

Non-Confidential Business Information (Non-CBI)

Certification Test Report

**Hearth & Home Technologies - Halifax
Freestanding Pellet Stove
Model: Absolute 63**

Prepared for: Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032

Prepared by: OMNI-Test Laboratories, Inc.
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Portland, OR 97230
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Test Period: February 8-11, 2016

Report Date: May 2016

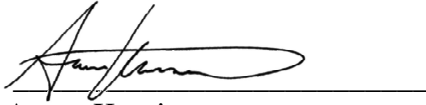
Report Number: 0135PS036E.REV001

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AUTHORIZED SIGNATORIES

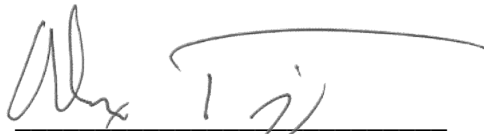
This report has been reviewed and approved by the following authorized signatories:

Technician:




Aaron Kravitz
OMNI-Test Laboratories, Inc.

QA Review:



Alex Tiegs, QA Administrator
OMNI-Test Laboratories, Inc.

Evaluation Decision:



Sebastian Button, Testing Supervisor
OMNI-Test Laboratories, Inc.

May 3, 2016
Issue Date

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*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
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Section 1

Sampling Procedures and Test Results

INTRODUCTION

Hearth & Home Technologies - Halifax retained OMNI-Test Laboratories, Inc. (*OMNI*) to perform U.S. Environmental Protection Agency (EPA) certification testing on the Absolute 63. The Absolute 63 is a freestanding, pellet-fired room heater.

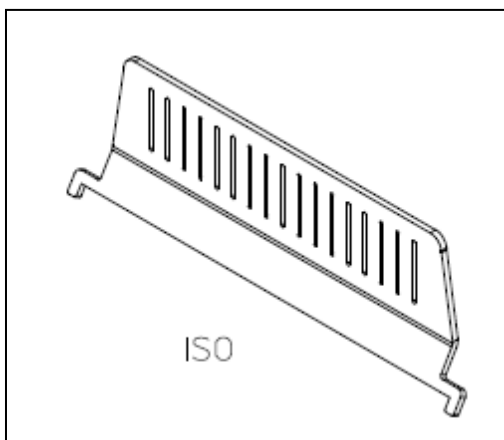
The testing was performed at *OMNI*'s testing facility in Portland, Oregon. The altitude of the laboratory is 30 feet above sea level. The unit was received in good condition and logged in at the *OMNI*'s testing facility on January 27, 2016. It was assigned and labeled with *OMNI* ID #2146. *OMNI* representative Aaron Kravitz conducted the certification testing and completed all testing by February 11, 2015.

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 submitted.

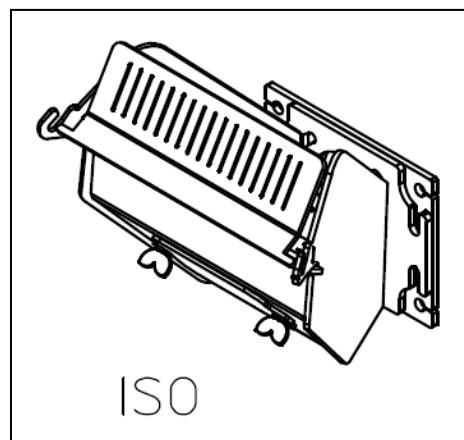
MODEL DIFFERENCES

The Absolute 63 was previously tested by *OMNI* in July 2014. All testing and results are documented in *OMNI* report # 0135PS036E. The results of the integrated test run indicated an average particulate emission rate of 1.64 g/hr.

The manufacturer requested re-testing in order to confirm emissions compliance following a design change. A firebox element called the "flame enhancer" (pictured below) was removed. The flame enhancer is designed to sit at the front of the burn pot and shape the flame more directly upwards. It was removed due to long term ash buildup observed during the manufacturer's durability testing.



Flame Enhancer
Drawing 2-00-999675



Flame Enhancer Installed
Drawing 1-10-999676

SAMPLING PROCEDURE

The Absolute 63 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 hardwood pellet fuel; this fuel was graded as Premium by the Pellet Fuels Institute and was produced at registered mill # 03304. Particulate emissions were measured using dual sampling trains consisting of two sets of filters (front and back). The results of the integrated test runs indicate an average particulate emission rate of 1.43 g/hr. The Absolute 63 results are within the emission limit of 4.5 g/hr for affected facilities manufactured on or after May 15, 2015, or sold at retail after December 31, 2015.

The model Absolute 63 was tested for thermal efficiency and carbon monoxide (CO) emissions in accordance with CSA B415.1-10. The heater has a demonstrated average thermal efficiency of 77.7%. The calculated CO emission rate was 55.5 g/hr.

RUN NARRATIVE

Three runs were conducted on the Absolute 63. Following the first run it was discovered that the stove settings were not correctly altered between the medium and minimum burn rate phases of the integrated test run. While feed, temperature, and combustion settings were reduced to minimum, the warm air distribution fan was left on fully. This cooled the heat exchanger and in response the unit burned more fuel than it would have if the fan was off. Therefore the burn rates for this run are not in accordance with ASTM E2779, and Run 1 is not a valid test run.

The second run was performed with all burn rate settings correctly modulated throughout the integrated test run. However, the manufacturer was not satisfied with the high burn setting fuel input rate. The manufacturer believes that this was due to natural variation in the control systems of the heater. A third run was therefore performed, and the high burn performance met the manufacturer's expectations. Both runs 2 and 3 were valid, so average emissions values are reported here for the purposes of certification.

SUMMARY OF RESULTS

The average particulate emission rate over the complete, integrated test runs was measured to be 1.43 g/hr.

The average particulate emission factor for the complete, integrated test runs was measured to be 0.97 g/dry kg of fuel.

The average thermal efficiency for the complete, integrated test runs was measured to be 77.7%.

The particulate emission rate calculated from the one-hour filters was 3.04 g/hr.

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

SUMMARY TABLES – RUNS 2 & 3 AVERAGE VALUES

Table 1.1 – Particulate Emissions

	One-Hour Filter	Integrated Total
Emission Rate (g/hr)	3.04	1.43
Emission Factor (g/dry kg)	0.89	0.97

Table 1.2 – Efficiency and CO

	Burn Rate Segment			Integrated Total
	Maximum	Medium	Minimum	
Burn Rate (dry kg/hr)	3.34	1.57	0.76	1.47
Heat Input Rate (BTU/hr, HHV)	61826	29106	14069	27223
Heat Output Rate (BTU/hr, HHV)	46399	23935	10164	21170
Efficiency (% , HHV)	75.24%	82.08%	72.23%	77.71%
Efficiency (% , LHV)	80.54%	87.86%	77.32%	83.18%
CO Emission Rate (g/hr)	345.84	6.57	0.00	55.50

SUMMARY TABLES – RUN 1

Table 1.3.1 – Particulate Emissions

	One-Hour Filter	Integrated Total
Emission Rate (g/hr)	4.43	1.94
Emission Factor (g/dry kg)	1.22	1.04

Table 1.3.2 – Efficiency and CO

	Burn Rate Segment			Integrated Total
	Maximum	Medium	Minimum	
Time (minutes)	62	121	180	363
Burn Rate (dry kg/hr)	3.59	1.67	1.40	1.86
Heat Input Rate (BTU/hr, HHV)	66,463	30,888	25,821	34,451
Heat Output Rate (BTU/hr, HHV)	45,599	25,216	21,356	26,975
Efficiency (% , HHV)	68.61%	81.64%	82.71%	78.30%
Efficiency (% , LHV)	73.44%	87.39%	88.54%	83.81%
CO Emission Rate (g/hr)	700.8	11.5	15.6	126.1

Table 1.3.3 – Test Facility Conditions

	Initial	Middle	Final
Room Temperature (°F)	72	70	71
Barometric Pressure (in Hg)	30.47	30.39	30.32
Air Velocity (ft/min)	< 50	< 50	< 50
Induced Draft (in H2O)	0	0	0

Table 1.3.4 – Fuel Measurement Summary

Segment	Time (min)	Burn Rate (dry kg/hr)	Consumed Fuel Weight (lbs)	Fuel Moisture Content (dry basis - %)
Pretest	66	3.50	8.9	5.05
Maximum	62	3.59	8.6	5.05
Medium	121	1.67	7.8	5.05
Minimum	180	1.40	9.7	5.05
Integrated Total	363	1.86	26.1	5.05

Table 1.3.5 – Dilution Tunnel and Flue Gas Measurements

Segment	Average Flue Draft (in H₂O)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
Integrated Total	-0.011	12.15	136.4	91.3

Table 1.3.6 – Heater Configuration

Segment	Temperature Control	Feed Rate	Distribution Blower Setting	Combustion Blower Setting (max RPM)	Combustion Blower Setting (min RPM)
Pretest	7.0	93%	100%	3100	2600
Maximum	7.0	93%	100%	3100	2600
Medium	2.5	38%	100%	2625	2250
Minimum	1.0	25%	100%*	2625	2100

*Blower should have been set to OFF. Run invalid due to not being true minimum.

SUMMARY TABLES – RUN 2

Table 1.4.1 – Particulate Emissions

	One-Hour Filter	Integrated Total
Emission Rate (g/hr)	2.31	1.26
Emission Factor (g/dry kg)	0.75	0.91

Table 1.4.2 – Efficiency and CO

	Burn Rate Segment			Integrated Total
	Maximum	Medium	Minimum	
Time (minutes)	62	121	181	364
Burn Rate (dry kg/hr)	3.05	1.43	0.76	1.37
Heat Input Rate (BTU/hr, HHV)	56,416	26,532	14,030	25,406
Heat Output Rate (BTU/hr, HHV)	43,681	21,316	9,748	19,524
Efficiency (% , HHV)	77.43%	80.34%	69.48%	76.85%
Efficiency (% , LHV)	82.88%	86.00%	74.37%	82.26%
CO Emission Rate (g/hr)	136.7	1.3	0.0	21.7

Table 1.4.3 – Test Facility Conditions

	Initial	Middle	Final
Room Temperature (°F)	71	70	68
Barometric Pressure (in Hg)	30.47	30.39	30.32
Air Velocity (ft/min)	< 50	< 50	< 50
Induced Draft (in H₂O)	0	0	0

Table 1.4.4 – Fuel Measurement Summary

Segment	Time (min)	Burn Rate (dry kg/hr)	Consumed Fuel Weight (lbs)	Fuel Moisture Content (dry basis - %)
Pretest	62	2.51	6.0	5.05
Maximum	62	3.05	7.3	5.05
Medium	121	1.43	6.7	5.05
Minimum	181	0.76	5.3	5.05
Integrated Total	364	1.37	19.3	5.05

Table 1.4.5 – Dilution Tunnel and Flue Gas Measurements

Segment	Average Flue Draft (in H₂O)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
Integrated Total	-0.022	11.91	134.7	87.5

Table 1.4.6 – Heater Configuration

Segment	Temperature Control	Feed Rate	Distribution Blower Setting	Combustion Blower Setting (max RPM)	Combustion Blower Setting (min RPM)
Pretest	7.0	93%	100%	3100	2600
Maximum	7.0	93%	100%	3100	2600
Medium	2.5	38%	100%	2625	2250
Minimum	1.0	25%	OFF	2625	2100

SUMMARY TABLES – RUN 3

Table 1.5.1 – Particulate Emissions

	One-Hour Filter	Integrated Total
Emission Rate (g/hr)	3.77	1.60
Emission Factor (g/dry kg)	1.03	1.02

Table 1.5.2 – Efficiency and CO

	Burn Rate Segment			Integrated Total
	Maximum	Medium	Minimum	
Time (minutes)	62	121	180	363
Burn Rate (dry kg/hr)	3.64	1.71	0.76	1.57
Heat Input Rate (BTU/hr, HHV)	67,236	31,680	14,108	29,040
Heat Output Rate (BTU/hr, HHV)	49,118	26,553	10,579	22,816
Efficiency (% , HHV)	73.05%	83.82%	74.99%	78.57%
Efficiency (% , LHV)	78.20%	89.72%	80.27%	84.10%
CO Emission Rate (g/hr)	555.0	11.8	0.0	89.4

Table 1.5.3 – Test Facility Conditions

	Initial	Middle	Final
Room Temperature (°F)	69	68	69
Barometric Pressure (in Hg)	29.83	29.84	29.84
Air Velocity (ft/min)	< 50	< 50	< 50
Induced Draft (in H₂O)	0	0	0

Table 1.5.4 – Fuel Measurement Summary

Segment	Time (min)	Burn Rate (dry kg/hr)	Consumed Fuel Weight (lbs)	Fuel Moisture Content (dry basis - %)
Pretest	62	2.51	6.0	5.05
Maximum	62	3.64	8.7	5.05
Medium	121	1.71	8.0	5.05
Minimum	180	0.76	5.3	5.05
Integrated Total	363	1.57	22.0	5.05

Table 1.5.5 – Dilution Tunnel and Flue Gas Measurements

Segment	Average Flue Draft (in H₂O)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
Integrated Total	-0.031	12.17	136.2	83.1

Table 1.5.6 – Heater Configuration

Segment	Temperature Control	Feed Rate	Distribution Blower Setting	Combustion Blower Setting (max RPM)	Combustion Blower Setting (min RPM)
Pretest	7.0	93%	100%	3100	2600
Maximum	7.0	93%	100%	3100	2600
Medium	2.5	38%	100%	2625	2250
Minimum	1.0	25%	OFF	2625	2100

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Hearth & Home Technologies - Halifax
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Section 2

Photographs Appliance Description Drawings

Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032

Hearth & Home Technologies - Halifax Absolute 63

PHOTOGRAPHS



Absolute 63 Front



Absolute 63 Back



Absolute 63 Left



Absolute 63 Right

APPLIANCE DESCRIPTION

Appliance Manufacturer: Hearth & Home Technologies - Halifax

Pellet Stove Model: Absolute 63

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

The Absolute 63's principle elements include a fuel hopper, steel firebox chamber, steel burn pot, and electrical fuel feed, combustion air, and convection air supply systems.

Air is forced by the combustion air blower through holes in the burn pot and combustion products are routed out of the firebox chamber 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 an auger which moves pellets horizontally towards the front of the appliance. 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 5mm glass viewing window sealed by fiberglass rope gasket

The electrical systems are regulated by a user-operated control board. On this board settings such as feed rate, combustion and distribution fan speeds, and desired temperature and can be adjusted to achieve desired heat output. The unit can also be controlled by an external thermostat system.

*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Engineering Drawings [Redacted]

*Model: Absolute 63
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Halifax, PA 17032*

Section 3

Quality Assurance/Quality Control

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 Absolute 63 at Hearth & Home Technologies - Halifax 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.

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*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Manufacturer's Quality Assurance Plan [Redacted]

*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Sample Analysis
Analysis Worksheets
Moisture Content Worksheet
Fuel Certification Label
Tared Filter, Probe, and O-Ring Data

Pellet Heater Lab Data - ASTM E2779 / ASTM E2515

Manufacturer: <u>Harman</u>	Equipment Numbers: <u>23, 283A, 592</u>
Model: <u>Absolute 63</u>	_____
Tracking No.: <u>2146</u>	_____
Project No.: <u>0135PS036E.REV001</u>	_____
Run #: <u>1</u>	_____
Date: <u>2/8/16</u>	_____

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C342	125.9	120.7	5.2
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:	5.2
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TRAIN 1 (Remainder of Test)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C343	128.3	120.4	7.9
B. Rear filter catch	Filter	C344	120.6	121.0	-0.4
C. Probe catch*	Probe	8	115597.2	115597.1	0.1
D. Filter seals catch*	Seals	R371	4140.2	4139.6	0.6

Sub-Total	Total Particulate, mg:	8.2
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Train 1 Aggregate	Total Particulate, mg:	13.4
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TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C345	133.1	120.8	12.3
B. Rear filter catch	Filter	C346	120.2	120.5	-0.3
C. Probe catch*	Probe	9	115693.6	115693.5	0.1
D. Filter seals catch*	Seals	R372	3300.9	3299.9	1.0

Total Particulate, mg:	13.1
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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
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*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

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

ASTM E2779 Pellet Heater Run Sheets

Client: Harman Project Number: 0135PS036E.REV001 Run Number: 1

Model: Absolute 63 43 Tracking Number: 2146 Date: 2/8/16

Test Crew: A. Kravitz

OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 335, 336, 410, 420, 559, 592

ASTM E2515 Lab Sheet

Assembled By:

A. Kravitz

Date/Time in Dessicator:

2/8/16 16:30

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date: 2/10/16	Date: 2/12/16	Date: 2/15/16	Date:	Date:
Time: 0830	Time: 1530	Time: 0900	Time:	Time:
R/H %: 12.6	R/H %: 11.1	R/H %: 16.8	R/H %:	R/H %:
Temp: 75.9	Temp: 73.5	Temp: 76.1	Temp:	Temp:
Audit: 500.2 2000.4 10000.0	Audit: 500.2 2000.4 10000.0	Audit: 2000.3	Audit:	Audit:
Initials: <u>A</u>	Initials: <u>A</u>	Initials: <u>A</u>	Initials:	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	C342	120.7	126.1	125.9	-		
	Rear Filter	N/A	N/A	-	-	-		
	Probe	N/A	N/A	-	-	-		
	O-Ring Set	N/A	N/A	-	-	-		
A (Remainder)	Front Filter	C343	120.4	128.4	128.3	-		
	Rear Filter	C344	121.0	120.7	120.6	-		
	Probe	8	115597.1	115597.3	115597.2	-		
	O-Ring Set	R371	4139.6	4140.6	4140.3	4140.2		
B	Front Filter	C345	120.8	133.3	133.1	-		
	Rear Filter	C346	120.5	120.3	120.2	-		
	Probe	9	115693.5	115693.7	115693.6	-		
	O-Ring Set	R372	3299.9	3301.0	3300.9	-		
BG	Filter	N/A	N/A	-	-	-		

Technician Signature: 

Date: 2/15/16

Pellet Heater Lab Data - ASTM E2779 / ASTM E2515

Manufacturer: <u>Harman</u>	Equipment Numbers: <u>23, 283A, 592</u>
Model: <u>Absolute 63</u>	_____
Tracking No.: <u>2146</u>	_____
Project No.: <u>0135PS036E.REV001</u>	_____
Run #: <u>2</u>	_____
Date: <u>2/11/16</u>	_____

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C347	123.1	120.4	2.7
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:	2.7
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TRAIN 1 (Remainder of Test)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C348	126.3	121.3	5.0
B. Rear filter catch	Filter	C349	120.8	120.6	0.2
C. Probe catch*	Probe	11	114192.4	114192.4	0.0
D. Filter seals catch*	Seals	R383	4122.5	4121.5	1.0

Sub-Total	Total Particulate, mg:	6.2
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Train 1 Aggregate	Total Particulate, mg:	8.9
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TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C350	127.4	119.9	7.5
B. Rear filter catch	Filter	C351	120.5	120.4	0.1
C. Probe catch*	Probe	12	114287.4	114287.5	0.0
D. Filter seals catch*	Seals	R384	3326.8	3325.8	1.0

Total Particulate, mg:	8.6
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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

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

ASTM E2779 Pellet Heater Run Sheets

Client: **Harman** Project Number: **0135PS036E.REV001** Run Number: 2

Model: **Absolute 63** Tracking Number: **2146** Date: 2/11/16

Test Crew: **A. Kravitz**

OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 335, 336, 410, 420, 559, 592

ASTM E2515 Lab Sheet

Assembled By:

A. Kravitz

Date/Time in Dessicator:

2/11/16 15:30

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date: 2/12/16	Date: 2/15/16	Date: 2/16/16	Date:	Date:
Time: 15:30	Time: 0900	Time: 1000	Time:	Time:
R/H %: 11.1	R/H %: 16.8	R/H %: 11.2	R/H %:	R/H %:
Temp: 73.5	Temp: 76.1	Temp: 75.5	Temp:	Temp:
Audit: 500.2 2000.4 100000.0	Audit: 500.5 2000.3 92888.9	Audit: 2000.4	Audit:	Audit:
Initials: A	Initials: A	Initials: A	Initials:	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	C347	120.4	123.2	123.1	-		
	Rear Filter	NA	-	-	-	-		
	Probe	NA	-	-	-	-		
	O-Ring Set	NA	-	-	-	-		
A (Remainder)	Front Filter	C348	121.3	126.3	126.3	-		
	Rear Filter	C349	120.6	120.7	120.8	-		
	Probe	11	114192.4	114192.4	114192.4	-		
	O-Ring Set	R383	4121.5	4122.8	4122.5	4122.5		
B	Front Filter	C350	119.9	127.3	127.4	-		
	Rear Filter	C351	120.4	120.5	120.5	-		
	Probe	12	114287.5	114287.4	114287.4	-		
	O-Ring Set	R384	3325.8	3327.5	3326.8	3326.8		
BG	Filter	NA	-	-	-			

Technician Signature:

A. Kravitz

Date:

2/16/16

Pellet Heater Lab Data - ASTM E2779 / ASTM E2515

Manufacturer: <u>Harman</u>	Equipment Numbers: <u>23, 283A, 592</u>
Model: <u>Absolute 63</u>	_____
Tracking No.: <u>2146</u>	_____
Project No.: <u>0135PS036E.REV001</u>	_____
Run #: <u>3</u>	_____
Date: <u>3/21/16</u>	_____

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C377	125.0	120.7	4.3
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:	4.3
------------------	------------------------	-----

TRAIN 1 (Remainder of Test)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C378	127.2	121.6	5.6
B. Rear filter catch	Filter	C379	120.3	120.6	-0.3
C. Probe catch*	Probe	11	114192.5	114192.6	0.0
D. Filter seals catch*	Seals	R395	3505.9	3504.9	1.0

Sub-Total	Total Particulate, mg:	6.3
------------------	------------------------	-----

Train 1 Aggregate	Total Particulate, mg:	10.6
--------------------------	------------------------	------

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	C380	130.7	120.5	10.2
B. Rear filter catch	Filter	C381	121.2	121.3	-0.1
C. Probe catch*	Probe	12	114287.5	114287.5	0.0
D. Filter seals catch*	Seals	R396	3581.2	3579.7	1.5

Total Particulate, mg:	11.6
-------------------------------	------

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

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

ASTM E2779 Pellet Heater Run Sheets

Client: Harman Project Number: 0135PS036E.REV001 Run Number: 3

Model: Absolute Tracking Number: 2146 Date: 3/21/16

Test Crew: A. Kravitz

OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 283A, 335, 336, 410, 420, 559, 592

ASTM E2515 Lab Sheet

Assembled By:

A. Kravitz

Date/Time in Dessicator:

3/21/16 16:40

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date: <u>3/23/16</u>	Date: <u>3/24/16</u>	Date:	Date:	Date:
Time: <u>0930</u>	Time: <u>1100</u>	Time:	Time:	Time:
R/H %: <u>14.0</u>	R/H %: <u>12.6</u>	R/H %:	R/H %:	R/H %:
Temp: <u>69.6</u>	Temp: <u>68.7</u>	Temp:	Temp:	Temp:
Audit: <u>9999.9</u>	Audit: <u>10000.0</u>	Audit:	Audit:	Audit:
Initials: <u>A</u>	Initials: <u>A</u>	Initials:	Initials:	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A	Front Filter (60 min)	C377	120.7	<u>125.0</u>	<u>126.0</u>			
A	Front Filter (Remainder)	C378	121.6	<u>127.2</u>	<u>127.2</u>			
A	Rear Filter	C379	120.6	<u>120.4</u>	<u>120.3</u>			
A	Probe	11	114192.6	<u>114192.4</u>	<u>114192.5</u>			
A	O-Ring Set	R395	3504.9	<u>3505.9</u>	<u>3505.9</u>			
B	Front Filter	C380	120.5	<u>130.7</u>	<u>130.7</u>			
B	Rear Filter	C381	121.3	<u>121.4</u>	<u>121.2</u>			
B	Probe	12	114287.5	<u>114287.4</u>	<u>114287.5</u>			
B	O-Ring Set	R396	3579.7	<u>3581.3</u>	<u>3581.2</u>			
BG	Filter	N/A						

Technician Signature: _____



Date: _____

3/24/16

TARE SHEET - FILTERS

Date Placed in Dessicator: 1/15/16 16:30


Thermohyrometer ID #: 291

Cleaned By: S. Button

Balance ID #: 23

Audit Weight ID #: 131

Filter ID #	Date: 1/17/16 Time: 12:30 RH %: 14.17. T (°F): 78.1 Audit: 500.1	Date: 1/18/16 Time: 8:00 RH %: 16.17. T (°F): 79.1 Audit: 500.1	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.	
C338	120.6	120.5						
C339	120.8	120.9						
C340	120.4	120.3						
C341	120.6	120.6						
C342	120.7	120.7			2/8/16	0135PS036E- RA R01001	1	
C343	120.5	120.4			↓	↓	↓	
C344	120.9	121.0			↓	↓	↓	
C345	120.9	120.8			↓	↓	↓	
C346	120.5	120.5			↓	↓	↓	
C347	120.5	120.4			2/11/16		2	
C348	121.3	121.3			↓	↓	↓	
C349	120.7	120.6			↓	↓	↓	
C350	120.0	119.9			↓	↓	↓	
C351	120.4	120.4			↓	↓	↓	
C352	120.0	120.8						
	Initials: <u>SB</u>	Initials: <u>SB</u>	Initials:	Initials:				

Final Technician Signature: 

Date: ²⁸ 1/18/16

TARE SHEET - PROBES

Date Placed in Dessicator: 11/5/15 1610

Thermohyrometer ID #: OMNI-00391

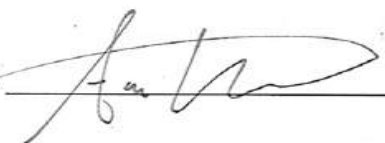
Cleaned By: B Davis

Balance ID #: OMNI 00023

Audit Weight ID #: OMNI-00283A

Probe ID #	Date: 11/12/16 Time: 14:00 RH %: 15.6 T (°F): 74.2 Audit: 99.999	Date: 11/13/16 Time: 1000 RH %: 16.6 T (°F): 76.1 Audit: 100000.0	Date: 11/14/16 Time: 1130 RH %: 20.1 T (°F): 71.2 Audit: 100000.0	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.		
1	122770.9	122771.4	122771.5						
2	115017.4	115017.6	-						
OES 3	114771.2	114771.4	-						
4	114862.9	114863.7	114863.6						
6	115354.4 115354.4	115355.0	115355.0						
OES 6	113701.9	113702.7	113702.5						
7	114984.7	114984.9	-						
8	115596.4	115597.0	115597.1	2/8/16				0135PS03: F REV011	1
9	115693.4	115693.7	115693.5	↓				↓	↓
11	114191.9	114192.4	114192.4	↓				↓	2
12	114286.8	114287.4	114287.5	↓				↓	↓
13	114324.5	114325.2	114325.0						
14	114555.4	114555.6	-						
15	114347.9	114348.1	-						
18	114404.5	114405.2	114405.1						
	Initials: SB	Initials: A	Initials: A	Initials:					

Final Technician Signature: _____



Date: _____

11/14/16

TARE SHEET - FILTERS

Date Placed in Dessicator: 1/15/16 16:30

Thermohygrometer ID #: 291

Cleaned By: S. Button

Balance ID #: 23

Audit Weight ID #:

Filter ID #	Date: 2/8/16 Time: 1600 RH %: 14.5 T (°F): 75.0 Audit: 560.2	Date: 2/12/16 Time: 1530 RH %: 11.1 T (°F): 73.5 Audit: 500.2	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.			
C368	120.7	120.5								
C369	120.5	120.5								
C370	121.1	121.0								
C371	121.3	121.3								
C372	120.8	120.8								
C373	120.8	120.9								
C374	120.0	120.1								
C375	121.7	121.6								
C376	120.7	120.8								
C377	120.6	120.7						3/21/16	0135PS056 E. REV01	3
C378	121.6	121.6						↓		↓
C379	120.5	120.6								↓
C380	120.5	120.5								↓
C381	121.4	121.3								↓
C382	120.7	120.7								↓
	Initials: <u>A</u>	Initials: <u>A</u>	Initials:	Initials:						

Final Technician Signature: _____

[Handwritten Signature]

Date: ³⁰ 2/12/16

O-RING TARES

Date Placed in Desiccator: 9/24/15 Technician: A. Kranitz Balance ID # 23

Thermo/Hygro meter ID #: 291 Audit Weight ID # 283A (Balance audit mfr. Std.: 500 ± 0.72)

O-Ring Size/ID#	Date: 10/1 Time: 1300 RH%: 23.1 T (F): 74.6 Initials: <i>AK</i>	Date: 10/2 Time: 1030 RH%: 24.2 T (F): 73.6 Initials: <i>A</i>	Date: 10/5 Time: 1200 RH%: 16.1 T (F): 75.0 Initials: <i>A</i>	Date: Time: RH%: T (F): Initials:	Manufacturer	Appliance	Project No.	Run No.
R379	3390.4	3390.5	-					
R380	4172.4	4172.4	-					
R381	3377.6	3377.7	-					
R382	4320.0	4319.8	-					
R383	4121.7	4121.5	-					
R384	3325.9	3325.8	-		Harman	Absolute 63	OISS PROGE. 1	2
R385	3356.2	3356.6	-		↓	↓	↓	↓
R386	4077.5	4077.2	4077.1					
R387	3360.8	3360.4	3360.3					
R388	4127.6	4127.2	4127.2					
R389	3290.5	3290.3	-					
R390	3608.9	3609.0	-					
R391	4519.5	4519.1	4519.1					
R392	3345.6	3345.3	3345.1					

Avg: 5000.2 5000.1 5000.1

Final Technician signature: *AK*

Date: 10/5/15

TARE SHEET - PROBES

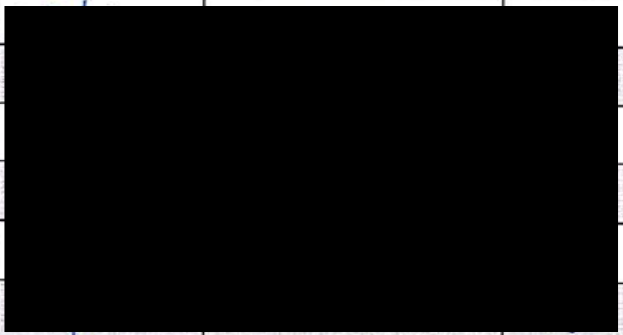
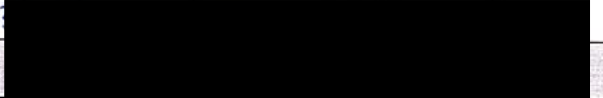
Date Placed in Dessicator: 2/18/16

Thermohyrometer ID #: 592

Cleaned By: A. Kravitz

Balance ID #: 23

Audit Weight ID #: 383A

Probe ID #	Date: 3/4/16 Time: 1230 RH %: 15.6 T (°F): 74.1 Audit: 100.0000	Date: 3/8/16 Time: 1000 RH %: 18.2 T (°F): 70.8 Audit: 100000.0	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.			
0ES 3	114771.4	114771.6								
4	114863.9	114863.9								
6	115355.2	115355.3								
7	114985.0	114985.0								
8	115597.1	115597.3								
9	115693.7	115693.9								
11	114192.4	114192.6						3/21/16	0135PS036 E. PEOL	3
12	114287.6	114287.5						↓	↓	↓
24	114130.6	114130.8								
28	114758.6	114758.7								
37	114469.4	114169.3								
38	114154.5	114154.6								
52	122774.9	122775.0								
54	122837.3	122837.1								
55	123235.1	123235.3								
	Initials: <u>A</u>	Initials: <u>Az</u>	Initials:	Initials:						

Final Technician Signature: 

Date: ³² 3/8/16

O-RING TARES

Date Placed in Desiccator: 10/16/15 Technician: B Davis Balance ID # OMNE-00023

Thermo/Hygro meter ID #: OMNE-00291 Audit Weight ID # OMNE-00283A (Balance audit mfr. Std.: 500 ± 0.72)

O-Ring Size/ID#	Date: ^{50.0005} Time: 0915 RH%: 19.3 T (F): 74.7 Initials: <i>BD</i>	Date: ^{50.0005} Time: 0940 RH%: 11.8 T (F): 73.1 Initials: <i>BD</i>	Date:	Date:	Manufacturer	Appliance	Project No.	Run No.
R348	3474.5	3474.5						
R349	3246.0	3246.0						
R359	3510.2	3500.2						
R360	3308.6	3308.6						
R361	4916.8	4916.6						
R362	3379.2	3379.2						
R363	4059.9	4059.9						
R364	3318.5	3318.5						
R367	3366.8	3366.7						
R368	3296.9	3296.9						
R369	3287.7	3287.7						
R370	3338.1	3338.2						
R371	4139.7	4139.6						
R372	3300.0	3299.9						
R373	3333.4	3333.3						
					Harman	Absolute 63	613 CPS036 E. R. Davis	1
					↓	↓	↓	↓

Final Technician signature: *B Davis*

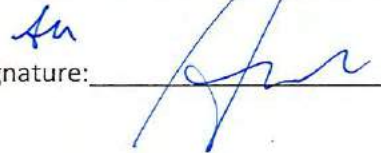
Date: 11/30/15

O-RING TARES

Date Placed in Desiccator: 10/27/15 11:20 Technician: J. Button Balance ID # 00023

Thermo/Hygro meter ID #: 00291 Audit Weight ID # 00131 (Balance audit mfr. Std.: 500 ± 0.72)

O-Ring Size/ID#	Date: 3/4/16 Time: 12:45 RH%: 12.9 T (F): 74.4 Initials: 2-0003	Date: 3/8/16 Time: 10:15 RH%: 15.2 T (F): 71.7 Initials: 20004	Date: Time: RH%: T (F): Initials:	Date: Time: RH%: T (F): Initials:	Manufacturer	Appliance	Project No.	Run No.
R393	3546.8	3456.6						
R394	3508.2	3508.1						
R395	3505.1	3504.9			Harman	Abs 63	0135P503%LEVA	3
R396	3574.7	3574.7			↓	↓	↓	↓
R397	3432.6	3432.7						
R398	3280.2	3280.4						
R399	3332.9	3332.9						
R400	3301.5	3301.6						
R401	3373.0	3373.0						
R402	4163.8	4163.8						
R403	3402.0	3402.0						
R404	3370.5	3370.4						
R405	3376.1	3376.1						
R406	4334.4	4334.2						

Final Technician signature: 

Date: 3/8/16

Calibrations

EPA Method 28R, ASTM E2515, ASTM E2779

ID #	Lab Name/Purpose	Log Name	Attachment Type
1	Calibrator Dry Gas Meter	Rockwell Int'l Standard Test Meter	Calibration Certificate
23	Scale-Analytical Balance	Mettler Analytical Balance	Calibration Certificate
128	Scale	Acculab V1200	Calibration Log
131	500 mg Weight	Ohaus Weight Standard, 500 mg	Calibration Certificate
132	10 lb Weight	Weight Standard, 10 lb.	Calibration Certificate
185	Platform Scale	Weigh-Tronix Platform Scale	See Test Run Notes
209	Barometer	Barometer – Princo	Manual Cover
283B	Calibration Weights	Troemner Metric Weight Standards	Calibration Certificate
296-T32	Tape Measure	Tape Measure	Calibration Log
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
343	Thermohygrometer	Omega Digital Thermohygrometer	Calibration Log
410	Microtector	Dwyer Microtector	Manual, Photograph
420	Combustion Gas Analyzer	ZRE Combustion Gas Analyzer	Manual Cover
559	Vaneometer	Dwyer Vaneometer	Manual

Certificate of Calibration

Certificate Number: **615462**



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

PO: 160070

Order Date: 03/04/2016

Authorized By: N/A

Calibrated on: 03/04/2016

*Recommended Due: 09/04/2016

Environment: 20 °C 40 % RH

* As Received: Out of Tolerance

* As Returned: Within Tolerance

Action Taken: Calibrated

Technician: 123



0723.01
Calibration

Property #: OMNI-00023

User: N/A

Department: N/A

Make: Mettler

Model: AE200

Serial #: E17657

Description: Scale, 205g

Procedure: DCN 500818/500887

Accuracy: ±0.0004g ±1 LSD

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
723A	Rice Lake	1mg-200g (Class O)	Mass Set	12/01/2016	603626

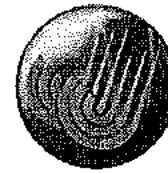
Parameter

Measurement Data

Measurement Description	Range	Unit	Reference	Min	Max	Error	UUT	Uncertainty
Before								Accredited = ✓
Force								
	g		0.00100	0.0005	0.0015	0.0001	0.0011g	5.7E-04 ✓
	g		0.01000	0.0095	0.0105	0.0002	0.0102g	5.7E-04 ✓
	g		0.10000	0.0995	0.1005	0.0002	0.1002g	5.7E-04 ✓
	g		0.50000	0.4995	0.5005	0.0002	0.5002g	5.7E-04 ✓
	g		1.00000	0.9995	1.0005	0.0002	1.0002g	5.7E-04 ✓
	g		40.00000	39.9995	40.0005	0.0010	40.0010g	5.7E-04 ✓
	g		80.00000	79.9995	80.0005	0.0019	80.0019g	5.7E-04 ✓
	g		120.00000	119.9995	120.0005	0.0028	120.0028g	5.7E-04 ✓
	g		160.00000	159.9995	160.0005	0.0039	160.0039g	5.8E-04 ✓
	g		200.00000	199.9995	200.0005	0.0043	200.0043g	5.7E-04 ✓
After								Accredited = ✓
	g		0.00100	0.0005	0.0015	0.0000	0.0010g	5.7E-04 ✓
	g		0.01000	0.0095	0.0105	0.0000	0.0100g	5.7E-04 ✓
	g		0.10000	0.0995	0.1005	0.0000	0.1000g	5.7E-04 ✓
	g		0.50000	0.4995	0.5005	0.0001	0.4999g	5.7E-04 ✓
	g		1.00000	0.9995	1.0005	0.0000	1.0000g	5.7E-04 ✓
	g		40.00000	39.9995	40.0005	0.0002	40.0002g	5.7E-04 ✓
	g		80.00000	79.9995	80.0005	0.0003	80.0003g	5.7E-04 ✓
	g		120.00000	119.9995	120.0005	0.0002	120.0002g	5.7E-04 ✓
	g		160.00000	159.9995	160.0005	0.0004	160.0004g	5.8E-04 ✓
	g		200.00000	199.9995	200.0005	0.0004	200.0004g	5.7E-04 ✓

Certificate of Calibration

Certificate Number: **547339**



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

PO: OTL-13-035
Order Date: 11/19/2013
Authorized By: N/A



Property #: **OMNI-00131**
User: **N/A**
Department: **N/A**
Make: **Ohaus**
Model: **500mg**
Serial #: **27503**
Description: **Mass**
Procedure: **DCN 500901**
Accuracy: **CLASS F ($\pm 0.72\text{mg}$)**

Calibrated on: **12/02/2013**
*Recommended Due: **12/02/2018**
Environment: **20 °C 34 % RH**
As Received: **Within Tolerance**
As Returned: **Within Tolerance**
Action Taken: **Calibrated**
Technician: **34**

Remarks: * Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired
Refer to attachment for measurement results.

Standards Used

<u>Std ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Nomenclature</u>	<u>Due Date</u>	<u>Trace ID</u>
432A	Sartorius	C-44	Microbalance 5.1g	03/11/2014	517747
723A	Rice Lake	1mg-200g (Class O)	Mass Set	09/05/2014	540048

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 (NMIs), 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 12/06/2013

Rev #14

Inspector

SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: 10 lb

ID Number: 132-

Standard Calibration Weight: 10 lb

ID Number: 255

Scale Used: MTW-150K

ID Number: 353

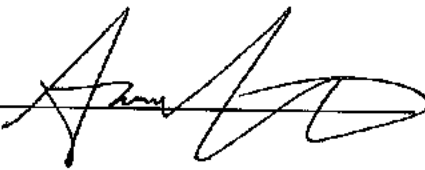
Date: 2/19/13

By: A. Kavitz

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

*Acceptable tolerance is 1%.

This calibration is traceable to NIST using calibrated standard weights.

Technician signature:  Date: 2/19/13



QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
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OMNI-Test Laboratories, Inc.
13327 NE Airport Way
Portland, OR 97230

Report Number: OMNE0321676151027

A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Weigh-Tronix	WI-127	21676	185	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.2	QC033	10/27/15	N/A	10/2016

FUNCTIONAL CHECKS

SHIFT TEST		LINEARITY		REPEATABILITY		ENVIRONMENTAL CONDITIONS		
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:			
300	0.4	HB44	HB44	500	0.2			
As-Found:		As-Found:		As-Found:				
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	<input type="checkbox"/> Good <input checked="" type="checkbox"/> Fair <input type="checkbox"/> Poor		
As-Left:		As-Left:		As-Left:		Temperature: 18.8°C		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>			

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	1000.0	1000.0	0.16
700	700.0	700.0	0.16
500	500.0	500.0	0.13
200	200.0	200.0	0.13
100	100.0	100.0	0.11
50	50.0	50.0	0.11

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	10/28/13	10/2015	34XX

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

Report prepared/reviewed by: J. Colacchio

Date: 10/27/15

Technician: J. Colacchio

Signature: [Signature]

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE APPROVAL OF QUALITY CONTROL SERVICES, INC.

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

Equipment Record

Name: Fortin Type Mercurial Barometer

Type of Equipment: Barometer

S/N: 0674 **OMNI ID #:** OMNI-00209

Manufacturer: PRINCO Instruments, Inc.

Is Manufacturer's manual available in the equipment file? : Yes, if not why? _____

Date Received: June 2000 **Date Placed in Service:** June 2000

Condition When Received: : New 9 Used 9 Reconditioned

Location: Lab

Location of Calibration Procedures: All PRINCO Fortin mercurial barometers have scales which are set at the time of manufacture to a near zero correction by comparison with a Fortin type mercurial barometer whose scales were calibrated traceable to NIST. If the barometer is not abused an any way , it should never go out of calibration.

Location of Dates/Results of Calibrations: If the barometer is not abused an any way , it should never go out of calibration. The barometer currently hangs on the wall and is never moved.

Location of Maintenance Procedures: Maintenance is performed on an "as needed" basis.

Dates / Results of Maintenance: Regularly scheduled maintenance is not required. Pre-service and post-service maintenance is conducted per QA Manual Section 5.3.5. To date, maintenance has not been required beyond the in-service maintenance prescribed in QA Manual Section 5.3.5.

Any Planned Maintenance? : No, if yes what: _____

Equipment History of any damage, malfunction, modification and/or repair (including a statement on the suitability of the equipment for testing): To date, this instrument has not been damaged, has not malfunctioned, has not been modified, and has not been repaired.

Certificate of Calibration

Certificate Number: 543402



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

PO: OTL-13-031
Order Date: 09/27/2013
Authorized By: N/A



Property #: OMNI-00283A
User: N/A
Department: N/A
Make: Troemner Inc
Model: 1mg-100g (Class F)
Serial #: 47883
Description: Mass Set, 21 Pc.
Procedure: DCN 500901
Accuracy: Class F

Calibrated on: 10/09/2013
*Recommended Due: 10/09/2018
Environment: 20 °C 41 % RH
As Received: Other - See Remarks
As Returned: Within Tolerance
Action Taken: Calibrated
Technician: 34

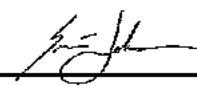
Remarks: * Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired
Changed set from a Class 4 to a Class F per Jeremy Clark.
Received missing 1g weight.
Refer to attachment for measurement results.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
432A	Sartorius	C-44	Microbalance 5.1g	03/11/2014	517747
479A	Sartorius	NC210S	Scale, 210g	02/22/2014	517755
503A	Rice Lake	1mg-200g (Class O)	Mass Set	12/07/2013	517746
723A	Rice Lake	1mg-200g (Class O)	Mass Set	09/05/2014	540048

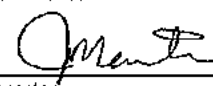
JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (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/NCCL 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 10/11/2013 Rev # 14



Inspector

Thermal Metering System Calibration

Y Factor

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

Average Gas Meter y Factor
1.001

Orifice Meter dH@
N/A

Calibration Date: 01/07/16
 Calibrated by: B. Davis
 Calibration Frequency: Six month
 Next Calibration Due: 7/6/2016
 Instrument Range: 1.000 cfm
 Standard Temp.: 68 oF
 Standard Press.: 29.92 "Hg
 Barometric Press., Pb: 29.98 "Hg
 Signature/Date: *B. Davis* 1/7/16

Previous Calibration Comparison

Date	6/4/2015	Acceptable Deviation (5%)	Deviation
y Factor	1.001	0.05005	0.000
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.002
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	Acceptable

Reference Standard *

Standard Calibrator	Model	Standard Test Meter
	S/N	OMNI-00001
	Calib. Date	05-Nov-15
	Calib. Value	0.9983 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	1.30	2.22	0.70
Initial Reference Meter	653.7	659.252	666.017
Final Reference Meter	659.162	665.997	671.748
Initial DGM	0	0	0
Final DGM	5.535	6.827	5.861
Temp. Ref. Meter (°F), Tr	68.0	67.0	67.0
Temperature DGM (°F), Td	78.0	79.0	80.0
Time (min)	34.0	32.0	49.0
Net Volume Ref. Meter, Vr	5.462	6.745	5.731
Net Volume DGM, Vd	5.535	6.827	5.861
Gas Meter y Factor =	1.001	1.003	0.999
Gas Meter y Factor Deviation (from avg.)	0.000	0.002	0.002
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. $y = [Vr \times (y \text{ factor (ref)}) \times (Pb + (Pr / 13.6)) \times (Td + 460)] / [Vd \times (Pb + (Pd / 13.6)) \times (Tr + 460)]$
- ** 3. $dH@ = 0.0317 \times Pd / (Pb (Td + 460)) \times [(Tr + 460) \times \text{time}] / Vr^2$

* 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 $\pm 0.14 \text{ ft}^3/\text{min}$. 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: Flue draft box 00335

Maximum Range: 0.25" WC

ID Number: OMNF-00335

Calibration Instrument: Digital Manometer

ID Number: OMNF-00896

Date: 1/8/16

By: B. David

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 <u>0.0 - 0.05</u>	<u>0.035</u>	<u>0.034</u>	<u>0.001</u>	<u>0.4</u>
20-40% Max. Range <u>0.05 - 0.10</u>	<u>0.072</u>	<u>0.064</u>	<u>0.008</u>	<u>3.2</u>
40-60% Max. Range <u>0.10 - 0.15</u>	<u>0.150</u>	<u>0.145</u>	<u>0.005</u>	<u>2.0</u>
60-80% Max. Range <u>0.15 - 0.20</u>	<u>0.200</u>	<u>0.192</u>	<u>0.008</u>	<u>3.2</u>
80-100% Max. Range <u>0.20 - 0.25</u>	<u>0.235</u>	<u>0.226</u>	<u>0.009</u>	<u>3.6</u>

*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: 1/8/16

Reviewed by:  Date: 1/11/16

Temperature Calibration EPA Method 28R, ASTM 2515								
BOOTH:	TEMPERATURE MONITOR TYPE:				EQUIPMENT NUMBER:			
E1	National Instruments Type K data logger				OMNI-00335-OMNI-00336			
REFERENCE METER EQUIPMENT NUMBER:				Calibration Due Date:				
CALIBRATION PERFORMED BY:		DATE:		AMBIENT TEMPERATURE:		BAROMETRIC PRESSURE:		
B. Davis		1-8-16		66		30.16		
Input Temperature (F)	Ambient	Meter A					Tunnel	Catalyst
			Meter B	Filter A	Filter B			
0	0	0	0	0	0	-1	0	
100	100	100	100	100	100	100	100	
300	300	300	300	300	300	300	300	
500	500	500	500	500	500	500	500	
700	700	700	700	700	700	700	700	
1000	1001	1001	1001	1001	1000	1000	1001	

Input (F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Stack
0	0	-1	0	-1	-1	-1
100	100	100	99	100	100	100
300	300	300	300	300	300	300
500	500	500	500	500	500	500
700	700	700	700	700	700	700
1000	1000	1000	1000	1000	1000	1000

Technician signature: B. Davis Date: 1/8/16

Reviewed By: [Signature] Date: 1/11/16

Thermal Metering System Calibration Y Factor

Manufacturer: APEX Instruments
Model: XC-60-EP
Serial Number: 606001
OMNI Tracking No.: OMNI-00336
Calibrated Orifice: Yes

Average Gas Meter y Factor
1.001

Orifice Meter dH@
N/A

Calibration Date: 01/07/16
Calibrated by: B. Davis
Calibration Frequency: Six month
Next Calibration Due: 7/6/2016
Instrument Range: 1.000 cfm
Standard Temp.: 68 oF
Standard Press.: 29.92 "Hg
Barometric Press., Pb: 29.98 "Hg
Signature/Date: *B. Davis* 1/7/16

Previous Calibration Comparison

Date	6/4/2015	Acceptable Deviation (5%)	Deviation
y Factor	1.003	0.05015	0.002
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.002
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	Acceptable

Reference Standard *

Standard Calibrator	Model	Standard Test Meter
	S/N	OMNI-00001
	Calib. Date	05-Nov-15
	Calib. Value	0.9983 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	0.51	1.00	1.84
Initial Reference Meter	671.748	679.511	686.563
Final Reference Meter	679.472	686.515	693.337
Initial DGM	0	0	0
Final DGM	7.822	7.133	6.878
Temp. Ref. Meter (°F), Tr	67.0	68.0	68.0
Temperature DGM (°F), Td	77.0	80.0	79.0
Time (min)	66.0	44.0	32.0
Net Volume Ref. Meter, Vr	7.724	7.004	6.774
Net Volume DGM, Vd	7.822	7.133	6.878
Gas Meter y Factor =	1.003	1.000	0.999
Gas Meter y Factor Deviation (from avg.)	0.002	0.001	0.002
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. $y = [Vr \times (y \text{ factor (ref)}) \times (Pb + (Pr / 13.6)) \times (Td + 460)] / [Vd \times (Pb + (Pd / 13.6)) \times (Tr + 460)]$
- ** 3. $dH@ = 0.0317 \times Pd / (Pb (Td + 460)) \times [(Tr + 460) \times \text{time}] / Vr^2$

* 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 ft³/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: Tunnel Static box 00336

Maximum Range: 1" WC

ID Number: OMNI-00336

Calibration Instrument: Digital Manometer

ID Number: OMNI-00396

Date: 1/8/16

By: B Davis

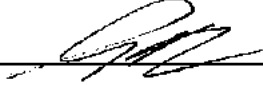
This form is to be used only in conjunction with Standard Procedure C-SPC.

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 - 0.2	0.128	0.133	0.005	0.5
20-40% Max. Range 0.2 - 0.4	0.382	0.387	0.005	0.5
40-60% Max. Range 0.4 - 0.6	0.576	0.574	0.002	0.2
60-80% Max. Range 0.6 - 0.8	0.749	0.747	0.002	0.2
80-100% Max. Range 0.8 - 1.0	0.870	0.864	0.006	0.6

*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: 1/8/16

Reviewed by:  Date: 1/11/16

Temperature Calibration EPA Method 28R, ASTM 2515								
BOOTH:	TEMPERATURE MONITOR TYPE:					EQUIPMENT NUMBER:		
E1	National Instruments Type K data logger					OMNI-00335-OMNI-00336		
REFERENCE METER EQUIPMENT NUMBER:				Calibration Due Date:				
CALIBRATION PERFORMED BY:			DATE:		AMBIENT TEMPERATURE:		BAROMETRIC PRESSURE:	
B. Davis			1-8-16		66		30.16	
Input Temperature (F)	Ambient	Meter A					Tunnel	Catalyst
			Meter B	Filter A	Filter B			
0	0	0	0	0	0	-1	0	
100	100	100	100	100	100	100	100	
300	300	300	300	300	300	300	300	
500	500	500	500	500	500	500	500	
700	700	700	700	700	700	700	700	
1000	1001	1001	1001	1001	1000	1000	1001	

Input (F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Stack
0	0	-1	0	-1	-1	-1
100	100	100	99	100	100	100
300	300	300	300	300	300	300
500	500	500	500	500	500	500
700	700	700	700	700	700	700
1000	1000	1000	1000	1000	1000	1000

Technician signature: B. Davis Date: 1/8/16
 Reviewed By: [Signature] Date: 1/11/16

Equipment Record

Name: Microtector

Type of Equipment: Hook Gage Liquid Manometer with Micrometer Gage in Inches

Model: 1430

S/N: 115004-00

OMNI ID #: OMNI-00410

Manufacturer: Dwyer Instruments

Vendor/Retailer: Dwyer Instruments

Is Manufacturer's manual available in the equipment file? Yes, if not why? _____

Date Received: December 2007

Date Placed in Service: December 2007

Condition When Received: New Used Reconditioned

Location: shop

Location of Calibration Procedures: Calibrate prior to use using NIST Traceable standard OMNI-00033. "Zeroing" instructions in attached manual.

Location of Dates/Results of Calibrations: N/A

Location of Maintenance Procedures: Maintenance is performed on an "as needed" basis as determined by calibrations.

Dates / Results of Maintenance: Regularly scheduled maintenance is not required. Pre- and post-service maintenance is conducted per QA Manual Section 5.3.5. To date, maintenance has not been required beyond the in-service maintenance prescribed in QA Manual Section 5.3.5.

Any Planned Maintenance? No, if yes what: _____

Equipment History of any damage, malfunction, modification and/or repair (including a statement on the suitability of the equipment for testing): To date, this instrument has not been damaged, modified or repaired, nor has it malfunctioned.

Equipment Record

Name: Infrared Gas Analyzer

Type of Equipment: gas analyzer Model: 300 NDIR

S/N: A8P9073T OMNI ID #: OMNI-00420

Manufacturer: California Analytical Instruments

Vendor/Retailer: California Analytical Instruments

Is Manufacturer's manual available in the equipment file? Yes, if not why? _____

Date Received: 5/2009 Date Placed in Service: 6/2009

Condition When Received: New Used Reconditioned

Location: shop

Location of Calibration Procedures: Unit is calibrated prior to use using the procedures and specifications outlined in the instruction manual. Additional information avail in file OMNI-00419

Location of Dates/Results of Calibrations: See attached calibration sheets.

Location of Maintenance Procedures: Maintenance is performed on an "as needed" basis as determined by calibrations.

Dates / Results of Maintenance: Regularly scheduled maintenance is not required. Pre- and post-service maintenance is conducted per QA Manual Section 5.3.5. To date, maintenance has not been required beyond the in-service maintenance prescribed in QA Manual Section 5.3.5.

Any Planned Maintenance? No, if yes what: _____

Equipment History of any damage, malfunction, modification and/or repair (including a statement on the suitability of the equipment for testing): To date, this instrument has not been damaged, modified or repaired, nor has it malfunctioned.

Equipment Record

Name: Vaneometer Air Velocity Meter

Type of Equipment: Air Velocity Meter

Model: 480

S/N: T36Z

OMNI ID #: OMNI-00559

Manufacturer: Dwyer Instruments

Vendor/Retailer: Dwyer Instruments

Is Manufacturer's manual available in the equipment file? Yes, if not why? _____

Date Received: 9/5/2014

Date Placed in Service: 9/5/2014

Condition When Received: New Used Reconditioned Unknown

Location: Cabinet 1

Location of Calibration Procedures: The meter is equipped with a factory pre-calibrated vane. The vane is replaced at least every six months, or in case of damage.

Location of Dates/Results of Calibrations: See attached calibration record.

Location of Maintenance Procedures: Maintenance is performed on a six month basis by replacing the pre-calibrated vane.

Dates / Results of Maintenance: See attachments.

Any Planned Maintenance? No, if yes what: _____

Equipment History of any damage, malfunction, modification and/or repair (including a statement on the suitability of the equipment for testing): _____

VWR Temperature Hygrometer Calibration Procedure and Data Sheet

Frequency: Every Two Years

Step 1: Locate NIST traceable standard.

Step 2: Place unit to be calibrated, tracking No. OMNI-00592, inside OMNI desiccator box on the same shelf with the NIST traceable standard.

Step 3: After a period of not less than four hours record the temperature and humidity of both units in the spaces provide below.

Step 4: If the unit to be calibrated matches the NIST standard within $\pm 4\%$, it is acceptable. If not, the unit needs to be sent to a repair company or replaced.

Verification Data:

Date: 4/13/16 Technician: B Davis

Time in desiccator: 10:30 Recording time: 14:30

NIST Standard Temperature: 74.5 °F NIST Standard Humidity: ^{BA}21.7 19.2

Test Unit Temperature Reading: 74.4 °F Test Unit Humidity Reading: 16.8

Test unit OMNI- 00592 is or was not within acceptable limits.

Technician Signature: 

Comments: Hygrometer OMNI-00291 was used to verify new unit.
A difference of 2.4% RH was found, this result is within $\pm 4\%$, with a
full scale of 100% for OMNI-00291, and 95% for OMNI-00592

*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Example Calculations

Equations and Sample Calculations – ASTM E2779 & E2515

Manufacturer: Harman
 Model: Absolute 63
 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

Q_{sd} – Average gas flow rate

$V_{m(std)}$ – Volume of Gas S Volume of gas sampled corrected to standard conditions, dscf

m_n – Total Particulate Ma Average dilution tunnel gas velocity, ft/sec

C_s - Concentration of part Particulate concentration, g/dscf

E_T – Total Particulate Err Dilution tunnel gas flow rate, dscf/min

PR - Proportional Rate V_s Particulate emission rate, lbs/hr

PM_R – Average particulat Total particulate emissions, grams

PM_F – Average particulat Average fuel load moisture content, %

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:

5.1 %

$$M_{Swb} = 30.1 \text{ lbs}$$

$$M_{Ewb} = 4.0 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{Bdb} = [(30.1 \times 0.4536) - (4.0 \times 0.4536)] (100/(100 + 5.05))$$

$$M_{Bdb} = 11 \text{ kg}$$

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

$$M_{BSidb} = (M_{S_{Siwb}} - M_{E_{Siwb}})(100/(100 + FM))$$

Where,

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

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

Sample Calculation (from medium burn rate segment):

$$FM = 5.1 \%$$

$$M_{S_{Siwb}} = 21.5 \text{ lbs}$$

$$M_{E_{Siwb}} = 13.7 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{BSidb} = [(21.5 \times 0.4536) - (13.7 \times 0.4536)] (100/(100 + 5))$$

$$M_{BSidb} = 3.4 \text{ kg}$$

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

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

Where,

θ = Total length of full intergrated test run, min

Sample Calculation:

$$M_{Bdb} = 11.27 \text{ kg}$$

$$\theta = 363 \text{ min}$$

$$BR = \frac{60 \times 11.3}{363}$$

$$BR = \mathbf{1.86} \text{ kg/hr}$$

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,

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

Sample Calculation (from medium burn rate segment):

$$M_{BSidb} = 3.37 \text{ kg}$$

$$\theta = 121 \text{ min}$$

$$BR = \frac{60 \times 3.37}{121}$$

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

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

ASTM E2515 equations (9)

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

Where:

- F_p = Adjustment factor for center of tunnel pitot tube placement, $F_p = \frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)
- V_{scent} = Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
- V_{strav} = Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
- k_p = Pitot tube constant, 85.49
- C_p = Pitot tube coefficient: 0.99, unitless
- ΔP* = Velocity pressure in the dilution tunnel, in H₂O
- T_s = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P_s = Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g, in Hg
- P_{bar} = Barometric pressure at test site, in. Hg
- P_g = Static pressure of tunnel, in. H₂O; (in Hg = in H₂O/13.6)
- M_s = **The dilution tunnel wet molecular weight; M_s = 28.78 assuming a dry weight of 29 lb/lb-mole

Sample calculation:

$$F_p = \frac{12.31}{14.28} = 0.862$$

$$V_s = 0.862 \times 85.49 \times 0.99 \times 0.210 \times \left(\frac{91.3 + 460}{\left(30.39 + \frac{-0.16}{13.6} \right) \times 28.78} \right)^{1/2}$$

$$V_s = 12.15 \text{ ft/s}$$

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

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

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

ASTM E2515 equation (3)

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

Where:

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

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 12.15 \times 0.196 \times \frac{528}{91.3 + 460} \times \frac{30.4 + \frac{-0.16}{13.6}}{29.92}$$

Q_{sd} = **8185.5** dscf/hr

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

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

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. H₂O
- T_m = Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 57.443 \times 1.001 \times \frac{\left(30.39 + \frac{1.27}{13.6} \right)}{\left(80.7 + 460 \right)}$$

$$V_{m(std)} = \mathbf{57.194} \text{ dscf}$$

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 54.610 \times 1.001 \times \frac{\left(30.39 + \frac{1.04}{13.6} \right)}{\left(80.0 + 460 \right)}$$

$$V_{m(std)} = \mathbf{54.412} \text{ dscf}$$

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 0.00 \times 0 \times \frac{\left(30.39 + \frac{0.00}{13.6} \right)}{\left(70.7 + 460 \right)}$$

$$V_{m(std)} = \mathbf{0.000} \text{ dscf}$$

m_n – Total Particulate Matter Collected, mg

ASTM E2515 Equation (12)

$$m_n = m_p + m_f + m_g$$

Where:

m_p = mass of particulate matter from probe, mg

m_f = mass of particulate matter from filters, mg

m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train 1 (first hour):

$$m_n = 0.0 + 5.2 + 0.0$$

$$m_n = 5.2 \text{ mg}$$

Using equation for Train 1 (remainder):

$$m_n = 0.1 + 7.5 + 0.6$$

$$m_n = 8.2 \text{ mg}$$

Train 1 Aggregate = **13.4 mg**

Using equation for Train 2:

$$m_n = 0.1 + 12.0 + 1.0$$

$$m_n = \mathbf{13.1 \text{ mg}}$$

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:

K₂ = Constant, 0.001 g/mg

m_n = Total mass of particulate matter collected in the sampling train, mg

V_{m(std)} = Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{13.4}{57.19}$$

$$C_s = \mathbf{0.00023} \text{ g/dscf}$$

For Train 2

$$C_s = 0.001 \times \frac{13.1}{54.41}$$

$$C_s = \mathbf{0.00024} \text{ g/dscf}$$

For Ambient Train

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

$$C_r = \mathbf{0.000000} \text{ g/dscf}$$

E_T – Total Particulate Emissions, g

ASTM E2515 equation (15)

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

Where:

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

Sample calculation:

For Train 1

$$E_T = (\underline{0.000234} - 0.000000) \times \underline{8185.5} \times \underline{363} /60$$
$$E_T = \underline{11.60} \text{ g}$$

For Train 2

$$E_T = (\underline{0.000241} - 0.000000) \times \underline{8185.5} \times \underline{363} /60$$
$$E_T = \underline{11.92} \text{ g}$$

Average

$$E = \underline{11.76} \text{ g}$$

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

$$7.5\% \text{ of the average} = \underline{0.88}$$

$$\text{Train 1 difference} = \underline{0.16}$$

$$\text{Train 2 difference} = \underline{0.16}$$

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

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

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

$$PR = \left(\frac{363 \times 0.145 \times 12.15 \times (108.0 + 460) \times (80.7 + 460)}{1 \times 57.44 \times 12.33 \times (91.3 + 460) \times (67.0 + 460)} \right) \times 100$$

$$PR = \underline{95} \%$$

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 = Total particulate emissions, grams

θ = Total length of full integrated test run, min

Sample Calculation:

$$E_T (\text{Dual train average}) = 11.76 \text{ g}$$

$$\theta = 363 \text{ min}$$

$$PM_R = 60 \times (11.76 / 363)$$

$$PM_R = 1.94 \text{ g/hr}$$

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 = Total particulate emissions, grams

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

Sample Calculation:

$$E_T (\text{Dual train average}) = 11.76 \text{ g}$$

$$M_{Bdb} = 11.27 \text{ kg}$$

$$PM_F = 11.76 / \text{#### })$$

$$PM_F = \mathbf{1.04} \text{ g/kg}$$

*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Section 4

Labeling & Owner's Manuals

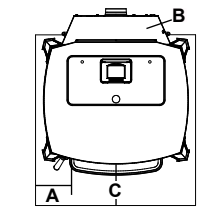
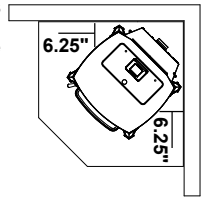
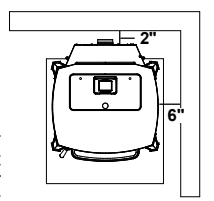


Model: ABSOLUTE63
Room Heater Pellet Fuel-Burning Type
SUITABLE FOR MOBILE-HOME INSTALLATION

Report #/Rapport # 0135PS036S & 0135PS036E Manufactured Homes in accordance with OAR 814-23-900 through 814-23-909

Test to/testé à: ASTM E 2779-10, ASTM E 2515-11, ASTM E 1509-12, ULC-S627-00, EPA Method 28R
Test date: March 2016
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.

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.



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.

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 48" (1219mm)
Max. Alcove Depth 36" (914mm)

FOR USE WITH PELLETIZED WOOD FUEL ONLY.
EPA Certified Emissions: 1.4 g/hr
Input Rating Max: 7.6 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.

THIS AREA MUST BE KEPT BLANK

Modèle: ABSOLUTE63
Appareil de chauffage à granulés de bois
CONÇU POUR MAISONS MOBILES

Serial No. **008**
N° de série:



Test pour / tested à la norme ASTM E 2779-10, ASTM E 2515-11, ASTM E 1509-12, ULC-S627-00, EPA Method 28R
Date du test: juillet 2015

Appareil de chauffage à granulés de type combustion de carburant (UM) 84 - HUD
"PRÉVENIR LES FEUX DE MAISON" Installer et utiliser uniquement en conformité avec installation et d'utilisation les instructions du fabricant.

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

Contactez les responsables de feu ou de construction locales sur les restrictions et l'inspection dans votre région.

DISTANCES DE SECURITE PAR RAPPORT AUX MATERIAUX COMBUSTIBLES

AVERTISSEMENT: POUR maisons préfabriquées: Ne pas installer l'appareil dans une salle de repos. Une entrée d'air de combustion à l'extérieur doit être fournie. L'intégrité de la structure du plancher de la maison, le plafond et les murs fabriqué doit être maintenue.

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

Reportez-vous aux instructions du fabricant et les codes locaux pour connaître les précautions nécessaires pour faire passer la cheminée à travers un mur ou un plafond combustible. Inspectez et nettoyez système d'évacuation des gaz d'échappement souvent en conformité avec les instructions du fabricant.

Installation en angle
Entre murs et appareil 159 mm

Utilisez un type de diamètre "L" 3 "ou 4" ou "PL" du système de ventilation.

Installation en alcôve
Hauter minimale de l'alcôve 1219 mm
Profondeur maximale de l'alcôve 914 mm

Ne pas connecter cet appareil à un conduit de cheminée servant un autre appareil.

PROTECTION DU SOL*
Côtés (A) 152 mm
Arrière (B) 25 mm
Avant (C) 152 mm

Ne pas obstruer l'espace sous le chauffe-eau.

Utiliser une protection de sol non combustible sous l'appareil qui s'étend sur les côtés, 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.

POUR UTILISATION AVEC GRANULE DE BOIS.

Il est recommandé 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.

Entrée Puissance Max: £ 7,3 combustible / h
Puissance électrique: 240 V, 50 Hz, Lancer 1.75 AMPS, Exécuter 1.25 AMPS

Do not remove this label/Ne pas enlever cette étiquette. Made in the USA/Fabriqué aux É.-U.

États-Unis électrique Note: 115 VAC, 60 Hz, Lancer 3.5 AMPS, Run 2.5 AMPS

Type de carburant: granulés de bois, 5 mm de diamètre.

Route cordon électrique de l'appareil.
FAIRE FONCTIONNER UNIQUEMENT LORSQUE LES PORTES SONT FERMÉES

US ENVIRONMENTAL PROTECTION AGENCY
Certified to comply with 2020 particulate emission standards.
Certifié conforme aux normes 2020 d'émission de particules.

Date of Manufacture / Date de fabrication
2016 2017 2018 JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
3-90-063 Manufactured by/Fabriqué par: Hearth and Home Technologies Rev C

LABEL TICKET

ECO:	CLASS:
PART # / REV: 3-90-063_ Rev C	ADHESIVE: 468
ORIGINATOR: SpidleT	MATERIAL: METAL
DATE: 02/16	INK: BLACK
LABEL SIZE: 13 in. x 5.75 in.	OVERCOAT:
LOCATION:	Hole Size = .312 / Oblong Hole Size: .125 x .21
 352 Mountain House Road Halifax, PA 17032 The Hearth Experts®	This unit will need the addendum label that refers to the "Wood heater needs periodic inspection" Information

Installation Manual

Installation and Appliance Setup

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

OWNER: Retain this manual for future reference.

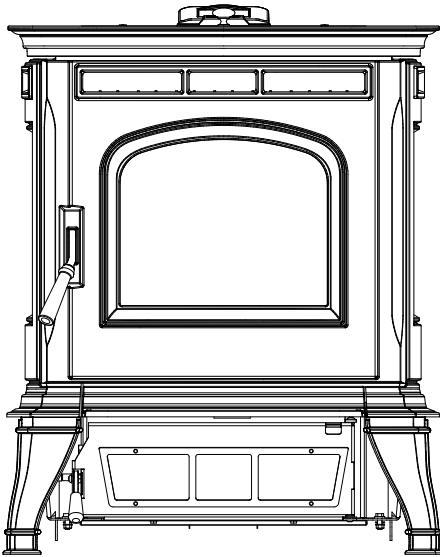
NOTICE: SAVE THESE INSTRUCTIONS

HARMAN®

BUILT TO A STANDARD, NOT A PRICE

Model(s):

Absolute63 Freestanding Pellet Stove



Tested & Listed By  Portland Oregon USA
OMNI-Test Laboratories, Inc.

We suggest that our hearth products be installed and serviced by professionals who are certified in the U.S. by the National Fireplace Institute (NFI) as NFI Specialists.



CAUTION

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

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

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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 could cause damage to the stove or to property.

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/Distributor 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

	YES	IF NO, WHY?
Required non-combustible floor protection. (Pg. 9)	<input type="checkbox"/>	_____
Verified clearances to combustible. (Pg. 10-14)	<input type="checkbox"/>	_____
Unit is Leveled and secured.	<input type="checkbox"/>	_____

Venting/Chimney Section 4 (Pg. 10-19)

Venting Configuration complies to vent diagrams.	<input type="checkbox"/>	_____
Venting installed, sealed and secured in place with proper clearances.	<input type="checkbox"/>	_____
Exterior wall/roof flashing installed and sealed.	<input type="checkbox"/>	_____
Terminations installed and sealed.	<input type="checkbox"/>	_____

Electrical Section 1 (Pg. 4)

120VAC unswitched power provided to the appliance.	<input type="checkbox"/>	_____
--	--------------------------	-------

Appliance Setup Section 5 (Pg. 20-21)

All packaging and protective materials are removed.	<input type="checkbox"/>	_____
Accessories installed properly.	<input type="checkbox"/>	_____
Manual bag and all it's contents are removed from inside the appliance and given to party responsible for use and operation.	<input type="checkbox"/>	_____
Started appliance and verified that all motors and blowers operate as they should.	<input type="checkbox"/>	_____

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)

1 Product Specific and Important Safety Information

A. Appliance Certification

MODEL:	Absolute63 Pellet Stove
LABORATORY:	OMNI Test Laboratories, Inc
REPORT NO.	0135PS036S
TYPE:	Pellet Fueled/Supplementary For Residential Use
STANDARD(s):	ASTM E 2779-10, ASTM E 2515-11, ASTM E 1509-04, ULC-S627-00, EPA Method 28R
ELECTRICAL RATING:	115 VAC, 60 Hz, Start 3.5 Amps, Run 2.5 Amps
GLASS SPECIFICATION:	5mm mirrored ceramic glass

The Absolute63 is Certified to comply with 2015 particulate emission standards. Not approved for sale after May 15, 2020.



Note: This installation must conform with local codes. In the absence of local codes you must comply with the **ASTM E1509-2012, 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
THE STRUCTURAL INTEGRITY OF THE MANUFACTURED HOME FLOOR, WALL, AND CEILING/ROOF MUST BE MAINTAINED.
DO NOT INSTALL IN SLEEPING ROOM.

D. BTU & Efficiency Specifications

EPA Certification Number:	
EPA Certified Emissions:	1.64 g/hr
*LHV Tested Efficiency:	84.8%
**HHV Tested Efficiency:	79.2%
***EPA BTU Output:	48,600
****BTU Input	63,900
Vent Size:	3 Inch
Hopper Capacity:	72 lbs
Fuel:	Wood Pellets

* 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

115 VAC, 60 Hz, Start 3.5 AMPS, Run 2.5 AMPS

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.

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

2 Getting Started

A. Design and Installation Considerations

1. Appliance Location

NOTE: 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 and 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.

NOTE: 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.

⚠ WARNING

Risk of Fire!
Damaged parts could impair safe operation. Do NOT install damaged, incomplete or substitute components.

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

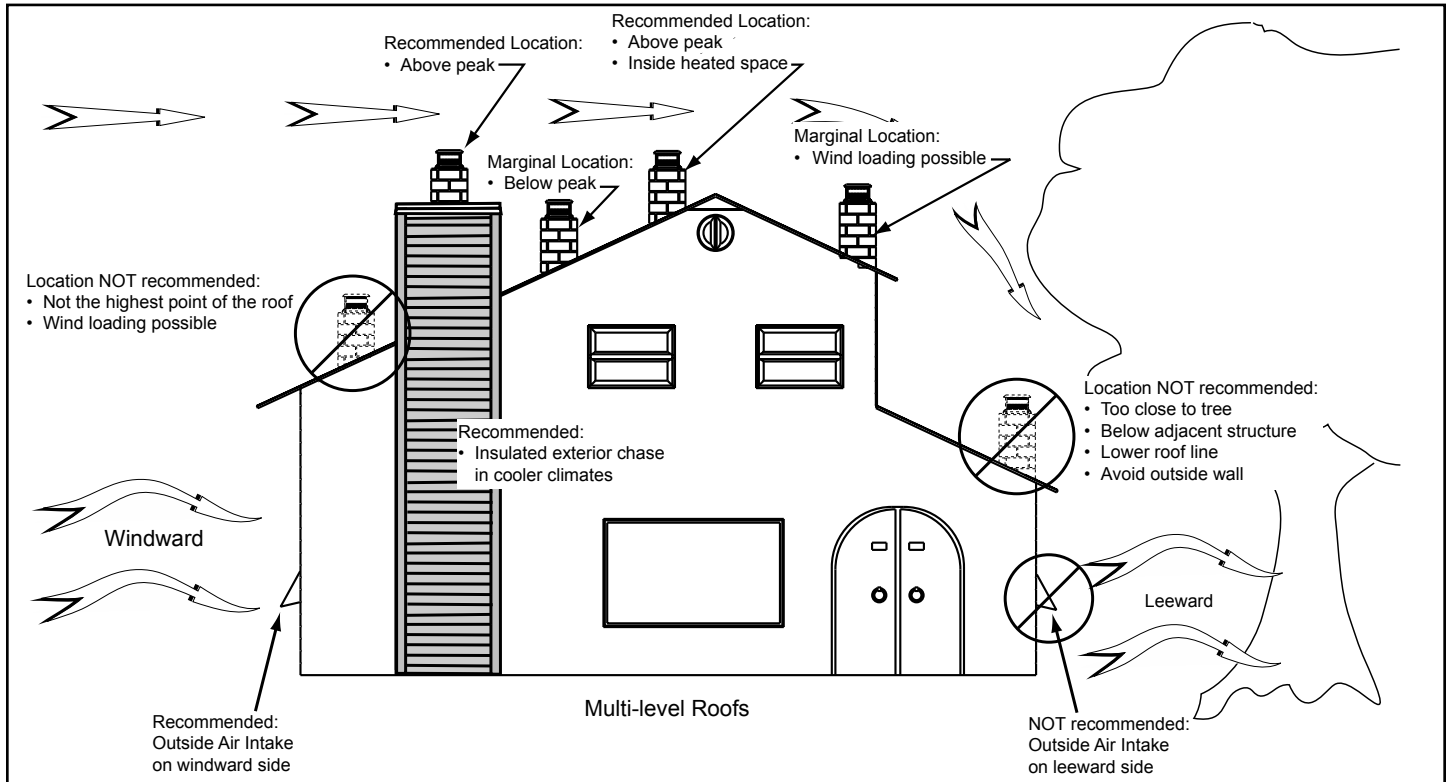


Figure 2.1

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
- 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 a 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.

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.



WARNING



RISK OF FIRE OR EXPLOSION!

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

3 Clearances

A. Appliance Dimension Diagram

Dimensions are actual appliance dimensions. Use for reference only.

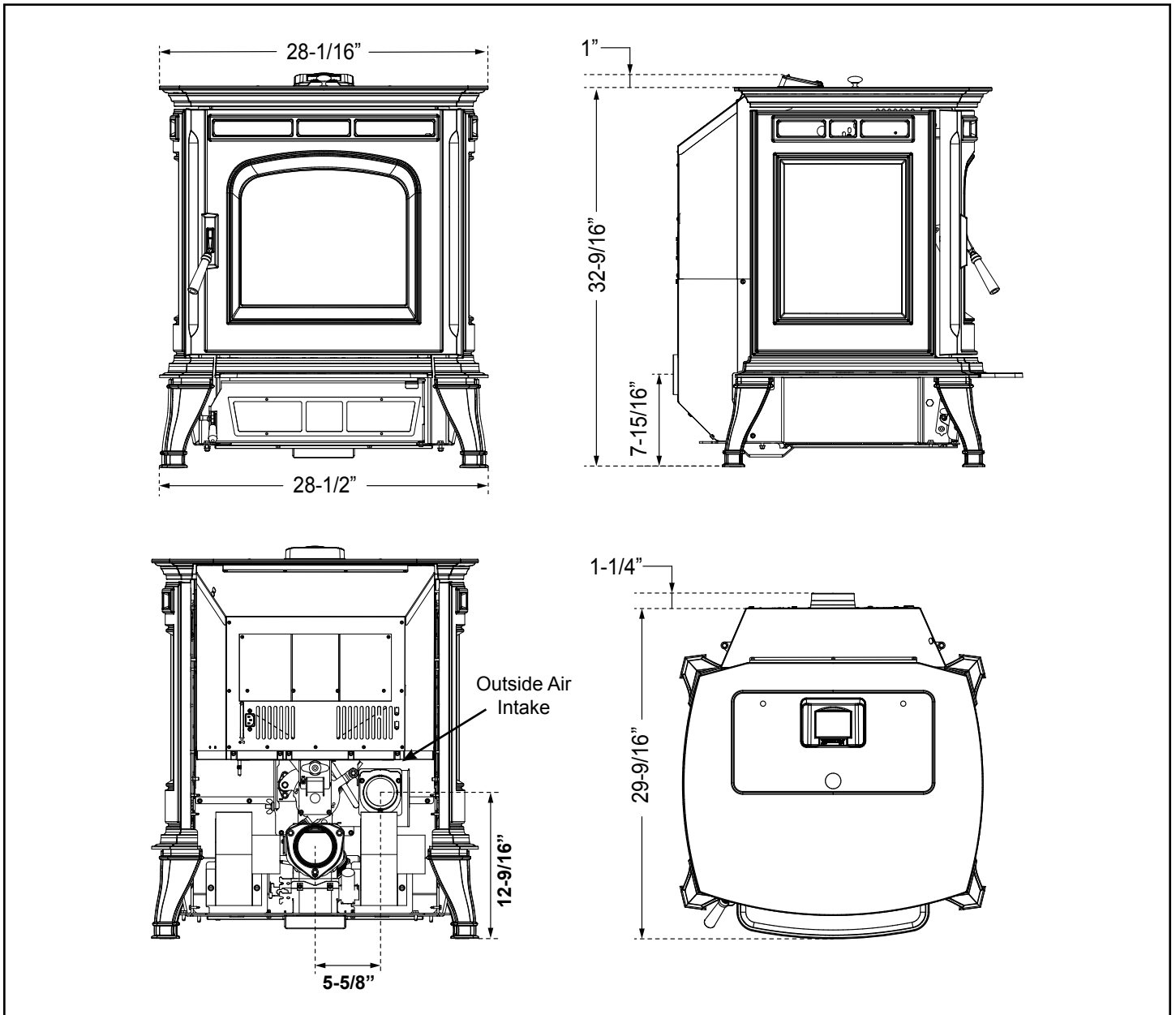


Figure 3.1

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 unplastered 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.

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.

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

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

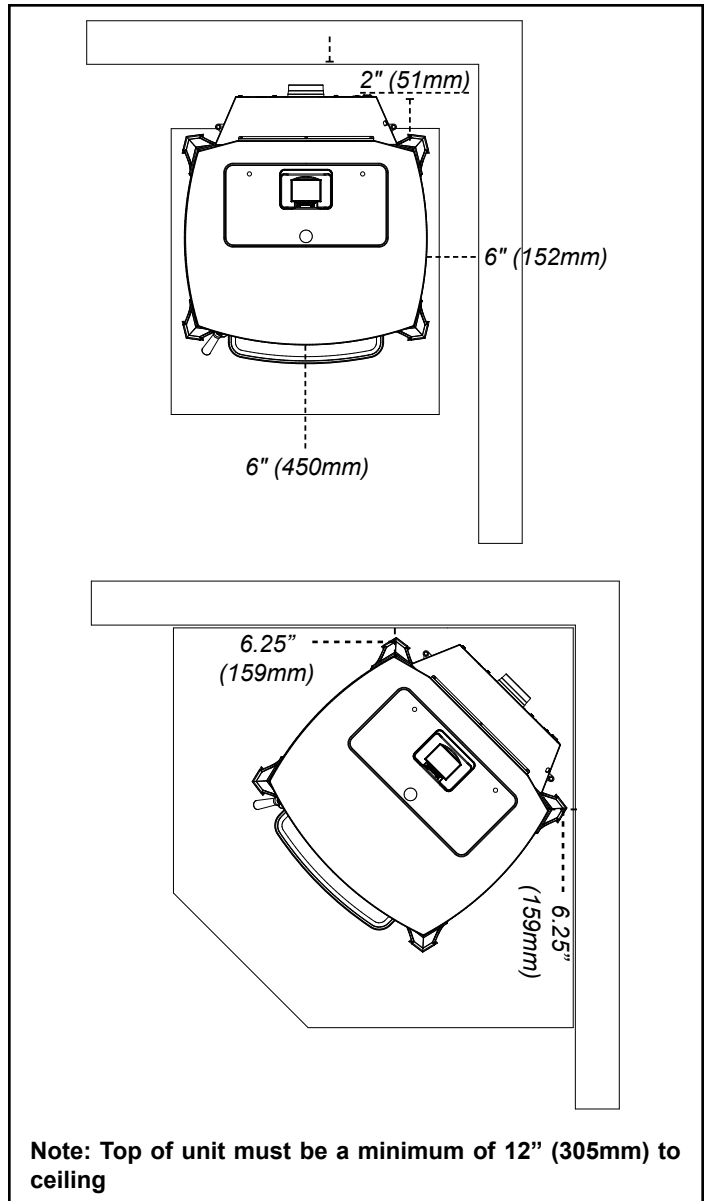
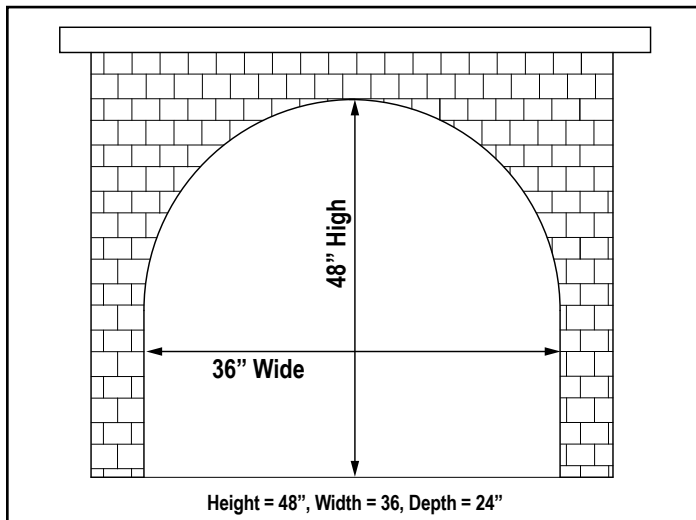


Figure 3.2

⚠ 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

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. Floor protection must also extend 2 inches (51mm) beyond each side of any horizontal flue pipe. The minimum floor protector material is 20 gauge sheet metal. Other floor protector materials are ceramic tile, stone, brick, etc. Figure 3.3

For Canadian installation only: Per ULC-S627-00, if installed on a combustible floor, the need to provide a noncombustible *floor protector* covering the area beneath the *space heater* and extending at least 17.72" (450mm) on the firing side and at least 7.87" (200mm) on the other sides.

In Canada, you may follow the smaller U.S. floor protection requirements ONLY if the user agrees to completely shut-down the appliance, and allow it to cool to where all fire is extinguished and the combustion blower and its indicator light shuts off, prior to opening the firebox door or ash door.

Minimum Size floor protection (USA) is 40-1/16" Wide By 30-7/8" Deep (658mm X 711mm).

*Floor protection dimensions for the front and sides are measured from the appliance door opening in the United States. In Canada, the side dimension is measured from the widest part of the appliance.

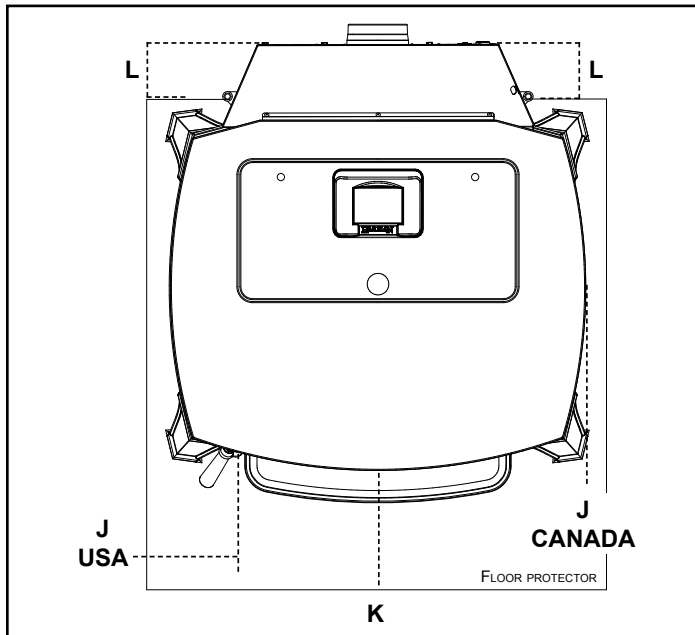
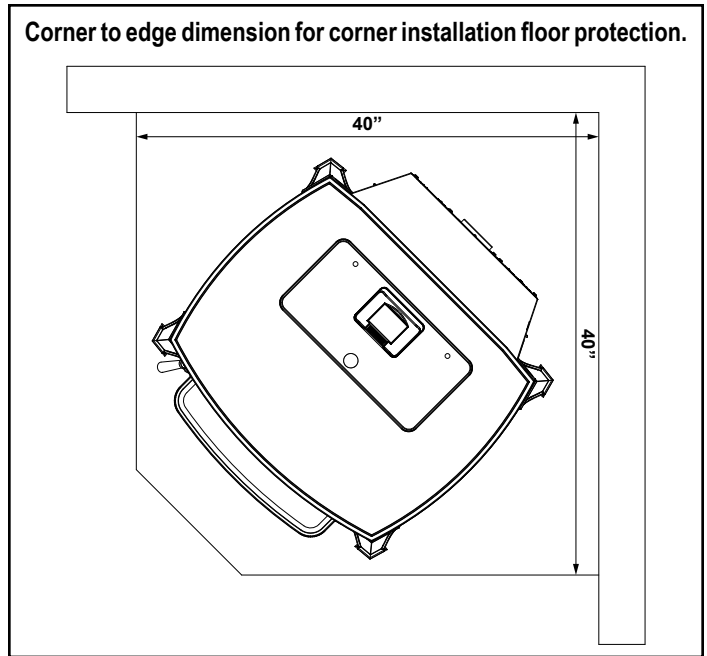


Figure 3.3

Floor Protection Requirements		US	Canada
J	Sides	6"	200mm
K	Front	6"	450mm
L	Rear	1"	25mm

Note: Measurement "L" is even with the rear of the hopper in the US ONLY

Note: Measurement "K" is measured from the glass in the US ONLY



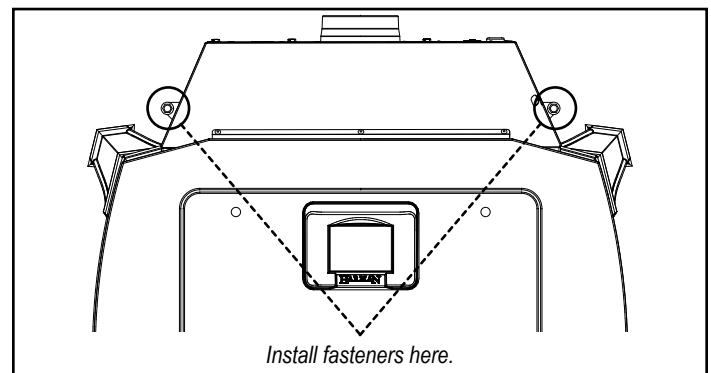
Alternate floor protector dimension may be used as long as they satisfy the measurement requirements shown below.

Minimum size floor protection for a corner installation hearth pad is 36" x 36" (USA ONLY). Note: Floor protector WILL NOT touch the wall.

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. Unit must be grounded to the metal frame of the mobile home.



4 Termination Location and Vent Information

A. Vent Termination Minimum Clearances

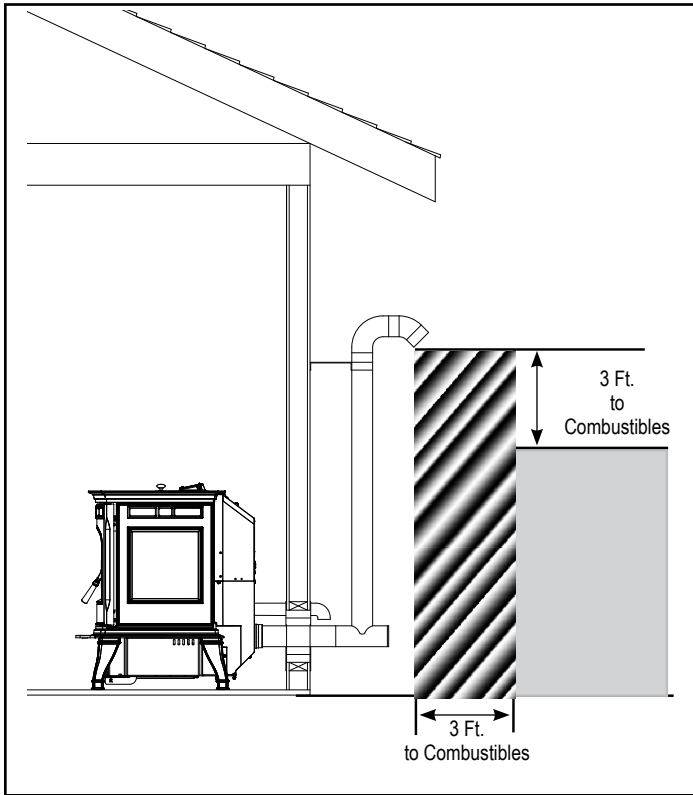


Figure 4.1

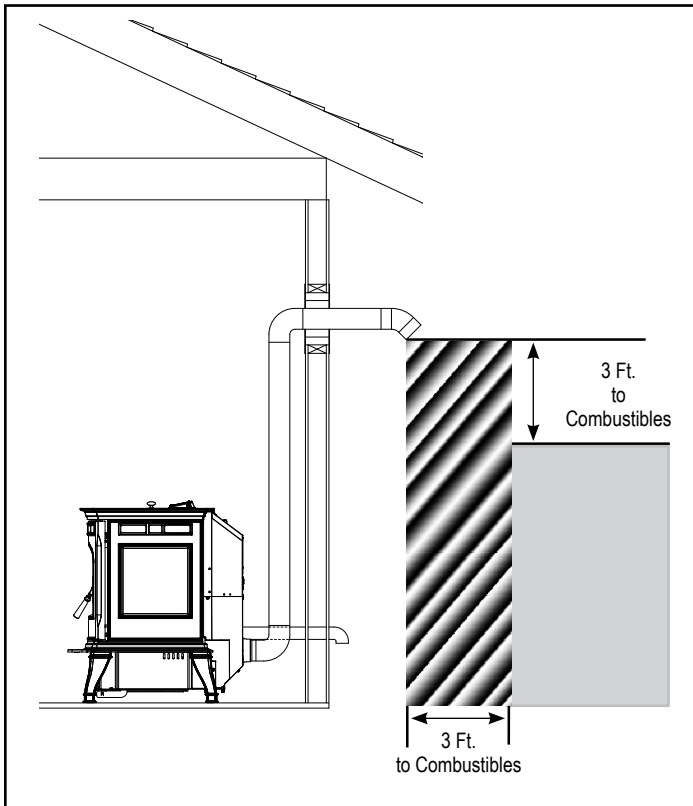


Figure 4.2

#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.

Seal pipe joints with silicone or aluminum tape in addition to the sealing system used by the manufacturer.

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.

Seal pipe joints with silicone or aluminum tape in addition to the sealing system used by the manufacturer.

If the stove is installed below grade be sure the vent termination is at least 12" above grade (with outside air only). The outlet must also be 12" 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.

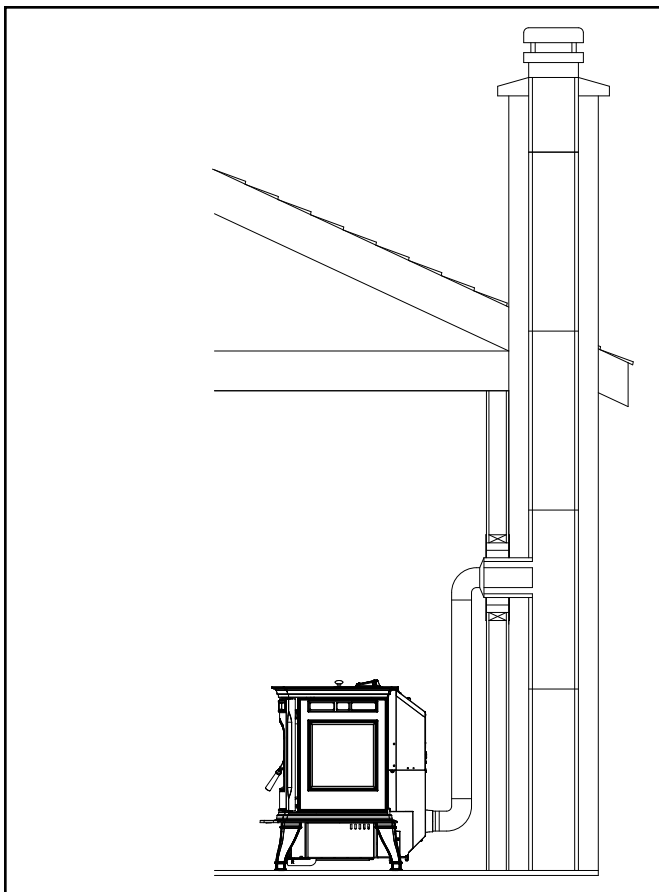


Figure 4.3

#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.* Seal pipe joints with silicone or aluminum tape in addition to the sealing system used by the manufacturer.

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

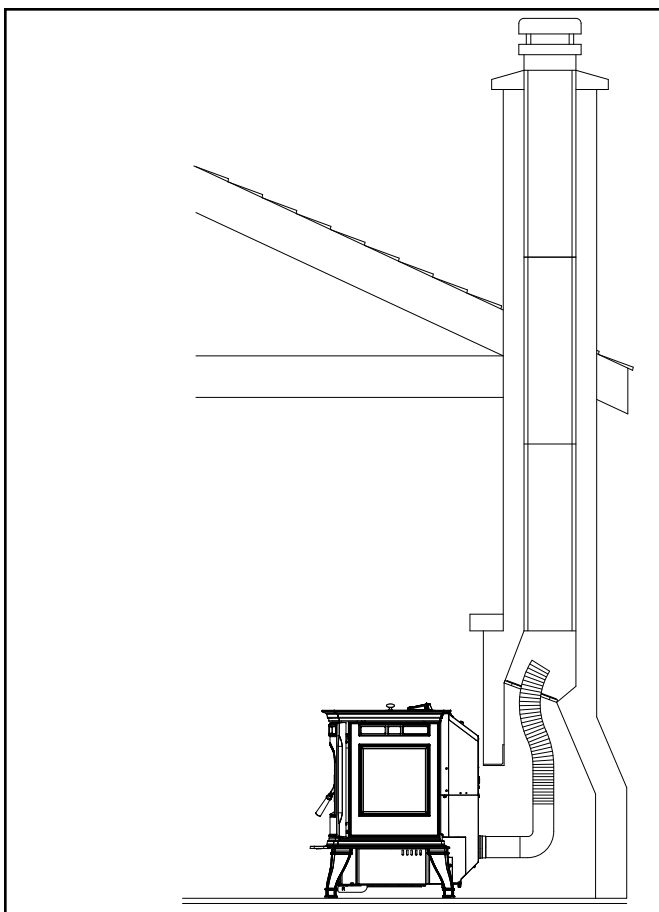


Figure 4.4

#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. Seal pipe joints with silicone or aluminum tape in addition to the sealing system used by the manufacturer.

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

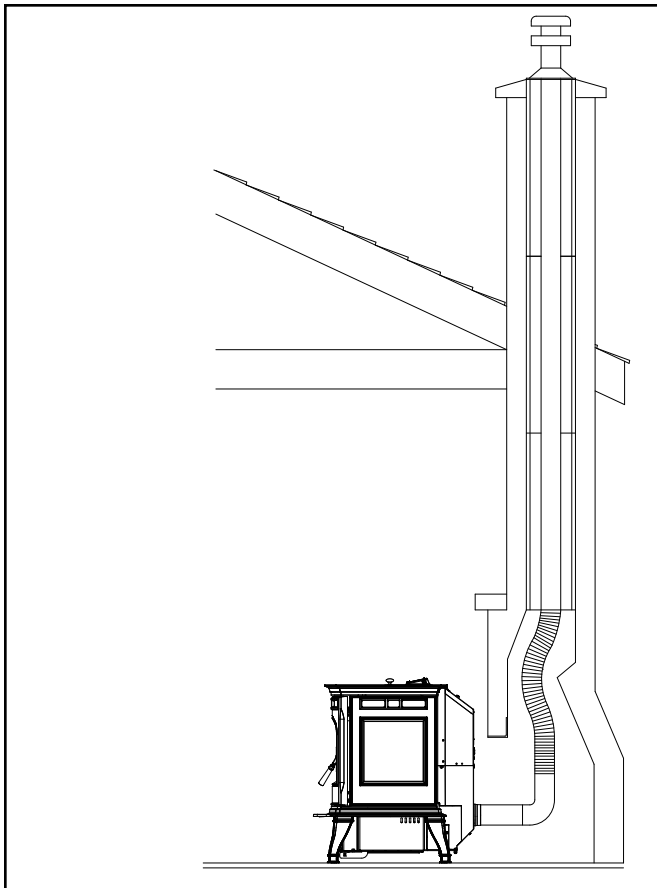


Figure 4.5

#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.

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. Seal pipe joints with silicone or aluminum tape in addition to the sealing system used by the manufacturer. Pipe size should be increased to 4" using this method.

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

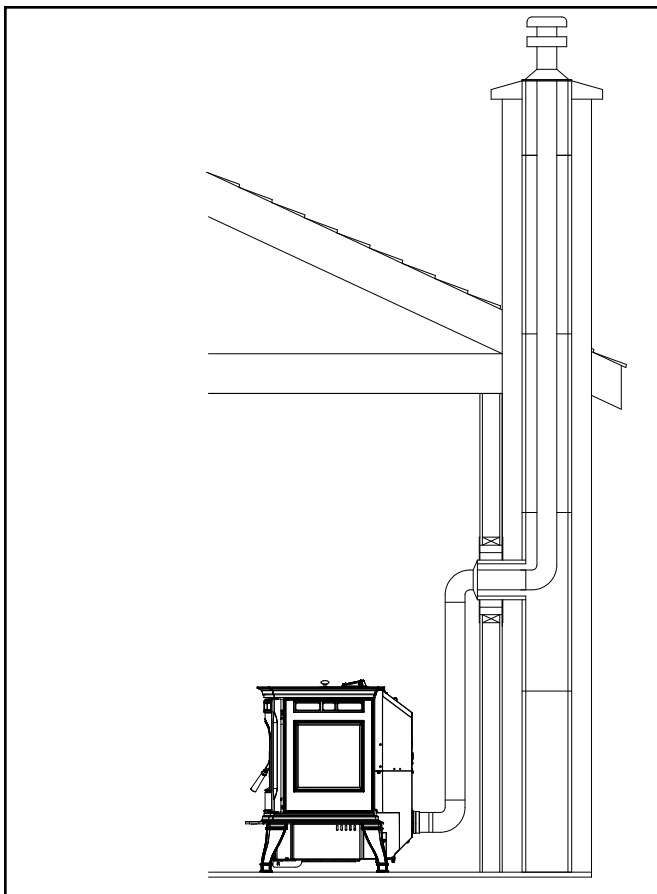


Figure 4.6

#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. Seal pipe joints with silicone or aluminum tape in addition to the sealing system used by the manufacturer. 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.

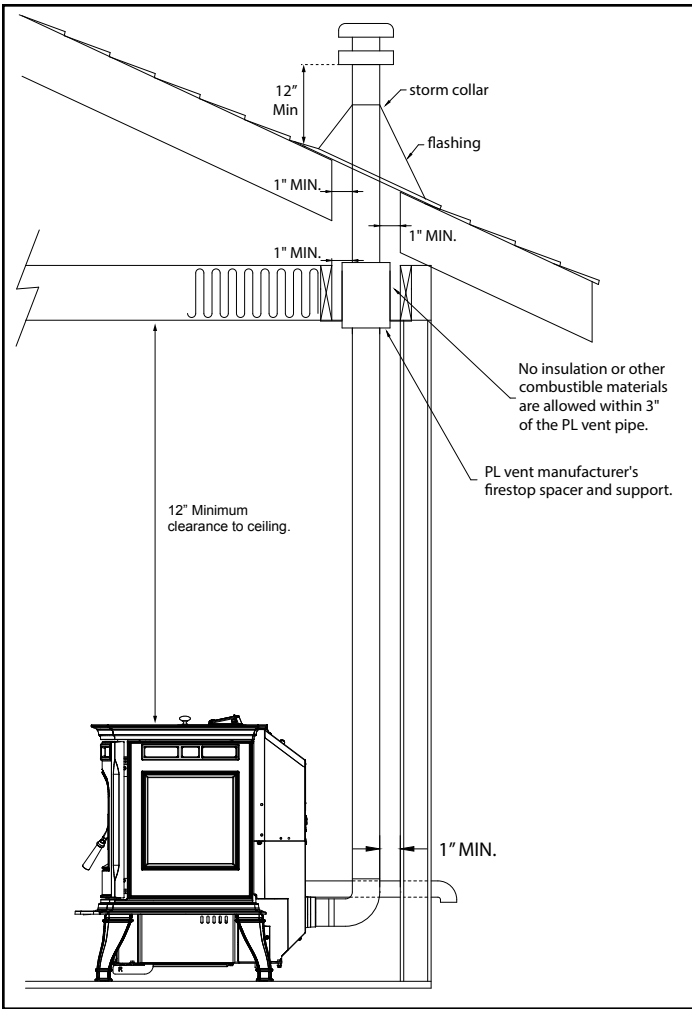


Figure 4.7

#7 Installing through the ceiling (Figure 4.7)

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

Seal pipe joints with silicone or aluminum tape in addition to the sealing system used by the manufacturer.

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

CAUTION
<p>DO NOT USE MAKESHIFT COMPROMISES WHEN INSTALLING THIS APPLIANCE. DAMAGE AND/OR INJURY MAY RESULT.</p>

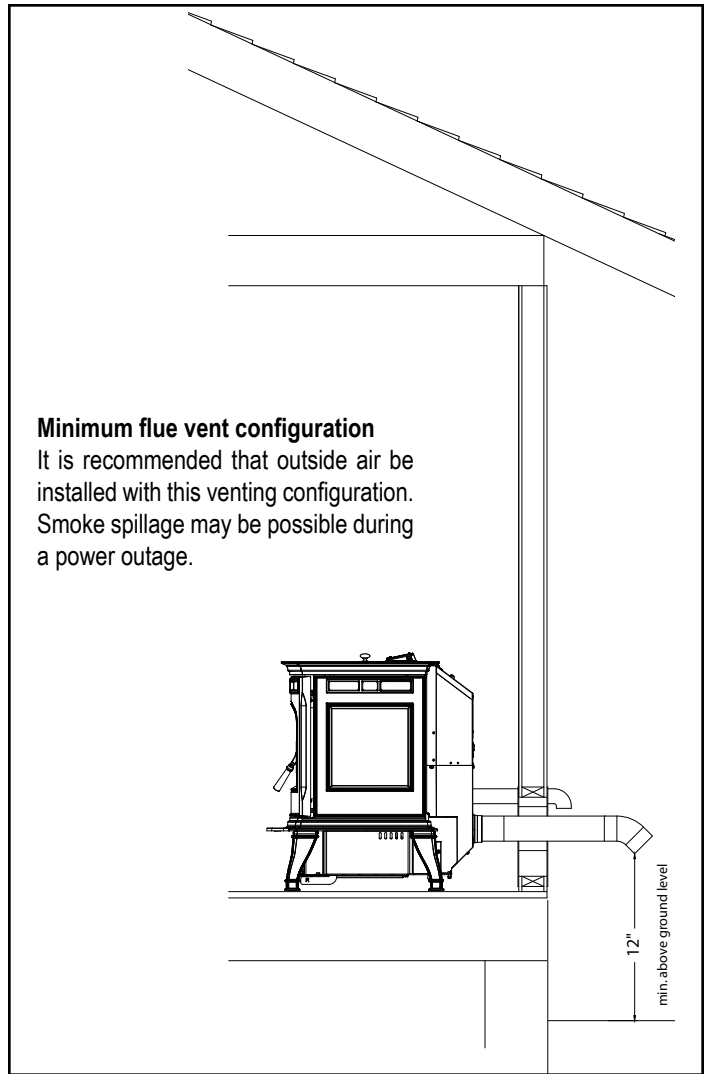


Figure 4.8

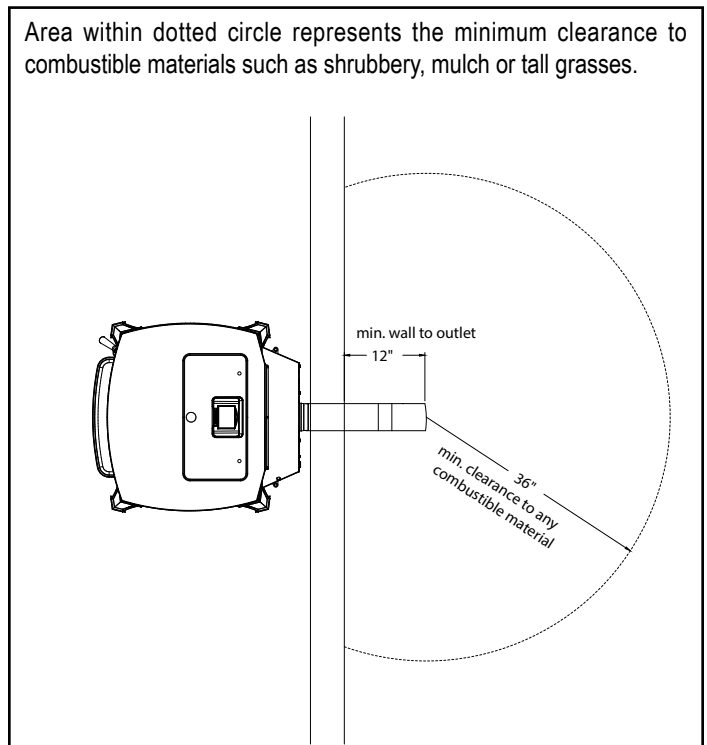


Figure 4.9

#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.

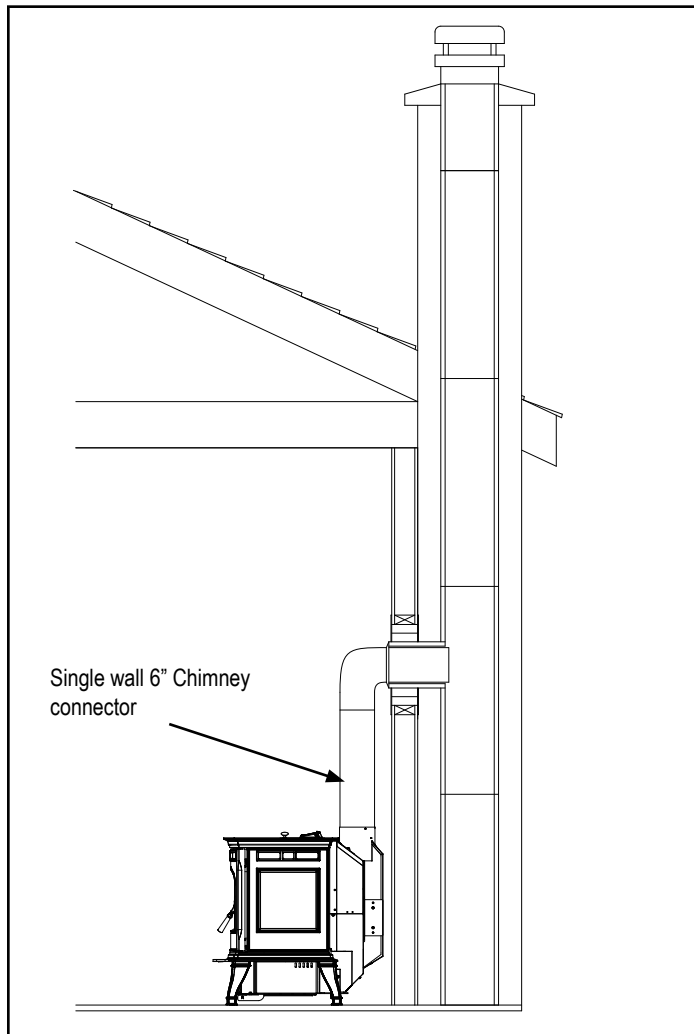
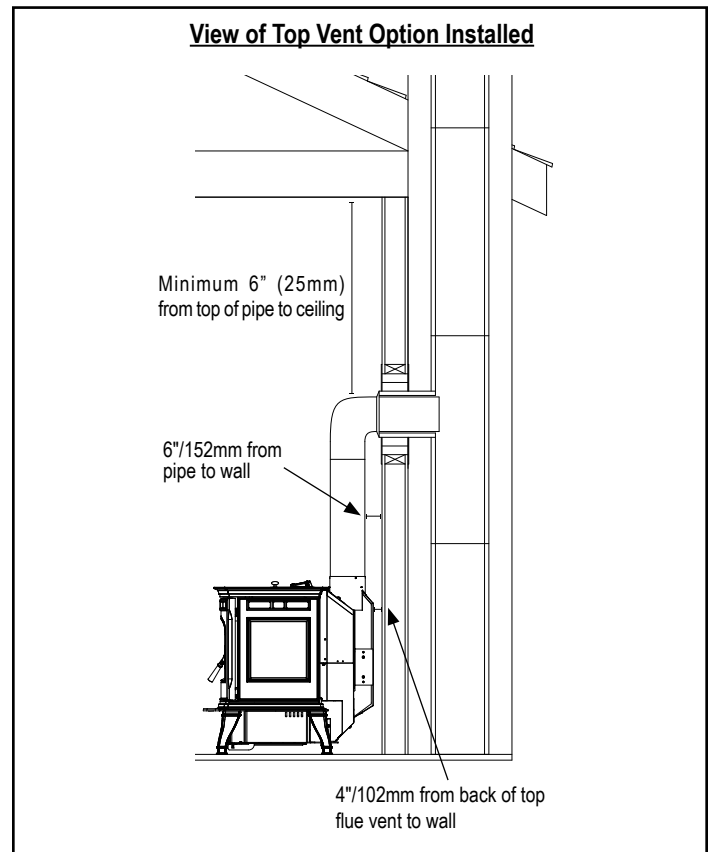


Figure 4.10

Optional Top Vent Pipe Clearances



Chimney Connectors

- Seal single wall joints with silicone to prevent smoke leakage.
- Use three (3) screws at each Joint.

B. Chimney Diagram

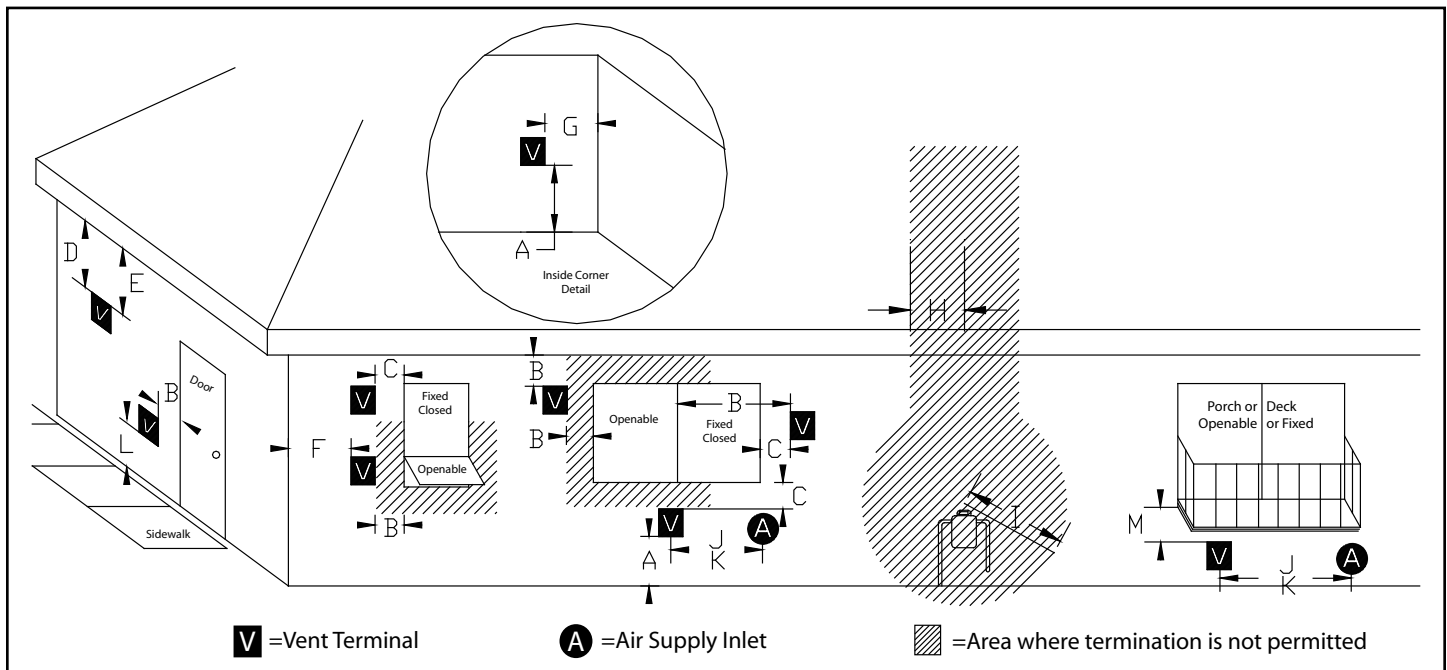


Figure 4.10

Requirements for Terminating the Venting



WARNING

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

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)**

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 or a minimum of 7 feet below the outlet.

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.

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

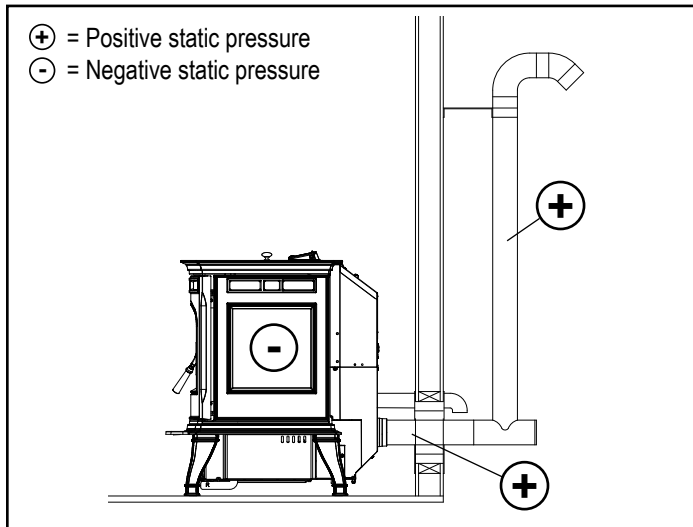


Figure 4.11

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 Vent 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
<u>Termination Cap</u>	= 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 Vent 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:

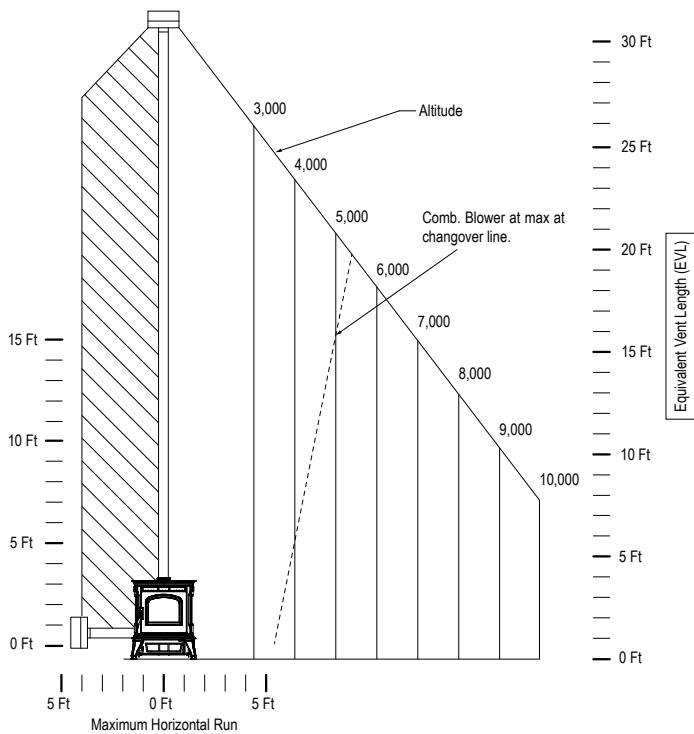
2 ft. of Horizontal Pipe (1 x 2 EVL)	= 2 EVL
90° Tee (1 x 5 EVL)	= 5 EVL
4 ft. of Vertical Pipe (4 x .5 EVL)	= 2 EVL
90° Elbow (1 x 5 EVL)	= 5 EVL
90° Tee (1 x 5 EVL)	= 5 EVL
21 ft. of Vertical Liner (21 x .5 EVL)	= 10.5 EVL
<u>Termination Cap</u>	= 0 EVL
Equivalent Vent Length	= 29.5 EVL

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.

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 the 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

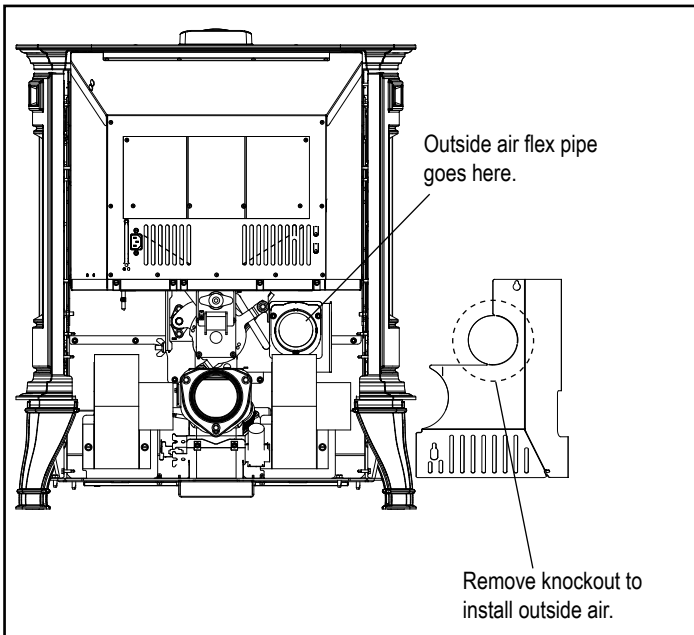


Figure 4.12

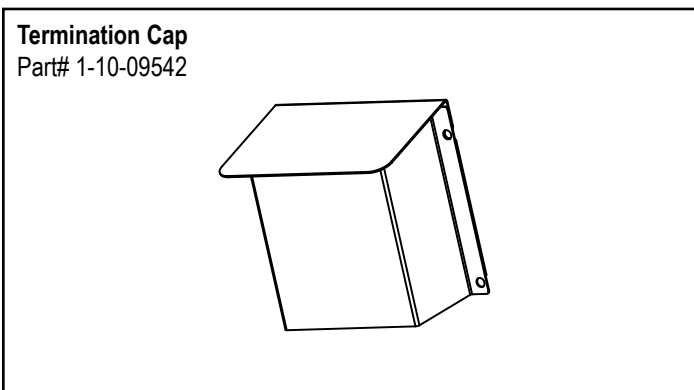


Figure 4.13

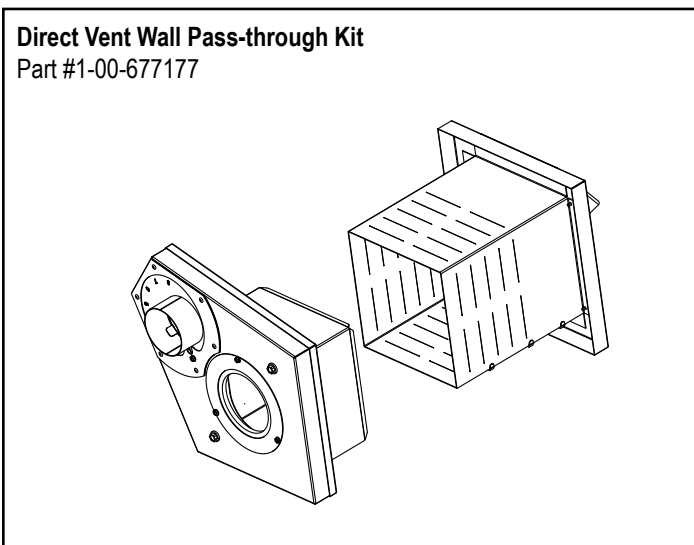


Figure 4.14

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. There is a break-away hole on the rear panel of the Absolute63 stove which must be removed before connecting the flex pipe, Figure 4.12. 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 4.13.

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 4.14.

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 in your appliance use a manahelic 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
-------------------------------------	------------

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 vent 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 in most cases; however, in some cases a perfect seal is not achieved. For this reason and the fact that the Absolute63 operates with a positive vent pressure, we specify that the joints also be sealed with silicone or aluminum tape in addition to the sealing system used by the manufacturer.

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.
- Installing outside air.

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.



WARNING



Fire Risk.

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

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

Or any such action that may cause a fire hazard.

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 Absolute63 is bolted (5/16" x 2" Lag Screws) to the skid to prevent movement during shipping.

To free the stove from the skid you must remove the Lag Screws from each shipping bracket using a 1/2" socket or wrench. Figure 5.1.

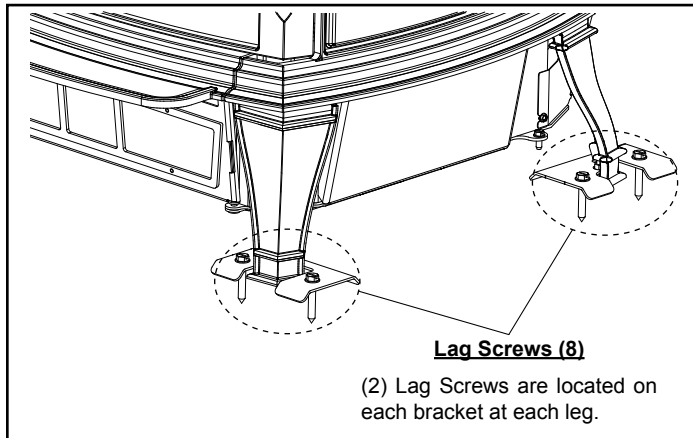


Figure 5.1

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 at the pressure switch 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)

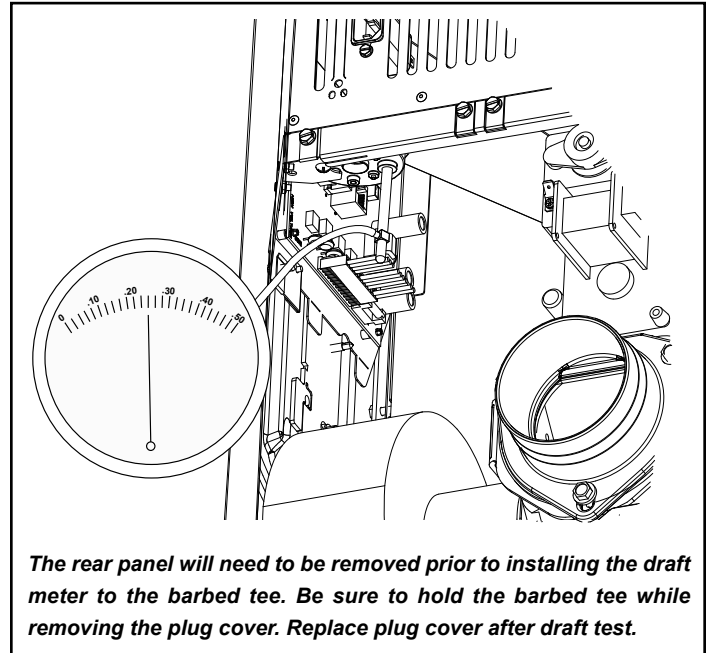


Figure 5.2

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.

6 Reference Material

A. Safety Reminders

When installing and operating your Harman® Absolute63, respect basic safety standards. Read these instructions carefully before you attempt to install or operate the Absolute63. 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

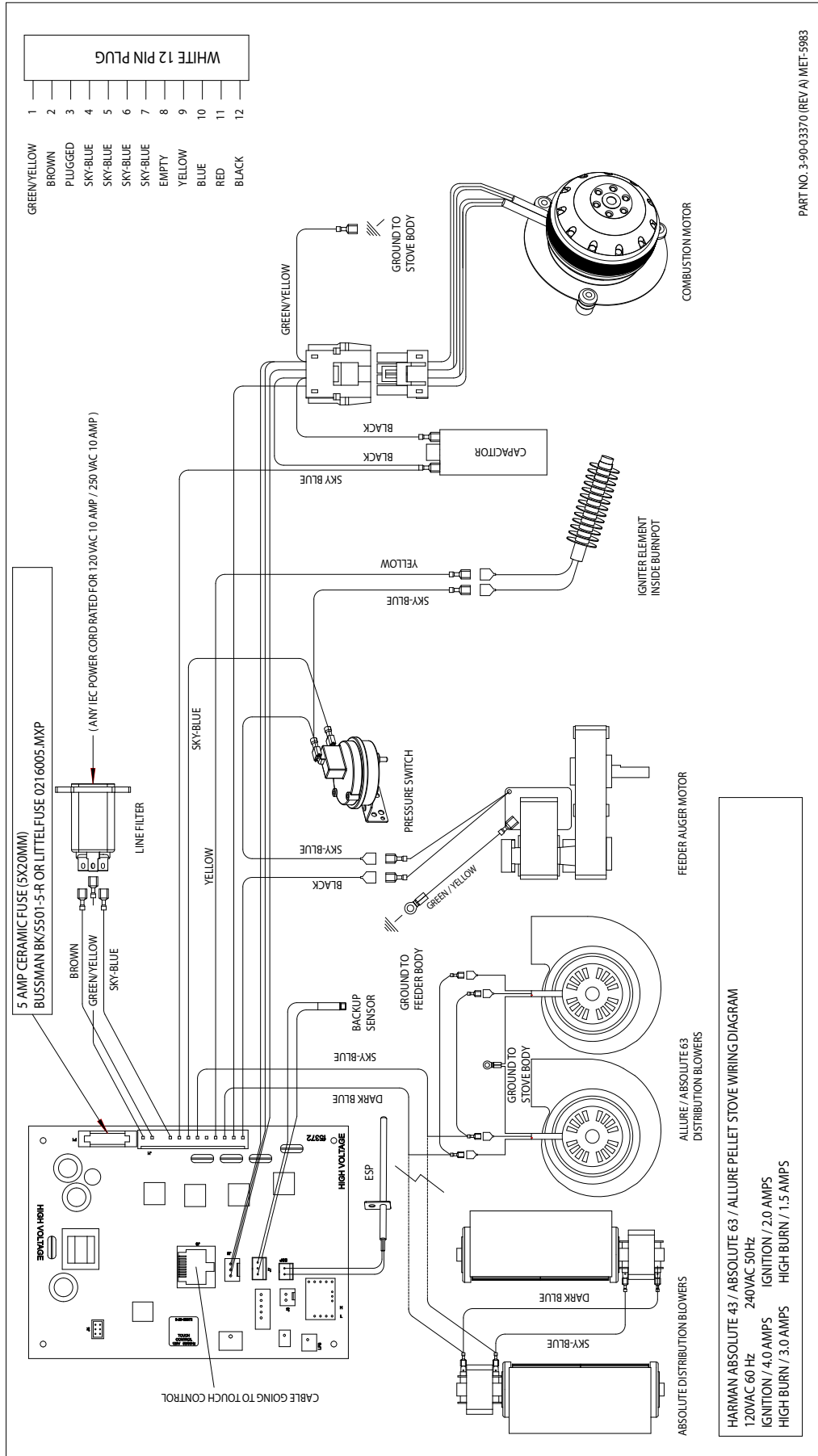
THIS APPLIANCE MUST BE VENTED TO THE OUTSIDE.



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.

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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®

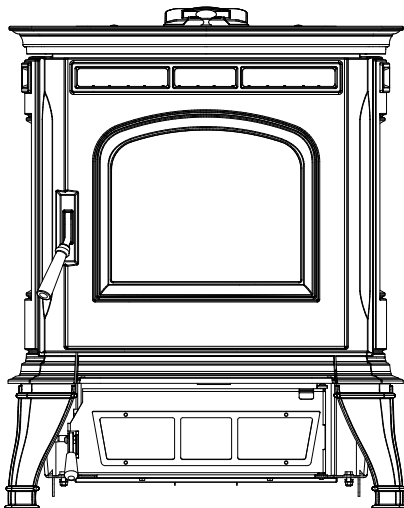
BUILT TO A STANDARD, NOT A PRICE

Model(s):

Absolute63 Freestanding Pellet Stove



Absolute63
Use & Care Video



Tested & Listed By Portland Oregon USA
OMNI-Test Laboratories, Inc.



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.



CAUTION

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



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.

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

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▲ 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.

3 Reference Materials

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→ = Contains updated information

1 Product Specific and Important Safety Information

A. Appliance Certification / Specifications

MODEL:	Absolute63 Pellet Stove
LABORATORY:	OMNI Test Laboratories, Inc
REPORT NO.	0135PS036S & 0135PS036E
TYPE:	Pellet Fueled/Supplementary For Residential Use
STANDARD(s):	ASTM E 2779-10, ASTM E 2515-11, ASTM E 1509-12, ULC-S627-00, EPA Method 28R
ELECTRICAL RATING:	115 VAC, 60 Hz, Start 3.5 AMPS, Run 2.5 AMPS
GLASS SPECIFICATION:	5mm mirrored ceramic glass

The Absolute63 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 E 1509-12, ULC-S627-00, (UM) 84-HUD**

B. Mobile Home Approval

This appliance is approved for mobile and manufactured 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" or "L" connector pipe.

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



WARNING

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

DO NOT INSTALL IN SLEEPING ROOM.

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

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

C. BTU & Efficiency Specifications

EPA Certification Number:	
EPA Certified Emissions:	1.4 g/hr
*LHV Tested Efficiency:	83.2%
**HHV Tested Efficiency:	77.1%
***EPA BTU Output:	10,600 - 49,100
****BTU Input	14,100 - 67,200
Vent Size:	3 Inch
Hopper Capacity:	72 lbs
Fuel:	Wood Pellets

* 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.

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

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.

D. Appliance Safety (Cont.)

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. It is imperative that control compartments and circulating air passageways of this stove be kept clean.

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.

E. 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.

WARNING

USE OF IMPROPER FUELS, FIRESTARTERS 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

THE STOVE IS HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS.

F. Helpful Hints

When operating your Harman® Absolute63 Pellet Stove, follow basic safety standards. Read these instructions carefully before you attempt to operate the Absolute63 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 - All interior seams and joints should be sealed with silicone where applicable. Follow vent manufacturers instructions for proper sealing.



CAUTION

This appliance must be vented to the outside

G. Fuel Specifications

The Absolute63 Pellet Stove is approved for burning any grade of pelletized bio-mass fuel.

It should be noted, that higher ash content fuel 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.

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

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.

G. Fuel Specifications (Cont.)

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.

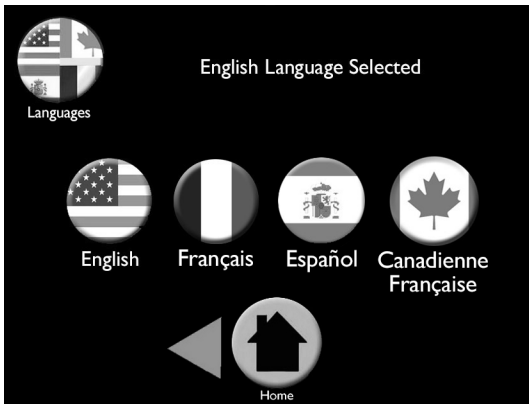
WARNING

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.

H. Quick Start Guide

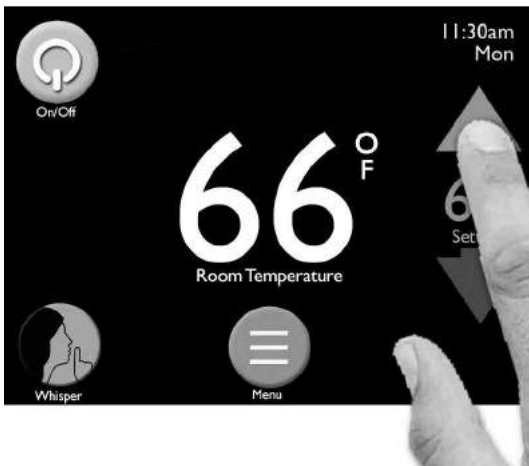


Initial start-up Only

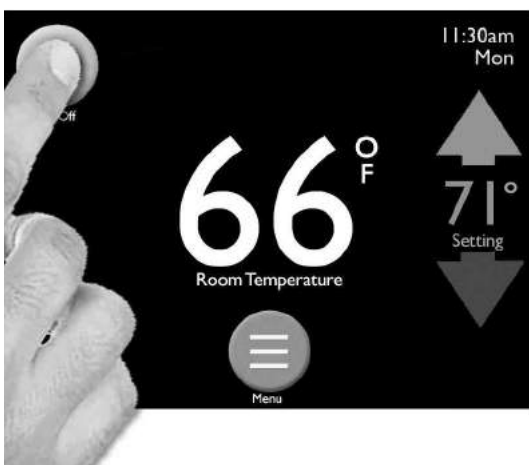
1. Select Language



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.

I. 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 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.	<p>Ensure there are pellets in burnpot.</p> <p>Ensure holes in burnpot are clear of obstructions above the igniter. See Burnpot Maintenance.</p> <p>Check to see if the ignitor is getting hot, if not replace ignitor.</p> <p>*See manual ignition instructions for emergency heating needs.</p>

J. 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	Scrape Burn Pot and Reset Here 	When prompted, scrape burnpot. Press check-mark to reset.
	Empty Ash Pan and Press Here 	When prompted, inspect and empty ash pan as needed. Press check-mark to reset.
	Total Clean and Reset 	When prompted, inspect and perform total clean. Press check-mark to reset.
MESSAGES	Touch Here If Hopper Was Filled 	Press check-mark if you filled the hopper. If you did not fill hopper, The message will disappear in 30 seconds.
	Wireless Sensor Low Battery Warning	Replace the 2 “AA” batteries in the Wireless Remote Sensor.
	Using Backup Sensor	If Wireless Remote Sensor batteries die, the Back Up Sensor will continue to heat your home.
ERRORS	Warning: Door Open	Check and close the front and ash doors for the stove to continue to heat.
	Warning: Hopper Lid Open	Close the hopper lid for the stove to continue to heat.
	Error: Check Fuel and Reset 	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.
	Wireless Signal Lost Replace Batteries in Wireless Sensor	Batteries in Wireless Remote Sensor have expired. Replace the 2 “AA” batteries.
	Return Air Sensor Failure	Return Air Sensor has failed. Call your Harman Dealer.
	Ignition Failure Correct and Reset 	Unit has failed to ignite. Scrape the burnpot. Call your Harman Dealer if problem persists.
	Connection Failure Control <===> Display	Touch Control has lost communication to the stove. Call your Harman Dealer.
	Exhaust Sensing Probe Failure	Exhaust Sensing Probe (ESP) as failed. Clean the ESP. If issue persists, call your Harman Dealer.
	Combustion Error Correct and Reset 	Clean your stove. Call your Harman Dealer if problem persists.

2 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.

A. Proper Shutdown Procedure

 CAUTION	
	<p>Shock and Smoke Hazard</p> <ul style="list-style-type: none"> • 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.

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. <i>Not properly cleaning your appliance on a regular basis will void your warranty.</i>

Follow the detailed instructions found in this section for each step listed in the chart below.

B. Quick Reference Maintenance Chart

Cleaning or Inspection	Frequency		Daily	Weekly	Monthly	Yearly
Ash Pan	Every 5 bags of fuel depending on the fuel type or ash build-up	OR		X		
Ash Removal from Firebox	Every 5 bags or more frequently depending on the fuel type or ash build-up	OR		X		
Heat Exchanger	Every 1 ton of fuel	OR			X	
Fan, Combustion (Exhaust)	More frequently depending on the fuel type	OR				X
Fan, Distribution	Every 25 bags or more frequently depending on the fuel type	OR			X	
Door Gasket Inspection	Prior to heating season	OR				X
Exhaust Path	More frequently depending on ash build-up	OR				X
Firebox - Prepare for Non-Burn Season	At end of heating season	OR				X
Burnpot - Burning pellets - hardwood	Every 3 bags	OR	X			
Burnpot - Burning pellets - softwood	Every 5 bags	OR	X			
Glass	When clear view of burnpot becomes obscure	OR		X		
Hopper / Hopper Lid Gasket	Every 50 bags of fuel or when changing fuel types	OR			X	
Venting System	More frequently depending on the fuel type	OR				X

C. Burnpot Maintenance

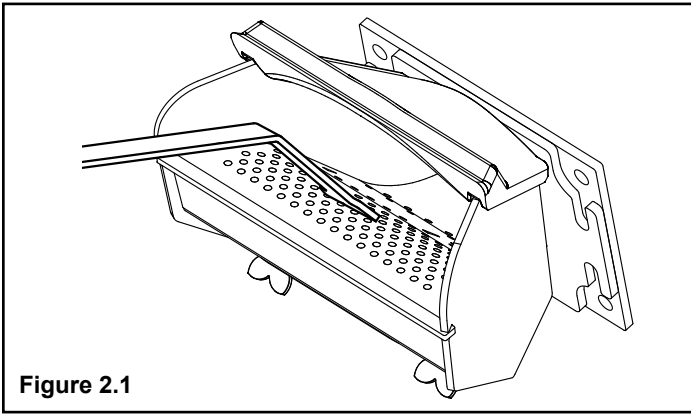


Figure 2.1

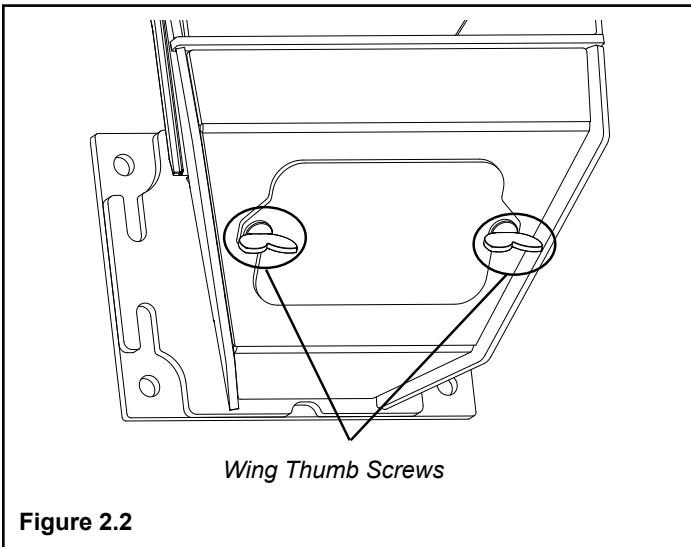


Figure 2.2

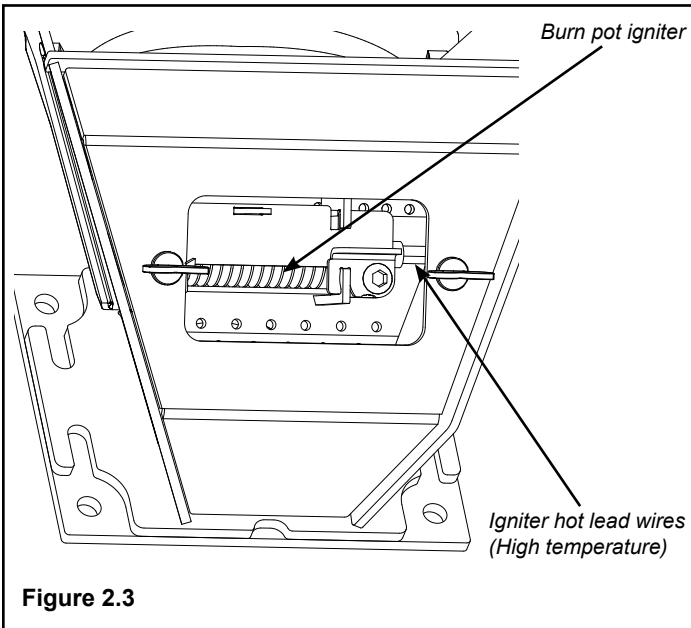


Figure 2.3

Viewed from below through the ash pan opening.

Whenever adding fuel, take the opportunity to clean the burn pot. **(Weekly at minimum)**

- Scrape the top grate and sides of the burn pot down to auger tube Figure 2.1. It is not necessary to completely remove all material from the burn pot. The excess will be pushed out during the next use.
- With the fire out and burn pot cold, 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.

Monthly, or after each ton of fuel burned:

- Loosen the (2) wing thumb screws on the lower front angle of the burn pot. Figure 2.2
- Lift off the clean-out cover to open the bottom clean-out chamber. Figure 2.3

⚠ DANGER

Disconnect the power to the unit before removing cover.

- Clean ash buildup from inside the chamber while cover is off. Use the scraper tool and tap on the top front edge of the burn pot. This will help knock loose ash and other debris down through the burnpot. Prior to reinstalling the clean-out cover, ensure the igniter and bracket is clear of any ash build-up. Build-up can be removed using a vacuum.

Figure 2.3

The igniter is made to be removable for service by insulated male/female wire connectors. These connections between the hot leads (the wires inside the burn pot) and the cold leads (the wires from the control board) are always pulled to the inside rear of the feeder body. **(Not coiled inside the burn pot.)**

It is very important that these connections are to the inside rear of the feeder body. Also, the extra wire of the igniter wire service loop must be pulled out through the rear of the feeder and tied up so that it will not be damaged by any moving parts.

⚠ WARNING

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.

D. Combustion Fan Chamber

Monthly Cleaning- continued:

The combustion inlet cover is located behind the ash pan must be removed to properly clean the combustion fan blade. Figure 2.4.

- Remove the combustion inlet cover by pulling up on cover. This allows access to the combustion fan blade and exhaust path. Figure 2.4.
- Remove any flyash or debris that has collected around combustion fan blade with the provided paint brush.
- Clean exhaust passage.

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.

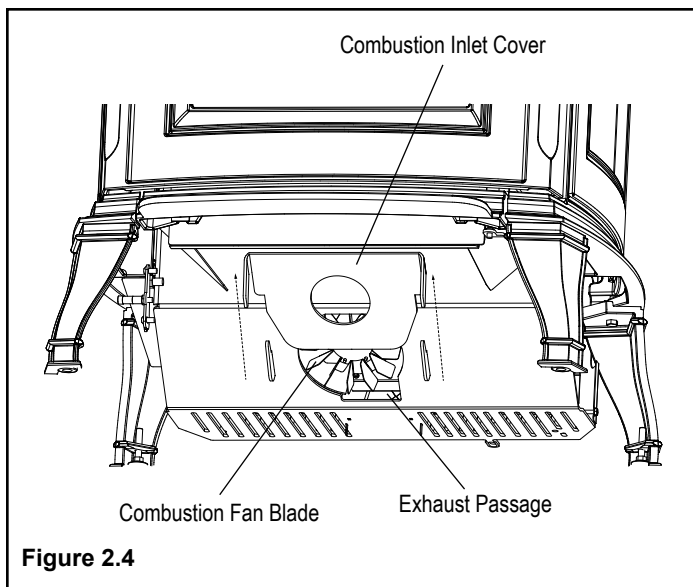


Figure 2.4

E. Glass Maintenance

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 - Cleaning

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.

Glass - Replacement

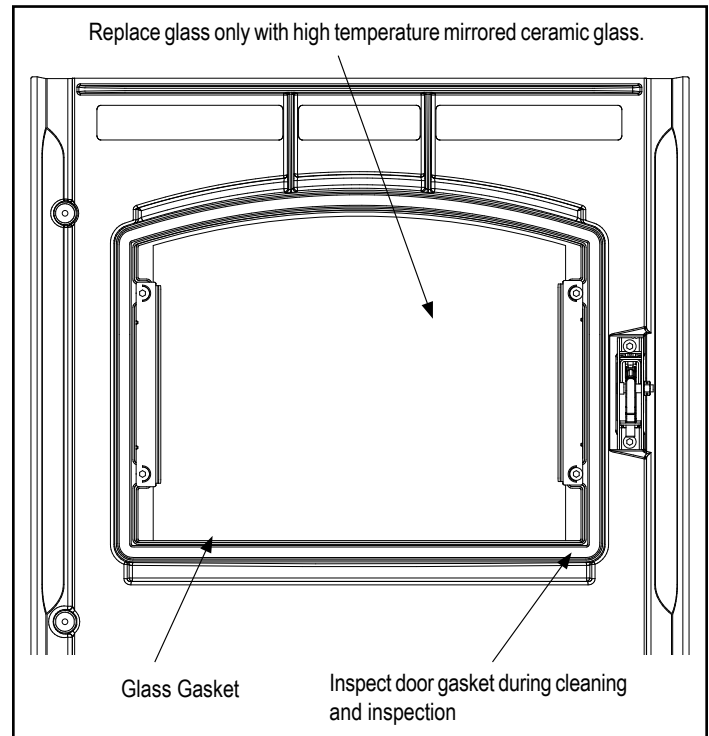
If the stove's glass is cracked or broken, you must replace it before operating your stove. Remove pieces carefully. Replace glass only with Harman® replacement glass; **do not use substitutes.**

Glass - Replacement (Cont.)

Carefully remove damaged glass, gasket material, and hold down clips (set aside).

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 hold down clips and tighten with bolts.

Be sure to keep firing and de-ashing doors closed and ensure all seals are maintained and are in good condition



F. Firebox

Yearly Cleaning:

Remove flyash and carbon buildup from the smooth surfaces of the heat exchanger as well as other surfaces inside the firebox. Figure 2.7.

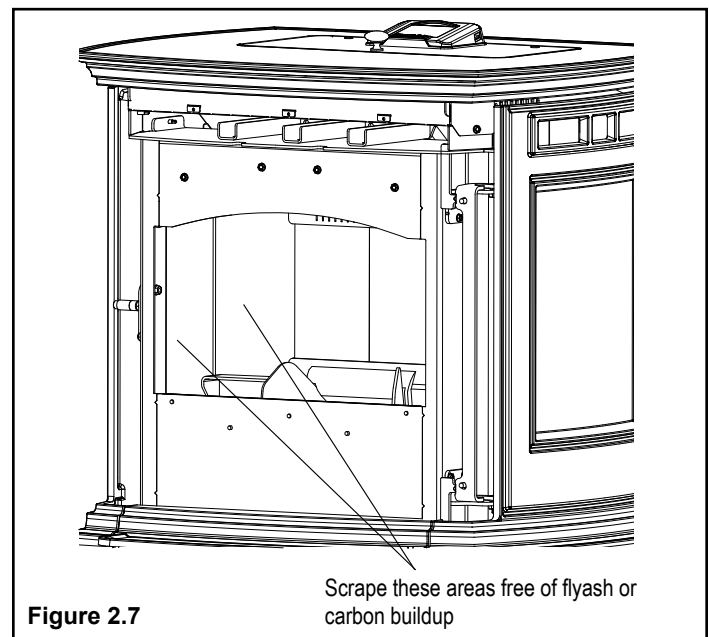


Figure 2.7

3 Reference Material

A. Service Parts

**Service Parts
List**

Service Parts List

Service Parts List

Service Parts List

Service Parts List

B. Limited Lifetime Warranty

Hearth & Home Technologies LIMITED LIFETIME WARRANTY

Hearth & Home Technologies, on behalf of its hearth brands ("HHT"), extends the following warranty for HHT gas, wood, pellet, coal and electric hearth appliances that are purchased from an HHT authorized dealer.

WARRANTY COVERAGE:

HHT warrants to the original owner of the HHT appliance at the site of installation, and to any transferee taking ownership of the appliance at the site of installation within two years following the date of original purchase, that the HHT appliance will be free from defects in materials and workmanship at the time of manufacture. After installation, if covered components manufactured by HHT are found to be defective in materials or workmanship during the applicable warranty period, HHT will, at its option, repair or replace the covered components. HHT, at its own discretion, may fully discharge all of its obligations under such warranties by replacing the product itself or refunding the verified purchase price of the product itself. The maximum amount recoverable under this warranty is limited to the purchase price of the product. This warranty is subject to conditions, exclusions and limitations as described below.

WARRANTY PERIOD:

Warranty coverage begins on the date of original purchase. In the case of new home construction, warranty coverage begins on the date of first occupancy of the dwelling or six months after the sale of the product by an independent, authorized HHT dealer/ distributor, whichever occurs earlier. The warranty shall commence no later than 24 months following the date of product shipment from HHT, regardless of the installation or occupancy date. The warranty period for parts and labor for covered components is produced in the following table.

The term "Limited 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, pellet, and coal appliances. These time periods reflect the minimum expected useful lives of the designated components under normal operating conditions.

Warranty Period		HHT Manufactured Appliances and Venting							Components Covered
Parts	Labor	Gas	Wood	Pellet	EPA Wood	Coal	Electric	Venting	
1 Year		X	X	X	X	X	X	X	All parts and material except as covered by Conditions, Exclusions, and Limitations listed
2 years				X	X	X			Igniters, electronic components, and glass
		X	X	X	X	X			Factory-installed blowers
			X						Molded refractory panels
3 years				X					Firepots and burnpots
5 years	1 year			X	X				Castings and baffles
7 years	3 years		X	X	X				Manifold tubes, HHT chimney and termination
10 years	1 year	X							Burners, logs and refractory
Limited Lifetime	3 years	X	X	X	X	X			Firebox and heat exchanger
90 Days		X	X	X	X	X	X	X	All replacement parts beyond warranty period

See conditions, exclusions, and limitations on next page.

B. Limited Lifetime Warranty (*continued*)

WARRANTY CONDITIONS:

- This warranty only covers HHT appliances that are purchased through an HHT authorized dealer or distributor. A list of HHT authorized dealers is available on the HHT branded websites.
- This warranty is only valid while the HHT appliance 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 appliance resides.
- Contact your installing dealer for warranty service. If the installing dealer 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 product.
- Check with your dealer 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 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. These parts include: paint, wood, pellet and coal 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 appliance in accordance with the installation instructions, operating instructions, and listing agent identification label furnished with the appliance; (2) failure to install the appliance 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 operating instructions; (7) installation or use of components not supplied with the appliance 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 appliance.
- Non-HHT venting components, hearth components or other accessories used in conjunction with the appliance.
- Any part of a pre-existing fireplace system in which an insert or a decorative gas appliance is installed.
- HHT's obligation under this warranty does not extend to the appliance's capability to heat the desired space. Information is provided to assist the consumer and the dealer in selecting the proper appliance for the application. Consideration must be given to appliance location and configuration, environmental conditions, insulation and air tightness of the structure.

This warranty is void if:

- The appliance has been over-fired or 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, rust colored cast iron, bubbling, cracking and discoloration of steel or enamel finishes.
- The appliance is subjected to prolonged periods of dampness or condensation.
- There is any damage to the appliance or other components due to water or weather damage which is the result of, but not limited to, improper chimney or venting installation.

LIMITATIONS OF LIABILITY:

- The owner's exclusive remedy and HHT's sole obligation under this warranty, under any other warranty, express or implied, or in contract, tort or otherwise, shall be limited to replacement, repair, or refund, as specified above. In no event will HHT be liable for any incidental or consequential damages caused by defects in the appliance. Some states do not allow exclusions or limitation of incidental or consequential damages, so these limitations may not apply to you. This warranty gives you specific rights; you may also have other rights, which vary from state to state. EXCEPT TO THE EXTENT PROVIDED BY LAW, HHT MAKES NO EXPRESS WARRANTIES OTHER THAN THE WARRANTY SPECIFIED HEREIN. THE DURATION OF ANY IMPLIED WARRANTY IS LIMITED TO DURATION OF THE EXPRESSED WARRANTY SPECIFIED ABOVE.

C. Loss of Power

Minimizing Smoke During Loss of Power Using Battery Back-up

Harman® strongly recommends installing battery back-up to minimize entry of smoke into the room in the event of power loss.

Your pellet/biomass burning appliance relies on a combustion blower to remove exhaust. A power failure will cause the combustion blower to stop. This may lead to exhaust seeping into the room. Vertical rise in the venting may provide natural draft. It is, however, no guarantee against leakage.

There are two Harman® approved battery back-up options for your appliance:

Uninterruptible Power Supply (UPS) battery back-ups are available online or at computer and office equipment stores. Your Harman® appliance may be plugged directly into a Harman® approved UPS:

- The APC (American Power Conversion) model #BE750G and the TrippLite model INTERNET750U are 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.**

- The Surefire 512 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.

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 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.



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	<ul style="list-style-type: none"> • No fuel in hopper. • 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. • Restriction in the hopper or feeder. Remove all fuel and examine. Clear the obstruction. • Feed motor has failed.
Partially burned pellets	<ul style="list-style-type: none"> • Feed rate too high. • Poor air to fuel mixture. (Check burn pot clean-out cover and air intake). • Burn pot may need to be cleaned. • 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	<ul style="list-style-type: none"> • No fuel in hopper. • Draft is too low, blocked flue. • Something is restricting fuel flow. • Hopper lid not closed properly. • Feed motor or combustion fan has failed.
Smoke is visible coming out of vent	<ul style="list-style-type: none"> • Air-fuel ratio is too rich. <ul style="list-style-type: none"> - Feed rate too high. - Draft too low caused by a gasket leak.
Low heat output	<ul style="list-style-type: none"> • Feed rate too low. • Draft too low because of gasket leak. • Poor quality or damp pellets. • Combination of 1 and 2.
Stove does not ignite but igniter is operating correctly	<ul style="list-style-type: none"> • Burnpot has excess ash located around igniter and bracket. • Burpot grate holes are blocked or partially block.

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 -

NOTICE



- Important operating and maintenance instructions included.

DO NOT DISCARD THIS MANUAL

- 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.

Section 5

Test Data by Run

(Note – Hearth & Home Technologies – Halifax is referred to by its previous name, Harman, throughout the test run documentation.)

*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Run 1

Pellet Heater Test Results - ASTM E2779 / ASTM E2515

Manufacturer: Harman
 Model: Absolute 63
 Project No.: 0135PS036E.REV001
 Tracking No.: 2146
 Run: 1
 Test Date: 02/08/16

Burn Rate (Composite)	1.86 kg/hr dry
Average Tunnel Temperature	91 degrees F
Average Gas Velocity in Dilution Tunnel - vs	12.15 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8185.5 dscf/hour
Average Delta p	0.044 inches H2O
Average Delta H	1.27 inches H2O
Total Time of Test	363 minutes

Burn Rate (High)	3.59 kg/hr dry
Burn Rate (Med)	1.67 kg/hr dry 46.5% of High
Burn Rate (Low)	1.40 kg/hr dry 38.9% of High

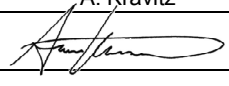
	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	1 st HR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	57.443 cubic feet	54.610 cubic feet	9.515 cubic feet
Average Gas Meter Temperature	71 degrees F	81 degrees F	80 degrees F	73 degrees F
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	57.194 dscf	54.412 dscf	9.605 dscf
Total Particulates - m _p	0 mg	13.4 mg	13.1 mg	5.2 mg
Particulate Concentration (dry-standard) - C _p /C _s	0.000000 grams/dscf	0.00023 grams/dscf	0.00024 grams/dscf	0.00054 grams/dscf
Total Particulate Emissions - E _T	0.00 grams	11.60 grams	11.92 grams	4.43 grams
Particulate Emission Rate	0.00 grams/hour	1.92 grams/hour	1.97 grams/hour	4.43 grams/hour
Emissions Factor		1.03 g/kg	1.06 g/kg	1.22 g/kg
Difference from Average Total Particulate Emissions		0.16 grams	0.16 grams	
Dual Train Comparison Results Are Acceptable				

FINAL AVERAGE RESULTS

Integrated Test Run	
Total Particulate Emissions - E _T	11.76 grams
Particulate Emission Rate	1.94 grams/hour
Emissions Factor	1.04 grams/kg
First Hour Emissions	
Total Particulate Emissions - E _T	4.43 grams
Particulate Emission Rate	4.43 grams/hour
Emissions Factor	1.22 grams/kg

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/08/16
Run: 1
Control #: 2146
Test Duration: 363
Output Category: Integrated

Technicians: A. Kravitz


Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	78.3%	83.8%
Combustion Efficiency	95.5%	95.5%
Heat Transfer Efficiency	82%	87.8%

Output Rate (kJ/h)	28,436	26,975	(Btu/h)
Burn Rate (kg/h)	1.86	4.11	(lb/h)
Input (kJ/h)	36,318	34,451	(Btu/h)

Test Load Weight (dry kg)	11.27	24.84	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	763		
Test Duration (h)	6.05		

Emissions	Particulate	CO
g/MJ Output	0.00	4.43
g/kg Dry Fuel	0.00	67.66
g/h	0.00	126.06
lb/MM Btu Output	0.00	10.30

Air/Fuel Ratio (A/F)	13.44
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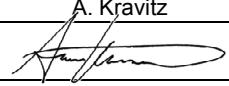
VERSION:

2.3

3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/08/16
Run: 1
Control #: 2146
Test Duration: 62
Output Category: Maximum

Technicians: A. Kravitz


Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	68.6%	73.4%
Combustion Efficiency	85.8%	85.8%
Heat Transfer Efficiency	80%	85.6%

Output Rate (kJ/h)	48,070	45,599	(Btu/h)
Burn Rate (kg/h)	3.59	7.92	(lb/h)
Input (kJ/h)	70,064	66,463	(Btu/h)

Test Load Weight (dry kg)	3.71	8.19	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	724		
Test Duration (h)	1.03		

Emissions	Particulate	CO
g/MJ Output	0.00	14.58
g/kg Dry Fuel	0.00	194.97
g/h	0.00	700.81
lb/MM Btu Output	0.00	33.88

Air/Fuel Ratio (A/F)	9.04
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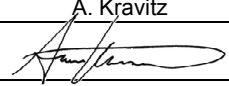
VERSION:

2.3

3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/08/16
Run: 1
Control #: 2146
Test Duration: 121
Output Category: Medium

Technicians: A. Kravitz


Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	81.6%	87.4%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	82%	87.8%

Output Rate (kJ/h)	26,582	25,216	(Btu/h)
Burn Rate (kg/h)	1.67	3.68	(lb/h)
Input (kJ/h)	32,561	30,888	(Btu/h)

Test Load Weight (dry kg)	3.37	7.42	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	23		
Test Duration (h)	2.02		

Emissions	Particulate	CO
g/MJ Output	0.00	0.43
g/kg Dry Fuel	0.00	6.86
g/h	0.00	11.46
lb/MM Btu Output	0.00	1.00

Air/Fuel Ratio (A/F)	13.97
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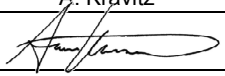
VERSION:

2.3

3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/08/16
Run: 1
Control #: 2146
Test Duration: 180
Output Category: Minimum

Technicians: A. Kravitz


Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	82.7%	88.5%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	83%	89.0%

Output Rate (kJ/h)	22,513	21,356	(Btu/h)
Burn Rate (kg/h)	1.40	3.08	(lb/h)
Input (kJ/h)	27,220	25,821	(Btu/h)

Test Load Weight (dry kg)	4.19	9.23	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	47		
Test Duration (h)	3.00		

Emissions	Particulate	CO
g/MJ Output	0.00	0.69
g/kg Dry Fuel	0.00	11.19
g/h	0.00	15.62
lb/MM Btu Output	0.00	1.61

Air/Fuel Ratio (A/F)	15.62
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VERSION:

2.3

3/23/2010

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{strav}	12.31			ft/sec			V_{scent}	14.28	
	ft/sec			ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data					
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)	
0	0.000	0.000			0.05	67	0.15	1.38	67	2.14	1.06	68	-0.5	107	0.044			383	72	73	72	-0.020	10.7	1.9
1	0.145	0.143	0.15	0.14	1.38	67	2.14	1.06	68	1	108	0.044	95	99	30.0	-0.1	382	73	74	72	-0.019	10.2	1.8	
2	0.308	0.290	0.16	0.15	1.39	67	2.15	1.06	68	1	108	0.044	107	101	29.8	-0.2	382	74	74	72	-0.021	10	1.6	
3	0.470	0.438	0.16	0.15	1.39	67	2.16	1.07	68	1	108	0.044	107	102	29.7	-0.1	382	74	75	72	-0.021	9.9	1.7	
4	0.632	0.585	0.16	0.15	1.38	67	2.16	1.07	68	1	108	0.044	107	101	29.6	-0.1	382	74	75	72	-0.019	10	1.7	
5	0.794	0.733	0.16	0.15	1.38	68	2.16	1.07	68	1	108	0.044	106	102	29.4	-0.2	383	74	75	72	-0.020	9.8	1.6	
6	0.956	0.881	0.16	0.15	1.38	68	2.16	1.06	68	1	108	0.044	106	102	29.3	-0.1	383	74	75	72	-0.020	10.5	1.7	
7	1.119	1.030	0.16	0.15	1.38	68	2.17	1.06	68	1	108	0.044	107	103	29.1	-0.2	383	74	75	72	-0.020	10.1	1.8	
8	1.281	1.178	0.16	0.15	1.39	68	2.17	1.06	69	1	108	0.044	106	102	29.0	-0.1	383	74	75	72	-0.020	10.2	2.2	
9	1.444	1.326	0.16	0.15	1.38	68	2.15	1.06	69	1	108	0.044	107	102	28.9	-0.1	382	74	75	72	-0.020	10.3	2.2	
10	1.606	1.474	0.16	0.15	1.37	69	2.16	1.07	69	1	109	0.044	106	102	28.7	-0.2	383	74	75	72	-0.020	10	2.1	
11	1.768	1.622	0.16	0.15	1.38	69	2.15	1.06	69	1	108	0.044	106	102	28.6	-0.1	384	75	75	73	-0.020	10	2.2	
12	1.930	1.770	0.16	0.15	1.38	69	2.15	1.06	69	1	108	0.044	106	102	28.4	-0.2	384	75	75	72	-0.020	10.6	2.2	
13	2.092	1.919	0.16	0.15	1.38	69	2.16	1.06	70	1	108	0.044	106	102	28.3	-0.1	382	75	75	72	-0.020	10	2	
14	2.255	2.068	0.16	0.15	1.38	70	2.15	1.07	70	1.1	108	0.044	107	102	28.2	-0.1	383	75	75	72	-0.021	9.9	2	
15	2.418	2.216	0.16	0.15	1.37	70	2.16	1.06	70	1	108	0.044	107	102	28.0	-0.2	382	75	76	73	-0.020	10	2.2	
16	2.579	2.364	0.16	0.15	1.37	70	2.15	1.07	70	1.1	109	0.044	105	102	27.9	-0.1	382	75	76	73	-0.020	9.9	2.1	
17	2.741	2.513	0.16	0.15	1.37	70	2.15	1.06	71	1.1	109	0.044	106	102	27.8	-0.1	383	75	76	73	-0.020	10	2.2	
18	2.903	2.662	0.16	0.15	1.38	71	2.15	1.06	71	1.1	109	0.044	106	102	27.6	-0.2	383	75	76	71	-0.020	10.3	2.4	
19	3.065	2.811	0.16	0.15	1.37	71	2.16	1.06	71	1.1	109	0.044	106	102	27.5	-0.1	384	75	76	71	-0.020	10.1	2.2	
20	3.228	2.959	0.16	0.15	1.38	71	2.16	1.06	72	1.1	108	0.044	106	101	27.3	-0.2	385	75	76	72	-0.021	10.7	1.8	
21	3.391	3.107	0.16	0.15	1.37	72	2.16	1.06	72	1.1	108	0.044	106	101	27.2	-0.1	384	75	76	73	-0.021	10.5	1.9	
22	3.546	3.256	0.16	0.15	1.27	72	2.05	1.06	72	1.1	109	0.044	101	102	27.1	-0.1	384	75	76	72	-0.020	10	2	
23	3.702	3.405	0.16	0.15	1.28	72	2.06	1.06	72	1.1	109	0.044	102	102	26.9	-0.2	384	75	76	73	-0.020	10.3	2.3	
24	3.859	3.554	0.16	0.15	1.27	72	2.06	1.05	73	1.1	109	0.044	102	102	26.8	-0.1	383	75	76	73	-0.021	9.8	2.1	
25	4.015	3.701	0.16	0.15	1.28	73	2.06	1.06	73	1.1	109	0.044	102	101	26.6	-0.2	382	75	76	73	-0.021	10.3	1.9	
26	4.172	3.852	0.16	0.15	1.27	73	2.06	1.10	73	1.1	109	0.044	102	103	26.5	-0.1	383	75	76	73	-0.021	10	1.5	
27	4.327	4.005	0.16	0.15	1.27	73	2.06	1.10	73	1.1	109	0.044	101	105	26.3	-0.2	382	75	76	73	-0.021	10	2	
28	4.484	4.156	0.16	0.15	1.28	73	2.07	1.11	74	1.1	108	0.044	102	103	26.2	-0.1	381	75	76	73	-0.020	9.3	2	
29	4.640	4.309	0.16	0.15	1.27	74	2.09	1.10	74	1.1	108	0.044	101	104	26.1	-0.1	380	75	76	73	-0.021	9.4	2.1	
30	4.797	4.461	0.16	0.15	1.27	74	2.1	1.10	74	1.1	108	0.044	102	104	25.9	-0.2	381	75	76	73	-0.020	8.7	1.9	
31	4.954	4.613	0.16	0.15	1.27	74	2.1	1.11	74	1.1	108	0.044	102	104	25.8	-0.1	381	75	76	72	-0.021	9.7	2.1	
32	5.110	4.766	0.16	0.15	1.28	74	2.11	1.10	74	1.1	108	0.044	101	104	25.7	-0.1	382	75	76	71	-0.021	9.3	1.8	
33	5.267	4.919	0.16	0.15	1.28	75	2.12	1.11	75	1.1	108	0.044	102	104	25.5	-0.2	382	75	76	69	-0.021	9.9	2.1	
34	5.424	5.070	0.16	0.15	1.27	75	2.13	1.10	75	1.1	108	0.044	102	103	25.4	-0.1	382	75	76	69	-0.021	10	2.2	

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{strav}	12.31			ft/sec			V_{scent}	14.28	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
35	5.580	5.223	0.16	0.15	1.28	75	2.15	1.10	75	1.1	108	0.044	101	104	25.3	-0.1	381	75	76	70	-0.021	9.7	1.9
36	5.738	5.376	0.16	0.15	1.27	75	2.15	1.11	75	1.1	107	0.044	102	104	25.2	-0.1	381	75	76	72	-0.021	9.6	1.8
37	5.894	5.528	0.16	0.15	1.28	75	2.17	1.11	75	1.1	108	0.044	101	104	25.0	-0.2	381	75	76	72	-0.021	9.9	2
38	6.052	5.680	0.16	0.15	1.28	76	2.18	1.10	76	1.1	107	0.044	102	103	24.8	-0.2	382	75	76	72	-0.021	9.5	1.9
39	6.209	5.833	0.16	0.15	1.27	76	2.19	1.11	76	1.1	107	0.044	101	104	24.7	-0.1	381	75	76	72	-0.021	10	1.9
40	6.365	5.985	0.16	0.15	1.28	76	2.19	1.11	76	1.1	107	0.044	101	103	24.6	-0.1	381	75	76	71	-0.021	9.7	1.6
41	6.523	6.138	0.16	0.15	1.27	76	2.2	1.10	76	1.1	107	0.044	102	104	24.5	-0.1	381	75	76	72	-0.020	9.5	1.9
42	6.679	6.290	0.16	0.15	1.27	76	2.22	1.10	76	1.1	107	0.044	101	103	24.3	-0.2	383	75	76	71	-0.022	9.7	2
43	6.836	6.443	0.16	0.15	1.28	76	2.23	1.10	77	1.1	107	0.044	101	104	24.1	-0.2	384	75	76	71	-0.022	10.2	2.1
44	6.994	6.596	0.16	0.15	1.27	77	2.23	1.10	77	1.1	107	0.044	102	104	24.0	-0.1	384	75	76	71	-0.021	10.3	2.4
45	7.150	6.749	0.16	0.15	1.28	77	2.24	1.10	77	1.1	107	0.044	101	104	23.9	-0.1	383	75	76	72	-0.022	9.3	2.4
46	7.309	6.901	0.16	0.15	1.28	77	2.25	1.10	77	1.1	107	0.044	103	103	23.7	-0.2	384	75	76	71	-0.022	10.4	2.5
47	7.465	7.055	0.16	0.15	1.27	77	2.25	1.10	77	1.1	107	0.044	101	104	23.6	-0.1	385	75	76	71	-0.021	10	2.1
48	7.622	7.207	0.16	0.15	1.28	77	2.25	1.11	77	1.1	107	0.044	101	103	23.4	-0.2	385	75	76	71	-0.022	10.6	2.4
49	7.781	7.360	0.16	0.15	1.28	77	2.25	1.10	77	1.1	107	0.044	103	104	23.3	-0.1	385	75	75	71	-0.021	10.2	2.4
50	7.937	7.512	0.16	0.15	1.28	77	2.26	1.10	77	1.1	107	0.044	101	103	23.1	-0.2	384	75	75	71	-0.021	10.2	2.2
51	8.095	7.665	0.16	0.15	1.28	78	2.27	1.10	77	1.1	108	0.044	102	104	23.0	-0.1	384	75	75	71	-0.022	9.6	1.9
52	8.253	7.818	0.16	0.15	1.27	78	2.27	1.10	78	1.1	108	0.044	102	104	22.9	-0.1	383	75	75	70	-0.020	9.8	1.9
53	8.409	7.971	0.16	0.15	1.27	78	2.27	1.10	78	1.1	108	0.044	101	104	22.7	-0.2	383	75	75	71	-0.021	10	2.3
54	8.567	8.124	0.16	0.15	1.27	78	2.27	1.10	78	1.1	108	0.044	102	104	22.6	-0.1	382	75	75	71	-0.021	9.9	2.1
55	8.725	8.277	0.16	0.15	1.27	78	2.26	1.10	78	1.1	108	0.044	102	104	22.4	-0.2	384	74	75	70	-0.022	9.7	2.2
56	8.882	8.429	0.16	0.15	1.28	78	2.25	1.10	78	1.1	108	0.044	101	103	22.3	-0.1	383	74	75	71	-0.021	10.2	2.5
57	9.040	8.582	0.16	0.15	1.27	78	2.25	1.09	78	1.1	108	0.044	102	104	22.2	-0.1	382	74	75	71	-0.021	9.9	2.6
58	9.197	8.735	0.16	0.15	1.27	78	2.25	1.10	78	1.1	108	0.044	101	104	22.0	-0.2	382	74	75	71	-0.022	9.7	2.2
59	9.354	8.888	0.16	0.15	1.28	78	2.26	1.10	78	1.1	108	0.044	101	104	21.9	-0.1	384	74	75	71	-0.021	9.7	2.1
60	9.515	9.041	0.16	0.15	1.29	78	2.23	1.10	78	1.1	108	0.044	104	104	21.7	-0.2	383	74	75	71	-0.021	10.4	2.4
61	9.673	9.193	0.16	0.15	1.28	78	2.22	1.10	78	1.1	108	0.044	102	103	21.6	-0.1	382	75	75	71	-0.021	9.9	2.2
62	9.831	9.346	0.16	0.15	1.29	78	2.22	1.09	78	1.1	107	0.044	102	104	21.5	-0.1	379	75	75	70	-0.020	9.6	2.1
63	9.990	9.500	0.16	0.15	1.28	78	2.21	1.10	78	1.1	105	0.044	102	104	21.5	0	369	75	74	70	-0.021	9.5	0.8
64	10.148	9.652	0.16	0.15	1.28	79	2.21	1.09	78	1.1	102	0.044	101	102	21.4	-0.1	354	75	74	71	-0.019	6.9	0.1
65	10.306	9.805	0.16	0.15	1.28	79	2.21	1.09	78	1.1	101	0.044	101	103	21.4	0	342	75	74	71	-0.018	5.6	0
66	10.466	9.958	0.16	0.15	1.28	79	2.21	1.09	78	1.1	99	0.044	102	103	21.3	-0.1	331	74	74	70	-0.017	4.9	0
67	10.624	10.111	0.16	0.15	1.29	79	2.21	1.09	78	1.1	98	0.044	101	103	21.3	0	323	74	74	70	-0.016	4.8	0
68	10.782	10.264	0.16	0.15	1.29	79	2.2	1.09	79	1.1	98	0.044	101	103	21.3	0	315	74	74	70	-0.015	5.2	0
69	10.941	10.417	0.16	0.15	1.29	79	2.2	1.09	79	1.1	97	0.044	101	102	21.2	-0.1	308	74	74	70	-0.014	4.9	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{strav}	12.31			ft/sec			V_{scent}	14.28	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
70	11.100	10.570	0.16	0.15	1.28	79	2.2	1.09	79	1.1	96	0.044	101	102	21.2	0	301	74	74	70	-0.014	4.5	0
71	11.258	10.724	0.16	0.15	1.29	79	2.2	1.09	79	1.1	95	0.044	100	103	21.1	-0.1	294	74	73	70	-0.013	4.1	0
72	11.417	10.876	0.16	0.15	1.28	79	2.21	1.09	79	1.1	94	0.044	101	101	21.1	0	287	73	73	70	-0.012	3.7	0
73	11.576	11.030	0.16	0.15	1.29	79	2.21	1.09	79	1.1	94	0.044	101	103	21.0	-0.1	281	73	73	70	-0.011	3.3	0
74	11.735	11.182	0.16	0.15	1.29	79	2.2	1.09	79	1.1	93	0.044	101	101	21.0	0	276	73	73	70	-0.011	3.3	0
75	11.893	11.335	0.16	0.15	1.29	79	2.2	1.09	79	1.1	93	0.044	100	102	21.0	0	270	73	73	70	-0.010	3.7	0
76	12.053	11.489	0.16	0.15	1.29	79	2.2	1.09	79	1.1	93	0.044	102	103	21.0	0	265	73	73	70	-0.009	3.2	0
77	12.211	11.642	0.16	0.15	1.28	79	2.19	1.09	79	1.1	92	0.044	100	102	20.9	-0.1	262	73	73	70	-0.009	3.1	0
78	12.370	11.795	0.16	0.15	1.29	79	2.19	1.09	79	1.1	92	0.044	101	102	20.9	0	258	73	73	70	-0.008	3.8	0
79	12.530	11.948	0.16	0.15	1.29	79	2.21	1.09	79	1.1	92	0.044	101	102	20.9	0	255	73	73	69	-0.008	3.9	0
80	12.688	12.101	0.16	0.15	1.29	79	2.2	1.09	79	1.1	91	0.044	100	102	20.8	-0.1	253	73	72	69	-0.008	3.8	0
81	12.846	12.254	0.16	0.15	1.29	79	2.2	1.09	79	1.1	91	0.044	100	102	20.8	0	250	72	72	69	-0.007	3.9	0
82	13.006	12.407	0.16	0.15	1.29	79	2.2	1.09	79	1.1	91	0.044	101	102	20.7	-0.1	249	72	72	67	-0.007	4.3	0
83	13.165	12.560	0.16	0.15	1.29	79	2.19	1.09	79	1.1	91	0.044	101	102	20.7	0	248	72	72	67	-0.007	4.8	0
84	13.323	12.714	0.16	0.15	1.29	79	2.2	1.08	79	1.1	91	0.044	100	103	20.6	-0.1	248	72	72	67	-0.007	5	0
85	13.482	12.866	0.16	0.15	1.29	79	2.19	1.09	79	1.1	90	0.044	101	101	20.6	0	249	72	72	67	-0.008	6	0
86	13.641	13.020	0.16	0.15	1.29	79	2.2	1.09	79	1.1	91	0.044	101	103	20.5	-0.1	251	72	72	69	-0.007	6.3	0
87	13.800	13.173	0.16	0.15	1.29	79	2.2	1.09	79	1.1	91	0.044	101	102	20.4	-0.1	252	72	72	69	-0.008	7.1	0
88	13.958	13.326	0.16	0.15	1.29	79	2.19	1.09	79	1.1	91	0.044	100	102	20.3	-0.1	254	72	72	67	-0.008	7.2	0
89	14.118	13.479	0.16	0.15	1.29	79	2.2	1.08	79	1.1	91	0.044	101	102	20.3	0	256	72	72	68	-0.009	7.7	0
90	14.276	13.632	0.16	0.15	1.29	79	2.2	1.09	79	1.1	91	0.044	100	102	20.2	-0.1	258	72	72	67	-0.008	8.2	0
91	14.435	13.785	0.16	0.15	1.29	80	2.19	1.08	79	1.1	91	0.044	101	102	20.1	-0.1	259	72	72	68	-0.009	7.6	0
92	14.594	13.938	0.16	0.15	1.29	80	2.2	1.09	79	1.1	91	0.044	101	102	20.1	0	260	72	72	68	-0.009	7.6	0
93	14.753	14.091	0.16	0.15	1.29	80	2.19	1.09	79	1.1	91	0.044	101	102	20.0	-0.1	261	72	72	69	-0.009	7.8	0
94	14.911	14.244	0.16	0.15	1.29	80	2.19	1.08	79	1.1	91	0.044	100	102	20.0	0	261	72	72	69	-0.009	8.3	0
95	15.071	14.397	0.16	0.15	1.29	80	2.19	1.09	79	1.1	91	0.044	101	102	19.8	-0.2	262	72	72	69	-0.009	7.9	0
96	15.230	14.550	0.16	0.15	1.28	80	2.19	1.08	79	1.1	91	0.044	101	102	19.8	0	262	72	72	69	-0.010	7.6	0
97	15.388	14.704	0.16	0.15	1.29	80	2.19	1.09	79	1.1	91	0.044	100	103	19.7	-0.1	262	72	72	68	-0.010	7.6	0
98	15.547	14.856	0.16	0.15	1.29	80	2.18	1.09	79	1.1	92	0.044	101	101	19.7	0	263	72	72	69	-0.010	7.5	0
99	15.706	15.010	0.16	0.15	1.29	80	2.19	1.08	79	1.1	92	0.044	101	103	19.6	-0.1	263	72	72	69	-0.009	7.8	0
100	15.865	15.162	0.16	0.15	1.29	80	2.18	1.08	79	1.1	92	0.044	101	101	19.5	-0.1	264	71	72	69	-0.009	8.1	0
101	16.023	15.315	0.16	0.15	1.29	80	2.18	1.08	79	1.1	92	0.044	100	102	19.4	-0.1	264	72	72	69	-0.010	8.2	0
102	16.183	15.468	0.16	0.15	1.29	80	2.19	1.08	79	1.1	92	0.044	101	102	19.4	0	264	72	72	70	-0.010	8.1	0
103	16.341	15.621	0.16	0.15	1.28	80	2.19	1.08	79	1.1	92	0.044	100	102	19.3	-0.1	264	72	72	70	-0.009	7.5	0
104	16.499	15.773	0.16	0.15	1.29	80	2.19	1.08	79	1.1	92	0.044	100	101	19.3	0	265	72	72	70	-0.009	7.4	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{strav}	12.31			ft/sec			V_{scent}	14.28	
	ft/sec			ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
105	16.659	15.927	0.16	0.15	1.29	80	2.19	1.08	79	1.1	92	0.044	101	103	19.2	-0.1	266	72	72	70	-0.010	7.8	0
106	16.817	16.079	0.16	0.15	1.28	80	2.19	1.08	79	1.1	92	0.044	100	101	19.1	-0.1	267	72	73	71	-0.010	7.9	0
107	16.975	16.232	0.16	0.15	1.29	80	2.19	1.07	79	1.1	93	0.044	100	102	19.1	0	266	72	73	70	-0.010	8.1	0
108	17.135	16.385	0.16	0.15	1.29	80	2.19	1.08	79	1.1	92	0.044	101	102	19.0	-0.1	268	72	73	70	-0.010	7.3	0
109	17.293	16.537	0.16	0.15	1.28	80	2.19	1.08	79	1.1	93	0.044	100	101	18.9	-0.1	269	73	73	71	-0.010	8.3	0
110	17.450	16.690	0.16	0.15	1.29	80	2.19	1.08	79	1.1	93	0.044	99	102	18.8	-0.1	269	73	73	70	-0.009	9	0.1
111	17.610	16.842	0.16	0.15	1.28	80	2.18	1.08	79	1.1	93	0.044	101	101	18.8	0	269	73	73	71	-0.010	7.6	0
112	17.768	16.994	0.16	0.15	1.28	80	2.19	1.08	79	1.1	93	0.044	100	101	18.7	-0.1	269	73	73	71	-0.010	7.9	0
113	17.926	17.148	0.16	0.15	1.28	80	2.17	1.07	79	1.1	93	0.044	100	103	18.6	-0.1	269	73	73	71	-0.010	7.6	0
114	18.085	17.299	0.16	0.15	1.28	80	2.18	1.07	80	1.1	92	0.044	101	100	18.6	0	269	73	73	71	-0.010	7.9	0
115	18.243	17.452	0.16	0.15	1.28	80	2.18	1.07	80	1.1	93	0.044	100	102	18.5	-0.1	269	73	74	71	-0.010	7.6	0
116	18.401	17.605	0.16	0.15	1.28	80	2.18	1.07	80	1.1	92	0.044	100	102	18.4	-0.1	271	73	74	71	-0.010	8.2	0
117	18.560	17.757	0.16	0.15	1.28	80	2.17	1.07	80	1.2	92	0.044	101	101	18.4	0	271	73	74	71	-0.010	8.9	0.2
118	18.718	17.909	0.16	0.15	1.27	80	2.17	1.07	80	1.1	93	0.044	100	101	18.3	-0.1	270	73	74	71	-0.010	8.1	0
119	18.876	18.062	0.16	0.15	1.28	81	2.17	1.07	80	1.1	93	0.044	100	102	18.2	-0.1	270	73	74	70	-0.010	8	0
120	19.035	18.214	0.16	0.15	1.28	81	2.17	1.08	80	1.2	93	0.044	101	101	18.1	-0.1	270	73	74	71	-0.010	7.9	0
121	19.193	18.366	0.16	0.15	1.28	81	2.17	1.07	80	1.1	93	0.044	100	101	18.1	0	270	73	74	71	-0.010	8.3	0.1
122	19.351	18.519	0.16	0.15	1.28	81	2.16	1.07	80	1.1	93	0.044	100	102	18.0	-0.1	269	73	74	72	-0.010	8	0
123	19.510	18.671	0.16	0.15	1.28	81	2.16	1.07	80	1.2	93	0.044	101	101	17.9	-0.1	269	73	74	71	-0.010	7.3	0
124	19.668	18.824	0.16	0.15	1.27	81	2.15	1.06	80	1.1	93	0.044	100	102	17.9	0	269	74	74	70	-0.010	7.2	0
125	19.826	18.976	0.16	0.15	1.28	81	2.16	1.07	80	1.2	94	0.044	100	101	17.8	-0.1	269	74	74	70	-0.010	8	0
126	19.985	19.128	0.16	0.15	1.28	81	2.15	1.07	80	1.1	94	0.044	101	101	17.7	-0.1	270	74	74	70	-0.010	8.2	0.1
127	20.144	19.281	0.16	0.15	1.28	81	2.15	1.07	80	1.1	94	0.044	101	102	17.6	-0.1	271	74	74	71	-0.010	8.6	0
128	20.301	19.433	0.16	0.15	1.28	81	2.15	1.07	81	1.2	93	0.044	99	101	17.6	0	271	74	74	72	-0.010	8.7	0.1
129	20.460	19.585	0.16	0.15	1.28	81	2.15	1.07	81	1.2	94	0.044	101	101	17.5	-0.1	271	74	74	71	-0.011	8.2	0.1
130	20.619	19.738	0.16	0.15	1.28	81	2.14	1.07	81	1.2	94	0.044	101	102	17.4	-0.1	271	74	74	71	-0.010	8.5	0
131	20.777	19.890	0.16	0.15	1.28	81	2.14	1.07	81	1.2	94	0.044	100	101	17.4	0	271	74	74	72	-0.011	8.4	0.1
132	20.935	20.042	0.16	0.15	1.28	82	2.13	1.06	81	1.2	94	0.044	100	101	17.3	-0.1	271	74	74	72	-0.010	7.9	0
133	21.094	20.195	0.16	0.15	1.28	82	2.14	1.07	81	1.2	94	0.044	100	102	17.2	-0.1	271	74	74	72	-0.010	8.6	0.1
134	21.252	20.347	0.16	0.15	1.28	82	2.14	1.06	81	1.2	94	0.044	100	101	17.1	-0.1	271	74	74	72	-0.010	7.8	0
135	21.411	20.499	0.16	0.15	1.28	82	2.14	1.06	81	1.2	94	0.044	100	101	17.1	0	271	74	74	72	-0.010	7.9	0
136	21.570	20.652	0.16	0.15	1.28	82	2.13	1.07	81	1.2	94	0.044	100	102	17.0	-0.1	271	74	74	72	-0.010	8.1	0
137	21.728	20.804	0.16	0.15	1.28	82	2.14	1.07	81	1.2	94	0.044	100	101	16.9	-0.1	270	74	74	72	-0.010	7.7	0
138	21.886	20.956	0.16	0.15	1.28	82	2.14	1.06	81	1.2	94	0.044	100	101	16.9	0	270	74	74	71	-0.010	7.3	0
139	22.046	21.109	0.16	0.15	1.28	82	2.14	1.07	81	1.2	94	0.044	101	102	16.8	-0.1	269	74	74	72	-0.010	8.1	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{straw}	12.31			ft/sec			V_{scent}	14.28	
	ft/sec			ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
140	22.204	21.261	0.16	0.15	1.28	82	2.13	1.07	81	1.2	94	0.044	100	101	16.8	0	268	74	74	72	-0.010	7.5	0
141	22.362	21.413	0.16	0.15	1.28	82	2.14	1.06	81	1.2	94	0.044	100	101	16.7	-0.1	269	74	74	71	-0.010	7.2	0
142	22.522	21.565	0.16	0.15	1.28	82	2.13	1.06	81	1.2	94	0.044	101	101	16.6	-0.1	269	74	74	71	-0.011	7.7	0
143	22.679	21.717	0.16	0.15	1.28	82	2.13	1.06	81	1.2	94	0.044	99	101	16.6	0	269	74	75	72	-0.010	8.2	0.1
144	22.838	21.870	0.16	0.15	1.28	82	2.13	1.06	81	1.2	94	0.044	100	102	16.5	-0.1	269	74	74	72	-0.010	8.1	0.1
145	22.997	22.022	0.16	0.15	1.28	82	2.13	1.06	81	1.2	94	0.044	100	101	16.4	-0.1	268	74	74	72	-0.010	7.7	0
146	23.156	22.174	0.16	0.15	1.28	82	2.12	1.06	81	1.2	94	0.044	100	101	16.3	-0.1	268	74	75	71	-0.010	8.2	0.1
147	23.313	22.327	0.16	0.15	1.28	82	2.13	1.06	81	1.2	95	0.044	99	102	16.3	0	268	74	74	72	-0.010	8.1	0
148	23.473	22.478	0.16	0.15	1.28	82	2.12	1.06	81	1.2	94	0.044	101	100	16.2	-0.1	267	74	74	72	-0.010	7.7	0
149	23.632	22.631	0.16	0.15	1.27	82	2.13	1.06	81	1.2	95	0.044	101	102	16.2	0	267	74	75	72	-0.010	7.9	0.1
150	23.789	22.783	0.16	0.15	1.28	82	2.13	1.06	82	1.2	95	0.044	99	101	16.1	-0.1	267	74	75	72	-0.010	7.4	0
151	23.948	22.935	0.16	0.15	1.28	82	2.12	1.06	82	1.2	95	0.044	101	101	16.0	-0.1	266	74	75	72	-0.009	7.9	0.1
152	24.107	23.087	0.16	0.15	1.27	82	2.12	1.06	82	1.2	95	0.044	101	101	15.9	-0.1	266	74	75	72	-0.010	8	0.1
153	24.265	23.240	0.16	0.15	1.28	83	2.13	1.06	82	1.2	95	0.044	100	102	15.9	0	267	74	75	72	-0.009	8.1	0.2
154	24.424	23.391	0.16	0.15	1.28	82	2.13	1.06	82	1.2	95	0.044	101	100	15.8	-0.1	266	74	75	72	-0.010	8	0.1
155	24.583	23.543	0.16	0.15	1.28	83	2.13	1.06	82	1.2	95	0.044	100	101	15.7	-0.1	266	74	75	72	-0.010	7.7	0
156	24.741	23.696	0.16	0.15	1.28	83	2.13	1.05	82	1.2	95	0.044	100	102	15.6	-0.1	267	74	75	72	-0.010	8	0.1
157	24.899	23.847	0.16	0.15	1.28	83	2.13	1.06	82	1.2	95	0.044	100	100	15.6	0	267	74	75	72	-0.010	8.3	0.2
158	25.059	23.999	0.16	0.15	1.28	83	2.13	1.06	82	1.2	95	0.044	101	101	15.5	-0.1	268	74	75	71	-0.010	8.6	0.2
159	25.217	24.151	0.16	0.15	1.27	83	2.12	1.05	82	1.2	95	0.044	100	101	15.4	-0.1	268	74	75	70	-0.010	8.6	0.2
160	25.375	24.303	0.16	0.15	1.28	83	2.13	1.05	82	1.2	95	0.044	100	101	15.4	0	268	74	75	71	-0.010	8	0.1
161	25.534	24.454	0.16	0.15	1.28	83	2.13	1.05	82	1.2	96	0.044	100	100	15.3	-0.1	268	74	75	71	-0.010	8.1	0.1
162	25.692	24.607	0.16	0.15	1.28	83	2.13	1.05	82	1.2	96	0.044	100	102	15.2	-0.1	269	74	75	71	-0.010	8.2	0.1
163	25.851	24.758	0.16	0.15	1.28	83	2.13	1.06	82	1.2	96	0.044	100	100	15.1	-0.1	269	74	75	71	-0.010	8.4	0.2
164	26.010	24.910	0.16	0.15	1.27	83	2.13	1.05	82	1.2	95	0.044	100	101	15.1	0	269	74	75	71	-0.010	8	0
165	26.168	25.062	0.16	0.15	1.28	83	2.12	1.05	82	1.2	95	0.044	100	101	15.0	-0.1	268	74	75	71	-0.010	7.8	0.1
166	26.326	25.213	0.16	0.15	1.28	83	2.13	1.05	82	1.2	95	0.044	100	100	15.0	0	268	74	75	72	-0.010	8.1	0.1
167	26.486	25.365	0.16	0.15	1.27	83	2.13	1.05	82	1.2	95	0.044	101	101	14.8	-0.2	268	74	75	71	-0.011	8.4	0.1
168	26.644	25.517	0.16	0.15	1.27	83	2.13	1.05	82	1.2	94	0.044	100	101	14.8	0	268	74	75	71	-0.010	8.3	0.2
169	26.802	25.669	0.16	0.15	1.27	83	2.14	1.05	82	1.2	94	0.044	100	101	14.7	-0.1	269	74	75	71	-0.011	8.1	0.1
170	26.961	25.820	0.16	0.15	1.28	83	2.13	1.05	82	1.2	94	0.044	100	100	14.6	-0.1	269	74	75	71	-0.011	8	0.1
171	27.120	25.972	0.16	0.15	1.27	83	2.14	1.05	82	1.2	93	0.044	100	101	14.6	0	269	74	75	71	-0.010	8.6	0.4
172	27.277	26.123	0.16	0.15	1.28	83	2.13	1.05	82	1.2	93	0.044	99	100	14.5	-0.1	268	74	75	71	-0.011	8	0
173	27.437	26.275	0.16	0.15	1.28	83	2.14	1.05	82	1.2	93	0.044	101	101	14.4	-0.1	268	74	75	72	-0.011	7.6	0
174	27.595	26.427	0.16	0.15	1.27	83	2.15	1.05	82	1.2	93	0.044	100	101	14.3	-0.1	268	74	75	71	-0.011	8.3	0.1

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{straw}	12.31			ft/sec			V_{scent}	14.28	
	ft/sec			ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
175	27.753	26.578	0.16	0.15	1.28	83	2.14	1.05	82	1.2	92	0.044	99	100	14.3	0	269	74	75	70	-0.011	7.8	0.1
176	27.912	26.729	0.16	0.15	1.27	83	2.15	1.05	82	1.2	92	0.044	100	100	14.2	-0.1	269	74	75	70	-0.011	8.6	0.4
177	28.071	26.881	0.16	0.15	1.27	83	2.15	1.04	82	1.2	92	0.044	100	101	14.1	-0.1	269	74	75	69	-0.011	8.4	0.1
178	28.229	27.032	0.16	0.15	1.28	83	2.15	1.05	82	1.2	92	0.044	99	100	14.0	-0.1	269	74	74	70	-0.011	8.5	0.1
179	28.387	27.183	0.16	0.15	1.28	83	2.14	1.05	82	1.2	91	0.044	99	100	14.0	0	269	74	74	70	-0.011	8	0.1
180	28.547	27.335	0.16	0.15	1.27	83	2.14	1.04	82	1.2	91	0.044	101	101	13.9	-0.1	268	74	74	70	-0.011	8.2	0.1
181	28.705	27.487	0.16	0.15	1.27	83	2.15	1.04	82	1.2	91	0.044	99	101	13.9	0	267	74	74	70	-0.011	7.6	0
182	28.863	27.638	0.16	0.15	1.28	83	2.14	1.04	82	1.2	91	0.044	99	100	13.8	-0.1	267	74	74	70	-0.011	7.1	0
183	29.022	27.789	0.16	0.15	1.27	83	2.15	1.04	82	1.2	93	0.044	100	100	13.7	-0.1	278	74	74	71	-0.012	7.5	0
184	29.180	27.941	0.16	0.15	1.27	83	2.16	1.04	82	1.2	92	0.044	99	101	13.7	0	277	74	74	70	-0.013	7.7	0
185	29.339	28.092	0.16	0.15	1.28	83	2.15	1.04	82	1.2	91	0.044	100	100	13.6	-0.1	271	74	74	70	-0.012	7.6	0
186	29.498	28.243	0.16	0.15	1.28	83	2.15	1.04	82	1.2	90	0.044	100	100	13.5	-0.1	267	74	74	71	-0.012	7	0
187	29.656	28.395	0.16	0.15	1.27	83	2.15	1.04	82	1.2	90	0.044	99	101	13.5	0	263	74	74	70	-0.011	6.6	0
188	29.815	28.546	0.16	0.15	1.28	83	2.16	1.04	82	1.2	89	0.044	100	100	13.5	0	259	74	74	70	-0.011	6.1	0
189	29.974	28.697	0.16	0.15	1.27	83	2.15	1.04	82	1.2	89	0.044	100	100	13.4	-0.1	256	74	74	70	-0.011	5.6	0
190	30.132	28.849	0.16	0.15	1.27	83	2.15	1.04	82	1.2	88	0.044	99	100	13.4	0	252	74	74	70	-0.010	5.2	0
191	30.290	28.999	0.16	0.15	1.28	83	2.16	1.04	82	1.2	88	0.044	99	99	13.3	-0.1	248	74	74	69	-0.009	5	0
192	30.450	29.151	0.16	0.15	1.27	83	2.15	1.04	82	1.2	87	0.044	100	100	13.3	0	244	74	74	70	-0.009	4.4	0
193	30.609	29.303	0.16	0.15	1.27	83	2.16	1.03	82	1.2	87	0.044	100	100	13.3	0	241	74	74	70	-0.008	3.8	0
194	30.767	29.454	0.16	0.15	1.28	83	2.16	1.04	82	1.2	87	0.044	99	100	13.2	-0.1	238	73	74	70	-0.008	3.8	0
195	30.926	29.605	0.16	0.15	1.27	83	2.15	1.04	82	1.2	87	0.044	100	100	13.2	0	236	73	74	70	-0.007	3.9	0
196	31.085	29.756	0.16	0.15	1.27	83	2.16	1.03	82	1.2	86	0.044	100	100	13.2	0	235	73	74	71	-0.007	4.3	0
197	31.243	29.908	0.16	0.15	1.28	83	2.15	1.04	82	1.2	86	0.044	99	100	13.1	-0.1	233	73	74	71	-0.007	4.7	0
198	31.402	30.058	0.16	0.15	1.28	83	2.15	1.04	82	1.2	86	0.044	100	99	13.1	0	231	73	73	69	-0.007	4.9	0
199	31.561	30.210	0.16	0.15	1.27	83	2.15	1.03	82	1.2	85	0.044	99	100	13.0	-0.1	230	73	73	70	-0.007	4.7	0
200	31.719	30.362	0.16	0.15	1.27	83	2.16	1.04	82	1.2	85	0.044	99	100	13.0	0	229	73	73	70	-0.007	4.8	0
201	31.878	30.512	0.16	0.15	1.28	83	2.16	1.04	82	1.2	85	0.044	99	99	12.9	-0.1	229	73	73	69	-0.007	5.2	0
202	32.037	30.663	0.16	0.15	1.28	83	2.16	1.04	82	1.2	85	0.044	99	99	12.9	0	229	73	73	69	-0.006	5.7	0
203	32.196	30.815	0.16	0.15	1.28	83	2.16	1.04	82	1.2	84	0.044	99	100	12.9	0	228	73	73	71	-0.006	5.5	0
204	32.354	30.966	0.16	0.15	1.28	83	2.16	1.04	82	1.2	85	0.044	99	99	12.8	-0.1	228	73	73	71	-0.007	5.6	0
205	32.514	31.117	0.16	0.15	1.27	83	2.16	1.03	82	1.2	85	0.044	100	99	12.8	0	228	73	73	71	-0.007	5.9	0
206	32.672	31.268	0.16	0.15	1.27	83	2.16	1.04	82	1.2	84	0.044	99	99	12.7	-0.1	228	73	73	70	-0.007	6.3	0
207	32.830	31.419	0.16	0.15	1.28	83	2.17	1.04	82	1.2	84	0.044	99	99	12.7	0	229	73	73	70	-0.007	6.2	0
208	32.990	31.570	0.16	0.15	1.27	83	2.16	1.03	82	1.2	84	0.044	100	99	12.6	-0.1	229	73	73	70	-0.007	6.4	0
209	33.148	31.721	0.16	0.15	1.27	83	2.16	1.03	82	1.2	84	0.044	99	99	12.5	-0.1	230	73	73	69	-0.007	6.6	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{strav}	12.31			ft/sec			V_{scent}	14.28	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
210	33.306	31.873	0.16	0.15	1.28	83	2.17	1.03	82	1.2	84	0.044	99	100	12.5	0	229	73	73	70	-0.007	6.8	0
211	33.465	32.023	0.16	0.15	1.28	83	2.16	1.03	82	1.2	84	0.044	99	99	12.4	-0.1	230	73	73	70	-0.007	6.5	0
212	33.624	32.174	0.16	0.15	1.27	83	2.16	1.03	82	1.2	84	0.044	99	99	12.4	0	230	73	73	70	-0.007	6.5	0
213	33.782	32.325	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	12.3	-0.1	230	73	73	70	-0.007	6.3	0
214	33.941	32.476	0.16	0.15	1.28	83	2.16	1.04	82	1.2	84	0.044	99	99	12.2	-0.1	231	73	73	69	-0.007	6.7	0
215	34.100	32.626	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	12.2	0	231	73	73	70	-0.007	6.7	0
216	34.258	32.778	0.16	0.15	1.27	83	2.16	1.03	82	1.2	84	0.044	99	100	12.1	-0.1	231	73	73	70	-0.007	6	0
217	34.416	32.929	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	12.1	0	231	72	73	70	-0.008	6.1	0
218	34.576	33.079	0.16	0.15	1.27	83	2.16	1.03	82	1.2	84	0.044	100	99	12.1	0	231	72	73	70	-0.008	6.6	0
219	34.734	33.230	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	12.0	-0.1	231	72	72	69	-0.008	6.6	0
220	34.892	33.382	0.16	0.15	1.27	83	2.16	1.03	82	1.2	84	0.044	99	100	11.9	-0.1	231	72	72	70	-0.008	6.7	0
221	35.051	33.532	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	11.9	0	231	72	72	70	-0.008	6.8	0
222	35.209	33.682	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	11.8	-0.1	231	72	72	70	-0.008	6.9	0
223	35.368	33.834	0.16	0.15	1.28	83	2.16	1.03	82	1.2	84	0.044	99	100	11.8	0	231	72	72	69	-0.007	6.3	0
224	35.527	33.985	0.16	0.15	1.27	83	2.16	1.03	82	1.2	84	0.044	99	99	11.7	-0.1	231	72	72	69	-0.007	6.5	0
225	35.685	34.135	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	11.7	0	231	72	72	69	-0.007	6.5	0
226	35.843	34.286	0.16	0.15	1.27	83	2.18	1.03	82	1.2	84	0.044	99	99	11.6	-0.1	231	72	72	69	-0.007	6.4	0
227	36.003	34.437	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	100	99	11.6	0	230	72	72	70	-0.007	6.4	0
228	36.161	34.587	0.16	0.15	1.27	83	2.18	1.03	82	1.2	84	0.044	99	99	11.5	-0.1	230	72	72	71	-0.007	6.2	0
229	36.319	34.737	0.16	0.15	1.28	83	2.17	1.03	82	1.2	84	0.044	99	99	11.5	0	229	72	72	70	-0.007	6.3	0
230	36.479	34.888	0.16	0.15	1.27	83	2.17	1.02	82	1.2	84	0.044	100	99	11.4	-0.1	229	72	72	70	-0.007	6.1	0
231	36.637	35.039	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	11.4	0	229	72	72	70	-0.007	6.1	0
232	36.795	35.189	0.16	0.15	1.27	83	2.17	1.03	82	1.2	84	0.044	99	99	11.3	-0.1	229	72	72	71	-0.007	6.2	0
233	36.954	35.340	0.16	0.15	1.26	83	2.17	1.02	82	1.2	84	0.044	99	99	11.3	0	229	72	72	71	-0.007	6.2	0
234	37.112	35.491	0.16	0.15	1.26	83	2.18	1.02	82	1.2	84	0.044	99	99	11.2	-0.1	229	72	72	71	-0.007	6.5	0
235	37.270	35.641	0.16	0.15	1.27	83	2.17	1.02	82	1.2	84	0.044	99	99	11.1	-0.1	229	72	72	70	-0.008	6.6	0
236	37.429	35.791	0.16	0.15	1.27	83	2.18	1.02	82	1.2	84	0.044	99	99	11.1	0	229	72	72	71	-0.008	6.7	0
237	37.587	35.941	0.16	0.15	1.27	83	2.18	1.02	82	1.2	84	0.044	99	99	11.0	-0.1	229	72	72	71	-0.007	6.7	0
238	37.745	36.092	0.16	0.15	1.27	83	2.18	1.02	82	1.2	84	0.044	99	99	11.0	0	229	72	72	70	-0.007	7	0
239	37.904	36.242	0.16	0.15	1.27	83	2.18	1.02	82	1.2	84	0.044	99	99	10.9	-0.1	229	72	72	71	-0.008	6.8	0
240	38.062	36.392	0.16	0.15	1.26	83	2.17	1.02	82	1.2	84	0.044	99	99	10.9	0	229	72	72	71	-0.007	6.8	0
241	38.220	36.543	0.16	0.15	1.27	83	2.17	1.02	82	1.2	84	0.044	99	99	10.8	-0.1	228	72	72	71	-0.008	6.9	0
242	38.378	36.693	0.16	0.15	1.27	83	2.17	1.02	82	1.2	84	0.044	99	99	10.8	0	228	72	72	71	-0.007	6.8	0.1
243	38.537	36.842	0.16	0.15	1.27	83	2.17	1.02	82	1.2	84	0.044	99	98	10.7	-0.1	228	72	72	71	-0.008	6.8	0
244	38.694	36.993	0.16	0.15	1.27	83	2.18	1.02	82	1.2	84	0.044	98	99	10.6	-0.1	228	72	72	71	-0.007	7.4	0.2

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{strav}	12.31			ft/sec			V_{scent}	14.28	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
245	38.853	37.143	0.16	0.15	1.27	83	2.18	1.01	82	1.2	84	0.044	99	99	10.5	-0.1	229	72	72	71	-0.008	7.3	0.1
246	39.012	37.293	0.16	0.15	1.26	83	2.18	1.01	82	1.2	84	0.044	99	99	10.5	0	230	72	72	72	-0.008	7.7	0.3
247	39.169	37.442	0.16	0.15	1.27	83	2.18	1.02	82	1.2	84	0.044	98	98	10.4	-0.1	231	72	72	72	-0.008	8	0.3
248	39.328	37.592	0.16	0.15	1.26	83	2.19	1.01	82	1.2	84	0.044	99	99	10.4	0	232	72	72	72	-0.008	8.2	0.3
249	39.486	37.742	0.16	0.15	1.26	83	2.18	1.01	82	1.2	85	0.044	99	99	10.3	-0.1	233	72	72	72	-0.008	7.9	0.2
250	39.643	37.893	0.16	0.15	1.27	83	2.18	1.01	82	1.2	84	0.044	98	99	10.2	-0.1	233	72	72	72	-0.008	7.7	0.1
251	39.802	38.042	0.16	0.15	1.26	83	2.18	1.02	82	1.2	85	0.044	99	98	10.2	0	233	72	73	72	-0.008	7.4	0
252	39.960	38.192	0.16	0.15	1.26	83	2.19	1.01	82	1.2	85	0.044	99	99	10.1	-0.1	234	72	73	72	-0.008	7	0
253	40.118	38.342	0.16	0.15	1.26	83	2.18	1.01	82	1.2	85	0.044	99	99	10.0	-0.1	234	72	72	71	-0.008	7.2	0
254	40.277	38.492	0.16	0.15	1.26	83	2.18	1.01	82	1.2	85	0.044	99	99	10.0	0	233	72	72	71	-0.008	6.6	0
255	40.435	38.641	0.16	0.15	1.26	83	2.18	1.01	82	1.2	85	0.044	99	98	10.0	0	232	72	73	71	-0.008	6.4	0
256	40.592	38.790	0.16	0.15	1.27	83	2.18	1.01	82	1.2	84	0.044	98	98	9.9	-0.1	232	72	73	71	-0.008	6.8	0
257	40.751	38.940	0.16	0.15	1.26	83	2.18	1.01	82	1.2	84	0.044	99	99	9.8	-0.1	232	72	73	71	-0.008	6.4	0
258	40.909	39.091	0.16	0.15	1.26	83	2.19	1.01	82	1.2	84	0.044	99	99	9.8	0	231	72	73	71	-0.008	6.6	0
259	41.066	39.239	0.16	0.15	1.27	83	2.19	1.01	82	1.2	84	0.044	98	97	9.7	-0.1	231	72	73	71	-0.008	6.5	0
260	41.226	39.389	0.16	0.15	1.26	83	2.19	1.01	82	1.2	84	0.044	100	99	9.7	0	231	72	73	71	-0.008	6.5	0
261	41.383	39.539	0.16	0.15	1.26	83	2.19	1.01	82	1.2	84	0.044	98	99	9.6	-0.1	231	72	73	72	-0.008	6.8	0
262	41.541	39.689	0.16	0.15	1.26	83	2.19	1.01	82	1.2	84	0.044	99	99	9.6	0	231	72	73	72	-0.008	6.8	0
263	41.700	39.838	0.16	0.15	1.26	83	2.19	1.01	82	1.2	84	0.044	99	98	9.5	-0.1	231	72	73	72	-0.008	6.8	0
264	41.857	39.987	0.16	0.15	1.27	83	2.19	1.01	82	1.2	84	0.044	98	98	9.5	0	231	72	73	71	-0.008	6.6	0
265	42.015	40.137	0.16	0.15	1.26	83	2.19	1.01	82	1.2	84	0.044	99	99	9.4	-0.1	231	72	73	71	-0.008	6.3	0
266	42.174	40.286	0.16	0.15	1.26	83	2.19	1.00	82	1.2	83	0.044	99	98	9.4	0	230	72	73	71	-0.008	6.5	0
267	42.331	40.436	0.16	0.15	1.26	83	2.19	1.01	82	1.2	83	0.044	98	99	9.3	-0.1	230	72	73	70	-0.008	6.5	0
268	42.489	40.585	0.16	0.15	1.27	83	2.19	1.01	82	1.2	83	0.044	99	98	9.3	0	230	72	73	69	-0.008	6.3	0
269	42.648	40.734	0.16	0.15	1.26	83	2.2	1.01	82	1.2	83	0.044	99	98	9.2	-0.1	229	72	73	70	-0.008	6.5	0
270	42.805	40.884	0.16	0.15	1.26	83	2.2	1.00	82	1.2	83	0.044	98	99	9.2	0	229	72	73	70	-0.008	6.7	0
271	42.963	41.034	0.16	0.15	1.26	83	2.2	1.00	82	1.2	83	0.044	99	99	9.1	-0.1	229	72	72	70	-0.008	6.6	0
272	43.122	41.182	0.16	0.15	1.27	83	2.2	1.01	82	1.2	83	0.044	99	97	9.0	-0.1	229	72	72	71	-0.008	6.4	0
273	43.279	41.331	0.16	0.15	1.26	83	2.2	1.01	82	1.2	83	0.044	98	98	9.0	0	229	72	72	71	-0.008	6.7	0
274	43.437	41.481	0.16	0.15	1.26	83	2.19	1.00	82	1.2	83	0.044	99	99	8.9	-0.1	229	72	72	70	-0.008	6.8	0
275	43.596	41.630	0.16	0.15	1.26	83	2.2	1.00	82	1.2	83	0.044	99	98	8.9	0	228	72	72	71	-0.008	6.8	0
276	43.753	41.780	0.16	0.15	1.26	83	2.2	1.01	82	1.2	84	0.044	98	99	8.8	-0.1	235	72	72	70	-0.009	6.3	0
277	43.911	41.928	0.16	0.15	1.26	83	2.2	1.00	82	1.2	86	0.044	99	98	8.7	-0.1	247	72	72	70	-0.009	6.7	0
278	44.069	42.078	0.16	0.15	1.26	83	2.19	1.00	82	1.2	86	0.044	99	99	8.7	0	251	72	72	69	-0.011	6.6	0
279	44.227	42.227	0.16	0.15	1.26	83	2.2	1.00	82	1.2	85	0.044	99	98	8.7	0	246	72	72	70	-0.011	5.8	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{strav}	12.31			ft/sec			V_{scent}	14.28	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
280	44.385	42.377	0.16	0.15	1.26	83	2.2	1.00	82	1.2	85	0.044	99	99	8.6	-0.1	243	72	72	70	-0.010	5.7	0
281	44.543	42.525	0.16	0.15	1.25	83	2.19	1.00	82	1.2	84	0.044	99	97	8.6	0	241	72	72	70	-0.010	5.7	0
282	44.701	42.674	0.16	0.15	1.27	83	2.2	1.00	82	1.2	84	0.044	99	98	8.5	-0.1	239	72	72	70	-0.010	5.6	0
283	44.859	42.823	0.16	0.15	1.27	83	2.2	1.00	82	1.2	84	0.044	99	98	8.5	0	237	72	72	71	-0.009	5.2	0
284	45.017	42.972	0.16	0.15	1.25	83	2.19	1.00	82	1.2	84	0.044	99	98	8.4	-0.1	235	72	72	71	-0.009	4.7	0
285	45.174	43.121	0.16	0.15	1.26	83	2.2	1.00	82	1.2	84	0.044	98	98	8.4	0	233	72	72	70	-0.009	4.9	0
286	45.333	43.270	0.16	0.15	1.26	83	2.2	1.00	82	1.2	84	0.044	99	98	8.4	0	232	72	72	70	-0.008	5.3	0
287	45.491	43.419	0.16	0.15	1.26	83	2.2	1.00	82	1.2	84	0.044	99	98	8.3	-0.1	230	72	72	71	-0.008	5.7	0
288	45.648	43.568	0.16	0.15	1.26	83	2.2	1.00	82	1.2	84	0.044	98	98	8.3	0	230	72	72	71	-0.008	5.3	0
289	45.807	43.717	0.16	0.15	1.26	83	2.2	1.00	82	1.2	84	0.044	99	98	8.2	-0.1	229	72	72	72	-0.008	5.8	0
290	45.964	43.866	0.16	0.15	1.25	83	2.2	1.00	82	1.3	84	0.044	98	98	8.2	0	229	72	72	72	-0.008	5.8	0
291	46.122	44.014	0.16	0.15	1.26	83	2.2	1.00	82	1.3	84	0.044	99	97	8.1	-0.1	228	72	72	72	-0.008	6	0
292	46.280	44.163	0.16	0.15	1.26	83	2.21	1.00	82	1.2	84	0.044	99	98	8.1	0	227	72	72	72	-0.007	6.1	0
293	46.437	44.312	0.16	0.15	1.26	83	2.21	0.99	82	1.3	83	0.044	98	98	8.0	-0.1	226	72	72	72	-0.008	5.9	0
294	46.595	44.461	0.16	0.15	1.26	83	2.2	1.00	82	1.2	83	0.044	99	98	8.0	0	225	72	72	72	-0.007	6	0
295	46.753	44.610	0.16	0.15	1.26	83	2.2	1.00	82	1.3	83	0.044	99	98	7.9	-0.1	226	72	72	71	-0.007	5.9	0
296	46.911	44.758	0.16	0.15	1.26	83	2.2	1.00	82	1.2	83	0.044	99	97	7.9	0	225	72	72	71	-0.008	5.9	0
297	47.068	44.907	0.16	0.15	1.26	83	2.2	1.00	82	1.2	83	0.044	98	98	7.8	-0.1	225	72	72	71	-0.007	5.8	0
298	47.227	45.056	0.16	0.15	1.26	83	2.21	0.99	82	1.3	83	0.044	99	98	7.8	0	224	72	72	71	-0.007	5.9	0
299	47.384	45.205	0.16	0.15	1.26	83	2.21	0.99	82	1.3	83	0.044	98	98	7.7	-0.1	224	72	72	71	-0.007	6.2	0
300	47.541	45.353	0.16	0.15	1.26	83	2.21	0.99	82	1.3	83	0.044	98	97	7.7	0	224	72	72	70	-0.007	6.3	0
301	47.700	45.501	0.16	0.15	1.25	83	2.21	0.99	82	1.3	83	0.044	99	97	7.6	-0.1	223	72	72	70	-0.008	6.3	0
302	47.857	45.650	0.16	0.15	1.26	83	2.21	0.99	82	1.3	83	0.044	98	98	7.6	0	223	72	72	71	-0.008	6.3	0
303	48.015	45.798	0.16	0.15	1.26	83	2.21	0.99	82	1.3	83	0.044	99	97	7.5	-0.1	222	72	72	71	-0.007	6.2	0
304	48.173	45.947	0.16	0.15	1.25	83	2.21	0.99	82	1.3	83	0.044	99	98	7.5	0	221	72	72	71	-0.007	6.4	0
305	48.330	46.095	0.16	0.15	1.26	83	2.2	0.99	82	1.3	83	0.044	98	97	7.4	-0.1	221	72	72	70	-0.008	6.3	0
306	48.488	46.243	0.16	0.15	1.25	83	2.21	0.99	82	1.3	83	0.044	99	97	7.3	-0.1	222	72	72	70	-0.007	6.8	0.1
307	48.645	46.391	0.16	0.15	1.25	83	2.21	0.99	82	1.3	83	0.044	98	97	7.2	-0.1	223	72	72	70	-0.008	7.5	0.2
308	48.803	46.539	0.16	0.15	1.26	83	2.21	0.99	82	1.3	83	0.044	99	97	7.2	0	224	72	72	70	-0.008	7.7	0.2
309	48.961	46.688	0.16	0.15	1.25	83	2.21	0.98	82	1.3	83	0.044	99	98	7.1	-0.1	224	72	72	70	-0.007	8.1	0.4
310	49.118	46.836	0.16	0.15	1.26	83	2.21	0.98	82	1.3	83	0.044	98	97	7.0	-0.1	225	72	72	70	-0.008	7.6	0.4
311	49.275	46.984	0.16	0.15	1.26	83	2.22	0.98	82	1.3	83	0.044	98	97	7.0	0	224	72	72	70	-0.008	7.8	0.5
312	49.433	47.131	0.16	0.15	1.25	83	2.21	0.98	82	1.3	83	0.044	99	97	6.9	-0.1	224	72	72	70	-0.007	7.3	0.4
313	49.590	47.279	0.16	0.15	1.26	83	2.22	0.98	82	1.3	83	0.044	98	97	6.8	-0.1	225	72	72	70	-0.009	7.4	0.4
314	49.748	47.427	0.16	0.15	1.25	83	2.22	0.98	82	1.3	83	0.044	99	97	6.8	0	226	72	72	69	-0.009	7.8	0.9

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V_{straw}	12.31			ft/sec			V_{scent}	14.28	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data											Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data					
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
315	49.905	47.574	0.16	0.15	1.25	83	2.23	0.98	82	1.3	83	0.044	98	97	6.7	-0.1	227	72	72	71	-0.008	7.9	1.2
316	50.062	47.722	0.16	0.15	1.25	83	2.23	0.98	82	1.3	84	0.044	98	97	6.6	-0.1	228	72	72	71	-0.009	7.8	1.2
317	50.220	47.869	0.16	0.15	1.25	83	2.22	0.97	82	1.3	84	0.044	99	97	6.6	0	230	72	72	71	-0.009	7.8	1
318	50.377	48.016	0.16	0.15	1.25	83	2.22	0.98	82	1.3	84	0.044	98	97	6.5	-0.1	230	72	72	71	-0.009	7.8	1.1
319	50.534	48.163	0.16	0.15	1.25	83	2.22	0.98	82	1.3	84	0.044	98	97	6.4	-0.1	231	72	72	72	-0.009	7.8	0.7
320	50.692	48.310	0.16	0.15	1.25	83	2.22	0.98	82	1.3	83	0.044	99	97	6.4	0	231	72	72	71	-0.009	7.8	0.4
321	50.848	48.458	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	97	97	6.3	-0.1	232	72	72	71	-0.010	7.6	0.2
322	51.006	48.605	0.16	0.15	1.26	83	2.22	0.97	82	1.3	83	0.044	99	97	6.2	-0.1	233	72	72	72	-0.009	7.4	0.1
323	51.163	48.753	0.16	0.15	1.24	83	2.23	0.97	82	1.3	83	0.044	98	97	6.1	-0.1	234	72	72	71	-0.009	7.5	0.2
324	51.320	48.900	0.16	0.15	1.25	83	2.22	0.97	82	1.3	83	0.044	98	97	6.1	0	234	72	72	70	-0.009	7.8	0.1
325	51.478	49.046	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	99	96	6.0	-0.1	234	72	72	71	-0.010	7.4	0
326	51.634	49.193	0.16	0.15	1.25	83	2.22	0.97	82	1.3	84	0.044	98	97	6.0	0	238	72	72	71	-0.010	7	0
327	51.791	49.340	0.16	0.15	1.25	83	2.23	0.97	82	1.3	84	0.044	98	97	5.9	-0.1	238	72	72	70	-0.010	7.3	0
328	51.949	49.487	0.16	0.15	1.25	83	2.23	0.97	82	1.3	84	0.044	99	97	5.8	-0.1	238	72	72	69	-0.010	7.7	0.2
329	52.105	49.634	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	97	97	5.8	0	239	72	72	70	-0.011	7.1	0.1
330	52.263	49.781	0.16	0.15	1.25	83	2.22	0.97	82	1.3	83	0.044	99	97	5.7	-0.1	238	72	72	70	-0.011	6.6	0
331	52.420	49.929	0.16	0.15	1.25	83	2.22	0.97	82	1.3	83	0.044	98	97	5.7	0	237	72	72	70	-0.010	5.6	0
332	52.577	50.075	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	98	96	5.7	0	236	72	72	70	-0.010	4.7	0
333	52.735	50.222	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	99	97	5.6	-0.1	235	72	72	70	-0.010	4.8	0
334	52.892	50.369	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	98	97	5.6	0	234	72	72	70	-0.009	5.8	0
335	53.048	50.515	0.16	0.15	1.25	83	2.22	0.97	82	1.3	83	0.044	97	96	5.5	-0.1	233	72	72	70	-0.009	5.7	0
336	53.206	50.662	0.16	0.15	1.24	83	2.23	0.97	82	1.3	83	0.044	99	97	5.5	0	232	72	72	70	-0.009	5.6	0
337	53.363	50.809	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	98	97	5.4	-0.1	230	72	72	70	-0.009	5.8	0
338	53.520	50.956	0.16	0.15	1.23	83	2.23	0.96	82	1.3	83	0.044	98	97	5.4	0	229	72	72	71	-0.009	5.7	0
339	53.677	51.103	0.16	0.15	1.25	83	2.23	0.97	82	1.3	83	0.044	98	97	5.3	-0.1	229	72	72	70	-0.009	5.7	0
340	53.834	51.250	0.16	0.15	1.25	83	2.23	0.97	82	1.3	82	0.044	98	97	5.3	0	228	72	72	71	-0.009	6.2	0
341	53.992	51.396	0.16	0.15	1.25	83	2.23	0.97	82	1.3	82	0.044	99	96	5.2	-0.1	228	72	72	71	-0.008	5.9	0
342	54.148	51.542	0.16	0.15	1.25	83	2.22	0.97	82	1.3	82	0.044	97	96	5.2	0	227	72	72	71	-0.008	6.1	0
343	54.305	51.689	0.16	0.15	1.25	83	2.23	0.97	82	1.3	82	0.044	98	97	5.1	-0.1	226	72	72	72	-0.008	5.9	0
344	54.463	51.836	0.16	0.15	1.24	83	2.23	0.97	82	1.3	82	0.044	99	97	5.0	-0.1	226	72	72	72	-0.008	6	0
345	54.619	51.982	0.16	0.15	1.25	83	2.23	0.96	82	1.3	82	0.044	97	96	5.0	0	226	72	72	71	-0.008	6.4	0
346	54.777	52.129	0.16	0.15	1.24	83	2.23	0.96	82	1.3	82	0.044	99	97	4.9	-0.1	225	72	72	71	-0.009	6.4	0
347	54.933	52.276	0.16	0.15	1.25	83	2.23	0.96	82	1.3	82	0.044	97	97	4.9	0	225	72	72	70	-0.008	6.5	0
348	55.090	52.422	0.16	0.15	1.24	83	2.24	0.96	82	1.3	82	0.044	98	96	4.8	-0.1	225	72	72	70	-0.009	6.7	0
349	55.248	52.568	0.16	0.15	1.24	83	2.24	0.96	82	1.3	85	0.044	99	96	4.8	0	242	72	72	70	-0.010	6.7	0.1

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 1

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 08-Feb-16
 Beginning Clock Time: 09:59 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) N/A (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 12.15 ft/sec.
 Initial Tunnel Flow: 131.7 scfm
 Average Tunnel Flow: 136.4 scfm
 Post-Test Leak Check (1): 0.001 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.016	0.040	0.040	0.026	0.024	0.036	0.040	0.034	0.044
Temp:	107	107	107	107	108	108	108	108	107
V _{strav}	12.31			ft/sec			V _{scent}	14.28	
				ft/sec			F _p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
350	55.404	52.714	0.16	0.15	1.24	83	2.23	0.95	82	1.3	85	0.044	98	96	4.7	-0.1	250	72	72	70	-0.011	7.1	0
351	55.562	52.860	0.16	0.15	1.24	83	2.24	0.96	82	1.3	84	0.044	99	96	4.6	-0.1	245	72	72	70	-0.011	6.2	0
352	55.718	53.005	0.16	0.15	1.24	83	2.24	0.96	82	1.3	83	0.044	97	95	4.6	0	241	72	72	69	-0.011	6.4	0
353	55.874	53.152	0.16	0.15	1.25	83	2.24	0.96	82	1.3	83	0.044	97	97	4.5	-0.1	238	72	72	70	-0.010	6.6	0
354	56.032	53.297	0.16	0.14	1.24	83	2.24	0.96	82	1.3	83	0.044	99	95	4.5	0	237	72	72	70	-0.010	6.2	0
355	56.188	53.444	0.16	0.15	1.25	83	2.24	0.95	82	1.3	83	0.044	97	97	4.4	-0.1	235	72	72	69	-0.010	6.3	0
356	56.346	53.589	0.16	0.14	1.24	83	2.24	0.95	82	1.3	83	0.044	99	95	4.3	-0.1	234	72	72	70	-0.010	6.1	0
357	56.502	53.735	0.16	0.15	1.24	83	2.25	0.95	82	1.3	82	0.044	97	96	4.3	0	233	72	72	69	-0.009	6.3	0
358	56.659	53.882	0.16	0.15	1.24	83	2.24	0.95	82	1.3	82	0.044	98	97	4.3	0	233	72	72	69	-0.010	6.8	0
359	56.817	54.028	0.16	0.15	1.25	83	2.24	0.95	82	1.3	82	0.044	99	96	4.2	-0.1	232	72	72	71	-0.009	6.4	0
360	56.973	54.173	0.16	0.15	1.24	83	2.24	0.95	82	1.3	82	0.044	97	95	4.2	0	231	72	72	71	-0.009	6.3	0
361	57.130	54.320	0.16	0.15	1.24	83	2.24	0.95	82	1.3	82	0.044	98	97	4.1	-0.1	230	72	72	71	-0.009	6.6	0
362	57.287	54.465	0.16	0.15	1.24	83	2.24	0.96	82	1.3	82	0.044	98	95	4.0	-0.1	229	72	72	71	-0.009	6.8	0
363	57.443	54.610	0.16	0.14	1.25	83	2.25	0.95	82	1.3	82	0.044	97	95	4.0	0	229	72	72	70	-0.009	6.5	0
Avg/Tot	57.443	54.610	0.16	0.15	1.27	81	///	1.04	80	///	91	0.044	100	100	///	///	///	73	73	71	-0.011	///	///

ASTM E2779 Pellet Heater Run Sheets

Client: **Harman** Project Number: **0135PS036E.REV001** Run Number: 1
 Model: **Absolute 63 43** Tracking Number: 2146 Date: 2/8/11
 Test Crew: **A. Kravitz**
 OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 335, 336, 410, 420, 559

Pellet Heater Run Notes

Air Control Settings

High Burn Rate Target: 100%
 Settings: Temp = 7.0 Comb. Blower Max = 3100 RPM
Fuel = 93% Comb. Blower min = 2600 RPM
Dist. Blower = 100%

Medium Burn Rate Target: 550%
 Settings: T = 2.5 CB Max = 2625 RPM
F = 38% CB min = 2250 RPM
DB = 100%

Low Burn Rate Target: Minimum
 Settings: T = 1.0 CB Max = 2625 RPM
F = 25% CB min = 2000 RPM
DB = off → 100% (error, should have been off)

Additional Settings Notes:
 Distribution blower should have been off for low burn (per manufacturer's instructions) but was mistakenly left at 100%.

Preburn Notes

Time	Notes
45:00 - 50:00	Calibrated Gas Analyzer
54:00	Began sampling stack gas
66:00	End PB

Test Notes

Time	Notes
60:00	Changes 1hr filter
62:00	Switched to Med
183:00	Switched to Low
363:00	Test End

Pellet Moisture Content: 5.05%

Technician Signature: 

Date: 2/8/11

ASTM E2779 Pellet Heater Run Sheets

Client: Harman Project Number: 0135PS036E.REV001 Run Number: 1
 Model: Absolute 63 48 Tracking Number: 2146 Date: 2/8/16
 Test Crew: A. Kravitz
 OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 335, 336, 410, 420, 559

Pellet Heater Supplemental Data

Start Time: 9:59 Booth #: E1
 Stop Time: 16:02

Stack Gas Leak Check:

Initial: 0 Final: 0

Sample Train Leak Check:

A: 0.001 @ -9 "Hg
 B: 0 @ -6 "Hg

Calibrations: Span Gas

CO₂: ^{16.89}16.78 CO: ^{4.290}4.244


	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	<u>09:40</u>	<u>09:46</u>	<u>16:07</u>	<u>16:06</u>
CO ₂	<u>0.00</u>	<u>16.25</u>	<u>-0.05</u>	<u>16.73</u>
CO	<u>0.000</u>	<u>4.248</u>	<u>-0.013</u>	<u>4.194</u>

Air Velocity (ft/min): Initial: 450 Final: 450
 Scale Audit (lbs): Initial: 10.0 Final: 10.0
 Pitot Tube Leak Test: Initial: 0 Final: 0
 Stack Diameter (in): 3
 Induced Draft: 0
 % Smoke Capture: 100
 Flue Pipe Cleaned Prior to First Test in Series:
 Date: 2/6/16 Initials: A

Tunnel Traverse		
Microtector Reading	dP (in H ₂ O)	T(°F)
<u>0.008</u>	<u>0.016</u>	<u>107</u>
<u>0.020</u>	<u>0.040</u>	
<u>0.020</u>	<u>0.040</u>	
<u>0.013</u>	<u>0.026</u>	
<u>0.012</u>	<u>0.024</u>	<u>108</u>
<u>0.018</u>	<u>0.036</u>	
<u>0.020</u>	<u>0.040</u>	
<u>0.017</u>	<u>0.034</u>	
Center:		
<u>0.022</u>	<u>0.044</u>	<u>107</u>
Static:		
<u>MA</u>	<u>-0.16</u>	<u>107</u>

	Initial	Middle	Ending
P _b (in/Hg)	<u>30.47</u>	<u>30.39</u>	<u>30.32</u>
Ambient (°F)	<u>72</u>	<u>71</u>	<u>70</u>

Background Filter Volume: MA

Technician Signature: 

Date: 2/8/16

*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Run 2

Pellet Heater Test Results - ASTM E2779 / ASTM E2515

Manufacturer: Harman
 Model: Absolute 63
 Project No.: 0135PS036E.REV001
 Tracking No.: 2146
 Run: 2
 Test Date: 02/11/16

Burn Rate (Composite)	1.37 kg/hr dry
Average Tunnel Temperature	87 degrees F
Average Gas Velocity in Dilution Tunnel - vs	11.91 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8080.4 dscf/hour
Average Delta p	0.042 inches H2O
Average Delta H	1.26 inches H2O
Total Time of Test	364 minutes

Burn Rate (High)	3.05 kg/hr dry
Burn Rate (Med)	1.43 kg/hr dry 47.0% of High
Burn Rate (Low)	0.76 kg/hr dry 24.9% of High

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	1 st HR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	57.564 cubic feet	55.496 cubic feet	9.411 cubic feet
Average Gas Meter Temperature	69 degrees F	81 degrees F	79 degrees F	76 degrees F
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	57.303 dscf	55.356 dscf	9.451 dscf
Total Particulates - m _p	0 mg	8.9 mg	8.6 mg	2.7 mg
Particulate Concentration (dry-standard) - C _p /C _s	0.000000 grams/dscf	0.00016 grams/dscf	0.00016 grams/dscf	0.00029 grams/dscf
Total Particulate Emissions - E _T	0.00 grams	7.61 grams	7.62 grams	2.31 grams
Particulate Emission Rate	0.00 grams/hour	1.26 grams/hour	1.26 grams/hour	2.31 grams/hour
Emissions Factor		0.91 g/kg	0.91 g/kg	0.75 g/kg
Difference from Average Total Particulate Emissions		0.00 grams	0.00 grams	
Dual Train Comparison Results Are Acceptable				

FINAL AVERAGE RESULTS

Integrated Test Run	
Total Particulate Emissions - E _T	7.61 grams
Particulate Emission Rate	1.26 grams/hour
Emissions Factor	0.91 grams/kg
First Hour Emissions	
Total Particulate Emissions - E _T	2.31 grams
Particulate Emission Rate	2.31 grams/hour
Emissions Factor	0.75 grams/kg

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/11/16
Run: 2
Control #: 2146
Test Duration: 364
Output Category: Integrated

Technicians: A. Kravitz



Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	76.8%	82.3%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	77%	82.7%

Output Rate (kJ/h)	20,582	19,524	(Btu/h)
Burn Rate (kg/h)	1.37	3.03	(lb/h)
Input (kJ/h)	26,782	25,406	(Btu/h)

Test Load Weight (dry kg)	8.34	18.37	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	131		
Test Duration (h)	6.07		

Emissions	Particulate	CO
g/MJ Output	0.00	1.05
g/kg Dry Fuel	0.00	15.76
g/h	0.00	21.65
lb/MM Btu Output	0.00	2.44

Air/Fuel Ratio (A/F)	18.85
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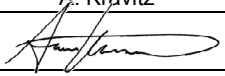
VERSION:

2.3

3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/11/16
Run: 2
Control #: 2146
Test Duration: 62
Output Category: Maximum

Technicians: A. Kravitz


Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	77.4%	82.9%
Combustion Efficiency	97.1%	97.1%
Heat Transfer Efficiency	80%	85.4%

Output Rate (kJ/h)	46,047	43,681	(Btu/h)
Burn Rate (kg/h)	3.05	6.72	(lb/h)
Input (kJ/h)	59,473	56,416	(Btu/h)

Test Load Weight (dry kg)	3.15	6.95	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	141		
Test Duration (h)	1.03		

Emissions	Particulate	CO
g/MJ Output	0.00	2.97
g/kg Dry Fuel	0.00	44.81
g/h	0.00	136.72
lb/MM Btu Output	0.00	6.90

Air/Fuel Ratio (A/F)	10.18
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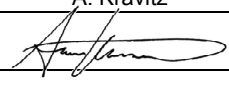
VERSION:

2.3

3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/11/16
Run: 2
Control #: 2146
Test Duration: 121
Output Category: Medium

Technicians: A. Kravitz


Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	80.3%	86.0%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	81%	86.4%

Output Rate (kJ/h)	22,471	21,316	(Btu/h)
Burn Rate (kg/h)	1.43	3.16	(lb/h)
Input (kJ/h)	27,969	26,532	(Btu/h)

Test Load Weight (dry kg)	2.89	6.38	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	3		
Test Duration (h)	2.02		

Emissions	Particulate	CO
g/MJ Output	0.00	0.06
g/kg Dry Fuel	0.00	0.93
g/h	0.00	1.33
lb/MM Btu Output	0.00	0.14

Air/Fuel Ratio (A/F)	17.07
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VERSION:

2.3

3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 02/11/16
Run: 2
Control #: 2146
Test Duration: 181
Output Category: Minimum

Technicians: A. Kravitz



Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	69.5%	74.4%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	70%	74.7%

Output Rate (kJ/h)	10,276	9,748	(Btu/h)
Burn Rate (kg/h)	0.76	1.67	(lb/h)
Input (kJ/h)	14,791	14,030	(Btu/h)

Test Load Weight (dry kg)	2.29	5.05	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	0		
Test Duration (h)	3.02		

Emissions	Particulate	CO
g/MJ Output	0.00	0.00
g/kg Dry Fuel	0.00	0.00
g/h	0.00	0.00
lb/MM Btu Output	0.00	0.00

Air/Fuel Ratio (A/F)	29.37
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VERSION:

2.3

3/23/2010

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{straw}	12.06			ft/sec			V_{scent}	13.90	
	ft/sec			ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
0	0.000	0.000			0.45	72	1.21	0.65	72	1.1	103	0.042			36.8		372	72	73	71	-0.029	10.4	0.3
1	0.151	0.144	0.15	0.14	1.27	72	2.16	1.00	72	1.1	103	0.042	98	97	36.7	-0.1	375	73	74	72	-0.029	10.3	0.3
2	0.308	0.295	0.16	0.15	1.28	72	2.17	1.01	72	1.1	102	0.042	102	102	36.6	-0.1	375	73	75	71	-0.030	11	0.6
3	0.466	0.448	0.16	0.15	1.27	72	2.17	1.01	72	1.1	102	0.042	103	103	36.5	-0.1	376	73	75	71	-0.031	10.3	0.2
4	0.622	0.599	0.16	0.15	1.27	72	2.17	1.01	72	1.1	102	0.042	102	102	36.4	-0.1	378	73	75	71	-0.031	10	0.2
5	0.780	0.751	0.16	0.15	1.27	72	2.17	1.01	72	1.1	103	0.042	103	102	36.2	-0.2	380	73	75	70	-0.030	10.7	0.3
6	0.937	0.904	0.16	0.15	1.27	72	2.16	1.01	72	1.1	103	0.042	102	103	36.1	-0.1	382	73	75	71	-0.031	11.1	0.5
7	1.094	1.056	0.16	0.15	1.27	72	2.16	1.01	72	1.1	102	0.042	102	102	36.0	-0.1	382	73	75	70	-0.031	11.2	0.6
8	1.251	1.208	0.16	0.15	1.27	72	2.17	1.01	72	1.1	103	0.042	102	102	35.9	-0.1	383	73	75	70	-0.032	10.6	0.2
9	1.408	1.361	0.16	0.15	1.26	72	2.16	1.00	72	1.1	103	0.042	102	103	35.7	-0.2	385	74	75	71	-0.031	10.8	0.3
10	1.564	1.512	0.16	0.15	1.27	73	2.16	1.01	73	1.1	103	0.042	101	102	35.6	-0.1	386	74	75	71	-0.032	11.6	0.5
11	1.722	1.664	0.16	0.15	1.26	73	2.16	1.00	73	1.1	103	0.042	103	102	35.5	-0.1	388	74	75	69	-0.032	11.4	0.5
12	1.877	1.817	0.16	0.15	1.26	73	2.15	1.01	73	1.1	102	0.042	101	103	35.4	-0.1	387	74	75	71	-0.031	11.8	0.7
13	2.035	1.969	0.16	0.15	1.25	73	2.15	1.01	73	1.1	102	0.042	103	102	35.2	-0.2	386	74	75	71	-0.031	10.7	0.2
14	2.191	2.121	0.16	0.15	1.26	73	2.16	1.00	73	1.1	102	0.042	101	102	35.1	-0.1	387	74	75	71	-0.032	10.2	0.2
15	2.348	2.273	0.16	0.15	1.26	73	2.15	1.01	73	1.1	103	0.042	102	102	35.0	-0.1	387	74	75	70	-0.032	11	0.3
16	2.505	2.425	0.16	0.15	1.25	74	2.15	1.01	73	1.1	103	0.042	102	102	34.9	-0.1	386	74	75	70	-0.031	11	0.2
17	2.661	2.578	0.16	0.15	1.26	74	2.15	1.00	74	1.1	102	0.042	101	103	34.8	-0.1	384	74	75	69	-0.031	10.2	0.1
18	2.818	2.730	0.16	0.15	1.26	74	2.15	1.01	74	1.1	102	0.042	102	102	34.7	-0.1	382	74	75	70	-0.031	9.6	0.1
19	2.974	2.882	0.16	0.15	1.26	74	2.15	1.00	74	1.1	103	0.042	101	102	34.5	-0.2	383	74	75	69	-0.031	9.4	0.1
20	3.131	3.035	0.16	0.15	1.26	74	2.14	1.00	74	1.1	103	0.042	102	103	34.4	-0.1	384	74	75	68	-0.031	10.1	0.2
21	3.288	3.186	0.16	0.15	1.25	75	2.14	1.00	74	1.1	103	0.042	102	101	34.3	-0.1	385	74	75	69	-0.032	10.8	0.3
22	3.444	3.339	0.16	0.15	1.25	75	2.15	1.00	75	1.1	103	0.042	101	103	34.2	-0.1	387	74	76	69	-0.031	11.1	0.4
23	3.601	3.492	0.16	0.15	1.25	75	2.15	1.00	75	1.1	103	0.042	102	103	34.0	-0.2	388	74	76	69	-0.032	11.3	0.9
24	3.757	3.643	0.16	0.15	1.25	75	2.15	1.00	75	1.1	102	0.042	101	101	33.9	-0.1	387	74	75	69	-0.031	11.5	0.8
25	3.914	3.796	0.16	0.15	1.26	75	2.15	1.00	75	1.1	102	0.042	102	102	33.8	-0.1	386	74	76	69	-0.032	10.6	0.3
26	4.071	3.949	0.16	0.15	1.25	75	2.15	1.00	75	1.1	103	0.042	102	103	33.7	-0.1	386	74	75	69	-0.032	10.4	0.2
27	4.227	4.100	0.16	0.15	1.26	76	2.15	1.00	76	1.1	102	0.042	101	101	33.6	-0.1	385	74	76	71	-0.031	10.1	0.2
28	4.384	4.253	0.16	0.15	1.25	76	2.14	1.00	76	1.1	103	0.042	102	102	33.5	-0.1	386	74	76	70	-0.032	9.7	0.1
29	4.540	4.406	0.16	0.15	1.25	76	2.14	1.00	76	1.1	103	0.042	101	102	33.3	-0.2	388	74	76	69	-0.032	10.1	0.5
30	4.697	4.557	0.16	0.15	1.25	76	2.15	1.00	76	1.1	103	0.042	102	101	33.2	-0.1	387	74	76	69	-0.032	10.9	0.8
31	4.854	4.710	0.16	0.15	1.25	76	2.15	1.00	76	1.1	103	0.042	102	102	33.1	-0.1	385	74	76	71	-0.031	10.3	0.5
32	5.010	4.863	0.16	0.15	1.25	77	2.15	1.00	76	1.1	103	0.042	101	102	33.0	-0.1	386	74	76	70	-0.031	9.3	0.2
33	5.168	5.015	0.16	0.15	1.25	77	2.15	1.00	77	1.1	103	0.042	102	102	32.9	-0.1	386	74	76	71	-0.032	9.7	0.2
34	5.324	5.168	0.16	0.15	1.25	77	2.15	1.00	77	1.1	103	0.042	101	102	32.8	-0.1	387	74	76	69	-0.031	10.1	0.4

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{straw}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
35	5.481	5.320	0.16	0.15	1.25	77	2.15	1.01	77	1.1	103	0.042	101	102	32.6	-0.2	386	74	76	69	-0.032	10.2	0.6
36	5.638	5.472	0.16	0.15	1.25	77	2.15	1.00	77	1.1	103	0.042	101	102	32.5	-0.1	386	74	76	69	-0.032	9.8	0.3
37	5.794	5.625	0.16	0.15	1.25	77	2.15	1.00	77	1.1	103	0.042	101	102	32.4	-0.1	388	74	76	70	-0.032	9.9	0.2
38	5.952	5.777	0.16	0.15	1.25	78	2.14	1.00	77	1.1	103	0.042	102	102	32.3	-0.1	389	74	76	71	-0.032	10.2	0.6
39	6.109	5.930	0.16	0.15	1.25	78	2.15	1.00	78	1.1	103	0.042	101	102	32.1	-0.2	388	74	76	71	-0.031	10.6	0.7
40	6.265	6.083	0.16	0.15	1.25	78	2.15	1.00	78	1.1	103	0.042	101	102	32.0	-0.1	387	74	76	70	-0.031	10	0.3
41	6.423	6.235	0.16	0.15	1.25	78	2.15	1.00	78	1.1	103	0.042	102	101	31.9	-0.1	386	74	76	70	-0.031	9.7	0.2
42	6.579	6.388	0.16	0.15	1.25	78	2.15	1.00	78	1.1	104	0.042	101	102	31.8	-0.1	386	74	76	70	-0.032	9.4	0.2
43	6.737	6.541	0.16	0.15	1.25	78	2.15	1.00	78	1.1	103	0.042	102	102	31.7	-0.1	387	74	76	70	-0.032	9.7	0.3
44	6.893	6.693	0.16	0.15	1.24	78	2.15	1.01	78	1.2	103	0.042	101	101	31.6	-0.1	385	74	76	70	-0.031	10	0.5
45	7.050	6.846	0.16	0.15	1.25	79	2.15	1.00	78	1.1	103	0.042	101	102	31.4	-0.2	386	74	76	70	-0.031	9.8	0.3
46	7.208	6.999	0.16	0.15	1.25	79	2.15	1.00	79	1.2	103	0.042	102	102	31.3	-0.1	386	74	76	70	-0.031	9.5	0.3
47	7.365	7.151	0.16	0.15	1.25	79	2.15	1.00	79	1.1	103	0.042	101	101	31.2	-0.1	386	74	76	69	-0.031	10	0.4
48	7.522	7.305	0.16	0.15	1.25	79	2.16	1.00	79	1.2	104	0.042	101	103	31.1	-0.1	387	74	76	70	-0.032	9.7	0.3
49	7.679	7.457	0.16	0.15	1.25	79	2.15	1.00	79	1.1	103	0.042	101	101	30.9	-0.2	388	74	76	70	-0.032	9.8	0.5
50	7.836	7.610	0.16	0.15	1.25	79	2.15	1.00	79	1.1	103	0.042	101	102	30.8	-0.1	387	74	76	71	-0.031	10.4	0.7
51	7.994	7.763	0.16	0.15	1.25	79	2.15	1.00	79	1.1	103	0.042	102	102	30.8	0	386	74	76	70	-0.031	9.9	0.3
52	8.151	7.915	0.16	0.15	1.25	79	2.15	1.00	79	1.1	103	0.042	101	101	30.6	-0.2	386	74	76	70	-0.032	9.7	0.1
53	8.307	8.068	0.16	0.15	1.25	80	2.15	1.00	79	1.2	103	0.042	100	102	30.5	-0.1	387	74	76	70	-0.032	9.7	0.2
54	8.465	8.221	0.16	0.15	1.25	80	2.15	1.00	79	1.1	103	0.042	101	102	30.4	-0.1	387	74	76	70	-0.032	9.9	0.4
55	8.622	8.373	0.16	0.15	1.25	80	2.15	1.00	80	1.1	103	0.042	101	101	30.3	-0.1	386	74	76	71	-0.032	9.8	0.4
56	8.779	8.527	0.16	0.15	1.25	80	2.15	1.00	80	1.2	103	0.042	101	102	30.2	-0.1	384	74	76	71	-0.031	9.7	0.3
57	8.937	8.679	0.16	0.15	1.25	80	2.15	1.00	80	1.2	103	0.042	101	101	30.1	-0.1	385	75	76	70	-0.031	9.2	0.2
58	9.094	8.832	0.16	0.15	1.25	80	2.15	1.00	80	1.2	103	0.042	101	102	29.9	-0.2	386	74	76	71	-0.031	9.8	0.5
59	9.252	8.986	0.16	0.15	1.25	80	2.16	1.00	80	1.2	103	0.042	101	102	29.8	-0.1	386	75	76	70	-0.032	10	0.4
60	9.411	9.137	0.16	0.15	1.25	80	2.15	1.00	80	1.2	103	0.042	102	100	29.7	-0.1	387	75	76	70	-0.031	10	0.5
61	9.568	9.291	0.16	0.15	1.26	80	2.15	1.00	80	1.1	104	0.042	101	102	30.0	0.3	387	76	76	71	-0.031	9.8	0.8
62	9.727	9.443	0.16	0.15	1.26	80	2.14	1.00	80	1.2	103	0.042	102	101	29.5	-0.5	383	76	76	70	-0.031	10	1.2
63	9.884	9.596	0.16	0.15	1.25	80	2.14	1.00	80	1.1	101	0.042	101	101	29.4	-0.1	373	76	76	70	-0.031	9.1	0.3
64	10.042	9.749	0.16	0.15	1.26	81	2.14	1.00	80	1.2	98	0.042	101	101	29.4	0	358	75	76	71	-0.030	6.9	0.1
65	10.201	9.901	0.16	0.15	1.25	81	2.14	1.00	80	1.1	97	0.042	101	100	29.3	-0.1	345	75	76	70	-0.029	5.6	0
66	10.358	10.055	0.16	0.15	1.26	81	2.14	1.00	80	1.2	95	0.042	100	102	29.3	0	334	75	76	70	-0.028	5	0
67	10.516	10.208	0.16	0.15	1.26	81	2.14	1.00	80	1.1	95	0.042	101	101	29.2	-0.1	325	75	76	70	-0.027	4.7	0
68	10.675	10.360	0.16	0.15	1.25	81	2.14	1.00	81	1.2	94	0.042	101	100	29.2	0	316	75	75	69	-0.025	4.5	0
69	10.832	10.514	0.16	0.15	1.26	81	2.14	1.00	81	1.1	93	0.042	100	101	29.2	0	307	75	75	70	-0.025	4.1	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{strav}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
70	10.990	10.667	0.16	0.15	1.26	81	2.14	1.00	81	1.1	92	0.042	100	100	29.1	-0.1	299	75	75	71	-0.024	3.7	0
71	11.149	10.819	0.16	0.15	1.26	81	2.14	1.00	81	1.1	91	0.042	101	100	29.1	0	292	74	75	71	-0.022	3.5	0
72	11.306	10.973	0.16	0.15	1.25	81	2.13	1.00	81	1.2	91	0.042	100	101	29.1	0	287	74	75	70	-0.022	3.6	0
73	11.464	11.126	0.16	0.15	1.26	81	2.14	1.00	81	1.2	90	0.042	100	100	29.0	-0.1	281	74	75	70	-0.021	3.6	0
74	11.624	11.279	0.16	0.15	1.26	81	2.13	1.00	81	1.1	89	0.042	101	100	29.0	0	275	74	75	70	-0.020	3.5	0
75	11.781	11.432	0.16	0.15	1.25	81	2.14	1.00	81	1.1	89	0.042	99	100	29.0	0	269	74	75	69	-0.020	3.3	0
76	11.939	11.585	0.16	0.15	1.26	81	2.14	1.00	81	1.1	88	0.042	100	100	29.0	0	265	74	75	69	-0.019	2.9	0
77	12.098	11.738	0.16	0.15	1.26	81	2.14	1.00	81	1.1	88	0.042	101	100	28.9	-0.1	260	74	74	70	-0.018	3.1	0
78	12.256	11.891	0.16	0.15	1.26	81	2.14	1.00	81	1.2	87	0.042	100	100	28.9	0	258	74	74	70	-0.018	3.2	0
79	12.414	12.044	0.16	0.15	1.26	81	2.14	1.00	81	1.2	87	0.042	100	100	28.8	-0.1	256	74	74	71	-0.018	3.4	0
80	12.573	12.198	0.16	0.15	1.26	82	2.14	1.00	81	1.2	87	0.042	100	101	28.8	0	255	74	74	70	-0.018	3.7	0
81	12.731	12.350	0.16	0.15	1.26	82	2.15	1.00	81	1.1	86	0.042	100	99	28.8	0	255	73	74	71	-0.018	4.2	0
82	12.889	12.503	0.16	0.15	1.26	82	2.14	1.00	81	1.1	86	0.042	100	100	28.7	-0.1	255	73	74	71	-0.018	4.7	0
83	13.048	12.656	0.16	0.15	1.26	82	2.15	1.00	81	1.2	86	0.042	100	100	28.7	0	255	73	74	71	-0.018	4.8	0
84	13.206	12.809	0.16	0.15	1.26	82	2.15	1.00	81	1.1	86	0.042	100	100	28.6	-0.1	255	73	74	71	-0.018	5.3	0
85	13.364	12.963	0.16	0.15	1.26	82	2.14	1.00	81	1.2	86	0.042	100	101	28.5	-0.1	255	73	74	71	-0.018	5	0
86	13.523	13.115	0.16	0.15	1.26	82	2.15	1.00	81	1.2	86	0.042	100	99	28.5	0	256	73	74	71	-0.018	5	0
87	13.680	13.268	0.16	0.15	1.26	82	2.15	1.00	81	1.2	86	0.042	99	100	28.4	-0.1	257	73	74	70	-0.019	5.5	0
88	13.838	13.422	0.16	0.15	1.26	82	2.14	1.00	81	1.1	86	0.042	100	101	28.3	-0.1	259	73	74	70	-0.019	5.6	0
89	13.997	13.574	0.16	0.15	1.26	82	2.15	1.00	81	1.1	86	0.042	100	99	28.3	0	261	73	74	70	-0.019	6.1	0
90	14.155	13.728	0.16	0.15	1.26	82	2.15	1.00	81	1.2	86	0.042	100	101	28.2	-0.1	263	73	74	70	-0.019	6.7	0
91	14.313	13.880	0.16	0.15	1.26	82	2.14	1.00	81	1.1	87	0.042	100	99	28.2	0	264	73	73	70	-0.019	6.8	0
92	14.472	14.033	0.16	0.15	1.26	82	2.14	1.00	81	1.2	87	0.042	100	100	28.1	-0.1	265	73	73	70	-0.020	6.7	0
93	14.630	14.187	0.16	0.15	1.25	82	2.15	1.00	81	1.2	87	0.042	100	101	28.0	-0.1	267	73	73	70	-0.020	6.5	0
94	14.788	14.340	0.16	0.15	1.26	82	2.14	1.00	81	1.2	87	0.042	100	100	28.0	0	269	73	73	71	-0.020	6.7	0
95	14.944	14.490	0.16	0.15	1.26	82	2.15	1.00	81	1.1	87	0.042	98	98	27.9	-0.1	271	73	73	70	-0.020	7.3	0
96	15.102	14.644	0.16	0.15	1.26	82	2.15	1.00	81	1.2	87	0.042	100	101	27.8	-0.1	272	73	73	71	-0.021	7	0
97	15.260	14.796	0.16	0.15	1.26	82	2.15	1.01	81	1.2	87	0.042	100	99	27.7	-0.1	274	73	73	70	-0.021	7	0
98	15.419	14.949	0.16	0.15	1.26	82	2.15	1.00	81	1.1	87	0.042	100	100	27.7	0	275	73	73	70	-0.021	6.9	0
99	15.577	15.102	0.16	0.15	1.26	82	2.15	1.00	81	1.2	87	0.042	100	100	27.6	-0.1	276	73	73	70	-0.021	7.2	0
100	15.735	15.255	0.16	0.15	1.26	82	2.15	1.00	81	1.2	87	0.042	100	100	27.6	0	275	73	73	70	-0.021	7.2	0
101	15.894	15.409	0.16	0.15	1.26	82	2.16	1.00	81	1.1	87	0.042	100	101	27.5	-0.1	275	73	73	70	-0.021	6.8	0
102	16.052	15.561	0.16	0.15	1.26	82	2.15	1.00	81	1.2	87	0.042	100	99	27.4	-0.1	275	73	73	70	-0.021	6.2	0
103	16.210	15.714	0.16	0.15	1.26	82	2.15	1.00	81	1.1	88	0.042	100	100	27.4	0	275	73	73	71	-0.021	6.1	0
104	16.370	15.868	0.16	0.15	1.26	82	2.16	1.00	81	1.2	88	0.042	101	101	27.3	-0.1	276	73	73	71	-0.022	6.1	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{straw}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
105	16.527	16.020	0.16	0.15	1.26	82	2.15	1.00	81	1.2	87	0.042	99	99	27.3	0	274	73	73	71	-0.021	6.9	0
106	16.686	16.174	0.16	0.15	1.26	82	2.15	1.00	81	1.2	87	0.042	100	101	27.2	-0.1	272	73	73	72	-0.021	6.2	0
107	16.845	16.326	0.16	0.15	1.26	82	2.16	1.00	81	1.2	87	0.042	100	99	27.1	-0.1	270	73	73	71	-0.020	5.3	0
108	17.003	16.479	0.16	0.15	1.26	82	2.15	1.00	81	1.1	87	0.042	100	100	27.1	0	268	73	73	71	-0.020	4.9	0
109	17.161	16.633	0.16	0.15	1.26	82	2.15	1.00	81	1.1	87	0.042	100	101	27.1	0	266	73	73	70	-0.020	4.9	0
110	17.321	16.786	0.16	0.15	1.26	82	2.16	1.00	81	1.1	87	0.042	101	100	27.0	-0.1	265	73	73	70	-0.020	4.8	0
111	17.478	16.939	0.16	0.15	1.26	82	2.15	1.00	81	1.2	87	0.042	99	100	26.9	-0.1	264	73	73	70	-0.019	4.7	0
112	17.637	17.092	0.16	0.15	1.27	82	2.15	1.00	82	1.1	87	0.042	100	100	26.9	0	264	73	73	70	-0.020	5	0
113	17.796	17.244	0.16	0.15	1.27	82	2.16	1.00	82	1.1	87	0.042	100	99	26.8	-0.1	264	72	73	70	-0.020	5.2	0
114	17.954	17.398	0.16	0.15	1.26	82	2.15	1.00	82	1.2	87	0.042	100	100	26.8	0	265	72	73	70	-0.020	5.8	0
115	18.112	17.551	0.16	0.15	1.26	82	2.16	1.00	82	1.2	87	0.042	100	100	26.7	-0.1	267	72	73	70	-0.020	5.9	0
116	18.272	17.704	0.16	0.15	1.26	82	2.16	1.00	82	1.2	87	0.042	101	100	26.6	-0.1	268	72	73	70	-0.020	6.5	0
117	18.430	17.857	0.16	0.15	1.26	82	2.15	1.00	82	1.2	87	0.042	100	100	26.6	0	269	72	73	70	-0.021	6.5	0
118	18.588	18.010	0.16	0.15	1.26	82	2.16	1.00	82	1.2	87	0.042	100	100	26.5	-0.1	270	72	73	71	-0.021	6.6	0
119	18.747	18.163	0.16	0.15	1.27	82	2.16	1.00	82	1.2	87	0.042	100	100	26.4	-0.1	271	72	73	70	-0.021	6.9	0
120	18.906	18.316	0.16	0.15	1.25	82	2.16	1.00	82	1.2	87	0.042	100	100	26.4	0	271	72	73	70	-0.021	6.7	0
121	19.063	18.468	0.16	0.15	1.26	82	2.16	1.00	82	1.2	87	0.042	99	99	26.3	-0.1	272	72	73	70	-0.021	6.5	0
122	19.222	18.622	0.16	0.15	1.26	82	2.16	1.00	82	1.2	87	0.042	100	100	26.2	-0.1	274	72	73	70	-0.021	6.6	0
123	19.381	18.774	0.16	0.15	1.26	82	2.16	1.00	82	1.2	87	0.042	100	99	26.2	0	276	72	73	70	-0.021	7.2	0
124	19.539	18.927	0.16	0.15	1.26	82	2.16	1.00	82	1.2	88	0.042	100	100	26.1	-0.1	276	72	73	70	-0.021	7.2	0
125	19.698	19.081	0.16	0.15	1.26	82	2.16	1.00	82	1.1	87	0.042	100	100	26.0	-0.1	277	72	73	70	-0.022	7.2	0
126	19.857	19.233	0.16	0.15	1.26	82	2.15	0.99	82	1.1	88	0.042	100	99	26.0	0	276	72	73	70	-0.021	7	0
127	20.015	19.386	0.16	0.15	1.26	83	2.15	1.00	82	1.2	87	0.042	99	100	25.9	-0.1	275	72	73	71	-0.022	6.5	0
128	20.173	19.539	0.16	0.15	1.26	82	2.16	1.00	82	1.2	87	0.042	100	100	25.9	0	274	73	73	71	-0.021	6.2	0
129	20.332	19.692	0.16	0.15	1.26	83	2.16	1.00	82	1.1	87	0.042	100	100	25.8	-0.1	274	73	73	70	-0.021	5.7	0
130	20.490	19.845	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	99	100	25.8	0	273	73	73	70	-0.021	5.8	0
131	20.648	19.998	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	99	100	25.7	-0.1	272	73	73	70	-0.021	5.8	0
132	20.808	20.151	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	101	100	25.6	-0.1	272	73	73	70	-0.022	5.6	0
133	20.966	20.304	0.16	0.15	1.25	83	2.16	1.00	82	1.2	87	0.042	99	100	25.5	-0.1	273	72	73	69	-0.021	5.6	0
134	21.124	20.456	0.16	0.15	1.26	83	2.17	1.00	82	1.2	87	0.042	99	99	25.5	0	274	72	73	70	-0.021	6.1	0
135	21.283	20.610	0.16	0.15	1.26	83	2.17	0.99	82	1.2	87	0.042	100	100	25.4	-0.1	274	72	73	70	-0.021	6.3	0
136	21.441	20.762	0.16	0.15	1.26	83	2.17	1.00	82	1.2	87	0.042	99	99	25.4	0	274	72	73	70	-0.021	6.5	0
137	21.600	20.915	0.16	0.15	1.27	83	2.16	1.00	82	1.2	87	0.042	100	100	25.3	-0.1	275	72	100	70	-0.021	6	0
138	21.759	21.068	0.16	0.15	1.26	83	2.17	1.00	82	1.2	87	0.042	100	100	25.2	-0.1	275	72	73	70	-0.021	6.3	0
139	21.917	21.221	0.16	0.15	1.26	83	2.17	1.00	82	1.2	87	0.042	99	100	25.2	0	276	72	73	71	-0.022	6.3	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{strav}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
140	22.076	21.374	0.16	0.15	1.26	83	2.17	1.00	82	1.2	87	0.042	100	100	25.1	-0.1	276	72	73	70	-0.021	6.5	0
141	22.235	21.527	0.16	0.15	1.26	83	2.17	1.00	82	1.2	87	0.042	100	100	25.1	0	275	72	73	70	-0.021	6.6	0
142	22.393	21.679	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	99	99	25.0	-0.1	273	72	73	69	-0.021	6.1	0
143	22.551	21.833	0.16	0.15	1.26	83	2.16	0.99	82	1.2	87	0.042	99	100	25.0	0	271	72	73	70	-0.021	5.8	0
144	22.711	21.985	0.16	0.15	1.27	83	2.17	1.00	82	1.2	87	0.042	101	99	24.9	-0.1	273	72	73	70	-0.021	5.4	0
145	22.870	22.138	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	100	100	24.8	-0.1	273	72	73	70	-0.021	5.3	0
146	23.028	22.291	0.16	0.15	1.26	83	2.17	1.00	82	1.2	87	0.042	99	100	24.8	0	274	72	73	69	-0.022	5.5	0
147	23.186	22.443	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	99	99	24.7	-0.1	275	72	73	69	-0.022	5.3	0
148	23.345	22.596	0.16	0.15	1.26	83	2.16	0.99	82	1.2	87	0.042	100	100	24.7	0	275	72	73	71	-0.022	5.7	0
149	23.503	22.750	0.16	0.15	1.26	83	2.17	0.99	82	1.2	87	0.042	99	100	24.6	-0.1	276	72	73	71	-0.021	6.1	0
150	23.662	22.902	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	100	99	24.5	-0.1	275	72	73	71	-0.021	6.2	0
151	23.821	23.055	0.16	0.15	1.26	83	2.17	0.99	82	1.2	87	0.042	100	100	24.5	0	273	72	73	71	-0.021	6	0
152	23.979	23.208	0.16	0.15	1.26	83	2.16	1.00	82	1.2	87	0.042	99	100	24.5	0	271	72	73	69	-0.021	5.6	0
153	24.138	23.360	0.16	0.15	1.26	83	2.16	1.00	82	1.2	86	0.042	100	99	24.4	-0.1	268	72	73	69	-0.021	5.1	0
154	24.297	23.514	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	100	100	24.4	0	267	72	73	71	-0.021	4.7	0
155	24.456	23.666	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	100	99	24.3	-0.1	266	72	73	70	-0.020	4.4	0
156	24.614	23.819	0.16	0.15	1.26	83	2.16	1.00	82	1.2	86	0.042	99	100	24.2	-0.1	264	72	73	71	-0.020	4.9	0
157	24.773	23.972	0.16	0.15	1.26	83	2.16	0.99	82	1.2	86	0.042	100	100	24.2	0	263	72	73	70	-0.020	5	0
158	24.931	24.124	0.16	0.15	1.26	83	2.16	1.00	82	1.2	86	0.042	99	99	24.1	-0.1	263	72	73	71	-0.020	4.8	0
159	25.090	24.277	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	100	100	24.1	0	263	72	73	70	-0.020	4.9	0
160	25.249	24.430	0.16	0.15	1.25	83	2.16	0.99	82	1.2	86	0.042	100	100	24.0	-0.1	263	72	73	71	-0.020	5.3	0
161	25.407	24.582	0.16	0.15	1.26	83	2.17	1.00	82	1.2	86	0.042	99	99	24.0	0	263	72	73	70	-0.020	5.6	0
162	25.566	24.736	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	100	100	23.9	-0.1	264	72	73	69	-0.021	5.7	0
163	25.725	24.888	0.16	0.15	1.25	83	2.16	0.99	82	1.2	86	0.042	100	99	23.8	-0.1	265	72	73	70	-0.021	5.9	0
164	25.883	25.040	0.16	0.15	1.25	83	2.17	0.99	82	1.2	86	0.042	99	99	23.7	-0.1	267	72	73	70	-0.021	6	0
165	26.041	25.194	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	99	100	23.7	0	268	72	73	69	-0.021	6.4	0
166	26.200	25.346	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	100	99	23.6	-0.1	270	72	73	70	-0.021	7	0.1
167	26.359	25.498	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	100	99	23.5	-0.1	272	72	73	69	-0.021	6.9	0
168	26.517	25.652	0.16	0.15	1.26	83	2.17	0.99	82	1.2	86	0.042	99	100	23.5	0	272	72	73	69	-0.022	7.2	0
169	26.676	25.804	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	99	23.4	-0.1	273	72	73	70	-0.022	6.9	0
170	26.835	25.956	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	99	23.3	-0.1	273	72	73	70	-0.022	6.5	0
171	26.993	26.109	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	100	23.3	0	273	72	73	70	-0.022	6.6	0
172	27.151	26.261	0.16	0.15	1.26	82	2.17	1.00	82	1.2	86	0.042	100	99	23.2	-0.1	274	72	73	70	-0.022	6.3	0
173	27.310	26.415	0.16	0.15	1.26	82	2.17	0.99	82	1.2	87	0.042	100	100	23.1	-0.1	274	72	73	70	-0.022	6.3	0
174	27.468	26.567	0.16	0.15	1.26	82	2.16	0.99	82	1.2	87	0.042	100	99	23.1	0	274	72	73	69	-0.022	6.6	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{strav}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
175	27.626	26.720	0.16	0.15	1.26	82	2.18	0.99	82	1.2	87	0.042	100	100	23.0	-0.1	274	72	73	69	-0.022	6.7	0
176	27.786	26.873	0.16	0.15	1.26	82	2.17	0.99	82	1.2	87	0.042	101	100	22.9	-0.1	274	72	73	70	-0.022	6.6	0
177	27.944	27.025	0.16	0.15	1.26	82	2.17	1.00	82	1.2	86	0.042	100	99	22.9	0	273	72	73	70	-0.021	6.4	0
178	28.102	27.177	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	99	22.8	-0.1	272	72	73	70	-0.021	6.2	0
179	28.262	27.331	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	101	100	22.8	0	272	72	73	69	-0.021	5.8	0
180	28.420	27.483	0.16	0.15	1.25	82	2.17	0.99	82	1.2	86	0.042	100	99	22.7	-0.1	272	72	73	70	-0.021	5.6	0
181	28.578	27.635	0.16	0.15	1.26	82	2.16	0.99	82	1.2	86	0.042	100	99	22.6	-0.1	272	72	73	70	-0.021	6	0
182	28.738	27.788	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	101	100	22.6	0	272	72	73	69	-0.022	6.1	0
183	28.896	27.940	0.16	0.15	1.26	82	2.16	0.99	82	1.2	86	0.042	100	99	22.8	0.2	273	72	73	70	-0.022	5.9	0
184	29.054	28.093	0.16	0.15	1.26	82	2.18	0.99	82	1.2	86	0.042	100	100	22.5	-0.3	274	72	73	70	-0.022	6.3	0
185	29.213	28.245	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	99	22.3	-0.2	273	72	73	69	-0.022	6.4	0
186	29.371	28.398	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	100	22.3	0	274	72	73	69	-0.023	6.4	0
187	29.529	28.551	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	100	22.3	0	275	72	73	69	-0.023	6.4	0
188	29.689	28.703	0.16	0.15	1.25	82	2.17	0.99	82	1.2	86	0.042	101	99	22.2	-0.1	276	72	73	70	-0.023	5.9	0
189	29.847	28.856	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	100	22.2	0	277	72	73	69	-0.023	5.3	0
190	30.005	29.009	0.16	0.15	1.26	82	2.16	0.99	82	1.2	86	0.042	100	100	22.1	-0.1	277	72	73	68	-0.023	4.7	0
191	30.164	29.161	0.16	0.15	1.27	82	2.16	0.99	82	1.2	86	0.042	100	99	22.1	0	277	72	73	69	-0.023	4.2	0
192	30.323	29.314	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	100	22.1	0	277	72	73	69	-0.023	4	0
193	30.481	29.467	0.16	0.15	1.26	82	2.17	0.99	82	1.2	86	0.042	100	100	22.0	-0.1	276	72	73	69	-0.023	3.6	0
194	30.640	29.619	0.16	0.15	1.26	82	2.16	0.99	82	1.2	86	0.042	100	99	22.0	0	275	72	73	69	-0.023	3.4	0
195	30.799	29.772	0.16	0.15	1.26	82	2.16	0.99	82	1.2	85	0.042	100	100	22.0	0	275	72	72	69	-0.023	3	0
196	30.957	29.924	0.16	0.15	1.26	82	2.16	0.99	82	1.2	85	0.042	99	99	21.9	-0.1	274	72	72	68	-0.023	2.9	0
197	31.115	30.077	0.16	0.15	1.26	82	2.17	0.99	82	1.2	85	0.042	99	100	21.9	0	273	72	72	69	-0.023	3	0
198	31.274	30.230	0.16	0.15	1.25	82	2.17	0.99	82	1.2	85	0.042	100	100	21.9	0	271	72	72	69	-0.023	2.9	0
199	31.433	30.382	0.16	0.15	1.26	82	2.16	0.99	82	1.2	85	0.042	100	99	21.9	0	271	72	72	69	-0.022	2.8	0
200	31.591	30.535	0.16	0.15	1.26	82	2.16	0.99	81	1.2	85	0.042	99	100	21.8	-0.1	270	72	72	69	-0.022	2.8	0
201	31.750	30.688	0.16	0.15	1.26	82	2.17	0.99	82	1.2	85	0.042	100	100	21.8	0	270	72	72	69	-0.022	2.9	0
202	31.908	30.840	0.16	0.15	1.26	82	2.17	0.99	82	1.2	85	0.042	99	99	21.8	0	269	72	72	68	-0.022	2.9	0
203	32.066	30.993	0.16	0.15	1.26	82	2.17	0.99	81	1.2	85	0.042	99	100	21.7	-0.1	268	72	72	68	-0.022	2.9	0
204	32.226	31.145	0.16	0.15	1.26	82	2.16	0.99	81	1.2	85	0.042	101	99	21.7	0	266	72	72	68	-0.022	2.9	0
205	32.384	31.297	0.16	0.15	1.25	82	2.17	0.99	81	1.2	84	0.042	99	99	21.7	0	266	72	72	68	-0.022	2.7	0
206	32.542	31.451	0.16	0.15	1.26	82	2.17	0.99	81	1.2	84	0.042	99	100	21.7	0	265	72	72	68	-0.021	2.6	0
207	32.701	31.603	0.16	0.15	1.26	82	2.17	0.99	81	1.2	85	0.042	100	99	21.6	-0.1	264	72	72	69	-0.021	2.7	0
208	32.860	31.755	0.16	0.15	1.25	82	2.17	0.99	81	1.2	84	0.042	100	99	21.6	0	263	72	72	69	-0.021	2.6	0
209	33.018	31.908	0.16	0.15	1.26	82	2.16	0.99	81	1.2	84	0.042	99	100	21.6	0	262	72	72	69	-0.022	2.6	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{strav}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
210	33.177	32.061	0.16	0.15	1.26	82	2.17	0.99	81	1.2	84	0.042	100	100	21.6	0	261	72	72	68	-0.022	2.7	0
211	33.335	32.213	0.16	0.15	1.25	82	2.16	0.99	81	1.2	84	0.042	99	99	21.5	-0.1	260	72	72	69	-0.021	2.7	0
212	33.493	32.367	0.16	0.15	1.26	82	2.17	0.99	81	1.2	84	0.042	99	100	21.5	0	258	72	72	69	-0.021	2.6	0
213	33.652	32.518	0.16	0.15	1.26	82	2.17	0.99	81	1.2	84	0.042	100	98	21.5	0	259	72	72	69	-0.021	2.4	0
214	33.811	32.671	0.16	0.15	1.25	82	2.17	0.99	81	1.2	84	0.042	100	100	21.5	0	258	72	72	70	-0.021	2.5	0
215	33.969	32.824	0.16	0.15	1.26	82	2.17	0.99	81	1.2	84	0.042	99	100	21.4	-0.1	257	72	72	69	-0.020	2.7	0
216	34.128	32.976	0.16	0.15	1.26	82	2.17	0.99	81	1.2	84	0.042	100	99	21.4	0	256	72	72	68	-0.020	2.7	0
217	34.287	33.129	0.16	0.15	1.25	82	2.17	0.99	81	1.2	83	0.042	100	100	21.4	0	254	72	72	68	-0.020	2.6	0
218	34.444	33.281	0.16	0.15	1.26	82	2.17	0.99	81	1.2	83	0.042	99	99	21.4	0	254	72	72	68	-0.020	2.5	0
219	34.603	33.434	0.16	0.15	1.26	82	2.16	0.99	81	1.2	83	0.042	100	100	21.3	-0.1	253	72	72	68	-0.020	2.3	0
220	34.762	33.587	0.16	0.15	1.25	82	2.16	0.99	81	1.2	84	0.042	100	100	21.3	0	252	72	72	69	-0.020	2.5	0
221	34.920	33.739	0.16	0.15	1.26	82	2.18	0.99	81	1.2	83	0.042	99	99	21.2	-0.1	252	72	72	69	-0.020	2.5	0
222	35.078	33.891	0.16	0.15	1.26	82	2.17	0.99	81	1.2	83	0.042	99	99	21.2	0	252	72	72	69	-0.020	2.7	0
223	35.238	34.045	0.16	0.15	1.26	82	2.17	0.98	81	1.2	83	0.042	101	100	21.2	0	251	72	72	68	-0.020	2.7	0
224	35.396	34.196	0.16	0.15	1.25	82	2.17	0.99	81	1.2	83	0.042	99	98	21.2	0	251	72	72	68	-0.020	2.8	0
225	35.554	34.349	0.16	0.15	1.26	82	2.17	0.98	81	1.2	83	0.042	99	100	21.1	-0.1	251	72	72	69	-0.020	2.7	0
226	35.713	34.502	0.16	0.15	1.26	82	2.17	0.99	81	1.2	83	0.042	100	100	21.1	0	250	72	72	68	-0.020	2.7	0
227	35.871	34.654	0.16	0.15	1.25	82	2.17	0.99	81	1.2	83	0.042	99	99	21.1	0	250	72	72	68	-0.020	2.8	0
228	36.029	34.807	0.16	0.15	1.26	82	2.17	0.98	81	1.2	82	0.042	99	100	21.1	0	249	72	72	68	-0.020	2.8	0
229	36.189	34.959	0.16	0.15	1.26	82	2.17	0.99	81	1.2	83	0.042	101	99	21.0	-0.1	248	72	72	68	-0.020	2.7	0
230	36.347	35.112	0.16	0.15	1.26	82	2.17	0.99	81	1.2	83	0.042	99	100	21.0	0	248	71	72	67	-0.020	2.6	0
231	36.505	35.265	0.16	0.15	1.26	82	2.16	0.99	81	1.2	82	0.042	99	100	21.0	0	247	71	72	68	-0.019	2.5	0
232	36.662	35.414	0.16	0.15	1.25	82	2.17	0.99	81	1.2	83	0.042	99	97	21.0	0	247	71	72	68	-0.020	2.6	0
233	36.820	35.567	0.16	0.15	1.25	82	2.17	0.99	81	1.2	82	0.042	99	100	21.0	0	246	71	71	68	-0.019	2.5	0
234	36.978	35.720	0.16	0.15	1.26	82	2.17	0.99	81	1.2	83	0.042	99	100	20.9	-0.1	246	71	71	68	-0.019	2.5	0
235	37.137	35.871	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	100	98	20.9	0	245	71	71	68	-0.019	2.5	0
236	37.295	36.024	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	100	20.9	0	245	71	71	69	-0.019	2.5	0
237	37.453	36.177	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	100	20.8	-0.1	245	71	71	68	-0.019	2.6	0
238	37.613	36.329	0.16	0.15	1.26	82	2.16	0.99	81	1.2	82	0.042	100	99	20.8	0	244	71	71	69	-0.019	2.5	0
239	37.771	36.481	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	99	20.8	0	244	71	71	68	-0.019	2.6	0
240	37.929	36.635	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	100	20.8	0	245	71	71	68	-0.019	2.4	0
241	38.088	36.786	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	100	98	20.7	-0.1	245	71	71	68	-0.019	2.4	0
242	38.246	36.939	0.16	0.15	1.26	82	2.17	0.98	81	1.2	82	0.042	99	100	20.7	0	245	71	71	68	-0.019	2.8	0
243	38.404	37.092	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	100	20.7	0	244	71	71	68	-0.019	2.8	0
244	38.564	37.244	0.16	0.15	1.26	82	2.16	0.99	81	1.2	82	0.042	100	99	20.7	0	244	71	71	68	-0.019	2.6	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{straw}	12.06			ft/sec			V_{scent}	13.90	
	ft/sec			ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
245	38.722	37.397	0.16	0.15	1.25	82	2.17	0.98	81	1.2	82	0.042	99	100	20.6	-0.1	243	71	71	67	-0.019	2.5	0
246	38.880	37.549	0.16	0.15	1.26	82	2.16	0.99	81	1.2	82	0.042	99	99	20.6	0	243	71	71	68	-0.019	2.5	0
247	39.039	37.701	0.16	0.15	1.25	82	2.18	0.99	81	1.2	82	0.042	100	99	20.6	0	243	71	71	68	-0.019	2.5	0
248	39.197	37.854	0.16	0.15	1.25	82	2.17	0.99	81	1.2	82	0.042	99	100	20.6	0	243	71	71	68	-0.019	2.6	0
249	39.355	38.006	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	99	20.5	-0.1	242	71	71	68	-0.018	2.6	0
250	39.514	38.158	0.16	0.15	1.26	82	2.16	0.99	81	1.2	82	0.042	100	99	20.5	0	242	71	71	68	-0.019	2.6	0
251	39.673	38.311	0.16	0.15	1.25	82	2.17	0.98	81	1.2	82	0.042	100	100	20.5	0	242	71	71	68	-0.019	2.5	0
252	39.830	38.463	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	99	20.5	0	242	71	71	68	-0.019	2.6	0
253	39.990	38.615	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	100	99	20.4	-0.1	243	71	71	68	-0.019	2.7	0
254	40.148	38.769	0.16	0.15	1.25	82	2.17	0.99	81	1.2	82	0.042	99	100	20.4	0	242	71	71	68	-0.019	2.7	0
255	40.306	38.920	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	98	20.4	0	242	71	71	68	-0.019	2.8	0
256	40.465	39.073	0.16	0.15	1.26	82	2.17	0.98	81	1.2	82	0.042	100	100	20.4	0	242	71	71	68	-0.018	2.6	0
257	40.623	39.226	0.16	0.15	1.25	81	2.17	0.99	81	1.2	82	0.042	99	100	20.3	-0.1	242	71	71	68	-0.019	2.6	0
258	40.781	39.377	0.16	0.15	1.26	82	2.17	0.99	81	1.2	82	0.042	99	98	20.3	0	242	71	71	68	-0.019	2.5	0
259	40.940	39.530	0.16	0.15	1.26	82	2.17	0.98	81	1.2	82	0.042	100	100	20.3	0	242	71	71	67	-0.019	2.5	0
260	41.099	39.682	0.16	0.15	1.26	82	2.16	0.99	81	1.2	82	0.042	100	99	20.2	-0.1	242	71	71	68	-0.019	2.7	0
261	41.257	39.834	0.16	0.15	1.26	81	2.17	0.99	81	1.2	82	0.042	99	99	20.2	0	242	71	71	68	-0.019	2.7	0
262	41.415	39.987	0.16	0.15	1.26	81	2.18	0.98	81	1.2	82	0.042	99	100	20.2	0	241	71	71	68	-0.019	2.8	0
263	41.574	40.139	0.16	0.15	1.25	81	2.17	0.99	81	1.2	82	0.042	100	99	20.2	0	242	71	71	68	-0.018	2.7	0
264	41.732	40.292	0.16	0.15	1.26	81	2.18	0.99	81	1.2	82	0.042	99	100	20.1	-0.1	241	71	71	68	-0.018	2.6	0
265	41.890	40.444	0.16	0.15	1.26	81	2.17	0.98	81	1.2	82	0.042	99	99	20.1	0	242	71	71	68	-0.019	2.6	0
266	42.049	40.596	0.16	0.15	1.25	81	2.17	0.99	81	1.2	82	0.042	100	99	20.1	0	241	71	71	69	-0.018	2.7	0
267	42.207	40.749	0.16	0.15	1.26	81	2.17	0.99	81	1.2	82	0.042	99	100	20.1	0	240	71	71	68	-0.018	2.7	0
268	42.365	40.901	0.16	0.15	1.26	81	2.17	0.98	81	1.2	82	0.042	99	99	20.0	-0.1	240	71	71	68	-0.019	2.5	0
269	42.524	41.053	0.16	0.15	1.25	81	2.17	0.99	81	1.2	81	0.042	100	99	20.0	0	240	71	71	67	-0.019	2.4	0
270	42.682	41.205	0.16	0.15	1.26	81	2.18	0.99	81	1.2	82	0.042	99	99	20.0	0	240	71	71	68	-0.018	2.5	0
271	42.840	41.359	0.16	0.15	1.26	81	2.16	0.98	81	1.2	82	0.042	99	100	20.0	0	239	71	71	68	-0.019	2.5	0
272	42.999	41.510	0.16	0.15	1.26	81	2.17	0.99	81	1.2	82	0.042	100	98	19.9	-0.1	238	71	71	68	-0.018	2.4	0
273	43.157	41.663	0.16	0.15	1.25	81	2.17	0.98	81	1.2	82	0.042	99	100	19.9	0	239	71	71	67	-0.018	2.3	0
274	43.315	41.815	0.16	0.15	1.26	81	2.17	0.98	81	1.2	82	0.042	99	99	19.9	0	238	71	71	67	-0.018	2.4	0
275	43.475	41.967	0.16	0.15	1.26	81	2.17	0.99	81	1.2	82	0.042	101	99	19.9	0	238	71	71	68	-0.018	2.6	0
276	43.633	42.119	0.16	0.15	1.25	81	2.16	0.98	81	1.2	82	0.042	99	99	19.9	0	238	71	71	67	-0.018	2.4	0
277	43.790	42.272	0.16	0.15	1.25	81	2.17	0.99	81	1.2	81	0.042	99	99	19.8	-0.1	238	71	71	67	-0.018	2.4	0
278	43.950	42.423	0.16	0.15	1.26	81	2.17	0.98	81	1.2	81	0.042	101	98	19.8	0	237	71	71	67	-0.018	2.4	0
279	44.108	42.576	0.16	0.15	1.26	81	2.17	0.98	81	1.2	82	0.042	99	100	19.8	0	237	71	71	67	-0.018	2.4	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
	V _{strav} <u>12.06</u> ft/sec			V _{scent} <u>13.90</u> ft/sec			F _p <u>0.868</u>		

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
280	44.266	42.728	0.16	0.15	1.26	81	2.17	0.99	81	1.2	81	0.042	99	99	19.8	0	236	71	71	67	-0.018	2.4	0
281	44.425	42.880	0.16	0.15	1.25	81	2.17	0.99	81	1.2	82	0.042	100	99	19.7	-0.1	237	71	71	67	-0.018	2.3	0
282	44.583	43.033	0.16	0.15	1.26	81	2.17	0.98	81	1.2	81	0.042	99	99	19.7	0	237	71	71	67	-0.018	2.4	0
283	44.741	43.185	0.16	0.15	1.26	81	2.17	0.99	81	1.2	81	0.042	99	99	19.7	0	237	71	71	68	-0.018	2.8	0
284	44.900	43.337	0.16	0.15	1.26	81	2.17	0.98	81	1.2	81	0.042	100	99	19.6	-0.1	237	71	71	68	-0.018	2.8	0
285	45.058	43.490	0.16	0.15	1.26	81	2.17	0.98	81	1.2	81	0.042	99	99	19.6	0	237	71	71	69	-0.018	2.8	0
286	45.216	43.641	0.16	0.15	1.26	81	2.17	0.98	81	1.2	81	0.042	99	98	19.6	0	238	71	71	68	-0.018	2.7	0
287	45.375	43.794	0.16	0.15	1.26	81	2.16	0.98	81	1.2	81	0.042	100	99	19.5	-0.1	238	71	71	67	-0.018	2.7	0
288	45.533	43.946	0.16	0.15	1.25	81	2.17	0.98	81	1.2	81	0.042	99	99	19.5	0	238	71	71	67	-0.018	2.7	0
289	45.691	44.098	0.16	0.15	1.26	81	2.17	0.98	81	1.2	81	0.042	99	99	19.5	0	239	71	71	68	-0.019	2.6	0
290	45.850	44.250	0.16	0.15	1.26	81	2.18	0.98	81	1.2	81	0.042	100	99	19.5	0	239	71	71	68	-0.019	2.7	0
291	46.007	44.403	0.16	0.15	1.26	81	2.17	0.98	81	1.2	81	0.042	99	99	19.4	-0.1	239	71	71	67	-0.019	2.8	0
292	46.165	44.554	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	99	98	19.4	0	239	71	71	67	-0.019	2.8	0
293	46.325	44.706	0.16	0.15	1.25	81	2.17	0.98	80	1.2	82	0.042	101	99	19.4	0	240	71	71	68	-0.018	2.7	0
294	46.482	44.859	0.16	0.15	1.25	81	2.18	0.98	80	1.2	82	0.042	99	100	19.4	0	239	71	71	67	-0.018	2.7	0
295	46.640	45.010	0.16	0.15	1.26	81	2.17	0.99	80	1.2	81	0.042	99	98	19.3	-0.1	240	71	71	67	-0.018	2.7	0
296	46.799	45.163	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	100	100	19.3	0	239	71	71	67	-0.018	2.7	0
297	46.957	45.315	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	99	19.3	0	239	71	71	67	-0.018	2.6	0
298	47.115	45.467	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	99	99	19.3	0	239	71	71	67	-0.019	2.5	0
299	47.274	45.619	0.16	0.15	1.25	81	2.17	0.98	80	1.2	81	0.042	100	99	19.2	-0.1	240	71	71	68	-0.019	2.5	0
300	47.432	45.772	0.16	0.15	1.26	81	2.18	0.98	80	1.2	82	0.042	99	100	19.2	0	240	71	71	68	-0.019	2.7	0
301	47.590	45.923	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	99	98	19.2	0	239	71	71	67	-0.018	2.7	0
302	47.749	46.075	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	100	99	19.2	0	239	71	71	67	-0.018	2.6	0
303	47.907	46.228	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	100	19.2	0	238	71	71	67	-0.018	2.5	0
304	48.065	46.379	0.16	0.15	1.26	81	2.18	0.99	80	1.2	81	0.042	99	98	19.1	-0.1	238	71	71	67	-0.018	2.3	0
305	48.224	46.532	0.16	0.15	1.26	81	2.17	0.98	80	1.2	82	0.042	100	100	19.1	0	239	71	71	67	-0.018	2.4	0
306	48.382	46.684	0.16	0.15	1.25	81	2.18	0.98	80	1.2	82	0.042	99	99	19.1	0	238	71	71	68	-0.018	2.6	0
307	48.540	46.835	0.16	0.15	1.26	81	2.18	0.99	80	1.2	81	0.042	99	98	19.1	0	238	71	71	67	-0.018	2.7	0
308	48.699	46.988	0.16	0.15	1.25	81	2.17	0.98	80	1.2	81	0.042	100	100	19.0	-0.1	238	71	71	67	-0.018	2.6	0
309	48.857	47.140	0.16	0.15	1.25	81	2.18	0.99	80	1.2	81	0.042	99	99	19.0	0	238	71	71	67	-0.018	2.7	0
310	49.015	47.292	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	19.0	0	238	71	71	67	-0.018	2.6	0
311	49.174	47.445	0.16	0.15	1.26	81	2.17	0.98	80	1.2	82	0.042	100	100	19.0	0	238	71	71	67	-0.018	2.5	0
312	49.332	47.596	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	99	98	18.9	-0.1	238	71	71	67	-0.018	2.4	0
313	49.490	47.748	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.9	0	238	71	71	67	-0.018	2.6	0
314	49.649	47.901	0.16	0.15	1.25	81	2.17	0.98	80	1.2	81	0.042	100	100	18.9	0	237	71	71	67	-0.018	2.5	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 364 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{strav}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
315	49.807	48.052	0.16	0.15	1.25	81	2.17	0.98	80	1.2	81	0.042	99	98	18.8	-0.1	237	71	71	67	-0.018	2.5	0
316	49.965	48.204	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	99	99	18.8	0	237	71	71	67	-0.018	2.6	0
317	50.124	48.357	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	100	100	18.8	0	237	71	71	67	-0.018	2.6	0
318	50.282	48.508	0.16	0.15	1.25	81	2.17	0.98	80	1.2	81	0.042	99	98	18.8	0	236	71	71	67	-0.018	2.7	0
319	50.440	48.661	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	100	18.7	-0.1	236	71	71	67	-0.018	2.6	0
320	50.599	48.813	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	100	99	18.7	0	237	71	71	67	-0.018	2.5	0
321	50.757	48.964	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	98	18.7	0	237	71	71	67	-0.018	3	0
322	50.915	49.116	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.6	-0.1	237	71	71	67	-0.018	3.3	0
323	51.074	49.269	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	100	100	18.6	0	238	71	71	67	-0.018	3.2	0
324	51.232	49.420	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	98	18.6	0	237	71	71	67	-0.018	3	0
325	51.390	49.572	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.6	0	237	71	71	67	-0.018	2.8	0
326	51.549	49.724	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	100	99	18.5	-0.1	237	71	71	67	-0.018	2.7	0
327	51.707	49.876	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	99	18.5	0	237	71	71	67	-0.018	2.8	0
328	51.864	50.028	0.16	0.15	1.26	81	2.17	0.98	80	1.2	81	0.042	99	99	18.5	0	237	71	71	67	-0.018	2.7	0
329	52.023	50.180	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	18.5	0	237	71	71	67	-0.018	2.7	0
330	52.182	50.332	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	18.5	0	237	71	71	67	-0.018	2.8	0
331	52.339	50.484	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.4	-0.1	237	71	71	67	-0.018	2.8	0
332	52.498	50.636	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	18.4	0	238	71	71	67	-0.019	2.8	0
333	52.656	50.787	0.16	0.15	1.25	81	2.19	0.98	80	1.2	81	0.042	99	98	18.4	0	238	71	71	67	-0.019	2.9	0
334	52.814	50.939	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.4	0	237	71	71	67	-0.019	3	0
335	52.973	51.092	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	100	18.3	-0.1	237	71	71	67	-0.018	2.8	0
336	53.131	51.243	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	98	18.3	0	236	71	71	67	-0.018	2.6	0
337	53.289	51.395	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.3	0	236	71	71	67	-0.018	2.6	0
338	53.448	51.547	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	18.2	-0.1	237	71	71	67	-0.018	2.6	0
339	53.606	51.699	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	99	18.2	0	237	71	71	67	-0.018	2.7	0
340	53.763	51.851	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	99	18.2	0	237	71	71	67	-0.018	2.9	0
341	53.922	52.003	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	18.2	0	237	71	71	67	-0.019	2.9	0
342	54.081	52.154	0.16	0.15	1.25	81	2.17	0.98	80	1.2	81	0.042	100	98	18.1	-0.1	237	71	71	68	-0.018	2.9	0
343	54.238	52.306	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.1	0	236	71	71	67	-0.018	2.7	0
344	54.397	52.458	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	18.1	0	236	71	71	67	-0.018	2.5	0
345	54.555	52.610	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	99	18.1	0	236	71	71	67	-0.018	2.6	0
346	54.713	52.762	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	18.0	-0.1	237	71	71	67	-0.018	2.6	0
347	54.872	52.914	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	18.0	0	237	71	71	67	-0.018	2.7	0
348	55.030	53.065	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	98	18.0	0	237	71	71	67	-0.018	2.9	0
349	55.187	53.217	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	99	99	17.9	-0.1	237	71	71	66	-0.018	2.9	0



Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 2

Manufacturer: Harman
 Model: Absolute 63
 Tracking No.: 2146
 Project No.: 0135PS036E.REV001
 Test Date: 11-Feb-16
 Beginning Clock Time: 09:25

High Burn End Time: 62
 Medium Burn End Time: 183
 Total Sampling Time: 364 min
 Recording Interval: 1 min

Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
30.47 30.39 30.32 30.39 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: 11.91 ft/sec.
 Initial Tunnel Flow: 130.3 scfm
 Average Tunnel Flow: 134.7 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0 cfm @ -6 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.040	0.040	0.018	0.022	0.032	0.036	0.036	0.042
Temp:	103	103	103	103	103	103	103	103	103
V_{straw}	12.06			ft/sec			V_{scent}	13.90	
				ft/sec			F_p	0.868	

Elapsed Time (min)	Particulate Sampling Data											Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data					
	Gas Meter 1 (ft ³)	Gas Meter 2 (ft ³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
350	55.346	53.369	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	100	99	17.9	0	237	71	71	67	-0.018	2.8	0
351	55.504	53.520	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	98	17.9	0	238	71	71	68	-0.018	2.7	0
352	55.662	53.672	0.16	0.15	1.26	81	2.18	0.98	80	1.2	80	0.042	99	99	17.9	0	237	71	71	67	-0.019	2.8	0
353	55.821	53.824	0.16	0.15	1.26	81	2.18	0.98	80	1.2	81	0.042	100	99	17.9	0	237	71	71	66	-0.018	2.8	0
354	55.979	53.976	0.16	0.15	1.25	81	2.18	0.98	80	1.2	81	0.042	99	99	17.8	-0.1	238	71	71	68	-0.018	2.7	0
355	56.136	54.127	0.16	0.15	1.26	81	2.18	0.98	80	1.2	80	0.042	99	98	17.8	0	238	71	71	67	-0.019	2.7	0
356	56.295	54.279	0.16	0.15	1.25	81	2.18	0.97	80	1.2	80	0.042	100	99	17.8	0	238	71	71	67	-0.019	2.9	0
357	56.454	54.431	0.16	0.15	1.25	81	2.18	0.98	80	1.2	80	0.042	100	99	17.7	-0.1	238	71	71	68	-0.019	2.9	0
358	56.611	54.582	0.16	0.15	1.25	81	2.18	0.98	80	1.2	80	0.042	99	98	17.7	0	238	71	71	67	-0.019	2.8	0
359	56.770	54.735	0.16	0.15	1.26	81	2.18	0.97	80	1.2	80	0.042	100	100	17.7	0	237	71	70	67	-0.019	2.8	0
360	56.928	54.886	0.16	0.15	1.25	81	2.18	0.98	80	1.2	80	0.042	99	98	17.7	0	237	71	71	68	-0.019	2.7	0
361	57.089	55.041	0.16	0.15	1.26	80	2.18	0.08	0.98	80	80	0.042	101	118	17.6	-0.1	236	70	72	68	-0.018	2.6	0
362	57.247	55.193	0.16	0.15	1.26	80	2.18	0.15	0.98	80	80	0.042	99	116	17.6	0	236	70	72	67	-0.018	2.6	0
363	57.406	55.344	0.16	0.15	1.25	81	2.18	0.15	0.98	80	80	0.042	100	115	17.6	0	236	70	72	68	-0.019	2.7	0
364	57.564	55.496	0.16	0.15	1.25	80	2.17	0.15	0.98	80	80	0.042	99	116	17.5	-0.1	236	70	72	68	-0.018	3	0
Avg/Tot	57.564	55.496	0.16	0.15	1.26	81	2.18	0.98	79	1.2	87	0.042	100	100	17.7	0	237	72	73	69	-0.022	2.7	0

Client: Harman Project Number: 0135PS036E.REV001 Run Number: 2
 Model: Absolute 63 Tracking Number: 2146 Date: 2/11/16
 Test Crew: A. Kravitz
 OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 335, 336, 410, 420, 559

Pellet Heater Run Notes

Air Control Settings

High Burn Rate Target: 100%
 Settings: Temp = 7.0 Comb. Blower Max = 3100 RPM
Fed = 93% Comb. Blower Min = 2600 RPM
Dist. Blower = 100%

Medium Burn Rate Target: < 50%
 Settings: T = 2.5 CB Max = 2625 RPM
F = 38% CB Min = 2250 RPM
DB = 100%

Low Burn Rate Target: Minimum
 Settings: T = 1.0 CB Max = 2625 RPM
F = 25% CB Min = 2100 RPM
DB = off

Additional Settings Notes:
 Repeat of Run 1
 with intended
 settings


Preburn Notes

Time	Notes
27:00	Degas sampling stock gas
62:00	End PB

Test Notes

Time	Notes
60:00	switched to med changed lbr filter
62:00	
193:00	switched to min
364:00	Test End

Pellet Moisture Content: 5.05%

Technician Signature: 

Date: 2/11/16

ASTM E2779 Pellet Heater Run Sheets

Client: Harman Project Number: 0135PS036E.REV001 Run Number: 2
 Model: Absolute 63 Tracking Number: 2146 Date: 2/11/16
 Test Crew: A. Kravitz

OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 335, 336, 410, 420, 559

Pellet Heater Supplemental Data

Start Time: 1:25 Booth #: E1
 Stop Time: 3:24

Stack Gas Leak Check:

Initial: 0 Final: 0

Sample Train Leak Check:

A: 0 @ 0 "Hg
 B: 0 @ -6 "Hg

Calibrations: Span Gas CO₂: 16.89 CO: 4.290

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	8:46	8:47	15:33	15:32
CO ₂	0.00	16.89	0.13	16.90
CO	0.000	4.293	0.015	4.293

Air Velocity (ft/min): Initial: 450 Final: 450
 Scale Audit (lbs): Initial: 10.0 Final: 10.6
 Pitot Tube Leak Test: Initial: 0 Final: 0
 Stack Diameter (in): 3
 Induced Draft: 0
 % Smoke Capture: 100
 Flue Pipe Cleaned Prior to First Test in Series:
 Date: 2/6/16 Initials: A

Tunnel Traverse			
Microtector Reading	dP (in H ₂ O)	T(°F)	
0.012	0.024	103	
0.020	0.040		
0.020	0.040		
0.009	0.018		
0.011	0.022		
0.016	0.032		
0.018	0.036		
0.018	0.036		
Center:			
0.021	0.042		103
Static:			
NA	-0.16	103	

	Initial	Middle	Ending
P _b (in/Hg)	30.21	30.14	30.18
Ambient (°F)	71	69	68

Background Filter Volume: NA

Technician Signature: [Signature]

Date: 2/11/16

*Model: Absolute 63
Hearth & Home Technologies - Halifax
352 Mountain House Road
Halifax, PA 17032*

Run 3

Pellet Heater Test Results - ASTM E2779 / ASTM E2515

Manufacturer: Harman
 Model: Absolute 63
 Project No.: 0135PS036E.REV001
 Tracking No.: 2146
 Run: 3
 Test Date: 03/21/16

Burn Rate (Composite)	1.57 kg/hr dry
Average Tunnel Temperature	83 degrees F
Average Gas Velocity in Dilution Tunnel - vs	12.17 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8169.7 dscf/hour
Average Delta p	0.044 inches H2O
Average Delta H	1.24 inches H2O
Total Time of Test	363 minutes

Burn Rate (High)	3.64 kg/hr dry
Burn Rate (Med)	1.71 kg/hr dry 47.1% of High
Burn Rate (Low)	0.76 kg/hr dry 21.0% of High

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	1 st HR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	57.423 cubic feet	57.824 cubic feet	9.387 cubic feet
Average Gas Meter Temperature	68 degrees F	78 degrees F	77 degrees F	73 degrees F
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	56.437 dscf	56.838 dscf	9.309 dscf
Total Particulates - m _p	0 mg	10.6 mg	11.6 mg	4.3 mg
Particulate Concentration (dry-standard) - C _p /C _s	0.000000 grams/dscf	0.00019 grams/dscf	0.00020 grams/dscf	0.00046 grams/dscf
Total Particulate Emissions - E _T	0.00 grams	9.28 grams	10.09 grams	3.77 grams
Particulate Emission Rate	0.00 grams/hour	1.53 grams/hour	1.67 grams/hour	3.77 grams/hour
Emissions Factor		0.98 g/kg	1.06 g/kg	1.03 g/kg
Difference from Average Total Particulate Emissions		0.40 grams	0.40 grams	
Dual Train Comparison Results Are Acceptable				

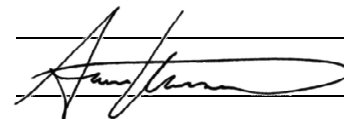
FINAL AVERAGE RESULTS

Integrated Test Run	
Total Particulate Emissions - E _T	9.69 grams
Particulate Emission Rate	1.60 grams/hour
Emissions Factor	1.02 grams/kg
First Hour Emissions	
Total Particulate Emissions - E _T	3.77 grams
Particulate Emission Rate	3.77 grams/hour
Emissions Factor	1.03 grams/kg

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 03/21/16
Run: 3
Control #: 2146
Test Duration: 363
Output Category: Integrated

Technicians: A. Kravitz



Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	78.6%	84.1%
Combustion Efficiency	96.3%	96.3%
Heat Transfer Efficiency	82%	87.3%

Output Rate (kJ/h)	24,052	22,816	(Btu/h)
Burn Rate (kg/h)	1.57	3.46	(lb/h)
Input (kJ/h)	30,613	29,040	(Btu/h)

Test Load Weight (dry kg)	9.50	20.94	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	541		
Test Duration (h)	6.05		

Emissions	Particulate	CO
g/MJ Output	0.00	3.72
g/kg Dry Fuel	0.00	56.89
g/h	0.00	89.35
lb/MM Btu Output	0.00	8.63

Air/Fuel Ratio (A/F)	14.16
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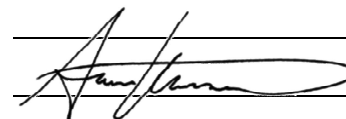
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3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 03/21/16
Run: 3
Control #: 2146
Test Duration: 62
Output Category: Max

Technicians: A. Kravitz



Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	73.1%	78.2%
Combustion Efficiency	89.5%	89.5%
Heat Transfer Efficiency	82%	87.4%

Output Rate (kJ/h)	51,779	49,118	(Btu/h)
Burn Rate (kg/h)	3.64	8.01	(lb/h)
Input (kJ/h)	70,879	67,236	(Btu/h)

Test Load Weight (dry kg)	3.76	8.28	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	573		
Test Duration (h)	1.03		

Emissions	Particulate	CO
g/MJ Output	0.00	10.72
g/kg Dry Fuel	0.00	152.62
g/h	0.00	554.96
lb/MM Btu Output	0.00	24.91

Air/Fuel Ratio (A/F)	7.53
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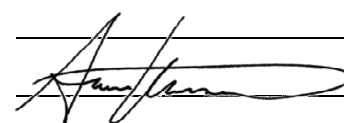
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3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 03/21/16
Run: 3
Control #: 2146
Test Duration: 121
Output Category: Med

Technicians: A. Kravitz



Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	83.8%	89.7%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	84%	90.2%

Output Rate (kJ/h)	27,992	26,553	(Btu/h)
Burn Rate (kg/h)	1.71	3.78	(lb/h)
Input (kJ/h)	33,396	31,680	(Btu/h)

Test Load Weight (dry kg)	3.46	7.62	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	24		
Test Duration (h)	2.02		

Emissions	Particulate	CO
g/MJ Output	0.00	0.42
g/kg Dry Fuel	0.00	6.89
g/h	0.00	11.81
lb/MM Btu Output	0.00	0.98

Air/Fuel Ratio (A/F)	11.92
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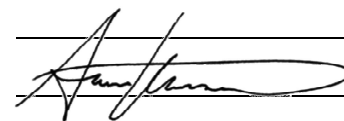
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3/23/2010

OMNI-Test Laboratories, Inc.

Manufacturer: Harman
Model: Absolute 63
Date: 03/21/16
Run: 3
Control #: 2146
Test Duration: 180
Output Category: Min

Technicians: A. Kravitz



Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.0%	80.3%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	75%	80.7%

Output Rate (kJ/h)	11,152	10,579	(Btu/h)
Burn Rate (kg/h)	0.76	1.68	(lb/h)
Input (kJ/h)	14,873	14,108	(Btu/h)

Test Load Weight (dry kg)	2.29	5.05	dry lb
MC wet (%)	4.81		
MC dry (%)	5.05		
Particulate (g)	0		
CO (g)	0		
Test Duration (h)	3.00		

Emissions	Particulate	CO
g/MJ Output	0.00	0.00
g/kg Dry Fuel	0.00	0.00
g/h	0.00	0.00
lb/MM Btu Output	0.00	0.00

Air/Fuel Ratio (A/F)	24.60
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VERSION:

2.3

3/23/2010

Pellet Heater Test Data - ASTM E2779 / ASTM E2515



Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
	V _{straw} <u>12.34</u> ft/sec		V _{scent} <u>14.32</u> ft/sec		F _p <u>0.862</u>				

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
0	0.000	0.000			0.03	69	1.71	0.01	69	-0.4	98	0.044			47.0		373	71	70	69	-0.041	13	2.2
1	0.148	0.161	0.15	0.16	1.35	69	2.4	1.15	69	1.3	98	0.044	96	104	46.8	-0.2	374	72	72	69	-0.041	12.9	1.6
2	0.308	0.321	0.16	0.16	1.24	69	2.27	1.06	69	1.2	98	0.044	104	103	46.6	-0.2	375	72	72	69	-0.042	13.2	2
3	0.465	0.481	0.16	0.16	1.24	69	2.26	1.05	69	1.2	98	0.044	102	103	46.5	-0.1	375	72	72	69	-0.042	13.3	1.9
4	0.621	0.640	0.16	0.16	1.24	69	2.26	1.06	69	1.2	98	0.044	102	103	46.4	-0.1	374	72	72	69	-0.041	13.3	2.3
5	0.777	0.799	0.16	0.16	1.24	69	2.27	1.06	69	1.2	97	0.044	102	103	46.3	-0.1	373	72	72	69	-0.042	12.9	1.7
6	0.934	0.959	0.16	0.16	1.23	69	2.27	1.05	69	1.2	97	0.044	102	103	46.1	-0.2	374	72	72	69	-0.042	12.8	1.2
7	1.089	1.117	0.16	0.16	1.24	69	2.27	1.06	69	1.2	98	0.044	101	102	46.0	-0.1	374	72	72	69	-0.042	13	1.4
8	1.246	1.277	0.16	0.16	1.24	69	2.26	1.05	69	1.2	98	0.044	102	103	45.8	-0.2	373	72	72	69	-0.041	13.3	1.8
9	1.402	1.436	0.16	0.16	1.23	69	2.26	1.05	70	1.2	98	0.044	102	103	45.7	-0.1	373	72	72	69	-0.041	13.2	1.5
10	1.559	1.596	0.16	0.16	1.24	70	2.26	1.06	70	1.2	98	0.044	102	103	45.6	-0.1	373	72	72	69	-0.042	13.1	1.6
11	1.714	1.756	0.16	0.16	1.23	70	2.27	1.05	70	1.2	97	0.044	101	103	45.4	-0.2	374	72	72	69	-0.041	13.1	1.6
12	1.870	1.914	0.16	0.16	1.24	70	2.26	1.05	70	1.2	98	0.044	101	102	45.3	-0.1	374	72	72	69	-0.041	13.2	1.8
13	2.027	2.074	0.16	0.16	1.23	70	2.26	1.05	70	1.2	98	0.044	102	103	45.1	-0.2	374	72	72	69	-0.041	13.2	1.8
14	2.183	2.234	0.16	0.16	1.24	70	2.27	1.05	70	1.2	98	0.044	101	103	45.0	-0.1	374	72	72	69	-0.042	13.3	1.8
15	2.340	2.393	0.16	0.16	1.24	70	2.27	1.05	71	1.2	98	0.044	102	102	44.8	-0.2	374	72	72	69	-0.041	13.3	1.7
16	2.495	2.551	0.16	0.16	1.23	71	2.27	1.05	71	1.2	98	0.044	101	102	44.7	-0.1	375	73	72	69	-0.042	13.2	1.8
17	2.651	2.711	0.16	0.16	1.23	71	2.26	1.05	71	1.2	98	0.044	101	103	44.6	-0.1	375	73	72	69	-0.042	13	1.7
18	2.807	2.870	0.16	0.16	1.23	71	2.27	1.05	71	1.2	98	0.044	101	102	44.5	-0.1	375	73	72	69	-0.042	13.2	2.1
19	2.963	3.029	0.16	0.16	1.23	71	2.27	1.05	71	1.2	98	0.044	101	102	44.2	-0.3	374	73	72	69	-0.041	13.2	2.2
20	3.120	3.189	0.16	0.16	1.23	71	2.26	1.04	71	1.2	98	0.044	102	103	44.1	-0.1	374	73	72	69	-0.042	13.1	2.1
21	3.275	3.348	0.16	0.16	1.23	72	2.27	1.05	72	1.2	97	0.044	100	102	44.0	-0.1	373	73	72	69	-0.041	13.1	1.9
22	3.432	3.508	0.16	0.16	1.23	72	2.27	1.05	72	1.2	97	0.044	102	103	43.9	-0.1	371	73	72	69	-0.041	13.2	1.7
23	3.588	3.667	0.16	0.16	1.23	72	2.26	1.04	72	1.2	97	0.044	101	102	43.7	-0.2	371	73	72	69	-0.041	13	1.5
24	3.744	3.826	0.16	0.16	1.23	72	2.28	1.05	72	1.2	98	0.044	101	102	43.6	-0.1	370	73	72	69	-0.041	12.8	1.5
25	3.901	3.986	0.16	0.16	1.22	72	2.28	1.05	72	1.2	98	0.044	102	103	43.5	-0.1	370	73	72	69	-0.041	12.4	1.5
26	4.057	4.145	0.16	0.16	1.23	72	2.27	1.05	72	1.2	98	0.044	101	102	43.3	-0.2	371	73	72	69	-0.042	12.3	1.5
27	4.214	4.304	0.16	0.16	1.23	73	2.28	1.05	73	1.2	97	0.044	101	102	43.2	-0.1	370	73	72	69	-0.041	12.6	1.8
28	4.370	4.464	0.16	0.16	1.23	73	2.27	1.05	73	1.2	98	0.044	101	103	43.0	-0.2	371	73	72	69	-0.042	12.9	2.2
29	4.526	4.623	0.16	0.16	1.23	73	2.28	1.05	73	1.2	98	0.044	101	102	42.9	-0.1	371	73	72	69	-0.041	12.8	2.2
30	4.683	4.782	0.16	0.16	1.22	73	2.27	1.05	73	1.2	97	0.044	101	102	42.7	-0.2	369	73	72	69	-0.040	12.8	2.3
31	4.839	4.942	0.16	0.16	1.23	73	2.27	1.05	73	1.2	98	0.044	101	103	42.6	-0.1	370	73	72	69	-0.041	12.8	2.1
32	4.996	5.101	0.16	0.16	1.23	73	2.28	1.05	74	1.2	98	0.044	101	102	42.5	-0.1	370	73	72	69	-0.042	12.5	1.7
33	5.152	5.261	0.16	0.16	1.23	74	2.28	1.05	74	1.2	98	0.044	101	102	42.3	-0.2	370	73	72	69	-0.041	12.5	1.8
34	5.309	5.421	0.16	0.16	1.23	74	2.28	1.05	74	1.2	98	0.044	101	102	42.2	-0.1	369	73	72	69	-0.041	12.6	2.2

Pellet Heater Test Data - ASTM E2779 / ASTM E2515



Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
	V _{strav} <u>12.34</u> ft/sec		V _{scent} <u>14.32</u> ft/sec		F _p <u>0.862</u>				

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
35	5.465	5.580	0.16	0.16	1.23	74	2.28	1.05	74	1.2	97	0.044	101	102	42.0	-0.2	369	73	72	69	-0.041	12.7	2.4
36	5.622	5.740	0.16	0.16	1.23	74	2.28	1.05	74	1.2	98	0.044	101	102	41.9	-0.1	370	73	72	69	-0.041	12.5	2
37	5.779	5.900	0.16	0.16	1.23	74	2.28	1.05	74	1.2	98	0.044	101	102	41.8	-0.1	370	73	72	69	-0.041	12.5	1.9
38	5.935	6.059	0.16	0.16	1.23	74	2.28	1.05	74	1.2	97	0.044	101	102	41.6	-0.2	369	73	72	69	-0.042	12.5	1.6
39	6.092	6.219	0.16	0.16	1.22	74	2.28	1.05	75	1.2	97	0.044	101	102	41.5	-0.1	369	73	72	69	-0.040	12.7	1.6
40	6.249	6.379	0.16	0.16	1.23	75	2.29	1.05	75	1.2	97	0.044	101	102	41.4	-0.1	369	73	72	69	-0.041	12.7	1.6
41	6.405	6.538	0.16	0.16	1.23	75	2.28	1.05	75	1.2	98	0.044	100	102	41.2	-0.2	371	73	72	69	-0.042	12.7	1.6
42	6.563	6.698	0.16	0.16	1.23	75	2.29	1.05	75	1.2	98	0.044	102	102	41.1	-0.1	371	73	72	69	-0.040	12.7	1.5
43	6.719	6.858	0.16	0.16	1.22	75	2.29	1.04	75	1.2	98	0.044	100	102	40.9	-0.2	371	73	72	69	-0.042	12.8	1.6
44	6.876	7.017	0.16	0.16	1.22	75	2.28	1.05	75	1.2	98	0.044	101	102	40.8	-0.1	370	73	72	69	-0.041	12.9	1.9
45	7.033	7.177	0.16	0.16	1.23	75	2.29	1.05	75	1.2	98	0.044	101	102	40.7	-0.1	369	73	72	69	-0.041	12.9	2
46	7.189	7.337	0.16	0.16	1.23	75	2.29	1.04	75	1.2	98	0.044	100	102	40.5	-0.2	370	73	72	69	-0.042	12.8	1.8
47	7.347	7.496	0.16	0.16	1.23	75	2.29	1.05	75	1.2	98	0.044	102	102	40.4	-0.1	370	73	72	69	-0.041	12.8	1.6
48	7.503	7.656	0.16	0.16	1.22	76	2.3	1.05	76	1.2	98	0.044	100	102	40.2	-0.2	370	73	72	69	-0.041	12.7	1.5
49	7.660	7.816	0.16	0.16	1.23	76	2.29	1.04	76	1.2	98	0.044	101	102	40.1	-0.1	370	73	72	69	-0.042	12.9	1.7
50	7.817	7.975	0.16	0.16	1.22	76	2.29	1.05	76	1.2	98	0.044	101	101	40.0	-0.1	370	73	72	69	-0.042	12.9	1.8
51	7.973	8.136	0.16	0.16	1.23	76	2.3	1.05	76	1.2	98	0.044	100	103	39.8	-0.2	370	73	72	69	-0.041	12.9	1.9
52	8.131	8.295	0.16	0.16	1.23	76	2.3	1.04	76	1.2	98	0.044	102	101	39.7	-0.1	370	73	72	69	-0.043	12.8	2.1
53	8.287	8.454	0.16	0.16	1.22	76	2.3	1.05	76	1.2	98	0.044	100	101	39.5	-0.2	371	73	72	69	-0.041	12.8	2
54	8.444	8.615	0.16	0.16	1.23	76	2.3	1.04	76	1.2	98	0.044	101	103	39.4	-0.1	370	73	72	69	-0.041	12.7	2
55	8.601	8.774	0.16	0.16	1.22	76	2.3	1.04	76	1.2	98	0.044	101	101	39.2	-0.2	369	73	72	69	-0.041	12.7	2.1
56	8.757	8.933	0.16	0.16	1.22	76	2.29	1.05	76	1.2	98	0.044	100	101	39.1	-0.1	369	73	72	69	-0.041	12.7	2.2
57	8.915	9.094	0.16	0.16	1.23	76	2.3	1.05	77	1.2	98	0.044	102	103	38.9	-0.2	369	73	72	69	-0.041	12.7	2.2
58	9.071	9.253	0.16	0.16	1.22	77	2.3	1.04	77	1.2	98	0.044	100	101	38.8	-0.1	369	73	72	69	-0.041	12.6	2.2
59	9.228	9.413	0.16	0.16	1.23	77	2.31	1.04	77	1.2	98	0.044	101	102	38.7	-0.1	370	73	72	69	-0.042	12.6	2.1
60	9.387	9.573	0.16	0.16	1.23	77	2.26	1.05	77	1.3	98	0.044	102	102	38.5	-0.2	369	72	72	69	-0.041	12.6	2
61	9.545	9.732	0.16	0.16	1.24	77	2.27	1.05	77	1.2	98	0.044	101	101	38.4	-0.1	369	73	72	69	-0.041	12.5	1.9
62	9.702	9.892	0.16	0.16	1.24	77	2.26	1.05	77	1.2	97	0.044	101	102	38.3	-0.1	365	73	72	69	-0.041	12.6	1.9
63	9.861	10.052	0.16	0.16	1.24	77	2.25	1.04	77	1.2	94	0.044	102	102	38.3	0	353	73	72	69	-0.040	12.6	2
64	10.019	10.211	0.16	0.16	1.24	77	2.25	1.04	77	1.2	92	0.044	101	101	38.2	-0.1	337	73	72	69	-0.039	12.6	1.9
65	10.177	10.371	0.16	0.16	1.24	77	2.25	1.05	77	1.2	90	0.044	101	101	38.1	-0.1	325	72	72	69	-0.038	12.3	1.7
66	10.336	10.532	0.16	0.16	1.24	77	2.25	1.04	77	1.2	89	0.044	101	102	38.1	0	314	72	72	69	-0.036	11.5	1.2
67	10.494	10.691	0.16	0.16	1.24	77	2.25	1.04	77	1.2	88	0.044	100	100	38.1	0	306	72	71	69	-0.036	10.2	0.8
68	10.652	10.851	0.16	0.16	1.24	77	2.25	1.05	77	1.2	87	0.044	100	101	38.0	-0.1	298	72	71	69	-0.035	9	0.5
69	10.811	11.011	0.16	0.16	1.24	77	2.25	1.04	77	1.2	87	0.044	101	101	38.0	0	291	72	71	69	-0.033	8	0.4

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
V_{strav}	12.34			ft/sec			V_{scent}	14.32	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
70	10.969	11.170	0.16	0.16	1.24	77	2.26	1.05	77	1.2	86	0.044	100	100	37.9	-0.1	284	72	71	69	-0.033	7.2	0.2
71	11.127	11.331	0.16	0.16	1.25	77	2.26	1.04	77	1.2	86	0.044	100	101	37.9	0	278	72	71	69	-0.032	6.6	0.1
72	11.286	11.491	0.16	0.16	1.24	78	2.25	1.04	77	1.2	85	0.044	101	101	37.8	-0.1	271	72	71	69	-0.031	6.1	0.1
73	11.444	11.650	0.16	0.16	1.24	78	2.25	1.04	78	1.2	84	0.044	100	100	37.8	0	266	71	71	69	-0.030	5.7	0.1
74	11.602	11.810	0.16	0.16	1.24	78	2.25	1.05	78	1.2	84	0.044	100	100	37.8	0	260	71	71	69	-0.030	5.4	0
75	11.761	11.971	0.16	0.16	1.24	78	2.25	1.05	78	1.2	83	0.044	100	101	37.8	0	254	71	71	69	-0.029	5.1	0
76	11.919	12.130	0.16	0.16	1.24	78	2.25	1.05	78	1.2	82	0.044	100	100	37.7	-0.1	250	71	71	69	-0.028	4.8	0
77	12.077	12.291	0.16	0.16	1.24	78	2.26	1.05	78	1.2	82	0.044	100	101	37.7	0	247	71	71	69	-0.027	4.6	0
78	12.237	12.451	0.16	0.16	1.25	78	2.25	1.05	78	1.2	82	0.044	101	100	37.7	0	244	71	70	69	-0.027	4.8	0
79	12.395	12.611	0.16	0.16	1.24	78	2.26	1.04	78	1.2	81	0.044	100	100	37.6	-0.1	242	71	70	69	-0.027	5	0
80	12.553	12.771	0.16	0.16	1.25	78	2.26	1.05	78	1.2	81	0.044	100	100	37.6	0	241	71	70	69	-0.027	5.5	0
81	12.713	12.931	0.16	0.16	1.24	78	2.26	1.05	78	1.2	80	0.044	101	100	37.5	-0.1	241	70	70	69	-0.027	6.2	0
82	12.870	13.091	0.16	0.16	1.25	78	2.26	1.04	78	1.2	80	0.044	99	100	37.5	0	240	70	70	69	-0.026	6.5	0
83	13.029	13.251	0.16	0.16	1.24	78	2.26	1.05	78	1.2	80	0.044	100	100	37.4	-0.1	240	70	70	69	-0.026	6.9	0
84	13.188	13.412	0.16	0.16	1.24	78	2.26	1.05	78	1.2	80	0.044	100	101	37.4	0	240	70	70	69	-0.027	7.4	0
85	13.346	13.571	0.16	0.16	1.24	78	2.26	1.05	78	1.2	80	0.044	100	99	37.3	-0.1	241	70	70	68	-0.027	7.3	0
86	13.505	13.731	0.16	0.16	1.25	78	2.27	1.05	78	1.2	80	0.044	100	100	37.2	-0.1	242	70	70	68	-0.028	9.1	0
87	13.664	13.892	0.16	0.16	1.25	78	2.26	1.05	78	1.3	80	0.044	100	101	37.1	-0.1	244	70	70	68	-0.027	9.1	0
88	13.823	14.052	0.16	0.16	1.24	78	2.26	1.04	78	1.2	80	0.044	100	100	37.1	0	246	70	69	68	-0.028	9.2	0
89	13.980	14.212	0.16	0.16	1.25	78	2.26	1.05	78	1.2	80	0.044	99	100	37.0	-0.1	246	70	69	68	-0.028	8.3	0
90	14.140	14.372	0.16	0.16	1.25	78	2.27	1.05	78	1.2	80	0.044	101	100	36.9	-0.1	247	70	69	68	-0.028	9.1	0
91	14.299	14.533	0.16	0.16	1.24	78	2.26	1.05	78	1.3	80	0.044	100	101	36.8	-0.1	248	69	69	68	-0.028	9	0
92	14.457	14.693	0.16	0.16	1.25	78	2.26	1.05	78	1.2	80	0.044	100	100	36.8	0	249	69	69	68	-0.028	9.2	0
93	14.615	14.853	0.16	0.16	1.25	78	2.27	1.05	78	1.2	80	0.044	100	100	36.7	-0.1	250	69	69	68	-0.028	9.2	0
94	14.775	15.014	0.16	0.16	1.25	78	2.27	1.05	78	1.3	80	0.044	101	101	36.6	-0.1	251	69	69	68	-0.029	9.5	0
95	14.933	15.173	0.16	0.16	1.24	78	2.26	1.05	78	1.2	80	0.044	100	99	36.6	0	252	69	69	68	-0.029	9.1	0
96	15.091	15.333	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	100	36.5	-0.1	253	69	69	68	-0.029	9.8	0.1
97	15.251	15.494	0.16	0.16	1.25	78	2.26	1.05	78	1.2	80	0.044	101	101	36.4	-0.1	253	69	69	68	-0.029	9.1	0
98	15.409	15.654	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	100	36.3	-0.1	254	69	69	68	-0.029	8.6	0
99	15.568	15.814	0.16	0.16	1.25	78	2.27	1.05	78	1.2	80	0.044	100	100	36.3	0	254	69	69	68	-0.029	8.8	0
100	15.728	15.975	0.16	0.16	1.25	78	2.27	1.04	78	1.2	81	0.044	101	101	36.2	-0.1	255	69	69	68	-0.029	8.9	0
101	15.886	16.135	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	100	36.1	-0.1	255	69	69	68	-0.029	9	0
102	16.044	16.295	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	100	36.1	0	256	69	69	68	-0.029	9.2	0
103	16.204	16.456	0.16	0.16	1.25	78	2.26	1.05	78	1.3	81	0.044	101	101	36.0	-0.1	256	69	69	68	-0.030	8.8	0
104	16.362	16.615	0.16	0.16	1.24	78	2.27	1.05	78	1.3	81	0.044	100	99	35.9	-0.1	256	69	69	68	-0.029	8.6	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420



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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
	V _{straw} <u>12.34</u> ft/sec		V _{scent} <u>14.32</u> ft/sec			F _p <u>0.862</u>			

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
105	16.520	16.775	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	100	35.8	-0.1	256	69	69	68	-0.030	8.5	0
106	16.679	16.936	0.16	0.16	1.25	78	2.26	1.05	78	1.2	81	0.044	100	101	35.8	0	256	69	69	68	-0.030	9	0
107	16.839	17.096	0.16	0.16	1.24	78	2.27	1.04	78	1.2	81	0.044	101	100	35.7	-0.1	256	69	69	68	-0.029	9.3	0
108	16.997	17.256	0.16	0.16	1.25	78	2.27	1.05	78	1.3	81	0.044	100	100	35.6	-0.1	256	69	69	68	-0.029	9.2	0
109	17.155	17.417	0.16	0.16	1.25	78	2.27	1.05	78	1.3	81	0.044	100	101	35.6	0	256	69	69	68	-0.030	8.8	0
110	17.315	17.577	0.16	0.16	1.25	78	2.27	1.04	78	1.2	81	0.044	101	100	35.5	-0.1	256	69	69	68	-0.029	8.5	0
111	17.473	17.736	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	99	35.5	0	256	69	69	68	-0.029	9.2	0
112	17.632	17.897	0.16	0.16	1.25	78	2.26	1.05	78	1.2	81	0.044	100	101	35.3	-0.2	257	69	69	68	-0.030	8.9	0
113	17.792	18.057	0.16	0.16	1.25	78	2.27	1.04	78	1.3	81	0.044	101	100	35.3	0	256	69	69	68	-0.029	8.6	0
114	17.950	18.217	0.16	0.16	1.25	78	2.28	1.05	78	1.2	81	0.044	100	100	35.2	-0.1	257	69	69	68	-0.029	9.5	0.1
115	18.108	18.377	0.16	0.16	1.25	78	2.27	1.05	78	1.3	81	0.044	100	100	35.2	0	256	69	69	68	-0.030	8.8	0
116	18.268	18.538	0.16	0.16	1.25	78	2.27	1.05	78	1.3	81	0.044	101	101	35.1	-0.1	257	69	69	68	-0.030	9.1	0
117	18.426	18.698	0.16	0.16	1.24	78	2.27	1.05	78	1.2	81	0.044	100	100	35.0	-0.1	257	69	69	68	-0.030	9.8	0
118	18.584	18.858	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	100	35.0	0	257	69	69	68	-0.029	8.6	0
119	18.744	19.018	0.16	0.16	1.25	78	2.28	1.05	78	1.2	81	0.044	101	100	34.9	-0.1	257	69	69	68	-0.029	9	0
120	18.903	19.178	0.16	0.16	1.24	78	2.27	1.05	78	1.2	82	0.044	100	100	34.8	-0.1	257	69	69	68	-0.029	9.2	0.1
121	19.061	19.338	0.16	0.16	1.25	78	2.28	1.05	78	1.2	82	0.044	100	100	34.7	-0.1	258	69	69	68	-0.030	9.5	0
122	19.220	19.499	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	101	34.6	-0.1	258	69	69	68	-0.029	9.4	0
123	19.379	19.659	0.16	0.16	1.25	78	2.27	1.05	78	1.2	81	0.044	100	100	34.5	-0.1	258	69	69	68	-0.030	8.9	0
124	19.537	19.819	0.16	0.16	1.25	78	2.26	1.05	78	1.3	82	0.044	100	100	34.5	0	257	69	69	68	-0.029	8.8	0
125	19.696	19.979	0.16	0.16	1.25	78	2.26	1.05	78	1.3	82	0.044	100	100	34.4	-0.1	257	69	69	68	-0.029	8.2	0
126	19.855	20.139	0.16	0.16	1.25	78	2.28	1.05	78	1.2	82	0.044	100	100	34.4	0	257	69	69	68	-0.030	8.3	0
127	20.013	20.299	0.16	0.16	1.25	78	2.27	1.05	78	1.3	82	0.044	100	100	34.3	-0.1	257	69	69	68	-0.030	9.6	0
128	20.172	20.459	0.16	0.16	1.25	78	2.27	1.05	78	1.3	82	0.044	100	100	34.2	-0.1	257	69	69	68	-0.029	8.8	0
129	20.331	20.619	0.16	0.16	1.24	78	2.27	1.05	78	1.2	82	0.044	100	100	34.2	0	257	69	69	68	-0.029	9.6	0
130	20.489	20.779	0.16	0.16	1.24	78	2.27	1.05	78	1.2	82	0.044	100	100	34.1	-0.1	258	69	69	68	-0.030	9.8	0.1
131	20.648	20.939	0.16	0.16	1.25	78	2.27	1.05	78	1.2	82	0.044	100	100	34.0	-0.1	257	69	69	68	-0.030	8.7	0.1
132	20.807	21.098	0.16	0.16	1.25	78	2.27	1.04	78	1.3	82	0.044	100	100	34.0	0	257	69	69	68	-0.030	8.4	0
133	20.966	21.258	0.16	0.16	1.24	78	2.27	1.05	78	1.3	82	0.044	100	100	33.9	-0.1	257	69	69	68	-0.029	9.2	0
134	21.124	21.419	0.16	0.16	1.25	78	2.27	1.04	78	1.3	82	0.044	100	101	33.8	-0.1	257	69	69	68	-0.029	9.3	0
135	21.283	21.578	0.16	0.16	1.25	78	2.28	1.04	78	1.3	82	0.044	100	100	33.7	-0.1	257	69	69	68	-0.029	9	0
136	21.442	21.738	0.16	0.16	1.25	78	2.28	1.05	78	1.3	82	0.044	100	100	33.7	0	256	69	69	68	-0.029	9.2	0
137	21.600	21.899	0.16	0.16	1.25	78	2.27	1.05	78	1.3	82	0.044	100	101	33.6	-0.1	256	69	69	68	-0.029	8.9	0
138	21.759	22.058	0.16	0.16	1.25	78	2.28	1.05	78	1.3	82	0.044	100	100	33.5	-0.1	256	69	69	68	-0.029	9.7	0.1
139	21.918	22.218	0.16	0.16	1.24	78	2.27	1.04	78	1.3	81	0.044	100	100	33.5	0	256	69	69	68	-0.029	8.8	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420



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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
V_{strav}	12.34			ft/sec			V_{scent}	14.32	
							ft/sec	F_p 0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
140	22.076	22.378	0.16	0.16	1.25	78	2.27	1.04	78	1.3	81	0.044	100	100	33.4	-0.1	256	69	69	68	-0.030	9.2	0.1
141	22.234	22.537	0.16	0.16	1.25	78	2.28	1.04	78	1.3	82	0.044	100	100	33.3	-0.1	256	69	69	68	-0.029	9.7	0.1
142	22.393	22.697	0.16	0.16	1.25	78	2.28	1.05	78	1.3	81	0.044	100	100	33.2	-0.1	256	69	69	68	-0.030	9.5	0
143	22.551	22.858	0.16	0.16	1.25	78	2.27	1.04	78	1.3	81	0.044	100	101	33.1	-0.1	256	69	69	68	-0.030	9.7	0
144	22.710	23.017	0.16	0.16	1.25	78	2.27	1.04	78	1.3	81	0.044	100	99	33.1	0	256	69	69	68	-0.029	9.2	0
145	22.869	23.177	0.16	0.16	1.25	78	2.27	1.04	78	1.3	81	0.044	100	100	33.0	-0.1	256	69	69	68	-0.029	8.8	0
146	23.027	23.337	0.16	0.16	1.24	78	2.27	1.04	78	1.3	82	0.044	100	100	32.9	-0.1	256	69	69	68	-0.030	9.5	0.1
147	23.185	23.496	0.16	0.16	1.25	78	2.28	1.04	78	1.3	82	0.044	100	100	32.9	0	256	69	69	68	-0.029	9.2	0
148	23.345	23.656	0.16	0.16	1.24	78	2.28	1.04	78	1.3	81	0.044	101	100	32.8	-0.1	256	69	69	68	-0.030	9.2	0
149	23.503	23.816	0.16	0.16	1.24	78	2.27	1.04	78	1.3	81	0.044	100	100	32.7	-0.1	256	69	69	68	-0.029	8.7	0
150	23.661	23.975	0.16	0.16	1.25	78	2.27	1.04	78	1.3	82	0.044	100	100	32.6	-0.1	256	69	69	68	-0.029	9	0
151	23.821	24.135	0.16	0.16	1.25	78	2.28	1.04	78	1.3	82	0.044	101	100	32.6	0	256	69	69	68	-0.030	10.2	0.2
152	23.979	24.295	0.16	0.16	1.25	78	2.28	1.04	78	1.3	82	0.044	100	100	32.5	-0.1	256	69	69	68	-0.030	9.5	0.1
153	24.137	24.454	0.16	0.16	1.25	78	2.27	1.04	78	1.3	81	0.044	100	99	32.4	-0.1	257	69	69	68	-0.030	9.3	0
154	24.297	24.614	0.16	0.16	1.25	78	2.28	1.04	78	1.3	81	0.044	101	100	32.3	-0.1	257	69	69	68	-0.030	9	0
155	24.455	24.774	0.16	0.16	1.24	78	2.27	1.04	78	1.3	81	0.044	100	100	32.3	0	256	69	69	68	-0.029	8.8	0
156	24.613	24.934	0.16	0.16	1.25	78	2.28	1.04	78	1.3	82	0.044	100	100	32.2	-0.1	257	69	69	68	-0.029	8.9	0
157	24.772	25.093	0.16	0.16	1.25	78	2.27	1.04	78	1.3	82	0.044	100	100	32.2	0	257	69	69	68	-0.030	9.4	0
158	24.931	25.253	0.16	0.16	1.24	78	2.28	1.04	78	1.3	82	0.044	100	100	32.1	-0.1	256	69	69	68	-0.029	8.9	0
159	25.088	25.413	0.16	0.16	1.25	78	2.27	1.04	78	1.3	82	0.044	99	100	32.0	-0.1	257	69	69	68	-0.030	9.1	0
160	25.247	25.572	0.16	0.16	1.25	78	2.28	1.04	78	1.3	82	0.044	100	100	32.0	0	256	69	69	68	-0.029	8.7	0
161	25.406	25.732	0.16	0.16	1.24	78	2.28	1.04	78	1.3	82	0.044	100	100	31.8	-0.2	255	69	69	68	-0.030	8.7	0
162	25.564	25.891	0.16	0.16	1.25	78	2.27	1.04	78	1.3	81	0.044	100	99	31.8	0	256	69	69	68	-0.030	9.3	0
163	25.723	26.051	0.16	0.16	1.25	78	2.28	1.04	78	1.3	81	0.044	100	100	31.7	-0.1	255	69	69	68	-0.029	9.1	0
164	25.882	26.211	0.16	0.16	1.24	78	2.28	1.03	78	1.3	82	0.044	100	100	31.7	0	255	69	69	68	-0.029	8.5	0
165	26.040	26.370	0.16	0.16	1.24	79	2.27	1.04	78	1.3	81	0.044	99	99	31.6	-0.1	255	69	69	68	-0.030	9.1	0
166	26.198	26.530	0.16	0.16	1.25	79	2.27	1.04	78	1.3	81	0.044	99	100	31.5	-0.1	255	69	69	68	-0.029	9.3	0
167	26.357	26.690	0.16	0.16	1.24	79	2.27	1.04	78	1.3	81	0.044	100	100	31.4	-0.1	255	69	69	68	-0.029	9.7	0
168	26.515	26.849	0.16	0.16	1.25	79	2.27	1.04	78	1.3	81	0.044	99	99	31.4	0	255	69	69	68	-0.030	8.7	0
169	26.673	27.009	0.16	0.16	1.25	79	2.27	1.04	78	1.3	82	0.044	100	100	31.3	-0.1	255	69	69	68	-0.029	9.1	0
170	26.833	27.168	0.16	0.16	1.25	79	2.27	1.04	78	1.3	81	0.044	101	99	31.2	-0.1	255	69	69	68	-0.029	8.4	0
171	26.991	27.327	0.16	0.16	1.24	79	2.28	1.04	78	1.3	81	0.044	99	99	31.2	0	255	69	69	68	-0.030	9	0.1
172	27.149	27.488	0.16	0.16	1.25	79	2.27	1.03	78	1.3	81	0.044	99	101	31.1	-0.1	254	69	69	68	-0.029	9	0
173	27.309	27.647	0.16	0.16	1.25	79	2.28	1.04	78	1.3	81	0.044	101	99	31.0	-0.1	254	69	69	68	-0.030	9.2	0
174	27.467	27.806	0.16	0.16	1.24	79	2.27	1.04	78	1.3	81	0.044	99	99	31.0	0	254	69	69	68	-0.029	9	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515



Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft²
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
	V _{strav} <u>12.34</u> ft/sec		V _{scent} <u>14.32</u> ft/sec		F _p <u>0.862</u>				

Elapsed Time (min)	Particulate Sampling Data											Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data					
	Gas Meter 1 (ft ³)	Gas Meter 2 (ft ³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
175	27.625	27.966	0.16	0.16	1.24	79	2.27	1.03	78	1.3	81	0.044	99	100	30.9	-0.1	254	69	69	68	-0.029	9	0
176	27.784	28.125	0.16	0.16	1.24	79	2.28	1.04	78	1.3	81	0.044	100	99	30.8	-0.1	254	69	69	68	-0.029	8.6	0
177	27.942	28.285	0.16	0.16	1.24	79	2.27	1.04	78	1.3	81	0.044	99	100	30.7	-0.1	254	69	69	68	-0.029	9	0
178	28.101	28.445	0.16	0.16	1.25	79	2.27	1.03	78	1.3	81	0.044	100	100	30.6	-0.1	254	69	69	68	-0.029	9.6	0
179	28.260	28.604	0.16	0.16	1.25	79	2.28	1.04	78	1.3	81	0.044	100	99	30.6	0	254	69	69	68	-0.029	9.8	0.1
180	28.418	28.763	0.16	0.16	1.24	79	2.28	1.04	78	1.3	81	0.044	99	99	30.5	-0.1	254	69	69	68	-0.029	8.9	0
181	28.576	28.923	0.16	0.16	1.25	79	2.28	1.04	78	1.3	81	0.044	99	100	30.5	0	254	69	69	68	-0.029	9.4	0
182	28.736	29.082	0.16	0.16	1.24	79	2.28	1.04	78	1.3	81	0.044	101	99	30.4	-0.1	254	69	69	68	-0.029	9.2	0
183	28.894	29.241	0.16	0.16	1.24	79	2.28	1.04	78	1.3	81	0.044	99	99	30.3	-0.1	255	69	69	68	-0.030	8.6	0
184	29.052	29.402	0.16	0.16	1.25	79	2.28	1.04	78	1.3	81	0.044	99	101	30.3	0	253	69	69	68	-0.030	7.7	0
185	29.211	29.561	0.16	0.16	1.25	79	2.27	1.04	78	1.3	80	0.044	100	99	30.2	-0.1	253	69	69	68	-0.030	7.2	0
186	29.370	29.720	0.16	0.16	1.25	79	2.27	1.04	78	1.3	80	0.044	100	99	30.1	-0.1	254	69	69	68	-0.031	7.1	0
187	29.528	29.880	0.16	0.16	1.25	79	2.28	1.03	78	1.3	80	0.044	99	100	30.1	0	256	69	69	68	-0.031	6.7	0
188	29.687	30.039	0.16	0.16	1.25	79	2.28	1.04	78	1.3	79	0.044	100	99	30.0	-0.1	258	69	69	68	-0.032	6.1	0
189	29.846	30.199	0.16	0.16	1.24	79	2.27	1.04	78	1.3	80	0.044	100	100	30.0	0	259	69	69	68	-0.032	5.5	0
190	30.004	30.358	0.16	0.16	1.24	79	2.27	1.03	78	1.3	79	0.044	99	99	29.9	-0.1	260	69	69	68	-0.032	4.4	0
191	30.162	30.517	0.16	0.16	1.24	79	2.27	1.04	78	1.3	79	0.044	99	99	29.9	0	260	69	69	68	-0.032	4	0
192	30.322	30.678	0.16	0.16	1.24	79	2.28	1.04	78	1.3	80	0.044	101	101	29.9	0	260	69	69	68	-0.032	3.5	0
193	30.480	30.837	0.16	0.16	1.24	79	2.28	1.03	78	1.3	80	0.044	99	99	29.8	-0.1	259	69	69	68	-0.032	3.7	0
194	30.638	30.996	0.16	0.16	1.24	79	2.27	1.04	78	1.3	80	0.044	99	99	29.8	0	259	69	69	68	-0.032	3.7	0
195	30.798	31.156	0.16	0.16	1.24	79	2.28	1.04	78	1.3	80	0.044	101	100	29.8	0	259	69	69	68	-0.032	3.8	0
196	30.956	31.315	0.16	0.16	1.24	79	2.28	1.04	78	1.3	79	0.044	99	99	29.7	-0.1	258	69	69	68	-0.031	3.5	0
197	31.114	31.474	0.16	0.16	1.25	79	2.28	1.03	78	1.3	80	0.044	99	99	29.7	0	258	69	69	68	-0.031	3.9	0
198	31.274	31.635	0.16	0.16	1.24	79	2.27	1.04	78	1.3	80	0.044	101	101	29.7	0	257	69	69	68	-0.031	3.4	0
199	31.432	31.793	0.16	0.16	1.24	79	2.28	1.04	78	1.3	80	0.044	99	99	29.7	0	257	69	69	68	-0.031	3.8	0
200	31.590	31.953	0.16	0.16	1.24	79	2.28	1.04	78	1.3	80	0.044	99	100	29.6	-0.1	256	69	69	68	-0.031	3.2	0
201	31.750	32.113	0.16	0.16	1.23	79	2.28	1.04	78	1.3	79	0.044	101	100	29.6	0	255	69	69	68	-0.031	3.2	0
202	31.908	32.272	0.16	0.16	1.24	79	2.28	1.04	78	1.3	79	0.044	99	99	29.6	0	254	69	69	68	-0.031	3.1	0
203	32.066	32.431	0.16	0.16	1.25	79	2.27	1.04	78	1.3	79	0.044	99	99	29.5	-0.1	253	69	69	68	-0.031	3.4	0
204	32.225	32.591	0.16	0.16	1.25	79	2.28	1.04	78	1.3	79	0.044	100	100	29.5	0	252	69	69	68	-0.030	3.3	0
205	32.384	32.750	0.16	0.16	1.24	79	2.28	1.04	78	1.3	79	0.044	100	99	29.5	0	251	69	69	69	-0.030	2.8	0
206	32.542	32.909	0.16	0.16	1.25	79	2.28	1.04	78	1.3	79	0.044	99	99	29.5	0	249	69	69	68	-0.030	3	0
207	32.701	33.069	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	100	100	29.5	0	249	69	69	68	-0.030	3.2	0
208	32.860	33.228	0.16	0.16	1.24	79	2.28	1.04	78	1.3	79	0.044	100	99	29.4	-0.1	248	69	69	68	-0.030	3.5	0
209	33.018	33.388	0.16	0.16	1.24	79	2.27	1.03	78	1.3	79	0.044	99	100	29.4	0	248	69	69	68	-0.030	4	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515



Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
V_{strav}	12.34			ft/sec			V_{scent}	14.32	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
210	33.176	33.547	0.16	0.16	1.25	79	2.27	1.03	78	1.3	79	0.044	99	99	29.3	-0.1	248	69	69	68	-0.030	4.1	0
211	33.336	33.706	0.16	0.16	1.24	79	2.27	1.04	78	1.3	79	0.044	101	99	29.3	0	248	69	69	68	-0.030	3.7	0
212	33.494	33.866	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	99	100	29.3	0	247	69	69	68	-0.030	3.5	0
213	33.652	34.025	0.16	0.16	1.25	79	2.28	1.04	78	1.3	79	0.044	99	99	29.3	0	247	69	69	68	-0.030	3.6	0
214	33.812	34.184	0.16	0.16	1.24	79	2.28	1.04	78	1.3	79	0.044	101	99	29.3	0	246	69	69	68	-0.029	3.1	0
215	33.970	34.344	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	99	100	29.2	-0.1	244	69	69	68	-0.029	2.9	0
216	34.128	34.503	0.16	0.16	1.25	79	2.28	1.03	78	1.3	79	0.044	99	99	29.2	0	244	69	69	68	-0.029	4	0
217	34.288	34.662	0.16	0.16	1.25	79	2.28	1.04	78	1.3	79	0.044	101	99	29.2	0	244	69	69	68	-0.029	3.5	0
218	34.446	34.822	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	99	100	29.2	0	242	69	69	68	-0.029	2.9	0
219	34.604	34.981	0.16	0.16	1.25	79	2.28	1.03	78	1.3	78	0.044	99	99	29.1	-0.1	241	69	69	68	-0.029	3	0
220	34.764	35.140	0.16	0.16	1.24	79	2.28	1.04	78	1.3	78	0.044	100	99	29.1	0	240	69	69	68	-0.029	3.2	0
221	34.922	35.300	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	99	100	29.1	0	240	69	69	68	-0.028	3.4	0
222	35.080	35.459	0.16	0.16	1.25	79	2.28	1.04	78	1.3	78	0.044	99	99	29.0	-0.1	239	69	69	68	-0.029	3.4	0
223	35.240	35.618	0.16	0.16	1.25	79	2.29	1.03	78	1.3	79	0.044	101	99	29.0	0	239	69	69	68	-0.029	3.3	0
224	35.399	35.778	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	100	100	29.0	0	238	69	69	68	-0.028	3.3	0
225	35.557	35.937	0.16	0.16	1.25	79	2.28	1.04	78	1.3	78	0.044	99	99	29.0	0	238	69	69	68	-0.028	3.6	0
226	35.715	36.097	0.16	0.16	1.25	79	2.28	1.03	78	1.3	78	0.044	99	100	28.9	-0.1	238	69	69	68	-0.028	3.4	0
227	35.875	36.255	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	100	99	28.9	0	237	69	69	68	-0.028	3.4	0
228	36.033	36.415	0.16	0.16	1.25	79	2.28	1.04	78	1.3	78	0.044	99	100	28.9	0	237	69	69	68	-0.028	3.2	0
229	36.191	36.575	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	99	100	28.9	0	236	69	69	68	-0.028	3	0
230	36.351	36.733	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	100	99	28.8	-0.1	236	69	69	68	-0.028	3.4	0
231	36.509	36.892	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	99	99	28.8	0	236	69	69	68	-0.028	2.9	0
232	36.667	37.052	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	100	28.8	0	235	69	69	68	-0.028	3.2	0
233	36.827	37.211	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	100	99	28.7	-0.1	234	69	69	68	-0.027	3.1	0
234	36.985	37.370	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	99	28.8	0.1	233	69	69	68	-0.027	2.9	0
235	37.143	37.530	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	100	28.7	-0.1	233	69	69	68	-0.028	3	0
236	37.303	37.688	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	100	99	28.7	0	233	69	69	68	-0.027	3.8	0
237	37.461	37.848	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	99	100	28.6	-0.1	233	69	69	68	-0.027	2.9	0
238	37.619	38.007	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	99	99	28.6	0	233	69	69	68	-0.028	3.2	0
239	37.779	38.166	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	101	99	28.6	0	233	69	69	68	-0.027	3.2	0
240	37.937	38.326	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	100	28.6	0	232	69	69	68	-0.027	2.6	0
241	38.095	38.484	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	99	28.5	-0.1	232	69	69	68	-0.027	3.1	0
242	38.254	38.643	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	100	99	28.5	0	232	69	69	68	-0.027	4.3	0
243	38.413	38.803	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	100	100	28.5	0	233	69	69	68	-0.028	3.8	0
244	38.571	38.961	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	99	28.5	0	232	69	69	68	-0.027	3.3	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %



Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
V_{strav}	12.34			ft/sec			V_{scent}	14.32	
				ft/sec			F_p	0.862	

Elapsed Time (min)	Particulate Sampling Data											Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data					
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
245	38.729	39.120	0.16	0.16	1.25	79	2.29	1.03	78	1.3	78	0.044	99	99	28.4	-0.1	232	69	69	68	-0.027	3.1	0
246	38.889	39.280	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	100	100	28.4	0	232	69	69	68	-0.027	3.4	0
247	39.047	39.438	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	99	28.4	0	232	69	69	68	-0.027	4.4	0
248	39.205	39.598	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	100	28.3	-0.1	233	69	69	68	-0.027	4	0
249	39.364	39.757	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	100	99	28.3	0	233	69	69	68	-0.027	3.9	0
250	39.522	39.916	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	99	28.3	0	233	69	69	68	-0.027	3.3	0
251	39.681	40.075	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	100	99	28.3	0	233	69	69	68	-0.027	3.6	0
252	39.840	40.234	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	100	99	28.2	-0.1	233	69	69	68	-0.027	3.6	0
253	39.998	40.392	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	99	28.2	0	233	69	69	68	-0.028	3.9	0
254	40.156	40.552	0.16	0.16	1.24	79	2.28	1.03	78	1.3	78	0.044	99	100	28.2	0	233	69	69	68	-0.028	3.4	0
255	40.316	40.711	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	100	99	28.1	-0.1	233	69	69	68	-0.028	3.8	0
256	40.474	40.870	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	99	99	28.1	0	233	69	69	68	-0.027	3.6	0
257	40.632	41.029	0.16	0.16	1.24	79	2.28	1.02	78	1.3	78	0.044	99	99	28.1	0	233	69	69	68	-0.028	3.8	0
258	40.791	41.187	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	100	99	28.0	-0.1	233	69	69	68	-0.028	3.2	0
259	40.950	41.347	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	100	100	28.1	0.1	233	69	69	68	-0.027	3.1	0
260	41.108	41.505	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	99	99	28.0	-0.1	232	69	69	68	-0.027	2.8	0
261	41.267	41.664	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	100	99	28.0	0	232	69	69	68	-0.027	2.8	0
262	41.425	41.824	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	99	100	28.0	0	232	69	69	68	-0.027	3.3	0
263	41.583	41.982	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	99	99	28.0	0	232	69	69	68	-0.027	3.8	0
264	41.742	42.141	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	100	99	27.9	-0.1	232	69	69	68	-0.027	3.1	0
265	41.901	42.300	0.16	0.16	1.24	79	2.29	1.02	78	1.3	78	0.044	100	99	27.8	-0.1	232	69	69	68	-0.027	3.6	0
266	42.059	42.458	0.16	0.16	1.24	79	2.29	1.03	78	1.3	78	0.044	99	99	27.8	0	232	69	69	68	-0.027	4	0
267	42.218	42.618	0.16	0.16	1.24	79	2.29	1.02	78	1.3	78	0.044	100	100	27.8	0	232	69	69	68	-0.027	3.3	0
268	42.377	42.776	0.16	0.16	1.23	79	2.29	1.03	78	1.3	79	0.044	100	99	27.8	0	232	69	69	68	-0.027	3.3	0
269	42.535	42.935	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	99	99	27.7	-0.1	233	69	69	68	-0.027	4	0
270	42.693	43.094	0.16	0.16	1.25	79	2.28	1.03	78	1.3	79	0.044	99	99	27.7	0	233	69	69	69	-0.027	3.4	0
271	42.852	43.252	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	100	99	27.7	0	233	69	69	68	-0.027	3.4	0
272	43.010	43.412	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	99	100	27.7	0	232	69	69	68	-0.027	3	0
273	43.168	43.570	0.16	0.16	1.24	79	2.29	1.02	78	1.3	79	0.044	99	99	27.7	0	232	69	69	68	-0.027	2.9	0
274	43.328	43.729	0.16	0.16	1.23	79	2.29	1.03	78	1.3	79	0.044	101	99	27.6	-0.1	232	69	69	68	-0.027	3.4	0
275	43.486	43.888	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	99	99	27.6	0	232	69	69	68	-0.027	3.7	0
276	43.644	44.046	0.16	0.16	1.24	79	2.29	1.02	78	1.3	79	0.044	99	99	27.6	0	233	69	69	68	-0.027	3.9	0
277	43.803	44.205	0.16	0.16	1.24	79	2.29	1.03	78	1.3	80	0.044	100	99	27.5	-0.1	233	69	69	68	-0.027	3.9	0
278	43.961	44.364	0.16	0.16	1.23	79	2.29	1.02	78	1.3	79	0.044	99	99	27.5	0	233	69	69	68	-0.027	3.3	0
279	44.119	44.522	0.16	0.16	1.24	79	2.29	1.03	78	1.3	79	0.044	99	99	27.5	0	232	69	69	68	-0.027	3	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
	V _{strav} <u>12.34</u> ft/sec		V _{scent} <u>14.32</u> ft/sec			F _p <u>0.862</u>			

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
280	44.278	44.682	0.16	0.16	1.24	79	2.28	1.03	78	1.3	79	0.044	100	100	27.4	-0.1	232	69	69	68	-0.027	3.2	0
281	44.436	44.840	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	27.4	0	233	69	69	68	-0.028	3.9	0
282	44.595	44.999	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	27.4	0	233	69	69	68	-0.028	3.8	0
283	44.754	45.158	0.16	0.16	1.24	79	2.28	1.02	79	1.3	79	0.044	100	99	27.3	-0.1	233	69	69	68	-0.028	3.7	0
284	44.912	45.316	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	27.3	0	233	69	69	68	-0.027	3.3	0
285	45.070	45.475	0.16	0.16	1.24	79	2.29	1.02	79	1.3	78	0.044	99	99	27.3	0	233	69	69	68	-0.027	3.5	0
286	45.229	45.633	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	27.3	0	233	69	69	68	-0.027	3.7	0
287	45.387	45.792	0.16	0.16	1.24	79	2.29	1.03	79	1.3	79	0.044	99	99	27.2	-0.1	233	69	69	68	-0.027	3.8	0
288	45.545	45.951	0.16	0.16	1.24	79	2.29	1.02	79	1.3	78	0.044	99	99	27.2	0	233	69	69	68	-0.028	3.6	0
289	45.705	46.109	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	101	99	27.2	0	234	69	69	68	-0.028	3.9	0
290	45.862	46.267	0.16	0.16	1.23	79	2.29	1.02	79	1.3	78	0.044	99	98	27.1	-0.1	234	69	69	68	-0.028	3.7	0
291	46.020	46.427	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	100	27.1	0	234	69	69	68	-0.028	3.5	0
292	46.180	46.585	0.16	0.16	1.24	79	2.29	1.03	79	1.3	79	0.044	101	99	27.1	0	233	69	69	68	-0.028	3.1	0
293	46.338	46.744	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	27.0	-0.1	233	69	69	68	-0.028	3.4	0
294	46.496	46.902	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	27.0	0	232	69	69	68	-0.027	3.1	0
295	46.655	47.061	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	27.0	0	233	69	69	68	-0.027	3.4	0
296	46.813	47.220	0.16	0.16	1.23	79	2.29	1.02	79	1.3	79	0.044	99	99	27.0	0	232	69	69	68	-0.027	3.5	0
297	46.971	47.378	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	26.9	-0.1	232	69	69	69	-0.027	3.3	0
298	47.130	47.537	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	26.9	0	232	69	69	68	-0.027	3.6	0
299	47.289	47.695	0.16	0.16	1.23	79	2.3	1.02	79	1.3	79	0.044	100	99	26.9	0	232	69	69	68	-0.027	4.3	0
300	47.446	47.854	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	26.9	0	233	69	69	68	-0.027	4.5	0
301	47.605	48.013	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	100	99	26.8	-0.1	233	69	69	69	-0.027	3.9	0
302	47.764	48.171	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	100	99	26.8	0	233	69	69	68	-0.027	3.9	0
303	47.921	48.329	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	26.8	0	233	69	69	68	-0.027	3.5	0
304	48.080	48.488	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	26.7	-0.1	233	69	69	68	-0.027	3.9	0
305	48.239	48.646	0.16	0.16	1.23	79	2.3	1.02	79	1.3	79	0.044	100	99	26.7	0	233	69	69	69	-0.027	3.3	0
306	48.397	48.806	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	100	26.7	0	232	69	69	69	-0.027	3.1	0
307	48.555	48.963	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	98	26.7	0	233	69	69	69	-0.027	3.3	0
308	48.715	49.122	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	101	99	26.6	-0.1	232	69	69	69	-0.027	3.3	0
309	48.872	49.281	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.6	0	232	69	69	69	-0.027	2.9	0
310	49.031	49.439	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	26.6	0	233	69	69	69	-0.027	3.4	0
311	49.190	49.598	0.16	0.16	1.23	79	2.29	1.02	79	1.3	79	0.044	100	99	26.5	-0.1	232	69	69	69	-0.027	3.2	0
312	49.348	49.756	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	26.5	0	232	69	69	69	-0.027	2.7	0
313	49.506	49.914	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	26.5	0	232	69	69	69	-0.027	3	0
314	49.665	50.073	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	26.5	0	232	69	69	68	-0.027	3.6	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515



Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420

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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044
Temp:	98	98	98	98	98	98	98	98	98
	V _{strav} <u>12.34</u> ft/sec		V _{scent} <u>14.32</u> ft/sec			F _p <u>0.862</u>			

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H ₂ O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H ₂ O)	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 ₂ O)	CO ₂ (%)	CO (%)
315	49.823	50.231	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	26.4	-0.1	232	69	69	68	-0.027	3.5	0
316	49.981	50.390	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.4	0	232	69	69	68	-0.028	3.2	0
317	50.140	50.548	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	26.4	0	232	69	69	69	-0.027	3.2	0
318	50.298	50.706	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.4	0	232	69	69	69	-0.027	3.8	0
319	50.456	50.865	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.3	-0.1	232	69	69	69	-0.027	3.8	0
320	50.615	51.023	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	26.3	0	232	69	69	68	-0.027	3	0
321	50.773	51.182	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.3	0	232	69	69	68	-0.027	3	0
322	50.931	51.340	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	26.2	-0.1	232	69	69	69	-0.027	3.8	0
323	51.090	51.498	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	100	99	26.2	0	232	69	69	69	-0.027	4.1	0
324	51.248	51.657	0.16	0.16	1.23	79	2.29	1.02	79	1.3	79	0.044	99	99	26.2	0	232	69	69	68	-0.027	3.6	0
325	51.406	51.815	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.2	0	232	69	69	69	-0.027	3.7	0
326	51.565	51.973	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	100	99	26.1	-0.1	232	69	69	69	-0.027	3.8	0
327	51.723	52.131	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.1	0	233	69	69	69	-0.027	3.8	0
328	51.881	52.289	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	26.1	0	233	69	69	69	-0.028	3.9	0
329	52.040	52.448	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	100	99	26.0	-0.1	233	69	69	69	-0.027	3.6	0
330	52.198	52.606	0.16	0.16	1.24	79	2.31	1.02	79	1.3	79	0.044	99	99	26.0	0	233	69	69	69	-0.027	3.3	0
331	52.356	52.764	0.16	0.16	1.24	79	2.29	1.02	79	1.3	79	0.044	99	99	25.9	-0.1	233	69	69	69	-0.027	3.2	0
332	52.515	52.923	0.16	0.16	1.24	79	2.3	1.01	79	1.3	79	0.044	100	99	25.9	0	232	69	69	69	-0.028	3.7	0
333	52.673	53.081	0.16	0.16	1.24	80	2.3	1.02	79	1.3	79	0.044	99	99	25.9	0	232	69	69	69	-0.027	3.4	0
334	52.831	53.240	0.16	0.16	1.24	80	2.3	1.02	79	1.3	79	0.044	99	99	25.9	0	232	69	69	69	-0.027	3.6	0
335	52.991	53.397	0.16	0.16	1.23	79	2.3	1.02	79	1.3	79	0.044	101	98	25.9	0	232	69	69	69	-0.027	3.6	0
336	53.148	53.556	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	25.8	-0.1	232	69	69	69	-0.028	3.5	0
337	53.306	53.714	0.16	0.16	1.24	80	2.3	1.01	79	1.3	79	0.044	99	99	25.8	0	232	69	69	69	-0.027	3.5	0
338	53.466	53.872	0.16	0.16	1.23	79	2.31	1.02	79	1.3	79	0.044	101	99	25.8	0	232	69	69	69	-0.027	3	0
339	53.623	54.031	0.16	0.16	1.23	79	2.31	1.02	79	1.3	79	0.044	99	99	25.7	-0.1	232	69	69	69	-0.027	3.3	0
340	53.781	54.188	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	98	25.8	0.1	232	69	69	69	-0.027	3.1	0
341	53.941	54.347	0.16	0.16	1.24	79	2.31	1.02	79	1.3	79	0.044	101	99	25.7	-0.1	231	69	69	69	-0.027	3.6	0
342	54.098	54.505	0.16	0.16	1.23	79	2.31	1.01	79	1.3	79	0.044	99	99	25.7	0	232	69	69	69	-0.028	4.1	0
343	54.256	54.663	0.16	0.16	1.24	80	2.3	1.02	79	1.3	79	0.044	99	99	25.6	-0.1	232	69	69	69	-0.027	4.1	0
344	54.416	54.822	0.16	0.16	1.24	80	2.3	1.02	79	1.3	79	0.044	100	99	25.6	0	232	69	69	69	-0.027	3.8	0
345	54.573	54.979	0.16	0.16	1.23	80	2.3	1.02	79	1.3	79	0.044	98	98	25.6	0	232	69	69	69	-0.028	3.4	0
346	54.731	55.138	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	25.6	0	232	69	69	69	-0.027	3.6	0
347	54.890	55.296	0.16	0.16	1.23	80	2.3	1.01	79	1.3	79	0.044	100	99	25.6	0	232	69	69	69	-0.027	3.8	0
348	55.048	55.454	0.16	0.16	1.24	80	2.31	1.02	79	1.3	79	0.044	99	99	25.5	-0.1	232	69	69	69	-0.027	3.8	0
349	55.206	55.612	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	25.5	0	232	69	69	69	-0.028	3.5	0

Pellet Heater Test Data - ASTM E2779 / ASTM E2515

Run: 3

Manufacturer: Harman High Burn End Time: 62
 Model: Absolute 63 Medium Burn End Time: 183
 Tracking No.: 2146 Total Sampling Time: 363 min
 Project No.: 0135PS036E.REV001 Recording Interval: 1 min
 Test Date: 21-Mar-16
 Beginning Clock Time: 10:26 Background Sample Volume: 0 cubic feet

Meter Box Y Factor: 1.001 (1) 1.001 (2) 0 (Amb)

Barometric Pressure: Begin Middle End Average
29.83 29.84 29.84 29.84 "Hg

OMNI Equipment Numbers: 335, 336, 410, 420



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: -0.180 "H2O
 Tunnel Area: 0.19635 ft2
 Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 12.17 ft/sec.
 Initial Tunnel Flow: 131.6 scfm
 Average Tunnel Flow: 136.2 scfm
 Post-Test Leak Check (1): 0 cfm @ -9 in. Hg
 Post-Test Leak Check (2): 0.001 cfm @ -7 in. Hg
 Fuel Moisture: 5.1 Dry Basis %

Velocity Traverse Data										
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.024	0.024	0.040	0.032	0.028	0.040	0.042	0.024	0.044	
Temp:	98	98	98	98	98	98	98	98	98	
V _{straw}	12.34			ft/sec			V _{scent}	14.32 ft/sec		
F _p	0.862									

Elapsed Time (min)	Particulate Sampling Data												Fuel Weight (lb)		Temperature Data (°F)				Stack Gas Data				
	Gas Meter 1 (ft³)	Gas Meter 2 (ft³)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H₂O)	Meter Temp 1 (°F)	Meter Vacuum 1 ("Hg)	Orifice dH 2 ("H₂O)	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 ("H₂O)	CO₂ (%)	CO (%)
350	55.365	55.770	0.16	0.16	1.23	79	2.31	1.02	79	1.3	79	0.044	100	99	25.5	0	232	69	69	69	-0.027	3.3	0
351	55.523	55.929	0.16	0.16	1.23	79	2.31	1.02	79	1.3	79	0.044	99	99	25.4	-0.1	232	69	69	69	-0.027	3.6	0
352	55.681	56.086	0.16	0.16	1.23	80	2.31	1.02	79	1.3	79	0.044	99	98	25.4	0	232	69	69	69	-0.027	3.4	0
353	55.840	56.244	0.16	0.16	1.24	80	2.3	1.02	79	1.3	79	0.044	100	99	25.4	0	232	69	69	69	-0.028	3.8	0
354	55.998	56.403	0.16	0.16	1.23	79	2.3	1.01	79	1.3	79	0.044	99	99	25.3	-0.1	232	69	69	69	-0.028	3.8	0
355	56.156	56.560	0.16	0.16	1.24	79	2.31	1.02	79	1.3	79	0.044	99	98	25.3	0	232	69	69	69	-0.027	3.2	0
356	56.315	56.719	0.16	0.16	1.23	79	2.3	1.01	79	1.3	79	0.044	100	99	25.3	0	231	69	69	69	-0.027	3	0
357	56.473	56.876	0.16	0.16	1.23	79	2.3	1.02	79	1.3	79	0.044	99	98	25.3	0	231	69	69	69	-0.028	4	0
358	56.631	57.034	0.16	0.16	1.24	79	2.31	1.02	79	1.3	78	0.044	99	98	25.2	-0.1	231	69	69	69	-0.028	4.3	0
359	56.790	57.193	0.16	0.16	1.23	79	2.31	1.01	79	1.3	79	0.044	100	99	25.2	0	232	69	69	69	-0.027	4.5	0
360	56.948	57.350	0.16	0.16	1.23	79	2.31	1.02	79	1.3	79	0.044	99	98	25.1	-0.1	233	69	69	69	-0.027	4.2	0
361	57.106	57.509	0.16	0.16	1.24	79	2.3	1.02	79	1.3	79	0.044	99	99	25.1	0	233	69	69	69	-0.028	4.1	0
362	57.265	57.666	0.16	0.16	1.22	79	2.31	1.01	79	1.3	78	0.044	100	98	25.1	0	233	69	69	69	-0.028	3.7	0
363	57.423	57.824	0.16	0.16	1.23	79	2.31	1.02	79	1.3	79	0.044	99	99	25.0	-0.1	233	69	69	69	-0.028	3.9	0
Avg/Tot	57.423	57.824	0.16	0.16	1.24	78	/	1.03	77	/	83	0.044	100	100	/	/	70	70	68	-0.031	/	/	/

ASTM E2779 Pellet Heater Run Sheets

Client: Harman Project Number: 0135PS036E.REV001 Run Number: 3
 Model: Absolute Tracking Number: 2146 Date: 3/21/16
 Test Crew: A. Kravitz
 OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 283A, 335, 336, 410, 420, 559, 592

Pellet Heater Run Notes

Air Control Settings

High Burn Rate Target: 100%

Settings: Temperature = 7.0 Combustion Blower: _____
Feed Limit = 93% Max = 3100 RPM
Distribution Blower = 100% Min = 2600 RPM

Medium Burn Rate Target: <50%

Settings: Temperature = 2.5 Combustion Blower: _____
Feed Limit = 38% Max = 2625 RPM
Distribution Blower = 100% Min = 2250 RPM

Low Burn Rate Target: Minimum

Settings: Temperature = 1.0 Combustion Blower: _____
Feed Limit = 25% Max = 2625 RPM
Distribution Blower = OFF Min = 2100 RPM

Additional Settings Notes:

N/A


Preburn Notes

Time	Notes
10:00	+ 36.5 lb
11:00-28:00	Weight change by minute not recorded, scale maxed out
68:00	PB End

Test Notes

Time	Notes
62:00	Switched to Medium
78:00 - 79:00	Replaced combustion gas sample pump – lost two readings
183:00	Switched to Low
363:00	Test End

Pellet Moisture Content: 5.05%

Technician Signature: 

Date: 3/21/16

ASTM E2779 Pellet Heater Run Sheets

Client: Harman Project Number: 0135PS036E.REV001 Run Number: 3
 Model: Absolute Tracking Number: 2146 Date: 3/21/16
 Test Crew: A. Kravitz
 OMNI Equipment ID numbers: 23, 131, 185, 132, 209, 283A, 335, 336, 410, 420, 559, 592

Pellet Heater Supplemental Data

Start Time: 10:26 Booth #: E1
 Stop Time: 16:29

Stack Gas Leak Check:

Initial: 0 Final: 0

Sample Train Leak Check:

A: 0 @-9 "Hg
 B: 0.001 @-7 "Hg

Calibrations: Span Gas CO₂: 16.89 CO: 4.29

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	10:12	10:14	16:33	16:35
CO ₂	0.00	16.89	-0.11	16.79
CO	0.000	4.295	-0.037	4.242

Air Velocity (ft/min): Initial: <50 Final: <50
 Scale Audit (lbs): Initial: 10.0 Final: 10.0
 Pitot Tube Leak Test: Initial: 0 Final: 0
 Stack Diameter (in): 3
 Induced Draft: 0
 % Smoke Capture: 100

Flue Pipe Cleaned Prior to First Test in Series:

Date: 9/1/15 Initials: A

	Initial	Middle	Ending
P _b (in/Hg)	29.83	29.84	29.84
Ambient (°F)	69	68	69

Tunnel Traverse		
Microtector Reading	dP (in H ₂ O)	T(°F)
0.012	0.024	98
0.022	0.044	98
0.020	0.040	98
0.016	0.032	98
0.014	0.028	98
0.020	0.040	98
0.021	0.042	98
0.012	0.024	98
Center:		
0.022	0.044	98
Static:		
--	-0.18	98

Background Filter Volume: N/A

Technician Signature: 

Date: 3/21/16