
Hearth & Home Technologies

Project # 24-321

Model(s): Heat & Glo Pioneer-II-ARC, Heat & Glo Pioneer-II-REC, Heat & Glo Northstar-D, Heatilator C40-D, Majestic WarmMajic-D (AKA Heatilator Pioneer-II-ARC, Majestic Pioneer-II-ARC, Heatilator Pioneer-II-REC, Majestic Pioneer-II-REC)
Type: Single Burn Rate Wood-Fired Room Heater

October 11, 2024

**ASTM E2780 Standard Test Method for
Determining Particulate Matter Emissions
from Wood Heaters
EPA Test Method 28R for Certification
and Auditing of Wood Heaters**

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Manager



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Revision Summary

Date: 10/11/2024– Original Issue

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Affidavit

PFS-TECO was contracted by Hearth & Home Technologies (HHT) to provide testing services for the Pioneer-II-ARC Single Burn Rate Wood-Fired Room Heater per EPA Method 28R, *Certification and Auditing of Wood Heaters*. All testing and associated procedures were conducted at PFS-TECO's Portland Laboratory beginning on 8/20/2024 and ending on 8/21/2024. PFS-TECO's Portland Laboratory is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed EPA Method 28R and ASTM E2780, *Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters*. Particulate sampling was performed per ASTM E2515, *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel*.

PFS-TECO is accredited by the U.S. Environmental Protection Agency for the certification and auditing of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards for Residential Wood Heaters and subpart QQQQ of 40 CFR Part 60, Standards of Performance for New Hydronic Heaters and Forced Air Furnaces, Methods 28R, 28WHH, 28 WHH-PTS, and all methods listed in Sections 60.534 and 60.5476. PFS-TECO holds EPA Accreditation Certificate Numbers 4 and 4M (mobile). PFS-TECO is accredited by IAS to ISO 17020:2012 "Criteria for Bodies Performing Inspections", and ISO 17025:2017 "Requirements for Testing Laboratories." PFS-TECO is also accredited by Standards Council of Canada to ISO 17065:2012 "Requirements for Bodies Operating Product Certification Systems."

The following people were associated with the testing, analysis and report writing associated with this project.



Aaron Kravitz, Laboratory Manager

Introduction

HHT contracted with PFS-TECO to perform EPA certification testing on the Pioneer-II-ARC Single Burn Rate Wood-Fired Room Heater. All testing was performed at PFS-TECO's Portland Laboratory. All testing was performed by Aaron Kravitz.

Notes

- Prior to start of testing, 50 hours of conditioning was performed by the manufacturer at a medium burn setting in accordance with ASTM E2780.
- Prior to start of testing, the dilution tunnel was cleaned with a steel brush.
- A separate, independent, third filter train was utilized to determine 1st hour emissions for all test runs.
- All filters and O-rings were weighed in pairs.
- A total of 2 test runs were completed on this single burn rate appliance. The burn rate from each test agrees within 10% of the average, meeting the requirements of a single burn rate appliance. All runs have been found to be appropriate, no anomalies occurred. See the Run Narrative section for further detail on each run.

Wood Heater Identification and Testing

- Appliance Tested: ***Pioneer-II-ARC***
- PFS Tracking Number: ***213***
- Manufacturer: ***Hearth And Home Technologies***
- Catalyst: ***No***
- Heat exchange blower: ***Integral***
- Type: ***Wood Stove***
- Style: ***Built-in Fireplace***
- Date Received: ***Thursday, August 15, 2024***
- Testing Period – Start: ***Tuesday, August 20, 2024***
Finish: ***Wednesday, August 21, 2024***
- Test Location: ***PFS TECO***
11785 SE Hwy 212
Clackamas, OR 97015
- Elevation: ***~131 Feet above sea level***
- Test Technician(s): ***Aaron Kravitz***
- Observers: ***Rick Burkett of HHT***

Test Procedures and Equipment

All Sampling and analytical procedures were performed by Aaron Kravitz. All procedures used are directly from ASTM E2780 and ASTM E2515. See the list below for equipment used. See Appendix C submitted with this report for calibration data.

Equipment List:

| Equipment ID# | Equipment Description |
|---------------|--|
| 50 | Digiweigh DWP12i Platform Scale |
| 53 | APEX XC-60-ED Digital Emissions Sampling Box A |
| 54 | APEX XC-60-ED Digital Emissions Sampling Box B |
| 203 | APEX XC-50-DIR Digital Emissions Sampling Box C |
| 55 | Apex Ambient Air Sample Box |
| 57 | California Analytical ZRE CO2/CO/O2 IR ANALYZER |
| 94 | Moisture meter calibration block |
| 95 | Anemometer |
| 97 | 10 lb audit weight |
| 107 | Sartorius Analytical Balance |
| 109A/B | Troemner 100mg/200mg Audit Weights |
| 111 | Dwyer 1430 Microtector |
| 115 | Delmhorst Wood Moisture Meter |
| 189 | Mettler 3'x3' floor scale w/digital weight indicator |
| 207 | Dewalt Tape Measure |
| 208 | Digital Calipers |
| 215 | Temperature Logger |
| CC505834 | Gas Analyzer Calibration Span Gas |
| CC341544 | Gas Analyzer Calibration Mid Gas |

Barometric pressure data was taken from local National Weather Service station KPDX. As PFS and KPDX are at the same altitude, the correction for altitude per ASTM E2515 6.1.2 is 1:1.

Results

A total of 2 test runs were performed on the Pioneer-II-ARC. The average emissions rate for the 2 run test series was measured to be **1.7 g/hr** with a Higher Heating Value efficiency of **69%**. The average CO emission rate for the 2 tests was **1.7 g/min**. The HHT Pioneer-II-ARC meets the 2020 cribwood PM emission standard of ≤ 2.0 g/hr per CFR 40 part 60, §60.532 (b).

Detailed individual run data can be found in Appendix A submitted with this report.

Summary Table

| | 8/20/2024 | 8/21/2024 |
|---|-----------|-----------|
| Date | 8/20/2024 | 8/21/2024 |
| Run Number | 1 | 2 |
| Emission Rate (g/hr) | 1.74 | 1.67 |
| Burn Rate (kg/hr) | 1.67 | 1.58 |
| Heat Output (Btu/hr) | 21,357 | 20,498 |
| Overall Efficiency (% HHV) | 69% | 70% |
| CO Emissions (g/MJ Output) | 4.44 | 5.15 |
| CO Emissions (g/kg Dry Fuel) | 60.66 | 70.96 |
| CO Emissions (g/min) | 1.67 | 1.85 |
| Emissions – 1 st hr (g/hr) | 6.21 | 5.46 |
| Particulate emission average of 2 test runs: 1.7 grams per hour. | | |
| Average HHV efficiency of 2 test runs: 69%. | | |
| Average CO Emissions Rate: 1.7 g/min | | |

Test Run Narrative

Run 1

Run 1 was performed on 8/20/2024 as a single burn rate appliance, per EPA Method 28R. The total test time was 273 minutes. The particulate emissions rate for the test was 1.74 g/hr, the burn rate was 1.67 kg/hr with an HHV efficiency of 68.9%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 2

Run 2 was performed on 8/21/2024 as a single burn rate appliance, per EPA Method 28R. The total test time was 281 minutes. The particulate emissions rate for the test was 1.67 g/hr, the burn rate was 1.58 kg/hr with an HHV efficiency of 69.5%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Test Conditions Summary

Testing conditions for all runs fell within allowable specifications of the ASTM 2780 and ASTM E2515. A summary of facility conditions, fuel burned, and run times is listed below.

| Run | Ambient (°F) | | Relative Humidity (%) | | Average Barometric Pressure (In. Hg.) | Preburn Fuel Weight (lbs) | Test Fuel Weight (lbs) | Test Fuel Moisture (%DB) | Test Run Time (Min) |
|-----|--------------|------|-----------------------|------|---------------------------------------|---------------------------|------------------------|--------------------------|---------------------|
| | Pre | Post | Pre | Post | | | | | |
| 1 | 75 | 74 | 35.7 | 31.1 | 29.94 | 16.09 | 20.19 | 22.1 | 273 |
| 2 | 74 | 73.7 | 45.1 | 32.8 | 29.90 | 16.69 | 19.77 | 22.1 | 281 |

Appliance Operation and Test Settings

The appliance was operated according to procedures as described in the Operations Manual, found in Appendix B submitted with this report. Detailed run information can be found in Appendix A submitted with this report.

Settings & Run Notes

| | Pre-Burn Air Setting | Test Run Air and Fan Settings |
|--------------|---|---|
| Run 1 | N/A – Single burn rate appliance has no air control | N/A – Single burn rate appliance has no air control |
| Run 2 | N/A – Single burn rate appliance has no air control | N/A – Single burn rate appliance has no air control |

Appliance Description

Branding: Heat & Glo, Heatilator, Majestic

Model(s): Pioneer-II-ARC

Additional Models: Pioneer-II-REC, C40-D, Northstar-D, Warmmajic-D

Appliance Type: Single Burn Rate Wood-Fired Room Heater

Total/Usable Firebox Volume: Total firebox volume for this appliance is 2.98 ft³, usable firebox volume is 2.75 ft³.

Additional Model Discussion: The additional models are differentiated for branding purposes only and are identical with the tested model in all respects that may affect emissions.

Air Introduction System: Combustion air enters the appliance through a round opening in the firebox back. Air is channeled to secondary air ports located at the rear of the baffle system, and to air ports directed at the glass for an air wash system.

Baffles: A C-Cast baffle is located at the top of the fire chamber, it is located so flames must travel to the front of the fire chamber around the front edge of the baffle.

Catalytic Combustor: N/A

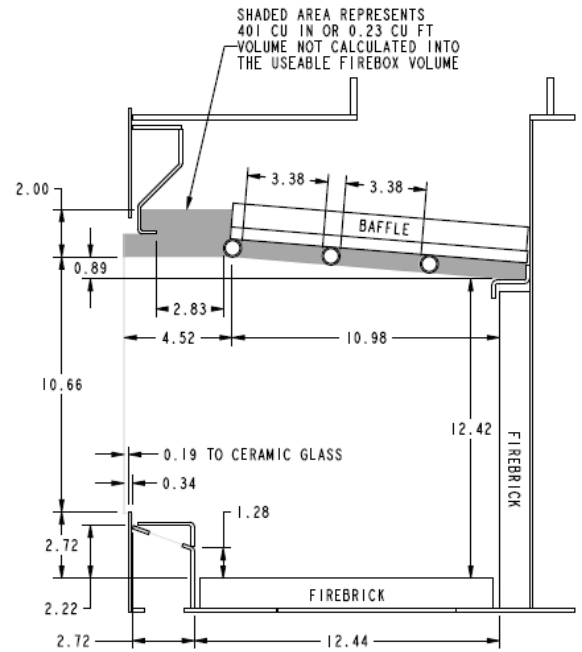
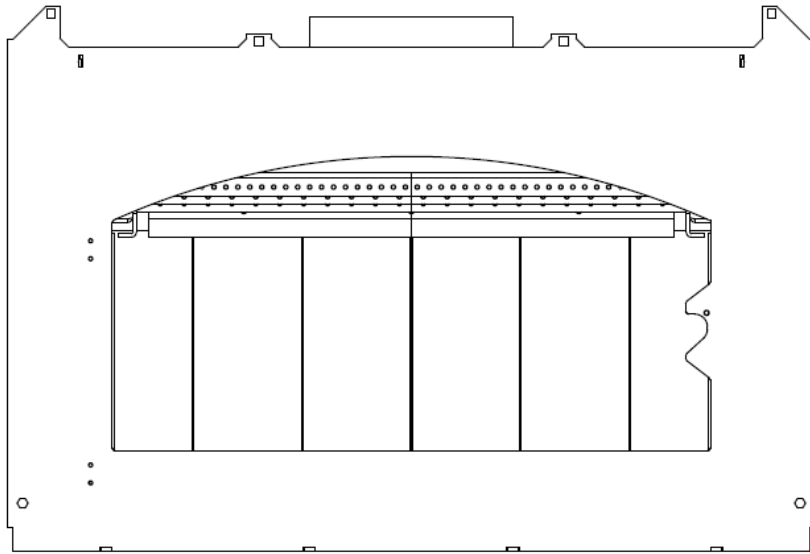
Refractory Insulation: The firebox is lined with 1.25" thick high-density firebrick.

Flue Outlet: 8-inch exhaust outlet located on the top of the appliance.

Fan: A dual air distribution fan is factory-installed on the appliance.

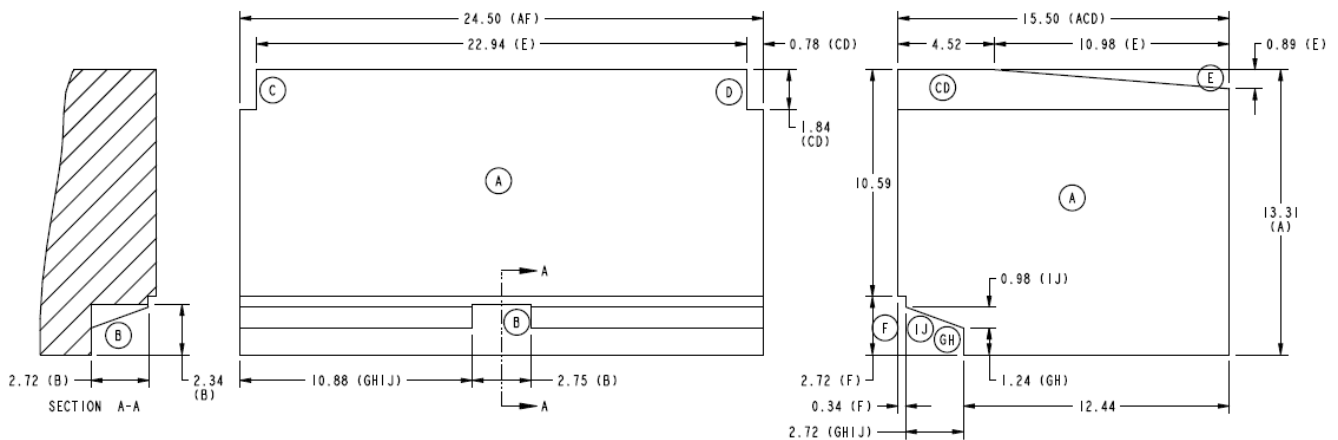
Appliance design drawings can be found in Appendix D submitted with the CBI copy of this report.

Firebox Volume Dimension



TOTAL FIREBOX VOLUME = 2.98 CU FT
 NON-USEABLE VOLUME = 0.23 CU FT
 USABLE FIREBOX VOLUME = 2.75 CU FT

| ZONE | W | H | D | CU |
|------|-------|-------|-------|------------|
| A □ | 24.50 | 13.31 | 15.50 | 5054.47 |
| B □ | 2.75 | 2.34 | 2.72 | -17.50 |
| C □ | 0.78 | 1.84 | 15.50 | -22.25 |
| D □ | 0.78 | 1.84 | 15.50 | -22.25 |
| E ▽ | 22.94 | 0.89 | 10.98 | -112.09 |
| F □ | 24.50 | 2.72 | 0.34 | -22.66 |
| G □ | 10.88 | 1.24 | 2.72 | -36.70 |
| H □ | 10.88 | 1.24 | 2.72 | -36.70 |
| I ▽ | 10.88 | 0.98 | 2.72 | -14.50 |
| J ▽ | 10.88 | 0.98 | 2.72 | -14.50 |
| | | | | 4755.32 |
| | | | | 2.75 CU FT |



Appliance Front



Appliance Left



Appliance Right



Appliance Rear



Test Fuel Properties

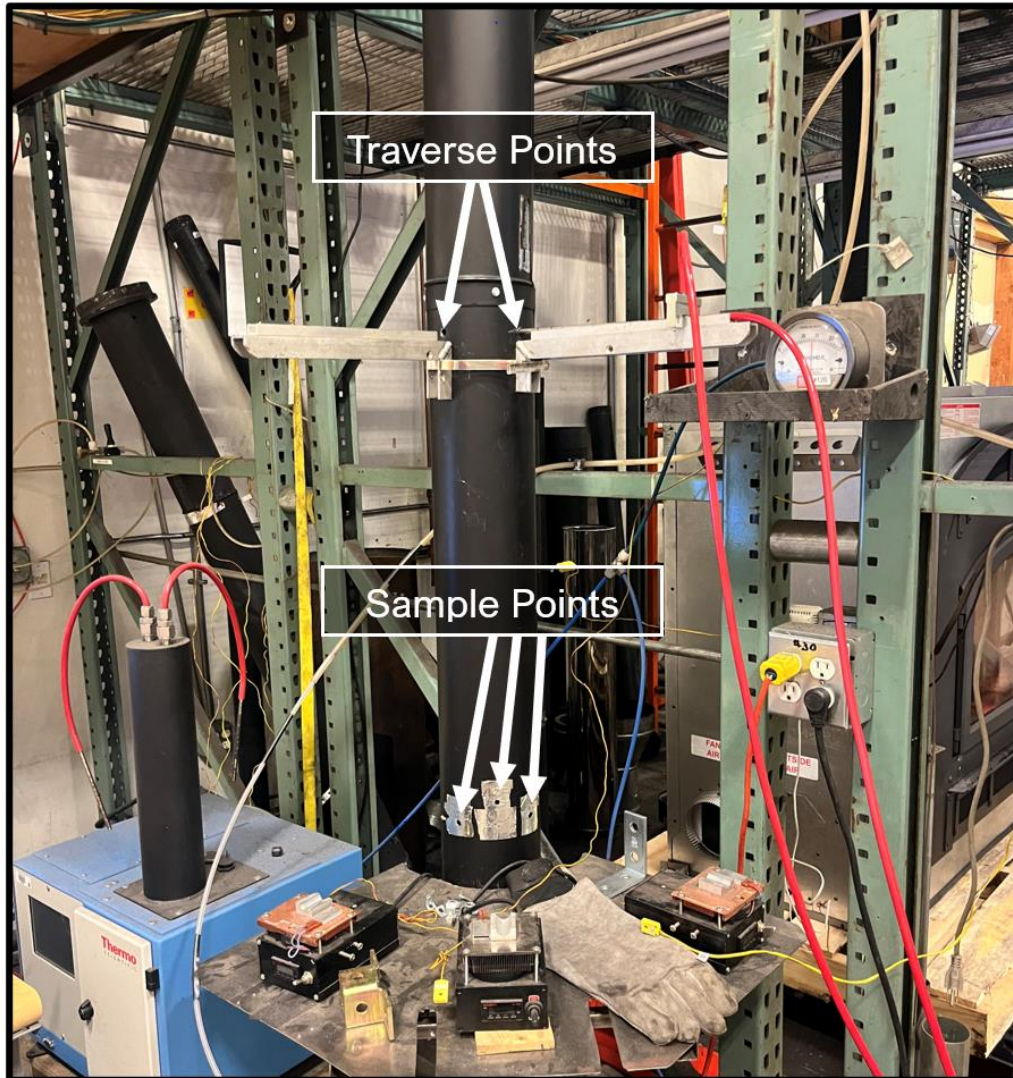
Test fuel used was Douglas Fir dimensional lumber, air-dried to the specified moisture content range. A typical fuel load is pictured below:

Typical Fuel Load



Sampling Locations and Descriptions

Sample ports are located 14 feet downstream from any disturbances and 2 feet upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 4 feet upstream from any disturbances. (See below).



Sampling Methods

ASTM E2515 was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per ASTM E2515 were followed. No alternate procedures were used.

Analytical Methods Description

All sample recovery and analysis procedures followed ASTM E2515 procedures. At the end of each test run, filters, O-Rings and probes were removed from their housings dessicated for a minimum of 24 hours, and then weighed at 6 hour intervals to a constant weight per ASTM E2515-11 Section 10. .

Calibration, Quality Control and Assurances

Calibration procedures and results were conducted per EPA Method 28R and ASTM E2515-11. Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined. All leak check data can be found on the Quality systems check page for each run performed in Appendix A of the report.

Appliance Sealing and Storage

Upon completion of testing, the appliance was secured with metal strapping and the seal below was applied, the appliance was then returned to the manufacturer’s location at: 1915 West Saunders Street Mt Pleasant IA, 52641, for archival.

Sealing Label

ATTENTION:

THIS SEAL IS NOT TO BE BROKEN WITHOUT PRIOR AUTHORIZATION FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.

THIS APPLIANCE HAS BEEN SEALED INACCORDANCE WITH REQUIREMNTS OF 40CFR PART 60 SUBPART AAA §60.535 (a)(2)(vii)

REPORT # _____ DATE SEALED _____
MANUFACTURER _____ MODEL # _____

Sealed Unit



List of Appendices

The following appendices have been submitted electronically in conjunction with this report:

Appendix A – Conditioning Data, Test Run Data, Technician Notes, and Sample Analysis- See page 20 of Non-CBI PDF report.

Appendix B – Labels and Manuals - See page 119 of Non-CBI PDF report.

Appendix C –Equipment Calibration Records - See page 220 of Non-CBI PDF report.

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

Appendix A: Test Run Data

Pre-Conditioning Data

| | |
|---------------------------|---|
| Client: HHT | Job #: |
| Model: Pioneer II | Tracking #: |
| Date(s): 7/24/2024 | Technician: Rick Burkett |

| Elapsed Time (hrs) | Flue (°F) | Catalyst Exit (°F) | Notes: Indicate initial air setting and any changes in in setting during conditioning, as well as weight and average moisture content of all fuel additions. |
|--------------------|-----------|--------------------|--|
| 0 | 433 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium high |
| 1 | 249 | NA | |
| 2 | 163 | NA | |
| 3 | 456 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium high |
| 4 | 275 | NA | |
| 5 | 168 | NA | |
| 6 | 150 | NA | |
| 7 | 150 | NA | |
| 8 | 440 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium high |
| 9 | 231 | NA | |
| 10 | 174 | NA | |
| 11 | 140 | NA | |
| 12 | 463 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 13 | 237 | NA | |
| 14 | 174 | NA | |
| 15 | 143 | NA | |
| 16 | 492 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 17 | 247 | NA | |
| 18 | 184 | NA | |
| 19 | 157 | NA | |
| 20 | 526 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 21 | 218 | NA | |
| 22 | 174 | NA | |
| 23 | 153 | NA | |
| 24 | 397 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium high |
| 25 | 369 | NA | |
| 26 | 375 | NA | |
| 27 | 379 | NA | |
| 28 | 433 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium high |
| 29 | 435 | NA | |
| 30 | 444 | NA | |
| 31 | 405 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 32 | 407 | NA | |
| 33 | 383 | NA | |
| 34 | 531 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 35 | 261 | NA | |
| 36 | 225 | NA | |
| 37 | 458 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 38 | 294 | NA | |
| 39 | 217 | NA | |
| 40 | 531 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 41 | 261 | NA | |
| 42 | 225 | NA | |
| 43 | 406 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 44 | 407 | NA | |
| 45 | 384 | NA | |
| 46 | 458 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 47 | 294 | NA | |
| 48 | 217 | NA | |
| 49 | 531 | NA | Fuel added - 19-23lb, 19-25% moisture, air set to medium low |
| 50 | 261 | NA | |

**WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515**



Run 1 Data Summary

| | |
|-------------|------------|
| Client: | HHT |
| Model: | Pioneer II |
| Job #: | 23-321 |
| Tracking #: | 213 |
| Test Date: | 8/20/2024 |



Technician Signature

8/28/2024

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| | |
|---------------------------|-------------|
| Burn Rate (kg/hr): | 1.67 |
|---------------------------|-------------|

| | Ambient Sample | Sample Train A | Sample Train B | 1st Hour Filter |
|---|----------------|----------------|----------------|-----------------|
| Total Sample Volume (ft ³) | 64.032 | 43.430 | 43.056 | 8.953 |
| Average Gas Velocity in Dilution Tunnel (ft/sec) | 18.8 | | | |
| Average Gas Flow Rate in Dilution Tunnel (dscf/hr) | 12236.5 | | | |
| Average Gas Meter Temperature (°F) | 75.1 | 93.2 | 97.3 | 84.1 |
| Total Sample Volume (dscf) | 63.443 | 41.545 | 41.536 | 8.781 |
| Average Tunnel Temperature (°F) | 102.2 | | | |
| Total Time of Test (min) | 273 | | | |
| Total Particulate Catch (mg) | 0.3 | 6.4 | 5.8 | 4.5 |
| Particulate Concentration, dry-standard (g/dscf) | 0.0000047 | 0.0001540 | 0.0001396 | 0.0005124 |
| Total PM Emissions (g) | 0.26 | 8.31 | 7.51 | 6.21 |
| Particulate Emission Rate (g/hr) | 0.06 | 1.83 | 1.65 | 6.21 |
| Emissions Factor (g/kg) | - | 1.09 | 0.99 | - |
| Difference from Average Total Particulate Emissions (g) | - | 0.40 | 0.40 | - |
| Difference from Average Total Particulate Emissions (%) | - | 5.1% | 5.1% | - |
| Difference from Average Emissions Factor (g/kg) | - | 0.05 | 0.05 | - |

| Final Average Results | |
|----------------------------------|-------|
| Total Particulate Emissions (g) | 7.91 |
| Particulate Emission Rate (g/hr) | 1.74 |
| Emissions Factor (g/kg) | 1.04 |
| HHV Efficiency (%) | 68.9% |
| LHV Efficiency (%) | 74.5% |
| CO Emissions (g/min) | 1.67 |

| Quality Checks | Requirement | Observed | Result |
|----------------------------------|---|---------------------------------|------------------------|
| Dual Train Precision | Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg | See Above | OK |
| Filter Temps | <90 °F | 89.9 | OK |
| Face Velocity | < 30 ft/min | 8.9 | OK |
| Leakage Rate | Less than 4% of average sample rate | 0.001 cfm | OK |
| Ambient Temp | 55-90 °F | Min:73.7/Max:76.6 | OK |
| Negative Probe Weight Evaluation | <5% of Total Catch | Probe Catch Not Negative | OK |
| Pro-Rate Variation | 90% of readings between 90-110%; none greater than 120% or less than 80% | See Data Tabs | OK |
| Stove Surface ΔT | <126°F | 195.4 | Check §10.3 Compliance |
| Stove Surface ΔT (§10.3) | DQH < 0.085(QFC) | .085*QFC = 12127 DQH = 10174 | OK |

| §10.3 Inputs | |
|-----------------|--------|
| Metal Mass | 447.9 |
| Refractory Mass | 36.4 |
| Fuel Dry Weight | 16.74 |
| QFC | 142666 |

B415.1 Efficiency Results

Manufacturer: HHT
Model: Pioneer II
Date: 08/20/24
Run: 1
Control #: 23-321
Test Duration: 273
Output Category: 3

Test Results in Accordance with CSA B415.1-09

| | HHV Basis | LHV Basis |
|---------------------------------|-----------|-----------|
| Overall Efficiency | 68.9% | 74.5% |
| Combustion Efficiency | 96.0% | 96.0% |
| Heat Transfer Efficiency | 71.8% | 77.6% |

| | | | |
|---------------------------|--------|--------|----------------|
| Output Rate (kJ/h) | 22,514 | 21,357 | (Btu/h) |
| Burn Rate (kg/h) | 1.65 | 3.63 | (lb/h) |
| Input (kJ/h) | 32,672 | 30,993 | (Btu/h) |

| | | | |
|----------------------------------|-------|-------|---------------|
| Test Load Weight (dry kg) | 7.50 | 16.54 | dry lb |
| MC wet (%) | 18.08 | | |
| MC dry (%) | 22.07 | | |
| Particulate (g) | 7.91 | | |
| CO (g) | 455 | | |
| Test Duration (h) | 4.55 | | |

| Emissions | Particulate | CO |
|-------------------------|-------------|--------|
| g/MJ Output | 0.08 | 4.44 |
| g/kg Dry Fuel | 1.05 | 60.66 |
| g/h | 1.74 | 100.04 |
| g/min | 0.03 | 1.67 |
| lb/MM Btu Output | 0.18 | 10.33 |

| | |
|-----------------------------|-------|
| Air/Fuel Ratio (A/F) | 16.52 |
|-----------------------------|-------|

VERSION:

2.4

4/15/2010

WOODSTOVE FUEL DATA - ASTM E2780

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Preburn Fuel Information | | | | | | |
|--------------------------|-------------|-------------------------|-------------------------|------|-------------|-------------------------|
| Size | Length (in) | Moisture Content (% DB) | | Size | Length (in) | Moisture Content (% DB) |
| 2x4 | 17.00 | 21.3 | | 2x4 | 11.00 | 23.2 |
| 2x4 | 17.00 | 20.0 | | 2x4 | 11.00 | 24.3 |
| 2x4 | 17.00 | 22.0 | | | | |
| 2x4 | 17.00 | 21.0 | | | | |
| 2x4 | 11.00 | 21.5 | | | | |
| 2x4 | 11.00 | 20.5 | | | | |
| 2x4 | 11.00 | 22.0 | | | | |
| 2x4 | 11.00 | 22.0 | | | | |
| Total Fuel Weight (lbs): | | 16.09 | Average Moisture (%DB): | | 21.8 | |

Firebox Volume (ft³): 2.75
 Total 2x4 Crib Weight, with spacers (lbs): 8.95
 Total 4x4 Crib Weight, with spacers (lbs): 11.24
 Total Wet Fuel Weight, with spacers (lbs): 20.19

Coal Bed Range (20-25%):
 Min (lbs): 4.04
 Max (lbs): 5.05

| Test Fuel Information | | | | | | |
|---------------------------------------|-------------|--------------|------------------------|------|------|------------------|
| Size | Length (in) | Weight (lbs) | Moisture Content (%DB) | | | Dry Weight (lbs) |
| 2x4 | 21.00 | 2.60 | 23.9 | 24.2 | 20.6 | 2.12 |
| 2x4 | 21.00 | 2.45 | 20.4 | 19.7 | 20.8 | 2.04 |
| 2x4 | 21.00 | 2.40 | 24.3 | 24.3 | 22.9 | 1.94 |
| 4x4 | 21.00 | 5.11 | 22.0 | 19.7 | 22.4 | 4.21 |
| 4x4 | 21.00 | 5.11 | 20.7 | 23.2 | 22.0 | 4.19 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Total Dry Weight, no spacers (lbs): | | | | | | 14.49 |
| Total Dry Weight, with spacers (lbs): | | | | | | 16.74 |

| Spacer Moisture Readings (%DB) | | | | | | |
|--------------------------------|------|------|--|--|--|--|
| 11.8 | 10.9 | 11.1 | | | | |
| 12.0 | 11.1 | 14.3 | | | | |
| 12.8 | 15.1 | 10.7 | | | | |
| 11.1 | 11.9 | 10.5 | | | | |
| 14.0 | 11.9 | | | | | |
| 10.8 | 10.8 | | | | | |
| 10.6 | 13.2 | | | | | |
| 11.7 | 13.1 | | | | | |

| Quality Checks | Requirement | Observed | Result |
|-----------------|--------------------------------------|----------|--------|
| Fuel Density | 25 - 36 (lbs/ft ³ , DB) | 29.6 | OK |
| Loading Density | 6.3 - 7.7 (lbs/ft ³ , WB) | 7.34 | OK |
| 2x4 Fuel Mix | 35 - 65 % of total weight | 44% | OK |

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

| | |
|-------------------------------|------------------------|
| Client: HHT | Job #: 23-321 |
| Model: Pioneer II | Tracking #: 213 |
| Run #: 1 | Technician: AK |
| Test Start Time: 11:33 | Date: 8/20/2024 |

Total Sampling Time (min): **273**
 Recording Interval (min): **1**

Meter Box γ Factor: **0.996 (A)**
 Meter Box γ Factor: **1.012 (B)**
 Meter Box γ Factor: **1.008 (C)**
 Meter Box γ Factor: **1.004 (Ambient)**

| | Pre-Test | Post Test | Avg. |
|------------------------------|------------------------------|-----------|-------|
| Barometric Pressure (in. Hg) | 29.97 | 29.90 | 29.94 |
| Relative Humidity (%) | 35.7 | 31.1 | |
| Room Air Velocity (ft/min) | <50 | <50 | |
| Pitot Tube Leak Check | 0 | 0 | |
| Ambient Sample Volume: | 64.032 ft³ | | |

Induced Draft Check (in. H₂O): **0**
 Smoke Capture Check (%): **100%**
 Date Flue Pipe Last Cleaned: **8/16/2024**
 Test Fuel Scale Audit (lbs): **10.00**
 Platform Scale Audit (lbs): **10.0**

Sample Train Leak Checks

| | Pre-test | Post-test | | |
|-----------|----------|-----------|-------|------------|
| (A) | 0.000 | 0.000 | cfm @ | -6 in. Hg |
| (B) | 0.000 | 0.001 | cfm @ | -7 in. Hg |
| (C) | 0.001 | 0.000 | cfm @ | -6 in. Hg |
| (Ambient) | 0.000 | 0.000 | cfm @ | -14 in. Hg |

DILUTION TUNNEL FLOW

Traverse Data

| Point | dP (in H ₂ O) | Temp (°F) |
|--------|--------------------------|-----------|
| 1 | 0.054 | 83 |
| 2 | 0.090 | 83 |
| 3 | 0.094 | 83 |
| 4 | 0.062 | 83 |
| 5 | 0.058 | 83 |
| 6 | 0.094 | 83 |
| 7 | 0.096 | 83 |
| 8 | 0.058 | 83 |
| Center | 0.097 | 83 |

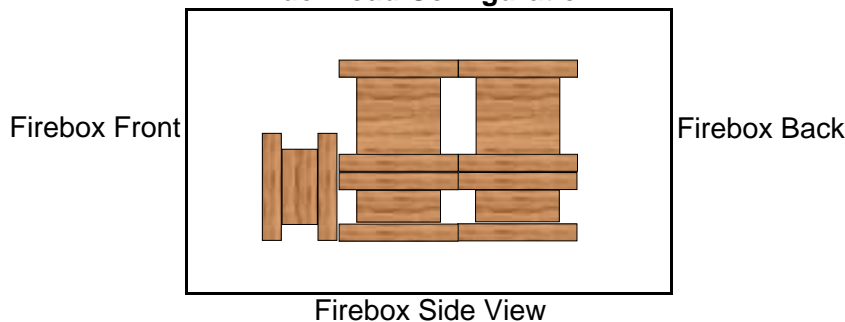
Dilution Tunnel H₂O: **2.00** percent
 Tunnel Diameter: **6** inches
 Pitot Tube Cp: **0.99** [unitless]
 Dilution Tunnel MW(dry): **29.00** lb/lb-mole
 Dilution Tunnel MW(wet): **28.78** lb/lb-mole
 Tunnel Area: **0.1963** ft²

V_{strav} : **18.35** ft/sec
 V_{scent} : **20.92** ft/sec
 F_p : **0.877** [ratio]
 Initial Tunnel Flow: **206.2** scf/min

Static Pressure: **-0.160** in. H₂O

TEST FUEL PROPERTIES

Fuel Load Configuration



Actual Fuel Used Properties

| | |
|-------------|---------------|
| Fuel Type: | D. Fir |
| HHV (kJ/kg) | 19,810 |
| %C | 48.73 |
| %H | 6.87 |
| %O | 43.9 |
| %Ash | 0.5 |
| MC (%DB) | 22.1 |

WOODSTOVE PREBURN DATA - ASTM E2780

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

Recording Interval (min): 1
 Run Time (min): 86

| Elapsed Time (min) | Scale Reading (lbs) | Flue Draft (in H ₂ O) | Temperatures (°F) | | | | | | | Flue | Ambient |
|--------------------|---------------------|----------------------------------|-------------------|----------|---------|--------|-----------|-----------------------|-----|------|---------|
| | | | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | | | |
| 0 | 19.61 | -0.072 | 485 | 498 | 330 | 391 | 493 | 439.2 | 329 | 73 | |
| 1 | 19.31 | -0.082 | 482 | 496 | 328 | 389 | 498 | 438.5 | 465 | 72 | |
| 2 | 19.04 | -0.065 | 479 | 495 | 326 | 404 | 500 | 440.7 | 501 | 72 | |
| 3 | 18.95 | -0.060 | 476 | 493 | 323 | 399 | 503 | 438.5 | 380 | 72 | |
| 4 | 18.86 | -0.055 | 471 | 492 | 319 | 388 | 504 | 434.7 | 331 | 71 | |
| 5 | 18.79 | -0.054 | 466 | 490 | 315 | 376 | 505 | 430.3 | 305 | 71 | |
| 6 | 18.72 | -0.053 | 461 | 487 | 310 | 364 | 507 | 425.7 | 288 | 72 | |
| 7 | 18.62 | -0.051 | 456 | 483 | 305 | 352 | 507 | 420.5 | 277 | 71 | |
| 8 | 18.54 | -0.052 | 450 | 478 | 300 | 341 | 507 | 415.2 | 269 | 71 | |
| 9 | 18.19 | -0.087 | 444 | 472 | 296 | 358 | 505 | 414.8 | 433 | 71 | |
| 10 | 17.99 | -0.068 | 437 | 466 | 292 | 386 | 502 | 416.6 | 422 | 71 | |
| 11 | 17.75 | -0.073 | 431 | 460 | 288 | 391 | 500 | 414.3 | 398 | 71 | |
| 12 | 17.51 | -0.076 | 426 | 455 | 286 | 404 | 498 | 413.4 | 419 | 71 | |
| 13 | 17.28 | -0.074 | 420 | 450 | 283 | 418 | 495 | 413.2 | 433 | 71 | |
| 14 | 17.02 | -0.075 | 416 | 446 | 281 | 433 | 492 | 413.5 | 449 | 70 | |
| 15 | 16.75 | -0.075 | 412 | 443 | 280 | 444 | 488 | 413.5 | 445 | 71 | |
| 16 | 16.49 | -0.073 | 408 | 441 | 279 | 451 | 486 | 412.8 | 439 | 71 | |
| 17 | 16.21 | -0.075 | 404 | 440 | 278 | 457 | 483 | 412.2 | 447 | 71 | |
| 18 | 15.89 | -0.083 | 401 | 439 | 277 | 488 | 480 | 416.9 | 501 | 71 | |
| 19 | 15.58 | -0.087 | 399 | 439 | 277 | 536 | 477 | 425.5 | 547 | 71 | |
| 20 | 15.30 | -0.086 | 397 | 439 | 277 | 576 | 475 | 432.8 | 555 | 71 | |
| 21 | 15.03 | -0.085 | 394 | 439 | 276 | 604 | 472 | 437.1 | 554 | 71 | |
| 22 | 14.74 | -0.086 | 392 | 439 | 276 | 628 | 470 | 441.0 | 557 | 71 | |
| 23 | 14.46 | -0.086 | 387 | 440 | 276 | 655 | 469 | 445.1 | 571 | 72 | |
| 24 | 14.18 | -0.088 | 384 | 440 | 276 | 685 | 467 | 450.3 | 599 | 72 | |
| 25 | 13.84 | -0.091 | 382 | 440 | 276 | 707 | 466 | 454.0 | 597 | 72 | |
| 26 | 13.55 | -0.087 | 380 | 440 | 276 | 720 | 466 | 456.4 | 597 | 72 | |
| 27 | 13.26 | -0.088 | 379 | 440 | 277 | 730 | 465 | 458.2 | 601 | 72 | |
| 28 | 12.97 | -0.089 | 378 | 441 | 278 | 739 | 465 | 460.0 | 607 | 72 | |
| 29 | 12.67 | -0.087 | 378 | 441 | 279 | 745 | 465 | 461.6 | 605 | 73 | |
| 30 | 12.38 | -0.087 | 378 | 443 | 280 | 752 | 465 | 463.5 | 604 | 73 | |
| 31 | 12.08 | -0.087 | 379 | 444 | 281 | 755 | 466 | 465.0 | 595 | 73 | |
| 32 | 11.86 | -0.087 | 381 | 446 | 283 | 756 | 466 | 466.2 | 589 | 73 | |
| 33 | 11.55 | -0.086 | 383 | 448 | 284 | 756 | 466 | 467.3 | 586 | 72 | |
| 34 | 11.31 | -0.085 | 386 | 450 | 285 | 754 | 467 | 468.2 | 577 | 73 | |
| 35 | 11.05 | -0.085 | 388 | 453 | 286 | 751 | 467 | 469.0 | 572 | 73 | |
| 36 | 10.79 | -0.085 | 392 | 456 | 287 | 746 | 467 | 469.6 | 563 | 73 | |
| 37 | 10.56 | -0.085 | 396 | 459 | 289 | 742 | 467 | 470.5 | 555 | 73 | |
| 38 | 10.31 | -0.083 | 400 | 462 | 290 | 738 | 467 | 471.2 | 547 | 72 | |
| 39 | 10.09 | -0.083 | 404 | 465 | 291 | 734 | 467 | 472.0 | 542 | 72 | |
| 40 | 9.87 | -0.083 | 408 | 468 | 292 | 730 | 467 | 472.8 | 533 | 72 | |
| 41 | 9.62 | -0.084 | 412 | 471 | 294 | 727 | 466 | 474.0 | 532 | 73 | |
| 42 | 9.41 | -0.083 | 416 | 474 | 295 | 727 | 466 | 475.5 | 539 | 73 | |
| 43 | 9.18 | -0.083 | 420 | 477 | 296 | 726 | 465 | 476.9 | 540 | 73 | |
| 44 | 8.95 | -0.082 | 425 | 480 | 298 | 729 | 463 | 478.7 | 543 | 73 | |

WOODSTOVE PREBURN DATA - ASTM E2780

Client: HHT
Model: Pioneer II
Run #: 1

Job #: 23-321
Tracking #: 213
Technician: AK
Date: 8/20/2024

Recording Interval (min): 1
Run Time (min): 86

| Elapsed Time (min) | Scale Reading (lbs) | Flue Draft (in H ₂ O) | Temperatures (°F) | | | | | | | Flue | Ambient |
|--------------------|---------------------|----------------------------------|-------------------|----------|---------|--------|-----------|-----------------------|-----|------|---------|
| | | | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | | | |
| 45 | 8.72 | -0.083 | 429 | 483 | 299 | 731 | 462 | 480.6 | 543 | 73 | |
| 46 | 8.49 | -0.083 | 434 | 486 | 301 | 734 | 460 | 482.8 | 546 | 73 | |
| 47 | 8.29 | -0.082 | 439 | 488 | 303 | 739 | 458 | 485.2 | 543 | 73 | |
| 48 | 8.05 | -0.084 | 444 | 491 | 305 | 741 | 456 | 487.3 | 540 | 74 | |
| 49 | 7.85 | -0.081 | 450 | 494 | 307 | 743 | 454 | 489.5 | 541 | 74 | |
| 50 | 7.63 | -0.083 | 456 | 497 | 309 | 744 | 451 | 491.2 | 541 | 74 | |
| 51 | 7.44 | -0.083 | 461 | 499 | 311 | 744 | 449 | 492.8 | 540 | 74 | |
| 52 | 7.25 | -0.081 | 467 | 502 | 313 | 744 | 446 | 494.4 | 536 | 74 | |
| 53 | 7.06 | -0.081 | 472 | 505 | 315 | 743 | 444 | 495.6 | 532 | 74 | |
| 54 | 6.86 | -0.080 | 477 | 507 | 317 | 740 | 441 | 496.3 | 526 | 74 | |
| 55 | 6.69 | -0.080 | 482 | 509 | 318 | 737 | 439 | 497.1 | 529 | 74 | |
| 56 | 6.53 | -0.079 | 486 | 512 | 320 | 732 | 436 | 497.2 | 516 | 73 | |
| 57 | 6.37 | -0.079 | 491 | 514 | 321 | 726 | 434 | 497.2 | 510 | 74 | |
| 58 | 6.24 | -0.079 | 495 | 516 | 322 | 725 | 431 | 497.9 | 516 | 74 | |
| 59 | 6.10 | -0.079 | 497 | 518 | 324 | 728 | 428 | 499.1 | 521 | 74 | |
| 60 | 5.95 | -0.082 | 502 | 520 | 325 | 738 | 426 | 502.0 | 527 | 74 | |
| 61 | 5.80 | -0.080 | 506 | 522 | 326 | 746 | 424 | 504.9 | 530 | 74 | |
| 62 | 5.66 | -0.081 | 511 | 524 | 328 | 751 | 422 | 507.1 | 528 | 74 | |
| 63 | 5.51 | -0.081 | 514 | 526 | 329 | 752 | 421 | 508.3 | 525 | 74 | |
| 64 | 5.39 | -0.079 | 517 | 528 | 332 | 750 | 420 | 509.3 | 521 | 75 | |
| 65 | 5.27 | -0.080 | 519 | 529 | 334 | 744 | 420 | 509.3 | 517 | 74 | |
| 66 | 5.16 | -0.077 | 521 | 532 | 336 | 730 | 421 | 507.8 | 509 | 74 | |
| 67 | 5.07 | -0.076 | 522 | 534 | 339 | 711 | 421 | 505.3 | 501 | 74 | |
| 68 | 4.99 | -0.076 | 523 | 536 | 341 | 690 | 423 | 502.5 | 487 | 75 | |
| 69 | 4.90 | -0.073 | 524 | 539 | 343 | 671 | 424 | 500.0 | 474 | 74 | |
| 70 | 4.82 | -0.073 | 524 | 541 | 344 | 650 | 426 | 497.0 | 462 | 74 | |
| 71 | 4.78 | -0.071 | 524 | 544 | 344 | 629 | 427 | 493.4 | 449 | 74 | |
| 72 | 4.71 | -0.070 | 524 | 546 | 344 | 609 | 430 | 490.3 | 436 | 74 | |
| 73 | 4.67 | -0.067 | 523 | 547 | 343 | 589 | 431 | 486.9 | 421 | 74 | |
| 74 | 4.63 | -0.065 | 522 | 549 | 343 | 570 | 433 | 483.5 | 405 | 74 | |
| 75 | 4.59 | -0.063 | 521 | 550 | 342 | 552 | 435 | 479.8 | 392 | 74 | |
| 76 | 4.56 | -0.063 | 519 | 550 | 340 | 535 | 437 | 476.4 | 383 | 74 | |
| 77 | 4.53 | -0.060 | 517 | 550 | 339 | 520 | 439 | 472.9 | 375 | 74 | |
| 78 | 4.49 | -0.061 | 515 | 549 | 338 | 505 | 441 | 469.6 | 368 | 75 | |
| 79 | 4.46 | -0.060 | 513 | 548 | 335 | 492 | 443 | 466.1 | 361 | 74 | |
| 80 | 4.43 | -0.059 | 510 | 547 | 333 | 479 | 445 | 462.8 | 350 | 74 | |
| 81 | 4.39 | -0.059 | 508 | 546 | 332 | 468 | 446 | 459.8 | 344 | 74 | |
| 82 | 4.37 | -0.056 | 506 | 544 | 330 | 456 | 448 | 456.7 | 339 | 74 | |
| 83 | 4.35 | -0.055 | 503 | 542 | 328 | 446 | 450 | 453.8 | 333 | 75 | |
| 84 | 4.32 | -0.055 | 501 | 540 | 326 | 437 | 452 | 451.0 | 327 | 74 | |
| 85 | 4.28 | -0.055 | 498 | 538 | 324 | 428 | 454 | 448.1 | 323 | 74 | |
| 86 | 4.25 | -0.054 | 495 | 535 | 322 | 420 | 456 | 445.5 | 316 | 74 | |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 0 | 0.000 | | 0.095 | 0.01 | 76 | 0.1 | | 20.19 | | 119 | 306 | 75 | 75 |
| 1 | 0.090 | 0.090 | 0.096 | 2.03 | 76 | 0.9 | - | 19.92 | -0.27 | 136 | 277 | 78 | 75 |
| 2 | 0.236 | 0.146 | 0.097 | 2.09 | 76 | 0.9 | - | 19.64 | -0.28 | 157 | 376 | 81 | 74 |
| 3 | 0.378 | 0.142 | 0.095 | 2.11 | 76 | 0.9 | - | 19.29 | -0.35 | 159 | 489 | 83 | 74 |
| 4 | 0.523 | 0.145 | 0.093 | 2.15 | 76 | 1.0 | - | 18.79 | -0.50 | 197 | 705 | 89 | 74 |
| 5 | 0.667 | 0.144 | 0.095 | 2.18 | 76 | 0.9 | - | 18.49 | -0.30 | 168 | 572 | 85 | 74 |
| 6 | 0.812 | 0.145 | 0.095 | 2.21 | 76 | 1.0 | - | 18.26 | -0.23 | 148 | 525 | 84 | 74 |
| 7 | 0.961 | 0.149 | 0.095 | 2.23 | 76 | 1.0 | - | 18.04 | -0.22 | 138 | 514 | 84 | 74 |
| 8 | 1.107 | 0.146 | 0.095 | 2.26 | 76 | 0.9 | - | 17.82 | -0.22 | 134 | 515 | 84 | 74 |
| 9 | 1.258 | 0.151 | 0.095 | 2.27 | 77 | 1.0 | - | 17.58 | -0.24 | 132 | 521 | 85 | 74 |
| 10 | 1.404 | 0.146 | 0.099 | 2.29 | 77 | 1.0 | 93 | 17.32 | -0.26 | 131 | 530 | 85 | 74 |
| 11 | 1.555 | 0.151 | 0.096 | 2.30 | 77 | 0.9 | - | 17.07 | -0.25 | 131 | 529 | 85 | 75 |
| 12 | 1.702 | 0.147 | 0.098 | 2.31 | 77 | 0.9 | - | 16.82 | -0.25 | 131 | 525 | 85 | 74 |
| 13 | 1.854 | 0.152 | 0.095 | 2.33 | 77 | 1.0 | - | 16.59 | -0.23 | 132 | 530 | 85 | 74 |
| 14 | 2.002 | 0.148 | 0.097 | 2.33 | 78 | 0.9 | - | 16.33 | -0.26 | 132 | 538 | 85 | 74 |
| 15 | 2.155 | 0.153 | 0.097 | 2.35 | 78 | 1.0 | - | 16.06 | -0.27 | 133 | 552 | 85 | 74 |
| 16 | 2.304 | 0.149 | 0.096 | 2.35 | 78 | 1.0 | - | 15.80 | -0.26 | 133 | 558 | 85 | 74 |
| 17 | 2.457 | 0.153 | 0.094 | 2.36 | 78 | 1.0 | - | 15.52 | -0.28 | 133 | 570 | 85 | 74 |
| 18 | 2.606 | 0.149 | 0.095 | 2.37 | 79 | 1.0 | - | 15.29 | -0.23 | 134 | 574 | 85 | 75 |
| 19 | 2.759 | 0.153 | 0.099 | 2.37 | 79 | 1.0 | - | 15.00 | -0.29 | 134 | 571 | 85 | 74 |
| 20 | 2.909 | 0.150 | 0.099 | 2.36 | 79 | 1.0 | 100 | 14.76 | -0.24 | 135 | 574 | 85 | 75 |
| 21 | 3.063 | 0.154 | 0.099 | 2.36 | 80 | 1.0 | - | 14.50 | -0.26 | 135 | 569 | 85 | 75 |
| 22 | 3.214 | 0.151 | 0.100 | 2.38 | 80 | 1.0 | - | 14.26 | -0.24 | 135 | 564 | 85 | 75 |
| 23 | 3.367 | 0.153 | 0.099 | 2.38 | 80 | 1.0 | - | 14.04 | -0.22 | 135 | 561 | 85 | 75 |
| 24 | 3.521 | 0.154 | 0.099 | 2.38 | 80 | 1.0 | - | 13.79 | -0.25 | 134 | 558 | 85 | 75 |
| 25 | 3.673 | 0.152 | 0.097 | 2.40 | 81 | 1.0 | - | 13.57 | -0.22 | 134 | 561 | 85 | 75 |
| 26 | 3.828 | 0.155 | 0.098 | 2.40 | 81 | 1.0 | - | 13.34 | -0.23 | 134 | 560 | 85 | 75 |
| 27 | 3.980 | 0.152 | 0.098 | 2.41 | 81 | 1.0 | - | 13.09 | -0.25 | 133 | 559 | 85 | 75 |
| 28 | 4.135 | 0.155 | 0.098 | 2.40 | 82 | 1.0 | - | 12.88 | -0.21 | 133 | 561 | 86 | 75 |
| 29 | 4.286 | 0.151 | 0.097 | 2.41 | 82 | 1.0 | - | 12.65 | -0.23 | 133 | 564 | 86 | 76 |
| 30 | 4.443 | 0.157 | 0.097 | 2.41 | 82 | 1.0 | 102 | 12.43 | -0.22 | 133 | 575 | 86 | 76 |
| 31 | 4.595 | 0.152 | 0.098 | 2.42 | 83 | 1.0 | - | 12.16 | -0.27 | 134 | 573 | 86 | 76 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 32 | 4.752 | 0.157 | 0.097 | 2.42 | 83 | 1.0 | - | 11.94 | -0.22 | 134 | 572 | 86 | 75 |
| 33 | 4.904 | 0.152 | 0.098 | 2.42 | 83 | 1.0 | - | 11.71 | -0.23 | 133 | 566 | 86 | 75 |
| 34 | 5.059 | 0.155 | 0.098 | 2.42 | 83 | 1.0 | - | 11.49 | -0.22 | 133 | 563 | 86 | 76 |
| 35 | 5.212 | 0.153 | 0.099 | 2.42 | 84 | 1.0 | - | 11.26 | -0.23 | 133 | 563 | 86 | 76 |
| 36 | 5.367 | 0.155 | 0.097 | 2.42 | 84 | 1.0 | - | 11.05 | -0.21 | 132 | 556 | 86 | 75 |
| 37 | 5.524 | 0.157 | 0.095 | 2.43 | 84 | 1.0 | - | 10.85 | -0.20 | 132 | 550 | 86 | 76 |
| 38 | 5.677 | 0.153 | 0.097 | 2.44 | 85 | 1.0 | - | 10.63 | -0.22 | 132 | 543 | 87 | 76 |
| 39 | 5.833 | 0.156 | 0.098 | 2.44 | 85 | 1.0 | - | 10.43 | -0.20 | 131 | 538 | 87 | 76 |
| 40 | 5.985 | 0.152 | 0.094 | 2.44 | 85 | 1.0 | 103 | 10.24 | -0.19 | 132 | 535 | 87 | 76 |
| 41 | 6.144 | 0.159 | 0.097 | 2.45 | 85 | 1.0 | - | 10.07 | -0.17 | 131 | 531 | 87 | 76 |
| 42 | 6.297 | 0.153 | 0.097 | 2.45 | 86 | 1.0 | - | 9.87 | -0.20 | 130 | 525 | 87 | 76 |
| 43 | 6.455 | 0.158 | 0.096 | 2.45 | 86 | 1.0 | - | 9.69 | -0.18 | 129 | 520 | 86 | 77 |
| 44 | 6.607 | 0.152 | 0.098 | 2.46 | 86 | 1.0 | - | 9.52 | -0.17 | 129 | 521 | 86 | 76 |
| 45 | 6.764 | 0.157 | 0.096 | 2.46 | 86 | 1.0 | - | 9.34 | -0.18 | 129 | 522 | 86 | 76 |
| 46 | 6.922 | 0.158 | 0.098 | 2.47 | 87 | 1.0 | - | 9.17 | -0.17 | 128 | 524 | 86 | 76 |
| 47 | 7.076 | 0.154 | 0.094 | 2.47 | 87 | 1.0 | - | 8.99 | -0.18 | 128 | 518 | 86 | 76 |
| 48 | 7.233 | 0.157 | 0.095 | 2.47 | 87 | 1.0 | - | 8.82 | -0.17 | 128 | 509 | 86 | 75 |
| 49 | 7.386 | 0.153 | 0.098 | 2.47 | 87 | 1.0 | - | 8.68 | -0.14 | 127 | 503 | 86 | 75 |
| 50 | 7.547 | 0.161 | 0.098 | 2.48 | 88 | 1.0 | 103 | 8.51 | -0.17 | 126 | 507 | 86 | 76 |
| 51 | 7.701 | 0.154 | 0.095 | 2.48 | 88 | 1.0 | - | 8.37 | -0.14 | 126 | 504 | 86 | 76 |
| 52 | 7.859 | 0.158 | 0.097 | 2.49 | 88 | 1.0 | - | 8.21 | -0.16 | 126 | 496 | 86 | 76 |
| 53 | 8.015 | 0.156 | 0.098 | 2.48 | 88 | 1.0 | - | 8.07 | -0.14 | 125 | 496 | 86 | 76 |
| 54 | 8.172 | 0.157 | 0.099 | 2.49 | 89 | 1.0 | - | 7.90 | -0.17 | 125 | 500 | 86 | 75 |
| 55 | 8.331 | 0.159 | 0.098 | 2.50 | 89 | 1.0 | - | 7.77 | -0.13 | 125 | 497 | 86 | 76 |
| 56 | 8.485 | 0.154 | 0.100 | 2.49 | 89 | 1.0 | - | 7.63 | -0.14 | 124 | 496 | 86 | 76 |
| 57 | 8.646 | 0.161 | 0.098 | 2.50 | 89 | 1.0 | - | 7.48 | -0.15 | 123 | 489 | 86 | 76 |
| 58 | 8.801 | 0.155 | 0.092 | 2.50 | 89 | 1.0 | - | 7.32 | -0.16 | 123 | 487 | 86 | 77 |
| 59 | 8.959 | 0.158 | 0.098 | 2.50 | 90 | 1.0 | - | 7.20 | -0.12 | 122 | 483 | 86 | 76 |
| 60 | 9.118 | 0.159 | 0.098 | 2.50 | 90 | 1.0 | 102 | 7.08 | -0.12 | 122 | 479 | 86 | 76 |
| 61 | 9.275 | 0.157 | 0.096 | 2.51 | 90 | 1.0 | - | 6.95 | -0.13 | 121 | 471 | 86 | 76 |
| 62 | 9.434 | 0.159 | 0.098 | 2.52 | 90 | 1.0 | - | 6.83 | -0.12 | 121 | 468 | 86 | 76 |
| 63 | 9.589 | 0.155 | 0.098 | 2.51 | 90 | 1.0 | - | 6.70 | -0.13 | 120 | 465 | 86 | 76 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 64 | 9.750 | 0.161 | 0.098 | 2.51 | 90 | 1.0 | - | 6.57 | -0.13 | 120 | 460 | 86 | 75 |
| 65 | 9.905 | 0.155 | 0.097 | 2.52 | 91 | 1.0 | - | 6.47 | -0.10 | 119 | 455 | 85 | 76 |
| 66 | 10.063 | 0.158 | 0.096 | 2.51 | 91 | 1.0 | - | 6.37 | -0.10 | 118 | 453 | 85 | 76 |
| 67 | 10.223 | 0.160 | 0.098 | 2.51 | 91 | 1.0 | - | 6.26 | -0.11 | 118 | 446 | 85 | 76 |
| 68 | 10.378 | 0.155 | 0.099 | 2.53 | 91 | 1.0 | - | 6.17 | -0.09 | 117 | 439 | 85 | 75 |
| 69 | 10.539 | 0.161 | 0.098 | 2.52 | 91 | 1.0 | - | 6.09 | -0.08 | 116 | 433 | 85 | 75 |
| 70 | 10.695 | 0.156 | 0.098 | 2.52 | 91 | 1.0 | 101 | 6.00 | -0.09 | 115 | 424 | 85 | 76 |
| 71 | 10.855 | 0.160 | 0.099 | 2.52 | 92 | 1.0 | - | 5.92 | -0.08 | 115 | 420 | 85 | 75 |
| 72 | 11.012 | 0.157 | 0.099 | 2.52 | 92 | 1.0 | - | 5.84 | -0.08 | 114 | 412 | 85 | 76 |
| 73 | 11.171 | 0.159 | 0.099 | 2.53 | 92 | 1.0 | - | 5.76 | -0.08 | 113 | 408 | 85 | 76 |
| 74 | 11.331 | 0.160 | 0.099 | 2.53 | 92 | 1.0 | - | 5.68 | -0.08 | 113 | 405 | 84 | 75 |
| 75 | 11.486 | 0.155 | 0.100 | 2.53 | 92 | 1.0 | - | 5.58 | -0.10 | 112 | 404 | 84 | 75 |
| 76 | 11.649 | 0.163 | 0.098 | 2.53 | 92 | 1.0 | - | 5.52 | -0.06 | 112 | 400 | 84 | 76 |
| 77 | 11.804 | 0.155 | 0.099 | 2.53 | 92 | 1.0 | - | 5.44 | -0.08 | 111 | 399 | 84 | 76 |
| 78 | 11.964 | 0.160 | 0.099 | 2.52 | 93 | 1.0 | - | 5.35 | -0.09 | 111 | 399 | 84 | 75 |
| 79 | 12.125 | 0.161 | 0.099 | 2.54 | 93 | 1.0 | - | 5.26 | -0.09 | 110 | 397 | 84 | 76 |
| 80 | 12.280 | 0.155 | 0.099 | 2.54 | 93 | 1.0 | 101 | 5.17 | -0.09 | 110 | 394 | 84 | 75 |
| 81 | 12.443 | 0.163 | 0.099 | 2.53 | 93 | 1.0 | - | 5.08 | -0.09 | 110 | 391 | 84 | 75 |
| 82 | 12.599 | 0.156 | 0.100 | 2.54 | 93 | 1.0 | - | 5.01 | -0.07 | 110 | 391 | 84 | 75 |
| 83 | 12.759 | 0.160 | 0.098 | 2.54 | 93 | 1.0 | - | 4.91 | -0.10 | 109 | 387 | 84 | 75 |
| 84 | 12.920 | 0.161 | 0.099 | 2.55 | 93 | 1.0 | - | 4.84 | -0.07 | 109 | 388 | 84 | 76 |
| 85 | 13.076 | 0.156 | 0.099 | 2.54 | 93 | 1.0 | - | 4.75 | -0.09 | 109 | 391 | 83 | 75 |
| 86 | 13.238 | 0.162 | 0.099 | 2.54 | 93 | 1.0 | - | 4.66 | -0.09 | 109 | 390 | 83 | 75 |
| 87 | 13.395 | 0.157 | 0.100 | 2.55 | 94 | 1.0 | - | 4.59 | -0.07 | 108 | 390 | 83 | 75 |
| 88 | 13.556 | 0.161 | 0.098 | 2.56 | 94 | 1.0 | - | 4.49 | -0.10 | 108 | 388 | 83 | 75 |
| 89 | 13.716 | 0.160 | 0.100 | 2.55 | 94 | 1.0 | - | 4.41 | -0.08 | 108 | 387 | 83 | 75 |
| 90 | 13.874 | 0.158 | 0.099 | 2.57 | 94 | 1.0 | 100 | 4.35 | -0.06 | 108 | 386 | 83 | 75 |
| 91 | 14.035 | 0.161 | 0.099 | 2.55 | 94 | 1.0 | - | 4.27 | -0.08 | 107 | 387 | 83 | 76 |
| 92 | 14.193 | 0.158 | 0.099 | 2.55 | 94 | 1.0 | - | 4.18 | -0.09 | 107 | 383 | 83 | 76 |
| 93 | 14.354 | 0.161 | 0.099 | 2.56 | 94 | 1.0 | - | 4.10 | -0.08 | 107 | 383 | 83 | 75 |
| 94 | 14.514 | 0.160 | 0.097 | 2.56 | 94 | 1.0 | - | 4.01 | -0.09 | 107 | 386 | 83 | 76 |
| 95 | 14.672 | 0.158 | 0.100 | 2.56 | 94 | 1.0 | - | 3.93 | -0.08 | 107 | 388 | 83 | 76 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 96 | 14.833 | 0.161 | 0.097 | 2.56 | 94 | 1.0 | - | 3.84 | -0.09 | 107 | 385 | 83 | 75 |
| 97 | 14.991 | 0.158 | 0.096 | 2.55 | 94 | 1.0 | - | 3.78 | -0.06 | 107 | 383 | 83 | 75 |
| 98 | 15.152 | 0.161 | 0.098 | 2.56 | 95 | 1.0 | - | 3.69 | -0.09 | 106 | 382 | 83 | 76 |
| 99 | 15.312 | 0.160 | 0.099 | 2.55 | 95 | 1.0 | - | 3.64 | -0.05 | 106 | 382 | 83 | 76 |
| 100 | 15.472 | 0.160 | 0.099 | 2.56 | 95 | 1.0 | 100 | 3.55 | -0.09 | 106 | 380 | 83 | 76 |
| 101 | 15.633 | 0.161 | 0.100 | 2.56 | 95 | 1.0 | - | 3.50 | -0.05 | 106 | 379 | 83 | 76 |
| 102 | 15.791 | 0.158 | 0.099 | 2.56 | 95 | 1.1 | - | 3.44 | -0.06 | 106 | 376 | 83 | 76 |
| 103 | 15.952 | 0.161 | 0.099 | 2.57 | 95 | 1.0 | - | 3.38 | -0.06 | 105 | 370 | 83 | 76 |
| 104 | 16.112 | 0.160 | 0.100 | 2.56 | 95 | 1.0 | - | 3.32 | -0.06 | 105 | 366 | 83 | 76 |
| 105 | 16.271 | 0.159 | 0.098 | 2.57 | 95 | 1.0 | - | 3.26 | -0.06 | 104 | 359 | 83 | 76 |
| 106 | 16.433 | 0.162 | 0.098 | 2.56 | 95 | 1.0 | - | 3.21 | -0.05 | 104 | 354 | 83 | 76 |
| 107 | 16.591 | 0.158 | 0.096 | 2.56 | 95 | 1.0 | - | 3.14 | -0.07 | 104 | 353 | 83 | 75 |
| 108 | 16.753 | 0.162 | 0.098 | 2.58 | 95 | 1.0 | - | 3.09 | -0.05 | 104 | 352 | 83 | 75 |
| 109 | 16.913 | 0.160 | 0.099 | 2.56 | 95 | 1.0 | - | 3.04 | -0.05 | 103 | 349 | 83 | 75 |
| 110 | 17.072 | 0.159 | 0.097 | 2.58 | 95 | 1.0 | 101 | 2.98 | -0.06 | 103 | 348 | 82 | 76 |
| 111 | 17.234 | 0.162 | 0.098 | 2.57 | 96 | 1.0 | - | 2.93 | -0.05 | 103 | 347 | 82 | 76 |
| 112 | 17.393 | 0.159 | 0.098 | 2.57 | 96 | 1.0 | - | 2.87 | -0.06 | 103 | 344 | 82 | 76 |
| 113 | 17.554 | 0.161 | 0.100 | 2.58 | 96 | 1.0 | - | 2.83 | -0.04 | 102 | 340 | 82 | 76 |
| 114 | 17.716 | 0.162 | 0.098 | 2.58 | 96 | 1.0 | - | 2.78 | -0.05 | 102 | 335 | 82 | 76 |
| 115 | 17.873 | 0.157 | 0.099 | 2.57 | 96 | 1.0 | - | 2.74 | -0.04 | 101 | 330 | 82 | 76 |
| 116 | 18.037 | 0.164 | 0.099 | 2.57 | 96 | 1.0 | - | 2.67 | -0.07 | 101 | 325 | 82 | 76 |
| 117 | 18.195 | 0.158 | 0.099 | 2.58 | 96 | 1.0 | - | 2.63 | -0.04 | 101 | 320 | 82 | 76 |
| 118 | 18.356 | 0.161 | 0.099 | 2.58 | 96 | 1.0 | - | 2.61 | -0.02 | 100 | 317 | 82 | 76 |
| 119 | 18.519 | 0.163 | 0.099 | 2.58 | 96 | 1.0 | - | 2.57 | -0.04 | 100 | 314 | 82 | 75 |
| 120 | 18.676 | 0.157 | 0.098 | 2.58 | 96 | 1.0 | 101 | 2.54 | -0.03 | 100 | 313 | 82 | 75 |
| 121 | 18.841 | 0.165 | 0.098 | 2.59 | 96 | 1.0 | - | 2.50 | -0.04 | 100 | 309 | 82 | 76 |
| 122 | 18.998 | 0.157 | 0.097 | 2.59 | 96 | 1.0 | - | 2.45 | -0.05 | 100 | 309 | 82 | 75 |
| 123 | 19.161 | 0.163 | 0.099 | 2.58 | 96 | 1.0 | - | 2.43 | -0.02 | 99 | 307 | 82 | 75 |
| 124 | 19.323 | 0.162 | 0.100 | 2.59 | 96 | 1.0 | - | 2.40 | -0.03 | 99 | 306 | 82 | 75 |
| 125 | 19.481 | 0.158 | 0.096 | 2.59 | 96 | 1.0 | - | 2.36 | -0.04 | 99 | 302 | 82 | 76 |
| 126 | 19.646 | 0.165 | 0.095 | 2.59 | 96 | 1.0 | - | 2.31 | -0.05 | 99 | 301 | 81 | 76 |
| 127 | 19.804 | 0.158 | 0.100 | 2.59 | 96 | 1.0 | - | 2.29 | -0.02 | 98 | 301 | 81 | 76 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 128 | 19.966 | 0.162 | 0.099 | 2.59 | 96 | 1.0 | - | 2.26 | -0.03 | 98 | 297 | 81 | 76 |
| 129 | 20.128 | 0.162 | 0.098 | 2.60 | 96 | 1.0 | - | 2.23 | -0.03 | 97 | 296 | 81 | 76 |
| 130 | 20.287 | 0.159 | 0.098 | 2.59 | 96 | 1.0 | 101 | 2.20 | -0.03 | 97 | 294 | 81 | 75 |
| 131 | 20.449 | 0.162 | 0.097 | 2.60 | 96 | 1.0 | - | 2.17 | -0.03 | 97 | 293 | 81 | 76 |
| 132 | 20.611 | 0.162 | 0.099 | 2.57 | 97 | 1.0 | - | 2.13 | -0.04 | 97 | 292 | 81 | 76 |
| 133 | 20.770 | 0.159 | 0.099 | 2.59 | 97 | 1.0 | - | 2.11 | -0.02 | 96 | 292 | 81 | 76 |
| 134 | 20.934 | 0.164 | 0.099 | 2.58 | 97 | 1.0 | - | 2.08 | -0.03 | 96 | 289 | 81 | 76 |
| 135 | 21.093 | 0.159 | 0.100 | 2.59 | 97 | 1.0 | - | 2.04 | -0.04 | 96 | 290 | 81 | 76 |
| 136 | 21.254 | 0.161 | 0.097 | 2.59 | 97 | 1.0 | - | 2.01 | -0.03 | 96 | 289 | 81 | 75 |
| 137 | 21.418 | 0.164 | 0.100 | 2.58 | 97 | 1.0 | - | 1.98 | -0.03 | 96 | 287 | 81 | 75 |
| 138 | 21.575 | 0.157 | 0.100 | 2.59 | 97 | 1.0 | - | 1.95 | -0.03 | 95 | 283 | 81 | 76 |
| 139 | 21.740 | 0.165 | 0.097 | 2.59 | 97 | 1.0 | - | 1.91 | -0.04 | 96 | 283 | 81 | 75 |
| 140 | 21.899 | 0.159 | 0.099 | 2.60 | 97 | 1.0 | 100 | 1.90 | -0.01 | 95 | 279 | 81 | 75 |
| 141 | 22.061 | 0.162 | 0.098 | 2.59 | 97 | 1.0 | - | 1.88 | -0.02 | 95 | 278 | 81 | 75 |
| 142 | 22.223 | 0.162 | 0.100 | 2.60 | 97 | 1.0 | - | 1.85 | -0.03 | 95 | 274 | 81 | 75 |
| 143 | 22.383 | 0.160 | 0.100 | 2.59 | 97 | 1.0 | - | 1.82 | -0.03 | 94 | 273 | 81 | 76 |
| 144 | 22.546 | 0.163 | 0.096 | 2.60 | 97 | 1.0 | - | 1.79 | -0.03 | 94 | 269 | 81 | 75 |
| 145 | 22.707 | 0.161 | 0.099 | 2.58 | 97 | 1.0 | - | 1.77 | -0.02 | 94 | 269 | 81 | 75 |
| 146 | 22.868 | 0.161 | 0.099 | 2.60 | 97 | 1.0 | - | 1.74 | -0.03 | 94 | 265 | 81 | 75 |
| 147 | 23.031 | 0.163 | 0.099 | 2.59 | 97 | 1.0 | - | 1.73 | -0.01 | 94 | 263 | 80 | 75 |
| 148 | 23.191 | 0.160 | 0.098 | 2.61 | 97 | 1.0 | - | 1.67 | -0.06 | 94 | 261 | 80 | 75 |
| 149 | 23.352 | 0.161 | 0.100 | 2.59 | 97 | 1.0 | - | 1.66 | -0.01 | 93 | 257 | 80 | 75 |
| 150 | 23.516 | 0.164 | 0.099 | 2.58 | 97 | 1.0 | 100 | 1.66 | 0.00 | 93 | 253 | 80 | 75 |
| 151 | 23.673 | 0.157 | 0.099 | 2.60 | 97 | 1.0 | - | 1.62 | -0.04 | 93 | 250 | 80 | 75 |
| 152 | 23.839 | 0.166 | 0.099 | 2.58 | 97 | 1.0 | - | 1.61 | -0.01 | 93 | 249 | 80 | 76 |
| 153 | 23.997 | 0.158 | 0.099 | 2.60 | 97 | 1.0 | - | 1.59 | -0.02 | 92 | 247 | 80 | 75 |
| 154 | 24.160 | 0.163 | 0.098 | 2.59 | 97 | 1.0 | - | 1.58 | -0.01 | 92 | 244 | 80 | 76 |
| 155 | 24.322 | 0.162 | 0.097 | 2.60 | 97 | 1.0 | - | 1.53 | -0.05 | 92 | 242 | 80 | 76 |
| 156 | 24.482 | 0.160 | 0.098 | 2.59 | 97 | 1.0 | - | 1.53 | 0.00 | 92 | 241 | 80 | 75 |
| 157 | 24.645 | 0.163 | 0.099 | 2.59 | 97 | 1.0 | - | 1.51 | -0.02 | 92 | 239 | 80 | 75 |
| 158 | 24.806 | 0.161 | 0.096 | 2.59 | 97 | 1.0 | - | 1.50 | -0.01 | 91 | 234 | 80 | 75 |
| 159 | 24.967 | 0.161 | 0.095 | 2.61 | 97 | 1.0 | - | 1.48 | -0.02 | 91 | 233 | 80 | 76 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 160 | 25.130 | 0.163 | 0.099 | 2.59 | 97 | 1.0 | 99 | 1.45 | -0.03 | 91 | 230 | 80 | 75 |
| 161 | 25.290 | 0.160 | 0.099 | 2.59 | 97 | 1.0 | - | 1.44 | -0.01 | 91 | 229 | 80 | 75 |
| 162 | 25.452 | 0.162 | 0.100 | 2.59 | 97 | 1.0 | - | 1.41 | -0.03 | 90 | 226 | 80 | 75 |
| 163 | 25.616 | 0.164 | 0.098 | 2.60 | 97 | 1.0 | - | 1.41 | 0.00 | 90 | 224 | 80 | 76 |
| 164 | 25.773 | 0.157 | 0.097 | 2.60 | 97 | 1.0 | - | 1.39 | -0.02 | 89 | 225 | 80 | 76 |
| 165 | 25.939 | 0.166 | 0.099 | 2.60 | 97 | 1.0 | - | 1.38 | -0.01 | 89 | 223 | 80 | 75 |
| 166 | 26.097 | 0.158 | 0.097 | 2.60 | 97 | 1.0 | - | 1.35 | -0.03 | 89 | 221 | 80 | 75 |
| 167 | 26.260 | 0.163 | 0.100 | 2.59 | 97 | 1.0 | - | 1.33 | -0.02 | 89 | 220 | 80 | 75 |
| 168 | 26.423 | 0.163 | 0.098 | 2.60 | 97 | 1.0 | - | 1.32 | -0.01 | 89 | 221 | 80 | 75 |
| 169 | 26.583 | 0.160 | 0.100 | 2.60 | 97 | 1.0 | - | 1.31 | -0.01 | 89 | 217 | 80 | 75 |
| 170 | 26.746 | 0.163 | 0.099 | 2.61 | 97 | 1.0 | 99 | 1.28 | -0.03 | 88 | 215 | 80 | 76 |
| 171 | 26.908 | 0.162 | 0.098 | 2.59 | 97 | 1.0 | - | 1.26 | -0.02 | 88 | 215 | 80 | 76 |
| 172 | 27.067 | 0.159 | 0.098 | 2.60 | 97 | 1.0 | - | 1.25 | -0.01 | 88 | 214 | 79 | 75 |
| 173 | 27.232 | 0.165 | 0.098 | 2.61 | 97 | 1.0 | - | 1.24 | -0.01 | 88 | 213 | 79 | 75 |
| 174 | 27.391 | 0.159 | 0.098 | 2.60 | 97 | 1.0 | - | 1.22 | -0.02 | 88 | 211 | 79 | 75 |
| 175 | 27.554 | 0.163 | 0.099 | 2.60 | 97 | 1.0 | - | 1.21 | -0.01 | 88 | 209 | 79 | 75 |
| 176 | 27.717 | 0.163 | 0.099 | 2.61 | 98 | 1.0 | - | 1.20 | -0.01 | 88 | 207 | 79 | 75 |
| 177 | 27.876 | 0.159 | 0.098 | 2.60 | 98 | 1.0 | - | 1.20 | 0.00 | 87 | 204 | 79 | 75 |
| 178 | 28.041 | 0.165 | 0.099 | 2.61 | 98 | 1.0 | - | 1.18 | -0.02 | 87 | 202 | 79 | 75 |
| 179 | 28.201 | 0.160 | 0.100 | 2.59 | 98 | 1.0 | - | 1.15 | -0.03 | 87 | 200 | 79 | 75 |
| 180 | 28.363 | 0.162 | 0.098 | 2.60 | 98 | 1.0 | 99 | 1.15 | 0.00 | 87 | 197 | 79 | 75 |
| 181 | 28.526 | 0.163 | 0.099 | 2.59 | 98 | 1.0 | - | 1.14 | -0.01 | 86 | 195 | 79 | 75 |
| 182 | 28.686 | 0.160 | 0.097 | 2.60 | 98 | 1.0 | - | 1.11 | -0.03 | 86 | 194 | 79 | 75 |
| 183 | 28.848 | 0.162 | 0.099 | 2.58 | 98 | 1.0 | - | 1.12 | 0.01 | 86 | 191 | 79 | 75 |
| 184 | 29.012 | 0.164 | 0.099 | 2.59 | 98 | 1.0 | - | 1.10 | -0.02 | 86 | 189 | 79 | 75 |
| 185 | 29.170 | 0.158 | 0.100 | 2.60 | 98 | 1.0 | - | 1.09 | -0.01 | 86 | 187 | 79 | 75 |
| 186 | 29.335 | 0.165 | 0.099 | 2.59 | 98 | 1.0 | - | 1.08 | -0.01 | 86 | 186 | 79 | 75 |
| 187 | 29.494 | 0.159 | 0.099 | 2.61 | 98 | 1.0 | - | 1.06 | -0.02 | 86 | 185 | 79 | 75 |
| 188 | 29.657 | 0.163 | 0.098 | 2.59 | 98 | 1.0 | - | 1.06 | 0.00 | 86 | 183 | 79 | 75 |
| 189 | 29.820 | 0.163 | 0.099 | 2.61 | 98 | 1.0 | - | 1.05 | -0.01 | 86 | 180 | 79 | 75 |
| 190 | 29.980 | 0.160 | 0.096 | 2.60 | 98 | 1.0 | 100 | 1.05 | 0.00 | 86 | 179 | 79 | 75 |
| 191 | 30.143 | 0.163 | 0.098 | 2.60 | 98 | 1.0 | - | 1.02 | -0.03 | 86 | 180 | 79 | 75 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 192 | 30.306 | 0.163 | 0.099 | 2.60 | 98 | 1.0 | - | 1.01 | -0.01 | 86 | 180 | 79 | 75 |
| 193 | 30.465 | 0.159 | 0.100 | 2.60 | 98 | 1.0 | - | 1.00 | -0.01 | 86 | 178 | 79 | 75 |
| 194 | 30.630 | 0.165 | 0.100 | 2.60 | 98 | 1.0 | - | 0.98 | -0.02 | 86 | 177 | 79 | 75 |
| 195 | 30.789 | 0.159 | 0.095 | 2.59 | 98 | 1.0 | - | 0.98 | 0.00 | 85 | 177 | 79 | 75 |
| 196 | 30.952 | 0.163 | 0.099 | 2.59 | 98 | 1.0 | - | 0.97 | -0.01 | 85 | 176 | 79 | 75 |
| 197 | 31.115 | 0.163 | 0.099 | 2.60 | 98 | 1.0 | - | 0.95 | -0.02 | 85 | 176 | 79 | 75 |
| 198 | 31.274 | 0.159 | 0.098 | 2.59 | 98 | 1.0 | - | 0.93 | -0.02 | 85 | 175 | 79 | 75 |
| 199 | 31.439 | 0.165 | 0.099 | 2.60 | 98 | 1.0 | - | 0.91 | -0.02 | 85 | 175 | 78 | 75 |
| 200 | 31.599 | 0.160 | 0.100 | 2.60 | 98 | 1.0 | 100 | 0.92 | 0.01 | 85 | 175 | 78 | 75 |
| 201 | 31.761 | 0.162 | 0.097 | 2.61 | 98 | 1.0 | - | 0.90 | -0.02 | 85 | 175 | 78 | 75 |
| 202 | 31.924 | 0.163 | 0.100 | 2.60 | 98 | 1.0 | - | 0.90 | 0.00 | 85 | 173 | 78 | 75 |
| 203 | 32.085 | 0.161 | 0.100 | 2.61 | 98 | 1.0 | - | 0.88 | -0.02 | 85 | 172 | 78 | 75 |
| 204 | 32.246 | 0.161 | 0.100 | 2.59 | 98 | 1.0 | - | 0.88 | 0.00 | 84 | 170 | 78 | 75 |
| 205 | 32.411 | 0.165 | 0.100 | 2.60 | 98 | 1.0 | - | 0.87 | -0.01 | 84 | 170 | 78 | 75 |
| 206 | 32.568 | 0.157 | 0.100 | 2.59 | 98 | 1.0 | - | 0.84 | -0.03 | 84 | 169 | 78 | 76 |
| 207 | 32.735 | 0.167 | 0.100 | 2.59 | 98 | 1.0 | - | 0.84 | 0.00 | 84 | 169 | 79 | 75 |
| 208 | 32.894 | 0.159 | 0.100 | 2.60 | 98 | 1.0 | - | 0.83 | -0.01 | 84 | 168 | 79 | 75 |
| 209 | 33.057 | 0.163 | 0.100 | 2.58 | 98 | 1.0 | - | 0.80 | -0.03 | 84 | 168 | 79 | 75 |
| 210 | 33.220 | 0.163 | 0.099 | 2.60 | 98 | 1.0 | 99 | 0.78 | -0.02 | 84 | 168 | 79 | 75 |
| 211 | 33.380 | 0.160 | 0.098 | 2.59 | 98 | 1.0 | - | 0.79 | 0.01 | 84 | 168 | 78 | 75 |
| 212 | 33.543 | 0.163 | 0.100 | 2.59 | 98 | 1.0 | - | 0.76 | -0.03 | 84 | 166 | 78 | 75 |
| 213 | 33.706 | 0.163 | 0.100 | 2.59 | 98 | 1.0 | - | 0.77 | 0.01 | 84 | 165 | 78 | 75 |
| 214 | 33.865 | 0.159 | 0.099 | 2.61 | 98 | 1.0 | - | 0.77 | 0.00 | 83 | 165 | 78 | 75 |
| 215 | 34.031 | 0.166 | 0.098 | 2.60 | 98 | 1.0 | - | 0.75 | -0.02 | 83 | 165 | 78 | 75 |
| 216 | 34.190 | 0.159 | 0.099 | 2.61 | 98 | 1.0 | - | 0.70 | -0.05 | 83 | 166 | 78 | 75 |
| 217 | 34.353 | 0.163 | 0.098 | 2.60 | 98 | 1.0 | - | 0.72 | 0.02 | 83 | 164 | 78 | 75 |
| 218 | 34.516 | 0.163 | 0.099 | 2.61 | 98 | 1.0 | - | 0.70 | -0.02 | 83 | 163 | 78 | 75 |
| 219 | 34.676 | 0.160 | 0.100 | 2.60 | 98 | 1.0 | - | 0.70 | 0.00 | 83 | 160 | 78 | 75 |
| 220 | 34.839 | 0.163 | 0.099 | 2.61 | 98 | 1.0 | 99 | 0.69 | -0.01 | 84 | 161 | 78 | 75 |
| 221 | 35.002 | 0.163 | 0.100 | 2.61 | 98 | 1.0 | - | 0.69 | 0.00 | 83 | 160 | 78 | 75 |
| 222 | 35.161 | 0.159 | 0.099 | 2.60 | 98 | 1.0 | - | 0.67 | -0.02 | 83 | 160 | 78 | 75 |
| 223 | 35.327 | 0.166 | 0.100 | 2.59 | 98 | 1.0 | - | 0.66 | -0.01 | 83 | 158 | 78 | 75 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 224 | 35.486 | 0.159 | 0.100 | 2.60 | 98 | 1.0 | - | 0.65 | -0.01 | 83 | 158 | 78 | 75 |
| 225 | 35.649 | 0.163 | 0.100 | 2.60 | 98 | 1.0 | - | 0.65 | 0.00 | 83 | 157 | 78 | 75 |
| 226 | 35.812 | 0.163 | 0.099 | 2.60 | 98 | 1.0 | - | 0.62 | -0.03 | 83 | 157 | 78 | 75 |
| 227 | 35.972 | 0.160 | 0.099 | 2.59 | 98 | 1.0 | - | 0.63 | 0.01 | 83 | 158 | 78 | 75 |
| 228 | 36.136 | 0.164 | 0.097 | 2.60 | 98 | 1.0 | - | 0.61 | -0.02 | 83 | 157 | 78 | 75 |
| 229 | 36.298 | 0.162 | 0.100 | 2.60 | 98 | 1.0 | - | 0.61 | 0.00 | 83 | 157 | 78 | 74 |
| 230 | 36.459 | 0.161 | 0.099 | 2.61 | 98 | 1.0 | 99 | 0.60 | -0.01 | 83 | 157 | 78 | 74 |
| 231 | 36.624 | 0.165 | 0.098 | 2.60 | 98 | 1.0 | - | 0.57 | -0.03 | 83 | 157 | 78 | 74 |
| 232 | 36.783 | 0.159 | 0.099 | 2.60 | 98 | 1.0 | - | 0.57 | 0.00 | 83 | 156 | 78 | 75 |
| 233 | 36.946 | 0.163 | 0.099 | 2.61 | 98 | 1.0 | - | 0.55 | -0.02 | 83 | 156 | 78 | 75 |
| 234 | 37.110 | 0.164 | 0.099 | 2.60 | 98 | 1.0 | - | 0.54 | -0.01 | 83 | 155 | 78 | 74 |
| 235 | 37.268 | 0.158 | 0.100 | 2.60 | 98 | 1.0 | - | 0.54 | 0.00 | 83 | 154 | 78 | 74 |
| 236 | 37.434 | 0.166 | 0.099 | 2.59 | 98 | 1.0 | - | 0.54 | 0.00 | 83 | 154 | 78 | 74 |
| 237 | 37.593 | 0.159 | 0.098 | 2.59 | 98 | 1.0 | - | 0.53 | -0.01 | 83 | 153 | 78 | 74 |
| 238 | 37.756 | 0.163 | 0.098 | 2.61 | 98 | 1.0 | - | 0.51 | -0.02 | 83 | 153 | 78 | 74 |
| 239 | 37.919 | 0.163 | 0.099 | 2.60 | 98 | 1.0 | - | 0.49 | -0.02 | 83 | 152 | 78 | 74 |
| 240 | 38.080 | 0.161 | 0.099 | 2.59 | 98 | 1.0 | 99 | 0.48 | -0.01 | 82 | 153 | 78 | 74 |
| 241 | 38.241 | 0.161 | 0.098 | 2.60 | 98 | 1.0 | - | 0.48 | 0.00 | 82 | 152 | 78 | 75 |
| 242 | 38.406 | 0.165 | 0.100 | 2.59 | 98 | 1.0 | - | 0.46 | -0.02 | 82 | 151 | 78 | 75 |
| 243 | 38.564 | 0.158 | 0.099 | 2.60 | 98 | 1.0 | - | 0.45 | -0.01 | 82 | 152 | 78 | 74 |
| 244 | 38.730 | 0.166 | 0.098 | 2.60 | 98 | 1.0 | - | 0.44 | -0.01 | 82 | 151 | 78 | 74 |
| 245 | 38.889 | 0.159 | 0.097 | 2.60 | 98 | 1.0 | - | 0.42 | -0.02 | 82 | 152 | 78 | 74 |
| 246 | 39.052 | 0.163 | 0.098 | 2.60 | 98 | 1.0 | - | 0.40 | -0.02 | 82 | 152 | 78 | 74 |
| 247 | 39.215 | 0.163 | 0.100 | 2.60 | 98 | 1.0 | - | 0.40 | 0.00 | 82 | 151 | 78 | 74 |
| 248 | 39.376 | 0.161 | 0.099 | 2.59 | 98 | 1.0 | - | 0.40 | 0.00 | 82 | 151 | 78 | 74 |
| 249 | 39.539 | 0.163 | 0.100 | 2.62 | 98 | 1.0 | - | 0.37 | -0.03 | 82 | 152 | 78 | 74 |
| 250 | 39.702 | 0.163 | 0.097 | 2.60 | 98 | 1.0 | 99 | 0.34 | -0.03 | 82 | 153 | 78 | 74 |
| 251 | 39.861 | 0.159 | 0.099 | 2.61 | 98 | 1.0 | - | 0.34 | 0.00 | 82 | 152 | 77 | 74 |
| 252 | 40.027 | 0.166 | 0.099 | 2.60 | 98 | 1.0 | - | 0.34 | 0.00 | 82 | 152 | 77 | 74 |
| 253 | 40.186 | 0.159 | 0.100 | 2.60 | 98 | 1.0 | - | 0.33 | -0.01 | 82 | 152 | 77 | 74 |
| 254 | 40.349 | 0.163 | 0.100 | 2.60 | 98 | 1.0 | - | 0.31 | -0.02 | 82 | 151 | 77 | 74 |
| 255 | 40.513 | 0.164 | 0.098 | 2.61 | 98 | 1.0 | - | 0.29 | -0.02 | 82 | 151 | 78 | 74 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

| | |
|--------------------------|------------------------|
| Client: <u>HHT</u> | Job #: <u>23-321</u> |
| Model: <u>Pioneer II</u> | Tracking #: <u>213</u> |
| Run #: <u>1</u> | Technician: <u>AK</u> |
| | Date: <u>8/20/2024</u> |

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|-------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 256 | 40.672 | 0.159 | 0.100 | 2.60 | 98 | 1.0 | - | 0.28 | -0.01 | 82 | 153 | 78 | 74 |
| 257 | 40.836 | 0.164 | 0.098 | 2.61 | 98 | 1.0 | - | 0.25 | -0.03 | 82 | 157 | 78 | 74 |
| 258 | 40.999 | 0.163 | 0.098 | 2.60 | 98 | 1.0 | - | 0.24 | -0.01 | 82 | 159 | 78 | 74 |
| 259 | 41.158 | 0.159 | 0.098 | 2.62 | 98 | 1.0 | - | 0.22 | -0.02 | 82 | 160 | 78 | 74 |
| 260 | 41.324 | 0.166 | 0.098 | 2.60 | 98 | 1.0 | 100 | 0.20 | -0.02 | 83 | 162 | 77 | 74 |
| 261 | 41.482 | 0.158 | 0.098 | 2.61 | 98 | 1.0 | - | 0.17 | -0.03 | 83 | 162 | 78 | 74 |
| 262 | 41.646 | 0.164 | 0.098 | 2.60 | 98 | 1.0 | - | 0.17 | 0.00 | 83 | 163 | 77 | 74 |
| 263 | 41.809 | 0.163 | 0.100 | 2.60 | 98 | 1.0 | - | 0.15 | -0.02 | 83 | 164 | 77 | 74 |
| 264 | 41.969 | 0.160 | 0.098 | 2.60 | 98 | 1.0 | - | 0.12 | -0.03 | 83 | 164 | 77 | 74 |
| 265 | 42.133 | 0.164 | 0.097 | 2.60 | 98 | 1.0 | - | 0.12 | 0.00 | 83 | 163 | 77 | 74 |
| 266 | 42.295 | 0.162 | 0.098 | 2.60 | 98 | 1.0 | - | 0.10 | -0.02 | 83 | 163 | 77 | 74 |
| 267 | 42.455 | 0.160 | 0.098 | 2.60 | 98 | 1.0 | - | 0.08 | -0.02 | 83 | 165 | 77 | 74 |
| 268 | 42.620 | 0.165 | 0.099 | 2.59 | 98 | 1.0 | - | 0.07 | -0.01 | 83 | 165 | 78 | 74 |
| 269 | 42.779 | 0.159 | 0.100 | 2.61 | 98 | 1.0 | - | 0.04 | -0.03 | 83 | 166 | 77 | 74 |
| 270 | 42.943 | 0.164 | 0.099 | 2.60 | 98 | 1.0 | 99 | 0.03 | -0.01 | 83 | 167 | 77 | 74 |
| 271 | 43.106 | 0.163 | 0.099 | 2.61 | 98 | 1.0 | - | 0.01 | -0.02 | 83 | 167 | 77 | 74 |
| 272 | 43.266 | 0.160 | 0.100 | 2.59 | 98 | 1.0 | - | 0.01 | 0.00 | 83 | 165 | 78 | 74 |
| 273 | 43.430 | 0.164 | 0.100 | 2.62 | 98 | 1.0 | 98 | 0.00 | -0.01 | 83 | 166 | 78 | 74 |
| Avg/Tot | 43.430 | 0.159 | 0.098 | 2.53 | 93.2 | 1.0 | 100 | | | 102.2 | 313.4 | 81.3 | 75.1 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 0 | 0.000 | | 0.01 | 76 | 0.7 | | 77 | -0.055 | 1.89 | 0.276 |
| 1 | 0.107 | 0.107 | 2.40 | 76 | 1.9 | - | 81 | -0.059 | 1.17 | 0.198 |
| 2 | 0.257 | 0.150 | 2.41 | 76 | 2.1 | - | 86 | -0.067 | 2.67 | 0.201 |
| 3 | 0.410 | 0.153 | 2.40 | 76 | 2.0 | - | 88 | -0.095 | 3.87 | 0.429 |
| 4 | 0.558 | 0.148 | 2.39 | 76 | 1.7 | - | 89 | -0.102 | 7.45 | 0.246 |
| 5 | 0.711 | 0.153 | 2.39 | 77 | 2.0 | - | 89 | -0.081 | 10.88 | 0.375 |
| 6 | 0.861 | 0.150 | 2.39 | 77 | 1.8 | - | 90 | -0.079 | 9.51 | 0.379 |
| 7 | 1.013 | 0.152 | 2.39 | 77 | 1.7 | - | 90 | -0.081 | 9.58 | 0.245 |
| 8 | 1.165 | 0.152 | 2.40 | 77 | 1.6 | - | 90 | -0.082 | 10.04 | 0.168 |
| 9 | 1.317 | 0.152 | 2.40 | 77 | 1.8 | - | 89 | -0.081 | 10.63 | 0.226 |
| 10 | 1.469 | 0.152 | 2.40 | 77 | 1.6 | 99 | 89 | -0.082 | 11.23 | 0.235 |
| 11 | 1.620 | 0.151 | 2.41 | 78 | 1.8 | - | 89 | -0.082 | 10.83 | 0.162 |
| 12 | 1.773 | 0.153 | 2.41 | 78 | 1.8 | - | 89 | -0.082 | 10.50 | 0.138 |
| 13 | 1.922 | 0.149 | 2.40 | 78 | 1.6 | - | 89 | -0.081 | 10.70 | 0.142 |
| 14 | 2.076 | 0.154 | 2.40 | 78 | 2.0 | - | 89 | -0.083 | 11.07 | 0.166 |
| 15 | 2.226 | 0.150 | 2.39 | 79 | 2.2 | - | 90 | -0.085 | 11.62 | 0.257 |
| 16 | 2.381 | 0.155 | 2.41 | 79 | 1.7 | - | 90 | -0.085 | 11.57 | 0.265 |
| 17 | 2.531 | 0.150 | 2.41 | 79 | 2.0 | - | 90 | -0.086 | 11.93 | 0.294 |
| 18 | 2.685 | 0.154 | 2.40 | 79 | 2.1 | - | 90 | -0.084 | 12.06 | 0.251 |
| 19 | 2.835 | 0.150 | 2.41 | 80 | 1.9 | - | 90 | -0.086 | 11.96 | 0.233 |
| 20 | 2.989 | 0.154 | 2.40 | 80 | 1.8 | 102 | 90 | -0.085 | 11.87 | 0.236 |
| 21 | 3.140 | 0.151 | 2.40 | 80 | 2.1 | - | 90 | -0.084 | 11.84 | 0.197 |
| 22 | 3.293 | 0.153 | 2.40 | 81 | 2.1 | - | 90 | -0.085 | 11.68 | 0.193 |
| 23 | 3.446 | 0.153 | 2.41 | 81 | 1.9 | - | 90 | -0.085 | 11.51 | 0.170 |
| 24 | 3.599 | 0.153 | 2.41 | 81 | 2.1 | - | 89 | -0.084 | 11.47 | 0.168 |
| 25 | 3.754 | 0.155 | 2.42 | 82 | 2.1 | - | 90 | -0.083 | 11.60 | 0.228 |
| 26 | 3.904 | 0.150 | 2.41 | 82 | 1.8 | - | 90 | -0.082 | 11.57 | 0.212 |
| 27 | 4.059 | 0.155 | 2.42 | 82 | 1.7 | - | 90 | -0.084 | 11.63 | 0.215 |
| 28 | 4.210 | 0.151 | 2.42 | 83 | 1.9 | - | 90 | -0.086 | 11.75 | 0.197 |
| 29 | 4.367 | 0.157 | 2.43 | 83 | 1.7 | - | 90 | -0.085 | 12.18 | 0.229 |
| 30 | 4.519 | 0.152 | 2.43 | 83 | 1.8 | 103 | 89 | -0.084 | 12.77 | 0.357 |
| 31 | 4.674 | 0.155 | 2.42 | 84 | 1.9 | - | 89 | -0.083 | 12.82 | 0.311 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 32 | 4.826 | 0.152 | 2.43 | 84 | 1.8 | - | 88 | -0.084 | 12.61 | 0.283 |
| 33 | 4.982 | 0.156 | 2.43 | 84 | 2.0 | - | 88 | -0.083 | 12.41 | 0.262 |
| 34 | 5.136 | 0.154 | 2.44 | 85 | 2.0 | - | 88 | -0.083 | 12.41 | 0.253 |
| 35 | 5.290 | 0.154 | 2.43 | 85 | 2.0 | - | 87 | -0.083 | 12.33 | 0.258 |
| 36 | 5.445 | 0.155 | 2.43 | 85 | 1.9 | - | 87 | -0.083 | 12.05 | 0.221 |
| 37 | 5.596 | 0.151 | 2.42 | 86 | 2.1 | - | 87 | -0.084 | 11.89 | 0.186 |
| 38 | 5.754 | 0.158 | 2.43 | 86 | 1.7 | - | 87 | -0.082 | 11.54 | 0.138 |
| 39 | 5.906 | 0.152 | 2.43 | 86 | 1.7 | - | 87 | -0.081 | 11.34 | 0.129 |
| 40 | 6.062 | 0.156 | 2.43 | 87 | 2.1 | 104 | 87 | -0.081 | 11.20 | 0.127 |
| 41 | 6.214 | 0.152 | 2.43 | 87 | 1.7 | - | 86 | -0.081 | 11.01 | 0.113 |
| 42 | 6.371 | 0.157 | 2.43 | 87 | 1.7 | - | 86 | -0.080 | 10.84 | 0.119 |
| 43 | 6.526 | 0.155 | 2.44 | 87 | 1.7 | - | 86 | -0.081 | 10.71 | 0.112 |
| 44 | 6.679 | 0.153 | 2.43 | 88 | 1.8 | - | 86 | -0.081 | 10.86 | 0.110 |
| 45 | 6.836 | 0.157 | 2.43 | 88 | 1.6 | - | 86 | -0.079 | 10.73 | 0.128 |
| 46 | 6.989 | 0.153 | 2.43 | 88 | 1.8 | - | 85 | -0.081 | 10.79 | 0.113 |
| 47 | 7.147 | 0.158 | 2.44 | 89 | 2.1 | - | 85 | -0.079 | 10.72 | 0.112 |
| 48 | 7.299 | 0.152 | 2.44 | 89 | 2.0 | - | 85 | -0.079 | 10.34 | 0.101 |
| 49 | 7.456 | 0.157 | 2.43 | 89 | 1.9 | - | 85 | -0.078 | 10.29 | 0.115 |
| 50 | 7.612 | 0.156 | 2.44 | 90 | 2.1 | 103 | 85 | -0.077 | 10.23 | 0.117 |
| 51 | 7.767 | 0.155 | 2.44 | 90 | 1.7 | - | 85 | -0.077 | 10.14 | 0.116 |
| 52 | 7.924 | 0.157 | 2.44 | 90 | 1.9 | - | 85 | -0.076 | 10.16 | 0.111 |
| 53 | 8.077 | 0.153 | 2.44 | 90 | 1.9 | - | 85 | -0.077 | 10.23 | 0.090 |
| 54 | 8.236 | 0.159 | 2.44 | 91 | 2.1 | - | 85 | -0.076 | 10.27 | 0.085 |
| 55 | 8.389 | 0.153 | 2.44 | 91 | 1.9 | - | 84 | -0.077 | 10.14 | 0.100 |
| 56 | 8.546 | 0.157 | 2.44 | 91 | 1.8 | - | 84 | -0.077 | 10.19 | 0.080 |
| 57 | 8.702 | 0.156 | 2.45 | 92 | 2.0 | - | 84 | -0.075 | 9.89 | 0.091 |
| 58 | 8.858 | 0.156 | 2.44 | 92 | 1.7 | - | 84 | -0.078 | 9.75 | 0.087 |
| 59 | 9.015 | 0.157 | 2.44 | 92 | 2.1 | - | 84 | -0.075 | 9.72 | 0.088 |
| 60 | 9.169 | 0.154 | 2.44 | 92 | 2.1 | 102 | 84 | -0.075 | 9.42 | 0.123 |
| 61 | 9.327 | 0.158 | 2.44 | 93 | 1.7 | - | 84 | -0.076 | 9.24 | 0.142 |
| 62 | 9.480 | 0.153 | 2.44 | 93 | 1.7 | - | 84 | -0.072 | 9.16 | 0.143 |
| 63 | 9.638 | 0.158 | 2.44 | 93 | 2.2 | - | 84 | -0.074 | 9.00 | 0.181 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
Model: Pioneer II
Run #: 1

Job #: 23-321
Tracking #: 213
Technician: AK
Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 64 | 9.795 | 0.157 | 2.45 | 93 | 1.7 | - | 83 | -0.073 | 8.89 | 0.191 |
| 65 | 9.950 | 0.155 | 2.45 | 94 | 1.7 | - | 83 | -0.073 | 8.61 | 0.210 |
| 66 | 10.107 | 0.157 | 2.44 | 94 | 2.1 | - | 83 | -0.071 | 8.55 | 0.218 |
| 67 | 10.262 | 0.155 | 2.44 | 94 | 1.9 | - | 83 | -0.072 | 8.35 | 0.222 |
| 68 | 10.421 | 0.159 | 2.45 | 94 | 2.0 | - | 83 | -0.071 | 8.09 | 0.232 |
| 69 | 10.574 | 0.153 | 2.44 | 94 | 2.1 | - | 83 | -0.069 | 7.67 | 0.159 |
| 70 | 10.732 | 0.158 | 2.45 | 95 | 2.1 | 101 | 82 | -0.068 | 7.44 | 0.160 |
| 71 | 10.890 | 0.158 | 2.45 | 95 | 2.0 | - | 82 | -0.068 | 7.28 | 0.180 |
| 72 | 11.044 | 0.154 | 2.45 | 95 | 1.7 | - | 82 | -0.068 | 7.38 | 0.218 |
| 73 | 11.203 | 0.159 | 2.45 | 95 | 1.7 | - | 82 | -0.067 | 7.29 | 0.204 |
| 74 | 11.358 | 0.155 | 2.45 | 95 | 2.1 | - | 82 | -0.067 | 7.24 | 0.196 |
| 75 | 11.516 | 0.158 | 2.46 | 96 | 1.7 | - | 82 | -0.068 | 7.39 | 0.205 |
| 76 | 11.672 | 0.156 | 2.45 | 96 | 2.2 | - | 82 | -0.068 | 7.50 | 0.212 |
| 77 | 11.830 | 0.158 | 2.45 | 96 | 1.8 | - | 82 | -0.067 | 7.48 | 0.256 |
| 78 | 11.987 | 0.157 | 2.46 | 96 | 1.7 | - | 81 | -0.065 | 7.58 | 0.255 |
| 79 | 12.142 | 0.155 | 2.46 | 96 | 1.9 | - | 81 | -0.067 | 7.49 | 0.306 |
| 80 | 12.302 | 0.160 | 2.46 | 96 | 2.1 | 101 | 81 | -0.066 | 7.55 | 0.395 |
| 81 | 12.457 | 0.155 | 2.46 | 97 | 1.9 | - | 81 | -0.065 | 7.59 | 0.329 |
| 82 | 12.615 | 0.158 | 2.46 | 97 | 1.8 | - | 81 | -0.066 | 7.54 | 0.418 |
| 83 | 12.774 | 0.159 | 2.46 | 97 | 1.7 | - | 81 | -0.064 | 7.46 | 0.454 |
| 84 | 12.929 | 0.155 | 2.46 | 97 | 2.1 | - | 81 | -0.065 | 7.66 | 0.397 |
| 85 | 13.089 | 0.160 | 2.46 | 97 | 1.7 | - | 81 | -0.064 | 7.79 | 0.356 |
| 86 | 13.244 | 0.155 | 2.47 | 97 | 2.1 | - | 81 | -0.069 | 7.79 | 0.391 |
| 87 | 13.403 | 0.159 | 2.46 | 98 | 1.6 | - | 81 | -0.064 | 7.72 | 0.353 |
| 88 | 13.561 | 0.158 | 2.46 | 98 | 1.9 | - | 81 | -0.067 | 7.62 | 0.410 |
| 89 | 13.717 | 0.156 | 2.47 | 98 | 1.9 | - | 81 | -0.067 | 7.55 | 0.428 |
| 90 | 13.876 | 0.159 | 2.46 | 98 | 2.0 | 100 | 81 | -0.064 | 7.58 | 0.489 |
| 91 | 14.032 | 0.156 | 2.47 | 98 | 2.0 | - | 80 | -0.066 | 7.62 | 0.435 |
| 92 | 14.191 | 0.159 | 2.47 | 98 | 1.9 | - | 80 | -0.063 | 7.59 | 0.412 |
| 93 | 14.348 | 0.157 | 2.47 | 98 | 1.8 | - | 80 | -0.064 | 7.70 | 0.354 |
| 94 | 14.507 | 0.159 | 2.47 | 98 | 2.1 | - | 80 | -0.065 | 7.75 | 0.311 |
| 95 | 14.666 | 0.159 | 2.47 | 99 | 1.7 | - | 80 | -0.065 | 7.95 | 0.321 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 96 | 14.822 | 0.156 | 2.46 | 99 | 1.8 | - | 80 | -0.064 | 7.75 | 0.432 |
| 97 | 14.982 | 0.160 | 2.47 | 99 | 2.1 | - | 80 | -0.065 | 7.79 | 0.404 |
| 98 | 15.137 | 0.155 | 2.47 | 99 | 1.9 | - | 80 | -0.065 | 7.83 | 0.239 |
| 99 | 15.297 | 0.160 | 2.47 | 99 | 2.1 | - | 80 | -0.065 | 7.81 | 0.233 |
| 100 | 15.455 | 0.158 | 2.47 | 99 | 2.1 | 100 | 80 | -0.062 | 7.71 | 0.212 |
| 101 | 15.611 | 0.156 | 2.47 | 99 | 1.7 | - | 80 | -0.061 | 7.74 | 0.233 |
| 102 | 15.772 | 0.161 | 2.47 | 99 | 1.7 | - | 80 | -0.061 | 7.60 | 0.228 |
| 103 | 15.928 | 0.156 | 2.47 | 99 | 1.7 | - | 80 | -0.061 | 7.34 | 0.320 |
| 104 | 16.087 | 0.159 | 2.47 | 99 | 2.1 | - | 80 | -0.061 | 7.00 | 0.431 |
| 105 | 16.246 | 0.159 | 2.48 | 100 | 1.7 | - | 80 | -0.062 | 6.77 | 0.501 |
| 106 | 16.402 | 0.156 | 2.47 | 100 | 1.9 | - | 80 | -0.061 | 6.75 | 0.507 |
| 107 | 16.563 | 0.161 | 2.47 | 100 | 1.8 | - | 80 | -0.061 | 6.91 | 0.520 |
| 108 | 16.718 | 0.155 | 2.48 | 100 | 2.0 | - | 80 | -0.061 | 6.93 | 0.469 |
| 109 | 16.879 | 0.161 | 2.47 | 100 | 1.9 | - | 80 | -0.058 | 7.07 | 0.479 |
| 110 | 17.038 | 0.159 | 2.48 | 100 | 1.7 | 100 | 80 | -0.060 | 7.06 | 0.484 |
| 111 | 17.194 | 0.156 | 2.48 | 100 | 2.0 | - | 80 | -0.056 | 6.97 | 0.512 |
| 112 | 17.355 | 0.161 | 2.48 | 100 | 2.1 | - | 80 | -0.059 | 6.94 | 0.543 |
| 113 | 17.511 | 0.156 | 2.47 | 100 | 1.7 | - | 80 | -0.058 | 6.90 | 0.536 |
| 114 | 17.671 | 0.160 | 2.48 | 100 | 1.8 | - | 79 | -0.055 | 6.64 | 0.594 |
| 115 | 17.831 | 0.160 | 2.48 | 100 | 1.8 | - | 79 | -0.059 | 6.41 | 0.610 |
| 116 | 17.987 | 0.156 | 2.48 | 101 | 1.7 | - | 79 | -0.056 | 6.33 | 0.574 |
| 117 | 18.148 | 0.161 | 2.48 | 101 | 1.9 | - | 79 | -0.054 | 6.06 | 0.520 |
| 118 | 18.304 | 0.156 | 2.48 | 101 | 2.1 | - | 79 | -0.055 | 6.19 | 0.477 |
| 119 | 18.465 | 0.161 | 2.48 | 101 | 1.8 | - | 79 | -0.054 | 6.15 | 0.449 |
| 120 | 18.624 | 0.159 | 2.49 | 101 | 1.7 | 100 | 79 | -0.051 | 6.14 | 0.400 |
| 121 | 18.781 | 0.157 | 2.48 | 101 | 1.7 | - | 79 | -0.052 | 6.18 | 0.379 |
| 122 | 18.942 | 0.161 | 2.48 | 101 | 1.9 | - | 79 | -0.053 | 6.13 | 0.372 |
| 123 | 19.099 | 0.157 | 2.49 | 101 | 1.6 | - | 79 | -0.050 | 6.13 | 0.380 |
| 124 | 19.259 | 0.160 | 2.48 | 101 | 2.0 | - | 79 | -0.050 | 6.24 | 0.381 |
| 125 | 19.419 | 0.160 | 2.49 | 101 | 1.7 | - | 79 | -0.054 | 6.16 | 0.379 |
| 126 | 19.575 | 0.156 | 2.49 | 101 | 2.1 | - | 79 | -0.051 | 6.24 | 0.380 |
| 127 | 19.738 | 0.163 | 2.49 | 101 | 1.6 | - | 79 | -0.050 | 6.27 | 0.386 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 128 | 19.894 | 0.156 | 2.49 | 101 | 1.7 | - | 79 | -0.050 | 6.19 | 0.396 |
| 129 | 20.055 | 0.161 | 2.49 | 101 | 2.1 | - | 78 | -0.050 | 6.11 | 0.401 |
| 130 | 20.214 | 0.159 | 2.49 | 101 | 1.8 | 100 | 78 | -0.051 | 6.04 | 0.407 |
| 131 | 20.371 | 0.157 | 2.49 | 101 | 1.9 | - | 78 | -0.049 | 6.10 | 0.425 |
| 132 | 20.533 | 0.162 | 2.49 | 101 | 1.7 | - | 78 | -0.051 | 6.12 | 0.430 |
| 133 | 20.689 | 0.156 | 2.48 | 101 | 1.9 | - | 78 | -0.050 | 6.23 | 0.443 |
| 134 | 20.850 | 0.161 | 2.48 | 102 | 1.7 | - | 78 | -0.050 | 6.12 | 0.448 |
| 135 | 21.009 | 0.159 | 2.49 | 102 | 1.8 | - | 78 | -0.052 | 6.13 | 0.457 |
| 136 | 21.167 | 0.158 | 2.49 | 102 | 1.6 | - | 78 | -0.052 | 5.91 | 0.527 |
| 137 | 21.328 | 0.161 | 2.50 | 102 | 1.8 | - | 78 | -0.051 | 5.76 | 0.595 |
| 138 | 21.485 | 0.157 | 2.50 | 102 | 2.1 | - | 78 | -0.050 | 5.72 | 0.644 |
| 139 | 21.646 | 0.161 | 2.50 | 102 | 1.7 | - | 78 | -0.047 | 5.71 | 0.672 |
| 140 | 21.806 | 0.160 | 2.49 | 102 | 1.7 | 100 | 78 | -0.051 | 5.72 | 0.693 |
| 141 | 21.964 | 0.158 | 2.49 | 102 | 2.1 | - | 78 | -0.048 | 5.67 | 0.722 |
| 142 | 22.124 | 0.160 | 2.50 | 102 | 1.9 | - | 78 | -0.049 | 5.58 | 0.723 |
| 143 | 22.283 | 0.159 | 2.50 | 102 | 1.6 | - | 78 | -0.048 | 5.58 | 0.737 |
| 144 | 22.442 | 0.159 | 2.50 | 102 | 1.8 | - | 78 | -0.046 | 5.59 | 0.765 |
| 145 | 22.603 | 0.161 | 2.50 | 102 | 2.1 | - | 78 | -0.047 | 5.60 | 0.791 |
| 146 | 22.761 | 0.158 | 2.50 | 102 | 1.6 | - | 78 | -0.047 | 5.50 | 0.789 |
| 147 | 22.921 | 0.160 | 2.49 | 102 | 1.7 | - | 78 | -0.048 | 5.54 | 0.805 |
| 148 | 23.080 | 0.159 | 2.49 | 102 | 2.0 | - | 77 | -0.045 | 5.54 | 0.829 |
| 149 | 23.239 | 0.159 | 2.49 | 102 | 2.1 | - | 78 | -0.048 | 5.36 | 0.835 |
| 150 | 23.400 | 0.161 | 2.49 | 102 | 1.8 | 99 | 77 | -0.044 | 5.39 | 0.848 |
| 151 | 23.557 | 0.157 | 2.50 | 102 | 1.8 | - | 77 | -0.043 | 5.19 | 0.833 |
| 152 | 23.718 | 0.161 | 2.50 | 102 | 1.9 | - | 77 | -0.044 | 4.91 | 0.950 |
| 153 | 23.879 | 0.161 | 2.50 | 102 | 1.7 | - | 77 | -0.041 | 4.70 | 0.999 |
| 154 | 24.035 | 0.156 | 2.49 | 102 | 1.7 | - | 77 | -0.041 | 4.70 | 1.022 |
| 155 | 24.198 | 0.163 | 2.49 | 102 | 1.7 | - | 77 | -0.041 | 4.64 | 1.063 |
| 156 | 24.355 | 0.157 | 2.50 | 102 | 1.9 | - | 77 | -0.042 | 4.62 | 1.090 |
| 157 | 24.516 | 0.161 | 2.50 | 102 | 1.6 | - | 77 | -0.040 | 4.55 | 1.076 |
| 158 | 24.675 | 0.159 | 2.49 | 102 | 1.7 | - | 77 | -0.042 | 4.58 | 1.095 |
| 159 | 24.833 | 0.158 | 2.49 | 102 | 1.6 | - | 77 | -0.041 | 4.56 | 1.108 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 160 | 24.995 | 0.162 | 2.50 | 102 | 1.9 | 99 | 77 | -0.038 | 4.55 | 1.138 |
| 161 | 25.152 | 0.157 | 2.49 | 102 | 1.7 | - | 77 | -0.041 | 4.47 | 1.164 |
| 162 | 25.313 | 0.161 | 2.49 | 102 | 1.7 | - | 77 | -0.039 | 4.42 | 1.205 |
| 163 | 25.473 | 0.160 | 2.50 | 103 | 2.0 | - | 77 | -0.040 | 4.33 | 1.184 |
| 164 | 25.631 | 0.158 | 2.49 | 102 | 1.8 | - | 77 | -0.043 | 4.43 | 1.228 |
| 165 | 25.792 | 0.161 | 2.49 | 103 | 1.9 | - | 77 | -0.039 | 4.45 | 1.204 |
| 166 | 25.950 | 0.158 | 2.50 | 103 | 1.9 | - | 77 | -0.037 | 4.43 | 1.213 |
| 167 | 26.110 | 0.160 | 2.50 | 102 | 1.7 | - | 77 | -0.040 | 4.31 | 1.231 |
| 168 | 26.270 | 0.160 | 2.50 | 102 | 2.1 | - | 77 | -0.039 | 4.43 | 1.241 |
| 169 | 26.429 | 0.159 | 2.50 | 103 | 1.9 | - | 76 | -0.035 | 4.43 | 1.270 |
| 170 | 26.589 | 0.160 | 2.49 | 103 | 2.1 | 99 | 76 | -0.037 | 4.41 | 1.311 |
| 171 | 26.749 | 0.160 | 2.50 | 103 | 1.8 | - | 76 | -0.038 | 4.38 | 1.278 |
| 172 | 26.908 | 0.159 | 2.50 | 103 | 1.6 | - | 76 | -0.037 | 4.40 | 1.275 |
| 173 | 27.070 | 0.162 | 2.50 | 103 | 2.0 | - | 76 | -0.035 | 4.43 | 1.283 |
| 174 | 27.226 | 0.156 | 2.50 | 103 | 1.6 | - | 76 | -0.036 | 4.42 | 1.296 |
| 175 | 27.388 | 0.162 | 2.50 | 103 | 2.1 | - | 76 | -0.034 | 4.38 | 1.337 |
| 176 | 27.548 | 0.160 | 2.50 | 103 | 1.9 | - | 76 | -0.034 | 4.35 | 1.321 |
| 177 | 27.706 | 0.158 | 2.50 | 103 | 1.8 | - | 76 | -0.036 | 4.25 | 1.345 |
| 178 | 27.869 | 0.163 | 2.50 | 103 | 2.1 | - | 76 | -0.036 | 4.19 | 1.336 |
| 179 | 28.025 | 0.156 | 2.49 | 103 | 1.8 | - | 76 | -0.036 | 4.27 | 1.336 |
| 180 | 28.186 | 0.161 | 2.49 | 103 | 1.9 | 99 | 76 | -0.035 | 4.20 | 1.304 |
| 181 | 28.347 | 0.161 | 2.50 | 103 | 1.8 | - | 76 | -0.034 | 4.25 | 1.345 |
| 182 | 28.505 | 0.158 | 2.50 | 103 | 1.6 | - | 76 | -0.033 | 4.26 | 1.364 |
| 183 | 28.666 | 0.161 | 2.50 | 103 | 1.9 | - | 76 | -0.033 | 4.22 | 1.337 |
| 184 | 28.825 | 0.159 | 2.50 | 103 | 2.0 | - | 76 | -0.033 | 4.18 | 1.323 |
| 185 | 28.985 | 0.160 | 2.50 | 103 | 2.1 | - | 76 | -0.033 | 4.23 | 1.343 |
| 186 | 29.145 | 0.160 | 2.50 | 103 | 2.0 | - | 76 | -0.034 | 4.17 | 1.339 |
| 187 | 29.304 | 0.159 | 2.50 | 103 | 2.0 | - | 76 | -0.032 | 4.22 | 1.353 |
| 188 | 29.464 | 0.160 | 2.50 | 103 | 1.7 | - | 76 | -0.030 | 4.19 | 1.392 |
| 189 | 29.624 | 0.160 | 2.49 | 103 | 2.0 | - | 76 | -0.028 | 4.13 | 1.405 |
| 190 | 29.782 | 0.158 | 2.50 | 103 | 1.7 | 99 | 76 | -0.031 | 4.07 | 1.470 |
| 191 | 29.944 | 0.162 | 2.50 | 103 | 2.0 | - | 76 | -0.030 | 4.07 | 1.522 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 192 | 30.101 | 0.157 | 2.50 | 103 | 1.7 | - | 76 | -0.030 | 4.02 | 1.451 |
| 193 | 30.263 | 0.162 | 2.49 | 103 | 1.7 | - | 76 | -0.029 | 4.30 | 1.447 |
| 194 | 30.423 | 0.160 | 2.50 | 103 | 2.1 | - | 76 | -0.029 | 4.36 | 1.567 |
| 195 | 30.580 | 0.157 | 2.49 | 103 | 1.7 | - | 76 | -0.030 | 4.32 | 1.555 |
| 196 | 30.743 | 0.163 | 2.50 | 103 | 2.1 | - | 76 | -0.028 | 4.43 | 1.584 |
| 197 | 30.900 | 0.157 | 2.49 | 103 | 1.7 | - | 76 | -0.030 | 4.34 | 1.543 |
| 198 | 31.061 | 0.161 | 2.49 | 103 | 2.0 | - | 76 | -0.027 | 4.39 | 1.520 |
| 199 | 31.222 | 0.161 | 2.50 | 103 | 1.7 | - | 76 | -0.029 | 4.54 | 1.571 |
| 200 | 31.380 | 0.158 | 2.49 | 103 | 1.7 | 99 | 76 | -0.030 | 4.43 | 1.571 |
| 201 | 31.541 | 0.161 | 2.50 | 103 | 1.8 | - | 75 | -0.028 | 4.26 | 1.580 |
| 202 | 31.700 | 0.159 | 2.49 | 103 | 1.9 | - | 75 | -0.027 | 4.14 | 1.577 |
| 203 | 31.860 | 0.160 | 2.50 | 103 | 1.9 | - | 75 | -0.029 | 4.21 | 1.551 |
| 204 | 32.021 | 0.161 | 2.49 | 103 | 1.7 | - | 75 | -0.029 | 4.15 | 1.623 |
| 205 | 32.179 | 0.158 | 2.50 | 103 | 1.8 | - | 75 | -0.028 | 4.14 | 1.574 |
| 206 | 32.339 | 0.160 | 2.50 | 103 | 2.0 | - | 75 | -0.028 | 4.02 | 1.531 |
| 207 | 32.500 | 0.161 | 2.49 | 103 | 2.1 | - | 75 | -0.027 | 4.07 | 1.540 |
| 208 | 32.658 | 0.158 | 2.50 | 103 | 1.6 | - | 75 | -0.026 | 4.07 | 1.519 |
| 209 | 32.821 | 0.163 | 2.49 | 103 | 2.1 | - | 75 | -0.028 | 4.12 | 1.522 |
| 210 | 32.978 | 0.157 | 2.50 | 103 | 1.8 | 98 | 75 | -0.028 | 4.11 | 1.526 |
| 211 | 33.139 | 0.161 | 2.50 | 103 | 1.7 | - | 75 | -0.026 | 4.30 | 1.543 |
| 212 | 33.299 | 0.160 | 2.50 | 103 | 1.7 | - | 75 | -0.027 | 4.18 | 1.480 |
| 213 | 33.458 | 0.159 | 2.50 | 103 | 2.1 | - | 75 | -0.028 | 4.16 | 1.496 |
| 214 | 33.620 | 0.162 | 2.50 | 103 | 2.0 | - | 75 | -0.029 | 4.11 | 1.480 |
| 215 | 33.777 | 0.157 | 2.50 | 103 | 1.9 | - | 75 | -0.030 | 4.16 | 1.481 |
| 216 | 33.939 | 0.162 | 2.50 | 103 | 2.1 | - | 75 | -0.028 | 4.17 | 1.485 |
| 217 | 34.099 | 0.160 | 2.50 | 103 | 1.9 | - | 75 | -0.024 | 3.85 | 1.612 |
| 218 | 34.257 | 0.158 | 2.50 | 103 | 2.0 | - | 75 | -0.025 | 3.75 | 1.687 |
| 219 | 34.419 | 0.162 | 2.49 | 103 | 2.1 | - | 75 | -0.027 | 3.67 | 1.664 |
| 220 | 34.578 | 0.159 | 2.50 | 103 | 2.1 | 98 | 75 | -0.027 | 3.62 | 1.669 |
| 221 | 34.737 | 0.159 | 2.49 | 103 | 1.6 | - | 75 | -0.027 | 3.62 | 1.676 |
| 222 | 34.899 | 0.162 | 2.50 | 103 | 2.1 | - | 75 | -0.025 | 3.58 | 1.666 |
| 223 | 35.056 | 0.157 | 2.51 | 103 | 2.1 | - | 75 | -0.026 | 3.58 | 1.696 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 224 | 35.217 | 0.161 | 2.50 | 103 | 1.9 | - | 75 | -0.026 | 3.59 | 1.717 |
| 225 | 35.379 | 0.162 | 2.50 | 103 | 2.1 | - | 75 | -0.025 | 3.57 | 1.777 |
| 226 | 35.536 | 0.157 | 2.49 | 103 | 1.6 | - | 75 | -0.026 | 3.53 | 1.774 |
| 227 | 35.699 | 0.163 | 2.50 | 103 | 1.8 | - | 75 | -0.025 | 3.50 | 1.822 |
| 228 | 35.856 | 0.157 | 2.50 | 103 | 2.1 | - | 75 | -0.026 | 3.53 | 1.833 |
| 229 | 36.017 | 0.161 | 2.50 | 103 | 2.0 | - | 75 | -0.025 | 3.57 | 1.843 |
| 230 | 36.178 | 0.161 | 2.50 | 103 | 1.9 | 98 | 75 | -0.025 | 3.71 | 1.889 |
| 231 | 36.336 | 0.158 | 2.50 | 103 | 2.1 | - | 75 | -0.027 | 3.63 | 1.861 |
| 232 | 36.497 | 0.161 | 2.50 | 103 | 1.6 | - | 75 | -0.024 | 3.51 | 1.787 |
| 233 | 36.657 | 0.160 | 2.50 | 103 | 1.8 | - | 75 | -0.023 | 3.73 | 1.886 |
| 234 | 36.816 | 0.159 | 2.50 | 103 | 1.6 | - | 75 | -0.025 | 3.59 | 1.865 |
| 235 | 36.977 | 0.161 | 2.50 | 103 | 1.9 | - | 75 | -0.023 | 3.57 | 1.879 |
| 236 | 37.136 | 0.159 | 2.50 | 103 | 1.9 | - | 75 | -0.024 | 3.68 | 1.933 |
| 237 | 37.296 | 0.160 | 2.49 | 103 | 2.0 | - | 75 | -0.027 | 3.62 | 1.940 |
| 238 | 37.457 | 0.161 | 2.50 | 103 | 1.7 | - | 75 | -0.025 | 3.59 | 2.002 |
| 239 | 37.615 | 0.158 | 2.50 | 103 | 1.6 | - | 75 | -0.025 | 3.63 | 1.915 |
| 240 | 37.778 | 0.163 | 2.50 | 103 | 1.8 | 98 | 75 | -0.025 | 3.80 | 1.905 |
| 241 | 37.935 | 0.157 | 2.50 | 103 | 2.0 | - | 75 | -0.025 | 3.77 | 1.796 |
| 242 | 38.096 | 0.161 | 2.50 | 103 | 1.6 | - | 75 | -0.024 | 3.92 | 1.846 |
| 243 | 38.257 | 0.161 | 2.50 | 103 | 1.6 | - | 75 | -0.024 | 4.01 | 1.861 |
| 244 | 38.415 | 0.158 | 2.49 | 103 | 1.7 | - | 75 | -0.026 | 4.05 | 1.837 |
| 245 | 38.577 | 0.162 | 2.50 | 103 | 1.9 | - | 75 | -0.025 | 4.12 | 1.820 |
| 246 | 38.735 | 0.158 | 2.50 | 103 | 2.0 | - | 75 | -0.022 | 4.03 | 1.855 |
| 247 | 38.896 | 0.161 | 2.50 | 103 | 1.6 | - | 75 | -0.025 | 4.05 | 1.862 |
| 248 | 39.056 | 0.160 | 2.50 | 103 | 1.9 | - | 75 | -0.024 | 4.17 | 1.792 |
| 249 | 39.215 | 0.159 | 2.50 | 104 | 1.8 | - | 75 | -0.022 | 4.22 | 1.802 |
| 250 | 39.376 | 0.161 | 2.50 | 104 | 2.0 | 99 | 75 | -0.025 | 4.28 | 1.781 |
| 251 | 39.536 | 0.160 | 2.50 | 104 | 1.6 | - | 75 | -0.025 | 4.32 | 1.731 |
| 252 | 39.695 | 0.159 | 2.51 | 104 | 1.8 | - | 75 | -0.024 | 4.24 | 1.786 |
| 253 | 39.857 | 0.162 | 2.50 | 103 | 1.6 | - | 75 | -0.024 | 4.26 | 1.828 |
| 254 | 40.015 | 0.158 | 2.50 | 103 | 1.8 | - | 75 | -0.023 | 4.21 | 1.840 |
| 255 | 40.176 | 0.161 | 2.50 | 103 | 1.8 | - | 75 | -0.022 | 4.14 | 1.826 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
Model: Pioneer II
Run #: 1

Job #: 23-321
Tracking #: 213
Technician: AK
Date: 8/20/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 256 | 40.337 | 0.161 | 2.51 | 103 | 1.6 | - | 75 | -0.023 | 4.76 | 1.612 |
| 257 | 40.494 | 0.157 | 2.50 | 103 | 2.1 | - | 74 | -0.027 | 5.28 | 1.398 |
| 258 | 40.658 | 0.164 | 2.50 | 103 | 2.1 | - | 75 | -0.024 | 5.53 | 1.351 |
| 259 | 40.814 | 0.156 | 2.50 | 103 | 1.9 | - | 75 | -0.024 | 5.37 | 1.318 |
| 260 | 40.976 | 0.162 | 2.50 | 103 | 1.9 | 99 | 75 | -0.024 | 5.46 | 1.255 |
| 261 | 41.136 | 0.160 | 2.50 | 103 | 1.6 | - | 75 | -0.025 | 5.36 | 1.218 |
| 262 | 41.295 | 0.159 | 2.50 | 103 | 2.1 | - | 75 | -0.023 | 5.28 | 1.190 |
| 263 | 41.456 | 0.161 | 2.50 | 103 | 1.8 | - | 75 | -0.025 | 5.29 | 1.222 |
| 264 | 41.615 | 0.159 | 2.50 | 103 | 1.8 | - | 75 | -0.025 | 5.13 | 1.191 |
| 265 | 41.775 | 0.160 | 2.50 | 103 | 1.8 | - | 75 | -0.025 | 5.03 | 1.188 |
| 266 | 41.937 | 0.162 | 2.50 | 103 | 1.8 | - | 75 | -0.026 | 5.22 | 1.221 |
| 267 | 42.095 | 0.158 | 2.51 | 103 | 2.1 | - | 75 | -0.026 | 5.14 | 1.209 |
| 268 | 42.255 | 0.160 | 2.50 | 103 | 1.9 | - | 75 | -0.024 | 5.06 | 1.181 |
| 269 | 42.417 | 0.162 | 2.51 | 103 | 1.6 | - | 74 | -0.026 | 5.14 | 1.177 |
| 270 | 42.574 | 0.157 | 2.50 | 103 | 2.0 | 98 | 74 | -0.024 | 5.11 | 1.120 |
| 271 | 42.737 | 0.163 | 2.50 | 103 | 1.9 | - | 74 | -0.026 | 5.08 | 1.103 |
| 272 | 42.894 | 0.157 | 2.51 | 103 | 1.7 | - | 75 | -0.026 | 5.02 | 1.076 |
| 273 | 43.056 | 0.162 | 2.50 | 103 | 1.8 | 98 | 75 | -0.026 | 4.97 | 1.091 |
| Avg/Tot | 43.056 | 0.158 | 2.46 | 97.3 | 1.9 | 100 | 79.5 | -0.051 | 6.54 | 0.845 |

BOX C TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Particulate Sampling Data | | | | | | | |
|---------------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|
| Elapsed Time (min) | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) |
| 0 | -0.003 | | -0.01 | 79 | 0.1 | | 76 |
| 1 | 0.118 | 0.121 | 1.01 | 78 | 1.6 | - | 76 |
| 2 | 0.265 | 0.147 | 1.01 | 78 | 1.7 | - | 77 |
| 3 | 0.410 | 0.145 | 1.01 | 78 | 1.7 | - | 78 |
| 4 | 0.554 | 0.144 | 1.00 | 78 | 1.7 | - | 80 |
| 5 | 0.698 | 0.144 | 1.00 | 78 | 1.7 | - | 81 |
| 6 | 0.844 | 0.146 | 1.01 | 78 | 1.8 | - | 81 |
| 7 | 0.989 | 0.145 | 1.01 | 79 | 1.7 | - | 82 |
| 8 | 1.136 | 0.147 | 1.02 | 79 | 1.8 | - | 82 |
| 9 | 1.283 | 0.147 | 1.03 | 79 | 1.7 | - | 82 |
| 10 | 1.430 | 0.147 | 1.03 | 79 | 1.8 | 100 | 82 |
| 11 | 1.577 | 0.147 | 1.03 | 79 | 1.7 | - | 82 |
| 12 | 1.723 | 0.146 | 1.03 | 80 | 1.8 | - | 82 |
| 13 | 1.870 | 0.147 | 1.02 | 80 | 1.9 | - | 82 |
| 14 | 2.017 | 0.147 | 1.03 | 80 | 1.9 | - | 82 |
| 15 | 2.164 | 0.147 | 1.02 | 80 | 1.9 | - | 82 |
| 16 | 2.311 | 0.147 | 1.02 | 80 | 1.8 | - | 82 |
| 17 | 2.458 | 0.147 | 1.02 | 81 | 1.8 | - | 82 |
| 18 | 2.605 | 0.147 | 1.03 | 81 | 1.7 | - | 83 |
| 19 | 2.753 | 0.148 | 1.03 | 81 | 1.7 | - | 82 |
| 20 | 2.901 | 0.148 | 1.04 | 81 | 1.7 | 102 | 82 |
| 21 | 3.050 | 0.149 | 1.04 | 81 | 1.9 | - | 83 |
| 22 | 3.198 | 0.148 | 1.04 | 82 | 1.9 | - | 83 |
| 23 | 3.347 | 0.149 | 1.04 | 82 | 1.9 | - | 83 |
| 24 | 3.496 | 0.149 | 1.05 | 82 | 1.8 | - | 83 |
| 25 | 3.644 | 0.148 | 1.05 | 83 | 1.7 | - | 83 |
| 26 | 3.794 | 0.150 | 1.05 | 83 | 1.7 | - | 83 |
| 27 | 3.943 | 0.149 | 1.05 | 83 | 1.7 | - | 83 |
| 28 | 4.092 | 0.149 | 1.06 | 83 | 1.7 | - | 83 |
| 29 | 4.242 | 0.150 | 1.06 | 84 | 1.8 | - | 84 |
| 30 | 4.392 | 0.150 | 1.06 | 84 | 1.8 | 103 | 84 |
| 31 | 4.542 | 0.150 | 1.06 | 84 | 1.9 | - | 84 |

BOX C TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| Particulate Sampling Data | | | | | | | |
|---------------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|
| Elapsed Time (min) | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) |
| 32 | 4.691 | 0.149 | 1.06 | 85 | 1.9 | - | 84 |
| 33 | 4.842 | 0.151 | 1.06 | 85 | 1.7 | - | 84 |
| 34 | 4.992 | 0.150 | 1.05 | 85 | 1.8 | - | 84 |
| 35 | 5.143 | 0.151 | 1.05 | 85 | 1.7 | - | 84 |
| 36 | 5.294 | 0.151 | 1.05 | 86 | 1.7 | - | 84 |
| 37 | 5.444 | 0.150 | 1.05 | 86 | 1.8 | - | 85 |
| 38 | 5.595 | 0.151 | 1.06 | 86 | 1.9 | - | 85 |
| 39 | 5.746 | 0.151 | 1.06 | 86 | 1.9 | - | 85 |
| 40 | 5.898 | 0.152 | 1.06 | 87 | 1.7 | 105 | 85 |
| 41 | 6.049 | 0.151 | 1.07 | 87 | 1.8 | - | 85 |
| 42 | 6.200 | 0.151 | 1.07 | 87 | 1.8 | - | 85 |
| 43 | 6.352 | 0.152 | 1.07 | 87 | 1.8 | - | 85 |
| 44 | 6.503 | 0.151 | 1.07 | 87 | 1.8 | - | 85 |
| 45 | 6.654 | 0.151 | 1.07 | 88 | 1.9 | - | 85 |
| 46 | 6.806 | 0.152 | 1.06 | 88 | 1.7 | - | 85 |
| 47 | 6.959 | 0.153 | 1.06 | 88 | 1.7 | - | 85 |
| 48 | 7.111 | 0.152 | 1.07 | 89 | 1.9 | - | 85 |
| 49 | 7.264 | 0.153 | 1.07 | 89 | 1.9 | - | 85 |
| 50 | 7.417 | 0.153 | 1.08 | 89 | 1.9 | 105 | 85 |
| 51 | 7.570 | 0.153 | 1.08 | 89 | 1.9 | - | 85 |
| 52 | 7.722 | 0.152 | 1.08 | 89 | 1.9 | - | 85 |
| 53 | 7.875 | 0.153 | 1.08 | 89 | 1.7 | - | 85 |
| 54 | 8.028 | 0.153 | 1.07 | 90 | 1.9 | - | 85 |
| 55 | 8.182 | 0.154 | 1.08 | 90 | 1.8 | - | 85 |
| 56 | 8.335 | 0.153 | 1.08 | 90 | 1.7 | - | 85 |
| 57 | 8.489 | 0.154 | 1.09 | 91 | 1.7 | - | 85 |
| 58 | 8.642 | 0.153 | 1.09 | 91 | 1.8 | - | 85 |
| 59 | 8.796 | 0.154 | 1.08 | 91 | 1.8 | - | 85 |
| 60 | 8.950 | 0.154 | 1.08 | 91 | 1.7 | 104 | 85 |
| Avg/Tot | 8.953 | 0.149 | 1.03 | 84.1 | 1.7 | 103 | 83.0 |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

Stove ΔT: 195

| Elapsed Time (min) | Temperature Data (°F) | | | | | | Stove Surface Average | Catalyst Exit |
|--------------------|-----------------------|----------|---------|--------|-----------|-------|-----------------------|---------------|
| | FB Left | FB Right | FB Back | FB Top | FB Bottom | | | |
| 0 | 491 | 532 | 320 | 400 | 460 | 440.5 | N/A | |
| 1 | 489 | 530 | 318 | 377 | 465 | 435.7 | N/A | |
| 2 | 487 | 527 | 315 | 362 | 467 | 431.6 | N/A | |
| 3 | 484 | 524 | 313 | 363 | 467 | 429.9 | N/A | |
| 4 | 480 | 520 | 311 | 398 | 466 | 435.0 | N/A | |
| 5 | 476 | 517 | 310 | 440 | 466 | 441.7 | N/A | |
| 6 | 472 | 514 | 308 | 473 | 466 | 446.7 | N/A | |
| 7 | 469 | 512 | 306 | 501 | 465 | 450.5 | N/A | |
| 8 | 465 | 509 | 304 | 528 | 464 | 453.9 | N/A | |
| 9 | 461 | 506 | 302 | 554 | 463 | 457.2 | N/A | |
| 10 | 457 | 504 | 300 | 579 | 462 | 460.3 | N/A | |
| 11 | 453 | 501 | 299 | 599 | 461 | 462.3 | N/A | |
| 12 | 446 | 498 | 297 | 614 | 459 | 462.6 | N/A | |
| 13 | 440 | 496 | 295 | 626 | 457 | 462.6 | N/A | |
| 14 | 436 | 493 | 294 | 639 | 455 | 463.4 | N/A | |
| 15 | 433 | 491 | 292 | 654 | 453 | 464.7 | N/A | |
| 16 | 431 | 490 | 292 | 670 | 451 | 466.7 | N/A | |
| 17 | 429 | 488 | 290 | 687 | 449 | 468.7 | N/A | |
| 18 | 427 | 487 | 290 | 703 | 447 | 470.7 | N/A | |
| 19 | 426 | 486 | 289 | 714 | 445 | 472.1 | N/A | |
| 20 | 425 | 485 | 289 | 723 | 443 | 473.1 | N/A | |
| 21 | 425 | 485 | 289 | 728 | 441 | 473.8 | N/A | |
| 22 | 426 | 485 | 289 | 731 | 440 | 474.0 | N/A | |
| 23 | 426 | 485 | 289 | 733 | 438 | 474.2 | N/A | |
| 24 | 427 | 486 | 289 | 734 | 436 | 474.2 | N/A | |
| 25 | 428 | 486 | 290 | 735 | 434 | 474.5 | N/A | |
| 26 | 429 | 487 | 290 | 736 | 433 | 474.9 | N/A | |
| 27 | 431 | 488 | 290 | 736 | 431 | 475.1 | N/A | |
| 28 | 432 | 488 | 291 | 737 | 430 | 475.7 | N/A | |
| 29 | 434 | 489 | 291 | 742 | 429 | 476.9 | N/A | |
| 30 | 436 | 490 | 292 | 753 | 428 | 479.6 | N/A | |
| 31 | 437 | 491 | 292 | 765 | 427 | 482.3 | N/A | |
| 32 | 439 | 492 | 294 | 773 | 426 | 484.8 | N/A | |
| 33 | 440 | 493 | 295 | 778 | 425 | 486.4 | N/A | |
| 34 | 442 | 495 | 296 | 781 | 424 | 487.6 | N/A | |
| 35 | 444 | 496 | 297 | 782 | 424 | 488.6 | N/A | |
| 36 | 445 | 498 | 299 | 784 | 423 | 489.7 | N/A | |
| 37 | 447 | 500 | 300 | 782 | 422 | 490.0 | N/A | |
| 38 | 450 | 501 | 301 | 776 | 421 | 489.7 | N/A | |
| 39 | 451 | 503 | 302 | 769 | 419 | 488.8 | N/A | |
| 40 | 453 | 504 | 303 | 761 | 418 | 487.9 | N/A | |
| 41 | 455 | 506 | 303 | 753 | 416 | 486.6 | N/A | |
| 42 | 457 | 507 | 304 | 744 | 415 | 485.4 | N/A | |
| 43 | 459 | 508 | 305 | 736 | 413 | 484.1 | N/A | |
| 44 | 461 | 509 | 305 | 729 | 411 | 483.1 | N/A | |
| 45 | 463 | 510 | 306 | 725 | 410 | 482.6 | N/A | |
| 46 | 465 | 511 | 306 | 722 | 408 | 482.2 | N/A | |
| 47 | 466 | 512 | 307 | 719 | 406 | 481.8 | N/A | |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

Stove ΔT: 195

| Elapsed Time (min) | Temperature Data (°F) | | | | | | Stove Surface Average | Catalyst Exit |
|--------------------|-----------------------|----------|---------|--------|-----------|-------|-----------------------|---------------|
| | FB Left | FB Right | FB Back | FB Top | FB Bottom | | | |
| 48 | 468 | 512 | 307 | 715 | 405 | 481.3 | N/A | |
| 49 | 470 | 513 | 308 | 709 | 403 | 480.6 | N/A | |
| 50 | 472 | 514 | 308 | 704 | 401 | 479.9 | N/A | |
| 51 | 473 | 514 | 309 | 699 | 399 | 478.8 | N/A | |
| 52 | 475 | 515 | 309 | 694 | 398 | 478.1 | N/A | |
| 53 | 476 | 516 | 309 | 691 | 396 | 477.6 | N/A | |
| 54 | 477 | 516 | 310 | 688 | 394 | 477.1 | N/A | |
| 55 | 477 | 517 | 311 | 686 | 393 | 476.5 | N/A | |
| 56 | 478 | 517 | 311 | 683 | 392 | 476.2 | N/A | |
| 57 | 478 | 518 | 312 | 679 | 390 | 475.5 | N/A | |
| 58 | 479 | 519 | 312 | 675 | 389 | 474.6 | N/A | |
| 59 | 479 | 519 | 313 | 670 | 387 | 473.6 | N/A | |
| 60 | 480 | 519 | 313 | 666 | 386 | 472.7 | N/A | |
| 61 | 480 | 520 | 314 | 659 | 385 | 471.3 | N/A | |
| 62 | 480 | 520 | 314 | 652 | 383 | 469.8 | N/A | |
| 63 | 480 | 520 | 314 | 646 | 382 | 468.6 | N/A | |
| 64 | 482 | 521 | 315 | 638 | 380 | 467.1 | N/A | |
| 65 | 485 | 521 | 315 | 630 | 379 | 466.0 | N/A | |
| 66 | 488 | 521 | 315 | 621 | 378 | 464.5 | N/A | |
| 67 | 489 | 521 | 315 | 613 | 377 | 462.9 | N/A | |
| 68 | 490 | 521 | 315 | 603 | 376 | 460.9 | N/A | |
| 69 | 491 | 521 | 315 | 591 | 374 | 458.3 | N/A | |
| 70 | 491 | 520 | 314 | 580 | 373 | 455.8 | N/A | |
| 71 | 492 | 520 | 314 | 569 | 372 | 453.4 | N/A | |
| 72 | 492 | 519 | 313 | 558 | 372 | 450.8 | N/A | |
| 73 | 491 | 519 | 313 | 549 | 371 | 448.3 | N/A | |
| 74 | 490 | 518 | 312 | 540 | 370 | 446.0 | N/A | |
| 75 | 490 | 517 | 311 | 533 | 369 | 443.9 | N/A | |
| 76 | 488 | 516 | 310 | 527 | 368 | 442.0 | N/A | |
| 77 | 488 | 516 | 309 | 522 | 368 | 440.4 | N/A | |
| 78 | 486 | 516 | 308 | 517 | 367 | 438.8 | N/A | |
| 79 | 485 | 515 | 307 | 512 | 367 | 437.2 | N/A | |
| 80 | 483 | 516 | 306 | 508 | 366 | 435.7 | N/A | |
| 81 | 482 | 516 | 306 | 503 | 366 | 434.4 | N/A | |
| 82 | 480 | 516 | 306 | 499 | 365 | 433.0 | N/A | |
| 83 | 478 | 517 | 305 | 496 | 364 | 431.9 | N/A | |
| 84 | 476 | 517 | 305 | 492 | 364 | 431.0 | N/A | |
| 85 | 474 | 517 | 305 | 490 | 364 | 430.2 | N/A | |
| 86 | 473 | 518 | 306 | 489 | 363 | 429.7 | N/A | |
| 87 | 471 | 519 | 306 | 488 | 363 | 429.1 | N/A | |
| 88 | 469 | 519 | 306 | 487 | 363 | 428.7 | N/A | |
| 89 | 468 | 519 | 306 | 485 | 363 | 428.2 | N/A | |
| 90 | 466 | 520 | 307 | 483 | 363 | 427.7 | N/A | |
| 91 | 465 | 520 | 307 | 481 | 363 | 427.1 | N/A | |
| 92 | 464 | 520 | 308 | 479 | 362 | 426.6 | N/A | |
| 93 | 462 | 520 | 309 | 478 | 362 | 426.3 | N/A | |
| 94 | 461 | 521 | 310 | 477 | 362 | 426.1 | N/A | |
| 95 | 460 | 521 | 311 | 476 | 362 | 426.0 | N/A | |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

Stove ΔT: 195

| Elapsed Time (min) | Temperature Data (°F) | | | | | | Stove Surface Average | Catalyst Exit |
|--------------------|-----------------------|----------|---------|--------|-----------|-------|-----------------------|---------------|
| | FB Left | FB Right | FB Back | FB Top | FB Bottom | | | |
| 96 | 460 | 521 | 312 | 475 | 362 | 425.9 | N/A | |
| 97 | 459 | 521 | 313 | 473 | 362 | 425.6 | N/A | |
| 98 | 459 | 521 | 315 | 472 | 362 | 425.7 | N/A | |
| 99 | 458 | 521 | 317 | 473 | 362 | 426.0 | N/A | |
| 100 | 457 | 522 | 318 | 473 | 362 | 426.3 | N/A | |
| 101 | 457 | 522 | 319 | 472 | 362 | 426.4 | N/A | |
| 102 | 457 | 522 | 319 | 472 | 362 | 426.3 | N/A | |
| 103 | 456 | 522 | 320 | 469 | 363 | 426.0 | N/A | |
| 104 | 456 | 522 | 321 | 466 | 363 | 425.4 | N/A | |
| 105 | 456 | 522 | 321 | 461 | 363 | 424.6 | N/A | |
| 106 | 456 | 522 | 320 | 455 | 364 | 423.5 | N/A | |
| 107 | 455 | 522 | 320 | 450 | 364 | 422.4 | N/A | |
| 108 | 455 | 522 | 320 | 446 | 365 | 421.6 | N/A | |
| 109 | 454 | 521 | 320 | 442 | 366 | 420.7 | N/A | |
| 110 | 454 | 520 | 320 | 439 | 368 | 420.0 | N/A | |
| 111 | 453 | 520 | 320 | 436 | 369 | 419.3 | N/A | |
| 112 | 452 | 519 | 321 | 432 | 370 | 418.7 | N/A | |
| 113 | 451 | 518 | 321 | 430 | 371 | 418.0 | N/A | |
| 114 | 450 | 516 | 322 | 426 | 372 | 417.2 | N/A | |
| 115 | 449 | 515 | 322 | 422 | 374 | 416.4 | N/A | |
| 116 | 448 | 514 | 323 | 417 | 376 | 415.3 | N/A | |
| 117 | 447 | 513 | 322 | 411 | 377 | 414.0 | N/A | |
| 118 | 446 | 512 | 322 | 406 | 379 | 412.8 | N/A | |
| 119 | 444 | 511 | 322 | 401 | 380 | 411.7 | N/A | |
| 120 | 443 | 509 | 322 | 397 | 382 | 410.5 | N/A | |
| 121 | 441 | 508 | 322 | 393 | 383 | 409.4 | N/A | |
| 122 | 440 | 507 | 322 | 389 | 385 | 408.4 | N/A | |
| 123 | 439 | 506 | 321 | 385 | 386 | 407.4 | N/A | |
| 124 | 438 | 504 | 321 | 382 | 387 | 406.4 | N/A | |
| 125 | 437 | 504 | 321 | 378 | 388 | 405.4 | N/A | |
| 126 | 436 | 502 | 320 | 375 | 390 | 404.7 | N/A | |
| 127 | 435 | 502 | 320 | 372 | 391 | 403.9 | N/A | |
| 128 | 434 | 501 | 320 | 369 | 391 | 403.0 | N/A | |
| 129 | 433 | 500 | 319 | 367 | 392 | 402.2 | N/A | |
| 130 | 432 | 499 | 319 | 364 | 393 | 401.3 | N/A | |
| 131 | 432 | 498 | 319 | 362 | 393 | 400.7 | N/A | |
| 132 | 431 | 497 | 319 | 359 | 394 | 400.0 | N/A | |
| 133 | 430 | 497 | 318 | 357 | 395 | 399.3 | N/A | |
| 134 | 429 | 496 | 317 | 355 | 395 | 398.5 | N/A | |
| 135 | 429 | 495 | 317 | 353 | 396 | 397.9 | N/A | |
| 136 | 428 | 494 | 316 | 351 | 397 | 397.3 | N/A | |
| 137 | 427 | 494 | 315 | 349 | 397 | 396.5 | N/A | |
| 138 | 427 | 493 | 314 | 347 | 398 | 395.7 | N/A | |
| 139 | 426 | 492 | 314 | 345 | 398 | 394.9 | N/A | |
| 140 | 426 | 491 | 313 | 343 | 398 | 393.9 | N/A | |
| 141 | 425 | 489 | 311 | 340 | 399 | 392.9 | N/A | |
| 142 | 424 | 488 | 310 | 338 | 400 | 391.9 | N/A | |
| 143 | 423 | 486 | 308 | 336 | 400 | 390.7 | N/A | |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
Model: Pioneer II
Run #: 1

Job #: 23-321
Tracking #: 213
Technician: AK
Date: 8/20/2024

Stove ΔT: 195

| Temperature Data (°F) | | | | | | | |
|-----------------------|---------|----------|---------|--------|-----------|-----------------------|---------------|
| Elapsed Time (min) | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 144 | 423 | 484 | 307 | 334 | 400 | 389.6 | N/A |
| 145 | 422 | 482 | 306 | 331 | 401 | 388.5 | N/A |
| 146 | 422 | 480 | 304 | 329 | 402 | 387.4 | N/A |
| 147 | 421 | 478 | 303 | 327 | 402 | 386.2 | N/A |
| 148 | 421 | 476 | 301 | 325 | 402 | 384.9 | N/A |
| 149 | 420 | 474 | 301 | 322 | 403 | 383.8 | N/A |
| 150 | 419 | 472 | 299 | 320 | 403 | 382.5 | N/A |
| 151 | 418 | 469 | 298 | 317 | 403 | 381.1 | N/A |
| 152 | 418 | 467 | 296 | 314 | 404 | 379.8 | N/A |
| 153 | 417 | 465 | 295 | 312 | 404 | 378.4 | N/A |
| 154 | 416 | 462 | 294 | 309 | 404 | 377.0 | N/A |
| 155 | 415 | 460 | 293 | 306 | 405 | 375.7 | N/A |
| 156 | 414 | 457 | 291 | 304 | 404 | 374.0 | N/A |
| 157 | 413 | 455 | 289 | 301 | 405 | 372.5 | N/A |
| 158 | 412 | 452 | 287 | 299 | 404 | 370.7 | N/A |
| 159 | 410 | 450 | 285 | 297 | 404 | 369.3 | N/A |
| 160 | 409 | 447 | 283 | 294 | 404 | 367.5 | N/A |
| 161 | 407 | 445 | 281 | 292 | 404 | 365.9 | N/A |
| 162 | 406 | 442 | 279 | 290 | 404 | 364.0 | N/A |
| 163 | 404 | 439 | 277 | 288 | 404 | 362.4 | N/A |
| 164 | 402 | 436 | 275 | 286 | 403 | 360.6 | N/A |
| 165 | 400 | 434 | 273 | 284 | 403 | 358.9 | N/A |
| 166 | 399 | 431 | 272 | 282 | 403 | 357.2 | N/A |
| 167 | 397 | 428 | 270 | 280 | 402 | 355.5 | N/A |
| 168 | 395 | 426 | 268 | 278 | 402 | 353.7 | N/A |
| 169 | 393 | 423 | 266 | 276 | 402 | 352.0 | N/A |
| 170 | 391 | 420 | 265 | 274 | 402 | 350.4 | N/A |
| 171 | 389 | 417 | 263 | 273 | 401 | 348.6 | N/A |
| 172 | 387 | 415 | 261 | 271 | 401 | 347.0 | N/A |
| 173 | 385 | 412 | 259 | 270 | 401 | 345.5 | N/A |
| 174 | 383 | 410 | 258 | 268 | 401 | 344.0 | N/A |
| 175 | 381 | 407 | 256 | 266 | 401 | 342.4 | N/A |
| 176 | 380 | 405 | 255 | 265 | 401 | 341.1 | N/A |
| 177 | 378 | 402 | 253 | 262 | 401 | 339.3 | N/A |
| 178 | 376 | 400 | 252 | 261 | 402 | 338.0 | N/A |
| 179 | 374 | 398 | 250 | 259 | 401 | 336.4 | N/A |
| 180 | 372 | 395 | 249 | 257 | 402 | 334.9 | N/A |
| 181 | 371 | 393 | 247 | 255 | 401 | 333.3 | N/A |
| 182 | 369 | 391 | 246 | 253 | 401 | 332.0 | N/A |
| 183 | 367 | 388 | 245 | 251 | 401 | 330.4 | N/A |
| 184 | 365 | 386 | 243 | 249 | 401 | 328.9 | N/A |
| 185 | 363 | 384 | 242 | 247 | 401 | 327.3 | N/A |
| 186 | 361 | 382 | 240 | 245 | 400 | 325.7 | N/A |
| 187 | 360 | 379 | 239 | 243 | 400 | 324.1 | N/A |
| 188 | 357 | 377 | 237 | 241 | 399 | 322.3 | N/A |
| 189 | 355 | 375 | 236 | 239 | 398 | 320.8 | N/A |
| 190 | 354 | 373 | 235 | 238 | 398 | 319.3 | N/A |
| 191 | 351 | 371 | 233 | 236 | 397 | 317.7 | N/A |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

Stove ΔT: 195

| Temperature Data (°F) | | | | | | | |
|-----------------------|---------|----------|---------|--------|-----------|-----------------------|---------------|
| Elapsed Time (min) | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 192 | 349 | 368 | 232 | 235 | 396 | 316.0 | N/A |
| 193 | 347 | 366 | 230 | 233 | 396 | 314.4 | N/A |
| 194 | 345 | 364 | 229 | 232 | 395 | 312.9 | N/A |
| 195 | 343 | 362 | 228 | 230 | 394 | 311.4 | N/A |
| 196 | 340 | 360 | 227 | 229 | 393 | 309.9 | N/A |
| 197 | 338 | 359 | 225 | 229 | 392 | 308.4 | N/A |
| 198 | 336 | 357 | 224 | 228 | 390 | 306.9 | N/A |
| 199 | 334 | 355 | 223 | 227 | 389 | 305.6 | N/A |
| 200 | 332 | 353 | 222 | 226 | 388 | 304.2 | N/A |
| 201 | 330 | 352 | 221 | 225 | 387 | 302.9 | N/A |
| 202 | 328 | 350 | 219 | 224 | 386 | 301.5 | N/A |
| 203 | 326 | 349 | 218 | 224 | 385 | 300.3 | N/A |
| 204 | 324 | 347 | 218 | 223 | 384 | 299.0 | N/A |
| 205 | 322 | 345 | 217 | 222 | 383 | 297.7 | N/A |
| 206 | 320 | 344 | 216 | 221 | 382 | 296.5 | N/A |
| 207 | 319 | 342 | 215 | 220 | 381 | 295.2 | N/A |
| 208 | 317 | 340 | 214 | 219 | 380 | 294.0 | N/A |
| 209 | 315 | 339 | 213 | 218 | 379 | 292.9 | N/A |
| 210 | 314 | 337 | 212 | 217 | 378 | 291.6 | N/A |
| 211 | 312 | 336 | 211 | 217 | 377 | 290.5 | N/A |
| 212 | 310 | 334 | 210 | 215 | 376 | 289.2 | N/A |
| 213 | 309 | 333 | 210 | 215 | 375 | 288.1 | N/A |
| 214 | 307 | 331 | 209 | 214 | 374 | 286.9 | N/A |
| 215 | 306 | 329 | 207 | 213 | 373 | 285.6 | N/A |
| 216 | 305 | 328 | 206 | 212 | 372 | 284.5 | N/A |
| 217 | 303 | 326 | 205 | 211 | 371 | 283.3 | N/A |
| 218 | 302 | 325 | 205 | 210 | 369 | 282.1 | N/A |
| 219 | 300 | 323 | 203 | 209 | 368 | 280.8 | N/A |
| 220 | 299 | 322 | 203 | 208 | 367 | 279.7 | N/A |
| 221 | 298 | 320 | 202 | 207 | 366 | 278.6 | N/A |
| 222 | 296 | 318 | 201 | 206 | 365 | 277.3 | N/A |
| 223 | 295 | 317 | 200 | 205 | 363 | 276.0 | N/A |
| 224 | 294 | 315 | 199 | 204 | 362 | 274.8 | N/A |
| 225 | 293 | 314 | 199 | 203 | 361 | 273.7 | N/A |
| 226 | 291 | 312 | 198 | 202 | 360 | 272.4 | N/A |
| 227 | 290 | 310 | 197 | 201 | 359 | 271.3 | N/A |
| 228 | 288 | 309 | 196 | 200 | 358 | 270.1 | N/A |
| 229 | 287 | 307 | 195 | 200 | 356 | 269.0 | N/A |
| 230 | 286 | 306 | 195 | 199 | 355 | 267.9 | N/A |
| 231 | 284 | 304 | 194 | 198 | 354 | 266.7 | N/A |
| 232 | 283 | 303 | 193 | 198 | 352 | 265.7 | N/A |
| 233 | 281 | 301 | 193 | 197 | 351 | 264.6 | N/A |
| 234 | 280 | 299 | 192 | 197 | 350 | 263.6 | N/A |
| 235 | 278 | 298 | 192 | 196 | 348 | 262.4 | N/A |
| 236 | 277 | 297 | 191 | 195 | 347 | 261.3 | N/A |
| 237 | 275 | 295 | 191 | 195 | 346 | 260.3 | N/A |
| 238 | 274 | 294 | 190 | 194 | 344 | 259.2 | N/A |
| 239 | 272 | 292 | 190 | 193 | 344 | 258.2 | N/A |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

Stove ΔT: 195

| Temperature Data (°F) | | | | | | | |
|-----------------------|---------|----------|---------|--------|-----------|-----------------------|---------------|
| Elapsed Time (min) | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 240 | 271 | 291 | 189 | 193 | 342 | 257.2 | N/A |
| 241 | 269 | 290 | 189 | 192 | 341 | 256.3 | N/A |
| 242 | 268 | 289 | 189 | 192 | 340 | 255.4 | N/A |
| 243 | 266 | 288 | 189 | 191 | 339 | 254.5 | N/A |
| 244 | 265 | 287 | 188 | 191 | 338 | 253.6 | N/A |
| 245 | 263 | 286 | 188 | 191 | 337 | 252.7 | N/A |
| 246 | 262 | 285 | 187 | 190 | 335 | 251.8 | N/A |
| 247 | 260 | 284 | 187 | 190 | 335 | 251.1 | N/A |
| 248 | 259 | 283 | 187 | 189 | 334 | 250.5 | N/A |
| 249 | 258 | 282 | 186 | 189 | 333 | 249.7 | N/A |
| 250 | 257 | 281 | 186 | 189 | 332 | 249.0 | N/A |
| 251 | 255 | 281 | 186 | 189 | 332 | 248.4 | N/A |
| 252 | 254 | 280 | 186 | 188 | 331 | 247.8 | N/A |
| 253 | 252 | 279 | 186 | 188 | 330 | 247.2 | N/A |
| 254 | 251 | 279 | 186 | 188 | 330 | 246.8 | N/A |
| 255 | 250 | 278 | 186 | 188 | 330 | 246.3 | N/A |
| 256 | 249 | 278 | 186 | 188 | 329 | 245.8 | N/A |
| 257 | 248 | 277 | 185 | 188 | 329 | 245.4 | N/A |
| 258 | 247 | 276 | 185 | 188 | 329 | 245.0 | N/A |
| 259 | 246 | 276 | 185 | 187 | 329 | 244.6 | N/A |
| 260 | 246 | 275 | 185 | 187 | 329 | 244.3 | N/A |
| 261 | 245 | 274 | 185 | 187 | 329 | 244.0 | N/A |
| 262 | 244 | 274 | 185 | 187 | 329 | 243.9 | N/A |
| 263 | 244 | 273 | 185 | 187 | 330 | 243.8 | N/A |
| 264 | 244 | 273 | 185 | 187 | 331 | 243.7 | N/A |
| 265 | 243 | 272 | 185 | 187 | 332 | 243.7 | N/A |
| 266 | 243 | 272 | 184 | 187 | 333 | 243.7 | N/A |
| 267 | 243 | 272 | 184 | 187 | 334 | 243.8 | N/A |
| 268 | 242 | 272 | 184 | 187 | 335 | 244.0 | N/A |
| 269 | 242 | 272 | 184 | 187 | 336 | 244.1 | N/A |
| 270 | 242 | 272 | 184 | 187 | 338 | 244.4 | N/A |
| 271 | 242 | 272 | 184 | 187 | 339 | 244.6 | N/A |
| 272 | 241 | 272 | 184 | 187 | 340 | 244.8 | N/A |
| 273 | 241 | 272 | 184 | 187 | 342 | 245.1 | N/A |
| Average | 393.9 | 434.5 | 269.2 | 398.6 | 386.2 | 376.5 | N/A |

LAB SAMPLE DATA - ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 1

Job #: 23-321
 Tracking #: 213
 Technician: AK
 Date: 8/20/2024

| | | Sample ID | Tare, mg | Final, mg | Catch, mg |
|----------------|---------------------|-----------|----------|-----------|-----------|
| Filters | A | G01133 | 245.3 | 250.8 | 5.5 |
| | B | G01134 | 245.2 | 251.0 | 5.8 |
| | C - 1st Hour | G01135 | 244.2 | 248.2 | 4.0 |
| | Amb | G01136 | 244.0 | 244.3 | 0.3 |
| Probes | A | 20A | 115627.8 | 115628.3 | 0.5 |
| | B | 20B | 115967.5 | 115967.5 | 0.0 |
| | C - 1st Hour | 20C | 113776.1 | 113776.4 | 0.3 |
| | | | | | |
| O-rings | A | 20A | 3558.9 | 3559.3 | 0.4 |
| | B | 20B | 3614.7 | 3614.7 | 0.0 |
| | C - 1st Hour | 20C | 3611.0 | 3611.2 | 0.2 |
| | | | | | |

Placed in Dessicator on: 8/20/2024

Balance Audit (mg): 200.0 200.0 200.0

| | | Weight (mg) | Date/Time | Weight (mg) | Date/Time | Weight (mg) | Date/Time | Weight (mg) | Date/Time |
|----------------|---------------------|-------------|------------|-------------|------------|-------------|------------|-------------|-----------|
| Filters | A | 251.0 | 8/26 10:30 | 250.8 | 8/27 14:15 | | | | |
| | B | 251.1 | 8/26 10:30 | 251.0 | 8/27 14:15 | | | | |
| | C - 1st Hour | 248.4 | 8/26 10:30 | 248.2 | 8/27 14:15 | | | | |
| | Amb | 244.3 | 8/26 10:30 | 244.3 | 8/27 14:15 | | | | |
| Probes | A | 115628.5 | 8/26 10:30 | 115628.3 | 8/27 14:15 | | | | |
| | B | 115968.0 | 8/26 10:30 | 115967.6 | 8/27 14:15 | 115967.5 | 8/28 13:45 | | |
| | C - 1st Hour | 113776.6 | 8/26 10:30 | 113776.4 | 8/27 14:15 | | | | |
| | | | | | | | | | |
| O-Rings | A | 3559.4 | 8/26 10:30 | 3559.3 | 8/27 14:15 | | | | |
| | B | 3614.8 | 8/26 10:30 | 3614.7 | 8/27 14:15 | | | | |
| | C - 1st Hour | 3611.4 | 8/26 10:30 | 3611.2 | 8/27 14:15 | | | | |
| | | | | | | | | | |

| | |
|-------------------------------|------------|
| Train A Aggregate, mg: | 6.4 |
| Train B Aggregate, mg: | 5.8 |
| Train C Aggregate, mg: | 4.5 |
| Ambient, mg: | 0.3 |

ASTM E2780 Wood Heater Run Sheets

Client: Hearth & Home Technologies Job Number: 24-321 Tracking #: 213
 Model: Pioneer II Run Number: 1 Test Date: 8/20/24

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): N/A -Single Burn Rate
 Targeted Burn Category: N/A -Single Burn Rate

Preburn Notes

| Time | Notes |
|------|--------|
| | -None- |

Test Notes

Test Burn Start Time: 11:33 Test Fuel Loaded by: 35 seconds
 Door Closed: 210 seconds Air Control Set at: N/A seconds
 Other Loading Notes: Actuated ACC handle @ 300 sec, fan on Auto

| Time | Notes |
|------|--------|
| | -None- |

Test Burn End Time: 16:06

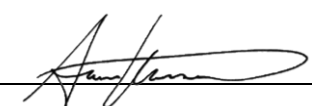
Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.98 CO (%): 4.300
 Mid Gas CO₂ (%): 10.00 CO (%): 2.500

Calibration Results:

| | Pre Test | | | Post Test | | |
|-----------------|----------|-------|-------|------------|------------|------------|
| | Zero | Mid | Span | Zero | Mid | Span |
| Time | 09:21 | 09:22 | 09:23 | 8/21 09:42 | 8/21 09:43 | 8/21 09:44 |
| CO ₂ | 0.00 | 17.00 | 10.09 | 0.06 | 17.08 | 10.14 |
| CO | 0.000 | 4.303 | 2.511 | 0.011 | 4.314 | 2.520 |

Flue Gas Probe Leak Check: Initial: No Leakage Final: No Leakage

Technician Signature: 

Date: 8/21/24

ASTM E2780 Wood Heater Run Sheets

Client: Hearth & Home Technologies Job Number: 24-321 Tracking #: 213
Model: Pioneer II Run Number: 1 Test Date: 8/20/24



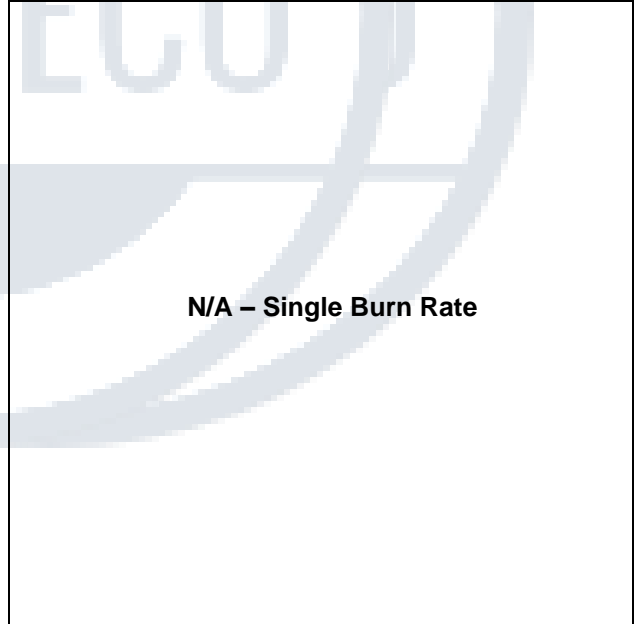
Test Fuel Front/Side View



Test Fuel Iso View

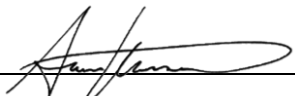


Test Fuel Loaded in Stove



N/A - Single Burn Rate

Air Setting

Technician Signature: 

Date: 8/21/24

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 2 Data Summary

Client: HHT
Model: Pioneer II
Job #: 24-321
Tracking #: 213
Test Date: 8/21/2024

A handwritten signature in black ink, appearing to read "A. [unclear]", is written over a horizontal line.

Techician Signature

8/28/2024

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| | |
|---------------------------|-------------|
| Burn Rate (kg/hr): | 1.58 |
|---------------------------|-------------|

| | Ambient Sample | Sample Train A | Sample Train B | 1st Hour Filter |
|---|----------------|----------------|----------------|-----------------|
| Total Sample Volume (ft ³) | 65.574 | 44.769 | 44.708 | 8.842 |
| Average Gas Velocity in Dilution Tunnel (ft/sec) | 17.9 | | | |
| Average Gas Flow Rate in Dilution Tunnel (dscf/hr) | 11655.2 | | | |
| Average Gas Meter Temperature (°F) | 74.4 | 92.4 | 96.8 | 83.8 |
| Total Sample Volume (dscf) | 64.978 | 42.840 | 43.126 | 8.665 |
| Average Tunnel Temperature (°F) | 99.7 | | | |
| Total Time of Test (min) | 281 | | | |
| Total Particulate Catch (mg) | 0.3 | 6.2 | 6.5 | 4.1 |
| Particulate Concentration, dry-standard (g/dscf) | 0.0000046 | 0.0001447 | 0.0001507 | 0.0004731 |
| Total PM Emissions (g) | 0.25 | 7.65 | 7.98 | 5.46 |
| Particulate Emission Rate (g/hr) | 0.05 | 1.63 | 1.70 | 5.46 |
| Emissions Factor (g/kg) | - | 1.03 | 1.08 | - |
| Difference from Average Total Particulate Emissions (g) | - | 0.16 | 0.16 | - |
| Difference from Average Total Particulate Emissions (%) | - | 2.1% | 2.1% | - |
| Difference from Average Emissions Factor (g/kg) | - | 0.02 | 0.02 | - |

| Final Average Results | |
|----------------------------------|-------|
| Total Particulate Emissions (g) | 7.81 |
| Particulate Emission Rate (g/hr) | 1.67 |
| Emissions Factor (g/kg) | 1.05 |
| HHV Efficiency (%) | 69.5% |
| LHV Efficiency (%) | 75.2% |
| CO Emissions (g/min) | 1.86 |

| Quality Checks | Requirement | Observed | Result |
|----------------------------------|---|---------------------------------|------------------------|
| Dual Train Precision | Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg | See Above | OK |
| Filter Temps | <90 °F | 89.3 | OK |
| Face Velocity | < 30 ft/min | 9.1 | OK |
| Leakage Rate | Less than 4% of average sample rate | 0.001 cfm | OK |
| Ambient Temp | 55-90 °F | Min:73.1/Max:76.7 | OK |
| Negative Probe Weight Evaluation | <5% of Total Catch | Probe Catch Not Negative | OK |
| Pro-Rate Variation | 90% of readings between 90-110%; none greater than 120% or less than 80% | See Data Tabs | OK |
| Stove Surface ΔT | <126°F | 198.9 | Check §10.3 Compliance |
| Stove Surface ΔT (§10.3) | DQH < 0.085(QFC) | .085*QFC = 11836 DQH = 10357 | OK |

| §10.3 Inputs | |
|-----------------|--------|
| Metal Mass | 447.9 |
| Refractory Mass | 36.4 |
| Fuel Dry Weight | 16.34 |
| QFC | 139242 |

B415.1 Efficiency Results

Manufacturer: HHT
Model: Pioneer II
Date: 08/21/24
Run: 2
Control #: 24-321
Test Duration: 281
Output Category: 3

Test Results in Accordance with CSA B415.1-09

| | HHV Basis | LHV Basis |
|---------------------------------|-----------|-----------|
| Overall Efficiency | 69.5% | 75.2% |
| Combustion Efficiency | 95.1% | 95.1% |
| Heat Transfer Efficiency | 73.1% | 79.0% |

| | | | |
|---------------------------|--------|--------|----------------|
| Output Rate (kJ/h) | 21,614 | 20,504 | (Btu/h) |
| Burn Rate (kg/h) | 1.57 | 3.46 | (lb/h) |
| Input (kJ/h) | 31,078 | 29,481 | (Btu/h) |

| | | | |
|----------------------------------|-------|-------|---------------|
| Test Load Weight (dry kg) | 7.35 | 16.19 | dry lb |
| MC wet (%) | 18.09 | | |
| MC dry (%) | 22.09 | | |
| Particulate (g) | 7.81 | | |
| CO (g) | 522 | | |
| Test Duration (h) | 4.68 | | |

| Emissions | Particulate | CO |
|-------------------------|-------------|--------|
| g/MJ Output | 0.08 | 5.15 |
| g/kg Dry Fuel | 1.06 | 70.99 |
| g/h | 1.67 | 111.37 |
| g/min | 0.03 | 1.86 |
| lb/MM Btu Output | 0.18 | 11.97 |

| | |
|-----------------------------|-------|
| Air/Fuel Ratio (A/F) | 16.50 |
|-----------------------------|-------|

VERSION: 2.4 4/15/2010

WOODSTOVE FUEL DATA - ASTM E2780

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Preburn Fuel Information | | | | | | |
|--------------------------|-------------|-------------------------|-------------------------|------|-------------|-------------------------|
| Size | Length (in) | Moisture Content (% DB) | | Size | Length (in) | Moisture Content (% DB) |
| 2x4 | 17.00 | 19.8 | | 2x4 | 11.00 | 22.7 |
| 2x4 | 17.00 | 19.5 | | 2x4 | 11.00 | 20.6 |
| 2x4 | 17.00 | 21.6 | | | | |
| 2x4 | 17.00 | 19.6 | | | | |
| 2x4 | 11.00 | 20.9 | | | | |
| 2x4 | 11.00 | 23.1 | | | | |
| 2x4 | 11.00 | 24.5 | | | | |
| 2x4 | 11.00 | 23.0 | | | | |
| Total Fuel Weight (lbs): | | 16.69 | Average Moisture (%DB): | | 21.5 | |

Firebox Volume (ft³): 2.75
 Total 2x4 Crib Weight, with spacers (lbs): 7.87
 Total 4x4 Crib Weight, with spacers (lbs): 11.90
 Total Wet Fuel Weight, with spacers (lbs): 19.77

Coal Bed Range (20-25%):
 Min (lbs): 3.95
 Max (lbs): 4.94

| Test Fuel Information | | | | | | |
|---------------------------------------|-------------|--------------|------------------------|------|------|------------------|
| Size | Length (in) | Weight (lbs) | Moisture Content (%DB) | | | Dry Weight (lbs) |
| 2x4 | 21.00 | 2.12 | 22.3 | 22.0 | 24.2 | 1.73 |
| 2x4 | 21.00 | 2.16 | 19.8 | 19.0 | 19.5 | 1.81 |
| 2x4 | 21.00 | 2.07 | 23.7 | 22.6 | 24.5 | 1.67 |
| 4x4 | 21.00 | 5.27 | 19.9 | 22.4 | 24.8 | 4.31 |
| 4x4 | 21.00 | 5.60 | 20.4 | 21.5 | 24.7 | 4.58 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Total Dry Weight, no spacers (lbs): | | | | | | 14.10 |
| Total Dry Weight, with spacers (lbs): | | | | | | 16.34 |

| Spacer Moisture Readings (%DB) | | | | | | |
|--------------------------------|------|------|--|--|--|--|
| 14.2 | 14.4 | 12.9 | | | | |
| 14.7 | 13.0 | 15.0 | | | | |
| 13.4 | 14.6 | 12.9 | | | | |
| 14.4 | 15.6 | 13.5 | | | | |
| 12.4 | 12.9 | | | | | |
| 14.8 | 14.0 | | | | | |
| 13.9 | 13.7 | | | | | |
| 13.1 | 12.9 | | | | | |

| Quality Checks | Requirement | Observed | Result |
|-----------------|--------------------------------------|----------|--------|
| Fuel Density | 25 - 36 (lbs/ft ³ , DB) | 28.8 | OK |
| Loading Density | 6.3 - 7.7 (lbs/ft ³ , WB) | 7.19 | OK |
| 2x4 Fuel Mix | 35 - 65 % of total weight | 40% | OK |

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

| | |
|-------------------------------|------------------------|
| Client: HHT | Job #: 24-321 |
| Model: Pioneer II | Tracking #: 213 |
| Run #: 2 | Technician: AK |
| Test Start Time: 10:49 | Date: 8/21/2024 |

Total Sampling Time (min): **281**
 Recording Interval (min): **1**

Meter Box γ Factor: **0.996 (A)**
 Meter Box γ Factor: **1.012 (B)**
 Meter Box γ Factor: **1.008 (C)**
 Meter Box γ Factor: **1.004 (Ambient)**

| | Pre-Test | Post Test | Avg. |
|------------------------------|------------------------------|-----------|-------|
| Barometric Pressure (in. Hg) | 29.95 | 29.85 | 29.90 |
| Relative Humidity (%) | 45.1 | 32.8 | |
| Room Air Velocity (ft/min) | <50 | <50 | |
| Pitot Tube Leak Check | 0 | 0 | |
| Ambient Sample Volume: | 65.574 ft³ | | |

Induced Draft Check (in. H₂O): **0**
 Smoke Capture Check (%): **100%**
 Date Flue Pipe Last Cleaned: **8/16/2024**
 Test Fuel Scale Audit (lbs) **10.00**
 Platform Scale Audit (lbs) **10.0**

Sample Train Leak Checks

| | Pre-test | Post-test | | |
|-----------|----------|-----------|-------|------------|
| (A) | 0.000 | 0.000 | cfm @ | -6 in. Hg |
| (B) | 0.000 | 0.000 | cfm @ | -6 in. Hg |
| (C) | 0.001 | 0.001 | cfm @ | -7 in. Hg |
| (Ambient) | 0.000 | 0.000 | cfm @ | -14 in. Hg |

DILUTION TUNNEL FLOW

Traverse Data

| Point | dP (in H ₂ O) | Temp (°F) |
|--------|--------------------------|-----------|
| 1 | 0.058 | 86 |
| 2 | 0.088 | 86 |
| 3 | 0.086 | 86 |
| 4 | 0.060 | 86 |
| 5 | 0.056 | 86 |
| 6 | 0.090 | 86 |
| 7 | 0.092 | 86 |
| 8 | 0.054 | 86 |
| Center | 0.096 | 86 |

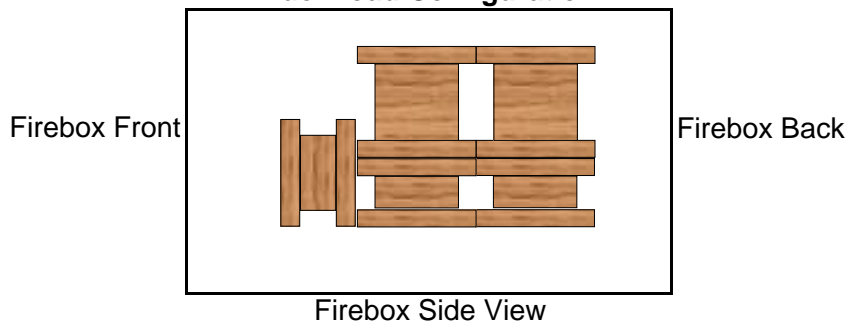
Dilution Tunnel H₂O: **2.00** percent
 Tunnel Diameter: **6** inches
 Pitot Tube Cp: **0.99** [unitless]
 Dilution Tunnel MW(dry): **29.00** lb/lb-mole
 Dilution Tunnel MW(wet): **28.78** lb/lb-mole
 Tunnel Area: **0.1963** ft²

V_{strav} : **18.09** ft/sec
 V_{scent} : **20.87** ft/sec
 F_p : **0.867** [ratio]
 Initial Tunnel Flow: **201.9** scf/min

Static Pressure: **-0.160** in. H₂O

TEST FUEL PROPERTIES

Fuel Load Configuration



Actual Fuel Used Properties

| | |
|-------------|---------------|
| Fuel Type: | D. Fir |
| HHV (kJ/kg) | 19,810 |
| %C | 48.73 |
| %H | 6.87 |
| %O | 43.9 |
| %Ash | 0.5 |
| MC (%DB) | 22.1 |

WOODSTOVE PREBURN DATA - ASTM E2780

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

Recording Interval (min): 1
 Run Time (min): 78

| Elapsed Time (min) | Scale Reading (lbs) | Flue Draft (in H ₂ O) | Temperatures (°F) | | | | | | | Flue | Ambient |
|--------------------|---------------------|----------------------------------|-------------------|----------|---------|--------|-----------|-----------------------|-----|------|---------|
| | | | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | | | |
| 0 | 18.58 | -0.070 | 499 | 530 | 344 | 453 | 451 | 455.3 | 332 | 72 | |
| 1 | 18.29 | -0.076 | 496 | 528 | 341 | 443 | 454 | 452.3 | 419 | 72 | |
| 2 | 18.11 | -0.064 | 492 | 525 | 338 | 441 | 457 | 450.4 | 403 | 72 | |
| 3 | 17.95 | -0.060 | 487 | 521 | 334 | 430 | 459 | 446.3 | 358 | 72 | |
| 4 | 17.77 | -0.061 | 482 | 517 | 330 | 419 | 461 | 441.5 | 347 | 71 | |
| 5 | 17.54 | -0.070 | 476 | 512 | 325 | 430 | 462 | 440.8 | 396 | 72 | |
| 6 | 17.32 | -0.077 | 469 | 507 | 321 | 458 | 462 | 443.4 | 443 | 71 | |
| 7 | 17.03 | -0.082 | 462 | 502 | 316 | 495 | 462 | 447.4 | 512 | 71 | |
| 8 | 16.75 | -0.083 | 457 | 496 | 312 | 541 | 461 | 453.4 | 544 | 71 | |
| 9 | 16.44 | -0.086 | 452 | 492 | 310 | 588 | 460 | 460.1 | 571 | 71 | |
| 10 | 16.12 | -0.087 | 448 | 489 | 307 | 629 | 459 | 466.3 | 600 | 72 | |
| 11 | 15.81 | -0.087 | 444 | 487 | 306 | 663 | 458 | 471.4 | 595 | 72 | |
| 12 | 15.53 | -0.089 | 438 | 485 | 304 | 691 | 456 | 474.6 | 589 | 71 | |
| 13 | 15.23 | -0.087 | 430 | 484 | 303 | 714 | 454 | 477.1 | 588 | 71 | |
| 14 | 14.95 | -0.089 | 426 | 484 | 302 | 731 | 452 | 479.0 | 585 | 72 | |
| 15 | 14.66 | -0.087 | 422 | 483 | 300 | 744 | 450 | 480.0 | 591 | 72 | |
| 16 | 14.35 | -0.090 | 419 | 483 | 300 | 752 | 448 | 480.3 | 588 | 72 | |
| 17 | 14.07 | -0.089 | 416 | 482 | 299 | 760 | 446 | 480.6 | 600 | 72 | |
| 18 | 13.73 | -0.089 | 416 | 481 | 299 | 768 | 444 | 481.4 | 605 | 72 | |
| 19 | 13.43 | -0.088 | 416 | 481 | 298 | 776 | 442 | 482.5 | 608 | 72 | |
| 20 | 13.13 | -0.088 | 418 | 480 | 298 | 783 | 439 | 483.7 | 606 | 72 | |
| 21 | 12.80 | -0.089 | 420 | 480 | 299 | 789 | 437 | 484.9 | 608 | 72 | |
| 22 | 12.51 | -0.090 | 422 | 481 | 300 | 794 | 435 | 486.4 | 613 | 72 | |
| 23 | 12.18 | -0.090 | 426 | 482 | 301 | 799 | 433 | 488.0 | 613 | 72 | |
| 24 | 11.90 | -0.088 | 430 | 483 | 302 | 803 | 431 | 489.7 | 615 | 72 | |
| 25 | 11.61 | -0.088 | 434 | 485 | 303 | 808 | 429 | 491.5 | 613 | 72 | |
| 26 | 11.33 | -0.088 | 439 | 486 | 304 | 809 | 427 | 493.1 | 597 | 72 | |
| 27 | 11.07 | -0.086 | 444 | 489 | 305 | 803 | 425 | 493.2 | 581 | 73 | |
| 28 | 10.83 | -0.083 | 449 | 491 | 306 | 794 | 424 | 492.7 | 568 | 72 | |
| 29 | 10.61 | -0.085 | 453 | 494 | 308 | 783 | 423 | 492.0 | 557 | 73 | |
| 30 | 10.37 | -0.083 | 457 | 497 | 309 | 772 | 421 | 491.1 | 547 | 74 | |
| 31 | 10.16 | -0.082 | 460 | 500 | 310 | 761 | 421 | 490.2 | 541 | 74 | |
| 32 | 9.93 | -0.082 | 463 | 503 | 311 | 753 | 419 | 489.6 | 536 | 74 | |
| 33 | 9.71 | -0.082 | 467 | 506 | 311 | 746 | 417 | 489.2 | 536 | 74 | |
| 34 | 9.49 | -0.081 | 469 | 509 | 312 | 741 | 416 | 489.4 | 538 | 74 | |
| 35 | 9.27 | -0.082 | 471 | 512 | 313 | 738 | 414 | 489.4 | 536 | 74 | |
| 36 | 9.06 | -0.082 | 473 | 515 | 313 | 736 | 412 | 489.8 | 540 | 74 | |
| 37 | 8.83 | -0.084 | 475 | 518 | 314 | 737 | 410 | 490.6 | 541 | 74 | |
| 38 | 8.59 | -0.083 | 478 | 521 | 315 | 740 | 408 | 492.3 | 548 | 74 | |
| 39 | 8.36 | -0.084 | 480 | 523 | 316 | 748 | 406 | 494.6 | 556 | 73 | |
| 40 | 8.12 | -0.084 | 482 | 526 | 318 | 758 | 403 | 497.3 | 564 | 74 | |
| 41 | 7.88 | -0.084 | 485 | 530 | 318 | 768 | 401 | 500.3 | 567 | 74 | |
| 42 | 7.67 | -0.085 | 487 | 533 | 320 | 777 | 399 | 503.1 | 568 | 73 | |
| 43 | 7.45 | -0.083 | 490 | 536 | 322 | 781 | 396 | 505.1 | 560 | 74 | |
| 44 | 7.24 | -0.084 | 493 | 539 | 324 | 782 | 395 | 506.4 | 560 | 74 | |

WOODSTOVE PREBURN DATA - ASTM E2780

Client: HHT
Model: Pioneer II
Run #: 2

Job #: 24-321
Tracking #: 213
Technician: AK
Date: 8/21/2024

Recording Interval (min): 1
Run Time (min): 78

| Elapsed Time (min) | Scale Reading (lbs) | Flue Draft (in H ₂ O) | Temperatures (°F) | | | | | | | |
|--------------------|---------------------|----------------------------------|-------------------|----------|---------|--------|-----------|-----------------------|------|---------|
| | | | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Flue | Ambient |
| 45 | 7.03 | -0.085 | 495 | 543 | 325 | 780 | 392 | 507.0 | 556 | 74 |
| 46 | 6.85 | -0.081 | 499 | 546 | 326 | 775 | 390 | 507.0 | 542 | 74 |
| 47 | 6.68 | -0.080 | 501 | 549 | 327 | 765 | 388 | 506.0 | 529 | 74 |
| 48 | 6.53 | -0.079 | 504 | 552 | 329 | 751 | 385 | 504.2 | 521 | 73 |
| 49 | 6.37 | -0.078 | 506 | 555 | 329 | 743 | 383 | 503.3 | 524 | 74 |
| 50 | 6.22 | -0.081 | 509 | 557 | 330 | 740 | 381 | 503.3 | 521 | 75 |
| 51 | 6.05 | -0.081 | 512 | 559 | 331 | 737 | 379 | 503.7 | 521 | 73 |
| 52 | 5.92 | -0.079 | 516 | 561 | 332 | 736 | 377 | 504.2 | 519 | 74 |
| 53 | 5.77 | -0.079 | 519 | 562 | 334 | 733 | 375 | 504.8 | 512 | 74 |
| 54 | 5.66 | -0.078 | 522 | 564 | 336 | 730 | 374 | 505.2 | 505 | 73 |
| 55 | 5.55 | -0.078 | 525 | 566 | 337 | 723 | 372 | 504.7 | 498 | 73 |
| 56 | 5.43 | -0.078 | 528 | 567 | 339 | 715 | 371 | 504.0 | 497 | 73 |
| 57 | 5.36 | -0.075 | 530 | 568 | 340 | 706 | 370 | 503.0 | 497 | 73 |
| 58 | 5.27 | -0.073 | 532 | 569 | 342 | 696 | 370 | 501.9 | 486 | 74 |
| 59 | 5.20 | -0.071 | 534 | 569 | 344 | 684 | 370 | 500.2 | 474 | 74 |
| 60 | 5.15 | -0.070 | 536 | 569 | 346 | 670 | 370 | 498.2 | 460 | 74 |
| 61 | 5.09 | -0.069 | 537 | 569 | 348 | 654 | 370 | 495.6 | 446 | 74 |
| 62 | 5.05 | -0.069 | 537 | 569 | 351 | 637 | 371 | 492.7 | 431 | 74 |
| 63 | 5.01 | -0.068 | 538 | 568 | 353 | 618 | 372 | 489.6 | 416 | 74 |
| 64 | 4.98 | -0.065 | 537 | 568 | 354 | 599 | 373 | 486.3 | 401 | 73 |
| 65 | 4.93 | -0.063 | 538 | 567 | 356 | 580 | 375 | 483.1 | 390 | 74 |
| 66 | 4.89 | -0.062 | 538 | 566 | 357 | 561 | 377 | 479.7 | 380 | 74 |
| 67 | 4.87 | -0.062 | 537 | 564 | 358 | 543 | 378 | 476.2 | 370 | 74 |
| 68 | 4.84 | -0.059 | 536 | 563 | 359 | 526 | 380 | 472.9 | 362 | 73 |
| 69 | 4.81 | -0.058 | 535 | 561 | 359 | 510 | 382 | 469.6 | 352 | 74 |
| 70 | 4.78 | -0.058 | 534 | 559 | 359 | 496 | 384 | 466.2 | 347 | 74 |
| 71 | 4.75 | -0.057 | 532 | 557 | 358 | 483 | 386 | 463.1 | 342 | 74 |
| 72 | 4.73 | -0.057 | 529 | 555 | 358 | 471 | 388 | 460.0 | 339 | 74 |
| 73 | 4.69 | -0.057 | 527 | 552 | 357 | 460 | 390 | 457.1 | 334 | 74 |
| 74 | 4.68 | -0.056 | 525 | 550 | 356 | 450 | 392 | 454.3 | 329 | 74 |
| 75 | 4.64 | -0.056 | 522 | 547 | 356 | 441 | 394 | 451.8 | 326 | 74 |
| 76 | 4.59 | -0.053 | 520 | 545 | 355 | 432 | 396 | 449.4 | 322 | 74 |
| 77 | 4.58 | -0.054 | 517 | 542 | 354 | 425 | 398 | 447.1 | 317 | 74 |
| 78 | 4.55 | -0.054 | 514 | 539 | 353 | 418 | 401 | 445.0 | 318 | 74 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 0 | 0.000 | | 0.088 | 0.01 | 76 | 0.1 | | 19.77 | | 119 | 317 | 74 | 74 |
| 1 | 0.096 | 0.096 | 0.086 | 2.04 | 76 | 0.9 | - | 19.63 | -0.14 | 135 | 284 | 77 | 74 |
| 2 | 0.235 | 0.139 | 0.089 | 2.08 | 76 | 0.9 | - | 19.34 | -0.29 | 149 | 404 | 80 | 74 |
| 3 | 0.382 | 0.147 | 0.086 | 2.12 | 76 | 0.9 | - | 19.00 | -0.34 | 184 | 633 | 86 | 74 |
| 4 | 0.525 | 0.143 | 0.090 | 2.16 | 76 | 0.9 | - | 18.63 | -0.37 | 155 | 527 | 81 | 74 |
| 5 | 0.675 | 0.150 | 0.094 | 2.18 | 76 | 1.0 | - | 18.40 | -0.23 | 138 | 506 | 81 | 74 |
| 6 | 0.819 | 0.144 | 0.090 | 2.22 | 76 | 1.0 | - | 18.16 | -0.24 | 133 | 505 | 82 | 73 |
| 7 | 0.967 | 0.148 | 0.088 | 2.24 | 76 | 1.0 | - | 17.91 | -0.25 | 130 | 505 | 82 | 74 |
| 8 | 1.114 | 0.147 | 0.087 | 2.27 | 76 | 1.0 | - | 17.66 | -0.25 | 131 | 522 | 82 | 74 |
| 9 | 1.262 | 0.148 | 0.091 | 2.28 | 76 | 0.9 | - | 17.40 | -0.26 | 131 | 537 | 82 | 74 |
| 10 | 1.411 | 0.149 | 0.091 | 2.29 | 76 | 0.9 | 94 | 17.13 | -0.27 | 132 | 540 | 83 | 74 |
| 11 | 1.560 | 0.149 | 0.089 | 2.30 | 77 | 1.0 | - | 16.87 | -0.26 | 132 | 541 | 83 | 74 |
| 12 | 1.710 | 0.150 | 0.083 | 2.31 | 77 | 1.0 | - | 16.60 | -0.27 | 133 | 544 | 83 | 75 |
| 13 | 1.860 | 0.150 | 0.091 | 2.32 | 77 | 1.0 | - | 16.32 | -0.28 | 134 | 567 | 83 | 75 |
| 14 | 2.009 | 0.149 | 0.088 | 2.34 | 77 | 1.0 | - | 16.03 | -0.29 | 135 | 572 | 83 | 75 |
| 15 | 2.158 | 0.149 | 0.088 | 2.33 | 78 | 1.0 | - | 15.76 | -0.27 | 135 | 567 | 84 | 74 |
| 16 | 2.310 | 0.152 | 0.087 | 2.34 | 78 | 1.0 | - | 15.51 | -0.25 | 136 | 568 | 84 | 74 |
| 17 | 2.464 | 0.154 | 0.088 | 2.34 | 78 | 1.0 | - | 15.22 | -0.29 | 136 | 567 | 84 | 74 |
| 18 | 2.616 | 0.152 | 0.082 | 2.35 | 78 | 1.0 | - | 14.95 | -0.27 | 137 | 568 | 84 | 74 |
| 19 | 2.768 | 0.152 | 0.089 | 2.37 | 79 | 1.0 | - | 14.70 | -0.25 | 136 | 572 | 84 | 74 |
| 20 | 2.919 | 0.151 | 0.089 | 2.37 | 79 | 1.0 | 101 | 14.42 | -0.28 | 137 | 581 | 84 | 74 |
| 21 | 3.073 | 0.154 | 0.085 | 2.37 | 79 | 1.0 | - | 14.14 | -0.28 | 138 | 585 | 84 | 74 |
| 22 | 3.224 | 0.151 | 0.083 | 2.38 | 79 | 1.0 | - | 13.88 | -0.26 | 138 | 588 | 84 | 75 |
| 23 | 3.378 | 0.154 | 0.084 | 2.39 | 80 | 1.0 | - | 13.61 | -0.27 | 139 | 591 | 84 | 75 |
| 24 | 3.527 | 0.149 | 0.087 | 2.38 | 80 | 1.0 | - | 13.34 | -0.27 | 138 | 587 | 84 | 75 |
| 25 | 3.683 | 0.156 | 0.089 | 2.40 | 80 | 1.0 | - | 13.08 | -0.26 | 138 | 587 | 84 | 75 |
| 26 | 3.832 | 0.149 | 0.088 | 2.39 | 81 | 1.0 | - | 12.81 | -0.27 | 138 | 587 | 84 | 75 |
| 27 | 3.988 | 0.156 | 0.091 | 2.39 | 81 | 1.0 | - | 12.55 | -0.26 | 138 | 588 | 84 | 75 |
| 28 | 4.139 | 0.151 | 0.086 | 2.39 | 81 | 1.0 | - | 12.29 | -0.26 | 138 | 588 | 84 | 75 |
| 29 | 4.295 | 0.156 | 0.091 | 2.39 | 82 | 1.0 | - | 12.04 | -0.25 | 137 | 581 | 84 | 75 |
| 30 | 4.446 | 0.151 | 0.092 | 2.39 | 82 | 1.0 | 102 | 11.80 | -0.24 | 137 | 579 | 84 | 75 |
| 31 | 4.602 | 0.156 | 0.084 | 2.40 | 82 | 1.0 | - | 11.54 | -0.26 | 136 | 578 | 84 | 75 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 32 | 4.750 | 0.148 | 0.086 | 2.40 | 82 | 1.0 | - | 11.29 | -0.25 | 136 | 572 | 84 | 75 |
| 33 | 4.904 | 0.154 | 0.084 | 2.39 | 83 | 1.0 | - | 11.06 | -0.23 | 135 | 573 | 84 | 75 |
| 34 | 5.057 | 0.153 | 0.086 | 2.40 | 83 | 1.1 | - | 10.85 | -0.21 | 135 | 568 | 84 | 76 |
| 35 | 5.211 | 0.154 | 0.087 | 2.40 | 83 | 1.0 | - | 10.61 | -0.24 | 135 | 565 | 83 | 76 |
| 36 | 5.369 | 0.158 | 0.088 | 2.41 | 84 | 1.0 | - | 10.38 | -0.23 | 135 | 558 | 83 | 76 |
| 37 | 5.521 | 0.152 | 0.085 | 2.40 | 84 | 1.1 | - | 10.17 | -0.21 | 134 | 545 | 83 | 76 |
| 38 | 5.677 | 0.156 | 0.084 | 2.41 | 84 | 1.1 | - | 9.96 | -0.21 | 133 | 539 | 83 | 76 |
| 39 | 5.827 | 0.150 | 0.084 | 2.41 | 84 | 1.0 | - | 9.77 | -0.19 | 132 | 529 | 83 | 76 |
| 40 | 5.983 | 0.156 | 0.087 | 2.41 | 85 | 1.1 | 102 | 9.59 | -0.18 | 131 | 526 | 83 | 77 |
| 41 | 6.134 | 0.151 | 0.086 | 2.41 | 85 | 1.1 | - | 9.41 | -0.18 | 130 | 517 | 82 | 76 |
| 42 | 6.292 | 0.158 | 0.086 | 2.41 | 85 | 1.1 | - | 9.24 | -0.17 | 129 | 512 | 82 | 76 |
| 43 | 6.444 | 0.152 | 0.094 | 2.41 | 85 | 1.0 | - | 9.08 | -0.16 | 128 | 509 | 82 | 76 |
| 44 | 6.601 | 0.157 | 0.090 | 2.42 | 86 | 1.1 | - | 8.90 | -0.18 | 128 | 507 | 82 | 76 |
| 45 | 6.750 | 0.149 | 0.092 | 2.42 | 86 | 1.1 | - | 8.74 | -0.16 | 128 | 502 | 82 | 76 |
| 46 | 6.906 | 0.156 | 0.093 | 2.43 | 86 | 1.1 | - | 8.58 | -0.16 | 127 | 501 | 82 | 76 |
| 47 | 7.060 | 0.154 | 0.090 | 2.43 | 86 | 1.0 | - | 8.41 | -0.17 | 126 | 497 | 82 | 76 |
| 48 | 7.216 | 0.156 | 0.087 | 2.44 | 87 | 1.1 | - | 8.25 | -0.16 | 126 | 496 | 83 | 76 |
| 49 | 7.376 | 0.160 | 0.090 | 2.45 | 87 | 1.0 | - | 8.10 | -0.15 | 126 | 491 | 83 | 76 |
| 50 | 7.528 | 0.152 | 0.091 | 2.45 | 87 | 1.0 | 102 | 7.92 | -0.18 | 125 | 491 | 83 | 76 |
| 51 | 7.686 | 0.158 | 0.089 | 2.45 | 87 | 1.0 | - | 7.76 | -0.16 | 125 | 490 | 83 | 76 |
| 52 | 7.840 | 0.154 | 0.090 | 2.46 | 88 | 1.0 | - | 7.60 | -0.16 | 125 | 489 | 83 | 76 |
| 53 | 7.999 | 0.159 | 0.091 | 2.47 | 88 | 1.0 | - | 7.46 | -0.14 | 124 | 488 | 83 | 76 |
| 54 | 8.153 | 0.154 | 0.094 | 2.47 | 88 | 1.0 | - | 7.31 | -0.15 | 123 | 481 | 83 | 76 |
| 55 | 8.309 | 0.156 | 0.092 | 2.48 | 88 | 1.0 | - | 7.16 | -0.15 | 123 | 477 | 83 | 76 |
| 56 | 8.468 | 0.159 | 0.093 | 2.48 | 88 | 1.0 | - | 7.01 | -0.15 | 122 | 477 | 83 | 76 |
| 57 | 8.623 | 0.155 | 0.091 | 2.50 | 89 | 1.0 | - | 6.87 | -0.14 | 122 | 476 | 82 | 76 |
| 58 | 8.779 | 0.156 | 0.091 | 2.50 | 89 | 1.0 | - | 6.73 | -0.14 | 121 | 469 | 82 | 76 |
| 59 | 8.933 | 0.154 | 0.091 | 2.50 | 89 | 1.0 | - | 6.62 | -0.11 | 120 | 469 | 82 | 76 |
| 60 | 9.094 | 0.161 | 0.087 | 2.51 | 89 | 1.0 | 102 | 6.48 | -0.14 | 120 | 465 | 82 | 76 |
| 61 | 9.249 | 0.155 | 0.089 | 2.50 | 89 | 1.0 | - | 6.36 | -0.12 | 120 | 461 | 82 | 76 |
| 62 | 9.410 | 0.161 | 0.086 | 2.51 | 90 | 1.0 | - | 6.24 | -0.12 | 119 | 458 | 82 | 77 |
| 63 | 9.570 | 0.160 | 0.090 | 2.50 | 90 | 1.0 | - | 6.11 | -0.13 | 119 | 455 | 82 | 76 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 64 | 9.724 | 0.154 | 0.090 | 2.52 | 90 | 1.0 | - | 6.03 | -0.08 | 119 | 449 | 82 | 76 |
| 65 | 9.886 | 0.162 | 0.091 | 2.52 | 90 | 1.0 | - | 5.89 | -0.14 | 118 | 445 | 82 | 75 |
| 66 | 10.042 | 0.156 | 0.090 | 2.53 | 90 | 1.0 | - | 5.79 | -0.10 | 117 | 441 | 82 | 76 |
| 67 | 10.201 | 0.159 | 0.094 | 2.53 | 90 | 1.0 | - | 5.70 | -0.09 | 116 | 434 | 82 | 76 |
| 68 | 10.360 | 0.159 | 0.089 | 2.54 | 90 | 1.0 | - | 5.60 | -0.10 | 116 | 432 | 82 | 76 |
| 69 | 10.519 | 0.159 | 0.094 | 2.54 | 91 | 1.0 | - | 5.49 | -0.11 | 115 | 424 | 82 | 76 |
| 70 | 10.676 | 0.157 | 0.092 | 2.54 | 91 | 1.0 | 102 | 5.41 | -0.08 | 114 | 415 | 82 | 76 |
| 71 | 10.832 | 0.156 | 0.088 | 2.55 | 91 | 1.0 | - | 5.31 | -0.10 | 114 | 408 | 82 | 76 |
| 72 | 10.995 | 0.163 | 0.089 | 2.56 | 91 | 1.0 | - | 5.25 | -0.06 | 113 | 402 | 82 | 76 |
| 73 | 11.153 | 0.158 | 0.089 | 2.56 | 91 | 1.0 | - | 5.15 | -0.10 | 112 | 396 | 82 | 76 |
| 74 | 11.314 | 0.161 | 0.092 | 2.56 | 91 | 1.0 | - | 5.04 | -0.11 | 112 | 390 | 82 | 76 |
| 75 | 11.474 | 0.160 | 0.089 | 2.55 | 91 | 1.0 | - | 4.97 | -0.07 | 112 | 385 | 82 | 76 |
| 76 | 11.630 | 0.156 | 0.083 | 2.55 | 91 | 1.0 | - | 4.88 | -0.09 | 111 | 385 | 82 | 76 |
| 77 | 11.793 | 0.163 | 0.093 | 2.55 | 92 | 1.0 | - | 4.80 | -0.08 | 111 | 381 | 82 | 76 |
| 78 | 11.950 | 0.157 | 0.090 | 2.57 | 92 | 1.0 | - | 4.72 | -0.08 | 110 | 379 | 82 | 76 |
| 79 | 12.110 | 0.160 | 0.092 | 2.57 | 92 | 1.0 | - | 4.64 | -0.08 | 110 | 379 | 81 | 76 |
| 80 | 12.272 | 0.162 | 0.086 | 2.57 | 92 | 1.0 | 103 | 4.54 | -0.10 | 109 | 373 | 81 | 76 |
| 81 | 12.427 | 0.155 | 0.093 | 2.56 | 92 | 1.0 | - | 4.46 | -0.08 | 109 | 375 | 81 | 76 |
| 82 | 12.591 | 0.164 | 0.091 | 2.57 | 92 | 1.0 | - | 4.38 | -0.08 | 108 | 374 | 81 | 75 |
| 83 | 12.747 | 0.156 | 0.092 | 2.57 | 92 | 1.0 | - | 4.30 | -0.08 | 108 | 374 | 81 | 76 |
| 84 | 12.905 | 0.158 | 0.094 | 2.57 | 92 | 1.0 | - | 4.23 | -0.07 | 108 | 374 | 81 | 75 |
| 85 | 13.067 | 0.162 | 0.091 | 2.56 | 92 | 1.0 | - | 4.13 | -0.10 | 108 | 375 | 81 | 75 |
| 86 | 13.224 | 0.157 | 0.088 | 2.58 | 93 | 1.0 | - | 4.04 | -0.09 | 108 | 371 | 81 | 76 |
| 87 | 13.387 | 0.163 | 0.089 | 2.57 | 93 | 1.0 | - | 3.96 | -0.08 | 108 | 373 | 81 | 75 |
| 88 | 13.546 | 0.159 | 0.091 | 2.57 | 93 | 1.0 | - | 3.89 | -0.07 | 107 | 372 | 81 | 75 |
| 89 | 13.708 | 0.162 | 0.092 | 2.57 | 93 | 1.0 | - | 3.79 | -0.10 | 107 | 376 | 81 | 75 |
| 90 | 13.870 | 0.162 | 0.094 | 2.58 | 93 | 1.0 | 102 | 3.71 | -0.08 | 107 | 376 | 81 | 75 |
| 91 | 14.026 | 0.156 | 0.090 | 2.57 | 93 | 1.0 | - | 3.63 | -0.08 | 107 | 379 | 81 | 76 |
| 92 | 14.190 | 0.164 | 0.086 | 2.57 | 93 | 1.0 | - | 3.54 | -0.09 | 107 | 383 | 81 | 76 |
| 93 | 14.347 | 0.157 | 0.095 | 2.58 | 93 | 1.0 | - | 3.45 | -0.09 | 107 | 380 | 81 | 75 |
| 94 | 14.505 | 0.158 | 0.088 | 2.58 | 93 | 1.0 | - | 3.38 | -0.07 | 107 | 378 | 81 | 76 |
| 95 | 14.668 | 0.163 | 0.085 | 2.59 | 93 | 1.0 | - | 3.29 | -0.09 | 107 | 372 | 81 | 75 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 96 | 14.824 | 0.156 | 0.090 | 2.58 | 93 | 1.0 | - | 3.19 | -0.10 | 107 | 377 | 81 | 75 |
| 97 | 14.991 | 0.167 | 0.090 | 2.58 | 94 | 1.0 | - | 3.12 | -0.07 | 107 | 379 | 81 | 76 |
| 98 | 15.148 | 0.157 | 0.093 | 2.59 | 94 | 1.0 | - | 3.03 | -0.09 | 107 | 378 | 81 | 76 |
| 99 | 15.310 | 0.162 | 0.089 | 2.58 | 94 | 1.0 | - | 2.98 | -0.05 | 106 | 370 | 81 | 76 |
| 100 | 15.471 | 0.161 | 0.090 | 2.59 | 94 | 1.0 | 100 | 2.92 | -0.06 | 106 | 366 | 81 | 76 |
| 101 | 15.628 | 0.157 | 0.083 | 2.59 | 94 | 1.0 | - | 2.84 | -0.08 | 105 | 362 | 81 | 76 |
| 102 | 15.790 | 0.162 | 0.089 | 2.58 | 94 | 1.0 | - | 2.80 | -0.04 | 105 | 356 | 81 | 76 |
| 103 | 15.948 | 0.158 | 0.089 | 2.59 | 94 | 1.0 | - | 2.77 | -0.03 | 104 | 350 | 81 | 76 |
| 104 | 16.112 | 0.164 | 0.093 | 2.58 | 94 | 1.0 | - | 2.70 | -0.07 | 104 | 342 | 81 | 76 |
| 105 | 16.274 | 0.162 | 0.092 | 2.60 | 94 | 1.0 | - | 2.69 | -0.01 | 103 | 332 | 81 | 75 |
| 106 | 16.432 | 0.158 | 0.088 | 2.58 | 94 | 1.0 | - | 2.63 | -0.06 | 102 | 322 | 80 | 76 |
| 107 | 16.594 | 0.162 | 0.088 | 2.59 | 94 | 1.0 | - | 2.61 | -0.02 | 101 | 313 | 80 | 75 |
| 108 | 16.750 | 0.156 | 0.093 | 2.58 | 94 | 1.0 | - | 2.59 | -0.02 | 101 | 309 | 80 | 76 |
| 109 | 16.912 | 0.162 | 0.091 | 2.57 | 94 | 1.0 | - | 2.55 | -0.04 | 100 | 296 | 80 | 75 |
| 110 | 17.076 | 0.164 | 0.091 | 2.59 | 94 | 1.0 | 101 | 2.53 | -0.02 | 99 | 289 | 80 | 75 |
| 111 | 17.233 | 0.157 | 0.088 | 2.59 | 94 | 1.0 | - | 2.50 | -0.03 | 98 | 282 | 80 | 75 |
| 112 | 17.397 | 0.164 | 0.093 | 2.59 | 95 | 1.0 | - | 2.50 | 0.00 | 97 | 276 | 80 | 75 |
| 113 | 17.559 | 0.162 | 0.090 | 2.59 | 95 | 1.0 | - | 2.46 | -0.04 | 97 | 272 | 80 | 75 |
| 114 | 17.717 | 0.158 | 0.087 | 2.59 | 95 | 1.0 | - | 2.45 | -0.01 | 96 | 269 | 80 | 75 |
| 115 | 17.881 | 0.164 | 0.092 | 2.59 | 95 | 1.0 | - | 2.42 | -0.03 | 96 | 268 | 80 | 75 |
| 116 | 18.040 | 0.159 | 0.091 | 2.59 | 95 | 1.0 | - | 2.39 | -0.03 | 96 | 269 | 80 | 75 |
| 117 | 18.201 | 0.161 | 0.093 | 2.58 | 95 | 1.0 | - | 2.37 | -0.02 | 96 | 267 | 80 | 75 |
| 118 | 18.361 | 0.160 | 0.092 | 2.60 | 95 | 1.0 | - | 2.38 | 0.01 | 95 | 265 | 79 | 75 |
| 119 | 18.519 | 0.158 | 0.093 | 2.60 | 95 | 1.0 | - | 2.32 | -0.06 | 95 | 263 | 79 | 75 |
| 120 | 18.686 | 0.167 | 0.093 | 2.58 | 95 | 1.0 | 100 | 2.31 | -0.01 | 95 | 263 | 79 | 75 |
| 121 | 18.843 | 0.157 | 0.093 | 2.60 | 95 | 1.0 | - | 2.29 | -0.02 | 94 | 260 | 79 | 75 |
| 122 | 19.006 | 0.163 | 0.094 | 2.59 | 95 | 1.0 | - | 2.26 | -0.03 | 94 | 256 | 79 | 75 |
| 123 | 19.168 | 0.162 | 0.090 | 2.60 | 95 | 1.0 | - | 2.24 | -0.02 | 93 | 252 | 79 | 75 |
| 124 | 19.323 | 0.155 | 0.091 | 2.59 | 95 | 1.0 | - | 2.23 | -0.01 | 93 | 249 | 79 | 75 |
| 125 | 19.489 | 0.166 | 0.090 | 2.59 | 95 | 1.0 | - | 2.23 | 0.00 | 93 | 247 | 79 | 75 |
| 126 | 19.650 | 0.161 | 0.092 | 2.59 | 95 | 1.0 | - | 2.19 | -0.04 | 92 | 245 | 79 | 75 |
| 127 | 19.812 | 0.162 | 0.089 | 2.60 | 95 | 1.0 | - | 2.17 | -0.02 | 92 | 242 | 79 | 75 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 128 | 19.974 | 0.162 | 0.089 | 2.60 | 95 | 1.0 | - | 2.16 | -0.01 | 92 | 237 | 79 | 75 |
| 129 | 20.134 | 0.160 | 0.091 | 2.60 | 95 | 1.0 | - | 2.14 | -0.02 | 92 | 235 | 79 | 75 |
| 130 | 20.293 | 0.159 | 0.091 | 2.60 | 95 | 1.0 | 99 | 2.12 | -0.02 | 91 | 230 | 79 | 75 |
| 131 | 20.455 | 0.162 | 0.091 | 2.59 | 95 | 1.0 | - | 2.10 | -0.02 | 91 | 230 | 79 | 75 |
| 132 | 20.617 | 0.162 | 0.090 | 2.60 | 95 | 1.0 | - | 2.09 | -0.01 | 91 | 227 | 79 | 75 |
| 133 | 20.782 | 0.165 | 0.093 | 2.59 | 95 | 1.0 | - | 2.05 | -0.04 | 90 | 222 | 79 | 75 |
| 134 | 20.940 | 0.158 | 0.095 | 2.61 | 95 | 1.0 | - | 2.06 | 0.01 | 90 | 220 | 79 | 74 |
| 135 | 21.103 | 0.163 | 0.093 | 2.59 | 96 | 1.0 | - | 2.05 | -0.01 | 90 | 216 | 78 | 75 |
| 136 | 21.264 | 0.161 | 0.091 | 2.60 | 96 | 1.0 | - | 2.03 | -0.02 | 89 | 211 | 78 | 75 |
| 137 | 21.421 | 0.157 | 0.096 | 2.59 | 96 | 1.0 | - | 2.02 | -0.01 | 89 | 206 | 78 | 74 |
| 138 | 21.589 | 0.168 | 0.094 | 2.60 | 96 | 1.0 | - | 2.00 | -0.02 | 89 | 204 | 78 | 74 |
| 139 | 21.748 | 0.159 | 0.093 | 2.60 | 96 | 1.0 | - | 1.98 | -0.02 | 88 | 203 | 78 | 74 |
| 140 | 21.911 | 0.163 | 0.094 | 2.61 | 96 | 1.0 | 99 | 1.98 | 0.00 | 88 | 200 | 78 | 75 |
| 141 | 22.073 | 0.162 | 0.096 | 2.60 | 96 | 1.0 | - | 1.96 | -0.02 | 88 | 199 | 78 | 74 |
| 142 | 22.230 | 0.157 | 0.094 | 2.60 | 96 | 1.0 | - | 1.94 | -0.02 | 88 | 197 | 78 | 74 |
| 143 | 22.393 | 0.163 | 0.094 | 2.61 | 96 | 1.0 | - | 1.93 | -0.01 | 88 | 196 | 78 | 74 |
| 144 | 22.559 | 0.166 | 0.094 | 2.59 | 96 | 1.0 | - | 1.94 | 0.01 | 87 | 192 | 78 | 74 |
| 145 | 22.717 | 0.158 | 0.091 | 2.60 | 96 | 1.0 | - | 1.91 | -0.03 | 87 | 190 | 78 | 74 |
| 146 | 22.882 | 0.165 | 0.093 | 2.60 | 96 | 1.0 | - | 1.91 | 0.00 | 87 | 189 | 78 | 74 |
| 147 | 23.040 | 0.158 | 0.091 | 2.61 | 96 | 1.0 | - | 1.97 | 0.06 | 87 | 187 | 78 | 74 |
| 148 | 23.201 | 0.161 | 0.094 | 2.59 | 96 | 1.0 | - | 1.87 | -0.10 | 87 | 186 | 78 | 74 |
| 149 | 23.364 | 0.163 | 0.087 | 2.60 | 96 | 1.0 | - | 1.86 | -0.01 | 87 | 185 | 78 | 74 |
| 150 | 23.526 | 0.162 | 0.092 | 2.60 | 96 | 1.0 | 99 | 1.85 | -0.01 | 86 | 185 | 78 | 74 |
| 151 | 23.690 | 0.164 | 0.093 | 2.61 | 96 | 1.0 | - | 1.83 | -0.02 | 86 | 184 | 78 | 74 |
| 152 | 23.851 | 0.161 | 0.094 | 2.59 | 96 | 1.0 | - | 1.83 | 0.00 | 86 | 184 | 77 | 74 |
| 153 | 24.012 | 0.161 | 0.094 | 2.61 | 96 | 1.0 | - | 1.83 | 0.00 | 86 | 181 | 77 | 74 |
| 154 | 24.172 | 0.160 | 0.091 | 2.59 | 96 | 1.0 | - | 1.78 | -0.05 | 86 | 180 | 77 | 74 |
| 155 | 24.333 | 0.161 | 0.092 | 2.60 | 96 | 1.0 | - | 1.78 | 0.00 | 86 | 179 | 77 | 74 |
| 156 | 24.497 | 0.164 | 0.091 | 2.60 | 96 | 1.0 | - | 1.78 | 0.00 | 86 | 179 | 77 | 74 |
| 157 | 24.662 | 0.165 | 0.091 | 2.61 | 96 | 1.0 | - | 1.77 | -0.01 | 85 | 180 | 77 | 74 |
| 158 | 24.819 | 0.157 | 0.089 | 2.60 | 96 | 1.0 | - | 1.75 | -0.02 | 85 | 178 | 77 | 74 |
| 159 | 24.982 | 0.163 | 0.095 | 2.60 | 96 | 1.0 | - | 1.74 | -0.01 | 85 | 178 | 77 | 74 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 160 | 25.142 | 0.160 | 0.091 | 2.61 | 96 | 1.0 | 99 | 1.72 | -0.02 | 85 | 176 | 77 | 74 |
| 161 | 25.307 | 0.165 | 0.090 | 2.60 | 96 | 1.0 | - | 1.73 | 0.01 | 85 | 176 | 77 | 74 |
| 162 | 25.470 | 0.163 | 0.096 | 2.61 | 96 | 1.0 | - | 1.71 | -0.02 | 85 | 176 | 77 | 74 |
| 163 | 25.630 | 0.160 | 0.093 | 2.60 | 96 | 1.0 | - | 1.70 | -0.01 | 85 | 175 | 77 | 74 |
| 164 | 25.793 | 0.163 | 0.093 | 2.62 | 96 | 1.0 | - | 1.68 | -0.02 | 85 | 174 | 77 | 74 |
| 165 | 25.953 | 0.160 | 0.095 | 2.60 | 96 | 1.0 | - | 1.68 | 0.00 | 85 | 173 | 77 | 74 |
| 166 | 26.112 | 0.159 | 0.095 | 2.61 | 96 | 1.0 | - | 1.68 | 0.00 | 85 | 174 | 77 | 74 |
| 167 | 26.281 | 0.169 | 0.091 | 2.60 | 96 | 1.0 | - | 1.66 | -0.02 | 85 | 173 | 77 | 74 |
| 168 | 26.440 | 0.159 | 0.090 | 2.62 | 96 | 1.0 | - | 1.64 | -0.02 | 85 | 172 | 77 | 74 |
| 169 | 26.603 | 0.163 | 0.090 | 2.61 | 96 | 1.0 | - | 1.64 | 0.00 | 84 | 172 | 77 | 74 |
| 170 | 26.763 | 0.160 | 0.093 | 2.61 | 96 | 1.0 | 99 | 1.61 | -0.03 | 84 | 171 | 77 | 74 |
| 171 | 26.925 | 0.162 | 0.093 | 2.61 | 96 | 1.0 | - | 1.61 | 0.00 | 84 | 170 | 77 | 74 |
| 172 | 27.089 | 0.164 | 0.093 | 2.62 | 96 | 1.0 | - | 1.59 | -0.02 | 84 | 169 | 77 | 74 |
| 173 | 27.251 | 0.162 | 0.096 | 2.60 | 96 | 1.0 | - | 1.58 | -0.01 | 84 | 169 | 77 | 74 |
| 174 | 27.409 | 0.158 | 0.091 | 2.62 | 96 | 1.0 | - | 1.56 | -0.02 | 84 | 169 | 77 | 74 |
| 175 | 27.576 | 0.167 | 0.093 | 2.60 | 96 | 1.0 | - | 1.58 | 0.02 | 84 | 168 | 77 | 74 |
| 176 | 27.735 | 0.159 | 0.090 | 2.60 | 96 | 1.0 | - | 1.56 | -0.02 | 84 | 165 | 77 | 74 |
| 177 | 27.898 | 0.163 | 0.093 | 2.60 | 96 | 1.0 | - | 1.55 | -0.01 | 84 | 166 | 77 | 74 |
| 178 | 28.060 | 0.162 | 0.091 | 2.61 | 96 | 1.0 | - | 1.53 | -0.02 | 84 | 166 | 77 | 74 |
| 179 | 28.221 | 0.161 | 0.091 | 2.60 | 96 | 1.0 | - | 1.53 | 0.00 | 84 | 167 | 77 | 74 |
| 180 | 28.386 | 0.165 | 0.091 | 2.62 | 96 | 1.0 | 99 | 1.51 | -0.02 | 84 | 167 | 77 | 74 |
| 181 | 28.546 | 0.160 | 0.094 | 2.59 | 96 | 1.0 | - | 1.50 | -0.01 | 84 | 166 | 77 | 73 |
| 182 | 28.706 | 0.160 | 0.092 | 2.60 | 96 | 1.0 | - | 1.50 | 0.00 | 84 | 166 | 77 | 74 |
| 183 | 28.871 | 0.165 | 0.091 | 2.60 | 96 | 1.0 | - | 1.49 | -0.01 | 84 | 166 | 77 | 73 |
| 184 | 29.032 | 0.161 | 0.093 | 2.60 | 96 | 1.0 | - | 1.47 | -0.02 | 84 | 165 | 77 | 74 |
| 185 | 29.191 | 0.159 | 0.096 | 2.60 | 96 | 1.0 | - | 1.45 | -0.02 | 84 | 162 | 77 | 74 |
| 186 | 29.359 | 0.168 | 0.093 | 2.61 | 96 | 1.0 | - | 1.45 | 0.00 | 83 | 163 | 77 | 74 |
| 187 | 29.516 | 0.157 | 0.092 | 2.61 | 96 | 1.0 | - | 1.43 | -0.02 | 83 | 161 | 77 | 73 |
| 188 | 29.682 | 0.166 | 0.093 | 2.59 | 96 | 1.0 | - | 1.43 | 0.00 | 83 | 161 | 77 | 74 |
| 189 | 29.839 | 0.157 | 0.091 | 2.62 | 96 | 1.0 | - | 1.42 | -0.01 | 83 | 160 | 77 | 74 |
| 190 | 30.004 | 0.165 | 0.094 | 2.62 | 96 | 1.0 | 99 | 1.39 | -0.03 | 83 | 160 | 77 | 74 |
| 191 | 30.168 | 0.164 | 0.097 | 2.61 | 96 | 1.0 | - | 1.39 | 0.00 | 83 | 159 | 77 | 74 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 192 | 30.328 | 0.160 | 0.090 | 2.60 | 96 | 1.0 | - | 1.38 | -0.01 | 83 | 156 | 77 | 74 |
| 193 | 30.488 | 0.160 | 0.092 | 2.62 | 96 | 1.0 | - | 1.36 | -0.02 | 83 | 159 | 77 | 74 |
| 194 | 30.654 | 0.166 | 0.090 | 2.60 | 97 | 1.0 | - | 1.35 | -0.01 | 83 | 161 | 77 | 74 |
| 195 | 30.813 | 0.159 | 0.089 | 2.61 | 97 | 1.0 | - | 1.35 | 0.00 | 83 | 162 | 77 | 74 |
| 196 | 30.979 | 0.166 | 0.092 | 2.60 | 96 | 1.0 | - | 1.33 | -0.02 | 83 | 163 | 77 | 74 |
| 197 | 31.134 | 0.155 | 0.094 | 2.61 | 97 | 1.0 | - | 1.30 | -0.03 | 83 | 164 | 77 | 74 |
| 198 | 31.301 | 0.167 | 0.093 | 2.60 | 97 | 1.0 | - | 1.30 | 0.00 | 83 | 165 | 77 | 74 |
| 199 | 31.464 | 0.163 | 0.091 | 2.62 | 97 | 1.0 | - | 1.29 | -0.01 | 83 | 165 | 77 | 74 |
| 200 | 31.621 | 0.157 | 0.089 | 2.60 | 97 | 1.0 | 99 | 1.27 | -0.02 | 83 | 167 | 77 | 73 |
| 201 | 31.788 | 0.167 | 0.093 | 2.61 | 97 | 1.0 | - | 1.25 | -0.02 | 83 | 167 | 77 | 73 |
| 202 | 31.951 | 0.163 | 0.089 | 2.61 | 97 | 1.0 | - | 1.25 | 0.00 | 83 | 166 | 77 | 74 |
| 203 | 32.110 | 0.159 | 0.091 | 2.62 | 97 | 1.0 | - | 1.23 | -0.02 | 83 | 164 | 77 | 73 |
| 204 | 32.273 | 0.163 | 0.094 | 2.61 | 97 | 1.0 | - | 1.22 | -0.01 | 83 | 164 | 77 | 73 |
| 205 | 32.434 | 0.161 | 0.089 | 2.61 | 97 | 1.0 | - | 1.21 | -0.01 | 83 | 164 | 77 | 73 |
| 206 | 32.598 | 0.164 | 0.094 | 2.61 | 97 | 1.0 | - | 1.19 | -0.02 | 83 | 165 | 77 | 74 |
| 207 | 32.761 | 0.163 | 0.093 | 2.61 | 97 | 1.0 | - | 1.18 | -0.01 | 83 | 164 | 77 | 74 |
| 208 | 32.918 | 0.157 | 0.095 | 2.60 | 97 | 1.0 | - | 1.17 | -0.01 | 83 | 163 | 77 | 74 |
| 209 | 33.084 | 0.166 | 0.093 | 2.62 | 97 | 1.0 | - | 1.14 | -0.03 | 83 | 165 | 77 | 74 |
| 210 | 33.247 | 0.163 | 0.092 | 2.60 | 97 | 1.0 | 100 | 1.15 | 0.01 | 83 | 164 | 77 | 73 |
| 211 | 33.407 | 0.160 | 0.093 | 2.60 | 97 | 1.0 | - | 1.13 | -0.02 | 83 | 164 | 77 | 73 |
| 212 | 33.569 | 0.162 | 0.091 | 2.60 | 97 | 1.0 | - | 1.12 | -0.01 | 83 | 163 | 77 | 74 |
| 213 | 33.731 | 0.162 | 0.091 | 2.60 | 97 | 1.0 | - | 1.09 | -0.03 | 83 | 163 | 77 | 73 |
| 214 | 33.895 | 0.164 | 0.093 | 2.60 | 97 | 1.0 | - | 1.09 | 0.00 | 83 | 165 | 77 | 74 |
| 215 | 34.058 | 0.163 | 0.095 | 2.61 | 97 | 1.0 | - | 1.08 | -0.01 | 83 | 163 | 77 | 73 |
| 216 | 34.214 | 0.156 | 0.091 | 2.60 | 97 | 1.0 | - | 1.05 | -0.03 | 83 | 164 | 77 | 73 |
| 217 | 34.382 | 0.168 | 0.092 | 2.62 | 97 | 1.0 | - | 1.06 | 0.01 | 83 | 163 | 77 | 73 |
| 218 | 34.544 | 0.162 | 0.093 | 2.60 | 97 | 1.0 | - | 1.03 | -0.03 | 83 | 162 | 77 | 74 |
| 219 | 34.705 | 0.161 | 0.092 | 2.61 | 97 | 1.0 | - | 1.03 | 0.00 | 83 | 162 | 77 | 73 |
| 220 | 34.866 | 0.161 | 0.093 | 2.60 | 97 | 1.0 | 99 | 1.02 | -0.01 | 83 | 163 | 77 | 73 |
| 221 | 35.029 | 0.163 | 0.093 | 2.61 | 97 | 1.0 | - | 1.01 | -0.01 | 83 | 162 | 77 | 73 |
| 222 | 35.192 | 0.163 | 0.092 | 2.61 | 97 | 1.0 | - | 1.01 | 0.00 | 83 | 161 | 77 | 73 |
| 223 | 35.354 | 0.162 | 0.093 | 2.61 | 97 | 1.0 | - | 0.97 | -0.04 | 82 | 162 | 77 | 73 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 224 | 35.515 | 0.161 | 0.093 | 2.61 | 97 | 1.0 | - | 0.97 | 0.00 | 82 | 162 | 77 | 73 |
| 225 | 35.680 | 0.165 | 0.092 | 2.61 | 97 | 1.0 | - | 0.95 | -0.02 | 82 | 162 | 77 | 74 |
| 226 | 35.841 | 0.161 | 0.091 | 2.61 | 97 | 1.0 | - | 0.95 | 0.00 | 82 | 161 | 77 | 73 |
| 227 | 36.000 | 0.159 | 0.092 | 2.60 | 97 | 1.0 | - | 0.93 | -0.02 | 82 | 160 | 77 | 73 |
| 228 | 36.167 | 0.167 | 0.094 | 2.62 | 97 | 1.0 | - | 0.92 | -0.01 | 82 | 160 | 77 | 74 |
| 229 | 36.327 | 0.160 | 0.092 | 2.61 | 97 | 1.0 | - | 0.90 | -0.02 | 83 | 160 | 77 | 73 |
| 230 | 36.489 | 0.162 | 0.090 | 2.62 | 97 | 1.0 | 99 | 0.89 | -0.01 | 82 | 159 | 77 | 73 |
| 231 | 36.651 | 0.162 | 0.092 | 2.61 | 97 | 1.0 | - | 0.89 | 0.00 | 82 | 158 | 77 | 73 |
| 232 | 36.812 | 0.161 | 0.093 | 2.60 | 97 | 1.0 | - | 0.88 | -0.01 | 82 | 158 | 77 | 73 |
| 233 | 36.978 | 0.166 | 0.092 | 2.61 | 97 | 1.0 | - | 0.86 | -0.02 | 82 | 157 | 77 | 73 |
| 234 | 37.135 | 0.157 | 0.093 | 2.61 | 97 | 1.0 | - | 0.84 | -0.02 | 82 | 156 | 77 | 74 |
| 235 | 37.298 | 0.163 | 0.092 | 2.61 | 97 | 1.0 | - | 0.82 | -0.02 | 82 | 156 | 77 | 73 |
| 236 | 37.464 | 0.166 | 0.093 | 2.61 | 97 | 1.0 | - | 0.83 | 0.01 | 82 | 156 | 77 | 73 |
| 237 | 37.625 | 0.161 | 0.091 | 2.60 | 97 | 1.0 | - | 0.80 | -0.03 | 82 | 154 | 77 | 73 |
| 238 | 37.785 | 0.160 | 0.091 | 2.61 | 97 | 1.0 | - | 0.81 | 0.01 | 82 | 153 | 77 | 73 |
| 239 | 37.952 | 0.167 | 0.092 | 2.62 | 97 | 1.0 | - | 0.79 | -0.02 | 82 | 153 | 77 | 73 |
| 240 | 38.110 | 0.158 | 0.095 | 2.61 | 97 | 1.0 | 99 | 0.78 | -0.01 | 82 | 153 | 77 | 73 |
| 241 | 38.276 | 0.166 | 0.093 | 2.61 | 97 | 1.0 | - | 0.75 | -0.03 | 83 | 152 | 77 | 73 |
| 242 | 38.435 | 0.159 | 0.091 | 2.60 | 97 | 1.0 | - | 0.72 | -0.03 | 82 | 152 | 77 | 74 |
| 243 | 38.599 | 0.164 | 0.092 | 2.60 | 97 | 1.0 | - | 0.73 | 0.01 | 82 | 151 | 77 | 74 |
| 244 | 38.760 | 0.161 | 0.090 | 2.62 | 97 | 1.0 | - | 0.70 | -0.03 | 82 | 150 | 77 | 74 |
| 245 | 38.923 | 0.163 | 0.092 | 2.61 | 97 | 1.0 | - | 0.69 | -0.01 | 82 | 152 | 77 | 73 |
| 246 | 39.085 | 0.162 | 0.094 | 2.62 | 97 | 1.0 | - | 0.67 | -0.02 | 82 | 154 | 77 | 73 |
| 247 | 39.250 | 0.165 | 0.092 | 2.60 | 97 | 1.0 | - | 0.65 | -0.02 | 82 | 155 | 77 | 73 |
| 248 | 39.406 | 0.156 | 0.088 | 2.61 | 97 | 1.0 | - | 0.63 | -0.02 | 82 | 157 | 77 | 73 |
| 249 | 39.574 | 0.168 | 0.095 | 2.60 | 97 | 1.0 | - | 0.60 | -0.03 | 82 | 159 | 77 | 73 |
| 250 | 39.733 | 0.159 | 0.093 | 2.61 | 97 | 1.0 | 98 | 0.60 | 0.00 | 82 | 162 | 77 | 73 |
| 251 | 39.894 | 0.161 | 0.091 | 2.60 | 97 | 1.0 | - | 0.58 | -0.02 | 82 | 163 | 77 | 73 |
| 252 | 40.058 | 0.164 | 0.090 | 2.61 | 97 | 1.0 | - | 0.54 | -0.04 | 82 | 165 | 77 | 73 |
| 253 | 40.220 | 0.162 | 0.095 | 2.60 | 97 | 1.0 | - | 0.54 | 0.00 | 82 | 165 | 77 | 73 |
| 254 | 40.383 | 0.163 | 0.091 | 2.62 | 97 | 1.0 | - | 0.52 | -0.02 | 82 | 165 | 77 | 73 |
| 255 | 40.544 | 0.161 | 0.092 | 2.61 | 97 | 1.0 | - | 0.50 | -0.02 | 82 | 168 | 77 | 73 |

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | |
|--------------------|---------------------------|-------------------|--|----------------------------------|-----------------|----------------------|---------------|------------------|---------------|-----------------------|-------|--------|---------|
| | Gas Meter (ft³) | Sample Rate (cfm) | Dilution Tunnel dP (in H ₂ O) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Scale Reading | Weight Change | Dilution Tunnel | Flue | Filter | Ambient |
| 256 | 40.706 | 0.162 | 0.093 | 2.61 | 97 | 1.0 | - | 0.50 | 0.00 | 83 | 168 | 77 | 74 |
| 257 | 40.872 | 0.166 | 0.095 | 2.60 | 97 | 1.0 | - | 0.46 | -0.04 | 82 | 168 | 77 | 74 |
| 258 | 41.032 | 0.160 | 0.095 | 2.62 | 97 | 1.0 | - | 0.42 | -0.04 | 82 | 169 | 77 | 74 |
| 259 | 41.192 | 0.160 | 0.093 | 2.61 | 97 | 1.0 | - | 0.42 | 0.00 | 82 | 170 | 77 | 74 |
| 260 | 41.359 | 0.167 | 0.094 | 2.61 | 97 | 1.0 | 98 | 0.39 | -0.03 | 82 | 172 | 77 | 74 |
| 261 | 41.519 | 0.160 | 0.088 | 2.60 | 97 | 1.0 | - | 0.36 | -0.03 | 83 | 175 | 77 | 74 |
| 262 | 41.682 | 0.163 | 0.090 | 2.62 | 97 | 1.0 | - | 0.35 | -0.01 | 83 | 176 | 77 | 74 |
| 263 | 41.846 | 0.164 | 0.091 | 2.60 | 97 | 1.0 | - | 0.33 | -0.02 | 83 | 178 | 77 | 74 |
| 264 | 42.003 | 0.157 | 0.093 | 2.61 | 97 | 1.0 | - | 0.29 | -0.04 | 83 | 180 | 77 | 74 |
| 265 | 42.171 | 0.168 | 0.096 | 2.61 | 97 | 1.0 | - | 0.29 | 0.00 | 83 | 180 | 77 | 74 |
| 266 | 42.330 | 0.159 | 0.094 | 2.61 | 97 | 1.0 | - | 0.26 | -0.03 | 83 | 178 | 77 | 74 |
| 267 | 42.494 | 0.164 | 0.094 | 2.60 | 97 | 1.0 | - | 0.24 | -0.02 | 83 | 178 | 77 | 74 |
| 268 | 42.654 | 0.160 | 0.092 | 2.61 | 97 | 1.0 | - | 0.22 | -0.02 | 83 | 179 | 77 | 74 |
| 269 | 42.818 | 0.164 | 0.097 | 2.60 | 97 | 1.0 | - | 0.20 | -0.02 | 83 | 178 | 77 | 73 |
| 270 | 42.978 | 0.160 | 0.094 | 2.62 | 97 | 1.0 | 98 | 0.19 | -0.01 | 83 | 178 | 77 | 74 |
| 271 | 43.145 | 0.167 | 0.092 | 2.61 | 97 | 1.0 | - | 0.16 | -0.03 | 83 | 178 | 77 | 74 |
| 272 | 43.301 | 0.156 | 0.094 | 2.62 | 97 | 1.0 | - | 0.14 | -0.02 | 83 | 178 | 77 | 74 |
| 273 | 43.470 | 0.169 | 0.094 | 2.62 | 97 | 1.0 | - | 0.12 | -0.02 | 83 | 177 | 77 | 74 |
| 274 | 43.629 | 0.159 | 0.091 | 2.62 | 97 | 1.0 | - | 0.09 | -0.03 | 83 | 178 | 77 | 74 |
| 275 | 43.792 | 0.163 | 0.092 | 2.60 | 97 | 1.0 | - | 0.08 | -0.01 | 83 | 176 | 77 | 74 |
| 276 | 43.953 | 0.161 | 0.090 | 2.62 | 97 | 1.0 | - | 0.06 | -0.02 | 83 | 177 | 77 | 74 |
| 277 | 44.116 | 0.163 | 0.094 | 2.61 | 97 | 1.0 | - | 0.05 | -0.01 | 83 | 176 | 77 | 74 |
| 278 | 44.280 | 0.164 | 0.094 | 2.62 | 97 | 1.0 | - | 0.03 | -0.02 | 83 | 175 | 77 | 74 |
| 279 | 44.441 | 0.161 | 0.097 | 2.61 | 97 | 1.0 | - | 0.01 | -0.02 | 83 | 174 | 77 | 74 |
| 280 | 44.600 | 0.159 | 0.095 | 2.61 | 97 | 1.0 | 98 | 0.01 | 0.00 | 83 | 173 | 77 | 74 |
| 281 | 44.769 | 0.169 | 0.093 | 2.61 | 97 | 1.0 | 99 | 0.00 | -0.01 | 83 | 173 | 77 | 74 |
| Avg/Tot | 44.769 | 0.159 | 0.091 | 2.54 | 92.4 | 1.0 | 100 | | | 99.7 | 291.6 | 79.1 | 74.4 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 0 | 0.000 | | 0.01 | 76 | 0.7 | | 76 | -0.055 | 2.66 | 0.293 |
| 1 | 0.105 | 0.105 | 2.45 | 76 | 1.9 | - | 80 | -0.066 | 1.45 | 0.183 |
| 2 | 0.258 | 0.153 | 2.45 | 76 | 1.6 | - | 84 | -0.075 | 3.34 | 0.394 |
| 3 | 0.408 | 0.150 | 2.42 | 76 | 1.7 | - | 89 | -0.084 | 6.29 | 0.390 |
| 4 | 0.563 | 0.155 | 2.44 | 76 | 1.7 | - | 89 | -0.075 | 8.84 | 0.477 |
| 5 | 0.716 | 0.153 | 2.43 | 77 | 1.8 | - | 87 | -0.080 | 9.03 | 0.418 |
| 6 | 0.872 | 0.156 | 2.44 | 77 | 1.7 | - | 86 | -0.079 | 10.44 | 0.246 |
| 7 | 1.023 | 0.151 | 2.44 | 77 | 1.7 | - | 85 | -0.080 | 10.25 | 0.211 |
| 8 | 1.177 | 0.154 | 2.44 | 77 | 2.0 | - | 85 | -0.083 | 11.11 | 0.152 |
| 9 | 1.328 | 0.151 | 2.44 | 77 | 1.7 | - | 85 | -0.083 | 11.79 | 0.161 |
| 10 | 1.482 | 0.154 | 2.44 | 77 | 2.2 | 100 | 85 | -0.082 | 11.45 | 0.134 |
| 11 | 1.635 | 0.153 | 2.44 | 77 | 1.7 | - | 86 | -0.083 | 11.39 | 0.131 |
| 12 | 1.788 | 0.153 | 2.44 | 78 | 2.1 | - | 86 | -0.083 | 11.13 | 0.154 |
| 13 | 1.943 | 0.155 | 2.44 | 78 | 1.9 | - | 86 | -0.084 | 12.18 | 0.183 |
| 14 | 2.091 | 0.148 | 2.44 | 78 | 2.2 | - | 86 | -0.087 | 12.24 | 0.164 |
| 15 | 2.246 | 0.155 | 2.44 | 78 | 2.1 | - | 86 | -0.085 | 11.99 | 0.148 |
| 16 | 2.396 | 0.150 | 2.43 | 79 | 2.1 | - | 86 | -0.085 | 11.99 | 0.144 |
| 17 | 2.556 | 0.160 | 2.44 | 79 | 1.9 | - | 86 | -0.085 | 12.05 | 0.145 |
| 18 | 2.707 | 0.151 | 2.44 | 79 | 1.9 | - | 86 | -0.086 | 12.31 | 0.152 |
| 19 | 2.862 | 0.155 | 2.44 | 80 | 2.1 | - | 86 | -0.086 | 12.47 | 0.161 |
| 20 | 3.013 | 0.151 | 2.44 | 80 | 2.1 | 103 | 86 | -0.088 | 12.67 | 0.195 |
| 21 | 3.168 | 0.155 | 2.45 | 80 | 2.2 | - | 87 | -0.086 | 12.85 | 0.185 |
| 22 | 3.323 | 0.155 | 2.45 | 80 | 2.2 | - | 87 | -0.087 | 12.85 | 0.174 |
| 23 | 3.476 | 0.153 | 2.45 | 81 | 1.7 | - | 87 | -0.087 | 13.09 | 0.213 |
| 24 | 3.631 | 0.155 | 2.44 | 81 | 1.7 | - | 87 | -0.088 | 13.16 | 0.238 |
| 25 | 3.782 | 0.151 | 2.45 | 81 | 1.9 | - | 86 | -0.086 | 13.19 | 0.300 |
| 26 | 3.940 | 0.158 | 2.45 | 82 | 1.8 | - | 86 | -0.085 | 13.09 | 0.277 |
| 27 | 4.091 | 0.151 | 2.45 | 82 | 1.7 | - | 87 | -0.086 | 13.38 | 0.357 |
| 28 | 4.248 | 0.157 | 2.46 | 82 | 2.1 | - | 86 | -0.087 | 13.39 | 0.390 |
| 29 | 4.400 | 0.152 | 2.45 | 83 | 1.6 | - | 86 | -0.087 | 13.25 | 0.329 |
| 30 | 4.555 | 0.155 | 2.45 | 83 | 2.0 | 103 | 86 | -0.084 | 13.14 | 0.368 |
| 31 | 4.711 | 0.156 | 2.45 | 83 | 1.6 | - | 86 | -0.084 | 13.13 | 0.409 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 32 | 4.863 | 0.152 | 2.45 | 84 | 1.8 | - | 86 | -0.084 | 13.15 | 0.467 |
| 33 | 5.018 | 0.155 | 2.45 | 84 | 1.8 | - | 86 | -0.085 | 13.05 | 0.426 |
| 34 | 5.171 | 0.153 | 2.45 | 84 | 1.9 | - | 85 | -0.083 | 12.92 | 0.400 |
| 35 | 5.329 | 0.158 | 2.46 | 85 | 1.8 | - | 85 | -0.084 | 12.67 | 0.403 |
| 36 | 5.485 | 0.156 | 2.46 | 85 | 2.1 | - | 84 | -0.082 | 12.20 | 0.214 |
| 37 | 5.641 | 0.156 | 2.46 | 85 | 2.0 | - | 84 | -0.082 | 11.85 | 0.198 |
| 38 | 5.795 | 0.154 | 2.45 | 86 | 1.6 | - | 84 | -0.081 | 11.58 | 0.159 |
| 39 | 5.952 | 0.157 | 2.46 | 86 | 1.7 | - | 84 | -0.079 | 11.30 | 0.117 |
| 40 | 6.108 | 0.156 | 2.46 | 86 | 1.8 | 104 | 84 | -0.079 | 11.04 | 0.097 |
| 41 | 6.261 | 0.153 | 2.46 | 87 | 1.8 | - | 83 | -0.077 | 10.83 | 0.105 |
| 42 | 6.420 | 0.159 | 2.47 | 87 | 1.8 | - | 83 | -0.079 | 10.74 | 0.127 |
| 43 | 6.574 | 0.154 | 2.47 | 87 | 1.7 | - | 83 | -0.078 | 10.62 | 0.135 |
| 44 | 6.731 | 0.157 | 2.47 | 88 | 2.0 | - | 83 | -0.079 | 10.62 | 0.150 |
| 45 | 6.883 | 0.152 | 2.46 | 88 | 2.0 | - | 82 | -0.078 | 10.50 | 0.181 |
| 46 | 7.041 | 0.158 | 2.48 | 88 | 1.8 | - | 82 | -0.078 | 10.47 | 0.201 |
| 47 | 7.198 | 0.157 | 2.48 | 88 | 1.7 | - | 82 | -0.080 | 10.44 | 0.233 |
| 48 | 7.352 | 0.154 | 2.47 | 89 | 2.0 | - | 82 | -0.078 | 10.62 | 0.213 |
| 49 | 7.514 | 0.162 | 2.48 | 89 | 2.1 | - | 82 | -0.078 | 10.56 | 0.233 |
| 50 | 7.668 | 0.154 | 2.48 | 89 | 1.6 | 103 | 82 | -0.077 | 10.59 | 0.304 |
| 51 | 7.826 | 0.158 | 2.48 | 90 | 1.9 | - | 81 | -0.077 | 10.63 | 0.317 |
| 52 | 7.984 | 0.158 | 2.48 | 90 | 1.8 | - | 81 | -0.075 | 10.67 | 0.251 |
| 53 | 8.139 | 0.155 | 2.48 | 90 | 1.7 | - | 81 | -0.076 | 10.45 | 0.263 |
| 54 | 8.298 | 0.159 | 2.48 | 90 | 1.9 | - | 81 | -0.077 | 10.25 | 0.224 |
| 55 | 8.454 | 0.156 | 2.48 | 91 | 1.9 | - | 81 | -0.076 | 10.18 | 0.211 |
| 56 | 8.612 | 0.158 | 2.48 | 91 | 2.1 | - | 81 | -0.074 | 10.02 | 0.222 |
| 57 | 8.768 | 0.156 | 2.49 | 91 | 1.8 | - | 81 | -0.075 | 10.13 | 0.138 |
| 58 | 8.924 | 0.156 | 2.49 | 91 | 1.8 | - | 80 | -0.076 | 9.84 | 0.189 |
| 59 | 9.082 | 0.158 | 2.50 | 92 | 1.6 | - | 80 | -0.076 | 9.78 | 0.161 |
| 60 | 9.237 | 0.155 | 2.49 | 92 | 1.6 | 103 | 80 | -0.076 | 9.63 | 0.129 |
| 61 | 9.398 | 0.161 | 2.49 | 92 | 1.6 | - | 80 | -0.075 | 9.62 | 0.119 |
| 62 | 9.556 | 0.158 | 2.50 | 92 | 2.1 | - | 80 | -0.073 | 9.53 | 0.114 |
| 63 | 9.714 | 0.158 | 2.50 | 93 | 1.7 | - | 80 | -0.073 | 9.35 | 0.120 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 64 | 9.873 | 0.159 | 2.50 | 93 | 1.9 | - | 80 | -0.072 | 9.16 | 0.175 |
| 65 | 10.028 | 0.155 | 2.49 | 93 | 1.8 | - | 80 | -0.071 | 9.02 | 0.150 |
| 66 | 10.189 | 0.161 | 2.50 | 93 | 1.9 | - | 80 | -0.070 | 8.95 | 0.153 |
| 67 | 10.344 | 0.155 | 2.50 | 93 | 1.8 | - | 79 | -0.070 | 8.54 | 0.148 |
| 68 | 10.503 | 0.159 | 2.50 | 94 | 2.1 | - | 79 | -0.069 | 8.44 | 0.157 |
| 69 | 10.662 | 0.159 | 2.50 | 94 | 1.6 | - | 79 | -0.070 | 8.21 | 0.196 |
| 70 | 10.816 | 0.154 | 2.50 | 94 | 1.7 | 102 | 79 | -0.068 | 7.84 | 0.288 |
| 71 | 10.975 | 0.159 | 2.50 | 94 | 1.6 | - | 79 | -0.069 | 7.50 | 0.498 |
| 72 | 11.132 | 0.157 | 2.50 | 94 | 2.1 | - | 79 | -0.066 | 7.39 | 0.514 |
| 73 | 11.294 | 0.162 | 2.50 | 94 | 1.6 | - | 79 | -0.064 | 7.35 | 0.535 |
| 74 | 11.453 | 0.159 | 2.50 | 95 | 2.1 | - | 79 | -0.066 | 7.31 | 0.577 |
| 75 | 11.610 | 0.157 | 2.50 | 95 | 1.6 | - | 79 | -0.065 | 7.44 | 0.492 |
| 76 | 11.771 | 0.161 | 2.51 | 95 | 1.6 | - | 79 | -0.064 | 7.32 | 0.518 |
| 77 | 11.927 | 0.156 | 2.51 | 95 | 1.6 | - | 79 | -0.063 | 7.48 | 0.505 |
| 78 | 12.087 | 0.160 | 2.50 | 96 | 2.0 | - | 79 | -0.063 | 7.47 | 0.495 |
| 79 | 12.246 | 0.159 | 2.51 | 96 | 1.7 | - | 79 | -0.064 | 7.45 | 0.529 |
| 80 | 12.403 | 0.157 | 2.51 | 96 | 2.1 | 102 | 79 | -0.062 | 7.42 | 0.534 |
| 81 | 12.564 | 0.161 | 2.51 | 96 | 1.9 | - | 79 | -0.063 | 7.49 | 0.499 |
| 82 | 12.721 | 0.157 | 2.52 | 96 | 2.0 | - | 79 | -0.064 | 7.53 | 0.450 |
| 83 | 12.880 | 0.159 | 2.51 | 96 | 1.9 | - | 79 | -0.060 | 7.62 | 0.458 |
| 84 | 13.037 | 0.157 | 2.51 | 96 | 1.6 | - | 79 | -0.063 | 7.56 | 0.437 |
| 85 | 13.195 | 0.158 | 2.51 | 96 | 1.8 | - | 79 | -0.063 | 7.69 | 0.406 |
| 86 | 13.356 | 0.161 | 2.52 | 97 | 1.6 | - | 79 | -0.064 | 7.76 | 0.398 |
| 87 | 13.514 | 0.158 | 2.52 | 97 | 1.7 | - | 79 | -0.064 | 7.75 | 0.371 |
| 88 | 13.676 | 0.162 | 2.52 | 97 | 1.9 | - | 79 | -0.061 | 7.80 | 0.319 |
| 89 | 13.836 | 0.160 | 2.52 | 97 | 1.7 | - | 79 | -0.062 | 7.98 | 0.305 |
| 90 | 13.993 | 0.157 | 2.52 | 97 | 1.6 | 101 | 79 | -0.061 | 7.98 | 0.276 |
| 91 | 14.155 | 0.162 | 2.52 | 97 | 1.6 | - | 79 | -0.064 | 8.13 | 0.271 |
| 92 | 14.311 | 0.156 | 2.51 | 97 | 1.7 | - | 79 | -0.063 | 8.13 | 0.274 |
| 93 | 14.472 | 0.161 | 2.52 | 98 | 1.6 | - | 79 | -0.064 | 8.08 | 0.261 |
| 94 | 14.630 | 0.158 | 2.52 | 98 | 2.1 | - | 79 | -0.064 | 8.14 | 0.224 |
| 95 | 14.787 | 0.157 | 2.52 | 98 | 2.1 | - | 79 | -0.064 | 7.98 | 0.243 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 96 | 14.949 | 0.162 | 2.52 | 98 | 1.7 | - | 79 | -0.064 | 8.18 | 0.186 |
| 97 | 15.108 | 0.159 | 2.52 | 98 | 1.8 | - | 79 | -0.065 | 8.13 | 0.237 |
| 98 | 15.269 | 0.161 | 2.52 | 98 | 1.9 | - | 79 | -0.066 | 7.99 | 0.226 |
| 99 | 15.429 | 0.160 | 2.52 | 98 | 1.9 | - | 79 | -0.061 | 7.63 | 0.263 |
| 100 | 15.587 | 0.158 | 2.52 | 98 | 2.1 | 100 | 79 | -0.061 | 7.05 | 0.230 |
| 101 | 15.749 | 0.162 | 2.53 | 98 | 1.6 | - | 79 | -0.060 | 6.99 | 0.222 |
| 102 | 15.903 | 0.154 | 2.52 | 99 | 2.1 | - | 79 | -0.061 | 6.71 | 0.236 |
| 103 | 16.064 | 0.161 | 2.52 | 99 | 2.0 | - | 79 | -0.061 | 6.55 | 0.334 |
| 104 | 16.227 | 0.163 | 2.52 | 99 | 2.1 | - | 79 | -0.059 | 6.19 | 0.502 |
| 105 | 16.385 | 0.158 | 2.51 | 99 | 2.0 | - | 79 | -0.056 | 5.79 | 0.652 |
| 106 | 16.547 | 0.162 | 2.53 | 99 | 2.0 | - | 79 | -0.055 | 5.43 | 0.789 |
| 107 | 16.706 | 0.159 | 2.52 | 99 | 2.0 | - | 78 | -0.056 | 5.17 | 0.935 |
| 108 | 16.863 | 0.157 | 2.53 | 99 | 2.0 | - | 78 | -0.054 | 5.16 | 0.977 |
| 109 | 17.023 | 0.160 | 2.53 | 99 | 1.7 | - | 78 | -0.051 | 5.01 | 0.995 |
| 110 | 17.184 | 0.161 | 2.53 | 99 | 2.0 | 101 | 78 | -0.050 | 4.95 | 1.001 |
| 111 | 17.342 | 0.158 | 2.52 | 99 | 1.6 | - | 78 | -0.051 | 4.87 | 0.994 |
| 112 | 17.507 | 0.165 | 2.53 | 100 | 2.0 | - | 78 | -0.050 | 4.90 | 1.021 |
| 113 | 17.664 | 0.157 | 2.52 | 99 | 2.1 | - | 78 | -0.050 | 4.82 | 0.990 |
| 114 | 17.827 | 0.163 | 2.53 | 99 | 2.0 | - | 78 | -0.047 | 4.88 | 1.018 |
| 115 | 17.984 | 0.157 | 2.53 | 100 | 1.7 | - | 78 | -0.050 | 4.89 | 1.040 |
| 116 | 18.146 | 0.162 | 2.53 | 100 | 2.0 | - | 78 | -0.049 | 4.92 | 1.110 |
| 117 | 18.307 | 0.161 | 2.53 | 100 | 1.9 | - | 77 | -0.047 | 4.87 | 1.137 |
| 118 | 18.462 | 0.155 | 2.53 | 100 | 2.1 | - | 77 | -0.045 | 4.92 | 1.156 |
| 119 | 18.624 | 0.162 | 2.53 | 100 | 2.0 | - | 77 | -0.047 | 4.84 | 1.139 |
| 120 | 18.787 | 0.163 | 2.53 | 100 | 1.6 | 99 | 77 | -0.044 | 4.96 | 1.202 |
| 121 | 18.946 | 0.159 | 2.53 | 100 | 1.6 | - | 77 | -0.046 | 4.90 | 1.181 |
| 122 | 19.108 | 0.162 | 2.53 | 100 | 1.7 | - | 77 | -0.046 | 4.77 | 1.187 |
| 123 | 19.266 | 0.158 | 2.53 | 100 | 1.8 | - | 77 | -0.045 | 4.93 | 1.232 |
| 124 | 19.425 | 0.159 | 2.53 | 100 | 1.6 | - | 77 | -0.043 | 4.83 | 1.245 |
| 125 | 19.586 | 0.161 | 2.53 | 100 | 1.9 | - | 77 | -0.044 | 4.91 | 1.264 |
| 126 | 19.747 | 0.161 | 2.53 | 100 | 1.6 | - | 77 | -0.042 | 4.88 | 1.284 |
| 127 | 19.910 | 0.163 | 2.54 | 100 | 2.1 | - | 76 | -0.043 | 4.90 | 1.265 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 128 | 20.068 | 0.158 | 2.53 | 100 | 1.6 | - | 77 | -0.042 | 4.86 | 1.264 |
| 129 | 20.230 | 0.162 | 2.54 | 101 | 1.8 | - | 76 | -0.041 | 4.80 | 1.253 |
| 130 | 20.388 | 0.158 | 2.54 | 101 | 1.6 | 99 | 76 | -0.043 | 4.69 | 1.227 |
| 131 | 20.547 | 0.159 | 2.53 | 101 | 2.1 | - | 76 | -0.041 | 4.77 | 1.251 |
| 132 | 20.711 | 0.164 | 2.54 | 101 | 2.0 | - | 76 | -0.038 | 4.75 | 1.278 |
| 133 | 20.872 | 0.161 | 2.53 | 101 | 1.7 | - | 76 | -0.039 | 4.62 | 1.275 |
| 134 | 21.031 | 0.159 | 2.54 | 101 | 2.1 | - | 76 | -0.037 | 4.46 | 1.324 |
| 135 | 21.194 | 0.163 | 2.54 | 101 | 1.9 | - | 76 | -0.038 | 4.50 | 1.381 |
| 136 | 21.349 | 0.155 | 2.54 | 101 | 1.6 | - | 76 | -0.037 | 4.37 | 1.377 |
| 137 | 21.511 | 0.162 | 2.53 | 101 | 1.6 | - | 76 | -0.038 | 4.47 | 1.354 |
| 138 | 21.675 | 0.164 | 2.54 | 101 | 1.6 | - | 76 | -0.035 | 4.45 | 1.399 |
| 139 | 21.834 | 0.159 | 2.54 | 101 | 1.9 | - | 76 | -0.035 | 4.39 | 1.417 |
| 140 | 21.996 | 0.162 | 2.54 | 101 | 1.9 | 99 | 76 | -0.036 | 4.35 | 1.381 |
| 141 | 22.157 | 0.161 | 2.54 | 101 | 2.1 | - | 76 | -0.035 | 4.32 | 1.412 |
| 142 | 22.315 | 0.158 | 2.54 | 101 | 2.0 | - | 76 | -0.033 | 4.25 | 1.390 |
| 143 | 22.476 | 0.161 | 2.54 | 101 | 2.1 | - | 75 | -0.035 | 4.35 | 1.418 |
| 144 | 22.638 | 0.162 | 2.54 | 101 | 1.7 | - | 75 | -0.032 | 4.04 | 1.442 |
| 145 | 22.800 | 0.162 | 2.53 | 101 | 2.1 | - | 75 | -0.032 | 3.92 | 1.402 |
| 146 | 22.961 | 0.161 | 2.54 | 101 | 1.7 | - | 75 | -0.031 | 4.06 | 1.468 |
| 147 | 23.120 | 0.159 | 2.54 | 101 | 1.6 | - | 75 | -0.035 | 4.04 | 1.464 |
| 148 | 23.281 | 0.161 | 2.54 | 101 | 1.7 | - | 75 | -0.032 | 4.09 | 1.510 |
| 149 | 23.438 | 0.157 | 2.53 | 101 | 1.6 | - | 75 | -0.031 | 4.07 | 1.509 |
| 150 | 23.603 | 0.165 | 2.54 | 101 | 1.8 | 98 | 75 | -0.032 | 4.01 | 1.510 |
| 151 | 23.765 | 0.162 | 2.54 | 101 | 2.0 | - | 75 | -0.031 | 4.04 | 1.507 |
| 152 | 23.924 | 0.159 | 2.54 | 101 | 1.6 | - | 75 | -0.031 | 3.94 | 1.570 |
| 153 | 24.085 | 0.161 | 2.54 | 101 | 1.7 | - | 75 | -0.033 | 3.97 | 1.621 |
| 154 | 24.244 | 0.159 | 2.53 | 101 | 1.9 | - | 75 | -0.033 | 3.78 | 1.568 |
| 155 | 24.403 | 0.159 | 2.54 | 101 | 1.8 | - | 75 | -0.033 | 3.80 | 1.526 |
| 156 | 24.570 | 0.167 | 2.54 | 102 | 2.0 | - | 75 | -0.031 | 3.85 | 1.573 |
| 157 | 24.728 | 0.158 | 2.54 | 102 | 2.1 | - | 75 | -0.032 | 3.88 | 1.577 |
| 158 | 24.891 | 0.163 | 2.54 | 102 | 2.1 | - | 75 | -0.032 | 3.87 | 1.564 |
| 159 | 25.049 | 0.158 | 2.55 | 101 | 1.7 | - | 75 | -0.030 | 3.89 | 1.592 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 160 | 25.208 | 0.159 | 2.54 | 102 | 1.9 | 99 | 75 | -0.031 | 3.83 | 1.545 |
| 161 | 25.373 | 0.165 | 2.54 | 102 | 1.9 | - | 75 | -0.029 | 3.90 | 1.582 |
| 162 | 25.535 | 0.162 | 2.54 | 102 | 2.1 | - | 75 | -0.030 | 3.92 | 1.595 |
| 163 | 25.693 | 0.158 | 2.54 | 102 | 1.6 | - | 75 | -0.030 | 3.83 | 1.531 |
| 164 | 25.858 | 0.165 | 2.54 | 102 | 1.7 | - | 74 | -0.027 | 3.82 | 1.516 |
| 165 | 26.013 | 0.155 | 2.54 | 102 | 1.6 | - | 74 | -0.033 | 3.79 | 1.505 |
| 166 | 26.175 | 0.162 | 2.54 | 102 | 2.0 | - | 74 | -0.027 | 3.79 | 1.524 |
| 167 | 26.339 | 0.164 | 2.54 | 102 | 1.8 | - | 74 | -0.027 | 3.81 | 1.511 |
| 168 | 26.499 | 0.160 | 2.54 | 102 | 1.9 | - | 74 | -0.030 | 3.82 | 1.502 |
| 169 | 26.661 | 0.162 | 2.54 | 102 | 2.1 | - | 74 | -0.029 | 3.88 | 1.550 |
| 170 | 26.819 | 0.158 | 2.54 | 102 | 1.7 | 99 | 74 | -0.028 | 3.82 | 1.521 |
| 171 | 26.981 | 0.162 | 2.54 | 102 | 1.8 | - | 74 | -0.029 | 3.84 | 1.523 |
| 172 | 27.145 | 0.164 | 2.53 | 102 | 1.9 | - | 74 | -0.027 | 3.81 | 1.492 |
| 173 | 27.303 | 0.158 | 2.54 | 102 | 1.7 | - | 74 | -0.028 | 3.82 | 1.535 |
| 174 | 27.463 | 0.160 | 2.54 | 102 | 1.6 | - | 74 | -0.025 | 3.82 | 1.536 |
| 175 | 27.627 | 0.164 | 2.55 | 102 | 1.8 | - | 74 | -0.028 | 3.84 | 1.554 |
| 176 | 27.787 | 0.160 | 2.54 | 102 | 2.0 | - | 74 | -0.026 | 3.79 | 1.505 |
| 177 | 27.949 | 0.162 | 2.54 | 102 | 1.7 | - | 74 | -0.028 | 3.85 | 1.540 |
| 178 | 28.107 | 0.158 | 2.54 | 102 | 1.6 | - | 74 | -0.029 | 3.84 | 1.512 |
| 179 | 28.269 | 0.162 | 2.53 | 102 | 1.7 | - | 74 | -0.027 | 3.88 | 1.499 |
| 180 | 28.433 | 0.164 | 2.53 | 102 | 1.9 | 99 | 74 | -0.029 | 3.91 | 1.496 |
| 181 | 28.592 | 0.159 | 2.54 | 102 | 2.0 | - | 74 | -0.027 | 3.89 | 1.471 |
| 182 | 28.751 | 0.159 | 2.54 | 102 | 1.7 | - | 74 | -0.028 | 3.89 | 1.463 |
| 183 | 28.915 | 0.164 | 2.54 | 102 | 2.1 | - | 74 | -0.028 | 3.78 | 1.395 |
| 184 | 29.075 | 0.160 | 2.53 | 102 | 2.0 | - | 74 | -0.026 | 3.81 | 1.441 |
| 185 | 29.235 | 0.160 | 2.54 | 102 | 2.1 | - | 74 | -0.027 | 3.87 | 1.429 |
| 186 | 29.398 | 0.163 | 2.53 | 102 | 1.9 | - | 74 | -0.025 | 3.92 | 1.534 |
| 187 | 29.558 | 0.160 | 2.54 | 102 | 1.7 | - | 74 | -0.025 | 3.92 | 1.535 |
| 188 | 29.721 | 0.163 | 2.54 | 102 | 1.8 | - | 74 | -0.024 | 3.82 | 1.519 |
| 189 | 29.877 | 0.156 | 2.54 | 102 | 2.1 | - | 74 | -0.026 | 3.85 | 1.532 |
| 190 | 30.042 | 0.165 | 2.54 | 102 | 1.6 | 98 | 74 | -0.026 | 3.89 | 1.534 |
| 191 | 30.204 | 0.162 | 2.55 | 102 | 2.1 | - | 74 | -0.027 | 3.83 | 1.503 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 192 | 30.363 | 0.159 | 2.54 | 102 | 1.6 | - | 74 | -0.027 | 3.76 | 1.412 |
| 193 | 30.523 | 0.160 | 2.54 | 102 | 1.6 | - | 74 | -0.026 | 4.01 | 1.566 |
| 194 | 30.687 | 0.164 | 2.54 | 102 | 1.6 | - | 74 | -0.028 | 4.18 | 1.587 |
| 195 | 30.846 | 0.159 | 2.54 | 102 | 2.1 | - | 74 | -0.027 | 4.26 | 1.603 |
| 196 | 31.010 | 0.164 | 2.54 | 102 | 2.1 | - | 74 | -0.026 | 4.28 | 1.596 |
| 197 | 31.165 | 0.155 | 2.54 | 102 | 2.1 | - | 74 | -0.026 | 4.28 | 1.534 |
| 198 | 31.331 | 0.166 | 2.54 | 102 | 2.0 | - | 74 | -0.028 | 4.36 | 1.574 |
| 199 | 31.492 | 0.161 | 2.54 | 102 | 1.6 | - | 74 | -0.028 | 4.37 | 1.541 |
| 200 | 31.649 | 0.157 | 2.54 | 102 | 1.9 | 98 | 74 | -0.028 | 4.27 | 1.629 |
| 201 | 31.814 | 0.165 | 2.54 | 102 | 1.6 | - | 74 | -0.026 | 4.16 | 1.613 |
| 202 | 31.975 | 0.161 | 2.54 | 102 | 1.9 | - | 74 | -0.025 | 4.21 | 1.650 |
| 203 | 32.135 | 0.160 | 2.54 | 102 | 2.1 | - | 74 | -0.024 | 4.06 | 1.563 |
| 204 | 32.296 | 0.161 | 2.54 | 102 | 1.6 | - | 74 | -0.026 | 4.09 | 1.545 |
| 205 | 32.457 | 0.161 | 2.54 | 102 | 1.9 | - | 74 | -0.027 | 4.05 | 1.561 |
| 206 | 32.620 | 0.163 | 2.54 | 102 | 1.8 | - | 74 | -0.028 | 4.10 | 1.576 |
| 207 | 32.781 | 0.161 | 2.54 | 102 | 2.0 | - | 74 | -0.025 | 4.16 | 1.577 |
| 208 | 32.938 | 0.157 | 2.54 | 102 | 1.8 | - | 74 | -0.026 | 4.13 | 1.551 |
| 209 | 33.103 | 0.165 | 2.54 | 102 | 2.0 | - | 74 | -0.027 | 4.18 | 1.569 |
| 210 | 33.265 | 0.162 | 2.54 | 102 | 1.9 | 99 | 74 | -0.026 | 4.10 | 1.509 |
| 211 | 33.424 | 0.159 | 2.54 | 102 | 2.1 | - | 74 | -0.025 | 4.20 | 1.518 |
| 212 | 33.585 | 0.161 | 2.54 | 102 | 1.8 | - | 74 | -0.027 | 4.26 | 1.540 |
| 213 | 33.746 | 0.161 | 2.55 | 102 | 1.6 | - | 74 | -0.025 | 4.17 | 1.513 |
| 214 | 33.909 | 0.163 | 2.54 | 102 | 1.6 | - | 74 | -0.024 | 4.16 | 1.509 |
| 215 | 34.071 | 0.162 | 2.54 | 102 | 1.7 | - | 74 | -0.025 | 4.13 | 1.499 |
| 216 | 34.228 | 0.157 | 2.54 | 102 | 2.0 | - | 74 | -0.025 | 4.16 | 1.510 |
| 217 | 34.392 | 0.164 | 2.54 | 102 | 2.1 | - | 74 | -0.027 | 4.00 | 1.487 |
| 218 | 34.554 | 0.162 | 2.54 | 102 | 1.9 | - | 74 | -0.027 | 3.98 | 1.534 |
| 219 | 34.713 | 0.159 | 2.54 | 102 | 1.6 | - | 74 | -0.028 | 4.02 | 1.559 |
| 220 | 34.874 | 0.161 | 2.53 | 102 | 2.0 | 98 | 74 | -0.028 | 4.04 | 1.581 |
| 221 | 35.036 | 0.162 | 2.55 | 102 | 1.6 | - | 74 | -0.026 | 3.98 | 1.575 |
| 222 | 35.198 | 0.162 | 2.54 | 102 | 2.0 | - | 74 | -0.026 | 3.97 | 1.547 |
| 223 | 35.357 | 0.159 | 2.55 | 102 | 1.7 | - | 74 | -0.025 | 4.09 | 1.614 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 224 | 35.519 | 0.162 | 2.54 | 102 | 2.1 | - | 74 | -0.026 | 4.12 | 1.610 |
| 225 | 35.681 | 0.162 | 2.54 | 102 | 2.0 | - | 74 | -0.026 | 4.04 | 1.684 |
| 226 | 35.843 | 0.162 | 2.54 | 102 | 1.8 | - | 74 | -0.026 | 3.93 | 1.705 |
| 227 | 36.000 | 0.157 | 2.55 | 102 | 2.0 | - | 74 | -0.027 | 3.87 | 1.713 |
| 228 | 36.166 | 0.166 | 2.54 | 102 | 1.8 | - | 74 | -0.026 | 3.83 | 1.687 |
| 229 | 36.325 | 0.159 | 2.55 | 102 | 2.0 | - | 74 | -0.025 | 3.96 | 1.714 |
| 230 | 36.487 | 0.162 | 2.54 | 102 | 2.1 | 99 | 74 | -0.024 | 3.88 | 1.713 |
| 231 | 36.647 | 0.160 | 2.54 | 102 | 2.0 | - | 74 | -0.027 | 3.74 | 1.645 |
| 232 | 36.809 | 0.162 | 2.54 | 102 | 1.6 | - | 74 | -0.028 | 3.78 | 1.652 |
| 233 | 36.971 | 0.162 | 2.54 | 102 | 1.6 | - | 74 | -0.025 | 3.81 | 1.679 |
| 234 | 37.130 | 0.159 | 2.54 | 102 | 2.0 | - | 74 | -0.024 | 3.85 | 1.675 |
| 235 | 37.290 | 0.160 | 2.55 | 102 | 2.1 | - | 74 | -0.026 | 3.79 | 1.648 |
| 236 | 37.456 | 0.166 | 2.54 | 102 | 1.6 | - | 74 | -0.023 | 3.81 | 1.645 |
| 237 | 37.614 | 0.158 | 2.54 | 102 | 2.1 | - | 74 | -0.024 | 3.74 | 1.612 |
| 238 | 37.774 | 0.160 | 2.54 | 102 | 1.6 | - | 74 | -0.023 | 3.82 | 1.657 |
| 239 | 37.938 | 0.164 | 2.54 | 102 | 1.8 | - | 74 | -0.025 | 3.80 | 1.659 |
| 240 | 38.099 | 0.161 | 2.54 | 102 | 1.7 | 98 | 74 | -0.025 | 3.80 | 1.645 |
| 241 | 38.260 | 0.161 | 2.54 | 102 | 2.0 | - | 74 | -0.024 | 3.69 | 1.633 |
| 242 | 38.423 | 0.163 | 2.54 | 102 | 2.1 | - | 74 | -0.024 | 3.67 | 1.856 |
| 243 | 38.581 | 0.158 | 2.54 | 102 | 1.7 | - | 74 | -0.023 | 4.07 | 1.731 |
| 244 | 38.743 | 0.162 | 2.54 | 102 | 2.0 | - | 74 | -0.025 | 4.40 | 1.793 |
| 245 | 38.904 | 0.161 | 2.54 | 103 | 1.9 | - | 74 | -0.025 | 4.40 | 1.848 |
| 246 | 39.067 | 0.163 | 2.54 | 102 | 1.9 | - | 74 | -0.023 | 4.75 | 1.653 |
| 247 | 39.228 | 0.161 | 2.54 | 102 | 1.6 | - | 74 | -0.024 | 4.81 | 1.588 |
| 248 | 39.385 | 0.157 | 2.53 | 102 | 1.8 | - | 74 | -0.027 | 4.92 | 1.622 |
| 249 | 39.550 | 0.165 | 2.54 | 102 | 1.7 | - | 74 | -0.027 | 5.04 | 1.655 |
| 250 | 39.712 | 0.162 | 2.54 | 103 | 1.6 | 97 | 74 | -0.025 | 5.11 | 1.591 |
| 251 | 39.868 | 0.156 | 2.55 | 102 | 1.6 | - | 74 | -0.026 | 4.93 | 1.852 |
| 252 | 40.032 | 0.164 | 2.53 | 103 | 1.8 | - | 74 | -0.030 | 4.89 | 1.791 |
| 253 | 40.193 | 0.161 | 2.54 | 102 | 1.8 | - | 74 | -0.024 | 5.00 | 1.788 |
| 254 | 40.356 | 0.163 | 2.54 | 102 | 1.8 | - | 74 | -0.029 | 4.95 | 1.757 |
| 255 | 40.515 | 0.159 | 2.54 | 102 | 2.0 | - | 74 | -0.028 | 4.99 | 1.778 |

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Elapsed Time (min) | Particulate Sampling Data | | | | | | | Flue Gas Data | | |
|--------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|----------------------------------|---------------------|--------|
| | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) | Flue Draft (in H ₂ O) | CO ₂ (%) | CO (%) |
| 256 | 40.678 | 0.163 | 2.54 | 102 | 2.0 | - | 74 | -0.025 | 5.02 | 1.746 |
| 257 | 40.839 | 0.161 | 2.54 | 102 | 1.9 | - | 74 | -0.027 | 5.10 | 1.751 |
| 258 | 41.002 | 0.163 | 2.54 | 103 | 2.1 | - | 74 | -0.029 | 5.09 | 1.785 |
| 259 | 41.158 | 0.156 | 2.54 | 102 | 1.8 | - | 74 | -0.029 | 5.08 | 1.785 |
| 260 | 41.325 | 0.167 | 2.54 | 103 | 1.6 | 97 | 74 | -0.027 | 5.09 | 1.772 |
| 261 | 41.483 | 0.158 | 2.54 | 103 | 1.6 | - | 74 | -0.031 | 5.30 | 1.686 |
| 262 | 41.646 | 0.163 | 2.54 | 103 | 2.1 | - | 74 | -0.029 | 5.27 | 1.794 |
| 263 | 41.807 | 0.161 | 2.54 | 103 | 1.7 | - | 74 | -0.029 | 5.42 | 1.660 |
| 264 | 41.964 | 0.157 | 2.54 | 103 | 2.0 | - | 74 | -0.030 | 5.36 | 1.624 |
| 265 | 42.129 | 0.165 | 2.54 | 103 | 1.6 | - | 74 | -0.029 | 5.27 | 1.733 |
| 266 | 42.291 | 0.162 | 2.54 | 103 | 1.6 | - | 74 | -0.029 | 5.21 | 1.752 |
| 267 | 42.450 | 0.159 | 2.54 | 103 | 2.1 | - | 74 | -0.029 | 5.19 | 1.756 |
| 268 | 42.611 | 0.161 | 2.54 | 103 | 2.1 | - | 74 | -0.029 | 5.09 | 1.684 |
| 269 | 42.772 | 0.161 | 2.54 | 103 | 1.6 | - | 74 | -0.031 | 5.16 | 1.686 |
| 270 | 42.932 | 0.160 | 2.54 | 103 | 1.6 | 97 | 74 | -0.029 | 5.11 | 1.659 |
| 271 | 43.096 | 0.164 | 2.54 | 103 | 2.0 | - | 74 | -0.029 | 5.05 | 1.633 |
| 272 | 43.254 | 0.158 | 2.54 | 103 | 1.8 | - | 74 | -0.031 | 5.10 | 1.657 |
| 273 | 43.418 | 0.164 | 2.54 | 103 | 1.9 | - | 74 | -0.029 | 4.95 | 1.583 |
| 274 | 43.581 | 0.163 | 2.54 | 103 | 1.7 | - | 74 | -0.030 | 5.02 | 1.522 |
| 275 | 43.739 | 0.158 | 2.54 | 103 | 2.1 | - | 74 | -0.029 | 5.14 | 1.490 |
| 276 | 43.901 | 0.162 | 2.54 | 103 | 1.6 | - | 74 | -0.031 | 5.09 | 1.494 |
| 277 | 44.062 | 0.161 | 2.54 | 103 | 1.6 | - | 74 | -0.031 | 5.07 | 1.554 |
| 278 | 44.224 | 0.162 | 2.54 | 103 | 2.1 | - | 74 | -0.029 | 4.95 | 1.497 |
| 279 | 44.383 | 0.159 | 2.54 | 103 | 1.6 | - | 74 | -0.029 | 5.00 | 1.563 |
| 280 | 44.544 | 0.161 | 2.54 | 103 | 1.6 | 97 | 74 | -0.028 | 4.97 | 1.513 |
| 281 | 44.708 | 0.164 | 2.54 | 103 | 1.8 | 98 | 74 | -0.030 | 5.04 | 1.564 |
| Avg/Tot | 44.708 | 0.159 | 2.51 | 96.8 | 1.8 | 100 | 77.4 | -0.047 | 6.34 | 1.045 |

BOX C TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Particulate Sampling Data | | | | | | | |
|---------------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|
| Elapsed Time (min) | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) |
| 0 | -0.002 | | -0.01 | 79 | 0.1 | | 75 |
| 1 | 0.116 | 0.118 | 0.98 | 78 | 1.8 | - | 76 |
| 2 | 0.260 | 0.144 | 0.99 | 78 | 1.7 | - | 77 |
| 3 | 0.404 | 0.144 | 0.99 | 78 | 1.7 | - | 79 |
| 4 | 0.547 | 0.143 | 0.99 | 78 | 1.8 | - | 79 |
| 5 | 0.694 | 0.147 | 1.00 | 78 | 1.8 | - | 80 |
| 6 | 0.838 | 0.144 | 1.00 | 78 | 1.8 | - | 80 |
| 7 | 0.982 | 0.144 | 1.00 | 78 | 1.7 | - | 81 |
| 8 | 1.129 | 0.147 | 1.01 | 78 | 1.8 | - | 81 |
| 9 | 1.274 | 0.145 | 1.01 | 79 | 1.7 | - | 81 |
| 10 | 1.419 | 0.145 | 1.01 | 79 | 1.7 | 100 | 81 |
| 11 | 1.565 | 0.146 | 1.01 | 79 | 1.9 | - | 82 |
| 12 | 1.710 | 0.145 | 1.01 | 79 | 1.8 | - | 82 |
| 13 | 1.855 | 0.145 | 1.00 | 80 | 1.9 | - | 82 |
| 14 | 1.999 | 0.144 | 1.02 | 80 | 1.9 | - | 82 |
| 15 | 2.146 | 0.147 | 1.02 | 80 | 1.7 | - | 83 |
| 16 | 2.291 | 0.145 | 1.02 | 80 | 1.7 | - | 83 |
| 17 | 2.439 | 0.148 | 1.02 | 81 | 1.7 | - | 83 |
| 18 | 2.585 | 0.146 | 1.02 | 81 | 1.7 | - | 83 |
| 19 | 2.731 | 0.146 | 1.01 | 81 | 1.9 | - | 83 |
| 20 | 2.877 | 0.146 | 1.01 | 81 | 1.8 | 103 | 83 |
| 21 | 3.023 | 0.146 | 1.01 | 81 | 1.8 | - | 83 |
| 22 | 3.169 | 0.146 | 1.02 | 82 | 1.9 | - | 83 |
| 23 | 3.317 | 0.148 | 1.02 | 82 | 1.9 | - | 83 |
| 24 | 3.464 | 0.147 | 1.03 | 82 | 1.7 | - | 83 |
| 25 | 3.611 | 0.147 | 1.03 | 82 | 1.9 | - | 83 |
| 26 | 3.758 | 0.147 | 1.03 | 83 | 1.9 | - | 83 |
| 27 | 3.906 | 0.148 | 1.03 | 83 | 1.9 | - | 83 |
| 28 | 4.053 | 0.147 | 1.03 | 84 | 1.7 | - | 83 |
| 29 | 4.200 | 0.147 | 1.03 | 84 | 1.9 | - | 83 |
| 30 | 4.348 | 0.148 | 1.03 | 84 | 1.9 | 104 | 83 |
| 31 | 4.496 | 0.148 | 1.03 | 84 | 1.8 | - | 83 |

BOX C TEST DATA - ASTM E2780 / ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| Particulate Sampling Data | | | | | | | |
|---------------------------|------------------------------|-------------------|----------------------------------|-----------------|----------------------|---------------|-------------|
| Elapsed Time (min) | Gas Meter (ft ³) | Sample Rate (cfm) | Orifice dH (in H ₂ O) | Meter Temp (°F) | Meter Vacuum (in Hg) | Pro. Rate (%) | Filter (°F) |
| 32 | 4.641 | 0.145 | 1.02 | 84 | 1.9 | - | 83 |
| 33 | 4.789 | 0.148 | 1.02 | 84 | 1.7 | - | 83 |
| 34 | 4.937 | 0.148 | 1.02 | 85 | 1.9 | - | 83 |
| 35 | 5.085 | 0.148 | 1.02 | 85 | 1.9 | - | 83 |
| 36 | 5.236 | 0.151 | 1.02 | 85 | 1.9 | - | 83 |
| 37 | 5.385 | 0.149 | 1.03 | 86 | 1.8 | - | 84 |
| 38 | 5.533 | 0.148 | 1.03 | 86 | 1.9 | - | 84 |
| 39 | 5.682 | 0.149 | 1.03 | 86 | 1.9 | - | 84 |
| 40 | 5.831 | 0.149 | 1.03 | 87 | 1.7 | 104 | 84 |
| 41 | 5.980 | 0.149 | 1.03 | 87 | 1.9 | - | 84 |
| 42 | 6.129 | 0.149 | 1.03 | 87 | 1.9 | - | 84 |
| 43 | 6.278 | 0.149 | 1.03 | 88 | 1.7 | - | 84 |
| 44 | 6.428 | 0.150 | 1.03 | 87 | 1.7 | - | 84 |
| 45 | 6.575 | 0.147 | 1.04 | 88 | 1.8 | - | 84 |
| 46 | 6.725 | 0.150 | 1.04 | 88 | 1.8 | - | 84 |
| 47 | 6.875 | 0.150 | 1.04 | 89 | 1.9 | - | 84 |
| 48 | 7.025 | 0.150 | 1.04 | 88 | 1.7 | - | 84 |
| 49 | 7.179 | 0.154 | 1.04 | 89 | 1.8 | - | 84 |
| 50 | 7.329 | 0.150 | 1.05 | 89 | 1.8 | 105 | 84 |
| 51 | 7.480 | 0.151 | 1.05 | 89 | 1.8 | - | 84 |
| 52 | 7.631 | 0.151 | 1.06 | 89 | 1.9 | - | 84 |
| 53 | 7.782 | 0.151 | 1.06 | 89 | 1.8 | - | 84 |
| 54 | 7.933 | 0.151 | 1.06 | 90 | 1.7 | - | 84 |
| 55 | 8.085 | 0.152 | 1.06 | 90 | 1.8 | - | 84 |
| 56 | 8.235 | 0.150 | 1.07 | 90 | 1.9 | - | 84 |
| 57 | 8.386 | 0.151 | 1.06 | 90 | 1.9 | - | 84 |
| 58 | 8.535 | 0.149 | 1.06 | 90 | 1.9 | - | 84 |
| 59 | 8.688 | 0.153 | 1.06 | 90 | 1.7 | - | 83 |
| 60 | 8.840 | 0.152 | 1.06 | 90 | 1.8 | 105 | 83 |
| Avg/Tot | 8.842 | 0.147 | 1.01 | 83.8 | 1.8 | 104 | 82.6 |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

Stove ΔT: 199

| Temperature Data (°F) | | | | | | | |
|-----------------------|---------|----------|---------|--------|-----------|-----------------------|---------------|
| Elapsed Time (min) | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 0 | 510 | 536 | 352 | 404 | 405 | 441.4 | N/A |
| 1 | 507 | 535 | 350 | 383 | 410 | 437.0 | N/A |
| 2 | 503 | 533 | 348 | 373 | 412 | 433.9 | N/A |
| 3 | 499 | 531 | 347 | 389 | 413 | 435.9 | N/A |
| 4 | 495 | 529 | 345 | 419 | 413 | 440.2 | N/A |
| 5 | 490 | 525 | 342 | 452 | 414 | 444.7 | N/A |
| 6 | 486 | 521 | 339 | 488 | 415 | 449.6 | N/A |
| 7 | 480 | 516 | 336 | 518 | 416 | 453.0 | N/A |
| 8 | 476 | 511 | 332 | 546 | 416 | 456.2 | N/A |
| 9 | 474 | 506 | 329 | 575 | 416 | 459.8 | N/A |
| 10 | 472 | 501 | 325 | 600 | 416 | 462.6 | N/A |
| 11 | 469 | 496 | 321 | 620 | 416 | 464.1 | N/A |
| 12 | 466 | 491 | 318 | 636 | 416 | 465.3 | N/A |
| 13 | 463 | 487 | 315 | 655 | 415 | 466.9 | N/A |
| 14 | 458 | 483 | 312 | 676 | 415 | 468.8 | N/A |
| 15 | 453 | 481 | 310 | 693 | 414 | 470.1 | N/A |
| 16 | 449 | 478 | 307 | 705 | 414 | 470.7 | N/A |
| 17 | 446 | 476 | 306 | 715 | 414 | 471.6 | N/A |
| 18 | 444 | 475 | 304 | 725 | 414 | 472.5 | N/A |
| 19 | 441 | 475 | 303 | 734 | 413 | 473.2 | N/A |
| 20 | 439 | 474 | 302 | 742 | 413 | 474.0 | N/A |
| 21 | 437 | 474 | 301 | 751 | 412 | 475.1 | N/A |
| 22 | 436 | 474 | 300 | 759 | 412 | 476.2 | N/A |
| 23 | 435 | 475 | 299 | 766 | 411 | 477.4 | N/A |
| 24 | 435 | 475 | 299 | 774 | 411 | 478.8 | N/A |
| 25 | 434 | 477 | 300 | 778 | 411 | 479.8 | N/A |
| 26 | 434 | 478 | 299 | 782 | 411 | 480.7 | N/A |
| 27 | 434 | 480 | 300 | 786 | 410 | 481.9 | N/A |
| 28 | 435 | 481 | 301 | 791 | 410 | 483.5 | N/A |
| 29 | 435 | 483 | 301 | 796 | 410 | 485.1 | N/A |
| 30 | 436 | 485 | 303 | 799 | 410 | 486.5 | N/A |
| 31 | 437 | 488 | 304 | 799 | 409 | 487.3 | N/A |
| 32 | 439 | 490 | 304 | 800 | 408 | 488.2 | N/A |
| 33 | 440 | 492 | 305 | 799 | 408 | 488.9 | N/A |
| 34 | 441 | 494 | 306 | 797 | 408 | 489.4 | N/A |
| 35 | 444 | 497 | 307 | 794 | 407 | 489.8 | N/A |
| 36 | 446 | 499 | 309 | 788 | 406 | 489.5 | N/A |
| 37 | 448 | 501 | 310 | 780 | 406 | 488.9 | N/A |
| 38 | 450 | 504 | 311 | 770 | 406 | 487.8 | N/A |
| 39 | 452 | 506 | 312 | 758 | 405 | 486.4 | N/A |
| 40 | 454 | 508 | 312 | 745 | 404 | 484.8 | N/A |
| 41 | 457 | 511 | 313 | 733 | 403 | 483.2 | N/A |
| 42 | 459 | 513 | 313 | 721 | 403 | 481.8 | N/A |
| 43 | 461 | 515 | 314 | 711 | 402 | 480.5 | N/A |
| 44 | 464 | 516 | 314 | 702 | 401 | 479.3 | N/A |
| 45 | 466 | 518 | 314 | 693 | 400 | 478.1 | N/A |
| 46 | 469 | 519 | 314 | 684 | 399 | 476.8 | N/A |
| 47 | 471 | 520 | 315 | 677 | 397 | 476.1 | N/A |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
Model: Pioneer II
Run #: 2

Job #: 24-321
Tracking #: 213
Technician: AK
Date: 8/21/2024

Stove ΔT: **199**

| Elapsed Time (min) | Temperature Data (°F) | | | | | | |
|--------------------|-----------------------|----------|---------|--------|-----------|-----------------------|---------------|
| | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 48 | 473 | 521 | 316 | 670 | 396 | 475.2 | N/A |
| 49 | 474 | 522 | 316 | 666 | 395 | 474.8 | N/A |
| 50 | 476 | 523 | 317 | 662 | 394 | 474.5 | N/A |
| 51 | 477 | 524 | 318 | 659 | 394 | 474.3 | N/A |
| 52 | 479 | 525 | 319 | 656 | 392 | 474.2 | N/A |
| 53 | 480 | 526 | 320 | 653 | 391 | 474.0 | N/A |
| 54 | 480 | 527 | 321 | 649 | 390 | 473.5 | N/A |
| 55 | 482 | 528 | 322 | 645 | 389 | 473.1 | N/A |
| 56 | 483 | 529 | 323 | 638 | 388 | 472.2 | N/A |
| 57 | 484 | 529 | 325 | 633 | 387 | 471.6 | N/A |
| 58 | 485 | 530 | 325 | 629 | 386 | 470.8 | N/A |
| 59 | 486 | 530 | 327 | 623 | 385 | 470.3 | N/A |
| 60 | 488 | 530 | 329 | 617 | 384 | 469.7 | N/A |
| 61 | 490 | 531 | 330 | 613 | 384 | 469.3 | N/A |
| 62 | 492 | 531 | 331 | 608 | 383 | 469.0 | N/A |
| 63 | 494 | 531 | 332 | 603 | 382 | 468.4 | N/A |
| 64 | 495 | 531 | 334 | 598 | 381 | 467.8 | N/A |
| 65 | 496 | 531 | 334 | 592 | 381 | 466.9 | N/A |
| 66 | 498 | 532 | 335 | 586 | 380 | 466.0 | N/A |
| 67 | 498 | 531 | 335 | 580 | 380 | 464.8 | N/A |
| 68 | 498 | 531 | 336 | 573 | 379 | 463.5 | N/A |
| 69 | 499 | 531 | 337 | 566 | 379 | 462.1 | N/A |
| 70 | 499 | 530 | 337 | 559 | 378 | 460.4 | N/A |
| 71 | 498 | 530 | 337 | 551 | 378 | 458.4 | N/A |
| 72 | 497 | 529 | 337 | 542 | 377 | 456.4 | N/A |
| 73 | 496 | 528 | 337 | 533 | 376 | 454.2 | N/A |
| 74 | 495 | 527 | 337 | 525 | 376 | 452.0 | N/A |
| 75 | 494 | 526 | 337 | 517 | 376 | 449.8 | N/A |
| 76 | 492 | 525 | 336 | 509 | 376 | 447.6 | N/A |
| 77 | 490 | 524 | 336 | 503 | 375 | 445.7 | N/A |
| 78 | 488 | 524 | 335 | 498 | 375 | 443.8 | N/A |
| 79 | 486 | 523 | 334 | 493 | 375 | 442.0 | N/A |
| 80 | 484 | 522 | 334 | 488 | 374 | 440.4 | N/A |
| 81 | 482 | 521 | 334 | 484 | 374 | 438.9 | N/A |
| 82 | 481 | 520 | 334 | 480 | 373 | 437.5 | N/A |
| 83 | 479 | 519 | 334 | 476 | 373 | 436.5 | N/A |
| 84 | 477 | 519 | 334 | 473 | 373 | 435.3 | N/A |
| 85 | 476 | 518 | 335 | 471 | 373 | 434.5 | N/A |
| 86 | 474 | 518 | 335 | 468 | 373 | 433.6 | N/A |
| 87 | 473 | 518 | 336 | 467 | 373 | 433.1 | N/A |
| 88 | 471 | 517 | 337 | 466 | 373 | 432.7 | N/A |
| 89 | 470 | 517 | 337 | 465 | 373 | 432.4 | N/A |
| 90 | 469 | 516 | 338 | 466 | 373 | 432.4 | N/A |
| 91 | 468 | 516 | 339 | 467 | 373 | 432.4 | N/A |
| 92 | 467 | 516 | 340 | 467 | 373 | 432.5 | N/A |
| 93 | 467 | 516 | 341 | 468 | 373 | 432.8 | N/A |
| 94 | 466 | 515 | 342 | 469 | 374 | 433.1 | N/A |
| 95 | 466 | 515 | 343 | 470 | 374 | 433.5 | N/A |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

Stove ΔT: 199

| Temperature Data (°F) | | | | | | | |
|-----------------------|---------|----------|---------|--------|-----------|-----------------------|---------------|
| Elapsed Time (min) | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 96 | 466 | 515 | 343 | 472 | 374 | 433.9 | N/A |
| 97 | 466 | 515 | 344 | 474 | 374 | 434.3 | N/A |
| 98 | 465 | 515 | 345 | 474 | 374 | 434.6 | N/A |
| 99 | 465 | 515 | 345 | 472 | 375 | 434.3 | N/A |
| 100 | 465 | 515 | 345 | 469 | 375 | 433.7 | N/A |
| 101 | 465 | 515 | 344 | 465 | 375 | 432.9 | N/A |
| 102 | 465 | 515 | 344 | 461 | 376 | 432.1 | N/A |
| 103 | 465 | 516 | 343 | 455 | 376 | 431.1 | N/A |
| 104 | 465 | 516 | 342 | 449 | 377 | 429.7 | N/A |
| 105 | 464 | 516 | 340 | 441 | 378 | 427.9 | N/A |
| 106 | 464 | 516 | 338 | 433 | 378 | 425.8 | N/A |
| 107 | 463 | 516 | 336 | 424 | 378 | 423.3 | N/A |
| 108 | 462 | 515 | 333 | 416 | 378 | 420.6 | N/A |
| 109 | 460 | 514 | 330 | 406 | 378 | 417.5 | N/A |
| 110 | 459 | 512 | 327 | 397 | 378 | 414.4 | N/A |
| 111 | 457 | 509 | 322 | 389 | 378 | 411.1 | N/A |
| 112 | 455 | 507 | 319 | 381 | 378 | 407.9 | N/A |
| 113 | 454 | 504 | 315 | 374 | 378 | 404.7 | N/A |
| 114 | 451 | 501 | 312 | 367 | 377 | 401.4 | N/A |
| 115 | 450 | 498 | 308 | 361 | 376 | 398.4 | N/A |
| 116 | 447 | 494 | 305 | 356 | 375 | 395.5 | N/A |
| 117 | 445 | 491 | 301 | 351 | 375 | 392.4 | N/A |
| 118 | 443 | 487 | 298 | 347 | 374 | 389.7 | N/A |
| 119 | 441 | 484 | 294 | 342 | 373 | 386.7 | N/A |
| 120 | 439 | 481 | 291 | 338 | 371 | 383.9 | N/A |
| 121 | 436 | 477 | 287 | 334 | 371 | 381.1 | N/A |
| 122 | 434 | 474 | 285 | 330 | 370 | 378.5 | N/A |
| 123 | 431 | 470 | 282 | 326 | 369 | 375.8 | N/A |
| 124 | 429 | 467 | 280 | 323 | 368 | 373.4 | N/A |
| 125 | 427 | 464 | 277 | 320 | 367 | 370.8 | N/A |
| 126 | 425 | 460 | 274 | 317 | 367 | 368.5 | N/A |
| 127 | 422 | 457 | 272 | 314 | 366 | 366.1 | N/A |
| 128 | 420 | 454 | 269 | 311 | 365 | 363.9 | N/A |
| 129 | 418 | 451 | 267 | 307 | 365 | 361.6 | N/A |
| 130 | 416 | 448 | 265 | 304 | 365 | 359.4 | N/A |
| 131 | 414 | 445 | 262 | 301 | 364 | 357.1 | N/A |
| 132 | 412 | 442 | 260 | 298 | 363 | 354.9 | N/A |
| 133 | 410 | 439 | 259 | 294 | 363 | 352.9 | N/A |
| 134 | 408 | 436 | 257 | 291 | 362 | 350.7 | N/A |
| 135 | 406 | 433 | 255 | 288 | 362 | 348.6 | N/A |
| 136 | 404 | 430 | 253 | 284 | 361 | 346.4 | N/A |
| 137 | 402 | 427 | 252 | 281 | 361 | 344.5 | N/A |
| 138 | 400 | 425 | 250 | 277 | 360 | 342.3 | N/A |
| 139 | 398 | 422 | 248 | 274 | 359 | 340.3 | N/A |
| 140 | 396 | 419 | 247 | 271 | 359 | 338.3 | N/A |
| 141 | 394 | 416 | 245 | 268 | 358 | 336.2 | N/A |
| 142 | 392 | 413 | 244 | 265 | 357 | 334.3 | N/A |
| 143 | 390 | 410 | 241 | 263 | 356 | 332.1 | N/A |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

Stove ΔT: 199

| Temperature Data (°F) | | | | | | | |
|-----------------------|---------|----------|---------|--------|-----------|-----------------------|---------------|
| Elapsed Time (min) | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 144 | 388 | 407 | 240 | 260 | 356 | 330.3 | N/A |
| 145 | 386 | 405 | 239 | 258 | 356 | 328.4 | N/A |
| 146 | 384 | 402 | 237 | 255 | 355 | 326.6 | N/A |
| 147 | 382 | 399 | 236 | 253 | 354 | 324.8 | N/A |
| 148 | 380 | 396 | 234 | 251 | 354 | 323.1 | N/A |
| 149 | 378 | 394 | 232 | 249 | 353 | 321.2 | N/A |
| 150 | 376 | 391 | 231 | 248 | 352 | 319.5 | N/A |
| 151 | 374 | 388 | 229 | 246 | 352 | 317.6 | N/A |
| 152 | 372 | 385 | 228 | 244 | 351 | 315.8 | N/A |
| 153 | 370 | 383 | 226 | 242 | 350 | 314.1 | N/A |
| 154 | 368 | 380 | 225 | 240 | 349 | 312.5 | N/A |
| 155 | 366 | 378 | 223 | 239 | 348 | 310.7 | N/A |
| 156 | 364 | 375 | 222 | 237 | 347 | 308.9 | N/A |
| 157 | 362 | 373 | 220 | 235 | 346 | 307.3 | N/A |
| 158 | 360 | 370 | 219 | 234 | 345 | 305.6 | N/A |
| 159 | 358 | 368 | 218 | 232 | 344 | 303.9 | N/A |
| 160 | 356 | 365 | 217 | 231 | 343 | 302.3 | N/A |
| 161 | 354 | 363 | 215 | 229 | 342 | 300.5 | N/A |
| 162 | 352 | 360 | 214 | 228 | 341 | 299.0 | N/A |
| 163 | 350 | 358 | 213 | 227 | 340 | 297.4 | N/A |
| 164 | 348 | 356 | 212 | 225 | 339 | 295.9 | N/A |
| 165 | 346 | 353 | 211 | 224 | 338 | 294.3 | N/A |
| 166 | 344 | 351 | 209 | 223 | 337 | 292.8 | N/A |
| 167 | 342 | 349 | 208 | 221 | 336 | 291.2 | N/A |
| 168 | 340 | 347 | 207 | 220 | 335 | 289.8 | N/A |
| 169 | 338 | 345 | 206 | 219 | 334 | 288.3 | N/A |
| 170 | 336 | 343 | 205 | 218 | 333 | 286.9 | N/A |
| 171 | 335 | 340 | 204 | 217 | 332 | 285.5 | N/A |
| 172 | 333 | 338 | 203 | 216 | 331 | 284.1 | N/A |
| 173 | 331 | 336 | 202 | 215 | 330 | 282.7 | N/A |
| 174 | 330 | 334 | 201 | 214 | 329 | 281.4 | N/A |
| 175 | 328 | 333 | 200 | 213 | 328 | 280.1 | N/A |
| 176 | 326 | 331 | 199 | 212 | 327 | 278.8 | N/A |
| 177 | 325 | 329 | 198 | 211 | 326 | 277.6 | N/A |
| 178 | 323 | 327 | 197 | 210 | 325 | 276.4 | N/A |
| 179 | 322 | 325 | 196 | 209 | 324 | 275.2 | N/A |
| 180 | 320 | 324 | 195 | 209 | 322 | 274.0 | N/A |
| 181 | 319 | 322 | 194 | 208 | 321 | 272.9 | N/A |
| 182 | 318 | 320 | 194 | 207 | 320 | 271.7 | N/A |
| 183 | 316 | 319 | 193 | 206 | 319 | 270.6 | N/A |
| 184 | 315 | 317 | 192 | 205 | 318 | 269.4 | N/A |
| 185 | 314 | 315 | 191 | 204 | 317 | 268.3 | N/A |
| 186 | 312 | 314 | 190 | 203 | 316 | 267.1 | N/A |
| 187 | 312 | 312 | 190 | 202 | 315 | 266.1 | N/A |
| 188 | 311 | 311 | 189 | 201 | 314 | 265.1 | N/A |
| 189 | 309 | 309 | 188 | 201 | 313 | 264.0 | N/A |
| 190 | 309 | 308 | 188 | 200 | 312 | 263.0 | N/A |
| 191 | 308 | 306 | 187 | 199 | 311 | 262.0 | N/A |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

Stove ΔT: 199

| Elapsed Time (min) | Temperature Data (°F) | | | | | | Stove Surface Average | Catalyst Exit |
|--------------------|-----------------------|----------|---------|--------|-----------|-------|-----------------------|---------------|
| | FB Left | FB Right | FB Back | FB Top | FB Bottom | | | |
| 192 | 307 | 305 | 186 | 198 | 310 | 261.1 | N/A | |
| 193 | 306 | 303 | 186 | 198 | 309 | 260.2 | N/A | |
| 194 | 305 | 302 | 185 | 198 | 308 | 259.5 | N/A | |
| 195 | 304 | 301 | 184 | 198 | 307 | 258.9 | N/A | |
| 196 | 303 | 299 | 184 | 199 | 306 | 258.2 | N/A | |
| 197 | 302 | 298 | 183 | 199 | 305 | 257.5 | N/A | |
| 198 | 301 | 296 | 183 | 199 | 305 | 257.0 | N/A | |
| 199 | 301 | 295 | 182 | 199 | 304 | 256.2 | N/A | |
| 200 | 300 | 294 | 182 | 200 | 303 | 255.6 | N/A | |
| 201 | 299 | 293 | 181 | 200 | 302 | 254.9 | N/A | |
| 202 | 298 | 292 | 181 | 200 | 302 | 254.3 | N/A | |
| 203 | 297 | 290 | 181 | 200 | 301 | 253.7 | N/A | |
| 204 | 296 | 289 | 180 | 200 | 300 | 253.0 | N/A | |
| 205 | 295 | 289 | 180 | 199 | 300 | 252.4 | N/A | |
| 206 | 294 | 288 | 180 | 199 | 299 | 251.7 | N/A | |
| 207 | 293 | 287 | 179 | 199 | 299 | 251.3 | N/A | |
| 208 | 292 | 286 | 179 | 199 | 298 | 250.6 | N/A | |
| 209 | 291 | 285 | 178 | 198 | 297 | 250.1 | N/A | |
| 210 | 290 | 285 | 178 | 198 | 297 | 249.5 | N/A | |
| 211 | 289 | 284 | 178 | 198 | 296 | 248.9 | N/A | |
| 212 | 288 | 283 | 177 | 198 | 295 | 248.4 | N/A | |
| 213 | 288 | 283 | 177 | 198 | 295 | 248.0 | N/A | |
| 214 | 287 | 282 | 177 | 198 | 295 | 247.6 | N/A | |
| 215 | 286 | 282 | 176 | 198 | 294 | 247.2 | N/A | |
| 216 | 285 | 281 | 176 | 198 | 294 | 246.7 | N/A | |
| 217 | 284 | 280 | 176 | 197 | 293 | 246.1 | N/A | |
| 218 | 283 | 280 | 176 | 197 | 293 | 245.7 | N/A | |
| 219 | 282 | 279 | 175 | 197 | 292 | 245.2 | N/A | |
| 220 | 282 | 279 | 175 | 196 | 292 | 244.7 | N/A | |
| 221 | 281 | 278 | 175 | 196 | 291 | 244.2 | N/A | |
| 222 | 280 | 278 | 175 | 196 | 291 | 243.7 | N/A | |
| 223 | 279 | 277 | 174 | 195 | 290 | 243.1 | N/A | |
| 224 | 278 | 277 | 174 | 195 | 289 | 242.6 | N/A | |
| 225 | 277 | 277 | 174 | 194 | 289 | 242.1 | N/A | |
| 226 | 277 | 276 | 174 | 194 | 288 | 241.6 | N/A | |
| 227 | 276 | 276 | 173 | 194 | 288 | 241.1 | N/A | |
| 228 | 275 | 275 | 173 | 193 | 287 | 240.7 | N/A | |
| 229 | 274 | 275 | 173 | 193 | 286 | 240.2 | N/A | |
| 230 | 273 | 275 | 173 | 192 | 285 | 239.6 | N/A | |
| 231 | 272 | 274 | 173 | 192 | 285 | 239.1 | N/A | |
| 232 | 271 | 274 | 173 | 191 | 284 | 238.5 | N/A | |
| 233 | 271 | 274 | 173 | 190 | 283 | 238.0 | N/A | |
| 234 | 270 | 273 | 173 | 189 | 283 | 237.6 | N/A | |
| 235 | 269 | 273 | 172 | 189 | 282 | 236.9 | N/A | |
| 236 | 268 | 272 | 173 | 188 | 281 | 236.5 | N/A | |
| 237 | 267 | 272 | 172 | 188 | 281 | 236.0 | N/A | |
| 238 | 266 | 272 | 172 | 187 | 280 | 235.4 | N/A | |
| 239 | 265 | 271 | 172 | 187 | 279 | 234.9 | N/A | |

WOODSTOVE SURFACE TEMPERATURE DATA

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

Stove ΔT: 199

| Temperature Data (°F) | | | | | | | |
|-----------------------|---------|----------|---------|--------|-----------|-----------------------|---------------|
| Elapsed Time (min) | FB Left | FB Right | FB Back | FB Top | FB Bottom | Stove Surface Average | Catalyst Exit |
| 240 | 265 | 271 | 172 | 187 | 279 | 234.5 | N/A |
| 241 | 264 | 271 | 172 | 185 | 278 | 233.8 | N/A |
| 242 | 264 | 270 | 172 | 184 | 277 | 233.4 | N/A |
| 243 | 263 | 270 | 172 | 182 | 277 | 232.9 | N/A |
| 244 | 263 | 270 | 172 | 182 | 276 | 232.4 | N/A |
| 245 | 262 | 270 | 172 | 182 | 276 | 232.2 | N/A |
| 246 | 261 | 269 | 172 | 182 | 275 | 231.8 | N/A |
| 247 | 260 | 270 | 171 | 182 | 275 | 231.6 | N/A |
| 248 | 260 | 270 | 171 | 183 | 274 | 231.6 | N/A |
| 249 | 259 | 270 | 171 | 184 | 273 | 231.5 | N/A |
| 250 | 258 | 271 | 171 | 186 | 273 | 231.6 | N/A |
| 251 | 257 | 271 | 171 | 187 | 272 | 231.5 | N/A |
| 252 | 256 | 272 | 171 | 188 | 271 | 231.5 | N/A |
| 253 | 255 | 272 | 171 | 188 | 271 | 231.5 | N/A |
| 254 | 254 | 273 | 171 | 189 | 271 | 231.5 | N/A |
| 255 | 254 | 274 | 171 | 190 | 270 | 231.6 | N/A |
| 256 | 253 | 274 | 171 | 191 | 270 | 231.9 | N/A |
| 257 | 253 | 275 | 171 | 192 | 270 | 232.1 | N/A |
| 258 | 252 | 275 | 171 | 193 | 270 | 232.3 | N/A |
| 259 | 252 | 276 | 171 | 194 | 270 | 232.5 | N/A |
| 260 | 251 | 277 | 171 | 196 | 270 | 232.8 | N/A |
| 261 | 251 | 277 | 171 | 197 | 269 | 233.0 | N/A |
| 262 | 251 | 278 | 171 | 198 | 269 | 233.4 | N/A |
| 263 | 251 | 279 | 172 | 199 | 269 | 233.9 | N/A |
| 264 | 251 | 279 | 172 | 201 | 269 | 234.4 | N/A |
| 265 | 251 | 280 | 172 | 202 | 270 | 234.8 | N/A |
| 266 | 251 | 281 | 172 | 203 | 270 | 235.3 | N/A |
| 267 | 251 | 282 | 172 | 204 | 271 | 235.7 | N/A |
| 268 | 251 | 282 | 172 | 204 | 271 | 236.1 | N/A |
| 269 | 251 | 283 | 173 | 205 | 272 | 236.7 | N/A |
| 270 | 252 | 284 | 173 | 205 | 272 | 237.1 | N/A |
| 271 | 252 | 285 | 173 | 206 | 273 | 237.7 | N/A |
| 272 | 253 | 285 | 173 | 207 | 274 | 238.3 | N/A |
| 273 | 253 | 286 | 174 | 207 | 274 | 238.7 | N/A |
| 274 | 253 | 287 | 174 | 207 | 275 | 239.2 | N/A |
| 275 | 254 | 287 | 174 | 208 | 276 | 239.7 | N/A |
| 276 | 255 | 288 | 174 | 208 | 277 | 240.2 | N/A |
| 277 | 254 | 288 | 175 | 208 | 278 | 240.5 | N/A |
| 278 | 256 | 289 | 175 | 208 | 279 | 241.1 | N/A |
| 279 | 256 | 289 | 175 | 207 | 280 | 241.5 | N/A |
| 280 | 257 | 290 | 176 | 207 | 281 | 242.0 | N/A |
| 281 | 257 | 290 | 176 | 207 | 283 | 242.5 | N/A |
| Average | 379.5 | 404.6 | 251.9 | 370.9 | 345.1 | 350.4 | N/A |

LAB SAMPLE DATA - ASTM E2515

Client: HHT
 Model: Pioneer II
 Run #: 2

Job #: 24-321
 Tracking #: 213
 Technician: AK
 Date: 8/21/2024

| | | Sample ID | Tare, mg | Final, mg | Catch, mg |
|----------------|---------------------|-----------|----------|-----------|-----------|
| Filters | A | G01137 | 243.8 | 249.6 | 5.8 |
| | B | G01138 | 244.7 | 250.7 | 6.0 |
| | C - 1st Hour | G01139 | 244.7 | 247.7 | 3.0 |
| | Amb | G01140 | 243.6 | 243.9 | 0.3 |
| Probes | A | 1A | 115628.5 | 115628.6 | 0.1 |
| | B | 1B | 115903.6 | 115904.0 | 0.4 |
| | C - 1st Hour | 1C | 116434.3 | 116434.3 | 0.0 |
| | | | | | |
| O-rings | A | 1A | 3568.7 | 3569.0 | 0.3 |
| | B | 1B | 3556.9 | 3557.0 | 0.1 |
| | C - 1st Hour | 1C | 4167.9 | 4169.0 | 1.1 |
| | | | | | |

Placed in Dessicator on: 8/21/2024

Balance Audit (mg): 200.0 200.0 200.0

| | | Weight (mg) | Date/Time | Weight (mg) | Date/Time | Weight (mg) | Date/Time | Weight (mg) | Date/Time |
|----------------|---------------------|-------------|------------|-------------|------------|-------------|------------|-------------|-----------|
| Filters | A | 249.7 | 8/26 10:30 | 249.6 | 8/27 14:15 | | | | |
| | B | 250.9 | 8/26 10:30 | 250.7 | 8/27 14:15 | | | | |
| | C - 1st Hour | 248.2 | 8/26 10:30 | 247.7 | 8/27 14:15 | 247.7 | 8/28 13:45 | | |
| | Amb | 244.1 | 8/26 10:30 | 243.9 | 8/27 14:15 | | | | |
| Probes | A | 115629.0 | 8/26 10:30 | 115628.7 | 8/27 14:15 | 115628.6 | 8/28 13:45 | | |
| | B | 115904.4 | 8/26 10:30 | 115904.0 | 8/27 14:15 | 115904.0 | 8/28 13:45 | | |
| | C - 1st Hour | 116434.6 | 8/26 10:30 | 116434.2 | 8/27 14:15 | 116434.3 | 8/28 13:45 | | |
| | | | | | | | | | |
| O-Rings | A | 3569.2 | 8/26 10:30 | 3569.0 | 8/27 14:15 | | | | |
| | B | 3557.4 | 8/26 10:30 | 3557.1 | 8/27 14:15 | 3557.0 | 8/28 13:45 | | |
| | C - 1st Hour | 4169.5 | 8/26 10:30 | 4168.9 | 8/27 14:15 | 4169.0 | 8/28 13:45 | | |
| | | | | | | | | | |

| | |
|-------------------------------|------------|
| Train A Aggregate, mg: | 6.2 |
| Train B Aggregate, mg: | 6.5 |
| Train C Aggregate, mg: | 4.1 |
| Ambient, mg: | 0.3 |

ASTM E2780 Wood Heater Run Sheets

Client: Hearth & Home Technologies Job Number: 24-321 Tracking #: 213
 Model: Pioneer II Run Number: 2 Test Date: 8/21/24

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): N/A -Single Burn Rate
 Targeted Burn Category: N/A -Single Burn Rate

Preburn Notes

| Time | Notes |
|------|--------|
| | -None- |

Test Notes

Test Burn Start Time: 10:49 Test Fuel Loaded by: 40 seconds
 Door Closed: 205 seconds Air Control Set at: N/A seconds
 Other Loading Notes: Actuated ACC handle @ 300 sec, fan on Auto

| Time | Notes |
|------|--------|
| | -None- |

Test Burn End Time: 15:30

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.98 CO (%): 4.300
 Mid Gas CO₂ (%): 10.00 CO (%): 2.500

Calibration Results:

| | Pre Test | | | Post Test | | |
|-----------------|----------|-------|-------|-----------|-------|-------|
| | Zero | Mid | Span | Zero | Mid | Span |
| Time | 09:42 | 09:43 | 09:44 | 15:32 | 15:33 | 15:35 |
| CO ₂ | 0.06 | 17.08 | 10.14 | 0.01 | 16.94 | 10.14 |
| CO | 0.011 | 4.314 | 2.520 | -0.008 | 4.260 | 2.487 |

Flue Gas Probe Leak Check: Initial: No Leakage Final: No Leakage

Technician Signature: 

Date: 8/21/24

ASTM E2780 Wood Heater Run Sheets

Client: Hearth & Home Technologies Job Number: 24-321 Tracking #: 213
Model: Pioneer II Run Number: 2 Test Date: 8/21/24



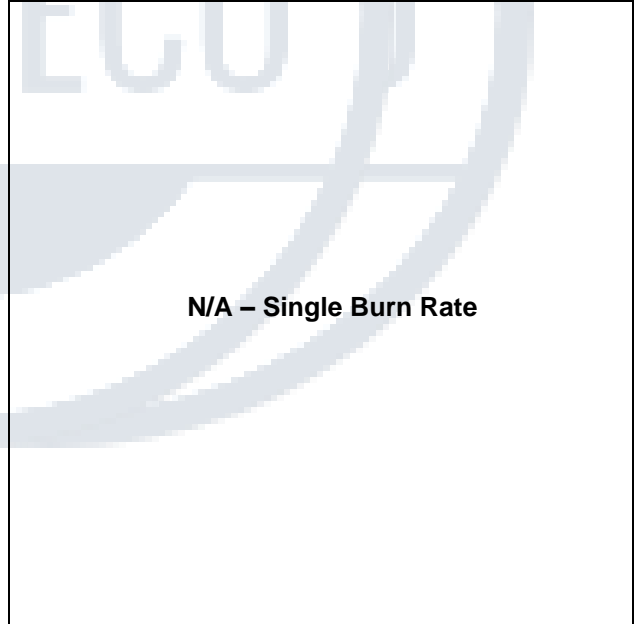
Test Fuel Front/Side View



Test Fuel Iso View




Test Fuel Loaded in Stove



N/A - Single Burn Rate

Air Setting

Technician Signature: 

Date: 8/21/24

ASTM E2515 - Glass Fiber Filters

| Date: | 7/30/24 | 7/31/24 | | | | | |
|--------|----------|----------|----------|----------|---------|---------|-----|
| Time: | 3:00 p | 4:30 | | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| G01125 | 245.4 | 245.5 | - | - | | 24-265 | #1 |
| G01126 | 245.6 | 245.5 | - | - | | ↓ | ↓ |
| G01127 | 244.2 | 244.1 | - | - | | ↓ | ↓ |
| G01128 | 245.6 | 245.6 | - | - | | ↓ | ↓ |
| G01129 | 244.4 | 244.4 | - | - | | ↓ | #2 |
| G01130 | 244.9 | 244.8 | - | - | | ↓ | ↓ |
| G01131 | 244.8 | 244.6 | - | - | | ↓ | ↓ |
| G01132 | 243.7 | 243.7 | - | - | | ↓ | ↓ |
| G01133 | 245.4 | 245.3 | - | - | | 24-321 | #1 |
| G01134 | 245.1 | 245.2 | - | - | | ↓ | ↓ |
| G01135 | 244.3 | 244.2 | - | - | | ↓ | ↓ |
| G01136 | 244.2 | 244.0 | - | - | | ↓ | ↓ |
| G01137 | 244.0 | 243.8 | - | - | | ↓ | #2 |
| G01138 | 244.9 | 244.7 | - | - | | ↓ | ↓ |
| G01139 | 244.7 | 244.7 | - | - | | ↓ | ↓ |
| G01140 | 244.1 | 243.6 | | | | ↓ | ↓ |

| Date: | | | | | | | |
|--------|----------|----------|----------|----------|---------|---------|-----|
| Time: | | | | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| G01141 | | | | | | | |
| G01142 | | | | | | | |
| G01143 | | | | | | | |
| G01144 | | | | | | | |
| G01145 | | | | | | | |
| G01146 | | | | | | | |
| G01147 | | | | | | | |
| G01148 | | | | | | | |
| G01149 | | | | | | | |
| G01150 | | | | | | | |
| G01151 | | | | | | | |
| G01152 | | | | | | | |
| G01153 | | | | | | | |
| G01154 | | | | | | | |
| G01155 | | | | | | | |
| G01156 | | | | | | | |

ASTM E2515 - Probe Samples 11-20

| Date: | 6/25/24 | 6/26/24 | | | | | |
|-------|----------|----------|----------|----------|---------|---------|-----|
| Time: | 0900 | 0900 | | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 11A | 116868.4 | 116868.6 | - | - | A | 24-309 | #4 |
| 11B | 117342.3 | 117342.4 | - | - | A | | |
| 11C | 116188.1 | 116188.2 | - | - | A | | |
| 12A | 116708.9 | 116708.9 | - | - | A | 24-309 | #3 |
| 12B | 117775.1 | 117775.2 | - | - | A | | |
| 12C | 117174.0 | 117174.1 | - | - | A | | |
| 13A | 117316.6 | 117316.8 | - | - | A | 24-309 | #5 |
| 13B | 116943.0 | 116943.1 | - | - | A | | |
| 13C | 115651.6 | 115651.4 | - | - | A | | |
| 14A | 116634.9 | 116635.1 | - | - | A | 24-330 | #1 |
| 14B | 116620.9 | 116621.1 | - | - | A | | |
| 14C | 116531.6 | 116531.6 | - | - | A | | |
| 15A | 117241.5 | 117241.5 | - | - | A | 24-330 | #2 |
| 15B | 116754.3 | 116754.2 | - | - | A | | |
| 15C | 116848.3 | 116848.3 | - | - | A | | |

| Date: | 7/30/24 | 8/1/24 | 8/2/24 | 8/3/24 | | | |
|-------|----------|----------|----------|-----------|---------|---------|-----|
| Time: | 3:30 pm | 13:30 | 15:00 | 13:30 | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 16A | 116380.1 | 116379.9 | - | - | A | 24-330 | #3 |
| 16B | 115862.7 | 115862.5 | - | - | A | | |
| 16C | 114148.1 | 114148.2 | - | - | A | | |
| 17A | 116811.0 | 116811.2 | - | - | A | 24-330 | #4 |
| 17B | 117140.9 | 117141.1 | - | - | A | | |
| 17C | 113141.3 | 113141.9 | 113141.4 | 113141.86 | A | | |
| 18A | 117501.2 | 117501.0 | - | - | A | 24-265 | #1 |
| 18B | 117333.1 | 117333.0 | - | - | A | | |
| 18C | 114335.7 | 114335.8 | - | - | A | | |
| 19A | 117027.2 | 117027.0 | - | - | A | 24-265 | #2 |
| 19B | 117014.3 | 117014.1 | - | - | A | | |
| 19C | 114231.7 | 114231.9 | - | - | A | | |
| 20A | 115628.3 | 115627.9 | 115627.8 | - | A | 24-321 | #1 |
| 20B | 115967.6 | 115967.5 | - | - | A | | |
| 20C | 113776.2 | 113776.1 | - | - | A | | |

ASTM E2515 - Probe Samples 1-10

| Date: | 8/19/24 | 8/20/24 | 8/21/24 | | | | |
|-------|----------|----------|----------|----------|---------|---------|-----|
| Time: | 13:30 | 10:15 | 09:00 | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 1A | 115628.3 | 115628.5 | - | - | A | 24-321 | #2 |
| 1B | 115903.4 | 115903.6 | - | - | A | | |
| 1C | 116433.9 | 116434.4 | 116434.3 | - | A | | |
| 2A | 116058.9 | 116058.9 | - | - | A | | |
| 2B | 116175.2 | 116175.1 | - | - | A | | |
| 2C | 116429.9 | 116430.0 | - | - | A | | |
| 3A | 115881.7 | 115882.0 | 115881.9 | - | A | | |
| 3B | 116121.8 | 116122.0 | - | - | A | | |
| 3C | 116619.4 | 116619.2 | - | - | A | | |
| 4A | 116024.7 | 116024.8 | - | - | A | | |
| 4B | 116183.6 | 116183.5 | - | - | A | | |
| 4C | 116999.0 | 116999.1 | - | - | A | | |
| 5A | 116758.7 | 116758.8 | - | - | A | | |
| 5B | 116876.9 | 116877.1 | - | - | A | | |
| 5C | 115856.4 | 115856.5 | - | - | A | | |

| Date: | | | | | | | |
|-------|----------|----------|----------|----------|---------|---------|-----|
| Time: | | | | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 6A | | | | | | | |
| 6B | | | | | | | |
| 6C | | | | | | | |
| 7A | | | | | | | |
| 7B | | | | | | | |
| 7C | | | | | | | |
| 8A | | | | | | | |
| 8B | | | | | | | |
| 8C | | | | | | | |
| 9A | | | | | | | |
| 9B | | | | | | | |
| 9C | | | | | | | |
| 10A | | | | | | | |
| 10B | | | | | | | |
| 10C | | | | | | | |

ASTM E2515 - O-Ring Samples 11-20

| Date: | | 6/25/24 | 6/26/24 | | | | |
|-------|----------|----------|----------|----------|---------|---------|-----|
| Time: | | 09:00 | 10:00 | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 11A | 3423.6 | 3423.5 | - | - | A | 24-309 | #3 |
| 11B | 4233.9 | 4233.9 | - | - | A | | |
| 11C | 3588.2 | 3588.3 | - | - | A | | |
| 12A | 3586.0 | 3585.9 | - | - | A | 24-309 | #4 |
| 12B | 3550.7 | 3550.8 | - | - | A | | |
| 12C | 3615.9 | 3615.9 | - | - | A | | |
| 13A | 3596.4 | 3596.5 | - | - | A | 24-309 | #5 |
| 13B | 3642.3 | 3642.3 | - | - | A | | |
| 13C | 4409.7 | 4409.7 | - | - | A | | |
| 14A | 3342.7 | 3342.7 | - | - | A | 24-330 | #1 |
| 14B | 3367.4 | 3367.4 | - | - | A | | |
| 14C | 3444.7 | 3444.7 | - | - | A | | |
| 15A | 3570.0 | 3570.0 | - | - | A | 24-330 | #2 |
| 15B | 3571.0 | 3571.1 | - | - | A | | |
| 15C | 3397.5 | 3397.5 | - | - | N | | |

| Date: | | 7/30/24 | 8/1/24 | | | | |
|-------|----------|----------|----------|----------|---------|---------|-----|
| Time: | | 3:00 pm | 13:00 | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 16A | 3573.0 | 3573.1 | - | - | A | 24-330 | #3 |
| 16B | 3638.0 | 3638.1 | - | - | A | | |
| 16C | 3601.9 | 3601.9 | - | - | A | | |
| 17A | 3613.0 | 3612.9 | - | - | A | 24-330 | #4 |
| 17B | 3569.1 | 3569.0 | - | - | A | | |
| 17C | 3597.3 | 3597.2 | - | - | A | | |
| 18A | 3602.8 | 3602.7 | - | - | A | 24-265 | #1 |
| 18B | 3546.1 | 3546.1 | - | - | A | | |
| 18C | 3528.6 | 3528.5 | - | - | A | | |
| 19A | 3586.2 | 3586.1 | - | - | A | 24-265 | #2 |
| 19B | 3633.1 | 3633.1 | - | - | A | | |
| 19C | 3615.1 | 3615.3 | - | - | A | | |
| 20A | 3559.0 | 3558.9 | - | - | A | 24-321 | #1 |
| 20B | 3614.7 | 3614.7 | - | - | A | | |
| 20C | 3610.9 | 3611.0 | - | - | A | | |

ASTM E2515 - O-Ring Samples 1-10

| Date: | 8/19/24 | | | | | | |
|-------|----------|----------|----------|----------|---------|---------|-----|
| Time: | 11:30 | | | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 1A | 3568.5 | 3568.7 | | | | 24-321 | #2 |
| 1B | 3557.0 | 3556.0 | | | | | |
| 1C | 4167.9 | 4167.9 | | | | | |
| 2A | 3554.2 | 3554.1 | | | | | |
| 2B | 3573.4 | 3573.3 | | | | | |
| 2C | 3392.0 | 3392.0 | | | | | |
| 3A | 3580.4 | 3580.3 | | | | | |
| 3B | 3569.1 | 3568.9 | | | | | |
| 3C | 3623.2 | 3623.3 | | | | | |
| 4A | 3377.8 | 3377.6 | | | | | |
| 4B | 3579.9 | 3578.0.1 | | | | | |
| 4C | 3373.5 | 3373.4 | | | | | |
| 5A | 3536.4 | 3536.6 | | | | | |
| 5B | 3531.9 | 3531.8 | | | | | |
| 5C | 3377.2 | 3377.0 | | | | | |

| Date: | | | | | | | |
|-------|----------|----------|----------|----------|---------|---------|-----|
| Time: | | | | | | | |
| | Weight 1 | Weight 2 | Weight 3 | Weight 4 | Initial | Project | Run |
| 6A | | | | | | | |
| 6B | | | | | | | |
| 6C | | | | | | | |
| 7A | | | | | | | |
| 7B | | | | | | | |
| 7C | | | | | | | |
| 8A | | | | | | | |
| 8B | | | | | | | |
| 8C | | | | | | | |
| 9A | | | | | | | |
| 9B | | | | | | | |
| 9C | | | | | | | |
| 10A | | | | | | | |
| 10B | | | | | | | |
| 10C | | | | | | | |

Sample Calculations – ASTM E2780 & E2515

Client: HHT
Model: Pioneer II
Run: 1

Equations used to calculate the parameters listed below are described in this appendix. Sample calculations are provided for each equation. The raw data and printout results from a sample run are also provided for comparison to the sample calculations.

- M_{Sdb} – Weight of test fuel spacers, dry basis, kg
- M_{Cdb} – Weight of test fuel crib, excluding nails and spacers, dry basis, kg
- D_{Cdb} - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft³
- M_{FTAdb} - Total weight of fuel crib excluding nails, dry basis, kg
- BR – Dry burn rate, kg/hr
- V_s – Average gas velocity in the dilution tunnel, ft/sec
- Q_{sd} – Average gas flow rate in dilution tunnel, dscf/hr
- $V_{m(std)}$ – Volume of gas sampled, corrected to dry standard conditions, dscf
- m_n – Total particulate matter collected, mg
- C_s - Concentration of particulate matter in tunnel gas, dry basis, corrected to STP, g/dscf
- E_T – Total particulate emissions, g
- PR - Proportional rate variation
- PM_R – Particulate emissions for test run, g/hr
- PM_F – Particulate emission factor for test run, g/dry kg of fuel burned

M_{Sdb} – Weight of test fuel spacers, dry basis, kg

ASTM E2780 equation (1)

$$M_{Sdb} = (M_{Swb})(100/(100 + FM_S))$$

Where,

FM_S = average fuel moisture of test fuel spacers, % dry basis

M_{Swb} = weight of test fuel spacers, wet basis, kg

Sample Calculation:

$$FM_S = 12.0 \%$$

$$M_{Swb} = 2.5 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{Sdb} = [(2.5 \times 0.4536) (100/(100 + 12.0))]$$

$$M_{Sdb} = \mathbf{1.02 \text{ kg}}$$

M_{Cdb} – Weight of test fuel crib, excluding nails and spacers, dry basis, kg
ASTM E2780 equation (2)

$$M_{Cdb} = \sum[(M_{CPnwb})(100/(100 + FM_{CPn}))]$$

Where,

M_{CPnwb} = weight of each test fuel piece n in fuel crib, excluding nails and spacers, wet basis, kg

FM_{CPn} = Average fuel moisture of test fuel n in fuel crib, % dry basis

Sample Calculation (test fuel piece 1):

$$M_{CPnwb} = 2.6$$

$$FM_{CPn} = 22.9$$

$$= 2.6 (100/(100 + 22.9))$$

$$= 2.1 \text{ lbs}$$

Total dry crib weight, excluding spacers = 14.49 lbs

$$M_{Cdb} = \mathbf{6.57 \text{ kg}}$$

D_{Cdb} - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft³
ASTM E2780 equation (3)

$$D_{Cdb} = M_{Cdb} / V_C$$

Where,

$$V_C = \text{Volume of fuel crib, ft}^3$$

Sample calculation:

$$V_C = 845.3 \text{ in}^3$$
$$1728 = \text{conversion from in}^3 \text{ to ft}^3$$

$$D_{Cdb} = 14.49 / 845.3 * 1728$$
$$= \mathbf{29.62 \text{ lbs/ft}^3}$$

M_{FTAdb} - Total weight of fuel crib excluding nails, dry basis, kg
ASTM E2780 equation (4)

$$M_{FTAdb} = M_{Sdb} + M_{Cdb}$$

Sample calculation:

$$M_{FTAdb} = 1.02 + 6.57$$

$$= 7.59 \text{ kg}$$

BR – dry burn rate, kg/hr
ASTM E2780 equation (5)

$$BR = \frac{60 M_{FTAdb}}{\theta}$$

Where,

θ = Total length of test run, min

Sample Calculation:

$$M_{Bdb} = 7.59 \quad \text{kg}$$
$$\theta = 273 \quad \text{min}$$

$$BR = \frac{60 \times 7.59}{273}$$

$$BR = 1.67 \quad \text{kg/hr}$$

V_s – Average gas velocity in the dilution tunnel, ft/sec

ASTM E2515 equations (9)

$$V_s = F_p \times k_p \times C_p \times (\sqrt{\Delta P})_{avg} \times \sqrt{\frac{T_{s(avg)}}{P_s \times M_s}}$$

Where:

- F_p = Adjustment factor for pitot tube center point reading = $\frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)
- V_{scent} = Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
- V_{strav} = Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
- k_p = Pitot tube constant, 85.49
- C_p = Pitot tube coefficient: 0.99, unitless
- ΔP* = Velocity pressure in the dilution tunnel, in H₂O
- T_s = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P_s = Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g, in Hg
- P_{bar} = Barometric pressure at test site, in. Hg
- P_g = Static pressure of tunnel, in. H₂O; (in Hg = in H₂O/13.6)
- M_s =

**The dilution tunnel wet molecular weight; M_s = 28.78 assuming a dry weight of 29 lb/lb-mole

Sample calculation:

$$F_p = \frac{18.35}{20.92} = 0.877$$

$$V_s = 0.877 \times 85.49 \times 0.99 \times 0.313 \times \left(\left(\frac{102.2}{29.94} + \frac{460}{13.6} \right) \times 28.78 \right)^{1/2}$$

$$V_s = 18.81 \text{ ft/s}$$

*The ASTM test standard mistakenly has the square root of the average delta p instead of the average of the square root of delta p. The current EPA Method 2 is also incorrect. This was verified by Mike Toney at EPA.

**The ASTM test standard mistakenly identifies M_s as the dry molecular weight. It should be the wet molecular weight as indicated in EPA Method 2.

Q_{sd} – Average gas flow rate in dilution tunnel, dscf/hr

ASTM E2515 equation (3)

$$Q_{sd} = 3600 \times (1 - B_{ws}) \times v_s \times A \times \frac{T_{std}}{T_{s(avg)}} \times \frac{P_s}{P_{std}}$$

Where:

- 3600 = Conversion from seconds to hours (ASTM method uses 60 to convert in minutes)
- B_{ws} = Water vapor in gas stream, proportion by volume; assume 2%
- A = Cross sectional area of dilution tunnel, ft²
- T_{std} = Standard absolute temperature, 528 °R
- P_s = Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g, in Hg
- T_{s(avg)} = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P_{std} = Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 18.81 \times 0.1963 \times \frac{528}{102.2 + 460} \times \frac{29.94 + \frac{-0.16}{13.6}}{29.92}$$

Q_{sd} = **12236.5** dscf/hr

$V_{m(std)}$ – Volume of Gas Sampled Corrected to Dry Standard Conditions, dscf
ASTM E2515 equation (6)

$$V_{m(std)} = K_1 V_m Y \frac{P_{bar} + \left(\frac{\Delta H}{13.6} \right)}{T_m}$$

Where:

- K_1 = 17.64 °R/in. Hg
- V_m = Volume of gas sample measured at the dry gas meter, dcf
- Y = Dry gas meter calibration factor, dimensionless
- P_{bar} = Barometric pressure at the testing site, in. Hg
- ΔH = Average pressure differential across the orifice meter, in. H₂O
- T_m = Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train A:

$$V_{m(std)} = 17.64 \times 43.430 \times 0.996 \times \frac{\left(29.94 + \frac{2.53}{13.6} \right)}{\left(93.2 + 460 \right)}$$

$$V_{m(std)} = \mathbf{41.545} \text{ dscf}$$

Using equation for Train B:

$$V_{m(std)} = 17.64 \times 43.056 \times 1.012 \times \frac{\left(29.94 + \frac{2.46}{13.6} \right)}{\left(97.3 + 460 \right)}$$

$$V_{m(std)} = \mathbf{41.536} \text{ dscf}$$

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 64.03 \times 1.004 \times \frac{\left(\underline{29.935} + \frac{0.00}{13.6} \right)}{\left(75.1 + 460 \right)}$$

$$V_{m(std)} = \mathbf{63.443} \text{ dscf}$$

m_n – Total Particulate Matter Collected, mg

ASTM E2515 Equation (12)

$$m_n = m_p + m_f + m_g$$

Where:

- m_p = mass of particulate matter from probe, mg
- m_f = mass of particulate matter from filters, mg
- m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train A:

$$m_n = 0.5 + 5.5 + 0.4$$

$$m_n = \mathbf{6.4} \text{ mg}$$

Using equation for Train B:

$$m_n = 0 + 5.8 + 0$$

$$m_n = \mathbf{5.8} \text{ mg}$$

C_s - Concentration of particulate matter in tunnel gas, dry basis, corrected to STP, g/dscf
ASTM E2515 equation (13)

$$C_s = K_2 \times \frac{m_n}{V_{m(\text{std})}}$$

Where:

- K₂ = Constant, 0.001 g/mg
- m_n = Total mass of particulate matter collected in the sampling train, mg
- V_{m(std)} = Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train A:

$$C_s = 0.001 \times \frac{6.4}{41.54}$$

$$C_s = \mathbf{0.00015} \text{ g/dscf}$$

For Train B

$$C_s = 0.001 \times \frac{5.8}{41.54}$$

$$C_s = \mathbf{0.00014} \text{ g/dscf}$$

For Ambient Train

$$C_r = 0.001 \times \frac{0.3}{63.44}$$

$$C_r = \mathbf{0.000005} \text{ g/dscf}$$

E_T – Total Particulate Emissions, g

ASTM E2515 equation (15)

$$E_T = (C_s - C_r) \times Q_{std} \times \theta$$

Where:

- C_s = Concentration of particulate matter in tunnel gas, g/dscf
- C_r = Concentration particulate matter room air, g/dscf
- Q_{std} = Average dilution tunnel gas flow rate, dscf/hr
- θ = Total time of test run, minutes

Sample calculation:

For Train A

$$E_T = (0.000154 - 0.000005) \times 12236.5 \times 273 / 60$$
$$E_T = \mathbf{8.31} \text{ g}$$

For Train B

$$E_T = (0.000140 - 0.000005) \times 12236.5 \times 273 / 60$$
$$E_T = \mathbf{7.51} \text{ g}$$

Average

$$E = \mathbf{7.91} \text{ g}$$

PR - Proportional Rate Variation

ASTM E2515 equation (16)

$$PR = \left[\frac{\theta \times V_{mi} \times V_s \times T_m \times T_{si}}{\theta_i \times V_m \times V_{si} \times T_{mi} \times T_s} \right] \times 100$$

Where:

- θ = Total sampling time, min
- θ_i = Length of recording interval, min
- V_{mi} = Volume of gas sample measured by the dry gas meter during the "ith" time interval, dcf
- V_m = Volume of gas sample as measured by dry gas meter, dcf
- V_{si} = Average gas velocity in the dilution tunnel during the "ith" time interval, ft/sec
- V_s = Average gas velocity in the dilution tunnel, ft/sec
- T_{mi} = Absolute average dry gas meter temperature during the "ith" time interval, °R
- T_m = Absolute average dry gas meter temperature, °R
- T_{si} = Absolute average gas temperature in the dilution tunnel during the "ith" time interval, °R
- T_s = Absolute average gas temperature in the dilution tunnel, °R

Sample calculation (for the first 10-min interval of Train 1):

$$PR = \left(\frac{273 \times 1.404 \times 18.81 \times (131.3 + 460) \times (93.2 + 460)}{10 \times 43.43 \times 19.36 \times (102.2 + 460) \times (76.7 + 460)} \right) \times 100$$

PR = 93 %

PM_R – Particulate emissions for test run, g/hr

ASTM E2780 equation (6)

$$PM_R = 60 (E_T/\theta)$$

Where,

E_T = Total particulate emissions, grams

θ = Total length of full integrated test run, min

Sample Calculation:

$$E_T \text{ (Dual train average)} = 7.91 \text{ g}$$

$$\theta = 273 \text{ min}$$

$$PM_R = 60 \times (7.91 / 273)$$

$$PM_R = 1.74 \text{ g/hr}$$

PM_F – Particulate emission factor for test run, g/dry kg of fuel burned
ASTM E2780 equation (7)

$$PM_F = E_T / M_{FTAdb}$$

Sample Calculation:

$$\begin{aligned} E_T \text{ (Dual train average)} &= 7.91 \text{ g} \\ M_{Bdb} &= 7.59 \text{ kg} \\ \\ PM_F &= 7.91 / 7.59 \\ \\ PM_F &= \mathbf{1.04} \text{ g/kg} \end{aligned}$$

Stack Loss Efficiency and CO emissions calculations are done in accordance with CSA B415.1, using the password protected excel spreadsheet provided with the test standard. No alterations or alternative calculations are used for determining efficiency or CO emissions. The following pages are a sample of the calculations page from the B415.1 Spreadsheet (V2_4 - Dated April 15, 2010).

Manufacturer: HHT
Model: Pioneer II
Date: 08/20/24
Run: 1
Control #: 23-321
Test Duration: 273 min

| | HHV | LHV |
|-----------|--------|--------|
| Eff | 68.91% | 74.48% |
| Comb Eff | 95.97% | 95.97% |
| HT Eff | 71.80% | 77.61% |
| Output | 22,514 | kJ/h |
| Burn Rate | 1.65 | kg/h |
| Grams CO | 455 | g |
| Input | 32,672 | kJ/h |
| MC wet | 18.08 | |
| Averages | 0.85 | 6.54 |

Note: In the "Input data", "Calc. % O₂", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a], [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses 13.7.3 to 13.7.5.

Ultimate CO₂
 CO_{2-ult} 19.64
 F₀
 1.061

Overall Heating Efficiency: 68.91%
 Combustion Efficiency: 95.97%
 Heat Transfer Efficiency: 71.80%
 Heat Output: 21,357 Btu/h
 Heat Input: 30,993 Btu/h
 Burn Duration: 4.55 h
 Burn Rate: 3.63 lb/h
 Stack Temp: 313.4 Deg. F

| | |
|------------------|-----------------|
| Air Fuel | Dry Molecular W |
| Dry Moles Exhaus | Air Fuel Ratio |

22,514 kJ/h
32,672 kJ/h

1.649 kg/h

156.3 Deg. C

| INPUT DATA | | | | Oxygen Calculation | | | Input Data | | Combust | Heat | Net | Air | Wet Wt |
|--------------|-----------------------|----------|-----------------------|--------------------|----------------------|----------------------------|---------------|----------------|---------|------------|-------|------------|--------|
| 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 % | Fuel Ratio | Now Wt |
| 0 | 9.16 | 0.28 | 1.89 | 809.0% | 20.80 | 18.77 | 152.4 | 23.6 | 91.7% | 48.6% | 44.6% | 54.2 | 9.16 |
| 1 | 9.04 | 0.20 | 1.17 | 1341.2% | 20.85 | 19.59 | 136.2 | 23.6 | 91.9% | 33.5% | 30.8% | 86.5 | 9.04 |
| 2 | 8.91 | 0.20 | 2.67 | 583.7% | 20.75 | 17.98 | 191.1 | 23.9 | 95.9% | 50.8% | 48.7% | 41.0 | 8.91 |
| 3 | 8.75 | 0.43 | 3.87 | 357.5% | 20.66 | 16.58 | 253.7 | 23.4 | 92.7% | 51.6% | 47.8% | 27.2 | 8.75 |
| 4 | 8.53 | 0.25 | 7.45 | 155.4% | 20.43 | 12.86 | 373.9 | 23.2 | 97.8% | 56.9% | 55.6% | 15.4 | 8.53 |
| 5 | 8.39 | 0.38 | 10.88 | 74.5% | 20.20 | 9.13 | 299.9 | 23.3 | 97.4% | 71.1% | 69.2% | 10.5 | 8.39 |
| 6 | 8.28 | 0.38 | 9.51 | 98.7% | 20.29 | 10.59 | 274.0 | 23.4 | 97.1% | 70.8% | 68.8% | 11.9 | 8.28 |
| 7 | 8.19 | 0.25 | 9.58 | 99.8% | 20.29 | 10.58 | 267.7 | 23.4 | 98.2% | 71.5% | 70.2% | 12.0 | 8.19 |
| 8 | 8.09 | 0.17 | 10.04 | 92.5% | 20.27 | 10.14 | 268.3 | 23.3 | 98.9% | 72.2% | 71.4% | 11.6 | 8.09 |
| 9 | 7.98 | 0.23 | 10.63 | 81.0% | 20.22 | 9.48 | 271.7 | 23.4 | 98.5% | 72.7% | 71.6% | 10.9 | 7.98 |
| 10 | 7.86 | 0.24 | 11.23 | 71.4% | 20.18 | 8.84 | 276.7 | 23.3 | 98.5% | 73.1% | 72.0% | 10.3 | 7.86 |
| 11 | 7.75 | 0.16 | 10.83 | 78.8% | 20.21 | 9.31 | 276.0 | 23.6 | 99.0% | 72.7% | 72.0% | 10.8 | 7.75 |
| 12 | 7.63 | 0.14 | 10.50 | 84.6% | 20.24 | 9.66 | 273.8 | 23.7 | 99.2% | 72.5% | 71.9% | 11.1 | 7.63 |
| 13 | 7.53 | 0.14 | 10.70 | 81.1% | 20.22 | 9.45 | 276.8 | 23.5 | 99.1% | 72.5% | 71.9% | 10.9 | 7.53 |
| 14 | 7.41 | 0.17 | 11.07 | 74.9% | 20.20 | 9.05 | 281.2 | 23.2 | 99.0% | 72.7% | 71.9% | 10.6 | 7.41 |
| 15 | 7.29 | 0.26 | 11.62 | 65.4% | 20.16 | 8.41 | 289.0 | 23.6 | 98.4% | 72.8% | 71.6% | 10.0 | 7.29 |
| 16 | 7.17 | 0.27 | 11.57 | 66.0% | 20.16 | 8.46 | 292.1 | 23.5 | 98.3% | 72.5% | 71.3% | 10.0 | 7.17 |
| 17 | 7.04 | 0.29 | 11.93 | 60.7% | 20.13 | 8.05 | 298.7 | 23.4 | 98.2% | 72.5% | 71.2% | 9.7 | 7.04 |
| 18 | 6.94 | 0.25 | 12.06 | 59.5% | 20.13 | 7.94 | 300.8 | 23.2 | 98.5% | 72.6% | 71.4% | 9.6 | 6.94 |
| 19 | 6.81 | 0.23 | 11.96 | 61.0% | 20.13 | 8.05 | 299.2 | 23.7 | 98.6% | 72.6% | 71.5% | 9.7 | 6.81 |
| 20 | 6.70 | 0.24 | 11.87 | 62.3% | 20.14 | 8.15 | 301.1 | 23.5 | 98.5% | 72.3% | 71.3% | 9.8 | 6.70 |
| 21 | 6.58 | 0.20 | 11.84 | 63.2% | 20.15 | 8.21 | 298.1 | 23.7 | 98.8% | 72.5% | 71.6% | 9.9 | 6.58 |
| 22 | 6.47 | 0.19 | 11.68 | 65.5% | 20.16 | 8.38 | 295.3 | 23.9 | 98.8% | 72.5% | 71.7% | 10.0 | 6.47 |
| 23 | 6.37 | 0.17 | 11.51 | 68.1% | 20.17 | 8.57 | 294.1 | 24.0 | 99.0% | 72.4% | 71.7% | 10.2 | 6.37 |
| 24 | 6.26 | 0.17 | 11.47 | 68.8% | 20.17 | 8.62 | 292.2 | 23.9 | 99.0% | 72.5% | 71.7% | 10.2 | 6.26 |
| 25 | 6.16 | 0.23 | 11.60 | 66.1% | 20.16 | 8.45 | 294.1 | 23.8 | 98.6% | 72.5% | 71.4% | 10.0 | 6.16 |
| 26 | 6.05 | 0.21 | 11.57 | 66.8% | 20.16 | 8.49 | 293.4 | 23.7 | 98.7% | 72.5% | 71.5% | 10.1 | 6.05 |
| 27 | 5.94 | 0.22 | 11.63 | 65.9% | 20.16 | 8.42 | 292.5 | 23.7 | 98.7% | 72.6% | 71.6% | 10.0 | 5.94 |
| 28 | 5.84 | 0.20 | 11.75 | 64.4% | 20.15 | 8.30 | 293.8 | 23.9 | 98.8% | 72.7% | 71.8% | 9.9 | 5.84 |
| 29 | 5.74 | 0.23 | 12.18 | 58.4% | 20.12 | 7.83 | 295.5 | 23.8 | 98.6% | 73.1% | 72.0% | 9.6 | 5.74 |
| 30 | 5.64 | 0.36 | 12.77 | 49.7% | 20.07 | 7.13 | 301.5 | 24.2 | 97.9% | 73.3% | 71.7% | 9.0 | 5.64 |
| 31 | 5.52 | 0.31 | 12.82 | 49.6% | 20.07 | 7.10 | 300.7 | 24.2 | 98.1% | 73.4% | 72.1% | 9.0 | 5.52 |
| 32 | 5.42 | 0.28 | 12.61 | 52.3% | 20.09 | 7.33 | 299.8 | 24.2 | 98.3% | 73.3% | 72.0% | 9.2 | 5.42 |
| 33 | 5.31 | 0.26 | 12.41 | 55.1% | 20.10 | 7.57 | 296.6 | 24.1 | 98.4% | 73.2% | 72.1% | 9.4 | 5.31 |
| 34 | 5.21 | 0.25 | 12.41 | 55.1% | 20.10 | 7.57 | 294.8 | 24.1 | 98.5% | 73.4% | 72.2% | 9.4 | 5.21 |
| 35 | 5.11 | 0.26 | 12.33 | 56.1% | 20.11 | 7.65 | 295.1 | 24.4 | 98.4% | 73.3% | 72.1% | 9.4 | 5.11 |
| 36 | 5.01 | 0.22 | 12.05 | 60.1% | 20.13 | 7.97 | 291.1 | 24.4 | 98.7% | 73.2% | 72.3% | 9.7 | 5.01 |
| 37 | 4.92 | 0.19 | 11.89 | 62.6% | 20.14 | 8.16 | 287.7 | 24.0 | 98.9% | 73.3% | 72.4% | 9.8 | 4.92 |

| | |
|---------------------------|--------|
| Ratio (A/F) | |
| Weight (M _g) | 29.59 |
| Wet Gas (N _g) | 575.69 |
| Ratio (A/F) | 16.52 |

%HC
1.32

Combustion Efficiency: 95.97%
 Total Input (kJ): 148,658 140,995 (Btu)
 Total Output (kJ): 102,437 97,156 (Btu)
 Efficiency: 68.91%
 Total CO (g): 455.19

Moisture of Wood (wet basis): 18.082
 Initial Dry Weight W_{t,do} (kg): 7.50
 Moisture Content Dry 22.07

Load Weight (kg): **9.16**
 Fuel Heating HHV LHV HHV
 Value in kJ/kg - CV: **19,810 18,329** Btu/lb **8522.5**

| 78.22 | 1.74 | 76.82 | 148701 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.12 | 20.99 | 1.84 | 6.13 | 0.10 | 0.18 | 34.57 |
|----------------|----------------------------------|----------------|-------------|-----------------|------------------|-----------------|-----------------|---------------------------|---|-------|------|-------|------|-----------------------------|-----------------|
| % Wet Consumed | Dry Wt. Now W _{t,dn} | % Dry Consumed | Total Input | Fuel Properties | | | | Mw Moisture Fuel Burnt | Mass Balance (moles/100 mole dry flue gas) | | | | | kg Wood per 100 mole dfp | |
| | | | | Carbon /12= [a] | Hydrogen /1= [b] | Oxygen /16= [c] | Calorific Value | | [h] | [u] | [w] | [j] | [k] | Nk | CO ₂ |
| 0.00 | 7.50 | 0.00 | 0 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.06 | 20.97 | 0.53 | 1.82 | 0.01 | 0.05 | 35.44 |
| 1.34 | 7.40 | 1.34 | 3019 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.05 | 20.97 | 0.33 | 1.16 | 0.00 | 0.03 | 34.95 |
| 2.72 | 7.30 | 2.72 | 2319 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.15 | 20.99 | 0.71 | 2.43 | 0.00 | 0.07 | 37.95 |
| 4.46 | 7.17 | 4.46 | 3129 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.13 | 20.99 | 1.07 | 3.59 | 0.04 | 0.11 | 36.43 |
| 6.93 | 6.98 | 6.93 | 2945 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.44 | 21.07 | 1.90 | 6.49 | 0.02 | 0.19 | 39.43 |
| 8.42 | 6.87 | 8.42 | 1951 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.62 | 21.12 | 2.78 | 9.48 | 0.04 | 0.28 | 39.31 |
| 9.56 | 6.79 | 9.56 | 1657 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.52 | 21.09 | 2.44 | 8.32 | 0.04 | 0.24 | 39.10 |
| 10.65 | 6.71 | 10.65 | 1620 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.59 | 21.11 | 2.43 | 8.29 | 0.02 | 0.24 | 39.72 |
| 11.74 | 6.62 | 11.74 | 1693 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.65 | 21.13 | 2.52 | 8.62 | 0.01 | 0.25 | 40.11 |
| 12.93 | 6.53 | 12.93 | 1841 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.66 | 21.13 | 2.68 | 9.16 | 0.02 | 0.27 | 39.90 |
| 14.21 | 6.44 | 14.21 | 1878 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.70 | 21.14 | 2.83 | 9.67 | 0.02 | 0.28 | 39.91 |
| 15.45 | 6.34 | 15.45 | 1841 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.70 | 21.14 | 2.71 | 9.28 | 0.01 | 0.27 | 40.18 |
| 16.69 | 6.25 | 16.69 | 1767 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.69 | 21.14 | 2.62 | 9.00 | 0.00 | 0.26 | 40.27 |
| 17.83 | 6.17 | 17.83 | 1804 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.71 | 21.14 | 2.67 | 9.17 | 0.01 | 0.27 | 40.26 |
| 19.12 | 6.07 | 19.12 | 1951 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.72 | 21.15 | 2.77 | 9.49 | 0.01 | 0.28 | 40.17 |
| 20.46 | 5.97 | 20.46 | 1951 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.72 | 21.14 | 2.93 | 10.02 | 0.02 | 0.29 | 39.85 |
| 21.74 | 5.87 | 21.74 | 1988 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.71 | 21.14 | 2.92 | 9.98 | 0.03 | 0.29 | 39.81 |
| 23.13 | 5.77 | 23.13 | 1878 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.72 | 21.15 | 3.02 | 10.31 | 0.03 | 0.30 | 39.73 |
| 24.27 | 5.68 | 24.27 | 1914 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.75 | 21.15 | 3.04 | 10.39 | 0.02 | 0.30 | 39.90 |
| 25.71 | 5.58 | 25.71 | 1951 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.75 | 21.15 | 3.01 | 10.29 | 0.02 | 0.30 | 39.96 |
| 26.89 | 5.49 | 26.89 | 1841 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.74 | 21.15 | 2.99 | 10.21 | 0.02 | 0.30 | 39.95 |
| 28.18 | 5.39 | 28.18 | 1841 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.76 | 21.16 | 2.97 | 10.16 | 0.02 | 0.30 | 40.09 |
| 29.37 | 5.30 | 29.37 | 1693 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.75 | 21.15 | 2.93 | 10.03 | 0.01 | 0.29 | 40.10 |
| 30.46 | 5.22 | 30.46 | 1730 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.75 | 21.15 | 2.88 | 9.87 | 0.01 | 0.29 | 40.18 |
| 31.70 | 5.13 | 31.70 | 1730 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.74 | 21.15 | 2.87 | 9.83 | 0.01 | 0.29 | 40.19 |
| 32.79 | 5.04 | 32.79 | 1657 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.73 | 21.15 | 2.92 | 9.98 | 0.02 | 0.29 | 39.96 |
| 33.93 | 4.96 | 33.93 | 1767 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.73 | 21.15 | 2.90 | 9.94 | 0.02 | 0.29 | 40.02 |
| 35.17 | 4.87 | 35.17 | 1693 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.73 | 21.15 | 2.92 | 10.00 | 0.02 | 0.29 | 40.01 |
| 36.21 | 4.79 | 36.21 | 1620 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.75 | 21.15 | 2.95 | 10.09 | 0.02 | 0.29 | 40.09 |
| 37.35 | 4.70 | 37.35 | 1657 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.76 | 21.16 | 3.06 | 10.47 | 0.02 | 0.30 | 39.99 |
| 38.43 | 4.62 | 38.43 | 1804 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.75 | 21.15 | 3.24 | 11.05 | 0.04 | 0.32 | 39.58 |
| 39.77 | 4.52 | 39.77 | 1804 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.77 | 21.16 | 3.24 | 11.06 | 0.03 | 0.32 | 39.74 |
| 40.86 | 4.44 | 40.86 | 1657 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.77 | 21.16 | 3.18 | 10.88 | 0.03 | 0.32 | 39.83 |
| 42.00 | 4.35 | 42.00 | 1657 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.77 | 21.16 | 3.13 | 10.69 | 0.03 | 0.31 | 39.89 |
| 43.09 | 4.27 | 43.09 | 1657 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.77 | 21.16 | 3.12 | 10.68 | 0.02 | 0.31 | 39.92 |
| 44.23 | 4.19 | 44.23 | 1620 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.76 | 21.16 | 3.11 | 10.62 | 0.03 | 0.31 | 39.90 |
| 45.27 | 4.11 | 45.27 | 1509 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.76 | 21.16 | 3.03 | 10.35 | 0.02 | 0.30 | 40.01 |
| 46.26 | 4.03 | 46.26 | 1546 | 4.06 | 6.87 | 2.74 | 19810.00 | 18.08 | 79.76 | 21.16 | 2.98 | 10.20 | 0.01 | 0.30 | 40.14 |

Moisture Content M_{Cwb} : 18.08203

Dry kg : 7.50
 CA: 49
 HY: 7
 OX: 43.9

LHV
 7885.2

| 84.38 | 5.57 | 0.68 | 469.48 | 33.17 | 12.26 | 429.48 | 5399.79 | 4007.84 | 3883.59 | 3843.43 | 5320.53 | 4642.97 | 297.09 | 55402.25 | 73547.29 | |
|--------------------------|------|-------|----------------|------------------|-----------------|------------------|--------------|--|----------|----------------|-----------------|------------------|--------|-------------|-----------------|----------------|
| Moles per kg of Dry Wood | | | | | | Moisture Present | Stack Temp K | Heat Content Change - Ambient to Stack Temperature Flue Gas Constituent | | | | | | Room Temp K | CO ₂ | O ₂ |
| O ₂ | CO | HC | N ₂ | H ₂ O | CO ₂ | | | O ₂ | CO | N ₂ | CH ₄ | H ₂ O | | | | |
| 352.93 | 5.19 | 0.19 | 1486.31 | 34.15 | 12.26 | 425.59 | 5155.16 | 3869.20 | 3759.95 | 3718.81 | 4985.46 | 4498.57 | 296.76 | 182.68 | 1365.56 | |
| 587.61 | 5.94 | -0.08 | 2371.64 | 34.68 | 12.26 | 409.37 | 4479.55 | 3373.78 | 3281.39 | 3244.89 | 4306.56 | 3926.92 | 296.76 | 156.57 | 1982.46 | |
| 255.35 | 2.85 | 0.01 | 1124.21 | 34.51 | 12.26 | 464.26 | 6785.69 | 5051.42 | 4898.55 | 4847.11 | 6653.34 | 5857.58 | 297.04 | 257.53 | 1289.88 | |
| 156.25 | 4.04 | 0.34 | 745.85 | 33.85 | 12.26 | 526.82 | 9551.61 | 7020.50 | 6785.69 | 6719.14 | 9562.27 | 8107.06 | 296.54 | 347.97 | 1096.96 | |
| 68.13 | 1.30 | 0.08 | 420.75 | 34.36 | 12.26 | 647.09 | 15160.43 | 10883.70 | 10454.42 | 10365.68 | 15745.19 | 12469.35 | 296.32 | 597.76 | 741.50 | |
| 32.97 | 1.35 | 0.14 | 287.60 | 34.23 | 12.26 | 573.09 | 11660.97 | 8492.24 | 8188.41 | 8112.29 | 11846.21 | 9776.61 | 296.43 | 458.43 | 279.96 | |
| 43.54 | 1.56 | 0.16 | 326.97 | 34.21 | 12.26 | 547.15 | 10466.78 | 7661.70 | 7397.52 | 7326.65 | 10547.35 | 8835.51 | 296.59 | 409.22 | 333.56 | |
| 43.87 | 1.02 | 0.08 | 329.84 | 34.37 | 12.26 | 540.87 | 10184.41 | 7464.47 | 7209.48 | 7139.90 | 10242.09 | 8611.68 | 296.54 | 404.52 | 327.44 | |
| 40.53 | 0.67 | 0.03 | 318.25 | 34.46 | 12.26 | 541.43 | 10211.66 | 7483.69 | 7227.86 | 7158.14 | 10271.14 | 8633.57 | 296.48 | 409.57 | 303.33 | |
| 35.61 | 0.85 | 0.07 | 299.11 | 34.39 | 12.26 | 544.87 | 10363.43 | 7589.50 | 7328.69 | 7258.29 | 10435.63 | 8753.57 | 296.59 | 413.47 | 270.27 | |
| 31.43 | 0.84 | 0.07 | 283.34 | 34.38 | 12.26 | 549.87 | 10594.74 | 7751.32 | 7483.03 | 7411.55 | 10685.14 | 8937.31 | 296.48 | 422.79 | 243.62 | |
| 34.55 | 0.60 | 0.03 | 295.84 | 34.46 | 12.26 | 549.15 | 10553.42 | 7721.86 | 7454.78 | 7383.53 | 10641.78 | 8903.64 | 296.71 | 424.03 | 266.79 | |
| 37.05 | 0.53 | 0.02 | 305.50 | 34.49 | 12.26 | 546.93 | 10446.10 | 7646.47 | 7382.80 | 7312.07 | 10526.69 | 8817.92 | 296.87 | 420.62 | 283.28 | |
| 35.54 | 0.53 | 0.02 | 299.77 | 34.48 | 12.26 | 549.98 | 10593.43 | 7749.94 | 7481.59 | 7410.14 | 10684.77 | 8935.55 | 296.65 | 426.47 | 275.41 | |
| 32.85 | 0.60 | 0.03 | 289.42 | 34.45 | 12.26 | 554.32 | 10801.42 | 7895.71 | 7620.69 | 7548.26 | 10908.55 | 9101.17 | 296.37 | 433.94 | 259.40 | |
| 28.86 | 0.88 | 0.08 | 273.46 | 34.36 | 12.26 | 562.15 | 11146.92 | 8135.04 | 7848.34 | 7774.46 | 11286.42 | 9371.98 | 296.71 | 444.19 | 234.74 | |
| 29.10 | 0.91 | 0.09 | 274.29 | 34.35 | 12.26 | 565.21 | 11289.24 | 8234.01 | 7942.58 | 7868.07 | 11441.26 | 9484.12 | 296.65 | 449.47 | 239.60 | |
| 26.82 | 0.98 | 0.10 | 265.47 | 34.32 | 12.26 | 571.87 | 11600.33 | 8449.94 | 8148.09 | 8072.24 | 11780.55 | 9728.62 | 296.54 | 460.93 | 226.62 | |
| 26.26 | 0.83 | 0.08 | 263.80 | 34.37 | 12.26 | 573.98 | 11704.13 | 8522.27 | 8217.01 | 8140.70 | 11893.13 | 9810.64 | 296.37 | 467.03 | 223.79 | |
| 26.90 | 0.78 | 0.07 | 266.39 | 34.38 | 12.26 | 572.32 | 11610.24 | 8455.95 | 8153.58 | 8077.75 | 11793.26 | 9735.08 | 296.82 | 463.99 | 227.50 | |
| 27.44 | 0.79 | 0.07 | 268.38 | 34.38 | 12.26 | 574.26 | 11706.36 | 8522.97 | 8217.44 | 8141.17 | 11897.44 | 9811.08 | 296.65 | 467.63 | 233.89 | |
| 27.81 | 0.67 | 0.05 | 270.14 | 34.42 | 12.26 | 571.21 | 11556.88 | 8418.84 | 8118.24 | 8042.64 | 11735.21 | 9693.03 | 296.87 | 463.35 | 234.11 | |
| 28.77 | 0.66 | 0.05 | 273.81 | 34.42 | 12.26 | 568.48 | 11423.00 | 8325.42 | 8029.21 | 7954.22 | 11590.25 | 9587.06 | 297.09 | 458.06 | 239.56 | |
| 29.91 | 0.59 | 0.04 | 278.32 | 34.45 | 12.26 | 567.21 | 11362.09 | 8283.04 | 7988.84 | 7914.11 | 11524.07 | 9539.01 | 297.15 | 456.54 | 247.76 | |
| 30.19 | 0.59 | 0.04 | 279.39 | 34.45 | 12.26 | 565.37 | 11279.94 | 8226.23 | 7934.83 | 7860.44 | 11434.02 | 9474.77 | 297.09 | 453.30 | 248.37 | |
| 29.10 | 0.79 | 0.07 | 274.66 | 34.39 | 12.26 | 567.26 | 11373.12 | 8291.35 | 7996.93 | 7922.11 | 11534.66 | 9548.70 | 296.93 | 454.46 | 241.26 | |
| 29.38 | 0.73 | 0.06 | 275.88 | 34.40 | 12.26 | 566.59 | 11346.71 | 8273.37 | 7979.91 | 7905.18 | 11505.08 | 9528.48 | 296.82 | 454.09 | 243.05 | |
| 28.99 | 0.74 | 0.06 | 274.39 | 34.40 | 12.26 | 565.65 | 11301.18 | 8241.63 | 7949.66 | 7875.14 | 11455.74 | 9492.48 | 296.87 | 452.18 | 238.91 | |
| 28.30 | 0.67 | 0.05 | 272.00 | 34.42 | 12.26 | 566.98 | 11356.11 | 8279.22 | 7985.30 | 7910.58 | 11516.81 | 9534.83 | 297.04 | 455.24 | 234.32 | |
| 25.72 | 0.75 | 0.07 | 262.01 | 34.39 | 12.26 | 568.65 | 11434.91 | 8334.01 | 8037.47 | 7962.40 | 11602.54 | 9596.91 | 296.98 | 457.30 | 214.39 | |
| 22.10 | 1.11 | 0.13 | 247.25 | 34.27 | 12.26 | 574.65 | 11698.90 | 8515.76 | 8210.04 | 8133.94 | 11893.74 | 9802.10 | 297.32 | 463.04 | 188.22 | |
| 22.02 | 0.96 | 0.11 | 247.37 | 34.31 | 12.26 | 573.82 | 11658.28 | 8487.49 | 8183.12 | 8107.20 | 11849.59 | 9770.07 | 297.37 | 463.33 | 186.92 | |
| 23.15 | 0.89 | 0.09 | 251.86 | 34.34 | 12.26 | 572.98 | 11621.93 | 8462.51 | 8159.41 | 8083.63 | 11809.39 | 9741.88 | 297.32 | 462.85 | 195.92 | |
| 24.33 | 0.84 | 0.08 | 256.45 | 34.36 | 12.26 | 569.76 | 11477.59 | 8362.92 | 8064.78 | 7989.58 | 11650.68 | 9629.35 | 297.21 | 457.80 | 203.45 | |
| 24.35 | 0.81 | 0.08 | 256.61 | 34.36 | 12.26 | 567.93 | 11393.19 | 8304.43 | 8009.15 | 7934.30 | 11558.41 | 9563.16 | 297.21 | 454.81 | 202.19 | |
| 24.76 | 0.83 | 0.08 | 258.12 | 34.36 | 12.26 | 568.21 | 11391.13 | 8301.83 | 8006.37 | 7931.61 | 11558.72 | 9559.75 | 297.59 | 454.46 | 205.58 | |
| 26.48 | 0.73 | 0.06 | 264.92 | 34.39 | 12.26 | 564.21 | 11209.41 | 8175.96 | 7886.64 | 7812.64 | 11359.96 | 9417.33 | 297.54 | 448.53 | 216.50 | |
| 27.54 | 0.63 | 0.05 | 269.24 | 34.43 | 12.26 | 560.87 | 11071.41 | 8081.27 | 7796.81 | 7723.33 | 11207.04 | 9310.55 | 297.15 | 444.38 | 222.55 | |

| SUMS | | | | | AVERAGE | SUMS | | | | | | |
|-----------------------------------|----------------|-----------------|-----------------------|--------------------------|-----------------------|---------------|--------------------|-----------------------------|-----------------|----------------|----------------|-------|
| 435087.63 | 433248.34 | 165345.41 | 442668.02 | 163340.04 | 6454.89 | 46205.37 | 5978.64 | 40226.73 | 102495.37 | 5994.71 | 455.19 | 24.77 |
| Energy Losses (kJ/kg of Dry Fuel) | | | | | Total Loss Rate | Total Loss | Chemical Loss 1 | Sensible and Latent Loss | Total Output | Chem Loss 2 | Grams Produced | |
| Flue Gas Constituent | | | | | | | | | | | CO | HC |
| CO | N ₂ | CH ₄ | H ₂ O Comb | H ₂ O Fuel MC | | | | | | | | |
| 1487.58 | 5527.31 | 168.72 | 1654.96 | 594.36 | 10981.18 | 0.00 | 0 | 0.00 | 0 | 0 | 0.00 | 0.00 |
| 1700.55 | 7695.71 | -71.09 | 1661.11 | 587.35 | 13712.65 | 2089.65 | 245 | 1844.25 | 929 | 245 | 25.35 | -0.19 |
| 821.91 | 5449.15 | 4.78 | 1719.61 | 611.03 | 10153.90 | 1188.81 | 95 | 1093.66 | 1131 | 95 | 9.36 | 0.01 |
| 1171.77 | 5011.49 | 304.15 | 1762.59 | 638.61 | 10333.55 | 1632.32 | 228 | 1404.03 | 1497 | 228 | 17.89 | 0.85 |
| 382.31 | 4361.32 | 72.74 | 1939.34 | 692.11 | 8787.08 | 1306.39 | 65 | 1240.95 | 1639 | 65 | 5.42 | 0.19 |
| 394.44 | 2333.10 | 130.27 | 1839.91 | 659.09 | 6095.21 | 600.35 | 50 | 549.93 | 1351 | 50 | 3.74 | 0.23 |
| 452.51 | 2395.57 | 141.51 | 1806.36 | 647.54 | 6186.27 | 517.34 | 49 | 468.77 | 1139 | 49 | 3.65 | 0.21 |
| 294.66 | 2354.99 | 69.72 | 1807.08 | 644.80 | 5903.21 | 482.70 | 29 | 453.57 | 1137 | 29 | 2.32 | 0.10 |
| 194.82 | 2278.11 | 29.39 | 1812.54 | 645.07 | 5672.83 | 484.95 | 19 | 466.23 | 1209 | 19 | 1.61 | 0.04 |
| 246.36 | 2171.05 | 59.80 | 1813.12 | 646.54 | 5620.61 | 522.26 | 28 | 494.46 | 1318 | 28 | 2.21 | 0.10 |
| 242.68 | 2099.96 | 64.15 | 1818.93 | 648.79 | 5540.93 | 525.16 | 28 | 496.74 | 1352 | 28 | 2.22 | 0.11 |
| 174.64 | 2184.33 | 28.88 | 1821.91 | 648.38 | 5548.97 | 515.61 | 18 | 497.14 | 1325 | 18 | 1.56 | 0.05 |
| 153.61 | 2233.81 | 15.77 | 1820.49 | 647.33 | 5574.92 | 497.30 | 15 | 482.55 | 1270 | 15 | 1.32 | 0.02 |
| 155.13 | 2221.34 | 18.62 | 1824.22 | 648.77 | 5569.96 | 507.21 | 15 | 491.77 | 1297 | 15 | 1.36 | 0.03 |
| 175.14 | 2184.59 | 31.53 | 1828.41 | 650.80 | 5563.81 | 548.01 | 20 | 528.14 | 1403 | 20 | 1.66 | 0.06 |
| 256.42 | 2126.03 | 74.00 | 1832.71 | 654.12 | 5622.22 | 553.76 | 32 | 521.99 | 1397 | 32 | 2.43 | 0.13 |
| 265.31 | 2158.15 | 77.64 | 1836.14 | 655.50 | 5681.81 | 570.19 | 34 | 536.60 | 1418 | 34 | 2.56 | 0.14 |
| 285.03 | 2142.94 | 89.80 | 1843.09 | 658.50 | 5706.91 | 540.89 | 35 | 506.23 | 1337 | 35 | 2.60 | 0.15 |
| 241.79 | 2147.50 | 71.06 | 1848.14 | 659.50 | 5658.82 | 546.85 | 29 | 517.37 | 1368 | 29 | 2.25 | 0.12 |
| 226.60 | 2151.82 | 63.29 | 1846.47 | 658.58 | 5638.24 | 555.34 | 28 | 527.49 | 1396 | 28 | 2.15 | 0.11 |
| 231.30 | 2184.92 | 64.61 | 1848.92 | 659.51 | 5690.78 | 528.79 | 27 | 501.97 | 1312 | 27 | 2.07 | 0.11 |
| 194.24 | 2172.63 | 47.37 | 1846.92 | 658.06 | 5616.67 | 521.90 | 22 | 500.01 | 1319 | 22 | 1.74 | 0.08 |
| 192.85 | 2177.94 | 45.36 | 1843.51 | 656.76 | 5614.03 | 479.92 | 20 | 460.06 | 1214 | 20 | 1.59 | 0.07 |
| 172.64 | 2202.64 | 34.59 | 1843.13 | 656.17 | 5613.47 | 490.31 | 18 | 472.66 | 1240 | 18 | 1.45 | 0.05 |
| 171.24 | 2196.16 | 33.56 | 1841.04 | 655.38 | 5599.07 | 489.05 | 17 | 471.60 | 1241 | 17 | 1.44 | 0.05 |
| 228.56 | 2175.92 | 61.03 | 1840.33 | 656.29 | 5657.85 | 473.15 | 24 | 449.53 | 1184 | 24 | 1.84 | 0.09 |
| 213.44 | 2180.86 | 53.80 | 1840.49 | 656.04 | 5641.76 | 503.26 | 23 | 480.01 | 1264 | 23 | 1.83 | 0.09 |
| 215.26 | 2160.82 | 55.19 | 1839.08 | 655.60 | 5617.04 | 480.18 | 23 | 457.62 | 1213 | 23 | 1.77 | 0.08 |
| 195.50 | 2151.65 | 47.25 | 1841.48 | 656.12 | 5581.58 | 456.40 | 19 | 437.04 | 1163 | 19 | 1.54 | 0.07 |
| 218.92 | 2086.21 | 61.56 | 1841.92 | 656.88 | 5537.17 | 463.06 | 23 | 440.18 | 1194 | 23 | 1.76 | 0.09 |
| 322.32 | 2011.12 | 113.46 | 1842.79 | 659.40 | 5600.35 | 509.98 | 39 | 471.26 | 1294 | 39 | 2.82 | 0.18 |
| 280.82 | 2005.50 | 94.85 | 1843.91 | 659.01 | 5534.33 | 503.96 | 33 | 470.59 | 1300 | 33 | 2.46 | 0.15 |
| 260.15 | 2035.91 | 83.88 | 1844.25 | 658.66 | 5541.63 | 463.43 | 28 | 435.36 | 1193 | 28 | 2.09 | 0.12 |
| 245.17 | 2048.95 | 75.44 | 1841.39 | 657.28 | 5529.48 | 462.42 | 26 | 436.26 | 1194 | 26 | 1.97 | 0.11 |
| 236.84 | 2036.05 | 71.66 | 1839.56 | 656.47 | 5497.58 | 459.75 | 25 | 434.57 | 1197 | 25 | 1.91 | 0.11 |
| 242.97 | 2047.34 | 73.82 | 1839.19 | 656.43 | 5519.77 | 451.35 | 25 | 426.07 | 1169 | 25 | 1.91 | 0.11 |
| 213.52 | 2069.73 | 58.06 | 1836.16 | 654.68 | 5497.18 | 418.85 | 20 | 398.66 | 1091 | 20 | 1.57 | 0.08 |
| 182.57 | 2079.43 | 42.56 | 1834.32 | 653.37 | 5459.17 | 426.10 | 17 | 408.95 | 1120 | 17 | 1.37 | 0.06 |

Appendix B: Labels & Manuals



UL 127-2011, CAN/ULC-S610



Model: PIONEER-II-ARC PIONEER-II-REC EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044 www.fireplaces.com

SERIAL NO./NUMÉRO DE SÉRIE MP184

FIREPLACE ALSO FOR USE IN MANUFACTURED/MOBILE HOMES WITH SOLID FUEL ONLY YES [X] NO []

FIREPLACE FOR USE OUTDOORS YES [] NO [X]

FIREBOX/FOYER

Table with dimensions: BACK 1/2 IN. MIN., DOS 13 MM MIN., SIDE 1 IN. MIN., COTÉ 25 MM MIN.

CLEARANCE TO CHIMNEY/CHEMINÉE 2 IN. MIN. 51 MM



INSTALLATION MANUAL



OWNERS MANUAL

IF INSTALLATION OR OPERATING INSTRUCTIONS ARE MISSING CONTACT: HEARTH & HOME TECHNOLOGIES, 7571 215th Street West, Lakeville, MN 55044

FIRE CHAMBER INTENDED FOR USE WITH HEARTH & HOME TECHNOLOGIES LISTED FIREPLACE PARTS. SEE INSTALLATION AND OPERATING INSTRUCTIONS FOR THIS MODEL. REPLACE GLASS ONLY WITH CERAMIC.

DO NOT OVERFIRE. USE ONLY: SOLID WOOD FUEL. DO NOT USE A FIREPLACE INSERT OR OTHER PRODUCTS NOT SPECIFIED FOR USE WITH THIS PRODUCT.

WARNING! THIS FIREPLACE HAS NOT BEEN TESTED WITH AN UNVENTED GAS LOG SET. TO REDUCE THE RISK OF FIRE OR INJURY, DO NOT INSTALL AN UNVENTED GAS LOG SET INTO FIREPLACE.

DO NOT USE GRATE OR ELEVATE FIRE. BUILD WOOD FIRE DIRECTLY ON FIREBRICK.

WARNING! TO AVOID THE RISK OF DAMAGING FIREPLACE MATERIALS AND INCREASING THE RISK OF SPREADING A FIRE DO NOT USE THE FIREPLACE TO COOK OR WARM FOOD.

INSTALL AND USE ONLY IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION, VENTING AND OPERATING INSTRUCTIONS. ANY AREA INCORPORATING WARM OR COLD AIR DUCTS SHALL BE ENCLOSED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS OR AUTHORITY HAVING JURISDICTION ABOUT RESTRICTIONS, INSTALLATION INSPECTION AND PERMITS REQUIRED IN YOUR AREA.

COMPONENTS REQUIRED FOR INSTALLATION: HHT SL SERIES PIPE OR DURA PLUS SYSTEM, TERMINATION CAP, HEARTH EXTENSION AND REQUIRED ACCESSORY CHIMNEY AIR KIT PART CAK4A. DO NOT CONNECT THIS UNIT TO A CHIMNEY SERVING ANOTHER APPLIANCE.

DANGER: RISK OF ELECTRICAL SHOCK. DISCONNECT POWER SUPPLY BEFORE SERVICING.

ELECTRICAL RATING: 115 VAC <3.0 AMPS 60 HZ

MUST PROVIDE A SOURCE OF AIR TO PREVENT AIR STARVATION FROM COMBUSTION WHICH COULD RESULT IN HIGH LEVELS OF CARBON MONOXIDE.

THE HEARTH EXTENSION MUST BE INSTALLED ACCORDING TO THE INSTALLATION INSTRUCTIONS.

This wood heater needs periodic inspection and repair for proper operation. Consult 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.

DO NOT REMOVE THIS LABEL

Made in U.S.A. of US and imported parts

Mfg by:



2024 2025 2026 2027 2028 2029 Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards for single burn rate heaters.

This single burn rate wood heater is not approved for use with a flue damper.

Emission test result of 1.7 g/hr were obtained using crib wood and following EPA Method 28R, ASTM E2515, ASTM E2780 and CSA B415.1.

4184-990E

NOTES:

- 1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h
5. Starting Serial No. MP184000001
6. Bar code part number should read P4184-990

Table with 5 columns: REV, REVISIONS, ECO #, DATE, BY. Includes revision history and technical specifications.



UL 127-2011, CAN/ULC-S610



Model:
PIONEER-II-ARC
PIONEER-II-REC
EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044
www.fireplaces.com

NE PAS surcuison. UTILISER UNIQUEMENT: COMBUSTIBLES SOLIDES OU BOIS COTÉES APPLIANCE DE GAZ DÉCORATIF. NE PAS UTILISER UN INSERT CHEMINÉE OU AUTRES PRODUITS NON POUR USAGE SPÉCIFIÉ AVEC CE PRODUIT.

AVERTISSEMENT! CE FOYER N'A PAS ÉTÉ TESTÉ AVEC UN JOURNAL DE GAZ NON APPROUVÉ. POUR RÉDUIRE LES RISQUES D'INCENDIE OU DE BLESSURES, N'INSTALLEZ PAS D'ENREGISTREMENT DE GAZ NON CONTINU AU FOYER.

NE PAS UTILISER DE GRATE OU D'ÉLEVER UN FEU. CONSTRUISEZ UN FEU DE BOIS DIRECTEMENT SUR FIREBRICK.

ATTENTION! POUR ÉVITER LE RISQUE DE MATÉRIAUX ENDOMMAGER FOYER ET AUGMENTER LE RISQUE DE DIFFUSER UN INCENDIE NE PAS UTILISER LA FOYER À CHAUD DES ALIMENTS OU COOK.

INSTALLEZ ET UTILISEZ EN ACCORD AVEC LES INSTRUCTIONS D'INSTALLATION ET D'OPÉRATION DU FABRICANT. LES ZONES DE L'APPAREIL COMPORTANT DES CONDUITS D'AIR CHAUD ET FROID DOIVENT ÊTRE ENFERMÉES SELON LES INSTRUCTIONS D'INSTALLATION DU FABRICANT. CONTACTEZ LE BUREAU DE LA CONSTRUCTION OU LE BUREAU DES INCENDIES AU SUJET DES RESTRICTIONS ET DES INSPECTIONS D'INSTALLATION DANS VOTRE VOISINAGE.

LES PIÈCES EXIGÉES POUR L'INSTALLATION: LES SÉRIES DE CONDUITS HEARTH & HOME TECHNOLOGIES SL, CHAPEAU DE TERMINAISON, EXTENSION DE PROTECTION DE SOL ET LE KIT ACCESSOIRE DE CHEMINÉE CAK4A. NE PAS CONNECTER CET APPAREIL À UNE CHEMINÉE SERVANT UN AUTRE APPAREIL. DANGER: IL Y A RISQUE DE DÉCHARGE ÉLECTRIQUE. DÉCONNECTEZ LE FIL ÉLECTRIQUE DE LA PRISE DE CONTACT AVANT LE SERVICE. PUISSANCE ÉLECTRIQUE: 115 VAC, 3.0T AMPS, 60 HZ. DOIT FOURNIR UNE SOURCE D'AIR AFIN DE PRÉVENIR L'INANITION D'AIR DURANT LA COMBUSTION CE QUI POURRAIT CONDUIRE À DE HAUTS NIVEAUX DE MONOXYDE DE CARBONE.

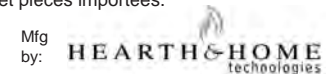
SI DES INSTRUCTIONS D'INSTALLATION OU D'UTILISATION SONT MANQUANTES, CONTACTEZ: HEARTH & HOME TECHNOLOGIES, 7571 215th Street West, Lakeville, MN 55044

LA PROTECTION DE SOL DOIT ÊTRE INSTALLÉE SELON LES INSTRUCTIONS D'INSTALLATION

Cet appareil de chauffage au bois doit être inspecté et réparé périodiquement pour fonctionner correctement. Consultez le manuel du propriétaire pour plus d'informations. Il est contraire à la réglementation fédérale d'utiliser ce poêle à bois d'une manière non conforme aux instructions d'utilisation du manuel du propriétaire.

NE PAS ENLEVER L'ÉTIQUETTE

Fabriqué aux États-Unis-d'Amérique par des pièces d'origine américaine et pièces importées.



4184-990E

NOTES:

- 1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h

Table with 5 columns: Description, Part Number, Date, By, and Material. Includes revision history and technical specifications.



UL 127-2011, CAN/ULC-S610



Model: C40-D
EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044
www.fireplaces.com

SERIAL NO./NUMÉRO DE SÉRIE

MP186

FIREPLACE ALSO FOR USE IN MANUFACTURED/MOBILE HOMES WITH SOLID FUEL ONLY YES NO

FIREPLACE FOR USE OUTDOORS YES NO

FIREBOX/FOYER

BACK 1/2 IN. MIN.
DOS 13 MM MIN.
SIDE 1 IN. MIN.
COTÉ 25 MM MIN.

CLEARANCE TO CHIMNEY/CHEMINÉE
COMBUSTIBLES: 2 IN. MIN.
DÉGAGEMENT DES MATEAUX COMBUSTIBLES: 51 MM



INSTALLATION MANUAL



OWNERS MANUAL

IF INSTALLATION OR OPERATING INSTRUCTIONS ARE MISSING CONTACT: HEARTH & HOME TECHNOLOGIES, 7571 215th Street West, Lakeville, MN 55044

FIRE CHAMBER INTENDED FOR USE WITH HEARTH & HOME TECHNOLOGIES LISTED FIREPLACE PARTS. SEE INSTALLATION AND OPERATING INSTRUCTIONS FOR THIS MODEL. REPLACE GLASS ONLY WITH CERAMIC.

DO NOT OVERFIRE. USE ONLY: SOLID WOOD FUEL. DO NOT USE A FIREPLACE INSERT OR OTHER PRODUCTS NOT SPECIFIED FOR USE WITH THIS PRODUCT.

WARNING! THIS FIREPLACE HAS NOT BEEN TESTED WITH AN UNVENTED GAS LOG SET. TO REDUCE THE RISK OF FIRE OR INJURY, DO NOT INSTALL AN UNVENTED GAS LOG SET INTO FIREPLACE.

DO NOT USE GRATE OR ELEVATE FIRE. BUILD WOOD FIRE DIRECTLY ON FIREBRICK.

WARNING! TO AVOID THE RISK OF DAMAGING FIREPLACE MATERIALS AND INCREASING THE RISK OF SPREADING A FIRE DO NOT USE THE FIREPLACE TO COOK OR WARM FOOD.

INSTALL AND USE ONLY IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION, VENTING AND OPERATING INSTRUCTIONS. ANY AREA INCORPORATING WARM OR COLD AIR DUCTS SHALL BE ENCLOSED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS OR AUTHORITY HAVING JURISDICTION ABOUT RESTRICTIONS, INSTALLATION INSPECTION AND PERMITS REQUIRED IN YOUR AREA. COMPONENTS REQUIRED FOR INSTALLATION: HHT SL SERIES PIPE OR DURA PLUS SYSTEM, TERMINATION CAP, HEARTH EXTENSION AND REQUIRED ACCESSORY CHIMNEY AIR KIT PART CAK4A. DO NOT CONNECT THIS UNIT TO A CHIMNEY SERVING ANOTHER APPLIANCE. DANGER: RISK OF ELECTRICAL SHOCK. DISCONNECT POWER SUPPLY BEFORE SERVICING. ELECTRICAL RATING: 115 VAC <3.0 AMPS 60 HZ MUST PROVIDE A SOURCE OF AIR TO PREVENT AIR STARVATION FROM COMBUSTION WHICH COULD RESULT IN HIGH LEVELS OF CARBON MONOXIDE. THE HEARTH EXTENSION MUST BE INSTALLED ACCORDING TO THE INSTALLATION INSTRUCTIONS.

This wood heater needs periodic inspection and repair for proper operation. Consult 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.

DO NOT REMOVE THIS LABEL

Made in U.S.A. of US and imported parts

Mfg by:



2024 2025 2026 2027 2028 2029 Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards for single burn rate heaters. This single burn rate wood heater is not approved for use with a flue damper. Emission test result of 1.7 g/hr were obtained using crib wood and following EPA Method 28R, ASTM E2515, ASTM E2780 and CSA B415.1.

4186-990E

NOTES:

1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h
5. Starting Serial No. MP186000001
6. Bar code part number should read P4186-990

| | | | | | |
|-----|--|--------|-------|-----|--|
| E | Updated for C40-D | 101030 | 9/24 | DLH | <p>UNLESS OTHERWISE SPECIFIED: TOLERANCE - (2) PLACE DEC : ± 0.03 (3) PLACE DEC: ± 0.005 ANGLE: ± 2° FRACTION: ± 1/16</p> <p>← OUTSIDE MATERIAL. ← NORMAL DIM & INSIDE MATERIAL. ← OUTSIDE APEX ← INSIDE APEX ← DIMS ENCLOSED BY AN OVAL ARE CRITICAL DIMENSIONS</p> |
| D | Removed serial number prefix | 94197 | 9/20 | RAG | |
| C | Added part number bar code to label | 93916 | 8/20 | RAG | |
| B | Removed serial number under notes on french side | 92341 | 11/19 | RAG | |
| REV | REVISIONS | ECO # | DATE | BY | |

| | | |
|---|------------|---------------|
| PART NAME: C40-D English Serial | | |
| DRAWN BY: PAA | SCALE: NTS | MATERIAL: |
| This print is checked and controlled by the engineering departments of Hearth & Home Technologies | | SHEET: 1 OF 2 |
| PART NUMBER: 4186-990 | | REV: E |

Confidential property of Hearth & Home Technologies



UL 127-2011, CAN/ULC-S610



Model: C40-D
EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044
www.fireplaces.com

NE PAS surcuison. UTILISER UNIQUEMENT: COMBUSTIBLES SOLIDES OU BOIS COTÉES APPLIANCE DE GAZ DÉCORATIF. NE PAS UTILISER UN INSERT CHEMINÉE OU AUTRES PRODUITS NON POUR USAGE SPÉCIFIÉ AVEC CE PRODUIT.

AVERTISSEMENT! CE FOYER N'A PAS ÉTÉ TESTÉ AVEC UN JOURNAL DE GAZ NON APPROUVÉ. POUR RÉDUIRE LES RISQUES D'INCENDIE OU DE BLESSURES, N'INSTALLEZ PAS D'ENREGISTREMENT DE GAZ NON CONTINU AU FOYER.

NE PAS UTILISER DE GRATE OU D'ÉLEVER UN FEU. CONSTRUISEZ UN FEU DE BOIS DIRECTEMENT SUR FIREBRICK.

ATTENTION! POUR ÉVITER LE RISQUE DE MATÉRIAUX ENDOMMAGER FOYER ET AUGMENTER LE RISQUE DE DIFFUSER UN INCENDIE NE PAS UTILISER LA FOYER À CHAUD DES ALIMENTS OU COOK.

INSTALLEZ ET UTILISEZ EN ACCORD AVEC LES INSTRUCTIONS D'INSTALLATION ET D'OPÉRATION DU FABRICANT. LES ZONES DE L'APPAREIL COMPORTANT DES CONDUITS D'AIR CHAUD ET FROID DOIVENT ÊTRE ENFERMÉES SELON LES INSTRUCTIONS D'INSTALLATION DU FABRICANT. CONTACTEZ LE BUREAU DE LA CONSTRUCTION OU LE BUREAU DES INCENDIES AU SUJET DES RESTRICTIONS ET DES INSPECTIONS D'INSTALLATION DANS VOTRE VOISINAGE.

LES PIÈCES EXIGÉES POUR L'INSTALLATION: LES SÉRIES DE CONDUITS HEARTH & HOME TECHNOLOGIES SL, CHAPEAU DE TERMINAISON, EXTENSION DE PROTECTION DE SOL ET LE KIT ACCESSOIRE DE CHEMINÉE CAK4A. NE PAS CONNECTER CET APPAREIL À UNE CHEMINÉE SERVANT UN AUTRE APPAREIL. DANGER: IL Y A RISQUE DE DÉCHARGE ÉLECTRIQUE. DÉCONNECTEZ LE FIL ÉLECTRIQUE DE LA PRISE DE CONTACT AVANT LE SERVICE. PUISSANCE ÉLECTRIQUE: 115 VAC, 3.0T AMPS, 60 HZ. DOIT FOURNIR UNE SOURCE D'AIR AFIN DE PRÉVENIR L'INANITION D'AIR DURANT LA COMBUSTION CE QUI POURRAIT CONDUIRE À DE HAUTS NIVEAUX DE MONOXYDE DE CARBONE.

SI DES INSTRUCTIONS D'INSTALLATION OU D'UTILISATION SONT MANQUANTES, CONTACTEZ:
HEARTH & HOME TECHNOLOGIES,
7571 215th Street West, Lakeville, MN 55044

LA PROTECTION DE SOL DOIT ÊTRE INSTALLÉE SELON LES INSTRUCTIONS D'INSTALLATION

Cet appareil de chauffage au bois doit être inspecté et réparé périodiquement pour fonctionner correctement. Consultez le manuel du propriétaire pour plus d'informations. Il est contraire à la réglementation fédérale d'utiliser ce poêle à bois d'une manière non conforme aux instructions d'utilisation du manuel du propriétaire.

NE PAS ENLEVER L'ÉTIQUETTE

Fabriqué aux États-Unis-d'Amérique par des pièces d'origine américaine et pièces importées.

Mfg
by: HEARTH & HOME technologies

4186-990E

NOTES:

1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h

| E | Updated for C40-D | 101030 | 9/24 | DLH | UNLESS OTHERWISE SPECIFIED: TOLERANCE - (2) PLACE DEC : ± 0.03 (3) PLACE DEC: ± 0.005 ANGLE: ± 2° FRACTION: ± 1/16 ←← OUTSIDE MATERIAL. ← NORMAL DIM & INSIDE MATERIAL. ↗ OUTSIDE APEX ← INSIDE APEX - DIMS ENCLOSED BY AN OVAL ARE CRITICAL DIMENSIONS | | | | | |
|-----|--|--------|-------|-----|--|------------|-----------|---------------|-----------------------|--------|
| D | Removed serial number prefix | 94197 | 9/20 | RAG | Confidential property of Hearth & Home Technologies | | | | | |
| C | Added part number bar code to label | 93916 | 8/20 | RAG | | | | | | |
| B | Removed serial number under notes on french side | 92341 | 11/19 | RAG | | | | | | |
| REV | REVISIONS | ECO # | DATE | BY | | | | | | |
| | | | | | PART NAME: C40-D French Serial | | | | | |
| | | | | | DRAWN BY: PAA | SCALE: NTS | MATERIAL: | | | |
| | | | | | This print is checked and controlled by the engineering departments of Hearth & Home Technologies | | | SHEET: 2 OF 2 | PART NUMBER: 4186-990 | REV: E |



UL 127-2011, CAN/ULC-S610



Model: NORTHSTAR-D EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044 www.fireplaces.com

SERIAL NO./NUMÉRO DE SÉRIE

MP187

FIREPLACE ALSO FOR USE IN MANUFACTURED/MOBILE HOMES WITH SOLID FUEL ONLY YES NO

FIREPLACE FOR USE OUTDOORS YES NO

FIREBOX/FOYER

| | | |
|------|-----|----------|
| BACK | 1/2 | IN. MIN. |
| DOS | 13 | MM MIN. |
| SIDE | 1 | IN. MIN. |
| COTÉ | 25 | MM MIN. |

CLEARANCE TO CHIMNEY/CHEMINÉE COMBUSTIBLES: 2 IN. MIN. DÉGAGEMENT DES MATEAUX COMBUSTIBLES: 51 MM



INSTALLATION MANUAL



OWNERS MANUAL

IF INSTALLATION OR OPERATING INSTRUCTIONS ARE MISSING CONTACT: HEARTH & HOME TECHNOLOGIES, 7571 215th Street West, Lakeville, MN 55044

FIRE CHAMBER INTENDED FOR USE WITH HEARTH & HOME TECHNOLOGIES LISTED FIREPLACE PARTS. SEE INSTALLATION AND OPERATING INSTRUCTIONS FOR THIS MODEL. REPLACE GLASS ONLY WITH CERAMIC.

DO NOT OVERFIRE. USE ONLY: SOLID WOOD FUEL. DO NOT USE A FIREPLACE INSERT OR OTHER PRODUCTS NOT SPECIFIED FOR USE WITH THIS PRODUCT.

WARNING! THIS FIREPLACE HAS NOT BEEN TESTED WITH AN UNVENTED GAS LOG SET. TO REDUCE THE RISK OF FIRE OR INJURY, DO NOT INSTALL AN UNVENTED GAS LOG SET INTO FIREPLACE.

DO NOT USE GRATE OR ELEVATE FIRE. BUILD WOOD FIRE DIRECTLY ON FIREBRICK.

WARNING! TO AVOID THE RISK OF DAMAGING FIREPLACE MATERIALS AND INCREASING THE RISK OF SPREADING A FIRE DO NOT USE THE FIREPLACE TO COOK OR WARM FOOD.

INSTALL AND USE ONLY IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION, VENTING AND OPERATING INSTRUCTIONS. ANY AREA INCORPORATING WARM OR COLD AIR DUCTS SHALL BE ENCLOSED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS OR AUTHORITY HAVING JURISDICTION ABOUT RESTRICTIONS, INSTALLATION INSPECTION AND PERMITS REQUIRED IN YOUR AREA.

COMPONENTS REQUIRED FOR INSTALLATION: HHT SL SERIES PIPE OR DURA PLUS SYSTEM, TERMINATION CAP, HEARTH EXTENSION AND REQUIRED ACCESSORY CHIMNEY AIR KIT PART CAK4A. DO NOT CONNECT THIS UNIT TO A CHIMNEY SERVING ANOTHER APPLIANCE.

DANGER: RISK OF ELECTRICAL SHOCK. DISCONNECT POWER SUPPLY BEFORE SERVICING.

ELECTRICAL RATING: 115 VAC <3.0 AMPS 60 HZ

MUST PROVIDE A SOURCE OF AIR TO PREVENT AIR STARVATION FROM COMBUSTION WHICH COULD RESULT IN HIGH LEVELS OF CARBON MONOXIDE.

THE HEARTH EXTENSION MUST BE INSTALLED ACCORDING TO THE INSTALLATION INSTRUCTIONS.

This wood heater needs periodic inspection and repair for proper operation. Consult 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.

DO NOT REMOVE THIS LABEL

Made in U.S.A. of US and imported parts

Mfg by:



2024 2025 2026 2027 2028 2029 Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards for single burn rate heaters.

This single burn rate wood heater is not approved for use with a flue damper.

Emission test result of 1.7 g/hr were obtained using crib wood and following EPA Method 28R, ASTM E2515, ASTM E2780 and CSA B415.1.

4187-990E

NOTES:

1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h
5. Starting Serial No. MP187000001
6. Bar code part number should read P4187-990

| | | | | | | | | |
|-----|--|--------|-------|-----|--|---|-----------------------|-----------|
| E | Updated for NORTHSTAR-D | 101030 | 9/24 | DLH | <p>UNLESS OTHERWISE SPECIFIED: TOLERANCE - (2) PLACE DEC : ± 0.03 (3) PLACE DEC : ± 0.005 ANGLE: ± 2° FRACTION: ± 1/16</p> <p>← OUTSIDE MATERIAL. ← NORMAL DIM & INSIDE MATERIAL. ← OUTSIDE APEX ← INSIDE APEX ← DIMS ENCLOSED BY AN OVAL ARE CRITICAL DIMENSIONS</p> <p>Confidential property of Hearth & Home Technologies</p> | PART NAME: NORTHSTAR-D English Serial | | |
| D | Removed serial number prefix | 94197 | 9/20 | RAG | | DRAWN BY: PAA | SCALE: NTS | MATERIAL: |
| C | Added part number bar code to label | 93916 | 8/20 | RAG | | This print is checked and controlled by the engineering departments of Hearth & Home Technologies | | |
| B | Removed serial number under notes on french side | 92341 | 11/19 | RAG | | SHEET: 1 OF 2 | PART NUMBER: 4187-990 | REV: E |
| REV | REVISIONS | ECO # | DATE | BY | | | | |



UL 127-2011, CAN/ULC-S610



Model: NORTHSTAR-D EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044 www.fireplaces.com

NE PAS surcuison. UTILISER UNIQUEMENT: COMBUSTIBLES SOLIDES OU BOIS COTÉES APPLIANCE DE GAZ DÉCORATIF. NE PAS UTILISER UN INSERT CHEMINÉE OU AUTRES PRODUITS NON POUR USAGE SPÉCIFIÉ AVEC CE PRODUIT.

AVERTISSEMENT! CE FOYER N'A PAS ÉTÉ TESTÉ AVEC UN JOURNAL DE GAZ NON APPROUVÉ. POUR RÉDUIRE LES RISQUES D'INCENDIE OU DE BLESSURES, N'INSTALLEZ PAS D'ENREGISTREMENT DE GAZ NON CONTINU AU FOYER.

NE PAS UTILISER DE GRATE OU D'ÉLEVER UN FEU. CONSTRUISEZ UN FEU DE BOIS DIRECTEMENT SUR FIREBRICK.

ATTENTION! POUR ÉVITER LE RISQUE DE MATÉRIAUX ENDOMMAGER FOYER ET AUGMENTER LE RISQUE DE DIFFUSER UN INCENDIE NE PAS UTILISER LA FOYER À CHAUD DES ALIMENTS OU COOK.

INSTALLEZ ET UTILISEZ EN ACCORD AVEC LES INSTRUCTIONS D'INSTALLATION ET D'OPÉRATION DU FABRICANT. LES ZONES DE L'APPAREIL COMPORTANT DES CONDUITS D'AIR CHAUD ET FROID DOIVENT ÊTRE ENFERMÉES SELON LES INSTRUCTIONS D'INSTALLATION DU FABRICANT. CONTACTEZ LE BUREAU DE LA CONSTRUCTION OU LE BUREAU DES INCENDIES AU SUJET DES RESTRICTIONS ET DES INSPECTIONS D'INSTALLATION DANS VOTRE VOISINAGE.

LES PIÈCES EXIGÉES POUR L'INSTALLATION: LES SÉRIES DE CONDUITS HEARTH & HOME TECHNOLOGIES SL, CHAPEAU DE TERMINAISON, EXTENSION DE PROTECTION DE SOL ET LE KIT ACCESSOIRE DE CHEMINÉE CAK4A. NE PAS CONNECTER CET APPAREIL À UNE CHEMINÉE SERVANT UN AUTRE APPAREIL. DANGER: IL Y A RISQUE DE DÉCHARGE ÉLECTRIQUE. DÉCONNECTEZ LE FIL ÉLECTRIQUE DE LA PRISE DE CONTACT AVANT LE SERVICE. PUISSANCE ÉLECTRIQUE: 115 VAC, 3.0T AMPS, 60 HZ. DOIT FOURNIR UNE SOURCE D'AIR AFIN DE PRÉVENIR L'INANITION D'AIR DURANT LA COMBUSTION CE QUI POURRAIT CONDUIRE À DE HAUTS NIVEAUX DE MONOXYDE DE CARBONE.

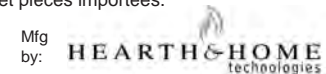
SI DES INSTRUCTIONS D'INSTALLATION OU D'UTILISATION SONT MANQUANTES, CONTACTEZ: HEARTH & HOME TECHNOLOGIES, 7571 215th Street West, Lakeville, MN 55044

LA PROTECTION DE SOL DOIT ÊTRE INSTALLÉE SELON LES INSTRUCTIONS D'INSTALLATION

Cet appareil de chauffage au bois doit être inspecté et réparé périodiquement pour fonctionner correctement. Consultez le manuel du propriétaire pour plus d'informations. Il est contraire à la réglementation fédérale d'utiliser ce poêle à bois d'une manière non conforme aux instructions d'utilisation du manuel du propriétaire.

NE PAS ENLEVER L'ÉTIQUETTE


Fabriqué aux États-Unis-d'Amérique par des pièces d'origine américaine et pièces importées.



4187-990E

NOTES:

1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h

| REV | REVISIONS | ECO # | DATE | BY | UNLESS OTHERWISE SPECIFIED: TOLERANCE - (2) PLACE DEC : ± 0.03 (3) PLACE DEC: ± 0.005 ANGLE: ± 2° FRACTION: ± 1/16 ←← OUTSIDE MATERIAL. ← NORMAL DIM & INSIDE MATERIAL. ↗ OUTSIDE APEX ← INSIDE APEX - DIMS ENCLOSED BY AN OVAL ARE CRITICAL DIMENSIONS | | | | |
|-----|--|--------|-------|-----|--|------------|---------------|-----------------------|--------|
| E | Updated for NORTHSTAR-D | 101030 | 9/24 | DLH |  Confidential property of Hearth & Home Technologies | | | | |
| D | Removed serial number prefix | 94197 | 9/20 | RAG | | | | | |
| C | Added part number bar code to label | 93916 | 8/20 | RAG | | | | | |
| B | Removed serial number under notes on french side | 92341 | 11/19 | RAG | | | | | |
| | | | | | PART NAME: NORTHSTAR-D French Serial | | | | |
| | | | | | DRAWN BY: PAA | SCALE: NTS | MATERIAL: | | |
| | | | | | This print is checked and controlled by the engineering departments of Hearth & Home Technologies | | SHEET: 2 OF 2 | PART NUMBER: 4187-990 | REV: E |



UL 127-2011, CAN/ULC-S610



Model: WARMMAJIC-D
EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044
www.fireplaces.com

SERIAL NO./NUMÉRO DE SÉRIE

MP188

FIREPLACE ALSO FOR USE IN MANUFACTURED/MOBILE HOMES WITH SOLID FUEL ONLY YES NO

FIREPLACE FOR USE OUTDOORS YES NO

FIREBOX/FOYER

BACK 1/2 IN. MIN.
DOS 13 MM MIN.
SIDE 1 IN. MIN.
COTÉ 25 MM MIN.

CLEARANCE TO CHIMNEY/CHEMINÉE
COMBUSTIBLES: 2 IN. MIN.
DÉGAGEMENT DES MATEAUX COMBUSTIBLES: 51 MM



INSTALLATION MANUAL



OWNERS MANUAL

IF INSTALLATION OR OPERATING INSTRUCTIONS ARE MISSING CONTACT: HEARTH & HOME TECHNOLOGIES, 7571 215th Street West, Lakeville, MN 55044

FIRE CHAMBER INTENDED FOR USE WITH HEARTH & HOME TECHNOLOGIES LISTED FIREPLACE PARTS. SEE INSTALLATION AND OPERATING INSTRUCTIONS FOR THIS MODEL. REPLACE GLASS ONLY WITH CERAMIC.

DO NOT OVERFIRE. USE ONLY: SOLID WOOD FUEL. DO NOT USE A FIREPLACE INSERT OR OTHER PRODUCTS NOT SPECIFIED FOR USE WITH THIS PRODUCT.

WARNING! THIS FIREPLACE HAS NOT BEEN TESTED WITH AN UNVENTED GAS LOG SET. TO REDUCE THE RISK OF FIRE OR INJURY, DO NOT INSTALL AN UNVENTED GAS LOG SET INTO FIREPLACE.

DO NOT USE GRATE OR ELEVATE FIRE. BUILD WOOD FIRE DIRECTLY ON FIREBRICK.

WARNING! TO AVOID THE RISK OF DAMAGING FIREPLACE MATERIALS AND INCREASING THE RISK OF SPREADING A FIRE DO NOT USE THE FIREPLACE TO COOK OR WARM FOOD.

INSTALL AND USE ONLY IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION, VENTING AND OPERATING INSTRUCTIONS. ANY AREA INCORPORATING WARM OR COLD AIR DUCTS SHALL BE ENCLOSED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS OR AUTHORITY HAVING JURISDICTION ABOUT RESTRICTIONS, INSTALLATION INSPECTION AND PERMITS REQUIRED IN YOUR AREA.

COMPONENTS REQUIRED FOR INSTALLATION: HHT SL SERIES PIPE OR DURA PLUS SYSTEM, TERMINATION CAP, HEARTH EXTENSION AND REQUIRED ACCESSORY CHIMNEY AIR KIT PART CAK4A. DO NOT CONNECT THIS UNIT TO A CHIMNEY SERVING ANOTHER APPLIANCE.

DANGER: RISK OF ELECTRICAL SHOCK. DISCONNECT POWER SUPPLY BEFORE SERVICING. ELECTRICAL RATING: 115 VAC <3.0 AMPS 60 HZ

MUST PROVIDE A SOURCE OF AIR TO PREVENT AIR STARVATION FROM COMBUSTION WHICH COULD RESULT IN HIGH LEVELS OF CARBON MONOXIDE.

THE HEARTH EXTENSION MUST BE INSTALLED ACCORDING TO THE INSTALLATION INSTRUCTIONS.

This wood heater needs periodic inspection and repair for proper operation. Consult 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.

DO NOT REMOVE THIS LABEL

Made in U.S.A. of US and imported parts

Mfg by:



2024 2025 2026 2027 2028 2029 Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards for single burn rate heaters.

This single burn rate wood heater is not approved for use with a flue damper.

Emission test result of 1.7 g/hr were obtained using crib wood and following EPA Method 28R, ASTM E2515, ASTM E2780 and CSA B415.1.

4188-990E

NOTES:

1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h
5. Starting Serial No. MP188000001
6. Bar code part number should read P4188-990

| | | | | | |
|-----|--|--------|-------|-----|---|
| E | Updated for WARMMAJIC-D | 101030 | 9/24 | DLH | <p>UNLESS OTHERWISE SPECIFIED: TOLERANCE - (2) PLACE DEC : ± 0.03 (3) PLACE DEC : ± 0.005 ANGLE: ± 2° FRACTION: ± 1/16</p> <p>← OUTSIDE MATERIAL. ← NORMAL DIM & INSIDE MATERIAL. ← OUTSIDE APEX ← INSIDE APEX ← DIMS ENCLOSED BY AN OVAL ARE CRITICAL DIMENSIONS</p> |
| D | Removed serial number prefix | 94197 | 9/20 | RAG | |
| C | Added part number bar code to label | 93916 | 8/20 | RAG | |
| B | Removed serial number under notes on french side | 92341 | 11/19 | RAG | |
| REV | REVISIONS | ECO # | DATE | BY | |



Confidential property of Hearth & Home Technologies

| | |
|---|-----------------------|
| PART NAME: WARMMAJIC-D English Serial | |
| DRAWN BY: PAA | SCALE: NTS |
| MATERIAL: | |
| This print is checked and controlled by the engineering departments of Hearth & Home Technologies | |
| SHEET: 1 OF 2 | PART NUMBER: 4188-990 |
| REV: E | |



UL 127-2011, CAN/ULC-S610



Model: WARMMAJIC-D EPA Certified Fireplace



7571 - 215th Street West, Lakeville, MN 55044 www.fireplaces.com

NE PAS surcuison. UTILISER UNIQUEMENT: COMBUSTIBLES SOLIDES OU BOIS COTÉES APPLIANCE DE GAZ DÉCORATIF. NE PAS UTILISER UN INSERT CHEMINÉE OU AUTRES PRODUITS NON POUR USAGE SPÉCIFIÉ AVEC CE PRODUIT.

AVERTISSEMENT! CE FOYER N'A PAS ÉTÉ TESTÉ AVEC UN JOURNAL DE GAZ NON APPROUVÉ. POUR RÉDUIRE LES RISQUES D'INCENDIE OU DE BLESSURES, N'INSTALLEZ PAS D'ENREGISTREMENT DE GAZ NON CONTINU AU FOYER.

NE PAS UTILISER DE GRATE OU D'ÉLEVER UN FEU. CONSTRUISEZ UN FEU DE BOIS DIRECTEMENT SUR FIREBRICK.

ATTENTION! POUR ÉVITER LE RISQUE DE MATÉRIAUX ENDOMMAGER FOYER ET AUGMENTER LE RISQUE DE DIFFUSER UN INCENDIE NE PAS UTILISER LA FOYER À CHAUD DES ALIMENTS OU COOK.

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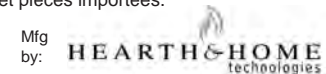
SI DES INSTRUCTIONS D'INSTALLATION OU D'UTILISATION SONT MANQUANTES, CONTACTEZ: HEARTH & HOME TECHNOLOGIES, 7571 215th Street West, Lakeville, MN 55044

LA PROTECTION DE SOL DOIT ÊTRE INSTALLÉE SELON LES INSTRUCTIONS D'INSTALLATION

Cet appareil de chauffage au bois doit être inspecté et réparé périodiquement pour fonctionner correctement. Consultez le manuel du propriétaire pour plus d'informations. Il est contraire à la réglementation fédérale d'utiliser ce poêle à bois d'une manière non conforme aux instructions d'utilisation du manuel du propriétaire.

NE PAS ENLEVER L'ÉTIQUETTE


Fabriqué aux États-Unis-d'Amérique par des pièces d'origine américaine et pièces importées.



4188-990E

NOTES:

1. Material: Metal, double sided
2. Copy: Black
3. Background: Silver
4. Size: 8" w x 5.5" h

| | | | | | | | | |
|-----|--|--------|-------|-----|--|---|-----------------------|-----------|
| E | Updated for WARMMAJIC-D | 101030 | 9/24 | DLH | <p>UNLESS OTHERWISE SPECIFIED: TOLERANCE - (2) PLACE DEC : ± 0.03 (3) PLACE DEC: ± 0.005 ANGLE: ± 2° FRACTION: ± 1/16</p> <p>←←← OUTSIDE MATERIAL. ←←← NORMAL DIM & INSIDE MATERIAL. ←←← OUTSIDE APEX ←←← INSIDE APEX - DIMS ENCLOSED BY AN OVAL ARE CRITICAL DIMENSIONS</p>  <p>Confidential property of Hearth & Home Technologies</p> | PART NAME: WARMMAJIC-D French Serial | | |
| D | Removed serial number prefix | 94197 | 9/20 | RAG | | DRAWN BY: PAA | SCALE: NTS | MATERIAL: |
| C | Added part number bar code to label | 93916 | 8/20 | RAG | | This print is checked and controlled by the engineering departments of Hearth & Home Technologies | | |
| B | Removed serial number under notes on french side | 92341 | 11/19 | RAG | | SHEET: 2 OF 2 | PART NUMBER: 4188-990 | REV: E |
| REV | REVISIONS | ECO # | DATE | BY | | | | |

Owner's Manual


Care and Operation

Pour demander un exemplaire en français de ce Manuel du propriétaire, visitez www.fireplaces.com/translations



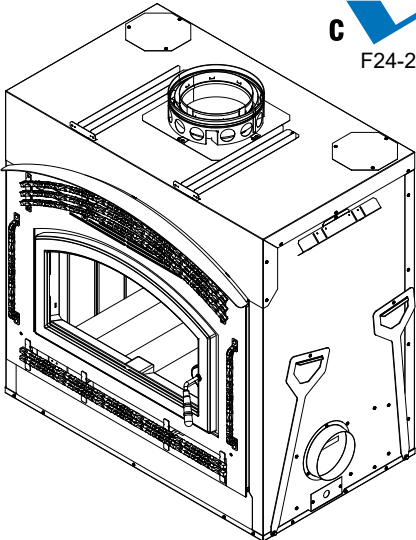
INSTALLER: Leave this manual with party responsible for use and operation.

OWNER: Retain this manual for future reference.


NOTICE: *DO NOT* discard this manual!



Model(s):
PIONEER-II-ARC
PIONEER-II-REC

HEAT & GLO
heatilator




EPA CERTIFIED
WOODBURNING FIREPLACE

⚠ WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

- **DO NOT** store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **DO NOT** overfire. Overfiring will void your warranty.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may cause house fire.

⚠ WARNING



HOT SURFACES!
 Glass and other surfaces are hot during operation AND cool down.

Hot glass will cause burns.


- **DO NOT** touch glass until it is cooled
- **NEVER** allow children to touch glass
- Keep children away

- **CAREFULLY SUPERVISE** children in same room as fireplace.
- Alert children and adults to hazards of high temperatures.

High temperatures may ignite clothing or other flammable materials.

- Keep clothing, furniture, draperies and other flammable materials away.

⚠ WARNING



Fire Risk.

For use with solid wood fuel only.
 Other fuels may overfire and generate poisonous gases (i.e. carbon monoxide).

Installation and service of this appliance should be performed by qualified personnel. Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.




Safety Alert Key:

- **DANGER!** Indicates a hazardous situation which, if not avoided will result in death or serious injury.
- **WARNING!** Indicates a hazardous situation which, if not avoided could result in death or serious injury.
- **CAUTION!** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE:** Indicates practices which may cause damage to the fireplace or to property.

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1 Welcome

Read this manual before installing or operating this fireplace.
Please retain this owner's manual for future references.

A. Congratulations

Congratulations on selecting a Quadra-Fire wood burning fireplace. The Quadra-Fire fireplace you have selected is designed to provide the utmost in safety, reliability, and efficiency.

As the owner of a new fireplace, you'll want to read and carefully follow all of the instructions contained in this Owner's Manual. Pay special attention to all Cautions and Warnings.

This Owner's Manual should be retained for future reference. We suggest that you keep it with your other important documents and product manuals.

Your new Quadra-Fire wood burning fireplace will give you years of durable use and trouble-free enjoyment. Welcome to the Quadra-Fire family of fireplace products!

Quadra-Fire is a registered trademark of Hearth & Home Technologies.

Local Dealer Information

DEALER: Fill in your name, address, phone and email information here and fireplace information below.

Dealer Name: _____
 Address: _____

 Phone: _____
 Email: _____

Fireplace Information:

Brand: _____ Model Name: _____
 Serial Number: _____ Date Installed: _____

Listing Label Information/Location

The model information regarding your specific fireplace can be found on the rating plate usually located in the control area of the fireplace.

Model:
PIONEER-II-ARC
PIONEER-II-REC
EPA Certified Fireplace

SERIAL NO./NUMÉRO DE SÉRIE
MP184

Model Number (points to PIONEER-II-ARC/PIONEER-II-REC)
Serial Number (points to MP184)

HEARTH & HOME technologies
7571 - 215th Street West, Lakeville, MN 55044
www.fireplaces.com

FIREPLACE ALSO FOR USE IN MANUFACTURED HOMES WITH SOLID FUEL ONLY: YES NO

FIREPLACE FOR USE OUTDOORS: YES NO

CHIMNEY/CHEMINÉE
BACK: 1/2 IN. MIN.
DOS: 13 IN. MIN.
SIDE: 1 IN. MIN.
COTE: 25 IN. MIN.

INSTALLATION AND OPERATING INSTRUCTIONS ARE MISSING CONTACT:
HEARTH & HOME TECHNOLOGIES,
7571 215th Street West, Lakeville, MN 55044

2024 2025 2026 2027 2028 2029 Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

4184-990E

B. LIMITED LIFETIME WARRANTY

Hearth & Home Technologies LLC LIMITED WARRANTY

Hearth & Home Technologies LLC (“HHT”) extends the following warranty for HHT gas, wood, pellet and electric hearth appliances (each a “Product” and collectively, the “Product(s)”) and certain component parts set forth in the table below (“Component Part(s)”) that are purchased from a HHT authorized dealer or distributor.

WARRANTY COVERAGE:

HHT warrants that the Products and their Component Parts will be free from defects in materials and workmanship for the applicable period of Warranty coverage set forth in the table below (“Warranty Period”). If a Product or Component Parts are found to be defective in materials or workmanship during the applicable Warranty Period, HHT will, at our discretion, repair the applicable Component Part(s), replace the applicable Component Part(s), or refund the purchase price of the applicable Product(s). The maximum amount recoverable under this Warranty is limited to the purchase price of the Product. This Warranty is transferable from the original purchaser to subsequent owners, but the Warranty Period will not be extended in duration or expanded in coverage for any such transfer. This Warranty is subject to conditions, exclusions, and limitations as described below.

WARRANTY PERIOD:

Warranty coverage begins at the date of installation. In the case of new home constructions, Warranty coverage begins six months after invoice of the final sale of the Product(s) by an independent, authorized HHT dealer or distributor. However, the Warranty coverage shall commence no later than 24 months following the date of Product shipment from HHT, regardless of the installation or purchase date.

| Warranty Period | | HHT Manufactured Appliances and Venting | | | | | |
|---|---------|---|--------|------|----------|---|--|
| Component Parts | Labor | Gas | Pellet | Wood | Electric | Component Parts Covered by this Warranty | |
| 1 Year | | X | X | X | | All parts including handles, external enameled components and other material except as covered by Warranty Conditions, Warranty Exclusions, and Warranty Limitations listed | |
| 2 Years | | | | | X | All parts except as covered by Warranty Conditions, Warranty Exclusions, and Warranty Limitations listed | |
| | | | X | X | | Glass, Electrical components limited to heating element/igniters, Top feed auger assembly, Blowers, Junction Box, Remotes/Wall switches, linear actuator, power cord, vacuum switch, snap disc, wire harnesses and thermocouple | |
| | | X | | | | Electrical components limited to modules, remotes/wall switches, valves, pilots, blowers, junction boxes, wire harnesses, transformers and lights (excluding light bulbs) | |
| | | X | | X | | Cement Refractory Panels, Glass Liner Panels | |
| 3 years | | | X | | | Firepots, burnpots, Harman mechanical feeders | |
| 5 years | | X | | X | | Catalysts, Vented and Vent Free burners and logs | |
| 10 years | 1 year | X | | | | Burners, logs and metal/fiber refractory components of HHT manufactured fireplaces or stoves, venting due to poor workmanship | |
| 10 years | 3 years | | X | X | | Castings, Medallions & Baffles, FlexBurn® System (engine, inner cover, access cover and fireback), Firebox and heat exchanger, HHT Chimney & Terminations, Manifolds | |
| 20 years | 3 years | X | | | | Firebox and heat exchanger | |
| All purchased replacement parts and optional accessories | | | | | | | |
| 1 Year | None | X | X | X | X | All purchased replacement parts and optional accessories | |

WARRANTY CONDITIONS:

- Because HHT cannot control the quality of any Products sold by unauthorized sellers, this Warranty only covers Products that are purchased through an HHT authorized dealer or distributor unless otherwise prohibited by law; a list of HHT authorized dealers is available on the HHT branded websites.
- This Warranty is only valid while the applicable Product remains at the site of original installation.
- This Warranty is only valid in the country in which the HHT authorized dealer or distributor that sold the applicable Product is authorized to sell applicable Product.
- Contact your installing distributor or dealer for Warranty service. If the installing dealer or distributor is unable to provide necessary parts, contact the nearest HHT authorized dealer or supplier. Additional service fees may apply if you are seeking Warranty service from a dealer other than the dealer from whom you originally purchased the applicable Product.
- No HHT consumer should bear cost of warranty service or costs incurred while servicing warranty claims (i.e., travel, gas, or mileage) when the service is performed within the terms of this Warranty. Check with your dealer or distributor in advance for any costs to you when arranging a warranty call. Travel and shipping charges for parts are not covered by this Warranty.

WARRANTY EXCLUSIONS:

This Warranty does not cover the following:

- Changes in surface finishes as a result of normal use. As a heating appliance, some changes in color of interior and exterior surface finishes may occur. This is not a flaw and is not covered under the Warranty.
- Damage to printed, plated, or enameled surfaces caused by fingerprints, accidents, misuse, scratches, melted items or other external sources and residues left on the plated surfaces from the use of abrasive cleaners or polishes.
- Repair or replacement of parts that are subject to normal wear and tear during the Warranty Period are not covered. These parts include: paint, wood and pellet gaskets, firebricks, wood grates, flame guides, batteries and the discoloration of glass.
- Minor expansion, contraction, or movement of certain parts causing noise. These conditions are normal and complaints related to this noise are not covered by this Warranty.
- Damages resulting from: (1) failure to install, operate, or maintain the applicable Product in accordance with the installation instructions, operating instructions, and listing agent identification label furnished with the applicable Product; (2) failure to install the applicable Product in accordance with local building codes; (3) shipping or improper handling; (4) improper operation, abuse, misuse, continued operation with damaged, corroded or failed components, accident, or improperly/incorrectly performed repairs; (5) environmental conditions, inadequate ventilation, negative pressure, or drafting caused by tightly sealed constructions, insufficient make-up air supply, or handling devices such as exhaust fans or forced air furnaces or other such causes; (6) use of fuels other than those specified in the operation instructions; (7) installation or use of components not supplied with the applicable Product or any other components not expressly authorized and approved by HHT; (8) modification of the appliance not expressly authorized and approved by HHT in writing; and/or (9) interruptions or fluctuations of electrical power supply to the applicable Product.
- Non-HHT venting components, hearth connections or other accessories used in conjunction with the applicable Product.
- Any part of a pre-existing fireplace system in which an insert or a decorative gas applicable Product is installed.
- HHT's obligation under this Warranty does not extend to the Product's capability to heat the desired space. Information is provided to assist the consumer and the dealer in selecting the proper Product for the application. Consideration must be given to the Product location and configuration, environmental conditions, insulation and air tightness of the structure.

This warranty is void if:

- The applicable Product has been over-fired, operated in atmospheres contaminated by chlorine, fluorine, or other damaging chemicals. Over-firing can be identified by, but not limited to, warped plates or tubes, deformation/warping of interior cast iron structure or components, rust colored cast iron, bubbling, cracking and discoloration of steel or enamel finishes.
- The applicable Product is subjected to prolonged periods of dampness or condensation.
- There is any damage to the applicable Product due to water or weather damage which is the result of, but not limited to, improper chimney or venting installation.

LIMITATIONS OF REMEDIES AND LIABILITY:

- **EXCEPT TO THE EXTENT PROVIDED BY LAW, HHT MAKES NO EXPRESS WARRANTIES OTHER THAN THE WARRANTY SPECIFIED HEREIN. The owner's exclusive remedy and HHT's sole obligation under this Warranty or in contract, tort or otherwise, shall be limited to, at HHT's sole option, replacement of the Component Part(s), repair of the Component Part(s), or refund of the original purchase price of the applicable Product(s). In no event will HHT be liable for any incidental or consequential damages caused by defects in the applicable Product. 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. This Warranty gives you specific legal rights and you may also have other rights which vary from State to State. THE DURATION OF ANY IMPLIED WARRANTY IS LIMITED TO DURATION OF THE EXPRESSED WARRANTY SPECIFIED ABOVE FOR THE APPLICABLE PRODUCT. Some States do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.**

2 Listing and Code Approvals

A. Appliance Safety Certification

| | |
|--------------------|--|
| Model: | PIONEER-II-ARC & PIONEER-II-REC |
| Laboratory: | Underwriters Laboratories, Inc. |
| Report No: | Project 4789042842 |
| Type: | Wood Fireplace |
| Standard: | UL 127 - 2011 and CAN/ULC S610-2018 (A1998) and (UM) 84-HUD, Manufactured Home Approved. |

B. Appliance Emissions Certification

| | |
|---|---|
| Model: | PIONEER-II-ARC & PIONEER-II-REC |
| Laboratory: | PFS TECO |
| Report No: | F24-253 |
| Standard: | EPA Method 28R, ASTM E2515, ASTM E2780 and CSA B415.1 |
| Can be found at: www.fireplaces.com/shopping-tools/epa-certifications | |

C. BTU & Efficiency Specifications

| | |
|---|---|
| EPA Certified Emissions: | 1.7 grams per hour |
| *LHV Tested Efficiency: | 73% |
| **HHV Tested Efficiency: | 69% |
| ***EPA BTU Output: | 20,900 BTU/hr |
| ****Peak BTU/Hour Output: | 81,000 BTU/hr |
| Vent Size: | 8 inches |
| Firebox Size: | 2.75 cubic feet |
| Recommended Log Length: | 22 inches |
| Fuel | Seasoned Cord Wood less than 20% moisture |
| *Weighted average LHV (Low Heating Value) efficiency using crib wood and data collected during EPA emission test. LHV assumes the moisture is already in a vapor state so there is no loss in energy to vaporize. | |
| **Weighted average HHV (High Heating Value) efficiency using crib wood and data collected during EPA emission test. HHV includes the energy required to vaporize the water in the fuel. | |
| ***BTU outputs based on HHV (High Heating Value) and the burn rate from EPA tests using crib wood. | |
| ****A peak BTU out of the appliance calculated using the maximum first hour burn rate from the High EPA Test and BTU content of seasoned cordwood (8600) times the efficiency. | |

PIONEER-II-ARC & PIONEER-II-REC are Certified to comply with 2020 particulate emission standards.



The PIONEER-II-ARC & PIONEER-II-REC Wood Appliances meet the U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using crib wood.

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

D. Mobile Home Approved

- This appliance is approved for mobile home installations when not installed in a sleeping room and when an outside combustion air inlet is provided.
- The structural integrity of the mobile home floor, ceiling, and walls must be maintained.
- The appliance must be properly grounded to the frame of the mobile home with #8 copper ground wire.
- Outside Air Kit must be installed in a mobile home installation.

E. Glass Specifications

This fireplace is equipped with 5mm ceramic glass. Replace glass only with 5mm ceramic glass. Please contact your dealer for replacement glass.

WARNING



Fire Risk.

Hearth & Home Technologies disclaims any responsibility for, and the warranty will be voided by, the following actions:

- Installation and use of any damaged appliance.
- Modification of the appliance.
- Installation other than as instructed by Hearth & Home Technologies.
- Installation and/or use of any component part not approved by Hearth & Home Technologies.
- Operating appliance without fully assembling all components.
- Do NOT Overfire - If appliance or chimney connector glows, you are overfiring.

Any such action that may cause a fire hazard.

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage.

For assistance or additional information, consult a qualified installer, service agency or your dealer.

NOTE: Hearth & Home Technologies, manufacturer of this appliance, reserves the right to alter its products, their specifications and/or price without notice.

Hearth & Home Technologies is a registered trademark of Hearth & Home Technologies.

3 Important Safety and Operating Information

A. Fireplace Safety

Most problems are caused by improper installation and operation of the fireplace. To provide reasonable fire safety, the following should be given serious consideration:


- The fire should be supervised whenever the fireplace is in use.
- An annual inspection should be performed on the fireplace system.
- Install at least one smoke detector on each floor of your home to ensure your safety.
- Install a CO detector in the room with the fireplace.
- Install a conveniently located Class A fire extinguisher near the fireplace.
- Devise a practiced evacuation plan, consisting of at least two escape routes.
- Devise a plan to deal with a chimney fire:
 - Close all openings into the fireplace.
 - Evacuate.
 - Notify the fire department.

WARNING! Risk of Fire! *Hearth & Home Technologies disclaims any responsibility for, and the warranty and agency listing will be voided by the following actions.*

DO NOT:

- operate damaged fireplace
- modify fireplace
- overfire
- install any gas log set
- install any component not approved by *Hearth & Home Technologies*
- install parts or components not Listed or approved
- operate the fireplace without fully assembling all components

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage.

 **WARNING:** This product and the fuels used to operate this product (wood and wood pellets), and the products of combustion of such fuels, can expose you to chemicals including carbon black, which is known to the State of California to cause cancer and carbon monoxide, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to: www.P65Warnings.ca.gov.

1. Clear Space

Combustible materials must not be stored on the hearth extension. Room furnishings such as drapes, curtains, chairs or other combustibles must be at least 4 ft (1219 mm) from the open front of the fireplace.

Combustible materials are materials made of or surfaced with any of the following materials:

- Wood
- Plant fibers
- Plywood/OSB
- Compressed paper
- Plastic
- Drywall
- Any material that can ignite and burn, flame proofed or not, plastered or un-plastered.

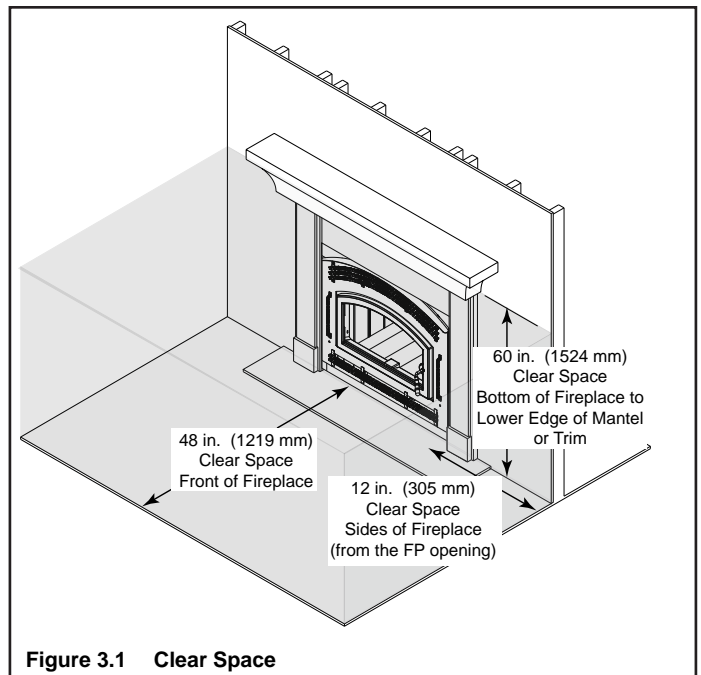
Non-combustible materials are materials which will not ignite and burn, composed of any combination of the following:

- Steel
- Brick
- Concrete
- Glass
- Iron
- Tile
- Slate
- Plasters

WARNING! Risk of Fire! *Keep combustible materials, gasoline and other flammable vapors and liquids clear of the fireplace.*

DO NOT:

- store flammable materials close to the fireplace
- use gasoline, lantern fuel, kerosene, charcoal lighter fluid or similar liquids to start or “freshen up” a fire in this fireplace.



2. Firebrick

Your fireplace is lined with high quality firebrick, which has exceptional insulating properties.

Do not operate the fireplace without bricks. Make sure bricks are installed as shown in Section 4.

Do not use a grate; simply build a fire on the firebox floor.

3. Baffle and Blanket

Ensure correct baffle and baffle protection channel placement; replace baffle components if damaged or missing. (Please refer to Section 4.)

NOTICE: Firebox damage due to improper baffle placement is not covered by warranty. Operate the wood burning fireplace with the baffle in the correct position only. Not doing so could result in:

- reduced efficiency
- overheating the chimney
- overheating the rear of the firebox
- poor performance

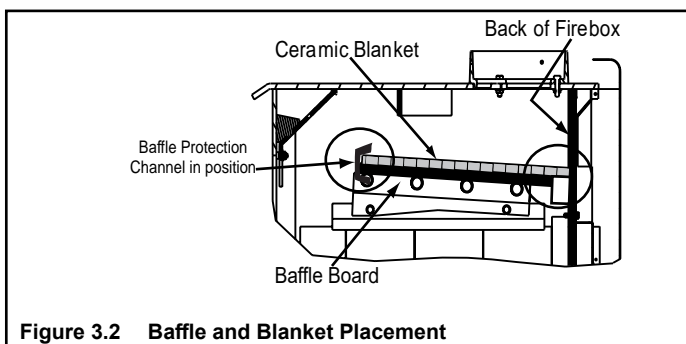


Figure 3.2 Baffle and Blanket Placement

The baffle board must be in contact with the back of the firebox. The ceramic blanket should lay on top of the baffle board. The baffle protection channel should be in position and cover the front of the blanket and baffle board.

4. Over-Firing Your Fireplace

DO NOT OVERFIRE THIS FIREPLACE UNIT

Attempts to achieve heat output rates that exceed design specifications can result in permanent damage to the fireplace.

To prevent over-firing your fireplace. DO NOT:

- use flammable liquids
- overload with wood
- burn trash or large amounts of scrap lumber
- permit too much air to the fire (leaving the door open)

Symptoms of over-firing may include one or more of the following:

- chimney connector or fireplace glowing
- roaring, rumbling noises
- loud cracking or banging sounds
- metal warping
- chimney fire

What to do if your fireplace is over-firing:

- Immediately close the door and air controls to reduce air supply to the fire.
- If you suspect a chimney fire, call the fire department and evacuate your house.
- Contact your local chimney professional and have your fireplace and chimney inspected for any damage.
- Do not use your fireplace until the chimney professional informs you it is safe to do so.
- Hearth & Home Technologies WILL NOT warranty fireplaces that exhibit evidence of over-firing. Evidence of over-firing includes, but is not limited to:
 - warped air tube
 - deteriorated refractory brick
 - deteriorated baffle and other interior components

5. Chimney Fire

In the event of a chimney fire:

- Have the chimney and adjacent structure inspected by qualified professionals. Hearth & Home Technologies recommends that NFI or CSIA certified professionals, or technicians under the direction of certified professionals, conduct an inspection of the chimney per the criteria in NFPA 211.
- Replace components of the chimney and fireplace as specified by the professionals.
- Ensure all joints are properly engaged and the chimney is properly secured.

WARNING! Risk of Fire! A chimney fire can permanently damage your chimney system. Failure to replace damaged components and make proper repairs can cause a structure fire.

WARNING



HOT SURFACES!

Glass and other surfaces are hot during operation AND cool down.

Hot glass will cause burns.

- **DO NOT** touch glass until it is cooled
- NEVER allow children to touch glass
- Keep children away
- CAREFULLY SUPERVISE children in same room as fireplace.
- Alert children and adults to hazards of high temperatures.

High temperatures may ignite clothing or other flammable materials.

- Keep clothing, furniture, draperies and other flammable materials away.

B. General Operating Parts

WARNING! DO NOT operate fireplace before reading and understanding operating instructions. Failure to operate fireplace according to operating instructions could cause fire or injury.

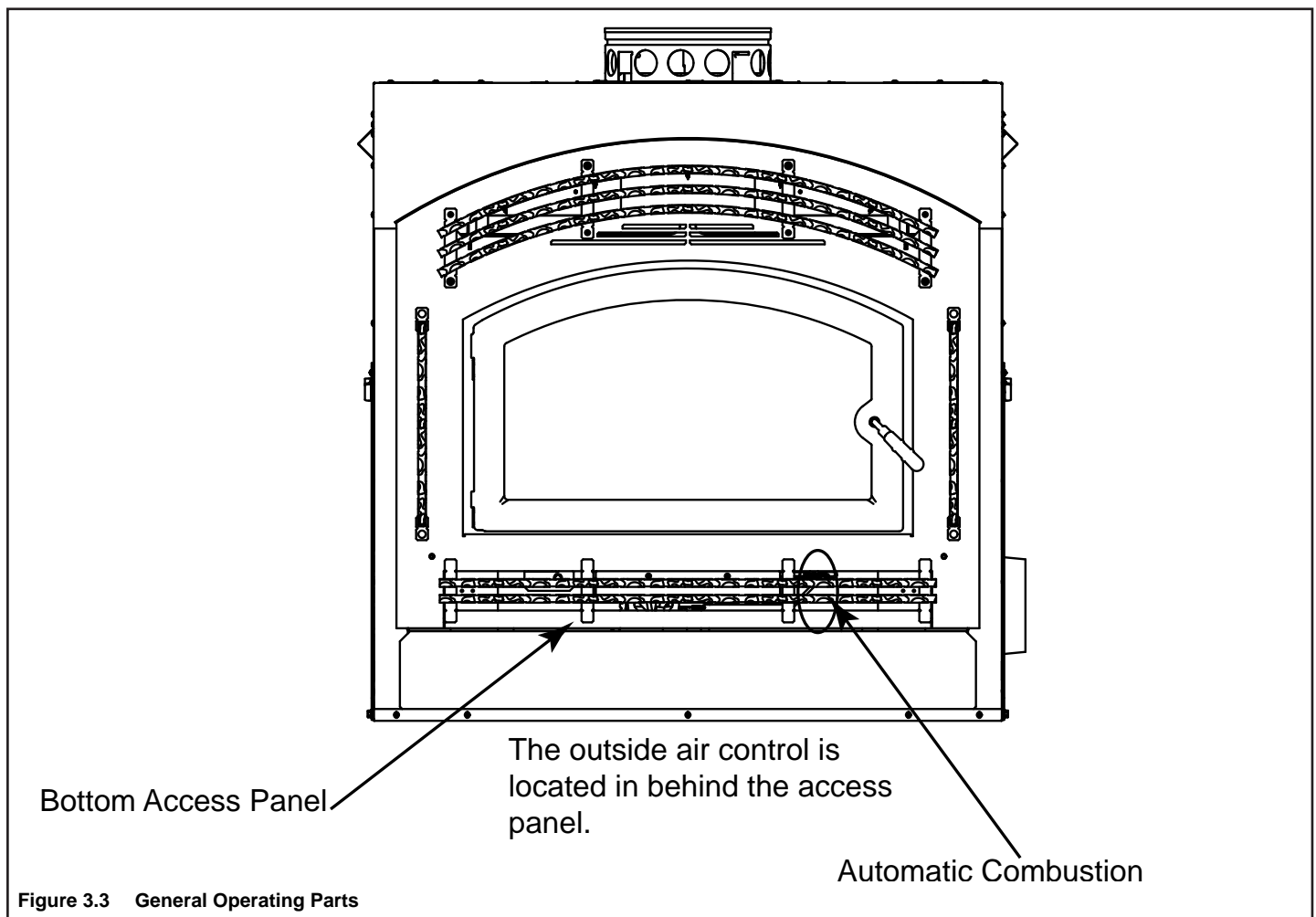


Figure 3.3 General Operating Parts

1. Automatic Combustion Control (ACC)

The automatic combustion control system allows you to set the fireplace to high (slide the combustion air control all the way to the right), start the fire, and then move the combustion air control back to the left. The fire will automatically go to that level once it is fully established. This allows for less interaction with the fire by the homeowner and more efficient use of fuel while maintaining the set heat output.

After the fireplace becomes hot, you may prefer to not activate the ACC when reloading fuel. If you do not slide the combustion air control all the way to the right, the ACC will not be activated.

NOTICE: If reloading a bright, hot coal bed for longer (low) burn time, setting the ACC may not be required. Burn dry, well seasoned wood.

IMPORTANT! As you move the combustion air control to the RIGHT, you will feel resistance about three-fourths of the way. You must move past that resistance approximately 1 in. (25mm) to fully engage the automatic combustion control (ACC) system.

Slide the combustion air control all the way to the left also. Reinstall the access panel.

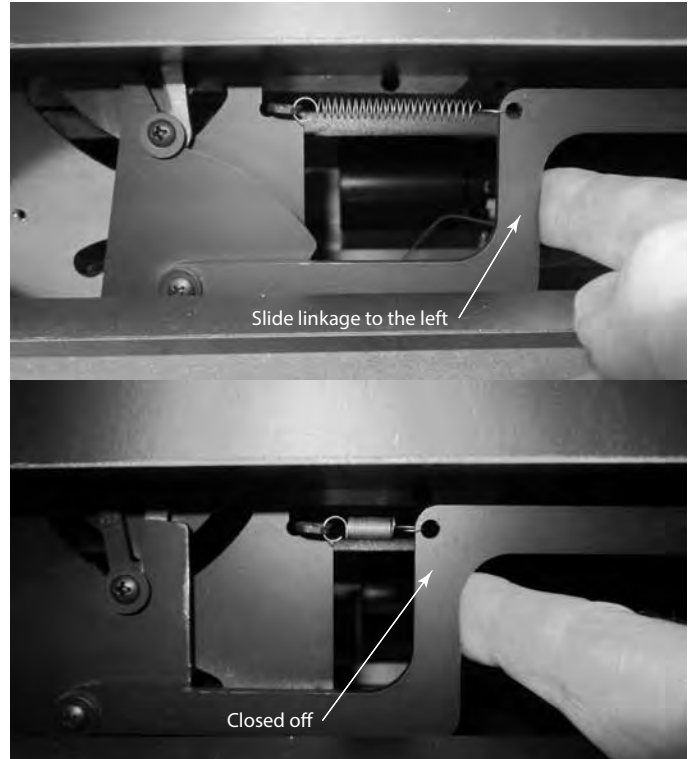


Figure 3.5 ACC Override

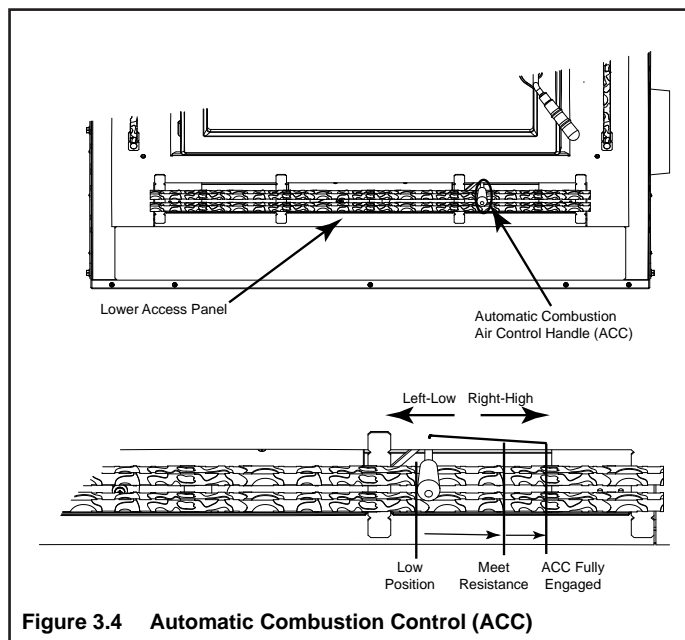


Figure 3.4 Automatic Combustion Control (ACC)

2. ACC Override

The ACC OVERRIDE lever is located behind the lower access panel (See Figure 3.4) and may be used to override the setting of the automatic combustion air control. If the ACC has been activated and burn rate needs to be slowed, remove the bottom access panel by lifting it up and pulling it off. To close down the air supply for an over-fire situation or to slow the burn rate down immediately, slide the linkage to the left. See Figure 3.5.

3. Outside Air

NOTICE: Use of outside air is required.

CAUTION! Outside air control handle may be warm. Allow unit to cool down before closing.

A source of air (oxygen) is required in order for combustion to take place.

1. Before lighting the fire open the bottom access panel by lifting it up and pulling it off.
2. Locate the handle on either the left or right side. Lift the handle up and pull out to open the door (pushing the handle in will close the door).
3. Reinstall the bottom access panel.

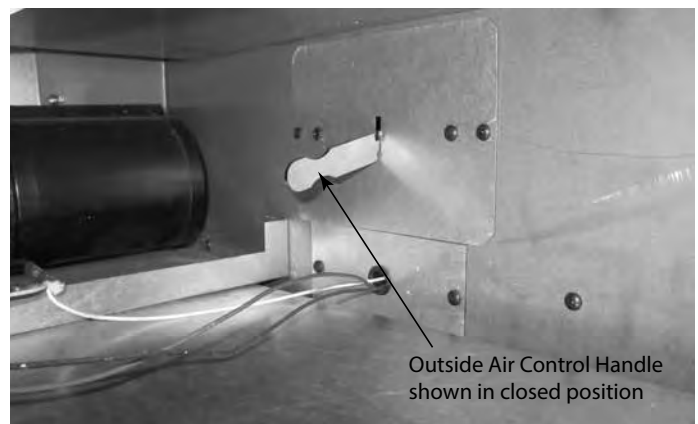


Figure 3.6 Outside Air Control Handle

4. Glass Door

This fireplace has been tested and is intended for use with doors as supplied with this fireplace.

WARNING! Risk of Fire and Smoke! Fireplace should be operated only with door fully closed. If door is left partly open, gas and flame may be drawn out of the fireplace opening.

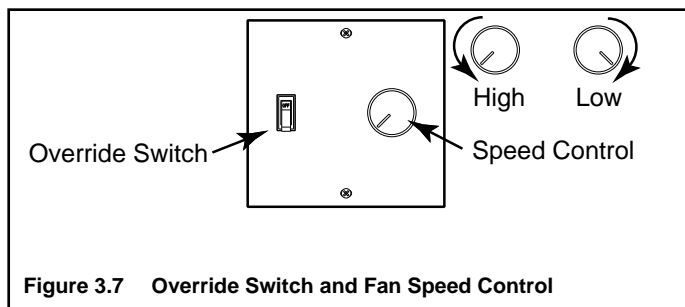
WARNING! Fire Risk!

- Do not use glass door to hold burning material in fireplace.
- Glass may break or burning material may roll out.

WARNING! RISK OF Fire! Do NOT install and or use any component not approved by Hearth & Home Technologies.

5. Convection Fan Operation

The fireplace is equipped with a temperature-sensitive snap disc that will turn the convection fan on and off automatically, depending on the temperature of the fireplace.



An override switch and fan speed control have been installed on the wall in close proximity to the fireplace.

The speed of the fan can be regulated by the speed control knob.

If the fan is not coming on at the desired time, flip the override switch to manually operate fan as desired.

C. Fuel

WARNING! For use with solid wood fuel only.

Other fuels may overfire and generate poisonous gases (i.e. carbon monoxide).

This fireplace 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 or yard waste
 - Materials containing rubber, including tires
 - Materials containing plastic
 - Waste petroleum products, paints or paint thinners, or asphalt products
 - Materials containing asbestos
 - Construction or demolition debris
 - Railroad ties or 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.
- The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater.
- Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke.

1. Hardwood vs. Softwood

Your fireplace's performance depends on the quality of the firewood you use. One species of wood varies very little to the other in terms of energy content. All seasoned wood contains about 8,000 BTU's per pound. Hardwoods have a greater density than softwoods; a piece of hardwood will contain about 60% more BTU's than an equal size piece of softwood. A cord of seasoned oak (hardwood) would contain about 60% more potential energy than a cord of seasoned pine (softwood).

Most softwoods are coniferous. These are trees with needle-like leaves that stay green all year and carry their seeds exposed in a cone. Examples of coniferous trees are Douglas fir, pine, spruce and cedar. Softwoods, being more porous, require less time to dry, burn faster and are easier to ignite than hardwoods. Hardwoods are deciduous trees, broadleaf trees that lose their leaves in the fall. Their seeds are usually found within a protective pod or enclosure. Some examples of deciduous trees are oak, maple, apple, and birch. However, it should be noted that there are some deciduous trees that are definitely not considered hardwoods such as poplar, aspen and alder. Hardwoods require more time to season, burn slower and are usually harder to ignite than softwoods. Obviously, you will use the type of wood that is most readily available in your area. However, if at all possible the best arrangement is to have a mix of softwood and hardwood. This way you can use the softwood for starting the fire, giving off quick heat to bring the fireplace up to operating temperature. Add the hardwood for slow, even heat and longer burn time.

WARNING! Risk of Fire!

- **DO NOT** burn wet or green wood.
- Wet, unseasoned wood can cause accumulation of creosote.

| Soft woods | Hard woods |
|---------------|------------|
| • Douglas Fir | • Oak |
| • Pine | • Maple |
| • Spruce | • Apple |
| • Cedar | • Birch |
| • Poplar | |
| • Aspen | |
| • Alder | |

2. Moisture Content

The majority of the problems fireplace owners experience are caused by trying to burn wet, unseasoned wood. Freshly cut wood can be as much water as it is wood, having a moisture content of around 50%. Imagine a wooden bucket that weighs about 8 pounds. Fill it with a gallon of water, put it in the firebox and try to burn it. This sounds ridiculous but that is exactly what you are doing if you burn unseasoned wood. Dead wood lying on the forest floor should be considered wet, and requires full seasoning time. Standing dead wood can be considered to be about two-thirds seasoned, if cut at the dry time of the year.

Burning wet, unseasoned wood will produce less heat output because it requires energy in the form of heat to evaporate the water trapped inside. This is wasted energy that should be used for heating your home. This moisture evaporates in the form of steam which has a cooling effect in your firebox and chimney system. When combined with tar and other organic vapors from burning wood it will form creosote which condenses in the relatively cool firebox and chimney.

Even dry wood contains at least 15% moisture by weight, and should be burned hot enough to keep the chimney hot for as long as it takes to dry the wood out - about one hour. To tell if wood is dry enough to burn, check the ends of the logs. If there are cracks radiating in all directions from the center, it is dry. If your wood sizzles in the fire, even though the surface is dry, it may not be fully cured.

3. Seasoning

Seasoned firewood is nothing more than wood that is cut to size, split and air dried to a moisture content of around 20%. The time it takes to season wood varies from around nine months for soft woods to as long as eighteen months for hardwoods. The key to seasoning wood is to be sure it has been split, exposing the wet interior and increasing the surface area of each piece. A tree that was cut down a year ago and not split is likely to have almost as high a moisture content now as it did when it was cut.

To season wood:

- Cut logs to size
- Split to 6 in. (152 mm) or less
- Air dry to a moisture content of around 20%
 - Soft wood - about nine months
 - Hard wood - about eighteen months

NOTICE: Seasoning time may vary depending on drying conditions.

4. Storing Wood

Splitting wood before it is stored reduces drying time. The following guideline will ensure properly seasoned wood:

- Stack the wood to allow air to circulate freely around and through the woodpile.
- Elevate the woodpile off the ground to allow air circulation underneath.
- The smaller the pieces, the faster the drying process. Any piece over 6 in. (152 mm) in diameter should be split.
- Wood should be stacked so that both ends of each piece are exposed to air, since more drying occurs through the cut ends than the sides. This is true even with wood that has been split.
- Store wood under cover, such as in a shed, or covered with a tarp, plastic, tar paper, sheets of scrap plywood, etc., as uncovered wood can absorb water from rain or snow, delaying the seasoning process. Avoid covering the sides and ends completely. Doing so may trap moisture from the ground and impede air circulation.

5. Burning Process

Fire requires fuel, air and heat. If heat is robbed from the fireplace during the drying stage, the new load of wood has reduced the chances for a good clean burn. Always burn dry, seasoned firewood.

• Kindling or 1st stage:

In this stage, the wood is heated to a temperature high enough to evaporate the moisture which is present in all wood. The wood will reach the boiling point of water (212°F) and will not get any hotter until the water is evaporated. This process takes heat from coals and tends to cool the fireplace.

• 2nd stage:

The secondary stage is when the wood gives off flammable gases which burn above the fuel with bright flames. It is very important that the flames be maintained and not allowed to go out. This will ensure the cleanest possible fire. You should close down the air to control the point where you can still maintain some flame. If the flames tend to go out, more air is necessary.

• Final stage:

The final stage of burning is the charcoal stage. This occurs when the flammable gases have been mostly burned and only charcoal remains. This is a naturally clean portion of the burn. The coals burn with hot blue flames.

It is very important to reload your fireplace while enough lively hot coals remain in order to rekindle the next load of wood.

6. Dirty Glass

A portion of the combustion air entering the firebox is deflected down over the inside of the door glass. This air flow “washes” the glass, helping to keep smoke from adhering to its surface. When operated at a low burn rate, less air will be flowing over the glass and the smoky, relatively cool condition of a low fire will cause the glass to become coated. Operating the fireplace with the burn rate air control and start-up air control all the way open for 15-20 minutes should remove the built up coating.

7. Creosote Formation and Need For Removal

When wood is burned slowly, it produces tar and other organic vapors which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a newly-started or a slow-burning fire. As a result, creosote residue accumulates on the flue lining.

When ignited, creosote creates an extremely hot fire which may damage the chimney or even destroy the house.

The chimney shall be inspected at least annually before lighting, or once every two months during heating season.

When creosote has accumulated it shall be removed to reduce the risk of a chimney fire.

8. Opacity

Opacity indicates how cleanly your fireplace is burning. Opacity is measured in percent; 100% opacity is when an object is totally obscured by the smoke column from a chimney, and 0% opacity means that no smoke column can be seen. Periodically check the opacity and burn your fireplace as nearly smoke-free as possible (goal of 0% opacity).

D. First Fire

Before lighting your first fire in the fireplace, make certain that:

- the baffle and ceramic blanket are correctly positioned, resting against the rear support
- firebrick are in place
- all labels have been removed
- all plated surfaces have been cleaned

NOTICE: Oils can cause permanent markings on plating if not removed before the first fire.

NOTICE: The first three or four fires should be of moderate size to allow the oils and binders to be burned from the fireplace and the refractory and paint to cure. You may notice an industrial odor the first few fires. This is considered normal.

E. Lighting Instructions/Establish Coal Bed

- Open outside air by opening the lower access panel and locate the outside air handle (it could be on the left or right). Lift the handle up and pull out to open. See Figure 3.20.

Note: This may be closed only when the fireplace is not in use to prevent cold air infiltration.



Figure 3.20 Outside Air Handle Shown on Right Side

- Move the combustion air control to the right, you will feel resistance about three-fourths of the way. You must move past that resistance approximately 3/4 in. (19 mm) to fully engage the automatic combustion control (ACC) system.
- Place several wads (3-4 pieces) of crumpled newspaper on the firebox floor. Add 5-6 lbs. of kindling (pieces of dry cord wood less than 1 inch in diameter) stacked on top of the paper crisscrossed. See Figure 3.21.
- Make sure that no matches or other combustibles are in the immediate area of the fireplace. Be sure the room is adequately ventilated and the flue unobstructed.
- For best results, use a hand held homeowner-type gas torch to light the paper and wood for approximately one minute.



Figure 3.21 Placing Kindling

- Leave the door slightly open 1 inch (see Figure 3.25) for 2-3 minutes then close the door, latching it lightly to allow the flame to get going good.
- When 1/2 to 2/3 of the kindling burns down, open the door and level the firebox.
- Add 7 to 9 pounds of start-up wood (1-3 inch diameter pieces of cord wood) by stacking them in a crisscross pattern. This will allow for proper air flow.
- Leave door slightly open 1 inch (see Figure 3.25) for 1-5 minutes or until a good flame is present. Then close the door, latching it lightly. See Figure 3.26.
- After the flame gets established (approximately 3-5 minutes) shut and latch the door. See Figure 3.27.
- When the start-up has burned down 1/2 to 2/3 and a good flame is still present, open the door. Level the coal bed insuring that the combustion air holes are not blocked.

Burn

- Load 4-6 pieces of cord wood 22 inches long to achieve maximum firebox volume, stack 2 to 3 pieces high in the back first, then 2 to 3 pieces in the front, making sure to work the bottom pieces into the coal bed to insure solid stack once all the wood is loaded. Leave at least a 1 inch gap between the two stacks to insure good air flow around the wood. See Figures 3.22, 3.23 & 3.24 for examples.
- Leave the door slightly open 1 inch (see Figure 3.25) for up to 5 minutes to get a good flame going then close the door. See Figure 3.27.
- When fire has burned down and ready for reloading, level out the coal bed first and reset the ACC if needed.



Figure 3.22 Loading Wood

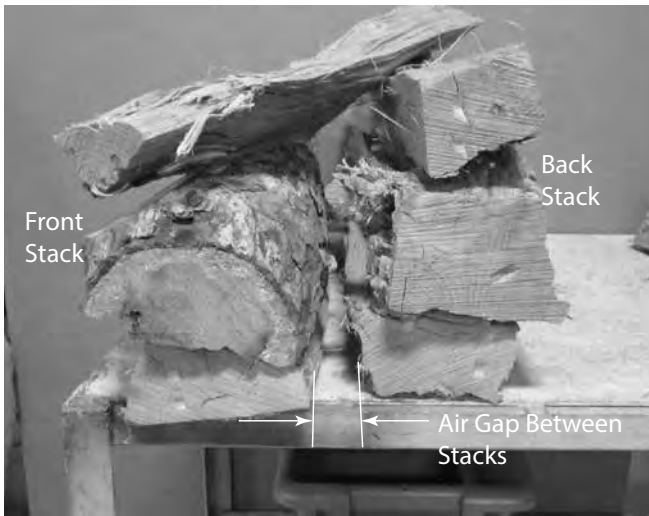


Figure 3.23 Stacking Wood



Figure 3.25 Door Open 2-4 Inches

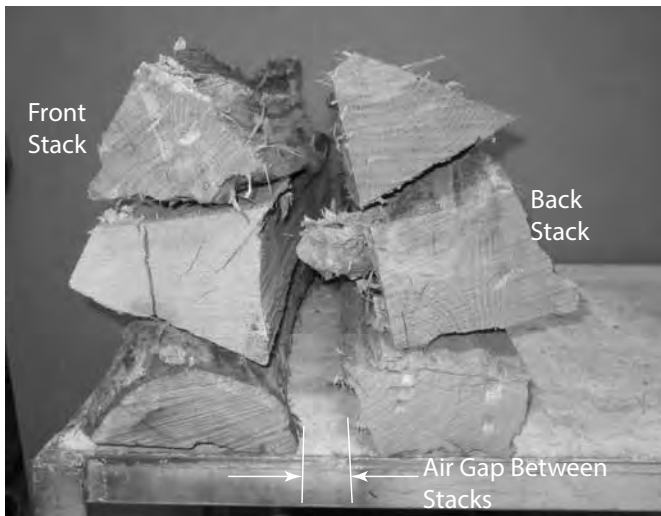


Figure 3.24 Stacking Wood



Figure 3.26 Door Latched Lightly

Burn Rate

- Burn rate will be set by the amount of fuel to be added to firebox.

NOTE: The ACC should only need to be activated when starting from a cold start or if a lively coal bed isn't present when reloading.



Figure 3.27 Door Fully Closed

F. Frequently Asked Questions

| ISSUES | SOLUTIONS |
|---------------------|---|
| Odor from appliance | When first operated, this appliance may release an odor for the first several hours. This is caused by the curing of the paint and the burning off of any oils remaining from manufacturing. |
| Metallic noise | Noise is caused by metal expanding and contracting as it heats up and cools down, similar to the sound produced by a furnace or heating duct. This noise does not affect the operation or longevity of the appliance. |
| Whirring sound | The fan produces a whirring sound which increases in volume as the speed is increased. |

CONTACT YOUR DEALER for additional information regarding operation and troubleshooting.
Visit www.fireplaces.com to find a dealer.

WARNING

DO NOT PLACE COMBUSTIBLE OBJECTS IN FRONT OF THE APPLIANCE. High temperatures may ignite clothing, furniture or draperies.

WARNING



Fire Risk.

- DO NOT BURN GARBAGE OR FLAMMABLE FLUIDS SUCH AS GASOLINE, NAPHTHA OR ENGINE OIL.
 - Do NOT burn treated wood or wood with salt (driftwood).
 - May generate carbon monoxide if burn material other than wood.
- May result in illness or possible death.

WARNING



Fire Risk.

Keep combustible materials, gasoline and other flammable vapors and liquids clear of appliance.

- Do NOT store flammable materials in the appliance's vicinity.
- DO NOT USE GASOLINE, 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.
- Combustible materials may ignite.

NOTE: Home owners are encouraged to provide smoke and carbon monoxide detectors in accordance with the authority having jurisdiction.

4 Maintenance and Service

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

WARNING! Hot Surfaces!

Glass and other surfaces are hot during operation AND cool down. **DO NOT** clean fireplace until it is cooled.

| Task | Frequency | To be completed by |
|-------------------------------------|------------|----------------------------|
| 1. Chimney Inspection | As needed | Homeowner or Chimney Sweep |
| 2. Chimney Cleaning | As needed | Chimney Sweep |
| 3. Plated Surfaces Cleaning | As needed | Homeowner |
| 4. Glass Door | Seasonally | |
| 5. Glass Cleaning | As needed | |
| 6. Door Gasket | Seasonally | |
| 7. Ash Removal | As needed | |
| 8. Baffle/Blanket/Channel Protector | Seasonally | |
| 9. Firebrick | Seasonally | |

A. Maintenance Tasks-Homeowners

Installation and repair should be done by a qualified service technician only. The fireplace should be inspected before use and at least annually by a professional service person.

The following tasks may be performed annually by the homeowner. If you are uncomfortable performing any of the listed tasks, please call your dealer for a service appointment.

1. Chimney Inspection

Frequency: As necessary; at least annually before lighting fireplace, or once every two months during heating season.

By: Homeowner/Chimney Sweep

- Confirm that termination cap remains clear and unobstructed.
- Inspect for blockages such as bird nests, leaves, etc.
- Inspect for corrosion or separation.
- Inspect for creosote and remove as needed, at least every two months during the heating season.
- Inspect the system at the fireplace connection and at the chimney top.

Have the chimney and adjacent structure inspected by qualified professionals. Hearth & Home Technologies recommends that NFI or CSIA certified professionals, or technicians under the direction of certified professionals, conduct an inspection of the chimney per the criteria in NFPA 211.

WARNING! Risk of Asphyxiation and Fire! Annual inspection by qualified technician recommended.

Check:

- condition of door, surrounds and fronts
- condition of glass and glass assembly
- obstructions of combustion and ventilation air
- obstructions of termination cap

Clean:

- glass
- air passageways, grilles

2. Creosote (Chimney) Cleaning

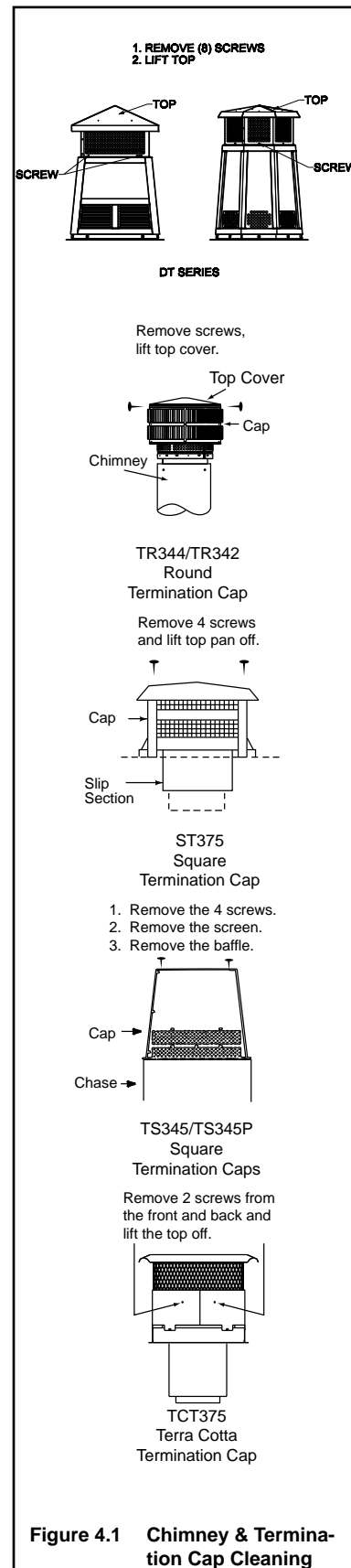
Frequency: As needed; at least annually before lighting, or once every two months during heating season. When creosote has accumulated it shall be removed to reduce the risk of a chimney fire.

By: Chimney Sweep

Tools Needed: Brush, Phillips screwdriver

- When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire.
- Remove all ash from the firebox and extinguish all hot embers before disposal. Allow the fireplace to cool completely.
- Remove baffle and ceramic blanket from fireplace before cleaning chimney (refer to Section 4.B.5. Baffle Removal and Installation).
- Close the door tightly.
- Remove the top of the termination cap as shown in Figure 4.1 to clean the cap and chimney.
- The creosote or soot should be removed from the chimney with a brush specifically designed for the size of chimney in use.
- Reinstall termination cap.
- Clean out fallen debris from the firebox.
- Replace baffle and ceramic blanket.

WARNING! Risk of Fire! Ignited creosote is extremely HOT. Prevent creosote buildup.



3. Care and Cleaning of Plated Surfaces

Frequency: Initially and as needed

By: Homeowner

Tools Needed: Vinegar or glass cleaner, soft towel

CAUTION! Do not use a polish with abrasives. It will scratch plated surfaces.

- Use a glass cleaner or vinegar and towel to remove the oils.
- Oils can cause permanent markings on plating if not removed.
- After plating is cured, oils will not affect the finish.

4. Glass Door

Frequency: As necessary

By: Homeowner

- Inspect glass panel for cracks. Replace if this condition is present.
- Inspect glass gasket. Confirm glass does not move around in glass frame.

5. Glass Cleaning

Frequency: As necessary

By: Homeowner

Tools Needed: Vinegar or glass cleaner, soft towel

- Clean glass with a non-abrasive glass cleaner. Use a damp cloth dipped in wood ashes or a commercially available oven cleaner. Remove any oven cleaner residue with a glass cleaner or soap and water.

6. Door Gasket

Frequency: Seasonally

By: Homeowner

- Open door, place half a dollar bill inside and close the door.
- Attempt to pull the bill out.
- If the bill gives good resistance or is not removable, the gasket is adjusted correctly. If the bill is easily removed, the gasket needs adjustment or replacement to create an even seal all around door.

It may be necessary to adjust or tighten the door latch.

7. Ash Removal

Frequency: As necessary

By: Homeowner

Tools Needed: Covered metal container, metal shovel, fireplace broom

WARNING! Risk of Fire! DO NOT remove ashes until the fire is out and the fireplace is cold.

- Ashes should be placed in metal container with tight fitting lid.
- The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal.
- 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.

8. Baffle and Blanket

Frequency: As necessary

By: Homeowner

Tools Needed:

- Ensure correct baffle and baffle protection channel placement; replace baffle components if damaged or missing.
- The ceramic blanket and baffle board **MUST** be in contact with the back of the firebox and even with each other in the front. The baffle protection channel **MUST** be in position. Refer to Section 3.A.3.

9. Firebrick

Frequency:

By:

Tools Needed:

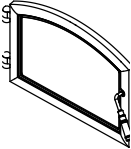
- Inspect condition of brick. Replace if crumbly or otherwise deteriorated, or if cracks exceed 1/4 in. (6 mm).


B. Replacement Maintenance

1. Glass Replacement

- Ensure that the fire is out and the fireplace is cool to the touch.
- Protect a table or counter top with padding or towels.
- Remove door with broken glass from the fireplace by lifting door up and off of the hinges.
- Lay door face down on table or counter making sure handle and handle attachment knob hang over the edge of the table top so door lays flat on the soft surface.
- Remove screws from the top and bottom glass frames (five on each door) using a #2 Phillips Head screwdriver. Set frames aside and retain screws.
HINT: Soak screws in penetrating oil for easy removal.
- Remove the glass and discard.
- Position the new glass with edges evenly overlapping the opening in the front door.
- Replace the glass frames.
- Start screws to secure glass frames to door, keeping them loose for adjusting the glass. Then continue to tighten each screw alternately, a few turns at a time, until the glass panel is tightened snugly. **DO NOT OVERTIGHTEN OR CROSS THREAD SCREWS.**
- Replace the door on the fireplace.
- After the first burn, recheck the tightness of the screws.

NOTICE: Remove all labels from glass before lighting the first fire in your fireplace.

| CAUTION! | |
|--|--|
|  | Handle glass assembly with care. |
| | When cleaning glass: |
| | <ul style="list-style-type: none">• Avoid striking, scratching or slamming glass. |
| | <ul style="list-style-type: none">• Do NOT clean glass when hot.• Do NOT use abrasive cleaners.• Use a hard water deposit glass cleaner on white film.• Refer to maintenance instructions. |

| WARNING | |
|---|--|
|  | Injury Risk. |
| | <ul style="list-style-type: none">• Use only glass specified in manual.• DO NOT REPLACE with any other material. |

2. Tighten or Adjust Door Latch

Remove the lock nut holding latch cam and two spacing washers on the door as shown in Figure 4.2. Move 1-2 spacing washers to the opposite side of cam. Reinstall the cam and tighten locknut. The black washer must be left in place.

OR

Replace the gasket material. Wear or damage to the gasket material can cause air leakage into the firebox resulting in overfiring and loss of efficiency.

A replacement gasket is available from your dealer.

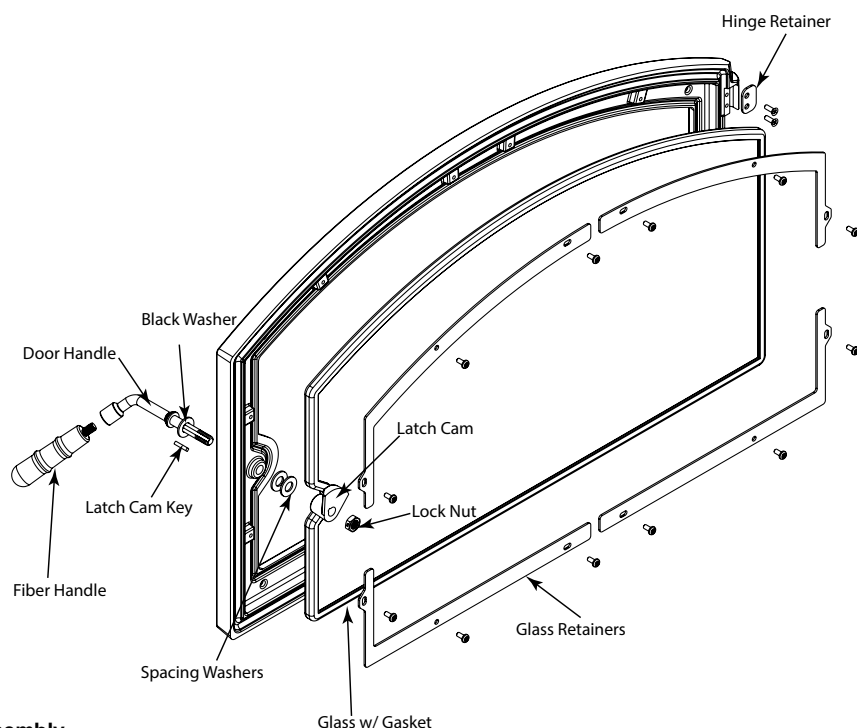


Figure 4.2 Door Handle Assembly

3. Door Handle Assembly

- Slide door handle through door.
- Install washer(s) as shown in Figure 4.3.
- Install key groove.
- Align groove in latch cam with key; slide latch cam over shaft.
- Install locknut but do not overtighten, the handle needs to move smoothly.
- Install fiber handle using a clockwise motion until the fiber handle is snug against the door handle shaft.

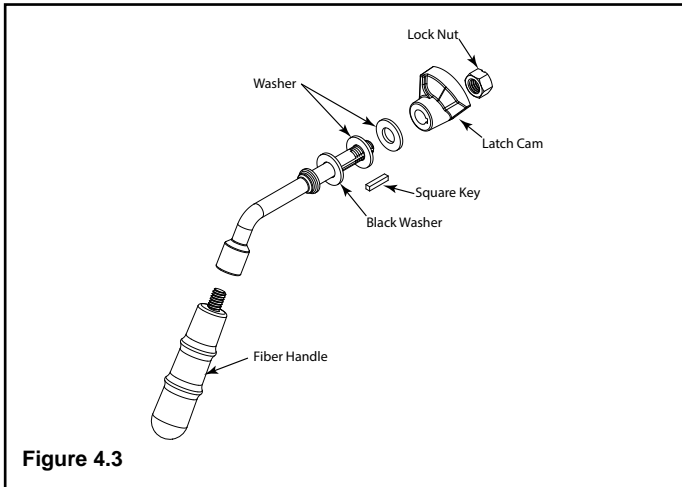


Figure 4.3

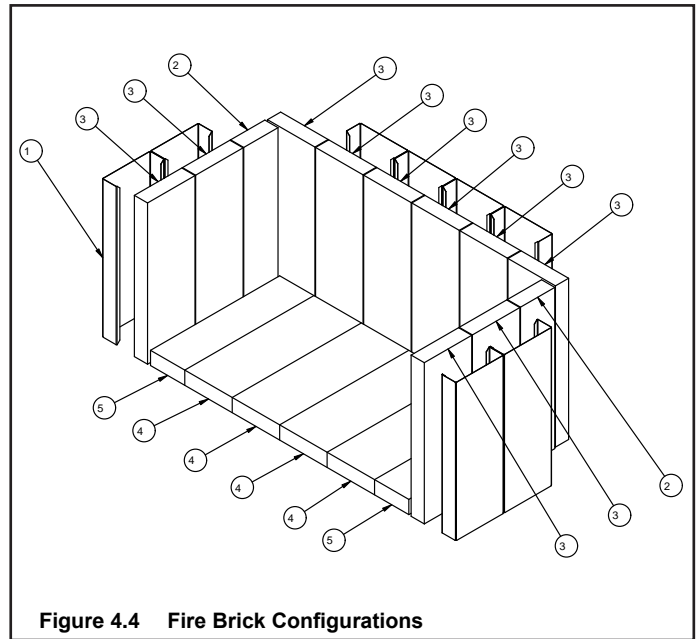


Figure 4.4 Fire Brick Configurations

| # | Brick Size | Qty. in Set |
|---|-------------------------------|-------------|
| 1 | Brick Wrap | 8 |
| 2 | Firebrick 13.25 x 3.25 | 2 |
| 3 | Firebrick 13.25 x 4.50 x 1.25 | 10 |
| 4 | Firebrick 12.25 x 4.50 | 4 |
| 5 | Firebrick 12.25 x 3.25 | 2 |

4. Firebrick Replacement

The firebox of your fireplace is lined with high quality firebrick, which has exceptional insulating properties. Do not use a grate; simply build a fire on the firebox floor. Do not operate the fireplace without bricks.

IMPORTANT: The bricks are very similar in size. Be certain you have the proper brick in the correct location. Measure the brick size for accuracy.

After the coals are completely cooled, remove all old firebrick and ash from unit and vacuum out firebox.

- Remove new brick set from box and lay out to diagram shown in Figure 4.4.
- Install rear bricks. Slide top of bricks under clip on back of firebox wall and push bottom of brick back.
- Install side bricks. Slide top of brick under clips on side of firebox and push the bottom of the brick until it is flush with the side of the unit.
- Lay bottom bricks in unit.

5. Baffle Removal and Installation

WARNING! Hot Surfaces!

Glass and other surfaces are hot during operation AND cool down. **DO NOT** clean fireplace until it is cooled.

1. Remove all ash from firebox and place into a metal container.
2. Remove the baffle protection channel by lifting it up and turning it down and pulling it out of the firebox. See Figure 4.5.

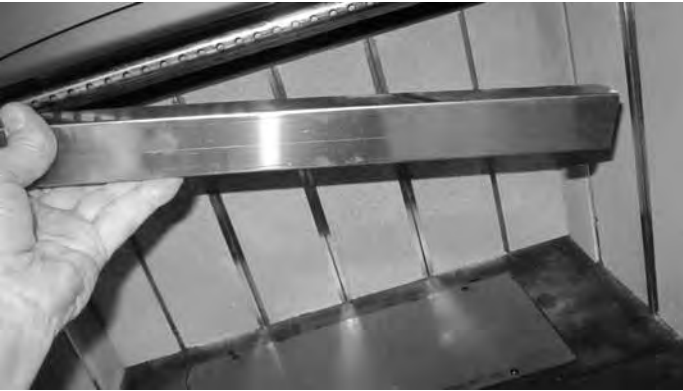


Figure 4.5 Removing Baffle Protection Channel

3. Using a 3/16 inch Allen wrench, remove the front manifold tube retainer bolt on the air channel behind the end of the front tube on the right side. See Figure 4.6.

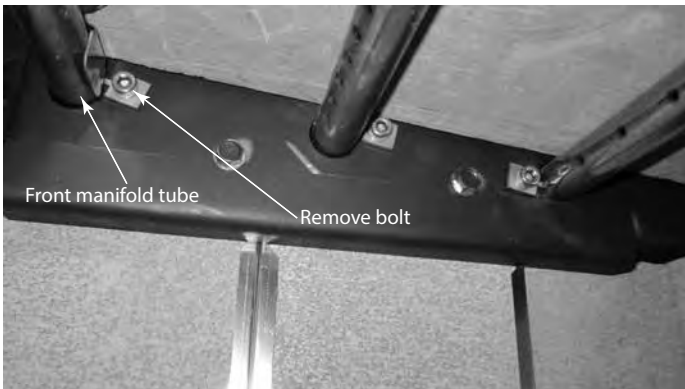


Figure 4.6 Remove Retainer Bolt

4. To remove the manifold tube, slide the tube to one side until one end is out of its hole then pull it down and out of the other hole. It is only necessary to remove the front tube in order to remove the baffle.
5. Pull the two (2) piece baffle board and insulation down and out of the fireplace. See Figure 4.7.



Figure 4.7

6. To install the baffle board and insulation, repeat steps 2 thru 5 in reverse. Be sure the baffle board and insulation are pushed back fully and the insulation is down and flat. See Figures 4.8 & 4.9.



Figure 4.8 Reinstall Baffle Boards



Figure 4.9 Reinstall Baffle Protection Channel

6. Fan Replacement

CAUTION! Risk of Shock! Disconnect power by turning off circuit breaker before servicing or unplugging control board from junction box in behind the access panel..

The Fireplace comes equipped with two fans, installed at the factory with electric access on both sides of the fireplace.

1. Remove the bottom firebrick.
2. Remove the four (4) 5/32 Allen head screws and pry open the access door with a flat blade screwdriver. See Figure 4.10 and remove it.

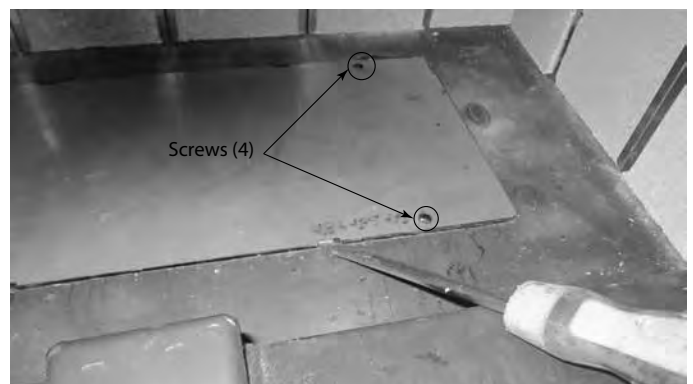


Figure 4.10 Pry Open Access Door

3. While holding the handle, remove the four (4) screws at each corner of the combustion cover and fish it up and out of the bottom of the fireplace. See Figures 4.11 & 4.12.



Figure 4.11 Removal of Combustion Cover Screws



Figure 4.12 Removal of Combustion Cover

4. Unplug the wire harness from the fans and remove the wing nut holding the fan in place. See Figure 4.13.

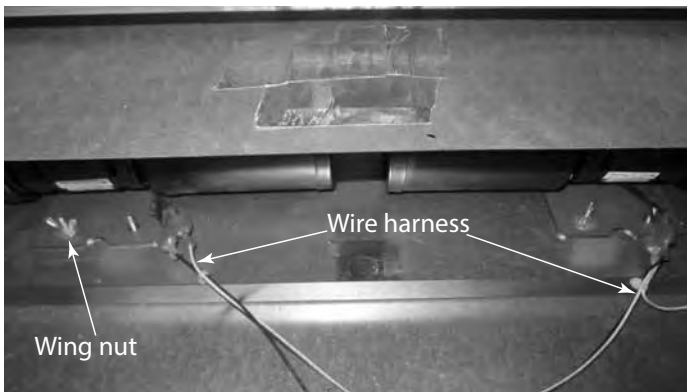


Figure 4.13 Unplug Wire Harness

5. Lift the fan up and off of the locating pins and remove up through the access hole. See Figure 4.14.



Figure 4.14 Remove Fan from Access Hole

6. Install new fans in reverse order.

7. Timer Assembly Replacement

1. Remove the bottom front access panel by lifting it up and off.
2. Remove the two (2) screws in the air chamber cover. See Figure 4.15. Pull it down and off. See Figure 4.16.

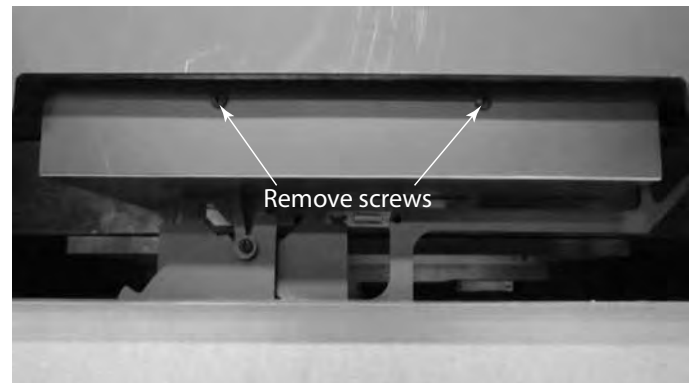


Figure 4.15 Removal of Screws on Air Chamber Cover



Figure 4.16 Removal of Air Chamber Cover

3. Unscrew and remove the black knob. See Figure 4.17.
4. Pull off and remove the front hairpin clip and washer on the rod. See Figure 4.17.

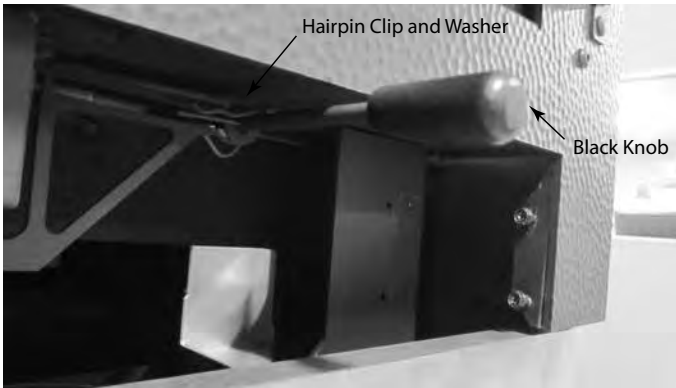


Figure 4.17 Removal of Handle

5. While holding on to the timer assembly, remove the two (2) screws and slide the linkage arm off of the rod and pull the assembly out of the front. See Figure 4.18.

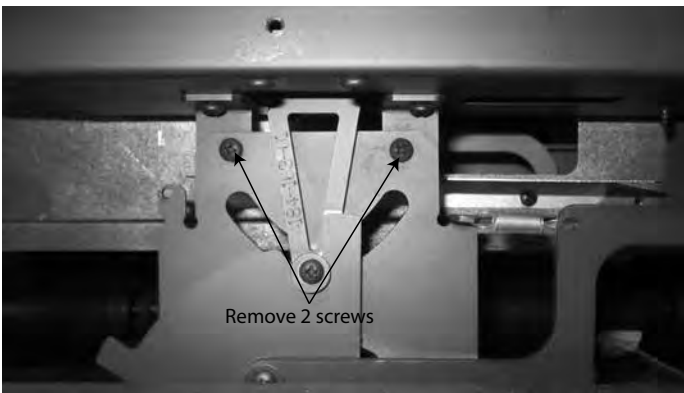


Figure 4.18 Removal of Timer Assembly Screws

6. While supporting the air chamber, remove the two (2) 1/4-20 bolts at each end of it. Then pull it down and out the front. See Figures 4.19 & 4.20.



Figure 4.19 Location of Bolts

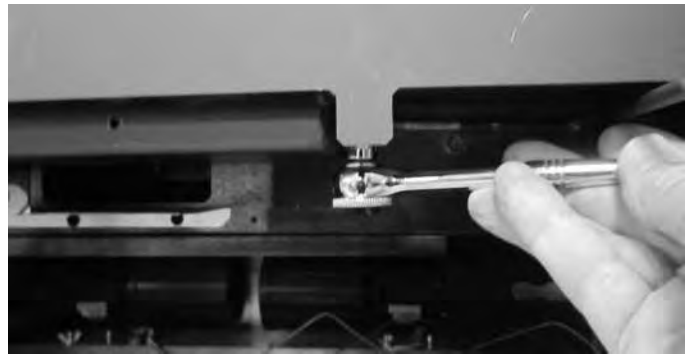


Figure 4.20 Removal of Bolts (2)

7. On the new timer assembly, Figure 4.21, remove the front hairpin clip and washer then two (2) screws disconnecting the air chamber before installation. See Figure 4.22.



Figure 4.21 Timer Assembly

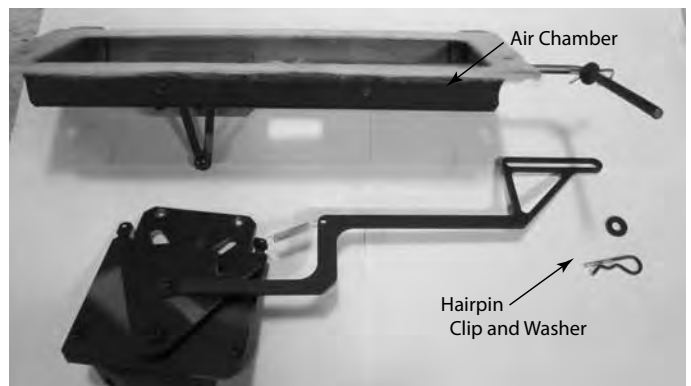


Figure 4.22 Removal of Hairpin Clip, Washer and Air Chamber

8. Install the new air chamber using the 1/4-20 bolts making sure the gasket is installed also. See Figure 4.22.



Figure 4.22 Install New Air Chamber

9. Install the timer/linkage by inserting the timer in first and slipping the linkage over the rod. See Figure 4.23.



Figure 4.23 Inserting Timer Assembly

10. Screw the timer to the air chamber. See Figure 4.24.

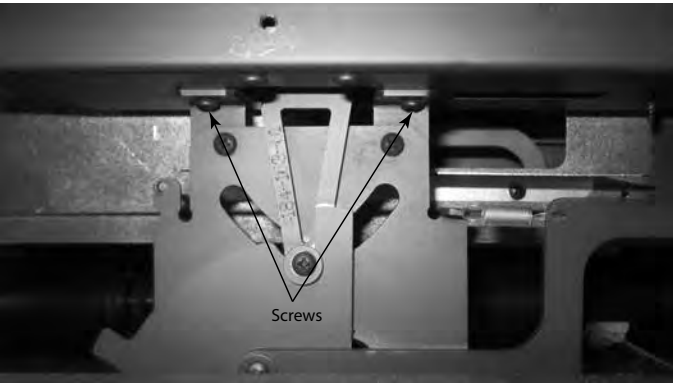


Figure 4.24 Screwing Timer to Air Chamber

11. Install the washer and hairpin clip back on the rod. See Figure 4.25.

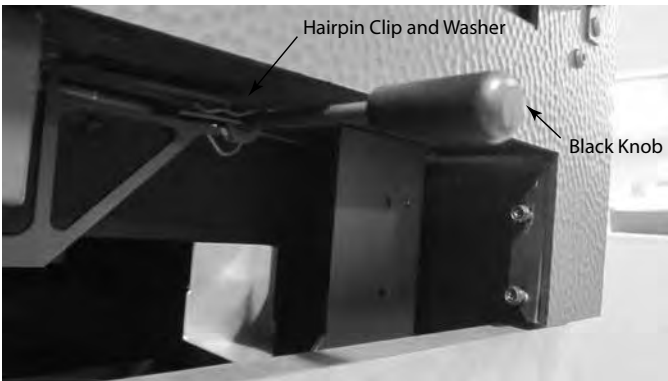


Figure 4.25 Reinstalling Hairpin Clip and Washer

12. Reinstall air chamber cover. See Figure 4.26.
13. Reinstall the bottom front access panel.
14. Screw the black knob back on.

8. Timer Removal & Replacement

1. Remove the bottom front access panel by lifting it up and off.
2. Remove the two (2) screws in the cover. See Figure 4.26 and pull it down and off. See Figure 4.27.

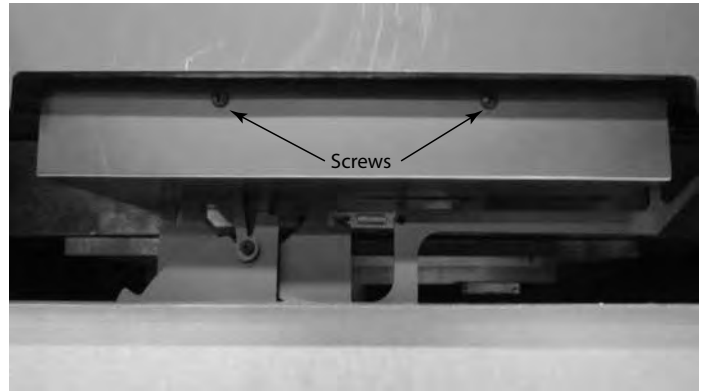


Figure 4.26 Air Chamber Cover

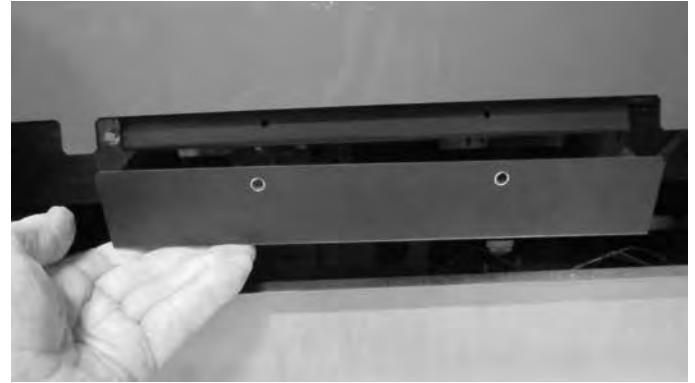


Figure 4.27 Removal of Air Chamber Cover

3. Unscrew and remove the black knob. See Figure 4.28.
4. Pull off and remove the hairpin clip and the washer on the rod. See Figure 4.28.

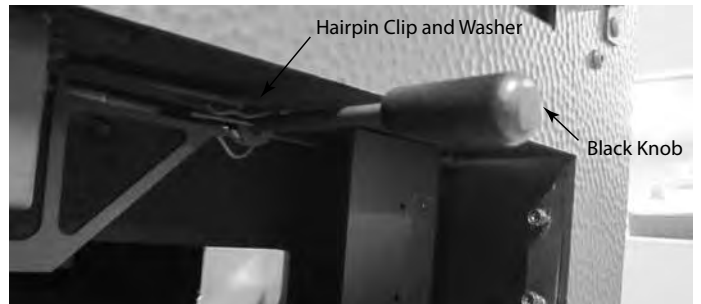


Figure 4.28 Removal of Handle

5. While holding on to the timer assembly, remove the two (2) screws, Figure 4.29 and slide the linkage arm off of the rod and pull the assembly out of the front.



Figure 4.29 Removal of Screws

- Remove the linkage arm and the spring from the timer. See Figure 4.30.

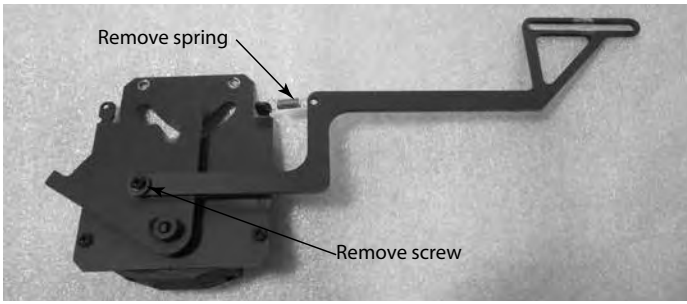


Figure 4.30 Removal of Linkage Arm and Spring

- Loosen set screw on timer, remove two screws and remove timer. See Figure 4.31.

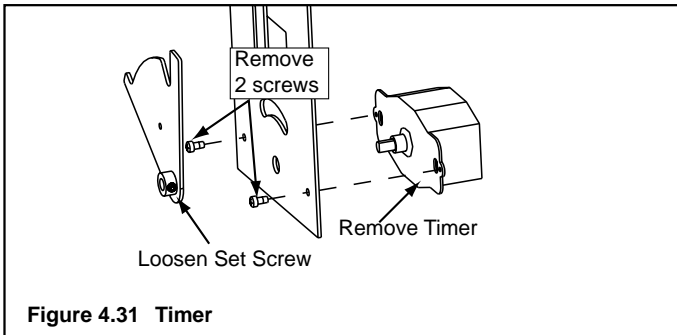


Figure 4.31 Timer

- Install new timer using same two screws. It is very important that the D cut side of the timer shaft is facing the opposite side of the linkage timer arm. See Figure 4.32.

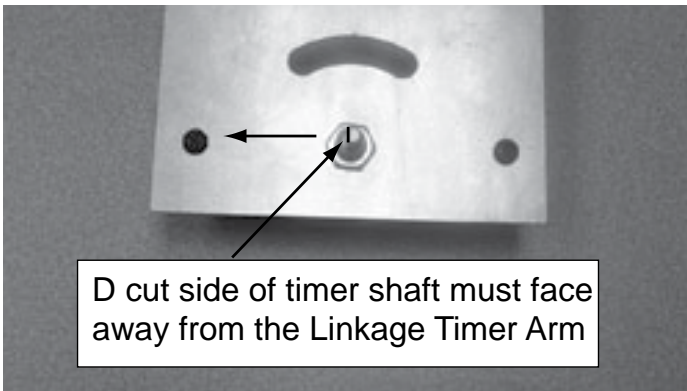


Figure 4.32 D Cut on Shaft

- Place linkage control arm over timer shaft and tighten set screw, Figure 4.33.

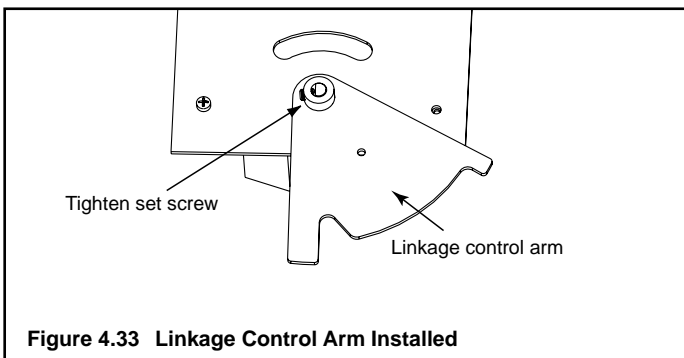


Figure 4.33 Linkage Control Arm Installed

- Rotate linkage control arm into final position. Note that the D cut is now facing the linkage timer arm. Re-attach the linkage timer arm and spring. See Figure 4.34.

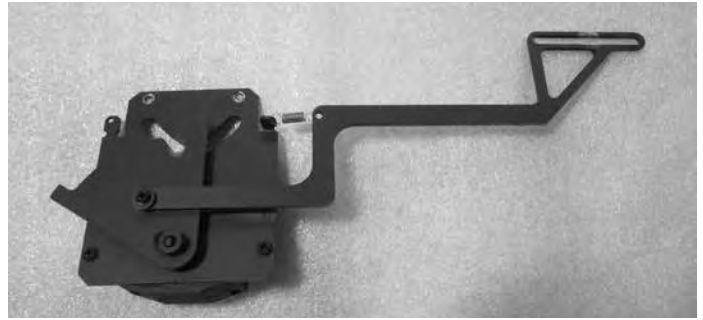


Figure 4.34 Reattach the Linkage Timer Arm

- Install the timer/leakage by inserting the timer in first and slipping the linkage over the rod. See Figure 4.34.



Figure 4.34 Insert the Timer/Leakage

- Screw the timer to the air chamber. See Figure 4.35.

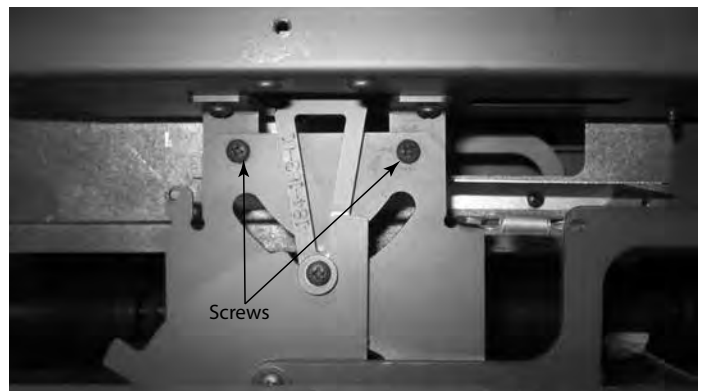


Figure 4.35 Screw Timer to Air Chamber

13. Install the washer and the hairpin clip back on the rod. See Figure 4.36.

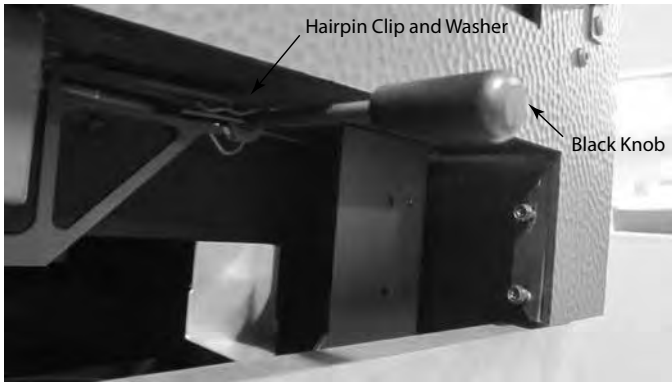


Figure 4.36 Reinstalling Hairpin Clip and Washer

14. Reinstall the air chamber cover. See Figure 4.37.

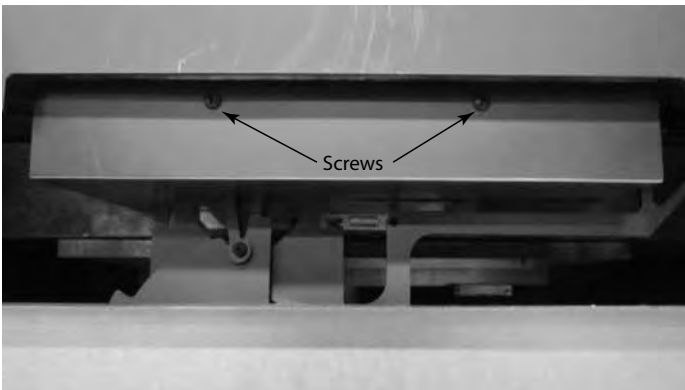


Figure 4.37 Air Chamber Cover

15. Reinstall the bottom front access panel.

16. Screw the knob back on the rod.

9. Fan Snap Disc Replacement

1. Remove the bottom front access panel by lifting it up and off.
2. Locate the snap disc to the left of the timer assembly.
3. Remove the wires from the snap disc.
4. Remove the 1/4" bolt using a 3/8" socket along with the bracket.
5. Pull the snap disc out of the bracket.
6. Install the new snap disc in the bracket and reinstall in the fireplace. See Figure 4.38.

NOTE: Remember to reattach the wires.

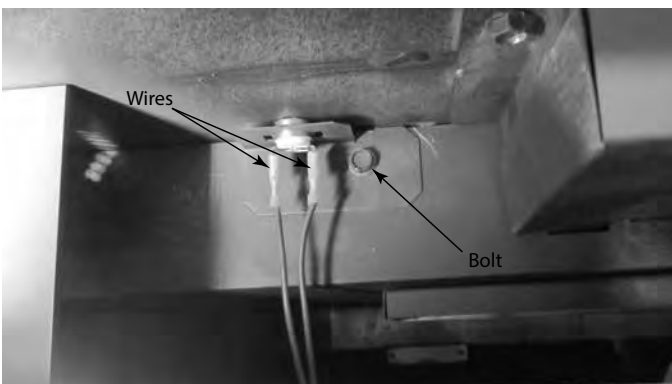


Figure 4.38 Snap Disc Replacement

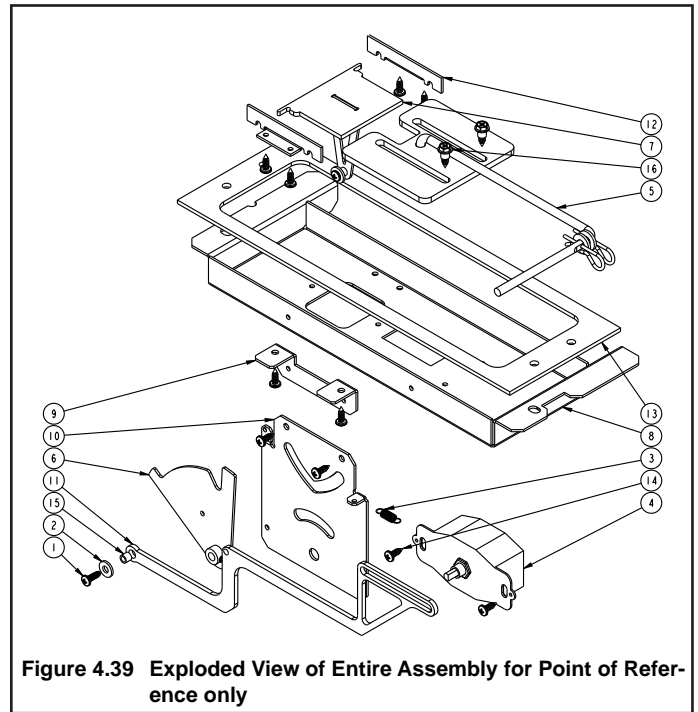


Figure 4.39 Exploded View of Entire Assembly for Point of Reference only

| Item | Description | Qty |
|------|--------------------------|-----|
| 1 | Screw 8-32 x 1/2 PPH BK | 1 |
| 2 | Washer #10 SAE ZN | 1 |
| 3 | Extension Spring | 1 |
| 4 | Timer Mechanical 12 HR | 1 |
| 5 | Slide Assembly | 1 |
| 6 | Timer Arm Assembly | 1 |
| 7 | Timer Door Assembly | 1 |
| 8 | Air Channel Bottom | 1 |
| 9 | Timer Bracket | 1 |
| 10 | Timer Base | 1 |
| 11 | Timer Handle | 1 |
| 12 | Timer Door Retainer | 2 |
| 13 | Air Channel Gasket | 1 |
| 14 | Screw 8 x 12 PPH BK | 10 |
| 15 | Spacer #8 1/4D 7/32L ZN | 1 |
| 16 | HHSS #10 x 1/4D 1/4 L BK | 2 |

5 Troubleshooting

A. FAQs

Hearth & Home Technologies assumes no responsibility for the improper performance of the fireplace system caused by inadequate draft due to environmental conditions, down drafts, tight sealing construction of the structure, or mechanical exhausting devices which will create a negative air pressure within the structure where the fireplace is located.

If smoke spillage occurs from a fireplace opening when the door is open, there is either a leakage in the flue, a blockage in the flue, or some condition is affecting draft. Understanding and differentiating the conditions which can cause each of these kinds of spillage problems is essential to their solution.

- **Flue Leakage**
Check for improperly connected flue joints or a damaged flue joint in the chimney system. Such leakage would reduce draft (air would be drawn in through the leaks rather than through the fireplace). The result might be difficult start-up and smoky fires that might spill if other adverse draft conditions accompany this problem.
- **Flue Blockage**
The damper should be open.
Check for objects that may have fallen down the chimney.

Flue draft is measured as negative pressure in the chimney. The amount of negative pressure determines how strong the draft is. The draft is important because it draws the combustion air into the fireplace and pulls the smoke out of the chimney.

There are three basic criteria essential in establishing and maintaining flue draft:

- availability of combustion air
- heat generated from the fire
- diameter and height of the flue system

These three factors work together as a system to create the flue draft. Increasing or decreasing any one of them will affect the other two and thus change the amount of draft in the entire system.

If the fire is hard to start and smoke spills out of the fireplace, or you find it difficult to establish and maintain a moderately high burn rate, then the flue draft is too low and corrective measures must be taken.

Be sure you have air available for combustion and that your firewood is dry and well seasoned. Build your fires properly and according to the instructions given in op-

erating instructions, "Starting a Fire". Be sure your flue system is installed correctly and that it is the proper diameter and height. Check for the following:

- All chimney sections are properly installed.
- The chimney is clean and free of creosote or soot buildup.
- Make sure overhanging trees and branches are cut back within ten feet of the top of the chimney and the chimney is free of debris from animals.
- Ensure the chimney cap is clean and free of any buildup of soot or creosote if cap is equipped with a spark arrestor screen.
- Be sure the ceramic blanket (above the baffle) and the baffle are in their proper positions
- The wood being used is dry and well seasoned.

If you still suspect you have a low draft problem it may be necessary to increase the volume of air in your flue system. Since the diameter of your flue system is matched with the size of the flue collar and should not be changed, then the height of the system must be increased. Add chimney sections one at a time until the draft improves.

In some cases, regardless of what you do, it can still be difficult to establish the proper flue draft. This is especially evident when using an exterior factory-built chimney or exterior masonry chimney. Try holding a burning rolled up newspaper as close to the flue outlet as possible for a few minutes, then light the paper under the kindling. The heat generated from the burning rolled up newspaper should help get the draft established.

Still other factors can affect how well your flue system performs. Neighboring structures, high winds, tall trees, even hillsides can affect air currents around the chimney. Well designed chimney caps are available that can help. Your fireplace dealer is the local expert in your area. He can usually make suggestions or discover problems that can be easily corrected allowing your fireplace to operate correctly as it has been designed, providing safe and economical heat for your home.

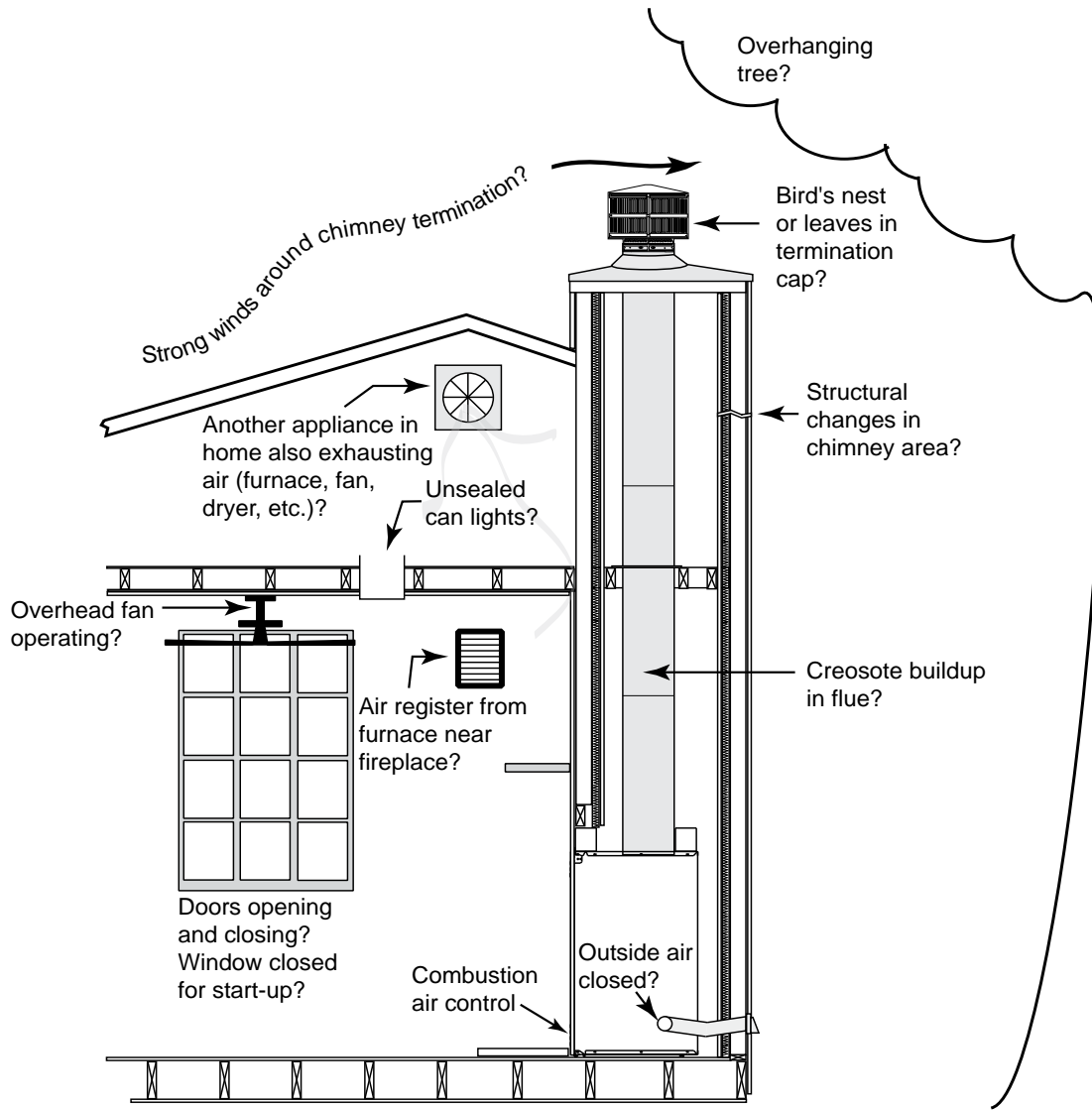


Figure 5.1 Factory-built Fireplaces: Troubleshooting

B. Troubleshooting Table

| | |
|-------------------------------------|---|
| Fire is difficult to start | • Refer to section 3.E. Lighting Instructions |
| | • Open air controls |
| | • Establish draft: Hold a lighted, rolled up newspaper under the front of the baffle |
| | • Place DRY kindling over wadded up newspaper; leave air spaces between pieces of wood |
| | • Light the paper, allow kindling to ignite and progress to a lively burn |
| | • Slowly add progressively larger pieces of dry wood until the fire is well established |
| Smoke in the house at startup | • Check and clean chimney if needed |
| | • Open air controls |
| | • Establish draft |
| | • Do not use exhaust fans during startup |
| | • Do not close doors until the fire is well-established |
| Smoke in the house during operation | • Check and clean chimney if needed |
| | • Check door rope for seal |
| | • Open air controls (ACC) |
| Smoke in the house during refueling | • Open air controls (ACC) to establish a lively coal bed |
| | • Open doors SLOWLY |
| | • Add progressively larger wood to establish a hot fire |
| Fuel burns too fast | • ACC not working properly |
| | • Wood too dry, mix in less seasoned wood after the fire is established |
| | • User larger diameter wood |
| | • Check baffle/ceramic blanket for proper placement (Section 3.A.3) |
| | • Close down ACC (refer to section 3.B.) |
| Glass doesn't stay clean | • Establish a good, hot fire |
| | • Use well-seasoned wood |
| Not enough or no heat | • Move combustion air control to fully open position |
| | • Fan is not on |
| | • Insufficient fuel for fire/heat required |
| Fan doesn't come on | • No power |
| | • Fireplace is not hot enough to activate snap disc |
| | • Snap disc may be faulty |

6 Reference Materials

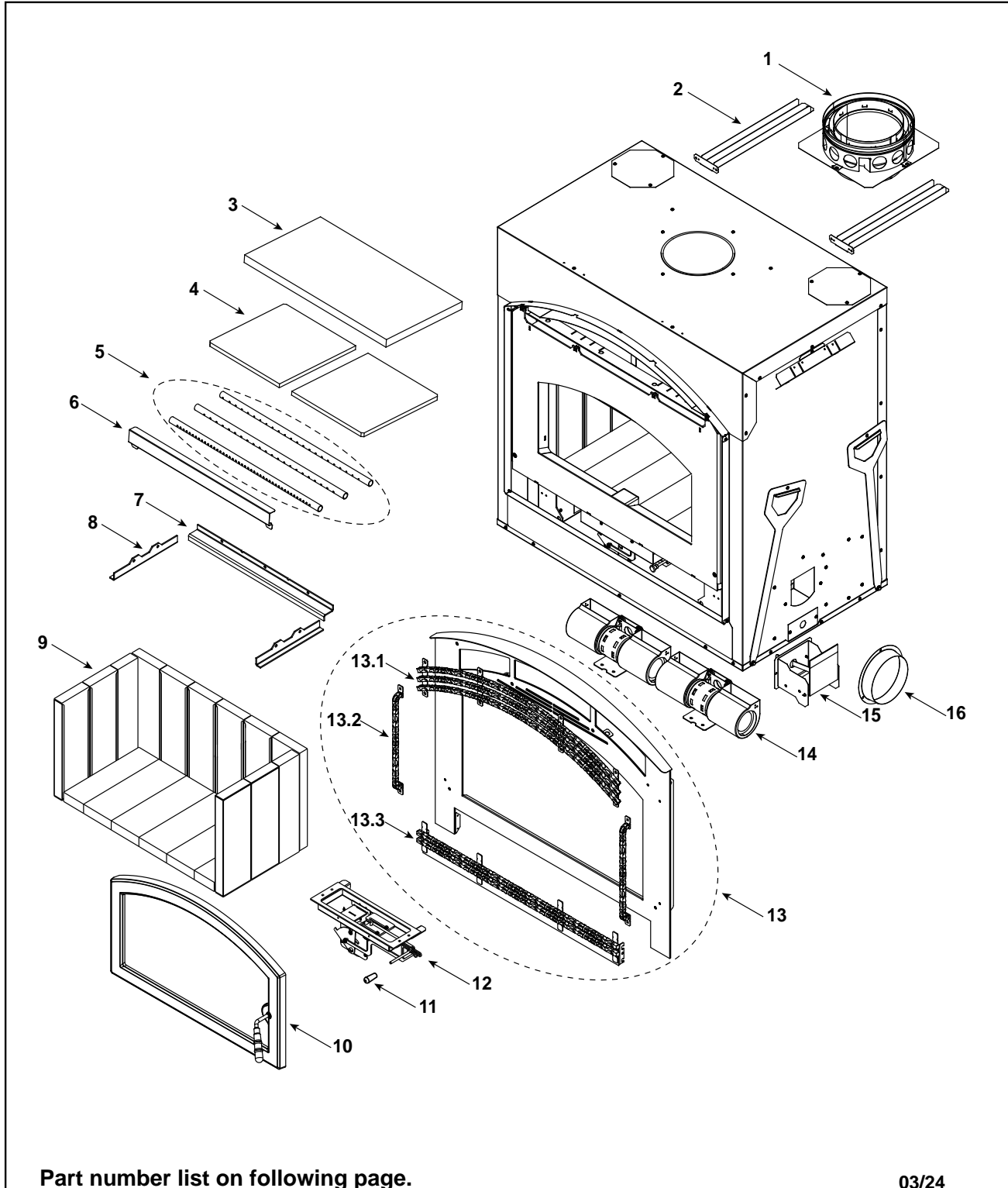
► A. Service Parts



Service Parts
Wood-burning Fireplace

PIONEER-II-C

Beginning Manufacturing Date: May 2019
Ending Manufacturing Date: Active



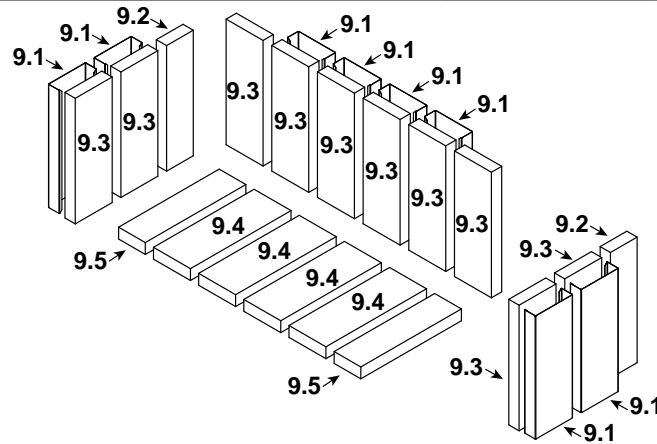
IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers.** Provide model number and serial number when requesting service parts from your dealer or distributor.



Stocked at Depot

| ITEM | DESCRIPTION | COMMENTS | PART NUMBER | |
|------|------------------------|-----------|-------------|---|
| 1 | Starter Plate Assembly | | SL1 | |
| | Starter Section | | SRV22069 | Y |
| 2 | Standoff, Front | Qty 2 req | SRV4182-233 | |
| 3 | Baffle Blanket | | SRV4184-205 | |
| 4 | Baffle | Qty 2 req | SRV4184-113 | |
| 5 | Manifold Tube Set | | TUBES-4184 | Y |
| 6 | Baffle Protector | | SRV4184-195 | |
| 7 | Brick Retainer, Back | | SRV4184-123 | |
| 8 | Brick Retainer, Side | Qty 2 req | SRV4184-121 | |

#9 Brick Assembly



| | | | | |
|------|------------------------------------|------------|----------------------------|---|
| 9 | Brick Assembly | | SRV4184-016 | Y |
| 9.1 | Brick Wrap | Qty 8 req | SRV4182-101 | |
| 9.2 | Firebrick, 13.25 x 3.25 | Qty 2 req | SRV4182-203 | |
| 9.3 | Firebrick, 13.25 x 4.5 x 1.25 | Qty 10 req | SRV4182-301 | |
| 9.4 | Firebrick, 12.25 x 4.5 | Qty 4 req | SRV4184-201 | |
| 9.5 | Firebrick, 12.25 x 3.25 | Qty 2 req | SRV4184-203 | |
| 10 | Door Assembly | | See following pages | |
| 11 | Handle | | SRV4121-163 | Y |
| 12 | Timer Assembly | | See following pages | |
| 13 | Front Assembly (Complete) | | SRV4184-070 | |
| 13.1 | Upper Grille Assembly | | SRV4182-074 | |
| 13.2 | Side Bar Assembly | Qty 2 req | SRV4181-034 | |
| 13.3 | Front Access Lower Grille Assembly | | SRV4184-076 | |
| 14 | Blower Assembly | Qty 2 req | SRV433-5890 | Y |
| | Fan Speed Control | | SRV7000-143 | |
| | Wire Harness | | SRV480-0990 | Y |
| | Snap Disc, F180F-30 | | SRV4021-827 | |

Additional service part numbers on following page.

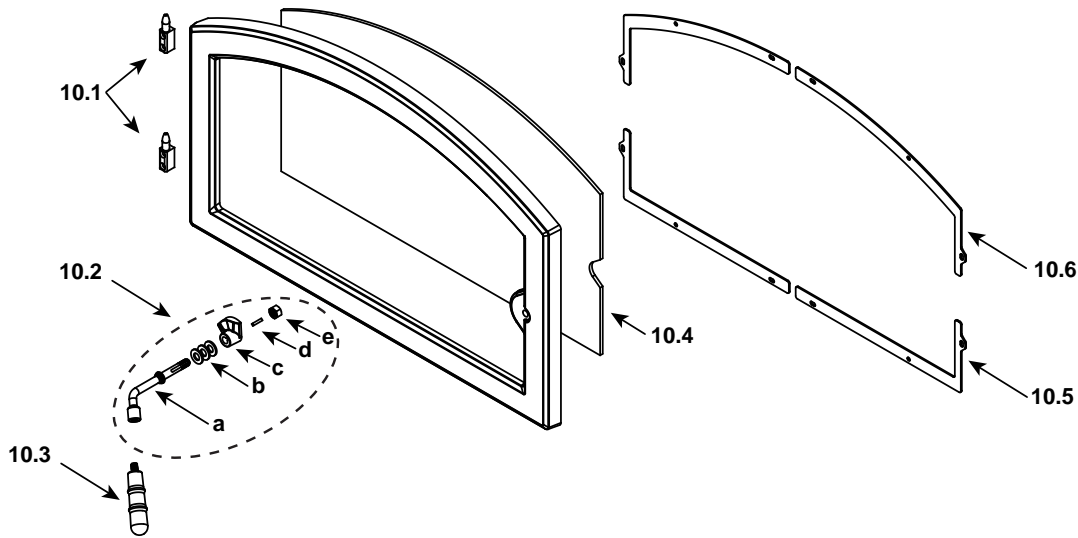
IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers.** Provide model number and serial number when requesting service parts from your dealer or distributor.



Stocked at Depot

| ITEM | DESCRIPTION | COMMENTS | PART NUMBER |
|------|----------------------|----------|-------------|
| 15 | Outside Air Assembly | | SRV4184-039 |
| 16 | Unit Collar | | SRV4087-314 |

#10 Door Assembly



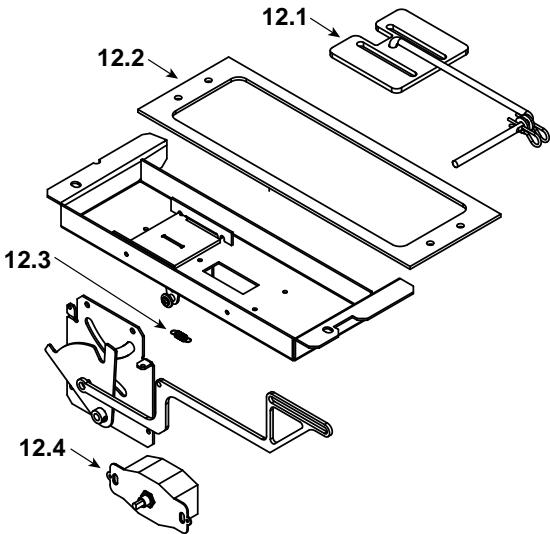
| | | | | |
|------|------------------------------|-----------|-------------|---|
| 10 | Door Assembly | | SRV4181-020 | |
| 10.1 | Hing Male | Qty 2 req | SRV4181-302 | |
| | Hing Retainer | | SRV4181-122 | |
| 10.2 | Door Handle Assembly | | SRV4181-022 | Y |
| a | Door Handle | | SRV4181-301 | |
| b | Washer, 3/8 SAE Black | Qty 3 req | 832-0990 | Y |
| c | Cam Latch | | SRV430-1141 | |
| d | Latch Cam Key | | SRV430-1151 | |
| e | Nut, 3/8-16 Lock (Pkg of 24) | Qty 2 req | 226-0100/24 | Y |
| 10.3 | Handle, Fiber | | SRV433-1380 | Y |
| 10.4 | Glass Assembly | | SRV4181-021 | |
| | Rope, 1/2 Wire Jacket | 10 Ft | 7000-811/10 | Y |
| 10.5 | Glass Retainer, Bottom | Qty 2 req | SRV4181-120 | Y |
| 10.6 | Glass Retainer, Top | Qty 2 req | SRV4181-121 | Y |

Additional service part numbers on following page.

IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers.** Provide model number and serial number when requesting service parts from your dealer or distributor.



Stocked at Depot

| ITEM | DESCRIPTION | COMMENTS | PART NUMBER | |
|--|--|-----------|----------------|---|
| <p>#12 Timer Assembly</p>  | | | | |
| 12 | Timer Assembly (Complete) | | SRV4184-044 | |
| 12.1 | Slide Assembly | | SRV4184-041 | |
| 12.2 | Air Channel Gasket | | SRV4184-189 | Y |
| 12.3 | Extension Spring | | SRV433-3950 | |
| 12.4 | Timer Mechanical, 12 Hour | | SRV480-1940 | Y |
| | Combustion Cover Gasket | | SRV4184-359 | |
| | Outside Air Hood Assembly | | 4059-051 | |
| | Chimney Air Kit | | CAK4A | |
| | Fastener Pack, Chimney Air Kit | | 13580 | |
| | Face Board Assembly, Non-combustible board | | SRV4184-064 | |
| | Hearth Strip | | SRV18320 | |
| | Template | | HHT-TEMPLATE-C | |
| | Touch Up Paint | Black | 812-0910 | |
| Fastener Packs | | | | |
| | AVK Repair Kit 1/4-20 | | RIVNUT-REPAIR | Y |
| | Nut, 1/4-20 | Pkg of 4 | SRV221-0110 | |
| | Screw, HWH MS 1/4-20 x 3/4 | Pkg of 25 | 220-0080/25 | Y |
| | Screw, PH 8-32 x 1/2 | Pkg of 25 | 220-0030/25 | Y |
| | Washer, 1/4 SAE (for door) | Pkg of 24 | 28758/24 | Y |

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B. Contact Information



Hearth & Home Technologies
1915 West Saunders Street
Mount Pleasant, Iowa 52641

Please contact your dealer with any questions or concerns.

For the number of your nearest dealer, please visit www.fireplaces.com.

– NOTES –

CAUTION

DO NOT DISCARD THIS MANUAL



- Important operating and maintenance instructions included.

- Read, understand and follow these instructions for safe installation and operation.

- Leave this manual with party responsible for use and operation.



This product may be covered by one or more of the following patents: (United States) 6601579, 6769426, 6863064, 7077122, 7074035, 7098269, 7234932, 7258116, 7322819, 7422011, 7470729, 7726300, 8147240, 9625149 or other U.S. and foreign patents pending.

2000-945E

Owner's Manual

Care and Operation

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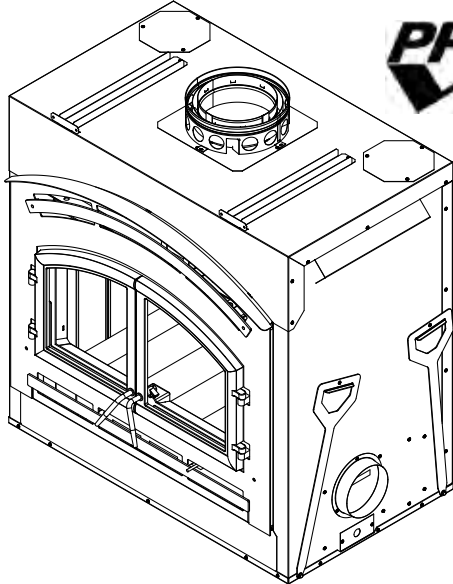
NOTICE: *DO NOT* discard this manual!

heatilator[®]
The first name in fireplaces

Model(s):

C40-D

Constitution



**EPA CERTIFIED WOODBURNING
FIREPLACE**

Installation and service of this appliance should be performed by qualified personnel. Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.

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FACTORY TRAINING
Fuel Your Fire



⚠ WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

- **DO NOT** store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **DO NOT** overfire. Overfiring will void your warranty.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may cause house fire.

⚠ WARNING



HOT SURFACES!

Glass and other surfaces are hot during operation AND cool down.

Hot glass will cause burns.

- **DO NOT** touch glass until it is cooled
 - **NEVER** allow children to touch glass
 - Keep children away
 - **CAREFULLY SUPERVISE** children in same room as fireplace.
 - Alert children and adults to hazards of high temperatures.
- High temperatures may ignite clothing or other flammable materials.**
- Keep clothing, furniture, draperies and other flammable materials away.

⚠ WARNING



Fire Risk.

For use with solid wood fuel only.
Other fuels may overfire and generate poisonous gases (i.e. carbon monoxide).

Owner's Manual

Care and Operation

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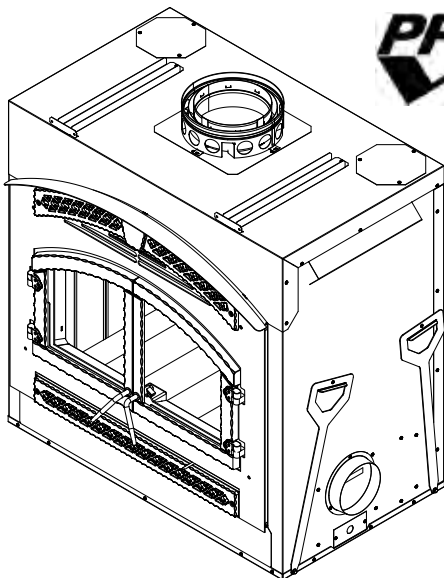
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NOTICE: *DO NOT* discard this manual!

HEAT & GLO™

Model(s):

NORTHSTAR-D



**EPA CERTIFIED WOODBURNING
FIREPLACE**

Installation and service of this appliance should be performed by qualified personnel. Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.



⚠ WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

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 - Alert children and adults to hazards of high temperatures.
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- Keep clothing, furniture, draperies and other flammable materials away.

⚠ WARNING



Fire Risk.

For use with solid wood fuel only.
Other fuels may overfire and generate poisonous gases (i.e. carbon monoxide).

Owner's Manual

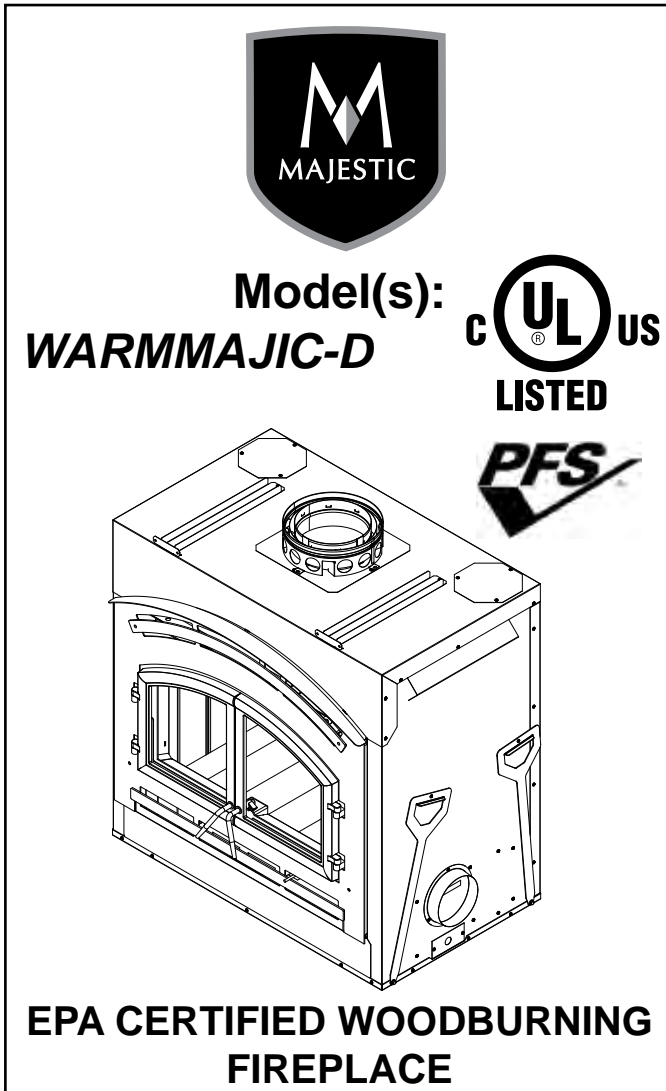
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NOTICE: *DO NOT* discard this manual!



Installation and service of this appliance should be performed by qualified personnel. Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.

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NFI NATIONAL FIREPLACE INSTITUTE
A CERTIFICATION AGENCY

⚠ WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

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- Keep clothing, furniture, draperies and other flammable materials away.

⚠ WARNING



Fire Risk.

For use with solid wood fuel only.

Other fuels may overfire and generate poisonous gases (i.e. carbon monoxide).

Installation Manual

Installation and Fireplace Setup

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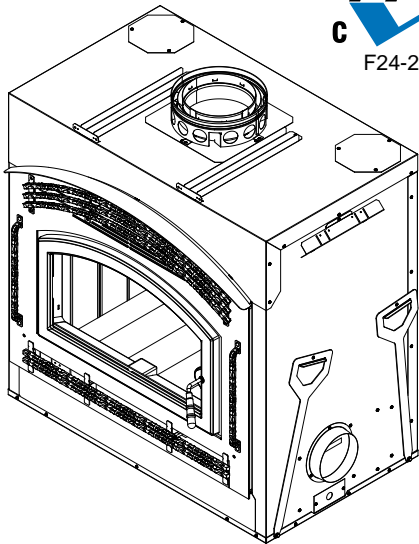
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OWNER: Retain this manual for future reference.

Contact your dealer with questions on installation, operation, or service.



Model(s):

PIONEER-II-ARC
PIONEER-II-REC



HEAT & GLO
heatilator



EPA CERTIFIED
WOODBURNING FIREPLACE

WARNING! Risk of Fire and/or Asphyxiation!

- Read all the instructions before starting the installation. Follow these instructions carefully during the installation to ensure maximum safety and benefit.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may cause house fire.

▲ WARNING



HOT SURFACES!

Glass and other surfaces are hot during operation AND cool down.

Hot glass will cause burns.

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- **NEVER** allow children to touch glass
- Keep children away
- **CAREFULLY SUPERVISE** children in same room as fireplace.
- Alert children and adults to hazards of high temperatures.
- **High temperatures may ignite clothing or other flammable materials.**
- Keep clothing, furniture, draperies and other flammable materials away.

Installation and service of this appliance should be performed by qualified personnel. Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.



Safety Alert Key:

- **DANGER!** Indicates a hazardous situation which, if not avoided will result in death or serious injury.
- **WARNING!** Indicates a hazardous situation which, if not avoided could result in death or serious injury.
- **CAUTION!** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE:** Indicates practices which may cause damage to the fireplace or to property.

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ATTENTION INSTALLER:
Follow this Standard Work Checklist

This standard work checklist is to be used by the installer in conjunction with, not instead of, the instructions contained in this installation manual.

| | | | |
|--------------------|----------------|-----------------------------------|-------|
| Customer: | _____ | Date Installed: | _____ |
| Lot/Address | _____ | Location of Fireplace: | _____ |
| | _____ | Installer: | _____ |
| | | Dealer/Distributor Phone # | _____ |
| Model: | PIONEER-II-ARC | Serial #: | _____ |
| | PIONNER-II-REC | | _____ |

⚠ WARNING! Risk of Fire or Explosion! Failure to install fireplace according to these instructions can lead to a fire or explosion.

| Fireplace Install Section 3 (page 10-21) | YES | IF NO, WHY? |
|--|--------------------------|--------------------|
| Verified that the chase is insulated and sealed. | <input type="checkbox"/> | _____ |
| Required top standoffs installed. | <input type="checkbox"/> | _____ |
| Required non-combustible board is installed. | <input type="checkbox"/> | _____ |
| Verified clearances to combustibles. | <input type="checkbox"/> | _____ |
| Fireplace is leveled and secured. | <input type="checkbox"/> | _____ |
| Hearth extension size/height decided. | <input type="checkbox"/> | _____ |
| Outside air kit installed. | <input type="checkbox"/> | _____ |
| Optional Heat Zone has been installed by a qualified service technician. | <input type="checkbox"/> | _____ |
| Fan air kit installed. | <input type="checkbox"/> | _____ |

| | | |
|---|--------------------------|-------|
| Chimney Section 5 and 6 (page 23-34) | | |
| Chimney configuration complies with diagrams. | <input type="checkbox"/> | _____ |
| Chimney installed, locked and secured in place with proper clearance. | <input type="checkbox"/> | _____ |
| Chimney air kit installed. | <input type="checkbox"/> | _____ |
| Firestops installed. | <input type="checkbox"/> | _____ |
| Attic insulation shields installed. | <input type="checkbox"/> | _____ |
| Roof flashing installed and sealed. | <input type="checkbox"/> | _____ |
| Terminations installed and sealed. | <input type="checkbox"/> | _____ |

| | | |
|---------------------------------------|--------------------------|-------|
| Electrical Section 4 (page 22) | | |
| Switch wires properly installed. | <input type="checkbox"/> | _____ |

| | | |
|--|--------------------------|-------|
| Finishing Section 7 (page 35-38) | | |
| Combustible materials not installed in non-combustible areas. | <input type="checkbox"/> | _____ |
| Verified all clearances meet installation manual requirements. | <input type="checkbox"/> | _____ |
| Mantels and wall projections comply with installation manual requirements. | <input type="checkbox"/> | _____ |
| Protective hearth strips and hearth extension installed per manual requirements. | <input type="checkbox"/> | _____ |

| | | |
|--|--------------------------|-------|
| Fireplace Setup Section 8 (page 39-40) | | |
| All packaging and protective materials removed. | <input type="checkbox"/> | _____ |
| Firebrick, baffle and ceramic blanket installed correctly. | <input type="checkbox"/> | _____ |
| Facia and doors properly installed. | <input type="checkbox"/> | _____ |
| Manual bag and all of its contents are removed from inside/under the fireplace and given to the party responsible for use and operation. | <input type="checkbox"/> | _____ |
| All packaging materials are removed from inside/under the fireplace. | <input type="checkbox"/> | _____ |

Hearth & Home Technologies recommends the following:

- Photographing the installation and copying this checklist for your file.
- That this checklist remain visible at all times on the fireplace until the installation is complete.

Comments: Further description of the issues, who is responsible (Installer/Builder/Other Trades, etc.) and corrective action needed:

Comments communicated to party responsible _____ by _____ on _____
 (Builder/Gen. Contractor) (Installer) (Date)

1 Product Specific & Important Safety Information

A. Appliance Safety Certification

| | |
|--------------------|---|
| Model: | PIONEER-II-ARC & PIONEER-II-REC |
| Laboratory: | Underwriter's Laboratories, Inc. |
| Report No: | Project 4789042842 |
| Type: | Wood Fireplace |
| Standard: | UL127-2011 and CAN/ULC-S610-2018 (A1998) and (UM) 84-HUD, Manufactured Home Approved. |

B. Appliance Emissions Certification

| | |
|---|---|
| Model: | PIONEER-II-ARC & PIONEER-II-REC |
| Laboratory: | PFS TECO |
| Report No: | F24-253 |
| Standard: | EPA Method 28R, ASTM E2515, ASTM E2780 and CSA B415.1 |
| Can be found at: www.fireplaces.com/shopping-tools/epa-certifications | |

C. BTU & Efficiency Specifications

| | |
|---|---|
| EPA Certified Emissions: | 1.7 g/hr |
| *LHV Tested Efficiency: | 73% |
| **HHV Tested Efficiency: | 69% |
| ***EPA BTU Output: | 20,900 BTU/hr |
| ****Peak BTU/Hour Output: | 81,000 BTU/hr |
| Vent Size: | 8 inches |
| Firebox Size: | 2.75 cubic feet |
| Recommended Log Length: | 22 inches |
| Fuel | Seasoned Cord Wood less than 20% moisture |
| HHT: | SL300 Series |
| DuraVent: | DuraPlus |
| *Weighted average LHV (Low Heating Value) efficiency using crib wood and data collected during EPA emission test. LHV assumes the moisture is already in a vapor state so there is no loss in energy to vaporize. | |
| **Weighted average HHV (High Heating Value) efficiency using crib wood and data collected during EPA emission test. HHV includes the energy required to vaporize the water in the fuel. | |
| ***BTU outputs based on HHV (High Heating Value) and the burn rate from EPA tests using crib wood. | |
| ****A peak BTU out of the appliance calculated using the maximum first hour burn rate from the High EPA Test and BTU content of seasoned cordwood (8600) times the efficiency. | |

PIONEER-II-ARC & PIONEER-II-REC are Certified to comply with 2020 particulate emission standards.



The PIONEER-II-ARC & PIONEER-II-REC Wood Appliances meet the U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using crib wood.

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

D. Mobile Home Approved

This appliance is approved for mobile home installations when not installed in a sleeping room and when an outside combustion air inlet is provided. The structural integrity of the mobile home floor, ceiling, and walls must be maintained. The appliance must be properly grounded to the frame of the mobile home and use only listed double-wall connector pipe.

E. Glass Specifications

This appliance is equipped with 5mm ceramic glass. Replace glass only with 5mm ceramic glass. Please contact your dealer for replacement glass.

NOTE: This installation must conform with local codes. In the absence of local codes you must comply with the **UL127-2011, (UM) 84-HUD and NPFA211** in the U.S.A. and the **CAN/ULC S610-2018 (A1998) and CAN/CSA-B365 Installation Codes** in Canada.

DO NOT:

- install or operate damaged fireplace
- modify fireplace
- install other than as instructed by *Hearth & Home Technologies*
- operate the fireplace without fully assembling all components
- install unvented gas log set
- install any component not approved by *Hearth & Home Technologies*
- install parts or components not Listed or approved

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. For assistance or additional information, consult a qualified installer, service agency or your dealer.

WARNING! Risk of Fire! *Hearth & Home Technologies disclaims any responsibility for, and the warranty and agency listing will be voided by the above actions.*

Hearth & Home Technologies WILL NOT warranty appliances that exhibit evidence of over-firing. Evidence of over-firing includes, but is not limited to:

- Warped air tube
- Deteriorated refractory brick retainers
- Deteriorated baffle and other interior components

F. Non-Combustible Materials

Material which will not ignite and burn, composed of any combination of the following:

- Steel
- Brick
- Concrete
- Glass
- Plaster
- Iron
- Tile
- Slate

Materials reported as passing **ASTM E 136, Standard Test Method for Behavior of Metals, in a Vertical Tube Furnace of 750° C.**

G. Combustible Materials

Material made of or surfaced with any of the following materials:

- Wood
- Plant Fibers
- Plywood/OSB
- Foam insulation & sealants
- Compressed Paper
- Plastic
- Sheet Rock (drywall)

Any material that can ignite and burn: flame proofed or not, plastered or un-plastered.

H. Electrical Codes

NOTICE: *This fireplace must be electrically wired and grounded in accordance with local codes or, in the absence of local codes, with **National Electric Code ANSI/NFPA 70-latest edition** or the **Canadian Electric Code CSA C22.1.***

- A 110-120 VAC circuit for this product must be protected with ground-fault circuit-interrupter protection, in compliance with the applicable electrical codes, when it is installed in damp locations.

WARNING! *Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage.*

2 Getting Started

A. Typical Fireplace System

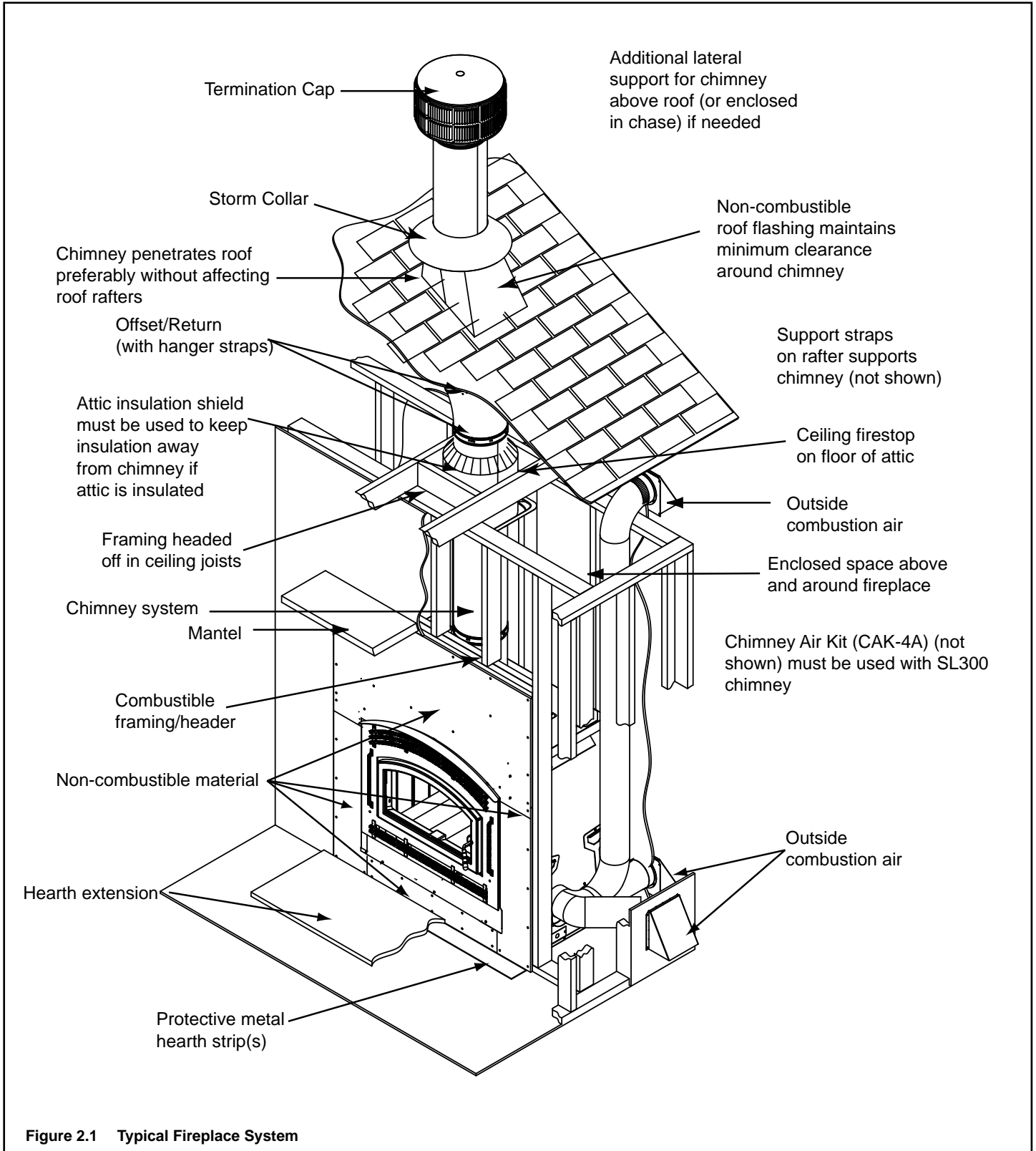


Figure 2.1 Typical Fireplace System

B. Design and Installation Considerations

NOTICE: Check building codes prior to installation.

- Installation MUST comply with local, regional, state and national codes and regulations.
- Consult insurance carrier, local building inspector, fire officials or authorities having jurisdiction over restrictions, installation inspection and permits.

1. Selecting Fireplace Locations

This fireplace may be used as a room divider, installed along a wall, across a corner or used in an exterior chase. See Figure 2.2.

Locating the fireplace in a basement, near frequently opened doors, central heat outlets or returns, or other locations of considerable air movement can affect the performance.

Outside air must be used for combustion. The PIONEER II-ARC & PIONEER-II-REC comes equipped with an outside air inlet to feed combustion air from outside the home, along with an outside air termination cap; the metal duct is required but not supplied. Consideration should be given to these factors before deciding on a location.

NOTICE: In addition to these framing dimensions, also reference the following section:

- Clearances (Section 3).

NOTICE:

- Illustrations and photos reflect typical installations and are FOR DESIGN PURPOSES ONLY.
- Illustrations/diagrams are not drawn to scale.
- Actual installation/appearance may vary due to individual design preference.
- Hearth & Home Technologies reserves the right to alter its products.

NOTICE:

A minimum 1/2 in. air clearance at the back and a minimum 1 in. air clearance to the sides of the fireplace assembly must be maintained.

Chimney sections at any level require a 2 in. minimum air space clearance between the framing and chimney sections.

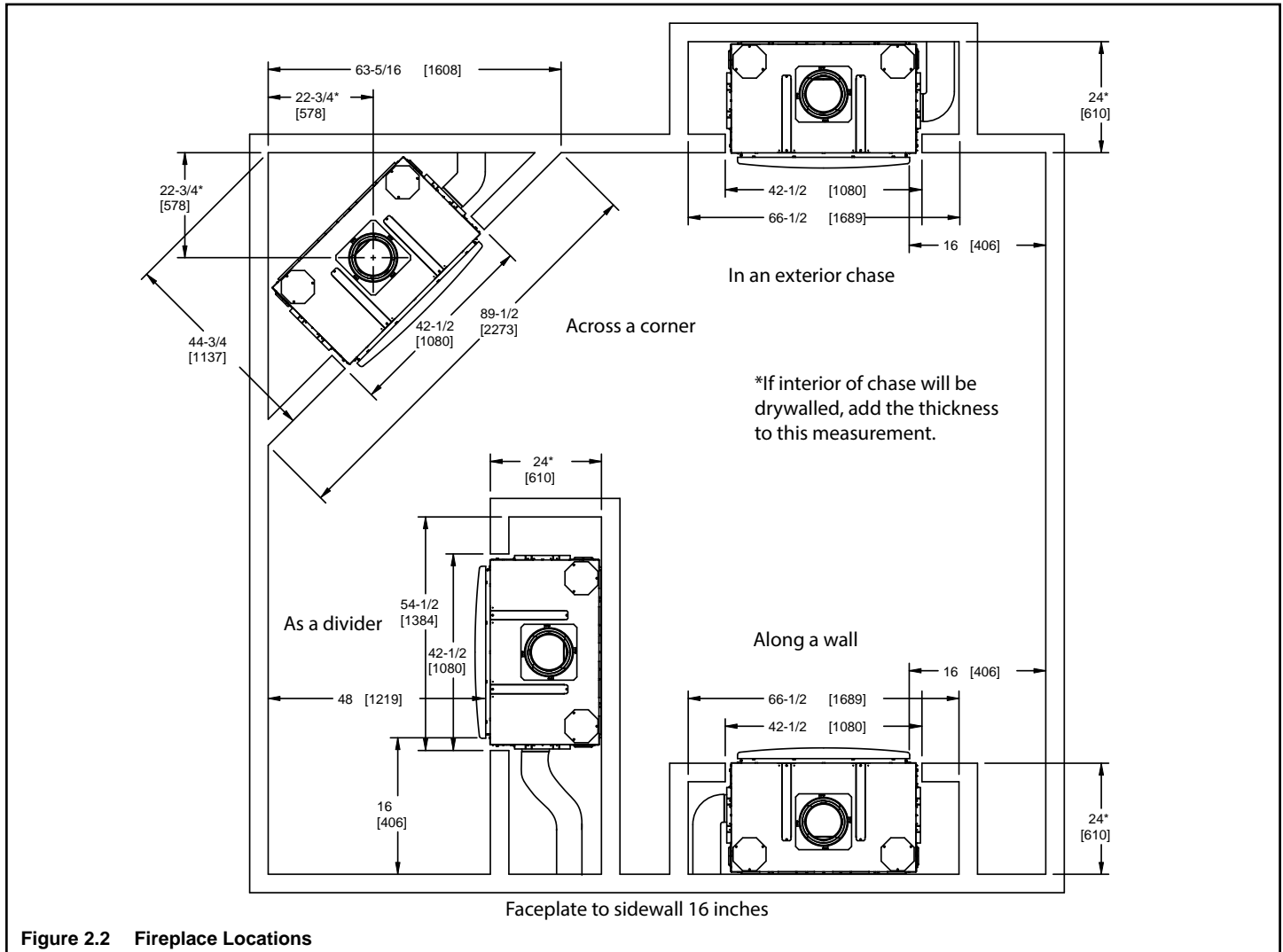
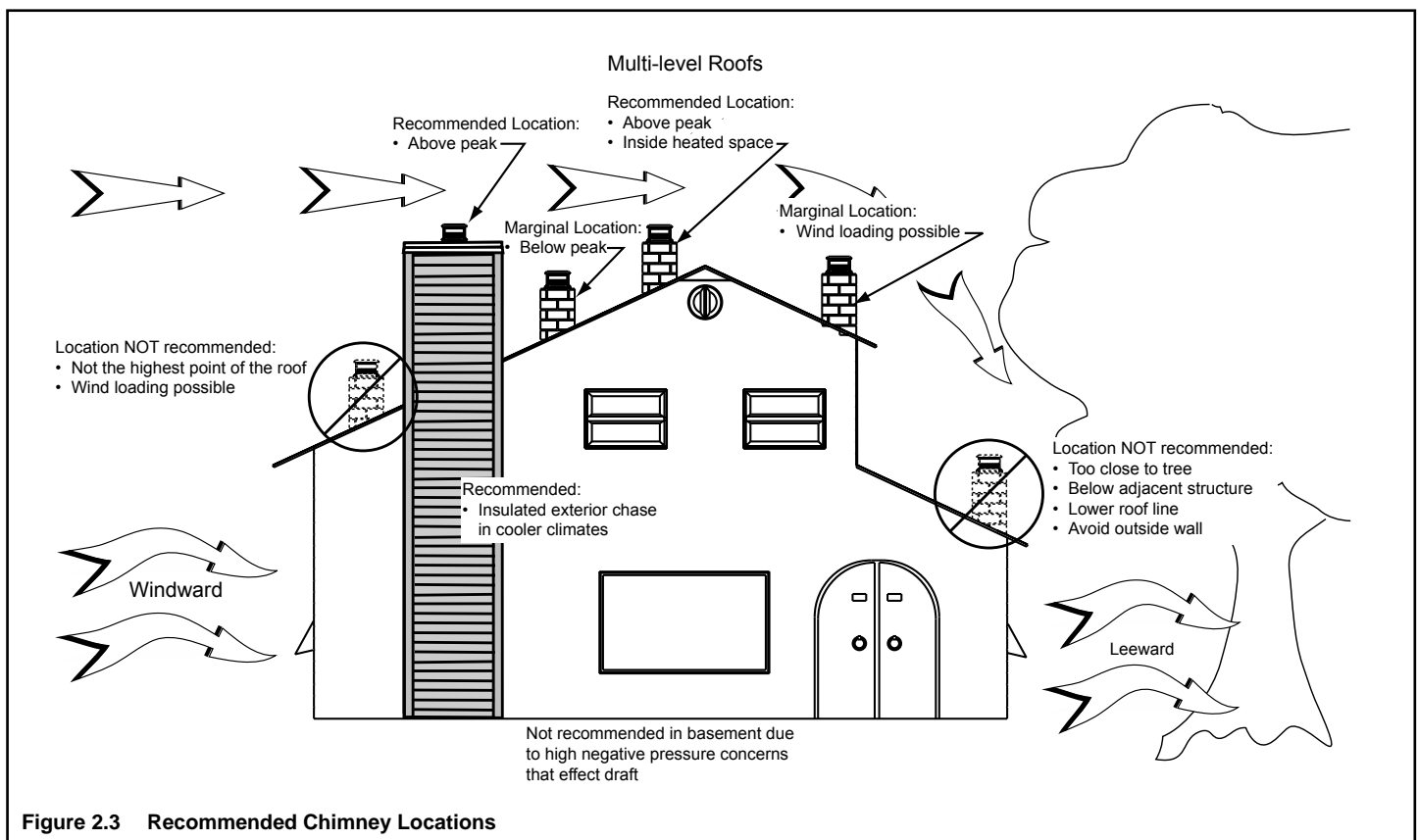


Figure 2.2 Fireplace Locations

2. Locating Fireplace & Chimney

Location of the fireplace and chimney will affect performance.

- Install within the warm airspace enclosed by the building envelope. This helps to produce more draft, especially during lighting and die-down of the fire.
- Penetrate the highest part of the roof. This minimizes the effects of wind loading.
- Locate termination cap away from trees, adjacent structures, uneven roof lines and other obstructions.
- Minimize the use of chimney offsets.
- Consider the fireplace location relative to floor and ceiling and attic joists.
- Take into consideration the termination requirements in Sections 5 and 6.
- Install the outside air kit and CAK (chimney air kit) with the intake facing prevailing winds during the heating season.
- Ensure adequate outdoor air for all combustion appliances and exhaust equipment.
- Ensure furnace and air conditioning return vents are not located in the immediate vicinity of the fireplace.
- Avoid installing the fireplace near doors, walkways or small isolated spaces.
- Recessed lighting should be a “sealed can” design.
- Attic hatches weather stripped or sealed.
- Attic mounted duct work and air handler joints and seams taped or sealed.



C. Tools and Supplies Needed

Before beginning the installation be sure the following tools and building supplies are available:

| | |
|---|-------------------------|
| Reciprocating saw | Framing material |
| Pliers | Misc. screws and nails |
| Hammer | Gloves |
| Phillips screwdriver | Framing square |
| Flat blade screwdriver | Electric drill and bits |
| Plumb line | Safety glasses |
| Level | Tape measure |
| 1/2-3/4 in. length, #6 or #8 self-drilling screws | |
| Non-combustible 300° silicone sealant | |

D. Inspect Fireplace and Components

WARNING! Risk of Fire and Asphyxiation! Damaged parts could impair safe operation. DO NOT install damaged, incomplete or substitute components.

- Remove fireplace and components from packaging and inspect for damage.
- Chimney system components and other optional components are shipped separately.
- Report to your dealer any parts damaged in shipment.

E. Fireplace System Requirements

The fireplace system requirements consist of the following:

- Fireplace
 - Firebrick (included with fireplace)
 - Door (included with fireplace)
 - Non-combustible facing material (included with fireplace)
 - Hearth Extension
 - Metal Hearth Strips (included with fireplace)
- Outside Air System (hood and collars included with fireplace)
- Fascia
- Chimney System
 - CAK4A Chimney air kit (included with fireplace, required with SL300 series chimney)
 - Attic Insulation Shield (included with fireplace)
 - Chimney termination cap
- Non-combustible finish material
- Fans (included with fireplace)

Optional components include:

- LINTEL BAR-HHT - Lintel Bar Kit
- Heat-Zone-WD-C Kit
- OA-RD-6 - Outside Air Offset Adapter

F. Lower Access Panel Removal and Installation

The lower access panel comes attached to the fireplace for shipping purposes only.

1. While holding on to the access panel, remove the screws on each end. See Figure 2.4.
2. Remove the two (2) shipping brackets and discard them. See Figure 2.5.
3. Hang the lower access panel on the fireplace so that it rests on the screw pins on each end.



Figure 2.4 Remove Screws

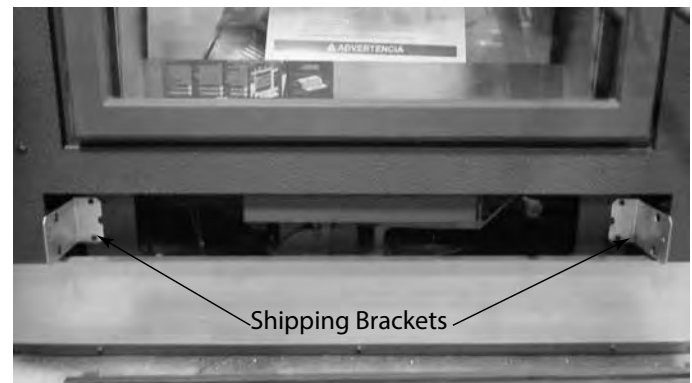


Figure 2.5 Remove Shipping Brackets

3 Framing and Clearances

A. Appliance Dimensions/Weight

Appliance Weight Table

| Model | Pounds |
|----------------|--------|
| PIONEER-II-ARC | 617 |
| PIONEER-II-REC | 617 |

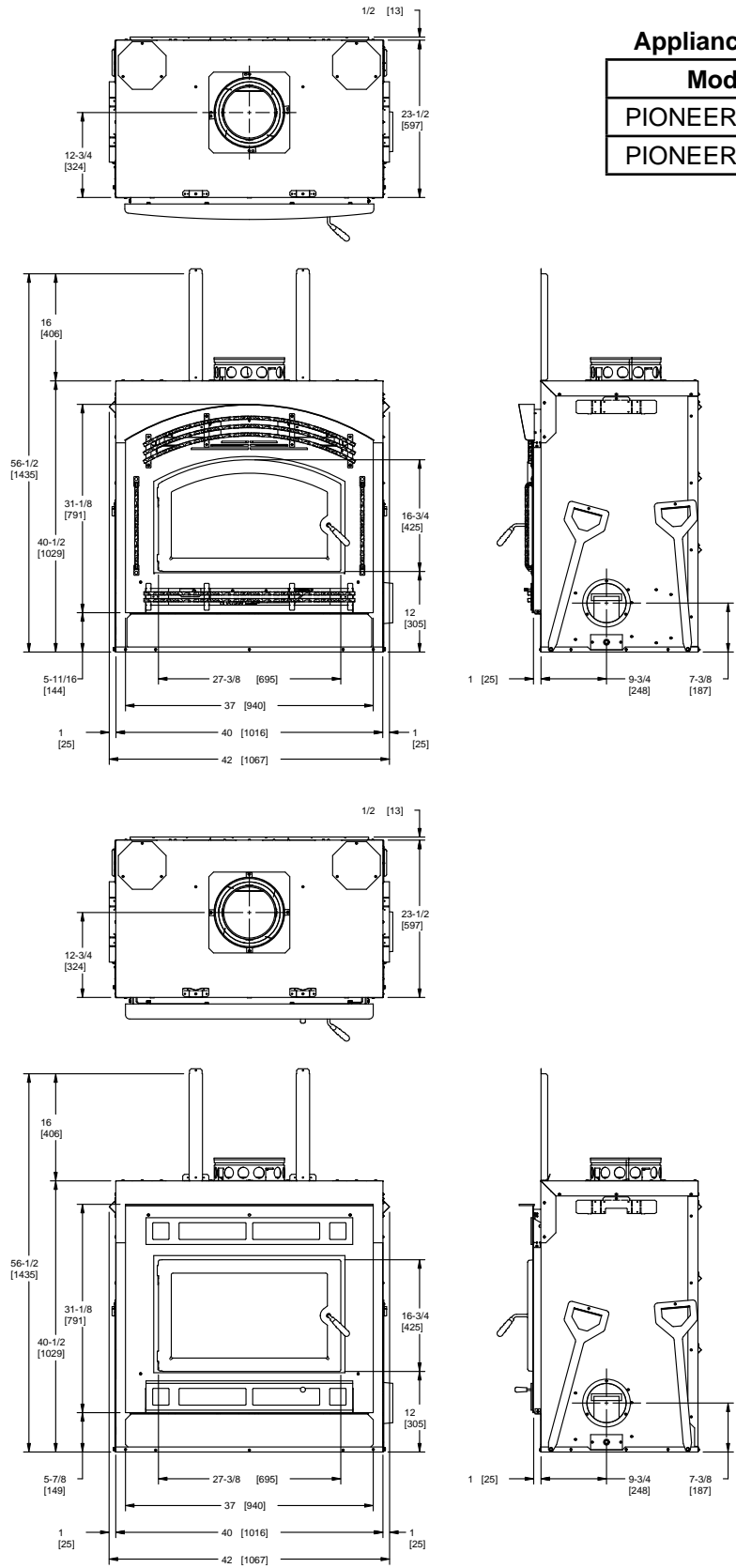
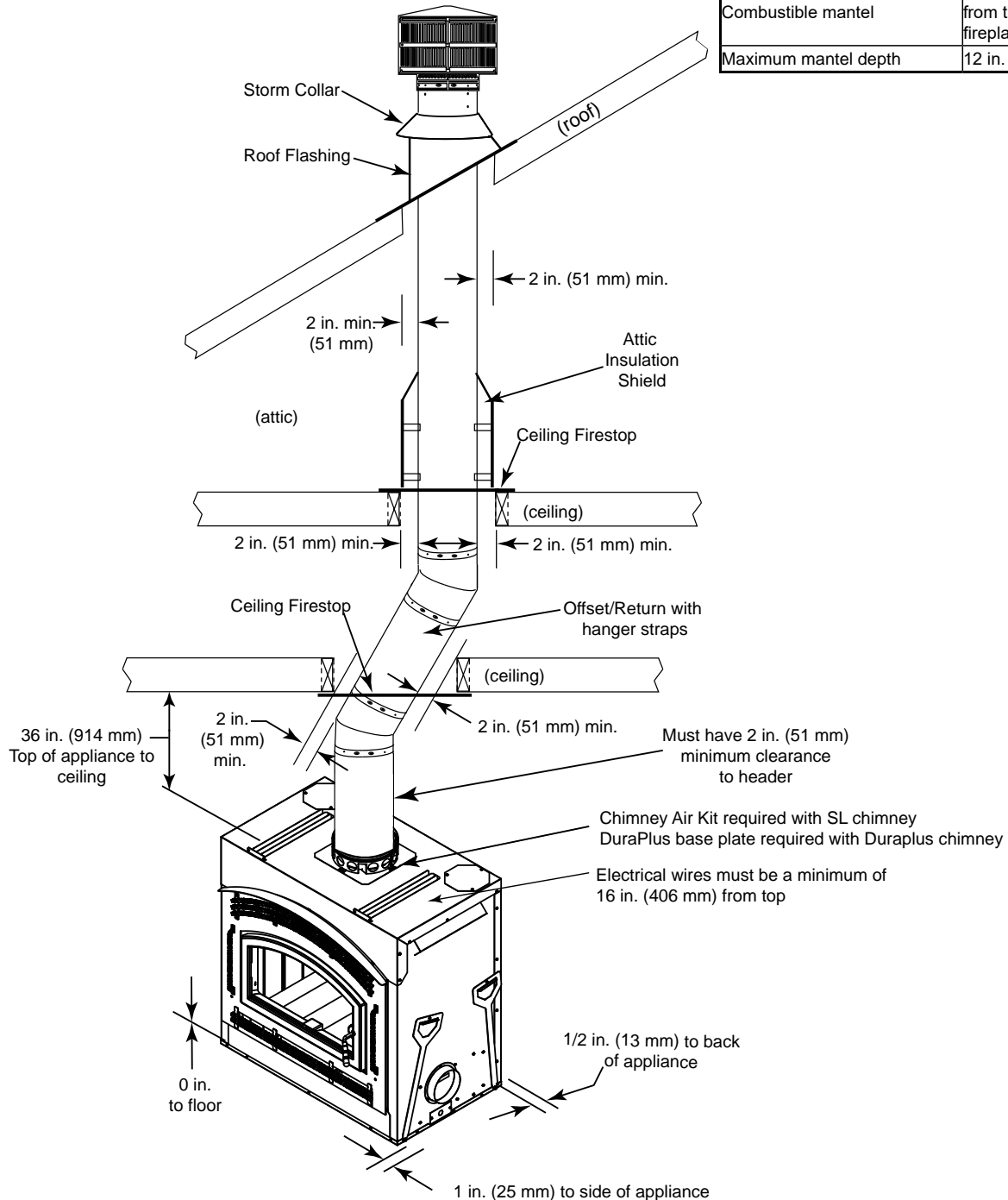


Figure 3.1 Appliance Dimensions

B. Clearances

WARNING! Risk of Fire!

You must comply with all minimum air space clearances to combustibles as specified in Figure 3.2. **DO NOT** pack required air spaces with insulation or other materials. Framing or finishing material used on the front of, or in front of the fireplace closer than the minimums listed must be constructed entirely of non-combustible materials (i.e., steel studs, concrete board, etc.). Failure to comply may cause fire.



| WITHIN ENCLOSURE AREA | |
|---------------------------------|--|
| Fireplace to backwall | 1/2 in. (13 mm) |
| Fireplace to sidewall | 1 in. (25 mm) |
| Duct boots to framing | 0 in. (0 mm) |
| Top of fireplace to header | 16 in. (406 mm) |
| Door opening to sidewall | 22-3/4 in. (578 mm) |
| EXPOSED SURFACES | |
| Faceplate to sidewall | 16 in. (406 mm) |
| Heat zone air grills to ceiling | 12 in. (305 mm) |
| MANTEL | |
| Non-combustible mantel | 38 in. (965 mm) from the base of the fireplace up |
| Combustible mantel | 60 in. (1524 mm) from the base of the fireplace up |
| Maximum mantel depth | 12 in. (305 mm) |

Figure 3.2 Clearances to Combustible Materials

C. Construct the Chase

WARNING! Risk of Fire! DO NOT seal area between fire stop opening and chimney pipe except where they enter the attic or leave the warm air envelope of the home (use 600° F sealant).

WARNING! Risk of Fire! You must maintain a minimum 2 in. (51 mm) air space clearance to insulation and framing surrounding the chimney system.

A chase is a vertical boxlike structure built to enclose the fireplace and/or its vent system. Vertical chimneys that run on the outside of a building must be installed inside a chase. See Figure 3.4.

Construction of the chase may vary with the type of building. Local building codes **MUST** be followed.

Hearth & Home Technologies recommends:

- The inside surfaces be drywalled and taped (or the use of an equivalent method) for maximum air tightness to the false ceiling.
 - In cold climates, the walls of the chase should be insulated to the level of the false ceiling as shown in Figure 3.3. This will help reduce heat loss from the home around the fireplace.
 - Holes and other openings should be caulked with high temperature caulk or stuffed with unfaced fiber glass insulation.
- Requirements for constructing the chase:
 - A firestop spacer and attic insulation shield should be installed at the false ceiling.
 - The chase must be properly blocked to prevent blown insulation or other combustibles from entering and making contact with fireplace or chimney.
 - The chase top must be constructed of non-combustible material.
 - The chase is constructed using framing materials much the same as the walls in your home. A variety of siding materials may be used including brick, stone, veneer brick, or standard siding materials.
 - In constructing the chase, several factors must be considered:
 - Maintain a 2 in. (51 mm) air space around the chimney.
 - The chase top must be constructed of non-combustible material.
 - In cold climates, a firestop spacer and attic insulation shield should be installed in an insulated false ceiling at the 8 ft. (2438 mm) level above the fireplace assembly. This reduces heat loss through the chase.
 - In cold climates, the walls of the chase should be insulated to the level of the false ceiling as shown in Figure 3.4. This will help reduce heat loss from the home around the fireplace.

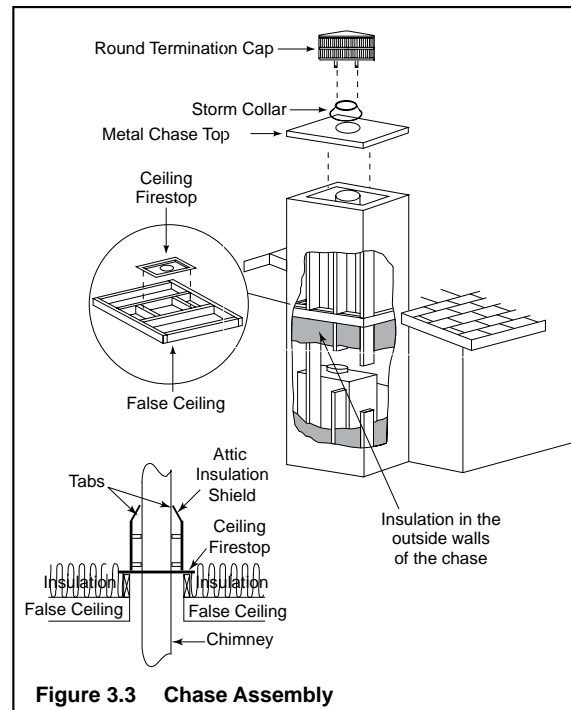


Figure 3.3 Chase Assembly

Three examples of chase applications are shown in Figure 3.4.

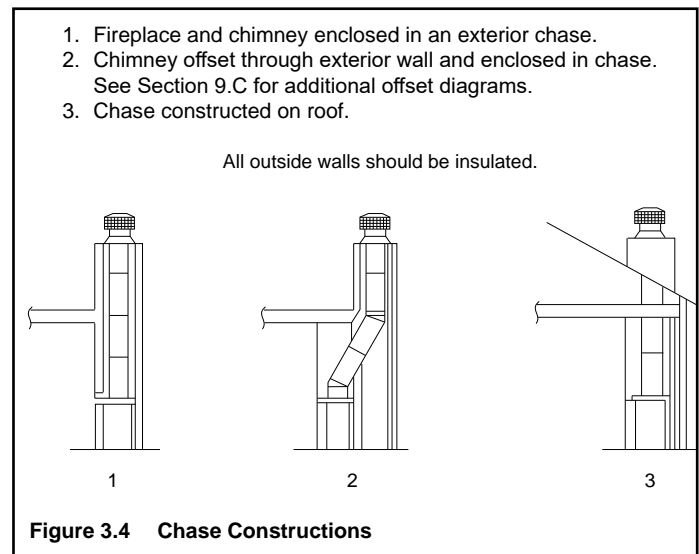


Figure 3.4 Chase Constructions

D. Frame the Fireplace

WARNING! Risk of Fire! Comply with all minimum clearances specified.

- A minimum 1/2 in. (13 mm) air clearance must be maintained at the back and 1 in. (25 mm) to the sides of the fireplace assembly.
- Chimney sections at any level require a 2 in. (51 mm) minimum air space clearance between the framing and chimney section.

WARNING! Risk of Fire! You must comply with all minimum air space clearances to combustibles. **DO NOT** pack required air spaces with insulation or other materials.

NOTICE: Hearth extension design must be determined before installation of fireplace.

If the fireplace is placed on the floor, the maximum height of a finished raised hearth (constructed of non-combustible material) is 5-3/4 in. (147 mm). If a higher raised hearth is preferred, the fireplace must be placed on a platform.

NOTICE: Wiring for fans must be done before framed enclosure is completed. If using the Heat-Zone-WD-C Kit, it also must be installed before enclosure is complete.

Standoffs are attached to the fireplace.

NOTE: Before framing up the chase, consider where and how the chimney will run. If there are obstacles that might be in the way, it may be necessary to make the chase larger than shown to allow for offsets to be used. Refer to offset chart on page 24.

The unit can be positioned with the standoffs touching combustible walls or framing but DO NOT pack insulation or other materials in the air space between the fireplace and wall.

Figure 3.5 shows a typical framing (using 2 x 4 lumber) of the fireplace, assuming combustible materials are used. All required clearances to combustibles around the fireplace must be adhered to. See Figure 3.2. (No recess above fireplace.)

The finished cavity depth must be no less than 24 in. (610 mm) from the finished back wall to the outside of front wall framing. Framing must extend straight up all the way to the ceiling.

CAUTION! Risk of Cuts/Abrasions. Wear protective gloves and safety glasses during installation. Sheet metal edges are sharp.

NOTE: Before framing up the chase, consider where and how the chimney will run. If there are obstacles that might be in the way, it may be necessary to make the chase larger than shown to allow for offsets to be used. Refer to offset chart on page 24 if needed.

E. Secure and Level the Fireplace

This fireplace may be placed on either a combustible or noncombustible continuous flat surface. Follow the instructions for framing in Section 3. Slide the fireplace into position. Be sure to provide the minimum 1 in. air clearance at the sides and 1/2 in. at the back of the fireplace.

The fireplace should be positioned so the face of the non-combustible material on the fireplace will be flush with the face of the drywall on the walls. See Figure 3.6.

Level the fireplace and shim as necessary. Secure the fireplace (using the pallet mounting brackets located on either side of the fireplace) to the sub floor.

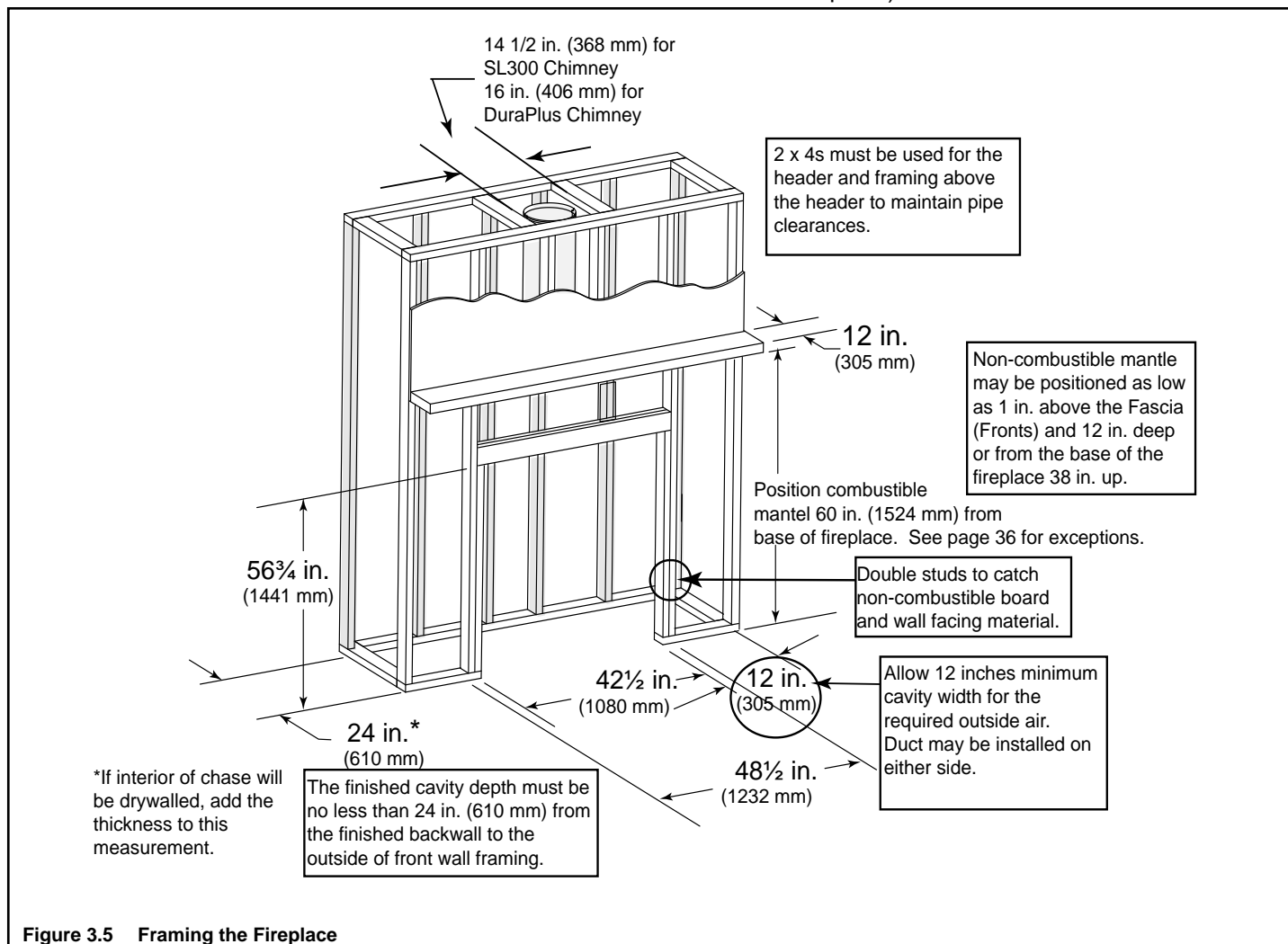


Figure 3.5 Framing the Fireplace

WARNING! Risk of Fire! Prevent contact with sagging, loose insulation.

- **DO NOT** install against vapor barriers or exposed insulation.
- Secure insulation and vapor barriers.
- Provide minimum air space clearances at the sides and back of the fireplace assembly as outlined in Section 3.

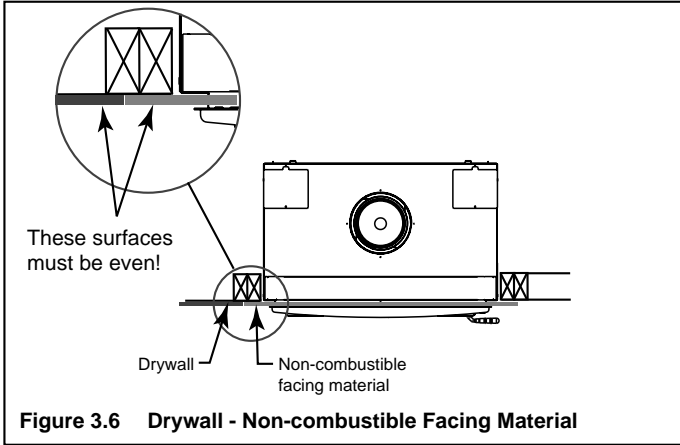


Figure 3.6 Drywall - Non-combustible Facing Material

F. Installation of Top Standoffs

Remove the top front standoffs from the top of the fireplace. See Figure 3.7. Screw the standoffs to the fireplace as shown in Figure 3.8. The top of the standoffs will be screwed to the header.

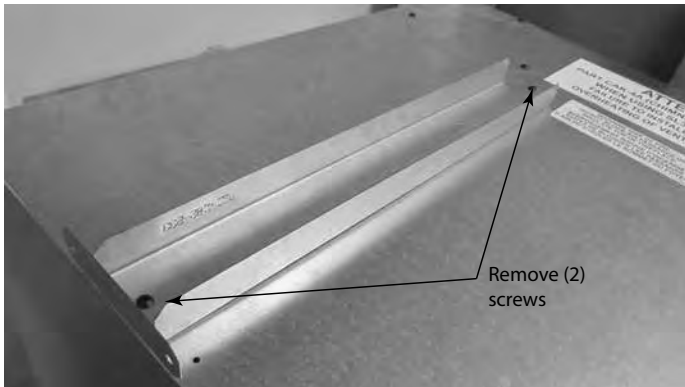


Figure 3.7 Remove Standoffs

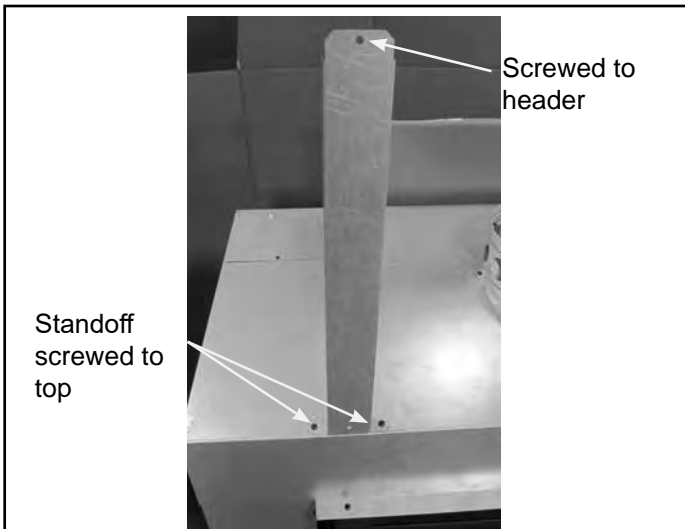


Figure 3.8 Screw Standoffs to Fireplace

G. Protective Metal Hearth Strips

WARNING! Risk of fire! High temperatures, sparks, embers or other burning material falling from the fireplace may ignite flooring or concealed combustible surfaces.

- Protective metal hearth strips **MUST** be installed over combustible surfaces.
- Hearth extensions **MUST** be installed exactly as specified.
- Locate the two protective metal hearth strips measuring approximately 26 in. x 4 in. (660 mm x 102 mm) included with this fireplace.
- Slide each metal strip 2 in. (51 mm) under front edge of fireplace.
- Overlap strips in the middle of fireplace opening by 1 in.-(25 mm) minimum.
- Metal strips must extend beyond the front and sides of the fireplace opening by at least 2 in. (51 mm). See Figure 3.9.
- Protect the front of a platform elevated above the front of the hearth extension with metal strips (not included with fireplace) per Figure 3.10. See Section 7 for hearth extension instructions.
- **DO NOT cover metal strips with combustible materials.** Sparks or embers may ignite flooring.

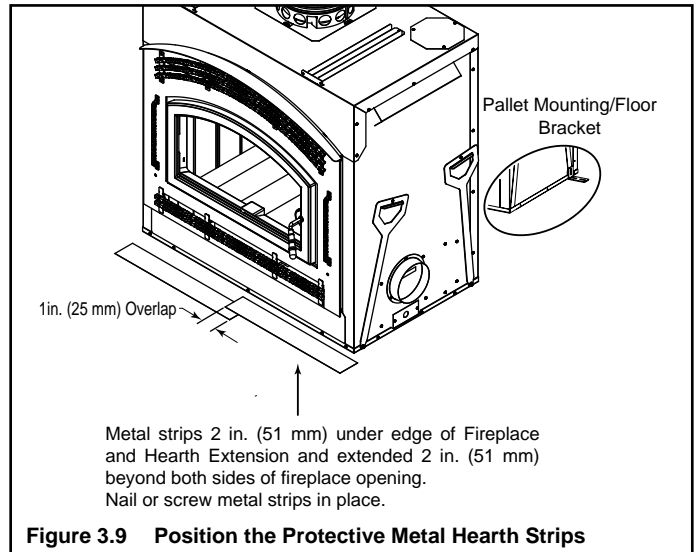


Figure 3.9 Position the Protective Metal Hearth Strips

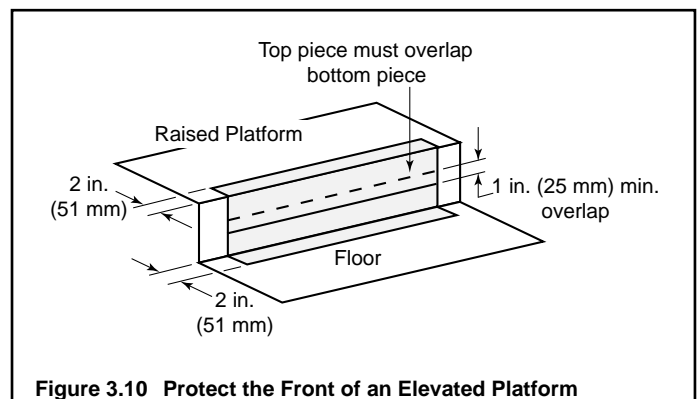


Figure 3.10 Protect the Front of an Elevated Platform

H. Non-Combustible Facing Board (Provided)

WARNING! Risk of Fire!

Follow these instructions exactly.

Facing materials must be installed properly to prevent fire.

No materials may be substituted without authorization by Hearth & Home Technologies.

TOOLS NEEDED: Powered drill with #2 Phillips head bit; caulking gun.

Only non-combustible materials (supplied with fireplace) may be used to cover the metal fireplace front.

NOTE: All boards are pre-drilled for your convenience. Boards **MUST** be attached in the following order: bottom, sides, and then the top, red-painted side out. The top and bottom board should each have a hang tag attached. Leave them attached for referral for the finishing operation.

- Attach the bottom board to the bottom of the fireplace outer shell with enclosed screws, ensuring the board is centered. **DO NOT remove hang tags.** Attach the side pieces to the outer shell and framing members. See Figure 3.11.
- Center and attach the top board to the outer shell and framing members. **DO NOT remove hang tags.**

NOTICE: 1/8 in. of the facing material may be visible after finishing materials are applied. This 1/8 in. must be painted or the red will show.

AFTER finishing materials are applied. This 1/8 in. must be painted or the red will show.

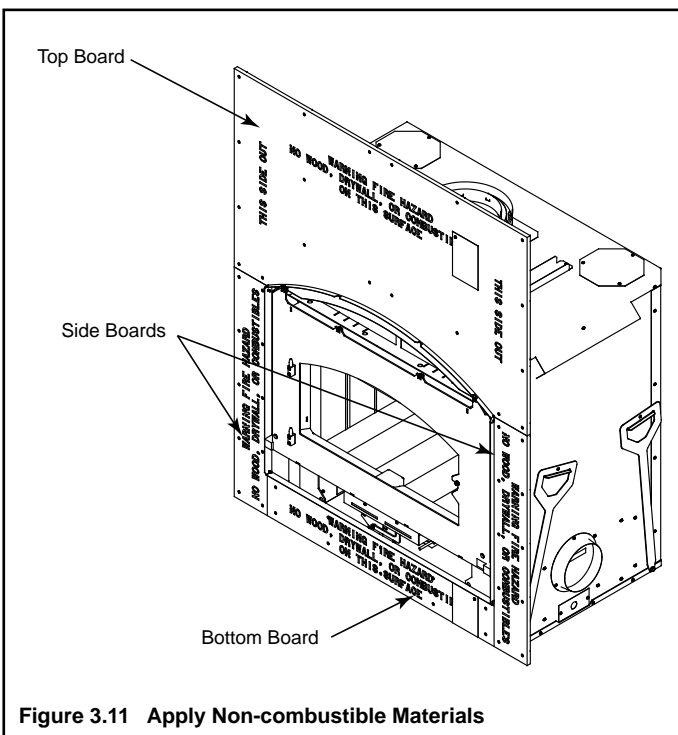


Figure 3.11 Apply Non-combustible Materials

I. Outside Air Kit

An outside air kit must be used for combustion. Hearth & Home Technologies recommends you utilize the shortest duct run and install a P-Trap (see Figure 3.18) to optimize the performance of the outside air kit with a maximum length of 40 ft. The outside air inlet hood should be positioned in a manner that will not allow snow, leaves, etc. to block the inlet. In some installations the air duct may need to be run vertically. In such an installation, a 3 ft (914 mm) height difference must be maintained from the top of the uppermost chimney section to the outside air inlet hood.

Refer to Figures 3.19 and 3.20 when placing the outside air inlet hood.

NOTE: The minimum cross-sectional area of the inlet hood is 17.5 square inches.

The outside air kit comes installed on the right hand side of the fireplace but may be moved to the other side by following these steps:

1. Remove outside air collar (Figure 3.12) and the outside air cover plate (Figure 3.13).
2. Install the cover plate on the right side and the collar on the left side.
3. Open and remove the lower access panel.
4. Remove the two (2) outer screws (Figure 3.16) to allow the outside air box to be removed.
5. Pull the outside air box straight out. See Figure 3.17.
6. On the left side, remove the cover plate two (2) screws. See Figure 3.14.
7. Install the cover plate on the right side where the outside air box was and install the outside air box in through the hole on the left side where the cover plate was.

- Cut a 6-1/2 in. (165 mm) hole in outside wall to accommodate air piping.
- ▶ Use 6 in. (152 mm) UL181 Class1 or Class 0 rigid or flexible ducting (not supplied) to directly connect outside air to fireplace intake. Insulate the pipe to prevent frost condensation. See Figure 3.18.
- Insulating the pipe isn't required but will help prevent frost condensation.
- Use the supplied outside air inlet hood.
- Seal between the wall and the pipe with silicone to prevent moisture penetration and air leaks.
- Seal between the outside air inlet hood and the house with silicone to prevent air infiltration.

CAUTION! Risk of Fire or Asphyxiation! DO NOT draw outside combustion air from wall, floor or ceiling cavity, or enclosed spaces such as an attic or garage.

- **DO NOT** place outside air inlet hood close to exhaust vents or chimneys. Fumes or odor could be drawn into the room through the fireplace.
- Locate outside air inlet hood to prevent blockage from leaves, snow/ice, or other debris. Blockages could cause combustion air starvation.

CAUTION! Risk of Cuts/Abrasions. Wear protective gloves and safety glasses during installation. Sheet metal edges are sharp.

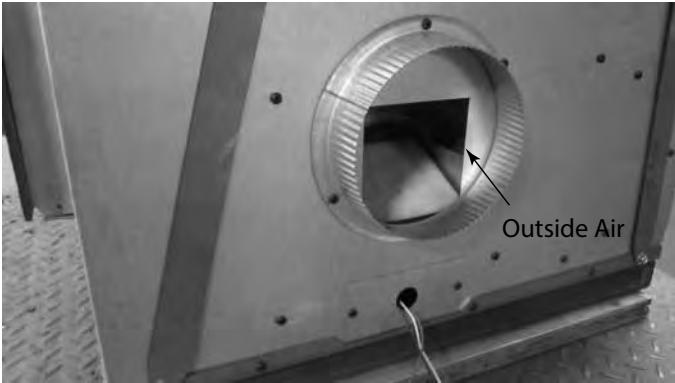


Figure 3.12 Right Side

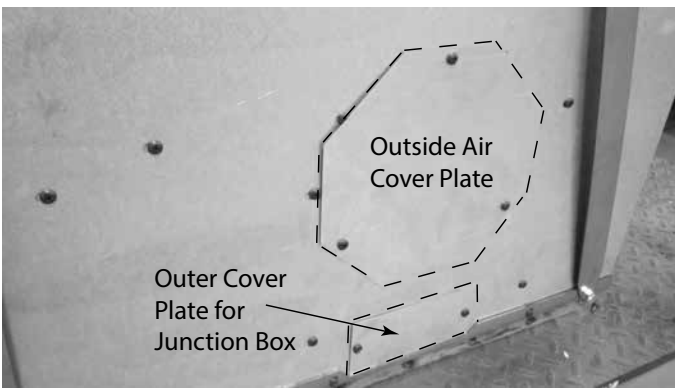


Figure 3.13 Left Side

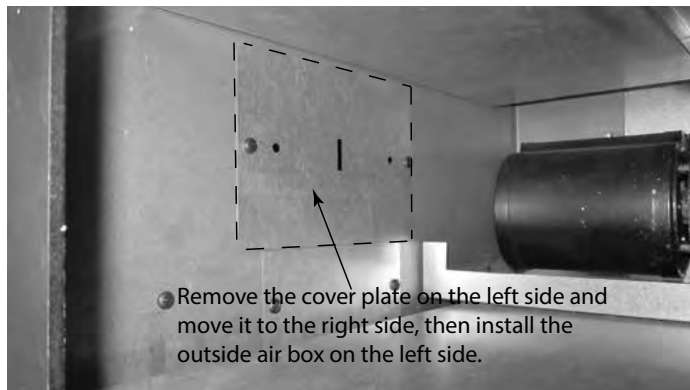


Figure 3.14 Remove Cover Plate (Left Side)

NOTE: An Outside Air Offset Adapter (OA-RD-6) is available if needed. See Figure 3.15.

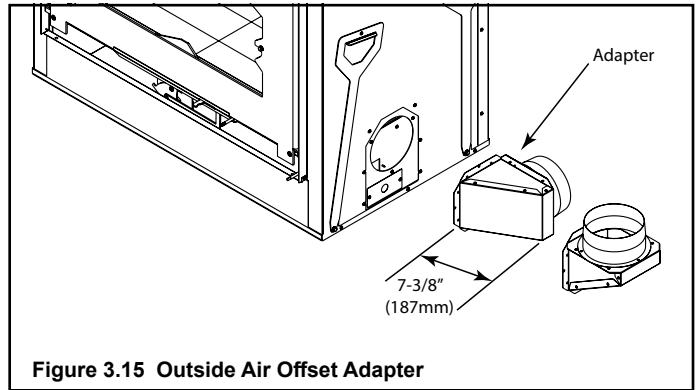


Figure 3.15 Outside Air Offset Adapter

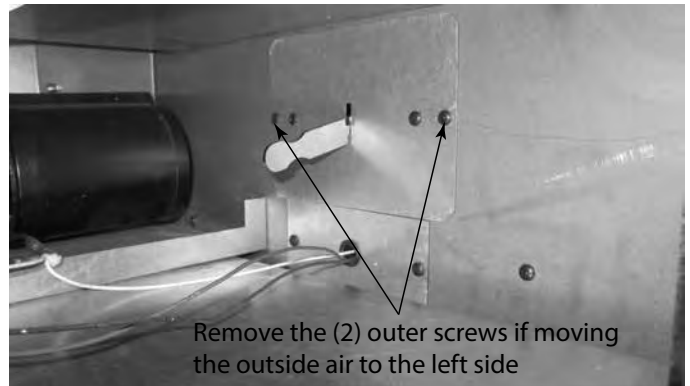


Figure 3.16 Outside air handle shown on right side



Figure 3.17 Outside Air Box

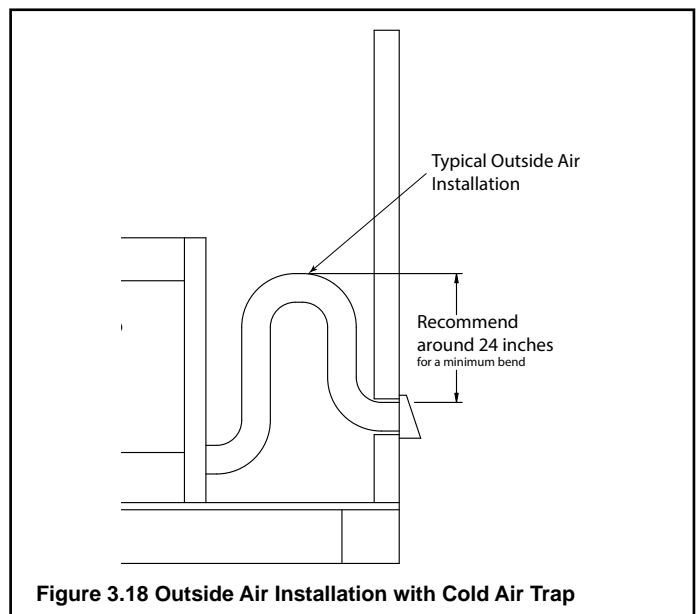


Figure 3.18 Outside Air Installation with Cold Air Trap

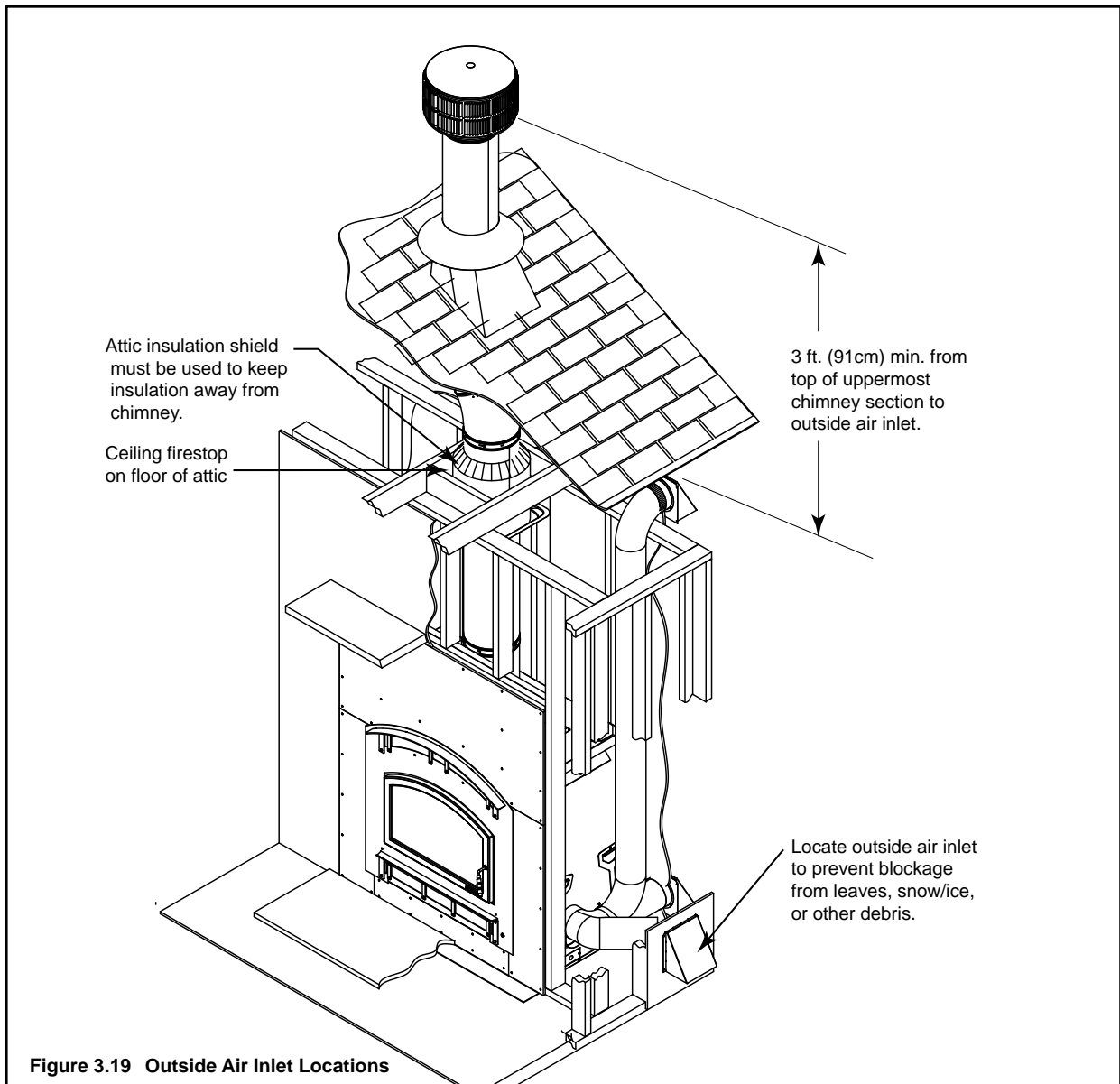


Figure 3.19 Outside Air Inlet Locations

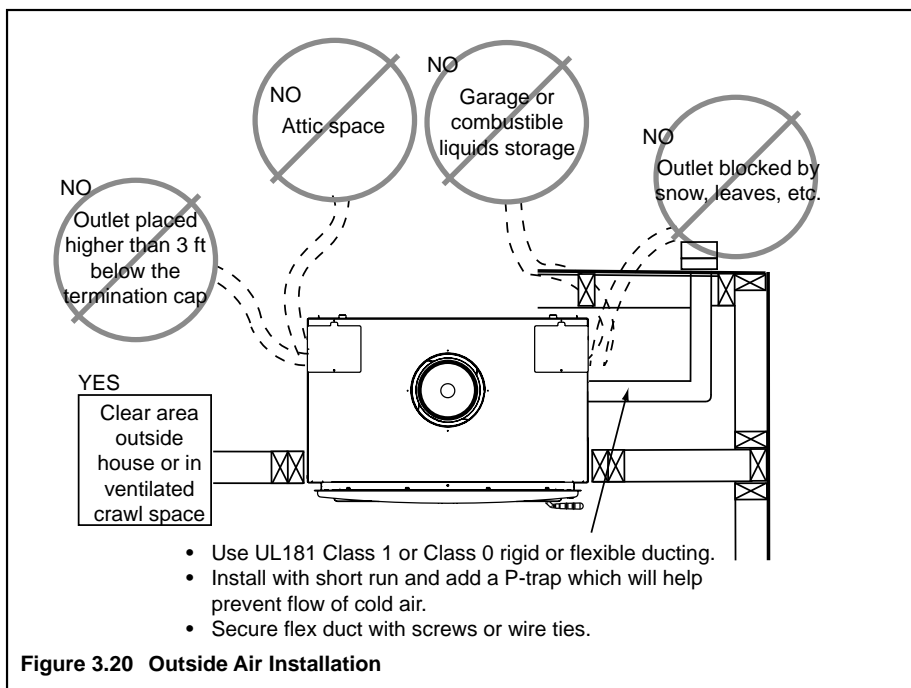


Figure 3.20 Outside Air Installation

J. Heat-Zone-WD-C Kit (Optional)

The Heat-Zone-WD-C accessory kit conveys warm air from the fireplace through air duct(s) to remote locations in the same room or other rooms of the building. You may install 1 or 2 Heat-Zone-WD-C kits on the fireplace. Installation of this kit **MUST** be performed by a qualified service technician. If any parts are missing or damaged, contact your local dealer before starting installation. **DO NOT** install a damaged kit.

This kit is tested and safe when installed in accordance with this installation manual. It is your responsibility to read all instructions before starting installation and to follow these instructions carefully during installations.

The Heat-Zone-WD-C kit is carefully engineered and must be installed only as specified. If you modify it or any of its components you will void the warranty and you may possibly cause a fire hazard. Installation must be done according to applicable local, state, provincial and/or national codes.

Plan the location of the fireplace and warm air duct run(s).

DUCT RUN REQUIREMENTS

MAXIMUM Duct Run = 40-ft. (12 m)

MINIMUM Duct Run = 36 in. (914 mm)

DUCTING MATERIAL

6 in. (152 mm) B-vent Only

DO NOT duct into existing furnace plenum

MINIMUM CLEARANCE TO COMBUSTIBLES

1 in. (25 mm) from the B-vent

0 in. (0 mm) from top & bottom of outlet box

0 in. (0 mm) from the sides of outlet box

12 in. (305 mm) from wall register to ceiling

Refer to Figure 3.24.

CAUTION! ALL wiring should be done by a qualified electrician and shall be in compliance with local codes and with the National Electric Code NFPA/NEC No. 70-current. CSC22.1 Canadian Electric Code.

Possible Air Duct Runs / Locations

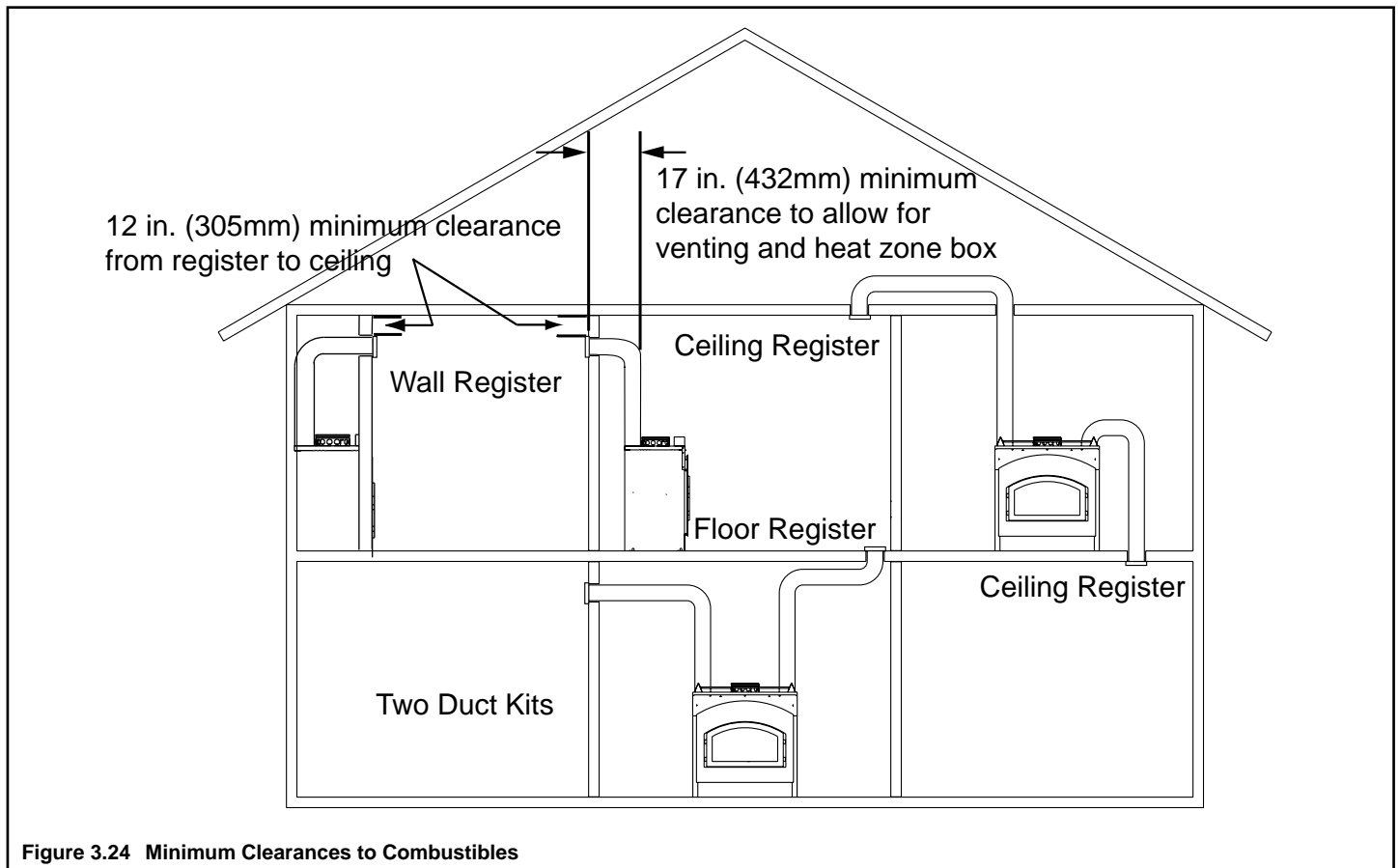
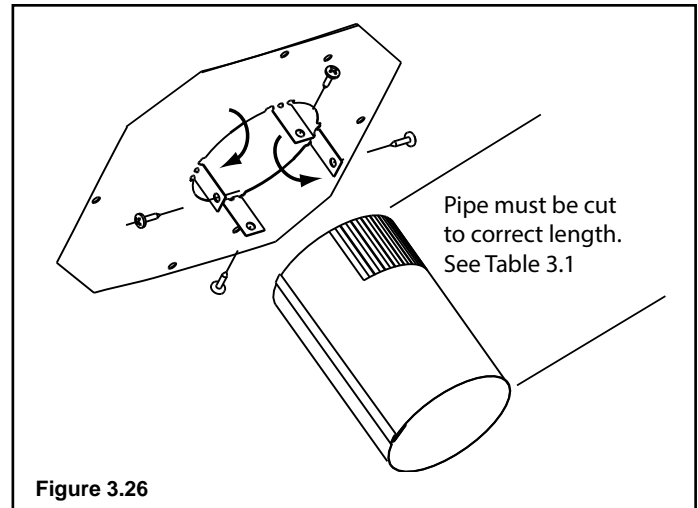
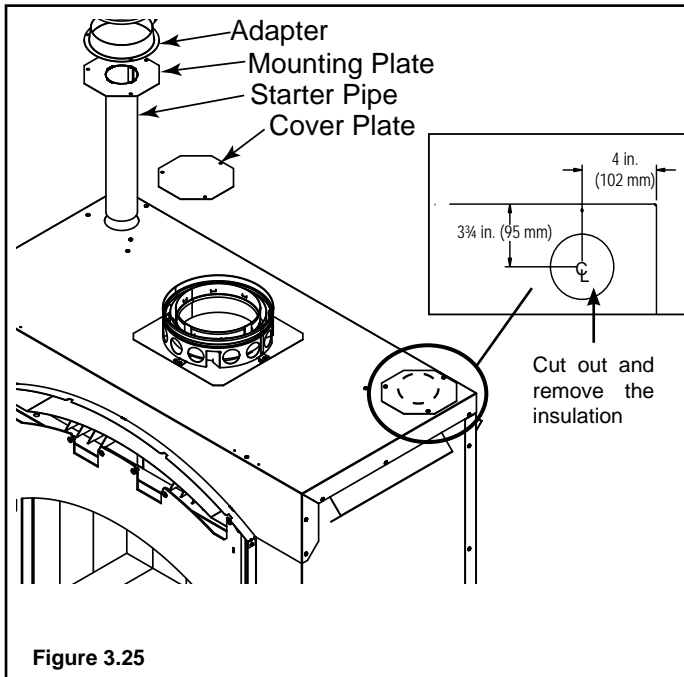


Figure 3.24 Minimum Clearances to Combustibles

Installation

- Remove the knockout or cover plate from the top of the fireplace and discard it. See Figure 3.25.
- Cut a 3 in. (76 mm) hole in the insulation board and remove it as per the dimensions shown in Figure 3.25.



- Slide the starter pipe into the fireplace, matching the holes in the plate to the holes on the fireplace.
- Place the adapter on the mounting plate lining up holes. Using four sheet metal screws included in the kit, secure the adapter and mounting plate on the fireplace. After securing to the fireplace, tape down the adapter edges to the top of the fireplace with aluminum tape to prevent leakage.
- Determine the location for the air register and fan housing assembly. Cut a 6-3/4 in. x 13-1/8 in. (177 mm x 333 mm) hole between framing members (wall studs or floor joists). Attach the brackets to the fan housing with the screws provided. The brackets can be rotated 180° and mounted to the back side of the 2 x 4 if necessary. See Figure 3.27.

NOTICE: The fan and electrical connections must be accessible for servicing per local code requirements.

- Attach enough 6 in. (152 mm) B-Vent as required for your installation to the fan housing. **A maximum of (4) 90° elbows are allowed.** Screw the B-vent to the adapter. Also screw the B-vent to the outlet box on the fan housing. See Figure 3.28. Support duct at intervals of no greater than 4 ft (1 m) as required by local code.

WARNING! Risk of Fire! Comply with all minimum clearances specified.

- A minimum 1/2 in. (13 mm) air clearance must be maintained at the back and 1 in. (25 mm) to the sides of the fireplace assembly.

- Determine the necessary length of starter pipe from Table 3.1 and cut as required.

Table 3.1

| <u>Run Length</u> | <u>Cut Pipe Length</u> |
|---|---|
| 20 - 40 ft (6-12 m) | 16 in. (406 mm) (1 full piece of pipe) |
| 10 - 20 ft (3 - 6 m) 3 - 10 ft (1 - 3 m) | 24 in. (607 mm) 30-1/2 in. (775 mm) (2 full pieces of pipe) |

NOTE: It is important the pipe length be adhered to or it will affect the performance of your fireplace.

- On the mounting plate, hand bend the tabs downward. Slide the tabs over the outside of the starter pipe. Secure with four sheet metal screws included in fasteners package. Figure 3.26.

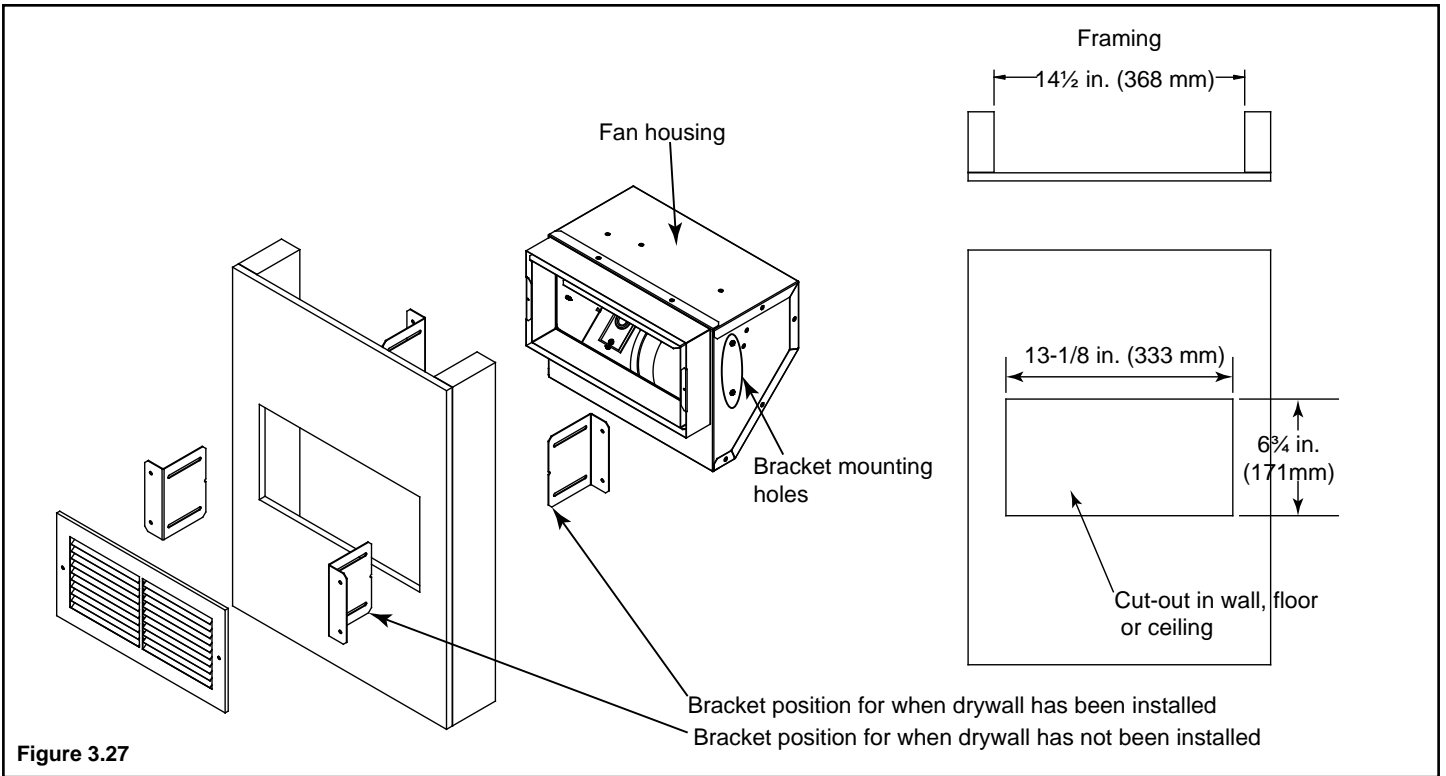


Figure 3.27

NOTICE: Secure the duct so that clearance to the fireplace outer wrap is maintained. Tape all seams with aluminum tape 1-1/4 in. (32 mm) minimum width or as specified by local codes.

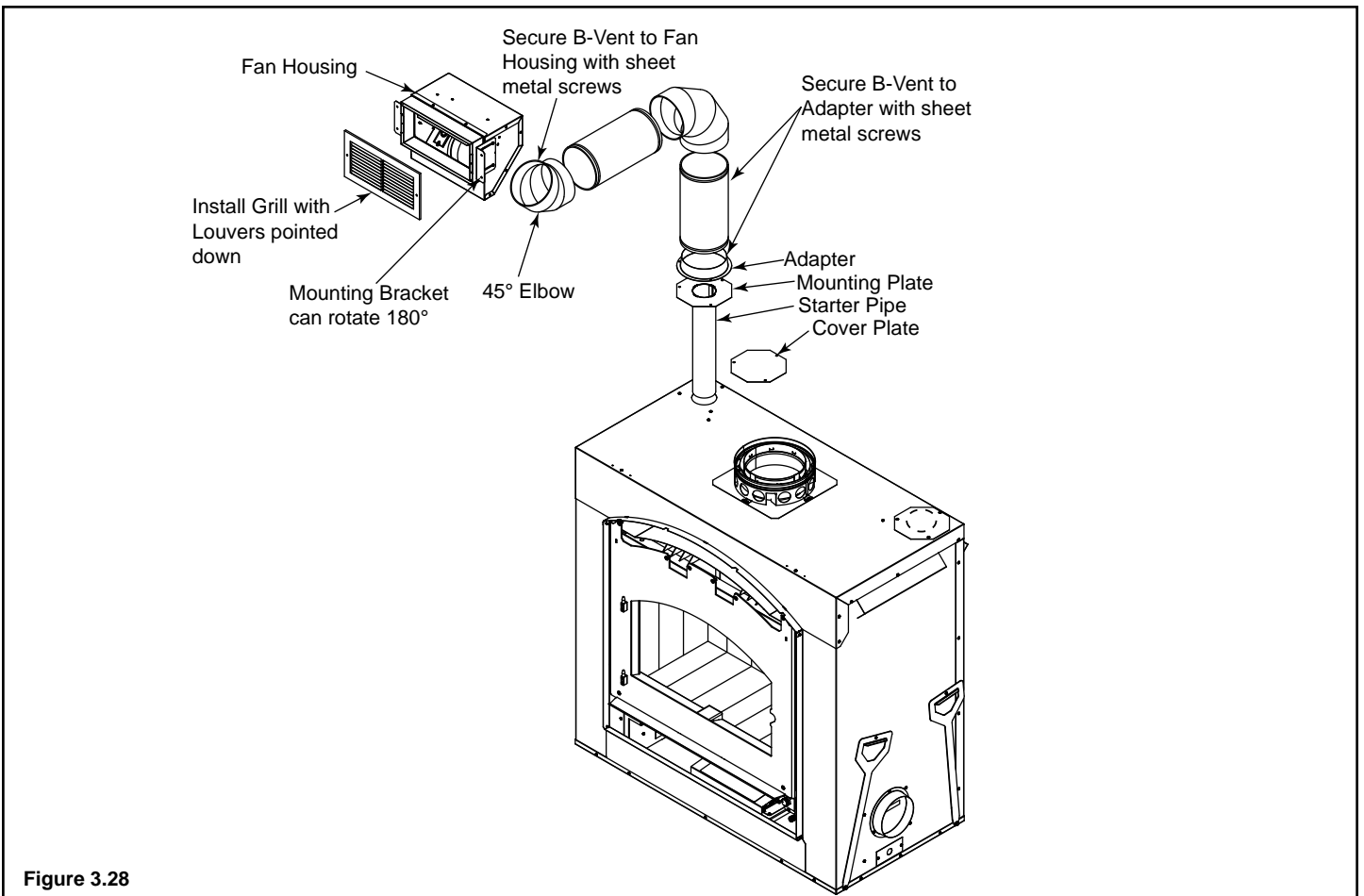


Figure 3.28

4 Electrical Wiring

NOTICE: The manual override switch, rheostat speed control and cover plate are supplied. You will need to supply: 14-3 wire with ground; 14-2 wire with ground; standard wall mount junction box; wire nuts.

- Remove junction box cover plate on the bottom right side of the fireplace to access the outlet wires. See Figure 4.1.

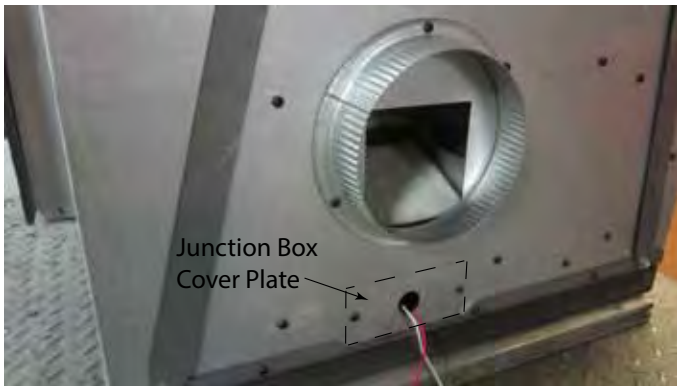


Figure 4.1 Junction Box Cover Plate

NOTE: The power may enter from either side by switching the cover plates on the outer shell and switching the cover plates in the bottom access area to the opposite sides. See Figure 4.2.

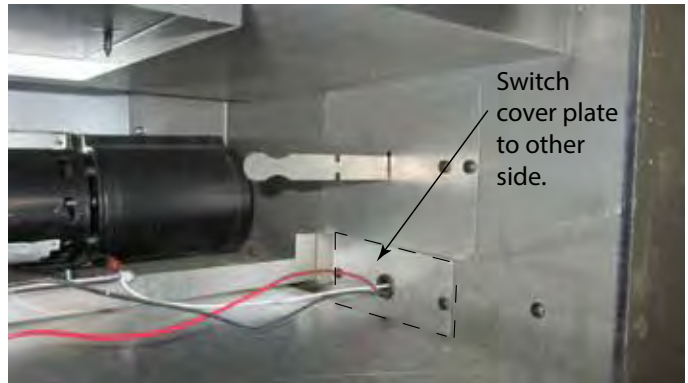


Figure 4.2 Bottom Access Area

- Thread the 14-3 with ground wire through the opening with the strain relief on the cover plate.
- Match colors to wire harness, (red to red, white to white, etc.) and secure with wire nuts.

NOTICE: Wiring for fans must be done before framed enclosure is completed. If using a Heat-Zone-WD-C kit, it also must be installed before enclosure is complete.

WARNING! Risk of Fire! DO NOT apply combustible finishing materials over any part of the front of this fireplace.

- The metal fireplace face may only be covered with noncombustible materials such as ceramic tile, brick, or stone.
- Do not cover or block any cooling air slots.

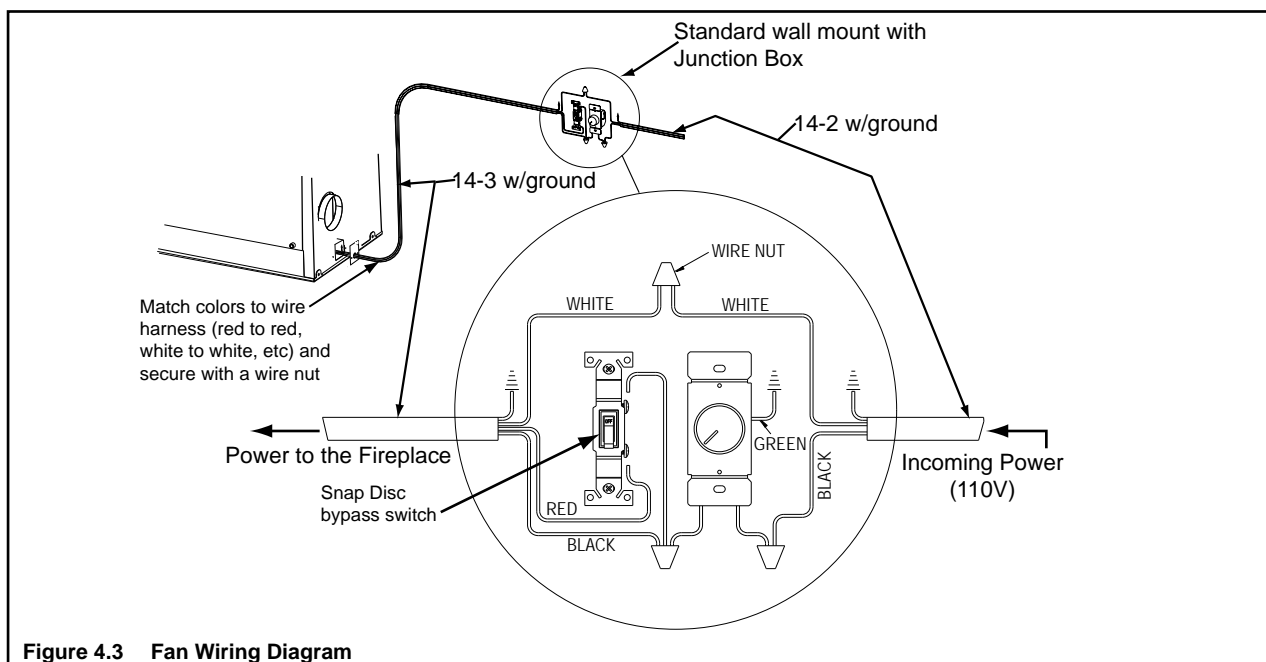


Figure 4.3 Fan Wiring Diagram

5 Chimney and Termination Requirements

A. Chimney Requirements

Vertical distances are measured from the base of the fireplace as shown in Figure 5.1.

Table 5.1 Chimney Requirements

| | | |
|--|---------|---------|
| Minimum overall straight height | 13 ft | 3.96 m |
| Minimum height with single offset/return | 14.5 ft | 4.42 m |
| Double offset/return minimum height | 20 ft | 6.1 m |
| Maximum height | 90 ft | 25.60 m |
| Maximum chimney length between an offset and return | 20 ft | 6.1 m |
| Maximum distance between chimney stabilizers | 35 ft | 10.67 m |
| Maximum unsupported chimney length between the offset and return | 6 ft | 1.83 m |
| Maximum unsupported chimney height above the fireplace | 35 ft | 10.67 m |
| Maximum unsupported chimney above roof | 6 ft | 1.83 m |

NOTICE: A maximum of two pairs of offsets and returns may be used.

WARNING! Risk of Fire! You must maintain 2 in. (51 mm) air space clearance to insulation and other combustible materials around the chimney system. Failure to do so may cause overheating and fire.

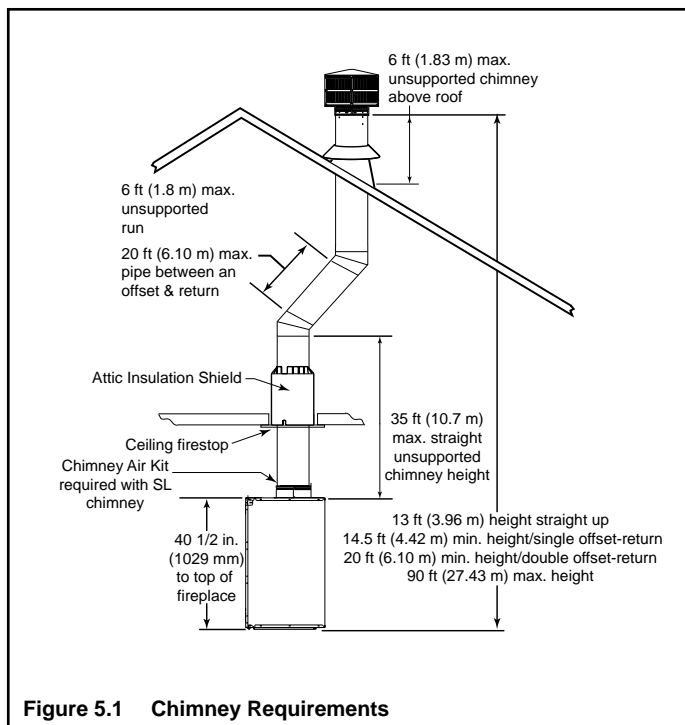


Figure 5.1 Chimney Requirements

NOTICE: You must provide support for the pipe during construction and check to be sure inadvertent loading has not dislodged the chimney section from the fireplace or at any chimney joint.

Table 5.2 Chimney Component Dimensions

| HEIGHT OF CHIMNEY COMPONENTS | | in. | mm |
|------------------------------|--|--------|------|
| Chimney Stabilizer | | | |
| SL3 | | 4-3/4 | 121 |
| Offsets/Returns | | | |
| SL315 | | 13-3/8 | 340 |
| SL330 | | 15-1/2 | 394 |
| Chimney Sections* | | | |
| SL306 | | 4-3/4 | 121 |
| SL312 | | 10-3/4 | 273 |
| SL318 | | 16-3/4 | 425 |
| SL324 | | 22-3/4 | 578 |
| SL336 | | 34-3/4 | 883 |
| SL348 | | 46-3/4 | 1187 |

* Dimensions reflect effective height.

Note: 8 in. DuraPlus can also be used. See page 45.

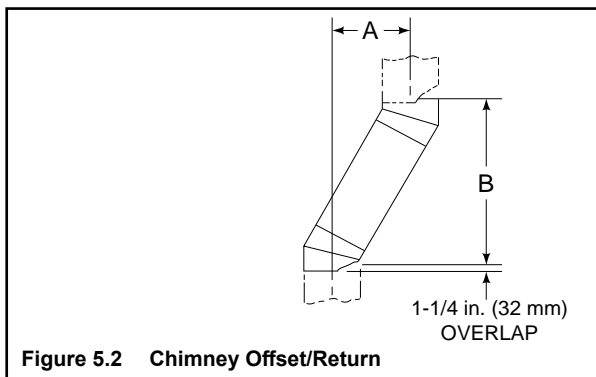
B. Offsets/Returns

A 30° Elbow (measured from the vertical) is the largest that can be used in an offset. A 30° Elbow may not be combined with another Elbow to make a steeper offset (e.g. two 30° Elbows are not allowed to be put together to form a 60° elbow.). Avoid Elbows if possible. A totally vertical chimney is more efficient. When Elbows are necessary to avoid obstructions such as rafters, ridgepoles, or joists, you are only allowed to use 2 pair of Elbows in any one chimney system. Horizontal runs of chimney violate building code and are not allowed.

- An offset and return can be used as a single entity or separated by chimney section(s).

WARNING! Risk of Fire! DO NOT use offset/returns greater than 30° from vertical. Chimney draft will be restricted and could cause overheating and fire.

- Measure the shift needed to avoid the overhead obstruction. Refer to dimension A in Figure 5.2.
- Find the appropriate A dimension listed in Table 5.3. The B dimension coinciding with the A dimension measurement in Table 5.3 represents the required vertical clearance needed to complete the offset/return.
- Read across the chart to find the number of chimney sections/model numbers needed between the offset and return.



Example:

Your "A" dimension from Figure 5.2 is 14-1/2 in. (368 mm). Using Table 5.3 the dimension closest to, but not less than 14-1/2 in. (368 mm) is 14-1/2 in. (368 mm) using a 30° offset/return.

You determine from the table that you need 34-1/8 in. (867 mm) (Dimension "B") between the offset and return.

The chimney component that best fits your application is one SL324.

Table 5.3 Offset Dimensions

| 15-degree | | | | 30-degree | | | | SL306 | SL312 | SL318 | SL324 | SL336 | SL348 |
|-----------|-----|---------|------|-----------|------|--------|------|-------|-------|-------|-------|-------|-------|
| A | | B | | A | | B | | | | | | | |
| in. | mm | in. | mm | in. | mm | in. | mm | | | | | | |
| 1 5/8 | 41 | 13 3/8 | 340 | 3 5/8 | 92 | 15 1/2 | 394 | - | - | - | - | - | - |
| 2 7/8 | 73 | 17 3/4 | 451 | 5 1/2 | 140 | 18 5/8 | 473 | 1 | - | - | - | - | - |
| 4 1/8 | 102 | 22 3/8 | 568 | 7 1/4 | 184 | 21 3/4 | 552 | 2 | - | - | - | - | - |
| 4 1/2 | 114 | 23 5/8 | 600 | 8 1/2 | 216 | 23 3/4 | 603 | - | 1 | - | - | - | - |
| 5 3/4 | 146 | 28 1/4 | 718 | 10 1/4 | 260 | 27 | 686 | 1 | 1 | - | - | - | - |
| 6 | 152 | 29 3/8 | 746 | 11 1/2 | 292 | 29 | 737 | - | - | 1 | - | - | - |
| 7 1/4 | 184 | 34 | 864 | 13 1/4 | 337 | 32 1/8 | 816 | - | 2 | - | - | - | - |
| 7 3/4 | 197 | 36 1/8 | 918 | 14 1/2 | 368 | 34 1/8 | 867 | - | - | - | 1 | - | - |
| 8 3/4 | 222 | 39 3/4 | 1010 | 16 1/4 | 413 | 37 3/8 | 949 | 1 | - | - | 1 | - | - |
| 10 3/8 | 264 | 45 5/8 | 1159 | 19 1/4 | 489 | 42 1/2 | 1080 | - | - | 2 | - | - | - |
| 10 5/8 | 270 | 46 3/4 | 1187 | 20 1/2 | 521 | 44 5/8 | 1133 | - | - | - | - | 1 | - |
| 11 7/8 | 302 | 51 3/8 | 1305 | 22 1/4 | 565 | 47 3/4 | 1213 | 1 | - | - | - | 1 | - |
| 13 1/2 | 243 | 57 1/4 | 1454 | 25 1/4 | 641 | 52 7/8 | 1343 | - | - | - | 2 | - | - |
| 13 3/4 | 349 | 58 3/8 | 1483 | 26 1/2 | 673 | 55 | 1397 | - | - | - | - | - | 1 |
| 15 | 381 | 63 | 1600 | 28 1/4 | 718 | 58 1/8 | 1476 | 1 | - | - | - | - | 1 |
| 16 1/2 | 419 | 68 3/4 | 1746 | 31 1/4 | 794 | 63 1/4 | 1607 | - | 1 | - | - | - | 1 |
| 18 | 457 | 74 5/8 | 1895 | 34 1/4 | 870 | 68 1/2 | 1740 | - | - | 1 | - | - | 1 |
| 19 5/8 | 498 | 80 3/8 | 2042 | 37 1/4 | 946 | 73 3/4 | 1873 | - | - | - | 1 | - | 1 |
| 20 5/8 | 524 | 84 1/8 | 2137 | 39 1/8 | 994 | 76 7/8 | 1953 | 1 | - | - | 1 | - | 1 |
| 22 3/4 | 578 | 91 7/8 | 2334 | 43 1/4 | 1099 | 84 1/8 | 2137 | - | - | - | - | 1 | 1 |
| 24 | 610 | 96 1/2 | 2451 | 45 1/8 | 1146 | 87 1/4 | 2216 | 1 | - | - | - | 1 | 1 |
| 25 7/8 | 657 | 103 1/2 | 2629 | 49 1/4 | 1251 | 94 1/2 | 2400 | - | - | - | - | - | 2 |

Proper assembly of air-cooled chimney parts result in an overlap at chimney joints of 1-1/4 in. (32 mm). Effective length is built into this chart.

C. Termination Requirements

- Install a cap approved and listed for this fireplace system.
- Locate cap where it will not become plugged by snow or other materials.
- Locate cap away from trees or other structures.
- The bottom of the termination cap must be at least 3 ft (.91 m) above the roof AND at least 2 ft (.61 m) above any portion of roof within 10 ft (3.05 m) as shown in Figure 5.3.
- The distance required between caps is shown in Figure 5.3.

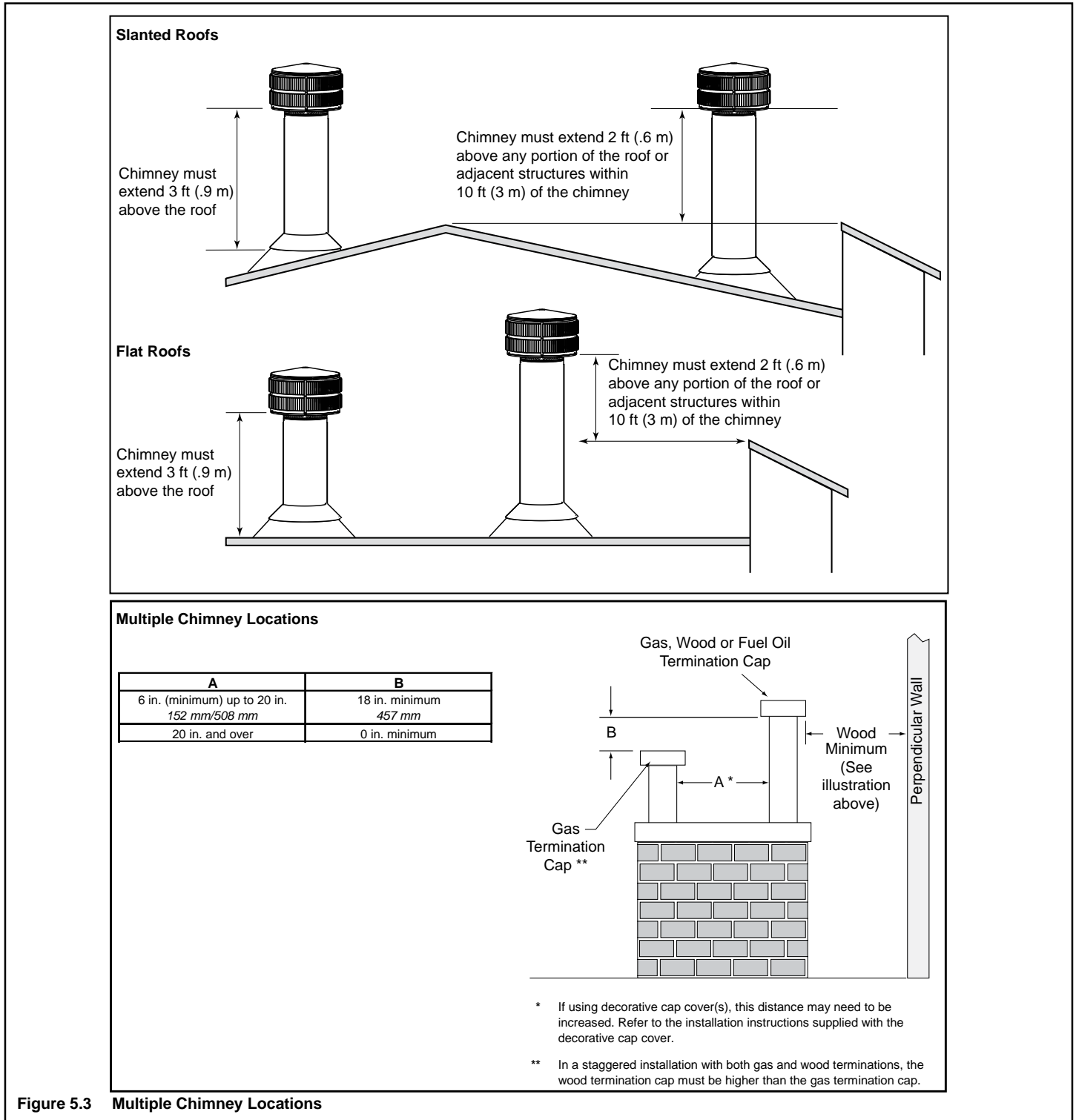


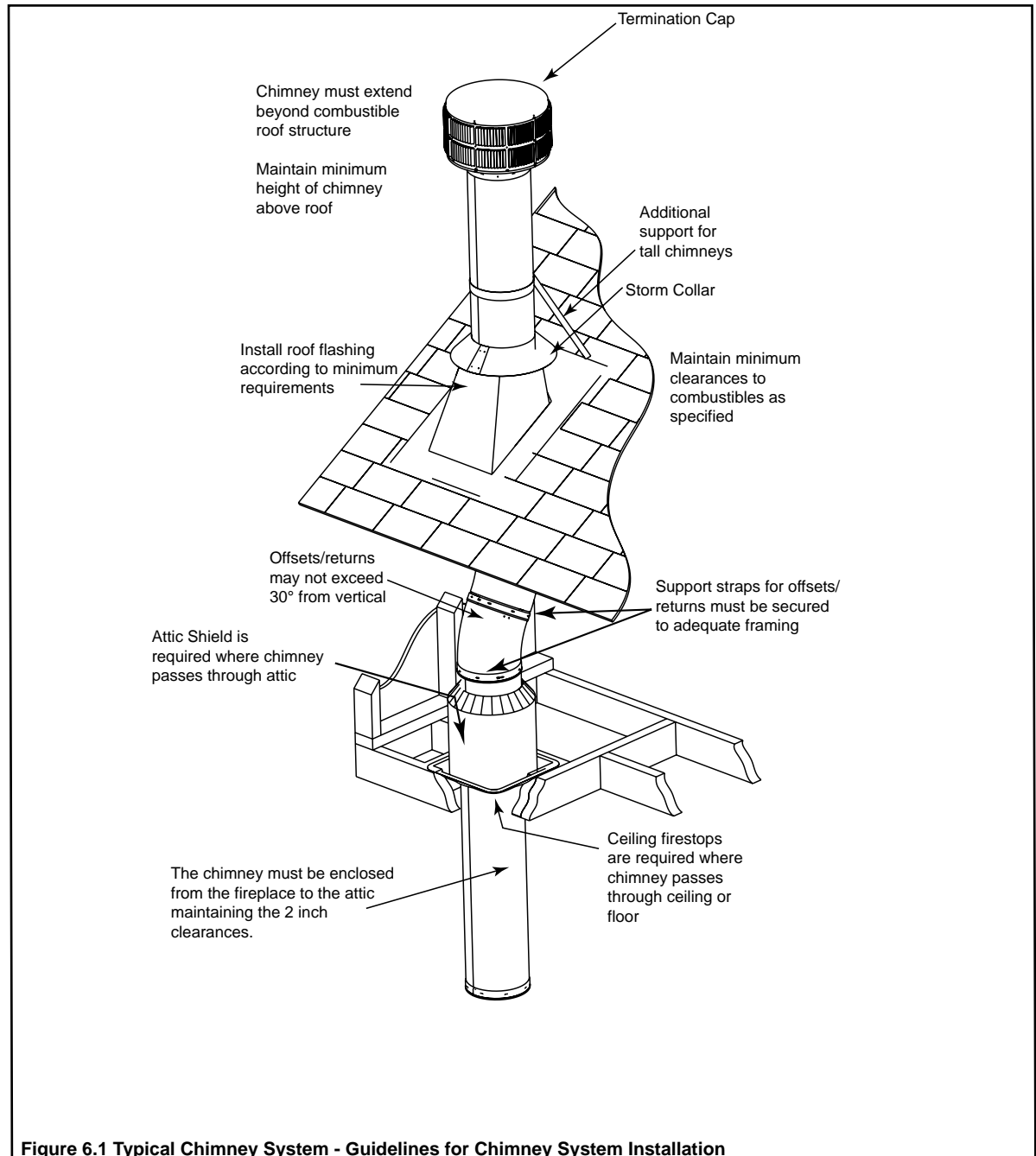
Figure 5.3 Multiple Chimney Locations

6 Chimney Installation

A. Typical Chimney System

NOTICE: Chimney performance may vary.

- Trees, buildings, roof lines and wind conditions affect performance.
- Chimney height may need adjustment if smoking or overdraft occurs.



The SL300 series chimney (UL127 approved for use with this fireplace) is shipped with wrap around warning labels installed. These labels may be removed from the sections of chimney exposed above the roofline.

B. Assemble Chimney Sections

WARNING! Risk of Fire! DO NOT install substitute or damaged chimney components.

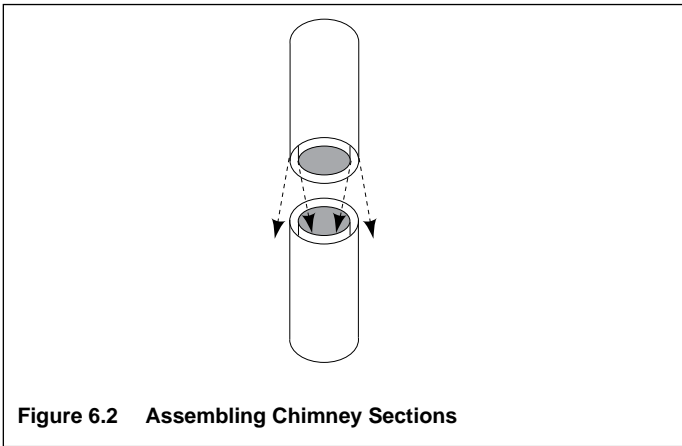
Use only those components described in this manual.

Attach either a straight chimney section or an offset to the top of the fireplace starting with the inner flue followed by the outer casing. Continue this order until termination cap is reached (depending on your installation requirement). Chimney sections are locked together by pushing downward until the top section meets the stop bead on the lower section.

The inner flue is placed to the inside of the flue section below it. The outer casing is placed outside the outer casing of the chimney section below it. See Figure 6.2.

NOTICE: Chimney sections cannot be disassembled once locked together. Plan ahead!

- Lock chimney sections and/or offsets/returns together by pushing downward until the top section meets the stop bead on the lower section.
- Pull on the top of each section as installed to make sure it is fully engaged and will not separate.
- You may use #6 or #8 sheet metal screws no longer than 1/2 in. (13 mm) to fasten chimney outer sections together. Do NOT penetrate inner flue.
- Vertical straight runs of chimney must be supported every 35 ft (10.7 m).



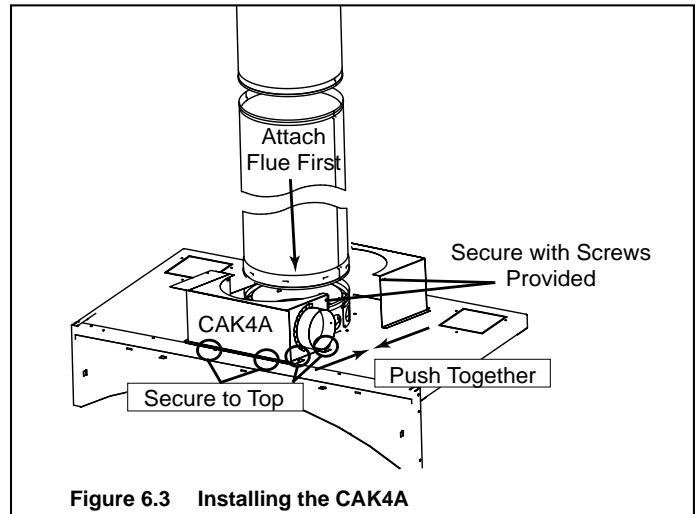
WARNING! Risk of Fire! DO NOT install substitute or damaged chimney components.

C. Install Chimney Air kit (CAK4A)

NOTICE: Chimney Air Kit, Part CAK4A is required when using the SL-300 Pipe Series. Detailed instructions are supplied with the kit. If using the Dura-Plus System (must be 8 in./203 mm in diameter), the starter ring that came with the fireplace must be removed and replaced with the Dura-Plus Base Plate. The CAK4A is not required with a Dura-Plus System.

- Install the chimney pipe first.
- Hand bend the tabs in position before placing on the fireplace.

- Place the box on top of the fireplace around the chimney pipe, push both pieces together and secure with screws provided.
- Use the pre-punched holes in the tabs as guides and drill holes through the fireplace top.
- Secure the CAK4A in place. See Figure 6.3.
- Seal around the kit at the flue and at the top of the can with high temp caulk with a minimum rating of 500 degrees. See Figure 6.3.



NOTES:

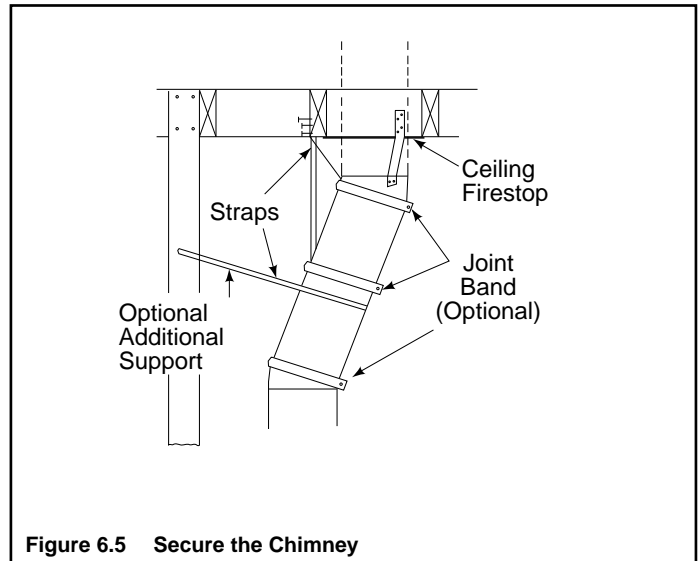
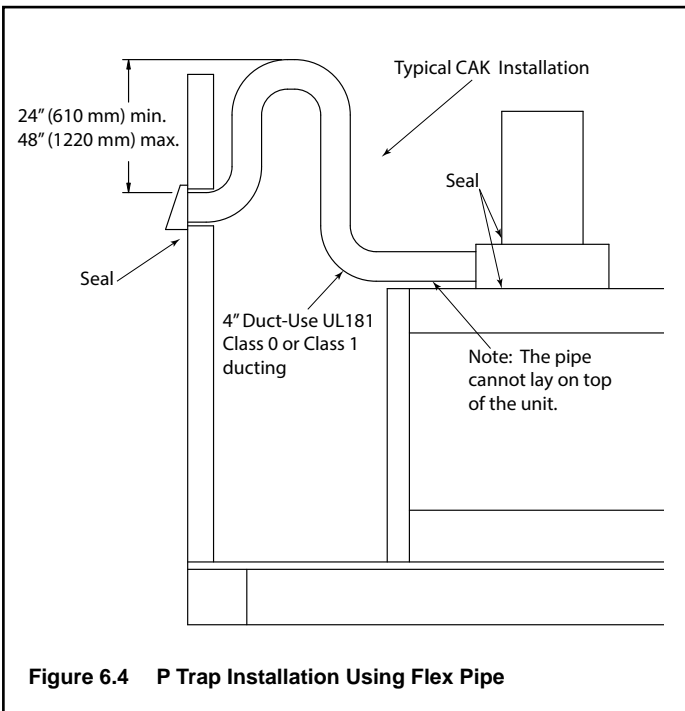
- The CAK4A termination cap must be a minimum of 4 ft (1219 mm) above the ground and kept free of debris.
- If the CAK4A is installed in a chase, the CAK4A side termination cap must be at least 3 ft (914 mm) below the chimney top.
- Seal around the cap and flex with caulk to stop air from getting into the chase. See Figure 6.4.
- The pipe cannot lay on top of the unit.

WARNING! Risk of Fire!

- The flex pipe must never be compressed or deformed!
- Restricting the airflow inside the flex pipe may increase flue pipe temperatures causing a chase fire.

P Traps

When using the chimney air kit (CAK) and the outside air kits, it is recommended that you install a P trap as shown in Figure 6.4 by bending the flex duct, or using 90° elbows if using rigid duct to help prevent air circulation when the fireplace is not in use. In colder climates, it is strongly recommended to use an insulated duct.



D. Secure Offset/Return

WARNING! Risk of Fire!

- Secure offsets with screws (not to exceed 1/2 in./13 mm in length).
- Secure returns with strapping.
- Straight chimney sections may be secured with screw (not to exceed 1/2 in./13 mm in length) at the joints.
- Keep chimney sections from separating or twisting.

When offsets and returns are joined to straight pipe sections, they must be locked into position with screws (outer only). To prevent gravity from pulling the chimney sections apart, the returns and the chimney stabilizers have hanger straps for securing these parts to joists or rafters. See Figure 6.5.

* Use # 6 or # 8 sheet metal screw, or larger, no longer than 1/2 in. (13 mm).

E. Install Firestops

WARNING! Risk of Fire! Firestops must be used whenever the chimney penetrates a ceiling/floor.

- Mark and cut an opening in ceiling/floor as shown in Figure 6.6.
- Frame the opening with the same size lumber used in the ceiling joists.
- Nail the firestop to the bottom of the ceiling/floor joists.
- Provide a means to maintain the required air space between the chimney and insulation or install an attic insulation shield.

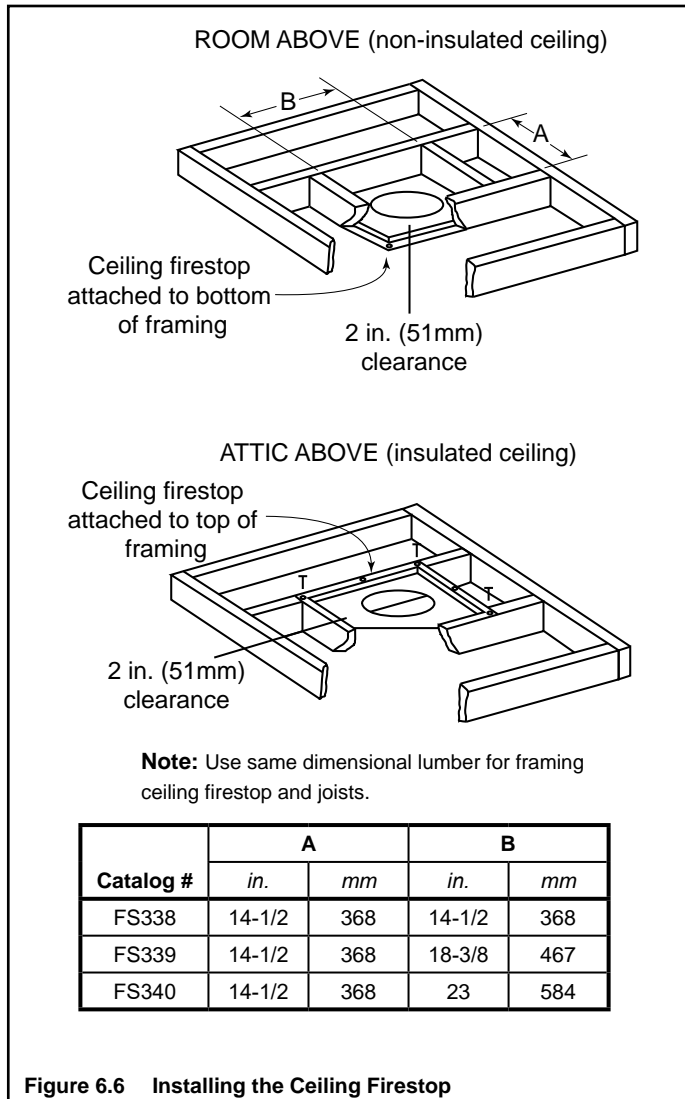


Figure 6.6 Installing the Ceiling Firestop

WARNING! Risk of Fire! DO NOT seal area between firestop opening and chimney pipe except where they enter the attic or leave the warm air envelope of the home (use 600° F sealant).

F. Install Attic Insulation Shield

WARNING! Risk of Fire! You **MUST** install an attic insulation shield when there is any possibility of insulation or other combustible material coming into contact with the chimney.

- **DO NOT** pack insulation between the chimney and the attic insulation shield.
- Failure to keep insulation and other materials away from chimney pipe could cause fire.
- **DO NOT** offset chimney inside insulation shield.
- Combustible material may come in contact with the attic insulation shield as long as the required clearances are maintained to the chimney pipe.

Installation of a ceiling firestop is required:

Note: In Canada a CAS8 must be installed. See instructions provided with kit.

- Refer to Figures 6.6, 6.7, 6.8 and 6.9.
- If the attic shield is pre-rolled continue. If it is a flat part, try and roll it up to aid in wrapping it around the chimney.
- Pre-bend all the tabs in at the top to 45°.
- Wrap the shield (around the chimney if already installed) until you have an overlap and the three holes on each side match up (large holes on top).
- Insert three screws into the matching holes to form a tube starting at the bottom.
- Bend the tabs on the bottom of the tube inward to 90° to maintain chimney air space.
- Rest the insulation shield on the ceiling firestop below.
- Tape off any opening around the bottom.

If you wish to make a custom shield or barrier, follow these guidelines:

- Metal is preferred, although any material stiff enough to hold back the insulation can be used.

WARNING! Risk of Fire! Use of cardboard or other materials that can deflect under humidity or other environmental conditions is not recommended.

- The shield or barrier must be tall enough to extend above the insulation and prevent blown-in insulation from spilling into the cavity and accommodate the amount of insulation as required by the National Building Code.
- Maintain specified air spaces around chimney.
- Check instructions and local codes for further details.

Double-check the Chimney Assembly

Continue assembling the chimney sections up through the ceiling firestops as needed. While doing so, be aware of the height and unsupported chimney length limitations given under Section 5.

Check each section by pulling up slightly from the top to ensure proper engagement before installing the succeeding sections. If they have been connected correctly, they will not disengage when tested.

The chimney must be enclosed from the fireplace to the attic, maintaining the 2 inch clearances to combustibles.

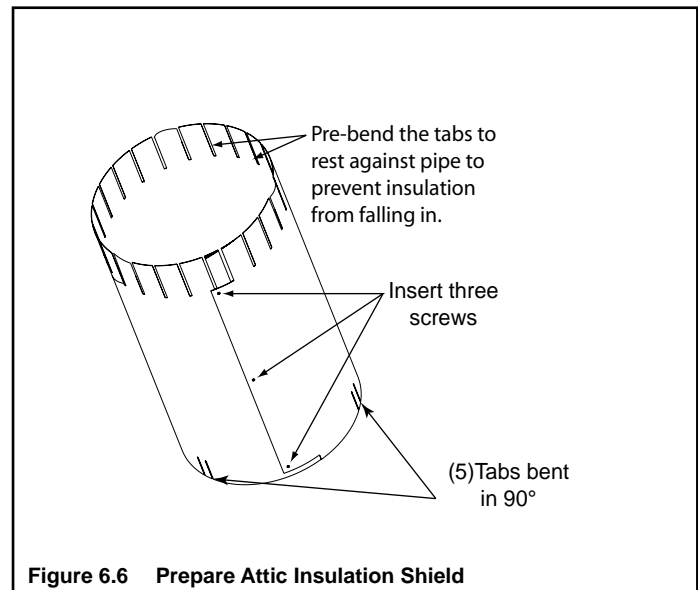


Figure 6.6 Prepare Attic Insulation Shield

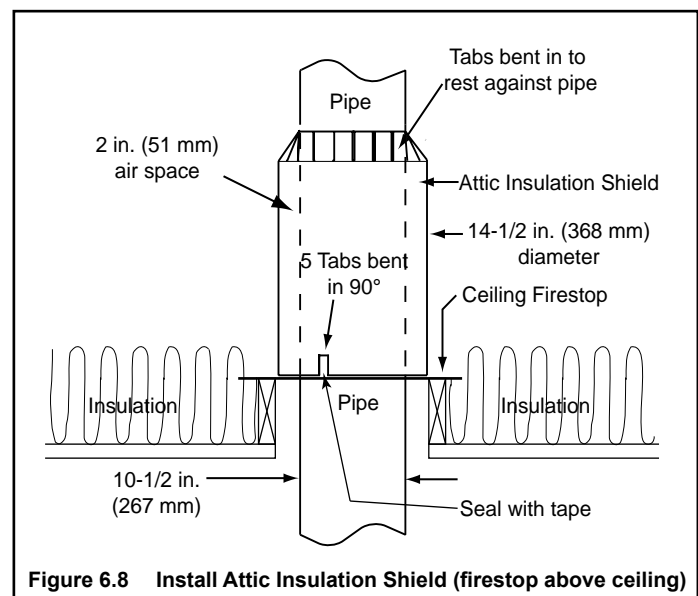


Figure 6.8 Install Attic Insulation Shield (firestop above ceiling)

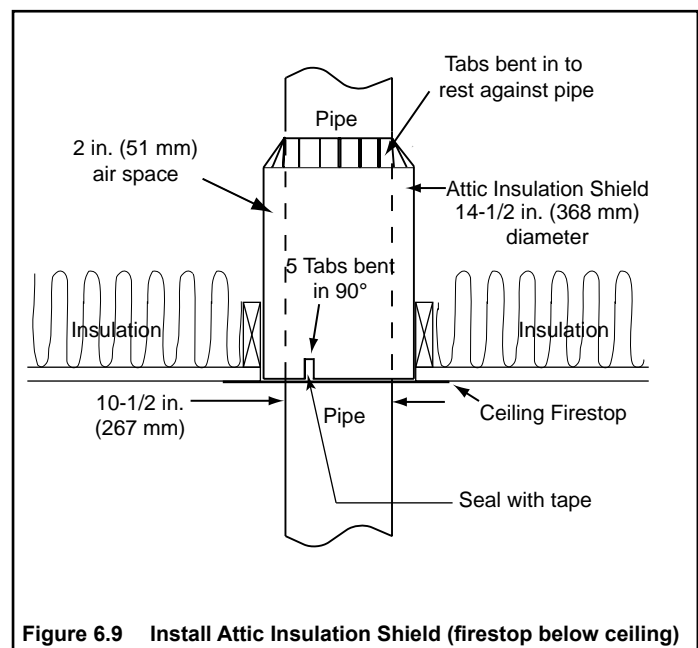


Figure 6.9 Install Attic Insulation Shield (firestop below ceiling)

G. Roof Penetration

- Refer to Figure 6.10.
- Plumb from roof to center of chimney.
- Drive a nail up through roof to mark center of pipe.
- Measure to either side of nail and mark the 14-1/2 in. x 14-1/2 in. (368 mm x 368 mm) opening required.
- Measure opening on the horizontal; actual length may be larger depending on roof pitch.
- Cut out and frame opening.

Install Flashing

- Assemble chimney so it passes through the framed opening.
- Slip the flashing over the chimney.

NOTICE: Roofing shingles must be below the flashing plate on the lower side of a sloped roof and over the flashing plate on the sides and top.

- Nail the flashing to the roof. Keep gaps between the flashing plate and the roof to a minimum.
- Caulk the flashing plate and roof junction as well as the vertical seam on the flashing. All nail heads must be caulked with a roofing sealant.
- Caulk the overlap seam of any exposed pipe sections that are located above the roof line to prevent leaks.

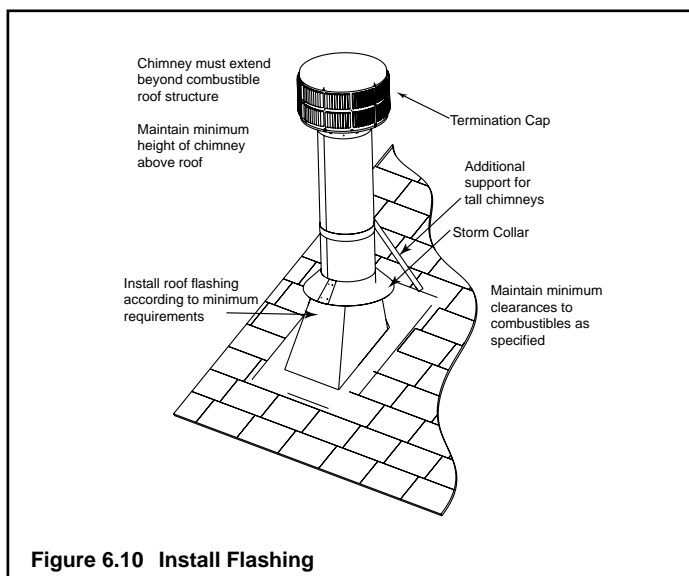


Figure 6.10 Install Flashing

H. Manufactured Home Installation

SL-300 Series Ceiling/Roof Thimble

NOTICE: REQUIRED for manufactured homes.

- Locate the point where the chimney will exit the roof by plumbing down to the center of the chimney. Lay out, cut and frame a 14-1/2 in. (368 mm) square opening (measured on the horizontal) through the ceiling and roof structure. **Consult local codes for framing details.**

- The thimble must extend completely through the roof structure shielding combustible materials. Five location holes have been provided to allow for a variety of ceiling/roof thicknesses. A thimble extension is required when the ceiling/roof thickness exceeds 12-1/2 in. (318 mm). The extension should overlap the thimble one inch.
- To attach the extension to the thimble, drill 1/8 in. (3 mm) holes through the outer shield of the thimble using the predrilled holes in the extension as guides. Attach the extension to the thimble using the screws provided with the extension.
- Install the thimble assembly and nail it securely to the framing members.

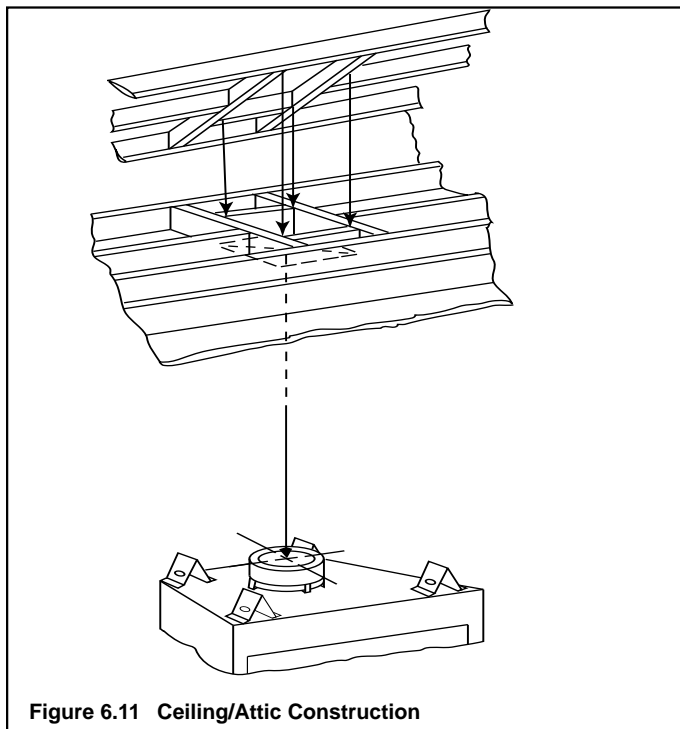


Figure 6.11 Ceiling/Attic Construction

- Center the flashing over the chimney and nail it to the roof. Keep gaps between the flashing plate and the roof to a minimum. Caulk the flashing plate and roof junction as well as the vertical seam on the flashing. All nail heads must be caulked with a roofing sealant.
- Finish assembling the chimney storm collar and termination cap following the installation instructions provided with them.

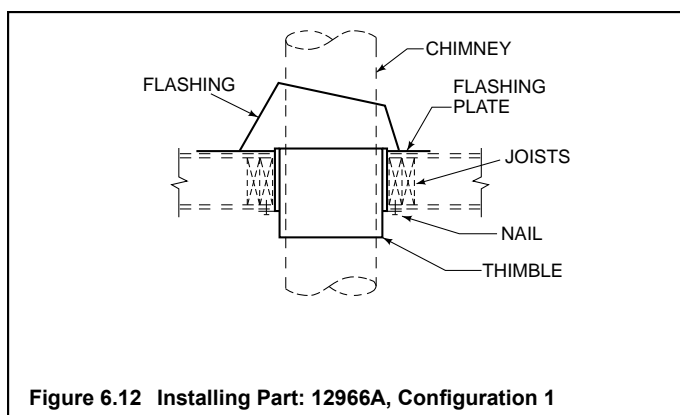


Figure 6.12 Installing Part: 12966A, Configuration 1

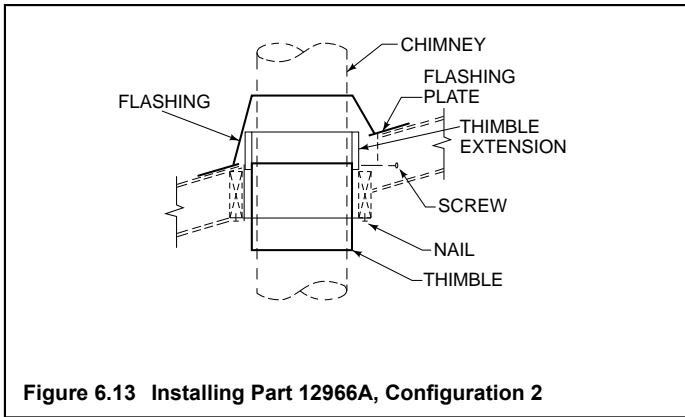


Figure 6.13 Installing Part 12966A, Configuration 2

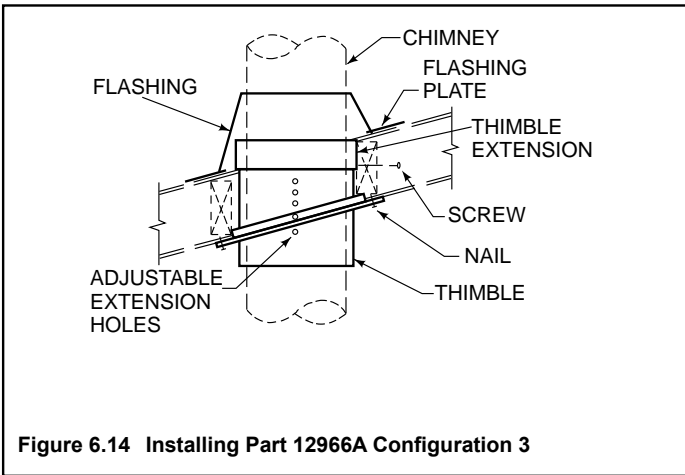


Figure 6.14 Installing Part 12966A Configuration 3

I. Install Chase/Chase Top

- You MUST use a chase top in a chase installation. Chase tops are available from your dealer or may be field constructed.
- Include a turndown and drip edge to prevent water from seeping into the chase.
- Include a 2 in. (51 mm) soldered, welded or spun collar around pipe opening to keep water out.
- Provide a 1/8 in. (3 mm) gap around the flue pipe.
- Slope the chase top downward away from the opening.

WARNING! Risk of Fire! DO NOT caulk the pipe to the chase top collar.

- Caulk all seams to prevent leaks.

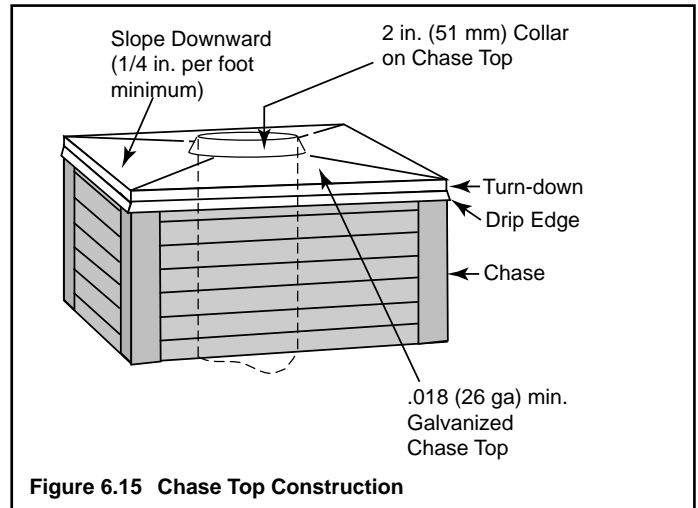


Figure 6.15 Chase Top Construction

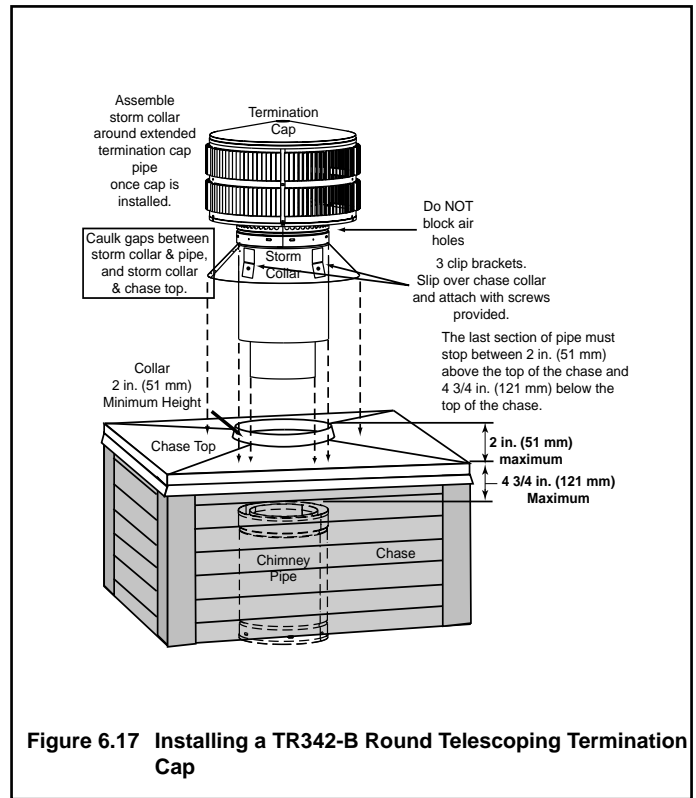
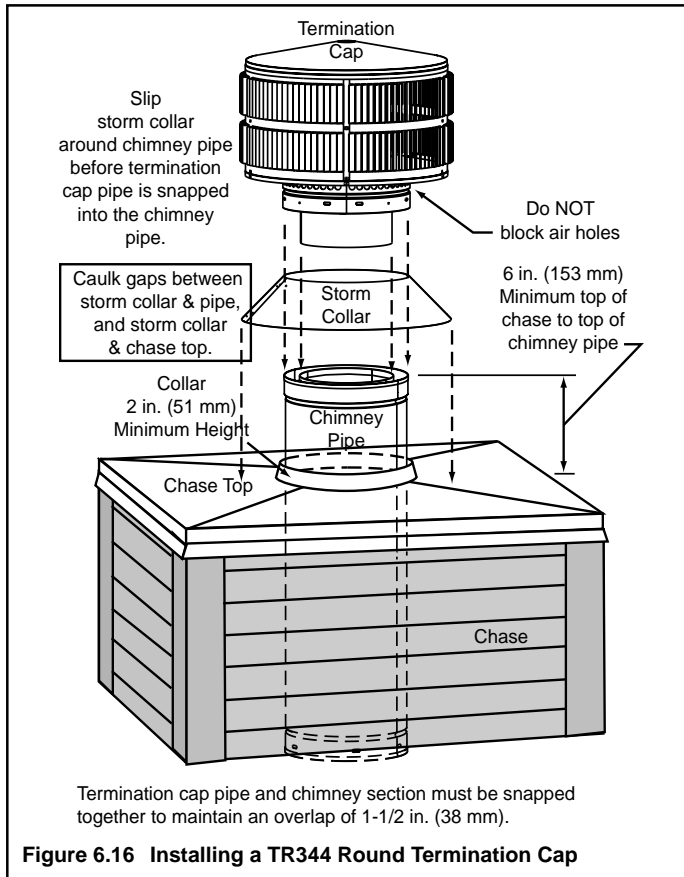
J. Install Termination Cap

Install the chimney sections up through the chase enclosure.

- Using 300° silicone sealant, caulk the overlap seam of any exposed pipe sections that are located above the roof line to prevent leaks.
- Refer to termination cap instructions.

WARNING! Risk of Fire! The minimum overlap of cap to pipe (as shown in the following illustrations) **MUST** be met or chimney may separate from cap. Separation allows sparks, heat and embers to escape.

NOTICE: Paint the termination cap with a rust-resistant paint to protect against the effects of corrosion on those parts exposed to the weather.



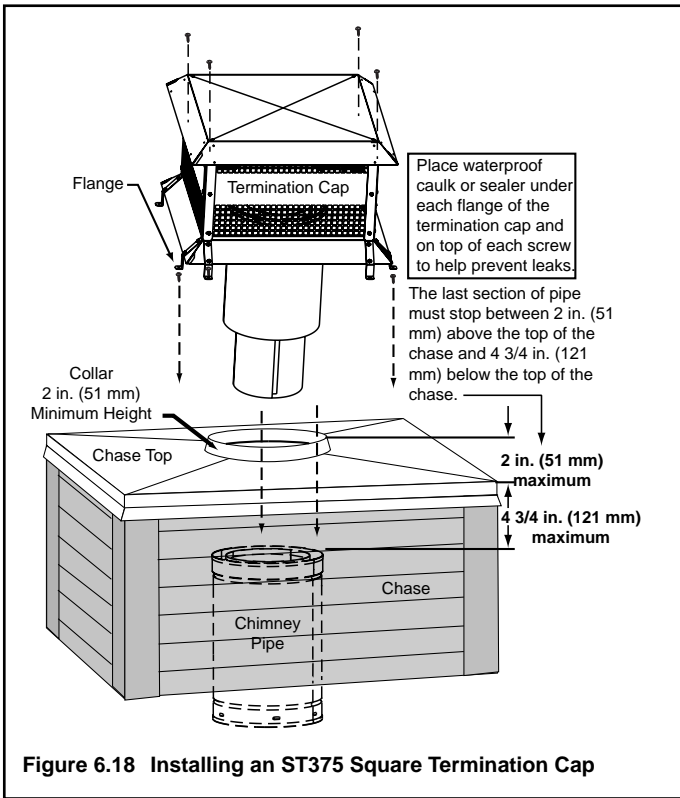


Figure 6.18 Installing an ST375 Square Termination Cap

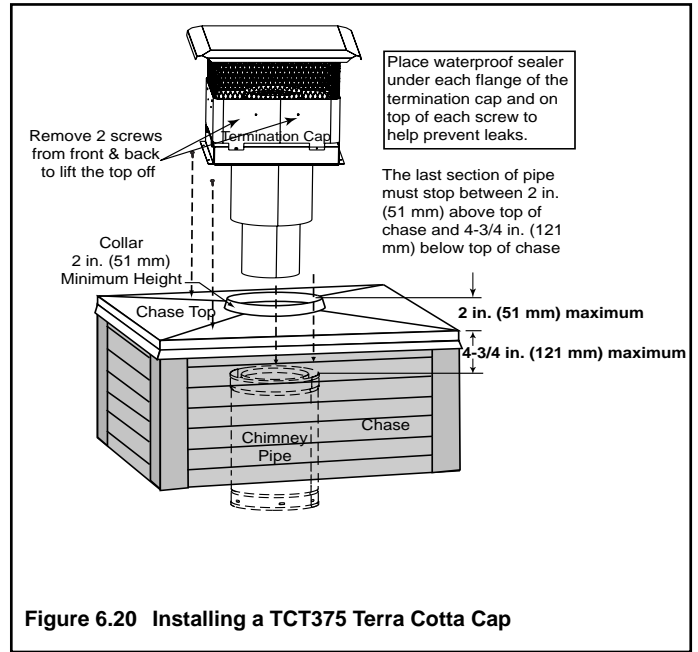


Figure 6.20 Installing a TCT375 Terra Cotta Cap

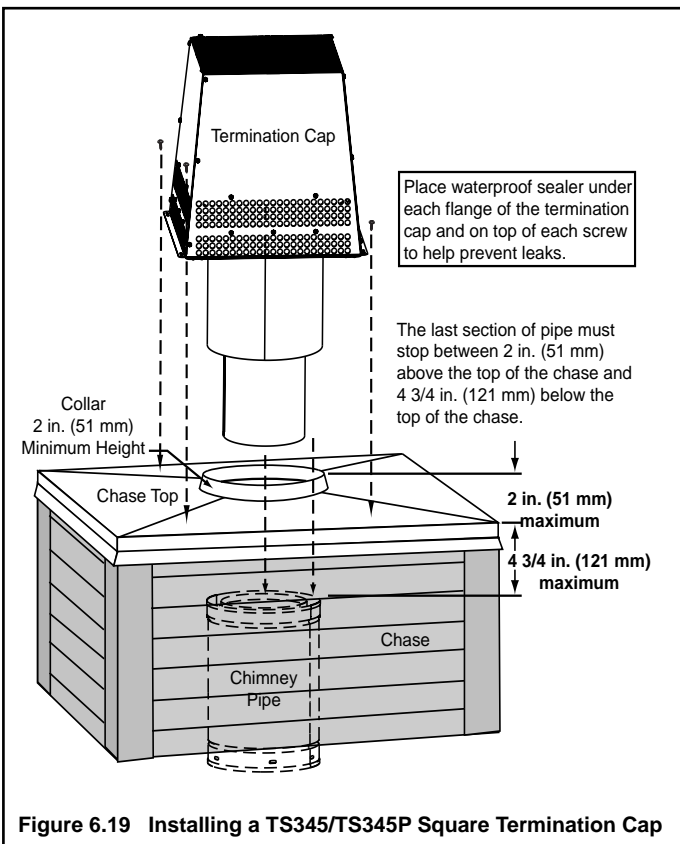


Figure 6.19 Installing a TS345/TS345P Square Termination Cap

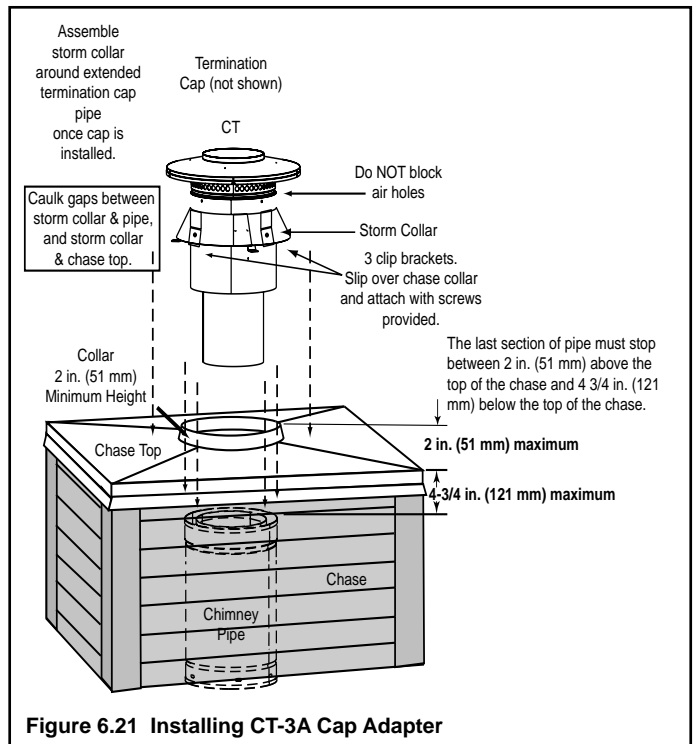


Figure 6.21 Installing CT-3A Cap Adapter

7 Shrouds

WARNING! Risk of Fire! Shrouds must be constructed as specified. Improper construction may overheat chase top.

Shrouds may be field constructed where permitted by regional building codes.

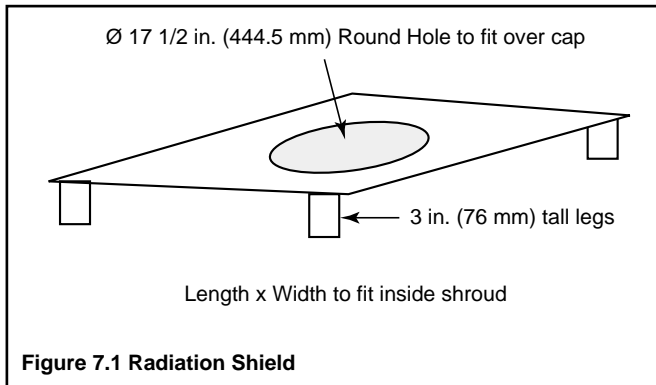
NOTICE: Some regional codes require an agency-Listed shroud. Consult your local building officials.

The shrouds must be constructed from minimum .018 in. (26 ga) thick aluminized steel.

Some shrouds require a radiation shield. Use where specified.

A. Radiation Shield

Radiation shield must be constructed of minimum 26 ga thick sheet metal.

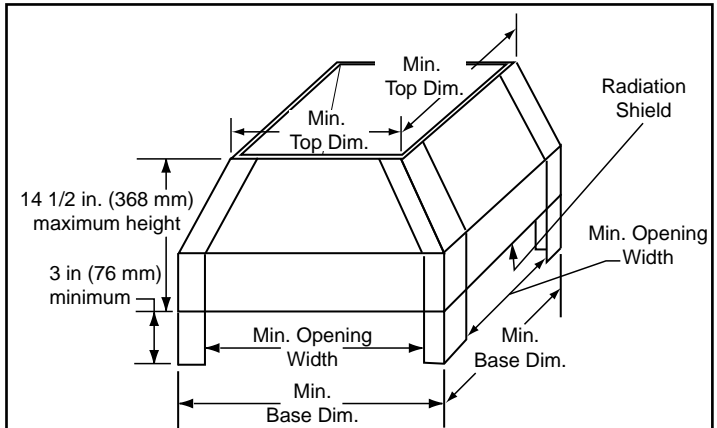


B. Field Constructed Shrouds

The following field constructed shroud designs have been tested for HHT fireplace systems and termination caps.

1. Open Top Shroud

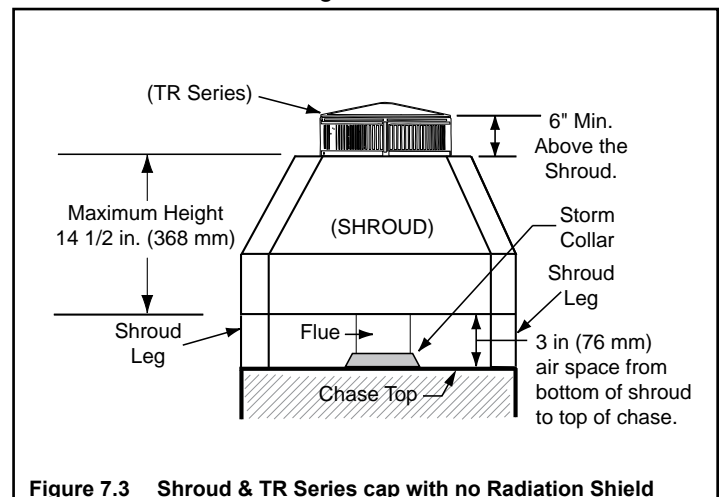
TR11/TR11T TV (top vented) caps do not require radiation shield.



| | TR11/11T | TR11/11T TV |
|---------------------------|----------------------------------|-------------------------------|
| Min. Base Dims. | | |
| <i>in</i> | 32 x 32 | 26 x 26 |
| <i>mm</i> | 813 x 813 | 660 x 660 |
| | Radiation Shield Required | Radiation Shield Not Required |
| Min. Top Dims. | | |
| <i>in</i> | 29 x 29 | 23 x 23 |
| <i>mm</i> | 737 x 737 | 584 x 584 |
| Min. Opening Width | | |
| <i>in</i> | 26 x 26 | 20 x 20 |
| <i>mm</i> | 660 x 660 | 508 x 508 |

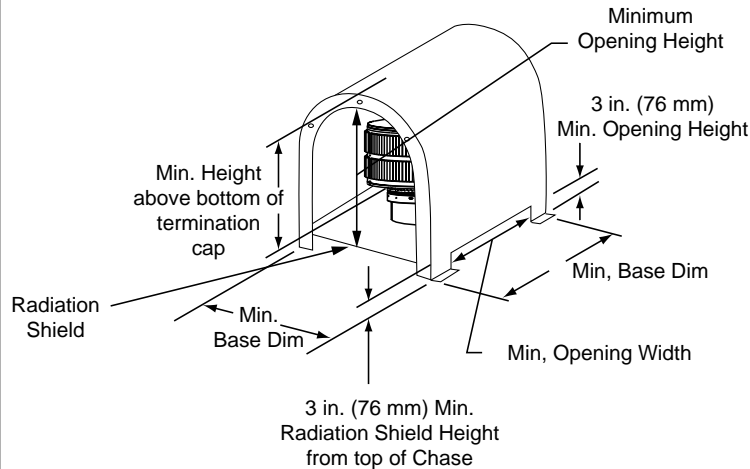
Figure 7.2 Open Top Shroud Dimensions (with Radiation Shield)

TR11/TR11T caps require radiation shield unless installed partially above the shroud. The TR cap must be raised to the minimum dimensions (or greater) above the shroud. Refer to Figure 7.3.



2. Mailbox Style Shroud

Radiation shield required

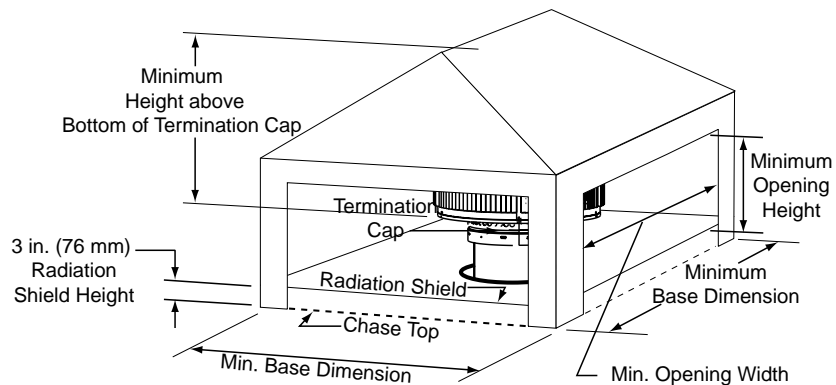


| | TR11/11T | TR11/11T TV |
|--|-----------|-------------|
| Min. Base Dims. | | |
| <i>in</i> | 34 x 34 | 28 x 30 |
| <i>mm</i> | 864 x 864 | 711 x 762 |
| Min. Height Above Bottom of Termination Cap | | |
| <i>in</i> | 28-1/4 | 27-1/2 |
| <i>mm</i> | 718 | 698 |
| Min. Opening Width | | |
| <i>in</i> | 28 | 22 |
| <i>mm</i> | 711 | 559 |
| Min. Opening Height | | |
| <i>in</i> | 18-1/4 | 17-1/2 |
| <i>mm</i> | 464 | 445 |

Figure 7.4 Mailbox Style Shroud Dimensions

3. Roofed Style Shroud

Radiation shield required



| TR11/11T TR11/11T TV | |
|--|-----------|
| Min. Base Dims. | |
| <i>in</i> | 34 x 34 |
| <i>mm</i> | 864 x 864 |
| Min. Height Above Bottom of Termination Cap | |
| <i>in</i> | 23 |
| <i>mm</i> | 584 |
| Min. Opening Width | |
| <i>in</i> | 28 |
| <i>mm</i> | 711 |
| Min. Opening Height | |
| <i>in</i> | 12 |
| <i>mm</i> | 305 |

Figure 7.5 Roofed Style Shroud Dimensions

8 Finishing

A. Template

A cardboard template of the front is printed on the outside of the shipping box. Cut out the template along the outside of the line for use in your installation. If using the cardboard template, it will require 1/4-20 bolts to attach it to the fireplace, (NOT INCLUDED). A metal template (see catalog) is available for more durable continued use, remaining accurate over time. Both measure 1/8 in. (3 mm) larger all the way around than the actual front.

Note: This 1/8 in. of the non-combustible material must be painted or the red will be visible.

Tools Required: 5/32 in. Allen wrench.

- Remove the screws from the fascia and remove fascia from the fireplace (if installed). Save the screws. Store the fascia in a safe, protected area to prevent scratching or other damage.
- Install the template on the front of the fireplace (Figure 8.1) with screws removed or provided.

NOTE: Do not over tighten the screws, just tighten up the template enough so that it comes in contact with the outer flanges on the front of the fireplace.

You are now ready to continue your installation with the desired decorative material. The template also serves as a protective covering and prevents damage to the front of the fireplace.

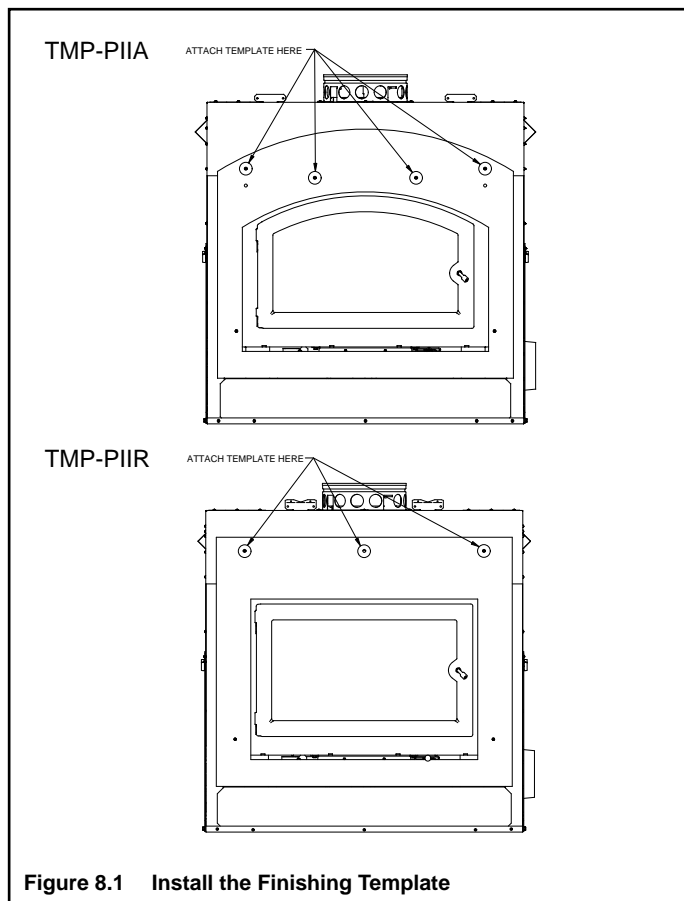


Figure 8.1 Install the Finishing Template

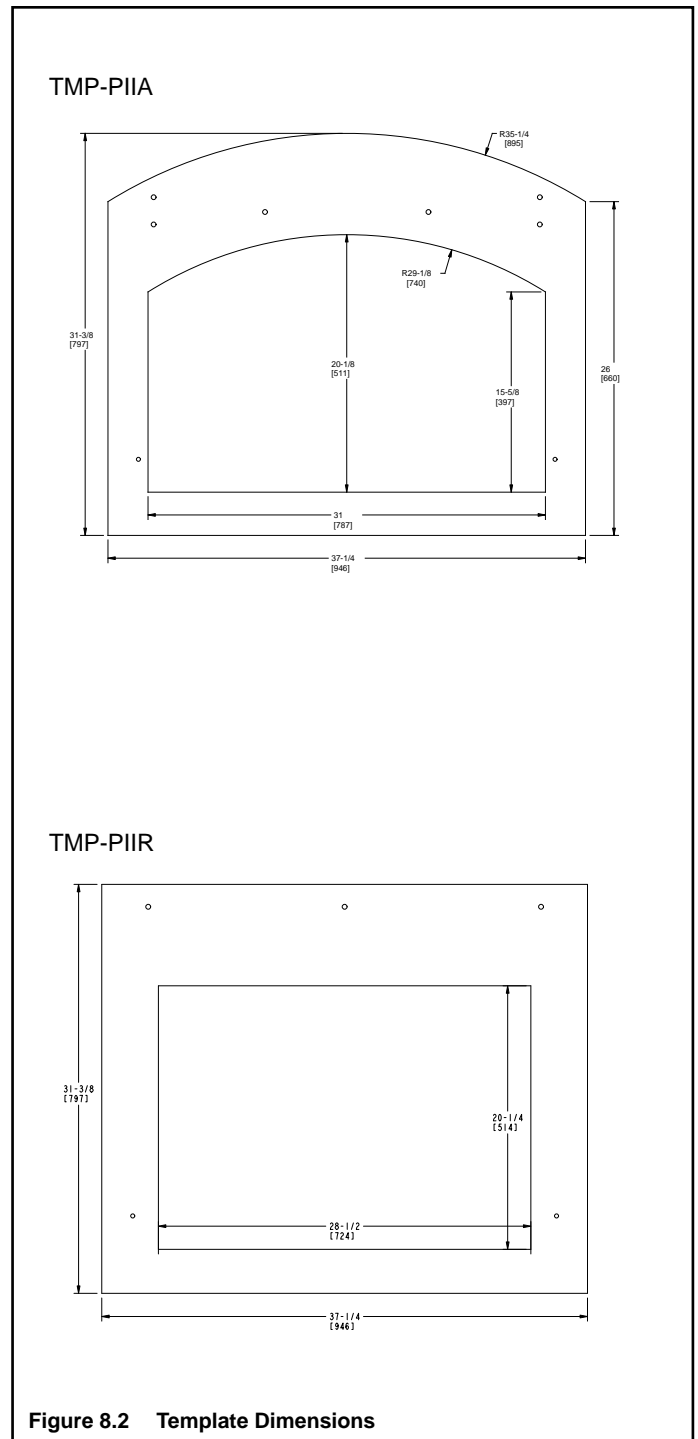


Figure 8.2 Template Dimensions

Note: DO NOT remove hang tags until installing finish materials.

NOTE: The decorative fascia must be removable for future serviceability.

B. Finish the Wall

Use a wet or dry towel or a soft brush to remove any dust or dirt from the non-combustible facing material.

Apply a non-combustible adhesive to attach tile, stone or other non-combustible finishing materials per manufacturer's instructions.

1. Stone, Brick Finish

WARNING! Risk of Fire! DO NOT apply tar paper or water resistive barrier over non-combustible board.

- Apply metal lath to the 1/2 in. thick non-combustible board with corrosion resistant self-tapping screws capable of penetrating the metal surface behind the non-combustible board.
- HHT recommends using type N or type S mortar. Due to high temperatures, review polymer modifiers specification sheet before using.

2. Tile, Granite, Marble Finish

- Due to high temperatures, HHT recommends using unmodified thinset when applying tile.
- When applying granite or marble, HHT recommends using thinset to adhere. If using a different adhesive, review specification sheet for application in high temperature areas.

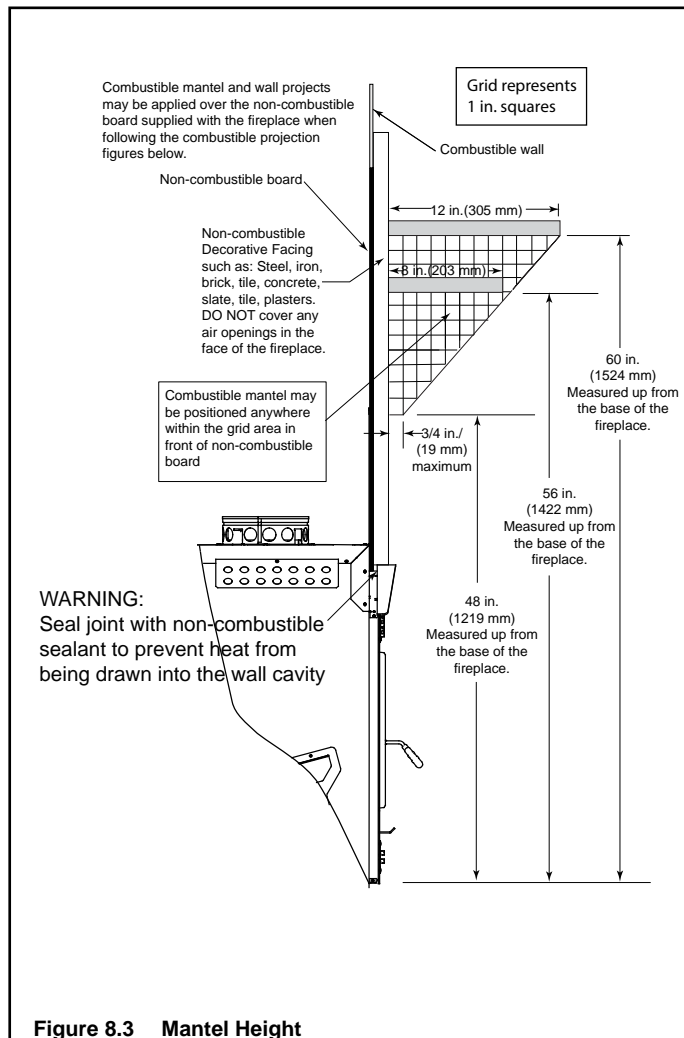


Figure 8.3 Mantel Height

C. Mantel and Wall Projections

A combustible mantel may be positioned no lower than 60 in. (1524 mm) at 12 in. (305 mm) deep from the base of the fireplace. Combustible mantel and wall projections may be applied over the non-combustible board supplied with the fireplace when following the combustible projection figures below.

Minimum clearance faceplate to sidewall is 16 in.

The combustible mantel may have a maximum depth of 12 in. (305 mm). Combustible trim pieces that project no more than 3/4 in. (19 mm) from the face of the fireplace can be placed no closer than 6 in. (152 mm) from the side of the decorative front. Surround legs that project more than 3/4 in. (19 mm) must be 16 in. (406 mm) away from the side of the decorative front. Combustible trim must not cover:

- the metal surfaces of the fireplace
- where the non-combustible board is placed over the metal surfaces
- the space between the metal face of the fireplace and framing members

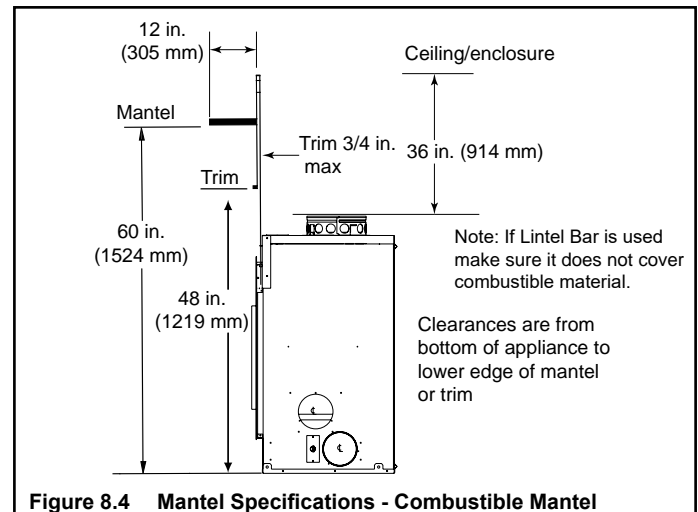


Figure 8.4 Mantel Specifications - Combustible Mantel

A noncombustible mantel may be positioned no lower than 38 in. (965 mm) from the base of the fireplace.

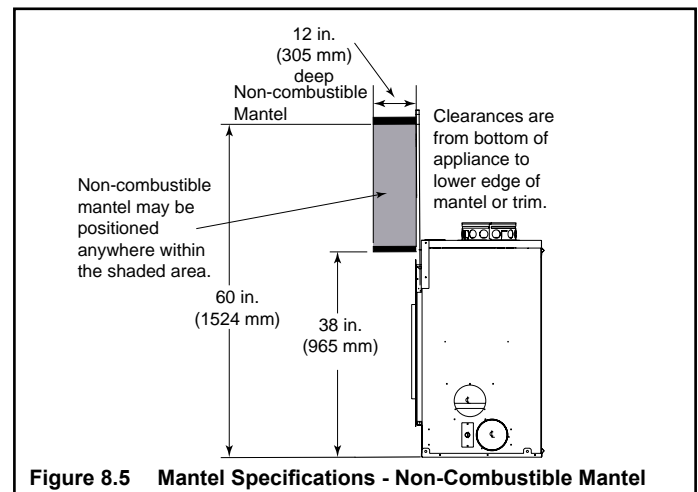


Figure 8.5 Mantel Specifications - Non-Combustible Mantel

D. Finishing the Hearth Extension

WARNING! Risk of Fire! High temperatures, sparks, embers or other burning material falling from the fireplace may ignite flooring or concealed combustible surfaces.

- Protective metal hearth strips **MUST** be installed.
- Hearth extensions **MUST** be installed exactly as specified.

A hearth extension must be installed with all fireplaces to protect the combustible floor in front of the fireplace from both radiant heat and sparks.

- You **MUST** use a hearth extension with this fireplace.
- Refer to Figure 8.6 for minimum dimensions.
- This fireplace has been tested and approved for use with a hearth extension insulated to a minimum R value of 1.03.
- The hearth extension material **MUST** be covered with tile, stone or other non-combustible material.
- Manufactured hearth materials will usually have a published **R value** (resistance to heat) or **k value** (conductivity of heat). Refer to the formula in Table 8.1 to convert a k value to an R value,
- Refer to Table 8.2 for hearth extension insulation alternatives.

Table 8.1

$$R = 1/k \times \text{inches of thickness}$$

Table 8.2

| Hearth Extension Insulation Alternatives, R Value = 1.03 | | | |
|--|------------------|------------------|----------------------------|
| Material | k per inch thick | r per inch thick | Minimum thickness required |
| Hearth & Home HX3, HX4 | 0.49 | 2.06 | 1/2 in. |
| USG Micore 300™ | 0.49 | 2.06 | 1/2 in. |
| USG Durock™ Cement Board | 1.92 | 0.52 | 2 in. |
| Cement Mortar | 5.0 | 0.20 | 5 1/8 in. |
| Common Brick | 5.0 | 0.20 | 5 1/8 in. |
| Ceramic Tile | 12.50 | 0.08 | 12 1/4 in. |
| Armstrong™ Privacy Guard Plus | 0.46 | 2.18 | 1 in. |
| Marble | 14.3-20.0 | 0.07-0.05 | 14 5/8 in. - 20 3/8 in. |

WARNING! Risk of Fire!

You must comply with all minimum air space clearances to combustibles as specified. Framing or finishing material used on the front of, or in front of, the fireplace closer than the minimums listed must be constructed entirely of non-combustible materials (i.e., steel studs, concrete board, etc.). Failure to comply may cause fire.

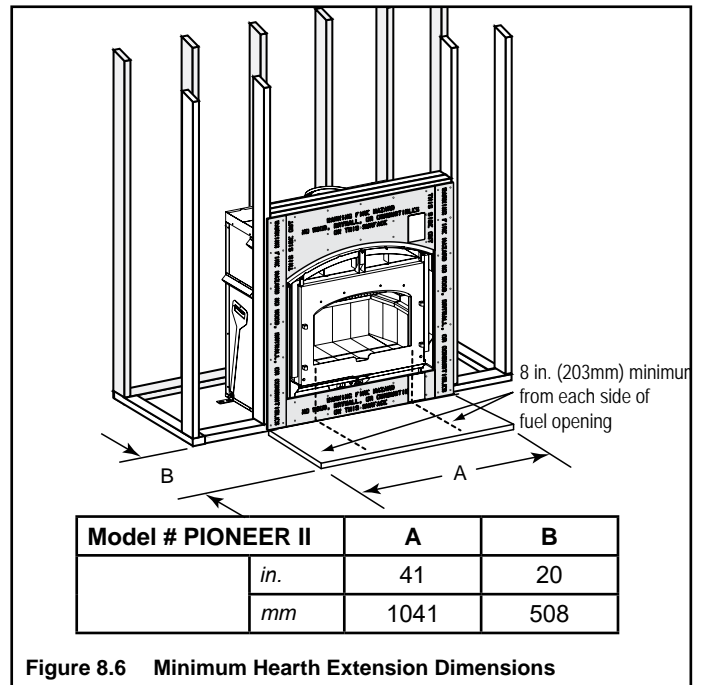


Figure 8.6 Minimum Hearth Extension Dimensions

- Fireplace and Hearth Extension flush on the floor
Non-combustible flooring a minimum of 20 in. (508 mm) in front of and 8 in. (203 mm) to either side of the fuel opening is required as shown in Figure 8.6.
The construction of, and materials used for a hearth extension are shown in Figure 8.7. A hearth extension of this construction may be covered with any non-combustible decorative material and may have a minimum thickness as per Figure 8.7. Seal gaps between the hearth extension and the front of the fireplace with a bead of non-combustible sealant or grout.

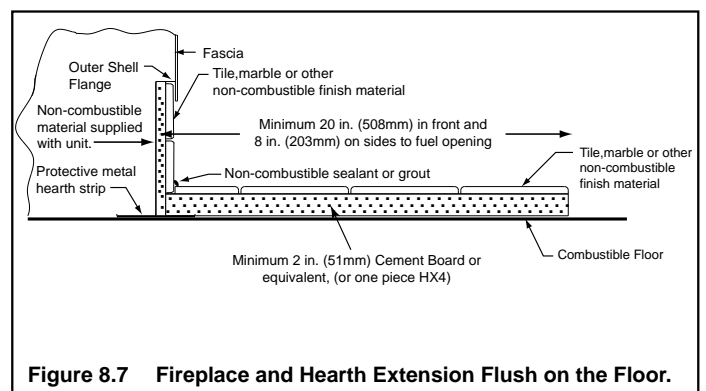


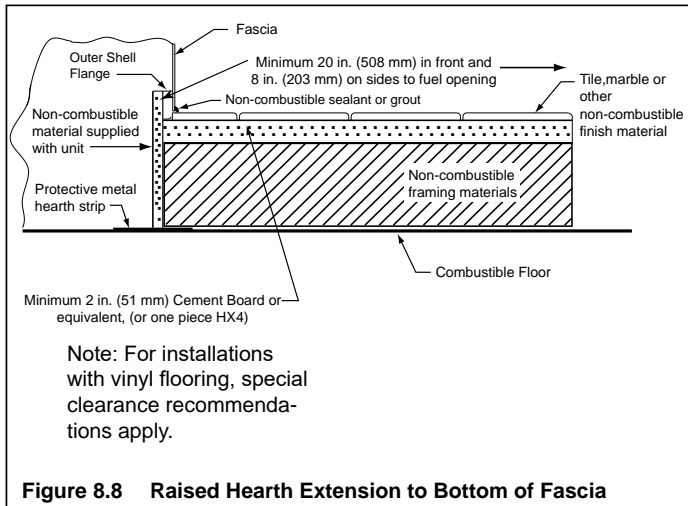
Figure 8.7 Fireplace and Hearth Extension Flush on the Floor.

- Fireplace installed flush on the floor and hearth extension raised to bottom of fascia:
Non-combustible flooring a minimum of 20 in. (508 mm) in front of and 8 in. (203 mm) to either side of the fuel opening is required (see Figure 8.6).

- **Raised Hearth Extension Framing**

The hearth framing must be constructed of non-combustible materials (such as metal framing or equivalent material) and topped with one HX4, or equivalent material (Table 8.2).

When creating the platform, allow for the thickness of the non-combustible finishing materials (Figure 8.8).



WARNING! Risk of Fire!

Hearth extensions are to be installed only as illustrated to prevent high temperatures from occurring on concealed combustible materials.

Vinyl Flooring

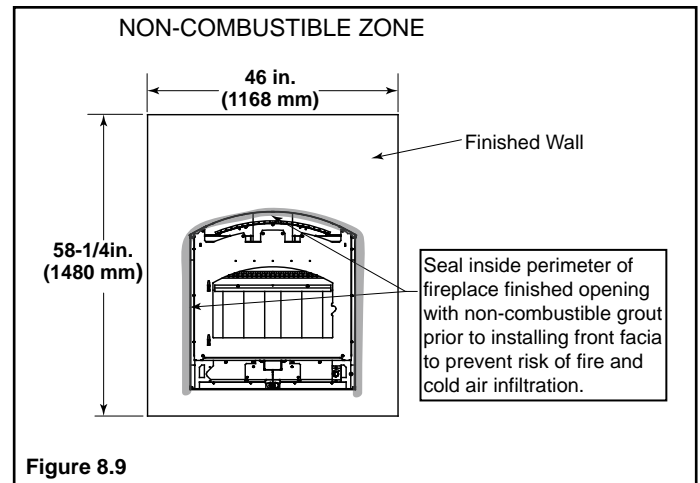
Vinyl Flooring is sensitive to heat. A 48 inch minimum depth hearth extension is recommended when using vinyl flooring up to the wall. See Figure 8.8.

Notice: Clearances that do not meet the minimum guidelines could result in damage or buckling to the vinyl flooring and is done at the installer's or homeowner's risk.

Hearth and Home Technologies does not recommend adhesive based vinyl flooring due to thermal expansion. Floating-style flooring can be used, but will reach temperatures up to 110°F in a room with ambient temperatures of 70°F. Consult flooring specifications to ensure compatibility.

E. Non-Combustible Sealant Material

- After completing the installation of non-combustible facing board in the required non-combustible zone and the non-combustible finishing material over that, remove the template.
- A bead of non-combustible sealant must be used to close off any gaps at the top and sides between the fireplace and non-combustible facing (Figure 8.9) to prevent cold air leaks and the risk of fire. Large gaps can be bridged with fiberglass rope gasket.
- When installation of the decorative material is complete, replace/install the fascia and fireplace doors.



WARNING! Risk of Fire!

- Maintain clearances.
- Use only non-combustible material below standoffs, material such as cement board is acceptable.
- Framing or finishing material used on the front of the fireplace closer than the minimums listed, must be constructed entirely of non-combustible materials (i.e., steel studs, concrete board, etc.).

WARNING! Risk of Fire!

Hearth & Home Technologies is not responsible for discoloration, cracking or other material failures of finishing materials due to heat exposure or smoke.

- Choose finishing materials carefully.

WARNING! Risk of Fire!

Seal around finishing material to fireplace.

9 Fireplace Setup

A. Firebrick Placement

The firebox of your fireplace is lined with high quality firebrick, which has exceptional insulating properties.

Do not use a grate; simply build a fire on the firebox floor.

Do not operate the fireplace without bricks. Make sure bricks are installed as shown.

IMPORTANT: Be certain you have the proper brick in the correct location. Measure the brick size for accuracy.

- Remove new brick set from box and lay out to diagram as shown in Figure 9.1.
- Lay bottom bricks in firebox.
- Install rear bricks on the top of the bottom bricks. Slide top of bricks under clip on back of firebox wall and push bottom of brick back.
- Install side bricks. Slide top of brick under clips on side of firebox and push the bottom of the brick until it is flush with the side of the firebox.

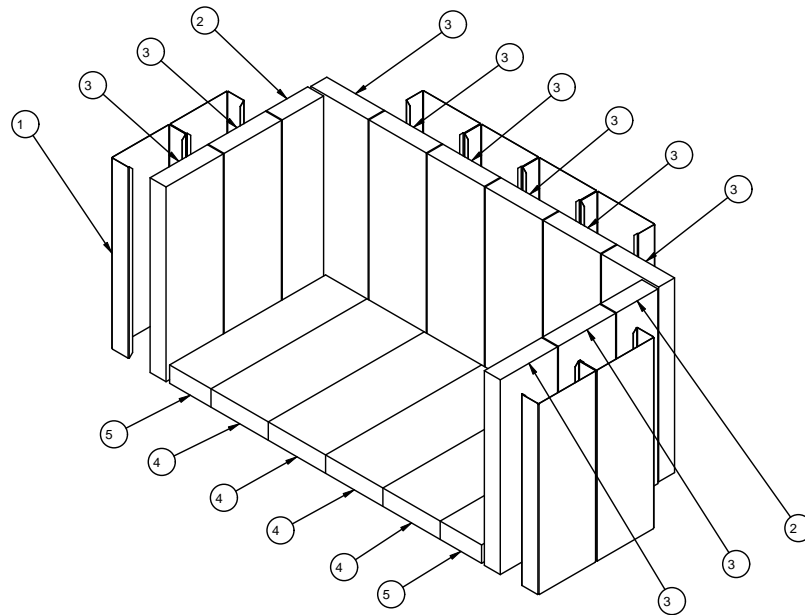


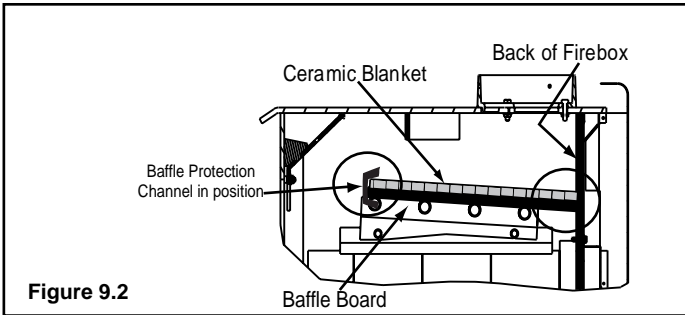
Figure 9.1 Fire Brick Configurations

Table 9.1

| # | Brick Size | Qty. in Set |
|---|-------------------------------|-------------|
| 1 | Brick Wrap | 8 |
| 2 | Firebrick 13.25 x 3.25 | 2 |
| 3 | Firebrick 13.25 x 4.50 x 1.25 | 10 |
| 4 | Firebrick 12.25 x 4.50 | 4 |
| 5 | Firebrick 12.25 x 3.25 | 2 |

B. Baffle and Blanket Placement

Ensure correct baffle and baffle protection channel placement; replace baffle components if damaged or missing.



The ceramic blanket and baffle board **MUST** be in contact with the back of the firebox and even with each other in the front. The baffle protection channel **MUST** be in position.

C. Install Fascia (Fronts)

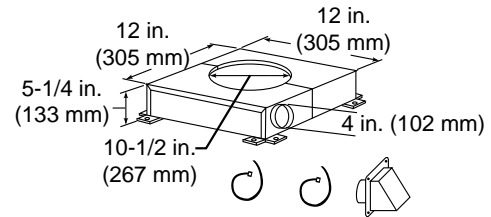
Front is required to complete the installation. Instructions for attachment of the front is included with it. Contact your local dealer with any questions on offerings or installation.

10 Reference Materials

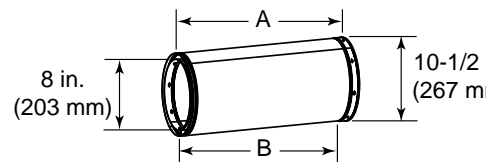
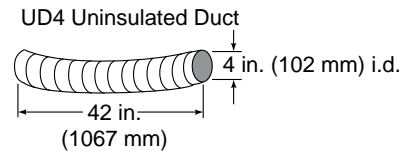
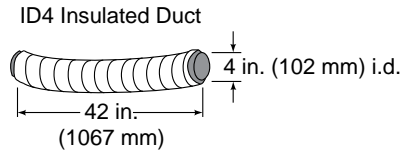
A. Chimney Components

The following drawings show the SL-300 Series chimney and fireplace components which may be safely used with this fireplace. The 8 in. DuraPlus can also be used.

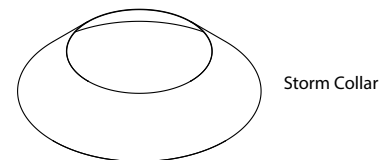
| Catalog # | Description |
|------------|--|
| CAK4A | Chimney Air Kit (shipped with fireplace) |
| ID4 | Insulated Duct (used with chimney air kit) |
| UD4 | Uninsulated Duct (used with chimney air kit) |
| SL306 | Chimney Section - 6 in. (152 mm) long |
| SL312 | Chimney Section - 12 in. (305 mm) long |
| SL318 | Chimney Section - 18 in. (457 mm) long |
| SL324 | Chimney Section - 24 in. (610 mm) long |
| SL336 | Chimney Section - 36 in. (914 mm) long |
| SL348 | Chimney Section - 48 in. (1219 mm) long |
| SL3 | Chimney Stabilizer |
| CAS8 | Attic Shield Kit |
| SL315 | Chimney Offset/Return - 15 deg |
| SL330 | Chimney Offset/Return - 30 deg |
| FS338 | Ceiling Firestop - Straight |
| FS339 | Ceiling Firestop - 15 deg |
| FS340 | Ceiling Firestop - 30 deg |
| AS8 | SL300 Straight Attic Insulation Shield, 24 in. (610 mm) (shipped with fireplace) |
| JB877 | Chimney Joint Band |
| CB876 | Chimney Bracket |
| RF370 | Roof Flashing - Flat to 6/12 Pitch |
| RF371 | Roof Flashing - 6/12 to 12/12 Pitch |
| DTO134/146 | Octagonal Decorative Caps |
| DTS134/146 | Square Decorative Caps |
| ST375 | Square Termination Cap |
| TCT375 | Terra Cotta Termination Cap |
| TR344 | Round Termination Cap |
| TR342-B | Round Telescoping Termination Cap |
| TR-TVK | TR Top Vent Kit |
| TS345 | Square Termination Cap |
| TS345P | Square Termination Cap - Painted |
| 12966A | Manufactured Home Thimble |
| MH841 | Manufactured Home Thimble Extension 20 in./508 mm |
| HX4 | Micore Hearth Extension, 20 in./508 mm wide |
| LDS33 | Decorative Shroud - 3 ft x 3 ft (.91 m x .91 m) |
| LDS46 | Decorative Shroud - 4 ft x 6 ft (1.22 m x 1.83 m) |
| LDS-BV | Decorative Shroud - 26 in. x 26 in. (660 mm x 660 mm) |
| | Field Constructed Shrouds (See "Woodburning Termination Cap") |
| CT-3A-B | Adapter - May be used with the following caps |
| | CT Series |
| | DT Series |
| 8DP-BP | Duraplus Base Plate (required if using DuraPlus Chimney) |



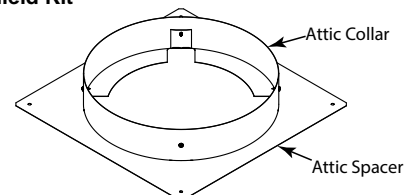
CAK4A Chimney Air Kit (shipped with fireplace)

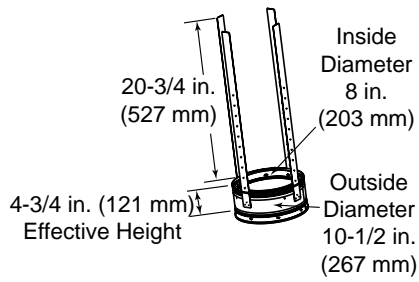


| Catalog # | A | | B | |
|-----------|----|------|--------|------|
| | in | mm | in | mm |
| SL306 | 6 | 152 | 4-3/4 | 121 |
| SL312 | 12 | 305 | 10-3/4 | 273 |
| SL318 | 18 | 457 | 16-3/4 | 425 |
| SL324 | 24 | 610 | 22-3/4 | 578 |
| SL336 | 36 | 914 | 34-3/4 | 883 |
| SL348 | 48 | 1219 | 46-3/4 | 1187 |

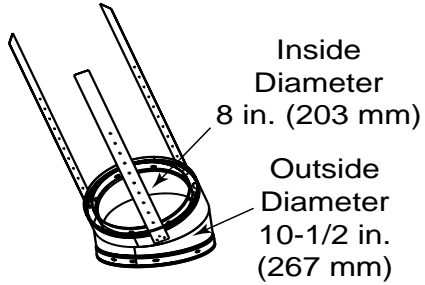


Attic Shield Kit

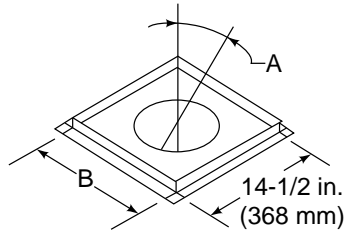




SL3 Chimney Stabilizer



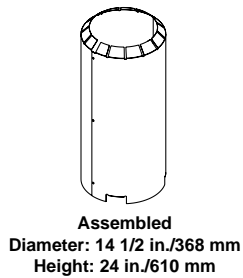
SL315 Chimney Offset/Return - Effective Height 13-3/8 in. (340 mm)
SL330 Chimney Offset/Return - Effective Height 15-1/2 in. (394 mm)



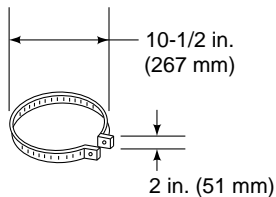
Firestop Spacer

| Catalog # | A | B |
|-----------|---------|-------------------|
| FS338 | 0-deg. | 14-1/2 in. 368 mm |
| FS339 | 15-deg. | 18-3/8 in. 467 mm |
| FS340 | 30-deg. | 23 in. 584 mm |

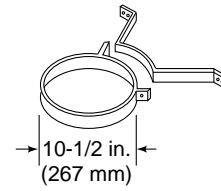
A = Actual Length
 B = Effective length (length of chimney part after it has been snapped to another)



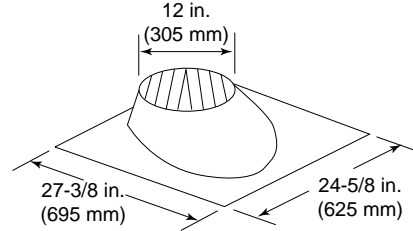
AS8 SL300 Straight Attic Insulation Shield (shipped with unit)



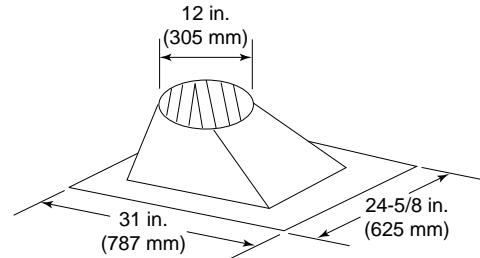
JB877 Chimney Joint Band



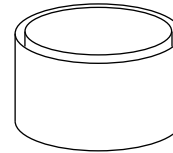
CB876 Chimney Bracket



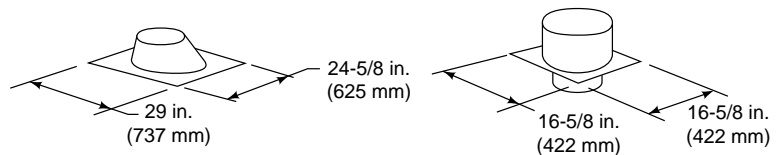
RF370 - Roof Flashing Flat to 6/12 Pitch



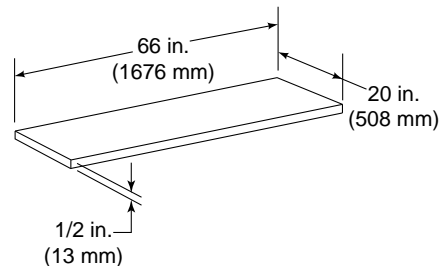
RF371 - Roof Flashing 6/12 to 12/12 Pitch



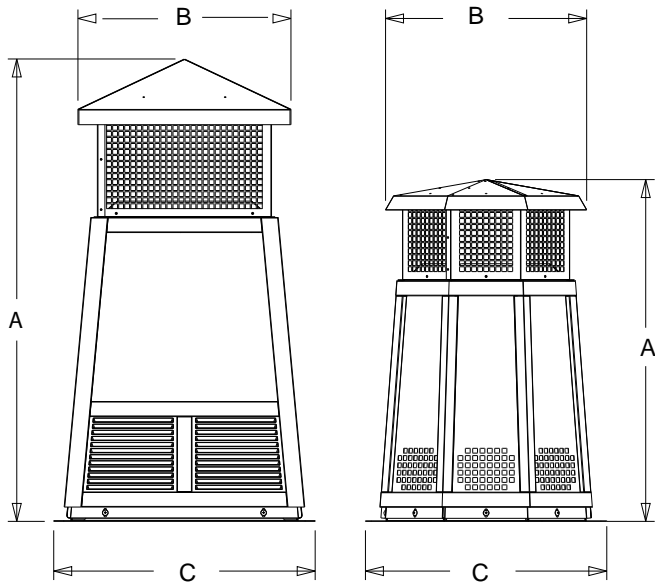
MH841 Manufactured Home Thimble Extension



12966A Manufactured Home Thimble



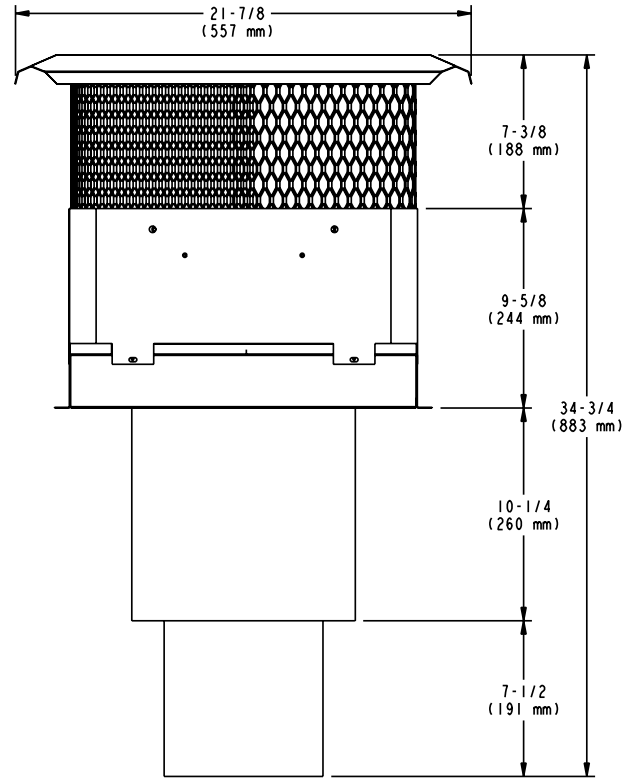
HX4 Micore Hearth Extension



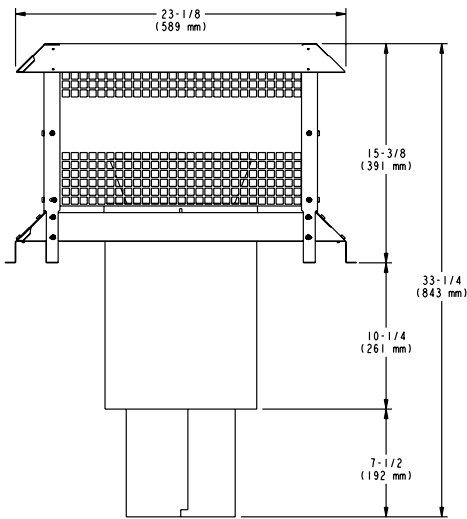
DTS134/DTS146 DTO134/DTO146
Decorative Caps

| Model | | A | B | C |
|--------|----|------|------|-----|
| DTO134 | in | 34 | 20 | 24 |
| | mm | 864 | 508 | 610 |
| DTO146 | in | 46 | 22.7 | 26 |
| | mm | 1168 | 576 | 660 |

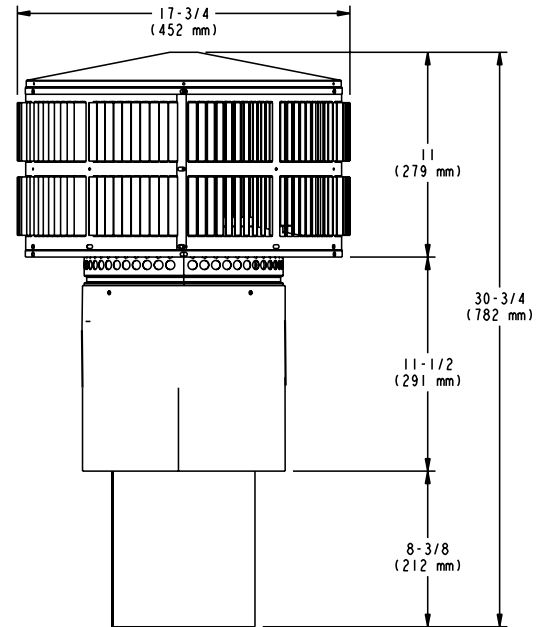
| Model | | A | B | C |
|--------|----|------|-------|-----|
| DTS134 | in | 34 | 21.18 | 24 |
| | mm | 864 | 538 | 610 |
| DTS146 | in | 46 | 21.18 | 26 |
| | mm | 1168 | 538 | 660 |



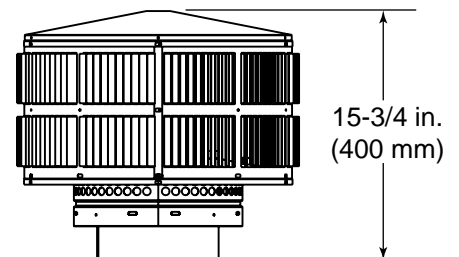
TCT375 Terra Cotta Cap



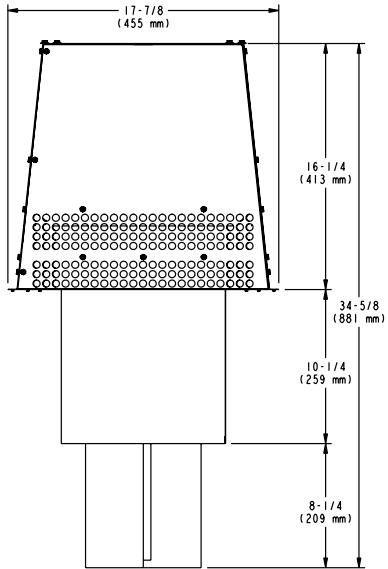
ST375 Square Termination Cap



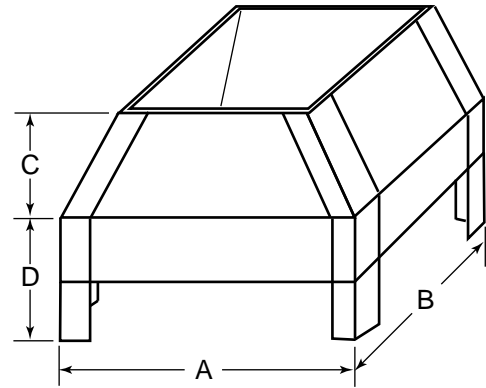
TR342-B Round Telescoping Termination Cap



TR344 Round Termination Cap

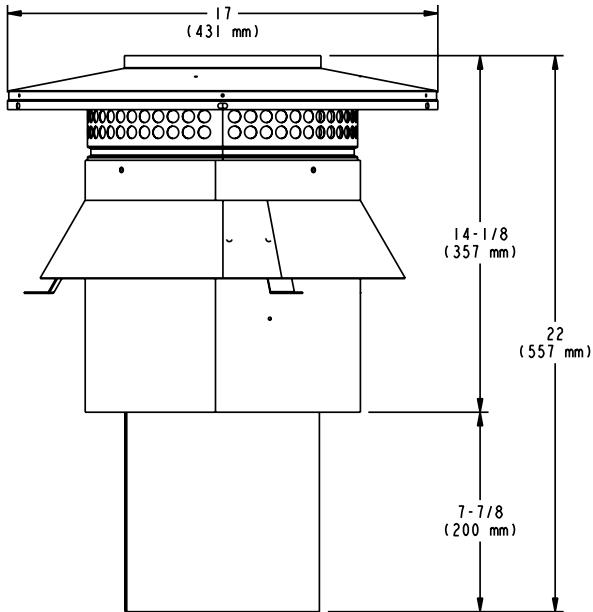


TS345/TS345P Square Termination Cap

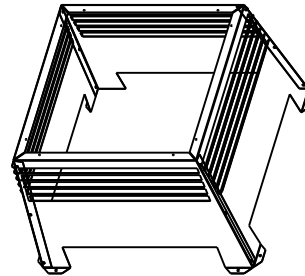


LDS33/LDS46 Decorative Shroud

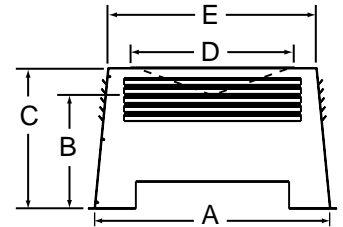
| Catalog # | A | | B | | C | | D | |
|-----------|-----|------|-----|------|-----|-----|-----|-----|
| | in. | mm | in. | mm | in. | mm | in. | mm |
| LDS33 | 36 | 914 | 36 | 914 | 8.5 | 216 | 11 | 279 |
| LDS46 | 48 | 1219 | 72 | 1829 | 8.5 | 216 | 11 | 279 |



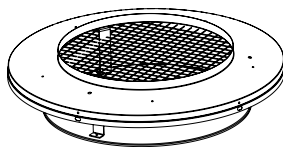
CT-3-B



LDS-BV Decorative Shroud



| Catalog # | A | B | C | D | E | |
|-----------|-----|-----|------|------|-----|-----|
| LDS-BV | in. | 26 | 12.5 | 15.5 | 22 | 23 |
| | mm | 660 | 318 | 394 | 559 | 584 |



TR-TVK Top Vent Kit

DuraPlus Venting

| Catalog # | Description |
|---------------|---------------------------------------|
| DV-8DP-BP | 8" DuraPlus base plate |
| DV-8DP-E15 | 8" DuraPlus 15° elbow kit |
| DV-8DP-E30 | 8" DuraPlus 30° elbow kit |
| DV-8DP-E15KSS | 8" DuraPlus 15° elbow kit (SS) |
| DV-8DP-E30KSS | 8" DuraPlus 30° elbow kit (SS) |
| DV-8DP-WS | 8" DuraPlus wall strap |
| DV-8DP-ES | 8" DuraPlus elbow strap |
| DV-8DP-AWS | 8" DuraPlus adjustable wall strap |
| DV-8DP-WSSS | 8" DuraPlus wall strap (SS) |
| DV-8DP-FRS | 8" DuraPlus firestop radiation shield |
| DV-8DP-XRB | 8" DuraPlus extended roof bracket |
| DV-6DP-SC | 6-8 Storm collar |
| DV-8DP-F6 | 8" DuraPlus flashing 0/12-6/12 |
| DV-8DP-FF | 8" DuraPlus flat roof flashing |
| DV-8DP-F12 | 8" DuraPlus flashing 7/12-12/12 |
| DV-8DP-06 | 8x6 DuraPlus pipe |
| DV-8DP-09 | 8x9 DuraPlus pipe |
| DV-8DP-12 | 8x12 DuraPlus pipe |
| DV-8DP-24 | 8x24 DuraPlus pipe |
| DV-8DP-24SS | 8x24 DuraPlus pipe (SS) |
| DV-8DP-36 | 8x36 DuraPlus pipe |
| DV-8DP-36SS | 8x36 DuraPlus pipe (SS) |
| DV-8DP-VC | 8" DuraPlus chimney cap |
| DV-6DP-IS | Attic Insulation Shield |

B. Accessories

Lintel Bar

LINTEL BAR-HHT

Finishing Template

TMP-PIIA

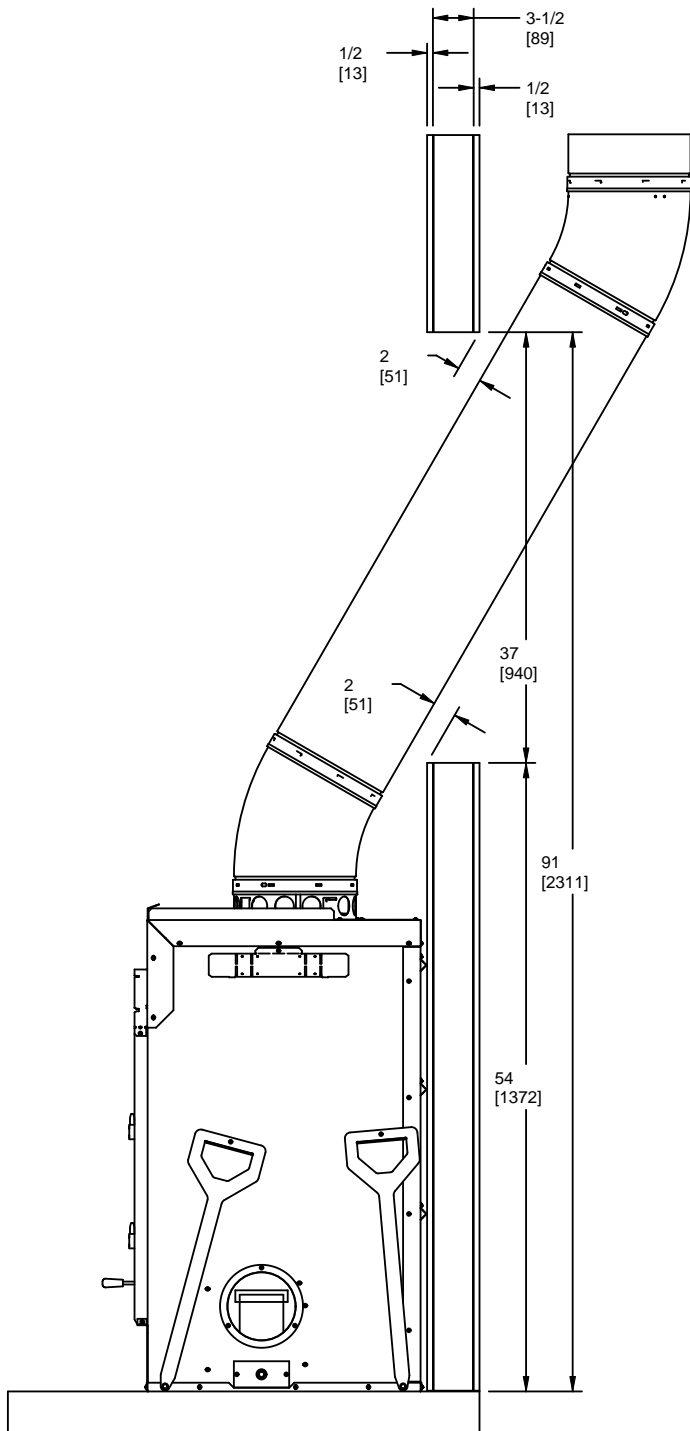
TMP-PIIR

Heat-Zone-WD-C

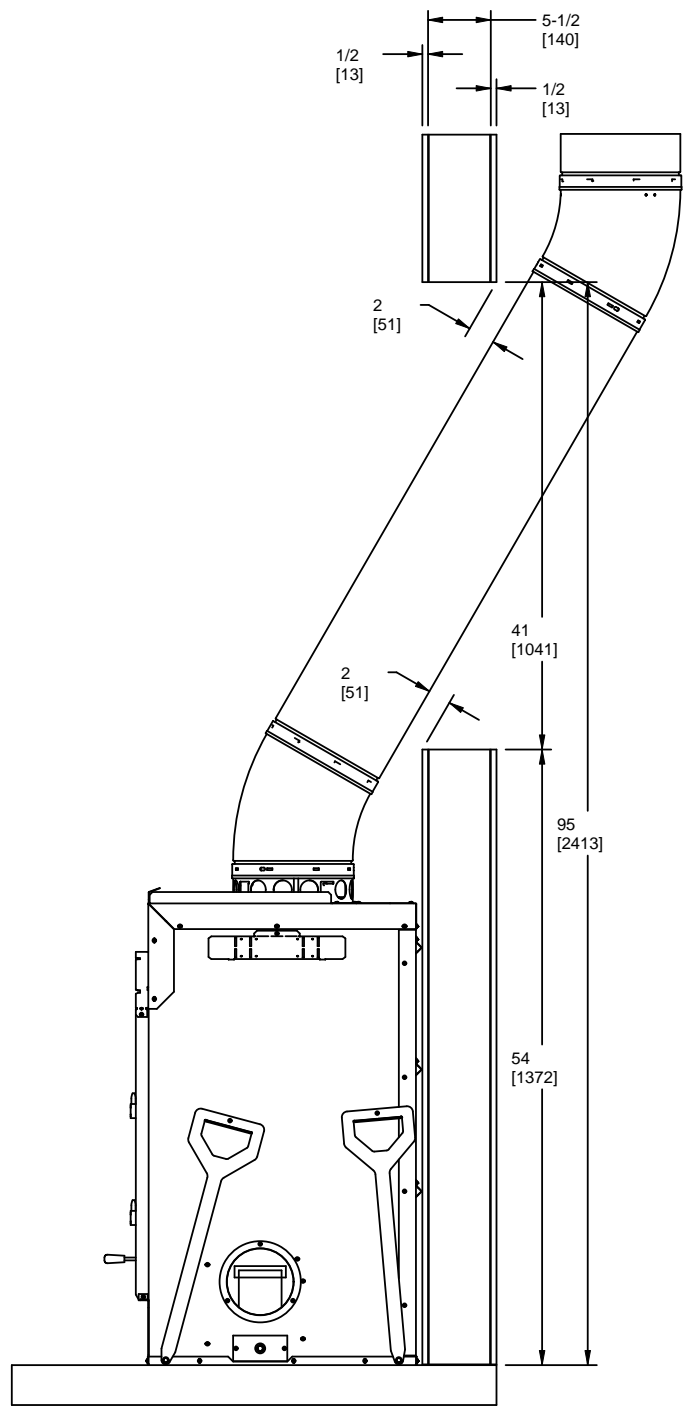
Outside Air Offset Adapter

OA-RD-6

C. Offset Diagrams



Offset for 2x4 Wall Construction



Offset for 2x6 Wall Construction

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Hearth & Home Technologies
1915 West Saunders Street, Mount Pleasant, Iowa 52641
www.fireplaces.com

Please contact your dealer with any questions or concerns.
For the location of your nearest dealer, please visit www.fireplaces.com.

Installation Manual

Installation and Fireplace Setup

Pour demander un exemplaire en français de ce Manuel du propriétaire, visitez www.fireplaces.com/translations.

INSTALLER: Leave this manual with party responsible for use and operation.

OWNER: Retain this manual for future reference.

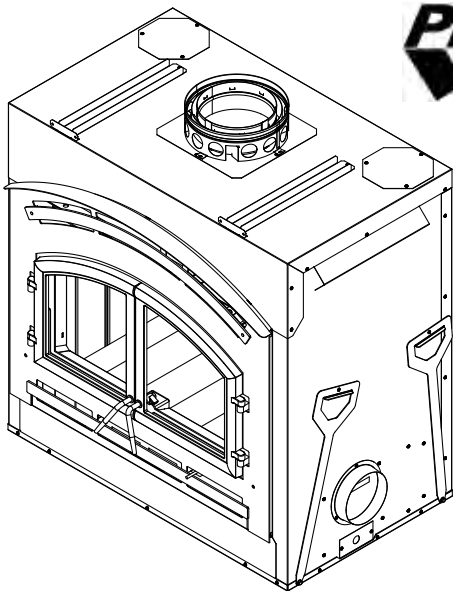
Contact your dealer with questions on installation, operation, or service.

heatilator[®]
The first name in fireplaces

Model(s):

C40-D

Constitution



**EPA CERTIFIED WOODBURNING
FIREPLACE**

WARNING! Risk of Fire and/or Asphyxiation!

- Read all the instructions before starting the installation. Follow these instructions carefully during the installation to ensure maximum safety and benefit.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may cause house fire.

▲ WARNING



HOT SURFACES!

Glass and other surfaces are hot during operation AND cool down.

Hot glass will cause burns.

- **DO NOT** touch glass until it is cooled
 - **NEVER** allow children to touch glass
 - Keep children away
 - **CAREFULLY SUPERVISE** children in same room as fireplace.
 - Alert children and adults to hazards of high temperatures.
- High temperatures may ignite clothing or other flammable materials.**
- Keep clothing, furniture, draperies and other flammable materials away.

Installation and service of this appliance should be performed by qualified personnel, Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.



Installation Manual

Installation and Fireplace Setup

Pour demander un exemplaire en français de ce Manuel du propriétaire, visitez www.fireplaces.com/translations.

INSTALLER: Leave this manual with party responsible for use and operation.

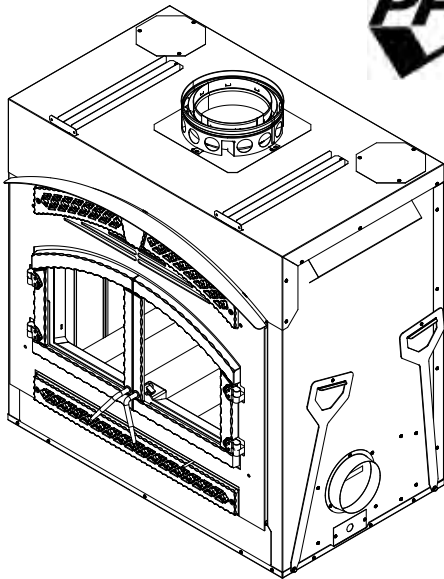
OWNER: Retain this manual for future reference.

Contact your dealer with questions on installation, operation, or service.

HEAT & GLO™

Model(s):

NORTHSTAR-D



**EPA CERTIFIED WOODBURNING
FIREPLACE**

WARNING! Risk of Fire and/or Asphyxiation!

- Read all the instructions before starting the installation. Follow these instructions carefully during the installation to ensure maximum safety and benefit.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may cause house fire.

▲ WARNING



HOT SURFACES!

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 - Keep children away
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 - Alert children and adults to hazards of high temperatures.
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- Keep clothing, furniture, draperies and other flammable materials away.

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Installation Manual

Installation and Fireplace Setup

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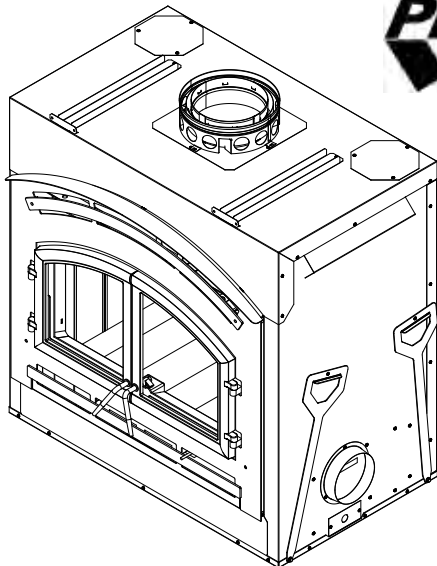
OWNER: Retain this manual for future reference.

Contact your dealer with questions on installation, operation, or service.



Model(s):

WARMMAJIC-D



**EPA CERTIFIED WOODBURNING
FIREPLACE**

WARNING! Risk of Fire and/or Asphyxiation!

- Read all the instructions before starting the installation. Follow these instructions carefully during the installation to ensure maximum safety and benefit.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may cause house fire.

▲ WARNING



HOT SURFACES!

Glass and other surfaces are hot during operation AND cool down.

Hot glass will cause burns.

- **DO NOT** touch glass until it is cooled
 - **NEVER** allow children to touch glass
 - Keep children away
- **CAREFULLY SUPERVISE** children in same room as fireplace.
 - Alert children and adults to hazards of high temperatures.
- High temperatures may ignite clothing or other flammable materials.**
- Keep clothing, furniture, draperies and other flammable materials away.

Installation and service of this appliance should be performed by qualified personnel, Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.



Appendix C: Calibrations



QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



PFS Teco
11785 SE Hwy 212 STE#305
Clackamas, OR 97015

Report Number: DIRI0182484A0912013i231228

A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

| Item | Make | Model | Serial Number | Customer ID | Location |
|-------|-------------|-------------------|----------------|---------------|--------------|
| Scale | Digiweigh | DWP12i 300kg x 0. | 82484A0912013i | #050 | Lab |
| Units | Readability | SOP | Cal Date | Last Cal Date | Cal Due Date |
| lbs | 0.01 | QC033 | 12/28/23 | 12/14/22 | 12/2024 |

FUNCTIONAL CHECKS

| SHIFT TEST | | LINEARITY | | REPEATABILITY | | ENVIRONMENTAL CONDITIONS | | |
|---|--------------------------------|---|--------------------------------|---|--------------------------------|--------------------------|-------------------------------------|--------------------------|
| Test Wt: | Tol: | Test Wt: | Tol: | Test Wt: | Tol: | | | |
| 100 | 0.05 | HB44 | HB44 | 100 | 0.01 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| As-Found: | | As-Found: | | As-Found: | | Good Fair Poor | | |
| Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | | | |
| As-Left: | | As-Left: | | As-Left: | | Temperature: 19.3°C | | |
| Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | | | |

CALIBRATION DATA

| Standard | As-Found | As-Left | Expanded Uncertainty |
|----------|----------|---------|----------------------|
| 400 | 399.87 | 400.01 | 0.006 |
| 200 | 200.00 | 200.00 | 0.005 |
| 100 | 100.02 | 100.02 | 0.005 |
| 75 | 75.02 | 75.02 | 0.005 |
| 50 | 50.02 | 50.02 | 0.005 |
| 25 | 25.00 | 25.00 | 0.005 |

CALIBRATION STANDARDS

| Item | Make | Model | Serial Number | Cal Date | Cal Due Date | NIST ID |
|--------------------|-----------|-------------|---------------|----------|--------------|----------|
| Avoirdupois Cast W | Rice Lake | 25 and 50lb | PWO990-CA | 7/18/22 | 7/2024 | 20221688 |

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

12/28/23: RH-42.5%

Report prepared/reviewed by: R.A. Date: 12-28-23

Technician: C.Call

Signature: [Signature]

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE APPROVAL OF QUALITY CONTROL SERVICES, INC.

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Member: National Conference of Standards Laboratories and Weights & Measures

Dry Gas Meter Calibration

DUT

| | |
|-------------------------|--------------|
| Manufacturer: | Apex |
| Model: | XC-60 |
| Lab ID #: | 53 |
| Serial #: | 1902130 |
| Calibration Date: | 8/1/2024 |
| Calibration Expiration: | 2/1/2025 |
| Barometric Pressure: | 29.93 in. Hg |



| Equipment Used: | Ref. Std. DGM | Thermometer | Barometer | Manometer |
|------------------------------|---------------|-------------|-----------|-----------|
| Manufacturer: | Apex | Fuke | Aquatech | Dwyer |
| Model: | SK25DA | 52 II | DBX2 | W17AE |
| Lab ID#: | 47 | 196 | 202 | 124 |
| Calibration Expiration Date: | 5/1/2025 | 1/3/2025 | 6/17/2025 | 6/16/2025 |
| Calibration γ Factor: | 0.998 | | | |

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Calibrate over expected operating flow range of DUT.

| Calibration Data | Run 1 | Run 2 | Run 3 |
|--|---------|---------|---------|
| Standard DGM Initial Volume (L) | 0.000 | 0.000 | 0.000 |
| Standard DGM Final Volume (L) | 196.683 | 150.909 | 260.397 |
| Standard DGM Temperature (°F) | 76.0 | 77.0 | 77.0 |
| Standard DGM Pressure (in H ₂ O) | 0.00 | 0.00 | 0.0 |
| DGM Initial Volume (ft ³) | 0.000 | 0.000 | 0.000 |
| DGM Final Volume (ft ³) | 7.090 | 5.446 | 9.498 |
| DGM Temperature (°F) | 90.0 | 92.0 | 95.0 |
| DGM Pressure (in H ₂ O) | 3.34 | 1.59 | 2.35 |
| Net Volume for Standard DGM (ft ³) | 6.946 | 5.329 | 9.196 |
| Net Volume for DGM (ft ³) | 7.090 | 5.446 | 9.498 |
| Dry Gas Meter γ Factor | 0.995 | 1.000 | 0.993 |
| γ Factor Deviation From Average | 0.995 | 1.000 | 0.993 |

Average Gas Meter γ Factor

0.996

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Technician:

Dry Gas Meter Calibration

DUT

Manufacturer: Apex
 Model: XC-60
 Lab ID #: 54
 Serial #: 1902133
 Calibration Date: 8/1/2024
 Calibration Expiration: 2/1/2025
 Barometric Pressure: 29.93 in. Hg



| Equipment Used: | Ref. Std. DGM | Thermometer | Barometer | Manometer |
|---------------------------------------|---------------|-------------|-----------|-----------|
| Manufacturer: Apex | | Fuke | Aquatech | Dwyer |
| Model: SK25DA | | 52 II | DBX2 | W17AE |
| Lab ID#: 47 | | 196 | 202 | 124 |
| Calibration Expiration Date: 5/1/2025 | | 1/3/2025 | 6/17/2025 | 6/16/2025 |
| Calibration γ Factor: 0.998 | | | | |

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Calibrate over expected operating flow range of DUT.

| Calibration Data | Run 1 | Run 2 | Run 3 |
|--|---------|---------|---------|
| Standard DGM Initial Volume (L) | 0.000 | 0.000 | 0.000 |
| Standard DGM Final Volume (L) | 156.724 | 182.210 | 191.576 |
| Standard DGM Temperature (°F) | 73.0 | 74.0 | 75.0 |
| Standard DGM Pressure (in H ₂ O) | 0.00 | 0.00 | 0.0 |
| DGM Initial Volume (ft ³) | 0.000 | 0.000 | 0.000 |
| DGM Final Volume (ft ³) | 5.412 | 6.423 | 6.840 |
| DGM Temperature (°F) | 77.0 | 82.0 | 88.0 |
| DGM Pressure (in H ₂ O) | 2.83 | 3.29 | 1.54 |
| Net Volume for Standard DGM (ft ³) | 5.535 | 6.435 | 6.765 |
| Net Volume for DGM (ft ³) | 5.412 | 6.423 | 6.840 |
| Dry Gas Meter γ Factor | 1.021 | 1.007 | 1.007 |
| γ Factor Deviation From Average | 1.021 | 1.007 | 1.007 |

Average Gas Meter γ Factor

1.012

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Report and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 33086-203325-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

| |
|--|
| 10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/26/2024 Due: 01/31/2025 Vendor: Fluke Report #: EVL943251 |
| LP-01782 Thermo-Hygrometer Comark SN: 06247790052 Cal: 01/24/2024 Due: 01/31/2025 Range: 122 °F 95 %RH Report #: 32568-205513-3646 |
| |
| |

Instrument Data

| | | | |
|-------------------------------|---------------------|----------------------------|-----------------|
| Calibration Date: | February 26, 2024 | Reference: | ASME B40.100 |
| Recommended Due Date: | February 26, 2025 | Cal-Cert Procedure: | CP-003 |
| Calibration Frequency: | 12 Months | Indicating System: | Digital |
| Manufacturer: | Newport Industries | Temperature: | 64 °F |
| Type: | Pressure Transducer | Humidity: | 36% RH |
| Model Number: | Unknown | Cal Factor: | None |
| Serial #: | Unknown | Asset #: | 54B |
| Capacity: | 1 PSI | Service Location: | Service Address |
| Tolerance: | ± 1.00% of Span | As Found: | Pass |
| Gauge Class: | A | As Left: | Pass |

| Instrument Range: | | 1.00 | | Range Resolution: | | 0.01 | | Mode Verified: | | Pressure | |
|-------------------|-------------------|----------------------------------|-------|----------------------------------|-------|-----------|------------------------|----------------|-------|----------|-------|
| UUT Reading | Standard As Found | Standard Verification Reading #1 | Error | Standard Verification Reading #2 | Error | Tolerance | Expanded Uncertainty ± | PSI | PSI | PSI | PSI |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.005 | 0.00 | 0.00 | 0.01 | 0.005 |
| 0.10 | 0.10 | 0.10 | 0.00 | 0.10 | 0.00 | 0.01 | 0.005 | 0.10 | 0.00 | 0.01 | 0.005 |
| 0.25 | 0.25 | 0.25 | 0.00 | 0.25 | 0.00 | 0.01 | 0.006 | 0.25 | 0.00 | 0.01 | 0.006 |
| 0.50 | 0.50 | 0.50 | 0.00 | 0.50 | 0.00 | 0.01 | 0.014 | 0.50 | 0.00 | 0.01 | 0.014 |
| 0.75 | 0.75 | 0.75 | 0.00 | 0.74 | -0.01 | 0.01 | 0.018 | 0.75 | -0.01 | 0.01 | 0.018 |
| 1.00 | 1.00 | 1.00 | 0.00 | 0.99 | -0.01 | 0.01 | 0.013 | 1.00 | -0.01 | 0.01 | 0.013 |
| 0.75 | 0.76 | 0.76 | 0.01 | 0.76 | 0.01 | 0.01 | 0.005 | 0.75 | 0.01 | 0.01 | 0.005 |
| 0.50 | 0.50 | 0.50 | 0.00 | 0.51 | 0.01 | 0.01 | 0.015 | 0.50 | 0.01 | 0.01 | 0.015 |
| 0.25 | 0.25 | 0.25 | 0.00 | 0.26 | 0.01 | 0.01 | 0.017 | 0.25 | 0.01 | 0.01 | 0.017 |
| 0.10 | 0.11 | 0.11 | 0.01 | 0.11 | 0.01 | 0.01 | 0.008 | 0.10 | 0.01 | 0.01 | 0.008 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.005 | 0.00 | 0.00 | 0.01 | 0.005 |

Manufacturer: Newport Industries

Type: Pressure Transducer

Serial #: Unknown

Remarks:

**We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.**

**Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).**

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSS Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above. Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.

All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

This report shall not be reproduced except in full, without written approval from Cal-Cert.

Service Engineer: Steven White

Date: February 26, 2024

Technical Manager: Marshall Doyle

Signature:



Report and Certificate of Calibration



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800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620

Report #: 33086-203326-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

| |
|--|
| 10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/26/2024 Due: 01/31/2025 Vendor: Fluke Report #: EVL943251 |
| LP-01782 Thermo-Hygrometer Comark SN: 06247790052 Cal: 01/24/2024 Due: 01/31/2025 Range: 122 °F 95 %RH Report #: 32568-205513-3646 |
| |
| |

Instrument Data

| | | | |
|-------------------------------|---------------------|----------------------------|-----------------|
| Calibration Date: | February 26, 2024 | Reference: | ASME B40.100 |
| Recommended Due Date: | February 26, 2025 | Cal-Cert Procedure: | CP-003 |
| Calibration Frequency: | 12 Months | Indicating System: | Digital |
| Manufacturer: | Newport Industries | Temperature: | 64 °F |
| Type: | Pressure Transducer | Humidity: | 36% RH |
| Model Number: | Unknown | Cal Factor: | None |
| Serial #: | Unknown | Asset #: | 54C |
| Capacity: | 5 In H2O | Service Location: | Service Address |
| Tolerance: | ± 1.00% of Span | As Found: | Pass |
| Gauge Class: | A | As Left: | Pass |

| Instrument Range: 5.00 | | Range Resolution: 0.01 | | Mode Verified: Pressure | | | |
|-------------------------------|-------------------|----------------------------------|--------|----------------------------------|--------|-----------|------------------------|
| UUT Reading | Standard As Found | Standard Verification Reading #1 | Error | Standard Verification Reading #2 | Error | Tolerance | Expanded Uncertainty ± |
| In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | In H2O |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.005 |
| 0.50 | 0.50 | 0.50 | 0.00 | 0.48 | -0.02 | 0.05 | 0.045 |
| 1.25 | 1.25 | 1.25 | 0.00 | 1.23 | -0.02 | 0.05 | 0.036 |
| 2.50 | 2.49 | 2.49 | -0.01 | 2.49 | -0.01 | 0.05 | 0.006 |
| 3.75 | 3.74 | 3.74 | -0.01 | 3.74 | -0.01 | 0.05 | 0.007 |
| 5.00 | 4.98 | 4.98 | -0.02 | 4.99 | -0.01 | 0.05 | 0.026 |
| 3.75 | 3.74 | 3.74 | -0.01 | 3.74 | -0.01 | 0.05 | 0.023 |
| 2.50 | 2.50 | 2.50 | 0.00 | 2.49 | -0.01 | 0.05 | 0.014 |
| 1.25 | 1.26 | 1.26 | 0.01 | 1.24 | -0.01 | 0.05 | 0.042 |
| 0.50 | 0.51 | 0.51 | 0.01 | 0.50 | 0.00 | 0.05 | 0.04 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.05 | 0.005 |

Manufacturer: Newport Industries

Type: Pressure Transducer

Serial #: Unknown

Remarks:

**We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

This report shall not be reproduced except in full, without written approval from Cal-Cert.

Service Engineer: Steven White

Date: February 26, 2024

Technical Manager: Marshall Doyle

Signature:



Dry Gas Meter Calibration

DUT

Manufacturer: Apex
 Model: XC-50-DIR
 Lab ID #: 203
 Serial #: A2204292
 Calibration Date: 8/2/2024
 Calibration Expiration: 2/2/2025
 Barometric Pressure: 29.96 in. Hg



| Equipment Used: | Ref. Std. DGM | Thermometer | Barometer | Manometer |
|---------------------------------------|---------------|-------------|-----------|-----------|
| Manufacturer: Apex | Apex | Fuke | Aquatech | Dwyer |
| Model: SK25DA | SK25DA | 52 II | DBX2 | W17AE |
| Lab ID#: 47 | 47 | 196 | 202 | 124 |
| Calibration Expiration Date: 5/1/2025 | 5/1/2025 | 1/3/2025 | 6/17/2025 | 6/16/2025 |
| Calibration γ Factor: 0.998 | 0.998 | | | |

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Calibrate over expected operating flow range of DUT.

| Calibration Data | Run 1 | Run 2 | Run 3 |
|--|---------|---------|---------|
| Standard DGM Initial Volume (L) | 0.000 | 0.000 | 0.000 |
| Standard DGM Final Volume (L) | 176.263 | 245.171 | 145.418 |
| Standard DGM Temperature (°F) | 79.0 | 80.0 | 81.0 |
| Standard DGM Pressure (in H ₂ O) | 0.00 | 0.00 | 0.0 |
| DGM Initial Volume (ft ³) | 0.000 | 0.000 | 0.000 |
| DGM Final Volume (ft ³) | 6.331 | 8.851 | 5.233 |
| DGM Temperature (°F) | 96.0 | 98.0 | 98.0 |
| DGM Pressure (in H ₂ O) | 1.10 | 0.81 | 1.41 |
| Net Volume for Standard DGM (ft ³) | 6.225 | 8.658 | 5.135 |
| Net Volume for DGM (ft ³) | 6.331 | 8.851 | 5.233 |
| Dry Gas Meter γ Factor | 1.009 | 1.007 | 1.007 |
| γ Factor Deviation From Average | 1.009 | 1.007 | 1.007 |

Average Gas Meter γ Factor

1.008

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Technician:

Report and Certificate of Calibration



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Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620

Report #: 33086-203319-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

| |
|--|
| 10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/26/2024 Due: 01/31/2025 Vendor: Fluke Report #: EVL943251 |
| LP-01782 Thermo-Hygrometer Comark SN: 06247790052 Cal: 01/24/2024 Due: 01/31/2025 Range: 122 °F 95 %RH Report #: 32568-205513-3646 |
| |
| |

Instrument Data

| | | | |
|-------------------------------|---------------------|----------------------------|-----------------|
| Calibration Date: | February 26, 2024 | Reference: | ASME B40.100 |
| Recommended Due Date: | February 26, 2025 | Cal-Cert Procedure: | CP-003 |
| Calibration Frequency: | 12 Months | Indicating System: | Digital |
| Manufacturer: | Red Lion | Temperature: | 65 °F |
| Type: | Pressure Transducer | Humidity: | 36% RH |
| Model Number: | Unknown | Cal Factor: | None |
| Serial #: | Unknown | Asset #: | 203B |
| Capacity: | 1 In H2O | Service Location: | Service Address |
| Tolerance: | ± 1.00% of Span | As Found: | Pass |
| Gauge Class: | A | As Left: | Pass |

| Instrument Range: | | 1.00 | | Range Resolution: | | 0.001 | | Mode Verified: | | Pressure | |
|-------------------|-------------------|----------------------------------|--------|----------------------------------|--------|-----------|------------------------|----------------|--|----------|--|
| UUT Reading | Standard As Found | Standard Verification Reading #1 | Error | Standard Verification Reading #2 | Error | Tolerance | Expanded Uncertainty ± | | | | |
| In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | | | | |
| 0.000 | 0.000 | 0.000 | 0.00 | 0.000 | 0.00 | 0.01 | 0.0005 | | | | |
| 0.100 | 0.098 | 0.098 | 0.00 | 0.099 | 0.00 | 0.01 | 0.0036 | | | | |
| 0.250 | 0.252 | 0.252 | 0.00 | 0.250 | 0.00 | 0.01 | 0.0055 | | | | |
| 0.500 | 0.502 | 0.502 | 0.00 | 0.499 | 0.00 | 0.01 | 0.0065 | | | | |
| 0.750 | 0.751 | 0.751 | 0.00 | 0.748 | 0.00 | 0.01 | 0.0086 | | | | |
| 1.000 | 1.001 | 1.001 | 0.00 | 0.998 | 0.00 | 0.01 | 0.0068 | | | | |
| 0.750 | 0.752 | 0.752 | 0.00 | 0.749 | 0.00 | 0.01 | 0.0073 | | | | |
| 0.500 | 0.501 | 0.501 | 0.00 | 0.499 | 0.00 | 0.01 | 0.0065 | | | | |
| 0.250 | 0.251 | 0.251 | 0.00 | 0.250 | 0.00 | 0.01 | 0.0024 | | | | |
| 0.100 | 0.103 | 0.103 | 0.00 | 0.101 | 0.00 | 0.01 | 0.0057 | | | | |
| 0.000 | 0.001 | 0.001 | 0.00 | 0.000 | 0.00 | 0.01 | 0.0005 | | | | |

Manufacturer: Red Lion

Type: Pressure Transducer

Serial #: Unknown

Remarks:

**We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.**

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This report shall not be reproduced except in full, without written approval from Cal-Cert.

Service Engineer:

Steven White

Date:

February 26, 2024

Technical Manager:

Marshall Doyle

Signature:



Report and Certificate of Calibration



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Local
503-654-9620



Report #: 33086-203320-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

| |
|--|
| 10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/26/2024 Due: 01/31/2025 Vendor: Fluke Report #: EVL943251 |
| LP-01782 Thermo-Hygrometer Comark SN: 06247790052 Cal: 01/24/2024 Due: 01/31/2025 Range: 122 °F 95 %RH Report #: 32568-205513-3646 |
| |
| |

Instrument Data

| | | | |
|-------------------------------|---------------------|----------------------------|-----------------|
| Calibration Date: | February 26, 2024 | Reference: | ASME B40.100 |
| Recommended Due Date: | February 26, 2025 | Cal-Cert Procedure: | CP-003 |
| Calibration Frequency: | 12 Months | Indicating System: | Digital |
| Manufacturer: | Red Lion | Temperature: | 66 °F |
| Type: | Pressure Transducer | Humidity: | 38% RH |
| Model Number: | Unknown | Cal Factor: | None |
| Serial #: | Unknown | Asset #: | 203C |
| Capacity: | 5 In H2O | Service Location: | Service Address |
| Tolerance: | ± 1.00% of Span | As Found: | Pass |
| Gauge Class: | A | As Left: | Pass |

| Instrument Range: | | 5.00 | | Range Resolution: | | 0.01 | | Mode Verified: | | Pressure | |
|-------------------|-------------------|----------------------------------|--------|----------------------------------|--------|-----------|------------------------|----------------|--|----------|--|
| UUT Reading | Standard As Found | Standard Verification Reading #1 | Error | Standard Verification Reading #2 | Error | Tolerance | Expanded Uncertainty ± | | | | |
| In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | In H2O | | | | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.005 | | | | |
| 0.50 | 0.50 | 0.50 | 0.00 | 0.49 | -0.01 | 0.05 | 0.038 | | | | |
| 1.25 | 1.25 | 1.25 | 0.00 | 1.22 | -0.03 | 0.05 | 0.067 | | | | |
| 2.50 | 2.48 | 2.48 | -0.02 | 2.47 | -0.03 | 0.05 | 0.021 | | | | |
| 3.75 | 3.72 | 3.72 | -0.03 | 3.71 | -0.04 | 0.05 | 0.043 | | | | |
| 5.00 | 5.00 | 5.00 | 0.00 | 4.99 | -0.01 | 0.05 | 0.045 | | | | |
| 3.75 | 3.72 | 3.72 | -0.03 | 3.71 | -0.04 | 0.05 | 0.034 | | | | |
| 2.50 | 2.49 | 2.49 | -0.01 | 2.47 | -0.03 | 0.05 | 0.05 | | | | |
| 1.25 | 1.23 | 1.23 | -0.02 | 1.23 | -0.02 | 0.05 | 0.008 | | | | |
| 0.50 | 0.50 | 0.50 | 0.00 | 0.49 | -0.01 | 0.05 | 0.018 | | | | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.005 | | | | |

Manufacturer: Red Lion

Type: Pressure Transducer

Serial #: Unknown

Remarks:

**We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
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This report shall not be reproduced except in full, without written approval from Cal-Cert.

Service Engineer: Steven White

Date: February 26, 2024

Technical Manager: Marshall Doyle

Signature:



Dry Gas Meter Calibration

DUT

Manufacturer: Apex
 Model: XC-60
 Lab ID #: 55
 Serial #: 810016
 Calibration Date: 8/3/2024
 Calibration Expiration: 2/3/2025
 Barometric Pressure: 29.98 in. Hg



| Equipment Used: | Ref. Std. DGM | Thermometer | Barometer | Manometer |
|---------------------------------------|---------------|-------------|-----------|-----------|
| Manufacturer: Apex | Apex | Fuke | Aquatech | Dwyer |
| Model: SK25DA | SK25DA | 52 II | DBX2 | W17AE |
| Lab ID#: 47 | 47 | 196 | 202 | 124 |
| Calibration Expiration Date: 5/1/2025 | 5/1/2025 | 1/3/2025 | 6/17/2025 | 6/16/2025 |
| Calibration γ Factor: 0.998 | 0.998 | | | |

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Calibrate over expected operating flow range of DUT.

| Calibration Data | Run 1 | Run 2 | Run 3 |
|--|---------|---------|---------|
| Standard DGM Initial Volume (L) | 0.000 | 0.000 | 0.000 |
| Standard DGM Final Volume (L) | 226.392 | 146.151 | 296.953 |
| Standard DGM Temperature (°F) | 81.0 | 82.0 | 82.0 |
| Standard DGM Pressure (in H ₂ O) | 0.00 | 0.00 | 0.0 |
| DGM Initial Volume (ft ³) | 0.000 | 0.000 | 0.000 |
| DGM Final Volume (ft ³) | 8.064 | 5.174 | 10.408 |
| DGM Temperature (°F) | 85.0 | 86.0 | 86.0 |
| DGM Pressure (in H ₂ O) | 0.00 | 0.00 | 0.00 |
| Net Volume for Standard DGM (ft ³) | 7.995 | 5.161 | 10.487 |
| Net Volume for DGM (ft ³) | 8.064 | 5.174 | 10.408 |
| Dry Gas Meter γ Factor | 0.997 | 1.003 | 1.013 |
| γ Factor Deviation From Average | 0.997 | 1.003 | 1.013 |

Average Gas Meter γ Factor

1.004

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Technician:

Report and Certificate of Calibration



Portland Laboratory
5777 SE International Way
Milwaukie, OR 97222
800-356-4662
503-654-9620

Anaheim Laboratory
120 S. Chaparral Ct Suite 110
Anaheim Hills, CA 92808
888-700-4100
714-696-5300

www.Cal-Cert.com

Report #: 30452-28785-3646 **Customer PO#:** 1100
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: John Steinert
Service Address: 5777 SE International Way Milwaukie, OR 97222

Calibration Standards

| |
|--|
| LP-00051 Electrical Meter Fluke SN: 9663004 Cal: 01/10/2023 Due: 01/10/2024 Vendor: Fluke Report #: EVL861119 |
| LP-01333 Electrical Meter IET Labs, Inc. SN: E3-1842499 Cal: 01/19/2023 Due: 01/31/2024 Vendor: Transcat Calibration Lab Report #: 5-G584Z-20-1 |
| LP-01347 Thermo-Hygrometer Comark SN: 06210350163 Cal: 04/18/2023 Due: 04/30/2024 Vendor: Cal-Cert Range: 122 °F 95 %RH Report #: 28945-67214-3646 |

Instrument Data

| | | | |
|-------------------------------|----------------------|----------------------------|-------------------------|
| Calibration Date: | August 9, 2023 | Reference: | Manufactures Tolerances |
| Recommended Due Date: | August 9, 2024 | Cal-Cert Procedure: | CP-080 |
| Calibration Frequency: | 12 Months | Indicating System: | Digital |
| Manufacturer: | Delmhorst | Temperature: | 74 °F |
| Type: | Resistivity Meter | Humidity: | 36% RH |
| Model Number: | MCS-1 | Asset #: | #094 |
| Serial #: | #094 | Service Location: | Cal-Cert Lab |
| Capacity: | 120 Megaohms | As Found: | Pass |
| Tolerance: | 3.00 % of indication | As Left: | Pass |

| Instrument Range: | 120 Megaohms | | Resolution: | 0.001 | Mode Verified: | Resistance |
|-------------------|--------------|----------------|-------------|----------------|----------------|------------|
| Standard Reading | UUT As Found | UUT Reading #1 | Error | UUT Reading #2 | Error | |
| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| 1.100 | 1.095 | 1.095 | -0.005 | 1.095 | -0.005 | |
| 54.545 | 54.719 | 54.719 | 0.173 | 54.719 | 0.173 | |
| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

Expanded Uncertainty± 2.50 Megaohms

Remarks:

100Mohm std Parallel with 120Mohm UUT= 54.545Mohms

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
 Cleaning and preventative maintenance were performed as part of this service.

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Service Engineer: Brent Enbysk **Date:** August 9, 2023
Technical Manager: Marshall Doyle **Signature:** *M Doyle*



CERTIFICATE OF CALIBRATION

| | | | |
|----------------------------|--|----------------------------|-----------------------|
| CUSTOMER: | PFS-TECO : CLACKAMAS, OR | CALIBRATION DATE: | 06/17/2024 |
| PO NUMBER: | 1120 | CALIBRATION DUE: | 06/17/2025 |
| INST. MANUFACTURER: | DWYER | PROCEDURE: | T.O.33K6-4-1769-1 |
| INST. DESCRIPTION: | VELOMETER | CALIBRATION FLUID: | AIR @ 14.7 PSIA 70°F |
| MODEL NUMBER: | 471 | RECEIVED CONDITION: | WITHIN MFG. SPECS. |
| SERIAL NUMBER: | CP288559 ID# 095 | LEFT CONDITION: | WITHIN MFG. SPECS. |
| RATED ACCURACY: | SEE NOTES BELOW. | AMBIENT CONDITIONS: | 763mm HGA 53% RH 70°F |
| UNCERTAINTY GIVEN: | ± 0.43% RD ; k=2 | CERTIFICATE FILE #: | 490265.2024 |
| NOTES: | ± 3.0% FS (0-500 / 0-1500) ** ± 4.0% F.S. (0-5000) **± 5.0% F.S. (0-15000) ** ± 2 °F | | |

Q.MANUAL IM 2.0 REV 2020.2 DATED 7-27-2020

DECISION RULE: SIMPLE ACCEPTANCE. MEASUREMENT UNCERTAINTIES NOT TAKEN INTO CONSIDERATION WHEN DETERMINING PASS/FAIL

| UUT INDICATED | DM.STD. ACTUAL | UUT INDICATED | DM STD. ACTUAL |
|---------------|----------------|---------------|----------------|
| FT/MIN | FT/MIN | DEG. F | DEG. F |
| 70 | 73 | 0 TO 200°F | 0 TO 200°F |
| 126 | 130 | 44.7 | 44.1 |
| 242 | 249 | 71.8 | 71.0 |
| 495 | 508 | 99.9 | 99.3 |
| 521 | 533 | | |
| 1039 | 1066 | | |
| 1490 | 1530 | | |
| 507 | 522 | | |
| 3214 | 3311 | | |
| 4998 | 5156 | | |
| 6975 | 7182 | | |
| 14853 | 15322 | | |

STANDARDS USED:

| | | |
|--|------------|-----------------|
| A312 ± .02% RD -140 TO 1372 DEG °C TRACE# 2023004415 | DUE | 11/13/24 |
| A800 flow nozzles +/- .2% RD (.2-5, 5-100, 100-1650 SCFM)TRACE# 144613547,1424683640,1583314714 | DUE | 02/14/25 |

All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) and the Unit Under Test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed according to the shown procedure. The use of IAS/ILAC logo indicates calibrations are in accordance to ISO/IEC 17025:2017.

Dick Munns Company - 11133 Winners Circle, Los Alamitos, CA 90720
Phone: 714-827-1215 - www.dickmunns.com

This Calibration Certificate shall not be reproduced except, in full, without approval by Dick Munns Company. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Issuing Date:

Approved By:

Cal. Technician:

Calibrated at: Lab

On-Site (Customer's)

06/17/2024

[Signature]

[Signature]

Page 1 of 1

Certificate of Calibration

Certificate Number: 743892



JJ Calibrations, Inc.

7724 SE Aspen Summit Drive
Portland, OR 97266-9217
Phone 503.786.3005
FAX 503.786.2994

PFS TECO

11785 SE Hwy 212
Suite 305
Clackamas, OR 97015

PO: 1033

Order Date: 03/08/2021

Authorized By: N/A



Calibrated on: 03/18/2021

*Recommended Due: 03/18/2026

Environment: 19 °C 41 % RH

* As Received: Other - See Remarks

* As Returned: Other - See Remarks

Action Taken: Calibrated

Technician: 126

Property #: 097
User: N/A
Department: N/A
Make: Unknown
Model: 10 Lbs.
Serial #: 097
Description: Mass
Procedure: DCN 500901
Accuracy: Raw Data

Remarks: * Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

Data is provided for your determination of acceptability. Received/returned without accessories.

Standards Used

| Std ID | Manufacturer | Model | Nomenclature | Due Date | Trace ID |
|--------|---------------|-------------------------|---------------|------------|----------|
| 484A | Rice Lake | 1kg-10kg (Class ASTM 1) | Mass Set, | 05/28/2021 | 699197 |
| 503A | Rice Lake | 1mg-200g (Class 0) | Mass Set, | 09/11/2021 | 729241 |
| 550A | And (A&D) Co. | HP-30K | Balance 30 Kg | 12/31/2021 | 739307 |
| 723A | Rice Lake | 1mg-200g (Class 0) | Mass Set, | 06/09/2021 | 723431 |

Measurement Data

| Parameter | Measurement Description | Range | Unit | Reference | Min | Max | *Error | UUT | Uncertainty |
|---------------------|-------------------------|-------|------|---------------|-----------|-----------|-----------|----------------|------------------------|
| Before/After | | | | | | | | | Accredited = \bar{U} |
| Mass | | | | | | | | | |
| | Raw Data | | g | 4535.92370000 | 0.0000000 | 0.0000000 | 0.1785299 | 4536.1022299 g | 3.5E-01 \bar{U} |

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to either the SI or to National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2017, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless stated in the comments, certificates reflect the "Simple Acceptance Rule" as specified by JCGM 106:2012. Unless otherwise stated, a test accuracy ratio (TAR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without written approval of JJ Calibrations.

Reviewer

3 Issued 03/25/2021

Rev # 15

Inspector



QUALITY CONTROL SERVICES

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2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



PFS Teco
11785 SE Hwy 212 STE#305
Clackamas, OR 97015

Report Number: DIRI0134307497240612

A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

| Item | Make | Model | Serial Number | Customer ID | Location |
|---------|-------------|--------------|---------------|---------------|--------------|
| Balance | Sartorius | ENTRIS224-1S | 34307497 | #107 | Lab |
| Units | Readability | SOP | Cal Date | Last Cal Date | Cal Due Date |
| g | 0.0001 | QC012 | 6/12/24 | 12/28/23 | 12/2024 |

FUNCTIONAL CHECKS

| ECCENTRICITY | | LINEARITY | | STANDARD DEVIATION | | | ENVIRONMENTAL CONDITIONS |
|---|--------------------------------|---|--------------------------------|--------------------|-------------|---------------|---|
| Test Wt: | Tol: | Test Wt: | Tol: | Test Wt: | Tol: | | |
| 100 | 0.0003 | 50 x 4 | 0.0002 | 100 | 0.0001 | | <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> |
| As-Found: | | As-Found: | | 1. 99.9999 | 5. 99.9999 | 9. 100.0000 | Good Fair Poor |
| Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | 2. 99.9999 | 6. 100.0000 | 10. 100.0001 | |
| As-Left: | | As-Left: | | 3. 100.0000 | 7. 100.0000 | <u>Result</u> | Temperature: 23.1°C |
| Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | 4. 100.0000 | 8. 100.0000 | 0.00006 | |

A2LA ACCREDITED SECTION OF REPORT

| Standard | As-Found | As-Left | Expanded Uncertainty |
|----------|----------|----------|----------------------|
| 200 | 199.9984 | 200.0000 | 0.00018 |
| 100 | 99.9991 | 99.9999 | 0.00018 |
| 50 | 49.9996 | 50.0001 | 0.00017 |
| 20 | 19.9998 | 20.0000 | 0.00017 |
| 0.1 | 0.1000 | 0.1000 | 0.00017 |
| 0.05 | 0.0499 | 0.0500 | 0.00017 |

CALIBRATION STANDARDS

| Item | Make | Model | Serial Number | Cal Date | Cal Due Date | NIST ID |
|------------|---------------|-------------|---------------|----------|--------------|----------|
| Weight Set | R.L./Troemner | 10kg to 1mg | G782 | 4/27/24 | 4/2025 | 20240900 |

Permanent Information Concerning this Equipment:

6 month calibration cycle

Comments/Info Concerning this Calibration:

06/12/2024: Cleaned, leveled, and adjusted span. RH=37.8%

Report prepared/reviewed by: TLP

Date: 06-12-2024

Technician: T. Peterson

Signature: [Signature]

THIS CERTIFICATE SHALL NOT BE REPRODUCED WITHOUT THE APPROVAL OF QUALITY CONTROL SERVICES, INC.

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards. Results relate only to the item(s) tested. Unless otherwise noted, statements of conformity do not include measurement

Member: National Conference of Standards Laboratories and Weights & Measures



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(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



Report of Calibration

Firm: PFS-TECO
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 05/09/22
Purchase Order: 1067
Traceable Number: 20220682

Test Item: 200 mg and 100 mg Individual Weights
Serial No.: Listed in Table

Manufacturer: Troemner
Customer ID: Listed in Table

| <u>Material</u> | <u>Assumed Density</u> | <u>Range</u> | <u>Tolerance Class</u> |
|-----------------|------------------------|-----------------|------------------------|
| Stainless Steel | 7.95 g/cm ³ | 200 mg & 100 mg | ASTM Class 1 |

Method and Traceability

The procedure used for this calibration is NIST IR 6969 SOP 4 Double Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:

100 g to 1 mg Working Standards Were Calibrated: 07/02/21 Due: 07/31/22 Standards ID: 723318
Mass Comparators Used: MET-05 Tested by: D. Thompson

Conventional Mass: “The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). “Conventional Value of the Result of Weighing in Air” (Previously known as “Apparent Mass vs. 8.0 g/cm³).


Uncertainty Statement: The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor $k=2$ for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

page 1 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 05/09/22


Signature David S. Thompson

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Report of Calibration

Firm: PFS-TECO
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 05/09/22
Purchase Order: 1067
Traceable Number: 20220682

Test Item: 200 mg and 100 mg Individual Weights
Serial No.: Listed in Table

Manufacturer: Troemner
Customer ID: Listed in Table

Laboratory Environment at time of test

| Temperature °C | Pressure mmHg | Humidity %RH |
|----------------|----------------|--------------|
| 21.93 to 21.94 | 760.7 to 760.8 | 47.8 to 47.9 |

Conventional Mass Value

| Nominal Value | As Found Value (g) | As Found Correction* (mg) | As Left Value (g) | As Left Correction* (mg) | Uncertainty (mg) | Tolerance (mg) |
|----------------------------|--------------------|---------------------------|-------------------|--------------------------|------------------|----------------|
| 200 mg, 1000101395, #109-B | 0.2000082 | 0.0082 | 0.2000082 | 0.0082 | 0.0014 | 0.010 |
| 100 mg, 1000126267, #109-A | 0.1000065 | 0.0065 | 0.1000065 | 0.0065 | 0.0014 | 0.010 |

*Correction is the difference between the conventional mass value of a weight and its nominal value.

Comments: These weights were received in good condition and were within ASTM Class 1 tolerances As Found.


Recalibration Due: The customer has requested a 5-year calibration cycle. The calibration due date for these weights is 05/09/27. The values listed above were found at the time of calibration. Any number of factors may cause these items to drift out of calibration before the calibration interval has expired.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2017 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 to 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 05/09/22


Signature David S. Thompson

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Member: National Conference of Standards Laboratories and Weights & Measures

Mettler Toledo
Service Business Unit Industrial
1900 Polaris Parkway
Columbus, OH 43240
1-800-523-5123



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: PFS-TECO
Address: 11785 SE Hwy 212; Ste 305
City: Clackamas **Contact:** John Steinert
Zip / Postal: 97015-9050
State / Province: Oregon

Weighing Device

Manufacturer: Mettler Toledo **Instrument Type:** Weighing Instrument
Model: PFD774-US11 **Asset Number:** 1
Serial No.: C112381341 **Terminal Model:** IND570
Building: N/A **Terminal Serial No.:** C101887027
Floor: N/A **Terminal Asset No.:** N/A
Room: N/A

| Range | Max. Capacity | Readability (d) |
|-------|---------------|-----------------|
| 1 | 1000 lb | 0.02 lb |

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.

| | Temperature | | Humidity | |
|----------|----------------|--------------|---------------|-------------|
| As Found | Start: 20.0 °C | End: 20.0 °C | Start: 44.0 % | End: 44.0 % |
| As Left | Start: 20.0 °C | End: 20.0 °C | Start: 44.0 % | End: 28.0 % |

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: 16-Apr-2021
As Left Calibration Date: 16-Apr-2021
Issue Date: 16-Apr-2021
Requested Next Calibration Date: 30-Apr-2022

Authorized A2LA Signatory: 
Gary Sargent

Measurement Results

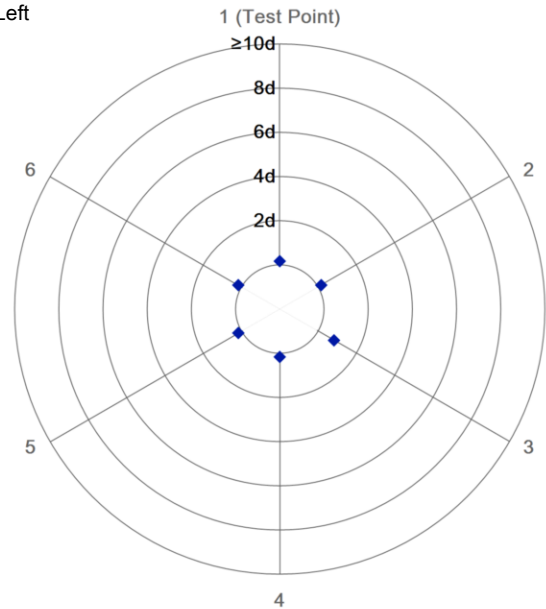
Repeatability

Test Load: 500 lb

| | As Found | As Left |
|---|----------|-----------|
| 1 | N/A | 500.00 lb |
| 2 | N/A | 500.00 lb |
| 3 | N/A | 500.02 lb |
| 4 | N/A | 500.00 lb |
| 5 | N/A | 500.00 lb |
| 6 | N/A | 500.00 lb |

| | | |
|--------------------|-----|----------|
| Standard Deviation | N/A | 0.008 lb |
|--------------------|-----|----------|

○ As Found
◆ As Left



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

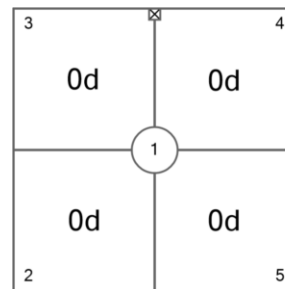
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

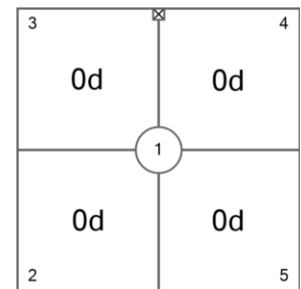
Test Load: 325 lb

| Position | As Found | As Left |
|----------|-----------|-----------|
| 1 | 325.00 lb | 325.00 lb |
| 2 | 325.00 lb | 325.00 lb |
| 3 | 325.00 lb | 325.00 lb |
| 4 | 325.00 lb | 325.00 lb |
| 5 | 325.00 lb | 325.00 lb |

| | | |
|-------------------|---------|---------|
| Maximum Deviation | 0.00 lb | 0.00 lb |
|-------------------|---------|---------|



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

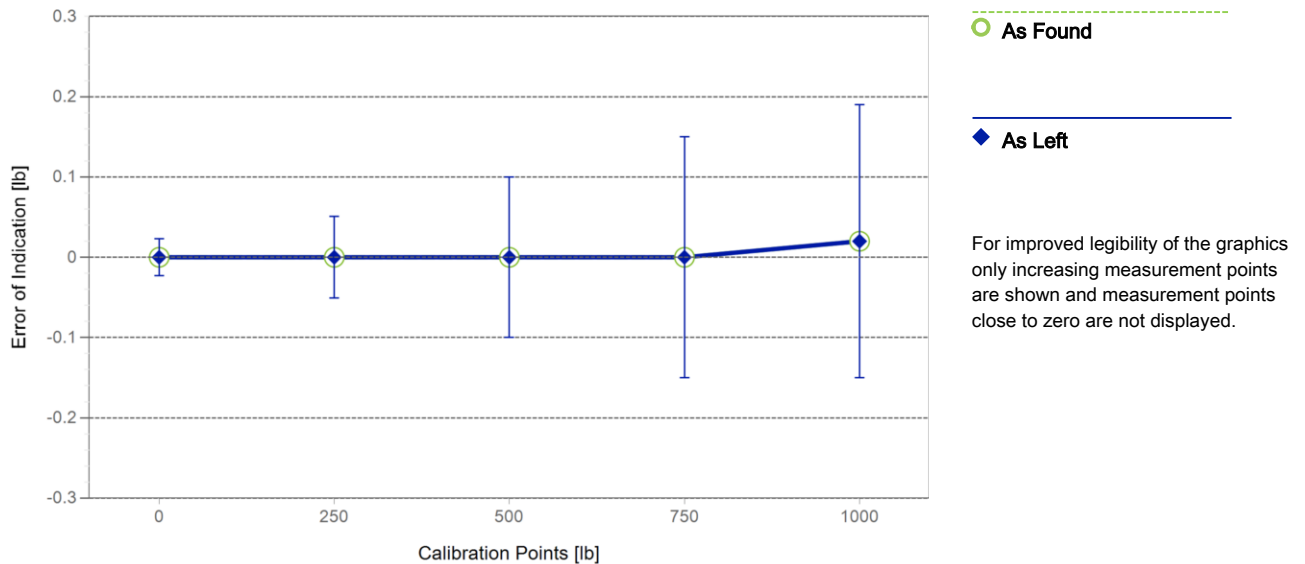
As Found

| | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|----------------|-----------------|------------|---------------------|----------------------|-----|
| 1 | 0 lb | 0.00 lb | 0.00 lb | N/A | N/A |
| 2 ¹ | 250 lb | 250.00 lb | 0.00 lb | N/A | N/A |
| 3 ¹ | 500 lb | 500.00 lb | 0.00 lb | N/A | N/A |
| 4 ¹ | 750 lb | 750.00 lb | 0.00 lb | N/A | N/A |
| 5 | 1000 lb | 1000.02 lb | 0.02 lb | N/A | N/A |
| 6 ¹ | 750 lb | 750.00 lb | 0.00 lb | N/A | N/A |
| 7 ¹ | 500 lb | 500.00 lb | 0.00 lb | N/A | N/A |
| 8 ¹ | 250 lb | 250.00 lb | 0.00 lb | N/A | N/A |
| 9 | 0 lb | 0.00 lb | 0.00 lb | N/A | N/A |

As Left

| | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|----------------|-----------------|------------|---------------------|----------------------|------|
| 1 | 0 lb | 0.00 lb | 0.00 lb | 0.023 lb | 2.28 |
| 2 ¹ | 250 lb | 250.00 lb | 0.00 lb | 0.051 lb | 2 |
| 3 ¹ | 500 lb | 500.00 lb | 0.00 lb | 0.10 lb | 2 |
| 4 ¹ | 750 lb | 750.00 lb | 0.00 lb | 0.15 lb | 2 |
| 5 | 1000 lb | 1000.02 lb | 0.02 lb | 0.17 lb | 2.05 |
| 6 ¹ | 750 lb | 750.00 lb | 0.00 lb | 0.15 lb | 2 |
| 7 ¹ | 500 lb | 500.00 lb | 0.00 lb | 0.10 lb | 2 |
| 8 ¹ | 250 lb | 250.00 lb | 0.00 lb | 0.051 lb | 2 |
| 9 | 0 lb | 0.00 lb | 0.00 lb | 0.023 lb | 2.28 |

¹The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



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.

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: NIST NIST-F

| | | | |
|---------------------|----------------------------|-----------------------|--------------------|
| Weight Set No.: | <u>182 50's & 25's</u> | Date of Issue: | <u>25-Jun-2019</u> |
| Certificate Number: | <u>OR-19-186-F</u> | Calibration Due Date: | <u>30-Jun-2021</u> |

Remarks

Equipment condition: Good

Calibration after installation

The recording of false fictitious or fraudulent statements or entries on this document may be punishable as a felony under federal Statute

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: 10.0 · 10⁻⁶ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 10 K

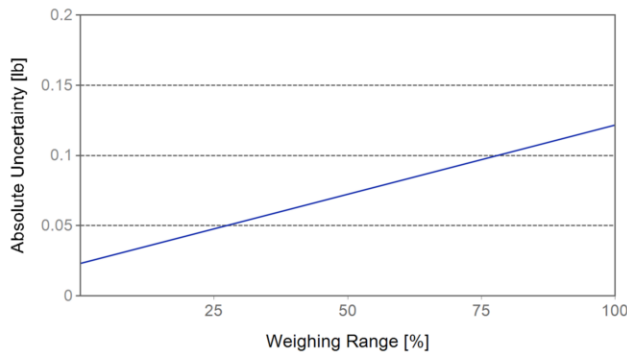
Linearization of Uncertainty Equation

| Range | | | As Found | As Left |
|-------|---------|---------|----------|--|
| | d | Max | | |
| 1 | 0.02 lb | 1000 lb | N/A | $U_1 = 0.023 \text{ lb} + 0.0000986 \text{ lb/lb} \cdot R$ |

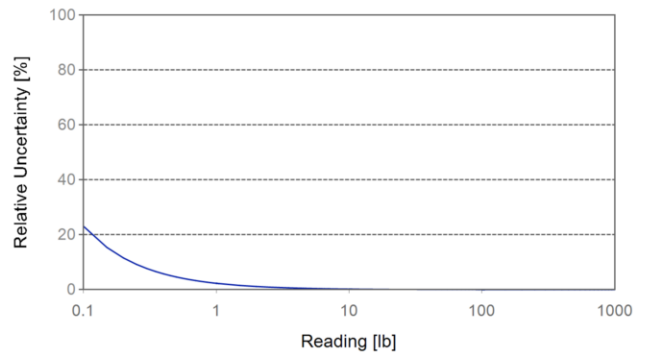
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

| Net Indication | As Found | | As Left | |
|----------------|----------|-----|----------|--------|
| | | | | |
| 1.00 lb | N/A | N/A | 0.023 lb | 2.3% |
| 10.00 lb | N/A | N/A | 0.024 lb | 0.24% |
| 100.00 lb | N/A | N/A | 0.033 lb | 0.033% |
| 500.00 lb | N/A | N/A | 0.072 lb | 0.014% |
| 1000.00 lb | N/A | N/A | 0.12 lb | 0.012% |



As Found



As Left

Handbook 44 Tolerance Assessment(Acceptance)

Assessment done without considering measurement uncertainty.

The measurements from the attached calibration certificate were assessed against the Tolerances defined by NIST Handbook 44.

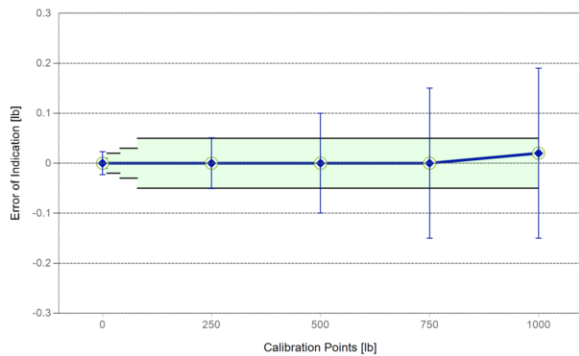
The range of measurements for both Eccentricity and Repeatability (if performed) tests is assessed against Maintenance Tolerances.

Overall **As Found** **As Left**

✔ ✔ ✔ = Passed
✘ = Failed

Weighing Device

| Range | Max. Capacity | Readability (d) | Verification Scale Interval (e) | Class |
|-------|---------------|-----------------|---------------------------------|-------|
| 1 | 1000 lb | 0.02 lb | 0.02 lb | III |



Tolerances according to NIST Handbook 44

| Test Load | | Tolerance |
|-----------|------------|-----------|
| From | To | |
| 0.00 lb | 0.00 lb | 0.005 lb |
| 0.02 lb | 10.00 lb | 0.01 lb |
| 10.02 lb | 40.00 lb | 0.02 lb |
| 40.02 lb | 80.00 lb | 0.03 lb |
| 80.02 lb | 1000.00 lb | 0.05 lb |

○ 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) | 325 lb | 0.05 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| Eccentricity (Range) | 325 lb | 0.1 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| Repeatability (Max. Error) | 500 lb | 0.05 lb | N/A | N/A | 0.02 lb | ✔ |
| Repeatability (Range) | 500 lb | 0.10 lb | N/A | N/A | 0.02 lb | ✔ |

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 lb | 0.01 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| 2 | 250 lb | 0.05 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| 3 | 500 lb | 0.05 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| 4 | 750 lb | 0.05 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| 5 | 1000 lb | 0.05 lb | 0.02 lb | ✔ | 0.02 lb | ✔ |
| 6 | 750 lb | 0.05 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| 7 | 500 lb | 0.05 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| 8 | 250 lb | 0.05 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |
| 9 | 0 lb | 0.01 lb | 0.00 lb | ✔ | 0.00 lb | ✔ |

Report and Certificate of Calibration



www.Cal-Cert.com



Toll Free
800-356-4682

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620

Report #: 32102-201251-4686 Customer PO#: 1102
 Customer Name: PFS TECO
 Customer Address: 11785 SE Highway 212, Suite 305
 City: Clackamas State: OR Zip: 97015
 Contact: Ethan Frederick
 Service Address: 5777 SE International Way Milwaukie, OR 97222

Calibration Standards

| |
|--|
| 10-00954 Gage Block Set Shars SN: 120018 Cal: 05/26/2023 Due: 05/26/2025 Vendor: American Gage Report #: 109141 |
| LP-00397 Gage Block Set Mitutoyo SN: 509020 Cal: 12/28/2022 Due: 12/28/2024 Vendor: BHD Test and Measurement Report #: 99826 |
| LP-01757 Thermo-Hygrometer Comark SN: 06257740560 Cal: 04/28/2023 Due: 04/28/2024 Report #: 29096-209333-4201 |

Instrument Data

| | | | |
|-------------------------------|----------------------|----------------------------|---------------------|
| Calibration Date: | December 6, 2023 | Reference: | Manufacturer's Spec |
| Calibration Due Date: | December 6, 2024 | Cal-Cert Procedure: | CP-115 |
| Calibration Frequency: | 12 Months | Indicating System: | Stamped |
| Manufacturer: | Starrett | Temperature: | 69 °F |
| Type: | Tape Measure | Humidity: | 51% RH |
| Model Number: | Exact | Asset #: | 207 |
| Serial #: | 138054-2203-00002249 | Service Location: | Cal-Cert Lab |
| Capacity: | 192.00 Inches | As Found: | Pass |
| | | As Left: | Pass |

| | | | |
|--------------------------|----------------|--------------------------|----------------|
| Instrument Range: | 192.000 Inches | Range Resolution: | 0.06250 Inches |
|--------------------------|----------------|--------------------------|----------------|

| Calibration Standard | As Found Reading | Verification Reading #1 | Verification Reading #2 |
|----------------------|------------------|-------------------------|-------------------------|
| 0.2500 | 0.2500 | 0.2500 | 0.2500 |
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 6.0000 | 6.0000 | 6.0000 | 6.0000 |
| 12.0000 | 12.0000 | 12.0000 | 12.0000 |
| 64.0000 | 64.0000 | 64.0000 | 64.0000 |
| 128.0000 | 128.0000 | 128.0000 | 128.0000 |
| 192.0000 | 192.0000 | 192.0000 | 192.0000 |

Expanded Uncertainty ± 0.07217 Inches

Remarks:

Metric scale not calibrated.

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs. Cleaning and preventative maintenance were performed as part of this service.

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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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Service Engineer: Scott McGuire Date: December 6, 2023

Technical Manager: Marshall Doyle Signature: *McDoyle*

Report and Certificate of Calibration



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800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620

Report #: 31621-201253-5 **Customer PO#:** 1102
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Ethan Frederick
Service Address: 5777 SE International Way Milwaukie, OR 97222

Calibration Standards

| |
|--|
| LP-00397 Gage Block Set Mitutoyo SN: 509020 Cal: 12/28/2022 Due: 12/28/2024 Vendor: BHD Test and Measurement Report #: 99826 |
| LP-01782 Thermo-Hygrometer Comark SN: 06247790052 Cal: 01/30/2023 Due: 01/31/2024 Range: 122 °F 95 %RH Report #: 27747-205513-4239 |
| |

Instrument Data

| | | | |
|-------------------------------|------------------|----------------------------|--------------------|
| Calibration Date: | October 23, 2023 | Reference: | ASME B89.1.14 2018 |
| Calibration Due Date: | October 23, 2024 | Cal-Cert Procedure: | CP-008 |
| Calibration Frequency: | 12 Months | Indicating System: | Digital |
| Manufacturer: | Mitutoyo | Temperature: | 66 °F |
| Type: | Digital Caliper | Humidity: | 51% RH |
| Model Number: | CD-P6"S | Asset #: | 208 |
| Serial #: | B22159310 | Service Location: | Cal-Cert Lab |
| Capacity: | 6 Inches | As Found: | PASS |
| Resolution: | 0.0005 Inches | As Left: | PASS |

| | | | |
|--------------------------|---------------|--------------------------|---------------|
| Instrument Range: | 6.0000 Inches | Range Resolution: | 0.0005 Inches |
|--------------------------|---------------|--------------------------|---------------|

| Outside Jaws / Linearity | | | | |
|--------------------------|----------|-------------------|-------------------|-------------|
| Calibration Standard | As Found | As Left Reading 1 | As Left Reading 2 | Tolerance ± |
| Inches | Inches | Inches | Inches | Inches |
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.0500 | 0.0495 | 0.0495 | 0.0495 | 0.0010 |
| 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.0010 |
| 0.6000 | 0.6000 | 0.6000 | 0.6000 | 0.0010 |
| 1.2000 | 1.1995 | 1.1995 | 1.1995 | 0.0010 |
| 2.4000 | 2.4000 | 2.4000 | 2.4000 | 0.0010 |
| 3.5000 | 3.5000 | 3.5000 | 3.5000 | 0.0010 |
| 5.0000 | 5.0000 | 5.0000 | 5.0000 | 0.0010 |
| 6.0000 | 5.9995 | 5.9995 | 5.9995 | 0.0010 |

Expanded Uncertainty ± 0.00036 Inches

| Scale Shift Verification | | | |
|--------------------------|------------|----------|-------------|
| | Target | Measured | Tolerance ± |
| Resolution Check | 0.1005 | 0.10050 | N/A |
| Depth | 1.000 | 1.00000 | 0.001 |
| Step | 1.000 | 1.00000 | 0.001 |
| Inside Jaws | 1.000 | 0.99950 | 0.001 |
| Inspections | | | |
| Jaws Parallel | Acceptable | | |

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs. Cleaning and preventative maintenance were performed as part of this service.

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Service Engineer: Cameron Walling **Date:** October 23, 2023
Technical Manager: Marshall Doyle **Signature:** *McDoyle*

Caliper CF-008-01

Revision 17 6/30/2023

Report and Certificate of Calibration



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800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 33086-206391-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

| |
|---|
| 13-01811 Thermocouple Meter/Calibrator Tegam SN: 2454186 Cal: 10/04/2023 Due: 02/28/2024 Range: 2400 °F Report #: 31363-217443-3646 |
| LP-01782 Thermo-Hygrometer Comark SN: 06247790052 Cal: 01/24/2024 Due: 01/31/2025 Range: 122 °F 95 %RH Report #: 32568-205513-3646 |
| |
| |

Instrument Data

| | | | |
|-------------------------------|----------------------|----------------------------|-------------------|
| Calibration Date: | February 26, 2024 | Reference: | Navair 17-20ST-95 |
| Recommended Due Date: | February 26, 2025 | Cal-Cert Procedure: | CP-013 |
| Calibration Frequency: | 12 Months | Indicating System: | Computer |
| Manufacturer: | National Instruments | Temperature: | 64 °F |
| Type: | Data Logger | Humidity: | 39% RH |
| Model Number: | NI 9213 | Asset #: | 215 Booth 1 |
| Serial #: | 1B182FB | Service Location: | Service Address |
| Resolution: | 0.1 °F | As Found: | Pass |
| Capacity: | 2,500 °F | As Left: | Pass |
| Tolerance: | ± 3.0 °F | | |
| Thermocouple Type: | K | | |

| Thermocouple METER FUNCTION | | | | | | |
|--------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Tunnel | 0.00 | 1.10 | 1.10 | 1.10 | 1.10 | 0.346 |
| | 500.00 | 501.10 | 501.10 | 501.10 | 1.10 | |
| | 1000.00 | 1001.10 | 1001.10 | 1001.10 | 1.10 | |
| | 1500.00 | 1501.20 | 1501.20 | 1501.20 | 1.20 | |
| | 2000.00 | 2001.30 | 2001.30 | 2001.30 | 1.30 | |
| | 2400.00 | 2401.40 | 2401.40 | 2401.40 | 1.40 | |
| | 0.00 | 1.20 | 1.20 | 1.20 | 1.20 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Flue | 0.00 | 0.80 | 0.80 | 0.80 | 0.80 | 0.346 |
| | 500.00 | 500.80 | 500.80 | 500.80 | 0.80 | |
| | 1000.00 | 1000.80 | 1000.80 | 1000.80 | 0.80 | |
| | 1500.00 | 1500.90 | 1500.90 | 1500.90 | 0.90 | |
| | 2000.00 | 2001.00 | 2001.00 | 2001.00 | 1.00 | |
| | 2400.00 | 2401.10 | 2401.10 | 2401.10 | 1.10 | |
| | 0.00 | 0.80 | 0.80 | 0.80 | 0.80 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Filter A | 0.00 | 0.60 | 0.60 | 0.60 | 0.60 | 0.346 |
| | 500.00 | 500.60 | 500.60 | 500.60 | 0.60 | |
| | 1000.00 | 1000.70 | 1000.70 | 1000.70 | 0.70 | |
| | 1500.00 | 1500.70 | 1500.70 | 1500.70 | 0.70 | |
| | 2000.00 | 2000.80 | 2000.80 | 2000.80 | 0.80 | |
| | 2400.00 | 2400.00 | 2400.00 | 2400.00 | 0.00 | |
| | 0.00 | 0.60 | 0.60 | 0.60 | 0.60 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Back | 0.00 | 0.40 | 0.40 | 0.40 | 0.40 | 0.346 |
| | 500.00 | 500.40 | 500.40 | 500.40 | 0.40 | |
| | 1000.00 | 1000.50 | 1000.50 | 1000.50 | 0.50 | |
| | 1500.00 | 1500.50 | 1500.50 | 1500.50 | 0.50 | |
| | 2000.00 | 2000.60 | 2000.60 | 2000.60 | 0.60 | |
| | 2400.00 | 2400.70 | 2400.70 | 2400.70 | 0.70 | |
| | 0.00 | 0.50 | 0.50 | 0.50 | 0.50 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Catalyst | 0.00 | 0.30 | 0.30 | 0.30 | 0.30 | 0.346 |
| | 500.00 | 500.20 | 500.20 | 500.20 | 0.20 | |
| | 1000.00 | 1000.30 | 1000.30 | 1000.30 | 0.30 | |
| | 1500.00 | 1500.40 | 1500.40 | 1500.40 | 0.40 | |
| | 2000.00 | 2000.40 | 2000.40 | 2000.40 | 0.40 | |
| | 2400.00 | 2400.40 | 2400.40 | 2400.40 | 0.40 | |
| | 0.00 | 0.20 | 0.20 | 0.20 | 0.20 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Meter A | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.346 |
| | 500.00 | 500.10 | 500.10 | 500.10 | 0.10 | |
| | 1000.00 | 1000.20 | 1000.20 | 1000.20 | 0.20 | |
| | 1500.00 | 1500.20 | 1500.20 | 1500.20 | 0.20 | |
| | 2000.00 | 2000.30 | 2000.30 | 2000.30 | 0.30 | |
| | 2400.00 | 2400.30 | 2400.30 | 2400.30 | 0.30 | |
| | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Left | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.346 |
| | 500.00 | 500.10 | 500.10 | 500.10 | 0.10 | |
| | 1000.00 | 1000.20 | 1000.20 | 1000.20 | 0.20 | |
| | 1500.00 | 1500.20 | 1500.20 | 1500.20 | 0.20 | |
| | 2000.00 | 2000.20 | 2000.20 | 2000.20 | 0.20 | |
| | 2400.00 | 2400.20 | 2400.20 | 2400.20 | 0.20 | |
| | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Right | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.346 |
| | 500.00 | 500.00 | 500.00 | 500.00 | 0.00 | |
| | 1000.00 | 1000.10 | 1000.10 | 1000.10 | 0.10 | |
| | 1500.00 | 1500.10 | 1500.10 | 1500.10 | 0.10 | |
| | 2000.00 | 2000.20 | 2000.20 | 2000.20 | 0.20 | |
| | 2400.00 | 2400.20 | 2400.20 | 2400.20 | 0.20 | |
| | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Filter B | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.346 |
| | 500.00 | 501.30 | 501.30 | 501.30 | 1.30 | |
| | 1000.00 | 1001.00 | 1001.00 | 1001.00 | 1.00 | |
| | 1500.00 | 1500.70 | 1500.70 | 1500.70 | 0.70 | |
| | 2000.00 | 2000.40 | 2000.40 | 2000.40 | 0.40 | |
| | 2400.00 | 2400.00 | 2400.00 | 2400.00 | 0.00 | |
| | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|----------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Top | 0.00 | -0.10 | -0.10 | -0.10 | 0.10 | 0.346 |
| | 500.00 | 499.90 | 499.90 | 499.90 | -0.10 | |
| | 1000.00 | 1000.10 | 1000.10 | 1000.10 | 0.10 | |
| | 1500.00 | 1500.10 | 1500.10 | 1500.10 | 0.10 | |
| | 2000.00 | 2000.10 | 2000.10 | 2000.10 | 0.10 | |
| | 2400.00 | 2400.10 | 2400.10 | 2400.10 | 0.10 | |
| | 0.00 | -0.10 | -0.10 | -0.10 | 0.10 | |

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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Service Engineer: Steven White

Date: February 26, 2024

Technical Manager: Marshall Doyle

Signature: 

Report and Certificate of Calibration



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Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-0620

| | | | |
|--------------------------|---------------------------------|----------------------|-------|
| Report #: | 33086-206391-4525-B | Customer PO#: | 1109 |
| Customer Name: | PFS TECO | | |
| Customer Address: | 1507 Matt Pass | | |
| City: | Cottage Grove | State: | WI |
| Contact: | Ethan Frederick | | |
| Service Address: | 11785 SE Highway 212, Suite 305 | Clackamas, OR | 97015 |
| | | Zip: | 53527 |

Calibration Standards

| |
|---|
| 13-01811 Thermocouple Meter/Calibrator Tegam SN: 2454186 Cal: 10/04/2023 Due: 02/28/2024 Range: 2400 °F Report #: 31363-217443-3646 |
| LP-01782 Thermo-Hygrometer Comark SN: 06247790052 Cal: 01/24/2024 Due: 01/31/2025 Range: 122 °F 95 %RH Report #: 32568-205513-3646 |
| |
| |

Instrument Data

| | | | |
|-------------------------------|----------------------|----------------------------|-------------------|
| Calibration Date: | February 26, 2024 | Reference: | Navair 17-20ST-95 |
| Recommended Due Date: | February 26, 2025 | Cal-Cert Procedure: | CP-013 |
| Calibration Frequency: | 12 Months | Indicating System: | Computer |
| Manufacturer: | National Instruments | Temperature: | 66 °F |
| Type: | Data Logger | Humidity: | 34% RH |
| Model Number: | NI 9213 | Asset #: | 215 Booth 1 |
| Serial #: | 1B182FB | Service Location: | Service Address |
| Resolution: | 0.1 °F | As Found: | Pass |
| Capacity: | 2,500 °F | As Left: | Pass |
| Tolerance: | ± 3.0 °F | | |
| Thermocouple Type: | K | | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|-------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Bottom | 0.00 | -0.10 | -0.10 | -0.10 | 0.10 | 0.346 |
| | 500.00 | 499.90 | 499.90 | 499.90 | -0.10 | |
| | 1000.00 | 1000.00 | 1000.00 | 1000.00 | 0.00 | |
| | 1500.00 | 1500.10 | 1500.10 | 1500.10 | 0.10 | |
| | 2000.00 | 2000.10 | 2000.10 | 2000.10 | 0.10 | |
| | 2400.00 | 2400.00 | 2400.00 | 2400.00 | 0.00 | |
| | 0.00 | -0.10 | -0.10 | -0.10 | 0.10 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|-------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Meter B | 0.00 | -0.10 | -0.10 | -0.10 | 0.10 | 0.346 |
| | 500.00 | 499.90 | 499.90 | 499.90 | -0.10 | |
| | 1000.00 | 1000.10 | 1000.10 | 1000.10 | 0.10 | |
| | 1500.00 | 1500.10 | 1500.10 | 1500.10 | 0.10 | |
| | 2000.00 | 2000.20 | 2000.20 | 2000.20 | 0.20 | |
| | 2400.00 | 2400.20 | 2400.20 | 2400.20 | 0.20 | |
| | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|-------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Meter C | 0.00 | -0.20 | -0.20 | -0.20 | 0.20 | 0.346 |
| | 500.00 | 499.90 | 499.90 | 499.90 | -0.10 | |
| | 1000.00 | 1000.00 | 1000.00 | 1000.00 | 0.00 | |
| | 1500.00 | 1500.00 | 1500.00 | 1500.00 | 0.00 | |
| | 2000.00 | 2000.10 | 2000.10 | 2000.10 | 0.10 | |
| | 2400.00 | 2400.10 | 2400.10 | 2400.10 | 0.10 | |
| | 0.00 | -0.10 | -0.10 | -0.10 | 0.10 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|-------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Filter C | 0.00 | -0.20 | -0.20 | -0.20 | 0.20 | 0.346 |
| | 500.00 | 499.90 | 499.90 | 499.90 | -0.10 | |
| | 1000.00 | 1000.00 | 1000.00 | 1000.00 | 0.00 | |
| | 1500.00 | 1500.10 | 1500.10 | 1500.10 | 0.10 | |
| | 2000.00 | 2000.10 | 2000.10 | 2000.10 | 0.10 | |
| | 2400.00 | 2400.10 | 2400.10 | 2400.10 | 0.10 | |
| | 0.00 | -0.10 | -0.10 | -0.10 | 0.10 | |

| Thermocouple LOGGING FUNCTION | | | | | | |
|-------------------------------|----------------------|--------------|-----------------------|-----------------------|---------------|-----------------------|
| Channel | Calibration Standard | UUT As Found | UUT As Left Reading 1 | UUT As Left Reading 2 | As Left Error | Expanded Uncertainty± |
| Ambient | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.346 |
| | 20.00 | 18.70 | 18.70 | 18.70 | -1.30 | |
| | 40.00 | 38.70 | 38.70 | 38.70 | -1.30 | |
| | 60.00 | 58.90 | 58.90 | 58.90 | -1.10 | |
| | 80.00 | 78.80 | 78.80 | 78.80 | -1.20 | |
| | 100.00 | 98.80 | 98.80 | 98.80 | -1.20 | |
| | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

Remarks:

15 Channels Tested, Ambient is Type T tested from 0-100°F per customer request.

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs. Cleaning and preventative maintenance were performed as part of this service.

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Service Engineer: Steven White

Date: February 26, 2024

Technical Manager: Marshall Doyle

Signature: 



Making our world
more productive

DocNumber: 539508



Linde Gas & Equipment Inc.
5700 S. Alameda Street
Los Angeles CA 90058
Tel: 323-585-2154
Fax: 714-542-6689
PGVP ID: F22023

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

LGEPKG TUALATIN OR H
10450 SW TUALATIN SHERWOOD ROAD
TUALATIN OR 97062-9547

Certificate Issuance Date: 05/08/2023
Linde Order Number: 72422600
Part Number: NI CD17C08E-AS
Customer PO Number: 80430965

Fill Date: 05/02/2023
Lot Number: 70086312207
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 1290 psig 99 ft3

Certified Concentration

| | | |
|------------------|-----------------|----------------------|
| Expiration Date: | 05/08/2031 | NIST Traceable |
| Cylinder Number: | CC505834 | Expanded Uncertainty |
| 16.98 % | Carbon dioxide | ± 0.13 % |
| 4.30 % | Carbon monoxide | ± 0.03 % |
| 17.16 % | Oxygen | ± 0.05 % |
| Balance | Nitrogen | |

ProSpec EZ Cert



Certification Information:

Certification Date: 05/08/2023 Term: 96 Months Expiration Date: 05/08/2031

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Uncertainty above is expressed as absolute expanded uncertainty at a level of confidence of approximately 95% with a coverage factor k = 2. Do Not Use this Standard if Pressure is less than 100 PSIG.

CO2 responses have been corrected for Oxygen IR Broadening effect. O2 responses have been corrected for CO2 interference.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: Carbon dioxide

Requested Concentration: 17 %
Certified Concentration: 16.98 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 04/25/2023

Reference Standard: Type / Cylinder #: NTRM / CC725981
Concentration / Uncertainty: 19.34 % ±0.03 %
Expiration Date: 01/12/2027
Traceable to: SRM # / Sample # / Cylinder #: NTRM / 190701 / CC725973
SRM Concentration / Uncertainty: 19.34% ±0.031%
SRM Expiration Date: 01/12/27

| First Analysis Data: | | | | Date | | | |
|----------------------|-------|----|------------------|------|---------|-------|-------|
| Z: | 0 | R: | 19.34 | C: | 16.98 | Conc: | 16.97 |
| R: | 19.36 | Z: | 0 | C: | 16.99 | Conc: | 16.98 |
| Z: | 0 | C: | 17 | R: | 19.35 | Conc: | 16.99 |
| UOM: | % | | Mean Test Assay: | | 16.98 % | | |

| Second Analysis Data: | | | | Date | | | |
|-----------------------|---|----|---|------|---|-------|---|
| Z: | 0 | R: | 0 | C: | 0 | Conc: | 0 |
| R: | 0 | Z: | 0 | C: | 0 | Conc: | 0 |
| Z: | 0 | C: | 0 | R: | 0 | Conc: | 0 |

2. Component: Carbon monoxide



Compressed gas, n.o.s.
(Carbon Monoxide, Carbon Dioxide, Oxygen,
Nitrogen)

UN1956

SPG 5P10162.5VM2
Part Number

Primary Standard, +/- 0.02% Absolute

| | | |
|-------------------------|------|-----------|
| 2.500 % Carbon Monoxide | CAS: | 630-08-0 |
| 10.00 % Carbon Dioxide | CAS: | 124-38-9 |
| 10.00 % Oxygen | CAS: | 7782-44-7 |
| Balance Nitrogen | CAS: | 7727-37-9 |

DANGER: CAUSES DAMAGE TO ORGANS THROUGH PROLONGED OR REPEATED EXPOSURE. CONTAINS GAS UNDER PRESSURE; MAY EXPLODE WHEN HEATED. MAY DAMAGE FERTILITY OR THE UNBORN CHILD. MAY INCREASE RESPIRATION AND HEARTRATE. Use only with equipment of compatible materials of construction and rated for cylinder pressure. Protect from sunlight when ambient temperature exceeds 52C (125F). Use a back flow preventive device in the piping. Close valve after each use and when empty. Do not open valve until connected to equipment prepared for use. Obtain special instructions before use. Protect from sunlight. Store in a well-ventilated place. IF exposed or concerned: Get medical advice. Store locked up. Dispose of contents/container in accordance with container/supplier owner instructions. Do not handle until all safety precautions have been read and understood. Do not breathe gas. Wash hands thoroughly after handling. Do not eat, drink, or smoke when using this product. Wear protective gloves, protective clothing, eye protection, and/or face protection. Read and follow the Safety Data Sheet (SDS) before use.

FIRST AID: IF ON SKIN: wash with plenty of water. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing. IF exposed or concerned: Get medical advice.



WARNING: This product can expose you to Carbon Monoxide which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Lot No: 1-053-122
Serial Number: CC341544
SPG 5P10162.5VM2
Part Number
PO #: 206483
Expires: 2-2024

NorLAB

To Order Call: 800-657-6672

In Emergency Call: 1-800-424-6300
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