,3 | 834,7 | 0,19 | 79,64 | 79,52 | 85,18 | 0,18 | 84,33 | 84,49 | 88,06 | 0,07 | 0,06 |
| 51,0 | 303,0 | 2,6 | 1,7 | 14,6 | 0,0 | 335,7 | 79,6 | 90,1 | 527,0 | 389,9 | 530,9 | 485,4 | 337,1 | 837,9 | 0,19 | 79,87 | 79,55 | 85,22 | 0,18 | 84,50 | 84,56 | 88,48 | 0,08 | 0,07 |
| 52,0 | 304,0 | 2,5 | 1,6 | 14,5 | 0,0 | 334,8 | 79,5 | 87,6 | 528,7 | 388,4 | 535,2 | 489,7 | 335,8 | 839,5 | 0,19 | 79,86 | 79,55 | 85,01 | 0,18 | 84,51 | 84,60 | 88,16 | 0,08 | 0,07 |
| 53,0 | 305,0 | 2,5 | 1,5 | 14,4 | 0,0 | 334,4 | 79,4 | 87,0 | 530,5 | 388,1 | 541,4 | 493,7 | 334,5 | 835,0 | 0,19 | 79,80 | 79,55 | 84,76 | 0,18 | 84,48 | 84,59 | 87,77 | 0,07 | 0,06 |
| 54,0 | 306,0 | 2,4 | 1,3 | 14,5 | 0,0 | 333,9 | 79,5 | 87,2 | 531,1 | 389,2 | 546,4 | 498,9 | 333,2 | 835,9 | 0,19 | 79,85 | 79,54 | 84,57 | 0,18 | 84,50 | 84,63 | 87,45 | 0,08 | 0,06 |
| 55,0 | 307,0 | 2,3 | 1,2 | 14,6 | 0,0 | 333,7 | 79,6 | 87,3 | 532,6 | 390,7 | 551,7 | 505,1 | 332,1 | 838,3 | 0,19 | 79,90 | 79,58 | 84,44 | 0,18 | 84,51 | 84,66 | 87,18 | 0,07 | 0,06 |
| 56,0 | 308,0 | 2,3 | 1,0 | 14,6 | 0,0 | 332,8 | 79,5 | 86,3 | 534,4 | 388,1 | 555,7 | 511,1 | 330,7 | 831,4 | 0,19 | 79,95 | 79,59 | 84,21 | 0,18 | 84,59 | 84,70 | 86,89 | 0,08 | 0,06 |
| 57,0 | 309,0 | 2,2 | 0,7 | 14,7 | 0,0 | 332,5 | 79,6 | 86,7 | 536,1 | 386,6 | 561,4 | 517,4 | 329,4 | 830,6 | 0,19 | 79,92 | 79,60 | 84,05 | 0,18 | 84,54 | 84,65 | 86,65 | 0,07 | 0,06 |
| 58,0 | 310,0 | 2,1 | 0,5 | 14,7 | 0,0 | 331,9 | 79,6 | 87,0 | 537,8 | 387,2 | 566,0 | 523,4 | 328,3 | 830,3 | 0,19 | 79,97 | 79,62 | 83,92 | 0,18 | 84,51 | 84,67 | 86,39 | 0,08 | 0,06 |
| 59,0 | 311,0 | 2,0 | 0,4 | 14,6 | 0,0 | 332,0 | 79,6 | 86,2 | 539,6 | 384,9 | 569,4 | 528,1 | 327,0 | 834,5 | 0,19 | 80,08 | 79,65 | 83,58 | 0,18 | 84,63 | 84,71 | 86,22 | 0,08 | 0,07 |
| 60,0 | 312,0 | 2,0 | 0,3 | 14,5 | 0,0 | 331,4 | 79,7 | 86,3 | 541,7 | 384,4 | 573,3 | 532,8 | 325,9 | 821,8 | 0,19 | 80,11 | 79,68 | 83,33 | 0,18 | 84,64 | 84,74 | 85,99 | 0,07 | 0,06 |
| 61,0 | 313,0 | 1,9 | 0,2 | 14,2 | 0,0 | 328,7 | 79,8 | 87,4 | 544,1 | 386,1 | 576,6 | 537,2 | 325,0 | 806,3 | 0,19 | 80,10 | 79,69 | 83,19 | 0,18 | 84,65 | 84,78 | 85,81 | 0,08 | 0,06 |
| 62,0 | 314,0 | 1,8 | 0,1 | 13,7 | 0,0 | 325,4 | 79,8 | 86,7 | 546,2 | 383,1 | 579,2 | 540,3 | 323,8 | 792,9 | 0,19 | 80,08 | 79,71 | 83,07 | 0,18 | 84,71 | 84,79 | 85,71 | 0,08 | 0,06 |
| 63,0 | 315,0 | 1,8 | 0,1 | 13,3 | 0,0 | 322,1 | 79,5 | 85,9 | 547,0 | 384,0 | 580,7 | 543,0 | 322,8 | 789,1 | 0,19 | 80,06 | 79,70 | 82,18 | 0,18 | 84,61 | 84,77 | 85,47 | 0,08 | 0,06 |
| 64,0 | 316,0 | 1,8 | 0,1 | 13,0 | 0,0 | 318,3 | 79,6 | 85,9 | 548,3 | 383,9 | 581,8 | 544,7 | 321,8 | 790,6 | 0,19 | 80,18 | 79,74 | 83,00 | 0,18 | 84,71 | 84,83 | 85,33 | 0,07 | 0,06 |
| 65,0 | 317,0 | 1,7 | 0,1 | 12,8 | 0,0 | 315,1 | 79,4 | 85,6 | 549,2 | 381,2 | 583,1 | 546,1 | 320,8 | 780,1 | 0,19 | 80,15 | 79,76 | 85,72 | 0,18 | 84,71 | 84,90 | 85,11 | 0,07 | 0,06 |
| 66,0 | 318,0 | 1,7 | 0,0 | 12,5 | 0,0 | 310,7 | 79,7 | 87,0 | 548,6 | 383,2 | 584,5 | 547,7 | 320,0 | 766,8 | 0,19 | 80,11 | 79,75 | 87,30 | 0,18 | 84,69 | 84,91 | 84,97 | 0,08 | 0,06 |
| 67,0 | 319,0 | 1,6 | 0,0 | 12,2 | 0,0 | 307,3 | 79,8 | 86,0 | 547,3 | 382,1 | 584,9 | 548,7 | 319,1 | 761,0 | 0,19 | 80,10 | 79,74 | 87,51 | 0,18 | 84,73 | 84,93 | 84,81 | 0,08 | 0,06 |
| 68,0 | 320,0 | 1,6 | 0,0 | 11,8 | 0,0 | 303,1 | 79,4 | 85,2 | 545,8 | 380,0 | 585,1 | 549,4 | 318,2 | 754,5 | 0,19 | 80,07 | 79,74 | 87,29 | 0,18 | 84,71 | 84,93 | 84,64 | 0,07 | 0,06 |
| 69,0 | 321,0 | 1,5 | 0,0 | 11,4 | 0,0 | 300,3 | 79,7 | 85,1 | 543,8 | 380,9 | 584,6 | 549,4 | 317,4 | 746,3 | 0,19 | 80,08 | 79,74 | 87,01 | 0,18 | 84,72 | 84,95 | 84,50 | 0,07 | 0,06 |
| 70,0 | 322,0 | 1,5 | 0,0 | 11,2 | 0,0 | 297,2 | 79,6 | 84,8 | 540,9 | 378,3 | 584,1 | 549,4 | 316,6 | 739,1 | 0,19 | 80,04 | 79,74 | 86,72 | 0,18 | 84,71 | 84,96 | 84,33 | 0,07 | 0,06 |
| 71,0 | 323,0 | 1,5 | 0,0 | 11,1 | 0,0 | 293,5 | 79,4 | 85,4 | 537,4 | 376,8 | 583,4 | 549,1 | 315,7 | 735,1 | 0,19 | 79,94 | 79,72 | 86,49 | 0,18 | 84,65 | 84,93 | 84,19 | 0,07 | 0,06 |
| 72,0 | 324,0 | 1,5 | 0,0 | 11,0 | 0,0 | 291,9 | 79,4 | 85,0 | 533,7 | 374,2 | 584,3 | 548,1 | 314,8 | 733,5 | 0,19 | 79,88 | 79,73 | 86,24 | 0,18 | 84,57 | 84,87 | 84,01 | 0,08 | 0,06 |
| 73,0 | 325,0 | 1,4 | 0,0 | 10,9 | 0,0 | 289,5 | 79,3 | 84,4 | 529,3 | 372,8 | 584,2 | 547,9 | 313,9 | 728,7 | 0,19 | 79,83 | 79,72 | 85,95 | 0,18 | 84,47 | 84,85 | 83,84 | 0,08 | 0,05 |
| 74,0 | 326,0 | 1,4 | 0,0 | 11,0 | 0,0 | 287,3 | 79,4 | 84,5 | 524,9 | 372,1 | 584,1 | 547,0 | 313,2 | 724,8 | 0,19 | 79,77 | 79,68 | 85,65 | 0,18 | 84,43 | 84,81 | 83,66 | 0,07 | 0,05 |
| 75,0 | 327,0 | 1,3 | 0,0 | 10,8 | 0,0 | 285,4 | 79,4 | 85,9 | 521,2 | 373,0 | 584,9 | 547,6 | 312,7 | 717,8 | 0,19 | 79,76 | 79,67 | 85,49 | 0,18 | 84,42 | 84,81 | 83,58 | 0,07 | 0,05 |
| 76,0 | 328,0 | 1,3 | 0,0 | 10,9 | 0,0 | 284,2 | 79,3 | 86,0 | 516,8 | 371,8 | 585,6 | 547,3 | 312,2 | 711,8 | 0,19 | 79,79 | 79,66 | 85,40 | 0,18 | 84,46 | 84,83 | 83,51 | 0,07 | 0,05 |
| 77,0 | 329,0 | 1,3 | 0,0 | 10,9 | 0,0 | 282,7 | 79,3 | 84,9 | 513,0 | 368,6 | 586,1 | 546,7 | 311,2 | 709,6 | 0,19 | 79,82 | 79,67 | 85,21 | 0,18 | 84,50 | 84,85 | 83,40 | 0,07 | 0,05 |
| 78,0 | 330,0 | 1,3 | 0,0 | 10,9 | 0,0 | 281,0 | 79,5 | 84,6 | 509,2 | 368,3 | 587,0 | 547,1 | 310,8 | 703,4 | 0,19 | 79,85 | 79,68 | 84,96 | 0,18 | 84,46 | 84,85 | 83,27 | 0,08 | 0,05 |
| 79,0 | 331,0 | 1,2 | 0,0 | 11,1 | 0,0 | 280,6 | 79,7 | 85,9 | 505,4 | 368,1 | 586,2 | 546,9 | 310,2 | 704,0 | 0,19 | 79,91 | 79,70 | 84,83 | 0,18 | 84,52 | 84,88 | 84,26 | 0,08 | 0,05 |
| 80,0 | 332,0 | 1,2 | 0,0 | 10,9 | 0,0 | 279,1 | 79,7 | 87,6 | 501,7 | 368,2 | 585,3 | 546,9 | 309,9 | 701,7 | 0,19 | 80,05 | 79,73 | 84,86 | 0,18 | 84,67 | 84,98 | 87,97 | 0,07 | 0,05 |
| 81,0 | 333,0 | 1,2 | 0,0 | 11,0 | 0,0 | 277,0 | 79,6 | 87,1 | 498,4 | 366,4 | 587,8 | 547,0 | 309,4 | 691,7 | 0,19 | 80,11 | 79,76 | 84,83 | 0,18 | 84,80 | 85,08 | 88,58 | 0,08 | 0,05 |
| 82,0 | 334,0 | 1,2 | 0,0 | 10,5 | 0,0 | 275,3 | 79,3 | 87,4 | 494,8 | 366,5 | 588,8 | 547,6 | 309,1 | 686,0 | 0,19 | 80,11 | 79,77 | 84,79 | 0,18 | 84,86 | 85,14 | 88,33 | 0,07 | 0,05 |
| 83,0 | 335,0 | 1,1 | 0,0 | 10,4 | 0,0 | 274,0 | 79,6 | 86,1 | 491,8 | 365,1 | 590,7 | 547,0 | 308,7 | 685,4 | 0,19 | 80,11 | 79,78 | 84,64 | 0,18 | 84,87 | 85,22 | 87,99 | 0,07 | 0,05 |
| 84,0 | 336,0 | 1,1 | 0,0 | 10,3 | 0,0 | 272,2 | 79,2 | 85,7 | 488,1 | 363,6 | 590,4 | 546,4 | 308,3 | 683,8 | 0,19 | 80,04 | 79,78 | 84,44 | 0,18 | 84,85 | 85,26 | 87,60 | 0,08 | 0,05 |
| 85,0 | 337,0 | 1,1 | 0,0 | 10,2 | 0,0 | 270,7 | 79,3 | 84,1 | 484,3 | 360,7 | 591,2 | 546,0 | 307,9 | 686,2 | 0,19 | 80,03 | 79,79 | 84,23 | 0,18 | 84,88 | 85,31 | 87,26 | 0,08 | 0,05 |
| 86,0 | 338,0 | 1,0 | 0,0 | 10,1 | 0,0 | 270,8 | 79,3 | 84,1 | 480,2 | 358,9 | 592,3 | 546,0 | 307,5 | 691,0 | 0,19 | 80,02 | 79,79 | 84,01 | 0,18 | 84,87 | 85,33 | 86,96 | 0,07 | 0,05 |
| 87,0 | 339,0 | 1,0 | 0,0 | 9,6 | 0,0 | 269,9 | 79,3 | 84,4 | 475,7 | 357,5 | 592,4 | 545,8 | 307,2 | 691,7 | 0,19 | 79,98 | 79,78 | 83,85 | 0,18 | 84,82 | 85,32 | 86,66 | 0,07 | 0,05 |
| 88,0 | 340,0 | 1,0 | 0,0 | 9,4 | 0,0 | 269,6 | 79,5 | 84,3 | 470,4 | 354,4 | 591,8 | 544,8 | 306,8 | 689,1 | 0,19 | 80,00 | 79,79 | 83,74 | 0,18 | 84,81 | 85,38 | 86,41 | 0,07 | 0,05 |
| 89,0 | 341,0 | 1,0 | 0,0 | 9,3 | 0,0 | 269,2 | 79,4 | 84,4 | 465,7 | 354,2 | 591,7 | 544,8 | 306,5 | 689,3 | 0,19 | 79,98 | 79,79 | 83,67 | 0,18 | 84,78 | 85,37 | 86,18 | 0,07 | 0,05 |
| 90,0 | 342,0 | 1,0 | 0,1 | 9,5 | 0,0 | 268,3 | 79,5 | 84,3 | 461,0 | 351,6 | 592,1 | 544,2 | 306,1 | 687,1 | 0,19 | 80,02 | 79,79 | 83,57 | 0,18 | 84,81 | 85,38 | 85,90 | 0,07 | 0,05 |
| 91,0 | 343,0 | 0,9 | 0,1 | 9,7 | 0,0 | 267,4 | 79,4 | 84,1 | 456,7 | 349,9 | 591,4 | 543,4 | 305,7 | 682,2 | 0,19 | 79,96 | 79,77 | 83,47 | 0,18 | 84,72 | 85,37 | 85,62 | 0,08 | 0,05 |
| 92,0 | 344,0 | 0,9 | 0,0 | 9,6 | 0,0 | 266,6 | 79,3 | 84,3 | 452,4 | 349,1 | 590,7 | 544,1 | 305,3 | 680,6 | 0,19 | 79,90 | 79,76 | 83,38 | 0,18 | 84,67 | 85,32 | 85,37 | 0,07 | 0,05 |
| 93,0 | 345,0 | 0,9 | 0,1 | 9,6 | 0,0 | 265,4 | 79,3 | 84,3 | 448,7 | 350,8 | 590,4 | 544,6 | 305,2 | 675,4 | 0,19 | 79,91 | 79,78 | 83,28 | 0,18 | 84,66 | 85,30 | 85,11 | 0,08 | 0,05 |
| 94,0 | 346,0 | 0,9 | 0,0 | 9,7 | 0,0 | 265,0 | 79,2 | 84,7 | 444,3 | 350,5 | 590,8 | 544,9 | 304,9 | 673,8 | 0,19 | 79,83 | 79,74 | 83,27 | 0,18 | 84,66 | 85,27 | 85,01 | 0,08 | 0,05 |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 95,0 | 347,0 | 0,9 | 0,1 | 9,6 | 0,0 | 264,4 | 79,2 | 84,9 | 440,3 | 348,4 | 590,1 | 545,4 | 304,6 | 673,9 | 0,19 | 79,87 | 79,76 | 83,25 | 0,18 | 84,65 | 85,28 | 84,87 | 0,07 | 0,05 |
| 96,0 | 348,0 | 0,9 | 0,1 | 9,5 | 0,0 | 263,6 | 79,2 | 84,8 | 436,7 | 345,6 | 590,6 | 545,3 | 304,2 | 672,2 | 0,19 | 79,78 | 79,73 | 83,15 | 0,18 | 84,59 | 85,22 | 84,64 | 0,07 | 0,05 |
| 97,0 | 349,0 | 0,8 | 0,1 | 9,6 | 0,0 | 263,9 | 79,1 | 84,4 | 433,2 | 345,6 | 591,3 | 546,3 | 303,9 | 673,8 | 0,19 | 79,70 | 79,70 | 83,07 | 0,18 | 84,47 | 85,15 | 84,41 | 0,07 | 0,05 |
| 98,0 | 350,0 | 0,8 | 0,1 | 9,6 | 0,0 | 264,0 | 79,0 | 84,3 | 429,6 | 345,3 | 591,2 | 546,8 | 303,8 | 672,1 | 0,19 | 79,65 | 79,67 | 82,95 | 0,18 | 84,37 | 85,12 | 84,21 | 0,07 | 0,05 |
| 99,0 | 351,0 | 0,8 | 0,1 | 9,3 | 0,0 | 262,8 | 78,9 | 84,1 | 426,5 | 344,1 | 590,5 | 547,1 | 303,5 | 667,8 | 0,19 | 79,63 | 79,67 | 82,89 | 0,18 | 84,34 | 85,09 | 84,02 | 0,08 | 0,05 |
| 100,0 | 352,0 | 0,8 | 0,1 | 9,3 | 0,0 | 262,3 | 79,0 | 84,3 | 423,2 | 342,8 | 589,8 | 547,7 | 303,4 | 666,7 | 0,19 | 79,59 | 79,66 | 82,79 | 0,18 | 84,32 | 85,08 | 83,87 | 0,08 | 0,05 |
| 101,0 | 353,0 | 0,8 | 0,1 | 9,2 | 0,0 | 261,5 | 78,8 | 84,1 | 419,9 | 341,5 | 589,8 | 547,9 | 303,2 | 666,4 | 0,19 | 79,60 | 79,63 | 82,69 | 0,18 | 84,30 | 85,05 | 83,66 | 0,07 | 0,05 |
| 102,0 | 354,0 | 0,8 | 0,1 | 9,2 | 0,0 | 261,2 | 79,0 | 84,3 | 417,0 | 340,5 | 590,1 | 547,9 | 303,0 | 664,6 | 0,19 | 79,53 | 79,61 | 82,63 | 0,18 | 84,25 | 85,01 | 83,55 | 0,08 | 0,05 |
| 103,0 | 355,0 | 0,8 | 0,1 | 9,2 | 0,0 | 260,2 | 78,9 | 84,2 | 414,0 | 339,3 | 589,9 | 548,4 | 302,9 | 662,8 | 0,19 | 79,51 | 79,59 | 82,56 | 0,18 | 84,21 | 84,97 | 83,41 | 0,07 | 0,05 |
| 104,0 | 356,0 | 0,7 | 0,1 | 9,2 | 0,0 | 259,9 | 78,8 | 84,3 | 411,7 | 337,4 | 589,8 | 547,7 | 302,7 | 663,2 | 0,19 | 79,50 | 79,60 | 82,52 | 0,18 | 84,15 | 84,94 | 83,26 | 0,08 | 0,05 |
| 105,0 | 357,0 | 0,7 | 0,1 | 9,1 | 0,0 | 259,8 | 79,0 | 84,0 | 408,9 | 338,4 | 589,6 | 549,2 | 302,8 | 662,5 | 0,19 | 79,54 | 79,58 | 82,46 | 0,18 | 84,13 | 84,95 | 85,66 | 0,08 | 0,05 |
| 106,0 | 358,0 | 0,7 | 0,1 | 9,2 | 0,0 | 260,6 | 79,2 | 84,5 | 406,0 | 339,3 | 589,4 | 549,7 | 303,1 | 659,5 | 0,19 | 79,66 | 79,63 | 82,46 | 0,18 | 84,29 | 85,04 | 88,20 | 0,08 | 0,05 |
| 107,0 | 359,0 | 0,7 | 0,1 | 9,1 | 0,0 | 260,2 | 79,2 | 84,8 | 403,4 | 337,5 | 588,8 | 549,3 | 303,2 | 663,2 | 0,19 | 79,69 | 79,63 | 82,52 | 0,18 | 84,38 | 85,11 | 88,21 | 0,08 | 0,05 |
| 108,0 | 360,0 | 0,7 | 0,1 | 9,1 | 0,0 | 259,9 | 79,0 | 84,0 | 401,2 | 334,7 | 587,9 | 545,9 | 302,9 | 658,2 | 0,19 | 79,66 | 79,63 | 82,44 | 0,18 | 84,32 | 85,05 | 87,75 | 0,07 | 0,05 |
| 109,0 | 361,0 | 0,6 | 0,1 | 9,1 | 0,0 | 258,8 | 79,0 | 83,8 | 398,9 | 332,8 | 588,2 | 547,7 | 302,9 | 657,2 | 0,19 | 79,67 | 79,64 | 82,35 | 0,18 | 84,27 | 85,03 | 87,25 | 0,07 | 0,05 |
| 110,0 | 362,0 | 0,6 | 0,1 | 9,1 | 0,0 | 259,4 | 79,2 | 84,1 | 396,7 | 331,9 | 587,9 | 548,0 | 303,1 | 657,5 | 0,19 | 79,72 | 79,64 | 82,30 | 0,18 | 84,30 | 85,03 | 86,91 | 0,07 | 0,05 |
| 111,0 | 363,0 | 0,6 | 0,1 | 9,3 | 0,0 | 258,5 | 79,2 | 84,1 | 394,6 | 329,8 | 586,9 | 547,4 | 303,1 | 644,6 | 0,19 | 79,74 | 79,65 | 82,27 | 0,18 | 84,28 | 85,02 | 86,60 | 0,07 | 0,05 |
| 112,0 | 364,0 | 0,6 | 0,1 | 9,2 | 0,0 | 256,8 | 79,3 | 84,2 | 392,6 | 331,1 | 586,6 | 547,6 | 303,4 | 639,1 | 0,19 | 79,74 | 79,65 | 82,98 | 0,18 | 84,26 | 85,05 | 86,31 | 0,07 | 0,05 |
| 113,0 | 365,0 | 0,6 | 0,1 | 9,2 | 0,0 | 255,7 | 78,9 | 84,3 | 390,8 | 330,5 | 585,3 | 546,6 | 303,6 | 635,3 | 0,19 | 79,76 | 79,65 | 85,49 | 0,18 | 84,30 | 85,03 | 85,99 | 0,07 | 0,05 |
| 114,0 | 366,0 | 0,6 | 0,1 | 9,3 | 0,0 | 254,3 | 79,2 | 84,0 | 388,5 | 328,8 | 585,1 | 546,2 | 303,7 | 634,7 | 0,19 | 79,80 | 79,65 | 86,79 | 0,18 | 84,34 | 85,05 | 85,63 | 0,08 | 0,05 |
| 115,0 | 367,0 | 0,5 | 0,1 | 9,2 | 0,0 | 253,7 | 79,2 | 84,2 | 386,6 | 329,8 | 583,9 | 546,2 | 303,9 | 635,5 | 0,19 | 79,87 | 79,70 | 86,88 | 0,18 | 84,40 | 85,06 | 85,36 | 0,07 | 0,05 |
| 116,0 | 368,0 | 0,5 | 0,1 | 9,1 | 0,0 | 253,2 | 79,3 | 83,8 | 384,4 | 329,9 | 583,2 | 545,8 | 304,1 | 633,1 | 0,19 | 79,90 | 79,70 | 86,72 | 0,18 | 84,46 | 85,07 | 85,16 | 0,08 | 0,05 |
| 117,0 | 369,0 | 0,5 | 0,1 | 9,2 | 0,0 | 252,3 | 79,0 | 84,5 | 382,5 | 331,1 | 582,9 | 546,3 | 304,5 | 633,5 | 0,19 | 79,94 | 79,72 | 86,46 | 0,18 | 84,50 | 85,09 | 84,96 | 0,08 | 0,05 |
| 118,0 | 370,0 | 0,5 | 0,1 | 9,1 | 0,0 | 252,0 | 79,3 | 84,8 | 380,6 | 329,2 | 581,8 | 544,9 | 304,7 | 632,7 | 0,19 | 79,97 | 79,75 | 86,28 | 0,18 | 84,59 | 85,15 | 84,80 | 0,07 | 0,05 |
| 119,0 | 371,0 | 0,5 | 0,1 | 9,1 | 0,0 | 252,1 | 79,3 | 84,6 | 378,8 | 328,8 | 580,9 | 544,4 | 304,9 | 632,4 | 0,19 | 79,95 | 79,76 | 86,03 | 0,18 | 84,52 | 85,12 | 84,59 | 0,08 | 0,05 |
| 120,0 | 372,0 | 0,5 | 0,1 | 9,2 | 0,0 | 252,2 | 79,2 | 84,5 | 377,1 | 329,5 | 579,5 | 543,8 | 305,2 | 634,0 | 0,19 | 79,92 | 79,75 | 85,77 | 0,18 | 84,49 | 85,10 | 84,35 | 0,08 | 0,05 |
| 121,0 | 373,0 | 0,5 | 0,1 | 9,2 | 0,0 | 252,2 | 79,1 | 84,2 | 375,5 | 329,5 | 578,8 | 543,4 | 305,6 | 635,0 | 0,19 | 79,82 | 79,74 | 85,54 | 0,18 | 84,45 | 85,09 | 84,19 | 0,07 | 0,05 |
| 122,0 | 374,0 | 0,5 | 0,1 | 9,2 | 0,0 | 251,9 | 79,1 | 84,1 | 374,2 | 328,7 | 577,6 | 543,1 | 305,9 | 631,6 | 0,19 | 79,86 | 79,72 | 85,31 | 0,18 | 84,49 | 85,08 | 84,05 | 0,07 | 0,05 |
| 123,0 | 375,0 | 0,4 | 0,1 | 9,1 | 0,0 | 251,2 | 79,1 | 84,2 | 372,2 | 326,4 | 576,8 | 540,8 | 306,1 | 625,9 | 0,19 | 79,86 | 79,74 | 85,07 | 0,18 | 84,44 | 85,03 | 83,86 | 0,07 | 0,05 |
| 124,0 | 376,0 | 0,4 | 0,1 | 9,1 | 0,0 | 250,4 | 79,0 | 84,1 | 370,9 | 328,2 | 575,2 | 540,9 | 306,4 | 623,7 | 0,19 | 79,82 | 79,73 | 84,89 | 0,18 | 84,38 | 85,00 | 83,73 | 0,08 | 0,05 |
| 125,0 | 377,0 | 0,4 | 0,1 | 9,0 | 0,0 | 249,6 | 79,1 | 84,0 | 369,5 | 326,4 | 573,9 | 540,1 | 306,8 | 624,3 | 0,19 | 79,94 | 79,75 | 84,70 | 0,18 | 84,50 | 85,00 | 83,55 | 0,08 | 0,05 |
| 126,0 | 378,0 | 0,4 | 0,1 | 9,1 | 0,0 | 249,6 | 79,2 | 84,1 | 368,1 | 327,1 | 572,5 | 540,0 | 307,2 | 629,1 | 0,18 | 79,99 | 79,78 | 84,53 | 0,18 | 84,53 | 85,04 | 83,46 | 0,08 | 0,04 |
| 127,0 | 379,0 | 0,3 | 0,1 | 9,2 | 0,0 | 250,2 | 79,2 | 84,3 | 366,7 | 328,2 | 571,4 | 539,8 | 307,8 | 631,3 | 0,19 | 80,05 | 79,79 | 84,40 | 0,18 | 84,62 | 85,11 | 83,40 | 0,07 | 0,05 |
| 128,0 | 380,0 | 0,3 | 0,1 | 9,2 | 0,0 | 250,6 | 79,0 | 84,3 | 365,1 | 326,4 | 570,0 | 537,4 | 308,0 | 634,3 | 0,18 | 80,07 | 79,81 | 84,30 | 0,18 | 84,64 | 85,15 | 83,31 | 0,08 | 0,05 |
| 129,0 | 381,0 | 0,3 | 0,1 | 9,1 | 0,0 | 250,3 | 79,1 | 84,3 | 363,8 | 326,1 | 569,1 | 536,8 | 308,4 | 632,8 | 0,19 | 80,02 | 79,80 | 84,17 | 0,18 | 84,63 | 85,20 | 84,43 | 0,08 | 0,05 |
| 130,0 | 382,0 | 0,3 | 0,1 | 9,2 | 0,0 | 249,7 | 79,2 | 84,6 | 362,8 | 324,2 | 569,2 | 536,5 | 308,7 | 630,1 | 0,19 | 80,04 | 79,81 | 84,10 | 0,18 | 84,65 | 85,23 | 87,84 | 0,07 | 0,05 |
| 131,0 | 383,0 | 0,3 | 0,1 | 9,0 | 0,0 | 249,5 | 79,3 | 84,8 | 361,6 | 322,7 | 569,2 | 534,3 | 308,8 | 632,1 | 0,19 | 80,03 | 79,82 | 84,02 | 0,18 | 84,59 | 85,19 | 88,13 | 0,08 | 0,05 |
| 132,0 | 384,0 | 0,3 | 0,1 | 9,0 | 0,0 | 249,6 | 79,2 | 84,6 | 360,3 | 322,8 | 568,4 | 535,0 | 309,2 | 633,3 | 0,19 | 80,00 | 79,80 | 83,89 | 0,18 | 84,56 | 85,17 | 87,82 | 0,08 | 0,05 |
| 133,0 | 385,0 | 0,3 | 0,1 | 8,9 | 0,0 | 250,3 | 79,3 | 84,5 | 359,2 | 320,4 | 567,9 | 532,5 | 309,4 | 636,4 | 0,18 | 80,02 | 79,83 | 83,77 | 0,18 | 84,57 | 85,18 | 87,47 | 0,07 | 0,05 |
| 134,0 | 386,0 | 0,3 | 0,1 | 9,0 | 0,0 | 249,3 | 79,2 | 84,3 | 358,3 | 319,7 | 566,8 | 531,4 | 309,8 | 625,2 | 0,19 | 80,04 | 79,83 | 83,65 | 0,18 | 84,55 | 85,16 | 87,14 | 0,07 | 0,05 |
| 135,0 | 387,0 | 0,3 | 0,1 | 8,9 | 0,0 | 249,3 | 79,5 | 84,5 | 357,3 | 319,7 | 566,7 | 532,4 | 310,3 | 627,0 | 0,19 | 80,10 | 79,85 | 83,56 | 0,18 | 84,65 | 85,18 | 86,82 | 0,07 | 0,05 |
| 136,0 | 388,0 | 0,2 | 0,1 | 8,7 | 0,0 | 249,6 | 79,4 | 84,5 | 356,1 | 319,8 | 566,1 | 532,0 | 310,8 | 629,7 | 0,19 | 80,10 | 79,88 | 83,46 | 0,18 | 84,68 | 85,18 | 86,59 | 0,07 | 0,05 |
| 137,0 | 389,0 | 0,2 | 0,1 | 8,8 | 0,0 | 250,9 | 79,5 | 84,3 | 355,1 | 319,8 | 565,2 | 532,4 | 311,3 | 634,0 | 0,19 | 80,15 | 79,85 | 83,39 | 0,18 | 84,70 | 85,18 | 86,28 | 0,07 | 0,05 |
| 138,0 | 390,0 | 0,2 | 0,1 | 8,8 | 0,0 | 251,1 | 79,4 | 84,5 | 354,2 | 318,1 | 563,7 | 531,4 | 311,7 | 637,2 | 0,19 | 80,14 | 79,89 | 83,32 | 0,18 | 84,74 | 85,22 | 86,07 | 0,07 | 0,05 |
| 139,0 | 391,0 | 0,2 | 0,1 | 8,8 | 0,0 | 252,0 | 79,4 | 84,8 | 353,1 | 316,0 | 562,8 | 528,5 | 311,8 | 641,4 | 0,19 | 80,09 | 79,89 | 83,28 | 0,18 | 84,69 | 85,19 | 85,82 | 0,08 | 0,05 |
| 140,0 | 392,0 | 0,2 | 0,1 | 8,6 | 0,0 | 253,0 | 79,3 | 84,7 | 352,5 | 317,4 | 561,7 | 528,3 | 312,2 | 644,8 | 0,19 | 80,03 | 79,85 | 83,20 | 0,18 | 84,59 | 85,18 | 85,51 | 0,08 | 0,05 |
| 141,0 | 393,0 | 0,2 | 0,1 | 8,5 | 0,0 | 252,9 | 79,2 | 84,4 | 351,3 | 315,3 | 560,7 | 527,7 | 312,3 | 642,8 | 0,19 | 80,06 | 79,87 | 83,10 | 0,18 | 84,60 | 85,19 | 85,25 | 0,07 | 0,05 |
| 142,0 | 394,0 | 0,2 | 0,1 | 8,3 | 0,0 | 252,7 | 79,3 | 84,4 | 350,7 | 313,7 | 560,0 | 527,1 | 312,7 | 643,0 | 0,19 | 80,00 | 79,87 | 83,01 | 0,18 | 84,58 | 85,20 | 85,01 | 0,07 | 0,05 |
| 143,0 | 395,0 | 0,2 | 0,1 | 8,2 | 0,0 | 253,2 | 79,2 | 84,7 | 350,0 | 312,8 | 558,3 | 523,8 | 312,8 | 641,2 | 0,19 | 80,02 | 79,88 | 82,95 | 0,18 | 84,56 | 85,22 | 84,86 | 0,07 | 0,05 |
| 144,0 | 396,0 | 0,1 | 0,1 | 8,2 | 0,0 | 253,8 | 79,4 | 84,7 | 348,8 | 311,5 | 557,9 | 523,5 | 313,1 | 642,2 | 0,19 | 80,00 | 79,87 | 82,92 | 0,18 | 84,52 | 85,20 | 84,70 | 0,07 | 0,05 |
| 145,0 | 397,0 | 0,1 | 0,1 | 8,2 | 0,0 | 254,4 | 79,3 | 84,7 | 347,9 | 311,0 | 555,0 | 520,6 | 313,3 | 643,3 | 0,19 | 80,04 | 79,88 | 82,88 | 0,18 | 84,54 | 85,21 | 84,53 | 0,07 | 0,05 |
| 146,0 | 398,0 | 0,1 | 0,1 | 8,2 | 0,0 | 254,8 | 79,4 | 84,7 | 347,2 | 309,1 | 554,0 | 519,1 | 313,4 | 636,5 | 0,19 | 80,16 | 79,91 | 82,83 | 0,18 | 84,65 | 85,22 | 84,29 | 0,07 | 0,05 |
| 147,0 | 399,0 | 0,1 | 0,1 | 8,2 | 0,0 | 253,2 | 79,4 | 84,4 | 346,2 | 308,8 | 552,9 | 518,6 | 313,7 | 628,1 | 0,19 | 80,25 | 79,94 | 82,75 | 0,18 | 84,70 | 85,25 | 84,12 | 0,08 | 0,05 |
| 148,0 | 400,0 | 0,1 | 0,1 | 8,0 | 0,0 | 252,5 | 79,6 | 84,6 | 345,3 | 308,0 | 552,0 | 517,4 | 314,0 | 629,3 | 0,19 | 80,39 | 79,97 | 82,73 | 0,18 | 84,80 | 85,26 | 83,96 | 0,08 | 0,05 |
| 149,0 | 401,0 | 0,1 | 0,1 | 7,8 | 0,0 | 252,3 | 79,5 | 84,9 | 344,2 | 305,1 | 550,3 | 514,5 | 314,0 | 629,0 | 0,19 | 80,44 | 80,03 | 82,72 | 0,18 | 84,82 | 85,30 | 83,86 | 0,07 | 0,05 |
| 150,0 | 402,0 | 0,1 | 0,1 | 7,8 | 0,0 | 252,7 | 79,5 | 84,9 | 343,0 | 303,9 | 549,0 | 513,3 | 314,1 | 626,9 | 0,19 | 80,37 | 80,01 | 82,67 | 0,18 | 84,73 | 85,26 | 83,73 | 0,07 | 0,05 |
| 151,0 | 403,0 | 0,1 | 0,1 | 7,5 | 0,0 | 252,7 | 79,4 | 84,9 | 342,4 | 302,5 | 546,7 | 511,3 | 314,1 | 623,7 | 0,19 | 80,33 | 80,02 | 82,67 | 0,18 | 84,71 | 85,26 | 83,61 | 0,08 | 0,05 |
| 152,0 | 404,0 | 0,1 | 0,1 | 7,6 | 0,0 | 252,3 | 79,5 | 84,6 | 341,1 | 301,4 | 545,0 | 510,5 | 314,3 | 622,5 | 0,19 | 80,24 | 80,02 | 82,63 | 0,18 | 84,70 | 85,24 | 83,51 | 0,08 | 0,05 |
| 153,0 | 405,0 | 0,1 | 0,1 | 7,7 | 0,0 | 252,3 | 79,3 | 84,1 | 340,3 | 299,6 | 542,8 | 506,0 | 314,0 | 624,1 | 0,19 | 80,17 | 80,00 | 82,55 | 0,18 | 84,67 | 85,24 | 83,42 | 0,07 | 0,05 |
| 154,0 | 406,0 | 0,1 | 0,1 | 7,8 | 0,0 | 252,9 | 79,3 | 84,2 | 339,0 | 297,5 | 542,5 | 506,0 | 314,1 | 626,1 | 0,19 | 80,13 | 80,00 | 82,48 | 0,18 | 84,56 | 85,22 | 84,64 | 0,08 | 0,05 |
| 155,0 | 407,0 | 0,1 | 0,1 | 7,7 | 0,0 | 253,2 | 79,4 | 84,7 | 338,2 | 296,6 | 540,9 | 504,4 | 314,2 | 628,4 | 0,19 | 80,10 | 79,98 | 82,55 | 0,18 | 84,55 | 85,22 | 87,86 | 0,07 | 0,05 |
| 156,0 | 408,0 | 0,1 | 0,1 | 7,8 | 0,0 | 253,1 | 79,1 | 84,7 | 337,4 | 295,1 | 539,0 | 501,4 | 314,1 | 627,1 | 0,19 | 80,13 | 79,99 | 82,54 | 0,18 | 84,52 | 85,20 | 88,08 | 0,08 | 0,05 |
| 157,0 | 409,0 | 0,1 | 0,1 | 7,6 | 0,0 | 253,3 | 79,3 | 84,4 | 336,5 | 292,7 | 537,5 | 500,0 | 314,1 | 623,9 | 0,19 | 80,12 | 79,98 | 82,49 | 0,18 | 84,50 | 85,20 | 87,66 | 0,07 | 0,05 |
| 158,0 | 410,0 | 0,1 | 0,1 | 7,6 | 0,0 | 253,7 | 79,4 | 84,5 | 335,9 | 291,6 | 536,8 | 498,5 | 314,2 | 626,3 | 0,19 | 80,15 | 79,99 | 82,44 | 0,18 | 84,53 | 85,19 | 87,31 | 0,07 | 0,05 |
| 159,0 | 411,0 | 0,0 | 0,1 | 7,4 | 0,0 | 254,3 | 79,3 | 84,2 | 335,6 | 290,1 | 534,7 | 497,1 | 314,1 | 629,7 | 0,19 | 80,22 | 80,00 | 82,43 | 0,18 | 84,62 | 85,20 | 86,94 | 0,08 | 0,05 |

Manufacturer: HEARTHSTONE
Model: 8060

Run: 1
Project #: PI 20272
Test Duration: 159 min

| | HHV | LHV |
|---|---|---|
| Eff | 79,36% | 85,78% |
| Comb Eff | 97,26% | 97,26% |
| HT Eff | 81,60% | 88,20% |
| Output | 15 333 | kJ/h |
| Burn Rate | 0,98 | kg/h |
| Grams CO | 102 | g |
| Input | 19 319 | kJ/h |
| MC wet | 17,17 | |

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

Ultimate $CO_2$
$CO_{2\text{-ult}}$ 19,64
$F_0$
1,062

Overall Heating Efficiency: 79,36%
Combustion Efficiency: 97,26%
Heat Transfer Efficiency: 81,60%

Heat Output: 14 545 Btu/h
Heat Input: 18 327 Btu/h
Burn Duration: 2,65 h
Burn Rate: 2,15 lb/h
Stack Temp: 286,3 Deg. F

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Averages | 0,33 | 10,59 | 0,94 | 20,22 | 9,46 | 141,28 | 26,25 | 0,98 | 0,82 | #DIV/0! |
| INPUT DATA | | | Oxygen Calculation | | | Input Data | | Combust | Heat | Net |
| Elapsed | Weight | % | % | Excess | Total | Calc. % | Flue | Room | Eff | Transfer | Eff |
| Time | Remaining (kg) | CO [e] | $CO_2$ [d] | Air EA | $O_2$ | $O_2$ [g] | Gas (°C) | Temp (°C) | % | % | % |
| 0,00 | 3,12 | 0,13 | 2,93 | 540,3% | 20,74 | 17,74 | 139,5 | 26,3 | 98,0% | 65,7% | 64,4% |
| 1,00 | 3,12 | 0,40 | 4,03 | 343,8% | 20,65 | 16,42 | 141,6 | 26,2 | 93,4% | 71,4% | 66,7% |
| 2,00 | 3,07 | 0,09 | 5,68 | 240,7% | 20,56 | 14,84 | 151,9 | 26,1 | 99,5% | 75,2% | 74,8% |
| 3,00 | 3,07 | 0,06 | 6,44 | 202,1% | 20,51 | 14,04 | 157,0 | 26,3 | 99,8% | 76,3% | 76,1% |
| 4,00 | 3,03 | 0,06 | 6,57 | 196,0% | 20,50 | 13,90 | 159,3 | 26,0 | 99,8% | 76,3% | 76,1% |
| 5,00 | 2,98 | 0,07 | 10,25 | 90,2% | 20,26 | 9,97 | 153,0 | 26,1 | 99,7% | 81,0% | 80,8% |
| 6,00 | 2,94 | 0,11 | 12,04 | 61,6% | 20,14 | 8,04 | 149,6 | 26,2 | 99,4% | 82,3% | 81,9% |
| 7,00 | 2,94 | 0,05 | 10,02 | 95,0% | 20,27 | 10,23 | 144,7 | 26,1 | 99,9% | 81,5% | 81,4% |
| 8,00 | 2,89 | 0,05 | 7,43 | 162,7% | 20,45 | 12,99 | 141,3 | 26,1 | 100,0% | 79,3% | 79,3% |
| 9,00 | 2,85 | 0,05 | 6,51 | 199,8% | 20,51 | 13,98 | 138,8 | 26,1 | 100,0% | 78,3% | 78,3% |
| 10,00 | 2,85 | 0,04 | 7,71 | 153,6% | 20,43 | 12,70 | 136,5 | 26,1 | 100,1% | 80,1% | 80,2% |
| 11,00 | 2,81 | 0,04 | 9,64 | 103,0% | 20,30 | 10,64 | 136,7 | 26,1 | 100,0% | 81,8% | 81,8% |
| 12,00 | 2,80 | 0,04 | 10,92 | 79,3% | 20,22 | 9,28 | 138,2 | 26,1 | 100,0% | 82,5% | 82,4% |
| 13,00 | 2,76 | 0,04 | 11,39 | 71,8% | 20,18 | 8,77 | 141,0 | 26,0 | 99,9% | 82,6% | 82,5% |
| 14,00 | 2,71 | 0,05 | 12,28 | 59,4% | 20,13 | 7,82 | 144,2 | 26,0 | 99,8% | 82,8% | 82,7% |
| 15,00 | 2,67 | 0,05 | 12,42 | 57,5% | 20,12 | 7,67 | 146,5 | 26,0 | 99,9% | 82,7% | 82,6% |
| 16,00 | 2,67 | 0,05 | 11,91 | 64,2% | 20,15 | 8,21 | 147,0 | 26,1 | 99,9% | 82,5% | 82,4% |
| 17,00 | 2,62 | 0,05 | 11,31 | 73,0% | 20,19 | 8,86 | 147,1 | 26,0 | 99,9% | 82,1% | 82,0% |
| 18,00 | 2,57 | 0,05 | 11,09 | 76,3% | 20,20 | 9,09 | 147,0 | 26,1 | 99,9% | 82,0% | 81,9% |
| 19,00 | 2,53 | 0,05 | 10,93 | 78,9% | 20,22 | 9,26 | 148,4 | 26,1 | 99,9% | 81,8% | 81,7% |
| 20,00 | 2,48 | 0,06 | 11,06 | 76,7% | 20,21 | 9,12 | 149,4 | 26,2 | 99,8% | 81,8% | 81,7% |
| 21,00 | 2,48 | 0,06 | 11,11 | 76,0% | 20,20 | 9,07 | 149,8 | 26,1 | 99,8% | 81,8% | 81,7% |
| 22,00 | 2,44 | 0,06 | 11,22 | 74,1% | 20,20 | 8,94 | 151,5 | 26,2 | 99,8% | 81,8% | 81,6% |
| 23,00 | 2,39 | 0,07 | 11,63 | 67,9% | 20,17 | 8,50 | 153,8 | 26,2 | 99,7% | 81,9% | 81,7% |
| 24,00 | 2,35 | 0,06 | 12,16 | 60,7% | 20,13 | 7,94 | 157,1 | 26,1 | 99,8% | 82,0% | 81,8% |
| 25,00 | 2,30 | 0,22 | 13,83 | 39,8% | 20,01 | 6,07 | 160,2 | 26,0 | 98,8% | 82,5% | 81,5% |
| 26,00 | 2,26 | 0,10 | 13,50 | 44,5% | 20,04 | 6,50 | 161,8 | 26,1 | 99,5% | 82,3% | 81,9% |
| 27,00 | 2,21 | 0,47 | 13,76 | 38,1% | 20,00 | 6,01 | 164,9 | 26,2 | 97,4% | 82,1% | 80,0% |
| 28,00 | 2,17 | 0,62 | 13,68 | 37,4% | 20,00 | 6,01 | 167,3 | 26,2 | 96,5% | 81,9% | 79,0% |
| 29,00 | 2,12 | 0,38 | 13,40 | 42,6% | 20,03 | 6,44 | 168,5 | 26,2 | 97,8% | 81,8% | 80,0% |
| 30,00 | 2,12 | 0,10 | 13,00 | 50,0% | 20,08 | 7,02 | 167,1 | 26,1 | 99,5% | 81,8% | 81,4% |
| 31,00 | 2,08 | 0,05 | 13,00 | 50,5% | 20,08 | 7,05 | 165,7 | 26,2 | 99,8% | 81,9% | 81,8% |
| 32,00 | 2,03 | 0,07 | 13,41 | 45,7% | 20,05 | 6,60 | 166,1 | 26,2 | 99,7% | 82,1% | 81,8% |
| 33,00 | 1,98 | 0,21 | 13,63 | 41,9% | 20,03 | 6,29 | 166,9 | 26,2 | 98,8% | 82,1% | 81,1% |
| 34,00 | 1,94 | 0,47 | 13,86 | 37,1% | 19,99 | 5,90 | 167,9 | 26,2 | 97,4% | 82,0% | 79,9% |
| 35,00 | 1,89 | 0,85 | 14,01 | 32,2% | 19,96 | 5,52 | 169,9 | 26,3 | 95,3% | 81,9% | 78,0% |
| 36,00 | 1,85 | 1,22 | 13,91 | 29,8% | 19,94 | 5,42 | 171,4 | 26,2 | 93,3% | 81,6% | 76,2% |
| 37,00 | 1,80 | 1,52 | 14,04 | 26,2% | 19,91 | 5,11 | 172,1 | 26,1 | 91,9% | 81,5% | 74,9% |
| 38,00 | 1,76 | 1,71 | 14,09 | 24,3% | 19,90 | 4,95 | 173,2 | 26,1 | 91,0% | 81,4% | 74,1% |
| 39,00 | 1,71 | 2,46 | 14,40 | 16,5% | 19,83 | 4,19 | 173,1 | 26,3 | 87,9% | 81,3% | 71,5% |
| 40,00 | 1,67 | 2,44 | 14,47 | 16,2% | 19,82 | 4,13 | 173,0 | 26,4 | 88,1% | 81,4% | 71,7% |
| 41,00 | 1,62 | 2,55 | 14,34 | 16,3% | 19,82 | 4,21 | 173,0 | 26,3 | 87,5% | 81,3% | 71,1% |
| 42,00 | 1,58 | 2,64 | 14,41 | 15,2% | 19,81 | 4,09 | 172,4 | 26,4 | 87,2% | 81,3% | 70,9% |
| 43,00 | 1,49 | 2,60 | 14,40 | 15,5% | 19,82 | 4,11 | 171,7 | 26,4 | 87,3% | 81,4% | 71,1% |
| 44,00 | 1,49 | 2,44 | 14,40 | 16,6% | 19,83 | 4,21 | 171,6 | 26,3 | 88,0% | 81,4% | 71,7% |
| 45,00 | 1,44 | 2,29 | 14,45 | 17,3% | 19,83 | 4,24 | 172,2 | 26,3 | 88,7% | 81,5% | 72,2% |
| 46,00 | 1,39 | 2,14 | 14,62 | 17,2% | 19,83 | 4,14 | 172,1 | 26,3 | 89,4% | 81,6% | 72,9% |
| 47,00 | 1,35 | 1,96 | 14,65 | 18,2% | 19,84 | 4,21 | 171,6 | 26,0 | 90,2% | 81,7% | 73,7% |
| 48,00 | 1,30 | 1,81 | 14,57 | 20,0% | 19,86 | 4,39 | 170,9 | 26,3 | 90,8% | 81,7% | 74,2% |
| 49,00 | 1,26 | 1,60 | 14,55 | 21,7% | 19,87 | 4,52 | 170,3 | 26,2 | 91,8% | 81,8% | 75,1% |
| 50,00 | 1,23 | 1,70 | 14,54 | 21,0% | 19,87 | 4,48 | 169,1 | 26,3 | 91,3% | 81,9% | 74,7% |
| 51,00 | 1,17 | 1,71 | 14,59 | 20,5% | 19,86 | 4,42 | 168,7 | 26,4 | 91,3% | 81,9% | 74,8% |
| 52,00 | 1,15 | 1,62 | 14,50 | 21,9% | 19,88 | 4,57 | 168,2 | 26,4 | 91,7% | 81,9% | 75,1% |
| 53,00 | 1,12 | 1,50 | 14,44 | 23,2% | 19,89 | 4,70 | 168,0 | 26,3 | 92,2% | 81,9% | 75,5% |
| 54,00 | 1,08 | 1,34 | 14,50 | 23,9% | 19,89 | 4,72 | 167,7 | 26,4 | 93,0% | 82,0% | 76,3% |
| 55,00 | 1,03 | 1,16 | 14,62 | 24,5% | 19,90 | 4,70 | 167,6 | 26,4 | 93,9% | 82,1% | 77,1% |
| 56,00 | 1,03 | 0,95 | 14,62 | 26,1% | 19,91 | 4,82 | 167,1 | 26,4 | 94,9% | 82,2% | 78,1% |
| 57,00 | 0,99 | 0,70 | 14,67 | 27,9% | 19,93 | 4,91 | 167,0 | 26,4 | 96,3% | 82,4% | 79,3% |
| 58,00 | 0,94 | 0,52 | 14,65 | 29,5% | 19,94 | 5,02 | 166,6 | 26,5 | 97,2% | 82,4% | 80,1% |
| 59,00 | 0,90 | 0,43 | 14,60 | 30,7% | 19,95 | 5,13 | 166,7 | 26,4 | 97,7% | 82,4% | 80,5% |
| 60,00 | 0,90 | 0,30 | 14,49 | 32,8% | 19,96 | 5,32 | 166,4 | 26,5 | 98,4% | 82,5% | 81,1% |
| 61,00 | 0,85 | 0,18 | 14,16 | 37,1% | 19,99 | 5,75 | 164,8 | 26,6 | 99,1% | 82,4% | 81,7% |
| 62,00 | 0,80 | 0,11 | 13,71 | 42,1% | 20,03 | 6,26 | 163,0 | 26,6 | 99,5% | 82,4% | 81,9% |
| 63,00 | 0,80 | 0,07 | 13,35 | 46,4% | 20,05 | 6,67 | 161,2 | 26,4 | 99,7% | 82,3% | 82,1% |
| 64,00 | 0,80 | 0,07 | 13,03 | 49,9% | 20,07 | 7,01 | 159,1 | 26,4 | 99,7% | 82,3% | 82,1% |
| 65,00 | 0,76 | 0,06 | 12,82 | 52,5% | 20,09 | 7,24 | 157,3 | 26,3 | 99,8% | 82,3% | 82,1% |
| 66,00 | 0,76 | 0,04 | 12,51 | 56,6% | 20,11 | 7,59 | 154,8 | 26,5 | 99,9% | 82,3% | 82,2% |
| 67,00 | 0,71 | 0,03 | 12,23 | 60,3% | 20,13 | 7,89 | 152,9 | 26,6 | 100,0% | 82,3% | 82,3% |
| 68,00 | 0,71 | 0,02 | 11,77 | 66,6% | 20,16 | 8,38 | 150,6 | 26,3 | 100,0% | 82,2% | 82,2% |
| 69,00 | 0,70 | 0,02 | 11,36 | 72,6% | 20,19 | 8,82 | 149,0 | 26,5 | 100,1% | 82,1% | 82,1% |
| 70,00 | 0,67 | 0,02 | 11,20 | 75,1% | 20,20 | 8,99 | 147,3 | 26,5 | 100,1% | 82,1% | 82,1% |
| 71,00 | 0,67 | 0,02 | 11,08 | 76,9% | 20,21 | 9,11 | 145,3 | 26,4 | 100,1% | 82,1% | 82,2% |
| 72,00 | 0,67 | 0,03 | 10,98 | 78,4% | 20,21 | 9,21 | 144,4 | 26,3 | 100,0% | 82,1% | 82,2% |
| 73,00 | 0,62 | 0,03 | 10,87 | 80,3% | 20,22 | 9,34 | 143,0 | 26,3 | 100,0% | 82,2% | 82,2% |
| 74,00 | 0,62 | 0,03 | 11,05 | 77,3% | 20,21 | 9,15 | 141,9 | 26,3 | 100,0% | 82,3% | 82,4% |
| 75,00 | 0,58 | 0,03 | 10,79 | 81,6% | 20,23 | 9,43 | 140,8 | 26,3 | 100,0% | 82,3% | 82,3% |
| 76,00 | 0,58 | 0,03 | 10,85 | 80,6% | 20,22 | 9,36 | 140,1 | 26,3 | 100,0% | 82,3% | 82,4% |
| 77,00 | 0,58 | 0,03 | 10,91 | 79,5% | 20,22 | 9,29 | 139,3 | 26,3 | 100,0% | 82,4% | 82,4% |
| 78,00 | 0,58 | 0,03 | 10,95 | 78,9% | 20,22 | 9,25 | 138,3 | 26,4 | 100,0% | 82,5% | 82,5% |
| 79,00 | 0,53 | 0,03 | 11,10 | 76,5% | 20,21 | 9,09 | 138,1 | 26,5 | 100,0% | 82,6% | 82,6% |
| 80,00 | 0,53 | 0,03 | 10,89 | 79,9% | 20,22 | 9,32 | 137,3 | 26,5 | 100,0% | 82,6% | 82,6% |
| 81,00 | 0,53 | 0,03 | 11,01 | 77,8% | 20,21 | 9,18 | 136,1 | 26,4 | 100,0% | 82,7% | 82,7% |
| 82,00 | 0,53 | 0,03 | 10,47 | 87,0% | 20,25 | 9,76 | 135,2 | 26,3 | 100,0% | 82,4% | 82,5% |
| 83,00 | 0,49 | 0,03 | 10,40 | 88,3% | 20,25 | 9,83 | 134,4 | 26,4 | 100,0% | 82,5% | 82,5% |
| 84,00 | 0,49 | 0,03 | 10,34 | 89,4% | 20,26 | 9,90 | 133,5 | 26,2 | 100,0% | 82,5% | 82,5% |
| 85,00 | 0,49 | 0,04 | 10,15 | 92,8% | 20,27 | 10,09 | 132,6 | 26,3 | 100,0% | 82,4% | 82,4% |
| 86,00 | 0,44 | 0,04 | 10,10 | 93,6% | 20,27 | 10,15 | 132,6 | 26,3 | 99,9% | 82,4% | 82,3% |
| 87,00 | 0,44 | 0,05 | 9,60 | 103,6% | 20,30 | 10,68 | 132,2 | 26,3 | 99,9% | 82,1% | 82,0% |
| 88,00 | 0,44 | 0,05 | 9,36 | 108,8% | 20,32 | 10,93 | 132,0 | 26,4 | 99,9% | 82,0% | 81,9% |
| 89,00 | 0,44 | 0,05 | 9,33 | 109,5% | 20,32 | 10,97 | 131,8 | 26,3 | 99,9% | 81,9% | 81,9% |
| 90,00 | 0,44 | 0,05 | 9,46 | 106,4% | 20,31 | 10,82 | 131,3 | 26,4 | 99,9% | 82,1% | 82,0% |
| 91,00 | 0,42 | 0,05 | 9,67 | 102,0% | 20,30 | 10,60 | 130,8 | 26,3 | 99,9% | 82,3% | 82,1% |
| 92,00 | 0,40 | 0,05 | 9,59 | 103,7% | 20,30 | 10,69 | 130,3 | 26,3 | 99,9% | 82,2% | 82,1% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 93,00 | 0,40 | 0,05 | 9,64 | 102,7% | 20,30 | 10,63 | 129,6 | 26,3 | 99,9% | 82,3% | 82,2% |
| 94,00 | 0,40 | 0,05 | 9,67 | 102,0% | 20,30 | 10,60 | 129,5 | 26,2 | 99,9% | 82,3% | 82,2% |
| 95,00 | 0,40 | 0,05 | 9,64 | 102,7% | 20,30 | 10,63 | 129,1 | 26,2 | 99,9% | 82,3% | 82,2% |
| 96,00 | 0,40 | 0,05 | 9,52 | 105,1% | 20,31 | 10,76 | 128,7 | 26,2 | 99,9% | 82,3% | 82,2% |
| 97,00 | 0,35 | 0,05 | 9,57 | 104,0% | 20,30 | 10,70 | 128,8 | 26,2 | 99,8% | 82,3% | 82,2% |
| 98,00 | 0,35 | 0,06 | 9,57 | 104,0% | 20,30 | 10,70 | 128,9 | 26,1 | 99,8% | 82,3% | 82,2% |
| 99,00 | 0,35 | 0,05 | 9,34 | 109,1% | 20,32 | 10,95 | 128,2 | 26,1 | 99,9% | 82,2% | 82,1% |
| 100,00 | 0,35 | 0,05 | 9,26 | 110,9% | 20,32 | 11,04 | 127,9 | 26,1 | 99,9% | 82,2% | 82,0% |
| 101,00 | 0,35 | 0,06 | 9,21 | 112,0% | 20,33 | 11,09 | 127,5 | 26,0 | 99,8% | 82,2% | 82,0% |
| 102,00 | 0,35 | 0,06 | 9,20 | 112,3% | 20,33 | 11,10 | 127,3 | 26,1 | 99,8% | 82,2% | 82,0% |
| 103,00 | 0,35 | 0,06 | 9,18 | 112,7% | 20,33 | 11,12 | 126,8 | 26,1 | 99,8% | 82,2% | 82,1% |
| 104,00 | 0,33 | 0,06 | 9,18 | 112,7% | 20,33 | 11,12 | 126,6 | 26,0 | 99,8% | 82,2% | 82,1% |
| 105,00 | 0,30 | 0,06 | 9,15 | 113,5% | 20,33 | 11,16 | 126,5 | 26,1 | 99,8% | 82,2% | 82,0% |
| 106,00 | 0,30 | 0,06 | 9,18 | 112,7% | 20,33 | 11,12 | 127,0 | 26,2 | 99,8% | 82,2% | 82,0% |
| 107,00 | 0,30 | 0,06 | 9,15 | 113,4% | 20,33 | 11,16 | 126,8 | 26,2 | 99,8% | 82,2% | 82,0% |
| 108,00 | 0,30 | 0,06 | 9,14 | 113,4% | 20,33 | 11,16 | 126,6 | 26,1 | 99,8% | 82,2% | 82,0% |
| 109,00 | 0,26 | 0,06 | 9,09 | 114,6% | 20,34 | 11,21 | 126,0 | 26,1 | 99,8% | 82,2% | 82,0% |
| 110,00 | 0,26 | 0,06 | 9,13 | 113,7% | 20,33 | 11,17 | 126,3 | 26,2 | 99,8% | 82,2% | 82,0% |
| 111,00 | 0,26 | 0,06 | 9,31 | 109,7% | 20,32 | 10,98 | 125,8 | 26,2 | 99,8% | 82,4% | 82,2% |
| 112,00 | 0,26 | 0,06 | 9,20 | 112,3% | 20,33 | 11,11 | 124,9 | 26,3 | 99,8% | 82,4% | 82,2% |
| 113,00 | 0,26 | 0,06 | 9,19 | 112,4% | 20,33 | 11,11 | 124,3 | 26,1 | 99,8% | 82,4% | 82,3% |
| 114,00 | 0,26 | 0,06 | 9,26 | 110,9% | 20,32 | 11,04 | 123,5 | 26,2 | 99,8% | 82,5% | 82,4% |
| 115,00 | 0,24 | 0,06 | 9,21 | 111,8% | 20,33 | 11,08 | 123,2 | 26,2 | 99,8% | 82,5% | 82,3% |
| 116,00 | 0,22 | 0,06 | 9,15 | 113,4% | 20,33 | 11,16 | 122,9 | 26,3 | 99,8% | 82,5% | 82,3% |
| 117,00 | 0,22 | 0,06 | 9,16 | 113,1% | 20,33 | 11,14 | 122,4 | 26,1 | 99,8% | 82,5% | 82,4% |
| 118,00 | 0,22 | 0,06 | 9,14 | 113,4% | 20,33 | 11,16 | 122,2 | 26,3 | 99,8% | 82,5% | 82,4% |
| 119,00 | 0,22 | 0,06 | 9,15 | 113,4% | 20,33 | 11,16 | 122,3 | 26,3 | 99,8% | 82,5% | 82,4% |
| 120,00 | 0,22 | 0,06 | 9,16 | 113,0% | 20,33 | 11,14 | 122,3 | 26,2 | 99,8% | 82,5% | 82,4% |
| 121,00 | 0,22 | 0,06 | 9,16 | 113,0% | 20,33 | 11,14 | 122,3 | 26,1 | 99,8% | 82,5% | 82,3% |
| 122,00 | 0,22 | 0,06 | 9,18 | 112,6% | 20,33 | 11,12 | 122,2 | 26,1 | 99,8% | 82,5% | 82,4% |
| 123,00 | 0,17 | 0,06 | 9,09 | 114,6% | 20,34 | 11,21 | 121,8 | 26,2 | 99,8% | 82,5% | 82,4% |
| 124,00 | 0,17 | 0,06 | 9,06 | 115,3% | 20,34 | 11,25 | 121,3 | 26,1 | 99,8% | 82,5% | 82,4% |
| 125,00 | 0,17 | 0,06 | 9,03 | 116,2% | 20,34 | 11,28 | 120,9 | 26,2 | 99,8% | 82,5% | 82,4% |
| 126,00 | 0,17 | 0,06 | 9,13 | 113,6% | 20,33 | 11,17 | 120,9 | 26,2 | 99,8% | 82,6% | 82,4% |
| 127,00 | 0,12 | 0,07 | 9,21 | 111,7% | 20,33 | 11,08 | 121,2 | 26,2 | 99,7% | 82,6% | 82,4% |
| 128,00 | 0,13 | 0,07 | 9,23 | 111,4% | 20,33 | 11,07 | 121,4 | 26,1 | 99,7% | 82,6% | 82,4% |
| 129,00 | 0,12 | 0,07 | 9,15 | 113,2% | 20,33 | 11,15 | 121,3 | 26,1 | 99,7% | 82,6% | 82,4% |
| 130,00 | 0,12 | 0,06 | 9,16 | 112,9% | 20,33 | 11,14 | 120,9 | 26,2 | 99,8% | 82,6% | 82,4% |
| 131,00 | 0,12 | 0,06 | 9,03 | 116,0% | 20,34 | 11,28 | 120,8 | 26,3 | 99,8% | 82,6% | 82,4% |
| 132,00 | 0,12 | 0,07 | 8,96 | 117,5% | 20,34 | 11,35 | 120,9 | 26,2 | 99,7% | 82,5% | 82,3% |
| 133,00 | 0,12 | 0,07 | 8,94 | 117,9% | 20,34 | 11,37 | 121,3 | 26,3 | 99,7% | 82,5% | 82,2% |
| 134,00 | 0,12 | 0,06 | 9,00 | 116,8% | 20,34 | 11,31 | 120,7 | 26,2 | 99,8% | 82,5% | 82,3% |
| 135,00 | 0,12 | 0,06 | 8,88 | 119,6% | 20,35 | 11,44 | 120,7 | 26,4 | 99,8% | 82,5% | 82,3% |
| 136,00 | 0,08 | 0,07 | 8,75 | 122,8% | 20,36 | 11,58 | 120,9 | 26,3 | 99,7% | 82,3% | 82,1% |
| 137,00 | 0,08 | 0,07 | 8,76 | 122,4% | 20,36 | 11,56 | 121,6 | 26,4 | 99,7% | 82,3% | 82,1% |
| 138,00 | 0,08 | 0,07 | 8,77 | 122,3% | 20,36 | 11,56 | 121,7 | 26,3 | 99,7% | 82,3% | 82,0% |
| 139,00 | 0,08 | 0,07 | 8,82 | 120,9% | 20,35 | 11,50 | 122,2 | 26,3 | 99,7% | 82,3% | 82,0% |
| 140,00 | 0,08 | 0,07 | 8,63 | 125,6% | 20,37 | 11,70 | 122,8 | 26,3 | 99,7% | 82,1% | 81,8% |
| 141,00 | 0,08 | 0,07 | 8,50 | 129,1% | 20,37 | 11,84 | 122,7 | 26,2 | 99,7% | 82,0% | 81,7% |
| 142,00 | 0,08 | 0,07 | 8,33 | 133,7% | 20,38 | 12,01 | 122,6 | 26,3 | 99,7% | 81,9% | 81,6% |
| 143,00 | 0,08 | 0,07 | 8,20 | 137,3% | 20,39 | 12,15 | 122,9 | 26,2 | 99,7% | 81,7% | 81,5% |
| 144,00 | 0,03 | 0,07 | 8,23 | 136,5% | 20,39 | 12,12 | 123,2 | 26,3 | 99,7% | 81,7% | 81,5% |
| 145,00 | 0,03 | 0,08 | 8,20 | 137,3% | 20,39 | 12,15 | 123,6 | 26,3 | 99,6% | 81,7% | 81,4% |
| 146,00 | 0,03 | 0,07 | 8,24 | 136,2% | 20,39 | 12,11 | 123,8 | 26,3 | 99,7% | 81,7% | 81,4% |
| 147,00 | 0,03 | 0,07 | 8,19 | 138,0% | 20,40 | 12,18 | 122,9 | 26,3 | 99,8% | 81,7% | 81,5% |
| 148,00 | 0,03 | 0,07 | 7,99 | 143,7% | 20,41 | 12,38 | 122,5 | 26,4 | 99,8% | 81,6% | 81,4% |
| 149,00 | 0,03 | 0,07 | 7,84 | 148,3% | 20,42 | 12,54 | 122,4 | 26,4 | 99,7% | 81,5% | 81,2% |
| 150,00 | 0,03 | 0,07 | 7,79 | 149,9% | 20,42 | 12,60 | 122,6 | 26,4 | 99,7% | 81,4% | 81,2% |
| 151,00 | 0,03 | 0,07 | 7,54 | 158,1% | 20,44 | 12,86 | 122,6 | 26,3 | 99,7% | 81,2% | #DIV/0! |
| 152,00 | 0,03 | 0,07 | 7,63 | 155,2% | 20,43 | 12,77 | 122,4 | 26,4 | 99,7% | 81,3% | #DIV/0! |
| 153,00 | 0,03 | 0,07 | 7,71 | 152,5% | 20,43 | 12,68 | 122,4 | 26,3 | 99,7% | 81,3% | #DIV/0! |
| 154,00 | 0,03 | 0,07 | 7,77 | 150,4% | 20,42 | 12,61 | 122,7 | 26,3 | 99,7% | 81,4% | #DIV/0! |
| 155,00 | 0,03 | 0,07 | 7,74 | 151,4% | 20,42 | 12,65 | 122,9 | 26,3 | 99,7% | 81,3% | #DIV/0! |
| 156,00 | 0,03 | 0,07 | 7,83 | 148,7% | 20,42 | 12,56 | 122,8 | 26,2 | 99,7% | 81,4% | #DIV/0! |
| 157,00 | 0,03 | 0,07 | 7,65 | 154,5% | 20,43 | 12,75 | 123,0 | 26,3 | 99,7% | 81,2% | #DIV/0! |
| 158,00 | 0,03 | 0,07 | 7,60 | 156,0% | 20,43 | 12,80 | 123,2 | 26,3 | 99,7% | 81,2% | 80,9% |
| 159,00 | 0,00 | 0,07 | 7,44 | 161,4% | 20,44 | 12,97 | 123,5 | 26,3 | 99,7% | 81,0% | 80,7% |

DATA 2022-06-27 EPA PI 20272 RUN 1 MODEL 8060
preburn

| Temps | Flue | Room | Tunnel | Catalyst | scale | Right | Back | bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|
| acquisition | temp | temp | dry bulb | | | | | | | |
| minutes | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| 1 | 77,22 | 76,63 | 77,80 | 77,66 | 2,77 | 77,93 | 77,78 | 77,86 | 78,24 | 78,06 |
| 2 | 85,58 | 76,65 | 78,30 | 97,70 | 2,77 | 78,00 | 77,95 | 77,87 | 78,29 | 78,11 |
| 3 | 111,70 | 76,56 | 80,71 | 151,85 | 2,76 | 78,30 | 78,48 | 77,95 | 78,38 | 78,55 |
| 4 | 142,08 | 76,57 | 83,71 | 181,02 | 2,67 | 80,13 | 80,68 | 78,17 | 78,47 | 79,85 |
| 5 | 158,38 | 76,67 | 85,81 | 190,45 | 2,67 | 85,59 | 85,33 | 78,42 | 78,63 | 82,11 |
| 6 | 170,38 | 76,67 | 81,84 | 249,41 | 2,57 | 91,89 | 86,42 | 78,64 | 79,29 | 84,57 |
| 7 | 179,04 | 76,65 | 80,38 | 300,25 | 2,47 | 98,45 | 86,87 | 78,87 | 80,91 | 89,58 |
| 8 | 207,22 | 76,62 | 81,09 | 383,14 | 2,37 | 105,54 | 89,70 | 79,14 | 83,52 | 96,02 |
| 9 | 293,98 | 76,65 | 84,12 | 591,37 | 2,27 | 114,34 | 93,58 | 79,59 | 87,78 | 102,75 |
| 10 | 356,50 | 76,62 | 86,35 | 717,72 | 2,09 | 126,70 | 99,05 | 80,56 | 94,03 | 110,57 |
| 11 | 388,01 | 76,64 | 87,36 | 749,88 | 1,97 | 141,13 | 104,98 | 82,49 | 101,60 | 120,31 |
| 12 | 420,28 | 76,66 | 89,47 | 819,59 | 1,77 | 156,22 | 111,10 | 86,06 | 109,61 | 133,51 |
| 13 | 422,74 | 76,69 | 89,21 | 793,19 | 1,67 | 173,63 | 117,71 | 91,00 | 116,83 | 151,08 |
| 14 | 428,90 | 76,74 | 90,07 | 806,15 | 1,57 | 195,07 | 125,11 | 96,47 | 123,81 | 168,95 |
| 15 | 405,86 | 76,75 | 89,01 | 705,24 | 1,47 | 215,05 | 134,03 | 101,92 | 130,78 | 186,97 |
| 16 | 393,27 | 76,77 | 89,65 | 684,54 | 1,37 | 233,16 | 143,45 | 107,04 | 136,43 | 204,82 |
| 17 | 400,26 | 76,84 | 89,85 | 695,34 | 1,27 | 248,66 | 153,02 | 112,09 | 142,37 | 222,81 |
| 18 | 401,64 | 76,89 | 90,54 | 683,57 | 1,17 | 262,43 | 162,57 | 117,75 | 147,89 | 241,81 |
| 19 | 398,48 | 76,90 | 89,83 | 670,46 | 1,07 | 274,86 | 172,19 | 123,68 | 153,15 | 262,67 |
| 20 | 408,92 | 77,10 | 108,43 | 550,35 | 0,97 | 286,31 | 184,14 | 129,85 | 155,50 | 283,64 |
| 21 | 340,35 | 77,22 | 112,92 | 339,74 | 7,87 | 300,22 | 201,67 | 136,27 | 161,37 | 303,10 |
| 22 | 312,01 | 77,12 | 92,19 | 444,79 | 7,77 | 312,43 | 206,94 | 141,85 | 173,23 | 315,83 |
| 23 | 290,84 | 77,12 | 88,47 | 433,74 | 7,77 | 319,98 | 209,31 | 146,10 | 181,50 | 319,89 |
| 24 | 282,86 | 77,11 | 87,62 | 448,74 | 7,67 | 323,03 | 209,96 | 149,12 | 188,52 | 319,40 |
| 25 | 272,70 | 77,06 | 86,32 | 433,01 | 7,58 | 322,92 | 210,93 | 151,41 | 194,48 | 317,28 |
| 26 | 266,62 | 77,05 | 86,26 | 427,44 | 7,58 | 322,09 | 212,56 | 152,97 | 199,35 | 314,02 |
| 27 | 256,54 | 77,09 | 85,14 | 404,40 | 7,58 | 320,78 | 213,51 | 154,33 | 203,28 | 310,77 |
| 28 | 244,60 | 77,03 | 84,52 | 384,90 | 7,47 | 319,67 | 212,83 | 155,35 | 206,54 | 307,24 |
| 29 | 235,85 | 77,06 | 84,08 | 374,46 | 7,47 | 317,66 | 210,32 | 156,27 | 209,05 | 303,13 |
| 30 | 231,57 | 77,04 | 83,84 | 373,37 | 7,47 | 316,55 | 206,92 | 157,18 | 211,07 | 299,24 |
| 31 | 236,52 | 77,05 | 83,98 | 391,39 | 7,37 | 315,91 | 203,01 | 158,15 | 212,66 | 295,45 |
| 32 | 262,81 | 77,04 | 85,11 | 468,95 | 7,37 | 317,73 | 199,12 | 159,25 | 213,92 | 292,12 |
| 33 | 314,22 | 77,06 | 87,00 | 617,17 | 7,17 | 319,64 | 195,81 | 160,38 | 215,19 | 289,59 |
| 34 | 318,78 | 77,07 | 86,48 | 572,62 | 7,17 | 325,55 | 193,10 | 161,68 | 216,41 | 288,78 |
| 35 | 303,97 | 77,12 | 85,97 | 514,72 | 7,17 | 333,45 | 191,03 | 163,25 | 218,28 | 288,91 |
| 36 | 280,70 | 77,14 | 86,10 | 452,51 | 7,07 | 340,67 | 189,37 | 164,95 | 220,14 | 289,13 |
| 37 | 258,94 | 77,20 | 85,04 | 410,75 | 7,03 | 343,91 | 187,01 | 166,82 | 222,11 | 288,32 |
| 38 | 242,36 | 77,18 | 84,55 | 378,83 | 6,97 | 344,96 | 184,94 | 168,74 | 223,88 | 286,59 |
| 39 | 230,53 | 77,16 | 84,60 | 361,66 | 6,97 | 343,90 | 182,29 | 170,77 | 225,15 | 284,70 |
| 40 | 221,16 | 77,15 | 83,91 | 347,16 | 6,97 | 342,04 | 179,50 | 172,90 | 226,00 | 282,21 |
| 41 | 213,44 | 77,14 | 83,90 | 333,17 | 6,97 | 340,01 | 176,72 | 175,00 | 226,70 | 278,98 |
| 42 | 206,95 | 77,16 | 83,48 | 321,72 | 6,97 | 338,24 | 174,06 | 177,09 | 226,84 | 276,07 |
| 43 | 203,29 | 77,17 | 83,70 | 303,05 | 6,97 | 336,30 | 171,77 | 179,21 | 226,67 | 272,93 |
| 44 | 199,45 | 77,17 | 91,41 | 233,06 | 6,97 | 334,65 | 170,69 | 181,33 | 226,00 | 269,94 |
| 45 | 200,73 | 77,13 | 92,75 | 228,71 | 6,88 | 333,08 | 169,38 | 183,53 | 224,93 | 267,15 |
| 46 | 229,21 | 77,16 | 87,19 | 376,20 | 6,88 | 331,79 | 166,89 | 185,61 | 223,78 | 264,87 |
| 47 | 260,66 | 77,23 | 86,28 | 488,01 | 6,74 | 332,91 | 165,29 | 187,48 | 222,61 | 264,93 |
| 48 | 325,41 | 77,24 | 88,13 | 670,12 | 6,57 | 340,10 | 164,32 | 189,50 | 221,80 | 265,67 |
| 49 | 382,94 | 77,26 | 90,32 | 777,93 | 6,47 | 349,35 | 164,73 | 191,45 | 221,85 | 267,75 |
| 50 | 419,94 | 77,33 | 91,89 | 839,63 | 6,27 | 357,78 | 166,88 | 193,43 | 222,96 | 272,08 |
| 51 | 431,01 | 77,38 | 91,91 | 811,13 | 6,18 | 364,68 | 169,99 | 195,47 | 225,10 | 278,00 |
| 52 | 432,43 | 77,40 | 92,51 | 801,48 | 6,07 | 371,51 | 174,44 | 197,65 | 228,89 | 284,28 |
| 53 | 435,81 | 77,43 | 93,19 | 804,90 | 5,97 | 377,63 | 178,63 | 199,88 | 233,28 | 290,64 |
| 54 | 444,53 | 77,52 | 93,83 | 835,38 | 5,77 | 384,12 | 183,16 | 202,00 | 238,77 | 296,74 |
| 55 | 454,31 | 77,53 | 95,10 | 845,97 | 5,67 | 390,39 | 187,89 | 204,09 | 245,10 | 302,13 |
| 56 | 460,21 | 77,63 | 94,81 | 847,63 | 5,57 | 396,21 | 192,79 | 206,12 | 251,91 | 307,32 |
| 57 | 461,24 | 77,71 | 95,33 | 845,03 | 5,47 | 403,29 | 197,78 | 208,20 | 259,29 | 313,14 |
| 58 | 460,91 | 77,80 | 96,22 | 842,72 | 5,37 | 411,60 | 202,24 | 210,25 | 266,81 | 319,09 |
| 59 | 462,48 | 78,11 | 96,88 | 846,26 | 5,17 | 419,39 | 206,76 | 212,43 | 274,03 | 324,72 |
| 60 | 468,87 | 78,30 | 95,63 | 884,96 | 5,07 | 427,79 | 210,84 | 214,60 | 281,85 | 330,00 |
| 61 | 493,07 | 78,45 | 96,28 | 953,70 | 4,97 | 434,69 | 214,76 | 216,79 | 289,47 | 335,81 |
| 62 | 498,74 | 78,70 | 97,35 | 940,18 | 4,77 | 442,49 | 218,94 | 219,05 | 297,22 | 343,30 |
| 63 | 495,83 | 79,03 | 97,84 | 933,31 | 4,67 | 449,59 | 223,48 | 221,24 | 305,34 | 351,67 |
| 64 | 495,74 | 79,08 | 97,79 | 935,36 | 4,49 | 456,65 | 227,76 | 223,46 | 313,48 | 360,32 |
| 65 | 501,05 | 79,32 | 98,92 | 964,09 | 4,37 | 463,22 | 231,72 | 225,71 | 321,70 | 368,28 |
| 66 | 514,25 | 79,32 | 100,39 | 999,31 | 4,27 | 471,65 | 236,20 | 227,96 | 329,84 | 376,59 |
| 67 | 522,43 | 79,47 | 100,51 | 1014,49 | 4,07 | 481,10 | 239,83 | 230,16 | 337,95 | 385,06 |
| 68 | 528,68 | 79,35 | 101,85 | 1020,79 | 3,97 | 493,21 | 245,22 | 232,43 | 346,32 | 394,30 |
| 69 | 532,54 | 79,53 | 100,46 | 1018,44 | 3,78 | 506,16 | 248,26 | 234,63 | 355,19 | 403,05 |
| 70 | 532,53 | 79,55 | 101,07 | 1010,64 | 3,67 | 521,14 | 252,77 | 236,85 | 364,03 | 411,25 |
| 71 | 533,03 | 79,65 | 101,37 | 1008,68 | 3,47 | 537,67 | 257,41 | 239,30 | 373,59 | 419,93 |
| 72 | 536,51 | 79,67 | 101,60 | 1015,93 | 3,30 | 554,27 | 261,30 | 241,64 | 383,31 | 429,65 |
| 73 | 532,63 | 79,72 | 101,60 | 993,67 | 3,17 | 569,89 | 266,27 | 244,22 | 393,31 | 439,96 |
| 74 | 533,35 | 79,65 | 101,98 | 1004,01 | 3,07 | 583,43 | 271,49 | 246,85 | 403,56 | 450,84 |
| 75 | 529,86 | 79,76 | 102,18 | 998,90 | 2,87 | 595,36 | 278,05 | 249,73 | 413,90 | 461,05 |
| 76 | 527,48 | 79,96 | 102,92 | 996,39 | 2,77 | 605,99 | 284,82 | 252,75 | 423,67 | 472,37 |
| 77 | 527,39 | 80,05 | 102,33 | 992,72 | 2,67 | 613,92 | 291,67 | 255,75 | 432,91 | 482,70 |
| 78 | 527,10 | 80,32 | 103,17 | 1005,03 | 2,47 | 620,42 | 300,84 | 259,14 | 441,86 | 493,58 |
| 79 | 524,62 | 79,97 | 101,67 | 998,51 | 2,37 | 623,76 | 308,29 | 262,55 | 449,42 | 502,43 |
| 80 | 518,97 | 79,74 | 104,06 | 984,89 | 2,27 | 626,52 | 316,41 | 266,04 | 456,18 | 513,64 |
| 81 | 513,47 | 79,75 | 103,11 | 969,75 | 2,17 | 630,53 | 323,46 | 269,67 | 462,80 | 523,19 |
| 82 | 504,76 | 79,54 | 101,27 | 946,37 | 2,07 | 633,31 | 328,85 | 273,31 | 468,22 | 532,00 |
| 83 | 492,80 | 79,28 | 99,36 | 908,93 | 1,97 | 637,32 | 332,45 | 276,88 | 472,73 | 539,79 |
| 84 | 481,73 | 79,25 | 99,02 | 891,48 | 1,87 | 641,04 | 335,24 | 280,44 | 476,53 | 547,85 |
| 85 | 474,30 | 79,33 | 98,58 | 876,56 | 1,87 | 644,93 | 338,09 | 284,27 | 479,35 | 556,43 |
| 86 | 467,29 | 79,39 | 98,00 | 866,63 | 1,77 | 646,31 | 339,96 | 288,00 | 481,55 | 564,02 |
| 87 | 459,00 | 79,19 | 97,02 | 845,94 | 1,68 | 647,99 | 341,54 | 291,59 | 482,88 | 569,78 |
| 88 | 450,34 | 79,44 | 98,93 | 815,39 | 1,66 | 647,36 | 344,91 | 295,47 | 483,18 | 578,09 |
| 89 | 441,61 | 79,46 | 98,19 | 796,13 | 1,57 | 647,66 | 346,07 | 299,40 | 483,30 | 584,03 |
| 90 | 431,85 | 79,10 | 95,57 | 782,71 | 1,57 | 647,58 | 347,07 | 303,02 | 482,95 | 588,41 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 423,37 | 79,05 | 94,49 | 767,26 | 1,47 | 645,75 | 346,22 | 306,77 | 481,52 | 591,59 |
| 92 | 414,91 | 78,94 | 94,54 | 752,31 | 1,47 | 643,14 | 347,50 | 310,49 | 479,62 | 595,66 |
| 93 | 407,83 | 79,14 | 94,89 | 738,17 | 1,37 | 644,31 | 349,06 | 314,79 | 477,10 | 602,50 |
| 94 | 399,78 | 78,91 | 94,01 | 720,58 | 1,37 | 643,07 | 347,55 | 318,58 | 474,33 | 604,11 |
| 95 | 391,35 | 78,84 | 98,93 | 707,31 | 1,37 | 643,03 | 347,55 | 322,52 | 470,80 | 609,33 |
| 96 | 382,91 | 79,44 | 98,93 | 694,04 | 1,37 | 642,99 | 347,56 | 326,46 | 467,26 | 614,56 |
| 97 | 374,48 | 79,46 | 98,19 | 680,77 | 1,35 | 642,94 | 347,56 | 330,39 | 463,73 | 619,79 |
| 98 | 366,05 | 79,10 | 95,57 | 667,50 | 1,32 | 642,90 | 347,56 | 334,33 | 460,19 | 625,02 |
| 99 | 357,62 | 79,05 | 94,49 | 654,24 | 1,29 | 642,85 | 347,57 | 338,27 | 456,66 | 630,25 |
| 100 | 349,18 | 78,94 | 94,54 | 640,97 | 1,26 | 642,81 | 347,57 | 342,21 | 453,12 | 635,48 |
| 101 | 353,57 | 79,14 | 91,62 | 657,35 | 1,24 | 638,52 | 337,74 | 344,24 | 446,50 | 614,74 |
| 102 | 349,67 | 79,14 | 106,67 | 484,90 | 1,21 | 639,96 | 338,69 | 348,56 | 441,08 | 614,19 |
| 103 | 316,31 | 79,20 | 113,99 | 363,67 | 8,28 | 639,27 | 339,34 | 352,79 | 435,20 | 611,16 |
| 104 | 303,83 | 78,86 | 96,68 | 487,56 | 8,18 | 634,88 | 336,03 | 356,90 | 427,97 | 605,29 |
| 105 | 303,07 | 78,90 | 92,89 | 520,43 | 8,08 | 626,71 | 329,09 | 360,75 | 422,05 | 598,76 |
| 106 | 301,90 | 78,76 | 92,05 | 526,55 | 7,98 | 615,96 | 325,24 | 363,89 | 416,21 | 589,42 |
| 107 | 307,41 | 78,82 | 91,98 | 557,79 | 7,88 | 605,67 | 321,76 | 366,35 | 410,75 | 579,83 |
| 108 | 319,78 | 78,62 | 92,19 | 592,70 | 7,77 | 594,13 | 320,31 | 367,75 | 404,99 | 566,47 |
| 109 | 332,51 | 78,37 | 92,65 | 625,84 | 7,59 | 583,08 | 321,64 | 368,80 | 399,88 | 556,64 |
| 110 | 375,28 | 78,71 | 94,03 | 764,26 | 7,38 | 576,57 | 329,67 | 370,27 | 395,37 | 549,48 |
| 111 | 408,97 | 78,72 | 94,54 | 803,97 | 7,17 | 568,38 | 333,45 | 371,16 | 391,88 | 541,66 |
| 112 | 421,10 | 78,57 | 95,12 | 804,66 | 7,07 | 562,04 | 340,26 | 372,11 | 390,12 | 534,23 |
| 113 | 437,29 | 78,47 | 96,51 | 829,07 | 6,88 | 556,27 | 346,67 | 372,82 | 388,95 | 527,72 |
| 114 | 454,75 | 78,48 | 96,99 | 853,98 | 6,61 | 553,50 | 355,86 | 373,78 | 388,12 | 523,38 |
| 115 | 468,87 | 78,63 | 98,81 | 876,56 | 6,47 | 551,06 | 364,92 | 375,13 | 388,68 | 520,35 |
| 116 | 481,84 | 78,53 | 98,41 | 905,17 | 6,21 | 547,89 | 370,65 | 376,08 | 390,60 | 515,59 |
| 117 | 491,54 | 78,53 | 98,13 | 925,91 | 5,98 | 547,15 | 379,72 | 377,62 | 392,83 | 514,99 |
| 118 | 503,71 | 78,54 | 98,89 | 955,37 | 5,87 | 546,13 | 389,09 | 379,50 | 395,78 | 515,10 |
| 119 | 515,76 | 78,61 | 98,50 | 980,70 | 5,67 | 546,63 | 401,13 | 381,56 | 399,50 | 515,21 |
| 120 | 522,48 | 78,57 | 98,92 | 992,93 | 5,48 | 544,70 | 406,91 | 382,86 | 404,01 | 513,90 |
| 121 | 536,11 | 78,53 | 99,66 | 1046,29 | 5,36 | 544,74 | 417,10 | 383,93 | 408,89 | 515,32 |
| 122 | 545,49 | 78,43 | 98,87 | 1068,63 | 5,17 | 543,93 | 425,29 | 384,63 | 414,43 | 516,08 |
| 123 | 549,29 | 78,81 | 101,44 | 1067,33 | 5,07 | 544,63 | 435,96 | 385,61 | 420,08 | 517,24 |
| 124 | 552,83 | 78,64 | 101,40 | 1082,24 | 4,87 | 544,52 | 443,15 | 386,15 | 426,70 | 518,23 |
| 125 | 554,96 | 78,65 | 99,99 | 1080,35 | 4,78 | 542,33 | 446,51 | 386,26 | 433,25 | 517,45 |
| 126 | 549,47 | 78,46 | 100,00 | 1071,87 | 4,57 | 540,82 | 451,56 | 386,57 | 440,93 | 518,29 |
| 127 | 549,76 | 78,68 | 103,21 | 1070,15 | 4,47 | 540,85 | 461,07 | 387,32 | 447,52 | 520,70 |
| 128 | 546,26 | 78,96 | 101,84 | 1067,48 | 4,32 | 540,51 | 462,21 | 387,92 | 454,83 | 521,45 |
| 129 | 545,05 | 79,06 | 102,21 | 1066,38 | 4,17 | 540,75 | 464,47 | 388,53 | 461,97 | 522,05 |
| 130 | 545,33 | 78,79 | 102,83 | 1072,72 | 4,08 | 540,39 | 462,44 | 389,15 | 467,73 | 522,96 |
| 131 | 548,94 | 78,90 | 101,31 | 1092,49 | 3,87 | 538,98 | 459,33 | 389,32 | 473,82 | 521,99 |
| 132 | 553,16 | 79,04 | 101,41 | 1104,64 | 3,79 | 539,25 | 457,37 | 389,59 | 479,51 | 520,95 |
| 133 | 558,21 | 78,90 | 101,45 | 1109,62 | 3,67 | 539,28 | 456,67 | 389,90 | 485,82 | 522,33 |
| 134 | 560,68 | 79,06 | 102,00 | 1117,80 | 3,57 | 539,91 | 457,06 | 390,53 | 491,75 | 524,53 |
| 135 | 558,42 | 79,21 | 102,32 | 1099,11 | 3,47 | 540,12 | 457,94 | 390,98 | 498,61 | 526,42 |
| 136 | 557,49 | 79,14 | 102,46 | 1106,58 | 3,27 | 541,51 | 459,51 | 391,76 | 505,13 | 528,68 |
| 137 | 471,78 | 79,41 | 97,25 | 927,34 | 3,21 | 543,46 | 464,84 | 393,02 | 533,36 | 532,19 |
| 138 | 434,31 | 79,34 | 95,10 | 924,62 | 3,07 | 545,28 | 468,24 | 394,48 | 550,07 | 535,23 |
| 139 | 414,99 | 79,32 | 95,02 | 931,18 | 2,97 | 547,47 | 468,71 | 396,15 | 561,25 | 537,33 |
| 140 | 402,85 | 79,24 | 93,86 | 930,14 | 2,97 | 549,39 | 467,60 | 397,56 | 570,17 | 539,57 |
| 141 | 394,64 | 79,26 | 94,39 | 937,52 | 2,87 | 551,08 | 468,42 | 399,33 | 576,40 | 542,95 |
| 142 | 385,95 | 79,39 | 92,95 | 930,78 | 2,77 | 554,30 | 465,71 | 400,68 | 582,15 | 545,94 |
| 143 | 377,11 | 79,31 | 92,49 | 916,15 | 2,77 | 556,66 | 459,71 | 401,58 | 586,95 | 546,45 |
| 144 | 372,19 | 79,37 | 92,15 | 922,09 | 2,68 | 558,47 | 454,46 | 402,60 | 589,56 | 549,09 |
| 145 | 367,40 | 79,19 | 91,94 | 924,17 | 2,68 | 560,17 | 451,36 | 403,72 | 591,71 | 552,09 |
| 146 | 363,47 | 79,23 | 91,47 | 922,32 | 2,57 | 561,25 | 446,25 | 404,58 | 593,41 | 553,93 |
| 147 | 359,67 | 79,31 | 91,31 | 912,55 | 2,47 | 563,12 | 441,26 | 405,57 | 596,37 | 556,22 |
| 148 | 355,97 | 79,39 | 91,36 | 893,17 | 2,47 | 564,08 | 436,18 | 406,45 | 598,44 | 557,95 |
| 149 | 352,84 | 79,26 | 90,42 | 897,17 | 2,47 | 564,89 | 429,53 | 407,20 | 598,99 | 558,41 |
| 150 | 349,48 | 79,31 | 90,74 | 890,68 | 2,37 | 565,44 | 424,49 | 408,07 | 598,54 | 559,21 |
| 151 | 344,64 | 79,27 | 90,48 | 869,76 | 2,27 | 567,87 | 421,11 | 409,05 | 598,01 | 562,16 |
| 152 | 341,14 | 79,32 | 90,52 | 867,37 | 2,27 | 568,74 | 416,65 | 409,99 | 597,10 | 563,08 |
| 153 | 336,76 | 79,12 | 90,08 | 870,69 | 2,27 | 568,75 | 413,48 | 410,91 | 597,21 | 563,19 |
| 154 | 333,40 | 79,25 | 91,47 | 868,30 | 2,17 | 571,01 | 413,82 | 412,33 | 595,68 | 565,88 |
| 155 | 330,13 | 79,35 | 91,29 | 861,72 | 2,17 | 571,59 | 410,18 | 413,54 | 593,18 | 567,45 |
| 156 | 326,54 | 79,24 | 89,99 | 850,09 | 2,17 | 571,71 | 407,61 | 414,54 | 591,93 | 569,55 |
| 157 | 323,63 | 79,61 | 91,22 | 836,31 | 2,10 | 574,18 | 406,64 | 415,90 | 588,47 | 572,48 |
| 158 | 319,58 | 79,68 | 89,65 | 825,33 | 2,07 | 574,86 | 402,70 | 417,13 | 583,31 | 575,16 |
| 159 | 316,85 | 79,72 | 90,33 | 815,08 | 2,07 | 575,66 | 402,51 | 418,37 | 575,31 | 578,03 |
| 160 | 314,52 | 79,81 | 89,27 | 801,45 | 2,01 | 577,34 | 399,34 | 419,57 | 565,42 | 581,18 |
| 161 | 311,88 | 80,04 | 90,46 | 786,69 | 1,98 | 579,20 | 398,02 | 420,87 | 555,60 | 584,05 |
| 162 | 308,28 | 79,89 | 90,27 | 776,20 | 1,98 | 580,03 | 394,77 | 422,03 | 546,33 | 586,62 |
| 163 | 304,50 | 79,44 | 88,93 | 765,17 | 1,98 | 580,23 | 390,77 | 422,77 | 537,54 | 587,92 |
| 164 | 301,38 | 79,52 | 89,01 | 754,51 | 1,98 | 582,54 | 389,40 | 424,00 | 528,90 | 590,44 |
| 165 | 298,39 | 79,60 | 88,34 | 744,93 | 1,98 | 583,85 | 387,23 | 425,08 | 521,15 | 591,48 |
| 166 | 294,37 | 79,67 | 89,51 | 732,51 | 1,90 | 586,27 | 385,73 | 426,23 | 512,99 | 593,02 |
| 167 | 291,37 | 79,74 | 89,64 | 726,33 | 1,98 | 588,47 | 383,49 | 427,36 | 505,66 | 593,73 |
| 168 | 288,70 | 79,65 | 89,25 | 720,07 | 1,87 | 589,29 | 383,04 | 428,21 | 498,39 | 593,78 |
| 169 | 286,52 | 79,85 | 89,02 | 715,98 | 1,87 | 591,13 | 380,13 | 429,04 | 491,16 | 593,35 |
| 170 | 284,22 | 79,57 | 88,56 | 711,63 | 1,87 | 593,38 | 376,05 | 429,68 | 484,64 | 592,77 |
| 171 | 281,37 | 79,16 | 88,20 | 705,72 | 1,87 | 594,15 | 369,42 | 429,59 | 478,38 | 588,95 |
| 172 | 279,28 | 79,35 | 88,58 | 701,27 | 1,87 | 596,01 | 367,69 | 430,01 | 472,14 | 589,39 |
| 173 | 276,63 | 79,19 | 88,24 | 698,65 | 1,87 | 598,06 | 363,32 | 430,01 | 466,65 | 586,03 |
| 174 | 275,24 | 79,33 | 87,98 | 694,68 | 1,86 | 600,28 | 361,57 | 430,35 | 461,36 | 587,66 |
| 175 | 273,61 | 79,52 | 87,94 | 689,83 | 1,77 | 602,13 | 362,07 | 430,72 | 456,05 | 587,52 |
| 176 | 272,24 | 79,60 | 87,24 | 684,69 | 1,77 | 603,45 | 356,85 | 430,95 | 450,95 | 586,24 |
| 177 | 271,43 | 79,53 | 88,09 | 684,76 | 1,77 | 604,13 | 358,08 | 431,41 | 446,14 | 585,17 |
| 178 | 269,63 | 79,36 | 88,29 | 679,61 | 1,77 | 605,24 | 354,52 | 431,94 | 441,93 | 584,32 |
| 179 | 267,70 | 79,41 | 87,56 | 673,71 | 1,77 | 606,06 | 349,91 | 432,22 | 437,83 | 583,16 |
| 180 | 266,48 | 79,37 | 87,13 | 669,81 | 1,77 | 605,78 | 347,29 | 432,76 | 433,71 | 582,76 |
| 181 | 264,53 | 79,30 | 87,19 | 664,04 | 1,67 | 606,39 | 343,94 | 433,16 | 430,08 | 581,41 |
| 182 | 262,90 | 79,25 | 87,21 | 660,66 | 1,68 | 605,38 | 344,17 | 433,83 | 426,55 | 581,33 |
| 183 | 262,54 | 79,07 | 87,07 | 657,54 | 1,67 | 604,02 | 343,82 | 434,47 | 423,14 | 580,84 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 184 | 260,39 | 79,31 | 87,25 | 651,81 | 1,67 | 602,69 | 339,92 | 435,05 | 419,43 | 580,78 |
| 185 | 258,80 | 79,40 | 87,74 | 648,78 | 1,67 | 601,84 | 339,17 | 435,70 | 416,48 | 579,83 |
| 186 | 257,84 | 79,55 | 88,85 | 648,47 | 1,67 | 599,30 | 340,28 | 436,38 | 413,28 | 580,32 |
| 187 | 257,65 | 79,63 | 88,71 | 646,57 | 1,67 | 598,44 | 339,55 | 437,24 | 409,89 | 579,65 |
| 188 | 256,74 | 79,49 | 87,58 | 645,13 | 1,57 | 596,63 | 335,28 | 437,87 | 407,12 | 578,70 |
| 189 | 255,91 | 79,74 | 86,46 | 644,60 | 1,62 | 597,05 | 335,17 | 438,64 | 404,67 | 578,44 |
| 190 | 255,83 | 79,61 | 86,90 | 643,89 | 1,57 | 594,78 | 332,01 | 439,10 | 401,91 | 577,86 |
| 191 | 255,10 | 79,66 | 86,82 | 644,13 | 1,57 | 594,30 | 330,74 | 439,50 | 399,48 | 577,01 |
| 192 | 254,39 | 79,38 | 86,61 | 642,06 | 1,57 | 592,07 | 328,31 | 439,46 | 397,24 | 575,21 |
| 193 | 253,03 | 79,17 | 86,39 | 643,36 | 1,57 | 591,67 | 328,40 | 439,29 | 394,82 | 574,49 |
| 194 | 253,04 | 79,38 | 86,40 | 644,51 | 1,57 | 589,87 | 327,20 | 439,43 | 392,21 | 574,30 |
| 195 | 259,97 | 79,20 | 89,30 | 590,84 | 3,32 | 589,99 | 324,79 | 439,17 | 390,77 | 572,50 |
| 196 | 260,55 | 79,26 | 89,02 | 570,41 | 1,48 | 588,71 | 323,56 | 439,20 | 387,20 | 571,47 |
| 197 | 250,27 | 79,01 | 86,55 | 588,91 | 1,47 | 585,85 | 320,52 | 438,96 | 382,65 | 567,04 |
| 198 | 245,09 | 79,22 | 85,14 | 585,51 | 1,47 | 583,55 | 322,70 | 439,25 | 378,90 | 564,81 |

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 2 Tech: MM Reviewer: DP

- Kindling 28 LBS START FIRE
- by pass open
- Door open
- At 25 LBS close Door
- At 12 LBS INSERT 1st preload
- close Door immediatly
- At 12 LBS INSERT Second preload
- close Door immediatly
- At 78 LBS close air inlet and by pass
- At 66 LBS open bypass and air inlet
- At 43 LBS close air inlet and by pass
- At 18 LBS Rack coal Bed
- After 3 min INSERT load and open ~~by pass~~ air inlet MM
- At 5 min close air inlet to lowest setting

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE / POST CHECKS

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 2 Tech: MM Reviewer: DP

Moisture Meter Calibration Check:

| Equipment # | Time | 12% | 22% |
|---|---|---|---|
| EM-334 | 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 (tunnel velocity) | Ok | NA |
| Picture (4 sides) | Ok | Ok |

**Wood Heater Conditions:**

| | |
|---|---|
| Date Wood Heater Stack Cleaned | 2022-06-27 |
| Date Dilution Tunnel Cleaned | 2022-06-27 |
| Induced Draft Check (max 0.005 H2O) | Ok |
| Traverse before ignition | Ok |

**Temperature System:**

| | |
|---|---|
| Ambient (65°-90°F) | Ok °F |

**Proportional Checks:**

| | | |
|---|---|---|
| Thermocouple check | Ok | |
| Pitot Clean | Ok | |
| Pitot verification | Ok | |
| Pictures for report | Side | Ok |
| | Coal bed | Ok |
| | Load | Ok |
| | Load in stove | Ok |
| | Fuel adjustment | Ok |

Load Length approximately 5/6 of firebox Lenght: Ok

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 2 Tech: MM Reviewer: [illegible]

## Leakage Checks Tunnel Samplers

| | System 1st hour | | System 1 | | System 2 | |
|---|---|---|---|---|---|---|
| Unplugged Flow Rate = .25cfm | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) |
| Vacuum (inches Hg.) | -10 | -10 | -10 | -10 | -10 | -10 |
| Final 1minute DGM (Liter) | 6564426,05 | 6572425,53 | 6564426,35 | 6572425,80 | 4042687,78 | 4050650,00 |
| Initial 1minute DGM (Liter) | 6564426,05 | 6572425,53 | 6564426,33 | 6572425,75 | 4042687,78 | 4050650,00 |
| Change (Liter) | 0 | 0,01 | 0,02 | 0,05 | 0 | 0 |
| Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56) | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** |
| Check OK | OK | OK | OK | OK | OK | OK |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 2 Tech: MM Reviewer: DP

## 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 | O/K | O/K |

## 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.) | O/K | O/K | O/K | O/K |

## Scales checks

| Scale Type | Audit | | Measured Weight |
|---|---|---|---|
| | Equipment # | Weight | |
| Platform | EM-090 | 44 lbs, Class F | 44 lbs |
| Platform | EM-205 | 10,00 kg ~~lbs~~, Class F | 10,00 kg ~~lbs~~ |
| Wood | EM-090 | 440 lbs, Class F | 440 lbs |
| Analytical | EM-335 | 100 mg, Class S | 100 mg |
| Analytical | EM-129 | 200 g, Class S | 200 g |

## LIMITS OF WEIGHT RANGES

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

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 2 Tech: MM Reviewer: DP

FOR TUNNELS < 12 in

Barometric pressure ($P_{bar}$) 1014 (KPa.) Static pressure ($P_q$) 0,19 (inches w.c.)
Inside diameter: Port A _____ Port B ____.
Tunnel cross sectional area: .1963$Ft^2$
Pitot tube type: Standard

| Traverse Point | Position (inches) | | | Velocity Head $\Delta_p$ (inches $H_2O$) | Tunnel Temperature (°F) |
|---|---|---|---|---|---|
| | 6 po | 7 po | 8 po | | |
| A- Centroid | 3.00 | 3.50 | 4 | 0071 | 7575 |
| B - Centroid | 3.00 | 3.50 | 4 | 0072 | 7549 |
| A-1 | 0.40 | 0.50 | 0.50 | 0057 / 0063 MM | 7575 / 7564 MM |
| A-2 | 1.50 | 1.75 | 2 | 0063 | 7575 |
| A-3 | 4.50 | 5.25 | 6 | 0060 | 7564 |
| A-4 | 5.60 | 6.5 | 7.5 | 0057 | 7553 |
| B-1 | 0.40 | 0.50 | 0.50 | 0057 | 7549 |
| B-2 | 1.50 | 1.75 | 2 | 0077 | 7548 |
| B-3 | 4.50 | 5.25 | 6 | 0074 | 7548 |
| B-4 | 5.60 | 6.5 | 7.5 | 0058 | 7540 |
| | | | | 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.
$\Delta_p$ = 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 ($\Delta_p$) measured at each traverse point.

POLYTESTS
TESTING THROUGH YOUR REALITY

# CONTINUOUS ANALYZERS

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 2 Tech: MM Reviewer: JP

Pre-Test (Adjust and Record)

| | ZERO | | SPAN | | CAL. (Record Only) | |
|---|---|---|---|---|---|---|
| CO | 0 | 0 | 3,014 | 3000 | 1,022 | 1,000 |
| Tolerance CO | 0 | +/- 0.02 | 0,014 | +/- 0.15 | 0,022 | +/- 0.05 |
| $CO_2$ | 0 | 0 | 17,88 | 18,00 | 9,86 | 10,00 |
| Tolerance CO2 | 0 | +/- 0.02 | 0,12 | +/- 0.5 | 0,20 | +/- 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 | 3010 | 1,009 | 0 | 0.02 | 0,004 | 0.15 | 0,013 | 0.05 | ✓ | |
| $CO_2$ | 0 | 17,81 | 9,86 | 0 | 0.02 | 0,07 | 0.5 | 0,06 | 0.5 | ✓ | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# TEST DATA LOG

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PE 20272 Run: 2 Tech: MM Reviewer: [illegible]

## RAW DRY GAS METER READINGS

| | System 1 | System 2 | Blanck |
|---|---|---|---|
| Final (Liter) | 657241,71 | 405063,82 | 390673,92 |
| Initial (Liter) | 656426,68 | 404268,48 | 390000,41 |

## AMBIENT CONDITIONS

| | Before | After |
|---|---|---|
| Barometer (kPa): | 101,4 | 101,4 |
| Dry Bulb (F): | 73,6 | 78,1 |
| Humidity (%): | 51,2 | 33,6 |

## Flow Meter

| | Start | End |
|---|---|---|
| Flow meter reading | N.A | NA |

## Flow Meter Verification

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

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 2 Tech: M M Reviewer: [illegible]

## FUEL DESCRIPTION:

Type of wood:

## PRE-TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3/4 x 14 in. | 1410 lbs. | 20.1 | 20.4 | 20.3 | 20.6 | 20.4 |
| 1 1/2 x 3/4 x 14 in. | 1490 lbs. | 20.8 | 21.0 | 20.9 | 20.8 | 20.7 |
| 1 1/2 x 3/4 x 14 in. | 1424 lbs. | 20.1 | 19.9 | 19.8 | 19.8 | 19.8 |
| 1 1/2 x 3/4 x 7 in. | 0858 lbs. | 19.6 | 19.4 | 19.3 | 19.6 | 19.4 |
| 1 1/2 x 3/4 x 7 in. | 0586 lbs. | 20.0 | 20.0 | 20.1 | 20.1 | 20.4 |
| 1 1/2 x 3/4 x 7 in. | 0676 lbs. | 21.0 | 21.1 | 21.1 | 21.2 | 21.3 |
| 1 1/2 x 3/4 x 7 in. | 0868 lbs. | 19.1 | 19.1 | 19.2 | 19.2 | 19.3 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3 1/2 x 14 in. | 1476 lbs. | 20.0 | 21.0 | 20.9 | 20.8 | 20.8 |
| 1 1/2 x 3 1/2 x 14 in. | 1416 lbs. | 19.9 | 19.8 | 19.6 | 19.8 | 19.9 |
| 1 1/2 x 3 1/2 x 14 in. | 1508 lbs. | 20.1 | 20.2 | 20.2 | 19.9 | 19.8 |
| 1 1/2 x 3 1/2 x 7 in. | 0586 lbs. | 21.1 | 21.0 | 21.1 | 21.0 | 21.2 |
| 1 1/2 x 3 1/2 x 7 in. | 0858 lbs. | 21.6 | 21.5 | 21.4 | 21.5 | 21.5 |
| 1 1/2 x 3 1/2 x 7 in. | 0676 lbs. | 20.9 | 21.0 | 20.9 | 21.0 | 21.0 |
| 1 1/2 x 3 1/2 x 7 in. | 0850 lbs. | 20.6 | 20.3 | 20.8 | 20.6 | 20.4 |
| 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. | | | | | |

**TEST LOAD WEIGHT:** 7316 + 7366 lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: pt 20272 Run: 2 Tech: M M Reviewer: [illegible]

## FUEL DESCRIPTION:

Type of wood :

## TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 15 in. | 1372 lbs. | 209 | 211 | 208 | 207 | 208 |
| 1 1/2 x 3 1/2 x 15 in. | 1470 lbs. | 208 | 206 | 209 | 208 | 203 |
| 1 1/2 x 3 1/2 x 15 in. | 1528 lbs. | 211 | 214 | 213 | 212 | 212 |
| 1 1/2 x 3 1/2 x 15 in. | 1440 lbs. | 201 | 203 | 204 | 205 | 203 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3/4 x 4 in. | 0098 lbs. | | | 201 | | |
| 1 1/2 x 3/4 x 4 in. | 0100 lbs. | | | 193 | | |
| 1 1/2 x 3/4 x 4 in. | 0122 lbs. | | | 194 | | |
| 1 1/2 x 3/4 x 4 in. | 0122 lbs. | | | 193 | | |
| 1 1/2 x 3/4 x 4 in. | 0108 lbs. | | | 192 | | |
| 1 1/2 x 3/4 x 4 in. | 0108 lbs. | | | 192 | | |
| 1 1/2 x 3/4 x 4 in. | 0080 lbs. | | | 194 | | |
| 1 1/2 x 3/4 x 4 in. | 0082 lbs. | | | 195 | | |
| 1 1/2 x 3/4 x 4 in. | 0110 lbs. | | | 196 | | |
| 1 1/2 x 3/4 x 4 in. | 0130 lbs. | | | 194 | | |
| 1 1/2 x 3/4 x 4 in. | 0096 lbs. | | | 193 | | |
| 1 1/2 x 3/4 x 4 in. | 0094 lbs. | | | 194 | | |
| 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**: 7068 lbs Min 20%: 141 Max 25%: 177

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-27 Manufacturer: Heathstone Model: 8060

Project #: PT 20272 Run: 2 Tech: MM Reviewer: DP

| | | 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 | 17 | 311 | 312 | 9 | 9 | 309 | 310 | 8 | 315 |
| 2022-06-27 | 17:00 | 108942 | | 352120 | | 614546 | | 360289 | | 01288 |
| 2022-06-28 | 9:00 | 108942 | | 352121 | | 614547 | | 360288 | | 01288 |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | | 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 | 17 | 311 | 312 | 9 | 9 | 309 | 310 | 8 | 315 |
| 2022-06-28 | 15:00 | 108942 | | 352148 | | 614548 | | 360293 | | 01288 |
| 2022-07-07 | 8:00 | 108942 | | 352137 | | 614548 | | 360293 | | 01289 |
| 2022-07-08 | 8:00 | 108942 | | 352136 | | 614547 | | 360293 | | 01289 |
| | | | | | | | | | | |
| | | | | | | | | | | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-27 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 2 Tech: MM Reviewer: DP

| Pre-test Weight Record | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 50 | 313 | 314 | 13 |
| 2022-06-27 | ~~9:00~~ 17:00 | 107 6474 | | 35 0398 | |
| 2022-06-28 | 9:00 | 107 6475 | | 35 0397 | |
| | | | | | |
| | | | | | |

| Post-test Weight Record | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 50 | 313 | 314 | 13 |
| 2022-06-28 | 15:00 | 107 6477 | | 35 0423 | |
| 2022-07-07 | 8:00 | 107 6476 | | 35 0415 | |
| 2022-07-08 | 8:00 | 107 6476 | | 35 0416 | |
| | | | | | |
| | | | | | |

# Paramètres

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

| | |
|---|---|
| Code verrouillage: | HEA |

## Description du test

| | | |
|---|---|---|
| Test standard | EPA | |
| Run # | 2 | |
| Date | 28-06-2022 | |
| Technicien | M.M | |
| Project # | PI 20272 | |

## Description de l'unité

| | | |
|---|---|---|
| Manufacturier | HEARTHSTONE | |
| Modèle | 8060 | |
| Combustion system | Cat | |
| Appliance type | WOOD STOVE | |
| Firebox volume | 1 | 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 | 1 | |
| 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): | 1,007 | Dimensionless |
| Equipment number (DGM #1): | EM 178 | |
| Calibration Factor (DGM #2): | 1,005 | Dimensionless |
| Equipment number (DGM #2): | EM 318 | |
| Calibration Factor (DGM #3): | 0,988 | |
| Equipment number (DGM #3): | EM 179 | Dimensionless |

## Tunnel

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 28-06-2022 |
| **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): | 101,4 | 101,4 |
| Barometer (in.Hg): | 29,943409 | 29,94340873 |
| Dry Bulb (F): | 73,6 | 78,1 |
| Humidity (%): | 51,2 | 33,6 |
| Air velocity (ft/min) | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DGM #1 | Final: | 23210,272 | cuft | Final: | 657241,710 | Liter |
| | Initial: | 23181,490 | cuft | Initial: | 656426,680 | Liter |
| DGM #2 | Final: | 14304,694 | cuft | Final: | 405063,820 | Liter |
| | Initial: | 14276,607 | cuft | Initial: | 404268,480 | Liter |
| DGM room | Final: | 13796,520 | cuft | Final: | 390673,920 | Liter |
| | Initial: | 13772,735 | cuft | Initial: | 390000,410 | Liter |

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 275

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 28-06-2022 |
| **Technicien** | M.M |

## Preload data sheet

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,30 | 7,00 | 7,70 |

Load Volume: 0,4253 cu. ft

Loading Density: 14,682 lbs./ft3

Number of Spaces:

Spacer weight (lbs):

Load Density (wet): 34,518 lbs./ft3

Dry Wood Density: 28,681834

| Piece Size (in): Thick | Wide | x Length | Weight lbs | Meter Moisture Content Dry Uncorrected % | | | | | Ave. MC x Weight | Volume Cubic Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 3,5 | 14 | 1,41 | 20,1 | 20,4 | 20,3 | 20,6 | 20,4 | 28,7076 | 73,50 |
| 1,5 | 3,5 | 14 | 1,49 | 20,8 | 21 | 20,9 | 20,8 | 20,7 | 31,0516 | 73,50 |
| 1,5 | 3,5 | 14 | 1,424 | 20,1 | 19,9 | 19,8 | 19,8 | 19,8 | 28,30912 | 73,50 |
| 1,5 | 3,5 | 7 | 0,858 | 19,6 | 19,4 | 19,3 | 19,6 | 19,4 | 16,69668 | 36,75 |
| 1,5 | 3,5 | 7 | 0,586 | 20 | 20 | 20,1 | 20,1 | 20,4 | 11,79032 | 36,75 |
| 1,5 | 3,5 | 7 | 0,676 | 21 | 21,1 | 21,1 | 21,2 | 21,3 | 14,29064 | 36,75 |
| 1,5 | 3,5 | 7 | 0,868 | 19,1 | 19,1 | 19,2 | 19,2 | 19,3 | 16,64824 | 36,75 |
| | | | | | | | | | | 0,00 |
| 1,5 | 3,5 | 14 | 1,476 | 20 | 21 | 20,9 | 20,8 | 20,8 | 30,5532 | 73,50 |
| 1,5 | 3,5 | 14 | 1,416 | 19,9 | 19,8 | 19,6 | 19,8 | 19,9 | 28,0368 | 73,50 |
| 1,5 | 3,5 | 14 | 1,508 | 20,1 | 20,2 | 20,2 | 19,9 | 19,8 | 30,22032 | 73,50 |
| 1,5 | 3,5 | 7 | 0,586 | 21,1 | 21 | 21,1 | 21 | 21,2 | 12,35288 | 36,75 |
| 1,5 | 3,5 | 7 | 0,858 | 21,6 | 21,5 | 21,4 | 21,5 | 21,5 | 18,447 | 36,75 |
| 1,5 | 3,5 | 7 | 0,676 | 20,9 | 21 | 20,9 | 21 | 21 | 14,16896 | 36,75 |
| 1,5 | 3,5 | 7 | 0,85 | 20,6 | 20,3 | 20,8 | 20,6 | 20,4 | 17,459 | 36,75 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00

## FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,3 | 7,0 | 7,7 |

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

Load Volume: 0,18 cu. ft

Loading Density: 7,1 lbs./ft3

Number of Spaces: 12

Spacer weight: lbs

Load Density (wet): 31,9 lbs./ft3

Dry Wood Density: 26,4 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 | 15 | 1,37 | 20,90 | 21,10 | 20,80 | 20,70 | 20,80 | 28,61992 | 78,75 | 20,9 |
| 1,5 | 3,5 | 15 | 1,47 | 20,80 | 20,60 | 20,90 | 20,80 | 20,30 | 30,3996 | 78,75 | 20,7 |
| 1,5 | 3,5 | 15 | 1,53 | 21,10 | 21,40 | 21,30 | 21,20 | 21,20 | 32,45472 | 78,75 | 21,2 |
| 1,5 | 3,5 | 15 | 1,44 | 20,10 | 20,30 | 20,40 | 20,50 | 20,30 | 29,2608 | 78,75 | 20,3 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,10 | | | 1,9698 | 4,50 | 20,1 |
| 1,5 | 0,75 | 4 | 0,10 | | | 19,30 | | | 1,93 | 4,50 | 19,3 |
| 1,5 | 0,75 | 4 | 0,12 | | | 19,40 | | | 2,3668 | 4,50 | 19,4 |
| 1,5 | 0,75 | 4 | 0,12 | | | 19,30 | | | 2,3546 | 4,50 | 19,3 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,20 | | | 2,0736 | 4,50 | 19,2 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,20 | | | 2,0736 | 4,50 | 19,2 |
| 1,5 | 0,75 | 4 | 0,08 | | | 19,40 | | | 1,552 | 4,50 | 19,4 |
| 1,5 | 0,75 | 4 | 0,08 | | | 19,50 | | | 1,599 | 4,50 | 19,5 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,60 | | | 2,156 | 4,50 | 19,6 |
| 1,5 | 0,75 | 4 | 0,13 | | | 19,40 | | | 2,522 | 4,50 | 19,4 |
| 1,5 | 0,75 | 4 | 0,10 | | | 19,30 | | | 1,8528 | 4,50 | 19,3 |
| 1,5 | 0,75 | 4 | 0,09 | | | 19,40 | | | 1,8236 | 4,50 | 19,4 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 |

# Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,19 in. H20 absolute value
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=**
0,949

**Pour un tunnel moins de 12", prendre 4 lectures**

| | TUNNEL VELOCITY | TUNNEL TEMP | SQUARE ROOT |
|---|---|---|---|
| | In. wc | °F | |
| A center | 0,071 | 75,75 | 0,2665 |
| B center | 0,072 | 75,49 | 0,2683 |
| A1 | 0,057 | 75,64 | 0,2387 |
| A2 | 0,063 | 75,75 | 0,2510 |
| A3 | 0,060 | 75,64 | 0,2449 |
| A4 | 0,057 | 75,53 | 0,2387 |
| | | | |
| B1 | 0,057 | 75,490 | 0,2387 |
| B2 | 0,077 | 75,480 | 0,2775 |
| B3 | 0,074 | 75,480 | 0,2720 |
| B4 | 0,058 | 75,400 | 0,2408 |
| AVERAGE | 0,0646 | 75,5650 | 0,2537 |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 28-06-2022 |
| **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 | 17 | 311 | 312 | 9 | 9 | 309 | 310 | 8 | 50 | 313 | 314 | 13 | 315 | | |
| Before (1) | | | | | | | | | | | | | | | |
| Before (2) | | | | | | | | | | | | | | | |
| Before (3) | | | | | | | | | | | | | | | |
| Before (4) | | | | | | | | | | | | | | | |
| Before (5) | 108,9421 | | 35,2120 | | 61,4546 | | 36,0289 | | 107,6474 | | 35,0398 | | 0,1288 | 2022-06-27 | 17:00 |
| Before (6) | 108,9422 | | 35,2121 | | 61,4547 | | 36,0288 | | 107,6475 | | 35,0397 | | 0,1288 | 2022-06-28 | 09:00 |
| After (1) | 108,9427 | | 35,2148 | | 61,4548 | | 36,0293 | | 107,6477 | | 35,0423 | | 0,1288 | 2022-06-28 | 15:00 |
| After (2) | 108,9424 | | 35,2137 | | 61,4548 | | 36,0293 | | 107,6476 | | 35,0415 | | 0,1289 | 2022-07-07 | 08:00 |
| After (3) | 108,9423 | | 35,2136 | | 61,4547 | | 36,0293 | | 107,6476 | | 35,0416 | | 0,1289 | 2022-07-08 | 08:00 |
| After (4) | | | | | | | | | | | | | | | |
| After (5) | | | | | | | | | | | | | | | |
| After (6) | 108,9423 | | 35,2136 | | 61,4547 | | 36,0293 | | 107,6476 | | 35,0416 | | 0,1289 | 2022-07-08 | 08:00 |
| Difference | 0,0001 | 0,0000 | 0,0015 | 0,0000 | 0,0000 | 0,0000 | 0,0005 | 0,0000 | 0,0001 | 0,0000 | 0,0019 | 0,0000 | 0,0001 | | |
| Total (mg) | | 1,6 | | | | 2,1 | | | | 2 | | | 0,1 | | |
| Total ajusté (mg) | | **1,50** | | | | **2,00** | | | | **1,90** | | | | | |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 28-06-2022 |
| **Technicien** | M.M |

SFBA EPA EMISSION RESULTS

**Test Duration:** **149** min

| | | | |
|---|---|---|---|
| PRESSURE FACTOR: | DGM 1 | 0,97528 | |
| | DGM 2 | 0,97930 | |
| | DGM 3 | 1,00078 | |
| TEMPERATURE FACTORS | DGM 1 | 0,98219 | |
| | DGM 2 | 0,97344 | |
| | DGM 3 | 0,98131 | |
| VOLUMES SAMPLED | DGM 1 | 27,752 | SCft |
| | DGM 2 | 26,921 | Scft |
| | DGM 3 | 23,082 | SCft |

TOTAL TUNNEL VOLUME : 52518

SAMPLE RATIOS

| | |
|---|---|
| Sample Train 1: | 1892,407 |
| Sample Train 2: | 1950,816 |

Paticulate concentration

| | | |
|---|---|---|
| Sample Train 1 | **0,000076** | g/dscf |
| Sample Train 2 | **0,000074** | g/dscf |
| Room | **0,000004** | g/dscf |

TOTAL EMISSIONS

| | | |
|---|---|---|
| Sample Train 1 | **3,75** | g |
| Sample Train 2 | **3,67** | g |

EMISSION RATES

| | | |
|---|---|---|
| Sample Train 1 | **1,51** | g/hr |
| Sample Train 2 | **1,48** | g/hr |

1st hour emission rate **3,03** g/hr

| | Train 1 | Train 2 |
|---|---|---|
| Cs | 7,567E-05 | 7,42919E-05 |

RESULTS

**Average emission rate:** 1,5 g/hr

Burn Rate : 1,070 Dry kg/hr

BAROMETRIC PRESSURE

| | | |
|---|---|---|
| Average: | 29,943409 | in Hg |
| Start: | 29,943409 | in Hg |
| End: | 29,943409 | in Hg |

DGM CONTROLLER VALUES

| | | | |
|---|---|---|---|
| DGM 1 | Final: | 23210,272 | Cuft |
| | Initial: | 23181,490 | Cuft |
| DGM 2 | Final: | 14304,694 | Cuft |
| | Initial: | 14276,607 | Cuft |
| DGM #3 | Final: | 13796,520 | Cuft |
| | Initial: | 13772,735 | Cuft |

TEMPERATURES

| | | |
|---|---|---|
| DGM 1 | 537,573 | °R |
| DGM 2 | 542,409 | °R |

CALIBRATION FACTORS

| | |
|---|---|
| DGM 1 | 1,0066 |
| DGM 2 | 1,0054 |
| DGM #3 | 0,9882 |

TUNNEL FLOW RATE: 352,467 Dscfm

PARTICULATE CATCH

| | | |
|---|---|---|
| Total Sample Train 1: | 2,10 | mg |
| Total Sample Train 2: | 2,00 | mg |
| Total Sample Train 1 1st hour: | 1,60 | mg |

DEVIATION: 0,98%

| * | | * | * | * | * | *1 | *2 | *3 | *4 | *5 | *6 | *7 | *8 | *9 | Mass flow 1 | DGM 1 | DGM 1 | Filter 1 | Mass flow 2 | DGM 2 | DGM 2 | Filter 2 | Tunnel Velo | Flue draft | Change in |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed | | Weight | | | | Flue | Room | Tunnel | Unit | Unit | Unit | Unit | Unit | Catalyst | Reading | Inlet T | Outlet T | Temp | Reading | Inlet T | Outlet T | Temp | Pressure | Pressure | Surface |
| Time | Raw data row | Remaining | CO | $CO_2$ | $O_2$ | Gas | Temp | Dry Bulb | Top | Back | R.Side | L.Side | Bottom | | | | | | | | | | in wc | in wc | Temp. |
| min | | lbs | % | % | % | °F | °F | °F | °F | °F | °F | °F | °F | °F | cuft/min | oF | oF | oF | cuft/min | oF | oF | oF | in wc | in wc | °F |
| 0,00 | 275,00 | 6,9 | 0,2 | 3,1 | 0,0 | 287,4 | 76,7 | 93,3 | 359,1 | 335,8 | 555,7 | 561,9 | 395,9 | 415,7 | 0,18 | 75,57 | 75,84 | 83,02 | 0,18 | 76,00 | 78,30 | 84,79 | 0,07 | 0,04 | 0 |
| 1,0 | 276,0 | 6,9 | 0,6 | 2,8 | 0,0 | 278,1 | 76,4 | 88,1 | 353,8 | 331,4 | 550,4 | 556,0 | 396,7 | 583,1 | 0,18 | 75,51 | 75,91 | 82,77 | 0,18 | 76,12 | 78,36 | 84,46 | 0,07 | 0,06 | -4,010718 |
| 2,0 | 277,0 | 6,8 | 0,1 | 5,6 | 0,0 | 309,7 | 76,6 | 87,9 | 349,5 | 326,5 | 541,3 | 547,3 | 397,4 | 674,8 | 0,18 | 75,48 | 75,93 | 82,56 | 0,18 | 76,29 | 78,43 | 84,26 | 0,07 | 0,06 | -9,268909 |
| 3,0 | 278,0 | 6,8 | 0,1 | 6,1 | 0,0 | 327,9 | 76,6 | 88,3 | 347,1 | 323,1 | 531,6 | 538,6 | 397,9 | 685,6 | 0,18 | 75,43 | 75,94 | 82,33 | 0,18 | 76,36 | 78,51 | 84,10 | 0,07 | 0,07 | -14,00001 |
| 4,0 | 279,0 | 6,7 | 0,1 | 7,3 | 0,0 | 331,3 | 76,7 | 88,7 | 347,6 | 322,4 | 522,1 | 528,4 | 398,1 | 664,6 | 0,19 | 75,57 | 75,97 | 82,15 | 0,18 | 76,59 | 78,59 | 84,00 | 0,08 | 0,06 | -17,95072 |
| 5,0 | 280,0 | 6,6 | 0,1 | 9,1 | 0,0 | 323,2 | 76,7 | 87,9 | 352,9 | 323,5 | 511,9 | 518,4 | 398,1 | 691,4 | 0,19 | 75,64 | 76,01 | 81,99 | 0,18 | 76,78 | 78,68 | 83,87 | 0,07 | 0,07 | -20,70491 |
| 6,0 | 281,0 | 6,6 | 0,1 | 10,9 | 0,0 | 309,5 | 76,9 | 86,5 | 357,1 | 326,5 | 502,7 | 508,7 | 397,8 | 697,1 | 0,18 | 75,82 | 76,05 | 80,08 | 0,18 | 77,11 | 78,80 | 83,64 | 0,07 | 0,06 | -23,09835 |
| 7,0 | 282,0 | 6,5 | 0,1 | 7,5 | 0,0 | 307,8 | 76,3 | 86,4 | 356,0 | 329,3 | 494,7 | 499,8 | 397,3 | 716,2 | 0,18 | 75,84 | 76,09 | 83,50 | 0,18 | 77,28 | 78,89 | 83,45 | 0,08 | 0,06 | -26,2194 |
| 8,0 | 283,0 | 6,4 | 0,1 | 7,2 | 0,0 | 306,4 | 76,6 | 86,4 | 354,5 | 331,2 | 487,9 | 491,1 | 396,8 | 709,6 | 0,19 | 75,93 | 76,11 | 86,89 | 0,18 | 77,52 | 79,02 | 83,29 | 0,08 | 0,06 | -29,36508 |
| 9,0 | 284,0 | 6,4 | 0,1 | 7,2 | 0,0 | 301,5 | 76,9 | 86,8 | 352,9 | 332,7 | 482,3 | 483,8 | 396,0 | 681,5 | 0,19 | 76,09 | 76,15 | 87,44 | 0,18 | 77,82 | 79,15 | 83,16 | 0,08 | 0,06 | -32,13777 |
| 10,0 | 285,0 | 6,3 | 0,1 | 8,4 | 0,0 | 300,8 | 77,3 | 87,0 | 355,4 | 333,6 | 476,4 | 476,7 | 395,2 | 693,3 | 0,19 | 76,33 | 76,22 | 87,24 | 0,18 | 78,18 | 79,30 | 83,08 | 0,08 | 0,06 | -34,18931 |
| 11,0 | 286,0 | 6,2 | 0,6 | 14,2 | 0,0 | 313,0 | 77,4 | 88,1 | 365,0 | 335,3 | 470,5 | 470,1 | 394,2 | 759,5 | 0,18 | 76,62 | 76,30 | 87,01 | 0,18 | 78,54 | 79,47 | 83,06 | 0,08 | 0,07 | -34,63585 |
| 12,0 | 287,0 | 6,1 | 0,4 | 14,1 | 0,0 | 317,5 | 77,7 | 88,1 | 375,7 | 336,5 | 465,4 | 463,9 | 393,2 | 752,3 | 0,19 | 76,96 | 76,40 | 86,76 | 0,18 | 78,94 | 79,64 | 83,02 | 0,08 | 0,07 | -34,72039 |
| 13,0 | 288,0 | 6,0 | 0,1 | 13,5 | 0,0 | 316,8 | 77,6 | 88,4 | 384,8 | 338,3 | 460,4 | 457,9 | 392,0 | 740,3 | 0,19 | 77,05 | 76,47 | 86,58 | 0,18 | 79,19 | 79,81 | 82,94 | 0,08 | 0,06 | -34,96772 |
| 14,0 | 289,0 | 5,9 | 0,1 | 13,0 | 0,0 | 316,4 | 76,8 | 88,1 | 393,0 | 339,3 | 457,1 | 451,8 | 390,9 | 737,1 | 0,18 | 76,74 | 76,47 | 86,36 | 0,18 | 79,19 | 79,83 | 85,34 | 0,08 | 0,06 | -35,25058 |
| 15,0 | 290,0 | 5,8 | 0,3 | 14,4 | 0,0 | 323,1 | 76,6 | 88,2 | 402,6 | 341,6 | 454,1 | 447,7 | 389,6 | 762,0 | 0,19 | 76,32 | 76,44 | 86,09 | 0,18 | 79,07 | 79,88 | 87,88 | 0,08 | 0,07 | -34,53843 |
| 16,0 | 291,0 | 5,8 | 0,2 | 14,8 | 0,0 | 328,1 | 76,9 | 87,6 | 411,3 | 343,1 | 449,6 | 445,2 | 388,2 | 758,8 | 0,19 | 76,24 | 76,41 | 85,80 | 0,18 | 79,15 | 79,97 | 87,72 | 0,07 | 0,07 | -34,17412 |
| 17,0 | 292,0 | 5,7 | 0,1 | 14,3 | 0,0 | 328,3 | 76,8 | 88,1 | 420,0 | 345,6 | 449,0 | 442,3 | 386,8 | 743,9 | 0,18 | 76,41 | 76,45 | 85,61 | 0,18 | 79,35 | 80,10 | 87,31 | 0,08 | 0,07 | -32,9036 |
| 18,0 | 293,0 | 5,6 | 0,0 | 14,0 | 0,0 | 328,1 | 77,1 | 87,9 | 428,1 | 347,6 | 447,4 | 440,0 | 385,4 | 744,5 | 0,19 | 76,58 | 76,51 | 85,40 | 0,18 | 79,58 | 80,22 | 86,93 | 0,08 | 0,07 | -31,94767 |
| 19,0 | 294,0 | 5,5 | 0,1 | 14,6 | 0,0 | 331,6 | 77,0 | 87,3 | 435,4 | 348,5 | 446,5 | 439,6 | 384,0 | 754,7 | 0,18 | 76,67 | 76,54 | 85,16 | 0,18 | 79,78 | 80,34 | 86,57 | 0,08 | 0,07 | -30,85565 |
| 20,0 | 295,0 | 5,4 | 0,1 | 14,5 | 0,0 | 334,4 | 77,0 | 88,1 | 443,1 | 350,8 | 446,6 | 438,0 | 382,6 | 758,4 | 0,18 | 76,71 | 76,59 | 84,98 | 0,18 | 79,92 | 80,43 | 86,22 | 0,08 | 0,07 | -29,44182 |
| 21,0 | 296,0 | 5,3 | 0,1 | 14,3 | 0,0 | 336,0 | 77,2 | 87,7 | 449,2 | 351,7 | 446,1 | 437,3 | 381,2 | 755,8 | 0,19 | 76,64 | 76,62 | 84,80 | 0,18 | 79,98 | 80,55 | 85,90 | 0,08 | 0,07 | -28,55769 |
| 22,0 | 297,0 | 5,2 | 0,0 | 14,2 | 0,0 | 336,3 | 77,1 | 87,6 | 453,8 | 352,1 | 445,8 | 438,3 | 379,7 | 764,8 | 0,19 | 76,66 | 76,63 | 84,65 | 0,18 | 80,07 | 80,66 | 85,65 | 0,08 | 0,07 | -27,7251 |
| 23,0 | 298,0 | 5,1 | 0,2 | 14,4 | 0,0 | 338,8 | 77,3 | 88,3 | 460,2 | 354,2 | 446,8 | 438,1 | 378,3 | 782,6 | 0,19 | 76,70 | 76,66 | 84,51 | 0,18 | 80,21 | 80,76 | 85,41 | 0,08 | 0,07 | -26,1622 |
| 24,0 | 299,0 | 4,9 | 0,1 | 14,5 | 0,0 | 342,1 | 77,3 | 88,2 | 466,3 | 354,6 | 447,2 | 438,3 | 376,9 | 785,6 | 0,19 | 76,78 | 76,71 | 84,43 | 0,18 | 80,32 | 80,89 | 85,20 | 0,08 | 0,07 | -24,99619 |
| 25,0 | 300,0 | 4,8 | 0,3 | 14,6 | 0,0 | 347,4 | 77,4 | 87,8 | 472,0 | 355,4 | 448,0 | 440,3 | 375,4 | 816,2 | 0,19 | 76,82 | 76,74 | 84,29 | 0,18 | 80,46 | 80,97 | 84,95 | 0,08 | 0,07 | -23,41931 |
| 26,0 | 301,0 | 4,7 | 0,5 | 14,3 | 0,0 | 349,8 | 77,0 | 88,0 | 477,5 | 355,6 | 450,0 | 442,4 | 374,0 | 818,1 | 0,19 | 76,89 | 76,76 | 84,14 | 0,18 | 80,56 | 81,06 | 84,76 | 0,07 | 0,07 | -21,77815 |
| 27,0 | 302,0 | 4,6 | 0,3 | 14,5 | 0,0 | 350,2 | 77,2 | 88,3 | 481,5 | 357,1 | 453,7 | 444,4 | 372,6 | 831,1 | 0,18 | 76,88 | 76,78 | 84,00 | 0,18 | 80,59 | 81,12 | 84,50 | 0,07 | 0,07 | -19,79592 |
| 28,0 | 303,0 | 4,5 | 0,2 | 14,8 | 0,0 | 352,5 | 77,0 | 87,7 | 484,2 | 357,5 | 457,9 | 447,3 | 371,2 | 835,1 | 0,19 | 76,78 | 76,80 | 83,88 | 0,18 | 80,61 | 81,21 | 84,29 | 0,07 | 0,07 | -18,03411 |
| 29,0 | 304,0 | 4,4 | 0,3 | 14,8 | 0,0 | 353,1 | 77,1 | 88,2 | 486,1 | 358,7 | 462,4 | 449,9 | 369,9 | 833,0 | 0,19 | 76,72 | 76,80 | 83,79 | 0,18 | 80,64 | 81,31 | 84,12 | 0,08 | 0,07 | -16,25309 |
| 30,0 | 305,0 | 4,3 | 0,3 | 14,8 | 0,0 | 354,3 | 77,2 | 88,8 | 489,3 | 360,0 | 467,6 | 453,1 | 368,6 | 840,4 | 0,19 | 76,71 | 76,83 | 83,74 | 0,18 | 80,69 | 81,41 | 83,96 | 0,07 | 0,07 | -13,9303 |
| 31,0 | 306,0 | 4,2 | 0,3 | 14,7 | 0,0 | 355,2 | 77,0 | 89,0 | 492,4 | 360,4 | 473,6 | 456,9 | 367,3 | 854,0 | 0,19 | 76,68 | 76,82 | 83,68 | 0,18 | 80,72 | 81,53 | 83,82 | 0,08 | 0,07 | -11,53228 |
| 32,0 | 307,0 | 4,1 | 0,4 | 14,3 | 0,0 | 356,4 | 77,4 | 89,0 | 494,9 | 361,5 | 479,0 | 459,6 | 366,0 | 843,6 | 0,18 | 76,69 | 76,84 | 83,62 | 0,18 | 80,76 | 81,61 | 83,73 | 0,08 | 0,07 | -9,454718 |
| 33,0 | 308,0 | 4,3 | 0,3 | 14,2 | 0,0 | 356,3 | 77,5 | 89,2 | 497,6 | 362,2 | 482,7 | 462,3 | 364,8 | 838,9 | 0,19 | 76,70 | 76,86 | 83,58 | 0,18 | 80,80 | 81,70 | 83,64 | 0,07 | 0,07 | -7,742621 |
| 34,0 | 309,0 | 3,9 | 0,3 | 14,2 | 0,0 | 356,0 | 77,6 | 89,0 | 500,7 | 362,8 | 485,5 | 465,7 | 363,6 | 835,5 | 0,19 | 76,91 | 76,88 | 83,50 | 0,18 | 81,02 | 81,80 | 83,55 | 0,08 | 0,07 | -5,973078 |
| 35,0 | 310,0 | 3,8 | 0,3 | 14,2 | 0,0 | 355,6 | 77,7 | 89,0 | 502,8 | 363,8 | 487,5 | 468,3 | 362,4 | 832,3 | 0,19 | 77,02 | 76,93 | 83,45 | 0,18 | 81,09 | 81,90 | 83,47 | 0,07 | 0,07 | -4,714276 |
| 36,0 | 311,0 | 3,7 | 0,3 | 14,3 | 0,0 | 355,5 | 77,6 | 89,4 | 505,7 | 364,4 | 489,0 | 470,0 | 361,3 | 833,9 | 0,19 | 76,98 | 76,97 | 83,41 | 0,18 | 81,11 | 81,99 | 83,41 | 0,08 | 0,07 | -3,58324 |
| 37,0 | 312,0 | 3,6 | 0,4 | 14,3 | 0,0 | 354,2 | 77,5 | 89,5 | 509,0 | 365,5 | 490,5 | 472,5 | 360,1 | 830,3 | 0,19 | 76,86 | 76,95 | 83,40 | 0,18 | 81,10 | 81,99 | 83,33 | 0,07 | 0,07 | -2,143726 |
| 38,0 | 313,0 | 3,5 | 0,4 | 14,5 | 0,0 | 353,1 | 77,6 | 89,9 | 510,9 | 366,8 | 492,7 | 475,1 | 359,0 | 837,1 | 0,19 | 76,77 | 76,95 | 83,39 | 0,18 | 81,06 | 82,02 | 83,26 | 0,08 | 0,07 | -0,771619 |
| 39,0 | 314,0 | 3,4 | 0,4 | 14,4 | 0,0 | 353,0 | 77,7 | 90,4 | 514,1 | 367,4 | 495,3 | 477,5 | 357,9 | 848,6 | 0,19 | 76,80 | 76,98 | 83,36 | 0,18 | 81,10 | 82,09 | 83,24 | 0,08 | 0,07 | 0,7912532 |
| 40,0 | 315,0 | 3,3 | 0,4 | 14,4 | 0,0 | 352,2 | 77,7 | 90,8 | 516,9 | 369,1 | 496,2 | 480,2 | 356,8 | 850,2 | 0,19 | 76,86 | 77,00 | 83,44 | 0,18 | 81,14 | 82,12 | 83,21 | 0,08 | 0,07 | 2,1805418 |
| 41,0 | 316,0 | 3,2 | 0,5 | 14,5 | 0,0 | 352,0 | 77,8 | 90,9 | 519,6 | 370,6 | 498,0 | 482,4 | 355,8 | 848,7 | 0,19 | 76,93 | 77,04 | 83,43 | 0,18 | 81,21 | 82,17 | 83,22 | 0,08 | 0,07 | 3,6249938 |
| 42,0 | 317,0 | 3,1 | 0,5 | 14,5 | 0,0 | 351,1 | 78,0 | 91,1 | 521,7 | 371,7 | 500,2 | 485,2 | 354,9 | 852,5 | 0,19 | 76,97 | 77,05 | 83,44 | 0,18 | 81,25 | 82,19 | 83,19 | 0,08 | 0,07 | 5,0813048 |
| 43,0 | 318,0 | 3,0 | 0,5 | 14,5 | 0,0 | 350,5 | 77,8 | 90,4 | 524,5 | 371,7 | 503,5 | 487,5 | 354,0 | 853,3 | 0,19 | 76,99 | 77,10 | 83,42 | 0,18 | 81,29 | 82,22 | 83,09 | 0,08 | 0,07 | 6,5818542 |
| 44,0 | 319,0 | 2,8 | 0,5 | 14,5 | 0,0 | 349,0 | 77,8 | 90,1 | 526,3 | 374,3 | 505,3 | 490,4 | 353,0 | 851,6 | 0,19 | 77,02 | 77,10 | 83,35 | 0,18 | 81,33 | 82,21 | 83,09 | 0,08 | 0,07 | 8,2136474 |
| 45,0 | 320,0 | 2,8 | 0,5 | 14,6 | 0,0 | 348,9 | 78,0 | 90,0 | 528,2 | 376,1 | 507,3 | 493,4 | 352,1 | 852,7 | 0,19 | 77,11 | 77,15 | 83,28 | 0,18 | 81,41 | 82,30 | 86,69 | 0,08 | 0,07 | 9,7598814 |
| 46,0 | 321,0 | 2,7 | 0,5 | 14,5 | 0,0 | 348,1 | 78,2 | 89,2 | 529,5 | 378,4 | 509,9 | 496,9 | 351,3 | 847,7 | 0,19 | 77,09 | 77,17 | 83,21 | 0,18 | 81,43 | 82,39 | 88,07 | 0,08 | 0,07 | 11,546631 |
| 47,0 | 322,0 | 2,6 | 0,5 | 14,6 | 0,0 | 346,9 | 78,1 | 90,4 | 531,2 | 380,3 | 512,7 | 499,3 | 350,5 | 843,8 | 0,19 | 77,14 | 77,22 | 83,25 | 0,18 | 81,49 | 82,47 | 87,85 | 0,08 | 0,07 | 13,130511 |
| 48,0 | 323,0 | 2,5 | 0,4 | 14,6 | 0,0 | 345,1 | 78,1 | 90,3 | 532,9 | 382,2 | 516,0 | 502,4 | 349,8 | 841,8 | 0,19 | 77,15 | 77,22 | 83,27 | 0,18 | 81,54 | 82,56 | 87,49 | 0,08 | 0,07 | 14,994226 |
| 49,0 | 324,0 | 2,4 | 0,4 | 14,7 | 0,0 | 343,4 | 78,0 | 89,9 | 534,1 | 383,5 | 518,2 | 505,6 | 349,0 | 842,3 | 0,19 | 77,21 | 77,26 | 83,22 | 0,18 | 81,59 | 82,65 | 87,15 | 0,08 | 0,07 | 16,431451 |
| 50,0 | 325,0 | 2,4 | 0,3 | 14,5 | 0,0 | 342,2 | 77,7 | 89,7 | 535,1 | 384,7 | 520,7 | 508,8 | 348,3 | 840,7 | 0,18 | 77,12 | 77,27 | 83,16 | 0,18 | 81,56 | 82,69 | 86,81 | 0,08 | 0,07 | 17,863721 |
| 51,0 | 326,0 | 2,2 | 0,3 | 14,4 | 0,0 | 340,6 | 77,9 | 89,7 | 535,7 | 385,1 | 524,6 | 512,2 | 347,6 | 834,0 | 0,19 | 76,98 | 77,25 | 83,12 | 0,18 | 81,48 | 82,73 | 86,50 | 0,08 | 0,07 | 19,375146 |
| 52,0 | 327,0 | 2,2 | 0,4 | 14,3 | 0,0 | 340,0 | 78,0 | 89,9 | 536,8 | 385,1 | 529,1 | 515,7 | 346,9 | 824,6 | 0,19 | 76,99 | 77,27 | 83,11 | 0,18 | 81,51 | 82,78 | 86,27 | 0,08 | 0,06 | 21,072906 |
| 53,0 | 328,0 | 2,1 | 0,3 | 14,4 | 0,0 | 338,3 | 78,2 | 90,0 | 539,1 | 385,4 | 533,8 | 520,0 | 346,1 | 824,6 | 0,19 | 77,06 | 77,27 | 83,12 | 0,18 | 81,54 | 82,81 | 86,04 | 0,07 | 0,07 | 23,241937 |
| 54,0 | 329,0 | 2,1 | 0,2 | 14,5 | 0,0 | 337,7 | 78,2 | 89,8 | 541,1 | 385,6 | 538,7 | 525,2 | 345,6 | 832,7 | 0,19 | 77,17 | 77,30 | 83,11 | 0,18 | 81,67 | 82,87 | 85,77 | 0,07 | 0,07 | 25,557818 |
| 55,0 | 330,0 | 2,0 | 0,3 | 14,4 | 0,0 | 338,4 | 78,4 | 89,8 | 543,3 | 384,9 | 542,7 | 529,9 | 344,9 | 831,6 | 0,19 | 77,22 | 77,34 | 83,07 | 0,18 | 81,71 | 82,93 | 85,61 | 0,07 | 0,07 | 27,471368 |
| 56,0 | 331,0 | 1,9 | 0,2 | 14,7 | 0,0 | 338,4 | 78,4 | 89,6 | 547,4 | 384,4 | 546,3 | 534,3 | 344,3 | 836,4 | 0,18 | 77,27 | 77,37 | 83,07 | 0,18 | 81,75 | 83,02 | 85,42 | 0,08 | 0,07 | 29,690357 |
| 57,0 | 332,0 | 1,9 | 0,3 | 14,6 | 0,0 | 337,0 | 78,4 | 90,1 | 550,5 | 383,7 | 549,5 | 537,9 | 343,8 | 824,7 | 0,19 | 77,34 | 77,41 | 83,06 | 0,18 | 81,84 | 83,11 | 85,28 | 0,08 | 0,06 | 31,424182 |
| 58,0 | 333,0 | 1,8 | 0,1 | 14,1 | 0,0 | 332,7 | 78,3 | 89,1 | 552,2 | 382,9 | 552,7 | 542,0 | 343,2 | 811,6 | 0,19 | 77,31 | 77,43 | 83,04 | 0,18 | 81,82 | 83,10 | 85,07 | 0,08 | 0,06 | 32,955212 |
| 59,0 | 334,0 | 1,7 | 0,1 | 13,7 | 0,0 | 328,2 | 78,3 | 88,8 | 553,0 | 382,7 | 554,8 | 546,2 | 342,7 | 808,5 | 0,19 | 77,34 | 77,44 | 81,63 | 0,18 | 81,87 | 83,15 | 84,83 | 0,08 | 0,07 | 34,208374 |
| 60,0 | 335,0 | 1,7 | 0,1 | 13,5 | 0,0 | 326,0 | 78,1 | 89,0 | 553,6 | 381,1 | 557,3 | 549,8 | 342,1 | 805,4 | 0,19 | 77,52 | 77,46 | 83,59 | 0,18 | 82,01 | 83,21 | 84,70 | 0,08 | 0,06 | 35,123743 |
| 61,0 | 336,0 | 1,6 | 0,0 | 13,1 | 0,0 | 322,6 | 78,5 | 89,1 | 554,0 | 380,7 | 558,2 | 552,9 | 341,6 | 797,5 | 0,19 | 77,64 | 77,52 | 86,47 | 0,18 | 82,12 | 83,31 | 84,56 | 0,07 | 0,06 | 35,854156 |
| 62,0 | 337,0 | 1,6 | 0,0 | 12,8 | 0,0 | 319,7 | 78,4 | 88,6 | 554,3 | 379,4 | 560,7 | 556,5 | 341,2 | 784,8 | 0,19 | 77,56 | 77,53 | 86,53 | 0,18 | 82,11 | 83,38 | 84,43 | 0,08 | 0,06 | 36,771313 |
| 63,0 | 338,0 | 1,6 | 0,0 | 12,5 | 0,0 | 315,4 | 78,3 | 88,9 | 553,5 | 378,5 | 560,1 | 560,0 | 340,8 | 770,3 | 0,19 | 77,55 | 77,56 | 86,24 | 0,18 | 82,10 | 83,44 | 84,33 | 0,08 | 0,06 | 36,906879 |
| 64,0 | 339,0 | 1,5 | 0,0 | 12,2 | 0,0 | 313,4 | 78,4 | 88,6 | 554,1 | 377,1 | 559,9 | 561,7 | 340,4 | 759,8 | 0,19 | 77,61 | 77,59 | 85,82 | 0,18 | 82,18 | 83,50 | 84,17 | 0,08 | 0,06 | 36,994122 |
| 65,0 | 340,0 | 1,5 | 0,0 | 12,8 | 0,0 | 311,9 | 78,5 | 89,0 | 553,7 | 376,3 | 559,9 | 563,5 | 339,9 | 755,4 | 0,19 | 77,58 | 77,61 | 85,59 | 0,18 | 82,19 | 83,57 | 84,10 | 0,08 | 0,06 | 36,993829 |
| 66,0 | 341,0 | 1,4 | 0,0 | 12,8 | 0,0 | 309,2 | 78,4 | 88,3 | 553,2 | 374,8 | 558,6 | 564,7 | 339,6 | 743,7 | 0,19 | 77,67 | 77,62 | 85,29 | 0,18 | 82,26 | 83,57 | 83,99 | 0,08 | 0,06 | 36,536548 |
| 67,0 | 342,0 | 1,4 | 0,0 | 12,6 | 0,0 | 305,9 | 78,2 | 88,9 | 552,2 | 374,3 | 558,0 | 564,3 | 339,2 | 745,5 | 0,19 | 77,66 | 77,65 | 85,02 | 0,18 | 82,27 | 83,69 | 83,86 | 0,07 | 0,06 | 35,949732 |
| 68,0 | 343,0 | 1,4 | 0,0 | 12,3 | 0,0 | 303,3 | 78,3 | 88,8 | 549,1 | 372,4 | 559,0 | 564,9 | 338,9 | 743,2 | 0,19 | 77,55 | 77,65 | 84,85 | 0,18 | 82,21 | 83,72 | 83,79 | 0,07 | 0,06 | 35,216589 |
| 69,0 | 344,0 | 1,3 | 0,0 | 11,8 | 0,0 | 299,8 | 78,5 | 87,5 | 545,1 | 371,3 | 559,0 | 565,1 | 338,6 | 731,1 | 0,19 | 77,56 | 77,65 | 84,57 | 0,18 | 82,21 | 83,70 | 83,60 | 0,08 | 0,06 | 34,16607 |
| 70,0 | 345,0 | 1,3 | 0,0 | 11,2 | 0,0 | 296,4 | 78,3 | 88,0 | 540,4 | 370,3 | 559,9 | 565,7 | 338,3 | 715,7 | 0,19 | 77,65 | 77,66 | 84,38 | 0,18 | 82,25 | 83,76 | 83,51 | 0,08 | 0,06 | 33,29516 |
| 71,0 | 346,0 | 1,3 | 0,0 | 11,2 | 0,0 | 293,4 | 78,1 | 87,8 | 535,5 | 369,9 | 560,2 | 566,6 | 338,0 | 709,8 | 0,19 | 77,64 | 77,65 | 84,20 | 0,18 | 82,28 | 83,77 | 83,41 | 0,08 | 0,06 | 32,371594 |
| 72,0 | 347,0 | 1,3 | 0,0 | 11,0 | 0,0 | 290,0 | 78,6 | 87,7 | 530,7 | 368,6 | 559,7 | 567,7 | 337,8 | 702,7 | 0,19 | 77,96 | 77,73 | 83,98 | 0,18 | 82,51 | 83,83 | 83,28 | 0,08 | 0,06 | 31,246527 |
| 73,0 | 348,0 | 1,2 | 0,0 | 10,7 | 0,0 | 287,6 | 78,4 | 87,7 | 525,2 | 367,4 | 560,4 | 569,0 | 337,6 | 697,5 | 0,19 | 77,96 | 77,76 | 83,80 | 0,18 | 82,54 | 83,92 | 83,23 | 0,07 | 0,06 | 30,255871 |
| 74,0 | 349,0 | 1,2 | 0,0 | 10,5 | 0,0 | 285,4 | 78,3 | 87,9 | 520,6 | 365,9 | 561,1 | 569,4 | 337,4 | 692,4 | 0,19 | 77,89 | 77,77 | 83,67 | 0,18 | 82,53 | 83,94 | 83,18 | 0,08 | 0,05 | 29,220319 |
| 75,0 | 350,0 | 1,1 | 0,0 | 10,3 | 0,0 | 283,5 | 78,5 | 87,6 | 515,1 | 365,0 | 562,1 | 570,3 | 337,2 | 689,2 | 0,19 | 77,88 | 77,80 | 83,55 | 0,18 | 82,53 | 84,01 | 83,09 | 0,08 | 0,06 | 28,289899 |
| 76,0 | 351,0 | 1,1 | 0,0 | 10,2 | 0,0 | 281,3 | 78,7 | 87,2 | 510,0 | 363,9 | 561,7 | 571,0 | 337,1 | 687,1 | 0,19 | 77,75 | 77,79 | 83,43 | 0,18 | 82,48 | 84,00 | 84,18 | 0,08 | 0,05 | 27,09436 |
| 77,0 | 352,0 | 1,1 | 0,0 | 10,1 | 0,0 | 279,4 | 78,7 | 87,6 | 504,0 | 361,8 | 562,1 | 572,8 | 337,0 | 678,9 | 0,19 | 77,72 | 77,81 | 83,34 | 0,18 | 82,45 | 84,05 | 87,73 | 0,08 | 0,05 | 25,888153 |
| 78,0 | 353,0 | 1,1 | 0,0 | 9,9 | 0,0 | 277,5 | 78,7 | 87,5 | 499,2 | 361,2 | 561,5 | 573,3 | 336,9 | 674,9 | 0,19 | 77,98 | 77,87 | 83,16 | 0,18 | 82,61 | 84,11 | 87,95 | 0,08 | 0,05 | 24,752283 |
| 79,0 | 354,0 | 1,0 | 0,0 | 9,7 | 0,0 | 276,3 | 78,6 | 87,1 | 492,4 | 360,4 | 560,3 | 573,6 | 336,8 | 675,8 | 0,19 | 77,97 | 77,88 | 83,07 | 0,18 | 82,62 | 84,18 | 87,60 | 0,08 | 0,05 | 23,047864 |
| 80,0 | 355,0 | 1,0 | 0,0 | 9,6 | 0,0 | 275,8 | 78,7 | 87,3 | 487,7 | 359,4 | 561,2 | 573,4 | 336,8 | 673,9 | 0,19 | 77,94 | 77,90 | 82,97 | 0,18 | 82,62 | 84,22 | 87,24 | 0,08 | 0,06 | 22,04129 |
| 81,0 | 356,0 | 1,0 | 0,0 | 9,4 | 0,0 | 274,4 | 78,7 | 87,6 | 481,9 | 358,2 | 559,8 | 573,4 | 336,8 | 671,0 | 0,19 | 77,94 | 77,94 | 82,93 | 0,18 | 82,62 | 84,26 | 86,91 | 0,08 | 0,05 | 20,370715 |
| 82,0 | 357,0 | 1,0 | 0,0 | 9,4 | 0,0 | 274,0 | 78,8 | 87,4 | 476,7 | 357,9 | 559,1 | 572,4 | 336,7 | 666,2 | 0,19 | 78,02 | 77,96 | 82,89 | 0,18 | 82,67 | 84,28 | 86,61 | 0,08 | 0,05 | 18,903906 |
| 83,0 | 358,0 | 1,0 | 0,0 | 9,6 | 0,0 | 273,3 | 78,4 | 87,3 | 471,8 | 356,7 | 558,2 | 573,2 | 336,8 | 661,2 | 0,19 | 78,01 | 77,99 | 82,78 | 0,18 | 82,63 | 84,27 | 86,27 | 0,08 | 0,05 | 17,682599 |
| 84,0 | 359,0 | 1,0 | 0,0 | 9,6 | 0,0 | 271,9 | 78,5 | 87,1 | 467,0 | 355,2 | 558,2 | 573,5 | 336,9 | 655,3 | 0,19 | 78,07 | 78,02 | 82,71 | 0,18 | 82,69 | 84,29 | 85,99 | 0,08 | 0,05 | 16,50296 |
| 85,0 | 360,0 | 0,9 | 0,0 | 9,6 | 0,0 | 270,5 | 78,8 | 87,1 | 462,7 | 354,9 | 556,9 | 573,9 | 336,9 | 653,3 | 0,19 | 78,09 | 78,00 | 82,66 | 0,18 | 82,73 | 84,27 | 85,76 | 0,07 | 0,05 | 15,403949 |
| 86,0 | 361,0 | 0,9 | 0,0 | 9,7 | 0,0 | 269,0 | 78,7 | 87,2 | 458,5 | 354,1 | 555,7 | 574,5 | 337,0 | 646,7 | 0,19 | 78,10 | 78,04 | 82,63 | 0,18 | 82,68 | 84,25 | 85,44 | 0,08 | 0,05 | 14,293725 |
| 87,0 | 362,0 | 0,9 | 0,0 | 9,7 | 0,0 | 267,7 | 78,5 | 86,3 | 454,6 | 351,9 | 555,3 | 574,2 | 337,0 | 645,3 | 0,19 | 78,07 | 78,05 | 82,53 | 0,18 | 82,67 | 84,23 | 85,17 | 0,08 | 0,05 | 12,948144 |
| 88,0 | 363,0 | 0,9 | 0,0 | 9,4 | 0,0 | 268,0 | 78,2 | 86,7 | 450,0 | 352,0 | 554,6 | 575,6 | 337,1 | 650,5 | 0,19 | 78,02 | 78,03 | 82,41 | 0,18 | 82,60 | 84,20 | 84,85 | 0,08 | 0,05 | 12,189203 |
| 89,0 | 364,0 | 0,9 | 0,0 | 9,0 | 0,0 | 268,1 | 78,7 | 86,3 | 446,0 | 351,0 | 554,0 | 575,8 | 337,2 | 655,2 | 0,19 | 78,18 | 78,10 | 82,25 | 0,18 | 82,75 | 84,31 | 84,63 | 0,07 | 0,05 | 11,138409 |
| 90,0 | 365,0 | 0,9 | 0,0 | 8,6 | 0,0 | 267,5 | 78,8 | 85,6 | 441,7 | 349,9 | 552,8 | 575,2 | 337,2 | 651,5 | 0,19 | 78,28 | 78,12 | 82,16 | 0,18 | 82,85 | 84,37 | 84,45 | 0,08 | 0,05 | 9,7232484 |
| 91,0 | 366,0 | 0,9 | 0,0 | 8,5 | 0,0 | 266,7 | 78,6 | 86,0 | 436,6 | 348,8 | 551,5 | 574,3 | 337,4 | 648,9 | 0,19 | 78,32 | 78,14 | 82,12 | 0,18 | 82,94 | 84,44 | 84,30 | 0,08 | 0,05 | 8,061389 |
| 92,0 | 367,0 | 0,8 | 0,0 | 8,5 | 0,0 | 266,5 | 78,4 | 86,2 | 433,0 | 347,1 | 551,8 | 572,3 | 337,5 | 645,5 | 0,19 | 78,22 | 78,12 | 82,08 | 0,18 | 82,86 | 84,52 | 84,18 | 0,08 | 0,05 | 6,6982482 |
| 93,0 | 368,0 | 0,8 | 0,0 | 8,5 | 0,0 | 266,0 | 78,4 | 86,8 | 429,0 | 346,3 | 551,3 | 570,7 | 337,8 | 645,2 | 0,19 | 78,07 | 78,13 | 82,04 | 0,18 | 82,80 | 84,58 | 84,08 | 0,08 | 0,05 | 5,3521118 |
| 94,0 | 369,0 | 0,8 | 0,0 | 8,5 | 0,0 | 265,9 | 78,3 | 86,6 | 424,6 | 345,4 | 550,2 | 569,2 | 337,8 | 644,7 | 0,19 | 77,91 | 78,10 | 82,00 | 0,18 | 82,69 | 84,61 | 83,96 | 0,08 | 0,05 | 3,7930236 |
| 95,0 | 370,0 | 0,8 | 0,0 | 8,5 | 0,0 | 265,6 | 78,3 | 86,2 | 421,1 | 343,8 | 549,2 | 567,4 | 338,0 | 644,4 | 0,19 | 77,90 | 78,10 | 81,94 | 0,18 | 82,66 | 84,61 | 83,83 | 0,08 | 0,05 | 2,2518124 |
| 96,0 | 371,0 | 0,8 | 0,0 | 8,5 | 0,0 | 265,2 | 78,5 | 85,9 | 417,3 | 342,0 | 547,7 | 567,7 | 338,2 | 644,4 | 0,19 | 78,07 | 78,13 | 82,33 | 0,18 | 82,76 | 84,60 | 83,68 | 0,08 | 0,05 | 0,9050966 |
| 97,0 | 372,0 | 0,7 | 0,0 | 8,5 |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102,0 | 377,0 | 0,7 | 0,0 | 8,9 | 0,0 | 264,3 | 78,2 | 86,6 | 399,3 | 335,6 | 546,5 | 559,8 | 339,0 | 647,9 | 0,19 | 77,93 | 78,20 | 85,67 | 0,18 | 82,66 | 84,63 | 85,85 | 0,08 | 0,05 | -5,612482 |
| 103,0 | 378,0 | 0,6 | 0,1 | 8,9 | 0,0 | 263,8 | 78,4 | 86,6 | 397,1 | 334,9 | 546,8 | 559,3 | 339,1 | 649,1 | 0,19 | 77,94 | 78,19 | 85,35 | 0,18 | 82,67 | 84,64 | 88,15 | 0,07 | 0,05 | -6,20965 |
| 104,0 | 379,0 | 0,6 | 0,1 | 8,8 | 0,0 | 264,8 | 78,3 | 86,9 | 394,9 | 334,6 | 546,9 | 559,2 | 339,2 | 654,1 | 0,19 | 77,92 | 78,19 | 85,07 | 0,18 | 82,67 | 84,67 | 88,01 | 0,08 | 0,05 | -6,6896 |
| 105,0 | 380,0 | 0,6 | 0,1 | 8,8 | 0,0 | 265,5 | 78,4 | 85,3 | 392,3 | 333,2 | 546,7 | 560,8 | 339,3 | 655,1 | 0,19 | 77,93 | 78,21 | 84,77 | 0,18 | 82,68 | 84,66 | 87,56 | 0,07 | 0,05 | -7,209229 |
| 106,0 | 381,0 | 0,7 | 0,1 | 8,7 | 0,0 | 266,4 | 78,5 | 85,9 | 390,4 | 332,6 | 547,6 | 558,9 | 339,4 | 658,0 | 0,19 | 78,01 | 78,25 | 84,46 | 0,18 | 82,73 | 84,67 | 87,08 | 0,07 | 0,05 | -7,887531 |
| 107,0 | 382,0 | 0,6 | 0,1 | 8,6 | 0,0 | 266,9 | 78,3 | 84,2 | 388,4 | 331,5 | 546,6 | 560,7 | 339,5 | 659,3 | 0,19 | 78,28 | 78,27 | 84,14 | 0,18 | 82,95 | 84,69 | 86,62 | 0,08 | 0,05 | -8,329095 |
| 108,0 | 383,0 | 0,6 | 0,1 | 8,6 | 0,0 | 267,7 | 78,7 | 85,5 | 386,4 | 331,2 | 547,6 | 559,1 | 339,6 | 662,1 | 0,19 | 78,43 | 78,33 | 83,85 | 0,18 | 83,10 | 84,76 | 86,25 | 0,08 | 0,05 | -8,873541 |
| 109,0 | 384,0 | 0,5 | 0,1 | 8,6 | 0,0 | 267,6 | 78,4 | 85,2 | 384,1 | 329,7 | 546,9 | 559,7 | 339,7 | 663,2 | 0,19 | 78,42 | 78,37 | 83,68 | 0,18 | 83,13 | 84,78 | 86,03 | 0,08 | 0,05 | -9,643085 |
| 110,0 | 385,0 | 0,5 | 0,1 | 8,7 | 0,0 | 267,8 | 79,0 | 85,1 | 383,0 | 329,7 | 547,7 | 559,1 | 339,9 | 661,6 | 0,19 | 78,63 | 78,42 | 83,43 | 0,18 | 83,32 | 84,81 | 85,70 | 0,08 | 0,05 | -9,759021 |
| 111,0 | 386,0 | 0,5 | 0,1 | 8,6 | 0,0 | 268,0 | 78,6 | 85,4 | 380,6 | 328,5 | 547,3 | 558,3 | 340,0 | 663,0 | 0,19 | 78,62 | 78,45 | 83,31 | 0,18 | 83,34 | 84,88 | 85,47 | 0,08 | 0,05 | -10,71464 |
| 112,0 | 387,0 | 0,5 | 0,1 | 8,5 | 0,0 | 268,7 | 78,6 | 85,9 | 379,1 | 327,2 | 547,3 | 557,0 | 340,2 | 664,8 | 0,19 | 78,44 | 78,46 | 83,22 | 0,18 | 83,23 | 84,93 | 85,25 | 0,08 | 0,05 | -11,51886 |
| 113,0 | 388,0 | 0,5 | 0,1 | 8,5 | 0,0 | 270,2 | 78,6 | 85,6 | 377,1 | 326,1 | 547,1 | 556,4 | 340,2 | 667,1 | 0,19 | 78,26 | 78,43 | 83,08 | 0,18 | 83,08 | 84,87 | 84,95 | 0,08 | 0,05 | -12,27433 |
| 114,0 | 389,0 | 0,5 | 0,1 | 8,5 | 0,0 | 269,3 | 78,5 | 86,3 | 375,8 | 325,0 | 546,7 | 554,7 | 340,3 | 663,7 | 0,19 | 78,12 | 78,40 | 83,01 | 0,18 | 82,96 | 84,78 | 84,67 | 0,07 | 0,05 | -13,16991 |
| 115,0 | 390,0 | 0,5 | 0,1 | 8,4 | 0,0 | 269,6 | 78,4 | 85,8 | 374,2 | 324,2 | 544,5 | 555,1 | 340,3 | 667,6 | 0,19 | 78,05 | 78,39 | 82,93 | 0,18 | 82,88 | 84,73 | 84,45 | 0,08 | 0,05 | -14,02335 |
| 116,0 | 391,0 | 0,5 | 0,1 | 8,4 | 0,0 | 270,1 | 78,4 | 85,8 | 372,7 | 323,7 | 544,4 | 553,9 | 340,3 | 667,7 | 0,19 | 78,02 | 78,37 | 82,77 | 0,18 | 82,83 | 84,72 | 84,23 | 0,08 | 0,05 | -14,66506 |
| 117,0 | 392,0 | 0,4 | 0,1 | 8,3 | 0,0 | 270,3 | 78,5 | 84,6 | 370,6 | 321,4 | 542,7 | 555,1 | 340,3 | 665,8 | 0,19 | 78,06 | 78,37 | 82,64 | 0,18 | 82,87 | 84,75 | 84,06 | 0,08 | 0,05 | -15,64644 |
| 118,0 | 393,0 | 0,4 | 0,1 | 8,2 | 0,0 | 270,2 | 78,6 | 84,7 | 369,3 | 321,2 | 542,9 | 552,5 | 340,3 | 666,6 | 0,19 | 78,32 | 78,42 | 82,41 | 0,18 | 83,05 | 84,83 | 83,82 | 0,07 | 0,05 | -16,40962 |
| 119,0 | 394,0 | 0,4 | 0,1 | 8,2 | 0,0 | 270,0 | 78,2 | 84,1 | 367,4 | 318,7 | 539,9 | 553,3 | 340,3 | 665,4 | 0,19 | 78,36 | 78,42 | 82,29 | 0,18 | 83,05 | 84,91 | 83,68 | 0,07 | 0,05 | -17,73619 |
| 120,0 | 395,0 | 0,4 | 0,1 | 8,0 | 0,0 | 270,8 | 78,4 | 83,7 | 366,4 | 317,8 | 540,3 | 552,0 | 340,3 | 663,1 | 0,19 | 78,40 | 78,43 | 82,07 | 0,18 | 83,10 | 85,00 | 83,43 | 0,08 | 0,05 | -18,29295 |
| 121,0 | 396,0 | 0,4 | 0,1 | 7,9 | 0,0 | 270,3 | 78,5 | 84,9 | 365,3 | 317,3 | 540,2 | 549,4 | 340,4 | 665,1 | 0,19 | 78,43 | 78,46 | 81,99 | 0,18 | 83,13 | 85,07 | 83,33 | 0,08 | 0,05 | -19,13885 |
| 122,0 | 397,0 | 0,4 | 0,1 | 7,8 | 0,0 | 270,2 | 78,4 | 84,7 | 363,6 | 315,9 | 538,9 | 548,1 | 340,4 | 663,9 | 0,19 | 78,30 | 78,46 | 83,59 | 0,18 | 83,08 | 85,05 | 83,19 | 0,08 | 0,05 | -20,28942 |
| 123,0 | 398,0 | 0,4 | 0,1 | 7,8 | 0,0 | 270,6 | 78,3 | 85,2 | 362,4 | 314,6 | 537,9 | 546,8 | 340,5 | 662,1 | 0,19 | 78,22 | 78,45 | 86,08 | 0,18 | 83,04 | 85,02 | 83,07 | 0,08 | 0,05 | -21,21315 |
| 124,0 | 399,0 | 0,4 | 0,1 | 7,8 | 0,0 | 270,1 | 78,3 | 85,7 | 361,1 | 312,8 | 536,8 | 544,4 | 340,4 | 661,9 | 0,19 | 78,12 | 78,44 | 86,13 | 0,18 | 82,98 | 85,00 | 83,01 | 0,07 | 0,05 | -22,56273 |
| 125,0 | 400,0 | 0,3 | 0,1 | 7,8 | 0,0 | 270,1 | 78,1 | 85,4 | 359,2 | 311,4 | 535,5 | 542,1 | 340,4 | 660,2 | 0,19 | 78,00 | 78,43 | 85,58 | 0,18 | 82,89 | 84,98 | 85,23 | 0,08 | 0,05 | -23,93643 |
| 126,0 | 401,0 | 0,4 | 0,1 | 7,8 | 0,0 | 269,8 | 78,3 | 85,1 | 357,6 | 309,4 | 533,1 | 541,7 | 340,4 | 658,9 | 0,19 | 77,95 | 78,39 | 85,12 | 0,18 | 82,81 | 84,97 | 88,03 | 0,08 | 0,05 | -25,24047 |
| 127,0 | 402,0 | 0,3 | 0,1 | 7,9 | 0,0 | 269,4 | 78,3 | 85,5 | 357,0 | 307,9 | 534,0 | 538,6 | 340,4 | 657,2 | 0,19 | 77,96 | 78,40 | 84,62 | 0,18 | 82,82 | 84,98 | 87,83 | 0,08 | 0,05 | -26,05645 |
| 128,0 | 403,0 | 0,3 | 0,1 | 8,0 | 0,0 | 269,4 | 78,4 | 85,8 | 355,9 | 306,4 | 533,0 | 536,4 | 340,3 | 657,0 | 0,19 | 78,00 | 78,42 | 84,35 | 0,18 | 82,83 | 84,91 | 87,38 | 0,08 | 0,05 | -27,26173 |
| 129,0 | 404,0 | 0,3 | 0,1 | 7,9 | 0,0 | 268,8 | 78,2 | 84,8 | 354,6 | 305,5 | 532,2 | 535,3 | 340,2 | 655,7 | 0,19 | 78,06 | 78,43 | 84,04 | 0,18 | 82,84 | 84,84 | 86,86 | 0,08 | 0,05 | -28,09127 |
| 130,0 | 405,0 | 0,3 | 0,1 | 7,9 | 0,0 | 269,2 | 78,5 | 85,3 | 353,6 | 303,5 | 531,2 | 533,3 | 340,2 | 656,0 | 0,19 | 78,23 | 78,44 | 83,81 | 0,18 | 82,97 | 84,85 | 86,52 | 0,08 | 0,05 | -29,29826 |
| 131,0 | 406,0 | 0,2 | 0,1 | 7,9 | 0,0 | 268,8 | 78,4 | 84,6 | 352,3 | 302,7 | 529,9 | 531,4 | 340,1 | 654,0 | 0,19 | 78,22 | 78,45 | 83,52 | 0,18 | 82,95 | 84,82 | 86,14 | 0,08 | 0,05 | -30,3406 |
| 132,0 | 407,0 | 0,3 | 0,1 | 8,0 | 0,0 | 268,5 | 78,4 | 85,2 | 351,4 | 301,9 | 529,4 | 530,6 | 340,1 | 650,0 | 0,19 | 78,14 | 78,44 | 83,37 | 0,18 | 82,89 | 84,78 | 85,82 | 0,08 | 0,05 | -30,96323 |
| 133,0 | 408,0 | 0,2 | 0,1 | 8,1 | 0,0 | 267,9 | 78,7 | 85,6 | 350,0 | 301,6 | 528,6 | 529,9 | 340,0 | 649,0 | 0,19 | 78,20 | 78,46 | 83,26 | 0,18 | 82,94 | 84,79 | 85,56 | 0,08 | 0,05 | -31,63538 |
| 134,0 | 409,0 | 0,2 | 0,1 | 8,1 | 0,0 | 267,3 | 78,7 | 86,2 | 349,6 | 301,1 | 528,6 | 529,0 | 340,0 | 646,6 | 0,19 | 78,31 | 78,51 | 83,17 | 0,18 | 83,04 | 84,81 | 85,35 | 0,08 | 0,05 | -32,01079 |
| 135,0 | 410,0 | 0,2 | 0,1 | 8,0 | 0,0 | 266,8 | 78,7 | 85,4 | 348,5 | 300,2 | 527,0 | 529,0 | 339,9 | 646,5 | 0,19 | 78,37 | 78,52 | 83,04 | 0,18 | 83,10 | 84,79 | 85,07 | 0,08 | 0,05 | -32,74395 |
| 136,0 | 411,0 | 0,2 | 0,1 | 7,9 | 0,0 | 266,4 | 78,4 | 85,6 | 347,4 | 298,7 | 526,1 | 527,7 | 339,9 | 643,3 | 0,19 | 78,44 | 78,53 | 82,87 | 0,18 | 83,16 | 84,83 | 84,88 | 0,08 | 0,05 | -33,70322 |
| 137,0 | 412,0 | 0,2 | 0,1 | 8,0 | 0,0 | 265,9 | 78,7 | 86,0 | 346,7 | 298,3 | 526,9 | 527,5 | 340,0 | 642,5 | 0,19 | 78,51 | 78,57 | 82,79 | 0,18 | 83,22 | 84,89 | 84,68 | 0,08 | 0,05 | -33,77791 |
| 138,0 | 413,0 | 0,2 | 0,1 | 8,0 | 0,0 | 265,7 | 78,9 | 85,7 | 345,6 | 297,7 | 526,1 | 526,9 | 340,0 | 637,7 | 0,19 | 78,62 | 78,58 | 82,70 | 0,18 | 83,31 | 84,90 | 84,52 | 0,08 | 0,05 | -34,40236 |
| 139,0 | 414,0 | 0,1 | 0,1 | 7,9 | 0,0 | 264,9 | 78,9 | 85,4 | 344,4 | 296,9 | 524,5 | 526,6 | 340,0 | 636,6 | 0,19 | 78,64 | 78,62 | 82,58 | 0,18 | 83,35 | 84,91 | 84,32 | 0,08 | 0,05 | -35,19782 |
| 140,0 | 415,0 | 0,1 | 0,1 | 7,7 | 0,0 | 263,8 | 78,8 | 84,9 | 343,5 | 295,6 | 523,5 | 524,6 | 340,0 | 635,3 | 0,18 | 78,56 | 78,63 | 82,45 | 0,18 | 83,32 | 84,87 | 84,08 | 0,08 | 0,05 | -36,20591 |
| 141,0 | 416,0 | 0,1 | 0,1 | 7,7 | 0,0 | 263,7 | 78,8 | 85,2 | 342,1 | 294,7 | 521,5 | 523,9 | 340,0 | 633,7 | 0,19 | 78,53 | 78,63 | 82,40 | 0,18 | 83,27 | 84,81 | 83,92 | 0,08 | 0,05 | -37,21744 |
| 142,0 | 417,0 | 0,1 | 0,1 | 7,5 | 0,0 | 263,3 | 78,6 | 84,2 | 341,0 | 294,2 | 520,8 | 522,3 | 340,0 | 632,1 | 0,19 | 78,50 | 78,63 | 82,23 | 0,18 | 83,25 | 84,79 | 83,68 | 0,08 | 0,05 | -37,97261 |
| 143,0 | 418,0 | 0,1 | 0,1 | 7,5 | 0,0 | 263,2 | 78,3 | 84,5 | 339,6 | 293,5 | 517,9 | 522,6 | 340,1 | 633,2 | 0,19 | 78,42 | 78,60 | 82,11 | 0,18 | 83,17 | 84,74 | 83,45 | 0,08 | 0,05 | -38,92237 |
| 144,0 | 419,0 | 0,1 | 0,1 | 7,8 | 0,0 | 262,9 | 78,5 | 84,3 | 338,9 | 292,2 | 516,8 | 521,6 | 340,1 | 627,8 | 0,19 | 78,40 | 78,61 | 81,95 | 0,18 | 83,18 | 84,75 | 83,27 | 0,08 | 0,05 | -39,72761 |
| 145,0 | 420,0 | 0,1 | 0,1 | 8,1 | 0,0 | 260,7 | 78,6 | 84,4 | 338,0 | 291,7 | 514,8 | 519,7 | 340,2 | 619,9 | 0,19 | 78,38 | 78,62 | 81,92 | 0,18 | 83,16 | 84,75 | 83,17 | 0,07 | 0,05 | -40,76328 |
| 146,0 | 421,0 | 0,1 | 0,1 | 7,7 | 0,0 | 260,2 | 78,6 | 84,7 | 336,4 | 291,9 | 512,7 | 519,1 | 340,1 | 626,1 | 0,19 | 78,33 | 78,60 | 84,03 | 0,18 | 83,13 | 84,72 | 86,05 | 0,08 | 0,05 | -41,61736 |
| 147,0 | 422,0 | 0,1 | 0,1 | 7,6 | 0,0 | 260,7 | 78,3 | 84,3 | 334,9 | 292,2 | 510,7 | 516,9 | 340,2 | 625,8 | 0,19 | 78,27 | 78,59 | 85,98 | 0,18 | 83,07 | 84,68 | 88,08 | 0,08 | 0,05 | -42,69703 |
| 148,0 | 423,0 | 0,1 | 0,1 | 7,5 | 0,0 | 261,0 | 78,5 | 84,6 | 334,1 | 292,1 | 509,9 | 514,7 | 340,2 | 627,8 | 0,19 | 78,31 | 78,61 | 85,64 | 0,18 | 83,07 | 84,70 | 87,79 | 0,07 | 0,05 | -43,45912 |
| 149,0 | 424,0 | 0,0 | 0,1 | 7,7 | 0,0 | 260,2 | 78,4 | 84,9 | 333,2 | 291,2 | 507,7 | 511,5 | 340,2 | 628,7 | 0,19 | 78,22 | 78,60 | 85,13 | 0,18 | 83,07 | 84,78 | 87,38 | 0,08 | 0,05 | -44,89171 |

Manufacturer: HEARTHSTONE
Model: 8060

Run: 2
Project #: PI 20272
Test Duration: 149 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 | 80,50% | 87,00% |
| Comb Eff | 98,92% | 98,92% |
| HT Eff | 81,38% | 87,95% |
| Output | 16 620 | kJ/h |
| Burn Rate | 1,04 | kg/h |
| Grams CO | 45 | g |
| Input | 20 648 | kJ/h |
| MC wet | 17,04 | |

Ultimate $CO_2$
$CO_{2\text{-ult}}$ 19,64
$F_0$
1,062

Overall Heating Efficiency: 80,50%
Combustion Efficiency: 98,92%
Heat Transfer Efficiency: 81,38%

Heat Output: 15 766 Btu/h
Heat Input: 19 586 Btu/h
Burn Duration: 2,48 h
Burn Rate: 2,30 lb/h
Stack Temp: 298,9 Deg. F

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Averages | 0,14 | 10,66 | 0,99 | 20,23 | 9,50 | 148,25 | 25,59 | 0,99 | 0,81 | 0,81 |
| INPUT DATA | | | Oxygen Calculation | | | Input Data | | Combust | Heat | Net |
| Elapsed Time | Weight Remaining (kg) | % CO [e] | % $CO_2$ [d] | Excess Air EA | Total $O_2$ | Calc. % $O_2$ [g] | Flue Gas (°C) | Room Temp (°C) | Eff % | Transfer % | Eff % |
| 0,00 | 3,12 | 0,21 | 3,05 | 502,5% | 20,72 | 17,57 | 141,9 | 24,8 | 96,2% | 65,9% | 63,4% |
| 1,00 | 3,12 | 0,59 | 2,80 | 478,7% | 20,72 | 17,62 | 136,7 | 24,7 | 87,0% | 65,0% | 56,6% |
| 2,00 | 3,07 | 0,15 | 5,62 | 240,3% | 20,56 | 14,86 | 154,3 | 24,8 | 98,6% | 74,7% | 73,6% |
| 3,00 | 3,07 | 0,11 | 6,15 | 213,8% | 20,53 | 14,32 | 164,4 | 24,8 | 99,1% | 74,7% | 74,1% |
| 4,00 | 3,03 | 0,09 | 7,29 | 166,1% | 20,45 | 13,12 | 166,3 | 24,8 | 99,5% | 76,7% | 76,4% |
| 5,00 | 2,98 | 0,07 | 9,15 | 113,2% | 20,33 | 11,15 | 161,8 | 24,8 | 99,7% | 79,4% | 79,2% |
| 6,00 | 2,98 | 0,08 | 10,91 | 78,8% | 20,21 | 9,27 | 154,2 | 25,0 | 99,6% | 81,4% | 81,1% |
| 7,00 | 2,94 | 0,07 | 7,49 | 159,8% | 20,44 | 12,91 | 153,2 | 24,6 | 99,7% | 78,2% | 78,0% |
| 8,00 | 2,89 | 0,06 | 7,25 | 168,8% | 20,46 | 13,18 | 152,4 | 24,8 | 99,8% | 77,9% | 77,8% |
| 9,00 | 2,89 | 0,06 | 7,18 | 171,4% | 20,46 | 13,25 | 149,7 | 25,0 | 99,9% | 78,1% | 78,0% |
| 10,00 | 2,85 | 0,05 | 8,38 | 132,8% | 20,38 | 11,97 | 149,4 | 25,2 | 99,9% | 79,7% | 79,6% |
| 11,00 | 2,80 | 0,62 | 14,19 | 32,6% | 19,96 | 5,46 | 156,1 | 25,2 | 96,5% | 82,7% | 79,9% |
| 12,00 | 2,79 | 0,35 | 14,14 | 35,6% | 19,98 | 5,67 | 158,6 | 25,4 | 98,1% | 82,7% | 81,1% |
| 13,00 | 2,71 | 0,11 | 13,53 | 44,0% | 20,04 | 6,45 | 158,2 | 25,3 | 99,5% | 82,5% | 82,1% |
| 14,00 | 2,67 | 0,05 | 12,97 | 50,9% | 20,08 | 7,09 | 158,0 | 24,9 | 99,8% | 82,3% | 82,1% |
| 15,00 | 2,62 | 0,29 | 14,35 | 34,2% | 19,97 | 5,48 | 161,7 | 24,8 | 98,5% | 82,6% | 81,3% |
| 16,00 | 2,61 | 0,22 | 14,76 | 31,1% | 19,95 | 5,08 | 164,5 | 24,9 | 98,9% | 82,6% | 81,7% |
| 17,00 | 2,57 | 0,08 | 14,26 | 37,0% | 19,99 | 5,70 | 164,6 | 24,9 | 99,6% | 82,5% | 82,2% |
| 18,00 | 2,53 | 0,04 | 13,98 | 40,2% | 20,01 | 6,02 | 164,5 | 25,1 | 99,9% | 82,4% | 82,3% |
| 19,00 | 2,48 | 0,09 | 14,60 | 33,7% | 19,97 | 5,32 | 166,4 | 25,0 | 99,6% | 82,5% | 82,2% |
| 20,00 | 2,44 | 0,09 | 14,50 | 34,7% | 19,98 | 5,43 | 168,0 | 25,0 | 99,6% | 82,4% | 82,1% |
| 21,00 | 2,39 | 0,06 | 14,32 | 36,7% | 19,99 | 5,65 | 168,9 | 25,1 | 99,8% | 82,3% | 82,1% |
| 22,00 | 2,35 | 0,05 | 14,21 | 37,8% | 20,00 | 5,77 | 169,1 | 25,1 | 99,8% | 82,2% | 82,1% |
| 23,00 | 2,30 | 0,16 | 14,44 | 34,6% | 19,98 | 5,46 | 170,5 | 25,2 | 99,2% | 82,2% | 81,6% |
| 24,00 | 2,21 | 0,12 | 14,47 | 34,6% | 19,98 | 5,44 | 172,3 | 25,2 | 99,4% | 82,2% | 81,7% |
| 25,00 | 2,19 | 0,28 | 14,63 | 31,7% | 19,96 | 5,18 | 175,2 | 25,2 | 98,5% | 82,0% | 80,8% |
| 26,00 | 2,12 | 0,46 | 14,29 | 33,1% | 19,97 | 5,44 | 176,5 | 25,0 | 97,4% | 81,7% | 79,6% |
| 27,00 | 2,08 | 0,32 | 14,54 | 32,2% | 19,96 | 5,26 | 176,8 | 25,1 | 98,3% | 81,9% | 80,5% |
| 28,00 | 2,03 | 0,25 | 14,78 | 30,7% | 19,95 | 5,04 | 178,0 | 25,0 | 98,7% | 81,9% | 80,9% |
| 29,00 | 1,98 | 0,35 | 14,75 | 30,1% | 19,94 | 5,02 | 178,4 | 25,1 | 98,2% | 81,9% | 80,4% |
| 30,00 | 1,94 | 0,34 | 14,78 | 29,9% | 19,94 | 4,99 | 179,1 | 25,1 | 98,2% | 81,9% | 80,4% |
| 31,00 | 1,89 | 0,33 | 14,73 | 30,4% | 19,95 | 5,05 | 179,5 | 25,0 | 98,2% | 81,8% | 80,4% |
| 32,00 | 1,85 | 0,35 | 14,25 | 34,5% | 19,98 | 5,54 | 180,2 | 25,2 | 98,1% | 81,6% | 80,0% |
| 33,00 | 1,97 | 0,29 | 14,22 | 35,3% | 19,98 | 5,61 | 180,2 | 25,3 | 98,4% | 81,6% | 80,3% |
| 34,00 | 1,76 | 0,25 | 14,19 | 36,0% | 19,99 | 5,67 | 180,0 | 25,3 | 98,6% | 81,6% | 80,5% |
| 35,00 | 1,71 | 0,26 | 14,24 | 35,4% | 19,98 | 5,61 | 179,8 | 25,4 | 98,6% | 81,6% | 80,4% |
| 36,00 | 1,67 | 0,32 | 14,26 | 34,8% | 19,98 | 5,56 | 179,7 | 25,3 | 98,3% | 81,6% | 80,2% |
| 37,00 | 1,62 | 0,36 | 14,32 | 33,8% | 19,97 | 5,47 | 179,0 | 25,3 | 98,0% | 81,7% | 80,0% |
| 38,00 | 1,58 | 0,40 | 14,49 | 31,9% | 19,96 | 5,27 | 178,4 | 25,3 | 97,8% | 81,8% | 80,0% |
| 39,00 | 1,53 | 0,42 | 14,37 | 32,8% | 19,96 | 5,38 | 178,3 | 25,4 | 97,7% | 81,7% | 79,8% |
| 40,00 | 1,49 | 0,45 | 14,42 | 32,1% | 19,96 | 5,31 | 177,9 | 25,4 | 97,6% | 81,7% | 79,7% |
| 41,00 | 1,44 | 0,47 | 14,49 | 31,3% | 19,95 | 5,23 | 177,8 | 25,5 | 97,4% | 81,8% | 79,7% |
| 42,00 | 1,39 | 0,48 | 14,52 | 30,9% | 19,95 | 5,19 | 177,3 | 25,5 | 97,4% | 81,8% | 79,7% |
| 43,00 | 1,35 | 0,50 | 14,50 | 30,9% | 19,95 | 5,20 | 176,9 | 25,4 | 97,3% | 81,8% | 79,6% |
| 44,00 | 1,26 | 0,50 | 14,47 | 31,2% | 19,95 | 5,23 | 176,1 | 25,5 | 97,3% | 81,8% | 79,6% |
| 45,00 | 1,26 | 0,47 | 14,55 | 30,7% | 19,95 | 5,16 | 176,1 | 25,6 | 97,4% | 81,9% | 79,8% |
| 46,00 | 1,21 | 0,47 | 14,54 | 30,9% | 19,95 | 5,18 | 175,6 | 25,7 | 97,4% | 81,9% | 79,8% |
| 47,00 | 1,17 | 0,47 | 14,63 | 30,1% | 19,94 | 5,08 | 174,9 | 25,6 | 97,5% | 82,0% | 79,9% |
| 48,00 | 1,12 | 0,43 | 14,63 | 30,4% | 19,95 | 5,10 | 174,0 | 25,6 | 97,7% | 82,1% | 80,2% |
| 49,00 | 1,08 | 0,38 | 14,67 | 30,5% | 19,95 | 5,09 | 173,0 | 25,6 | 98,0% | 82,1% | 80,5% |
| 50,00 | 1,07 | 0,30 | 14,52 | 32,5% | 19,96 | 5,29 | 172,3 | 25,4 | 98,4% | 82,1% | 80,8% |
| 51,00 | 0,99 | 0,34 | 14,39 | 33,4% | 19,97 | 5,41 | 171,4 | 25,5 | 98,2% | 82,1% | 80,6% |
| 52,00 | 0,99 | 0,39 | 14,25 | 34,1% | 19,97 | 5,52 | 171,1 | 25,5 | 97,8% | 82,0% | 80,3% |
| 53,00 | 0,94 | 0,33 | 14,35 | 33,8% | 19,97 | 5,45 | 170,2 | 25,6 | 98,2% | 82,2% | 80,7% |
| 54,00 | 0,93 | 0,22 | 14,52 | 33,2% | 19,97 | 5,34 | 169,8 | 25,7 | 98,8% | 82,3% | 81,3% |
| 55,00 | 0,89 | 0,28 | 14,44 | 33,5% | 19,97 | 5,39 | 170,2 | 25,8 | 98,5% | 82,2% | 81,0% |
| 56,00 | 0,85 | 0,19 | 14,67 | 32,2% | 19,96 | 5,20 | 170,2 | 25,8 | 99,0% | 82,4% | 81,6% |
| 57,00 | 0,85 | 0,34 | 14,65 | 31,1% | 19,95 | 5,13 | 169,5 | 25,8 | 98,2% | 82,3% | 80,8% |
| 58,00 | 0,80 | 0,12 | 14,11 | 38,0% | 20,00 | 5,83 | 167,1 | 25,7 | 99,4% | 82,3% | 81,8% |
| 59,00 | 0,76 | 0,08 | 13,68 | 42,8% | 20,03 | 6,31 | 164,6 | 25,7 | 99,6% | 82,3% | 82,0% |
| 60,00 | 0,76 | 0,07 | 13,53 | 44,4% | 20,04 | 6,48 | 163,3 | 25,6 | 99,7% | 82,3% | 82,0% |
| 61,00 | 0,71 | 0,04 | 13,12 | 49,3% | 20,07 | 6,93 | 161,5 | 25,8 | 99,9% | 82,2% | 82,1% |
| 62,00 | 0,71 | 0,04 | 12,75 | 53,6% | 20,10 | 7,32 | 159,8 | 25,8 | 99,9% | 82,1% | 82,1% |
| 63,00 | 0,71 | 0,03 | 12,47 | 57,1% | 20,11 | 7,63 | 157,5 | 25,7 | 100,0% | 82,1% | 82,1% |
| 64,00 | 0,67 | 0,03 | 12,23 | 60,3% | 20,13 | 7,89 | 156,3 | 25,8 | 100,0% | 82,1% | 82,1% |
| 65,00 | 0,67 | 0,03 | 12,75 | 53,7% | 20,10 | 7,33 | 155,5 | 25,8 | 100,0% | 82,4% | 82,4% |
| 66,00 | 0,62 | 0,02 | 12,84 | 52,7% | 20,09 | 7,24 | 154,0 | 25,8 | 100,0% | 82,5% | 82,5% |
| 67,00 | 0,62 | 0,02 | 12,56 | 56,2% | 20,11 | 7,54 | 152,1 | 25,7 | 100,1% | 82,5% | 82,5% |
| 68,00 | 0,62 | 0,02 | 12,30 | 59,5% | 20,13 | 7,82 | 150,7 | 25,7 | 100,1% | 82,4% | 82,5% |
| 69,00 | 0,58 | 0,02 | 11,78 | 66,5% | 20,16 | 8,37 | 148,8 | 25,8 | 100,1% | 82,3% | 82,4% |
| 70,00 | 0,58 | 0,02 | 11,18 | 75,4% | 20,20 | 9,01 | 146,9 | 25,7 | 100,1% | 82,1% | 82,2% |
| 71,00 | 0,58 | 0,02 | 11,23 | 74,6% | 20,20 | 8,96 | 145,2 | 25,6 | 100,1% | 82,2% | 82,3% |
| 72,00 | 0,58 | 0,02 | 10,98 | 78,5% | 20,21 | 9,22 | 143,4 | 25,9 | 100,1% | 82,2% | 82,3% |
| 73,00 | 0,53 | 0,02 | 10,73 | 82,6% | 20,23 | 9,48 | 142,0 | 25,8 | 100,1% | 82,1% | 82,2% |
| 74,00 | 0,53 | 0,02 | 10,51 | 86,4% | 20,24 | 9,72 | 140,8 | 25,7 | 100,1% | 82,1% | 82,1% |
| 75,00 | 0,49 | 0,03 | 10,31 | 90,1% | 20,26 | 9,94 | 139,7 | 25,8 | 100,1% | 82,0% | 82,1% |
| 76,00 | 0,49 | 0,03 | 10,22 | 91,8% | 20,26 | 10,03 | 138,5 | 26,0 | 100,1% | 82,1% | 82,1% |
| 77,00 | 0,49 | 0,03 | 10,05 | 94,8% | 20,27 | 10,21 | 137,4 | 26,0 | 100,1% | 82,0% | 82,1% |
| 78,00 | 0,49 | 0,03 | 9,88 | 98,4% | 20,29 | 10,40 | 136,4 | 25,9 | 100,1% | 82,0% | 82,1% |
| 79,00 | 0,47 | 0,03 | 9,69 | 102,0% | 20,30 | 10,59 | 135,7 | 25,9 | 100,1% | 81,9% | 82,0% |
| 80,00 | 0,45 | 0,03 | 9,57 | 104,5% | 20,31 | 10,72 | 135,5 | 25,9 | 100,0% | 81,8% | 81,9% |
| 81,00 | 0,44 | 0,03 | 9,37 | 108,8% | 20,32 | 10,93 | 134,7 | 26,0 | 100,0% | 81,8% | 81,8% |
| 82,00 | 0,44 | 0,03 | 9,43 | 107,6% | 20,32 | 10,87 | 134,5 | 26,0 | 100,0% | 81,8% | 81,8% |
| 83,00 | 0,44 | 0,03 | 9,61 | 103,7% | 20,30 | 10,68 | 134,0 | 25,8 | 100,0% | 82,0% | 82,0% |
| 84,00 | 0,44 | 0,03 | 9,59 | 104,0% | 20,30 | 10,69 | 133,3 | 25,8 | 100,0% | 82,0% | 82,0% |
| 85,00 | 0,40 | 0,03 | 9,59 | 104,0% | 20,30 | 10,69 | 132,5 | 26,0 | 100,0% | 82,1% | 82,1% |
| 86,00 | 0,40 | 0,03 | 9,73 | 101,2% | 20,30 | 10,55 | 131,7 | 26,0 | 100,0% | 82,2% | 82,2% |
| 87,00 | 0,40 | 0,03 | 9,71 | 101,7% | 20,30 | 10,57 | 130,9 | 25,8 | 100,0% | 82,3% | 82,3% |
| 88,00 | 0,40 | 0,04 | 9,36 | 109,1% | 20,32 | 10,94 | 131,1 | 25,7 | 100,0% | 82,0% | 82,0% |
| 89,00 | 0,40 | 0,04 | 8,96 | 118,2% | 20,35 | 11,36 | 131,2 | 25,9 | 100,0% | 81,7% | 81,7% |
| 90,00 | 0,39 | 0,04 | 8,65 | 126,1% | 20,37 | 11,70 | 130,9 | 26,0 | 100,0% | 81,5% | 81,5% |
| 91,00 | 0,40 | 0,04 | 8,50 | 130,0% | 20,38 | 11,86 | 130,4 | 25,9 | 100,0% | 81,4% | 81,4% |
| 92,00 | 0,35 | 0,04 | 8,48 | 130,4% | 20,38 | 11,87 | 130,3 | 25,8 | 100,0% | 81,4% | 81,4% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 93,00 | 0,35 | 0,04 | 8,50 | 130,0% | 20,38 | 11,85 | 130,0 | 25,8 | 100,0% | 81,4% | 81,4% |
| 94,00 | 0,35 | 0,04 | 8,52 | 129,4% | 20,37 | 11,83 | 129,9 | 25,7 | 100,0% | 81,4% | 81,4% |
| 95,00 | 0,35 | 0,04 | 8,53 | 129,0% | 20,37 | 11,82 | 129,8 | 25,7 | 100,0% | 81,5% | 81,4% |
| 96,00 | 0,35 | 0,04 | 8,53 | 129,0% | 20,37 | 11,82 | 129,6 | 25,8 | 100,0% | 81,5% | 81,5% |
| 97,00 | 0,30 | 0,05 | 8,47 | 130,8% | 20,38 | 11,89 | 129,5 | 25,8 | 100,0% | 81,4% | 81,4% |
| 98,00 | 0,30 | 0,05 | 8,50 | 129,8% | 20,38 | 11,85 | 129,3 | 25,7 | 99,9% | 81,5% | 81,4% |
| 99,00 | 0,30 | 0,05 | 8,63 | 126,4% | 20,37 | 11,71 | 129,2 | 25,8 | 99,9% | 81,6% | 81,5% |
| 100,00 | 0,30 | 0,05 | 8,75 | 123,3% | 20,36 | 11,59 | 129,4 | 25,8 | 99,9% | 81,7% | 81,6% |
| 101,00 | 0,30 | 0,05 | 8,96 | 118,0% | 20,35 | 11,36 | 129,2 | 25,7 | 99,9% | 81,8% | 81,8% |
| 102,00 | 0,30 | 0,05 | 8,95 | 118,4% | 20,35 | 11,38 | 129,1 | 25,7 | 99,9% | 81,8% | 81,8% |
| 103,00 | 0,26 | 0,05 | 8,86 | 120,4% | 20,35 | 11,46 | 128,8 | 25,8 | 99,9% | 81,8% | 81,7% |
| 104,00 | 0,26 | 0,05 | 8,81 | 121,5% | 20,35 | 11,51 | 129,3 | 25,7 | 99,9% | 81,7% | 81,6% |
| 105,00 | 0,26 | 0,06 | 8,80 | 121,9% | 20,36 | 11,53 | 129,7 | 25,8 | 99,9% | 81,7% | 81,6% |
| 106,00 | 0,30 | 0,06 | 8,70 | 124,3% | 20,36 | 11,63 | 130,2 | 25,9 | 99,8% | 81,6% | 81,4% |
| 107,00 | 0,26 | 0,06 | 8,60 | 126,9% | 20,37 | 11,74 | 130,5 | 25,7 | 99,8% | 81,4% | 81,3% |
| 108,00 | 0,26 | 0,06 | 8,58 | 127,3% | 20,37 | 11,76 | 130,9 | 25,9 | 99,8% | 81,4% | 81,3% |
| 109,00 | 0,22 | 0,06 | 8,60 | 126,8% | 20,37 | 11,74 | 130,9 | 25,8 | 99,8% | 81,4% | 81,3% |
| 110,00 | 0,22 | 0,06 | 8,67 | 125,1% | 20,36 | 11,67 | 131,0 | 26,1 | 99,8% | 81,5% | 81,3% |
| 111,00 | 0,22 | 0,06 | 8,57 | 127,7% | 20,37 | 11,78 | 131,1 | 25,9 | 99,8% | 81,4% | 81,2% |
| 112,00 | 0,22 | 0,06 | 8,50 | 129,4% | 20,37 | 11,84 | 131,5 | 25,9 | 99,8% | 81,3% | 81,1% |
| 113,00 | 0,22 | 0,06 | 8,45 | 130,7% | 20,38 | 11,89 | 132,3 | 25,9 | 99,8% | 81,2% | 81,0% |
| 114,00 | 0,22 | 0,06 | 8,47 | 130,2% | 20,38 | 11,88 | 131,8 | 25,8 | 99,8% | 81,2% | 81,1% |
| 115,00 | 0,22 | 0,06 | 8,44 | 131,1% | 20,38 | 11,91 | 132,0 | 25,8 | 99,8% | 81,2% | 81,0% |
| 116,00 | 0,22 | 0,07 | 8,39 | 132,4% | 20,38 | 11,96 | 132,3 | 25,8 | 99,8% | 81,1% | 80,9% |
| 117,00 | 0,17 | 0,07 | 8,25 | 136,2% | 20,39 | 12,11 | 132,4 | 25,8 | 99,8% | 81,0% | 80,8% |
| 118,00 | 0,17 | 0,06 | 8,19 | 137,9% | 20,39 | 12,17 | 132,4 | 25,9 | 99,8% | 80,9% | 80,8% |
| 119,00 | 0,17 | 0,06 | 8,17 | 138,6% | 20,40 | 12,20 | 132,2 | 25,7 | 99,8% | 80,9% | 80,7% |
| 120,00 | 0,17 | 0,06 | 8,02 | 142,9% | 20,41 | 12,35 | 132,7 | 25,8 | 99,8% | 80,7% | 80,6% |
| 121,00 | 0,17 | 0,07 | 7,93 | 145,8% | 20,41 | 12,45 | 132,4 | 25,8 | 99,8% | 80,7% | 80,5% |
| 122,00 | 0,17 | 0,06 | 7,82 | 149,0% | 20,42 | 12,56 | 132,3 | 25,8 | 99,8% | 80,6% | 80,4% |
| 123,00 | 0,17 | 0,06 | 7,81 | 149,4% | 20,42 | 12,58 | 132,5 | 25,7 | 99,8% | 80,5% | 80,4% |
| 124,00 | 0,17 | 0,06 | 7,77 | 150,6% | 20,42 | 12,62 | 132,3 | 25,7 | 99,8% | 80,5% | 80,3% |
| 125,00 | 0,12 | 0,07 | 7,77 | 150,6% | 20,42 | 12,62 | 132,3 | 25,6 | 99,8% | 80,5% | 80,3% |
| 126,00 | 0,17 | 0,07 | 7,75 | 151,2% | 20,42 | 12,64 | 132,1 | 25,7 | 99,8% | 80,5% | 80,3% |
| 127,00 | 0,12 | 0,06 | 7,85 | 148,1% | 20,42 | 12,53 | 131,9 | 25,7 | 99,8% | 80,6% | 80,4% |
| 128,00 | 0,12 | 0,07 | 7,99 | 143,8% | 20,41 | 12,38 | 131,9 | 25,8 | 99,8% | 80,8% | 80,6% |
| 129,00 | 0,12 | 0,06 | 7,94 | 145,3% | 20,41 | 12,44 | 131,6 | 25,7 | 99,8% | 80,7% | 80,6% |
| 130,00 | 0,12 | 0,07 | 7,91 | 146,4% | 20,41 | 12,48 | 131,8 | 25,9 | 99,8% | 80,7% | 80,5% |
| 131,00 | 0,09 | 0,06 | 7,94 | 145,5% | 20,41 | 12,44 | 131,6 | 25,8 | 99,8% | 80,7% | 80,6% |
| 132,00 | 0,12 | 0,06 | 8,03 | 142,8% | 20,41 | 12,35 | 131,4 | 25,8 | 99,8% | 80,9% | 80,7% |
| 133,00 | 0,08 | 0,06 | 8,12 | 139,9% | 20,40 | 12,24 | 131,0 | 25,9 | 99,8% | 81,0% | 80,8% |
| 134,00 | 0,08 | 0,06 | 8,08 | 141,3% | 20,40 | 12,30 | 130,7 | 25,9 | 99,8% | 81,0% | 80,8% |
| 135,00 | 0,08 | 0,06 | 8,04 | 142,5% | 20,41 | 12,34 | 130,5 | 25,9 | 99,8% | 81,0% | 80,8% |
| 136,00 | 0,08 | 0,06 | 7,94 | 145,5% | 20,41 | 12,44 | 130,2 | 25,8 | 99,8% | 80,9% | 80,7% |
| 137,00 | 0,08 | 0,06 | 7,97 | 144,5% | 20,41 | 12,41 | 129,9 | 26,0 | 99,8% | 80,9% | 80,8% |
| 138,00 | 0,08 | 0,06 | 7,96 | 144,9% | 20,41 | 12,42 | 129,8 | 26,0 | 99,8% | 80,9% | 80,8% |
| 139,00 | 0,03 | 0,06 | 7,87 | 147,6% | 20,42 | 12,51 | 129,4 | 26,0 | 99,8% | 80,9% | 80,7% |
| 140,00 | 0,03 | 0,06 | 7,73 | 152,1% | 20,43 | 12,66 | 128,8 | 26,0 | 99,8% | 80,8% | 80,6% |
| 141,00 | 0,03 | 0,06 | 7,75 | 151,5% | 20,42 | 12,65 | 128,7 | 26,0 | 99,8% | 80,8% | 80,7% |
| 142,00 | 0,03 | 0,06 | 7,53 | 158,8% | 20,44 | 12,88 | 128,5 | 25,9 | 99,8% | 80,6% | 80,4% |
| 143,00 | 0,03 | 0,06 | 7,51 | 159,4% | 20,44 | 12,90 | 128,5 | 25,7 | 99,8% | 80,6% | 80,4% |
| 144,00 | 0,03 | 0,06 | 7,76 | 151,1% | 20,42 | 12,63 | 128,3 | 25,9 | 99,8% | 80,9% | 80,7% |
| 145,00 | 0,03 | 0,06 | 8,12 | 140,2% | 20,40 | 12,25 | 127,0 | 25,9 | 99,8% | 81,3% | 81,2% |
| 146,00 | 0,03 | 0,06 | 7,75 | 151,5% | 20,42 | 12,65 | 126,8 | 25,9 | 99,8% | 81,0% | 80,8% |
| 147,00 | 0,03 | 0,06 | 7,62 | 155,5% | 20,43 | 12,78 | 127,1 | 25,7 | 99,8% | 80,8% | 80,6% |
| 148,00 | 0,03 | 0,06 | 7,54 | 158,2% | 20,44 | 12,86 | 127,2 | 25,8 | 99,8% | 80,7% | 80,6% |
| 149,00 | 0,00 | 0,07 | 7,66 | 154,3% | 20,43 | 12,74 | 126,8 | 25,8 | 99,8% | 80,9% | 80,7% |

DATA 2022-06-28 EPA PI 20272 RUN 2 MODEL 8060
preburn

| Temps | Flue | Room | Tunnel | Catalyst | scale | Right | Back | bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|
| acquisition | temp | temp | dry bulb | | | | | | | |
| minutes | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| 0 | 74,30 | 71,56 | 75,91 | 75,40 | 2,67 | 76,07 | 75,80 | 76,32 | 76,20 | 76,69 |
| 1 | 84,65 | 71,61 | 76,48 | 94,50 | 2,67 | 76,12 | 75,90 | 76,29 | 76,27 | 76,80 |
| 2 | 134,02 | 71,60 | 81,51 | 207,65 | 2,47 | 76,59 | 76,11 | 76,36 | 76,65 | 78,02 |
| 3 | 190,16 | 71,51 | 79,40 | 476,98 | 2,47 | 77,38 | 76,72 | 76,60 | 77,20 | 81,39 |
| 4 | 275,70 | 71,71 | 80,99 | 643,93 | 2,34 | 78,98 | 78,86 | 77,11 | 79,24 | 84,60 |
| 5 | 333,38 | 71,93 | 82,97 | 760,00 | 2,27 | 81,47 | 82,65 | 78,17 | 83,23 | 90,61 |
| 6 | 358,66 | 71,69 | 84,10 | 771,73 | 2,07 | 85,31 | 87,00 | 80,08 | 89,10 | 106,66 |
| 7 | 376,29 | 72,02 | 84,80 | 747,73 | 1,89 | 91,52 | 91,54 | 82,77 | 96,46 | 128,09 |
| 8 | 366,78 | 72,20 | 85,05 | 674,31 | 1,77 | 99,81 | 97,06 | 85,90 | 104,01 | 147,52 |
| 9 | 405,99 | 72,19 | 87,08 | 805,53 | 1,57 | 110,66 | 104,49 | 89,15 | 112,25 | 161,14 |
| 10 | 433,82 | 72,18 | 88,48 | 836,01 | 1,47 | 127,39 | 114,21 | 92,31 | 120,48 | 172,92 |
| 11 | 452,97 | 72,48 | 89,85 | 870,92 | 1,27 | 146,97 | 125,22 | 95,27 | 128,28 | 186,23 |
| 12 | 467,68 | 72,82 | 107,27 | 679,66 | 1,17 | 167,23 | 140,94 | 98,04 | 134,34 | 201,53 |
| 13 | 423,55 | 73,03 | 120,02 | 451,05 | 1,87 | 190,33 | 163,62 | 100,78 | 134,66 | 219,95 |
| 14 | 332,83 | 72,63 | 111,75 | 307,90 | 8,28 | 216,12 | 180,64 | 103,53 | 136,02 | 242,01 |
| 15 | 323,91 | 72,46 | 95,95 | 500,87 | 8,18 | 235,15 | 189,74 | 106,28 | 142,85 | 254,79 |
| 16 | 313,65 | 72,46 | 88,88 | 485,71 | 8,08 | 246,29 | 194,62 | 108,93 | 149,80 | 260,12 |
| 17 | 316,80 | 72,46 | 86,73 | 538,09 | 7,98 | 251,58 | 199,54 | 111,40 | 156,78 | 262,03 |
| 18 | 347,20 | 72,48 | 86,83 | 641,27 | 7,98 | 254,07 | 204,37 | 113,77 | 164,61 | 263,01 |
| 19 | 360,08 | 72,58 | 86,68 | 645,52 | 7,77 | 257,19 | 208,48 | 115,99 | 171,75 | 264,07 |
| 20 | 354,66 | 72,52 | 86,47 | 616,91 | 7,73 | 259,72 | 213,31 | 118,15 | 178,36 | 266,10 |
| 21 | 342,25 | 72,49 | 86,12 | 565,69 | 7,67 | 262,75 | 217,69 | 120,51 | 184,61 | 268,01 |
| 22 | 336,88 | 72,66 | 86,01 | 584,35 | 7,58 | 265,56 | 220,62 | 123,17 | 190,82 | 269,94 |
| 23 | 350,95 | 72,74 | 86,64 | 633,47 | 7,48 | 268,10 | 223,26 | 126,14 | 196,58 | 272,00 |
| 24 | 352,47 | 72,81 | 86,68 | 624,48 | 7,40 | 271,62 | 224,19 | 129,45 | 202,13 | 274,65 |
| 25 | 351,26 | 72,82 | 86,50 | 619,53 | 7,38 | 275,33 | 223,83 | 132,75 | 207,54 | 277,19 |
| 26 | 340,97 | 72,70 | 85,88 | 585,39 | 7,27 | 278,33 | 222,68 | 136,44 | 212,75 | 279,56 |
| 27 | 325,86 | 72,68 | 85,96 | 551,02 | 7,17 | 281,83 | 221,95 | 140,24 | 217,65 | 282,54 |
| 28 | 320,75 | 72,01 | 85,26 | 553,98 | 7,17 | 283,66 | 219,41 | 144,20 | 222,18 | 284,25 |
| 29 | 318,93 | 71,96 | 85,22 | 544,66 | 7,17 | 285,45 | 215,77 | 148,33 | 226,26 | 286,10 |
| 30 | 300,99 | 72,09 | 84,57 | 489,18 | 7,07 | 287,87 | 212,56 | 152,52 | 229,90 | 287,99 |
| 31 | 277,09 | 72,34 | 83,90 | 436,11 | 6,97 | 288,86 | 208,79 | 156,85 | 233,27 | 289,18 |
| 32 | 318,70 | 72,32 | 88,34 | 533,68 | 6,88 | 289,11 | 204,62 | 161,26 | 235,55 | 289,03 |
| 33 | 381,57 | 72,43 | 88,85 | 757,61 | 6,78 | 293,88 | 200,62 | 165,66 | 237,79 | 290,14 |
| 34 | 430,54 | 72,37 | 90,58 | 849,83 | 6,57 | 305,28 | 200,01 | 170,06 | 240,37 | 294,16 |
| 35 | 461,44 | 72,61 | 92,50 | 882,98 | 6,47 | 319,95 | 201,09 | 174,71 | 243,97 | 300,46 |
| 36 | 469,26 | 72,49 | 92,65 | 852,35 | 6,27 | 335,62 | 203,78 | 179,73 | 248,79 | 308,06 |
| 37 | 456,70 | 72,37 | 92,35 | 820,72 | 6,18 | 350,38 | 207,05 | 185,23 | 254,80 | 316,46 |
| 38 | 454,13 | 72,65 | 92,93 | 824,41 | 6,08 | 364,55 | 210,33 | 191,09 | 261,51 | 324,44 |
| 39 | 458,54 | 72,24 | 93,40 | 835,51 | 5,97 | 376,28 | 213,04 | 197,10 | 268,40 | 331,05 |
| 40 | 475,33 | 72,29 | 94,20 | 878,05 | 5,77 | 389,02 | 215,41 | 203,30 | 275,76 | 337,51 |
| 41 | 490,03 | 72,49 | 95,18 | 907,48 | 5,67 | 401,60 | 220,20 | 209,98 | 283,69 | 345,15 |
| 42 | 495,55 | 72,70 | 95,73 | 918,28 | 5,57 | 414,40 | 224,38 | 216,60 | 291,49 | 353,40 |
| 43 | 500,21 | 72,79 | 96,22 | 929,18 | 5,38 | 426,22 | 229,64 | 223,21 | 299,67 | 361,81 |
| 44 | 506,54 | 72,91 | 97,17 | 942,06 | 5,17 | 439,13 | 234,16 | 229,61 | 308,06 | 370,63 |
| 45 | 510,09 | 73,08 | 97,19 | 935,19 | 5,07 | 452,53 | 239,29 | 235,88 | 316,39 | 379,56 |
| 46 | 512,97 | 73,22 | 97,34 | 938,94 | 4,87 | 464,44 | 243,97 | 241,97 | 325,02 | 388,16 |
| 47 | 512,76 | 73,24 | 97,13 | 922,68 | 4,78 | 476,15 | 250,01 | 248,01 | 333,69 | 396,87 |
| 48 | 513,06 | 73,38 | 97,07 | 939,00 | 4,68 | 485,38 | 256,12 | 254,07 | 342,28 | 404,78 |
| 49 | 513,01 | 73,41 | 97,02 | 944,28 | 4,47 | 494,07 | 261,33 | 259,62 | 350,26 | 411,05 |
| 50 | 511,90 | 73,32 | 96,99 | 936,67 | 4,37 | 502,62 | 266,31 | 264,84 | 358,64 | 418,46 |
| 51 | 506,57 | 73,16 | 97,30 | 916,56 | 4,27 | 510,00 | 271,44 | 269,68 | 366,07 | 425,33 |
| 52 | 499,00 | 73,17 | 97,47 | 905,39 | 4,17 | 516,64 | 276,20 | 274,08 | 373,65 | 432,60 |
| 53 | 493,00 | 73,36 | 97,59 | 898,05 | 4,08 | 522,37 | 281,05 | 278,17 | 380,53 | 439,93 |
| 54 | 490,54 | 73,43 | 96,95 | 902,99 | 3,97 | 526,26 | 284,54 | 281,80 | 386,46 | 447,25 |
| 55 | 491,49 | 73,53 | 96,78 | 921,01 | 3,87 | 532,03 | 286,95 | 285,03 | 392,32 | 455,09 |
| 56 | 496,25 | 73,43 | 96,85 | 944,98 | 3,67 | 536,40 | 289,90 | 288,10 | 397,51 | 463,70 |
| 57 | 504,95 | 73,41 | 98,06 | 980,46 | 3,57 | 541,37 | 293,31 | 291,37 | 402,53 | 473,19 |
| 58 | 522,19 | 73,36 | 99,08 | 1050,90 | 3,47 | 546,22 | 296,19 | 294,47 | 407,84 | 482,26 |
| 59 | 538,53 | 73,45 | 99,66 | 1096,32 | 3,27 | 551,60 | 299,52 | 297,78 | 413,17 | 491,59 |
| 60 | 551,13 | 73,80 | 101,12 | 1122,37 | 3,17 | 557,68 | 302,65 | 301,10 | 418,99 | 500,78 |
| 61 | 557,96 | 73,78 | 101,78 | 1130,89 | 2,97 | 564,91 | 306,36 | 304,45 | 425,23 | 510,35 |
| 62 | 556,81 | 74,07 | 102,15 | 1080,50 | 2,87 | 572,08 | 311,46 | 308,06 | 432,19 | 520,17 |
| 63 | 554,93 | 73,84 | 101,92 | 1079,02 | 2,68 | 579,43 | 316,67 | 311,77 | 438,70 | 529,70 |
| 64 | 549,44 | 73,93 | 101,42 | 1055,72 | 2,58 | 586,78 | 323,44 | 315,75 | 445,07 | 538,31 |
| 65 | 540,00 | 74,27 | 101,53 | 1032,37 | 2,47 | 594,26 | 328,86 | 319,55 | 451,35 | 546,64 |
| 66 | 530,23 | 73,90 | 100,25 | 1009,57 | 2,37 | 601,13 | 334,22 | 322,91 | 457,36 | 554,29 |
| 67 | 520,29 | 74,09 | 99,63 | 979,72 | 2,27 | 608,31 | 339,30 | 325,84 | 463,47 | 560,65 |
| 68 | 504,03 | 73,98 | 98,99 | 924,11 | 2,27 | 613,30 | 343,39 | 328,41 | 468,24 | 566,81 |
| 69 | 489,85 | 74,07 | 98,48 | 889,08 | 2,17 | 617,36 | 347,27 | 330,83 | 472,87 | 572,40 |
| 70 | 478,87 | 74,40 | 97,45 | 867,99 | 2,16 | 621,29 | 350,63 | 333,08 | 475,48 | 576,97 |
| 71 | 468,18 | 74,57 | 97,38 | 856,23 | 2,07 | 624,08 | 352,92 | 335,29 | 477,61 | 581,01 |
| 72 | 458,61 | 74,87 | 96,53 | 830,62 | 1,98 | 625,73 | 354,38 | 337,44 | 477,98 | 584,02 |
| 73 | 446,97 | 75,09 | 95,78 | 800,61 | 1,98 | 629,13 | 354,91 | 339,65 | 478,34 | 586,57 |
| 74 | 436,18 | 74,94 | 95,04 | 777,38 | 1,87 | 630,35 | 354,26 | 341,90 | 477,30 | 589,01 |
| 75 | 428,23 | 74,81 | 95,08 | 764,41 | 1,87 | 633,17 | 355,01 | 344,21 | 475,54 | 590,73 |
| 76 | 425,92 | 74,85 | 94,99 | 761,41 | 1,86 | 635,30 | 354,53 | 346,70 | 473,60 | 592,06 |
| 77 | 423,68 | 74,64 | 95,06 | 761,26 | 1,77 | 637,56 | 353,91 | 349,36 | 470,89 | 592,85 |
| 78 | 418,35 | 74,98 | 94,58 | 774,08 | 1,67 | 638,85 | 353,84 | 352,26 | 467,46 | 593,44 |
| 79 | 413,71 | 75,23 | 94,25 | 759,74 | 1,67 | 640,91 | 353,48 | 355,24 | 464,42 | 593,86 |
| 80 | 409,37 | 75,29 | 93,72 | 752,48 | 1,57 | 641,17 | 353,79 | 358,37 | 460,95 | 594,96 |
| 81 | 404,07 | 75,18 | 93,88 | 742,06 | 1,57 | 641,97 | 353,04 | 361,49 | 457,38 | 595,70 |
| 82 | 399,85 | 75,20 | 93,31 | 734,79 | 1,57 | 642,58 | 353,23 | 364,67 | 454,04 | 595,72 |
| 83 | 395,52 | 75,00 | 93,17 | 730,58 | 1,47 | 641,88 | 352,67 | 367,93 | 450,32 | 595,79 |
| 84 | 391,11 | 74,89 | 93,21 | 716,78 | 1,47 | 641,93 | 352,57 | 371,22 | 447,00 | 595,63 |
| 85 | 387,41 | 75,02 | 93,06 | 707,46 | 1,37 | 641,48 | 353,52 | 374,58 | 442,81 | 595,25 |
| 86 | 382,89 | 75,24 | 92,13 | 699,98 | 1,37 | 641,17 | 352,99 | 377,92 | 439,39 | 594,94 |
| 87 | 377,61 | 75,30 | 92,61 | 687,24 | 1,37 | 640,36 | 353,11 | 381,33 | 435,21 | 595,40 |
| 88 | 373,30 | 75,17 | 92,40 | 677,44 | 1,28 | 638,94 | 351,88 | 384,74 | 431,52 | 595,17 |
| 89 | 367,56 | 75,38 | 91,66 | 665,93 | 1,28 | 637,42 | 351,02 | 388,13 | 427,60 | 595,64 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 362,71 | 75,46 | 91,76 | 657,84 | 1,28 | 635,71 | 349,70 | 391,50 | 423,16 | 597,58 |
| 91 | 358,09 | 75,56 | 91,08 | 657,80 | 1,28 | 634,96 | 347,13 | 394,91 | 419,95 | 597,51 |
| 92 | 337,23 | 75,83 | 112,29 | 396,13 | 4,45 | 632,58 | 353,57 | 398,60 | 413,94 | 598,25 |
| 93 | 304,87 | 75,57 | 104,23 | 415,06 | 8,48 | 630,02 | 353,41 | 402,63 | 408,70 | 596,53 |
| 94 | 304,08 | 75,21 | 94,44 | 504,52 | 8,37 | 623,90 | 346,84 | 406,42 | 403,31 | 592,51 |
| 95 | 303,33 | 75,34 | 91,95 | 525,41 | 8,30 | 613,24 | 340,56 | 409,64 | 397,82 | 584,50 |
| 96 | 302,35 | 75,32 | 91,16 | 537,88 | 8,28 | 603,18 | 336,56 | 412,34 | 392,59 | 575,06 |
| 97 | 337,02 | 75,50 | 91,16 | 635,06 | 8,18 | 591,90 | 335,28 | 414,30 | 390,21 | 565,60 |
| 98 | 314,57 | 75,09 | 88,55 | 723,68 | 8,08 | 580,79 | 338,86 | 415,63 | 394,98 | 555,68 |
| 99 | 315,45 | 75,28 | 89,31 | 582,83 | 8,01 | 570,85 | 339,56 | 416,46 | 402,79 | 546,31 |
| 100 | 344,77 | 75,22 | 90,95 | 737,24 | 7,95 | 561,80 | 340,76 | 416,72 | 399,04 | 537,20 |
| 101 | 377,42 | 75,25 | 91,17 | 765,84 | 7,86 | 552,19 | 345,40 | 416,53 | 400,72 | 529,19 |
| 102 | 347,80 | 75,32 | 89,49 | 775,31 | 7,78 | 543,00 | 354,44 | 415,87 | 410,81 | 521,13 |
| 103 | 334,37 | 75,25 | 88,77 | 741,81 | 7,67 | 534,50 | 361,53 | 415,11 | 416,40 | 513,70 |
| 104 | 325,28 | 75,46 | 88,29 | 728,12 | 7,58 | 527,07 | 365,59 | 414,03 | 420,65 | 506,96 |
| 105 | 318,51 | 75,14 | 87,93 | 727,11 | 7,58 | 520,83 | 364,75 | 412,86 | 422,42 | 499,97 |
| 106 | 313,98 | 75,11 | 87,74 | 727,36 | 7,48 | 514,90 | 362,87 | 411,42 | 422,50 | 493,67 |
| 107 | 310,65 | 74,74 | 87,70 | 733,98 | 7,48 | 508,45 | 358,13 | 409,88 | 420,85 | 487,74 |
| 108 | 309,51 | 75,03 | 87,27 | 761,16 | 7,38 | 502,71 | 354,41 | 408,27 | 417,07 | 482,05 |
| 109 | 309,73 | 75,15 | 86,56 | 755,63 | 7,38 | 496,41 | 348,74 | 406,60 | 411,63 | 476,01 |
| 110 | 305,91 | 75,27 | 86,88 | 731,79 | 7,38 | 490,38 | 344,26 | 404,85 | 405,14 | 470,84 |
| 111 | 302,88 | 75,15 | 86,23 | 719,40 | 7,28 | 483,72 | 339,01 | 403,13 | 399,72 | 464,94 |
| 112 | 300,31 | 75,09 | 86,64 | 715,95 | 7,28 | 478,85 | 334,04 | 401,32 | 393,99 | 459,35 |
| 113 | 298,64 | 74,86 | 86,89 | 694,58 | 7,28 | 472,85 | 329,43 | 399,56 | 388,89 | 453,82 |
| 114 | 294,76 | 74,63 | 86,81 | 663,04 | 7,17 | 467,53 | 329,05 | 397,79 | 385,17 | 448,47 |
| 115 | 296,85 | 74,82 | 87,25 | 686,32 | 7,17 | 461,86 | 331,10 | 396,04 | 382,89 | 444,16 |
| 116 | 311,03 | 75,21 | 87,44 | 785,05 | 7,07 | 456,76 | 334,98 | 394,32 | 383,83 | 440,26 |
| 117 | 322,47 | 75,30 | 87,72 | 828,31 | 6,97 | 452,47 | 339,19 | 392,71 | 385,79 | 436,49 |
| 118 | 328,65 | 75,47 | 87,38 | 819,75 | 6,88 | 448,33 | 343,47 | 391,15 | 388,22 | 433,01 |
| 119 | 331,18 | 75,46 | 87,55 | 803,05 | 6,78 | 446,32 | 349,03 | 389,47 | 391,37 | 429,74 |
| 120 | 332,56 | 75,04 | 87,41 | 812,32 | 6,68 | 443,95 | 354,07 | 387,85 | 395,62 | 427,12 |
| 121 | 344,61 | 74,91 | 88,26 | 868,53 | 6,68 | 441,16 | 357,78 | 386,26 | 402,64 | 424,70 |
| 122 | 424,61 | 75,41 | 92,75 | 956,45 | 6,51 | 440,26 | 358,57 | 384,68 | 420,78 | 423,66 |
| 123 | 485,11 | 75,13 | 96,62 | 1003,92 | 6,37 | 439,33 | 360,18 | 383,18 | 418,56 | 424,15 |
| 124 | 512,06 | 75,18 | 97,84 | 1022,12 | 6,18 | 440,71 | 362,81 | 381,67 | 415,70 | 425,15 |
| 125 | 531,11 | 75,53 | 98,99 | 1050,47 | 5,98 | 443,31 | 367,92 | 380,11 | 413,72 | 428,10 |
| 126 | 540,76 | 75,51 | 100,15 | 1053,51 | 5,77 | 448,39 | 373,76 | 378,81 | 413,36 | 429,38 |
| 127 | 545,95 | 75,74 | 100,89 | 1050,94 | 5,57 | 454,03 | 378,73 | 377,74 | 414,34 | 432,26 |
| 128 | 548,97 | 75,89 | 102,24 | 1054,07 | 5,48 | 460,95 | 383,49 | 376,84 | 416,58 | 435,14 |
| 129 | 550,44 | 75,91 | 102,45 | 1056,96 | 5,28 | 467,75 | 386,69 | 376,19 | 420,78 | 439,64 |
| 130 | 553,60 | 76,07 | 103,01 | 1060,21 | 5,17 | 476,34 | 389,90 | 375,76 | 425,44 | 444,75 |
| 131 | 557,13 | 76,30 | 103,26 | 1076,26 | 4,97 | 485,76 | 392,60 | 375,54 | 431,04 | 450,59 |
| 132 | 561,11 | 76,12 | 103,45 | 1084,24 | 4,78 | 494,79 | 394,57 | 375,42 | 436,88 | 457,41 |
| 133 | 556,94 | 75,59 | 102,81 | 986,96 | 4,68 | 504,48 | 397,14 | 375,51 | 449,00 | 463,61 |
| 134 | 468,40 | 76,41 | 97,23 | 911,95 | 4,57 | 513,59 | 402,81 | 375,72 | 480,47 | 470,32 |
| 135 | 437,61 | 76,69 | 95,76 | 925,05 | 4,47 | 521,01 | 407,27 | 376,01 | 499,98 | 476,77 |
| 136 | 420,09 | 76,24 | 95,24 | 927,59 | 4,37 | 526,33 | 409,31 | 376,47 | 514,86 | 482,09 |
| 137 | 407,99 | 76,07 | 93,34 | 924,83 | 4,27 | 530,12 | 410,21 | 376,85 | 524,87 | 486,31 |
| 138 | 398,21 | 75,91 | 92,51 | 919,39 | 4,17 | 532,69 | 410,68 | 377,21 | 532,34 | 489,91 |
| 139 | 389,58 | 75,93 | 92,23 | 904,42 | 4,08 | 534,82 | 411,67 | 377,37 | 538,46 | 493,04 |
| 140 | 383,04 | 76,07 | 92,10 | 887,18 | 3,98 | 537,31 | 410,96 | 377,54 | 543,12 | 496,10 |
| 141 | 378,45 | 76,13 | 92,00 | 875,49 | 3,97 | 538,84 | 411,08 | 377,56 | 547,05 | 498,90 |
| 142 | 375,19 | 76,25 | 91,58 | 870,60 | 3,87 | 540,40 | 410,33 | 377,54 | 550,18 | 501,23 |
| 143 | 371,53 | 76,11 | 91,73 | 891,60 | 3,77 | 541,60 | 410,35 | 377,42 | 552,66 | 503,61 |
| 144 | 368,82 | 76,09 | 91,64 | 895,22 | 3,67 | 543,54 | 410,11 | 377,28 | 555,03 | 505,11 |
| 145 | 366,05 | 76,14 | 91,29 | 896,79 | 3,67 | 545,00 | 410,40 | 377,09 | 556,23 | 507,33 |
| 146 | 363,10 | 76,30 | 91,36 | 895,09 | 3,57 | 546,63 | 410,63 | 376,90 | 557,21 | 509,17 |
| 147 | 360,26 | 76,39 | 90,72 | 892,50 | 3,47 | 549,18 | 408,77 | 376,72 | 557,76 | 510,35 |
| 148 | 358,93 | 76,27 | 90,52 | 888,91 | 3,47 | 549,81 | 410,09 | 376,43 | 558,51 | 512,08 |
| 149 | 357,95 | 76,43 | 90,43 | 889,66 | 3,32 | 551,71 | 409,94 | 376,14 | 559,26 | 513,30 |
| 150 | 356,95 | 76,45 | 90,22 | 890,33 | 3,28 | 552,29 | 409,70 | 375,87 | 559,56 | 515,88 |
| 151 | 357,37 | 76,48 | 90,17 | 892,16 | 3,17 | 554,24 | 409,21 | 375,60 | 560,65 | 516,56 |
| 152 | 357,95 | 76,22 | 89,91 | 891,51 | 3,17 | 556,02 | 408,89 | 375,28 | 561,54 | 518,36 |
| 153 | 357,42 | 76,27 | 89,65 | 888,95 | 3,07 | 558,56 | 407,53 | 375,07 | 562,96 | 519,08 |
| 154 | 356,72 | 76,26 | 89,08 | 888,06 | 2,97 | 562,47 | 405,83 | 374,81 | 563,45 | 520,39 |
| 155 | 355,37 | 76,50 | 89,22 | 882,34 | 2,87 | 566,10 | 405,08 | 374,53 | 564,11 | 522,42 |
| 156 | 351,89 | 76,39 | 89,03 | 873,46 | 2,81 | 570,15 | 404,31 | 374,30 | 564,52 | 524,02 |
| 157 | 348,31 | 76,46 | 89,80 | 866,94 | 2,77 | 574,30 | 403,09 | 374,10 | 566,76 | 526,36 |
| 158 | 341,37 | 76,67 | 90,18 | 836,03 | 2,77 | 576,74 | 401,41 | 373,99 | 568,24 | 528,55 |
| 159 | 335,78 | 76,72 | 89,32 | 810,97 | 2,68 | 578,09 | 399,65 | 373,84 | 568,91 | 530,14 |
| 160 | 330,32 | 76,88 | 89,64 | 785,09 | 2,68 | 578,44 | 397,60 | 373,69 | 568,97 | 532,29 |
| 161 | 325,73 | 76,77 | 89,24 | 772,93 | 2,57 | 578,90 | 394,76 | 373,56 | 568,73 | 533,57 |
| 162 | 321,75 | 76,43 | 89,26 | 765,25 | 2,57 | 579,16 | 392,95 | 373,38 | 567,61 | 535,16 |
| 163 | 318,43 | 76,50 | 88,60 | 755,60 | 2,47 | 579,25 | 390,92 | 373,27 | 565,91 | 536,53 |
| 164 | 312,97 | 76,75 | 87,90 | 750,14 | 2,47 | 579,58 | 388,65 | 373,22 | 563,87 | 538,20 |
| 165 | 313,14 | 77,13 | 88,77 | 784,23 | 2,47 | 579,89 | 387,55 | 373,07 | 559,12 | 540,45 |
| 166 | 314,00 | 77,06 | 88,72 | 793,30 | 2,47 | 580,07 | 385,91 | 372,92 | 553,87 | 544,53 |
| 167 | 311,64 | 77,00 | 88,19 | 768,33 | 2,37 | 579,58 | 384,43 | 372,86 | 547,08 | 550,04 |
| 168 | 306,99 | 76,70 | 88,09 | 742,00 | 2,37 | 579,03 | 382,40 | 372,77 | 539,18 | 555,83 |
| 169 | 301,59 | 76,64 | 88,29 | 726,70 | 2,37 | 579,44 | 380,18 | 372,83 | 532,47 | 561,17 |
| 170 | 297,32 | 76,83 | 87,71 | 715,03 | 2,37 | 579,92 | 379,58 | 372,78 | 525,12 | 567,11 |
| 171 | 293,41 | 76,43 | 87,54 | 706,11 | 2,27 | 579,78 | 377,62 | 372,82 | 517,84 | 571,90 |
| 172 | 289,99 | 76,52 | 87,20 | 700,19 | 2,27 | 580,44 | 376,07 | 372,93 | 510,69 | 577,43 |
| 173 | 286,48 | 76,47 | 87,61 | 692,10 | 2,27 | 581,29 | 374,38 | 373,12 | 504,16 | 582,44 |
| 174 | 284,02 | 76,50 | 87,15 | 693,63 | 2,27 | 582,23 | 373,03 | 373,33 | 497,99 | 585,87 |
| 175 | 283,03 | 76,26 | 86,97 | 696,20 | 2,27 | 583,53 | 370,18 | 373,69 | 490,97 | 588,43 |
| 176 | 281,61 | 76,30 | 87,01 | 691,65 | 2,17 | 583,91 | 368,37 | 373,89 | 484,16 | 591,15 |
| 177 | 280,27 | 76,57 | 86,62 | 689,51 | 2,21 | 583,07 | 366,65 | 374,11 | 477,29 | 593,53 |
| 178 | 279,58 | 76,44 | 86,46 | 684,18 | 2,27 | 582,44 | 364,73 | 374,50 | 470,39 | 596,47 |
| 179 | 277,75 | 76,61 | 86,38 | 680,17 | 2,17 | 582,60 | 363,24 | 374,86 | 465,18 | 596,72 |
| 180 | 276,31 | 76,32 | 86,08 | 675,20 | 2,25 | 582,80 | 361,31 | 375,34 | 458,75 | 596,61 |
| 181 | 274,28 | 76,38 | 86,38 | 670,35 | 2,17 | 582,61 | 359,09 | 375,81 | 453,87 | 596,84 |
| 182 | 272,52 | 76,37 | 86,36 | 662,62 | 2,17 | 582,57 | 357,77 | 376,31 | 448,25 | 597,30 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 183 | 270,28 | 76,28 | 86,26 | 655,29 | 2,17 | 582,22 | 355,56 | 376,83 | 443,49 | 596,51 |
| 184 | 268,11 | 76,26 | 85,90 | 654,87 | 2,17 | 581,79 | 355,75 | 377,24 | 438,19 | 595,82 |
| 185 | 266,85 | 76,45 | 86,31 | 652,64 | 2,17 | 581,41 | 355,46 | 377,78 | 434,52 | 594,90 |
| 186 | 265,06 | 76,40 | 86,45 | 649,01 | 2,10 | 580,14 | 355,51 | 378,23 | 429,78 | 593,89 |
| 187 | 263,29 | 76,41 | 85,88 | 643,78 | 2,07 | 579,21 | 355,25 | 378,70 | 425,55 | 593,34 |
| 188 | 262,07 | 76,72 | 86,64 | 639,68 | 2,07 | 578,70 | 355,46 | 379,26 | 422,10 | 592,25 |
| 189 | 261,25 | 76,76 | 86,19 | 637,84 | 2,07 | 577,15 | 353,89 | 379,82 | 418,34 | 590,25 |
| 190 | 260,72 | 76,57 | 86,01 | 634,76 | 2,07 | 575,30 | 353,64 | 380,28 | 414,40 | 590,31 |
| 191 | 260,40 | 76,40 | 86,11 | 635,39 | 2,07 | 573,84 | 353,52 | 380,87 | 411,56 | 588,68 |
| 192 | 260,13 | 76,68 | 85,92 | 635,55 | 1,97 | 572,66 | 353,28 | 381,33 | 408,17 | 587,18 |
| 193 | 259,30 | 76,59 | 86,26 | 633,28 | 1,97 | 571,20 | 352,67 | 381,86 | 404,98 | 585,95 |
| 194 | 258,09 | 76,76 | 86,44 | 630,15 | 1,97 | 570,52 | 352,25 | 382,45 | 402,34 | 585,05 |
| 195 | 257,41 | 77,02 | 86,24 | 625,61 | 1,97 | 569,43 | 351,00 | 383,07 | 399,66 | 583,05 |
| 196 | 256,29 | 77,02 | 85,65 | 622,08 | 1,97 | 568,34 | 350,12 | 383,67 | 396,70 | 581,58 |
| 197 | 255,31 | 77,19 | 85,67 | 623,21 | 1,97 | 566,83 | 349,73 | 384,26 | 394,47 | 580,68 |
| 198 | 254,49 | 77,02 | 86,01 | 621,39 | 1,97 | 566,26 | 348,86 | 384,90 | 392,38 | 579,14 |
| 199 | 253,71 | 77,29 | 85,68 | 620,31 | 1,97 | 564,69 | 347,86 | 385,57 | 390,00 | 578,64 |
| 200 | 253,01 | 77,01 | 85,80 | 617,67 | 1,87 | 563,92 | 347,15 | 386,24 | 387,91 | 577,42 |
| 201 | 252,74 | 77,27 | 85,78 | 613,01 | 1,87 | 563,48 | 346,31 | 387,05 | 386,38 | 576,09 |
| 202 | 251,75 | 77,35 | 85,90 | 611,40 | 1,87 | 562,83 | 345,42 | 387,83 | 384,17 | 575,09 |
| 203 | 251,30 | 77,22 | 85,66 | 611,14 | 1,87 | 562,76 | 343,94 | 388,64 | 382,23 | 573,12 |
| 204 | 251,04 | 77,27 | 85,52 | 610,93 | 1,87 | 562,37 | 342,34 | 389,45 | 380,64 | 572,32 |
| 205 | 251,07 | 77,06 | 85,32 | 608,43 | 1,78 | 561,31 | 341,29 | 390,24 | 378,68 | 570,30 |
| 206 | 250,81 | 77,02 | 85,29 | 609,78 | 1,77 | 561,19 | 340,34 | 391,10 | 376,67 | 570,41 |
| 207 | 251,09 | 76,40 | 85,32 | 613,28 | 1,80 | 560,96 | 339,56 | 391,86 | 374,45 | 569,04 |
| 208 | 251,39 | 76,39 | 85,02 | 615,21 | 1,77 | 560,98 | 338,29 | 392,71 | 373,20 | 567,95 |
| 209 | 251,66 | 76,35 | 85,00 | 616,07 | 1,77 | 560,31 | 337,44 | 393,53 | 371,22 | 567,55 |
| 210 | 265,89 | 76,40 | 93,03 | 485,40 | 1,77 | 559,91 | 338,30 | 394,25 | 371,15 | 566,27 |
| 211 | 252,72 | 76,77 | 86,81 | 550,00 | 1,77 | 558,43 | 335,96 | 394,99 | 365,81 | 565,96 |

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: pI 20272 Run: 3 Tech: MM Reviewer: JP

- Kindling 28 LBS stAN Fire
- by pass open
- Door open
- At ~~45LBS~~ 35LBS close Door
- At 12LBS insert 1st preload
- close Door immediatly
- At 12 LBS insert 2nd preload
- close by pass immediatly
- close Door immediatly
- At 16 LBS pAck coal Bed

After 2min insert load and close immediatly

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE / POST CHECKS

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 3 Tech: MM Reviewer: [illegible]

Moisture Meter Calibration Check:

| Equipment # | Time | 12% | 22% |
|---|---|---|---|
| EM- 334 | 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 (tunnel velocity) | Ok | NA |
| Picture | 4 sides Ok | Ok |

## Wood Heater Conditions:

| | |
|---|---|
| Date Wood Heater Stack Cleaned | 2022-06-27 |
| Date Dilution Tunnel Cleaned | 2022-06-27 |
| Induced Draft Check (max 0.005 H2O) | Ok |
| Traverse before ignition | ok |

## Temperature System:

| | |
|---|---|
| Ambient (65°-90°F) | Ok °F |

## Proportional Checks:

| | | |
|---|---|---|
| Thermocouple check | Ok | |
| Pitot Clean | Ok | |
| Pitot verification | Ok | |
| Pictures for report | Side | Ok |
| | Coal bed | Ok |
| | Load | ok |
| | Load in stove | ok |
| | Fuel adjustment | ok |
| Load Length approximately 5/6 of firebox Lenght | | Ok |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 3 Tech: MM Reviewer: JP

## Leakage Checks Tunnel Samplers

| | System 1st hour | | System 1 | | System 2 | |
|---|---|---|---|---|---|---|
| Unplugged Flow Rate = .25cfm | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) |
| Vacuum (inches Hg.) | -10 | -10 | -10 | -10 | -10 | -10 |
| Final 1minute DGM (Liter) | 65744.96 | 65784.68 | 65743.12 | 65784.96 | 40506.22 | 40566.06 |
| Initial 1minute DGM (Liter) | 65744.95 | 65784.65 | 65743.11 | 65784.95 | 40506.22 | 40566.05 |
| Change (Liter) | 0.01 | 0.03 | 0.01 | 0.01 | 0 | 0.01 |
| Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56) | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** |
| Check OK | OK | OK | OK | OK | OK | OK |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: PI 20222 Run: 3 Tech: MM Reviewer: JP

## 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 | .4 |
| Check OK (no change after 15 sec.) | ok | ok | ok | ok |

## Scales checks

| Scale Type | Audit | | Measured Weight |
|---|---|---|---|
| | Equipment # | Weight | |
| Platform | EM-090 | 44 lbs, Class F | 44 lbs |
| Platform | EM-205 | 10.00 ~~lbs~~ kg, Class F | 10.00 ~~lbs~~ kg |
| Wood | EM-090 | 440 lbs, Class F | 440 lbs |
| Analytical | EM-335 | 100 mg, Class S | 100 mg |
| Analytical | EM-129 | 200 g, Class S | 200 g |

## LIMITS OF WEIGHT RANGES

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

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: 01 2022 Run: 3 Tech: MM Reviewer: DP

FOR TUNNELS < 12 in

Barometric pressure ($P_{bar}$) 101.5 (KPa.) Static pressure ($P_q$) 0.16 (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 $\Delta_p$ (inches $H_2O$) | Tunnel Temperature (°F) |
|---|---|---|---|---|---|
| | 6 po | 7 po | 8 po | | |
| A- Centroid | 3.00 | 3.50 | 4 | 0.070 | 74.39 |
| B - Centroid | 3.00 | 3.50 | 4 | 0.069 | 74.32 |
| A-1 | 0.40 | 0.50 | 0.50 | 0.056 | 74.39 |
| A-2 | 1.50 | 1.75 | 2 | 0.058 | 74.34 |
| A-3 | 4.50 | 5.25 | 6 | 0.061 | 74.34 |
| A-4 | 5.60 | 6.5 | 7.5 | 0.056 | 74.33 |
| B-1 | 0.40 | 0.50 | 0.50 | 0.057 | 74.32 |
| B-2 | 1.50 | 1.75 | 2 | 0.058 | 74.39 |
| B-3 | 4.50 | 5.25 | 6 | 0.069 | 74.39 |
| B-4 | 5.60 | 6.5 | 7.5 | 0.057 | 74.47 |
| | | | | 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.
$\Delta_p$ = 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 $\underline{\text{in. } H_2O}$ { 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 ($\Delta_p$) measured at each traverse point.

POLYTESTS
TESTING THROUGH YOUR REALITY

# CONTINUOUS ANALYZERS

Date: 2022-06-29 2pm Manufacturer: Hearthstone Model: 8060

Project #: pI 20272 Run: 3 Tech: MM Reviewer: JP

Pre-Test (Adjust and Record)

| | ZERO | | SPAN | | CAL. (Record Only) | |
|---|---|---|---|---|---|---|
| CO | 0 | 0 | 3026 | 3 000 | 1021 | 1000 |
| Tolerance CO | 0 | +/- 0.02 | 0026 | +/- 0.15 | 0021 | +/- 0.05 |
| $CO_2$ | 0 | 0 | 17 90 | 18 00 | 9 80 | 10 00 |
| Tolerance CO2 | 0 | +/- 0.02 | 0 10 | +/- 0.5 | 0 20 | +/- 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 | 3019 | 1018 | ✓ | 0.02 | 0007 | 0.15 | 0003 | 0.05 | ✓ | |
| $CO_2$ | 0 | 17 93 | 989 | ✓ | 0.02 | 003 | 0.5 | 0009 | 0.5 | ✓ | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# TEST DATA LOG

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: pI 20272 Run: 3 Tech: MM Reviewer: DO

## RAW DRY GAS METER READINGS

| | System 1 | System 2 | Blanck |
|---|---|---|---|
| Final (Liter) | 657 841, 15 | 405 648, 98 | 391 160, 72 |
| Initial (Liter) | 657 243, 56 | 405 064, 90 | 390 674, 00 |

## AMBIENT CONDITIONS

| | Before | After |
|---|---|---|
| Barometer (kPa): | 101,5 | 101,5 |
| Dry Bulb (F): | 77,8 | 83,3 |
| Humidity (%): | 44,9 | 33,9 |

## Flow Meter

| | Start | End |
|---|---|---|
| Flow meter reading | N.A | N.A |

## Flow Meter Verification

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

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 3 Tech: MM Reviewer: DP

## FUEL DESCRIPTION:

Type of wood:

## PRE-TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 14 in. | 1224 lbs. | 20.4 | 20.2 | 20.2 | 20.1 | 20.0 |
| 1 1/2 x 3 1/2 x 14 in. | 1'448 lbs. | 210 | 21.1 | 21.1 | 21.4 | 20.0 |
| 1 1/2 x 3 1/2 x 14 in. | 1464 lbs. | 20.8 | 20.6 | 20.7 | 20.7 | 20.8 |
| 1 1/2 x 3 1/2 x 7 in. | 0720 lbs. | 20.1 | 20.2 | 20.4 | 20.5 | 20.4 |
| 1 1/2 x 3 1/2 x 7 in. | 0814 lbs. | 20.1 | 20.6 | 20.4 | 20.6 | 20.7 |
| 1 1/2 x 3 1/2 x 7 in. | 0744 lbs. | 20.1 | 20.6 | 20.1 | 20.2 | 20.6 |
| 1 1/2 x 3 1/2 x 7 in. | 0784 lbs. | 20.6 | 20.8 | 20.9 | 20.7 | 20.8 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3 1/2 x 14 in. | 1204 lbs. | 21.1 | 20.8 | 20.7 | 20.7 | 20.6 |
| 1 1/2 x 3 1/2 x 14 in. | 1'480 lbs. | 19.9 | 20.0 | 20.1 | 20.1 | 20.0 |
| 1 1/2 x 3 1/2 x 14 in. | 1478 lbs. | 20.6 | 20.5 | 20.4 | 20.3 | 20.4 |
| 1 1/2 x 3 1/2 x 7 in. | 0716 lbs. | 20.6 | 20.7 | 20.8 | 20.8 | 20.6 |
| 1 1/2 x 3 1/2 x 7 in. | 0808 lbs. | 21.0 | 20.9 | 20.8 | 20.6 | 20.7 |
| 1 1/2 x 3 1/2 x 7 in. | 0754 lbs. | 21.1 | 21.3 | 21.4 | 21.3 | 21.4 |
| 1 1/2 x 3 1/2 x 7 in. | 0738 lbs. | 21.0 | 21.3 | 21.3 | 21.3 | 21.2 |
| 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:** 7184 719 lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: pT 20272 Run: 3 Tech: M M Reviewer: [illegible]

## FUEL DESCRIPTION:

Type of wood :

## TEST LOAD

| Piece Size | Weight | | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 15 in. | 1 342 | lbs. | 191 | 192 | 193 | 194 | 193 |
| 1 1/2 x 3 1/2 x 15 in. | 1 522 | lbs. | 208 | 203 | 204 | 203 | 202 |
| 1 1/2 x 3 1/2 x 15 in. | 1 486 | lbs. | 210 | 207 | 208 | 206 | 204 |
| 1 1/2 x 3 1/2 x 15 in. | 1 442 | lbs. | 211 | 205 | 206 | 204 | 205 |
| x x in. | | lbs. | | | | | |
| 1 1/2 x 3/4 x 4 in. | 0 122 | lbs. | | | 191 | | |
| 1 1/2 x 3/4 x 4 in. | 0 108 | lbs. | | | 193 | | |
| 1 1/2 x 3/4 x 4 in. | 0 096 | lbs. | | | 196 | | |
| 1 1/2 x 3/4 x 4 in. | 0 092 | lbs. | | | 195 | | |
| 1 1/2 x 3/4 x 4 in. | 0 080 | lbs. | | | 191 | | |
| 1 1/2 x 3/4 x 4 in. | 0 120 | lbs. | | | 198 | | |
| 1 1/2 x 3/4 x 4 in. | 0 118 | lbs. | | | 195 | | |
| 1 1/2 x 3/4 x 4 in. | 0 106 | lbs. | | | 20 | | |
| 1 1/2 x 3/4 x 4 in. | 0 094 | lbs. | | | 26 | | |
| 1 1/2 x 3/4 x 4 in. | 0 088 | lbs. | | | 203 | | |
| 1 1/2 x 3/4 x 4 in. | 0 098 | lbs. | | | 203 | | |
| 1 1/2 x 3/4 x 4 in. | 0 114 | lbs. | | | 204 | | |
| 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**: 7 028 lbs Min 20%: 140 Max 25%: 176

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-28 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 3 Tech: MA Reviewer: [illegible]

| | | 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 | 007 | 316 | 317 | 19 | 33 | 318 | 319 | 41 | 322 |
| 2022-06-28 | 17:00 | 61,4737 | | 34,3601 | | 109,3631 | | 35,3470 | | 0,1263 |
| 2022-06-29 | 9:00 | 61,4737 | | 34,3600 | | 109,3630 | | 35,3471 | | 0,1263 |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | | 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 | 007 | 316 | 317 | 19 | 33 | 318 | 319 | 41 | 322 |
| 2022-06-29 | 15:00 | 61,4741 | | 34,3626 | | 109,3636 | | 35,3482 | | 0,1266 |
| 2022-07-06 | 8:00 | 61,4739 | | 34,3607 | | 109,3632 | | 35,3472 | | 0,1264 |
| 2022-07-07 | 8:00 | 61,4739 | | 34,3607 | | 109,3632 | | 35,3473 | | 0,1264 |
| | | | | | | | | | | |
| | | | | | | | | | | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: PZ20272 Run: 3 Tech: MM Reviewer: DO

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Pre-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 35 | 320 | 321 | 42 |
| 2022-06-28 | 17:00 | 109,2826 | | 34,0072 | |
| 2022-06-29 | 9:30 | 109,2826 | | 34,0073 | |
| | | | | | |
| | | | | | |

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Post-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 35 | 320 | 321 | 42 |
| ~~2022-06-29~~ ~~2022-07-06~~ | 15:00 | 109,2829 | | 34,0104 | |
| 2022-07-06 | 8:30 | 109,2828 | | 34,0084 | |
| 2022-07-07 | 8:30 | 109,2828 | | 34,0084 | |
| | | | | | |
| | | | | | |

# Paramètres

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

| | |
|---|---|
| Code verrouillage: | HEA |

## Description du test

| | | |
|---|---|---|
| Test standard | EPA | |
| Run # | 3 | |
| Date | 29-06-2022 | |
| Technicien | m.m | |
| Project # | pi 20272 | |

## Description de l'unité

| | | |
|---|---|---|
| Manufacturier | heaerthstone | |
| Modèle | 8060 | |
| Combustion system | Cat | |
| Appliance type | wood stove | |
| Firebox volume | 1 | 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): | 1,007 | Dimensionless |
| Equipment number (DGM #1): | em 178 | |
| Calibration Factor (DGM #2): | 1,005 | Dimensionless |
| Equipment number (DGM #2): | em 318 | |
| Calibration Factor (DGM #3): | 0,988 | |
| Equipment number (DGM #3): | em 179 | Dimensionless |

## Tunnel

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

| | |
|---|---|
| **Project nu.** | pi 20272 |
| **Date** | 29-06-2022 |
| **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): | 101,5 | 101,5 |
| Barometer (in.Hg): | 29,972939 | 29,97293872 |
| Dry Bulb (F): | 77,8 | 83,3 |
| Humidity (%): | 44,9 | 33,9 |
| Air velocity (ft/min) | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DGM #1 | Final: | 23231,441 | cuft | Final: | 657841,150 | Liter |
| | Initial: | 23210,338 | cuft | Initial: | 657243,560 | Liter |
| DGM #2 | Final: | 14325,359 | cuft | Final: | 405648,980 | Liter |
| | Initial: | 14304,732 | cuft | Initial: | 405064,900 | Liter |
| DGM room | Final: | 13813,711 | cuft | Final: | 391160,720 | Liter |
| | Initial: | 13796,522 | cuft | Initial: | 390674,000 | Liter |

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 255

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

| | |
|---|---|
| **Project nu.** | pi 20272 |
| **Date** | 29-06-2022 |
| **Technicien** | m.m |

## Preload data sheet

| Test Load Weight: Lower | Ideal | Upper |
|---|---|---|
| 6,30 | 7,00 | 7,70 |

Load Volume: 0,4253 cu. ft

Number of Spaces:

Spacer weight (lbs):

Loading Density: 14,376 lbs./ft3

Load Density (wet): 33,798 lbs./ft3

Dry Wood Density: 28,023754

| Piece Size (in): Thick | Wide | x Length | Weight lbs | Meter Moisture Content Dry Uncorrected % | | | | | Ave. MC x Weight | Volume Cubic Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 3,5 | 14 | 1,224 | 20,4 | 20,2 | 20,2 | 20,1 | 20 | 24,70032 | 73,50 |
| 1,5 | 3,5 | 14 | 1,448 | 21 | 21,1 | 21,1 | 21,4 | 20 | 30,29216 | 73,50 |
| 1,5 | 3,5 | 14 | 1,464 | 20,8 | 20,6 | 20,7 | 20,7 | 20,8 | 30,33408 | 73,50 |
| 1,5 | 3,5 | 7 | 0,72 | 20,1 | 20,2 | 20,4 | 20,5 | 20,4 | 14,6304 | 36,75 |
| 1,5 | 3,5 | 7 | 0,814 | 20,1 | 20,6 | 20,4 | 20,6 | 20,7 | 16,67072 | 36,75 |
| 1,5 | 3,5 | 7 | 0,744 | 20,1 | 20,6 | 20,1 | 20,2 | 20,6 | 15,11808 | 36,75 |
| 1,5 | 3,5 | 7 | 0,784 | 20,6 | 20,8 | 20,9 | 20,7 | 20,8 | 16,27584 | 36,75 |
| | | | | | | | | | | 0,00 |
| 1,5 | 3,5 | 14 | 1,204 | 21,1 | 20,8 | 20,7 | 20,7 | 20,6 | 25,01912 | 73,50 |
| 1,5 | 3,5 | 14 | 1,48 | 19,9 | 20 | 20,1 | 20,1 | 20 | 29,6296 | 73,50 |
| 1,5 | 3,5 | 14 | 1,478 | 20,6 | 20,5 | 20,4 | 20,3 | 20,4 | 30,21032 | 73,50 |
| 1,5 | 3,5 | 7 | 0,716 | 20,6 | 20,7 | 20,8 | 20,8 | 20,6 | 14,8212 | 36,75 |
| 1,5 | 3,5 | 7 | 0,808 | 21 | 20,9 | 20,8 | 20,6 | 20,7 | 16,8064 | 36,75 |
| 1,5 | 3,5 | 7 | 0,754 | 21,1 | 21,3 | 21,4 | 21,3 | 21,4 | 16,0602 | 36,75 |
| 1,5 | 3,5 | 7 | 0,738 | 21 | 21,3 | 21,3 | 21,3 | 21,2 | 15,66036 | 36,75 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00

# Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,16 in. H20 absolute value
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=**
0,937

**Pour un tunnel moins de 12", prendre 4 lectures**

| | TUNNEL VELOCITY | TUNNEL TEMP | SQUARE ROOT |
|---|---|---|---|
| | In. wc | °F | |
| A center | 0,070 | 74,39 | 0,2646 |
| B center | 0,069 | 74,32 | 0,2627 |
| A1 | 0,056 | 74,39 | 0,2366 |
| A2 | 0,058 | 74,34 | 0,2408 |
| A3 | 0,061 | 74,34 | 0,2470 |
| A4 | 0,056 | 74,33 | 0,2366 |
| | | | |
| B1 | 0,057 | 74,320 | 0,2387 |
| B2 | 0,058 | 74,390 | 0,2408 |
| B3 | 0,069 | 74,390 | 0,2627 |
| B4 | 0,057 | 74,470 | 0,2387 |
| AVERAGE | 0,0611 | 74,3680 | 0,2469 |

| | |
|---|---|
| **Project nu.** | pi 20272 |
| **Date** | 29-06-2022 |
| **Technicien** | m.m |

# FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,3 | 7,0 | 7,7 |

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

Load Volume: 0,18 cu. ft

Loading Density: 7,0 lbs./ft3

Number of Spaces: 12

Spacer weight: lbs

Load Density (wet): 31,8 lbs./ft3

Dry Wood Density: 26,4 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 | 15 | 1,34 | 19,10 | 19,20 | 19,30 | 19,40 | 19,30 | 25,84692 | 78,75 | 19,3 |
| 1,5 | 3,5 | 15 | 1,52 | 20,80 | 20,30 | 20,40 | 20,30 | 20,40 | 31,10968 | 78,75 | 20,4 |
| 1,5 | 3,5 | 15 | 1,49 | 21,00 | 20,70 | 20,80 | 20,60 | 20,40 | 30,7602 | 78,75 | 20,7 |
| 1,5 | 3,5 | 15 | 1,44 | 21,10 | 20,50 | 20,60 | 20,40 | 20,40 | 29,7052 | 78,75 | 20,6 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 0,75 | 4 | 0,12 | | | 19,10 | | | 2,3302 | 4,50 | 19,1 |
| 1,5 | 0,75 | 4 | 0,11 | | | 19,30 | | | 2,0844 | 4,50 | 19,3 |
| 1,5 | 0,75 | 4 | 0,10 | | | 19,60 | | | 1,8816 | 4,50 | 19,6 |
| 1,5 | 0,75 | 4 | 0,09 | | | 19,50 | | | 1,794 | 4,50 | 19,5 |
| 1,5 | 0,75 | 4 | 0,08 | | | 19,10 | | | 1,528 | 4,50 | 19,1 |
| 1,5 | 0,75 | 4 | 0,12 | | | 19,80 | | | 2,376 | 4,50 | 19,8 |
| 1,5 | 0,75 | 4 | 0,12 | | | 19,40 | | | 2,2892 | 4,50 | 19,4 |
| 1,5 | 0,75 | 4 | 0,11 | | | 20,00 | | | 2,12 | 4,50 | 20,0 |
| 1,5 | 0,75 | 4 | 0,09 | | | 20,00 | | | 1,88 | 4,50 | 20,0 |
| 1,5 | 0,75 | 4 | 0,09 | | | 20,10 | | | 1,7688 | 4,50 | 20,1 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,30 | | | 1,9894 | 4,50 | 20,3 |
| 1,5 | 0,75 | 4 | 0,11 | | | 20,40 | | | 2,3256 | 4,50 | 20,4 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 |

## 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 | 7 | 316 | 317 | 19 | 33 | 318 | 319 | 41 | 35 | 320 | 321 | 42 | 322 | | |
| Before (1) | | | | | | | | | | | | | | | |
| Before (2) | | | | | | | | | | | | | | | |
| Before (3) | | | | | | | | | | | | | | | |
| Before (4) | | | | | | | | | | | | | | | |
| Before (5) | 61,4737 | | 34,3601 | | 109,3631 | | 35,3470 | | 109,2826 | | 34,0072 | | 0,1263 | 2022-06-28 | 17:00 |
| Before (6) | 61,4737 | | 34,3600 | | 109,3630 | | 35,3471 | | 109,2826 | | 34,0073 | | 0,1263 | 2022-06-29 | 09:00 |
| After (1) | 61,4741 | | 34,3626 | | 109,3636 | | 35,3482 | | 109,2829 | | 34,0104 | | 0,1266 | 2022-06-29 | 15:00 |
| After (2) | 61,4739 | | 34,3607 | | 109,3632 | | 35,3472 | | 109,2828 | | 34,0084 | | 0,1264 | 2022-07-06 | 08:00 |
| After (3) | 61,4739 | | 34,3607 | | 109,3632 | | 35,3473 | | 109,2828 | | 34,0084 | | 0,1264 | 2022-07-07 | 08:00 |
| After (4) | | | | | | | | | | | | | | | |
| After (5) | | | | | | | | | | | | | | | |
| After (6) | 61,4739 | | 34,3607 | | 109,3632 | | 35,3473 | | 109,2828 | | 34,0084 | | 0,1264 | 2022-07-07 | 08:00 |
| Difference | 0,0002 | 0,0000 | 0,0007 | 0,0000 | 0,0002 | 0,0000 | 0,0002 | 0,0000 | 0,0002 | 0,0000 | 0,0011 | 0,0000 | 0,0001 | | |
| Total (mg) | | 0,9 | | | | 1,3 | | | | 1,3 | | | 0,1 | | |
| Total ajusté (mg) | | **0,80** | | | | **1,20** | | | | **1,20** | | | | | |

| | |
|---|---|
| **Project nu.** | pi 20272 |
| **Date** | 29-06-2022 |
| **Technicien** | m.m |

SFBA EPA EMISSION RESULTS

**Test Duration:** **108** min

| | | | |
|---|---|---|---|
| PRESSURE FACTOR: | DGM 1 | 0,97661 | |
| | DGM 2 | 0,97958 | |
| | DGM 3 | 1,00177 | |
| TEMPERATURE FACTORS | DGM 1 | 0,97590 | |
| | DGM 2 | 0,96824 | |
| | DGM 3 | 0,97780 | |
| VOLUMES SAMPLED | DGM 1 | 20,245 | SCft |
| | DGM 2 | 19,670 | Scft |
| | DGM 3 | 16,637 | SCft |

TOTAL TUNNEL VOLUME : 34571

SAMPLE RATIOS

| | |
|---|---|
| Sample Train 1: | 1707,637 |
| Sample Train 2: | 1757,550 |

Paticulate concentration

| | | |
|---|---|---|
| Sample Train 1 | **0,000064** | g/dscf |
| Sample Train 2 | **0,000066** | g/dscf |
| Room | **0,000006** | g/dscf |

TOTAL EMISSIONS

| | | |
|---|---|---|
| Sample Train 1 | **2,01** | g |
| Sample Train 2 | **2,08** | g |

EMISSION RATES

| | | |
|---|---|---|
| Sample Train 1 | **1,12** | g/hr |
| Sample Train 2 | **1,15** | g/hr |

1st hour emission rate **1,54** g/hr

| | Train 1 | Train 2 |
|---|---|---|
| Cs | 6,421E-05 | 6,609E-05 |

RESULTS

**Average emission rate:** 1,14 g/hr

Burn Rate : 1,474 Dry kg/hr

BAROMETRIC PRESSURE

| | | |
|---|---|---|
| Average: | 29,972939 | in Hg |
| Start: | 29,972939 | in Hg |
| End: | 29,972939 | in Hg |

DGM CONTROLLER VALUES

| | | | |
|---|---|---|---|
| DGM 1 | Final: | 23231,441 | Cuft |
| | Initial: | 23210,338 | Cuft |
| DGM 2 | Final: | 14325,359 | Cuft |
| | Initial: | 14304,732 | Cuft |
| DGM #3 | Final: | 13813,711 | Cuft |
| | Initial: | 13796,522 | Cuft |

TEMPERATURES

| | | |
|---|---|---|
| DGM 1 | 541,041 | °R |
| DGM 2 | 545,320 | °R |

CALIBRATION FACTORS

| | |
|---|---|
| DGM 1 | 1,0066 |
| DGM 2 | 1,0054 |
| DGM #3 | 0,9882 |

TUNNEL FLOW RATE: 320,104 Dscfm

PARTICULATE CATCH

| | | |
|---|---|---|
| Total Sample Train 1: | 1,30 | mg |
| Total Sample Train 2: | 1,30 | mg |
| Total Sample Train 1 1st hour: | 0,90 | mg |

DEVIATION: 1,59%

| * | | * | * | * | * | *1 | *2 | *3 | *4 | *5 | *6 | *7 | *8 | *9 | Mass flow 1 | DGM 1 | DGM 1 | Filter 1 | Mass flow 2 | DGM 2 | DGM 2 | Filter 2 | Tunnel Velo | Flue draft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed | | Weight | | | | Flue | Room | Tunnel | Unit | Unit | Unit | Unit | Unit | Catalyst | Reading | Inlet T | Outlet T | Temp | Reading | Inlet T | Outlet T | Temp | Pressure | Pressure |
| Time | Raw data row | Remaining | CO | $CO_2$ | $O_2$ | Gas | Temp | Dry Bulb | Top | Back | R.Side | L.Side | Bottom | | | | | | | | | | in wc | in wc |
| min | | lbs | % | % | % | °F | °F | °F | °F | °F | °F | °F | °F | °F | cuft/min | oF | oF | oF | cuft/min | oF | oF | oF | in wc | in wc |
| 0,00 | 255,00 | 6,9 | 0,1 | 2,9 | 0,0 | 334,2 | 78,6 | 99,6 | 388,0 | 336,2 | 595,8 | 637,8 | 447,4 | 468,8 | 0,19 | 79,10 | 79,11 | 83,87 | 0,18 | 79,63 | 80,69 | 85,42 | 0,07 | 0,05 |
| 1,0 | 256,0 | 6,8 | 0,3 | 2,8 | 0,0 | 314,4 | 78,5 | 95,1 | 382,5 | 332,2 | 590,5 | 631,7 | 448,9 | 579,9 | 0,19 | 79,22 | 79,19 | 83,80 | 0,18 | 79,88 | 80,83 | 85,25 | 0,07 | 0,06 |
| 2,0 | 257,0 | 6,8 | 0,1 | 4,2 | 0,0 | 318,2 | 78,7 | 95,5 | 378,0 | 328,7 | 583,0 | 622,3 | 450,6 | 620,3 | 0,19 | 79,37 | 79,26 | 83,90 | 0,18 | 80,10 | 80,97 | 85,22 | 0,07 | 0,06 |
| 3,0 | 258,0 | 6,8 | 0,1 | 4,9 | 0,0 | 320,6 | 78,6 | 95,8 | 375,4 | 326,5 | 572,8 | 610,3 | 452,1 | 619,2 | 0,19 | 79,51 | 79,31 | 84,00 | 0,18 | 80,35 | 81,13 | 85,29 | 0,07 | 0,06 |
| 4,0 | 259,0 | 6,7 | 0,1 | 5,8 | 0,0 | 321,4 | 78,8 | 95,8 | 373,5 | 325,0 | 562,4 | 597,6 | 453,3 | 621,3 | 0,19 | 79,55 | 79,33 | 84,15 | 0,18 | 80,57 | 81,26 | 85,31 | 0,07 | 0,07 |
| 5,0 | 260,0 | 6,6 | 0,1 | 6,9 | 0,0 | 326,6 | 78,5 | 95,6 | 376,3 | 325,7 | 551,6 | 585,0 | 454,0 | 651,8 | 0,19 | 79,55 | 79,36 | 84,21 | 0,18 | 80,73 | 81,39 | 85,31 | 0,06 | 0,07 |
| 6,0 | 261,0 | 6,5 | 0,1 | 11,7 | 0,0 | 348,2 | 78,5 | 96,7 | 386,9 | 329,7 | 542,3 | 573,2 | 454,5 | 726,6 | 0,19 | 79,56 | 79,39 | 84,35 | 0,18 | 80,92 | 81,52 | 85,35 | 0,07 | 0,07 |
| 7,0 | 262,0 | 6,4 | 0,1 | 12,0 | 0,0 | 359,8 | 78,7 | 97,5 | 398,1 | 334,2 | 534,3 | 562,3 | 454,5 | 741,8 | 0,19 | 79,57 | 79,40 | 84,48 | 0,18 | 81,11 | 81,62 | 85,44 | 0,07 | 0,07 |
| 8,0 | 263,0 | 6,3 | 0,1 | 12,1 | 0,0 | 375,5 | 78,5 | 98,0 | 410,1 | 338,8 | 527,4 | 552,0 | 454,2 | 801,2 | 0,19 | 79,56 | 79,39 | 84,68 | 0,18 | 81,30 | 81,69 | 85,52 | 0,07 | 0,07 |
| 9,0 | 264,0 | 6,2 | 0,2 | 13,6 | 0,0 | 392,0 | 78,6 | 98,9 | 424,2 | 344,3 | 520,8 | 543,5 | 453,5 | 817,3 | 0,19 | 79,56 | 79,40 | 84,85 | 0,18 | 81,46 | 81,79 | 85,64 | 0,07 | 0,08 |
| 10,0 | 265,0 | 6,0 | 0,1 | 13,9 | 0,0 | 400,0 | 78,6 | 98,7 | 438,3 | 348,0 | 515,8 | 535,4 | 452,6 | 826,3 | 0,19 | 79,54 | 79,40 | 85,00 | 0,18 | 81,62 | 81,86 | 85,69 | 0,07 | 0,07 |
| 11,0 | 266,0 | 5,9 | 0,1 | 13,8 | 0,0 | 403,8 | 78,7 | 99,4 | 451,4 | 351,7 | 512,9 | 529,3 | 451,5 | 825,7 | 0,19 | 79,55 | 79,42 | 85,16 | 0,18 | 81,78 | 81,94 | 85,74 | 0,07 | 0,08 |
| 12,0 | 267,0 | 5,8 | 0,1 | 13,7 | 0,0 | 409,1 | 78,7 | 100,3 | 462,1 | 355,5 | 510,5 | 524,1 | 450,3 | 851,6 | 0,19 | 79,68 | 79,44 | 85,36 | 0,18 | 82,00 | 82,06 | 85,88 | 0,07 | 0,08 |
| 13,0 | 268,0 | 5,7 | 0,1 | 14,2 | 0,0 | 419,0 | 78,7 | 100,4 | 472,8 | 358,0 | 508,9 | 523,2 | 448,9 | 898,8 | 0,19 | 79,76 | 79,49 | 85,52 | 0,18 | 82,24 | 82,17 | 85,95 | 0,07 | 0,08 |
| 14,0 | 269,0 | 5,5 | 0,6 | 15,1 | 0,0 | 431,6 | 78,9 | 100,6 | 485,3 | 360,3 | 509,2 | 525,2 | 447,4 | 935,9 | 0,19 | 79,91 | 79,53 | 85,65 | 0,18 | 82,47 | 82,29 | 86,01 | 0,06 | 0,08 |
| 15,0 | 270,0 | 5,4 | 0,4 | 14,5 | 0,0 | 441,1 | 79,0 | 100,3 | 497,0 | 362,8 | 510,5 | 528,6 | 446,0 | 935,8 | 0,19 | 79,98 | 79,56 | 85,76 | 0,18 | 82,63 | 82,44 | 86,09 | 0,07 | 0,08 |
| 16,0 | 271,0 | 5,2 | 0,4 | 14,5 | 0,0 | 449,9 | 78,9 | 101,9 | 507,4 | 364,5 | 511,5 | 530,4 | 444,4 | 968,4 | 0,19 | 80,02 | 79,60 | 85,96 | 0,18 | 82,83 | 82,59 | 86,23 | 0,07 | 0,09 |
| 17,0 | 272,0 | 5,1 | 0,5 | 15,0 | 0,0 | 454,3 | 79,1 | 102,7 | 516,7 | 365,8 | 512,6 | 531,4 | 442,8 | 948,0 | 0,19 | 80,13 | 79,67 | 86,20 | 0,18 | 83,07 | 82,74 | 86,41 | 0,07 | 0,08 |
| 18,0 | 273,0 | 4,9 | 0,2 | 14,9 | 0,0 | 454,5 | 79,5 | 102,7 | 524,9 | 366,2 | 516,0 | 531,2 | 441,2 | 939,6 | 0,19 | 80,29 | 79,73 | 86,37 | 0,18 | 83,31 | 82,92 | 86,55 | 0,06 | 0,08 |
| 19,0 | 274,0 | 4,8 | 0,3 | 15,2 | 0,0 | 456,5 | 79,4 | 103,3 | 533,2 | 368,3 | 519,0 | 530,7 | 439,4 | 959,1 | 0,19 | 80,49 | 79,79 | 86,56 | 0,18 | 83,53 | 83,06 | 86,70 | 0,06 | 0,08 |
| 20,0 | 275,0 | 4,7 | 0,3 | 15,7 | 0,0 | 458,8 | 79,5 | 103,7 | 540,2 | 370,6 | 523,4 | 530,4 | 437,8 | 978,1 | 0,19 | 80,76 | 79,88 | 86,73 | 0,18 | 83,80 | 83,23 | 86,87 | 0,07 | 0,08 |
| 21,0 | 276,0 | 4,5 | 0,8 | 15,9 | 0,0 | 461,0 | 79,5 | 102,9 | 546,0 | 372,1 | 529,3 | 530,0 | 436,2 | 976,0 | 0,19 | 80,92 | 79,95 | 86,87 | 0,18 | 84,03 | 83,40 | 86,96 | 0,06 | 0,08 |
| 22,0 | 277,0 | 4,4 | 0,9 | 15,2 | 0,0 | 461,3 | 79,7 | 103,2 | 551,1 | 374,0 | 535,6 | 530,5 | 434,6 | 946,3 | 0,19 | 81,02 | 80,03 | 87,00 | 0,18 | 84,24 | 83,55 | 87,09 | 0,06 | 0,08 |
| 23,0 | 278,0 | 4,2 | 0,8 | 15,0 | 0,0 | 459,9 | 79,9 | 104,3 | 556,6 | 377,2 | 539,5 | 531,1 | 433,1 | 946,2 | 0,19 | 81,00 | 80,09 | 87,15 | 0,18 | 84,33 | 83,73 | 87,21 | 0,06 | 0,08 |
| 24,0 | 279,0 | 4,2 | 0,6 | 14,8 | 0,0 | 459,9 | 79,9 | 103,9 | 560,3 | 378,2 | 542,1 | 533,0 | 431,6 | 946,6 | 0,19 | 81,13 | 80,15 | 87,29 | 0,18 | 84,56 | 83,89 | 87,33 | 0,06 | 0,08 |
| 25,0 | 280,0 | 4,0 | 0,5 | 14,6 | 0,0 | 459,3 | 79,6 | 103,7 | 563,7 | 379,8 | 545,0 | 534,1 | 430,1 | 953,3 | 0,19 | 81,14 | 80,20 | 87,42 | 0,18 | 84,68 | 84,05 | 87,45 | 0,07 | 0,08 |
| 26,0 | 281,0 | 3,9 | 0,7 | 14,7 | 0,0 | 459,9 | 79,8 | 103,3 | 567,0 | 378,6 | 546,6 | 535,1 | 428,5 | 955,9 | 0,19 | 81,03 | 80,23 | 87,48 | 0,18 | 84,74 | 84,13 | 87,47 | 0,06 | 0,08 |
| 27,0 | 282,0 | 3,8 | 1,0 | 14,8 | 0,0 | 460,2 | 79,3 | 102,7 | 570,1 | 378,9 | 548,5 | 536,6 | 426,9 | 966,0 | 0,19 | 80,74 | 80,22 | 87,42 | 0,18 | 84,61 | 84,12 | 87,38 | 0,07 | 0,08 |
| 28,0 | 283,0 | 3,6 | 1,2 | 15,0 | 0,0 | 460,7 | 79,5 | 103,1 | 573,5 | 381,4 | 550,5 | 538,8 | 425,4 | 975,1 | 0,19 | 80,75 | 80,24 | 87,51 | 0,18 | 84,63 | 84,17 | 87,46 | 0,07 | 0,08 |
| 29,0 | 284,0 | 3,5 | 1,5 | 15,1 | 0,0 | 461,0 | 79,5 | 102,0 | 576,4 | 382,7 | 552,2 | 540,7 | 424,0 | 973,2 | 0,19 | 80,85 | 80,26 | 87,50 | 0,18 | 84,74 | 84,26 | 87,45 | 0,07 | 0,08 |
| 30,0 | 285,0 | 3,3 | 1,2 | 16,0 | 0,0 | 457,3 | 79,8 | 101,7 | 580,9 | 383,4 | 554,7 | 543,3 | 422,5 | 958,4 | 0,19 | 80,92 | 80,28 | 87,53 | 0,18 | 84,87 | 84,35 | 87,44 | 0,07 | 0,08 |
| 31,0 | 286,0 | 3,2 | 1,3 | 15,9 | 0,0 | 456,6 | 79,8 | 103,0 | 585,5 | 385,4 | 556,6 | 546,3 | 421,1 | 959,1 | 0,19 | 80,94 | 80,32 | 87,64 | 0,18 | 84,92 | 84,39 | 87,47 | 0,07 | 0,08 |
| 32,0 | 287,0 | 3,1 | 1,4 | 15,9 | 0,0 | 456,4 | 79,6 | 102,6 | 589,7 | 387,3 | 559,1 | 549,7 | 419,6 | 961,0 | 0,19 | 80,85 | 80,33 | 87,70 | 0,18 | 84,91 | 84,46 | 87,52 | 0,07 | 0,08 |
| 33,0 | 288,0 | 2,9 | 1,4 | 15,9 | 0,0 | 456,4 | 79,6 | 103,6 | 594,2 | 390,5 | 560,9 | 553,2 | 418,4 | 964,3 | 0,19 | 80,85 | 80,35 | 87,84 | 0,18 | 84,95 | 84,50 | 87,66 | 0,07 | 0,08 |
| 34,0 | 289,0 | 2,8 | 1,4 | 16,0 | 0,0 | 457,5 | 79,4 | 104,5 | 598,5 | 393,6 | 564,3 | 557,8 | 417,1 | 977,6 | 0,19 | 80,67 | 80,34 | 87,98 | 0,18 | 84,87 | 84,55 | 87,75 | 0,07 | 0,08 |
| 35,0 | 290,0 | 2,7 | 1,5 | 16,0 | 0,0 | 458,0 | 79,9 | 103,9 | 602,3 | 395,9 | 567,0 | 562,1 | 415,9 | 982,4 | 0,19 | 80,73 | 80,36 | 88,05 | 0,18 | 84,92 | 84,62 | 87,82 | 0,07 | 0,08 |
| 36,0 | 291,0 | 2,5 | 1,6 | 16,0 | 0,0 | 458,5 | 79,6 | 102,4 | 607,6 | 397,9 | 570,2 | 566,4 | 414,6 | 983,6 | 0,19 | 80,79 | 80,38 | 87,96 | 0,18 | 85,00 | 84,67 | 87,82 | 0,07 | 0,08 |
| 37,0 | 292,0 | 2,4 | 2,0 | 15,8 | 0,0 | 457,0 | 79,6 | 103,1 | 612,3 | 401,0 | 572,9 | 570,5 | 413,5 | 972,8 | 0,19 | 80,82 | 80,40 | 87,45 | 0,18 | 85,03 | 84,78 | 87,52 | 0,07 | 0,08 |
| 38,0 | 293,0 | 2,3 | 2,3 | 15,7 | 0,0 | 455,4 | 80,1 | 104,1 | 616,4 | 404,8 | 576,2 | 574,3 | 412,4 | 969,5 | 0,19 | 80,96 | 80,44 | 87,14 | 0,18 | 85,16 | 84,89 | 87,17 | 0,07 | 0,08 |
| 39,0 | 294,0 | 2,1 | 2,5 | 15,6 | 0,0 | 454,3 | 80,1 | 103,6 | 620,8 | 406,5 | 579,6 | 579,0 | 411,3 | 970,5 | 0,19 | 81,12 | 80,50 | 87,10 | 0,18 | 85,33 | 85,02 | 86,90 | 0,07 | 0,08 |
| 40,0 | 295,0 | 2,0 | 2,4 | 15,5 | 0,0 | 454,1 | 80,0 | 101,5 | 624,4 | 408,6 | 582,0 | 583,3 | 410,2 | 983,7 | 0,19 | 81,09 | 80,54 | 86,81 | 0,18 | 85,38 | 85,04 | 86,61 | 0,07 | 0,08 |
| 41,0 | 296,0 | 1,9 | 2,1 | 15,5 | 0,0 | 454,4 | 79,8 | 103,4 | 627,8 | 411,1 | 585,9 | 587,4 | 409,2 | 1001,1 | 0,19 | 81,02 | 80,54 | 86,69 | 0,18 | 85,35 | 85,07 | 86,45 | 0,07 | 0,08 |
| 42,0 | 297,0 | 1,8 | 1,6 | 15,4 | 0,0 | 454,3 | 79,6 | 103,9 | 629,8 | 412,9 | 591,0 | 592,7 | 408,2 | 1007,3 | 0,19 | 80,82 | 80,56 | 86,71 | 0,18 | 85,24 | 85,11 | 86,40 | 0,06 | 0,08 |
| 43,0 | 298,0 | 1,7 | 1,2 | 15,2 | 0,0 | 454,5 | 79,9 | 103,3 | 630,6 | 413,2 | 596,4 | 598,1 | 407,3 | 1008,3 | 0,19 | 80,91 | 80,57 | 86,65 | 0,18 | 85,32 | 85,23 | 86,32 | 0,06 | 0,08 |
| 44,0 | 299,0 | 1,6 | 0,8 | 15,1 | 0,0 | 454,4 | 80,1 | 103,6 | 631,5 | 414,4 | 602,1 | 604,0 | 406,5 | 1013,4 | 0,19 | 81,14 | 80,63 | 86,60 | 0,18 | 85,50 | 85,33 | 86,32 | 0,07 | 0,08 |
| 45,0 | 300,0 | 1,6 | 0,5 | 15,0 | 0,0 | 453,2 | 80,1 | 103,8 | 633,8 | 416,9 | 607,2 | 610,5 | 405,7 | 1010,4 | 0,19 | 81,30 | 80,69 | 86,59 | 0,18 | 85,63 | 85,49 | 86,28 | 0,07 | 0,08 |
| 46,0 | 301,0 | 1,5 | 0,1 | 14,3 | 0,0 | 448,0 | 80,3 | 103,1 | 633,9 | 416,4 | 613,3 | 616,3 | 404,8 | 971,1 | 0,19 | 81,47 | 80,78 | 86,59 | 0,18 | 85,82 | 85,62 | 86,29 | 0,06 | 0,08 |
| 47,0 | 302,0 | 1,4 | 0,0 | 13,0 | 0,0 | 439,4 | 80,4 | 103,3 | 631,7 | 414,0 | 619,4 | 622,3 | 404,0 | 932,1 | 0,19 | 81,43 | 80,80 | 86,55 | 0,18 | 85,85 | 85,68 | 86,28 | 0,06 | 0,08 |
| 48,0 | 303,0 | 1,3 | 0,0 | 12,4 | 0,0 | 430,9 | 80,5 | 103,2 | 628,3 | 413,2 | 623,1 | 627,6 | 403,3 | 909,1 | 0,19 | 81,53 | 80,87 | 86,55 | 0,18 | 85,92 | 85,75 | 86,28 | 0,07 | 0,08 |
| 49,0 | 304,0 | 1,3 | 0,0 | 12,0 | 0,0 | 423,1 | 80,5 | 100,6 | 623,4 | 409,9 | 628,5 | 632,0 | 402,4 | 885,6 | 0,19 | 81,77 | 80,95 | 86,39 | 0,18 | 86,08 | 85,84 | 86,19 | 0,06 | 0,07 |
| 50,0 | 305,0 | 1,2 | 0,0 | 11,5 | 0,0 | 416,2 | 80,6 | 101,0 | 617,8 | 409,0 | 632,8 | 636,3 | 401,7 | 867,1 | 0,19 | 81,78 | 80,99 | 86,23 | 0,18 | 86,13 | 85,93 | 86,07 | 0,07 | 0,07 |
| 51,0 | 306,0 | 1,2 | 0,0 | 11,1 | 0,0 | 409,5 | 80,4 | 101,6 | 611,9 | 408,1 | 636,1 | 640,6 | 400,9 | 851,2 | 0,19 | 81,73 | 81,01 | 86,19 | 0,18 | 86,15 | 85,97 | 86,04 | 0,07 | 0,07 |
| 52,0 | 307,0 | 1,2 | 0,0 | 10,8 | 0,0 | 403,9 | 80,6 | 101,1 | 605,3 | 407,3 | 639,1 | 644,4 | 400,2 | 837,4 | 0,19 | 81,80 | 81,06 | 86,14 | 0,18 | 86,23 | 86,04 | 86,02 | 0,07 | 0,07 |
| 53,0 | 308,0 | 1,2 | 0,0 | 10,5 | 0,0 | 398,5 | 80,5 | 101,2 | 598,1 | 405,7 | 642,6 | 648,5 | 399,6 | 823,3 | 0,19 | 81,82 | 81,10 | 86,18 | 0,18 | 86,33 | 86,20 | 86,04 | 0,06 | 0,07 |
| 54,0 | 309,0 | 1,1 | 0,0 | 10,0 | 0,0 | 393,4 | 80,4 | 101,1 | 591,4 | 403,8 | 645,2 | 652,1 | 398,9 | 810,2 | 0,19 | 81,74 | 81,14 | 86,10 | 0,18 | 86,29 | 86,31 | 85,99 | 0,07 | 0,07 |
| 55,0 | 310,0 | 1,1 | 0,0 | 9,6 | 0,0 | 389,3 | 80,4 | 100,2 | 584,1 | 401,4 | 647,6 | 655,4 | 398,3 | 798,9 | 0,19 | 81,67 | 81,17 | 86,10 | 0,18 | 86,27 | 86,41 | 86,00 | 0,07 | 0,07 |
| 56,0 | 311,0 | 1,1 | 0,0 | 9,2 | 0,0 | 384,6 | 80,4 | 98,7 | 576,8 | 398,1 | 648,6 | 657,6 | 397,5 | 790,9 | 0,19 | 81,61 | 81,19 | 85,95 | 0,18 | 86,26 | 86,46 | 85,89 | 0,06 | 0,07 |
| 57,0 | 312,0 | 1,0 | 0,0 | 8,9 | 0,0 | 380,7 | 80,3 | 99,9 | 568,8 | 396,9 | 647,7 | 659,1 | 397,1 | 783,1 | 0,19 | 81,58 | 81,21 | 85,86 | 0,18 | 86,24 | 86,50 | 85,82 | 0,07 | 0,07 |
| 58,0 | 313,0 | 1,0 | 0,0 | 8,8 | 0,0 | 377,5 | 80,2 | 98,9 | 561,0 | 393,6 | 648,1 | 660,7 | 396,5 | 778,8 | 0,19 | 81,51 | 81,22 | 85,85 | 0,18 | 86,18 | 86,50 | 85,80 | 0,07 | 0,07 |
| 59,0 | 314,0 | 0,9 | 0,1 | 8,7 | 0,0 | 375,0 | 80,1 | 98,7 | 552,7 | 390,5 | 647,6 | 661,2 | 395,9 | 775,9 | 0,19 | 81,44 | 81,23 | 85,72 | 0,18 | 86,13 | 86,50 | 85,70 | 0,06 | 0,07 |
| 60,0 | 315,0 | 0,9 | 0,1 | 8,5 | 0,0 | 372,6 | 80,1 | 98,7 | 545,0 | 387,5 | 647,0 | 661,7 | 395,3 | 770,6 | 0,19 | 81,38 | 81,22 | 85,66 | 0,18 | 86,08 | 86,48 | 85,64 | 0,07 | 0,07 |
| 61,0 | 316,0 | 0,9 | 0,1 | 8,4 | 0,0 | 370,6 | 80,3 | 98,2 | 537,0 | 385,8 | 646,1 | 661,7 | 394,9 | 765,5 | 0,19 | 81,38 | 81,24 | 85,59 | 0,18 | 86,05 | 86,53 | 85,57 | 0,07 | 0,07 |
| 62,0 | 317,0 | 0,9 | 0,1 | 8,1 | 0,0 | 368,2 | 80,0 | 99,0 | 529,7 | 383,8 | 645,4 | 661,0 | 394,4 | 758,9 | 0,19 | 81,36 | 81,23 | 85,59 | 0,18 | 86,01 | 86,55 | 85,56 | 0,07 | 0,07 |
| 63,0 | 318,0 | 0,9 | 0,1 | 8,1 | 0,0 | 366,0 | 80,1 | 98,8 | 522,4 | 381,9 | 643,4 | 660,7 | 394,1 | 752,9 | 0,19 | 81,33 | 81,23 | 83,29 | 0,18 | 86,00 | 86,51 | 85,52 | 0,06 | 0,07 |
| 64,0 | 319,0 | 0,8 | 0,1 | 8,1 | 0,0 | 363,7 | 80,0 | 98,3 | 515,2 | 380,2 | 641,1 | 659,6 | 393,7 | 748,9 | 0,19 | 81,30 | 81,26 | 83,26 | 0,18 | 85,99 | 86,53 | 85,43 | 0,07 | 0,07 |
| 65,0 | 320,0 | 0,8 | 0,1 | 8,0 | 0,0 | 362,1 | 80,0 | 98,2 | 508,9 | 378,6 | 639,7 | 659,0 | 393,4 | 744,1 | 0,19 | 81,30 | 81,26 | 83,25 | 0,18 | 86,00 | 86,54 | 85,42 | 0,07 | 0,07 |
| 66,0 | 321,0 | 0,8 | 0,1 | 8,1 | 0,0 | 360,6 | 80,1 | 98,5 | 502,3 | 376,4 | 637,6 | 658,2 | 393,2 | 741,3 | 0,19 | 81,51 | 81,31 | 83,24 | 0,18 | 86,13 | 86,63 | 85,38 | 0,07 | 0,07 |
| 67,0 | 322,0 | 0,8 | 0,1 | 8,0 | 0,0 | 358,6 | 80,3 | 98,1 | 496,2 | 374,8 | 635,6 | 657,1 | 393,0 | 736,5 | 0,19 | 81,58 | 81,36 | 83,29 | 0,18 | 86,16 | 86,69 | 85,33 | 0,07 | 0,07 |
| 68,0 | 323,0 | 0,8 | 0,1 | 7,9 | 0,0 | 357,1 | 80,3 | 98,6 | 490,4 | 372,6 | 634,2 | 656,6 | 392,9 | 731,0 | 0,19 | 81,61 | 81,36 | 83,31 | 0,18 | 86,22 | 86,74 | 85,29 | 0,06 | 0,07 |
| 69,0 | 324,0 | 0,8 | 0,1 | 7,9 | 0,0 | 355,8 | 80,3 | 97,9 | 485,3 | 370,1 | 631,7 | 655,0 | 392,7 | 726,8 | 0,19 | 81,59 | 81,40 | 83,33 | 0,18 | 86,21 | 86,76 | 85,24 | 0,07 | 0,07 |
| 70,0 | 325,0 | 0,7 | 0,1 | 8,0 | 0,0 | 354,5 | 80,2 | 99,5 | 480,1 | 368,9 | 629,0 | 654,7 | 392,7 | 723,6 | 0,19 | 81,58 | 81,41 | 83,35 | 0,18 | 86,21 | 86,79 | 85,23 | 0,07 | 0,06 |
| 71,0 | 326,0 | 0,7 | 0,1 | 8,1 | 0,0 | 352,5 | 80,4 | 97,6 | 475,4 | 365,9 | 627,7 | 653,7 | 392,6 | 717,5 | 0,19 | 81,66 | 81,44 | 83,36 | 0,18 | 86,26 | 86,87 | 85,22 | 0,07 | 0,07 |
| 72,0 | 327,0 | 0,7 | 0,1 | 8,0 | 0,0 | 350,6 | 80,1 | 97,6 | 470,3 | 364,4 | 625,2 | 652,5 | 392,5 | 712,5 | 0,19 | 81,72 | 81,48 | 83,38 | 0,18 | 86,32 | 86,92 | 85,18 | 0,07 | 0,06 |
| 73,0 | 328,0 | 0,7 | 0,1 | 7,9 | 0,0 | 349,6 | 80,2 | 98,7 | 465,8 | 364,3 | 623,2 | 651,4 | 392,6 | 710,0 | 0,19 | 81,70 | 81,48 | 83,41 | 0,18 | 86,34 | 86,97 | 85,18 | 0,07 | 0,06 |
| 74,0 | 329,0 | 0,7 | 0,1 | 7,9 | 0,0 | 348,1 | 79,9 | 98,5 | 461,4 | 363,3 | 620,5 | 649,5 | 392,7 | 707,4 | 0,19 | 81,64 | 81,51 | 83,44 | 0,18 | 86,29 | 87,06 | 85,20 | 0,06 | 0,06 |
| 75,0 | 330,0 | 0,6 | 0,1 | 7,9 | 0,0 | 347,4 | 79,9 | 98,4 | 457,6 | 361,7 | 619,1 | 647,9 | 392,7 | 706,5 | 0,19 | 81,47 | 81,49 | 83,42 | 0,18 | 86,22 | 87,04 | 85,14 | 0,06 | 0,07 |
| 76,0 | 331,0 | 0,6 | 0,1 | 7,9 | 0,0 | 346,1 | 79,9 | 98,1 | 453,5 | 359,2 | 617,1 | 646,2 | 392,7 | 704,7 | 0,19 | 81,41 | 81,46 | 83,45 | 0,18 | 86,17 | 87,04 | 85,09 | 0,07 | 0,06 |
| 77,0 | 332,0 | 0,6 | 0,1 | 8,0 | 0,0 | 345,9 | 80,7 | 97,4 | 450,1 | 359,1 | 615,7 | 644,1 | 392,9 | 704,7 | 0,19 | 81,45 | 81,49 | 83,48 | 0,18 | 86,18 | 87,00 | 85,03 | 0,07 | 0,06 |
| 78,0 | 333,0 | 0,6 | 0,1 | 8,0 | 0,0 | 346,3 | 80,9 | 97,4 | 446,6 | 357,6 | 613,9 | 642,1 | 393,0 | 707,1 | 0,19 | 81,54 | 81,50 | 83,45 | 0,18 | 86,22 | 87,02 | 85,00 | 0,07 | 0,06 |
| 79,0 | 334,0 | 0,6 | 0,1 | 8,1 | 0,0 | 346,3 | 81,1 | 97,4 | 443,4 | 356,5 | 612,1 | 641,0 | 393,1 | 707,9 | 0,19 | 81,65 | 81,52 | 83,45 | 0,18 | 86,31 | 87,07 | 84,94 | 0,07 | 0,06 |
| 80,0 | 335,0 | 0,5 | 0,1 | 8,1 | 0,0 | 346,7 | 81,1 | 97,7 | 440,2 | 355,1 | 610,6 | 639,6 | 393,3 | 707,8 | 0,19 | 81,66 | 81,53 | 83,48 | 0,18 | 86,29 | 87,07 | 84,91 | 0,07 | 0,06 |
| 81,0 | 336,0 | 0,5 | 0,1 | 8,1 | 0,0 | 346,5 | 81,3 | 96,9 | 437,5 | 353,4 | 610,0 | 638,0 | 393,5 | 707,9 | 0,19 | 81,74 | 81,56 | 83,50 | 0,18 | 86,32 | 87,08 | 84,88 | 0,06 | 0,06 |
| 82,0 | 337,0 | 0,5 | 0,1 | 8,1 | 0,0 | 345,8 | 81,2 | 95,8 | 434,8 | 351,4 | 607,6 | 636,4 | 393,6 | 707,0 | 0,19 | 81,79 | 81,57 | 83,50 | 0,18 | 86,35 | 87,05 | 84,78 | 0,07 | 0,06 |
| 83,0 | 338,0 | 0,5 | 0,1 | 8,1 | 0,0 | 346,4 | 81,3 | 96,6 | 431,9 | 350,6 | 607,5 | 635,6 | 393,9 | 706,7 | 0,19 | 81,85 | 81,62 | 83,52 | 0,18 | 86,40 | 87,10 | 84,74 | 0,06 | 0,06 |
| 84,0 | 339,0 | 0,5 | 0,1 | 8,0 | 0,0 | 345,5 | 80,8 | 97,2 | 429,6 | 350,4 | 606,1 | 634,2 | 394,2 | 706,5 | 0,19 | 81,91 | 81,62 | 83,55 | 0,18 | 86,47 | 87,14 | 84,73 | 0,07 | 0,06 |
| 85,0 | 340,0 | 0,4 | 0,1 | 8,1 | 0,0 | 346,1 | 80,7 | 96,9 | 426,7 | 349,4 | 604,4 | 634,4 | 394,6 | 709,8 | 0,19 | 82,01 | 81,67 | 83,52 | 0,18 | 86,55 | 87,21 | 84,73 | 0,07 | 0,06 |
| 86,0 | 341,0 | 0,4 | 0,1 | 8,0 | 0,0 | 347,4 | 80,8 | 97,4 | 424,5 | 348,1 | 604,0 | 633,0 | 395,0 | 710,5 | 0,19 | 82,17 | 81,72 | 83,55 | 0,18 | 86,64 | 87,33 | 84,76 | 0,07 | 0,06 |
| 87,0 | 342,0 | 0,4 | 0,1 | 8,0 | 0,0 | 348,6 | 80,5 | 97,3 | 422,1 | 347,2 | 603,8 | 632,1 | 395,3 | 712,9 | 0,19 | 82,36 | 81,80 | 83,54 | 0,18 | 86,79 | 87,50 | 84,74 | 0,06 | 0,07 |
| 88,0 | 343,0 | 0,4 | 0,1 | 8,0 | 0,0 | 349,0 | 80,6 | 96,9 | 419,8 | 345,8 | 602,7 | 630,6 | 395,8 | 714,8 | 0,19 | 82,46 | 81,87 | 83,52 | 0,18 | 86,93 | 87,66 | 84,71 | 0,07 | 0,07 |
| 89,0 | 344,0 | 0,4 | 0,1 | 7,9 | 0,0 | 349,0 | 80,6 | 96,9 | 417,8 | 343,5 | 601,3 | 629,9 | 396,3 | 716,0 | 0,19 | 82,39 | 81,92 | 83,52 | 0,18 | 86,97 | 87,71 | 84,68 | 0,07 | 0,06 |
| 90,0 | 345,0 | 0,3 | 0,1 | 7,9 | 0,0 | 348,3 | 80,3 | 95,8 | 415,7 | 341,3 | 600,5 | 628,6 | 396,4 | 712,0 | 0,19 | 82,25 | 81,94 | 83,51 | 0,18 | 86,94 | 87,74 | 84,62 | 0,07 | 0,07 |
| 91,0 | 346,0 | 0,3 | 0,1 | 7,6 | 0,0 | 347,6 | 80,7 | 96,7 | 413,6 | 340,5 | 600,1 | 627,8 | 396,9 | 713,4 | 0,19 | 82,26 | 81,97 | 83,54 | 0,18 | 86,93 | 87,80 | 84,59 | 0,07 | 0,06 |
| 92,0 | 347,0 | 0,3 | 0,1 | 7,6 | 0,0 | 348,6 | 80,7 | 96,6 | 411,4 | 339,0 | 599,8 | 627,0 | 397,2 | 716,5 | 0,19 | 82,34 | 81,97 | 83,54 | 0,18 | 86,98 | 87,85 | 84,69 | 0,07 | 0,06 |
| 93,0 | 348,0 | 0,3 | 0,1 | 7,7 | 0,0 | 349,1 | 80,9 | 97,0 | 409,5 | 337,4 | 598,9 | 625,5 | 397,7 | 717,8 | 0,19 | 82,34 | 82,01 | 83,59 | 0,18 | 86,99 | 87,94 | 84,87 | 0,07 | 0,06 |
| 94,0 | 349,0 | 0,3 | 0,1 | 7,7 | 0,0 | 349,3 | 80,4 | 98,0 | 407,6 | 337,0 | 597,5 | 624,6 | 398,1 | 720,6 | 0,19 | 82,20 | 82,04 | 83,59 | 0,18 | 86,87 | 88,02 | 85,09 | 0,07 | 0,06 |
| 95,0 | 350,0 | 0,2 | 0,1 | 7,8 | 0,0 | 350,2 | 80,6 | 96,9 | 405,8 | 334,7 | 596,2 | 622,9 | 398,4 | 723,0 | 0,19 | 82,21 | 82,03 | 83,62 | 0,18 | 86,91 | 88,01 | 85,19 | 0,07 | 0,06 |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 96,0 | 351,0 | 0,2 | 0,1 | 7,7 | 0,0 | 351,1 | 80,3 | 98,1 | 404,0 | 334,6 | 595,7 | 621,6 | 398,8 | 724,1 | 0,19 | 82,17 | 82,05 | 83,62 | 0,18 | 86,89 | 88,02 | 85,36 | 0,07 | 0,06 |
| 97,0 | 352,0 | 0,2 | 0,1 | 7,7 | 0,0 | 351,4 | 80,2 | 98,2 | 402,7 | 333,1 | 595,4 | 620,1 | 399,0 | 722,0 | 0,19 | 82,11 | 82,03 | 83,63 | 0,18 | 86,84 | 87,97 | 85,51 | 0,07 | 0,06 |
| 98,0 | 353,0 | 0,2 | 0,1 | 7,8 | 0,0 | 348,1 | 80,6 | 97,5 | 400,9 | 332,0 | 593,8 | 618,4 | 399,3 | 700,6 | 0,19 | 82,16 | 82,04 | 83,64 | 0,18 | 86,86 | 87,95 | 85,63 | 0,07 | 0,06 |
| 99,0 | 354,0 | 0,2 | 0,1 | 7,8 | 0,0 | 344,3 | 80,7 | 96,4 | 399,4 | 331,6 | 593,1 | 616,9 | 399,6 | 692,9 | 0,19 | 82,19 | 82,06 | 83,67 | 0,18 | 86,90 | 87,95 | 85,65 | 0,07 | 0,06 |
| 100,0 | 355,0 | 0,2 | 0,1 | 7,8 | 0,0 | 342,4 | 80,6 | 95,9 | 397,8 | 331,1 | 591,7 | 615,2 | 399,8 | 690,8 | 0,19 | 82,11 | 82,06 | 83,69 | 0,18 | 86,86 | 87,92 | 85,70 | 0,07 | 0,06 |
| 101,0 | 356,0 | 0,1 | 0,1 | 7,8 | 0,0 | 342,0 | 80,7 | 96,0 | 396,4 | 331,4 | 590,3 | 613,9 | 400,0 | 690,5 | 0,19 | 82,03 | 82,03 | 83,69 | 0,18 | 86,79 | 87,87 | 85,74 | 0,07 | 0,06 |
| 102,0 | 357,0 | 0,1 | 0,1 | 7,8 | 0,0 | 341,4 | 80,7 | 96,0 | 394,8 | 332,4 | 589,4 | 612,4 | 400,1 | 689,6 | 0,19 | 82,01 | 82,04 | 83,72 | 0,18 | 86,78 | 87,81 | 85,78 | 0,07 | 0,06 |
| 103,0 | 358,0 | 0,1 | 0,1 | 7,8 | 0,0 | 341,5 | 80,4 | 96,0 | 393,4 | 332,8 | 588,7 | 611,3 | 400,4 | 692,6 | 0,19 | 81,94 | 82,05 | 83,72 | 0,18 | 86,74 | 87,78 | 85,88 | 0,06 | 0,06 |
| 104,0 | 359,0 | 0,1 | 0,1 | 7,7 | 0,0 | 342,0 | 80,3 | 95,4 | 392,3 | 333,5 | 586,2 | 610,5 | 400,6 | 696,7 | 0,19 | 81,92 | 82,02 | 83,71 | 0,18 | 86,67 | 87,72 | 85,95 | 0,07 | 0,06 |
| 105,0 | 360,0 | 0,1 | 0,1 | 7,6 | 0,0 | 342,1 | 80,5 | 95,9 | 391,0 | 333,5 | 585,1 | 609,0 | 401,0 | 695,2 | 0,19 | 81,93 | 82,01 | 83,73 | 0,18 | 86,66 | 87,69 | 85,97 | 0,07 | 0,06 |
| 106,0 | 361,0 | 0,1 | 0,1 | 7,5 | 0,0 | 342,9 | 80,4 | 95,6 | 389,8 | 333,6 | 583,4 | 607,3 | 401,3 | 696,1 | 0,19 | 82,00 | 82,05 | 83,76 | 0,18 | 86,70 | 87,74 | 86,06 | 0,07 | 0,06 |
| 107,0 | 362,0 | 0,1 | 0,1 | 7,5 | 0,0 | 342,7 | 80,5 | 96,3 | 388,4 | 333,5 | 582,2 | 606,9 | 401,8 | 695,5 | 0,19 | 82,10 | 82,07 | 83,74 | 0,18 | 86,76 | 87,79 | 86,14 | 0,07 | 0,06 |
| 108,0 | 363,0 | 0,0 | 0,1 | 7,5 | 0,0 | 343,1 | 80,6 | 95,4 | 386,8 | 331,9 | 581,8 | 605,0 | 402,1 | 698,2 | 0,19 | 82,11 | 82,10 | 83,72 | 0,18 | 86,76 | 87,84 | 86,17 | 0,06 | 0,06 |

Manufacturer: heaerthstone
Model: 8060

Run: 3
Project #: pi 20272
Test Duration: 108 min

| | HHV | LHV |
|---|---|---|
| Eff | 75,65% | 81,77% |
| Comb Eff | 96,65% | 96,65% |
| HT Eff | 78,28% | 84,60% |
| Output | 21 618 | kJ/h |
| Burn Rate | 1,44 | kg/h |
| Grams CO | 124 | g |
| Input | 28 575 | kJ/h |
| MC wet | 16,79 | |

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

Ultimate $CO_2$
$CO_{2\text{-ult}}$ 19,64
$F_0$
1,062

Overall Heating Efficiency: 75,65%
Combustion Efficiency: 96,65%
Heat Transfer Efficiency: 78,28%

Heat Output: 20 507 Btu/h
Heat Input: 27 107 Btu/h
Burn Duration: 1,80 h
Burn Rate: 3,18 lb/h
Stack Temp: 390,0 Deg. F

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Averages | 0,39 | 10,66 | 1,06 | 20,21 | 9,36 | 198,62 | 26,66 | 0,98 | 0,77 | #DIV/0! |
| INPUT DATA | | | Oxygen Calculation | | | Input Data | | Combust | Heat | Net |
| Elapsed Time | Weight Remaining (kg) | % CO [e] | % $CO_2$ [d] | Excess Air EA | Total $O_2$ | Calc. % $O_2$ [g] | Flue Gas (°C) | Room Temp (°C) | Eff % | Transfer % | Eff % |
| 0,00 | 3,12 | 0,15 | 2,90 | 544,0% | 20,74 | 17,76 | 167,9 | 25,9 | 97,5% | 59,3% | 57,9% |
| 1,00 | 3,07 | 0,34 | 2,82 | 520,5% | 20,73 | 17,74 | 156,9 | 25,8 | 92,5% | 61,1% | 56,5% |
| 2,00 | 3,07 | 0,10 | 4,16 | 360,8% | 20,66 | 16,45 | 159,0 | 25,9 | 99,1% | 69,4% | 68,8% |
| 3,00 | 3,07 | 0,08 | 4,93 | 292,7% | 20,61 | 15,65 | 160,3 | 25,9 | 99,6% | 72,1% | 71,9% |
| 4,00 | 3,03 | 0,06 | 5,81 | 234,3% | 20,55 | 14,71 | 160,8 | 26,0 | 99,8% | 74,6% | 74,5% |
| 5,00 | 2,98 | 0,05 | 6,86 | 184,0% | 20,48 | 13,59 | 163,7 | 25,8 | 99,9% | 76,4% | 76,4% |
| 6,00 | 2,94 | 0,06 | 11,67 | 67,5% | 20,17 | 8,47 | 175,6 | 25,9 | 99,8% | 80,6% | 80,4% |
| 7,00 | 2,89 | 0,06 | 12,01 | 62,8% | 20,14 | 8,10 | 182,1 | 25,9 | 99,8% | 80,4% | 80,3% |
| 8,00 | 2,85 | 0,06 | 12,11 | 61,3% | 20,14 | 7,99 | 190,8 | 25,8 | 99,7% | 79,9% | 79,7% |
| 9,00 | 2,80 | 0,16 | 13,57 | 43,1% | 20,03 | 6,39 | 200,0 | 25,9 | 99,1% | 80,3% | 79,6% |
| 10,00 | 2,71 | 0,14 | 13,86 | 40,3% | 20,02 | 6,09 | 204,5 | 25,9 | 99,3% | 80,2% | 79,6% |
| 11,00 | 2,67 | 0,08 | 13,77 | 41,8% | 20,03 | 6,21 | 206,6 | 26,0 | 99,7% | 80,1% | 79,8% |
| 12,00 | 2,62 | 0,06 | 13,72 | 42,5% | 20,03 | 6,28 | 209,5 | 25,9 | 99,7% | 79,9% | 79,7% |
| 13,00 | 2,57 | 0,11 | 14,23 | 37,0% | 19,99 | 5,71 | 215,0 | 26,0 | 99,5% | 79,9% | 79,4% |
| 14,00 | 2,48 | 0,59 | 15,14 | 24,9% | 19,90 | 4,46 | 222,0 | 26,1 | 96,9% | 79,8% | 77,4% |
| 15,00 | 2,44 | 0,38 | 14,53 | 31,7% | 19,96 | 5,23 | 227,3 | 26,1 | 97,9% | 79,3% | 77,7% |
| 16,00 | 2,35 | 0,39 | 14,49 | 32,0% | 19,96 | 5,28 | 232,2 | 26,1 | 97,9% | 79,0% | 77,3% |
| 17,00 | 2,30 | 0,49 | 14,98 | 26,9% | 19,92 | 4,69 | 234,6 | 26,1 | 97,4% | 79,1% | 77,1% |
| 18,00 | 2,21 | 0,23 | 14,93 | 29,5% | 19,94 | 4,89 | 234,7 | 26,4 | 98,8% | 79,2% | 78,2% |
| 19,00 | 2,17 | 0,32 | 15,24 | 26,2% | 19,91 | 4,51 | 235,8 | 26,3 | 98,3% | 79,3% | 78,0% |
| 20,00 | 2,12 | 0,32 | 15,74 | 22,3% | 19,88 | 3,98 | 237,1 | 26,4 | 98,4% | 79,5% | 78,2% |
| 21,00 | 2,03 | 0,79 | 15,92 | 17,6% | 19,84 | 3,52 | 238,3 | 26,4 | 96,1% | 79,4% | 76,3% |
| 22,00 | 1,98 | 0,85 | 15,19 | 22,4% | 19,88 | 4,26 | 238,5 | 26,5 | 95,6% | 79,0% | 75,5% |
| 23,00 | 1,91 | 0,79 | 14,98 | 24,5% | 19,90 | 4,52 | 237,7 | 26,6 | 95,8% | 78,9% | 75,6% |
| 24,00 | 1,89 | 0,59 | 14,80 | 27,6% | 19,92 | 4,83 | 237,7 | 26,6 | 96,8% | 78,9% | 76,4% |
| 25,00 | 1,80 | 0,52 | 14,62 | 29,8% | 19,94 | 5,06 | 237,4 | 26,5 | 97,2% | 78,8% | 76,6% |
| 26,00 | 1,76 | 0,72 | 14,72 | 27,2% | 19,92 | 4,84 | 237,7 | 26,5 | 96,1% | 78,8% | 75,7% |
| 27,00 | 1,71 | 0,99 | 14,83 | 24,1% | 19,90 | 4,57 | 237,9 | 26,3 | 94,8% | 78,7% | 74,6% |
| 28,00 | 1,62 | 1,22 | 15,00 | 21,2% | 19,87 | 4,26 | 238,2 | 26,4 | 93,8% | 78,7% | 73,8% |
| 29,00 | 1,58 | 1,48 | 15,08 | 18,6% | 19,85 | 4,03 | 238,3 | 26,4 | 92,6% | 78,7% | 72,9% |
| 30,00 | 1,49 | 1,23 | 16,04 | 13,8% | 19,80 | 3,15 | 236,3 | 26,5 | 94,1% | 79,4% | 74,7% |
| 31,00 | 1,44 | 1,33 | 15,90 | 14,0% | 19,80 | 3,24 | 235,9 | 26,5 | 93,6% | 79,3% | 74,2% |
| 32,00 | 1,39 | 1,41 | 15,87 | 13,7% | 19,80 | 3,22 | 235,8 | 26,5 | 93,2% | 79,3% | 73,9% |
| 33,00 | 1,30 | 1,40 | 15,92 | 13,4% | 19,80 | 3,18 | 235,8 | 26,5 | 93,3% | 79,3% | 74,0% |
| 34,00 | 1,26 | 1,45 | 15,97 | 12,8% | 19,79 | 3,10 | 236,4 | 26,4 | 93,1% | 79,3% | 73,8% |
| 35,00 | 1,21 | 1,45 | 15,99 | 12,6% | 19,79 | 3,08 | 236,6 | 26,6 | 93,1% | 79,3% | 73,8% |
| 36,00 | 1,12 | 1,58 | 15,99 | 11,8% | 19,78 | 3,00 | 237,0 | 26,4 | 92,5% | 79,2% | 73,3% |
| 37,00 | 1,08 | 2,02 | 15,84 | 10,0% | 19,76 | 2,91 | 236,1 | 26,5 | 90,6% | 79,1% | 71,6% |
| 38,00 | 1,03 | 2,31 | 15,72 | 9,0% | 19,75 | 2,87 | 235,2 | 26,7 | 89,4% | 79,0% | 70,6% |
| 39,00 | 0,94 | 2,47 | 15,61 | 8,7% | 19,75 | 2,91 | 234,6 | 26,7 | 88,7% | 78,9% | 70,0% |
| 40,00 | 0,90 | 2,37 | 15,54 | 9,6% | 19,76 | 3,03 | 234,5 | 26,6 | 89,0% | 78,9% | 70,2% |
| 41,00 | 0,85 | 2,09 | 15,51 | 11,6% | 19,78 | 3,23 | 234,7 | 26,6 | 90,1% | 79,0% | 71,2% |
| 42,00 | 0,80 | 1,63 | 15,41 | 15,3% | 19,82 | 3,59 | 234,6 | 26,5 | 92,1% | 79,0% | 72,8% |
| 43,00 | 0,76 | 1,19 | 15,19 | 19,9% | 19,86 | 4,07 | 234,7 | 26,6 | 94,0% | 79,1% | 74,3% |
| 44,00 | 0,71 | 0,76 | 15,14 | 23,5% | 19,89 | 4,37 | 234,7 | 26,7 | 96,1% | 79,2% | 76,0% |
| 45,00 | 0,71 | 0,48 | 14,97 | 27,1% | 19,92 | 4,71 | 234,0 | 26,7 | 97,4% | 79,2% | 77,2% |
| 46,00 | 0,67 | 0,14 | 14,29 | 36,2% | 19,99 | 5,63 | 231,1 | 26,8 | 99,3% | 79,0% | 78,5% |
| 47,00 | 0,62 | 0,05 | 13,05 | 50,0% | 20,08 | 7,00 | 226,4 | 26,9 | 99,9% | 78,5% | 78,4% |
| 48,00 | 0,58 | 0,03 | 12,44 | 57,6% | 20,12 | 7,67 | 221,6 | 27,0 | 100,0% | 78,4% | 78,4% |
| 49,00 | 0,58 | 0,03 | 11,97 | 63,7% | 20,15 | 8,16 | 217,3 | 26,9 | 100,0% | 78,3% | 78,3% |
| 50,00 | 0,53 | 0,02 | 11,55 | 69,8% | 20,18 | 8,62 | 213,5 | 27,0 | 100,0% | 78,2% | 78,2% |
| 51,00 | 0,53 | 0,02 | 11,05 | 77,3% | 20,21 | 9,14 | 209,7 | 26,9 | 100,1% | 78,0% | 78,0% |
| 52,00 | 0,53 | 0,03 | 10,78 | 81,8% | 20,23 | 9,44 | 206,6 | 27,0 | 100,1% | 78,0% | 78,0% |
| 53,00 | 0,52 | 0,03 | 10,46 | 87,3% | 20,25 | 9,77 | 203,6 | 27,0 | 100,1% | 77,9% | 77,9% |
| 54,00 | 0,49 | 0,03 | 9,96 | 96,6% | 20,28 | 10,30 | 200,8 | 26,9 | 100,0% | 77,5% | 77,6% |
| 55,00 | 0,49 | 0,03 | 9,56 | 104,8% | 20,31 | 10,73 | 198,5 | 26,9 | 100,0% | 77,3% | 77,3% |
| 56,00 | 0,49 | 0,04 | 9,22 | 112,2% | 20,33 | 11,09 | 195,9 | 26,9 | 100,0% | 77,1% | 77,1% |
| 57,00 | 0,44 | 0,04 | 8,92 | 119,1% | 20,35 | 11,40 | 193,7 | 26,9 | 100,0% | 76,9% | 76,9% |
| 58,00 | 0,44 | 0,05 | 8,83 | 121,4% | 20,35 | 11,50 | 191,9 | 26,8 | 99,9% | 76,9% | 76,8% |
| 59,00 | 0,41 | 0,06 | 8,70 | 124,4% | 20,36 | 11,64 | 190,6 | 26,7 | 99,9% | 76,8% | 76,7% |
| 60,00 | 0,40 | 0,06 | 8,54 | 128,3% | 20,37 | 11,80 | 189,2 | 26,7 | 99,8% | 76,7% | 76,6% |
| 61,00 | 0,40 | 0,07 | 8,38 | 132,6% | 20,38 | 11,97 | 188,1 | 26,8 | 99,8% | 76,6% | 76,4% |
| 62,00 | 0,40 | 0,07 | 8,13 | 139,5% | 20,40 | 12,23 | 186,8 | 26,6 | 99,7% | 76,4% | 76,2% |
| 63,00 | 0,40 | 0,07 | 8,13 | 139,6% | 20,40 | 12,23 | 185,6 | 26,7 | 99,7% | 76,5% | 76,2% |
| 64,00 | 0,35 | 0,07 | 8,12 | 139,9% | 20,40 | 12,25 | 184,3 | 26,7 | 99,7% | 76,6% | 76,3% |
| 65,00 | 0,35 | 0,07 | 8,03 | 142,3% | 20,40 | 12,33 | 183,4 | 26,7 | 99,7% | 76,5% | 76,3% |
| 66,00 | 0,35 | 0,07 | 8,08 | 140,8% | 20,40 | 12,28 | 182,6 | 26,7 | 99,7% | 76,7% | 76,4% |
| 67,00 | 0,35 | 0,08 | 7,99 | 143,6% | 20,41 | 12,38 | 181,5 | 26,8 | 99,6% | 76,6% | 76,3% |
| 68,00 | 0,35 | 0,08 | 7,89 | 146,6% | 20,41 | 12,49 | 180,6 | 26,8 | 99,6% | 76,5% | 76,3% |
| 69,00 | 0,35 | 0,08 | 7,94 | 145,1% | 20,41 | 12,44 | 179,9 | 26,9 | 99,6% | 76,7% | 76,4% |
| 70,00 | 0,30 | 0,08 | 8,00 | 143,1% | 20,41 | 12,36 | 179,1 | 26,8 | 99,6% | 76,8% | 76,6% |
| 71,00 | 0,30 | 0,08 | 8,05 | 141,6% | 20,40 | 12,31 | 178,1 | 26,9 | 99,6% | 77,0% | 76,7% |
| 72,00 | 0,30 | 0,08 | 7,95 | 144,6% | 20,41 | 12,42 | 177,0 | 26,7 | 99,6% | 76,9% | 76,7% |
| 73,00 | 0,30 | 0,08 | 7,90 | 146,0% | 20,41 | 12,47 | 176,5 | 26,8 | 99,6% | 76,9% | 76,6% |
| 74,00 | 0,30 | 0,08 | 7,89 | 146,6% | 20,41 | 12,49 | 175,6 | 26,6 | 99,6% | 77,0% | 76,7% |
| 75,00 | 0,29 | 0,08 | 7,90 | 146,0% | 20,41 | 12,47 | 175,2 | 26,6 | 99,6% | 77,0% | 76,7% |
| 76,00 | 0,26 | 0,08 | 7,92 | 145,5% | 20,41 | 12,45 | 174,5 | 26,6 | 99,6% | 77,1% | 76,8% |
| 77,00 | 0,26 | 0,08 | 7,95 | 144,4% | 20,41 | 12,41 | 174,4 | 27,0 | 99,6% | 77,2% | 76,9% |
| 78,00 | 0,26 | 0,09 | 8,00 | 142,8% | 20,41 | 12,36 | 174,6 | 27,2 | 99,5% | 77,3% | 76,9% |
| 79,00 | 0,26 | 0,09 | 8,07 | 140,7% | 20,40 | 12,29 | 174,6 | 27,3 | 99,5% | 77,4% | 77,0% |
| 80,00 | 0,22 | 0,09 | 8,10 | 139,7% | 20,40 | 12,25 | 174,8 | 27,3 | 99,5% | 77,4% | 77,0% |
| 81,00 | 0,22 | 0,09 | 8,09 | 140,2% | 20,40 | 12,27 | 174,7 | 27,4 | 99,5% | 77,4% | 77,0% |
| 82,00 | 0,22 | 0,09 | 8,08 | 140,2% | 20,40 | 12,27 | 174,4 | 27,3 | 99,5% | 77,4% | 77,0% |
| 83,00 | 0,22 | 0,09 | 8,07 | 140,6% | 20,40 | 12,29 | 174,7 | 27,4 | 99,5% | 77,4% | 77,0% |
| 84,00 | 0,21 | 0,09 | 8,03 | 141,7% | 20,40 | 12,32 | 174,2 | 27,1 | 99,5% | 77,3% | 76,9% |
| 85,00 | 0,17 | 0,10 | 8,05 | 141,1% | 20,40 | 12,30 | 174,5 | 27,0 | 99,5% | 77,3% | 76,9% |
| 86,00 | 0,17 | 0,10 | 8,01 | 142,3% | 20,40 | 12,35 | 175,2 | 27,1 | 99,4% | 77,2% | 76,7% |
| 87,00 | 0,17 | 0,10 | 7,97 | 143,3% | 20,41 | 12,39 | 175,9 | 26,9 | 99,4% | 77,1% | 76,6% |
| 88,00 | 0,17 | 0,10 | 7,99 | 142,7% | 20,41 | 12,36 | 176,1 | 27,0 | 99,4% | 77,1% | 76,6% |
| 89,00 | 0,17 | 0,11 | 7,92 | 144,7% | 20,41 | 12,44 | 176,1 | 27,0 | 99,3% | 77,0% | 76,5% |
| 90,00 | 0,12 | 0,11 | 7,91 | 145,2% | 20,41 | 12,45 | 175,7 | 26,8 | 99,3% | 77,0% | 76,5% |
| 91,00 | 0,12 | 0,11 | 7,61 | 154,6% | 20,43 | 12,77 | 175,3 | 27,1 | 99,3% | 76,6% | 76,1% |
| 92,00 | 0,12 | 0,12 | 7,59 | 154,9% | 20,43 | 12,78 | 175,9 | 27,0 | 99,2% | 76,5% | 75,9% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 93,00 | 0,12 | 0,12 | 7,69 | 151,5% | 20,42 | 12,67 | 176,2 | 27,2 | 99,2% | 76,7% | 76,0% |
| 94,00 | 0,12 | 0,12 | 7,71 | 151,0% | 20,42 | 12,66 | 176,3 | 26,9 | 99,2% | 76,7% | 76,0% |
| 95,00 | 0,08 | 0,12 | 7,76 | 149,2% | 20,42 | 12,60 | 176,8 | 27,0 | 99,2% | 76,7% | 76,1% |
| 96,00 | 0,08 | 0,12 | 7,73 | 150,3% | 20,42 | 12,64 | 177,3 | 26,8 | 99,2% | 76,6% | 75,9% |
| 97,00 | 0,08 | 0,12 | 7,69 | 151,4% | 20,42 | 12,67 | 177,4 | 26,8 | 99,1% | 76,5% | 75,8% |
| 98,00 | 0,08 | 0,11 | 7,84 | 147,1% | 20,42 | 12,52 | 175,6 | 27,0 | 99,3% | 76,9% | 76,4% |
| 99,00 | 0,08 | 0,10 | 7,81 | 148,5% | 20,42 | 12,56 | 173,5 | 27,1 | 99,4% | 77,1% | 76,6% |
| 100,00 | 0,08 | 0,10 | 7,81 | 148,4% | 20,42 | 12,56 | 172,5 | 27,0 | 99,4% | 77,2% | 76,7% |
| 101,00 | 0,03 | 0,10 | 7,85 | 147,2% | 20,42 | 12,52 | 172,2 | 27,0 | 99,4% | 77,2% | 76,8% |
| 102,00 | 0,03 | 0,10 | 7,82 | 147,9% | 20,42 | 12,54 | 171,9 | 27,1 | 99,4% | 77,2% | 76,7% |
| 103,00 | 0,03 | 0,11 | 7,82 | 147,7% | 20,42 | 12,54 | 172,0 | 26,9 | 99,3% | 77,2% | 76,7% |
| 104,00 | 0,03 | 0,11 | 7,66 | 152,9% | 20,43 | 12,72 | 172,2 | 26,8 | 99,3% | 76,9% | 76,4% |
| 105,00 | 0,03 | 0,11 | 7,58 | 155,5% | 20,43 | 12,80 | 172,3 | 26,9 | 99,3% | 76,8% | #DIV/0! |
| 106,00 | 0,03 | 0,12 | 7,53 | 157,1% | 20,44 | 12,85 | 172,7 | 26,9 | 99,2% | 76,7% | #DIV/0! |
| 107,00 | 0,03 | 0,11 | 7,53 | 157,1% | 20,44 | 12,85 | 172,6 | 27,0 | 99,2% | 76,7% | 76,1% |
| 108,00 | 0,00 | 0,12 | 7,46 | 159,3% | 20,44 | 12,92 | 172,8 | 27,0 | 99,2% | 76,6% | 76,0% |

DATA 2022-06-29 EPA PI 20272 RUN 3 MODEL 8060
preburn

| Temps | Flue | Room | Tunnel | Catalyst down | scale | Right | Back | bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|
| acquisition | temp | temp | dry bulb | | | | | | | |
| minutes | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| 1 | 74,57 | 73,10 | 77,64 | 76,11 | 2,67 | 75,29 | 75,20 | 75,49 | 75,35 | 75,81 |
| 2 | 84,11 | 72,99 | 78,39 | 100,39 | 2,67 | 75,26 | 75,47 | 75,51 | 75,43 | 75,88 |
| 3 | 102,65 | 73,07 | 80,49 | 140,17 | 2,57 | 75,40 | 75,74 | 75,51 | 75,56 | 76,43 |
| 4 | 165,07 | 73,12 | 90,42 | 315,52 | 1,36 | 76,07 | 80,80 | 75,64 | 75,71 | 79,84 |
| 5 | 249,16 | 73,15 | 84,96 | 601,89 | 2,37 | 78,25 | 80,96 | 75,87 | 77,26 | 91,78 |
| 6 | 309,63 | 73,15 | 86,67 | 718,68 | 2,17 | 83,14 | 85,04 | 76,68 | 80,80 | 113,40 |
| 7 | 351,13 | 73,06 | 88,39 | 745,14 | 1,97 | 90,99 | 91,74 | 78,89 | 85,93 | 136,52 |
| 8 | 385,31 | 73,33 | 90,13 | 779,61 | 1,87 | 103,38 | 100,62 | 82,31 | 92,69 | 161,67 |
| 9 | 405,84 | 73,57 | 91,16 | 812,17 | 1,67 | 121,76 | 110,89 | 86,49 | 100,69 | 187,61 |
| 10 | 421,48 | 73,60 | 92,26 | 827,82 | 1,57 | 144,23 | 121,60 | 91,00 | 109,36 | 214,28 |
| 11 | 435,22 | 73,57 | 93,31 | 838,96 | 1,37 | 168,62 | 133,18 | 95,49 | 118,60 | 240,99 |
| 12 | 446,95 | 73,64 | 94,34 | 869,82 | 1,17 | 192,65 | 145,12 | 100,01 | 127,61 | 265,54 |
| 13 | 423,06 | 73,72 | 124,64 | 561,04 | 6,22 | 213,76 | 165,73 | 104,42 | 131,27 | 288,13 |
| 14 | 332,91 | 73,70 | 113,78 | 345,49 | 8,28 | 235,18 | 182,46 | 108,88 | 133,12 | 307,47 |
| 15 | 284,97 | 73,66 | 110,02 | 311,93 | 8,18 | 248,68 | 194,62 | 113,14 | 134,92 | 318,30 |
| 16 | 266,40 | 73,66 | 107,61 | 316,63 | 8,07 | 254,14 | 205,49 | 116,98 | 138,04 | 321,06 |
| 17 | 320,20 | 73,74 | 111,00 | 358,90 | 7,94 | 255,15 | 211,76 | 120,23 | 144,06 | 320,38 |
| 18 | 392,05 | 73,74 | 103,98 | 660,20 | 7,67 | 254,68 | 217,89 | 123,00 | 152,72 | 319,59 |
| 19 | 404,49 | 73,64 | 95,65 | 763,64 | 7,58 | 254,03 | 224,03 | 125,42 | 159,79 | 319,48 |
| 20 | 374,93 | 73,69 | 92,49 | 649,69 | 7,47 | 255,14 | 230,65 | 127,51 | 166,41 | 319,31 |
| 21 | 358,77 | 73,84 | 91,23 | 637,57 | 7,37 | 255,37 | 238,87 | 129,39 | 172,93 | 318,11 |
| 22 | 368,63 | 73,84 | 91,84 | 690,36 | 7,27 | 255,70 | 244,83 | 131,17 | 179,39 | 316,74 |
| 23 | 382,63 | 73,82 | 92,42 | 748,50 | 7,17 | 256,33 | 250,93 | 132,95 | 186,02 | 315,57 |
| 24 | 406,09 | 73,69 | 93,76 | 801,94 | 6,97 | 257,91 | 257,31 | 134,70 | 192,92 | 314,56 |
| 25 | 419,76 | 73,73 | 93,97 | 802,57 | 6,88 | 259,59 | 263,97 | 136,48 | 199,93 | 314,06 |
| 26 | 419,92 | 73,76 | 94,69 | 770,03 | 6,77 | 261,78 | 271,44 | 138,29 | 207,19 | 314,71 |
| 27 | 420,33 | 73,69 | 94,63 | 772,99 | 6,67 | 264,31 | 278,87 | 140,18 | 214,96 | 314,84 |
| 28 | 419,58 | 73,73 | 94,77 | 776,75 | 6,57 | 266,22 | 285,55 | 142,16 | 222,76 | 314,48 |
| 29 | 416,56 | 73,68 | 94,62 | 769,52 | 6,47 | 268,35 | 291,59 | 144,41 | 230,72 | 315,20 |
| 30 | 414,22 | 73,80 | 94,55 | 764,76 | 6,37 | 270,85 | 297,55 | 146,72 | 238,39 | 316,78 |
| 31 | 415,71 | 73,93 | 94,60 | 778,66 | 6,27 | 274,12 | 301,90 | 149,35 | 246,06 | 316,88 |
| 32 | 417,57 | 73,91 | 94,90 | 780,99 | 6,07 | 277,19 | 305,89 | 152,31 | 253,55 | 318,81 |
| 33 | 419,17 | 74,00 | 95,50 | 790,32 | 6,04 | 280,92 | 309,78 | 155,47 | 261,02 | 320,77 |
| 34 | 422,27 | 74,09 | 95,89 | 819,95 | 5,87 | 285,02 | 312,79 | 158,92 | 268,47 | 324,04 |
| 35 | 428,36 | 74,15 | 96,13 | 811,43 | 5,77 | 288,68 | 314,57 | 162,52 | 275,23 | 326,17 |
| 36 | 441,44 | 74,10 | 97,28 | 836,45 | 5,67 | 293,81 | 316,99 | 166,39 | 282,20 | 331,83 |
| 37 | 453,74 | 74,11 | 97,96 | 876,65 | 5,57 | 300,09 | 318,69 | 170,21 | 288,96 | 336,79 |
| 38 | 463,38 | 74,10 | 98,47 | 890,05 | 5,48 | 305,78 | 319,72 | 174,30 | 295,66 | 342,04 |
| 39 | 468,22 | 74,34 | 98,41 | 899,63 | 5,27 | 312,54 | 320,88 | 178,31 | 302,76 | 345,57 |
| 40 | 470,70 | 74,37 | 99,78 | 897,71 | 5,17 | 320,84 | 324,99 | 182,39 | 310,13 | 350,86 |
| 41 | 468,69 | 74,46 | 99,73 | 886,42 | 5,07 | 328,41 | 324,34 | 186,38 | 317,32 | 354,36 |
| 42 | 464,14 | 74,46 | 99,25 | 864,28 | 4,97 | 334,95 | 324,90 | 190,26 | 324,55 | 356,35 |
| 43 | 462,10 | 74,58 | 98,62 | 861,89 | 4,87 | 341,12 | 326,01 | 194,42 | 331,58 | 359,44 |
| 44 | 463,21 | 74,64 | 99,66 | 867,31 | 4,72 | 347,90 | 330,34 | 198,72 | 338,47 | 365,36 |
| 45 | 467,85 | 74,75 | 99,06 | 892,30 | 4,57 | 351,94 | 331,31 | 202,98 | 344,50 | 367,84 |
| 46 | 474,80 | 74,71 | 100,22 | 907,41 | 4,47 | 357,52 | 334,26 | 207,59 | 350,78 | 374,60 |
| 47 | 479,61 | 74,72 | 100,42 | 916,02 | 4,37 | 362,89 | 335,43 | 212,11 | 357,02 | 378,36 |
| 48 | 485,36 | 74,86 | 101,48 | 931,98 | 4,17 | 369,03 | 337,52 | 216,78 | 363,40 | 385,27 |
| 49 | 492,25 | 74,98 | 102,16 | 947,42 | 4,07 | 375,62 | 340,01 | 221,49 | 369,73 | 393,57 |
| 50 | 498,16 | 75,00 | 102,46 | 969,29 | 3,97 | 383,21 | 343,22 | 226,27 | 376,49 | 401,51 |
| 51 | 504,68 | 75,07 | 103,23 | 991,17 | 3,77 | 391,39 | 345,87 | 230,96 | 382,97 | 409,21 |
| 52 | 510,59 | 75,17 | 103,60 | 1008,85 | 3,67 | 399,47 | 349,93 | 235,75 | 389,98 | 417,66 |
| 53 | 514,91 | 75,19 | 104,49 | 1014,85 | 3,50 | 407,94 | 351,91 | 240,50 | 396,93 | 427,17 |
| 54 | 524,69 | 75,53 | 105,20 | 1037,75 | 3,37 | 416,86 | 354,90 | 245,30 | 404,42 | 437,56 |
| 55 | 530,79 | 75,54 | 105,66 | 1048,08 | 3,27 | 425,12 | 356,58 | 250,14 | 411,53 | 446,03 |
| 56 | 532,39 | 75,55 | 105,71 | 1035,42 | 3,17 | 432,96 | 358,38 | 255,00 | 419,47 | 451,14 |
| 57 | 532,64 | 75,61 | 106,17 | 1025,53 | 2,97 | 442,09 | 362,07 | 259,92 | 427,30 | 454,45 |
| 58 | 534,39 | 75,83 | 106,11 | 1027,63 | 2,87 | 451,75 | 364,29 | 264,87 | 435,16 | 458,40 |
| 59 | 535,09 | 76,03 | 105,09 | 1023,84 | 2,77 | 461,90 | 366,31 | 269,97 | 442,97 | 461,10 |
| 60 | 532,20 | 76,10 | 105,65 | 1011,25 | 2,57 | 470,82 | 369,49 | 275,19 | 450,52 | 463,49 |
| 61 | 531,16 | 75,99 | 105,48 | 1007,47 | 2,47 | 480,38 | 372,01 | 280,52 | 458,04 | 466,82 |
| 62 | 527,82 | 76,09 | 105,97 | 1005,38 | 2,37 | 492,19 | 372,33 | 285,88 | 464,90 | 470,13 |
| 63 | 524,67 | 75,91 | 105,70 | 995,00 | 2,27 | 504,37 | 373,38 | 291,31 | 471,18 | 473,41 |
| 64 | 519,21 | 75,80 | 106,50 | 972,50 | 2,17 | 517,67 | 375,93 | 296,89 | 476,71 | 477,77 |
| 65 | 512,56 | 76,07 | 105,21 | 958,92 | 1,97 | 530,17 | 376,70 | 302,28 | 481,52 | 481,69 |
| 66 | 505,41 | 76,11 | 104,42 | 945,26 | 1,87 | 540,62 | 374,33 | 307,54 | 485,38 | 485,44 |
| 67 | 499,39 | 75,91 | 104,22 | 933,79 | 1,87 | 551,28 | 376,00 | 313,04 | 489,09 | 490,79 |
| 68 | 493,28 | 75,94 | 103,43 | 925,29 | 1,77 | 563,20 | 373,86 | 318,31 | 491,93 | 494,97 |
| 69 | 486,12 | 76,16 | 102,31 | 910,84 | 1,67 | 574,57 | 374,49 | 323,68 | 494,23 | 500,35 |
| 70 | 476,52 | 76,50 | 101,21 | 888,94 | 1,66 | 584,40 | 372,82 | 328,85 | 495,93 | 504,60 |
| 71 | 465,37 | 76,24 | 100,72 | 856,27 | 1,57 | 592,71 | 372,98 | 334,16 | 496,84 | 509,69 |
| 72 | 456,58 | 76,22 | 100,86 | 839,41 | 1,57 | 601,13 | 372,01 | 339,35 | 496,80 | 513,82 |
| 73 | 450,23 | 76,14 | 101,67 | 830,93 | 1,47 | 608,01 | 371,38 | 344,72 | 496,51 | 519,68 |
| 74 | 441,81 | 76,20 | 100,58 | 816,54 | 1,47 | 614,41 | 370,89 | 350,22 | 495,75 | 525,58 |
| 75 | 427,82 | 76,31 | 98,93 | 769,30 | 1,39 | 619,09 | 366,13 | 355,64 | 493,85 | 531,31 |
| 76 | 413,38 | 76,31 | 97,89 | 736,88 | 1,37 | 621,80 | 363,92 | 361,32 | 491,98 | 536,80 |
| 77 | 401,53 | 76,56 | 98,48 | 717,34 | 1,37 | 626,36 | 362,19 | 367,63 | 489,11 | 544,79 |
| 78 | 391,22 | 76,48 | 98,73 | 699,80 | 1,37 | 627,81 | 358,57 | 373,99 | 485,45 | 551,95 |
| 79 | 382,06 | 76,39 | 98,17 | 682,76 | 1,37 | 628,80 | 355,11 | 380,44 | 481,52 | 557,71 |
| 80 | 373,99 | 76,63 | 96,35 | 668,53 | 1,37 | 628,66 | 349,55 | 386,57 | 476,84 | 561,04 |
| 81 | 367,34 | 76,54 | 96,79 | 665,90 | 1,27 | 628,82 | 347,60 | 392,89 | 472,31 | 565,21 |
| 82 | 361,65 | 76,65 | 95,38 | 658,65 | 1,27 | 627,18 | 341,70 | 398,81 | 466,77 | 567,95 |
| 83 | 356,86 | 76,59 | 94,86 | 652,31 | 1,27 | 625,53 | 338,50 | 404,61 | 461,70 | 570,03 |
| 84 | 352,76 | 76,44 | 95,18 | 646,98 | 1,27 | 623,64 | 336,63 | 410,47 | 456,31 | 573,39 |
| 85 | 349,44 | 76,53 | 95,43 | 639,76 | 1,27 | 622,22 | 333,93 | 416,13 | 450,94 | 575,76 |
| 86 | 340,05 | 76,55 | 117,64 | 403,18 | 1,21 | 619,73 | 334,06 | 421,67 | 444,67 | 578,30 |
| 87 | 308,49 | 76,69 | 108,54 | 398,56 | 8,37 | 616,64 | 336,42 | 427,37 | 437,34 | 579,68 |
| 88 | 313,89 | 76,55 | 97,35 | 617,44 | 8,28 | 611,31 | 332,44 | 432,90 | 431,02 | 577,53 |
| 89 | 349,38 | 76,73 | 96,91 | 768,70 | 8,28 | 602,03 | 325,75 | 437,84 | 424,33 | 572,48 |
| 90 | 364,30 | 76,68 | 96,17 | 760,04 | 8,18 | 592,12 | 323,83 | 441,92 | 418,62 | 564,45 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 383,42 | 76,76 | 97,39 | 891,05 | 8,08 | 580,18 | 323,78 | 445,03 | 417,92 | 556,64 |
| 92 | 402,59 | 76,90 | 97,39 | 919,51 | 7,98 | 571,22 | 326,30 | 447,06 | 423,78 | 547,96 |
| 93 | 411,16 | 76,78 | 98,80 | 924,80 | 7,88 | 561,09 | 329,85 | 448,28 | 433,56 | 540,30 |
| 94 | 421,69 | 76,75 | 97,85 | 984,38 | 7,77 | 551,64 | 334,92 | 448,69 | 446,11 | 531,40 |
| 95 | 435,45 | 76,95 | 98,77 | 1010,83 | 7,62 | 544,89 | 341,65 | 448,66 | 459,37 | 524,16 |
| 96 | 441,59 | 77,30 | 98,13 | 1007,50 | 7,52 | 538,26 | 346,65 | 448,01 | 471,95 | 517,36 |
| 97 | 444,54 | 77,11 | 98,90 | 993,29 | 7,38 | 531,19 | 353,89 | 447,23 | 485,00 | 510,44 |
| 98 | 445,85 | 77,13 | 99,25 | 994,71 | 7,28 | 525,93 | 359,60 | 446,12 | 497,74 | 504,64 |
| 99 | 447,59 | 77,15 | 99,85 | 981,64 | 7,18 | 521,24 | 365,73 | 444,81 | 509,81 | 499,32 |
| 100 | 454,04 | 77,25 | 99,46 | 989,44 | 6,99 | 516,66 | 368,52 | 443,34 | 521,32 | 493,91 |
| 101 | 455,08 | 77,16 | 99,64 | 994,23 | 6,88 | 512,70 | 373,05 | 441,82 | 531,04 | 488,64 |
| 102 | 455,89 | 77,03 | 100,87 | 990,89 | 6,78 | 510,25 | 376,85 | 440,20 | 539,75 | 484,74 |
| 103 | 456,80 | 77,01 | 100,64 | 991,08 | 6,68 | 508,01 | 381,75 | 438,49 | 548,37 | 480,35 |
| 104 | 458,33 | 77,04 | 100,33 | 1006,28 | 6,58 | 506,12 | 386,47 | 436,82 | 557,34 | 476,67 |
| 105 | 458,28 | 77,01 | 99,92 | 1000,67 | 6,47 | 504,61 | 391,14 | 435,07 | 564,97 | 473,61 |
| 106 | 457,57 | 76,95 | 100,41 | 992,84 | 6,27 | 503,42 | 395,20 | 433,37 | 572,70 | 470,99 |
| 107 | 457,08 | 76,94 | 99,44 | 999,70 | 6,18 | 502,45 | 397,71 | 431,51 | 579,96 | 468,89 |
| 108 | 457,97 | 77,06 | 100,48 | 1014,42 | 6,08 | 501,83 | 402,26 | 429,98 | 586,40 | 467,07 |
| 109 | 457,96 | 77,22 | 100,20 | 1009,65 | 5,98 | 501,57 | 404,98 | 428,40 | 592,84 | 466,07 |
| 110 | 456,93 | 77,29 | 100,43 | 1001,85 | 5,87 | 501,79 | 408,24 | 426,76 | 598,18 | 465,78 |
| 111 | 455,30 | 77,31 | 100,48 | 995,79 | 5,77 | 501,38 | 409,35 | 425,21 | 602,58 | 465,50 |
| 112 | 455,26 | 77,23 | 99,46 | 994,63 | 5,57 | 502,29 | 408,53 | 423,53 | 607,80 | 465,61 |
| 113 | 456,11 | 77,38 | 100,98 | 1011,18 | 5,57 | 503,62 | 409,74 | 422,10 | 612,55 | 466,64 |
| 114 | 457,99 | 77,30 | 100,66 | 1014,29 | 5,38 | 505,44 | 411,20 | 420,56 | 616,94 | 466,72 |
| 115 | 460,20 | 77,08 | 100,35 | 1014,58 | 5,28 | 508,25 | 413,77 | 419,25 | 621,26 | 468,06 |
| 116 | 460,82 | 77,17 | 100,63 | 1017,49 | 5,17 | 510,57 | 414,64 | 417,88 | 625,19 | 468,61 |
| 117 | 461,62 | 77,24 | 99,91 | 1016,43 | 5,07 | 513,82 | 415,89 | 416,52 | 628,97 | 469,61 |
| 118 | 462,30 | 77,34 | 101,16 | 1021,82 | 4,97 | 517,92 | 418,28 | 415,22 | 632,59 | 471,83 |
| 119 | 461,78 | 77,40 | 100,24 | 1027,72 | 4,87 | 521,24 | 422,17 | 414,14 | 636,18 | 473,46 |
| 120 | 461,45 | 77,55 | 100,15 | 1032,76 | 4,68 | 524,71 | 424,10 | 412,88 | 639,67 | 474,34 |
| 121 | 461,17 | 77,25 | 100,69 | 1020,68 | 4,68 | 528,09 | 426,04 | 411,75 | 642,27 | 476,42 |
| 122 | 462,21 | 77,44 | 100,38 | 1027,76 | 4,47 | 532,49 | 430,16 | 410,71 | 644,79 | 478,47 |
| 123 | 462,59 | 77,28 | 101,40 | 1021,77 | 4,37 | 535,38 | 432,92 | 409,78 | 645,70 | 481,37 |
| 124 | 463,51 | 77,37 | 102,15 | 1023,08 | 4,27 | 541,21 | 435,15 | 408,82 | 646,76 | 484,54 |
| 125 | 462,79 | 77,51 | 101,21 | 1024,28 | 4,17 | 547,17 | 436,08 | 407,92 | 648,65 | 487,57 |
| 126 | 462,35 | 77,81 | 100,70 | 1019,32 | 4,08 | 551,74 | 435,16 | 406,99 | 650,36 | 490,55 |
| 127 | 460,99 | 77,51 | 100,60 | 1017,04 | 3,98 | 557,56 | 436,36 | 406,16 | 652,77 | 493,97 |
| 128 | 461,09 | 77,48 | 100,92 | 1021,87 | 3,87 | 563,59 | 437,55 | 405,32 | 654,42 | 497,28 |
| 129 | 459,67 | 77,42 | 100,86 | 1023,23 | 3,77 | 569,73 | 437,69 | 404,52 | 655,91 | 500,80 |
| 130 | 458,23 | 77,42 | 100,97 | 1021,24 | 3,67 | 577,28 | 439,41 | 403,83 | 657,10 | 504,28 |
| 131 | 457,86 | 77,47 | 101,26 | 1021,72 | 3,57 | 585,55 | 439,85 | 403,20 | 658,48 | 508,53 |
| 132 | 455,58 | 77,48 | 101,88 | 1017,23 | 3,47 | 592,81 | 441,18 | 402,63 | 660,15 | 513,19 |
| 133 | 455,81 | 77,40 | 101,83 | 1013,81 | 3,38 | 599,73 | 441,32 | 402,11 | 660,43 | 517,33 |
| 134 | 454,25 | 77,71 | 100,01 | 1007,82 | 3,28 | 606,11 | 442,63 | 401,51 | 661,22 | 521,51 |
| 135 | 452,73 | 77,96 | 101,65 | 997,46 | 3,17 | 615,25 | 442,17 | 401,16 | 662,44 | 525,25 |
| 136 | 451,24 | 77,70 | 101,48 | 1002,73 | 3,07 | 621,67 | 443,30 | 400,90 | 663,31 | 529,20 |
| 137 | 450,23 | 77,88 | 102,13 | 997,26 | 2,97 | 628,32 | 442,73 | 400,75 | 664,33 | 533,04 |
| 138 | 447,76 | 77,91 | 102,39 | 985,13 | 2,87 | 636,25 | 443,30 | 400,61 | 664,74 | 537,01 |
| 139 | 444,21 | 78,00 | 102,01 | 973,18 | 2,87 | 642,40 | 443,06 | 400,52 | 665,48 | 540,90 |
| 140 | 440,42 | 77,99 | 102,73 | 955,09 | 2,77 | 647,71 | 442,20 | 400,45 | 664,97 | 545,29 |
| 141 | 436,51 | 78,21 | 102,12 | 942,55 | 2,68 | 651,98 | 439,10 | 400,33 | 663,68 | 549,90 |
| 142 | 431,57 | 78,48 | 101,91 | 925,28 | 2,68 | 655,95 | 437,28 | 400,35 | 661,77 | 553,67 |
| 143 | 427,92 | 78,54 | 100,88 | 911,66 | 2,58 | 660,04 | 434,41 | 400,32 | 658,97 | 558,10 |
| 144 | 424,05 | 78,71 | 100,67 | 905,04 | 2,47 | 663,45 | 431,65 | 400,34 | 655,20 | 561,55 |
| 145 | 420,59 | 78,57 | 100,50 | 886,29 | 2,47 | 667,11 | 426,24 | 400,43 | 650,55 | 566,12 |
| 146 | 415,95 | 78,59 | 99,45 | 872,43 | 2,47 | 669,55 | 421,57 | 400,42 | 644,98 | 570,57 |
| 147 | 411,14 | 78,48 | 98,13 | 859,07 | 2,37 | 671,31 | 417,31 | 400,52 | 638,20 | 574,39 |
| 148 | 406,57 | 78,54 | 96,79 | 847,46 | 2,37 | 672,18 | 413,05 | 400,56 | 629,77 | 578,96 |
| 149 | 403,83 | 78,27 | 99,41 | 837,29 | 2,27 | 672,82 | 411,97 | 400,93 | 620,03 | 585,25 |
| 150 | 398,76 | 78,59 | 98,01 | 825,32 | 2,27 | 672,74 | 407,95 | 401,37 | 609,50 | 589,42 |
| 151 | 394,04 | 78,59 | 98,79 | 811,75 | 2,27 | 672,60 | 404,13 | 401,88 | 598,18 | 592,94 |
| 152 | 389,84 | 78,48 | 97,37 | 800,37 | 2,27 | 670,84 | 401,34 | 402,37 | 586,11 | 597,21 |
| 153 | 384,60 | 78,42 | 96,75 | 789,91 | 2,27 | 671,71 | 395,90 | 402,95 | 575,06 | 600,25 |
| 154 | 380,01 | 78,15 | 96,53 | 780,61 | 2,22 | 669,65 | 393,43 | 403,77 | 564,98 | 603,19 |
| 155 | 376,20 | 78,51 | 97,32 | 772,35 | 2,17 | 669,58 | 391,21 | 404,57 | 554,70 | 606,49 |
| 156 | 373,28 | 78,29 | 97,02 | 770,18 | 2,17 | 667,98 | 389,42 | 405,52 | 546,42 | 609,70 |
| 157 | 370,23 | 78,20 | 97,06 | 766,08 | 2,17 | 667,52 | 387,22 | 406,43 | 537,50 | 613,28 |
| 158 | 367,27 | 78,18 | 97,17 | 760,95 | 2,17 | 665,89 | 383,98 | 407,51 | 528,88 | 616,88 |
| 159 | 365,32 | 78,39 | 96,32 | 757,28 | 2,07 | 664,23 | 380,88 | 408,48 | 520,98 | 620,21 |
| 160 | 363,53 | 78,02 | 96,58 | 750,96 | 2,07 | 661,96 | 378,75 | 409,57 | 513,87 | 623,67 |
| 161 | 360,49 | 78,12 | 96,21 | 741,26 | 2,07 | 661,19 | 377,27 | 410,78 | 506,31 | 627,11 |
| 162 | 357,77 | 78,09 | 96,00 | 736,69 | 2,07 | 658,92 | 374,04 | 411,88 | 499,17 | 629,50 |
| 163 | 355,65 | 78,37 | 95,89 | 731,08 | 1,98 | 656,19 | 373,03 | 413,09 | 492,26 | 632,23 |
| 164 | 353,19 | 78,57 | 95,58 | 726,53 | 2,07 | 652,95 | 370,93 | 414,29 | 485,98 | 633,61 |
| 165 | 351,20 | 78,69 | 95,41 | 724,00 | 1,98 | 649,69 | 368,99 | 415,50 | 480,01 | 635,79 |
| 166 | 350,84 | 78,60 | 95,56 | 722,20 | 1,98 | 647,11 | 367,17 | 416,79 | 474,35 | 637,76 |
| 167 | 348,84 | 78,47 | 96,39 | 717,90 | 1,98 | 644,22 | 365,77 | 418,10 | 468,47 | 639,01 |
| 168 | 348,05 | 78,34 | 96,67 | 717,64 | 1,98 | 641,42 | 363,88 | 419,48 | 463,00 | 640,22 |
| 169 | 346,99 | 78,21 | 95,53 | 714,33 | 1,98 | 638,13 | 361,40 | 420,82 | 458,22 | 641,10 |
| 170 | 346,32 | 78,35 | 95,84 | 709,59 | 1,87 | 636,37 | 360,42 | 422,13 | 453,56 | 641,52 |
| 171 | 344,83 | 78,37 | 96,63 | 706,97 | 1,87 | 634,36 | 358,39 | 423,51 | 449,17 | 642,83 |
| 172 | 344,04 | 78,40 | 95,37 | 704,23 | 1,87 | 631,12 | 356,30 | 424,87 | 444,92 | 643,73 |
| 173 | 342,65 | 78,53 | 94,41 | 701,05 | 1,87 | 628,22 | 354,16 | 426,24 | 440,73 | 644,06 |
| 174 | 341,88 | 78,38 | 95,87 | 699,37 | 1,87 | 625,76 | 354,42 | 427,57 | 437,18 | 644,64 |
| 175 | 341,31 | 78,35 | 95,81 | 696,92 | 1,87 | 623,93 | 353,25 | 428,97 | 433,45 | 645,57 |
| 176 | 340,23 | 78,35 | 95,75 | 692,96 | 1,82 | 622,66 | 350,90 | 430,39 | 429,58 | 646,68 |
| 177 | 338,29 | 78,20 | 94,47 | 688,52 | 1,77 | 619,60 | 349,17 | 431,71 | 426,23 | 646,99 |
| 178 | 336,82 | 78,17 | 95,46 | 684,79 | 1,77 | 618,33 | 347,59 | 432,97 | 422,66 | 645,73 |
| 179 | 335,94 | 78,12 | 95,54 | 682,77 | 1,77 | 615,80 | 346,45 | 434,29 | 419,57 | 645,39 |
| 180 | 335,36 | 78,04 | 94,53 | 680,99 | 1,77 | 613,68 | 344,79 | 435,60 | 416,69 | 644,44 |
| 181 | 334,25 | 78,34 | 94,23 | 679,06 | 1,77 | 611,95 | 343,78 | 436,93 | 413,64 | 643,58 |
| 182 | 333,34 | 78,53 | 94,83 | 678,61 | 1,77 | 609,90 | 342,64 | 438,26 | 410,99 | 643,40 |
| 183 | 332,05 | 78,65 | 94,70 | 676,88 | 1,67 | 608,21 | 340,49 | 439,57 | 408,55 | 642,95 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 184 | 331,05 | 78,66 | 94,23 | 675,43 | 1,67 | 605,95 | 338,33 | 440,93 | 405,89 | 642,57 |
| 185 | 330,87 | 78,58 | 94,68 | 672,43 | 1,67 | 604,12 | 337,36 | 442,22 | 403,41 | 641,66 |
| 186 | 329,71 | 78,59 | 94,48 | 670,51 | 1,67 | 602,90 | 336,56 | 443,56 | 401,16 | 641,32 |
| 187 | 329,48 | 78,76 | 94,88 | 669,41 | 1,57 | 600,91 | 334,09 | 444,73 | 398,97 | 640,33 |
| 188 | 349,47 | 78,67 | 99,31 | 580,71 | 1,62 | 598,41 | 336,87 | 446,09 | 394,60 | 639,51 |

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2022-06-30 Manufacturer: Heathstone Model: 8060

Project #: PT 20272 Run: 4 Tech: MM Reviewer: NP

- kindling 2 8 LBS 5 MIN FIRE
- by pass open
- air inlet Full open
- At 2,5 LBS close Door
- At 1,2 LBS insert 1st preload
- close Door immediatly
- At 1,2 LBS insert Second preload
- close Door immediatly
- At 5 3 LBS close by pass
- At 16 LBS ~~insert~~ mix Back coal Bed
- After 5 min insert load and close Door immediatly

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE / POST CHECKS

Date: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 4 Tech: MM Reviewer: DP

| Moisture Meter Calibration Check: | Equipment # | Time | 12% | 22% |
|---|---|---|---|---|
| | EM-334 | 7100 | ok | ok |

| | Pre-Test | Post-Test |
|---|---|---|
| **Facility Conditions:** | | |
| Air Velocity from less than 2 feet | 0 (max50 Fpm) | 0 (max50 Fpm) |
| Smoke Capture Check (tunnel velocity) | 0 | NA |
| Picture | 4 sides ok | ok |
| **Wood Heater Conditions:** | | |
| Date Wood Heater Stack Cleaned | 2022-06-27 | |
| Date Dilution Tunnel Cleaned | 2022-06-27 | |
| Induced Draft Check (max 0.005 H2O) | ok | |
| Traverse before ignition | ok | |
| **Temperature System:** | | |
| Ambient (65°-90°F) | ok °F | |
| **Proportional Checks:** | | |
| Thermocouple check | OK | |
| Pitot Clean | ok | |
| Pitot verification | ok | |
| Pictures for report | Side ok<br>Coal bed ok<br>Load ok<br>Load in stove ok<br>Fuel adjustment ok | |
| Load Length approximately 5/6 of firebox Lenght | ok | |

**POLYTESTS**
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 4 Tech: MM Reviewer: DP

## Leakage Checks Tunnel Samplers

| | System 1st hour | | System 1 | | System 2 | |
|---|---|---|---|---|---|---|
| Unplugged Flow Rate = .25cfm | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) |
| Vacuum (inches Hg.) | -10 | -15 | -10 | -10 | -10 | -10 |
| Final 1minute DGM (Liter) | 6578427.48 | 6584706 | 6578427.75 | 6584706.18 | 4056491.2 | 4062641.32 |
| Initial 1minute DGM (Liter) | 6578427.43 | 6584700.6 | 6578427.65 | 6584706.15 | 4056491.52 | 4062641.32 |
| Change (Liter) | 0.05 | | 0.10 | | 0.10 | |
| Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56) | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** |
| Check OK | OK | OK | OK | OK | OK | OK |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: pI 20272 Run: 4 Tech: MP Reviewer: DP

## 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 MP |
| Check OK (no change after 15 sec.) | ok | ok | ok | ok |

## Scales checks

| Scale Type | Audit | | Measured Weight |
|---|---|---|---|
| | Equipment # | Weight | |
| Platform | EM-090 | 44 lbs, Class F | 44.0 lbs |
| Platform | EM-205 | 10.00 kg lbs, Class F | 10.01 kg lbs |
| Wood | EM-090 | 44.0 lbs, Class F | 44.0 lbs |
| Analytical | EM-325 | 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: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 4 Tech: MR Reviewer: DP

FOR TUNNELS < 12 in

Barometric pressure ($P_{bar}$) 1018 (KPa.) Static pressure ($P_q$) 0.17 (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 $\Delta_p$ (inches $H_2O$) | Tunnel Temperature (°F) |
|---|---|---|---|---|---|
| | 6 po | 7 po | 8 po | | |
| A- Centroid | 3.00 | 3.50 | 4 | 0.070 | 73.11 |
| B - Centroid | 3.00 | 3.50 | 4 | 0.069 | 72.88 |
| A-1 | 0.40 | 0.50 | 0.50 | 0.056 | 73.11 |
| A-2 | 1.50 | 1.75 | 2 | 0.058 | 73.00 |
| A-3 | 4.50 | 5.25 | 6 | 0.060 | 73.00 |
| A-4 | 5.60 | 6.5 | 7.5 | 0.057 | 72.89 |
| B-1 | 0.40 | 0.50 | 0.50 | 0.057 | 72.89 |
| B-2 | 1.50 | 1.75 | 2 | 0.060 | 72.78 |
| B-3 | 4.50 | 5.25 | 6 | 0.069 | 72.78 |
| B-4 | 5.60 | 6.5 | 7.5 | 0.057 | 72.73 |
| | | | | 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.
$\Delta_p$ = 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 ($\Delta_p$) measured at each traverse point.

POLYTESTS
TESTING THROUGH YOUR REALITY

# CONTINUOUS ANALYZERS

Date: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: 01 2022 Run: 4 Tech: MM Reviewer: DP

Pre-Test (Adjust and Record)

| | ZERO | | SPAN | | CAL. (Record Only) | |
|---|---|---|---|---|---|---|
| CO | 0 | 0 | 3019 | 3.000 | 1018 | 1.000 |
| Tolerance CO | 0 | +/- 0.02 | .0019 | +/- 0.15 | .0018 | +/- 0.05 |
| $CO_2$ | 0 | 0 | 17.86 | 18.00 | 9.81 | 10.00 |
| Tolerance CO2 | 0 | +/- 0.02 | 6.14 | +/- 0.5 | ~~0.0~~ 019 | +/- 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 | 3.009 | 1.016 | 0 | 0.02 | 0.010 | 0.15 | 0.002 | 0.05 | ✓ | |
| $CO_2$ | 0 | 17.90 | 9.88 | 0 | 0.02 | 0.04 | 0.5 | 0.07 | 0.5 | ✓ | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# TEST DATA LOG

Date: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 4 Tech: MM Reviewer: DP

## RAW DRY GAS METER READINGS

| | System 1 | System 2 | Blanck |
|---|---|---|---|
| Final (Liter) | 658469,23 | 406262,82 | 391675,65 |
| Initial (Liter) | 657873,55 | 405649,70 | 391160,72 |

## AMBIENT CONDITIONS

| | Before | After |
|---|---|---|
| Barometer (kPa): | 101,8 | 101,6 |
| Dry Bulb (F): | 74,8 | 79,3 |
| Humidity (%): | 46 | 40,1 |

## Flow Meter

| | Start | End |
|---|---|---|
| Flow meter reading | N.A | N.A |

## Flow Meter Verification

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

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 4 Tech: MM Reviewer: DP

## FUEL DESCRIPTION:

Type of wood:

## PRE-TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 14 in. | 1110 lbs. | 20,3 | 20,9 | 20,8 | 20,8 | 20,6 |
| 1 1/2 x 3 1/2 x 14 in. | 1726 lbs. | 20,9 | 21,0 | 20,9 | 20,8 | 20,7 |
| 1 1/2 x 3 1/2 x 14 in. | 1686 lbs. | 19,9 | 19,8 | 19,7 | 19,7 | 19,8 |
| 1 1/2 x 3 1/2 x 7 in. | 0,584 lbs. | 20,1 | 20,0 | 20,1 | 20,3 | 20,2 |
| 1 1/2 x 3 1/2 x 7 in. | 0,568 lbs. | 19,6 | 19,7 | 19,6 | 19,8 | 19,9 |
| 1 1/2 x 3 1/2 x 7 in. | 0,588 lbs. | 20,1 | 20,3 | 20,4 | 20,6 | 20,9 |
| 1 1/2 x 3 1/2 x 7 in. | 0,664 lbs. | 19,1 | 19,2 | 19,3 | 19,4 | 19,3 |
| x x in. | lbs. | | | | | |
| 1 1/2 x3 1/2 x 14 in. | 1632 lbs. | 19,3 | 19,4 | 19,6 | 19,8 | 19,4 |
| 1 1/2 x 3 1/2 x 14 in. | 1704 lbs. | 19,8 | 19,9 | 19,7 | 19,6 | 19,8 |
| 1 1/2 x 3 1/2 x 14 in. | ~~1672~~ 1184 lbs. | 20,1 | 20,0 | 20,0 | 20,3 | 20,6 |
| 1 1/2 x 3 1/2 x 7 in. | 0,544 lbs. | 20,6 | 20,9 | 20,8 | 20,6 | 20,5 |
| 1 1/2 x 3 1/2 x 7 in. | 0,574 lbs. | 20,6 | 20,8 | 20,9 | 21,0 | 21,0 |
| 1 1/2 x 3 1/2 x 7 in. | 0,574 lbs. | 21,1 | 21,3 | 21,6 | 21,3 | 21,4 |
| 1 1/2 x x 7 in. | 0,712 lbs. | 20,0 | 20,1 | 20,3 | 20,2 | 20,3 |
| 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:** 6,924 + 6,924 lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-06-30 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 4 Tech: MA Reviewer: DO

## FUEL DESCRIPTION:

Type of wood :

## TEST LOAD

| Piece Size | Weight | | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 15 in. | 1282 | lbs. | 202 | 203 | 204 | 205 | 203 |
| 1 1/2 x 3 1/2 x 15 in. | 1'530 | lbs. | 200 | 196 | 198 | 198 | 198 |
| 1 1/2 x 3 1/2 x 15 in. | 1'462 | lbs. | 217 | 218 | 215 | 218 | 219 |
| 1 1/2 x 3 1/2 x 15 in. | 1 510 | lbs. | 193 | 197 | 196 | 196 | 198 |
| x x in. | | lbs. | | | | | |
| 1 1/2 x 3/4 x 4 in. | 0 092 | lbs. | | 196 | 0 106 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 128 | lbs. | | 193 | 0 116 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 164 | lbs. | | 194 | 0 120 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 094 | lbs. | | 193 | 0 094 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 094 | lbs. | | 200 | 0 114 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 114 | lbs. | | 199 | 0 094 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 080 | lbs. | | 200 | 0 098 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 098 | lbs. | | 196 | 0 096 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 116 | lbs. | | 197 | 0 120 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 094 | lbs. | | 197 | 0 080 MA | | |
| 1 1/2 x 3/4 x 4 in. | 0 128 | lbs. | | 198 | | | |
| 1 1/2 x 3/4 x 4 in. | 0 106 | lbs. | | 201 | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |
| x x in. | | lbs. | | | | | |

**TEST LOAD WEIGHT**: 703 lbs Min 20%: 140 Max 25%: 175

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 4 Tech: MM Reviewer: DP

| | | 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 | 21 | 323 | 324 | 4 | 34 | 325 | 326 | 21 | 329 |
| 2022-06-29 | 17:00 | 108 7376 | | 34 7547 | | 110 1040 | | 33 9212 | | 0 1286 |
| 2022-06-30 | 9:00 | 108 7375 | | 34 7546 | | 110 1040 | | 33 9213 | | 0 1286 |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | | 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 | 21 | 323 | 324 | 4 | 34 | 325 | 326 | 21 | 329 |
| 2022-06-30 | 14:00 | 108 7377 | | 34 7561 | | 110 1041 | | 33 9223 | | 0 1287 |
| 2022-07-06 | 8:30 | 108 7376 | | 34 7548 | | 110 1040 | | 33 9223 | | 0 1287 |
| 2022-07-07 | 8:30 | 108 7376 | | 34 7548 | | 110 1040 | | 33 9223 | | 0 1287 |
| | | | | | | | | | | |
| | | | | | | | | | | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-06-29 Manufacturer: Hearthstone Model: 8060

Project #: pI 20272 Run: 4 Tech: MM Reviewer: DO

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Pre-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 40 | 327 | 328 | 44 |
| 2022-06-29 | 17:00 | 110 1013 | | 356755 | |
| 2022-06-30 | 9:00 | 110 1013 | | 356754 | 35 MM |
| | | | | | |
| | | | | | |

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Post-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 40 | 327 | 328 | 44 |
| 2022-06-30 | 14:00 | 110 1015 | | 356767 | |
| 2022-07-06 | 8:00 | 110 1014 | | 356767 | |
| 2022-07-07 | 8:00 | 110 1014 | | 356767 | |
| | | | | | |
| | | | | | |

# Paramètres

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

| | |
|---|---|
| Code verrouillage: | HEA |

## Description du test

| | | |
|---|---|---|
| Test standard | EPA | |
| Run # | 4 | |
| Date | 30-06-2022 | |
| Technicien | M.M | |
| Project # | PI 20272 | |

## Description de l'unité

| | | |
|---|---|---|
| Manufacturier | HEARTHSTONE | |
| Modèle | 8060 | |
| Combustion system | Cat | |
| Appliance type | WOOD STOVE | |
| Firebox volume | 1 | cu ft. |
| Appliance weight empty | N.A | lbs |
| Appliance weight full | N.A | lbs |

## Paramètres du test

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

## Échantillonnage

| | | |
|---|---|---|
| Blank sampling rate | 0,20 | cuft/min |
| Internal probe diameter | 0,18 | in. |
| Calibration Factor (DGM #1): | 1,007 | Dimensionless |
| Equipment number (DGM #1): | EM 178 | |
| Calibration Factor (DGM #2): | 1,005 | Dimensionless |
| Equipment number (DGM #2): | EM 318 | |
| Calibration Factor (DGM #3): | 0,988 | |
| Equipment number (DGM #3): | EM 179 | Dimensionless |

## Tunnel

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 30-06-2022 |
| **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): | 101,8 | 101,6 |
| Barometer (in.Hg): | 30,061529 | 30,00246871 |
| Dry Bulb (F): | 74,8 | 79,3 |
| Humidity (%): | 46,6 | 40,1 |
| Air velocity (ft/min) | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DGM #1 | Final: | 23253,622 | cuft | Final: | 658469,230 | Liter |
| | Initial: | 23232,586 | cuft | Initial: | 657873,550 | Liter |
| | | | | | | |
| DGM #2 | Final: | 14347,036 | cuft | Final: | 406262,820 | Liter |
| | Initial: | 14325,384 | cuft | Initial: | 405649,700 | Liter |
| | | | | | | |
| DGM room | Final: | 13831,895 | cuft | Final: | 391675,650 | Liter |
| | Initial: | 13813,711 | cuft | Initial: | 391160,720 | Liter |

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 258

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 30-06-2022 |
| **Technicien** | M.M |

## Preload data sheet

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,30 | 7,00 | 7,70 |

Load Volume: 0,4253 cu. ft

Loading Density: 13,830 lbs./ft3

Number of Spaces:

Spacer weight (lbs):

Load Density (wet): 32,515 lbs./ft3

Dry Wood Density: 27,057813

| Piece Size (in): Thick | Wide | x Length | Weight lbs | Meter Moisture Content Dry Uncorrected % | | | | | Ave. MC x Weight | Volume Cubic Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 3,5 | 14 | 1,11 | 20,3 | 20,9 | 20,8 | 20,8 | 20,6 | 22,9548 | 73,50 |
| 1,5 | 3,5 | 14 | 1,726 | 20,9 | 21 | 20,9 | 20,8 | 20,7 | 36,00436 | 73,50 |
| 1,5 | 3,5 | 14 | 1,686 | 19,9 | 19,8 | 19,7 | 19,7 | 19,8 | 33,34908 | 73,50 |
| 1,5 | 3,5 | 7 | 0,584 | 20,1 | 20 | 20,1 | 20,3 | 20,2 | 11,76176 | 36,75 |
| 1,5 | 3,5 | 7 | 0,568 | 19,6 | 19,3 | 19,6 | 19,8 | 19,9 | 11,15552 | 36,75 |
| 1,5 | 3,5 | 7 | 0,588 | 20,1 | 20,3 | 20,4 | 20,6 | 20,9 | 12,03048 | 36,75 |
| 1,5 | 3,5 | 7 | 0,644 | 19,1 | 19,2 | 19,3 | 19,4 | 19,3 | 12,40344 | 36,75 |
| | | | | | | | | | | 0,00 |
| 1,5 | 3,5 | 14 | 1,632 | 19,3 | 19,4 | 19,6 | 19,8 | 19,4 | 31,824 | 73,50 |
| 1,5 | 3,5 | 14 | 1,704 | 19,8 | 19,9 | 19,7 | 19,6 | 19,8 | 33,67104 | 73,50 |
| 1,5 | 3,5 | 14 | 1,184 | 20,1 | 20 | 20 | 20,3 | 20,6 | 23,9168 | 73,50 |
| 1,5 | 3,5 | 7 | 0,544 | 20,6 | 20,9 | 20,8 | 20,6 | 20,5 | 11,24992 | 36,75 |
| 1,5 | 3,5 | 7 | 0,574 | 20,6 | 20,8 | 20,9 | 21 | 21 | 11,97364 | 36,75 |
| 1,5 | 3,5 | 7 | 0,574 | 21,1 | 21,3 | 21,6 | 21,3 | 21,4 | 12,24916 | 36,75 |
| 1,5 | 3,5 | 7 | 0,712 | 20 | 20,1 | 20,3 | 20,2 | 20,3 | 14,36816 | 36,75 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00

## FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,3 | 7,0 | 7,7 |

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

Load Volume: 0,18 cu. ft

Loading Density: 7,0 lbs./ft3

Number of Spaces: 12

Spacer weight: lbs

Load Density (wet): 31,7 lbs./ft3

Dry Wood Density: 26,4 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 | 15 | 1,28 | 20,20 | 20,30 | 20,40 | 20,50 | 20,30 | 26,07588 | 78,75 | 20,3 |
| 1,5 | 3,5 | 15 | 1,53 | 20,00 | 19,60 | 19,80 | 19,80 | 19,80 | 30,294 | 78,75 | 19,8 |
| 1,5 | 3,5 | 15 | 1,46 | 21,70 | 21,80 | 21,50 | 21,80 | 21,90 | 31,78388 | 78,75 | 21,7 |
| 1,5 | 3,5 | 15 | 1,51 | 19,30 | 19,30 | 19,60 | 19,60 | 19,80 | 29,4752 | 78,75 | 19,5 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| 1,4 | 0,75 | 4 | 0,09 | | | 19,60 | | | 1,8032 | 4,20 | 19,6 |
| 1,4 | 0,75 | 4 | 0,13 | | | 19,30 | | | 2,4704 | 4,20 | 19,3 |
| 1,4 | 0,75 | 4 | 0,10 | | | 19,40 | | | 2,0176 | 4,20 | 19,4 |
| 1,4 | 0,75 | 4 | 0,09 | | | 19,30 | | | 1,8142 | 4,20 | 19,3 |
| 1,4 | 0,75 | 4 | 0,09 | | | 20,00 | | | 1,88 | 4,20 | 20,0 |
| 1,4 | 0,75 | 4 | 0,11 | | | 19,90 | | | 2,2686 | 4,20 | 19,9 |
| 1,4 | 0,75 | 4 | 0,08 | | | 20,00 | | | 1,6 | 4,20 | 20,0 |
| 1,4 | 0,75 | 4 | 0,10 | | | 19,60 | | | 1,9208 | 4,20 | 19,6 |
| 1,4 | 0,75 | 4 | 0,12 | | | 19,70 | | | 2,2852 | 4,20 | 19,7 |
| 1,4 | 0,75 | 4 | 0,09 | | | 19,70 | | | 1,8518 | 4,20 | 19,7 |
| 1,4 | 0,75 | 4 | 0,13 | | | 19,80 | | | 2,5344 | 4,20 | 19,8 |
| 1,4 | 0,75 | 4 | 0,11 | | | 20,10 | | | 2,1306 | 4,20 | 20,1 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 |

## Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,17 in. H20 Absolute value
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=**
0,938

**Pour un tunnel moins de 12", prendre 4 lectures**

| | TUNNEL VELOCITY | TUNNEL TEMP | SQUARE ROOT |
|---|---|---|---|
| | In. wc | °F | |
| A center | 0,070 | 73,11 | 0,2646 |
| B center | 0,069 | 72,88 | 0,2627 |
| A1 | 0,056 | 73,11 | 0,2366 |
| A2 | 0,058 | 73 | 0,2408 |
| A3 | 0,060 | 73 | 0,2449 |
| A4 | 0,057 | 72,89 | 0,2387 |
| | | | |
| B1 | 0,057 | 72,890 | 0,2387 |
| B2 | 0,060 | 72,780 | 0,2449 |
| B3 | 0,069 | 72,780 | 0,2627 |
| B4 | 0,057 | 72,730 | 0,2387 |
| AVERAGE | 0,0613 | 72,9170 | 0,2474 |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 30-06-2022 |
| **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 | 21 | 323 | 324 | 4 | 34 | 325 | 326 | 21 | 40 | 327 | 328 | 44 | 329 | | |
| Before (1) | | | | | | | | | | | | | | | |
| Before (2) | | | | | | | | | | | | | | | |
| Before (3) | | | | | | | | | | | | | | | |
| Before (4) | | | | | | | | | | | | | | | |
| Before (5) | 108,7376 | | 34,7547 | | 110,1040 | | 33,9212 | | 110,1013 | | 35,6755 | | 0,1286 | 2022-06-29 | 17:00 |
| Before (6) | 108,7375 | | 34,7546 | | 110,1040 | | 33,9213 | | 110,1013 | | 35,6754 | | 0,1286 | 2022-06-30 | 09:00 |
| After (1) | 108,7377 | | 34,7561 | | 110,1041 | | 33,9223 | | 110,1015 | | 35,6767 | | 0,1287 | 2022-06-30 | 14:00 |
| After (2) | 108,7376 | | 34,7548 | | 110,1040 | | 33,9223 | | 110,1014 | | 35,6767 | | 0,1287 | 2022-07-06 | 08:00 |
| After (3) | 108,7376 | | 34,7548 | | 110,1040 | | 33,9223 | | 110,1014 | | 35,6767 | | 0,1287 | 2022-07-07 | 08:00 |
| After (4) | | | | | | | | | | | | | | | |
| After (5) | | | | | | | | | | | | | | | |
| After (6) | 108,7376 | | 34,7548 | | 110,1040 | | 33,9223 | | 110,1014 | | 35,6767 | | 0,1287 | 2022-07-25 | 08:00 |
| Difference | 0,0001 | 0,0000 | 0,0002 | 0,0000 | 0,0000 | 0,0000 | 0,0010 | 0,0000 | 0,0001 | 0,0000 | 0,0013 | 0,0000 | 0,0001 | | |
| Total (mg) | | 0,3 | | | | 1,3 | | | | 1,4 | | | 0,1 | | |
| Total ajusté (mg) | | **0,20** | | | | **1,20** | | | | **1,30** | | | | | |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 30-06-2022 |
| **Technicien** | M.M |

SFBA EPA EMISSION RESULTS

**Test Duration:** **114** min

| | | | |
|---|---|---|---|
| PRESSURE FACTOR: | DGM 1 | 0,97651 | |
| | DGM 2 | 0,97982 | |
| | DGM 3 | 1,00374 | |
| TEMPERATURE FACTORS | DGM 1 | 0,98235 | |
| | DGM 2 | 0,97456 | |
| | DGM 3 | 0,98320 | |
| VOLUMES SAMPLED | DGM 1 | 20,312 | SCft |
| | DGM 2 | 20,788 | Scft |
| | DGM 3 | 17,734 | SCft |

TOTAL TUNNEL VOLUME : 37106

SAMPLE RATIOS

| | |
|---|---|
| Sample Train 1: | 1826,815 |
| Sample Train 2: | 1784,956 |

Paticulate concentration

| | | |
|---|---|---|
| Sample Train 1 | **0,000064** | g/dscf |
| Sample Train 2 | **0,000067** | g/dscf |
| Room | **0,000006** | g/dscf |

TOTAL EMISSIONS

| | | |
|---|---|---|
| Sample Train 1 | **2,17** | g |
| Sample Train 2 | **2,29** | g |

EMISSION RATES

| | | |
|---|---|---|
| Sample Train 1 | **1,14** | g/hr |
| Sample Train 2 | **1,21** | g/hr |

1st hour emission rate **0,55** g/hr

| | Train 1 | Train 2 |
|---|---|---|
| Cs | 6,4E-05 | 6,7346E-05 |

RESULTS

**Average emission rate:** 1,17 g/hr

Burn Rate : 1,396 Dry kg/hr

BAROMETRIC PRESSURE

| | | |
|---|---|---|
| Average: | 30,0319987 | in Hg |
| Start: | 30,06152868 | in Hg |
| End: | 30,00246871 | in Hg |

DGM CONTROLLER VALUES

| | | | |
|---|---|---|---|
| DGM 1 | Final: | 23253,622 | Cuft |
| | Initial: | 23232,586 | Cuft |
| DGM 2 | Final: | 14347,036 | Cuft |
| | Initial: | 14325,384 | Cuft |
| DGM #3 | Final: | 13831,895 | Cuft |
| | Initial: | 13813,711 | Cuft |

TEMPERATURES

| | | |
|---|---|---|
| DGM 1 | 537,486 | °R |
| DGM 2 | 541,785 | °R |

CALIBRATION FACTORS

| | |
|---|---|
| DGM 1 | 1,0066 |
| DGM 2 | 1,0054 |
| DGM #3 | 0,9882 |

TUNNEL FLOW RATE: 325,489 Dscfm

PARTICULATE CATCH

| | | |
|---|---|---|
| Total Sample Train 1: | 1,30 | mg |
| Total Sample Train 2: | 1,40 | mg |
| Total Sample Train 1 1st hour: | 0,30 | mg |

DEVIATION: 2,78%

| * | | * | * | * | * | *1 | *2 | *3 | *4 | *5 | *6 | *7 | *8 | *9 | Mass flow 1 | DGM 1 | DGM 1 | Filter 1 | Mass flow 2 | DGM 2 | DGM 2 | Filter 2 | Tunnel Velo | Flue draft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed | | Weight | | | | Flue | Room | Tunnel | Unit | Unit | Unit | Unit | Unit | Catalyst | Reading | Inlet T | Outlet T | Temp | Reading | Inlet T | Outlet T | Temp | Pressure | Pressure |
| Time | Raw data row | Remaining | CO | $CO_2$ | $O_2$ | Gas | Temp | Dry Bulb | Top | Back | R.Side | L.Side | Bottom | Down | | | | | | | | | in wc | in wc |
| min | | lbs | % | % | % | °F | °F | °F | °F | °F | °F | °F | °F | °F | cuft/min | oF | oF | oF | cuft/min | oF | oF | oF | in wc | in wc |
| 0,00 | 258,00 | 7,0 | 0,1 | 2,9 | 0,0 | 316,3 | 74,5 | 97,3 | 390,7 | 340,4 | 603,8 | 583,6 | 412,9 | 465,7 | 0,18 | 74,37 | 74,38 | 82,74 | 0,18 | 75,10 | 75,68 | 84,05 | 0,07 | 0,05 |
| 1,0 | 259,0 | 6,9 | 0,2 | 3,8 | 0,0 | 300,6 | 74,7 | 92,3 | 385,6 | 339,9 | 596,7 | 576,5 | 413,6 | 566,0 | 0,18 | 74,45 | 74,41 | 82,53 | 0,18 | 75,24 | 75,79 | 83,75 | 0,07 | 0,06 |
| 2,0 | 260,0 | 6,9 | 0,0 | 5,3 | 0,0 | 301,7 | 74,9 | 91,7 | 382,6 | 338,2 | 586,2 | 566,7 | 413,9 | 587,3 | 0,18 | 74,50 | 74,42 | 82,41 | 0,18 | 75,37 | 75,89 | 83,52 | 0,07 | 0,06 |
| 3,0 | 261,0 | 6,9 | 0,0 | 5,7 | 0,0 | 302,6 | 74,8 | 91,3 | 380,4 | 338,4 | 574,4 | 556,3 | 414,2 | 590,4 | 0,18 | 74,57 | 74,43 | 82,24 | 0,18 | 75,57 | 76,00 | 83,36 | 0,07 | 0,06 |
| 4,0 | 262,0 | 6,8 | 0,0 | 6,0 | 0,0 | 304,6 | 74,8 | 91,8 | 379,4 | 339,7 | 563,0 | 545,4 | 414,3 | 596,4 | 0,18 | 74,67 | 74,47 | 82,21 | 0,18 | 75,75 | 76,11 | 83,21 | 0,07 | 0,06 |
| 5,0 | 263,0 | 6,7 | 0,0 | 8,4 | 0,0 | 319,3 | 75,0 | 92,6 | 386,4 | 340,7 | 551,7 | 534,8 | 413,8 | 678,0 | 0,18 | 74,74 | 74,46 | 82,12 | 0,18 | 75,97 | 76,21 | 83,12 | 0,06 | 0,07 |
| 6,0 | 264,0 | 6,6 | 0,0 | 11,4 | 0,0 | 336,5 | 74,9 | 92,7 | 395,4 | 344,6 | 541,8 | 524,1 | 413,2 | 702,7 | 0,18 | 74,84 | 74,52 | 82,07 | 0,18 | 76,19 | 76,34 | 83,00 | 0,06 | 0,07 |
| 7,0 | 265,0 | 6,5 | 0,0 | 10,3 | 0,0 | 343,6 | 74,8 | 93,1 | 402,6 | 348,7 | 533,5 | 514,7 | 412,6 | 703,6 | 0,18 | 74,83 | 74,55 | 82,00 | 0,18 | 76,37 | 76,42 | 82,93 | 0,07 | 0,07 |
| 8,0 | 266,0 | 6,5 | 0,0 | 10,2 | 0,0 | 347,2 | 74,6 | 92,9 | 407,6 | 352,2 | 525,7 | 506,4 | 411,7 | 697,4 | 0,18 | 74,83 | 74,55 | 81,95 | 0,18 | 76,55 | 76,52 | 82,88 | 0,07 | 0,07 |
| 9,0 | 267,0 | 6,4 | 0,0 | 8,8 | 0,0 | 347,1 | 74,9 | 93,1 | 411,0 | 356,4 | 519,2 | 497,5 | 410,6 | 688,6 | 0,18 | 74,92 | 74,58 | 81,93 | 0,18 | 76,74 | 76,65 | 82,79 | 0,07 | 0,06 |
| 10,0 | 268,0 | 6,3 | 0,0 | 9,3 | 0,0 | 347,4 | 75,0 | 93,0 | 414,3 | 358,3 | 513,7 | 490,7 | 409,3 | 686,3 | 0,18 | 75,09 | 74,62 | 81,93 | 0,18 | 77,02 | 76,82 | 83,61 | 0,07 | 0,07 |
| 11,0 | 269,0 | 6,2 | 0,0 | 8,8 | 0,0 | 346,8 | 75,0 | 92,9 | 416,6 | 363,4 | 509,5 | 484,5 | 408,0 | 679,5 | 0,18 | 75,16 | 74,66 | 81,86 | 0,18 | 77,21 | 76,91 | 87,01 | 0,07 | 0,06 |
| 12,0 | 270,0 | 6,1 | 0,0 | 8,7 | 0,0 | 347,9 | 75,0 | 93,5 | 419,9 | 366,6 | 506,0 | 479,1 | 406,6 | 694,2 | 0,18 | 75,13 | 74,69 | 81,82 | 0,18 | 77,39 | 77,02 | 87,68 | 0,06 | 0,07 |
| 13,0 | 271,0 | 6,0 | 0,1 | 10,6 | 0,0 | 359,4 | 75,0 | 93,9 | 427,8 | 370,4 | 502,1 | 474,1 | 405,0 | 756,4 | 0,18 | 75,15 | 74,70 | 81,81 | 0,18 | 77,54 | 77,11 | 87,40 | 0,07 | 0,07 |
| 14,0 | 272,0 | 5,9 | 0,1 | 13,0 | 0,0 | 379,7 | 75,1 | 94,4 | 438,9 | 374,0 | 498,6 | 469,6 | 403,4 | 817,0 | 0,18 | 75,27 | 74,74 | 81,84 | 0,18 | 77,76 | 77,23 | 87,03 | 0,06 | 0,07 |
| 15,0 | 273,0 | 5,8 | 0,1 | 12,6 | 0,0 | 383,4 | 75,3 | 94,5 | 448,9 | 375,3 | 495,3 | 465,9 | 401,5 | 783,7 | 0,18 | 75,36 | 74,78 | 81,85 | 0,18 | 77,95 | 77,33 | 86,71 | 0,07 | 0,07 |
| 16,0 | 274,0 | 5,7 | 0,0 | 11,8 | 0,0 | 384,7 | 75,4 | 94,8 | 456,7 | 378,8 | 493,3 | 464,4 | 399,9 | 789,2 | 0,18 | 75,44 | 74,84 | 81,86 | 0,18 | 78,10 | 77,46 | 86,39 | 0,07 | 0,07 |
| 17,0 | 275,0 | 5,6 | 0,1 | 12,9 | 0,0 | 397,7 | 75,3 | 94,7 | 467,5 | 380,6 | 491,5 | 464,2 | 397,9 | 841,7 | 0,18 | 75,53 | 74,87 | 81,87 | 0,18 | 78,32 | 77,59 | 86,14 | 0,07 | 0,08 |
| 18,0 | 276,0 | 5,4 | 0,3 | 15,0 | 0,0 | 416,4 | 75,5 | 96,5 | 478,9 | 382,6 | 491,5 | 465,1 | 396,3 | 916,0 | 0,18 | 75,51 | 74,90 | 81,95 | 0,18 | 78,42 | 77,65 | 85,91 | 0,07 | 0,08 |
| 19,0 | 277,0 | 5,3 | 0,6 | 15,4 | 0,0 | 429,9 | 75,3 | 96,5 | 489,2 | 383,8 | 493,7 | 466,2 | 394,4 | 931,8 | 0,18 | 75,54 | 74,94 | 82,00 | 0,18 | 78,56 | 77,73 | 85,73 | 0,06 | 0,08 |
| 20,0 | 278,0 | 5,2 | 0,2 | 14,3 | 0,0 | 428,5 | 75,2 | 96,4 | 497,2 | 384,4 | 497,1 | 469,4 | 392,6 | 856,7 | 0,18 | 75,55 | 74,96 | 81,99 | 0,18 | 78,69 | 77,80 | 85,52 | 0,07 | 0,08 |
| 21,0 | 279,0 | 5,1 | 0,1 | 12,8 | 0,0 | 423,6 | 75,1 | 97,5 | 503,7 | 386,9 | 501,0 | 473,5 | 391,1 | 846,7 | 0,18 | 75,47 | 74,97 | 82,04 | 0,18 | 78,70 | 77,86 | 85,34 | 0,07 | 0,08 |
| 22,0 | 280,0 | 5,0 | 0,0 | 13,4 | 0,0 | 423,4 | 75,0 | 96,7 | 512,2 | 387,4 | 503,1 | 475,6 | 389,4 | 860,2 | 0,18 | 75,40 | 74,98 | 82,09 | 0,18 | 78,75 | 77,91 | 85,19 | 0,07 | 0,08 |
| 23,0 | 281,0 | 4,8 | 0,0 | 14,1 | 0,0 | 425,3 | 74,8 | 97,3 | 521,5 | 387,3 | 503,9 | 477,6 | 387,7 | 874,7 | 0,18 | 75,34 | 74,97 | 82,16 | 0,18 | 78,76 | 77,98 | 85,07 | 0,06 | 0,08 |
| 24,0 | 282,0 | 4,7 | 0,0 | 14,9 | 0,0 | 428,5 | 75,1 | 97,6 | 532,4 | 387,3 | 505,1 | 479,5 | 385,9 | 897,1 | 0,18 | 75,30 | 74,97 | 82,24 | 0,18 | 78,80 | 78,06 | 84,96 | 0,07 | 0,08 |
| 25,0 | 283,0 | 4,6 | 0,2 | 15,4 | 0,0 | 438,5 | 75,4 | 98,2 | 540,7 | 387,4 | 506,0 | 480,9 | 384,0 | 957,7 | 0,18 | 75,37 | 74,99 | 82,27 | 0,18 | 78,87 | 78,15 | 84,81 | 0,07 | 0,08 |
| 26,0 | 284,0 | 4,4 | 0,7 | 15,7 | 0,0 | 444,5 | 75,4 | 97,8 | 548,4 | 386,7 | 509,7 | 483,0 | 382,0 | 959,6 | 0,18 | 75,51 | 75,02 | 82,30 | 0,18 | 79,05 | 78,27 | 84,67 | 0,06 | 0,08 |
| 27,0 | 285,0 | 4,3 | 0,5 | 15,8 | 0,0 | 447,6 | 75,6 | 98,9 | 556,0 | 387,8 | 517,0 | 486,5 | 380,2 | 940,2 | 0,18 | 75,63 | 75,07 | 82,36 | 0,18 | 79,17 | 78,36 | 84,66 | 0,07 | 0,08 |
| 28,0 | 286,0 | 4,2 | 0,1 | 15,1 | 0,0 | 445,2 | 75,5 | 98,0 | 560,8 | 388,8 | 524,1 | 491,2 | 378,3 | 932,7 | 0,18 | 75,69 | 75,12 | 82,33 | 0,18 | 79,30 | 78,44 | 84,50 | 0,06 | 0,08 |
| 29,0 | 287,0 | 4,0 | 0,1 | 15,0 | 0,0 | 443,0 | 75,7 | 97,4 | 565,2 | 388,8 | 530,1 | 494,1 | 376,5 | 910,4 | 0,18 | 75,72 | 75,14 | 82,31 | 0,18 | 79,37 | 78,50 | 84,36 | 0,07 | 0,08 |
| 30,0 | 288,0 | 3,9 | 0,1 | 14,6 | 0,0 | 438,9 | 75,6 | 97,5 | 569,7 | 389,9 | 535,1 | 497,3 | 374,8 | 891,5 | 0,18 | 75,78 | 75,18 | 82,29 | 0,18 | 79,49 | 78,60 | 84,25 | 0,06 | 0,08 |
| 31,0 | 289,0 | 3,9 | 0,1 | 14,4 | 0,0 | 436,2 | 75,8 | 98,8 | 573,1 | 391,6 | 540,1 | 501,2 | 373,4 | 883,2 | 0,18 | 75,83 | 75,22 | 82,41 | 0,18 | 79,54 | 78,70 | 84,23 | 0,07 | 0,08 |
| 32,0 | 290,0 | 3,7 | 0,1 | 14,4 | 0,0 | 434,1 | 75,9 | 100,1 | 576,4 | 393,9 | 545,2 | 505,0 | 372,1 | 881,9 | 0,18 | 75,99 | 75,26 | 82,57 | 0,18 | 79,72 | 78,86 | 84,26 | 0,07 | 0,08 |
| 33,0 | 291,0 | 3,6 | 0,1 | 14,7 | 0,0 | 433,5 | 76,1 | 101,1 | 579,2 | 396,0 | 549,8 | 508,3 | 370,8 | 886,5 | 0,18 | 76,24 | 75,33 | 82,86 | 0,18 | 79,97 | 79,04 | 84,43 | 0,07 | 0,08 |
| 34,0 | 292,0 | 3,5 | 0,1 | 15,1 | 0,0 | 436,3 | 76,5 | 100,9 | 582,8 | 397,2 | 553,9 | 511,5 | 369,5 | 902,4 | 0,18 | 76,57 | 75,46 | 83,07 | 0,18 | 80,30 | 79,23 | 84,54 | 0,07 | 0,08 |
| 35,0 | 293,0 | 3,4 | 0,2 | 15,5 | 0,0 | 440,0 | 76,9 | 101,8 | 587,0 | 398,0 | 556,4 | 514,8 | 368,1 | 929,1 | 0,18 | 77,01 | 75,61 | 83,31 | 0,18 | 80,67 | 79,45 | 84,69 | 0,07 | 0,08 |
| 36,0 | 294,0 | 3,2 | 0,4 | 15,9 | 0,0 | 445,0 | 77,2 | 102,2 | 591,7 | 399,8 | 559,9 | 517,9 | 366,9 | 964,6 | 0,18 | 77,41 | 75,76 | 83,53 | 0,18 | 81,07 | 79,69 | 84,88 | 0,07 | 0,08 |
| 37,0 | 295,0 | 3,2 | 0,8 | 16,1 | 0,0 | 449,8 | 77,4 | 101,3 | 596,6 | 400,6 | 561,9 | 520,8 | 365,7 | 984,3 | 0,18 | 77,74 | 75,93 | 83,69 | 0,18 | 81,41 | 79,91 | 84,98 | 0,07 | 0,08 |
| 38,0 | 296,0 | 3,0 | 0,2 | 16,1 | 0,0 | 452,6 | 77,7 | 103,2 | 601,5 | 403,6 | 564,2 | 523,0 | 364,6 | 990,2 | 0,18 | 78,05 | 76,08 | 83,97 | 0,18 | 81,74 | 80,14 | 85,16 | 0,07 | 0,08 |
| 39,0 | 297,0 | 2,9 | 0,3 | 16,0 | 0,0 | 453,3 | 77,9 | 103,1 | 605,9 | 406,4 | 566,0 | 525,4 | 363,5 | 984,9 | 0,18 | 78,29 | 76,25 | 84,19 | 0,18 | 82,01 | 80,34 | 85,33 | 0,07 | 0,08 |
| 40,0 | 298,0 | 2,8 | 0,3 | 16,0 | 0,0 | 452,1 | 78,0 | 103,3 | 610,5 | 409,4 | 568,5 | 527,6 | 362,3 | 971,4 | 0,18 | 78,54 | 76,39 | 84,41 | 0,18 | 82,31 | 80,55 | 85,48 | 0,07 | 0,08 |
| 41,0 | 299,0 | 2,6 | 0,2 | 16,0 | 0,0 | 452,7 | 78,3 | 103,4 | 615,6 | 412,5 | 570,8 | 530,1 | 361,2 | 987,3 | 0,18 | 78,70 | 76,52 | 84,60 | 0,18 | 82,52 | 80,76 | 85,63 | 0,07 | 0,08 |
| 42,0 | 300,0 | 2,5 | 0,7 | 15,9 | 0,0 | 451,9 | 78,3 | 103,4 | 619,3 | 415,6 | 572,8 | 533,2 | 360,2 | 987,0 | 0,18 | 78,90 | 76,66 | 84,75 | 0,18 | 82,74 | 80,94 | 85,76 | 0,06 | 0,08 |
| 43,0 | 301,0 | 2,4 | 0,4 | 15,6 | 0,0 | 450,7 | 78,4 | 103,7 | 622,9 | 418,3 | 575,7 | 536,4 | 359,2 | 972,8 | 0,18 | 79,06 | 76,78 | 84,92 | 0,18 | 82,93 | 81,17 | 85,88 | 0,07 | 0,08 |
| 44,0 | 302,0 | 2,3 | 0,2 | 15,1 | 0,0 | 448,5 | 78,3 | 103,5 | 625,3 | 419,8 | 578,9 | 540,6 | 358,2 | 963,8 | 0,18 | 79,21 | 76,92 | 85,06 | 0,18 | 83,14 | 81,36 | 86,03 | 0,07 | 0,08 |
| 45,0 | 303,0 | 2,3 | 0,1 | 14,9 | 0,0 | 449,6 | 78,7 | 103,8 | 626,6 | 421,6 | 582,5 | 545,0 | 357,3 | 972,4 | 0,18 | 79,36 | 77,03 | 85,24 | 0,18 | 83,32 | 81,56 | 86,18 | 0,07 | 0,08 |
| 46,0 | 304,0 | 2,2 | 0,1 | 14,7 | 0,0 | 448,2 | 78,6 | 103,5 | 627,2 | 422,5 | 586,2 | 550,1 | 356,3 | 956,4 | 0,18 | 79,50 | 77,13 | 85,40 | 0,18 | 83,49 | 81,70 | 86,28 | 0,07 | 0,08 |
| 47,0 | 305,0 | 2,1 | 0,1 | 14,5 | 0,0 | 446,5 | 78,5 | 104,0 | 627,5 | 424,1 | 591,3 | 554,9 | 355,5 | 953,6 | 0,18 | 79,61 | 77,24 | 85,53 | 0,18 | 83,63 | 81,90 | 86,42 | 0,07 | 0,08 |
| 48,0 | 306,0 | 2,0 | 0,1 | 14,3 | 0,0 | 442,3 | 78,8 | 104,0 | 627,2 | 425,1 | 596,7 | 560,0 | 354,7 | 944,3 | 0,18 | 79,76 | 77,36 | 85,69 | 0,18 | 83,83 | 82,08 | 86,53 | 0,07 | 0,08 |
| 49,0 | 307,0 | 1,9 | 0,0 | 14,2 | 0,0 | 439,8 | 78,8 | 103,8 | 626,6 | 425,3 | 602,3 | 565,3 | 353,8 | 932,0 | 0,18 | 79,87 | 77,46 | 85,84 | 0,18 | 83,96 | 82,24 | 86,64 | 0,07 | 0,08 |
| 50,0 | 308,0 | 1,8 | 0,0 | 14,0 | 0,0 | 436,2 | 78,9 | 103,6 | 625,9 | 424,7 | 607,6 | 570,9 | 353,1 | 923,8 | 0,18 | 79,97 | 77,59 | 85,96 | 0,18 | 84,12 | 82,44 | 86,79 | 0,07 | 0,08 |
| 51,0 | 309,0 | 1,8 | 0,0 | 13,9 | 0,0 | 432,4 | 79,0 | 103,5 | 624,8 | 424,5 | 612,4 | 576,3 | 352,4 | 904,7 | 0,18 | 80,08 | 77,69 | 86,10 | 0,18 | 84,25 | 82,58 | 86,92 | 0,07 | 0,08 |
| 52,0 | 310,0 | 1,7 | 0,0 | 13,3 | 0,0 | 429,2 | 79,0 | 103,7 | 623,1 | 423,7 | 616,7 | 582,0 | 351,7 | 902,2 | 0,18 | 80,19 | 77,78 | 86,19 | 0,18 | 84,36 | 82,75 | 87,01 | 0,07 | 0,08 |
| 53,0 | 311,0 | 1,6 | 0,0 | 13,1 | 0,0 | 425,2 | 79,1 | 101,8 | 622,2 | 421,6 | 620,2 | 588,0 | 351,0 | 901,2 | 0,18 | 80,26 | 77,86 | 86,29 | 0,18 | 84,48 | 82,90 | 87,10 | 0,07 | 0,07 |
| 54,0 | 312,0 | 1,6 | 0,0 | 12,9 | 0,0 | 421,5 | 79,2 | 103,4 | 620,2 | 420,9 | 623,7 | 593,5 | 350,4 | 887,5 | 0,18 | 80,39 | 77,98 | 86,40 | 0,18 | 84,65 | 83,07 | 87,19 | 0,07 | 0,08 |
| 55,0 | 313,0 | 1,5 | 0,0 | 12,7 | 0,0 | 417,3 | 79,1 | 102,8 | 617,6 | 419,8 | 627,9 | 598,5 | 349,8 | 886,1 | 0,18 | 80,49 | 78,07 | 86,50 | 0,18 | 84,76 | 83,21 | 87,27 | 0,07 | 0,07 |
| 56,0 | 314,0 | 1,4 | 0,0 | 12,6 | 0,0 | 414,4 | 79,5 | 102,7 | 614,8 | 417,7 | 631,3 | 603,1 | 349,2 | 877,1 | 0,18 | 80,62 | 78,20 | 86,62 | 0,18 | 84,93 | 83,35 | 87,37 | 0,07 | 0,07 |
| 57,0 | 315,0 | 1,4 | 0,0 | 12,4 | 0,0 | 411,0 | 79,5 | 102,5 | 611,1 | 415,9 | 635,2 | 607,7 | 348,7 | 867,2 | 0,18 | 80,83 | 78,30 | 86,70 | 0,18 | 85,12 | 83,51 | 87,45 | 0,07 | 0,07 |
| 58,0 | 316,0 | 1,3 | 0,0 | 12,2 | 0,0 | 407,2 | 79,5 | 102,0 | 606,9 | 414,4 | 638,7 | 612,2 | 348,2 | 853,7 | 0,18 | 80,96 | 78,40 | 86,74 | 0,18 | 85,24 | 83,65 | 87,51 | 0,07 | 0,07 |
| 59,0 | 317,0 | 1,3 | 0,0 | 12,0 | 0,0 | 403,1 | 79,7 | 101,7 | 602,7 | 412,7 | 642,4 | 616,2 | 347,8 | 841,6 | 0,18 | 81,08 | 78,54 | 86,82 | 0,18 | 85,39 | 83,78 | 87,60 | 0,07 | 0,07 |
| 60,0 | 318,0 | 1,2 | 0,0 | 11,8 | 0,0 | 398,9 | 79,8 | 101,8 | 598,9 | 411,2 | 646,3 | 620,5 | 347,4 | 837,9 | 0,18 | 81,20 | 78,64 | 86,89 | 0,18 | 85,52 | 83,95 | 87,69 | 0,07 | 0,07 |
| 61,0 | 319,0 | 1,2 | 0,0 | 11,5 | 0,0 | 395,5 | 79,5 | 100,8 | 594,8 | 409,2 | 649,8 | 624,6 | 347,0 | 826,1 | 0,18 | 81,31 | 78,74 | 86,89 | 0,18 | 85,65 | 84,08 | 87,73 | 0,07 | 0,07 |
| 62,0 | 320,0 | 1,1 | 0,0 | 10,9 | 0,0 | 391,7 | 79,8 | 100,9 | 590,1 | 407,8 | 651,8 | 628,9 | 346,7 | 815,1 | 0,18 | 81,40 | 78,83 | 83,44 | 0,18 | 85,73 | 84,25 | 87,75 | 0,07 | 0,07 |
| 63,0 | 321,0 | 1,1 | 0,0 | 10,9 | 0,0 | 388,9 | 79,8 | 102,0 | 584,7 | 406,8 | 655,6 | 632,0 | 346,5 | 808,6 | 0,18 | 81,51 | 78,95 | 86,86 | 0,18 | 85,84 | 84,38 | 87,86 | 0,07 | 0,07 |
| 64,0 | 322,0 | 1,1 | 0,0 | 10,8 | 0,0 | 385,9 | 79,8 | 100,0 | 580,1 | 403,9 | 658,0 | 635,2 | 346,3 | 804,6 | 0,18 | 81,51 | 79,03 | 87,93 | 0,18 | 85,93 | 84,48 | 87,91 | 0,07 | 0,07 |
| 65,0 | 323,0 | 1,1 | 0,0 | 10,8 | 0,0 | 383,2 | 79,9 | 101,8 | 575,3 | 403,1 | 659,9 | 638,4 | 346,2 | 798,8 | 0,18 | 81,59 | 79,11 | 88,34 | 0,18 | 86,01 | 84,59 | 88,02 | 0,07 | 0,07 |
| 66,0 | 324,0 | 1,0 | 0,0 | 10,4 | 0,0 | 381,0 | 79,7 | 100,7 | 569,9 | 401,0 | 662,4 | 641,0 | 346,0 | 791,2 | 0,18 | 81,58 | 79,18 | 88,49 | 0,18 | 86,04 | 84,69 | 88,06 | 0,07 | 0,07 |
| 67,0 | 325,0 | 1,0 | 0,0 | 9,6 | 0,0 | 377,7 | 80,0 | 101,0 | 563,7 | 399,3 | 664,8 | 643,9 | 346,0 | 782,6 | 0,18 | 81,61 | 79,26 | 88,53 | 0,18 | 86,15 | 84,80 | 88,08 | 0,07 | 0,07 |
| 68,0 | 326,0 | 1,0 | 0,1 | 8,7 | 0,0 | 375,9 | 80,0 | 100,9 | 555,9 | 396,7 | 666,6 | 646,3 | 346,0 | 778,9 | 0,18 | 81,71 | 79,35 | 88,59 | 0,18 | 86,26 | 84,92 | 88,15 | 0,07 | 0,07 |
| 69,0 | 327,0 | 0,9 | 0,1 | 8,4 | 0,0 | 374,5 | 80,1 | 100,4 | 548,3 | 394,3 | 667,0 | 647,7 | 346,1 | 778,1 | 0,18 | 81,80 | 79,43 | 88,64 | 0,18 | 86,40 | 85,06 | 88,20 | 0,07 | 0,07 |
| 70,0 | 328,0 | 0,9 | 0,1 | 8,3 | 0,0 | 373,7 | 79,8 | 99,6 | 541,0 | 391,5 | 665,9 | 649,0 | 346,2 | 774,3 | 0,18 | 81,88 | 79,52 | 88,63 | 0,18 | 86,48 | 85,19 | 88,17 | 0,07 | 0,07 |
| 71,0 | 329,0 | 0,9 | 0,1 | 8,2 | 0,0 | 372,2 | 80,1 | 100,8 | 533,9 | 388,6 | 663,9 | 650,1 | 346,4 | 771,1 | 0,18 | 81,96 | 79,60 | 88,68 | 0,18 | 86,48 | 85,31 | 88,21 | 0,07 | 0,07 |
| 72,0 | 330,0 | 0,9 | 0,1 | 8,2 | 0,0 | 369,9 | 79,5 | 98,7 | 526,3 | 384,2 | 662,4 | 650,1 | 346,3 | 767,8 | 0,18 | 81,92 | 79,67 | 88,64 | 0,18 | 86,48 | 85,44 | 88,24 | 0,07 | 0,07 |
| 73,0 | 331,0 | 0,8 | 0,1 | 8,5 | 0,0 | 368,8 | 78,6 | 96,9 | 520,0 | 380,2 | 659,5 | 649,2 | 346,2 | 764,9 | 0,18 | 81,25 | 79,58 | 88,37 | 0,18 | 86,07 | 85,36 | 88,01 | 0,07 | 0,07 |
| 74,0 | 332,0 | 0,8 | 0,1 | 8,4 | 0,0 | 367,1 | 78,4 | 96,4 | 513,3 | 377,3 | 657,2 | 649,4 | 346,3 | 761,5 | 0,18 | 80,73 | 79,51 | 88,16 | 0,18 | 85,63 | 85,30 | 87,84 | 0,07 | 0,07 |
| 75,0 | 333,0 | 0,8 | 0,1 | 8,2 | 0,0 | 365,9 | 77,9 | 95,9 | 507,0 | 374,7 | 654,8 | 648,0 | 346,4 | 759,0 | 0,18 | 80,12 | 79,36 | 87,96 | 0,18 | 85,15 | 85,18 | 87,61 | 0,07 | 0,07 |
| 76,0 | 334,0 | 0,8 | 0,1 | 8,1 | 0,0 | 364,6 | 77,8 | 95,7 | 501,1 | 371,8 | 652,1 | 648,0 | 346,6 | 756,5 | 0,18 | 79,67 | 79,21 | 87,79 | 0,18 | 84,78 | 85,05 | 87,43 | 0,07 | 0,07 |
| 77,0 | 335,0 | 0,7 | 0,1 | 8,0 | 0,0 | 363,8 | 77,4 | 95,5 | 495,3 | 368,4 | 649,1 | 647,5 | 346,7 | 753,3 | 0,18 | 79,17 | 79,04 | 87,69 | 0,18 | 84,39 | 84,92 | 87,26 | 0,07 | 0,07 |
| 78,0 | 336,0 | 0,7 | 0,1 | 8,0 | 0,0 | 362,2 | 77,0 | 95,2 | 489,6 | 367,3 | 646,0 | 646,9 | 347,1 | 750,8 | 0,18 | 78,76 | 78,88 | 87,49 | 0,18 | 84,03 | 84,78 | 87,05 | 0,07 | 0,07 |
| 79,0 | 337,0 | 0,7 | 0,1 | 8,1 | 0,0 | 359,3 | 76,9 | 94,3 | 484,3 | 364,8 | 643,2 | 646,3 | 347,5 | 734,4 | 0,18 | 78,43 | 78,73 | 87,33 | 0,18 | 83,71 | 84,63 | 86,86 | 0,07 | 0,07 |
| 80,0 | 338,0 | 0,7 | 0,1 | 7,8 | 0,0 | 354,9 | 76,8 | 94,5 | 478,5 | 363,0 | 640,2 | 645,4 | 347,9 | 727,0 | 0,18 | 78,26 | 78,64 | 87,17 | 0,18 | 83,48 | 84,54 | 86,70 | 0,07 | 0,07 |
| 81,0 | 339,0 | 0,7 | 0,1 | 7,9 | 0,0 | 353,7 | 76,7 | 94,0 | 473,4 | 362,2 | 637,0 | 643,3 | 348,5 | 726,7 | 0,18 | 78,10 | 78,53 | 87,04 | 0,18 | 83,32 | 84,44 | 86,51 | 0,07 | 0,07 |
| 82,0 | 340,0 | 0,6 | 0,1 | 8,0 | 0,0 | 353,3 | 76,7 | 92,6 | 468,6 | 360,3 | 633,4 | 640,6 | 348,8 | 730,8 | 0,18 | 77,99 | 78,44 | 86,83 | 0,18 | 83,18 | 84,32 | 86,31 | 0,07 | 0,06 |
| 83,0 | 341,0 | 0,6 | 0,1 | 8,1 | 0,0 | 352,4 | 77,0 | 92,4 | 463,8 | 359,5 | 630,3 | 638,4 | 349,2 | 731,9 | 0,18 | 78,03 | 78,39 | 86,63 | 0,18 | 83,09 | 84,25 | 86,11 | 0,07 | 0,07 |
| 84,0 | 342,0 | 0,6 | 0,1 | 8,1 | 0,0 | 353,0 | 76,9 | 92,5 | 459,5 | 359,7 | 626,6 | 635,8 | 349,8 | 729,8 | 0,18 | 78,14 | 78,39 | 86,47 | 0,18 | 83,12 | 84,27 | 85,97 | 0,07 | 0,06 |
| 85,0 | 343,0 | 0,6 | 0,1 | 8,1 | 0,0 | 352,2 | 77,2 | 91,5 | 455,3 | 357,4 | 623,2 | 633,2 | 350,1 | 728,6 | 0,18 | 78,18 | 78,37 | 86,34 | 0,18 | 83,15 | 84,30 | 85,86 | 0,07 | 0,07 |
| 86,0 | 344,0 | 0,5 | 0,1 | 8,0 | 0,0 | 351,8 | 77,0 | 91,9 | 451,1 | 358,6 | 620,0 | 631,3 | 350,7 | 725,2 | 0,18 | 78,11 | 78,34 | 86,21 | 0,18 | 83,13 | 84,36 | 85,75 | 0,07 | 0,07 |
| 87,0 | 345,0 | 0,5 | 0,1 | 8,0 | 0,0 | 351,0 | 77,2 | 92,8 | 447,1 | 357,2 | 617,0 | 629,0 | 351,2 | 724,0 | 0,18 | 78,22 | 78,36 | 86,19 | 0,18 | 83,17 | 84,35 | 85,71 | 0,07 | 0,06 |
| 88,0 | 346,0 | 0,6 | 0,1 | 8,0 | 0,0 | 350,6 | 76,8 | 93,4 | 443,5 | 357,7 | 614,6 | 626,8 | 351,8 | 723,0 | 0,18 | 78,16 | 78,32 | 86,12 | 0,18 | 83,11 | 84,37 | 85,58 | 0,07 | 0,06 |
| 89,0 | 347,0 | 0,5 | 0,1 | 7,8 | 0,0 | 349,7 | 76,9 | 92,8 | 439,6 | 355,7 | 611,4 | 624,3 | 352,2 | 721,2 | 0,18 | 78,09 | 78,29 | 86,06 | 0,18 | 83,00 | 84,35 | 85,47 | 0,07 | 0,06 |
| 90,0 | 348,0 | 0,5 | 0,1 | 7,9 | 0,0 | 348,9 | 76,8 | 92,4 | 436,0 | 354,2 | 608,7 | 622,3 | 352,6 | 719,7 | 0,18 | 77,89 | 78,25 | 85,97 | 0,18 | 82,87 | 84,28 | 85,32 | 0,07 | 0,06 |
| 91,0 | 349,0 | 0,5 | 0,1 | 7,9 | 0,0 | 348,3 | 76,7 | 92,1 | 432,9 | 353,8 | 606,0 | 620,0 | 353,2 | 718,4 | 0,18 | 77,83 | 78,22 | 85,85 | 0,18 | 82,79 | 84,26 | 85,16 | 0,07 | 0,06 |
| 92,0 | 350,0 | 0,4 | 0,1 | 8,0 | 0,0 | 348,8 | 76,6 | 93,3 | 429,7 | 353,5 | 603,7 | 618,5 | 353,8 | 722,9 | 0,18 | 77,76 | 78,19 | 85,88 | 0,18 | 82,77 | 84,26 | 85,15 | 0,07 | 0,06 |
| 93,0 | 351,0 | 0,4 | 0,1 | 8,0 | 0,0 | 348,6 | 76,5 | 92,8 | 426,5 | 352,0 | 600,8 | 616,3 | 354,4 | 720,9 | 0,18 | 77,61 | 78,16 | 85,77 | 0,18 | 82,62 | 84,26 | 85,04 | 0,07 | 0,06 |
| 94,0 | 352,0 | 0,4 | 0,1 | 8,0 | 0,0 | 348,5 | 76,2 | 92,7 | 423,3 | 352,0 | 598,5 | 615,4 | 355,1 | 718,2 | 0,18 | 77,39 | 78,10 | 85,70 | 0,18 | 82,47 | 84,25 | 84,97 | 0,07 | 0,06 |
| 95,0 | 353,0 | 0,4 | 0,1 | 7,7 | 0,0 | 348,3 | 76,2 | 92,4 | 420,8 | 349,9 | 596,3 | 613,3 | 355,7 | 713,1 | 0,18 | 77,35 | 78,08 | 85,58 | 0,18 | 82,42 | 84,27 | 84,89 | 0,07 | 0,06 |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 96,0 | 354,0 | 0,3 | 0,1 | 7,8 | 0,0 | 348,1 | 76,4 | 91,9 | 418,5 | 348,9 | 594,8 | 611,1 | 356,3 | 715,6 | 0,18 | 77,40 | 78,07 | 85,47 | 0,18 | 82,44 | 84,28 | 84,77 | 0,07 | 0,06 |
| 97,0 | 355,0 | 0,3 | 0,1 | 7,9 | 0,0 | 347,6 | 76,5 | 92,3 | 415,7 | 347,5 | 592,4 | 609,2 | 357,0 | 717,3 | 0,18 | 77,58 | 78,07 | 85,42 | 0,18 | 82,54 | 84,29 | 84,69 | 0,06 | 0,06 |
| 98,0 | 356,0 | 0,3 | 0,1 | 7,8 | 0,0 | 347,5 | 76,5 | 92,0 | 413,3 | 346,5 | 590,7 | 608,3 | 357,6 | 719,0 | 0,18 | 77,56 | 78,07 | 85,32 | 0,18 | 82,49 | 84,26 | 84,56 | 0,07 | 0,06 |
| 99,0 | 357,0 | 0,3 | 0,1 | 7,9 | 0,0 | 348,2 | 76,3 | 92,2 | 410,9 | 346,0 | 588,9 | 606,9 | 358,3 | 720,2 | 0,18 | 77,44 | 78,04 | 85,26 | 0,18 | 82,38 | 84,19 | 84,51 | 0,07 | 0,06 |
| 100,0 | 358,0 | 0,3 | 0,1 | 7,8 | 0,0 | 348,1 | 76,3 | 92,4 | 408,6 | 345,4 | 587,1 | 605,4 | 359,0 | 718,5 | 0,18 | 77,30 | 77,99 | 85,21 | 0,18 | 82,28 | 84,08 | 84,44 | 0,07 | 0,06 |
| 101,0 | 359,0 | 0,3 | 0,1 | 7,8 | 0,0 | 348,4 | 76,4 | 92,6 | 406,7 | 344,8 | 584,6 | 603,6 | 359,7 | 716,7 | 0,18 | 77,30 | 77,94 | 85,17 | 0,18 | 82,25 | 84,04 | 84,39 | 0,07 | 0,06 |
| 102,0 | 360,0 | 0,3 | 0,1 | 7,8 | 0,0 | 347,4 | 76,5 | 92,7 | 404,7 | 343,5 | 584,5 | 603,4 | 360,3 | 711,7 | 0,18 | 77,37 | 77,93 | 85,12 | 0,18 | 82,29 | 84,03 | 84,32 | 0,07 | 0,06 |
| 103,0 | 361,0 | 0,3 | 0,1 | 7,4 | 0,0 | 346,2 | 76,4 | 91,7 | 402,9 | 342,0 | 582,7 | 601,2 | 361,0 | 706,8 | 0,18 | 77,33 | 77,91 | 85,04 | 0,18 | 82,23 | 83,95 | 84,21 | 0,07 | 0,06 |
| 104,0 | 362,0 | 0,2 | 0,1 | 7,1 | 0,0 | 345,0 | 76,6 | 92,2 | 400,2 | 340,6 | 581,6 | 600,7 | 361,7 | 707,0 | 0,18 | 77,40 | 77,88 | 85,02 | 0,18 | 82,28 | 83,93 | 84,14 | 0,07 | 0,06 |
| 105,0 | 363,0 | 0,2 | 0,1 | 7,2 | 0,0 | 345,7 | 76,4 | 91,7 | 398,4 | 338,9 | 579,3 | 598,7 | 362,4 | 710,3 | 0,18 | 77,37 | 77,87 | 84,93 | 0,18 | 82,23 | 83,88 | 83,99 | 0,07 | 0,07 |
| 106,0 | 364,0 | 0,2 | 0,1 | 7,2 | 0,0 | 347,2 | 76,4 | 92,2 | 396,3 | 337,9 | 577,8 | 596,6 | 363,2 | 713,9 | 0,18 | 77,30 | 77,86 | 84,89 | 0,18 | 82,19 | 83,88 | 83,93 | 0,07 | 0,06 |
| 107,0 | 365,0 | 0,2 | 0,1 | 7,3 | 0,0 | 347,1 | 76,1 | 91,3 | 394,3 | 335,5 | 575,7 | 594,2 | 363,7 | 714,0 | 0,18 | 77,14 | 77,81 | 84,83 | 0,18 | 82,11 | 83,84 | 83,85 | 0,07 | 0,07 |
| 108,0 | 366,0 | 0,1 | 0,1 | 7,3 | 0,0 | 348,1 | 76,3 | 92,4 | 392,7 | 335,4 | 573,5 | 592,7 | 364,7 | 719,3 | 0,18 | 77,23 | 77,81 | 84,76 | 0,18 | 82,17 | 83,84 | 83,80 | 0,07 | 0,06 |
| 109,0 | 367,0 | 0,1 | 0,1 | 7,2 | 0,0 | 349,3 | 76,2 | 91,3 | 390,7 | 333,3 | 570,2 | 589,9 | 365,5 | 721,6 | 0,18 | 77,34 | 77,80 | 84,71 | 0,18 | 82,18 | 83,83 | 83,74 | 0,07 | 0,07 |
| 110,0 | 368,0 | 0,1 | 0,1 | 7,3 | 0,0 | 351,0 | 76,2 | 91,1 | 389,0 | 330,8 | 569,6 | 587,4 | 366,2 | 724,0 | 0,18 | 77,27 | 77,80 | 84,61 | 0,18 | 82,08 | 83,82 | 83,67 | 0,07 | 0,06 |
| 111,0 | 369,0 | 0,1 | 0,1 | 7,3 | 0,0 | 351,6 | 76,1 | 91,8 | 387,4 | 329,8 | 567,9 | 585,2 | 367,0 | 727,0 | 0,18 | 77,07 | 77,74 | 84,55 | 0,18 | 81,98 | 83,76 | 83,57 | 0,07 | 0,06 |
| 112,0 | 370,0 | 0,1 | 0,1 | 7,4 | 0,0 | 353,4 | 76,4 | 91,1 | 385,8 | 327,5 | 567,1 | 583,3 | 367,7 | 734,5 | 0,18 | 77,14 | 77,74 | 84,51 | 0,18 | 82,00 | 83,76 | 83,49 | 0,07 | 0,06 |
| 113,0 | 371,0 | 0,1 | 0,1 | 7,2 | 0,0 | 353,9 | 76,5 | 91,5 | 384,6 | 326,6 | 565,8 | 581,3 | 368,5 | 734,9 | 0,18 | 77,21 | 77,73 | 84,51 | 0,18 | 82,05 | 83,79 | 83,48 | 0,07 | 0,07 |
| 114,0 | 372,0 | 0,0 | 0,2 | 7,0 | 0,0 | 355,7 | 76,5 | 91,5 | 383,2 | 325,5 | 563,6 | 579,4 | 369,3 | 738,7 | 0,18 | 77,35 | 77,76 | 84,50 | 0,18 | 82,15 | 83,85 | 83,45 | 0,07 | 0,07 |

Manufacturer: HEARTHSTONE
Model: 8060

Run: 4
Project #: PI 20272
Test Duration: 114 min

| | HHV | LHV |
|---|---|---|
| Eff | 78,00% | 84,31% |
| Comb Eff | 99,30% | 99,30% |
| HT Eff | 78,55% | 84,90% |
| Output | 21 405 | kJ/h |
| Burn Rate | 1,39 | kg/h |
| Grams CO | 33 | g |
| Input | 27 442 | kJ/h |
| MC wet | 16,82 | |

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

Ultimate $CO_2$
$CO_{2\text{-ult}}$ 19,64
$F_0$
1,062

Overall Heating Efficiency: 78,00%
Combustion Efficiency: 99,30%
Heat Transfer Efficiency: 78,55%

Heat Output: 20 305 Btu/h
Heat Input: 26 032 Btu/h
Burn Duration: 1,90 h
Burn Rate: 3,05 lb/h
Stack Temp: 385,2 Deg. F

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Averages | 0,12 | 10,65 | 1,04 | 20,23 | 9,51 | 195,87 | 25,01 | 0,99 | 0,78 | 0,77 |
| INPUT DATA | | | Oxygen Calculation | | | Input Data | | Combust | Heat | Net |
| Elapsed Time | Weight Remaining (kg) | % CO [e] | % $CO_2$ [d] | Excess Air EA | Total $O_2$ | Calc. % $O_2$ [g] | Flue Gas (°C) | Room Temp (°C) | Eff % | Transfer % | Eff % |
| 0,00 | 3,16 | 0,14 | 2,92 | 542,6% | 20,74 | 17,75 | 157,9 | 23,6 | 97,8% | 61,1% | 59,8% |
| 1,00 | 3,15 | 0,21 | 3,84 | 385,8% | 20,67 | 16,73 | 149,2 | 23,7 | 96,9% | 69,0% | 66,9% |
| 2,00 | 3,12 | 0,05 | 5,28 | 269,0% | 20,59 | 15,29 | 149,8 | 23,8 | 100,1% | 74,3% | 74,4% |
| 3,00 | 3,12 | 0,03 | 5,72 | 241,6% | 20,56 | 14,83 | 150,3 | 23,8 | 100,3% | 75,3% | 75,5% |
| 4,00 | 3,07 | 0,03 | 6,01 | 225,1% | 20,54 | 14,51 | 151,5 | 23,8 | 100,3% | 75,9% | 76,1% |
| 5,00 | 3,03 | 0,03 | 8,40 | 133,1% | 20,38 | 11,97 | 159,6 | 23,9 | 100,1% | 78,8% | 78,9% |
| 6,00 | 2,98 | 0,04 | 11,42 | 71,3% | 20,18 | 8,74 | 169,2 | 23,9 | 99,9% | 80,7% | 80,6% |
| 7,00 | 2,94 | 0,04 | 10,34 | 89,4% | 20,26 | 9,90 | 173,1 | 23,8 | 100,0% | 79,6% | 79,6% |
| 8,00 | 2,94 | 0,04 | 10,15 | 92,6% | 20,27 | 10,09 | 175,1 | 23,7 | 99,9% | 79,3% | 79,3% |
| 9,00 | 2,89 | 0,04 | 8,84 | 121,2% | 20,35 | 11,49 | 175,0 | 23,8 | 100,0% | 78,0% | 78,0% |
| 10,00 | 2,85 | 0,04 | 9,27 | 110,9% | 20,33 | 11,03 | 175,2 | 23,9 | 100,0% | 78,5% | 78,5% |
| 11,00 | 2,80 | 0,04 | 8,80 | 122,2% | 20,36 | 11,54 | 174,9 | 23,9 | 100,0% | 78,0% | 78,0% |
| 12,00 | 2,76 | 0,04 | 8,70 | 124,9% | 20,36 | 11,65 | 175,5 | 23,9 | 100,0% | 77,8% | 77,8% |
| 13,00 | 2,71 | 0,05 | 10,64 | 83,8% | 20,23 | 9,57 | 181,9 | 23,9 | 99,8% | 79,3% | 79,2% |
| 14,00 | 2,67 | 0,08 | 13,00 | 50,2% | 20,08 | 7,03 | 193,2 | 23,9 | 99,6% | 80,3% | 80,0% |
| 15,00 | 2,62 | 0,05 | 12,60 | 55,3% | 20,10 | 7,48 | 195,2 | 24,0 | 99,8% | 79,9% | 79,7% |
| 16,00 | 2,57 | 0,04 | 11,85 | 65,3% | 20,16 | 8,29 | 195,9 | 24,1 | 99,9% | 79,3% | 79,3% |
| 17,00 | 2,53 | 0,07 | 12,87 | 51,8% | 20,09 | 7,18 | 203,2 | 24,1 | 99,7% | 79,6% | 79,3% |
| 18,00 | 2,44 | 0,25 | 14,96 | 29,1% | 19,94 | 4,84 | 213,5 | 24,2 | 98,7% | 80,2% | 79,1% |
| 19,00 | 2,39 | 0,58 | 15,43 | 22,7% | 19,88 | 4,16 | 221,1 | 24,1 | 97,0% | 79,9% | 77,5% |
| 20,00 | 2,35 | 0,16 | 14,29 | 36,0% | 19,99 | 5,62 | 220,3 | 24,0 | 99,2% | 79,5% | 78,8% |
| 21,00 | 2,30 | 0,05 | 12,76 | 53,4% | 20,09 | 7,31 | 217,6 | 23,9 | 99,8% | 78,7% | 78,5% |
| 22,00 | 2,26 | 0,04 | 13,36 | 46,5% | 20,05 | 6,67 | 217,4 | 23,9 | 99,9% | 79,1% | 79,0% |
| 23,00 | 2,19 | 0,04 | 14,12 | 38,7% | 20,01 | 5,87 | 218,5 | 23,8 | 99,9% | 79,5% | 79,4% |
| 24,00 | 2,12 | 0,05 | 14,87 | 31,7% | 19,96 | 5,06 | 220,3 | 24,0 | 99,8% | 79,8% | 79,7% |
| 25,00 | 2,08 | 0,21 | 15,40 | 25,8% | 19,91 | 4,41 | 225,8 | 24,1 | 98,9% | 79,8% | 78,9% |
| 26,00 | 1,98 | 0,70 | 15,74 | 19,5% | 19,85 | 3,76 | 229,2 | 24,1 | 96,5% | 79,6% | 76,8% |
| 27,00 | 1,94 | 0,50 | 15,84 | 20,2% | 19,86 | 3,77 | 230,9 | 24,2 | 97,5% | 79,7% | 77,7% |
| 28,00 | 1,89 | 0,13 | 15,15 | 28,6% | 19,93 | 4,72 | 229,6 | 24,2 | 99,4% | 79,5% | 79,0% |
| 29,00 | 1,81 | 0,13 | 14,99 | 29,9% | 19,94 | 4,89 | 228,3 | 24,3 | 99,4% | 79,5% | 79,0% |
| 30,00 | 1,76 | 0,07 | 14,60 | 33,9% | 19,97 | 5,34 | 226,1 | 24,2 | 99,7% | 79,4% | 79,2% |
| 31,00 | 1,75 | 0,05 | 14,38 | 36,1% | 19,99 | 5,58 | 224,6 | 24,3 | 99,8% | 79,4% | 79,2% |
| 32,00 | 1,67 | 0,05 | 14,39 | 36,0% | 19,99 | 5,57 | 223,4 | 24,4 | 99,8% | 79,4% | 79,3% |
| 33,00 | 1,62 | 0,07 | 14,68 | 33,2% | 19,97 | 5,25 | 223,1 | 24,5 | 99,7% | 79,6% | 79,4% |
| 34,00 | 1,58 | 0,12 | 15,08 | 29,3% | 19,94 | 4,80 | 224,6 | 24,7 | 99,4% | 79,7% | 79,3% |
| 35,00 | 1,53 | 0,25 | 15,46 | 25,1% | 19,90 | 4,32 | 226,7 | 24,9 | 98,7% | 79,8% | 78,8% |
| 36,00 | 1,44 | 0,44 | 15,89 | 20,3% | 19,86 | 3,75 | 229,4 | 25,1 | 97,8% | 79,8% | 78,1% |
| 37,00 | 1,44 | 0,75 | 16,12 | 16,4% | 19,83 | 3,33 | 232,1 | 25,2 | 96,3% | 79,7% | 76,8% |
| 38,00 | 1,35 | 0,23 | 16,07 | 20,5% | 19,86 | 3,68 | 233,7 | 25,4 | 98,9% | 79,8% | 78,9% |
| 39,00 | 1,30 | 0,28 | 15,95 | 21,0% | 19,87 | 3,78 | 234,0 | 25,5 | 98,6% | 79,7% | 78,6% |
| 40,00 | 1,26 | 0,26 | 16,03 | 20,5% | 19,86 | 3,70 | 233,4 | 25,6 | 98,7% | 79,8% | 78,7% |
| 41,00 | 1,17 | 0,24 | 15,98 | 21,1% | 19,87 | 3,77 | 233,7 | 25,7 | 98,8% | 79,7% | 78,8% |
| 42,00 | 1,12 | 0,73 | 15,94 | 17,9% | 19,84 | 3,54 | 233,3 | 25,7 | 96,4% | 79,6% | 76,7% |
| 43,00 | 1,08 | 0,38 | 15,61 | 22,9% | 19,88 | 4,09 | 232,6 | 25,8 | 98,1% | 79,6% | 78,0% |
| 44,00 | 1,04 | 0,20 | 15,06 | 28,7% | 19,93 | 4,77 | 231,4 | 25,7 | 99,0% | 79,4% | 78,6% |
| 45,00 | 1,03 | 0,13 | 14,93 | 30,4% | 19,95 | 4,95 | 232,0 | 25,9 | 99,4% | 79,3% | 78,8% |
| 46,00 | 0,99 | 0,12 | 14,73 | 32,3% | 19,96 | 5,17 | 231,2 | 25,9 | 99,4% | 79,3% | 78,8% |
| 47,00 | 0,94 | 0,07 | 14,48 | 35,0% | 19,98 | 5,46 | 230,3 | 25,8 | 99,7% | 79,2% | 78,9% |
| 48,00 | 0,90 | 0,06 | 14,35 | 36,3% | 19,99 | 5,61 | 228,0 | 26,0 | 99,8% | 79,2% | 79,0% |
| 49,00 | 0,85 | 0,04 | 14,17 | 38,2% | 20,00 | 5,81 | 226,6 | 26,0 | 99,9% | 79,2% | 79,1% |
| 50,00 | 0,81 | 0,03 | 13,99 | 40,1% | 20,01 | 6,01 | 224,5 | 26,0 | 99,9% | 79,2% | 79,1% |
| 51,00 | 0,81 | 0,03 | 13,86 | 41,5% | 20,02 | 6,15 | 222,4 | 26,1 | 100,0% | 79,2% | 79,2% |
| 52,00 | 0,76 | 0,02 | 13,33 | 47,1% | 20,06 | 6,72 | 220,6 | 26,1 | 100,0% | 79,0% | 79,0% |
| 53,00 | 0,71 | 0,03 | 13,12 | 49,4% | 20,07 | 6,94 | 218,5 | 26,2 | 100,0% | 79,0% | 79,0% |
| 54,00 | 0,71 | 0,03 | 12,92 | 51,7% | 20,09 | 7,15 | 216,4 | 26,2 | 100,0% | 79,0% | 79,0% |
| 55,00 | 0,67 | 0,03 | 12,70 | 54,3% | 20,10 | 7,38 | 214,1 | 26,1 | 100,0% | 79,0% | 79,0% |
| 56,00 | 0,62 | 0,03 | 12,57 | 55,9% | 20,11 | 7,52 | 212,4 | 26,4 | 100,0% | 79,0% | 79,0% |
| 57,00 | 0,62 | 0,03 | 12,39 | 58,2% | 20,12 | 7,72 | 210,6 | 26,4 | 100,0% | 79,0% | 79,0% |
| 58,00 | 0,58 | 0,02 | 12,18 | 61,0% | 20,13 | 7,95 | 208,4 | 26,4 | 100,0% | 78,9% | 79,0% |
| 59,00 | 0,58 | 0,02 | 12,01 | 63,2% | 20,15 | 8,12 | 206,2 | 26,5 | 100,0% | 79,0% | 79,0% |
| 60,00 | 0,53 | 0,02 | 11,82 | 65,9% | 20,16 | 8,33 | 203,8 | 26,5 | 100,0% | 79,0% | 79,0% |
| 61,00 | 0,53 | 0,02 | 11,54 | 69,9% | 20,18 | 8,63 | 201,9 | 26,4 | 100,0% | 78,9% | 78,9% |
| 62,00 | 0,49 | 0,02 | 10,95 | 79,0% | 20,22 | 9,26 | 199,8 | 26,6 | 100,1% | 78,5% | 78,6% |
| 63,00 | 0,49 | 0,03 | 10,86 | 80,4% | 20,22 | 9,35 | 198,3 | 26,6 | 100,1% | 78,6% | 78,6% |
| 64,00 | 0,49 | 0,03 | 10,83 | 80,9% | 20,22 | 9,38 | 196,6 | 26,6 | 100,0% | 78,6% | 78,7% |
| 65,00 | 0,49 | 0,03 | 10,78 | 81,7% | 20,23 | 9,43 | 195,1 | 26,6 | 100,0% | 78,7% | 78,7% |
| 66,00 | 0,44 | 0,03 | 10,45 | 87,4% | 20,25 | 9,78 | 193,9 | 26,5 | 100,0% | 78,5% | 78,5% |
| 67,00 | 0,44 | 0,04 | 9,62 | 103,3% | 20,30 | 10,66 | 192,1 | 26,6 | 100,0% | 77,8% | 77,8% |
| 68,00 | 0,44 | 0,06 | 8,72 | 123,9% | 20,36 | 11,62 | 191,1 | 26,7 | 99,8% | 76,8% | 76,7% |
| 69,00 | 0,40 | 0,07 | 8,42 | 131,5% | 20,38 | 11,93 | 190,3 | 26,7 | 99,7% | 76,5% | 76,3% |
| 70,00 | 0,40 | 0,08 | 8,29 | 134,9% | 20,39 | 12,06 | 189,8 | 26,6 | 99,6% | 76,3% | 76,0% |
| 71,00 | 0,40 | 0,08 | 8,19 | 137,5% | 20,39 | 12,17 | 189,0 | 26,7 | 99,6% | 76,2% | 75,9% |
| 72,00 | 0,40 | 0,09 | 8,24 | 136,1% | 20,39 | 12,11 | 187,7 | 26,4 | 99,5% | 76,4% | 76,0% |
| 73,00 | 0,36 | 0,09 | 8,45 | 130,0% | 20,38 | 11,88 | 187,1 | 25,9 | 99,5% | 76,7% | 76,4% |
| 74,00 | 0,35 | 0,09 | 8,35 | 132,7% | 20,38 | 11,99 | 186,2 | 25,8 | 99,5% | 76,6% | 76,2% |
| 75,00 | 0,35 | 0,09 | 8,20 | 136,8% | 20,39 | 12,14 | 185,5 | 25,5 | 99,5% | 76,5% | 76,1% |
| 76,00 | 0,35 | 0,10 | 8,09 | 140,0% | 20,40 | 12,26 | 184,8 | 25,5 | 99,4% | 76,4% | 75,9% |
| 77,00 | 0,31 | 0,10 | 8,04 | 141,5% | 20,40 | 12,32 | 184,4 | 25,2 | 99,4% | 76,3% | 75,8% |
| 78,00 | 0,31 | 0,10 | 7,99 | 142,9% | 20,41 | 12,37 | 183,5 | 25,0 | 99,4% | 76,3% | 75,8% |
| 79,00 | 0,31 | 0,10 | 8,09 | 140,0% | 20,40 | 12,26 | 181,8 | 24,9 | 99,4% | 76,6% | 76,1% |
| 80,00 | 0,31 | 0,09 | 7,77 | 150,0% | 20,42 | 12,61 | 179,4 | 24,9 | 99,5% | 76,3% | 75,9% |
| 81,00 | 0,31 | 0,09 | 7,91 | 145,4% | 20,41 | 12,45 | 178,7 | 24,9 | 99,5% | 76,6% | 76,2% |
| 82,00 | 0,29 | 0,10 | 8,00 | 142,5% | 20,41 | 12,35 | 178,5 | 24,8 | 99,4% | 76,7% | 76,3% |
| 83,00 | 0,29 | 0,10 | 8,10 | 139,4% | 20,40 | 12,24 | 178,0 | 25,0 | 99,4% | 76,9% | 76,5% |
| 84,00 | 0,26 | 0,10 | 8,05 | 140,8% | 20,40 | 12,30 | 178,3 | 25,0 | 99,4% | 76,8% | 76,3% |
| 85,00 | 0,26 | 0,10 | 8,06 | 140,8% | 20,40 | 12,29 | 177,9 | 25,1 | 99,4% | 76,9% | 76,4% |
| 86,00 | 0,22 | 0,10 | 8,02 | 141,7% | 20,40 | 12,33 | 177,6 | 25,0 | 99,4% | 76,8% | 76,3% |
| 87,00 | 0,23 | 0,10 | 8,01 | 142,2% | 20,40 | 12,35 | 177,2 | 25,1 | 99,4% | 76,9% | 76,4% |
| 88,00 | 0,26 | 0,11 | 7,95 | 143,8% | 20,41 | 12,40 | 177,0 | 24,9 | 99,3% | 76,8% | 76,3% |
| 89,00 | 0,22 | 0,11 | 7,84 | 147,1% | 20,42 | 12,52 | 176,5 | 24,9 | 99,3% | 76,7% | 76,1% |
| 90,00 | 0,22 | 0,11 | 7,91 | 145,0% | 20,41 | 12,45 | 176,1 | 24,9 | 99,3% | 76,8% | 76,3% |
| 91,00 | 0,22 | 0,11 | 7,86 | 146,6% | 20,41 | 12,50 | 175,7 | 24,8 | 99,3% | 76,7% | 76,2% |
| 92,00 | 0,17 | 0,11 | 8,01 | 141,9% | 20,40 | 12,34 | 176,0 | 24,8 | 99,3% | 76,9% | 76,4% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 93,00 | 0,17 | 0,11 | 8,03 | 141,2% | 20,40 | 12,31 | 175,9 | 24,7 | 99,3% | 77,0% | 76,4% |
| 94,00 | 0,17 | 0,11 | 8,01 | 142,0% | 20,40 | 12,34 | 175,8 | 24,6 | 99,3% | 76,9% | 76,4% |
| 95,00 | 0,17 | 0,11 | 7,66 | 152,8% | 20,43 | 12,71 | 175,7 | 24,6 | 99,3% | 76,4% | 75,9% |
| 96,00 | 0,15 | 0,11 | 7,79 | 148,4% | 20,42 | 12,57 | 175,6 | 24,7 | 99,2% | 76,6% | 76,1% |
| 97,00 | 0,12 | 0,11 | 7,89 | 145,4% | 20,41 | 12,46 | 175,3 | 24,7 | 99,2% | 76,8% | 76,2% |
| 98,00 | 0,12 | 0,12 | 7,82 | 147,3% | 20,42 | 12,53 | 175,3 | 24,7 | 99,2% | 76,7% | 76,1% |
| 99,00 | 0,12 | 0,12 | 7,86 | 146,3% | 20,41 | 12,50 | 175,7 | 24,6 | 99,2% | 76,7% | 76,1% |
| 100,00 | 0,12 | 0,12 | 7,83 | 147,3% | 20,42 | 12,53 | 175,6 | 24,6 | 99,2% | 76,7% | 76,1% |
| 101,00 | 0,12 | 0,12 | 7,79 | 148,4% | 20,42 | 12,57 | 175,8 | 24,6 | 99,2% | 76,6% | 76,0% |
| 102,00 | 0,11 | 0,12 | 7,76 | 149,4% | 20,42 | 12,60 | 175,2 | 24,7 | 99,2% | 76,6% | 76,0% |
| 103,00 | 0,12 | 0,12 | 7,40 | 161,5% | 20,44 | 12,99 | 174,6 | 24,6 | 99,2% | 76,1% | 75,5% |
| 104,00 | 0,08 | 0,12 | 7,15 | 170,2% | 20,46 | 13,25 | 173,9 | 24,8 | 99,1% | 75,8% | 75,1% |
| 105,00 | 0,08 | 0,13 | 7,16 | 169,6% | 20,46 | 13,23 | 174,3 | 24,7 | 99,1% | 75,7% | 75,0% |
| 106,00 | 0,08 | 0,13 | 7,23 | 166,7% | 20,45 | 13,16 | 175,1 | 24,7 | 99,0% | 75,8% | 75,0% |
| 107,00 | 0,08 | 0,13 | 7,26 | 165,7% | 20,45 | 13,12 | 175,1 | 24,5 | 99,0% | 75,8% | 75,1% |
| 108,00 | 0,03 | 0,13 | 7,27 | 165,4% | 20,45 | 13,12 | 175,6 | 24,6 | 99,0% | 75,8% | 75,0% |
| 109,00 | 0,03 | 0,14 | 7,22 | 167,1% | 20,45 | 13,17 | 176,3 | 24,5 | 98,9% | 75,6% | 74,8% |
| 110,00 | 0,03 | 0,14 | 7,32 | 163,5% | 20,45 | 13,06 | 177,2 | 24,5 | 98,9% | 75,7% | 74,9% |
| 111,00 | 0,03 | 0,14 | 7,32 | 163,4% | 20,45 | 13,06 | 177,6 | 24,5 | 98,9% | 75,7% | 74,9% |
| 112,00 | 0,03 | 0,15 | 7,37 | 161,5% | 20,44 | 13,00 | 178,5 | 24,7 | 98,9% | 75,7% | 74,8% |
| 113,00 | 0,03 | 0,15 | 7,18 | 167,9% | 20,46 | 13,20 | 178,8 | 24,7 | 98,8% | 75,3% | 74,4% |
| 114,00 | 0,00 | 0,15 | 6,98 | 175,3% | 20,47 | 13,41 | 179,8 | 24,7 | 98,7% | 74,9% | 73,9% |

DATA 2022-06-30 EPA PI 20272 RUN 4 MODEL 8060
preburn

| Temps | Flue | Room | Tunnel | Catalyst down | scale | Right | Back | bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|
| acquisition | temp | temp | dry bulb | | | | | | | |
| minutes | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| 1 | 71,82 | 69,19 | 73,29 | 72,01 | 2,67 | 73,77 | 73,41 | 74,24 | 73,53 | 74,30 |
| 2 | 76,80 | 69,23 | 73,66 | 84,38 | 2,67 | 73,74 | 73,64 | 74,21 | 73,54 | 74,44 |
| 3 | 94,92 | 69,13 | 75,73 | 128,56 | 2,66 | 73,97 | 76,52 | 74,25 | 73,55 | 78,27 |
| 4 | 165,97 | 69,29 | 86,37 | 243,71 | 2,47 | 74,70 | 76,43 | 74,58 | 74,58 | 92,11 |
| 5 | 246,69 | 69,25 | 80,46 | 581,65 | 2,27 | 78,57 | 79,49 | 75,42 | 77,76 | 114,59 |
| 6 | 329,63 | 69,03 | 83,71 | 721,33 | 2,07 | 88,94 | 87,91 | 76,55 | 83,24 | 140,34 |
| 7 | 381,16 | 68,92 | 85,45 | 801,74 | 1,87 | 103,72 | 99,39 | 78,00 | 90,30 | 164,35 |
| 8 | 410,40 | 69,09 | 86,33 | 845,48 | 1,77 | 120,59 | 110,93 | 79,82 | 98,70 | 185,21 |
| 9 | 437,21 | 69,30 | 88,27 | 881,67 | 1,57 | 140,08 | 121,89 | 81,86 | 107,33 | 203,26 |
| 10 | 450,94 | 69,23 | 89,28 | 893,24 | 1,37 | 161,03 | 132,80 | 84,18 | 116,11 | 219,24 |
| 11 | 459,99 | 69,17 | 89,98 | 900,43 | 1,27 | 183,30 | 143,29 | 86,74 | 124,96 | 233,41 |
| 12 | 459,68 | 69,16 | 90,04 | 892,58 | 1,17 | 204,34 | 153,01 | 89,58 | 132,51 | 247,54 |
| 13 | 467,09 | 69,14 | 90,89 | 897,13 | 1,29 | 221,94 | 161,70 | 92,65 | 140,06 | 263,64 |
| 14 | 416,10 | 69,03 | 123,55 | 453,60 | 5,17 | 241,32 | 178,83 | 95,97 | 141,45 | 280,98 |
| 15 | 332,43 | 69,00 | 97,89 | 394,45 | 7,77 | 260,34 | 187,16 | 99,74 | 144,44 | 298,75 |
| 16 | 313,90 | 69,30 | 87,18 | 458,30 | 7,77 | 272,58 | 188,46 | 103,85 | 151,39 | 307,80 |
| 17 | 303,30 | 69,27 | 85,07 | 471,62 | 7,67 | 277,08 | 189,72 | 107,72 | 158,02 | 310,72 |
| 18 | 298,27 | 69,40 | 84,15 | 484,05 | 7,67 | 277,35 | 192,08 | 111,19 | 165,74 | 310,12 |
| 19 | 291,22 | 69,46 | 83,47 | 484,09 | 7,58 | 276,00 | 195,83 | 114,09 | 173,41 | 308,43 |
| 20 | 296,24 | 69,66 | 83,47 | 507,23 | 7,51 | 274,34 | 200,62 | 116,61 | 180,56 | 305,86 |
| 21 | 314,54 | 69,68 | 84,08 | 576,39 | 7,47 | 273,32 | 205,61 | 118,80 | 186,49 | 303,06 |
| 22 | 320,64 | 69,74 | 84,56 | 577,85 | 7,37 | 272,52 | 211,52 | 120,75 | 191,72 | 300,85 |
| 23 | 310,23 | 70,07 | 83,83 | 529,71 | 7,27 | 271,22 | 216,69 | 122,47 | 196,27 | 298,20 |
| 24 | 301,10 | 70,32 | 83,13 | 513,98 | 7,27 | 271,26 | 220,89 | 124,05 | 200,59 | 296,34 |
| 25 | 296,33 | 70,53 | 83,00 | 512,68 | 7,17 | 270,58 | 223,92 | 125,59 | 204,48 | 294,14 |
| 26 | 291,09 | 70,40 | 82,72 | 499,23 | 7,11 | 270,53 | 226,03 | 127,09 | 208,04 | 292,86 |
| 27 | 293,27 | 70,29 | 83,44 | 517,66 | 7,07 | 269,75 | 226,89 | 128,56 | 211,33 | 290,49 |
| 28 | 294,30 | 70,36 | 83,17 | 514,88 | 6,97 | 270,50 | 227,86 | 130,08 | 214,24 | 289,32 |
| 29 | 287,46 | 70,25 | 83,01 | 494,41 | 6,97 | 270,59 | 229,05 | 131,59 | 216,86 | 288,43 |
| 30 | 275,95 | 70,36 | 82,52 | 461,77 | 6,87 | 270,35 | 230,19 | 133,21 | 219,18 | 287,55 |
| 31 | 265,27 | 70,63 | 82,23 | 438,69 | 6,88 | 269,87 | 231,03 | 134,92 | 221,30 | 286,67 |
| 32 | 257,59 | 70,74 | 81,95 | 427,32 | 6,77 | 268,43 | 230,66 | 136,70 | 222,97 | 285,64 |
| 33 | 250,35 | 70,61 | 81,75 | 412,45 | 6,77 | 267,45 | 229,95 | 138,62 | 224,43 | 284,60 |
| 34 | 242,51 | 70,76 | 81,30 | 399,60 | 6,77 | 266,35 | 228,43 | 140,69 | 225,19 | 283,27 |
| 35 | 239,44 | 70,90 | 81,24 | 397,93 | 6,77 | 265,32 | 226,26 | 142,93 | 225,84 | 281,88 |
| 36 | 234,92 | 70,81 | 80,74 | 387,39 | 6,67 | 264,19 | 223,50 | 145,23 | 226,17 | 280,07 |
| 37 | 229,72 | 70,63 | 80,43 | 374,00 | 6,67 | 263,47 | 220,49 | 147,62 | 226,32 | 278,31 |
| 38 | 224,22 | 70,54 | 80,18 | 364,15 | 6,67 | 262,64 | 217,29 | 150,04 | 226,21 | 276,50 |
| 39 | 218,56 | 70,60 | 79,62 | 346,96 | 6,67 | 261,27 | 214,24 | 152,50 | 225,66 | 274,51 |
| 40 | 212,14 | 70,66 | 79,59 | 330,13 | 6,67 | 260,30 | 210,43 | 154,90 | 225,45 | 272,81 |
| 41 | 205,12 | 70,57 | 79,22 | 318,66 | 6,67 | 259,22 | 206,69 | 157,32 | 224,97 | 271,15 |
| 42 | 198,39 | 70,65 | 79,39 | 303,11 | 6,57 | 257,99 | 203,43 | 159,70 | 224,02 | 269,09 |
| 43 | 192,92 | 70,75 | 78,76 | 292,32 | 6,57 | 256,15 | 200,06 | 161,92 | 223,07 | 267,24 |
| 44 | 188,93 | 70,68 | 78,77 | 283,94 | 6,57 | 254,77 | 196,14 | 164,01 | 221,85 | 265,35 |
| 45 | 186,44 | 70,60 | 78,78 | 286,22 | 6,57 | 253,58 | 192,64 | 165,99 | 220,68 | 263,79 |
| 46 | 185,76 | 70,71 | 78,38 | 294,32 | 6,57 | 252,26 | 188,80 | 167,79 | 219,26 | 262,21 |
| 47 | 186,70 | 70,73 | 78,78 | 315,12 | 6,47 | 250,60 | 185,54 | 169,43 | 217,76 | 260,99 |
| 48 | 191,04 | 70,75 | 78,58 | 337,13 | 6,47 | 249,25 | 183,14 | 171,00 | 216,27 | 260,53 |
| 49 | 202,95 | 70,75 | 79,00 | 386,94 | 6,47 | 248,48 | 180,74 | 172,48 | 214,61 | 260,67 |
| 50 | 232,32 | 70,92 | 80,16 | 468,14 | 6,37 | 247,92 | 179,59 | 173,87 | 213,15 | 262,29 |
| 51 | 259,18 | 70,98 | 81,09 | 477,75 | 6,27 | 248,28 | 179,00 | 175,20 | 211,81 | 264,28 |
| 52 | 280,21 | 71,14 | 82,03 | 509,86 | 6,18 | 249,11 | 179,88 | 176,53 | 210,83 | 265,64 |
| 53 | 295,28 | 70,98 | 82,49 | 543,12 | 6,07 | 249,88 | 180,92 | 177,76 | 210,35 | 267,55 |
| 54 | 305,28 | 70,93 | 82,91 | 585,04 | 5,97 | 251,73 | 183,52 | 179,23 | 210,71 | 269,21 |
| 55 | 333,32 | 70,90 | 84,34 | 696,34 | 5,97 | 253,82 | 185,53 | 180,66 | 211,49 | 270,92 |
| 56 | 360,97 | 70,88 | 85,93 | 725,85 | 5,77 | 257,43 | 187,71 | 182,27 | 212,83 | 273,45 |
| 57 | 373,92 | 70,80 | 86,60 | 746,13 | 5,67 | 263,46 | 189,35 | 183,99 | 214,82 | 276,76 |
| 58 | 386,85 | 70,62 | 87,71 | 779,55 | 5,57 | 272,80 | 190,87 | 185,92 | 217,73 | 279,99 |
| 59 | 408,63 | 70,57 | 88,92 | 826,95 | 5,47 | 284,27 | 192,97 | 187,93 | 220,99 | 284,53 |
| 60 | 417,08 | 70,69 | 89,41 | 835,33 | 5,37 | 298,73 | 195,47 | 190,11 | 225,01 | 289,65 |
| 61 | 441,32 | 71,00 | 90,82 | 896,84 | 5,21 | 315,30 | 199,08 | 192,33 | 230,00 | 295,40 |
| 62 | 453,19 | 71,00 | 92,35 | 899,24 | 5,07 | 333,07 | 203,80 | 194,72 | 235,72 | 301,55 |
| 63 | 461,00 | 71,21 | 93,23 | 889,90 | 4,97 | 349,86 | 209,00 | 197,09 | 242,11 | 308,00 |
| 64 | 471,22 | 71,20 | 93,89 | 897,81 | 4,87 | 364,79 | 214,79 | 199,47 | 249,62 | 314,32 |
| 65 | 478,61 | 70,99 | 94,29 | 891,71 | 4,67 | 379,84 | 221,32 | 201,80 | 257,58 | 320,61 |
| 66 | 486,96 | 71,16 | 95,54 | 913,90 | 4,47 | 393,80 | 229,69 | 204,34 | 266,07 | 327,35 |
| 67 | 490,50 | 70,84 | 95,89 | 913,19 | 4,37 | 408,37 | 237,97 | 206,95 | 274,98 | 334,40 |
| 68 | 492,72 | 70,79 | 96,62 | 921,55 | 4,18 | 424,41 | 245,50 | 209,55 | 284,80 | 341,73 |
| 69 | 498,74 | 70,59 | 97,45 | 939,02 | 4,07 | 439,18 | 252,71 | 212,07 | 294,44 | 349,59 |
| 70 | 506,28 | 70,92 | 98,08 | 963,67 | 3,97 | 454,56 | 260,32 | 214,53 | 304,30 | 357,93 |
| 71 | 512,78 | 71,05 | 99,06 | 971,89 | 3,77 | 469,07 | 268,18 | 216,92 | 314,44 | 366,67 |
| 72 | 515,30 | 71,10 | 98,95 | 984,90 | 3,67 | 481,76 | 276,02 | 219,27 | 324,72 | 375,62 |
| 73 | 513,01 | 71,24 | 98,72 | 968,00 | 3,47 | 492,06 | 282,92 | 221,57 | 334,72 | 384,58 |
| 74 | 509,38 | 71,10 | 98,19 | 961,69 | 3,37 | 502,29 | 289,39 | 223,77 | 344,75 | 393,73 |
| 75 | 507,30 | 71,16 | 97,88 | 961,75 | 3,17 | 511,00 | 295,91 | 226,04 | 354,51 | 402,72 |
| 76 | 505,84 | 71,49 | 98,73 | 960,57 | 3,07 | 520,02 | 301,91 | 228,42 | 363,45 | 411,38 |
| 77 | 506,04 | 71,54 | 98,94 | 966,88 | 2,97 | 529,13 | 305,94 | 230,92 | 371,97 | 419,45 |
| 78 | 505,73 | 71,45 | 99,16 | 964,16 | 2,87 | 537,71 | 310,50 | 233,63 | 380,71 | 427,31 |
| 79 | 503,44 | 71,58 | 98,73 | 954,27 | 2,77 | 546,31 | 314,07 | 236,47 | 388,75 | 434,95 |
| 80 | 501,13 | 71,50 | 97,67 | 950,06 | 2,57 | 554,89 | 317,70 | 239,44 | 397,02 | 443,02 |
| 81 | 498,23 | 71,66 | 98,32 | 946,50 | 2,57 | 560,91 | 322,21 | 242,49 | 404,14 | 450,22 |
| 82 | 497,37 | 71,67 | 98,74 | 951,62 | 2,46 | 568,57 | 325,25 | 245,63 | 410,86 | 457,61 |
| 83 | 497,03 | 71,59 | 99,26 | 953,97 | 2,33 | 575,26 | 328,99 | 248,84 | 417,22 | 464,67 |
| 84 | 497,23 | 71,65 | 99,08 | 965,87 | 2,17 | 581,56 | 330,93 | 252,00 | 423,29 | 471,49 |
| 85 | 497,76 | 71,65 | 99,08 | 953,45 | 2,07 | 588,47 | 333,67 | 255,26 | 428,79 | 478,27 |
| 86 | 498,20 | 71,52 | 99,19 | 963,79 | 1,97 | 594,63 | 337,97 | 258,61 | 433,84 | 487,58 |
| 87 | 496,40 | 71,51 | 99,13 | 955,96 | 1,87 | 601,36 | 340,15 | 261,97 | 438,62 | 498,05 |
| 88 | 491,60 | 71,51 | 99,36 | 938,67 | 1,77 | 607,42 | 343,11 | 265,37 | 443,32 | 509,15 |
| 89 | 485,62 | 71,49 | 98,83 | 905,03 | 1,67 | 612,67 | 346,22 | 268,88 | 447,33 | 518,78 |
| 90 | 477,44 | 71,50 | 97,41 | 862,01 | 1,67 | 617,48 | 347,81 | 272,39 | 450,95 | 527,62 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 468,63 | 71,41 | 97,64 | 824,50 | 1,57 | 621,52 | 349,88 | 276,03 | 453,96 | 535,84 |
| 92 | 461,09 | 71,31 | 97,28 | 811,64 | 1,48 | 624,74 | 351,75 | 279,74 | 456,67 | 543,37 |
| 93 | 448,87 | 71,67 | 96,19 | 793,00 | 1,47 | 627,21 | 352,62 | 283,51 | 458,68 | 551,90 |
| 94 | 436,21 | 71,59 | 95,49 | 773,46 | 1,47 | 630,49 | 352,53 | 287,43 | 459,37 | 558,81 |
| 95 | 425,97 | 72,03 | 94,44 | 756,28 | 1,37 | 630,77 | 352,16 | 291,48 | 459,32 | 568,22 |
| 96 | 416,24 | 71,91 | 94,28 | 745,42 | 1,37 | 633,37 | 351,76 | 295,72 | 458,90 | 576,26 |
| 97 | 406,77 | 71,81 | 93,49 | 735,93 | 1,37 | 634,15 | 351,02 | 300,14 | 457,30 | 583,94 |
| 98 | 397,66 | 71,57 | 92,39 | 720,07 | 1,27 | 634,39 | 349,51 | 304,68 | 455,25 | 591,23 |
| 99 | 388,43 | 71,58 | 92,51 | 700,71 | 1,27 | 635,40 | 347,72 | 309,32 | 452,76 | 598,00 |
| 100 | 380,39 | 71,79 | 104,36 | 563,51 | 1,37 | 634,99 | 347,32 | 314,05 | 449,03 | 602,25 |
| 101 | 351,00 | 72,11 | 119,82 | 399,03 | 8,18 | 633,63 | 351,51 | 319,07 | 444,09 | 605,96 |
| 102 | 330,49 | 72,22 | 95,17 | 512,72 | 8,08 | 629,96 | 346,67 | 324,39 | 439,11 | 604,95 |
| 103 | 324,66 | 72,47 | 91,67 | 546,37 | 8,08 | 621,31 | 340,61 | 329,57 | 433,68 | 600,48 |
| 104 | 336,50 | 72,49 | 94,15 | 552,67 | 7,98 | 611,43 | 335,45 | 334,32 | 428,30 | 591,90 |
| 105 | 326,58 | 72,56 | 90,89 | 569,60 | 7,88 | 597,77 | 331,83 | 338,41 | 422,98 | 583,50 |
| 106 | 326,63 | 72,54 | 90,70 | 615,94 | 7,87 | 584,82 | 330,31 | 341,87 | 417,53 | 574,57 |
| 107 | 358,84 | 72,51 | 92,73 | 752,95 | 7,77 | 572,91 | 330,10 | 344,52 | 411,69 | 565,96 |
| 108 | 394,36 | 72,40 | 93,50 | 835,76 | 7,64 | 561,22 | 331,36 | 346,70 | 406,58 | 556,65 |
| 109 | 427,90 | 72,22 | 95,23 | 900,23 | 7,48 | 550,86 | 334,73 | 348,37 | 402,64 | 548,82 |
| 110 | 461,70 | 72,22 | 97,14 | 981,10 | 7,38 | 541,99 | 339,54 | 349,62 | 399,95 | 542,00 |
| 111 | 483,62 | 72,35 | 98,60 | 989,74 | 7,27 | 534,27 | 344,82 | 350,46 | 399,59 | 535,08 |
| 112 | 493,14 | 72,37 | 98,97 | 991,83 | 7,07 | 527,72 | 351,07 | 351,07 | 401,31 | 529,88 |
| 113 | 499,64 | 72,32 | 99,97 | 994,79 | 6,97 | 521,11 | 357,70 | 351,41 | 403,21 | 524,04 |
| 114 | 504,25 | 72,37 | 100,26 | 996,67 | 6,78 | 516,55 | 364,29 | 351,62 | 406,34 | 520,10 |
| 115 | 503,58 | 72,36 | 99,77 | 979,35 | 6,68 | 512,43 | 370,34 | 351,70 | 409,89 | 516,01 |
| 116 | 502,60 | 72,62 | 99,84 | 972,51 | 6,58 | 507,35 | 375,02 | 351,68 | 412,81 | 514,84 |
| 117 | 501,54 | 72,64 | 99,83 | 964,57 | 6,37 | 504,21 | 380,38 | 351,71 | 417,70 | 513,07 |
| 118 | 502,21 | 72,97 | 101,13 | 966,28 | 6,27 | 501,60 | 384,35 | 351,74 | 422,40 | 512,24 |
| 119 | 500,27 | 72,88 | 100,70 | 957,24 | 6,18 | 499,66 | 387,34 | 351,84 | 426,58 | 510,81 |
| 120 | 499,95 | 72,89 | 101,72 | 955,79 | 6,08 | 496,70 | 389,21 | 351,94 | 430,91 | 510,26 |
| 121 | 496,15 | 72,75 | 100,20 | 951,54 | 5,98 | 494,54 | 391,19 | 352,00 | 435,48 | 510,22 |
| 122 | 493,30 | 72,99 | 99,01 | 937,54 | 5,84 | 492,52 | 392,40 | 352,07 | 439,41 | 510,48 |
| 123 | 492,69 | 73,16 | 99,64 | 940,07 | 5,77 | 490,94 | 394,55 | 352,21 | 443,72 | 510,54 |
| 124 | 496,46 | 72,89 | 99,82 | 963,47 | 5,57 | 488,06 | 394,99 | 352,31 | 447,65 | 510,74 |
| 125 | 502,80 | 73,17 | 99,86 | 977,67 | 5,48 | 486,74 | 397,12 | 352,50 | 451,25 | 511,35 |
| 126 | 507,45 | 73,47 | 100,84 | 991,37 | 5,38 | 486,45 | 398,39 | 352,61 | 454,75 | 512,36 |
| 127 | 491,56 | 73,43 | 98,76 | 891,36 | 5,17 | 485,60 | 400,13 | 352,72 | 470,23 | 513,14 |
| 128 | 469,67 | 73,57 | 97,21 | 950,24 | 5,09 | 486,92 | 405,18 | 353,05 | 502,31 | 514,55 |
| 129 | 460,25 | 73,63 | 96,24 | 932,24 | 5,02 | 487,38 | 407,20 | 353,38 | 523,59 | 516,33 |
| 130 | 452,61 | 73,72 | 96,23 | 926,76 | 4,97 | 488,00 | 407,21 | 353,59 | 539,91 | 517,92 |
| 131 | 448,83 | 73,57 | 96,64 | 922,83 | 4,85 | 489,85 | 408,94 | 354,01 | 553,33 | 519,35 |
| 132 | 445,80 | 73,44 | 95,71 | 917,70 | 4,68 | 491,52 | 409,14 | 354,34 | 564,21 | 520,49 |
| 133 | 443,55 | 73,23 | 95,29 | 919,05 | 4,57 | 492,28 | 410,34 | 354,73 | 572,73 | 521,54 |
| 134 | 440,91 | 73,23 | 96,13 | 914,17 | 4,57 | 494,03 | 410,81 | 355,12 | 578,77 | 522,76 |
| 135 | 437,88 | 73,07 | 95,81 | 907,21 | 4,47 | 495,85 | 410,32 | 355,41 | 583,73 | 524,27 |
| 136 | 433,51 | 72,97 | 94,73 | 895,75 | 4,37 | 497,32 | 410,03 | 355,63 | 587,45 | 525,07 |
| 137 | 428,93 | 72,89 | 95,22 | 885,28 | 4,27 | 499,43 | 410,77 | 355,92 | 589,38 | 526,48 |
| 138 | 425,16 | 72,83 | 94,92 | 876,55 | 4,17 | 500,68 | 412,64 | 356,30 | 590,02 | 527,45 |
| 139 | 422,26 | 73,18 | 96,17 | 873,16 | 4,08 | 503,08 | 412,98 | 356,65 | 590,01 | 529,40 |
| 140 | 419,98 | 73,22 | 95,20 | 874,29 | 4,08 | 504,74 | 411,86 | 356,90 | 590,74 | 531,23 |
| 141 | 418,83 | 73,44 | 95,34 | 883,11 | 3,98 | 506,40 | 411,90 | 357,20 | 592,28 | 531,88 |
| 142 | 418,32 | 73,65 | 94,98 | 894,36 | 3,87 | 507,74 | 411,94 | 357,40 | 592,55 | 533,89 |
| 143 | 419,42 | 73,58 | 95,38 | 900,87 | 3,77 | 509,40 | 414,08 | 357,72 | 592,99 | 534,88 |
| 144 | 420,47 | 73,67 | 95,41 | 906,80 | 3,67 | 511,75 | 412,89 | 357,98 | 594,75 | 536,70 |
| 145 | 420,89 | 73,44 | 95,21 | 914,21 | 3,67 | 514,59 | 414,04 | 358,22 | 597,51 | 537,92 |
| 146 | 421,77 | 73,50 | 94,63 | 919,33 | 3,56 | 516,19 | 412,68 | 358,41 | 600,30 | 538,25 |
| 147 | 422,26 | 73,58 | 93,75 | 952,62 | 3,47 | 519,22 | 413,34 | 358,59 | 602,22 | 539,28 |
| 148 | 424,50 | 73,45 | 95,18 | 963,00 | 3,38 | 521,55 | 417,01 | 358,88 | 603,10 | 542,00 |
| 149 | 425,56 | 73,67 | 95,79 | 967,03 | 3,27 | 524,80 | 418,01 | 359,33 | 604,65 | 543,73 |
| 150 | 425,05 | 73,82 | 95,62 | 960,49 | 3,17 | 527,23 | 417,74 | 359,66 | 605,56 | 545,78 |
| 151 | 424,13 | 73,98 | 96,13 | 943,19 | 3,09 | 529,96 | 419,21 | 360,06 | 605,85 | 548,51 |
| 152 | 424,00 | 74,15 | 95,72 | 955,03 | 3,07 | 531,86 | 419,25 | 360,44 | 606,03 | 551,38 |
| 153 | 425,03 | 74,13 | 96,07 | 960,45 | 2,97 | 535,03 | 418,45 | 360,79 | 606,33 | 554,59 |
| 154 | 426,00 | 73,91 | 95,78 | 954,22 | 2,97 | 539,29 | 418,20 | 361,20 | 606,23 | 557,87 |
| 155 | 424,23 | 73,97 | 97,20 | 932,99 | 2,87 | 543,95 | 418,42 | 361,67 | 607,53 | 560,99 |
| 156 | 423,01 | 73,94 | 95,29 | 930,28 | 2,77 | 546,91 | 415,23 | 361,94 | 608,76 | 565,12 |
| 157 | 420,94 | 74,06 | 95,52 | 924,31 | 2,68 | 549,73 | 416,17 | 362,50 | 609,62 | 569,29 |
| 158 | 418,19 | 73,96 | 95,92 | 913,62 | 2,68 | 552,07 | 416,45 | 362,98 | 609,81 | 573,57 |
| 159 | 415,04 | 73,97 | 96,09 | 894,90 | 2,57 | 555,14 | 415,08 | 363,54 | 608,70 | 577,98 |
| 160 | 410,23 | 74,20 | 94,90 | 882,24 | 2,57 | 557,59 | 412,39 | 363,97 | 607,85 | 582,26 |
| 161 | 407,74 | 74,00 | 94,42 | 897,00 | 2,47 | 560,06 | 411,11 | 364,55 | 605,86 | 586,23 |
| 162 | 406,78 | 73,57 | 94,96 | 894,21 | 2,47 | 563,08 | 409,55 | 365,09 | 601,47 | 589,56 |
| 163 | 405,96 | 73,62 | 94,00 | 910,36 | 2,37 | 565,86 | 408,76 | 365,76 | 597,39 | 592,97 |
| 164 | 404,61 | 73,52 | 94,75 | 912,51 | 2,27 | 571,63 | 407,67 | 366,51 | 592,75 | 596,63 |
| 165 | 402,55 | 73,61 | 95,16 | 902,86 | 2,27 | 578,66 | 404,33 | 367,26 | 588,32 | 599,32 |
| 166 | 399,19 | 74,01 | 94,55 | 874,85 | 2,27 | 586,06 | 402,36 | 368,14 | 584,02 | 601,84 |
| 167 | 393,48 | 74,53 | 93,52 | 844,52 | 2,27 | 594,61 | 399,29 | 369,00 | 578,53 | 604,90 |
| 168 | 387,97 | 75,00 | 93,68 | 823,35 | 2,17 | 602,29 | 396,67 | 369,94 | 571,72 | 606,73 |
| 169 | 382,60 | 74,63 | 93,20 | 805,55 | 2,17 | 607,99 | 393,70 | 370,86 | 564,09 | 608,47 |
| 170 | 378,83 | 74,64 | 92,87 | 792,64 | 2,17 | 612,22 | 390,13 | 371,87 | 555,88 | 610,06 |
| 171 | 374,74 | 74,95 | 93,42 | 782,48 | 2,07 | 618,01 | 387,94 | 373,02 | 548,05 | 613,18 |
| 172 | 371,55 | 74,73 | 93,58 | 774,43 | 2,07 | 622,34 | 384,97 | 374,20 | 540,11 | 614,75 |
| 173 | 368,66 | 74,28 | 92,88 | 769,08 | 2,07 | 625,87 | 382,67 | 375,37 | 532,46 | 616,27 |
| 174 | 367,27 | 74,15 | 92,33 | 765,89 | 2,07 | 628,28 | 379,57 | 376,49 | 524,86 | 616,39 |
| 175 | 365,04 | 74,12 | 92,43 | 762,62 | 1,98 | 629,88 | 375,50 | 377,60 | 516,94 | 617,17 |
| 176 | 363,82 | 74,30 | 92,59 | 759,73 | 2,07 | 634,61 | 373,61 | 378,85 | 509,17 | 618,69 |
| 177 | 363,30 | 74,26 | 92,81 | 756,27 | 1,98 | 636,72 | 371,62 | 380,19 | 501,43 | 619,84 |
| 178 | 361,18 | 74,11 | 92,38 | 751,02 | 1,98 | 637,67 | 368,20 | 381,41 | 494,38 | 620,45 |
| 179 | 358,77 | 74,03 | 92,45 | 745,90 | 1,98 | 638,09 | 365,55 | 382,75 | 487,98 | 620,63 |
| 180 | 356,17 | 74,12 | 92,51 | 739,81 | 1,88 | 638,63 | 363,78 | 384,05 | 481,72 | 620,40 |
| 181 | 355,30 | 74,07 | 92,11 | 735,20 | 1,88 | 638,01 | 362,17 | 385,39 | 475,98 | 619,98 |
| 182 | 353,39 | 73,96 | 92,82 | 730,43 | 1,87 | 638,06 | 360,75 | 386,78 | 470,50 | 619,46 |
| 183 | 351,41 | 74,28 | 91,56 | 725,62 | 1,87 | 637,38 | 357,43 | 387,96 | 465,20 | 618,24 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 184 | 349,94 | 74,36 | 91,73 | 722,10 | 1,87 | 635,88 | 356,07 | 389,47 | 460,22 | 617,36 |
| 185 | 348,52 | 74,34 | 92,05 | 717,83 | 1,87 | 635,22 | 354,17 | 390,93 | 455,31 | 616,21 |
| 186 | 347,03 | 74,25 | 91,96 | 714,38 | 1,87 | 634,31 | 353,10 | 392,37 | 450,85 | 615,28 |
| 187 | 346,10 | 74,58 | 91,93 | 717,49 | 1,77 | 633,61 | 351,75 | 393,82 | 446,49 | 614,55 |
| 188 | 345,09 | 74,58 | 91,46 | 716,32 | 1,77 | 631,26 | 348,54 | 395,07 | 442,16 | 612,45 |
| 189 | 345,11 | 74,82 | 91,09 | 712,38 | 1,77 | 631,66 | 347,22 | 396,44 | 438,01 | 611,20 |
| 190 | 344,50 | 74,81 | 91,20 | 709,77 | 1,77 | 630,94 | 345,97 | 397,84 | 434,26 | 611,81 |
| 191 | 343,41 | 74,56 | 91,60 | 707,50 | 1,77 | 629,32 | 344,12 | 399,21 | 430,59 | 610,42 |
| 192 | 342,22 | 74,67 | 92,17 | 701,97 | 1,77 | 628,31 | 342,69 | 400,70 | 426,52 | 610,04 |
| 193 | 339,90 | 74,48 | 91,71 | 698,56 | 1,67 | 627,46 | 341,19 | 401,89 | 422,78 | 607,51 |
| 194 | 339,27 | 74,67 | 91,84 | 697,50 | 1,67 | 626,22 | 338,93 | 403,21 | 419,09 | 604,94 |
| 195 | 339,33 | 74,57 | 92,01 | 696,01 | 1,67 | 625,46 | 337,58 | 404,54 | 416,14 | 604,35 |
| 196 | 338,01 | 74,99 | 92,02 | 695,05 | 1,67 | 623,40 | 334,74 | 405,71 | 412,57 | 602,18 |
| 197 | 326,16 | 75,11 | 95,28 | 596,88 | 1,67 | 621,54 | 333,30 | 406,90 | 409,97 | 599,02 |
| 198 | 318,11 | 75,11 | 91,64 | 614,05 | 1,67 | 619,59 | 332,02 | 408,27 | 405,32 | 596,08 |
| 199 | 312,39 | 74,83 | 91,31 | 612,03 | 1,67 | 615,08 | 333,01 | 409,99 | 401,61 | 591,61 |
| 200 | 308,91 | 74,62 | 91,08 | 608,76 | 1,57 | 609,23 | 334,37 | 411,46 | 397,93 | 587,29 |

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: PT 202 72 Run: 5 Tech: MM Reviewer: DP

- kindling 28 LBS START FIRE
- by pass open
- DOOR open
- At 25 LBS close DOOR
- At 12 LBS insert 1st preload
- close DOOR immediatly
- At 13 LBS insert second preload
- close DOOR immediatly
- close by pass
- At 16 LBS rack coal Bed

After 2 min insert load and close DOOR immediatly

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE / POST CHECKS

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 5 Tech: MM Reviewer: DP

| Moisture Meter Calibration Check: | Equipment # | Time | 12% | 22% |
|---|---|---|---|---|
| | EM-334 | 7:00 | ok | ok |

| | Pre-Test | Post-Test |
|---|---|---|
| **Facility Conditions:** | | |
| Air Velocity from less than 2 feet | 0 (max50 Fpm) | 0 (max50 Fpm) |
| Smoke Capture Check (tunnel velocity) | ok | NA |
| Picture (4 sides) | ok | ok |
| **Wood Heater Conditions:** | | |
| Date Wood Heater Stack Cleaned | 2022-07-25 | |
| Date Dilution Tunnel Cleaned | 2022-07-25 | |
| Induced Draft Check (max 0.005 H2O) | ok | |
| Traverse before ignition | ok | |
| **Temperature System:** | | |
| Ambient (65°-90°F) | ok °F | |
| **Proportional Checks:** | | |
| Thermocouple check | ok | |
| Pitot Clean | ok | |
| Pitot verification | ok | |
| Pictures for report | Side: ok<br>Coal bed: ok<br>Load: ok<br>Load in stove: ok<br>Fuel adjustment: ok | |
| Load Length approximately 5/6 of firebox Lenght | ok | |

**POLYTESTS**
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: pt 20272 Run: 5 Tech: MM Reviewer: DP

## Leakage Checks Tunnel Samplers

| | System 1st hour | | System 1 | | System 2 | |
|---|---|---|---|---|---|---|
| Unplugged Flow Rate = .25cfm | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) |
| Vacuum (inches Hg.) | -10 | -10 | -10 | -10 | -10 | -10 |
| Final 1minute DGM (Liter) | 659668.72 | 660302.51 | 659668.94 | 660302.58 | 407967.15 | 408601.95 |
| Initial 1minute DGM (Liter) | 659668.72 | 660302.51 | 659668.94 | 660302.58 | 407967.99 | 408601.85 |
| Change (Liter) | 0 | 0 | 0 | 0 | 0.16 | 0.10 |
| Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56) | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** | **0.20** |
| Check OK | ok | ok | ok | ok | ok | ok |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 5 Tech: MR Reviewer: DP

## 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 | .5 | 3 | .4 |
| Check OK (no change after 15 sec.) | Ok | Ok | Ok | Ok |

## Scales checks

| Scale Type | Audit | | Measured Weight |
|---|---|---|---|
| | Equipment # | Weight | |
| Platform | EM-090 | 44 lbs, Class F | 44 lbs |
| Platform | EM-205 | 10,000 lbs, Class F | 10,000 lbs |
| Wood | EM-090 | 440 lbs, Class F | 440 lbs |
| Analytical | EM-335 | 100 mg, Class S | 100 mg |
| Analytical | EM-129 | 200 g, Class S | 200 g |

## LIMITS OF WEIGHT RANGES

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

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 5 Tech: MM Reviewer: DP

FOR TUNNELS < 12 in

Barometric pressure ($P_{bar}$) 1060 (KPa.) Static pressure ($P_q$) 0.15 (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 $\Delta_p$ (inches $H_2O$) | Tunnel Temperature (°F) |
|---|---|---|---|---|---|
| | 6 po | 7 po | 8 po | | |
| A- Centroid | 3.00 | 3.50 | 4 | 0073 | 7727 |
| B - Centroid | 3.00 | 3.50 | 4 | 0074 | 7711 |
| A-1 | 0.40 | 0.50 | 0.50 | 0060 | 7727 |
| A-2 | 1.50 | 1.75 | 2 | 0070 | 7716 |
| A-3 | 4.50 | 5.25 | 6 | 0073 | 7716 |
| A-4 | 5.60 | 6.5 | 7.5 | 0059 | 7708 |
| B-1 | 0.40 | 0.50 | 0.50 | 0060 | 7711 |
| B-2 | 1.50 | 1.75 | 2 | 0073 | 7718 |
| B-3 | 4.50 | 5.25 | 6 | 0077 | 7718 |
| B-4 | 5.60 | 6.5 | 7.5 | 0060 | 7702 |
| | | | | 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.
$\Delta_p$ = 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 ($\Delta_p$) measured at each traverse point.

POLYTESTS
TESTING THROUGH YOUR REALITY

# CONTINUOUS ANALYZERS

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 5 Tech: MM Reviewer: DP

Pre-Test (Adjust and Record)

| | ZERO | | SPAN | | CAL. (Record Only) | |
|---|---|---|---|---|---|---|
| CO | 0 | 6 | 2.986 | 3.000 | 1.006 | 1.000 |
| Tolerance CO | 0 | +/- 0.02 | 0014 | +/- 0.15 | 0.006 | +/- 0.05 |
| $CO_2$ | 0 | 6 | 17.99 | 18.00 | 9.78 | 10.00 |
| Tolerance CO2 | 0 | +/- 0.02 | 0.01 | +/- 0.5 | 0.22 | +/- 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 | 2.991 | 1.002 | 0 | 0.02 | 0.005 | 0.15 | 0.004 | 0.05 | ✓ | |
| $CO_2$ | 0 | 18.04 | 9.81 | 0 | 0.02 | 0.05 | 0.5 | 0.03 | 0.5 | ✓ | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# TEST DATA LOG

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 5 Tech: MM Reviewer: DP

## RAW DRY GAS METER READINGS

| | System 1 | System 2 | Blanck |
|---|---|---|---|
| Final (Liter) | 660301,75 | 408599,12 | 392989,38 |
| Initial (Liter) | 659669,31 | 407966,31 | 392505,49 |

## AMBIENT CONDITIONS

| | Before | After |
|---|---|---|
| Barometer (kPa): | 1000 | 1000 |
| Dry Bulb (F): | 813 | 847 |
| Humidity (%): | 446 | 370 |

## Flow Meter

| | Start | End |
|---|---|---|
| Flow meter reading | N.A | N.A |

## Flow Meter Verification

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

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: pT 20272 Run: 5 Tech: MM Reviewer: DP

## FUEL DESCRIPTION:

Type of wood:

## PRE-TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 14 in. | 132 lbs. | 20.1 | 20.2 | 20.2 | 20.3 | 20.4 |
| 1 1/2 x 3 1/2 x 14 in. | 138 lbs. | 20.6 | 20.5 | 20.4 | 20.3 | 20.3 |
| 1 1/2 x 3 1/2 x 14 in. | 128 lbs. | 20.2 | 20.1 | 20.3 | 20.4 | 20.4 |
| 1 1/2 x 3 1/2 x 7 in. | 086 lbs. | 21.1 | 21.0 | 21.1 | 21.1 | 21.0 |
| 1 1/2 x 3 1/2 x 7 in. | 086 lbs. | 20.9 | 20.8 | 20.8 | 20.4 | 20.5 |
| 1 1/2 x 3 1/2 x 7 in. | 086 lbs. | 19.9 | 20.0 | 20.3 | 20.2 | 20.1 |
| 1 1/2 x 3 1/2 x ~~7~~ in. | ~~084~~ 080 lbs. | 20.0 | 20.1 | 20.2 | 20.1 | 20.0 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3 1/2 x 14 in. | 134 lbs. | 21.1 | 21.2 | 21.2 | 20.9 | 20.9 |
| 1 1/2 x 3 1/2 x 14 in. | 138 lbs. | 20.6 | 20.3 | 20.5 | 20.6 | 20.8 |
| 1 1/2 x 3 1/2 x 14 in. | 138 lbs. | 20.6 | 20.3 | 20.4 | 20.3 | 20.8 |
| 1 1/2 x 3 1/2 x 7 in. | 086 lbs. | 19.1 | 19.2 | 19.2 | 19.2 | 19.3 |
| 1 1/2 x 3 1/2 x 7 in. | 084 lbs. | 20.0 | 20.1 | 20.0 | 19.9 | 19.8 |
| 1 1/2 x 3 1/2 x 7 in. | 082 lbs. | 20.1 | 20.8 | 20.8 | 20.8 | 20.4 |
| 1 1/2 x 3 1/2 x 7 in. | 086 lbs. | 20.0 | 20.1 | 20.1 | 20.4 | 20.3 |
| 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**: 736 + 738 lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: pT 20272 Run: 5 Tech: MM Reviewer: DP

## FUEL DESCRIPTION:

Type of wood :

## TEST LOAD

| Piece Size | Weight | | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 15 in. | 1320 | lbs. | 206 | 205 | 208 | 209 | 207 |
| 1 1/2 x 3 1/2 x 15 in. | 1'566 | lbs. | 207 | 208 | 207 | 207 | 208 |
| 1 1/2 x 3 1/2 x 15 in. | 1'580 | lbs. | 201 | 200 | 199 | 198 | 198 |
| 1 1/2 x 3 1/2 x 15 in. | 1400 | lbs. | 201 | 201 | 200 | 204 | 203 |
| x x in. | | lbs. | | | | | |
| 1 1/2 x 3/4 x 4 in. | 0082 | lbs. | | | 211 | | |
| 1 1/2 x 3/4 x 4 in. | 0'102 | lbs. | | | 210 | | |
| 1 1/2 x 3/4 x 4 in. | 0'100 | lbs. | | | 208 | | |
| 1 1/2 x 3/4 x 4 in. | 0'082 | lbs. | | | 206 | | |
| 1 1/2 x 3/4 x 4 in. | 0'100 | lbs. | | | 204 | | |
| 1 1/2 x 3/4 x 4 in. | 0'102 | lbs. | | | 205 | | |
| 1 1/2 x 3/4 x 4 in. | 0'102 | lbs. | | | 206 | | |
| 1 1/2 x 3/4 x 4 in. | 0'100 | lbs. | | | 207 | | |
| 1 1/2 x 3/4 x 4 in. | 0'122 | lbs. | | | 208 | | |
| 1 1/2 x 3/4 x 4 in. | 0'100 | lbs. | | | 206 | | |
| 1 1/2 x 3/4 x 4 in. | 0120 | lbs. | | | 199 | | |
| 1 1/2 x 3/4 x 4 in. | 0100 | lbs. | | | 198 | | |
| 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**: 708 lbs Min 20%: 141.6 Max 25%: 177

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-07-07 Manufacturer: Hearthstone Model: 8060

Project #: PJ 20272 Run: 5 Tech: MM Reviewer: AP

| | | 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 | 18 | 624 | 625 | 02 | 35 | 626 | 627 | 12 | 630 |
| 2022-07-07 | 17:00 | 108,9466 | | 0,2616 | 34,5729 | 109,2831 | | 0,2602 | 35,1644 | 0,1310 |
| 2022-07-25 | 11:00 | 108,9466 | | 0,2615 | 34,5728 | 109,2832 | | 0,2603 | 35,1645 | 0,1311 |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | | 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 | 18 | 624 | 625 | 02 | 35 | 626 | 627 | 12 | 630 |
| 2022-07-25 | 17:00 | 108,9468 | | 0,2617 | 34,5753 | 109,2834 | | 0,2597 | 35,1670 | 0,1314 |
| 2022-07-28 | 8:00 | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2598 | 35,1652 | 0,1312 |
| 2022-08-01 | 8:00 | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2598 | 35,1652 | 0,1312 |
| | | | | | | | | | | |
| | | | | | | | | | | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-07-07 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 5 Tech: MM Reviewer: DP

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Pre-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 40 | 628 | 629 | 28 |
| 2022-07-07 | 17:00 | 110 1014 | | 02615 | 35 3630 |
| ~~2022-07-25~~ 2022-07-25 | 11:00 | 110 1015 | | 02614 | 35 3631 |
| | | | | | |
| | | | | | |

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Post-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 40 | 628 | 629 | 28 |
| 2022-07-25 | 17:00 | 110 1017 | | 02616 | 35 3650 |
| 2022-07-28 | 8:00 | 110 1015 | | 02615 | 35 3642 |
| 2022-08-01 | 8:00 | 110 1015 | | 02615 | 35 3642 |
| | | | | | |
| | | | | | |

# Paramètres

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

| | |
|---|---|
| Code verrouillage: | HEA |

## Description du test

| | | |
|---|---|---|
| Test standard | EPA | |
| Run # | 1 | |
| Date | 25-07-2022 | |
| Technicien | M.M | |
| Project # | PI 20272 | |

## Description de l'unité

| | | |
|---|---|---|
| Manufacturier | HEARTHSTONE | |
| Modèle | 8060 | |
| Combustion system | Non-Cat | |
| Appliance type | WOOD STOVE | |
| Firebox volume | 1 | 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): | 1,003 | Dimensionless |
| Equipment number (DGM #1): | EM 178 | |
| Calibration Factor (DGM #2): | 1,014 | Dimensionless |
| Equipment number (DGM #2): | EM 318 | |
| Calibration Factor (DGM #3): | 0,997 | |
| Equipment number (DGM #3): | EM 179 | Dimensionless |

## Tunnel

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 25-07-2022 |
| **Technicien** | M.M |

## Fuel data

| | | |
|---|---|---|
| Fuel type | Cord | |
| Fuel specie | D. Fir | |
| HHV | 19810,0 | kJ/kg |
| %C | 48,7 | |
| %H | 6,9 | |
| %O | 43,9 | |
| %Ash | 0,5 | |
| HHV | 8519,2 | Btu/lb |
| LHV | 7451,0 | Btu/lb |

**Default Fuel Values**

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

| | Start | End |
|---|---|---|
| Barometer (kPa): | 100 | 100 |
| Barometer (in.Hg): | 29,529989 | 29,52998888 |
| Dry Bulb (F): | 81,3 | 84,7 |
| Humidity (%): | 44,6 | 37 |
| Air velocity (ft/min) | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DGM #1 | Final: | 23318,337 | cuft | Final: | 660301,750 | Liter |
| | Initial: | 23296,002 | cuft | Initial: | 659669,310 | Liter |
| DGM #2 | Final: | 14429,542 | cuft | Final: | 408599,120 | Liter |
| | Initial: | 14407,195 | cuft | Initial: | 407966,310 | Liter |
| DGM room | Final: | 13878,289 | cuft | Final: | 392989,380 | Liter |
| | Initial: | 13861,201 | cuft | Initial: | 392505,490 | Liter |

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 395

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 25-07-2022 |
| **Technicien** | M.M |

## Preload data sheet

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,30 | 7,00 | 7,70 |

Load Volume: 0,4253 cu. ft

Loading Density: 14,740 lbs./ft3

Number of Spaces:

Spacer weight (lbs):

Load Density (wet): 34,654 lbs./ft3

Dry Wood Density: 28,786105

| Piece Size (in): Thick | Wide | x Length | Weight lbs | Meter Moisture Content Dry Uncorrected % | | | | | Ave. MC x Weight | Volume Cubic Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 3,5 | 14 | 1,32 | 20,1 | 20,2 | 20,2 | 20,3 | 20,4 | 26,7168 | 73,50 |
| 1,5 | 3,5 | 14 | 1,38 | 20,6 | 20,5 | 20,4 | 20,3 | 20,3 | 28,1796 | 73,50 |
| 1,5 | 3,5 | 14 | 1,28 | 20,2 | 20,1 | 20,3 | 20,4 | 20,4 | 25,9584 | 73,50 |
| 1,5 | 3,5 | 7 | 0,86 | 21,1 | 21 | 21,1 | 21 | 21 | 18,0944 | 36,75 |
| 1,5 | 3,5 | 7 | 0,86 | 20,9 | 20,8 | 20,8 | 20,4 | 20,5 | 17,7848 | 36,75 |
| 1,5 | 3,5 | 7 | 0,86 | 19,9 | 20 | 20,3 | 20,2 | 20,1 | 17,286 | 36,75 |
| 1,5 | 3,5 | 7 | 0,8 | 20 | 20,1 | 20,2 | 20,1 | 20 | 16,064 | 36,75 |
| | | | | | | | | | | 0,00 |
| 1,5 | 3,5 | 14 | 1,34 | 21,1 | 21,2 | 21,2 | 20,9 | 20,9 | 28,2204 | 73,50 |
| 1,5 | 3,5 | 14 | 1,28 | 20,6 | 20,3 | 20,8 | 20,6 | 20,8 | 26,3936 | 73,50 |
| 1,5 | 3,5 | 14 | 1,38 | 20,6 | 20,3 | 20,4 | 20,3 | 20,8 | 28,2624 | 73,50 |
| 1,5 | 3,5 | 7 | 0,86 | 19,1 | 19,2 | 19,2 | 19,2 | 19,3 | 16,512 | 36,75 |
| 1,5 | 3,5 | 7 | 0,84 | 20 | 20,1 | 20 | 19,9 | 19,8 | 16,7664 | 36,75 |
| 1,5 | 3,5 | 7 | 0,82 | 20,1 | 20,8 | 20,8 | 20,8 | 20,4 | 16,8756 | 36,75 |
| 1,5 | 3,5 | 7 | 0,86 | 20 | 20,1 | 20,1 | 20,4 | 20,3 | 17,3548 | 36,75 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00

## FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,3 | 7,0 | 7,7 |

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

Load Volume: 0,18 cu. ft

Loading Density: 7,1 lbs./ft3

Number of Spaces: 12

Spacer weight: lbs

Load Density (wet): 32,2 lbs./ft3

Dry Wood Density: 26,7 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 | 15 | 1,32 | 20,60 | 20,50 | 20,80 | 20,90 | 20,70 | 27,324 | 78,75 | 20,7 |
| 1,5 | 3,5 | 15 | 1,57 | 20,70 | 20,80 | 20,70 | 20,70 | 20,80 | 32,47884 | 78,75 | 20,7 |
| 1,5 | 3,5 | 15 | 1,58 | 20,10 | 20,00 | 19,90 | 19,80 | 19,80 | 31,4736 | 78,75 | 19,9 |
| 1,5 | 3,5 | 15 | 1,40 | 20,10 | 20,10 | 20,00 | 20,40 | 20,30 | 28,252 | 78,75 | 20,2 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| 1,5 | 0,75 | 4 | 0,08 | | | 21,10 | | | 1,7302 | 4,50 | 21,1 |
| 1,5 | 0,75 | 4 | 0,10 | | | 21,00 | | | 2,142 | 4,50 | 21,0 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,80 | | | 2,08 | 4,50 | 20,8 |
| 1,5 | 0,75 | 4 | 0,08 | | | 20,60 | | | 1,6892 | 4,50 | 20,6 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,40 | | | 2,04 | 4,50 | 20,4 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,50 | | | 2,091 | 4,50 | 20,5 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,60 | | | 2,1012 | 4,50 | 20,6 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,70 | | | 2,07 | 4,50 | 20,7 |
| 1,5 | 0,75 | 4 | 0,12 | | | 20,80 | | | 2,5376 | 4,50 | 20,8 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,60 | | | 2,06 | 4,50 | 20,6 |
| 1,5 | 0,75 | 4 | 0,12 | | | 19,90 | | | 2,388 | 4,50 | 19,9 |
| 1,5 | 0,75 | 4 | 0,10 | | | 19,80 | | | 1,98 | 4,50 | 19,8 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 |

## Tunnel Traverse Worksheet (for velocity calculations)

| | | | |
|---|---|---|---|
| Static Pressure: | 0,2 | in. H20 | absolute value |
| 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=**
0,960

**Pour un tunnel moins de 12", prendre 4 lectures**

| | TUNNEL VELOCITY | TUNNEL TEMP | SQUARE ROOT |
|---|---|---|---|
| | In. wc | °F | |
| A center | 0,073 | 77,27 | 0,2702 |
| B center | 0,074 | 77,11 | 0,2720 |
| A1 | 0,060 | 77,27 | 0,2449 |
| A2 | 0,070 | 77,16 | 0,2646 |
| A3 | 0,073 | 77,16 | 0,2702 |
| A4 | 0,059 | 77,08 | 0,2429 |
| | | | |
| B1 | 0,060 | 77,110 | 0,2449 |
| B2 | 0,073 | 77,180 | 0,2702 |
| B3 | 0,077 | 77,180 | 0,2775 |
| B4 | 0,060 | 77,020 | 0,2449 |
| AVERAGE | 0,0679 | 77,1540 | 0,2602 |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 25-07-2022 |
| **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 | 18 | 624 | 625 | 2 | 35 | 626 | 627 | 12 | 40 | 628 | 629 | 28 | 630 | | |
| Before (1) | | | | | | | | | | | | | | | |
| Before (2) | | | | | | | | | | | | | | | |
| Before (3) | | | | | | | | | | | | | | | |
| Before (4) | | | | | | | | | | | | | | | |
| Before (5) | 108,9466 | | 0,2616 | 34,5729 | 109,2831 | | 0,2602 | 35,1644 | 110,1014 | | 0,2615 | 35,3630 | 0,1310 | 2022-07-07 | 17:00 |
| Before (6) | 108,9466 | | 0,2615 | 34,5728 | 109,2832 | | 0,2603 | 35,1645 | 110,1014 | | 0,2614 | 35,3631 | 0,1311 | 2022-07-25 | 11:00 |
| After (1) | 108,9468 | | 0,2617 | 34,5753 | 109,2834 | | 0,2597 | 35,1670 | 110,1017 | | 0,2616 | 35,3650 | 0,1314 | 2022-07-25 | 17:00 |
| After (2) | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2598 | 35,1652 | 110,1015 | | 0,2615 | 35,3642 | 0,1312 | 2022-07-28 | 08:00 |
| After (3) | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2598 | 35,1652 | 110,1015 | | 0,2615 | 35,3642 | 0,1312 | 2022-08-01 | 08:00 |
| After (4) | | | | | | | | | | | | | | | |
| After (5) | | | | | | | | | | | | | | | |
| After (6) | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2598 | 35,1652 | 110,1015 | | 0,2615 | 35,3642 | 0,1312 | 2022-08-01 | 08:00 |
| Difference | 0,0000 | 0,0000 | 0,0003 | 0,0008 | 0,0000 | 0,0000 | -0,0005 | 0,0007 | 0,0001 | 0,0000 | 0,0001 | 0,0011 | 0,0001 | | |
| Total (mg) | | 1,1 | | | | 1,3 | | | | 1,3 | | | 0,1 | | |
| Total ajusté (mg) | | **1,00** | | | | **1,20** | | | | **1,20** | | | | | |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 25-07-2022 |
| **Technicien** | |

# Not the real number filter weight to zero for comparison purpose only

## 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 | 18 | 624 | 625 | 2 | 35 | 626 | 627 | 12 | 40 | 628 | 629 | 28 | 630 | | |
| Before (1) | | | | | | | | | | | | | | | |
| Before (2) | | | | | | | | | | | | | | | |
| Before (3) | | | | | | | | | | | | | | | |
| Before (4) | | | | | | | | | | | | | | | |
| Before (5) | 108,9466 | | 0,2616 | 34,5729 | 109,2831 | | 0,2602 | 35,1644 | 110,1014 | | 0,2615 | 35,3630 | 0,1310 | 2022-07-07 | 17:00 |
| Before (6) | 108,9466 | | 0,2615 | 34,5728 | 109,2832 | | 0,2603 | 35,1645 | 110,1014 | | 0,2614 | 35,3631 | 0,1311 | 2022-07-25 | 11:00 |
| After (1) | 108,9468 | | 0,2617 | 34,5753 | 109,2834 | | 0,2597 | 35,1670 | 110,1017 | | 0,2616 | 35,3650 | 0,1314 | 2022-07-25 | 17:00 |
| After (2) | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2598 | 35,1652 | 110,1015 | | 0,2615 | 35,3642 | 0,1312 | 2022-07-28 | 08:00 |
| After (3) | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2598 | 35,1652 | 110,1015 | | 0,2615 | 35,3642 | 0,1312 | 2022-08-01 | 08:00 |
| After (4) | | | | | | | | | | | | | | | |
| After (5) | | | | | | | | | | | | | | | |
| After (6) | 108,9466 | | 0,2618 | 34,5736 | 109,2832 | | 0,2603 | 35,1652 | 110,1015 | | 0,2615 | 35,3642 | 0,1312 | 2022-08-01 | 08:00 |
| Difference | 0,0000 | 0,0000 | 0,0003 | 0,0008 | 0,0000 | 0,0000 | 0,0000 | 0,0007 | 0,0001 | 0,0000 | 0,0001 | 0,0011 | 0,0001 | | |
| Total (mg) | | 1,1 | | | | 1,8 | | | | 1,3 | | | 0,1 | | |
| Total ajusté (mg) | | **1,00** | | | | **1,70** | | | | **1,20** | | | | | |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 25-07-2022 |
| **Technicien** | mm |

SFBA EPA EMISSION RESULTS

**Test Duration:** **113** min

PRESSURE FACTOR: DGM 1 0,96221
DGM 2 0,96500
DGM 3 0,98696

TEMPERATURE FACTORS DGM 1 0,97362
DGM 2 0,96519
DGM 3 0,97685

VOLUMES SAMPLED DGM 1 20,976 SCft
DGM 2 21,108 Scft
DGM 3 16,418 SCft

TOTAL TUNNEL VOLUME : 39023

SAMPLE RATIOS
Sample Train 1: 1860,326
Sample Train 2: 1848,750

Paticulate concentration
Sample Train 1 **0,000062** g/dscf
Sample Train 2 **0,000062** g/dscf
Room **0,000006** g/dscf

TOTAL EMISSIONS
Sample Train 1 **2,18** g
Sample Train 2 **2,17** g

EMISSION RATES
Sample Train 1 **1,16** g/hr
Sample Train 2 **1,15** g/hr

1st hour emission rate **2,05** g/hr

| | Train 1 | Train 2 |
|---|---|---|
| Cs | 6,197E-05 | 6,1589E-05 |

RESULTS

**Average emission rate:** 1,15 g/hr

Burn Rate : 1,416 Dry kg/hr

BAROMETRIC PRESSURE
Average: 29,52998888 in Hg
Start: 29,52998888 in Hg
End: 29,52998888 in Hg

DGM CONTROLLER VALUES

DGM 1 Final: 23318,337 Cuft
Initial: 23296,002 Cuft

DGM 2 Final: 14429,542 Cuft
Initial: 14407,195 Cuft

DGM #3 Final: 13878,289 Cuft
Initial: 13861,201 Cuft

TEMPERATURES
DGM 1 542,307 °R
DGM 2 547,042 °R

CALIBRATION FACTORS
DGM 1 1,0025
DGM 2 1,0141
DGM #3 0,9965

TUNNEL FLOW RATE: 345,333 Dscfm

PARTICULATE CATCH
Total Sample Train 1: 1,30 mg
Total Sample Train 2: 1,30 mg
Total Sample Train 1 1st hour: 1,10 mg

DEVIATION: 0,35%

| * | | * | * | * | * | *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 | Flue draft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed | | Weight | | | | Flue | Room | Tunnel | Unit | Unit | Unit | Unit | Unit | Catalyst | Reading | Inlet T | Outlet T | Temp | Reading | Inlet T | Outlet T | Temp | Pressure | Pressure |
| Time | Raw data row | Remaining | CO | $CO_2$ | $O_2$ | Gas | Temp | Dry Bulb | Top | Back | R.Side | L.Side | Bottom | up | | | | | | | | | in wc | in wc |
| min | | lbs | % | % | % | °F | °F | °F | °F | °F | °F | °F | °F | °F | cuft/min | oF | oF | oF | cuft/min | oF | oF | oF | in wc | in wc |
| 0,00 | 395,00 | 7,0 | 0,0 | 3,6 | 0,0 | 361,4 | 79,8 | 98,8 | 407,1 | 333,4 | 611,4 | 605,6 | 392,9 | 489,4 | 0,18 | 80,46 | 80,98 | 88,59 | 0,18 | 81,77 | 82,48 | 85,25 | 0,08 | 0,05 |
| 1,0 | 396,0 | 6,9 | 0,1 | 3,6 | 0,0 | 335,0 | 79,8 | 92,1 | 401,3 | 329,8 | 606,7 | 599,7 | 393,8 | 623,1 | 0,18 | 80,51 | 81,01 | 88,12 | 0,18 | 81,74 | 82,59 | 85,14 | 0,08 | 0,06 |
| 2,0 | 397,0 | 6,9 | 0,1 | 5,3 | 0,0 | 337,7 | 79,7 | 91,6 | 396,9 | 328,2 | 597,8 | 590,0 | 394,7 | 651,6 | 0,18 | 80,48 | 80,97 | 87,81 | 0,18 | 81,71 | 82,70 | 85,10 | 0,08 | 0,06 |
| 3,0 | 398,0 | 6,8 | 0,1 | 5,7 | 0,0 | 341,7 | 79,6 | 91,7 | 393,4 | 326,7 | 585,5 | 578,1 | 395,5 | 664,9 | 0,18 | 80,53 | 80,95 | 87,60 | 0,18 | 81,74 | 82,80 | 85,09 | 0,07 | 0,06 |
| 4,0 | 399,0 | 6,8 | 0,0 | 6,6 | 0,0 | 345,2 | 79,7 | 92,3 | 393,3 | 328,2 | 574,8 | 566,1 | 396,1 | 681,7 | 0,18 | 80,54 | 80,92 | 87,49 | 0,18 | 81,80 | 82,93 | 85,15 | 0,07 | 0,07 |
| 5,0 | 400,0 | 6,7 | 0,0 | 9,6 | 0,0 | 363,2 | 79,6 | 92,9 | 400,4 | 330,3 | 563,2 | 554,4 | 396,5 | 755,1 | 0,18 | 80,57 | 80,90 | 87,35 | 0,18 | 81,88 | 83,04 | 84,96 | 0,08 | 0,07 |
| 6,0 | 401,0 | 6,6 | 0,0 | 11,2 | 0,0 | 375,7 | 79,6 | 93,1 | 411,8 | 333,5 | 552,2 | 542,6 | 396,5 | 772,5 | 0,18 | 80,63 | 80,90 | 87,28 | 0,18 | 81,96 | 83,19 | 84,69 | 0,07 | 0,07 |
| 7,0 | 402,0 | 6,5 | 0,0 | 10,5 | 0,0 | 378,3 | 79,6 | 93,1 | 420,0 | 336,7 | 542,8 | 532,7 | 396,4 | 761,8 | 0,19 | 80,69 | 80,88 | 86,75 | 0,18 | 82,09 | 83,34 | 84,49 | 0,07 | 0,07 |
| 8,0 | 403,0 | 6,3 | 0,0 | 10,4 | 0,0 | 388,2 | 79,6 | 92,7 | 427,8 | 340,7 | 535,5 | 523,0 | 396,0 | 795,2 | 0,19 | 80,77 | 80,87 | 86,12 | 0,18 | 82,23 | 83,51 | 84,29 | 0,07 | 0,07 |
| 9,0 | 404,0 | 6,3 | 0,1 | 12,8 | 0,0 | 401,0 | 79,6 | 93,6 | 440,3 | 345,7 | 529,4 | 514,7 | 395,6 | 816,6 | 0,18 | 80,86 | 80,85 | 85,76 | 0,18 | 82,37 | 83,67 | 84,18 | 0,08 | 0,07 |
| 10,0 | 405,0 | 6,1 | 0,0 | 12,1 | 0,0 | 404,7 | 79,7 | 94,6 | 449,9 | 350,1 | 523,5 | 507,8 | 394,9 | 817,3 | 0,19 | 80,92 | 80,87 | 85,45 | 0,18 | 82,51 | 83,79 | 84,15 | 0,07 | 0,07 |
| 11,0 | 406,0 | 6,0 | 0,1 | 12,2 | 0,0 | 412,0 | 79,7 | 93,9 | 459,3 | 353,3 | 517,5 | 503,4 | 394,1 | 836,0 | 0,18 | 81,01 | 80,87 | 85,12 | 0,18 | 82,68 | 83,97 | 84,06 | 0,07 | 0,07 |
| 12,0 | 407,0 | 5,9 | 0,1 | 11,9 | 0,0 | 417,0 | 79,8 | 94,6 | 467,4 | 357,2 | 513,1 | 501,0 | 393,2 | 846,8 | 0,18 | 81,07 | 80,87 | 84,89 | 0,18 | 82,86 | 84,12 | 84,02 | 0,08 | 0,07 |
| 13,0 | 408,0 | 5,8 | 0,1 | 11,7 | 0,0 | 419,7 | 79,7 | 95,2 | 476,0 | 360,5 | 508,2 | 499,6 | 392,2 | 862,7 | 0,19 | 81,12 | 80,89 | 84,65 | 0,18 | 83,02 | 84,32 | 83,99 | 0,07 | 0,07 |
| 14,0 | 409,0 | 5,6 | 0,1 | 12,3 | 0,0 | 428,8 | 79,8 | 95,5 | 485,0 | 363,7 | 504,1 | 498,0 | 391,0 | 890,6 | 0,18 | 81,16 | 80,89 | 84,45 | 0,18 | 83,15 | 84,47 | 83,97 | 0,07 | 0,08 |
| 15,0 | 410,0 | 5,6 | 0,1 | 12,8 | 0,0 | 434,8 | 79,7 | 95,5 | 495,0 | 365,9 | 500,0 | 496,5 | 389,8 | 884,5 | 0,18 | 81,24 | 80,90 | 84,34 | 0,18 | 83,29 | 84,65 | 83,97 | 0,07 | 0,08 |
| 16,0 | 411,0 | 5,4 | 0,1 | 12,6 | 0,0 | 437,7 | 79,8 | 95,6 | 504,4 | 368,7 | 496,8 | 494,3 | 388,5 | 897,2 | 0,18 | 81,38 | 80,92 | 84,21 | 0,19 | 83,44 | 84,83 | 83,97 | 0,08 | 0,08 |
| 17,0 | 412,0 | 5,4 | 0,1 | 12,4 | 0,0 | 437,5 | 79,8 | 96,2 | 510,2 | 370,8 | 494,2 | 491,9 | 387,2 | 896,9 | 0,18 | 81,45 | 80,92 | 84,08 | 0,18 | 83,60 | 84,96 | 83,97 | 0,07 | 0,08 |
| 18,0 | 413,0 | 5,2 | 0,1 | 12,9 | 0,0 | 449,5 | 79,8 | 96,2 | 517,7 | 373,8 | 492,1 | 490,0 | 385,9 | 972,1 | 0,19 | 81,47 | 80,97 | 83,99 | 0,19 | 83,74 | 85,12 | 83,99 | 0,07 | 0,08 |
| 19,0 | 414,0 | 5,1 | 0,2 | 14,3 | 0,0 | 460,1 | 79,9 | 97,2 | 526,6 | 376,9 | 490,5 | 489,1 | 384,5 | 977,5 | 0,19 | 81,57 | 80,99 | 83,92 | 0,18 | 83,87 | 85,27 | 84,03 | 0,07 | 0,08 |
| 20,0 | 415,0 | 4,9 | 0,4 | 14,0 | 0,0 | 455,5 | 79,9 | 97,3 | 533,2 | 379,7 | 490,2 | 491,2 | 383,1 | 900,9 | 0,19 | 81,62 | 81,01 | 83,92 | 0,18 | 84,02 | 85,41 | 84,09 | 0,08 | 0,08 |
| 21,0 | 416,0 | 4,8 | 0,1 | 11,5 | 0,0 | 444,4 | 79,9 | 97,2 | 535,9 | 381,8 | 490,9 | 494,5 | 381,8 | 873,6 | 0,19 | 81,70 | 81,03 | 83,83 | 0,18 | 84,12 | 85,53 | 84,09 | 0,08 | 0,07 |
| 22,0 | 417,0 | 4,8 | 0,0 | 10,9 | 0,0 | 439,2 | 79,9 | 96,7 | 538,0 | 383,4 | 492,4 | 496,0 | 380,4 | 867,4 | 0,19 | 81,75 | 81,07 | 83,75 | 0,18 | 84,25 | 85,72 | 84,06 | 0,08 | 0,08 |
| 23,0 | 418,0 | 4,6 | 0,0 | 11,5 | 0,0 | 439,3 | 79,9 | 95,7 | 540,8 | 384,8 | 493,5 | 496,2 | 379,1 | 887,2 | 0,19 | 81,80 | 81,09 | 83,61 | 0,18 | 84,35 | 85,89 | 84,04 | 0,07 | 0,08 |
| 24,0 | 419,0 | 4,5 | 0,1 | 12,6 | 0,0 | 446,3 | 80,0 | 97,0 | 545,7 | 385,9 | 494,3 | 496,3 | 377,8 | 915,0 | 0,19 | 81,84 | 81,10 | 83,56 | 0,19 | 84,45 | 86,01 | 84,05 | 0,08 | 0,08 |
| 25,0 | 420,0 | 4,4 | 0,3 | 13,7 | 0,0 | 460,4 | 80,0 | 97,3 | 551,7 | 386,8 | 496,8 | 496,7 | 376,6 | 985,6 | 0,19 | 81,95 | 81,16 | 83,55 | 0,19 | 84,56 | 86,16 | 84,06 | 0,07 | 0,08 |
| 26,0 | 421,0 | 4,3 | 0,2 | 14,6 | 0,0 | 466,7 | 80,1 | 98,0 | 556,5 | 387,9 | 499,8 | 498,1 | 375,4 | 992,2 | 0,19 | 82,07 | 81,19 | 83,54 | 0,18 | 84,68 | 86,26 | 84,12 | 0,08 | 0,08 |
| 27,0 | 422,0 | 4,1 | 0,9 | 14,9 | 0,0 | 469,9 | 80,1 | 96,7 | 560,6 | 388,1 | 501,6 | 501,2 | 374,2 | 994,5 | 0,19 | 82,10 | 81,23 | 83,46 | 0,18 | 84,78 | 86,39 | 84,12 | 0,08 | 0,08 |
| 28,0 | 423,0 | 4,0 | 0,7 | 14,8 | 0,0 | 469,3 | 80,1 | 98,3 | 566,1 | 389,8 | 505,0 | 504,2 | 373,0 | 981,9 | 0,19 | 82,13 | 81,25 | 83,45 | 0,19 | 84,89 | 86,54 | 84,13 | 0,07 | 0,08 |
| 29,0 | 424,0 | 3,9 | 0,6 | 14,6 | 0,0 | 467,4 | 80,1 | 98,0 | 571,7 | 390,9 | 507,6 | 506,7 | 371,8 | 972,1 | 0,19 | 82,14 | 81,28 | 83,46 | 0,18 | 84,99 | 86,66 | 84,18 | 0,08 | 0,08 |
| 30,0 | 425,0 | 3,8 | 0,4 | 14,3 | 0,0 | 464,0 | 80,2 | 97,4 | 576,7 | 391,8 | 509,3 | 508,9 | 370,6 | 951,0 | 0,19 | 82,24 | 81,31 | 83,41 | 0,19 | 85,08 | 86,77 | 84,20 | 0,08 | 0,08 |
| 31,0 | 426,0 | 3,7 | 0,2 | 14,0 | 0,0 | 461,8 | 80,2 | 98,4 | 583,3 | 393,3 | 511,4 | 510,8 | 369,5 | 932,4 | 0,19 | 82,30 | 81,37 | 83,37 | 0,19 | 85,17 | 86,87 | 84,19 | 0,08 | 0,08 |
| 32,0 | 427,0 | 3,5 | 0,1 | 13,8 | 0,0 | 459,9 | 80,3 | 98,2 | 587,3 | 394,6 | 512,4 | 513,0 | 368,3 | 938,3 | 0,19 | 82,33 | 81,39 | 83,39 | 0,19 | 85,26 | 87,01 | 84,21 | 0,07 | 0,08 |
| 33,0 | 428,0 | 3,5 | 0,2 | 13,8 | 0,0 | 458,9 | 80,3 | 97,3 | 591,7 | 396,2 | 513,6 | 515,3 | 367,2 | 957,4 | 0,18 | 82,33 | 81,40 | 83,29 | 0,19 | 85,35 | 87,14 | 84,20 | 0,07 | 0,08 |
| 34,0 | 429,0 | 3,3 | 0,2 | 14,0 | 0,0 | 458,8 | 80,3 | 97,5 | 595,6 | 398,1 | 514,6 | 518,6 | 366,2 | 969,2 | 0,19 | 82,38 | 81,43 | 83,27 | 0,18 | 85,41 | 87,27 | 84,22 | 0,07 | 0,08 |
| 35,0 | 430,0 | 3,2 | 0,2 | 14,3 | 0,0 | 460,3 | 80,4 | 98,0 | 600,0 | 399,3 | 515,8 | 522,1 | 365,2 | 987,0 | 0,19 | 82,37 | 81,46 | 83,28 | 0,18 | 85,48 | 87,40 | 84,22 | 0,08 | 0,08 |
| 36,0 | 431,0 | 3,1 | 0,4 | 14,5 | 0,0 | 462,4 | 80,4 | 99,5 | 605,0 | 401,9 | 518,1 | 526,1 | 364,2 | 994,2 | 0,19 | 82,37 | 81,47 | 83,33 | 0,19 | 85,54 | 87,51 | 84,28 | 0,07 | 0,08 |
| 37,0 | 432,0 | 3,0 | 0,5 | 14,7 | 0,0 | 465,8 | 80,4 | 98,5 | 608,9 | 403,7 | 519,4 | 530,4 | 363,2 | 1001,5 | 0,19 | 82,38 | 81,49 | 83,31 | 0,18 | 85,58 | 87,61 | 84,31 | 0,08 | 0,08 |
| 38,0 | 433,0 | 2,9 | 0,5 | 14,9 | 0,0 | 468,0 | 80,5 | 99,3 | 613,7 | 405,6 | 520,8 | 534,4 | 362,2 | 1004,4 | 0,19 | 82,43 | 81,52 | 83,33 | 0,19 | 85,65 | 87,71 | 84,35 | 0,07 | 0,08 |
| 39,0 | 434,0 | 2,8 | 0,7 | 15,0 | 0,0 | 470,3 | 80,5 | 98,9 | 619,1 | 407,6 | 522,9 | 538,4 | 361,3 | 1004,9 | 0,19 | 82,47 | 81,55 | 83,32 | 0,19 | 85,71 | 87,81 | 84,38 | 0,08 | 0,08 |
| 40,0 | 435,0 | 2,6 | 0,9 | 15,2 | 0,0 | 472,1 | 80,6 | 99,1 | 624,6 | 409,8 | 525,1 | 542,5 | 360,4 | 1002,7 | 0,19 | 82,51 | 81,57 | 83,32 | 0,19 | 85,75 | 87,93 | 84,43 | 0,08 | 0,08 |
| 41,0 | 436,0 | 2,5 | 0,3 | 15,2 | 0,0 | 473,0 | 80,6 | 99,8 | 629,4 | 411,9 | 526,8 | 546,3 | 359,5 | 996,5 | 0,19 | 82,59 | 81,61 | 83,34 | 0,18 | 85,83 | 88,02 | 84,50 | 0,08 | 0,08 |
| 42,0 | 437,0 | 2,3 | 0,4 | 15,1 | 0,0 | 471,7 | 80,7 | 100,1 | 634,0 | 414,4 | 529,4 | 550,3 | 358,7 | 991,0 | 0,19 | 82,68 | 81,65 | 83,38 | 0,19 | 85,90 | 88,14 | 84,50 | 0,08 | 0,08 |
| 43,0 | 438,0 | 2,2 | 0,4 | 15,0 | 0,0 | 470,6 | 80,8 | 99,5 | 638,1 | 416,2 | 531,7 | 554,5 | 357,8 | 989,0 | 0,19 | 82,77 | 81,72 | 83,36 | 0,19 | 86,00 | 88,24 | 84,48 | 0,07 | 0,08 |
| 44,0 | 439,0 | 2,1 | 0,3 | 15,0 | 0,0 | 466,9 | 80,8 | 98,6 | 640,9 | 418,9 | 534,6 | 558,3 | 357,0 | 992,5 | 0,19 | 82,81 | 81,74 | 83,27 | 0,18 | 86,08 | 88,33 | 84,48 | 0,07 | 0,08 |
| 45,0 | 440,0 | 2,1 | 0,2 | 15,0 | 0,0 | 466,9 | 80,8 | 99,1 | 644,0 | 420,9 | 536,4 | 562,7 | 356,2 | 1005,7 | 0,18 | 82,85 | 81,80 | 83,27 | 0,19 | 86,14 | 88,44 | 84,46 | 0,08 | 0,08 |
| 46,0 | 441,0 | 1,9 | 0,3 | 14,7 | 0,0 | 464,4 | 80,8 | 98,7 | 646,7 | 423,1 | 539,7 | 566,5 | 355,5 | 984,4 | 0,19 | 82,90 | 81,83 | 83,25 | 0,19 | 86,20 | 88,55 | 84,48 | 0,07 | 0,08 |
| 47,0 | 442,0 | 1,9 | 0,2 | 13,9 | 0,0 | 460,6 | 80,8 | 99,2 | 647,2 | 424,6 | 541,9 | 570,9 | 354,8 | 967,5 | 0,19 | 82,98 | 81,89 | 83,26 | 0,18 | 86,25 | 88,62 | 84,51 | 0,07 | 0,07 |
| 48,0 | 443,0 | 1,8 | 0,1 | 13,3 | 0,0 | 455,7 | 80,9 | 98,2 | 647,1 | 424,9 | 545,4 | 576,6 | 354,1 | 957,1 | 0,19 | 82,98 | 81,91 | 83,23 | 0,19 | 86,32 | 88,70 | 84,48 | 0,07 | 0,08 |
| 49,0 | 444,0 | 1,7 | 0,1 | 12,8 | 0,0 | 451,1 | 80,9 | 97,8 | 646,7 | 425,2 | 548,7 | 582,1 | 353,3 | 959,4 | 0,19 | 82,97 | 81,92 | 83,15 | 0,19 | 86,37 | 88,78 | 84,45 | 0,07 | 0,07 |
| 50,0 | 445,0 | 1,6 | 0,1 | 13,0 | 0,0 | 451,8 | 80,9 | 97,5 | 645,0 | 425,5 | 553,1 | 588,8 | 352,6 | 969,9 | 0,19 | 83,01 | 81,95 | 83,12 | 0,19 | 86,39 | 88,84 | 84,40 | 0,08 | 0,07 |
| 51,0 | 446,0 | 1,6 | 0,0 | 12,7 | 0,0 | 447,1 | 80,9 | 98,5 | 642,9 | 424,2 | 557,7 | 595,2 | 351,9 | 940,7 | 0,19 | 83,05 | 81,99 | 83,13 | 0,19 | 86,48 | 88,98 | 84,46 | 0,07 | 0,08 |
| 52,0 | 447,0 | 1,5 | 0,0 | 12,1 | 0,0 | 441,8 | 81,0 | 97,2 | 639,8 | 423,0 | 563,0 | 600,7 | 351,4 | 922,3 | 0,19 | 83,10 | 82,04 | 83,05 | 0,19 | 86,56 | 89,09 | 84,37 | 0,07 | 0,07 |
| 53,0 | 448,0 | 1,5 | 0,0 | 11,7 | 0,0 | 436,7 | 81,0 | 98,3 | 635,9 | 421,5 | 567,8 | 605,9 | 350,8 | 908,4 | 0,19 | 83,16 | 82,07 | 83,05 | 0,18 | 86,59 | 89,17 | 84,40 | 0,07 | 0,07 |
| 54,0 | 449,0 | 1,4 | 0,0 | 11,1 | 0,0 | 430,3 | 81,0 | 96,0 | 631,0 | 420,0 | 572,1 | 611,2 | 350,3 | 878,0 | 0,18 | 83,21 | 82,12 | 83,01 | 0,19 | 86,61 | 89,21 | 84,33 | 0,08 | 0,07 |
| 55,0 | 450,0 | 1,3 | 0,0 | 10,4 | 0,0 | 423,8 | 81,0 | 96,3 | 624,8 | 418,2 | 575,8 | 615,0 | 349,8 | 859,7 | 0,19 | 83,21 | 82,13 | 82,96 | 0,19 | 86,64 | 89,30 | 84,29 | 0,07 | 0,07 |
| 56,0 | 451,0 | 1,3 | 0,0 | 10,3 | 0,0 | 418,6 | 81,1 | 95,8 | 619,0 | 416,5 | 579,6 | 618,4 | 349,4 | 847,5 | 0,19 | 83,28 | 82,19 | 82,88 | 0,19 | 86,72 | 89,40 | 84,23 | 0,08 | 0,07 |
| 57,0 | 452,0 | 1,2 | 0,0 | 10,1 | 0,0 | 413,9 | 81,1 | 97,1 | 612,5 | 414,8 | 582,7 | 621,7 | 349,0 | 837,1 | 0,19 | 83,27 | 82,22 | 82,87 | 0,19 | 86,74 | 89,47 | 84,21 | 0,08 | 0,07 |
| 58,0 | 453,0 | 1,2 | 0,0 | 9,9 | 0,0 | 409,3 | 81,0 | 96,7 | 605,6 | 413,6 | 585,6 | 624,5 | 348,6 | 828,6 | 0,19 | 83,24 | 82,24 | 82,84 | 0,19 | 86,81 | 89,55 | 84,21 | 0,07 | 0,07 |
| 59,0 | 454,0 | 1,2 | 0,0 | 9,6 | 0,0 | 405,8 | 81,0 | 96,0 | 598,6 | 412,4 | 588,5 | 626,9 | 348,2 | 820,2 | 0,19 | 83,28 | 82,25 | 82,80 | 0,18 | 86,83 | 89,63 | 84,20 | 0,08 | 0,07 |
| 60,0 | 455,0 | 1,1 | 0,0 | 9,4 | 0,0 | 402,0 | 80,9 | 96,0 | 591,0 | 410,3 | 590,6 | 630,7 | 347,9 | 813,6 | 0,19 | 83,22 | 82,27 | 82,78 | 0,19 | 86,83 | 89,71 | 84,16 | 0,07 | 0,07 |
| 61,0 | 456,0 | 1,1 | 0,0 | 9,3 | 0,0 | 399,2 | 81,0 | 94,9 | 584,4 | 409,1 | 593,0 | 633,0 | 347,6 | 807,8 | 0,19 | 83,19 | 82,28 | 82,63 | 0,19 | 86,83 | 89,77 | 84,08 | 0,07 | 0,07 |
| 62,0 | 457,0 | 1,1 | 0,0 | 9,2 | 0,0 | 395,4 | 81,0 | 96,9 | 577,1 | 407,6 | 595,2 | 634,8 | 347,3 | 797,5 | 0,19 | 83,16 | 82,29 | 82,69 | 0,19 | 86,82 | 89,85 | 84,13 | 0,08 | 0,07 |
| 63,0 | 458,0 | 1,0 | 0,0 | 9,0 | 0,0 | 392,8 | 80,9 | 94,3 | 570,7 | 406,1 | 597,3 | 636,6 | 347,1 | 790,8 | 0,19 | 83,24 | 82,32 | 82,60 | 0,18 | 86,81 | 89,88 | 84,06 | 0,08 | 0,07 |
| 64,0 | 459,0 | 1,0 | 0,0 | 8,9 | 0,0 | 390,2 | 80,9 | 94,7 | 563,7 | 404,0 | 599,5 | 637,8 | 346,8 | 784,6 | 0,19 | 83,28 | 82,34 | 82,52 | 0,19 | 86,84 | 89,95 | 84,01 | 0,08 | 0,07 |
| 65,0 | 460,0 | 1,0 | 0,0 | 8,9 | 0,0 | 387,6 | 80,8 | 95,3 | 557,6 | 402,2 | 601,9 | 639,1 | 346,6 | 778,9 | 0,19 | 83,31 | 82,36 | 82,47 | 0,19 | 86,85 | 90,00 | 83,99 | 0,08 | 0,07 |
| 66,0 | 461,0 | 0,9 | 0,0 | 8,8 | 0,0 | 385,2 | 80,9 | 95,1 | 551,2 | 400,3 | 605,0 | 638,5 | 346,4 | 774,4 | 0,19 | 83,33 | 82,39 | 82,41 | 0,19 | 86,85 | 90,02 | 83,94 | 0,08 | 0,07 |
| 67,0 | 462,0 | 0,9 | 0,0 | 8,6 | 0,0 | 383,6 | 80,9 | 95,0 | 544,6 | 397,9 | 607,4 | 639,6 | 346,2 | 775,4 | 0,19 | 83,42 | 82,41 | 82,40 | 0,19 | 86,90 | 90,09 | 83,90 | 0,08 | 0,07 |
| 68,0 | 463,0 | 0,9 | 0,0 | 8,6 | 0,0 | 383,1 | 80,9 | 94,3 | 538,0 | 395,8 | 609,2 | 640,0 | 346,1 | 774,2 | 0,19 | 83,38 | 82,42 | 82,35 | 0,19 | 86,86 | 90,12 | 83,87 | 0,07 | 0,07 |
| 69,0 | 464,0 | 0,8 | 0,0 | 8,3 | 0,0 | 378,8 | 80,9 | 94,9 | 531,2 | 394,0 | 610,7 | 640,1 | 345,9 | 762,4 | 0,19 | 83,36 | 82,42 | 82,30 | 0,18 | 86,90 | 90,17 | 83,84 | 0,08 | 0,06 |
| 70,0 | 465,0 | 0,8 | 0,0 | 8,2 | 0,0 | 376,3 | 80,8 | 93,9 | 524,8 | 392,0 | 611,1 | 641,1 | 345,8 | 756,8 | 0,19 | 83,36 | 82,45 | 83,19 | 0,18 | 86,88 | 90,25 | 83,83 | 0,07 | 0,06 |
| 71,0 | 466,0 | 0,8 | 0,0 | 8,0 | 0,0 | 374,2 | 80,8 | 94,2 | 518,0 | 390,0 | 611,1 | 641,4 | 345,6 | 753,5 | 0,19 | 83,34 | 82,48 | 82,63 | 0,18 | 86,86 | 90,31 | 83,79 | 0,07 | 0,06 |
| 72,0 | 467,0 | 0,8 | 0,0 | 7,9 | 0,0 | 372,0 | 80,8 | 94,2 | 511,6 | 387,8 | 611,1 | 642,5 | 345,5 | 751,6 | 0,19 | 83,29 | 82,48 | 82,74 | 0,19 | 86,83 | 90,33 | 83,77 | 0,08 | 0,06 |
| 73,0 | 468,0 | 0,8 | 0,1 | 7,8 | 0,0 | 372,2 | 80,8 | 94,1 | 505,4 | 385,8 | 611,0 | 642,8 | 345,5 | 750,2 | 0,19 | 83,31 | 82,48 | 83,40 | 0,19 | 86,85 | 90,36 | 83,76 | 0,07 | 0,06 |
| 74,0 | 469,0 | 0,7 | 0,1 | 7,7 | 0,0 | 370,1 | 80,8 | 94,1 | 499,1 | 384,2 | 610,8 | 643,3 | 345,5 | 748,4 | 0,19 | 83,36 | 82,51 | 84,12 | 0,19 | 86,89 | 90,35 | 83,72 | 0,08 | 0,06 |
| 75,0 | 470,0 | 0,7 | 0,1 | 7,8 | 0,0 | 368,7 | 80,8 | 94,4 | 493,4 | 381,7 | 610,5 | 643,9 | 345,5 | 746,0 | 0,19 | 83,42 | 82,52 | 84,73 | 0,19 | 86,93 | 90,38 | 83,75 | 0,07 | 0,06 |
| 76,0 | 471,0 | 0,7 | 0,1 | 7,7 | 0,0 | 368,1 | 80,8 | 93,3 | 488,1 | 380,0 | 610,0 | 643,6 | 345,6 | 745,5 | 0,19 | 83,48 | 82,56 | 85,71 | 0,19 | 86,93 | 90,32 | 83,66 | 0,07 | 0,06 |
| 77,0 | 472,0 | 0,7 | 0,1 | 7,5 | 0,0 | 366,9 | 80,9 | 92,7 | 482,8 | 378,8 | 609,8 | 643,1 | 345,7 | 742,4 | 0,19 | 83,41 | 82,56 | 86,56 | 0,19 | 86,90 | 90,32 | 83,71 | 0,08 | 0,06 |
| 78,0 | 473,0 | 0,7 | 0,1 | 7,5 | 0,0 | 365,4 | 80,9 | 94,5 | 477,0 | 376,9 | 608,8 | 642,3 | 345,8 | 738,9 | 0,19 | 83,38 | 82,57 | 86,55 | 0,19 | 86,90 | 90,39 | 83,93 | 0,08 | 0,06 |
| 79,0 | 474,0 | 0,6 | 0,1 | 7,5 | 0,0 | 364,8 | 80,9 | 92,2 | 472,5 | 375,6 | 607,2 | 641,5 | 346,0 | 736,0 | 0,19 | 83,40 | 82,58 | 86,36 | 0,18 | 86,89 | 90,44 | 84,05 | 0,07 | 0,06 |
| 80,0 | 475,0 | 0,6 | 0,1 | 7,5 | 0,0 | 363,6 | 80,9 | 93,3 | 467,2 | 373,9 | 606,5 | 640,7 | 346,2 | 733,7 | 0,19 | 83,37 | 82,61 | 86,20 | 0,19 | 86,90 | 90,46 | 84,23 | 0,08 | 0,06 |
| 81,0 | 476,0 | 0,6 | 0,1 | 7,6 | 0,0 | 362,1 | 81,0 | 92,8 | 462,5 | 372,5 | 604,8 | 639,0 | 346,3 | 730,6 | 0,19 | 83,38 | 82,62 | 86,08 | 0,19 | 86,95 | 90,50 | 84,37 | 0,08 | 0,06 |
| 82,0 | 477,0 | 0,6 | 0,1 | 7,6 | 0,0 | 360,9 | 80,9 | 94,0 | 458,2 | 371,1 | 604,2 | 637,7 | 346,6 | 728,4 | 0,19 | 83,40 | 82,62 | 86,00 | 0,19 | 86,94 | 90,54 | 84,56 | 0,08 | 0,06 |
| 83,0 | 478,0 | 0,6 | 0,1 | 7,5 | 0,0 | 360,2 | 80,9 | 92,4 | 454,0 | 369,5 | 602,8 | 636,2 | 346,8 | 729,2 | 0,19 | 83,41 | 82,62 | 85,94 | 0,18 | 86,95 | 90,57 | 84,65 | 0,07 | 0,06 |
| 84,0 | 479,0 | 0,6 | 0,1 | 7,4 | 0,0 | 359,6 | 80,9 | 93,5 | 450,5 | 368,7 | 602,4 | 634,9 | 347,1 | 729,8 | 0,18 | 83,44 | 82,66 | 85,91 | 0,18 | 86,96 | 90,63 | 84,77 | 0,08 | 0,06 |
| 85,0 | 480,0 | 0,5 | 0,1 | 7,5 | 0,0 | 359,4 | 80,8 | 93,1 | 446,2 | 367,4 | 601,2 | 633,2 | 347,5 | 728,0 | 0,19 | 83,41 | 82,68 | 85,84 | 0,19 | 86,95 | 90,68 | 84,91 | 0,08 | 0,06 |
| 86,0 | 481,0 | 0,5 | 0,1 | 7,5 | 0,0 | 358,3 | 80,8 | 93,6 | 442,7 | 366,3 | 600,4 | 631,2 | 347,9 | 727,4 | 0,19 | 83,40 | 82,67 | 85,79 | 0,19 | 86,96 | 90,68 | 85,04 | 0,07 | 0,06 |
| 87,0 | 482,0 | 0,5 | 0,1 | 7,5 | 0,0 | 358,5 | 80,8 | 93,2 | 439,3 | 364,3 | 599,1 | 629,3 | 348,2 | 726,0 | 0,19 | 83,37 | 82,68 | 85,72 | 0,19 | 86,95 | 90,71 | 85,14 | 0,07 | 0,06 |
| 88,0 | 483,0 | 0,5 | 0,1 | 7,6 | 0,0 | 358,1 | 80,8 | 92,5 | 435,9 | 363,7 | 597,7 | 627,3 | 348,6 | 723,9 | 0,19 | 83,37 | 82,67 | 85,67 | 0,19 | 86,91 | 90,71 | 85,24 | 0,08 | 0,06 |
| 89,0 | 484,0 | 0,5 | 0,1 | 7,7 | 0,0 | 357,7 | 80,8 | 93,4 | 433,2 | 362,9 | 597,0 | 625,3 | 349,0 | 723,5 | 0,19 | 83,38 | 82,68 | 85,63 | 0,19 | 86,91 | 90,74 | 85,34 | 0,08 | 0,06 |
| 90,0 | 485,0 | 0,4 | 0,1 | 7,6 | 0,0 | 357,0 | 80,8 | 93,3 | 429,8 | 361,8 | 596,3 | 623,9 | 349,5 | 721,3 | 0,19 | 83,35 | 82,67 | 85,58 | 0,19 | 86,88 | 90,79 | 85,41 | 0,08 | 0,06 |
| 91,0 | 486,0 | 0,4 | 0,1 | 7,6 | 0,0 | 356,0 | 80,7 | 92,9 | 426,7 | 360,5 | 595,5 | 621,8 | 349,9 | 719,2 | 0,19 | 83,36 | 82,68 | 85,50 | 0,18 | 86,89 | 90,80 | 85,46 | 0,07 | 0,06 |
| 92,0 | 487,0 | 0,4 | 0,1 | 7,5 | 0,0 | 355,2 | 80,7 | 93,3 | 423,9 | 359,1 | 594,7 | 620,6 | 350,4 | 716,9 | 0,19 | 83,32 | 82,66 | 85,44 | 0,19 | 86,88 | 90,82 | 85,55 | 0,08 | 0,06 |
| 93,0 | 488,0 | 0,4 | 0,1 | 7,4 | 0,0 | 354,3 | 80,7 | 93,6 | 421,4 | 358,2 | 594,4 | 619,1 | 350,9 | 715,7 | 0,19 | 83,36 | 82,67 | 85,37 | 0,19 | 86,88 | 90,79 | 85,61 | 0,08 | 0,06 |
| 94,0 | 489,0 | 0,3 | 0,1 | 7,5 | 0,0 | 354,0 | 80,8 | 92,2 | 419,2 | 357,4 | 594,1 | 617,8 | 351,4 | 716,9 | 0,19 | 83,36 | 82,67 | 85,33 | 0,18 | 86,88 | 90,82 | 85,65 | 0,08 | 0,06 |
| 95,0 | 490,0 | 0,3 | 0,1 | 7,4 | 0,0 | 354,0 | 80,8 | 93,4 | 416,7 | 356,1 | 593,8 | 616,1 | 351,9 | 718,3 | 0,18 | 83,37 | 82,69 | 85,28 | 0,18 | 86,87 | 90,85 | 85,69 | 0,08 | 0,06 |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 96,0 | 491,0 | 0,3 | 0,1 | 7,4 | 0,0 | 355,4 | 80,7 | 92,3 | 414,0 | 355,2 | 593,5 | 614,4 | 352,3 | 720,7 | 0,18 | 83,34 | 82,67 | 85,18 | 0,18 | 86,83 | 90,84 | 85,73 | 0,07 | 0,06 |
| 97,0 | 492,0 | 0,3 | 0,1 | 7,5 | 0,0 | 355,4 | 80,7 | 92,0 | 411,9 | 354,0 | 593,3 | 612,2 | 352,9 | 719,3 | 0,19 | 83,35 | 82,70 | 85,12 | 0,19 | 86,88 | 90,89 | 85,70 | 0,07 | 0,06 |
| 98,0 | 493,0 | 0,2 | 0,1 | 7,4 | 0,0 | 354,6 | 80,7 | 93,2 | 409,4 | 353,4 | 593,0 | 610,7 | 353,3 | 720,6 | 0,18 | 83,33 | 82,68 | 85,03 | 0,19 | 86,88 | 90,93 | 85,79 | 0,07 | 0,06 |
| 99,0 | 494,0 | 0,2 | 0,1 | 7,3 | 0,0 | 355,8 | 80,8 | 93,2 | 407,3 | 351,9 | 591,9 | 608,9 | 353,9 | 724,7 | 0,19 | 83,34 | 82,73 | 84,98 | 0,19 | 86,87 | 90,94 | 85,85 | 0,07 | 0,06 |
| 100,0 | 495,0 | 0,2 | 0,1 | 7,3 | 0,0 | 357,1 | 80,8 | 92,1 | 405,3 | 350,3 | 591,3 | 607,6 | 354,4 | 725,5 | 0,19 | 83,37 | 82,73 | 84,94 | 0,19 | 86,85 | 90,90 | 85,86 | 0,07 | 0,06 |
| 101,0 | 496,0 | 0,2 | 0,1 | 7,3 | 0,0 | 356,7 | 80,8 | 92,0 | 403,3 | 348,9 | 591,2 | 605,8 | 354,9 | 724,6 | 0,19 | 83,39 | 82,73 | 84,83 | 0,19 | 86,88 | 90,93 | 85,87 | 0,08 | 0,06 |
| 102,0 | 497,0 | 0,2 | 0,1 | 7,2 | 0,0 | 356,7 | 80,7 | 92,2 | 401,0 | 347,7 | 590,8 | 604,2 | 355,4 | 723,4 | 0,19 | 83,45 | 82,71 | 84,75 | 0,19 | 86,86 | 90,92 | 85,87 | 0,08 | 0,06 |
| 103,0 | 498,0 | 0,2 | 0,1 | 7,1 | 0,0 | 357,5 | 80,7 | 93,1 | 399,4 | 346,4 | 591,3 | 602,8 | 356,0 | 721,6 | 0,19 | 83,48 | 82,74 | 84,70 | 0,19 | 86,89 | 90,93 | 85,97 | 0,07 | 0,06 |
| 104,0 | 499,0 | 0,1 | 0,1 | 7,1 | 0,0 | 356,7 | 80,7 | 92,8 | 397,4 | 344,8 | 590,3 | 600,7 | 356,5 | 718,0 | 0,19 | 83,41 | 82,75 | 84,61 | 0,18 | 86,87 | 90,91 | 85,98 | 0,08 | 0,06 |
| 105,0 | 500,0 | 0,2 | 0,1 | 7,1 | 0,0 | 356,0 | 80,7 | 91,4 | 395,6 | 343,5 | 589,9 | 599,2 | 357,0 | 717,7 | 0,19 | 83,39 | 82,76 | 84,53 | 0,18 | 86,86 | 90,89 | 85,94 | 0,07 | 0,06 |
| 106,0 | 501,0 | 0,1 | 0,1 | 7,0 | 0,0 | 355,2 | 80,7 | 91,8 | 393,5 | 342,2 | 589,9 | 597,9 | 357,6 | 716,6 | 0,19 | 83,37 | 82,74 | 84,49 | 0,19 | 86,89 | 90,90 | 85,96 | 0,08 | 0,06 |
| 107,0 | 502,0 | 0,1 | 0,1 | 6,9 | 0,0 | 354,5 | 80,6 | 92,3 | 391,7 | 340,5 | 589,8 | 596,3 | 358,1 | 712,8 | 0,19 | 83,33 | 82,73 | 84,42 | 0,19 | 86,83 | 90,85 | 85,97 | 0,08 | 0,06 |
| 108,0 | 503,0 | 0,1 | 0,1 | 6,9 | 0,0 | 353,4 | 80,8 | 91,8 | 390,4 | 339,1 | 589,8 | 593,9 | 358,7 | 705,9 | 0,19 | 83,33 | 82,75 | 84,38 | 0,19 | 86,83 | 90,90 | 85,97 | 0,07 | 0,06 |
| 109,0 | 504,0 | 0,1 | 0,1 | 6,7 | 0,0 | 349,5 | 80,7 | 92,9 | 388,7 | 338,1 | 589,2 | 592,6 | 359,3 | 696,3 | 0,19 | 83,35 | 82,76 | 84,30 | 0,19 | 86,84 | 90,92 | 86,01 | 0,08 | 0,06 |
| 110,0 | 505,0 | 0,1 | 0,1 | 6,5 | 0,0 | 348,7 | 80,7 | 90,9 | 387,0 | 336,8 | 588,9 | 590,4 | 359,9 | 696,1 | 0,19 | 83,40 | 82,77 | 84,25 | 0,19 | 86,86 | 90,94 | 86,00 | 0,08 | 0,06 |
| 111,0 | 506,0 | 0,1 | 0,1 | 6,5 | 0,0 | 348,5 | 80,7 | 91,7 | 385,0 | 335,3 | 587,8 | 588,2 | 360,4 | 697,1 | 0,19 | 83,36 | 82,78 | 84,19 | 0,19 | 86,83 | 90,93 | 85,97 | 0,08 | 0,06 |
| 112,0 | 507,0 | 0,1 | 0,1 | 6,5 | 0,0 | 348,4 | 80,7 | 91,5 | 383,5 | 334,0 | 586,7 | 586,7 | 361,1 | 699,3 | 0,19 | 83,40 | 82,78 | 84,15 | 0,19 | 86,82 | 90,94 | 85,96 | 0,08 | 0,06 |
| 113,0 | 508,0 | 0,0 | 0,1 | 6,5 | 0,0 | 348,0 | 80,7 | 91,9 | 381,4 | 332,3 | 585,4 | 584,6 | 361,7 | 696,3 | 0,19 | 83,46 | 82,79 | 84,11 | 0,19 | 86,81 | 90,87 | 85,98 | 0,08 | 0,06 |

Manufacturer: HEARTHSTONE
Model: 8060

Run: 1
Project #: PI 20272
Test Duration: 113 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 | 76,90% | 83,12% |
| Comb Eff | 99,01% | 99,01% |
| HT Eff | 77,67% | 83,95% |
| Output | 14 827 | kJ/h |
| Burn Rate | 0,97 | kg/h |
| Grams CO | 45 | g |
| Input | 19 280 | kJ/h |
| MC wet | 16,95 | |

Ultimate $CO_2$
$CO_{2\text{-ult}}$ 19,64
$F_0$
1,062

Overall Heating Efficiency: 76,90%
Combustion Efficiency: 99,01%
Heat Transfer Efficiency: 77,67%

Heat Output: 14 065 Btu/h
Heat Input: 18 289 Btu/h
Burn Duration: 2,70 h
Burn Rate: 2,15 lb/h
Stack Temp: 361,4 Deg. F

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Averages | 0,15 | 9,55 | 1,19 | 20,30 | 10,68 | 182,99 | 26,88 | 0,99 | 0,78 | #DIV/0! |
| INPUT DATA | | | Oxygen Calculation | | | Input Data | | Combust | Heat | Net |
| Elapsed Time | Weight Remaining (kg) | % CO [e] | % $CO_2$ [d] | Excess Air EA | Total $O_2$ | Calc. % $O_2$ [g] | Flue Gas (°C) | Room Temp (°C) | Eff % | Transfer % | Eff % |
| 0,00 | 3,16 | 0,05 | 3,63 | 433,9% | 20,70 | 17,04 | 183,0 | 26,6 | 100,3% | 62,5% | 62,7% |
| 1,00 | 3,12 | 0,14 | 3,60 | 424,5% | 20,69 | 17,02 | 168,3 | 26,5 | 98,1% | 64,9% | 63,7% |
| 2,00 | 3,12 | 0,07 | 5,28 | 267,3% | 20,59 | 15,27 | 169,8 | 26,5 | 99,8% | 72,1% | 71,9% |
| 3,00 | 3,09 | 0,06 | 5,66 | 243,8% | 20,56 | 14,88 | 172,0 | 26,5 | 99,9% | 72,9% | 72,8% |
| 4,00 | 3,07 | 0,05 | 6,57 | 196,8% | 20,50 | 13,91 | 174,0 | 26,5 | 100,0% | 74,8% | 74,8% |
| 5,00 | 3,03 | 0,05 | 9,64 | 102,9% | 20,30 | 10,64 | 184,0 | 26,4 | 99,9% | 78,4% | 78,3% |
| 6,00 | 2,98 | 0,04 | 11,15 | 75,4% | 20,20 | 9,03 | 190,9 | 26,4 | 99,9% | 79,2% | 79,2% |
| 7,00 | 2,94 | 0,03 | 10,55 | 85,7% | 20,24 | 9,68 | 192,4 | 26,5 | 100,0% | 78,6% | 78,7% |
| 8,00 | 2,85 | 0,03 | 10,37 | 88,9% | 20,25 | 9,87 | 197,9 | 26,4 | 100,0% | 78,1% | 78,1% |
| 9,00 | 2,85 | 0,06 | 12,85 | 52,1% | 20,09 | 7,21 | 205,0 | 26,5 | 99,8% | 79,6% | 79,4% |
| 10,00 | 2,76 | 0,04 | 12,09 | 62,0% | 20,14 | 8,03 | 207,0 | 26,5 | 99,9% | 78,9% | 78,9% |
| 11,00 | 2,71 | 0,06 | 12,20 | 60,2% | 20,13 | 7,90 | 211,1 | 26,5 | 99,8% | 78,8% | 78,6% |
| 12,00 | 2,67 | 0,07 | 11,89 | 64,3% | 20,15 | 8,23 | 213,9 | 26,5 | 99,7% | 78,4% | 78,1% |
| 13,00 | 2,62 | 0,07 | 11,73 | 66,4% | 20,16 | 8,39 | 215,4 | 26,5 | 99,7% | 78,1% | 77,9% |
| 14,00 | 2,53 | 0,13 | 12,29 | 58,1% | 20,12 | 7,76 | 220,4 | 26,5 | 99,3% | 78,3% | 77,7% |
| 15,00 | 2,53 | 0,12 | 12,77 | 52,3% | 20,09 | 7,26 | 223,8 | 26,5 | 99,3% | 78,4% | 77,9% |
| 16,00 | 2,44 | 0,07 | 12,62 | 54,7% | 20,10 | 7,44 | 225,4 | 26,5 | 99,7% | 78,2% | 78,0% |
| 17,00 | 2,44 | 0,09 | 12,39 | 57,4% | 20,12 | 7,68 | 225,3 | 26,6 | 99,6% | 78,0% | 77,7% |
| 18,00 | 2,35 | 0,08 | 12,85 | 51,9% | 20,09 | 7,19 | 231,9 | 26,5 | 99,6% | 78,0% | 77,7% |
| 19,00 | 2,30 | 0,23 | 14,33 | 34,9% | 19,98 | 5,53 | 237,8 | 26,6 | 98,8% | 78,6% | 77,7% |
| 20,00 | 2,21 | 0,38 | 14,02 | 36,3% | 19,99 | 5,77 | 235,3 | 26,6 | 97,9% | 78,5% | 76,9% |
| 21,00 | 2,17 | 0,06 | 11,55 | 69,1% | 20,17 | 8,59 | 229,1 | 26,6 | 99,8% | 77,1% | 76,9% |
| 22,00 | 2,16 | 0,05 | 10,87 | 79,8% | 20,22 | 9,32 | 226,2 | 26,6 | 99,9% | 76,7% | 76,6% |
| 23,00 | 2,08 | 0,05 | 11,48 | 70,4% | 20,18 | 8,67 | 226,3 | 26,6 | 99,9% | 77,2% | 77,1% |
| 24,00 | 2,03 | 0,07 | 12,55 | 55,6% | 20,11 | 7,52 | 230,2 | 26,6 | 99,7% | 77,9% | 77,7% |
| 25,00 | 1,98 | 0,27 | 13,72 | 40,4% | 20,02 | 6,16 | 238,0 | 26,7 | 98,5% | 78,2% | 77,1% |
| 26,00 | 1,94 | 0,23 | 14,57 | 32,7% | 19,96 | 5,28 | 241,5 | 26,7 | 98,8% | 78,6% | 77,6% |
| 27,00 | 1,85 | 0,86 | 14,87 | 24,9% | 19,90 | 4,60 | 243,3 | 26,7 | 95,5% | 78,5% | 74,9% |
| 28,00 | 1,80 | 0,68 | 14,80 | 26,9% | 19,92 | 4,78 | 243,0 | 26,7 | 96,4% | 78,5% | 75,7% |
| 29,00 | 1,76 | 0,60 | 14,57 | 29,5% | 19,94 | 5,07 | 241,9 | 26,7 | 96,8% | 78,5% | 75,9% |
| 30,00 | 1,71 | 0,36 | 14,27 | 34,3% | 19,97 | 5,52 | 240,0 | 26,8 | 98,0% | 78,5% | 76,9% |
| 31,00 | 1,67 | 0,19 | 14,01 | 38,4% | 20,00 | 5,90 | 238,8 | 26,8 | 99,0% | 78,4% | 77,6% |
| 32,00 | 1,58 | 0,13 | 13,84 | 40,5% | 20,02 | 6,11 | 237,7 | 26,8 | 99,3% | 78,4% | 77,8% |
| 33,00 | 1,58 | 0,16 | 13,76 | 41,1% | 20,02 | 6,18 | 237,2 | 26,8 | 99,2% | 78,3% | 77,7% |
| 34,00 | 1,49 | 0,19 | 13,96 | 38,8% | 20,01 | 5,95 | 237,1 | 26,9 | 99,0% | 78,5% | 77,7% |
| 35,00 | 1,44 | 0,24 | 14,33 | 34,8% | 19,98 | 5,53 | 237,9 | 26,9 | 98,7% | 78,6% | 77,6% |
| 36,00 | 1,39 | 0,39 | 14,50 | 32,0% | 19,96 | 5,26 | 239,1 | 26,9 | 97,9% | 78,6% | 77,0% |
| 37,00 | 1,34 | 0,48 | 14,66 | 29,7% | 19,94 | 5,03 | 241,0 | 26,9 | 97,4% | 78,6% | 76,6% |
| 38,00 | 1,30 | 0,48 | 14,86 | 28,0% | 19,93 | 4,83 | 242,2 | 27,0 | 97,5% | 78,7% | 76,7% |
| 39,00 | 1,25 | 0,65 | 15,05 | 25,1% | 19,90 | 4,53 | 243,5 | 27,0 | 96,6% | 78,7% | 76,0% |
| 40,00 | 1,17 | 0,91 | 15,19 | 22,0% | 19,88 | 4,23 | 244,5 | 27,0 | 95,3% | 78,6% | 74,9% |
| 41,00 | 1,12 | 0,27 | 15,24 | 26,6% | 19,92 | 4,54 | 245,0 | 27,0 | 98,6% | 78,8% | 77,7% |
| 42,00 | 1,03 | 0,37 | 15,13 | 26,7% | 19,92 | 4,60 | 244,3 | 27,0 | 98,1% | 78,8% | 77,2% |
| 43,00 | 1,00 | 0,39 | 15,02 | 27,5% | 19,92 | 4,71 | 243,7 | 27,1 | 97,9% | 78,7% | 77,1% |
| 44,00 | 0,94 | 0,33 | 14,98 | 28,3% | 19,93 | 4,78 | 241,6 | 27,1 | 98,2% | 78,8% | 77,4% |
| 45,00 | 0,94 | 0,21 | 14,98 | 29,3% | 19,94 | 4,85 | 241,6 | 27,1 | 98,9% | 78,9% | 78,0% |
| 46,00 | 0,85 | 0,35 | 14,65 | 31,0% | 19,95 | 5,12 | 240,2 | 27,1 | 98,1% | 78,7% | 77,2% |
| 47,00 | 0,85 | 0,16 | 13,93 | 39,4% | 20,01 | 6,00 | 238,1 | 27,1 | 99,2% | 78,4% | 77,8% |
| 48,00 | 0,80 | 0,09 | 13,27 | 47,0% | 20,06 | 6,74 | 235,4 | 27,2 | 99,6% | 78,1% | 77,8% |
| 49,00 | 0,76 | 0,06 | 12,80 | 52,8% | 20,09 | 7,26 | 232,8 | 27,1 | 99,8% | 78,0% | 77,8% |
| 50,00 | 0,71 | 0,06 | 12,98 | 50,6% | 20,08 | 7,07 | 233,2 | 27,1 | 99,8% | 78,1% | 77,9% |
| 51,00 | 0,71 | 0,05 | 12,71 | 54,0% | 20,10 | 7,37 | 230,6 | 27,2 | 99,8% | 78,0% | 77,9% |
| 52,00 | 0,67 | 0,03 | 12,09 | 62,1% | 20,14 | 8,03 | 227,7 | 27,2 | 100,0% | 77,7% | 77,7% |
| 53,00 | 0,67 | 0,03 | 11,68 | 67,7% | 20,17 | 8,47 | 224,9 | 27,2 | 100,0% | 77,6% | 77,6% |
| 54,00 | 0,62 | 0,02 | 11,06 | 77,3% | 20,21 | 9,14 | 221,3 | 27,2 | 100,1% | 77,2% | 77,3% |
| 55,00 | 0,58 | 0,02 | 10,45 | 87,8% | 20,25 | 9,80 | 217,7 | 27,2 | 100,2% | 76,8% | 77,0% |
| 56,00 | 0,58 | 0,02 | 10,33 | 89,8% | 20,26 | 9,92 | 214,8 | 27,3 | 100,1% | 76,9% | 77,0% |
| 57,00 | 0,53 | 0,02 | 10,12 | 93,8% | 20,27 | 10,14 | 212,1 | 27,3 | 100,1% | 76,9% | 77,0% |
| 58,00 | 0,53 | 0,02 | 9,92 | 97,6% | 20,28 | 10,35 | 209,6 | 27,2 | 100,1% | 76,9% | 77,0% |
| 59,00 | 0,53 | 0,02 | 9,61 | 104,0% | 20,30 | 10,69 | 207,7 | 27,2 | 100,1% | 76,6% | 76,7% |
| 60,00 | 0,49 | 0,02 | 9,37 | 109,0% | 20,32 | 10,94 | 205,6 | 27,2 | 100,1% | 76,5% | 76,6% |
| 61,00 | 0,49 | 0,02 | 9,28 | 111,2% | 20,33 | 11,04 | 204,0 | 27,2 | 100,1% | 76,5% | 76,6% |
| 62,00 | 0,49 | 0,03 | 9,24 | 112,0% | 20,33 | 11,07 | 201,9 | 27,2 | 100,1% | 76,6% | 76,7% |
| 63,00 | 0,44 | 0,03 | 9,04 | 116,6% | 20,34 | 11,29 | 200,5 | 27,2 | 100,1% | 76,5% | 76,6% |
| 64,00 | 0,44 | 0,03 | 8,91 | 119,7% | 20,35 | 11,42 | 199,0 | 27,2 | 100,1% | 76,4% | 76,5% |
| 65,00 | 0,44 | 0,03 | 8,87 | 120,6% | 20,35 | 11,46 | 197,6 | 27,1 | 100,1% | 76,5% | 76,6% |
| 66,00 | 0,40 | 0,03 | 8,79 | 122,7% | 20,36 | 11,55 | 196,2 | 27,2 | 100,1% | 76,5% | 76,6% |
| 67,00 | 0,40 | 0,03 | 8,59 | 127,7% | 20,37 | 11,76 | 195,4 | 27,2 | 100,1% | 76,3% | 76,4% |
| 68,00 | 0,40 | 0,04 | 8,63 | 126,6% | 20,37 | 11,72 | 195,1 | 27,1 | 100,0% | 76,4% | 76,4% |
| 69,00 | 0,36 | 0,04 | 8,33 | 134,5% | 20,39 | 12,03 | 192,7 | 27,2 | 100,0% | 76,2% | 76,2% |
| 70,00 | 0,35 | 0,04 | 8,18 | 138,8% | 20,40 | 12,19 | 191,3 | 27,1 | 100,0% | 76,1% | 76,1% |
| 71,00 | 0,35 | 0,04 | 7,99 | 144,6% | 20,41 | 12,40 | 190,1 | 27,1 | 100,0% | 75,9% | 75,9% |
| 72,00 | 0,35 | 0,05 | 7,87 | 148,0% | 20,42 | 12,52 | 188,9 | 27,1 | 100,0% | 75,8% | 75,8% |
| 73,00 | 0,35 | 0,05 | 7,77 | 151,1% | 20,42 | 12,63 | 189,0 | 27,1 | 99,9% | 75,6% | 75,6% |
| 74,00 | 0,30 | 0,06 | 7,74 | 151,9% | 20,43 | 12,65 | 187,8 | 27,1 | 99,9% | 75,7% | 75,6% |
| 75,00 | 0,30 | 0,06 | 7,79 | 150,3% | 20,42 | 12,60 | 187,1 | 27,1 | 99,8% | 75,8% | 75,7% |
| 76,00 | 0,30 | 0,06 | 7,74 | 151,9% | 20,43 | 12,66 | 186,7 | 27,1 | 99,8% | 75,8% | 75,6% |
| 77,00 | 0,30 | 0,07 | 7,53 | 158,7% | 20,44 | 12,88 | 186,0 | 27,2 | 99,7% | 75,5% | 75,3% |
| 78,00 | 0,30 | 0,07 | 7,54 | 158,1% | 20,44 | 12,86 | 185,2 | 27,1 | 99,7% | 75,6% | 75,4% |
| 79,00 | 0,26 | 0,07 | 7,54 | 158,1% | 20,44 | 12,86 | 184,9 | 27,2 | 99,7% | 75,6% | 75,4% |
| 80,00 | 0,26 | 0,07 | 7,54 | 158,0% | 20,44 | 12,86 | 184,2 | 27,2 | 99,7% | 75,7% | 75,5% |
| 81,00 | 0,26 | 0,07 | 7,59 | 156,4% | 20,43 | 12,81 | 183,4 | 27,2 | 99,7% | 75,8% | 75,6% |
| 82,00 | 0,26 | 0,07 | 7,64 | 154,7% | 20,43 | 12,75 | 182,7 | 27,1 | 99,7% | 76,0% | 75,8% |
| 83,00 | 0,26 | 0,07 | 7,54 | 157,9% | 20,44 | 12,86 | 182,3 | 27,2 | 99,7% | 75,9% | 75,6% |
| 84,00 | 0,26 | 0,08 | 7,45 | 161,0% | 20,44 | 12,96 | 182,0 | 27,2 | 99,6% | 75,7% | 75,4% |
| 85,00 | 0,22 | 0,08 | 7,53 | 158,2% | 20,44 | 12,87 | 181,9 | 27,1 | 99,6% | 75,9% | 75,6% |
| 86,00 | 0,22 | 0,08 | 7,49 | 159,3% | 20,44 | 12,90 | 181,3 | 27,1 | 99,6% | 75,9% | 75,6% |
| 87,00 | 0,21 | 0,08 | 7,50 | 158,9% | 20,44 | 12,90 | 181,4 | 27,1 | 99,6% | 75,9% | 75,5% |
| 88,00 | 0,22 | 0,08 | 7,63 | 154,9% | 20,43 | 12,76 | 181,1 | 27,1 | 99,6% | 76,1% | 75,8% |
| 89,00 | 0,21 | 0,08 | 7,69 | 152,7% | 20,43 | 12,70 | 180,9 | 27,1 | 99,6% | 76,2% | 75,9% |
| 90,00 | 0,17 | 0,08 | 7,64 | 154,2% | 20,43 | 12,75 | 180,5 | 27,1 | 99,6% | 76,2% | 75,8% |
| 91,00 | 0,17 | 0,08 | 7,59 | 155,9% | 20,43 | 12,80 | 180,0 | 27,1 | 99,6% | 76,1% | 75,8% |
| 92,00 | 0,17 | 0,08 | 7,51 | 158,7% | 20,44 | 12,89 | 179,5 | 27,0 | 99,6% | 76,0% | 75,7% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 93,00 | 0,17 | 0,08 | 7,42 | 161,6% | 20,44 | 12,98 | 179,1 | 27,1 | 99,6% | 75,9% | 75,6% |
| 94,00 | 0,12 | 0,09 | 7,46 | 160,3% | 20,44 | 12,94 | 178,9 | 27,1 | 99,5% | 76,0% | 75,7% |
| 95,00 | 0,12 | 0,09 | 7,38 | 162,8% | 20,45 | 13,02 | 178,9 | 27,1 | 99,5% | 75,9% | 75,5% |
| 96,00 | 0,12 | 0,09 | 7,36 | 163,4% | 20,45 | 13,04 | 179,6 | 27,1 | 99,4% | 75,8% | 75,4% |
| 97,00 | 0,12 | 0,09 | 7,49 | 158,8% | 20,44 | 12,90 | 179,7 | 27,1 | 99,4% | 76,0% | 75,6% |
| 98,00 | 0,11 | 0,09 | 7,41 | 161,9% | 20,44 | 12,99 | 179,2 | 27,1 | 99,4% | 75,9% | 75,5% |
| 99,00 | 0,08 | 0,10 | 7,33 | 164,3% | 20,45 | 13,07 | 179,9 | 27,1 | 99,3% | 75,7% | 75,2% |
| 100,00 | 0,08 | 0,11 | 7,33 | 164,1% | 20,45 | 13,06 | 180,6 | 27,1 | 99,3% | 75,6% | 75,1% |
| 101,00 | 0,08 | 0,11 | 7,26 | 166,5% | 20,45 | 13,14 | 180,4 | 27,1 | 99,3% | 75,5% | 75,0% |
| 102,00 | 0,08 | 0,11 | 7,21 | 168,3% | 20,46 | 13,19 | 180,4 | 27,1 | 99,3% | 75,5% | 74,9% |
| 103,00 | 0,08 | 0,11 | 7,10 | 172,6% | 20,46 | 13,31 | 180,8 | 27,0 | 99,3% | 75,2% | 74,7% |
| 104,00 | 0,03 | 0,10 | 7,13 | 171,5% | 20,46 | 13,28 | 180,4 | 27,0 | 99,3% | 75,3% | 74,8% |
| 105,00 | 0,08 | 0,10 | 7,08 | 173,3% | 20,47 | 13,33 | 180,0 | 27,1 | 99,3% | 75,3% | 74,7% |
| 106,00 | 0,03 | 0,11 | 6,95 | 178,3% | 20,47 | 13,47 | 179,5 | 27,1 | 99,3% | 75,1% | 74,5% |
| 107,00 | 0,03 | 0,10 | 6,92 | 179,8% | 20,48 | 13,51 | 179,2 | 27,0 | 99,3% | 75,0% | 74,5% |
| 108,00 | 0,03 | 0,11 | 6,95 | 178,6% | 20,47 | 13,48 | 178,5 | 27,1 | 99,3% | 75,2% | 74,6% |
| 109,00 | 0,03 | 0,09 | 6,66 | 191,0% | 20,49 | 13,79 | 176,4 | 27,1 | 99,5% | 74,8% | #DIV/0! |
| 110,00 | 0,03 | 0,09 | 6,53 | 196,8% | 20,50 | 13,93 | 176,0 | 27,1 | 99,4% | 74,6% | #DIV/0! |
| 111,00 | 0,03 | 0,10 | 6,54 | 195,8% | 20,50 | 13,91 | 175,8 | 27,0 | 99,4% | 74,6% | #DIV/0! |
| 112,00 | 0,03 | 0,10 | 6,54 | 195,7% | 20,50 | 13,91 | 175,8 | 27,1 | 99,3% | 74,6% | 74,1% |
| 113,00 | 0,00 | 0,10 | 6,53 | 196,2% | 20,50 | 13,92 | 175,6 | 27,0 | 99,3% | 74,6% | 74,1% |
| 114,00 | 0,30 | 0,17 | 9,01 | 113,9% | 20,33 | 11,24 | 135,6 | 26,5 | 98,8% | 81,4% | 80,4% |
| 115,00 | 0,31 | 0,17 | 9,00 | 114,3% | 20,33 | 11,25 | 135,1 | 26,6 | 98,8% | 81,4% | 80,5% |
| 116,00 | 0,31 | 0,17 | 8,80 | 119,0% | 20,35 | 11,46 | 134,7 | 26,6 | 98,8% | 81,3% | 80,3% |
| 117,00 | 0,31 | 0,17 | 8,83 | 118,2% | 20,35 | 11,43 | 134,7 | 26,5 | 98,8% | 81,3% | 80,3% |
| 118,00 | 0,31 | 0,15 | 9,39 | 105,8% | 20,31 | 10,84 | 133,5 | 26,6 | 99,0% | 81,9% | 81,0% |
| 119,00 | 0,26 | 0,15 | 9,14 | 111,3% | 20,33 | 11,11 | 132,8 | 26,7 | 99,0% | 81,7% | 80,9% |
| 120,00 | 0,26 | 0,15 | 9,04 | 113,6% | 20,33 | 11,21 | 132,0 | 26,7 | 98,9% | 81,7% | 80,9% |
| 121,00 | 0,26 | 0,15 | 8,82 | 119,1% | 20,35 | 11,46 | 131,5 | 26,7 | 99,0% | 81,6% | 80,8% |
| 122,00 | 0,26 | 0,15 | 8,70 | 122,0% | 20,36 | 11,58 | 131,0 | 26,7 | 98,9% | 81,5% | 80,7% |
| 123,00 | 0,26 | 0,16 | 8,62 | 123,9% | 20,36 | 11,67 | 131,0 | 26,6 | 98,9% | 81,5% | 80,5% |
| 124,00 | 0,22 | 0,17 | 8,88 | 117,1% | 20,34 | 11,38 | 130,9 | 26,6 | 98,8% | 81,7% | 80,7% |
| 125,00 | 0,22 | 0,17 | 8,86 | 117,5% | 20,34 | 11,40 | 130,8 | 26,6 | 98,8% | 81,7% | 80,7% |
| 126,00 | 0,22 | 0,17 | 8,59 | 124,5% | 20,36 | 11,69 | 130,5 | 26,5 | 98,8% | 81,5% | 80,5% |
| 127,00 | 0,22 | 0,17 | 8,50 | 126,5% | 20,37 | 11,78 | 130,4 | 26,7 | 98,7% | 81,4% | 80,4% |
| 128,00 | 0,22 | 0,17 | 8,63 | 123,1% | 20,36 | 11,64 | 130,6 | 26,6 | 98,7% | 81,5% | 80,4% |
| 129,00 | 0,22 | 0,18 | 8,78 | 119,1% | 20,35 | 11,47 | 130,8 | 26,6 | 98,6% | 81,6% | 80,5% |
| 130,00 | 0,22 | 0,19 | 8,80 | 118,7% | 20,35 | 11,46 | 131,1 | 26,7 | 98,6% | 81,6% | 80,4% |
| 131,00 | 0,18 | 0,19 | 8,78 | 119,0% | 20,35 | 11,47 | 130,9 | 26,7 | 98,6% | 81,6% | 80,4% |
| 132,00 | 0,17 | 0,19 | 8,78 | 119,0% | 20,35 | 11,47 | 130,9 | 26,7 | 98,6% | 81,6% | 80,4% |
| 133,00 | 0,17 | 0,19 | 8,75 | 119,8% | 20,35 | 11,51 | 130,9 | 26,7 | 98,6% | 81,6% | 80,4% |
| 134,00 | 0,17 | 0,19 | 8,70 | 121,0% | 20,35 | 11,56 | 131,0 | 26,6 | 98,6% | 81,5% | 80,3% |
| 135,00 | 0,15 | 0,18 | 8,73 | 120,5% | 20,35 | 11,53 | 130,5 | 26,7 | 98,7% | 81,6% | 80,5% |
| 136,00 | 0,12 | 0,18 | 8,65 | 122,6% | 20,36 | 11,62 | 129,9 | 26,6 | 98,7% | 81,6% | 80,5% |
| 137,00 | 0,12 | 0,18 | 8,60 | 123,7% | 20,36 | 11,67 | 129,6 | 26,7 | 98,7% | 81,6% | 80,5% |
| 138,00 | 0,12 | 0,18 | 8,58 | 124,1% | 20,36 | 11,69 | 129,6 | 26,7 | 98,6% | 81,5% | 80,4% |
| 139,00 | 0,12 | 0,18 | 8,47 | 127,0% | 20,37 | 11,81 | 129,5 | 26,7 | 98,6% | 81,4% | 80,3% |
| 140,00 | 0,12 | 0,19 | 8,42 | 128,2% | 20,37 | 11,86 | 130,0 | 26,7 | 98,5% | 81,4% | 80,2% |
| 141,00 | 0,12 | 0,20 | 8,34 | 130,1% | 20,38 | 11,94 | 130,3 | 26,7 | 98,4% | 81,3% | 80,0% |
| 142,00 | 0,08 | 0,20 | 8,22 | 133,2% | 20,38 | 12,06 | 130,8 | 26,7 | 98,4% | 81,1% | 79,8% |
| 143,00 | 0,12 | 0,21 | 8,10 | 136,3% | 20,39 | 12,18 | 130,9 | 26,7 | 98,3% | 81,0% | 79,6% |
| 144,00 | 0,09 | 0,21 | 8,04 | 138,1% | 20,40 | 12,25 | 131,3 | 26,7 | 98,3% | 80,9% | 79,5% |
| 145,00 | 0,08 | 0,21 | 8,02 | 138,5% | 20,40 | 12,27 | 131,4 | 26,7 | 98,2% | 80,9% | 79,5% |
| 146,00 | 0,08 | 0,22 | 7,99 | 139,4% | 20,40 | 12,30 | 131,6 | 26,7 | 98,2% | 80,8% | 79,3% |
| 147,00 | 0,08 | 0,22 | 7,97 | 139,8% | 20,40 | 12,32 | 131,6 | 26,7 | 98,2% | 80,8% | 79,3% |
| 148,00 | 0,08 | 0,22 | 7,92 | 141,3% | 20,40 | 12,37 | 131,7 | 26,7 | 98,2% | 80,7% | 79,3% |
| 149,00 | 0,08 | 0,22 | 7,94 | 140,7% | 20,40 | 12,35 | 131,3 | 26,8 | 98,1% | 80,8% | 79,3% |
| 150,00 | 0,06 | 0,22 | 7,84 | 143,6% | 20,41 | 12,46 | 131,5 | 26,8 | 98,1% | 80,7% | 79,1% |
| 151,00 | 0,03 | 0,23 | 7,89 | 142,0% | 20,40 | 12,40 | 131,2 | 26,8 | 98,1% | 80,8% | 79,2% |
| 152,00 | 0,03 | 0,23 | 7,78 | 145,2% | 20,41 | 12,51 | 131,3 | 26,8 | 98,0% | 80,6% | 79,0% |
| 153,00 | 0,03 | 0,23 | 7,64 | 149,5% | 20,42 | 12,66 | 131,3 | 26,8 | 98,0% | 80,5% | 78,9% |
| 154,00 | 0,03 | 0,23 | 7,60 | 150,8% | 20,42 | 12,71 | 131,7 | 26,8 | 97,9% | 80,4% | 78,7% |
| 155,00 | 0,03 | 0,23 | 7,64 | 149,5% | 20,42 | 12,66 | 131,7 | 26,8 | 98,0% | 80,4% | 78,8% |
| 156,00 | 0,03 | 0,23 | 7,51 | 153,8% | 20,43 | 12,80 | 131,3 | 26,8 | 98,0% | 80,3% | 78,7% |
| 157,00 | 0,03 | 0,23 | 7,45 | 155,8% | 20,43 | 12,87 | 131,6 | 26,8 | 97,9% | 80,2% | #DIV/0! |
| 158,00 | 0,03 | 0,23 | 7,35 | 158,9% | 20,44 | 12,97 | 131,3 | 26,8 | 97,9% | 80,2% | 78,5% |
| 159,00 | 0,02 | 0,25 | 7,03 | 169,9% | 20,46 | 13,30 | 132,0 | 26,8 | 97,7% | 79,7% | 77,9% |
| 160,00 | 0,02 | 0,26 | 6,97 | 171,9% | 20,46 | 13,37 | 132,4 | 26,9 | 97,5% | 79,6% | #DIV/0! |
| 161,00 | 0,02 | 0,24 | 6,69 | 183,4% | 20,48 | 13,67 | 131,9 | 26,8 | 97,7% | 79,3% | 77,4% |
| 162,00 | 0,00 | 0,23 | 6,54 | 190,4% | 20,49 | 13,84 | 131,4 | 26,9 | 97,8% | 79,1% | 77,3% |

DATA 2022-07-25 EPA PI 20272 RUN 5 MODEL 8060 OTHER CATALIST
preburn

| Temps | Flue | Room | Tunnel | Catalyst up | scale | Right | Back | bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|
| acquisition | temp | temp | dry bulb | | | | | | | |
| minutes | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| 1 | 77,00 | 75,98 | 77,34 | 77,46 | 2,48 | 77,00 | 77,01 | 76,76 | 77,96 | 77,09 |
| 2 | 94,23 | 76,05 | 78,28 | 101,98 | 2,77 | 77,12 | 77,09 | 76,78 | 78,12 | 77,13 |
| 3 | 135,31 | 76,06 | 81,42 | 144,46 | 2,67 | 77,80 | 77,42 | 76,83 | 78,33 | 77,30 |
| 4 | 223,75 | 76,06 | 85,12 | 328,97 | 2,57 | 79,78 | 78,95 | 77,36 | 79,40 | 78,27 |
| 5 | 277,39 | 76,10 | 82,55 | 615,88 | 2,45 | 83,97 | 82,05 | 78,32 | 81,91 | 80,75 |
| 6 | 362,71 | 76,13 | 85,62 | 759,86 | 2,27 | 94,41 | 87,08 | 79,81 | 86,16 | 85,25 |
| 7 | 410,11 | 76,18 | 87,64 | 820,13 | 2,07 | 112,53 | 94,70 | 81,91 | 91,86 | 92,62 |
| 8 | 429,06 | 76,21 | 88,55 | 826,83 | 1,87 | 137,70 | 103,80 | 84,55 | 99,25 | 102,12 |
| 9 | 434,01 | 76,23 | 89,12 | 799,29 | 1,77 | 167,05 | 113,51 | 87,56 | 107,82 | 115,30 |
| 10 | 416,34 | 76,26 | 88,47 | 753,06 | 1,67 | 195,04 | 123,61 | 90,62 | 116,27 | 130,95 |
| 11 | 420,25 | 76,27 | 89,11 | 759,91 | 1,52 | 216,41 | 133,35 | 93,85 | 124,32 | 147,10 |
| 12 | 415,76 | 76,38 | 89,12 | 722,26 | 1,47 | 236,01 | 143,07 | 97,10 | 131,05 | 163,61 |
| 13 | 429,68 | 76,41 | 90,12 | 769,27 | 1,35 | 255,61 | 152,32 | 100,41 | 137,34 | 179,81 |
| 14 | 439,48 | 76,46 | 90,91 | 776,72 | 1,21 | 273,76 | 161,47 | 103,52 | 143,45 | 195,09 |
| 15 | 436,69 | 76,43 | 90,48 | 766,26 | 1,07 | 291,11 | 170,26 | 106,41 | 148,75 | 209,34 |
| 16 | 463,10 | 76,58 | 106,99 | 685,63 | 0,97 | 306,62 | 180,49 | 109,20 | 152,81 | 221,97 |
| 17 | 390,60 | 76,57 | 118,46 | 436,19 | 8,28 | 322,10 | 196,63 | 112,15 | 151,48 | 236,95 |
| 18 | 344,84 | 76,56 | 94,07 | 521,90 | 8,18 | 337,33 | 201,51 | 115,18 | 163,16 | 253,18 |
| 19 | 432,51 | 76,61 | 94,19 | 903,73 | 7,97 | 345,41 | 204,00 | 118,28 | 173,76 | 260,57 |
| 20 | 412,60 | 76,59 | 91,95 | 690,76 | 7,87 | 347,32 | 207,54 | 121,14 | 182,85 | 263,23 |
| 21 | 372,56 | 76,58 | 90,08 | 604,90 | 7,87 | 347,01 | 213,72 | 123,67 | 191,41 | 264,80 |
| 22 | 355,99 | 76,61 | 89,23 | 587,01 | 7,77 | 344,77 | 220,92 | 125,84 | 199,34 | 264,90 |
| 23 | 347,09 | 76,63 | 88,56 | 576,52 | 7,67 | 342,00 | 229,12 | 127,73 | 206,37 | 264,42 |
| 24 | 336,63 | 76,66 | 88,20 | 562,67 | 7,67 | 339,26 | 236,60 | 129,63 | 212,55 | 263,95 |
| 25 | 345,37 | 76,62 | 88,48 | 611,38 | 7,58 | 336,44 | 242,69 | 131,39 | 218,24 | 263,52 |
| 26 | 333,89 | 76,64 | 87,77 | 562,79 | 7,47 | 334,96 | 246,41 | 133,18 | 223,12 | 263,44 |
| 27 | 340,00 | 76,67 | 88,15 | 576,13 | 7,48 | 332,49 | 248,40 | 135,06 | 227,71 | 262,76 |
| 28 | 326,09 | 76,63 | 87,80 | 542,31 | 7,37 | 330,22 | 249,60 | 136,83 | 231,63 | 262,49 |
| 29 | 304,83 | 76,64 | 87,18 | 502,06 | 7,27 | 328,46 | 249,78 | 138,58 | 235,25 | 262,53 |
| 30 | 294,78 | 76,65 | 86,44 | 486,74 | 7,27 | 325,67 | 249,44 | 140,36 | 238,53 | 262,16 |
| 31 | 295,60 | 76,67 | 86,64 | 496,46 | 7,27 | 323,48 | 248,71 | 142,17 | 241,22 | 261,95 |
| 32 | 297,26 | 76,70 | 86,80 | 503,02 | 7,17 | 321,12 | 247,93 | 143,93 | 243,07 | 261,04 |
| 33 | 297,12 | 76,64 | 87,22 | 496,84 | 7,13 | 319,50 | 247,69 | 145,66 | 244,68 | 260,37 |
| 34 | 282,86 | 76,66 | 86,59 | 467,06 | 7,07 | 317,02 | 247,60 | 147,64 | 246,15 | 260,09 |
| 35 | 271,23 | 76,64 | 85,86 | 448,56 | 7,07 | 314,23 | 247,44 | 149,72 | 247,09 | 259,64 |
| 36 | 262,86 | 76,69 | 85,57 | 429,71 | 6,97 | 312,56 | 246,97 | 151,97 | 247,85 | 258,83 |
| 37 | 253,57 | 76,62 | 85,08 | 413,04 | 6,97 | 309,55 | 245,30 | 154,25 | 248,46 | 257,89 |
| 38 | 244,39 | 76,62 | 84,29 | 398,48 | 6,97 | 307,05 | 243,29 | 156,65 | 248,61 | 257,07 |
| 39 | 236,60 | 76,65 | 84,75 | 384,97 | 6,97 | 304,45 | 240,49 | 159,11 | 248,40 | 256,27 |
| 40 | 229,23 | 76,63 | 84,11 | 363,92 | 6,88 | 301,68 | 237,09 | 161,74 | 247,96 | 254,86 |
| 41 | 222,62 | 76,70 | 83,98 | 349,49 | 6,88 | 299,05 | 233,45 | 164,38 | 247,31 | 253,93 |
| 42 | 216,80 | 76,71 | 84,16 | 337,45 | 6,88 | 296,60 | 229,39 | 166,97 | 246,28 | 252,84 |
| 43 | 211,47 | 76,65 | 83,39 | 327,99 | 6,77 | 293,59 | 225,48 | 169,63 | 245,14 | 251,20 |
| 44 | 206,69 | 76,67 | 83,02 | 321,66 | 6,88 | 290,99 | 221,28 | 172,16 | 243,69 | 250,18 |
| 45 | 202,56 | 76,69 | 83,28 | 311,76 | 6,77 | 288,80 | 217,50 | 174,79 | 242,52 | 248,94 |
| 46 | 199,23 | 76,66 | 82,79 | 310,56 | 6,77 | 286,04 | 213,57 | 177,30 | 240,87 | 247,38 |
| 47 | 196,04 | 76,67 | 82,82 | 308,49 | 6,77 | 283,53 | 210,13 | 179,90 | 239,07 | 246,02 |
| 48 | 193,36 | 76,65 | 82,79 | 303,02 | 6,77 | 281,25 | 206,62 | 182,37 | 237,20 | 244,91 |
| 49 | 189,93 | 76,67 | 82,71 | 297,18 | 6,67 | 279,12 | 203,44 | 184,77 | 235,52 | 243,40 |
| 50 | 187,10 | 76,64 | 82,24 | 290,76 | 6,67 | 276,66 | 200,32 | 187,15 | 233,43 | 241,84 |
| 51 | 184,86 | 76,65 | 81,97 | 289,98 | 6,67 | 274,39 | 197,37 | 189,50 | 231,43 | 240,37 |
| 52 | 206,65 | 76,68 | 82,95 | 365,22 | 6,57 | 272,35 | 194,35 | 191,92 | 229,45 | 239,31 |
| 53 | 293,08 | 76,63 | 85,50 | 581,66 | 6,47 | 271,38 | 191,60 | 194,41 | 227,46 | 238,61 |
| 54 | 371,52 | 76,71 | 88,14 | 710,28 | 6,37 | 273,34 | 189,93 | 196,90 | 226,18 | 239,69 |
| 55 | 406,57 | 76,72 | 89,38 | 752,08 | 6,27 | 278,47 | 190,17 | 199,65 | 225,89 | 242,01 |
| 56 | 418,70 | 76,72 | 90,63 | 726,86 | 6,07 | 285,44 | 192,34 | 202,72 | 226,97 | 245,25 |
| 57 | 438,26 | 76,82 | 91,30 | 763,34 | 5,97 | 293,13 | 195,49 | 206,17 | 229,49 | 248,77 |
| 58 | 465,08 | 76,83 | 93,06 | 838,63 | 5,77 | 302,03 | 199,54 | 209,96 | 233,36 | 253,43 |
| 59 | 484,43 | 76,85 | 94,68 | 872,36 | 5,67 | 312,32 | 203,76 | 213,90 | 238,80 | 259,26 |
| 60 | 501,05 | 76,93 | 95,99 | 909,39 | 5,47 | 324,02 | 208,47 | 217,94 | 245,32 | 266,77 |
| 61 | 512,88 | 77,02 | 96,54 | 926,86 | 5,37 | 337,99 | 213,31 | 222,01 | 252,95 | 275,05 |
| 62 | 512,47 | 77,05 | 96,49 | 905,81 | 5,17 | 352,34 | 218,46 | 225,91 | 261,38 | 283,06 |
| 63 | 508,59 | 77,13 | 97,06 | 894,16 | 5,07 | 367,21 | 223,72 | 229,87 | 270,13 | 291,21 |
| 64 | 505,12 | 77,15 | 96,73 | 890,42 | 4,97 | 382,00 | 228,77 | 233,82 | 278,93 | 299,04 |
| 65 | 501,87 | 77,18 | 96,54 | 884,87 | 4,77 | 396,11 | 233,79 | 237,57 | 287,76 | 305,81 |
| 66 | 498,34 | 77,30 | 96,91 | 871,58 | 4,67 | 409,64 | 238,21 | 241,24 | 296,73 | 312,36 |
| 67 | 493,01 | 77,36 | 96,49 | 858,40 | 4,57 | 422,33 | 242,69 | 244,88 | 305,15 | 318,72 |
| 68 | 493,05 | 77,44 | 96,78 | 850,35 | 4,43 | 433,02 | 246,67 | 248,52 | 313,42 | 324,18 |
| 69 | 492,66 | 77,41 | 96,25 | 858,50 | 4,27 | 442,60 | 250,75 | 252,17 | 321,30 | 329,67 |
| 70 | 492,23 | 77,64 | 96,85 | 853,91 | 4,17 | 451,37 | 254,95 | 255,84 | 328,58 | 335,39 |
| 71 | 493,69 | 77,64 | 97,23 | 856,90 | 4,07 | 459,65 | 259,82 | 259,73 | 335,98 | 341,81 |
| 72 | 494,50 | 77,63 | 96,92 | 864,69 | 3,97 | 467,89 | 264,46 | 263,59 | 343,27 | 348,16 |
| 73 | 492,39 | 77,74 | 97,00 | 865,04 | 3,77 | 476,67 | 268,82 | 267,37 | 349,78 | 354,91 |
| 74 | 491,11 | 77,76 | 98,55 | 866,48 | 3,67 | 485,16 | 273,13 | 271,08 | 356,50 | 362,01 |
| 75 | 494,48 | 77,76 | 98,38 | 882,16 | 3,57 | 493,49 | 276,90 | 274,69 | 362,60 | 369,71 |
| 76 | 499,83 | 77,73 | 99,08 | 895,19 | 3,47 | 501,97 | 280,52 | 278,27 | 368,79 | 378,41 |
| 77 | 503,09 | 77,82 | 98,92 | 910,11 | 3,27 | 511,32 | 284,04 | 281,86 | 374,51 | 386,77 |
| 78 | 510,97 | 77,87 | 99,16 | 930,06 | 3,17 | 520,96 | 287,93 | 285,46 | 379,99 | 394,00 |
| 79 | 516,62 | 77,91 | 99,69 | 943,50 | 3,07 | 530,52 | 291,45 | 289,17 | 385,17 | 400,91 |
| 80 | 522,59 | 77,98 | 100,30 | 957,75 | 2,97 | 540,82 | 295,31 | 292,96 | 390,99 | 407,55 |
| 81 | 528,97 | 77,95 | 101,20 | 966,52 | 2,87 | 551,16 | 299,35 | 296,87 | 396,66 | 413,25 |
| 82 | 533,29 | 78,11 | 101,15 | 974,09 | 2,67 | 562,05 | 303,56 | 301,00 | 402,74 | 419,32 |
| 83 | 531,70 | 78,08 | 101,10 | 962,27 | 2,57 | 573,32 | 307,83 | 305,09 | 408,90 | 424,69 |
| 84 | 531,92 | 78,18 | 101,06 | 961,34 | 2,37 | 584,56 | 311,90 | 309,20 | 414,92 | 430,22 |
| 85 | 529,45 | 78,21 | 101,58 | 955,40 | 2,37 | 594,84 | 316,03 | 313,30 | 421,08 | 435,78 |
| 86 | 531,67 | 78,25 | 100,44 | 969,70 | 2,17 | 606,18 | 319,80 | 317,60 | 426,89 | 441,43 |
| 87 | 529,09 | 78,37 | 99,89 | 954,69 | 2,07 | 615,27 | 323,29 | 321,86 | 432,81 | 446,00 |
| 88 | 522,77 | 78,40 | 100,83 | 936,06 | 1,97 | 623,53 | 325,99 | 326,11 | 438,12 | 449,26 |
| 89 | 514,67 | 78,33 | 101,16 | 908,21 | 1,87 | 630,25 | 329,15 | 330,21 | 443,54 | 451,85 |
| 90 | 504,65 | 78,41 | 100,35 | 886,98 | 1,87 | 636,11 | 331,80 | 334,14 | 447,48 | 454,90 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 491,77 | 78,43 | 99,02 | 857,61 | 1,77 | 641,13 | 333,92 | 338,15 | 451,11 | 457,91 |
| 92 | 476,04 | 78,44 | 99,04 | 829,35 | 1,67 | 645,66 | 335,67 | 342,18 | 454,50 | 461,55 |
| 93 | 459,99 | 78,45 | 97,87 | 801,78 | 1,67 | 647,98 | 337,39 | 346,26 | 456,38 | 465,28 |
| 94 | 448,83 | 78,45 | 97,59 | 779,53 | 1,57 | 648,49 | 337,95 | 350,37 | 457,51 | 470,03 |
| 95 | 441,10 | 78,45 | 96,15 | 770,79 | 1,57 | 647,67 | 337,92 | 354,51 | 458,07 | 475,30 |
| 96 | 435,06 | 78,50 | 96,10 | 763,90 | 1,47 | 645,89 | 337,17 | 358,57 | 457,38 | 481,25 |
| 97 | 429,59 | 78,51 | 95,98 | 759,87 | 1,47 | 644,69 | 336,33 | 362,61 | 456,41 | 487,52 |
| 98 | 425,46 | 78,58 | 96,29 | 748,03 | 1,47 | 642,94 | 335,37 | 366,68 | 454,80 | 494,62 |
| 99 | 421,56 | 78,56 | 96,18 | 741,97 | 1,37 | 640,85 | 333,99 | 370,77 | 453,40 | 503,14 |
| 100 | 415,88 | 78,61 | 94,84 | 731,40 | 1,37 | 640,00 | 332,56 | 375,03 | 450,78 | 512,98 |
| 101 | 409,26 | 78,58 | 96,01 | 719,16 | 1,27 | 638,76 | 331,73 | 379,49 | 448,45 | 524,47 |
| 102 | 399,17 | 78,63 | 94,32 | 698,71 | 1,27 | 637,50 | 329,87 | 384,16 | 445,19 | 535,17 |
| 103 | 389,13 | 78,61 | 93,33 | 680,40 | 1,27 | 636,39 | 328,92 | 389,10 | 442,50 | 544,59 |
| 104 | 380,47 | 78,56 | 93,31 | 666,66 | 2,18 | 634,66 | 327,08 | 394,24 | 439,50 | 550,96 |
| 105 | 328,64 | 78,58 | 106,16 | 464,15 | 8,57 | 634,42 | 330,57 | 400,35 | 435,43 | 555,56 |
| 106 | 346,11 | 78,60 | 95,13 | 644,32 | 8,47 | 629,71 | 327,41 | 406,97 | 431,04 | 555,97 |
| 107 | 349,68 | 78,49 | 93,43 | 658,73 | 8,47 | 621,65 | 323,63 | 412,68 | 425,23 | 551,53 |
| 108 | 346,41 | 78,41 | 91,60 | 651,09 | 8,37 | 610,63 | 319,60 | 417,25 | 419,26 | 543,60 |
| 109 | 343,54 | 78,54 | 92,00 | 648,53 | 8,47 | 598,48 | 316,27 | 420,55 | 412,62 | 535,12 |
| 110 | 341,84 | 78,51 | 91,92 | 650,50 | 8,37 | 586,71 | 313,73 | 422,73 | 406,09 | 525,81 |
| 111 | 341,86 | 78,48 | 91,82 | 654,02 | 8,35 | 575,34 | 311,76 | 424,04 | 399,48 | 516,26 |
| 112 | 341,68 | 78,43 | 91,13 | 655,16 | 8,28 | 564,32 | 310,20 | 424,58 | 393,44 | 507,41 |
| 113 | 341,85 | 78,41 | 91,56 | 659,65 | 8,28 | 553,59 | 308,24 | 424,58 | 387,17 | 498,59 |
| 114 | 341,68 | 78,46 | 91,01 | 644,52 | 8,18 | 543,27 | 306,79 | 424,13 | 381,89 | 490,16 |
| 115 | 362,95 | 78,41 | 92,54 | 784,86 | 8,08 | 533,15 | 306,29 | 423,36 | 382,21 | 481,97 |
| 116 | 411,65 | 78,39 | 93,54 | 925,55 | 7,98 | 524,24 | 309,15 | 422,49 | 390,60 | 473,96 |
| 117 | 435,97 | 78,43 | 93,17 | 955,72 | 7,87 | 517,30 | 314,32 | 421,40 | 403,37 | 466,79 |
| 118 | 427,34 | 78,38 | 94,92 | 824,85 | 7,77 | 513,21 | 320,50 | 420,15 | 414,75 | 460,67 |
| 119 | 417,71 | 78,38 | 94,25 | 795,52 | 7,67 | 509,76 | 325,28 | 418,74 | 424,04 | 455,25 |
| 120 | 410,22 | 78,38 | 94,21 | 792,32 | 7,58 | 506,90 | 328,84 | 417,22 | 431,10 | 450,07 |
| 121 | 408,36 | 78,45 | 94,19 | 791,46 | 7,54 | 504,03 | 331,26 | 415,53 | 433,93 | 445,21 |
| 122 | 403,14 | 78,46 | 93,97 | 777,45 | 7,48 | 499,19 | 331,96 | 413,81 | 433,55 | 441,06 |
| 123 | 397,36 | 78,45 | 94,19 | 767,05 | 7,38 | 495,35 | 332,89 | 412,10 | 430,55 | 436,48 |
| 124 | 393,74 | 78,57 | 92,92 | 759,01 | 7,37 | 490,68 | 333,33 | 410,32 | 427,62 | 432,07 |
| 125 | 393,79 | 78,52 | 92,96 | 772,96 | 7,27 | 485,45 | 334,05 | 408,57 | 425,85 | 427,74 |
| 126 | 397,77 | 78,54 | 92,89 | 792,94 | 7,17 | 481,28 | 335,90 | 406,94 | 427,37 | 423,55 |
| 127 | 405,20 | 78,54 | 94,03 | 810,28 | 7,07 | 477,27 | 338,19 | 405,23 | 431,30 | 419,68 |
| 128 | 416,05 | 78,52 | 94,46 | 843,20 | 6,97 | 473,83 | 340,84 | 403,61 | 437,42 | 416,16 |
| 129 | 432,88 | 78,62 | 94,21 | 886,94 | 6,88 | 470,19 | 344,12 | 402,02 | 446,06 | 412,62 |
| 130 | 451,32 | 78,61 | 95,22 | 975,98 | 6,78 | 467,90 | 349,38 | 400,54 | 457,32 | 410,01 |
| 131 | 459,65 | 78,69 | 96,30 | 992,22 | 6,57 | 466,07 | 355,39 | 399,08 | 468,18 | 407,78 |
| 132 | 466,89 | 78,68 | 96,23 | 992,06 | 6,47 | 466,35 | 362,20 | 397,70 | 479,93 | 406,28 |
| 133 | 469,80 | 78,72 | 95,81 | 973,90 | 6,37 | 467,87 | 369,39 | 396,33 | 491,29 | 405,44 |
| 134 | 470,91 | 78,69 | 96,63 | 953,07 | 6,18 | 469,37 | 376,19 | 395,03 | 501,79 | 405,14 |
| 135 | 468,55 | 78,83 | 95,69 | 932,45 | 6,08 | 471,97 | 382,12 | 393,80 | 511,45 | 405,06 |
| 136 | 463,42 | 78,82 | 97,06 | 915,38 | 5,97 | 474,89 | 388,25 | 392,61 | 520,37 | 405,42 |
| 137 | 459,22 | 78,77 | 95,94 | 906,17 | 5,87 | 478,37 | 393,63 | 391,43 | 528,26 | 406,15 |
| 138 | 455,40 | 78,85 | 96,05 | 899,24 | 5,77 | 480,68 | 397,63 | 390,21 | 534,07 | 406,96 |
| 139 | 450,69 | 78,86 | 96,53 | 887,21 | 5,67 | 482,06 | 400,97 | 388,97 | 538,34 | 407,72 |
| 140 | 446,80 | 78,91 | 96,27 | 882,36 | 5,57 | 484,46 | 404,27 | 387,73 | 541,84 | 408,50 |
| 141 | 449,61 | 78,95 | 94,97 | 904,41 | 5,57 | 485,90 | 406,51 | 386,49 | 547,09 | 409,53 |
| 142 | 454,24 | 79,03 | 94,73 | 918,49 | 5,48 | 487,51 | 409,17 | 385,35 | 553,74 | 410,73 |
| 143 | 456,72 | 79,07 | 95,72 | 938,55 | 5,30 | 489,53 | 411,78 | 384,23 | 560,46 | 412,11 |
| 144 | 460,11 | 79,23 | 96,47 | 962,41 | 5,17 | 491,49 | 415,19 | 383,19 | 565,70 | 413,31 |
| 145 | 463,45 | 79,15 | 96,82 | 971,58 | 5,07 | 493,27 | 418,97 | 382,23 | 569,91 | 415,08 |
| 146 | 464,51 | 79,09 | 97,75 | 975,45 | 4,97 | 493,75 | 422,27 | 381,27 | 573,95 | 416,45 |
| 147 | 467,28 | 79,21 | 96,51 | 992,86 | 4,87 | 495,31 | 424,93 | 380,34 | 579,18 | 418,42 |
| 148 | 469,13 | 79,18 | 96,49 | 1011,02 | 4,78 | 496,30 | 427,86 | 379,44 | 584,29 | 420,63 |
| 149 | 470,31 | 79,22 | 95,71 | 988,47 | 4,67 | 497,12 | 430,20 | 378,58 | 588,63 | 423,31 |
| 150 | 468,33 | 79,31 | 95,70 | 971,85 | 4,57 | 498,20 | 431,52 | 377,75 | 592,70 | 426,16 |
| 151 | 463,18 | 79,19 | 95,52 | 964,08 | 4,47 | 498,57 | 432,89 | 376,83 | 596,39 | 428,46 |
| 152 | 458,96 | 79,24 | 96,79 | 955,38 | 4,37 | 500,44 | 434,58 | 376,06 | 599,73 | 431,08 |
| 153 | 457,51 | 79,30 | 94,98 | 959,03 | 4,27 | 502,24 | 436,00 | 375,29 | 602,15 | 433,80 |
| 154 | 456,93 | 79,43 | 96,04 | 967,22 | 4,17 | 503,79 | 437,64 | 374,64 | 604,61 | 435,97 |
| 155 | 457,43 | 79,37 | 96,91 | 965,72 | 4,08 | 504,98 | 438,14 | 373,96 | 607,82 | 438,71 |
| 156 | 457,97 | 79,45 | 95,97 | 968,92 | 3,97 | 507,07 | 439,80 | 373,34 | 611,02 | 441,40 |
| 157 | 458,66 | 79,49 | 95,57 | 971,93 | 3,97 | 508,63 | 441,12 | 372,76 | 613,82 | 443,58 |
| 158 | 458,52 | 79,40 | 97,07 | 975,98 | 3,84 | 510,47 | 442,32 | 372,09 | 616,02 | 445,92 |
| 159 | 458,80 | 79,43 | 95,66 | 974,34 | 3,67 | 512,67 | 443,42 | 371,57 | 619,28 | 448,31 |
| 160 | 457,95 | 79,51 | 96,75 | 962,83 | 3,65 | 515,21 | 444,68 | 371,04 | 621,95 | 450,98 |
| 161 | 455,94 | 79,46 | 95,85 | 957,17 | 3,57 | 517,64 | 445,50 | 370,53 | 623,60 | 453,56 |
| 162 | 453,05 | 79,48 | 96,54 | 953,37 | 3,47 | 520,43 | 446,15 | 370,00 | 625,48 | 455,72 |
| 163 | 451,30 | 79,45 | 96,44 | 953,49 | 3,38 | 523,92 | 447,66 | 369,58 | 627,22 | 458,21 |
| 164 | 450,33 | 79,50 | 94,40 | 946,10 | 3,27 | 526,75 | 448,17 | 369,14 | 629,17 | 460,96 |
| 165 | 448,27 | 79,55 | 94,53 | 936,30 | 3,17 | 529,29 | 448,03 | 368,65 | 629,91 | 463,28 |
| 166 | 445,21 | 79,52 | 95,65 | 925,62 | 3,17 | 531,66 | 449,29 | 368,28 | 629,17 | 465,67 |
| 167 | 442,63 | 79,66 | 96,62 | 923,03 | 3,07 | 536,17 | 449,28 | 367,92 | 628,87 | 468,16 |
| 168 | 441,53 | 79,64 | 96,52 | 929,96 | 2,97 | 539,46 | 450,30 | 367,66 | 628,58 | 470,87 |
| 169 | 441,04 | 79,72 | 96,54 | 938,66 | 2,87 | 541,98 | 450,39 | 367,39 | 628,44 | 474,06 |
| 170 | 440,01 | 79,70 | 95,80 | 935,43 | 2,77 | 545,96 | 450,70 | 367,19 | 627,91 | 476,99 |
| 171 | 437,41 | 79,69 | 96,85 | 920,17 | 2,77 | 549,73 | 450,15 | 367,02 | 626,60 | 480,02 |
| 172 | 434,41 | 79,60 | 96,97 | 908,16 | 2,68 | 553,27 | 449,67 | 366,83 | 623,27 | 483,13 |
| 173 | 430,14 | 79,65 | 95,28 | 893,37 | 2,64 | 557,58 | 448,75 | 366,76 | 618,87 | 486,58 |
| 174 | 426,33 | 79,71 | 95,93 | 901,55 | 2,57 | 561,92 | 447,17 | 366,67 | 614,92 | 489,61 |
| 175 | 426,54 | 79,75 | 95,19 | 916,00 | 2,47 | 566,29 | 444,96 | 366,66 | 614,16 | 492,72 |
| 176 | 425,97 | 79,81 | 96,31 | 910,42 | 2,47 | 571,03 | 441,96 | 366,61 | 612,11 | 495,60 |
| 177 | 421,99 | 79,81 | 95,03 | 886,86 | 2,38 | 574,55 | 438,06 | 366,64 | 607,75 | 498,71 |
| 178 | 417,95 | 79,78 | 94,42 | 875,56 | 2,37 | 577,60 | 433,87 | 366,65 | 603,57 | 501,66 |
| 179 | 414,57 | 79,83 | 94,58 | 864,19 | 2,32 | 581,26 | 429,78 | 366,75 | 599,04 | 504,46 |
| 180 | 409,98 | 79,86 | 93,98 | 853,16 | 2,27 | 584,88 | 425,86 | 366,90 | 593,62 | 506,46 |
| 181 | 406,42 | 79,88 | 94,74 | 833,71 | 2,27 | 590,38 | 422,00 | 367,15 | 587,11 | 509,36 |
| 182 | 403,20 | 79,81 | 93,21 | 824,29 | 2,17 | 595,99 | 417,91 | 367,41 | 578,45 | 511,96 |
| 183 | 400,73 | 79,96 | 92,88 | 817,42 | 2,17 | 600,28 | 414,10 | 367,76 | 569,56 | 514,36 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 184 | 398,06 | 79,87 | 94,48 | 810,53 | 2,17 | 603,47 | 410,55 | 368,12 | 560,86 | 516,60 |
| 185 | 395,96 | 79,87 | 93,70 | 805,56 | 2,17 | 606,23 | 406,69 | 368,54 | 552,74 | 519,61 |
| 186 | 393,35 | 79,91 | 93,39 | 798,78 | 2,07 | 607,00 | 402,81 | 369,01 | 543,85 | 521,65 |
| 187 | 390,19 | 79,87 | 92,69 | 793,49 | 2,07 | 608,76 | 398,76 | 369,50 | 535,88 | 524,17 |
| 188 | 387,81 | 79,89 | 92,29 | 786,97 | 2,07 | 609,22 | 395,43 | 370,08 | 528,48 | 526,49 |
| 189 | 385,02 | 79,90 | 92,67 | 780,60 | 2,07 | 610,62 | 392,60 | 370,68 | 521,35 | 528,32 |
| 190 | 383,23 | 79,79 | 93,14 | 772,92 | 1,97 | 611,52 | 388,26 | 371,38 | 514,78 | 530,62 |
| 191 | 381,17 | 79,75 | 92,55 | 769,03 | 1,97 | 612,78 | 386,08 | 372,10 | 508,66 | 532,42 |
| 192 | 379,48 | 79,79 | 92,54 | 764,27 | 1,97 | 613,74 | 383,03 | 372,91 | 503,24 | 534,80 |
| 193 | 377,14 | 79,78 | 91,91 | 762,23 | 1,97 | 614,73 | 380,65 | 373,82 | 497,82 | 537,17 |
| 194 | 376,06 | 79,78 | 92,48 | 761,75 | 1,95 | 615,45 | 377,53 | 374,70 | 492,44 | 539,21 |
| 195 | 376,38 | 79,74 | 91,85 | 763,46 | 1,95 | 616,63 | 374,54 | 375,53 | 487,30 | 542,38 |
| 196 | 375,73 | 79,82 | 92,13 | 763,84 | 1,87 | 618,31 | 372,17 | 376,47 | 482,43 | 546,01 |
| 197 | 375,05 | 79,80 | 91,11 | 761,73 | 1,87 | 619,05 | 369,56 | 377,42 | 477,72 | 550,65 |
| 198 | 374,21 | 79,79 | 91,57 | 758,83 | 1,87 | 619,54 | 366,56 | 378,37 | 472,65 | 555,49 |
| 199 | 372,73 | 79,75 | 91,21 | 756,92 | 1,77 | 620,54 | 364,93 | 379,43 | 468,34 | 560,92 |
| 200 | 372,35 | 79,73 | 91,90 | 754,58 | 1,85 | 621,09 | 361,90 | 380,36 | 463,70 | 566,40 |
| 201 | 370,80 | 79,67 | 92,23 | 752,15 | 1,77 | 621,10 | 359,71 | 381,32 | 459,38 | 571,40 |
| 202 | 370,76 | 79,79 | 92,68 | 751,41 | 1,77 | 621,65 | 356,77 | 382,29 | 455,30 | 576,64 |
| 203 | 370,52 | 79,80 | 92,30 | 749,63 | 1,77 | 621,20 | 354,56 | 383,25 | 451,28 | 581,26 |
| 204 | 369,62 | 79,83 | 91,97 | 746,86 | 1,77 | 621,18 | 351,94 | 384,20 | 447,62 | 584,89 |
| 205 | 369,68 | 79,71 | 91,97 | 744,72 | 1,77 | 620,65 | 350,40 | 385,16 | 444,08 | 588,96 |
| 206 | 367,82 | 79,76 | 91,39 | 742,14 | 1,67 | 620,43 | 347,84 | 386,12 | 440,45 | 592,45 |
| 207 | 367,59 | 79,78 | 92,42 | 741,66 | 1,67 | 620,38 | 345,07 | 387,08 | 436,83 | 595,99 |
| 208 | 367,73 | 79,73 | 91,94 | 742,95 | 1,57 | 621,95 | 342,50 | 387,97 | 433,30 | 599,86 |
| 209 | 366,76 | 79,80 | 92,31 | 744,46 | 1,67 | 619,93 | 339,69 | 388,88 | 429,78 | 601,98 |
| 210 | 367,53 | 79,67 | 91,59 | 744,35 | 1,57 | 618,20 | 336,83 | 389,63 | 426,70 | 604,36 |
| 211 | 367,37 | 79,79 | 90,91 | 744,37 | 1,67 | 618,29 | 333,86 | 390,41 | 423,34 | 605,32 |
| 212 | 415,79 | 79,85 | 99,28 | 659,78 | 1,57 | 616,57 | 333,87 | 391,13 | 418,81 | 606,91 |
| 213 | 356,31 | 79,81 | 91,82 | 645,32 | 1,57 | 616,37 | 331,86 | 392,06 | 414,72 | 607,64 |

POLYTESTS
TESTING THROUGH YOUR REALITY

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 6 Tech: MM Reviewer: DP

- kindling 2.96 Bs START FIRE
- ~~At~~ by pass Open and Door open
- At 2.7LBs close Door
- At 1,2LBS insert preload
- close Door immediatly
- At 1,2 LBS insert second preload
- close Door immediatly
- At 4,7LBs close air inlet and by pass
- At 1,7LBs Rack coal Bed
- After 2 min insert load and open air inlet
- At 5 min close air inlet

TEST LOAD CONFIGURATION

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE / POST CHECKS

Date: 2022-07-26 Manufacturer: Heathstone Model: 8060

Project #: PI 20272 Run: 6 Tech: MM Reviewer: DP

| Moisture Meter Calibration Check: | Equipment # | Time | 12% | 22% |
|---|---|---|---|---|
| | EM-334 | 7:00 | ok | ok |

| | Pre-Test | Post-Test |
|---|---|---|
| **Facility Conditions:** | | |
| Air Velocity from less than 2 feet | 0 (max50 Fpm) | 0 (max50 Fpm) |
| Smoke Capture Check (tunnel velocity) | ok | NA |
| Picture | 4 sides ok | ok |
| **Wood Heater Conditions:** | | |
| Date Wood Heater Stack Cleaned | 2022-07-25 | |
| Date Dilution Tunnel Cleaned | 2022-07-25 | |
| Induced Draft Check (max 0.005 H2O) | ok | |
| Traverse before ignition | ok | |
| **Temperature System:** | | |
| Ambient (65°-90°F) | ok °F | |
| **Proportional Checks:** | | |
| Thermocouple check | ok | |
| Pitot Clean | ok | |
| Pitot verification | ok | |
| Pictures for report | Side: ok<br>Coal bed: ok<br>Load: ok<br>Load in stove: ok<br>Fuel adjustment: ok | |
| Load Length approximately 5/6 of firebox Lenght | ok | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 6 6mm Tech: MM Reviewer: SP

## Leakage Checks Tunnel Samplers

| | System 1st hour | | System 1 | | System 2 | |
|---|---|---|---|---|---|---|
| Unplugged Flow Rate = .25cfm | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) | Pre-Test ASTM (-15) CSA B415 (-5) | Post-Test ASTM (-15) CSA B415 (-5) |
| Vacuum (inches Hg.) | -10 | -10 | -10 | -10 | -10 | -10 |
| Final 1minute DGM (Liter) | 660 303,40 | 661 207,60 | 660 303,48 | 661 207,67 | 408 628,18 | 409 522,80 |
| Initial 1minute DGM (Liter) | 660 303,36 | 661 207,60 | 660 303,48 | 661 207,65 | 408 628,18 | 409 522,80 |
| Change (Liter) | 0,04 | 0 | 0 | 0,02 | 0 | 0,05 |
| Allowable leakage .04 x Sample rate or 0.28Lpm CSA B415 (0.56) | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Check OK | ok | ok | ok | ok | ok | ok |

POLYTESTS
TESTING THROUGH YOUR REALITY

# PRE-TEST SCALE AUDIT

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 6 Tech: MM Reviewer: DP

## 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 | .5 | 3 | .5 |
| Check OK (no change after 15 sec.) | ok | ok | ok | ok |

## Scales checks

| Scale Type | Audit | | Measured Weight |
|---|---|---|---|
| | Equipment # | Weight | |
| Platform | EM-090 | 44 lbs, Class F | 44 lbs |
| Platform | EM-205 | 10.00 ~~lbs~~ kg mm, Class F | 10.00 ~~lbs~~ Kg mm |
| Wood | ~~EM-335~~ EM-090 mm | 440 lbs, Class F | 440 lbs |
| Analytical | EM-335 | 100 mg, Class S | 100 mg |
| Analytical | EM-129 | 200 g, Class S | 200 g |

## LIMITS OF WEIGHT RANGES

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

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: PT 28272 Run: 6 Tech: MM Reviewer: DP

FOR TUNNELS < 12 in

Barometric pressure ($P_{bar}$) 1008 (KPa.) Static pressure ($P_q$) 0.18 (inches w.c.)
Inside diameter: Port A _____ Port B ____.
Tunnel cross sectional area: .1963$Ft^2$
Pitot tube type: Standard

| Traverse Point | Position (inches) | | | Velocity Head $\Delta_p$ (inches $H_2O$) | Tunnel Temperature (°F) |
|---|---|---|---|---|---|
| | 6 po | 7 po | 8 po | | |
| A- Centroid | 3.00 | 3.50 | 4 | 0.075 | 72.91 |
| B - Centroid | 3.00 | 3.50 | 4 | 0.074 | 73.41 |
| A-1 | 0.40 | 0.50 | 0.50 | 0.061 | 72.91 |
| A-2 | 1.50 | 1.75 | 2 | 0.073 | 73.09 |
| A-3 | 4.50 | 5.25 | 6 | 0.063 | 73.09 |
| A-4 | 5.60 | 6.5 | 7.5 | 0.061 | 73.18 |
| B-1 | 0.40 | 0.50 | 0.50 | 0.060 | 73.41 |
| B-2 | 1.50 | 1.75 | 2 | 0.064 | 73.56 |
| B-3 | 4.50 | 5.25 | 6 | 0.078 | 73.56 |
| B-4 | 5.60 | 6.5 | 7.5 | 0.062 | 73.71 |
| | | | | 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.
$\Delta_p$ = 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 ($\Delta_p$) measured at each traverse point.

POLYTESTS
TESTING THROUGH YOUR REALITY

# CONTINUOUS ANALYZERS

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 6 Tech: M M Reviewer: DP

Pre-Test (Adjust and Record)

| | ZERO | | SPAN | | CAL. (Record Only) | |
|---|---|---|---|---|---|---|
| CO | 0 | 0 | 3 009 | 3 000 | 1 023 | 1 000 |
| Tolerance CO | 0 | +/- 0.02 | 0 009 | +/- 0.15 | 0 023 | +/- 0.05 |
| $CO_2$ | 0 | 0 | 17 96 | 18 00 | 9 82 | 10,00 |
| Tolerance CO2 | 0 | +/- 0.02 | 0,4 | +/- 0.5 | 0 18 | +/- 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 | 3001 | 1009 | 0 | 0.02 | 0,008 | 0.15 | 0014 | 0.05 | ✓ | |
| $CO_2$ | 0 | 1792 | 986 | 0 | 0.02 | 0,04 | 0.5 | 0,04 | 0.5 | ✓ | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# TEST DATA LOG

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: pt 20272 Run: 6 Tech: MR Reviewer: DP

## RAW DRY GAS METER READINGS

| | System 1 | System 2 | Blanck |
|---|---|---|---|
| Final (Liter) | 661201,60 | 409525,38 | 393675,86 |
| Initial (Liter) | 660303,76 | 408627,65 | 392986,72 |

## AMBIENT CONDITIONS

| | Before | After |
|---|---|---|
| Barometer (kPa): | 100,8 | 100,9 |
| Dry Bulb (F): | 74,9 | 81,6 |
| Humidity (%): | 55,4 | 40,3 |

## Flow Meter

| | Start | End |
|---|---|---|
| Flow meter reading | N.A | N.A |

## Flow Meter Verification

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

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 6 Tech: MM Reviewer: SD

## FUEL DESCRIPTION:

Type of wood:

## PRE-TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 14 in. | 1 70 lbs. | 206 | 203 | 204 | 203 | 206 |
| 1 1/2 x 3 1/2 x 14 in. | 1 26 lbs. | 211 | 210 | 210 | 211 | 212 |
| 1 1/2 x 3 1/2 x 14 in. | 1 68 lbs. | 211 | 211 | 211 | 212 | 212 |
| 1 1/2 x 3 1/2 x 7 in. | 0 66 lbs. | 199 | 205 | 200 | 201 | 202 |
| 1 1/2 x 3 1/2 x 7 in. | 0 66 lbs. | 191 | 191 | 192 | 193 | 192 |
| 1 1/2 x 3 1/2 x 7 in. | 0 62 lbs. | 196 | 196 | 194 | 193 | 193 |
| 1 1/2 x 3 1/2 x 7 in. | 0 64 lbs. | 200 | 204 | 206 | 208 | 209 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3 1/2 x 14 in. | 1 44 lbs. | 203 | 204 | 208 | 203 | 206 |
| 1 1/2 x 3 1/2 x 14 in. | 1 74 lbs. | 204 | 208 | 206 | 208 | 207 |
| 1 1/2 x 3 1/2 x 14 in. | 1 68 lbs. | 201 | 201 | 202 | 203 | 204 |
| 1 1/2 x 3 1/2 x 7 in. | 0 66 lbs. | 191 | 192 | 191 | 191 | 192 |
| 1 1/2 x 3 1/2 x 7 in. | 0 62 lbs. | 200 | 201 | 203 | 204 | 206 |
| 1 1/2 x 3 1/2 x 7 in. | 0 62 lbs. | 201 | 205 | 201 | 202 | 203 |
| 1 1/2 x 3 1/2 x 7 in. | 0 60 lbs. | 206 | 205 | 204 | 203 | 203 |
| 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:** 736 + 720 lbs

POLYTESTS
TESTING THROUGH YOUR REALITY

# FUEL DATA

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: pt 20272 Run: 6 Tech: MM Reviewer: DP

## FUEL DESCRIPTION:

Type of wood :

## TEST LOAD

| Piece Size | Weight | Meter Moisture Content (% dry)* | | | | |
|---|---|---|---|---|---|---|
| 1 1/2 x 3 1/2 x 15 in. | 1320 lbs. | 204 | 206 | 206 | 208 | 209 |
| 1 1/2 x 3 1/2 x 15 in. | 1340 lbs. | 199 | 200 | 201 | 200 | 200 |
| 1 1/2 x 3 1/2 x 15 in. | 1600 lbs. | 203 | 202 | 201 | 204 | 206 |
| 1 1/2 x 3 1/2 x 15 in. | 1600 lbs. | 199 | 196 | 198 | 197 | 198 |
| x x in. | lbs. | | | | | |
| 1 1/2 x 3/4 x 4 in. | 0082 lbs. | | | 206 | | |
| 1 1/2 x 3/4 x 4 in. | ~~0080~~ 0082 lbs. | | | 203 | | |
| 1 1/2 x 3/4 x 4 in. | 0104 lbs. | | | 204 | | |
| 1 1/2 x 3/4 x 4 in. | 0100 lbs. | | | 206 | | |
| 1 1/2 x 3/4 x 4 in. | 0104 lbs. | | | 208 | | |
| 1 1/2 x 3/4 x 4 in. | 0106 lbs. | | | 204 | | |
| 1 1/2 x 3/4 x 4 in. | 0060 lbs. | | | 205 | | |
| 1 1/2 x 3/4 x 4 in. | 0088 lbs. | | | 205 | | |
| 1 1/2 x 3/4 x 4 in. | 0088 lbs. | | | 204 | | |
| 1 1/2 x 3/4 x 4 in. | 0108 lbs. | | | 203 | | |
| 1 1/2 x 3/4 x 4 in. | 0080 lbs. | | | 204 | | |
| 1 1/2 x 3/4 x 4 in. | 0080 lbs. | | | 206 | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |
| x x in. | lbs. | | | | | |

**TEST LOAD WEIGHT**: 6 94 lbs Min 20%: 138 Max 25%: 173

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-07-25 Manufacturer: Hearthstone Model: 8060

Project #: PT 20272 Run: 6 Tech: MM Reviewer: DP

| | | 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 | 15 | 616 | 617 | 3 | 17 | 618 | 619 | 23 | 622 |
| 2022-07-25 | 17:00 | 108,7800 | | 0,2613 | 34,3301 | 108,9419 | | 0,2610 | 33,4490 | 0,1314 |
| 2022-07-26 | 9:00 | 108,7801 | | 0,2613 | 34,3300 | 108,9418 | | 0,2611 | 33,4489 | 0,1315 |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | | 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 | 15 | 616 | 617 | 3 | 17 | 618 | 619 | 23 | 622 |
| 2022-07-26 | 16:00 | 108,7806 | | 0,2616 mm ~~0,2615~~ | 34,3318 | 108,9423 | | 0,2610 | 334514 | 0,1318 |
| 2022-07-28 | 8:00 | 108,7802 | | 0,2616 | 34,3305 | 108,9419 | | 0,2610 | 33,4495 | 0,1316 |
| 2022-08-01 | 8:00 | 108,7802 | | 0,2615 | 34,3305 | 108,9419 | | 0,2611 | 33,4494 | 0,1316 |
| | | | | | | | | | | |
| | | | | | | | | | | |

POLYTESTS
TESTING THROUGH YOUR REALITY

# DILUTION TUNNEL PARTICULATE SAMPLER DATA

Date: 2022-07-26 Manufacturer: Hearthstone Model: 8060

Project #: PI 20272 Run: 6 Tech: MP Reviewer: DP

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Pre-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 32 | 620 | 621 | 39 |
| 2022-07-25 | 17:00 | 110,1781 | | 0,2624 | 35,3434 |
| 2022-07-26 | 9:00 | 110,1780 | | 0,2625 | 35,3435 |
| | | | | | |
| | | | | | |

| | | SYSTEM 2 | | | |
|---|---|---|---|---|---|
| Post-test Weight Record | | Probe & Housing Number | Front Filter Number | Back Filter Number | gaskets |
| Date | Time | 32 | 620 | 621 | 39 |
| 2022-07-26 | 16:00 | 110,1782 | | 0,2623 | 35,3454 |
| 2022-07-28 | 8:00 | 110,1781 | | 0,2624 | 35,3446 |
| 2022-08-01 | 8:00 | 110,1781 | | 0,2625 | 35,3447 |
| | | | | | |
| | | | | | |

# Paramètres

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

| | |
|---|---|
| Code verrouillage: | HEA |

## Description du test

| | | |
|---|---|---|
| Test standard | EPA | |
| Run # | 6 | |
| Date | 26-07-2022 | |
| Technicien | M.M | |
| Project # | PI 20272 | |

## Description de l'unité

| | | |
|---|---|---|
| Manufacturier | HEARTHSTONE | |
| Modèle | 8060 | |
| Combustion system | Cat | |
| Appliance type | WOOD STOVE | |
| Firebox volume | 1 | 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 | 1 | |
| 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): | 1,003 | Dimensionless |
| Equipment number (DGM #1): | EM 178 | |
| Calibration Factor (DGM #2): | 1,014 | Dimensionless |
| Equipment number (DGM #2): | EM 318 | |
| Calibration Factor (DGM #3): | 0,997 | |
| Equipment number (DGM #3): | EM 179 | Dimensionless |

## Tunnel

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 26-07-2022 |
| **Technicien** | M.M |

## Fuel data

| | | |
|---|---|---|
| Fuel type | Dimension | |
| Fuel specie | D. Fir | |
| HHV | 19810,0 | kJ/kg |
| %C | 48,7 | |
| %H | 6,9 | |
| %O | 43,9 | |
| %Ash | 0,5 | |
| HHV | 8519,2 | Btu/lb |
| LHV | 7451,0 | Btu/lb |

**Default Fuel Values**

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

| | Start | End |
|---|---|---|
| Barometer (kPa): | 100,8 | 100,9 |
| Barometer (in.Hg): | 29,766229 | 29,79575878 |
| Dry Bulb (F): | 74,9 | 81,6 |
| Humidity (%): | 55,4 | 40,3 |
| Air velocity (ft/min) | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DGM #1 | Final: | 23350,115 | cuft | Final: | 661201,600 | Liter |
| | Initial: | 23318,408 | cuft | Initial: | 660303,760 | Liter |
| | | | | | | |
| DGM #2 | Final: | 14462,253 | cuft | Final: | 409525,380 | Liter |
| | Initial: | 14430,550 | cuft | Initial: | 408627,650 | Liter |
| | | | | | | |
| DGM room | Final: | 13902,532 | cuft | Final: | 393675,860 | Liter |
| | Initial: | 13878,195 | cuft | Initial: | 392986,720 | Liter |

Numéro de la ligne dans "Raw data" à partir duquel les données du VRAI test commencent: 243

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

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 26-07-2022 |
| **Technicien** | M.M |

## Preload data sheet

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,30 | 7,00 | 7,70 |

Load Volume: 0,4253 cu. ft

Loading Density: 14,580 lbs./ft3

Number of Spaces:

Spacer weight (lbs):

Load Density (wet): 34,278 lbs./ft3

Dry Wood Density: 28,472762

| Piece Size (in): Thick | Wide | x Length | Weight lbs | Meter Moisture Content Dry Uncorrected % | | | | | Ave. MC x Weight | Volume Cubic Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,5 | 3,5 | 14 | 1,7 | 20,6 | 20,3 | 20,4 | 20,3 | 20,6 | 34,748 | 73,50 |
| 1,5 | 3,5 | 14 | 1,26 | 21,1 | 21 | 21 | 21,1 | 21,2 | 26,5608 | 73,50 |
| 1,5 | 3,5 | 14 | 1,68 | 21,1 | 21,1 | 21,1 | 21,2 | 21,2 | 35,5152 | 73,50 |
| 1,5 | 3,5 | 7 | 0,66 | 19,9 | 20 | 20 | 20,1 | 20,2 | 13,2264 | 36,75 |
| 1,5 | 3,5 | 7 | 0,66 | 19,1 | 19,1 | 19,2 | 19,3 | 19,2 | 12,6588 | 36,75 |
| 1,5 | 3,5 | 7 | 0,62 | 19,6 | 19,6 | 19,4 | 19,3 | 19,3 | 12,0528 | 36,75 |
| 1,5 | 3,5 | 7 | 0,64 | 20 | 20,4 | 20,6 | 20,8 | 20,9 | 13,1456 | 36,75 |
| | | | | | | | | | | 0,00 |
| 1,5 | 3,5 | 14 | 1,44 | 20,3 | 20,4 | 20,8 | 20,3 | 20,6 | 29,4912 | 73,50 |
| 1,5 | 3,5 | 14 | 1,74 | 20,4 | 20,8 | 20,6 | 20,8 | 20,7 | 35,9484 | 73,50 |
| 1,5 | 3,5 | 14 | 1,68 | 20,1 | 20,1 | 20,2 | 20,3 | 20,4 | 33,9696 | 73,50 |
| 1,5 | 3,5 | 7 | 0,66 | 19,1 | 19,2 | 19,1 | 19,1 | 19,2 | 12,6324 | 36,75 |
| 1,5 | 3,5 | 7 | 0,62 | 20 | 20,1 | 20,3 | 20,4 | 20,6 | 12,5736 | 36,75 |
| 1,5 | 3,5 | 7 | 0,62 | 20,1 | 20 | 20,1 | 20,2 | 20,3 | 12,4868 | 36,75 |
| 1,5 | 3,5 | 7 | 0,6 | 20,6 | 20,5 | 20,4 | 20,3 | 20,3 | 12,252 | 36,75 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00 |
| | | | | | | | | | | 0,00

## FUEL LOAD DATA SHEET, CSA B415

Test Load Weight:

| Lower | Ideal | Upper |
|---|---|---|
| 6,3 | 7,0 | 7,7 |

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

Load Volume: 0,18 cu. ft

Loading Density: 6,9 lbs./ft3

Number of Spaces: 12

Spacer weight: lbs

Load Density (wet): 32,1 lbs./ft3

Dry Wood Density: 26,7 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 | 15 | 1,32 | 20,40 | 20,60 | 20,60 | 20,80 | 20,90 | 27,2712 | 78,75 | 20,7 |
| 1,5 | 3,5 | 15 | 1,34 | 19,90 | 20,00 | 20,10 | 20,00 | 20,00 | 26,8 | 78,75 | 20,0 |
| 1,5 | 3,5 | 15 | 1,60 | 20,30 | 20,20 | 20,10 | 20,40 | 20,60 | 32,512 | 78,75 | 20,3 |
| 1,5 | 3,5 | 15 | 1,60 | 19,90 | 19,60 | 19,80 | 19,70 | 19,80 | 31,616 | 78,75 | 19,8 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| 1,5 | 0,75 | 4 | 0,08 | | | 20,60 | | | 1,6892 | 4,50 | 20,6 |
| 1,5 | 0,75 | 4 | 0,08 | | | 20,30 | | | 1,6646 | 4,50 | 20,3 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,40 | | | 2,1216 | 4,50 | 20,4 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,60 | | | 2,06 | 4,50 | 20,6 |
| 1,5 | 0,75 | 4 | 0,10 | | | 20,80 | | | 2,1632 | 4,50 | 20,8 |
| 1,5 | 0,75 | 4 | 0,11 | | | 20,40 | | | 2,1624 | 4,50 | 20,4 |
| 1,5 | 0,75 | 4 | 0,06 | | | 20,50 | | | 1,23 | 4,50 | 20,5 |
| 1,5 | 0,75 | 4 | 0,09 | | | 20,50 | | | 1,804 | 4,50 | 20,5 |
| 1,5 | 0,75 | 4 | 0,09 | | | 20,40 | | | 1,7952 | 4,50 | 20,4 |
| 1,5 | 0,75 | 4 | 0,11 | | | 20,30 | | | 2,1924 | 4,50 | 20,3 |
| 1,5 | 0,75 | 4 | 0,08 | | | 20,40 | | | 1,632 | 4,50 | 20,4 |
| 1,5 | 0,75 | 4 | 0,08 | | | 20,60 | | | 1,648 | 4,50 | 20,6 |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 | |
| | | | | | | | | | | 0,00 |

## Tunnel Traverse Worksheet (for velocity calculations)

Static Pressure: 0,18 in. H20 Absolute value
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=**
0,948

**Pour un tunnel moins de 12", prendre 4 lectures**

| | TUNNEL VELOCITY | TUNNEL TEMP | SQUARE ROOT |
|---|---|---|---|
| | In. wc | °F | |
| A center | 0,075 | 72,91 | 0,2739 |
| B center | 0,074 | 73,41 | 0,2720 |
| A1 | 0,061 | 72,91 | 0,2470 |
| A2 | 0,073 | 73,09 | 0,2702 |
| A3 | 0,063 | 73,09 | 0,2510 |
| A4 | 0,061 | 73,18 | 0,2470 |
| | | | |
| B1 | 0,060 | 73,410 | 0,2449 |
| B2 | 0,064 | 73,560 | 0,2530 |
| B3 | 0,078 | 73,560 | 0,2793 |
| B4 | 0,062 | 73,710 | 0,2490 |
| AVERAGE | 0,0671 | 73,2830 | 0,2587 |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 26-07-2022 |
| **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 | 15 | 616 | 617 | 3 | 17 | 618 | 619 | 23 | 32 | 620 | 621 | 39 | 622 | | |
| Before (1) | | | | | | | | | | | | | | | |
| Before (2) | | | | | | | | | | | | | | | |
| Before (3) | | | | | | | | | | | | | | | |
| Before (4) | | | | | | | | | | | | | | | |
| Before (5) | 108,7800 | | 0,2613 | 34,3301 | 108,9419 | | 0,2610 | 33,4490 | 110,1781 | | 0,2624 | 35,3434 | 0,1314 | 2022-07-25 | 17:00 |
| Before (6) | 108,7801 | | 0,2613 | 34,3300 | 108,9418 | | 0,2611 | 33,4489 | 110,1780 | | 0,2625 | 35,3435 | 0,1315 | 2022-07-26 | 09:00 |
| After (1) | 108,7806 | | 0,2616 | 34,3318 | 108,9423 | | 0,2610 | 33,4514 | 110,1782 | | 0,2623 | 35,3454 | 0,1318 | 2022-07-26 | 16:00 |
| After (2) | 108,7802 | | 0,2616 | 34,3305 | 108,9419 | | 0,2610 | 33,4495 | 110,1781 | | 0,2624 | 35,3446 | 0,1316 | 2022-07-28 | 08:00 |
| After (3) | 108,7802 | | 0,2615 | 34,3305 | 108,9419 | | 0,2611 | 33,4494 | 110,1781 | | 0,2625 | 35,3447 | 0,1316 | 2022-08-01 | 08:00 |
| After (4) | | | | | | | | | | | | | | | 08:00 |
| After (5) | | | | | | | | | | | | | | | |
| After (6) | 108,7802 | | 0,2615 | 34,3305 | 108,9419 | | 0,2611 | 33,4494 | 110,1781 | | 0,2625 | 35,3447 | 0,1316 | 2022-08-01 | |
| Difference | 0,0001 | 0,0000 | 0,0002 | 0,0005 | 0,0001 | 0,0000 | 0,0000 | 0,0005 | 0,0001 | 0,0000 | 0,0000 | 0,0012 | 0,0001 | | |
| Total (mg) | | 0,8 | | | | 1,4 | | | | 1,3 | | | 0,1 | | |
| Total ajusté (mg) | | **0,70** | | | | **1,30** | | | | **1,20** | | | | | |

| | |
|---|---|
| **Project nu.** | PI 20272 |
| **Date** | 26-07-2022 |
| **Technicien** | M.M |

SFBA EPA EMISSION RESULTS

**Test Duration:** **162** min

RESULTS

**Average emission rate:** 0,84 g/hr

Burn Rate : 0,970 Dry kg/hr

| | | | |
|---|---|---|---|
| PRESSURE FACTOR: | DGM 1 | 0,96842 | |
| | DGM 2 | 0,97256 | |
| | DGM 3 | 0,99535 | |
| TEMPERATURE FACTORS | DGM 1 | 0,97752 | |
| | DGM 2 | 0,97010 | |
| | DGM 3 | 0,97890 | |
| VOLUMES SAMPLED | DGM 1 | 30,091 | SCft |
| | DGM 2 | 30,332 | Scft |
| | DGM 3 | 23,630 | SCft |

TOTAL TUNNEL VOLUME : 56271

SAMPLE RATIOS

| | |
|---|---|
| Sample Train 1: | 1870,038 |
| Sample Train 2: | 1855,160 |

Paticulate concentration

| | | |
|---|---|---|
| Sample Train 1 | **0,000047** | g/dscf |
| Sample Train 2 | **0,000043** | g/dscf |
| Room | **0,000004** | g/dscf |

TOTAL EMISSIONS

| | | |
|---|---|---|
| Sample Train 1 | **2,38** | g |
| Sample Train 2 | **2,17** | g |

EMISSION RATES

| | | |
|---|---|---|
| Sample Train 1 | **0,88** | g/hr |
| Sample Train 2 | **0,81** | g/hr |

1st hour emission rate **1,50** g/hr

| | Train 1 | Train 2 |
|---|---|---|
| Cs | 4,653E-05 | 4,2859E-05 |

BAROMETRIC PRESSURE

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

DGM CONTROLLER VALUES

| | | | |
|---|---|---|---|
| DGM 1 | Final: | 23350,115 | Cuft |
| | Initial: | 23318,408 | Cuft |
| DGM 2 | Final: | 14462,253 | Cuft |
| | Initial: | 14430,550 | Cuft |
| DGM #3 | Final: | 13902,532 | Cuft |
| | Initial: | 13878,195 | Cuft |

TEMPERATURES

| | | |
|---|---|---|
| DGM 1 | 540,144 | °R |
| DGM 2 | 544,274 | °R |

CALIBRATION FACTORS

| | |
|---|---|
| DGM 1 | 1,0025 |
| DGM 2 | 1,0141 |
| DGM #3 | 0,9965 |

TUNNEL FLOW RATE: 347,354 Dscfm

PARTICULATE CATCH

| | | |
|---|---|---|
| Total Sample Train 1: | 1,40 | mg |
| Total Sample Train 2: | 1,30 | mg |
| Total Sample Train 1 1st hour: | 0,80 | mg |

DEVIATION: 4,53%

| * | | * | * | * | * | *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 | Flue draft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed | | Weight | | | | Flue | Room | Tunnel | Unit | Unit | Unit | Unit | Unit | Catalyst | Reading | Inlet T | Outlet T | Temp | Reading | Inlet T | Outlet T | Temp | Pressure | Pressure |
| Time | Raw data row | Remaining | CO | $CO_2$ | $O_2$ | Gas | Temp | Dry Bulb | Top | Back | R.Side | L.Side | Bottom | up | | | | | | | | | in wc | in wc |
| min | | lbs | % | % | % | °F | °F | °F | °F | °F | °F | °F | °F | °F | cuft/min | oF | oF | oF | cuft/min | oF | oF | oF | in wc | in wc |
| 0,00 | 243,00 | 6,9 | 0,1 | 2,8 | 0,0 | 314,2 | 78,4 | 96,6 | 374,2 | 341,8 | 586,5 | 589,1 | 429,5 | 427,2 | 0,18 | 77,96 | 78,06 | 83,76 | 0,19 | 79,29 | 79,61 | 84,60 | 0,08 | 0,04 |
| 1,0 | 244,0 | 6,8 | 0,1 | 2,5 | 0,0 | 286,2 | 78,3 | 89,4 | 369,2 | 336,2 | 579,8 | 582,8 | 429,9 | 534,9 | 0,18 | 77,96 | 78,09 | 83,45 | 0,19 | 79,28 | 79,75 | 84,30 | 0,08 | 0,05 |
| 2,0 | 245,0 | 6,8 | 0,0 | 4,0 | 0,0 | 288,9 | 78,1 | 89,0 | 365,8 | 331,0 | 569,8 | 573,0 | 430,1 | 568,7 | 0,18 | 77,96 | 78,13 | 83,19 | 0,19 | 79,29 | 79,87 | 84,07 | 0,08 | 0,06 |
| 3,0 | 246,0 | 6,8 | 0,0 | 4,1 | 0,0 | 291,3 | 78,0 | 88,4 | 363,0 | 327,4 | 559,2 | 562,3 | 430,2 | 576,2 | 0,18 | 77,97 | 78,12 | 83,01 | 0,19 | 79,35 | 79,98 | 83,94 | 0,08 | 0,06 |
| 4,0 | 247,0 | 6,7 | 0,0 | 3,8 | 0,0 | 292,9 | 78,2 | 88,8 | 359,6 | 324,0 | 548,0 | 550,8 | 429,8 | 578,9 | 0,18 | 77,97 | 78,13 | 82,89 | 0,19 | 79,43 | 80,03 | 83,82 | 0,08 | 0,06 |
| 5,0 | 248,0 | 6,7 | 0,0 | 3,5 | 0,0 | 293,2 | 78,1 | 88,9 | 356,8 | 323,9 | 536,8 | 539,4 | 429,4 | 577,1 | 0,19 | 78,04 | 78,14 | 82,76 | 0,19 | 79,53 | 80,13 | 83,72 | 0,08 | 0,06 |
| 6,0 | 249,0 | 6,7 | 0,0 | 4,0 | 0,0 | 269,1 | 78,2 | 87,8 | 353,7 | 324,9 | 525,8 | 528,6 | 428,6 | 561,8 | 0,18 | 78,23 | 78,17 | 82,67 | 0,19 | 79,79 | 80,26 | 83,64 | 0,08 | 0,05 |
| 7,0 | 250,0 | 6,6 | 0,0 | 3,6 | 0,0 | 257,2 | 78,4 | 87,6 | 350,2 | 327,3 | 515,9 | 518,1 | 427,6 | 565,4 | 0,18 | 78,44 | 78,22 | 82,58 | 0,19 | 80,05 | 80,41 | 83,55 | 0,08 | 0,05 |
| 8,0 | 251,0 | 6,6 | 0,1 | 4,0 | 0,0 | 255,4 | 78,6 | 87,9 | 349,4 | 327,1 | 505,9 | 507,5 | 426,3 | 567,5 | 0,19 | 78,62 | 78,26 | 82,51 | 0,19 | 80,30 | 80,55 | 83,51 | 0,08 | 0,05 |
| 9,0 | 252,0 | 6,5 | 0,0 | 8,4 | 0,0 | 259,2 | 78,3 | 87,5 | 354,2 | 325,4 | 497,8 | 499,1 | 425,1 | 603,0 | 0,19 | 78,70 | 78,32 | 82,50 | 0,19 | 80,48 | 80,70 | 83,50 | 0,08 | 0,05 |
| 10,0 | 253,0 | 6,5 | 0,0 | 6,7 | 0,0 | 260,4 | 78,4 | 87,7 | 356,7 | 322,4 | 488,9 | 490,3 | 423,5 | 612,2 | 0,18 | 78,81 | 78,34 | 82,49 | 0,19 | 80,64 | 80,87 | 83,47 | 0,08 | 0,05 |
| 11,0 | 254,0 | 6,4 | 0,1 | 3,5 | 0,0 | 258,1 | 78,4 | 87,3 | 354,5 | 318,9 | 479,3 | 482,6 | 421,6 | 599,5 | 0,19 | 78,85 | 78,35 | 82,44 | 0,19 | 80,75 | 80,99 | 83,41 | 0,08 | 0,05 |
| 12,0 | 255,0 | 6,4 | 0,1 | 3,3 | 0,0 | 253,6 | 78,1 | 86,4 | 351,6 | 314,4 | 473,9 | 475,5 | 419,8 | 583,4 | 0,19 | 78,81 | 78,38 | 82,28 | 0,19 | 80,84 | 81,07 | 83,28 | 0,07 | 0,05 |
| 13,0 | 256,0 | 6,4 | 0,1 | 3,9 | 0,0 | 250,7 | 78,3 | 86,6 | 348,6 | 310,5 | 467,9 | 469,7 | 417,9 | 583,1 | 0,18 | 78,82 | 78,39 | 82,18 | 0,19 | 80,97 | 81,17 | 83,17 | 0,08 | 0,05 |
| 14,0 | 257,0 | 6,3 | 0,1 | 3,2 | 0,0 | 250,0 | 78,3 | 86,7 | 344,8 | 306,7 | 461,4 | 465,0 | 416,0 | 591,6 | 0,19 | 78,84 | 78,39 | 82,08 | 0,19 | 81,11 | 81,24 | 83,08 | 0,08 | 0,05 |
| 15,0 | 258,0 | 6,4 | 0,1 | 2,9 | 0,0 | 248,8 | 78,4 | 86,5 | 341,4 | 304,8 | 455,1 | 460,3 | 414,1 | 567,7 | 0,19 | 78,95 | 78,42 | 82,05 | 0,19 | 81,29 | 81,34 | 83,02 | 0,08 | 0,05 |
| 16,0 | 259,0 | 6,3 | 0,0 | 3,8 | 0,0 | 244,1 | 78,5 | 86,3 | 337,8 | 304,0 | 445,1 | 455,0 | 412,0 | 547,6 | 0,19 | 79,10 | 78,46 | 85,37 | 0,19 | 81,47 | 81,45 | 83,61 | 0,08 | 0,05 |
| 17,0 | 260,0 | 6,3 | 0,0 | 4,1 | 0,0 | 242,7 | 78,3 | 86,5 | 335,2 | 303,8 | 440,8 | 449,2 | 410,0 | 546,2 | 0,19 | 79,23 | 78,50 | 86,86 | 0,19 | 81,63 | 81,58 | 86,13 | 0,08 | 0,05 |
| 18,0 | 261,0 | 6,2 | 0,0 | 4,5 | 0,0 | 240,3 | 78,5 | 86,2 | 333,0 | 305,2 | 436,0 | 443,2 | 408,0 | 543,1 | 0,18 | 79,26 | 78,54 | 86,59 | 0,19 | 81,74 | 81,66 | 87,50 | 0,08 | 0,05 |
| 19,0 | 262,0 | 6,2 | 0,0 | 4,6 | 0,0 | 239,4 | 78,5 | 86,6 | 330,7 | 307,6 | 429,7 | 437,1 | 405,9 | 541,5 | 0,19 | 79,34 | 78,57 | 86,22 | 0,19 | 81,88 | 81,77 | 87,47 | 0,08 | 0,05 |
| 20,0 | 263,0 | 6,1 | 0,0 | 4,9 | 0,0 | 239,2 | 78,5 | 87,7 | 329,9 | 309,8 | 425,2 | 431,5 | 403,9 | 534,6 | 0,19 | 79,33 | 78,58 | 86,00 | 0,19 | 81,95 | 81,89 | 87,37 | 0,07 | 0,05 |
| 21,0 | 264,0 | 6,1 | 0,0 | 7,1 | 0,0 | 244,8 | 78,5 | 88,9 | 331,4 | 312,7 | 420,5 | 425,8 | 401,8 | 569,4 | 0,19 | 79,33 | 78,58 | 85,90 | 0,19 | 82,03 | 82,00 | 87,33 | 0,08 | 0,05 |
| 22,0 | 265,0 | 6,0 | 0,2 | 10,6 | 0,0 | 262,0 | 78,6 | 89,9 | 336,9 | 316,0 | 416,2 | 421,2 | 399,8 | 646,7 | 0,19 | 79,46 | 78,62 | 85,83 | 0,19 | 82,21 | 82,10 | 87,34 | 0,07 | 0,06 |
| 23,0 | 266,0 | 6,0 | 0,2 | 11,4 | 0,0 | 278,1 | 78,6 | 90,7 | 343,2 | 319,5 | 413,6 | 417,2 | 397,8 | 689,0 | 0,18 | 79,59 | 78,68 | 85,78 | 0,19 | 82,38 | 82,24 | 87,32 | 0,08 | 0,06 |
| 24,0 | 267,0 | 5,9 | 0,1 | 10,9 | 0,0 | 283,9 | 78,6 | 91,5 | 348,9 | 323,5 | 411,5 | 414,0 | 395,7 | 668,8 | 0,19 | 79,79 | 78,72 | 85,75 | 0,19 | 82,56 | 82,35 | 87,30 | 0,08 | 0,06 |
| 25,0 | 268,0 | 5,8 | 0,1 | 10,0 | 0,0 | 283,3 | 78,7 | 91,5 | 353,8 | 327,2 | 409,7 | 411,5 | 393,7 | 650,4 | 0,19 | 79,95 | 78,79 | 85,73 | 0,19 | 82,77 | 82,49 | 87,29 | 0,07 | 0,05 |
| 26,0 | 269,0 | 5,7 | 0,1 | 9,3 | 0,0 | 281,0 | 78,8 | 92,0 | 357,7 | 330,7 | 408,4 | 409,8 | 391,7 | 631,7 | 0,19 | 80,13 | 78,86 | 85,68 | 0,19 | 82,95 | 82,62 | 87,27 | 0,08 | 0,05 |
| 27,0 | 270,0 | 5,7 | 0,0 | 9,2 | 0,0 | 278,3 | 78,9 | 92,1 | 361,4 | 334,0 | 407,4 | 408,5 | 389,6 | 629,8 | 0,19 | 80,32 | 78,91 | 85,61 | 0,19 | 83,14 | 82,75 | 87,22 | 0,07 | 0,05 |
| 28,0 | 271,0 | 5,6 | 0,1 | 9,2 | 0,0 | 277,9 | 78,9 | 92,3 | 364,3 | 336,9 | 406,4 | 407,8 | 387,6 | 633,2 | 0,18 | 80,50 | 79,00 | 85,61 | 0,19 | 83,32 | 82,90 | 87,17 | 0,08 | 0,05 |
| 29,0 | 272,0 | 5,5 | 0,1 | 8,8 | 0,0 | 276,1 | 79,0 | 92,5 | 367,3 | 339,4 | 405,8 | 406,9 | 385,5 | 625,5 | 0,19 | 80,68 | 79,07 | 85,58 | 0,19 | 83,51 | 83,02 | 87,13 | 0,07 | 0,05 |
| 30,0 | 273,0 | 5,5 | 0,0 | 8,8 | 0,0 | 274,8 | 79,1 | 92,6 | 369,7 | 341,1 | 405,9 | 406,6 | 383,4 | 620,4 | 0,18 | 80,85 | 79,16 | 85,56 | 0,19 | 83,69 | 83,16 | 87,08 | 0,07 | 0,05 |
| 31,0 | 274,0 | 5,4 | 0,0 | 8,6 | 0,0 | 274,5 | 79,1 | 92,2 | 371,7 | 342,7 | 406,0 | 406,2 | 381,4 | 619,5 | 0,19 | 80,96 | 79,26 | 85,51 | 0,19 | 83,84 | 83,27 | 87,03 | 0,08 | 0,05 |
| 32,0 | 275,0 | 5,4 | 0,0 | 8,8 | 0,0 | 272,8 | 79,2 | 92,1 | 374,1 | 343,4 | 406,1 | 406,3 | 379,3 | 619,1 | 0,18 | 81,17 | 79,32 | 85,49 | 0,19 | 83,98 | 83,39 | 86,95 | 0,08 | 0,05 |
| 33,0 | 276,0 | 5,3 | 0,0 | 8,8 | 0,0 | 271,9 | 79,3 | 91,5 | 376,3 | 342,7 | 407,3 | 405,8 | 377,2 | 617,3 | 0,19 | 81,33 | 79,40 | 85,44 | 0,19 | 84,12 | 83,50 | 86,89 | 0,08 | 0,05 |
| 34,0 | 277,0 | 5,2 | 0,0 | 9,0 | 0,0 | 272,1 | 79,1 | 89,6 | 378,1 | 343,7 | 405,3 | 405,3 | 374,9 | 618,2 | 0,18 | 81,33 | 79,47 | 85,20 | 0,19 | 84,17 | 83,59 | 86,64 | 0,08 | 0,05 |
| 35,0 | 278,0 | 5,2 | 0,0 | 9,4 | 0,0 | 277,5 | 79,2 | 89,7 | 380,9 | 343,3 | 408,2 | 405,0 | 372,8 | 672,9 | 0,19 | 81,29 | 79,52 | 84,95 | 0,19 | 84,25 | 83,69 | 86,36 | 0,08 | 0,06 |
| 36,0 | 279,0 | 5,1 | 0,1 | 10,4 | 0,0 | 285,6 | 79,1 | 88,1 | 384,7 | 344,3 | 409,7 | 404,0 | 370,7 | 674,2 | 0,19 | 81,09 | 79,54 | 84,70 | 0,19 | 84,19 | 83,72 | 86,09 | 0,08 | 0,06 |
| 37,0 | 280,0 | 5,0 | 0,1 | 11,3 | 0,0 | 291,9 | 79,0 | 88,9 | 390,4 | 345,2 | 411,4 | 403,7 | 368,6 | 707,4 | 0,18 | 80,80 | 79,53 | 84,56 | 0,19 | 84,08 | 83,72 | 85,82 | 0,08 | 0,06 |
| 38,0 | 281,0 | 4,9 | 0,1 | 11,3 | 0,0 | 296,3 | 79,0 | 89,5 | 395,9 | 346,7 | 412,2 | 403,9 | 366,5 | 703,1 | 0,19 | 80,68 | 79,51 | 84,47 | 0,19 | 84,00 | 83,73 | 85,71 | 0,08 | 0,06 |
| 39,0 | 282,0 | 4,9 | 0,1 | 11,7 | 0,0 | 307,2 | 78,9 | 88,3 | 402,5 | 345,2 | 414,6 | 405,3 | 364,3 | 768,1 | 0,19 | 80,61 | 79,50 | 84,34 | 0,19 | 83,98 | 83,78 | 85,55 | 0,07 | 0,06 |
| 40,0 | 283,0 | 4,7 | 0,6 | 13,5 | 0,0 | 320,3 | 79,0 | 88,6 | 409,8 | 349,1 | 416,4 | 405,7 | 362,4 | 797,4 | 0,18 | 80,53 | 79,48 | 84,16 | 0,19 | 83,97 | 83,78 | 85,39 | 0,07 | 0,06 |
| 41,0 | 284,0 | 4,7 | 0,6 | 13,8 | 0,0 | 329,3 | 79,0 | 89,1 | 417,0 | 351,6 | 419,1 | 408,0 | 360,5 | 807,3 | 0,19 | 80,55 | 79,48 | 84,09 | 0,19 | 83,95 | 83,85 | 85,32 | 0,08 | 0,06 |
| 42,0 | 285,0 | 4,5 | 0,2 | 13,7 | 0,0 | 336,2 | 78,9 | 89,9 | 423,7 | 353,4 | 422,4 | 411,7 | 358,7 | 811,3 | 0,18 | 80,43 | 79,49 | 84,08 | 0,19 | 83,92 | 83,87 | 85,28 | 0,08 | 0,06 |
| 43,0 | 286,0 | 4,4 | 0,2 | 13,6 | 0,0 | 341,4 | 78,7 | 89,9 | 428,6 | 356,0 | 424,0 | 417,1 | 356,7 | 822,9 | 0,19 | 80,40 | 79,47 | 83,99 | 0,19 | 83,92 | 83,90 | 85,16 | 0,08 | 0,07 |
| 44,0 | 287,0 | 4,3 | 0,2 | 13,6 | 0,0 | 346,1 | 78,9 | 90,4 | 434,6 | 357,4 | 433,0 | 425,1 | 354,8 | 817,8 | 0,19 | 80,48 | 79,51 | 83,94 | 0,19 | 83,94 | 84,02 | 85,09 | 0,08 | 0,07 |
| 45,0 | 288,0 | 4,2 | 0,3 | 13,5 | 0,0 | 349,2 | 79,0 | 89,8 | 439,3 | 359,0 | 439,3 | 433,2 | 353,0 | 811,4 | 0,19 | 80,35 | 79,49 | 83,84 | 0,19 | 83,96 | 84,03 | 84,98 | 0,08 | 0,07 |
| 46,0 | 289,0 | 4,1 | 0,4 | 13,5 | 0,0 | 350,1 | 79,0 | 90,1 | 444,1 | 361,1 | 444,6 | 441,8 | 351,2 | 809,3 | 0,19 | 80,30 | 79,50 | 83,80 | 0,19 | 83,92 | 84,04 | 84,92 | 0,08 | 0,07 |
| 47,0 | 290,0 | 4,0 | 0,4 | 13,5 | 0,0 | 350,0 | 78,9 | 89,8 | 449,8 | 362,7 | 450,7 | 450,2 | 349,5 | 799,4 | 0,18 | 80,25 | 79,48 | 83,71 | 0,19 | 83,91 | 84,04 | 84,79 | 0,08 | 0,07 |
| 48,0 | 291,0 | 3,9 | 0,3 | 13,6 | 0,0 | 349,2 | 78,8 | 88,6 | 455,6 | 362,5 | 456,2 | 459,1 | 347,6 | 793,8 | 0,19 | 80,13 | 79,47 | 83,55 | 0,19 | 83,86 | 84,00 | 84,67 | 0,08 | 0,07 |
| 49,0 | 292,0 | 3,8 | 0,4 | 13,5 | 0,0 | 351,0 | 79,1 | 89,5 | 460,5 | 366,8 | 459,8 | 467,0 | 346,1 | 792,4 | 0,19 | 80,24 | 79,47 | 83,45 | 0,19 | 83,93 | 84,05 | 84,56 | 0,08 | 0,07 |
| 50,0 | 293,0 | 3,7 | 0,4 | 13,5 | 0,0 | 351,0 | 78,9 | 89,8 | 465,8 | 367,2 | 463,1 | 473,7 | 344,4 | 806,2 | 0,18 | 80,18 | 79,47 | 83,43 | 0,19 | 83,92 | 84,07 | 84,51 | 0,08 | 0,07 |
| 51,0 | 294,0 | 3,6 | 0,3 | 13,6 | 0,0 | 350,7 | 79,0 | 88,5 | 471,0 | 369,0 | 466,4 | 477,4 | 342,7 | 814,9 | 0,19 | 80,15 | 79,47 | 83,31 | 0,19 | 83,90 | 84,05 | 84,36 | 0,07 | 0,07 |
| 52,0 | 295,0 | 3,6 | 0,3 | 13,6 | 0,0 | 351,4 | 79,1 | 88,7 | 476,8 | 371,6 | 467,9 | 478,2 | 341,1 | 828,2 | 0,18 | 80,24 | 79,49 | 83,16 | 0,19 | 83,96 | 84,12 | 84,26 | 0,08 | 0,07 |
| 53,0 | 296,0 | 3,4 | 0,3 | 13,6 | 0,0 | 352,6 | 79,3 | 90,2 | 481,5 | 374,4 | 470,3 | 480,1 | 339,5 | 829,4 | 0,19 | 80,42 | 79,53 | 83,20 | 0,19 | 84,03 | 84,22 | 84,31 | 0,08 | 0,07 |
| 54,0 | 297,0 | 3,3 | 0,3 | 13,6 | 0,0 | 353,1 | 79,2 | 90,3 | 485,5 | 376,9 | 472,6 | 480,9 | 338,0 | 826,7 | 0,19 | 80,41 | 79,55 | 83,22 | 0,19 | 84,03 | 84,29 | 84,29 | 0,08 | 0,07 |
| 55,0 | 298,0 | 3,2 | 0,3 | 13,6 | 0,0 | 353,6 | 79,1 | 89,3 | 489,2 | 378,4 | 475,9 | 482,6 | 336,6 | 818,8 | 0,18 | 80,26 | 79,55 | 83,16 | 0,19 | 84,00 | 84,31 | 84,18 | 0,08 | 0,07 |
| 56,0 | 299,0 | 3,1 | 0,3 | 13,5 | 0,0 | 352,6 | 79,0 | 89,9 | 492,7 | 381,3 | 479,4 | 483,9 | 335,2 | 817,1 | 0,18 | 80,23 | 79,55 | 83,14 | 0,19 | 84,04 | 84,35 | 84,17 | 0,07 | 0,07 |
| 57,0 | 300,0 | 3,1 | 0,3 | 13,5 | 0,0 | 351,4 | 79,2 | 90,0 | 496,5 | 382,9 | 481,8 | 485,4 | 333,8 | 825,7 | 0,18 | 80,28 | 79,57 | 83,18 | 0,19 | 84,03 | 84,38 | 84,17 | 0,08 | 0,07 |
| 58,0 | 301,0 | 2,9 | 0,3 | 13,7 | 0,0 | 351,8 | 79,2 | 90,2 | 500,3 | 384,7 | 485,1 | 487,5 | 332,5 | 834,7 | 0,19 | 80,28 | 79,59 | 82,47 | 0,19 | 84,03 | 84,43 | 84,15 | 0,08 | 0,06 |
| 59,0 | 302,0 | 2,9 | 0,2 | 13,9 | 0,0 | 353,9 | 79,4 | 91,9 | 504,0 | 387,2 | 488,5 | 489,4 | 331,2 | 869,5 | 0,19 | 80,42 | 79,59 | 82,22 | 0,19 | 84,13 | 84,52 | 84,26 | 0,08 | 0,06 |
| 60,0 | 303,0 | 2,8 | 0,9 | 13,9 | 0,0 | 354,7 | 79,4 | 89,5 | 508,0 | 387,1 | 492,0 | 492,6 | 329,8 | 863,1 | 0,19 | 80,47 | 79,63 | 82,14 | 0,19 | 84,09 | 84,58 | 84,19 | 0,08 | 0,07 |
| 61,0 | 304,0 | 2,7 | 0,5 | 13,7 | 0,0 | 353,3 | 79,3 | 89,6 | 511,8 | 389,0 | 494,6 | 494,7 | 328,4 | 845,9 | 0,19 | 80,44 | 79,64 | 84,42 | 0,19 | 84,10 | 84,63 | 84,10 | 0,08 | 0,06 |
| 62,0 | 305,0 | 2,7 | 0,3 | 13,5 | 0,0 | 351,0 | 79,4 | 90,6 | 514,1 | 390,8 | 499,5 | 497,0 | 327,3 | 829,0 | 0,19 | 80,47 | 79,65 | 87,93 | 0,19 | 84,16 | 84,69 | 84,15 | 0,07 | 0,06 |
| 63,0 | 306,0 | 2,6 | 0,2 | 13,1 | 0,0 | 347,9 | 79,4 | 90,1 | 515,8 | 392,1 | 502,8 | 499,3 | 326,1 | 810,3 | 0,19 | 80,43 | 79,67 | 88,40 | 0,19 | 84,20 | 84,73 | 84,08 | 0,08 | 0,06 |
| 64,0 | 307,0 | 2,5 | 0,1 | 12,7 | 0,0 | 345,0 | 79,2 | 90,7 | 517,3 | 392,9 | 505,3 | 502,0 | 324,8 | 793,3 | 0,19 | 80,36 | 79,66 | 88,17 | 0,19 | 84,12 | 84,78 | 84,10 | 0,08 | 0,06 |
| 65,0 | 308,0 | 2,5 | 0,1 | 12,5 | 0,0 | 340,6 | 79,2 | 90,2 | 518,4 | 392,2 | 510,4 | 505,8 | 323,6 | 788,2 | 0,19 | 80,31 | 79,67 | 87,81 | 0,19 | 84,11 | 84,78 | 84,08 | 0,08 | 0,06 |
| 66,0 | 309,0 | 2,4 | 0,1 | 12,6 | 0,0 | 338,3 | 79,2 | 88,5 | 519,4 | 393,1 | 514,6 | 509,1 | 322,5 | 788,4 | 0,19 | 80,21 | 79,68 | 87,39 | 0,19 | 84,13 | 84,78 | 83,93 | 0,08 | 0,06 |
| 67,0 | 310,0 | 2,3 | 0,1 | 12,4 | 0,0 | 336,4 | 79,2 | 89,2 | 520,5 | 394,8 | 519,0 | 511,6 | 321,4 | 786,3 | 0,19 | 80,14 | 79,68 | 86,98 | 0,19 | 84,12 | 84,72 | 83,81 | 0,08 | 0,06 |
| 68,0 | 311,0 | 2,3 | 0,1 | 12,6 | 0,0 | 335,8 | 79,2 | 89,0 | 522,6 | 393,0 | 522,8 | 516,2 | 320,3 | 799,8 | 0,18 | 80,13 | 79,69 | 86,61 | 0,19 | 84,13 | 84,72 | 83,80 | 0,07 | 0,07 |
| 69,0 | 312,0 | 2,2 | 0,1 | 12,8 | 0,0 | 336,5 | 79,2 | 88,7 | 525,1 | 393,4 | 526,4 | 518,9 | 319,1 | 805,0 | 0,19 | 80,06 | 79,69 | 86,21 | 0,19 | 84,12 | 84,67 | 83,71 | 0,08 | 0,06 |
| 70,0 | 313,0 | 2,2 | 0,1 | 12,8 | 0,0 | 335,8 | 79,3 | 90,3 | 526,6 | 395,7 | 529,6 | 520,4 | 318,2 | 806,2 | 0,19 | 80,06 | 79,69 | 85,84 | 0,19 | 84,11 | 84,66 | 83,70 | 0,08 | 0,06 |
| 71,0 | 314,0 | 2,1 | 0,1 | 12,6 | 0,0 | 333,4 | 79,3 | 89,5 | 527,6 | 393,6 | 533,2 | 524,1 | 317,1 | 800,1 | 0,18 | 80,09 | 79,69 | 85,54 | 0,19 | 84,17 | 84,67 | 83,68 | 0,08 | 0,06 |
| 72,0 | 315,0 | 2,0 | 0,1 | 12,4 | 0,0 | 333,0 | 79,3 | 88,6 | 529,1 | 394,1 | 536,8 | 525,7 | 316,1 | 814,9 | 0,19 | 80,10 | 79,72 | 85,21 | 0,19 | 84,19 | 84,69 | 83,60 | 0,08 | 0,06 |
| 73,0 | 316,0 | 2,0 | 0,2 | 12,8 | 0,0 | 331,9 | 79,4 | 87,9 | 530,4 | 392,0 | 539,2 | 528,2 | 315,0 | 811,0 | 0,19 | 80,13 | 79,73 | 84,93 | 0,19 | 84,24 | 84,69 | 83,55 | 0,08 | 0,06 |
| 74,0 | 317,0 | 1,9 | 0,1 | 12,1 | 0,0 | 328,4 | 79,4 | 87,4 | 532,1 | 391,5 | 541,4 | 530,9 | 314,0 | 794,9 | 0,19 | 80,13 | 79,73 | 84,59 | 0,19 | 84,23 | 84,67 | 83,47 | 0,08 | 0,06 |
| 75,0 | 318,0 | 1,9 | 0,1 | 12,4 | 0,0 | 329,9 | 79,1 | 87,4 | 533,2 | 389,6 | 542,3 | 532,9 | 312,9 | 826,4 | 0,18 | 80,08 | 79,73 | 84,28 | 0,19 | 84,15 | 84,62 | 83,36 | 0,08 | 0,06 |
| 76,0 | 319,0 | 1,8 | 0,2 | 13,0 | 0,0 | 330,5 | 79,3 | 87,4 | 534,1 | 388,5 | 545,3 | 535,1 | 312,1 | 833,9 | 0,18 | 80,04 | 79,73 | 84,00 | 0,19 | 84,06 | 84,61 | 83,30 | 0,08 | 0,06 |
| 77,0 | 320,0 | 1,8 | 0,1 | 12,6 | 0,0 | 328,6 | 79,3 | 88,2 | 535,2 | 387,8 | 548,0 | 537,4 | 311,2 | 818,3 | 0,19 | 80,01 | 79,73 | 83,76 | 0,19 | 84,05 | 84,61 | 83,25 | 0,08 | 0,06 |
| 78,0 | 321,0 | 1,7 | 0,1 | 12,5 | 0,0 | 325,9 | 79,4 | 89,3 | 535,2 | 386,5 | 551,5 | 540,2 | 310,3 | 810,3 | 0,19 | 80,01 | 79,72 | 83,53 | 0,19 | 84,07 | 84,63 | 83,31 | 0,08 | 0,06 |
| 79,0 | 322,0 | 1,7 | 0,1 | 12,4 | 0,0 | 324,1 | 79,3 | 88,2 | 535,1 | 384,2 | 554,6 | 543,3 | 309,4 | 804,7 | 0,18 | 80,11 | 79,73 | 83,33 | 0,19 | 84,17 | 84,72 | 83,32 | 0,07 | 0,06 |
| 80,0 | 323,0 | 1,6 | 0,1 | 12,0 | 0,0 | 322,0 | 79,4 | 87,8 | 535,5 | 383,4 | 556,7 | 544,6 | 308,6 | 794,0 | 0,18 | 80,15 | 79,76 | 83,07 | 0,19 | 84,19 | 84,75 | 83,23 | 0,08 | 0,06 |
| 81,0 | 324,0 | 1,5 | 0,1 | 12,2 | 0,0 | 319,1 | 79,4 | 88,1 | 535,5 | 382,0 | 559,0 | 546,9 | 307,8 | 787,1 | 0,19 | 80,21 | 79,79 | 83,07 | 0,19 | 84,21 | 84,77 | 83,19 | 0,07 | 0,06 |
| 82,0 | 325,0 | 1,5 | 0,1 | 11,7 | 0,0 | 317,6 | 79,4 | 89,4 | 534,6 | 380,8 | 556,4 | 548,6 | 306,8 | 779,4 | 0,19 | 80,23 | 79,79 | 83,15 | 0,19 | 84,23 | 84,78 | 83,23 | 0,08 | 0,06 |
| 83,0 | 326,0 | 1,4 | 0,0 | 11,3 | 0,0 | 314,4 | 79,4 | 88,2 | 534,1 | 378,6 | 561,3 | 551,0 | 306,1 | 765,5 | 0,19 | 80,20 | 79,82 | 83,18 | 0,19 | 84,16 | 84,82 | 83,25 | 0,08 | 0,06 |
| 84,0 | 327,0 | 1,4 | 0,0 | 11,2 | 0,0 | 311,6 | 79,3 | 87,9 | 532,3 | 378,1 | 561,8 | 552,5 | 305,2 | 758,9 | 0,19 | 80,16 | 79,83 | 83,10 | 0,19 | 84,22 | 84,82 | 83,16 | 0,08 | 0,06 |
| 85,0 | 328,0 | 1,4 | 0,0 | 11,1 | 0,0 | 309,1 | 79,4 | 87,8 | 531,6 | 376,6 | 562,4 | 553,6 | 304,6 | 755,0 | 0,19 | 80,26 | 79,81 | 83,16 | 0,19 | 84,25 | 84,90 | 83,22 | 0,08 | 0,06 |
| 86,0 | 329,0 | 1,3 | 0,1 | 11,1 | 0,0 | 308,9 | 79,4 | 86,9 | 530,9 | 374,9 | 564,2 | 555,3 | 303,8 | 761,7 | 0,18 | 80,18 | 79,85 | 83,07 | 0,19 | 84,21 | 84,90 | 83,10 | 0,08 | 0,06 |
| 87,0 | 330,0 | 1,3 | 0,1 | 11,2 | 0,0 | 309,8 | 79,3 | 86,7 | 530,3 | 373,6 | 563,9 | 555,9 | 303,2 | 781,1 | 0,18 | 80,23 | 79,85 | 83,04 | 0,19 | 84,26 | 84,94 | 84,47 | 0,08 | 0,06 |
| 88,0 | 331,0 | 1,3 | 0,1 | 11,5 | 0,0 | 311,7 | 79,6 | 88,3 | 528,8 | 371,9 | 563,4 | 556,9 | 302,5 | 793,1 | 0,19 | 80,42 | 79,89 | 83,12 | 0,19 | 84,35 | 85,06 | 87,06 | 0,07 | 0,06 |
| 89,0 | 332,0 | 1,2 | 0,1 | 11,2 | 0,0 | 310,6 | 79,4 | 87,9 | 526,6 | 370,5 | 564,1 | 558,2 | 302,0 | 777,1 | 0,19 | 80,38 | 79,91 | 83,17 | 0,19 | 84,39 | 85,10 | 87,65 | 0,08 | 0,06 |
| 90,0 | 333,0 | 1,2 | 0,1 | 11,2 | 0,0 | 309,3 | 79,5 | 88,0 | 523,2 | 369,9 | 563,6 | 560,1 | 301,4 | 787,1 | 0,19 | 80,34 | 79,93 | 83,14 | 0,19 | 84,40 | 85,15 | 87,51 | 0,08 | 0,06 |
| 91,0 | 334,0 | 1,2 | 0,1 | 11,4 | 0,0 | 307,4 | 79,3 | 88,7 | 519,7 | 369,4 | 565,7 | 561,9 | 300,9 | 780,7 | 0,19 | 80,34 | 79,96 | 83,25 | 0,19 | 84,35 | 85,20 | 87,43 | 0,07 | 0,06 |
| 92,0 | 335,0 | 1,1 | 0,1 | 11,3 | 0,0 | 304,9 | 79,5 | 88,7 | 516,3 | 369,1 | 565,7 | 564,8 | 300,3 | 763,0 | 0,19 | 80,35 | 79,95 | 83,31 | 0,19 | 84,38 | 85,25 | 87,31 | 0,08 | 0,06 |
| 93,0 | 336,0 | 1,1 | 0,1 | 11,1 | 0,0 | 300,9 | 79,5 | 89,4 | 512,5 | 368,2 | 567,9 | 567,0 | 299,9 | 742,8 | 0,19 | 80,45 | 79,98 | 83,38 | 0,19 | 84,36 | 85,29 | 87,22 | 0,08 | 0,05 |
| 94,0 | 337,0 | 1,1 | 0,1 | 10,8 | 0,0 | 296,7 | 79,6 | 89,5 | 508,7 | 368,2 | 571,1 | 569,6 | 299,6 | 728,2 | 0,18 | 80,39 | 79,98 | 83,46 | 0,19 | 84,29 | 85,32 | 87,10 | 0,08 | 0,05 |
| 95,0 | 338,0 | 1,1 | 0,1 | 10,4 | 0,0 | 292,1 | 79,6 | 88,0 | 504,1 | 366,0 | 574,3 | 573,1 | 299,2 | 712,4 | 0,19 | 80,33 | 79,99 | 83,43 | 0,19 | 84,31 | 85,34 | 86,84 | 0,08 | 0,05 |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 96,0 | 339,0 | 1,0 | 0,1 | 9,9 | 0,0 | 288,6 | 79,4 | 88,8 | 499,2 | 366,4 | 576,6 | 575,2 | 298,9 | 699,2 | 0,19 | 80,51 | 80,03 | 83,41 | 0,19 | 84,52 | 85,40 | 86,67 | 0,08 | 0,05 |
| 97,0 | 340,0 | 1,0 | 0,1 | 10,0 | 0,0 | 284,9 | 79,5 | 87,3 | 494,1 | 364,6 | 579,1 | 579,0 | 298,7 | 693,2 | 0,18 | 80,57 | 80,05 | 83,35 | 0,19 | 84,57 | 85,44 | 86,52 | 0,08 | 0,05 |
| 98,0 | 341,0 | 1,0 | 0,1 | 9,8 | 0,0 | 281,5 | 79,5 | 88,7 | 489,6 | 364,8 | 580,6 | 581,4 | 298,4 | 691,8 | 0,19 | 80,55 | 80,07 | 83,40 | 0,19 | 84,63 | 85,47 | 86,37 | 0,08 | 0,05 |
| 99,0 | 342,0 | 1,0 | 0,1 | 9,5 | 0,0 | 281,3 | 79,6 | 88,1 | 483,8 | 363,4 | 584,0 | 584,5 | 298,2 | 695,2 | 0,19 | 80,52 | 80,06 | 83,46 | 0,19 | 84,56 | 85,48 | 86,25 | 0,08 | 0,05 |
| 100,0 | 343,0 | 0,9 | 0,1 | 9,4 | 0,0 | 281,1 | 79,6 | 87,3 | 478,6 | 361,3 | 586,7 | 587,5 | 297,8 | 701,0 | 0,19 | 80,46 | 80,10 | 83,41 | 0,19 | 84,58 | 85,46 | 86,03 | 0,07 | 0,05 |
| 101,0 | 344,0 | 0,9 | 0,1 | 9,3 | 0,0 | 279,7 | 79,6 | 87,9 | 473,6 | 360,5 | 588,7 | 589,7 | 297,7 | 702,9 | 0,19 | 80,48 | 80,10 | 83,40 | 0,19 | 84,65 | 85,47 | 85,87 | 0,08 | 0,05 |
| 102,0 | 345,0 | 0,9 | 0,1 | 9,3 | 0,0 | 279,0 | 79,7 | 88,0 | 468,5 | 359,3 | 590,7 | 591,7 | 297,5 | 699,9 | 0,19 | 80,56 | 80,12 | 83,43 | 0,19 | 84,68 | 85,48 | 85,72 | 0,07 | 0,05 |
| 103,0 | 346,0 | 0,9 | 0,1 | 9,2 | 0,0 | 278,6 | 79,7 | 87,2 | 464,0 | 358,1 | 591,9 | 593,4 | 297,4 | 699,9 | 0,19 | 80,57 | 80,13 | 83,37 | 0,19 | 84,71 | 85,46 | 85,49 | 0,08 | 0,05 |
| 104,0 | 347,0 | 0,9 | 0,1 | 9,1 | 0,0 | 277,4 | 79,6 | 87,2 | 459,4 | 355,8 | 593,2 | 596,1 | 297,2 | 701,9 | 0,19 | 80,57 | 80,17 | 83,37 | 0,19 | 84,75 | 85,48 | 85,39 | 0,07 | 0,05 |
| 105,0 | 348,0 | 0,9 | 0,1 | 9,1 | 0,0 | 276,8 | 79,6 | 87,5 | 455,2 | 355,5 | 594,9 | 597,0 | 297,2 | 701,8 | 0,19 | 80,52 | 80,14 | 83,35 | 0,19 | 84,73 | 85,43 | 85,23 | 0,08 | 0,05 |
| 106,0 | 349,0 | 0,9 | 0,2 | 9,0 | 0,0 | 276,6 | 79,8 | 87,7 | 451,0 | 353,3 | 596,1 | 599,3 | 297,1 | 701,6 | 0,18 | 80,52 | 80,16 | 83,39 | 0,19 | 84,73 | 85,48 | 85,19 | 0,08 | 0,05 |
| 107,0 | 350,0 | 0,9 | 0,2 | 8,9 | 0,0 | 277,1 | 79,7 | 87,9 | 447,0 | 353,2 | 596,7 | 599,7 | 297,2 | 700,1 | 0,19 | 80,63 | 80,18 | 83,44 | 0,19 | 84,83 | 85,53 | 85,14 | 0,07 | 0,05 |
| 108,0 | 351,0 | 0,8 | 0,2 | 8,9 | 0,0 | 276,9 | 79,8 | 88,2 | 443,3 | 352,5 | 596,3 | 600,5 | 297,2 | 700,4 | 0,19 | 80,69 | 80,20 | 83,43 | 0,19 | 84,81 | 85,55 | 85,08 | 0,08 | 0,05 |
| 109,0 | 352,0 | 0,8 | 0,2 | 8,8 | 0,0 | 277,0 | 79,8 | 87,8 | 439,2 | 350,1 | 595,9 | 602,4 | 297,2 | 702,3 | 0,19 | 80,80 | 80,24 | 83,49 | 0,19 | 84,89 | 85,62 | 85,00 | 0,08 | 0,05 |
| 110,0 | 353,0 | 0,8 | 0,2 | 8,9 | 0,0 | 277,6 | 79,7 | 88,7 | 435,7 | 349,1 | 594,7 | 602,6 | 297,0 | 703,6 | 0,19 | 80,77 | 80,25 | 83,53 | 0,19 | 84,81 | 85,66 | 84,88 | 0,08 | 0,05 |
| 111,0 | 354,0 | 0,8 | 0,2 | 8,9 | 0,0 | 277,1 | 79,8 | 89,4 | 432,5 | 347,8 | 596,0 | 603,2 | 297,3 | 701,8 | 0,19 | 80,79 | 80,27 | 83,63 | 0,19 | 84,80 | 85,74 | 84,86 | 0,08 | 0,05 |
| 112,0 | 355,0 | 0,7 | 0,2 | 8,9 | 0,0 | 276,7 | 79,8 | 88,2 | 429,4 | 345,5 | 597,0 | 604,1 | 297,3 | 701,1 | 0,18 | 80,77 | 80,28 | 83,60 | 0,19 | 84,82 | 85,73 | 84,67 | 0,08 | 0,05 |
| 113,0 | 356,0 | 0,7 | 0,2 | 9,0 | 0,0 | 277,3 | 79,4 | 89,3 | 426,8 | 345,6 | 595,9 | 604,2 | 297,5 | 699,0 | 0,19 | 80,78 | 80,29 | 83,64 | 0,19 | 84,83 | 85,76 | 84,63 | 0,08 | 0,05 |
| 114,0 | 357,0 | 0,7 | 0,2 | 9,0 | 0,0 | 276,1 | 79,7 | 88,7 | 423,9 | 343,2 | 595,5 | 604,7 | 297,6 | 694,8 | 0,19 | 80,85 | 80,31 | 83,72 | 0,19 | 84,85 | 85,80 | 84,64 | 0,08 | 0,05 |
| 115,0 | 358,0 | 0,7 | 0,2 | 9,0 | 0,0 | 275,1 | 79,9 | 88,0 | 421,5 | 342,1 | 596,9 | 604,7 | 297,8 | 691,6 | 0,19 | 80,85 | 80,33 | 83,67 | 0,19 | 84,88 | 85,82 | 84,49 | 0,08 | 0,05 |
| 116,0 | 359,0 | 0,7 | 0,2 | 8,8 | 0,0 | 274,5 | 79,9 | 88,6 | 418,8 | 340,6 | 596,4 | 606,1 | 298,0 | 690,8 | 0,19 | 80,80 | 80,36 | 83,70 | 0,19 | 84,90 | 85,84 | 84,48 | 0,08 | 0,05 |
| 117,0 | 360,0 | 0,7 | 0,2 | 8,8 | 0,0 | 274,5 | 79,8 | 88,5 | 416,6 | 340,5 | 596,9 | 605,3 | 298,2 | 689,0 | 0,19 | 80,88 | 80,37 | 83,72 | 0,19 | 84,96 | 85,87 | 84,38 | 0,08 | 0,05 |
| 118,0 | 361,0 | 0,7 | 0,2 | 9,4 | 0,0 | 272,3 | 79,8 | 86,7 | 414,0 | 339,5 | 596,4 | 605,9 | 298,4 | 680,0 | 0,19 | 81,14 | 80,42 | 83,63 | 0,19 | 85,11 | 85,90 | 84,24 | 0,08 | 0,05 |
| 119,0 | 362,0 | 0,6 | 0,2 | 9,1 | 0,0 | 271,0 | 80,0 | 87,0 | 411,6 | 338,7 | 596,1 | 605,1 | 298,7 | 675,5 | 0,19 | 81,28 | 80,49 | 83,58 | 0,19 | 85,21 | 85,94 | 84,16 | 0,08 | 0,05 |
| 120,0 | 363,0 | 0,6 | 0,2 | 9,0 | 0,0 | 269,7 | 80,0 | 87,8 | 409,5 | 338,8 | 595,1 | 605,2 | 298,9 | 670,9 | 0,19 | 81,32 | 80,53 | 83,64 | 0,19 | 85,27 | 86,01 | 84,15 | 0,07 | 0,05 |
| 121,0 | 364,0 | 0,6 | 0,1 | 8,8 | 0,0 | 268,7 | 80,0 | 88,2 | 407,3 | 339,3 | 594,1 | 605,0 | 299,2 | 665,4 | 0,19 | 81,30 | 80,55 | 83,69 | 0,19 | 85,26 | 86,07 | 84,16 | 0,08 | 0,05 |
| 122,0 | 365,0 | 0,6 | 0,2 | 8,7 | 0,0 | 267,9 | 80,0 | 87,6 | 405,1 | 337,0 | 593,5 | 605,3 | 299,3 | 667,4 | 0,19 | 81,25 | 80,57 | 83,73 | 0,19 | 85,22 | 86,09 | 84,14 | 0,07 | 0,05 |
| 123,0 | 366,0 | 0,6 | 0,2 | 8,6 | 0,0 | 267,8 | 80,0 | 87,6 | 403,0 | 337,4 | 592,8 | 603,4 | 299,7 | 669,2 | 0,19 | 81,20 | 80,58 | 83,69 | 0,19 | 85,24 | 86,08 | 84,05 | 0,08 | 0,05 |
| 124,0 | 367,0 | 0,5 | 0,2 | 8,9 | 0,0 | 267,7 | 79,9 | 87,1 | 401,4 | 337,1 | 592,2 | 600,8 | 299,9 | 670,9 | 0,19 | 81,14 | 80,60 | 83,64 | 0,19 | 85,25 | 86,06 | 83,98 | 0,08 | 0,05 |
| 125,0 | 368,0 | 0,5 | 0,2 | 8,9 | 0,0 | 267,4 | 79,9 | 87,0 | 399,3 | 336,2 | 592,4 | 599,5 | 300,2 | 667,6 | 0,19 | 81,05 | 80,59 | 83,61 | 0,19 | 85,23 | 86,04 | 83,87 | 0,08 | 0,05 |
| 126,0 | 369,0 | 0,5 | 0,2 | 8,6 | 0,0 | 266,9 | 79,8 | 86,9 | 397,5 | 335,9 | 592,2 | 597,7 | 300,5 | 668,2 | 0,19 | 81,03 | 80,58 | 83,58 | 0,19 | 85,17 | 86,05 | 83,79 | 0,07 | 0,05 |
| 127,0 | 370,0 | 0,5 | 0,2 | 8,5 | 0,0 | 266,8 | 80,0 | 89,0 | 395,5 | 336,9 | 590,8 | 594,8 | 300,9 | 668,7 | 0,19 | 81,16 | 80,63 | 83,68 | 0,19 | 85,27 | 86,07 | 83,82 | 0,08 | 0,05 |
| 128,0 | 371,0 | 0,5 | 0,2 | 8,6 | 0,0 | 267,1 | 79,9 | 87,3 | 393,8 | 332,7 | 591,0 | 592,2 | 301,0 | 672,1 | 0,19 | 81,17 | 80,61 | 83,71 | 0,19 | 85,22 | 86,05 | 83,79 | 0,08 | 0,05 |
| 129,0 | 372,0 | 0,5 | 0,2 | 8,8 | 0,0 | 267,4 | 79,8 | 87,4 | 392,2 | 333,6 | 590,6 | 588,6 | 301,5 | 673,2 | 0,19 | 81,13 | 80,63 | 83,63 | 0,19 | 85,20 | 86,03 | 83,70 | 0,08 | 0,05 |
| 130,0 | 373,0 | 0,5 | 0,2 | 8,8 | 0,0 | 268,1 | 80,0 | 88,5 | 390,8 | 334,0 | 588,9 | 585,5 | 301,8 | 675,0 | 0,19 | 81,15 | 80,62 | 83,65 | 0,19 | 85,14 | 86,05 | 83,69 | 0,08 | 0,05 |
| 131,0 | 374,0 | 0,4 | 0,2 | 8,8 | 0,0 | 267,7 | 80,1 | 88,3 | 389,1 | 333,3 | 589,8 | 583,6 | 302,2 | 674,2 | 0,19 | 81,19 | 80,66 | 83,73 | 0,19 | 85,16 | 86,08 | 83,73 | 0,07 | 0,05 |
| 132,0 | 375,0 | 0,4 | 0,2 | 8,8 | 0,0 | 267,6 | 80,0 | 88,0 | 387,3 | 333,1 | 588,7 | 581,5 | 302,7 | 675,4 | 0,19 | 81,23 | 80,64 | 83,75 | 0,19 | 85,21 | 86,14 | 83,71 | 0,08 | 0,05 |
| 133,0 | 376,0 | 0,4 | 0,2 | 8,7 | 0,0 | 267,7 | 80,0 | 88,2 | 386,0 | 332,8 | 588,4 | 580,0 | 303,1 | 674,6 | 0,19 | 81,25 | 80,67 | 83,76 | 0,19 | 85,22 | 86,19 | 83,71 | 0,08 | 0,05 |
| 134,0 | 377,0 | 0,4 | 0,2 | 8,7 | 0,0 | 267,8 | 79,9 | 87,5 | 384,3 | 332,9 | 587,7 | 578,7 | 303,6 | 672,4 | 0,19 | 81,37 | 80,69 | 83,74 | 0,19 | 85,26 | 86,24 | 83,70 | 0,08 | 0,05 |
| 135,0 | 378,0 | 0,3 | 0,2 | 8,7 | 0,0 | 267,0 | 80,1 | 87,3 | 382,8 | 331,9 | 586,3 | 577,8 | 304,1 | 664,2 | 0,19 | 81,48 | 80,75 | 83,73 | 0,19 | 85,39 | 86,30 | 83,63 | 0,08 | 0,05 |
| 136,0 | 379,0 | 0,3 | 0,2 | 8,6 | 0,0 | 265,9 | 79,9 | 87,9 | 381,5 | 331,0 | 585,0 | 576,7 | 304,4 | 662,8 | 0,19 | 81,41 | 80,76 | 83,75 | 0,19 | 85,35 | 86,30 | 83,62 | 0,08 | 0,05 |
| 137,0 | 380,0 | 0,3 | 0,2 | 8,6 | 0,0 | 265,2 | 80,0 | 88,4 | 380,2 | 331,3 | 583,4 | 573,9 | 304,8 | 661,9 | 0,19 | 81,48 | 80,79 | 83,77 | 0,19 | 85,37 | 86,32 | 83,61 | 0,08 | 0,05 |
| 138,0 | 381,0 | 0,3 | 0,2 | 8,6 | 0,0 | 265,3 | 80,1 | 88,2 | 378,8 | 330,4 | 584,0 | 572,1 | 305,3 | 660,9 | 0,19 | 81,53 | 80,81 | 83,84 | 0,19 | 85,41 | 86,40 | 83,64 | 0,08 | 0,05 |
| 139,0 | 382,0 | 0,3 | 0,2 | 8,5 | 0,0 | 265,1 | 80,0 | 87,9 | 377,6 | 329,7 | 584,0 | 569,9 | 305,7 | 661,2 | 0,18 | 81,47 | 80,82 | 83,82 | 0,19 | 85,37 | 86,40 | 83,60 | 0,08 | 0,05 |
| 140,0 | 383,0 | 0,3 | 0,2 | 8,4 | 0,0 | 266,0 | 80,0 | 88,1 | 376,6 | 329,7 | 581,5 | 566,9 | 306,1 | 664,5 | 0,19 | 81,48 | 80,82 | 83,77 | 0,19 | 85,41 | 86,46 | 83,56 | 0,08 | 0,05 |
| 141,0 | 384,0 | 0,3 | 0,2 | 8,3 | 0,0 | 266,6 | 80,1 | 87,8 | 375,4 | 328,2 | 582,7 | 564,8 | 306,6 | 667,0 | 0,19 | 81,54 | 80,85 | 83,82 | 0,19 | 85,46 | 86,49 | 83,58 | 0,08 | 0,05 |
| 142,0 | 385,0 | 0,2 | 0,2 | 8,2 | 0,0 | 267,4 | 80,0 | 88,4 | 374,5 | 327,8 | 580,6 | 562,7 | 307,0 | 668,6 | 0,19 | 81,58 | 80,85 | 83,86 | 0,19 | 85,52 | 86,54 | 83,61 | 0,07 | 0,05 |
| 143,0 | 386,0 | 0,3 | 0,2 | 8,1 | 0,0 | 267,7 | 80,0 | 88,1 | 373,3 | 326,6 | 581,0 | 559,9 | 307,4 | 670,6 | 0,18 | 81,58 | 80,88 | 83,86 | 0,19 | 85,52 | 86,57 | 83,63 | 0,08 | 0,05 |
| 144,0 | 387,0 | 0,2 | 0,2 | 8,0 | 0,0 | 268,4 | 80,1 | 88,3 | 371,9 | 324,9 | 580,2 | 557,9 | 307,9 | 673,8 | 0,19 | 81,63 | 80,89 | 83,94 | 0,19 | 85,56 | 86,58 | 83,67 | 0,08 | 0,05 |
| 145,0 | 388,0 | 0,2 | 0,2 | 8,0 | 0,0 | 268,5 | 80,1 | 88,9 | 370,6 | 324,0 | 578,5 | 555,2 | 308,3 | 675,3 | 0,19 | 81,56 | 80,90 | 83,94 | 0,19 | 85,51 | 86,62 | 83,65 | 0,08 | 0,05 |
| 146,0 | 389,0 | 0,2 | 0,2 | 8,0 | 0,0 | 269,0 | 80,1 | 87,8 | 369,4 | 321,1 | 578,3 | 553,3 | 308,7 | 677,4 | 0,19 | 81,52 | 80,91 | 83,95 | 0,19 | 85,50 | 86,63 | 83,65 | 0,08 | 0,05 |
| 147,0 | 390,0 | 0,2 | 0,2 | 8,0 | 0,0 | 268,9 | 80,0 | 87,3 | 368,6 | 318,4 | 577,4 | 550,7 | 309,0 | 677,5 | 0,19 | 81,49 | 80,91 | 83,88 | 0,19 | 85,44 | 86,60 | 83,56 | 0,08 | 0,05 |
| 148,0 | 391,0 | 0,2 | 0,2 | 7,9 | 0,0 | 269,1 | 80,1 | 87,3 | 367,5 | 317,8 | 575,4 | 548,4 | 309,4 | 677,9 | 0,19 | 81,70 | 80,96 | 83,83 | 0,19 | 85,51 | 86,57 | 83,53 | 0,08 | 0,05 |
| 149,0 | 392,0 | 0,2 | 0,2 | 7,9 | 0,0 | 268,4 | 80,2 | 87,2 | 366,2 | 315,3 | 574,9 | 546,1 | 309,7 | 678,6 | 0,19 | 81,82 | 81,00 | 83,80 | 0,19 | 85,58 | 86,57 | 83,48 | 0,08 | 0,05 |
| 150,0 | 393,0 | 0,1 | 0,2 | 7,8 | 0,0 | 268,7 | 80,2 | 87,4 | 365,3 | 314,5 | 573,9 | 542,6 | 310,0 | 678,3 | 0,19 | 81,76 | 80,98 | 83,80 | 0,19 | 85,54 | 86,53 | 83,45 | 0,08 | 0,05 |
| 151,0 | 394,0 | 0,1 | 0,2 | 7,9 | 0,0 | 268,2 | 80,3 | 87,3 | 364,1 | 313,7 | 573,5 | 539,8 | 310,3 | 678,2 | 0,19 | 81,69 | 81,01 | 83,81 | 0,19 | 85,53 | 86,52 | 83,43 | 0,08 | 0,05 |
| 152,0 | 395,0 | 0,1 | 0,2 | 7,8 | 0,0 | 268,3 | 80,2 | 87,1 | 363,1 | 311,6 | 571,6 | 538,0 | 310,5 | 681,0 | 0,19 | 81,64 | 81,01 | 83,81 | 0,19 | 85,53 | 86,53 | 83,46 | 0,08 | 0,05 |
| 153,0 | 396,0 | 0,1 | 0,2 | 7,6 | 0,0 | 268,4 | 80,2 | 87,3 | 362,1 | 311,0 | 570,7 | 535,3 | 310,8 | 680,9 | 0,19 | 81,60 | 81,01 | 83,80 | 0,19 | 85,49 | 86,51 | 83,44 | 0,08 | 0,05 |
| 154,0 | 397,0 | 0,1 | 0,2 | 7,6 | 0,0 | 269,1 | 80,2 | 87,9 | 360,8 | 308,5 | 568,9 | 532,6 | 311,0 | 680,6 | 0,19 | 81,65 | 81,00 | 83,86 | 0,19 | 85,49 | 86,53 | 83,48 | 0,08 | 0,05 |
| 155,0 | 398,0 | 0,1 | 0,2 | 7,6 | 0,0 | 269,1 | 80,3 | 87,4 | 359,8 | 307,2 | 567,7 | 530,0 | 311,1 | 678,0 | 0,19 | 81,57 | 81,01 | 83,83 | 0,19 | 85,44 | 86,51 | 83,43 | 0,08 | 0,05 |
| 156,0 | 399,0 | 0,1 | 0,2 | 7,5 | 0,0 | 268,3 | 80,2 | 87,5 | 358,6 | 306,1 | 567,3 | 527,3 | 311,3 | 676,8 | 0,19 | 81,52 | 81,01 | 83,84 | 0,19 | 85,42 | 86,46 | 83,40 | 0,07 | 0,05 |
| 157,0 | 400,0 | 0,1 | 0,2 | 7,4 | 0,0 | 268,9 | 80,3 | 88,0 | 357,7 | 306,1 | 566,2 | 524,8 | 311,6 | 678,1 | 0,19 | 81,57 | 81,01 | 83,86 | 0,19 | 85,45 | 86,50 | 83,45 | 0,08 | 0,05 |
| 158,0 | 401,0 | 0,1 | 0,2 | 7,4 | 0,0 | 268,4 | 80,3 | 87,6 | 356,3 | 304,8 | 565,1 | 522,5 | 311,9 | 676,6 | 0,19 | 81,56 | 81,02 | 83,85 | 0,19 | 85,44 | 86,51 | 83,50 | 0,08 | 0,05 |
| 159,0 | 402,0 | 0,1 | 0,2 | 7,0 | 0,0 | 269,6 | 80,2 | 89,2 | 355,0 | 304,6 | 562,6 | 520,1 | 312,2 | 680,0 | 0,19 | 81,66 | 81,03 | 83,92 | 0,19 | 85,55 | 86,57 | 83,58 | 0,08 | 0,05 |
| 160,0 | 403,0 | 0,1 | 0,3 | 7,0 | 0,0 | 270,4 | 80,4 | 88,4 | 353,5 | 303,4 | 561,8 | 517,5 | 312,4 | 678,5 | 0,19 | 81,76 | 81,05 | 84,01 | 0,19 | 85,60 | 86,61 | 83,61 | 0,08 | 0,05 |
| 161,0 | 404,0 | 0,1 | 0,2 | 6,7 | 0,0 | 269,4 | 80,2 | 88,8 | 351,4 | 301,9 | 553,8 | 514,6 | 312,4 | 669,7 | 0,19 | 81,99 | 81,12 | 84,06 | 0,19 | 85,73 | 86,72 | 83,67 | 0,08 | 0,05 |
| 162,0 | 405,0 | 0,0 | 0,2 | 6,5 | 0,0 | 268,5 | 80,4 | 89,1 | 350,3 | 301,1 | 555,9 | 511,7 | 312,7 | 665,2 | 0,19 | 82,22 | 81,19 | 84,02 | 0,19 | 85,82 | 86,83 | 83,64 | 0,08 | 0,05 |

Manufacturer: HEARTHSTONE
Model: 8060

Run: 6
Project #: PI 20272
Test Duration: 162 min

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

| | HHV | LHV |
|---|---|---|
| Eff | 79,70% | 86,15% |
| Comb Eff | 98,97% | 98,97% |
| HT Eff | 80,54% | 87,04% |
| Output | 15 178 | kJ/h |
| Burn Rate | 0,96 | kg/h |
| Grams CO | 48 | g |
| Input | 19 042 | kJ/h |
| MC wet | 16,82 | |

Ultimate $CO_2$
$CO_{2\text{-ult}}$ 19,64
$F_0$
1,062

Overall Heating Efficiency: 79,70%
Combustion Efficiency: 98,97%
Heat Transfer Efficiency: 80,54%

Heat Output: 14 398 Btu/h
Heat Input: 18 064 Btu/h
Burn Duration: 2,70 h
Burn Rate: 2,12 lb/h
Stack Temp: 292,2 Deg. F

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Averages | 0,16 | 9,51 | 1,35 | 20,30 | 10,71 | 144,61 | 26,32 | 0,99 | 0,80 | #DIV/0! |
| INPUT DATA | | | Oxygen Calculation | | | Input Data | | Combust | Heat | Net |
| Elapsed Time | Weight Remaining (kg) | % CO [e] | % $CO_2$ [d] | Excess Air EA | Total $O_2$ | Calc. % $O_2$ [g] | Flue Gas (°C) | Room Temp (°C) | Eff % | Transfer % | Eff % |
| 0,00 | 3,12 | 0,08 | 2,78 | 585,3% | 20,75 | 17,93 | 156,8 | 25,8 | 99,4% | 60,6% | 60,2% |
| 1,00 | 3,07 | 0,13 | 2,55 | 633,6% | 20,76 | 18,15 | 141,2 | 25,7 | 97,8% | 61,8% | 60,5% |
| 2,00 | 3,07 | 0,05 | 4,04 | 380,5% | 20,67 | 16,61 | 142,7 | 25,6 | 100,2% | 71,4% | 71,5% |
| 3,00 | 3,07 | 0,04 | 4,15 | 369,1% | 20,66 | 16,50 | 144,0 | 25,6 | 100,4% | 71,6% | 71,9% |
| 4,00 | 3,03 | 0,04 | 3,79 | 412,9% | 20,69 | 16,88 | 144,9 | 25,6 | 100,5% | 69,9% | 70,2% |
| 5,00 | 3,03 | 0,04 | 3,49 | 456,2% | 20,71 | 17,20 | 145,1 | 25,6 | 100,5% | 68,3% | 68,6% |
| 6,00 | 3,03 | 0,03 | 3,96 | 391,8% | 20,68 | 16,70 | 131,7 | 25,7 | 100,5% | 72,8% | 73,2% |
| 7,00 | 2,98 | 0,05 | 3,62 | 435,9% | 20,70 | 17,06 | 125,1 | 25,8 | 100,2% | 72,5% | 72,7% |
| 8,00 | 2,98 | 0,05 | 3,99 | 385,4% | 20,67 | 16,65 | 124,1 | 25,9 | 100,1% | 74,2% | 74,3% |
| 9,00 | 2,94 | 0,04 | 8,42 | 132,1% | 20,38 | 11,94 | 126,2 | 25,7 | 100,0% | 81,7% | 81,7% |
| 10,00 | 2,94 | 0,05 | 6,68 | 191,7% | 20,50 | 13,79 | 126,9 | 25,8 | 100,0% | 79,8% | 79,8% |
| 11,00 | 2,89 | 0,06 | 3,48 | 454,8% | 20,71 | 17,19 | 125,6 | 25,8 | 100,1% | 71,8% | 71,9% |
| 12,00 | 2,89 | 0,05 | 3,28 | 488,7% | 20,72 | 17,41 | 123,1 | 25,6 | 100,2% | 71,2% | 71,4% |
| 13,00 | 2,89 | 0,05 | 3,86 | 401,3% | 20,68 | 16,79 | 121,5 | 25,7 | 100,1% | 74,1% | 74,2% |
| 14,00 | 2,87 | 0,06 | 3,21 | 499,6% | 20,72 | 17,48 | 121,1 | 25,7 | 100,0% | 71,3% | 71,2% |
| 15,00 | 2,89 | 0,06 | 2,92 | 558,5% | 20,74 | 17,79 | 120,4 | 25,8 | 100,1% | 69,7% | 69,8% |
| 16,00 | 2,85 | 0,04 | 3,77 | 415,2% | 20,69 | 16,90 | 117,8 | 25,8 | 100,4% | 74,4% | 74,7% |
| 17,00 | 2,85 | 0,04 | 4,07 | 378,2% | 20,67 | 16,58 | 117,1 | 25,7 | 100,3% | 75,6% | 75,8% |
| 18,00 | 2,80 | 0,04 | 4,46 | 336,2% | 20,64 | 16,16 | 115,7 | 25,8 | 100,3% | 77,0% | 77,2% |
| 19,00 | 2,80 | 0,04 | 4,62 | 321,6% | 20,63 | 15,99 | 115,2 | 25,8 | 100,3% | 77,4% | 77,7% |
| 20,00 | 2,76 | 0,04 | 4,88 | 299,5% | 20,62 | 15,72 | 115,1 | 25,8 | 100,3% | 78,1% | 78,3% |
| 21,00 | 2,76 | 0,03 | 7,08 | 176,3% | 20,47 | 13,38 | 118,2 | 25,8 | 100,1% | 81,1% | 81,2% |
| 22,00 | 2,71 | 0,19 | 10,62 | 81,5% | 20,23 | 9,50 | 127,8 | 25,9 | 98,7% | 83,0% | 82,0% |
| 23,00 | 2,71 | 0,19 | 11,39 | 69,7% | 20,18 | 8,70 | 136,7 | 25,9 | 98,8% | 82,8% | 81,9% |
| 24,00 | 2,67 | 0,12 | 10,88 | 78,6% | 20,21 | 9,28 | 139,9 | 25,9 | 99,4% | 82,4% | 81,8% |
| 25,00 | 2,62 | 0,07 | 10,00 | 95,2% | 20,28 | 10,25 | 139,6 | 25,9 | 99,7% | 81,9% | 81,7% |
| 26,00 | 2,58 | 0,05 | 9,33 | 109,4% | 20,32 | 10,97 | 138,3 | 26,0 | 99,9% | 81,5% | 81,4% |
| 27,00 | 2,57 | 0,04 | 9,20 | 112,6% | 20,33 | 11,11 | 136,8 | 26,0 | 100,0% | 81,5% | 81,5% |
| 28,00 | 2,53 | 0,06 | 9,19 | 112,3% | 20,33 | 11,11 | 136,6 | 26,1 | 99,8% | 81,5% | 81,4% |
| 29,00 | 2,48 | 0,05 | 8,80 | 122,0% | 20,36 | 11,53 | 135,6 | 26,1 | 99,9% | 81,3% | 81,2% |
| 30,00 | 2,48 | 0,05 | 8,78 | 122,5% | 20,36 | 11,55 | 134,9 | 26,2 | 99,9% | 81,3% | 81,3% |
| 31,00 | 2,44 | 0,04 | 8,65 | 126,1% | 20,37 | 11,70 | 134,7 | 26,2 | 100,0% | 81,2% | 81,2% |
| 32,00 | 2,44 | 0,04 | 8,80 | 122,3% | 20,36 | 11,54 | 133,8 | 26,2 | 100,0% | 81,4% | 81,4% |
| 33,00 | 2,39 | 0,04 | 8,83 | 121,6% | 20,35 | 11,51 | 133,3 | 26,3 | 100,0% | 81,5% | 81,5% |
| 34,00 | 2,35 | 0,04 | 8,99 | 117,4% | 20,34 | 11,33 | 133,4 | 26,2 | 100,0% | 81,6% | 81,6% |
| 35,00 | 2,35 | 0,05 | 9,39 | 108,1% | 20,32 | 10,90 | 136,4 | 26,2 | 99,9% | 81,7% | 81,6% |
| 36,00 | 2,30 | 0,10 | 10,43 | 86,5% | 20,24 | 9,76 | 140,9 | 26,2 | 99,4% | 82,1% | 81,6% |
| 37,00 | 2,26 | 0,07 | 11,26 | 73,5% | 20,19 | 8,90 | 144,4 | 26,1 | 99,7% | 82,3% | 82,1% |
| 38,00 | 2,24 | 0,09 | 11,30 | 72,5% | 20,19 | 8,84 | 146,8 | 26,1 | 99,6% | 82,2% | 81,9% |
| 39,00 | 2,21 | 0,10 | 11,75 | 65,7% | 20,16 | 8,36 | 152,9 | 26,1 | 99,5% | 82,1% | 81,6% |
| 40,00 | 2,15 | 0,63 | 13,53 | 38,7% | 20,01 | 6,16 | 160,2 | 26,1 | 96,4% | 82,3% | 79,3% |
| 41,00 | 2,12 | 0,59 | 13,78 | 36,7% | 19,99 | 5,92 | 165,2 | 26,1 | 96,7% | 82,2% | 79,4% |
| 42,00 | 2,03 | 0,23 | 13,68 | 41,2% | 20,02 | 6,23 | 169,0 | 26,1 | 98,7% | 82,0% | 81,0% |
| 43,00 | 1,99 | 0,18 | 13,58 | 42,8% | 20,03 | 6,36 | 171,9 | 25,9 | 99,0% | 81,8% | 81,0% |
| 44,00 | 1,94 | 0,24 | 13,63 | 41,6% | 20,02 | 6,27 | 174,5 | 26,1 | 98,6% | 81,7% | 80,6% |
| 45,00 | 1,92 | 0,35 | 13,51 | 41,8% | 20,03 | 6,34 | 176,2 | 26,1 | 98,0% | 81,5% | 79,9% |
| 46,00 | 1,85 | 0,35 | 13,54 | 41,3% | 20,02 | 6,30 | 176,7 | 26,1 | 98,0% | 81,5% | 79,8% |
| 47,00 | 1,80 | 0,36 | 13,54 | 41,3% | 20,02 | 6,30 | 176,6 | 26,1 | 97,9% | 81,5% | 79,8% |
| 48,00 | 1,76 | 0,35 | 13,56 | 41,2% | 20,02 | 6,29 | 176,2 | 26,0 | 98,0% | 81,5% | 79,9% |
| 49,00 | 1,71 | 0,41 | 13,50 | 41,3% | 20,02 | 6,32 | 177,2 | 26,1 | 97,7% | 81,4% | 79,5% |
| 50,00 | 1,67 | 0,38 | 13,55 | 41,0% | 20,02 | 6,28 | 177,2 | 26,1 | 97,8% | 81,5% | 79,7% |
| 51,00 | 1,63 | 0,32 | 13,61 | 41,0% | 20,02 | 6,25 | 177,0 | 26,1 | 98,2% | 81,5% | 80,0% |
| 52,00 | 1,62 | 0,28 | 13,61 | 41,5% | 20,02 | 6,27 | 177,4 | 26,2 | 98,4% | 81,5% | 80,3% |
| 53,00 | 1,53 | 0,26 | 13,58 | 42,0% | 20,03 | 6,32 | 178,1 | 26,3 | 98,5% | 81,5% | 80,3% |
| 54,00 | 1,49 | 0,28 | 13,58 | 41,7% | 20,02 | 6,31 | 178,4 | 26,2 | 98,4% | 81,5% | 80,2% |
| 55,00 | 1,44 | 0,31 | 13,56 | 41,6% | 20,02 | 6,31 | 178,7 | 26,2 | 98,2% | 81,4% | 80,0% |
| 56,00 | 1,39 | 0,34 | 13,51 | 41,8% | 20,03 | 6,34 | 178,1 | 26,1 | 98,0% | 81,4% | 79,8% |
| 57,00 | 1,39 | 0,34 | 13,48 | 42,1% | 20,03 | 6,37 | 177,4 | 26,2 | 98,0% | 81,4% | 79,8% |
| 58,00 | 1,33 | 0,30 | 13,69 | 40,4% | 20,02 | 6,17 | 177,7 | 26,2 | 98,3% | 81,6% | 80,2% |
| 59,00 | 1,30 | 0,24 | 13,87 | 39,2% | 20,01 | 6,02 | 178,8 | 26,3 | 98,7% | 81,6% | 80,5% |
| 60,00 | 1,26 | 0,85 | 13,86 | 33,5% | 19,97 | 5,68 | 179,3 | 26,3 | 95,2% | 81,4% | 77,5% |
| 61,00 | 1,21 | 0,53 | 13,68 | 38,2% | 20,00 | 6,06 | 178,5 | 26,3 | 97,0% | 81,4% | 78,9% |
| 62,00 | 1,21 | 0,34 | 13,51 | 41,7% | 20,02 | 6,34 | 177,2 | 26,3 | 98,0% | 81,5% | 79,9% |
| 63,00 | 1,17 | 0,19 | 13,10 | 47,8% | 20,06 | 6,87 | 175,5 | 26,3 | 98,9% | 81,4% | 80,6% |
| 64,00 | 1,15 | 0,11 | 12,74 | 52,8% | 20,09 | 7,30 | 173,9 | 26,2 | 99,4% | 81,3% | 80,9% |
| 65,00 | 1,12 | 0,08 | 12,49 | 56,3% | 20,11 | 7,58 | 171,4 | 26,2 | 99,6% | 81,4% | 81,1% |
| 66,00 | 1,08 | 0,10 | 12,61 | 54,6% | 20,10 | 7,44 | 170,2 | 26,2 | 99,5% | 81,5% | 81,1% |
| 67,00 | 1,04 | 0,09 | 12,42 | 57,0% | 20,11 | 7,65 | 169,1 | 26,2 | 99,6% | 81,5% | 81,1% |
| 68,00 | 1,03 | 0,10 | 12,57 | 55,0% | 20,10 | 7,48 | 168,8 | 26,2 | 99,5% | 81,5% | 81,1% |
| 69,00 | 0,99 | 0,14 | 12,82 | 51,5% | 20,08 | 7,19 | 169,2 | 26,2 | 99,2% | 81,6% | 81,0% |
| 70,00 | 0,99 | 0,11 | 12,82 | 51,9% | 20,09 | 7,21 | 168,8 | 26,3 | 99,4% | 81,7% | 81,2% |
| 71,00 | 0,94 | 0,11 | 12,57 | 54,9% | 20,10 | 7,48 | 167,4 | 26,3 | 99,5% | 81,6% | 81,2% |
| 72,00 | 0,90 | 0,10 | 12,44 | 56,7% | 20,11 | 7,63 | 167,2 | 26,3 | 99,5% | 81,6% | 81,2% |
| 73,00 | 0,90 | 0,19 | 12,75 | 51,7% | 20,09 | 7,24 | 166,6 | 26,3 | 98,9% | 81,7% | 80,9% |
| 74,00 | 0,85 | 0,08 | 12,06 | 61,8% | 20,14 | 8,04 | 164,6 | 26,3 | 99,6% | 81,5% | 81,2% |
| 75,00 | 0,85 | 0,12 | 12,43 | 56,6% | 20,11 | 7,63 | 165,5 | 26,2 | 99,4% | 81,7% | 81,2% |
| 76,00 | 0,80 | 0,19 | 12,98 | 49,1% | 20,07 | 6,99 | 165,9 | 26,3 | 99,0% | 81,9% | 81,1% |
| 77,00 | 0,80 | 0,13 | 12,62 | 54,1% | 20,10 | 7,41 | 164,8 | 26,3 | 99,3% | 81,8% | 81,3% |
| 78,00 | 0,76 | 0,08 | 12,52 | 55,9% | 20,11 | 7,55 | 163,3 | 26,4 | 99,6% | 81,9% | 81,6% |
| 79,00 | 0,75 | 0,08 | 12,36 | 57,9% | 20,12 | 7,72 | 162,3 | 26,3 | 99,6% | 81,8% | 81,5% |
| 80,00 | 0,71 | 0,06 | 11,96 | 63,4% | 20,15 | 8,15 | 161,1 | 26,3 | 99,8% | 81,7% | 81,5% |
| 81,00 | 0,67 | 0,07 | 12,18 | 60,4% | 20,13 | 7,92 | 159,5 | 26,4 | 99,7% | 81,9% | 81,7% |
| 82,00 | 0,67 | 0,05 | 11,75 | 66,4% | 20,16 | 8,39 | 158,7 | 26,3 | 99,8% | 81,7% | 81,6% |
| 83,00 | 0,62 | 0,05 | 11,34 | 72,6% | 20,19 | 8,83 | 156,9 | 26,3 | 99,9% | 81,6% | 81,5% |
| 84,00 | 0,62 | 0,04 | 11,17 | 75,1% | 20,20 | 9,00 | 155,3 | 26,3 | 99,9% | 81,6% | 81,5% |
| 85,00 | 0,62 | 0,04 | 11,06 | 77,0% | 20,21 | 9,13 | 154,0 | 26,3 | 99,9% | 81,6% | 81,6% |
| 86,00 | 0,58 | 0,06 | 11,12 | 75,7% | 20,20 | 9,05 | 153,8 | 26,3 | 99,8% | 81,7% | 81,5% |
| 87,00 | 0,58 | 0,07 | 11,24 | 73,8% | 20,19 | 8,92 | 154,3 | 26,3 | 99,7% | 81,7% | 81,5% |
| 88,00 | 0,58 | 0,08 | 11,45 | 70,3% | 20,18 | 8,68 | 155,4 | 26,4 | 99,6% | 81,8% | 81,4% |
| 89,00 | 0,53 | 0,08 | 11,15 | 74,9% | 20,20 | 9,01 | 154,8 | 26,3 | 99,6% | 81,6% | 81,3% |
| 90,00 | 0,53 | 0,09 | 11,22 | 73,8% | 20,19 | 8,93 | 154,0 | 26,4 | 99,6% | 81,7% | 81,4% |
| 91,00 | 0,53 | 0,10 | 11,38 | 71,1% | 20,18 | 8,75 | 153,0 | 26,3 | 99,5% | 81,9% | 81,5% |
| 92,00 | 0,49 | 0,09 | 11,30 | 72,5% | 20,19 | 8,84 | 151,6 | 26,4 | 99,6% | 81,9% | 81,6% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 93,00 | 0,49 | 0,07 | 11,05 | 76,6% | 20,21 | 9,12 | 149,4 | 26,4 | 99,7% | 81,9% | 81,7% |
| 94,00 | 0,49 | 0,07 | 10,78 | 81,1% | 20,22 | 9,41 | 147,1 | 26,4 | 99,7% | 81,9% | 81,7% |
| 95,00 | 0,49 | 0,07 | 10,41 | 87,4% | 20,25 | 9,80 | 144,5 | 26,4 | 99,7% | 81,8% | 81,6% |
| 96,00 | 0,47 | 0,06 | 9,93 | 96,6% | 20,28 | 10,32 | 142,5 | 26,3 | 99,8% | 81,6% | 81,4% |
| 97,00 | 0,44 | 0,07 | 9,98 | 95,5% | 20,28 | 10,26 | 140,5 | 26,4 | 99,7% | 81,8% | 81,6% |
| 98,00 | 0,44 | 0,07 | 9,81 | 98,7% | 20,29 | 10,44 | 138,6 | 26,4 | 99,7% | 81,8% | 81,6% |
| 99,00 | 0,44 | 0,09 | 9,55 | 103,7% | 20,30 | 10,71 | 138,5 | 26,4 | 99,5% | 81,7% | 81,3% |
| 100,00 | 0,40 | 0,11 | 9,37 | 107,3% | 20,31 | 10,89 | 138,4 | 26,4 | 99,4% | 81,5% | 81,0% |
| 101,00 | 0,40 | 0,12 | 9,28 | 109,0% | 20,32 | 10,98 | 137,6 | 26,4 | 99,3% | 81,5% | 80,9% |
| 102,00 | 0,40 | 0,12 | 9,28 | 108,9% | 20,32 | 10,98 | 137,2 | 26,5 | 99,2% | 81,5% | 80,9% |
| 103,00 | 0,40 | 0,13 | 9,16 | 111,4% | 20,33 | 11,10 | 137,0 | 26,5 | 99,2% | 81,5% | 80,8% |
| 104,00 | 0,40 | 0,14 | 9,09 | 112,8% | 20,33 | 11,17 | 136,3 | 26,4 | 99,1% | 81,5% | 80,7% |
| 105,00 | 0,40 | 0,14 | 9,06 | 113,4% | 20,33 | 11,20 | 136,0 | 26,5 | 99,0% | 81,5% | 80,7% |
| 106,00 | 0,40 | 0,15 | 9,00 | 114,7% | 20,34 | 11,26 | 135,9 | 26,6 | 99,0% | 81,4% | 80,6% |
| 107,00 | 0,40 | 0,16 | 8,95 | 115,9% | 20,34 | 11,32 | 136,1 | 26,5 | 98,9% | 81,3% | 80,5% |
| 108,00 | 0,35 | 0,16 | 8,88 | 117,2% | 20,34 | 11,38 | 136,1 | 26,6 | 98,9% | 81,3% | 80,4% |
| 109,00 | 0,35 | 0,17 | 8,81 | 118,8% | 20,35 | 11,45 | 136,1 | 26,6 | 98,8% | 81,2% | 80,3% |
| 110,00 | 0,35 | 0,17 | 8,88 | 117,0% | 20,34 | 11,37 | 136,4 | 26,5 | 98,8% | 81,3% | 80,3% |
| 111,00 | 0,35 | 0,17 | 8,94 | 115,5% | 20,34 | 11,31 | 136,2 | 26,5 | 98,8% | 81,3% | 80,3% |
| 112,00 | 0,31 | 0,18 | 8,95 | 115,3% | 20,34 | 11,30 | 135,9 | 26,6 | 98,7% | 81,4% | 80,3% |
| 113,00 | 0,33 | 0,18 | 8,96 | 115,0% | 20,34 | 11,29 | 136,3 | 26,3 | 98,7% | 81,3% | 80,3% |
| 114,00 | 0,30 | 0,17 | 9,01 | 113,9% | 20,33 | 11,24 | 135,6 | 26,5 | 98,8% | 81,4% | 80,4% |
| 115,00 | 0,31 | 0,17 | 9,00 | 114,3% | 20,33 | 11,25 | 135,1 | 26,6 | 98,8% | 81,5% | 80,5% |
| 116,00 | 0,31 | 0,17 | 8,80 | 119,0% | 20,35 | 11,46 | 134,7 | 26,6 | 98,8% | 81,3% | 80,3% |
| 117,00 | 0,31 | 0,17 | 8,83 | 118,2% | 20,35 | 11,43 | 134,7 | 26,5 | 98,8% | 81,4% | 80,3% |
| 118,00 | 0,31 | 0,15 | 9,39 | 105,8% | 20,31 | 10,84 | 133,5 | 26,6 | 99,0% | 81,9% | 81,0% |
| 119,00 | 0,26 | 0,15 | 9,14 | 111,3% | 20,33 | 11,11 | 132,8 | 26,7 | 99,0% | 81,8% | 80,9% |
| 120,00 | 0,26 | 0,15 | 9,04 | 113,6% | 20,33 | 11,21 | 132,0 | 26,7 | 98,9% | 81,8% | 80,9% |
| 121,00 | 0,26 | 0,15 | 8,82 | 119,1% | 20,35 | 11,46 | 131,5 | 26,7 | 99,0% | 81,6% | 80,8% |
| 122,00 | 0,26 | 0,15 | 8,70 | 122,0% | 20,36 | 11,58 | 131,0 | 26,7 | 98,9% | 81,6% | 80,7% |
| 123,00 | 0,26 | 0,16 | 8,62 | 123,9% | 20,36 | 11,67 | 131,0 | 26,6 | 98,9% | 81,5% | 80,6% |
| 124,00 | 0,22 | 0,17 | 8,88 | 117,1% | 20,34 | 11,38 | 130,9 | 26,6 | 98,8% | 81,7% | 80,7% |
| 125,00 | 0,22 | 0,17 | 8,86 | 117,5% | 20,34 | 11,40 | 130,8 | 26,6 | 98,8% | 81,7% | 80,7% |
| 126,00 | 0,22 | 0,17 | 8,59 | 124,5% | 20,36 | 11,69 | 130,5 | 26,5 | 98,8% | 81,5% | 80,5% |
| 127,00 | 0,22 | 0,17 | 8,50 | 126,5% | 20,37 | 11,78 | 130,4 | 26,7 | 98,7% | 81,4% | 80,4% |
| 128,00 | 0,22 | 0,17 | 8,63 | 123,1% | 20,36 | 11,64 | 130,6 | 26,6 | 98,7% | 81,5% | 80,5% |
| 129,00 | 0,22 | 0,18 | 8,78 | 119,1% | 20,35 | 11,47 | 130,8 | 26,6 | 98,6% | 81,6% | 80,5% |
| 130,00 | 0,22 | 0,19 | 8,80 | 118,7% | 20,35 | 11,46 | 131,1 | 26,7 | 98,6% | 81,6% | 80,5% |
| 131,00 | 0,18 | 0,19 | 8,78 | 119,0% | 20,35 | 11,47 | 130,9 | 26,7 | 98,6% | 81,6% | 80,5% |
| 132,00 | 0,17 | 0,19 | 8,78 | 119,0% | 20,35 | 11,47 | 130,9 | 26,7 | 98,6% | 81,6% | 80,5% |
| 133,00 | 0,17 | 0,19 | 8,75 | 119,8% | 20,35 | 11,51 | 130,9 | 26,7 | 98,6% | 81,6% | 80,4% |
| 134,00 | 0,17 | 0,19 | 8,70 | 121,0% | 20,35 | 11,56 | 131,0 | 26,6 | 98,6% | 81,5% | 80,4% |
| 135,00 | 0,15 | 0,18 | 8,73 | 120,5% | 20,35 | 11,53 | 130,5 | 26,7 | 98,7% | 81,6% | 80,5% |
| 136,00 | 0,12 | 0,18 | 8,65 | 122,6% | 20,36 | 11,62 | 129,9 | 26,6 | 98,7% | 81,6% | 80,5% |
| 137,00 | 0,12 | 0,18 | 8,60 | 123,7% | 20,36 | 11,67 | 129,6 | 26,7 | 98,7% | 81,6% | 80,5% |
| 138,00 | 0,12 | 0,18 | 8,58 | 124,1% | 20,36 | 11,69 | 129,6 | 26,7 | 98,6% | 81,6% | 80,4% |
| 139,00 | 0,12 | 0,18 | 8,47 | 127,0% | 20,37 | 11,81 | 129,5 | 26,7 | 98,6% | 81,5% | 80,3% |
| 140,00 | 0,12 | 0,19 | 8,42 | 128,2% | 20,37 | 11,86 | 130,0 | 26,7 | 98,5% | 81,4% | 80,2% |
| 141,00 | 0,12 | 0,20 | 8,34 | 130,1% | 20,38 | 11,94 | 130,3 | 26,7 | 98,4% | 81,3% | 80,0% |
| 142,00 | 0,08 | 0,20 | 8,22 | 133,2% | 20,38 | 12,06 | 130,8 | 26,7 | 98,4% | 81,1% | 79,8% |
| 143,00 | 0,12 | 0,21 | 8,10 | 136,3% | 20,39 | 12,18 | 130,9 | 26,7 | 98,3% | 81,0% | 79,6% |
| 144,00 | 0,09 | 0,21 | 8,04 | 138,1% | 20,40 | 12,25 | 131,3 | 26,7 | 98,3% | 80,9% | 79,5% |
| 145,00 | 0,08 | 0,21 | 8,02 | 138,5% | 20,40 | 12,27 | 131,4 | 26,7 | 98,2% | 80,9% | 79,5% |
| 146,00 | 0,08 | 0,22 | 7,99 | 139,4% | 20,40 | 12,30 | 131,6 | 26,7 | 98,2% | 80,8% | 79,4% |
| 147,00 | 0,08 | 0,22 | 7,97 | 139,8% | 20,40 | 12,32 | 131,6 | 26,7 | 98,2% | 80,8% | 79,3% |
| 148,00 | 0,08 | 0,22 | 7,92 | 141,3% | 20,40 | 12,37 | 131,7 | 26,7 | 98,2% | 80,8% | 79,3% |
| 149,00 | 0,08 | 0,22 | 7,94 | 140,7% | 20,40 | 12,35 | 131,3 | 26,8 | 98,1% | 80,8% | 79,3% |
| 150,00 | 0,06 | 0,22 | 7,84 | 143,6% | 20,41 | 12,46 | 131,5 | 26,8 | 98,1% | 80,7% | 79,2% |
| 151,00 | 0,03 | 0,23 | 7,89 | 142,0% | 20,40 | 12,40 | 131,2 | 26,8 | 98,1% | 80,8% | 79,2% |
| 152,00 | 0,03 | 0,23 | 7,78 | 145,2% | 20,41 | 12,51 | 131,3 | 26,8 | 98,0% | 80,7% | 79,1% |
| 153,00 | 0,03 | 0,23 | 7,64 | 149,5% | 20,42 | 12,66 | 131,3 | 26,8 | 98,0% | 80,5% | 78,9% |
| 154,00 | 0,03 | 0,23 | 7,60 | 150,8% | 20,42 | 12,71 | 131,7 | 26,8 | 97,9% | 80,4% | 78,8% |
| 155,00 | 0,03 | 0,23 | 7,64 | 149,5% | 20,42 | 12,66 | 131,7 | 26,8 | 98,0% | 80,5% | 78,9% |
| 156,00 | 0,03 | 0,23 | 7,51 | 153,8% | 20,43 | 12,80 | 131,3 | 26,8 | 98,0% | 80,4% | 78,8% |
| 157,00 | 0,03 | 0,23 | 7,45 | 155,8% | 20,43 | 12,87 | 131,6 | 26,8 | 97,9% | 80,3% | #DIV/0! |
| 158,00 | 0,03 | 0,23 | 7,35 | 158,9% | 20,44 | 12,97 | 131,3 | 26,8 | 97,9% | 80,2% | 78,5% |
| 159,00 | 0,02 | 0,25 | 7,03 | 169,9% | 20,46 | 13,30 | 132,0 | 26,8 | 97,7% | 79,7% | 77,9% |
| 160,00 | 0,02 | 0,26 | 6,97 | 171,9% | 20,46 | 13,37 | 132,4 | 26,9 | 97,5% | 79,6% | #DIV/0! |
| 161,00 | 0,02 | 0,24 | 6,69 | 183,4% | 20,48 | 13,67 | 131,9 | 26,8 | 97,7% | 79,3% | 77,5% |
| 162,00 | 0,00 | 0,23 | 6,54 | 190,4% | 20,49 | 13,84 | 131,4 | 26,9 | 97,8% | 79,1% | 77,4% |

DATA 2022-07-26 EPA PI 20272 RUN 6 MODEL 8060 OTHER CATALIST
preburn

| Temps | Flue | Room | Tunnel | Catalyst up | scale | Right | Back | bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|
| acquisition | temp | temp | dry bulb | | | | | | | |
| minutes | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| 1 | 73,86 | 72,21 | 73,71 | 79,54 | 2,97 | 75,62 | 75,19 | 75,71 | 75,44 | 75,72 |
| 2 | 81,95 | 72,16 | 74,02 | 89,24 | 2,87 | 75,65 | 75,54 | 75,77 | 75,49 | 75,81 |
| 3 | 104,43 | 72,28 | 75,83 | 127,66 | 2,79 | 75,89 | 75,84 | 76,23 | 75,66 | 76,59 |
| 4 | 186,14 | 72,24 | 83,03 | 218,75 | 2,67 | 76,52 | 76,42 | 77,31 | 76,43 | 79,44 |
| 5 | 168,06 | 72,19 | 75,72 | 238,82 | 2,67 | 78,62 | 78,13 | 79,50 | 78,28 | 88,53 |
| 6 | 177,74 | 72,12 | 75,80 | 294,91 | 2,57 | 82,19 | 80,39 | 82,37 | 80,61 | 102,50 |
| 7 | 223,01 | 72,14 | 77,08 | 412,74 | 2,57 | 86,75 | 82,91 | 85,19 | 83,58 | 118,27 |
| 8 | 263,07 | 72,37 | 78,36 | 489,42 | 2,37 | 93,09 | 85,92 | 87,93 | 87,09 | 142,76 |
| 9 | 282,88 | 72,45 | 78,90 | 526,47 | 2,37 | 99,61 | 89,23 | 90,73 | 91,54 | 168,69 |
| 10 | 306,27 | 72,17 | 79,70 | 550,34 | 2,17 | 106,11 | 92,77 | 93,87 | 96,66 | 191,38 |
| 11 | 360,26 | 72,37 | 82,39 | 694,05 | 2,07 | 114,56 | 97,25 | 97,63 | 102,78 | 212,26 |
| 12 | 401,37 | 72,23 | 83,86 | 766,30 | 1,87 | 128,62 | 104,69 | 102,17 | 109,63 | 230,51 |
| 13 | 424,69 | 72,38 | 85,22 | 787,42 | 1,67 | 148,05 | 114,57 | 107,54 | 116,98 | 249,61 |
| 14 | 438,62 | 72,38 | 86,38 | 808,85 | 1,57 | 169,62 | 125,76 | 113,65 | 124,32 | 268,11 |
| 15 | 437,56 | 72,42 | 86,10 | 781,21 | 1,37 | 190,90 | 137,59 | 120,51 | 130,94 | 285,32 |
| 16 | 448,13 | 72,54 | 87,58 | 823,57 | 1,37 | 210,89 | 150,04 | 127,76 | 137,43 | 301,47 |
| 17 | 461,61 | 72,53 | 88,06 | 841,86 | 1,07 | 231,21 | 162,38 | 135,12 | 143,63 | 317,22 |
| 18 | 478,22 | 72,69 | 120,60 | 587,29 | 3,97 | 250,51 | 180,11 | 142,89 | 144,47 | 334,08 |
| 19 | 350,30 | 72,57 | 99,29 | 461,45 | 8,07 | 271,62 | 193,61 | 151,12 | 145,82 | 351,42 |
| 20 | 335,05 | 72,51 | 87,55 | 500,51 | 7,99 | 286,48 | 197,54 | 158,13 | 151,76 | 362,03 |
| 21 | 316,56 | 72,53 | 84,46 | 480,29 | 7,97 | 294,37 | 197,57 | 163,96 | 157,43 | 363,87 |
| 22 | 306,79 | 72,61 | 84,01 | 474,62 | 7,87 | 299,63 | 196,85 | 168,99 | 164,23 | 362,41 |
| 23 | 316,45 | 72,63 | 84,00 | 529,43 | 7,77 | 305,33 | 196,67 | 173,60 | 171,82 | 358,35 |
| 24 | 351,43 | 72,57 | 84,75 | 609,97 | 7,67 | 309,45 | 198,29 | 177,51 | 179,31 | 353,78 |
| 25 | 378,77 | 72,54 | 85,72 | 667,26 | 7,48 | 311,89 | 201,59 | 180,64 | 186,12 | 349,00 |
| 26 | 390,13 | 72,60 | 86,18 | 680,65 | 7,37 | 314,75 | 206,55 | 183,25 | 192,55 | 344,53 |
| 27 | 382,42 | 72,57 | 86,58 | 649,20 | 7,27 | 317,80 | 212,84 | 185,74 | 199,17 | 340,05 |
| 28 | 370,98 | 72,74 | 86,39 | 626,00 | 7,17 | 320,56 | 220,04 | 188,37 | 205,69 | 336,69 |
| 29 | 387,14 | 72,60 | 86,40 | 674,65 | 7,07 | 323,63 | 227,78 | 191,04 | 212,16 | 333,38 |
| 30 | 400,01 | 72,60 | 86,54 | 694,74 | 6,96 | 327,21 | 235,73 | 193,77 | 218,53 | 330,57 |
| 31 | 407,63 | 72,78 | 87,54 | 700,98 | 6,87 | 331,89 | 243,68 | 196,69 | 225,29 | 328,53 |
| 32 | 404,90 | 72,86 | 88,21 | 697,70 | 6,67 | 337,53 | 251,87 | 199,77 | 231,87 | 326,88 |
| 33 | 396,72 | 72,99 | 87,94 | 682,98 | 6,57 | 344,18 | 259,61 | 202,92 | 238,71 | 325,42 |
| 34 | 389,76 | 72,78 | 87,48 | 681,19 | 6,47 | 350,60 | 265,39 | 206,11 | 244,91 | 324,86 |
| 35 | 389,38 | 73,06 | 87,86 | 675,19 | 6,37 | 356,32 | 271,05 | 209,33 | 250,56 | 324,21 |
| 36 | 388,49 | 72,86 | 87,16 | 670,24 | 6,37 | 361,33 | 274,18 | 212,49 | 255,75 | 324,80 |
| 37 | 396,01 | 73,04 | 87,32 | 694,69 | 6,17 | 366,99 | 277,37 | 215,96 | 260,91 | 325,73 |
| 38 | 403,24 | 73,20 | 88,97 | 707,40 | 6,07 | 373,62 | 278,73 | 219,50 | 265,82 | 326,86 |
| 39 | 399,88 | 73,25 | 89,09 | 678,96 | 6,06 | 380,32 | 280,42 | 223,04 | 270,24 | 328,03 |
| 40 | 395,49 | 73,22 | 88,55 | 660,79 | 5,97 | 385,72 | 281,69 | 226,55 | 274,42 | 328,90 |
| 41 | 405,27 | 73,19 | 88,83 | 689,10 | 5,77 | 390,01 | 283,81 | 230,28 | 278,76 | 329,20 |
| 42 | 435,49 | 73,21 | 90,48 | 776,27 | 5,67 | 394,48 | 286,79 | 234,11 | 283,65 | 330,08 |
| 43 | 475,36 | 73,19 | 92,13 | 862,83 | 5,57 | 399,76 | 289,98 | 238,01 | 288,35 | 331,48 |
| 44 | 478,29 | 73,18 | 92,39 | 836,15 | 5,47 | 405,70 | 292,77 | 242,03 | 293,56 | 335,90 |
| 45 | 461,82 | 73,24 | 91,65 | 786,14 | 5,37 | 411,12 | 295,71 | 246,36 | 299,99 | 341,83 |
| 46 | 457,80 | 73,38 | 93,00 | 817,85 | 5,17 | 416,96 | 299,16 | 251,20 | 306,01 | 346,74 |
| 47 | 477,18 | 73,56 | 94,36 | 867,60 | 5,07 | 422,86 | 302,76 | 256,24 | 312,41 | 350,92 |
| 48 | 473,72 | 73,62 | 93,10 | 853,50 | 4,97 | 429,17 | 304,64 | 261,51 | 318,73 | 354,56 |
| 49 | 463,94 | 73,70 | 93,01 | 830,56 | 4,87 | 437,31 | 305,07 | 266,95 | 324,25 | 357,90 |
| 50 | 456,42 | 73,76 | 92,61 | 815,61 | 4,77 | 446,44 | 306,23 | 272,64 | 330,43 | 361,20 |
| 51 | 453,55 | 73,80 | 92,53 | 813,97 | 4,67 | 455,35 | 305,94 | 278,54 | 335,90 | 364,65 |
| 52 | 450,86 | 73,76 | 92,65 | 807,68 | 4,57 | 465,04 | 305,21 | 284,73 | 341,16 | 368,97 |
| 53 | 452,26 | 73,72 | 92,74 | 813,67 | 4,47 | 473,67 | 303,93 | 291,16 | 345,82 | 373,83 |
| 54 | 457,47 | 73,79 | 93,49 | 829,95 | 4,37 | 481,64 | 302,99 | 297,55 | 350,08 | 379,28 |
| 55 | 465,24 | 73,75 | 93,06 | 842,96 | 4,27 | 487,91 | 302,07 | 303,76 | 354,05 | 385,38 |
| 56 | 467,63 | 73,88 | 93,91 | 845,88 | 4,17 | 494,87 | 301,75 | 309,89 | 357,50 | 391,56 |
| 57 | 471,95 | 73,75 | 93,78 | 856,25 | 4,07 | 501,34 | 301,29 | 315,79 | 361,35 | 395,96 |
| 58 | 473,62 | 73,73 | 94,31 | 855,82 | 3,97 | 508,42 | 303,96 | 322,01 | 365,34 | 399,96 |
| 59 | 474,44 | 73,78 | 94,27 | 860,55 | 3,87 | 515,35 | 305,23 | 327,97 | 368,79 | 403,48 |
| 60 | 482,10 | 73,91 | 93,50 | 882,50 | 3,77 | 521,80 | 307,49 | 333,88 | 372,55 | 407,04 |
| 61 | 491,40 | 74,02 | 95,69 | 898,62 | 3,67 | 527,92 | 309,76 | 339,90 | 375,81 | 410,30 |
| 62 | 495,29 | 73,89 | 94,87 | 899,87 | 3,48 | 533,64 | 312,46 | 345,68 | 379,94 | 415,56 |
| 63 | 492,56 | 73,86 | 95,62 | 890,43 | 3,47 | 539,45 | 315,40 | 351,35 | 383,38 | 421,37 |
| 64 | 487,64 | 73,92 | 95,06 | 882,97 | 3,29 | 544,77 | 317,45 | 356,83 | 387,14 | 427,93 |
| 65 | 488,25 | 73,81 | 94,32 | 889,84 | 3,17 | 549,39 | 317,59 | 361,82 | 390,98 | 433,98 |
| 66 | 489,51 | 73,88 | 95,10 | 894,18 | 3,07 | 554,69 | 320,50 | 367,20 | 394,89 | 441,53 |
| 67 | 492,51 | 74,12 | 96,95 | 910,89 | 2,97 | 561,44 | 324,08 | 372,71 | 398,11 | 448,84 |
| 68 | 501,44 | 74,39 | 96,10 | 925,03 | 2,87 | 566,19 | 326,26 | 378,06 | 401,37 | 457,09 |
| 69 | 504,49 | 74,19 | 94,90 | 926,42 | 2,77 | 569,77 | 326,78 | 383,03 | 404,63 | 465,05 |
| 70 | 505,11 | 74,23 | 96,40 | 925,82 | 2,67 | 575,85 | 329,13 | 388,42 | 408,32 | 474,62 |
| 71 | 507,92 | 74,25 | 96,23 | 937,80 | 2,57 | 580,40 | 330,46 | 393,86 | 411,26 | 483,90 |
| 72 | 510,25 | 74,45 | 97,70 | 937,05 | 2,38 | 586,74 | 333,63 | 399,48 | 415,26 | 492,24 |
| 73 | 512,00 | 74,61 | 97,56 | 939,41 | 2,37 | 591,54 | 335,43 | 404,97 | 418,73 | 500,64 |
| 74 | 514,74 | 74,53 | 98,01 | 941,31 | 2,27 | 594,95 | 336,23 | 410,03 | 421,88 | 508,93 |
| 75 | 514,66 | 74,81 | 97,47 | 938,26 | 2,07 | 601,86 | 338,46 | 415,21 | 426,40 | 517,18 |
| 76 | 511,54 | 74,84 | 98,14 | 927,63 | 2,07 | 605,88 | 339,69 | 420,12 | 430,53 | 525,02 |
| 77 | 512,09 | 74,96 | 97,61 | 917,03 | 1,97 | 611,99 | 342,34 | 424,89 | 434,58 | 530,98 |
| 78 | 506,47 | 75,03 | 97,85 | 904,25 | 1,87 | 617,21 | 344,92 | 429,20 | 438,00 | 537,33 |
| 79 | 502,82 | 75,18 | 98,04 | 894,50 | 1,77 | 621,84 | 347,87 | 433,38 | 442,01 | 543,15 |
| 80 | 493,39 | 75,09 | 97,76 | 876,82 | 1,67 | 626,69 | 349,62 | 437,62 | 445,32 | 549,76 |
| 81 | 478,70 | 74,91 | 95,77 | 847,88 | 1,67 | 631,56 | 351,00 | 441,63 | 448,22 | 555,47 |
| 82 | 466,14 | 74,96 | 95,94 | 822,74 | 1,57 | 633,53 | 352,36 | 445,26 | 449,72 | 559,52 |
| 83 | 452,41 | 75,01 | 94,46 | 793,18 | 1,57 | 634,93 | 352,15 | 448,86 | 451,41 | 562,05 |
| 84 | 439,39 | 75,29 | 93,87 | 773,68 | 1,47 | 638,23 | 352,62 | 452,68 | 452,53 | 563,77 |
| 85 | 429,81 | 75,34 | 94,30 | 758,30 | 1,47 | 639,18 | 352,39 | 456,54 | 451,79 | 566,33 |
| 86 | 421,87 | 75,34 | 94,28 | 745,01 | 1,47 | 641,27 | 351,69 | 460,54 | 451,30 | 567,85 |
| 87 | 415,77 | 75,18 | 93,22 | 729,39 | 1,37 | 641,64 | 350,65 | 464,65 | 449,87 | 569,48 |
| 88 | 410,37 | 75,00 | 93,16 | 717,80 | 1,37 | 640,52 | 349,28 | 468,78 | 447,40 | 571,38 |
| 89 | 406,06 | 75,25 | 92,68 | 711,83 | 1,37 | 640,45 | 348,33 | 472,62 | 445,06 | 572,77 |
| 90 | 400,35 | 75,43 | 92,40 | 700,36 | 1,27 | 639,02 | 346,59 | 475,92 | 442,59 | 572,45 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 395,44 | 75,51 | 92,66 | 693,02 | 1,27 | 636,34 | 345,86 | 478,67 | 439,61 | 572,25 |
| 92 | 389,52 | 75,44 | 92,33 | 683,81 | 1,27 | 634,54 | 345,39 | 481,24 | 436,67 | 571,65 |
| 93 | 359,60 | 75,70 | 115,90 | 433,36 | 5,87 | 631,61 | 350,23 | 484,34 | 432,05 | 570,70 |
| 94 | 321,09 | 75,60 | 102,62 | 459,44 | 8,47 | 627,51 | 350,24 | 487,65 | 426,71 | 569,23 |
| 95 | 327,39 | 75,62 | 93,54 | 543,53 | 8,48 | 620,18 | 342,89 | 490,41 | 421,68 | 566,58 |
| 96 | 348,30 | 75,53 | 93,44 | 628,36 | 8,28 | 610,48 | 336,77 | 492,31 | 416,94 | 561,37 |
| 97 | 363,26 | 75,49 | 92,48 | 692,53 | 8,18 | 598,02 | 334,72 | 493,24 | 411,71 | 553,82 |
| 98 | 368,96 | 75,59 | 93,03 | 688,09 | 8,18 | 588,37 | 333,76 | 493,57 | 407,11 | 546,47 |
| 99 | 355,38 | 75,78 | 91,81 | 641,05 | 8,08 | 578,62 | 334,39 | 493,13 | 402,70 | 538,30 |
| 100 | 400,13 | 75,71 | 93,02 | 813,68 | 7,92 | 568,44 | 337,29 | 492,19 | 399,08 | 529,99 |
| 101 | 460,82 | 75,65 | 95,38 | 919,60 | 7,77 | 559,63 | 341,74 | 490,88 | 396,15 | 522,32 |
| 102 | 492,31 | 75,75 | 97,95 | 970,67 | 7,58 | 550,70 | 348,96 | 489,06 | 394,05 | 515,64 |
| 103 | 512,85 | 75,75 | 98,58 | 999,02 | 7,48 | 543,52 | 356,42 | 486,99 | 393,63 | 510,44 |
| 104 | 520,50 | 75,74 | 99,66 | 997,33 | 7,30 | 537,58 | 363,42 | 484,78 | 395,03 | 505,19 |
| 105 | 527,39 | 75,80 | 100,88 | 1009,88 | 7,17 | 531,44 | 370,16 | 482,40 | 396,68 | 500,77 |
| 106 | 527,92 | 75,86 | 100,42 | 1006,92 | 7,07 | 528,33 | 375,99 | 480,00 | 400,22 | 497,00 |
| 107 | 528,20 | 75,94 | 101,24 | 988,64 | 6,88 | 524,41 | 380,92 | 477,41 | 403,79 | 494,57 |
| 108 | 530,10 | 76,14 | 101,72 | 984,30 | 6,78 | 521,16 | 384,20 | 474,92 | 408,09 | 492,70 |
| 109 | 522,54 | 76,06 | 100,36 | 951,67 | 6,68 | 518,63 | 385,85 | 472,39 | 412,97 | 491,45 |
| 110 | 514,93 | 76,21 | 99,83 | 936,99 | 6,47 | 515,52 | 388,09 | 469,84 | 418,24 | 490,08 |
| 111 | 514,00 | 76,26 | 99,77 | 934,34 | 6,37 | 512,86 | 390,06 | 467,41 | 423,46 | 489,25 |
| 112 | 515,11 | 76,31 | 100,81 | 940,61 | 6,27 | 508,74 | 392,29 | 465,02 | 427,84 | 488,86 |
| 113 | 516,73 | 76,32 | 100,44 | 955,52 | 6,18 | 506,12 | 393,27 | 462,74 | 432,37 | 488,36 |
| 114 | 523,17 | 76,58 | 101,06 | 980,36 | 5,98 | 504,99 | 393,06 | 460,73 | 436,50 | 488,63 |
| 115 | 529,34 | 76,53 | 100,45 | 1001,60 | 5,88 | 503,34 | 394,33 | 458,74 | 440,68 | 489,34 |
| 116 | 535,15 | 76,79 | 101,34 | 1020,88 | 5,77 | 501,83 | 395,68 | 456,93 | 444,60 | 490,43 |
| 117 | 543,66 | 76,71 | 101,74 | 1046,22 | 5,57 | 500,61 | 396,85 | 455,25 | 448,29 | 492,44 |
| 118 | 551,99 | 76,87 | 103,02 | 1053,32 | 5,38 | 500,26 | 399,15 | 453,82 | 452,78 | 494,84 |
| 119 | 557,85 | 76,82 | 103,62 | 1052,34 | 5,28 | 501,48 | 401,77 | 452,53 | 457,65 | 497,82 |
| 120 | 560,43 | 76,73 | 102,26 | 1064,18 | 5,17 | 503,59 | 403,70 | 451,38 | 462,84 | 501,73 |
| 121 | 563,89 | 76,69 | 102,88 | 1068,51 | 4,97 | 505,69 | 406,44 | 450,28 | 468,03 | 506,06 |
| 122 | 564,39 | 76,84 | 102,65 | 1068,34 | 4,87 | 510,02 | 408,49 | 449,31 | 473,52 | 511,14 |
| 123 | 565,10 | 76,62 | 101,98 | 1073,04 | 4,98 | 513,27 | 410,19 | 448,46 | 479,13 | 516,70 |
| 124 | 465,33 | 76,45 | 95,25 | 920,47 | 4,65 | 517,82 | 416,43 | 447,77 | 507,26 | 521,90 |
| 125 | 433,97 | 76,79 | 93,69 | 942,64 | 4,58 | 523,06 | 420,49 | 447,32 | 524,92 | 527,27 |
| 126 | 417,37 | 76,83 | 93,30 | 942,96 | 4,47 | 528,10 | 424,23 | 446,84 | 537,73 | 531,61 |
| 127 | 407,14 | 76,93 | 94,95 | 939,20 | 4,37 | 531,91 | 427,11 | 446,41 | 546,85 | 534,94 |
| 128 | 397,49 | 76,96 | 94,33 | 924,07 | 4,27 | 536,30 | 428,00 | 445,99 | 554,22 | 537,59 |
| 129 | 389,40 | 76,88 | 93,16 | 915,58 | 4,27 | 540,24 | 427,12 | 445,58 | 559,11 | 539,77 |
| 130 | 384,25 | 76,79 | 92,79 | 921,91 | 4,17 | 541,93 | 425,73 | 445,13 | 563,10 | 542,17 |
| 131 | 382,71 | 76,90 | 93,65 | 927,48 | 4,08 | 544,57 | 425,77 | 444,53 | 565,53 | 543,34 |
| 132 | 383,16 | 77,03 | 93,24 | 928,29 | 3,98 | 546,55 | 425,38 | 443,97 | 567,80 | 545,13 |
| 133 | 381,54 | 76,84 | 92,16 | 926,06 | 3,88 | 549,44 | 424,05 | 443,39 | 569,87 | 546,91 |
| 134 | 381,42 | 76,93 | 92,47 | 927,08 | 3,77 | 552,20 | 423,71 | 442,69 | 571,28 | 548,42 |
| 135 | 379,11 | 76,97 | 91,81 | 924,13 | 3,77 | 555,03 | 422,60 | 442,03 | 572,19 | 550,17 |
| 136 | 377,44 | 77,05 | 92,12 | 919,81 | 3,67 | 557,91 | 423,12 | 441,28 | 573,73 | 551,74 |
| 137 | 374,10 | 76,97 | 92,17 | 914,38 | 3,57 | 560,15 | 422,91 | 440,42 | 574,28 | 553,23 |
| 138 | 371,30 | 77,11 | 93,30 | 912,29 | 3,47 | 561,63 | 423,86 | 439,53 | 574,80 | 554,73 |
| 139 | 369,01 | 76,99 | 93,04 | 909,66 | 3,38 | 563,48 | 423,76 | 438,59 | 575,21 | 555,98 |
| 140 | 366,97 | 77,17 | 92,78 | 902,84 | 3,38 | 565,21 | 423,44 | 437,68 | 575,05 | 557,25 |
| 141 | 364,57 | 77,35 | 92,96 | 899,68 | 3,28 | 565,68 | 424,77 | 436,78 | 574,06 | 558,67 |
| 142 | 363,21 | 77,26 | 91,49 | 900,99 | 3,17 | 568,54 | 423,24 | 435,89 | 573,49 | 560,00 |
| 143 | 363,10 | 77,06 | 91,31 | 909,36 | 3,17 | 569,09 | 423,66 | 434,98 | 574,04 | 561,25 |
| 144 | 364,14 | 77,15 | 92,44 | 915,44 | 3,07 | 568,88 | 425,09 | 433,97 | 574,36 | 562,81 |
| 145 | 364,07 | 77,02 | 91,88 | 908,64 | 2,97 | 570,24 | 425,10 | 433,05 | 575,22 | 564,59 |
| 146 | 363,38 | 77,21 | 91,24 | 904,62 | 2,87 | 572,05 | 424,55 | 432,13 | 576,20 | 566,35 |
| 147 | 361,49 | 77,02 | 90,59 | 896,24 | 2,87 | 572,27 | 422,37 | 431,16 | 576,24 | 569,01 |
| 148 | 358,97 | 77,12 | 89,84 | 886,25 | 2,77 | 573,17 | 420,73 | 430,16 | 576,08 | 571,10 |
| 149 | 356,52 | 77,14 | 90,28 | 881,03 | 2,69 | 574,04 | 421,79 | 429,11 | 575,98 | 572,14 |
| 150 | 352,01 | 77,39 | 90,52 | 861,56 | 2,68 | 576,18 | 420,08 | 428,05 | 575,19 | 574,39 |
| 151 | 346,45 | 77,46 | 90,41 | 845,30 | 2,60 | 577,89 | 421,67 | 427,17 | 574,44 | 575,19 |
| 152 | 341,03 | 77,46 | 89,50 | 829,50 | 2,58 | 578,72 | 418,99 | 426,11 | 572,99 | 577,09 |
| 153 | 335,38 | 77,37 | 89,49 | 825,01 | 2,47 | 579,64 | 420,49 | 425,17 | 572,20 | 578,13 |
| 154 | 330,03 | 77,07 | 88,92 | 816,60 | 2,47 | 580,16 | 419,56 | 424,16 | 569,50 | 579,68 |
| 155 | 324,29 | 76,89 | 89,86 | 797,16 | 2,47 | 581,40 | 420,10 | 423,20 | 566,55 | 580,64 |
| 156 | 319,08 | 77,39 | 89,84 | 783,52 | 2,41 | 582,59 | 419,06 | 422,35 | 562,80 | 581,89 |
| 157 | 314,15 | 77,25 | 89,37 | 774,38 | 2,37 | 581,88 | 414,32 | 421,42 | 559,25 | 584,48 |
| 158 | 309,41 | 77,29 | 89,23 | 765,25 | 2,37 | 582,26 | 410,82 | 420,57 | 554,03 | 585,63 |
| 159 | 305,39 | 77,45 | 89,70 | 753,08 | 2,37 | 582,97 | 407,99 | 419,84 | 547,67 | 586,00 |
| 160 | 302,53 | 77,42 | 89,54 | 749,48 | 2,37 | 582,97 | 403,70 | 419,12 | 540,36 | 586,91 |
| 161 | 300,67 | 77,49 | 88,35 | 752,66 | 2,27 | 582,97 | 401,36 | 418,40 | 533,50 | 586,59 |
| 162 | 299,54 | 77,66 | 89,38 | 751,50 | 2,27 | 583,15 | 400,14 | 417,86 | 525,72 | 586,07 |
| 163 | 297,87 | 77,82 | 91,06 | 748,32 | 2,27 | 582,35 | 398,39 | 417,45 | 517,99 | 586,11 |
| 164 | 296,41 | 77,70 | 90,49 | 748,67 | 2,27 | 581,71 | 395,62 | 417,11 | 510,48 | 586,51 |
| 165 | 295,65 | 77,73 | 90,57 | 747,98 | 2,27 | 581,49 | 393,34 | 416,86 | 502,94 | 586,65 |
| 166 | 293,96 | 77,86 | 88,44 | 746,33 | 2,17 | 579,71 | 387,72 | 416,72 | 495,48 | 587,92 |
| 167 | 292,38 | 77,68 | 89,75 | 743,43 | 2,17 | 579,22 | 386,66 | 416,60 | 488,79 | 587,57 |
| 168 | 290,96 | 78,01 | 89,84 | 738,97 | 2,17 | 579,04 | 384,31 | 416,59 | 482,26 | 588,07 |
| 169 | 289,46 | 78,08 | 89,85 | 733,80 | 2,17 | 579,23 | 382,89 | 416,61 | 475,97 | 588,15 |
| 170 | 287,24 | 77,87 | 89,11 | 726,61 | 2,17 | 578,15 | 378,42 | 416,76 | 470,09 | 589,50 |
| 171 | 284,46 | 78,07 | 88,88 | 717,05 | 2,17 | 578,46 | 376,46 | 416,92 | 464,99 | 589,96 |
| 172 | 282,81 | 78,02 | 88,76 | 706,38 | 2,17 | 579,04 | 375,78 | 417,14 | 460,22 | 589,86 |
| 173 | 280,12 | 77,89 | 89,10 | 696,91 | 2,07 | 579,41 | 373,94 | 417,39 | 455,38 | 590,55 |
| 174 | 277,20 | 77,61 | 88,57 | 691,94 | 2,07 | 579,11 | 372,11 | 417,61 | 451,62 | 591,87 |
| 175 | 275,94 | 77,79 | 89,03 | 685,47 | 2,07 | 579,90 | 371,30 | 417,90 | 447,51 | 592,21 |
| 176 | 274,01 | 77,89 | 88,85 | 682,29 | 2,04 | 580,01 | 371,60 | 418,20 | 444,04 | 592,55 |
| 177 | 272,39 | 78,03 | 89,52 | 679,45 | 2,04 | 581,52 | 369,80 | 418,61 | 440,06 | 593,01 |
| 178 | 270,46 | 77,63 | 87,99 | 674,78 | 1,98 | 581,15 | 365,81 | 418,87 | 436,39 | 594,92 |
| 179 | 268,91 | 77,79 | 87,86 | 669,94 | 1,98 | 582,07 | 363,87 | 419,22 | 433,26 | 594,66 |
| 180 | 267,19 | 77,84 | 88,30 | 665,68 | 1,98 | 583,96 | 365,07 | 419,62 | 430,09 | 594,31 |
| 181 | 266,10 | 78,08 | 89,77 | 662,67 | 1,98 | 585,41 | 365,86 | 420,02 | 426,66 | 594,20 |
| 182 | 264,98 | 78,09 | 88,33 | 662,83 | 1,98 | 586,23 | 364,30 | 420,53 | 423,78 | 594,40 |
| 183 | 264,59 | 78,08 | 88,70 | 663,14 | 1,98 | 586,69 | 363,61 | 420,94 | 420,93 | 594,68 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 184 | 263,11 | 78,03 | 88,26 | 660,95 | 1,87 | 587,30 | 360,90 | 421,48 | 418,19 | 595,37 |
| 185 | 261,91 | 77,93 | 88,28 | 659,75 | 1,89 | 587,79 | 359,29 | 421,93 | 415,57 | 595,69 |
| 186 | 261,54 | 78,06 | 87,89 | 658,81 | 1,87 | 588,23 | 357,71 | 422,37 | 413,14 | 595,50 |
| 187 | 260,80 | 78,23 | 88,00 | 653,54 | 1,87 | 589,06 | 358,24 | 422,79 | 410,70 | 594,75 |
| 188 | 259,25 | 78,18 | 88,41 | 650,14 | 1,87 | 589,41 | 357,97 | 423,21 | 408,49 | 594,69 |
| 189 | 258,93 | 78,24 | 88,15 | 648,70 | 1,87 | 589,89 | 357,86 | 423,50 | 406,26 | 594,71 |
| 190 | 257,98 | 78,16 | 87,68 | 648,39 | 1,87 | 590,36 | 355,07 | 423,86 | 404,33 | 595,12 |
| 191 | 257,07 | 78,26 | 87,94 | 649,21 | 1,87 | 590,90 | 354,21 | 424,31 | 402,22 | 595,14 |
| 192 | 256,99 | 78,02 | 87,78 | 650,01 | 1,81 | 591,35 | 352,93 | 424,75 | 400,65 | 594,64 |
| 193 | 257,06 | 78,14 | 87,85 | 648,96 | 1,77 | 591,89 | 352,70 | 425,16 | 398,70 | 593,99 |
| 194 | 256,42 | 78,29 | 88,75 | 647,76 | 1,77 | 592,96 | 352,35 | 425,64 | 396,89 | 593,64 |
| 195 | 255,48 | 78,41 | 88,40 | 647,72 | 1,77 | 592,93 | 349,55 | 426,15 | 395,34 | 594,11 |
| 196 | 255,27 | 78,39 | 88,56 | 648,57 | 1,77 | 591,60 | 349,49 | 426,59 | 393,56 | 593,91 |
| 197 | 255,53 | 78,53 | 87,88 | 646,76 | 1,77 | 592,57 | 348,39 | 427,01 | 392,07 | 593,18 |
| 198 | 255,04 | 78,60 | 87,97 | 645,89 | 1,67 | 593,41 | 347,56 | 427,45 | 390,33 | 593,01 |
| 199 | 254,57 | 78,66 | 88,45 | 646,15 | 1,67 | 592,63 | 346,02 | 427,92 | 388,98 | 592,93 |
| 200 | 255,19 | 78,78 | 88,63 | 649,56 | 1,67 | 591,98 | 346,19 | 428,25 | 387,27 | 593,01 |
| 201 | 338,69 | 78,72 | 97,62 | 564,71 | 1,67 | 591,09 | 344,82 | 428,67 | 384,23 | 593,40 |
| 202 | 278,71 | 78,75 | 88,66 | 574,86 | 1,67 | 589,90 | 344,17 | 429,10 | 380,90 | 591,77 |

# APPENDIX 2: Proportionality results

| | Outlet | Outlet | Average | Average | #1 | #2 | | |
|---|---|---|---|---|---|---|---|---|
| Tunnel | Temp. | Temp. | 100,03 | 100,03 | 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 |
| 17,631 | 539,0 | 540,0 | | | 0,180 | 0,176 | 0 | 0,2732026 |
| 17,377 | 538,9 | 540,1 | 102,05 | 102,68 | 0,180 | 0,176 | 1 | 0,2699891 |
| 17,831 | 539,0 | 540,2 | 99,40 | 99,93 | 0,181 | 0,176 | 2 | 0,2771211 |
| 18,522 | 539,0 | 540,3 | 95,71 | 96,22 | 0,181 | 0,176 | 3 | 0,287843 |
| 17,323 | 539,0 | 540,4 | 102,33 | 103,08 | 0,181 | 0,176 | 4 | 0,26904 |
| 17,627 | 539,0 | 540,6 | 100,51 | 100,73 | 0,181 | 0,176 | 5 | 0,2741398 |
| 18,352 | 539,1 | 540,7 | 96,42 | 96,80 | 0,181 | 0,176 | 6 | 0,2855199 |
| 17,381 | 539,1 | 540,9 | 101,67 | 102,16 | 0,181 | 0,176 | 7 | 0,2705441 |
| 16,927 | 539,1 | 540,9 | 104,29 | 104,64 | 0,181 | 0,176 | 8 | 0,263637 |
| 16,989 | 539,1 | 541,1 | 103,92 | 104,42 | 0,181 | 0,176 | 9 | 0,2646021 |
| 18,012 | 539,1 | 541,2 | 97,99 | 98,54 | 0,181 | 0,176 | 10 | 0,2804634 |
| 17,975 | 539,2 | 541,4 | 98,17 | 98,64 | 0,181 | 0,176 | 11 | 0,2798877 |
| 17,657 | 539,1 | 541,5 | 100,02 | 100,46 | 0,181 | 0,176 | 12 | 0,2748922 |
| 18,472 | 539,1 | 541,6 | 95,74 | 96,26 | 0,181 | 0,176 | 13 | 0,2874774 |
| 17,623 | 539,1 | 541,7 | 100,34 | 100,52 | 0,181 | 0,176 | 14 | 0,2742553 |
| 17,754 | 539,1 | 541,8 | 99,67 | 99,82 | 0,181 | 0,176 | 15 | 0,2763782 |
| 17,484 | 539,2 | 541,9 | 101,26 | 101,54 | 0,181 | 0,176 | 16 | 0,2721432 |
| 17,871 | 539,2 | 542,1 | 98,97 | 99,09 | 0,181 | 0,176 | 17 | 0,2782016 |
| 17,565 | 539,2 | 542,2 | 100,63 | 100,70 | 0,181 | 0,176 | 18 | 0,2734195 |
| 18,019 | 539,3 | 542,3 | 98,30 | 98,69 | 0,181 | 0,176 | 19 | 0,2802523 |
| 17,555 | 539,3 | 542,4 | 100,85 | 100,85 | 0,181 | 0,176 | 20 | 0,2732035 |
| 17,014 | 539,3 | 542,5 | 104,24 | 104,22 | 0,181 | 0,176 | 21 | 0,2646104 |
| 17,802 | 539,3 | 542,7 | 99,55 | 99,69 | 0,181 | 0,176 | 22 | 0,2767544 |
| 17,451 | 539,5 | 542,9 | 101,67 | 101,77 | 0,181 | 0,176 | 23 | 0,2713165 |
| 17,336 | 539,5 | 542,9 | 102,17 | 102,27 | 0,181 | 0,176 | 24 | 0,2696646 |
| 18,030 | 539,5 | 543,0 | 98,25 | 98,22 | 0,181 | 0,176 | 25 | 0,2805607 |
| 17,948 | 539,5 | 543,1 | 98,49 | 98,75 | 0,181 | 0,176 | 26 | 0,2793363 |
| 17,557 | 539,5 | 543,1 | 101,05 | 101,26 | 0,181 | 0,176 | 27 | 0,2728257 |
| 18,009 | 539,5 | 543,3 | 98,57 | 98,74 | 0,181 | 0,176 | 28 | 0,279887 |
| 18,389 | 539,5 | 543,4 | 96,38 | 96,58 | 0,181 | 0,176 | 29 | 0,285878 |
| 17,293 | 539,5 | 543,4 | 102,58 | 102,55 | 0,181 | 0,176 | 30 | 0,2690356 |
| 17,534 | 539,5 | 543,4 | 100,88 | 101,19 | 0,181 | 0,176 | 31 | 0,2728258 |
| 17,073 | 539,5 | 543,5 | 103,64 | 103,88 | 0,181 | 0,176 | 32 | 0,265683 |
| 18,057 | 539,5 | 543,5 | 98,22 | 98,45 | 0,181 | 0,176 | 33 | 0,2806197 |
| 17,507 | 539,5 | 543,6 | 101,53 | 101,57 | 0,181 | 0,176 | 34 | 0,2718837 |
| 17,467 | 539,6 | 543,7 | 101,28 | 101,53 | 0,181 | 0,175 | 35 | 0,2715782 |
| 17,970 | 539,6 | 543,7 | 98,70 | 98,59 | 0,181 | 0,175 | 36 | 0,2793368 |
| 17,817 | 539,5 | 543,7 | 99,60 | 99,40 | 0,181 | 0,175 | 37 | 0,2771206 |
| 17,554 | 539,5 | 543,7 | 100,96 | 101,86 | 0,181 | 0,176 | 38 | 0,272826 |
| 18,210 | 539,5 | 543,8 | 97,43 | 97,64 | 0,181 | 0,176 | 39 | 0,2828087 |
| 18,456 | 539,6 | 543,9 | 96,02 | 96,16 | 0,181 | 0,175 | 40 | 0,2867729 |
| 17,522 | 539,7 | 544,0 | 101,35 | 101,10 | 0,181 | 0,175 | 41 | 0,2722603 |
| 17,526 | 539,7 | 544,1 | 101,61 | 101,40 | 0,181 | 0,175 | 42 | 0,2718834 |
| 18,303 | 539,8 | 544,2 | 97,22 | 97,01 | 0,181 | 0,175 | 43 | 0,2839669 |
| 18,511 | 539,7 | 544,3 | 95,99 | 95,74 | 0,181 | 0,175 | 44 | 0,2874936 |
| 18,484 | 539,7 | 544,4 | 95,88 | 95,80 | 0,181 | 0,175 | 45 | 0,287135 |
| 18,071 | 539,6 | 544,4 | 98,25 | 98,28 | 0,181 | 0,175 | 46 | 0,2806214 |
| 17,511 | 539,6 | 544,4 | 101,33 | 101,13 | 0,181 | 0,175 | 47 | 0,2723352 |
| 18,484 | 539,6 | 544,5 | 95,94 | 95,85 | 0,181 | 0,175 | 48 | 0,2874925 |
| 17,029 | 539,6 | 544,4 | 103,88 | 104,02 | 0,181 | 0,176 | 49 | 0,2650006 |
| 17,262 | 539,6 | 544,4 | 102,77 | 102,50 | 0,181 | 0,175 | 50 | 0,2682884 |
| 18,006 | 539,7 | 544,5 | 98,86 | 98,80 | 0,181 | 0,175 | 51 | 0,2793404 |
| 18,001 | 539,7 | 544,6 | 98,77 | 98,64 | 0,181 | 0,175 | 52 | 0,2798901 |
| 17,293 | 539,7 | 544,5 | 102,36 | 102,23 | 0,181 | 0,175 | 53 | 0,2690374 |
| 18,016 | 539,7 | 544,6 | 98,24 | 98,17 | 0,181 | 0,175 | 54 | 0,2802352 |
| 17,297 | 539,7 | 544,6 | 102,25 | 102,37 | 0,181 | 0,175 | 55 | 0,2690366 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18,224 | 539,8 | 544,6 | 97,03 | 96,91 | 0,181 | 0,175 | 56 | 0,2837161 |
| 17,434 | 539,8 | 544,6 | 101,42 | 101,47 | 0,181 | 0,175 | 57 | 0,2713163 |
| 17,956 | 539,8 | 544,6 | 98,51 | 98,47 | 0,181 | 0,175 | 58 | 0,2793685 |
| 17,692 | 539,9 | 544,7 | 99,73 | 99,75 | 0,181 | 0,175 | 59 | 0,2754508 |
| 17,489 | 539,9 | 544,7 | 101,05 | 100,75 | 0,181 | 0,175 | 60 | 0,2722616 |
| 18,358 | 539,9 | 544,7 | 96,39 | 96,07 | 0,181 | 0,175 | 61 | 0,285512 |
| 17,807 | 539,9 | 544,7 | 99,41 | 99,20 | 0,181 | 0,175 | 62 | 0,2771246 |
| 18,136 | 539,9 | 544,7 | 97,43 | 97,51 | 0,181 | 0,175 | 63 | 0,2824458 |
| 17,095 | 540,0 | 544,8 | 103,30 | 103,18 | 0,181 | 0,175 | 64 | 0,2662386 |
| 17,453 | 540,0 | 544,8 | 101,01 | 101,11 | 0,181 | 0,175 | 65 | 0,2718864 |
| 17,620 | 539,9 | 544,8 | 100,49 | 100,22 | 0,181 | 0,175 | 66 | 0,2741385 |
| 17,974 | 539,9 | 544,8 | 98,10 | 98,24 | 0,181 | 0,175 | 67 | 0,2798885 |
| 17,531 | 539,9 | 544,8 | 100,55 | 100,68 | 0,181 | 0,175 | 68 | 0,273203 |
| 17,236 | 539,9 | 544,8 | 102,23 | 102,05 | 0,181 | 0,175 | 69 | 0,2686339 |
| 17,465 | 539,9 | 544,8 | 100,95 | 101,00 | 0,181 | 0,175 | 70 | 0,2722614 |
| 17,329 | 539,8 | 544,8 | 101,90 | 101,42 | 0,181 | 0,175 | 71 | 0,2699903 |
| 18,318 | 539,8 | 544,7 | 96,24 | 96,24 | 0,181 | 0,175 | 72 | 0,2855211 |
| 17,626 | 539,8 | 544,7 | 99,92 | 100,12 | 0,181 | 0,176 | 73 | 0,2748889 |
| 17,147 | 539,7 | 544,6 | 102,64 | 102,60 | 0,181 | 0,175 | 74 | 0,2673959 |
| 17,103 | 539,7 | 544,6 | 103,38 | 103,12 | 0,181 | 0,175 | 75 | 0,2663505 |
| 17,568 | 539,7 | 544,6 | 100,55 | 100,36 | 0,181 | 0,175 | 76 | 0,2735611 |
| 17,466 | 539,7 | 544,7 | 100,94 | 100,87 | 0,181 | 0,175 | 77 | 0,2722614 |
| 18,290 | 539,8 | 544,7 | 96,51 | 96,31 | 0,181 | 0,175 | 78 | 0,2851852 |
| 18,018 | 539,8 | 544,7 | 98,09 | 97,90 | 0,181 | 0,175 | 79 | 0,2806153 |
| 17,591 | 539,9 | 544,8 | 100,70 | 100,79 | 0,181 | 0,175 | 80 | 0,2735378 |
| 17,957 | 539,9 | 544,9 | 98,57 | 98,37 | 0,181 | 0,175 | 81 | 0,2793373 |
| 17,249 | 539,9 | 545,0 | 102,82 | 102,57 | 0,181 | 0,175 | 82 | 0,2682653 |
| 17,507 | 539,9 | 545,0 | 100,85 | 100,90 | 0,181 | 0,175 | 83 | 0,272584 |
| 17,600 | 539,9 | 545,1 | 100,30 | 100,31 | 0,181 | 0,175 | 84 | 0,2741406 |
| 17,775 | 539,9 | 545,1 | 98,95 | 98,61 | 0,181 | 0,175 | 85 | 0,2772744 |
| 17,453 | 539,9 | 545,1 | 100,96 | 100,60 | 0,181 | 0,175 | 86 | 0,2722615 |
| 17,078 | 539,9 | 545,1 | 102,93 | 103,09 | 0,181 | 0,175 | 87 | 0,2663252 |
| 17,311 | 539,9 | 545,1 | 101,87 | 101,57 | 0,181 | 0,175 | 88 | 0,2699908 |
| 17,398 | 539,9 | 545,1 | 101,22 | 101,05 | 0,181 | 0,175 | 89 | 0,2713176 |
| 17,456 | 539,9 | 545,1 | 100,95 | 100,83 | 0,181 | 0,175 | 90 | 0,2722619 |
| 17,599 | 539,9 | 545,0 | 100,05 | 99,98 | 0,181 | 0,175 | 91 | 0,2745468 |
| 17,347 | 539,8 | 545,0 | 101,52 | 101,46 | 0,181 | 0,175 | 92 | 0,2705579 |
| 17,720 | 539,8 | 545,0 | 99,37 | 99,33 | 0,181 | 0,175 | 93 | 0,2763788 |
| 18,115 | 539,8 | 545,0 | 97,38 | 97,16 | 0,181 | 0,175 | 94 | 0,2824326 |
| 16,975 | 539,8 | 545,0 | 103,78 | 103,57 | 0,181 | 0,175 | 95 | 0,2646108 |
| 17,501 | 539,8 | 544,9 | 100,59 | 100,66 | 0,181 | 0,175 | 96 | 0,2728271 |
| 17,557 | 539,7 | 544,8 | 100,23 | 100,35 | 0,181 | 0,175 | 97 | 0,2738132 |
| 17,396 | 539,7 | 544,7 | 101,21 | 101,10 | 0,181 | 0,175 | 98 | 0,2713179 |
| 18,187 | 539,7 | 544,7 | 96,95 | 96,71 | 0,181 | 0,175 | 99 | 0,2837133 |
| 18,052 | 539,6 | 544,7 | 97,54 | 97,61 | 0,181 | 0,175 | 100 | 0,2815335 |
| 17,050 | 539,6 | 544,7 | 103,39 | 103,29 | 0,181 | 0,175 | 101 | 0,2659659 |
| 17,578 | 539,6 | 544,6 | 100,11 | 100,00 | 0,181 | 0,175 | 102 | 0,274151 |
| 17,432 | 539,5 | 544,6 | 101,14 | 101,08 | 0,181 | 0,175 | 103 | 0,2718918 |
| 18,109 | 539,5 | 544,5 | 97,20 | 97,29 | 0,181 | 0,175 | 104 | 0,2824432 |
| 18,170 | 539,6 | 544,5 | 96,90 | 96,71 | 0,181 | 0,175 | 105 | 0,2834578 |
| 17,758 | 539,6 | 544,7 | 99,22 | 99,03 | 0,181 | 0,175 | 106 | 0,2769097 |
| 18,036 | 539,7 | 544,7 | 97,65 | 97,56 | 0,181 | 0,175 | 107 | 0,2811718 |
| 17,392 | 539,6 | 544,7 | 101,27 | 101,31 | 0,181 | 0,175 | 108 | 0,2713165 |
| 17,384 | 539,7 | 544,6 | 101,23 | 101,16 | 0,181 | 0,175 | 109 | 0,2712674 |
| 17,535 | 539,7 | 544,7 | 100,35 | 100,18 | 0,181 | 0,175 | 110 | 0,2735329 |
| 17,308 | 539,7 | 544,6 | 101,63 | 101,77 | 0,181 | 0,175 | 111 | 0,2699842 |
| 17,346 | 539,7 | 544,7 | 101,55 | 101,49 | 0,181 | 0,175 | 112 | 0,2705571 |
| 17,055 | 539,7 | 544,7 | 103,74 | 103,30 | 0,181 | 0,175 | 113 | 0,2660103 |
| 18,104 | 539,7 | 544,7 | 97,12 | 97,04 | 0,181 | 0,175 | 114 | 0,282443 |
| 17,455 | 539,8 | 544,7 | 100,93 | 100,84 | 0,181 | 0,175 | 115 | 0,2722615 |
| 18,042 | 539,8 | 544,8 | 97,39 | 97,37 | 0,181 | 0,175 | 116 | 0,281526 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18,012 | 539,8 | 544,8 | 97,72 | 97,64 | 0,181 | 0,175 | 117 | 0,280862 |
| 17,525 | 539,9 | 544,9 | 100,54 | 100,37 | 0,181 | 0,175 | 118 | 0,2732018 |
| 18,138 | 539,9 | 544,8 | 97,16 | 97,00 | 0,181 | 0,175 | 119 | 0,2828083 |
| 17,855 | 539,8 | 544,8 | 98,63 | 98,46 | 0,181 | 0,175 | 120 | 0,2784148 |
| 17,346 | 539,8 | 544,8 | 101,45 | 100,76 | 0,181 | 0,175 | 121 | 0,2705562 |
| 17,429 | 539,8 | 544,8 | 101,09 | 101,32 | 0,181 | 0,175 | 122 | 0,2718822 |
| 17,432 | 539,8 | 544,7 | 101,05 | 101,02 | 0,181 | 0,176 | 123 | 0,2719075 |
| 17,942 | 539,8 | 544,7 | 97,98 | 97,95 | 0,181 | 0,175 | 124 | 0,2798875 |
| 18,128 | 539,8 | 544,7 | 97,16 | 97,01 | 0,181 | 0,175 | 125 | 0,2828079 |
| 18,129 | 539,9 | 544,8 | 96,89 | 96,93 | 0,181 | 0,175 | 126 | 0,2828082 |
| 17,431 | 539,9 | 544,9 | 101,02 | 100,89 | 0,181 | 0,175 | 127 | 0,2718716 |
| 17,578 | 539,9 | 544,9 | 99,76 | 100,29 | 0,180 | 0,175 | 128 | 0,2741471 |
| 18,272 | 539,9 | 544,9 | 96,41 | 96,32 | 0,180 | 0,175 | 129 | 0,2849786 |
| 17,082 | 539,9 | 544,9 | 103,05 | 103,13 | 0,181 | 0,175 | 130 | 0,2663532 |
| 18,256 | 539,9 | 544,9 | 96,50 | 96,45 | 0,181 | 0,175 | 131 | 0,2846185 |
| 17,604 | 539,9 | 544,9 | 100,19 | 100,10 | 0,181 | 0,175 | 132 | 0,2744924 |
| 17,229 | 539,9 | 544,9 | 101,84 | 101,87 | 0,180 | 0,175 | 133 | 0,2686538 |
| 17,433 | 539,9 | 544,9 | 101,00 | 101,01 | 0,180 | 0,175 | 134 | 0,2718834 |
| 16,822 | 540,0 | 544,9 | 104,81 | 104,77 | 0,181 | 0,175 | 135 | 0,2623127 |
| 17,459 | 540,0 | 544,9 | 101,06 | 100,30 | 0,181 | 0,175 | 136 | 0,2722606 |
| 17,225 | 540,0 | 544,9 | 102,19 | 102,22 | 0,181 | 0,175 | 137 | 0,268654 |
| 17,495 | 540,0 | 545,0 | 100,75 | 100,42 | 0,181 | 0,175 | 138 | 0,2728252 |
| 17,635 | 540,0 | 544,9 | 99,92 | 99,88 | 0,181 | 0,175 | 139 | 0,2749234 |
| 18,139 | 539,9 | 544,9 | 97,29 | 97,15 | 0,181 | 0,175 | 140 | 0,28281 |
| 17,398 | 540,0 | 544,9 | 101,17 | 101,09 | 0,181 | 0,175 | 141 | 0,2713163 |
| 17,519 | 539,9 | 544,9 | 100,65 | 100,46 | 0,181 | 0,175 | 142 | 0,2732019 |
| 16,784 | 539,9 | 544,9 | 105,20 | 104,70 | 0,181 | 0,175 | 143 | 0,261689 |
| 17,084 | 539,9 | 544,9 | 103,19 | 102,98 | 0,181 | 0,175 | 144 | 0,2663499 |
| 17,403 | 540,0 | 544,9 | 101,32 | 101,32 | 0,181 | 0,175 | 145 | 0,2713157 |
| 17,121 | 540,0 | 544,9 | 102,88 | 102,97 | 0,181 | 0,175 | 146 | 0,2669282 |
| 17,948 | 540,1 | 545,0 | 98,11 | 98,06 | 0,181 | 0,175 | 147 | 0,2798813 |
| 17,950 | 540,2 | 545,0 | 98,16 | 98,11 | 0,181 | 0,175 | 148 | 0,2798895 |
| 17,124 | 540,2 | 545,1 | 103,14 | 102,79 | 0,181 | 0,175 | 149 | 0,2669276 |
| 17,552 | 540,2 | 545,0 | 100,43 | 100,10 | 0,181 | 0,175 | 150 | 0,2736047 |
| 17,610 | 540,2 | 545,0 | 99,97 | 100,10 | 0,181 | 0,175 | 151 | 0,2745116 |
| 18,114 | 540,1 | 545,0 | 97,36 | 97,26 | 0,181 | 0,175 | 152 | 0,282445 |
| 17,344 | 540,1 | 545,0 | 101,46 | 101,35 | 0,181 | 0,175 | 153 | 0,2705582 |
| 18,185 | 540,1 | 544,9 | 96,86 | 96,89 | 0,181 | 0,175 | 154 | 0,2836626 |
| 17,256 | 540,0 | 544,9 | 102,04 | 102,00 | 0,181 | 0,175 | 155 | 0,2690344 |
| 17,918 | 540,1 | 544,9 | 98,37 | 97,84 | 0,181 | 0,175 | 156 | 0,2793363 |
| 17,519 | 540,0 | 544,8 | 100,37 | 100,51 | 0,181 | 0,175 | 157 | 0,2732019 |
| 17,547 | 540,1 | 544,9 | 100,42 | 100,36 | 0,181 | 0,175 | 158 | 0,2736067 |
| 18,131 | 540,1 | 544,9 | 97,38 | 97,24 | 0,181 | 0,175 | 159 | 0,2828093 |

| | Outlet | Outlet | Average | Average | #1 | #2 | | |
|---|---|---|---|---|---|---|---|---|
| Tunnel | Temp. | Temp. | 99,48 | 100,39 | 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 |
| 17,055 | 535,7 | 537,1 | | | 0,183 | 0,179 | 0 | 0,2659677 |
| 17,375 | 535,7 | 537,2 | 102,18 | 103,41 | 0,183 | 0,179 | 1 | 0,2722652 |
| 17,373 | 535,7 | 537,4 | 102,00 | 103,41 | 0,183 | 0,178 | 2 | 0,2722646 |
| 17,038 | 535,7 | 537,4 | 104,15 | 105,75 | 0,183 | 0,179 | 3 | 0,2669325 |
| 17,977 | 535,8 | 537,6 | 99,01 | 100,31 | 0,184 | 0,179 | 4 | 0,2815209 |
| 16,736 | 535,8 | 537,7 | 106,11 | 107,66 | 0,184 | 0,179 | 5 | 0,2622838 |
| 17,350 | 535,9 | 538,0 | 101,96 | 103,52 | 0,183 | 0,179 | 6 | 0,272264 |
| 17,880 | 536,0 | 538,1 | 98,99 | 100,38 | 0,183 | 0,179 | 7 | 0,2806002 |
| 17,940 | 536,0 | 538,3 | 98,75 | 100,13 | 0,184 | 0,179 | 8 | 0,2815334 |
| 18,167 | 536,1 | 538,5 | 97,50 | 98,81 | 0,184 | 0,179 | 9 | 0,2849823 |
| 17,786 | 536,3 | 538,7 | 99,61 | 100,99 | 0,183 | 0,179 | 10 | 0,2789718 |
| 17,910 | 536,5 | 539,0 | 99,01 | 100,50 | 0,183 | 0,179 | 11 | 0,2806433 |
| 17,887 | 536,7 | 539,3 | 99,28 | 100,41 | 0,183 | 0,178 | 12 | 0,280258 |
| 18,055 | 536,8 | 539,5 | 98,45 | 99,56 | 0,184 | 0,178 | 13 | 0,2828123 |
| 17,663 | 536,6 | 539,5 | 100,40 | 101,98 | 0,183 | 0,179 | 14 | 0,276754 |
| 17,865 | 536,4 | 539,5 | 99,49 | 100,57 | 0,183 | 0,179 | 15 | 0,2798907 |
| 17,452 | 536,3 | 539,6 | 101,75 | 102,73 | 0,184 | 0,178 | 16 | 0,2735967 |
| 17,968 | 536,4 | 539,7 | 98,72 | 99,87 | 0,183 | 0,178 | 17 | 0,2815387 |
| 18,046 | 536,5 | 539,9 | 98,44 | 99,32 | 0,183 | 0,178 | 18 | 0,2828123 |
| 17,812 | 536,6 | 540,1 | 99,36 | 100,51 | 0,183 | 0,178 | 19 | 0,2793079 |
| 17,746 | 536,7 | 540,2 | 99,91 | 101,16 | 0,183 | 0,178 | 20 | 0,2780504 |
| 18,181 | 536,6 | 540,3 | 97,64 | 98,69 | 0,183 | 0,178 | 21 | 0,2849832 |
| 17,820 | 536,6 | 540,4 | 99,50 | 100,59 | 0,183 | 0,178 | 22 | 0,2793409 |
| 18,110 | 536,7 | 540,5 | 97,97 | 98,92 | 0,183 | 0,178 | 23 | 0,2837175 |
| 17,910 | 536,7 | 540,6 | 99,15 | 99,95 | 0,183 | 0,178 | 24 | 0,2806242 |
| 17,492 | 536,8 | 540,7 | 101,54 | 102,51 | 0,184 | 0,178 | 25 | 0,2741438 |
| 17,403 | 536,8 | 540,8 | 102,06 | 103,24 | 0,184 | 0,178 | 26 | 0,2726975 |
| 17,172 | 536,8 | 540,9 | 103,26 | 104,41 | 0,183 | 0,178 | 27 | 0,269037 |
| 16,993 | 536,8 | 540,9 | 104,35 | 105,47 | 0,183 | 0,178 | 28 | 0,2663544 |
| 17,854 | 536,8 | 541,0 | 99,50 | 100,53 | 0,183 | 0,178 | 29 | 0,2797241 |
| 17,047 | 536,8 | 541,0 | 104,44 | 105,27 | 0,184 | 0,178 | 30 | 0,2669316 |
| 17,736 | 536,7 | 541,1 | 100,29 | 100,93 | 0,184 | 0,178 | 31 | 0,2776808 |
| 17,901 | 536,8 | 541,2 | 99,19 | 100,52 | 0,183 | 0,178 | 32 | 0,2802586 |
| 16,957 | 536,8 | 541,3 | 104,82 | 105,68 | 0,183 | 0,178 | 33 | 0,2654211 |
| 17,842 | 536,9 | 541,4 | 99,60 | 100,56 | 0,183 | 0,178 | 34 | 0,2793404 |
| 17,099 | 537,0 | 541,5 | 103,98 | 104,66 | 0,183 | 0,178 | 35 | 0,2677004 |
| 18,056 | 537,0 | 541,5 | 98,49 | 99,35 | 0,183 | 0,177 | 36 | 0,2826026 |
| 17,341 | 536,9 | 541,5 | 102,56 | 103,53 | 0,183 | 0,178 | 37 | 0,2713613 |
| 18,055 | 536,9 | 541,5 | 98,75 | 99,45 | 0,184 | 0,178 | 38 | 0,2824494 |
| 18,064 | 536,9 | 541,6 | 98,68 | 99,56 | 0,184 | 0,178 | 39 | 0,2824494 |
| 17,908 | 536,9 | 541,6 | 99,84 | 100,54 | 0,184 | 0,178 | 40 | 0,2799002 |
| 17,684 | 537,0 | 541,7 | 100,90 | 101,84 | 0,184 | 0,178 | 41 | 0,2763789 |
| 17,876 | 537,0 | 541,7 | 99,80 | 100,76 | 0,183 | 0,178 | 42 | 0,2793412 |
| 18,188 | 537,0 | 541,8 | 98,06 | 99,20 | 0,183 | 0,178 | 43 | 0,2843787 |
| 17,894 | 537,1 | 541,8 | 99,44 | 100,26 | 0,183 | 0,178 | 44 | 0,2798918 |
| 18,162 | 537,1 | 541,9 | 98,07 | 99,08 | 0,183 | 0,178 | 45 | 0,2840815 |
| 17,884 | 537,1 | 541,9 | 99,36 | 100,32 | 0,183 | 0,178 | 46 | 0,2799452 |
| 17,645 | 537,2 | 542,0 | 100,95 | 101,89 | 0,183 | 0,178 | 47 | 0,2758939 |
| 17,863 | 537,2 | 542,0 | 99,71 | 100,59 | 0,183 | 0,178 | 48 | 0,2793394 |
| 18,253 | 537,2 | 542,1 | 97,52 | 98,24 | 0,183 | 0,177 | 49 | 0,2855255 |
| 17,827 | 537,2 | 542,1 | 99,61 | 100,95 | 0,183 | 0,178 | 50 | 0,2789224 |
| 18,075 | 537,1 | 542,1 | 98,43 | 99,32 | 0,183 | 0,178 | 51 | 0,282809 |
| 18,137 | 537,1 | 542,1 | 98,17 | 99,01 | 0,183 | 0,178 | 52 | 0,2837293 |
| 17,261 | 537,2 | 542,2 | 103,08 | 104,08 | 0,183 | 0,178 | 53 | 0,2699925 |
| 17,010 | 537,2 | 542,3 | 104,53 | 105,59 | 0,183 | 0,178 | 54 | 0,2661167 |
| 17,344 | 537,3 | 542,3 | 102,60 | 103,35 | 0,183 | 0,178 | 55 | 0,2713445 |

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|---|---|---|---|---|---|---|---|---|
| 18,156 | 537,3 | 542,4 | 97,71 | 98,95 | 0,183 | 0,178 | 56 | 0,2840828 |
| 17,890 | 537,4 | 542,5 | 99,41 | 100,48 | 0,183 | 0,178 | 57 | 0,2798132 |
| 18,355 | 537,4 | 542,5 | 96,79 | 97,56 | 0,183 | 0,178 | 58 | 0,2873241 |
| 17,674 | 537,4 | 542,5 | 100,62 | 101,26 | 0,183 | 0,177 | 59 | 0,276756 |
| 18,098 | 537,5 | 542,6 | 98,27 | 98,98 | 0,184 | 0,177 | 60 | 0,2833576 |
| 17,052 | 537,6 | 542,7 | 104,14 | 104,80 | 0,183 | 0,177 | 61 | 0,2669383 |
| 17,893 | 537,5 | 542,7 | 99,21 | 100,03 | 0,183 | 0,177 | 62 | 0,2802527 |
| 18,062 | 537,6 | 542,8 | 98,27 | 99,21 | 0,183 | 0,178 | 63 | 0,2828135 |
| 17,836 | 537,6 | 542,8 | 99,63 | 100,43 | 0,183 | 0,178 | 64 | 0,2793421 |
| 18,145 | 537,6 | 542,9 | 97,95 | 98,89 | 0,183 | 0,178 | 65 | 0,2840801 |
| 17,773 | 537,6 | 542,9 | 99,89 | 100,53 | 0,183 | 0,178 | 66 | 0,2784211 |
| 17,158 | 537,7 | 543,0 | 103,51 | 104,72 | 0,183 | 0,178 | 67 | 0,2686596 |
| 17,327 | 537,6 | 543,0 | 102,45 | 103,33 | 0,183 | 0,178 | 68 | 0,2713245 |
| 17,901 | 537,6 | 543,0 | 99,09 | 99,76 | 0,183 | 0,177 | 69 | 0,2806359 |
| 17,767 | 537,7 | 543,0 | 99,92 | 100,52 | 0,183 | 0,177 | 70 | 0,2784212 |
| 18,049 | 537,6 | 543,0 | 98,27 | 99,08 | 0,183 | 0,177 | 71 | 0,2828801 |
| 17,918 | 537,8 | 543,2 | 98,80 | 99,70 | 0,183 | 0,177 | 72 | 0,2808555 |
| 17,429 | 537,9 | 543,2 | 101,78 | 102,30 | 0,183 | 0,177 | 73 | 0,2732065 |
| 17,924 | 537,8 | 543,2 | 98,87 | 99,70 | 0,183 | 0,177 | 74 | 0,2808999 |
| 17,531 | 537,8 | 543,3 | 101,15 | 101,86 | 0,183 | 0,177 | 75 | 0,2748094 |
| 18,288 | 537,8 | 543,2 | 96,69 | 97,56 | 0,183 | 0,177 | 76 | 0,2867824 |
| 18,179 | 537,8 | 543,3 | 97,55 | 98,15 | 0,183 | 0,177 | 77 | 0,2849843 |
| 17,794 | 537,9 | 543,4 | 99,48 | 100,39 | 0,183 | 0,177 | 78 | 0,278974 |
| 18,032 | 537,9 | 543,4 | 98,09 | 98,83 | 0,183 | 0,177 | 79 | 0,2827937 |
| 17,830 | 537,9 | 543,4 | 99,33 | 100,05 | 0,183 | 0,177 | 80 | 0,2795761 |
| 18,158 | 537,9 | 543,4 | 97,61 | 98,49 | 0,183 | 0,177 | 81 | 0,2846459 |
| 17,740 | 538,0 | 543,5 | 99,77 | 100,72 | 0,183 | 0,178 | 82 | 0,2781343 |
| 17,949 | 538,0 | 543,4 | 98,45 | 99,36 | 0,183 | 0,177 | 83 | 0,2814509 |
| 17,753 | 538,0 | 543,5 | 99,78 | 100,46 | 0,183 | 0,177 | 84 | 0,2784223 |
| 17,252 | 538,0 | 543,5 | 102,49 | 103,31 | 0,183 | 0,177 | 85 | 0,2705654 |
| 18,173 | 538,1 | 543,5 | 97,37 | 98,17 | 0,183 | 0,177 | 86 | 0,2849826 |
| 17,997 | 538,1 | 543,5 | 98,09 | 98,92 | 0,183 | 0,177 | 87 | 0,2824483 |
| 17,487 | 538,0 | 543,4 | 101,24 | 101,98 | 0,183 | 0,177 | 88 | 0,2743588 |
| 17,425 | 538,1 | 543,5 | 101,43 | 102,12 | 0,183 | 0,177 | 89 | 0,2734916 |
| 18,008 | 538,2 | 543,6 | 97,80 | 98,93 | 0,183 | 0,177 | 90 | 0,2828145 |
| 17,830 | 538,2 | 543,7 | 98,89 | 99,82 | 0,183 | 0,177 | 91 | 0,2799035 |
| 17,859 | 538,2 | 543,7 | 98,86 | 99,60 | 0,183 | 0,177 | 92 | 0,2803178 |
| 18,099 | 538,1 | 543,7 | 97,61 | 98,50 | 0,183 | 0,177 | 93 | 0,2839387 |
| 18,324 | 538,0 | 543,6 | 96,60 | 97,28 | 0,183 | 0,177 | 94 | 0,287498 |
| 17,864 | 538,0 | 543,6 | 98,75 | 99,68 | 0,183 | 0,177 | 95 | 0,2804002 |
| 18,047 | 538,1 | 543,7 | 97,81 | 98,55 | 0,183 | 0,177 | 96 | 0,2833585 |
| 18,291 | 538,2 | 543,7 | 96,41 | 97,27 | 0,183 | 0,177 | 97 | 0,2871407 |
| 17,121 | 538,1 | 543,7 | 103,25 | 103,75 | 0,183 | 0,177 | 98 | 0,2686592 |
| 17,587 | 538,2 | 543,8 | 100,47 | 101,24 | 0,183 | 0,177 | 99 | 0,2760392 |
| 17,999 | 538,2 | 543,8 | 98,26 | 99,00 | 0,183 | 0,177 | 100 | 0,2824515 |
| 18,099 | 538,1 | 543,7 | 97,62 | 98,89 | 0,183 | 0,178 | 101 | 0,2840825 |
| 17,984 | 538,1 | 543,6 | 98,22 | 99,02 | 0,183 | 0,178 | 102 | 0,2821796 |
| 17,098 | 538,1 | 543,7 | 103,35 | 104,12 | 0,183 | 0,177 | 103 | 0,2682705 |
| 18,225 | 538,1 | 543,7 | 97,06 | 97,96 | 0,183 | 0,177 | 104 | 0,2858854 |
| 17,415 | 538,1 | 543,7 | 101,15 | 101,80 | 0,183 | 0,177 | 105 | 0,2735842 |
| 17,317 | 538,1 | 543,7 | 101,96 | 102,73 | 0,183 | 0,177 | 106 | 0,2718895 |
| 17,705 | 538,3 | 543,8 | 99,43 | 100,30 | 0,183 | 0,177 | 107 | 0,2784217 |
| 18,179 | 538,4 | 543,9 | 96,91 | 97,69 | 0,183 | 0,177 | 108 | 0,2855269 |
| 18,036 | 538,4 | 544,0 | 97,89 | 98,50 | 0,183 | 0,177 | 109 | 0,2833596 |
| 18,195 | 538,5 | 544,1 | 96,79 | 97,72 | 0,183 | 0,177 | 110 | 0,2858856 |
| 17,643 | 538,5 | 544,1 | 99,81 | 100,62 | 0,183 | 0,177 | 111 | 0,2771279 |
| 18,153 | 538,4 | 544,1 | 97,08 | 98,04 | 0,183 | 0,177 | 112 | 0,2850112 |
| 17,789 | 538,3 | 544,0 | 99,16 | 99,83 | 0,183 | 0,177 | 113 | 0,2793709 |
| 17,324 | 538,3 | 543,9 | 101,87 | 102,90 | 0,183 | 0,177 | 114 | 0,2718871 |
| 18,203 | 538,2 | 543,8 | 96,98 | 97,92 | 0,183 | 0,178 | 115 | 0,2858207 |
| 18,155 | 538,2 | 543,8 | 97,26 | 97,90 | 0,183 | 0,177 | 116 | 0,2850735 |

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|---|---|---|---|---|---|---|---|---|
| 18,026 | 538,2 | 543,8 | 97,75 | 98,47 | 0,183 | 0,177 | 117 | 0,2833557 |
| 17,359 | 538,4 | 543,9 | 101,41 | 102,22 | 0,183 | 0,177 | 118 | 0,2728313 |
| 17,108 | 538,4 | 544,0 | 102,84 | 103,56 | 0,183 | 0,177 | 119 | 0,2690418 |
| 18,090 | 538,4 | 544,0 | 97,06 | 97,92 | 0,183 | 0,177 | 120 | 0,2846064 |
| 17,775 | 538,4 | 544,1 | 99,05 | 99,85 | 0,183 | 0,177 | 121 | 0,2793422 |
| 18,050 | 538,4 | 544,1 | 97,50 | 98,32 | 0,183 | 0,177 | 122 | 0,2837198 |
| 17,841 | 538,3 | 544,0 | 98,63 | 99,48 | 0,183 | 0,177 | 123 | 0,2802806 |
| 17,047 | 538,3 | 544,0 | 103,63 | 104,43 | 0,183 | 0,177 | 124 | 0,2677017 |
| 18,221 | 538,2 | 543,9 | 96,80 | 97,56 | 0,183 | 0,177 | 125 | 0,286208 |
| 17,994 | 538,2 | 543,9 | 97,84 | 98,48 | 0,183 | 0,177 | 126 | 0,2827391 |
| 18,008 | 538,2 | 543,9 | 97,89 | 98,59 | 0,183 | 0,177 | 127 | 0,282839 |
| 18,184 | 538,2 | 543,9 | 97,05 | 97,47 | 0,183 | 0,177 | 128 | 0,2855257 |
| 17,491 | 538,2 | 543,8 | 100,65 | 101,41 | 0,183 | 0,177 | 129 | 0,2748926 |
| 17,842 | 538,3 | 543,9 | 98,84 | 99,63 | 0,183 | 0,177 | 130 | 0,2802764 |
| 18,107 | 538,3 | 543,9 | 97,13 | 98,14 | 0,183 | 0,177 | 131 | 0,2846227 |
| 18,389 | 538,3 | 543,8 | 95,77 | 96,48 | 0,183 | 0,177 | 132 | 0,2889227 |
| 18,228 | 538,3 | 543,9 | 96,70 | 97,60 | 0,183 | 0,177 | 133 | 0,2862628 |
| 17,690 | 538,4 | 543,9 | 99,89 | 100,51 | 0,183 | 0,177 | 134 | 0,2776622 |
| 18,177 | 538,4 | 543,9 | 97,04 | 97,75 | 0,183 | 0,177 | 135 | 0,285524 |
| 18,123 | 538,5 | 544,0 | 97,25 | 97,86 | 0,183 | 0,177 | 136 | 0,2846235 |
| 17,949 | 538,5 | 544,1 | 98,32 | 99,17 | 0,183 | 0,177 | 137 | 0,2817664 |
| 18,285 | 538,6 | 544,1 | 96,34 | 97,36 | 0,183 | 0,177 | 138 | 0,2871385 |
| 18,085 | 538,6 | 544,1 | 97,35 | 98,28 | 0,183 | 0,177 | 139 | 0,2840821 |
| 18,272 | 538,6 | 544,1 | 96,11 | 97,14 | 0,183 | 0,177 | 140 | 0,2871383 |
| 18,037 | 538,6 | 544,0 | 97,66 | 98,30 | 0,183 | 0,177 | 141 | 0,2833525 |
| 17,798 | 538,6 | 544,0 | 98,82 | 99,59 | 0,183 | 0,177 | 142 | 0,2798923 |
| 17,827 | 538,5 | 544,0 | 98,70 | 99,77 | 0,183 | 0,177 | 143 | 0,2802476 |
| 17,684 | 538,5 | 544,0 | 99,46 | 100,42 | 0,183 | 0,178 | 144 | 0,2780496 |
| 17,294 | 538,5 | 544,0 | 101,65 | 102,61 | 0,183 | 0,177 | 145 | 0,2718863 |
| 18,245 | 538,5 | 543,9 | 96,50 | 97,51 | 0,183 | 0,177 | 146 | 0,2867836 |
| 17,825 | 538,4 | 543,9 | 98,75 | 99,60 | 0,183 | 0,178 | 147 | 0,2802607 |
| 17,176 | 538,5 | 543,9 | 102,48 | 103,29 | 0,183 | 0,177 | 148 | 0,2699912 |
| 17,775 | 538,4 | 543,9 | 98,97 | 99,96 | 0,183 | 0,177 | 149 | 0,2793399 |

| | Outlet | Outlet | Average | Average | #1 | #2 | | |
|---|---|---|---|---|---|---|---|---|
| Tunnel | Temp. | Temp. | 100,91 | 100,71 | 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 |
| 17,007 | 539,1 | 540,2 | | | 0,186 | 0,180 | 0 | 0,2673222 |
| 16,346 | 539,2 | 540,4 | 101,16 | 101,47 | 0,186 | 0,180 | 1 | 0,2579667 |
| 16,501 | 539,3 | 540,5 | 100,14 | 100,59 | 0,186 | 0,180 | 2 | 0,2603149 |
| 17,033 | 539,4 | 540,7 | 97,26 | 97,57 | 0,186 | 0,180 | 3 | 0,2686438 |
| 16,579 | 539,4 | 540,9 | 99,86 | 100,03 | 0,186 | 0,180 | 4 | 0,2614883 |
| 15,995 | 539,5 | 541,1 | 103,56 | 103,63 | 0,186 | 0,180 | 5 | 0,2523051 |
| 16,647 | 539,5 | 541,2 | 99,59 | 99,83 | 0,186 | 0,180 | 6 | 0,262324 |
| 17,145 | 539,5 | 541,4 | 97,03 | 97,15 | 0,186 | 0,180 | 7 | 0,2699975 |
| 16,960 | 539,5 | 541,5 | 98,12 | 98,35 | 0,186 | 0,180 | 8 | 0,2669526 |
| 16,527 | 539,5 | 541,6 | 100,83 | 101,31 | 0,186 | 0,180 | 9 | 0,2599203 |
| 17,106 | 539,5 | 541,7 | 97,29 | 97,46 | 0,186 | 0,180 | 10 | 0,269092 |
| 16,788 | 539,5 | 541,9 | 99,33 | 99,72 | 0,186 | 0,180 | 11 | 0,2639237 |
| 16,547 | 539,6 | 542,0 | 100,90 | 101,08 | 0,186 | 0,180 | 12 | 0,2599154 |
| 16,333 | 539,6 | 542,2 | 102,19 | 102,35 | 0,186 | 0,180 | 13 | 0,2565419 |
| 16,157 | 539,7 | 542,4 | 103,34 | 103,46 | 0,186 | 0,179 | 14 | 0,2537258 |
| 16,463 | 539,8 | 542,5 | 101,31 | 101,38 | 0,186 | 0,179 | 15 | 0,2585979 |
| 16,444 | 539,8 | 542,7 | 101,88 | 101,92 | 0,186 | 0,179 | 16 | 0,2579403 |
| 16,695 | 539,9 | 542,9 | 100,60 | 100,64 | 0,186 | 0,180 | 17 | 0,2616921 |
| 16,248 | 540,0 | 543,1 | 103,28 | 103,06 | 0,186 | 0,179 | 18 | 0,2546853 |
| 16,260 | 540,1 | 543,3 | 103,27 | 103,29 | 0,186 | 0,179 | 19 | 0,2547366 |
| 16,292 | 540,3 | 543,5 | 103,13 | 102,96 | 0,186 | 0,179 | 20 | 0,2551382 |
| 16,239 | 540,4 | 543,7 | 103,17 | 103,02 | 0,186 | 0,179 | 21 | 0,2544863 |
| 16,194 | 540,5 | 543,9 | 103,47 | 103,35 | 0,186 | 0,179 | 22 | 0,2537196 |
| 16,274 | 540,5 | 544,0 | 103,23 | 103,19 | 0,186 | 0,179 | 23 | 0,2547356 |
| 16,049 | 540,6 | 544,2 | 104,62 | 104,53 | 0,186 | 0,179 | 24 | 0,2512877 |
| 16,560 | 540,7 | 544,4 | 101,47 | 101,26 | 0,186 | 0,179 | 25 | 0,2593396 |
| 16,260 | 540,6 | 544,4 | 103,11 | 102,87 | 0,186 | 0,179 | 26 | 0,2547382 |
| 16,646 | 540,5 | 544,4 | 100,59 | 100,38 | 0,186 | 0,179 | 27 | 0,2609071 |
| 16,826 | 540,5 | 544,4 | 99,62 | 99,62 | 0,186 | 0,179 | 28 | 0,2636497 |
| 16,810 | 540,6 | 544,5 | 99,62 | 99,38 | 0,186 | 0,179 | 29 | 0,2636516 |
| 16,289 | 540,6 | 544,6 | 102,79 | 102,71 | 0,186 | 0,179 | 30 | 0,2555427 |
| 16,612 | 540,6 | 544,7 | 100,78 | 100,78 | 0,186 | 0,179 | 31 | 0,2603174 |
| 16,671 | 540,6 | 544,7 | 100,55 | 100,14 | 0,186 | 0,179 | 32 | 0,2613318 |
| 16,658 | 540,6 | 544,7 | 100,74 | 100,59 | 0,186 | 0,179 | 33 | 0,2609074 |
| 16,393 | 540,5 | 544,7 | 102,58 | 102,17 | 0,186 | 0,179 | 34 | 0,2565439 |
| 16,944 | 540,5 | 544,8 | 99,10 | 98,94 | 0,186 | 0,179 | 35 | 0,2652984 |
| 17,075 | 540,6 | 544,8 | 98,10 | 97,83 | 0,186 | 0,179 | 36 | 0,2677073 |
| 16,411 | 540,6 | 544,9 | 102,20 | 102,09 | 0,186 | 0,179 | 37 | 0,2571419 |
| 16,691 | 540,7 | 545,0 | 100,61 | 100,43 | 0,186 | 0,179 | 38 | 0,2613022 |
| 17,154 | 540,8 | 545,2 | 97,91 | 97,57 | 0,186 | 0,179 | 39 | 0,2686653 |
| 16,388 | 540,8 | 545,2 | 102,07 | 101,83 | 0,186 | 0,179 | 40 | 0,2571449 |
| 16,831 | 540,8 | 545,2 | 99,55 | 99,61 | 0,186 | 0,179 | 41 | 0,2636502 |
| 16,075 | 540,7 | 545,2 | 104,31 | 104,01 | 0,186 | 0,179 | 42 | 0,2516973 |
| 16,169 | 540,7 | 545,3 | 103,66 | 103,62 | 0,186 | 0,179 | 43 | 0,2533202 |
| 16,426 | 540,9 | 545,4 | 102,13 | 102,18 | 0,186 | 0,179 | 44 | 0,2572663 |
| 16,537 | 541,0 | 545,6 | 101,26 | 101,19 | 0,186 | 0,179 | 45 | 0,2589385 |
| 16,128 | 541,1 | 545,7 | 103,86 | 103,48 | 0,186 | 0,178 | 46 | 0,2527155 |
| 16,131 | 541,1 | 545,8 | 103,62 | 103,67 | 0,186 | 0,178 | 47 | 0,2527148 |
| 16,954 | 541,2 | 545,8 | 98,78 | 98,75 | 0,186 | 0,179 | 48 | 0,2656237 |
| 16,049 | 541,4 | 546,0 | 103,93 | 103,52 | 0,186 | 0,179 | 49 | 0,2520404 |
| 16,645 | 541,4 | 546,0 | 100,39 | 99,94 | 0,186 | 0,178 | 50 | 0,2613016 |
| 16,478 | 541,4 | 546,1 | 101,26 | 101,19 | 0,186 | 0,179 | 51 | 0,2585377 |
| 17,143 | 541,4 | 546,1 | 97,28 | 96,84 | 0,186 | 0,178 | 52 | 0,2690929 |
| 16,230 | 541,5 | 546,3 | 102,81 | 102,51 | 0,186 | 0,178 | 53 | 0,2547364 |
| 16,433 | 541,4 | 546,3 | 101,60 | 101,28 | 0,186 | 0,178 | 54 | 0,2579416 |
| 16,526 | 541,4 | 546,3 | 100,84 | 100,60 | 0,186 | 0,179 | 55 | 0,2596223 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 16,194 | 541,4 | 546,4 | 102,75 | 102,39 | 0,186 | 0,179 | 56 | 0,2547382 |
| 16,803 | 541,4 | 546,4 | 99,11 | 98,79 | 0,186 | 0,179 | 57 | 0,2640412 |
| 16,640 | 541,4 | 546,3 | 99,80 | 99,58 | 0,186 | 0,178 | 58 | 0,2616974 |
| 16,194 | 541,3 | 546,3 | 102,45 | 102,26 | 0,186 | 0,178 | 59 | 0,2547397 |
| 16,395 | 541,3 | 546,3 | 101,38 | 101,08 | 0,186 | 0,178 | 60 | 0,257913 |
| 16,516 | 541,3 | 546,3 | 100,58 | 100,31 | 0,186 | 0,179 | 61 | 0,2599238 |
| 16,600 | 541,3 | 546,3 | 100,11 | 99,77 | 0,186 | 0,178 | 62 | 0,2610611 |
| 16,131 | 541,3 | 546,3 | 103,17 | 102,68 | 0,186 | 0,178 | 63 | 0,2537265 |
| 16,605 | 541,3 | 546,3 | 100,01 | 99,56 | 0,186 | 0,178 | 64 | 0,261304 |
| 16,590 | 541,3 | 546,3 | 100,17 | 100,08 | 0,186 | 0,179 | 65 | 0,2610995 |
| 16,395 | 541,4 | 546,4 | 101,40 | 101,13 | 0,186 | 0,179 | 66 | 0,2579434 |
| 16,628 | 541,5 | 546,4 | 99,84 | 99,58 | 0,186 | 0,179 | 67 | 0,2616995 |
| 16,128 | 541,5 | 546,5 | 102,99 | 102,56 | 0,186 | 0,178 | 68 | 0,2537289 |
| 16,364 | 541,5 | 546,5 | 101,39 | 101,15 | 0,186 | 0,178 | 69 | 0,2576007 |
| 16,256 | 541,5 | 546,5 | 102,43 | 101,94 | 0,186 | 0,178 | 70 | 0,255536 |
| 16,381 | 541,5 | 546,6 | 101,16 | 100,74 | 0,186 | 0,178 | 71 | 0,2579431 |
| 16,448 | 541,6 | 546,6 | 100,69 | 100,55 | 0,186 | 0,178 | 72 | 0,2589873 |
| 16,347 | 541,6 | 546,7 | 101,62 | 101,31 | 0,186 | 0,178 | 73 | 0,2571448 |
| 16,191 | 541,6 | 546,7 | 102,58 | 102,28 | 0,186 | 0,178 | 74 | 0,2547411 |
| 16,061 | 541,5 | 546,6 | 103,42 | 102,96 | 0,186 | 0,178 | 75 | 0,2527166 |
| 16,451 | 541,4 | 546,6 | 100,91 | 100,73 | 0,186 | 0,178 | 76 | 0,2589365 |
| 16,353 | 541,5 | 546,6 | 101,44 | 101,09 | 0,186 | 0,179 | 77 | 0,2575436 |
| 16,913 | 541,5 | 546,6 | 98,02 | 97,90 | 0,186 | 0,179 | 78 | 0,2663641 |
| 16,442 | 541,6 | 546,7 | 100,85 | 100,48 | 0,186 | 0,179 | 79 | 0,2589358 |
| 16,443 | 541,6 | 546,7 | 100,87 | 100,59 | 0,186 | 0,178 | 80 | 0,2588916 |
| 15,793 | 541,6 | 546,7 | 104,87 | 104,54 | 0,186 | 0,178 | 81 | 0,2488284 |
| 16,593 | 541,7 | 546,7 | 99,63 | 99,21 | 0,186 | 0,178 | 82 | 0,2616982 |
| 16,125 | 541,7 | 546,8 | 102,60 | 102,17 | 0,186 | 0,178 | 83 | 0,2541362 |
| 16,738 | 541,8 | 546,8 | 98,82 | 98,59 | 0,186 | 0,178 | 84 | 0,2636537 |
| 16,497 | 541,8 | 546,9 | 100,44 | 100,00 | 0,186 | 0,178 | 85 | 0,2599267 |
| 16,561 | 541,9 | 547,0 | 100,14 | 99,56 | 0,186 | 0,178 | 86 | 0,26082 |
| 16,172 | 542,1 | 547,1 | 102,42 | 101,83 | 0,186 | 0,178 | 87 | 0,2547299 |
| 16,882 | 542,2 | 547,3 | 97,97 | 97,77 | 0,186 | 0,178 | 88 | 0,2659796 |
| 16,434 | 542,2 | 547,3 | 100,59 | 100,35 | 0,186 | 0,178 | 89 | 0,2589367 |
| 16,358 | 542,1 | 547,3 | 101,11 | 100,37 | 0,186 | 0,178 | 90 | 0,2579929 |
| 16,644 | 542,1 | 547,4 | 99,35 | 99,11 | 0,186 | 0,178 | 91 | 0,2622851 |
| 16,877 | 542,2 | 547,4 | 98,11 | 97,47 | 0,186 | 0,178 | 92 | 0,265978 |
| 16,581 | 542,2 | 547,5 | 99,82 | 99,50 | 0,186 | 0,178 | 93 | 0,2612345 |
| 16,513 | 542,1 | 547,4 | 100,48 | 100,19 | 0,186 | 0,178 | 94 | 0,2599253 |
| 16,498 | 542,1 | 547,5 | 100,34 | 99,95 | 0,186 | 0,178 | 95 | 0,2599254 |
| 16,363 | 542,1 | 547,5 | 100,96 | 100,71 | 0,185 | 0,178 | 96 | 0,2575447 |
| 16,478 | 542,1 | 547,4 | 100,78 | 100,18 | 0,185 | 0,178 | 97 | 0,2593212 |
| 16,768 | 542,1 | 547,4 | 98,77 | 98,50 | 0,186 | 0,178 | 98 | 0,2640395 |
| 16,640 | 542,1 | 547,4 | 99,40 | 98,88 | 0,186 | 0,178 | 99 | 0,2622852 |
| 16,804 | 542,1 | 547,4 | 98,33 | 98,16 | 0,186 | 0,178 | 100 | 0,2650061 |
| 16,695 | 542,0 | 547,3 | 99,00 | 98,80 | 0,186 | 0,179 | 101 | 0,2632611 |
| 16,892 | 542,0 | 547,3 | 97,74 | 97,53 | 0,186 | 0,178 | 102 | 0,2663641 |
| 16,091 | 542,0 | 547,3 | 102,82 | 102,30 | 0,186 | 0,178 | 103 | 0,2537295 |
| 17,113 | 542,0 | 547,2 | 96,49 | 96,21 | 0,186 | 0,178 | 104 | 0,2699875 |
| 16,419 | 542,0 | 547,2 | 100,74 | 100,24 | 0,186 | 0,178 | 105 | 0,2589353 |
| 16,390 | 542,0 | 547,2 | 100,82 | 100,49 | 0,186 | 0,178 | 106 | 0,2585376 |
| 16,933 | 542,1 | 547,3 | 97,60 | 97,36 | 0,186 | 0,178 | 107 | 0,2669422 |
| 15,992 | 542,1 | 547,3 | 103,14 | 102,92 | 0,186 | 0,178 | 108 | 0,2523079 |

| | Outlet | Outlet | Average | Average | #1 | #2 | | |
|---|---|---|---|---|---|---|---|---|
| Tunnel | Temp. | Temp. | 100,91 | 100,54 | 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 |
| 17,008 | 534,4 | 535,4 | | | 0,179 | 0,182 | 0 | 0,2676873 |
| 16,761 | 534,4 | 535,5 | 99,59 | 100,05 | 0,179 | 0,182 | 1 | 0,265005 |
| 16,462 | 534,5 | 535,6 | 101,35 | 101,66 | 0,178 | 0,182 | 2 | 0,2604102 |
| 16,722 | 534,5 | 535,8 | 99,86 | 100,04 | 0,179 | 0,182 | 3 | 0,2646033 |
| 16,894 | 534,6 | 535,9 | 98,96 | 99,16 | 0,179 | 0,182 | 4 | 0,2672169 |
| 15,897 | 534,6 | 536,1 | 105,31 | 105,56 | 0,179 | 0,182 | 5 | 0,251272 |
| 16,117 | 534,7 | 536,3 | 103,77 | 104,03 | 0,179 | 0,182 | 6 | 0,2547175 |
| 16,835 | 534,7 | 536,4 | 99,61 | 99,60 | 0,179 | 0,182 | 7 | 0,2659549 |
| 16,873 | 534,7 | 536,5 | 99,35 | 99,19 | 0,179 | 0,181 | 8 | 0,2666116 |
| 16,712 | 534,8 | 536,7 | 100,36 | 100,49 | 0,179 | 0,181 | 9 | 0,2640192 |
| 16,711 | 534,9 | 536,9 | 100,35 | 100,43 | 0,179 | 0,182 | 10 | 0,264018 |
| 16,891 | 534,9 | 537,1 | 99,21 | 99,24 | 0,179 | 0,182 | 11 | 0,2668909 |
| 16,000 | 534,9 | 537,2 | 104,81 | 104,81 | 0,179 | 0,181 | 12 | 0,2526804 |
| 16,489 | 534,9 | 537,3 | 101,68 | 101,73 | 0,179 | 0,181 | 13 | 0,2602998 |
| 16,081 | 535,0 | 537,5 | 104,64 | 104,41 | 0,179 | 0,181 | 14 | 0,2537503 |
| 16,434 | 535,1 | 537,6 | 102,24 | 102,26 | 0,179 | 0,181 | 15 | 0,2593105 |
| 16,885 | 535,1 | 537,8 | 99,49 | 99,36 | 0,179 | 0,181 | 16 | 0,2663405 |
| 16,587 | 535,2 | 538,0 | 101,32 | 101,34 | 0,179 | 0,181 | 17 | 0,2616754 |
| 16,655 | 535,2 | 538,0 | 101,28 | 101,12 | 0,179 | 0,181 | 18 | 0,2623181 |
| 16,024 | 535,2 | 538,1 | 105,26 | 105,25 | 0,179 | 0,181 | 19 | 0,2523898 |
| 16,481 | 535,3 | 538,2 | 102,32 | 102,17 | 0,179 | 0,181 | 20 | 0,2596064 |
| 16,479 | 535,2 | 538,3 | 102,44 | 102,40 | 0,179 | 0,181 | 21 | 0,2593111 |
| 16,398 | 535,2 | 538,3 | 102,63 | 102,70 | 0,179 | 0,181 | 22 | 0,258237 |
| 16,094 | 535,2 | 538,4 | 104,76 | 104,82 | 0,179 | 0,181 | 23 | 0,2533008 |
| 16,543 | 535,1 | 538,4 | 102,03 | 102,14 | 0,179 | 0,181 | 24 | 0,2602999 |
| 16,615 | 535,2 | 538,5 | 101,92 | 101,52 | 0,179 | 0,181 | 25 | 0,2612832 |
| 16,041 | 535,3 | 538,7 | 105,45 | 105,18 | 0,179 | 0,181 | 26 | 0,2523453 |
| 16,537 | 535,3 | 538,8 | 102,44 | 102,13 | 0,179 | 0,181 | 27 | 0,2599035 |
| 16,104 | 535,4 | 538,9 | 104,99 | 104,81 | 0,179 | 0,181 | 28 | 0,2533057 |
| 16,291 | 535,4 | 538,9 | 103,64 | 103,40 | 0,179 | 0,181 | 29 | 0,2563874 |
| 15,967 | 535,5 | 539,0 | 105,85 | 105,39 | 0,179 | 0,181 | 30 | 0,2512692 |
| 16,385 | 535,5 | 539,1 | 103,21 | 103,31 | 0,179 | 0,181 | 31 | 0,2575248 |
| 16,618 | 535,6 | 539,3 | 102,19 | 101,74 | 0,179 | 0,181 | 32 | 0,2608928 |
| 16,823 | 535,8 | 539,5 | 101,01 | 100,59 | 0,179 | 0,181 | 33 | 0,2638853 |
| 16,529 | 536,0 | 539,8 | 102,82 | 102,52 | 0,179 | 0,181 | 34 | 0,2593033 |
| 16,668 | 536,3 | 540,1 | 101,95 | 101,70 | 0,179 | 0,181 | 35 | 0,2612845 |
| 16,614 | 536,6 | 540,4 | 102,35 | 102,11 | 0,179 | 0,181 | 36 | 0,2603438 |
| 16,509 | 536,8 | 540,7 | 102,62 | 102,33 | 0,178 | 0,180 | 37 | 0,2589213 |
| 16,449 | 537,1 | 540,9 | 103,42 | 102,95 | 0,178 | 0,180 | 38 | 0,257526 |
| 16,599 | 537,3 | 541,2 | 102,48 | 102,19 | 0,178 | 0,180 | 39 | 0,2598996 |
| 16,540 | 537,5 | 541,4 | 102,88 | 102,35 | 0,178 | 0,180 | 40 | 0,2589228 |
| 17,053 | 537,6 | 541,6 | 99,81 | 99,26 | 0,178 | 0,180 | 41 | 0,2669254 |
| 16,182 | 537,8 | 541,8 | 104,94 | 104,87 | 0,178 | 0,180 | 42 | 0,2533086 |
| 16,684 | 537,9 | 542,0 | 102,03 | 101,54 | 0,178 | 0,180 | 43 | 0,2611016 |
| 17,053 | 538,1 | 542,3 | 99,73 | 99,17 | 0,178 | 0,180 | 44 | 0,2669244 |
| 16,547 | 538,2 | 542,4 | 102,69 | 102,38 | 0,178 | 0,180 | 45 | 0,2589225 |
| 16,903 | 538,3 | 542,6 | 100,48 | 100,22 | 0,178 | 0,180 | 46 | 0,2645728 |
| 16,679 | 538,4 | 542,8 | 101,96 | 101,42 | 0,178 | 0,180 | 47 | 0,2609501 |
| 17,110 | 538,6 | 543,0 | 99,35 | 98,90 | 0,178 | 0,180 | 48 | 0,2676951 |
| 16,910 | 538,7 | 543,1 | 100,39 | 100,07 | 0,178 | 0,180 | 49 | 0,2646109 |
| 16,325 | 538,8 | 543,3 | 104,03 | 103,56 | 0,178 | 0,180 | 50 | 0,2555057 |
| 16,905 | 538,9 | 543,4 | 100,29 | 100,24 | 0,178 | 0,180 | 51 | 0,2646114 |
| 16,608 | 539,0 | 543,6 | 102,23 | 101,85 | 0,178 | 0,180 | 52 | 0,2599146 |
| 16,669 | 539,1 | 543,7 | 101,39 | 101,08 | 0,178 | 0,180 | 53 | 0,2612931 |
| 16,755 | 539,2 | 543,9 | 101,23 | 100,50 | 0,178 | 0,179 | 54 | 0,2622738 |
| 16,896 | 539,3 | 544,0 | 100,24 | 99,81 | 0,178 | 0,179 | 55 | 0,2646127 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 16,745 | 539,4 | 544,1 | 101,08 | 100,72 | 0,178 | 0,179 | 56 | 0,262275 |
| 16,917 | 539,6 | 544,3 | 100,16 | 99,58 | 0,178 | 0,179 | 57 | 0,2650211 |
| 16,821 | 539,7 | 544,4 | 100,57 | 100,30 | 0,178 | 0,180 | 58 | 0,2636422 |
| 16,643 | 539,8 | 544,6 | 101,44 | 101,19 | 0,178 | 0,180 | 59 | 0,2609015 |
| 16,731 | 539,9 | 544,7 | 101,11 | 100,63 | 0,178 | 0,179 | 60 | 0,2622759 |
| 16,778 | 540,0 | 544,9 | 100,50 | 100,10 | 0,178 | 0,179 | 61 | 0,263256 |
| 16,916 | 540,1 | 545,0 | 99,74 | 99,03 | 0,178 | 0,179 | 62 | 0,2653893 |
| 16,445 | 540,2 | 545,1 | 102,75 | 102,20 | 0,178 | 0,179 | 63 | 0,2577359 |
| 16,879 | 540,3 | 545,2 | 99,78 | 99,22 | 0,178 | 0,179 | 64 | 0,2650037 |
| 16,518 | 540,3 | 545,3 | 102,32 | 101,55 | 0,178 | 0,179 | 65 | 0,2589277 |
| 17,122 | 540,4 | 545,4 | 98,37 | 97,88 | 0,177 | 0,179 | 66 | 0,2686596 |
| 16,792 | 540,4 | 545,5 | 100,54 | 99,91 | 0,177 | 0,179 | 67 | 0,2634161 |
| 16,656 | 540,5 | 545,6 | 101,25 | 100,71 | 0,178 | 0,179 | 68 | 0,2613056 |
| 16,498 | 540,6 | 545,7 | 102,17 | 101,53 | 0,178 | 0,179 | 69 | 0,2589306 |
| 16,661 | 540,7 | 545,8 | 100,89 | 100,44 | 0,177 | 0,179 | 70 | 0,2616884 |
| 16,891 | 540,8 | 545,9 | 99,74 | 99,26 | 0,177 | 0,179 | 71 | 0,2650058 |
| 16,384 | 540,8 | 546,0 | 102,35 | 102,06 | 0,177 | 0,179 | 72 | 0,2575372 |
| 16,954 | 540,4 | 545,7 | 98,81 | 98,19 | 0,177 | 0,179 | 73 | 0,2669363 |
| 17,203 | 540,1 | 545,5 | 97,23 | 96,66 | 0,178 | 0,179 | 74 | 0,2709596 |
| 16,215 | 539,7 | 545,2 | 103,24 | 102,47 | 0,178 | 0,179 | 75 | 0,2555353 |
| 16,276 | 539,4 | 544,9 | 102,93 | 102,53 | 0,178 | 0,179 | 76 | 0,2565418 |
| 16,723 | 539,1 | 544,7 | 99,99 | 99,35 | 0,178 | 0,179 | 77 | 0,2636207 |
| 16,893 | 538,8 | 544,4 | 99,19 | 98,59 | 0,178 | 0,179 | 78 | 0,2663796 |
| 16,854 | 538,6 | 544,2 | 98,97 | 98,56 | 0,178 | 0,180 | 79 | 0,2659723 |
| 17,148 | 538,4 | 544,0 | 97,64 | 97,18 | 0,178 | 0,180 | 80 | 0,2705659 |
| 17,104 | 538,3 | 543,9 | 97,87 | 97,00 | 0,178 | 0,180 | 81 | 0,269996 |
| 16,142 | 538,2 | 543,7 | 103,44 | 102,67 | 0,178 | 0,179 | 82 | 0,2551307 |
| 17,080 | 538,2 | 543,7 | 97,67 | 97,06 | 0,178 | 0,180 | 83 | 0,2699967 |
| 17,283 | 538,3 | 543,7 | 96,53 | 96,22 | 0,178 | 0,180 | 84 | 0,2731927 |
| 16,154 | 538,3 | 543,7 | 103,12 | 102,42 | 0,178 | 0,180 | 85 | 0,2555809 |
| 16,927 | 538,2 | 543,7 | 98,54 | 97,99 | 0,178 | 0,180 | 86 | 0,2677025 |
| 16,793 | 538,3 | 543,8 | 99,30 | 98,79 | 0,178 | 0,180 | 87 | 0,2653909 |
| 16,686 | 538,2 | 543,7 | 100,21 | 99,56 | 0,178 | 0,180 | 88 | 0,2635283 |
| 17,025 | 538,2 | 543,7 | 98,07 | 97,64 | 0,178 | 0,180 | 89 | 0,2690391 |
| 16,528 | 538,1 | 543,6 | 100,78 | 100,53 | 0,178 | 0,180 | 90 | 0,2612961 |
| 16,374 | 538,0 | 543,5 | 101,94 | 101,06 | 0,178 | 0,180 | 91 | 0,2589287 |
| 16,557 | 538,0 | 543,5 | 100,98 | 100,19 | 0,178 | 0,179 | 92 | 0,2615191 |
| 16,855 | 537,9 | 543,4 | 98,93 | 98,35 | 0,178 | 0,180 | 93 | 0,2663725 |
| 16,975 | 537,7 | 543,4 | 98,29 | 97,70 | 0,178 | 0,180 | 94 | 0,2682769 |
| 17,198 | 537,7 | 543,3 | 97,01 | 96,55 | 0,178 | 0,180 | 95 | 0,2718873 |
| 16,841 | 537,7 | 543,4 | 99,12 | 98,42 | 0,178 | 0,180 | 96 | 0,2663547 |
| 16,022 | 537,8 | 543,4 | 104,36 | 103,30 | 0,179 | 0,180 | 97 | 0,2533151 |
| 17,005 | 537,8 | 543,4 | 97,95 | 97,60 | 0,178 | 0,180 | 98 | 0,2689093 |
| 16,885 | 537,7 | 543,3 | 98,77 | 98,25 | 0,178 | 0,180 | 99 | 0,2669771 |
| 16,652 | 537,6 | 543,2 | 100,11 | 99,66 | 0,178 | 0,180 | 100 | 0,2632511 |
| 16,912 | 537,6 | 543,1 | 98,76 | 98,23 | 0,178 | 0,180 | 101 | 0,2673153 |
| 16,823 | 537,6 | 543,2 | 99,31 | 98,73 | 0,178 | 0,180 | 102 | 0,2658769 |
| 16,752 | 537,6 | 543,1 | 99,54 | 98,94 | 0,178 | 0,180 | 103 | 0,2649999 |
| 16,930 | 537,6 | 543,1 | 98,56 | 97,91 | 0,178 | 0,180 | 104 | 0,2676997 |
| 16,927 | 537,6 | 543,1 | 98,44 | 98,37 | 0,178 | 0,180 | 105 | 0,2677724 |
| 16,640 | 537,6 | 543,0 | 100,30 | 99,71 | 0,178 | 0,180 | 106 | 0,263094 |
| 17,206 | 537,5 | 543,0 | 96,63 | 96,12 | 0,178 | 0,180 | 107 | 0,272263 |
| 16,376 | 537,5 | 543,0 | 101,71 | 101,48 | 0,178 | 0,180 | 108 | 0,2588881 |
| 16,808 | 537,6 | 543,0 | 99,18 | 98,60 | 0,178 | 0,180 | 109 | 0,265977 |
| 16,658 | 537,5 | 542,9 | 100,07 | 99,51 | 0,179 | 0,180 | 110 | 0,2636397 |
| 16,909 | 537,4 | 542,9 | 98,66 | 98,15 | 0,179 | 0,180 | 111 | 0,2674496 |
| 17,059 | 537,4 | 542,9 | 97,82 | 97,14 | 0,179 | 0,180 | 112 | 0,2700117 |
| 16,896 | 537,5 | 542,9 | 98,67 | 97,97 | 0,179 | 0,180 | 113 | 0,2673134 |
| 17,004 | 537,6 | 543,0 | 98,04 | 97,40 | 0,178 | 0,180 | 114 | 0,2690377 |

| | Outlet | Outlet | Average | Average | #1 | #2 | | |
|---|---|---|---|---|---|---|---|---|
| Tunnel | Temp. | Temp. | 99,80 | 99,10 | 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 |
| 18,046 | 540,7 | 542,1 | | | 0,178 | 0,180 | 0 | 0,2749139 |
| 18,119 | 540,8 | 542,2 | 98,29 | 98,15 | 0,178 | 0,180 | 1 | 0,2777012 |
| 17,966 | 540,7 | 542,2 | 98,95 | 99,00 | 0,178 | 0,180 | 2 | 0,2754727 |
| 17,846 | 540,7 | 542,3 | 99,68 | 99,62 | 0,178 | 0,180 | 3 | 0,2736049 |
| 17,708 | 540,7 | 542,4 | 100,63 | 100,47 | 0,178 | 0,180 | 4 | 0,2713407 |
| 17,926 | 540,7 | 542,5 | 99,58 | 99,46 | 0,179 | 0,180 | 5 | 0,2745392 |
| 17,868 | 540,8 | 542,6 | 99,87 | 99,77 | 0,179 | 0,180 | 6 | 0,2736035 |
| 17,763 | 540,8 | 542,7 | 100,58 | 100,15 | 0,179 | 0,180 | 7 | 0,2719855 |
| 17,837 | 540,8 | 542,9 | 100,07 | 99,66 | 0,179 | 0,180 | 8 | 0,2732268 |
| 18,218 | 540,9 | 543,0 | 97,99 | 97,73 | 0,179 | 0,180 | 9 | 0,2788374 |
| 17,810 | 540,9 | 543,2 | 100,59 | 100,33 | 0,179 | 0,180 | 10 | 0,2723397 |
| 17,881 | 540,9 | 543,3 | 99,75 | 99,63 | 0,178 | 0,180 | 11 | 0,273602 |
| 17,953 | 541,0 | 543,5 | 99,70 | 99,48 | 0,178 | 0,180 | 12 | 0,274538 |
| 17,704 | 541,0 | 543,7 | 101,24 | 100,68 | 0,179 | 0,179 | 13 | 0,2705814 |
| 17,820 | 541,0 | 543,8 | 100,45 | 99,98 | 0,178 | 0,179 | 14 | 0,2722814 |
| 17,796 | 541,1 | 544,0 | 100,74 | 100,33 | 0,178 | 0,179 | 15 | 0,2719014 |
| 18,177 | 541,1 | 544,1 | 98,62 | 98,42 | 0,179 | 0,180 | 16 | 0,2777 |
| 17,770 | 541,2 | 544,3 | 100,98 | 100,37 | 0,179 | 0,179 | 17 | 0,2713396 |
| 17,813 | 541,2 | 544,4 | 100,76 | 100,56 | 0,179 | 0,179 | 18 | 0,2719944 |
| 17,847 | 541,3 | 544,6 | 100,81 | 100,07 | 0,179 | 0,179 | 19 | 0,2722837 |
| 17,998 | 541,3 | 544,7 | 100,07 | 99,43 | 0,179 | 0,179 | 20 | 0,2745377 |
| 18,057 | 541,4 | 544,8 | 99,69 | 98,89 | 0,179 | 0,179 | 21 | 0,2754713 |
| 18,279 | 541,4 | 545,0 | 98,27 | 97,77 | 0,179 | 0,179 | 22 | 0,2789864 |
| 17,675 | 541,4 | 545,1 | 101,53 | 100,94 | 0,179 | 0,179 | 23 | 0,2700111 |
| 18,199 | 541,5 | 545,2 | 98,82 | 98,27 | 0,179 | 0,179 | 24 | 0,2776994 |
| 17,887 | 541,6 | 545,4 | 100,62 | 100,02 | 0,179 | 0,179 | 25 | 0,2728484 |
| 17,998 | 541,6 | 545,5 | 100,14 | 99,39 | 0,179 | 0,179 | 26 | 0,2743873 |
| 18,012 | 541,7 | 545,6 | 99,66 | 99,08 | 0,179 | 0,179 | 27 | 0,2749108 |
| 17,952 | 541,7 | 545,7 | 100,31 | 99,76 | 0,178 | 0,179 | 28 | 0,2736013 |
| 17,984 | 541,7 | 545,8 | 100,17 | 99,40 | 0,179 | 0,179 | 29 | 0,2741627 |
| 18,060 | 541,8 | 545,9 | 99,57 | 98,99 | 0,179 | 0,179 | 30 | 0,2754704 |
| 18,331 | 541,8 | 546,0 | 98,34 | 97,66 | 0,179 | 0,179 | 31 | 0,2793573 |
| 17,901 | 541,9 | 546,1 | 100,67 | 100,12 | 0,179 | 0,179 | 32 | 0,2728487 |
| 17,833 | 541,9 | 546,2 | 100,66 | 100,29 | 0,178 | 0,179 | 33 | 0,272031 |
| 17,850 | 541,9 | 546,3 | 100,77 | 99,97 | 0,178 | 0,179 | 34 | 0,2722369 |
| 18,008 | 541,9 | 546,4 | 99,99 | 99,21 | 0,179 | 0,179 | 35 | 0,2745372 |
| 17,971 | 541,9 | 546,5 | 100,50 | 99,93 | 0,179 | 0,179 | 36 | 0,2736006 |
| 18,138 | 541,9 | 546,6 | 99,49 | 98,47 | 0,179 | 0,179 | 37 | 0,2764021 |
| 17,943 | 542,0 | 546,7 | 100,53 | 99,96 | 0,179 | 0,179 | 38 | 0,2732245 |
| 18,023 | 542,0 | 546,8 | 99,99 | 99,69 | 0,178 | 0,179 | 39 | 0,2745355 |
| 18,050 | 542,0 | 546,8 | 99,88 | 99,29 | 0,178 | 0,179 | 40 | 0,274911 |
| 18,007 | 542,1 | 546,9 | 100,36 | 99,05 | 0,179 | 0,178 | 41 | 0,2740641 |
| 18,043 | 542,2 | 547,0 | 100,16 | 99,83 | 0,179 | 0,179 | 42 | 0,2745499 |
| 17,971 | 542,2 | 547,1 | 100,55 | 100,26 | 0,179 | 0,180 | 43 | 0,2736013 |
| 17,871 | 542,3 | 547,2 | 100,70 | 99,99 | 0,178 | 0,179 | 44 | 0,2722836 |
| 17,996 | 542,3 | 547,3 | 100,02 | 99,56 | 0,178 | 0,179 | 45 | 0,2740631 |
| 17,811 | 542,4 | 547,4 | 101,17 | 100,37 | 0,178 | 0,179 | 46 | 0,2713457 |
| 17,819 | 542,4 | 547,4 | 101,21 | 100,31 | 0,178 | 0,179 | 47 | 0,2713395 |
| 17,864 | 542,4 | 547,5 | 100,88 | 100,20 | 0,179 | 0,179 | 48 | 0,2722841 |
| 17,858 | 542,4 | 547,6 | 100,83 | 99,93 | 0,179 | 0,179 | 49 | 0,2722824 |
| 18,038 | 542,5 | 547,6 | 100,02 | 99,00 | 0,179 | 0,179 | 50 | 0,2751136 |
| 17,758 | 542,5 | 547,7 | 101,34 | 100,55 | 0,179 | 0,179 | 51 | 0,2705818 |
| 17,823 | 542,6 | 547,8 | 100,87 | 99,95 | 0,178 | 0,178 | 52 | 0,2719048 |
| 17,951 | 542,6 | 547,9 | 100,35 | 99,34 | 0,179 | 0,178 | 53 | 0,2736009 |
| 17,945 | 542,7 | 547,9 | 99,55 | 99,29 | 0,178 | 0,179 | 54 | 0,2740692 |
| 17,809 | 542,7 | 548,0 | 100,63 | 99,91 | 0,178 | 0,179 | 55 | 0,2719063 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18,034 | 542,7 | 548,1 | 99,22 | 98,46 | 0,178 | 0,178 | 56 | 0,2754714 |
| 17,960 | 542,7 | 548,1 | 100,01 | 99,12 | 0,178 | 0,178 | 57 | 0,2740102 |
| 17,922 | 542,7 | 548,2 | 99,96 | 99,26 | 0,178 | 0,178 | 58 | 0,2735277 |
| 18,037 | 542,8 | 548,2 | 99,38 | 98,36 | 0,178 | 0,178 | 59 | 0,2754696 |
| 17,866 | 542,7 | 548,3 | 100,27 | 99,49 | 0,178 | 0,178 | 60 | 0,2728491 |
| 17,786 | 542,7 | 548,3 | 100,57 | 99,95 | 0,178 | 0,179 | 61 | 0,2719072 |
| 18,068 | 542,7 | 548,3 | 99,39 | 98,91 | 0,178 | 0,179 | 62 | 0,2757195 |
| 18,104 | 542,8 | 548,3 | 98,76 | 97,61 | 0,178 | 0,179 | 63 | 0,2769166 |
| 18,211 | 542,8 | 548,4 | 98,14 | 97,28 | 0,178 | 0,178 | 64 | 0,2784401 |
| 17,981 | 542,8 | 548,4 | 99,41 | 98,67 | 0,178 | 0,178 | 65 | 0,2747787 |
| 17,986 | 542,9 | 548,4 | 99,42 | 98,62 | 0,178 | 0,178 | 66 | 0,274913 |
| 17,984 | 542,9 | 548,5 | 99,48 | 98,65 | 0,178 | 0,178 | 67 | 0,2749123 |
| 17,887 | 542,9 | 548,5 | 99,80 | 98,96 | 0,178 | 0,178 | 68 | 0,2736032 |
| 17,934 | 542,9 | 548,5 | 99,67 | 98,69 | 0,178 | 0,178 | 69 | 0,2741646 |
| 17,878 | 542,9 | 548,6 | 99,73 | 98,76 | 0,178 | 0,178 | 70 | 0,2735545 |
| 17,838 | 542,9 | 548,6 | 99,95 | 98,71 | 0,178 | 0,178 | 71 | 0,2728799 |
| 17,971 | 542,9 | 548,6 | 99,54 | 98,52 | 0,178 | 0,178 | 72 | 0,2749133 |
| 17,736 | 542,9 | 548,6 | 100,61 | 99,75 | 0,178 | 0,178 | 73 | 0,2713406 |
| 17,921 | 542,9 | 548,6 | 99,76 | 98,76 | 0,178 | 0,178 | 74 | 0,2741649 |
| 17,889 | 543,0 | 548,7 | 99,88 | 99,06 | 0,178 | 0,178 | 75 | 0,2736012 |
| 17,872 | 543,0 | 548,6 | 99,77 | 98,86 | 0,178 | 0,178 | 76 | 0,2736026 |
| 17,948 | 543,0 | 548,6 | 99,42 | 98,27 | 0,178 | 0,178 | 77 | 0,2749133 |
| 17,976 | 543,0 | 548,6 | 99,43 | 98,82 | 0,178 | 0,178 | 78 | 0,2749135 |
| 17,853 | 543,0 | 548,7 | 99,77 | 98,66 | 0,178 | 0,178 | 79 | 0,2735946 |
| 17,933 | 543,0 | 548,7 | 99,50 | 98,57 | 0,178 | 0,178 | 80 | 0,27454 |
| 17,986 | 543,0 | 548,7 | 99,08 | 98,34 | 0,178 | 0,178 | 81 | 0,2754736 |
| 18,035 | 543,0 | 548,7 | 99,08 | 98,16 | 0,178 | 0,179 | 82 | 0,2759257 |
| 17,857 | 543,0 | 548,8 | 99,66 | 98,62 | 0,178 | 0,178 | 83 | 0,273603 |
| 18,106 | 543,0 | 548,8 | 98,17 | 97,50 | 0,178 | 0,178 | 84 | 0,2771476 |
| 17,911 | 543,0 | 548,8 | 99,46 | 98,66 | 0,178 | 0,178 | 85 | 0,2742491 |
| 17,827 | 543,0 | 548,8 | 99,94 | 99,19 | 0,178 | 0,178 | 86 | 0,2728516 |
| 17,481 | 543,0 | 548,8 | 101,93 | 101,11 | 0,178 | 0,178 | 87 | 0,267655 |
| 17,920 | 543,0 | 548,8 | 99,40 | 98,45 | 0,178 | 0,178 | 88 | 0,2745398 |
| 17,934 | 543,0 | 548,8 | 99,43 | 98,68 | 0,178 | 0,178 | 89 | 0,2745406 |
| 18,054 | 543,0 | 548,8 | 98,91 | 97,86 | 0,178 | 0,178 | 90 | 0,2763929 |
| 17,755 | 543,0 | 548,8 | 100,36 | 99,22 | 0,178 | 0,178 | 91 | 0,2719043 |
| 18,139 | 543,0 | 548,9 | 98,36 | 97,45 | 0,178 | 0,178 | 92 | 0,2777019 |
| 17,990 | 543,0 | 548,8 | 99,08 | 98,79 | 0,178 | 0,179 | 93 | 0,2753409 |
| 18,036 | 543,0 | 548,8 | 98,64 | 97,61 | 0,178 | 0,179 | 94 | 0,2764066 |
| 17,959 | 543,0 | 548,9 | 99,08 | 98,01 | 0,178 | 0,178 | 95 | 0,2749123 |
| 17,807 | 543,0 | 548,8 | 99,62 | 98,91 | 0,178 | 0,178 | 96 | 0,272852 |
| 17,801 | 543,0 | 548,9 | 99,98 | 99,11 | 0,178 | 0,178 | 97 | 0,2728512 |
| 17,839 | 543,0 | 548,9 | 99,65 | 99,29 | 0,178 | 0,179 | 98 | 0,2731325 |
| 17,820 | 543,0 | 548,9 | 99,91 | 99,00 | 0,178 | 0,178 | 99 | 0,2728516 |
| 17,851 | 543,0 | 548,9 | 99,67 | 98,81 | 0,178 | 0,178 | 100 | 0,2736039 |
| 17,912 | 543,1 | 548,9 | 99,42 | 98,37 | 0,178 | 0,178 | 101 | 0,2745451 |
| 18,036 | 543,1 | 548,9 | 98,69 | 98,00 | 0,178 | 0,178 | 102 | 0,2763975 |
| 17,868 | 543,1 | 548,9 | 99,98 | 98,99 | 0,179 | 0,179 | 103 | 0,2736027 |
| 17,985 | 543,1 | 548,9 | 98,94 | 97,88 | 0,178 | 0,178 | 104 | 0,2754692 |
| 17,806 | 543,1 | 548,9 | 99,71 | 98,67 | 0,178 | 0,178 | 105 | 0,2730644 |
| 17,933 | 543,1 | 548,9 | 99,51 | 98,55 | 0,179 | 0,178 | 106 | 0,274911 |
| 18,062 | 543,0 | 548,8 | 98,39 | 97,73 | 0,178 | 0,179 | 107 | 0,2767757 |
| 17,797 | 543,0 | 548,9 | 99,81 | 99,12 | 0,178 | 0,178 | 108 | 0,2728504 |
| 17,891 | 543,1 | 548,9 | 99,53 | 98,56 | 0,178 | 0,178 | 109 | 0,2740157 |
| 18,015 | 543,1 | 548,9 | 98,44 | 97,73 | 0,178 | 0,178 | 110 | 0,2764057 |
| 18,077 | 543,1 | 548,9 | 98,29 | 97,66 | 0,178 | 0,179 | 111 | 0,277146 |
| 17,879 | 543,1 | 548,9 | 99,31 | 98,57 | 0,178 | 0,179 | 112 | 0,2741649 |
| 17,913 | 543,1 | 548,8 | 99,29 | 98,43 | 0,178 | 0,178 | 113 | 0,2745971 |

| | Outlet | Outlet | Average | Average | #1 | #2 | | |
|---|---|---|---|---|---|---|---|---|
| Tunnel | Temp. | Temp. | 99,72 | 99,83 | 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 |
| 17,912 | 538,0 | 539,5 | | | 0,181 | 0,184 | 0 | 0,2780602 |
| 17,714 | 538,0 | 539,5 | 99,61 | 100,25 | 0,181 | 0,184 | 1 | 0,2767649 |
| 17,849 | 538,0 | 539,6 | 98,91 | 99,53 | 0,181 | 0,184 | 2 | 0,2789827 |
| 17,898 | 538,0 | 539,7 | 98,43 | 99,12 | 0,181 | 0,184 | 3 | 0,2798997 |
| 17,810 | 538,1 | 539,7 | 99,26 | 99,59 | 0,181 | 0,184 | 4 | 0,2784292 |
| 17,787 | 538,1 | 539,8 | 99,53 | 99,90 | 0,181 | 0,184 | 5 | 0,2780608 |
| 17,763 | 538,2 | 540,0 | 99,25 | 99,95 | 0,181 | 0,184 | 6 | 0,2779407 |
| 17,744 | 538,3 | 540,2 | 99,33 | 100,05 | 0,181 | 0,184 | 7 | 0,2776927 |
| 17,913 | 538,4 | 540,4 | 98,57 | 98,67 | 0,181 | 0,184 | 8 | 0,2802679 |
| 17,705 | 538,5 | 540,6 | 99,64 | 99,93 | 0,181 | 0,184 | 9 | 0,277125 |
| 17,744 | 538,6 | 540,8 | 99,29 | 99,59 | 0,181 | 0,184 | 10 | 0,2776748 |
| 17,844 | 538,6 | 540,9 | 98,75 | 99,05 | 0,181 | 0,184 | 11 | 0,2793494 |
| 17,438 | 538,6 | 541,0 | 100,88 | 101,37 | 0,181 | 0,184 | 12 | 0,2732161 |
| 18,055 | 538,6 | 541,1 | 97,38 | 97,82 | 0,181 | 0,184 | 13 | 0,2828138 |
| 17,668 | 538,6 | 541,2 | 99,71 | 100,02 | 0,181 | 0,184 | 14 | 0,2767307 |
| 17,831 | 538,7 | 541,3 | 98,77 | 98,98 | 0,181 | 0,184 | 15 | 0,2793482 |
| 17,863 | 538,8 | 541,5 | 98,47 | 98,75 | 0,181 | 0,184 | 16 | 0,2799006 |
| 17,548 | 538,9 | 541,6 | 100,30 | 100,62 | 0,181 | 0,184 | 17 | 0,274901 |
| 17,804 | 538,9 | 541,7 | 98,63 | 98,95 | 0,181 | 0,184 | 18 | 0,2789845 |
| 17,750 | 539,0 | 541,8 | 99,08 | 99,80 | 0,181 | 0,184 | 19 | 0,278043 |
| 17,338 | 539,0 | 541,9 | 101,76 | 101,89 | 0,181 | 0,184 | 20 | 0,2713301 |
| 17,538 | 539,0 | 542,0 | 100,72 | 101,05 | 0,181 | 0,184 | 21 | 0,2741533 |
| 17,439 | 539,0 | 542,2 | 101,53 | 101,72 | 0,181 | 0,184 | 22 | 0,2723508 |
| 17,793 | 539,1 | 542,3 | 99,32 | 99,87 | 0,181 | 0,183 | 23 | 0,2776909 |
| 17,746 | 539,3 | 542,5 | 100,25 | 100,22 | 0,181 | 0,183 | 24 | 0,2767645 |
| 17,522 | 539,4 | 542,6 | 101,16 | 101,77 | 0,181 | 0,184 | 25 | 0,2732632 |
| 17,680 | 539,5 | 542,8 | 100,42 | 100,53 | 0,181 | 0,184 | 26 | 0,2756121 |
| 16,826 | 539,6 | 542,9 | 105,52 | 105,86 | 0,181 | 0,183 | 27 | 0,2622611 |
| 17,759 | 539,7 | 543,1 | 99,76 | 100,08 | 0,181 | 0,183 | 28 | 0,2767667 |
| 17,008 | 539,9 | 543,3 | 104,36 | 104,53 | 0,180 | 0,183 | 29 | 0,2650117 |
| 17,489 | 540,0 | 543,4 | 101,34 | 101,83 | 0,180 | 0,183 | 30 | 0,2724863 |
| 17,675 | 540,1 | 543,6 | 100,38 | 100,34 | 0,180 | 0,183 | 31 | 0,2754772 |
| 17,733 | 540,2 | 543,7 | 99,79 | 100,38 | 0,180 | 0,183 | 32 | 0,2763959 |
| 18,054 | 540,4 | 543,8 | 98,08 | 98,52 | 0,180 | 0,183 | 33 | 0,281551 |
| 17,587 | 540,4 | 543,9 | 100,18 | 100,36 | 0,180 | 0,183 | 34 | 0,2747365 |
| 17,883 | 540,4 | 544,0 | 98,67 | 98,94 | 0,180 | 0,183 | 35 | 0,2793532 |
| 17,525 | 540,3 | 544,0 | 100,78 | 100,87 | 0,181 | 0,183 | 36 | 0,2741571 |
| 18,010 | 540,2 | 543,9 | 97,78 | 97,91 | 0,181 | 0,183 | 37 | 0,2815477 |
| 17,822 | 540,1 | 543,9 | 98,99 | 99,24 | 0,180 | 0,183 | 38 | 0,2784498 |
| 17,202 | 540,1 | 543,9 | 102,75 | 102,75 | 0,181 | 0,183 | 39 | 0,2690518 |
| 17,390 | 540,0 | 543,9 | 101,19 | 101,56 | 0,181 | 0,183 | 40 | 0,2719004 |
| 17,791 | 540,0 | 543,9 | 99,60 | 99,38 | 0,181 | 0,183 | 41 | 0,2780633 |
| 17,741 | 540,0 | 543,9 | 99,48 | 99,80 | 0,181 | 0,183 | 42 | 0,2770877 |
| 18,027 | 539,9 | 543,9 | 97,97 | 98,17 | 0,180 | 0,183 | 43 | 0,2815494 |
| 17,730 | 540,0 | 544,0 | 99,71 | 100,02 | 0,181 | 0,183 | 44 | 0,2767669 |
| 17,827 | 539,9 | 544,0 | 99,09 | 99,20 | 0,181 | 0,183 | 45 | 0,2784324 |
| 17,605 | 539,9 | 544,0 | 100,33 | 100,48 | 0,181 | 0,183 | 46 | 0,2749051 |
| 17,803 | 539,9 | 544,0 | 99,00 | 99,41 | 0,180 | 0,183 | 47 | 0,2780627 |
| 17,617 | 539,8 | 543,9 | 100,10 | 100,36 | 0,180 | 0,183 | 48 | 0,275465 |
| 17,738 | 539,9 | 544,0 | 99,54 | 99,57 | 0,181 | 0,183 | 49 | 0,2771375 |
| 17,783 | 539,8 | 544,0 | 99,11 | 99,32 | 0,180 | 0,183 | 50 | 0,2777597 |
| 17,472 | 539,8 | 544,0 | 101,27 | 100,70 | 0,181 | 0,183 | 51 | 0,2732173 |
| 17,535 | 539,9 | 544,0 | 100,45 | 100,66 | 0,181 | 0,183 | 52 | 0,2741569 |
| 17,784 | 540,0 | 544,1 | 99,50 | 99,52 | 0,181 | 0,183 | 53 | 0,2776751 |
| 17,787 | 540,0 | 544,2 | 99,54 | 100,06 | 0,181 | 0,183 | 54 | 0,2776927 |
| 17,593 | 539,9 | 544,2 | 100,22 | 100,48 | 0,181 | 0,183 | 55 | 0,2749041 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 17,517 | 539,9 | 544,2 | 100,78 | 100,80 | 0,180 | 0,183 | 56 | 0,2735923 |
| 17,556 | 539,9 | 544,2 | 100,44 | 100,79 | 0,180 | 0,183 | 57 | 0,2741563 |
| 17,560 | 539,9 | 544,2 | 100,77 | 100,85 | 0,180 | 0,183 | 58 | 0,2741887 |
| 17,778 | 540,0 | 544,3 | 99,85 | 100,06 | 0,181 | 0,183 | 59 | 0,2771428 |
| 17,715 | 540,1 | 544,3 | 99,82 | 99,64 | 0,181 | 0,183 | 60 | 0,2767652 |
| 17,714 | 540,0 | 544,4 | 99,60 | 99,80 | 0,181 | 0,183 | 61 | 0,2767387 |
| 17,531 | 540,1 | 544,4 | 100,96 | 101,13 | 0,181 | 0,183 | 62 | 0,2736251 |
| 17,784 | 540,0 | 544,5 | 99,41 | 99,47 | 0,181 | 0,183 | 63 | 0,2776921 |
| 17,592 | 540,0 | 544,4 | 100,74 | 100,81 | 0,181 | 0,183 | 64 | 0,2745303 |
| 18,043 | 540,0 | 544,4 | 97,99 | 97,76 | 0,181 | 0,183 | 65 | 0,2817089 |
| 17,894 | 539,9 | 544,5 | 98,62 | 98,32 | 0,181 | 0,182 | 66 | 0,2798198 |
| 17,627 | 539,9 | 544,4 | 100,07 | 100,27 | 0,181 | 0,183 | 67 | 0,2754621 |
| 17,358 | 539,9 | 544,4 | 101,44 | 101,84 | 0,180 | 0,183 | 68 | 0,2713314 |
| 17,809 | 539,9 | 544,4 | 99,00 | 99,15 | 0,180 | 0,183 | 69 | 0,2784423 |
| 17,709 | 539,9 | 544,4 | 99,92 | 99,76 | 0,181 | 0,183 | 70 | 0,276478 |
| 17,917 | 539,9 | 544,4 | 98,29 | 98,44 | 0,180 | 0,183 | 71 | 0,2799076 |
| 17,724 | 539,9 | 544,4 | 99,43 | 99,49 | 0,180 | 0,183 | 72 | 0,2771355 |
| 17,796 | 539,9 | 544,5 | 98,87 | 99,10 | 0,181 | 0,183 | 73 | 0,2784317 |
| 17,844 | 539,9 | 544,5 | 98,90 | 98,71 | 0,181 | 0,183 | 74 | 0,2793159 |
| 17,705 | 539,9 | 544,4 | 99,22 | 99,64 | 0,181 | 0,183 | 75 | 0,2771362 |
| 17,705 | 539,9 | 544,3 | 99,22 | 99,35 | 0,180 | 0,183 | 76 | 0,2771369 |
| 17,610 | 539,9 | 544,3 | 100,14 | 100,16 | 0,181 | 0,183 | 77 | 0,275464 |
| 17,877 | 539,9 | 544,4 | 98,87 | 98,73 | 0,181 | 0,183 | 78 | 0,2793525 |
| 17,406 | 539,9 | 544,4 | 101,06 | 101,12 | 0,181 | 0,183 | 79 | 0,272276 |
| 17,569 | 540,0 | 544,5 | 99,99 | 100,36 | 0,180 | 0,183 | 80 | 0,2749037 |
| 16,916 | 540,0 | 544,5 | 104,22 | 104,18 | 0,180 | 0,183 | 81 | 0,2646262 |
| 17,630 | 540,0 | 544,5 | 100,10 | 100,13 | 0,181 | 0,183 | 82 | 0,2754634 |
| 17,894 | 540,0 | 544,5 | 98,56 | 98,51 | 0,181 | 0,183 | 83 | 0,2798993 |
| 17,748 | 540,0 | 544,5 | 99,13 | 99,33 | 0,181 | 0,183 | 84 | 0,2776932 |
| 17,747 | 540,0 | 544,6 | 99,22 | 99,27 | 0,181 | 0,183 | 85 | 0,2776925 |
| 18,120 | 540,0 | 544,6 | 96,87 | 97,09 | 0,181 | 0,183 | 86 | 0,2837801 |
| 17,836 | 540,0 | 544,6 | 98,37 | 98,44 | 0,180 | 0,183 | 87 | 0,2793512 |
| 17,408 | 540,2 | 544,7 | 101,19 | 101,48 | 0,180 | 0,183 | 88 | 0,2722768 |
| 17,747 | 540,1 | 544,7 | 99,19 | 99,34 | 0,181 | 0,183 | 89 | 0,2776914 |
| 17,857 | 540,1 | 544,8 | 98,61 | 98,94 | 0,181 | 0,183 | 90 | 0,2793515 |
| 17,477 | 540,1 | 544,8 | 100,86 | 101,00 | 0,181 | 0,183 | 91 | 0,2732535 |
| 17,785 | 540,1 | 544,8 | 99,13 | 99,01 | 0,181 | 0,183 | 92 | 0,2780601 |
| 17,853 | 540,2 | 544,8 | 98,89 | 98,96 | 0,181 | 0,183 | 93 | 0,2789457 |
| 17,595 | 540,2 | 544,8 | 100,11 | 100,34 | 0,180 | 0,183 | 94 | 0,2749023 |
| 17,773 | 540,2 | 544,8 | 99,08 | 99,09 | 0,180 | 0,183 | 95 | 0,2780637 |
| 17,679 | 540,3 | 545,0 | 99,67 | 99,99 | 0,181 | 0,183 | 96 | 0,2763929 |
| 17,560 | 540,3 | 545,0 | 99,95 | 99,91 | 0,180 | 0,183 | 97 | 0,2749052 |
| 17,768 | 540,3 | 545,0 | 99,21 | 99,13 | 0,180 | 0,182 | 98 | 0,2778089 |
| 17,751 | 540,3 | 545,0 | 99,15 | 99,43 | 0,181 | 0,183 | 99 | 0,2776923 |
| 17,137 | 540,3 | 545,0 | 102,65 | 103,15 | 0,181 | 0,183 | 100 | 0,2682905 |
| 17,830 | 540,3 | 545,1 | 98,75 | 98,56 | 0,181 | 0,183 | 101 | 0,2789851 |
| 17,258 | 540,3 | 545,1 | 101,94 | 101,96 | 0,181 | 0,183 | 102 | 0,2699964 |
| 17,594 | 540,3 | 545,1 | 99,79 | 99,81 | 0,180 | 0,183 | 103 | 0,2754644 |
| 17,330 | 540,4 | 545,1 | 101,49 | 101,36 | 0,181 | 0,183 | 104 | 0,2713321 |
| 17,882 | 540,3 | 545,1 | 98,34 | 98,21 | 0,181 | 0,183 | 105 | 0,2799022 |
| 17,551 | 540,3 | 545,1 | 100,11 | 100,23 | 0,180 | 0,183 | 106 | 0,2746536 |
| 17,439 | 540,4 | 545,2 | 100,85 | 101,00 | 0,180 | 0,183 | 107 | 0,2728407 |
| 17,694 | 540,4 | 545,2 | 99,48 | 99,50 | 0,180 | 0,183 | 108 | 0,2767668 |
| 17,771 | 540,5 | 545,3 | 99,13 | 99,03 | 0,181 | 0,183 | 109 | 0,2780622 |
| 17,696 | 540,5 | 545,2 | 99,75 | 99,55 | 0,181 | 0,183 | 110 | 0,2766874 |
| 17,595 | 540,5 | 545,3 | 100,31 | 100,34 | 0,181 | 0,183 | 111 | 0,2749147 |
| 17,574 | 540,5 | 545,3 | 99,95 | 100,12 | 0,180 | 0,183 | 112 | 0,2749054 |
| 17,629 | 540,5 | 545,3 | 100,06 | 100,30 | 0,180 | 0,183 | 113 | 0,2754654 |
| 17,842 | 540,6 | 545,3 | 98,77 | 98,95 | 0,180 | 0,183 | 114 | 0,2789625 |
| 17,607 | 540,6 | 545,3 | 99,99 | 99,85 | 0,181 | 0,183 | 115 | 0,2754646 |
| 17,724 | 540,6 | 545,4 | 99,50 | 99,40 | 0,181 | 0,183 | 116 | 0,2771388 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 17,536 | 540,6 | 545,4 | 100,37 | 100,60 | 0,181 | 0,183 | 117 | 0,2742162 |
| 17,577 | 540,8 | 545,5 | 99,92 | 100,02 | 0,180 | 0,183 | 118 | 0,2753028 |
| 17,508 | 540,9 | 545,6 | 100,36 | 100,23 | 0,181 | 0,183 | 119 | 0,2741489 |
| 17,340 | 540,9 | 545,6 | 101,50 | 101,32 | 0,181 | 0,182 | 120 | 0,2713338 |
| 17,777 | 540,9 | 545,7 | 99,19 | 98,97 | 0,181 | 0,182 | 121 | 0,2780642 |
| 17,457 | 540,9 | 545,7 | 100,72 | 100,55 | 0,181 | 0,182 | 122 | 0,2732238 |
| 17,565 | 540,9 | 545,7 | 100,29 | 100,11 | 0,181 | 0,182 | 123 | 0,2749025 |
| 17,818 | 540,9 | 545,7 | 98,66 | 98,39 | 0,181 | 0,182 | 124 | 0,2789855 |
| 17,532 | 540,8 | 545,6 | 100,14 | 100,31 | 0,180 | 0,183 | 125 | 0,2745318 |
| 17,176 | 540,8 | 545,6 | 102,55 | 102,10 | 0,181 | 0,183 | 126 | 0,2689895 |
| 17,623 | 540,9 | 545,7 | 100,18 | 100,00 | 0,181 | 0,182 | 127 | 0,275465 |
| 18,102 | 540,9 | 545,6 | 97,20 | 97,01 | 0,181 | 0,183 | 128 | 0,2833698 |
| 17,563 | 540,9 | 545,6 | 99,92 | 100,04 | 0,180 | 0,183 | 129 | 0,2749077 |
| 17,667 | 540,9 | 545,6 | 99,52 | 99,54 | 0,180 | 0,182 | 130 | 0,2762766 |
| 17,496 | 540,9 | 545,6 | 100,61 | 100,69 | 0,180 | 0,183 | 131 | 0,2736621 |
| 17,524 | 540,9 | 545,7 | 100,61 | 100,38 | 0,181 | 0,183 | 132 | 0,2741579 |
| 17,895 | 541,0 | 545,7 | 98,63 | 98,11 | 0,181 | 0,182 | 133 | 0,2799046 |
| 17,711 | 541,0 | 545,8 | 99,17 | 99,24 | 0,181 | 0,182 | 134 | 0,2772083 |
| 17,762 | 541,1 | 545,8 | 98,88 | 98,78 | 0,180 | 0,182 | 135 | 0,2780652 |
| 17,666 | 541,1 | 545,8 | 99,75 | 99,36 | 0,181 | 0,182 | 136 | 0,2763957 |
| 17,779 | 541,1 | 545,8 | 98,87 | 98,89 | 0,180 | 0,182 | 137 | 0,2780641 |
| 17,942 | 541,2 | 545,9 | 98,15 | 97,87 | 0,180 | 0,182 | 138 | 0,2806515 |
| 17,889 | 541,1 | 545,9 | 98,05 | 98,27 | 0,180 | 0,182 | 139 | 0,2798978 |
| 17,549 | 541,1 | 545,9 | 100,11 | 100,05 | 0,180 | 0,182 | 140 | 0,2745324 |
| 17,853 | 541,2 | 546,0 | 98,40 | 98,40 | 0,180 | 0,182 | 141 | 0,2793546 |
| 17,470 | 541,2 | 546,0 | 100,76 | 100,55 | 0,180 | 0,182 | 142 | 0,273219 |
| 17,752 | 541,2 | 546,0 | 98,79 | 98,86 | 0,180 | 0,182 | 143 | 0,277694 |
| 17,861 | 541,3 | 546,1 | 98,39 | 98,51 | 0,180 | 0,182 | 144 | 0,2793544 |
| 17,706 | 541,2 | 546,1 | 99,53 | 99,57 | 0,180 | 0,183 | 145 | 0,2767678 |
| 17,759 | 541,2 | 546,1 | 98,87 | 99,02 | 0,180 | 0,183 | 146 | 0,2778816 |
| 17,513 | 541,2 | 546,0 | 100,28 | 100,34 | 0,180 | 0,183 | 147 | 0,2741733 |
| 17,786 | 541,3 | 546,0 | 98,82 | 98,89 | 0,180 | 0,183 | 148 | 0,2784334 |
| 17,737 | 541,4 | 546,1 | 99,00 | 99,09 | 0,180 | 0,183 | 149 | 0,2776949 |
| 17,651 | 541,4 | 546,0 | 99,45 | 99,49 | 0,180 | 0,183 | 150 | 0,2763009 |
| 17,560 | 541,4 | 546,0 | 100,08 | 100,14 | 0,180 | 0,183 | 151 | 0,2749062 |
| 17,924 | 541,3 | 546,0 | 97,91 | 98,03 | 0,180 | 0,183 | 152 | 0,2806381 |
| 17,551 | 541,3 | 546,0 | 100,08 | 100,20 | 0,180 | 0,183 | 153 | 0,2747539 |
| 17,906 | 541,3 | 546,0 | 98,34 | 98,09 | 0,181 | 0,183 | 154 | 0,280174 |
| 17,684 | 541,3 | 546,0 | 99,38 | 99,29 | 0,181 | 0,182 | 155 | 0,2768098 |
| 17,456 | 541,3 | 545,9 | 100,66 | 100,93 | 0,180 | 0,183 | 156 | 0,2732192 |
| 17,750 | 541,3 | 546,0 | 99,31 | 98,86 | 0,181 | 0,183 | 157 | 0,2776937 |
| 17,786 | 541,3 | 546,0 | 98,63 | 98,86 | 0,180 | 0,182 | 158 | 0,2783753 |
| 17,567 | 541,3 | 546,1 | 100,28 | 100,26 | 0,180 | 0,183 | 159 | 0,2745426 |
| 18,084 | 541,4 | 546,1 | 97,14 | 97,17 | 0,180 | 0,182 | 160 | 0,282825 |
| 17,904 | 541,6 | 546,2 | 98,17 | 98,30 | 0,180 | 0,182 | 161 | 0,2799055 |
| 17,784 | 541,7 | 546,3 | 99,03 | 99,00 | 0,180 | 0,182 | 162 | 0,2779308 |

# APPENDIX 3: Calibration data

Instrumentation
Saint•Laurent inc.
Certified ISO 17025

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Accrédité CCN
N°669

80 rue de la montagne
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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-006 2022-05-10 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9106 |
| **Required Accuracy:** | +\-0.25"H2O |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Indicator | **Input Type:** | Pression |
| **Manufacturer:** | Dwyer | **Output Type:** | Digitale |
| **Model #:** | MS-321-LCD | **Measurement Type:** | Pressure |
| **Serial #:** | E47U020014 | **Range:** | 0-0.5"H2O |
| **Location:** | N.A. | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke Pression | **Certification #:** | 2021008414 |
| **Serial #:** | 3330050 | **Certification Date:** | 2021-11-22 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-11-22 |
| **Comments:** | | | |
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022001379 |
| **Serial #:** | 8223003 | **Certification Date:** | 2022-02-18 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-05-18 |
| **Comments:** | | | |

5F09106 Version 1

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CLAS 2010-02

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-006 2022-05-10 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 0.0000 "H2O | 0.000 "H2O | -0.012 "H2O | -0.012 "H2O | -0.012 "H2O | +\-0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.2500 "H2O | 0.250 "H2O | 0.237 "H2O | -0.013 "H2O | 0.237 "H2O | +\-0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.5000 "H2O | 0.500 "H2O | 0.488 "H2O | -0.012 "H2O | 0.488 "H2O | +\-0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.7500 "H2O | 0.750 "H2O | 0.742 "H2O | -0.008 "H2O | 0.742 "H2O | +\-0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 1.0000 "H2O | 1.000 "H2O | 0.989 "H2O | -0.011 "H2O | 0.989 "H2O | +\-0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0000 "H2O | 0.0000 V.DC. | 0.0004 V.DC. | +0.0004 V.DC. | 0.0004 V.DC. | +\-0.25 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.2500 "H2O | 2.5000 V.DC. | 2.3569 V.DC. | -0.1431 V.DC. | 2.3569 V.DC. | +\-0.25 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.5000 "H2O | 5.0000 V.DC. | 4.9466 V.DC. | -0.0534 V.DC. | 4.9466 V.DC. | +\-0.25 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.7500 "H2O | 7.5000 V.DC. | 7.4342 V.DC. | -0.0658 V.DC. | 7.4342 V.DC. | +\-0.25 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 1.0000 "H2O | 10.0000 V.DC. | 9.8526 V.DC. | -0.1474 V.DC. | 9.8526 V.DC. | +\-0.25 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |

**Environmental Conditions:** Temperature: N.A. Humidity: N.A.

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-10 |
| **Next Calibration:** | 2023-05-10 |
| **Certificate Date:** | 2022-05-10 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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

Marco Miron - Technicien

Version 1

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May 2022

Instrumentation
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CLAS 2010-02

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

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-001 2022-05-10 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9105 |
| **Required Accuracy:** | +\- 2.0°C |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Indicator | **Input Type:** | Temp |
| **Manufacturer:** | Fluke | **Output Type:** | Digitale |
| **Model #:** | 52-II | **Measurement Type:** | Temperature |
| **Serial #:** | 90630037 | **Range:** | Divers |
| **Location:** | N.A. | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |

5F09105 Version 1

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-001 2022-05-10 |
|---|---|

| CALIBRATION RESULTS | | | | | | |
|---|---|---|---|---|---|---|
| **Entry Source** | **Given Value** | **Actual Value** | **Deviation Error** | **After Calib Value** | **Accuracy** | **Uncertainty** |
| **Conformity** | **Comment** | | | | | |
| 0.0 °C | 0.0 °C | 0.1 °C | +0.1 °C | 0.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T1 typeJ | | | | | |
| 125.0 °C | 125.0 °C | 125.1 °C | +0.1 °C | 125.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T1 typeJ | | | | | |
| 250.0 °C | 250.0 °C | 250.1 °C | +0.1 °C | 250.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T1 typeJ | | | | | |
| 375.0 °C | 375.0 °C | 375.1 °C | +0.1 °C | 375.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T1 typeJ | | | | | |
| 500.0 °C | 500.0 °C | 500.1 °C | +0.1 °C | 500.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T1 typeJ | | | | | |
| | | | | | | |
| 0.0 °C | 0.0 °C | 0.2 °C | +0.2 °C | 0.2 °C | +/- 2 °C | 0.2 °C |
| Compliant | T2 typeJ | | | | | |
| 125.0 °C | 125.0 °C | 125.1 °C | +0.1 °C | 125.1 °C | +/- 2 °C | 0.2 °C |
| Compliant | T2 typeJ | | | | | |
| 250.0 °C | 250.0 °C | 250.1 °C | +0.1 °C | 250.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T2 typeJ | | | | | |
| 375.0 °C | 375.0 °C | 375.1 °C | +0.1 °C | 375.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T2 typeJ | | | | | |
| 500.0 °C | 500.0 °C | 500.1 °C | +0.1 °C | 500.1 °C | +/- 2.0 °C | 0.2 °C |
| Compliant | T2 typeJ | | | | | |
| 0.0 °C | 0.0 °C | 0.2 °C | +0.2 °C | 0.2 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T1 typeK | | | | | |
| 125.0 °C | 125.0 °C | 125.2 °C | +0.2 °C | 125.2 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T1 typeK | | | | | |
| 250.0 °C | 250.0 °C | 250.1 °C | +0.1 °C | 250.1 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T1 typeK | | | | | |
| 375.0 °C | 375.0 °C | 375.1 °C | +0.1 °C | 375.1 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T1 typeK | | | | | |
| 500.0 °C | 500.0 °C | 500.1 °C | +0.1 °C | 500.1 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T1 typeK | | | | | |
| 0.0 °C | 0.0 °C | 0.3 °C | +0.3 °C | 0.3 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T2 typeK | | | | | |
| 125.0 °C | 125.0 °C | 125.2 °C | +0.2 °C | 125.2 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T2 typeK | | | | | |
| 250.0 °C | 250.0 °C | 250.2 °C | +0.2 °C | 250.2 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T2 typeK | | | | | |
| 375.0 °C | 375.0 °C | 375.2 °C | +0.2 °C | 375.2 °C | +/- 2.0 °C | 0.3 °C |
| Compliant | T2 typeK | | | | | |

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CLAS NRC-CNRC CLAS 2010-02

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St-Joseph du lac
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Phone: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-001 2022-05-10 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 500.0 °C | 500.0 °C | 500.1 °C | +0.1 °C | 500.1 °C | +/- 2.0 °C | 1.0 °C |
| Compliant | T2 typeK | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 41 %RH

**Comments:**

## CALIBRATION DATE/ISSUANCE OF CERTIFICATE

| | |
|---|---|
| **Calibration Date:** | 2022-05-10 |
| **Next Calibration:** | 2023-05-10 |
| **Certificate Date:** | 2022-05-10 |

## CALIBRATION CONFORMITY

| | Before | After |
|---|---|---|
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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

Marco Miron - Technicien

May 2022

5F09105 Version 1

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Certified ISO 17025

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

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-015/2 2022-05-11 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9101 |
| **Required Accuracy:** | +\- 4.0°F |
| **Calibration Frequency:(days)** | 181 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Recorder | **Input Type:** | Temp |
| **Manufacturer:** | Keithley | **Output Type:** | Digitale |
| **Model #:** | 7700 | **Measurement Type:** | Temperature |
| **Serial #:** | 1213648 | **Range:** | Divers |
| **Location:** | N/A | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |

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Instrumentation Saint•Laurent inc.
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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-015/2 2022-05-11 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 662.0 °F | 662.0 °F | 661.4 °F | -0.6 °F | 661.4 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 201 (Flue) en type "K" En Loop avec EM-015 | | | | | |
| 482.0 °F | 482.0 °F | 481.4 °F | -0.6 °F | 481.4 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 202 (Right) en type "K" En Loop avec EM-015 | | | | | |
| 482.0 °F | 482.0 °F | 481.7 °F | -0.3 °F | 481.7 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 203 (Back) en type "K" En Loop avec EM-015 | | | | | |
| 482.0 °F | 482.0 °F | 481.7 °F | -0.3 °F | 481.7 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 204 (Bottom) en type "K" En Loop avec EM-015 | | | | | |
| 482.0 °F | 482.0 °F | 481.9 °F | -0.1 °F | 481.9 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 205 (Top) en type "K" En Loop avec EM-015 | | | | | |
| 482.0 °F | 482.0 °F | 481.8 °F | -0.2 °F | 481.8 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 206 (Left) en type "K" En Loop avec EM-015 | | | | | |
| 662.0 °F | 662.0 °F | 661.8 °F | -0.2 °F | 661.8 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 208 (Catalyst down) en type "K" En Loop avec EM-015 | | | | | |
| 77.0 °F | 77.0 °F | 76.7 °F | -0.3 °F | 76.7 °F | +/- 4.0 °F | +/- 0.4 °F |
| Compliant | ID. No. 215 (DGM 1 In) en type "J" En Loop avec EM-015 | | | | | |
| 77.0 °F | 77.0 °F | 76.7 °F | -0.3 °F | 76.7 °F | +/- 4.0 °F | +/- 0.4 °F |
| Compliant | ID. No. 216 (DGM 1 Out) en type "J" En Loop avec EM-015 | | | | | |
| 77.0 °F | 77.0 °F | 76.8 °F | -0.2 °F | 76.8 °F | +/- 4.0 °F | +/- 0.4 °F |
| Compliant | ID. No. 217 (DGM 2 In) en type "J" En Loop avec EM-015 | | | | | |
| 77.0 °F | 77.0 °F | 76.8 °F | -0.2 °F | 76.8 °F | +/- 4.0 °F | +/- 0.4 °F |
| Compliant | ID. No. 218 (DGM 2 Out) en type "J" En Loop avec EM-015 | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 42 %RH

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-11 |
| **Next Calibration:** | 2022-11-11 |
| **Certificate Date:** | 2022-05-11 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-015/2 2022-05-11 |
|---|---|

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

Marco Miron - Technicien

MAY 2022

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-015 2022-05-11 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9101 |
| **Required Accuracy:** | +\- 2°C |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Recorder | **Input Type:** | Temp |
| **Manufacturer:** | Keithley | **Output Type:** | Digitale |
| **Model #:** | 7700 | **Measurement Type:** | Temperature |
| **Serial #:** | 1213648 | **Range:** | Divers |
| **Location:** | N/A | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |

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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-015 2022-05-11 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| Conformity | Comment | | | | | |
| -190.0 °C | -190.0 °C | -190.0 °C | 0.0 °C | 190.0 °C | +\- 2.0 °C | +/- 0.4 °C |
| Compliant | Input#1TypeK | | | | | |
| 0.0 °C | 0.0 °C | 0.0 °C | 0.0 °C | 0.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#1TypeK | | | | | |
| 750.0 °C | 750.0 °C | 750.0 °C | 0.0 °C | 750.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#1TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#2 TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#3 TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#4 TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#5TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#6TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#7TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#8TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#9TypeK | | | | | |
| 100.0 °C | 100.0 °C | 100.0 °C | 0.0 °C | 100.0 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#10TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.1 °C | +0.1 °C | 100.1 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#11TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.1 °C | +0.1 °C | 100.1 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#12TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.1 °C | +0.1 °C | 100.1 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#13 TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.2 °C | +0.2 °C | 100.2 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#14TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.1 °C | +0.1 °C | 100.1 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#15 TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.2 °C | +0.2 °C | 100.2 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#16TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.2 °C | +0.2 °C | 100.2 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#17TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.2 °C | +0.2 °C | 100.2 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#18TypeJ | | | | | |

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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-015 2022-05-11 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 100.0 °C | 100.0 °C | 100.2 °C | +0.2 °C | 100.2 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#19TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 100.1 °C | +0.1 °C | 100.1 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#20TypeJ | | | | | |
| 12.000 mA | 12.000 mA | 12.000 mA | 0.000 mA | 12.000 mA | +\- 0,100 mA | 1.00 mA |
| Compliant | Input#21 | | | | | |
| 12.000 mA | 12.000 mA | 12.000 mA | 0.000 mA | 12.000 mA | +\- 0,100 mA | 1.00 mA |
| Compliant | Input#22 | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 42 %RH

**Comments:** Test avec EM-147

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-11 |
| **Next Calibration:** | 2023-05-11 |
| **Certificate Date:** | 2022-05-11 |

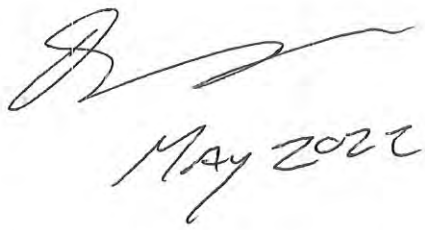
| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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



Marco Miron - Technicien




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Calibration Certificate ID
CA0123-007-042022-ACC

METTLER TOLEDO

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

# Accuracy Calibration Certificate

## Customer

| | | | |
|---|---|---|---|
| Company: | Services Polytests | | |
| Address: | 695-B Rue Gaudette | | |
| City: | Saint-Jean-Sur-Richelieu | Contact: | Danick Power |
| Zip / Postal: | J3B 7S7 | Order Number: | 0332427627 |
| State / Province: | Quebec | | |

## Weighing Device

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

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

## Procedure

| | |
|---|---|
| Calibration Guideline: | EURAMET cg-18 v. 4.0 (11/2015) |
| METTLER TOLEDO Work Instruction: | 30260953 |

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

The sensitivity/span of the weighing instrument was adjusted before As Left calibration with an external weight. As Left 350

| | | | |
|---|---|---|---|
| As Found Calibration Date: | 20-04-2022 | Service Technician: |  |
| As Left Calibration Date: | 20-04-2022 | | Kamel Mohand Kaci |
| Issue Date: | 20-04-2022 | | |
| Next Calibration Date: | 31-10-2022 | | |



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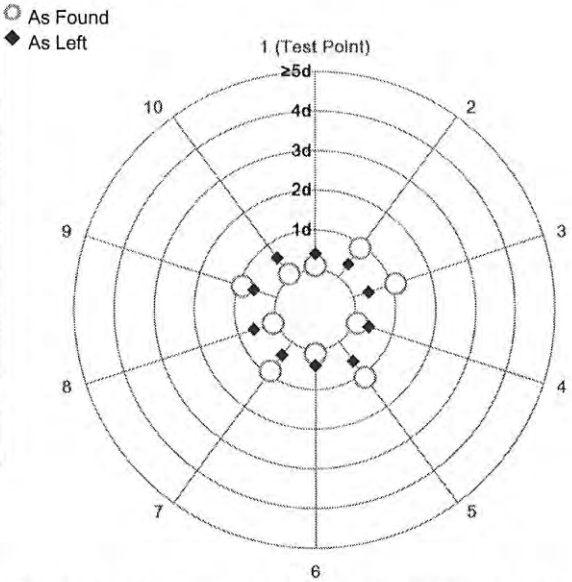
# Measurement Results

## Repeatability

Test Load: 100 g

| | As Found | As Left |
|---|---|---|
| 1 | 100.0000 g | 100.0000 g |
| 2 | 99.9999 g | 100.0000 g |
| 3 | 100.0001 g | 100.0000 g |
| 4 | 100.0000 g | 100.0000 g |
| 5 | 100.0001 g | 100.0001 g |
| 6 | 100.0000 g | 100.0000 g |
| 7 | 99.9999 g | 100.0000 g |
| 8 | 100.0000 g | 100.0001 g |
| 9 | 99.9999 g | 100.0001 g |
| 10 | 100.0000 g | 100.0001 g |

| | | |
|---|---|---|
| **Standard Deviation** | **0.00007 g** | **0.00005 g** |




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

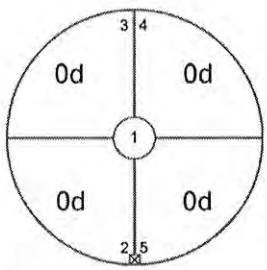
The results of this graph are based upon the absolute values of the differences from the mean value.

## Eccentricity

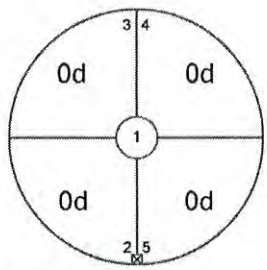
Test Load: 100 g

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

| | | |
|---|---|---|
| **Maximum Deviation** | **0.0000 g** | **0.0000 g** |




As Found




As Left

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

## Error of Indication

As Found

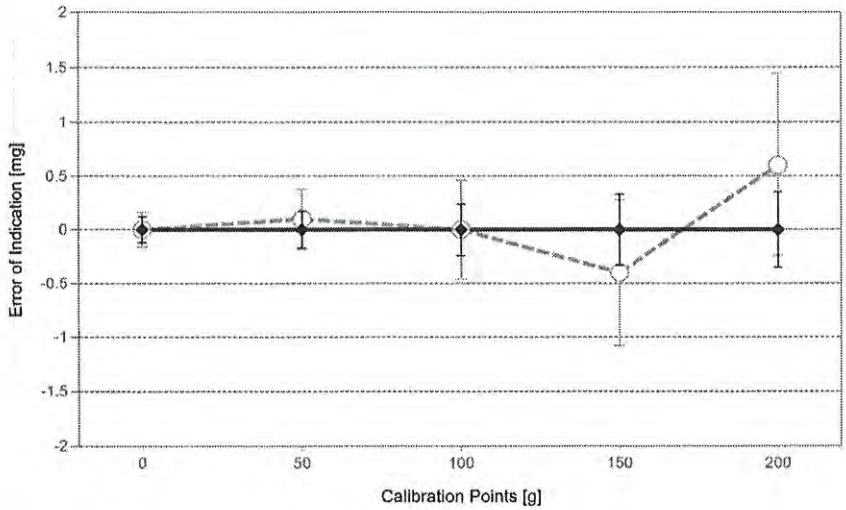
| | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|---|---|---|---|---|---|
| 1 | 0.0000 g | 0.0000 g | 0.0000 g | 0.16 mg | 2 |
| 2 | 50.0000 g | 50.0001 g | 0.0001 g | 0.28 mg | 2 |
| 3 | 100.0000 g | 100.0000 g | 0.0000 g | 0.46 mg | 2 |
| 4 | 150.0000 g | 149.9996 g | -0.0004 g | 0.68 mg | 2 |
| 5 | 200.0001 g | 200.0007 g | 0.0006 g | 0.84 mg | 2 |



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As Left

| | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|---|---|---|---|---|---|
| 1 | 0.0000 g | 0.0000 g | 0.0000 g | 0.12 mg | 2 |
| 2 | 50.0000 g | 50.0000 g | 0.0000 g | 0.17 mg | 2 |
| 3 | 100.0000 g | 100.0000 g | 0.0000 g | 0.24 mg | 2 |
| 4 | 150.0000 g | 150.0000 g | 0.0000 g | 0.33 mg | 2 |
| 5 | 200.0001 g | 200.0001 g | 0.0000 g | 0.35 mg | 2 |




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

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

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

## Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

Linearization of Uncertainty Equation

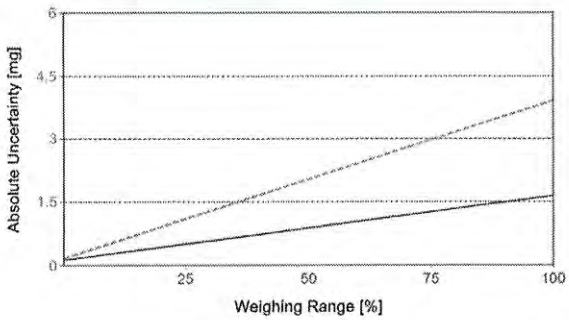
| | Range | | As Found | As Left |
|---|---|---|---|---|
| | d | Max | | |
| 1 | 0.0001 g | 210 g | $U_1 = 0.17$ mg + 0.0178 mg/g · R | $U_1 = 0.13$ mg + 0.00719 mg/g · R |

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

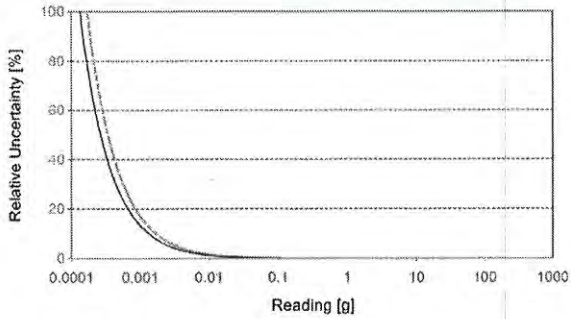
Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

| Net Indication | As Found | | As Left | |
|---|---|---|---|---|
| 0.0210 g | 0.17 mg | 0.81% | 0.13 mg | 0.62% |
| 0.2100 g | 0.17 mg | 0.083% | 0.13 mg | 0.063% |
| 2.1000 g | 0.21 mg | 0.0099% | 0.15 mg | 0.0069% |
| 21.0000 g | 0.54 mg | 0.0026% | 0.28 mg | 0.0013% |
| 210.0000 g | 3.9 mg | 0.0019% | 1.6 mg | 0.00078% |


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As Found




As Left

## Test Equipment

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

**Weight Set 1: OIML E2**

| | | | |
|---|---|---|---|
| Weight Set No.: | 350 | Date of Issue: | 15-02-2022 |
| Certificate Number: | 220554739-1 | Calibration Due Date: | 28-02-2023 |

## Remarks

This document is issued to record completion of the work performed by METTLER TOLEDO on the subject device in accordance with agreed standards. It does not guarantee the continued performance of the subject device. Any measurements recorded are based on the subject device's performance at a given time as tested by METTLER TOLEDO and, except where explicitly stated otherwise, do not express an opinion as to the sufficiency of any customer designed procedures used to test the device. This document is not a warranty, either implied or express. METTLER TOLEDO expressly disclaims any liability arising from the use of the information in this document for any purpose other than as specified herein.



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METTLER TOLEDO Service

# Custom Tolerance Assessment

Assessment done without considering measurement uncertainty.

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

| | As Found | As Left |
|---|---|---|
| **Overall** | ✓ | ✓ |
| Repeatability | ✓ | ✓ |
| Eccentricity | ✓ | ✓ |
| Error of Indication | ✓ | ✓ |

## Measurement Results

### Repeatability

Test Load: 100 g

| | As Found | As Left |
|---|---|---|
| 1 | 100.0000 g | 100.0000 g |
| 2 | 99.9999 g | 100.0000 g |
| 3 | 100.0001 g | 100.0000 g |
| 4 | 100.0000 g | 100.0000 g |
| 5 | 100.0001 g | 100.0001 g |
| 6 | 100.0000 g | 100.0000 g |
| 7 | 99.9999 g | 100.0000 g |
| 8 | 100.0000 g | 100.0001 g |
| 9 | 99.9999 g | 100.0001 g |
| 10 | 100.0000 g | 100.0001 g |

| | | |
|---|---|---|
| Standard Deviation | 0.00007 g | 0.00005 g |
| Tolerance | 0.00020 g ✓ | 0.00020 g ✓ |

2022-04-20



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## Eccentricity

Test Load: 100 g

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

| | | |
|---|---|---|
| **Maximum Deviation** | **0.0000 g** | **0.0000 g** |
| **Tolerance** | **0.0003 g** ✓ | **0.0003 g** ✓ |

## Error of Indication

As Found

| | Reference Value | Indication | Error of Indication | Tolerance |
|---|---|---|---|---|
| 1 | 0.0000 g | 0.0000 g | 0.0000 g | 0.0002 g ✓ |
| 2 | 50.0000 g | 50.0001 g | 0.0001 g | 0.0002 g ✓ |
| 3 | 100.0000 g | 100.0000 g | 0.0000 g | 0.0004 g ✓ |
| 4 | 150.0000 g | 149.9996 g | -0.0004 g | 0.0006 g ✓ |
| 5 | 200.0001 g | 200.0007 g | 0.0006 g | 0.0010 g ✓ |

As Left

| | Reference Value | Indication | Error of Indication | Tolerance |
|---|---|---|---|---|
| 1 | 0.0000 g | 0.0000 g | 0.0000 g | 0.0002 g ✓ |
| 2 | 50.0000 g | 50.0000 g | 0.0000 g | 0.0002 g ✓ |
| 3 | 100.0000 g | 100.0000 g | 0.0000 g | 0.0004 g ✓ |
| 4 | 150.0000 g | 150.0000 g | 0.0000 g | 0.0006 g ✓ |
| 5 | 200.0001 g | 200.0001 g | 0.0000 g | 0.0010 g ✓ |


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TRANSCAT® CANADA
Trust in every measure

ACCREDITATION ISO 17025 TM
SCC Scope Number 668

# CALIBRATION CERTIFICATE

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

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

**Technician:**
Coutu, Daniel

David Llorens, Quality Manager

## SERVICE DESCRIPTION:

| | | | |
|---|---|---|---|
| **Masses description :** | ASTM E617 | **Date approved :** | 04-03-2022 |
| **Precision class :** | ASTM 6 | **Next Calibration :** | 04-03-2027 |
| **Density :** | 7.95g/cm³ | **CCN accreditation # :** | 668 |
| **Identification (if unique) :** | EM-090 | **CLAS Certification # :** | 2010-01 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Test conditions :** | Temp °C: | 21.05 | kPa Pressure: | 102.3 | Humidity: | 49.4 |

## NOTES:

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

## REMARKS:

March 2022

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SCC Scope Number 668

# CALIBRATION CERTIFICATE

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

## CALIBRATION RESULTS, CONVENTIONAL MASS:

| Nominal Mass | Serial # | Inventory # | Conventional mass | Conventional mass after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 2 kg | | EM-090 | 2.0001384 kg | | 200 mg | 2.0 mg |

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

## CALIBRATION RESULTS, CORRECTIONS:

| Nominal Mass | Serial # | Inventory # | Conventional mass Corrections | Conventional mass Corrections after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 2 kg | | EM-090 | 138.4 mg | | 200 mg | 2.0 mg |

# CALIBRATION CERTIFICATE

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

## BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

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

## UNCERTAINTIES:

The following uncertainties exist :

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

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

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

## TRACEABILITY

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

# CALIBRATION CERTIFICATE

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

## USED REFERENCES

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

ENVIRONMENTAL CONDITIONS

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

Calibration Certificate ID
CA0206-112-122021-ACC-USI

# METTLER TOLEDO

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

Accredited by the American Association for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1902.01
ISO 17025 Registered
ANSI/NCSL Z540-1 Accredited

# Accuracy Calibration Certificate

## Customer

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

## Weighing Device

| | | | |
|---|---|---|---|
| Manufacturer: | RICE LAKE | Instrument Type: | Weighing Instrument |
| Model: | 4X4HP-10K | Asset Number: | EM-114 EM-137 |
| Serial No.: | C18395 | Terminal Model: | IQ+355 |
| Building: | N/A | Terminal Serial No.: | 164851 |
| Floor: | N/A | Terminal Asset No.: | N/A |
| Room: | N/A | | |

| Range | Max. Capacity | Readability (d) |
|---|---|---|
| 1 | 400 kg | 0.05 kg |

## Procedure

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

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

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

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

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

| | Temperature | |
|---|---|---|
| As Found | Start: 20.0 °C | End: 20.0 °C |
| As Left | Start: 20.0 °C | End: 20.0 °C |

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

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

As Found Calibration Date: 20-12-2021
As Left Calibration Date: 20-12-2021
Issue Date: 20-12-2021

Authorized A2LA Signatory:
Marc-Andre Chouinard

20 dec 2021



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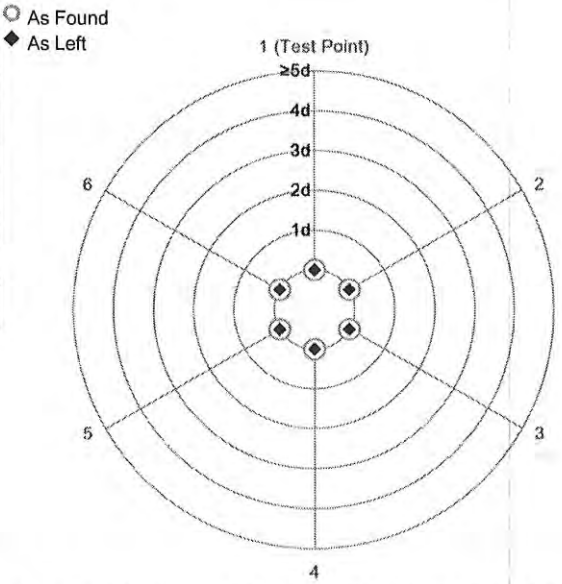
# Measurement Results

## Repeatability

**Test Load: 70 kg**

| | As Found | As Left |
|---|---|---|
| 1 | 70.10 kg | 70.00 kg |
| 2 | 70.10 kg | 70.00 kg |
| 3 | 70.10 kg | 70.00 kg |
| 4 | 70.10 kg | 70.00 kg |
| 5 | 70.10 kg | 70.00 kg |
| 6 | 70.10 kg | 70.00 kg |

| | | |
|---|---|---|
| **Standard Deviation** | **0.000 kg** | **0.000 kg** |




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

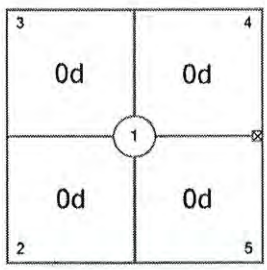
The results of this graph are based upon the absolute values of the differences from the mean value.

## Eccentricity

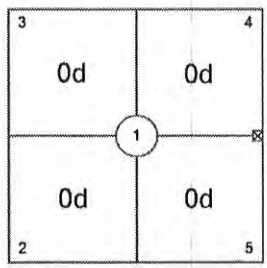
**Test Load: 50 kg**

| Position | As Found | As Left |
|---|---|---|
| 1 | 50.05 kg | 50.00 kg |
| 2 | 50.05 kg | 50.00 kg |
| 3 | 50.05 kg | 50.00 kg |
| 4 | 50.05 kg | 50.00 kg |
| 5 | 50.05 kg | 50.00 kg |

| | | |
|---|---|---|
| **Maximum Deviation** | **0.00 kg** | **0.00 kg** |




As Found




As Left

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



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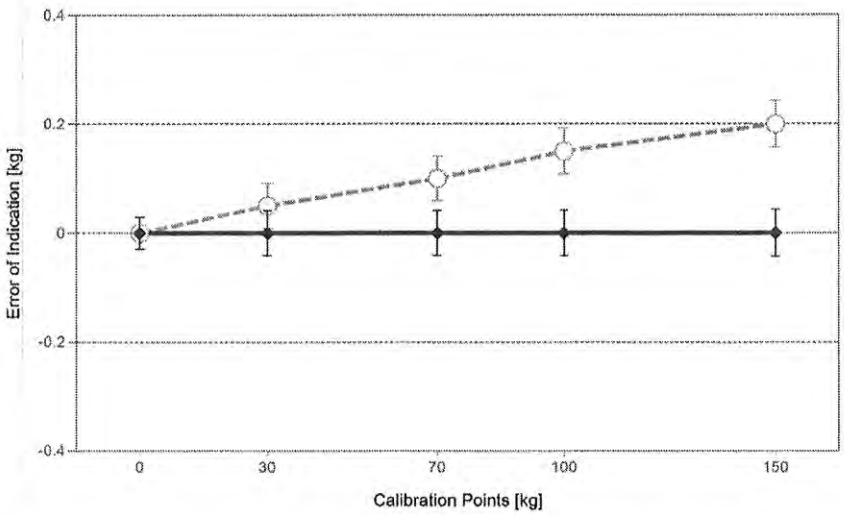
## Error of Indication

As Found

| | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|---|---|---|---|---|---|
| 1 | 0 kg | 0.00 kg | 0.00 kg | 0.029 kg | 2 |
| 2 | 30 kg | 30.05 kg | 0.05 kg | 0.041 kg | 2 |
| 3 | 70 kg | 70.10 kg | 0.10 kg | 0.041 kg | 2 |
| 4 | 100 kg | 100.15 kg | 0.15 kg | 0.042 kg | 2 |
| 5 | 150 kg | 150.20 kg | 0.20 kg | 0.043 kg | 2 |
| 6 | 100 kg | 100.15 kg | 0.15 kg | 0.042 kg | 2 |
| 7 | 70 kg | 70.10 kg | 0.10 kg | 0.041 kg | 2 |
| 8 | 30 kg | 30.05 kg | 0.05 kg | 0.041 kg | 2 |
| 9 | 0 kg | 0.00 kg | 0.00 kg | 0.029 kg | 2 |

As Left

| | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|---|---|---|---|---|---|
| 1 | 0 kg | 0.00 kg | 0.00 kg | 0.029 kg | 2 |
| 2 | 30 kg | 30.00 kg | 0.00 kg | 0.041 kg | 2 |
| 3 | 70 kg | 70.00 kg | 0.00 kg | 0.041 kg | 2 |
| 4 | 100 kg | 100.00 kg | 0.00 kg | 0.042 kg | 2 |
| 5 | 150 kg | 150.00 kg | 0.00 kg | 0.043 kg | 2 |
| 6 | 100 kg | 100.00 kg | 0.00 kg | 0.042 kg | 2 |
| 7 | 70 kg | 70.00 kg | 0.00 kg | 0.041 kg | 2 |
| 8 | 30 kg | 30.00 kg | 0.00 kg | 0.041 kg | 2 |
| 9 | 0 kg | 0.00 kg | 0.00 kg | 0.029 kg | 2 |




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

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

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.


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## Test Equipment

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

**Weight Set 1: OIML M1**

| | | | |
|---|---|---|---|
| Weight Set No.: | 92294 | Date of Issue: | 23-09-2021 |
| Certificate Number: | M21-0283 | Calibration Due Date: | 23-09-2022 |

**Weight Set 2: OIML M1**

| | | | |
|---|---|---|---|
| Weight Set No.: | T-100 | Date of Issue: | 12-05-2021 |
| Certificate Number: | 1412861 | Calibration Due Date: | 12-05-2022 |

## Remarks

N/A

**End of Accredited Section**

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



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## Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $10.0 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 20 K

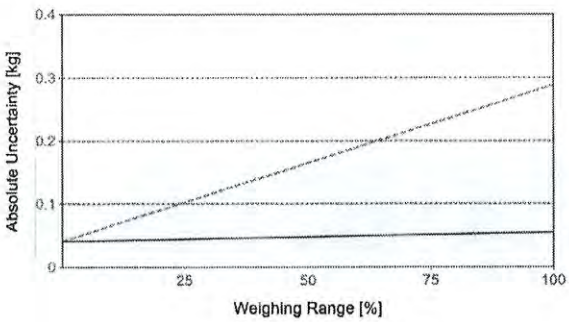
**Linearization of Uncertainty Equation**

| | Range | | As Found | As Left |
|---|---|---|---|---|
| | d | Max | | |
| 1 | 0.05 kg | 150 kg | $U_1$ = 41 g + 1.66 g/kg · R | $U_1$ = 41 g + 0.0938 g/kg · R |

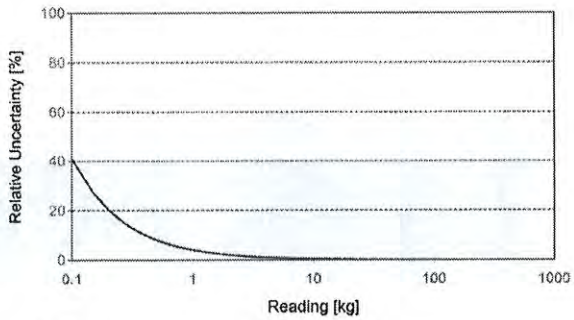
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

| Net Indication | As Found | | As Left | |
|---|---|---|---|---|
| 1.50 kg | 0.043 kg | 2.9% | 0.041 kg | 2.7% |
| 15.00 kg | 0.066 kg | 0.44% | 0.042 kg | 0.28% |
| 30.00 kg | 0.091 kg | 0.30% | 0.044 kg | 0.15% |
| 75.00 kg | 0.17 kg | 0.22% | 0.048 kg | 0.064% |
| 150.00 kg | 0.29 kg | 0.19% | 0.055 kg | 0.037% |




As Found




As Left



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METTLER TOLEDO Service

# Handbook 44 Tolerance Assessment (Maintenance)

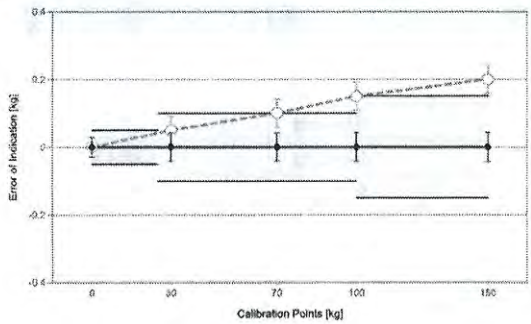
Assessment done without considering measurement uncertainty.
The measurements from the attached calibration certificate were assessed against the Tolerances defined by NIST Handbook 44.
The range of measurements for both Eccentricity and Repeatability (if performed) tests is assessed against Maintenance Tolerances.

| | As Found | As Left |
|---|---|---|
| **Overall** | ✗ | ✓ |

✓ = Passed
✗ = Failed

## Weighing Device

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




**Tolerances according to NIST Handbook 44**

| Test Load | | Tolerance |
|---|---|---|
| From | To | |
| 0.00 kg | 0.00 kg | 0.0125 kg |
| 0.05 kg | 25.00 kg | 0.05 kg |
| 25.05 kg | 100.00 kg | 0.1 kg |
| 100.05 kg | 150.00 kg | 0.15 kg |

○ As Found
◆ As Left
— Tolerance

## Eccentricity and Repeatability

| Test | Test Load | Tolerance | As Found | | As Left | |
|---|---|---|---|---|---|---|
| | | | Max. Error / Range | Result | Max. Error / Range | Result |
| Eccentricity (Max. Error) | 50 kg | 0.10 kg | 0.05 kg | ✓ | 0.00 kg | ✓ |
| Eccentricity (Range) | 50 kg | 0.1 kg | 0.00 kg | ✓ | 0.00 kg | ✓ |
| Repeatability (Max. Error) | 70 kg | 0.1 kg | 0.10 kg | ✓ | 0.00 kg | ✓ |
| Repeatability (Range) | 70 kg | 0.10 kg | 0.00 kg | ✓ | 0.00 kg | ✓ |

**Max. Error:** Maximum of the absolute values of the individual errors.
**Range:** Difference between largest and smallest measurement value.

## Error of Indication

| | Reference Value | Tolerance | As Found | | As Left | |
|---|---|---|---|---|---|---|
| | | | Error of Indication | Result | Error of Indication | Result |
| 1 | 0 kg | 0.05 kg | 0.00 kg | ✓ | 0.00 kg | ✓ |
| 2 | 30 kg | 0.10 kg | 0.05 kg | ✓ | 0.00 kg | ✓ |
| 3 | 70 kg | 0.10 kg | 0.10 kg | ✓ | 0.00 kg | ✓ |
| 4 | 100 kg | 0.10 kg | 0.15 kg | ✗ | 0.00 kg | ✓ |
| 5 | 150 kg | 0.15 kg | 0.20 kg | ✗ | 0.00 kg | ✓ |
| 6 | 100 kg | 0.10 kg | 0.15 kg | ✗ | 0.00 kg | ✓ |
| 7 | 70 kg | 0.10 kg | 0.10 kg | ✓ | 0.00 kg | ✓ |
| 8 | 30 kg | 0.10 kg | 0.05 kg | ✓ | 0.00 kg | ✓ |
| 9 | 0 kg | 0.05 kg | 0.00 kg | ✓ | 0.00 kg | ✓ |


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CLAS 2010-02

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

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-126 2022-05-10 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9106 |
| **Required Accuracy:** | +\- 1"Hg |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Pressure Gauge | **Input Type:** | Pression |
| **Manufacturer:** | Dwyer | **Output Type:** | Digitale |
| **Model #:** | DPG200 | **Measurement Type:** | Pressure |
| **Serial #:** | N.A. | **Range:** | 0-28"Hg |
| **Location:** | N.A. | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Crystal XP2i 300 | **Certification #:** | 2021008359 |
| **Serial #:** | 870437 | **Certification Date:** | 2021-11-15 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-11-15 |
| **Comments:** | | | |
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |

5F09106 Version 1

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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-126 2022-05-10 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 0.00 "Hg | 0.00 "Hg | 0.00 "Hg | 0.00 "Hg | 0.00 "Hg | +\- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -7.50 "Hg | -7.50 "Hg | -7.64 "Hg | -0.14 "Hg | -7.64 "Hg | +\- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -15.00 "Hg | -15.00 "Hg | -15.24 "Hg | -0.24 "Hg | -15.24 "Hg | +\- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -22.50 "Hg | -22.50 "Hg | -22.90 "Hg | -0.40 "Hg | -22.90 "Hg | +\- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -28.00 "Hg | -28.00 "Hg | -28.51 "Hg | -0.51 "Hg | -28.51 "Hg | +\- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| 0.00 "Hg | 10.0000 V.DC. | 10.0778 V.DC. | +0.0778 V.DC. | 10.0778 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -7.50 "Hg | 8.0000 V.DC. | 8.0447 V.DC. | +0.0447 V.DC. | 8.0447 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -15.00 "Hg | 6.0000 V.DC. | 6.0069 V.DC. | +0.0069 V.DC. | 6.0069 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -22.50 "Hg | 4.0000 V.DC. | 3.9596 V.DC. | -0.0404 V.DC. | 3.9596 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -28.00 "Hg | 2.5333 V.DC. | 2.4444 V.DC. | -0.0889 V.DC. | 2.4444 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 41 %RH

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-10 |
| **Next Calibration:** | 2023-05-10 |
| **Certificate Date:** | 2022-05-10 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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

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Version 1



MAY 2022

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

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-127 2022-05-10 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9106 |
| **Required Accuracy:** | +\- 1"Hg |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Pressure Gauge | **Input Type:** | Pression |
| **Manufacturer:** | Dwyer | **Output Type:** | Digitale |
| **Model #:** | DPG200 | **Measurement Type:** | Pressure |
| **Serial #:** | N.A. | **Range:** | 0-28"Hg |
| **Location:** | N.A. | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |
| **Calibrator:** | Crystal XP2i 300 | **Certification #:** | 2021008359 |
| **Serial #:** | 870437 | **Certification Date:** | 2021-11-15 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-11-15 |
| **Comments:** | | | |

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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-127 2022-05-10 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 0.00 "Hg | 0.00 "Hg | 0.00 "Hg | 0.00 "Hg | 0.00 "Hg | +/-1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -7.50 "Hg | -7.50 "Hg | -7.52 "Hg | -0.02 "Hg | -7.52 "Hg | +/- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -15.00 "Hg | -15.00 "Hg | -15.03 "Hg | -0.03 "Hg | -15.03 "Hg | +/- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -22.50 "Hg | -22.50 "Hg | -22.56 "Hg | -0.06 "Hg | -22.56 "Hg | +/- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| -28.00 "Hg | -28.00 "Hg | -28.11 "Hg | -0.11 "Hg | -28.11 "Hg | +/- 1 "Hg | 1 "Hg |
| Compliant | Verification of the indicator | | | | | |
| 0.00 "Hg | 10.0000 V.DC. | 10.0236 V.DC. | +0.0236 V.DC. | 10.0236 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -7.50 "Hg | 8.0000 V.DC. | 8.0275 V.DC. | +0.0275 V.DC. | 8.0275 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -15.00 "Hg | 6.0000 V.DC. | 6.0185 V.DC. | +0.0185 V.DC. | 6.0185 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -22.50 "Hg | 4.0000 V.DC. | 4.0002 V.DC. | +0.0002 V.DC. | 4.0002 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| -28.00 "Hg | 2.5333 V.DC. | 2.5160 V.DC. | -0.0173 V.DC. | 2.5160 V.DC. | +\- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 41 %RH

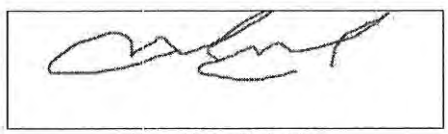
**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-10 |
| **Next Calibration:** | 2023-05-10 |
| **Certificate Date:** | 2022-05-10 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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



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Version 1

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May 2022

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ACCREDITATION ISO 17025
SCC Scope Number 668

# CALIBRATION CERTIFICATE

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

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

**Technician:**
Coutu, Daniel

David Llorens, Quality Manager

## SERVICE DESCRIPTION:

| | | | |
|---|---|---|---|
| **Masses description :** | ASTM E617 | **Date approved :** | 04-03-2022 |
| **Precision class :** | ASTM 1 | **Next Calibration :** | 04-03-2027 |
| **Density :** | 7.95g/cm³ | **CCN accreditation # :** | 668 |
| **Identification (if unique) :** | 1000026013 | **CLAS Certification # :** | 2010-01 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Test conditions :** | Temp °C: | 21.05 | kPa Pressure: | 102.3 | Humidity: | 49.4 |

## NOTES:

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

## REMARKS:

March 2022

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# CALIBRATION CERTIFICATE

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

## CALIBRATION RESULTS, CONVENTIONAL MASS:

| Nominal Mass | Serial # | Inventory # | Conventional mass | Conventional mass after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 200 g* | 1000026013 | EM-129 | 199.99954 g | 199.99986 g | 0.50 mg | 0.10 mg |

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

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www.dispersion.ca 1.866.390.5066

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

## CALIBRATION RESULTS, CORRECTIONS:

| Nominal Mass | Serial # | Inventory # | Conventional mass Corrections | Conventional mass Corrections after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 200 g* | 1000026013 | EM-129 | -0.46 mg | -0.14 mg | 0.50 mg | 0.10 mg |

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

# CALIBRATION CERTIFICATE

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## BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

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

## UNCERTAINTIES:

The following uncertainties exist :

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

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

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

## TRACEABILITY

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

# CALIBRATION CERTIFICATE

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

## USED REFERENCES

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

ENVIRONMENTAL CONDITIONS

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

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-136 2022-05-25 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | ISL-004 |
| **Required Accuracy:** | +\-2°C +\-3%RH |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Hygrometer | **Input Type:** | Temp/%RH |
| **Manufacturer:** | Fluke | **Output Type:** | Digitale |
| **Model #:** | 971 | **Measurement Type:** | Temp/Humidity |
| **Serial #:** | 10610850 | **Range:** | 5-95%RH -20a60°C |
| **Location:** | N.A. | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Hygrometre 485B-1/RPM | **Certification #:** | 2022001936 |
| **Serial #:** | 035V4V | **Certification Date:** | 2022-03-11 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-03-11 |
| **Comments:** | | | |

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-136 2022-05-25 |
|---|---|

**CALIBRATION RESULTS**

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 25.0 °C | 25.0 °C | 25.1 °C | +0.1 °C | 25.1 °C | +/- 2.0 °C | 1.0 °C |
| 40.0 °C | 40.0 °C | 40.3 °C | +0.3 °C | 40.3 °C | +/- 2.0 °C | 1.0 °C |
| 30.0 %RH | 30.0 %RH | 28.1 %RH | -1.9 %RH | 28.1 %RH | +/- 3.0 %RH | -- %RH |
| 55.0 %RH | 55.0 %RH | 52.8 %RH | -2.2 %RH | 52.8 %RH | +/- 3.0 %RH | -- %RH |
| 75.0 %RH | 75.0 %RH | 73.8 %RH | -1.2 %RH | 73.8 %RH | +/- 3.0 %RH | -- %RH |
| | | | | | | |

**Environmental Conditions:** Temperature: 22 °C Humidity: 39 %RH

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-25 |
| **Next Calibration:** | 2023-05-25 |
| **Certificate Date:** | 2022-05-25 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

May 2022

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-147 2022-05-11 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9101 |
| **Required Accuracy:** | +\- 2.0C |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Recorder | **Input Type:** | Divers |
| **Manufacturer:** | Keithley | **Output Type:** | Digital |
| **Model #:** | 2700 | **Measurement Type:** | Temperature |
| **Serial #:** | 1349443 | **Range:** | Divers |
| **Location:** | N.A. | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-147 2022-05-11 |
|---|---|

**CALIBRATION RESULTS**

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

**Environmental Conditions:** Temperature: 21 °C Humidity: 42 %RH

**Comments:** Data Acquisition system Conforme

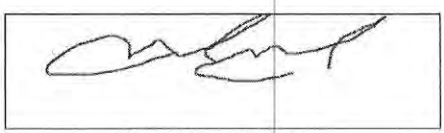
Les 2 slot de l'enregistreur ont été vérifié.

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-11 |
| **Next Calibration:** | 2023-05-11 |
| **Certificate Date:** | 2022-05-11 |

| CALIBRATION CONFORMITY | Before | After |
|---|---|---|
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-154/2 2022-05-11 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 77.0 °F | 77.0 °F | 76.4 °F | -0.6 °F | 76.4 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 111 (Filtre 1) en type "T" En Loop avec EM-154 | | | | | |
| 77.0 °F | 77.0 °F | 76.3 °F | -0.7 °F | 76.3 °F | +/- 4.0 °F | +/- 0.5 °F |
| Compliant | ID. No. 112 (Filtre 2) en type "T" En Loop avec EM-154 | | | | | |
| 140.0 °F | 140.0 °F | 139.7 °F | -0.3 °F | 139.7 °F | +/- 4.0 °F | +/- 0.4 °F |
| Compliant | ID. No. 113 (Tunnel) en type "J" En Loop avec EM-154 | | | | | |
| 68.0 °F | 68.0 °F | 67.6 °F | -0.4 °F | 67.6 °F | +/- 4.0 °F | +/- 0.4 °F |
| Compliant | ID. No. 114 (Room) en type "J" En Loop avec EM-154 | | | | | |
| 77.0 °F | 77.0 °F | 76.6 °F | -0.4 °F | 76.6 °F | +/- 4.0 °F | +/- 0.4 °F |
| Non-Compliant | ID. No. 115 (Analyzer gaz) en type "J" En Loop avec EM-154 | | | | | |
| | | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 42 %RH

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-11 |
| **Next Calibration:** | 2022-11-11 |
| **Certificate Date:** | 2022-05-11 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

¤ Instrumentation St. Laurent Inc. Certify that the above instrument, meets or exceeds the specifications established by the manufacturer. The company's quality system complies with the requirements of ISO 17025 :2017 and the standards used to perform the calibration is traceable to NRC and / or NIST.
¤ Reported uncertainties represent a 95 % of confidence level assuming a normal distribution k=2.
¤ The declaration of conformity does not include Instrumentation St-Laurent Inc. uncertainty measurement. Decision rule is based on binary statement for simple acceptance rule against ILAC G8 standard and test tolerance limits are based on customer specifications, unless otherwise specified.
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May 2022

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-154/2 2022-05-11 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9101 |
| **Required Accuracy:** | +\- 4.0°F |
| **Calibration Frequency:(days)** | 181 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Recorder | **Input Type:** | Temp |
| **Manufacturer:** | Keithley | **Output Type:** | Digitale |
| **Model #:** | 7700 | **Measurement Type:** | Temperature |
| **Serial #:** | 1306774 | **Range:** | Divers |
| **Location:** | N/A | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-154 2022-05-11 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9101 |
| **Required Accuracy:** | +\- 2°C |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Recorder | **Input Type:** | Temp |
| **Manufacturer:** | Keithley | **Output Type:** | Digitale |
| **Model #:** | 7700 | **Measurement Type:** | Temperature |
| **Serial #:** | 1306774 | **Range:** | Divers |
| **Location:** | N/A | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022003082 |
| **Serial #:** | 8180008 | **Certification Date:** | 2022-04-12 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2023-04-12 |
| **Comments:** | | | |

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-154 2022-05-11 |
|---|---|

**CALIBRATION RESULTS**

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| Conformity | Comment | | | | | |
| -17.000 mV | -17.000 mV | -17.106 mV | -0.106 mV | -17.106 mV | +/- 0.500 mV | 0.1 mV |
| Compliant | Input#1 | | | | | |
| 0.000 mV | 0.000 mV | -0.105 mV | -0.105 mV | -0.105 mV | +/- 0.500 mV | 0.1 mV |
| Compliant | Input#1 | | | | | |
| 20.000 mV | 20.000 mV | 19.897 mV | -0.103 mV | 19.897 mV | +/- 0.500 mV | 0.1 mV |
| Compliant | Input#1 | | | | | |
| 30.000 mV | 30.000 mV | 29.870 mV | -0.130 mV | 29.870 mV | +/- 0.500 mV | 0.1 mV |
| Compliant | Input#2 | | | | | |
| 30.000 mV | 30.000 mV | 29.870 mV | -0.130 mV | 29.870 mV | +/- 0.500 mV | 0.1 mV |
| Compliant | Input#3 Non-Conforme | | | | | |
| 5.000 V.DC. | 5.000 V.DC. | 5.000 V.DC. | 0.000 V.DC. | 5.000 V.DC. | +/- 0.050 V.DC. | 0.1 V.DC. |
| Compliant | Input#4 | | | | | |
| 30.000 mV | 30.000 mV | 29.647 mV | -0.353 mV | 29.647 mV | +/- 0.050 mV | 0.1 mV |
| Compliant | Input#5 | | | | | |
| 30.000 mV | 30.000 mV | 29.642 mV | -0.358 mV | 29.642 mV | +/- 0.050 mV | 0.1 mV |
| Compliant | Input#6 | | | | | |
| 100.00 Ohms | 100.00 Ohms | 101.02 Ohms | +1.02 Ohms | 101.02 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#7 | | | | | |
| 100.00 Ohms | 100.00 Ohms | 101.00 Ohms | +1.00 Ohms | 101.00 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#8 | | | | | |
| 100.00 Ohms | 100.00 Ohms | 101.00 Ohms | +1.00 Ohms | 101.00 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#9 | | | | | |
| 100.00 Ohms | 100.00 Ohms | 100.90 Ohms | +0.90 Ohms | 100.90 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#10 | | | | | |
| 100.0 °C | 100.0 °C | 99.6 °C | -0.4 °C | 99.6 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#11TypeT | | | | | |
| 100.0 °C | 100.0 °C | 99.6 °C | -0.4 °C | 99.6 °C | +\- 2.0 °C | +/- 0.3 °C |
| Compliant | Input#12TypeT | | | | | |
| 100.0 °C | 100.0 °C | 99.7 °C | +0.3 °C | 99.7 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#13 TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 99.7 °C | -0.3 °C | 99.7 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#14TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 99.9 °C | -0.1 °C | 99.9 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#15 TypeJ | | | | | |
| 100.0 °C | 100.0 °C | 99.7 °C | -0.3 °C | 99.7 °C | +\- 2.0 °C | +/- 0.2 °C |
| Compliant | Input#16TypeJ | | | | | |
| 100.00 Ohms | 100.00 Ohms | 101.08 Ohms | +1.08 Ohms | 101.08 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#17 | | | | | |
| 100.00 Ohms | 100.00 Ohms | 101.04 Ohms | +1.04 Ohms | 101.04 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#18 | | | | | |

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-154 2022-05-11 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 100.00 Ohms | 100.00 Ohms | 101.03 Ohms | +0.02 Ohms | 101.03 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#19 | | | | | |
| 100.00 Ohms | 100.00 Ohms | 100.99 Ohms | +0.99 Ohms | 100.99 Ohms | +/- 0.10 Ohms | +/- 0.051 Ohms |
| Non-Compliant | Input#20 | | | | | |
| 12.000 mA | 12.000 mA | 12.001 mA | +0.001 mA | 12.001 mA | +/- 0.100 mA | 1.00 mA |
| Compliant | Input#21 | | | | | |
| 12.000 mA | 12.000 mA | -------- mA | -------- mA | -------- mA | +/- 0.100 mA | 1.00 mA |
| Non-Compliant | Input#22 Fonctionne pas | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 42 %RH

**Comments:** Test avec EM-147

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-11 |
| **Next Calibration:** | 2023-05-11 |
| **Certificate Date:** | 2022-05-11 |

| CALIBRATION CONFORMITY | Before | After |
|---|---|---|
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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¤ It is the customer's responsibility to ensure that calibrated equipment meets its intended use.
¤ The date format used in this certificate is: YYYY-MM-DD.

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

Marco Miron - Technicien

May 2022

5F09101 Version 1

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Trescal

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H1H 1T6 Canada
TEL.: (514) 329-3242 / 1 888 774-6665
FAX : (514) 329-3750
info.canada@trescal.com

2022.01.17

# Certificat d'Étalonnage / Certificate of Calibration

CLIENT :
SERVICES POLYTESTS INC.
695-B GAUDETTE
ST-JEAN-SUR-RICHELIEU, QC J3B7S7

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

CERTIFICAT No / Certificate No: 347561

PROCÉDURE / Procedure :
TRESCAL - EXTECH_365510

Date étalonnage/ Calibration Performed : aaaa - mm - jj 2021-12-24

Echéance/ Due Date : 2022-12-24

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

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

Conditions de mesure / Measurement conditions

TEMPÉRATURE / Temp. : 23.0°C

HUMIDITÉ / Humidity : 36% RH

Usage restreint/ *Restricted use* : ☐

Réparation effectuée / *Repair performed* : ☐

Ajustement effectué / *Adjustment performed* : ☐

ÉTALONS UTILISÉS/ Standards Used:

| Identification | Manuf. | Model | Description | Ser. # | Étalonné/ Cal. | Échéance/ Due |
|---|---|---|---|---|---|---|
| PR0313 | H-P | 53132A | UNIVERSAL COUNTER | 3546A03142 | 2021-08-25 | 2022-08-25 |
| PR0392 | AGILENT | 33250A | FUNCTION/ARBITRARY WAVEFORM GENERATOR | MY40008014 | 2021-06-11 | 2023-06-11 |

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 :

Technicien :
Technician M. BARRAK

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.*

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# Certificat d'Étalonnage
# Certificate of Calibration

| | |
|---|---|
| | 347561 |
| CLIENT / Customer : | SERVICES POLYTESTS INC. |
| DESCRIPTION / Description : | STOPWATCH |
| MANUFACTURIER / Manufacturer : | EXTECH |
| MODÈLE / Model : | 365510 |

| DESCRIPTION<br>Description | LIMITES<br>Limits | LECTURES<br>Readings | LIMITES<br>Limits |
|---|---|---|---|
| | Min | Comptes / Counts<br>Chronomètre/timer<br>162444 | Max |

**Temps écoulé, chronomètre sous test / Elapsed time on test stopwatch**

| Minutes | Seconds | 1/100 sec |
|---|---|---|
| 27 | 4 | 44 |

Total au compteur / Reference timer: 162447,4 comptes/counts

(Δt ) Deviation (1/100sec): -3,40

**Deviation Par jour/ Per day (%):** -0,0021 %

**Deviation Par jour/ Per day (sec):** **-1,81 sec**

| | | |
|---|---|---|
| * Secondes<br>-3,00 | Deviation 24hrs<br>**-1,81** | * Secondes<br>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.*

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CLAS 2009-02

#655

# CALIBRATION CERTIFICATE # 17213

**Calibration date : 2022-07-05**
**Certificate issued : 2022-07-05**

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

**Calibration of**
**Shinigawa DCDa-2c S/N : 23544**

## QUALITY PROGRAM CONFORMANCE

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

## TRACEABILITY

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

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

## CALIBRATION AND MEASUREMENT CAPABILITY

Calibration measurement capabilities have an uncertainty of ±0.2% of reading for a flow range between 5 SCCM to 10 SLPM, ±0.3% of reading for a flow range between 10 SLPM to 30 SLPM, ±0.2% of reading for a flow range between 30 SLPM to 3000 SLPM, ±0.3% of reading for a flow range above 3000 SLPM to 6000 SLPM and ±0.5% of reading for a flow range under 5 SCCM down to 1 SCCM, air or nitrogen equivalent. The reported uncertainty is expanded using a coverage factor k=2 for a level of confidence of approximately 95%, assuming a normal distribution including resolution of the instrument. The test uncertainty ratio (TUR) of this calibration is at least 4:1 unless otherwise stated.

## CONDITION SUMMARY OF THE DEVICE UNDER TEST

| | |
|---|---|
| Initial conditions | In good condition |
| Work done | Initial readings = Final readings, no adjustment. Calibration of the instrument |
| Results | Final readings in tolerance with K factor = 0.98. Final readings in tolerance |
| Remarks | Calibration frequency every 12 months |

Louis-Philippe Tremblay
Metrologist

Laboratory Manager

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## Calibration certificate # 17213

| | | | |
|---|---|---|---|
| Serial Number: | 23544 | Test stand: | 3 |
| Calibration Date: | 2022-07-05 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM-178 | Decision rule: | Method #3 |

## Standard equipment used for final calibration

| Description | Model | Serial # | Traceability | Due date |
|---|---|---|---|---|
| Fluke molbloc_30 slpm | 3E4-VCR-V-Q | 2359 | 1500331212 | 2023-05-03 |
| Fluke molbox1+ | Molbox1+ | 2089 | 1500317991 | 2022-10-05 |
| RTD Mist | Mist | L00295 | 2022000011 | 2023-01-10 |
| Module 44.5 PSI avec Baro 163671 | Module 30 | 160659 | 2022003929 | 2023-05-13 |

| Final specifications of the device under test | | Calibration conditions | |
|---|---|---|---|
| Gas | Air | Gas | Air |
| Operation temperature | | Ambient temperature | 22 °C |
| Inlet pressure | | Ambient pressure | 1012.35 mbar |
| Outlet pressure | | Orientation | Horizontal |
| Reference temperature | | Seals | Viton |
| Reference pressure | | Valve | |
| Range | 10-2000 ALH | | |
| Input/Output Signals | - | | |
| Supply | | | |
| Accuracy | ±2 %O.R. | | |

## Final readings

| Test Flow ALH | Device under test m³ | Measured values Pressure PSIA | Temperature °C | Reference m³ | Calculated Reference m³ | Calculated Error m³ | Acceptable Error m³ | Uncertainty k = 2 m³ | TUR |
|---|---|---|---|---|---|---|---|---|---|
| 373.1579 | 61.9850 | 14.6731 | 22.39 | 57.3300 | 62.1414 | -0.1564 | 1.2428 | 0.2141 | >4 |
| 1078.5347 | 179.8300 | 14.6851 | 22.31 | 165.8700 | 179.5948 | 0.2352 | 3.5919 | 0.6186 | >4 |
| 1838.4293 | 304.8241 | 14.7102 | 22.40 | 283.1400 | 306.1385 | -1.3144 | 6.1228 | 1.0545 | >4 |

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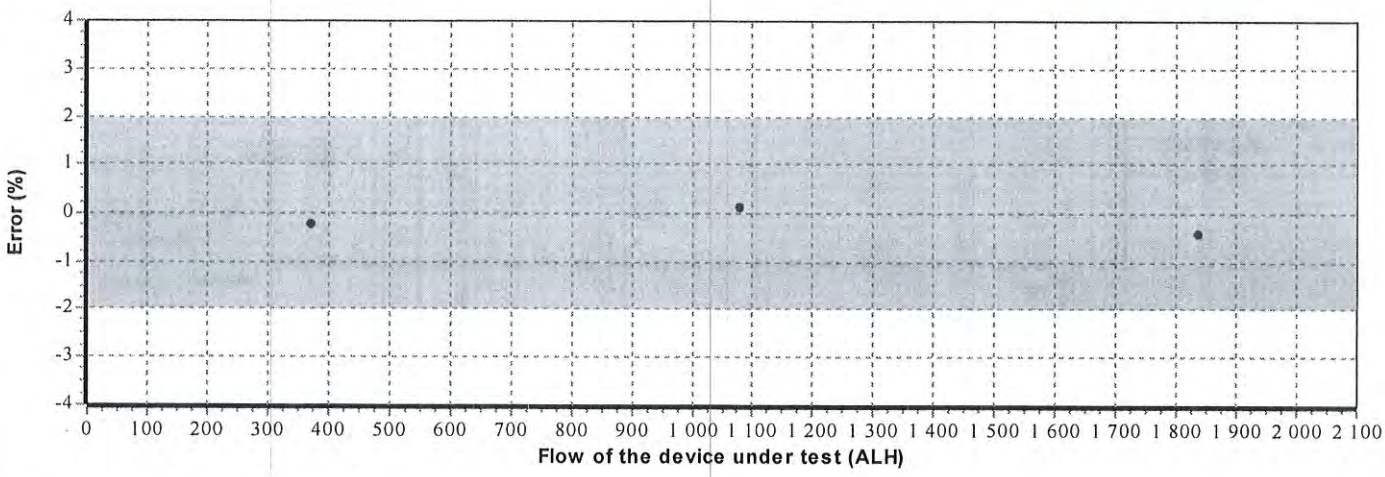
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## Calibration certificate # 17213

| | | | |
|---|---|---|---|
| Serial Number: | 23544 | Test stand: | 3 |
| Calibration Date: | 2022-07-05 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM-178 | Decision rule: | Method #3 |

### Final results




See the appendix for the guideline of decision rule

Cal Fact. 1.002523

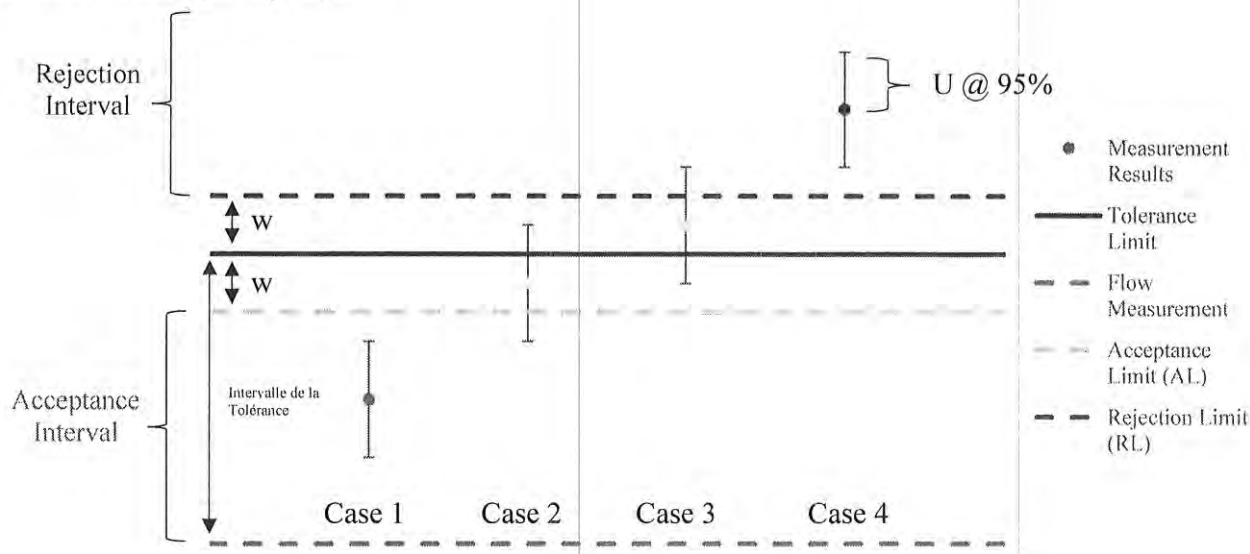
July 26th 2022

## *Appendix for the decision rule*

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

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

Statements of conformity are reported as:




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

***Case 1*** *– Below acceptance limit AL*
***Status: In tolerance***

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

***Case 2*** *– Below tolerance limit TL, greater than acceptance limit AL*
***Status: In tolerance-Conditional***

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

***Case 3*** *– Greater than tolerance limit, below rejection limit RL*
***Status: Out of tolerance-Conditional***

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

***Case 4*** *– Greater than rejection limit RL*
***Status: Out of tolerance***

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

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# CALIBRATION CERTIFICATE # 17215

**Calibration date : 2022-07-05**
**Certificate issued : 2022-07-05**

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

**Calibration of**
**Shinigawa DCDa-2c S/N : 23543**

## QUALITY PROGRAM CONFORMANCE

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

## TRACEABILITY

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

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

## CALIBRATION AND MEASUREMENT CAPABILITY

Calibration measurement capabilities have an uncertainty of ±0.2% of reading for a flow range between 5 SCCM to 10 SLPM, ±0.3% of reading for a flow range between 10 SLPM to 30 SLPM, ±0.2% of reading for a flow range between 30 SLPM to 3000 SLPM, ±0.3% of reading for a flow range above 3000 SLPM to 6000 SLPM and ±0.5% of reading for a flow range under 5 SCCM down to 1 SCCM, air or nitrogen equivalent. The reported uncertainty is expanded using a coverage factor k=2 for a level of confidence of approximately 95%, assuming a normal distribution including resolution of the instrument. The test uncertainty ratio (TUR) of this calibration is at least 4:1 unless otherwise stated.

## CONDITION SUMMARY OF THE DEVICE UNDER TEST

| | |
|---|---|
| Initial conditions | In good condition |
| Work done | Calibration of the instrument |
| Results | Initial readings in tolerance-conditional. Final readings in tolerance |
| Remarks | Calibration frequency every 12 months. Apply K factor 1.02 to display to meet accuracy. |

Louis-Philippe Tremblay
Metrologist

Laboratory Manager

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## Calibration certificate # 17215

| | | | |
|---|---|---|---|
| Serial Number: | 23543 | Test stand: | 3 |
| Calibration Date: | 2022-07-05 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM-179 | Decision rule: | Method #3 |

## Standard equipment used for initial calibration

| Description | Model | Serial # | Traceability | Due date |
|---|---|---|---|---|
| Fluke molbloc_30 slpm | 3E4-VCR-V-Q | 2359 | 1500331212 | 2023-05-03 |
| Fluke molbox1+ | Molbox1+ | 2089 | 1500317991 | 2022-10-05 |
| RTD Mist | Mist | L00295 | 2022000011 | 2023-01-10 |
| Module 44.5 PSI avec Baro 163671 | Module 30 | 160659 | 2022003929 | 2023-05-13 |

| Initial specifications of the device under test | | Calibration conditions | |
|---|---|---|---|
| Gas | Air | Gas | Air |
| Operation temperature | | Ambient temperature | 22 °C |
| Inlet pressure | | Ambient pressure | 1010.63 mbar |
| Outlet pressure | | Orientation | Horizontal |
| Reference temperature | | Seals | Viton |
| Reference pressure | | Valve | |
| Range | 10-2000 ALH | | |
| Input/Output Signals | - | | |
| Supply | | | |
| Accuracy ±2 %O.R. | | | |

## Initial readings

| Test Flow ALH | Device under test m³ | Measured values Pressure PSIA | Temperature °C | Reference m³ | Calculated Reference m³ | Calculated Error m³ | Acceptable Error m³ | Uncertainty k = 2 m³ | TUR |
|---|---|---|---|---|---|---|---|---|---|
| 344.0786 | 58.1450 | 14.6588 | 22.38 | 52.8000 | 57.2843 | 0.8607 | 1.1457 | 0.1974 | >4 |
| 1082.8864 | 183.5100 | 14.6686 | 22.37 | 166.3200 | 180.3206 | 3.1894 | 3.6064 | 0.6212 | >4 |
| 1832.4116 | 307.8200 | 14.6893 | 22.56 | 281.6500 | 305.1232 | 2.6968 | 6.1025 | 1.0513 | >4 |

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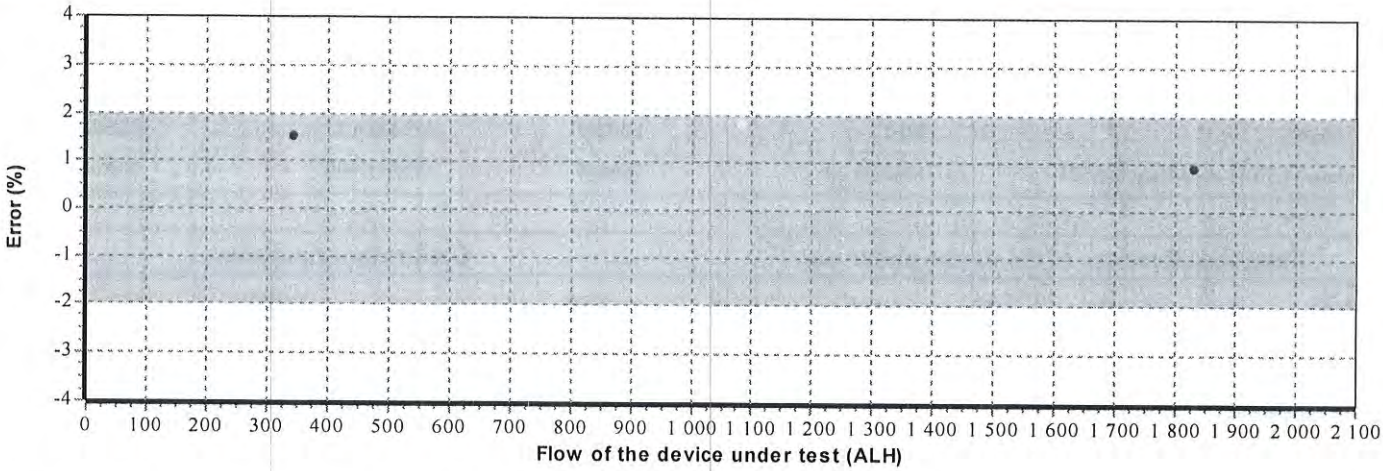
CLAS NRC-CNRC CLAS 2009-02

SCC Accredited LAB Accredite-SCC #655

## Calibration certificate # 17215

| | | | |
|---|---|---|---|
| Serial Number: | 23543 | Test stand: | 3 |
| Calibration Date: | 2022-07-05 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM-179 | Decision rule: | Method #3 |

## Initial results




See the appendix for the guideline of decision rule

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#655

## Calibration certificate # 17215

| | | | |
|---|---|---|---|
| Serial Number: | 23543 | Test stand: | 3 |
| Calibration Date: | 2022-07-05 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM-179 | Decision rule: | Method #3 |

## Standard equipment used for final calibration

| Description | Model | Serial # | Traceability | Due date |
|---|---|---|---|---|
| Fluke molbloc_30 slpm | 3E4-VCR-V-Q | 2359 | 1500331212 | 2023-05-03 |
| Fluke molbox1+ | Molbox1+ | 2089 | 1500317991 | 2022-10-05 |
| RTD Mist | Mist | L00295 | 2022000011 | 2023-01-10 |
| Module 44.5 PSI avec Baro 163671 | Module 30 | 160659 | 2022003929 | 2023-05-13 |

| Final specifications of the device under test | | Calibration conditions | |
|---|---|---|---|
| Gas | Air | Gas | Air |
| Operation temperature | | Ambient temperature | |
| Inlet pressure | | Ambient pressure | |
| Outlet pressure | | Orientation | Horizontal |
| Reference temperature | | Seals | Viton |
| Reference pressure | | Valve | |
| Range | 10-2000 ALH | | |
| Input/Output Signals | - | | |
| Supply | | | |
| Accuracy ±2 %O.R. | | | |

## Final readings

| Test Flow ALH | Device under test m³ | Measured values Pressure PSIA | Temperature °C | Reference m³ | Calculated Reference m³ | Calculated Error m³ | Acceptable Error m³ | Uncertainty k = 2 m³ | TUR |
|---|---|---|---|---|---|---|---|---|---|
| 373.8365 | 57.0049 | 14.6589 | 22.80 | 52.2843 | 56.8061 | 0.1988 | 1.1361 | 0.1958 | >4 |
| 1082.8910 | 179.9117 | 14.6686 | 22.37 | 166.3200 | 180.3214 | -0.4097 | 3.6064 | 0.6212 | >4 |
| 1832.4310 | 301.7843 | 14.6893 | 22.56 | 281.6500 | 305.1264 | -3.3421 | 6.1025 | 1.0513 | >4 |

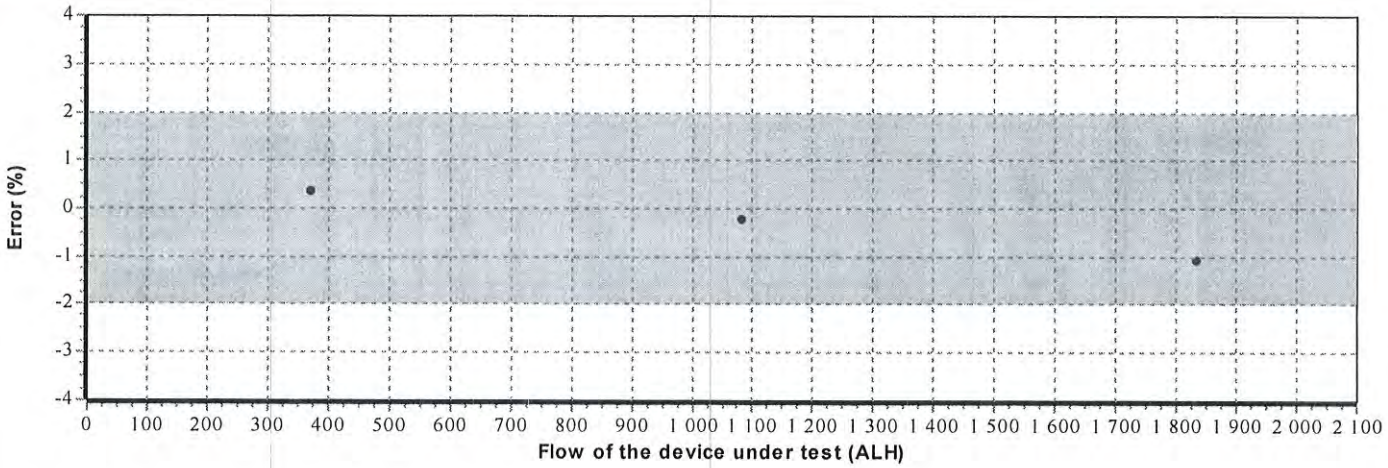
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#655

| Calibration certificate # 17215 | | | |
|---|---|---|---|
| Serial Number: | 23543 | Test stand: | 3 |
| Calibration Date: | 2022-07-05 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM-179 | Decision rule: | Method #3 |

**Final results**




See the appendix for the guideline of decision rule

CalFactor : 0.996513

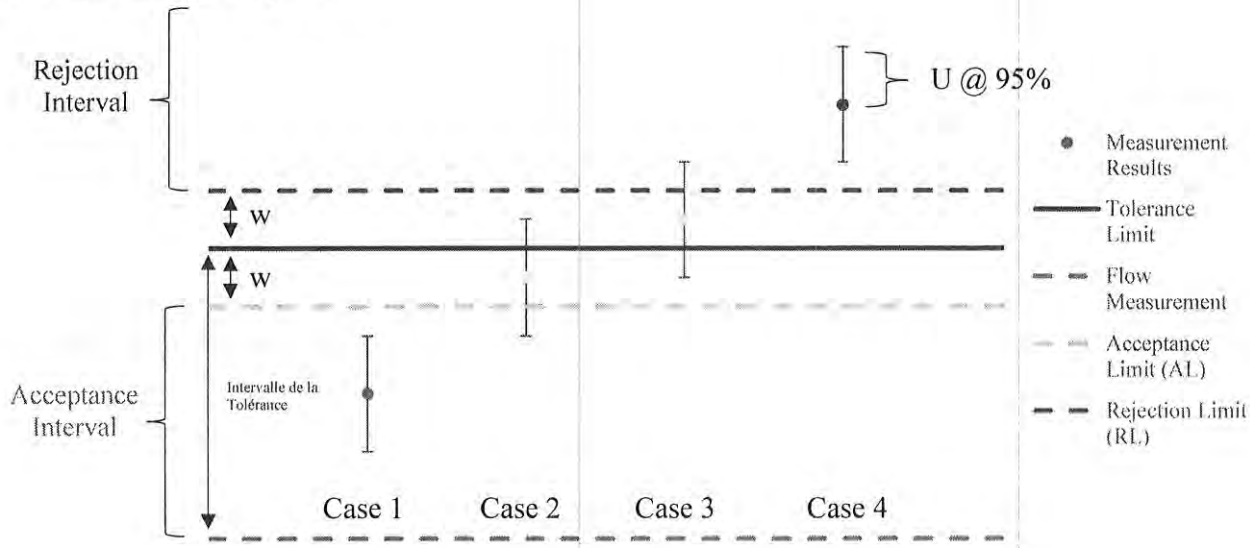
July 26th 2022

## *Appendix for the decision rule*

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

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

Statements of conformity are reported as:




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

***Case 1** – Below acceptance limit AL*
***Status: In tolerance***

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

***Case 2** – Below tolerance limit TL, greater than acceptance limit AL*
***Status: In tolerance-Conditional***

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

***Case 3** – Greater than tolerance limit, below rejection limit RL*
***Status: Out of tolerance-Conditional***

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

***Case 4** – Greater than rejection limit RL*
***Status: Out of tolerance***

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

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#655

# CALIBRATION CERTIFICATE # 17221

**Calibration date : 2022-07-06**
**Certificate issued : 2022-07-06**

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

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

## QUALITY PROGRAM CONFORMANCE

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

## TRACEABILITY

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

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

## CALIBRATION AND MEASUREMENT CAPABILITY

Calibration measurement capabilities have an uncertainty of ±0.2% of reading for a flow range between 5 SCCM to 10 SLPM, ±0.3% of reading for a flow range between 10 SLPM to 30 SLPM, ±0.2% of reading for a flow range between 30 SLPM to 3000 SLPM, ±0.3% of reading for a flow range above 3000 SLPM to 6000 SLPM and ±0.5% of reading for a flow range under 5 SCCM down to 1 SCCM, air or nitrogen equivalent. The reported uncertainty is expanded using a coverage factor k=2 for a level of confidence of approximately 95%, assuming a normal distribution including resolution of the instrument. The test uncertainty ratio (TUR) of this calibration is at least 4:1 unless otherwise stated.

## CONDITION SUMMARY OF THE DEVICE UNDER TEST

| | |
|---|---|
| Initial conditions | In good condition |
| Work done | Initial readings = Final readings, no adjustment. Calibration of the instrument |
| Results | Final readings in tolerance |
| Remarks | Calibration frequency every 12 months |

Louis-Philippe Tremblay
Metrologist

Laboratory Manager

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

POLYCONTROLS
INTEGRATION • CALIBRATION • INSTRUMENTATION

CLAS 2009-02

SCC Accredited LAB #655

## Calibration certificate # 17221

| | | | |
|---|---|---|---|
| Serial Number: | S8020 | Test stand: | 3 |
| Calibration Date: | 2022-07-06 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM 318 | Decision rule: | Method #3 |

## Standard equipment used for final calibration

| Description | Model | Serial # | Traceability | Due date |
|---|---|---|---|---|
| Fluke molbloc_30 slpm | 3E4-VCR-V-Q | 2359 | 1500331212 | 2023-05-03 |
| Fluke molbox1+ | Molbox1+ | 2089 | 1500317991 | 2022-10-05 |
| RTD Mist | Mist | L00295 | 2022000011 | 2023-01-10 |
| Module 44.5 PSI avec Baro 163671 | Module 30 | 160659 | 2022003929 | 2023-05-13 |

| Final specifications of the device under test | | Calibration conditions | |
|---|---|---|---|
| Gas | Air | Gas | Air |
| Operation temperature | | Ambient temperature | 22 °C |
| Inlet pressure | | Ambient pressure | 1013.54 mbar |
| Outlet pressure | | Orientation | |
| Reference temperature | | Seals | |
| Reference pressure | | Valve | |
| Range | 10-2000 ALH | | |
| Input/Output Signals | - | | |
| Supply | | | |
| Accuracy ±2 %O.R. | | | |

## Final readings

| Test Flow ALH | Device under test m³ | Measured values Pressure PSIA | Temperature °C | Reference m³ | Calculated Reference m³ | Calculated Error m³ | Acceptable Error m³ | Uncertainty k = 2 m³ | TUR |
|---|---|---|---|---|---|---|---|---|---|
| 361.5227 | 59.3600 | 14.6578 | 22.32 | 55.4900 | 60.1955 | -0.8355 | 1.2039 | 0.2074 | >4 |
| 1085.7119 | 181.7350 | 14.6623 | 22.42 | 166.9800 | 181.1431 | 0.5919 | 3.6229 | 0.6241 | >4 |
| 1826.9168 | 304.6100 | 14.6745 | 22.38 | 281.2500 | 304.8173 | -0.2073 | 6.0963 | 1.0501 | >4 |

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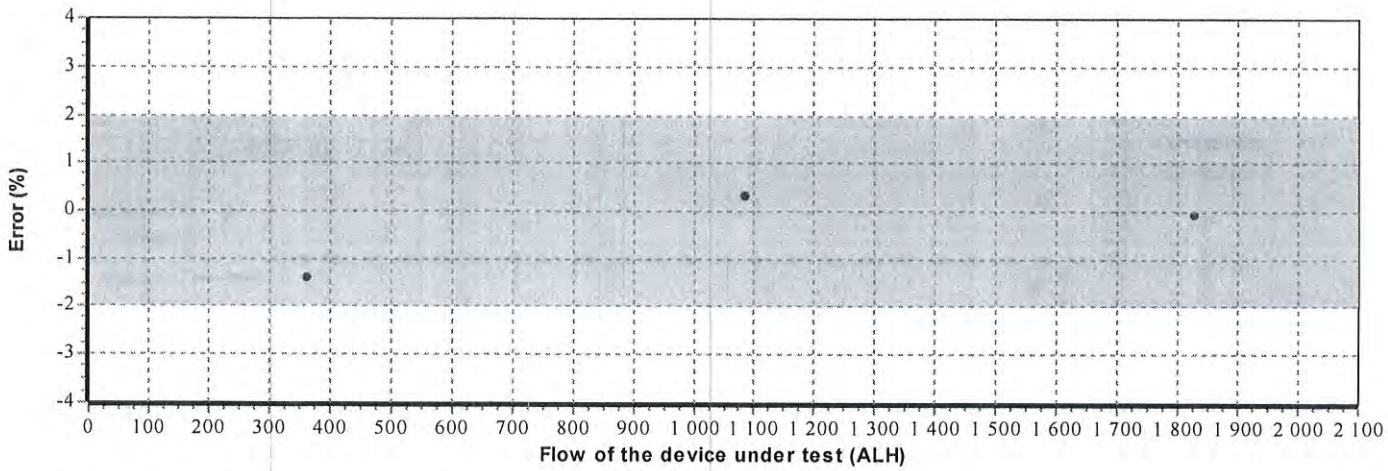
CLAS NRC-CNRC CLAS 2009-02

SCC Accredited LAB Accredited-CCN #655

## Calibration certificate # 17221

| | | | |
|---|---|---|---|
| Serial Number: | S8020 | Test stand: | 3 |
| Calibration Date: | 2022-07-06 | Procedure: | POS-CAL-005 |
| Instrument ID: | EM 318 | Decision rule: | Method #3 |

## Final results




See the appendix for the guideline of decision rule

CalFact: 1,014075

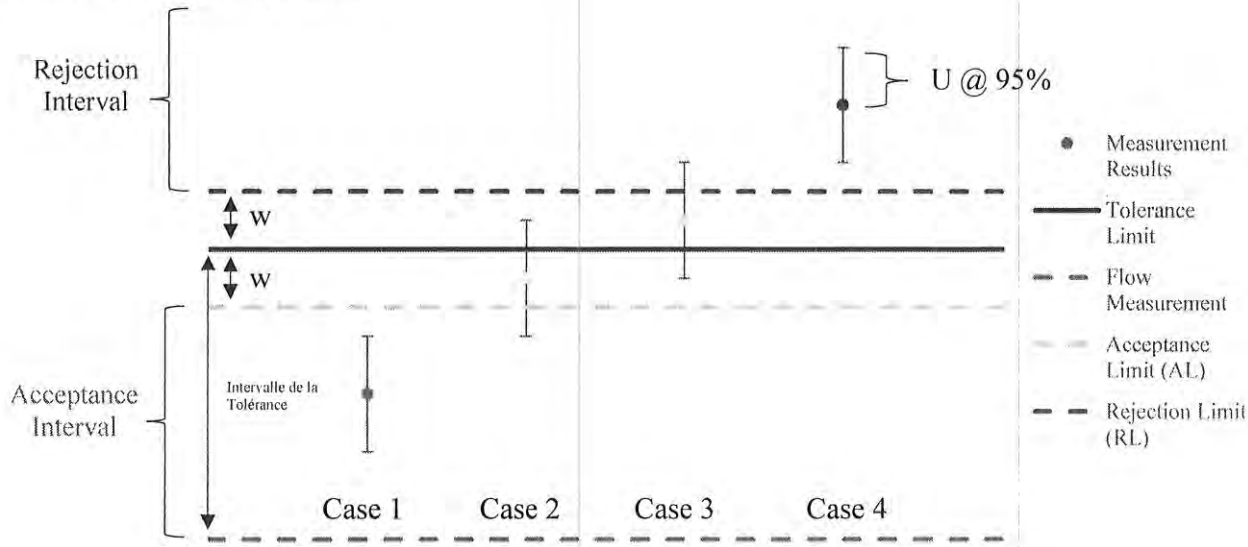
July 26th 2022

## *Appendix for the decision rule*

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

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

Statements of conformity are reported as:




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

***Case 1** – Below acceptance limit AL*
***Status: In tolerance***

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

***Case 2** – Below tolerance limit TL, greater than acceptance limit AL*
***Status: In tolerance-Conditional***

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

***Case 3** – Greater than tolerance limit, below rejection limit RL*
***Status: Out of tolerance-Conditional***

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

***Case 4** – Greater than rejection limit RL*
***Status: Out of tolerance***

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

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TRANSCAT® CANADA
Trust in every measure

ACCREDITATION ISO 17025 TM
SCC Scope Number 668

# CALIBRATION CERTIFICATE

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

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

**Technician:**
Coutu, Daniel

David Llorens, Quality Manager

## SERVICE DESCRIPTION:

| | | | |
|---|---|---|---|
| **Masses description :** | NIST F | **Date approved :** | 14-03-2022 |
| **Precision class :** | NIST F | **Next Calibration :** | 04-03-2026 |
| **Density :** | 7.7g/cm³ | **CCN accreditation # :** | 668 |
| **Identification (if unique) :** | DI000D532 | **CLAS Certification # :** | 2010-01 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Test conditions :** | Temp °C: | 21.05 | kPa Pressure: | 102.3 | Humidity: | 49.4 |

## NOTES:

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

## REMARKS:

March 2022

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# CALIBRATION CERTIFICATE

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www.dispersion.ca 1.866.390.5066

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

## CALIBRATION RESULTS, CONVENTIONAL MASS:

| Nominal Mass | Serial # | Inventory # | Conventional mass | Conventional mass after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 10 kg | DI000D532 | EM205 | 9.999938 kg | | 1 000 mg | 10 mg |

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

## CALIBRATION RESULTS, CORRECTIONS:

| Nominal Mass | Serial # | Inventory # | Conventional mass Corrections | Conventional mass Corrections after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 10 kg | DI000D532 | | -62 mg | | 1 000 mg | 10 mg |

# CALIBRATION CERTIFICATE

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www.dispersion.ca 1.866.390.5066

## BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

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

## UNCERTAINTIES:

The following uncertainties exist :

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

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

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

## TRACEABILITY

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

# CALIBRATION CERTIFICATE

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www.dispersion.ca 1.866.390.5066

## USED REFERENCES

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

ENVIRONMENTAL CONDITIONS

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

Instrumentation
Saint•Laurent inc.

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St-Joseph du lac
(Québec), J0N 1M0
Phone: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-224 2022-05-25 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | ISL-022 |
| **Required Accuracy:** | +/- 1/32" |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Ruban à mesurer | **Input Type:** | Mesure |
| **Manufacturer:** | Stanley | **Output Type:** | N/A |
| **Model #:** | Leverlock 12' | **Measurement Type:** | Inch |
| **Serial #:** | N/A | **Range:** | 0 à 12' |
| **Location:** | Portable | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | tape a mesurer | **Certification #:** | VB-19652440 |
| **Serial #:** | 22091327 | **Certification Date:** | 2022-03-10 |
| **Certified by:** | Starrett | **Next Certification:** | 2023-03-10 |
| **Comments:** | | | |

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Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-224 2022-05-25 |
|---|---|

**CALIBRATION RESULTS**

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | |
|---|---|---|---|---|---|---|
| | Comment | | | | | |
| 1.00 " | 1.00 " | 1.00 " | 0.00 " | 1.00 " | +/- 1/32 " | |
| 36.00 " | 36.00 " | 36.00 " | 0.00 " | 36.00 " | +/- 1/32 " | |
| 72.00 " | 72.00 " | 72.00 " | 0.00 " | 72.00 " | +/- 1/32 " | |
| 108.00 " | 108.00 " | 108.00 " | 0.00 " | 108.00 " | +/- 1/32 " | |
| 132.00 " | 132.00 " | 132.00 " | 0.00 " | 132.00 " | +/- 1/32 " | |
| | | | | | | |

**Environmental Conditions:** Temperature: 22 °C Humidity: 39 %RH

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-25 |
| **Next Calibration:** | 2023-05-25 |
| **Certificate Date:** | 2022-05-25 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

Martin Langlais - Technicien

MAY 2022

Version 1

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Instrumentation
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Accrédité CCN
N°669

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St-Joseph du lac
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Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-249 2022-05-10 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9106 |
| **Required Accuracy:** | +/- 0.25 "H2O |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Indicator | **Input Type:** | Pression |
| **Manufacturer:** | Dwyer | **Output Type:** | Voltage |
| **Model #:** | MS-321-LCD | **Measurement Type:** | Pressure |
| **Serial #:** | N/A | **Range:** | 0 à 0.10 "H2O |
| **Location:** | Banc de test | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke Pression | **Certification #:** | 2021008414 |
| **Serial #:** | 3330050 | **Certification Date:** | 2021-11-22 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-11-22 |
| **Comments:** | | | |
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022001379 |
| **Serial #:** | 8223003 | **Certification Date:** | 2022-02-18 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-05-18 |
| **Comments:** | | | |

5F09106 Version 1

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Instrumentation Saint-Laurent inc.
Certified ISO 17025

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# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-249 2022-05-10 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 0.0000 "H2O | 0.0000 "H2O | 0.0010 "H2O | 0.0010 "H2O | 0.0010 "H2O | +/- 0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0250 "H2O | 0.0250 "H2O | 0.0254 "H2O | +0.0004 "H2O | 0.0254 "H2O | +/- 0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0500 "H2O | 0.0500 "H2O | 0.0496 "H2O | -0.0004 "H2O | 0.0496 "H2O | +/- 0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0750 "H2O | 0.0750 "H2O | 0.0740 "H2O | -0.0010 "H2O | 0.0740 "H2O | +/- 0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.1000 "H2O | 0.1000 "H2O | 0.9963 "H2O | -0.0037 "H2O | 0.9963 "H2O | +/- 0.25 "H2O | 0.10 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0000 "H2O | 0.0000 V.DC. | 0.0715 V.DC. | +0.0715 V.DC. | 0.0715 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.0250 "H2O | 2.5000 V.DC. | 2.4770 V.DC. | -0.023 V.DC. | 2.4770 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.0500 "H2O | 5.0000 V.DC. | 4.9157 V.DC. | -0.0843 V.DC. | 4.9157 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.0750 "H2O | 7.5000 V.DC. | 7.4215 V.DC. | -0.0785 V.DC. | 7.4215 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.1000 "H2O | 10.0000 V.DC. | 9.9532 V.DC. | -0.0468 V.DC. | 9.9532 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 41 %RH

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-10 |
| **Next Calibration:** | 2023-05-10 |
| **Certificate Date:** | 2022-05-10 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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

Marco Miron - Technicien

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Version 1

MAY 2022

# CERTIFICATE OF CALIBRATION

ACCREDITED
CALIBRATION
CERT #2260.01

**Certificate Number: 2022004548** 

| | | | |
|---|---|---|---|
| ***Manufacturer:*** | Control Company | ***RMA:*** | AC22051901 |
| ***Model:*** | 4199 | ***Workorder:*** | 2022004548 |
| ***Description:*** | Barometer | ***Barcode:*** | AL00040350-P |
| ***Serial:*** | 192343395 | ***Received Conditions:*** | In Tolerance |
| ***ID:*** | EM 304 | ***Calibration Date:*** | 06-Jun-2022 |
| ***Customer:*** | SERVICES POLYTESTS<br>695-B GUADETTE<br>ST-JEAN-SUR-RICHELIEU QC<br>J3B 7S7 | ***Calibration Due:*** | 06-Jun-2023 |
| | | ***Temperature:*** | 21.52°C |
| | | ***Humidity:*** | 44.1%RH |

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

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

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

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**STANDARDS USED**

| *Description* | *Model* | *ID* | *Cal Date* | *Due Date* |
|---|---|---|---|---|
| Pressure Controller/Calibrator | Fluke Calibration 6270A | PRE-CAL-08 | No Cal Required | |
| Pressure Measurement Module | Fluke Calibration PM600-A7M | PRE-MOD-01 | 25-Oct-2021 | 25-Oct-2022 |

***Notes:*** Adjusted from adjustment screw on back of unit.

***Performed by:*** Anthony Morra
*Technician*
*(digitally signed on 06-Jun-2022 8:38 am)*

***QA Reviewed by:*** Slava Peciurov
*Lab Manager*
*(digitally signed on 06-Jun-2022 9:37 am)*

*Form: ROC101 Rev 9.3.a*

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

**Procedure: Pressure Gauge: CAL VER /6270A (1.1.A)** **FOUND (Pass)**

| Test Description | True Value | Test Results | Tolerance | Lower Limit | Upper Limit | Status | Uncertainty |
|---|---|---|---|---|---|---|---|
| PRESSURE TEST | | | | | | | |
| 993.05 mbar | 993.05 mbar | 998.0 mbar | ±5.00 mbar | 988.0 mbar | 998.0 mbar | Pass | 1.2e-001 mbar |

**Procedure: Pressure Gauge: CAL VER /6270A (1.1.A)** **LEFT (Pass)**

| Test Description | True Value | Test Results | Tolerance | Lower Limit | Upper Limit | Status | Uncertainty |
|---|---|---|---|---|---|---|---|
| PRESSURE TEST | | | | | | | |
| 992.90 mbar | 992.90 mbar | 993.0 mbar | ±5.00 mbar | 987.9 mbar | 997.9 mbar | Pass | 1.1e-001 mbar |

END OF CERTIFICATE

Instrumentation
Saint•Laurent inc.
Certified 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
Phone: (450) 473-6169
Fax: (450) 473-5207
Email: inst.st-laurent@videotron.ca

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-313 2022-05-10 |
|---|---|

| CLIENT | |
|---|---|
| **Company:** | Services Polytests Inc |
| **Address:** | 695 B rue Gaudette |
| | St-Jean-sur-Richelieu, Québec, J3B 7S7 |

| CALIBRATION SPECIFICATION | |
|---|---|
| **Service Procedure:** | 4IN9106 |
| **Required Accuracy:** | +/- 0.25"H2O |
| **Calibration Frequency:(days)** | 365 |

| INSTRUMENT SPECIFICATION | | | |
|---|---|---|---|
| **Instrument Type:** | Indicator | **Input Type:** | Pression |
| **Manufacturer:** | Dwyer | **Output Type:** | Voltage |
| **Model #:** | MS-321-LCD | **Measurement Type:** | Pressure |
| **Serial #:** | N.A. | **Range:** | 0 a 0.1 inchh20 |
| **Location:** | N.A. | **Version:** | |

| CALIBRATORS SPECIFICATION | | | |
|---|---|---|---|
| **Calibrator:** | Fluke Pression | **Certification #:** | 2021008414 |
| **Serial #:** | 3330050 | **Certification Date:** | 2021-11-22 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-11-22 |
| **Comments:** | | | |
| **Calibrator:** | Fluke 744 | **Certification #:** | 2022001379 |
| **Serial #:** | 8223003 | **Certification Date:** | 2022-02-18 |
| **Certified by:** | Alpha Controls | **Next Certification:** | 2022-05-18 |
| **Comments:** | | | |

5F09106 Version 1

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SCC Accredited LAB LAB Accrédité CCN N°669

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

# CALIBRATION CERTIFICATE

| CERTIFICATE # | CE-EM-313 2022-05-10 |
|---|---|

## CALIBRATION RESULTS

| Entry Source | Given Value | Actual Value | Deviation Error | After Calib Value | Accuracy | Uncertainty |
|---|---|---|---|---|---|---|
| **Conformity** | **Comment** | | | | | |
| 0.0000 "H2O | 0.0000 "H2O | +0.0015 "H2O | 0.0015 "H2O | +0.0015 "H2O | +/- 0.25 "H2O | 0.25 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0250 "H2O | 0.0250 "H2O | 0.0261 "H2O | +0.0011 "H2O | 0.0261 "H2O | +/- 0.25 "H2O | 0.25 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0500 "H2O | 0.0500 "H2O | 0.0510 "H2O | +0.0010 "H2O | 0.0510 "H2O | +/- 0.25 "H2O | 0.25 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0750 "H2O | 0.0750 "H2O | 0.0762 "H2O | +0.0012 "H2O | 0.0762 "H2O | +/- 0.25 "H2O | 0.25 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.1000 "H2O | 0.1000 "H2O | 0.1011 "H2O | +0.0011 "H2O | 0.1011 "H2O | +/- 0.25 "H2O | 0.25 "H2O |
| Compliant | Verification of the indicator | | | | | |
| 0.0000 "H2O | 0.0000 V.DC. | 0.0420 V.DC. | +0.0420 V.DC. | 0.0420 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.0250 "H2O | 2.5000 V.DC. | 2.5828 V.DC. | +0.0828 V.DC. | 2.5828 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.0500 "H2O | 5.0000 V.DC. | 5.1261 V.DC. | +0.1261 V.DC. | 5.1261 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.0750 "H2O | 7.5000 V.DC. | 7.6332 V.DC. | +0.1332 V.DC. | 7.6332 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |
| 0.1000 "H2O | 10.0000 V.DC. | 10.1287 V.DC. | +0.1287 V.DC. | 10.1287 V.DC. | +/- 0.5 V.DC. | 0.5 V.DC. |
| Compliant | Verification of the analogic output | | | | | |

**Environmental Conditions:** Temperature: 21 °C Humidity: 41 %RH

**Comments:**

| CALIBRATION DATE/ISSUANCE OF CERTIFICATE | |
|---|---|
| **Calibration Date:** | 2022-05-10 |
| **Next Calibration:** | 2023-05-10 |
| **Certificate Date:** | 2022-05-10 |

| CALIBRATION CONFORMITY | | |
|---|---|---|
| | **Before** | **After** |
| **Compliant:** | X | X |
| **Non Compliant:** | | |

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

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

Marco Miron - Technicien

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Version 1



MAY 2022

# Kalibrier-Protokoll

Certificate of conformity • Protocole d'étalonnage
Certificato di taratura • Informe de calibración

Be sure. testo

Gerät / Module type / Modèle / Modelo: **testo 405i**

Messbereich / Measuring range / Etendue de mesure / Rango de medición: **Velocity: 0 ... 30 m/s**
**Temperature: -20 ... +60 °C**

Serien-Nr. / Serial no. / N°. de série / Número de serie: 46100640

| Messwerte / Measured values / Valeurs mesurées / Valores medidos: | | |
|---|---|---|
| Sollwert / Reference / Référence / Referencia: | Zulässige Toleranz / Permissible tolerance / Tolérance admise / Tolerancia permitida: | Istwert / Actual Value / Valeur réelle / Valor medido: |
| **Velocity:** | | |
| **8.0 m/s** | **±0.7 m/s** | **8.1 m/s** |
| **Temperature :** | | |
| **24.8 °C** | **±0.5 °C** | **24.7 °C** |

Prüfer / Inspector / Responsable / Verificador

EM-332

ITM INSTRUMENTS INC

**MONTRÉAL**
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Calgary, AB T2C 5J3

**VANCOUVER**
1282 Cliveden Av
Delta, BC V3M 6G4

www.itm.com
information@itm.com
1.800.561.8187

# Certificat d'étalonnage / Calibration Certificate

## Client/Customer: *Services Polytests*

## Certificat/Certificate: C458078-00-01

**Identification de l'unité / Unit Identification**

Fabricant/Manufacturer: **Delmhorst**
Modèle/Model: **MCS-1**
Description: **Wood Moisture Content Standard**
Série/Serial: **NA**
ID de l'unité/Unit ID: **NA**

**Date d'étalonnage / Calibration Date**

Date d'étalonnage/Cal Date: **17-Jan-2022**
Échéance/Due Date: **17-Jan-2023**

**Conditions d'étalonnage / Calibration Conditions**

Température/Temperature: **21.76°C**
Humidité/Humidity: **15.39 %**
Pression barométrique/Barometric Pressure: **N/A**

**Information générales / General Information**

Commentaire/Remark:**N/A**

**Étalons utilisés / Standards Used**

| ID de l'unité / Unit ID | Fabricant / Manufacturer | Modèle / Model | Date d'étalonnage / Cal Date | Date Due / Due Date |
|---|---|---|---|---|
| INV022 | Hewlett Packard | 3458A | 17-Dec-2021 | 17-Dec-2022 |

L'étalonnage a été effectué à l'aide d'étalons qui ont été vérifiés par rapport à ceux de l'Institut des Étalons Nationaux de Mesure (IÉNM) du Conseil National de Recherches du Canada (CNRC) ou à ceux du National institute of Standards and Technology (NIST) des États-Unis, et/ou ont été dérivés de constantes physiques de base et/ou par technique d'autoétalonnage proportionelle. L'incertitude d'étalonnage indiqué dans ce rapport est obtenue en utilisant un facteur de couverture de k=2 selon un degré de confiance d'environ 95%.

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Étalonné par/Calibrated by: ***B. Cardin***

Approuvé par/Approved by:

EM. 334



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Calgary, AB T2C 5J3

**VANCOUVER**
1282 Cliveden Av
Delta, BC V3M 6G4

www.itm.com
information@itm.com
1.800.561.8187

**Résultats du test / Test Results**

Procédure/Procedure: **DELMHORST MCS-1 : 3458** Rev: **1**

Type de donnée/Data Type: **À la réception\As Found** Résultats/Results: **Passer\Pass**

| Description du test<br>Test Description | Valeur réelle<br>True Value | Lecture<br>Reading | Limite min.<br>Lower Limit | Limite max.<br>Upper Limit | Status de test<br>Test Status | Ince Elarg<br>Exp Uncert |
|---|---|---|---|---|---|---|
| ----- 12% MOISTURE ----- | | | | | | |
| ----- 120MOHMS +/-10% ----- | | | | | | |
| 120.00 MOhm | | 119.800 MOhm | 108.000 MOhm | 132.000 MOhm | Pass | 4.1e+004 Ohm |
| ----- 22% MOISTURE ----- | | | | | | |
| ----- 1.1MOHMS +/-10% ----- | | | | | | |
| 1.100 MOhm | | 1.0969 MOhm | 0.9900 MOhm | 1.2100 MOhm | Pass | 5.8e+002 Ohm |



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ACCREDITATION ISO 17025
SCC Scope Number 668

# CALIBRATION CERTIFICATE

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

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

**Technician:**
Coutu, Daniel

David Llorens, Quality Manager

## SERVICE DESCRIPTION:

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

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

## NOTES:

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

## REMARKS:

March 2022

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# CALIBRATION CERTIFICATE

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

## CALIBRATION RESULTS, CONVENTIONAL MASS:

| Nominal Mass | Serial # | Inventory # | Conventional mass | Conventional mass after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 100mg | DI000J378 | EM-335 | 99.9999 mg | | 0.010 mg | 0.002 mg |

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

## CALIBRATION RESULTS, CORRECTIONS:

| Nominal Mass | Serial # | Inventory # | Conventional mass Corrections | Conventional mass Corrections after adjustment | Tolerance ± (mg) | Uncertainties ± (mg) |
|---|---|---|---|---|---|---|
| 100mg | DI000J378 | | -0.0001 mg | | 0.010 mg | 0.002 mg |

# CALIBRATION CERTIFICATE

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www.dispersion.ca 1.866.390.5066

## BALANCES

The following balances are used for calibration purposes :

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

We are also using these balances in our automated procedure :

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

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

## UNCERTAINTIES:

The following uncertainties exist :

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

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

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

## TRACEABILITY

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

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www.dispersion.ca 1.866.390.5066

## USED REFERENCES

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

ENVIRONMENTAL CONDITIONS

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

# APPENDIX 4: Unit pre burn

| Temps | wood | Flue | Room | Tunnel | Catalyst | scale | Right | Back | Bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|---|
| acquisition | moisture content | temp | temp | dry bulb | | | | | | | |
| minutes | each pieces | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| | | Flue | Room | Tunnel | catlist down | weight | right | back | bottom | top | left |
| 0 | | 257,6 | 78,9 | 88,6 | 602,9 | 9,1 | 425,6 | 270,4 | 344,8 | 295,7 | 408,3 |
| 10 | | 396,5 | 79,1 | 96,3 | 929,6 | 7,9 | 410,4 | 309,9 | 338,2 | 405,2 | 437,4 |
| 20 | | 414,3 | 79,9 | 98,4 | 913,5 | 6,5 | 434,2 | 344,7 | 330,4 | 504,4 | 492,2 |
| 30 | | 423,2 | 80,2 | 99,8 | 959,2 | 5,2 | 464,2 | 368,3 | 322,9 | 559,9 | 527,4 |
| 40 | | 414,1 | 80,6 | 100,2 | 929,4 | 4,1 | 507,4 | 392,9 | 317,9 | 586,0 | 561,3 |
| 50 | | 412,7 | 81,1 | 100,6 | 953,6 | 2,9 | 553,6 | 412,3 | 315,9 | 600,1 | 596,5 |
| 60 | | 381,3 | 81,2 | 99,6 | 859,0 | 2,2 | 582,6 | 423,2 | 316,2 | 593,6 | 627,3 |
| 70 | | 341,7 | 81,0 | 97,9 | 754,7 | 1,9 | 600,1 | 404,4 | 319,5 | 538,4 | 623,6 |
| 80 | | 321,8 | 80,7 | 96,2 | 722,4 | 1,7 | 592,8 | 384,4 | 327,1 | 474,2 | 609,5 |
| 90 | | 310,5 | 80,7 | 95,4 | 698,1 | 1,5 | 589,7 | 374,4 | 338,0 | 435,0 | 601,7 |
| 100 | | 307,6 | 80,8 | 94,9 | 695,1 | 1,3 | 579,7 | 362,7 | 350,1 | 404,6 | 591,1 |
| 110 | | 300,7 | 80,5 | 93,7 | 680,6 | 1,1 | 568,0 | 364,4 | 361,2 | 385,9 | 586,9 |
| 120 | | 300,2 | 80,4 | 93,2 | 677,0 | 0,9 | 557,7 | 359,7 | 369,8 | 370,4 | 578,9 |
| 130 | | 294,1 | 80,5 | 92,8 | 655,6 | 0,8 | 546,6 | 353,3 | 376,4 | 357,7 | 569,7 |
| 140 | | 291,8 | 80,2 | 92,9 | 649,8 | 0,6 | 537,2 | 347,7 | 382,6 | 349,3 | 565,6 |
| 150 | | 285,0 | 80,2 | 92,8 | 629,9 | 0,5 | 531,2 | 340,8 | 387,1 | 341,4 | 559,6 |
| 160 | | 280,5 | 80,1 | 92,4 | 620,7 | 0,3 | 524,7 | 331,5 | 390,4 | 334,7 | 556,7 |
| 170 | | 270,3 | 80,1 | 92,0 | 588,3 | 0,2 | 515,6 | 315,7 | 392,1 | 324,4 | 536,5 |
| 180 | | 259,7 | 80,0 | 91,2 | 561,5 | 0,1 | 510,6 | 298,8 | 391,4 | 312,8 | 513,1 |
| 190 | | 249,6 | 79,7 | 90,6 | 535,9 | 0,0 | 486,9 | 283,5 | 387,9 | 299,1 | 493,1 |
| 200 | | 97,2 | 74,0 | 75,2 | 125,7 | 1,6 | 75,2 | 75,0 | 75,3 | 74,8 | 75,4 |
| 210 | 20-19-18 | 260,7 | 74,2 | 79,8 | 662,7 | 9,4 | 133,9 | 105,3 | 75,8 | 174,2 | 108,4 |
| 220 | | 387,3 | 74,4 | 87,8 | 769,8 | 7,8 | 269,5 | 163,8 | 85,6 | 326,5 | 183,9 |
| 230 | | 399,3 | 74,7 | 89,1 | 852,2 | 6,3 | 383,0 | 235,8 | 106,4 | 424,4 | 303,7 |
| 240 | | 409,8 | 75,2 | 91,2 | 870,0 | 5,0 | 463,1 | 294,1 | 132,4 | 483,1 | 405,1 |
| 250 | | 409,2 | 75,7 | 91,5 | 893,6 | 3,8 | 522,2 | 344,1 | 159,3 | 527,7 | 470,8 |
| 260 | | 404,2 | 76,1 | 92,1 | 917,8 | 2,8 | 575,0 | 376,3 | 188,0 | 553,2 | 531,3 |
| 270 | | 372,6 | 76,5 | 90,3 | 822,1 | 2,1 | 605,4 | 379,0 | 216,1 | 551,2 | 592,0 |
| 280 | | 346,5 | 76,7 | 89,1 | 768,4 | 1,8 | 581,1 | 361,6 | 238,6 | 487,7 | 584,8 |
| 290 | | 325,6 | 76,8 | 87,9 | 717,7 | 1,6 | 577,1 | 356,3 | 258,3 | 443,1 | 583,6 |
| 300 | | 303,8 | 76,7 | 87,3 | 666,6 | 1,4 | 564,0 | 343,7 | 277,3 | 406,5 | 577,2 |
| 310 | | 289,0 | 76,7 | 86,5 | 639,1 | 1,2 | 539,6 | 326,1 | 292,5 | 376,0 | 560,0 |
| 320 | | 283,7 | 76,6 | 86,0 | 633,3 | 1,1 | 521,7 | 315,8 | 304,7 | 355,9 | 545,6 |
| 330 | | 278,9 | 76,4 | 84,6 | 630,2 | 1,0 | 509,5 | 306,9 | 318,0 | 339,8 | 533,0 |
| 340 | | 275,4 | 76,5 | 84,6 | 613,0 | 0,8 | 504,5 | 298,4 | 326,7 | 328,3 | 520,9 |
| 350 | | 271,4 | 76,5 | 84,8 | 603,0 | 0,7 | 504,1 | 291,1 | 334,1 | 320,1 | 509,6 |
| 360 | | 257,7 | 76,5 | 84,1 | 563,6 | 0,6 | 494,8 | 280,6 | 340,3 | 309,4 | 495,9 |
| 370 | | 246,2 | 76,4 | 83,2 | 535,0 | 0,5 | 474,5 | 267,2 | 343,3 | 297,3 | 477,4 |
| 380 | | 238,8 | 76,2 | 82,9 | 508,0 | 0,4 | 455,0 | 256,3 | 343,9 | 286,3 | 460,1 |
| 390 | 20-21-22-23 | 190,3 | 74,9 | 82,0 | 370,2 | 12,8 | 415,7 | 248,7 | 346,5 | 262,7 | 418,5 |
| 400 | | 162,5 | 75,5 | 81,1 | 320,2 | 12,7 | 366,9 | 252,1 | 338,6 | 241,1 | 364,9 |
| 410 | | 149,1 | 75,4 | 79,4 | 292,6 | 12,5 | 330,2 | 246,4 | 322,5 | 223,9 | 326,1 |
| 420 | | 156,1 | 75,3 | 79,2 | 312,3 | 12,3 | 305,0 | 251,3 | 305,4 | 219,1 | 299,5 |
| 430 | | 152,7 | 75,4 | 79,4 | 303,8 | 12,0 | 292,9 | 273,9 | 289,4 | 218,0 | 285,6 |
| 440 | | 143,1 | 75,2 | 78,8 | 275,1 | 11,8 | 277,5 | 264,4 | 275,7 | 208,8 | 271,3 |
| 450 | | 140,2 | 75,3 | 78,4 | 267,8 | 11,6 | 264,2 | 253,5 | 265,1 | 200,6 | 260,5 |
| 460 | | 159,5 | 75,2 | 78,8 | 328,2 | 11,2 | 263,8 | 246,8 | 257,8 | 221,3 | 268,0 |
| 470 | | 273,6 | 75,2 | 82,9 | 649,8 | 10,3 | 306,4 | 257,2 | 257,0 | 341,7 | 342,6 |
| 480 | | 287,7 | 75,6 | 84,6 | 675,3 | 9,3 | 390,0 | 296,9 | 260,7 | 413,6 | 432,1 |
| 490 | | 317,5 | 75,9 | 86,3 | 785,0 | 8,3 | 462,7 | 331,1 | 265,7 | 459,2 | 498,1 |
| 500 | | 333,7 | 76,1 | 87,4 | 850,8 | 7,4 | 524,2 | 340,9 | 271,8 | 502,4 | 542,1 |
| 510 | | 316,8 | 76,4 | 86,8 | 810,2 | 6,8 | 555,7 | 339,2 | 279,0 | 513,9 | 561,1 |
| 520 | | 323,6 | 76,7 | 87,7 | 807,5 | 6,2 | 571,8 | 340,7 | 287,5 | 534,3 | 573,6 |
| 530 | | 325,7 | 76,8 | 88,0 | 846,9 | 5,6 | 578,5 | 343,0 | 303,6 | 542,6 | 593,2 |
| 540 | | 323,8 | 77,0 | 88,4 | 814,4 | 5,0 | 587,6 | 342,9 | 323,3 | 545,0 | 594,8 |
| 550 | | 291,5 | 76,9 | 87,2 | 733,4 | 4,7 | 582,0 | 333,1 | 342,4 | 503,6 | 586,5 |
| 560 | | 278,6 | 77,0 | 86,7 | 692,9 | 4,4 | 574,1 | 323,7 | 358,9 | 472,5 | 575,5 |
| 570 | | 264,7 | 76,7 | 86,0 | 658,4 | 4,2 | 559,1 | 313,0 | 370,6 | 420,5 | 561,1 |
| 580 | | 252,4 | 76,6 | 85,3 | 628,5 | 4,1 | 542,5 | 303,6 | 381,1 | 377,6 | 542,8 |
| 590 | | 243,6 | 76,7 | 84,5 | 605,4 | 4,0 | 527,6 | 295,2 | 388,2 | 350,3 | 529,8 |
| 600 | | 237,7 | 76,5 | 84,0 | 595,6 | 3,8 | 513,9 | 289,8 | 392,9 | 331,2 | 516,9 |
| 610 | | 233,0 | 76,4 | 83,9 | 589,6 | 3,7 | 500,9 | 290,5 | 394,4 | 316,6 | 504,1 |
| 620 | | 231,9 | 76,3 | 83,8 | 580,4 | 3,6 | 497,7 | 289,0 | 392,1 | 307,6 | 495,4 |
| 630 | | 227,6 | 76,2 | 83,4 | 568,2 | 3,5 | 492,9 | 286,0 | 391,1 | 300,0 | 488,3 |
| 640 | | 221,3 | 76,3 | 83,4 | 540,6 | 3,4 | 482,9 | 281,5 | 389,2 | 292,0 | 481,7 |
| 650 | | 214,6 | 76,1 | 82,8 | 525,5 | 3,3 | 470,6 | 272,0 | 385,8 | 283,5 | 472,6 |
| 660 | | 209,3 | 76,1 | 82,5 | 511,6 | 3,2 | 458,9 | 263,2 | 381,5 | 275,0 | 460,3 |
| 670 | | 204,0 | 76,0 | 82,2 | 495,6 | 3,1 | 445,8 | 254,5 | 375,6 | 266,1 | 446,4 |
| 680 | | 199,2 | 76,0 | 82,1 | 478,9 | 3,1 | 431,3 | 246,8 | 369,3 | 257,9 | 430,7 |
| 690 | | 194,2 | 75,9 | 81,8 | 464,6 | 3,0 | 415,3 | 239,4 | 361,6 | 249,9 | 414,7 |
| 700 | | 191,5 | 75,8 | 81,6 | 451,7 | 2,9 | 401,3 | 231,8 | 353,6 | 242,6 | 400,2 |
| 710 | | 188,2 | 75,9 | 81,1 | 452,2 | 2,8 | 388,8 | 225,5 | 345,8 | 236,0 | 387,9 |
| 720 | | 185,1 | 75,8 | 80,8 | 440,5 | 2,8 | 378,3 | 220,9 | 338,7 | 230,4 | 378,3 |
| 730 | | 181,4 | 75,8 | 80,7 | 429,3 | 2,7 | 367,2 | 216,6 | 330,4 | 224,9 | 366,9 |
| 740 | | 176,1 | 75,7 | 80,8 | 407,8 | 2,6 | 357,0 | 210,4 | 321,6 | 219,5 | 356,0 |
| 750 | | 155,6 | 75,6 | 80,0 | 334,8 | 2,5 | 346,6 | 202,9 | 313,4 | 213,2 | 342,7 |
| 760 | | 138,6 | 75,5 | 79,4 | 301,9 | 2,4 | 334,1 | 195,3 | 305,0 | 205,3 | 327,7 |
| 770 | | 130,7 | 75,5 | 78,8 | 252,4 | 2,3 | 319,3 | 186,5 | 295,1 | 197,1 | 311,2 |
| 780 | | 124,8 | 75,4 | 78,5 | 246,7 | 2,2 | 303,6 | 178,1 | 284,0 | 189,5 | 293,5 |
| 790 | | 120,1 | 75,3 | 78,1 | 250,4 | 2,1 | 289,1 | 170,3 | 272,1 | 182,4 | 276,8 |
| 800 | | 116,0 | 75,3 | 77,8 | 237,8 | 2,0 | 275,3 | 163,4 | 259,5 | 175,8 | 261,2 |
| 810 | | 112,5 | 75,2 | 77,5 | 227,5 | 1,9 | 263,4 | 157,3 | 247,3 | 170,2 | 247,0 |
| 820 | | 109,7 | 75,1 | 77,5 | 205,8 | 1,8 | 253,4 | 152,0 | 235,6 | 165,1 | 234,9 |
| 830 | | 107,1 | 75,1 | 77,2 | 209,7 | 1,7 | 244,7 | 147,1 | 224,7 | 159,9 | 223,9 |
| 840 | | 104,9 | 75,0 | 76,9 | 201,8 | 1,6 | 237,2 | 142,9 | 214,4 | 155,7 | 214,4 |
| 850 | 20-19-18-19 | 102,6 | 73,8 | 75,2 | 124,4 | 12,2 | 77,3 | 76,5 | 76,9 | 82,6 | 77,9 |
| 860 | | 199,0 | 73,7 | 77,7 | 407,6 | 11,7 | 93,3 | 93,4 | 77,8 | 155,5 | 192,7 |
| 870 | | 424,5 | 74,4 | 87,5 | 931,9 | 10,4 | 129,2 | 127,0 | 88,8 | 298,5 | 248,2 |
| 880 | | 448,6 | 74,8 | 92,1 | 938,1 | 9,1 | 183,7 | 196,7 | 111,1 | 371,5 | 288,3 |
| 890 | | 427,4 | 75,3 | 92,7 | 916,8 | 7,7 | 295,5 | 265,7 | 137,3 | 469,3 | 387,8 |
| 900 | | 428,9 | 75,8 | 93,9 | 951,5 | 6,4 | 376,9 | 317,8 | 169,5 | 515,1 | 473,1 |
| 910 | | 422,9 | 76,3 | 94,1 | 902,2 | 5,4 | 457,2 | 351,7 | 207,4 | 543,6 | 551,1 |
| 920 | | 371,1 | 76,7 | 92,4 | 800,2 | 4,8 | 515,6 | 371,0 | 242,3 | 526,8 | 590,4 |
| 930 | | 347,7 | 76,8 | 91,3 | 746,4 | 4,4 | 529,5 | 363,7 | 280,8 | 484,9 | 597,3 |
| 940 | | 330,4 | 77,0 | 90,4 | 707,0 | 4,0 | 532,3 | 355,7 | 321,7 | 451,4 | 596,7 |
| 950 | | 320,4 | 77,0 | 90,1 | 699,1 | 3,7 | 536,3 | 350,6 | 357,0 | 427,6 | 592,2 |
| 960 | | 320,8 | 77,1 | 89,6 | 681,6 | 3,5 | 531,6 | 341,8 | 374,3 | 398,8 | 575,4 |
| 970 | | 299,4 | 76,9 | 88,8 | 638,8 | 3,4 | 514,9 | 325,7 | 389,4 | 366,7 | 548,9 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 980 | | 289,6 | 76,9 | 88,5 | 618,7 | 3,2 | 504,0 | 314,2 | 403,7 | 344,8 | 528,3 |
| 990 | | 273,3 | 76,9 | 87,8 | 573,1 | 3,1 | 499,6 | 303,1 | 413,5 | 327,1 | 510,6 |
| 1000 | | 261,6 | 76,9 | 87,6 | 549,2 | 3,0 | 492,2 | 289,7 | 417,0 | 309,8 | 490,9 |
| 1010 | | 249,3 | 76,7 | 86,6 | 517,8 | 2,9 | 484,4 | 277,0 | 419,2 | 294,8 | 473,6 |
| 1020 | | 245,6 | 76,9 | 86,5 | 509,4 | 2,8 | 478,0 | 263,1 | 419,2 | 281,5 | 456,6 |
| 1030 | | 239,9 | 76,8 | 86,1 | 491,5 | 2,7 | 473,1 | 251,5 | 414,9 | 270,7 | 443,7 |
| 1040 | | 231,1 | 76,9 | 85,6 | 473,6 | 2,7 | 463,8 | 240,3 | 407,2 | 259,8 | 431,0 |
| 1050 | | 221,8 | 76,8 | 85,4 | 452,9 | 2,6 | 447,7 | 229,8 | 398,7 | 249,5 | 417,1 |
| 1060 | | 214,3 | 76,7 | 85,0 | 437,5 | 2,5 | 434,5 | 220,9 | 390,4 | 240,4 | 403,1 |
| 1070 | | 207,4 | 76,8 | 84,5 | 422,6 | 2,5 | 423,8 | 212,4 | 381,9 | 232,5 | 392,1 |
| 1080 | | 182,1 | 76,8 | 83,7 | 337,8 | 2,4 | 394,7 | 203,1 | 372,2 | 223,2 | 378,6 |
| 1090 | | 169,0 | 76,6 | 83,4 | 311,2 | 2,3 | 369,8 | 193,6 | 360,9 | 213,2 | 359,9 |
| 1100 | | 159,9 | 76,7 | 83,0 | 289,1 | 2,2 | 347,6 | 185,8 | 349,4 | 203,5 | 341,0 |
| 1110 | | 151,4 | 76,6 | 82,5 | 267,1 | 2,1 | 326,1 | 177,0 | 338,1 | 194,0 | 321,3 |
| 1120 | | 143,5 | 76,6 | 82,1 | 248,0 | 2,0 | 306,1 | 168,4 | 326,3 | 184,8 | 302,0 |
| 1130 | | 137,0 | 76,6 | 81,6 | 231,5 | 1,9 | 286,9 | 161,1 | 314,4 | 176,5 | 284,3 |
| 1140 | | 131,1 | 76,6 | 81,4 | 219,4 | 1,8 | 269,1 | 155,3 | 302,4 | 169,0 | 266,3 |
| 1150 | | 126,0 | 76,6 | 81,0 | 207,8 | 1,7 | 253,6 | 149,7 | 290,4 | 162,4 | 250,2 |
| 1160 | | 121,2 | 76,6 | 80,9 | 195,1 | 1,6 | 237,8 | 144,7 | 277,4 | 155,9 | 235,9 |
| 1170 | 18-19-20-21 | 136,1 | 76,7 | 82,4 | 175,9 | 8,4 | 224,1 | 140,7 | 264,6 | 148,9 | 222,9 |
| 1180 | 21-22-23 | 150,2 | 76,9 | 81,5 | 284,5 | 13,5 | 213,6 | 136,3 | 247,5 | 187,5 | 213,0 |
| 1190 | | 174,4 | 77,0 | 83,2 | 347,5 | 12,9 | 224,6 | 143,9 | 235,0 | 201,7 | 211,1 |
| 1200 | | 231,9 | 77,1 | 85,6 | 519,0 | 11,5 | 258,4 | 197,9 | 237,8 | 265,3 | 259,7 |
| 1210 | | 293,8 | 77,3 | 87,9 | 831,0 | 10,3 | 328,1 | 256,6 | 248,7 | 336,6 | 331,0 |
| 1220 | | 353,5 | 77,7 | 91,6 | 874,6 | 9,3 | 375,5 | 275,3 | 259,5 | 432,5 | 366,2 |
| 1230 | | 353,6 | 78,1 | 92,9 | 871,1 | 8,3 | 436,0 | 299,2 | 269,3 | 483,9 | 413,2 |
| 1240 | | 348,7 | 78,4 | 93,9 | 860,9 | 7,4 | 512,6 | 325,2 | 280,7 | 507,8 | 458,8 |
| 1250 | | 336,6 | 78,7 | 93,6 | 839,2 | 6,7 | 560,1 | 343,0 | 296,0 | 520,8 | 483,7 |
| 1260 | | 329,2 | 78,8 | 93,9 | 784,7 | 6,1 | 587,9 | 360,7 | 311,5 | 515,8 | 496,7 |
| 1270 | | 325,1 | 79,1 | 93,9 | 811,9 | 5,5 | 584,7 | 368,6 | 319,5 | 518,1 | 497,3 |
| 1280 | | 320,2 | 79,2 | 93,7 | 819,6 | 5,0 | 565,3 | 352,8 | 323,7 | 539,6 | 499,1 |
| 1290 | | 333,6 | 79,2 | 94,0 | 946,8 | 4,6 | 554,5 | 346,6 | 331,8 | 512,1 | 510,2 |
| 1300 | | 282,2 | 79,2 | 92,3 | 705,5 | 4,4 | 547,5 | 336,1 | 341,2 | 453,5 | 517,3 |
| 1310 | | 266,0 | 79,4 | 91,6 | 680,8 | 4,2 | 540,4 | 327,7 | 353,4 | 416,4 | 518,6 |
| 1320 | | 250,6 | 79,2 | 90,9 | 637,5 | 4,1 | 534,9 | 328,6 | 360,9 | 387,6 | 514,9 |
| 1330 | | 245,1 | 79,4 | 90,6 | 627,1 | 3,9 | 524,9 | 320,8 | 366,5 | 364,0 | 507,4 |
| 1340 | | 238,5 | 79,3 | 89,8 | 610,3 | 3,8 | 512,1 | 309,9 | 371,7 | 345,2 | 499,7 |
| 1350 | | 230,9 | 79,2 | 89,6 | 585,0 | 3,7 | 498,8 | 299,4 | 375,2 | 330,1 | 488,2 |
| 1360 | | 225,1 | 79,2 | 89,2 | 567,6 | 3,6 | 486,9 | 288,8 | 377,6 | 318,1 | 476,9 |
| 1370 | | 218,6 | 79,2 | 89,0 | 549,5 | 3,5 | 477,8 | 279,0 | 379,6 | 306,5 | 466,5 |
| 1380 | | 212,6 | 79,1 | 88,5 | 532,9 | 3,4 | 466,0 | 269,9 | 379,0 | 296,2 | 456,7 |
| 1390 | | 209,5 | 79,1 | 88,9 | 523,3 | 3,3 | 452,9 | 261,3 | 376,9 | 286,0 | 446,5 |
| 1400 | | 205,9 | 79,0 | 88,0 | 518,1 | 3,2 | 440,7 | 252,5 | 373,7 | 278,1 | 436,0 |
| 1410 | | 203,5 | 78,9 | 88,0 | 507,5 | 3,1 | 428,0 | 243,1 | 368,9 | 270,3 | 425,4 |
| 1420 | | 197,5 | 79,1 | 88,0 | 486,2 | 3,1 | 414,9 | 233,6 | 362,4 | 262,5 | 414,5 |
| 1430 | | 193,8 | 78,8 | 87,4 | 480,4 | 3,0 | 401,4 | 225,1 | 355,6 | 254,7 | 403,4 |
| 1440 | | 189,8 | 78,8 | 87,5 | 464,4 | 2,9 | 389,0 | 217,2 | 348,7 | 247,5 | 391,9 |
| 1450 | | 186,6 | 78,8 | 86,9 | 450,9 | 2,9 | 376,8 | 210,1 | 341,1 | 241,7 | 381,3 |
| 1460 | | 184,0 | 78,7 | 86,6 | 439,3 | 2,8 | 363,0 | 203,8 | 332,3 | 235,2 | 370,0 |
| 1470 | | 170,3 | 78,6 | 86,1 | 348,9 | 2,8 | 348,2 | 197,0 | 323,3 | 228,6 | 354,7 |
| 1480 | | 146,6 | 78,6 | 85,4 | 292,7 | 2,7 | 331,4 | 190,3 | 313,9 | 220,6 | 338,2 |
| 1490 | | 137,8 | 78,4 | 84,8 | 287,4 | 2,6 | 316,4 | 183,9 | 304,6 | 212,4 | 322,0 |
| 1500 | | 132,2 | 78,5 | 84,6 | 280,2 | 2,5 | 301,4 | 177,2 | 294,9 | 204,7 | 307,1 |
| 1510 | | 127,3 | 78,4 | 84,0 | 241,5 | 2,4 | 287,3 | 171,3 | 285,2 | 197,7 | 294,5 |
| 1520 | | 123,7 | 78,3 | 83,9 | 229,2 | 2,3 | 277,1 | 166,8 | 276,6 | 191,1 | 283,4 |
| 1530 | | 119,9 | 78,2 | 83,6 | 219,7 | 2,2 | 266,3 | 161,6 | 268,4 | 185,0 | 271,5 |
| 1540 | | 116,5 | 78,2 | 83,2 | 219,8 | 2,1 | 252,2 | 155,8 | 258,6 | 178,6 | 259,5 |
| 1550 | | 81,7 | 76,4 | 78,1 | 103,8 | 3,6 | 78,8 | 77,8 | 77,6 | 86,8 | 78,9 |
| 1560 | 20-18-19-20 | 152,6 | 76,4 | 79,5 | 311,9 | 12,1 | 101,2 | 95,7 | 78,7 | 142,1 | 144,6 |
| 1570 | | 372,4 | 76,6 | 88,4 | 884,7 | 10,9 | 167,5 | 135,7 | 88,4 | 301,7 | 269,7 |
| 1580 | | 419,1 | 77,1 | 93,1 | 920,7 | 9,5 | 296,5 | 191,0 | 112,6 | 428,8 | 373,1 |
| 1590 | | 409,3 | 77,3 | 94,5 | 866,7 | 8,4 | 409,4 | 238,1 | 140,5 | 496,1 | 440,1 |
| 1600 | | 425,8 | 78,0 | 96,6 | 924,0 | 7,3 | 486,9 | 274,9 | 169,0 | 539,1 | 500,7 |
| 1610 | | 421,9 | 78,4 | 97,3 | 932,0 | 6,3 | 551,0 | 307,4 | 196,7 | 563,3 | 555,2 |
| 1620 | | 392,1 | 78,7 | 96,4 | 815,4 | 5,4 | 595,5 | 338,3 | 222,5 | 565,9 | 594,8 |
| 1630 | | 371,9 | 79,1 | 95,2 | 802,0 | 4,7 | 598,1 | 356,4 | 241,9 | 559,0 | 601,5 |
| 1640 | | 352,6 | 79,1 | 94,7 | 771,4 | 4,3 | 575,4 | 344,0 | 265,0 | 520,8 | 590,6 |
| 1650 | | 337,6 | 79,1 | 94,0 | 733,6 | 4,0 | 562,7 | 336,8 | 289,4 | 496,4 | 581,7 |
| 1660 | | 318,1 | 79,1 | 92,8 | 683,1 | 3,9 | 553,2 | 325,1 | 311,6 | 437,8 | 573,3 |
| 1670 | | 305,5 | 79,2 | 92,3 | 656,4 | 3,7 | 541,0 | 312,1 | 330,8 | 399,9 | 564,0 |
| 1680 | | 296,3 | 79,0 | 91,8 | 631,9 | 3,6 | 531,5 | 301,2 | 346,9 | 374,9 | 556,1 |
| 1690 | | 285,9 | 79,1 | 91,6 | 607,0 | 3,4 | 517,4 | 288,7 | 359,7 | 353,9 | 542,3 |
| 1700 | | 284,0 | 79,2 | 90,9 | 605,7 | 3,3 | 504,3 | 279,0 | 367,9 | 338,9 | 527,8 |
| 1710 | | 275,8 | 79,2 | 91,1 | 581,5 | 3,2 | 494,9 | 274,7 | 372,7 | 327,1 | 515,7 |
| 1720 | | 267,4 | 79,0 | 90,5 | 560,2 | 3,1 | 487,3 | 269,2 | 376,5 | 316,9 | 507,1 |
| 1730 | | 254,5 | 79,2 | 90,5 | 524,5 | 2,9 | 475,8 | 264,2 | 378,1 | 305,9 | 494,4 |
| 1740 | | 243,3 | 79,2 | 90,0 | 492,9 | 2,8 | 460,3 | 253,6 | 377,2 | 293,3 | 477,4 |
| 1750 | | 229,9 | 79,0 | 89,4 | 460,1 | 2,8 | 441,3 | 240,4 | 372,4 | 280,2 | 455,4 |
| 1760 | | 218,5 | 79,0 | 88,7 | 430,6 | 2,7 | 421,3 | 226,9 | 365,2 | 266,8 | 431,5 |
| 1770 | | 210,8 | 79,2 | 88,3 | 411,7 | 2,6 | 402,6 | 214,9 | 358,2 | 255,5 | 410,0 |
| 1780 | | 199,8 | 79,0 | 87,7 | 389,5 | 2,5 | 385,8 | 204,2 | 351,2 | 244,6 | 390,2 |
| 1790 | | 188,9 | 79,0 | 87,6 | 348,2 | 2,4 | 370,0 | 195,0 | 343,4 | 234,5 | 373,0 |
| 1800 | | 174,0 | 79,1 | 86,9 | 319,0 | 2,3 | 355,7 | 186,7 | 334,7 | 224,7 | 355,5 |
| 1810 | | 160,1 | 78,9 | 86,3 | 286,2 | 2,2 | 338,5 | 177,9 | 323,8 | 214,2 | 334,8 |
| 1820 | 18-19-20-21 | 172,4 | 79,5 | 89,1 | 223,0 | 15,4 | 318,1 | 170,4 | 312,0 | 200,3 | 313,1 |
| 1830 | | 151,6 | 79,1 | 86,2 | 299,9 | 15,3 | 290,8 | 159,1 | 300,1 | 228,5 | 278,5 |
| 1840 | | 216,2 | 79,0 | 87,7 | 568,6 | 14,8 | 291,4 | 160,5 | 283,9 | 275,7 | 283,0 |
| 1850 | | 311,8 | 79,2 | 91,3 | 823,7 | 14,0 | 326,1 | 185,4 | 269,4 | 328,7 | 341,3 |
| 1860 | | 289,2 | 79,5 | 91,9 | 678,1 | 13,4 | 364,9 | 234,8 | 256,2 | 373,9 | 373,9 |
| 1870 | | 288,9 | 79,6 | 92,5 | 692,0 | 12,7 | 409,6 | 254,5 | 244,6 | 417,7 | 420,2 |
| 1880 | | 291,8 | 79,9 | 93,5 | 674,1 | 12,0 | 458,3 | 262,3 | 235,1 | 455,3 | 471,5 |
| 1890 | | 319,7 | 80,0 | 94,7 | 833,2 | 11,3 | 495,4 | 271,2 | 228,2 | 481,2 | 515,6 |
| 1900 | | 293,7 | 80,3 | 94,6 | 694,5 | 10,6 | 489,2 | 302,8 | 223,8 | 474,5 | 537,6 |
| 1910 | | 291,1 | 80,4 | 94,3 | 705,5 | 10,1 | 493,3 | 309,0 | 221,3 | 474,8 | 542,2 |
| 1920 | | 305,1 | 80,4 | 95,0 | 760,5 | 9,4 | 517,5 | 316,0 | 221,2 | 501,4 | 552,0 |
| 1930 | | 315,9 | 80,8 | 95,7 | 796,4 | 8,7 | 538,5 | 317,3 | 223,4 | 528,8 | 566,6 |
| 1940 | | 308,6 | 81,0 | 95,9 | 761,0 | 8,1 | 553,4 | 317,7 | 228,2 | 531,2 | 583,0 |
| 1950 | | 302,8 | 80,9 | 96,2 | 751,9 | 7,5 | 564,2 | 317,8 | 235,4 | 528,7 | 593,3 |
| 1960 | | 294,3 | 81,3 | 95,8 | 728,7 | 6,9 | 563,6 | 316,7 | 245,1 | 522,8 | 594,2 |
| 1970 | | 283,0 | 81,3 | 95,5 | 692,4 | 6,5 | 558,2 | 312,3 | 256,7 | 503,4 | 587,5 |
| 1980 | | 277,1 | 81,3 | 95,1 | 675,8 | 6,1 | 551,3 | 309,0 | 269,2 | 486,3 | 583,4 |
| 1990 | | 273,5 | 81,2 | 94,9 | 698,1 | 5,7 | 542,0 | 301,9 | 282,2 | 460,3 | 571,2 |
| 2000 | | 273,8 | 81,2 | 94,5 | 719,2 | 5,4 | 532,5 | 293,6 | 296,8 | 426,8 | 555,7 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | | 277,0 | 81,2 | 94,5 | 712,5 | 5,1 | 516,8 | 335,3 | 305,6 | 401,5 | 536,5 |
| 2020 | | 257,4 | 81,0 | 93,7 | 641,1 | 4,9 | 502,6 | 352,2 | 308,9 | 368,4 | 520,9 |
| 2030 | | 243,3 | 81,0 | 93,3 | 602,3 | 4,7 | 490,9 | 342,3 | 315,3 | 345,3 | 507,1 |
| 2040 | | 231,7 | 81,1 | 92,5 | 572,1 | 4,6 | 482,4 | 328,4 | 323,5 | 328,4 | 497,1 |
| 2050 | | 224,0 | 81,0 | 92,3 | 558,3 | 4,5 | 474,8 | 317,6 | 331,7 | 315,5 | 488,2 |
| 2060 | | 218,2 | 81,0 | 91,8 | 540,5 | 4,3 | 466,7 | 306,6 | 338,5 | 304,2 | 478,5 |
| 2070 | | 213,4 | 80,8 | 91,5 | 525,5 | 4,3 | 459,3 | 294,7 | 342,7 | 293,8 | 469,8 |
| 2080 | | 209,1 | 80,9 | 90,9 | 508,9 | 4,2 | 449,8 | 283,7 | 343,9 | 284,1 | 458,6 |
| 2090 | | 203,7 | 80,6 | 90,7 | 496,3 | 4,1 | 439,7 | 274,9 | 344,1 | 275,7 | 445,9 |
| 2100 | | 198,5 | 80,8 | 90,3 | 477,4 | 4,0 | 431,0 | 266,7 | 343,5 | 268,2 | 434,9 |
| 2110 | | 193,9 | 80,7 | 90,0 | 463,7 | 3,9 | 420,5 | 257,6 | 341,2 | 260,5 | 423,0 |
| 2120 | | 189,7 | 80,5 | 89,6 | 445,6 | 3,8 | 409,7 | 249,2 | 338,3 | 253,4 | 410,6 |
| 2130 | | 184,2 | 80,5 | 89,3 | 436,2 | 3,8 | 401,6 | 241,6 | 335,1 | 247,1 | 400,2 |
| 2140 | | 186,3 | 80,4 | 89,3 | 452,6 | 3,7 | 393,6 | 235,1 | 331,7 | 242,6 | 390,2 |
| 2150 | | 182,6 | 80,5 | 89,1 | 429,6 | 3,7 | 386,9 | 229,6 | 328,4 | 238,8 | 382,2 |
| 2160 | | 179,0 | 80,4 | 88,7 | 421,5 | 3,6 | 380,7 | 224,3 | 325,3 | 235,1 | 374,7 |
| 2170 | | 174,7 | 80,5 | 88,5 | 404,7 | 3,5 | 372,5 | 219,1 | 321,5 | 230,8 | 367,8 |
| 2180 | | 159,6 | 80,3 | 87,9 | 352,1 | 3,4 | 363,7 | 214,5 | 317,2 | 226,2 | 359,8 |
| 2190 | | 148,0 | 80,3 | 87,5 | 329,8 | 3,4 | 355,2 | 211,5 | 312,7 | 221,3 | 351,6 |
| 2200 | | 140,3 | 80,4 | 87,2 | 308,6 | 3,3 | 346,3 | 207,4 | 308,3 | 215,8 | 342,7 |
| 2210 | | 136,2 | 80,3 | 86,8 | 299,0 | 3,3 | 337,8 | 203,0 | 303,7 | 210,5 | 333,6 |
| 2220 | | 133,2 | 80,3 | 86,6 | 262,8 | 3,3 | 330,3 | 198,9 | 298,8 | 206,0 | 325,4 |
| 2230 | | 130,4 | 80,3 | 86,3 | 276,7 | 3,2 | 322,5 | 195,3 | 293,5 | 201,8 | 317,0 |
| 2240 | | 128,1 | 80,3 | 86,1 | 246,8 | 3,2 | 315,1 | 192,5 | 287,6 | 198,0 | 308,7 |
| 2250 | | 126,3 | 80,2 | 85,8 | 238,2 | 3,1 | 306,6 | 189,6 | 280,9 | 194,4 | 299,6 |
| 2260 | | 124,6 | 80,1 | 85,6 | 263,9 | 3,0 | 298,8 | 185,6 | 273,7 | 190,6 | 291,8 |
| 2270 | | 123,5 | 80,1 | 85,4 | 233,4 | 3,0 | 291,5 | 181,7 | 266,6 | 187,9 | 284,6 |
| 2280 | | 122,1 | 80,0 | 85,4 | 225,2 | 3,0 | 284,7 | 178,3 | 259,9 | 185,9 | 277,9 |
| 2290 | | 120,9 | 80,0 | 85,0 | 251,3 | 2,9 | 278,6 | 175,6 | 253,7 | 183,9 | 272,0 |
| 2300 | | 119,4 | 79,9 | 84,9 | 236,6 | 2,9 | 272,9 | 173,0 | 247,8 | 181,9 | 265,7 |
| 2310 | | 118,1 | 79,9 | 84,8 | 242,2 | 2,8 | 268,1 | 170,1 | 242,3 | 179,6 | 259,4 |
| 2320 | | 115,7 | 79,9 | 84,6 | 233,0 | 2,7 | 260,5 | 167,4 | 237,4 | 176,3 | 253,2 |
| 2330 | | 113,9 | 79,7 | 84,4 | 207,6 | 2,6 | 252,8 | 163,9 | 232,2 | 172,8 | 245,8 |
| 2340 | | 499,5 | 73,1 | 75,2 | 329,8 | 1,2 | 196,1 | 139,9 | 85,2 | 120,7 | 203,1 |
| 2350 | 22-23-22-23-21% | 224,6 | 74,5 | 75,6 | 308,6 | 5,8 | 254,7 | 187,7 | 139,6 | 177,4 | 262,9 |
| 2360 | | 233,8 | 76,5 | 75,7 | 375,4 | 5,4 | 255,2 | 177,6 | 181,0 | 190,1 | 263,4 |
| 2370 | | 185,1 | 77,4 | 75,9 | 305,9 | 5,0 | 264,6 | 168,7 | 216,6 | 190,9 | 274,8 |
| 2380 | | 177,6 | 77,6 | 76,2 | 308,6 | 4,5 | 272,1 | 162,7 | 244,8 | 183,8 | 267,9 |
| 2390 | | 195,1 | 76,8 | 76,3 | 242,8 | 3,9 | 277,1 | 161,4 | 269,9 | 178,1 | 277,1 |
| 2400 | | 334,5 | 78,9 | 76,9 | 690,7 | 3,0 | 373,4 | 202,4 | 290,9 | 326,2 | 368,2 |
| 2410 | | 317,6 | 82,2 | 77,8 | 680,1 | 2,3 | 461,2 | 250,9 | 313,9 | 418,5 | 476,6 |
| 2420 | | 306,2 | 82,9 | 78,1 | 688,4 | 1,9 | 468,8 | 248,7 | 333,5 | 429,7 | 490,5 |
| 2430 | | 312,2 | 84,2 | 78,1 | 665,5 | 1,6 | 464,3 | 237,7 | 347,5 | 409,3 | 487,7 |
| 2440 | | 291,3 | 85,1 | 77,7 | 604,0 | 1,4 | 442,8 | 224,9 | 359,3 | 342,7 | 464,0 |
| 2450 | | 274,2 | 86,6 | 77,4 | 567,8 | 1,3 | 419,2 | 215,1 | 368,2 | 304,2 | 443,0 |
| 2460 | | 252,5 | 87,2 | 76,9 | 512,5 | 1,2 | 404,5 | 210,6 | 374,1 | 280,8 | 427,6 |
| 2470 | | 239,7 | 87,0 | 76,8 | 488,6 | 1,0 | 391,6 | 203,8 | 378,0 | 263,3 | 413,3 |
| 2480 | | 229,6 | 85,9 | 76,4 | 465,9 | 0,9 | 378,4 | 197,3 | 378,0 | 250,4 | 401,4 |
| 2490 | | 216,5 | 85,0 | 77,0 | 435,5 | 0,9 | 368,1 | 191,8 | 373,8 | 238,9 | 388,0 |
| 2500 | | 185,9 | 84,2 | 75,9 | 347,6 | 0,8 | 351,1 | 184,1 | 365,8 | 227,2 | 371,6 |
| 2510 | | 164,0 | 82,3 | 76,9 | 301,7 | 0,7 | 333,7 | 176,1 | 353,1 | 213,5 | 349,0 |
| 2520 | 21- 21 22 22 23 22% | 172,7 | 81,8 | 77,3 | 238,6 | 8,2 | 306,9 | 166,1 | 335,9 | 198,0 | 324,6 |
| 2530 | | 170,3 | 81,0 | 77,6 | 221,3 | 7,9 | 269,2 | 153,2 | 319,3 | 182,3 | 287,0 |
| 2540 | | 180,5 | 80,3 | 78,1 | 229,1 | 7,6 | 244,3 | 143,2 | 301,9 | 174,1 | 259,7 |
| 2550 | | 254,0 | 79,4 | 77,7 | 453,8 | 7,0 | 239,6 | 145,0 | 289,0 | 218,7 | 297,4 |
| 2560 | | 303,2 | 79,0 | 78,0 | 621,0 | 6,3 | 277,8 | 163,6 | 285,4 | 300,9 | 411,1 |
| 2570 | | 380,4 | 80,7 | 79,4 | 769,1 | 5,4 | 367,5 | 202,7 | 295,7 | 425,3 | 458,7 |
| 2580 | | 403,8 | 80,6 | 80,0 | 809,3 | 4,3 | 483,0 | 254,1 | 313,7 | 497,9 | 526,3 |
| 2590 | | 396,9 | 86,8 | 80,4 | 816,2 | 3,5 | 559,8 | 288,6 | 336,1 | 524,1 | 585,7 |
| 2600 | | 324,4 | 90,0 | 80,5 | 701,6 | 2,9 | 592,6 | 306,9 | 358,3 | 504,8 | 613,6 |
| 2610 | | 300,8 | 92,3 | 80,5 | 671,4 | 2,6 | 572,9 | 291,3 | 381,3 | 443,8 | 590,2 |
| 2620 | | 290,7 | 91,2 | 80,4 | 660,1 | 2,4 | 544,4 | 277,6 | 409,4 | 395,9 | 562,6 |
| 2630 | | 283,7 | 91,6 | 80,6 | 640,0 | 2,1 | 521,4 | 266,4 | 433,2 | 365,3 | 539,9 |
| 2640 | | 259,6 | 91,8 | 80,2 | 578,5 | 1,9 | 512,6 | 276,3 | 448,3 | 350,8 | 532,3 |
| 2650 | | 256,7 | 91,3 | 79,7 | 584,5 | 1,7 | 499,0 | 266,6 | 459,9 | 331,7 | 521,4 |
| 2660 | | 246,0 | 91,5 | 78,5 | 555,4 | 1,6 | 481,7 | 255,4 | 463,4 | 313,8 | 502,4 |
| 2670 | | 237,5 | 90,6 | 79,3 | 542,5 | 1,4 | 463,0 | 247,4 | 458,4 | 298,5 | 479,1 |
| 2680 | | 228,3 | 88,2 | 78,8 | 511,9 | 1,3 | 446,7 | 244,1 | 449,3 | 285,7 | 457,8 |
| 2690 | | 220,9 | 87,3 | 78,7 | 496,3 | 1,2 | 429,8 | 237,4 | 438,0 | 273,7 | 437,5 |
| 2700 | | 212,6 | 88,8 | 78,2 | 474,4 | 1,1 | 409,7 | 228,7 | 425,4 | 261,2 | 415,9 |
| 2710 | | 353,7 | 87,0 | 78,2 | 799,4 | 2,8 | 415,6 | 265,8 | 411,0 | 338,8 | 420,6 |
| 2720 | | 379,3 | 89,7 | 78,8 | 842,6 | 1,8 | 500,8 | 320,0 | 397,4 | 458,5 | 506,6 |
| 2730 | 22-22-21% | 417,5 | 92,8 | 78,8 | 559,4 | 10,1 | 510,5 | 334,5 | 390,5 | 415,5 | 518,6 |
| 2740 | | 385,4 | 91,5 | 79,3 | 884,5 | 9,0 | 500,7 | 343,6 | 382,2 | 474,6 | 490,9 |
| 2750 | | 398,9 | 94,4 | 79,2 | 857,7 | 9,1 | 517,3 | 369,1 | 369,8 | 536,5 | 495,9 |
| 2760 | | 376,4 | 96,3 | 80,8 | 832,3 | 7,9 | 524,0 | 393,3 | 362,9 | 564,5 | 463,2 |
| 2770 | | 373,4 | 98,8 | 82,1 | 860,6 | 6,8 | 549,7 | 409,0 | 361,2 | 576,9 | 461,2 |
| 2780 | | 377,7 | 100,7 | 82,7 | 896,3 | 5,9 | 575,7 | 411,8 | 362,1 | 591,4 | 478,5 |
| 2790 | | 372,7 | 102,2 | 83,3 | 866,7 | 5,1 | 594,4 | 411,6 | 367,3 | 602,4 | 512,8 |
| 2800 | | 364,5 | 104,0 | 83,3 | 883,6 | 4,4 | 602,7 | 411,5 | 376,4 | 596,9 | 543,7 |
| 2810 | | 348,3 | 106,3 | 83,8 | 811,8 | 3,8 | 614,7 | 414,0 | 387,6 | 592,4 | 566,8 |
| 2820 | | 318,6 | 106,8 | 83,8 | 751,0 | 3,5 | 610,1 | 403,0 | 399,8 | 550,8 | 580,6 |
| 2830 | | 305,5 | 106,4 | 83,3 | 725,7 | 3,2 | 586,7 | 384,7 | 413,2 | 486,6 | 581,2 |
| 2840 | | 290,0 | 105,1 | 83,5 | 691,0 | 3,0 | 563,6 | 368,2 | 425,1 | 438,6 | 570,8 |
| 2850 | | 283,4 | 104,1 | 82,8 | 673,2 | 2,8 | 542,4 | 355,1 | 434,9 | 405,5 | 559,5 |
| 2860 | | 270,2 | 103,4 | 83,1 | 640,0 | 2,6 | 526,1 | 347,8 | 441,2 | 381,2 | 548,0 |
| 2870 | | 253,9 | 101,8 | 82,3 | 600,0 | 2,5 | 511,3 | 336,6 | 442,3 | 358,9 | 533,0 |
| 2880 | | 247,2 | 99,4 | 82,3 | 583,5 | 2,3 | 499,3 | 322,6 | 436,9 | 341,2 | 517,3 |
| 2890 | | 240,5 | 99,2 | 82,2 | 573,4 | 2,1 | 491,9 | 311,8 | 432,6 | 329,4 | 504,7 |
| 2900 | | 235,5 | 97,5 | 81,9 | 559,5 | 2,0 | 485,8 | 302,1 | 431,7 | 318,4 | 496,6 |
| 2910 | | 230,3 | 97,2 | 81,7 | 547,2 | 1,8 | 478,5 | 293,8 | 431,1 | 308,3 | 491,1 |
| 2920 | | 225,1 | 97,3 | 81,4 | 534,0 | 1,7 | 471,9 | 285,5 | 430,2 | 299,7 | 480,6 |
| 2930 | | 219,3 | 95,9 | 81,2 | 514,6 | 1,6 | 462,5 | 274,9 | 429,1 | 290,8 | 469,5 |
| 2940 | | 213,8 | 91,0 | 81,3 | 496,4 | 1,5 | 448,0 | 261,0 | 425,3 | 281,3 | 457,6 |
| 2950 | | 205,2 | 93,1 | 81,0 | 470,2 | 1,4 | 433,8 | 251,3 | 420,5 | 270,1 | 442,1 |
| 2960 | | 198,8 | 93,6 | 80,8 | 455,1 | 1,3 | 415,0 | 238,7 | 411,9 | 259,0 | 426,6 |
| 2970 | | 194,7 | 92,8 | 80,7 | 444,4 | 1,2 | 399,1 | 229,3 | 402,7 | 249,9 | 411,9 |
| 2980 | | 188,9 | 91,3 | 80,7 | 419,9 | 1,2 | 381,5 | 219,4 | 393,6 | 241,6 | 401,2 |
| 2990 | | 183,7 | 91,2 | 80,2 | 406,1 | 1,1 | 367,2 | 211,2 | 384,0 | 233,0 | 389,8 |
| 3000 | | 165,4 | 89,4 | 80,3 | 371,9 | 1,1 | 350,5 | 202,7 | 374,7 | 224,5 | 373,3 |
| 3010 | | 148,3 | 89,5 | 80,0 | 301,1 | 1,0 | 333,3 | 195,3 | 364,6 | 214,1 | 353,9 |
| 3020 | | 139,0 | 88,4 | 80,0 | 276,8 | 0,9 | 314,3 | 186,6 | 353,3 | 203,5 | 332,7 |
| 3030 | | 132,2 | 86,7 | 79,6 | 257,0 | 0,8 | 293,7 | 177,2 | 340,6 | 193,7 | 313,2 |

| moisture content | Temps | Flue | Room | Tunnel | Catalyst | scale | Right | Back | bottom | Top | Left |
|---|---|---|---|---|---|---|---|---|---|---|---|
| each pieces % | acquisition | temp | temp | dry bulb | | | | | | | |
| | minutes | °F | °F | °F | °F | lbs | °F | °F | °F | °F | °F |
| | 0 | 78,8 | 77,1 | 79,6 | 635,6 | 2,6 | 323,7 | 186,0 | 210,5 | 303,3 | 368,1 |
| 22-22-21-21% | 10 | 277,6 | 78,5 | 79,5 | 634,4 | 2,5 | 314,3 | 181,6 | 233,6 | 285,8 | 363,4 |
| | 20 | 266,1 | 80,4 | 78,8 | 604,9 | 2,3 | 309,1 | 179,1 | 251,6 | 270,9 | 357,6 |
| 21-22-22-23-22% | 30 | 259,5 | 79,7 | 80,3 | 716,7 | 9,2 | 283,9 | 170,7 | 257,3 | 244,2 | 332,8 |
| | 40 | 313,7 | 81,4 | 81,3 | 647,9 | 8,2 | 318,6 | 216,4 | 266,3 | 321,0 | 385,8 |
| | 50 | 367,4 | 84,2 | 82,1 | 825,6 | 7,2 | 393,6 | 285,7 | 280,8 | 403,3 | 475,4 |
| | 60 | 353,3 | 87,6 | 83,5 | 783,2 | 6,4 | 446,8 | 312,4 | 296,2 | 465,2 | 519,5 |
| | 70 | 328,5 | 87,2 | 81,9 | 759,1 | 5,9 | 457,1 | 297,9 | 308,1 | 495,6 | 514,9 |
| | 80 | 322,9 | 87,4 | 81,7 | 738,8 | 5,3 | 463,6 | 291,5 | 319,5 | 501,9 | 508,9 |
| | 90 | 322,3 | 87,5 | 81,6 | 738,2 | 4,7 | 473,6 | 288,8 | 331,0 | 503,7 | 506,1 |
| | 100 | 328,5 | 89,0 | 81,5 | 773,6 | 4,1 | 487,8 | 290,9 | 341,5 | 520,4 | 507,0 |
| | 110 | 315,2 | 93,6 | 84,8 | 746,2 | 3,6 | 503,2 | 297,4 | 353,7 | 529,4 | 513,0 |
| | 120 | 295,8 | 96,3 | 85,2 | 713,7 | 3,2 | 510,2 | 297,4 | 366,9 | 512,6 | 514,3 |
| | 130 | 287,3 | 98,0 | 85,8 | 688,5 | 2,9 | 507,5 | 291,7 | 380,8 | 487,8 | 510,1 |
| | 140 | 282,8 | 98,4 | 86,0 | 683,5 | 2,7 | 500,1 | 285,5 | 400,3 | 424,2 | 509,9 |
| | 150 | 271,3 | 98,1 | 86,1 | 658,8 | 2,5 | 491,7 | 282,8 | 420,4 | 381,4 | 505,1 |
| | 160 | 265,2 | 96,7 | 84,0 | 635,4 | 2,3 | 478,6 | 279,0 | 434,2 | 350,3 | 496,3 |
| | 170 | 254,1 | 93,8 | 83,8 | 600,7 | 2,2 | 469,5 | 274,3 | 441,9 | 327,1 | 484,1 |
| | 180 | 243,2 | 92,1 | 83,1 | 571,1 | 2,1 | 457,9 | 267,5 | 447,4 | 308,9 | 472,3 |
| 21-22-2223% | 190 | 255,9 | 89,0 | 81,6 | 650,6 | 10,0 | 439,7 | 255,8 | 448,8 | 290,1 | 452,5 |
| | 200 | 353,6 | 87,2 | 82,4 | 916,5 | 9,5 | 406,4 | 241,4 | 434,4 | 283,2 | 394,6 |
| | 210 | 362,9 | 86,9 | 82,2 | 910,8 | 8,9 | 400,2 | 248,6 | 415,6 | 294,7 | 364,7 |
| | 220 | 359,0 | 86,3 | 81,5 | 775,0 | 8,1 | 415,5 | 261,1 | 405,4 | 339,3 | 359,1 |
| | 230 | 368,6 | 87,6 | 82,0 | 949,4 | 7,4 | 451,9 | 279,2 | 399,5 | 392,9 | 388,0 |
| | 240 | 351,4 | 89,7 | 81,5 | 824,7 | 6,7 | 483,6 | 291,8 | 396,6 | 441,0 | 404,0 |
| | 250 | 341,6 | 91,6 | 81,7 | 808,6 | 6,0 | 528,8 | 317,0 | 394,5 | 477,8 | 452,0 |
| | 260 | 319,2 | 92,0 | 82,4 | 751,1 | 5,4 | 556,9 | 330,0 | 393,1 | 485,1 | 487,9 |
| | 270 | 308,4 | 95,1 | 82,7 | 736,9 | 4,8 | 571,4 | 336,3 | 393,2 | 479,3 | 511,0 |
| | 280 | 316,9 | 95,5 | 82,3 | 786,6 | 4,2 | 587,5 | 349,5 | 393,4 | 479,7 | 525,0 |
| | 290 | 295,9 | 96,0 | 82,5 | 709,6 | 3,7 | 593,3 | 372,5 | 392,5 | 480,6 | 543,9 |
| | 300 | 288,1 | 96,7 | 82,9 | 714,5 | 3,5 | 573,3 | 357,1 | 393,5 | 425,1 | 542,0 |
| | 310 | 274,8 | 95,8 | 82,0 | 680,0 | 3,3 | 544,6 | 337,1 | 399,2 | 380,5 | 524,9 |
| 121-22-23-22-21-20-22% | 320 | 280,8 | 95,3 | 81,8 | 597,6 | 12,6 | 529,4 | 321,8 | 409,3 | 348,3 | 511,4 |
| | 330 | 298,9 | 94,8 | 82,4 | 739,1 | 12,2 | 465,5 | 316,8 | 413,0 | 313,5 | 438,7 |
| | 340 | 309,8 | 96,0 | 82,5 | 770,4 | 11,8 | 421,3 | 320,8 | 403,6 | 296,1 | 392,7 |
| | 350 | 319,9 | 95,3 | 83,8 | 799,8 | 11,3 | 396,7 | 318,9 | 392,9 | 285,4 | 365,7 |
| | 360 | 340,1 | 95,8 | 83,2 | 881,5 | 10,8 | 383,8 | 322,1 | 383,6 | 282,8 | 350,0 |
| | 370 | 377,3 | 96,6 | 82,9 | 1017,7 | 10,3 | 381,8 | 328,9 | 375,5 | 291,2 | 343,9 |
| | 380 | 349,7 | 96,3 | 84,5 | 724,1 | 8,9 | 440,1 | 361,3 | 368,3 | 369,8 | 358,0 |
| | 390 | 345,8 | 96,9 | 84,9 | 818,4 | 7,9 | 513,3 | 380,1 | 359,3 | 454,0 | 396,6 |
| | 400 | 353,9 | 100,8 | 84,1 | 840,4 | 7,0 | 548,6 | 395,1 | 350,4 | 499,3 | 438,1 |
| | 410 | 355,8 | 103,7 | 84,5 | 893,2 | 6,3 | 578,3 | 402,4 | 344,1 | 522,3 | 489,9 |
| | 420 | 346,1 | 105,9 | 84,5 | 850,6 | 5,7 | 575,5 | 394,2 | 340,3 | 550,3 | 523,2 |
| | 430 | 309,7 | 105,5 | 86,5 | 767,0 | 5,3 | 570,6 | 384,1 | 338,8 | 534,7 | 532,7 |
| | 440 | 316,0 | 106,9 | 86,2 | 788,6 | 4,9 | 555,3 | 375,6 | 340,2 | 519,2 | 528,8 |
| | 450 | 306,2 | 107,2 | 85,1 | 776,4 | 4,6 | 555,3 | 369,2 | 344,2 | 500,3 | 531,3 |
| | 460 | 288,9 | 106,2 | 85,0 | 714,3 | 4,4 | 547,5 | 353,5 | 348,5 | 431,5 | 526,8 |
| | 470 | 273,5 | 104,2 | 85,6 | 674,9 | 4,2 | 542,3 | 340,0 | 353,4 | 391,1 | 523,0 |
| | 480 | 263,8 | 103,5 | 85,0 | 654,3 | 4,0 | 540,9 | 329,9 | 358,7 | 369,6 | 523,0 |
| | 490 | 252,6 | 102,6 | 85,2 | 623,3 | 3,8 | 533,7 | 319,2 | 363,9 | 351,3 | 517,8 |
| | 500 | 249,8 | 102,9 | 84,4 | 618,1 | 3,7 | 523,3 | 309,1 | 368,3 | 337,2 | 510,1 |
| | 510 | 246,3 | 102,1 | 84,1 | 609,4 | 3,5 | 514,5 | 301,1 | 373,6 | 326,9 | 505,7 |
| | 520 | 243,5 | 101,5 | 83,9 | 594,7 | 3,4 | 507,5 | 294,4 | 379,9 | 317,7 | 503,0 |
| | 530 | 238,0 | 100,9 | 84,1 | 581,3 | 3,2 | 500,2 | 288,2 | 385,8 | 309,7 | 498,1 |
| | 540 | 232,8 | 99,0 | 84,2 | 564,5 | 3,1 | 490,7 | 281,6 | 390,3 | 300,6 | 492,6 |
| | 550 | 227,7 | 99,2 | 83,9 | 549,8 | 3,0 | 484,0 | 277,9 | 393,7 | 293,5 | 485,5 |
| | 560 | 226,1 | 98,8 | 83,8 | 547,4 | 2,8 | 479,6 | 275,2 | 395,3 | 288,7 | 481,8 |
| | 570 | 222,9 | 98,2 | 83,6 | 535,5 | 2,7 | 475,2 | 273,3 | 395,0 | 283,5 | 478,6 |
| | 580 | 218,0 | 96,7 | 84,1 | 519,7 | 2,6 | 471,5 | 269,0 | 392,7 | 277,6 | 474,4 |
| | 590 | 216,2 | 96,0 | 83,7 | 516,0 | 2,5 | 464,4 | 264,3 | 388,6 | 274,3 | 469,8 |
| | 600 | 213,3 | 95,1 | 84,1 | 507,0 | 2,4 | 459,5 | 259,2 | 385,1 | 269,5 | 465,0 |
| | 610 | 213,4 | 95,8 | 83,3 | 504,3 | 2,3 | 452,1 | 254,0 | 381,4 | 265,6 | 459,4 |
| | 620 | 211,2 | 95,5 | 83,1 | 494,3 | 2,2 | 440,0 | 254,2 | 376,4 | 261,5 | 452,9 |
| | 630 | 205,6 | 94,9 | 83,1 | 478,9 | 2,1 | 427,4 | 249,6 | 370,5 | 256,3 | 445,7 |
| | 640 | 202,5 | 94,1 | 83,0 | 470,3 | 2,0 | 416,7 | 242,5 | 365,5 | 251,5 | 439,4 |
| | 650 | 199,1 | 93,0 | 83,1 | 459,0 | 1,9 | 407,7 | 236,1 | 361,5 | 247,2 | 433,2 |
| | 660 | 196,2 | 91,8 | 83,4 | 452,6 | 1,8 | 398,3 | 230,3 | 357,3 | 243,3 | 427,1 |
| | 670 | 196,4 | 91,3 | 83,3 | 449,8 | 1,7 | 390,1 | 226,7 | 352,6 | 239,5 | 410,7 |
| | 680 | 191,2 | 91,8 | 83,0 | 430,4 | 1,6 | 379,8 | 220,9 | 346,1 | 233,8 | 390,4 |
| | 690 | 185,8 | 91,6 | 82,3 | 411,9 | 1,6 | 367,8 | 214,1 | 339,8 | 228,3 | 374,2 |
| | 700 | 175,8 | 90,7 | 82,3 | 377,7 | 1,5 | 352,8 | 206,8 | 333,4 | 221,1 | 358,5 |
| | 710 | 167,1 | 89,8 | 82,5 | 352,0 | 1,5 | 333,7 | 197,2 | 324,9 | 212,4 | 340,3 |
| | 720 | 161,2 | 88,3 | 81,8 | 336,4 | 1,4 | 316,0 | 189,3 | 315,6 | 204,1 | 323,5 |
| | 730 | 144,0 | 88,2 | 81,9 | 268,7 | 1,4 | 299,1 | 182,7 | 306,2 | 196,6 | 308,4 |
| | 740 | 75,1 | 74,1 | 73,6 | 80,6 | 1,0 | 81,7 | 78,8 | 83,8 | 80,1 | 82,8 |
| 223-22-23-21-22% | 750 | 387,5 | 73,6 | 73,8 | 525,7 | 8,4 | 129,0 | 118,7 | 84,4 | 134,7 | 146,2 |
| | 760 | 368,4 | 72,9 | 74,0 | 722,2 | 7,2 | 216,5 | 185,0 | 95,1 | 305,3 | 263,7 |
| | 770 | 424,6 | 75,6 | 74,5 | 907,3 | 6,0 | 321,3 | 249,5 | 112,9 | 417,9 | 367,1 |
| | 780 | 431,0 | 78,5 | 74,8 | 933,1 | 5,0 | 433,2 | 290,6 | 133,8 | 489,1 | 467,8 |
| | 790 | 395,2 | 81,8 | 75,9 | 812,0 | 5,1 | 514,9 | 308,4 | 157,2 | 526,7 | 541,0 |
| | 800 | 367,8 | 85,5 | 76,2 | 771,8 | 4,6 | 564,2 | 306,9 | 183,3 | 524,1 | 573,2 |
| | 810 | 344,8 | 87,6 | 76,0 | 736,2 | 4,2 | 583,5 | 303,1 | 213,2 | 500,0 | 584,7 |
| | 820 | 329,8 | 89,7 | 76,4 | 712,7 | 3,9 | 590,1 | 299,0 | 241,4 | 467,5 | 579,4 |
| | 830 | 320,1 | 91,6 | 76,5 | 692,2 | 3,5 | 581,0 | 302,1 | 266,3 | 446,9 | 564,8 |
| | 840 | 307,1 | 91,0 | 76,1 | 656,8 | 3,4 | 560,9 | 286,5 | 286,4 | 393,8 | 540,8 |
| | 850 | 288,3 | 91,9 | 76,3 | 614,0 | 3,2 | 536,2 | 268,7 | 301,0 | 353,5 | 509,9 |
| | 860 | 273,9 | 90,6 | 76,1 | 582,0 | 3,1 | 515,0 | 258,6 | 311,5 | 327,5 | 484,0 |
| | 870 | 262,2 | 89,4 | 75,5 | 553,3 | 2,9 | 487,1 | 248,1 | 317,8 | 307,1 | 460,3 |
| | 880 | 247,4 | 88,4 | 75,9 | 514,9 | 2,8 | 458,1 | 238,1 | 321,2 | 290,1 | 437,6 |
| | 890 | 237,1 | 87,3 | 75,6 | 492,5 | 2,7 | 433,1 | 229,5 | 321,3 | 276,3 | 414,5 |
| | 900 | 228,9 | 86,4 | 76,4 | 468,7 | 2,6 | 415,1 | 222,7 | 320,2 | 263,9 | 397,0 |
| | 910 | 218,3 | 85,3 | 76,1 | 445,5 | 2,5 | 398,5 | 213,8 | 318,1 | 252,3 | 379,7 |
| | 920 | 210,1 | 85,3 | 76,3 | 422,9 | 2,4 | 382,5 | 205,3 | 315,3 | 240,9 | 362,7 |
| | 930 | 205,0 | 83,9 | 75,3 | 412,3 | 2,3 | 365,3 | 200,2 | 310,5 | 231,4 | 345,2 |
| | 940 | 195,4 | 83,1 | 75,5 | 385,0 | 2,3 | 348,4 | 192,9 | 304,1 | 221,0 | 327,8 |
| | 950 | 174,1 | 82,6 | 75,9 | 320,6 | 2,2 | 329,7 | 185,9 | 297,0 | 209,5 | 311,0 |
| | 960 | 151,8 | 81,9 | 75,9 | 276,5 | 2,2 | 308,4 | 177,4 | 288,6 | 197,8 | 292,2 |
| 23-23-23-23-21% | 970 | 137,9 | 81,0 | 75,6 | 236,9 | 9,3 | 284,1 | 166,8 | 279,0 | 184,5 | 271,2 |
| | 980 | 125,7 | 80,8 | 75,6 | 211,5 | 9,2 | 254,6 | 154,4 | 265,9 | 171,6 | 243,0 |
| | 990 | 143,1 | 80,2 | 75,6 | 158,5 | 9,1 | 232,3 | 146,3 | 250,2 | 160,2 | 219,6 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1000 | 165,0 | 79,9 | 76,0 | 183,4 | 8,9 | 215,6 | 140,0 | 236,7 | 149,8 | 200,5 |
| | 1010 | 175,9 | 79,2 | 75,8 | 202,5 | 8,6 | 219,5 | 138,3 | 227,6 | 149,9 | 192,8 |
| | 1020 | 178,1 | 79,3 | 76,7 | 267,5 | 8,2 | 235,9 | 138,7 | 224,4 | 159,5 | 195,4 |
| | 1030 | 146,0 | 79,3 | 76,2 | 231,3 | 8,0 | 248,2 | 133,0 | 227,0 | 162,0 | 201,3 |
| | 1040 | 140,4 | 79,4 | 76,3 | 225,4 | 7,8 | 236,3 | 126,2 | 232,3 | 158,6 | 202,6 |
| | 1050 | 140,6 | 78,4 | 75,9 | 227,5 | 7,5 | 229,3 | 123,1 | 242,3 | 157,2 | 208,7 |
| | 1060 | 143,0 | 78,7 | 76,4 | 230,7 | 7,3 | 229,0 | 122,4 | 254,5 | 157,6 | 219,4 |
| | 1070 | 148,0 | 78,8 | 76,6 | 258,4 | 7,0 | 231,6 | 123,2 | 265,2 | 161,8 | 231,1 |
| | 1080 | 331,3 | 79,2 | 76,9 | 657,1 | 6,2 | 314,9 | 154,5 | 275,5 | 284,1 | 320,6 |
| | 1090 | 291,7 | 80,9 | 77,5 | 682,6 | 5,7 | 380,4 | 178,8 | 284,8 | 312,6 | 379,8 |
| | 1100 | 296,1 | 83,4 | 78,2 | 702,3 | 5,4 | 381,9 | 183,2 | 292,0 | 313,1 | 399,8 |
| | 1110 | 311,4 | 84,9 | 78,4 | 752,6 | 5,1 | 376,4 | 183,0 | 298,9 | 314,4 | 408,2 |
| | 1120 | 284,1 | 86,7 | 78,4 | 620,0 | 4,8 | 379,5 | 188,0 | 304,6 | 328,4 | 405,3 |
| | 1130 | 262,6 | 87,2 | 79,1 | 591,7 | 4,3 | 457,9 | 235,0 | 307,8 | 356,5 | 455,7 |
| | 1140 | 243,3 | 88,3 | 79,4 | 556,4 | 4,1 | 463,0 | 239,0 | 310,9 | 325,8 | 456,0 |
| | 1150 | 269,1 | 88,9 | 79,5 | 652,3 | 4,0 | 442,1 | 223,5 | 314,1 | 298,8 | 445,3 |
| | 1160 | 259,6 | 89,5 | 79,9 | 605,8 | 3,8 | 424,3 | 211,7 | 318,2 | 283,6 | 437,1 |
| | 1170 | 248,6 | 89,6 | 79,7 | 579,4 | 3,7 | 416,5 | 208,4 | 326,5 | 274,6 | 443,4 |
| | 1180 | 238,0 | 89,4 | 79,7 | 548,8 | 3,6 | 412,1 | 205,8 | 334,0 | 267,1 | 444,3 |
| | 1190 | 234,3 | 89,1 | 80,1 | 544,7 | 3,4 | 406,0 | 203,1 | 338,6 | 260,0 | 440,0 |
| | 1200 | 225,3 | 89,4 | 79,8 | 516,8 | 3,3 | 405,6 | 200,4 | 339,9 | 254,5 | 425,9 |
| | 1210 | 216,0 | 89,7 | 80,0 | 491,4 | 3,2 | 400,5 | 196,9 | 340,7 | 247,8 | 410,8 |
| | 1220 | 209,2 | 91,0 | 79,2 | 473,4 | 3,1 | 392,9 | 193,7 | 339,6 | 242,4 | 394,9 |
| | 1230 | 201,2 | 89,7 | 80,0 | 448,4 | 3,0 | 382,0 | 189,9 | 336,6 | 233,9 | 381,4 |
| | 1240 | 177,5 | 90,1 | 79,9 | 352,4 | 2,9 | 369,9 | 185,5 | 330,8 | 226,7 | 368,0 |
| | 1250 | 149,3 | 89,2 | 80,2 | 294,6 | 2,8 | 357,3 | 184,3 | 324,4 | 218,0 | 353,9 |
| | 1260 | 140,7 | 89,2 | 79,8 | 277,0 | 2,8 | 343,9 | 187,0 | 314,9 | 210,1 | 338,2 |
| | 1270 | 136,5 | 89,5 | 79,5 | 263,9 | 2,7 | 331,8 | 190,8 | 305,4 | 204,6 | 322,5 |
| | 1280 | 132,2 | 89,2 | 79,8 | 254,1 | 2,5 | 319,3 | 193,5 | 296,1 | 198,2 | 308,3 |
| 22-23-22-22-22-22% | 1290 | 209,8 | 89,3 | 80,2 | 250,3 | 12,9 | 307,4 | 195,4 | 284,8 | 186,0 | 291,1 |
| | 1300 | 291,0 | 89,3 | 80,7 | 347,7 | 12,2 | 366,3 | 195,3 | 281,8 | 217,8 | 315,1 |
| | 1310 | 394,8 | 90,0 | 81,1 | 869,0 | 11,3 | 398,4 | 204,6 | 289,6 | 295,9 | 321,6 |
| | 1320 | 412,0 | 91,9 | 81,0 | 856,9 | 10,3 | 465,5 | 247,9 | 291,0 | 447,1 | 405,9 |
| | 1330 | 414,3 | 94,8 | 81,9 | 840,8 | 9,4 | 521,3 | 303,4 | 289,7 | 482,2 | 488,4 |
| | 1340 | 416,4 | 98,2 | 82,1 | 864,0 | 8,5 | 572,5 | 335,6 | 291,5 | 521,4 | 562,9 |
| | 1350 | 402,1 | 102,0 | 82,6 | 837,4 | 7,7 | 603,0 | 345,0 | 295,8 | 536,7 | 590,3 |
| | 1360 | 415,9 | 105,1 | 83,0 | 891,6 | 6,9 | 628,9 | 358,4 | 301,8 | 538,3 | 609,0 |
| | 1370 | 412,4 | 108,4 | 83,5 | 883,6 | 6,1 | 653,8 | 373,4 | 314,2 | 551,9 | 635,6 |
| | 1380 | 399,8 | 111,2 | 83,8 | 849,9 | 5,4 | 661,4 | 377,6 | 331,4 | 561,2 | 647,4 |
| | 1390 | 372,8 | 113,0 | 83,9 | 774,4 | 4,8 | 665,2 | 376,0 | 352,7 | 558,8 | 650,0 |
| | 1400 | 350,7 | 114,0 | 84,0 | 738,5 | 4,4 | 650,2 | 360,8 | 378,1 | 539,9 | 630,5 |
| | 1410 | 338,0 | 114,6 | 84,0 | 722,8 | 4,1 | 638,2 | 348,3 | 401,5 | 497,7 | 608,7 |
| | 1420 | 323,4 | 113,7 | 83,7 | 680,2 | 3,9 | 610,3 | 330,4 | 422,5 | 434,2 | 583,0 |
| | 1430 | 309,9 | 112,2 | 83,6 | 644,4 | 3,7 | 579,4 | 313,4 | 435,1 | 391,6 | 556,7 |
| | 1440 | 288,8 | 110,1 | 83,4 | 588,8 | 3,6 | 553,4 | 297,7 | 433,0 | 360,2 | 535,0 |
| | 1450 | 273,2 | 108,1 | 83,2 | 552,2 | 3,4 | 526,6 | 279,5 | 423,9 | 335,0 | 511,6 |
| | 1460 | 265,5 | 106,1 | 83,0 | 532,8 | 3,3 | 501,1 | 264,1 | 415,0 | 315,8 | 488,8 |
| | 1470 | 255,9 | 104,6 | 82,7 | 509,8 | 3,1 | 477,8 | 251,9 | 408,6 | 299,3 | 468,4 |
| | 1480 | 246,1 | 102,7 | 82,7 | 487,4 | 3,0 | 459,5 | 242,0 | 402,1 | 285,1 | 450,7 |
| | 1490 | 238,0 | 101,3 | 82,4 | 467,8 | 2,9 | 441,9 | 233,0 | 395,0 | 272,2 | 434,3 |
| | 1500 | 230,9 | 99,8 | 82,3 | 451,5 | 2,8 | 425,8 | 224,8 | 389,0 | 261,1 | 419,2 |
| | 1510 | 223,9 | 98,7 | 82,0 | 434,9 | 2,7 | 410,4 | 217,0 | 383,8 | 250,7 | 405,3 |
| | 1520 | 217,6 | 97,4 | 81,8 | 417,8 | 2,6 | 396,5 | 210,4 | 378,3 | 241,9 | 392,3 |
| | 1530 | 214,5 | 96,3 | 81,8 | 409,9 | 2,6 | 383,5 | 204,5 | 372,2 | 234,3 | 380,2 |
| | 1540 | 209,1 | 95,5 | 81,6 | 395,9 | 2,5 | 373,2 | 198,3 | 365,1 | 227,5 | 368,0 |
| | 1550 | 204,8 | 94,7 | 81,5 | 383,6 | 2,4 | 363,2 | 191,2 | 355,2 | 221,2 | 355,6 |
| | 1560 | 202,3 | 93,8 | 81,4 | 382,4 | 2,4 | 351,8 | 184,4 | 345,1 | 216,5 | 343,5 |
| | 1570 | 198,8 | 93,1 | 81,2 | 372,6 | 2,3 | 339,3 | 177,9 | 335,3 | 212,2 | 331,5 |
| | 1580 | 178,0 | 92,7 | 81,3 | 304,3 | 2,2 | 327,2 | 172,6 | 325,8 | 207,2 | 320,4 |
| | 1590 | 161,2 | 91,9 | 81,1 | 285,6 | 2,2 | 315,9 | 168,4 | 316,8 | 202,0 | 310,8 |
| | 1600 | 152,9 | 91,3 | 81,2 | 271,2 | 2,2 | 303,7 | 164,2 | 308,0 | 195,8 | 300,6 |
| | 1610 | 147,3 | 90,7 | 81,0 | 259,4 | 2,1 | 291,0 | 160,1 | 299,1 | 189,8 | 290,2 |
| | 1620 | 141,4 | 90,3 | 80,9 | 244,9 | 2,1 | 278,3 | 155,8 | 290,0 | 183,3 | 278,7 |
| | 1630 | 136,8 | 89,7 | 80,8 | 233,5 | 2,1 | 265,7 | 151,5 | 280,9 | 177,2 | 268,5 |
| | 1640 | 133,2 | 89,0 | 80,7 | 223,9 | 2,0 | 254,5 | 147,9 | 271,3 | 172,0 | 259,4 |
| | 1650 | 132,4 | 88,4 | 80,6 | 229,3 | 2,0 | 244,9 | 144,8 | 261,1 | 168,3 | 251,8 |
| | 1660 | 134,9 | 88,0 | 80,5 | 237,8 | 1,9 | 241,0 | 143,7 | 250,9 | 168,5 | 250,6 |
| | 1670 | 134,8 | 87,8 | 80,4 | 238,8 | 1,9 | 238,6 | 142,8 | 242,2 | 168,8 | 250,1 |
| | 1680 | 131,6 | 87,3 | 80,4 | 225,9 | 1,9 | 234,8 | 140,8 | 234,6 | 166,3 | 246,5 |
| | 1690 | 342,1 | 77,6 | 91,8 | 661,7 | 3,2 | 556,2 | 302,9 | 375,4 | 348,9 | 546,2 |
| 23-22-23-20-21% | 1700 | 328,7 | 77,8 | 92,7 | 696,5 | 10,8 | 495,3 | 310,9 | 373,0 | 358,6 | 492,2 |
| | 1710 | 349,5 | 78,3 | 93,3 | 747,3 | 10,0 | 485,8 | 344,3 | 362,9 | 431,2 | 488,2 |
| | 1720 | 365,9 | 78,2 | 92,7 | 779,8 | 9,2 | 480,2 | 361,9 | 354,6 | 484,3 | 493,7 |
| | 1730 | 370,1 | 78,8 | 94,9 | 781,7 | 8,3 | 542,9 | 379,7 | 346,5 | 518,5 | 525,4 |
| | 1740 | 353,8 | 78,2 | 93,8 | 754,9 | 7,5 | 582,3 | 379,3 | 341,0 | 521,9 | 561,1 |
| | 1750 | 348,5 | 78,3 | 94,2 | 752,2 | 6,8 | 592,3 | 367,9 | 336,2 | 515,4 | 592,1 |
| | 1760 | 345,8 | 79,4 | 93,8 | 750,8 | 6,2 | 623,4 | 358,0 | 332,4 | 517,9 | 622,9 |
| | 1770 | 341,1 | 79,4 | 93,2 | 743,8 | 5,5 | 625,1 | 347,2 | 331,2 | 513,5 | 630,8 |
| | 1780 | 332,0 | 79,1 | 92,9 | 730,7 | 5,0 | 623,4 | 336,2 | 332,0 | 505,5 | 622,1 |
| | 1790 | 322,8 | 80,2 | 92,2 | 706,1 | 4,6 | 609,0 | 323,6 | 336,7 | 492,4 | 604,0 |
| | 1800 | 315,4 | 79,6 | 92,7 | 688,0 | 4,3 | 602,6 | 311,4 | 342,4 | 477,7 | 590,9 |
| | 1810 | 309,6 | 79,5 | 92,1 | 671,6 | 4,1 | 581,6 | 301,3 | 347,9 | 423,1 | 576,6 |
| | 1820 | 300,6 | 79,3 | 90,6 | 645,7 | 3,9 | 547,0 | 287,0 | 352,2 | 383,1 | 545,8 |
| | 1830 | 287,3 | 79,2 | 91,2 | 601,4 | 3,8 | 520,5 | 274,6 | 355,5 | 353,4 | 516,3 |
| | 1840 | 278,9 | 78,8 | 89,9 | 586,2 | 3,7 | 496,7 | 263,5 | 359,9 | 331,1 | 491,6 |
| | 1850 | 276,4 | 78,7 | 89,5 | 584,9 | 3,6 | 478,1 | 257,3 | 365,3 | 314,5 | 473,9 |
| | 1860 | 275,2 | 79,2 | 98,9 | 352,7 | 3,5 | 466,5 | 258,1 | 369,9 | 298,4 | 459,6 |
| 23-22-22-23-21% | 1870 | 193,9 | 78,8 | 88,9 | 348,8 | 17,5 | 404,6 | 259,8 | 370,1 | 268,3 | 404,6 |
| | 1880 | 178,6 | 79,4 | 89,8 | 327,1 | 17,1 | 358,2 | 281,0 | 358,1 | 247,8 | 363,2 |
| | 1890 | 178,2 | 79,7 | 89,5 | 326,1 | 16,6 | 333,4 | 296,1 | 346,0 | 236,6 | 335,3 |
| | 1900 | 176,2 | 79,8 | 89,5 | 321,6 | 16,2 | 334,4 | 306,2 | 338,5 | 230,2 | 317,5 |
| | 1910 | 186,5 | 79,9 | 89,5 | 345,7 | 15,5 | 331,4 | 317,3 | 333,8 | 234,8 | 309,9 |
| | 1920 | 186,0 | 79,9 | 89,4 | 345,9 | 14,9 | 332,4 | 320,4 | 330,0 | 231,6 | 312,9 |
| | 1930 | 185,0 | 80,0 | 89,3 | 345,7 | 14,2 | 335,5 | 314,8 | 326,9 | 230,7 | 322,3 |
| | 1940 | 185,6 | 80,1 | 89,1 | 344,4 | 13,5 | 335,2 | 303,0 | 326,3 | 229,7 | 334,6 |
| | 1950 | 264,8 | 80,2 | 92,8 | 578,7 | 12,5 | 345,5 | 291,7 | 329,3 | 295,9 | 352,3 |
| | 1960 | 327,4 | 80,6 | 96,4 | 705,2 | 10,9 | 452,2 | 319,7 | 331,5 | 412,0 | 384,9 |
| | 1970 | 351,2 | 80,9 | 98,1 | 804,9 | 9,6 | 544,8 | 342,0 | 332,8 | 483,0 | 434,7 |
| | 1980 | 364,0 | 81,1 | 99,5 | 831,7 | 8,5 | 602,4 | 362,7 | 336,7 | 520,8 | 484,1 |
| | 1990 | 372,5 | 81,5 | 99,9 | 877,8 | 7,5 | 645,7 | 379,5 | 341,1 | 545,2 | 519,4 |
| | 2000 | 354,7 | 81,7 | 99,6 | 809,2 | 6,8 | 657,2 | 384,9 | 347,0 | 556,8 | 545,5 |
| | 2010 | 325,7 | 81,8 | 97,7 | 735,2 | 6,4 | 657,9 | 375,0 | 356,1 | 530,7 | 562,4 |
| | 2020 | 312,8 | 81,7 | 96,9 | 716,4 | 6,1 | 639,2 | 358,2 | 366,7 | 493,4 | 564,0 |
| | 2030 | 323,6 | 81,7 | 97,1 | 774,6 | 5,8 | 619,6 | 344,7 | 376,4 | 457,5 | 561,8 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2040 | 309,2 | 81,7 | 95,9 | 698,4 | 5,7 | 599,7 | 330,7 | 385,8 | 420,6 | 553,6 |
| | 2050 | 295,3 | 81,6 | 95,3 | 666,1 | 5,5 | 581,9 | 320,5 | 395,8 | 391,1 | 546,5 |
| | 2060 | 286,0 | 81,5 | 95,2 | 635,3 | 5,3 | 566,7 | 316,3 | 405,4 | 371,3 | 542,2 |
| | 2070 | 280,7 | 81,4 | 93,7 | 634,1 | 5,1 | 548,1 | 327,8 | 410,9 | 356,9 | 531,5 |
| | 2080 | 277,9 | 81,4 | 93,8 | 628,9 | 5,0 | 533,5 | 327,0 | 416,7 | 345,0 | 522,2 |
| | 2090 | 274,5 | 81,4 | 93,3 | 618,3 | 4,9 | 526,6 | 321,9 | 424,2 | 336,6 | 517,2 |
| | 2100 | 270,0 | 81,5 | 92,8 | 604,5 | 4,7 | 522,6 | 315,7 | 432,1 | 329,2 | 512,9 |
| | 2110 | 263,7 | 81,4 | 92,9 | 584,3 | 4,6 | 517,3 | 308,2 | 437,5 | 322,4 | 507,5 |
| | 2120 | 258,0 | 81,3 | 92,3 | 569,8 | 4,4 | 511,7 | 300,9 | 441,3 | 315,9 | 501,3 |
| | 2130 | 254,4 | 81,3 | 91,7 | 562,4 | 4,3 | 505,6 | 295,0 | 443,9 | 309,9 | 496,2 |
| | 2140 | 252,3 | 81,3 | 91,8 | 561,1 | 4,2 | 499,5 | 291,0 | 445,5 | 304,1 | 489,5 |
| | 2150 | 251,5 | 81,2 | 91,5 | 563,4 | 4,0 | 488,7 | 297,1 | 444,1 | 299,6 | 485,1 |
| | 2160 | 249,1 | 81,3 | 91,4 | 550,7 | 3,9 | 475,4 | 294,9 | 439,8 | 297,0 | 477,9 |
| | 2170 | 244,9 | 81,1 | 91,2 | 539,2 | 3,8 | 462,5 | 287,8 | 432,6 | 293,9 | 465,6 |
| | 2180 | 241,0 | 81,0 | 90,8 | 525,4 | 3,6 | 453,4 | 280,2 | 427,2 | 291,2 | 455,4 |
| | 2190 | 236,0 | 81,1 | 91,2 | 510,8 | 3,5 | 444,2 | 271,7 | 423,5 | 288,3 | 446,5 |
| | 2200 | 230,1 | 80,8 | 90,1 | 493,4 | 3,4 | 435,1 | 261,9 | 420,9 | 282,5 | 435,6 |
| | 2210 | 226,6 | 80,9 | 90,3 | 485,7 | 3,3 | 426,0 | 252,1 | 417,6 | 275,9 | 423,7 |
| | 2220 | 221,2 | 80,7 | 89,0 | 468,7 | 3,3 | 417,1 | 242,7 | 414,9 | 268,7 | 410,3 |
| | 2230 | 216,7 | 80,6 | 88,8 | 457,2 | 3,2 | 409,1 | 235,0 | 412,7 | 262,1 | 398,2 |
| | 2240 | 212,0 | 80,6 | 88,7 | 445,8 | 3,1 | 399,6 | 227,8 | 408,3 | 256,0 | 387,1 |
| | 2250 | 201,9 | 80,5 | 88,8 | 414,3 | 3,0 | 390,3 | 220,3 | 401,4 | 247,9 | 377,5 |
| | 2260 | 194,8 | 80,4 | 87,9 | 399,8 | 3,0 | 378,0 | 212,3 | 392,7 | 239,8 | 368,9 |
| | 2270 | 189,6 | 80,3 | 87,2 | 383,3 | 2,9 | 367,4 | 204,2 | 383,4 | 232,4 | 359,5 |
| | 2280 | 176,8 | 80,1 | 86,6 | 359,2 | 2,8 | 356,4 | 197,5 | 373,3 | 225,0 | 348,8 |
| | 2290 | 158,8 | 80,1 | 86,3 | 295,6 | 2,8 | 343,8 | 191,3 | 363,2 | 217,2 | 338,3 |
| | 2300 | 150,2 | 80,0 | 85,4 | 275,5 | 2,8 | 331,5 | 185,0 | 352,3 | 209,4 | 326,2 |
| | 2310 | 143,3 | 79,9 | 85,0 | 258,5 | 2,8 | 318,4 | 178,7 | 340,9 | 201,7 | 315,0 |
| | 2320 | 138,2 | 79,9 | 84,9 | 245,6 | 2,7 | 304,3 | 173,1 | 329,1 | 194,3 | 303,8 |
| 20-20-21 | 2330 | 94,5 | 78,0 | 78,9 | 99,8 | 5,8 | 81,5 | 80,3 | 80,8 | 84,6 | 81,5 |
| | 2340 | 183,7 | 78,3 | 81,6 | 288,4 | 5,4 | 110,7 | 97,7 | 84,6 | 131,9 | 116,7 |
| | 2350 | 223,8 | 78,6 | 83,1 | 380,1 | 4,8 | 177,2 | 122,2 | 98,3 | 186,9 | 234,4 |
| | 2360 | 322,4 | 79,0 | 88,5 | 626,7 | 4,1 | 255,4 | 148,2 | 120,5 | 288,7 | 299,4 |
| | 2370 | 335,0 | 79,2 | 91,0 | 638,3 | 3,3 | 353,8 | 176,7 | 154,0 | 353,4 | 373,3 |
| 21-20-20 | 2380 | 314,9 | 79,7 | 92,7 | 633,6 | 10,7 | 414,5 | 196,8 | 200,2 | 369,3 | 414,3 |
| | 2390 | 344,1 | 79,5 | 92,6 | 830,9 | 9,9 | 469,4 | 209,7 | 215,9 | 387,6 | 384,8 |
| | 2400 | 349,9 | 79,5 | 94,1 | 820,8 | 9,0 | 532,8 | 253,0 | 221,8 | 439,6 | 374,5 |
| | 2410 | 326,2 | 79,7 | 93,6 | 761,9 | 8,3 | 555,3 | 290,4 | 227,6 | 472,3 | 377,6 |
| | 2420 | 320,5 | 79,9 | 93,9 | 766,4 | 7,6 | 548,5 | 305,7 | 234,9 | 481,5 | 381,0 |
| | 2430 | 318,1 | 80,0 | 93,9 | 768,9 | 6,9 | 547,4 | 325,7 | 243,1 | 491,4 | 392,6 |
| | 2440 | 311,8 | 80,1 | 93,6 | 732,5 | 6,3 | 551,9 | 354,1 | 253,7 | 475,6 | 400,2 |
| | 2450 | 312,5 | 80,0 | 93,7 | 767,6 | 5,9 | 550,9 | 329,1 | 265,9 | 497,7 | 411,1 |
| | 2460 | 309,9 | 80,3 | 93,5 | 756,6 | 5,3 | 545,9 | 314,7 | 278,5 | 507,6 | 423,4 |
| | 2470 | 307,3 | 80,4 | 93,7 | 779,0 | 4,8 | 541,6 | 309,5 | 291,1 | 503,9 | 433,7 |
| | 2480 | 316,3 | 80,3 | 93,9 | 791,6 | 4,3 | 542,6 | 314,0 | 302,7 | 511,8 | 454,8 |
| | 2490 | 325,2 | 80,4 | 94,1 | 817,6 | 3,8 | 549,1 | 319,3 | 315,4 | 504,0 | 509,9 |
| | 2500 | 306,8 | 80,5 | 94,2 | 747,3 | 3,3 | 566,3 | 324,0 | 334,5 | 499,6 | 586,1 |
| | 2510 | 280,1 | 80,4 | 92,7 | 685,1 | 2,9 | 570,6 | 321,3 | 352,2 | 457,5 | 638,7 |
| 20-21-19-20 | 2520 | 275,3 | 80,4 | 92,6 | 697,6 | 14,6 | 557,2 | 310,9 | 368,7 | 404,3 | 643,9 |
| | 2530 | 326,0 | 80,4 | 94,6 | 838,5 | 14,0 | 492,6 | 309,4 | 373,5 | 392,6 | 544,3 |
| | 2540 | 357,0 | 80,4 | 96,0 | 962,6 | 13,2 | 474,1 | 333,1 | 363,1 | 468,5 | 491,1 |
| | 2550 | 379,7 | 80,5 | 96,6 | 1079,4 | 12,6 | 439,5 | 344,8 | 352,1 | 413,2 | 451,9 |
| | 2560 | 406,8 | 80,5 | 98,2 | 1187,8 | 12,0 | 418,8 | 354,8 | 343,5 | 392,3 | 425,9 |
| | 2570 | 395,0 | 80,4 | 99,1 | 978,7 | 11,2 | 423,6 | 364,7 | 337,9 | 437,1 | 416,6 |
| | 2580 | 366,4 | 80,6 | 98,1 | 885,3 | 10,3 | 477,6 | 368,6 | 334,8 | 510,7 | 429,9 |
| | 2590 | 383,2 | 80,9 | 98,5 | 1171,4 | 9,5 | 491,2 | 371,6 | 332,3 | 520,6 | 436,2 |
| | 2600 | 413,1 | 81,0 | 100,2 | 1221,1 | 8,9 | 490,0 | 367,6 | 331,6 | 471,9 | 434,2 |
| | 2610 | 419,3 | 81,0 | 100,9 | 1259,0 | 8,2 | 495,6 | 362,5 | 332,8 | 460,3 | 436,5 |
| | 2620 | 425,3 | 81,1 | 101,1 | 1281,2 | 7,5 | 498,9 | 360,6 | 334,6 | 460,9 | 439,6 |
| | 2630 | 427,0 | 81,0 | 101,2 | 1197,6 | 6,9 | 500,1 | 359,4 | 337,0 | 465,9 | 444,1 |
| | 2640 | 372,0 | 81,1 | 99,3 | 891,5 | 6,1 | 545,9 | 377,8 | 339,3 | 499,9 | 473,2 |
| | 2650 | 348,3 | 81,4 | 98,0 | 868,8 | 5,3 | 601,5 | 392,4 | 341,2 | 520,2 | 521,4 |
| | 2660 | 326,1 | 81,4 | 97,1 | 797,3 | 4,8 | 596,2 | 381,8 | 342,6 | 531,6 | 533,4 |
| | 2670 | 302,5 | 81,5 | 95,6 | 738,3 | 4,6 | 574,7 | 365,7 | 344,2 | 463,2 | 526,6 |
| | 2680 | 280,3 | 81,4 | 92,8 | 695,3 | 4,4 | 554,8 | 353,1 | 347,0 | 413,4 | 518,2 |
| 21-22-20-23 | 2690 | 291,5 | 81,5 | 93,8 | 748,1 | 12,3 | 531,8 | 338,8 | 351,3 | 373,9 | 504,9 |
| | 2700 | 310,0 | 81,2 | 94,4 | 793,5 | 12,0 | 469,3 | 331,4 | 352,9 | 342,9 | 456,9 |
| | 2710 | 324,2 | 81,2 | 95,0 | 844,1 | 11,6 | 427,5 | 336,5 | 347,8 | 329,8 | 420,5 |
| | 2720 | 340,2 | 81,1 | 95,6 | 900,2 | 11,1 | 399,6 | 343,1 | 340,8 | 319,1 | 394,4 |
| | 2730 | 358,6 | 81,2 | 96,5 | 950,8 | 10,7 | 384,2 | 345,2 | 334,0 | 315,6 | 377,4 |
| | 2740 | 321,2 | 81,3 | 96,8 | 695,4 | 9,7 | 394,8 | 365,0 | 328,0 | 396,2 | 383,1 |
| | 2750 | 335,3 | 81,3 | 97,4 | 840,8 | 8,7 | 439,9 | 385,9 | 323,1 | 463,9 | 422,9 |
| | 2760 | 348,0 | 81,6 | 98,0 | 871,8 | 7,9 | 479,1 | 400,0 | 318,5 | 499,9 | 468,7 |
| | 2770 | 349,6 | 81,8 | 98,6 | 872,7 | 7,0 | 512,5 | 408,6 | 314,8 | 519,2 | 506,1 |
| | 2780 | 340,0 | 82,0 | 98,2 | 869,0 | 6,3 | 539,9 | 410,8 | 311,9 | 533,1 | 539,5 |
| | 2790 | 335,4 | 82,1 | 98,3 | 877,1 | 5,8 | 558,0 | 407,0 | 309,8 | 553,5 | 555,0 |
| | 2800 | 344,8 | 82,1 | 98,9 | 901,3 | 5,3 | 565,4 | 402,2 | 308,9 | 516,3 | 563,7 |
| | 2810 | 317,6 | 82,1 | 97,0 | 792,8 | 5,1 | 568,9 | 396,2 | 309,4 | 468,1 | 573,7 |
| | 2820 | 287,6 | 82,1 | 95,8 | 718,4 | 4,9 | 560,9 | 383,5 | 311,1 | 424,5 | 575,0 |
| | 2830 | 273,2 | 82,0 | 95,1 | 681,8 | 4,8 | 546,8 | 373,2 | 313,7 | 395,6 | 574,9 |
| | 2840 | 265,1 | 81,9 | 94,2 | 664,5 | 4,6 | 533,8 | 364,0 | 316,8 | 375,9 | 572,9 |
| | 2850 | 261,3 | 81,8 | 93,8 | 657,1 | 4,5 | 524,2 | 357,4 | 320,1 | 361,6 | 570,4 |
| | 2860 | 253,0 | 81,8 | 93,3 | 630,4 | 4,3 | 515,3 | 354,2 | 323,2 | 349,0 | 555,6 |
| | 2870 | 249,4 | 81,7 | 93,1 | 619,2 | 4,2 | 508,2 | 348,1 | 325,8 | 339,0 | 543,8 |
| | 2880 | 247,7 | 81,8 | 92,8 | 618,4 | 4,0 | 504,8 | 341,5 | 328,0 | 332,0 | 541,1 |
| | 2890 | 247,1 | 81,7 | 92,5 | 619,9 | 3,9 | 502,9 | 337,1 | 330,3 | 326,2 | 542,5 |
| | 2900 | 242,9 | 81,6 | 92,3 | 603,1 | 3,8 | 498,7 | 334,8 | 332,5 | 321,8 | 542,4 |
| | 2910 | 238,3 | 81,6 | 91,9 | 592,0 | 3,6 | 496,2 | 330,4 | 333,6 | 317,5 | 540,6 |
| | 2920 | 241,9 | 81,6 | 92,3 | 599,9 | 3,5 | 490,8 | 326,4 | 333,7 | 315,0 | 540,1 |
| | 2930 | 236,6 | 81,5 | 91,7 | 579,5 | 3,4 | 480,7 | 323,0 | 332,5 | 311,9 | 540,1 |
| | 2940 | 232,4 | 81,5 | 91,6 | 568,6 | 3,2 | 470,0 | 317,4 | 330,3 | 307,8 | 532,6 |
| | 2950 | 227,2 | 81,5 | 91,0 | 551,1 | 3,2 | 461,7 | 307,9 | 327,9 | 300,8 | 511,5 |
| | 2960 | 224,5 | 81,4 | 91,0 | 540,8 | 3,0 | 453,2 | 297,1 | 324,9 | 294,7 | 495,7 |
| | 2970 | 220,3 | 81,4 | 90,7 | 527,5 | 2,9 | 444,1 | 286,9 | 321,8 | 288,4 | 482,9 |
| | 2980 | 218,7 | 81,4 | 90,6 | 524,3 | 2,8 | 436,5 | 276,2 | 318,5 | 282,6 | 467,0 |
| | 2990 | 216,9 | 81,2 | 90,1 | 518,2 | 2,8 | 431,1 | 266,0 | 314,8 | 277,5 | 452,6 |
| | 3000 | 213,8 | 81,2 | 89,8 | 509,7 | 2,6 | 426,9 | 257,9 | 311,3 | 273,0 | 442,4 |
| | 3010 | 209,5 | 81,2 | 89,4 | 490,2 | 2,6 | 424,2 | 249,3 | 308,1 | 267,6 | 429,0 |
| | 3020 | 203,4 | 81,2 | 89,1 | 472,4 | 2,5 | 416,7 | 240,6 | 304,6 | 260,9 | 416,1 |
| | 3030 | 199,2 | 81,0 | 88,7 | 459,9 | 2,5 | 407,3 | 232,5 | 301,1 | 254,4 | 403,1 |
| | 3040 | 193,8 | 81,0 | 88,5 | 436,5 | 2,4 | 398,0 | 226,5 | 297,7 | 247,8 | 389,5 |
| | 3050 | 179,8 | 80,8 | 87,9 | 363,8 | 2,3 | 386,2 | 219,2 | 294,3 | 240,8 | 375,4 |
| | 3060 | 155,2 | 80,7 | 86,9 | 306,2 | 2,3 | 375,1 | 213,3 | 290,5 | 233,8 | 364,2 |
| | 3070 | 146,0 | 80,6 | 86,2 | 286,4 | 2,2 | 363,1 | 206,7 | 286,5 | 225,9 | 352,6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3080 | 139,6 | 80,6 | 85,7 | 271,6 | 2,2 | 352,6 | 199,9 | 282,3 | 218,8 | 338,8 |

# 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

hearthstone



# Lincoln

(Model 8060)

# Woodstove

## OWNER'S MANUAL

### Installation And Operating Instructions

We recommend that our products be installed and serviced by professionals who are certified in the U.S. by NFI (National Fireplace Institute), or by W.E.T.T. (Wood Energy Technology Transfer) in Canada.
www.nficertified.org
www.wettinc.ca

PFS Report Fxx-xx

**SAVE THIS OWNER'S MANUAL FOR FUTURE REFERENCE**

**PLEASE READ THIS ENTIRE OWNER'S MANUAL BEFORE YOU INSTALL AND USE YOUR NEW LINCOLN 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. 1482-2011 (R2015)**
**Certified to ULC Std. S6270-00 (R2016)**

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

**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**

Lincoln (Model 8060)
Manual: 6400-41432
R: 8/9/22

# Notes on Stove Operation and Efficiency

**Rating:**

You have purchased a Hearthstone Lincoln tested to EPA Method 28R 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 1.14 gr/hr. emission rate and under specific test conditions has been shown to deliver heat at rates ranging from 14,545 to 20,507 Btu (output).

This wood heater has a manufacturer-set minimum allowable low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

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 Hearthstone dealer. Our dealer network processes all warranty claims. Authorized Hearthstone dealers can be located at www.hearthstonestoves.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 ensure 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 across all of the 4 burn rate categories using the higher heating value (HHV). The weighted average efficiency is 78.5% (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 moist

ure content. Burn only dry, seasoned wood as using wet wood will greatly reduce your efficiency.

**CO Emissions:**

The Lincoln has the following CO emission rates by burn level: Category 1 (low) –38.7 g/hr., Category 2 (med. low) – 18.2 g/hr., Category 3 (med. high) – 17.3 g/hr. and Category 4 – 69.0 g/hr. 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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# INTRODUCTION

Thank you for purchasing a Lincoln woodstove from Hearthstone Quality Home Heating Products. This stove will provide years of comfortable heat. This stove combines the warmth and comfort of soapstone and cast iron with the efficiency of advanced catalytic technology. The Lincoln blends modern technology with the unique beauty and qualities of cast iron and soapstone. We trust that you will appreciate the quality of this handcrafted product.

Your Lincoln woodstove burns very efficiently, and produces a large amount of heat. However, you should not consider your Lincoln the primary heat source for your home. The Lincoln's large glass window allows you to enjoy the fire from a variety of locations in the room.

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 Lincoln Model 8060 stove is warranted by:

**Hearthstone** ***Quality Home Heating Products, Inc***®
317 Stafford Ave.
Morrisville, Vermont 05661, USA
www.Hearthstonestoves.com

# CODES

When you install your Lincoln 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

If you are installing your Lincoln in a mobile or manufactured home, follow the guidelines described in the Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 (United States).

# 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. (See page 25)
- **Never** put articles of clothing or candles on a hot stove.
- **Never** connect the stove to a flue used by another appliance.
- **Never** connect to or use in conjunction with any air distribution ductwork unless specifically approved for such installations

**Other safety guidelines:**

- Keep all combustible items such as furniture, drapes, clothing, and other items, at least 36" (0.92 m) from the stove (See page 9)
- 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 23)
- 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. (See page 29)
- 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 the optional outside air kit #96-53400

## 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. (see page 29)
- 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. (Refer to page 29.)
- Inspect the face of the catalytic combustor for fly ash and soot. Use a soft-bristled brush to remove if present. It is recommended to visually inspect the catalytic combustor at least 3 times during the heating season, or every 2-3 months.

**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.
- Check and clean the catalytic combustor, if necessary
- 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 primary air control.
3. Close the stovepipe damper (if present).
4. Close the bypass damper
5. 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, leave the primary air control and bypass handle closed and 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:**
40,000 BTUs per hour of cordwood (based on independent laboratory test results).

**Floor Size of Heated Area:**
Up to a maximum of 1,400 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:**
1.0 cubic feet.

**Maximum Log Length:** Up To 18" (45cm), 16" (40cm) Recommended

**Emissions:** 1.14 g/hr.

**Burn Time:** Up to 16+ hrs. (*Heat Life*™: Up to 20 hours) 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:**

| | |
|---|---|
| **Height:** | 30 1/2" (77.2cm) |
| **Width:** | 23 3/4" (59.1cm) |
| **Depth:** | 19 3/8" (49.2cm) |
| **Weight:** | 350 lbs. (159 kg) |

| | |
|---|---|
| **Connector Size:** | 6" (152 mm) diameter |
| **Metal Chimney:** | 6" (152 mm) inside diameter |
| **Masonry Chimney:** | 6" (152 mm) inside diameter (round flue), 8" x 8" (203 x 203 mm) (square flue) |

**Crate Dimensions:** H-40" W-29" L-36" or 102x74x 92cm

**Optional Equipment:**

| | |
|---|---|
| Outside Air Kit | 96-53400 |
| Rear Heatshield | 90-68601 |
| Side Heatshield (Single) | 90-68605 |

**Figure 1 – Lincoln Dimensions**

# INSTALLATION

## UNPACKING

Hearthstone packages your Lincoln 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 Lincoln, 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 Hearthstone dealer immediately.

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

## PACK LIST

Lincoln Model 8060 Woodstove
Owner's Manual

The label is attached by a cable to the bottom of the stove. Take care when lifting the stove not to damage the label or cable. After final positioning of the stove, the label may be stored in the holding clip on the bottom shield of the stove.

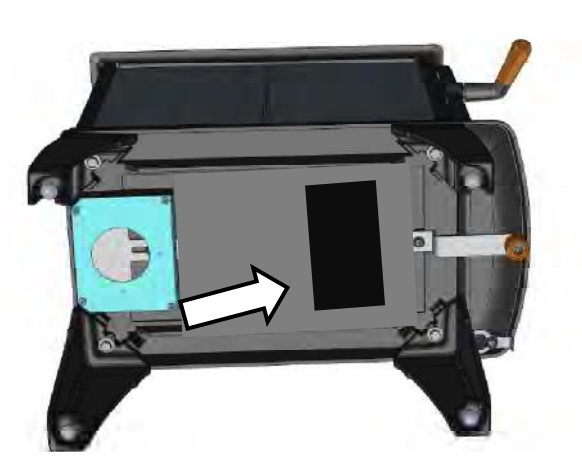


**Figure 2 - Label Location**

## INSTALLING YOUR STOVE

Choose a place to install your Lincoln 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 Simpson Dura-Vent DVL 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 noncombustible material. The Lincoln 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 33in x 31-1/2in.
The minimum floor protection for installations in Canada is 43in x 40in.

**Figure 3 – Hearth Dimensions**

Installing the stove in a room with Luxury Vinyl Plank (LVP) or Luxury Vinyl Tile (LVT) flooring requires a minimum clearance from the stove to the LVP or LVT flooring. LVP and LVT flooring begins to warp at 110 degrees Fahrenheit. The minimum required clearance for the LVP or LVT flooring to the front glass of the stove is 55”.

/ 46 cm

# COMBUSTIBLE SURFACE REQUIRED CLEARANCES

***Note:*** *Dimensions shown in the following figures are from the furthest point on cast 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.

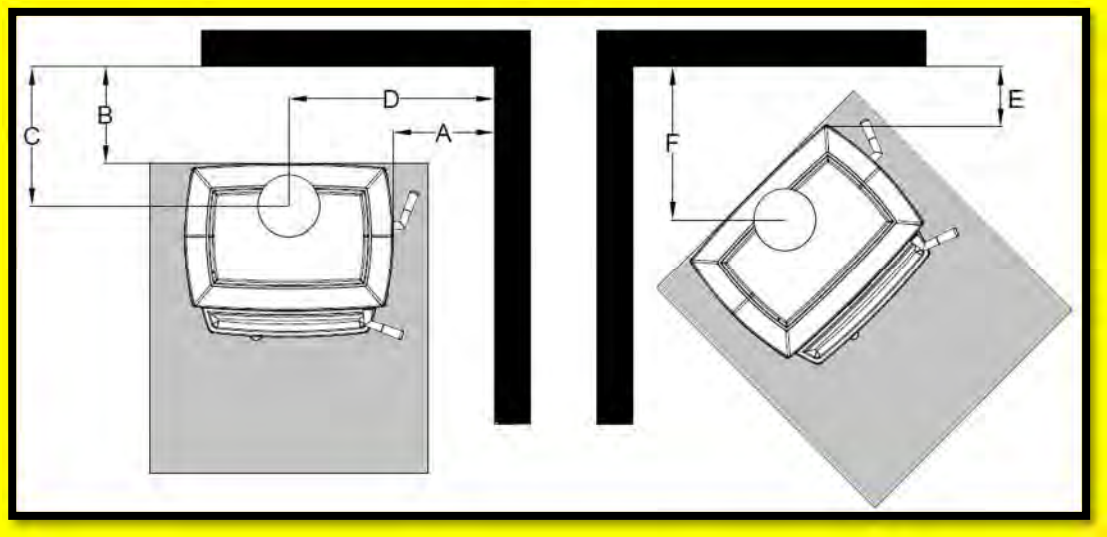



**Figure 4 – Clearance to Combustibles**

| | Parallel | | | | Corner | Corner |
|---|---|---|---|---|---|---|
| Clearances | A | B | C | D | E | F |
| Single wall Connector – Inc. Rear Heat Shield | 14”-36cm | 13-3/4”-35cm | 18-3/4”-48cm | 25-7/8”-66cm | 7”-18cm | 17.25”-44cm |
| Single Wall Connector – With Blower Kit Shield | 14”-36cm | 13-3/4”-35cm | 18-3/4”-48cm | 25-7/8”-66cm | 7”-18cm | 17.25”-44cm |
| Double Wall Connector – Inc. Rear Heat Shield | 14”-36cm | 9-3/4”-25cm | 14-3/4”-38cm | 25-7/8”-66cm | 7”-18cm | 17.25”-44cm |
| Double Wall Connector – With Blower Kit Shield | 14”-36cm | 9-3/4”-25cm | 14-3/4”-38cm | 25-7/8”-66cm | 7”-18cm | 17.25”-44cm |
| Single Wall Connector – No Rear Heat Shield | 14”-36cm | 16”-41cm | 21”-54cm | 25-7/8”-66cm | 14”-36cm | 25-1/2”-65cm |
| Alcove W/Sngl or Dbl Wall Conn – Inc. Rear Heat Shield | 14”-36cm | 13-3/4”-35cm | 18-3/4-48cm | 25-7/8”-66cm | See NFPA-211 | |
| Alcove W/Sngl or Dbl Wall Conn – With Blower Kit Shield | 14”-36cm | 13-3/4”-35cm | 18-3/4-48cm | 25-7/8”-66cm | See NFPA-211 | |

| Alcove Clearances (inches) | Unprotected Surfaces | Protected Surfaces (NFPA-211) |
|---|---|---|
| Minimum alcove width | 51-3/4” – 132cm | See NFPA-211 |
| Min. Alcove ceiling from floor with single wall connector | 56” – 142.3cm | See NFPA-211 |
| Min. Alcove ceiling from floor with double wall connector | 56” – 142.3cm | See NFPA-211 |

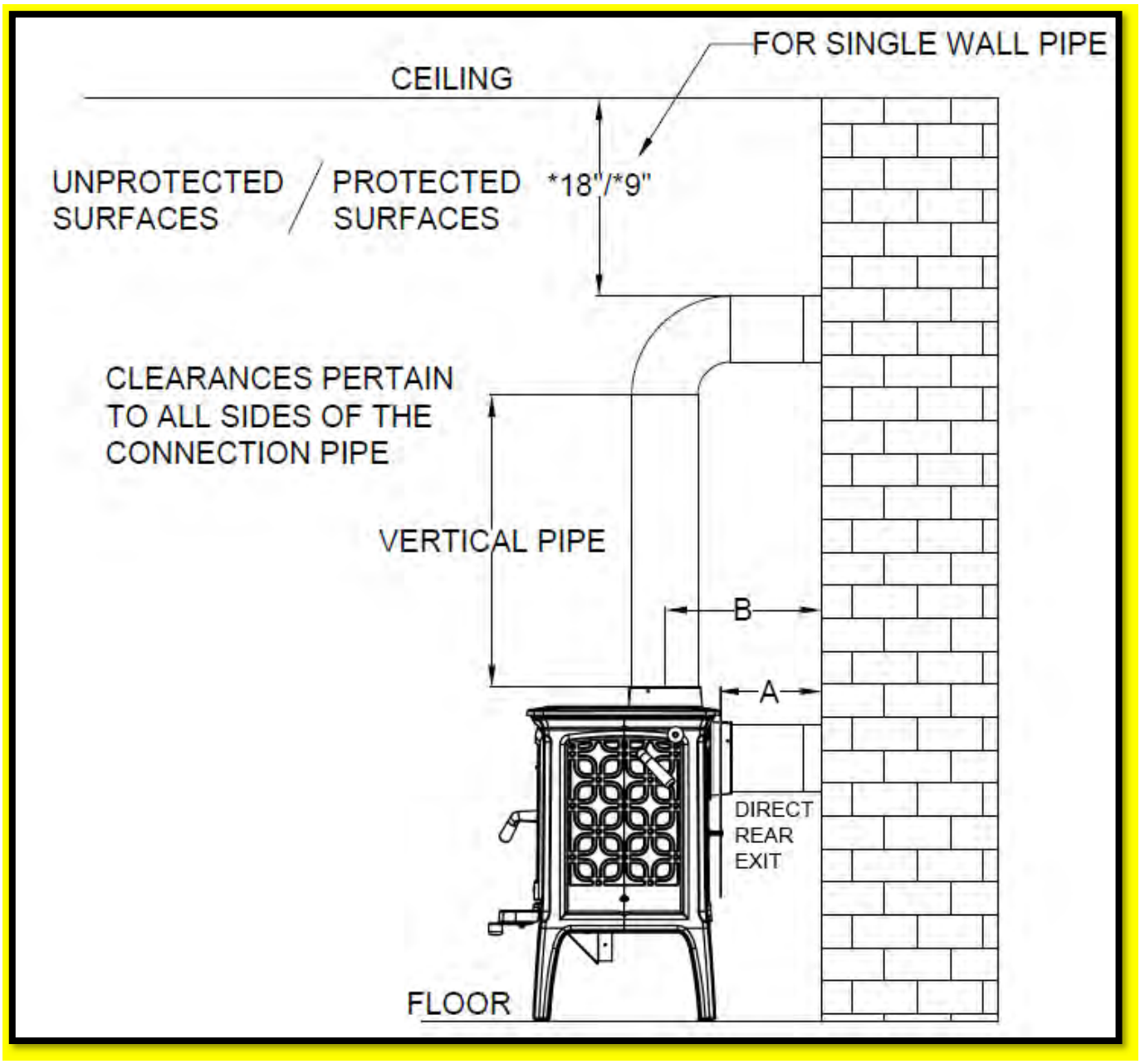
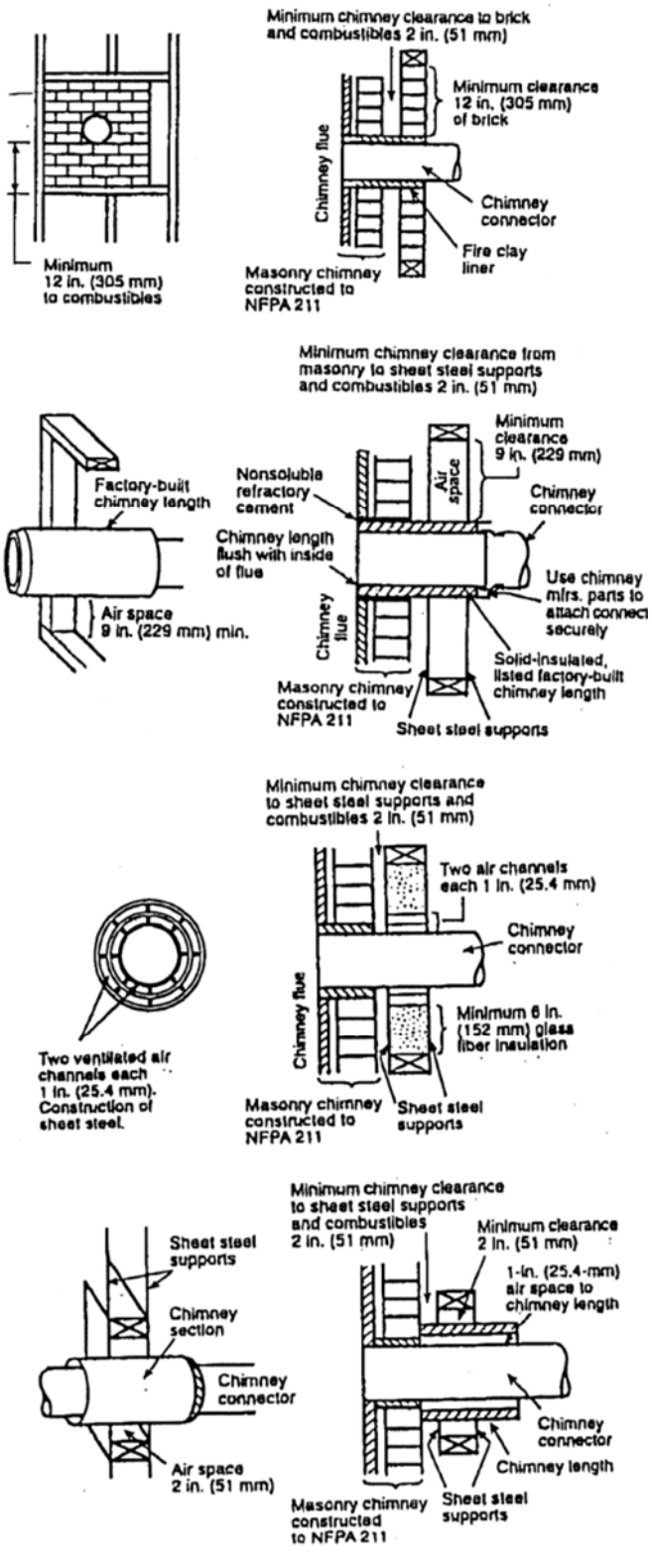



**Figure 5 Chimney Connector Clearances**

| | Single Wall Pipe | | | Double Wall Pipe | |
|---|---|---|---|---|---|
| **Through the wall top flue exit or direct rear exit** | **With Blower Kit Shield**** | **Inc. Rear Heat Shield** | **No Rear Heat Shield** | **With Blower Kit Shield**** | **Inc. Rear Heat Shield** |
| **A** | 13-3/4"-35cm | 13-3/4"-35cm | 15-1/2" – 40cm | 9-3/4"-25cm | 9-3/4"-25cm |
| **B** | 18-3/4"-48cm | 18-3/4"-48cm | 21" – 54cm | 14"-36cm | 14"-36cm |

***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.**




# 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.

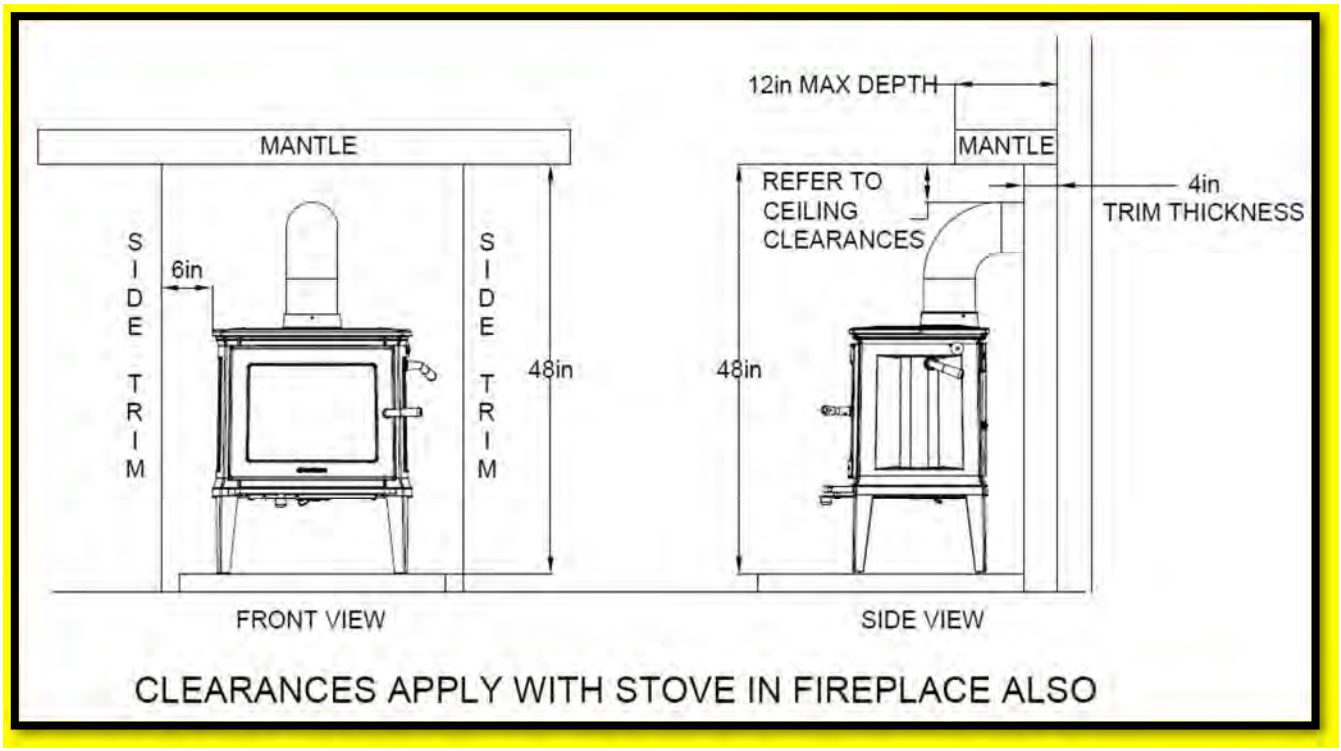



**Figure 6 Trim and Mantle Clearances**

## OUTSIDE AIR SUPPLY

(Optional Kit #96-xxxx)

You can connect an outside air source directly to this stove using an optional outside air kit. 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 kit for this stove allows for the direct connection of the stove's 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 duct from the outside of the house to the hearth, keep in mind the need to avoid structural members of the house. The outside air kit attaches to the underside of the stove. Refer to the instructions provided with the kit for installation.

*An adaptor for 4" duct is available if needed. KIT #90-53308

When using an outside air kit in Canada, the stove must be attached to your home's floor. Use the shipping clips that came with the stove and fasteners long enough to attach securely to the subfloor. (The clips and fastener heads may be painted to minimize visibility).

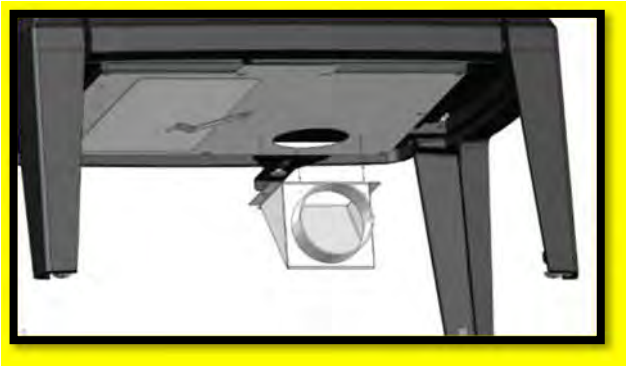


**Figure 7 – Outside Air Kit Detail**

The International Residential Code (IRC) does not allow the outside air duct to terminate higher than the appliance. Some building officials restrict vertical rise in the duct's termination. Hearthstone recommends the termination be at the same level, or lower than the air intake on the stove. When using an outside air kit in Canada, a damper allowing 100% closure shall be installed.

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 recommended are Simpson Dura Vent DVL and Metalbestos DS. Security, GSW and Ameritec also manufacture acceptable Rear connector pipe.

- When used in a mobile home, a spark arrester is required. (See page 18)

- 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 Simpson DuraVent DVL 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 site-constructed) 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 Lincoln. 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 Lincoln requires a draft between -0.06" and -0.1" WC. For drafts above -0.1" WC, install a stovepipe damper. To vent the Lincoln directly out the back flue exit, a minimum draft of -0.08" WC is required. 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 Lincoln 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 Lincoln 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 Lincoln. The Lincoln requires a 6" (152 mm) inside diameter flue for new installations. A 6" diameter flue provides adequate draft and performance. You can use an 8" (203 mm) diameter existing flue with a reducer. 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 for top of stove installation is 16 feet (4.9 m) off the floor or 13 feet 7 1/4 inches (4.3 m) from the top of the stove. For rear exit connection, the recommended minimum chimney height is 19 feet (5.8m) off the floor or 16 feet 7 1/4 inches (5.2m) from the top of the stove. The recommended maximum chimney height is 30 feet (9m). The Lincoln 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.

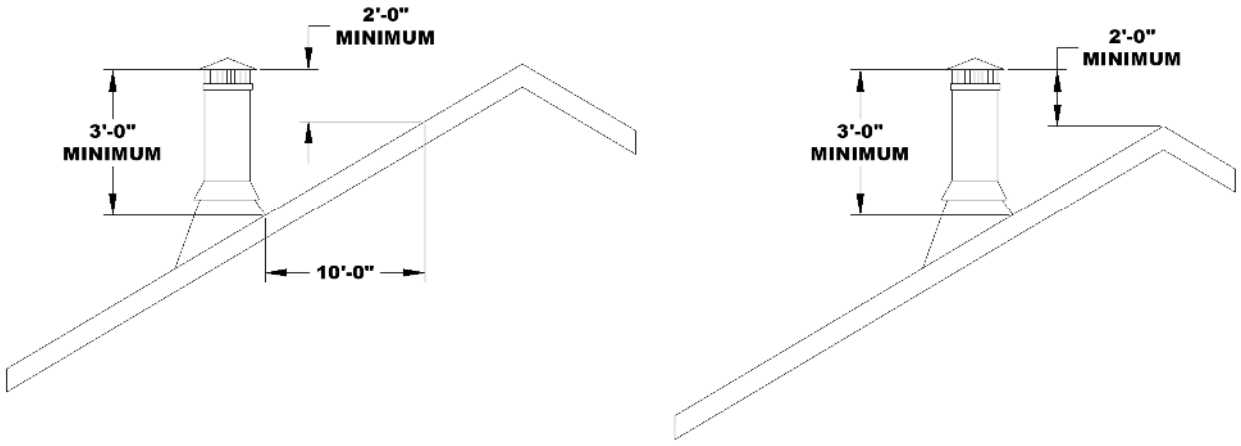



**Figure 9 – Chimney Height Requirements**

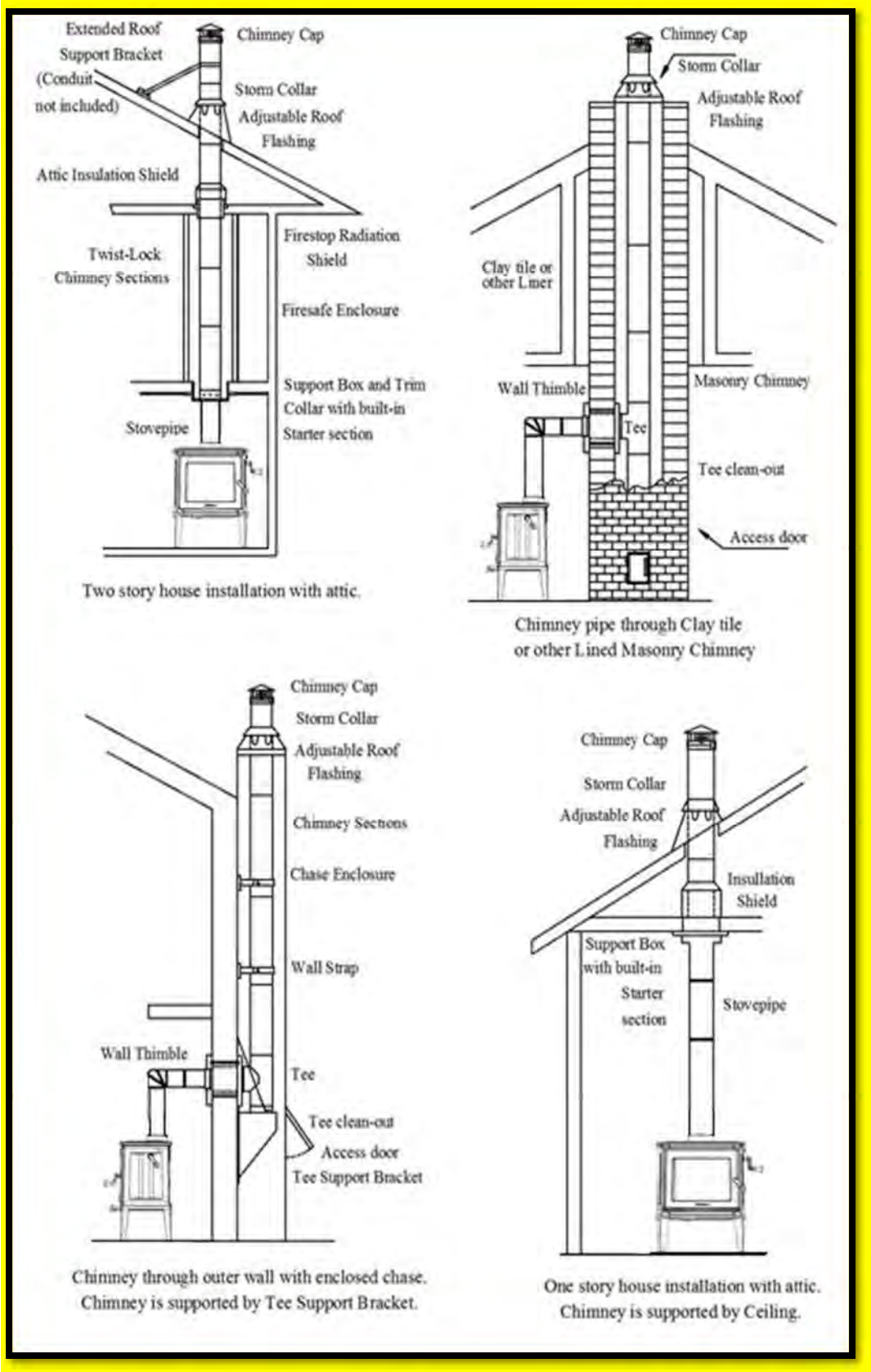



**Figure 10 – Typical Chimney Configurations**

# INSTALLING IN A MOBILE HOME

Follow these special requirements for installing your stove in a mobile home.

- Install the stove in accordance with 24 CFR, Part 3280 (HUD)
- An outside air kit must be used in all mobile home installations. See page 12 for details.
- Permanently attach the stove to your mobile home's floor. Use the shipping clips that came with the stove and fasteners long enough to attach securely to the subfloor. (The clips and fastener heads may be painted to minimize visibility).

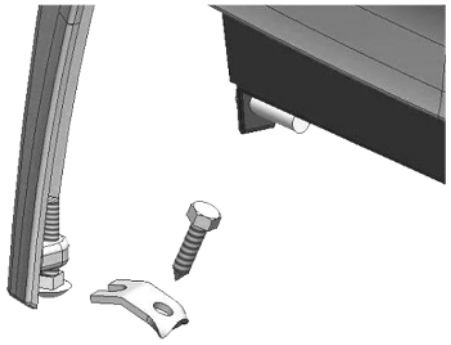


**Figure 11 - Lock Down Detail**

- Install a Mobile Home Chimney & Connector Kit*.

  Each kit must include:
  Stainless spark arrester cap, storm collar, Adjustable vented flashing – 0/12 – 6/12, Two 24" chimney pipes, 24" support box with built-in starter section and trim.

  * Install a Mobile Home Chimney and Connector Kit conforming to US/UL103 or CAN/ULC-S629, Standard for Factory-Built Chimneys.

- WARNING: DO NOT INSTALL IN A SLEEPING ROOM IN A MOBILE HOME.
- CAUTION: MAINTAIN THE STRUCTURAL INTEGRITY OF THE MOBILE HOME WALLS, FLOOR, CEILING, AND ROOF WHEN INSTALLING AND USING YOUR STOVE.
- FAILURE TO FOLLOW THESE INSTRUCTIONS AND SPECIFIED COMPONENTS OR USING MAKE-SHIFT COMPROMISES CAN RESULT IN FIRE, PROPERTY DAMAGE, BODILY INJURY, AND EVEN DEATH.
- Burning any fuel other than wood in this unit could generate dangerous levels of carbon monoxide within the living space.
- THE FRONT DOOR MUST REMAIN CLOSED WHEN IN OPERATION EXCEPT FOR START UP AND LOADING. Leaving the door open during use could cause any smoke or fire detectors in the home to be set off or a fire could escape the firebox and start the room on fire.
- If this unit is installed in a mobile home, care must be taken to ensure adequate air is available. If not enough air is available it could starve the room of all the oxygen. (See page 27 for more details)
- The chimney should be attached directly to the stove and must extend at least 3 feet (.9 m) above the part of the roof through which it passes. The top of the chimney is to be at least 2 feet (.6 m) above the highest elevation of any part of the mobile home within 10 feet (3 m) of the chimney.
- All roof-chimney terminations should be able to be readily removed / re-installed at or below an elevation of 13-1/2 feet (4.1 m) above ground level without the use of special tools or instructions. The chimney assembly shall be provided with a mechanical securement means to secure the chimney to the ceiling support box.
- When a chimney exits the mobile home at a location other than through the roof, and exits at a point 7 feet (2.1 m) or less above the ground level on which the mobile home is positioned, a guard or method of enclosing the chimney shall be provided at the point of exit for a height up to 7 feet.
- The chimney guard shall not allow the passage of a ¾ inch (19.1 mm) diameter rod, and a ½" (12.7 mm) diameter rod shall not be able to touch the chimney when inserted through any part of the guard a distance of 4 inches (102 mm).

- The chimney shall be provided with a spark arrester secured to the chimney. The net free area of the arrester above the chimney outlet shall not be less than 4 times the net area of the chimney outlet, and the vertical height of the arrester above the chimney outlet shall not be less than ½ the diameter of the chimney flue. Openings shall not permit the passage of a sphere having a diameter of ½ inch (12.7 mm), and shall allow the passage of a sphere of 3/8" (9.6 mm).

- CAUTION: REMOVE THE CHIMNEY WHEN TRANSPORTING THE MOBILE HOME!

- 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

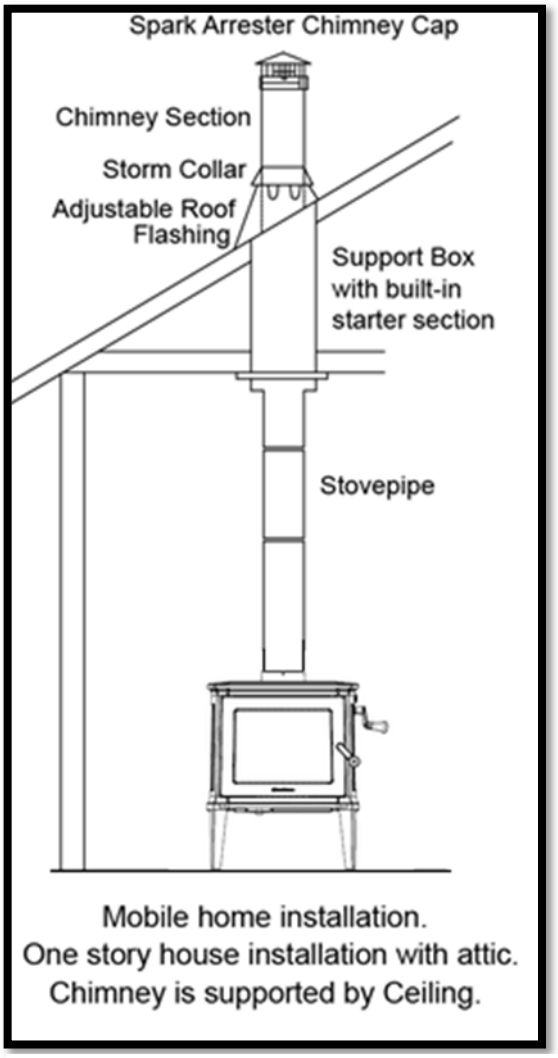



**Figure 12 – Mobile Home Installation**

# OPERATION

Once your Lincoln 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.

## CONTROLS AND FEATURES

Before lighting any fires, become familiar with the location and operation of your stove's controls and features and learn how to use them (*See Figure 13*). For your own safety, do not modify these features in any way. We recommend you use fireplace gloves when the stove is in operation and hot.

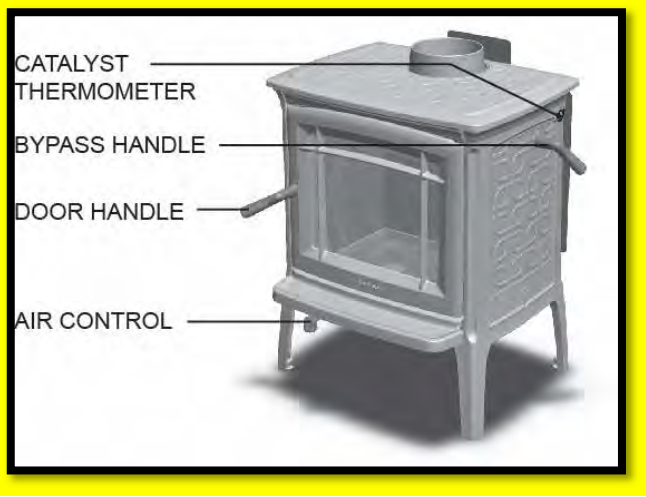



**Figure 13 - Controls & Features**

**FRONT DOOR HANDLE:** The firebox door allows you to load wood into your stove; a wood handle operates the door. To open the door, pull up on the handle and swing the door away from the stove. To latch the door, push the door tightly towards the firebox then continue to push the handle in and down until it latches shut. Gently pull on the door handle to make sure it is properly latched.

PRIMARY AIR CONTROL: The primary air control lever is located under the ash lip. The primary air control allows you to regulate the amount of air entering the firebox. Generally, the more air allowed into the firebox, the faster the rate of burn and the higher the heat output; conversely, less air creates a slower burn, with lower heat output. For maximum airflow, pull the lever out as far as possible; move the lever inwards as far as possible for minimum airflow (does not close completely).

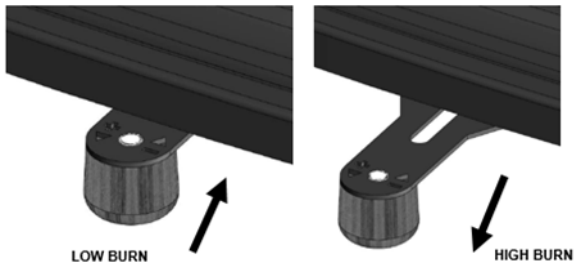



**Figure 14 – Air Control**

**BYPASS HANDLE:** The bypass handle controls the bypass door inside the stove. When the handle is pointed towards the front of the stove, the bypass door is open, and when the handle is pointed towards the rear of the stove, the bypass door is closed. The bypass door directs the flow of combustion products through or around the catalytic combustor. When the bypass handle is open, combustion products are directed around the catalytic combustor. The bypass handle should be open when first staring a fire until the catalytic combustor heats up to activation temperature, and whenever opening the front door to load the stove. When the bypass handle is closed, combustion products are directed through the catalytic combustor. The bypass handle should be closed once the catalytic combustor heats up to activation temperature, and remain closed whenever the stove is burning and in the active temperature range.

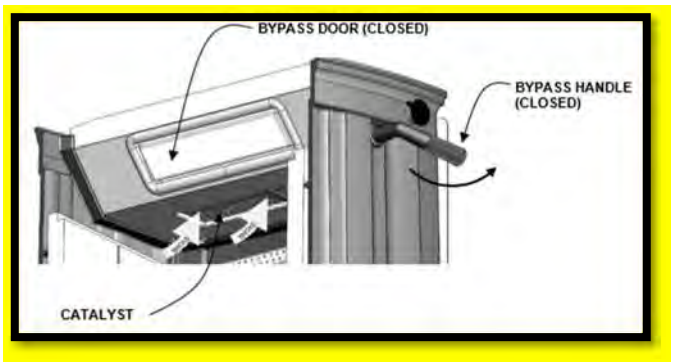



**Figure 15 – Bypass Closed**

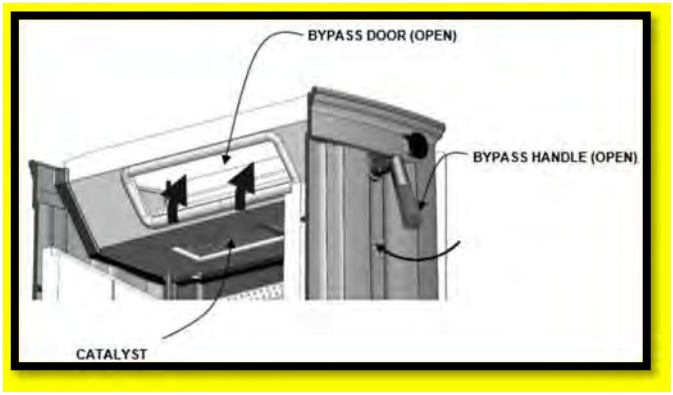



**Figure 16 – Bypass Open**

**CATALYST THERMOMETER:** The catalyst thermometer monitors the downstream temperature of the catalysts, and indicates when the stove is in the active range for the catalysts. The catalyst probe should be spaced 3/8" from the body of the stove. When the stove is in the "active" range, the bypass handle should be closed. When the stove is in the "Inactive" range, the bypass handle should be opened until the stove heats up. If the thermometer is in the "Too Hot" range, keep the door closed, fully close the air control, and allow the stove to cool down until the thermometer falls into the "Active" Range. Once the catalyst thermometer has reached the active range, heat generated from burning smoke keeps the catalysts warm and active as long as fuel remains in the stove. The Lincoln typically operates in the 800 ºF to 1300 ºF range.




**Figure 17 – Catalyst Thermometer**

## CHOOSING FIREWOOD

Burn only natural firewood (known as cordwood) in the Lincoln Model 8640 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 damage the catalysts.

**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, GASOLINE-TYPE LANTERN FUEL, KEROSENE, CHARCOAL LIGHTER FLUID, OR SIMILAR LIQUIDS TO START OR 'FRESHEN UP' A FIRE IN THIS HEATER. KEEP ALL SUCH LIQUIDS WELL AWAY FROM THE HEATER WHILE IT IS IN USE.**

### BREAKING IN YOUR WOOD STOVE

It is imperative that your stove is "broken in" gradually. Soapstone must be "seasoned"; over-firing a new stove may cause soapstone to crack or may damage other stove parts. Natural moisture in the freshly quarried soapstone must be driven out slowly to minimize the “shock” to the stone 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 shortly after first firing. 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, cast iron, and soapstone components of your stove will give you many years of trouble-free use. With use, the color of the soapstone may change and small fractures may appear on the surface. These changes do not affect the function of the stove. If a panel breaks completely, it must be replaced

Avoid the following conditions that can cause the glass, soapstone, 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.

## PROTECT YOUR HEARTH

While your stove radiates heat slowly and evenly when in use, it also absorbs moisture condensations when not in use. Specifically, true with a brand-new stove, but also for stoves during the off season, your stove and chimney flue has moisture in it. During the early stages of use and during certain heating conditions, this condensation can turn to a liquid. This dark liquid can find a way through the bottom of your stove and onto your hearth. We recommend placing some pieces of aluminum foil or other non-combustible material in the area around each of the legs of the stove temporarily to catch this liquid until the moisture has been removed from the heating system. As the system becomes seasoned these can be removed for normal use.

## A NOTE ABOUT MAJOLICA ENAMELS

The porcelain Majolica enamels Hearthstone uses are a natural glass-based product. The Majolica process consists of a neutral opaque color base, usually an off-white, with a translucent color applied over it. It is essentially molten-glass applied as a powder and each coat is fused to the iron in our ovens at nearly 2000 F. The darkness of the color is dependent upon the thickness of the translucent color over the base color, the thickness of the part and the oven temperatures. Details in the iron allow for the molten glass to pool darkly in low places and be thinner on edges of detail. Color variations are what makes it so beautiful. Please expect variations in color as this is a normal part of the process. Crazing (minuscule lines in the glaze) is common with repeated heating and cooling. or extreme use. Crazing has no significant effects on the ceramics, it is cosmetic and in the top coat only. Majolica finishes are applied by artists; having been used on ceramic pottery for hundreds of years. Antique Majolica plates, saucers, cups and teapots are normally crazed to varying degrees and have color variations piece to piece.
Enjoy a lifetime of beauty with this classic finish we are proud to offer.

## BUILDING A BREAK IN FIRE

1) Open the bypass handle. 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) Fully open the primary air control by pulling the control handle towards you, away from the firebox.
3) Light the paper under the kindling. Leave the door slightly ajar momentarily until the kindling has started to burn and draft begins to pull.
4) Close the door and allow the fire to burn. Keep the door closed while the stove is in use.
5) KEEP A WATCHFUL EYE ON YOUR STOVE to maintain a steady, low-heat fire. Your first fire should make the stove warm but **not hot to the**

**touch**. Visible steam, or boiling moisture and hissing indicate the soapstone is too hot. At most, a few small chunks of wood should be added to the fire to reach safe break-in temperatures.

6) Once the stove is warm but **not hot to the touch,** close the primary air control by pushing it fully inward toward the stove to allow the fire to die out completely.

7) 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 bypass handle. 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) Fully open the primary air control by pulling the lever completely out, away from the firebox.

3) Light the paper under the kindling. Leave the front door slightly ajar momentarily until the kindling begins to burn and draft begins to pull.

4) Close the door and allow the fire to burn.

5) 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.**

6) Once the fire is burning well, and the catalyst thermometer indicates that the stove is in the active range, close the bypass handle. Now the combustion products are passing through the catalytic combustor, and your stove will be burning at its optimal efficiency.

7) After closing the bypass door, allow the stove to run on a high setting for around 20 minutes to ensure the catalytic combustor stays in the active range. This will also allow the fire to burn off any residue on the door glass from any previous low-burn fires

8) Use the primary air control to regulate the desired rate of burn. Pull the handle towards you for a higher burn rate, and push the handle towards the stove for a lower burn rate. The air control does not close completely.

**Note:** Always remember to open the bypass 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 at a medium to high firing rate for about 10 minutes to ensure that the catalysts reach approximately 600 °F. Once the catalysts reach operating temperature, the bypass handle can be closed. When reloading the stove, try to keep an open path behind the Lower Primary Air Opening (LPAO). It is helpful to leave a small valley in the coal bed behind the LPAO to insure faster re-lighting.

### CATALYTIC COMBUSTOR OPERATION

The Lincoln uses a catalytic combustor to ensure highly clean and efficient burns. The catalytic combustor is made from a stainless steel corrugation that is coated with a catalytic material. The catalytic combustor becomes active around 500 ºF (260ºC), helping to burn up smoke and any remaining particles that were not fully burned in the firebox. During the startup of a cold stove, a medium to high firing rate must be maintained for about 20 minutes. This ensures that the stove, catalysts, and fuel are all stabilized and at proper operating temperatures. Even though it is possible to have gas temperatures reach 500 °F (260ºC) within 2 to 3 minutes after a fire is started, if the fire is allowed to die down immediately, it may go out or the combustor may stop working. Once the stove and catalytic combustor heat up, heat generated from burning smoke keeps the catalysts warm and active as long as fuel remains in the stove. You stove will burn the cleanest and most efficiently when the catalysts are in the active range. There should be little to no visible smoke from your chimney when the catalysts are in the active zone and fully functional.

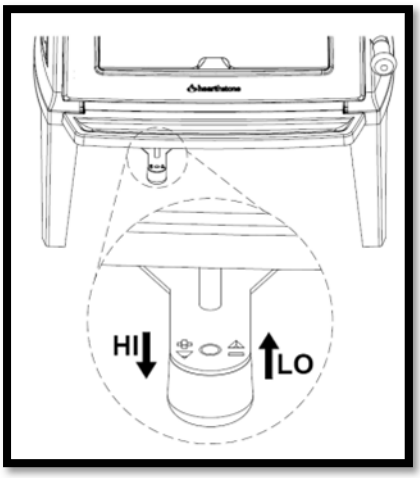



**Figure 17 – Air Control Position**

### BURN RATE

**This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual**

***LOW BURN:*** Move the air control lever all the way inward toward the stove. (*See figure 17*). This closes the air shutter to its minimum opening. A low burn rate over extended periods is not advisable as it can promote the accumulation of creosote. Inspect the venting system frequently if using low burn rates consistently.

***MEDIUM LOW BURN:*** With the primary air control in the low position, pull the air control forward (a little less than 1/4”). A medium-low burn rate is the typical setting and is preferable if the stove is unattended. At this burn rate, a little goes a long way.

***MEDIUM HIGH BURN:*** With the primary air control in the low position, pull the air control forward (a little less than 3/8”)

***HIGH BURN:*** Completely open the primary air control by moving it all the way outward toward the operator. Fully load the firebox with wood on a bed of hot coals or on an actively flaming fire. To minimize creosote accumulation, run the stove on high once or twice daily for 35 to 45 minutes to fully heat the stovepipe and chimney.

**CAUTION:** Do not burn fuel other than cordwood in your stove.

### 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-fire 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 noncombustible 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

## CATALYTIC COMBUSTOR INSPECTION AND REPLACEMENT PROCEDURES

- **WARNING: THIS WOOD HEATER CONTAINS A CATALYTIC COMBUSTOR, WHICH 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, OR IF THE CATALYTIC ELEMENT IS DEACTIVATED OR REMOVED**

It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions. Following is a list of items that should be checked on a periodic basis

-Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Actual removal of the combustor is not recommended unless more detailed inspection is warranted because of decreased performance. If any of these conditions exists, refer to Catalyst Troubleshooting section of this owner's manual.

-This catalytic (or hybrid) heater is equipped with a thermometer to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 500 °F, and often reach temperatures in excess of 1,000 °F. If catalyst temperatures are not in excess of 500 °F, refer to the Catalyst Troubleshooting section of this owner's manual.

You can get an indication of whether the catalysts are working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalysts light-off has been achieved, to the amount of smoke leaving the chimney when the smoke is not routed through the combustor (bypass mode).

1. Light stove in accordance with operator's instructions

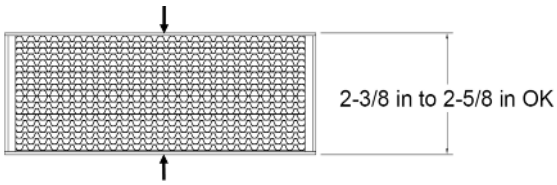



**Figure 21 - Acceptable Catalytic Distortion**

2. With smoke routed through the catalysts, go outside and observe the emissions leaving the chimney.
3. Engage the bypass mechanism and again observe the emissions leaving the chimney. Significantly more smoke will be seen when the exhaust is not routed through the combustor (bypass mode)

## INSPECTING THE CATALYSTS AND REMOVING/REPLACING THE BAFFLE

1. Allow the stove and ashes to fully cool.
2. Remove the metal baffle protector by sliding it to the left or right, and then rotating it towards you.
3. Lift up on the right-side baffle, and gently pull the left side baffle down and out of the stove

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

4. Use a small vacuum nozzle or soft bristled brush to remove any accumulated ash or soot on the face of the catalyst.
5. Inspect the catalyst for any unusual warping, corrosion, or plugged openings.
4. Use a small vacuum nozzle or soft bristled brush to remove any accumulated ash or soot on the face of the catalysts.
5. Inspect the catalysts for any unusual warping, corrosion, or plugged openings.
6. If any unusual conditions are found, remove the catalyst blocks – See replacing the catalysts.
7. Replace the baffles and baffle protector. Installation is the opposite of removal.
8. Ensure that the baffle pieces are pushed

**Figure 19a – Removing / Replacing the Baffle**

**Figure 19b – Removing / Replacing the Baffle**

## REMOVING OR REPLACING THE CATALYSTS

Refer to the Catalytic combustor warranty on page 35 for catalyst replacement information. DO NOT OPERATE UNIT WHITOUT CATALYSTS. Only remove the catalysts if required. In general, the less you handle the catalysts, the better. If any unusual conditions are found, remove the catalyst blocks

1. Allow the stove and ashes to fully cool.
2. Loosen, but do not remove the screws securing the rear heatshield. (If stove is so equipped).
3. Remove the heat shield by sliding the screw heads through the slots in the heatshield.
4. Remove the 2 bolts securing the cast iron catalyst access cover, and remove the cover.
5. Inspect the catalysts for visible damage or fly ash. If fly ash exists, gently brush the catalysts off with a narrow soft-bristle brush, or vacuum with a crevice tool.
6. If fly ash exists, or if there are suspected catalyst performance issues, fully remove the catalysts by gently pulling upwards from the ribs in the cast iron, and then pulling outwards through the catalyst access opening.
7. Remove any remaining gasket material from the opening and from the catalysts. Newer generations of stoves may not use a catalyst gasket.
8. Inspect the catalysts for any fly ash or clogging, and remove with a soft bristled brush or vacuum crevice tool. If extra cleaning is needed, follow the guidelines below:
   -You may use compressed air under 35 psi, air only, no chemicals.
   -You may soak the catalysts in a hot water mix (not boiling), 4 parts water, 1 part vinegar. Rinse with cold water until vinegar smell is mostly gone.
   -No metal tools such as gun cleaners should be used.
   -No detergents or chemicals.
9. Some warping or bowing of the catalysts over time is acceptable, as long as the catalyst gasket continues to seal. Measure the catalysts in the middle section – if the dimensions are outside the range shown in Figure 21, replace the catalysts.
10. Depending on the generation of your stove, re-gasketing the catalyst may not be necessary. If there was gasket material on the catalyst when you removed them, they will need to be re-gasketed during the installation. Beginning at one corner, re-install fiberglass gasket material on the catalysts.

**Figure 20 – Catalyst Access**

11. Wrap the gasket tape around the catalysts so it is reasonably tight. Double layer the material on three sides of the individual catalyst cartridges as shown in the following picture.

12. Once the gasket is installed on the catalysts, gently push the catalysts into the catalyst opening until the catalysts hit against the back wall of the cavity. Take care to ensure the gasket is not damaged and position the two cartridges so that the single layer gasket edges touch one another in the center. Replace the catalyst access door.

13. Replace catalyst access door.
14. Heat the stove slowly during your next fire to allow the gasket to fully expand and seal the catalysts.

## GLASS REPLACEMENT PROCEDURES

**Figure 23: Front Door assembly**

- **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 door.
3. Remove the screws from the glass clips (use penetrating oil if necessary) – Set aside for reinstallation.
4. Carefully lift the damaged glass off the door and discard.
5. Remove any remaining glass and old gasket material.
6. Clean the screw holes and place a small amount of anti-seize compound in each one.
7. Install a new glass gasket in the glass gasket groove.

8. Place the new glass onto the door.
9. **Important! Center the glass** and ensure that the edges of the glass are parallel with the edges of the opening.
10. 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 1/8$^{th}$ of a turn after they seat. The glass will break at this point if not positioned correctly.
11. Apply a light film of anti-seize lubricant on the door's hinge pins if needed.
12. Install the door.
13. After 5 or 6 fires, check the glass retainer screws, and retighten if necessary.

**Required Glass Kit:** Part Number: 93-58925. Use only Ceramic, or Neoceram glass. Contact your Hearthstone 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 primary air control fully open for 35 - 45 minutes daily to burn out creosote deposits from within the stove and the venting system.

After reloading with wood, burn the stove with the primary air control fully open 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 operating temperatures are too low or 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 Hearthstone 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.

**Required Glass Kit:** PN: 93-xxx.

# 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 the optional outside air adaptor connected to an air duct, 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 | Fully open the primary air control one minute before opening doors, and ensure the bypass is open before opening door. |
| | 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. |
| | Bypass not closed | Ensure that the bypass door is closed when the catalysts are in the active range. |
| | Catalysts not functioning | Inspect catalysts for damage, ash build-up, or plugging. Brush catalysts with a soft-bristled brush, or vacuum lightly. Replace if required. Follow instructions to ensure catalyst light-off. |
| | 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 | Fully open the primary air control one minute before opening the door and keep it fully open for a few minutes after reloading. Ensure the bypass door is open before opening the door |
| | Extra Low Burn Rate | Burn the stove at a higher burn rate. |
| | 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. |
| UNCONTROLL-ED OR SHORT BURN | Unsealed or Open Door | Close the door tightly or replace the gaskets.<br>Air leakage around glass gasket – replace gasket |
| | Excessive Draft | Check the installation. Operate at LOW BURN. 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. |
| | Low Burn Rate | Operate the stove at a higher burn rate. |
| | 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. |

## CATALYST TROUBLESHOOTING GUIDE

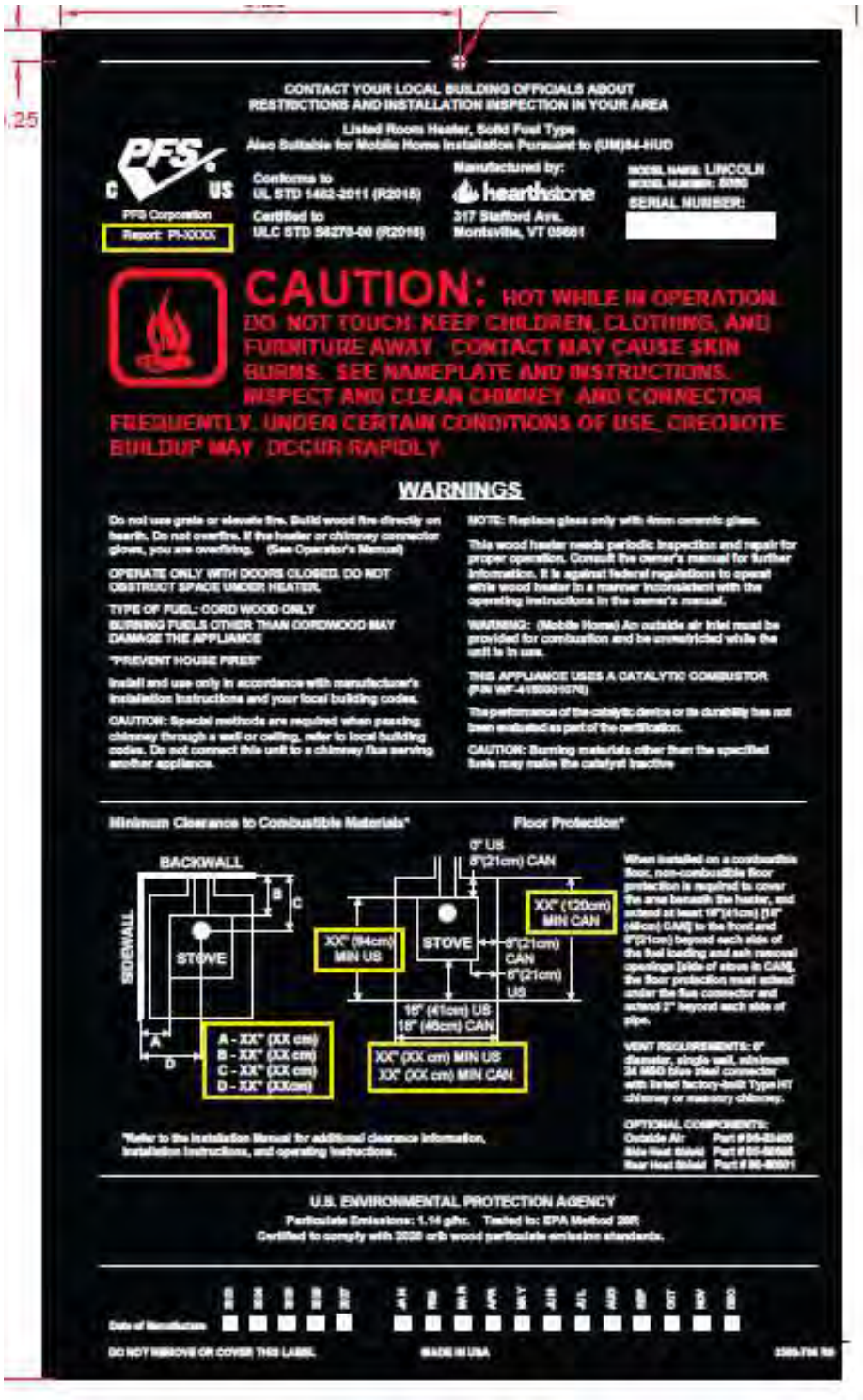
| PROBLEM | POSSIBLE CAUSE | SOLUTIONS |
|---|---|---|
| FLY ASH BUILD UP ON CATALYSTS | Catalysts have not maintained light-off temperature | Brush cold combustor with soft-bristled brush or vacuum lightly. Follow instructions in the manual for a proper catalyst light-off |
| | Burning materials that cause a lot of char and fly-ash | Don't burn cardboard, gift wrap paper, or garbage. Burn only dry, seasoned wood, per the owner's manual. |
| | Bypass closed too soon | Follow instructions in the manual for a proper catalyst light-off |
| CATALYSTS PLUGGING OR MASKING (SOOT/CRESO-TE) | Burning wet, pitchy woods, or burning large loads of small diameter wood with the combustor in the operating position without catalyst light off occurring | Burn dry seasoned wood. Follow instructions in the manual for a proper catalyst light-off, and ensure catalyst light-off as occurred before closing bypass damper. It may be possible to burn the soot or creosote off by building a hot fire, and allowing the stove to run until the catalysts are well within the operating range before closing the bypass. Continue to run the stove at a high temperature for one hour, while ensuring the catalysts stay in the upper operating range, but not too hot. |
| WARPING OR BOWING OF THE CATALYSTS | Excessive catalyst temperatures for long periods of time. | Ensure that the catalysts remain in the operating zone, and does not get to hot. Reduce air control settings for a lower burn rate to ensure catalyst temperatures do not exceed the operating range. |

# REPLACEMENT PARTS & OPTIONAL ACCESSORIES

| PART # | DESCRIPTION |
|---|---|
| | |
| | **REPLACEMENT PARTS** |
| | BOTTOM HEAT SHIELD |
| | DOOR HINGE |
| | |
| | |
| | |
| | BAFFLE GUARD |
| | |
| | DOOR CATCH |
| | DOOR LATCH |
| | |
| | CATALYST THERMOMETER |
| | |
| | **REPLACEMENT KITS AND ACCESSORIES** |
| 96-53400 | OUTSIDE AIR KIT |
| | GASKET KIT |
| | GLASS KIT |
| | HANDLE KIT |
| | FRONT DOOR LATCH KIT |
| | CATALYST REPLACEMENT KIT |
| | BAFFLE KIT |
| 90-68601 | Rear Heatshield |
| 90-68605 | Side Heatshield (Single) |
| | |
| | |
| | |
| | |
| | |
| | |

Refer to the Illustrated Parts list for further detail about stove components, available online at www.hearthstonestoves.com.

# SAFETY LABEL



# LIMITED WARRANTY

**These warranties give you specific legal rights. You may also have other rights, which vary from State to State.**

Hearthstone Quality Home Heating Products, Inc. (Hearthstone) warrants to the original retail purchaser only (the "Original Purchaser") the new appliance manufactured by Hearthstone, purchased by the Original Purchaser and installed by an authorized Hearthstone dealer or their designated representative against any of the occurrences listed in this document that result from defects in material or workmanship. This warranty is not transferrable. All obligations of Hearthstone under this document commence on the date of the Original Invoice (the "Purchase Date"). The term "Limited Lifetime" is defined as 10 years from the beginning of warranty coverage.
Hearthstone appliances are designed to be operated only with the fuels listed in your owner's manual.

**Catalytic combustor LIMITED LIFETIME WARRANTY:** The catalytic combustors are covered directly by the combustor manufacturer, Applied Ceramics. Included with your stove you will find the LIMITED LIFETIME WARRANTY for the catalysts, as well as a warranty card.

Catalyst Model Number: ACI-6M2 Catalyst Manufacturer: APPLIED CERAMICS

APPLIED CERAMICS warrants to the consumer who purchases a FIRECAT STEEL COMBUSTOR as a component in an EPA certified solid fuel appliance, to replace at no charge to the consumer the FIRECAT STEEL COMBUSTOR that ceases to function with two (2) years from the date of purchase by the original consumer, provided that the following conditions are met:

(1) A copy of the original bill of sale that includes place and date of purchase must be submitted with the warranty claim.
(2) The original FIRECAT STEEL COMBUSTOR must be returned to APPLIED CERAMICS
(3) The FIRECAT STEEL COMBUSTOR must not have been mechanically abused, nor must the wrong fuels have been used in the appliance.

If after two years the FIRECAT STEEL COMBUSTOR fails to function, the prorated warranty will allow replacement at the following special price schedule:

| | |
|---|---|
| Year 3 | $130.00 |
| Year 4 | $140.00 |
| Year 5 | $150.00 |
| Year 6 | $160.00 |
| Year 7 | and after at current retail price |

Conditions 1, 2, and 3 also apply to the Prorated portion of the warranty. Any EPA certified solid fuel appliance will receive one replacement catalyst for each defective catalyst returned during the three year period. The consumer will be responsible for any removal, any servicing, and return of any items required for filing the warranty claim. This warranty is APPLIED CERAMIC'S exclusive warranty, and APPLIED CERAMICS, disclaims any other express or implied warranty for the FIRECAT STEEL COMBUSTOR, including any warranty or merchantability fitness for a particular use.

Ensure the catalyst is well wrapped and padded for shipment in bubble wrap, or similar material. Ship the catalyst with padding inside of a cardboard box.

All warranty claims must include $12.50 for postage and handling within the continental U.S. Alaska and Canada claims must include $35.00.

Please allow 2-3 weeks for delivery. Order online @ www.firecatcombustors.com

Please read and understand the full warranty. Please return the completed warranty card promptly to Applied Ceramics. The warranty card, and any warranty claims can be shipped to:
**Applied Ceramics**
**55555 Pleasantdale Road**
**Doraville, GA, 30340**

**Stove components Limited Warranty**

| Warranty Period | Wood | Gas | Pellet | Covered Components |
|---|---|---|---|---|
| Limited Lifetime | X | X | X | Stone |
| | X | X | X | Cast iron not listed elsewhere |
| | X | | | Clean burning air supply system* |
| 5 Year | X | X | X | Door handles and latches |
| | X | X | X | Steel Components and Firebox |
| | | X | | Burner and logs |
| 3 Year | | | X | Burn Pot and Baffles |
| 2 Year | X | X | X | Appliance Electrical and Gas Components |
| | X | X | | Refractory, Vermiculite Panels, Baffles |
| 1 Year | X | X | X | Enamel finish against peeling or fading |
| | X | X | X | Accessories |
| | X | X | X | Glass |
| | X | | | Ash Grate |
| | X | X | X | All components not listed elsewhere |

Any parts repaired or replaced during the limited warranty period will be warranted under the terms of the limited warranty for a period not to exceed the remaining term of the original limited warranty or one year, whichever is longer.
**Parts:** Hearthstone will replace through an authorized dealer, defective parts covered by the foregoing warranty at no charge.
**Labor:** Within the first (1st) year after the Purchase Date, Hearthstone will pay for warranty labor performed by an authorized Dealer at Hearthstone's published labor rates in effect at the time the labor is performed only if the appliance is installed by an authorized dealer or their designated representative. Otherwise or thereafter, the Original Purchaser is responsible for the cost of labor.
**Shipping cost for parts:** Within the first ninety (90) days after the Purchase Date, Hearthstone will pay for the shipping of appliance parts covered by any of the foregoing warranties to and from Hearthstone or an authorized Dealer, as the case may be. Thereafter, the Original Purchaser is responsible for all shipping costs related to shipping appliance parts to and from Hearthstone or an authorized Dealer, as the case may be.
**Shipping cost for the appliance:** Within the first (1st) year after the Purchase Date, if the Original Purchaser is instructed to return the appliance to Hearthstone or an authorized Dealer for repair, Hearthstone will pay fifty percent (50%) and the Original Purchaser will pay fifty percent (50%) of the shipping costs related to shipping the appliance to and from Hearthstone or an authorized Dealer, as the case may be. Thereafter, the Original Purchaser is responsible for one hundred percent (100%) of all of the shipping costs related to shipping the appliance to and from Hearthstone or an authorized Dealer, as the case may be. Notwithstanding any other provision of this document, in no event will Hearthstone pay for any Dealer fees or other fees for pick up or delivery of the appliance returned for repair; the Original Purchaser shall be responsible for any such fees.

**EXCLUSIONS & CONDITIONS**
The warranties contained in this document do not cover, nor is Hearthstone responsible for:

1. Damages resulting from:
    a. Failure to install, operate, or maintain the appliance in accordance with the owner's manual, operating instructions, installation instructions, or safety rating label provided with the appliance.
    b. Over-firing the appliance. Over-firing can be identified by, but not limited to, warped cast iron or steel, rust colored cast iron, bubbling, cracking and discoloration of steel or enamel finishes.
    c. Failure to install the appliance in accordance with all national or local building codes.
    d. Shipping or improper handling.
    e. Improper operation, abuse, misuse, continued operation with damaged, corroded, or failed components, accident, or improper/incorrect service or repairs.
    f. Environmental conditions, inadequate ventilation, negative pressure, or improper drafting caused by tightly sealed constructions, insufficient make-up air supply, or air handling devices such as exhaust fans, forced air furnaces, or other such causes.
    g. Damage caused by direct exposure to water.
    h. Use of fuels other than those specified in the owner's manual.
    I. Installation or use of components not supplied with the appliance, or any other components not expressly authorized and approved by Hearthstone.
    J. Modifications of the appliance not expressly authorized and approved by Hearthstone in writing
    K. Interruptions or fluctuations of electrical power supplied to the appliance.
2. All stones are warranted against cracking or breakage due to thermal stress, excluding surface and hairline cracks and scratches that do not affect the operation, or safety of the appliance.
3. Repair or replacement of wear parts. Such parts that are subject to normal wear and tear during the warranty period such as paint, gaskets, baffles, refractory materials, ash grates, and glass.
4. Damage resulting from installation, modification, alteration, repair or service of the appliance by any party other than an authorized Hearthstone dealer (a "Dealer") or their designated representative, or Hearthstone.
5. Damage due to water or condensation due to installation of the appliance in a high moisture area.
6. Damage due to installation of the appliance in an atmosphere contaminated by damaging chemicals, including but not limited to chlorine, fluorine or salts.
7. Scratches on glass, enameled surfaces or stones due to mechanical abrasion.
8. Noise caused by expansion or contraction caused by the heating and cooling of the appliance.
9. Odors caused by the heating of the appliance, or surrounding materials
10. Consequential damage caused by leaking of condensate during startup
11. A defect in any part of the appliance if the Original Purchaser fails to comply with Hearthstone's or a Dealer's request to ship the part or the appliance to Hearthstone or a Dealer, as the case may be.
12. Replacement stones and enameled parts are taken from current stock, and may not match originals in color, grain, or pattern. Hearthstone will supply replacement parts for discontinued parts in finishes or colors as available, or at their discretion.
13. Hearthstone's obligation under this warranty does not extend to the appliance's ability to heat the desired space. Information is provided to assist the customer and the dealer in selecting the appropriate appliance for the application. Consideration must be given to appliance location and configuration, environmental conditions, insulation and air tightness of the structure.

THE WARRANTIES CONTAINED IN THIS DOCUMENT ARE EXCLUSIVE AND ARE GIVEN BY HEARTHSTONE AND ACCEPTED BY THE ORIGINAL PURCHASER IN LIEU OF ALL OTHER EXPRESS WARRANTIES AND ANY OBLIGATIONS, LIABILITIES, RIGHTS, CLAIMS, OR REMEDIES IN CONTRACT OR TORT, WHETHER OR NOT ARISING FROM HEARTHSTONE'S NEGLIGENCE, ACTUAL OR IMPUTED. ALL IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE GIVEN ONLY TO THE EXTENT REQUIRED BY FEDERAL OR STATE LAW. EXCEPT AS OTHERWISE REQUIRED BY STATE LAW, UPON THE EXPIRATION OF THE EXPRESS LIMITED WARRANTIES CONTAINED HEREIN, NO IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL APPLY TO THE SUBJECT APPLIANCE. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

THE WARRANTIES CONTAINED IN THIS DOCUMENT EXTEND ONLY TO THE ORIGINAL PURCHASER OF THE APPLIANCE WARRANTED HEREUNDER. THEY ARE NOT TRANSFERRABLE AND DO NOT EXTEND TO ANY SUBSEQUENT OWNERS.

UNDER NO CIRCUMSTANCES SHALL HEARTHSTONE BE LIABLE TO THE ORIGINAL PURCHASER OR ANY OTHER PERSON FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO DAMAGE TO PROPERTY OR PERSONAL INJURIES, WHETHER ARISING OUT OF LOSS OF USE, BREACH OF WARRANTY, TORT, OR OTHERWISE, EVEN IF HEARTHSTONE HAS BEEN APPRAISED OF THE POSSIBILITY OF SUCH DAMAGES. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

## QUALIFYING FOR WARRANTY COVERAGE

To obtain performance of any obligation under this document, the Original Purchaser must, within the applicable warranty time period, contact their original Hearthstone dealer, or the current responsible local Hearthstone dealer, for instructions regarding the return of defective parts for repair, the return of the appliance for repair, or to schedule a Dealer service call. The Original Purchaser should refer to the Dealer Network search engine contained on Hearthstone's Web site (www.hearthstonestoves.com) if the original dealer is not available, to find a Hearthstone dealer nearest to the Original Purchaser's location.

## REMEDY

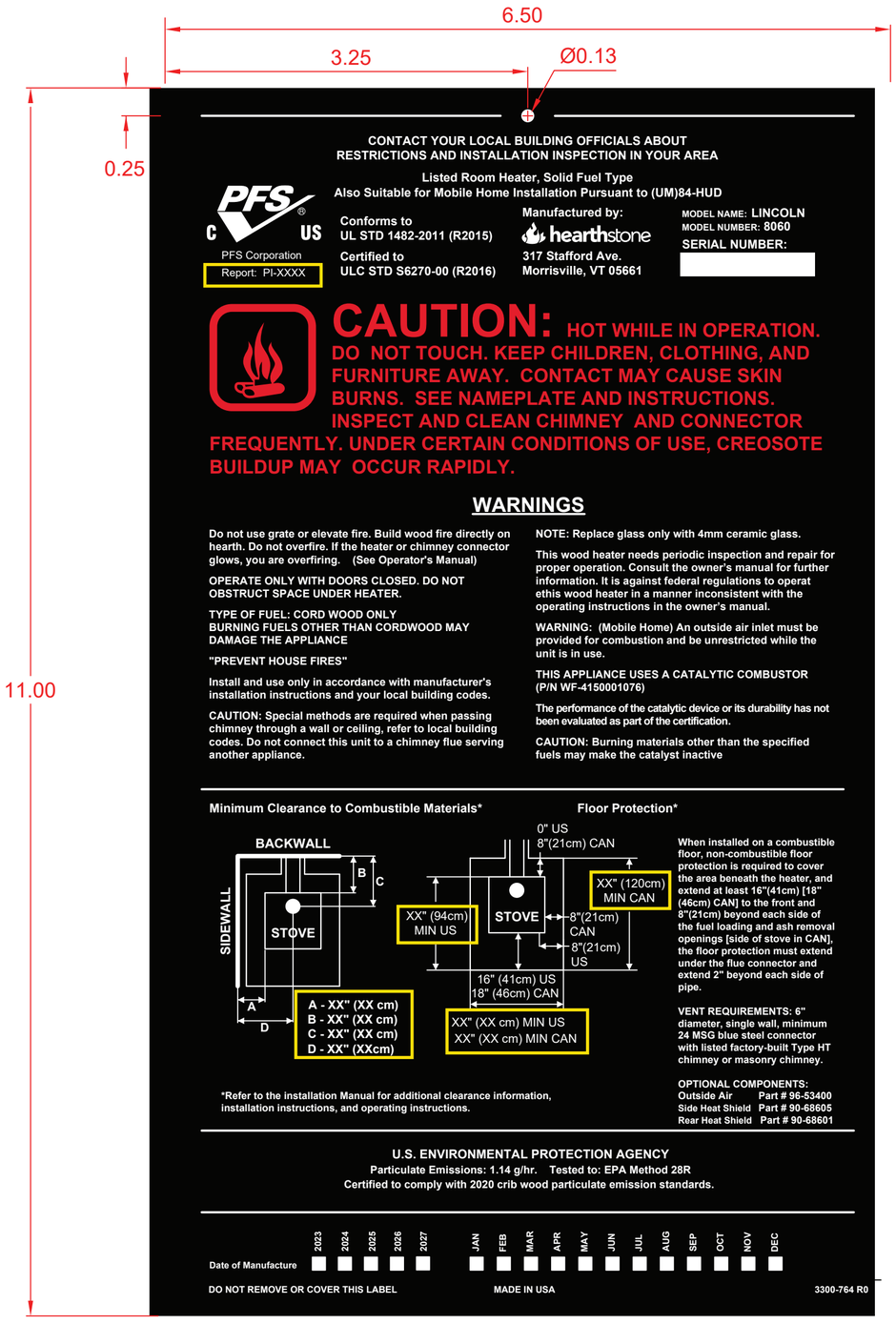
The remedy for any breach of the foregoing warranties will consist of repair or replacement, at Hearthstone's option, of any covered defect in the appliance. When the Original Purchaser contacts a Hearthstone Dealer, the Dealer on behalf of Hearthstone, as the case may be, will instruct the Original Purchaser to either return the defective part, or the entire appliance (if requested), to the Dealer or Hearthstone or allow a Dealer to make a service call at the place where the appliance is located. Hearthstone may require that a digital picture be provided to support the claim. Notwithstanding any other provision of this document, the Original Purchaser shall pay for any fees and service charges related to a Dealer's service call or the shipping charges associated with the return.

## WARRANTY REGISTRATION

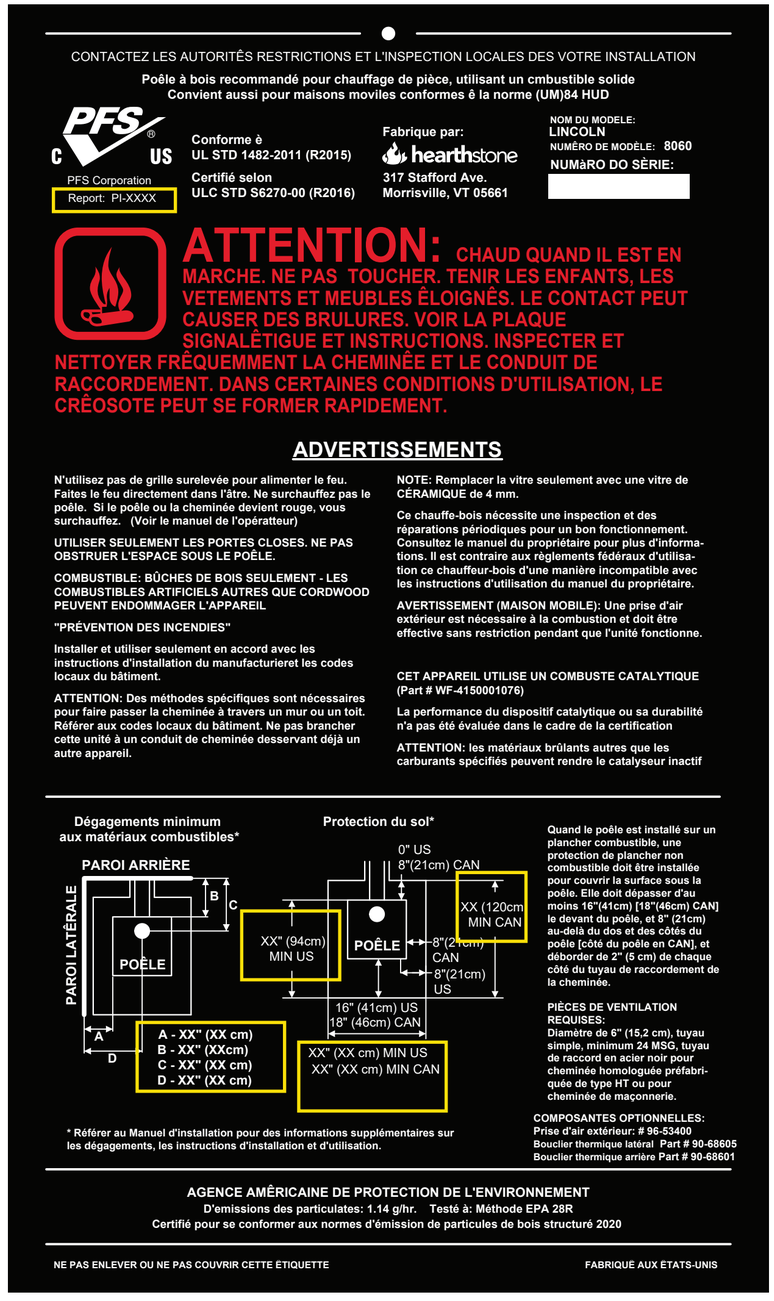
The Original Purchaser can complete their warranty registration on our website at www.hearthstonestoves.com, or send a completed and signed Warranty Registration Form, which is enclosed in the appliance document packet, to the following address:

Hearthstone Quality Home Heating Products, Inc.
Warranty Department
317 Stafford Avenue
Morrisville, VT 05661

**NOTE: SENDING IN THE SIGNED WARRANTY REGISTRATION FORM IS *NOT REQUIRED* AS A CONDITION OF WARRANTY COVERAGE OR HEARTHSTONE'S PERFORMANCE.**




FRONT / ENGLISH




BACK / FRENCH

NOTES:
1. MATERIAL: .020 ALUMINUM
2. PRINTING: BLACK LABEL WITH SILVER/RED LETTERS

| REVISIONS | | | | |
|---|---|---|---|---|
| ECO | REV. | DESCRIPTION | DATE | APPROVED |
| | 0 | INITIAL RELEASE FOR NEW CERTIFICATION | 8/17/22 | SPB |

VIEWS ARE THIRD ANGLE

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± 1/64 .XX± .015 ± 1/4°
.XXX± .005
1.) DIMENSIONS ARE IN INCHES / MM
2.) ALL MACHINED SURFACES TO BE DE-BURRED AND SMOOTHED
MATERIAL: SEE NOTES
FINISH: SEE NOTES

CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE

| | APPROVALS | DATE |
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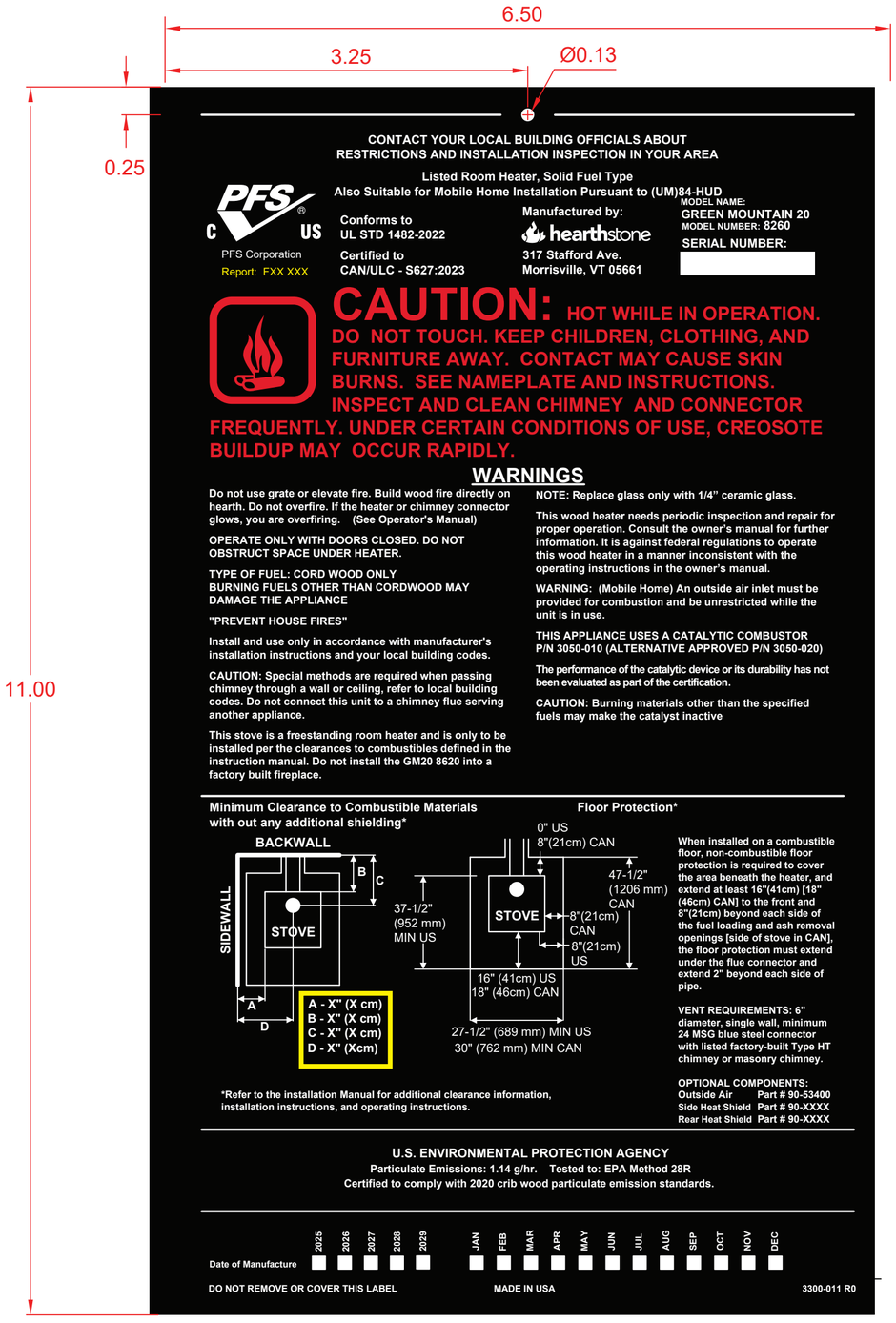
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LABEL: SAFETY

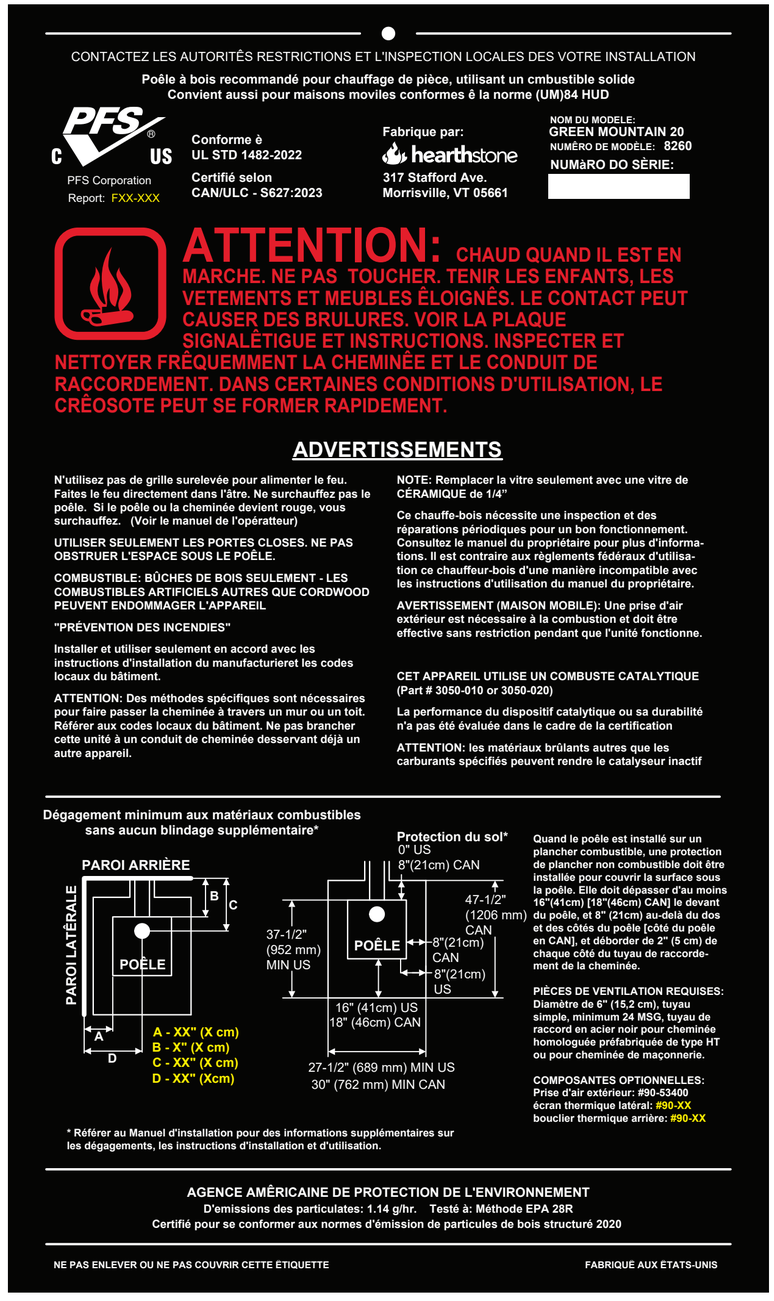
LINCOLN 8060

SIZE B | HEARTHSTONE DWG. NO. 3300-764 | REV. 0

SCALE: 1:1 | HERGOM DWG. NO. | SHEET 1 OF 2




FRONT / ENGLISH




BACK / FRENCH

NOTES:
1. MATERIAL: .020 ALUMINUM
2. PRINTING: BLACK LABEL WITH SILVER/RED LETTERS

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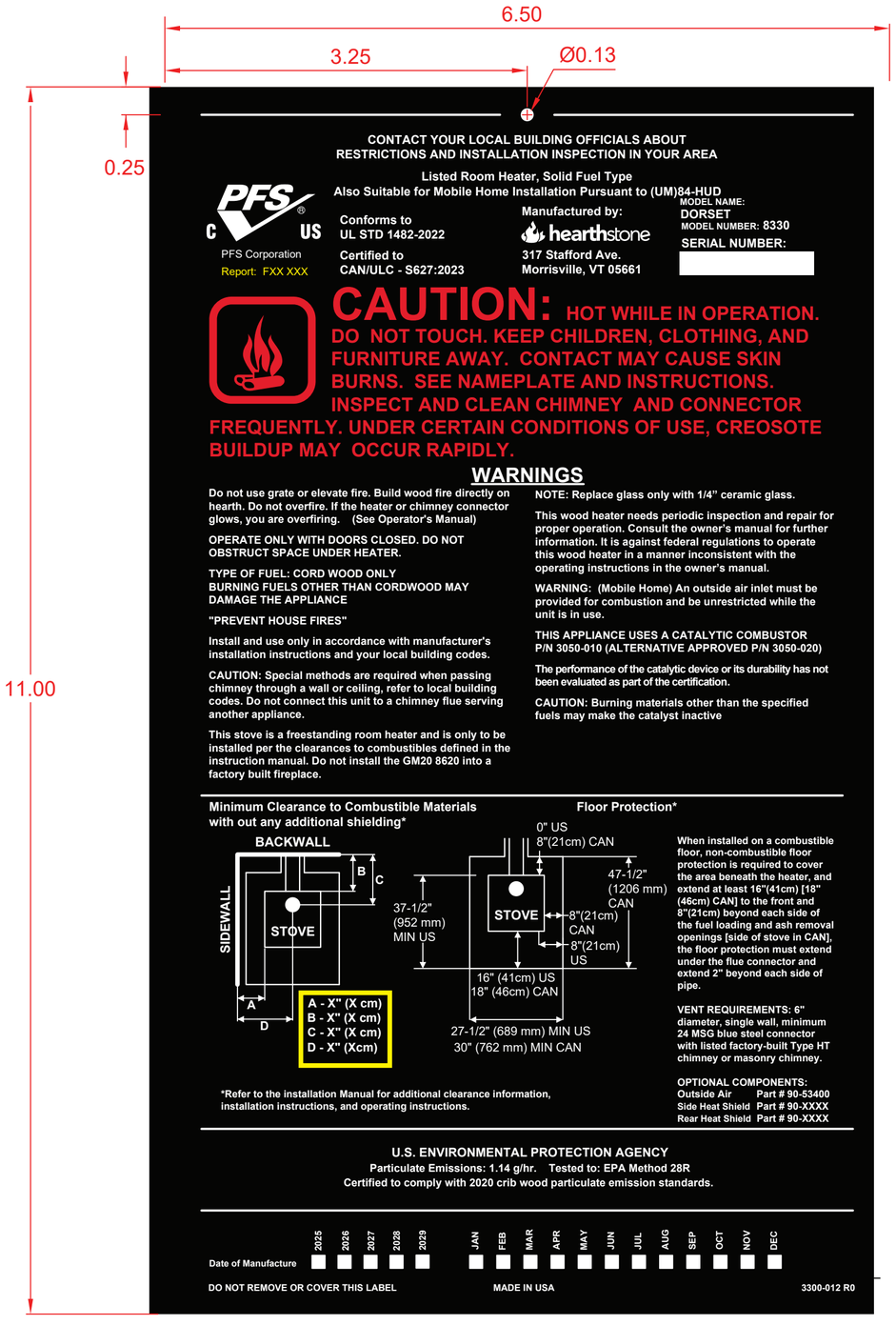
hearthstone

LABEL: SAFETY

GREEN MOUNTAIN 20 8620

SIZE B | HEARTHSTONE DWG. NO. 3300-011 | REV. 1

SCALE: 1:1 | HERGOM DWG. NO. | SHEET 1 OF 2




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

Listed Room Heater, Solid Fuel Type
Also Suitable for Mobile Home Installation Pursuant to (UM)84-HUD

PFS Corporation
Report: FXX XXX

Conforms to
UL STD 1482-2022

Certified to
CAN/ULC - S627:2023

Manufactured by:
hearthstone
317 Stafford Ave.
Morrisville, VT 05661

MODEL NAME: DORSET
MODEL NUMBER: 8330
SERIAL NUMBER:

**CAUTION:** HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING, AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS. INSPECT AND CLEAN CHIMNEY AND CONNECTOR FREQUENTLY. UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY.

## WARNINGS

Do not use grate or elevate fire. Build wood fire directly on hearth. Do not overfire. 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 FUELS OTHER THAN CORDWOOD MAY DAMAGE THE APPLIANCE

"PREVENT HOUSE FIRES"

Install and use only in accordance with manufacturer's installation instructions and your local building codes.

CAUTION: Special methods are required when passing chimney through a wall or ceiling, refer to local building codes. Do not connect this unit to a chimney flue serving another appliance.

This stove is a freestanding room heater and is only to be installed per the clearances to combustibles defined in the instruction manual. Do not install the GM20 8620 into a factory built fireplace.

NOTE: Replace glass only with 1/4" ceramic glass.

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

WARNING: (Mobile Home) An outside air inlet must be provided for combustion and be unrestricted while the unit is in use.

THIS APPLIANCE USES A CATALYTIC COMBUSTOR P/N 3050-010 (ALTERNATIVE APPROVED P/N 3050-020)

The performance of the catalytic device or its durability has not been evaluated as part of the certification.

CAUTION: Burning materials other than the specified fuels may make the catalyst inactive

**Minimum Clearance to Combustible Materials with out any additional shielding***




**Floor Protection***




When installed on a combustible floor, non-combustible floor protection is required to cover the area beneath the heater, and extend at least 16"(41cm) [18" (46cm) CAN] to the front and 8"(21cm) beyond each side of the fuel loading and ash removal openings [side of stove in CAN], 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.

OPTIONAL COMPONENTS:
Outside Air Part # 90-53400
Side Heat Shield Part # 90-XXXX
Rear Heat Shield Part # 90-XXXX

*Refer to the installation Manual for additional clearance information, installation instructions, and operating instructions.

U.S. ENVIRONMENTAL PROTECTION AGENCY
Particulate Emissions: 1.14 g/hr. Tested to: EPA Method 28R
Certified to comply with 2020 crib wood particulate emission standards.

Date of Manufacture: 2025 2026 2027 2028 2029 JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

DO NOT REMOVE OR COVER THIS LABEL MADE IN USA 3300-012 R0

FRONT / ENGLISH

CONTACTEZ LES AUTORITÉS RESTRICTIONS ET L'INSPECTION LOCALES DES VOTRE INSTALLATION

Poêle à bois recommandé pour chauffage de pièce, utilisant un cmbustible solide
Convient aussi pour maisons moviles conformes ê la norme (UM)84 HUD

PFS Corporation
Report: FXX-XXX

Conforme è
UL STD 1482-2022

Certifié selon
CAN/ULC - S627:2023

Fabrique par:
hearthstone
317 Stafford Ave.
Morrisville, VT 05661

NOM DU MODELE: DORSET
NUMÉRO DE MODÈLE: 8330
NUMâRO DO SÈRIE:

**ATTENTION:** CHAUD QUAND IL EST EN MARCHE. NE PAS TOUCHER. TENIR LES ENFANTS, LES VETEMENTS ET MEUBLES ÊLOIGNÊS. LE CONTACT PEUT CAUSER DES BRULURES. VOIR LA PLAQUE SIGNALÊTIGUE ET INSTRUCTIONS. INSPECTER ET NETTOYER FRÊQUEMMENT LA CHEMINÊE ET LE CONDUIT DE RACCORDEMENT. DANS CERTAINES CONDITIONS D'UTILISATION, LE CRÊOSOTE PEUT SE FORMER RAPIDEMENT.

## ADVERTISSEMENTS

N'utilisez pas de grille surelevée pour alimenter le feu. Faites le feu directement dans l'âtre. Ne surchauffez pas le poêle. Si le poêle ou la cheminée devient rouge, vous surchauffez. (Voir le manuel de l'opératteur)

UTILISER SEULEMENT LES PORTES CLOSES. NE PAS OBSTRUER L'ESPACE SOUS LE POÊLE.

COMBUSTIBLE: BÛCHES DE BOIS SEULEMENT - LES COMBUSTIBLES ARTIFICIELS AUTRES QUE CORDWOOD PEUVENT ENDOMMAGER L'APPAREIL

"PRÊVENTION DES INCENDIES"

Installer et utiliser seulement en accord avec les instructions d'installation du manufacturieret les codes locaux du bâtiment.

ATTENTION: Des méthodes spécifiques sont nécessaires pour faire passer la cheminée à travers un mur ou un toit. Référer aux codes locaux du bâtiment. Ne pas brancher cette unité à un conduit de cheminée desservant déjà un autre appareil.

NOTE: Remplacer la vitre seulement avec une vitre de CÉRAMIQUE de 1/4"

Ce chauffe-bois nécessite une inspection et des réparations périodiques pour un bon fonctionnement. Consultez le manuel du propriétaire pour plus d'informations. Il est contraire aux règlements fédéraux d'utilisation ce chauffeur-bois d'une manière incompatible avec les instructions d'utilisation du manuel du propriétaire.

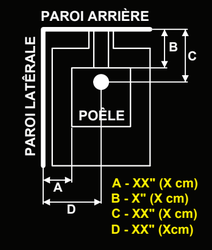
AVERTISSEMENT (MAISON MOBILE): Une prise d'air extérieur est nécessaire à la combustion et doit être effective sans restriction pendant que l'unité fonctionne.

CET APPAREIL UTILISE UN COMBUSTE CATALYTIQUE (Part # 3050-010 or 3050-020)

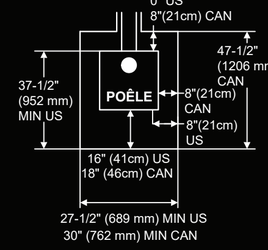
La performance du dispositif catalytique ou sa durabilité n'a pas été évaluée dans le cadre de la certification

ATTENTION: les matériaux brûlants autres que les carburants spécifiés peuvent rendre le catalyseur inactif

**Dégagement minimum aux matériaux combustibles sans aucun blindage supplémentaire***




**Protection du sol***




Quand le poêle est installé sur un plancher combustible, une protection de plancher non combustible doit être installée pour couvrir la surface sous la poêle. Elle doit dépasser d'au moins 16"(41cm) [18"(46cm) CAN] le devant du poêle, et 8" (21cm) au-delà du dos et des côtés du poêle [côté du poêle en CAN], et déborder de 2" (5 cm) de chaque côté du tuyau de raccordement de la cheminée.

PIÈCES DE VENTILATION REQUISES: Diamètre de 6" (15,2 cm), tuyau simple, minimum 24 MSG, tuyau de raccord en acier noir pour cheminée homologuée préfabriquée de type HT ou pour cheminée de maçonnerie.

COMPOSANTES OPTIONNELLES:
Prise d'air extérieur: #90-53400
écran thermique latéral: #90-XX
bouclier thermique arrière: #90-XX

* Référer au Manuel d'installation pour des informations supplémentaires sur les dégagements, les instructions d'installation et d'utilisation.

AGENCE AMÊRICAINE DE PROTECTION DE L'ENVIRONNEMENT
D'emissions des particulates: 1.14 g/hr. Testé à: Méthode EPA 28R
Certifié pour se conformer aux normes d'émission de particules de bois structuré 2020

NE PAS ENLEVER OU NE PAS COUVRIR CETTE ETIQUETTE FABRIQUÉ AUX ETATS-UNIS

BACK / FRENCH

NOTES:
1. MATERIAL: .020 ALUMINUM
2. PRINTING: BLACK LABEL WITH SILVER/RED LETTERS

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hearthstone

LABEL: SAFETY

DORSET 8330

SIZE B | HEARTHSTONE DWG. NO. 3300-012 | REV. 1

SCALE: 1:1 | HERGOM DWG. NO. | SHEET 1 OF 2

hearthstone



UNRELEASED DRAFT

# Dorset

(Model 8330)

# Woodstove

## OWNER'S MANUAL

### Installation And Operating Instructions

NFI NATIONAL FIREPLACE INSTITUTE A CERTIFICATION AGENCY

We recommend that our products be installed and serviced by professionals who are certified in the U.S. by NFI (National Fireplace Institute), or by W.E.T.T. (Wood Energy Technology Transfer) in Canada.
www.nficertified.org
www.wettinc.ca

PFS C US

PFS Report Fxx-xxx

**SAVE THIS OWNER'S MANUAL FOR FUTURE REFERENCE**

**PLEASE READ THIS ENTIRE OWNER'S MANUAL BEFORE YOU INSTALL AND USE YOUR NEW DORSET WOOD STOVE.**
**Ce manuel est disponible en français sur hearthstonetech.com**

**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. 1482-2022**
**Certified to CAN/ULC Std. S627:2023**

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

**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 a Hearthstone Dorset tested to EPA Method 28R 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 1.14 gr/hr. emission rate and under specific test conditions has been shown to deliver heat at rates ranging from 14,545 to 20,507 Btu (output).

This wood heater has a manufacturer-set minimum allowable low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

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 Hearthstone dealer. Our dealer network processes all warranty claims. Authorized Hearthstone dealers can be located at www.hearthstonestoves.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 ensure 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 across all of the 4 burn rate categories using the higher heating value (HHV). The weighted average efficiency is 78.5% (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:**

The Dorset has the following CO emission rates by burn level: Category 1 (low) –38.7 g/hr., Category 2 (med. low) – 18.2 g/hr., Category 3 (med. high) – 17.3 g/hr. and Category 4 – 69.0 g/hr. 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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# INTRODUCTION

Thank you for purchasing a Dorset woodstove from Hearthstone Quality Home Heating Products. This stove will provide years of comfortable heat. This stove combines the warmth and comfort of soapstone and cast iron with the efficiency of advanced catalytic technology. The Dorset blends modern technology with the unique beauty and qualities of cast iron and soapstone. We trust that you will appreciate the quality of this handcrafted product.

Your Dorset woodstove burns very efficiently, and produces a large amount of heat. The Dorset's large glass window allows you to enjoy the fire from a variety of locations in the room.

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.

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 Dorset Model 8330 stove is warranted by:

**Hearthstone** ***Quality Home Heating Products, Inc***®
317 Stafford Ave.
Morrisville, Vermont 05661, USA
www.Hearthstonestoves.com

# CODES

When you install your Dorset 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

If you are installing your Dorset in a mobile or manufactured home, follow the guidelines described in the Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 (United States).

# 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.
- **Never** connect to or use in conjunction with any air distribution ductwork unless specifically approved for such installations

**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.
- 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 the optional outside air kit #96-53400

## 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 level of ashes is even with the door sill.

**At the Beginning of Every Other Month:**

- Depending upon your use of the stove, visually inspect the chimney connector and chimney for creosote using a mirror through the firebox.
- 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.
- Inspect the face of the catalytic combustor for fly ash and soot. Use a soft-bristled brush to remove if present. It is recommended to visually inspect the catalytic combustor at least 3 times during the heating season, or every 2-3 months.

**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.
- Check and clean the catalytic combustor, if necessary
- 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 primary air control.
3. Close the stovepipe damper (if present).
4. Close the bypass damper
5. 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, leave the primary air control and bypass handle pushed in and 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:**
23,000 BTUs per hour of Maple cordwood.

**Floor Size of Heated Area:**
Up to a maximum of 575 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:**
1.0 cubic feet.

**Maximum Log Length:** Up To 18” (45cm), 16” (40cm) Recommended

**Emissions:** 1.14 g/hr.

**Burn Time:** Up to 9-1/2 hrs. on low. (*Heat Life*™: Up to 20 hours) 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:**

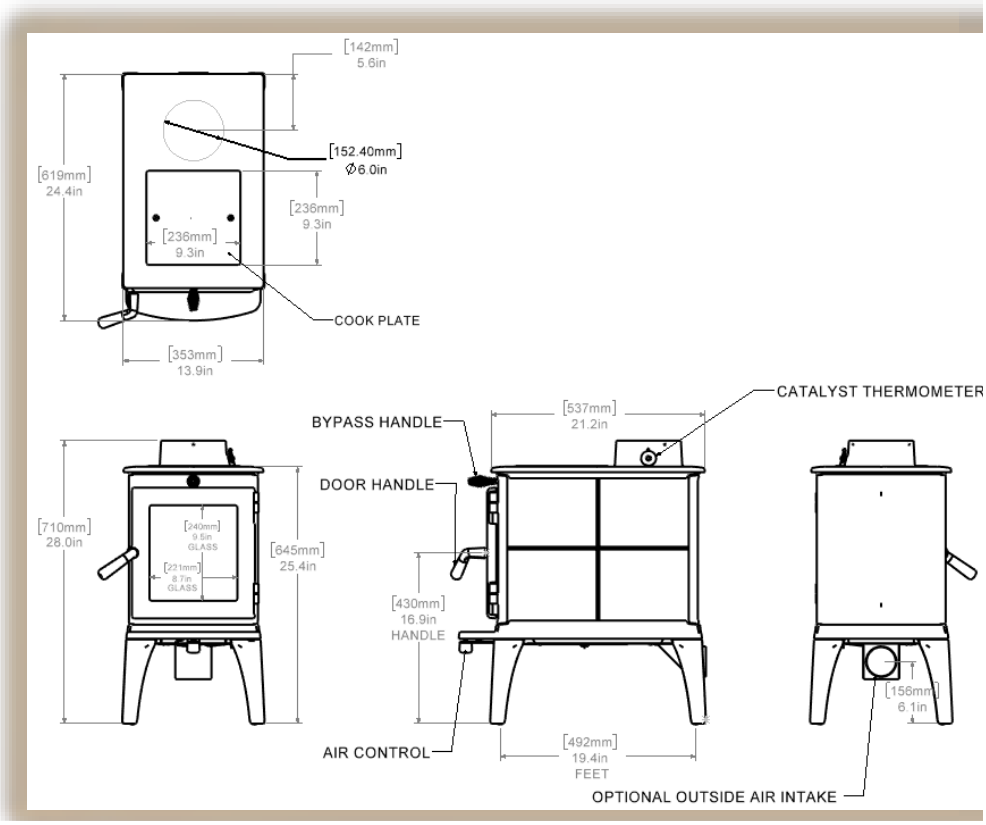
**Height:** 28” (71.1cm)
**Width:** 14" (35.5cm)
**Depth:** 24.5" (62.2Cm)
**Weight:** 250 lbs. (113.4 kg)

**Connector Size:** 6" (152 mm) diameter
**Metal Chimney:** 6" (152 mm) inside diameter
**Masonry Chimney:** 6” (152 mm) inside diameter (round flue), 8” x 8” (203 x 203 mm) (square flue)

**Crate Dimensions:** H-40” W-29” L-36” or 102x74x 92cm

**Optional Equipment:**

| | |
|---|---|
| Outside Air Kit | 96-53400 |
| Rear Heatshield | 90-68601 |
| Side Heatshield (Single) | 90-68605 |



# INSTALLATION

## UNPACKING

Hearthstone packages your Dorset 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 Dorset, 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 Hearthstone dealer immediately.

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

## PACK LIST

Dorset Model 8330 Woodstove
Owner's Manual
Hardware Kit

The label is attached by a cable to the bottom of the stove. Take care when lifting the stove not to damage the label or cable. After final positioning of the stove, the label may be stored in the holding clip on the bottom shield of the stove (See Figure 2).

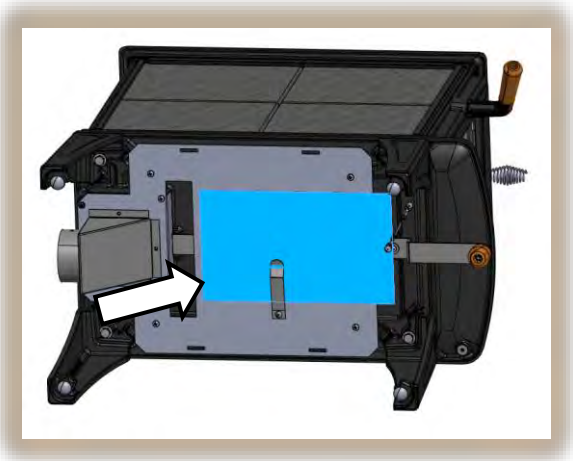


**Figure 2 - Label Location**

## HARDWARE KIT UNPACKING

Your Dorset is shipped with a hardware box in the firebox. Remove the hardware box and the three pieces of refractory stone on the floor of the stove to complete the assembly of the stove before installing the stove in the final location.

Hardware kit contents:
4 - feet
4 - carriage leveling bolts for feet
4 - hex head feet mounting bolts
4 - flat washer for feet mounting bolts
4 - lock washers for feet bolts
1 - front door handle
1 - 3-1/4" front door handle screw
1 - air control handle
1 - 1" air control screw
1 - nut for air control handle screw
1 - lock washer for air control handle screw
1 - catalyst temperature indicator

## ASSEMBLY

Your Dorset is shipped with two disposable shipping brackets installed to the bottom of the stove where the feet will mount.

1. Unbolt the shipping brackets from the pallet and discard lag bolts.
2. Lay down a blanket or other protective covering behind the stove. Ensure the floor refractory stone has been removed before continuing to the next step.
3. Flip the stove on to its back (See Figure 3).
4. Unbolt the two shipping brackets from the stove and discard bolts and bracket (See Figure 3).
5. Install the 4 feet in the location of the shipping brackets. Use one foot bolt (hex head bolt), one flat washer, and one lock washer per foot to secure the foot to the stove (See Figure 4). Ensure leveling bolts are installed in the bottom of the feet.






**Figure 4 – Foot Installation**

6. Stand the stove up on to its feet. Adjust leveling bolts if needed.
7. Install the air control wooden handle on to



the air control.
8. Install the front door handle.

9. Install the catalyst temperature indicator.




# INSTALLING YOUR STOVE

Choose a place to install your Dorset 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.

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 Simpson Dura-Vent DVL brand.

**This stove is a freestanding room heater and is only to be installed per the clearances to combustibles defined in this instruction manual. Do not install the Dorset 8330 into a factory-built fireplace.**

### 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 noncombustible material. The Dorset 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 27-1/2” x 37-1/2”.
The minimum floor protection for installations in Canada is 30” (762mm) x 47-1/2” (1206mm).

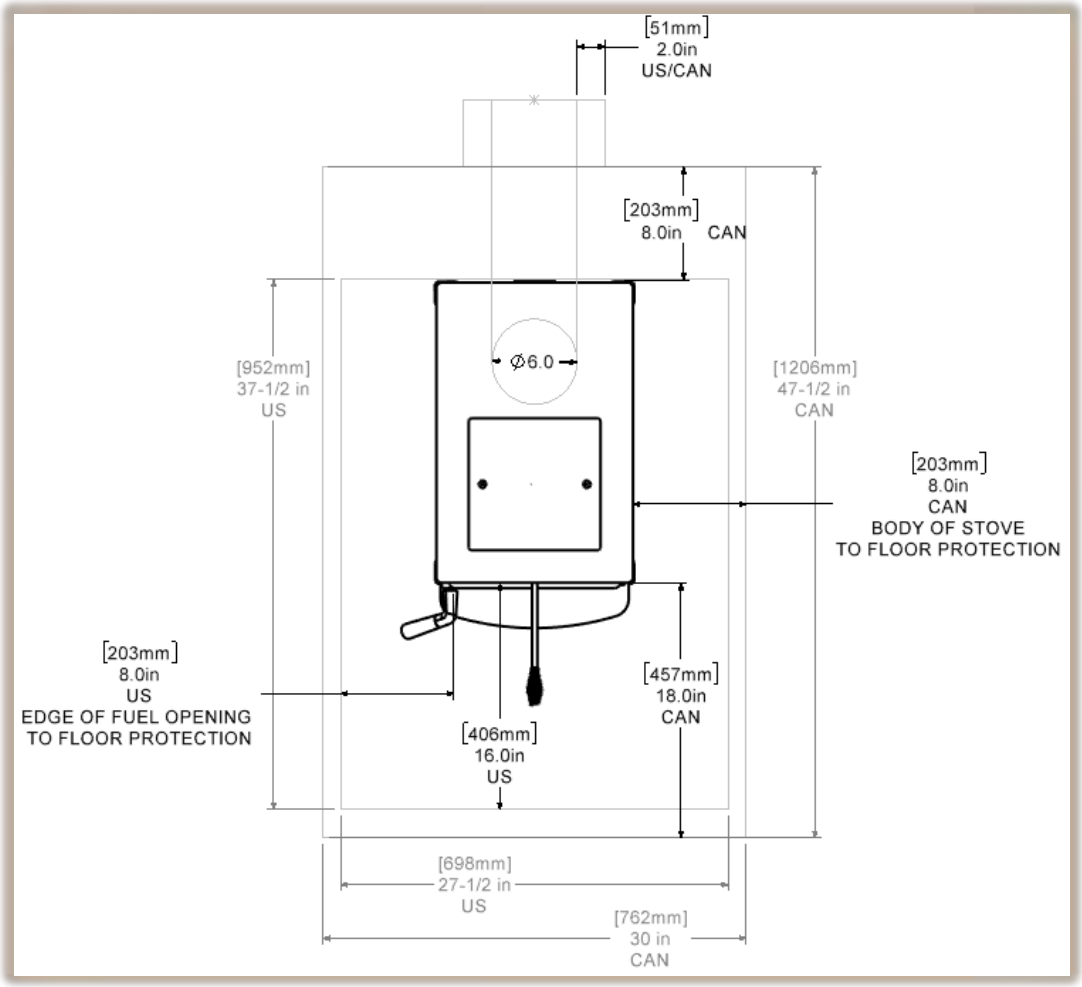



**Figure 5 – Hearth Dimensions**

Installing the stove in a room with Luxury Vinyl Plank (LVP) or Luxury Vinyl Tile (LVT) flooring requires extra consideration from the stove to the LVP or LVT flooring. Some LVP and LVT flooring begins to warp at 110° Fahrenheit. Each installation and flooring specification is different. **Consult the flooring manufacturer for maximum temperature recommendations. Additional shielding to prevent warping may be necessary depending on the flooring used.**

# COMBUSTIBLE SURFACE REQUIRED CLEARANCES

***Note:*** *Dimensions shown in the following figures are from the furthest point on cast 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. Optional side and rear heatshields are available for purchase to reduce clearances.

**These clearances govern clearances from the stove to combustibles. Pipe clearances may be dictated by your local building codes. Be sure to reference your pipe manufacturer's clearances for double wall or Class A pipe as some manufacturer's clearances may vary**.

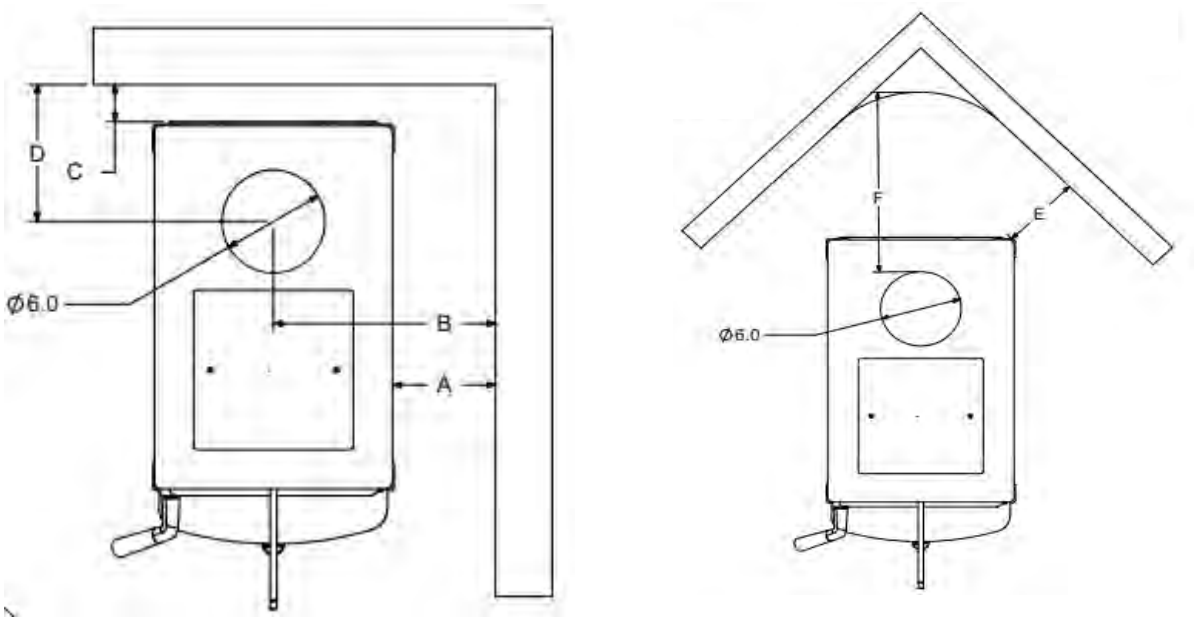



**Figure 6 – Clearance to Combustibles**

| | Parallel Install | | | | Non-Parallel Install | |
|---|---|---|---|---|---|---|
| Clearances | A | B | C | D | E | F |
| Single wall Connector – NO SHIELDS | TBD | | | | | |
| Single Wall Connector – WITH SIDE SHIELDS | | | | | | |
| Single Wall Connector – WITH REAR SHIELD | | | | | | |
| Single Wall Connector – WITH SIDE AND REAR SHIELDS | | | | | | |
| Double Wall Connector – NO SHIELDS | | | | | | |
| Double Wall Connector – WITH SIDE SHIELDS | | | | | | |
| Double Wall Connector – WITH REAR SHIELD | | | | | | |
| Double Wall Connector - WITH SIDE AND REAR SHIELDS | | | | | | |
| ALTERNATIVE INSTALLATION OPTIONS | **A** | **B** | **C** | **D** | | |
| Through the rear wall, single wall connector – NO SHIELDS - See Figure 6 | | | | | | |
| Through the rear wall, double wall connector – NO SHIELDS - ** See Figure 6** | | | | | | |

| | | | | |
|---|---|---|---|---|
| Through the rear wall, single wall connector – REAR SHIELD - See Figure 6 | | | | |
| Through the rear wall, double wall connector – REAR SHIELD - See Figure 6 | | | | |
| Through the rear wall, single wall connector – SIDE SHIELDS - See Figure 6 | | | | |
| Through the rear wall, double wall connector – SIDE SHIELDS - See Figure 6 | | | | |
| Through the rear wall, single wall connector – SIDE AND REAR SHIELDS - See Figure 6 | | | | |
| Through the rear wall, double wall connector – SIDE AND REAR SHIELDS - See Figure 6 | | | | |
| Alcove W/Sngl or Dbl Wall Conn – NO SHIELDS | | | | |
| Alcove W/Sngl or Dbl Wall Conn – WITH SIDE AND REAR SHIELD | | | | |
| FIREPLACE INSTALLATION | | | | |
| Mantle, 12” protrusion - NO SHIELD | | | | |

| Alcove Clearances (inches) | Unprotected Surfaces |
|---|---|
| Minimum unshielded alcove width | |
| Min. Alcove ceiling from floor with single wall connector | |
| Min. Alcove ceiling from floor with double wall connector | |

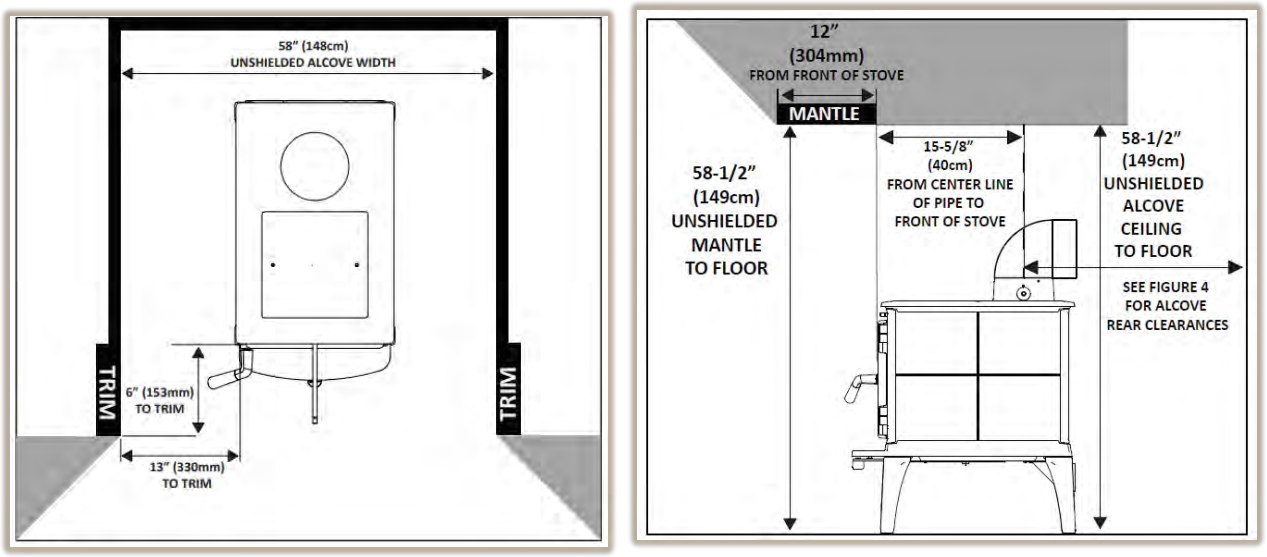



**Figure 7 trim, mantle, and alcove clearances**

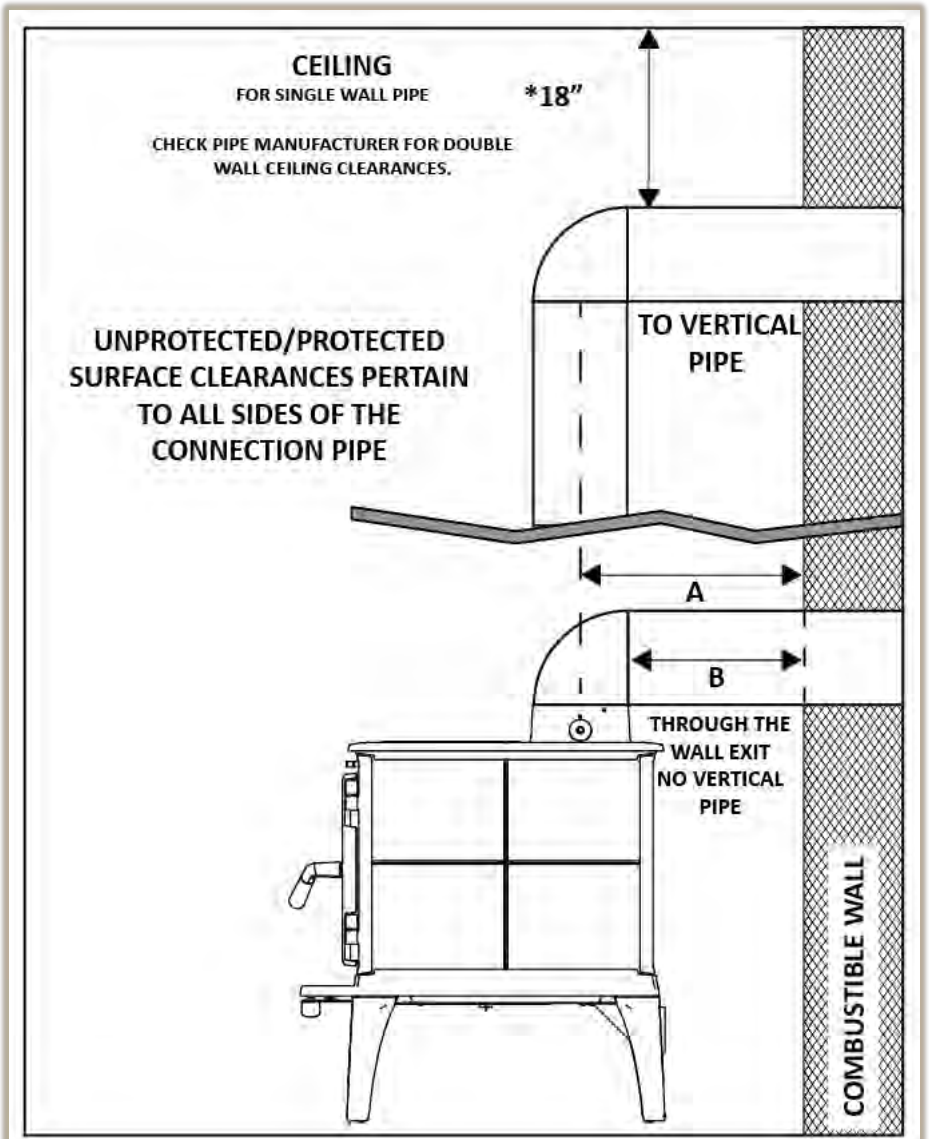
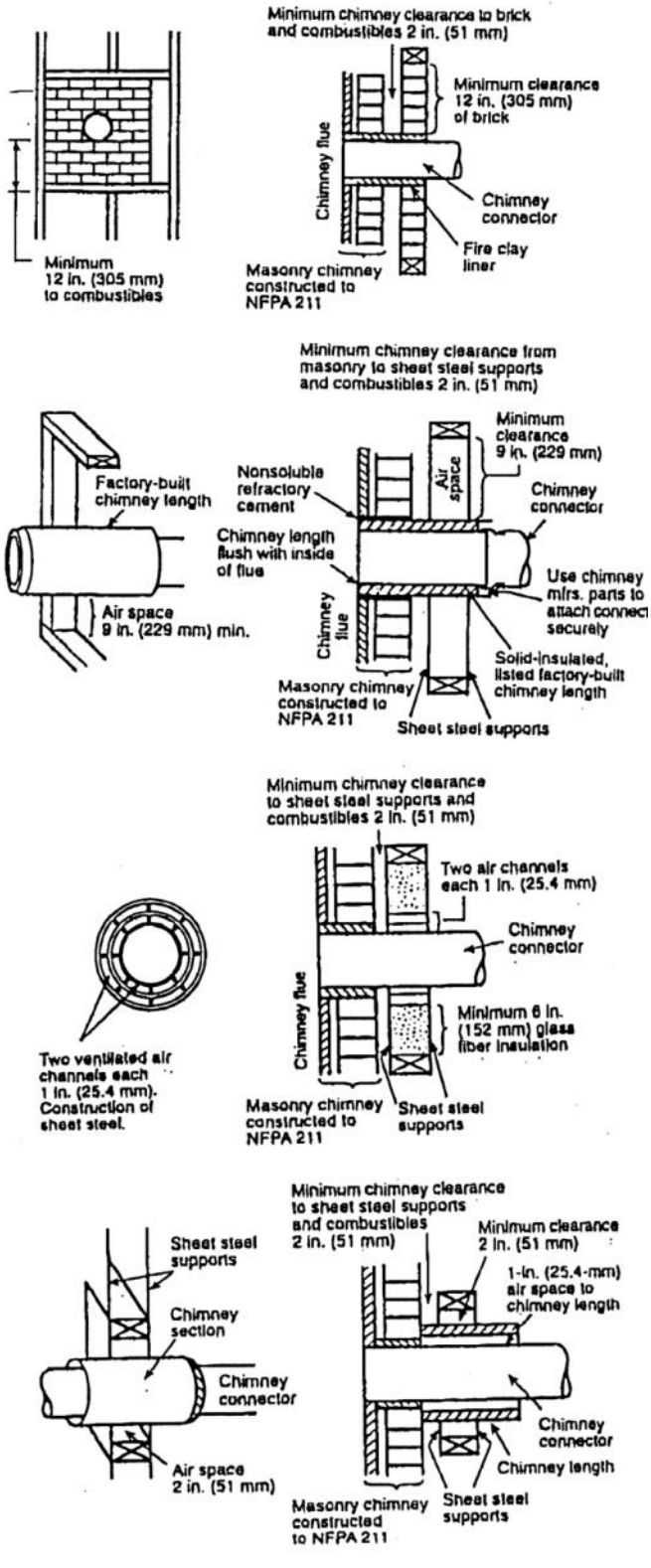



**Figure 8: Chimney Connector Clearances to Combustibles**

| | With Rear Shield US* | With Rear Shield CANADA* | No Rear Heat Shield US | No Rear Heat Shield CANADA |
|---|---|---|---|---|
| Through the wall flue exit. Elbow directly atop stove to rear exit. | **Single Wall Pipe** | | | |
| A | | | | |
| B | | | | |
| | **Double Wall Pipe** | | | |
| A | | | **Check Pipe Certification** | |
| B | | | | |

***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.**




# 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. Do not install the chimney directly at the outlet of the appliance. A chimney connector (flue pipe) is required.

## OUTSIDE AIR SUPPLY

(Optional Kit #96-53400)

If this unit is installed in a mobile home or a well-sealed, newer construction home, care must be taken to ensure adequate air is available. If not enough air is available, it could starve the room of all the oxygen.

You can connect an outside air source directly to this stove using an optional outside air kit. 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 kit for this stove allows for the direct connection of the stove's 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 duct from the outside of the house to the hearth, keep in mind the need to avoid structural members of the house. The outside air kit attaches to the underside of the stove. Refer to the instructions provided with the kit for installation.

*An adaptor for 4” duct is available if needed. KIT #90-53308

When using an outside air kit in Canada, the stove must be attached to your home’s floor. Request stove hold down brackets from your dealer and choose fasteners long enough to attach securely to the subfloor. (The clips and fastener heads may be painted to minimize visibility).

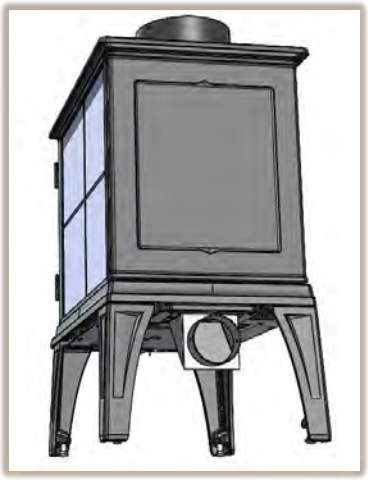


**Figure 9: Outside Air Kit Detail**

The International Residential Code (IRC) does not allow the outside air duct to terminate higher than the appliance. Some building officials restrict vertical rise in the duct’s termination. Hearthstone recommends the termination be at the same level, or lower than the air intake on the stove. When using an outside air kit in Canada, a damper allowing 100% closure shall be installed.

Locate the termination of the intake 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 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 recommended are Simpson Dura Vent DVL and Metalbestos DS. Security, GSW and Ameritec also manufacture acceptable connector pipe.

- When used in a mobile home, a spark arrester is required.

- 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 Simpson DuraVent DVL 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 site-constructed) 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 the chimney connector 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 chimney connector 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 Dorset. 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 Dorset 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 Dorset 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 Dorset 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 Dorset. The Dorset requires a 6" (152 mm) inside diameter flue for new installations. A 6" diameter flue provides adequate draft and performance. You can use an 8" (203 mm) diameter existing flue with a reducer. 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 8):

- 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 from the top of stove is 16 feet (4.9 m). The recommended maximum chimney height is 30 feet (9m). The Dorset 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.

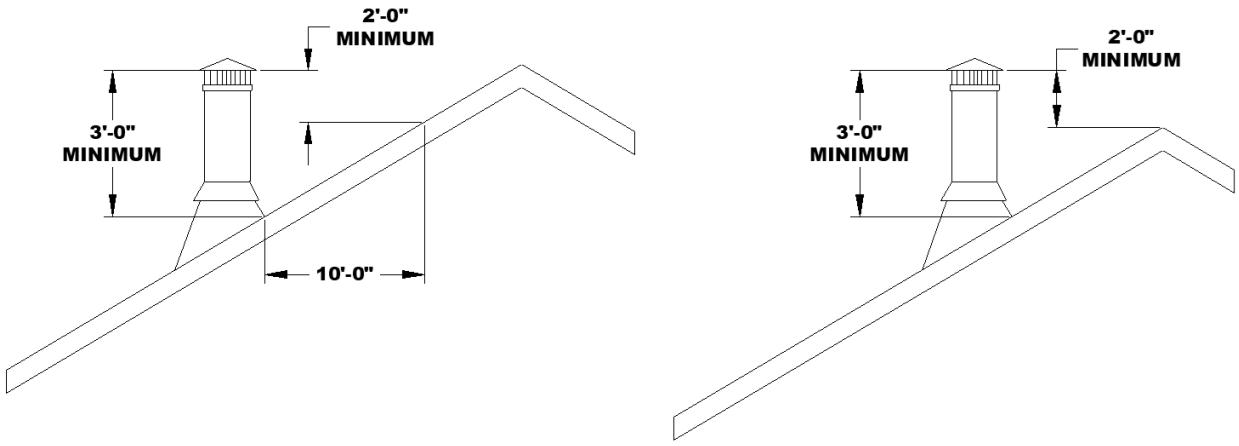



**Figure 10 - Chimney Height Requirements**

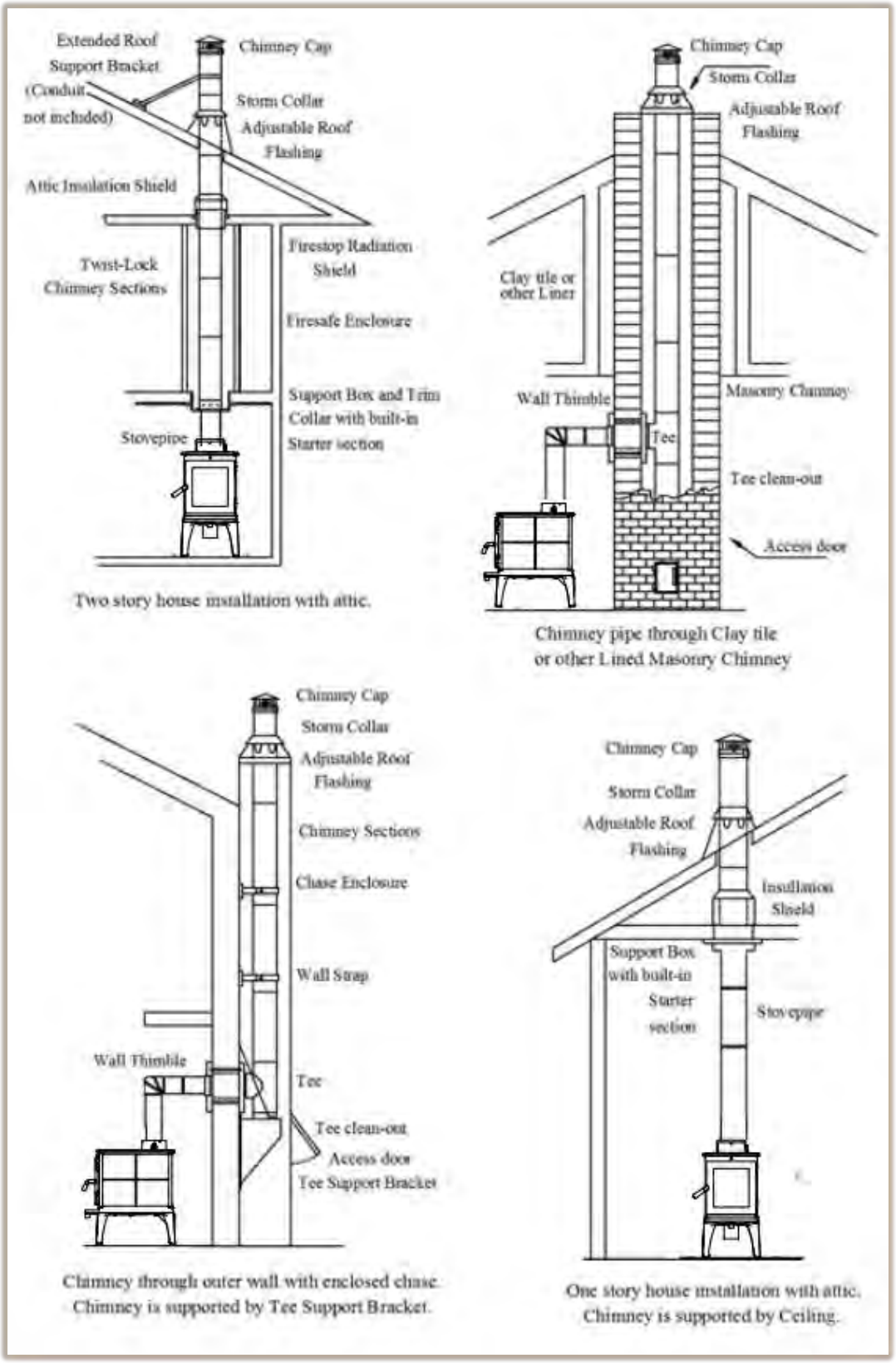



**Figure 11 - Typical Chimney Configurations**

# INSTALLING IN A MOBILE HOME

Follow these special requirements for installing your stove in a mobile home.

- Install the stove in accordance with 24 CFR, Part 3280 (HUD)
- An outside air kit must be used in all mobile home installations.
- Permanently attach the stove to your mobile home's floor. Request stove hold down clips from your dealer, or attach through the threaded leveling leg hole. (The clips and fastener heads may be painted to minimize visibility).

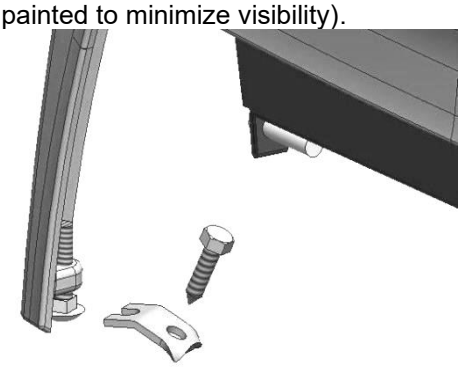


**Figure 12 - Lock Down Detail**

- Install a Mobile Home Chimney & Connector Kit*.

  Each kit must include:
  Stainless spark arrester cap, storm collar, Adjustable vented flashing – 0/12 – 6/12, Two 24" chimney pipes, 24" support box with built-in starter section and trim.

  * Install a Mobile Home Chimney and Connector Kit conforming to US/UL103 or CAN/ULC-S629, Standard for Factory-Built Chimneys.

- WARNING: DO NOT INSTALL IN A SLEEPING ROOM IN A MOBILE HOME.
- CAUTION: MAINTAIN THE STRUCTURAL INTEGRITY OF THE MOBILE HOME WALLS, FLOOR, CEILING, AND ROOF WHEN INSTALLING AND USING YOUR STOVE.
- FAILURE TO FOLLOW THESE INSTRUCTIONS AND SPECIFIED COMPONENTS OR USING MAKE-SHIFT COMPROMISES CAN RESULT IN FIRE, PROPERTY DAMAGE, BODILY INJURY, AND EVEN DEATH.
- Burning any fuel other than wood in this unit could generate dangerous levels of carbon monoxide within the living space.
- THE FRONT DOOR MUST REMAIN CLOSED WHEN IN OPERATION EXCEPT FOR START UP AND LOADING. Leaving the door open during use could cause any smoke or fire detectors in the home to be set off or a fire could escape the firebox and start the room on fire.
- If this unit is installed in a mobile home or a well sealed, newer construction home, care must be taken to ensure adequate air is available. If not enough air is available, it could starve the room of all the oxygen.
- The chimney should be attached directly to the stove and must extend at least 3 feet (.9 m) above the part of the roof through which it passes. The top of the chimney is to be at least 2 feet (.6 m) above the highest elevation of any part of the mobile home within 10 feet (3 m) of the chimney.
- All roof-chimney terminations should be able to be readily removed / re-installed at or below an elevation of 13-1/2 feet (4.1 m) above ground level without the use of special tools or instructions. The chimney assembly shall be provided with a mechanical securement means to secure the chimney to the ceiling support box.
- When a chimney exits the mobile home at a location other than through the roof, and exits at a point 7 feet (2.1 m) or less above the ground level on which the mobile home is positioned, a guard or method of enclosing the chimney shall be provided at the point of exit for a height up to 7 feet.
- The chimney guard shall not allow the passage of a ¾ inch (19.1 mm) diameter rod, and a ½" (12.7 mm) diameter rod shall not be able to touch the chimney when inserted through any part of the guard a distance of 4 inches (102 mm).

- The chimney shall be provided with a spark arrester secured to the chimney. The net free area of the arrester above the chimney outlet shall not be less than 4 times the net area of the chimney outlet, and the vertical height of the arrester above the chimney outlet shall not be less than ½ the diameter of the chimney flue. Openings shall not permit the passage of a sphere having a diameter of ½ inch (12.7 mm), and shall allow the passage of a sphere of 3/8" (9.6 mm).

- CAUTION: REMOVE THE CHIMNEY WHEN TRANSPORTING THE MOBILE HOME!

- 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

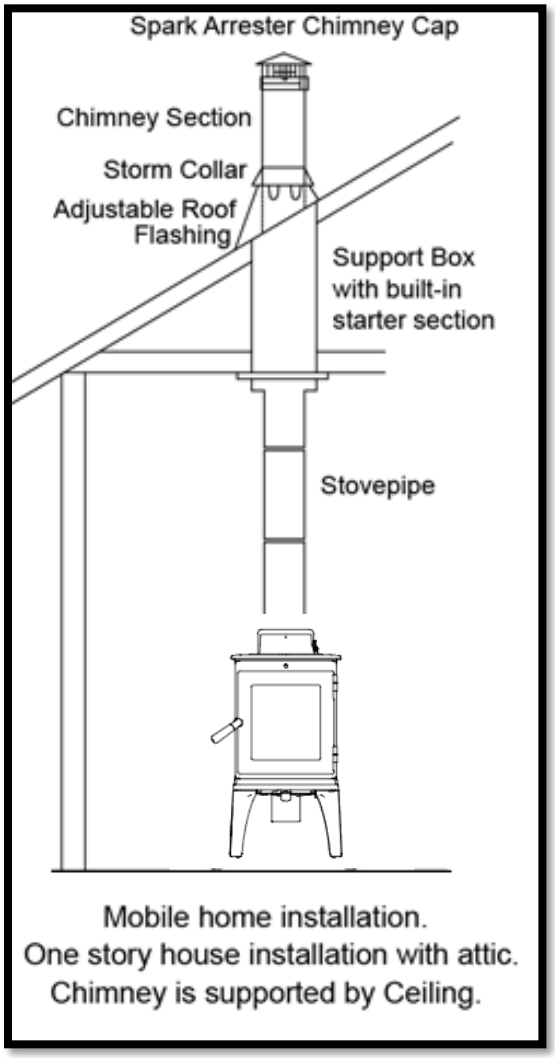



**Figure 13 - Mobile Home Installation**

# OPERATION

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

Every installation, season's firewood, and operator's technique vary. 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.

Prior to operation, ensure that nothing obstructs the space beneath the stove. Storage of wood or other materials is not allowed in this area. Ensure pets do not lay under or around the stove. Ensure that the air intakes of the stove, located on the bottom of the stove, are not obstructed.

## CONTROLS AND FEATURES

Before lighting any fires, become familiar with the location and operation of your stove's controls and features and learn how to use them (*See Figure 13*). For your own safety, do not modify these features in any way. We recommend you use fireplace gloves when the stove is in operation and hot.

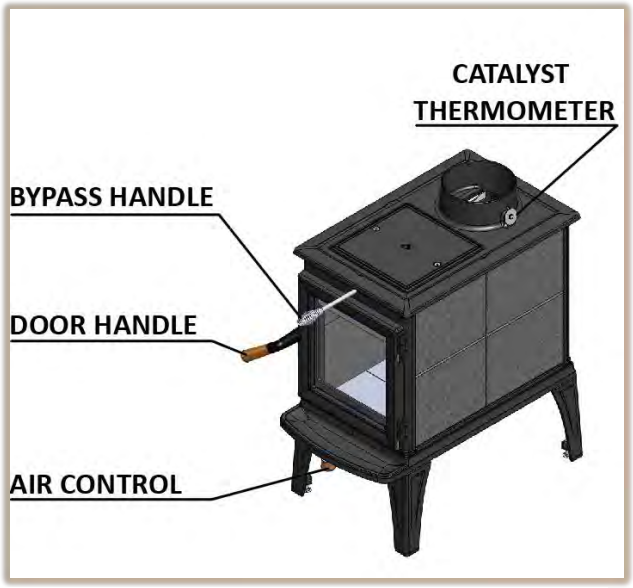



**Figure 14 - Controls & Features**

**Figure 12 -**

**DOOR HANDLE:** The firebox door allows you to load wood into your stove; a wood handle operates the door. To open the door, pull up on the handle and swing the door away from the stove. To latch the door, push the door tightly towards the firebox then continue to push the handle in and down until it latches shut. Gently pull on the door handle to make sure it is properly latched.

**AIR CONTROL:** The primary air control lever is located under the ash lip. The primary air control allows you to regulate the amount of air entering the firebox. Generally, the more air allowed into the firebox, the faster the rate of burn and the higher the heat output; conversely, less air creates a slower burn, with lower heat output. For maximum airflow, pull the lever out as far as possible; move the lever inwards as far as possible for minimum airflow (does not close completely).

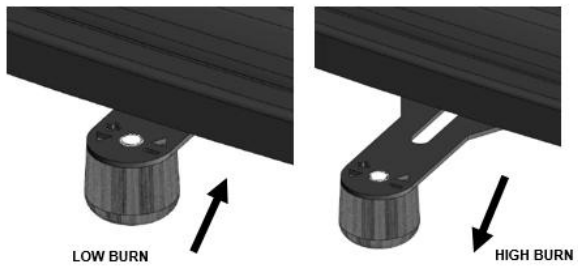



**Figure 15 - Air Control**

**BYPASS ROD HANDLE:** The bypass handle controls the bypass door inside the stove. **The spring handle should always be used to move the bypass rod. A leather wood stove glove is recommended.** When the rod is pulled out towards the front of the stove, the bypass door is open, and when the rod is pushed in, towards the rear of the stove, the bypass door is closed. The bypass door directs the flow of combustion products through or around the catalytic combustor. When the bypass handle is pulled out, combustion products are directed around the catalytic combustor. The bypass handle should be pulled out when first staring a fire until the catalytic combustor heats up to activation temperature, and whenever opening the front door to load the stove. When the bypass handle is

pushed in, combustion products are directed through the catalytic combustor. The bypass handle should be pushed in once the catalytic combustor heats up



**Figure 16 - Bypass Handle**

to activation temperature, and remain pushed in whenever the stove is burning and in the active temperature range.

**CATALYST THERMOMETER:** The catalyst thermometer monitors the downstream temperature of the catalysts, and indicates when the stove is in the active range for the catalysts. The catalyst probe should be spaced 3/8" from the body of the stove. When the stove is in the "active" range, the bypass handle should be pushed in. When the stove is in the "Inactive" range, the bypass handle should be pulled out until the stove heats up. If the thermometer is in the "Too Hot" range, keep the bypass pulled out, fully close the air control, and allow the stove to cool down until the thermometer falls into the "Catalyst Active" Range. Once the catalyst thermometer has reached the active range, heat generated from burning smoke keeps the catalysts warm and active as long as fuel remains in the stove.

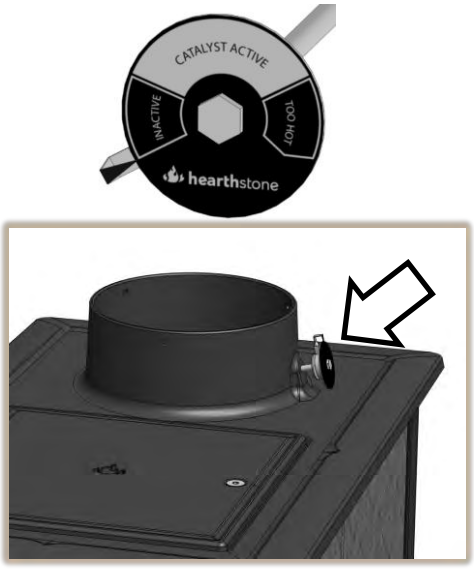



**Figure 17 - Catalyst Thermometer**

## CHOOSING FIREWOOD

Burn only natural firewood (known as cordwood) in the Dorset Model 8640 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 AND WILL DAMAGE YOUR CATALYST. 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 damage the catalysts.

| 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, GASOLINE-TYPE LANTERN FUEL, KEROSENE, CHARCOAL LIGHTER FLUID, OR SIMILAR LIQUIDS TO START OR 'FRESHEN UP' A FIRE IN THIS HEATER. KEEP**

**ALL SUCH LIQUIDS WELL AWAY FROM THE HEATER WHILE IT IS IN USE.**

## BREAKING IN YOUR WOOD STOVE

It is imperative that your stove is "broken in" gradually. Soapstone must be "seasoned"; over-firing a new stove may cause soapstone to crack or may damage other stove parts. Natural moisture in the freshly quarried soapstone must be driven out slowly to minimize the “shock” to the stone 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 shortly after first firing. 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, cast iron, and soapstone components of your stove will give you many years of trouble-free use. With use, the color of the soapstone may change and small fractures may appear on the surface. These changes do not affect the function of the stove. If a panel breaks completely, it must be replaced

Avoid the following conditions that can cause the glass, soapstone, 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.

## PROTECT YOUR HEARTH

While your stove radiates heat slowly and evenly when in use, it also absorbs moisture condensations when not in use. Specifically, true with a brand-new stove, but also for stoves during the off season, your stove and chimney flue has moisture in it. During the early stages of use and during certain heating conditions, this condensation can turn to a liquid. This dark liquid can find a way through the bottom of your stove and onto your hearth. We recommend placing some pieces of aluminum foil or other non-combustible material in the area around each of the legs of the stove temporarily to catch this liquid until the moisture has been removed from the heating system. As the system becomes seasoned these can be removed for normal use.

## A NOTE ABOUT MAJOLICA ENAMELS

The porcelain Majolica enamels Hearthstone uses are a natural glass-based product. The Majolica process consists of a neutral opaque color base, usually an off-white, with a translucent color applied over it. It is essentially molten-glass applied as a powder and each coat is fused to the iron in our ovens at nearly 2000 F. The darkness of the color is dependent upon the thickness of the translucent color over the base color, the thickness of the part and the oven temperatures. Details in the iron allow for the molten glass to pool darkly in low places and be thinner on edges of detail. Color variations are what makes it so beautiful. Please expect variations in color as this is a normal part of the process. Crazing (minuscule lines in the glaze) is common with repeated heating and cooling. or extreme use. Crazing has no significant effects on the ceramics, it is cosmetic and in the top coat only. Majolica finishes are applied by artists; having been used on ceramic pottery for hundreds of years. Antique Majolica plates, saucers, cups and teapots are normally crazed to varying degrees and have color variations piece to piece.
Enjoy a lifetime of beauty with this classic finish we are proud to offer.

## BUILDING A BREAK IN FIRE

1) Pull the bypass handle out. 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) Fully open the primary air control by pulling the control handle towards you, away from the firebox.

3) Light the paper under the kindling. Leave the door slightly ajar momentarily until the kindling has started to burn and draft begins to pull.

4) Close the door and allow the fire to burn. Keep the door closed while the stove is in use.

5) KEEP A WATCHFUL EYE ON YOUR STOVE to maintain a steady, low-heat fire. Your first fire should make the stove warm but **not hot to the touch**. Visible steam, or boiling moisture and hissing indicate the soapstone is too hot. At most, a few small chunks of wood should be added to the fire to reach safe break-in temperatures.

6) Once the stove is warm but **not hot to the touch,** close the primary air control by pushing it fully inward toward the stove to allow the fire to die out completely.

7) 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) Pull the bypass handle out. 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) Fully open the primary air control by pulling the lever completely out, away from the firebox.

3) Light the paper under the kindling. Leave the front door slightly ajar momentarily until the kindling begins to burn and draft begins to pull.

4) Close the door and allow the fire to burn.

5) 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.**

6) Once the fire is burning well, and the catalyst thermometer indicates that the stove is in the active range, push in the bypass handle. Now the combustion products are passing through the catalytic combustor, and your stove will be burning at its optimal efficiency.

7) After pushing in the bypass handle, allow the stove to run on a high setting for around 20 minutes to ensure the catalytic combustor stays in the active range. This will also allow the fire to burn off any residue on the door glass from any previous low-burn fires

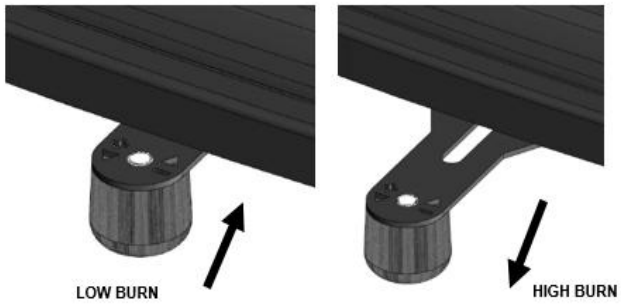



**Figure 18 - Hi/Lo Air Control**

8) Use the primary air control to regulate the desired rate of burn. Pull the handle towards you for a higher burn rate, and push the handle towards the stove for a lower burn rate. The air control does not close completely.

**Note:** Always remember to pull the bypass handle out 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 at a medium to high firing rate for about 10 minutes to ensure that the catalysts reach the "Catalyst Active" zone on the thermometer. Once the catalysts reach operating temperature, the bypass handle can be pushed in.

### CATALYTIC COMBUSTOR OPERATION

The Dorset uses a catalytic combustor to ensure highly clean and efficient burns. The catalytic combustor is made from a stainless-steel corrugation that is coated with a catalytic material. The catalytic combustor becomes active around 500 ºF (260ºC), helping to burn up smoke and any remaining particles that were not fully burned in the firebox. During the startup of a cold stove, a medium to high firing rate must be maintained for about 20 minutes. This ensures that the stove, catalysts, and fuel are all stabilized and at proper operating temperatures. Even though it is possible to have gas temperatures reach 500 °F (260ºC) within 2 to 3 minutes after a fire is started, if the fire is allowed to die down immediately, it may go out or the combustor may stop working. Once the stove and catalytic combustor heat up, heat generated from burning smoke keeps the catalysts warm and active as long as fuel remains in the stove. You stove will burn the cleanest and most efficiently when the catalysts are in the active range. There should be little to no visible smoke from your chimney when the catalysts are in the active zone and fully functional.

### BURN RATE

**This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual**

***LOW BURN:*** Move the air control lever all the way inward toward the stove. (*See figure 17*). This closes the air shutter to its minimum opening. A low burn rate over extended periods is not advisable as it can promote the accumulation of creosote. Inspect the venting system frequently if using low burn rates consistently.

***MEDIUM LOW BURN:*** With the primary air control in the low position, pull the air control forward (a little less than 1/4"). A medium-low burn rate is the typical setting and is preferable if the stove is unattended. At this burn rate, a little goes a long way.

***MEDIUM HIGH BURN:*** With the primary air control in the low position, pull the air control forward (a little less than 3/8")

***HIGH BURN:*** Completely open the primary air control by moving it all the way outward toward the operator. Fully load the firebox with wood on a bed of hot coals or on an actively flaming fire. To minimize creosote accumulation, run the stove on high once or twice daily for 35 to 45 minutes to fully heat the stovepipe and chimney.

**CAUTION:** Do not burn fuel other than cordwood in your stove.

### 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-fire 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**

## CHIMNEY FIRES

Regular chimney maintenance and inspection can prevent chimney fires. If you have a chimney fire, follow these steps:

1. Close the stove door and the air intake control
2. Alert the occupants of the house of the possible danger
3. If you require assistance, alert the fire department;
4. If possible, use a dry chemical fire extinguisher, baking soda or sand to control the fire. **Do not use water as it may cause a dangerous steam explosion**

**Do not use the appliance again until the stove and its chimney have been inspected by a qualified chimney sweep or a fire department inspector.**

## REMOVAL AND DISPOSAL OF ASHES

You should leave a thin layer of ashes in the firebox. 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 and immediately moved outdoors. 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 noncombustible 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

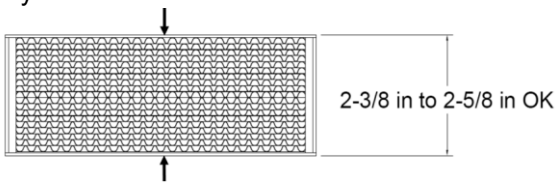
## CATALYTIC COMBUSTOR INSPECTION AND REPLACEMENT PROCEDURES

- **WARNING: THIS WOOD HEATER CONTAINS A CATALYTIC COMBUSTOR, WHICH 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, OR IF THE CATALYTIC ELEMENT IS DEACTIVATED OR REMOVED**

TWO DIFFERENT MODEL CATALYSTS ARE APPROVED FOR USE IN THIS STOVE. BOTH FUNCTION THE SAME. IF A REPLACEMENT IS NEEDED, INQUIRE ABOUT PART NUMBER 3050-010 OR 3050-020 WITH YOUR HEARTHSTONE DEALER.

It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions. Following is a list of items that should be checked on a periodic basis

-Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Inspect the catalyst for warpage or blockage. Use the diagram below to determine acceptable warpage of the catalyst.




If any of these conditions exists, refer to Catalyst Troubleshooting section of this owner's manual.

-This catalytic (or hybrid) heater is equipped with a thermometer to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 500 °F, and often reach temperatures in excess of 1,000 °F. If catalyst temperatures are not in excess of 500 °F, refer to the Catalyst Troubleshooting section of this owner's manual.

You can get an indication of whether the catalysts are working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalysts light-off has been achieved, to the amount of smoke leaving the chimney when the smoke is not routed through the combustor (bypass mode).

1. Light stove in accordance with operator's instructions
2. With smoke routed through the catalysts, go outside and observe the emissions leaving the chimney.
3. Engage the bypass mechanism and again observe the emissions leaving the chimney. Significantly more smoke will be seen when the exhaust is not routed through the combustor (bypass mode)

## INSPECTING AND REMOVING THE CATALYSTS

Refer to the Catalytic combustor warranty at the end of this manual for catalyst warranty information.

**ALLOW THE STOVE AND ASHES TO FULLY COOL.**

1. Remove the square cook plate on the top of the stove.
2. Pull the bypass handle out fully.
3. Remove the catalyst from the catalyst sled.
4. Perform any cleaning or replacement as necessary, then reinstall the catalyst into the sled.
5. Push the bypass handle in fully.
6. Replace the square access door on the top of the stove.



**Figure 19 - Catalyst Access Location**

## 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 Hearthstone 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.

**Required Gasket Kit:** PN: 90-58600.

## 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.

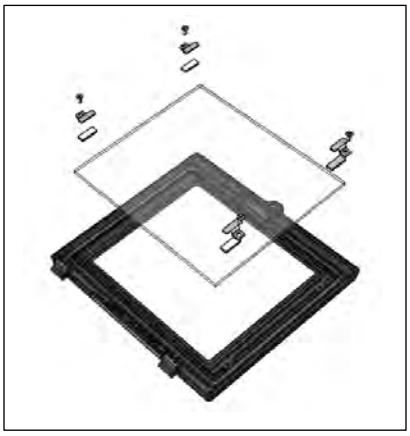
**Required Glass Kit:** PN: 90-58605.

## 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 door.
3. Remove the screws from the glass clips (use penetrating oil if necessary) – Set aside for reinstallation.
4. Carefully lift the damaged glass off the door and discard.
5. Remove any remaining glass and old gasket material.
6. Clean the screw holes and place a small amount of anti-seize compound in each one.
7. Install a new glass gasket in the glass gasket groove.
8. Place the new glass onto the door.
9. **Important! Center the glass** and ensure that the edges of the glass are parallel with the edges of the opening.
10. 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 1/8$^{th}$ of a turn after they seat. The glass will break at this point if not positioned correctly.
11. Apply a light film of anti-seize lubricant on the door's hinge pins if needed.
12. Install the door.
13. After 5 or 6 fires, check the glass retainer screws, and retighten if necessary.

**Required Glass Kit:** Part Number: 90-58605. Use only Ceramic, or Neoceram glass. Contact your Hearthstone 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 1/8" (3 mm) accumulates, immediately clean the stove pipe. Modifications to the burning procedure and more frequent inspections may be required in your situation.

## Prevention

Burn the stove with the primary air control fully open for 35 - 45 minutes daily to burn out creosote deposits from within the stove and the venting system.

After reloading with wood, burn the stove with the primary air control fully open 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 operating temperatures are too low or 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.

# 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 the optional outside air adaptor connected to an air duct, 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 | Fully open the primary air control one minute before opening doors, and ensure the bypass is open before opening door. |
| | 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. |
| | Bypass not closed | Ensure that the bypass door is closed when the catalysts are in the active range. |
| | Catalysts not functioning | Inspect catalysts for damage, ash build-up, or plugging. Brush catalysts with a soft-bristled brush, or vacuum lightly. Replace if required. Follow instructions to ensure catalyst light-off. |
| | 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 | Fully open the primary air control one minute before opening the door and keep it fully open for a few minutes after reloading. Ensure the bypass door is open before opening the door |
| | Extra Low Burn Rate | Burn the stove at a higher burn rate. |
| | 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. |
| UNCONTROLL-ED OR SHORT BURN | Unsealed or Open Door | Close the door tightly or replace the gaskets.<br>Air leakage around glass gasket – replace gasket |
| | Excessive Draft | Check the installation. Operate at LOW BURN. 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. |
| | Low Burn Rate | Operate the stove at a higher burn rate. |
| | 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. |

## CATALYST TROUBLESHOOTING GUIDE

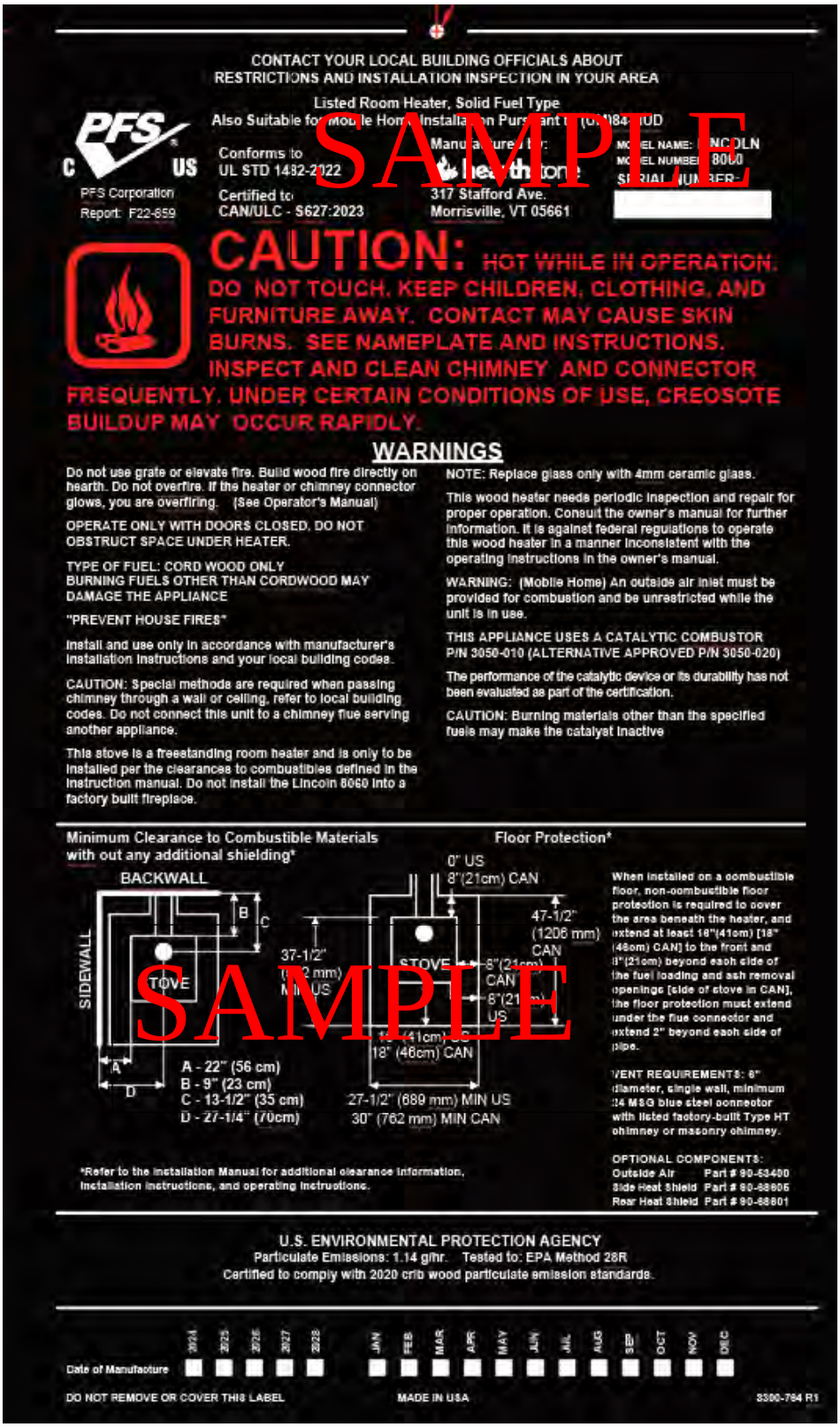
| PROBLEM | POSSIBLE CAUSE | SOLUTIONS |
|---|---|---|
| FLY ASH BUILD UP ON CATALYST | Catalysts have not maintained light-off temperature | Brush cold combustor with soft-bristled brush or vacuum lightly. Follow instructions in the manual for a proper catalyst light-off |
| | Burning materials that cause a lot of char and fly-ash | Don't burn cardboard, gift wrap paper, or garbage. Burn only dry, seasoned wood, per the owner's manual. |
| | Bypass closed too soon | Follow instructions in the manual for a proper catalyst light-off |
| CATALYST PLUGGING OR MASKING (SOOT/CRESO-TE) | Burning wet, pitchy woods, or burning large loads of small diameter wood with the combustor in the operating position without catalyst light off occurring | Burn dry seasoned wood. Follow instructions in the manual for a proper catalyst light-off, and ensure catalyst light-off as occurred before closing bypass damper. It may be possible to burn the soot or creosote off by building a hot fire, and allowing the stove to run until the catalysts are well within the operating range before closing the bypass. Continue to run the stove at a high temperature for one hour, while ensuring the catalysts stay in the upper operating range, but not too hot. |
| WARPING OR BOWING OF THE CATALYST | Excessive catalyst temperatures for long periods of time. | Ensure that the catalysts remain in the operating zone, and does not get to hot. Reduce air control settings for a lower burn rate to ensure catalyst temperatures do not exceed the operating range. |

# REPLACEMENT PARTS & OPTIONAL ACCESSORIES

| PART # | DESCRIPTION |
|---|---|
| | |
| | **REPLACEMENT PARTS** |
| 5060-005 | BOTTOM HEAT SHIELD |
| 5060-100 | DOOR HINGE |
| 5060-110 | DOOR PIN |
| 5060-035 | BAFFLE GUARD |
| 5030-060 | DOOR CATCH |
| 5021-022 | DOOR LATCH |
| 7200-523 | CATALYST THERMOMETER |
| | |
| | **REPLACEMENT KITS AND ACCESSORIES** |
| 96-53400 | OUTSIDE AIR KIT |
| 90-58600 | GASKET KIT |
| 90-58605 | GLASS KIT |
| 90-71240 | HANDLE KIT |
| 90-49600 | FRONT DOOR LATCH KIT |
| 3050-020 OR 3050-010 | CATALYST REPLACEMENT (TWO ALTERNATIVE CATALYSTS ARE APPROVED FOR USE IN THIS STOVE) |
| 90-76600 | BAFFLE KIT |
| 90-68601 | REAR HEATSHIELD |
| 90-68605 | SIDE HEATSHIELD (SINGLE) |
| | |
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Refer to the Illustrated Parts list for further detail about stove components, available online at www.hearthstonetech.com.

# SAFETY LABEL



## LIMITED WARRANTY

**These warranties give you specific legal rights. You may also have other rights, which vary from State to State.**

Hearthstone Quality Home Heating Products, Inc. (Hearthstone) warrants to the original retail purchaser only (the "Original Purchaser") the new appliance manufactured by Hearthstone, purchased by the Original Purchaser and installed by an authorized Hearthstone dealer or their designated representative against any of the occurrences listed in this document that result from defects in material or workmanship. This warranty is not transferrable. All obligations of Hearthstone under this document commence on the date of the Original Invoice (the "Purchase Date"). The term "Limited Lifetime" is defined as 10 years from the beginning of warranty coverage.
Hearthstone appliances are designed to be operated only with the fuels listed in your owner's manual.

**Catalytic combustor LIMITED LIFETIME WARRANTY:** The catalytic combustors are covered directly by the combustor manufacturer, Applied Ceramics. Included with your stove you will find the LIMITED LIFETIME WARRANTY for the catalysts, as well as a warranty card.
Catalyst Model Number: P/N WF-415000106 OR P/N WF-4150001076
Catalyst Manufacturer: APPLIED CERAMICS
APPLIED CERAMICS warrants to the consumer who purchases a FIRECAT STEEL COMBUSTOR as a component in an EPA certified solid fuel appliance, to replace at no charge to the consumer the FIRECAT STEEL COMBUSTOR that ceases to function with two (2) years from the date of purchase by the original consumer, provided that the following conditions are met:

(1) A copy of the original bill of sale that includes place and date of purchase must be submitted with the warranty claim.
(2) The original FIRECAT STEEL COMBUSTOR must be returned to APPLIED CERAMICS
(3) The FIRECAT STEEL COMBUSTOR must not have been mechanically abused, nor must the wrong fuels have been used in the appliance.

If after two years the FIRECAT STEEL COMBUSTOR fails to function, the prorated warranty will allow replacement at the following special price schedule:

| | |
|---|---|
| Year 3 | $130.00 |
| Year 4 | $140.00 |
| Year 5 | $150.00 |
| Year 6 | $160.00 |
| Year 7 | and after at current retail price |

Conditions 1, 2, and 3 also apply to the Prorated portion of the warranty. Any EPA certified solid fuel appliance will receive one replacement catalyst for each defective catalyst returned during the three year period. The consumer will be responsible for any removal, any servicing, and return of any items required for filing the warranty claim. This warranty is APPLIED CERAMIC'S exclusive warranty, and APPLIED CERAMICS, disclaims any other express or implied warranty for the FIRECAT STEEL COMBUSTOR, including any warranty or merchantability fitness for a particular use.
Ensure the catalyst is well wrapped and padded for shipment in bubble wrap, or similar material. Ship the catalyst with padding inside of a cardboard box.
All warranty claims must include $12.50 for postage and handling within the continental U.S. Alaska and Canada claims must include $35.00.
Please allow 2-3 weeks for delivery. Order online @ www.firecatcombustors.com

Please read and understand the full warranty. Please return the completed warranty card promptly to Applied Ceramics. The warranty card, and any warranty claims can be shipped to:

**Applied Ceramics**
**55555 Pleasantdale Road**
**Doraville, GA, 30340**

**Stove components Limited Warranty**

| Warranty Period | Wood | Gas | Covered Components |
|---|---|---|---|
| Limited Lifetime | X | X | Stone |
| | X | X | Cast iron not listed elsewhere |
| | X | | Clean burning air supply system* |
| 5 Year | X | X | Door handles and latches |
| | X | X | Steel Components and Firebox |
| | | X | Burner and logs |
| 2 Year | X | X | Appliance Electrical and Gas Components |
| | X | X | Refractory, Vermiculite Panels, Baffles |
| 1 Year | X | X | Enamel finish against peeling or fading |
| | X | X | Accessories |
| | X | X | Glass |
| | X | | Ash Grate |
| | X | X | All components not listed elsewhere |

Any parts repaired or replaced during the limited warranty period will be warranted under the terms of the limited warranty for a period not to exceed the remaining term of the original limited warranty or one year, whichever is longer.

**Parts:** Hearthstone will replace through an authorized dealer, defective parts covered by the foregoing warranty at no charge.

**Labor:** Within the first (1st) year after the Purchase Date, Hearthstone will pay for warranty labor performed by an authorized Dealer at Hearthstone's published labor rates in effect at the time the labor is performed only if the appliance is installed by an authorized dealer or their designated representative. Otherwise or thereafter, the Original Purchaser is responsible for the cost of labor.

**Shipping cost for parts:** Within the first ninety (90) days after the Purchase Date, Hearthstone will pay for the shipping of appliance parts covered by any of the foregoing warranties to and from Hearthstone or an authorized Dealer, as the case may be. Thereafter, the Original Purchaser is responsible for all shipping costs related to shipping appliance parts to and from Hearthstone or an authorized Dealer, as the case may be.

**Shipping cost for the appliance:** Within the first (1st) year after the Purchase Date, if the Original Purchaser is instructed to return the appliance to Hearthstone or an authorized Dealer for repair, Hearthstone will pay fifty percent (50%) and the Original Purchaser will pay fifty percent (50%) of the shipping costs related to shipping the appliance to and from Hearthstone or an authorized Dealer, as the case may be. Thereafter, the Original Purchaser is responsible for one hundred percent (100%) of all of the shipping costs related to shipping the appliance to and from Hearthstone or an authorized Dealer, as the case may be. Notwithstanding any other provision of this document, in no event will Hearthstone pay for any Dealer fees or other fees for pick up or delivery of the appliance returned for repair; the Original Purchaser shall be responsible for any such fees.

**EXCLUSIONS & CONDITIONS**

The warranties contained in this document do not cover, nor is Hearthstone responsible for:

1. Damages resulting from:
   a. Failure to install, operate, or maintain the appliance in accordance with the owner's manual, operating instructions, installation instructions, or safety rating label provided with the appliance.
   b. Over-firing the appliance. Over-firing can be identified by, but not limited to, warped cast iron or steel, rust colored cast iron, bubbling, cracking and discoloration of steel or enamel finishes.
   c. Failure to install the appliance in accordance with all national or local building codes.
   d. Shipping or improper handling.

e. Improper operation, abuse, misuse, continued operation with damaged, corroded, or failed components, accident, or improper/incorrect service or repairs.
f. Environmental conditions, inadequate ventilation, negative pressure, or improper drafting caused by tightly sealed constructions, insufficient make-up air supply, or air handling devices such as exhaust fans, forced air furnaces, or other such causes.
g. Damage caused by direct exposure to water.
h. Use of fuels other than those specified in the owner's manual.
I. Installation or use of components not supplied with the appliance, or any other components not expressly authorized and approved by Hearthstone.
J. Modifications of the appliance not expressly authorized and approved by Hearthstone in writing
K. Interruptions or fluctuations of electrical power supplied to the appliance.

2. All stones are warranted against cracking or breakage due to thermal stress, excluding surface and hairline cracks and scratches that do not affect the operation, or safety of the appliance.
3. Repair or replacement of wear parts. Such parts that are subject to normal wear and tear during the warranty period such as paint, gaskets, baffles, refractory materials, ash grates, and glass.
4. Damage resulting from installation, modification, alteration, repair or service of the appliance by any party other than an authorized Hearthstone dealer (a "Dealer") or their designated representative, or Hearthstone.
5. Damage due to water or condensation due to installation of the appliance in a high moisture area.
6. Damage due to installation of the appliance in an atmosphere contaminated by damaging chemicals, including but not limited to chlorine, fluorine or salts.
7. Scratches on glass, enameled surfaces or stones due to mechanical abrasion.
8. Noise caused by expansion or contraction caused by the heating and cooling of the appliance.
9. Odors caused by the heating of the appliance, or surrounding materials
10. Consequential damage caused by leaking of condensate during startup
11. A defect in any part of the appliance if the Original Purchaser fails to comply with Hearthstone's or a Dealer's request to ship the part or the appliance to Hearthstone or a Dealer, as the case may be.
12. Replacement stones and enameled parts are taken from current stock, and may not match originals in color, grain, or pattern. Hearthstone will supply replacement parts for discontinued parts in finishes or colors as available, or at their discretion.
13. Hearthstone's obligation under this warranty does not extend to the appliance's ability to heat the desired space. Information is provided to assist the customer and the dealer in selecting the appropriate appliance for the application. Consideration must be given to appliance location and configuration, environmental conditions, insulation and air tightness of the structure.

THE WARRANTIES CONTAINED IN THIS DOCUMENT ARE EXCLUSIVE AND ARE GIVEN BY HEARTHSTONE AND ACCEPTED BY THE ORIGINAL PURCHASER IN LIEU OF ALL OTHER EXPRESS WARRANTIES AND ANY OBLIGATIONS, LIABILITIES, RIGHTS, CLAIMS, OR REMEDIES IN CONTRACT OR TORT, WHETHER OR NOT ARISING FROM HEARTHSTONE'S NEGLIGENCE, ACTUAL OR IMPUTED. ALL IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE GIVEN ONLY TO THE EXTENT REQUIRED BY FEDERAL OR STATE LAW. EXCEPT AS OTHERWISE REQUIRED BY STATE LAW, UPON THE EXPIRATION OF THE EXPRESS LIMITED WARRANTIES CONTAINED HEREIN, NO IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL APPLY TO THE SUBJECT APPLIANCE. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

THE WARRANTIES CONTAINED IN THIS DOCUMENT EXTEND ONLY TO THE ORIGINAL PURCHASER OF THE APPLIANCE WARRANTED HEREUNDER. THEY ARE NOT TRANSFERRABLE AND DO NOT EXTEND TO ANY SUBSEQUENT OWNERS.

UNDER NO CIRCUMSTANCES SHALL HEARTHSTONE BE LIABLE TO THE ORIGINAL PURCHASER OR ANY OTHER PERSON FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO DAMAGE TO PROPERTY OR PERSONAL INJURIES, WHETHER ARISING OUT OF LOSS OF USE, BREACH OF WARRANTY, TORT, OR OTHERWISE, EVEN IF HEARTHSTONE HAS BEEN APPRAISED OF THE POSSIBILITY OF SUCH DAMAGES. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

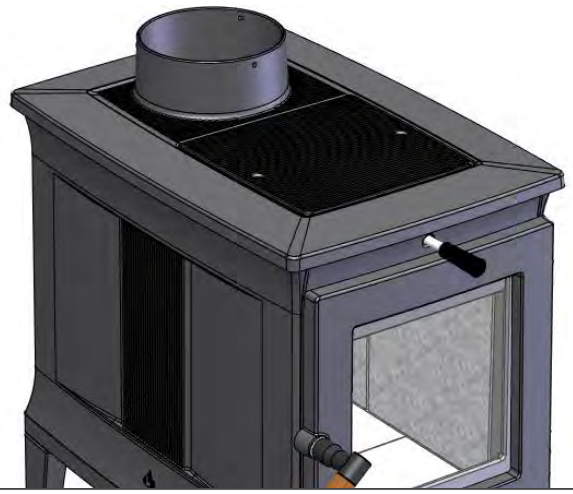
## QUALIFYING FOR WARRANTY COVERAGE

To obtain performance of any obligation under this document, the Original Purchaser must, within the applicable warranty time period, contact their original Hearthstone dealer, or the current responsible local Hearthstone dealer, for instructions regarding the return of defective parts for repair, the return of the appliance for repair, or to schedule a Dealer service call. The Original Purchaser should refer to the Dealer Network search engine contained on Hearthstone's Web site (www.hearthstonestoves.com) if the original dealer is not available, to find a Hearthstone dealer nearest to the Original Purchaser's location.

## REMEDY

The remedy for any breach of the foregoing warranties will consist of repair or replacement, at Hearthstone's option, of any covered defect in the appliance. When the Original Purchaser contacts a Hearthstone Dealer, the Dealer on behalf of Hearthstone, as the case may be, will instruct the Original Purchaser to either return the defective part, or the entire appliance (if requested), to the Dealer or Hearthstone or allow a Dealer to make a service call at the place where the appliance is located. Hearthstone may require that a digital picture be provided to support the claim. Notwithstanding any other provision of this document, the Original Purchaser shall pay for any fees and service charges related to a Dealer's service call or the shipping charges associated with the return.

hearthstone



# Green Mountain 20

(Model 8620)

# Woodstove

## OWNER'S MANUAL

### Installation And Operating Instructions

NFI NATIONAL FIREPLACE INSTITUTE
A CERTIFICATION AGENCY

We recommend that our products be installed and serviced by professionals who are certified in the U.S. by NFI (National Fireplace ...e), or by W.E.T.T. (Wood Energy ...ology Transfer) in Canada.
www.nficertified.org
www.wettinc.ca

UNRELEASED DRAFT

PFS C US

...PFS Report Fxx-xxx

**SAVE THIS OWNER'S MANUAL**
**FOR FUTURE REFERENCE**

**PLEASE READ THIS ENTIRE OWNER'S MANUAL BEFORE YOU INSTALL AND USE YOUR NEW GREEN MOUNTAIN 20 WOOD STOVE.**
**Ce manuel est disponible en français sur hearthstonetech.com**

**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. 1482-2022**
**Certified to CAN/ULC Std. S627:2023**

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

**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 Effici...

**Rating:**

You have purchased a Hearthstone Green Mountain 20 tested to EPA Method 28R 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 1.14 gr/hr. emission rate and under specific test conditions has been shown to deliver heat at rates ranging from 14,545 to 20,507 Btu (output).

This wood heater has a manufacturer-set minimum allowable low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

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 Hearthstone dealer. Our dealer network processes all warranty claims. Authorized Hearthstone dealers can be located at www.hearthstonestoves.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 ensure 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 across all of the 4 burn rate categories using the higher heating value (HHV). The weighted average efficiency is 78.5% (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:**

The Green Mountain 20 has the following CO emission rates by burn level: Category 1 (low) –38.7 g/hr., Category 2 (med. low) – 18.2 g/hr., Category 3 (med. high) – 17.3 g/hr. and Category 4 – 69.0 g/hr. 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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# INTRODUCTION

Thank you for purchasing a Green Mountain 20 woodstove from Hearthstone Quality Home Heating Products. This stove will provide years of comfortable heat. This stove combines the warmth and comfort of soapstone and cast iron with the efficiency of advanced catalytic technology. The Green Mountain 20 blends modern technology with the unique beauty and qualities of cast iron and soapstone. We trust that you will appreciate the quality of this handcrafted product.

Your Green Mountain 20 woodstove burns very efficiently, and produces a large amount of heat. The Green Mountain 20's large glass window allows you to enjoy the fire from a variety of locations in the room.

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.

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 Green Mountain 20 Model 8620 stove is warranted by:

**Hearthstone** ***Quality Home Heating Products, Inc***®
317 Stafford Ave.
Morrisville, Vermont 05661, USA
www.Hearthstonestoves.com

# CODES

When you install your Green Mountain 20 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

If you are installing your Green Mountain 20 in a mobile or manufactured home, follow the guidelines described in the Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 (United States).

# 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.
- **Never** connect to or use in conjunction with any air distribution ductwork unless specifically approved for such installations

**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.
- 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 the optional outside air kit #96-53400

## 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 level of ashes is even with the door sill.

**At the Beginning of Every Other Month:**

- Depending upon your use of the stove, visually inspect the chimney connector and chimney for creosote using a mirror through the firebox.
- 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.
- Inspect the face of the catalytic combustor for fly ash and soot. Use a soft-bristled brush to remove if present. It is recommended to visually inspect the catalytic combustor at least 3 times during the heating season, or every 2-3 months.

**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.
- Check and clean the catalytic combustor, if necessary
- 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 primary air control.
3. Close the stovepipe damper (if present).
4. Close the bypass damper
5. 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, leave the primary air control and bypass handle pushed in and 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:**
23,000 BTUs per hour of Maple cordwood.

**Floor Size of Heated Area:**
Up to a maximum of 575 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:**
1.0 cubic feet.

**Maximum Log Length:** Up To 18” (45cm), 16” (40cm) Recommended

**Emissions:** 1.14 g/hr.

**Burn Time:** Up to 9-1/2 hrs. on low. (*Heat Life*™: Up to 20 hours) 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:**

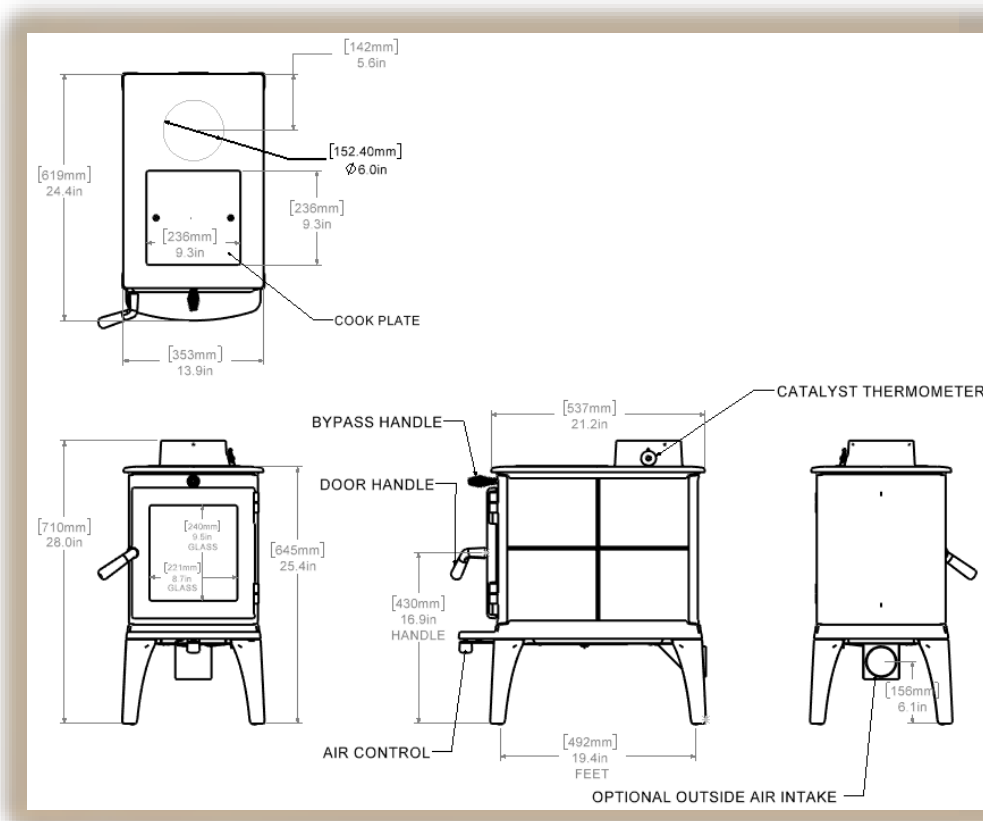
**Height:** 28” (71.1cm)
**Width:** 14" (35.5cm)
**Depth:** 24.5" (62.2Cm)
**Weight:** 250 lbs. (113.4 kg)

**Connector Size:** 6" (152 mm) diameter
**Metal Chimney:** 6" (152 mm) inside diameter
**Masonry Chimney:** 6” (152 mm) inside diameter (round flue), 8” x 8” (203 x 203 mm) (square flue)

**Crate Dimensions:** H-40” W-29” L-36” or 102x74x 92cm

**Optional Equipment:**

| | |
|---|---|
| Outside Air Kit | 96-53400 |
| Rear Heatshield | 90-68601 |
| Side Heatshield (Single) | 90-68605 |



# INSTALLATION

## UNPACKING

Hearthstone packages your Green Mountain 20 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 Green Mountain 20, 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 Hearthstone dealer immediately.

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

## PACK LIST

Green Mountain 20 Model 8620 Woodstove
Owner's Manual
Hardware Kit

The label is attached by a cable to the bottom of the stove. Take care when lifting the stove not to damage the label or cable. After final positioning of the stove, the label may be stored in the holding clip on the bottom shield of the stove (See Figure 2).

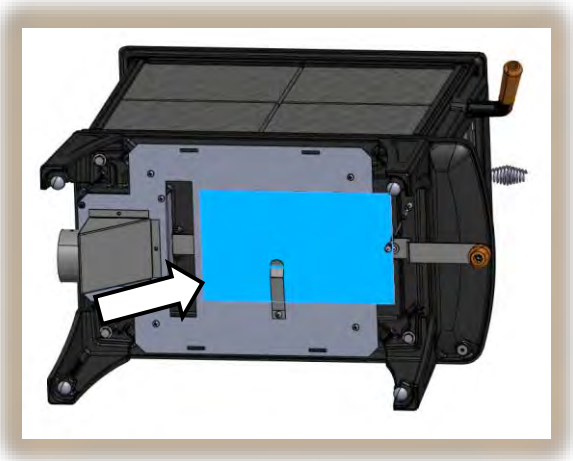


**Figure 2 - Label Location**

## HARDWARE KIT UNPACKING

Your Green Mountain 20 is shipped with a hardware box in the firebox. Remove the hardware box and the three pieces of refractory stone on the floor of the stove to complete the assembly of the stove before installing the stove in the final location.

Hardware kit contents:
4 - feet
4 - carriage leveling bolts for feet
4 - hex head feet mounting bolts
4 - flat washer for feet mounting bolts
4 - lock washers for feet bolts
1 - front door handle
1 - 3-1/4" front door handle screw
1 - air control handle
1 - 1" air control screw
1 - nut for air control handle screw
1 - lock washer for air control handle screw
1 - catalyst temperature indicator

## ASSEMBLY

Your Green Mountain 20 is shipped with two disposable shipping brackets installed to the bottom of the stove where the feet will mount.

1. Unbolt the shipping brackets from the pallet and discard lag bolts.
2. Lay down a blanket or other protective covering behind the stove. Ensure the floor refractory stone has been removed before continuing to the next step.
3. Flip the stove on to its back (See Figure 3).
4. Unbolt the two shipping brackets from the stove and discard bolts and bracket (See Figure 3).
5. Install the 4 feet in the location of the shipping brackets. Use one foot bolt (hex head bolt), one flat washer, and one lock washer per foot to secure the foot to the stove (See Figure 4). Ensure leveling bolts are installed in the bottom of the feet.






**Figure 4 – Foot Installation**

6. Stand the stove up on to its feet. Adjust leveling bolts if needed.
7. Install the air control wooden handle on to



the air control.
8. Install the front door handle.

9. Install the catalyst temperature indicator.




# INSTALLING YOUR STOVE

Choose a place to install your Green Mountain 20 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.

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 Simpson Dura-Vent DVL brand.

**This stove is a freestanding room heater and is only to be installed per the clearances to combustibles defined in this instruction manual. Do not install the Green Mountain 20 8620 into a factory-built fireplace.**

### 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 noncombustible material. The Green Mountain 20 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 27-1/2” x 37-1/2”.
The minimum floor protection for installations in Canada is 30” (762mm) x 47-1/2” (1206mm).

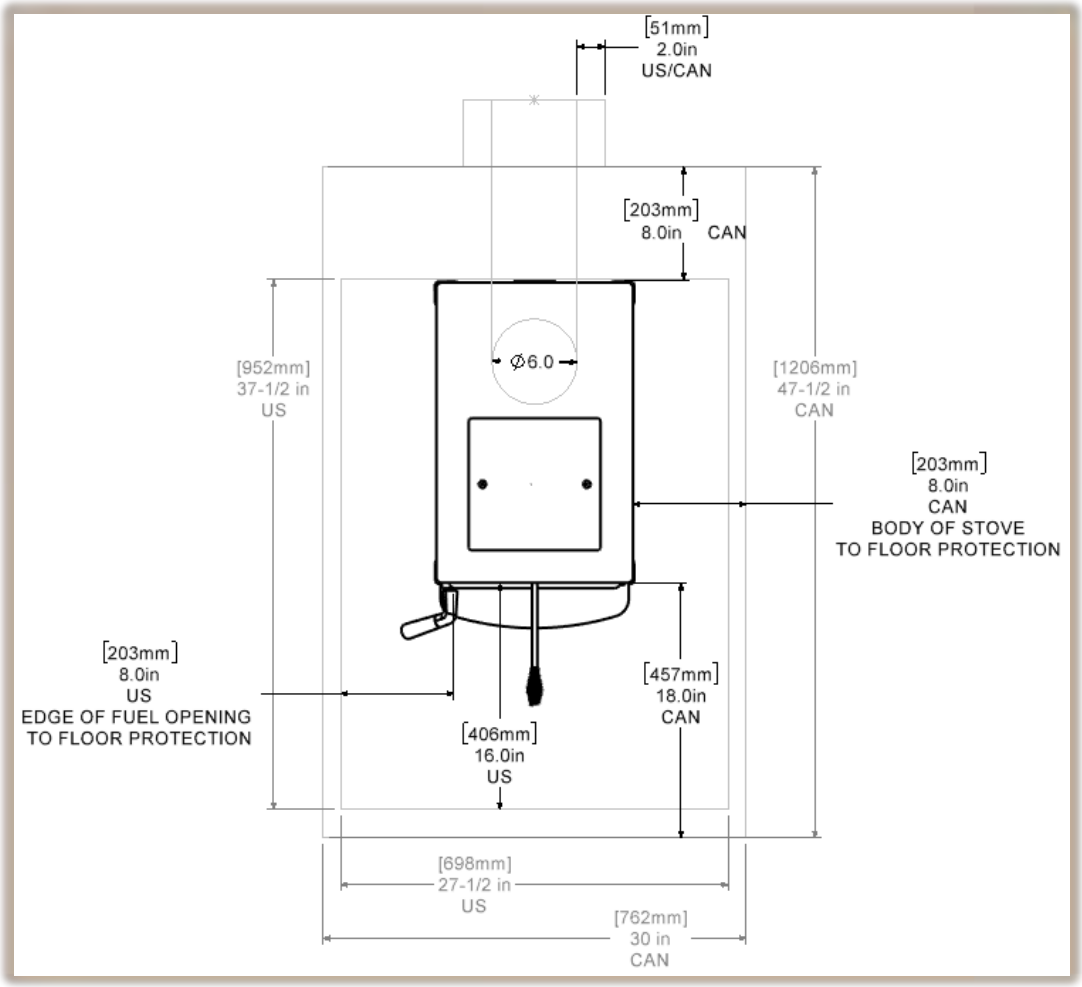



**Figure 5 – Hearth Dimensions**

Installing the stove in a room with Luxury Vinyl Plank (LVP) or Luxury Vinyl Tile (LVT) flooring requires extra consideration from the stove to the LVP or LVT flooring. Some LVP and LVT flooring begins to warp at 110° Fahrenheit. Each installation and flooring specification is different. **Consult the flooring manufacturer for maximum temperature recommendations. Additional shielding to prevent warping may be necessary depending on the flooring used.**

# COMBUSTIBLE SURFACE REQUIRED CLEARANCES

***Note:*** *Dimensions shown in the following figures are from the furthest point on cast 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. Optional side and rear heatshields are available for purchase to reduce clearances.

**These clearances govern clearances from the stove to combustibles. Pipe clearances may be dictated by your local building codes. Be sure to reference your pipe manufacturer's clearances for double wall or Class A pipe as some manufacturer's clearances may vary**.

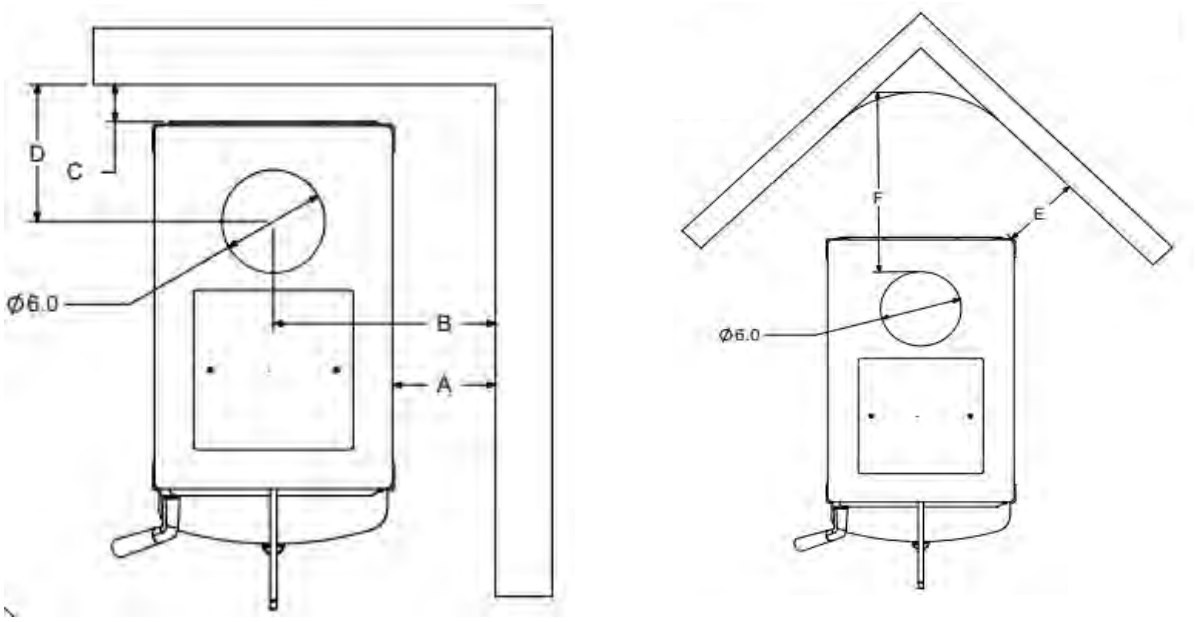



**Figure 6 – Clearance to Combustibles**

| | Parallel Install | | | | Non-Parallel Install | |
|---|---|---|---|---|---|---|
| Clearances | A | B | C | D | E | F |
| Single wall Connector – NO SHIELDS | TBD | | | | | |
| Single Wall Connector – WITH SIDE SHIELDS | | | | | | |
| Single Wall Connector – WITH REAR SHIELD | | | | | | |
| Single Wall Connector – WITH SIDE AND REAR SHIELDS | | | | | | |
| Double Wall Connector – NO SHIELDS | | | | | | |
| Double Wall Connector – WITH SIDE SHIELDS | | | | | | |
| Double Wall Connector – WITH REAR SHIELD | | | | | | |
| Double Wall Connector - WITH SIDE AND REAR SHIELDS | | | | | | |
| ALTERNATIVE INSTALLATION OPTIONS | **A** | **B** | **C** | **D** | | |
| Through the rear wall, single wall connector – NO SHIELDS - See Figure 6 | | | | | | |
| Through the rear wall, double wall connector – NO SHIELDS - ** See Figure 6** | | | | | | |

| | | | | |
|---|---|---|---|---|
| Through the rear wall, single wall connector – REAR SHIELD - See Figure 6 | | | | |
| Through the rear wall, double wall connector – REAR SHIELD - See Figure 6 | | | | |
| Through the rear wall, single wall connector – SIDE SHIELDS - See Figure 6 | | | | |
| Through the rear wall, double wall connector – SIDE SHIELDS - See Figure 6 | | | | |
| Through the rear wall, single wall connector – SIDE AND REAR SHIELDS - See Figure 6 | | | | |
| Through the rear wall, double wall connector – SIDE AND REAR SHIELDS - See Figure 6 | | | | |
| Alcove W/Sngl or Dbl Wall Conn – NO SHIELDS | | | | |
| Alcove W/Sngl or Dbl Wall Conn – WITH SIDE AND REAR SHIELD | | | | |
| FIREPLACE INSTALLATION | | | | |
| Mantle, 12” protrusion - NO SHIELD | | | | |

| Alcove Clearances (inches) | Unprotected Surfaces |
|---|---|
| Minimum unshielded alcove width | |
| Min. Alcove ceiling from floor with single wall connector | |
| Min. Alcove ceiling from floor with double wall connector | |

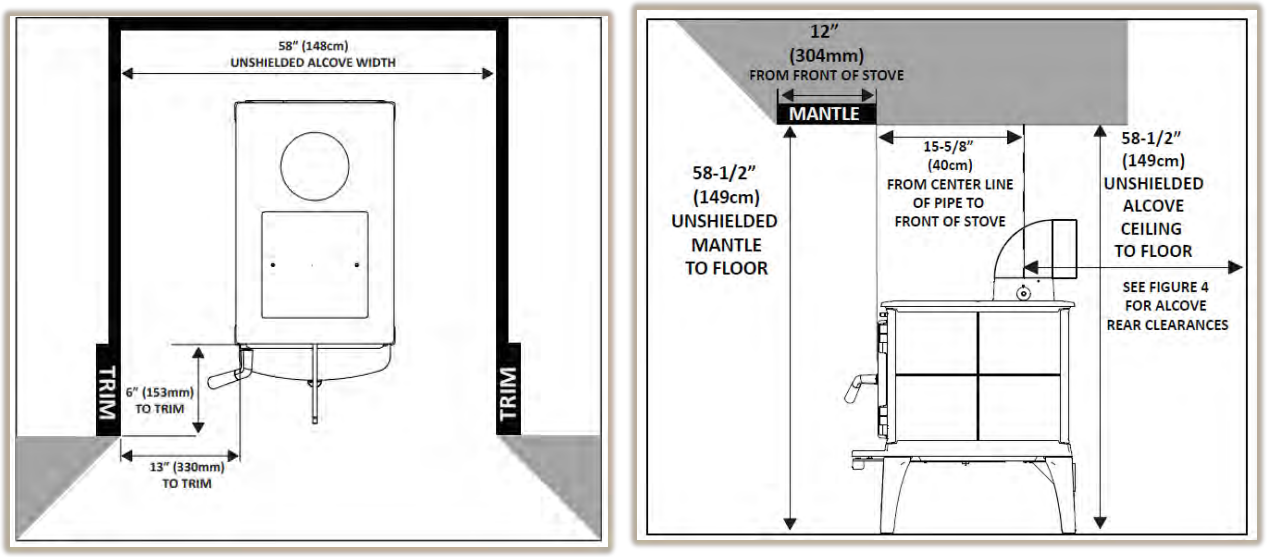



**Figure 7 trim, mantle, and alcove clearances**

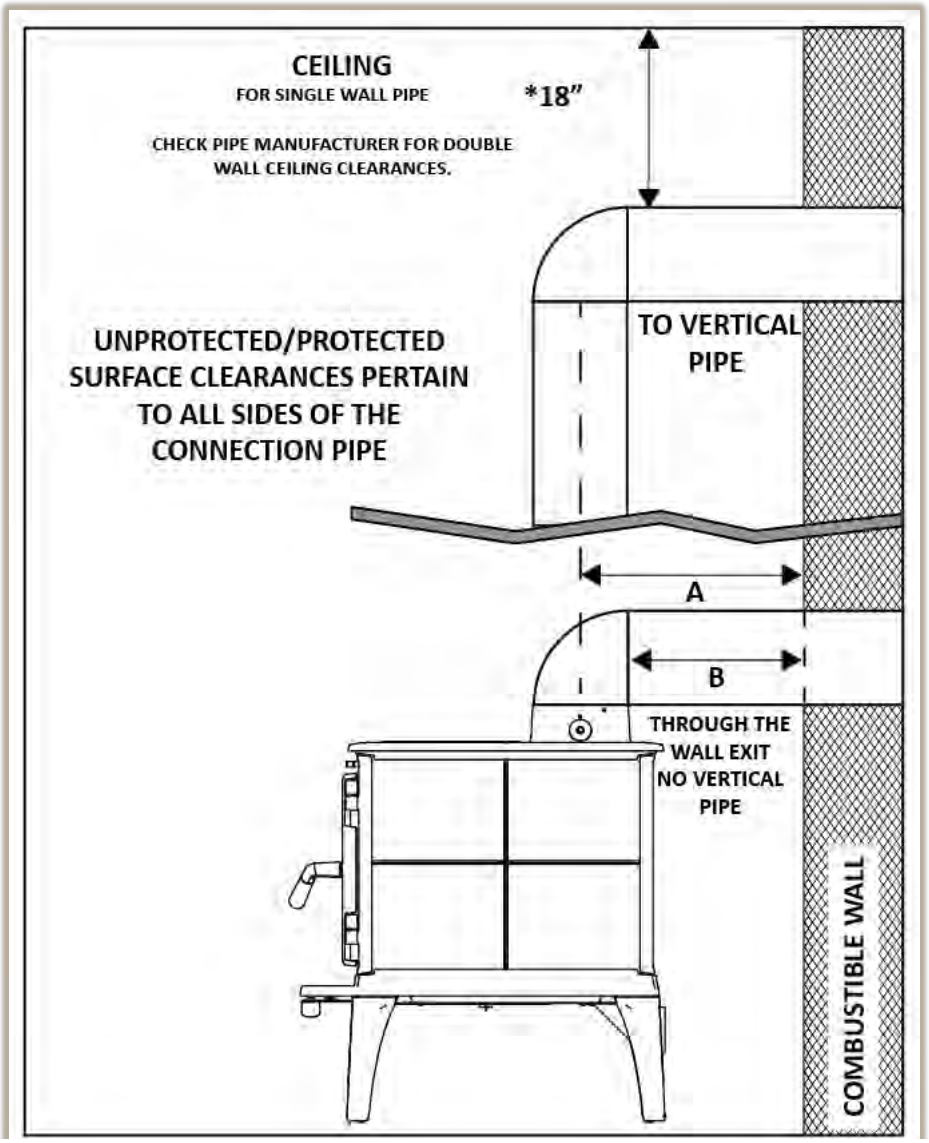
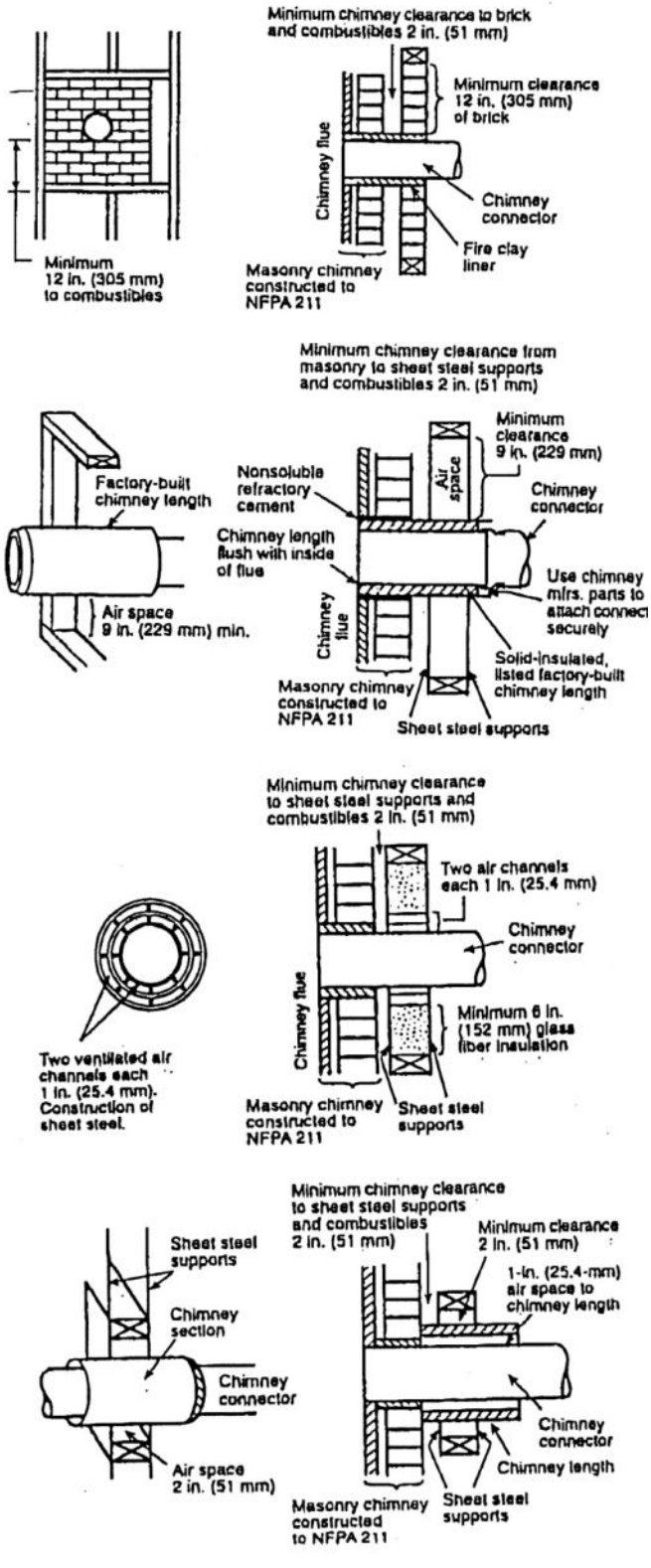



**Figure 8: Chimney Connector Clearances to Combustibles**

| | With Rear Shield US* | With Rear Shield CANADA* | No Rear Heat Shield US | No Rear Heat Shield CANADA |
|---|---|---|---|---|
| Through the wall flue exit. Elbow directly atop stove to rear exit. | **Single Wall Pipe** | | | |
| A | | | | |
| B | | | | |
| | **Double Wall Pipe** | | | |
| A | | | **Check Pipe Certification** | |
| B | | | | |

***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.**




# 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. Do not install the chimney directly at the outlet of the appliance. A chimney connector (flue pipe) is required.

## OUTSIDE AIR SUPPLY

(Optional Kit #96-53400)

If this unit is installed in a mobile home or a well-sealed, newer construction home, care must be taken to ensure adequate air is available. If not enough air is available, it could starve the room of all the oxygen.

You can connect an outside air source directly to this stove using an optional outside air kit. 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 kit for this stove allows for the direct connection of the stove's 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 duct from the outside of the house to the hearth, keep in mind the need to avoid structural members of the house. The outside air kit attaches to the underside of the stove. Refer to the instructions provided with the kit for installation.

*An adaptor for 4” duct is available if needed. KIT #90-53308

When using an outside air kit in Canada, the stove must be attached to your home’s floor. Request stove hold down brackets from your dealer and choose fasteners long enough to attach securely to the subfloor. (The clips and fastener heads may be painted to minimize visibility).

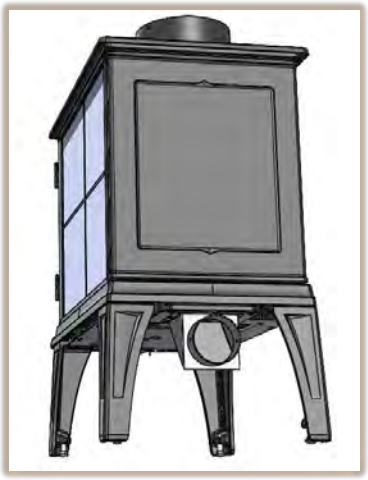


**Figure 9: Outside Air Kit Detail**

The International Residential Code (IRC) does not allow the outside air duct to terminate higher than the appliance. Some building officials restrict vertical rise in the duct’s termination. Hearthstone recommends the termination be at the same level, or lower than the air intake on the stove. When using an outside air kit in Canada, a damper allowing 100% closure shall be installed.

Locate the termination of the intake 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 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 recommended are Simpson Dura Vent DVL and Metalbestos DS. Security, GSW and Ameritec also manufacture acceptable connector pipe.

- When used in a mobile home, a spark arrester is required.

- 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 Simpson DuraVent DVL 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 site-constructed) 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 the chimney connector 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 chimney connector 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 Green Mountain 20. 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 Green Mountain 20 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 Green Mountain 20 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 Green Mountain 20 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 Green Mountain 20. The Green Mountain 20 requires a 6" (152 mm) inside diameter flue for new installations. A 6" diameter flue provides adequate draft and performance. You can use an 8" (203 mm) diameter existing flue with a reducer. 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 8):**

- 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 from the top of stove is 16 feet (4.9 m). The recommended maximum chimney height is 30 feet (9m). The Green Mountain 20 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.

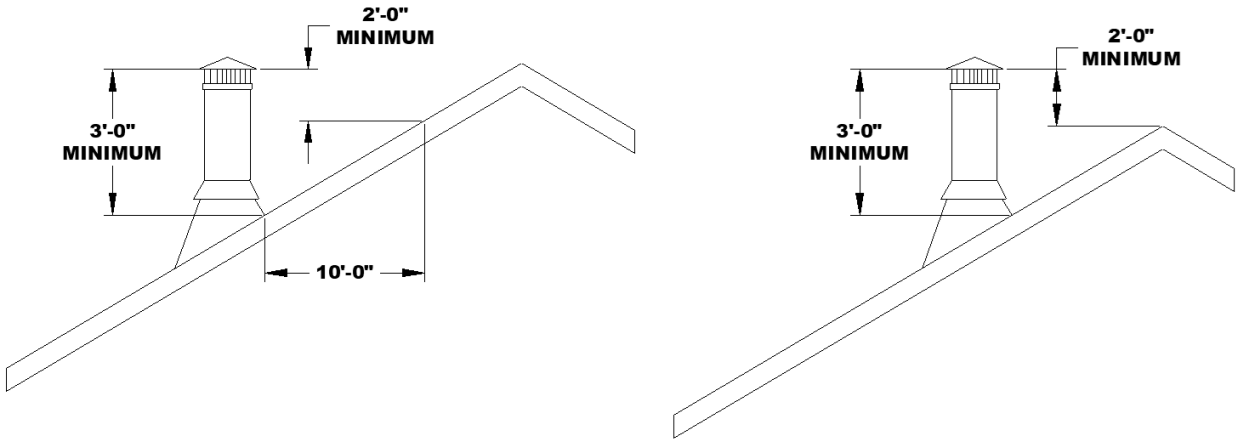



**Figure 10 - Chimney Height Requirements**

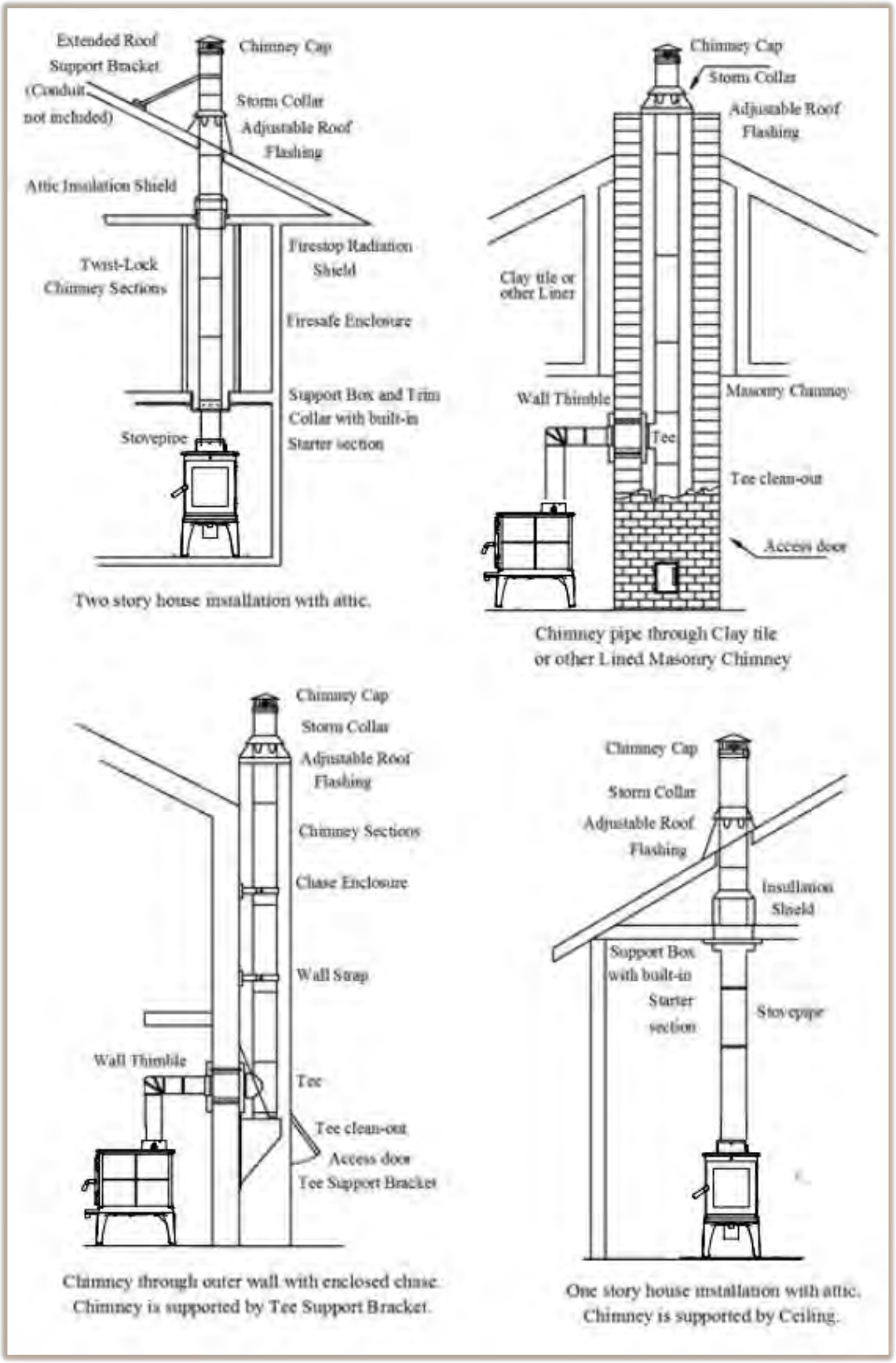



**Figure 11 - Typical Chimney Configurations**

# INSTALLING IN A MOBILE HOME

Follow these special requirements for installing your stove in a mobile home.

- Install the stove in accordance with 24 CFR, Part 3280 (HUD)
- An outside air kit must be used in all mobile home installations.
- Permanently attach the stove to your mobile home's floor. Request stove hold down clips from your dealer, or attach through the threaded leveling leg hole. (The clips and fastener heads may be painted to minimize visibility).

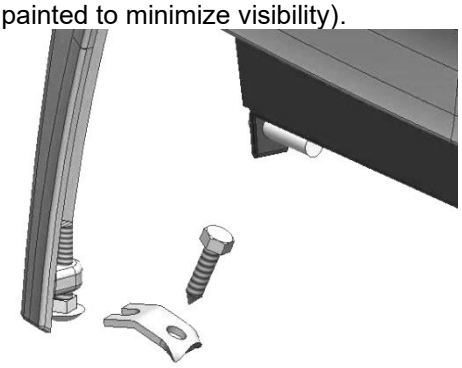


**Figure 12 - Lock Down Detail**

- Install a Mobile Home Chimney & Connector Kit*.

  Each kit must include:
  Stainless spark arrester cap, storm collar, Adjustable vented flashing – 0/12 – 6/12, Two 24" chimney pipes, 24" support box with built-in starter section and trim.

  * Install a Mobile Home Chimney and Connector Kit conforming to US/UL103 or CAN/ULC-S629, Standard for Factory-Built Chimneys.

- WARNING: DO NOT INSTALL IN A SLEEPING ROOM IN A MOBILE HOME.
- CAUTION: MAINTAIN THE STRUCTURAL INTEGRITY OF THE MOBILE HOME WALLS, FLOOR, CEILING, AND ROOF WHEN INSTALLING AND USING YOUR STOVE.
- FAILURE TO FOLLOW THESE INSTRUCTIONS AND SPECIFIED COMPONENTS OR USING MAKE-SHIFT COMPROMISES CAN RESULT IN FIRE, PROPERTY DAMAGE, BODILY INJURY, AND EVEN DEATH.
- Burning any fuel other than wood in this unit could generate dangerous levels of carbon monoxide within the living space.
- THE FRONT DOOR MUST REMAIN CLOSED WHEN IN OPERATION EXCEPT FOR START UP AND LOADING. Leaving the door open during use could cause any smoke or fire detectors in the home to be set off or a fire could escape the firebox and start the room on fire.
- If this unit is installed in a mobile home or a well sealed, newer construction home, care must be taken to ensure adequate air is available. If not enough air is available, it could starve the room of all the oxygen.
- The chimney should be attached directly to the stove and must extend at least 3 feet (.9 m) above the part of the roof through which it passes. The top of the chimney is to be at least 2 feet (.6 m) above the highest elevation of any part of the mobile home within 10 feet (3 m) of the chimney.
- All roof-chimney terminations should be able to be readily removed / re-installed at or below an elevation of 13-1/2 feet (4.1 m) above ground level without the use of special tools or instructions. The chimney assembly shall be provided with a mechanical securement means to secure the chimney to the ceiling support box.
- When a chimney exits the mobile home at a location other than through the roof, and exits at a point 7 feet (2.1 m) or less above the ground level on which the mobile home is positioned, a guard or method of enclosing the chimney shall be provided at the point of exit for a height up to 7 feet.
- The chimney guard shall not allow the passage of a ¾ inch (19.1 mm) diameter rod, and a ½" (12.7 mm) diameter rod shall not be able to touch the chimney when inserted through any part of the guard a distance of 4 inches (102 mm).

- The chimney shall be provided with a spark arrester secured to the chimney. The net free area of the arrester above the chimney outlet shall not be less than 4 times the net area of the chimney outlet, and the vertical height of the arrester above the chimney outlet shall not be less than ½ the diameter of the chimney flue. Openings shall not permit the passage of a sphere having a diameter of ½ inch (12.7 mm), and shall allow the passage of a sphere of 3/8" (9.6 mm).

- CAUTION: REMOVE THE CHIMNEY WHEN TRANSPORTING THE MOBILE HOME!

- 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

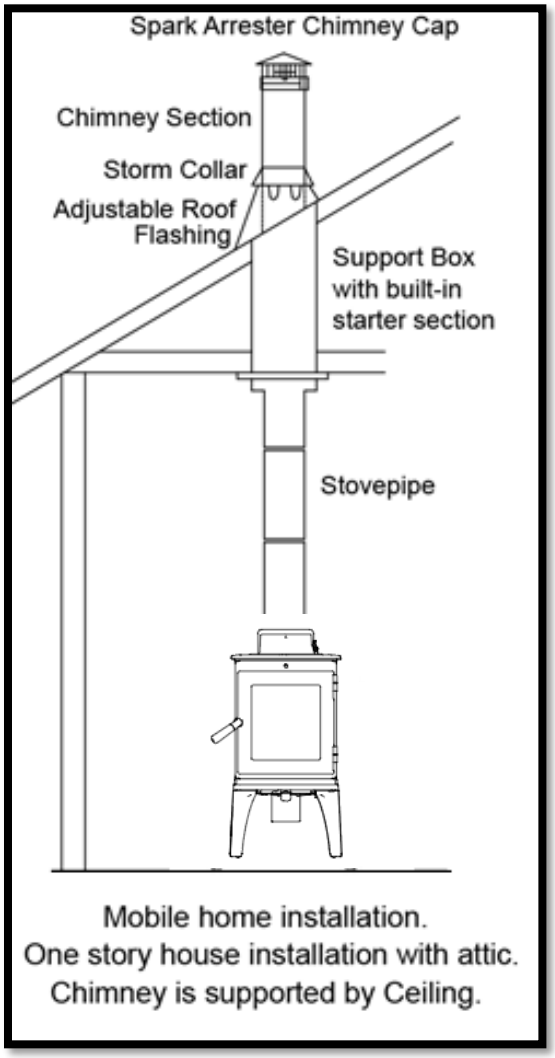



**Figure 13 - Mobile Home Installation**

# OPERATION

Once your Green Mountain 20 is installed, you are ready to light a fire.

Every installation, season's firewood, and operator's technique vary. 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.

Prior to operation, ensure that nothing obstructs the space beneath the stove. Storage of wood or other materials is not allowed in this area. Ensure pets do not lay under or around the stove. Ensure that the air intakes of the stove, located on the bottom of the stove, are not obstructed.

## CONTROLS AND FEATURES

Before lighting any fires, become familiar with the location and operation of your stove's controls and features and learn how to use them (*See Figure 13*). For your own safety, do not modify these features in any way. We recommend you use fireplace gloves when the stove is in operation and hot.

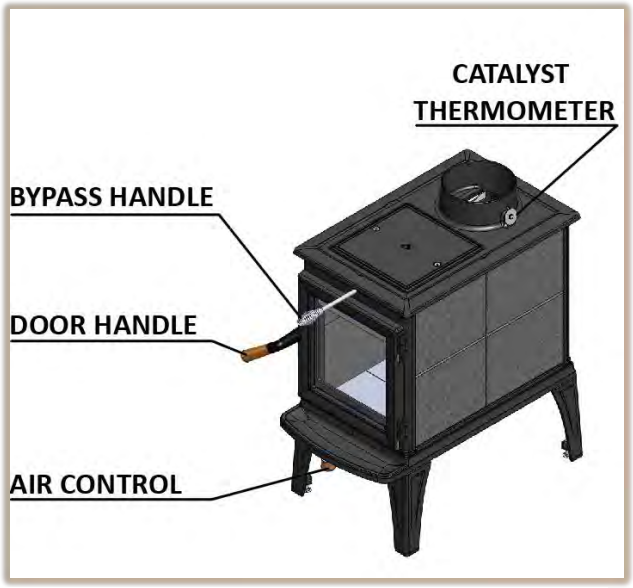



**Figure 14 - Controls & Features**

**Figure 12 -**

**DOOR HANDLE:** The firebox door allows you to load wood into your stove; a wood handle operates the door. To open the door, pull up on the handle and swing the door away from the stove. To latch the door, push the door tightly towards the firebox then continue to push the handle in and down until it latches shut. Gently pull on the door handle to make sure it is properly latched.

**AIR CONTROL:** The primary air control lever is located under the ash lip. The primary air control allows you to regulate the amount of air entering the firebox. Generally, the more air allowed into the firebox, the faster the rate of burn and the higher the heat output; conversely, less air creates a slower burn, with lower heat output. For maximum airflow, pull the lever out as far as possible; move the lever inwards as far as possible for minimum airflow (does not close completely).

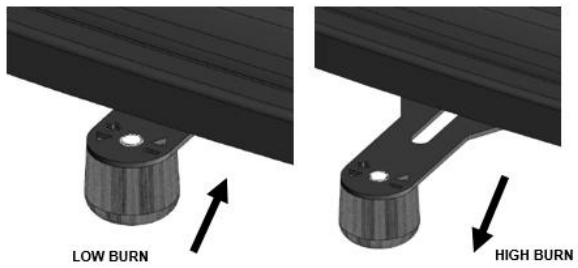



**Figure 15 - Air Control**

**BYPASS ROD HANDLE:** The bypass handle controls the bypass door inside the stove. **The spring handle should always be used to move the bypass rod. A leather wood stove glove is recommended.** When the rod is pulled out towards the front of the stove, the bypass door is open, and when the rod is pushed in, towards the rear of the stove, the bypass door is closed. The bypass door directs the flow of combustion products through or around the catalytic combustor. When the bypass handle is pulled out, combustion products are directed around the catalytic combustor. The bypass handle should be pulled out when first staring a fire until the catalytic combustor heats up to activation temperature, and whenever opening the front door to load the stove. When the bypass handle is

pushed in, combustion products are directed through the catalytic combustor. The bypass handle should be pushed in once the catalytic combustor heats up



**Figure 16 - Bypass Handle**

to activation temperature, and remain pushed in whenever the stove is burning and in the active temperature range.

**CATALYST THERMOMETER:** The catalyst thermometer monitors the downstream temperature of the catalysts, and indicates when the stove is in the active range for the catalysts. The catalyst probe should be spaced 3/8" from the body of the stove. When the stove is in the "active" range, the bypass handle should be pushed in. When the stove is in the "Inactive" range, the bypass handle should be pulled out until the stove heats up. If the thermometer is in the "Too Hot" range, keep the bypass pulled out, fully close the air control, and allow the stove to cool down until the thermometer falls into the "Catalyst Active" Range. Once the catalyst thermometer has reached the active range, heat generated from burning smoke keeps the catalysts warm and active as long as fuel remains in the stove.

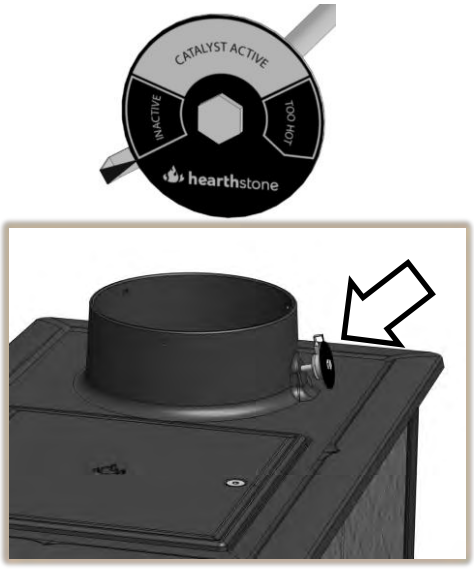



**Figure 17 - Catalyst Thermometer**

## CHOOSING FIREWOOD

Burn only natural firewood (known as cordwood) in the Green Mountain 20 Model 8640 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 AND WILL DAMAGE YOUR CATALYST. 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 damage the catalysts.

| 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, GASOLINE-TYPE LANTERN FUEL, KEROSENE, CHARCOAL LIGHTER FLUID, OR SIMILAR LIQUIDS TO START OR 'FRESHEN UP' A FIRE IN THIS HEATER. KEEP**

**ALL SUCH LIQUIDS WELL AWAY FROM THE HEATER WHILE IT IS IN USE.**

## BREAKING IN YOUR WOOD STOVE

It is imperative that your stove is "broken in" gradually. Soapstone must be "seasoned"; over-firing a new stove may cause soapstone to crack or may damage other stove parts. Natural moisture in the freshly quarried soapstone must be driven out slowly to minimize the “shock” to the stone 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 shortly after first firing. 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, cast iron, and soapstone components of your stove will give you many years of trouble-free use. With use, the color of the soapstone may change and small fractures may appear on the surface. These changes do not affect the function of the stove. If a panel breaks completely, it must be replaced

Avoid the following conditions that can cause the glass, soapstone, 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.

## PROTECT YOUR HEARTH

While your stove radiates heat slowly and evenly when in use, it also absorbs moisture condensations when not in use. Specifically, true with a brand-new stove, but also for stoves during the off season, your stove and chimney flue has moisture in it. During the early stages of use and during certain heating conditions, this condensation can turn to a liquid. This dark liquid can find a way through the bottom of your stove and onto your hearth. We recommend placing some pieces of aluminum foil or other non-combustible material in the area around each of the legs of the stove temporarily to catch this liquid until the moisture has been removed from the heating system. As the system becomes seasoned these can be removed for normal use.

## A NOTE ABOUT MAJOLICA ENAMELS

The porcelain Majolica enamels Hearthstone uses are a natural glass-based product. The Majolica process consists of a neutral opaque color base, usually an off-white, with a translucent color applied over it. It is essentially molten-glass applied as a powder and each coat is fused to the iron in our ovens at nearly 2000 F. The darkness of the color is dependent upon the thickness of the translucent color over the base color, the thickness of the part and the oven temperatures. Details in the iron allow for the molten glass to pool darkly in low places and be thinner on edges of detail. Color variations are what makes it so beautiful. Please expect variations in color as this is a normal part of the process. Crazing (minuscule lines in the glaze) is common with repeated heating and cooling. or extreme use. Crazing has no significant effects on the ceramics, it is cosmetic and in the top coat only. Majolica finishes are applied by artists; having been used on ceramic pottery for hundreds of years. Antique Majolica plates, saucers, cups and teapots are normally crazed to varying degrees and have color variations piece to piece.
Enjoy a lifetime of beauty with this classic finish we are proud to offer.

## BUILDING A BREAK IN FIRE

1) Pull the bypass handle out. 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) Fully open the primary air control by pulling the control handle towards you, away from the firebox.

3) Light the paper under the kindling. Leave the door slightly ajar momentarily until the kindling has started to burn and draft begins to pull.

4) Close the door and allow the fire to burn. Keep the door closed while the stove is in use.

5) KEEP A WATCHFUL EYE ON YOUR STOVE to maintain a steady, low-heat fire. Your first fire should make the stove warm but **not hot to the touch**. Visible steam, or boiling moisture and hissing indicate the soapstone is too hot. At most, a few small chunks of wood should be added to the fire to reach safe break-in temperatures.

6) Once the stove is warm but **not hot to the touch,** close the primary air control by pushing it fully inward toward the stove to allow the fire to die out completely.

7) 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) Pull the bypass handle out. 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) Fully open the primary air control by pulling the lever completely out, away from the firebox.

3) Light the paper under the kindling. Leave the front door slightly ajar momentarily until the kindling begins to burn and draft begins to pull.

4) Close the door and allow the fire to burn.

5) 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.**

6) Once the fire is burning well, and the catalyst thermometer indicates that the stove is in the active range, push in the bypass handle. Now the combustion products are passing through the catalytic combustor, and your stove will be burning at its optimal efficiency.

7) After pushing in the bypass handle, allow the stove to run on a high setting for around 20 minutes to ensure the catalytic combustor stays in the active range. This will also allow the fire to burn off any residue on the door glass from any previous low-burn fires

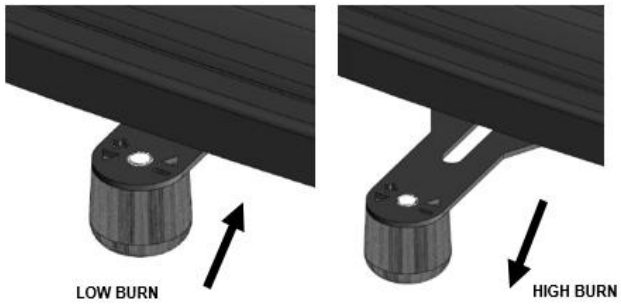



**Figure 18 - Hi/Lo Air Control**

8) Use the primary air control to regulate the desired rate of burn. Pull the handle towards you for a higher burn rate, and push the handle towards the stove for a lower burn rate. The air control does not close completely.

**Note:** Always remember to pull the bypass handle out 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 at a medium to high firing rate for about 10 minutes to ensure that the catalysts reach the "Catalyst Active" zone on the thermometer. Once the catalysts reach operating temperature, the bypass handle can be pushed in.

### CATALYTIC COMBUSTOR OPERATION

The Green Mountain 20 uses a catalytic combustor to ensure highly clean and efficient burns. The catalytic combustor is made from a stainless-steel corrugation that is coated with a catalytic material. The catalytic combustor becomes active around 500 ºF (260ºC), helping to burn up smoke and any remaining particles that were not fully burned in the firebox. During the startup of a cold stove, a medium to high firing rate must be maintained for about 20 minutes. This ensures that the stove, catalysts, and fuel are all stabilized and at proper operating temperatures. Even though it is possible to have gas temperatures reach 500 °F (260ºC) within 2 to 3 minutes after a fire is started, if the fire is allowed to die down immediately, it may go out or the combustor may stop working. Once the stove and catalytic combustor heat up, heat generated from burning smoke keeps the catalysts warm and active as long as fuel remains in the stove. You stove will burn the cleanest and most efficiently when the catalysts are in the active range. There should be little to no visible smoke from your chimney when the catalysts are in the active zone and fully functional.

### BURN RATE

**This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual**

***LOW BURN:*** Move the air control lever all the way inward toward the stove. (*See figure 17*). This closes the air shutter to its minimum opening. A low burn rate over extended periods is not advisable as it can promote the accumulation of creosote. Inspect the venting system frequently if using low burn rates consistently.

***MEDIUM LOW BURN:*** With the primary air control in the low position, pull the air control forward (a little less than 1/4"). A medium-low burn rate is the typical setting and is preferable if the stove is unattended. At this burn rate, a little goes a long way.

***MEDIUM HIGH BURN:*** With the primary air control in the low position, pull the air control forward (a little less than 3/8")

***HIGH BURN:*** Completely open the primary air control by moving it all the way outward toward the operator. Fully load the firebox with wood on a bed of hot coals or on an actively flaming fire. To minimize creosote accumulation, run the stove on high once or twice daily for 35 to 45 minutes to fully heat the stovepipe and chimney.

**CAUTION:** Do not burn fuel other than cordwood in your stove.

### 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-fire 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**

## CHIMNEY FIRES

Regular chimney maintenance and inspection can prevent chimney fires. If you have a chimney fire, follow these steps:

1. Close the stove door and the air intake control
2. Alert the occupants of the house of the possible danger
3. If you require assistance, alert the fire department;
4. If possible, use a dry chemical fire extinguisher, baking soda or sand to control the fire. **Do not use water as it may cause a dangerous steam explosion**

**Do not use the appliance again until the stove and its chimney have been inspected by a qualified chimney sweep or a fire department inspector.**

## REMOVAL AND DISPOSAL OF ASHES

You should leave a thin layer of ashes in the firebox. 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 and immediately moved outdoors. 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 noncombustible 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

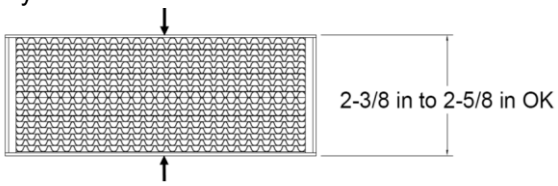
## CATALYTIC COMBUSTOR INSPECTION AND REPLACEMENT PROCEDURES

- **WARNING: THIS WOOD HEATER CONTAINS A CATALYTIC COMBUSTOR, WHICH 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, OR IF THE CATALYTIC ELEMENT IS DEACTIVATED OR REMOVED**

TWO DIFFERENT MODEL CATALYSTS ARE APPROVED FOR USE IN THIS STOVE. BOTH FUNCTION THE SAME. IF A REPLACEMENT IS NEEDED, INQUIRE ABOUT PART NUMBER 3050-010 OR 3050-020 WITH YOUR HEARTHSTONE DEALER.

It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions. Following is a list of items that should be checked on a periodic basis

-Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Inspect the catalyst for warpage or blockage. Use the diagram below to determine acceptable warpage of the catalyst.




If any of these conditions exists, refer to Catalyst Troubleshooting section of this owner's manual.

-This catalytic (or hybrid) heater is equipped with a thermometer to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 500 °F, and often reach temperatures in excess of 1,000 °F. If catalyst temperatures are not in excess of 500 °F, refer to the Catalyst Troubleshooting section of this owner's manual.

You can get an indication of whether the catalysts are working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalysts light-off has been achieved, to the amount of smoke leaving the chimney when the smoke is not routed through the combustor (bypass mode).

1. Light stove in accordance with operator's instructions
2. With smoke routed through the catalysts, go outside and observe the emissions leaving the chimney.
3. Engage the bypass mechanism and again observe the emissions leaving the chimney. Significantly more smoke will be seen when the exhaust is not routed through the combustor (bypass mode)

## INSPECTING AND REMOVING THE CATALYSTS

Refer to the Catalytic combustor warranty at the end of this manual for catalyst warranty information.

**ALLOW THE STOVE AND ASHES TO FULLY COOL.**

1. Remove the square cook plate on the top of the stove.
2. Pull the bypass handle out fully.
3. Remove the catalyst from the catalyst sled.
4. Perform any cleaning or replacement as necessary, then reinstall the catalyst into the sled.
5. Push the bypass handle in fully.
6. Replace the square access door on the top of the stove.



**Figure 19 - Catalyst Access Location**

## 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 Hearthstone 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.

**Required Gasket Kit:** PN: 90-58600.

## 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.

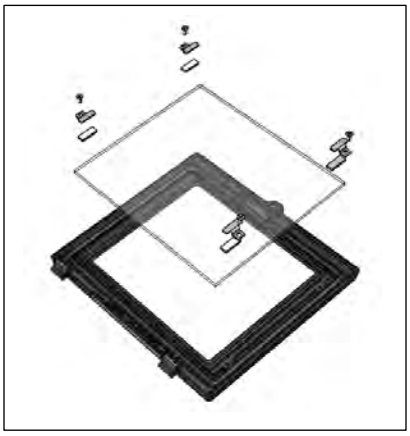
**Required Glass Kit:** PN: 90-58605.

## 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 door.
3. Remove the screws from the glass clips (use penetrating oil if necessary) – Set aside for reinstallation.
4. Carefully lift the damaged glass off the door and discard.
5. Remove any remaining glass and old gasket material.
6. Clean the screw holes and place a small amount of anti-seize compound in each one.
7. Install a new glass gasket in the glass gasket groove.
8. Place the new glass onto the door.
9. **Important! Center the glass** and ensure that the edges of the glass are parallel with the edges of the opening.
10. 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 1/8$^{th}$ of a turn after they seat. The glass will break at this point if not positioned correctly.
11. Apply a light film of anti-seize lubricant on the door's hinge pins if needed.
12. Install the door.
13. After 5 or 6 fires, check the glass retainer screws, and retighten if necessary.

**Required Glass Kit:** Part Number: 90-58605. Use only Ceramic, or Neoceram glass. Contact your Hearthstone 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 1/8" (3 mm) accumulates, immediately clean the stove pipe. Modifications to the burning procedure and more frequent inspections may be required in your situation.

## Prevention

Burn the stove with the primary air control fully open for 35 - 45 minutes daily to burn out creosote deposits from within the stove and the venting system.

After reloading with wood, burn the stove with the primary air control fully open 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 operating temperatures are too low or 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.

# 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 the optional outside air adaptor connected to an air duct, 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 | Fully open the primary air control one minute before opening doors, and ensure the bypass is open before opening door. |
| | 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. |
| | Bypass not closed | Ensure that the bypass door is closed when the catalysts are in the active range. |
| | Catalysts not functioning | Inspect catalysts for damage, ash build-up, or plugging. Brush catalysts with a soft-bristled brush, or vacuum lightly. Replace if required. Follow instructions to ensure catalyst light-off. |
| | 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 | Fully open the primary air control one minute before opening the door and keep it fully open for a few minutes after reloading. Ensure the bypass door is open before opening the door |
| | Extra Low Burn Rate | Burn the stove at a higher burn rate. |
| | 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. |
| UNCONTROLL-ED OR SHORT BURN | Unsealed or Open Door | Close the door tightly or replace the gaskets.<br>Air leakage around glass gasket – replace gasket |
| | Excessive Draft | Check the installation. Operate at LOW BURN. 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. |
| | Low Burn Rate | Operate the stove at a higher burn rate. |
| | 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. |

## CATALYST TROUBLESHOOTING GUIDE

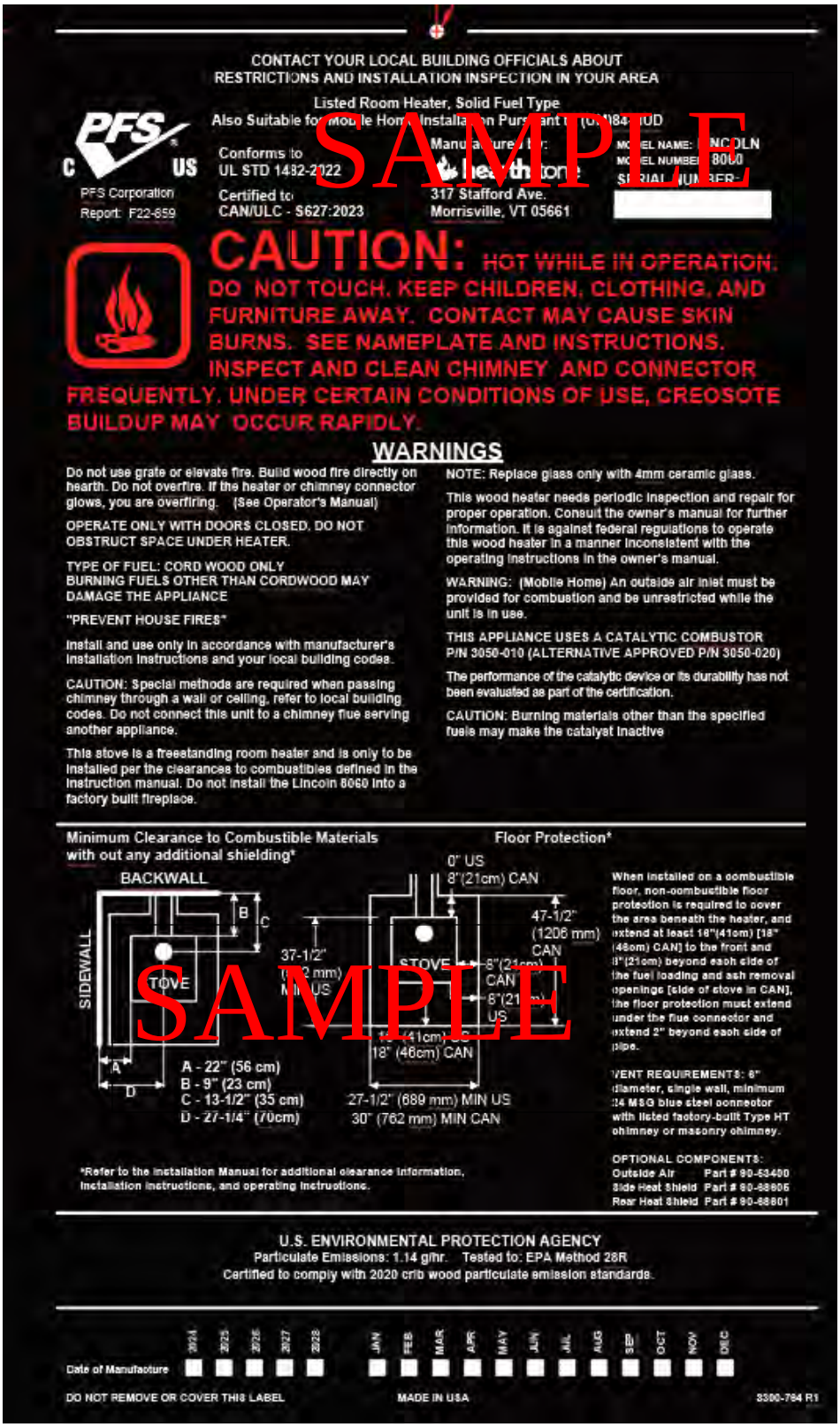
| PROBLEM | POSSIBLE CAUSE | SOLUTIONS |
|---|---|---|
| FLY ASH BUILD UP ON CATALYST | Catalysts have not maintained light-off temperature | Brush cold combustor with soft-bristled brush or vacuum lightly. Follow instructions in the manual for a proper catalyst light-off |
| | Burning materials that cause a lot of char and fly-ash | Don't burn cardboard, gift wrap paper, or garbage. Burn only dry, seasoned wood, per the owner's manual. |
| | Bypass closed too soon | Follow instructions in the manual for a proper catalyst light-off |
| CATALYST PLUGGING OR MASKING (SOOT/CRESO-TE) | Burning wet, pitchy woods, or burning large loads of small diameter wood with the combustor in the operating position without catalyst light off occurring | Burn dry seasoned wood. Follow instructions in the manual for a proper catalyst light-off, and ensure catalyst light-off as occurred before closing bypass damper. It may be possible to burn the soot or creosote off by building a hot fire, and allowing the stove to run until the catalysts are well within the operating range before closing the bypass. Continue to run the stove at a high temperature for one hour, while ensuring the catalysts stay in the upper operating range, but not too hot. |
| WARPING OR BOWING OF THE CATALYST | Excessive catalyst temperatures for long periods of time. | Ensure that the catalysts remain in the operating zone, and does not get to hot. Reduce air control settings for a lower burn rate to ensure catalyst temperatures do not exceed the operating range. |

# REPLACEMENT PARTS & OPTIONAL ACCESSORIES

| PART # | DESCRIPTION |
|---|---|
| | |
| | **REPLACEMENT PARTS** |
| 5060-005 | BOTTOM HEAT SHIELD |
| 5060-100 | DOOR HINGE |
| 5060-110 | DOOR PIN |
| 5060-035 | BAFFLE GUARD |
| 5030-060 | DOOR CATCH |
| 5021-022 | DOOR LATCH |
| 7200-523 | CATALYST THERMOMETER |
| | |
| | **REPLACEMENT KITS AND ACCESSORIES** |
| 96-53400 | OUTSIDE AIR KIT |
| 90-58600 | GASKET KIT |
| 90-58605 | GLASS KIT |
| 90-71240 | HANDLE KIT |
| 90-49600 | FRONT DOOR LATCH KIT |
| 3050-020 OR 3050-010 | CATALYST REPLACEMENT (TWO ALTERNATIVE CATALYSTS ARE APPROVED FOR USE IN THIS STOVE) |
| 90-76600 | BAFFLE KIT |
| 90-68601 | REAR HEATSHIELD |
| 90-68605 | SIDE HEATSHIELD (SINGLE) |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Refer to the Illustrated Parts list for further detail about stove components, available online at www.hearthstonetech.com.

# SAFETY LABEL



## LIMITED WARRANTY

**These warranties give you specific legal rights. You may also have other rights, which vary from State to State.**

Hearthstone Quality Home Heating Products, Inc. (Hearthstone) warrants to the original retail purchaser only (the "Original Purchaser") the new appliance manufactured by Hearthstone, purchased by the Original Purchaser and installed by an authorized Hearthstone dealer or their designated representative against any of the occurrences listed in this document that result from defects in material or workmanship. This warranty is not transferrable. All obligations of Hearthstone under this document commence on the date of the Original Invoice (the "Purchase Date"). The term "Limited Lifetime" is defined as 10 years from the beginning of warranty coverage.
Hearthstone appliances are designed to be operated only with the fuels listed in your owner's manual.

**Catalytic combustor LIMITED LIFETIME WARRANTY:** The catalytic combustors are covered directly by the combustor manufacturer, Applied Ceramics. Included with your stove you will find the LIMITED LIFETIME WARRANTY for the catalysts, as well as a warranty card.
Catalyst Model Number: P/N WF-415000106 OR P/N WF-4150001076
Catalyst Manufacturer: APPLIED CERAMICS
APPLIED CERAMICS warrants to the consumer who purchases a FIRECAT STEEL COMBUSTOR as a component in an EPA certified solid fuel appliance, to replace at no charge to the consumer the FIRECAT STEEL COMBUSTOR that ceases to function with two (2) years from the date of purchase by the original consumer, provided that the following conditions are met:

(1) A copy of the original bill of sale that includes place and date of purchase must be submitted with the warranty claim.
(2) The original FIRECAT STEEL COMBUSTOR must be returned to APPLIED CERAMICS
(3) The FIRECAT STEEL COMBUSTOR must not have been mechanically abused, nor must the wrong fuels have been used in the appliance.

If after two years the FIRECAT STEEL COMBUSTOR fails to function, the prorated warranty will allow replacement at the following special price schedule:

| | |
|---|---|
| Year 3 | $130.00 |
| Year 4 | $140.00 |
| Year 5 | $150.00 |
| Year 6 | $160.00 |
| Year 7 | and after at current retail price |

Conditions 1, 2, and 3 also apply to the Prorated portion of the warranty. Any EPA certified solid fuel appliance will receive one replacement catalyst for each defective catalyst returned during the three year period. The consumer will be responsible for any removal, any servicing, and return of any items required for filing the warranty claim. This warranty is APPLIED CERAMIC'S exclusive warranty, and APPLIED CERAMICS, disclaims any other express or implied warranty for the FIRECAT STEEL COMBUSTOR, including any warranty or merchantability fitness for a particular use.
Ensure the catalyst is well wrapped and padded for shipment in bubble wrap, or similar material. Ship the catalyst with padding inside of a cardboard box.
All warranty claims must include $12.50 for postage and handling within the continental U.S. Alaska and Canada claims must include $35.00.
Please allow 2-3 weeks for delivery. Order online @ www.firecatcombustors.com

Please read and understand the full warranty. Please return the completed warranty card promptly to Applied Ceramics. The warranty card, and any warranty claims can be shipped to:

**Applied Ceramics**
**55555 Pleasantdale Road**
**Doraville, GA, 30340**

**Stove components Limited Warranty**

| Warranty Period | Wood | Gas | Covered Components |
|---|---|---|---|
| Limited Lifetime | X | X | Stone |
| | X | X | Cast iron not listed elsewhere |
| | X | | Clean burning air supply system* |
| 5 Year | X | X | Door handles and latches |
| | X | X | Steel Components and Firebox |
| | | X | Burner and logs |
| 2 Year | X | X | Appliance Electrical and Gas Components |
| | X | X | Refractory, Vermiculite Panels, Baffles |
| 1 Year | X | X | Enamel finish against peeling or fading |
| | X | X | Accessories |
| | X | X | Glass |
| | X | | Ash Grate |
| | X | X | All components not listed elsewhere |

Any parts repaired or replaced during the limited warranty period will be warranted under the terms of the limited warranty for a period not to exceed the remaining term of the original limited warranty or one year, whichever is longer.

**Parts:** Hearthstone will replace through an authorized dealer, defective parts covered by the foregoing warranty at no charge.

**Labor:** Within the first (1st) year after the Purchase Date, Hearthstone will pay for warranty labor performed by an authorized Dealer at Hearthstone's published labor rates in effect at the time the labor is performed only if the appliance is installed by an authorized dealer or their designated representative. Otherwise or thereafter, the Original Purchaser is responsible for the cost of labor.

**Shipping cost for parts:** Within the first ninety (90) days after the Purchase Date, Hearthstone will pay for the shipping of appliance parts covered by any of the foregoing warranties to and from Hearthstone or an authorized Dealer, as the case may be. Thereafter, the Original Purchaser is responsible for all shipping costs related to shipping appliance parts to and from Hearthstone or an authorized Dealer, as the case may be.

**Shipping cost for the appliance:** Within the first (1st) year after the Purchase Date, if the Original Purchaser is instructed to return the appliance to Hearthstone or an authorized Dealer for repair, Hearthstone will pay fifty percent (50%) and the Original Purchaser will pay fifty percent (50%) of the shipping costs related to shipping the appliance to and from Hearthstone or an authorized Dealer, as the case may be. Thereafter, the Original Purchaser is responsible for one hundred percent (100%) of all of the shipping costs related to shipping the appliance to and from Hearthstone or an authorized Dealer, as the case may be. Notwithstanding any other provision of this document, in no event will Hearthstone pay for any Dealer fees or other fees for pick up or delivery of the appliance returned for repair; the Original Purchaser shall be responsible for any such fees.

**EXCLUSIONS & CONDITIONS**

The warranties contained in this document do not cover, nor is Hearthstone responsible for:

1. Damages resulting from:
   a. Failure to install, operate, or maintain the appliance in accordance with the owner's manual, operating instructions, installation instructions, or safety rating label provided with the appliance.
   b. Over-firing the appliance. Over-firing can be identified by, but not limited to, warped cast iron or steel, rust colored cast iron, bubbling, cracking and discoloration of steel or enamel finishes.
   c. Failure to install the appliance in accordance with all national or local building codes.
   d. Shipping or improper handling.

e. Improper operation, abuse, misuse, continued operation with damaged, corroded, or failed components, accident, or improper/incorrect service or repairs.
f. Environmental conditions, inadequate ventilation, negative pressure, or improper drafting caused by tightly sealed constructions, insufficient make-up air supply, or air handling devices such as exhaust fans, forced air furnaces, or other such causes.
g. Damage caused by direct exposure to water.
h. Use of fuels other than those specified in the owner's manual.
I. Installation or use of components not supplied with the appliance, or any other components not expressly authorized and approved by Hearthstone.
J. Modifications of the appliance not expressly authorized and approved by Hearthstone in writing
K. Interruptions or fluctuations of electrical power supplied to the appliance.

2. All stones are warranted against cracking or breakage due to thermal stress, excluding surface and hairline cracks and scratches that do not affect the operation, or safety of the appliance.
3. Repair or replacement of wear parts. Such parts that are subject to normal wear and tear during the warranty period such as paint, gaskets, baffles, refractory materials, ash grates, and glass.
4. Damage resulting from installation, modification, alteration, repair or service of the appliance by any party other than an authorized Hearthstone dealer (a "Dealer") or their designated representative, or Hearthstone.
5. Damage due to water or condensation due to installation of the appliance in a high moisture area.
6. Damage due to installation of the appliance in an atmosphere contaminated by damaging chemicals, including but not limited to chlorine, fluorine or salts.
7. Scratches on glass, enameled surfaces or stones due to mechanical abrasion.
8. Noise caused by expansion or contraction caused by the heating and cooling of the appliance.
9. Odors caused by the heating of the appliance, or surrounding materials
10. Consequential damage caused by leaking of condensate during startup
11. A defect in any part of the appliance if the Original Purchaser fails to comply with Hearthstone's or a Dealer's request to ship the part or the appliance to Hearthstone or a Dealer, as the case may be.
12. Replacement stones and enameled parts are taken from current stock, and may not match originals in color, grain, or pattern. Hearthstone will supply replacement parts for discontinued parts in finishes or colors as available, or at their discretion.
13. Hearthstone's obligation under this warranty does not extend to the appliance's ability to heat the desired space. Information is provided to assist the customer and the dealer in selecting the appropriate appliance for the application. Consideration must be given to appliance location and configuration, environmental conditions, insulation and air tightness of the structure.

THE WARRANTIES CONTAINED IN THIS DOCUMENT ARE EXCLUSIVE AND ARE GIVEN BY HEARTHSTONE AND ACCEPTED BY THE ORIGINAL PURCHASER IN LIEU OF ALL OTHER EXPRESS WARRANTIES AND ANY OBLIGATIONS, LIABILITIES, RIGHTS, CLAIMS, OR REMEDIES IN CONTRACT OR TORT, WHETHER OR NOT ARISING FROM HEARTHSTONE'S NEGLIGENCE, ACTUAL OR IMPUTED. ALL IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE GIVEN ONLY TO THE EXTENT REQUIRED BY FEDERAL OR STATE LAW. EXCEPT AS OTHERWISE REQUIRED BY STATE LAW, UPON THE EXPIRATION OF THE EXPRESS LIMITED WARRANTIES CONTAINED HEREIN, NO IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL APPLY TO THE SUBJECT APPLIANCE. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

THE WARRANTIES CONTAINED IN THIS DOCUMENT EXTEND ONLY TO THE ORIGINAL PURCHASER OF THE APPLIANCE WARRANTED HEREUNDER. THEY ARE NOT TRANSFERRABLE AND DO NOT EXTEND TO ANY SUBSEQUENT OWNERS.

UNDER NO CIRCUMSTANCES SHALL HEARTHSTONE BE LIABLE TO THE ORIGINAL PURCHASER OR ANY OTHER PERSON FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO DAMAGE TO PROPERTY OR PERSONAL INJURIES, WHETHER ARISING OUT OF LOSS OF USE, BREACH OF WARRANTY, TORT, OR OTHERWISE, EVEN IF HEARTHSTONE HAS BEEN APPRAISED OF THE POSSIBILITY OF SUCH DAMAGES. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

## QUALIFYING FOR WARRANTY COVERAGE

To obtain performance of any obligation under this document, the Original Purchaser must, within the applicable warranty time period, contact their original Hearthstone dealer, or the current responsible local Hearthstone dealer, for instructions regarding the return of defective parts for repair, the return of the appliance for repair, or to schedule a Dealer service call. The Original Purchaser should refer to the Dealer Network search engine contained on Hearthstone's Web site (www.hearthstonestoves.com) if the original dealer is not available, to find a Hearthstone dealer nearest to the Original Purchaser's location.

## REMEDY

The remedy for any breach of the foregoing warranties will consist of repair or replacement, at Hearthstone's option, of any covered defect in the appliance. When the Original Purchaser contacts a Hearthstone Dealer, the Dealer on behalf of Hearthstone, as the case may be, will instruct the Original Purchaser to either return the defective part, or the entire appliance (if requested), to the Dealer or Hearthstone or allow a Dealer to make a service call at the place where the appliance is located. Hearthstone may require that a digital picture be provided to support the claim. Notwithstanding any other provision of this document, the Original Purchaser shall pay for any fees and service charges related to a Dealer's service call or the shipping charges associated with the return.

# APPENDIX 8: Photographs of test set up

# Dilution picture Dia 8 no. EG-029

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



Velocity ports at 90 degrees and tunnel temperature sensor location

Particulate sample extraction ports located 48 inches under (requirement 4D=32 inches minimum) velocity ports and 18 inches above downstream Tee. (Requirement 2D=16 inches minimum)

Adjustable damper for flow adjustments

Extraction blower




Total length between hood and sampling port: 23 feet.

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Two 8 inches elbow with horizontal mixing section.

60 inches horizontal run between two elbows. Mixing section, No mixing baffle. 8 inches diameter pipe

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

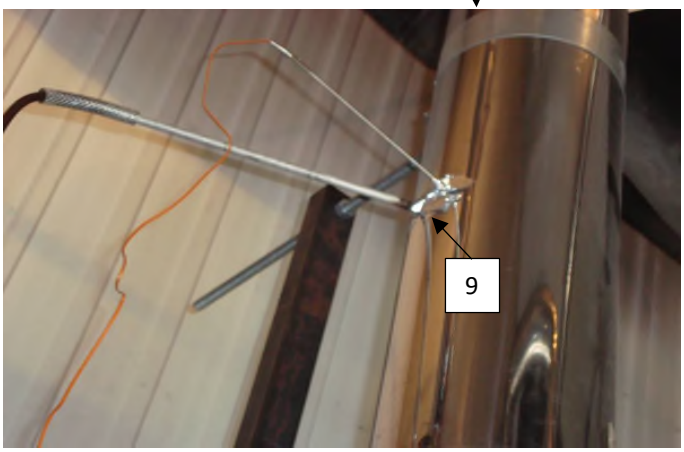
All pipe joints are sealed.

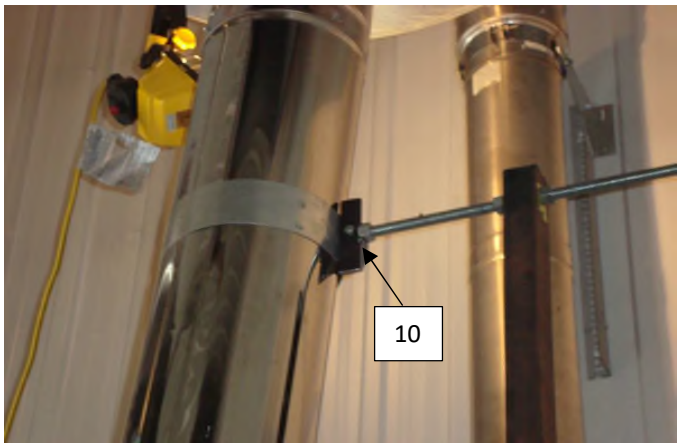
Stack sampling



Gas analysis and temperature probe

chimney support




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

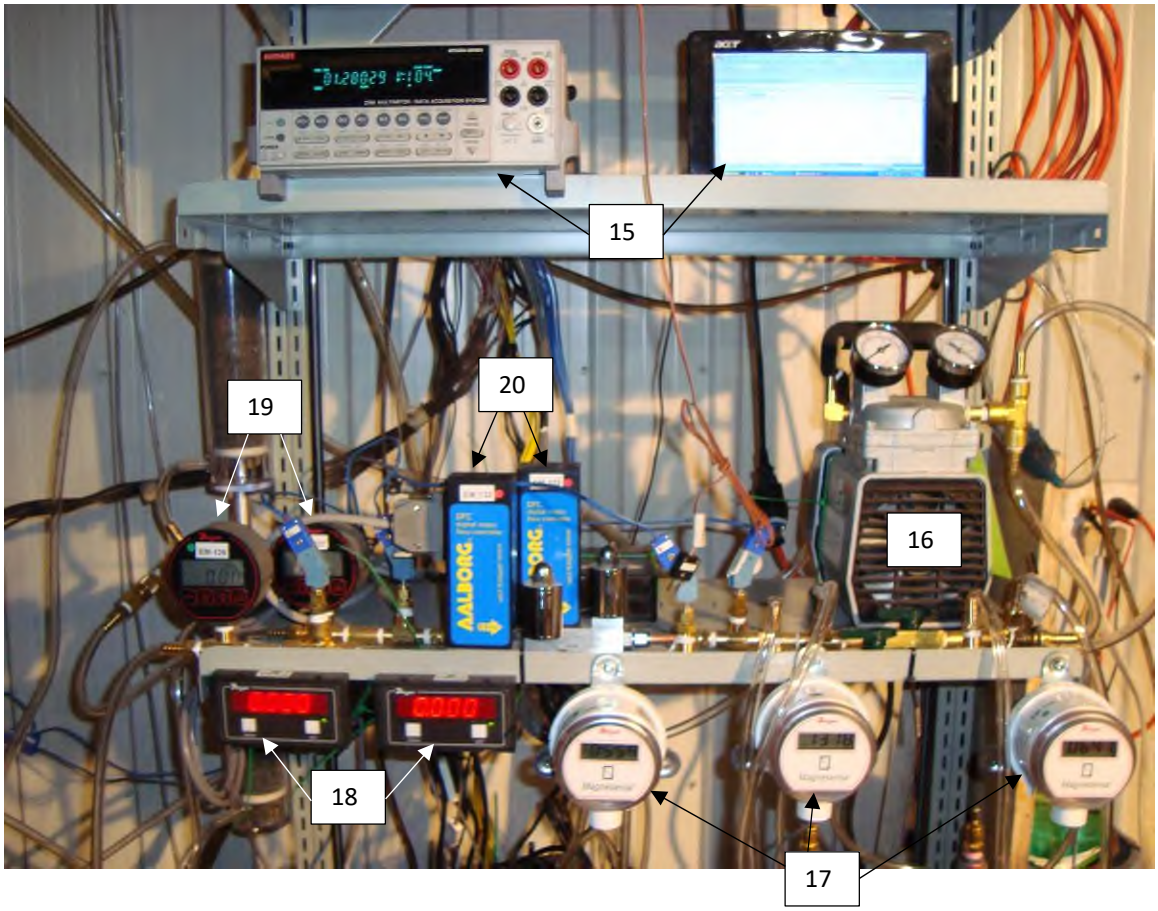
10 : Exhaust system support bracket

Draft sampling




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

Equipment's




15 : Acquisition system

16 : Vacuum pump

17 : Digital manometer

18 : Digital read out for mass flow meter

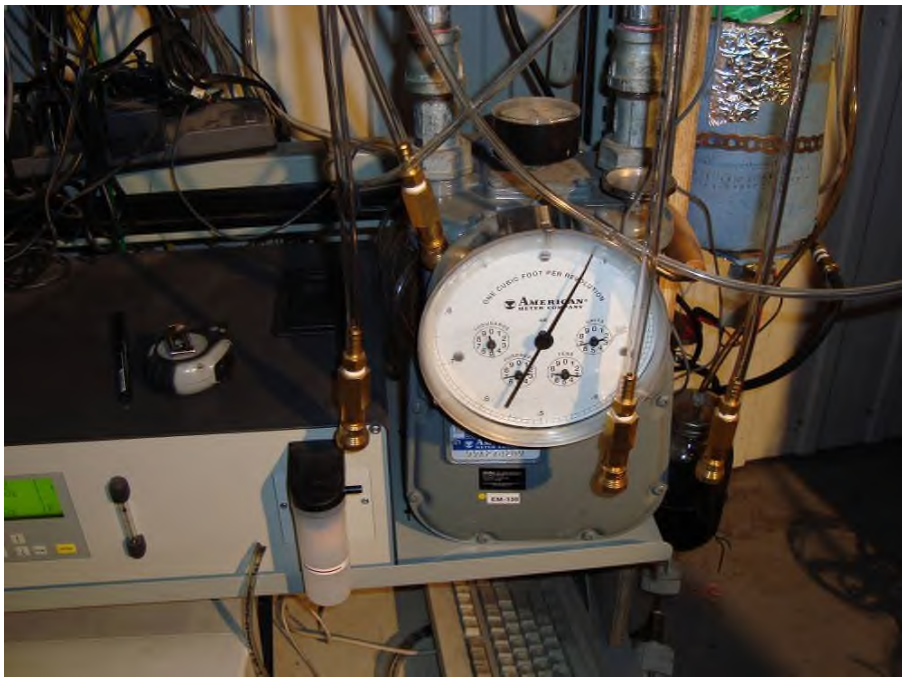
19 : Digital vacuum gage

20 : Mass flow meter

Gaz analyser



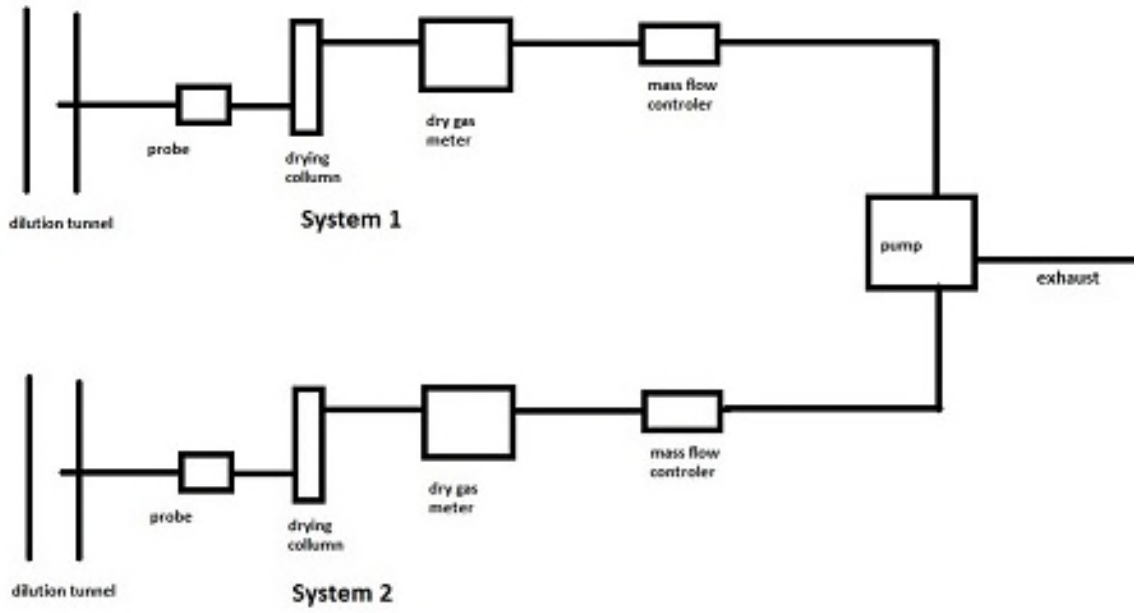

Reference dry gas meter



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



Dilution tunnel sample system



Dilution tunnel

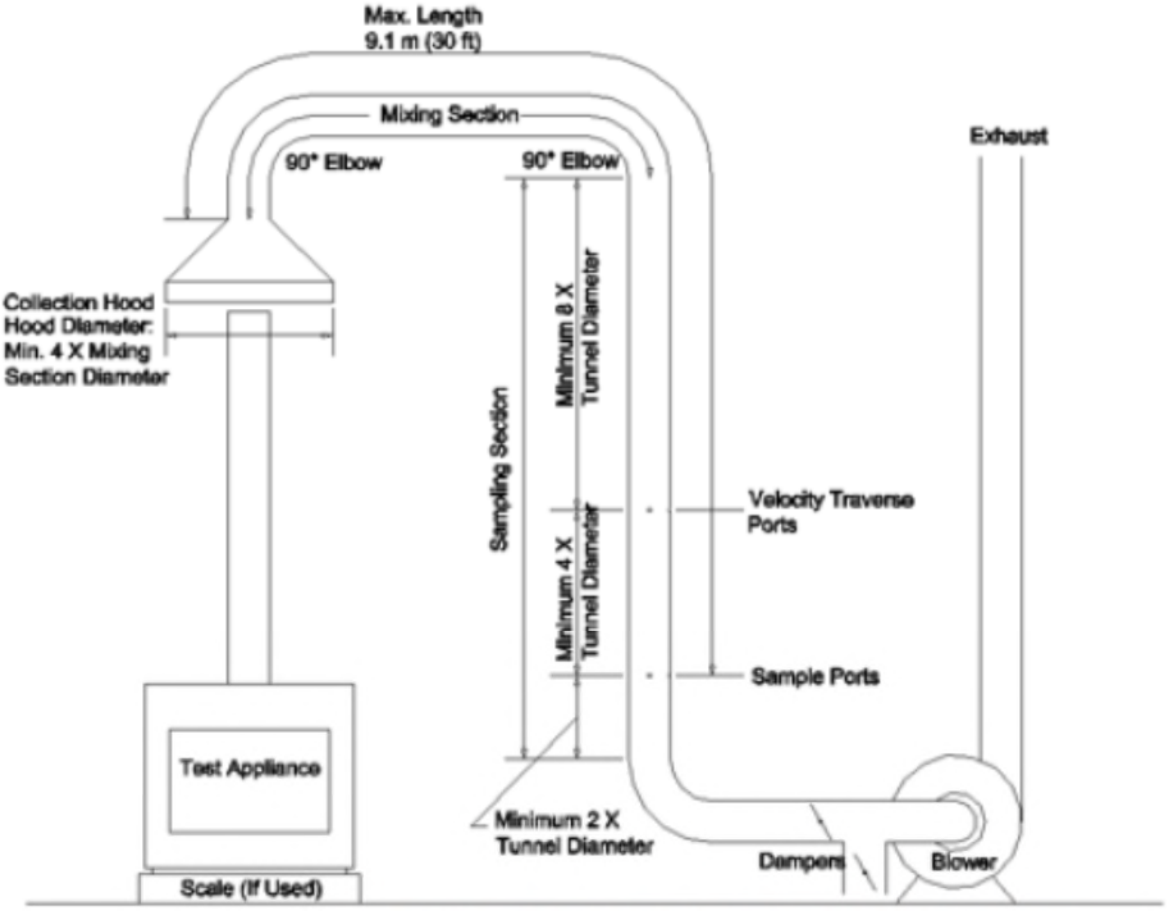



FIG. 3 Steel-Constructed Dilution Tunnel Apparatus

# APPENDIX 9: Test load photographs

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# Run 1 June 27th 2022

| | |
|---|---|
| Kindling<br>  | Front view<br>  |
| Coal bed for Load<br>  | Load in the stove<br>  |

POLYTESTS
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# Run 2 June 28th 2022

| | |
|---|---|
| Kindling<br>  | Pre-burn load<br>  |
| Coal bed for Load<br>  | Load in the stove<br>  |

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# Run 3 June 29th 2022

Kindling



Pre-burn load



Coal bed for Load



Load in the stove



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# Run 4 June 30th 2022

Kindling



Pre-burn load



Coal bed for Load



Load in the stove



POLYTESTS
TESTING THROUGH YOUR REALITY

# Run 5 July 25th 2022

| | |
|---|---|
| Front view<br>  | Preburn load<br>  |
| Coal bed for Load<br>  | Load in the stove<br>  |

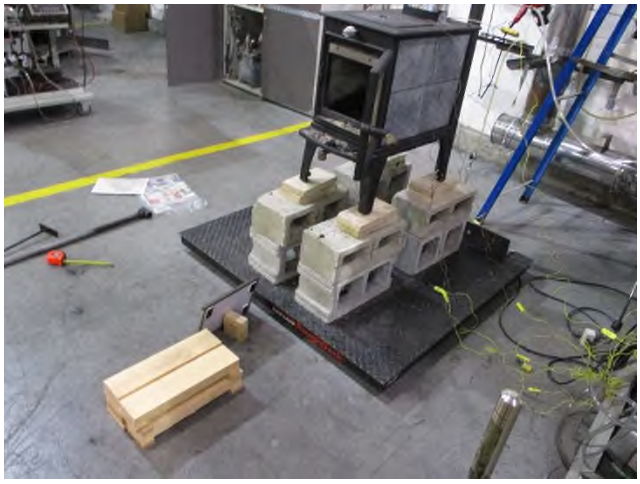
POLYTESTS
TESTING THROUGH YOUR REALITY

# Run 6 July 26th 2022

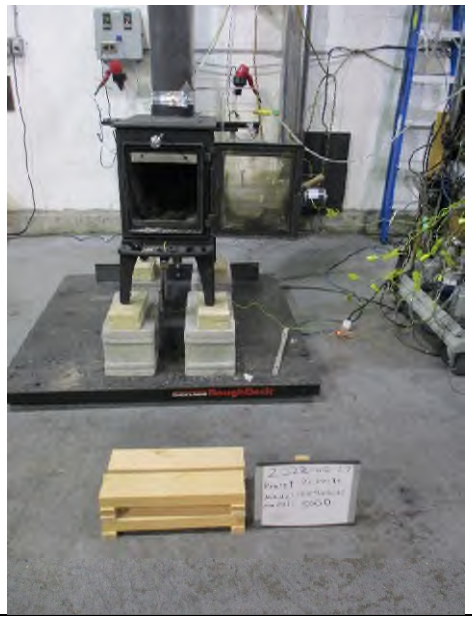
| | |
|---|---|
| Kindling  | Preburn load  |
| Coal bed for Load  | Load in the stove  |

POLYTESTS
TESTING THROUGH YOUR REALITY

Side view



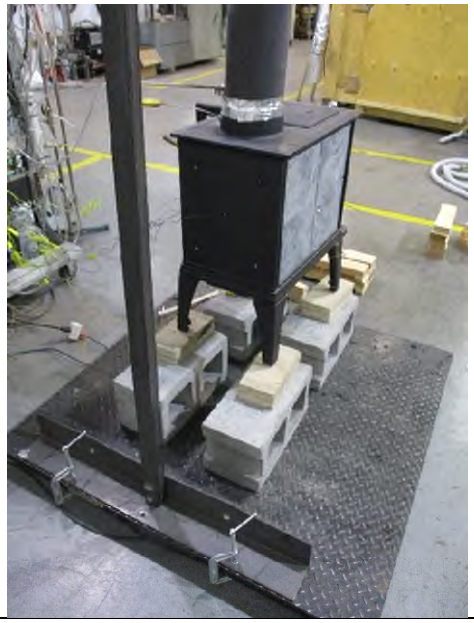
Front view



Side view



Back view



# 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, ALT-134, ASTME2779

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
9. ALT-134
10. ASTME2779

# 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) Fifty (50) hours at medium burn rate with Douglas Fir scrap or cordwood. Between 18% and 25% MC.

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

Record catalyst temperature at 1-hour intervals or on chart recorder. Operating should continue until data shows at least fifty (50) hours of operation with catalyst temperature in excess of 500 degrees Fahrenheit (active range).

For non-catalytic units a stack thermocouple should be installed and stack temperature recorded at 1-hour intervals. 50 hours minimum burn time with a stack temperature of at least 250 degrees Fahrenheit is required.

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

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 traceable calibration gas bottles. Adjust flow meter, if necessary, at each instrument to required flow value.

   a) Using span gas, adjust span control to values specified on calibration gas label.
   b) Using nitrogene, adjust zero controls to provide a 0.00 analyzer readout.
   c) Repeat a) and b) until no further adjustment is required.
   d) Check readout vs. calibration gases (2) labels.

   The $CO_2$ 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 48 hours prior to use.
b) Filters should be numbered and filter and probe combinations labeled prior to use.
c) Weigh desiccated filters and probe-filter units on analytical balance. Record weights data form no. EPA-10-TP. Note that probe and front half of front filter are to be weighed as a unit.
d) Carefully assemble filter holder units and connect to sampling systems. Check "DRIERITE" columns for adequate dry absorbent (blue).

2. Leak checking.

a) Each sample system is to be checked for leakage prior to inserting probes in tunnel.
b) Plug probes and start samplers, adjust pump bypass valve to produce a vacuum reading of 10 inches Hg. (NOTE: During test, vacuum must not exceed 10 inches unless posttest leak check shows acceptable results.)
c) Allow vacuum indication to stabilize for two (2) minutes, then record time and dry gas ($DGM_1$) 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 manufacturers.
7. Following addition of pretest fuel load (splitted pieces), start computer for data logging.
8. All fuel additions, air intake settings and operational characteristics shall be noted with associated time stamp on form no. EPA-1-TP.

## C. TEST RUN

1. Once the targeted test fuel bed weight is obtained, the test is to be started as follows:

   a) Insert the sample probes into the tunnel being careful not to hit sides of tunnel with probe tip.
   b) Check tunnel pitot tube for proper position. (Pitot should be carefully cleaned prior to each test.)
   c) Turn on probe sample systems and stack sampler.
   d) Open stove door, rake coals and load stove as follows: **TO BE DETERMINED**
   e) Close door or follow manufacturer's start-up procedures. (Five (5) minutes maximum time before all doors and controls must be set to final positions for duration of test. 15 minutes or 15% of lad burned allowed for ALT-125 method))
   f) An alarm will sound an audible signal at the (10) minutes intervals. This signals a reading interval. You must verify at each interval that the following readings are correctly logged by the data acquisition system and make observations of any unusual or non-routine events that could occur.

      1) Rotometer readings.
      2) Tunnel pitot tube reading.

(Zero regularly between readings)

      3) Gas meter readings.
      4) Temperature readings.
      5) Draft reading
      6) Test 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 48-hour desiccation before weighing.
4. Weigh probe filter holder units and filters at six (6) hour intervals minimum until weight change between weightings is less than 0.2 mg. Record all weights taken on data form no. EPA-10-TP.

**B. CALCULATION OF RESULTS**

The computer program carries out all final calculations. When run, it will ask for data from forms used during the test. Enter data as called for.

GENERAL

This guide cannot cover every possible contingency, which may develop during a particular test program. Many questions, which may arise, can be answered by a complete understanding of the test standards and their intent. When in doubt on any detail, check with the laboratory manager and be sure you understand the procedures involved.

It is critical that all spaces on the data forms be properly filled in. Each test must be represented by a complete record of what was done and when.

# APPENDIX 11: Sample calculations

**Validation du fichier de calcul avec les équations provenant des normes:**
ASTM E2515-11
ASTME2618

# Dry burn rate (BR)

## Equation used

*B415.1, 13.4*

$$BR = \left[\frac{60W_{WD}}{\theta}\right]\left[\frac{100 - \%M_W}{100}\right]$$

## Nomenclature

| | |
|---|---|
| BR | Dry wood burn rate, kg/hr (lb/hr) |
| $W_{WD}$ | Total mass of wood burned (wet basis) during the test run, kg (lb) |
| $\theta$ | 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**

| | | |
|---|---|---|
| $W_{WD}$ | 6,964 | lbs |
| $\theta$ | 159 | min |
| $\%M_W$ | 17,17 | % |

**Calculation**

| | | |
|---|---|---|
| BR | 0,988 | 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) |
| $\Delta H$ | 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

| | | |
|---|---|---|
| $V_m$ | 30,54 | dcf |
| Y | 1,005445 | |
| $P_{bar}$ | 29,65 | in Hg |
| $\Delta H$ | -0,6768 | in Hg |
| $T_m$ | 544,1 | R |

### Calculation

| | | |
|---|---|---|
| $V_{m(std)}$ | 28,84 | 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 |
| $\Delta$PF | Post-test weight gain of probe and filter holder assembly, mg |

## Sample calculation

### Data

| | | |
|---|---|---|
| $F_1$ | 0 | g |
| $F_2$ | 0,001 | g |
| $\Delta$PF | 0,000 | g |

### Calculation

| | | |
|---|---|---|
| $m_n$ | 1,300 | 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

| | | |
|---|---|---|
| $m_n$ | 1,300 | mg |
| $V_{m(std)}$ | 28,84 | dscf |

### Calculation

| | | |
|---|---|---|
| $C_s$ | 0,000045 | g/dscf |

Calculation based of train 2 data

# Particulate concentration for room air ($C_r$)

## Equation used

*ASTM 2515, equation 14*

$$C_r = (0{,}001\ g/mg) \times \left(\frac{m_r}{V_{mr\,(std)}}\right)$$

## Nomenclature

| | |
|---|---|
| $C_r$ | Concentration of particulate matter in room air, dry basis, corrected to standard conditions, g/dsm$^3$ (g/dscf) |
| $m_r$ | Total amount of particulate matter collected in the sampling train, mg |
| $V_{mr(std)}$ | Volume of room air sample measured corrected to dry standard conditions, dsm$^3$ (dsc |

## Sample calculation

### Data

| | | |
|---|---|---|
| $m_r$ | 0,100 | mg |
| $V_{mr(std)}$ | 24,20 | 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

| | |
|---|---|
| $V_{strav}$ | 0,250047615 |
| $V_{scent}$ | 0,262678511 |

### Calculation

| | |
|---|---|
| $F_P$ | 0,951915 |

# Average dilution tunnel gas velocity ($V_S$)

## Equation used

*ASTM 2515, equation 9*

$$V_S = F_p K_P C_P (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_S}{P_S M_S}}$$

## Nomenclature

| | |
|---|---|
| $V_S$ | Average dilution tunnel gas velocity, m/s (ft/s) |
| $K_P$ | Pitot tube constant<br>For the metric units: $34.97\ m/sec \left[\frac{\left(\frac{g}{g-mole}\right)(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$<br>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 |
| $(\sqrt{\Delta P})_{avg}$ | 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 | |
| $F_P$ | 0,952 | |
| $(\sqrt{\Delta P})_{avg}$ | 0,2751 | in $H_20^{1/2}$ |
| $P_{bar}$ | 29,65 | in Hg |
| $P_g$ | 0,28 | in $H_20$ |
| $P_S$ | 29,67 | in Hg |
| $M_S$ | 29 | lb/lb-mol |
| $t_S$ | 85,81 | F |
| $T_S$ | 545,81 | R |

### Calculation

| | | |
|---|---|---|
| $V_S$ | 17,6507 | 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 | |
| $V_S$ | 17,651 | |
| A | 0,349 | $ft^2$ |
| $T_{std}$ | 528 | R |
| $T_S$ | 545,81 | R |
| $P_S$ | 29,668 | in Hg |
| $P_{std}$ | 29,92 | in Hg |

### Calculation

| | | |
|---|---|---|
| $Q_{std}$ | 347,52 | 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

| | | |
|---|---|---|
| $C_S$ | 0,000045 | g/dscf |
| $C_r$ | 0,000004 | g/dscf |
| $Q_{std}$ | 347,52 | dscf/min |

### Calculation

| | | |
|---|---|---|
| E | 0,01 | g/min |
| E | 0,85 | 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) |
| $\theta$ | Total sampling time, min |

## Sample calculation

### Data

| | | |
|---|---|---|
| $C_S$ | 0,000045 | g/dscf |
| $C_r$ | 0,000004 | g/dscf |
| $Q_{std}$ | 347,52 | dscf/min |
| $\theta$ | 159 | min |

### Calculation

| | | |
|---|---|---|
| E | 2,26 | 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<br>For the metric units: $34.97\ m/sec \left[\frac{\left(\frac{g}{g-mole}\right)(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$<br>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) |
| $\Delta p_i$ | 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** | |
|---|---|---|---|
| $F_P$ | 0,952 | $F_P$ | 0,952 |
| $K_P$ | 85,49 | $K_P$ | 85,49 |
| $C_P$ | 0,99 | $C_P$ | 0,99 |
| $\Delta p_i$ | 0,073 in $H_20$ | $\Delta p_i$ | 0,077 in $H_20$ |
| $T_{Si}$ | 548,5 R | $T_{Si}$ | 548,1 R |
| $P_S$ | 29,67 in Hg | $P_S$ | 29,67 in Hg |
| $M_S$ | 29 lb/lb-mol | $M_S$ | 29 lb/lb-mol |

### Calculation

| **i=1** | | **i=2** | |
|---|---|---|---|
| $v_{si}$ | 17,37 ft/sec | $v_{si}$ | 17,82 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 (%) |
| $\theta$ | Total sampling time, min |
| $\theta_i$ | 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 | | |
|---|---|---|---|---|---|
| $\theta$ | 159 | min | $\theta$ | 159 | min |
| $\theta_i$ | 1 | min | $\theta_i$ | 1 | min |
| $V_m$ | 29,47 | dcf | $V_m$ | 28,85 | dcf |
| $V_{mi(std)}$ | 0,185 | cuft | $V_{mi(std)}$ | 0,1811 | cuft |
| $V_S$ | 17,66 | ft/sec | $V_S$ | 17,66 | ft/sec |
| $V_{Si}$ | 17,377 | ft/sec | $V_{Si}$ | 17,377 | ft/sec |
| $T_m$ | 539,7 | R | $T_m$ | 544,1 | R |
| $T_{mi}$ | 538,95 | R | $T_{mi}$ | 540,09 | R |
| $T_S$ | 545,81 | R | $T_S$ | 545,81 | R |
| $T_{Si}$ | 548,5 | R | $T_{Si}$ | 548,5 | R |

### Calculation

| **train=1** | | | **train=2** | | |
|---|---|---|---|---|---|
| PR | 102,1 | % | PR | 102,7 | % |

# 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

| | |
|---|---|
| $V_{mL}$ | 0,176 dcf |
| $F_A$ | 0,0116 $ft^2$ |

### Calculation

| | |
|---|---|
| $FV_{max}$ | 15,19 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 | 2,21 g |
| Train 2 | 2,26 g |

### Calculation

| | |
|---|---|
| Dual train precision | 1,17 % |

# 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

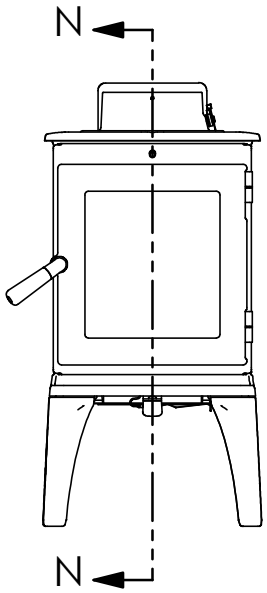
| | |
|---|---|
| ∆R | 0,015 % |
| Span | 5 % |

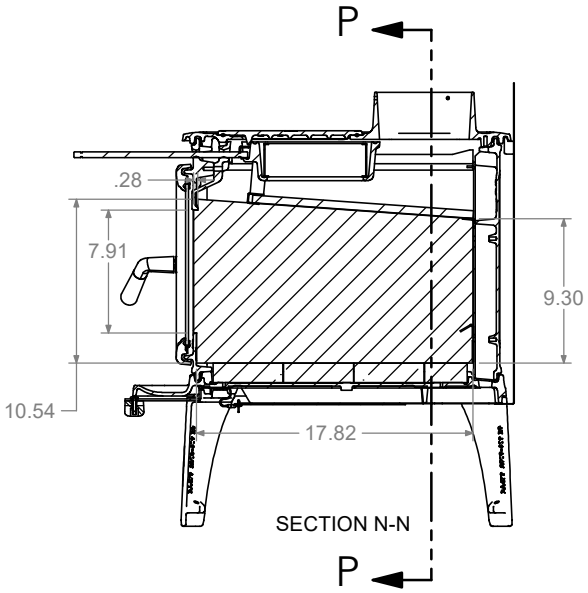
### Calculation

| | |
|---|---|
| Drift | 0,30 % |

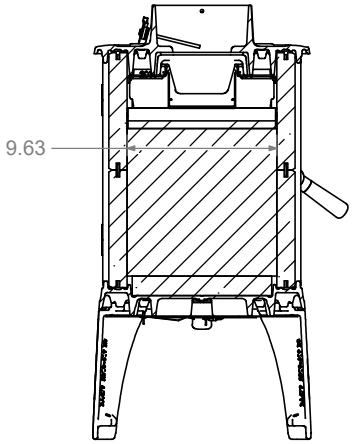
Calculated with CO concentration values.

# APPENDIX 12: Volume calculations

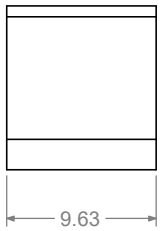


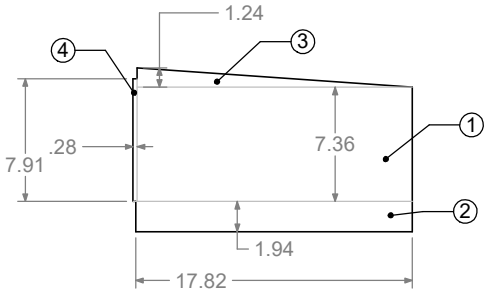




SECTION N-N




SECTION P-P




| ZONE | DIMENSIONS | VOLUME (IN3) | VOLUME (FT3) |
|---|---|---|---|
| 1 | 7.36 X 17.82 X 9.63 | 1263.02 | .730 |
| 2 | 1.94 X 17.82 X 9.63 | 332.92 | .193 |
| 3 | 17.82 X 1.24 X 9.63 | 106.40 | .062 |
| 4 | .28 X 7.91 X 9.63 | 21.33 | .012 |
| | | TOTAL | .997 |

WEIGHT:

| REVISIONS | | | | |
|---|---|---|---|---|
| ECO | REV. | DESCRIPTION | DATE | APPROVED |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

VIEWS ARE THIRD ANGLE

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TOLERANCES ARE:
FRACTIONS ± 1/64 DECIMALS .XX ± .015 .XXX ± .005 ANGLES ± 1/4°
1.) DIMENSIONS ARE IN INCHES / MM
2.) ALL MACHINED SURFACES TO BE DE-BURRED AND SMOOTHED
MATERIAL:
FINISH:

CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE

| APPROVALS | DATE |
|---|---|
| DRAWN | 8/30/2022 |
| CHECKED | |
| RESP ENG | |
| MFG ENG | |
| QUAL ENG. | |

hearthstone

LINCOLN 8060
VOLUME CALCULATION

SIZE B | HEARTHSTONE DWG. NO. | REV.
SCALE: 1:8 | HERGOM DWG. NO. | SHEET 4 OF 4

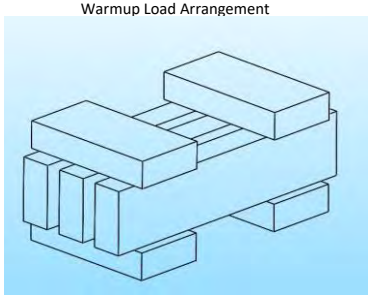
# APPENDIX 13: Operating instruction

MODEL: 8060
DATE: 6/20/2022
TEST ENGINEER: WE

**WOOD STOVE OPERATING INSTRUCTIONS**

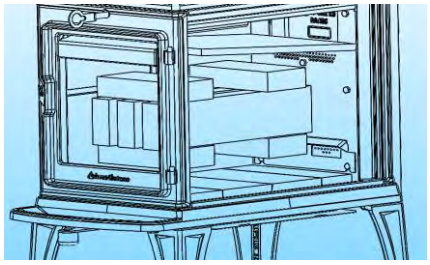
| BURN RATE CATEGORY | KINDLING | FIRST WARM UP | SECOND WARM UP AND PREBURN | PREBURN START | AIR SETTINGS | TEST FAN SETTING | COAL BED PREP | TEST LOAD | START OF TEST |
|---|---|---|---|---|---|---|---|---|---|
| LOW .85KGH | 2.5-2.8 LBS, BURN TO ABOUT 1.25 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD PIECES ARE INVOLED, BURN TO 1.2 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD IS FULLY INVOLED, BURN TO UP COAL BED RANGE | 1.5 LBS ABOVE COAL BED RANGE (UP RANGE), CLOSE BYPASS, SET PRIMARY AIR TO TEST SETTING | WARMUP SET AIR TO FULL OPEN, AT PREBURN START SET AIR TO LOWEST SETTING | NO FAN | BREAK UP COALS AND LEVEL, MAKE EVEN DENSITY AND HIGHT, FRONT TO BACK AND SIDE TO SIDE 2 MIN BEFORE START OF TEST | 4 PCS 2X4 CUT 15" LG +- 1" @6.3 TO 7.7LBS WITH 7 LBS IDEAL. CUT SPACERS TO 4". NO TOP SPACERS. | AT UPPER COAL BED WEIGHT OPEN PRIMARY, INSERT WOOD CLOSE LOADING DOOR, @5 MIN CLOSE BYPASS DOOR AND SET PRIMARY TO LOWEST SETTING |
| LOW .85KGH | 2.5-2.8 LBS, BURN TO ABOUT 1.25 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD PIECES ARE INVOLED, BURN TO 1.2 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD IS FULLY INVOLED, BURN TO UP COAL BED RANGE | 2.9 LBS ABOVE COAL BED RANGE (UP RANGE), CLOSE BYPASS, SET PRIMARY AIR TO TEST SETTING | WARMUP SET AIR TO FULL OPEN, AT PREBURN START SET AIR TO LOWEST SETTING | NO FAN | BREAK UP COALS AND LEVEL, MAKE EVEN DENSITY AND HIGHT, FRONT TO BACK AND SIDE TO SIDE 2 MIN BEFORE START OF TEST | 4 PCS 2X4 CUT 15" LG +- 1" @6.3 TO 7.7LBS WITH 7 LBS IDEAL. CUT SPACERS TO 4". NO TOP SPACERS. | AT UPPER COAL BED WEIGHT OPEN PRIMARY, INSERT WOOD CLOSE LOADING DOOR, @5 MIN CLOSE BYPASS DOOR AND SET PRIMARY TO LOWEST SETTING |
| MED HIGH 1.4KGH | 2.5-2.8 LBS, BURN TO ABOUT 1.25 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD PIECES ARE INVOLED, BURN TO 1.2 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD IS FULLY INVOLED, BURN TO UP COAL BED RANGE | 3.5 LBS ABOVE COAL BED RANGE (UP RANGE), CLOSE BYPASS, SET PRIMARY AIR TO TEST SETTING | WARMUP SET AIR TO FULL OPEN, AT PREBURN START SET AIR TO HIGHEST SETTING | NO FAN | BREAK UP COALS AND LEVEL, MAKE EVEN DENSITY AND HIGHT, FRONT TO BACK AND SIDE TO SIDE 2 MIN BEFORE START OF TEST | 4 PCS 2X4 CUT 15" LG +- 1" @6.3 TO 7.7LBS WITH 7 LBS IDEAL. CUT SPACERS TO 4". NO TOP SPACERS. | AT MID COAL BED WEIGHT OPEN PRIMARY, INSERT WOOD CLOSE LOADING DOOR, @5 MIN CLOSE BYPASS DOOR AND SET PRIMARY TO HIGHEST SETTING |
| HIGH 1.4KGH | 2.5-2.8 LBS, BURN TO ABOUT 1.25 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD PIECES ARE INVOLED, BURN TO 1.2 LBS | 7 AND 14" LG 2X4 @ 7 TO 8 LBS KEEP DOOR OPENED UNTIL ALL WOOD IS FULLY INVOLED, START PREBURN | START WHEN SECOND WARMUP LOAD IS ADDED,CLOSE BYPASS, SET PRIMARY AIR TO TEST SETTING | WARMUP SET AIR TO FULL OPEN, AT PREBURN START SET AIR TO HIGHEST SETTING | NO FAN | BREAK UP COALS AND LEVEL, MAKE EVEN DENSITY AND HIGHT, FRONT TO BACK AND SIDE TO SIDE 2 MIN BEFORE START OF TEST | 4 PCS 2X4 CUT 15" LG +- 1" @6.3 TO 7.7LBS WITH 7 LBS IDEAL. CUT SPACERS TO 4". NO TOP SPACERS. | AT MID COAL BED WEIGHT OPEN PRIMARY, INSERT WOOD CLOSE LOADING DOOR, @5 MIN CLOSE BYPASS DOOR AND SET PRIMARY TO HIGHEST SETTING |

Warmup Load Arrangement

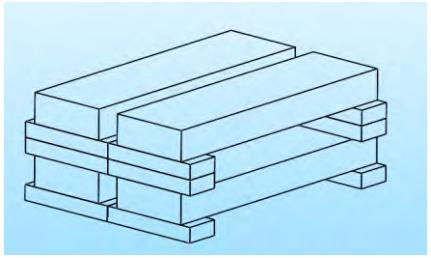


3 TO 4 PCS 14" LONG FRONT TO BACK ON EDGE,SET ON TOP OF 2 PCS 7" LONG LAYING LEFT TO RIGHT WITH 2 PCS 7" ON TOP . PLACE AT CENTER OF FIRE BOX KEEPING 1" AWAY FROM REAR HOOD FOR GOOD AIR CIRCULATION

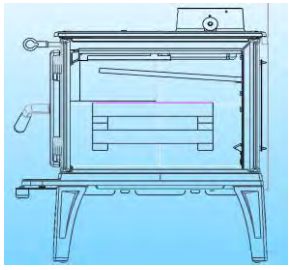
Warmup Load In Stove



Test Load Arrangement

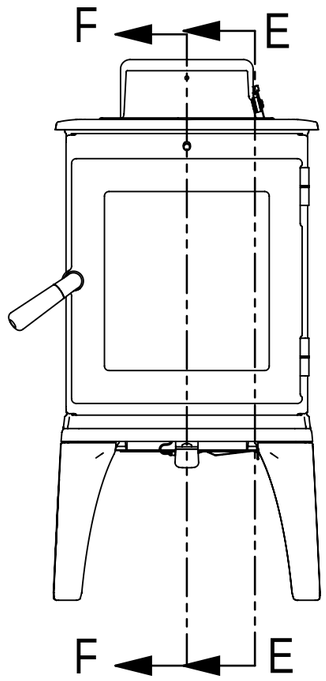


Test Load In Stove

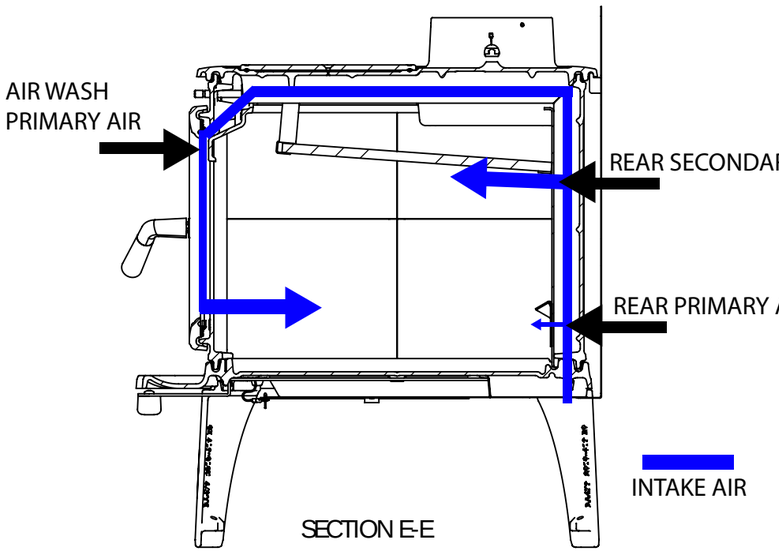


SET WOOD LOAD TO MIDDLE OF FIRE BOX FRONT TO BACK AND LEFT TO RIGHT. KEEP FUEL 1 INCH AWAY FROM REAR HOOD FOR BEST AIR MOVEMENT. DO NOT CRUSH COAL BED

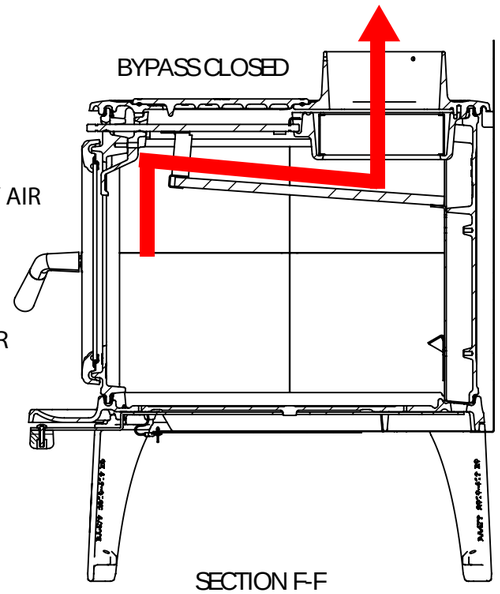
# APPENDIX 14: Drawing Air flow pattern



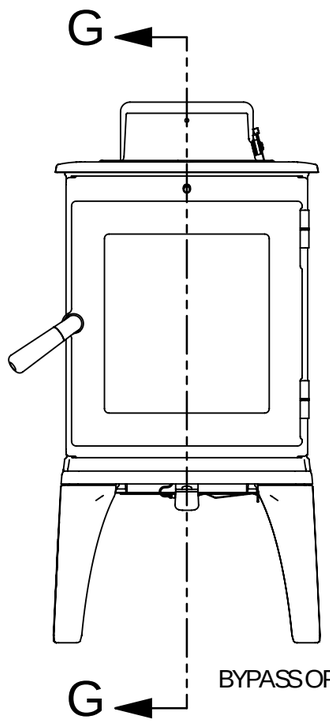

BYPASS CLOSED



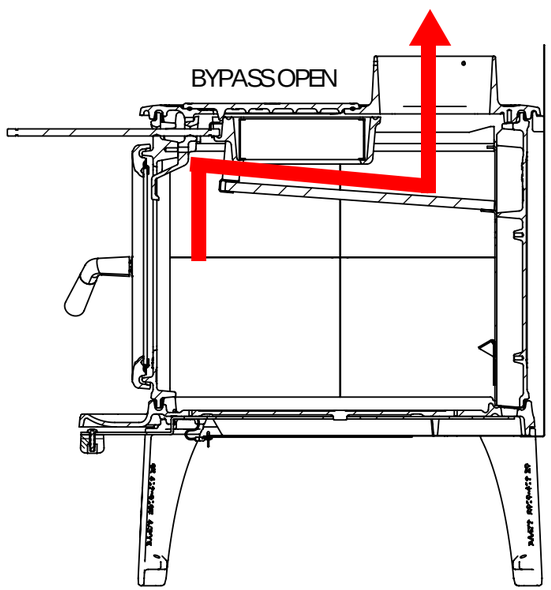

SECTION E-E



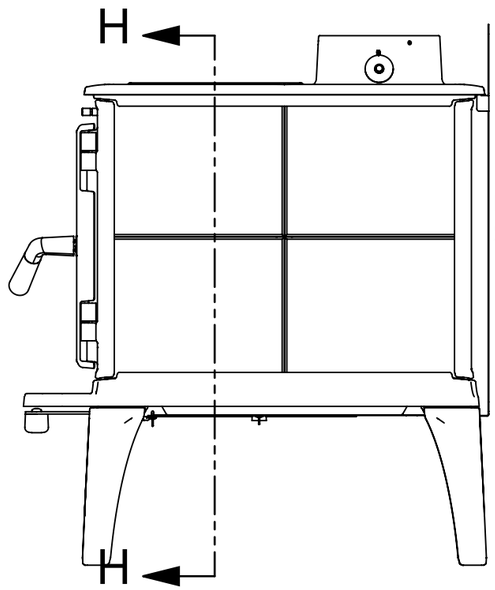

SECTION F-F

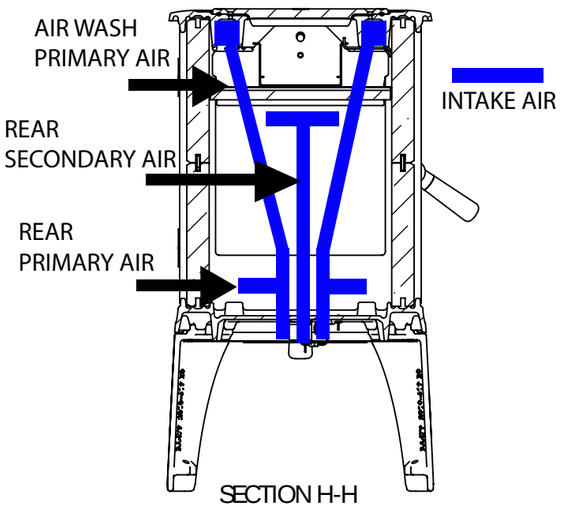



BYPASS OPEN




SECTION G-G




SECTION H-H

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1.) DIMENSIONS ARE IN INCHES / MM
2.) ALL MACHINED SURFACES TO BE DE-BURRED AND SMOOTHED

MATERIAL:

FINISH:

CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE

| APPROVALS | DATE |
|---|---|
| DRAWN | 8/30/2022 |
| CHECKED | |
| RESP ENG | |
| MFG ENG | |
| QUAL ENG. | |

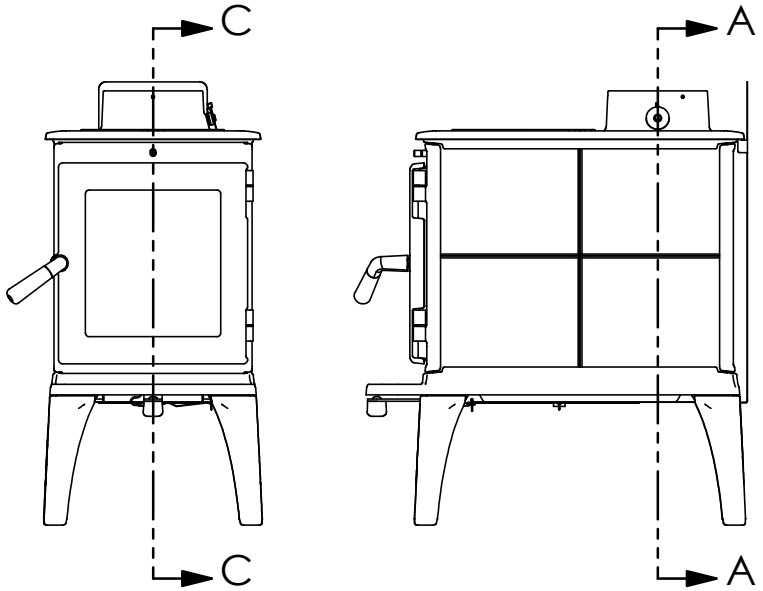
hearthstone

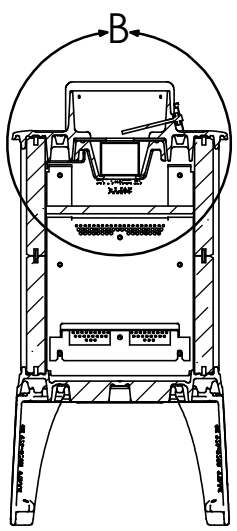
LINCOLN 8060

AIR FLOW DIAGRAM

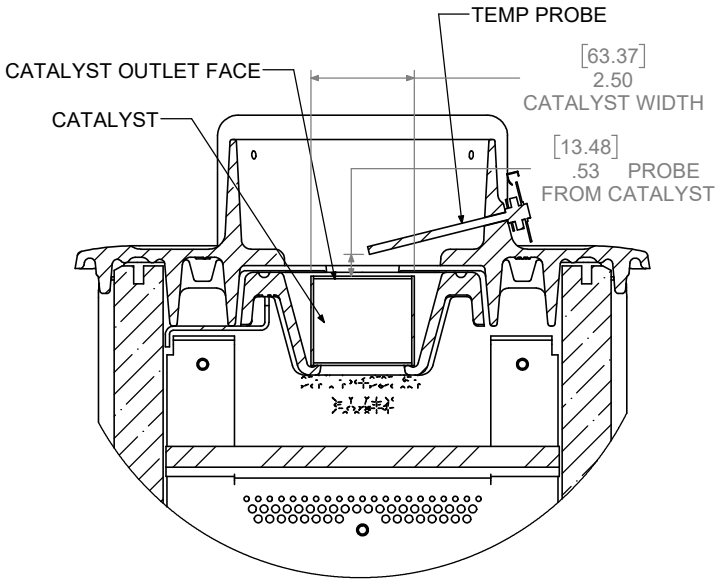
SIZE B | HEARTHSTONE DWG. NO. | REV.

SCALE: 1:8 | HERGOM DWG. NO. | SHEET2 OF 2

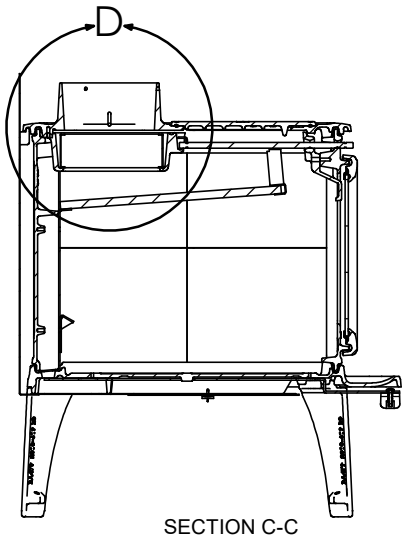


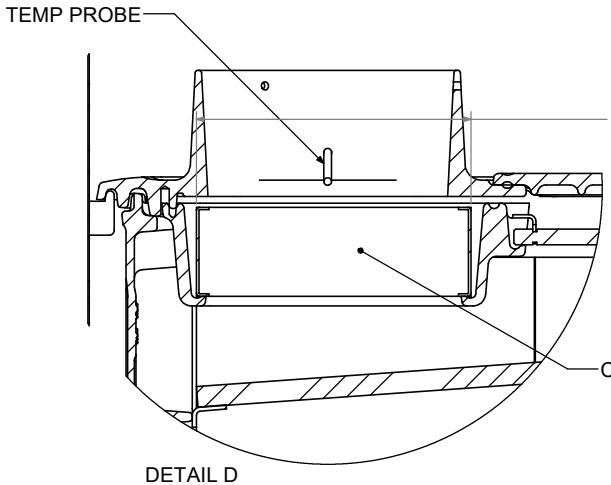

SECTION A-A




DETAIL B
SCALE 1 : 3




SECTION C-C




DETAIL D
SCALE 1 : 3

WEIGHT:

| REVISIONS | | | | |
|---|---|---|---|---|
| ECO | REV. | DESCRIPTION | DATE | APPROVED |
| | | | | |
| | | | | |
| | | | | |
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.XXX ± .005

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FINISH:

CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE

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|---|---|
| DRAWN | 8/30/2022 |
| CHECKED | |
| RESP ENG | |
| MFG ENG | |
| QUAL ENG. | |

hearthstone

LINCOLN 8060

CATALYST PROBE LOCATION

SIZE B | HEARTHSTONE DWG. NO. | REV.

SCALE: 1:8 | HERGOM DWG. NO. | SHEET 1 OF 2

# APPENDIX 15: Notice, CoC, WHA, others

March 28, 2022

Steffan Johnson
Measurement Technology Group Lead
US EPA Office of Air Quality Planning and Standards
Air Quality Assessment Division
U.S. Environmental Protection Agency (EPA)
109 TW Alexander Drive,
RTP, NC 27710

RE: Alternative Test Method Request

Dear Steffan Johnson,

Pursuant to section 60.8 (b) (2) of 40 CFR part 60, Hearthstone Quality Home Heating Products formally requests approval to test our Lincoln Model 8060 to a modified version of 40 CFR Part 60, sub part AAA, appendix A-8, Test Method 28R.

Specifically, Hearthstone Quality Home Heating Products requests to modify only section 9.4.1.10 (2) of ASTM E2780-10 which outlines the dimensions of crib spacers for the crib load. This request is necessitated by the width of the firebox size for the Lincoln 8060, which does not allow for two fuel cribs to be positioned side by side if the spacers are 5" in length. See Figure 1 in the appendix for firebox dimensions.

The modification to 9.4.1.10 (2) would change the spacer width from 5 x 1.5 x .75" to 4 x 1.5 x .75", with no other modifications to crib load specification. See Figure 2 in the appendix for proposed crib dimensions.

Additionally, Hearthstone would like to acknowledge and address another issue that presented during our in-house testing of the Lincoln 8060. The Lincoln 8060 is designed with a 1.0 cubic foot firebox. Due to the firebox dimensions, it has proven difficult to meet the requirements of ASTM E2780-10 Sections 9.4.1.5 and 9.4.1.6 at the same time. As shown in Photos 1 & 2 in the Appendix, which are documenting two different crib loads, in order to reach the 7.0 ± 0.7lbs loading density stated in 9.4.1.5, the load measures much below the exact 5/6 fuel length requirement of section 9.4.1.6. For the 18" deep firebox, the 5/6 load length should be 15", but loads are consistently coming out in the 11"-13" range. Hearthstone will direct the certification testing lab to make every effort to select wood which meets both requirements of 9.4.1.5 & 9.4.1.6, but this may not prove to be possible in reality. Hearthstone requests that consideration be given to the allowance of 9.4.1.6 that the fuel load "shall closely approximate 5/6" of the firebox length, and allow a greater variance, if necessary during testing, to the ±1" interpretation of "closely approximate" recently adopted by the Office of Air Quality Planning and Standards.

Sincerely,

Simon Booth
Engineering Manager
sbooth@hearthstonestoves.com
802.851.4044
Hearthstone Quality Home Heating Products
317 Stafford Ave, Morrisville VT 05661

3/29/2022 Digital Signiture

# Appendix

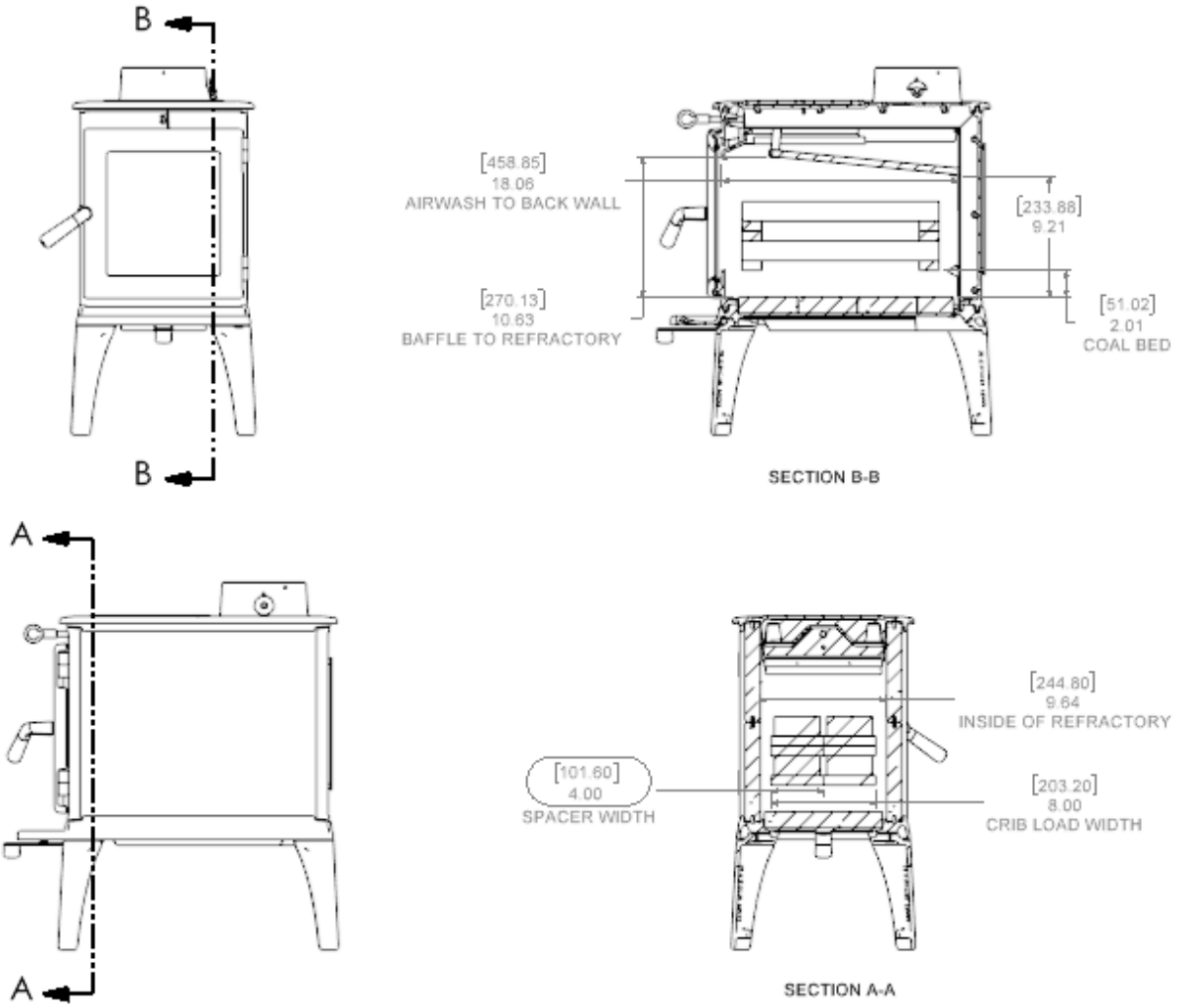



Figure 1: Firebox Dimensions

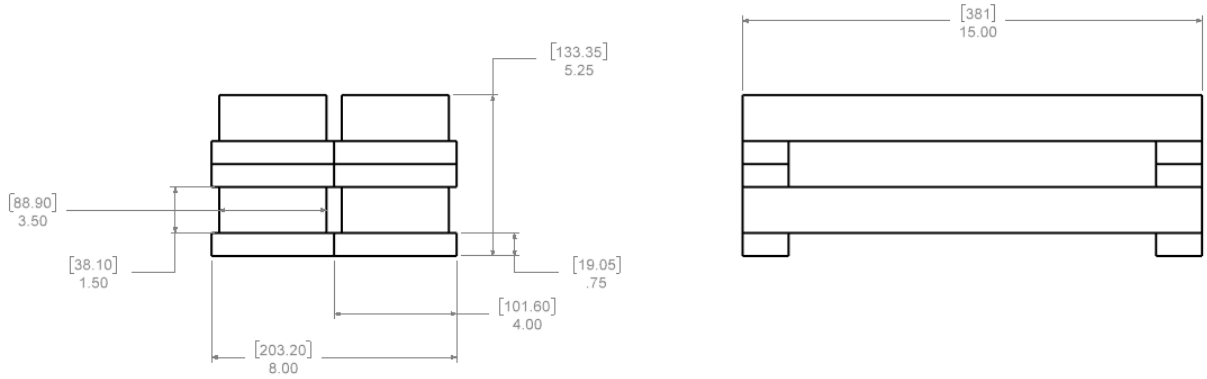



Figure 2: Proposed Crib Dimensions



Photo 1: 12″ long crib, 7.90lbs weight



Photo 2: 11″ long crib, 7.42 lbs weight

# 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: Hearthstone QHHP | | | | | | |
| 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: Lincoln 8060 | | | | | | |
| Catalyst: ☒ Yes ☐ No | | | | | | |
| Mailing Address: 317 Stafford Ave | | | | | | |
| Street Address: 317 Stafford Ave | | | | | | |
| City: Morrisville | State: VT | ZIP Code: 05661 | | | | |
| Phone: 802 851 4044 | Fax: N/A | Web Site: www.hearthstonestoves.com | | | | |
| Address of Manufacturing Facility: 317 Stafford Ave | | | | | | |
| City: Morrisville | State: VT | ZIP Code: 05661 | | | | |
| EPA APPROVED TEST LABORATORY | | | | | | |
| Name and Title of Authorized Representative: Danick Power | | | | | | |
| Company: Services Polytests inc. | | | | | | |

# U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
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| | | |
|---|---|---|
| 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: John Steinert, General Manager, Portland Laboratory | | |
| Company: PFS-TECO, Inc. | | |
| Phone: 580 650 0088 | E-mail: john.steinert@pfsteco.com | Fax: N/A |
| City: Clackamas | State: OR | ZIP Code: 97015 |
| COMPLIANCE TEST INFORMATION | | |
| Test Method(s): EPA Method 28R, ASTM E2515-11, ASTM E2780, CSA B415.1-10 MODIFIED ALTERNATIVE TEST METHOD and CATALYST EQUIVALENCY TESTING | | |
| Date(s) of Proposed Test: Primary preconditioning and performance testing scheduled for June 27th through July 1st 2022, Extended catalyst equivalency preconditioning and testing scheduled to take place between July 4th and July 26th, 2022. Services Polytests is closed for business for Canada Day Holidays from 7/8/2022-7/24/2022. | | |
| Testing Location:<br><br>Polytests Services Inc.<br>695 B rue Gaudette,<br>St-Jean-sur-Richelieu<br>Québec, Canada, J3B 7S7<br>*450.741.3636* | | |

# U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
# 30-DAY NOTIFICATION FORM
# PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
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- This notice must be received by the EPA at least 30 days before the start of testing.

Simon Booth, Engineering Lab Manager_____
Print Name and Title of Authorized Official

Simon Booth_____
Signature

5/19/2022__Updated 6/14/2022_____
Date

Remarks:

The Lincoln 8060 is a "Hybrid"-type appliance, incorporating both a secondary combustion system and a catalyst, and should be listed as such.

This testing is to follow an alternative test method approved by Steffan Johnson on 5/17/2022.

This testing is also to certify an alternative catalyst.

v1

Simon Booth
Hearthstone QHHP, Inc.
317 Stafford Ave.
Morrisville, VT 05661
802-851-4044

March 21, 2025

Rafael Sanchez
Wood Heater Program Lead
Air Branch
Monitoring, Assistance, and Media Programs Division
Office of Compliance
U.S. Environmental Protection Agency (EPA)
Room 7149-D
1200 Pennsylvania Ave., NW
MS: 2227A
Washington, DC 20004

Dear Mr. Sanchez,

I am writing to formally request two model additions to EPA Certification Letter Number 335-22.

Hearthstone Quality Home Heating Products requests to add the model identified as Green Mountain 20 (Model 8620) and the model identified as Dorset (Model 8330) to the certification letter which contains the Lincoln model 8060.

The Green Mountain 20 and Dorset will be identical to our already approved models listed on Certification Letter Number 335-22 in all functional aspects of the appliance, but will have a different aesthetic applied exclusively to the outer cast iron body. This model additions would allow Hearthstone to more dynamically market our appliances in specific market segments.

Hearthstone affirms that no changes will be made to the stove which would affect particulate emissions or any details as defined in 60.533, section k.
Hearthstone affirms that a unique label for Green Mountain 20 8620 and Dorset 8330 would be created per the requirements of sub section 60.536.

Thank you for your consideration,

Sincerely,

Simon Booth
Engineering Lab Manager
Hearthstone QHHP, Inc.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Mr. Simon Booth
Engineering Manager
Hearthstone Quality Home Heating Products
317 Stafford Avenue
Morrisville VT, 05661

05/17/2020

Dear Mr. Booth,

I am writing in response to your letter dated March 28, 2022, regarding certification testing of your Lincoln Model 8060 wood heater. You are planning to demonstrate compliance with 40 CFR 60, Subpart AAA - Standards of Performance for New Residential Wood Heaters (Subpart AAA) using EPA Method 28R. You are requesting an alternative certification testing procedure for your Lincoln Model 8060 wood heater because it cannot meet the 5 inch crib wood test fuel spacer length requirements as specified in Section 9.4.1.10 (2) ofASTM E2780-10, "Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters" Section 9.4.1.10 (2), which is referenced by Method 28R. You provided engineering drawings to show that the small firebox width of the Lincoln Model 8620, does not allow two fuel cribs to be placed side by side using the 5" x 1.5" x .75" spacers.

You instead propose to use test fuel spacers with a length of 4 inches (4" x 1.5" x .75") with no other changes to the crib load specifications.

Additionally, you state that the Lincoln Model 8060 is designed with a 1.0 cubic foot firebox volume and during in house testing, it proved to be difficult to meet the requirements of ASTM E2780-10 sections 9.4.1.5 and 9.4.1.6 at the same time. In the appendix of your letter, you provided photos 1 and 2, showing the weights for two different test fuel cribs constructed to meet the $7.0 \pm 0.7$ lbs/ft$^3$ loading density stated in section 9.4.1.5. These test fuel load lengths are significantly less than the 5/6$^{ths}$ fuel length requirement describesd in ASTM E2780-10 section 9.4.1.6. You state that for an 18.06 inch firebox depth (the longest dimension of your firebox) 5/6$^{ths}$ of this longest dimension equates to a test fuel crib length of 15 inches, but load lengths are consistently coming out to be in the 11 to 13 inch range.

You state that Heartstone will request that the test lab make every effort to construct a test fuel crib that meets both requirements in ASTM E2780-10 sections 9.4.1.5 and 9.4.1.6, but this may not prove to be possible. Hearthstone requests that consideration be given to the allowance of

section 9.4.1.6 that the fuel load "shall closely approximate 5/6" of the firebox length, and allow a greater variance, if necessary, to meet the ±1 inch interpretation of "closely approximate" recently adopted by the Office of Air Quality Planning and Standards.

With the caveats set forth below, we are approving your alternative method request for certification testing of the Lincoln 8060 wood heater to use crib wood spacer that are 4 inches length. We are also approving your request for potential flexibility in the 5/6 ± 1.0 inch requirement of ASTM E2780-10 section 9.4.1.6: however, Hearthstone and its' test lab must make every effort to meet both the load density requirement of 7.0 ± 0.7 lbs/ft$^3$ for every test fuel load and the requirement that the test fuel length shall closely approximate 5/6$^{ths}$ of the firebox length (defined as the longest horizontal firebox dimension).

We understand this is a balancing procedure between ASTM E2780-10 sections 9.4.1.5 and 9.4.1.6. and that it is possible only one of these two requirements may be met, depending on the maximum allowed loading density. At no time should Hearthstone choose a test fuel loading density that only meets the minimum load density requirement of 6.7 lbs/ft$^3$ with test fuel length that is significantly shorter than the 5/6 ± 1.0 inch requirement specifically where a longer test fuel length could be used to achieve the maximum loading density requirement of 7.7 lbs/ft$^3$ as described in ASTM E2780-10 section 9.4.1.5.

With the documented process laid out below, we will allow fuel lengths for your compliance test to be shorter than 5/6ths, AS NEEDED, in order to prevent going over the maximum fuel load density of 7.7 lb/ft$^3$. The test lab must document and report that they made a deliberate effort to meet each of these two requirements in ASTM E2780-10 section 9.4.1.5 and 9.4.1.6 and the test fuel crib does not exceed the maximum loading density of 7.7 lbs/ft$^3$. The lab test must also use a test fuel length that is the longest length possible in the firebox in order to meet the "must closely approximate 5/6$^{ths}$ of the longest dimension" test method requirement.

To achieve this, the test lab must demonstrate their attempt to meet both requirements in section 9.4.1.5 and 9.4.1.6. In order to do this they must build a test fuel load that is 5/6$^{ths}$ of the firebox longest length and calculate the loading density. If this test fuel load is over the loading density maximum allowance of 7.7 lbs/ft$^3$ requirement, then the assembled crib must be trimmed by cutting off an equal portion of wood from each test fuel piece and recalculating the density. If the test load remains over the maximum allowed loading density continue to cut equal portions off of each test fuel piece until the fuel load falls below maximum loading density requirement of 7.7 lbs/ft$^3$ in ASTM E2780-10 section 9.4.1.5. The resultant test fuel length may be less than the 5/6$^{ths}$ of the longest length method requirement BUT the test lab has then demonstrated an effort to meet this requirement. The test lab must take detailed notes for each test fuel load weight when crib was first made, piece reduction/amount cut off (1/4", 3/8", 1/2" etc) and the resulting weight. The test lab must document this process and must provide detailed notes of each stage of this process in order to arrive at the final test fuel load. The test report must include these detailed notes and must include the load dimensions and density calculations for each trial crib, including the final test fuel crib dimensions and mass.

As required in Subpart AAA, section 60.534(d), the manufacturer/approved test laboratory must also measure the first hour of particulate matter emissions for each test run using a separate set of filters in one of the two parallel sampling trains. These results must be reported separately and also included in the total particulate matter emissions per run. Also, as required in Subpart AAA, section 60.534(e), the manufacturer/approved test laboratory must measure the efficiency, heat output, and carbon monoxide emissions of the tested wood heater using CSA Method B415.1-10. For particulate matter emission concentrations, ASTM E2515-11 "Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel" must be used; four inch filters are acceptable.

The following caveats to ASTM E2515-11 should be followed for the certification testing:

1. The filter temperature must be maintained between 80 and 90 $^{o}$F during testing.
2. Filters must be weighed in pairs to reduce weighing error propagation see ASTM E2515-11 section 10.2.1.

Please remember the following items are required and listed in the third party certifier check list:

1. Dual train comparison (precision) must be calculated in terms of percent difference between the two sample trains and in terms of calculated emissions difference on a g/kg basis.
2. Negative filter weights must be discussed in the test report. Where negative mass (i.e..filter material left on O-rings and gaskets) is subtracted from the overall PM mass, the resultant PM mass must be reported with the mass subtracted and with the mass not subtracted for comparison purposes.

This approval is based on the understanding that the lowest heat output (BTU/hr) setting on the Hearthstone Lincoln Model 8060 room heater available to the user will correspond to the lowest burn rate to be evaluated during certification testing and the test report will reflect that the certification testing was conducted as such. This is consistent with section 60.534(a)(1) of Subpart AAA which states "the burn rate for the low burn rate category must be no greater than the burn rate that an operator can achieve in home use and no greater than is advertised by the manufactuer or retailer. This letter is only to be used for certification of the Hearthstone Lincoln Model 8060 wood heater. A copy of this letter must be included in the certification test report where this alternative test method determination is utilized.

If you have additional questions regarding this approval, please contact Michael Toney of my staff at 919-541-5247 or *toney.mike@epa.gov*.

Sincerely,

Steffan M. Johnson

Steffan M. Johnson
Group Leader
Measurement Technology Group

cc: Angelina Brashear, EPA/OAQPS/AQAD
Shanon Banner, EPA/OAQPS/SPPD
Rafael Sanchez, EPA/OECA
Robert Scinta, EPA/OECA
Michael Toney, EPA/OAQPS/AQAD
Mark Turner, EPA/OAQPS/SPPD
Chet Wayland, EPA/OAQPS/AQAD

## APPLIANCE LISTING DESIGN CHANGE FORM

| | |
|---|---|
| **Client/Manufacturer** | Hearthstone QHHP |
| **Model/Series Name** | Lincoln 8060 |
| **PFS File No.** | F22-859 |
| **Date** | 3/17/2025 |

| **Description of Change** |
|---|
| Hearthstone QHHP requests the addition of the Green Mountain 20 (Model 8620) and the Dorset (Model 8330) to the already certified Lincoln 8060 EPA report. |

| **Reason for Change** |
|---|
| Hearthstone seeks to expand this established model line by offering different exterior packages which do not effect the firebox size or construction, intake, exhaust, or any other variable which would effect the emissions as already certified in EPA letter 335-22.<br>The Green Mountain 20 (Model 8620) will offer a modern black cast iron appearance.<br>The Dorset (Model 8330) will offer a traditional appearance featuring enameled cast iron. |

| | |
|---|---|
| **Client/Manufacturer Representative:** | Simon Booth |
| **Changes are limited to those described above, all other aspects for the model line are as documented in the most current version test report** | |
| *Simon Booth* | 3/17/2024 |
| **Signature** | **Date** |

**TO BE COMPLETED BY PFS STAFF**

Upon review of the provided documentation it has been determined that:

| | YES | NO |
|---|---|---|
| This request has been approved without the need for further testing/evaluation | | |
| The Certification Report needs to be updated to reflect the changes contained herein | | |
| The Authorization to Mark needs to be updated to reflect the changes contained herein | | |

| Rationale/ Explanation of Decision |
|---|
| |

| PFS Representative: | |
|---|---|
| | |

**Signature** **Date**

SB 5/20/2020

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

OFFICE OF
COMPLIANCE

DEC 15 2016

Chris Neufeld
Vice President
Blaze King Industries, Inc.
146 A Street
Walla Walla, Washington 99362

RE: Blaze King Industries, Inc. (Blaze King) Request for Catalyst Suitable Replacement Procedures

Dear Mr. Neufeld:

This letter is in response to the February 3, 2016, Blaze King letter requesting the United States Environmental Protection Agency (EPA) implement a program to allow catalyst equipped wood heater manufacturers and suppliers to seek suitable replacement status during the life cycle of the product. As discussed below, replacement catalysts may be used if equivalency is properly demonstrated.

To have a catalyst deemed suitable for replacement, equivalency testing must be conducted by an EPA-approved test laboratory. Consistent with the 2015 Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces (Subpart AAA) (2015 Standards), the manufacturer must notify the EPA of the date that certification testing (catalyst equivalency testing) is scheduled to begin as stated in Section 60.534(g). This notice must be received by the EPA at least 30 days before the start of testing. EPA will consider the following steps to be adequate to demonstrate replacement catalyst equivalency:

1) The manufacturer uses the same test method as the original certification test was conducted. If the original certification test method is no longer valid, the manufacturer requests an alternative test method prior to testing.

2) The replacement catalyst is aged 50 hours prior to catalytic equivalency testing. The catalyst is tested in the same model or model line unit in which the original catalyst was tested.

3) Both a Category 1 run and Category 4 run are conducted by an EPA-approved test laboratory.

4) The new Category 1 run is compared to the original Category 1 run, and the new Category 4 run is compared to the original Category 4 run. The new runs are not more than 0.5 grams/hour greater than the original certification test results for each run. They are compared separately, with no averaging. In equation form:

Replacement catalyst category 1 ≤ (original catalyst category 1 + 0.5g/hr)

AND

Replacement catalyst category 4 ≤ (original catalyst category 4 + 0.5g/hr)

As noted in Section 60.533(k)(4)[1], the EPA Administrator must approve the change in the catalyst in advance, with proper documentation of the equivalency testing. This documentation consists of the original certification test report category 1 and 4 data and the new category 1 and 4 test data results. All demonstration test data must be sent to WoodHeaterReports@epa.gov within 60 days after the date of completing the test. EPA considers the catalyst equivalency testing to be a form of certification testing governed by the provisions in Section 60.534.

The EPA finds the request outside the scope of an applicability determination. The term "applicability determination" is limited to the Agency's formal decisions, issued in response to a non-hypothetical and site-specific request about the applicability of a specific rule to a specific facility. Therefore, the EPA considers this response to be a regulatory interpretation to a source request for clarification.[2]

This response has been prepared in consultation with the Office of Air Quality, Planning, and Standards, and the Office of General Counsel. If you have any questions, please contact Rafael Sanchez of my staff at 202-564-7028 or email at sanchez.rafael@epa.gov.

Sincerely,

Edward J. Messina

Edward J. Messina, Director
Monitoring, Assistance, and Media Programs Division
Office of Compliance

[1] A change in the make, model or composition of a catalyst is presumed to affect particulate matter and carbon monoxide emissions and efficiency, unless the change has been requested by the heater manufacturer and has been approved in advance by the Administrator, based on test data that demonstrate that the replacement catalyst is equivalent to or better than the original catalyst in terms of particulate matter emission reduction.
[2] This regulatory interpretation updates EPA Applicability Determination WDS-138 (July 6, 1990).

cc: Amanda Aldridge, OAQPS
Adam Baumgart-Getz, OAQPS
Mike Toney, OAQPS
Scott Jordan, OGC
Sara Ayres, OC

# U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
# 2015 Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces Application
# 40 CFR PART 60 SUBPARTS AAA AND QQQQ

Disclaimer: The statutory provisions and the EPA regulations described in this document contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. In the event of a discrepancy, please refer to 40 CFR PART 60 Subparts AAA AND QQQQ, Sections 60.533(b), 60.5475(b), and Appendix A–8. This document may be revised periodically without public notice. If you have additional questions, please contact Rafael Sanchez at 202-564-7028 or via email at sanchez.rafael@epa.gov.

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# 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: Hearthstone Quality Home Heating Products

| | | | | | | |
|---|---|---|---|---|---|---|
| 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) Preapproved Alternative test method. See Attached Letter of Approval | Catalyst: Yes |

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**"):
Lincoln 8060

| | |
|---|---|
| Physical Address (Street number and Address, not P.O. Box): 317 Stafford Ave | Mailing Address: 317 Stafford Ave |

| | | |
|---|---|---|
| City: Morrisville | State: VT | ZIP Code: 05661 |
| Phone: 1-802-851-4044 | Email: warm@hearthstonestoves.com | Website: https://www.hearthstonestoves.com/ |

EPA Submission Date of 30 day Notice: 5/19/2022, updated 6/14/2022

### **MANUFACTURER'S** AUTHORIZED REPRESENTATIVE INFORMATION

Name: SIMON BOOTH

Position/Title: ENGINEERING MANAGER

Address: 317 STAFFORD AVE

| | | |
|---|---|---|
| City: MORRISVILLE | State: VT | ZIP Code: 05661 |
| Phone: 802-851-4044 | E-mail: SBOOTH@HEARTHSTONESTOVES.COM | Website: https://www.hearthstonestoves.com/ |

Remarks:

# APPLICATION FOR A CERTIFICATE OF COMPLIANCE PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ

## 2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

| EPA-APPROVED TEST LABORATORY | | |
|---|---|---|
| Name of Test Laboratory:<br>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: PFS TECO | | |
| Name of Person Authorized or Responsible for Reviewing Test Report and/or Issuing Certification of Conformity: John Steinert | | |
| Position/Title: Laboratory Manager | | |
| Address: 11785 Highway 212. Ste. 305 | | |
| City: Clackasmas | State: OR | ZIP Code: 97015 |
| Phone: 503.650.0088 | Email:<br>john.steinert@pfsteco.com | Website: www.PFSTECO.com |
| 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.

Engineering drawings and specifications of components that may affect emissions are included with the CBI certification report. Dimensions and tolerances are in line with 60.533 (b), and our quality assurance plan and quality inspection sheets ensure on-going quality and conformance. Replacement instructions for emission-critical components are **included in our operator's manual.**

2. Firebox Statement Requirement

A statement whether the firebox or any firebox component (including the materials listed in paragraph (k)(3) of 60.533(b) and 60.5475(b) will be composed of material different from the material used for the firebox or firebox component in the wood heater on which certification testing was performed, a description of any such differences and demonstration that any such differences may not reasonably be anticipated to adversely affect emissions or efficiency.

All K-list items as described in 60.533 (b) on the certification test unit will be similar in all material respects to the production units.

3. CBI

Clear identification of any claimed confidential business information (CBI). Submit such information under separate cover to the EPA CBI Office; Attn: Residential Wood Heater Compliance Program Lead, 1200 Pennsylvania Ave., NW, Room 7138, MS:2227A, Washington, DC 20460. Note that all emissions data, including all information necessary to determine emission rates in the format of the standard, cannot be claimed as CBI.

A CBI and Non-CBI report will be provided separately.

4. Valid Certification Statement

All documentation pertaining to a valid certification test, including the complete test report and, for all test runs: Raw data sheets, laboratory technician notes, calculations and test results. Documentation must include the items specified in the applicable test methods. Documentation must include discussion of each test run and its appropriateness and validity, and must include detailed discussion of all anomalies, whether all burn rate categories were achieved, any data not used in the calculations and, for any test runs not completed, the data collected during the test run and the reason(s) that the test run was not completed and why. The burn rate for the low burn rate category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer. The test report must include a summary table that clearly presents the individual and overall emission rates, efficiencies and heat outputs. Submit the test report and all associated required information, according to the procedures for electronic reporting specified in § 60.537(f) and 60.5475(f).

A valid certification test report with all required documentation as specified above has been submitted by Polytests.

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.

**The warranty is detailed in the Operator's manual, which is provided with Polytest's report.**

6. Q/A Statement

A statement that the manufacturer will conduct a quality assurance program for the model line that satisfies the requirements of paragraph (m) of this section.

Hearthstone is contracted with PFS-Teco as our third party certifier to review our QA/QC program, **and to provide at least annual audits. Hearthstone's QA plan is included with the** certification report.

7. Laboratory Sealing of Unit

A statement describing how the tested unit was sealed by the laboratory after the completion of certification testing and asserting that such unit will be stored by the manufacturer in the sealed state until 5 years after the certification test.

The unit has been sealed by Polytests and will be transferred back to Hearthstone. Hearthstone will store the unit in a sealed state for at least five years.

8. Statements that the wood heaters manufactured under this certificate will be—

(i) Similar in all material respects that would affect emissions as defined in § 60.531 to the wood heater submitted for certification testing, and labeled as prescribed in § 60.536 and 60.5478.

(ii) Accompanied by an owner's manual that meets the requirements in § 60.536 and 60.5478. In addition, a copy of the owner's manual must be submitted to the Administrator and be available to the public on the manufacturer's web site.

i) The tested unit is the same in all material respects that would affect emissions to production units, and production units will be labeled in accordance with 60.536

(ii) All production units will **include a copy of the owner's** operation/installation manual that meets the requirements as specified **in 60.536. A copy of the owner's manual has been provided with the report, and will be made available on Hearthstone's website once the** unit is available for sale.

9. Third Party Certification Statement

A statement that the manufacturer has entered into contracts with an approved laboratory and an approved third-party certifier that satisfy the requirements of paragraph (f) of this section.

Hearthstone is contracted with PFS-Teco as our third party certifier.

10. Approved laboratory/third party Statement

A statement that the approved laboratory and approved third-party certifier are allowed to submit information on behalf of the manufacturer, including any claimed to be CBI.

Polytests and PFS-Teco are allowed to submit information related to EPA emissions testing performed by Polytests on behalf of Hearthstone, including any claimed CBI.

11. **Manufacturer's Website Certification Test Repor**ts 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.

Hearthstone will place a copy of the Non-CBI (or public version) of the certification test report and summary on our website as soon as the unit becomes available for sale.

12. Transferability Acknowledgement Statement

A statement of acknowledgment that the certificate of compliance cannot be transferred to another manufacturer or model line without written approval by the Administrator.

Hearthstone acknowledges that the certificate of compliance cannot be transferred to another manufacturer or model line without written approval by the Administrator.

13. Statement about Selling Wood Heaters without an EPA Certificate

A statement acknowledging that it is unlawful to sell, distribute or offer to sell or distribute an affected wood heater without a valid certificate of compliance.

Hearthstone acknowledges that it is unlawful to sell, distribute or offer to sell or distribute an affected wood heater without a valid certificate of compliance.

| | |
|---|---|
| Print Name and Title: Simon Booth | Date: 8/17/2022 |

Signature of responsible representative of the manufacturer certifying the accuracy of the above statements:



8/17/2022

The authorized or responsible party whose signature is above is certifying that the manufacturer has complied with and will continue to comply with all requirements of the 2015 NSPS for compliance certification and that the manufacturer remains responsible for compliance regardless of any error by the test laboratory or third-party certifier.

**Attachments**

**Instructions: Please complete the section applicable to your certification request. You may substitute your own data tables in lieu of the ones shown below provided that all the information is captured.**

# WOOD BURNING HEATERS

## I. Test Method 28R for Certification and Auditing of Wood Heaters

### A. *SUMMARY RESULTS – ADJUSTABLE 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 | 0,987 | 0,84 | 79,4% | 14 545 | 0,645 |
| 2 | 1,07 | 1,50 | 80,5% | 15 776 | 0,304 |
| 4 | 1,40 | 1,17 | 78,0% | 20 305 | 0,288 |
| 3 | 1,47 | 1,14 | 75,7% | 20 507 | 1,150 |
| Weighted particulate emission average of 4 test runs: 1.14 grams per hour. | | | | | |
| Weighted average HHV efficiency of 4 test runs: 78.5 %. | | | | | |
| Average Co 0.598 gr/min | | | | | |