# Non-Confidential Business Information (Non-CBI)

# Certification Test Report

## Hearth & Home Technologies, Inc.

**Heater Type:** Pellet-Fired, Freestanding
**Model:** Absolute43-C

**Prepared for**:
Hearth & Home Technologies, Inc.
352 Mountain House Road
Halifax, PA 17032

**Prepared by:**
OMNI-Test Laboratories, Inc.
13327 NE Airport Way
Portland, OR 97230
(503) 643-3788

**Test Period:** February 20, 2018

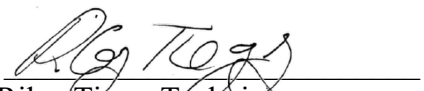
**Report Date:** March, 2018
**Report Revision Date:** May 24, 2023

**Report Number:** 0135PS039E

# AUTHORIZED SIGNATORIES

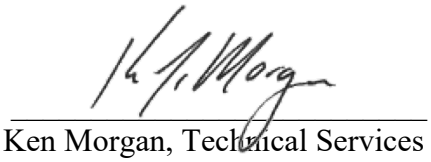
This report has been reviewed and approved by the following authorized signatories:

**Technician:**



Riley Tiegs, Technician
OMNI-Test Laboratories, Inc

**Evaluator:**



Ken Morgan, Technical Services Director
OMNI-Test Laboratories, Inc

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# 1.1 - Appliance Description

**Appliance Manufacturer:** Hearth & Home Technologies, Inc.

**Pellet Stove Model:** Absolute43-C

**Type:** Freestanding, air-circulating type, pellet-fired room heater.

The Absolute43-C's principle elements include a fuel hopper, grey cast iron firebox chamber, ductile iron burn pot, and electrical fuel feed, combustion air, and convection air supply systems. The frame of the unit is constructed of mild steel, as is the outer fascia and door.

Combustion products are routed out of the firebox chamber via a baffle-type heat exchanger through a 3 inch diameter flue outlet located on the rear of the unit.

Fuel is supplied from the hopper to the burn pot via a screw-type auger. Fuel supply rate is varied by cycling the auger motor as needed.

Ashes fall through the burn pot into a removable ash drawer located at the bottom of the unit. The drawer is accessed through the front firebox door, which also features a 10" x 12" glass panel.

The electrical systems are regulated by a user-operated touch screen located on the hopper door to achieve desired heat output. The unit can also be controlled by an external thermostat system.

More detailed information is shown in the manufacturer's design drawings, Appendix C of this report. This information is considered confidential business information (CBI) by the manufacturer and is not included in the non-CBI version of this report.

# Appliance Photographs

Absolute43-C

**Test Date:** 2/20/2018

| | |
|---|---|
|  |  |
| **Absolute43-C Front** | **Absolute43-C Back** |
|  |  |
| **Absolute43-C Left** | **Absolute43-C Right** |

# 1.2 - Procedures and Results Summary

## INTRODUCTION

Hearth & Home Technologies, Inc. retained OMNI-Test Laboratories, Inc. (*OMNI*) to perform U.S. Environmental Protection Agency (EPA) certification testing on the Absolute43-C. The Absolute43-C is a freestanding or insert style pellet-burning residential heating appliance.

The testing was performed at *OMNI*'s testing facility in Portland, Oregon. The altitude of the laboratory is 30 feet above sea level. The unit was received in good condition and logged in at the *OMNI*'s testing facility on February 19, 2018. It was assigned and labeled with *OMNI* ID #2269. *OMNI* representative Aaron Kravitz conducted the certification testing and completed all testing by February 20, 2018.

This report is organized in accordance with the EPA-recommended outline and is summarized in the Table of Contents immediately preceding this section. The results in this report are limited to the item(s) submitted.

## SUMMARY OF RESULTS

The average particulate emission rate over the complete, integrated test run was measured to be 0.99 g/hr.

The average particulate emission factor for the complete, integrated test run was measured to be 0.91 g/dry kg of fuel.

The average thermal efficiency for the complete, integrated test run was measured to be 77.0%.

The particulate emission rate calculated from the one-hour filter was 1.44 g/hr.

The proportionality results and sample train agreement for the test run was acceptable. Quality check results for each test run are presented in Section 3 of this report.

No sampling anomalies occurred during this test series, raw data, certification documents, and results were found to be valid and appropriate for certification to ASTM E2779.

## TESTING PROCEDURE

The Absolute43-C was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standards of Performance for New Residential Wood Heaters using ASTM E2515 and ASTM E2779. The fuel used for certification testing was Lignetics brand densified wood pellet fuel; this fuel was graded as Premium by the Pellet Fuels Institute and was produced at registered mill # 03434. Particulate emissions were measured using dual sampling trains consisting of two sets of filters (front and back).

The unit was installed and adjusted in accordance with the manufacturer's instructions.

The results of the integrated test run indicate an average particulate emission rate of 0.99 g/hr. The Absolute43-C results are within the emission limit of 2.0 g/hr for affected appliances manufactured on or after May 15, 2020 or sold at retail after December 31, 2020.

The model Absolute43-C was tested for thermal efficiency and carbon monoxide (CO) emissions in accordance with CSA B415.1-10. The heater has a demonstrated an average thermal efficiency of 77.0%. The calculated CO emission rate was 0.10 g/min.

Upon completion of emissions certification testing, the sample unit was sealed and will be stored by the manufacturer in accordance with the requirements of the CFR.

**Absolute43-C – Sealed Test Unit**

# 1.3 - Summary Tables

### Table 1 – Pellet Stove Results Summary

| Run # | Date | Setting | Burn Rate (dry kg/h) | Time (min) | Heat Output (Btu/hr) | 1st Hour PM (g/hr) | Total PM (g/hr) | CO Emissions (g/min) | Overall CO (g/min) | Heating Efficiency (% HHV) | Overall Heating Efficiency (% HHV) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Feb 21, 2018 | H | 2.30 | 61 | 44,183 | *1.44 | *0.99 | 0.22 | 0.10 | 79.2% | 77.0% |
| | | M | 1.00 | 120 | 19,132 | | | 0.08 | | 76.5% | |
| | | L | 0.74 | 180 | 14,141 | **1.44 | **0.99 | 0.07 | | 74.9% | |
| | | OA | 1.09 | 361 | 20,876 | | | 0.10 | | 77.0% | |

H= High burn rate, M= Medium burn rate, L= low burn rate, OA= overall burn rate.

*Corrected refers to gravimetric analysis that takes negative filter weights as a negative value in cases where filter residue was transferred to (stuck to) O-ring gaskets to account for the mass transfer.

**Uncorrected refers to gravimetric analysis where negative filter weights are taken as zero, thus reporting a higher value by over-reporting of transferred filter material. The uncorrected values were added to this report in response to a request by the US EPA.

### Table 2 – Test Facility Conditions

| | Initial | Middle | Final |
|---|---|---|---|
| **Room Temperature** (°F) | 72 | 71 | 70 |
| **Barometric Pressure** (in Hg) | 30.25 | 30.26 | 30.26 |
| **Air Velocity** (ft/min) | < 50 | < 50 | < 50 |
| **Induced Draft** (in H2O) | 0 | 0 | 0 |

### Table 3 – Fuel Measurement Summary

| Segment | Time (min) | Burn Rate (dry kg/hr) | Consumed Fuel Weight (lbs) | Fuel Moisture Content (dry basis - %) |
|---|---|---|---|---|
| Pretest | 90 | 2.17 | 7.5 | 4.84 |
| Maximum | 61 | 2.30 | 5.4 | 4.84 |
| Medium | 120 | 1.00 | 4.6 | 4.84 |
| Minimum | 180 | 0.74 | 5.1 | 4.84 |
| Integrated Total | 361 | 1.09 | 15.1 | 4.84 |

### Table 4 – Dilution Tunnel and Flue Gas Measurements

| Segment | Average Flue Draft (in $H_2O$) | Average Dilution Tunnel Gas Measurements | | |
|---|---|---|---|---|
| | | Velocity (ft/sec) | Flow Rate (dscf/min) | Temperature (°F) |
| Integrated Total | -0.042 | 13.56 | 152.0 | 89.5 |

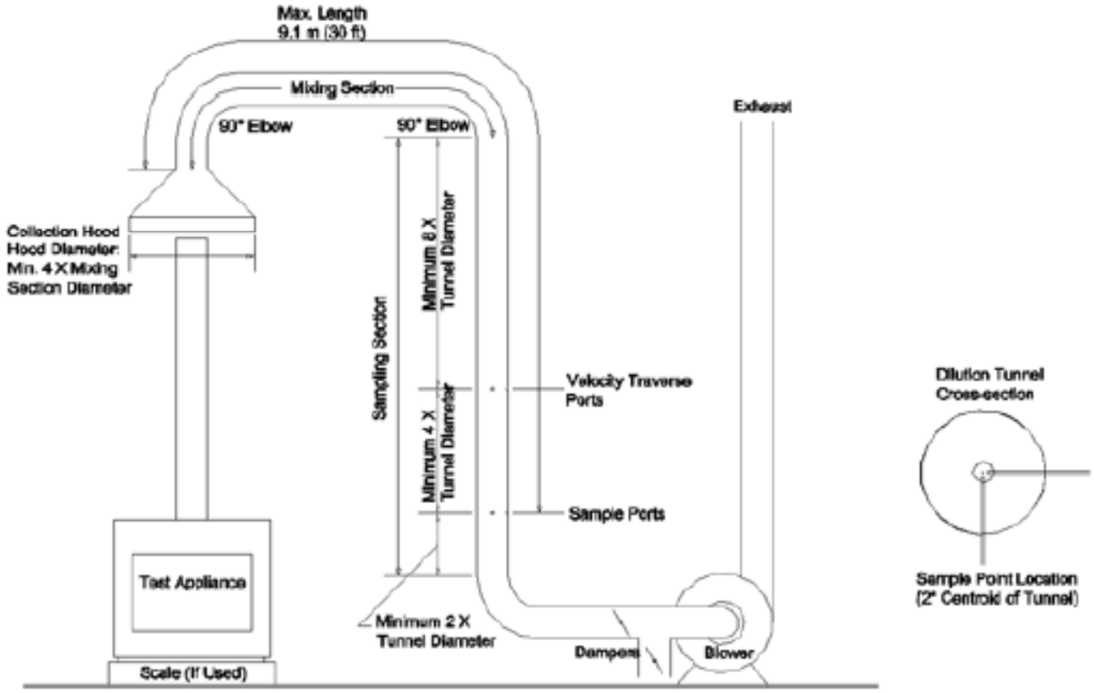
### Table 5 – Heater Configuration

| | Pretest | Burn Rate Segment | | |
|---|---|---|---|---|
| | | Maximum | Medium | Minimum |
| **Const. Burn Setting** | 7.0 (max) | 7.0 (max) | 4.0 | 1.0 (min) |
| **Feed Limit** | 83% | 83% | 37% | 25% |

# Section 2
## Test Data

2.1 Test Data by Run
2.2 Sample Analysis & Tares

## Example of ASTM E2515-11 Dilution Tunnel




Prior to testing, sample point and travers point locations are verified to ensure placement is within specifications. Collection hood, tunnel diameter, and mixing section length are also verified to be within specifications.

# 2.1 - Test Data by Run

Run 1 Notes & Results

# Pellet Heater Conditioning Data - ASTM E2779

| | |
|---|---|
| Manufacturer: | HHT Halifax |
| Model: | Absolute 43-C |
| Tracking No.: | 2269 |
| Project No.: | 0135PS039E |
| Test Date: | January, 2018 |
| Operation Category: | Medium |

| Elapsed Time (hours) | Scale Reading (lbs) | Stack (°F) |
|---|---|---|
| 0 | 17.8 | 434 |
| 1 | 12.4 | 432 |
| 2 | 9.3 | 302 |
| 3 | 6.6 | 300 |
| 4 | 5.2 | 270 |
| 5 | 3.9 | 259 |
| 6 | 2.8 | 267 |
| 7 | 50.5 | 437 |
| 8 | 44.6 | 377 |
| 9 | 42.0 | 308 |
| 10 | 39.4 | 309 |
| 11 | 37.5 | 252 |
| 12 | 35.5 | 249 |
| 13 | 33.8 | 248 |
| 14 | 60.0 | 437 |
| 15 | 54.4 | 438 |
| 16 | 51.3 | 308 |
| 17 | 48.8 | 297 |
| 18 | 47.0 | 244 |
| 19 | 45.0 | 245 |
| 20 | 43.3 | 252 |
| 21 | 48.6 | 447 |
| 22 | 43.1 | 445 |
| 23 | 40.1 | 316 |
| 24 | 37.4 | 315 |
| 25 | 35.3 | 264 |
| 26 | 33.4 | 255 |
| 27 | 31.5 | 256 |
| 28 | 46.1 | 446 |
| 29 | 40.7 | 438 |
| 30 | 37.7 | 311 |
| 31 | 35.1 | 314 |
| 32 | 33.2 | 262 |
| 33 | 31.6 | 261 |
| 34 | 29.7 | 260 |
| 35 | 65.7 | 448 |
| 36 | 60.5 | 455 |
| 37 | 57.6 | 342 |
| 38 | 54.9 | 339 |
| 39 | 53.0 | 289 |
| 40 | 51.0 | 302 |
| 41 | 49.1 | 295 |
| 42 | 58.2 | 449 |
| 43 | 53.1 | 450 |
| 44 | 49.8 | 351 |
| 45 | 47.3 | 345 |
| 46 | 44.8 | 293 |
| 47 | 42.9 | 297 |
| 48 | 41.1 | 287 |
| 49 | 54.3 | 452 |
| 50 | 49.1 | 455 |

**Sturm, Neil (HHT)**

**From:** Sturm, Neil (HHT)
**Sent:** Friday, February 02, 2018 12:25 PM
**To:** Bud Fongeallaz (HHT) (FongeallazB@hearthnhome.com)
**Subject:** ABSOLUTE 43-C

OK here we go. We are going to try to use as many existing programmed parameters as possible to keep the software rewrite as little as possible.

Prior to any test the inside heat exchanger surfaces should be clean. It will not be necessary to clean the combustion fan blade except for any 6 hour test for average effy. and emissions.

**High burn;** Mod. # 999043 (dealers section)
Combustion RPM High - 2800 (dealers section)
Combustion RPM Low - 2000 (dealers section)
Wisper Adjust – 10% (dealers section)
Screen Brightness - Both @ 100% ( Main Menu )
Home Screen Options - Dashboard ( Main Menu )
this will allow you to see RPM and ESP temp. on Home Screen
Set Feed Limit @75% ( Main Menu )
Burn Mode – Constant ( Main Menu )
Set Burn on scale to #7 (Home Screen)
Distribution Blower - Auto ( Main Menu )

Start unit and allow it to stabilize at (about 440 deg) then jump to 81% until stable 455-460 deg.

83% will be as high as you can probably go without exceeding **468 deg.( + 0 / - 1 )**At 470 deg the control will start to reduce the feed

So you will need to watch closely when you get in the 466-468 deg range ( it may be that the unit you have 83% may be too much or not enough to keep a steady 468 or so deg temp without spiking and reducing the feed rate during a test.

The object of this test is to burn a minimum of 5.1 lbs. per hr. at the best efficiency. (lignetic fuel) (83% in the unit we have gives us 5.1 #/hr)

I'm not sure what the fuel you have will do in any of these scenarios.

Achieving best effy. during High Burn; The only thing that can be adjusted during this test is the combustion RPM.

If you increase the RPM by let's say 100 RPMs you may get a better effy. # but you will then exceed the 470 deg and reduce the #/hr.

If you decrease the RPM by 100 RPM ( we never tried this so I don't know) does the effy. go up or down? The nice thing about this RPM reduction is that the ESP temp goes down allowing a higher feed rate %, but I'm not sure whether that helps us or hurts us. You will need to test this out during testing.

The best effy. may be with a dirtier burn so when it comes to the 6 hour test you need to understand we are no going for the cleanest burn (such as we achieved when we were there of 0.70 gph ) as long as it is about 1.0gph. ( I have no idea where this is) The customer only knows Effy.#s therefore we are going for these to be the best we can achieve.

Once you have a stable feed %, RPM, and ESP temp., we would like 2 or3 repeated tests to be sure these settings give us the results we want.

Send a picture of the test result for the NPD files.

**Medium Burn;** Set Feed Limit @~~39~~ 37% ( Main Menu )
Set Burn on scale to #4 (Home Screen)

This is the part of the 6 hour test burn that we need to get our highest effy. #s.

You can change the feed limit up or down, probably only down because we need to stay below 50% of high burn with our #/hr. The combustion RPMs

Will self-adjust up or down automatically with changes in ESP temp.

At the 39% setting we see ESP temp. of about 330 deg. And RPMs of about 2190, and our usage at 2.4 #/hr. So you will need to play with the feed

adjust a couple of % at the most to find the ideal effy. #s.

**Low Burn;** Set Feed Limit @25% ( Main Menu )
Set Burn on scale to #1 (Home Screen)

*OMNI-Test Laboratories, Inc.* **Pellet Heater Certification Run Sheets**

Client: HHT Halifax Project Number: 0135 RBSA 5039F Run Number: 1
Model: Absolute US-C Tracking Number: 2269 Date: 2/20/18
Test Crew: A. Kravitz
OMNI Equipment ID numbers: 335, 336

**ASTM E2779 Run Notes**

**Air Control Settings**

High Burn Rate Target: 100%
Settings: Const. Burn 7.0
Feed Limit 83%

Medium Burn Rate Target: <50%
Settings: Const. Burn 4.0
Feed Limit 37%

Low Burn Rate Target: Minimum
Settings: Const. Burn 1.0
Feed Limit 25%

Additional Settings Notes:
Comb. Fan Max: 2800
Min: 2000
Wisper Adj.: 10%

Pellet Moisture Content: TBD
Pellet Specifications: Lignetics Gold Mill # 03434
Pellet Analysis Notes: TBD

**Preburn Notes**

| Time | Notes |
|---|---|
| ~~60:00~~ | - None |

**Test Notes**

| Time | Notes |
|---|---|
| 60:00 | Changed Filter A |
| 61:00 | Changed settings to Med |
| 181:00 | Changed settings to low |
| 361:00 | Test End |

Technician Signature: Date: 2/20/18

*OMNI-Test Laboratories, Inc.* **Pellet Heater Certification Run Sheets**

Client: HHT Halifax Project Number: 0135 AS03AE Run Number: 1
Model: Absolute 45C Tracking Number: 2269 Date: 2/20/18
Test Crew: A. Krawiec
OMNI Equipment ID numbers: 132, 410, 494, 185, ~~285A~~ 209, 559

**ASTM E2515 Sampling Information**

Test Location: E1 Test Start Time: 07:43

Span Gas Concentrations: $CO_2$: 16.03 CO %: 5.000 CO ppm: 901

| Test Run Validation Checks | Pre Test | Post Test |
|---|---|---|
| Zero Stack Gas Leakage | ✓ | ✓ |
| Zero Pitot Line Leakage | ✓ | ✓ |
| Zero Induced Draft | ✓ | |
| 100% Smoke Capture | ✓ | |

| Test Run Validation Measurements | Pre Test | | Post Test | |
|---|---|---|---|---|
| Scale Audit (lbs) | 10.0 | | 10.0 | |
| $CO_2$ % (Zero/Span) | 0.00 | 16.03 | 0.00 ~~15.71~~ | 15.91 ~~4.849~~ |
| CO % (Zero/Span) | 0.000 | 4.996 | 0.001 | 4.897 |
| CO ppm (Zero/Span) | 0 | 901 | 17 | 913 |
| Sample A Leakage (cfm@"Hg) | 0 @ -12 | | 0 @ -13 | |
| Sample B Leakage (cfm@"Hg) | 0 @ -9 | | 0 @ -12 | |
| Room Air Velocity (ft/min) | <50 | | <50 | |
| Barometric Pressure (" Hg) | 30.25 | | 30.26 | |
| Relative Humidity (%) | 21.7 | | 19.1 | |

**Last Cleaning Dates**

| | |
|---|---|
| Flue Pipe | 2/19/18 |
| Dilution Tunnel | 2/19/18 |
| Sample Dryers | 2/9/18 |

**Dilution Tunnel Traverse**

| Traverse Point | 1 | 2 | Center | 3 | 4 | 5 | 6 | Center | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| Δp (" $H_2O$) | 0.030 | 0.048 | 0.052 | 0.048 | 0.034 | 0.036 | 0.048 | 0.051 | 0.046 | 0.030 |
| T (°F) | 103 | | | | | | | | | |

Technician Signature: Date: 2/20/18

# Pellet Heater Preburn Data - ASTM E2779

| | |
|---|---|
| Manufacturer: | HHT Halifax |
| Model: | Absolute 43-C |
| Tracking No.: | 2269 |
| Project No.: | 0135PS039E |
| Test Date: | 2/21/2018 |

PB Length: 90 min
Recording Interval: 1 min

| | Averages: | 387 | 69 | -0.05 | N/A | N/A |
|---|---|---|---|---|---|---|
| Elapsed Time (min) | Scale Reading | Weight Change | Stack (F) | Ambient (F) | Draft ("H2O) | CO2 (%) | CO (%) |
| 0 | 39.2 | - | 295 | 68 | -0.04 | 7.60 | 0.02 |
| 1 | 39.1 | -0.1 | 304 | 68 | -0.04 | 9.65 | 0.07 |
| 2 | 39.0 | -0.1 | 313 | 69 | -0.04 | 9.52 | 0.04 |
| 3 | 38.9 | -0.1 | 320 | 68 | -0.05 | 8.67 | 0.03 |
| 4 | 38.9 | 0 | 327 | 68 | -0.05 | 8.20 | 0.01 |
| 5 | 38.8 | -0.1 | 335 | 68 | -0.05 | 10.00 | 0.05 |
| 6 | 38.7 | -0.1 | 341 | 68 | -0.05 | 8.71 | 0.01 |
| 7 | 38.6 | -0.1 | 344 | 69 | -0.05 | 8.23 | 0.02 |
| 8 | 38.5 | -0.1 | 348 | 69 | -0.05 | 8.82 | 0.02 |
| 9 | 38.5 | 0 | 351 | 68 | -0.05 | 8.39 | 0.01 |
| 10 | 38.4 | -0.1 | 356 | 68 | -0.05 | 8.66 | 0.01 |
| 11 | 38.3 | -0.1 | 359 | 68 | -0.05 | 8.91 | 0.03 |
| 12 | 38.2 | -0.1 | 360 | 68 | -0.05 | 8.33 | 0.02 |
| 13 | 38.1 | -0.1 | 364 | 68 | -0.05 | 8.73 | 0.01 |
| 14 | 38.1 | 0 | 366 | 69 | -0.05 | 8.51 | 0.02 |
| 15 | 38.0 | -0.1 | 367 | 69 | -0.05 | 7.89 | 0.02 |
| 16 | 37.9 | -0.1 | 372 | 69 | -0.05 | 8.12 | 0.01 |
| 17 | 37.8 | -0.1 | 374 | 68 | -0.05 | 8.87 | 0.03 |
| 18 | 37.8 | 0 | 374 | 68 | -0.05 | 7.60 | 0.02 |
| 19 | 37.9 | 0.1 | 377 | 69 | -0.05 | 8.09 | 0.01 |
| 20 | 37.6 | -0.3 | 378 | 69 | -0.05 | 8.39 | 0.02 |
| 21 | 37.5 | -0.1 | 377 | 68 | -0.05 | 7.56 | 0.03 |
| 22 | 37.1 | -0.4 | 377 | 69 | -0.05 | 0.56 | 0.00 |
| 23 | 37.0 | -0.1 | 377 | 69 | -0.05 | 0.07 | 0.00 |
| 24 | 36.9 | -0.1 | 379 | 69 | -0.05 | 0.06 | 0.00 |
| 25 | 36.8 | -0.1 | 381 | 69 | -0.05 | 0.03 | 0.00 |
| 26 | 36.8 | 0 | 383 | 69 | -0.05 | 0.01 | 0.00 |
| 27 | 36.7 | -0.1 | 384 | 69 | -0.05 | 0.00 | 0.00 |
| 28 | 36.6 | -0.1 | 384 | 69 | -0.05 | 0.00 | 0.00 |
| 29 | 36.5 | -0.1 | 386 | 69 | -0.05 | 0.00 | 0.00 |
| 30 | 36.4 | -0.1 | 386 | 69 | -0.05 | 0.00 | 0.00 |
| 31 | 36.3 | -0.1 | 386 | 69 | -0.05 | 0.00 | 0.00 |
| 32 | 36.3 | 0 | 387 | 69 | -0.05 | 0.00 | 0.00 |
| 33 | 36.2 | -0.1 | 387 | 69 | -0.05 | 0.00 | 0.00 |
| 34 | 36.1 | -0.1 | 388 | 69 | -0.05 | 0.83 | 0.08 |
| 35 | 36.0 | -0.1 | 388 | 69 | -0.05 | 0.95 | 0.09 |
| 36 | 35.9 | -0.1 | 389 | 69 | -0.05 | 12.84 | 4.12 |
| 37 | 35.8 | -0.1 | 391 | 69 | -0.05 | 15.77 | 4.97 |
| 38 | 36.2 | 0.4 | 390 | 69 | -0.05 | 15.41 | 4.76 |
| 39 | 36.1 | -0.1 | 394 | 69 | -0.05 | 9.45 | 0.03 |
| 40 | 36.0 | -0.1 | 395 | 69 | -0.05 | 8.74 | 0.02 |
| 41 | 35.9 | -0.1 | 394 | 69 | -0.05 | 8.21 | 0.02 |
| 42 | 35.9 | 0 | 393 | 69 | -0.05 | 8.51 | 0.02 |
| 43 | 35.8 | -0.1 | 395 | 69 | -0.05 | 9.70 | 0.03 |
| 44 | 35.7 | -0.1 | 395 | 69 | -0.05 | 9.07 | 0.02 |
| 45 | 35.6 | -0.1 | 395 | 69 | -0.05 | 9.35 | 0.03 |

# Pellet Heater Preburn Data - ASTM E2779

| | |
|---|---|
| Manufacturer: | HHT Halifax |
| Model: | Absolute 43-C |
| Tracking No.: | 2269 |
| Project No.: | 0135PS039E |
| Test Date: | 2/21/2018 |

PB Length: 90 min
Recording Interval: 1 min

| | | | Averages: | 387 | 69 | -0.05 | N/A | N/A |
|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Scale Reading | Weight Change | Stack (F) | Ambient (F) | Draft ("H2O) | CO2 (%) | CO (%) |
| 46 | 35.5 | -0.1 | 398 | 69 | -0.05 | 10.31 | 0.04 |
| 47 | 35.4 | -0.1 | 398 | 69 | -0.05 | 9.72 | 0.03 |
| 48 | 35.3 | -0.1 | 399 | 69 | -0.05 | 9.65 | 0.03 |
| 49 | 35.3 | 0 | 398 | 69 | -0.05 | 9.56 | 0.03 |
| 50 | 35.2 | -0.1 | 397 | 69 | -0.05 | 8.96 | 0.01 |
| 51 | 35.1 | -0.1 | 399 | 69 | -0.05 | 9.83 | 0.02 |
| 52 | 35.0 | -0.1 | 399 | 69 | -0.05 | 9.51 | 0.02 |
| 53 | 34.9 | -0.1 | 401 | 69 | -0.05 | 9.47 | 0.01 |
| 54 | 34.8 | -0.1 | 401 | 69 | -0.05 | 9.60 | 0.02 |
| 55 | 34.7 | -0.1 | 401 | 69 | -0.05 | 9.11 | 0.02 |
| 56 | 34.7 | 0 | 400 | 69 | -0.05 | 8.85 | 0.01 |
| 57 | 34.6 | -0.1 | 399 | 69 | -0.05 | 9.16 | 0.04 |
| 58 | 34.5 | -0.1 | 402 | 69 | -0.05 | 10.32 | 0.07 |
| 59 | 34.4 | -0.1 | 404 | 69 | -0.05 | 10.31 | 0.02 |
| 60 | 34.3 | -0.1 | 404 | 69 | -0.05 | 9.78 | 0.04 |
| 61 | 34.4 | 0.1 | 405 | 69 | -0.05 | 10.05 | 0.04 |
| 62 | 34.1 | -0.3 | 406 | 69 | -0.05 | 9.92 | 0.04 |
| 63 | 34.0 | -0.1 | 407 | 69 | -0.05 | 10.35 | 0.03 |
| 64 | 33.9 | -0.1 | 407 | 69 | -0.05 | 9.69 | 0.03 |
| 65 | 33.8 | -0.1 | 407 | 69 | -0.05 | 9.63 | 0.01 |
| 66 | 33.8 | 0 | 405 | 69 | -0.05 | 8.71 | 0.02 |
| 67 | 33.7 | -0.1 | 405 | 69 | -0.05 | 9.49 | 0.01 |
| 68 | 41.6 | 7.9 | 412 | 69 | -0.05 | 9.55 | 0.02 |
| 69 | 41.4 | -0.2 | 406 | 69 | -0.05 | 8.02 | 0.01 |
| 70 | 41.3 | -0.1 | 405 | 69 | -0.05 | 9.45 | 0.02 |
| 71 | 41.2 | -0.1 | 403 | 69 | -0.05 | 9.05 | 0.02 |
| 72 | 41.2 | 0 | 403 | 69 | -0.05 | 9.26 | 0.01 |
| 73 | 41.1 | -0.1 | 403 | 69 | -0.05 | 9.21 | 0.02 |
| 74 | 41.0 | -0.1 | 405 | 69 | -0.05 | 9.19 | 0.01 |
| 75 | 41.0 | 0 | 406 | 69 | -0.06 | 10.35 | 0.05 |
| 76 | 40.9 | -0.1 | 405 | 69 | -0.05 | 9.52 | 0.04 |
| 77 | 40.8 | -0.1 | 405 | 69 | -0.06 | 9.73 | 0.04 |
| 78 | 40.7 | -0.1 | 406 | 69 | -0.06 | 10.26 | 0.06 |
| 79 | 40.6 | -0.1 | 406 | 69 | -0.05 | 9.52 | 0.02 |
| 80 | 40.5 | -0.1 | 407 | 69 | -0.05 | 10.09 | 0.06 |
| 81 | 40.4 | -0.1 | 408 | 69 | -0.05 | 10.63 | 0.08 |
| 82 | 40.3 | -0.1 | 409 | 69 | -0.06 | 10.21 | 0.03 |
| 83 | 40.2 | -0.1 | 409 | 69 | -0.06 | 9.36 | 0.06 |
| 84 | 40.1 | -0.1 | 408 | 69 | -0.06 | 9.00 | 0.03 |
| 85 | 40.0 | -0.1 | 410 | 69 | -0.06 | 11.64 | 0.08 |
| 86 | 40.0 | 0 | 410 | 69 | -0.06 | 10.02 | 0.05 |
| 87 | 39.9 | -0.1 | 410 | 69 | -0.06 | 9.85 | 0.02 |
| 88 | 39.8 | -0.1 | 409 | 69 | -0.06 | 9.14 | 0.01 |
| 89 | 39.7 | -0.1 | 408 | 69 | -0.06 | 10.09 | 0.03 |
| 90 | 39.6 | -0.1 | 408 | 70 | -0.06 | 10.37 | 0.03 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure:

| Begin | Middle | End | Average | |
|---|---|---|---|---|
| 30.25 | 30.26 | 30.26 | 30.26 | "Hg |

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 0 | 0.000 | 0.000 | | | 0.87 | 73 | 1.6 | 0.36 | 73 | 0.8 | 103 | 0.052 | | | 15.1 | | 408 | 68 | 68 | 70 | -0.056 | 10.15 | 0.030 | 70 | 71 |
| 1 | 0.154 | 0.162 | 0.15 | 0.16 | 1.35 | 73 | 2.01 | 1.17 | 73 | 1.2 | 103 | 0.052 | 96 | 102 | 15.0 | -0.1 | 409 | 69 | 69 | 69 | -0.055 | 10.53 | 0.036 | 71 | 71 |
| 2 | 0.318 | 0.328 | 0.16 | 0.17 | 1.35 | 73 | 2.02 | 1.17 | 73 | 1.2 | 103 | 0.051 | 104 | 106 | 14.9 | -0.1 | 409 | 69 | 69 | 69 | -0.056 | 10.26 | 0.039 | 71 | 71 |
| 3 | 0.481 | 0.494 | 0.16 | 0.17 | 1.35 | 73 | 2.02 | 1.16 | 73 | 1.2 | 103 | 0.050 | 104 | 107 | 14.8 | -0.1 | 410 | 70 | 70 | 69 | -0.056 | 10.94 | 0.160 | 71 | 71 |
| 4 | 0.644 | 0.659 | 0.16 | 0.17 | 1.35 | 73 | 2.02 | 1.11 | 73 | 1.2 | 103 | 0.050 | 104 | 106 | 14.7 | -0.1 | 410 | 70 | 70 | 69 | -0.056 | 9.73 | 0.051 | 72 | 71 |
| 5 | 0.806 | 0.821 | 0.16 | 0.16 | 1.35 | 73 | 2.02 | 1.10 | 73 | 1.2 | 103 | 0.051 | 102 | 103 | 14.6 | -0.1 | 409 | 70 | 70 | 69 | -0.056 | 9.59 | 0.039 | 72 | 71 |
| 6 | 0.970 | 0.982 | 0.16 | 0.16 | 1.35 | 73 | 2.02 | 1.10 | 73 | 1.2 | 104 | 0.050 | 105 | 104 | 14.6 | 0 | 411 | 70 | 70 | 69 | -0.056 | 10.92 | 0.043 | 72 | 72 |
| 7 | 1.133 | 1.144 | 0.16 | 0.16 | 1.35 | 73 | 2.01 | 1.10 | 73 | 1.2 | 104 | 0.051 | 103 | 103 | 14.5 | -0.1 | 414 | 71 | 70 | 69 | -0.056 | 10.85 | 0.070 | 72 | 72 |
| 8 | 1.297 | 1.307 | 0.16 | 0.16 | 1.35 | 73 | 2.01 | 1.10 | 74 | 1.2 | 104 | 0.050 | 105 | 105 | 14.4 | -0.1 | 413 | 71 | 71 | 69 | -0.056 | 10.34 | 0.052 | 72 | 72 |
| 9 | 1.459 | 1.469 | 0.16 | 0.16 | 1.34 | 74 | 2.01 | 1.10 | 74 | 1.2 | 104 | 0.051 | 102 | 103 | 14.3 | -0.1 | 411 | 71 | 71 | 69 | -0.055 | 9.40 | 0.032 | 72 | 72 |
| 10 | 1.622 | 1.631 | 0.16 | 0.16 | 1.33 | 74 | 2.01 | 1.10 | 74 | 1.2 | 104 | 0.051 | 103 | 103 | 14.2 | -0.1 | 411 | 71 | 71 | 69 | -0.055 | 9.66 | 0.045 | 72 | 72 |
| 11 | 1.784 | 1.793 | 0.16 | 0.16 | 1.34 | 74 | 2 | 1.10 | 74 | 1.2 | 104 | 0.050 | 103 | 104 | 14.1 | -0.1 | 410 | 71 | 71 | 69 | -0.055 | 10.11 | 0.032 | 73 | 72 |
| 12 | 1.947 | 1.955 | 0.16 | 0.16 | 1.34 | 74 | 2.01 | 1.10 | 74 | 1.2 | 104 | 0.049 | 105 | 105 | 14.0 | -0.1 | 409 | 72 | 71 | 69 | -0.055 | 9.24 | 0.017 | 73 | 73 |
| 13 | 2.110 | 2.117 | 0.16 | 0.16 | 1.34 | 74 | 2.01 | 1.09 | 74 | 1.2 | 104 | 0.050 | 104 | 104 | 13.9 | -0.1 | 410 | 72 | 72 | 70 | -0.056 | 10.86 | 0.049 | 73 | 73 |
| 14 | 2.272 | 2.278 | 0.16 | 0.16 | 1.34 | 74 | 2.01 | 1.09 | 74 | 1.2 | 104 | 0.050 | 103 | 104 | 13.9 | 0 | 410 | 72 | 72 | 70 | -0.056 | 10.36 | 0.038 | 73 | 73 |
| 15 | 2.436 | 2.440 | 0.16 | 0.16 | 1.33 | 74 | 2.01 | 1.09 | 74 | 1.2 | 104 | 0.050 | 105 | 104 | 13.8 | -0.1 | 409 | 72 | 72 | 70 | -0.055 | 9.66 | 0.022 | 73 | 73 |
| 16 | 2.598 | 2.602 | 0.16 | 0.16 | 1.33 | 74 | 2 | 1.09 | 74 | 1.2 | 104 | 0.050 | 103 | 104 | 13.7 | -0.1 | 409 | 72 | 72 | 69 | -0.055 | 10.16 | 0.049 | 73 | 73 |
| 17 | 2.761 | 2.763 | 0.16 | 0.16 | 1.33 | 75 | 2 | 1.09 | 75 | 1.2 | 104 | 0.050 | 104 | 103 | 13.6 | -0.1 | 408 | 72 | 72 | 69 | -0.055 | 8.96 | 0.020 | 74 | 73 |
| 18 | 2.923 | 2.924 | 0.16 | 0.16 | 1.33 | 75 | 2.01 | 1.09 | 75 | 1.2 | 104 | 0.053 | 100 | 100 | 13.5 | -0.1 | 408 | 72 | 72 | 69 | -0.055 | 10.67 | 0.047 | 74 | 73 |
| 19 | 3.085 | 3.086 | 0.16 | 0.16 | 1.34 | 75 | 2 | 1.09 | 75 | 1.2 | 103 | 0.053 | 100 | 101 | 13.4 | -0.1 | 408 | 73 | 72 | 69 | -0.055 | 10.36 | 0.060 | 74 | 73 |
| 20 | 3.247 | 3.248 | 0.16 | 0.16 | 1.33 | 75 | 2.01 | 1.09 | 75 | 1.2 | 104 | 0.048 | 105 | 106 | 13.3 | -0.1 | 411 | 73 | 72 | 69 | -0.056 | 11.10 | 0.051 | 74 | 73 |
| 21 | 3.411 | 3.409 | 0.16 | 0.16 | 1.34 | 75 | 2.01 | 1.09 | 75 | 1.2 | 104 | 0.050 | 104 | 103 | 13.2 | -0.1 | 412 | 73 | 72 | 69 | -0.055 | 10.44 | 0.050 | 74 | 74 |
| 22 | 3.574 | 3.571 | 0.16 | 0.16 | 1.33 | 75 | 2.01 | 1.09 | 75 | 1.2 | 104 | 0.051 | 103 | 103 | 13.2 | 0 | 411 | 73 | 72 | 69 | -0.056 | 9.76 | 0.026 | 74 | 74 |
| 23 | 3.736 | 3.732 | 0.16 | 0.16 | 1.33 | 75 | 2 | 1.09 | 75 | 1.2 | 104 | 0.052 | 101 | 101 | 13.1 | -0.1 | 410 | 73 | 73 | 69 | -0.055 | 10.10 | 0.056 | 74 | 74 |
| 24 | 3.898 | 3.894 | 0.16 | 0.16 | 1.33 | 76 | 2.01 | 1.09 | 76 | 1.2 | 104 | 0.050 | 103 | 104 | 13.0 | -0.1 | 411 | 73 | 73 | 69 | -0.055 | 10.67 | 0.044 | 74 | 74 |
| 25 | 4.061 | 4.055 | 0.16 | 0.16 | 1.33 | 76 | 2.01 | 1.08 | 76 | 1.2 | 103 | 0.052 | 101 | 101 | 12.9 | -0.1 | 411 | 73 | 73 | 69 | -0.055 | 9.45 | 0.021 | 75 | 74 |
| 26 | 4.223 | 4.216 | 0.16 | 0.16 | 1.33 | 76 | 2.01 | 1.09 | 76 | 1.2 | 104 | 0.051 | 102 | 102 | 12.8 | -0.1 | 412 | 73 | 73 | 69 | -0.056 | 10.33 | 0.032 | 75 | 74 |
| 27 | 4.386 | 4.378 | 0.16 | 0.16 | 1.33 | 76 | 2.01 | 1.08 | 76 | 1.2 | 104 | 0.049 | 105 | 105 | 12.7 | -0.1 | 413 | 73 | 73 | 69 | -0.056 | 10.06 | 0.047 | 75 | 74 |
| 28 | 4.549 | 4.540 | 0.16 | 0.16 | 1.33 | 76 | 2.01 | 1.09 | 76 | 1.2 | 104 | 0.049 | 105 | 105 | 12.6 | -0.1 | 412 | 73 | 73 | 70 | -0.056 | 10.31 | 0.048 | 75 | 74 |
| 29 | 4.712 | 4.701 | 0.16 | 0.16 | 1.33 | 76 | 2.01 | 1.08 | 76 | 1.2 | 104 | 0.050 | 104 | 103 | 12.5 | -0.1 | 412 | 73 | 73 | 69 | -0.056 | 9.94 | 0.035 | 75 | 74 |
| 30 | 4.874 | 4.862 | 0.16 | 0.16 | 1.32 | 77 | 2.01 | 1.08 | 77 | 1.2 | 104 | 0.051 | 102 | 102 | 12.4 | -0.1 | 412 | 74 | 73 | 69 | -0.055 | 9.92 | 0.053 | 75 | 74 |
| 31 | 5.040 | 5.026 | 0.17 | 0.16 | 1.32 | 77 | 2.01 | 1.09 | 77 | 1.2 | 104 | 0.052 | 103 | 103 | 12.4 | 0 | 412 | 74 | 73 | 69 | -0.055 | 10.26 | 0.027 | 75 | 74 |
| 32 | 5.202 | 5.189 | 0.16 | 0.16 | 1.32 | 77 | 2.01 | 1.09 | 77 | 1.2 | 104 | 0.050 | 103 | 104 | 12.3 | -0.1 | 411 | 74 | 73 | 69 | -0.056 | 10.14 | 0.034 | 75 | 74 |
| 33 | 5.364 | 5.349 | 0.16 | 0.16 | 1.33 | 77 | 2.01 | 1.08 | 77 | 1.2 | 104 | 0.051 | 102 | 101 | 12.2 | -0.1 | 414 | 74 | 73 | 70 | -0.056 | 11.38 | 0.070 | 75 | 74 |
| 34 | 5.527 | 5.511 | 0.16 | 0.16 | 1.33 | 77 | 2.01 | 1.09 | 77 | 1.2 | 103 | 0.051 | 102 | 103 | 12.1 | -0.1 | 414 | 74 | 73 | 69 | -0.056 | 10.17 | 0.043 | 75 | 75 |
| 35 | 5.690 | 5.672 | 0.16 | 0.16 | 1.32 | 77 | 2.01 | 1.08 | 77 | 1.2 | 104 | 0.051 | 102 | 102 | 12.0 | -0.1 | 415 | 74 | 73 | 69 | -0.056 | 10.59 | 0.047 | 76 | 75 |
| 36 | 5.854 | 5.834 | 0.16 | 0.16 | 1.33 | 77 | 2.01 | 1.08 | 77 | 1.2 | 103 | 0.051 | 103 | 103 | 11.9 | -0.1 | 414 | 74 | 73 | 69 | -0.056 | 9.46 | 0.032 | 76 | 75 |
| 37 | 6.016 | 5.995 | 0.16 | 0.16 | 1.32 | 77 | 2.01 | 1.08 | 78 | 1.2 | 104 | 0.052 | 101 | 101 | 11.8 | -0.1 | 414 | 74 | 73 | 69 | -0.056 | 10.06 | 0.020 | 76 | 75 |
| 38 | 6.179 | 6.157 | 0.16 | 0.16 | 1.32 | 78 | 2.02 | 1.08 | 78 | 1.2 | 104 | 0.049 | 104 | 105 | 11.8 | 0 | 414 | 74 | 74 | 69 | -0.056 | 9.45 | 0.021 | 76 | 75 |
| 39 | 6.341 | 6.319 | 0.16 | 0.16 | 1.33 | 78 | 2.02 | 1.08 | 78 | 1.2 | 104 | 0.053 | 100 | 101 | 11.7 | -0.1 | 415 | 74 | 74 | 69 | -0.056 | 10.70 | 0.025 | 76 | 75 |
| 40 | 6.504 | 6.480 | 0.16 | 0.16 | 1.33 | 78 | 2.02 | 1.08 | 78 | 1.2 | 104 | 0.052 | 101 | 101 | 11.6 | -0.1 | 414 | 74 | 74 | 69 | -0.056 | 10.59 | 0.078 | 76 | 75 |
| 41 | 6.667 | 6.641 | 0.16 | 0.16 | 1.33 | 78 | 2.02 | 1.08 | 78 | 1.2 | 104 | 0.053 | 100 | 100 | 11.5 | -0.1 | 414 | 74 | 74 | 69 | -0.056 | 9.94 | 0.015 | 76 | 75 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure:

| Begin | Middle | End | Average |
|---|---|---|---|
| 30.25 | 30.26 | 30.26 | 30.26 "Hg |

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 42 | 6.830 | 6.803 | 0.16 | 0.16 | 1.33 | 78 | 2.02 | 1.08 | 78 | 1.2 | 104 | 0.052 | 101 | 101 | 11.4 | -0.1 | 414 | 74 | 74 | 69 | -0.056 | 10.19 | 0.030 | 76 | 75 |
| 43 | 6.993 | 6.965 | 0.16 | 0.16 | 1.32 | 78 | 2.02 | 1.08 | 78 | 1.2 | 104 | 0.051 | 102 | 102 | 11.3 | -0.1 | 413 | 74 | 74 | 69 | -0.055 | 9.78 | 0.047 | 76 | 75 |
| 44 | 7.156 | 7.126 | 0.16 | 0.16 | 1.32 | 78 | 2.03 | 1.08 | 78 | 1.2 | 104 | 0.050 | 103 | 103 | 11.2 | -0.1 | 412 | 74 | 74 | 69 | -0.056 | 9.89 | 0.036 | 76 | 75 |
| 45 | 7.319 | 7.288 | 0.16 | 0.16 | 1.32 | 78 | 2.02 | 1.09 | 78 | 1.2 | 104 | 0.051 | 102 | 102 | 11.1 | -0.1 | 411 | 74 | 74 | 69 | -0.056 | 9.94 | 0.039 | 76 | 75 |
| 46 | 7.482 | 7.449 | 0.16 | 0.16 | 1.33 | 78 | 2.03 | 1.08 | 78 | 1.2 | 104 | 0.049 | 104 | 104 | 11.1 | 0 | 412 | 74 | 74 | 69 | -0.056 | 10.65 | 0.087 | 76 | 75 |
| 47 | 7.644 | 7.611 | 0.16 | 0.16 | 1.32 | 79 | 2.03 | 1.08 | 79 | 1.2 | 104 | 0.050 | 102 | 103 | 11.0 | -0.1 | 412 | 74 | 74 | 70 | -0.055 | 10.43 | 0.130 | 76 | 75 |
| 48 | 7.807 | 7.772 | 0.16 | 0.16 | 1.33 | 79 | 2.03 | 1.08 | 79 | 1.2 | 104 | 0.051 | 102 | 102 | 10.9 | -0.1 | 409 | 74 | 74 | 70 | -0.056 | 8.85 | 0.029 | 77 | 75 |
| 49 | 7.970 | 7.934 | 0.16 | 0.16 | 1.33 | 79 | 2.03 | 1.08 | 79 | 1.2 | 103 | 0.051 | 102 | 102 | 10.8 | -0.1 | 408 | 74 | 74 | 70 | -0.055 | 9.01 | 0.026 | 77 | 75 |
| 50 | 8.134 | 8.095 | 0.16 | 0.16 | 1.32 | 79 | 2.02 | 1.08 | 79 | 1.2 | 104 | 0.049 | 105 | 104 | 10.7 | -0.1 | 409 | 74 | 74 | 70 | -0.055 | 10.32 | 0.069 | 77 | 75 |
| 51 | 8.297 | 8.257 | 0.16 | 0.16 | 1.32 | 79 | 2.03 | 1.08 | 79 | 1.2 | 104 | 0.049 | 104 | 104 | 10.6 | -0.1 | 410 | 74 | 74 | 70 | -0.056 | 9.79 | 0.019 | 77 | 75 |
| 52 | 8.460 | 8.418 | 0.16 | 0.16 | 1.32 | 79 | 2.03 | 1.07 | 79 | 1.2 | 103 | 0.050 | 103 | 103 | 10.5 | -0.1 | 409 | 74 | 74 | 71 | -0.056 | 9.75 | 0.027 | 77 | 75 |
| 53 | 8.622 | 8.580 | 0.16 | 0.16 | 1.32 | 79 | 2.03 | 1.08 | 79 | 1.2 | 104 | 0.049 | 103 | 104 | 10.5 | 0 | 411 | 75 | 74 | 71 | -0.055 | 9.71 | 0.035 | 77 | 75 |
| 54 | 8.785 | 8.741 | 0.16 | 0.16 | 1.32 | 79 | 2.04 | 1.08 | 79 | 1.2 | 103 | 0.051 | 102 | 102 | 10.4 | -0.1 | 410 | 75 | 74 | 71 | -0.055 | 10.17 | 0.038 | 77 | 75 |
| 55 | 8.948 | 8.903 | 0.16 | 0.16 | 1.33 | 79 | 2.04 | 1.07 | 79 | 1.2 | 103 | 0.051 | 102 | 102 | 10.3 | -0.1 | 410 | 75 | 74 | 71 | -0.056 | 10.01 | 0.058 | 77 | 75 |
| 56 | 9.111 | 9.064 | 0.16 | 0.16 | 1.32 | 79 | 2.04 | 1.08 | 79 | 1.2 | 104 | 0.049 | 104 | 104 | 10.2 | -0.1 | 412 | 75 | 74 | 71 | -0.055 | 11.52 | 0.150 | 77 | 75 |
| 57 | 9.274 | 9.225 | 0.16 | 0.16 | 1.32 | 80 | 2.04 | 1.08 | 80 | 1.2 | 104 | 0.050 | 103 | 102 | 10.1 | -0.1 | 412 | 75 | 74 | 71 | -0.056 | 10.73 | 0.085 | 77 | 75 |
| 58 | 9.437 | 9.387 | 0.16 | 0.16 | 1.32 | 80 | 2.03 | 1.07 | 80 | 1.2 | 104 | 0.051 | 102 | 102 | 10.0 | -0.1 | 413 | 75 | 74 | 71 | -0.056 | 10.71 | 0.066 | 77 | 76 |
| 59 | 9.600 | 9.548 | 0.16 | 0.16 | 1.32 | 80 | 2.04 | 1.07 | 80 | 1.2 | 104 | 0.053 | 100 | 100 | 9.9 | -0.1 | 412 | 75 | 74 | 71 | -0.056 | 10.82 | 0.065 | 77 | 76 |
| 60 | 9.766 | 9.709 | 0.17 | 0.16 | 1.34 | 80 | 1.99 | 1.07 | 80 | 1.2 | 103 | 0.050 | 105 | 102 | 9.8 | -0.1 | 411 | 75 | 74 | 71 | -0.056 | 9.63 | 0.036 | 77 | 76 |
| 61 | 9.929 | 9.870 | 0.16 | 0.16 | 1.32 | 80 | 2.03 | 1.08 | 80 | 1.2 | 104 | 0.051 | 102 | 101 | 9.7 | -0.1 | 411 | 75 | 74 | 71 | -0.056 | 10.28 | 0.200 | 77 | 76 |
| 62 | 10.092 | 10.032 | 0.16 | 0.16 | 1.32 | 80 | 2.02 | 1.08 | 80 | 1.2 | 103 | 0.053 | 100 | 100 | 9.7 | 0 | 407 | 76 | 74 | 71 | -0.055 | 7.47 | 0.018 | 77 | 76 |
| 63 | 10.255 | 10.193 | 0.16 | 0.16 | 1.33 | 80 | 2.02 | 1.08 | 80 | 1.2 | 102 | 0.051 | 102 | 101 | 9.6 | -0.1 | 398 | 76 | 74 | 71 | -0.054 | 5.03 | 0.041 | 77 | 76 |
| 64 | 10.418 | 10.355 | 0.16 | 0.16 | 1.33 | 80 | 2.02 | 1.08 | 80 | 1.2 | 101 | 0.050 | 103 | 103 | 9.6 | 0 | 387 | 76 | 74 | 71 | -0.053 | 4.19 | 0.021 | 77 | 76 |
| 65 | 10.582 | 10.516 | 0.16 | 0.16 | 1.33 | 80 | 2.02 | 1.07 | 80 | 1.2 | 100 | 0.051 | 102 | 101 | 9.6 | 0 | 376 | 76 | 74 | 71 | -0.052 | 3.80 | 0.025 | 77 | 76 |
| 66 | 10.745 | 10.678 | 0.16 | 0.16 | 1.33 | 80 | 2.02 | 1.07 | 80 | 1.2 | 99 | 0.053 | 99 | 100 | 9.6 | 0 | 366 | 76 | 74 | 71 | -0.051 | 3.83 | 0.017 | 77 | 76 |
| 67 | 10.910 | 10.839 | 0.17 | 0.16 | 1.32 | 80 | 2.02 | 1.08 | 80 | 1.2 | 98 | 0.052 | 101 | 100 | 9.5 | -0.1 | 357 | 75 | 74 | 71 | -0.049 | 3.73 | 0.022 | 77 | 75 |
| 68 | 11.073 | 11.000 | 0.16 | 0.16 | 1.33 | 80 | 2.01 | 1.08 | 81 | 1.2 | 98 | 0.052 | 100 | 100 | 9.5 | 0 | 347 | 75 | 74 | 71 | -0.048 | 3.32 | 0.018 | 77 | 75 |
| 69 | 11.237 | 11.162 | 0.16 | 0.16 | 1.32 | 81 | 2.01 | 1.07 | 81 | 1.2 | 97 | 0.050 | 103 | 102 | 9.5 | 0 | 339 | 75 | 74 | 71 | -0.047 | 3.58 | 0.019 | 77 | 75 |
| 70 | 11.400 | 11.323 | 0.16 | 0.16 | 1.32 | 81 | 2.02 | 1.07 | 81 | 1.2 | 95 | 0.053 | 99 | 99 | 9.5 | 0 | 331 | 75 | 74 | 71 | -0.047 | 3.90 | 0.020 | 77 | 75 |
| 71 | 11.564 | 11.485 | 0.16 | 0.16 | 1.33 | 81 | 2.02 | 1.08 | 81 | 1.2 | 95 | 0.051 | 101 | 101 | 9.4 | -0.1 | 322 | 75 | 74 | 71 | -0.045 | 2.74 | 0.027 | 76 | 75 |
| 72 | 11.727 | 11.646 | 0.16 | 0.16 | 1.32 | 81 | 2.02 | 1.07 | 81 | 1.3 | 94 | 0.051 | 101 | 100 | 9.4 | 0 | 317 | 75 | 74 | 71 | -0.045 | 4.51 | 0.022 | 76 | 75 |
| 73 | 11.891 | 11.808 | 0.16 | 0.16 | 1.33 | 81 | 2.01 | 1.07 | 81 | 1.2 | 93 | 0.050 | 102 | 102 | 9.4 | 0 | 311 | 75 | 74 | 71 | -0.044 | 3.49 | 0.022 | 76 | 75 |
| 74 | 12.055 | 11.969 | 0.16 | 0.16 | 1.33 | 81 | 2.01 | 1.07 | 81 | 1.2 | 93 | 0.051 | 101 | 100 | 9.4 | 0 | 304 | 75 | 74 | 71 | -0.044 | 3.71 | 0.027 | 76 | 74 |
| 75 | 12.218 | 12.130 | 0.16 | 0.16 | 1.33 | 81 | 2.01 | 1.07 | 81 | 1.2 | 92 | 0.049 | 103 | 102 | 9.3 | -0.1 | 301 | 75 | 74 | 71 | -0.043 | 4.07 | 0.024 | 76 | 74 |
| 76 | 12.383 | 12.292 | 0.16 | 0.16 | 1.34 | 81 | 2.01 | 1.07 | 81 | 1.3 | 91 | 0.051 | 102 | 101 | 9.3 | 0 | 300 | 75 | 74 | 71 | -0.043 | 5.38 | 0.020 | 76 | 74 |
| 77 | 12.547 | 12.453 | 0.16 | 0.16 | 1.33 | 81 | 2.02 | 1.08 | 81 | 1.3 | 91 | 0.049 | 103 | 102 | 9.2 | -0.1 | 298 | 75 | 74 | 71 | -0.042 | 4.48 | 0.020 | 76 | 74 |
| 78 | 12.711 | 12.614 | 0.16 | 0.16 | 1.33 | 81 | 2.02 | 1.07 | 81 | 1.2 | 91 | 0.049 | 103 | 102 | 9.2 | 0 | 296 | 75 | 74 | 71 | -0.043 | 5.02 | 0.039 | 76 | 74 |
| 79 | 12.874 | 12.776 | 0.16 | 0.16 | 1.33 | 81 | 2.01 | 1.08 | 81 | 1.3 | 91 | 0.051 | 100 | 101 | 9.1 | -0.1 | 297 | 75 | 74 | 71 | -0.043 | 6.07 | 0.017 | 76 | 74 |
| 80 | 13.038 | 12.938 | 0.16 | 0.16 | 1.33 | 81 | 2.02 | 1.07 | 81 | 1.3 | 91 | 0.051 | 101 | 101 | 9.1 | 0 | 294 | 75 | 74 | 71 | -0.042 | 4.28 | 0.022 | 76 | 74 |
| 81 | 13.201 | 13.099 | 0.16 | 0.16 | 1.33 | 81 | 2.01 | 1.07 | 81 | 1.3 | 90 | 0.049 | 102 | 102 | 9.1 | 0 | 293 | 75 | 74 | 71 | -0.042 | 5.25 | 0.026 | 76 | 74 |
| 82 | 13.365 | 13.260 | 0.16 | 0.16 | 1.33 | 81 | 2.01 | 1.07 | 81 | 1.3 | 90 | 0.052 | 100 | 99 | 9.0 | -0.1 | 291 | 74 | 74 | 71 | -0.042 | 4.56 | 0.027 | 76 | 74 |
| 83 | 13.529 | 13.422 | 0.16 | 0.16 | 1.33 | 81 | 2.01 | 1.07 | 81 | 1.3 | 90 | 0.050 | 102 | 102 | 9.0 | 0 | 289 | 74 | 74 | 71 | -0.042 | 4.83 | 0.027 | 76 | 74 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure: Begin 30.25, Middle 30.26, End 30.26, Average 30.26 "Hg

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 84 | 13.693 | 13.584 | 0.16 | 0.16 | 1.33 | 81 | 2.02 | 1.07 | 81 | 1.2 | 90 | 0.052 | 100 | 100 | 9.0 | 0 | 289 | 74 | 74 | 71 | -0.042 | 4.94 | 0.022 | 76 | 74 |
| 85 | 13.856 | 13.745 | 0.16 | 0.16 | 1.33 | 81 | 2.02 | 1.07 | 81 | 1.3 | 90 | 0.051 | 100 | 100 | 8.9 | -0.1 | 290 | 74 | 74 | 71 | -0.042 | 6.00 | 0.014 | 76 | 73 |
| 86 | 14.021 | 13.906 | 0.17 | 0.16 | 1.33 | 81 | 2.02 | 1.07 | 81 | 1.2 | 90 | 0.052 | 101 | 99 | 8.9 | 0 | 289 | 74 | 74 | 71 | -0.042 | 5.48 | 0.025 | 76 | 73 |
| 87 | 14.185 | 14.067 | 0.16 | 0.16 | 1.33 | 81 | 2.02 | 1.07 | 81 | 1.3 | 90 | 0.050 | 102 | 101 | 8.9 | 0 | 288 | 74 | 74 | 71 | -0.042 | 5.16 | 0.030 | 76 | 73 |
| 88 | 14.349 | 14.229 | 0.16 | 0.16 | 1.33 | 82 | 2.02 | 1.07 | 81 | 1.3 | 89 | 0.053 | 99 | 99 | 8.8 | -0.1 | 288 | 74 | 74 | 71 | -0.042 | 5.73 | 0.024 | 76 | 73 |
| 89 | 14.513 | 14.390 | 0.16 | 0.16 | 1.32 | 81 | 2.02 | 1.07 | 81 | 1.3 | 89 | 0.051 | 101 | 100 | 8.8 | 0 | 288 | 74 | 74 | 71 | -0.043 | 5.58 | 0.022 | 75 | 73 |
| 90 | 14.677 | 14.551 | 0.16 | 0.16 | 1.32 | 82 | 2.02 | 1.07 | 82 | 1.3 | 89 | 0.051 | 101 | 100 | 8.7 | -0.1 | 289 | 74 | 74 | 71 | -0.042 | 5.76 | 0.023 | 75 | 73 |
| 91 | 14.840 | 14.713 | 0.16 | 0.16 | 1.32 | 82 | 2.03 | 1.07 | 82 | 1.3 | 89 | 0.051 | 100 | 100 | 8.7 | 0 | 289 | 74 | 73 | 71 | -0.042 | 5.49 | 0.018 | 75 | 73 |
| 92 | 15.004 | 14.874 | 0.16 | 0.16 | 1.33 | 82 | 2.02 | 1.07 | 82 | 1.3 | 89 | 0.050 | 102 | 101 | 8.6 | -0.1 | 288 | 74 | 73 | 71 | -0.042 | 4.74 | 0.032 | 75 | 73 |
| 93 | 15.167 | 15.035 | 0.16 | 0.16 | 1.33 | 82 | 2.03 | 1.07 | 82 | 1.3 | 89 | 0.051 | 100 | 100 | 8.6 | 0 | 289 | 74 | 74 | 71 | -0.042 | 5.90 | 0.014 | 75 | 73 |
| 94 | 15.331 | 15.196 | 0.16 | 0.16 | 1.33 | 82 | 2.02 | 1.07 | 82 | 1.3 | 89 | 0.048 | 104 | 103 | 8.6 | 0 | 289 | 74 | 73 | 71 | -0.042 | 5.25 | 0.026 | 75 | 73 |
| 95 | 15.495 | 15.358 | 0.16 | 0.16 | 1.33 | 82 | 2.03 | 1.07 | 82 | 1.3 | 89 | 0.052 | 100 | 99 | 8.5 | -0.1 | 288 | 74 | 73 | 71 | -0.042 | 4.68 | 0.030 | 75 | 73 |
| 96 | 15.659 | 15.518 | 0.16 | 0.16 | 1.33 | 82 | 2.03 | 1.06 | 82 | 1.3 | 89 | 0.052 | 100 | 98 | 8.5 | 0 | 288 | 74 | 73 | 71 | -0.042 | 5.32 | 0.018 | 75 | 73 |
| 97 | 15.823 | 15.679 | 0.16 | 0.16 | 1.33 | 82 | 2.03 | 1.07 | 82 | 1.3 | 89 | 0.049 | 103 | 102 | 8.4 | -0.1 | 289 | 74 | 73 | 71 | -0.042 | 5.92 | 0.016 | 75 | 73 |
| 98 | 15.987 | 15.841 | 0.16 | 0.16 | 1.33 | 82 | 2.03 | 1.07 | 82 | 1.3 | 89 | 0.051 | 101 | 100 | 8.4 | 0 | 287 | 74 | 73 | 71 | -0.042 | 4.56 | 0.034 | 75 | 73 |
| 99 | 16.151 | 16.002 | 0.16 | 0.16 | 1.32 | 82 | 2.03 | 1.07 | 82 | 1.3 | 89 | 0.051 | 101 | 100 | 8.4 | 0 | 285 | 74 | 73 | 71 | -0.041 | 4.36 | 0.028 | 75 | 73 |
| 100 | 16.314 | 16.162 | 0.16 | 0.16 | 1.32 | 82 | 2.02 | 1.07 | 82 | 1.3 | 89 | 0.051 | 100 | 99 | 8.3 | -0.1 | 284 | 74 | 73 | 71 | -0.042 | 4.74 | 0.034 | 75 | 73 |
| 101 | 16.478 | 16.324 | 0.16 | 0.16 | 1.32 | 82 | 2.03 | 1.07 | 82 | 1.3 | 89 | 0.051 | 101 | 100 | 8.3 | 0 | 283 | 74 | 73 | 71 | -0.041 | 4.67 | 0.020 | 75 | 72 |
| 102 | 16.641 | 16.486 | 0.16 | 0.16 | 1.32 | 82 | 2.03 | 1.06 | 82 | 1.3 | 89 | 0.052 | 99 | 99 | 8.3 | 0 | 282 | 73 | 73 | 71 | -0.041 | 5.37 | 0.015 | 75 | 72 |
| 103 | 16.805 | 16.646 | 0.16 | 0.16 | 1.33 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 99 | 8.2 | -0.1 | 282 | 73 | 73 | 70 | -0.041 | 5.18 | 0.017 | 74 | 72 |
| 104 | 16.969 | 16.807 | 0.16 | 0.16 | 1.32 | 82 | 2.03 | 1.06 | 82 | 1.3 | 88 | 0.052 | 100 | 99 | 8.2 | 0 | 283 | 73 | 73 | 70 | -0.042 | 5.73 | 0.022 | 74 | 72 |
| 105 | 17.132 | 16.968 | 0.16 | 0.16 | 1.32 | 82 | 2.04 | 1.07 | 82 | 1.3 | 88 | 0.051 | 100 | 100 | 8.1 | -0.1 | 284 | 73 | 73 | 71 | -0.042 | 5.75 | 0.015 | 74 | 72 |
| 106 | 17.297 | 17.129 | 0.16 | 0.16 | 1.33 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.050 | 102 | 101 | 8.1 | 0 | 285 | 73 | 73 | 70 | -0.042 | 5.77 | 0.016 | 74 | 72 |
| 107 | 17.461 | 17.290 | 0.16 | 0.16 | 1.32 | 82 | 2.03 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 100 | 8.1 | 0 | 285 | 73 | 73 | 70 | -0.042 | 5.40 | 0.016 | 74 | 72 |
| 108 | 17.625 | 17.451 | 0.16 | 0.16 | 1.32 | 82 | 2.03 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 100 | 8.0 | -0.1 | 284 | 73 | 73 | 70 | -0.042 | 5.20 | 0.020 | 74 | 72 |
| 109 | 17.788 | 17.612 | 0.16 | 0.16 | 1.33 | 82 | 2.04 | 1.07 | 82 | 1.3 | 88 | 0.053 | 98 | 98 | 8.0 | 0 | 284 | 73 | 73 | 71 | -0.042 | 5.34 | 0.014 | 74 | 72 |
| 110 | 17.952 | 17.773 | 0.16 | 0.16 | 1.32 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 100 | 7.9 | -0.1 | 283 | 73 | 73 | 71 | -0.041 | 5.11 | 0.023 | 74 | 72 |
| 111 | 18.115 | 17.933 | 0.16 | 0.16 | 1.32 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 7.9 | 0 | 282 | 73 | 73 | 71 | -0.041 | 4.87 | 0.023 | 74 | 72 |
| 112 | 18.279 | 18.094 | 0.16 | 0.16 | 1.32 | 82 | 2.04 | 1.07 | 82 | 1.3 | 88 | 0.050 | 102 | 101 | 7.9 | 0 | 282 | 73 | 73 | 71 | -0.041 | 5.32 | 0.013 | 74 | 72 |
| 113 | 18.442 | 18.255 | 0.16 | 0.16 | 1.32 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.052 | 99 | 99 | 7.8 | -0.1 | 282 | 73 | 73 | 71 | -0.042 | 4.87 | 0.032 | 74 | 72 |
| 114 | 18.606 | 18.416 | 0.16 | 0.16 | 1.33 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.052 | 100 | 99 | 7.8 | 0 | 281 | 73 | 73 | 71 | -0.041 | 4.87 | 0.022 | 74 | 72 |
| 115 | 18.770 | 18.576 | 0.16 | 0.16 | 1.33 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.052 | 100 | 98 | 7.8 | 0 | 282 | 73 | 73 | 70 | -0.042 | 6.19 | 0.015 | 74 | 72 |
| 116 | 18.934 | 18.738 | 0.16 | 0.16 | 1.33 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.050 | 102 | 101 | 7.7 | -0.1 | 282 | 73 | 73 | 71 | -0.041 | 5.20 | 0.020 | 74 | 72 |
| 117 | 19.098 | 18.898 | 0.16 | 0.16 | 1.32 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 99 | 7.7 | 0 | 281 | 73 | 73 | 71 | -0.041 | 5.28 | 0.019 | 74 | 72 |
| 118 | 19.261 | 19.058 | 0.16 | 0.16 | 1.32 | 82 | 2.04 | 1.06 | 82 | 1.3 | 88 | 0.050 | 101 | 100 | 7.6 | -0.1 | 281 | 73 | 73 | 71 | -0.041 | 5.16 | 0.024 | 74 | 72 |
| 119 | 19.425 | 19.220 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.054 | 98 | 97 | 7.6 | 0 | 283 | 73 | 73 | 71 | -0.041 | 5.83 | 0.013 | 74 | 72 |
| 120 | 19.588 | 19.380 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.05 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 7.6 | 0 | 283 | 73 | 73 | 70 | -0.042 | 5.35 | 0.014 | 74 | 72 |
| 121 | 19.752 | 19.540 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.050 | 102 | 100 | 7.5 | -0.1 | 285 | 73 | 73 | 71 | -0.042 | 5.67 | 0.011 | 74 | 72 |
| 122 | 19.915 | 19.701 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.052 | 99 | 99 | 7.5 | 0 | 286 | 73 | 73 | 71 | -0.042 | 6.03 | 0.017 | 74 | 72 |
| 123 | 20.078 | 19.862 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.05 | 82 | 1.3 | 88 | 0.052 | 99 | 99 | 7.4 | -0.1 | 286 | 73 | 73 | 71 | -0.042 | 5.64 | 0.029 | 74 | 72 |
| 124 | 20.242 | 20.022 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.050 | 102 | 100 | 7.4 | 0 | 285 | 73 | 73 | 70 | -0.042 | 5.34 | 0.023 | 74 | 72 |
| 125 | 20.406 | 20.182 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.053 | 99 | 97 | 7.4 | 0 | 286 | 73 | 73 | 71 | -0.042 | 5.38 | 0.018 | 74 | 72 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure:

| Begin | Middle | End | Average |
|---|---|---|---|
| 30.25 | 30.26 | 30.26 | 30.26 "Hg |

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 126 | 20.570 | 20.344 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.052 | 100 | 99 | 7.3 | -0.1 | 286 | 73 | 73 | 71 | -0.042 | 5.54 | 0.011 | 74 | 72 |
| 127 | 20.733 | 20.503 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 89 | 0.050 | 101 | 99 | 7.3 | 0 | 287 | 73 | 73 | 71 | -0.042 | 5.61 | 0.013 | 74 | 72 |
| 128 | 20.897 | 20.664 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 100 | 7.2 | -0.1 | 287 | 73 | 73 | 71 | -0.042 | 6.19 | 0.015 | 74 | 72 |
| 129 | 21.060 | 20.825 | 0.16 | 0.16 | 1.31 | 82 | 2.06 | 1.05 | 82 | 1.3 | 89 | 0.051 | 100 | 100 | 7.2 | 0 | 287 | 73 | 73 | 70 | -0.042 | 5.52 | 0.019 | 74 | 72 |
| 130 | 21.223 | 20.985 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.05 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 7.2 | 0 | 286 | 73 | 73 | 71 | -0.042 | 5.25 | 0.025 | 74 | 72 |
| 131 | 21.387 | 21.145 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 99 | 7.1 | -0.1 | 286 | 73 | 73 | 71 | -0.042 | 5.29 | 0.013 | 74 | 72 |
| 132 | 21.550 | 21.306 | 0.16 | 0.16 | 1.32 | 82 | 2.05 | 1.05 | 82 | 1.3 | 88 | 0.052 | 99 | 99 | 7.1 | 0 | 286 | 73 | 73 | 70 | -0.042 | 5.36 | 0.013 | 74 | 72 |
| 133 | 21.713 | 21.466 | 0.16 | 0.16 | 1.32 | 82 | 2.06 | 1.05 | 82 | 1.3 | 88 | 0.053 | 98 | 97 | 7.0 | -0.1 | 285 | 73 | 73 | 70 | -0.042 | 4.43 | 0.024 | 74 | 72 |
| 134 | 21.877 | 21.626 | 0.16 | 0.16 | 1.32 | 82 | 2.06 | 1.06 | 82 | 1.3 | 88 | 0.051 | 101 | 99 | 7.0 | 0 | 285 | 73 | 73 | 70 | -0.042 | 4.82 | 0.023 | 74 | 72 |
| 135 | 22.041 | 21.787 | 0.16 | 0.16 | 1.32 | 82 | 2.06 | 1.05 | 82 | 1.3 | 88 | 0.051 | 101 | 100 | 7.0 | 0 | 285 | 73 | 73 | 70 | -0.042 | 5.62 | 0.017 | 74 | 72 |
| 136 | 22.205 | 21.947 | 0.16 | 0.16 | 1.32 | 82 | 2.06 | 1.05 | 82 | 1.3 | 88 | 0.051 | 101 | 99 | 6.9 | -0.1 | 287 | 73 | 73 | 70 | -0.042 | 5.92 | 0.017 | 74 | 72 |
| 137 | 22.368 | 22.106 | 0.16 | 0.16 | 1.31 | 82 | 2.06 | 1.06 | 82 | 1.3 | 88 | 0.050 | 101 | 99 | 6.9 | 0 | 289 | 73 | 73 | 70 | -0.042 | 6.14 | 0.013 | 74 | 72 |
| 138 | 22.531 | 22.267 | 0.16 | 0.16 | 1.32 | 82 | 2.06 | 1.06 | 82 | 1.3 | 88 | 0.052 | 99 | 99 | 6.8 | -0.1 | 289 | 73 | 73 | 71 | -0.043 | 5.70 | 0.018 | 74 | 72 |
| 139 | 22.694 | 22.427 | 0.16 | 0.16 | 1.32 | 82 | 2.06 | 1.05 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 6.8 | 0 | 289 | 73 | 73 | 70 | -0.043 | 5.57 | 0.025 | 74 | 72 |
| 140 | 22.857 | 22.587 | 0.16 | 0.16 | 1.32 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 6.8 | 0 | 289 | 73 | 73 | 70 | -0.042 | 5.01 | 0.025 | 74 | 72 |
| 141 | 23.021 | 22.747 | 0.16 | 0.16 | 1.32 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.050 | 102 | 100 | 6.7 | -0.1 | 288 | 73 | 73 | 70 | -0.042 | 5.20 | 0.018 | 74 | 72 |
| 142 | 23.184 | 22.907 | 0.16 | 0.16 | 1.32 | 82 | 2.07 | 1.04 | 82 | 1.3 | 88 | 0.053 | 98 | 97 | 6.7 | 0 | 287 | 73 | 73 | 70 | -0.042 | 4.92 | 0.023 | 74 | 72 |
| 143 | 23.348 | 23.067 | 0.16 | 0.16 | 1.31 | 82 | 2.06 | 1.05 | 82 | 1.3 | 88 | 0.051 | 101 | 99 | 6.6 | -0.1 | 287 | 73 | 73 | 71 | -0.042 | 4.92 | 0.018 | 74 | 72 |
| 144 | 23.511 | 23.227 | 0.16 | 0.16 | 1.32 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 6.6 | 0 | 287 | 73 | 73 | 71 | -0.042 | 4.97 | 0.031 | 74 | 72 |
| 145 | 23.675 | 23.387 | 0.16 | 0.16 | 1.31 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.050 | 102 | 100 | 6.6 | 0 | 287 | 73 | 73 | 70 | -0.042 | 5.79 | 0.012 | 74 | 72 |
| 146 | 23.838 | 23.547 | 0.16 | 0.16 | 1.31 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.050 | 101 | 100 | 6.5 | -0.1 | 288 | 73 | 73 | 70 | -0.043 | 5.88 | 0.016 | 74 | 72 |
| 147 | 24.000 | 23.706 | 0.16 | 0.16 | 1.32 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.050 | 100 | 99 | 6.5 | 0 | 289 | 73 | 73 | 70 | -0.043 | 5.84 | 0.016 | 73 | 72 |
| 148 | 24.163 | 23.867 | 0.16 | 0.16 | 1.31 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.050 | 101 | 101 | 6.4 | -0.1 | 287 | 73 | 73 | 70 | -0.042 | 4.99 | 0.022 | 73 | 72 |
| 149 | 24.327 | 24.026 | 0.16 | 0.16 | 1.32 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.050 | 102 | 99 | 6.4 | 0 | 287 | 73 | 73 | 71 | -0.042 | 5.42 | 0.026 | 73 | 72 |
| 150 | 24.490 | 24.186 | 0.16 | 0.16 | 1.32 | 82 | 2.07 | 1.05 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 6.4 | 0 | 286 | 73 | 73 | 70 | -0.042 | 5.36 | 0.016 | 73 | 72 |
| 151 | 24.653 | 24.346 | 0.16 | 0.16 | 1.32 | 82 | 2.08 | 1.04 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 6.3 | -0.1 | 287 | 73 | 73 | 70 | -0.042 | 5.52 | 0.026 | 73 | 72 |
| 152 | 24.817 | 24.505 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.05 | 82 | 1.3 | 88 | 0.051 | 101 | 98 | 6.3 | 0 | 287 | 73 | 73 | 70 | -0.042 | 5.29 | 0.011 | 73 | 72 |
| 153 | 24.980 | 24.665 | 0.16 | 0.16 | 1.32 | 82 | 2.08 | 1.05 | 82 | 1.3 | 88 | 0.051 | 100 | 99 | 6.2 | -0.1 | 287 | 73 | 73 | 71 | -0.042 | 5.42 | 0.013 | 74 | 72 |
| 154 | 25.143 | 24.827 | 0.16 | 0.16 | 1.30 | 82 | 2.08 | 1.10 | 82 | 1.4 | 88 | 0.053 | 98 | 98 | 6.2 | 0 | 287 | 73 | 73 | 70 | -0.042 | 5.40 | 0.023 | 73 | 72 |
| 155 | 25.305 | 24.991 | 0.16 | 0.16 | 1.31 | 82 | 2.07 | 1.09 | 82 | 1.4 | 88 | 0.051 | 99 | 101 | 6.2 | 0 | 287 | 73 | 73 | 70 | -0.042 | 5.32 | 0.016 | 73 | 72 |
| 156 | 25.468 | 25.154 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.10 | 82 | 1.4 | 88 | 0.049 | 102 | 103 | 6.1 | -0.1 | 288 | 73 | 73 | 70 | -0.042 | 6.05 | 0.013 | 73 | 72 |
| 157 | 25.631 | 25.318 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.11 | 82 | 1.4 | 88 | 0.050 | 101 | 103 | 6.1 | 0 | 288 | 73 | 73 | 71 | -0.042 | 4.94 | 0.022 | 73 | 72 |
| 158 | 25.794 | 25.481 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.10 | 82 | 1.4 | 88 | 0.051 | 100 | 101 | 6.0 | -0.1 | 289 | 73 | 73 | 70 | -0.042 | 5.64 | 0.012 | 74 | 72 |
| 159 | 25.958 | 25.646 | 0.16 | 0.16 | 1.32 | 82 | 2.08 | 1.10 | 82 | 1.4 | 88 | 0.053 | 99 | 100 | 6.0 | 0 | 289 | 73 | 73 | 71 | -0.042 | 5.88 | 0.017 | 73 | 72 |
| 160 | 26.121 | 25.809 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.09 | 82 | 1.4 | 88 | 0.051 | 100 | 101 | 6.0 | 0 | 287 | 73 | 73 | 71 | -0.042 | 4.43 | 0.019 | 73 | 72 |
| 161 | 26.284 | 25.972 | 0.16 | 0.16 | 1.30 | 82 | 2.08 | 1.10 | 82 | 1.4 | 88 | 0.050 | 101 | 102 | 5.9 | -0.1 | 287 | 73 | 73 | 71 | -0.042 | 5.33 | 0.017 | 73 | 72 |
| 162 | 26.446 | 26.135 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.10 | 82 | 1.4 | 88 | 0.052 | 98 | 100 | 5.9 | 0 | 287 | 73 | 73 | 71 | -0.042 | 5.18 | 0.029 | 73 | 72 |
| 163 | 26.609 | 26.299 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.09 | 82 | 1.4 | 88 | 0.050 | 101 | 103 | 5.8 | -0.1 | 285 | 73 | 73 | 71 | -0.042 | 4.72 | 0.025 | 73 | 72 |
| 164 | 26.772 | 26.463 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.10 | 82 | 1.4 | 88 | 0.051 | 100 | 101 | 5.8 | 0 | 284 | 73 | 73 | 71 | -0.042 | 4.83 | 0.020 | 73 | 72 |
| 165 | 26.934 | 26.626 | 0.16 | 0.16 | 1.31 | 82 | 2.08 | 1.10 | 82 | 1.4 | 88 | 0.051 | 99 | 101 | 5.8 | 0 | 285 | 73 | 73 | 71 | -0.042 | 5.40 | 0.021 | 73 | 72 |
| 166 | 27.098 | 26.789 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.09 | 82 | 1.4 | 88 | 0.050 | 102 | 102 | 5.7 | -0.1 | 286 | 73 | 73 | 71 | -0.042 | 5.59 | 0.015 | 73 | 72 |
| 167 | 27.261 | 26.952 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.10 | 82 | 1.4 | 88 | 0.052 | 99 | 100 | 5.7 | 0 | 286 | 73 | 73 | 71 | -0.042 | 5.40 | 0.022 | 73 | 72 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure:

| Begin | Middle | End | Average |
|---|---|---|---|
| 30.25 | 30.26 | 30.26 | 30.26 "Hg |

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 168 | 27.424 | 27.115 | 0.16 | 0.16 | 1.30 | 82 | 2.09 | 1.09 | 82 | 1.4 | 88 | 0.052 | 99 | 100 | 5.6 | -0.1 | 286 | 73 | 73 | 71 | -0.042 | 5.62 | 0.011 | 73 | 72 |
| 169 | 27.586 | 27.279 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.09 | 82 | 1.4 | 89 | 0.051 | 99 | 102 | 5.6 | 0 | 287 | 73 | 73 | 71 | -0.042 | 5.94 | 0.015 | 73 | 72 |
| 170 | 27.749 | 27.442 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.09 | 82 | 1.4 | 88 | 0.052 | 99 | 100 | 5.5 | -0.1 | 287 | 73 | 73 | 71 | -0.042 | 5.99 | 0.022 | 73 | 72 |
| 171 | 27.911 | 27.605 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.09 | 82 | 1.4 | 89 | 0.051 | 99 | 101 | 5.5 | 0 | 288 | 73 | 73 | 71 | -0.042 | 5.97 | 0.012 | 73 | 72 |
| 172 | 28.073 | 27.768 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.09 | 82 | 1.4 | 89 | 0.050 | 100 | 102 | 5.5 | 0 | 288 | 73 | 73 | 71 | -0.043 | 5.48 | 0.024 | 73 | 72 |
| 173 | 28.237 | 27.930 | 0.16 | 0.16 | 1.31 | 82 | 2.1 | 1.09 | 82 | 1.4 | 89 | 0.050 | 102 | 101 | 5.4 | -0.1 | 289 | 73 | 73 | 71 | -0.043 | 5.75 | 0.017 | 73 | 72 |
| 174 | 28.400 | 28.094 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.09 | 82 | 1.4 | 89 | 0.050 | 101 | 103 | 5.4 | 0 | 290 | 73 | 73 | 71 | -0.042 | 5.79 | 0.019 | 73 | 72 |
| 175 | 28.562 | 28.257 | 0.16 | 0.16 | 1.30 | 82 | 2.1 | 1.09 | 82 | 1.4 | 89 | 0.051 | 99 | 101 | 5.4 | 0 | 289 | 73 | 73 | 70 | -0.042 | 4.65 | 0.016 | 73 | 72 |
| 176 | 28.724 | 28.419 | 0.16 | 0.16 | 1.30 | 82 | 2.1 | 1.09 | 82 | 1.4 | 89 | 0.048 | 103 | 103 | 5.3 | -0.1 | 289 | 73 | 73 | 70 | -0.042 | 5.22 | 0.015 | 73 | 72 |
| 177 | 28.887 | 28.582 | 0.16 | 0.16 | 1.31 | 82 | 2.1 | 1.09 | 82 | 1.4 | 89 | 0.051 | 100 | 101 | 5.3 | 0 | 291 | 73 | 73 | 71 | -0.043 | 6.22 | 0.013 | 73 | 72 |
| 178 | 29.049 | 28.745 | 0.16 | 0.16 | 1.31 | 82 | 2.09 | 1.09 | 82 | 1.4 | 89 | 0.050 | 100 | 102 | 5.2 | -0.1 | 289 | 73 | 73 | 70 | -0.043 | 4.62 | 0.018 | 73 | 72 |
| 179 | 29.212 | 28.908 | 0.16 | 0.16 | 1.30 | 82 | 2.1 | 1.08 | 82 | 1.4 | 89 | 0.050 | 101 | 102 | 5.2 | 0 | 289 | 73 | 73 | 71 | -0.043 | 5.64 | 0.011 | 73 | 72 |
| 180 | 29.375 | 29.071 | 0.16 | 0.16 | 1.30 | 82 | 2.1 | 1.09 | 82 | 1.4 | 89 | 0.051 | 100 | 101 | 5.1 | -0.1 | 289 | 73 | 73 | 71 | -0.043 | 5.51 | 0.017 | 73 | 72 |
| 181 | 29.537 | 29.233 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.09 | 82 | 1.4 | 88 | 0.050 | 100 | 101 | 5.1 | 0 | 288 | 73 | 73 | 70 | -0.042 | 5.43 | 0.012 | 73 | 72 |
| 182 | 29.699 | 29.395 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.09 | 82 | 1.4 | 89 | 0.051 | 99 | 100 | 5.1 | 0 | 288 | 73 | 73 | 71 | -0.043 | 5.44 | 0.021 | 73 | 72 |
| 183 | 29.862 | 29.558 | 0.16 | 0.16 | 1.30 | 82 | 2.1 | 1.08 | 82 | 1.4 | 88 | 0.049 | 102 | 103 | 5.0 | -0.1 | 286 | 73 | 73 | 70 | -0.042 | 4.60 | 0.012 | 73 | 72 |
| 184 | 30.024 | 29.721 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 88 | 0.052 | 98 | 100 | 5.0 | 0 | 284 | 73 | 73 | 70 | -0.042 | 4.09 | 0.034 | 73 | 72 |
| 185 | 30.186 | 29.883 | 0.16 | 0.16 | 1.31 | 82 | 2.11 | 1.08 | 82 | 1.4 | 88 | 0.051 | 99 | 100 | 5.0 | 0 | 281 | 73 | 73 | 70 | -0.041 | 4.21 | 0.017 | 73 | 72 |
| 186 | 30.349 | 30.045 | 0.16 | 0.16 | 1.30 | 82 | 2.1 | 1.08 | 82 | 1.4 | 88 | 0.051 | 100 | 100 | 4.9 | -0.1 | 278 | 73 | 73 | 70 | -0.041 | 3.68 | 0.021 | 73 | 72 |
| 187 | 30.512 | 30.208 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 87 | 0.052 | 99 | 100 | 4.9 | 0 | 273 | 73 | 73 | 70 | -0.040 | 2.72 | 0.020 | 73 | 72 |
| 188 | 30.674 | 30.371 | 0.16 | 0.16 | 1.29 | 82 | 2.1 | 1.08 | 82 | 1.4 | 87 | 0.051 | 99 | 101 | 4.9 | 0 | 267 | 73 | 73 | 71 | -0.039 | 2.46 | 0.019 | 73 | 72 |
| 189 | 30.836 | 30.533 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 87 | 0.051 | 99 | 100 | 4.9 | 0 | 263 | 73 | 73 | 71 | -0.038 | 2.52 | 0.035 | 73 | 71 |
| 190 | 30.998 | 30.695 | 0.16 | 0.16 | 1.31 | 82 | 2.11 | 1.08 | 82 | 1.4 | 86 | 0.051 | 99 | 100 | 4.9 | 0 | 257 | 73 | 73 | 71 | -0.038 | 2.19 | 0.034 | 73 | 71 |
| 191 | 31.161 | 30.857 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.09 | 82 | 1.4 | 86 | 0.050 | 101 | 101 | 4.9 | 0 | 254 | 73 | 73 | 70 | -0.037 | 2.38 | 0.025 | 73 | 71 |
| 192 | 31.323 | 31.020 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 86 | 0.051 | 99 | 101 | 4.9 | 0 | 249 | 73 | 73 | 71 | -0.036 | 2.14 | 0.038 | 73 | 71 |
| 193 | 31.486 | 31.183 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 86 | 0.051 | 100 | 101 | 4.8 | -0.1 | 247 | 73 | 73 | 70 | -0.036 | 2.83 | 0.021 | 73 | 71 |
| 194 | 31.649 | 31.344 | 0.16 | 0.16 | 1.29 | 82 | 2.11 | 1.08 | 82 | 1.4 | 86 | 0.050 | 101 | 100 | 4.8 | 0 | 246 | 73 | 73 | 70 | -0.036 | 2.72 | 0.017 | 73 | 71 |
| 195 | 31.810 | 31.506 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 85 | 0.053 | 97 | 98 | 4.8 | 0 | 244 | 73 | 73 | 70 | -0.035 | 2.63 | 0.020 | 73 | 71 |
| 196 | 31.973 | 31.669 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 85 | 0.051 | 100 | 101 | 4.8 | 0 | 243 | 73 | 73 | 70 | -0.035 | 2.67 | 0.021 | 73 | 71 |
| 197 | 32.135 | 31.832 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 85 | 0.050 | 100 | 102 | 4.8 | 0 | 241 | 73 | 72 | 70 | -0.035 | 2.64 | 0.021 | 73 | 71 |
| 198 | 32.297 | 31.994 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.07 | 82 | 1.4 | 85 | 0.052 | 98 | 99 | 4.7 | -0.1 | 241 | 73 | 72 | 71 | -0.035 | 3.07 | 0.026 | 73 | 71 |
| 199 | 32.460 | 32.155 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 85 | 0.050 | 101 | 100 | 4.7 | 0 | 242 | 72 | 72 | 71 | -0.035 | 3.61 | 0.027 | 73 | 71 |
| 200 | 32.622 | 32.318 | 0.16 | 0.16 | 1.29 | 82 | 2.12 | 1.08 | 82 | 1.4 | 85 | 0.052 | 98 | 100 | 4.7 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.72 | 0.020 | 73 | 71 |
| 201 | 32.784 | 32.480 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 85 | 0.053 | 97 | 98 | 4.6 | -0.1 | 244 | 72 | 72 | 70 | -0.035 | 3.84 | 0.022 | 73 | 71 |
| 202 | 32.946 | 32.642 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.08 | 82 | 1.4 | 85 | 0.050 | 100 | 101 | 4.6 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.76 | 0.023 | 73 | 71 |
| 203 | 33.108 | 32.804 | 0.16 | 0.16 | 1.30 | 82 | 2.11 | 1.08 | 82 | 1.4 | 85 | 0.053 | 97 | 98 | 4.6 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.86 | 0.019 | 73 | 71 |
| 204 | 33.271 | 32.966 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.08 | 82 | 1.4 | 85 | 0.050 | 101 | 101 | 4.6 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.53 | 0.019 | 73 | 71 |
| 205 | 33.434 | 33.128 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.07 | 82 | 1.4 | 85 | 0.050 | 101 | 101 | 4.5 | -0.1 | 245 | 72 | 72 | 70 | -0.036 | 3.53 | 0.018 | 73 | 71 |
| 206 | 33.596 | 33.290 | 0.16 | 0.16 | 1.29 | 82 | 2.12 | 1.07 | 82 | 1.4 | 85 | 0.053 | 97 | 98 | 4.5 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.52 | 0.022 | 73 | 71 |
| 207 | 33.757 | 33.452 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.08 | 82 | 1.4 | 85 | 0.050 | 99 | 101 | 4.5 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.77 | 0.020 | 73 | 71 |
| 208 | 33.920 | 33.614 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.08 | 82 | 1.4 | 85 | 0.052 | 99 | 99 | 4.4 | -0.1 | 244 | 72 | 72 | 70 | -0.036 | 3.09 | 0.023 | 73 | 71 |
| 209 | 34.081 | 33.776 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.07 | 82 | 1.4 | 85 | 0.051 | 98 | 100 | 4.4 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.53 | 0.019 | 73 | 71 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure:

| Begin | Middle | End | Average |
|---|---|---|---|
| 30.25 | 30.26 | 30.26 | 30.26 "Hg |

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 210 | 34.244 | 33.938 | 0.16 | 0.16 | 1.30 | 82 | 2.13 | 1.08 | 82 | 1.4 | 85 | 0.050 | 101 | 101 | 4.4 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.32 | 0.021 | 73 | 71 |
| 211 | 34.407 | 34.099 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.07 | 82 | 1.4 | 85 | 0.052 | 99 | 98 | 4.3 | -0.1 | 244 | 72 | 72 | 70 | -0.036 | 3.81 | 0.014 | 73 | 71 |
| 212 | 34.569 | 34.261 | 0.16 | 0.16 | 1.29 | 82 | 2.13 | 1.07 | 82 | 1.4 | 85 | 0.047 | 103 | 104 | 4.3 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.28 | 0.020 | 73 | 71 |
| 213 | 34.730 | 34.424 | 0.16 | 0.16 | 1.30 | 82 | 2.12 | 1.07 | 82 | 1.4 | 85 | 0.051 | 98 | 101 | 4.3 | 0 | 243 | 72 | 72 | 70 | -0.036 | 3.36 | 0.027 | 73 | 71 |
| 214 | 34.892 | 34.585 | 0.16 | 0.16 | 1.30 | 82 | 2.13 | 1.07 | 82 | 1.4 | 85 | 0.051 | 99 | 99 | 4.3 | 0 | 243 | 72 | 72 | 70 | -0.035 | 3.36 | 0.018 | 73 | 71 |
| 215 | 35.054 | 34.746 | 0.16 | 0.16 | 1.30 | 82 | 2.13 | 1.07 | 82 | 1.4 | 85 | 0.052 | 98 | 98 | 4.2 | -0.1 | 243 | 72 | 72 | 70 | -0.036 | 3.40 | 0.020 | 73 | 71 |
| 216 | 35.216 | 34.908 | 0.16 | 0.16 | 1.30 | 82 | 2.13 | 1.07 | 82 | 1.4 | 85 | 0.053 | 97 | 98 | 4.2 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.61 | 0.019 | 73 | 71 |
| 217 | 35.379 | 35.071 | 0.16 | 0.16 | 1.30 | 82 | 2.13 | 1.07 | 82 | 1.4 | 85 | 0.051 | 100 | 101 | 4.2 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.80 | 0.012 | 73 | 71 |
| 218 | 35.541 | 35.232 | 0.16 | 0.16 | 1.28 | 82 | 2.14 | 1.07 | 82 | 1.4 | 85 | 0.052 | 98 | 98 | 4.1 | -0.1 | 245 | 72 | 72 | 70 | -0.036 | 3.95 | 0.019 | 73 | 71 |
| 219 | 35.702 | 35.393 | 0.16 | 0.16 | 1.29 | 82 | 2.13 | 1.07 | 82 | 1.4 | 85 | 0.051 | 98 | 99 | 4.1 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.64 | 0.035 | 73 | 71 |
| 220 | 35.864 | 35.554 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.07 | 82 | 1.4 | 84 | 0.054 | 96 | 96 | 4.1 | 0 | 243 | 72 | 72 | 70 | -0.036 | 3.32 | 0.015 | 73 | 71 |
| 221 | 36.026 | 35.717 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.07 | 82 | 1.4 | 85 | 0.052 | 98 | 100 | 4.1 | 0 | 243 | 72 | 72 | 70 | -0.036 | 3.31 | 0.023 | 73 | 71 |
| 222 | 36.189 | 35.878 | 0.16 | 0.16 | 1.30 | 82 | 2.13 | 1.07 | 82 | 1.4 | 85 | 0.052 | 99 | 98 | 4.0 | -0.1 | 245 | 72 | 72 | 70 | -0.036 | 3.85 | 0.011 | 73 | 71 |
| 223 | 36.351 | 36.039 | 0.16 | 0.16 | 1.29 | 82 | 2.13 | 1.07 | 82 | 1.4 | 84 | 0.051 | 99 | 99 | 4.0 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.65 | 0.018 | 73 | 71 |
| 224 | 36.513 | 36.200 | 0.16 | 0.16 | 1.28 | 82 | 2.14 | 1.07 | 82 | 1.4 | 85 | 0.052 | 98 | 98 | 4.0 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.71 | 0.012 | 73 | 71 |
| 225 | 36.674 | 36.362 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.07 | 82 | 1.5 | 85 | 0.051 | 98 | 100 | 4.0 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.70 | 0.018 | 73 | 71 |
| 226 | 36.836 | 36.523 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.06 | 82 | 1.5 | 85 | 0.050 | 100 | 100 | 3.9 | -0.1 | 246 | 72 | 72 | 70 | -0.036 | 3.69 | 0.019 | 73 | 71 |
| 227 | 36.998 | 36.684 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.07 | 82 | 1.5 | 85 | 0.050 | 100 | 100 | 3.9 | 0 | 247 | 72 | 72 | 70 | -0.036 | 3.88 | 0.030 | 73 | 71 |
| 228 | 37.161 | 36.846 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.06 | 82 | 1.4 | 84 | 0.053 | 98 | 98 | 3.9 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.18 | 0.038 | 73 | 71 |
| 229 | 37.322 | 37.007 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.06 | 82 | 1.5 | 84 | 0.053 | 97 | 97 | 3.8 | -0.1 | 246 | 72 | 72 | 70 | -0.037 | 3.77 | 0.014 | 73 | 71 |
| 230 | 37.483 | 37.168 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.07 | 82 | 1.4 | 85 | 0.051 | 98 | 99 | 3.8 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.53 | 0.014 | 73 | 71 |
| 231 | 37.645 | 37.329 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.07 | 82 | 1.4 | 85 | 0.051 | 99 | 99 | 3.8 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.53 | 0.025 | 73 | 71 |
| 232 | 37.807 | 37.491 | 0.16 | 0.16 | 1.29 | 82 | 2.15 | 1.06 | 82 | 1.4 | 85 | 0.051 | 99 | 100 | 3.8 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.49 | 0.015 | 73 | 71 |
| 233 | 37.969 | 37.652 | 0.16 | 0.16 | 1.29 | 82 | 2.15 | 1.06 | 82 | 1.4 | 85 | 0.052 | 98 | 98 | 3.7 | -0.1 | 246 | 72 | 72 | 71 | -0.036 | 4.10 | 0.014 | 73 | 71 |
| 234 | 38.131 | 37.813 | 0.16 | 0.16 | 1.29 | 82 | 2.15 | 1.07 | 82 | 1.5 | 85 | 0.051 | 99 | 99 | 3.7 | 0 | 247 | 72 | 72 | 70 | -0.036 | 3.67 | 0.017 | 73 | 71 |
| 235 | 38.292 | 37.974 | 0.16 | 0.16 | 1.28 | 82 | 2.15 | 1.06 | 82 | 1.5 | 85 | 0.049 | 100 | 101 | 3.7 | 0 | 247 | 72 | 72 | 70 | -0.036 | 3.72 | 0.025 | 72 | 71 |
| 236 | 38.454 | 38.135 | 0.16 | 0.16 | 1.29 | 82 | 2.15 | 1.06 | 82 | 1.5 | 85 | 0.052 | 98 | 98 | 3.6 | -0.1 | 247 | 72 | 72 | 70 | -0.036 | 3.73 | 0.015 | 72 | 71 |
| 237 | 38.615 | 38.296 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.06 | 82 | 1.5 | 85 | 0.050 | 99 | 100 | 3.6 | 0 | 248 | 72 | 72 | 70 | -0.037 | 3.90 | 0.026 | 72 | 71 |
| 238 | 38.777 | 38.457 | 0.16 | 0.16 | 1.29 | 82 | 2.14 | 1.06 | 82 | 1.5 | 85 | 0.052 | 98 | 98 | 3.6 | 0 | 247 | 72 | 72 | 70 | -0.036 | 4.02 | 0.014 | 72 | 71 |
| 239 | 38.940 | 38.618 | 0.16 | 0.16 | 1.29 | 82 | 2.15 | 1.06 | 82 | 1.5 | 85 | 0.053 | 98 | 97 | 3.6 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.38 | 0.022 | 72 | 71 |
| 240 | 39.101 | 38.779 | 0.16 | 0.16 | 1.28 | 82 | 2.15 | 1.06 | 82 | 1.5 | 85 | 0.052 | 98 | 98 | 3.5 | -0.1 | 247 | 72 | 72 | 70 | -0.036 | 3.38 | 0.016 | 72 | 71 |
| 241 | 39.262 | 38.939 | 0.16 | 0.16 | 1.29 | 82 | 2.15 | 1.06 | 82 | 1.5 | 85 | 0.051 | 98 | 99 | 3.5 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.91 | 0.021 | 72 | 71 |
| 242 | 39.423 | 39.100 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.053 | 97 | 97 | 3.5 | 0 | 249 | 72 | 72 | 70 | -0.037 | 4.45 | 0.009 | 72 | 71 |
| 243 | 39.585 | 39.261 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.049 | 101 | 101 | 3.4 | -0.1 | 248 | 72 | 72 | 70 | -0.037 | 3.53 | 0.015 | 72 | 71 |
| 244 | 39.747 | 39.421 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.053 | 97 | 97 | 3.4 | 0 | 248 | 72 | 72 | 70 | -0.037 | 3.47 | 0.017 | 72 | 71 |
| 245 | 39.909 | 39.582 | 0.16 | 0.16 | 1.28 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.052 | 98 | 98 | 3.4 | 0 | 247 | 72 | 72 | 70 | -0.036 | 3.36 | 0.018 | 72 | 71 |
| 246 | 40.070 | 39.743 | 0.16 | 0.16 | 1.29 | 82 | 2.15 | 1.06 | 82 | 1.5 | 85 | 0.052 | 98 | 98 | 3.3 | -0.1 | 247 | 72 | 72 | 70 | -0.037 | 3.39 | 0.020 | 72 | 71 |
| 247 | 40.231 | 39.904 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.053 | 97 | 97 | 3.3 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.88 | 0.011 | 72 | 71 |
| 248 | 40.392 | 40.064 | 0.16 | 0.16 | 1.28 | 82 | 2.15 | 1.06 | 82 | 1.5 | 85 | 0.051 | 98 | 99 | 3.3 | 0 | 248 | 72 | 72 | 70 | -0.037 | 3.91 | 0.014 | 72 | 71 |
| 249 | 40.555 | 40.225 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.051 | 100 | 99 | 3.3 | 0 | 248 | 72 | 72 | 70 | -0.037 | 3.71 | 0.011 | 72 | 70 |
| 250 | 40.716 | 40.385 | 0.16 | 0.16 | 1.28 | 82 | 2.16 | 1.05 | 82 | 1.5 | 85 | 0.052 | 98 | 98 | 3.2 | -0.1 | 246 | 72 | 72 | 70 | -0.036 | 3.34 | 0.024 | 72 | 71 |
| 251 | 40.877 | 40.546 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.051 | 98 | 99 | 3.2 | 0 | 246 | 72 | 72 | 70 | -0.037 | 3.51 | 0.017 | 72 | 70 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure:

| Begin | Middle | End | Average |
|---|---|---|---|
| 30.25 | 30.26 | 30.26 | 30.26 "Hg |

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 252 | 41.038 | 40.707 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.051 | 98 | 99 | 3.2 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.45 | 0.017 | 72 | 71 |
| 253 | 41.199 | 40.867 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.05 | 82 | 1.5 | 85 | 0.051 | 98 | 99 | 3.2 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.32 | 0.016 | 72 | 70 |
| 254 | 41.362 | 41.027 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 85 | 0.050 | 101 | 100 | 3.1 | -0.1 | 245 | 72 | 72 | 70 | -0.036 | 3.42 | 0.014 | 72 | 71 |
| 255 | 41.523 | 41.187 | 0.16 | 0.16 | 1.28 | 82 | 2.16 | 1.06 | 82 | 1.5 | 84 | 0.052 | 97 | 98 | 3.1 | 0 | 244 | 72 | 72 | 70 | -0.035 | 3.05 | 0.013 | 72 | 71 |
| 256 | 41.684 | 41.348 | 0.16 | 0.16 | 1.28 | 82 | 2.17 | 1.05 | 82 | 1.5 | 85 | 0.052 | 98 | 98 | 3.1 | 0 | 244 | 72 | 72 | 70 | -0.037 | 3.46 | 0.035 | 72 | 70 |
| 257 | 41.845 | 41.508 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.05 | 82 | 1.5 | 85 | 0.050 | 99 | 100 | 3.0 | -0.1 | 245 | 72 | 72 | 70 | -0.036 | 3.67 | 0.010 | 72 | 70 |
| 258 | 42.006 | 41.668 | 0.16 | 0.16 | 1.29 | 82 | 2.16 | 1.06 | 82 | 1.5 | 84 | 0.052 | 97 | 98 | 3.0 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.08 | 0.023 | 72 | 70 |
| 259 | 42.169 | 41.829 | 0.16 | 0.16 | 1.28 | 82 | 2.16 | 1.06 | 82 | 1.5 | 84 | 0.054 | 97 | 96 | 3.0 | 0 | 243 | 72 | 72 | 70 | -0.036 | 3.17 | 0.015 | 72 | 70 |
| 260 | 42.330 | 41.989 | 0.16 | 0.16 | 1.28 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.051 | 98 | 99 | 3.0 | 0 | 243 | 72 | 72 | 70 | -0.036 | 3.52 | 0.020 | 72 | 70 |
| 261 | 42.490 | 42.149 | 0.16 | 0.16 | 1.28 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.055 | 94 | 95 | 2.9 | -0.1 | 244 | 72 | 72 | 70 | -0.037 | 3.65 | 0.015 | 72 | 70 |
| 262 | 42.651 | 42.310 | 0.16 | 0.16 | 1.29 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.052 | 97 | 98 | 2.9 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.65 | 0.013 | 72 | 70 |
| 263 | 42.813 | 42.469 | 0.16 | 0.16 | 1.29 | 82 | 2.17 | 1.05 | 82 | 1.5 | 85 | 0.053 | 97 | 96 | 2.9 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.68 | 0.019 | 72 | 70 |
| 264 | 42.975 | 42.630 | 0.16 | 0.16 | 1.28 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.053 | 97 | 97 | 2.9 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.38 | 0.022 | 72 | 70 |
| 265 | 43.136 | 42.790 | 0.16 | 0.16 | 1.27 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.050 | 99 | 100 | 2.8 | -0.1 | 245 | 72 | 72 | 69 | -0.036 | 3.80 | 0.015 | 72 | 70 |
| 266 | 43.296 | 42.950 | 0.16 | 0.16 | 1.28 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.051 | 98 | 99 | 2.8 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.68 | 0.013 | 72 | 70 |
| 267 | 43.457 | 43.110 | 0.16 | 0.16 | 1.28 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.051 | 98 | 99 | 2.8 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.82 | 0.016 | 72 | 70 |
| 268 | 43.619 | 43.271 | 0.16 | 0.16 | 1.28 | 82 | 2.18 | 1.05 | 82 | 1.5 | 84 | 0.053 | 97 | 97 | 2.7 | -0.1 | 246 | 72 | 72 | 70 | -0.037 | 3.60 | 0.020 | 72 | 70 |
| 269 | 43.780 | 43.430 | 0.16 | 0.16 | 1.28 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.051 | 98 | 98 | 2.7 | 0 | 246 | 72 | 72 | 70 | -0.037 | 3.73 | 0.008 | 72 | 70 |
| 270 | 43.942 | 43.590 | 0.16 | 0.16 | 1.27 | 82 | 2.17 | 1.05 | 82 | 1.5 | 84 | 0.053 | 97 | 97 | 2.7 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.93 | 0.016 | 72 | 70 |
| 271 | 44.102 | 43.751 | 0.16 | 0.16 | 1.27 | 82 | 2.18 | 1.05 | 82 | 1.5 | 84 | 0.053 | 96 | 97 | 2.7 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.84 | 0.020 | 72 | 70 |
| 272 | 44.263 | 43.910 | 0.16 | 0.16 | 1.29 | 82 | 2.18 | 1.05 | 81 | 1.5 | 84 | 0.054 | 96 | 95 | 2.6 | -0.1 | 247 | 72 | 72 | 70 | -0.037 | 3.69 | 0.014 | 72 | 70 |
| 273 | 44.425 | 44.070 | 0.16 | 0.16 | 1.32 | 82 | 2.24 | 1.08 | 82 | 1.5 | 84 | 0.052 | 98 | 98 | 2.6 | 0 | 247 | 72 | 72 | 70 | -0.036 | 3.91 | 0.010 | 72 | 70 |
| 274 | 44.589 | 44.232 | 0.16 | 0.16 | 1.32 | 82 | 2.24 | 1.08 | 81 | 1.5 | 84 | 0.052 | 99 | 99 | 2.6 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.75 | 0.021 | 72 | 70 |
| 275 | 44.753 | 44.394 | 0.16 | 0.16 | 1.32 | 82 | 2.24 | 1.07 | 81 | 1.5 | 84 | 0.052 | 99 | 99 | 2.5 | -0.1 | 246 | 72 | 72 | 70 | -0.037 | 3.52 | 0.018 | 72 | 70 |
| 276 | 44.917 | 44.556 | 0.16 | 0.16 | 1.31 | 82 | 2.25 | 1.08 | 81 | 1.5 | 84 | 0.054 | 97 | 97 | 2.5 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.49 | 0.018 | 72 | 70 |
| 277 | 45.080 | 44.718 | 0.16 | 0.16 | 1.31 | 82 | 2.25 | 1.08 | 81 | 1.5 | 84 | 0.050 | 101 | 101 | 2.5 | 0 | 247 | 72 | 72 | 70 | -0.037 | 4.25 | 0.011 | 72 | 70 |
| 278 | 45.243 | 44.880 | 0.16 | 0.16 | 1.32 | 82 | 2.25 | 1.08 | 81 | 1.5 | 84 | 0.053 | 98 | 98 | 2.4 | -0.1 | 247 | 72 | 72 | 70 | -0.037 | 4.02 | 0.009 | 72 | 70 |
| 279 | 45.407 | 45.042 | 0.16 | 0.16 | 1.32 | 82 | 2.25 | 1.08 | 81 | 1.5 | 84 | 0.051 | 100 | 100 | 2.4 | 0 | 248 | 72 | 72 | 70 | -0.037 | 3.90 | 0.015 | 72 | 70 |
| 280 | 45.570 | 45.203 | 0.16 | 0.16 | 1.32 | 82 | 2.25 | 1.07 | 81 | 1.5 | 84 | 0.053 | 98 | 98 | 2.4 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.64 | 0.020 | 72 | 70 |
| 281 | 45.734 | 45.365 | 0.16 | 0.16 | 1.32 | 82 | 2.25 | 1.07 | 81 | 1.5 | 84 | 0.051 | 100 | 100 | 2.3 | -0.1 | 248 | 72 | 72 | 70 | -0.037 | 4.18 | 0.010 | 72 | 70 |
| 282 | 45.897 | 45.527 | 0.16 | 0.16 | 1.33 | 82 | 2.25 | 1.07 | 81 | 1.5 | 84 | 0.052 | 99 | 99 | 2.3 | 0 | 248 | 72 | 72 | 70 | -0.037 | 3.74 | 0.016 | 72 | 70 |
| 283 | 46.062 | 45.689 | 0.16 | 0.16 | 1.32 | 82 | 2.25 | 1.07 | 81 | 1.5 | 84 | 0.053 | 99 | 98 | 2.3 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.71 | 0.020 | 72 | 70 |
| 284 | 46.225 | 45.850 | 0.16 | 0.16 | 1.32 | 82 | 2.25 | 1.07 | 81 | 1.5 | 84 | 0.051 | 100 | 99 | 2.3 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.45 | 0.018 | 72 | 70 |
| 285 | 46.388 | 46.012 | 0.16 | 0.16 | 1.31 | 82 | 2.26 | 1.07 | 81 | 1.5 | 84 | 0.051 | 100 | 100 | 2.2 | -0.1 | 246 | 72 | 72 | 70 | -0.037 | 3.40 | 0.021 | 72 | 70 |
| 286 | 46.551 | 46.174 | 0.16 | 0.16 | 1.32 | 82 | 2.26 | 1.07 | 81 | 1.5 | 84 | 0.050 | 101 | 101 | 2.2 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.96 | 0.014 | 72 | 70 |
| 287 | 46.715 | 46.335 | 0.16 | 0.16 | 1.31 | 82 | 2.25 | 1.07 | 81 | 1.5 | 84 | 0.052 | 99 | 98 | 2.2 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.77 | 0.014 | 72 | 70 |
| 288 | 46.878 | 46.496 | 0.16 | 0.16 | 1.32 | 82 | 2.26 | 1.07 | 81 | 1.5 | 84 | 0.051 | 100 | 99 | 2.2 | 0 | 247 | 72 | 72 | 70 | -0.037 | 3.84 | 0.011 | 72 | 70 |
| 289 | 47.041 | 46.657 | 0.16 | 0.16 | 1.32 | 82 | 2.26 | 1.07 | 81 | 1.5 | 84 | 0.052 | 99 | 98 | 2.1 | -0.1 | 246 | 72 | 72 | 70 | -0.037 | 3.53 | 0.020 | 72 | 70 |
| 290 | 47.204 | 46.819 | 0.16 | 0.16 | 1.32 | 82 | 2.26 | 1.07 | 81 | 1.5 | 84 | 0.051 | 100 | 100 | 2.1 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.93 | 0.015 | 72 | 70 |
| 291 | 47.368 | 46.980 | 0.16 | 0.16 | 1.32 | 82 | 2.27 | 1.07 | 81 | 1.5 | 84 | 0.051 | 100 | 99 | 2.1 | 0 | 247 | 72 | 72 | 70 | -0.036 | 4.03 | 0.009 | 72 | 70 |
| 292 | 47.531 | 47.141 | 0.16 | 0.16 | 1.31 | 82 | 2.27 | 1.07 | 81 | 1.6 | 84 | 0.050 | 101 | 100 | 2.0 | -0.1 | 248 | 72 | 72 | 70 | -0.037 | 4.05 | 0.011 | 72 | 70 |
| 293 | 47.695 | 47.302 | 0.16 | 0.16 | 1.31 | 82 | 2.26 | 1.07 | 81 | 1.5 | 84 | 0.051 | 100 | 99 | 2.0 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.27 | 0.027 | 72 | 70 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure:

| Begin | Middle | End | Average |
|---|---|---|---|
| 30.25 | 30.26 | 30.26 | 30.26 "Hg |

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

Velocity Traverse Data

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 294 | 47.857 | 47.464 | 0.16 | 0.16 | 1.31 | 82 | 2.26 | 1.07 | 81 | 1.5 | 84 | 0.050 | 100 | 101 | 2.0 | 0 | 245 | 72 | 72 | 70 | -0.036 | 3.05 | 0.016 | 72 | 70 |
| 295 | 48.020 | 47.625 | 0.16 | 0.16 | 1.31 | 82 | 2.26 | 1.07 | 81 | 1.6 | 84 | 0.052 | 99 | 98 | 2.0 | 0 | 244 | 72 | 72 | 70 | -0.036 | 3.40 | 0.016 | 72 | 70 |
| 296 | 48.183 | 47.786 | 0.16 | 0.16 | 1.31 | 82 | 2.27 | 1.06 | 81 | 1.6 | 84 | 0.052 | 99 | 98 | 1.9 | -0.1 | 244 | 72 | 72 | 70 | -0.036 | 3.34 | 0.016 | 72 | 70 |
| 297 | 48.346 | 47.947 | 0.16 | 0.16 | 1.32 | 82 | 2.27 | 1.06 | 81 | 1.6 | 84 | 0.051 | 100 | 99 | 1.9 | 0 | 245 | 72 | 72 | 70 | -0.036 | 4.47 | 0.006 | 72 | 70 |
| 298 | 48.509 | 48.108 | 0.16 | 0.16 | 1.31 | 82 | 2.27 | 1.06 | 81 | 1.6 | 84 | 0.054 | 97 | 97 | 1.9 | 0 | 246 | 72 | 72 | 70 | -0.037 | 4.21 | 0.017 | 72 | 70 |
| 299 | 48.673 | 48.268 | 0.16 | 0.16 | 1.31 | 82 | 2.27 | 1.06 | 81 | 1.6 | 84 | 0.052 | 99 | 98 | 1.8 | -0.1 | 246 | 72 | 72 | 70 | -0.036 | 3.93 | 0.007 | 72 | 70 |
| 300 | 48.836 | 48.430 | 0.16 | 0.16 | 1.31 | 82 | 2.28 | 1.06 | 81 | 1.6 | 84 | 0.051 | 100 | 100 | 1.8 | 0 | 246 | 72 | 72 | 70 | -0.037 | 4.15 | 0.008 | 72 | 70 |
| 301 | 48.999 | 48.591 | 0.16 | 0.16 | 1.30 | 82 | 2.27 | 1.06 | 81 | 1.6 | 84 | 0.049 | 102 | 101 | 1.8 | 0 | 246 | 72 | 72 | 70 | -0.036 | 3.41 | 0.010 | 72 | 70 |
| 302 | 49.161 | 48.751 | 0.16 | 0.16 | 1.30 | 82 | 2.27 | 1.06 | 81 | 1.6 | 84 | 0.050 | 100 | 100 | 1.7 | -0.1 | 246 | 72 | 71 | 70 | -0.037 | 4.34 | 0.017 | 72 | 70 |
| 303 | 49.324 | 48.911 | 0.16 | 0.16 | 1.30 | 82 | 2.28 | 1.06 | 81 | 1.6 | 84 | 0.051 | 100 | 99 | 1.7 | 0 | 247 | 71 | 71 | 70 | -0.037 | 4.02 | 0.013 | 72 | 70 |
| 304 | 49.486 | 49.073 | 0.16 | 0.16 | 1.31 | 82 | 2.28 | 1.06 | 81 | 1.6 | 84 | 0.051 | 99 | 100 | 1.7 | 0 | 247 | 72 | 71 | 70 | -0.037 | 3.75 | 0.020 | 72 | 70 |
| 305 | 49.649 | 49.233 | 0.16 | 0.16 | 1.31 | 82 | 2.28 | 1.05 | 81 | 1.6 | 84 | 0.053 | 98 | 97 | 1.6 | -0.1 | 247 | 72 | 71 | 70 | -0.037 | 4.10 | 0.012 | 72 | 70 |
| 306 | 49.813 | 49.393 | 0.16 | 0.16 | 1.30 | 82 | 2.29 | 1.06 | 81 | 1.6 | 84 | 0.054 | 97 | 96 | 1.6 | 0 | 247 | 72 | 71 | 70 | -0.036 | 3.83 | 0.026 | 72 | 70 |
| 307 | 49.975 | 49.555 | 0.16 | 0.16 | 1.31 | 81 | 2.29 | 1.06 | 81 | 1.6 | 84 | 0.052 | 98 | 99 | 1.6 | 0 | 246 | 72 | 71 | 70 | -0.037 | 3.51 | 0.032 | 72 | 70 |
| 308 | 50.138 | 49.715 | 0.16 | 0.16 | 1.30 | 82 | 2.28 | 1.05 | 81 | 1.6 | 84 | 0.051 | 100 | 99 | 1.6 | 0 | 245 | 71 | 71 | 70 | -0.037 | 3.53 | 0.034 | 72 | 70 |
| 309 | 50.300 | 49.874 | 0.16 | 0.16 | 1.30 | 81 | 2.28 | 1.06 | 81 | 1.6 | 84 | 0.052 | 98 | 97 | 1.5 | -0.1 | 245 | 72 | 71 | 70 | -0.036 | 3.56 | 0.013 | 72 | 70 |
| 310 | 50.463 | 50.035 | 0.16 | 0.16 | 1.30 | 81 | 2.29 | 1.06 | 81 | 1.6 | 84 | 0.049 | 102 | 101 | 1.5 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.36 | 0.016 | 72 | 70 |
| 311 | 50.625 | 50.196 | 0.16 | 0.16 | 1.31 | 82 | 2.29 | 1.04 | 81 | 1.6 | 84 | 0.055 | 95 | 96 | 1.5 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.78 | 0.013 | 72 | 70 |
| 312 | 50.788 | 50.356 | 0.16 | 0.16 | 1.31 | 81 | 2.29 | 1.06 | 81 | 1.6 | 84 | 0.051 | 100 | 99 | 1.4 | -0.1 | 244 | 71 | 71 | 70 | -0.036 | 3.57 | 0.012 | 72 | 70 |
| 313 | 50.951 | 50.516 | 0.16 | 0.16 | 1.30 | 81 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.050 | 101 | 100 | 1.4 | 0 | 244 | 71 | 71 | 70 | -0.037 | 3.40 | 0.020 | 72 | 70 |
| 314 | 51.114 | 50.677 | 0.16 | 0.16 | 1.30 | 82 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.053 | 98 | 98 | 1.4 | 0 | 245 | 71 | 71 | 70 | -0.036 | 4.40 | 0.019 | 72 | 70 |
| 315 | 51.276 | 50.836 | 0.16 | 0.16 | 1.30 | 81 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.052 | 98 | 97 | 1.3 | -0.1 | 244 | 71 | 71 | 70 | -0.036 | 3.75 | 0.020 | 72 | 70 |
| 316 | 51.438 | 50.997 | 0.16 | 0.16 | 1.30 | 81 | 2.29 | 1.06 | 81 | 1.6 | 84 | 0.051 | 99 | 99 | 1.3 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.18 | 0.013 | 72 | 70 |
| 317 | 51.600 | 51.157 | 0.16 | 0.16 | 1.30 | 81 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.054 | 96 | 96 | 1.3 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.73 | 0.019 | 72 | 70 |
| 318 | 51.763 | 51.317 | 0.16 | 0.16 | 1.30 | 81 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.052 | 99 | 98 | 1.3 | 0 | 245 | 71 | 71 | 70 | -0.036 | 3.51 | 0.019 | 72 | 70 |
| 319 | 51.925 | 51.477 | 0.16 | 0.16 | 1.30 | 82 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.050 | 100 | 100 | 1.2 | -0.1 | 244 | 71 | 71 | 70 | -0.036 | 3.41 | 0.018 | 72 | 70 |
| 320 | 52.088 | 51.637 | 0.16 | 0.16 | 1.30 | 82 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.053 | 98 | 97 | 1.2 | 0 | 244 | 71 | 71 | 70 | -0.037 | 3.17 | 0.021 | 72 | 70 |
| 321 | 52.251 | 51.797 | 0.16 | 0.16 | 1.30 | 82 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.050 | 101 | 100 | 1.2 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.71 | 0.011 | 72 | 70 |
| 322 | 52.412 | 51.956 | 0.16 | 0.16 | 1.30 | 82 | 2.29 | 1.05 | 81 | 1.6 | 84 | 0.051 | 98 | 98 | 1.2 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.52 | 0.012 | 72 | 70 |
| 323 | 52.575 | 52.117 | 0.16 | 0.16 | 1.30 | 81 | 2.3 | 1.05 | 81 | 1.6 | 84 | 0.052 | 99 | 98 | 1.1 | -0.1 | 245 | 71 | 71 | 70 | -0.036 | 3.80 | 0.016 | 72 | 70 |
| 324 | 52.737 | 52.276 | 0.16 | 0.16 | 1.30 | 81 | 2.3 | 1.05 | 81 | 1.6 | 84 | 0.051 | 99 | 98 | 1.1 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.80 | 0.016 | 72 | 70 |
| 325 | 52.899 | 52.436 | 0.16 | 0.16 | 1.30 | 82 | 2.3 | 1.05 | 81 | 1.6 | 84 | 0.051 | 99 | 99 | 1.1 | 0 | 245 | 71 | 71 | 70 | -0.036 | 4.15 | 0.009 | 72 | 70 |
| 326 | 53.062 | 52.596 | 0.16 | 0.16 | 1.30 | 82 | 2.31 | 1.05 | 81 | 1.6 | 84 | 0.052 | 99 | 98 | 1.0 | -0.1 | 246 | 71 | 71 | 70 | -0.037 | 4.09 | 0.012 | 72 | 70 |
| 327 | 53.224 | 52.756 | 0.16 | 0.16 | 1.29 | 82 | 2.31 | 1.04 | 81 | 1.6 | 84 | 0.051 | 99 | 99 | 1.0 | 0 | 245 | 71 | 71 | 70 | -0.037 | 3.27 | 0.024 | 72 | 70 |
| 328 | 53.383 | 52.913 | 0.16 | 0.16 | 1.30 | 82 | 2.31 | 1.05 | 81 | 1.6 | 84 | 0.053 | 95 | 95 | 1.0 | 0 | 245 | 71 | 71 | 70 | -0.036 | 3.86 | 0.011 | 72 | 70 |
| 329 | 53.545 | 53.072 | 0.16 | 0.16 | 1.30 | 82 | 2.3 | 1.04 | 81 | 1.6 | 84 | 0.052 | 98 | 97 | 1.0 | 0 | 245 | 71 | 71 | 70 | -0.037 | 3.49 | 0.009 | 72 | 70 |
| 330 | 53.707 | 53.232 | 0.16 | 0.16 | 1.30 | 81 | 2.3 | 1.14 | 81 | 1.7 | 84 | 0.051 | 99 | 99 | 0.9 | -0.1 | 245 | 71 | 71 | 70 | -0.036 | 3.68 | 0.008 | 72 | 70 |
| 331 | 53.871 | 53.394 | 0.16 | 0.16 | 1.34 | 82 | 2.36 | 1.08 | 81 | 1.6 | 84 | 0.051 | 100 | 100 | 0.9 | 0 | 245 | 71 | 71 | 70 | -0.036 | 3.65 | 0.014 | 72 | 70 |
| 332 | 54.036 | 53.557 | 0.16 | 0.16 | 1.33 | 82 | 2.36 | 1.08 | 81 | 1.6 | 84 | 0.051 | 101 | 101 | 0.9 | 0 | 246 | 71 | 71 | 70 | -0.037 | 4.43 | 0.020 | 72 | 70 |
| 333 | 54.201 | 53.718 | 0.16 | 0.16 | 1.33 | 82 | 2.37 | 1.07 | 81 | 1.6 | 84 | 0.050 | 102 | 100 | 0.8 | -0.1 | 248 | 71 | 71 | 70 | -0.037 | 4.51 | 0.014 | 72 | 70 |
| 334 | 54.365 | 53.880 | 0.16 | 0.16 | 1.33 | 82 | 2.36 | 1.08 | 81 | 1.6 | 84 | 0.051 | 100 | 100 | 0.8 | 0 | 249 | 71 | 71 | 70 | -0.037 | 4.26 | 0.013 | 72 | 70 |
| 335 | 54.529 | 54.042 | 0.16 | 0.16 | 1.32 | 82 | 2.36 | 1.08 | 81 | 1.6 | 84 | 0.053 | 98 | 98 | 0.8 | 0 | 248 | 71 | 71 | 70 | -0.037 | 3.93 | 0.012 | 72 | 70 |

# Pellet Heater Test Data - ASTM E2779 / ASTM E2515

**Run:** 1

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Test Date: 21-Feb-18
Beginning Clock Time: 07:43

High Burn End Time: 61
Medium Burn End Time: 181
Total Sampling Time: 361 min
Recording Interval: 1 min
Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 0.977 (1) 0.979 (2) 0 (Amb)

Barometric Pressure: Begin 30.25, Middle 30.26, End 30.26, Average 30.26 "Hg

OMNI Equipment Numbers: 132, 185, 209, 335, 336, 410, 494, 559

PM Control Modules: 335/336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.160 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.56 ft/sec.
Intial Tunnel Flow: 148.3 scfm
Average Tunnel Flow: 152.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ -13 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ -12 in. Hg
Fuel Moisture: 4.84 Dry Basis %

**Velocity Traverse Data**

| | Pt.1 | Pt.2 | Pt.3 | Pt.4 | Pt.5 | Pt.6 | Pt.7 | Pt.8 | Center | |
|---|---|---|---|---|---|---|---|---|---|---|
| Initial dP | 0.030 | 0.048 | 0.048 | 0.034 | 0.036 | 0.048 | 0.046 | 0.030 | 0.052 | "H2O |
| Temp: | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | 103 | °F |

$V_{strav}$ 13.76 ft/sec $V_{scent}$ 15.45 ft/sec $F_p$ 0.891

| | Particulate Sampling Data | | | | | | | | | | | | | | Fuel Weight (lb) | | Temperature Data (°F) | | | | Stack Gas Data | | | Dryer Temps | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Gas Meter 1 ($ft^3$) | Gas Meter 2 ($ft^3$) | Sample Rate 1 (cfm) | Sample Rate 2 (cfm) | Orifice dH 1 ("$H_2O$) | Meter Temp 1 (°F) | Meter Vacuum 1 ("Hg) | Orifice dH 2 ("$H_2O$) | Meter Temp 2 (°F) | Meter Vacuum 2 ("Hg) | Dilution Tunnel (°F) | Dilution Tunnel Center dP | Pro. Rate 1 | Pro. Rate 2 | Scale Reading | Weight Change | Stack | Filter 1 | Filter 2 | Ambient | Draft ("$H_2O$) | $CO_2$ (%) | CO (%) | Drier A | Drier B |
| 336 | 54.693 | 54.204 | 0.16 | 0.16 | 1.32 | 82 | 2.36 | 1.07 | 81 | 1.6 | 84 | 0.055 | 96 | 96 | 0.7 | -0.1 | 248 | 71 | 71 | 70 | -0.037 | 3.62 | 0.013 | 72 | 70 |
| 337 | 54.857 | 54.365 | 0.16 | 0.16 | 1.32 | 82 | 2.36 | 1.07 | 81 | 1.6 | 84 | 0.051 | 100 | 99 | 0.7 | 0 | 247 | 71 | 71 | 70 | -0.038 | 3.90 | 0.013 | 72 | 70 |
| 338 | 55.021 | 54.527 | 0.16 | 0.16 | 1.33 | 82 | 2.36 | 1.08 | 81 | 1.6 | 84 | 0.055 | 96 | 96 | 0.7 | 0 | 247 | 71 | 71 | 70 | -0.037 | 3.78 | 0.017 | 72 | 70 |
| 339 | 55.184 | 54.689 | 0.16 | 0.16 | 1.33 | 82 | 2.36 | 1.07 | 81 | 1.6 | 84 | 0.054 | 97 | 97 | 0.6 | -0.1 | 247 | 71 | 71 | 70 | -0.037 | 3.76 | 0.013 | 72 | 70 |
| 340 | 55.349 | 54.851 | 0.16 | 0.16 | 1.33 | 82 | 2.37 | 1.07 | 81 | 1.6 | 84 | 0.052 | 100 | 99 | 0.6 | 0 | 248 | 71 | 71 | 70 | -0.037 | 4.22 | 0.014 | 72 | 70 |
| 341 | 55.513 | 55.012 | 0.16 | 0.16 | 1.33 | 82 | 2.37 | 1.07 | 81 | 1.6 | 84 | 0.049 | 102 | 101 | 0.6 | 0 | 248 | 71 | 71 | 70 | -0.037 | 3.72 | 0.015 | 72 | 70 |
| 342 | 55.677 | 55.174 | 0.16 | 0.16 | 1.33 | 82 | 2.37 | 1.07 | 81 | 1.6 | 84 | 0.056 | 96 | 96 | 0.6 | 0 | 249 | 71 | 71 | 70 | -0.037 | 4.12 | 0.009 | 72 | 70 |
| 343 | 55.841 | 55.336 | 0.16 | 0.16 | 1.33 | 82 | 2.38 | 1.07 | 81 | 1.6 | 84 | 0.050 | 101 | 101 | 0.5 | -0.1 | 248 | 71 | 71 | 70 | -0.037 | 3.49 | 0.018 | 72 | 70 |
| 344 | 56.006 | 55.498 | 0.16 | 0.16 | 1.33 | 81 | 2.37 | 1.07 | 81 | 1.6 | 84 | 0.054 | 98 | 97 | 0.5 | 0 | 248 | 71 | 71 | 70 | -0.037 | 3.67 | 0.015 | 72 | 70 |
| 345 | 56.170 | 55.659 | 0.16 | 0.16 | 1.32 | 82 | 2.38 | 1.07 | 81 | 1.6 | 84 | 0.053 | 98 | 98 | 0.5 | 0 | 246 | 71 | 71 | 70 | -0.036 | 3.02 | 0.021 | 72 | 70 |
| 346 | 56.334 | 55.820 | 0.16 | 0.16 | 1.32 | 82 | 2.38 | 1.07 | 81 | 1.6 | 84 | 0.053 | 98 | 98 | 0.5 | 0 | 244 | 71 | 71 | 70 | -0.036 | 2.94 | 0.012 | 72 | 70 |
| 347 | 56.498 | 55.982 | 0.16 | 0.16 | 1.32 | 81 | 2.37 | 1.07 | 81 | 1.6 | 84 | 0.050 | 101 | 101 | 0.4 | -0.1 | 243 | 71 | 71 | 70 | -0.036 | 3.07 | 0.022 | 72 | 70 |
| 348 | 56.661 | 56.144 | 0.16 | 0.16 | 1.32 | 82 | 2.38 | 1.07 | 81 | 1.6 | 84 | 0.050 | 101 | 101 | 0.4 | 0 | 244 | 71 | 71 | 70 | -0.037 | 3.93 | 0.015 | 72 | 70 |
| 349 | 56.825 | 56.305 | 0.16 | 0.16 | 1.32 | 82 | 2.38 | 1.07 | 81 | 1.7 | 84 | 0.054 | 97 | 97 | 0.4 | 0 | 245 | 71 | 71 | 70 | -0.037 | 3.93 | 0.012 | 72 | 70 |
| 350 | 56.989 | 56.466 | 0.16 | 0.16 | 1.32 | 82 | 2.37 | 1.07 | 81 | 1.6 | 84 | 0.052 | 99 | 98 | 0.3 | -0.1 | 245 | 71 | 71 | 70 | -0.037 | 3.58 | 0.019 | 72 | 70 |
| 351 | 57.152 | 56.628 | 0.16 | 0.16 | 1.33 | 82 | 2.38 | 1.07 | 81 | 1.6 | 84 | 0.052 | 99 | 99 | 0.3 | 0 | 244 | 71 | 71 | 70 | -0.036 | 3.77 | 0.021 | 72 | 70 |
| 352 | 57.316 | 56.789 | 0.16 | 0.16 | 1.32 | 82 | 2.38 | 1.06 | 81 | 1.7 | 84 | 0.050 | 101 | 100 | 0.3 | 0 | 246 | 71 | 71 | 70 | -0.038 | 4.08 | 0.008 | 72 | 70 |
| 353 | 57.480 | 56.949 | 0.16 | 0.16 | 1.33 | 82 | 2.38 | 1.07 | 81 | 1.7 | 84 | 0.050 | 101 | 100 | 0.2 | -0.1 | 247 | 71 | 71 | 70 | -0.037 | 4.71 | 0.014 | 72 | 70 |
| 354 | 57.644 | 57.111 | 0.16 | 0.16 | 1.32 | 82 | 2.39 | 1.07 | 81 | 1.7 | 84 | 0.052 | 99 | 99 | 0.2 | 0 | 249 | 71 | 71 | 70 | -0.037 | 4.73 | 0.022 | 72 | 70 |
| 355 | 57.808 | 57.272 | 0.16 | 0.16 | 1.32 | 82 | 2.38 | 1.07 | 81 | 1.7 | 84 | 0.051 | 100 | 99 | 0.2 | 0 | 250 | 71 | 71 | 70 | -0.037 | 4.45 | 0.009 | 72 | 70 |
| 356 | 57.971 | 57.433 | 0.16 | 0.16 | 1.32 | 82 | 2.39 | 1.07 | 81 | 1.7 | 84 | 0.053 | 98 | 98 | 0.1 | -0.1 | 250 | 71 | 71 | 70 | -0.037 | 3.95 | 0.018 | 72 | 70 |
| 357 | 58.136 | 57.596 | 0.17 | 0.16 | 1.32 | 82 | 2.39 | 1.06 | 81 | 1.7 | 84 | 0.053 | 99 | 99 | 0.1 | 0 | 249 | 71 | 71 | 70 | -0.037 | 4.00 | 0.013 | 72 | 70 |
| 358 | 58.298 | 57.756 | 0.16 | 0.16 | 1.32 | 82 | 2.39 | 1.06 | 81 | 1.7 | 84 | 0.052 | 98 | 98 | 0.1 | 0 | 250 | 71 | 71 | 70 | -0.038 | 3.86 | 0.010 | 72 | 70 |
| 359 | 58.462 | 57.917 | 0.16 | 0.16 | 1.32 | 82 | 2.39 | 1.05 | 81 | 1.7 | 84 | 0.051 | 100 | 99 | 0.1 | 0 | 250 | 71 | 71 | 70 | -0.039 | 3.91 | 0.011 | 72 | 70 |
| 360 | 58.625 | 58.077 | 0.16 | 0.16 | 1.32 | 81 | 2.4 | 1.06 | 81 | 1.7 | 84 | 0.053 | 98 | 97 | 0.0 | -0.1 | 250 | 71 | 71 | 70 | -0.037 | 3.87 | 0.021 | 72 | 70 |
| 361 | 58.789 | 58.238 | 0.16 | 0.16 | 1.32 | 81 | 2.4 | 1.06 | 81 | 1.7 | 84 | 0.052 | 99 | 98 | 0.0 | 0 | 250 | 71 | 71 | 70 | -0.038 | 4.07 | 0.012 | 72 | 70 |
| Avg/Tot | 58.789 | 58.238 | 0.16 | 0.16 | 1.31 | 81 | 2.13 | 1.07 | 81 | 1.39 | 89 | 0.05 | 100 | 100 | | | 291 | 73 | 72 | 70 | -0.042 | 5.28 | 0.02 | 77 | 76 |

# Pellet Heater Test Results - ASTM E2779 / ASTM E2515

Manufacturer: HHT Halifax
Model: Absolute 43-C
Project No.: 0135PS039E
Tracking No.: 2269
Run: 1
Test Date: 02/21/18

| | |
|---|---|
| Burn Rate (Composite) | **1.09 kg/hr dry** |
| Average Tunnel Temperature | 89 degrees F |
| Average Gas Velocity in Dilution Tunnel - vs | 13.56 feet/second |
| Average Gas Flow Rate in Dilution Tunnel - Qsd | 9120.6 dscf/hour |
| Average Delta p | 0.051 inches H20 |
| Average Delta H | 1.31 inches H20 |
| Total Time of Test | 361 minutes |

| | | |
|---|---|---|
| **Burn Rate (High)** | **2.30** | kg/hr dry |
| **Burn Rate (Med)** | **1.00** | kg/hr dry |
| | 43.3% | of High |
| **Burn Rate (Low)** | **0.74** | kg/hr dry |
| | 32.0% | of High |

| | AMBIENT | SAMPLE TRAIN 1 | SAMPLE TRAIN 2 | 1st HR FILTER (TRAIN 1) |
|---|---|---|---|---|
| Total Sample Volume - Vm | 0.000 cubic feet | 58.789 cubic feet | 58.238 cubic feet | 9.766 cubic feet |
| Average Gas Meter Temperature | 70 degrees F | 81 degrees F | 81 degrees F | 76 degrees F |
| Total Sample Volume (Standard Conditions) - Vmstd | 0.000 dscf | 56.855 dscf | 56.425 dscf | 9.525 dscf |
| Total Particulates - $m_n$ | 0 mg | 6 mg | 6.3 mg | 1.5 mg |
| Particulate Concentration (dry-standard) - $C_f/C_s$ | 0.000000 grams/dscf | 0.00011 grams/dscf | 0.00011 grams/dscf | 0.00016 grams/dscf |
| Total Particulate Emissions - $E_T$ | 0.00 grams | 5.79 grams | 6.13 grams | 1.44 grams |
| Particulate Emission Rate | 0.00 grams/hour | 0.96 grams/hour | 1.02 grams/hour | 1.44 grams/hour |
| Emissisons Factor | | 0.89 g/kg | 0.94 g/kg | 0.63 g/kg |
| Difference from Average Total Particulate Emissions | | 0.17 grams | 0.17 grams | |

**Dual Train Comparison Results Are Acceptable**

FINAL AVERAGE RESULTS

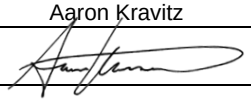
| | |
|---|---|
| **Integrated Test Run** | |
| Total Particulate Emissions - $E_T$ | 5.96 grams |
| Particulate Emission Rate | **0.99 grams/hour** |
| Emissisons Factor | 0.91 grams/kg |
| **First Hour Emissions** | |
| Total Particulate Emissions - $E_T$ | 1.44 grams |
| Particulate Emission Rate | 1.44 grams/hour |
| Emissisons Factor | 0.63 grams/kg |

| QUALITY CHECKS | |
|---|---|
| **Filter Temps < 90 °F** | OK |
| **Filter Face Velocity (47 mm)** | OK |
| **Leakage Rate** | OK |
| **Ambient Temp (55-90°F)** | OK |
| **Negative Probe Weight Eval.** | OK |
| **Pro-Rate Variation** | OK |
| **Medium Burn Rate < 50%** | OK |
| **Train Precesion 7.5%** | 2.82 |
| **Train Precision 0.5g/kg** | 0.06 |

# OMNI-Test Laboratories

**Manufacturer:** HHT Halifax
**Model:** Absolute 43-C
**Date:** 02/21/18
**Run:** 1
**Control #:** 0135PS039E
**Test Duration:** 361
**Output Category:** Integrated

**Technicians:** Aaron Kravitz



**Test Results in Accordance with CSA B415.1-09**

| | HHV Basis | LHV Basis |
|---|---|---|
| **Overall Efficiency** | 77.0% | 82.3% |
| **Combustion Efficiency** | 99.5% | 99.5% |
| **Heat Transfer Efficiency** | 77% | 82.8% |

| | | | |
|---|---|---|---|
| **Output Rate (kJ/h)** | 16,951 | 16,080 | **(Btu/h)** |
| **Burn Rate (kg/h)** | 1.09 | 2.39 | **(lb/h)** |
| **Input (kJ/h)** | 22,007 | 20,876 | **(Btu/h)** |

| | | | |
|---|---|---|---|
| **Test Load Weight (dry kg)** | 6.53 | 14.40 | **dry lb** |
| **MC wet (%)** | 4.62 | | |
| **MC dry (%)** | 4.84 | | |
| **Particulate (g )** | 5.96 | | |
| **CO (g)** | 35 | | |
| **Test Duration (h)** | 6.02 | | |

| Emissions | Particulate | CO |
|---|---|---|
| **g/MJ Output** | 0.06 | 0.34 |
| **g/kg Dry Fuel** | 0.91 | 5.33 |
| **g/h** | 0.99 | 5.79 |
| **lb/MM Btu Output** | 0.14 | 0.79 |

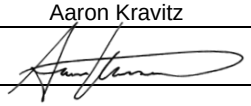
| | |
|---|---|
| **Air/Fuel Ratio (A/F)** | 23.09 |

**VERSION:** **2.2** **12/14/2009**

# OMNI-Test Laboratories

**Manufacturer:** HHT Halifax
**Model:** Absolute 43-C
**Date:** 02/21/18
**Run:** 1
**Control #:** 0135PS039E
**Test Duration:** 61
**Output Category:** Maximum

**Technicians:** Aaron Kravitz



**Test Results in Accordance with CSA B415.1-09**

| | HHV Basis | LHV Basis |
|---|---|---|
| **Overall Efficiency** | 79.2% | 84.6% |
| **Combustion Efficiency** | 99.5% | 99.5% |
| **Heat Transfer Efficiency** | 80% | 85.1% |

| | | | |
|---|---|---|---|
| **Output Rate (kJ/h)** | 36,872 | 34,977 | **(Btu/h)** |
| **Burn Rate (kg/h)** | 2.30 | 5.07 | **(lb/h)** |
| **Input (kJ/h)** | 46,576 | 44,183 | **(Btu/h)** |

| | | | |
|---|---|---|---|
| **Test Load Weight (dry kg)** | 2.34 | 5.15 | **dry lb** |
| **MC wet (%)** | 4.62 | | |
| **MC dry (%)** | 4.84 | | |
| **Particulate (g )** | 0 | | |
| **CO (g)** | 13 | | |
| **Test Duration (h)** | 1.02 | | |

| Emissions | Particulate | CO |
|---|---|---|
| **g/MJ Output** | 0.00 | 0.36 |
| **g/kg Dry Fuel** | 0.00 | 5.73 |
| **g/h** | 0.00 | 13.16 |
| **lb/MM Btu Output** | 0.00 | 0.83 |

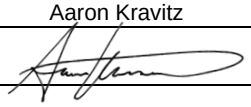
| | |
|---|---|
| **Air/Fuel Ratio (A/F)** | 12.00 |

**VERSION:** **2.2** **12/14/2009**

# OMNI-Test Laboratories

**Manufacturer:** HHT Halifax
**Model:** Absolute 43-C
**Date:** 02/21/18
**Run:** 1
**Control #:** 0135PS039E
**Test Duration:** 120
**Output Category:** Medium

**Technicians:** Aaron Kravitz



**Test Results in Accordance with CSA B415.1-09**

| | HHV Basis | LHV Basis |
|---|---|---|
| **Overall Efficiency** | 76.5% | 81.8% |
| **Combustion Efficiency** | 99.5% | 99.5% |
| **Heat Transfer Efficiency** | 77% | 82.2% |

| | | | |
|---|---|---|---|
| **Output Rate (kJ/h)** | 15,436 | 14,642 | **(Btu/h)** |
| **Burn Rate (kg/h)** | 1.00 | 2.19 | **(lb/h)** |
| **Input (kJ/h)** | 20,169 | 19,132 | **(Btu/h)** |

| | | | |
|---|---|---|---|
| **Test Load Weight (dry kg)** | 1.99 | 4.39 | **dry lb** |
| **MC wet (%)** | 4.62 | | |
| **MC dry (%)** | 4.84 | | |
| **Particulate (g )** | 0 | | |
| **CO (g)** | 9 | | |
| **Test Duration (h)** | 2.00 | | |

| Emissions | Particulate | CO |
|---|---|---|
| **g/MJ Output** | 0.00 | 0.30 |
| **g/kg Dry Fuel** | 0.00 | 4.64 |
| **g/h** | 0.00 | 4.62 |
| **lb/MM Btu Output** | 0.00 | 0.70 |

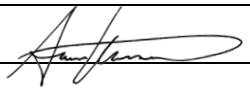
| | |
|---|---|
| **Air/Fuel Ratio (A/F)** | 23.25 |

**VERSION:** **2.2** **12/14/2009**

# OMNI-Test Laboratories

**Manufacturer:** HHT Halifax
**Model:** Absolute 43-C
**Date:** 02/21/18
**Run:** 1
**Control #:** 0135PS039E
**Test Duration:** 180
**Output Category:** Minimum

**Technicians:** Aaron Kravitz



**Test Results in Accordance with CSA B415.1-09**

| | HHV Basis | LHV Basis |
|---|---|---|
| **Overall Efficiency** | 74.9% | 80.1% |
| **Combustion Efficiency** | 99.5% | 99.5% |
| **Heat Transfer Efficiency** | 75% | 80.5% |

| | | | |
|---|---|---|---|
| **Output Rate (kJ/h)** | 11,163 | 10,589 | **(Btu/h)** |
| **Burn Rate (kg/h)** | 0.74 | 1.62 | **(lb/h)** |
| **Input (kJ/h)** | 14,907 | 14,141 | **(Btu/h)** |

| | | | |
|---|---|---|---|
| **Test Load Weight (dry kg)** | 2.21 | 4.86 | **dry lb** |
| **MC wet (%)** | 4.62 | | |
| **MC dry (%)** | 4.84 | | |
| **Particulate (g )** | 0 | | |
| **CO (g)** | 12 | | |
| **Test Duration (h)** | 3.00 | | |

| **Emissions** | **Particulate** | **CO** |
|---|---|---|
| **g/MJ Output** | 0.00 | 0.37 |
| **g/kg Dry Fuel** | 0.00 | 5.62 |
| **g/h** | 0.00 | 4.13 |
| **lb/MM Btu Output** | 0.00 | 0.86 |

| | |
|---|---|
| **Air/Fuel Ratio (A/F)** | 33.30 |

**VERSION:** **2.2** **12/14/2009**

# 2.2 - Sample Analysis & Tares

Analysis Worksheets
Tared Filter, Probe, and O-Ring Data
Pellet Fuel Label
Pellet Fuel Analysis Report

OMNI-Test Laboratories, Inc.

# Pellet Heater Certification Run Sheets

Client: HHT Halifax | Project Number: 0135PS039E | Run Number: 1
Model: Absolute 93-C | Tracking Number: 2269 | Date: 2/20/18
Test Crew: A. Kravitz
OMNI Equipment ID numbers: 637, 592, 283A

## ASTM E2515 Lab Sheet

**Assembled By:** A. Kravitz

**Date/Time in Dessicator:** 2/21/18

| | Weighing #1 | Weighing #2 | Weighing #3 | Weighing #4 | Weighing #5 |
|---|---|---|---|---|---|
| | Date: 2/24/18 | Date: 2/27/18 | Date: | Date: | Date: |
| | Time: 13:00 | Time: 13:00 | Time: | Time: | Time: |
| | R/H %: 12.4 | R/H %: 10.2 | R/H %: | R/H %: | R/H %: |
| | Temp (F): 71.7 | Temp (F): 71.9 | Temp (F): | Temp (F): | Temp (F): |
| | Audit 1: 199.9 | Audit 1: 199.9 | Audit 1: | Audit 1: | Audit 1: |
| | Audit 2: 1999.8 | Audit 2: 1999.9 | Audit 2: | Audit 2: | Audit 2: |
| | Audit 3: 99997.9 | Audit 3: 99997.8 | Audit 3: | Audit 3: | Audit 3: |
| | Initials: A | Initials: A | Initials: | Initials: | Initials: |

| Train | Item | ID # | Tare (mg) | Weight (mg) | Weight (mg) | Weight (mg) | Weight (mg) | Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | Front Filter (60 min) | D391 | 110.6 | 112.1 | 112.1 | | | |
| A | Front Filter (Remainder) | D417 | 237.7 | 241.3 | 241.1 | | | |
| A | Rear Filter | D418 | - | - | - | | | |
| A | Probe | 2 | 115014.5 | 115014.4 | 115014.5 | | | |
| A | O-Ring Set | R573 | 4136.6 | 4137.9 | 4137.7 ~~4317.8~~ A | | | |
| B | Front Filter | D419 | 237.9 | 243.8 | 243.6 ~~245.6~~ A | | | |
| B | Rear Filter | D420 | - | - | - | | | |
| B | Probe | 3 | 116008.6 | 116008.5 | 116008.6 | | | |
| B | O-Ring Set | R576 | 3367.5 | 3368.3 | 3368.1 | | | |
| BG | Filter | | | | | | | |

Technician Signature: A Date: 2/27/17

# Pellet Heater Lab Data - ASTM E2779 / ASTM E2515

Manufacturer: HHT Halifax
Model: Absolute 43-C
Tracking No.: 2269
Project No.: 0135PS039E
Run #: 1
Date: 2/21/18

Equipment Numbers: 632, 283A, 592

**TRAIN 1 (First Hour emissions)**

| Sample Component | Reagent | Filter, Probe or Dish # | Weights | | |
|---|---|---|---|---|---|
| | | | Final, mg | Tare, mg | Particulate, mg |
| A. Front filter catch | Filter | D391 | 112.1 | 110.6 | 1.5 |
| B. Rear filter catch | Filter | | | | 0.0 |
| C. Probe catch* | Probe | | | | 0.0 |
| D. Filter seals catch* | Seals | | | | 0.0 |

| Sub-Total | Total Particulate, mg: | 1.5 |
|---|---|---|

**TRAIN 1 (Remainder of Test)**

| Sample Component | Reagent | Filter, Probe or Dish # | Weights | | |
|---|---|---|---|---|---|
| | | | Final, mg | Tare, mg | Particulate, mg |
| A. Front filter catch | Filter | D417 | 241.1 | 237.7 | 3.4 |
| B. Rear filter catch | Filter | D418 | | | 0.0 |
| C. Probe catch* | Probe | 2 | 115014.5 | 115014.5 | 0.0 |
| D. Filter seals catch* | Seals | R573 | 4137.7 | 4136.6 | 1.1 |

| Sub-Total | Total Particulate, mg: | 4.5 |
|---|---|---|

| Train 1 Aggregate | Total Particulate, mg: | **6.0** |
|---|---|---|

**TRAIN 2**

| Sample Component | Reagent | Filter, Probe or Dish # | Weights | | |
|---|---|---|---|---|---|
| | | | Final, mg | Tare, mg | Particulate, mg |
| A. Front filter catch | Filter | D419 | 243.6 | 237.9 | 5.7 |
| B. Rear filter catch | Filter | D420 | | | 0.0 |
| C. Probe catch* | Probe | 3 | 116008.6 | 116008.6 | 0.0 |
| D. Filter seals catch* | Seals | R576 | 3368.1 | 3367.5 | 0.6 |

| Total Particulate, mg: | 6.3 |
|---|---|

**AMBIENT**

| Sample Component | Reagent | Filter # or Probe # | Weights | | |
|---|---|---|---|---|---|
| | | | Final, mg | Tare, mg | Particulate, mg |
| A. Front filter catch* | Filter | | | | 0.0 |

| Total Particulate, mg: | 0.0 |
|---|---|

*Particulate catch that results in a negative number, is assumed to be zero for probes and seals, negative numbers for filters are assumed to be part of the seal weight

| Component | Equations: |
|---|---|
| A. Front filter catch | Final (mg) - Tare (mg) = Particulate, mg |
| B. Rear filter catch | Final (mg) - Tare (mg) = Particulate, mg |
| C. Probe catch | Final (mg) - Tare (mg) = Particulate, mg |

**Tare Sheet: (check one)** **Probes**_____ **47mm Filters**_✓_ **100mm Filters**_____ **O-Ring Pair**_____

Prepared By: A. Kranich Balance ID #: 637 Thermohygrometer ID #: 542 Audit Weight ID #/Mass: 283A / 200 mg

| Placed in Dessicator: Date: 1/17/18 Time: 13:30 | Date: 1/19/18 Time: 1000 RH %: 12.0 T (°F): 73.7 Audit: 200.0 | Date: 1/19/18 Time: 1600 RH %: 14.2 T (°F): 74.7 Audit: 200.0 | Date: 2/8/18 Time: 1500 RH %: 12.4 T (°F): 71.0 Audit: 200.0 | Date: 2/12/18 Time: 0830 RH %: 10.5 T (°F): 66.9 Audit: 200.0 | Date Used | Project Number | Run No. |
|---|---|---|---|---|---|---|---|
| ID # | | | | | | | |
| D417/18 | | | 232.7 | 232.7 | 2/20/18 | 0135 PS03A E | 1 |
| D419/20 | | | 238.0 | 232.9 | ↓ | ↓ | ↓ |
| D421/22 | | | 239.2 | 239.2 | | | |
| D423/24 | | | 238.5 | 238.7 | | | |
| D425/26 | | | 239.2 | 239.2 | | | |
| T1 | | | 119.8 | 118.8 | | | |
| T2 | | | 116.8 | 116.6 | | | |
| T3 | | | 117.6 | 117.4 | | | |
| | Initials: | Initials: | Initials: | Initials: | | | |

Final Technician Signature: _____ Date: 1/19/18 Evaluator signature: _____



T4 120.0 120.7

**Tare Sheet: (check one)** Probes_____ 47mm Filters_✓_ 100mm Filters_____ O-Ring Pair_____

Prepared By: A. Kravitz Balance ID #: 637 Thermohygrometer ID #: 542 Audit Weight ID #/Mass: 283A / 200 mg

| Placed in Dessicator: Date: 1/17/18 Time: 13:30 | Date: 1/19/18 Time: 1000 RH %: 12.0 T (°F): 73.7 | Date: 1/19/18 Time: 1600 RH %: 14.2 T (°F): 74.7 | Date: 2/8/18 Time: 1500 RH %: 12.9 T (°F): 71.0 | Date: 2/12/18 Time: 0430 RH %: 10.5 T (°F): 66.9 | Date Used | Project Number | Run No. |
|---|---|---|---|---|---|---|---|
| ID # | Audit: 200.0 | Audit: 200.0 | Audit: 200.0 | Audit: 200.0 | | | |
| D417/18 | | | 232.7 | 237.7 | 2/20/18 | 0135 PS 039E | 1 |
| D419/20 | | | 238.0 | 232.9 | ↓ | ↓ | ↓ |
| D421/22 | | | 239.2 | 239.2 | | | |
| D423/24 | | | 238.5 | 238.7 | | | |
| D425/26 | | | 239.2 | 239.2 | | | |
| T1 | | | 119.0 | 118.8 | | | |
| T2 | | | 116.8 | 116.6 | | | |
| T3 | | | 117.6 | 117.4 | | | |
| | Initials: | Initials: | Initials: | Initials: | | | |

Final Technician Signature: _____ Date: 1/19/18 Evaluator signature: _____



T4 120.8 120.7

**Tare Sheet: Probes___ 47mm Filters✓ 100mm Filters___ O-Ring Pair___**

Date/time Placed in Dessicator: 1/4/18 1410

Thermohygrometer ID #: OMNI-00592

Prepared By: B Davis

Analytical Balance ID #: OMNI-00637

Audit Weight ID #/Mass: OMNI-00283A / 200 mg

| ID # | Date: 1/5/18<br>Time: 1425<br>RH %: 19.8<br>T (°F): 71.2<br>Audit: 0.2001 | Date: 1/8/18<br>Time: 10:20<br>RH %: 17.6<br>T (°F): 74.4<br>Audit: 0.2000 | Date: 1/9/18<br>Time: 0820<br>RH %: 8.6<br>T (°F): 77<br>Audit: 0.2000 | Date:<br>Time:<br>RH %:<br>T (°F):<br>Audit: | Date Used | Project Number | Run No. |
|---|---|---|---|---|---|---|---|
| D391 | 110.4 | 110.6 | | | 2/26/18 | | 1 |
| Initials: | BL | BL | BL | | | | |

Final Technician Signature: _____ Date: 1/10/18

Evaluator signature: _____

**Tare Sheet: (check one)** **Probes**____ **47mm Filters**____ **100mm Filters**____ **O-Ring Pair** ✓

Prepared By: Balance ID #: Thermohygrometer ID #: Audit Weight ID #/Mass: /

| Placed in Dessicator: Date: 2/13/18 Time: 1130 ID # | Date: 2/19/18 Time: 13:00 RH %: 8.0 T (°F): 71.7 Audit: 1999.7 | Date: 2/20/18 Time: 0600 RH %: 6.9 T (°F): 68.1 Audit: 1999.8 | Date: 3/14/18 Time: 1430 RH %: 7.7 T (°F): 73.4 Audit: 1999.8 | Date: Time: RH %: T (°F): Audit: | Date Used | Project Number | Run No. |
|---|---|---|---|---|---|---|---|
| R573 | 4136.4 | 4136.6 | - | ✓ | 2/20/18 | 0135PS034E | 1 |
| R574 | 3150.8 | [illegible] | [illegible] | | | | |
| R576 | 3517.3 | 3367.5 | - | ✓ | 2/20/18 | 0135PS035C | 1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Initials: | Initials: | Initials: | Initials: | | | |

Final Technician Signature: [signature] Date: 3/14/18

Evaluator signature: [signature]



Control No. P-SFDP-0002.xls, Effective date: 2/1/2017

**Tare Sheet: (check one)** **Probes** ✓ **47mm Filters**_____ **100mm Filters**_____ **O-Ring Pair**_____

Prepared By: Balance ID #: Thermohygrometer ID #: Audit Weight ID #/Mass: /

| Placed in Dessicator: Date: 2/13/18 Time: 1100 ID # | Date: 2/19/18 Time: 13:00 RH %: 41.7 T (°F): 71.7 Audit: 99997.8 | Date: 2/20/18 Time: 0600 RH %: 40.4 T (°F): 66.8 Audit: 99997.8 | Date: _____ Time: _____ RH %: _____ T (°F): _____ Audit: _____ | Date: _____ Time: _____ RH %: _____ T (°F): _____ Audit: _____ | Date Used | Project Number | Run No. |
|---|---|---|---|---|---|---|---|
| 2 | 115014.3 | 115014.5 | - | | 2/20/18 | 0135P50396 | 1 |
| 3 | 116088.7 | 116088.6 | - | | 〃 | 〃 | 〃 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Initials: | Initials: | Initials: | Initials: | | | |

Final Technician Signature: _____ Date: 2/20/18

Evaluator signature: _____

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

# Analytical Test Report

**Report No:** USR:W218-0204-01
**Issue No:** 1

**Client:** OMNI-TEST LABORATORIES INC.
13327 NE Airport Way
Portland, OR 97230
**Attention:** Finance Department

**PO No:** 180166

Signed:

Stephen Sundeen
Chemistry Laboratory Manager
Date of Issue: 3/6/2018



## Sample Details

| | | | |
|---|---|---|---|
| **Sample Log No:** | W218-0204-01 | **Sample Date:** | |
| **Sample Designation:** | 04415-2018 | **Sample Time:** | |
| **Sample Recognized As:** | Wood Pellets | **Arrival Date:** | 2/28/2018 |

## Test Results

| | METHOD | UNITS | MOISTURE FREE | AS RECEIVED |
|---|---|---|---|---|
| **Moisture Total** | ASTM E871 | wt. % | | 4.62 |
| **Ash** | ASTM D1102 | wt. % | 0.50 | 0.47 |
| **Volatile Matter** | ASTM D3175 | wt. % | | |
| **Fixed Carbon by Difference** | ASTM D3172 | wt. % | | |
| **Sulfur** | ASTM D4239 | wt. % | 0.009 | 0.008 |
| **$SO_2$** | Calculated | lb/mmbtu | | 0.020 |
| **Net Cal. Value at Const. Pressure** | ISO 1928 | GJ/tonne | 18.94 | 17.95 |
| **Net Cal. Value at Const. Pressure** | ISO 1928 | J/g | 18940 | 17953 |
| **Gross Cal. Value at Const. Vol.** | ASTM E711 | J/g | 20263 | 19327 |
| **Gross Cal. Value at Const. Vol.** | ASTM E711 | Btu/lb | 8712 | 8309 |
| **Carbon** | ASTM D5373 | wt. % | 50.40 | 48.07 |
| **Hydrogen*** | ASTM D5373 | wt. % | 6.07 | 5.79 |
| **Nitrogen** | ASTM D5373 | wt. % | < 0.20 | < 0.19 |
| **Oxygen*** | ASTM D3176 | wt. % | > 42.82 | > 40.84 |
| **Chlorine** | ASTM D6721 | mg/kg | | |
| **Fluorine** | ASTM D3761 | mg/kg | | |
| **Mercury** | ASTM D6722 | mg/kg | | |
| **Bulk Density** | ASTM E873 | $lbs/ft^3$ | | |
| **Fines (Less than 1/8")** | TPT CH-P-06 | wt.% | | |
| **Durability Index** | Kansas State | PDI | | |
| **Sample Above 1.50"** | TPT CH-P-06 | wt.% | | |
| **Maximum Length (Single Pellet)** | TPT CH-P-06 | inch | | |
| **Diameter, Range** | TPT CH-P-05 | inch | | to |
| **Diameter, Average** | TPT CH-P-05 | inch | | |
| **Stated Bag Weight** | TPT CH-P-01 | lbs | | |
| **Actual Bag Weight** | TPT CH-P-01 | lbs | | |

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

## Comments

Pellet Fuels Institute

PFI GRADED FUEL

**PFI Densified Fuel Grade: Premium**
**Mill Registration # 03434**

**Grade Requirements:**

| | |
|---|---|
| Bulk Density: | 40–46 lbs/ft³ |
| Diameter: | 230–.285 in/5.84–7.25 mm |
| Durability: | ≥98.5 |
| Fines: | ≤0.50% |
| Ash Content (as received): | ≤1% |
| Length: | ≤1.5 in. |
| Moisture: | ≤8.0% |
| Chlorine: | ≤300 ppm |

**Manufacturers Guaranteed Analysis:**

| | |
|---|---|
| Type of Material: | Hardwood Softwood Blend |
| Additives: | None |
| Minimum Higher Heating Value (as received) | 8000 BTU/lb. |
| Other Manufacturers Guarantees: | |

For more information, please visit the PFI website at www.pfinet.org

LIGNETICS OF WEST VIRGINIA, I
GLENVILLE, WV
26351

**Lignetics® Fue**
**designed to bu**
**responsible fo**
**improper burn**

**Californi**
**W**

**Handling and combust**
**exposure to carbon diox**
**chemicals known to the S**
**and birth defects or other**

**NET WT. 40**

U.S. Patent N

USE OF THIS AND OTHER
RESTRICTED AT TH
Please check 1-877-4NO-BURN
http://www.877no

LIGNETICS OF IDA
SANDPOINT, ID

# Section 3
## Laboratory Quality Assurance

3.1 - Quality Assurance/Quality Control
3.2 - Calibration Data
3.3 - Example Calculations

# 3.1 - Quality Assurance/Quality Control

*OMNI* follows the guidelines of ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories," and the quality assurance/quality control (QA/QC) procedures found in *OMNI*'s Quality Assurance Manual.

*OMNI*'s scope of accreditation includes, but is not limited to, the following:

- ANSI (American National Standards Institute) for certification of product to safety standards.
- To perform product safety testing by the International Accreditation Service, Inc. (formerly ICBO ES) under accreditation as a testing laboratory designated TL-130.
- To perform product safety testing as a "Certification Organization" by the Standards Council of Canada (SCC).
- Serving as a testing laboratory for the certification of wood heaters by the U.S. Environmental Protection Agency.

This report is issued within the scope of *OMNI*'s accreditation. Accreditation certificates are available upon request.

The manufacturing facilities and quality control system for the production of the Absolute43-C at Hearth & Home Technologies, Inc. were evaluated to determine if sufficient to maintain conformance with OMNI's requirements for product certification. OMNI has concluded that the manufacturing facilities, processes, and quality control system are adequate to produce the appliance congruous with the standards and model codes to which it was evaluated.

# 3.2 - Calibration Data

Equipment for ASTM E2515, ASTM E2779, & EPA Method 28R

| ID # | Lab Name/Purpose | Log Name | Attachment Type |
|---|---|---|---|
| 132 | 10 lb Weight | Weight Standard, 10 lb. | Calibration Certificate |
| 185 | Platform Scale | Weight Indicator, Model WI-127 | Calibration Certificate |
| 209 | Barometer | Barometer – Princo | Equipment Record |
| 283A | Audit Weights | Troemner 21pc Msas Set | Calibration Certificate |
| 335 | Sample Box / Dry Gas Meter | Apex Automated Emissions Sampling Box | Calibration Log |
| 336 | Sample Box / Dry Gas Meter | Apex Automated Emissions Sampling Box | Calibration Log |
| 410 | Microtector | Dwyer Microtector | Calibration Certificate |
| 559 | Vaneometer | Dwyer Vaneometer | Equipment Record |
| 592 | Thermohygrometer | Omega Digital Thermohygrometer | Calibration Log |
| 594 | Combustion Gas Analyzer | CAI Gas Analyzer | See Run Sheet |
| 637 | Milligram Balance | Analytical Balance - Mettler - Toledo | Calibration Certificate |

# SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: 132

ID Number: 132

Standard Calibration Weight: 274

ID Number: 274

Scale Used: ~~185~~ 1K 288

ID Number: ~~185~~ 1K 288

Date: 2-07-08 By: K. Morgan

| Standard Weight (A) (Lb.) | Weight Verified (B) (Lb.) | Difference (A - B) | % Error |
|---|---|---|---|
| 10.0 | 10.0 | 0 | 0 |

*Acceptable tolerance is 1%.

*This calibration is traceable to NIST using calibrated standard weights.*

Technician signature: K. Morgan Date: 2-07-08

# SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: 10 pounds

ID Number: OMNI-00132

Standard Calibration Weight: 10 pounds

ID Number: OMNI-00255

Scale Used: MTW-150K

ID Number: OMNI-00353

Date: 2/23/2018 By: B. Davis

| Standard Weight (A) (Lb.) | Weight Verified (B) (Lb.) | Difference (A - B) | % Error |
|---|---|---|---|
| 10.0 | 10.0 | 0.0 | 0 |

*Acceptable tolerance is 1%.

*This calibration is traceable to NIST using calibrated standard weights.*

Technician signature: _____ Date: 2/23/18

Established 1974

# 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

ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

OMNI-Test Laboratories, Inc.
13327 NE Airport Way
Portland, OR 97230

Report Number: OMNE0321676171004

## A2LA ACCREDITED
## CERTIFICATE OF CALIBRATION WITH DATA

### INSTRUMENT INFORMATION

| Item | Make | Model | Serial Number | Customer ID | Location |
|---|---|---|---|---|---|
| Scale | Weigh-Tronix | WI-127 1000x0.1lb | 21676 | 185 | Lab |
| **Units** | **Readability** | **SOP** | **Cal Date** | **Last Cal Date** | **Cal Due Date** |
| lbs | 0.1 | QC033 | 10/4/17 | 10/11/16 | 10/2018 |

### FUNCTIONAL CHECKS

| SHIFT TEST | LINEARITY | REPEATABILITY | ENVIRONMENTAL CONDITIONS |
|---|---|---|---|
| Test Wt: 500 Tol: 0.5 | Test Wt: HB44 Tol: HB44 | Test Wt: 200 Tol: 0.2 | ☐ Good ☑ Fair ☐ Poor |
| As-Found: Pass:☑ Fail:☐ | As-Found: Pass:☑ Fail:☐ | As-Found: Pass:☑ Fail:☐ | Temperature: 21.0°C |
| As-Left: Pass:☑ Fail:☐ | As-Left: Pass:☑ Fail:☐ | As-Left: Pass:☑ Fail:☐ | |

### CALIBRATION DATA

| Standard | As-Found | As-Left | Expanded Uncertainty |
|---|---|---|---|
| 1000 | 1000.0 | 1000.0 | 0.12 |
| 700 | 700.0 | 700.0 | 0.12 |
| 500 | 500.0 | 500.0 | 0.08 |
| 200 | 200.0 | 200.0 | 0.08 |
| 100 | 100.0 | 100.0 | 0.05 |
| 50 | 50.0 | 50.0 | 0.05 |

### CALIBRATION STANDARDS

| Item | Make | Model | Serial Number | Cal Date | Cal Due Date | NIST ID |
|---|---|---|---|---|---|---|
| Avoirdupois Cast W | Rice Lake | 25 and 50lb | PWO990-CA | 11/4/15 | 11/2017 | 20152112 |

**Permanent Information Concerning this Equipment:**

**Comments/Information Concerning this Calibration**

**Report prepared/reviewed by:** _____ **Date:** 10.4.17 **Technician:** D.Oudeans
**Signature:** _____



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.

453
National
Weather
Service
Type

OMNI 00209

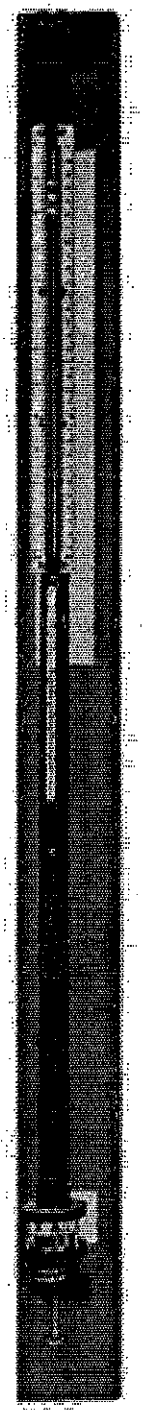
# Instruction Booklet

for use with

# PRINCO

Fortin type mercurial

## Barometers



469
NOVA™
Economy
Model

*Manufactured by*

PRINCO INSTRUMENTS, INC.
1020 Industrial Blvd.
Southampton, Pa. 18966-4095
U.S.A.

Phone: 215 355-1500
Fax: 215 355-7766

# JJ Calibrations, Inc.

**Manufacturer:** Troemner Inc.
**Model:** 1mg-100g (Class F)
**Nomenclature:** Mass Set, 21 Pc.
**Serial:** 47883

**Certificate #:** 543402
**Date:** 09Oct2013
**Technician:** 34
**Calibration Interval:** 60 Months

| Parameter | | Nominal | JJ Standard | UUT | UUT ± Limit | Uncertainty ± |
|---|---|---|---|---|---|---|
| Mass Verification | | | | | | |
| Data in mg | | 1 | 0.996 | 1.048 | 0.100 | 0.0115 |
| | dot | 2 | 2.002 | 1.973 | 0.120 | 0.0115 |
| | | 2 | 2.002 | 2.048 | 0.120 | 0.0115 |
| | | 5 | 4.996 | 5.033 | 0.170 | 0.0115 |
| | | 10 | 10.000 | 10.053 | 0.210 | 0.0115 |
| | dot | 20 | 19.999 | 19.966 | 0.260 | 0.0115 |
| | | 20 | 19.999 | 20.069 | 0.260 | 0.0115 |
| | | 50 | 49.998 | 50.018 | 0.350 | 0.0115 |
| | | 100 | 99.998 | 100.144 | 0.430 | 0.0115 |
| | dot | 200 | 199.999 | 200.045 | 0.540 | 0.0115 |
| | | 200 | 199.999 | 199.967 | 0.540 | 0.0115 |
| | | 500 | 499.996 | 500.334 | 0.720 | 0.0115 |
| Data in grams | | 1 | | Missing | | |
| | dot | 2 | 2.000000 | 1.999888 | 0.0011 | 0.0000394 |
| | | 2 | 2.000000 | 2.000335 | 0.0011 | 0.0000394 |
| | | 5 | 5.000002 | 4.999996 | 0.0015 | 0.0000395 |
| | | 10 | 9.99998 | 9.99984 | 0.0020 | 0.0000580 |
| | dot | 20 | 19.99999 | 20.00100 | 0.0040 | 0.0000855 |
| | | 20 | 19.99999 | 20.00079 | 0.0040 | 0.0000855 |
| | | 50 | 49.99997 | 49.99949 | 0.0100 | 0.0001390 |
| | | 100 | 99.99999 | 99.99802 | 0.0200 | 0.0002900 |

# Thermal Metering System Calibration
# Y Factor

| | |
|---|---|
| Manufacturer: | APEX |
| Model: | XC-60-EP |
| Serial Number: | 606001 |
| OMNI Tracking No.: | OMNI-00335 |
| Calibrated Orifice: | ☐Yes |

**Previous Calibration Comparision**

| Date | 7/18/2017 | Acceptable Deviation (5%) | Deviation |
|---|---|---|---|
| y Factor | 0.981 | 0.04905 | 0.004 |
| Acceptance | Acceptable | | |

**Current Calibration**

| | |
|---|---|
| Acceptable y Deviation | 0.020 |
| Maximum y Deviation | 0.005 |
| Acceptable dH@ Deviation | N/A |
| Maximum dH@ Deviation | N/A |
| Acceptance | Acceptable |

| **Average Gas Meter y Factor** | **Orifice Meter dH@** |
|---|---|
| **0.977** | **N/A** |

| | | |
|---|---|---|
| Calibration Date: | 01/17/18 | |
| Calibrated by: | B. Davis | |
| Calibration Frequency: | Six months | |
| Next Calibration Due: | 7/18/2018 | |
| Instrument Range: | 1.000 | cfm |
| Standard Temp.: | 68 | oF |
| Standard Press.: | 29.92 | "Hg |
| Barometric Press., Pb: | 29.94 | "Hg |
| Signature/Date: | | 1/18/2018 |

1/19/2018

| Reference Standard * | | | |
|---|---|---|---|
| Standard Calibrator | Model | Standard Test Meter | |
| | S/N | OMNI-00001 | |
| | Calib. Date | 30-Oct-17 | |
| | Calib. Value | 0.9977 | y factor (ref) |

| Calibration Parameters | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Reference Meter Pressure ("H2O), Pr | 0.00 | 0.00 | 0.00 |
| DGM Pressure ("H2O), Pd | 2.30 | 1.38 | 1.00 |
| Initial Reference Meter | 198.1 | 203.7 | 214.2 |
| Final Reference Meter | 203.602 | 208.8 | 222.5 |
| Initial DGM | 0 | 0 | 0 |
| Final DGM | 5.65 | 5.298 | 8.67 |
| Temp. Ref. Meter (°F), Tr | 68.1 | 68.1 | 68.0 |
| Temperature DGM (°F), Td | 77.0 | 78.0 | 80.0 |
| Time (min) | 26.5 | 31.8 | 43.5 |
| Net Volume Ref. Meter, Vr | 5.502 | 5.100 | 8.300 |
| Net Volume DGM, Vd | 5.65 | 5.298 | 8.67 |
| **Gas Meter y Factor =** | **0.982** | **0.975** | **0.974** |
| Gas Meter y Factor Deviation (from avg.) | 0.005 | 0.002 | 0.003 |
| **Orifice dH@** | **N/A** | **N/A** | **N/A** |
| Orifice dH@ Deviation (from avg.) | N/A | N/A | N/A |

where:

1. Deviation = |Average value for all runs - current run value|

** 2. y = [Vr x (y factor (ref)) x (Pb + (Pr/ 13.6)) x (Td + 460) ]/ [Vd x (Pb + (Pd / 13.6)) x (Tr + 460)]

** 3. dH@ = 0.0317 x Pd / (Pb (Td + 460)) x [ (Tr + 460) x time) / Vr ]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272, or NIST traceable laboratory

** Equations come from EPA Method 5

The uncertainty of measurement is ±0.14 $ft^3$/min. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

# DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer

Maximum Range: 0-2" WC ID Number: OMNI-00335

Calibration Instrument: Digital Manometer ID Number: OMNI-00395

Date: 1/17/2018 By: B. Davis

**This form is to be used only in conjunction with Standard Procedure C-SPC.**

| Range of Calibration Point ("WC) | Digital Manometer Input ("WC) | Pressure Gauge Response ("WC) | Difference (Input - Response) | % Error of Full Span* |
|---|---|---|---|---|
| 0-20% Max. Range 0 - 0.4 | 0.08 | 0.067 | 0.013 | 0.65 |
| 20-40% Max. Range 0.4 - 0.8 | 0.64 | 0.638 | 0.002 | 0.10 |
| 40-60% Max. Range 0.8 – 1.2 | 1.00 | 1.012 | 0.012 | 0.60 |
| 60-80% Max. Range 1.2 – 1.6 | 1.40 | 1.432 | 0.032 | 1.6 |
| 80-100% Max. Range 1.6 – 2.0 | 1.85 | 1.895 | 0.045 | 2.25 |

*Acceptable tolerance is 4%.

The uncertainty of measurement is ±0.4" WC. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

Technician signature: _____ Date: 1/18/2018

Reviewed by: _____ Date: 1/19/2018

# Temperature Calibration
# EPA Method 28R, ASTM 2515

| Booth: | Temperature Monitor Type: | Equipment Number: |
|---|---|---|
| E1 | National Instruments Logger | 00335, 00336 |

| Reference Meter Equipment Number: 00373 | Calibration Due Date: 7/17/18 |
|---|---|

| Calibration Performed By: | Date: | Ambient Temperature: | Barometric Pressure: |
|---|---|---|---|
| B. Davis | 1/17/2018 | 68 | 29.87 |

| Input Temperature (F) | Ambient | Meter A | Meter B | Filter A | Filter B | Tunnel | FB Interior |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 100 | 101 | 100 | 100 | 100 | 100 | 100 | 100 |
| 300 | 300 | 300 | 300 | 300 | 300 | 300 | 299 |
| 500 | 500 | 500 | 500 | 500 | 500 | 500 | 499 |
| 700 | 700 | 700 | 700 | 700 | 700 | 700 | 699 |
| 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |

| Input (F) | FB Top | FB Bottom | FB Back | FB Left | FB Right | Imp A | Imp B | Cat | Stack |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | -1 | -1 | 0 | 0 | 0 | 0 |
| 100 | 100 | 100 | 100 | 99 | 99 | 100 | 100 | 100 | 100 |
| 300 | 300 | 299 | 299 | 299 | 299 | 300 | 300 | 300 | 299 |
| 500 | 499 | 499 | 499 | 499 | 499 | 500 | 500 | 500 | 500 |
| 700 | 699 | 699 | 699 | 699 | 699 | 700 | 700 | 700 | 700 |
| 1000 | 1000 | 999 | 1000 | 1000 | 999 | 1000 | 1000 | 1000 | 1000 |
| 1500 | | | | | | | | 1500 | |
| 2000 | | | | | | | | 1999 | |

Technician signature: _____ Date: 1/17/2018

Reviewed By: _____ Date: 1/19/2018

# Thermal Metering System Calibration
# Y Factor

| | |
|---|---|
| Manufacturer: | APEX |
| Model: | XC-60-EP |
| Serial Number: | 606002 |
| OMNI Tracking No.: | OMNI-00336 |
| Calibrated Orifice: | ☐Yes |

**Previous Calibration Comparision**

| Date | 7/18/2017 | Acceptable Deviation (5%) | Deviation |
|---|---|---|---|
| y Factor | 0.984 | 0.0492 | 0.005 |
| Acceptance | Acceptable | | |

**Current Calibration**

| | |
|---|---|
| Acceptable y Deviation | 0.020 |
| Maximum y Deviation | 0.003 |
| Acceptable dH@ Deviation | N/A |
| Maximum dH@ Deviation | N/A |
| Acceptance | Acceptable |

| **Average Gas Meter y Factor** | **Orifice Meter dH@** |
|---|---|
| **0.979** | **N/A** |

| | | |
|---|---|---|
| Calibration Date: | 01/17/18 | |
| Calibrated by: | B. Davis | |
| Calibration Frequency: | Six months | |
| Next Calibration Due: | 1/18/2018 | |
| Instrument Range: | 1.000 | cfm |
| Standard Temp.: | 68 | oF |
| Standard Press.: | 29.92 | "Hg |
| Barometric Press., Pb: | 29.94 | "Hg |
| Signature/Date: | | 1/17/2018 |

1/19/2017

| Reference Standard * | | | |
|---|---|---|---|
| Standard Calibrator | Model | Standard Test Meter | |
| | S/N | OMNI-00001 | |
| | Calib. Date | 30-Oct-17 | |
| | Calib. Value | 0.9977 | y factor (ref) |

| Calibration Parameters | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Reference Meter Pressure ("H2O), Pr | 0.00 | 0.00 | 0.00 |
| DGM Pressure ("H2O), Pd | 1.95 | 1.20 | 0.80 |
| Initial Reference Meter | 223.4 | 231.9 | 238 |
| Final Reference Meter | 231.7 | 237.9 | 243.503 |
| Initial DGM | 0 | 0 | 0 |
| Final DGM | 8.517 | 6.215 | 5.713 |
| Temp. Ref. Meter (°F), Tr | 68.0 | 69.1 | 68.6 |
| Temperature DGM (°F), Td | 76.0 | 78.0 | 79.0 |
| Time (min) | 39.8 | 36.5 | 37.0 |
| Net Volume Ref. Meter, Vr | 8.300 | 6.000 | 5.503 |
| Net Volume DGM, Vd | 8.517 | 6.215 | 5.713 |
| **Gas Meter y Factor =** | **0.982** | **0.977** | **0.978** |
| Gas Meter y Factor Deviation (from avg.) | 0.003 | 0.002 | 0.001 |
| **Orifice dH@** | **N/A** | **N/A** | **N/A** |
| Orifice dH@ Deviation (from avg.) | N/A | N/A | N/A |

where:

1. Deviation = |Average value for all runs - current run value|
** 2. y = [Vr x (y factor (ref)) x (Pb + (Pr/ 13.6)) x (Td + 460) ]/ [Vd x (Pb + (Pd / 13.6)) x (Tr + 460)]
** 3. dH@ = 0.0317 x Pd / (Pb (Td + 460)) x [ (Tr + 460) x time) / Vr ]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272, or NIST traceable laboratory

** Equations come from EPA Method 5

The uncertainty of measurement is ±0.14 $ft^3$/min. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

# DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer

Maximum Range: 0-2" WC ID Number: OMNI-00336

Calibration Instrument: Digital Manometer ID Number: OMNI-00395

Date: 1/17/2018 By: B. Davis

**This form is to be used only in conjunction with Standard Procedure C-SPC.**

| Range of Calibration Point ("WC) | Digital Manometer Input ("WC) | Pressure Gauge Response ("WC) | Difference (Input - Response) | % Error of Full Span* |
|---|---|---|---|---|
| 0-20% Max. Range 0 - 0.4 | 0.35 | 0.362 | 0.012 | 0.6 |
| 20-40% Max. Range 0.4 - 0.8 | 0.65 | 0.672 | 0.022 | 1.1 |
| 40-60% Max. Range 0.8 – 1.2 | 1.00 | 1.024 | 0.024 | 1.2 |
| 60-80% Max. Range 1.2 – 1.6 | 1.30 | 1.340 | 0.040 | 2.0 |
| 80-100% Max. Range 1.6 – 2.0 | 1.70 | 1.749 | 0.049 | 2.45 |

*Acceptable tolerance is 4%.

The uncertainty of measurement is ±0.4" WC. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

Technician signature: _____ Date: 1/18/2018

Reviewed by: _____ Date: 1/19/2018

# Temperature Calibration
# EPA Method 28R, ASTM 2515

| Booth: | Temperature Monitor Type: | Equipment Number: |
|---|---|---|
| E1 | National Instruments Logger | 00335, 00336 |

| Reference Meter Equipment Number: 00373 | Calibration Due Date: 7/17/18 |
|---|---|

| Calibration Performed By: | Date: | Ambient Temperature: | Barometric Pressure: |
|---|---|---|---|
| B. Davis | 1/17/2018 | 68 | 29.87 |

| Input Temperature (F) | Ambient | Meter A | Meter B | Filter A | Filter B | Tunnel | FB Interior |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 100 | 101 | 100 | 100 | 100 | 100 | 100 | 100 |
| 300 | 300 | 300 | 300 | 300 | 300 | 300 | 299 |
| 500 | 500 | 500 | 500 | 500 | 500 | 500 | 499 |
| 700 | 700 | 700 | 700 | 700 | 700 | 700 | 699 |
| 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |

| Input (F) | FB Top | FB Bottom | FB Back | FB Left | FB Right | Imp A | Imp B | Cat | Stack |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | -1 | -1 | 0 | 0 | 0 | 0 |
| 100 | 100 | 100 | 100 | 99 | 99 | 100 | 100 | 100 | 100 |
| 300 | 300 | 299 | 299 | 299 | 299 | 300 | 300 | 300 | 299 |
| 500 | 499 | 499 | 499 | 499 | 499 | 500 | 500 | 500 | 500 |
| 700 | 699 | 699 | 699 | 699 | 699 | 700 | 700 | 700 | 700 |
| 1000 | 1000 | 999 | 1000 | 1000 | 999 | 1000 | 1000 | 1000 | 1000 |
| 1500 | | | | | | | | 1500 | |
| 2000 | | | | | | | | 1999 | |

Technician signature: B D — Date: 1/17/2018

Reviewed By: — Date: 1/19/2018

# Certificate of Calibration

Certificate Number: **659360**

**JJ Calibrations, Inc.**
7007 SE Lake Rd
Portland, OR 97267-2105
Phone 503.786.3005
FAX 503.786.2994

**Omni-Test Laboratories**
**13327 NE Airport Way**
**Portland, OR 97230**

ACCREDITED
0723.01
Calibration

PO: **170149**
Order Date: **09/22/2017**
Authorized By: **N/A**

Property #: **OMNI-00410**
User: **N/A**
Department: **N/A**
Make: **Dwyer**
Model: **1430**
Serial #: **OMNI-00410**
Description: **Microtector**
Procedure: **SEND TO VENDOR**
Accuracy: **±0.00025" WC**

Calibrated on: **10/11/2017**
*Recommended Due: **10/11/2018**
Environment: **19** °C **52** % RH
* As Received: **Limited**
* As Returned: **Limited**
Action Taken: **Calibrated**
Technician: **34**

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.

**Limited Calibration (est.2016) - Calibrated micrometer head only.**

## Standards Used

| Std ID | Manufacturer | Model | Nomenclature | Due Date | Trace ID |
|---|---|---|---|---|---|
| 541A | Select | E8FED2 | 8 Piece Gage Block Set | 12/14/2017 | 635720 |
| 103A | Brown & Sharpe | 598-81-14 | Gage Block Set, 81 pc. | 03/16/2019 | 643452 |
| 368A | Rutland | 2225-7081 | 81 Piece Gage Block Set | 06/01/2018 | 649394 |

## Measurement Data

| Parameter / Measurement Description | Range | Unit | Reference | Min | Max | ᵏError | UUT | Uncertainty |
|---|---|---|---|---|---|---|---|---|
| **Before/After** | | | | | | | | Accredited = ✓ |
| **Length** | | | | | | | | |
| | | Inch | 0.1300 | 0.129 | 0.131 | 0.000 | 0.130 Inch | 1.1E-03 ✓ |
| | | Inch | 0.3850 | 0.384 | 0.386 | 0.000 | 0.385 Inch | 1.1E-03 ✓ |
| | | Inch | 0.6150 | 0.614 | 0.616 | 0.000 | 0.615 Inch | 1.1E-03 ✓ |
| | | Inch | 0.8700 | 0.869 | 0.871 | 0.000 | 0.870 Inch | 1.1E-03 ✓ |
| | | Inch | 1.0000 | 0.999 | 1.001 | 0.000 | 1.000 Inch | 1.1E-03 ✓ |

JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (NMI's), or by using natural physical constants, intrinsic standards or ratio calibration techniques. The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2005, 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 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 prior written consent of JJ Calibrations, Inc.
JJ Calibrations, Inc. quality system has been assessed and accredited to ISO/IEC 17025:2005.

Reviewer

3 Issued 10/13/2017 Rev # 15

Inspector

# Calibration Record

Vaneometer Air Velocity Meter OMNI-00559

| Calibration Service Record | | | |
|---|---|---|---|
| **Date** | **By** | **Results** | **Date of next Calibration** |
| 11/17/17 | DQ | Installed New Vane From Manufactured | 5/17/18 |
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|---|---|
| OMNI Track # | OMNI-00594 |
| Equipment Name/Description | CAI ZRE-4 Gas Analyzer |
| Equipment S/N: | N5F0112 |
| Comments | CO2, O2, and dual range CO gas analyzer. |
| Status | Active, calibrate prior to use. |
| Part # | ZRE-4 |

| | | | | | |
|---|---|---|---|---|---|
| Reference Standard: | | YES | X | NO | (Check 'X' for answer) |

| | |
|---|---|
| Location of Equipment: | Portable gas cart. |
| Calibration Vendor | OMNI in house |
| Type of Calibration | Calibrate Prior to use. |
| Calibration Period (Months) | N/A |
| Date of Last Calibration | N/A |
| Date of Next Calibration | N/A |

Do the following:

1) Complete Calibration documentation
2) Complete top half of this form
3) Attach appropriate calibration forms and save in following location
   \\omni-serv\Test Equipment\Equipment\OMNI-XXXXX - Equipment Name
4) Repopulate database with updated information
5) Print, laminate and adhere calibration tag to equipment

**Verify before use**
**OMNI-00594**
**Gas Analyzer**

**Verify before use**
**OMNI-00594**
**Gas Analyzer**

# Certificate of Calibration

Certificate Number: **655889**

**JJ Calibrations, Inc.**
7007 SE Lake Rd
Portland, OR 97267-2105
Phone 503.786.3005
FAX 503.786.2994

**Omni-Test Laboratories**
**13327 NE Airport Way**
**Portland, OR 97230**

**OnSite**

0723.01
Calibration

PO: **170142**
Order Date: **08/07/2017**
Authorized By: **N/A**

Property #: **OMNI-00637**
User: **N/A**
Department: **N/A**
Make: **Mettler Toledo**
Model: **MS104TS/00**
Serial #: **B729400181**
Description: **Scale, Analytical, 120g**
Procedure: **DCN 500887**
Accuracy: **±0.0005g**

Calibrated on: **08/07/2017**
*Recommended Due: **02/07/2018**
Environment: **22 °C 45 % RH**
* As Received: **Within Tolerance**
* As Returned: **Within Tolerance**
Action Taken: **Calibrated**
Technician: **34**

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.

## Standards Used

| Std ID | Manufacturer | Model | Nomenclature | Due Date | Trace ID |
|---|---|---|---|---|---|
| 256A | Rice Lake | W0133K | Mass Set | 10/28/2017 | 616126 |

## Measurement Data

| Parameter / Measurement Description | Range Unit | Reference | Min | Max | *Error | UUT | Uncertainty Accredited = ✓ |
|---|---|---|---|---|---|---|---|
| **Before/After** | | | | | | | |
| **Force** | | | | | | | |
| | g | 10.00000 | 9.9995 | 10.0005 | 0.0001 | 10.0001 g | 5.7E-04 ✓ |
| | g | 30.00000 | 29.9995 | 30.0005 | 0.0001 | 30.0001 g | 5.7E-04 ✓ |
| | g | 60.00000 | 59.9995 | 60.0005 | 0.0003 | 60.0003 g | 5.7E-04 ✓ |
| | g | 90.00000 | 89.9995 | 90.0005 | 0.0002 | 90.0002 g | 5.7E-04 ✓ |
| | g | 120.00000 | 119.9995 | 120.0005 | 0.0003 | 120.0003 g | 5.7E-04 ✓ |

JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (NMI's), or by using natural physical constants, intrinsic standards or ratio calibration techniques. The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2005, 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 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 prior written consent of JJ Calibrations, Inc.
JJ Calibrations, Inc. quality system has been assessed and accredited to ISO/IEC 17025:2005.

Reviewer

3 Issued 08/14/2017 Rev # 15

Inspector

# Certificate of Calibration

Certificate Number: **668066**


**JJ Calibrations, Inc.**
7007 SE Lake Rd
Portland, OR 97267-2105
Phone 503.786.3005
FAX 503.786.2994


**Omni-Test Laboratories**
**13327 NE Airport Way**
**Portland, OR 97230**

**OnSite**

0723.01
Calibration

PO: **180161**
Order Date: **02/06/2018**
Authorized By: **N/A**

Property #: **OMNI-00637**
User: **N/A**
Department: **N/A**
Make: **Mettler Toledo**
Model: **MS104TS/00**
Serial #: **B729400181**
Description: **Analytical Scale, 120g**
Procedure: **DCN 500887**
Accuracy: **±0.0005g**

Calibrated on: **02/06/2018**
*Recommended Due: **08/06/2018**
Environment: **20 °C 53 % RH**
* As Received: **Within Tolerance**
* As Returned: **Within Tolerance**
Action Taken: **Calibrated**
Technician: **111**

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.

## Standards Used

| Std ID | Manufacturer | Model | Nomenclature | Due Date | Trace ID |
|---|---|---|---|---|---|
| 503A | Rice Lake | 1mg-200g (Class 0) | Mass Set, | 04/20/2018 | 642578 |

## Measurement Data

| Parameter / Measurement Description | Range Unit | Reference | Min | Max | *Error | UUT | Uncertainty |
|---|---|---|---|---|---|---|---|
| **Before/After** | | | | | | | Accredited = ✓ |
| **Force** | | | | | | | |
| | g | 10.00000 | 9.9995 | 10.0005 | 0.0001 | 10.0001 g | 5.7E-04 ✓ |
| | g | 30.00000 | 29.9995 | 30.0005 | 0.0003 | 30.0003 g | 5.7E-04 ✓ |
| | g | 60.00000 | 59.9995 | 60.0005 | 0.0001 | 60.0001 g | 5.7E-04 ✓ |
| | g | 90.00000 | 89.9995 | 90.0005 | 0.0001 | 89.9999 g | 5.7E-04 ✓ |
| | g | 120.00000 | 119.9995 | 120.0005 | 0.0002 | 119.9998 g | 5.7E-04 ✓ |

JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (NMI's), or by using natural physical constants, intrinsic standards or ratio calibration techniques. The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2005, 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 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 prior written consent of JJ Calibrations, Inc.
JJ Calibrations, Inc. quality system has been assessed and accredited to ISO/IEC 17025:2005.

Reviewer 3 Issued Rev # 15 Inspector

# 3.3 - Example Calculations

## Equations and Sample Calculations – ASTM E2779 & E2515

| | |
|---|---|
| Manufacturer: | HHT Halifax |
| Model: | Absolute 43-C |
| Run: | 1 |
| Category: | [Integrated] |

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.

$M_{Bdb}$ – Weight of test fuel burned during test run, dry basis, kg

$M_{BSidb}$ – Weight of test fuel burned during test run segment *i* , dry basis, kg

BR – Average dry burn rate over full integrated test run, kg/hr

$BR_{Si}$ – Average dry burn rate over test run segment *i* , 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 standard conditions, g/dscf

$E_T$ – Total Particulate Emissions, g

PR - Proportional Rate Variation

$PM_R$ – Average particulate emissions for full integrated test run, g/hr

$PM_F$ – Average particulate emission factor for full integrated test run, g/dry kg of fuel burned

**$M_{Bdb}$ – Weight of test fuel burned during test run, dry basis, kg**
ASTM E2779 equation (1)

$$M_{Bdb} = (M_{Swb} - M_{Ewb})(100/(100 + FM))$$

Where,

FM = average fuel moisture of test fuel, % dry basis
$M_{Swb}$ = weight of test fuel in hopper at start of test run, wet basis, kg
$M_{Ewb}$ = weight of test fuel in hopper at end of test run, wet basis, kg

Sample Calculation:

4.8 %
$M_{Swb}$ = 15.1 lbs
$M_{Ewb}$ = 0.0 lbs
0.4536 = Converstion factor from lbs to kg

$M_{Bdb}$ = [( 15.1 x 0.4536) - ( 0.0 x 0.4536)] (100/(100 + 4.844 )

$M_{Bdb}$ = **6.5** kg

**$M_{BSidb}$ – Weight of test fuel burned during test run segment *i* , dry basis, kg**
ASTM E2779 equation (2)

$$M_{BSidb} = (MS_{Siwb} - M_{ESiwb})(100/(100 + FM))$$

Where,

$M_{SSiwb}$ = weight of test fuel in hopper at start of test run segment *i* , wet basis, kg

$M_{ESiwb}$ = weight of test fuel in hopper at end of test run segment *i* , wet basis, kg

Sample Calculation (from medium burn rate segment):

FM = 4.8 %

$M_{SSiwb}$ = 9.7 lbs

$M_{ESiwb}$ = 5.1 lbs

0.4536 = Converstion factor from lbs to kg

$M_{BSidb}$ = [( 9.7 x 0.4536) - ( 5.1 x 0.4536)] (100/(100 + 5 )

$M_{BSidb}$ = **2** kg

**BR – Average dry burn rate over full integrated test run, kg/hr**
ASTM E2779 equation (3)

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

Where,

$\theta$ = Total length of full intergrated test run, min

Sample Calculation:

$M_{Bdb}$ = 6.53 kg

$\theta$ = 361 min

$$BR = \frac{60 \times 6.53}{361}$$

BR = **1.09** kg/hr

**$BR_{Si}$ – Average dry burn rate over test run segment *i* , kg/hr**
ASTM E2779 equation (4)

$$BR_{Si} = \frac{60\ M_{BSidb}}{\theta_{Si}}$$

Where,

$\theta_{Si}$ = Total length of test run segment *i* , min

Sample Calculation (from medium burn rate segment):

$M_{BSidb}$ = 1.99 kg

$\theta$ = 120 min

$$BR = \frac{60 \times 1.99}{120}$$

BR = **1.00** kg/hr

**$V_s$ – Average gas velocity in the dilution tunnel, ft/sec**
ASTM E2515 equations (9)

$$V_s = F_p \times K_p \times C_P \times \left(\sqrt{\Delta P}\right)_{avg} \times \sqrt{\frac{T_s}{P_s \times M_s}}$$

Where:

| | | |
|---|---|---|
| $F_p$ | = | Adjustment factor for center of tunnel pitot tube placement, Fp = $\frac{V_{strav}}{V_{scent}}$ , 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 $H_2O$ |
| $T_s$ | = | Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460) |
| $P_s$ | = | Absolute average gas static pressure in diltuion tunnel, = $P_{bar}$ + $P_g$ , in Hg |
| $P_{bar}$ | = | Barometric pressure at test site, in. Hg |
| $P_g$ | = | Static pressure of tunnel, in. $H_20$; (in Hg = in $H_20$/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:

$$Fp = \frac{13.76}{15.45} = 0.891$$

$$V_s = 0.891 \times 85.49 \times 0.99 \times 0.226 \times \left( \frac{89.5 + 460}{\left(30.26 + \frac{-0.16}{13.6}\right) \times 28.78} \right)^{1/2}$$

$V_s$ = **13.56** 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 Ms 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)

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

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, $ft^2$ |
| $T_{std}$ | = | Standard absolute temperature, 528 °R |
| $P_s$ | = | Absolute average gas static pressure in diltuion tunnel, = $P_{bar}$ + $P_g$ , in Hg |
| $T_s$ | = | Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460) |
| $P_{std}$ | = | Standard absolute pressure, 29.92 in Hg |

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 13.56 \times 0.196 \times \frac{528}{89.5 + 460} \times \frac{30.3 + \frac{-0.16}{13.6}}{29.92}$$

$Q_{sd}$ = **9120.6** dscf/hr

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

ASTM E2515 equation (6)

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

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. $H_2O$ |
| $T_m$ | = | Absolute average dry gas meter temperature, °R |

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 58.789 \times 0.977 \times \frac{\left(30.26 + \frac{1.31}{13.6}\right)}{(80.9 + 460)}$$

$V_{m(std)}$ = **56.855** dscf

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 58.238 \times 0.979 \times \frac{\left(30.26 + \frac{1.07}{13.6}\right)}{(80.7 + 460)}$$

$V_{m(std)}$ = **56.425** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 0.00 \times 0 \times \frac{\left(\underline{30.26} + \frac{0.00}{13.6}\right)}{(70.2 + 460)}$$

$V_{m(std)}$ = **0.000** 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 1 (first hour):

$m_n$ = 0.0 + 1.5 + 0.0

$m_n$ = 1.5 mg

Using equation for Train 1 (remainder):

$m_n$ = 0.0 + 3.4 + 1.1

$m_n$ = 4.5 mg

Train 1 Aggregate = **6.0** mg

Using equation for Train 2:

$m_n$ = 0.0 + 5.7 + 0.6

$m_n$ = **6.3** mg

**$C_s$ - Concentration of particulate matter in tunnel gas, dry basis, corrected to standard conditions, g/dsc**
ASTM E2515 equation (13)

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

Where:

| | | |
|---|---|---|
| $K_2$ | = | 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 1:

$$C_s = 0.001 \times \frac{6.0}{56.86}$$

$C_s$ = **0.00011** g/dscf

For Train 2

$$C_s = 0.001 \times \frac{6.3}{56.42}$$

$C_s$ = **0.00011** g/dscf

For Ambient Train

$$C_r = 0.001 \times \frac{0.0}{0.00}$$

$C_r$ = **0.000000** 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 1

$E_T$ = ( 0.000106 - 0.000000 ) x 9120.6 x 361 /60

$E_T$ = 5.79 g

For Train 2

$E_T$ = ( 0.000112 - 0.000000 ) x 9120.6 x 361 /60

$E_T$ = 6.13 g

Average

E = 5.96 g

Total emission values shall not differ by more than 7.5% from the total average emissions

| | |
|---|---|
| 7.5% of the average = | 0.45 |
| Train 1 difference = | 0.17 |
| Train 2 difference = | 0.17 |

**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:

$\theta$ = Total sampling time, min

$\theta_i$ = 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, $^oR$

$T_m$ = Absolute average dry gas meter temperature, $^oR$

$T_{si}$ = Absolute average gas temperature in the dilution tunnel during the "ith" time interval, $^oR$

$T_s$ = Absolute average gas temperature in the dilution tunnel, $^oR$

Sample calculation (for the first 1 minute interval of Train 1):

$$PR = \left( \frac{361 \times 0.154 \times 13.56 \times (103.0 + 460) \times (80.9 + 460)}{1 \times 58.79 \times 13.83 \times (89.5 + 460) \times (73.0 + 460)} \right) \times 100$$

PR = 96 %

**$PM_R$ – Average particulate emissions for full integrated test run, g/hr**
ASTM E2779 equation (5)

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

Where,

$E_T$ = Tota particulate emissions, grams

$\theta$ = Total length of full intergrated test run, min

Sample Calculation:

$E_T$ (Dual train average) = 5.96 g

$\theta$ = 361 min

$PM_R = 60$ x ( 5.96 / 361 )

$PM_R$ = **0.99** g/hr

**$PM_F$ – Average particulate emission factor for full integrated test run, g/dry kg of fuel burned**
ASTM E2779 equation (6)

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

Where,

$E_T$ = Tota particulate emissions, grams

$M_{Bdb}$ = Weight of test fuel burned during test run, dry basis, kg

Sample Calculation:

$E_T$ (Dual train average) = 5.96 g

$M_{Bdb}$ = 6.53 kg

$PM_F$ = 5.96 / 6.53 )

$PM_F$ = **0.91** g/kg

# Appendix A
## Labeling & Owner's/Installation Manual

**Report / Rapport** #0135PS039E, 0135PS032S
Test to/testé à ASTM E 1509-12, ULC-S627-00, ASTM E 2515-11, ASTM E 2779-10
Room Heater, Pellet Fuel-Burning Type, Also For Use In Mobile Homes. (UM) 84-HUD

**"PREVENT HOUSE FIRES"** Install and use only in accordance with manufactures installation and operation instructions.
Contact local building or fire officials about restrictions and installation inspection in your area.
**WARNING: FOR MANUFACTURED HOMES:** Do not install appliance in a sleeping room. An outside combustion air inlet must be provided. The structural integrity of the manufactured home floor, ceiling and walls must be maintained.
Refer to manufacturer's instructions and local codes for precautions required for passing chimney through a combustible wall or ceiling. Inspect and clean exhaust venting system frequently in accordance with manufacturer's instructions.
Use a 3" or 4" diameter type "L" or "PL" venting system.
Do not connect this unit to a chimney flue servicing another appliance.
Do not obstruct the space beneath the heater.
**FOR USE WITH PELLETIZED WOOD FUEL ONLY.**
EPA Certified Emissions: .99 g/hr
**Input Rating Max:** 5.0 lb. fuel/hr
**Electrical Rating:** 240 VAC, 50 Hz, Start 1.75 AMPS, Run 1.25 AMPS
**U.S. Electrical Rating:** 115 VAC, 60 Hz, Start 3.5 AMPS, Run 2.5 AMPS
Fuel Type: Wood Pellet ONLY
**Route power cord away from unit.**

**OPERATE ONLY WITH DOORS CLOSED**
**DANGER**: Risk of electrical shock. Disconnect power supply before servicing.
Replace glass only with 5mm ceramic available from your dealer.
For further instruction refer to owner's manual.
Keep viewing and ash removal doors tightly closed during operation.

## MODEL / MODÈLE: "Absolute43-C"

Room Heater Pellet Fuel-Burning Type
SUITABLE FOR MOBILE-HOME INSTALLATION
This pellet burning appliance has been tested and listed for use In Manufactured Homes In accordance with OAR 814-23-900 through 814-23-909

**MINIMUM CLEARANCES TO COMBUSTIBLES**

| | |
|---|---|
| Back Wall to Appliance | 2" |
| Side Wall to Appliance | 6" |

**Corner Installation**

| | |
|---|---|
| Walls to Appliance | 6.25" |

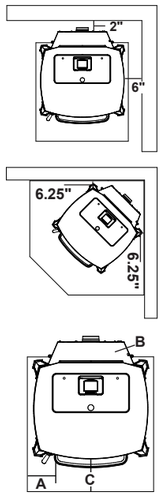
Use a non-combustible floor protector extending under and to the sides, front and back of the unit as shown in floor protection diagram. Measure front distance from the surface of the glass door.
**Recommended: Non-combustible floor protection extended beneath the flue pipe when installed with horizontal venting.**

**Floor Protection***

| | USA | CANADA |
|---|---|---|
| Sides (A) | 6" | 152 mm |
| Back (B) | 1" | 25 mm |
| Front (C) | 6" | 152 mm |

**Alcove Installation**

| | |
|---|---|
| Min. Alcove Height | 42" (1067mm) |
| Max. Alcove Depth | 24" (610mm) |




**US ENVIRONMENTAL PROTECTION AGENCY**
**The Absolute43-C is Certified to comply with 2020 particulate emission standards.**
**L'Absolute43-C est certifié conforme aux normes d'émission de particules de 2020.**

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

HARMAN®
352 Mountain House Road, Halifax, PA 17032 (É.-U.)

3-90-7772_R1

***THIS AREA MUST BE BLACK***

## Modèle: "Absolute43-C"

Appareil de chauffage à granulés de bois
CONÇU POUR MAISONS MOBILES

**Serial No.**
**N° de série:** HF

BARCODE LABEL

Test pour / tested à la norme ASTM E 1509-12, ULC-S627-00, EPA Method 28 & 5G
Chauffe-chambre, Pellet à combustibles Type, également pour les maisons mobiles. (UM) 84-HUD
**"Empêcher MAISON incendies"** Installer et utiliser uniquement en conformité avec les instructions du fabricant d'installation et d'exploitation.
Contactez le service des incendies à propos des restrictions et l'inspection d'installation dans votre région.
A**VERTISSEMENT: POUR maisons préfabriquées:** Ne pas installer l'appareil dans une chambre à coucher. Une entrée d'air de combustion à l'extérieur doit être fournie. L'intégrité structurale de la maison étage, plafond et murs fabriqués doit être maintenue. Reportez-vous aux instructions du fabricant et les codes locaux pour les précautions nécessaires pour faire passer la cheminée à travers un mur ou un plafond combustible. Inspectez et nettoyez système d'évacuation souvent en conformité avec les instructions du fabricant.
Utilisez un "ou 4" Type de diamètre «L» 3 ou le système de ventilation "PL".
Ne pas connecter cet appareil à un conduit de cheminée desservant un autre appareil.
**Ne pas obstruer l'espace sous le chauffe-eau.**
**À UTILISER AVEC LA GRANULE DE BOIS SEULEMENT.**
Émissions certifiés EPA: ,99 g / h
**Entrée Max Note:** £ 5,0 carburant / h
**Note électrique:** 240 VAC, 50 Hz, Lancer 1,75 AMPS, Exécuter 1,25 AMPS
**US Note électrique:** 115 VAC, 60 Hz, 3,5 AMPS Démarrer, Exécuter 2,5 AMPS
Type de carburant: Bois Pellet SEULEMENT
**Route cordon électrique de l'appareil.**
**Fonctionner uniquement avec les portes fermées**
Ce poêle à bois a besoin d'une inspection et d'une réparation périodiques 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.

**DANGER:** Risque d'électrocution. Coupez l'alimentation électrique avant l'entretien.
Remplacer le verre avec 5 mm miroir verre céramique de la même qualité disponible auprès de votre revendeur.
En tenant la porte d'entrée et le couvercle de la trémie hermétiquement fermé pendant le fonctionnement de l'appareil

**DISTANCES DE SECURITE PAR RAPPORT AUX MATERIAUX COMBUSTIBLES**

| | |
|---|---|
| Paroi arrière à l'appareil | 51 mm |
| paroi latérale de l'appareil | 152 mm |

**Installation en angle**

| | |
|---|---|
| Entre murs et apparell | 159 mm |

**Installation en alcôve**

| | |
|---|---|
| Hauter minimale de l'alcôve | 1067 mm |
| Profondeur maximale de l'alcôve | 610 mm |

**PROTECTION DU SOL***

| | |
|---|---|
| Côtés (A) | 152 mm |
| Arrière (B) | 25 mm |
| Avant (C) | 152 mm |

Utiliser une protection de sol non combustible sous l'appareil qui s'étend sur les côtes, l'avant et l'arrière du poêle (voir schéma). Pour la distance à l'avant, mesurer à partir de la surface de la porte en verre.
Il est recommendé que la protection s'étende jusque sous le conduit en cas d'installation d'un conduit horizontal ou sous le té en cas conduit vertical.
**Do not remove this label/Ne pas enlever cette étiquette.**
**Made in the USA/Fabriqué aux É.-U.**

**Date of Manufacture / Date de fabrication:**

| 2018 | 2019 | 2020 | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

**Manufactured by / Fabriqué par: Hearth and Home Technologies 352 Mountain House Road, Halifax PA 17032**

| LABEL TICKET | | | |
|---|---|---|---|
| **ECO:** | 87270 | **LABEL SIZE:** | 5.75" H x 13.562" W |
| **PART # / REV:** | 3-90-7772_R1 | **ADHESIVE:** | |
| **ORIGINATOR:** | Spidlet | **MATERIAL:** | 24 Gauge Aluminum |
| **DATE:** | 01/23/18 | **INK:** | Black Background |
| HARMAN® BUILT TO A STANDARD, NOT A PRICE — 352 Mountain House Road Halifax, PA 17032 | | (1) Holes = Ø.30<br>(5) Slotted Holes = .156 x .25<br>(4) Corners = R.062<br>Barcode label must have the serial number on it.<br>The barcode label must be able to read Code 39 Full ASCII. | |

# Installation Manual

## Installation and Appliance Setup

**INSTALLER: Leave this manual with party responsible for use and operation.**
**OWNER: Retain this manual for future reference.**

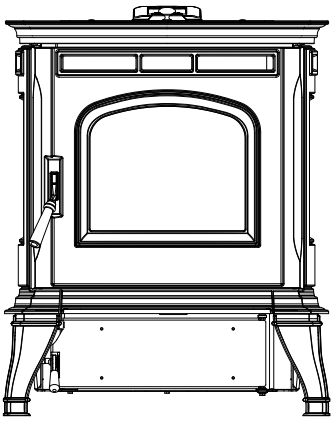
*NOTICE: SAVE THESE INSTRUCTIONS*

HARMAN®

BUILT TO A STANDARD, NOT A PRICE

## Model(s):

***Absolute43-C***
***Freestanding Pellet Stove***



Pellet Fuels Institute

NATIONAL FIREPLACE INSTITUTE® A CERTIFICATION AGENCY

### ⚠ CAUTION

Tested and approved for wood pellet fuel only. Burning of any other type of fuel voids your warranty.

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

hearthED FACTORY TRAINING Fuel Your Fire

NATIONAL FIREPLACE INSTITUTE® A CERTIFICATION AGENCY

### ⚠ CAUTION

Check building codes prior to installation.

- Installation MUST comply with local, regional, state and national codes and regulations.
- Contact local building or fire officials about restrictions and installation inspection requirements in your area.

### ⚠ WARNING

**Please read this entire manual before installation and use of this pellet fuel-burning room heater.**
**Failure to follow these instructions could result in property damage, bodily injury or even death.**

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- Do not overfire - If any external part starts to glow, you are overfiring. Reduce feed rate. 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 stove.
- 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.

### NOTE

To obtain a French translation of this manual, please contact your dealer or visit www.harmanstoves.com

Pour obtenir une traduction française de ce manuel, s'il vous plaît contacter votre revendeur ou visitez www.harmanstoves.com

## ⚠ 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 stove or to property.

# TABLE OF CONTENTS



➔ **= Contains updated information**

## Installation Standard Work Checklist

# 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:** _____
**Lot/Address:** _____
_____
**Model:** _____

**Date Installed:** _____
**Location of Stove:** _____
**Installer:** _____
**Dealer/Distributer Ph #** _____
**Serial Number:** _____

> ***WARNING! Risk of Fire or Explosion! Failure to install appliance to these instructions can lead to a fire or explosion.***

| **Appliance Install Section 3** | **YES** | **IF NO, WHY?** |
|---|---|---|
| Required non-combustible floor protection | ☐ | _____ |
| Verified clearances to combustible. | ☐ | _____ |
| Unit is Leveled and secured. | ☐ | _____ |
| **Venting/Chimney Section 4** | | |
| Venting Configuration complies to vent diagrams. | ☐ | _____ |
| Venting installed, sealed and secured in place with proper clearances. | ☐ | _____ |
| Exterior wall/roof flashing installed and sealed | ☐ | _____ |
| Terminations installed and sealed. | ☐ | _____ |
| **Electrical Section 1** | | |
| 120 VAC unswitched power provided to the appliance. | ☐ | _____ |
| Check outlet with multi-meter for proper voltage. (115-120 VAC) | ☐ | _____ |
| Record voltage reading: _____ | | |
| **Appliance Setup Section 5** | | |
| All packaging and protective materials are removed | ☐ | _____ |
| Accessories installed properly | ☐ | _____ |
| Manual bag and all it's contents are removed from inside the appliance and given to party responsible for use and operation | ☐ | _____ |
| Started appliance and verified that all motors and blowers operate as they should. | ☐ | _____ |
| Checked draft using a Manometer. Record readings: _____ | ☐ | _____ |
| During operation, verify that the hopper lid switch (If applicable) and pressure switch are working properly by briefly opening the hopper lid and main door and verifying that the feed motor is interrupted. | ☐ | _____ |

Hearth and Home Technologies recommends the following:
Photographing the installation and copying this checklist for your file.
This checklist remain visible at all times on the appliance 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)

04/23

# 1 Product Specific and Important Safety Information

## A. Appliance Certification

| | |
|---|---|
| **MODEL:** | Absolute43-C Pellet Stove |
| **LABORATORY:** | OMNI Test Laboratories, Inc |
| **REPORT NO.** | 0135PS039E, 0135PS032S |
| **TYPE:** | Pellet Fueled/Supplementary For Residential Use |
| **STANDARD(s):** | ASTM E 1509-12, ULC-S627-00, ASTM E 2515-11, ASTM E 2779-10 |
| **ELECTRICAL RATING:** | 115 VAC, 60 Hz, Start 4.0 Amps, Run 3.0 Amps |
| **GLASS SPECIFICATION:** | 5mm mirrored ceramic glass |

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

The Absolute43-C is Certified to comply with 2020 particulate emission standards.

**NOTE:** This installation must conform with local codes. In the absence of local codes you must comply with the **ASTM E1509-2004, ULC S628-93, (UM) 84-HUD**

## B. Glass Specifications

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

## C. 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 pellet vent, Class “PL” connector pipe.

**A Harman® Outside Air Kit must be installed in a mobile home installation.**

**WARNING**

**THESTRUCTURALINTEGRITYOFTHEMANUFACTURED HOME FLOOR, WALL, AND CEILING/ROOF MUST BE MAINTAINED.**

**DO NOT INSTALL IN SLEEPING ROOM.**

## D. BTU & Efficiency Specifications

| | |
|---|---|
| **EPA Certification Number:** | 126.18 |
| **EPA Certified Emissions:** | .99 g/hr |
| ***LHV Tested Efficiency:** | 82.3% |
| ****HHV Tested Efficiency:** | 77% |
| *****EPA BTU Output:** | 34,800 - 10,600 |
| ******BTU Input** | 44,200 - 14,100 |
| **Vent Size:** | 3 Inch |
| **Hopper Capacity:** | 52 lbs |
| **Fuel** | Wood Pellet |

** Weighted average LHV efficiency using data collected during EPA emissions test.*

***Weighted average HHV efficiency using data collected during EPA emissions test.*

****A range of BTU outputs based on EPA Default Efficiency and the burn rates from the low and high EPA tests.*

*****Based on the maximum feed rate per hour multiplied by approximately 8600 BTU’s which is the average BTU’s from a pound of pellets.*

## E. Electrical Codes

115 VAC, 60 Hz, Start 4.0 Amps, Run 3.0 Amps

***Notice**: This appliance 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.**

**NOTE:** Some generator or battery back-up systems may not be compatible with the micro-processor electronics on this appliance. Please consult the power supply manufacturer for compatible systems.

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

## F. California Safety Information

**WARNING**

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

# 2 Getting Started

## A. Design and Installation Considerations

### 1. Appliance Location

***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.

It is a good idea to plan your installation on paper, using exact measurements for clearances and floor protection, before actually beginning the installation

Consideration must be given to:

- Safety, convenience, traffic flow
- Placement of the chimney and chimney connector.
- If you are not using an existing chimney, place the appliance where there will be a clear passage for a factory-built listed chimney through the ceiling and roof.
- Installing an optional outside air kit would affect the location of the vent termination.

***NOTICE:*** *Locating the appliance in a location of considerable air movement can cause intermittent smoke spillage from appliance. Do not locate appliance near:*

- *Frequently open doors*
- *Central heat outlets or returns*

Since pellet exhaust can contain ash, soot or sparks, you must consider the location of:

- Windows
- Air Intakes
- Air Conditioner
- Overhang, soffits, porch roofs, adjacent walls
- Landscaping, vegetation

When locating vent and venting termination, vent above roof line when possible.

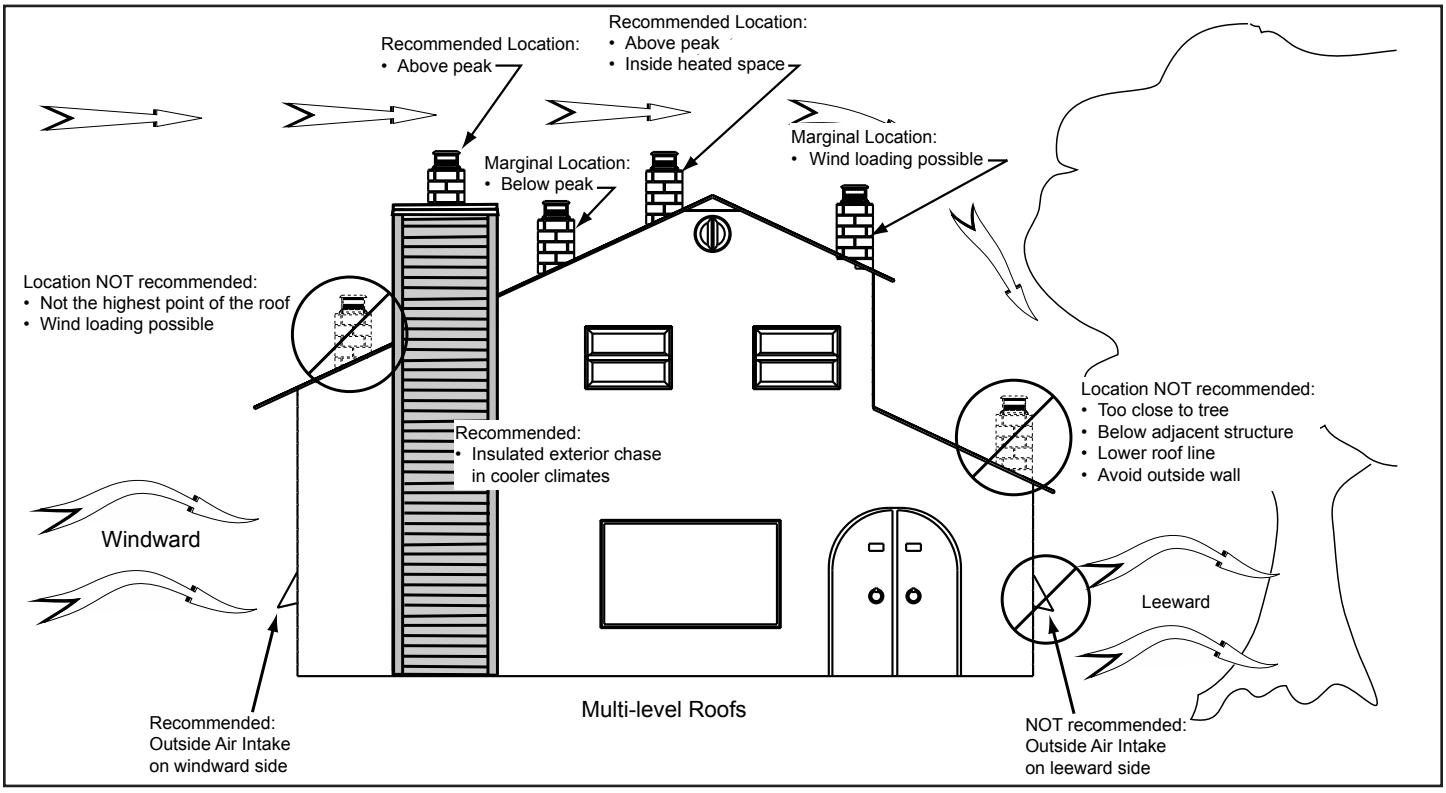



**Figure 2.1**

## B. Tools And Supplies Needed

**Tools and building supplies normally required for installation, unless installing into an existing masonry fireplace:**

- Reciprocating Saw
- Hammer
- Phillips Screwdriver
- Tape Measure
- Level
- Non-Combustible Sealant
- Material
- Gloves
- Safety Glasses
- Electric Drill & Bits

**May also need:**

- Vent Support Straps
- Venting Paint

## C. Inspect Appliance and Components

- Carefully remove the appliance and components from the packaging.
- Report to your dealer any parts damaged in shipment, particularly the condition of the glass.
- **Read all of the instructions before starting the installation. Follow these instructions carefully during the installation to ensure maximum safety and benefit.**

***DO NOT:***

- *Install or operate damaged appliance*
- *Modify appliance*
- *Install other than as instructed by Hearth & Home Technologies*
- *Operate the appliance without fully assembling all components*
- *Overfire*
- *Install any component not approved by Hearth & Home Technologies*
- *Install parts or components not Listed or approved.*
- *Disable safety switches*

*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.*

This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

This 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.

**⚠ WARNING**

***RISK OF FIRE OR EXPLOSION!***

***DAMAGED PARTS COULD IMPAIR SAFE OPERATION. DO NOT install damaged, incomplete or substitute components.*** *Keep appliance dry.*

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

- Installation and use of any damaged appliance or vent system component.
- Modification of the appliance or vent system.
- Installation other than as instructed by Hearth & Home Technologies.
- Installation and/or use of any component part not approved by Hearth & Home Technologies.

**Any such action may cause a fire hazard.**

**⚠ WARNING**

***Risk of Fire, Explosion or Electric Shock! DO NOT use this appliance if any part has been under water. Call a qualified service technician to inspect the appliance and to replace any part of the control system which has been under water.***

# 3 Clearances

## A. Appliance Dimension Diagram

Dimensions are actual appliance dimensions. Use for reference only.

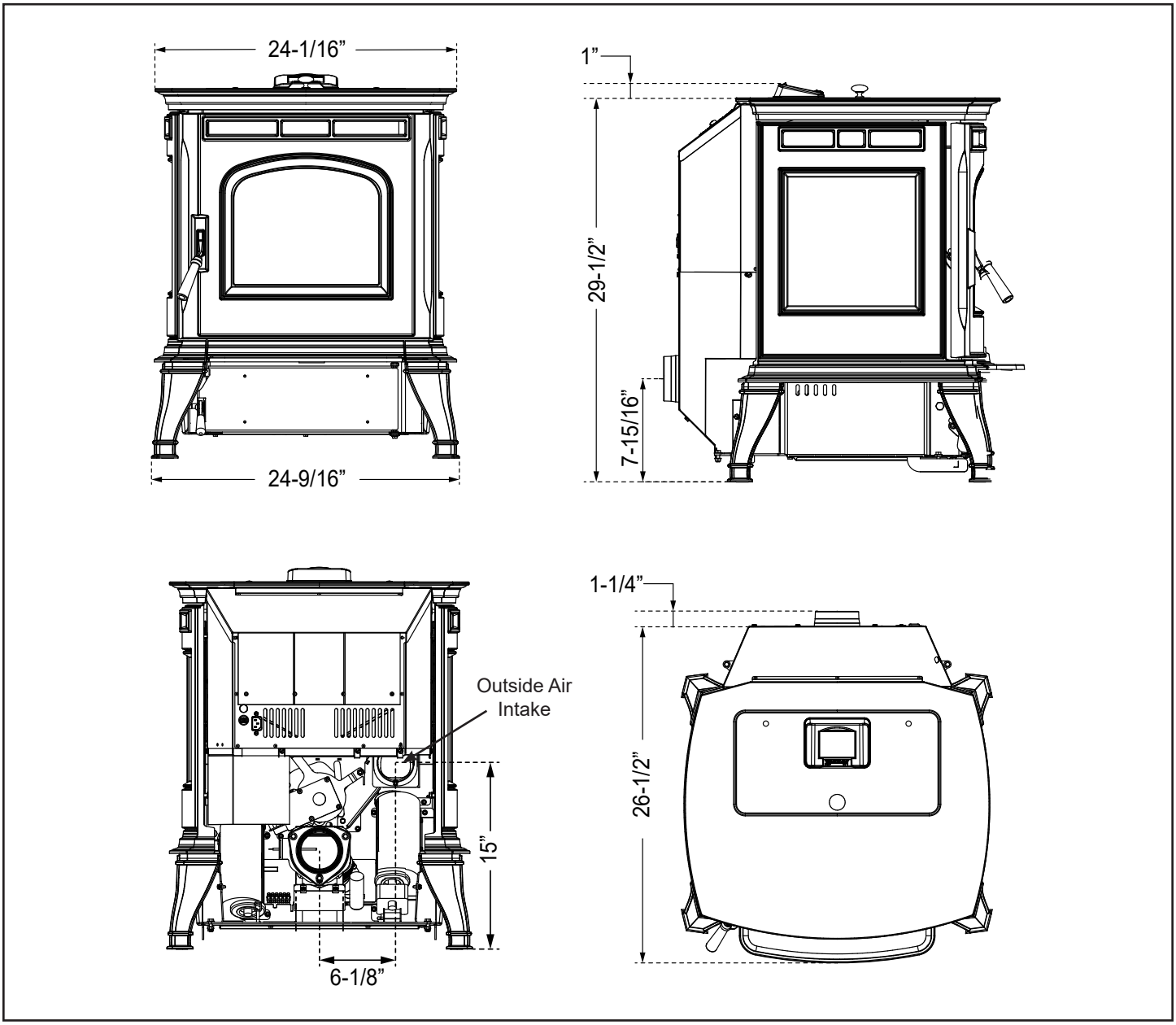



**Figure 3.1**

## B. Non-Combustible Materials Specification

Material which will not ignite and burn. Such materials are those consisting entirely of steel, iron, brick, tile, concrete, slate, glass or plasters, or any combination thereof.
Materials that are reported as passing **ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C** and **UL763** shall be considered non-combustible materials.

## C. Combustible Materials Specification

Materials made of or surfaced with wood, compressed paper, plant fibers, plastics, or other material that can ignite and burn, whether flame proofed or not, or plastered or un-plastered shall be considered combustible materials.

## D. Clearances to Combustibles

When selecting a location for the appliance it is important to consider the required clearances to walls (see Figure 3.2).

**⚠ WARNING**

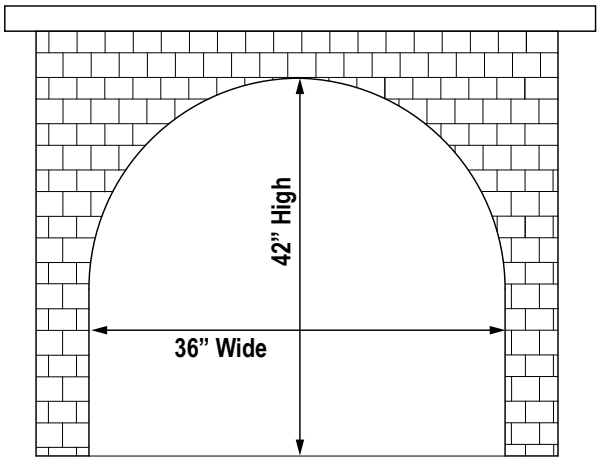
***RISK OF FIRE OR BURNS! Provide adequate clearance around air openings and for service access.*** *Due to high temperatures, the appliance should be located out of traffic and away from furniture and draperies.*

***NOTICE:*** *Illustrations reflect typical installations and are FOR DESIGN PURPOSES ONLY. Actual installation may vary due to individual design preference.*

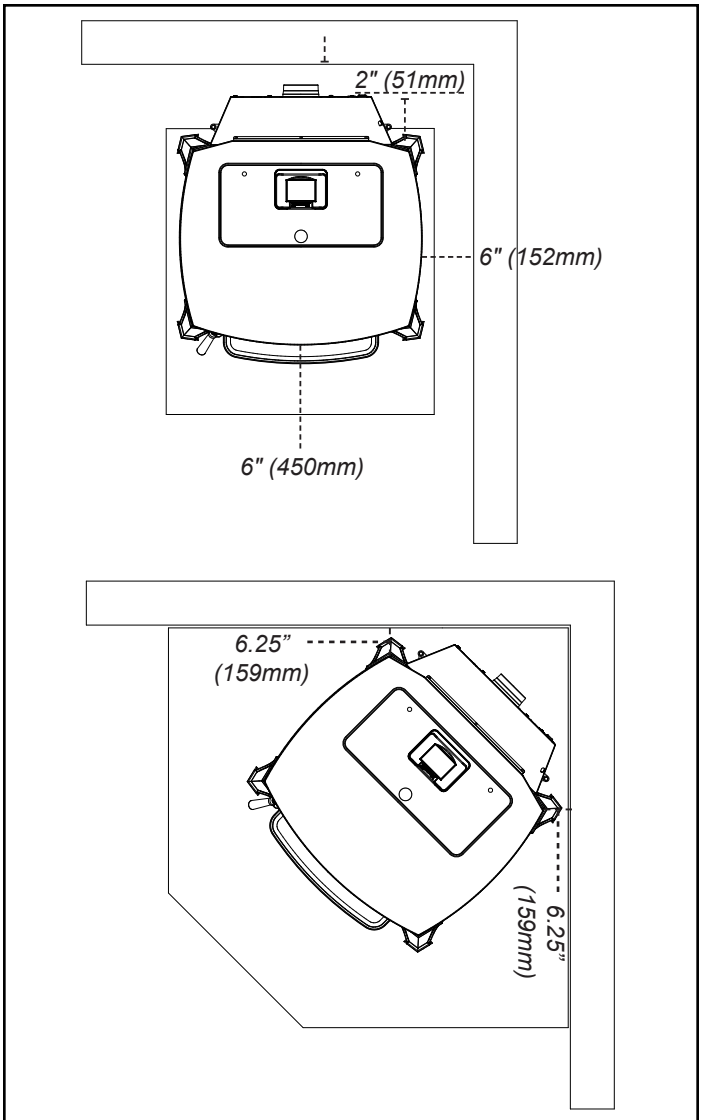
Place the stove away from combustible walls at least as far as shown in Figure 3.2.

Note that the clearances shown are minimum for safety but do not leave much room for access when cleaning or servicing. Please take this into account when placing the stove.

When installing the unit into an alcove it is important to consider the required clearances listed below.




**Min. Height = 42", Min. Width = 36, Max. Depth = 24"**




**NOTE: Top of unit must be a minimum of 12" (305mm) to ceiling**

**Figure 3.2**

**⚠ CAUTION**

**THIS APPLIANCE MUST BE VENTED TO THE OUTSIDE.**

**NOTICE:** Clearances may only be reduced by means approved by the regulatory authority having jurisdiction.

Due to high temperatures, the stove should be placed away from traffic, furniture and draperies.

Children and adults should be alerted to the hazards of high surface temperatures and should stay away to avoid burns to skin and/or clothing.

Young children should be carefully supervised when they are in the same room as the stove.

Clothing and other flammable materials should not be placed on or near this unit.

## E. Floor Protection

**CAUTION**

Hearth and Home Technologies does not recommend adhesive based vinyl flooring due to thermal expansion. Floating-style flooring (LVP - luxury vinyl plank or LVT – luxury vinyl tile) can be used, but it will reach temperatures up to 110 °F in a room with ambient temperature of 70 °F. Consult flooring specifications to ensure compatibility.

When using LVP/LVT flooring, HHT Recommends pellet stove and inserts have 29 inches of alternative flooring in front of the stove or insert before using LVP/LVT (luxury vinyl plank/tile flooring). Whether the stove or insert sits flush on the floor or is elevated on a raised hearth, 29 inches of alternative flooring is required in front of the stove or insert.

For all other flooring, continue to follow clearance to combustible requirements in the installation manual.

***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 risk.*

**Parallel Installation:**

Place the stove on a noncombustible floor or floor protector that extends a minimum of 6 inches (152mm) to the front of the load door opening, 6 inches (152mm) to the sides of the door opening, and 1 inches to the rear.

The minimum floor protector material is 20 gauge sheet metal (Not sold by Harman). **Note:** When using this method, installation of the included Bottom Heat Shield (1-00-777146) must be used. Other floor protector materials are ceramic tile, stone, brick, etc.

Minimum Size floor protection is 25-7/8" wide By 28" deep (658mm X 711mm). Figure 3.3

**Venting:**

**US** - Follow PL vent manufacturers recommendations when configuring vent pipe installation.

**Canada** - Must extend 2" (51mm) beyond each side of any horizontal flue pipe.

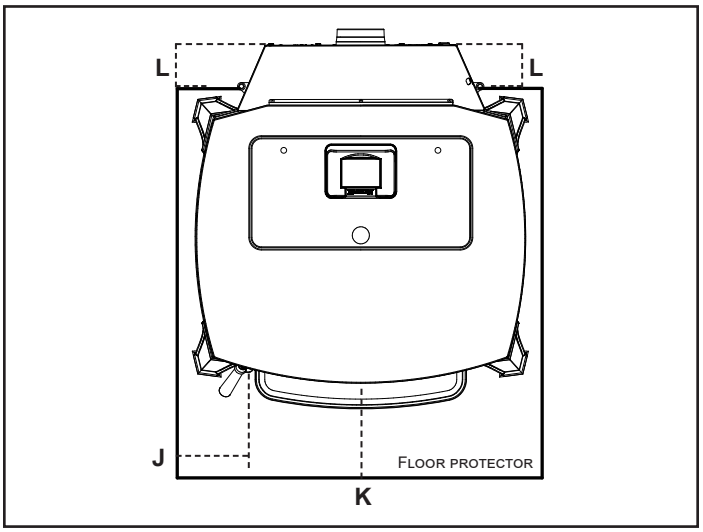



**Figure 3.3**

| Floor Protection Requirements | | US | Canada |
|---|---|---|---|
| J | Sides | 6" | 152mm |
| K | Front | 6" | 152mm |
| L | Rear | 1" | 25mm |

**Corner Installation:**

Minimum size floor protection for a corner installation hearth pad is 25-7/8" Wide By 28" Deep (658mm X 711mm). ***Note: Floor protector <u>WILL NOT</u> touch the wall using minimum clearances.***

If corner floor protection is desired to touch the wall, the floor protection will need to be at least 36" x 36" (914mm x 914mm). ***Note: This will allow the floor protection to touch the wall as shown. Figure 3.4***.

Alternate floor protector dimension may be used as long as they satisfy the measurement requirements shown below.

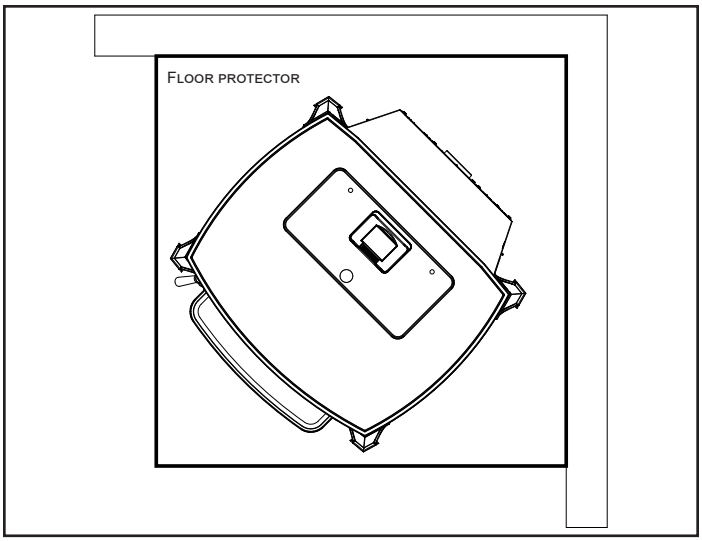



**Figure 3.4**

## F. Mobile Home Installation

When installing this unit in a mobile home, several requirements must be followed:

1. The unit must be bolted to the floor. This can be done using an appropriate fastener for the application.
2. The unit must be connected to an outside combustion air inlet. Proper supports and spark arresters must be considered when installing venting. See "Termination Location and Vent Information" Section D.
3. Floor protection and clearances must be followed as shown.
4. The appliance must be properly grounded to the frame of the mobile home using a minimum of 8 AWG copper solid or stranded, insulated or bare wire or equivalent.

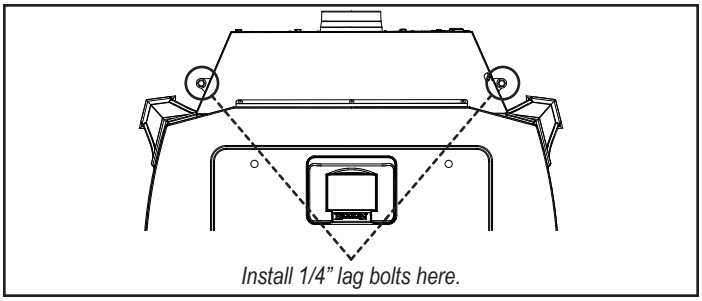



**Figure 3.5**

# 4 Termination Location and Vent Information

## A. Vent Termination Minimum Clearances

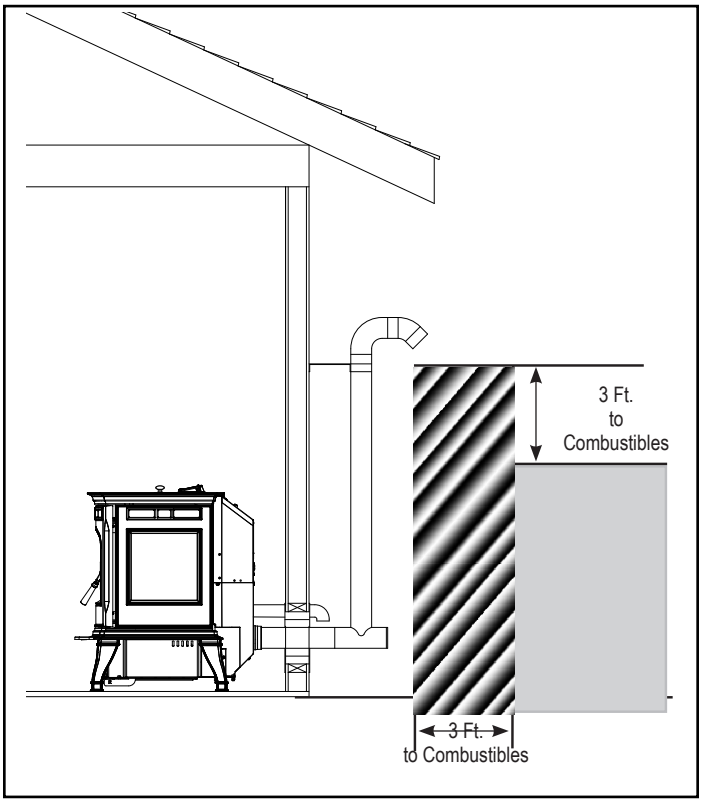



**Figure 4.1**

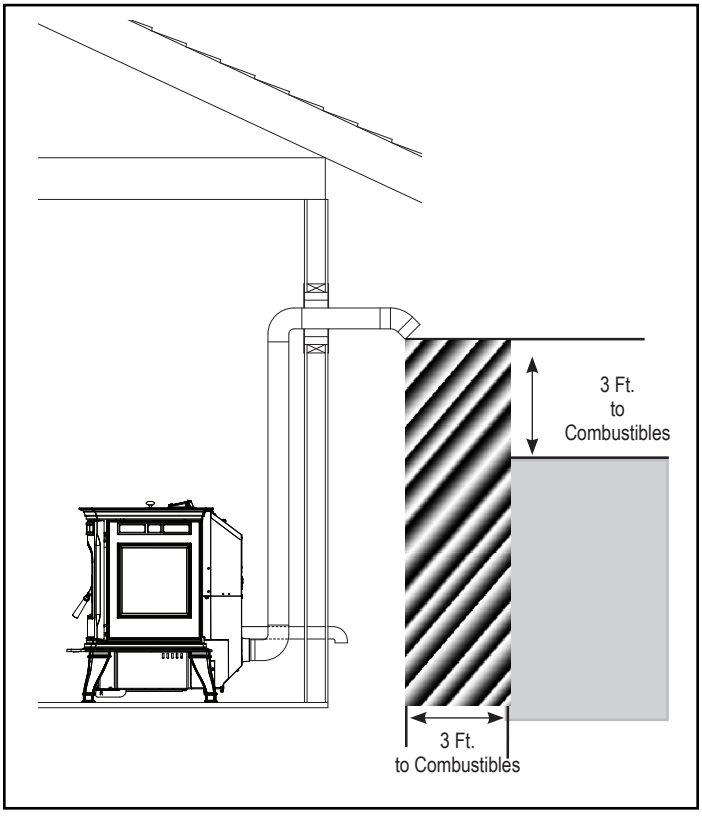



**Figure 4.2**

**Note:** Follow venting manufacturer's recommendations for sealing pipe joints.

**#1 Preferred method (Figure 4.1)**

This method provides excellent venting for normal operation and allows the stove to be installed closest to the wall. Two inches from the wall is safe; however, four inches allows better access to remove the rear panel. The vertical portion of the vent should be three to five feet high. This vertical section will help provide natural draft in the event of a power failure.

**Note: Do not place joints within wall pass-through.**

**THE CHIMNEY MUST BE OF A TYPE SUITABLE FOR SOLID-FUEL BURNING.**

**⚠ WARNING**

**THE CHIMNEY AND CONNECTOR MUST BE MAINTAINED IN GOOD CONDITION AND KEPT CLEAN.**

**⚠ CAUTION**

**DO NOT USE MAKESHIFT COMPROMISES WHEN INSTALLING THIS APPLIANCE. DAMAGE AND/OR INJURY MAY RESULT.**

**#2 Preferred method (Figure 4.2)**

This method also provides excellent venting for normal operation but requires the stove to be installed farther from the wall. The vertical portion of the vent should be three to five feet high and at least 1" from a combustible wall. This vertical section will provide natural draft in the event of a power failure.

If the stove is installed below grade be sure the vent t*ermination is at least 12" above grade* ***(with outside air only)****. The outlet must also be 1 foot from the house/building.*

***Note: Do not place joints within wall pass-through.***

**⚠ CAUTION**

**Keep combustible materials (such as grass, leaves, etc.) at least 3 feet away from the flue outlet on the outside of the building.**

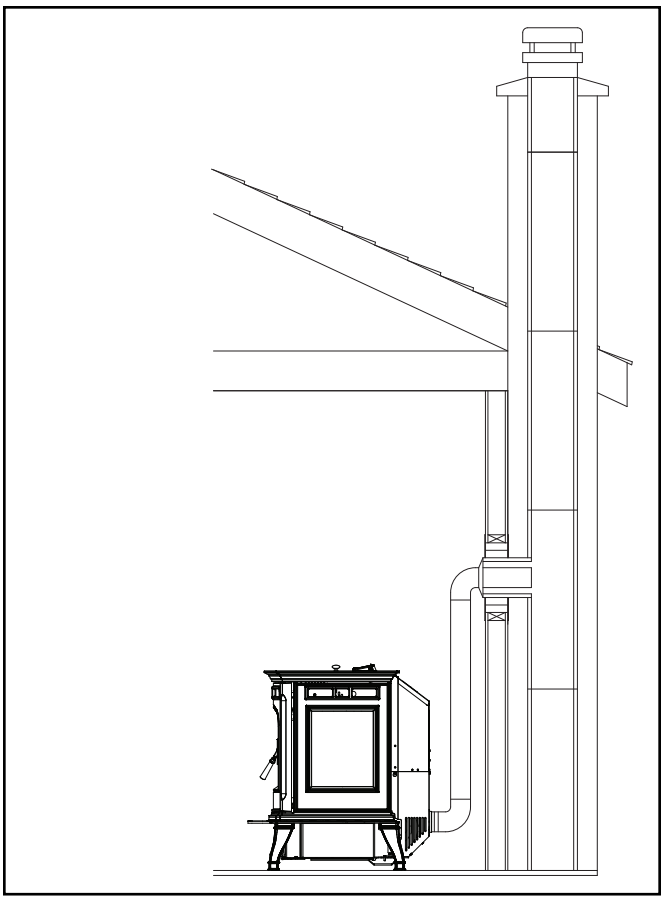


**Figure 4.3**

**#3 Installing into an existing chimney (Figure 4.3)**

This method provides excellent venting for normal operation. This method also provides natural draft in the event of a power failure. If the chimney condition is questionable* you may want to install a liner as in method #6.

In some places in the US and Canada it is required that the vent pipe extend all the way to the top of the chimney.

*The chimney should be inspected and cleaned before installing your stove. If you discover that the chimney does not have a clay tile liner or has cracks or flaking of the tile liner you will need to install a stainless steel liner within the chimney. In most cases the inside diameter of this liner should be 4". Either flexible or rigid liner may be used for this purpose. *Refer to Method 5 & 6*.

Be sure to design the venting so that it can be easily cleaned.

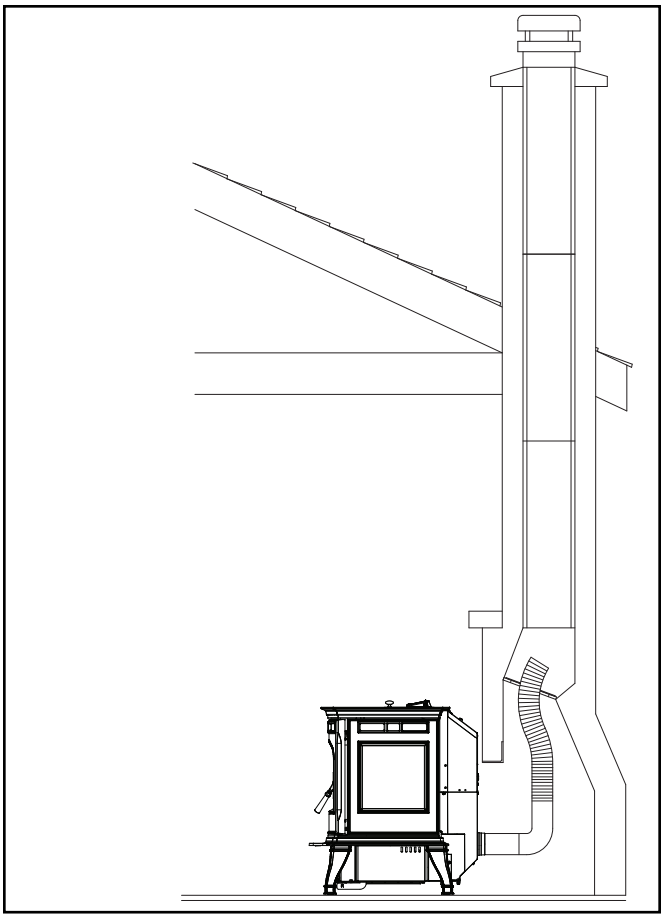


**Figure 4.4**

**#4 Installing into an existing fireplace chimney (Figure 4.4)**

This method provides excellent venting for normal operation. This method also provides natural draft in the event of a power failure. If the chimney condition is questionable* you may want to install a liner as in method #5.

In some places in the US and Canada it is required that the vent pipe extend all the way to the top of the chimney.

*The chimney should be inspected and cleaned before installing your stove. If you discover that the chimney does not have a clay tile liner or has cracks or flaking of the tile liner you will need to install a stainless steel liner within the chimney. In most cases the inside diameter of this liner should be 4". Either flexible or rigid liner may be used for this purpose. *Refer to Method 5 & 6.*

The chimney should be sealed at the damper using a steel plate. Kaowool, mineral wool or an equivalent non-combustible insulation is recommended to be installed on top of the sealing plate to reduce the possibility of condensation. The connector pipe should extend through the smoke chamber to the base or into the first flue tile.

Be sure to design the venting so that it can be easily cleaned.

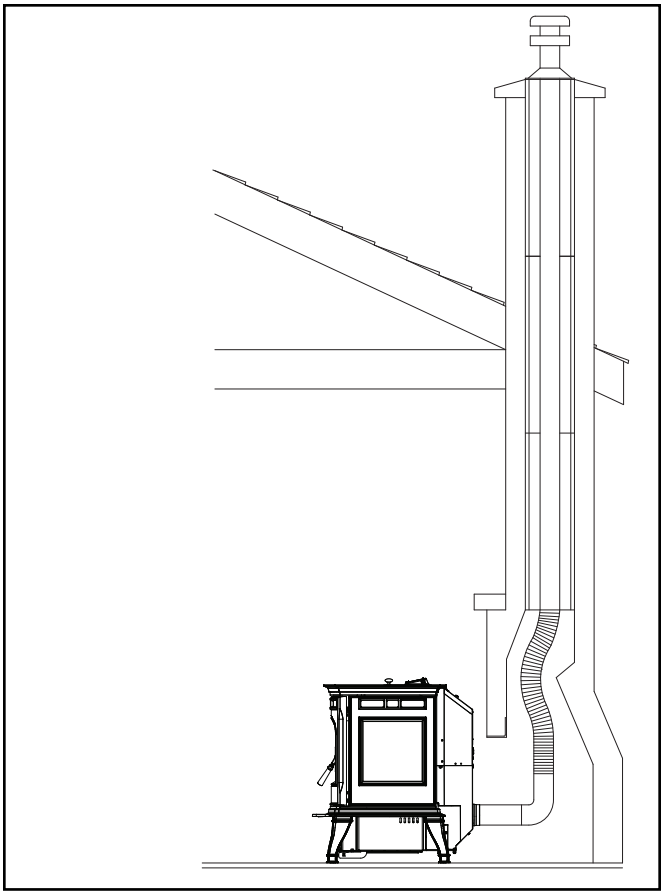


**Figure 4.5**

**#5 Installing into an existing fireplace chimney (Figure 4.5) w/Full Liner**

This method provides excellent venting for normal operation. This method also provides natural draft in the event of a power failure.

In some places in the US and Canada it is required that the vent pipe extend all the way to the top of the chimney. The pipe or liner inside the chimney should be 4" diameter.

In this method a cap should also be installed on the chimney to keep out rain. Be sure to use approved pellet vent pipe fittings. Pipe size should be increased to 4" using this method.

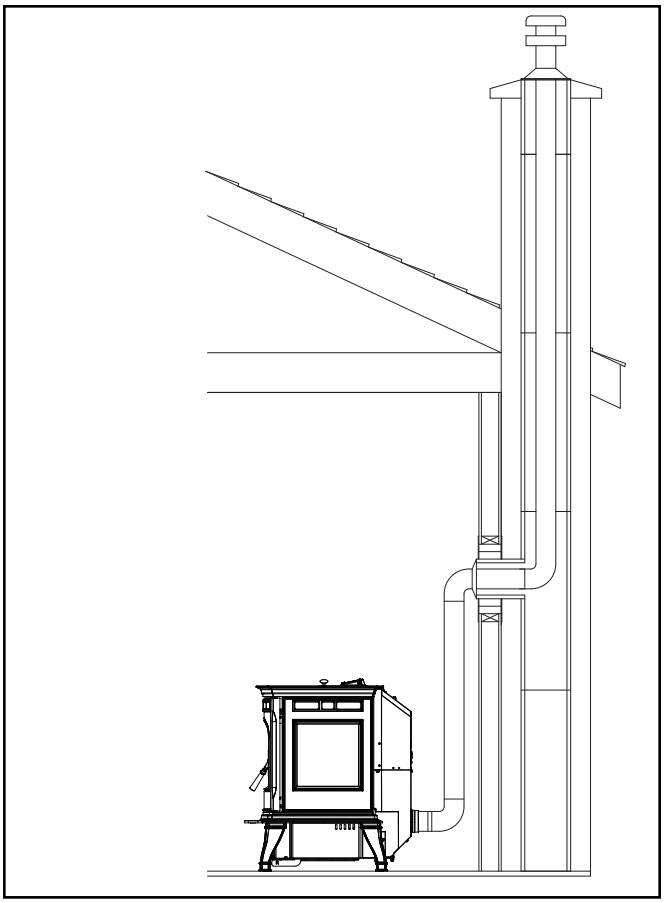


**Figure 4.6**

**#6 Installing into an existing chimney (Figure 4.6) w/Full liner**

This method provides excellent venting for normal operation. This method also provides natural draft in the event of a power failure.

In some places in the US and Canada it is required that the vent pipe extend all the way to the top of the chimney. The pipe or liner inside the chimney should be 4" diameter.

In this method a cap should also be installed on the chimney to keep out rain.

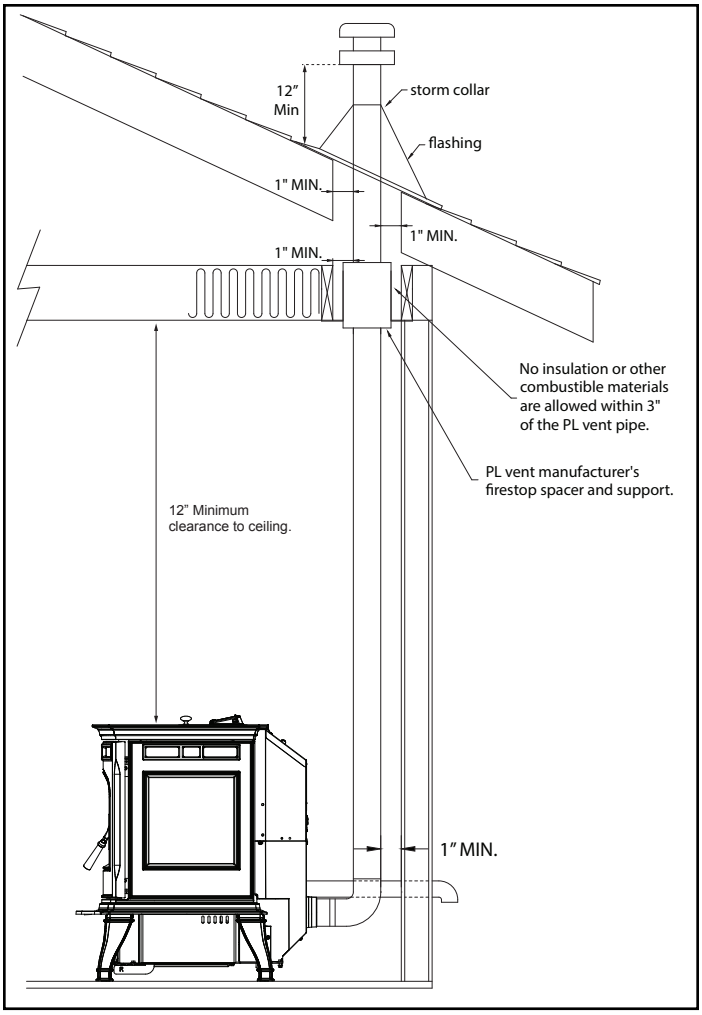



**Figure 4.7**

### #7 Installing through the ceiling (Figure 4.7)

Follow PL vent manufacturers recommendations when using wall and ceiling pass through.

**Note: Do not place joints within wall pass-through.**

**⚠ CAUTION**

**DO NOT USE MAKESHIFT COMPROMISES WHEN INSTALLING THIS APPLIANCE. DAMAGE AND/OR INJURY MAY RESULT.**

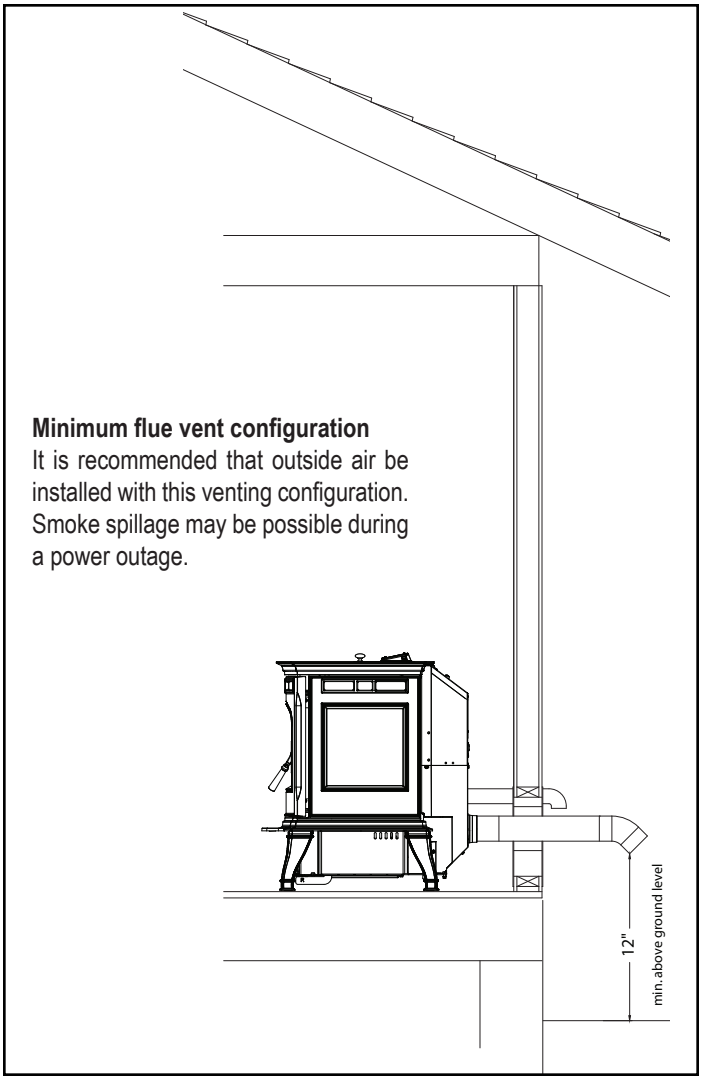



**Figure 4.8**

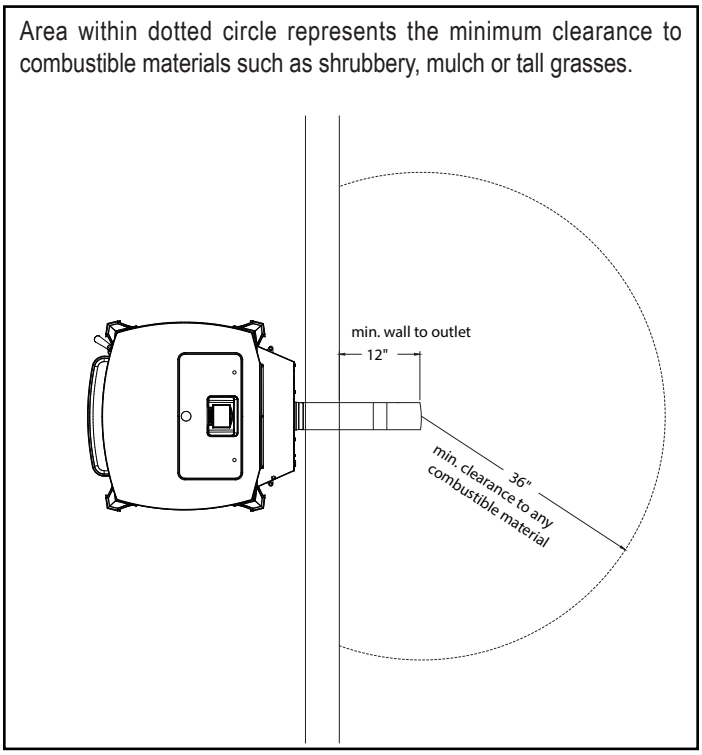



**Figure 4.9**

**#8 Installing into an existing chimney using the Optional Top Vent option. (Figure 4.10)**

This method provides excellent venting for normal operation. This method also provides natural draft in the event of a power failure. If the chimney condition is questionable* you may want to install a liner as in method #6.

In some places in the US and Canada it is required that the vent pipe extend all the way to the top of the chimney.

*The chimney should be inspected and cleaned before installing your stove. If you discover that the chimney does not have a clay tile liner or has cracks or flaking of the tile liner you will need to install a stainless steel liner within the chimney.

Be sure to design the venting so that it can be easily cleaned.

**Optional Top Vent Pipe Clearances**

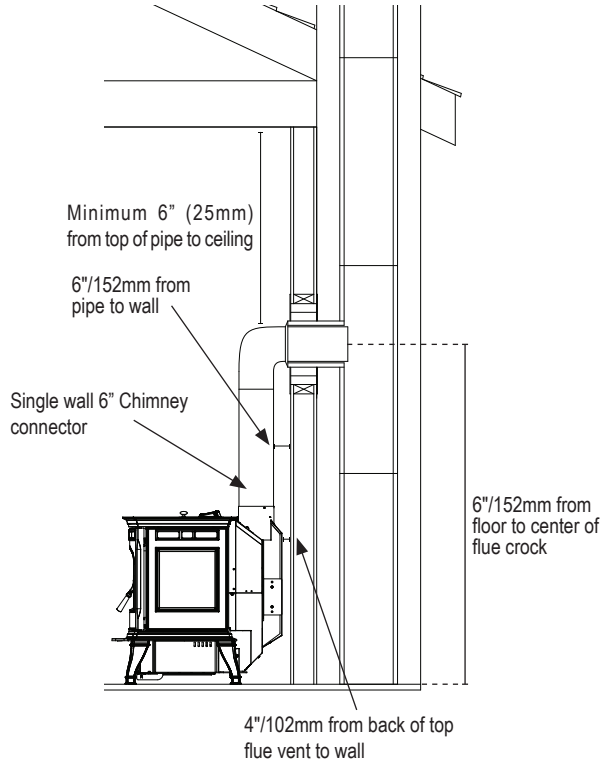
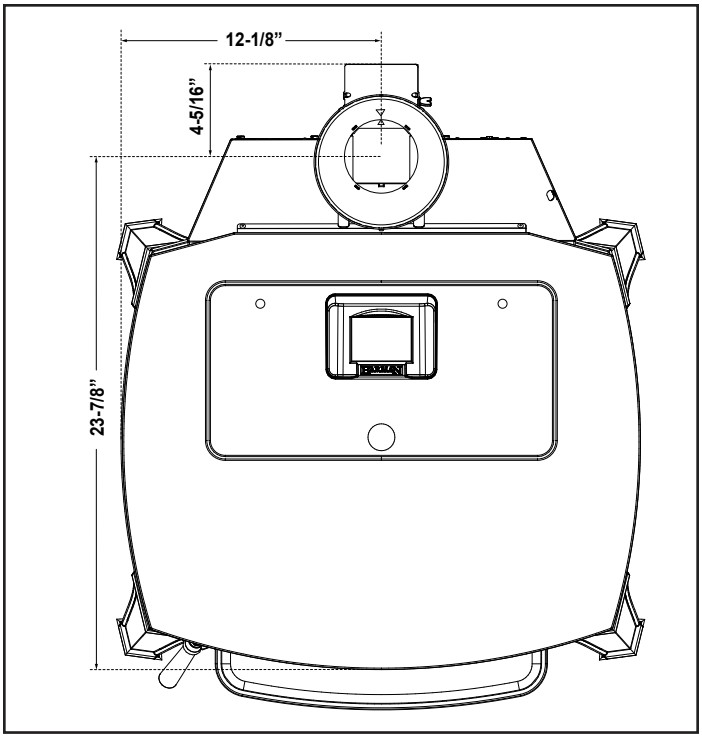


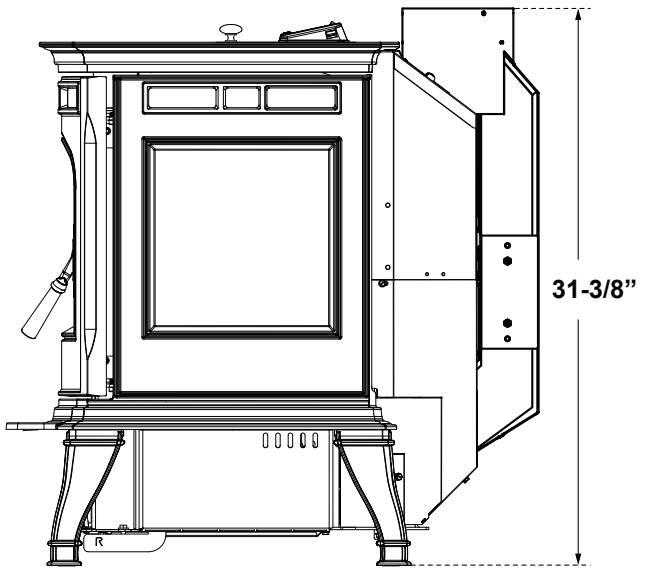

**Figure 4.10**

### Chimney Connectors

- Follow venting manufacturer's recommendations for sealing pipe joints.




Measurement from floor to the beginning of the 6" vent collar.



## B. Chimney Diagram

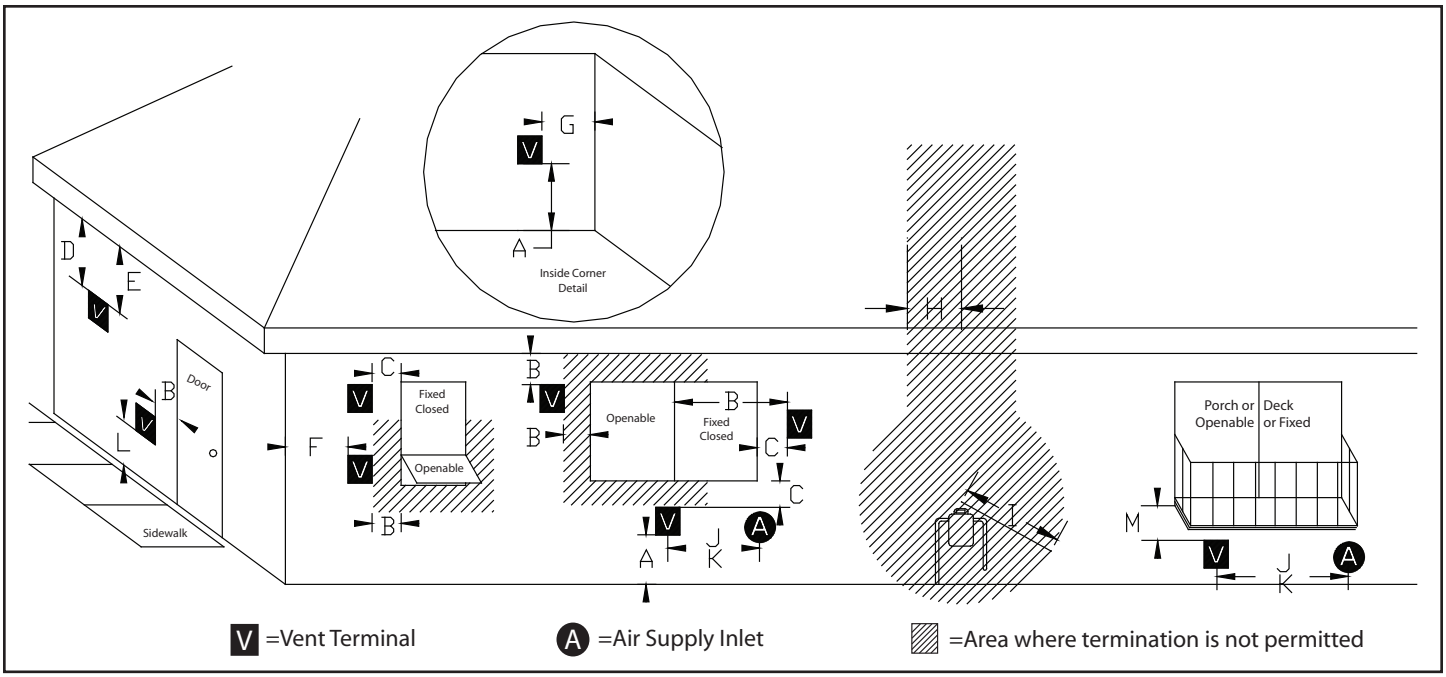



**Figure 4.11**

**Requirements for Terminating the Venting**

**WARNING**

**Venting terminals must not be recessed into a wall or siding.**

**NOTE**

**Only PL vent pipe wall pass-through and fire stops should be used when venting through combustible materials.**

**Always take into consideration the effect the prevailing wind direction or other wind currents will cause with flyash and /or smoke when placing the termination.**

**In addition, the following must be observed:**

A. The clearance above grade must be a minimum of 12".

B. The clearance to a window or door that may be opened must be a minimum of 48" to the side, 48" below the window/door, 12" above the window/door. (**with outside air installed, 12" to side and below**)

C. A 12" clearance to a permanently closed window is recommended to prevent condensation on the window.

D. The vertical clearance to a ventilated soffit located above the terminal within a horizontal distance of 2 feet (60 cm) from the center-line of the terminal must be a minimum of 18".

E. The clearance to an unventilated soffit must be a minimum of 12".

F. The clearance to an outside corner is 11" from center of pipe.

G. The clearance to an inside corner is 12".

H. A vent must not be installed within 3 feet (90 cm) above a gas meter/regulator assembly when measured from the horizontal center-line of the regulator.

I. The clearance to service regulator vent outlet must be a minimum of 6 feet.

J. The clearance to a non-mechanical air supply inlet to the building or the combustion air inlet to any other appliance must be a minimum of 48".

K. The clearance to a mechanical air supply inlet must be a minimum of 10 feet. (**with outside air installed, 6 feet**)

L. The clearance above a paved sidewalk or a paved driveway located on public property must be a minimum of 7 feet.

M. The clearance under a veranda, porch, deck or balcony must be a minimum of 12 inches. **(B. also)**

**NOTE**

**The clearance to vegetation and other exterior combustibles such as mulch is 36" as measured from the center of the outlet or cap. This 36" radius continues to grade.**

Certain Canadian and or Local codes or regulations may require different clearances.

A vent shall not terminate directly above a side-walk or paved driveway which is located between two single family dwellings and serves both dwellings.

Only permitted if veranda, porch, deck, or balcony is fully open on a minimum of 2 sides beneath the floor.

**See NFPA 211 for more installation clearance reductions when using outside air.**

**NOTE**

**Where passage through a wall, or partition of combustible construction is desired, the installation shall conform to CAN/CSA-B365. (if in Canada)**

## C. Venting & Use of Elbows

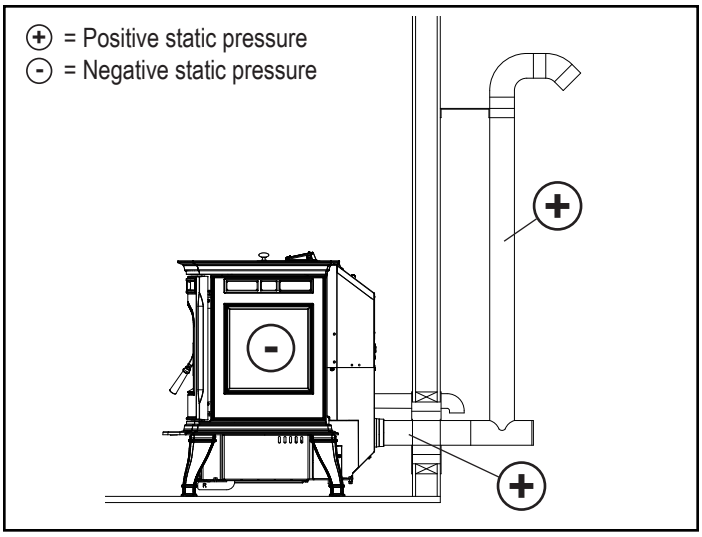



**Figure 4.12**

Harman pellet stoves depend on a combustion fan to pull air through the unit for combustion. The venting system restricts the ability of the combustion fan to move the required amount of air through the unit. A system with too much resistance will result in incomplete combustion, more frequent required cleaning and poor unit performance. It is always best to choose a location for the appliance that will result in a venting system with the shortest equivalent vent length (EVL).

It is best to have your venting system designed by a Harman authorized dealer before you finalize your purchase of an appliance.

***Equivalent Vent Length:* The equivalent vent length for common pellet vent components are:**

- 90° Elbows or Tee: 5 EVL Units
- 45° elbow: 3 EVL Units
- Vertical Pipe or Liner: ½ EVL Unit
- Horizontal Pipe or liner: 1 EVL Unit

***The total allowable equivalent vent length is:***

- 20 EVL for 3” pellet vent pipe or liner.
- 30 EVL for 4” pellet vent pipe or liner.

Due to the potential for fly ash accumulation in horizontal venting sections, the maximum permissible horizontal venting length is:

- 4 ft. for 3” & 4” pellet vent pipe.

**Example: First Floor Installation**

A unit is to be installed using 3” Pellet Pipe with 3 feet of horizontal pipe, a Tee, 10 feet of vertical pipe, a 90° elbow and a termination cap.

***The equivalent vent length is:***

| | |
|---|---|
| 3 ft. of Horizontal Pipe (1 x 3 EVL) | = 3 EVL |
| 90° Elbow or Tee (1 x EVL) | = 5 EVL |
| 10 ft. of Vertical Pipe (10 x .5 EVL) | = 5 EVL |
| 90° Elbow or Tee (1 x EVL) | = 5 EVL |
| Termination Cap | = 0 EVL |
| Equivalent Vent Length | = 18 EVL |

In the example system detailed above, the EVL was 18 which is less than the maximum of 20 EVL for 3” pellet vent pipe, thus this is a satisfactory venting configuration.

**Example: Connection to Masonry Chimney**

A unit is to be installed using 3” Pellet Pipe with 2 feet of horizontal pipe, a Tee, 4 feet of vertical pipe, an elbow, a Tee, 21 feet of vertical liner, and a termination cap.

***The equivalent vent length is:***

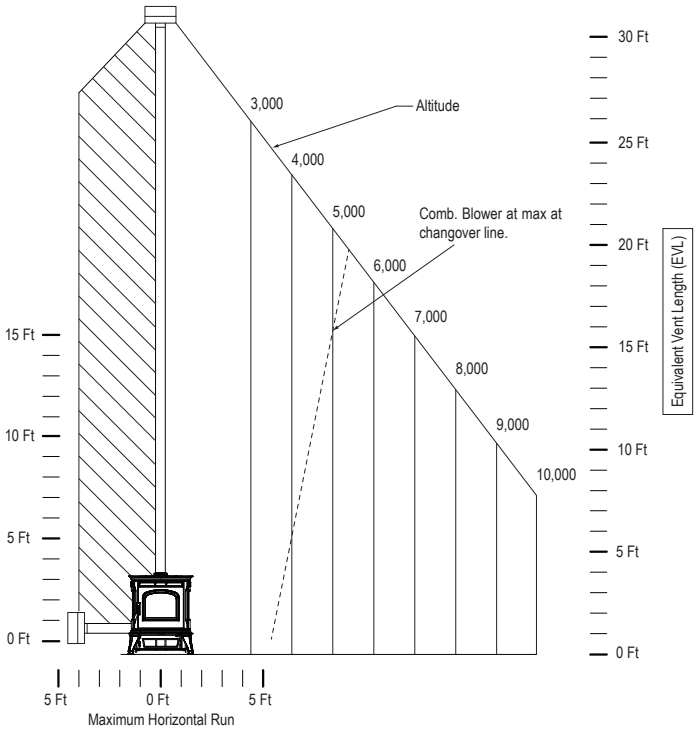
| | |
|---|---|
| 2 ft. of Horizontal Pipe (1 x 2 EVL) | = 2 EVL |
| 90° Tee (1 x 5 EVL) | = 5 EVL |
| 4 ft. of Vertical Pipe (4 x .5 EVL) | = 2 EVL |
| 90° Elbow (1 x 5 EVL) | = 5 EVL |
| 90° Tee (1 x 5 EVL) | = 5 EVL |
| 21 ft. of Vertical Liner (21 x .5 EVL) | = 10.5 EVL |
| Termination Cap | = 0 EVL |
| Equivalent Vent Length | = 29.5 EVL |

In the example system detailed above, the EVL was 29.5 which exceeds the maximum of 20 ft. for 3” pellet vent pipe, thus 3” vent pipe should not be used in this installation. However, since 4” pipe can support an EVL up to 30, the use of 4” pipe would create a satisfactory installation.

## C. Venting & Use of Elbows *continued*

**Note:** When the amount of vertical pellet vent pipe in the system exceeds 15 feet, 4” pellet vent pipe should be used.

**Note:** Equivalent Venting Length decreases as altitude increases.




**Example:**

A unit with an EVL of 13, is to be installed at an altitude of 3,000 feet above sea level.

From the chart to the left, at 3,000 feet of altitude, the maximum permissible equivalent venting length is 26 feet. Therefore this would be an acceptable installation with no need to change the combustion blower fan.

However, if the same unit (EVL 13)was to be installed an altitude of 9,000 feet above sea level, the installation would no longer be acceptable and the equivalent vent length of the pipe would have to be reduced for proper unit operation.

- Long runs of flex or PL vent pipe installed directly vertical from the flue stub may require more frequent cleaning due to fly ash falling off inside and collecting directly above the combustion blower outlet.
- 4" stainless steel flex vent piping is only allowed for use in masonry fireplaces and chimneys or factory built wood-burning fireplaces with Class A metal chimneys.
- All pellet vent pipe must be secured together either by means provided by pipe manufacturer or by 3 screws at each joint.
- Use only the specified venting components. Use of any other components will void the product warranty and may pose a hazard.
- Do Not Install a Flue Damper In The Exhaust Venting System of This Appliance.
- DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.
- Simpson DuraVent PelletVent Pro Harman®Adapter Part #3PVP-ADHB and PelletVent Pro Harman®Adapter Increaser Part #3PVPX4ADHB are highly recommended to be installed on the starter collar to insure a proper pipe connection to the unit.
- **INSTALL VENT AT CLEARANCES SPECIFIED BY THE VENT MANUFACTURER**
- Use silicone to create an effective vapor barrier at the location where the chimney or outside air ducting passes through to the exterior of the structure

## D. Outside Air

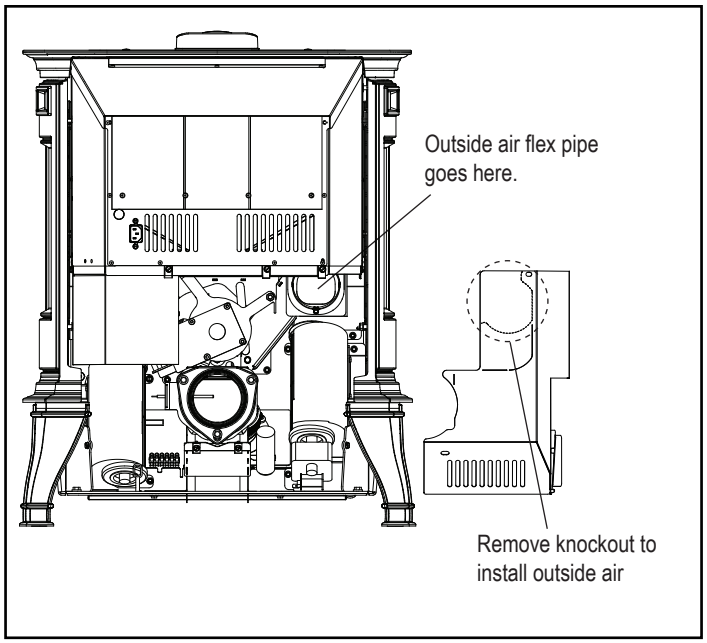



**Figure 4.13**

**Termination Cap**
Part# 1-10-09542

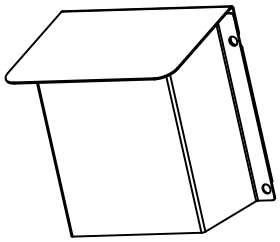


**Figure 4.14**

**Direct Vent Wall Pass-through Kit**
Part #1-00-677177

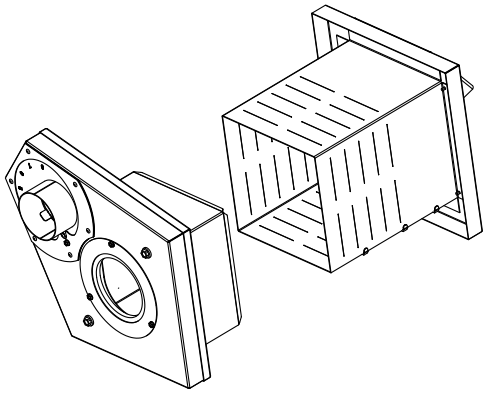


**Figure 4.15**

**Outside Air:**
**Hearth & Home Technologies recommend attaching outside air in all installations, especially lower level and main floor locations.**

Per national building codes, consideration must be given to combustion air supply to all combustion appliances. Failure to supply adequate combustion air for all appliance demands, may lead to back-drafting of those and other appliances.

When the appliance is side-wall vented: The air intake is best located on the same exterior wall as the exhaust vent outlet and located lower on the wall than the exhaust vent outlet.

When the appliance is roof vented: The air intake is best located on the exterior wall oriented towards the prevailing wind direction during the heating season.

The outside air connection will supply the demands of the pellet appliance, but consideration must be given to the total house demand. House demand may consume some air needed for the stove, especially during a power failure. It may be necessary to add additional ventilation to the space in which the pellet appliance is located. Consult with your local HVAC professional to determine the ventilation demands for your house.

To install outside air use 3" non-combustible flex pipe Figure 4.14. There is a break-away hole on the rear panel of the Absolute43-C stove which must be removed before connecting the flex pipe. Figure 4.13. The pipe should be run outside and terminate to the side or below the vent pipe outlet so the flue outlet is more than 12" from the inlet cover. The Termination Cap should be used to keep birds, rodents, etc. out of the pipe Figure 4.14.

You may choose to use the optional Direct Vent Wall Pass-through Kit which incorporates the venting pass-through and outside air inlet into one component. Figure 4.15.

## E. Locating Your Appliance & Chimney

Location of the appliance and chimney will affect performance.

- Install through 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 appliance location relative to floor and ceiling and attic joists.

**⚠ CAUTION**

- DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVICING ANOTHER APPLIANCE.
- DO NOT CONNECT TO ANY AIR DISTRIBUTION DUCT OR SYSTEM.

May allow flue gases to enter the house

## F. Draft

Draft is the pressure difference needed to vent appliances successfully. When an appliance is drafting successfully, all combustion byproducts are exiting the home through the chimney.

Considerations for successful draft include:

- Negative pressure in the firebox
- Location of appliance and chimney

To measure the draft or negative pressure on your appliance use a magnahelic or a digital pressure gauge capable of reading 0 - 1 inches of water column (W.C.).

The appliance should be running on high for at least 15 minutes for the test.

With the stove running on high you should have a negative pressure equal to or greater than the number given in the chart below. If you have a lower reading than you find on the chart, your appliance does not have adequate draft to burn the fuel properly.

| **Minimum Vacuum Requirements:** | **.20 - .25** |
|---|---|

Prior to installing the flue pipe, connect a draft meter. (The draft meter must have a minimum range of 0 - .5") Record the first reading. Connect flue pipe to stove and be sure all doors and windows in the home are closed. Record the second draft reading _____. If the second reading is more than .05" lower than the first reading, check for possible restrictions or the need for outside air. For more information on the draft test procedure, *refer to "Appliance Set-Up" Section C.*

## G. Negative Pressure

**⚠ WARNING**

**Risk of Asphyxiation!** Negative pressure can cause spillage of combustion fumes and soot.

Negative pressure results from the imbalance of air available for the appliance to operate properly. It can be strongest in lower levels of the house.

Causes include:

- Exhaust fans (kitchen, bath, etc.)
- Range hoods
- Combustion air requirements for furnaces, water heaters and other combustion appliances
- Clothes dryers
- Location of return-air vents to furnace or air conditioning
- Imbalances of the HVAC air handling system
- Upper level air leaks such as:
  - Recessed lighting
  - Attic hatch
  - Duct leaks

To minimize the effects of negative air pressure:

- Install the outside 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 appliance
- Avoid installing the appliance 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

**NOTICE**

HEARTH & Home Technologies assumes no responsibility for the improper performance of the chimney system caused by:

- Inadequate draft due to environmental conditions
- Downdrafts
- Tight sealing construction of the structure
- Mechanical exhausting devices

## H. Avoiding Smoke and Odors

**Negative Pressure, Shut-down, and Power Failure:**

**To reduce the probability of back-drafting or burn-back in the pellet burning appliance during power failure or shut-down conditions, the stove must be able to draft naturally** without exhaust blower operation. Negative pressure in the house will resist this natural draft if not accounted for in the pellet appliance installation.

Heat rises in the house and leaks out at upper levels. This air must be replaced with cold air from outdoors, which flows into lower levels of the house. Vents and chimneys into basements and lower levels of the house can become the conduit for air supply, and reverse under these conditions.

**Outside Air**

An outside air kit is recommended in all installations. The Outside Air Kit must be ordered separately.

Per national building codes, consideration must be given to combustion air supply to all combustion appliances. Failure to supply adequate combustion air for all appliance demands may lead to back drafting of those and other appliances.

When the appliance is roof vented (strongly recommended):
The air intake is best located on the exterior wall oriented towards the prevailing wind direction during the heating season.

When the appliance is side-wall vented:
The air intake is best located on the same exterior wall as the exhaust vent outlet and located lower on the wall than the exhaust vent outlet.

The outside air supply kit can supply most of the demands of the pellet appliance, but consideration must be given to the total house demand.

House demand may consume the air needed for the appliance. It may be necessary to add additional ventilation to the space in which the pellet appliance is located.

Consult with your local HVAC professional to determine the ventilation demands for your house.

**Vent Pipe**

Be sure to use approved pellet vent pipe wall and ceiling pass- through fittings to go through combustible walls and ceilings. Be sure to use a starting collar to attach the venting system to the stove. The starting collar must be secured to the flue stub with at least three screws, and sealed with high temp silicone caulking.

4” stainless steel flex vent piping is only allowed for use in masonry fireplaces and chimneys or factory built wood-burning fireplaces with class A metal chimneys.

Pellet venting pipe is constructed of two layers with air space between the layers. This air space acts as an insulator and reduces the outside surface temperature to allow a clearance to combustibles of only 1 inch. The sections of pipe lock together to form an air tight seal. Follow venting manufacturer’s recommendations for sealing pipe joints.

Where passing through an exterior wall or roof, use silicone to maintain an effective vapor barrier at the location where the chimney or component penetrates to the exterior of the structure.

**Vent Configurations:**

To reduce probability of reverse drafting during shut-down conditions, Hearth & Home Technologies strongly recommends:

- Installing the pellet vent with a minimum vertical run of five feet, preferably terminating above the roof line.
- Installing the outside air intake at least four feet below the vent termination.

To prevent soot damage to exterior walls of the house and to prevent re-entry of soot or ash into the house:

- Maintain specified clearances to windows, doors, and air inlets, including air conditioners.
- Vents should not be placed below ventilated soffits. Run the vent above the roof.
- Avoid venting into alcove locations.
- Vents should not terminate under overhangs, decks or onto covered porches.
- Maintain minimum clearance of 12 inches from the vent termination to the exterior wall. If you see deposits developing on the wall, you may need to extend this distance to accommodate your installation conditions.

**Hearth & Home Technologies assumes no responsibility for, nor does the warranty extend to, smoke damage caused by reverse drafting of pellet appliances under shut-down or power failure conditions.**

## I. Fire Safety

To provide reasonable fire safety, the following should be given serious consideration:

- Install at least one smoke detector and CO detector on each floor of your home. The National Fire Protection Association (NFPA), recommends one Smoke Alarm on every floor, in every sleeping area, and in every bedroom.
- Locate smoke detector away from the heating appliance and close to the sleeping areas.
- Follow the smoke detector manufacturer's placement and installation instructions and maintain regularly.
- Conveniently locate a Class A fire extinguisher to contend with small fires.
- In the event of a hopper fire:
    - Evacuate the house immediately.
    - Notify fire department.

## J. Inspect Appliance & Components

- Remove appliance and components from packaging and inspect for damage.
- Report to your dealer any parts damaged in shipment.
- **Read all the instructions before starting the installation. Follow these instructions carefully during the installation to ensure maximum safety and benefit.**

**⚠ WARNING**

Inspect appliance and components for damage. Damaged parts may impair safe operation.

- Do NOT install damaged components.
- Do NOT install incomplete components.
- Do NOT install substitute components.

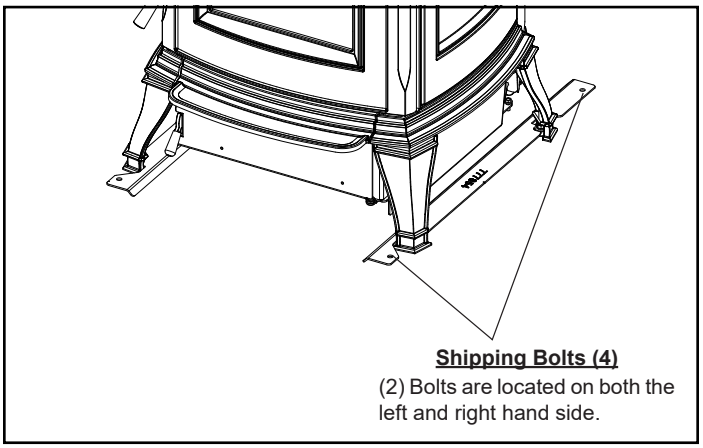
Report damaged parts to dealer.

# 5 Appliance Set-Up

## A. Unpacking

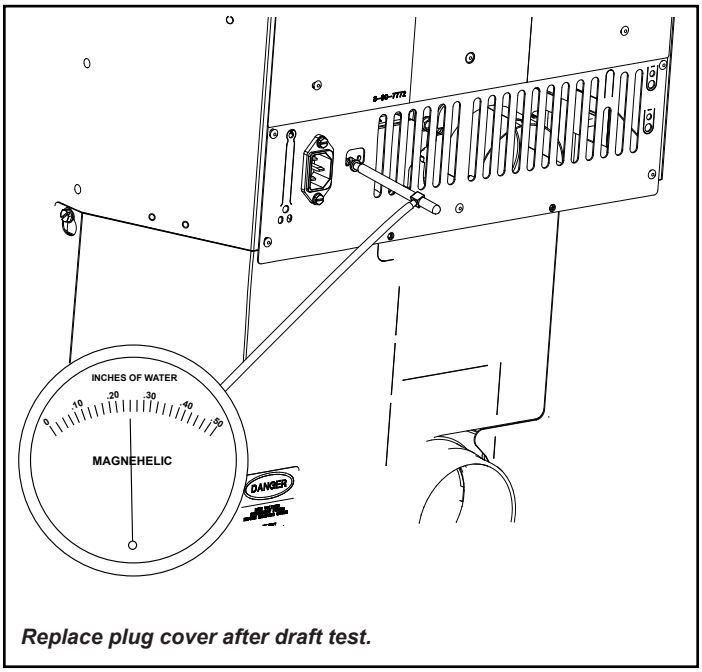
The Absolute43-C is bolted (1/4 x 1" hex head bolts) to the skid to prevent movement during shipping.

To free the stove from the skid you must remove the hold-down bolts from both the left and right hand side shipping brackets using a 7/16” socket or wrench. Figure 5.1.



**Shipping Bolts (4)**
(2) Bolts are located on both the left and right hand side.

**Figure 5.1**




***Replace plug cover after draft test.***

**Figure 5.2**

## B. Firebox Draft and Combustion Fan RPM

These units are pre-tested at the factory with exactly 120 VAC, 60 Hz. They are checked and adjusted for firebox tightness, gasket leakage, motor operation and igniter operation. The Allure50 is then factory set at a mid-point adjustment and in most cases will not need any adjustments.

Check and record the firebox draft before installing venting and after venting is installed ***(before starting fire)***.

There is a draft meter port located in the back of the unit where draft can be measured. Install the magnahelic meter *(capable of at least .5” of water column)* Figure 5.2.

Connect the power cord to a 120 VAC, 60Hz grounded receptacle. (A surge protector is recommended to protect the circuit board.) Also be sure that the polarity of the outlet that the stove is plugged into is correct.

Go to the “Home Screen”, the power icon should be gray. Press menu, on the first menu page press “test” icon.

The test page has 4 component test modes. The second icon is for the combustion fan test.

One press of the icon turns the combustion fan to full line voltage. **(Note: During this test , the combustion fan will not achieve its top RPM of 3200 due to the density of the ambient air.)** All RPM displays could vary +/- 50 from that of the set RPM’s. Allow several minutes for the fan motor to warm up.

Press the icon a second time, the combustion fan will go to “Maximum” (as set in the ***Authorized Dealer Only*** area under the combustion fan icon)

The “Maximum” is factory set at 3100 RPM. Allow the RPM to stabilize and record the firebox draft Maximum.

Before Install: _____ IWC
After Install: _____ IWC

***(Firebox Draft and Combustion Fan RPM Cont.)***

Press the icon a third time, the combustion fan will go to “Minimum” (as set in the ***Authorized Dealer Only*** area under the combustion fan icon) allow the RPM to stabilize and record the firebox draft minimum.

Before Install: _____ IWC
After Install: _____ IWC

**Cold Stove Draft:**

2400 RPM Low -.20 and -.25
3100 RPM High -.45 and -.50

Leaving the test page will end any tests in progress and goes back to whatever mode of operation it was set to on the home page.

If the unit is not adjusted properly, it does not cause a safety concern. If the unit is adjusted too high, only efficiency is lost. If the unit is adjusted too low, the low draft pressure switch will not allow the feed motor or the igniter to operate.

## C. Wireless Room Sensor

The Wireless Room Sensor was exclusively designed to communicate with the EASY Touch Controls on Harman pellet products. Simply place the wireless sensor up to 30 feet away, and enjoy the warmth of pellet heat exactly where you want it. The Wireless Room Sensor mounts on a wall wherever you want your heat measured.

The Wireless Room Sensor keeps your space within 1 degree of your set temperature. Simply sync to your EASY Touch Control (which takes about 20 seconds) and install with the provided screws.

**Smart Features:**

- After a power outage, the wireless room sensor resets the controls to the current time, allowing your heat schedule to resume automatically.
- Communicates to the EASY Touch Control every 17 seconds, keeping your set temperature as accurate as possible, all day, every day.
- Easily mount up to 30 feet away from the stove or insert on any interior wall (mounting hardware included).
- We provide two AA batteries with a life expectancy of more than a year.
- Track connection strength and battery levels on EASY Touch Control Diagnostic page 6 (Located on unit).
- Low Battery Warning messages will be seen on the home screen.
- If connection is lost due to a dead battery the stove continues operation by automatically switching to its back-up sensor when the batteries are dead, and will display a “replace batteries” message on the home screen of the EASY Touch Control).

The Wireless Room Sensor has light indicators to communicate the following:

- A green LED flashes when good communication is made to the display.
- An amber LED flashes when searching.
- A red LED flashes when searching in energy saving mode – this may occur when the appliance has been unplugged, or is experiencing an extended power loss.

## D. Flame Guide

Install the cast iron flame guide on top of the burn pot. Make sure that the flame guide is fully seated on the vertical sides of the burn pot and that the back of the guide rests against the body of the stove. Figure 5.3.

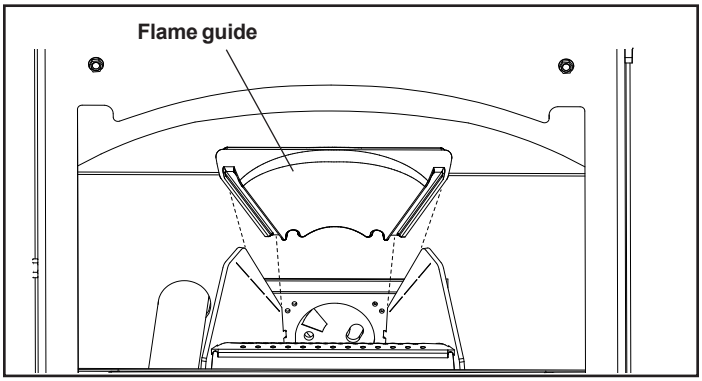



**Figure 5.3**

# 6 Reference Material

## A. Safety Reminders

When installing and operating your Harman® Absolute43-C, respect basic safety standards. Read these instructions carefully before you attempt to install or operate the Absolute43-C. Failure to do so may result in damage to property or personal injury and may void the product warranty.

Consult with your local building code agency and insurance representative before you begin your installation to ensure compliance with local codes, including the need for permits and follow-up inspections.

Due to high temperatures, this stove should be placed out of traffic and away from furniture and draperies.

Children and adults should be alerted to the hazards of high surface temperatures and should stay away to avoid burn to skin and/or clothing.

Young children should be carefully supervised when they are in the same room as the stove.

Clothing and other flammable materials should not be placed on or near this stove.

Installation and repair of this stove should be done by a qualified service person. The appliance should be inspected before use and at least annually by a qualified service person. More frequent cleaning may be required. It is imperative that control compartments, burners, and circulating air passageways of this stove be kept clean.

**⚠ WARNING**

**MOBILE/MANUFACTURED HOME GUIDELINES DO NOT ALLOW INSTALLATION IN A SLEEPING ROOM.**

**⚠ CAUTION**

**THE STRUCTURAL INTEGRITY OF THE MOBILE HOME FLOOR, WALL, AND CEILING/ROOF MUST BE MAINTAINED.**

**⚠ WARNING**

**KEEP COMBUSTIBLE MATERIALS SUCH AS GRASS, LEAVES, ETC. AT LEAST 3 FEET AWAY FROM THE POINT DIRECTLY UNDER THE VENT TERMINATION.**

**⚠ WARNING**

**USE OF IMPROPER FUELS, FIRE STARTERS OR ALTERING THE STOVE FOR HIGHER HEAT OUTPUT MAY CAUSE DAMAGE TO THE STOVE AND COULD RESULT IN A HOUSE FIRE. USE ONLY APPROVED FUELS AND OPERATION GUIDELINES**

**⚠ CAUTION**

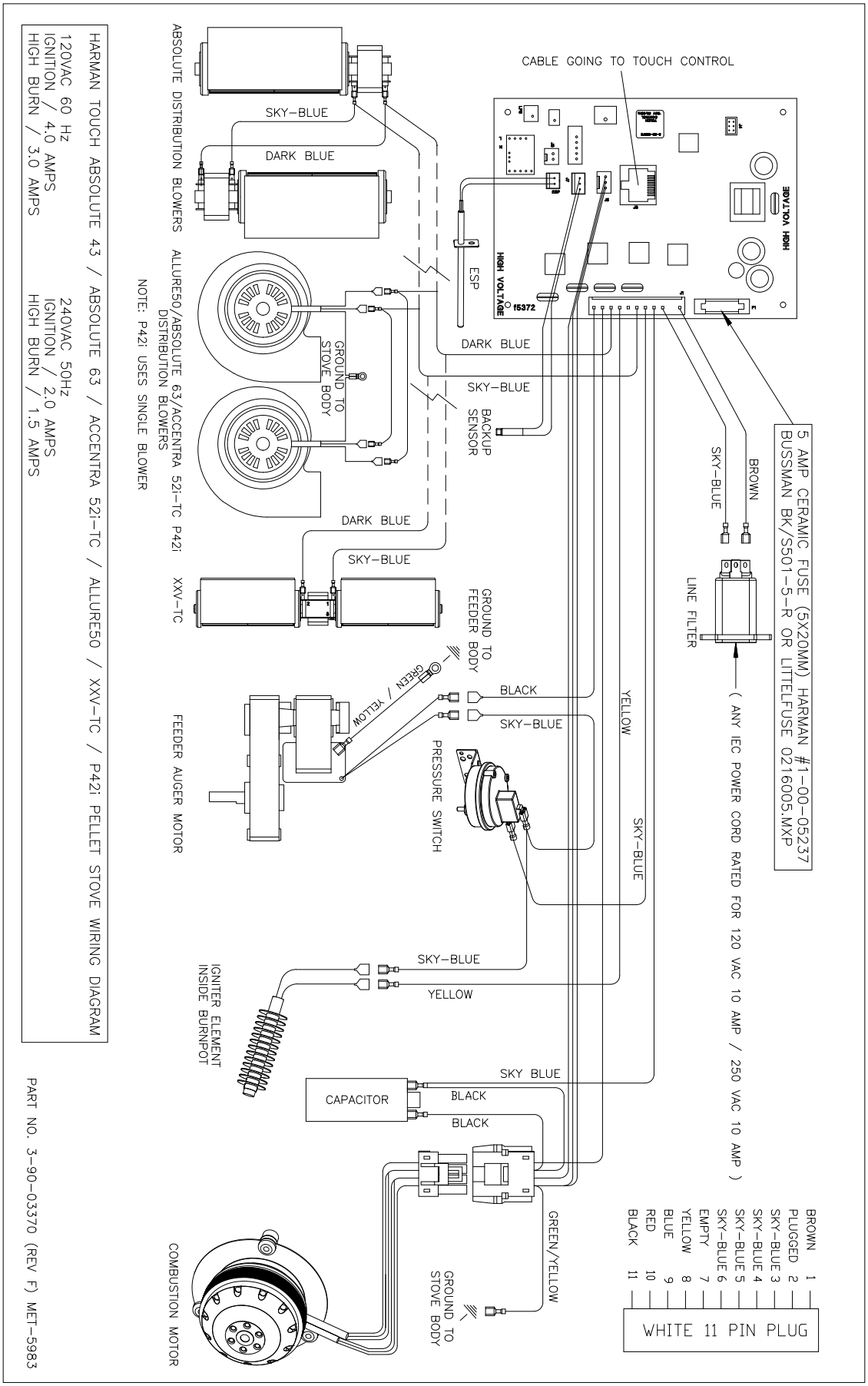
**This appliance must be vented to the outside.**

**⚠ CAUTION**

**THE STOVE IS HOT WHILE IN OPERATION.**

**KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS.**

# B. Wiring Diagram



Harman®, a brand of Hearth & Home Technologies Inc.
352 Mountain House Road, Halifax, PA 17032
www.harmanstoves.com

Please contact your Harman® dealer with any questions or concerns.
For the location of your nearest Harman® dealer,
please visit www.harmanstoves.com.

# Owner's Manual
## Care and Operation

**INSTALLER: Leave this manual with party responsible for use and operation.**
**OWNER: Retain this manual for future reference.**
**Contact your local dealer with questions on installation, operation or service.**

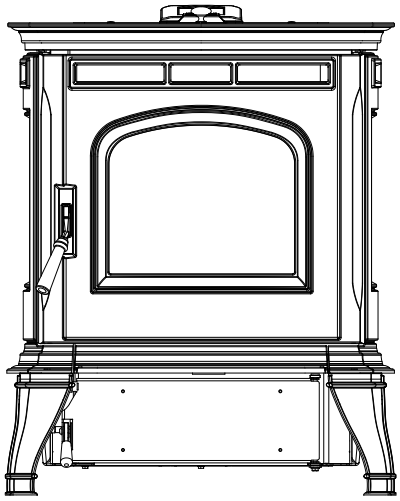
***NOTICE: SAVE THESE INSTRUCTIONS***

HARMAN®

BUILT TO A STANDARD, NOT A PRICE

## Model(s):

***Absolute43-C***
***Freestanding Pellet Stove***



NFI NATIONAL FIREPLACE INSTITUTE

Pellet Fuels Institute

### ⚠ CAUTION

Tested and approved for wood pellet fuel only. Burning of any other type of fuel voids your warranty.

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

hearthED FACTORY TRAINING

NFI NATIONAL FIREPLACE INSTITUTE A CERTIFICATION AGENCY

### ⚠ WARNING

**Please read this entire manual before installation and use of this pellet fuel-burning room heater.**
**Failure to follow these instructions could result in property damage, bodily injury or even death.**

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- Do not overfire - If any external part starts to glow, you are overfiring. Reduce feed rate. 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 stove.
- 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.

### NOTE

To obtain a French translation of this manual, please contact your dealer or visit www.harmanstoves.com

Pour obtenir une traduction française de ce manuel, s'il vous plaît contacter votre revendeur ou visitez www.harmanstoves.com

**Read this manual before operating this appliance.**
**Please retain this Owner's Manual for future reference.**
**Read the Installation Manual before making any installation or finishing changes.**

***Congratulations***, The Harman® Absolute43-C pellet stove you have selected is designed to provide the utmost in safety, reliability, and efficiency.

As the owner of a new pellet stove, 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.

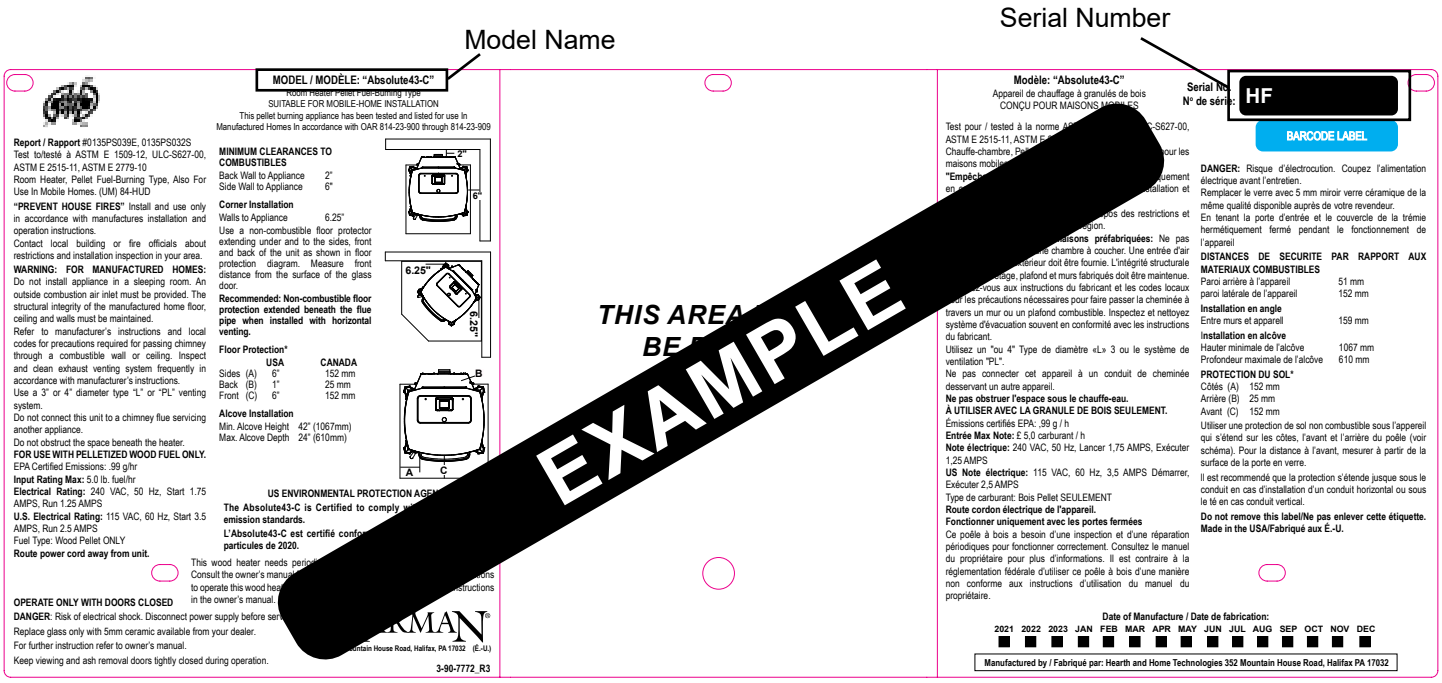
Your new Harman® Absolute43-C Freestanding Pellet Stove will give you years of durable use and trouble-free enjoyment. Welcome to the Harman® family!

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

**Note: Cast iron is an artisan crafted material, which is made the same way today as nearly 2000 years ago. Due to the intrinsic primitive nature of the casting process, part to part variation is normal and adds to the character of a hand built cast iron appliance**

## Listing Label Information/Location

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



## 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:*** *Used to address practices not related to personal injury.*

# Table of Contents



**➔ = Contains updated information**

# 1 Product Specific and Important Safety Information

## A. Appliance Certification

| | |
|---|---|
| **MODEL:** | Absolute43-C Pellet Stove |
| **LABORATORY:** | OMNI Test Laboratories, Inc |
| **REPORT NO.** | 0135PS039E, 0135PS032S |
| **TYPE:** | Pellet Fueled/Supplementary For Residential Use |
| **STANDARD(s):** | ASTM E 1509-12, ULC-S627-00, ASTM E 2515-11, ASTM E 2779-10 |
| **ELECTRICAL RATING:** | 120 VAC, 60 Hz, Start 4.0 Amps, Run 3.0 Amps |
| **GLASS SPECIFICATION:** | 5mm mirrored ceramic glass |

The Absolute43-C is Certified to comply with 2020 particulate emission standards.

**NOTE:** This installation must conform with local codes. In the absence of local codes you must comply with the **ASTM E1509-2004, ULC S628-93, (UM) 84-HUD**

## B. Glass Specifications

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

## C. 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 pellet vent, Class “PL” connector pipe.

**A Harman® Outside Air Kit must be installed in a mobile home installation.**

**WARNING**

**THESTRUCTURALINTEGRITYOFTHEMANUFACTURED HOME FLOOR, WALL, AND CEILING/ROOF MUST BE MAINTAINED.**

**DO NOT INSTALL IN SLEEPING ROOM.**

## D. BTU & Efficiency Specifications

| | |
|---|---|
| **EPA Certification Number:** | 126-18 |
| **EPA Certified Emissions:** | .99 g/hr |
| ***LHV Tested Efficiency:** | 82.3% |
| ****HHV Tested Efficiency:** | 77% |
| *****EPA BTU Output:** | 34,800 - 10,600 |
| ******BTU Input** | 44,200 - 14,100 |
| **Vent Size:** | 3 Inch |
| **Hopper Capacity:** | 52 lbs |
| **Fuel** | Wood Pellet |

** Weighted average LHV efficiency using data collected during EPA emissions test.*

***Weighted average HHV efficiency using data collected during EPA emissions test.*

****A range of BTU outputs based on EPA Default Efficiency and the burn rates from the low and high EPA tests.*

*****Based on the maximum feed rate per hour multiplied by approximately 8600 BTU’s which is the average BTU’s from a pound of pellets.*

This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

This 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.

## E. Electrical Codes

120 VAC, 60 Hz, Start 4.0 Amps, Run 3.0 Amps

***Notice**: This appliance 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.**

**NOTE:** Some generator or battery back-up systems may not be compatible with the micro-processor electronics on this appliance. Please consult the power supply manufacturer for compatible systems.

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

# 2 Important Safety and Operating Information

## A. Appliance Safety

**⚠ WARNING**

If you expect that small children or vulnerable adults may come into contact with this appliance, the following precautions are recommended:

- Install a physical barrier such as:
  - A decorative fire screen.
  - Adjustable safety gate.
- Never leave children alone near a hot stove, whether operating or cooling down.
- Teach children to ***NEVER*** touch the stove.
- Consider not using the stove when children will be present.
- Use only specified components as replacement parts. Other components may not allow your stove to operate as it was intended.

Contact your dealer for more information, or visit: www.hpba.org/safety-information.

To prevent unintended operation when not using your stove for an extended period of time (summer months, vacations, trips, etc):

- Unplug stove from receptacle.

Due to high temperatures, this stove should be placed away from traffic, furniture and draperies.

Children and adults should be alerted to the hazards of high surface temperatures and should stay away to avoid burns to the skin and/or clothing.

Young children should be carefully supervised when they are in the same room as the stove.

Clothing and other flammable materials should not be placed on or near this stove.

Installation and repair of this stove should be done by a qualified service person. The appliance should be inspected before use and at least annually by a qualified service person. More frequent cleaning will be required. It is imperative that control compartments and circulating air passageways of this stove be kept clean.

**⚠ CAUTION**

**This appliance must be vented to the outside**

**DO NOT:**

- *Install or operate damaged appliance*
- *Modify appliance*
- *Install other than as instructed by Hearth & Home Technologies*
- *Operate the appliance without fully assembling all components*
- *Overfire*
- *Install any component not approved by Hearth & Home Technologies*
- *Install parts or components not Listed or approved.*
- *Disable safety switches*

*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.*

Connect the power cord into a 120 VAC, 60 Hz grounded receptacle. (A surge protector is recommended to protect the circuit board.) Be sure the polarity of the outlet the stove is plugged into is correct.

**⚠ WARNING**

**THIS WOOD HEATER HAS A MANUFACTURER-SET MINIMUM LOW BURN RATE THAT MUST NOT BE ALTERED. IT IS AGAINST FEDERAL REGULATIONS TO ALTER THIS SETTING OR OTHERWISE OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH OPERATING INSTRUCTIONS IN THIS MANUAL.**

**⚠ CAUTION**

Check building codes prior to installation.

- Installation MUST comply with local, regional, state and national codes and regulations.
- Contact local building or fire officials about restrictions and installation inspection requirements in your area.

**⚠ WARNING**

***Risk of Fire, Explosion or Electric Shock! DO NOT use this appliance if any part has been under water. Call a qualified service technician to inspect the appliance and to replace any part of the control system which has been under water.***

## B. Clear Space

**WARNING**

***RISK OF FIRE! Do NOT place combustible objects in front or to the sides of the appliance.*** *High temperatures may ignite clothing, furniture or draperies.*

***NOTICE:*** *Clearances may only be reduced by means approved by the regulatory authority having jurisdiction.*

**WARNING**

***RISK OF FIRE!*** *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 as combustible materials may ignite.*

**WARNING**

**MOBILE/MANUFACTURED HOME GUIDELINES: DO NOT ALLOW INSTALLATION IN A SLEEPING ROOM.**

## C. California Safety Information

**WARNING**

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

## D. Helpful Hints

When operating your Harman® Absolute43-C Pellet Stove, follow basic safety standards. Read these instructions carefully before you attempt to operate the Absolute43-C Pellet Stove. Failure to do so may result in damage to property or personal injury and may void the product warranty.

**Cleaning Burn Pot:** Whenever your stove is not burning, take the opportunity to scrape the burn pot to remove carbon buildup. A vacuum cleaner is handy to remove the residue. Be sure the stove is cold if you use a vacuum.

Carbon buildup can be scraped loose with the fire burning using the special tool provided with your stove. Scrape the floor and sides of the burn pot. The carbon will be pushed out by the incoming fuel. Always wear gloves when scraping the burnpot.

**Disposal of Ashes**: Ashes should be placed in a steel container with a tight fitting lid. The closed container of ashes should be placed on a non-combustible floor or on the ground, well away from all combustible materials, 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. Other waste shall not be placed in this container.

**Soot and Flyash Formation and Need for Removal**: The products of combustion will contain small particles of flyash. The flyash will collect in the exhaust venting system and restrict the flow of the flue gases. Incomplete combustion, such as occurs during startup, shutdown, or incorrect operation of the room heater will lead to some soot formation which will collect in the exhaust venting system. The exhaust venting system should be inspected at least once every year to determine if cleaning is necessary.

When burning wood pellets on low, the potential exists for creosote to form. The venting system should be inspected periodically throughout the heating season to determine if creosote buildup has occurred. If a significant layer of creosote has accumulated (1/8" or more), it should be removed to reduce the risk of a chimney fire. If a fire occurs, call the fire department, shut down the stove, and evacuate the residence. Before using the appliance, have the venting system thoroughly inspected and replace any damaged components.

With any hearth appliance, installation of smoke detectors is recommended on every level of the home.

**Possible causes of smoke detector activation:**

Paint curing process - Open a window near the appliance for the first few hours of burning.

Exhaust being drawn back inside the dwelling - Outside air connection to the appliance is necessary.

Vent leakage - Follow venting manufacturer's recommendations for sealing pipe joints.

## E. Fuel Specifications

The Absolute43-C Pellet Stove is approved for burning premium grade pelletized bio-mass fuel.

Hearth & Home Technologies recommends using only fuel that is certified by the Pellet Fuels Institute (PFI).

It should be noted, however, that higher ash content will require more frequent cleaning.

The moisture content of pellets must not exceed 8%. Higher moisture will rob BTU's and may not burn properly.

Fuel should **not** be stored within the stove installation clearances or within the space required for cleaning and ash removal.

**Fuel and Fuel Storage**

Pellet fuel quality can fluctuate from manufacturer to manufacturer, and even from bag to bag.

Fuel Material
- Made from sawdust and/or other wood by-products
- Source material typically determines ash content

Higher Ash Content Material
- Hardwoods with high mineral content
- Bark and leaves as source material
- "Standard" grade pellets and other biomass

Lower Ash Content Material
- Softwood; pine, fir, etc.
- Materials with lower mineral content
- "Premium" grade pellets

Performance
- Higher ash content requires more frequent maintenance.
- "Premium" grade pellets will produce the highest heat output.
- Burning pellets longer than 1-1/2 inches (38mm) can cause inconsistent feeding and/or ignition.

Clinkers
- Minerals and other non-combustible materials, like sand, will turn into a hard glass-like substance when heated.
- Trees from different areas will vary in mineral content. For this reason, some fuels will produce more clinkers than others.

Moisture
- Always burn dry fuel. Burning fuel with high moisture content takes energy to dry and tends to cool the appliance thus, robbing heat from your home.
- Damp pellet fuel could turn back into sawdust which does not flow properly through the feed system.

Storage
- Wood pellets should be left in their original sealed bag until ready to use, to prevent moisture.
- Do not store fuel within the specified clearance areas, or in a location that will interfere with routine cleaning and maintenance procedures.

**NOTICE**

Hearth & Home Technologies is not responsible for stove performance or extra maintenance required as a result of using fuel with higher ash or mineral content.

**CAUTION**

***Do not burn fuel that contains an additive.***
- May cause hopper fire
- Damage to product may result

Read the list of ingredients on the packaging.

**CAUTION**

Tested and approved for use with wood pellets ONLY. Burning of any other fuel will void your warranty.

**WARNING**

**BURNING COLORED PAPER, CARDBOARD, SOLVENTS, TRASH AND GARBAGE OR ALTERING THE STOVE FOR HIGHER HEAT OUTPUT MAY CAUSE DAMAGE TO THE STOVE AND COULD RESULT IN A HOUSE FIRE. USE ONLY APPROVED FUELS AND FOLLOW ONLY THESE OPERATION GUIDELINES.**

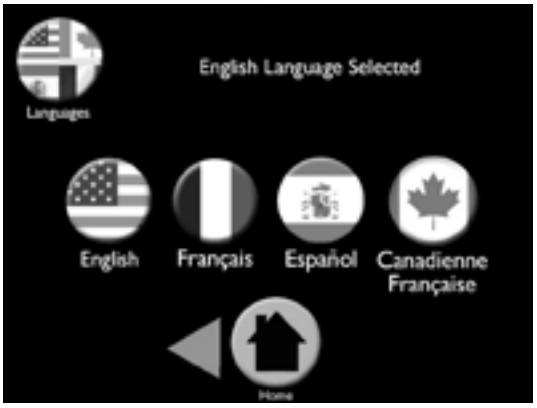
**WARNING**

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

**WARNING**

*Tested and approved for use with wood pellets ONLY. Burning of any other fuel will void your warranty.*

## F. Quick Start Guide




**Initial start-up Only**

1. Select Language

2. Fill hopper with pellets


3. Adjust arrows to set room desired temperature.


4. Touch the On/Off Power Icon.

*Refer to Touch Manual for all other operations.*

***Please Note:*** *The USB port on the EASY Touch Control* ***<u>is not</u>*** *a charging port for smartphones, tablets etc.*

## G. Frequently Asked Questions

With proper installation, operation, and maintenance your appliance will provide years of trouble-free service. If you do experience a problem, this troubleshooting guide will assist a qualified service person in the diagnosis of a problem and the corrective action to be taken.

**Contact your dealer for additional information regarding operation and troubleshooting. Visit www.harmanstoves.com to find a dealer.**

| ISSUES | SOLUTIONS |
|---|---|
| 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 your appliance. |
| White ash buildup on glass. | This is normal. Clean the glass using any non-abrasive glass cleaner. |
| Glass has buildup of black soot | Excessive build-up of ash. The lower burn settings will produce more ash, the higher burn settings produce less. The more it burns on low the more frequent cleaning of the glass is required. |
| Glass has turned dirty. | Excessive build up of ash. The lower burn settings will produce more ash, the higher burn settings produce less. The more it burns on low the more frequent cleaning of the glass is required. |
| Fire has tall flames with black tails and is lazy. | The feed rate needs to be reduced or the burnpot needs cleaning. Heat exchanger or exhaust blower needs cleaning. |
| Smoky start-up or puffs of smoke from the airwash. | Burnpot may be dirty, Clean the burnpot. |
| Large flame at start-up. | This is normal. Flame will settle down once the fire is established. |
| Missed Ignition | Ensure pellets in burnpot<br>Ensure holes in burnpot are clear of obstructions above the igniter. See Burnpot Maintenance.<br>Check to see if the ignitor is getting hot, if not replace ignitor. *See addendum for manual ignition instructions for emergency heating needs. |

### Touch Up Paint

The touch up paint provided with your unit is for fixing minor chips or blemishes that may occur after stove installation.

Unfortunately, because the finish of your stove is baked on, this touch up paint may not be a perfect match to the color of the original finish.

**To use this touch up paint:** Ensure the stove is cool and that the surface to be painted is clean. Apply in several light coats and take care to only coat the chipped area. Allow the paint to dry for 24 hours before touching or firing the stove.

## H. Fire Safety

To provide reasonable fire safety, the following should be given serious consideration:

- Install at least one smoke detector and CO detector on each floor of your home. The National Fire Protection Association (NFPA), recommends one Smoke Alarm on every floor, in every sleeping area, and in every bedroom.
- Locate smoke detector away from the heating appliance and close to the sleeping areas.
- Follow the smoke detector manufacturer's placement and installation instructions and maintain regularly.
- Conveniently locate a Class A fire extinguisher to contend with small fires.
- In the event of a hopper fire:
    - Evacuate the house immediately.
    - Notify fire department.

## I. Cleaning Prompts, Messages and Errors

Your EASY Touch Control communicates with you by showing messages on the top center of the EASY Touch Control home screen. If you have more than one message, the messages will show consecutively until you acknowledge the message by performing the task. These communications include:

| | | |
|---|---|---|
| PROMPTS |  | When prompted, scrape burnpot. Press check mark to reset. |
| |  | When prompted, inspect and empty ash pan as needed. Press check mark to reset. |
| |  | When prompted, inspect and perform total clean. Press check mark to reset. |
| MESSAGES |  | Press check mark if you filled the hopper. If you did not fill hopper, The message will disappear in 30 seconds. |
| |  | Replace the 2 “AA” batteries in the Wireless Remote Sensor. |
| |  | If Wireless Remote Sensor batteries die, the Back Up Sensor will continue to heat your home. |
| ERRORS |  | Check and close the front and ash doors for the stove to continue to heat. |
| |  | Close the hopper lid for the stove to continue to heat. |
| |  | Fill the hopper with pellets. Press check mark to reset. If you did not fill the hopper, the message will stop after 30 seconds. This error only appears if “Show Fuel Gauges” is turned on. |
| |  | Batteries in Wireless Remote Sensor have expired. Replace the 2 “AA” batteries. |
| |  | Return Air Sensor has failed. Call your Harman Dealer. |
| |  | Unit has failed to ignite. Scrape the burnpot. Call your Harman Dealer if problem persists. |
| |  | Touch Control has lost communication to the stove. Call your Harman Dealer. |
| |  | Exhaust Sensing Probe (ESP) as failed. Clean the ESP. If issue persists, call your Harman Dealer. |
| |  | Clean your stove. Call your Harman Dealer if problem persists. |

# 3 Maintenance & Service

When properly maintained, your stove will give you many years of trouble-free service. **Contact your dealer** to answer questions regarding proper operation, trouble-shooting and service for your appliance. Visit www.harmanstoves.com to find a dealer. We recommend annual service by a qualified service technician.

**Note:** Do not use a household vacuum to clean the stove. We recommend that you use a shop vacuum that is equipped with a fine dust filter called a HEPA filter or a vacuum specially made for fly ash and soot. USING A VACUUM WHICH IS NOT EQUIPPED WITH A FINE DUST FILTER WILL BLOW FLY ASH AND SOOT OUT INTO THE ROOM.

**NOTE:** THE STOVE MUST BE COMPLETELY OUT BEFORE YOU VACUUM THE STOVE. LIVE PELLET EMBERS, IF SUCKED INTO THE VACUUM, WILL LIGHT THE VACUUM ON FIRE AND MAY ULTIMATELY CAUSE A HOUSE FIRE.

**NOTICE**

The type of fuel you are burning will dictate how often you have to clean your burnpot. Clean more frequently if you encounter heavy build-up of ash at the recommended interval or you see soot coming from the vent. ***Not properly cleaning your appliance on a regular basis will void your warranty.***

## A. Proper Shutdown Procedure

**CAUTION**

**Shock and Smoke Hazard**

- Turn unit to the off position, let appliance completely cool and combustion fan must be off. Now you can unplug appliance before servicing.
- Smoke spillage into room can occur if appliance is not cool before unplugging.
- Risk of shock if appliance not unplugged before servicing appliance.

**Follow the detailed instructions found in this section for each step listed in the chart below.**

## B. Quick Reference Maintenance Chart

| Frequency | Cleaning Procedure | Safety Measures | Tips |
|---|---|---|---|
| **Daily** | Scrape Burn pot | Wear flame resistant gloves[3] | Vigorous, strong scraping specifically near neck of burn pot. Scrape every time you add pellets or at least every 3 bags of fuel.[2] |
| **Weekly** | Empty Ash Pan | Wear protective gloves.[1]<br>Put ashes into a steel non-combustible container with tight fitting lid outside. | Unit does not need to be turned off. Reduce to low burn during removal. |
| | Clean the Glass | Stove must be turned off and cold. | |
| **Monthly** | Scrape & Vacuum Heat Exchanger | Stove must be turned off and cold. | Use provided scraper. Scrape back and sides of firebox. |
| | Brush & vacuum the distribution fan | Stove must be turned off, cold and unplugged from power supply. | Use provided paint brush. This should be done approximately every 25 bags.[2] |
| | Inspect Hopper lid gasket for damage | | Replace gasketing if frays, tears or other visible damage to gasket. This should be done approximately every 50 bags.[2] |
| | Clean Igniter | Stove must be turned off, cold and unplugged from power supply.<br>Wear protective gloves.[1]<br>Put ashes into a steel non-combustible container with tight fitting lid outside. | Use provided paint brush. Vacuum loose ash from around igniter and inside burn pot. |
| **Stove MUST be turned off, cold and unplugged from power supply for Yearly Cleaning.** | | | |
| **Yearly[4]** | Brush & vacuum the combustion fan and venting/exhaust path | Wear protective gloves.[1]<br>Put ashes into a steel non-combustible container with tight fitting lid outside. | Use provided paint brush to brush fan blades. *Use flue brush to clean venting being careful not to damage the ESP.[2] |
| | Inspect door gasket | | Replace gasketing if frays, tears or other visible damage to gasket. |
| | Brush & vacuum venting system | Wear protective gloves.[1]<br>Put ashes into a steel non-combustible container with tight fitting lid outside. | |

* A flue brush of appropriate size and length may need to be purchased for proper maintenance.

1. Protective gloves will help prevent skin abrasion while working on steel surfaces.
2. Frequency of cleaning depends largely on fuel type. Lower quality pellets require most frequent cleaning.
3. Flame resistant gloves will help protect your skin from potential contact with heat or flames.
4. Yearly cleaning is also known as a Total Clean. This requires completing all the Daily, Weekly, Monthly and Yearly maintenance mentioned. This should be done before you begin burning the unit each heating season.

## C. Unit Maintenance

**Daily/Weekly Maintenance:** It is recommend that the burn pot be scraped whenever adding fuel; taking the opportunity to clean the burn pot will insure proper daily operation.

**Scraping the Burn Pot-**

- Using flame resistant gloves, vigorously scrape the top holed surface and sides of the burn pot down to auger tube, be sure to concentrate in the neck of the burnpot. Figure 2.1.
- Scrape loosened material over edge of burnpot grate into the ashpan.
- If needed, empty the ash pan while adding fuel and after scraping the burn pot.

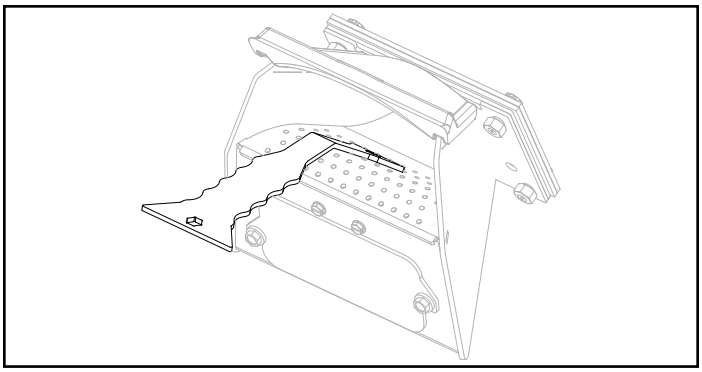


**Figure 2.1**

**Monthly Maintenance:** It is recommend that the unit be shut down and unplugged from any power source for a monthly cleaning. Monthly cleanings will insure proper operation of your unit throughout the heating season.

- Cleaning Glass - Once unit is cold, use a non-abrasive glass cleaner on glass and wipe clean.
- Scrape and Vacuum Heat Exchanger.

**Cleaning the Heat Exchanger-**
Clean the heat exchanger with scraper as shown in Figure 2.2. Brush or scrape the inside of the stove to remove fly ash. Remove the ash pan and dispose of ashes in an approved manner, according to local codes.

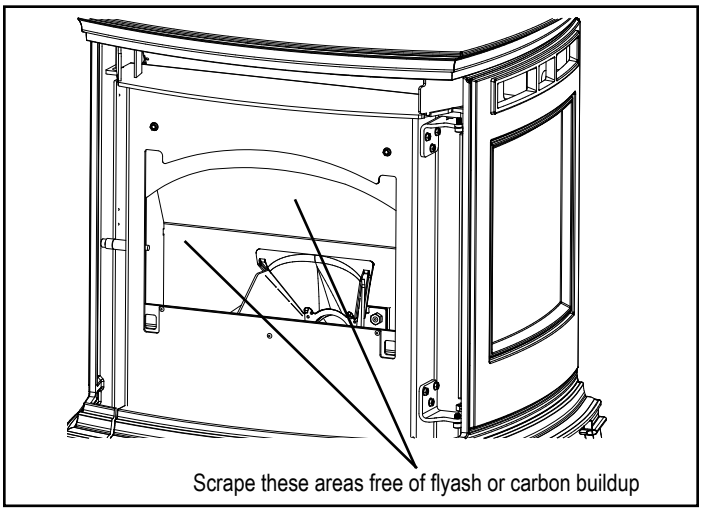



**Figure 2.2**

**Cleaning the Burn Pot-**

- Vigorously scrape the top holed surface and sides of the burn pot down to auger tube, as suggested in the Daily/ Weekly Maintenance Section.
- Use the supplied allen wrench to remove any build-up that may have accumulated in the holes of the burn pot grate. Simply push the allen wrench down through each hole ensuring it is clear of any build-up paying attention not to damage the igniter element in the process. Figure 2.3.

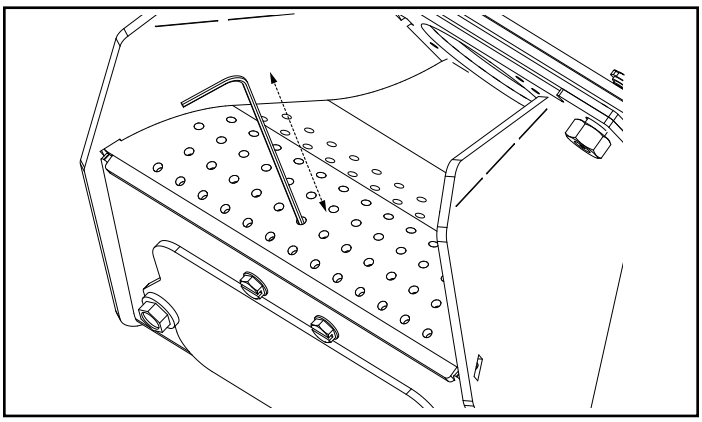


**Figure 2.3**

**DANGER**

**Disconnect the power to the unit before removing cover.**

- Loosen (2) 1/4-20 Flange Bolts and pull up on cover and remove to gain access to igniter element and cradle. Figure 2.4.
- Using the brush supplied, brush the igniter element free of any ash or debris. Figure 2.4.

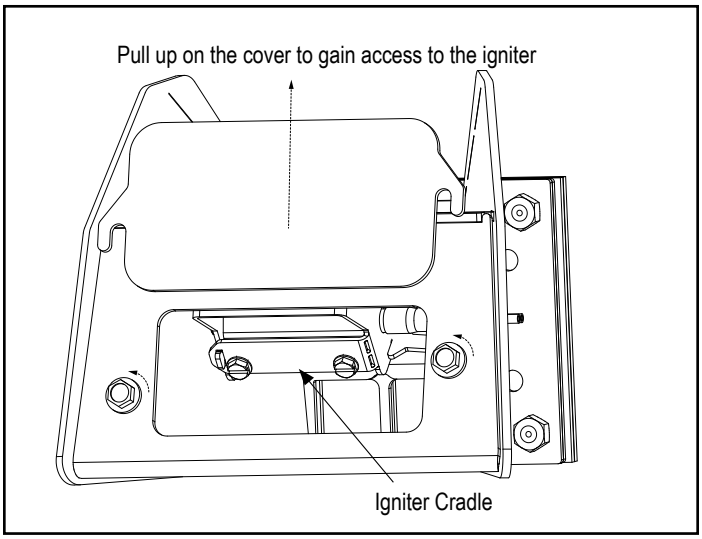



**Figure 2.4 -** *Viewed from below through the ash pan opening.*

The burnpot grate can be removed if needed. Figure 2.5.

- Remove the flame Enhancer by pulling straight up removing tabs from burn pot sides.
- Remove the (2) 1/2” allen head bolts from each side of the burn pot.
- Slide the grate toward you to remove.

**NOTE:** the grate **does not** need to be removed to properly clean the igniter. This part is removable for part(s) replacement only.

**NOTE:** The grate must be installed fully to the rear of the burnpot and the rear edge should be in contact with the front face of the burnpot flange before tightening the bolts.

**Cleaning Igniter Bracket-**

Check cleanliness of the igniter and inner burnpot. If the igniter has ash buildup it must be removed to insure proper ignition. Use the provided brush to remove ash buildup from in and around the igniter. Once ash is loose vacuum around igniter and at the base of burn pot.

**⚠ WARNING**

**Use caution when cleaning burn pot clean-out chamber. Do not damage the high temperature igniter wires.**

**Note: The hot lead/cold lead connection must always be pulled to the rear of the feeder body before operation.**

**Yearly Maintenance: Cleaning the Combustion Fan Chamber-**

The combustion inlet cover is located behind the ash pan that must be removed to properly clean the combustion fan blade. Figure 2.5.

- Remove combustion inlet cover by pulling up on cover. This allows access to the combustion fan blade and exhaust path. Figure 2.5.
- Remove any flyash or debris that has collected around combustion fan blade with the provided paint brush.
- Clean exhaust passage. Figure 2.5.

**NOTE: The ESP Sensor is located just inside the exhaust passage. Be sure not to damage the ESP Sensor while cleaning the exhaust passage.**

- Once cleaned replace combustion inlet cover and ashpan.

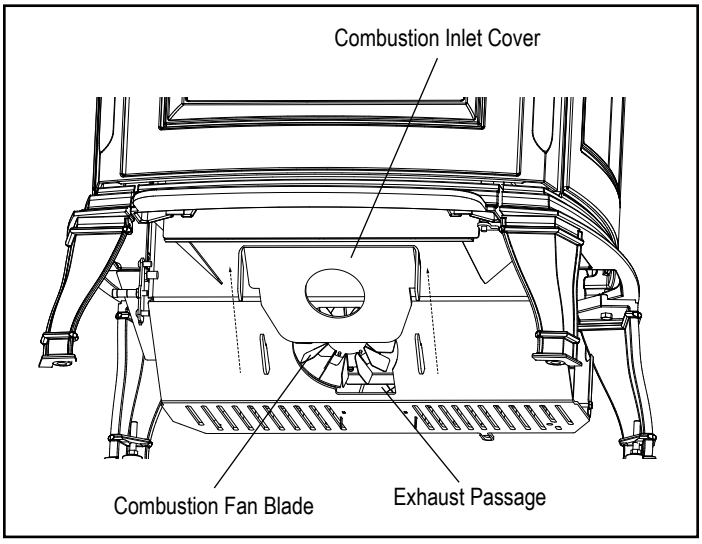



**Figure 2.5**

**Caring for your Glass-**

The glass used in your stove is manufactured to exact standards to withstand the high heat of the fire, but like all glass, it must be treated with common sense and care. Never abuse the glass by slamming the door shut or striking the glass with a heavy object. If the glass is broken or damaged, do not operate the stove until it has been replaced.

**Glass - Replacement:**

If the stove's glass is cracked or broken, you must replace it before operating your stove. Remove pieces carefully. Replace glass only with Harman® replacement glass; **do not use substitutes.**

Carefully remove damaged glass, gasket material, and glass clips (set aside). Figure 2.6.

Install the self adhesive 1/4" gasket material around the front face of the glass. Set the glass panel and gasket gently onto the door. Install the glass clips and 1/4-20 X 1/4" screws. **Note:** 1/4-20 X 1/4" screws only need to be snug fit. Do not overtighten.

**Glass - Cleaning:**

Sometimes it will be necessary to clean accumulated ash from the glass surface; allowing this ash to remain on the glass for long periods can result in "etching" due to the acidity of the ash. Never clean the glass while it is hot, and **do not** use abrasive substances. Wash the surface with cool water and rinse thoroughly. You may wish to use a non-abrasive cleaner specifically designed for use on stove glass. In any case, dry thoroughly before relighting your stove.

**Inspect all Gaskets-**

While the unit is cool, inspect all door gaskets to insure proper seal. The gasket should be continuous without frays or tears; having plyable gasket means having a correct seal for proper operation. Figure 2.6.

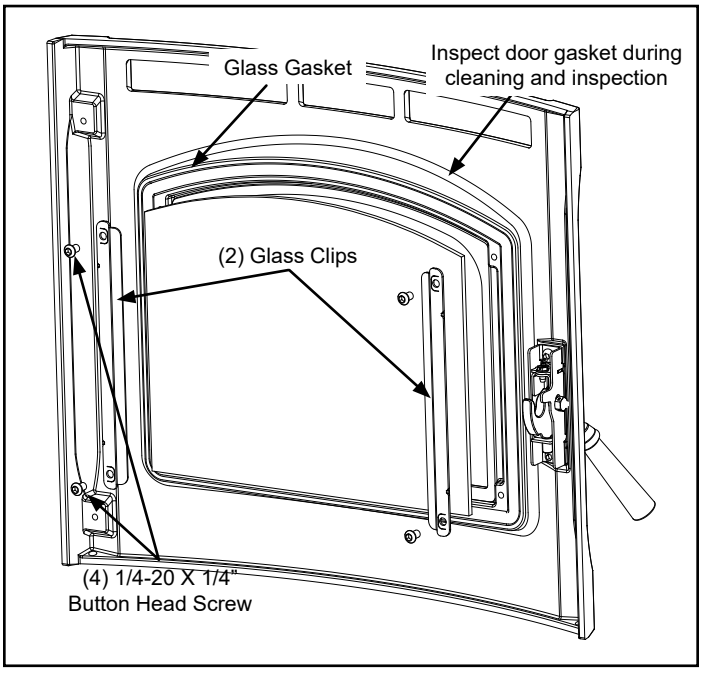



**Figure 2.6 -** Replace glass only with high temperature ceramic glass.

**Distribution Blower-**

Checking the distribution blowers yearly is a good habit to get into. Dust, animal hair or anything else that can make its way into that area can drastically cut down on the air movement throughout the unit ultimately causing less of a heating efficiency.

Once the unit is shut down and cooled, unplug the unit from its power supply. Remove the left and right rear panels. Once removed, you will have access to the distribution blowers. Figure 2.7.

Once access is gained to the rear of the unit, thoroughly vacuum around the Distribution Blowers. Figure 2.7.

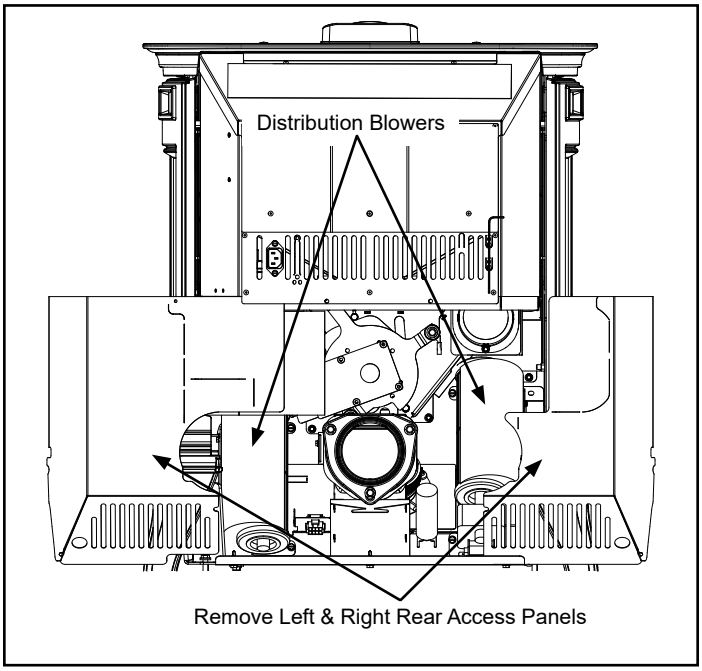



**Figure 2.7**

**Cleaning Venting System-**

Its is recommend that a certified chimney sweep perform service and inspection to your chimney system to insure your unit is vented safely and in accordance to local code.

# 4 Reference Material

## A. Service Parts

HARMAN®
BUILT TO A STANDARD, NOT A PRICE

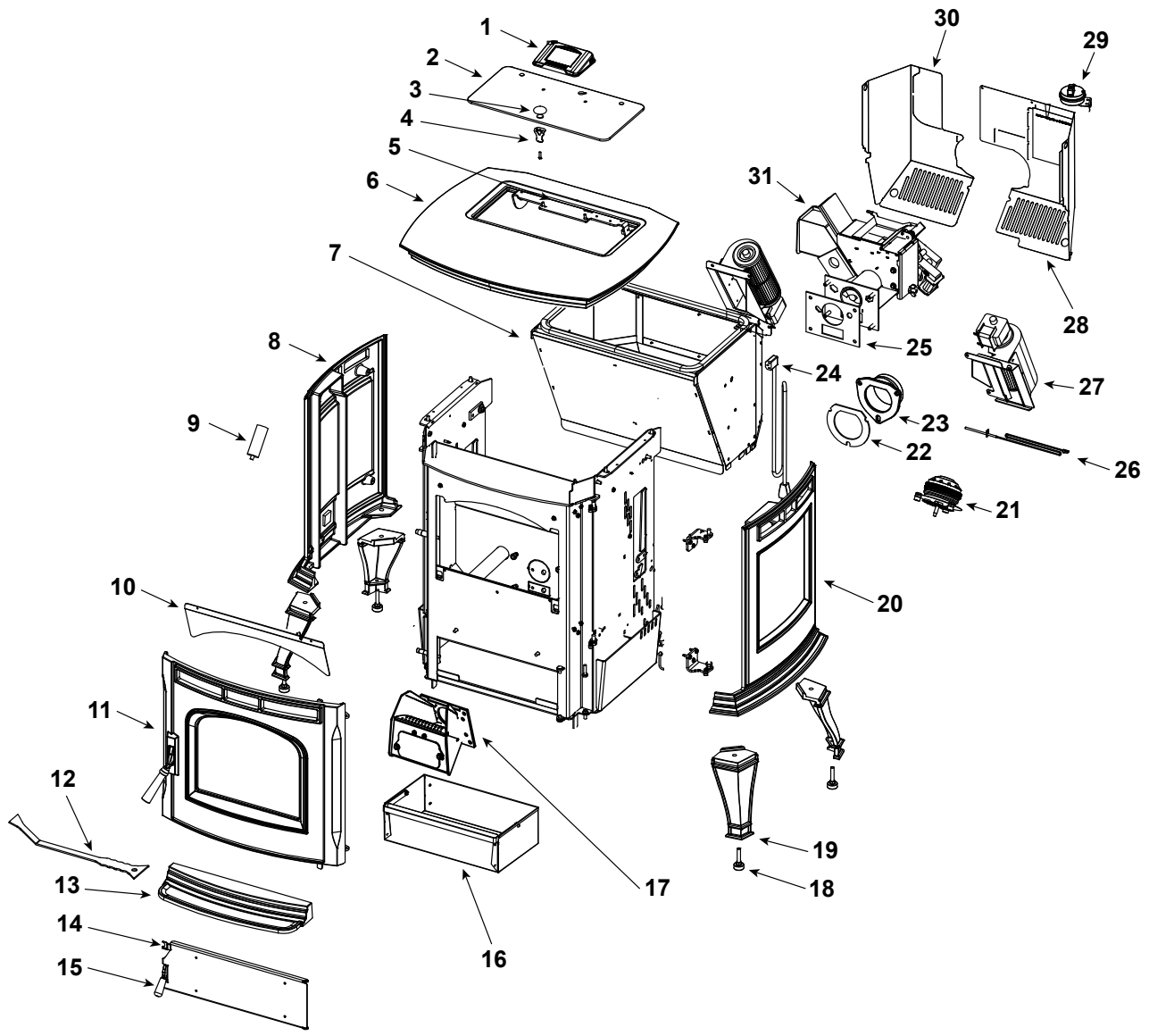
**Service Parts**

**Absolute43-C**

**Pellet Stove**

**Beginning Manufacturing Date: July 2018**
**Ending Manufacturing Date: Active**

**1-90-777100-1 (Black)(Beginning Manufacturing Date: July 2018)(Ending Manufacturing Date: Feb 2020)**
**1-90-777100-14 (Majolica Brown)(Beginning Manufacturing Date: July 2018)(Ending Manufacturing Date: Feb 2020)**
**1-90-777101-1 (Black w/Wireless)(Beginning Manufacturing Date: Feb 2020)**
**1-90-777101-14 (Majolica Brown w/Wireless)(Beginning Manufacturing Date: Feb 2020)**



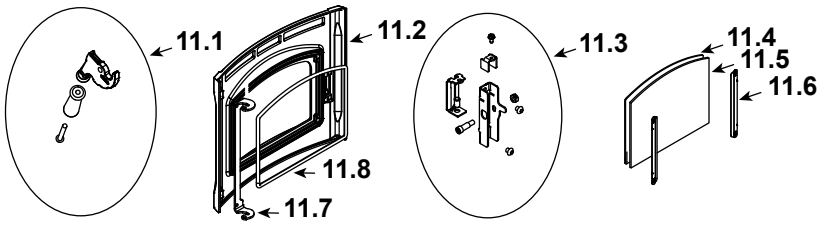

**Part number list on following page.**

02/23

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.

| ITEM | DESCRIPTION | COMMENTS | PART NUMBER | Stocked at Depot |
|---|---|---|---|---|
| 1 | Touch Control | | 1-00-777552 | **Y** |
| | Touch Control Screws | Pkg of 30 | SRV8787-011 | |
| | Cable Cover Gasket | | 3-44-777549 | |
| 2 | 16 X 8 Hopper Lid Glass | | 3-40-777770 | **Y** |
| | Screwposts/Washers | Pkg of 20 Sets | 1-00-129004 | **Y** |
| | Gasket 3/8 X 1/2 | 20 Feet | 1-00-375501 | **Y** |
| 3 | Black Plated Knob w/Screw | | 1-00-02000-1 | |
| 4 | Complete Latch | 2 Sets | 1-00-0669697 | |
| | 5/16 X 1/2 Ball Plunger | Pkg of 3 | 3-31-5500-3 | |
| | Bulk 5/16 Push Retainer | Pkg of 100 | 3-31-94807-100 | |
| 5 | Hopper Lid Hinge w/Hardware | | 1-00-777147 | **Y** |
| | Hopper Lid Hinge Pin Plates w/Hardware | 1 Set | 1-00-777560 | |
| 6 | Cast Top | Black | 4-00-247236S | |
| | | Majolica Brown | 1-00-247236-14 | |
| 7 | Hopper Assembly | **No longer available** | 1-10-777130A | |
| | Gasket Hopper Throat | | 3-44-677185 | **Y** |
| | Gasket, 3/8 X 1/2 | 20 Feet | 1-00-375501 | **Y** |
| | Gasket, 5/8 X 1/2 | 20 Feet | 1-00-625501 | **Y** |
| 8 | Left Side Cast | Black | 4-00-777645P | |
| | | Majolica Brown | 1-00-777645-14 | |
| 9 | Combustion Blower Capacitor | | 1-00-00276 | **Y** |
| 10 | Smoke Shield | | 1-00-777133 | |

**#11 Load Door**



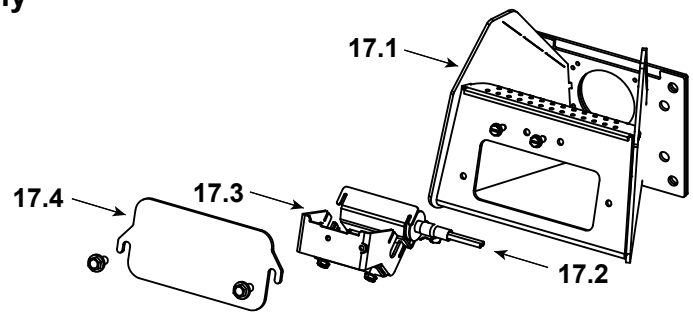

| | | | | |
|---|---|---|---|---|
| 11 | Load Door | | | |
| 11.1 | Cast Latch, Knob & Screw | | 1-00-0119 | **Y** |
| | Wood Handle | | 3-40-00247 | |
| 11.2 | Load Door Rope | Black | 4-00-777565P | **Y** |
| | | Majolica Brown | 1-00-777565-14 | **Y** |
| 11.3 | Latch Bracket w/Hardware | 1 Set | 1-00-777665 | **Y** |
| | Rollers & Hardware | 1 Set | 1-00-77753 | **Y** |
| 11.4 | Gasket 1/4 RD PSA | 15 Feet | 1-00-2312 | **Y** |
| 11.5 | Glass w/Gasket | | 1-00-777000 | **Y** |
| 11.6 | Glass Clips w/Hardware | 1 Set | 1-00-777619 | **Y** |
| 11.7 | Load Door Hinge w/Hardware | | 1-00-777610 | **Y** |
| 11.8 | Gasket 1/2” RD LD | 20 Feet | 1-00-1086204 | **Y** |

Additional service parts 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.

| ITEM | DESCRIPTION | COMMENTS | PART NUMBER | Stocked at Depot |
|---|---|---|---|---|
| 12 | Burn Pot Scraper | Pkg of 10 | 2-00-777138-10 | |
| 13 | Ashlip | Black | 3-00-777644P | |
| | | Majolica Brown | 1-00-777644-14 | |
| 14 | Ash Door, Complete | | 1-10-777135A | |
| | Gasket 1/2” RD LD | 20 Feet | 1-00-1086204 | **Y** |
| 15 | Ash Door Handle Assembly | 1 Set | 1-00-777149 | **Y** |
| | Rollers & Hardware | 1 Set | 1-00-77723 | **Y** |
| 16 | Ash Pan | | 1-10-777121A | **Y** |

## #17 Burn Pot Assembly



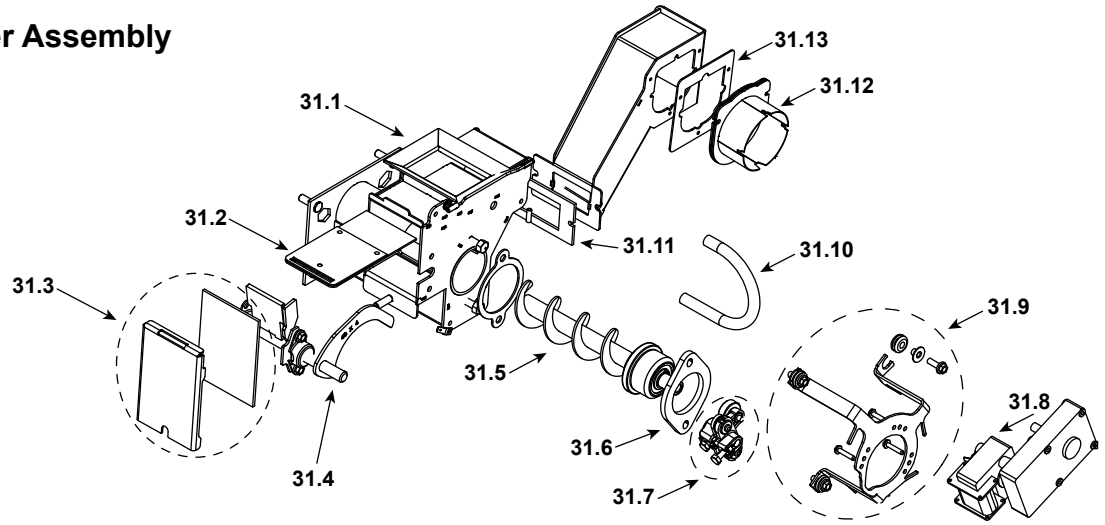

| | | | | |
|---|---|---|---|---|
| 17 | Burn Pot Assembly | | | |
| 17.1 | Burn Pot Weldment | | 1-10-777901A | **Y** |
| | Gasket, Burn Pot | | 3-44-237639 | **Y** |
| | Flame Guide | | 3-00-03000 | **Y** |
| 17.2 | Ingiter | | 3-20-677200 | **Y** |
| | | Pkg of 10 | 1-00-677200 | **Y** |
| 17.3 | Igniter Bracket | | 1-00-777906 | |
| 17.4 | Burn Pot Clean Out w/Hardware | | 1-00-777908 | **Y** |
| | 1/4/-20x1/2 | Pkg of 50 | 3-30-2001-50 | **Y** |
| 18 | Leg Leveling Kit | 1 Set | 1-00-12302 | |
| 19 | Leg w/Hardware | Black | 1-00-249100 | **Y** |
| | | Majolica Brown | 1-00-249100-14 | **Y** |
| 20 | Right Side Cast | Black | 4-00-777646P | |
| | | Majolica Brown | 1-00-777646-14 | |
| 21 | Combustion Blower | | 1-00-02275 | **Y** |
| | Fan Blade | | 1-10-574500A | **Y** |
| | Pound In Stud 6-32 X 1 1/4 **(Pre HF2265448)** | Pkg of 30 | 1-00-53463220 | |
| | Blower Mounting Screws **(Post HF2265448)** | 5 Sets | 1-00-832150 | |
| 22 | Gasket Set, Burn Pot & Tailpipe | Pkg of 5 Sets | 1-00-07381 | **Y** |
| 23 | Pellet Tailpipe, Cast | | 3-00-247237 | **Y** |

Additional service parts 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.

| ITEM | DESCRIPTION | COMMENTS | PART NUMBER | Stocked at Depot |
|---|---|---|---|---|
| 24 | Power Cord | | 3-20-51578 | **Y** |
| | Line Filter | | 3-20-803744 | **Y** |
| 25 | Gasket Set, Burn Pot & Tailpipe | Pkg of 5 Sets | 1-00-07381 | **Y** |
| 26 | ESP Probe-Red/Red | | 3-20-00844 | **Y** |
| 27 | Distribution Blower, 100CFM | Qty 2 req | SRV3-21-07775 | **Y** |
| 28 | Rear Cover, Right | | 1-00-777124 | **Y** |
| 29 | Differential Switch | | 3-20-6866 | **Y** |
| | Tubing, 1/8 Silicone | 5 Feet | 1-00-5113574 | **Y** |
| 30 | Rear Cover, Left | | 1-00-777123 | **Y** |

**#31 Feeder Assembly**




| | | | | |
|---|---|---|---|---|
| 31 | Feeder Assembly | | | |
| 31.1 | Feeder Body | | 1-10-777513A | **Y** |
| 31.2 | Slide Plate Assembly | | 1-10-777690A | **Y** |
| 31.3 | Feed Cover & Gasket | 2 Sets | 1-00-677122 | **Y** |
| 31.4 | Pusher Arm | | 1-10-677187W | **Y** |
| | Pillow Block | Pkg of 4 | 3-31-3614087-4 | **Y** |
| 31.5 | Auger | | 3-50-00565 | **Y** |
| 31.6 | Bearing Retainer w/Hardware | | 1-00-04035 | **Y** |
| | Cam Bearing | | 3-31-3014 | **Y** |
| 31.7 | Cam Block Assembly | | 1-10-777950A | **Y** |
| 31.8 | 4 RPM CW Outboard Motor, 120V | | 3-20-00677 | **Y** |
| 31.9 | Motor Mount w/Hardware | | 1-00-777598 | **Y** |
| 31.10 | Feeder Crossover Tube Kit | | 1-00-67900 | **Y** |
| 31.11 | Gasket, Snout | Pkg of 10 | 3-44-677160-10 | **Y** |
| 31.12 | Air Intake | | 1-10-06810A | |
| 31.13 | Gasket, Air Intake | Pgk of 6 | 3-44-72224-6 | **Y** |
| | Silicone Cap | Pgk of 10 | 3-99-123/10 | |

Additional service parts 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.

| ITEM | DESCRIPTION | COMMENTS | PART NUMBER | Stocked at Depot |
|---|---|---|---|---|
| | 5A Ceramic Fuse | Pkg of 5 | 1-00-05237 | **Y** |
| | Communication Cable | | 3-20-72662 | **Y** |
| | Component Pack | | SRV8000-093 | |
| | Draft Meter Assembly | | 1-00-00637 | |
| | Draft Meter Bolt & Tube | | 1-00-04004 | |
| | External Temp Extension | | 3-20-70607 | **Y** |
| | Flue Tube Cleaning Brush | | 3-40-00126 | |
| | Heat Shield | | 1-00-777146 | **Y** |
| | Inlet Cover | | 1-00-777607 | |
| | Control Board | | 1-00-05372 | **Y** |
| | Return Air Sensor | | 3-20-08780 | **Y** |
| | Touch Up Paint | Black | 3-42-19905 | |
| | | Majolica Brown | 1-00-0014 | |
| | Wiring Harness, 120V / 60HZ | | 3-20-08777 | **Y** |
| | Wireless Room Sensor | | 3-20-777556 | **Y** |

## B. Limited Lifetime Warranty

**Hearth & Home Technologies LLC**

**LIMITED LIFETIME 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 its option, 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 on the date of first occupancy of the dwelling or six months after the sale of the Product(s) by an independent, authorized HHT dealer or distributor, whichever occurs earlier. However, the Warranty coverage shall commence no later than 24 months following the date of Product shipment from HHT, regardless of the installation or occupancy date.

The term "Lifetime" in the table below is defined as: 20 years from the beginning date of warranty coverage for gas appliances, and 10 years from the beginning date of warranty coverage for wood and pellet appliances. These time periods reflect the minimum expected useful lives of the designated Component Parts under normal operating conditions.

| **Warranty Period** | | **HHT Manufactured Appliances and Venting** | | | | | |
|---|---|---|---|---|---|---|---|
| Component Parts | Labor | Gas | Pellet | Wood | Electric | Venting | Component Parts Covered by this Warranty |
| 1 Year | | X | 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 |
| 2 years | | | X | X | | | Igniters, Auger Motors, Electronic Components, and Glass |
| | | X | | | | | Electrical components limited to modules, remotes/wall switches, valves, pilots, blowers, junction boxes, wire harnesses, transformers and lights (excluding light bulbs) |
| | | X | | X | | | Molded Refractory Panels, Glass Liners |
| 3 years | | | X | | | | Firepots, burnpots, mechanical feeders/auger assemblies |
| 5 years | 1 year | X | | | | | Vent Free Burners, Vent Free Logs |
| | | | X | X | | | Castings, Medallions and Baffles |
| 6 years | 3 years | | | X | | | Catalysts |
| 7 years | 3 years | | X | X | | | Manifold tubes, HHT Chimney and Terminations |
| 10 years | 1 year | X | | | | | Burners, logs and refractory |
| Limited Lifetime | 3 years | X | X | X | | | Firebox and heat exchanger, FlexBurn® System (engine, inner cover, access cover and fireback) |
| 1 Year | None | X | X | X | X | X | All purchased replacement parts |

**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, 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 replacement of the Component Part(s), repair of the Component Part(s), or refund of the original purchase price of the applicable Product(s), as specified above; provided, however, that (i) if HHT is unable to provide replacement of the Component Part(s) and repair of the Component Part(s) is not commercially practicable or cannot be timely made, or (ii) the customer is willing to accept a refund of the purchase price of the applicable Product(s), HHT may discharge all such obligations by refunding the purchase price of the applicable Product. 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.**

## B. Loss of Power

Harman pellet burning appliances rely on a combustion blower to remove exhaust from the firebox. A power failure will cause the combustion blower to stop running, which may lead to exhaust see page into the room. Vertical rise in the venting system can help create natural draft, which may reduce the likelihood of exhaust leakage into the home.

Installation of a low-cost uninterruptible power supply (UPS) or battery backup system can help ensure the units shuts down without any minor smoke leakage into the home. Harman recommends the installation of one of these two systems for areas prone to power outages.

**There is one Harman® approved UPS option for your appliance:**

**Uninterruptible Power Supply UPS** battery back-ups are available online or at computer and office equipment stores. Your Harman® appliance with Rev E or later software available beginning in November 2010 may be plugged directly into a Harman® approved UPS:

- **TrippLite model INTERNET750U** is tested and approved. Other brands or models may not be compatible.

When power is lost, a fully charged UPS will power a safe, combustion blower only shut-down. Your appliance will pulse the blower every few seconds to clear exhaust until the fire is out. **NOTE: The UPS provides safe shut-down only. It is not intended for continued operation.**

- A Inverter/Charger connects to a 12 volt deep cycle battery that will run your appliance for up to eight (8) hours. It includes a trickle charge feature that keeps your battery charged when power is available. **NOTE:** If the power is out for longer than battery life, smoke leakage may still occur unless your stove has been safely shut down.

**For an approved Inverter/Charger refer to www.harmanstoves.com.**

Your appliance will recognize when power is restored. What happens depends on ESP temperature and whether it is equipped with automatic ignition:

- **In "Automatic" Mode**, units equipped with automatic ignition will respond to the set point and ESP temperature and resume normal operation.
- **In "Idle" Mode**, or for units without automatic ignition:
  - If the ESP is cool, the appliance will remain shut down.
  - If the fire is out and the ESP is still warm, the feeder may restart. Since the fire is out, the ESP temperature will not rise. The unit will then shut-down, and may flash a six-blink status error. (See ESP error codes)
  - If the fire is still burning, it will resume normal operation.

Contact your dealer if you have questions about UPS compatibility with your appliance.

**IMPORTANT! :** UPS or Battery Backup cannot prevent smoke leakage from an improperly maintained unit. Keep the venting system clean and free from obstructions and maintain all gaskets to keep an airtight seal.

**⚠ WARNING**

**Use only Harman® approved battery back-up devices. Other products may not operate properly, can create unsafe conditions or damage your appliance.**

**⚠ CAUTION**

**Always keep appliance doors and hopper lid closed and latched during operation and during power failures to minimize risk of smoke or burn-back.**

## D. Emergency Manual Ignition

Harman® pellet stoves and inserts should be lit using the automatic ignition system. This is the safest and most reliable way for igniting the unit. In the event the automatic igniter is not functioning, the steps below may be followed to manually light the stove or insert in the "Constant Burn" mode. Manual lighting is for emergency purposes only, and the igniter should be repaired or replaced as soon as practical.

**⚠ WARNING**

Only use firestarter commercially marketed for pellet stoves and inserts, including wax coated wood chips, pellet starter gel and pellet igniter blocks. Use of any other type of firestarter is prohibited.

To avoid serious injury or death read and follow manufacturer's warning and instructions for use of firestarter. Use of firestarter is only permitted when performing a cold start.

Never attempt to manually light a stove or insert that has been operated recently and is not at room temperature. If automatic ignition was attempted, be sure to give the stove or insert at least 30 minutes or longer to cool to room temperature.

Be sure that the stove or insert is in the "Igniter - Disabled" mode of operation.

Once all the precautions have been taken, follow these steps:

1. On the touch control, select the Burn Mode icon then select "Constant Burn".
2. Arrow back and select the Igniter icon then select "Manual" for the ignition method. Select the Home Icon to go back to the Main Menu.
3. Fill burn pot with pellets, only half way. (Do Not Over Fill).
4. Add firestarter to pellets following manufacturer's instructions.
5. Light pellet firestarter with a match, and close the door, touch the On/Off icon on the home screen. Operation will begin when the fire reaches the proper temperature.

## E. Troubleshooting

| ISSUES | SOLUTIONS |
|---|---|
| Stove does not feed | • No fuel in hopper.<br>• Firebox draft may be too low for sensing switch in feeder circuit to operate. **Check for closed doors**, loose or missing gasket on doors or hopper lid.<br>• Feed motor will not run until the ESP control senses a certain temperature. Maybe you did not put enough fuel or starting gel in the burn pot before manually lighting the fire (In Constant Burn, Manual Light Only.)<br>• Restriction in the hopper or feeder. Remove all fuel and examine. Clear the obstruction.<br>• Feed motor has failed. |
| Partially burned pellets | • Feed rate too high.<br>• Poor air to fuel mixture. (Check burn pot clean-out cover and air intake).<br>• Burn pot may need to be cleaned.<br>• Combination of all the above. |
| Smoke smell | Seal the vent pipe joints and connection to stove with silicone. The exhaust vent is the only part of the system that is under positive pressure. |
| Fire has gone out | • No fuel in hopper.<br>• Draft is too low, blocked flue.<br>• Something is restricting fuel flow.<br>• Hopper lid not closed properly.<br>• Feed motor or combustion fan has failed. |
| Smoke is visible coming out of vent | • Air-fuel ratio is too rich.<br>- Feed rate too high.<br>- Draft too low caused by a gasket leak. |
| Low heat output | • Feed rate too low<br>• Draft too low because of gasket leak.<br>• Poor quality or damp pellets<br>• Combination of 1 and 2. |

## F. Contact Information


HARMAN®
a brand of
**Hearth & Home Technologies**
352 Mountain House Road, Halifax, PA 17032
www.harmanstoves.com


Please contact your Harman® dealer with any questions or concerns.
For the location of your nearest Harman® dealer,
please visit www.harmanstoves.com.

**- NOTES -**

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## NOTICE

**DO NOT DISCARD THIS MANUAL**

- Important operating and maintenance instructions included.
- Read, understand and follow these instructions for safe installation and operation.
- Leave this manual with party responsible for use and operation.

*Printed in U.S.A.*

# Appendix B
## Revision History

| Date | Project No. | Tech. & Evaluator | Report Sect. | Summary of Changes |
|---|---|---|---|---|
| March 2018 | 0135PS039E | Aaron Kravits<br>Ken Morgan | ALL | First Issue of Report |
| 04/19/2018 | 0135PS039E<br>Edition 001 | Aaron Kravits<br>Ken Morgan | Section 1 | Appliance photos were added to report |
| 05/24/2023 | 0135PS039E<br>Edition 002 | Riley Tiegs<br>Ken Morgan | Preface | Edition of Report Updated |
| | | | Section 1 | Corrected/Uncorrected Values added to Table 1.3 (pg 9) |
| | | | | Statement mentioning anomalies and validity of run added to Summary of Results (pg 7) |
| | | | Appendix A | New Owners and Installation Manual Added to report |
| | | | Appendix B | Revision History added to report |
| | | | Section 2 | Train Precision added to Test Results (pg29) |
| | | | | Dilution Tunnel Schematic Added (pg 11) |
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