Innovative Hearth Products

Project # 036-S-063-1
Model: Montecito Estate
Type: Catalytic Wood Fired Heater
June 28, 2016

EPA Certification Testing to Method 28R –Certification and Auditing of Wood Heaters

Contact:
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Innovative Hearth Products
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Prepared by: Doug Towne, QA Manager

DIRIGO LABORATORIES INC.

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Clackamas, OR 97015-9050
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Report Revised: 9/7/2016, 6/30/2021, 9/13/2021

Non CBI

Revision Summary:

Rev 1 : September 7, 2016:

- Model Name Update to MontecitoEstateCat / WCT6940WS

Revision 2

6/30/2021: Reviewed request for 5 year renewal. No changes to original design. Submit report data package and QA package with new Certificate of Conformity. Updated report to include Firebox drawings and CO in g/min.

9/13/2021:

- Added fuel load density to the report. See page 25.
- Added Fuel load spec sheets to NonCBI- Fuel loads calculated using a tapered firebox with andirons resulting in 4 pieces 21 inches long and 2 pieces 17.5 inches long. Piece length was adjusted per ASTM E2780 9.4.1.10 to account for fuel density and stacking requirements due to the tapered firebox and andirons. - See pages 27-30
- Conditioning data was reported with catalyst and flue gas temperatures showing that it was performed at a medium air setting. See page 41
- Discussed the using of 2 category II burn rates per Method 28R and the reasoning behind it. See page 12 & 13
- Provided engineering drawing showing location of Catalyst temperature sensor is within 1" of catalytic combustor surface. See page 19. Also in CBI drawing package.
- There were no negative filter weights recorded for any of the test runs. See pages 23, and 127-130

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Affidavit:

Dirigo Laboratories, Inc. was contracted by Innovative Hearth Products to provide testing services for the Montecito Estate adjustable rate catalytic wood fired heater per EPA Method 28R *Certification and Auditing of Wood Heaters*, and particulate sampling performed per ASTM E2515-11 *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel*. All EPA protocols from Methods 28R and ASTM E2780-10 were followed in the testing, sampling, analysis, and calibrations for the test series and all results are based on these methods. Efficiency, CO emissions and heat output were calculated per CSA B415.1-10 *Performance Testing of Solid-Fuel-Burning Heating Appliances*. All testing and associated procedures were conducted at Dirigo Laboratories, Inc. beginning 6/21/2016 and ending on 6/24/2016. Dirigo Laboratories is located at 11785 SE Highway 212 - Suite 305, Clackamas, Oregon 97015.

Dirigo Laboratories is accredited by the U.S. Environmental Protection Agency for the certification and auditing of wood heaters pursuant to Subpart AAA of 40 CFR Part 60, *New Source Performance Standards for Residential Wood Heaters* and Subpart QQQQ of 40 CFR 60, *Standards of Performance for New Hydronic Heaters and Forced Air Furnaces*. Dirigo is certified for Methods 28R, 28 WHH, 28 WHH-PTS and all methods listed in 40 CFR 60 Sections 60.534 and 60.5476. Dirigo holds EPA Accreditation Certificate Numbers 4 and 4M (mobile). Dirigo Laboratories, Inc. is accredited by A2LA to ISO 17020:2012 “Criteria for Bodies Performing Inspections”; ISO 17025:2005 “Requirements for Testing Laboratories”; and ISO 17065:2012 “Requirements for Bodies Operating Product Certification Systems”. Dirigo holds A2LA Certificate Numbers 3726.01, 3726.02, and 3726.03.

See Appendix E for all certifications.

The following personnel performed the testing, analysis and report writing associated with this project:

John Steinert

Digitally signed by John Steinert
DN: cn=John Steinert, o=Dirigo, ou, email=jsteinert@dirigolab.com, c=US
Date: 2016.07.12 14:58:28 -07'00'

John Steinert, President

Ben Nelke

Digitally signed by Ben Nelke
DN: cn=Ben Nelke, o, ou, email=Bnelke@dirigolab.com, c=US
Date: 2016.07.12 14:54:52 -07'00'

Ben Nelke, Sr. Technician

Doug Towne

Digitally signed by Doug Towne
DN: cn=Doug Towne, o=Dirigo, ou=QA/QC, email=dtowne@dirigolab.com, c=US
Date: 2016.07.12 14:50:23 -07'00'

Doug Towne, QA Manager

Introduction:

Innovative Hearth Products LLC contracted with Dirigo Laboratories, Inc. to perform EPA certification testing on their Montecito Estate catalytic wood fired heater. All testing was performed at Dirigo Laboratories, Inc. by Mr. John Steinert and Mr. Ben Nelke.

Third Party Certification services to be provided by PFS Corporation.

Technician Notes:

- A 50-hour catalyst break-in was performed on the appliance prior to testing.
- Prior to the test series, the dilution tunnel was cleaned with a steel brush.
- Front filters were changed on sample train A at one hour for all runs.
- A Category 1 burn rate could not be achieved using the lowest possible air setting on this appliance. Two Category 2 runs were performed with burn rates of 0.93 kg/hr and 1.01 kg/hr per Applicable Determination WDS-109.

Wood Heater Identification and Testing:

- Appliance Tested: ***Montecito Estate***
- Serial Number: **1001**
- Manufacturer*:* ***Innovative Hearth Products***
- Catalyst: ***Yes***
- Heat exchange blower: ***Integral***
- Type: ***Wood Stove***
- Style: ***Insert***
- Date Received: ***Tuesday, June 14, 2016***
- Wood Heater Aging: **Wednesday, June 15, 2016** through **Tuesday, June 21, 2016**
- Testing Period – Start: ***Tuesday, June 21, 2016*** Finish: ***Friday, June 24, 2016***
- Test Location: ***Dirigo Laboratories, Inc., 11785 SE Hwy. 212 - Suite 305, Clackamas, OR 97015***
- Elevation: **≈ 131** ***Feet above sea level***
- Test Technician(s): ***John Steinert, Ben Nelke***
- Test Observer(s): ***Matt Romanow, Mike Pennington***

Test Procedures and Equipment:

All Sampling and analytical procedures were performed by John Steinert and Ben Nelke. All procedures used are directly from EPA Methods 28R, ASTM E2780-10, ASTM E2515-11, and CSA B415.1-10. See list below for equipment used. See Appendix D for calibration data.

Equipment List:

1. Analyzer - California Analytical ZRE CO2/CO/O2 IR ANALYZER
2. Delmhorst J-2000 Wood Moisture Meter
3. Dayton 4c121 Blower for dilution tunnel - Emissions Booth #2
4. ScienTech Balance Scale
5. 10 lb. Calibration Weight
6. DigiWeigh Bench Shipping Scale
7. APEX XC-60 Digital Emissions Sampling Box A
8. APEX XC-60 Digital Emissions Sampling Box B
9. APEX XC 60 Ambient Sampling Box
10. Gast MOA-P122-AA Vacuum Pump - Analyzer
11. Rice Lake 3'x3' floor scale w/digital weight indicator

Work Station

Non CBI

Results: Weighted Average Emissions and Efficiency

The overall weighted average emission rate based on the 4 certification runs is **1.3 g/hr**. The Montecito Estate catalytic wood fired heater meets the 2020 Step 2 standard PM limit of 2.0 g/hr. per CFR 40 part 60, §60.532 (a). The average CO emission rate for the 4 tests was 2.4 g/min.

The overall weighted average efficiency per CSA B415.1-10 is **70.2%.**

EPA Method 28 - Weighted Average

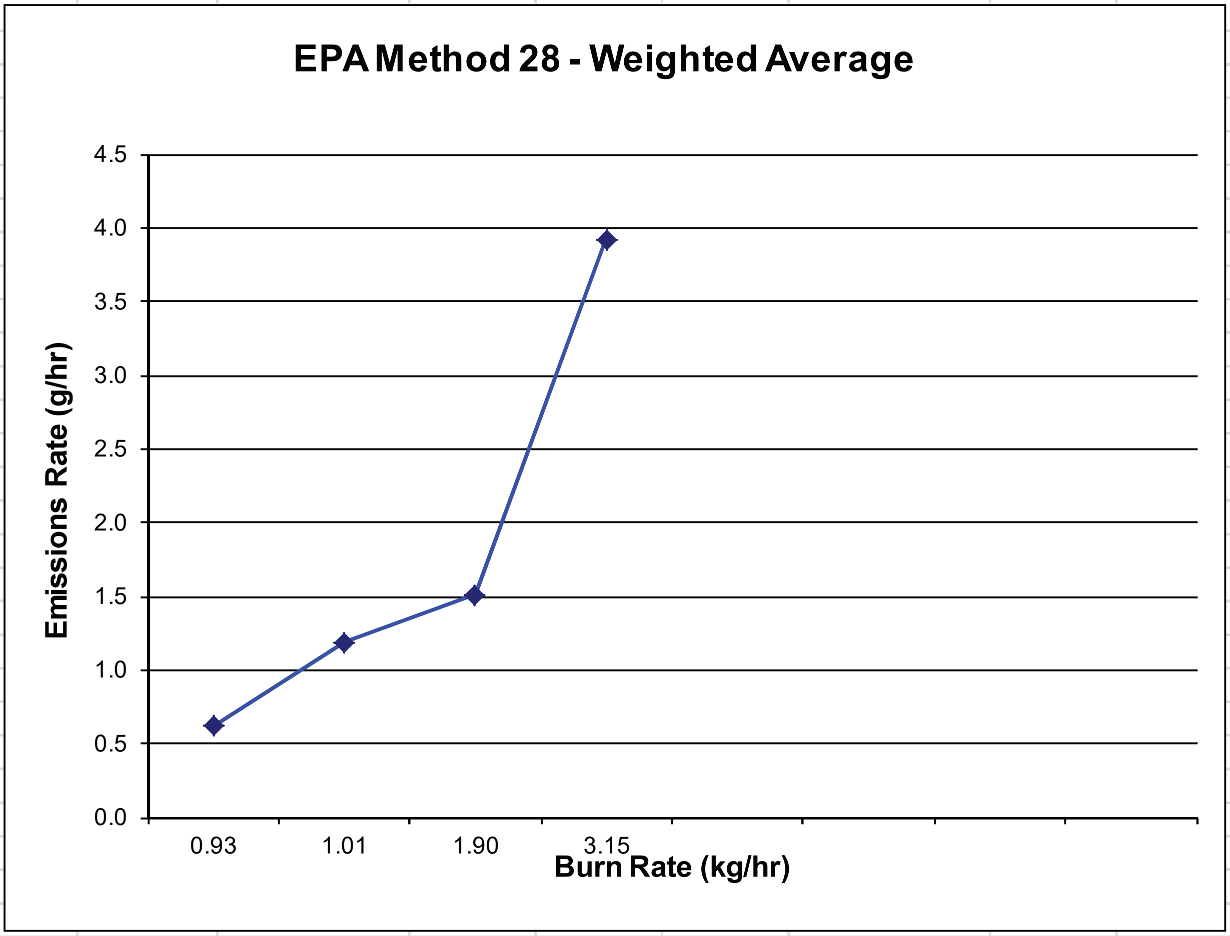
Weighted Average: 1.3 (g/hr)

Client:	IHP
Model:	Montecito Estate
Tracking No.:	63
Project No.:	036-S-063-1
Test Dates:	6/21/16 - 6/24/16

Burn Rate Category	2	Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.93	Burn Rate (kg/hr-dry)	1.01
Emissions Rate (g/hr)	0.6	Emissions Rate (g/hr)	1.2
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	23.08%	Weighting Factor	34.62%
Run Number	1	Run Number	2
Burn Rate Category	3	Burn Rate Category	4
Burn Rate (kg/hr-dry)	1.90	Burn Rate (kg/hr-dry)	3.15
Emissions Rate (g/hr)	1.5	Emissions Rate (g/hr)	3.9
Emissions Rate Cap (g/hr)	18	Emissions Rate Cap (g/hr)	18
Weighting Factor	36.02%	Weighting Factor	6.29%
Run Number	3	Run Number	4

EPA Method 28 - Weighted Average

Client:	IHP
Model:	Montecito Estate
Tracking No.:	63
Project No.:	036-S-063-1
Test Dates:	6/21/16 - 6/24/16



Non CBI

Weighted Average Efficiency:

CSA B415.1-10 Weighted Average

Weighted Average: 70.2 %

Client:	Innovative Hearth Products
Model:	Montecito Estate
Tracking No.:	63
Project No.:	036-S-063-1
Test Dates:	6/21/16 - 6/24/16

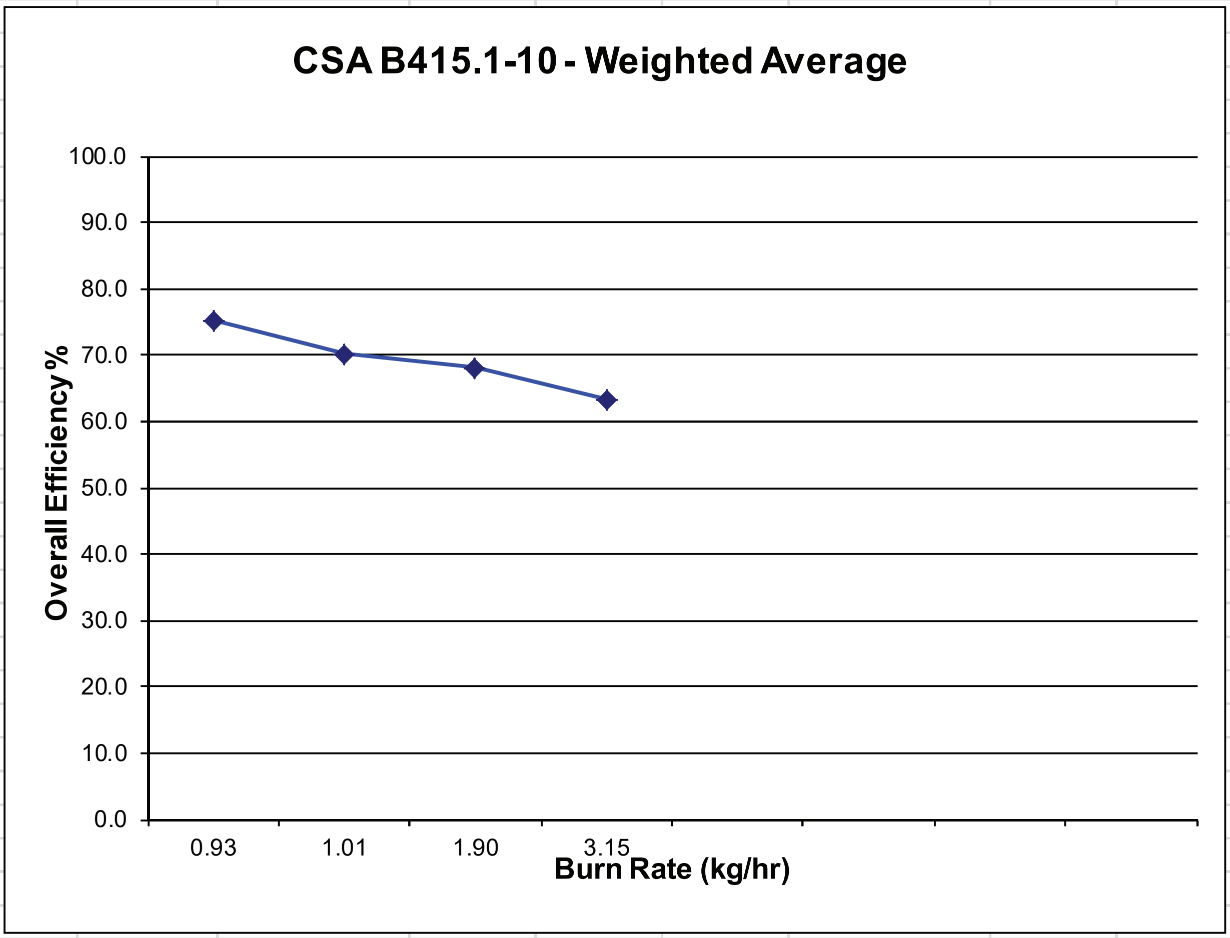
Burn Rate Category	2	Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.93	Burn Rate (kg/hr-dry)	1.01
OA Efficiency %	75.2	OA Efficiency %	70.2
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	23.08%	Weighting Factor	34.62%
Run Number	1	Run Number	2

Burn Rate Category	3	Burn Rate Category	4
Burn Rate (kg/hr-dry)	1.90	Burn Rate (kg/hr-dry)	3.15
OA Efficiency %	68.1	OA Efficiency %	63.3
Emissions Rate Cap (g/hr)	18	Emissions Rate Cap (g/hr)	18
Weighting Factor	36.02%	Weighting Factor	6.29%
Run Number	3	Run Number	4

Non CBI

CSA B415.1-10 - Weighted Average

Client:	Innovative Hearth Products
Model:	Montecito Estate
Tracking No.:	63
Project No.:	036-S-063-1
Test Dates:	6/21/16 - 6/24/16



Non CBI

Table 1: Results

Results in accordance with CSA B415.1-10.

Run	1st Hour Particulate Emissions-grams	Overall Avg. Emission Rate g/hr	Overall Efficiency HHV CSA B415.1-10	Output BTU/hr HHV CSA B415.1-10	Burn Rate kg/hr CSA B415.1-10	CO g/hr
1	1.6	0.62	75.2%	13,899	0.93	43.63
2	3.1	1.19	70.2%	13,987	1.01	117.06
3	4.6	1.51	68.1%	25,680	1.90	135.69
4	7.9	3.92	63.3%	39,519	3.15	269.46

* Run 1:

A Category 1 burn rate could not be achieved using the lowest possible air setting on this appliance. Run 1, performed on 6/21/16, was a category II burn rate with an average of 1.00 kg/hr or less per Method 28R, Section 8.1.1.3.2 (Note). The test duration was 8.2 hours. The fuel weight was 20.4 lbs. There were total PM emissions of 5.10 g. The appliance had a PM rate of 0.62 g/hr with a stack loss efficiency of 75.2%. The A filter was changed at 1 hr. The 1-hour filter catch was 1.6 mg. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all test criteria were met.

Run 2:

Run 2 was a category II burn rate performed on 6/22/16. The test duration was 7.3 hours. The fuel weight was 19.6 lbs. There were total PM emissions of 8.74 g. The appliance had a PM rate of 1.19 g/hr with a stack loss efficiency of 70.2%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.1 mg. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all test criteria were met.

Run 3:

Run 3 was a category III burn rate performed on 6/23/16. The test duration was 4.0 hours. The fuel weight was 20.2 lbs. There were total PM emissions of 6.04 g. The appliance had a PM rate of 1.51 g/hr with a stack loss efficiency of 68.1%. The A filter was changed at 1 hr. The 1-hour filter catch was 4.6 mg. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all test criteria were met.

Non CBI

Run 4:

Run 4 was a category IV burn rate performed on 6/24/16. The test duration was 2.5 hours. The fuel weight was 20.9 lbs. There were total PM emissions of 9.80 g. The appliance had a PM rate of 3.92 g/hr with a stack loss efficiency of 63.3%. The A filter was changed at 1 hr. The 1-hour filter catch was 7.9 mg. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all test criteria were met.

* Run 1 was performed at the lowest possible setting for this appliance which resulted in a category II burn rate. Per method 28R:

Note: After July 1, 1990, if a wood heater cannot be operated at a burn rate less than 0.80 kg/hr, at least one test run with an average burn rate of 1.00 kg/hr or less shall be conducted. Additionally, if flue dampering must be used to achieve burn rates below 1.25 kg/hr (or 1.0 kg/hr), results from a test run conducted at burn rates below 0.90 kg/hr need not be reported or included in the test run average provided that such results are replaced with results from a test run meeting the criteria above.

Test Condition Summary:

All testing conditions for all runs fell within allowable specifications of EPA Method 28R. A summary of facility conditions, ambient temperature averages, fuel burned and run times is listed below. Before and after each test run, measured air velocities were less than 1ft/sec.

Runs	Ambient (Deg. F)		Barometric Pressure (In. Hg.)	Test Fuel Burned (Lbs)	Test Fuel Moisture (Dry Basis)	Run Time (Min.)
	Pre	Post				
1	75	76	30.23	20.4	21.5	490
2	75	80	30.23	19.6	20.5	440
3	73	72	30.07	20.2	20.3	240
4	72	72	30.25	20.9	20.3	150

Filter Catch:

Run 1:

Project #	036-S-063-1	MFG	IHP
Run #	1	Model	Montecito Estate
Date	6/24/16		

Train A	Front	Rear	Filter #	Tare	Final	Net
First Hour	☑		2752	0.119	0.1206	0.0016
	☐	☑	2753			
	☑	☐	2757	0.2363	0.2389	
	☑	☐	O Ring			
	☐	☑	O Ring	3.5875	3.5885	0.0036
						5.2 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	2754			
	☐	☑	2755	0.2368	0.2412	
	☑	☐	O ring			
	☐	☑	O ring	3.5732	3.5742	0.0054
						5.4 mg

Nozzle

#	TARE	FINAL	Net	
13A	117.455	117.4553	0.0003	0.3

Nozzle

#	TARE	FINAL	Net	
13B	117.0657	117.0657	0.0	0.0

Train A Total Catch	5.5
Train B Total Catch	5.4

Ambient ☑	Filter #	Tare	Final	Net	Vol (liter)
	2756	0.1185	0.1187	0.0002	2611.312
	O ring	1.6729	1.6734	0.0005	
			Total	0.0007 mg	

Notes: Train A Total: 5.5mg Train B Total: 5.4mg Ambient Total: 0.7mg 1 Hour Catch: 1.6mg

Non CBI

Run 2:

Project #	036-S-063-1	MFG	IHP
Run #	2	Model	Montecito Estate
Date	6/24/16		

Train A	Front	Rear	Filter #	Tare	Final	Net
First Hour	☑		2758	0.1192	0.1223	0.0031
	☐	☑	2759			
	☑	☐	2763	0.2377	0.2427	
	☑	☐	O Ring			
	☐	☑	O Ring	3.5518	3.5526	0.0058
						8.9 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	2760			
	☐	☑	2761	0.2364	0.2441	
	☑	☐	O ring			
	☐	☑	O ring	3.6015	3.6025	0.0087
						8.7 mg

Nozzle

#	TARE	FINAL	Net	
1A	115.6607	115.6607	0.0	0.0

Nozzle

#	TARE	FINAL	Net	
1B	115.9027	115.9027	0.0	0.0

Train A Total Catch	8.9
Train B Total Catch	8.7

Ambient ☑	Filter #	Tare	Final	Net	Vol (liter)
	2762	0.1198	0.12	0.0002	2338.128
	O ring	1.6963	1.6967	0.0004	
			Total	0.0006	mg

Notes: Train A Total: 8.9mg Train B Total: 8.7mg Ambient Total: 0.6mg 1 Hour Catch: 3.1mg

Run 3:

Project #	036-S-063-1	MFG	IHP
Run #	3	Model	Montecito Estate
Date	6/26/16		

Train A	Front	Rear	Filter #	Tare	Final	Net
First Hour	☑		2764	0.1189	0.1235	0.0046
	☐	☑	2765			
	☑	☐	2769	0.2385	0.2396	
	☑	☐	O Ring			
	☐	☑	O Ring	3.5482	3.5486	0.0015
						6.1 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	2766			
	☐	☑	2767	0.2371	0.2425	
	☐	☐	O ring			
	☐	☐	O ring	3.555	3.5557	0.0061
						6.1 mg

Nozzle

#	TARE	FINAL	Net	
2A	116.2354	116.2356	0.0002	0.2

Nozzle

#	TARE	FINAL	Net	
2A	116.3299	116.33	0.0001	0.1

Train A Total Catch	6.3
Train B Total Catch	6.2

Ambient ☑	Filter #	Tare	Final	Net	Vol (liter)
	2768	0.1182	0.1183	0.0001	1282.928
	O ring	1.6911	1.6915	0.0004	
			Total	0.0005	mg

Notes: Train A Total: 6.3mg Train B Total: 6.2mg Ambient Total: 0.5mg 1 Hour Catch: 4.6mg

Run 4:

Project #	036-S-063-1	MFG	IHP
Run #	4	Model	Montecito Estate
Date	6/26/16		

Train A	Front	Rear	Filter #	Tare	Final	Net
First Hour	☑		2770	0.1193	0.1272	0.0079
	☐	☑	2771			
	☑	☐	2775	0.2374	0.2386	
	☑	☐	O Ring			
	☐	☑	O Ring	3.5911	3.5918	0.0019
						9.8 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	2772			
	☐	☑	2773	0.2365	0.2446	
	☑	☐	O ring			
	☐	☑	O ring	3.5797	3.5807	0.0091
						9.1 mg

Nozzle

#	TARE	FINAL	Net	
3A	116.071	116.0713	0.0003	0.3
3B	116.34	116.3402	0.0002	0.2

Train A Total Catch	10.1
Train B Total Catch	9.3

Ambient ☐	Filter #	Tare	Final	Net	Vol (liter)
	2774	0.1199	0.1199	0	806.341
	O ring	1.6797	1.6798	0.0001	
			Total	0.0001 mg	

Notes: Train A Total: 10.1mg Train B Total: 9.3mg Ambient Total: 0.1mg 1 Hour Catch: 7.9mg

There were no negative filter weights recorded for any of the test runs.

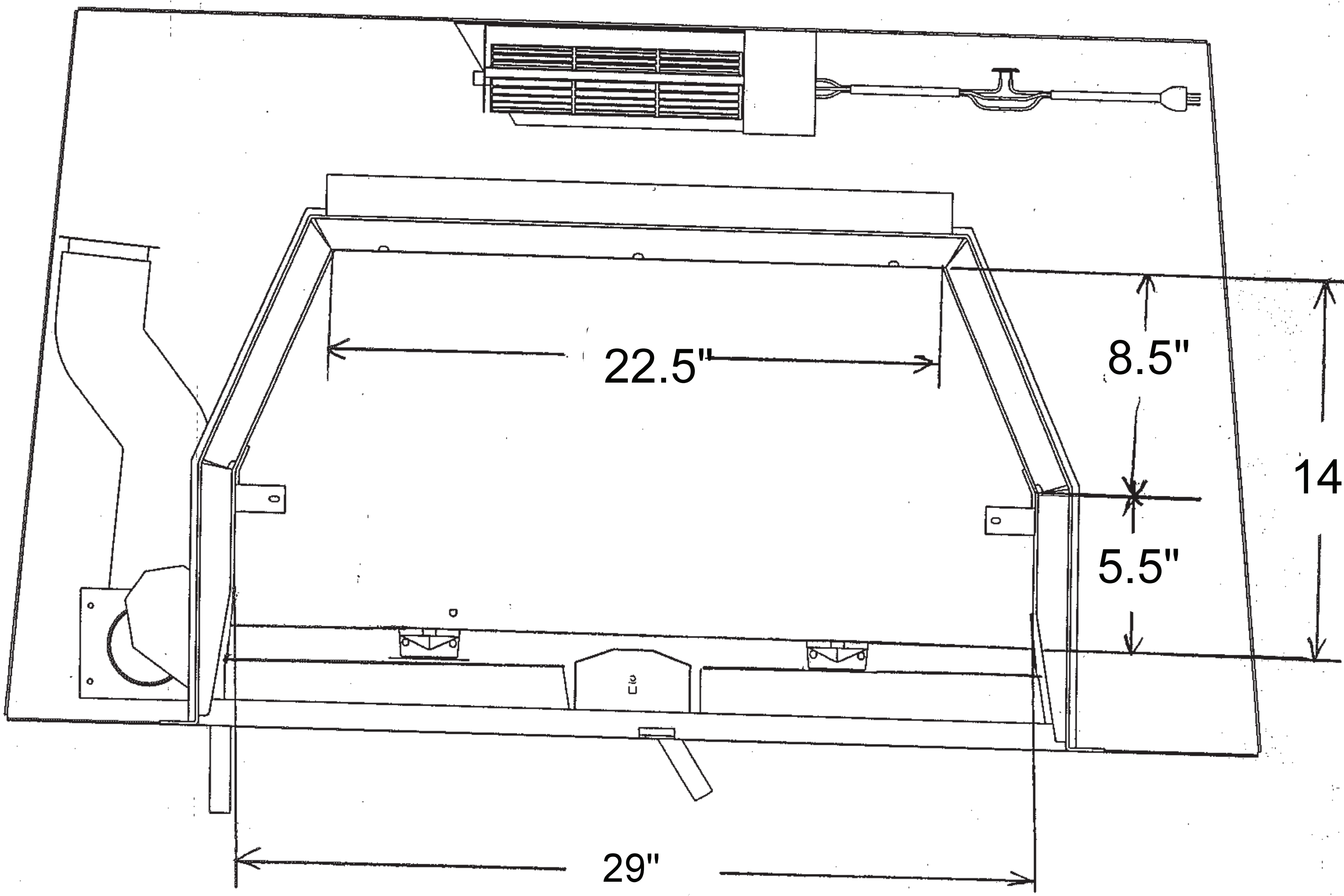
Heater Specifications:

Dimensions, firebox configuration, air supply locations, air introduction locations, and baffle locations of the wood heater are referenced in the table below and in the following schematics.

Heater Dimensions

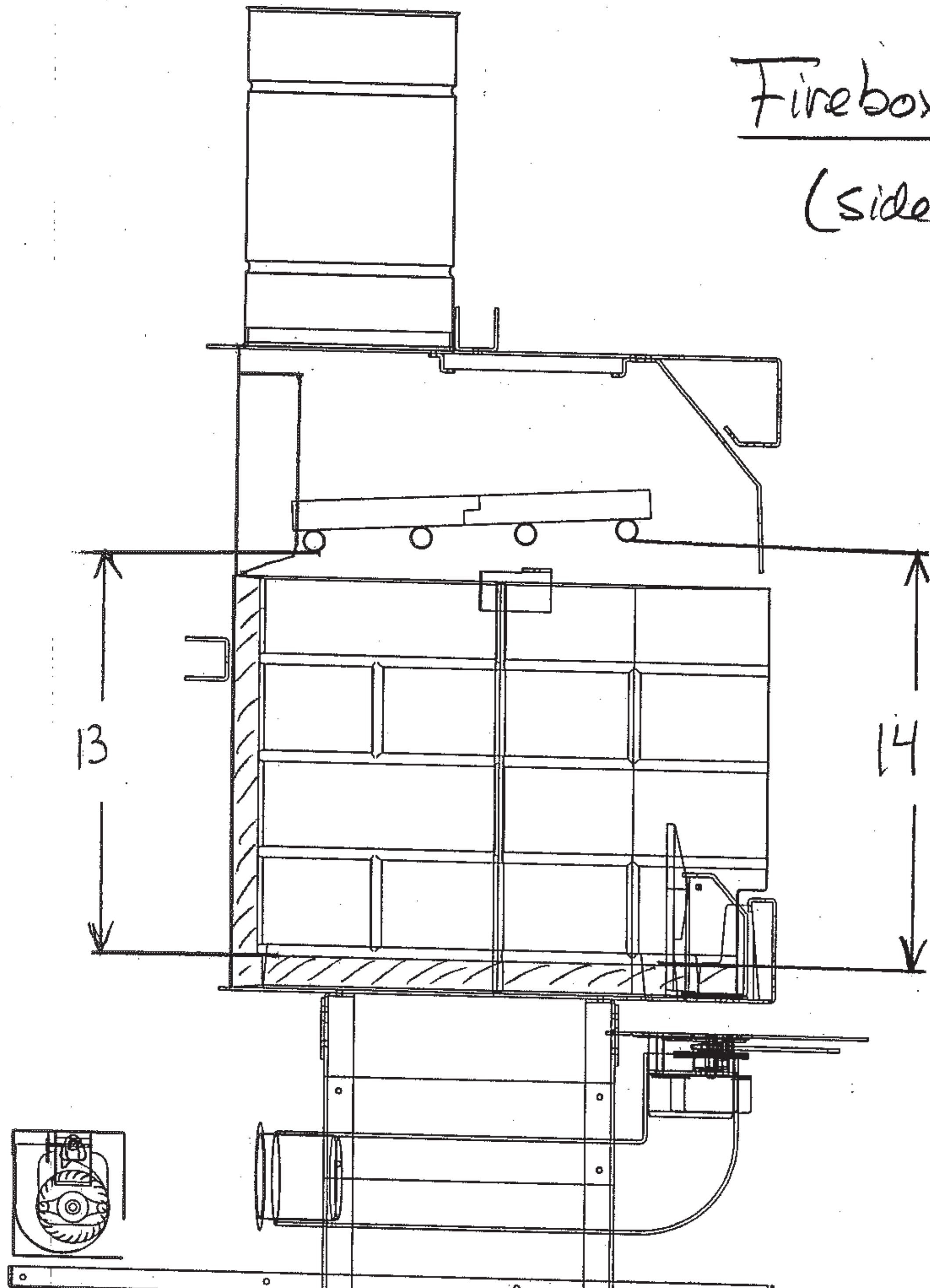
Height	Width	Depth	Firebox Volume	Weight
13”	29” for 5.5” then tapering down to 22.25” at the rear	14”	2.83 ft^3	496.4 lbs

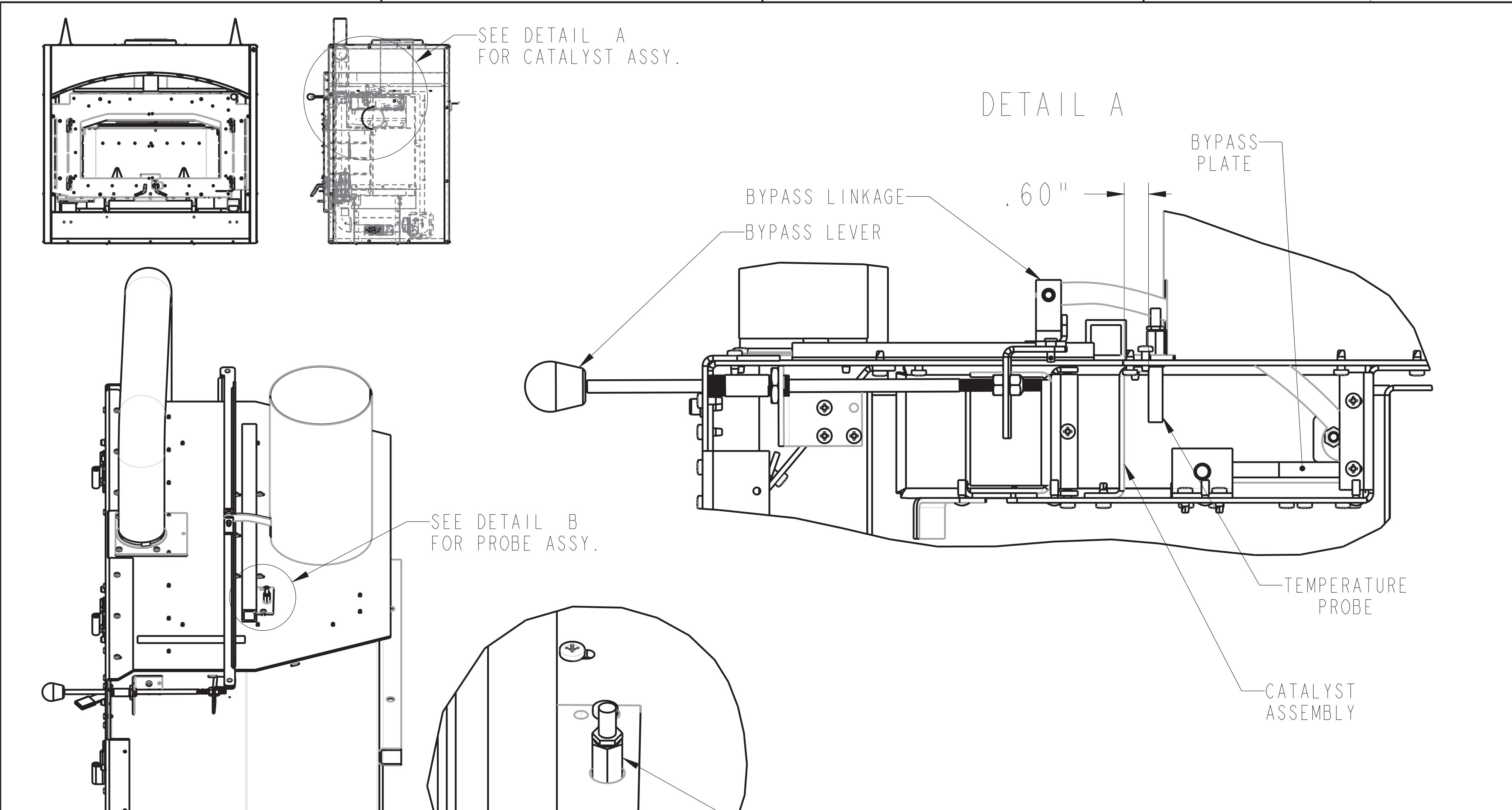
Firebox dimensions (top view)



Firebox dimensions

(side view)





TOLERANCES UNLESS OTHERWISE NOTED:
2 PL ±.03   3 PL ±.005
ANGLES ±2°
HOLES:
Ø1.0 OR LESS ±.005
GREATER THAN Ø1.0 ±.010
DIMENSIONS ARE IN INCHES.
TOLERANCES NONCUMULATIVE.
DO NOT SCALE DRAWING.
DRAWING IS THE PROPERTY OF IHP ENGINEERING.

THIRD ANGLE PROJECTION

DB REVISION

INNOVATIVE HEARTH PRODUCTS

MATERIAL	SEE NOTES
DESCRIPTION	MONTECITO ESTATE CAT, CATALYST DETAIL
FMEA NO.	SHEET NO. 1 OF 1 — DRAWING NO. CAT_ASSY_ME_CAT

Appliance Views:

Front

Rear

Non CBI

Left

Non CBI

Right

Non CBI

Process Operations and Description:

The appliance was operated according to procedures as described in the Operations Manual. Detailed Run information can be found in corresponding digital folders submitted with this report.

Conditioning:

50 hours of conditioning was performed at a medium burn rate setting. Catalyst temperatures, flue temperatures, and weight of fuel used was recorded over 50 hours and can be found on page 40 of this report as well as in the Data Folder. Catalyst temperatures below 500 degrees were not included in the 50 hours. All temperatures recorded during the 50 hour conditioning are indicative of a medium setting.

Negative Filter Weights:

There were no negative filter weights recorded.

Test Fuel Properties:

Non CBI

RUN 1									
Piece	Volume (in^3)	S1	S2	S3	S4	Avg Moist %	Weight (lbs)	Dry Weight (	Density (lbs/ft^3)
1	110.25	21.3	21.4	21.1	22	21.5	2.29	3.4	52.7
2	110.25	22.7	23.2	22.8	23.1	23.0	2.4	4.0	62.3
3	110.25	20.1	20.4	19.9	20.9	20.3	2.18	1.5	22.9
4	91.875	21	21	21.1	20.1	20.8	1.79	1.8	33.9
5	214.375	22.8	22.8	24	23.4	23.3	4.7	1.8	14.3
6	257.25	23	22.8	19	21.4	21.6	4.78	1.9	12.7
Averages						21.7			**33.1**
RUN 2									
Piece	Volume (in^3)	S1	S2	S3	S4	Avg Moist %	Weight (lbs)	Dry Weight (	Density (lbs/ft^3)
1	214.375	19	20.2	19.7		19.6	4.08	3.4	27.5
2	257.25	22	21.9	22.5		22.1	4.89	4.0	26.9
3	91.875	19.5	19.9	19.4		19.6	1.76	1.5	27.7
4	110.25	20.5	20.5	21		20.7	2.18	1.8	28.3
5	110.25	21.2	20.3	20.3		20.6	2.18	1.8	28.3
6	110.25	21.2	20.3	20.9		20.8	2.29	1.9	29.7
Averages						20.6			**28.1**
RUN 3									
Piece	Volume (in^3)	S1	S2	S3	S4	Avg Moist %	Weight (lbs)	Dry Weight (	Density (lbs/ft^3)
1	257.25	19.1	20	21.3		20.1	4.94	4.1	27.6
2	214.375	19	19	19.9		19.3	4.19	3.5	28.3
3	91.875	20.2	19.7	19.9		19.9	1.94	1.6	30.4
4	110.25	21.9	22.7	19.7		21.4	2.43	2.0	31.4
5	110.25	22.3	22.3	20.2		21.6	2.4	2.0	30.9
6	110.25	19	19.5	20.1		19.5	2.34	2.0	30.7
Averages						20.3			**29.9**
RUN 4									
Piece	Volume (in^3)	S1	S2	S3	S4	Avg Moist %	Weight (lbs)	Dry Weight (	Density (lbs/ft^3)
1	257.25	20.2	22	21.5		21.2	5.42	4.5	30.0

2	214.375	19	21.1	22.4		20.8	4.28	3.5	28.6
3	91.875	22.3	22.6	22.5		22.5	2.12	1.7	32.6
4	110.25	19.5	19.5	20		19.7	2.18	1.8	28.6
5	110.25	19.4	19.7	19.3		19.5	2.34	2.0	30.7
6	110.25	20	19.4	19.2		19.5	2.31	1.9	30.3
Averages						20.5			**30.1**

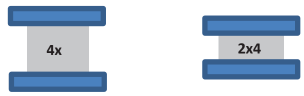
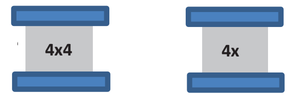
Fuel Load Information

Project Number	Client	Date
036-S-063-1	IHP	6/21/2016

Firebox Volume (ft^3)	2.8	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	29.5

Test Fuel Charge Range	**17.6**	**-**	**21.6**
Coal bed range (lbs)	**4.00**	**-**	**5.00**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**21 & 17.5 Inches**

Run # 1

Test Run Fuel Moisture (db)

Weight Without Cleats(Lbs)

Piece	S1	S2	S3	S4	Hydronic Heater S5	Hydronic Heater S6	AVG (%)	Fuel
1 2x4x21"	21.3	21.4	21.1	22.0			**21.5**	**2.29**
2 2x4x21"	22.7	23.2	22.8	23.1			**23.0**	**2.40**
3 2x4x21"	20.1	20.4	19.9	20.9			**20.3**	**2.18**
4 2x4x17.5"	21.0	21.0	21.1	20.1			**20.8**	**1.79**
5 4x4x17.5"	22.8	22.8	24.0	23.4			**23.3**	**4.70**
6 4x4x 21"	23.0	22.8	19.0	21.4			**21.6**	**4.78**
7								
8								
9								
10								
11								
12								
13								
14								
15								
Spacer Average	20				Fuel Average		**21.5**	**W/Cleats** **20.40**

Signature

Date

Fuel Load Information

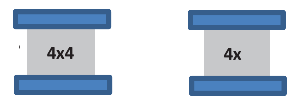
Project Number	Client	Date
036-S-063-1	IHP	6/22/2016

Firebox Volume (ft^3)	2.8

Assessment: No

Longest useable measurement parallel or perpendicular to front of unit.	29.5

Test Fuel Charge Range	**17.6**	**-**	**21.6**
Coal bed range (lbs)	**4.10**	**-**	**5.10**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		

Fuel Piece Length	**21 & 17.5 Inches**

Run # 2

Test Run Fuel Moisture (db)

Piece	S1	S2	S3	S4	S5 (Hydronic Heater)	S6 (Hydronic Heater)	AVG (%)		Weight With out cleats(Lbs) Fuel	
1	19.0	20.2	19.7					**19.6**		**4.08**
2	22.0	21.9	22.5					**22.1**		**4.89**
3	19.5	19.9	19.4					**19.6**		**1.76**
4	20.5	20.5	21.0					**20.7**		**2.18**
5	21.2	20.3	20.3					**20.6**		**2.18**
6	21.2	20.3	20.9					**20.8**		**2.29**
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	20				Fuel Average			**20.5**	**W/ Cleats**	**19.60**

Signature

Date

C:\Users\jdste\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\Y8NGC0C8\IHP Estate_Run2_Fuel

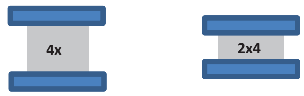
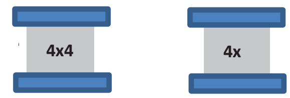
Fuel Load Information

Project Number	Client	Date
036-S-063-1	IHP	6/23/2016

Firebox Volume (ft^3)	2.8	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	29.5

Test Fuel Charge Range	**17.6**	**-**	**21.6**
Coal bed range (lbs)	**4.10**	**-**	**5.10**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**21 & 17.5 Inches**

Run # 3

Test Run Fuel Moisture (db)

Piece	S1	S2	S3	S4	S5 (Hydronic Heater)	S6 (Hydronic Heater)	AVG (%)		Weight Without Cleats (Lbs) Fuel	
1	19.1	20.0	21.3					**20.1**		**4.94**
2	19.0	19.0	19.9					**19.3**		**4.19**
3	20.2	19.7	19.9					**19.9**		**1.94**
4	21.9	22.7	19.7					**21.4**		**2.43**
5	22.3	22.3	20.2					**21.6**		**2.40**
6	19.0	19.5	20.1					**19.5**		**2.34**
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	20				Fuel Average			**20.3**	**W/Cleats**	**20.21**

Signature

Date

Fuel Load Information

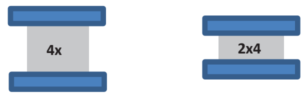
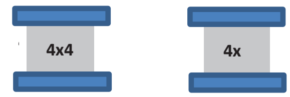
Project Number	Client	Date
036-S-063-1	IHP	6/24/2016

Firebox Volume (ft^3)	2.8

Assessment: No

Longest useable measurement parallel or perpendicular to front of unit.	29.5

Test Fuel Charge Range	**17.6**	**-**	**21.6**
Coal bed range (lbs)	**4.10**	**-**	**5.10**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**21 & 17.5 Inches**

Run # 4

Test Run Fuel Moisture (db)

Piece	S1	S2	S3	S4	S5 (Hydronic Heater)	S6 (Hydronic Heater)	AVG (%)	Weight Without Cleats(Lbs) Fuel
1	20.2	22.0	21.5				**21.2**	**5.42**
2	19.0	21.1	22.4				**20.8**	**4.28**
3	22.3	22.6	22.5				**22.5**	**2.12**
4	19.5	19.5	20.0				**19.7**	**2.18**
5	19.4	19.7	19.3				**19.5**	**2.34**
6	20.0	19.4	19.2				**19.5**	**2.31**
7								
8								
9								
10								
11								
12								
13								
14								
15								
Spacer Average	19			Fuel Average			**20.3**	**W/Cleats** **20.90**

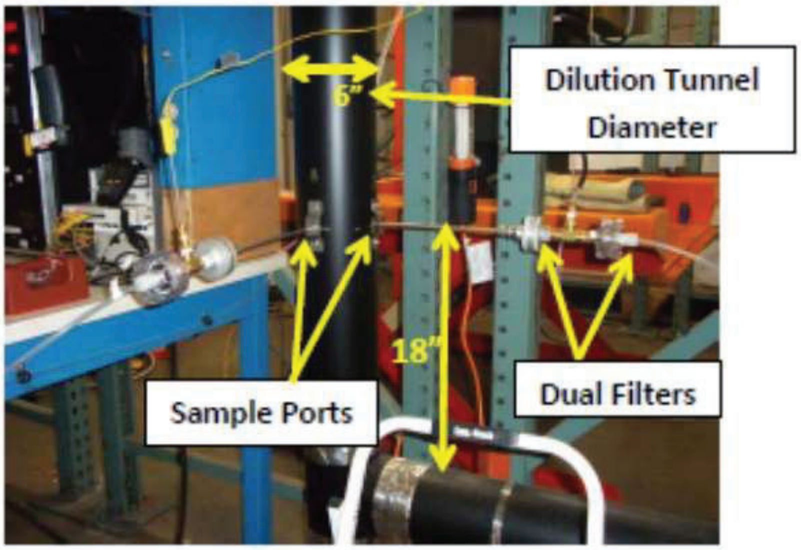
Signature

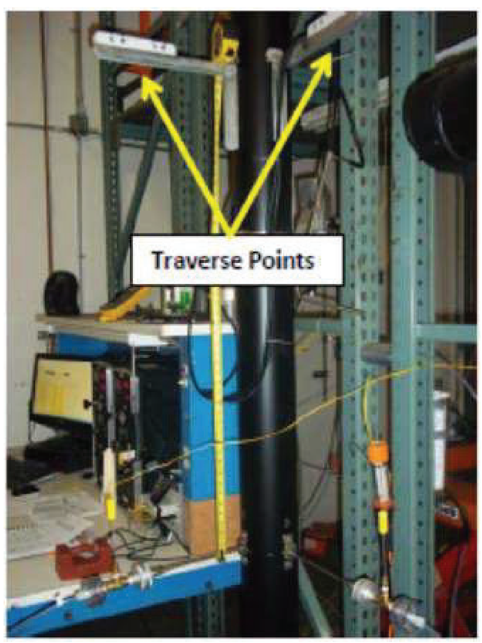
Date

Sampling Locations and Descriptions:

Sample ports are located 16.5 feet downstream from any disturbances and 1 foot upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 5.5 feet upstream from any disturbances.

Sample Points





Non CBI

Sampling Methods:

ASTM E2515-11 was used in collecting particulate samples from a diliution tunnel. The dilution tunnel is 6 inches in diameter. All fueling and operating protocols per EPA Method 28R and ASTM E2780-10 were followed. No alternate procedures were used.

Analytical Methods Description:

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

Calibration, Quality Control and Assurances:

Calibration procedures and results were conducted per ASTM E2515-11 Section 8 and ASTM E2779-10 Section 8. Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed procedures outlined in ASTM E2515-11.

Appliance Sealing and Storage:

Following testing the appliance was secured with metal strapping and the seal shown below. The appliance was placed into storage at client facilities located at: 1502 14th St. NW, Auburn, WA 98001.

Sealing Label

ATTENTION:

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

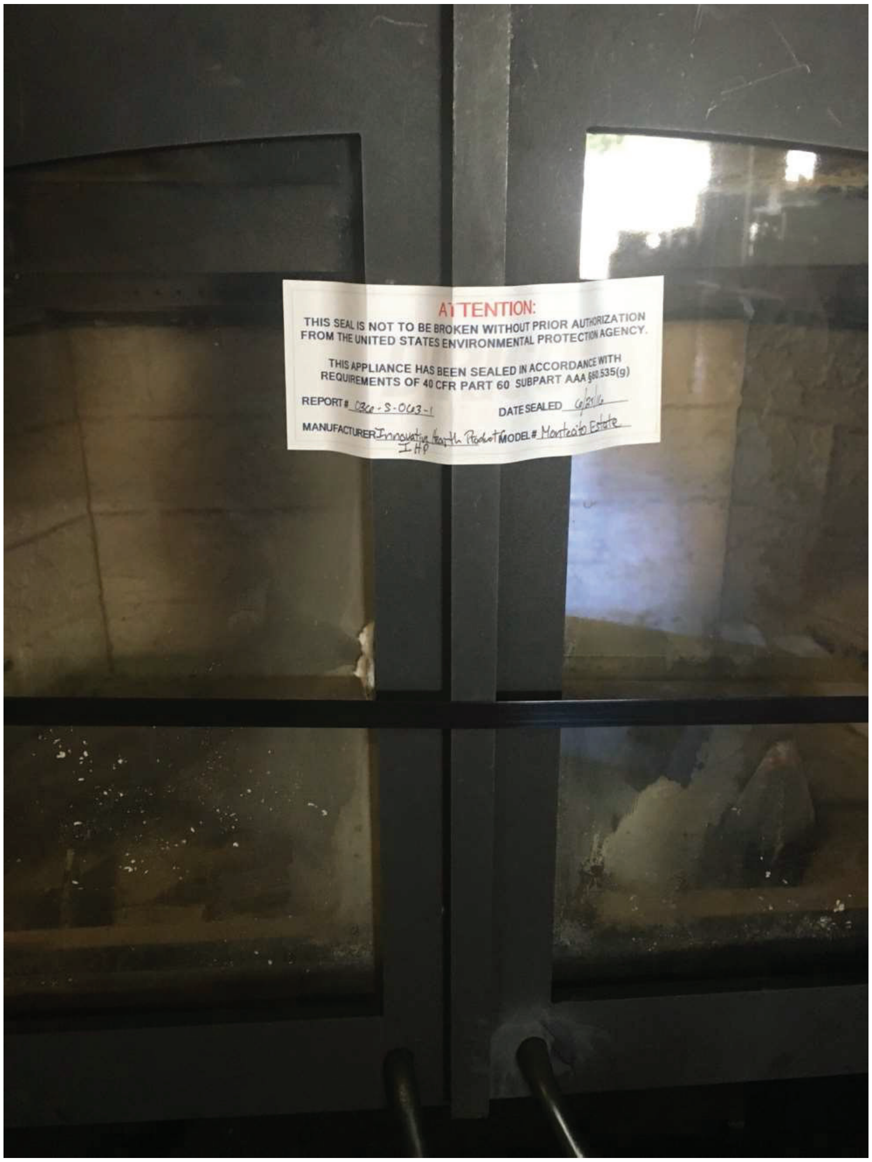
THIS APPLIANCE HAS BEEN SEALED IN ACCORDANCE WITH REQUIREMENTS OF 40 CFR PART 60 SUBPART AAA §60.535(g)

REPORT #__________ DATE SEALED__________

MANUFACTURER__________ MODEL #__________

Non CBI

Sealed Unit



Non CBI

Non CBI

Appendices:

Appendix A:

Sampling and Analytical Procedures

All Sampling and analytical procedures were performed by John Steinert and Ben Nelke. All procedures used come directly from EPA Method 28R, ASTM E2780-10, ASTM E2515-11, and CSA B415.1-10. No alternative procedures were used for this test series.

Appendix B:

Participants

The following personnel performed all testing:

- John Steinert
- Ben Nelke

Analysis and Report Writing

The following people were involved with analysis and report writing:

- Ben Nelke
- Doug Towne

Appendix C:

Appliance Updates

No updates to the appliance were made.

Appendix D:

Test Equipment Calibration Audit:

- Calibrations for the platform scale and bench scale were performed with Certified Class F weights
- Moisture meter calibration performed with a Delmhorst moisture meter calibrator
- Gas Analyzer calibration performed with certified EPA Protocol gases
- 47mm filters weighed to a constant weight with calibrated analytical balance

All equipment calibration data has been submitted in a separate digital file along with this report.

Appendix E:

Accreditations:

CERTIFICATE OF ACCREDITATION

This certifies that:

Dirigo Laboratories, Inc.

Has satisfied the requirements for laboratory accreditation for the certification of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards For Residential Wood Heaters and subpart QQQQ of 40 CFR Part 60, Standards of Performance for New Hydronic Heaters and Forced Air Furnaces.

October 21, 2015 - October 21, 2020
EFFECTIVE DATE

MEASUREMENT TECHNOLOGY GROUP
GROUP LEADER

Methods 28R, 28 WHH, 28 WHH-PTS,
All Methods listed in Sections 60.534 and 60.5476
METHODS

4
CERTIFICATE NUMBER

Non CBI

CERTIFICATE OF ACCREDITATION

This certifies that:

Dirigo Laboratories, Inc. (Mobile Laboratory)

Has satisfied the requirements for laboratory accreditation for the certification of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards For Residential Wood Heaters

October 21, 2015 - October 21, 2020
EFFECTIVE DATE

MEASUREMENT TECHNOLOGY GROUP
GROUP LEADER

Methods: 28R, 28 WHH, 28 WHH-PTS,
All Methods listed in Sections 60.534 and 60.547
METHODS

4M
CERTIFICATE NUMBER

Non CBI

American Association for Laboratory Accreditation

Accredited Inspection Body

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clackamas, OR

for technical competence as an

Inspection Body

This inspection body is accredited in accordance with the recognized International Standard ISO/IEC 17020:2012 *Conformity Assessment – Requirements for the operation of various types of bodies performing inspection.* This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 17th day of October 2014.

President & CEO
For the Accreditation Council
Certificate Number 3726.03
Valid to December 31, 2016

For the inspections to which this accreditation applies, please refer to the organization's Inspection Body Scope of Accreditation.

American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clakamas, OR

for technical competence in the field of

Mechanical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 17th day of October 2014.

Peter Abrye

President & CEO
For the Accreditation Council
Certificate Number 3726.01
Valid to December 31, 2016

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Mechanical Scope of Accreditation.

Non CBI

American Association for Laboratory Accreditation

Accredited Product Certification Body

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clackamas, OR

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 17th day of October 2014.

President & CEO
For the Accreditation Council
Certificate Number 3726.02
Valid to December 31, 2016

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation

Conditioning Data

Wednesday June 15, 2016 Performed at a medium setting

Clock Time	LV Time	Flue Temp (°F)	CAT Temp (°F)	Fuel Added (lbs)	Notes
1040	0	375	634.55	7.6 (1040)	Assessment Run #1
	1	407	593.64		
	2	402	513.68		
	3	388	475.9		Cat temp below 500°
	4	379	479.48		
	5	379	511.89		
	6	362	532.88		
	7	354	550.74		
	8	350	562.32		
	9	347	567.48		
	10	346	565.83		
	11	344	558.25		
	12	343	545.58		
	13	342	531.93		
	14	341	520.37		
	15	340	511.81		
	16	340	506.01		
	17	339	502.47		
	18	339	500.09		
	19	338	498.69		Cat temp below 500°
	20	339	498		
	21	339	497.8		
	22	339	498.31		
	23	339	498.33		
	24	338	497.84		
	25	338	497.22		
	26	337	497.11		
	27	336	497.95		
	28	336	500.28		
	29	335	502.32		
	30	335	503.45		
	31	335	504.71		
	32	336	505.45		
	33	337	504.99		
	34	336	504.8		
	35	337	504.62		
	36	337	504.48		
	37	338	504.54		
	38	338	505.13		
	39	338	505.54		
	40	339	506.5		
	41	340	510.59		
	42	342	516.73		

		43	343	520.57	
		44	344	521.53	
		45	346	523.18	
		46	347	526.02	
		47	347	530.44	
		48	349	537.18	
		49	352	545.08	
		50	354	553.38	
		51	357	563.6	
		52	359	579.07	
		53	364	603.14	
		54	370	650.22	
		55	377	743.03	
		56	384	847.1	
		57	390	898.17	
		58	398	920.78	
		59	406	930.39	
		60	413	932.43	
		61	418	932.67	
		62	422	934.88	
		63	424	938.84	
		64	425	938.38	
		65	430	942.1	
		66	432	944.39	
		67	435	944.15	
		68	437	943.19	
		69	439	938.84	
		70	442	937.32	
		71	443	936.59	
		72	446	932.7	
		73	447	929.11	
		74	450	926.72	
		75	451	924.13	
		76	452	921.56	
		77	453	919.38	
		78	453	918.16	
		79	453	916.81	
		80	455	918.1	
		81	456	917.34	
		82	456	917.05	
		83	458	917.93	
		84	459	916.1	
		85	461	911.98	
		86	461	909.28	
		87	462	906.77	
		88	462	904.43	
		89	461	903.46	

	90	463	904.01		
	91	462	902.01		
	92	461	900.08		
	93	462	900.6		
	94	460	900.41		
	95	460	898.76		
	96	460	897.23		
	97	460	899.64		
	98	461	898.41		
	99	461	899.34		
	100	461	899.04		
	101	462	897.43		
	102	463	896.61		
	103	462	892.41		
	104	462	894.37		
	105	461	892.35		
	106	459	890.69		
	107	458	894.87		
	108	456	900.42		
	109	455	896.83		
	110	454	880.67		
	111	453	879.57		
1300	112	463	882.06		

101 (Total 1.68 hours)

Thursday June 16, 2016

Clock Time	LV Time	Flue Temp (°F)	CAT Temp (°F)	Fuel Added (lbs)	Notes
1409	0	444	744.82	4.6 (1409)	Assessment Run #2
	10	478	809.25		
	20	518	913.61		
	30	589	1103.28		
	40	597	1119.39		
	50	617	1090.56		
	60	628	1104.87		
	70	630	1102.32		
	80	630	1144.33		
	90	631	1114.56		
	100	619	1111.03		
	110	610	1089.7		
	120	591	1017.61		
	130	562	967.68		
	140	544	956.14		
	150	533	962.91		
	160	509	897.4		
	170	494	875.83		
	180	480	853.74		
	190	471	845.98		
	200	462	823.57		
	210	453	816.79		
	220	449	812.39		
	230	441	804.25		
	240	440	808.28		
	250	438	804.12		
1829	260	433	802.29		

260 (Total 4.33 hours)

Friday June 17, 2016

Clock Time	LV Time	Flue Temp (°F)	CAT Temp (°F)	Fuel Added (lbs)	Notes
1246	0	391	707.56	4.5 (1246)	Assessment Run #3
	10	402	701.13		
	20	394	727.98		
	30	396	778.72		
	40	372	835.95		
	50	366	865.19		
	60	371	918.95		
	70	378	961.94		
	80	383	966.34		
	90	392	1016.02		
	100	398	1037.01		
	110	405	1038.78		
	120	419	1017.5		
	130	426	996.46		
	140	430	986.85		
	150	430	970.28		
	160	434	988.29		
	170	434	1007.03		
	180	433	1012.08		
	190	440	1020.67		
	200	443	1019.68		
	210	443	1012.62		
	220	443	1011.53		
	230	436	1027.72		
	240	415	863.09		
	250	389	809.02		
	260	374	794.52		
	270	363	778.34		
	280	355	802.26		
	290	349	762.68		
	300	341	755		
	310	333	748.14		
	320	326	747.13		
	330	322	755.43		
	340	319	748.56		
	350	315	742.86		
	360	310	730.8		
	370	305	686.27		
	380	296	666.04		
	390	291	655.44		
	400	287	661.27		
	410	286	669.45		
	420	283	660.37		

	430	280	652.16		
	440	279	657.98		
	450	277	666.43		
	460	277	666.28		
	470	276	657		
2046	480	274	649.2		

480 (Total 8 hours)

Saturday June 18, 2016

Clock Time	LV Time	Flue Temp (°F)	CAT Temp (°F)	Fuel Added (lbs)	Notes
1255	0	471	758.96	4.7 (1255)	Assessment Run #4
	10	454	746.63		
	20	446	799.36		
	30	447	827.01		
	40	406	812.47		
	50	391	867.93		
	60	411	970.57		
	70	408	932.22		
	80	417	985.62		
	90	435	955.41		
	100	435	966.18		
	110	437	964.95		
	120	432	942.23		
	130	429	1000.16		
	140	435	1000		
	150	438	939.32		
	160	430	950.8		
	170	428	989.42		
	180	426	1004.56		
	190	419	956.94		
	200	413	971.15		
	210	405	914.94		
	220	385	831.98		
	230	366	789.43		
	240	349	748.87		
	250	333	723.07		
	260	321	711.45		
	270	312	700.47		
	280	304	691.86		
	290	299	693.62		
	300	296	695.58		
	310	294	694.72		
	320	291	695.05		
	330	289	693.77		
	340	287	696.76		
	350	286	700.13		
	360	286	706.56		
	370	287	725.46		
	380	288	729.38		
	390	289	730.95		
	400	289	734.25		
	410	289	721.83		
	420	287	711.68		

	430	285	705.44		
	440	284	700.42		
	450	282	695.19		
	460	280	687.7		
	470	277	618.62		
	480	266	601.13		
	490	260	597.26		
	500	261	577.64		
2125	510	253	574.43		

510 (Total 8.5 hours)

Sunday June 19, 2016

Clock Time	LV Time	Flue Temp (°F)	CAT Temp (°F)	Fuel Added (lbs)	Notes
1008	0		1227	9.2 (1008)	Hand Recording CAT Temp
	10		1090		
	20		1026		
	30		866		
1048	40		1018	5.8 (1040)	
	50		1117		
	60		1098		
	70		1047		
	80		993		
	90		969		
1148	100		950		
	110		913		
	120		834	6.7 (1208)	
	130		1174		
	140		1144		
	150		1123		
1248	0	795	1110		Switched to Labview Data Acquisition
	10	784	1104.09		
	20	768	1071.42		
	30	754	1046.28		
	40	738	1013.95		
	50	722	981.68		
1348	60	706	966		
	70	697	958.15		
	80	682	917.7		
	90	656	871.3		
	100	636	843.14	4.6 (1431)	
	110	692	1087.95		
1448	120	764	1137.6		
	130	791	1182.3		
	140	792	1132.11		
	150	769	1052.21		
	160	751	1033.42		
	170	719	976.71	7.7 (1538)	
1548	180	791	1171.8		
	190	821	1194.31		
	200	833	1183.08		
	210	847	1225.76		
	220	850	1208.92		
	230	834	1156.45		
1648	240	811	1097.05		
	250	774	1032.32		
	260	742	974.65		

	270	711	933.15		
	280	670	863.67		
	290	638	826.71	5.75 (1743)	
1748	300	620	831.66		
	310	735	1155.44		
	320	764	1166.85		
	330	766	1133.57		
	340	764	1093.68		
	350	752	1056.46		
1848	360	739	1029.67		
	370	719	980.82		
	380	690	923.3		
	390	672	898.57	2.72 (1917)	
	400	704	1096.81		
	410	725	1136.02		
1948	420	719	1068.86		
	430	696	995.55		
	440	665	943.73	2.53 (2015)	
	450	640	885.9		
	460	668	985.32		
	470	690	978.88		
2048	480	695	975.72		
	490	688	947.12		
	500	683	927.83		
	510	663	868.91		
	520	648	859.77		
	530	625	821.15		
2148	540	608	792.94		

690 (Total of 11.5 hours)

Monday June 20, 2016 through Tuesday June 21, 2016

Clock Time	LV Time	Flue Temp (°F)	CAT Temp (°F)	Fuel Added (lbs)	Notes
800	0	108	140.59	6.0 (0800)	CAT temp below 500°
	10	230	461.95		
	20	531	1000.17		
	30	621	1090.01		
	40	850	1072.29		
	50	753	1188.78	16.0 (0850)	
900	60	751	1140.62		Data acquisition stopped
900	0	757	1252.51		and restarted.
	10	768	1284.75		
	20	767	1204.64		
	30	758	1192.77		
	40	733	1138.35	10.0 (0945)	
	50	703	1021.29		
1000	60	610	701.65		
	70	675	910.97	20.0 (1015)	
	80	986	1220.08		
	90	825	1265.67		
	100	814	1252.55		
	110	728	1100.36		
1100	120	604	1016.57		
	130	565	1039.24		
	140	525	993.83		
	150	493	957.96		
	160	502	805.01		
	170	412	731.3		
1200	180	430	641.11		
	190	392	747.78		
	200	377	773.46		
	210	371	797		
	220	372	838.03		
	230	385	934.22		
1300	240	535	1049.55	29.0 (1300)	
	250	593	1065.47		
	260	611	1080.26		
	270	619	1122.91		
	280	627	1121.66		
	290	628	1087.69		
1400	300	628	1087.01		
	310	614	1030.07		
	320	591	960.51		
	330	566	911.82		
	340	551	901.87		
	350	538	874.09		

1500	360	521	848.8	
	370	579	1042.53	9.1 (1516)
	380	606	1092.51	
	390	615	1102.25	
	400	611	1051.55	
	410	602	1029.98	
1600	420	609	965.85	
	430	590	924.19	
	440	574	897.36	
	450	557	860.6	
	460	541	829.87	
	470	544	821.05	
1700	480	606	1063.22	8 (1705)
	490	625	1013.19	
	500	627	999.81	
	510	626	990.19	
	520	613	965.61	
	530	615	995.98	
1800	540	590	904.8	
	550	566	862.69	
	560	538	821.73	
	570	526	815.11	
	580	514	804.12	
	590	566	1044.57	12.35 (1859)
1900	600	632	1129.2	
	610	656	1109.72	
	620	665	1078.56	
	630	656	1065.81	
	640	640	1023.37	
	650	629	998.11	
2000	660	620	989.2	
	670	617	989.02	
	680	587	897.92	
	690	566	876.99	
	700	570	823.49	
	710	620	1084.76	11.49 (2054)
2100	720	642	1067.81	
	730	639	1031.41	
	740	626	1002.32	
	750	617	986.68	
	760	604	952.66	
	770	591	930.31	
2200	780	583	925.14	
	790	575	907.79	
	800	559	876.28	
	810	598	1036.08	11.64 (2239)
	820	653	1105.22	

	830	668	1120.14		
2300	840	670	1084.98		
	850	655	1034.31		
	860	639	995.76		
	870	628	988.73		
	880	619	983.48		
	890	586	886.01		
2400	900	559	849.2		
	910	539	824.98		
	920	525	811.92		
	930	519	769.51		
	940	572	1053.18	7.58 (0044)	
	950	627	1144.04		
100	960	631	1077.35		
	970	621	1010.46		
	980	655	1131.98		
130	990	647	1048.06	8.66 (0130)	Heater left unattended
	1000	636	1022.04		overnight.
	1010	640	1063.52		
200	1020	636	1013.37		
	1030	623	982.57		
	1040	610	948.84		
	1050	596	930.43		
	1060	589	936.28		
	1070	582	926.43		
300	1080	577	923.29		
	1090	556	867.99		
	1100	539	840.42		
	1110	521	798.97		
	1120	506	782.9		
	1130	492	767.51		
400	1140	478	740.26		
	1150	462	715.12		
	1160	447	685.72		
	1170	430	654.66		
	1180	414	627.1		
	1190	397	595.26		
500	1200	381	571.68		
	1210	369	555.24		
	1220	357	538.43		
	1230	345	524.33		
540	1240	333	500.88		
	1250	320	476.87		CAT temp below 500°
600	1260	310	465.33		
	1270	298	444.82		
	1280	287	428.9		
	1290	278	404.46		

	1300	261	367.89		
	1310	246	342.36		
700	1320	233	322.21		
	1330	221	305.06		
	1340	211	289.37		
	1350	201	274.27		
	1360	193	219.82		
	1370	150	137.54		
800	1380	455	606.14		Warmup charge loaded.
	1390	715	1022.89		
	1400	773	1076.22		
	1410	772	1042.16		
	1420	827	1103.83		
	1430	826	1249.64		
900	1440	793	1238.46		
	1450	780	1185.22		
920	1460	714	976.05		

1360 (Total 22.67 hours)

EPA Method 28R Weighted Average Emissions

Client: IHP
Stove Model: Montecito Cat
Test Dates: 6/21/16 - 6/24/16
Job Number: 0

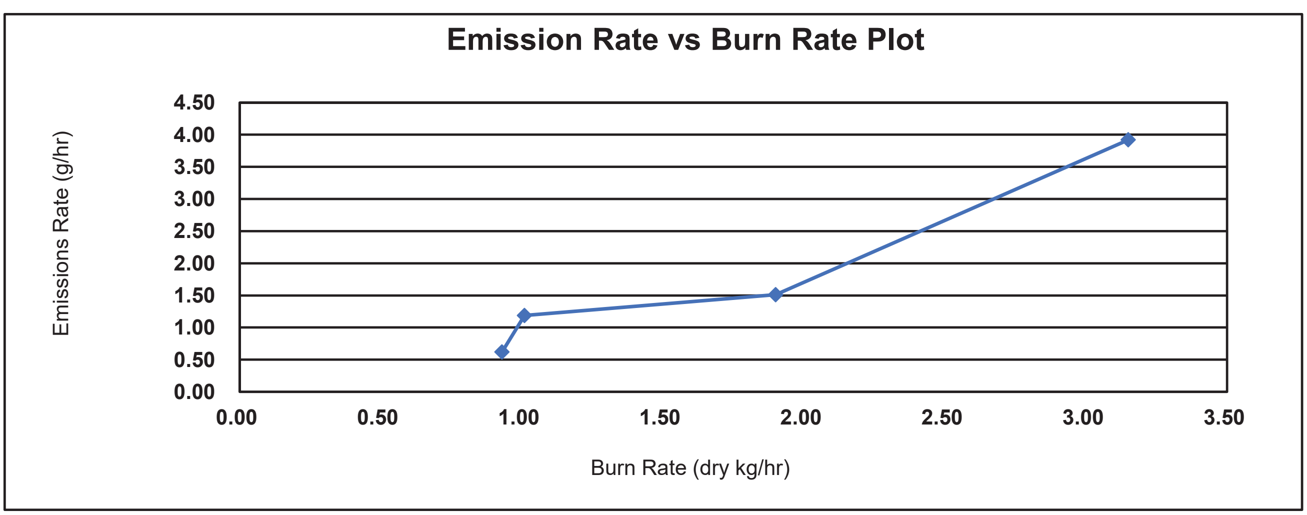
Signature/Date: ______________________

Weighted Average Particulate Emissions (g/hr):	**1.3**
Weighted Average HHV Efficiency (%):	**70.2%**
Weighted Average LHV Efficiency (%):	**0.0%**
Average CO Emissions (g/min):	**2.4**

Individual Run Summaries

Run Number:	1	Run Number:	2
Burn Rate (dry kg/hr):	0.93	Burn Rate (dry kg/hr):	1.01
Emissions Rate (g/hr):	0.62	Emissions Rate (g/hr):	1.19
HHV Efficiency (%):	75.2%	HHV Efficiency (%):	70.2%
LHV Efficiency (%):	0.0%	LHV Efficiency (%):	0.0%
Weighting Percentage (%):	23.08%	Weighting Percentage (%):	34.62%

Run Number:	3	Run Number:	4
Burn Rate (dry kg/hr):	1.90	Burn Rate (dry kg/hr):	3.15
Emissions Rate (g/hr):	1.51	Emissions Rate (g/hr):	3.92
HHV Efficiency (%):	68.1%	HHV Efficiency (%):	63.3%
LHV Efficiency (%):	0.0%	LHV Efficiency (%):	0.0%
Weighting Percentage (%):	36.02%	Weighting Percentage (%):	6.29%



PREBURN

JOB # 036_S_063_1

Model Designation IHP_ESTATE

TECHNICIAI JDS

DATE: 6_21_16

RUN #: EPA1

READING INTERVAL: 10

.

Run Time: 120

Tunnel Traverse Information	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.036	0.036	0.037	0.032	0.035	0.036	0.036	0.035
Temperature	100	100	100	100	100	100	100	100	100.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	20.9	-0.057	560	574	562	553	447	539.2
10	18.2	-0.076	518	530	514	667	445	534.8
20	15.8	-0.07	523	541	509	823	429	565
30	13.7	-0.072	522	549	504	856	413	568.8
40	11.4	-0.075	527	561	507	875	401	574.2
50	8.8	-0.072	544	585	532	875	394	586
60	7.6	-0.06	553	597	554	761	392	571.4
70	6.6	-0.049	534	567	534	701	390	545.2
80	5.7	-0.05	511	536	507	680	388	524.4
90	5.1	-0.046	491	511	485	672	383	508.4
100	4.7	-0.045	472	489	471	573	379	476.8
110	4.8	-0.038	453	466	454	500	378	450.2
120	4.6	-0.039	428	440	424	458	374	424.8

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity: 12.62881 ft/sec.

Intial Tunnel Flow: 140.1148 scfm

Average Tunnel Flow: 140.2883 scfm

Notes:

Technician____________________

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
			510.4615		504.3846			

Technician

Run #	EPA1
Date:	6/21/16

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.036	0.036	0.037	0.032	0.035	0.036	0.036	0.035
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	12.629	ft/sec.
Intial Tunnel Flow:	140.11	scfm
Average Tunnel Flow	140.29	scfm

JOB #	036_S_063_1						
TECHNICIAN	JDS	ROOM TEMP (F)	75.5	BEG	MID	END	AVG
DATE:	6_21_16	BAROMETRIC		30.23	30.23	30.23	30.23
RUN #:	EPA1						
READING INTERVAL:	10						
SAMPLE BOX :	A	METER Y FACTOR:	1.002	PROBE MATERIAL:	SS		
FRONT FILTER #:	2752&2757	REAR FILTER #		REAR FILTER #:	2753		
FINAL LEAK RATE (CFM):	<0.01	@ 5 IN-HG		FINAL LEAK RATE (CFM)	<0.01	@ 5 IN-HG	
Run Time:	490	AMBIENT FILTER #:	2756	VOLUME	2611.312 LITERS	FUEL MOISTURE DB	21.5 %
		FINAL LEAK RATE (CFM):	<0.01	@	5 IN-HG		
TEST START TIME:	10:57						

ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	TUNNEL DELTA P	ORIFICE DELTA H	FILTER VAC	TUNNEL VEL FT/SEC	Proportional Rate (%)	Scale Weight	Weight Chg	1 TUNNEL TEMP	2 FLUE TEMP	3 FILTER TEMP	4 FB REAR TEMP	5 FB INT	6 METER TEMP	AMBIENT TEMP
										TEMPERATURES						
0	0.000	0.000	0.035	0	-0.09		NA	20.4	0	98	373	77	420	718.12	79	75
10	1.379	0.138	0.035	2.02	-1.46	12.672	101	19.8	0.6	101	398	80	392	682.36	80	74
20	2.772	0.139	0.035	2.01	-1.3	12.638	102	19.3	0.5	98	391	80	358	686.3	82	74
30	4.168	0.140	0.035	2.01	-1.18	12.638	102	18.8	0.5	98	394	80	332	735.45	85	74
40	5.565	0.140	0.035	2.01	-1.24	12.627	101	18.1	0.7	97	370	80	305	763.58	88	74
50	6.971	0.141	0.035	2.02	-1.3	12.627	101	17.3	0.8	97	378	80	291	876	91	75
60	8.380	0.141	0.035	2.05	-1.51	12.627	101	16.6	0.7	97	381	80	286	896.07	93	74
70	9.793	0.141	0.035	2.03	-0.95	12.616	101	15.8	0.8	96	390	80	282	912.92	95	74
80	11.210	0.142	0.035	2.04	-1.43	12.627	101	15.1	0.7	97	402	80	282	964.3	96	74
90	12.626	0.142	0.035	2.03	-0.72	12.627	101	14.2	0.9	97	415	80	287	980.55	97	74
100	14.047	0.142	0.035	2.02	-1.38	12.627	101	13.3	0.9	97	422	80	293	1020.87	98	75
110	15.466	0.142	0.035	2.02	-1.39	12.638	101	12.5	0.8	98	429	80	298	1000.55	99	75
120	16.889	0.142	0.035	2.02	-1.33	12.638	101	11.6	0.9	98	428	80	306	950.8	99	75
130	18.312	0.142	0.035	2.03	-0.93	12.638	101	10.6	1	98	427	81	318	945.52	100	75
140	19.734	0.142	0.035	2.03	-0.75	12.650	101	9.6	1	99	429	81	329	915.41	100	75
150	21.159	0.143	0.035	2.03	-1.03	12.638	101	8.6	1	98	423	81	343	937.98	101	75
160	22.580	0.142	0.035	2.04	-1.16	12.638	100	7.8	0.8	98	426	81	358	1008.66	101	76
170	24.008	0.143	0.035	2.04	-0.71	12.638	101	7	0.8	98	430	80	371	1017.66	101	76
180	25.429	0.142	0.035	2.03	-1.15	12.627	100	6.4	0.6	97	432	80	393	1023.45	101	76
190	26.856	0.143	0.035	2	-1.33	12.627	101	5.8	0.6	97	426	80	418	987.15	101	76
200	28.285	0.143	0.035	2.01	-0.78	12.627	101	5.3	0.5	97	410	81	438	899.1	102	76
210	29.707	0.142	0.035	2.03	-1.2	12.616	100	4.9	0.4	96	399	80	442	897.09	102	76
220	31.138	0.143	0.035	2.01	-1.4	12.604	101	4.5	0.4	95	391	80	442	875.95	102	76
230	32.562	0.142	0.035	2.03	-0.91	12.593	100	4.1	0.4	94	378	80	442	828.56	102	75
240	33.989	0.143	0.035	2.03	-0.61	12.582	100	4	0.1	93	364	80	443	785.2	102	75
250	35.418	0.143	0.035	2.03	-1.22	12.570	100	3.7	0.3	92	349	79	443	744.53	102	75
260	36.842	0.142	0.035	2.04	-1.35	12.559	100	3.5	0.2	91	335	79	439	722.17	102	75
270	38.272	0.143	0.035	2.03	-1.49	12.559	100	3.3	0.2	91	325	79	433	712.35	101	75
280	39.697	0.143	0.035	2.04	-1.14	12.559	100	3.1	0.2	91	318	79	428	705.06	101	76
290	41.124	0.143	0.035	2.03	-0.77	12.548	100	3	0.1	90	312	79	422	701.55	101	75
300	42.553	0.143	0.035	2.04	-0.74	12.536	100	2.8	0.2	89	310	79	412	736.13	101	76
310	43.977	0.142	0.035	2.03	-0.8	12.536	100	2.6	0.2	89	308	79	400	736.86	101	76

TEST START TIME:		10:57								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP
320	45.407	0.143	0.035	2.04	-0.74	12.536	100	2.5	0.1	89	306	79	392	736.77	101	76
330	46.832	0.143	0.035	2.04	-1.35	12.536	100	2.3	0.2	89	305	79	385	737.19	101	76
340	48.260	0.143	0.035	2.03	-1.16	12.536	100	2.2	0.1	89	302	79	380	732.77	101	76
350	49.689	0.143	0.035	2.02	-0.76	12.536	100	2	0.2	89	301	79	377	729.16	101	76
360	51.113	0.142	0.035	2.02	-0.68	12.536	100	1.8	0.2	89	298	79	375	711.66	102	76
370	52.544	0.143	0.035	2.03	-1.25	12.536	100	1.7	0.1	89	294	79	372	700.8	102	76
380	53.968	0.142	0.035	2.03	-0.73	12.536	100	1.5	0.2	89	291	79	367	701.5	102	77
390	55.396	0.143	0.035	2.02	-1.39	12.525	100	1.4	0.1	88	285	79	365	660.28	102	76
400	56.826	0.143	0.035	2.03	-1.42	12.525	100	1.2	0.2	88	281	79	365	651.29	102	77
410	58.249	0.142	0.035	2.02	-0.68	12.525	99	1.1	0.1	88	277	79	362	648.24	102	77
420	59.681	0.143	0.035	2	-1.31	12.513	100	0.9	0.2	87	273	79	356	640.38	102	77
430	61.106	0.143	0.035	2.01	-0.92	12.525	100	0.8	0.1	88	270	79	351	634.33	102	77
440	62.535	0.143	0.035	2.03	-0.9	12.513	100	0.7	0.1	87	268	79	347	627.89	102	77
450	63.966	0.143	0.035	2.05	-0.74	12.513	100	0.5	0.2	87	264	79	343	623.76	102	77
460	65.391	0.143	0.035	2.03	-1.01	12.513	99	0.4	0.1	87	262	79	340	627.53	102	76
470	66.821	0.143	0.035	2.02	-1.2	12.513	100	0.3	0.1	87	261	79	336	627.71	103	76
480	68.250	0.143	0.035	2.01	-0.66	12.513	100	0.1	0.2	87	258	79	331	618.37	102	76
490	69.677	0.143	0.035	2.03	-1.02	12.513	100	0	0.1	87	256	79	327	596.17	102	76
	69.677		0.035	2.03		12.580	100.3			93	348				99	76

JOB #	036_S_063_1
TECHNICIA	JDS
DATE:	6_21_16
RUN #:	EPA1
READING INTERVAL:	10
SAMPLE BOX :	B

METER Y FACTOR:	1.001		PROBE MATERIAL:	SS
FRONT FILTER #:	2754		REAR FILTER #:	2755
FINAL LEAK RATE (CFM):	<0.01 @ 5 IN-HG		FINAL LEAK RATE (CFM):	<0.01 @ 5 IN-HG

Run Time: 490

Firebox Delta T 100

							1	2	3	4	5	6	
							TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T
0	0	0	NA	0	0	1	425	437	76	454	371	78	421
10	1.334	0.133	100	-0.04	1.97	1.9	384	396	80	468	400	79	408
20	2.694	0.136	101	-0.04	1.97	2.18	347	363	80	478	406	82	390
30	4.064	0.137	101	-0.04	1.96	1.71	320	339	81	499	404	85	379
40	5.439	0.138	101	-0.04	1.97	1.44	312	328	80	462	357	88	353
50	6.817	0.138	101	-0.04	1.97	1.35	302	318	80	514	341	91	353
60	8.200	0.138	101	-0.04	1.97	0.94	298	315	80	539	332	93	354
70	9.585	0.139	100	-0.04	1.96	1.56	294	312	80	570	325	95	357
80	10.972	0.139	100	-0.04	1.98	0.9	296	315	80	608	321	96	364
90	12.363	0.139	100	-0.04	1.97	1.46	302	324	80	640	319	97	374
100	13.756	0.139	100	-0.05	1.96	0.75	310	337	80	671	317	98	386
110	15.149	0.139	100	-0.05	1.97	0.82	318	349	80	670	316	99	390
120	16.542	0.139	100	-0.05	1.97	0.9	326	363	81	638	317	99	390
130	17.936	0.139	100	-0.05	1.96	2.07	339	378	81	630	317	100	396
140	19.337	0.140	101	-0.04	1.99	2.02	351	389	81	614	316	101	400
150	20.739	0.140	101	-0.04	1.98	1.88	361	398	81	621	315	101	408
160	22.142	0.140	101	-0.04	1.98	1.72	369	403	81	673	314	101	423
170	23.551	0.141	101	-0.04	1.99	1.35	371	403	81	683	311	101	428
180	24.952	0.140	100	-0.05	1.98	2.35	374	404	81	687	309	102	433
190	26.361	0.141	101	-0.04	1.98	1.91	375	407	81	659	308	102	433
200	27.767	0.141	101	-0.04	1.99	2.34	378	411	81	600	306	102	427
210	29.172	0.141	100	-0.04	1.99	1.55	379	412	81	577	306	102	423
220	30.583	0.141	101	-0.04	1.98	0.82	379	410	81	564	305	102	420
230	31.988	0.141	100	-0.04	1.98	2.45	379	407	80	530	305	103	413
240	33.400	0.141	101	-0.04	2	2.35	378	404	80	499	307	102	406
250	34.809	0.141	100	-0.03	1.99	2.07	374	399	80	468	307	102	398
260	36.216	0.141	100	-0.04	1.98	2.2	369	394	80	447	306	102	391
270	37.628	0.141	100	-0.03	2	2	365	389	79	435	305	102	385
280	39.036	0.141	100	-0.03	1.99	1.79	361	384	79	429	303	102	381
290	40.446	0.141	100	-0.03	1.99	0.87	359	379	79	423	302	102	377
300	41.855	0.141	100	-0.03	2	0.84	356	375	79	438	301	102	376
310	43.266	0.141	100	-0.03	1.99	2.05	352	370	79	443	298	102	373
320	44.676	0.141	100	-0.03	1.99	2.47	349	366	79	442	297	102	369
330	46.085	0.141	100	-0.03	1.98	1.28	346	362	79	442	295	102	366
340	47.499	0.141	100	-0.03	1.98	1.76	344	358	79	439	293	103	363
350	48.906	0.141	100	-0.03	1.98	1.78	343	354	79	436	291	102	360
360	50.319	0.141	100	-0.02	1.99	0.77	341	350	79	427	290	103	357

Run Notes:

							1	2	3	4	5	6	
							TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T
370	51.728	0.141	100	-0.02	1.99	1.95	338	345	79	418	289	103	352
380	53.140	0.141	100	-0.02	1.98	1.29	334	341	79	414	287	103	349
390	54.551	0.141	100	-0.02	1.99	1.94	331	336	79	394	285	103	342
400	55.961	0.141	100	-0.02	1.98	1.41	330	331	79	384	284	103	339
410	57.375	0.141	100	-0.02	1.99	2.26	330	328	79	381	288	103	338
420	58.784	0.141	100	-0.02	1.98	2.4	332	326	79	377	299	103	338
430	60.199	0.142	100	-0.02	1.98	2.11	333	324	79	372	309	103	338
440	61.608	0.141	100	-0.02	1.98	2.25	333	321	79	368	315	104	337
450	63.022	0.141	100	-0.02	1.97	1.59	333	318	79	364	317	104	335
460	64.434	0.141	100	-0.02	1.99	0.8	332	315	79	363	319	104	334
470	65.847	0.141	100	-0.02	1.99	2.32	330	310	79	363	316	104	331
480	67.260	0.141	100	-0.01	1.98	0.81	326	304	79	359	313	104	327
490	68.671	0.141	100	-0.03	2	0.99	324	299	79	348	309	104	321
	68.671	0.140	100.291	-0.033	1.981224	1.6344	345	360	80	494	315	99	100
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

321.4

Ambient Sample Results:

JOB NUMBER:	036_S_063_1
TECHNICIAN:	JDS
DATE:	6_21_16
RUN NUMBER:	EPA1

METER Y FACTOR: **0.999**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	80	0	0
End	2611.312	101	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	2611.132	Liters
Total Sample Volume - Vm	92.211	ft^3
Average Sample Rate	0.19	ft^3/min
Sample Time	490.00	Minutes
Average Meter Temperature	90.5	°F
Total Sample Volume (Standard Conditions) - Vmstd	89.269	dscf
Total Particulates	0.7	mg
Particulate Concentration (dry-standard)	0.000007841	grams/dscf
Particulate Emission Rate	0.000085714	grams/hour

JOB NUMBER: 036_S_063_1

RUN #: EPA1
DATE: 6_21_16

BURN RATE: 0.93 KG/HR DRY

FILTER A PARTICULATE: 5.5 mg

FILTER B PARTICULATE: 5.4 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	69.68		68.67	
Average Gas Velocity in Dilution Tunnel - vs	12.63	feet/second	12.63	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8417.30	dscf/hour	8417.30	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	66.98	dscf	65.87	dscf
Average Tunnel Temperature	92.9	F	92.9	F
Average Delta p	0.035		0.035	
Average Gas Meter Temperature	99	F	99	F
Average Delta H	2.03	in-h20	1.98	in-h20
Total Time of Test	490	min	490	min
Total Particulates	5.5	mg	5.4	mg
Particulate Concentration (dry-standard)	0.00008	grams/dscf	0.00008	grams/dscf
Ambient Train (dry-standard)	0.000007841	grams/dscf	0.000007841	grams/dscf
Net (dry-standard)	0.000074269	grams/dscf	0.00007414	grams/dscf
Particulate Emission Rate	0.63	grams/hour	0.62	grams/hour
Total PM Emissions	5.11	grams	5.10	grams

Average Total PM Emissions		5.10	grams
AVERAGE PARTICLATE EMISSIONS RATE		0.62	grams/hour

	SAMPLE A		SAMPLE B	
% OF AVERAGE	100.1		99.9	
Emissions Factor	0.670	g/Kg -Dry	0.669	g/Kg -Dry

PREBURN

JOB # 036_S_063_1
TECHNICIAI JDS
DATE: 6_22_16
RUN #: EPA2
READING INTERVAL: 10

.

Run Time: 70

Model Designation IHP_ESTATE

Tunnel Traverse Information	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.037	0.037	0.036	0.034	0.035	0.035	0.036	0.036
Temperature	100	100	100	100	100	100	100	100	100.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	9.9	-0.068	545	601	580	807	438	594.2
10	8.4	-0.064	547	606	580	728	433	578.8
20	7.1	-0.061	527	572	551	709	424	556.6
30	6.1	-0.058	506	541	522	707	412	537.6
40	5.3	-0.05	491	519	505	676	404	519
50	5.2	-0.047	479	501	493	568	400	488.2
60	5.1	-0.042	457	475	464	507	393	459.2
70	4.9	-0.035	435	448	434	470	385	434.4

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity: 12.8405 ft/sec.
Intial Tunnel Flow: 140.6241 scfm
Average Tunnel Flow: 141.9177 scfm

Notes:

Technician_______________

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
			498.375		516.125			

Technician____

Run #	EPA2
Date:	6/22/16

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.037	0.037	0.036	0.034	0.035	0.035	0.036	0.036
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	12.84	ft/sec.
Intial Tunnel Flow:	140.62	scfm
Average Tunnel Flow	141.92	scfm

JOB #	036_S_063_1													
TECHNICIAN	JDS					ROOM TEMP (F)		77.4			BEG	MID	END	AVG
DATE:	6_22_16						BAROMETRIC				30.23	30.23	30.23	30.23
RUN #:	EPA2													
READING INTERVAL:	10													
SAMPLE BOX :	A	METER Y FACTOR:		1.002				PROBE MATERIAL:			SS			
FRONT FILTER #:	2758&2763				REAR FILTER #	REAR FILTER #:		2759						
FINAL LEAK RATE (CFM):	<0.01	@	5	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	5	IN-HG			
Run Time:	440		AMBIENT FILTER #:			2762	VOLUME	2338.128	LITERS	FUEL MOISTURE DB		20.5	%	
			FINAL LEAK RATE (CFM):			<0.01	@	5	IN-HG					
TEST START TIME:	11:59													

										1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP
0	0.000	0.000	0.036	0	-0.06		NA	19.6	0	101	402	75	414	677.5	76	75
10	1.380	0.138	0.036	2	-1.39	12.852	102	18.7	0.9	101	437	79	392	787.73	77	75
20	2.769	0.139	0.036	1.99	-1.17	12.841	102	18	0.7	100	439	79	364	848.63	80	74
30	4.160	0.139	0.036	2.02	-1.32	12.841	101	17	1	100	465	80	345	945.55	84	74
40	5.552	0.139	0.036	2	-0.82	12.829	101	16.1	0.9	99	448	80	327	1017.48	87	74
50	6.952	0.140	0.036	2.01	-0.87	12.852	101	14.9	1.2	101	453	81	319	979.49	90	75
60	8.359	0.141	0.036	2.04	-1.32	12.852	101	13.6	1.3	101	452	81	323	963.39	92	75
70	9.766	0.141	0.036	2.02	-1.06	12.841	101	12.5	1.1	100	452	81	329	1029.9	94	75
80	11.180	0.141	0.036	2.02	-1.45	12.852	101	11.3	1.2	101	462	81	332	1005.78	96	75
90	12.592	0.141	0.036	2.02	-0.75	12.852	101	10	1.3	101	462	81	340	992.67	97	76
100	14.011	0.142	0.036	2.02	-1.42	12.841	101	8.8	1.2	100	455	81	354	998.6	98	76
110	15.426	0.142	0.036	2.02	-0.86	12.829	100	8.1	0.7	99	448	81	369	1020.55	99	76
120	16.848	0.142	0.036	2.01	-0.7	12.818	101	7.4	0.7	98	446	81	381	1038.55	99	76
130	18.267	0.142	0.036	2.02	-1.2	12.818	100	6.8	0.6	98	444	81	391	1042.57	100	76
140	19.692	0.143	0.036	2.02	-1	12.818	100	6.2	0.6	98	442	81	400	1043.11	101	77
150	21.113	0.142	0.036	2.03	-0.55	12.818	100	5.6	0.6	98	440	81	407	1031.66	101	77
160	22.539	0.143	0.036	2.01	-1.1	12.818	100	5	0.6	98	439	81	413	1032.44	102	77
170	23.966	0.143	0.036	2.02	-1.22	12.818	100	4.4	0.6	98	435	81	416	1035.47	102	77
180	25.391	0.143	0.036	2.02	-0.76	12.806	100	4	0.4	97	426	81	420	999.61	102	77
190	26.822	0.143	0.036	2.01	-1.31	12.806	100	3.8	0.2	97	405	82	420	890.81	103	77
200	28.249	0.143	0.036	2.01	-0.96	12.795	100	3.5	0.3	96	385	82	418	849.31	103	77
210	29.680	0.143	0.036	2.02	-1.39	12.783	100	3.3	0.2	95	370	82	414	827.08	103	78
220	31.111	0.143	0.036	2.02	-0.68	12.783	100	3.2	0.1	95	359	82	410	814.55	103	78
230	32.541	0.143	0.036	2.03	-0.92	12.783	100	3	0.2	95	350	82	404	805.26	104	78
240	33.974	0.143	0.036	2.02	-0.64	12.772	100	2.8	0.2	94	343	82	399	795.91	104	78
250	35.409	0.144	0.036	2.02	-0.85	12.772	100	2.6	0.2	94	337	82	395	786.68	104	78
260	36.840	0.143	0.036	2.02	-1.15	12.772	100	2.5	0.1	94	330	82	390	777.8	104	78
270	38.274	0.143	0.036	2.02	-1.18	12.772	100	2.3	0.2	94	323	82	388	714.21	104	78
280	39.710	0.144	0.036	2.03	-1.09	12.760	100	2.1	0.2	93	311	82	381	693.92	105	78
290	41.143	0.143	0.036	2.03	-1.5	12.760	100	1.9	0.2	93	305	82	371	709.71	105	78
300	42.579	0.144	0.036	2.01	-1.55	12.760	100	1.8	0.1	93	302	82	361	713.02	105	78
310	44.015	0.144	0.036	2.02	-0.78	12.749	100	1.7	0.1	92	298	82	353	693.96	105	78

TEST START TIME:	11:59									1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP
320	45.449	0.143	0.036	2.02	-1.03	12.749	100	1.5	0.2	92	294	82	347	692.75	105	79
330	46.886	0.144	0.036	2.01	-0.78	12.749	100	1.4	0.1	92	291	83	341	688.56	106	79
340	48.325	0.144	0.036	2.01	-1.12	12.749	100	1.2	0.2	92	289	83	336	693.85	106	80
350	49.759	0.143	0.036	2.02	-1.32	12.749	100	1.1	0.1	92	287	83	333	687.9	106	79
360	51.196	0.144	0.036	2	-1.01	12.749	100	1	0.1	92	285	83	330	693.4	106	79
370	52.636	0.144	0.036	1.99	-1.32	12.749	100	0.8	0.2	92	283	83	325	690.5	106	79
380	54.076	0.144	0.036	2.02	-1.27	12.749	100	0.7	0.1	92	281	83	321	682.69	107	80
390	55.513	0.144	0.036	2.01	-1.02	12.749	100	0.6	0.1	92	279	83	317	676.17	107	80
400	56.954	0.144	0.036	2.02	-1.46	12.749	100	0.5	0.1	92	277	83	314	672.41	107	80
410	58.395	0.144	0.036	2.02	-0.69	12.749	100	0.4	0.1	92	275	83	312	660	107	80
420	59.834	0.144	0.036	2	-1.34	12.749	100	0.2	0.2	92	272	83	312	657.82	107	80
430	61.271	0.144	0.036	2.02	-0.82	12.737	100	0.1	0.1	91	271	83	313	653.2	107	80
440	62.712	0.144	0.036	2.01	-1.14	12.737	100	0	0.1	91	268	83	313	645.8	107	80
	62.712		0.036	2.02		12.790	100.3			96	367				100	77

JOB #	036_S_063_1								
TECHNICIA	JDS								
DATE:	6_22_16								
RUN #:	EPA2								
READING INTERVAL:	10								
SAMPLE BOX :	B	METER Y FACTOR:		1.001		PROBE MATERIAL:		SS	
FRONT FILTER #:	2760				REAR FILTER #:	2761			
FINAL LEAK RATE (CFM):	<0.01	@	5	IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	5	IN-HG

Run Time: 440

Firebox Delta T 102.2

ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	TEMPERATURES 1 LEFT SIDE	2 RIGHT SIDE	3 FILTER	4 FB TOP	5 FB BOT	6 METER	STOVE AVG T
0	0	0	NA	0	0	1	414	428	75	457	387	76	420
10	1.346	0.135	101	-0.05	1.97	2.26	383	394	79	540	416	77	425
20	2.716	0.137	102	-0.05	1.97	1.69	355	367	80	576	422	80	417
30	4.090	0.137	102	-0.04	1.97	1.47	334	346	80	652	421	83	420
40	5.471	0.138	101	-0.05	1.97	1.99	334	342	80	652	376	87	406
50	6.855	0.138	101	-0.05	1.96	2.01	332	341	81	653	362	90	401
60	8.242	0.139	101	-0.05	1.98	1.89	337	346	81	637	354	92	399
70	9.632	0.139	101	-0.05	1.97	1.89	341	351	81	695	348	94	413
80	11.024	0.139	101	-0.05	1.96	1.34	344	355	81	689	343	96	413
90	12.420	0.140	101	-0.05	1.96	2.23	349	360	81	679	339	97	413
100	13.822	0.140	101	-0.05	1.98	1.53	355	366	81	677	335	98	417
110	15.226	0.140	101	-0.05	1.97	0.74	361	374	81	700	333	99	427
120	16.632	0.141	101	-0.04	1.97	0.87	367	381	81	713	330	100	434
130	18.039	0.141	101	-0.04	1.98	2.03	372	387	81	699	327	100	435
140	19.447	0.141	101	-0.04	1.98	0.88	375	392	81	705	323	101	439
150	20.856	0.141	101	-0.04	1.97	1.6	381	397	81	699	320	101	441
160	22.264	0.141	100	-0.04	1.97	1.45	386	401	81	698	318	102	443
170	23.676	0.141	101	-0.04	1.98	2.23	390	404	81	701	316	102	445
180	25.084	0.141	100	-0.04	1.97	1.5	393	407	82	677	314	102	442
190	26.497	0.141	101	-0.04	1.98	0.84	394	408	82	595	313	103	426
200	27.908	0.141	100	-0.03	1.98	2.24	392	405	82	551	311	103	415
210	29.319	0.141	100	-0.03	1.98	2.12	389	401	82	527	311	103	408
220	30.732	0.141	100	-0.03	1.97	1.54	384	396	82	514	311	104	403
230	32.143	0.141	100	-0.03	1.96	2.36	380	392	82	505	310	104	398
240	33.559	0.142	100	-0.03	1.97	1.72	377	388	82	497	309	104	394
250	34.970	0.141	100	-0.03	1.98	1.99	373	383	82	489	307	104	389
260	36.385	0.142	100	-0.03	1.97	2.26	369	379	82	481	304	104	385
270	37.796	0.141	100	-0.02	1.97	1.99	368	376	82	449	303	105	377
280	39.211	0.142	100	-0.03	1.97	1.65	367	376	82	425	303	105	370
290	40.624	0.141	100	-0.02	1.96	1.83	365	374	82	427	304	105	368
300	42.039	0.142	100	-0.02	1.98	1.94	362	370	82	430	306	105	366
310	43.454	0.142	100	-0.02	1.99	1.94	359	365	82	421	304	105	360
320	44.868	0.141	100	-0.02	1.97	1.96	355	361	82	415	305	105	357
330	46.282	0.141	100	-0.02	1.98	1.92	353	357	82	413	306	106	354
340	47.696	0.141	100	-0.02	1.97	2.05	351	352	83	414	305	106	352
350	49.111	0.142	100	-0.02	1.96	0.95	348	348	83	412	307	106	350
360	50.525	0.141	100	-0.02	1.97	2.14	344	344	83	413	307	106	348

Run Notes:

ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	TEMPERATURES 1 LEFT SIDE	2 RIGHT SIDE	3 FILTER	4 FB TOP	5 FB BOT	6 METER	STOVE AVG T
370	51.942	0.142	100	-0.02	1.97	1.59	339	338	83	411	306	107	344
380	53.357	0.142	100	-0.02	1.97	1.32	335	334	83	406	302	107	340
390	54.775	0.142	100	-0.02	1.96	2.28	331	329	83	400	298	107	335
400	56.189	0.141	99	-0.02	1.97	1.07	327	324	83	396	295	107	331
410	57.608	0.142	100	-0.02	1.97	1.19	324	320	83	392	290	107	328
420	59.022	0.141	99	-0.03	1.98	1.16	322	314	83	385	287	107	324
430	60.441	0.142	100	-0.02	1.98	1.48	320	309	83	382	284	107	322
440	61.856	0.142	99	-0.02	1.97	1.31	316	303	83	376	281	107	318
	61.856	0.141	100.275	-0.032	1.971818	1.676444	359	366	82	534	323	100	102
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

317.8

Ambient Sample Results:

JOB NUMBER: 036_S_063_1
TECHNICIAN: JDS
DATE: 6_22_16
RUN NUMBER: EPA2

METER Y FACTOR: **0.999**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	74.5	0	0
End	2338.128	106	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	2338.128	Liters
Total Sample Volume - Vm	82.570	ft³
Average Sample Rate	0.19	ft³/min
Sample Time	440.00	Minutes
Average Meter Temperature	90.25	°F
Total Sample Volume (Standard Conditions) - Vmstd	79.972	dscf
Total Particulates	0.6	mg
Particulate Concentration (dry-standard)	0.000007503	grams/dscf
Particulate Emission Rate	0.000081818	grams/hour

JOB NUMBER	036_S_063_1
RUN #	EPA2
DATE:	6_22_16
BURN RATE	1.01 KG/HR DRY
FILTER A PARTICULATE	8.9 mg
FILTER B PARTICULATE	8.7 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	62.71		61.86	
Average Gas Velocity in Dilution Tunnel - vs	12.84	feet/second	12.84	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8515.06	dscf/hour	8515.06	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	60.12	dscf	59.23	dscf
Average Tunnel Temperature	95.7	F	95.7	F
Average Delta p	0.036		0.036	
Average Gas Meter Temperature	100	F	100	F
Average Delta H	2.02	in-h20	1.97	in-h20
Total Time of Test	440	min	440	min
Total Particulates	8.9	mg	8.7	mg
Particulate Concentration (dry-standard)	0.00015	grams/dscf	0.00015	grams/dscf
Ambient Train (dry-standard)	0.000007503	grams/dscf	0.000007503	grams/dscf
Net (dry-standard)	0.000140527	grams/dscf	0.00013938	grams/dscf
Particulate Emission Rate	1.20	grams/hour	1.19	grams/hour
Total PM Emissions	8.78	grams	8.70	grams

Average Total PM Emissions	8.74	grams
AVERAGE PARTICLATE EMISSIONS RATE	1.19	grams/hour

	SAMPLE A		SAMPLE B	
% OF AVERAGE	100.4		99.6	
Emissions Factor	1.189	g/Kg -Dry	1.180	g/Kg -Dry

PREBURN

JOB # 036_S_063_1

TECHNICIAI JDS

DATE: 6_23_16

RUN #: EPA3

READING INTERVAL: 10

.

Run Time: 170

Model Designation IHP_ESTATE

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.037	0.037	0.036	0.034	0.035	0.035	0.036	0.036
Temperature	100	100	100	100	100	100	100	100	100.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	12.5	-0.074	533	518	523	852	436	572.4
10	10.2	-0.067	540	525	527	831	437	572
20	7.8	-0.067	537	538	524	814	439	570.4
30	5.4	-0.067	542	562	531	803	450	577.6
40	4.5	-0.057	548	571	547	705	444	563
50	19.2	-0.061	518	549	532	630	428	531.4
60	17.5	-0.07	472	501	481	797	409	532
70	15.4	-0.067	447	475	446	851	391	522
80	13.3	-0.067	445	469	434	860	377	517
90	11	-0.066	456	481	436	828	366	513.4
100	8.9	-0.062	472	504	451	818	358	520.6
110	7.3	-0.065	497	525	476	775	352	525
120	6.6	-0.059	525	547	521	742	351	537.2
130	6.3	-0.056	539	557	552	641	354	528.6
140	4.9	-0.052	536	555	558	573	361	516.6
150	4.6	-0.045	514	535	524	532	363	493.6
160	4.4	-0.046	487	506	484	479	359	463
170	4.2	-0.046	460	477	448	456	352	438.6

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.08635	ft/sec.
Intial Tunnel Flow:	140.2511	scfm
Average Tunnel Flow:	139.2515	scfm

Notes:

Technician________________________

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
			503.7778		499.7222			

Technician____________________

Run #	EPA3
Date:	6/23/16

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.037	0.037	0.036	0.034	0.035	0.035	0.036	0.036
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	13.086	ft/sec.
Intial Tunnel Flow:	140.25	scfm
Average Tunnel Flow	139.25	scfm

JOB #: 036_S_063_1
TECHNICIAN: JDS
DATE: 6_23_16
RUN #: EPA3
READING INTERVAL: 10
SAMPLE BOX : A
METER Y FACTOR: 1.002
FRONT FILTER #: 2764&2769
FINAL LEAK RATE (CFM): <0.01 @ 5 IN-HG
REAR FILTER #: 2765
FINAL LEAK RATE (CFM): <0.01 @ 5 IN-HG
ROOM TEMP (F): 73.0
PROBE MATERIAL: SS

BAROMETRIC	BEG	MID	END	AVG
	30.07	30.07	30.07	30.07

Run Time: 240
AMBIENT FILTER #: 2768
FINAL LEAK RATE (CFM): <0.01 @ 5 IN-HG
VOLUME: 1282.928 LITERS
FUEL MOISTURE DB: 20.3 %
TEST START TIME: 13:24

ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	TUNNEL DELTA P	ORIFICE DELTA H	FILTER VAC	TUNNEL VEL FT/SEC	Proportional Rate (%)	Scale Weight	Weight Chg	TUNNEL TEMP (1)	FLUE TEMP (2)	FILTER TEMP (3)	FB REAR TEMP (4)	FB INT (5)	METER TEMP (6)	AMBIENT TEMP
0	0.000	0.000	0.036	0.01	-0.11		NA	20.2	0	109	447	76	439	692.14	76	73
10	1.383	0.138	0.036	2.03	-0.88	13.001	101	19.5	0.7	111	473	80	406	710.36	77	73
20	2.775	0.139	0.036	2.01	-0.83	13.001	101	18.6	0.9	111	503	80	370	780.31	80	72
30	4.166	0.139	0.036	2	-0.77	13.035	101	17.3	1.3	114	573	81	347	996.49	83	72
40	5.564	0.140	0.036	2.01	-1.4	13.103	101	15.7	1.6	120	600	83	330	1065.51	86	73
50	6.970	0.141	0.036	2.01	-0.72	13.103	101	13.6	2.1	120	611	84	339	1089.12	89	73
60	8.373	0.140	0.036	2.01	-0.79	13.114	101	11.9	1.7	121	625	83	364	1094.88	91	73
70	9.788	0.142	0.036	2.02	-0.83	13.137	101	10.2	1.7	123	630	83	389	1059.04	93	74
80	11.200	0.141	0.036	2.01	-1.18	13.125	101	8.3	1.9	122	631	83	416	1068.3	94	74
90	12.617	0.142	0.036	2.02	-0.82	13.114	101	7	1.3	121	635	83	440	1082.65	96	73
100	14.033	0.142	0.036	2.03	-0.92	13.114	100	5.8	1.2	121	626	83	457	1063.47	97	74
110	15.455	0.142	0.036	2.03	-0.95	13.103	101	4.8	1	120	616	83	468	1050.55	97	74
120	16.872	0.142	0.036	2.03	-0.77	13.091	100	3.9	0.9	119	606	83	484	1031.83	98	74
130	18.297	0.143	0.036	2.02	-0.88	13.069	101	3.1	0.8	117	580	83	501	938.19	98	74
140	19.718	0.142	0.036	2.03	-0.66	13.057	100	2.6	0.5	116	552	83	509	899.48	99	74
150	21.147	0.143	0.036	2.03	-0.71	13.035	100	2.3	0.3	114	531	82	511	860.6	99	74
160	22.571	0.142	0.036	2.02	-1.24	13.012	100	1.9	0.4	112	511	82	504	837.62	100	74
170	23.999	0.143	0.036	2.02	-1.14	13.001	100	1.5	0.4	111	496	82	498	816.49	100	74
180	25.427	0.143	0.036	2.04	-0.72	12.989	100	1.4	0.1	110	485	82	490	806.7	100	73
190	26.853	0.143	0.036	2.03	-1.44	12.978	100	1.1	0.3	109	478	81	479	807.01	100	72
200	28.283	0.143	0.036	2.04	-1.41	12.966	100	0.8	0.3	108	471	80	467	800.7	100	72
210	29.710	0.143	0.036	2.01	-1.23	12.955	99	0.6	0.2	107	464	80	459	786.72	100	72
220	31.139	0.143	0.036	2.03	-1.48	12.955	99	0.4	0.2	107	458	80	453	782.12	101	73
230	32.569	0.143	0.036	2.02	-1.11	12.944	99	0.2	0.2	106	455	80	441	788.13	101	72
240	33.997	0.143	0.036	2.03	-1.2	12.932	99	0	0.2	105	448	80	430	771.01	101	72

TEST START TIME:		13:24								1	2	3	4	5	6			
										TEMPERATURES								
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT		
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP		
	33.997		0.036	2.02		13.039	100.3			114	540				94	73		

JOB #	036_S_063_1							
TECHNICIA	JDS							
DATE:	6_23_16							
RUN #:	EPA3							
READING INTERVAL:	10							
SAMPLE BOX :	B	METER Y FACTOR:	1.001		PROBE MATERIAL:	SS		
FRONT FILTER #:	2766			REAR FILTER #:	2767			
FINAL LEAK RATE (CFM):	<0.01	@	5	IN-HG	FINAL LEAK RATE (CFM):	<0.01	@ 5	IN-HG

Run Time: 240 Firebox Delta T 17

ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	TEMPERATURES 1 LEFT SIDE	2 RIGHT SIDE	3 FILTER	4 FB TOP	5 FB BOT	6 METER	STOVE AVG T
0	0	0	NA	0	0	1	453	470	76	451	349	76	432
10	1.354	0.135	100	-0.05	1.97	1.83	412	428	80	478	370	77	419
20	2.723	0.137	101	-0.05	1.98	0.94	372	395	80	530	377	79	409
30	4.096	0.137	101	-0.06	1.96	2.36	349	380	81	672	376	83	425
40	5.472	0.138	101	-0.06	1.99	2.3	351	384	83	739	336	86	428
50	6.855	0.138	101	-0.06	1.96	0.84	370	406	84	751	323	88	438
60	8.241	0.139	101	-0.06	1.98	2.12	405	436	84	781	318	91	461
70	9.629	0.139	101	-0.06	1.97	1.63	441	463	84	766	314	92	475
80	11.022	0.139	101	-0.06	1.98	1.26	472	488	84	770	314	94	492
90	12.416	0.139	101	-0.06	1.97	2.04	496	511	84	782	316	95	509
100	13.810	0.139	101	-0.06	1.97	2.25	511	526	84	761	317	96	514
110	15.206	0.140	100	-0.06	1.98	1.05	520	533	83	749	318	97	518
120	16.604	0.140	100	-0.06	1.97	1.52	525	539	83	728	318	98	519
130	18.003	0.140	100	-0.05	1.97	1.48	531	541	83	670	317	98	512
140	19.402	0.140	100	-0.06	1.98	1.75	534	536	83	619	319	98	503
150	20.807	0.141	100	-0.05	1.97	2.28	529	527	83	587	323	99	495
160	22.210	0.140	100	-0.05	1.97	1.87	516	516	83	561	326	99	485
170	23.614	0.140	100	-0.05	1.98	2.25	503	506	82	542	328	99	475
180	25.020	0.141	100	-0.05	1.97	2.04	490	494	82	529	330	100	467
190	26.425	0.141	100	-0.05	1.97	1.31	477	481	81	523	329	100	458
200	27.832	0.141	100	-0.05	1.99	2.03	464	469	81	517	328	100	449
210	29.239	0.141	100	-0.05	1.99	2.13	453	459	80	507	325	100	441
220	30.645	0.141	99	-0.05	1.98	0.7	442	450	80	498	323	100	433
230	32.054	0.141	100	-0.05	1.98	0.78	430	438	80	497	321	100	425
240	33.460	0.141	99	-0.05	1.96	1.06	418	425	80	488	316	100	415

Run Notes:

							TEMPERATURES 1	2	3	4	5	6	
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T
	33.46	0.139	100.268	-0.052	1.974583	1.6328	459	472	82	620	329	94	17
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	**DT**

415.4

Ambient Sample Results:

JOB NUMBER: 036_S_063_1
TECHNICIAN: JDS
DATE: 6_23_16
RUN NUMBER: EPA3

METER Y FACTOR: **0.999**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	80	0	0
End	1282.928	101	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1282.928	Liters
Total Sample Volume - Vm	45.306	ft^3
Average Sample Rate	0.19	ft^3/min
Sample Time	240.00	Minutes
Average Meter Temperature	90.5	°F
Total Sample Volume (Standard Conditions) - Vmstd	43.629	dscf
Total Particulates	0.5	mg
Particulate Concentration (dry-standard)	0.000011460	grams/dscf
Particulate Emission Rate	0.000125000	grams/hour

JOB NUMBER: 036_S_063_1

RUN #: EPA3
DATE: 6_23_16

BURN RATE: 1.90 KG/HR DRY

FILTER A PARTICULATE: 6.3 mg

FILTER B PARTICULATE: 6.2 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	34.00		33.46	
Average Gas Velocity in Dilution Tunnel - vs	13.09	feet/second	13.09	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8355.09	dscf/hour	8355.09	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	32.78	dscf	32.25	dscf
Average Tunnel Temperature	114.2	F	114.2	F
Average Delta p	0.036		0.036	
Average Gas Meter Temperature	94	F	94	F
Average Delta H	2.02	in-h20	1.97	in-h20
Total Time of Test	240	min	240	min
Total Particulates	6.3	mg	6.2	mg
Particulate Concentration (dry-standard)	0.00019	grams/dscf	0.00019	grams/dscf
Ambient Train (dry-standard)	0.000011460	grams/dscf	0.000011460	grams/dscf
Net (dry-standard)	0.000180752	grams/dscf	0.00018080	grams/dscf
Particulate Emission Rate	1.51	grams/hour	1.51	grams/hour
Total PM Emissions	6.04	grams	6.04	grams

Average Total PM Emissions		6.04	grams
AVERAGE PARTICULATE EMISSIONS RATE		1.51	grams/hour
% OF AVERAGE	100.0		100.0
Emissions Factor	0.793 g/Kg -Dry		0.793 g/Kg -Dry

PREBURN

JOB # 036_S_063_1
TECHNICIAI JDS
DATE: 6_24_16
RUN #: EPA4
READING INTERVAL: 10
.
Run Time: 70

Model Designation IHP_ESTATE

Tunnel Traverse Information	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.037	0.037	0.040	0.035	0.035	0.037	0.036	0.037
Temperature	100	100	100	100	100	100	100	100	100.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	23.6	-0.06	523	541	558	483	440	509
10	20.7	-0.071	495	506	516	755	451	544.6
20	18	-0.075	503	491	497	861	439	558.2
30	15	-0.073	538	486	495	881	427	565.4
40	12.1	-0.076	568	502	505	879	418	574.4
50	9.2	-0.075	598	528	525	849	413	582.6
60	7.1	-0.061	605	557	566	755	413	579.2
70	5.4	-0.075	582	553	575	879	414	600.6

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.50264	ft/sec.
Intial Tunnel Flow:	142.3688	scfm
Average Tunnel Flow:	138.7072	scfm

Notes:

Technician________________________

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
			551.5		529.625			

Technician___________________

Run #	EPA4
Date:	6/24/16

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.037	0.037	0.040	0.035	0.035	0.037	0.036	0.037
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	13.503	ft/sec.
Intial Tunnel Flow:	142.37	scfm
Average Tunnel Flow	138.71	scfm

JOB #	036_S_063_1									
TECHNICIA	JDS		ROOM TEMP (F)	72.6			BEG	MID	END	AVG
DATE:	6_24_16		BAROMETRIC				30.25	30.25	30.25	30.25
RUN #:	EPA4									
READING INTERVAL:	10									
SAMPLE BOX :	A	METER Y FACTOR:	1.002		PROBE MATERIAL:		SS			
FRONT FILTER #:	2770&2775	[redacted]	REAR FILTER #	REAR FILTER #:	2771	[redacted]				
FINAL LEAK RATE (CFM):	<0.01	@	5	IN-HG	FINAL LEAK RATE (CFM)	<0.01	@	5	IN-HG	
Run Time:	150	AMBIENT FILTER #:	2774	VOLUME	806.341	LITERS	FUEL MOISTURE DB	20.3	%	
		FINAL LEAK RATE (CFM):	<0.01	@	5	IN-HG				
TEST START TIME:	11:21									

											1	2	3	4	5	6	
											TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	TUNNEL DELTA P	ORIFICE DELTA H	FILTER VAC	TUNNEL VEL FT/SEC	Proportional Rate (%)	Scale Weight	Weight Chg		TUNNEL TEMP	FLUE TEMP	FILTER TEMP	FB REAR TEMP	FB INT	METER TEMP	AMBIENT TEMP
0	0.000	0.000	0.037	0	-0.05		NA	20.9	0		140	763	74	592	1147.81	74	72
10	1.373	0.137	0.037	2	-0.75	13.459	101	18.4	2.5		139	804	81	598	1195.93	75	72
20	2.750	0.138	0.037	2.02	-1.25	13.493	101	15.8	2.6		142	845	82	564	1238.28	78	72
30	4.138	0.139	0.037	2.01	-0.71	13.515	101	13	2.8		144	859	82	547	1253.21	81	72
40	5.528	0.139	0.037	2.03	-0.93	13.582	101	10.4	2.6		150	810	84	545	1183.23	84	74
50	6.924	0.140	0.037	2.03	-1.34	13.560	101	8.1	2.3		148	799	83	547	1227.16	87	73
60	8.327	0.140	0.037	2.04	-1.03	13.515	101	6	2.1		144	793	83	557	1209.52	89	72
70	9.733	0.141	0.037	2.04	-1.27	13.504	101	4.7	1.3		143	785	82	571	1184.39	91	72
80	11.141	0.141	0.037	2.03	-1.38	13.481	100	3.5	1.2		141	742	81	583	1056.1	92	72
90	12.548	0.141	0.037	2.02	-1.32	13.470	100	2.6	0.9		140	706	81	592	999.74	93	73
100	13.955	0.141	0.037	2.02	-1.3	13.425	100	1.9	0.7		136	670	80	595	940.1	94	73
110	15.368	0.141	0.037	2.02	-1	13.403	100	1.4	0.5		134	642	80	596	902.76	95	73
120	16.777	0.141	0.037	2.03	-0.83	13.369	99	0.9	0.5		131	619	80	594	871.17	96	73
130	18.196	0.142	0.037	2.01	-0.82	13.346	99	0.5	0.4		129	600	80	580	848.66	96	73
140	19.609	0.141	0.037	2.04	-1.19	13.324	99	0.2	0.3		127	581	80	563	825.9	97	73
150	21.028	0.142	0.037	2.04	-1.16	13.301	99	0	0.2		125	567	82	548	808.35	97	72

TEST START TIME:		11:21								1	2	3	4	5	6			
										TEMPERATURES								
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT		
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP		
	21.028		0.037	2.03		13.450	100.2			138	724				89	73		

JOB #	036_S_063_1							
TECHNICIA	JDS							
DATE:	6_24_16							
RUN #:	EPA4							
READING INTERVAL:	10							
SAMPLE BOX :	B	METER Y FACTOR:		1.001		PROBE MATERIAL:		SS
FRONT FILTER #:	2772				REAR FILTER #:	2773		
FINAL LEAK RATE (CFM):	<0.01	@	5	IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	5 IN-HG

Run Time: 150

Firebox Delta T 102.6

							1	2	3	4	5	6	
							TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T
0	0	0	NA	0	0	1	579	562	73	905	421	74	612
10	1.342	0.134	100	-0.08	1.94	1.76	545	555	81	910	474	75	616
20	2.699	0.136	101	-0.08	1.99	2.21	511	550	82	982	488	77	619
30	4.065	0.137	101	-0.08	1.98	2.32	502	561	83	1012	484	80	621
40	5.433	0.137	102	-0.08	1.97	1.06	527	597	84	917	426	83	602
50	6.806	0.137	101	-0.07	1.98	1.85	545	621	84	908	405	86	605
60	8.182	0.138	101	-0.07	1.99	1.35	566	632	83	900	393	88	610
70	9.561	0.138	100	-0.07	1.97	1.85	595	637	82	896	385	90	617
80	10.943	0.138	100	-0.07	1.99	1.88	616	633	81	801	381	92	603
90	12.327	0.138	100	-0.07	1.98	1.04	626	623	81	741	378	93	592
100	13.713	0.139	100	-0.06	1.97	0.93	624	610	81	685	380	93	579
110	15.102	0.139	100	-0.06	1.98	2.3	614	593	81	646	382	94	566
120	16.493	0.139	99	-0.06	1.99	1.25	597	578	81	618	383	95	554
130	17.884	0.139	99	-0.06	1.98	2	576	559	80	591	385	95	538
140	19.276	0.139	99	-0.06	1.98	0.78	554	541	81	570	386	96	523
150	20.671	0.140	99	-0.06	1.99	2.1	537	524	82	550	387	96	509

Run Notes:

ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	TEMPERATURES 1 LEFT SIDE	2 RIGHT SIDE	3 FILTER	4 FB TOP	5 FB BOT	6 METER	STOVE AVG T
	20.671	0.138	100.204	-0.064	1.978667	1.605	570	586	81	790	409	88	103
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

509.2

Ambient Sample Results:

JOB NUMBER: 036_S_063_1
TECHNICIAN: JDS
DATE: 6_24_16
RUN NUMBER: EPA4

METER Y FACTOR: 0.999

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	75	0	0
End	806.341	97	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	806.341	Liters
Total Sample Volume - Vm	28.476	ft^3
Average Sample Rate	0.19	ft^3/min
Sample Time	150.00	Minutes
Average Meter Temperature	86	°F
Total Sample Volume (Standard Conditions) - Vmstd	27.813	dscf
Total Particulates	0.1	mg
Particulate Concentration (dry-standard)	0.000003595	grams/dscf
Particulate Emission Rate	0.000040000	grams/hour

JOB NUMBER: 036_S_063_1

RUN #: EPA4

DATE: 6_24_16

BURN RATE: 3.15 KG/HR DRY

FILTER A PARTICULATE: 10.1 mg

FILTER B PARTICULATE: 9.3 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	21.03		20.67	
Average Gas Velocity in Dilution Tunnel - vs	13.50	feet/second	13.50	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8322.43	dscf/hour	8322.43	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	20.60	dscf	20.26	dscf
Average Tunnel Temperature	138.3	F	138.3	F
Average Delta p	0.037		0.037	
Average Gas Meter Temperature	89	F	88	F
Average Delta H	2.03	in-h20	1.98	in-h20
Total Time of Test	150	min	150	min
Total Particulates	10.1	mg	9.3	mg
Particulate Concentration (dry-standard)	0.00049	grams/dscf	0.00046	grams/dscf
Ambient Train (dry-standard)	0.000003595	grams/dscf	0.000003595	grams/dscf
Net (dry-standard)	0.000486691	grams/dscf	0.00045554	grams/dscf
Particulate Emission Rate	4.05	grams/hour	3.79	grams/hour
Total PM Emissions	10.13	grams	9.48	grams

Average Total PM Emissions	9.80	grams
AVERAGE PARTICLATE EMISSIONS RATE	3.92	grams/hour

	SAMPLE A		SAMPLE B	
% OF AVERAGE	103.3		96.7	
Emissions Factor	1.285	g/Kg -Dry	1.203	g/Kg -Dry

DIRIGO LABORATORIES INC.

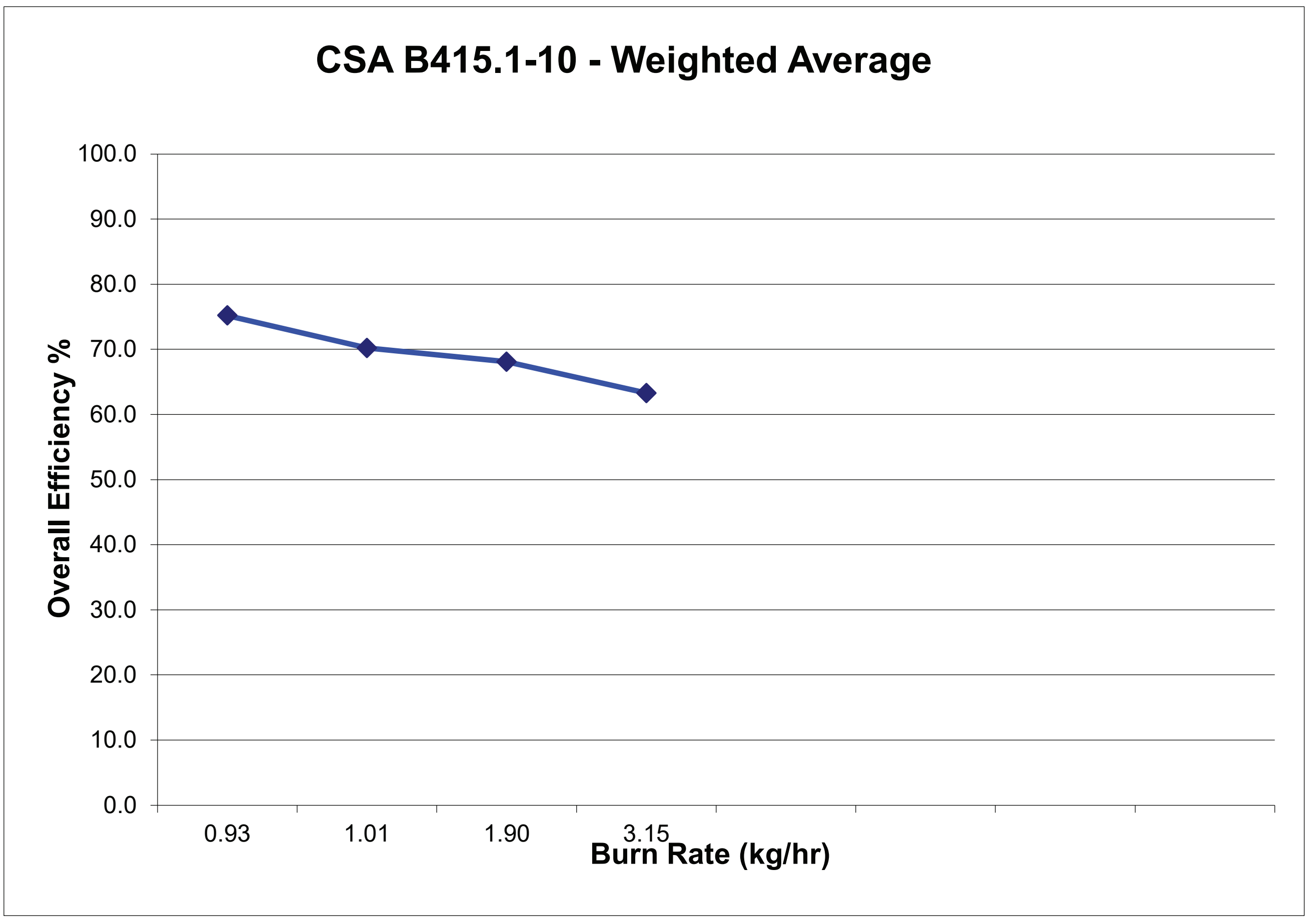
Weighted Average: 70.2 %

Client:	Innovative Hearth Products
Model:	Montecito Estate
Tracking No.:	63
Project No.:	036-S-063-1
Test Dates:	6/21/16 - 6/24/16

Burn Rate Category	2	Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.93	Burn Rate (kg/hr-dry)	1.01
OA Efficiency %	75.2	OA Efficiency %	70.2
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	23.08%	Weighting Factor	34.62%
Run Number	1	Run Number	2

Burn Rate Category	3	Burn Rate Category	4
Burn Rate (kg/hr-dry)	1.90	Burn Rate (kg/hr-dry)	3.15
OA Efficiency %	68.1	OA Efficiency %	63.3
Emissions Rate Cap (g/hr)	18	Emissions Rate Cap (g/hr)	18
Weighting Factor	36.02%	Weighting Factor	6.29%
Run Number	3	Run Number	4

Client:	Innovative Hearth Products
Model:	Montecito Estate
Tracking No.:	63
Project No.:	036-S-063-1
Test Dates:	6/21/16 - 6/24/16



VERSION: 2.4 4/15/2010

lanufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 1
Control #: 036-S-063-1
est Duration: 490
urn Category 2

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY): 21.5
Wood Moisture (% wet): 17.70
Load Weight (lb wet): 20.40
Burn Rate (dry kg/h): 0.93
Total Particulate Emissions: 5.1 g

Fuel Data

	D. Fir
HHV	19,810 kJ/kg
%C	48.73
%H	6.87
%O	43.90
%Ash	0.50

(●) Douglas Fir
( ) Oak

		Temp. (F)		Flue Gas Composition (%)		
Averages		348.3	75.5	10.95	9.75	0.28
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**O2**	**CO2**	**CO**
0	20.4	373.0	75.0	13.65	6.66	0.05
10	19.8	398.0	74.0	14.41	5.94	0.04
20	19.3	391.0	74.0	14.13	6.46	0.05
30	18.8	394.0	74.0	12.92	8.00	0.05
40	18.1	370.0	74.0	12.52	8.51	0.05
50	17.3	378.0	75.0	10.17	11.20	0.09
60	16.6	381.0	74.0	11.28	9.87	0.09
70	15.8	390.0	74.0	10.26	11.01	0.08
80	15.1	402.0	74.0	8.97	12.42	0.07
90	14.2	415.0	74.0	8.10	13.05	0.76
100	13.3	422.0	75.0	8.39	12.96	0.10
110	12.5	429.0	75.0	7.90	13.14	0.90
120	11.6	428.0	75.0	7.78	12.81	1.81
130	10.6	427.0	75.0	7.82	12.57	2.35
140	9.6	429.0	75.0	7.72	12.23	3.47
150	8.6	423.0	75.0	7.77	12.68	1.93
160	7.8	426.0	76.0	8.10	13.02	0.61
170	7.0	430.0	76.0	7.98	13.07	0.42
180	6.4	432.0	76.0	8.28	12.66	0.16
190	5.8	426.0	76.0	8.72	12.22	0.07
200	5.3	410.0	76.0	9.82	11.04	0.04
210	4.9	399.0	76.0	9.64	11.36	0.04
220	4.5	391.0	76.0	9.94	10.82	0.03
230	4.1	378.0	75.0	10.55	10.20	0.03
240	4.0	364.0	75.0	11.13	9.41	0.02
250	3.7	349.0	75.0	11.38	9.11	0.02
260	3.5	335.0	75.0	11.33	9.11	0.02
270	3.3	325.0	75.0	11.30	9.17	0.02
280	3.1	318.0	76.0	11.56	8.95	0.03
290	3.0	312.0	75.0	11.63	8.93	0.03
300	2.8	310.0	76.0	11.43	9.13	0.04
310	2.6	308.0	76.0	11.42	9.09	0.03
320	2.5	306.0	76.0	11.47	9.09	0.04
330	2.3	305.0	76.0	11.51	9.10	0.04
340	2.2	302.0	76.0	11.58	8.93	0.04
350	2.0	301.0	76.0	11.64	8.94	0.03
360	1.8	298.0	76.0	12.04	8.46	0.03
370	1.7	294.0	76.0	12.13	8.30	0.04
380	1.5	291.0	77.0	12.12	8.52	0.03
390	1.4	285.0	76.0	12.22	8.33	0.02
400	1.2	281.0	77.0	12.25	8.47	0.02
410	1.1	277.0	77.0	11.84	8.76	0.01
420	0.9	273.0	77.0	12.08	8.41	0.03
430	0.8	270.0	77.0	12.14	8.33	0.01
440	0.7	268.0	77.0	12.38	8.13	0.01
450	0.5	264.0	77.0	12.36	8.18	0.02
460	0.4	262.0	76.0	12.75	7.82	0.02
470	0.3	261.0	76.0	12.80	7.75	0.01
480	0.1	258.0	76.0	13.12	7.48	0.01
490	0.0	256.0	76.0	13.02	7.56	0.01

Manufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 1
Control #: 036-S-063-1
Test Duration: 490 min

	HHV	LHV
Eff	75.2%	81.3%
Comb Eff	96.8%	96.8%
HT Eff	77.7%	84.0%
Output	13,899	kJ/h
Burn Rate	0.93	kg/h
Grams CO	356	g
Input	18,479	kJ/h
MC wet	17.70	

Overall Heating Efficiency: 75.2%
Combustion Efficiency: 96.8%
Heat Transfer Efficiency: 77.7%

Heat Output: 13,185 Btu/h
Heat Input: 17,529 Btu/h

Ultimate CO2
CO2-ult 19.64
F0
1.062

Burn Duration: 8.166666667 h
Burn Rate: 2.1 lb/h
Stack Temp: 347.8 Deg. F

	Averages	0.28	9.75	106.7%	20.28	10.39	175.7	24.2	98.7%	78.6%	77.5%
INPUT DATA				Oxygen Calculation			Input Data		Combust	Heat	Net
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO2 [d]	Excess Air EA	Total O2	Calc. % O2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %
0	9.26	0.05	6.66	192.7%	20.50	13.81	189.4	23.9	100.0%	73.0%	73.0%
10	8.98	0.04	5.94	228.5%	20.55	14.59	203.3	23.3	100.2%	69.6%	69.7%
20	8.76	0.05	6.46	201.7%	20.51	14.03	199.4	23.3	100.0%	71.5%	71.5%
30	8.53	0.05	8.00	144.0%	20.41	12.38	201.1	23.3	99.9%	74.5%	74.4%
40	8.21	0.05	8.51	129.5%	20.37	11.84	187.8	23.3	99.9%	76.4%	76.3%
50	7.85	0.09	11.20	74.0%	20.19	8.95	192.2	23.9	99.6%	78.9%	78.5%
60	7.53	0.09	9.87	97.2%	20.28	10.37	193.9	23.3	99.5%	77.5%	77.1%
70	7.17	0.08	11.01	77.1%	20.21	9.16	198.9	23.3	99.6%	78.2%	77.9%
80	6.85	0.07	12.42	57.3%	20.12	7.66	205.6	23.3	99.7%	78.9%	78.7%
90	6.44	0.76	13.05	42.2%	20.03	6.60	212.8	23.3	95.5%	78.7%	75.2%
100	6.03	0.10	12.96	50.4%	20.08	7.07	216.7	23.9	99.5%	78.7%	78.3%
110	5.67	0.90	13.14	39.9%	20.01	6.42	220.6	23.9	94.7%	78.3%	74.2%
120	5.26	1.81	12.81	34.4%	19.97	6.26	220.0	23.9	89.8%	77.8%	69.8%
130	4.81	2.35	12.57	31.7%	19.95	6.21	219.4	23.9	87.0%	77.5%	67.4%
140	4.36	3.47	12.23	25.1%	19.90	5.94	220.6	23.9	81.9%	76.8%	62.9%
150	3.90	1.93	12.68	34.4%	19.98	6.33	217.2	23.9	89.1%	77.8%	69.3%
160	3.54	0.61	13.02	44.1%	20.04	6.72	218.9	24.4	96.4%	78.4%	75.6%
170	3.18	0.42	13.07	45.6%	20.05	6.77	221.1	24.4	97.5%	78.4%	76.5%
180	2.90	0.16	12.66	53.2%	20.09	7.35	222.2	24.4	99.1%	78.1%	77.4%

190	2.63	0.07	12.22	59.8%	20.13	7.87	218.9	24.4	99.7%	78.0%	77.8%
200	2.40	0.04	11.04	77.3%	20.21	9.15	210.0	24.4	99.9%	77.6%	77.6%
210	2.22	0.04	11.36	72.3%	20.19	8.81	203.9	24.4	99.9%	78.3%	78.2%
220	2.04	0.03	10.82	81.0%	20.22	9.39	199.4	24.4	100.0%	78.1%	78.1%
230	1.86	0.03	10.20	92.0%	20.26	10.05	192.2	23.9	100.0%	78.0%	78.0%
240	1.81	0.02	9.41	108.3%	20.32	10.90	184.4	23.9	100.2%	77.8%	77.9%
250	1.68	0.02	9.11	115.1%	20.34	11.22	176.1	23.9	100.2%	78.1%	78.2%
260	1.59	0.02	9.11	115.1%	20.34	11.22	168.3	23.9	100.2%	78.7%	78.8%
270	1.50	0.02	9.17	113.7%	20.33	11.15	162.8	23.9	100.2%	79.2%	79.3%
280	1.41	0.03	8.95	118.7%	20.35	11.38	158.9	24.4	100.1%	79.3%	79.4%
290	1.36	0.03	8.93	119.2%	20.35	11.40	155.6	23.9	100.1%	79.5%	79.6%
300	1.27	0.04	9.13	114.2%	20.33	11.18	154.4	24.4	100.0%	79.8%	79.8%
310	1.18	0.03	9.09	115.4%	20.34	11.23	153.3	24.4	100.1%	79.9%	79.9%
320	1.13	0.04	9.09	115.1%	20.34	11.23	152.2	24.4	100.0%	79.9%	79.9%
330	1.04	0.04	9.10	114.9%	20.34	11.22	151.7	24.4	100.0%	80.0%	80.0%
340	1.00	0.04	8.93	119.0%	20.35	11.40	150.0	24.4	100.0%	80.0%	80.0%
350	0.91	0.03	8.94	119.0%	20.35	11.39	149.4	24.4	100.1%	80.0%	80.1%
360	0.82	0.03	8.46	131.4%	20.38	11.90	147.8	24.4	100.1%	79.7%	79.8%
370	0.77	0.04	8.30	135.5%	20.39	12.07	145.6	24.4	100.0%	79.7%	79.7%
380	0.68	0.03	8.52	129.7%	20.38	11.84	143.9	25.0	100.1%	80.1%	80.2%
390	0.64	0.02	8.33	135.2%	20.39	12.05	140.6	24.4	100.2%	80.2%	80.3%
400	0.54	0.02	8.47	131.4%	20.38	11.90	138.3	25.0	100.2%	80.5%	80.7%
410	0.50	0.01	8.76	124.0%	20.36	11.60	136.1	25.0	100.3%	81.0%	81.2%
420	0.41	0.03	8.41	132.7%	20.38	11.96	133.9	25.0	100.1%	80.8%	80.9%
430	0.36	0.01	8.33	135.5%	20.39	12.05	132.2	25.0	100.3%	80.9%	81.2%
440	0.32	0.01	8.13	141.3%	20.40	12.27	131.1	25.0	100.3%	80.8%	81.1%
450	0.23	0.02	8.18	139.5%	20.40	12.21	128.9	25.0	100.2%	81.0%	81.2%
460	0.18	0.02	7.82	150.5%	20.42	12.59	127.8	24.4	100.3%	80.7%	81.0%
470	0.14	0.01	7.75	153.1%	20.43	12.67	127.2	24.4	100.4%	80.7%	81.0%
480	0.05	0.01	7.48	162.3%	20.45	12.96	125.6	24.4	100.4%	80.6%	80.9%
490	0.00	0.01	7.56	159.5%	20.44	12.88	124.4	24.4	100.4%	80.8%	81.1%

Air Fuel Ratio (A/F)	
Dry Molecular Weight (Md)	29.98
Dry Moles Exhaust Gas (Nr):	389.71
Air Fuel Ratio (A/F)	11.17

%HC
0.88

Combustion Efficiency:	96.8%		
Total Input (kJ):	150,913	143,134	(Btu)
Total Output (kJ):	113,511	107,660	(Btu)
Efficiency:	75.2%		
Total CO (g):	356.33		

13,899 kJ/h
18,479 kJ/h

Load Weight (kg):
Fuel Heating:
Value in kJ/kg - CV:

0.9 kg/h

175.4 Deg. C

12.5	3.04	67.18	0.13	67.18	151283	4.06	6.87	2.74	19810.00	17.70	79.58	21.11	2.47
Air	Wet Wt	% Wet	Dry Wt.	% Dry	Fuel Properties					Mw	Mass Balance		
Fuel	Now	Consumed	Now	Comsumed	Total	Carbon	Hydrogen	Oxygen	Calorific	Moisture	(moles/100 mole dry		
Ratio	Wt	x	Wtdn	y	Input	/12= [a]	/1= [b]	/16= [c]	Value	Fuel Burnt	[h]	[u]	[w]
17.7	9.26	0.00	7.62	0.00	0	4.06	6.87	2.74	19810.00	17.70	79.48	21.08	1.65
19.8	8.98	2.94	7.39	2.94	6288	4.06	6.87	2.74	19810.00	17.70	79.43	21.07	1.47
18.2	8.76	5.39	7.21	5.39	3699	4.06	6.87	2.74	19810.00	17.70	79.46	21.08	1.60
14.7	8.53	7.84	7.02	7.84	4439	4.06	6.87	2.74	19810.00	17.70	79.57	21.11	1.98
13.9	8.21	11.27	6.76	11.27	5548	4.06	6.87	2.74	19810.00	17.70	79.60	21.11	2.11
10.5	7.85	15.20	6.46	15.20	5548	4.06	6.87	2.74	19810.00	17.70	79.76	21.16	2.78
11.9	7.53	18.63	6.20	18.63	5548	4.06	6.87	2.74	19810.00	17.70	79.67	21.13	2.45
10.7	7.17	22.55	5.90	22.55	5548	4.06	6.87	2.74	19810.00	17.70	79.75	21.15	2.73
9.5	6.85	25.98	5.64	25.98	5918	4.06	6.87	2.74	19810.00	17.70	79.85	21.18	3.08
8.5	6.44	30.39	5.30	30.39	6658	4.06	6.87	2.74	19810.00	17.70	79.59	21.11	3.43
9.1	6.03	34.80	4.97	34.80	6288	4.06	6.87	2.74	19810.00	17.70	79.87	21.19	3.22
8.4	5.67	38.73	4.67	38.73	6288	4.06	6.87	2.74	19810.00	17.70	79.54	21.10	3.49
7.9	5.26	43.14	4.33	43.14	7028	4.06	6.87	2.74	19810.00	17.70	79.12	20.99	3.66
7.7	4.81	48.04	3.96	48.04	7398	4.06	6.87	2.74	19810.00	17.70	78.87	20.92	3.76
7.2	4.36	52.94	3.58	52.94	7398	4.06	6.87	2.74	19810.00	17.70	78.36	20.79	3.99
7.9	3.90	57.84	3.21	57.84	6658	4.06	6.87	2.74	19810.00	17.70	79.06	20.97	3.66
8.7	3.54	61.76	2.91	61.76	5918	4.06	6.87	2.74	19810.00	17.70	79.65	21.13	3.38
8.8	3.18	65.69	2.61	65.69	5178	4.06	6.87	2.74	19810.00	17.70	79.74	21.15	3.33
9.3	2.90	68.63	2.39	68.63	4439	4.06	6.87	2.74	19810.00	17.70	79.83	21.17	3.16

9.7	2.63	71.57	2.17	71.57	4069	4.06	6.87	2.74	19810.00	17.70	79.84	21.18	3.03
10.7	2.40	74.02	1.98	74.02	3329	4.06	6.87	2.74	19810.00	17.70	79.77	21.16	2.73
10.4	2.22	75.98	1.83	75.98	2959	4.06	6.87	2.74	19810.00	17.70	79.79	21.17	2.81
11.0	2.04	77.94	1.68	77.94	2959	4.06	6.87	2.74	19810.00	17.70	79.76	21.16	2.67
11.6	1.86	79.90	1.53	79.90	1849	4.06	6.87	2.74	19810.00	17.70	79.72	21.15	2.52
12.6	1.81	80.39	1.49	80.39	1480	4.06	6.87	2.74	19810.00	17.70	79.67	21.13	2.32
13.0	1.68	81.86	1.38	81.86	1849	4.06	6.87	2.74	19810.00	17.70	79.65	21.13	2.24
13.0	1.59	82.84	1.31	82.84	1480	4.06	6.87	2.74	19810.00	17.70	79.65	21.13	2.24
12.9	1.50	83.82	1.23	83.82	1480	4.06	6.87	2.74	19810.00	17.70	79.66	21.13	2.26
13.2	1.41	84.80	1.16	84.80	1110	4.06	6.87	2.74	19810.00	17.70	79.64	21.12	2.21
13.3	1.36	85.29	1.12	85.29	1110	4.06	6.87	2.74	19810.00	17.70	79.64	21.12	2.20
13.0	1.27	86.27	1.05	86.27	1480	4.06	6.87	2.74	19810.00	17.70	79.65	21.13	2.26
13.0	1.18	87.25	0.97	87.25	1110	4.06	6.87	2.74	19810.00	17.70	79.65	21.13	2.24
13.0	1.13	87.75	0.93	87.75	1110	4.06	6.87	2.74	19810.00	17.70	79.64	21.13	2.25
13.0	1.04	88.73	0.86	88.73	1110	4.06	6.87	2.74	19810.00	17.70	79.64	21.13	2.25
13.2	1.00	89.22	0.82	89.22	1110	4.06	6.87	2.74	19810.00	17.70	79.63	21.12	2.21
13.2	0.91	90.20	0.75	90.20	1480	4.06	6.87	2.74	19810.00	17.70	79.64	21.12	2.21
14.0	0.82	91.18	0.67	91.18	1110	4.06	6.87	2.74	19810.00	17.70	79.61	21.12	2.09
14.2	0.77	91.67	0.63	91.67	1110	4.06	6.87	2.74	19810.00	17.70	79.59	21.11	2.05
13.9	0.68	92.65	0.56	92.65	1110	4.06	6.87	2.74	19810.00	17.70	79.61	21.12	2.10
14.2	0.64	93.14	0.52	93.14	1110	4.06	6.87	2.74	19810.00	17.70	79.60	21.11	2.05
14.0	0.54	94.12	0.45	94.12	1110	4.06	6.87	2.74	19810.00	17.70	79.61	21.12	2.09
13.5	0.50	94.61	0.41	94.61	1110	4.06	6.87	2.74	19810.00	17.70	79.63	21.12	2.16
14.1	0.41	95.59	0.34	95.59	1110	4.06	6.87	2.74	19810.00	17.70	79.60	21.11	2.07
14.2	0.36	96.08	0.30	96.08	740	4.06	6.87	2.74	19810.00	17.70	79.61	21.12	2.05
14.6	0.32	96.57	0.26	96.57	1110	4.06	6.87	2.74	19810.00	17.70	79.59	21.11	2.00
14.5	0.23	97.55	0.19	97.55	1110	4.06	6.87	2.74	19810.00	17.70	79.59	21.11	2.02
15.1	0.18	98.04	0.15	98.04	740	4.06	6.87	2.74	19810.00	17.70	79.57	21.11	1.93
15.3	0.14	98.53	0.11	98.53	1110	4.06	6.87	2.74	19810.00	17.70	79.57	21.11	1.91
15.9	0.05	99.51	0.04	99.51	1480	4.06	6.87	2.74	19810.00	17.70	79.55	21.10	1.84
15.7	0.00	100.00	0.00	100.00	370	4.06	6.87	2.74	19810.00	17.70	79.55	21.10	1.86

Moisture Content MCwb:	17.70

Moisture of Wood (wet basis):	17.70
Initial Dry Weight Wtdo (kg):	7.62
Moisture Content Dry	21.50

Dry kg :	7.62
CA:	48.73
HY:	6.87
OX:	43.90

9.26				
HHV	LHV		HHV	LHV
19810.00	18328.69	Btu/lb	8522.48	7885.21

8.45	0.02	0.25	39.96	46.87	0.81	0.04	341.82	34.44	11.94	448.87	6132.34	4572.31
flue gas)		**kg Wood per 100 mole dfp**	**Moles per kg of Dry Wood**						**Moisture**	**Stack Temp**	**Heat Content Cha**	**F**
[j]	**[k]**	**Nk**	**CO2**	**O2**	**CO**	**HC**	**N2**	**H2O**	**Present**	**K**	**CO2**	**O2**
5.69	-0.01	0.16	40.60	84.20	0.30	-0.09	484.49	34.70	11.94	462.59	6714.05	4999.84
5.08	-0.02	0.15	40.66	99.84	0.27	-0.12	543.73	34.76	11.94	476.48	7334.64	5446.86
5.52	-0.02	0.16	40.59	88.13	0.31	-0.10	499.35	34.71	11.94	472.59	7166.25	5326.10
6.82	-0.01	0.20	40.62	62.88	0.25	-0.06	404.03	34.65	11.94	474.26	7238.36	5377.84
7.25	-0.01	0.21	40.63	56.53	0.24	-0.06	380.04	34.63	11.94	460.93	6663.69	4964.64
9.55	0.00	0.28	40.49	32.36	0.33	0.00	288.36	34.53	11.94	465.37	6833.49	5085.83
8.43	0.00	0.24	40.46	42.50	0.37	-0.01	326.59	34.55	11.94	467.04	6926.44	5153.82
9.38	0.00	0.27	40.53	33.71	0.29	-0.01	293.58	34.55	11.94	472.04	7142.23	5308.86
10.57	0.00	0.31	40.59	25.04	0.23	-0.01	260.96	34.54	11.94	478.71	7431.07	5515.93
11.57	0.10	0.34	38.29	19.36	2.23	0.29	233.52	33.93	11.94	485.93	7745.43	5740.71
11.04	0.00	0.32	40.49	22.08	0.31	0.01	249.54	34.50	11.94	489.82	7894.14	5845.57
11.74	0.12	0.35	37.87	18.51	2.59	0.35	229.23	33.83	11.94	493.71	8064.47	5966.94
12.07	0.25	0.36	35.15	17.18	4.97	0.70	217.10	33.13	11.94	493.15	8040.11	5949.59
12.24	0.33	0.37	33.63	16.62	6.29	0.89	211.04	32.74	11.94	492.59	8015.76	5932.25
12.71	0.50	0.40	30.82	14.96	8.74	1.25	197.46	32.02	11.94	493.71	8064.47	5966.94
12.05	0.27	0.36	34.78	17.36	5.29	0.74	216.83	33.04	11.94	490.37	7918.44	5862.90
11.44	0.08	0.34	38.76	19.99	1.82	0.23	237.15	34.06	11.94	492.04	7970.22	5898.54
11.35	0.05	0.33	39.39	20.40	1.27	0.15	240.35	34.22	11.94	494.26	8067.64	5967.92
10.83	0.01	0.31	40.27	23.39	0.51	0.04	253.90	34.45	11.94	495.37	8116.41	6002.62

10.40	0.00	0.30	40.59	26.15	0.23	-0.01	265.17	34.54	11.94	492.04	7970.22	5898.54
9.38	-0.01	0.27	40.70	33.72	0.15	-0.03	294.07	34.59	11.94	483.15	7581.95	5621.47
9.65	-0.01	0.28	40.70	31.55	0.14	-0.03	285.87	34.58	11.94	477.04	7316.34	5431.40
9.19	-0.01	0.27	40.74	35.35	0.11	-0.04	300.32	34.60	11.94	472.59	7123.85	5293.37
8.67	-0.01	0.25	40.74	40.14	0.12	-0.05	318.41	34.62	11.94	465.37	6833.49	5085.83
7.99	-0.01	0.23	40.79	47.24	0.09	-0.06	345.35	34.65	11.94	457.59	6499.64	4845.22
7.74	-0.02	0.22	40.79	50.23	0.09	-0.07	356.65	34.66	11.94	449.26	6143.89	4588.03
7.74	-0.02	0.22	40.79	50.23	0.09	-0.07	356.65	34.66	11.94	441.48	5813.68	4348.55
7.79	-0.02	0.22	40.79	49.61	0.09	-0.07	354.33	34.66	11.94	435.93	5578.89	4177.83
7.61	-0.01	0.22	40.74	51.81	0.14	-0.06	362.50	34.65	11.94	432.04	5393.87	4042.12
7.60	-0.01	0.22	40.74	52.02	0.14	-0.06	363.31	34.65	11.94	428.71	5275.00	3956.30
7.77	-0.01	0.22	40.69	49.84	0.18	-0.05	354.94	34.63	11.94	427.59	5207.18	3905.90
7.73	-0.01	0.22	40.74	50.34	0.13	-0.06	356.96	34.65	11.94	426.48	5160.60	3871.87
7.74	-0.01	0.22	40.69	50.25	0.18	-0.05	356.49	34.63	11.94	425.37	5114.05	3837.85
7.75	-0.01	0.22	40.69	50.15	0.18	-0.05	356.10	34.63	11.94	424.82	5090.79	3820.85
7.60	-0.01	0.22	40.69	51.93	0.18	-0.06	362.82	34.64	11.94	423.15	5021.07	3769.85
7.60	-0.01	0.22	40.74	51.92	0.14	-0.06	362.90	34.65	11.94	422.59	4997.84	3752.86
7.20	-0.01	0.21	40.74	57.33	0.14	-0.07	383.34	34.66	11.94	420.93	4928.22	3701.89
7.07	-0.01	0.20	40.68	59.16	0.20	-0.07	390.12	34.66	11.94	418.71	4835.52	3633.98
7.25	-0.01	0.21	40.74	56.62	0.14	-0.07	380.66	34.66	11.94	417.04	4744.88	3566.71
7.08	-0.02	0.20	40.80	59.01	0.10	-0.08	389.84	34.68	11.94	413.71	4627.47	3481.34
7.20	-0.02	0.21	40.79	57.31	0.10	-0.08	383.43	34.68	11.94	411.48	4514.03	3397.21
7.44	-0.02	0.21	40.85	54.07	0.05	-0.08	371.32	34.68	11.94	409.26	4421.94	3329.48
7.16	-0.01	0.21	40.74	57.92	0.15	-0.07	385.60	34.67	11.94	407.04	4329.99	3261.80
7.08	-0.02	0.20	40.85	59.12	0.05	-0.09	390.40	34.70	11.94	405.37	4261.13	3211.08
6.91	-0.02	0.20	40.85	61.65	0.05	-0.09	399.96	34.71	11.94	404.26	4215.26	3177.27
6.96	-0.02	0.20	40.80	60.89	0.10	-0.08	396.95	34.69	11.94	402.04	4123.63	3109.69
6.65	-0.02	0.19	40.80	65.70	0.10	-0.09	415.12	34.70	11.94	400.93	4099.09	3092.29
6.59	-0.02	0.19	40.86	66.81	0.05	-0.10	419.49	34.72	11.94	400.37	4076.22	3075.40
6.36	-0.02	0.18	40.86	70.80	0.05	-0.11	434.58	34.73	11.94	398.71	4007.68	3024.77
6.43	-0.02	0.19	40.86	69.59	0.05	-0.10	430.00	34.73	11.94	397.59	3962.02	2991.04

					SUMS							AVERAGE
4435.74	4388.78	5996.84	5304.73	297.34	12179.30	10051.78	11636.23	72484.45	1900.63	84827.30	29427.60	4450.15
nge - Ambient to Stack Temperature lue Gas Constituent				Room Temp	Energy Losses (kJ/kg of Dry Fuel) Flue Gas Constituent							Total Loss
CO	N2	CH4	H2O	K	CO2	O2	CO	N2	CH4	H2O Comb	H2O Fuel MC	Rate
4848.95	4797.94	6579.30	5798.41	297.04	272.58	420.97	87.72	2324.55	-81.63	1727.16	594.45	5345.80
5278.74	5224.00	7220.53	6311.15	296.48	298.22	543.79	78.93	2840.45	-108.32	1747.94	600.57	6001.58
5162.77	5109.01	7045.36	6172.85	296.48	290.91	469.41	90.54	2551.19	-86.13	1740.65	598.92	5655.49
5212.46	5158.28	7120.33	6232.11	296.48	294.04	338.16	73.17	2084.08	-57.57	1739.52	599.63	5071.03
4815.39	4764.61	6524.91	5758.45	296.48	270.74	280.64	68.71	1810.74	-50.35	1722.31	593.97	4696.76
4931.62	4879.89	6702.78	5897.03	297.04	276.70	164.55	93.68	1407.17	-4.15	1721.97	595.63	4255.55
4997.25	4944.90	6796.57	5975.42	296.48	280.23	219.02	106.24	1614.94	-13.09	1725.67	596.56	4529.57
5146.21	5092.59	7020.40	6153.10	296.48	289.47	178.97	84.85	1495.07	-10.15	1731.48	598.69	4368.38
5345.04	5289.74	7321.01	6390.22	296.48	301.63	138.09	65.96	1380.42	-6.22	1739.23	601.52	4220.63
5560.72	5503.64	7649.48	6647.39	296.48	296.56	111.13	643.43	1285.22	263.86	1717.66	604.59	4922.45
5660.96	5603.13	7808.07	6766.80	297.04	319.63	129.08	90.18	1398.20	8.99	1750.52	606.02	4302.62
5777.30	5718.54	7987.00	6905.48	297.04	305.40	110.46	749.03	1310.86	312.84	1720.88	607.67	5117.14
5760.67	5702.05	7961.38	6885.66	297.04	282.61	102.19	1434.09	1237.91	625.38	1684.81	607.44	5974.43
5744.05	5685.56	7935.79	6865.85	297.04	269.61	98.57	1815.60	1199.87	799.18	1664.48	607.20	6454.51
5777.30	5718.54	7987.00	6905.48	297.04	248.53	89.29	2524.99	1129.19	1123.14	1629.08	607.67	7351.89
5677.57	5619.62	7833.58	6786.60	297.04	275.37	101.79	1527.97	1218.48	667.78	1676.73	606.25	6074.37
5711.41	5653.25	7890.70	6826.84	297.59	308.96	117.93	524.32	1340.68	208.86	1729.98	606.73	4837.45
5777.91	5719.21	7993.11	6906.11	297.59	317.82	121.77	365.57	1374.61	136.26	1740.91	607.68	4664.61
5811.17	5752.21	8044.43	6945.75	297.59	326.82	140.39	146.97	1460.48	32.83	1753.99	608.15	4469.65

5711.41	5653.25	7890.70	6826.84	297.59	323.50	154.26	67.12	1499.09	-7.35	1754.44	606.73	4397.78
5445.70	5389.70	7483.80	6510.05	297.59	308.57	189.58	42.53	1584.94	-29.41	1745.98	602.95	4445.14
5263.28	5208.80	7206.62	6292.53	297.59	297.77	171.38	41.31	1489.04	-26.81	1738.16	600.35	4311.20
5130.74	5077.38	7006.35	6134.46	297.59	290.22	187.12	32.55	1524.84	-36.25	1733.75	598.46	4330.69
4931.62	4879.89	6702.78	5897.03	297.04	278.39	204.14	34.50	1553.81	-42.25	1726.20	595.63	4350.42
4700.26	4650.55	6358.12	5621.00	297.04	265.11	228.87	24.94	1606.08	-56.80	1718.26	592.33	4378.79
4452.75	4405.24	5992.59	5325.64	297.04	250.61	230.44	25.74	1571.13	-60.72	1708.46	588.80	4314.47
4222.09	4176.67	5654.95	5050.32	297.04	237.14	218.41	25.72	1489.61	-60.69	1698.92	585.51	4194.62
4057.54	4013.64	5415.84	4853.88	297.04	227.56	207.27	25.54	1422.16	-59.87	1692.02	583.17	4097.85
3926.45	3883.81	5229.99	4697.28	297.59	219.74	209.42	39.18	1407.89	-56.81	1686.26	581.30	4086.98
3843.89	3801.98	5107.59	4598.77	297.04	214.90	205.82	39.26	1381.29	-57.07	1682.88	580.12	4047.19
3795.03	3753.63	5040.92	4540.35	297.59	211.87	194.69	51.12	1332.33	-48.53	1679.93	579.42	4000.84
3762.19	3721.10	4993.82	4501.14	297.59	210.24	194.92	38.56	1328.29	-54.96	1679.27	578.95	3975.27
3729.36	3688.59	4946.80	4461.93	297.59	208.08	192.87	51.34	1314.95	-49.01	1677.27	578.49	3973.98
3712.95	3672.33	4923.31	4442.33	297.59	207.13	191.62	51.28	1307.73	-48.89	1676.57	578.25	3963.70
3663.72	3623.57	4852.95	4383.54	297.59	204.29	195.77	52.24	1314.71	-51.00	1674.77	577.55	3968.34
3647.32	3607.32	4829.54	4363.94	297.59	203.61	194.83	39.19	1309.11	-56.92	1674.73	577.31	3941.87
3598.11	3558.59	4759.39	4305.17	297.59	200.77	212.21	41.40	1364.15	-63.69	1673.42	576.61	4004.88
3532.53	3493.64	4666.10	4226.83	297.59	196.72	214.98	56.18	1362.93	-59.59	1670.27	575.68	4017.16
3467.34	3429.12	4576.78	4148.90	298.15	193.30	201.93	41.09	1305.33	-62.79	1667.91	574.75	3921.52
3385.06	3347.60	4457.20	4050.68	297.59	188.78	205.42	28.05	1305.02	-72.16	1665.51	573.57	3894.20
3303.55	3266.93	4345.28	3953.23	298.15	184.15	194.70	27.58	1252.64	-69.92	1661.89	572.41	3823.45
3238.08	3202.11	4253.17	3875.01	298.15	180.62	180.02	13.35	1188.99	-71.73	1659.37	571.47	3722.11
3172.64	3137.32	4161.33	3796.82	298.15	176.40	188.94	41.59	1209.76	-64.40	1655.88	570.54	3778.71
3123.58	3088.74	4092.63	3738.20	298.15	174.07	189.83	14.03	1205.83	-78.66	1655.37	569.84	3730.31
3090.88	3056.37	4046.92	3699.13	298.15	172.21	195.86	14.38	1222.42	-82.14	1654.39	569.37	3746.50
3025.51	2991.65	3955.70	3621.00	298.15	168.23	189.34	28.53	1187.52	-74.59	1650.87	568.44	3718.35
3008.85	2975.11	3929.73	3601.14	297.59	167.24	203.15	29.84	1235.03	-80.90	1650.85	568.20	3773.42
2992.51	2958.94	3907.00	3581.62	297.59	166.55	205.48	15.08	1241.26	-89.23	1651.06	567.97	3758.16
2943.51	2910.44	3838.93	3523.06	297.59	163.77	214.17	15.62	1264.83	-94.72	1649.61	567.27	3780.55
2910.85	2878.11	3793.63	3484.03	297.59	161.90	208.15	15.45	1237.59	-93.05	1648.08	566.80	3744.93

SUMS						
37402	4844	32557.84	113881	4844	356.33	22.34
Total Loss	**Chemical Loss 1**	**Sensible and Latent Loss**	**Total Output**	**Chem Loss 2**	**Grams Produced CO**	**HC**
0	0	0.00	0	0	0.00	0.00
1905	-10	1914.52	4383	-10	2.43	-0.61
1056	1	1055.33	2643	1	1.64	-0.29
1136	3	1132.91	3302	3	1.59	-0.23
1315	5	1310.52	4233	5	1.87	-0.25
1192	25	1167.23	4356	25	2.55	-0.02
1269	26	1243.02	4280	26	2.89	-0.07
1223	21	1202.95	4325	21	2.31	-0.05
1261	17	1243.40	4657	17	1.91	-0.03
1654	300	1354.38	5004	300	20.98	1.58
1366	31	1334.83	4922	31	2.78	0.05
1624	331	1292.86	4664	331	23.05	1.77
2119	719	1400.99	4908	719	49.33	3.95
2410	960	1450.01	4987	960	65.75	5.32
2745	1340	1405.70	4652	1340	91.43	7.47
2042	726	1315.62	4616	726	49.81	4.00
1445	215	1229.78	4473	215	15.19	1.11
1219	129	1090.39	3959	129	9.27	0.63
1001	40	961.91	3437	40	3.19	0.13

903	12	891.23	3165	12	1.34	-0.03
747	2	744.87	2582	2	0.69	-0.09
644	2	641.89	2315	2	0.60	-0.07
647	-1	647.49	2312	-1	0.47	-0.10
406	-1	406.90	1443	-1	0.31	-0.07
327	-2	329.42	1153	-2	0.18	-0.08
403	-3	406.06	1447	-3	0.23	-0.10
313	-3	315.89	1166	-3	0.19	-0.08
306	-3	308.62	1173	-3	0.19	-0.08
229	-1	229.93	881	-1	0.21	-0.06
227	-1	227.71	883	-1	0.21	-0.06
299	0	298.64	1181	0	0.37	-0.06
223	-1	223.60	887	-1	0.21	-0.06
223	0	222.49	887	0	0.28	-0.05
222	0	221.91	888	0	0.28	-0.05
222	0	222.24	887	0	0.29	-0.05
294	-1	295.74	1185	-1	0.29	-0.08
224	-1	225.59	885	-1	0.23	-0.06
225	0	225.23	885	0	0.31	-0.06
220	-1	220.89	890	-1	0.22	-0.06
218	-2	220.60	892	-2	0.15	-0.07
214	-2	216.54	895	-2	0.15	-0.07
208	-3	211.75	901	-3	0.07	-0.07
212	-1	212.95	898	-1	0.23	-0.06
139	-2	141.71	600	-2	0.05	-0.05
210	-4	213.64	900	-4	0.08	-0.08
208	-3	210.86	901	-3	0.16	-0.07
141	-2	142.82	599	-2	0.11	-0.05
211	-4	214.65	899	-4	0.08	-0.09
282	-6	288.25	1197	-6	0.11	-0.13
70	-1	71.37	300	-1	0.03	-0.03

Dirigo Laboratories, Inc.

Manufacturer:	**IHP**
Model:	**Montecito Estate**
Date:	**6/26/2016**
Run:	**1**
Control #:	**036-S-063-1**
Test Duration:	**490**
Output Category:	**2**

	HHV Basis	LHV Basis
Overall Efficiency	75.2%	81.3%
Combustion Efficiency	96.8%	96.8%
Heat Transfer Efficiency	77.7%	84.0%

HHV Output Rate (kJ/h)	13,899	13,185	**(Btu/h)**
Burn Rate (kg/h)	0.93	2.06	**(lb/h)**
Input (kJ/h)	18,479	17,529	**(Btu/h)**

Test Load Weight (dry kg)	7.6	16.8	**dry lb**
MC wet (%)	17.70		
MC dry (%)	21.50		
Particulate (g)	5.10		
CO (g)	356		
Test Duration (h)	8.166666667		

Emissions	Particulate	CO
g/MJ Output	0.04	3.14
g/kg Dry Fuel	0.67	46.77
g/h	0.62	43.63
lb/MM Btu Output	0.10	7.30

Air/Fuel Ratio (A/F)	11.17

Test Results in Accordance with CSA B415.1-10

Technician: ______________________________

Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

VERSION: 2.4 4/15/2010

lanufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 2
Control #: 036-S-063-1
est Duration: 440
urn Category 2

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY): 20.5
Wood Moisture (% wet): 17.01
Load Weight (lb wet): 19.60
Burn Rate (dry kg/h): 1.01
Total Particulate Emissions: 8.74 g

Fuel Data

	D. Fir
HHV	19,810 kJ/kg
%C	48.73
%H	6.87
%O	43.90
%Ash	0.50

(●) Douglas Fir
( ) Oak

Elapsed Time (min)	Fuel Weight Remaining (lb)	Temp. (F) Flue Gas	Room Temp	Flue Gas Composition (%) O2	CO2	CO
	Averages	**367.0**	**77.4**	**10.35**	**9.63**	**0.66**
0	19.6	402.0	75.0	15.24	5.57	0.06
10	18.7	437.0	75.0	12.08	8.17	0.08
20	18.0	439.0	74.0	11.33	9.21	0.09
30	17.0	465.0	74.0	9.48	11.24	0.10
40	16.1	448.0	74.0	8.36	12.36	0.10
50	14.9	453.0	75.0	7.41	11.87	3.90
60	13.6	452.0	75.0	7.37	11.90	4.07
70	12.5	452.0	75.0	7.66	12.06	2.75
80	11.3	462.0	75.0	7.22	11.42	5.00
90	10.0	462.0	76.0	7.14	11.38	5.00
100	8.8	455.0	76.0	7.47	11.68	3.85
110	8.1	448.0	76.0	8.12	12.25	0.75
120	7.4	446.0	76.0	8.19	12.23	0.18
130	6.8	444.0	76.0	8.21	12.25	0.12
140	6.2	442.0	77.0	8.06	12.36	0.45
150	5.6	440.0	77.0	7.98	12.25	0.92
160	5.0	439.0	77.0	7.96	12.15	0.90
170	4.4	435.0	77.0	8.10	11.98	0.50
180	4.0	426.0	77.0	9.33	10.70	0.10
190	3.8	405.0	77.0	10.52	9.52	0.08
200	3.5	385.0	77.0	10.49	9.56	0.06
210	3.3	370.0	78.0	10.51	9.51	0.06
220	3.2	359.0	78.0	10.51	9.51	0.06
230	3.0	350.0	78.0	10.74	9.28	0.05
240	2.8	343.0	78.0	10.72	9.25	0.05
250	2.6	337.0	78.0	10.82	9.13	0.05
260	2.5	330.0	78.0	11.00	8.96	0.05
270	2.3	323.0	78.0	11.33	8.85	0.02
280	2.1	311.0	78.0	11.18	8.85	0.02
290	1.9	305.0	78.0	11.06	8.88	0.03
300	1.8	302.0	78.0	11.38	8.72	0.03
310	1.7	298.0	78.0	11.59	8.34	0.01
320	1.5	294.0	79.0	11.32	8.58	0.02
330	1.4	291.0	79.0	11.26	8.68	0.03
340	1.2	289.0	80.0	11.37	8.50	0.03
350	1.1	287.0	79.0	11.83	8.02	0.03
360	1.0	285.0	79.0	11.97	7.90	0.03
370	0.8	283.0	79.0	12.21	7.71	0.03
380	0.7	281.0	80.0	12.24	7.63	0.03
390	0.6	279.0	80.0	12.28	7.65	0.02
400	0.5	277.0	80.0	12.40	7.51	0.04
410	0.4	275.0	80.0	12.14	8.13	0.02
420	0.2	272.0	80.0	12.46	7.56	0.04
430	0.1	271.0	80.0	12.88	7.15	0.02
440	0.0	268.0	80.0	12.95	7.07	0.03

Manufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 2
Control #: 036-S-063-1
Test Duration: 440 min

	HHV	LHV
Eff	70.2%	75.8%
Comb Eff	91.6%	91.6%
HT Eff	76.6%	82.8%
Output	13,987	kJ/h
Burn Rate	1.01	kg/h
Grams CO	858	g
Input	19,936	kJ/h
MC wet	17.01	

Ultimate CO2
CO2-ult 19.64
F_0 1.062

Overall Heating Efficiency:	70.2%				
Combustion Efficiency:	91.6%				
Heat Transfer Efficiency:	76.6%				
Heat Output:	13,268	Btu/h	13,987	kJ/h	
Heat Input:	18,912	Btu/h	19,936	kJ/h	
Burn Duration:	7.333333333	h			
Burn Rate:	2.2	lb/h	1.0	kg/h	
Stack Temp:	366.3	Deg. F	185.7	Deg. C	

Air Fuel Ratio (A/F)		
Dry Molecular Weight (Md)	29.95	
Dry Moles Exhaust Gas (Nr):	380.26	%HC
Air Fuel Ratio (A/F)	10.88	0.88

	INPUT DATA			Oxygen Calculation			Input Data		Combust	Heat	Net	Air	Wet Wt	% Wet	Dry Wt.	% Dry	Fuel Properties		
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO2 [d]	Excess Air EA	Total O2	Calc. % O2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %	Fuel Ratio	Now Wt	Consumed x	Now Wtdn	Comsumed y	Total Input	Carbon /12= [a]	Hydrogen /1= [b]
Averages		0.66	9.63	104.1%	20.26	10.30	186.1	25.2	96.7%	77.9%	75.4%	12.3	2.54	71.43	0.10	71.43	146571	4.06	6.87
0	8.89	0.06	5.57	248.9%	20.57	14.97	205.6	23.9	99.9%	68.3%	68.2%	21.1	8.89	0.00	7.38	0.00	0	4.06	6.87
10	8.48	0.08	8.17	138.1%	20.40	12.19	225.0	23.9	99.6%	72.9%	72.6%	14.4	8.48	4.59	7.04	4.59	9324	4.06	6.87
20	8.17	0.09	9.21	111.2%	20.33	11.07	226.1	23.3	99.5%	74.4%	74.0%	12.8	8.17	8.16	6.78	8.16	6340	4.06	6.87
30	7.71	0.10	11.24	73.2%	20.19	8.90	240.6	23.3	99.5%	75.8%	75.4%	10.5	7.71	13.27	6.40	13.27	7086	4.06	6.87
40	7.30	0.10	12.36	57.6%	20.12	7.71	231.1	23.3	99.5%	77.5%	77.1%	9.5	7.30	17.86	6.06	17.86	7832	4.06	6.87
50	6.76	3.90	11.87	24.6%	19.90	6.08	233.9	23.9	79.8%	75.7%	60.4%	7.1	6.76	23.98	5.61	23.98	9324	4.06	6.87
60	6.17	4.07	11.90	23.0%	19.89	5.95	233.3	23.9	79.2%	75.8%	60.0%	7.0	6.17	30.61	5.12	30.61	8951	4.06	6.87
70	5.67	2.75	12.06	32.6%	19.96	6.53	233.3	23.9	84.7%	76.3%	64.6%	7.7	5.67	36.22	4.71	36.22	8578	4.06	6.87
80	5.13	5.00	11.42	19.6%	19.86	5.94	238.9	23.9	75.3%	74.7%	56.3%	6.7	5.13	42.35	4.25	42.35	9324	4.06	6.87
90	4.54	5.00	11.38	19.9%	19.86	5.98	238.9	24.4	75.2%	74.7%	56.2%	6.8	4.54	48.98	3.77	48.98	9324	4.06	6.87
100	3.99	3.85	11.68	26.5%	19.91	6.31	235.0	24.4	79.8%	75.5%	60.3%	7.2	3.99	55.10	3.31	55.10	7086	4.06	6.87
110	3.68	0.75	12.25	51.1%	20.08	7.46	231.1	24.4	95.3%	77.2%	73.6%	9.0	3.68	58.67	3.05	58.67	5221	4.06	6.87
120	3.36	0.18	12.23	58.3%	20.12	7.80	230.0	24.4	99.0%	77.5%	76.7%	9.6	3.36	62.24	2.79	62.24	4848	4.06	6.87
130	3.09	0.12	12.25	58.8%	20.12	7.81	228.9	24.4	99.4%	77.6%	77.1%	9.6	3.09	65.31	2.56	65.31	4475	4.06	6.87
140	2.81	0.45	12.36	53.3%	20.09	7.51	227.8	25.0	97.2%	77.6%	75.5%	9.2	2.81	68.37	2.33	68.37	4475	4.06	6.87
150	2.54	0.92	12.25	49.1%	20.07	7.36	226.7	25.0	94.3%	77.5%	73.0%	8.9	2.54	71.43	2.11	71.43	4475	4.06	6.87
160	2.27	0.90	12.15	50.5%	20.08	7.48	226.1	25.0	94.4%	77.4%	73.1%	9.0	2.27	74.49	1.88	74.49	4475	4.06	6.87
170	2.00	0.50	11.98	57.4%	20.12	7.89	223.9	25.0	96.8%	77.6%	75.1%	9.5	2.00	77.55	1.66	77.55	3730	4.06	6.87
180	1.81	0.10	10.70	81.9%	20.23	9.48	218.9	25.0	99.5%	76.8%	76.4%	11.0	1.81	79.59	1.51	79.59	2238	4.06	6.87
190	1.72	0.08	9.52	104.6%	20.31	10.75	207.2	25.0	99.6%	76.4%	76.1%	12.4	1.72	80.61	1.43	80.61	1865	4.06	6.87
200	1.59	0.06	9.56	104.2%	20.30	10.71	196.1	25.0	99.8%	77.3%	77.1%	12.3	1.59	82.14	1.32	82.14	1865	4.06	6.87
210	1.50	0.06	9.51	105.3%	20.31	10.77	187.8	25.6	99.8%	77.9%	77.7%	12.4	1.50	83.16	1.24	83.16	1119	4.06	6.87
220	1.45	0.06	9.51	105.3%	20.31	10.77	181.7	25.6	99.8%	78.3%	78.2%	12.4	1.45	83.67	1.20	83.67	1119	4.06	6.87
230	1.36	0.05	9.28	110.5%	20.32	11.02	176.7	25.6	99.9%	78.5%	78.4%	12.7	1.36	84.69	1.13	84.69	1492	4.06	6.87
240	1.27	0.05	9.25	111.2%	20.33	11.05	172.8	25.6	99.9%	78.7%	78.7%	12.8	1.27	85.71	1.05	85.71	1492	4.06	6.87
250	1.18	0.05	9.13	114.0%	20.33	11.18	169.4	25.6	99.9%	78.9%	78.8%	12.9	1.18	86.73	0.98	86.73	1119	4.06	6.87
260	1.13	0.05	8.96	118.0%	20.35	11.36	165.6	25.6	99.9%	79.0%	78.9%	13.2	1.13	87.24	0.94	87.24	1119	4.06	6.87
270	1.04	0.02	8.85	121.5%	20.35	11.49	161.7	25.6	100.2%	79.2%	79.4%	13.4	1.04	88.27	0.87	88.27	1492	4.06	6.87
280	0.95	0.02	8.85	121.5%	20.35	11.49	155.0	25.6	100.2%	79.7%	79.9%	13.4	0.95	89.29	0.79	89.29	1492	4.06	6.87
290	0.86	0.03	8.88	120.5%	20.35	11.46	151.7	25.6	100.1%	80.0%	80.1%	13.3	0.86	90.31	0.72	90.31	1119	4.06	6.87
300	0.82	0.03	8.72	124.5%	20.36	11.63	150.0	25.6	100.1%	80.0%	80.1%	13.6	0.82	90.82	0.68	90.82	746	4.06	6.87
310	0.77	0.01	8.34	135.2%	20.39	12.04	147.8	25.6	100.3%	79.8%	80.1%	14.2	0.77	91.33	0.64	91.33	1119	4.06	6.87
320	0.68	0.02	8.58	128.4%	20.37	11.78	145.6	26.1	100.2%	80.3%	80.4%	13.8	0.68	92.35	0.56	92.35	1119	4.06	6.87

330	0.64	0.03	8.68	125.5%	20.36	11.67	143.9	26.1	100.1%	80.5%	80.6%	13.6	0.64	92.86	0.53	92.86	1119	4.06	6.87
340	0.54	0.03	8.50	130.3%	20.38	11.86	142.8	26.7	100.1%	80.5%	80.5%	13.9	0.54	93.88	0.45	93.88	1119	4.06	6.87
350	0.50	0.03	8.02	144.0%	20.41	12.37	141.7	26.1	100.1%	80.0%	80.1%	14.7	0.50	94.39	0.41	94.39	746	4.06	6.87
360	0.45	0.03	7.90	147.7%	20.42	12.50	140.6	26.1	100.1%	80.0%	80.1%	15.0	0.45	94.90	0.38	94.90	1119	4.06	6.87
370	0.36	0.03	7.71	153.8%	20.43	12.70	139.4	26.1	100.2%	79.9%	80.0%	15.3	0.36	95.92	0.30	95.92	1119	4.06	6.87
380	0.32	0.03	7.63	156.4%	20.43	12.79	138.3	26.7	100.2%	79.9%	80.1%	15.5	0.32	96.43	0.26	96.43	746	4.06	6.87
390	0.27	0.02	7.65	156.1%	20.43	12.77	137.2	26.7	100.3%	80.1%	80.3%	15.5	0.27	96.94	0.23	96.94	746	4.06	6.87
400	0.23	0.04	7.51	160.2%	20.44	12.91	136.1	26.7	100.1%	80.0%	80.0%	15.7	0.23	97.45	0.19	97.45	746	4.06	6.87
410	0.18	0.02	8.13	141.0%	20.40	12.26	135.0	26.7	100.2%	80.7%	80.9%	14.6	0.18	97.96	0.15	97.96	1119	4.06	6.87
420	0.09	0.04	7.56	158.5%	20.44	12.86	133.3	26.7	100.1%	80.3%	80.3%	15.6	0.09	98.98	0.08	98.98	1119	4.06	6.87
430	0.05	0.02	7.15	174.0%	20.47	13.31	132.8	26.7	100.3%	79.9%	80.1%	16.6	0.05	99.49	0.04	99.49	1119	4.06	6.87
440	0.00	0.03	7.07	176.7%	20.47	13.39	131.1	26.7	100.2%	79.9%	80.1%	16.7	0.00	100.00	0.00	100.00	373	4.06	6.87
0															0.00				
0															0.00				

Moisture Content MCwb: 17.01

Combustion Efficiency:	91.6%			Moisture of Wood (wet basis):	17.01	Dry kg :	7.38
Total Input (kJ):	146,198	138,662	(Btu)	Initial Dry Weight Wtdo (kg):	7.38	CA:	48.73
Total Output (kJ):	102,568	97,281	(Btu)	Moisture Content Dry	20.50	HY:	6.87
Efficiency:	70.2%					OX:	43.90
Total CO (g):	858.47						

Load Weight (kg):	8.89					
Fuel Heating:	HHV	LHV			HHV	LHV
Value in kJ/kg - CV:	19810.00	18328.69		Btu/lb	8522.48	7885.21

2.74	19810.00	17.01	79.41	21.06	2.56	8.62	0.08	0.25	38.86	46.17	1.77	0.18	336.32	34.16	11.39	459.29	6544.38	4865.20	4716.32
		Mw	Mass Balance (moles/100 mole dry flue gas)					kg Wood per 100 mole dfp	Moles per kg of Dry Wood							Stack	Heat Content Change - Ambie Flue Gas Cor		
Oxygen	Calorific	Moisture													Moisture	Temp			
/16= [c]	Value	Fuel Burnt	[h]	[u]	[w]	[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O	Present	K	CO2	O2	CO
2.74	19810.00	17.01	79.40	21.06	1.38	4.78	-0.02	0.14	40.49	108.80	0.44	-0.11	577.16	34.75	11.39	478.71	7409.87	5499.57	5329.03
2.74	19810.00	17.01	79.56	21.10	2.03	6.99	-0.01	0.20	40.46	60.34	0.40	-0.04	393.98	34.60	11.39	498.15	8259.68	6105.80	5910.36
2.74	19810.00	17.01	79.63	21.12	2.29	7.87	0.00	0.23	40.44	48.61	0.40	-0.02	349.62	34.56	11.39	499.26	8329.77	6156.91	5959.66
2.74	19810.00	17.01	79.76	21.16	2.79	9.59	0.00	0.28	40.45	32.03	0.36	0.00	287.04	34.52	11.39	513.71	8968.61	6609.61	6392.96
2.74	19810.00	17.01	79.83	21.18	3.07	10.54	0.00	0.31	40.48	25.24	0.33	0.01	261.44	34.51	11.39	504.26	8550.22	6313.40	6109.52
2.74	19810.00	17.01	78.15	20.73	4.02	12.69	0.56	0.40	29.67	15.19	9.75	1.40	195.33	31.73	11.39	507.04	8651.82	6384.07	6176.82
2.74	19810.00	17.01	78.08	20.71	4.08	12.84	0.58	0.41	29.34	14.67	10.03	1.44	192.50	31.64	11.39	506.48	8627.24	6366.66	6160.15
2.74	19810.00	17.01	78.66	20.87	3.74	12.08	0.39	0.37	32.38	17.53	7.38	1.05	211.21	32.43	11.39	506.48	8627.24	6366.66	6160.15
2.74	19810.00	17.01	77.64	20.60	4.22	13.06	0.72	0.42	27.19	14.13	11.91	1.71	184.89	31.10	11.39	512.04	8873.40	6540.91	6326.89
2.74	19810.00	17.01	77.64	20.59	4.21	13.03	0.72	0.42	27.16	14.27	11.93	1.72	185.31	31.09	11.39	512.04	8852.20	6524.55	6310.88
2.74	19810.00	17.01	78.16	20.73	3.96	12.50	0.55	0.39	29.64	16.01	9.77	1.40	198.36	31.73	11.39	508.15	8679.79	6402.54	6194.14
2.74	19810.00	17.01	79.54	21.10	3.23	10.88	0.10	0.32	38.17	23.24	2.34	0.30	247.86	33.92	11.39	504.26	8507.83	6280.67	6077.49
2.74	19810.00	17.01	79.79	21.16	3.06	10.48	0.01	0.30	40.18	25.63	0.59	0.04	262.11	34.43	11.39	503.15	8458.77	6245.88	6044.17
2.74	19810.00	17.01	79.82	21.17	3.05	10.46	0.00	0.30	40.40	25.77	0.40	0.02	263.24	34.49	11.39	502.04	8409.76	6211.09	6010.87
2.74	19810.00	17.01	79.68	21.14	3.17	10.77	0.05	0.32	39.21	23.82	1.43	0.17	252.81	34.18	11.39	500.93	8339.57	6159.95	5961.55
2.74	19810.00	17.01	79.47	21.08	3.27	11.00	0.12	0.33	37.61	22.60	2.82	0.38	244.00	33.77	11.39	499.82	8290.62	6125.19	5928.26
2.74	19810.00	17.01	79.47	21.08	3.24	10.90	0.12	0.32	37.65	23.18	2.79	0.37	246.29	33.78	11.39	499.26	8266.16	6107.81	5911.61
2.74	19810.00	17.01	79.63	21.12	3.09	10.49	0.06	0.31	38.99	25.67	1.63	0.20	259.17	34.13	11.39	497.04	8168.41	6038.34	5845.05
2.74	19810.00	17.01	79.72	21.15	2.66	9.14	0.00	0.26	40.44	35.81	0.38	0.00	301.29	34.53	11.39	492.04	7949.01	5882.17	5695.39
2.74	19810.00	17.01	79.65	21.13	2.36	8.13	-0.01	0.24	40.50	45.71	0.34	-0.02	338.83	34.57	11.39	480.37	7439.87	5518.66	5346.74
2.74	19810.00	17.01	79.67	21.13	2.37	8.15	-0.01	0.24	40.59	45.50	0.25	-0.04	338.27	34.59	11.39	469.26	6958.65	5173.60	5015.40
2.74	19810.00	17.01	79.66	21.13	2.35	8.11	-0.01	0.23	40.59	45.96	0.26	-0.04	340.03	34.60	11.39	460.93	6578.87	4899.17	4751.32
2.74	19810.00	17.01	79.66	21.13	2.35	8.11	-0.01	0.23	40.59	45.96	0.26	-0.04	340.03	34.60	11.39	454.82	6317.20	4710.32	4569.66
2.74	19810.00	17.01	79.65	21.13	2.29	7.90	-0.01	0.23	40.64	48.25	0.22	-0.05	348.81	34.61	11.39	449.82	6103.92	4556.05	4421.19
2.74	19810.00	17.01	79.65	21.13	2.29	7.88	-0.01	0.23	40.64	48.55	0.22	-0.05	349.93	34.61	11.39	445.93	5938.53	4436.23	4305.80
2.74	19810.00	17.01	79.64	21.12	2.26	7.78	-0.01	0.22	40.64	49.76	0.22	-0.05	354.48	34.62	11.39	442.59	5797.12	4333.62	4206.97
2.74	19810.00	17.01	79.63	21.12	2.22	7.63	-0.01	0.22	40.64	51.52	0.23	-0.05	361.14	34.62	11.39	438.71	5632.54	4214.05	4091.75
2.74	19810.00	17.01	79.64	21.12	2.18	7.52	-0.02	0.22	40.79	52.98	0.09	-0.07	367.06	34.67	11.39	434.82	5468.41	4094.61	3976.60
2.74	19810.00	17.01	79.64	21.12	2.18	7.52	-0.02	0.22	40.79	52.98	0.09	-0.07	367.06	34.67	11.39	428.15	5188.06	3890.17	3779.41
2.74	19810.00	17.01	79.63	21.12	2.19	7.55	-0.01	0.22	40.74	52.56	0.14	-0.06	365.34	34.65	11.39	424.82	5048.36	3788.11	3680.91
2.74	19810.00	17.01	79.62	21.12	2.15	7.42	-0.01	0.21	40.74	54.32	0.14	-0.07	371.99	34.66	11.39	423.15	4978.64	3737.11	3631.69
2.74	19810.00	17.01	79.61	21.12	2.05	7.08	-0.02	0.20	40.85	58.99	0.05	-0.09	389.93	34.70	11.39	420.93	4885.79	3669.15	3566.07
2.74	19810.00	17.01	79.62	21.12	2.11	7.29	-0.02	0.21	40.79	56.02	0.10	-0.08	378.54	34.68	11.39	418.71	4771.87	3584.87	3484.47

2.74	19810.00	17.01	79.62	21.12	2.14	7.38	-0.01	0.21	40.74	54.77	0.14	-0.07	373.69	34.66	11.39	417.04	4702.44	3533.96	3435.30
2.74	19810.00	17.01	79.61	21.12	2.10	7.23	-0.01	0.21	40.74	56.85	0.14	-0.07	381.55	34.66	11.39	415.93	4634.96	3483.66	3386.51
2.74	19810.00	17.01	79.58	21.11	1.98	6.83	-0.02	0.20	40.74	62.85	0.15	-0.08	404.22	34.68	11.39	414.82	4609.99	3466.13	3369.76
2.74	19810.00	17.01	79.57	21.11	1.95	6.73	-0.02	0.19	40.74	64.47	0.15	-0.08	410.32	34.68	11.39	413.71	4563.82	3432.23	3337.01
2.74	19810.00	17.01	79.56	21.10	1.90	6.57	-0.02	0.19	40.74	67.13	0.16	-0.08	420.37	34.69	11.39	412.59	4517.68	3398.34	3304.26
2.74	19810.00	17.01	79.55	21.10	1.88	6.50	-0.02	0.19	40.74	68.29	0.16	-0.09	424.74	34.70	11.39	411.48	4450.35	3348.08	3255.49
2.74	19810.00	17.01	79.56	21.10	1.88	6.51	-0.02	0.19	40.80	68.13	0.11	-0.09	424.30	34.71	11.39	410.37	4404.28	3314.22	3222.75
2.74	19810.00	17.01	79.54	21.10	1.86	6.40	-0.01	0.18	40.68	69.93	0.22	-0.08	430.81	34.68	11.39	409.26	4358.26	3280.36	3190.02
2.74	19810.00	17.01	79.59	21.11	2.00	6.91	-0.02	0.20	40.80	61.53	0.10	-0.08	399.37	34.69	11.39	408.15	4312.26	3246.52	3157.30
2.74	19810.00	17.01	79.54	21.10	1.87	6.45	-0.01	0.19	40.68	69.18	0.22	-0.08	427.98	34.68	11.39	406.48	4243.34	3195.77	3108.23
2.74	19810.00	17.01	79.52	21.09	1.76	6.09	-0.02	0.18	40.80	75.94	0.11	-0.11	453.83	34.73	11.39	405.93	4220.39	3178.86	3091.87
2.74	19810.00	17.01	79.51	21.09	1.74	6.03	-0.02	0.17	40.74	77.13	0.17	-0.10	458.17	34.72	11.39	404.26	4151.58	3128.15	3042.82

				SUMS							AVERAGE	SUMS						
4667.14	6431.18	5639.15	298.38	11267.33	9171.54	22979.03	66940.32	7418.24	76208.67	25424.38	4875.77	43630	12323	31307.74	102941	12323	858.47	65.54
ent to Stack Temperature			Room	Energy Losses (kJ/kg of Dry Fuel)							Total							
nstituent			Temp	Flue Gas Constituent							Loss	Total	Chemical	Sensible and	Total	Chem	Grams Produced	
N2	CH4	H2O	K	CO2	O2	CO	N2	CH4	H2O Comb	H2O Fuel MC	Rate	Loss	Loss 1	Latent Loss	Output	Loss 2	CO	HC
5273.93	7301.52	6371.03	297.04	300.01	598.37	125.72	3043.92	-100.04	1749.09	573.32	6290.39	0	0	0.00	0	0	0.00	0.00
5850.54	8192.52	7064.09	297.04	334.15	368.41	114.45	2305.01	-35.33	1765.81	581.21	5433.71	2557	36	2521.17	6766	36	5.22	-0.30
5899.37	8263.57	7122.95	296.48	336.84	299.28	114.18	2062.56	-18.51	1765.93	581.89	5142.16	1646	30	1615.84	4694	30	3.54	-0.11
6329.33	8940.06	7639.28	296.48	362.79	211.74	104.15	1816.79	0.83	1781.56	587.77	4865.62	1740	37	1703.73	5346	37	3.60	0.01
6048.06	8496.42	7301.54	296.48	346.09	159.35	94.68	1581.23	6.41	1769.26	583.92	4540.94	1795	39	1756.15	6037	39	3.63	0.05
6114.91	8606.89	7381.63	297.04	256.68	97.00	2818.76	1194.45	1255.10	1629.34	584.83	7836.15	3688	1883	1804.78	5636	1883	128.46	10.52
6098.38	8580.86	7361.77	297.04	253.11	93.40	2901.48	1173.95	1293.37	1624.33	584.61	7924.25	3580	1862	1718.60	5370	1862	126.95	10.40
6098.38	8580.86	7361.77	297.04	279.36	111.58	2135.00	1288.02	941.97	1664.47	584.61	7005.01	3033	1309	1724.47	5545	1309	89.52	7.26
6263.84	8841.91	7560.45	297.04	241.30	92.45	3444.67	1158.11	1539.80	1602.41	586.87	8665.61	4079	2303	1775.17	5245	2303	156.91	12.90
6248.02	8822.40	7541.25	297.59	240.44	93.10	3452.55	1157.85	1543.23	1601.42	586.65	8675.24	4083	2309	1774.37	5241	2309	157.27	12.93
6132.18	8639.48	7402.16	297.59	257.29	102.53	2825.64	1216.41	1257.00	1629.78	585.07	7873.71	2816	1434	1382.06	4270	1434	97.86	8.00
6016.43	8457.41	7263.15	297.59	324.76	145.93	675.58	1491.26	272.54	1737.59	583.48	5231.14	1379	245	1133.31	3843	245	17.25	1.28
5983.37	8405.55	7223.45	297.59	339.84	160.05	170.91	1568.31	40.41	1762.69	583.03	4625.25	1132	51	1081.26	3716	51	4.05	0.18
5950.33	8353.75	7183.76	297.59	339.76	160.05	114.38	1566.34	14.58	1764.27	582.58	4541.94	1026	29	997.54	3449	29	2.50	0.06
5901.47	8282.49	7124.88	298.15	327.04	146.76	412.55	1491.92	152.54	1746.54	581.91	4859.26	1098	125	972.37	3378	125	9.03	0.61
5868.44	8230.84	7085.20	298.15	311.83	138.42	816.13	1431.91	337.26	1724.19	581.46	5341.20	1207	256	950.59	3269	256	17.87	1.36
5851.93	8205.03	7065.36	298.15	311.25	141.55	805.81	1441.27	331.75	1724.15	581.23	5337.01	1206	253	953.15	3270	253	17.64	1.33
5785.89	8102.00	6986.03	298.15	318.48	154.97	470.02	1499.54	175.98	1739.14	580.33	4938.45	930	120	810.21	2800	120	8.58	0.59
5637.43	7871.17	6807.64	298.15	321.43	210.67	109.10	1698.48	-2.27	1753.20	578.29	4668.90	527	12	515.57	1710	12	1.20	0.00
5291.63	7338.02	6391.95	298.15	301.29	252.27	98.12	1792.96	-21.48	1741.00	573.56	4737.72	446	7	438.92	1419	7	0.90	-0.04
4963.07	6837.35	5996.78	298.15	282.48	235.38	73.38	1678.88	-32.35	1728.55	569.06	4535.39	427	4	423.16	1438	4	0.67	-0.05
4701.34	6446.83	5681.66	298.71	267.06	225.18	73.69	1598.61	-32.83	1717.71	565.47	4414.88	249	2	247.10	870	2	0.41	-0.03
4521.28	6177.26	5464.91	298.71	256.43	216.50	73.65	1537.38	-32.82	1710.21	563.00	4324.35	244	2	241.99	875	2	0.41	-0.03
4374.13	5958.25	5287.72	298.71	248.06	219.85	62.93	1525.74	-40.97	1704.97	560.98	4281.57	322	2	320.83	1169	2	0.46	-0.06
4259.78	5788.89	5150.01	298.71	241.33	215.38	63.11	1490.62	-41.30	1700.24	559.42	4228.81	318	2	316.86	1173	2	0.46	-0.06
4161.85	5644.39	5032.04	298.71	235.58	215.63	63.92	1475.30	-42.65	1696.31	558.07	4202.15	237	1	236.17	882	1	0.35	-0.04
4047.68	5476.59	4894.49	298.71	228.88	217.11	65.10	1461.77	-44.63	1691.77	556.51	4176.50	236	1	234.77	883	1	0.36	-0.05
3933.60	5309.64	4757.02	298.71	223.07	216.93	26.45	1443.88	-64.30	1689.15	554.94	4090.12	308	-3	310.86	1184	-3	0.19	-0.09
3738.26	5025.42	4521.56	298.71	211.63	206.10	26.44	1372.17	-64.27	1680.98	552.26	3985.31	300	-3	302.97	1192	-3	0.19	-0.09
3640.69	4884.24	4403.93	298.71	205.67	199.10	39.46	1330.08	-57.73	1676.20	550.92	3943.70	223	-1	223.78	896	-1	0.22	-0.06
3591.93	4813.88	4345.14	298.71	202.83	203.01	40.17	1336.17	-59.93	1674.40	550.25	3946.89	149	-1	149.36	597	-1	0.15	-0.04
3526.95	4720.31	4266.77	298.71	199.59	216.45	14.04	1375.26	-78.54	1673.69	549.36	3949.85	223	-4	226.72	896	-4	0.08	-0.08
3446.17	4607.46	4169.23	299.26	194.66	200.82	27.24	1304.52	-68.24	1669.20	548.25	3876.45	219	-2	221.26	900	-2	0.15	-0.07

3397.48	4537.67	4110.50	299.26	191.57	193.56	40.33	1269.62	-60.48	1666.33	547.58	3848.51	217	-1	218.51	902	-1	0.22	-0.06
3349.20	4471.65	4052.15	299.82	188.82	198.05	41.18	1277.89	-63.08	1664.59	546.91	3854.36	218	-1	218.94	901	-1	0.23	-0.06
3332.58	4444.86	4032.21	299.26	187.81	217.86	43.64	1347.10	-70.59	1664.70	546.68	3937.20	148	-1	149.27	598	-1	0.16	-0.05
3300.14	4398.57	3993.08	299.26	185.92	221.27	44.30	1354.12	-72.61	1663.56	546.24	3942.80	223	-2	224.30	896	-2	0.24	-0.07
3267.71	4352.33	3953.95	299.26	184.04	228.12	45.38	1373.63	-75.94	1662.56	545.79	3963.60	224	-2	225.60	895	-2	0.25	-0.08
3219.47	4286.59	3895.63	299.82	181.30	228.62	45.85	1367.45	-77.38	1660.69	545.13	3951.67	149	-1	149.99	597	-1	0.17	-0.05
3187.05	4240.50	3856.51	299.82	179.69	225.78	30.53	1352.26	-84.12	1660.06	544.68	3908.89	147	-2	149.20	599	-2	0.11	-0.06
3154.64	4194.48	3817.41	299.82	177.28	229.41	62.00	1359.04	-72.38	1657.45	544.24	3957.03	149	0	149.40	597	0	0.23	-0.05
3122.24	4148.52	3778.31	299.82	175.92	199.76	28.72	1246.94	-75.45	1656.42	543.79	3776.11	213	-3	215.91	906	-3	0.16	-0.08
3073.66	4079.72	3719.68	299.82	172.61	221.10	61.58	1315.46	-71.48	1653.96	543.13	3896.35	220	-1	220.64	899	-1	0.34	-0.07
3057.47	4056.82	3700.13	299.82	172.21	241.40	32.65	1387.56	-94.37	1655.72	542.90	3938.07	222	-3	225.90	896	-3	0.18	-0.10
3008.90	3988.23	3641.52	299.82	169.13	241.28	49.45	1378.59	-88.43	1653.06	542.24	3945.31	74	-1	75.01	299	-1	0.09	-0.03

Dirigo Laboratories, Inc.

Manufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 2
Control #: 036-S-063-1
Test Duration: 440
Output Category: 2

	HHV Basis	LHV Basis
Overall Efficiency	70.2%	75.8%
Combustion Efficiency	91.6%	91.6%
Heat Transfer Efficiency	76.6%	82.8%

HHV Output Rate (kJ/h)	13,987	13,268	(Btu/h)
Burn Rate (kg/h)	1.01	2.22	(lb/h)
Input (kJ/h)	19,936	18,912	(Btu/h)

Test Load Weight (dry kg)	7.4	16.3	dry lb
MC wet (%)	17.01		
MC dry (%)	20.50		
Particulate (g)	8.74		
CO (g)	858		
Test Duration (h)	7.333333333		

Emissions	Particulate	CO
g/MJ Output	0.09	8.37
g/kg Dry Fuel	1.18	116.32
g/h	1.19	117.06
lb/MM Btu Output	0.20	19.45

Air/Fuel Ratio (A/F)	10.88

Test Results in Accordance with CSA B415.1-10

Technician: ______________________________

VERSION: 2.4 4/15/2010

lanufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 3
Control #: 036-S-063-1
est Duration: 240
urn Category 4

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY):	20.3
Wood Moisture (% wet):	16.87
Load Weight (lb wet):	20.20
Burn Rate (dry kg/h):	1.90
Total Particulate Emissions:	6.04 g

Fuel Data	
	D. Fir
HHV	19,810 kJ/kg
%C	48.73
%H	6.87
%O	43.90
%Ash	0.50

Douglas Fir
Oak

Elapsed Time (min)	Fuel Weight Remaining (lb)	Temp. (F) Flue Gas	Room Temp	Flue Gas Composition (%) O2	CO2	CO
Averages		540.2	73.1	10.42	10.23	0.52
0	20.2	447.0	73.0	15.18	5.60	0.11
10	19.5	473.0	73.0	14.42	6.49	0.14
20	18.6	503.0	72.0	13.38	7.65	0.20
30	17.3	573.0	72.0	10.46	10.81	0.21
40	15.7	600.0	73.0	5.71	14.13	3.35
50	13.6	611.0	73.0	5.68	14.76	1.26
60	11.9	625.0	73.0	5.53	14.83	1.60
70	10.2	630.0	74.0	5.41	14.47	2.61
80	8.3	631.0	74.0	5.24	15.05	1.81
90	7.0	635.0	73.0	6.25	14.70	0.19
100	5.8	626.0	74.0	7.29	13.59	0.24
110	4.8	616.0	74.0	7.62	13.11	0.06
120	3.9	606.0	74.0	7.60	13.03	0.05
130	3.1	580.0	74.0	10.26	10.38	0.06
140	2.6	552.0	74.0	10.35	10.25	0.08
150	2.3	531.0	74.0	11.50	9.17	0.08
160	1.9	511.0	74.0	11.73	8.95	0.08
170	1.5	496.0	74.0	12.10	8.52	0.09
180	1.4	485.0	73.0	12.94	7.73	0.11
190	1.1	478.0	72.0	12.93	7.84	0.11
200	0.8	471.0	72.0	13.07	7.72	0.12
210	0.6	464.0	72.0	13.42	7.32	0.11
220	0.4	458.0	73.0	13.93	6.76	0.13
230	0.2	455.0	72.0	14.09	6.58	0.15
240	0.0	448.0	72.0	14.35	6.31	0.14

Manufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 3
Control #: 036-S-063-1
Test Duration: 240 min

	HHV	LHV
Eff	68.1%	73.6%
Comb Eff	94.9%	94.9%
HT Eff	71.7%	77.5%
Output	25,680	kJ/h
Burn Rate	1.90	kg/h
Grams CO	543	g
Input	37,731	kJ/h
MC wet	16.87	

Ultimate CO2
CO2-ult 19.64
Fo
1.062

Overall Heating Efficiency: 68.1%
Combustion Efficiency: 94.9%
Heat Transfer Efficiency: 71.7%

Heat Output: 24,360 Btu/h 25,680 kJ/h
Heat Input: 35,792 Btu/h 37,731 kJ/h
Burn Duration: 4 h
Burn Rate: 4.2 lb/h 1.9 kg/h
Stack Temp: 544.1 Deg. F 284.5 Deg. C

Air Fuel Ratio (A/F)	
Dry Molecular Weight (Md)	30.03
Dry Moles Exhaust Gas (Nr):	365.32
Air Fuel Ratio (A/F)	10.46

%HC
0.88

	Averages	0.52	10.23	106.3%	20.23	9.74	282.3	22.8	97.3%	70.7%	68.7%	12.4	3.13	65.80	0.07	65.80	151671	4.06
INPUT DATA				Oxygen Calculation			Input Data		Combust	Heat	Net	Air	Wet Wt	% Wet	Dry Wt.	% Dry	Fuel Properti	
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO2 [d]	Excess Air EA	Total O2	Calc. % O2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %	Fuel Ratio	Now Wt	Consumed x	Now Wtdn	Comsumed y	Total Input	Carbon /12= [a]
0	9.17	0.11	5.60	244.0%	20.56	14.91	230.6	22.8	99.1%	65.3%	64.8%	20.7	9.17	0.00	7.62	0.00	0	4.06
10	8.85	0.14	6.49	196.3%	20.50	13.94	245.0	22.8	98.8%	66.8%	66.0%	17.8	8.85	3.47	7.35	3.47	8592	4.06
20	8.44	0.20	7.65	150.2%	20.42	12.67	261.7	22.2	98.3%	68.3%	67.2%	15.1	8.44	7.92	7.02	7.92	8219	4.06
30	7.85	0.21	10.81	78.2%	20.21	9.30	300.6	22.2	98.6%	71.2%	70.2%	10.8	7.85	14.36	6.52	14.36	10834	4.06
40	7.12	3.35	14.13	12.4%	19.79	3.98	315.6	22.8	84.2%	73.2%	61.7%	6.5	7.12	22.28	5.92	22.28	13822	4.06
50	6.17	1.26	14.76	22.6%	19.88	4.49	321.7	22.8	93.5%	74.0%	69.1%	7.3	6.17	32.67	5.13	32.67	14196	4.06
60	5.40	1.60	14.83	19.6%	19.86	4.23	329.4	22.8	91.9%	73.5%	67.6%	7.1	5.40	41.09	4.49	41.09	12702	4.06
70	4.63	2.61	14.47	15.0%	19.81	4.04	332.2	23.3	87.4%	72.8%	63.6%	6.7	4.63	49.50	3.85	49.50	13449	4.06
80	3.77	1.81	15.05	16.5%	19.83	3.87	332.8	23.3	91.1%	73.5%	67.0%	6.9	3.77	58.91	3.13	58.91	11954	4.06
90	3.18	0.19	14.70	31.9%	19.96	5.16	335.0	22.8	99.0%	73.5%	72.8%	8.0	3.18	65.35	2.64	65.35	9339	4.06
100	2.63	0.24	13.59	42.0%	20.03	6.32	330.0	23.3	98.7%	72.7%	71.7%	8.6	2.63	71.29	2.19	71.29	8219	4.06
110	2.18	0.06	13.11	49.1%	20.07	6.93	324.4	23.3	99.8%	72.6%	72.4%	9.0	2.18	76.24	1.81	76.24	7098	4.06
120	1.77	0.05	13.03	50.2%	20.08	7.02	318.9	23.3	99.8%	72.8%	72.7%	9.1	1.77	80.69	1.47	80.69	6351	4.06
130	1.41	0.06	10.38	88.2%	20.25	9.84	304.4	23.3	99.8%	70.4%	70.2%	11.4	1.41	84.65	1.17	84.65	4856	4.06
140	1.18	0.08	10.25	90.2%	20.26	9.97	288.9	23.3	99.6%	71.3%	71.0%	11.5	1.18	87.13	0.98	87.13	2989	4.06
150	1.04	0.08	9.17	112.4%	20.33	11.12	277.2	23.3	99.6%	70.3%	70.1%	12.8	1.04	88.61	0.87	88.61	2615	4.06
160	0.86	0.08	8.95	117.5%	20.34	11.35	266.1	23.3	99.6%	70.8%	70.6%	13.1	0.86	90.59	0.72	90.59	2989	4.06
170	0.68	0.09	8.52	128.1%	20.37	11.81	257.8	23.3	99.5%	70.7%	70.4%	13.8	0.68	92.57	0.57	92.57	1868	4.06
180	0.64	0.11	7.73	150.5%	20.42	12.64	251.7	22.8	99.3%	69.5%	69.0%	15.1	0.64	93.07	0.53	93.07	1494	4.06
190	0.50	0.11	7.84	147.1%	20.42	12.52	247.8	22.2	99.3%	70.1%	69.6%	14.9	0.50	94.55	0.41	94.55	2241	4.06
200	0.36	0.12	7.72	150.5%	20.42	12.64	243.9	22.2	99.2%	70.2%	69.6%	15.1	0.36	96.04	0.30	96.04	1868	4.06
210	0.27	0.11	7.32	164.4%	20.45	13.07	240.0	22.2	99.3%	69.6%	69.1%	15.9	0.27	97.03	0.23	97.03	1494	4.06
220	0.18	0.13	6.76	185.1%	20.49	13.66	236.7	22.8	99.0%	68.5%	67.8%	17.2	0.18	98.02	0.15	98.02	1494	4.06
230	0.09	0.15	6.58	191.9%	20.50	13.84	235.0	22.2	98.7%	68.1%	67.2%	17.6	0.09	99.01	0.08	99.01	2241	4.06
240	0.00	0.14	6.31	204.5%	20.51	14.13	231.1	22.2	98.8%	67.7%	66.9%	18.3	0.00	100.00	0.00	100.00	747	4.06
0															0.00			
0															0.00			
0															0.00			

Moisture Content MCwb: 16.87

Combustion Efficiency:	94.9%		
Total Input (kJ):	150,924	143,144	(Btu)
Total Output (kJ):	102,720	97,425	(Btu)
Efficiency:	68.1%		
Total CO (g):	542.77		

Moisture of Wood (wet basis):	16.87
Initial Dry Weight Wtdo (kg):	7.62
Moisture Content Dry	20.30

Dry kg :	7.62
CA:	48.73
HY:	6.87
OX:	43.90

Load Weight (kg):	9.17				
Fuel Heating:	HHV	LHV		HHV	LHV
Value in kJ/kg - CV:	19810.00	18328.69	Btu/lb	8522.48	7885.21

6.87	2.74	19810.00	16.87	79.51	21.09	2.66	9.03	0.06	0.26	39.20	46.99	1.47	0.14	340.30	34.24	11.28	555.48	10890.33	7950.50
es			Mw	Mass Balance (moles/100 mole dry flue gas)					kg Wood per 100 mole dfp	Moles per kg of Dry Wood						Moisture	Stack Temp	Heat Content Cha F	
Hydrogen /1= [b]	Oxygen /16= [c]	Calorific Value	Moisture Fuel Burnt	[h]	[u]	[w]	[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O	Present	K	CO2	O2
6.87	2.74	19810.00	16.87	79.38	21.06	1.40	4.84	-0.01	0.14	40.08	106.70	0.79	-0.06	568.18	34.64	11.28	503.71	8546.87	6312.36
6.87	2.74	19810.00	16.87	79.43	21.07	1.63	5.61	0.00	0.16	39.96	85.85	0.86	-0.01	489.08	34.55	11.28	518.15	9187.58	6765.63
6.87	2.74	19810.00	16.87	79.48	21.08	1.94	6.63	0.01	0.19	39.73	65.81	1.04	0.05	412.75	34.43	11.28	534.82	9955.56	7307.33
6.87	2.74	19810.00	16.87	79.68	21.14	2.72	9.30	0.02	0.27	39.98	34.38	0.78	0.06	294.68	34.41	11.28	573.71	11729.42	8542.84
6.87	2.74	19810.00	16.87	78.54	20.83	4.42	14.23	0.48	0.44	32.11	9.05	7.61	1.10	178.45	32.33	11.28	588.71	12404.17	9006.68
6.87	2.74	19810.00	16.87	79.49	21.08	3.99	13.35	0.18	0.40	37.19	11.32	3.17	0.44	200.30	33.63	11.28	594.82	12689.57	9202.89
6.87	2.74	19810.00	16.87	79.34	21.05	4.10	13.64	0.23	0.41	36.34	10.35	3.92	0.55	194.41	33.41	11.28	602.59	13054.36	9453.11
6.87	2.74	19810.00	16.87	78.88	20.92	4.30	14.02	0.37	0.43	33.84	9.44	6.10	0.87	184.45	32.77	11.28	605.37	13163.89	9526.24
6.87	2.74	19810.00	16.87	79.27	21.03	4.22	13.96	0.26	0.42	35.88	9.23	4.32	0.61	188.99	33.29	11.28	605.93	13190.06	9544.15
6.87	2.74	19810.00	16.87	79.95	21.21	3.67	12.57	0.02	0.37	40.24	14.13	0.52	0.05	218.85	34.42	11.28	608.15	13316.01	9632.16
6.87	2.74	19810.00	16.87	79.85	21.18	3.41	11.67	0.02	0.34	40.03	18.61	0.71	0.07	235.22	34.38	11.28	603.15	13059.30	9454.64
6.87	2.74	19810.00	16.87	79.90	21.19	3.24	11.14	0.00	0.32	40.63	21.48	0.19	-0.01	247.65	34.54	11.28	597.59	12798.47	9275.83
6.87	2.74	19810.00	16.87	79.90	21.19	3.22	11.07	0.00	0.32	40.67	21.91	0.16	-0.01	249.38	34.55	11.28	592.04	12538.52	9097.30
6.87	2.74	19810.00	16.87	79.72	21.15	2.57	8.84	-0.01	0.26	40.61	38.50	0.23	-0.03	311.85	34.58	11.28	577.59	11866.86	8634.43
6.87	2.74	19810.00	16.87	79.70	21.14	2.54	8.74	0.00	0.25	40.51	39.40	0.32	-0.02	315.03	34.56	11.28	562.04	11150.30	8138.04
6.87	2.74	19810.00	16.87	79.63	21.12	2.28	7.83	-0.01	0.23	40.49	49.09	0.35	-0.03	351.58	34.58	11.28	550.37	10617.48	7767.18
6.87	2.74	19810.00	16.87	79.62	21.12	2.22	7.65	-0.01	0.22	40.48	51.35	0.36	-0.03	360.10	34.58	11.28	539.26	10113.71	7415.13
6.87	2.74	19810.00	16.87	79.58	21.11	2.12	7.29	-0.01	0.21	40.41	56.00	0.43	-0.03	377.49	34.58	11.28	530.93	9738.23	7151.81
6.87	2.74	19810.00	16.87	79.52	21.09	1.93	6.64	0.00	0.19	40.26	65.82	0.57	-0.02	414.20	34.57	11.28	524.82	9485.34	6975.47
6.87	2.74	19810.00	16.87	79.53	21.10	1.96	6.73	0.00	0.19	40.27	64.31	0.56	-0.02	408.49	34.56	11.28	520.93	9332.67	6869.37
6.87	2.74	19810.00	16.87	79.52	21.09	1.93	6.64	0.00	0.19	40.20	65.84	0.62	-0.01	414.09	34.55	11.28	517.04	9159.26	6747.06
6.87	2.74	19810.00	16.87	79.50	21.09	1.83	6.29	-0.01	0.18	40.24	71.87	0.60	-0.03	436.96	34.58	11.28	513.15	8986.29	6624.88
6.87	2.74	19810.00	16.87	79.45	21.07	1.70	5.83	0.00	0.17	40.06	80.95	0.77	-0.02	470.82	34.56	11.28	509.82	8817.20	6503.90
6.87	2.74	19810.00	16.87	79.43	21.07	1.66	5.69	0.00	0.16	39.91	83.94	0.91	0.00	481.71	34.53	11.28	508.15	8764.54	6467.99
6.87	2.74	19810.00	16.87	79.42	21.07	1.59	5.46	0.00	0.16	39.94	89.47	0.89	-0.01	502.69	34.55	11.28	504.26	8592.58	6346.12

					SUMS							AVERAGE	SUMS						
7671.00	7598.64	11020.66	9160.43	295.99	10626.11	8475.15	10718.22	61472.66	3137.42	45473.07	14979.67	6195.29	48204	7681	40522.95	103467	7681	542.77	39.46
nge - Ambient to Stack Temperature				Room	Energy Losses (kJ/kg of Dry Fuel)							Total							
lue Gas Constituent				Temp	Flue Gas Constituent							Loss	Total	Chemical	Sensible and	Total	Chem	Grams Produced	
CO	N2	CH4	H2O	K	CO2	O2	CO	N2	CH4	H2O Comb	H2O Fuel MC	Rate	Loss	Loss 1	Latent Loss	Output	Loss 2	CO	HC
6108.87	6047.34	8489.95	7300.89	295.93	342.58	673.55	227.57	3435.96	-51.14	1775.81	578.22	6982.54	0	0	0.00	0	0	0.00	0.00
6542.54	6477.70	9170.04	7817.58	295.93	367.16	580.83	249.60	3168.14	-11.21	1789.10	584.04	6727.67	2918	101	2817.00	5674	101	10.47	-0.09
7060.39	6991.68	9988.73	8434.44	295.37	395.52	480.87	301.26	2885.81	40.98	1804.33	591.00	6499.78	2697	139	2557.83	5522	139	12.07	0.30
8237.39	8160.77	11914.11	9835.15	295.37	468.92	293.74	226.18	2404.86	52.22	1851.23	606.80	5903.93	3229	148	3080.36	7605	148	11.89	0.51
8677.63	8598.40	12659.93	10358.54	295.93	398.24	81.47	2220.12	1534.42	988.58	1756.55	612.70	7592.08	5297	2183	3114.23	8525	2183	148.71	12.22
8863.87	8783.54	12975.32	10579.96	295.93	471.96	104.17	926.64	1759.31	401.53	1834.67	615.20	6113.49	4381	927	3453.45	9815	927	63.71	5.10
9101.21	9019.50	13379.75	10862.07	295.93	474.36	97.86	1145.13	1753.52	501.29	1832.07	618.38	6422.61	4118	1028	3089.98	8584	1028	70.38	5.69
9170.04	9088.05	13505.54	10943.71	296.48	445.40	89.93	1783.05	1676.30	790.19	1799.70	619.30	7203.86	4891	1701	3189.67	8558	1701	116.01	9.50
9187.02	9104.93	13534.64	10963.89	296.48	473.30	88.10	1260.89	1720.78	555.05	1828.95	619.53	6546.59	3951	1067	2883.66	8004	1067	72.92	5.93
9270.94	9188.28	13670.71	11063.79	295.93	535.83	136.10	152.01	2010.83	47.98	1894.03	620.65	5397.42	2545	92	2452.93	6795	92	6.87	0.40
9102.17	9020.56	13389.29	10863.04	296.48	522.79	175.93	206.50	2121.86	66.06	1884.93	618.39	5596.47	2322	110	2211.82	5897	110	8.21	0.49
8932.59	8851.96	13099.89	10661.48	296.48	520.05	199.25	54.29	2192.15	-6.73	1886.80	616.12	5461.92	1957	16	1940.52	5141	16	1.87	-0.04
8763.18	8683.55	12812.22	10460.09	296.48	509.93	199.37	45.53	2165.48	-11.30	1880.40	613.84	5403.25	1732	11	1721.61	4619	11	1.40	-0.06
8323.54	8246.57	12072.37	9937.31	296.48	481.86	332.39	68.38	2571.72	-25.01	1863.98	607.95	5901.26	1447	10	1436.47	3410	10	1.61	-0.11
7851.38	7777.44	11288.67	9375.65	296.48	451.74	320.63	91.97	2450.09	-15.59	1843.44	601.61	5743.89	867	11	855.36	2122	11	1.34	-0.04
7498.15	7426.57	10709.78	8955.31	296.48	429.87	381.31	102.60	2611.03	-24.77	1830.00	596.87	5926.91	782	10	772.42	1833	10	1.31	-0.06
7162.45	7093.19	10165.55	8555.70	296.48	409.41	380.79	104.99	2554.26	-26.90	1816.43	592.37	5831.34	880	11	868.30	2109	11	1.53	-0.07
6911.13	6843.66	9761.92	8256.46	296.48	393.55	400.52	123.76	2583.43	-25.08	1805.87	588.99	5871.05	554	9	544.53	1314	9	1.13	-0.04
6743.09	6676.76	9487.87	8056.46	295.93	381.90	459.14	166.00	2765.48	-20.14	1798.38	586.74	6137.50	463	11	452.23	1031	11	1.21	-0.03
6642.08	6576.42	9321.62	7936.27	295.37	375.81	441.75	163.64	2686.39	-18.98	1794.10	585.38	6028.09	682	16	666.10	1559	16	1.79	-0.04
6525.15	6460.36	9136.77	7796.99	295.37	368.22	444.20	180.92	2675.19	-13.34	1788.63	583.81	6027.63	568	15	552.91	1300	15	1.65	-0.02
6408.30	6344.39	8952.76	7657.78	295.37	361.57	476.10	174.98	2772.23	-24.71	1785.13	582.24	6127.53	462	11	451.15	1032	11	1.28	-0.03
6292.20	6229.26	8776.26	7519.34	295.93	353.22	526.49	222.86	2932.88	-16.13	1779.36	580.68	6379.35	481	15	465.96	1013	15	1.63	-0.02
6258.19	6195.43	8717.43	7478.93	295.37	349.75	542.91	263.13	2984.39	-2.19	1776.37	580.22	6494.58	735	29	705.96	1507	29	2.88	0.00
6141.54	6079.68	8535.35	7339.93	295.37	343.20	567.76	256.22	3056.17	-13.27	1772.83	578.66	6561.57	247	9	238.51	500	9	0.94	-0.01

Dirigo Laboratories, Inc.

Manufacturer:	**IHP**
Model:	**Montecito Estate**
Date:	**6/26/2016**
Run:	**3**
Control #:	**036-S-063-1**
Test Duration:	**240**
Output Category:	**4**

	HHV Basis	LHV Basis
Overall Efficiency	68.1%	73.6%
Combustion Efficiency	94.9%	94.9%
Heat Transfer Efficiency	71.7%	77.5%

HHV Output Rate (kJ/h)	25,680	24,360	**(Btu/h)**
Burn Rate (kg/h)	1.90	4.20	**(lb/h)**
Input (kJ/h)	37,731	35,792	**(Btu/h)**

Test Load Weight (dry kg)	7.6	16.8	**dry lb**
MC wet (%)	16.87		
MC dry (%)	20.30		
Particulate (g)	6.04		
CO (g)	543		
Test Duration (h)	4		

Emissions	**Particulate**	**CO**
g/MJ Output	0.06	5.28
g/kg Dry Fuel	0.79	71.24
g/h	1.51	135.69
lb/MM Btu Output	0.14	12.28

Air/Fuel Ratio (A/F)	10.46

Test Results in Accordance with CSA B415.1-10

Technician: ____________________________

VERSION: 2.4 4/15/2010

lanufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 4
Control #: 036-S-063-1
est Duration: 150
urn Category 4

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY): 20.3
Wood Moisture (% wet): 16.87
Load Weight (lb wet): 20.90
Burn Rate (dry kg/h): 3.15
Total Particulate Emissions: 9.8 g

Fuel Data	
	D. Fir
HHV	19,810 kJ/kg
%C	48.73
%H	6.87
%O	43.90
%Ash	0.50

Douglas
Oak

	Averages	724.1	72.6	8.73	11.70	0.73
		Temp. (F)				
Elapsed	Fuel Weight	Flue	Room	Flue Gas Composition (%)		
Time (min)	Remaining (lb)	Gas	Temp	O2	CO2	CO
0	20.9	763.0	72.0	11.43	9.02	0.11
10	18.4	804.0	72.0	5.34	15.31	0.89
20	15.8	845.0	72.0	5.18	15.31	1.25
30	13.0	859.0	72.0	4.34	15.80	2.46
40	10.4	810.0	74.0	4.15	15.46	3.08
50	8.1	799.0	73.0	4.17	15.63	1.95
60	6.0	793.0	72.0	4.66	15.25	0.94
70	4.7	785.0	72.0	6.22	14.04	0.39
80	3.5	742.0	72.0	8.52	12.03	0.01
90	2.6	706.0	73.0	9.77	11.02	0.02
100	1.9	670.0	73.0	10.94	9.70	0.03
110	1.4	642.0	73.0	11.67	9.03	0.06
120	0.9	619.0	73.0	12.80	7.78	0.10
130	0.5	600.0	73.0	13.23	7.54	0.13
140	0.2	581.0	73.0	13.58	7.15	0.14
150	0.0	567.0	72.0	13.67	7.14	0.16

Manufacturer: IHP
Model: Montecito Estate
Date: 6/26/2016
Run: 4
Control #: 036-S-063-1
Test Duration: 150 min

	HHV	LHV
Eff	63.3%	68.4%
Comb Eff	93.8%	93.8%
HT Eff	67.5%	72.9%
Output	39,519	kJ/h
Burn Rate	3.15	kg/h
Grams CO	674	g
Input	62,462	kJ/h
MC wet	16.87	

Ultimate CO2
CO2-ult 19.64
F_0
1.063

Overall Heating Efficiency:	63.3%				
Combustion Efficiency:	93.8%				
Heat Transfer Efficiency:	67.5%				
Heat Output:	37,488	Btu/h	39,519	kJ/h	
Heat Input:	59,252	Btu/h	62,462	kJ/h	
Burn Duration:	2.5	h			
Burn Rate:	6.9	lb/h	3.2	kg/h	
Stack Temp:	721.5	Deg. F	383.0	Deg. C	

Air Fuel Ratio (A/F)	
Dry Molecular Weight (Md)	30.19
Dry Moles Exhaust Gas (Nr):	319.23
Air Fuel Ratio (A/F)	9.13

%HC
0.88

	Averages	0.73	11.70	77.5%	20.12	8.05	384.5	22.5	96.5%	65.8%	63.5%	10.7	3.07	67.61	0.04	67.61	156901	4.06
INPUT DATA				Oxygen Calculation			Input Data		Combust	Heat	Net	Air	Wet Wt	% Wet	Dry Wt.	% Dry	Fuel Properti	
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO2 [d]	Excess Air EA	Total O2	Calc. % O2 [g]	Flue Gas (ºC)	Room Temp (ºC)	Eff %	Transfer %	Eff %	Fuel Ratio	Now Wt	Consumed x	Now Wtdn	Comsumed y	Total Input	Carbon /12= [a]
0	9.48	0.11	9.02	115.1%	20.34	11.26	406.1	22.2	99.3%	59.5%	59.1%	13.0	9.48	0.00	7.88	0.00	0	4.06
10	8.35	0.89	15.31	21.3%	19.87	4.12	428.9	22.2	95.4%	68.8%	65.7%	7.3	8.35	11.96	6.94	11.96	28392	4.06
20	7.17	1.25	15.31	18.6%	19.85	3.91	451.7	22.2	93.7%	67.5%	63.3%	7.1	7.17	24.40	5.96	24.40	20173	4.06
30	5.90	2.46	15.80	7.6%	19.73	2.70	459.4	22.2	88.8%	67.4%	59.8%	6.3	5.90	37.80	4.90	37.80	20173	4.06
40	4.72	3.08	15.46	5.9%	19.72	2.72	432.2	23.3	86.2%	68.4%	59.0%	6.2	4.72	50.24	3.92	50.24	18305	4.06
50	3.68	1.95	15.63	11.7%	19.78	3.17	426.1	22.8	90.8%	69.1%	62.7%	6.6	3.68	61.24	3.05	61.24	16437	4.06
60	2.72	0.94	15.25	21.3%	19.87	4.15	422.8	22.2	95.2%	69.1%	65.7%	7.3	2.72	71.29	2.26	71.29	12702	4.06
70	2.13	0.39	14.04	36.1%	19.99	5.75	418.3	22.2	97.8%	68.0%	66.6%	8.2	2.13	77.51	1.77	77.51	9339	4.06
80	1.59	0.01	12.03	63.1%	20.15	8.11	394.4	22.2	100.1%	66.8%	66.9%	9.9	1.59	83.25	1.32	83.25	7845	4.06
90	1.18	0.02	11.02	77.9%	20.21	9.18	374.4	22.8	100.1%	66.5%	66.5%	10.8	1.18	87.56	0.98	87.56	5977	4.06
100	0.86	0.03	9.70	101.9%	20.30	10.58	354.4	22.8	100.1%	65.3%	65.4%	12.2	0.86	90.91	0.72	90.91	4483	4.06
110	0.64	0.06	9.03	116.1%	20.34	11.28	338.9	22.8	99.8%	65.1%	64.9%	13.1	0.64	93.30	0.53	93.30	3736	4.06
120	0.41	0.10	7.78	149.3%	20.42	12.59	326.1	22.8	99.4%	62.8%	62.4%	15.0	0.41	95.69	0.34	95.69	3362	4.06
130	0.23	0.13	7.54	156.1%	20.43	12.83	315.6	22.8	99.1%	63.1%	62.5%	15.4	0.23	97.61	0.19	97.61	2615	4.06
140	0.09	0.14	7.15	169.5%	20.46	13.24	305.0	22.8	98.9%	62.8%	62.1%	16.2	0.09	99.04	0.08	99.04	2615	4.06
150	0.00	0.16	7.14	169.1%	20.46	13.24	297.2	22.2	98.7%	63.5%	62.7%	16.2	0.00	100.00	0.00	100.00	747	4.06
0															0.00			
0															0.00			
0																		

Moisture Content MCwb: 16.87

Combustion Efficiency:	93.8%			Moisture of Wood (wet basis):	16.87	Dry kg :	7.88
Total Input (kJ):	156,154	148,105	(Btu)	Initial Dry Weight Wtdo (kg):	7.88	CA:	48.73
Total Output (kJ):	98,798	93,705	(Btu)	Moisture Content Dry	20.30	HY:	6.87
Efficiency:	63.3%					OX:	43.90
Total CO (g):	673.65						

Load Weight (kg):	9.48				
Fuel Heating:	HHV	LHV		HHV	LHV
Value in kJ/kg - CV:	19810.00	18328.69	Btu/lb	8522.48	7885.21

6.87	2.74	19810.00	16.87	79.51	21.09	3.08	10.41	0.09	0.31	38.79	34.63	1.82	0.21	292.51	34.10	11.28	657.63	15735.31	11258.81
es			Mw	Mass Balance					kg Wood per								Stack	Heat Content Cha	
Hydrogen	Oxygen	Calorific	Moisture	(moles/100 mole dry flue gas)					100 mole dfp	Moles per kg of Dry Wood						Moisture	Temp		F
/1= [b]	/16= [c]	Value	Fuel Burnt	[h]	[u]	[w]	[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O	Present	K	CO2	O2
6.87	2.74	19810.00	16.87	79.61	21.12	2.25	7.73	0.00	0.22	40.33	50.35	0.49	-0.01	355.94	34.54	11.28	679.26	16765.27	11964.99
6.87	2.74	19810.00	16.87	79.68	21.14	4.02	13.56	0.12	0.40	38.28	10.29	2.23	0.31	199.23	33.91	11.28	702.04	17894.33	12716.61
6.87	2.74	19810.00	16.87	79.53	21.10	4.12	13.80	0.18	0.41	37.34	9.54	3.05	0.43	193.94	33.66	11.28	724.82	19038.45	13472.90
6.87	2.74	19810.00	16.87	79.04	20.96	4.58	15.04	0.35	0.46	34.64	5.93	5.39	0.78	173.29	32.97	11.28	732.59	19432.57	13732.21
6.87	2.74	19810.00	16.87	78.74	20.89	4.68	15.17	0.44	0.47	33.24	5.84	6.62	0.96	169.28	32.61	11.28	705.37	18018.47	12794.28
6.87	2.74	19810.00	16.87	79.25	21.02	4.40	14.55	0.28	0.44	35.72	7.25	4.46	0.64	181.10	33.25	11.28	699.26	17734.66	12608.34
6.87	2.74	19810.00	16.87	79.66	21.13	4.02	13.54	0.13	0.40	38.14	10.38	2.35	0.33	199.20	33.87	11.28	695.93	17589.94	12514.50
6.87	2.74	19810.00	16.87	79.82	21.17	3.57	12.15	0.05	0.35	39.58	16.22	1.10	0.13	225.01	34.25	11.28	691.48	17369.24	12367.72
6.87	2.74	19810.00	16.87	79.85	21.18	2.96	10.20	-0.01	0.29	40.82	27.52	0.03	-0.04	270.93	34.60	11.28	667.59	16192.79	11581.82
6.87	2.74	19810.00	16.87	79.78	21.16	2.72	9.35	-0.01	0.27	40.78	33.98	0.07	-0.04	295.24	34.61	11.28	647.59	15199.41	10911.46
6.87	2.74	19810.00	16.87	79.69	21.14	2.39	8.25	-0.01	0.24	40.74	44.45	0.13	-0.05	334.68	34.63	11.28	627.59	14238.81	10261.05
6.87	2.74	19810.00	16.87	79.63	21.12	2.24	7.70	-0.01	0.22	40.58	50.70	0.27	-0.04	357.89	34.61	11.28	612.04	13499.69	9757.67
6.87	2.74	19810.00	16.87	79.53	21.10	1.94	6.67	-0.01	0.19	40.32	65.25	0.52	-0.03	412.20	34.58	11.28	599.26	12897.81	9345.81
6.87	2.74	19810.00	16.87	79.50	21.09	1.89	6.49	0.00	0.19	40.13	68.28	0.69	-0.01	423.12	34.54	11.28	588.71	12404.17	9006.68
6.87	2.74	19810.00	16.87	79.47	21.08	1.79	6.17	0.00	0.18	40.03	74.12	0.78	0.00	444.97	34.53	11.28	578.15	11913.76	8668.55
6.87	2.74	19810.00	16.87	79.46	21.08	1.80	6.17	0.00	0.18	39.91	73.99	0.89	0.01	444.13	34.50	11.28	570.37	11575.66	8436.41

					SUMS							AVERAGE	SUMS						
10805.05	10715.39	16424.60	12884.44	295.68	9701.22	5571.61	8577.45	47678.81	3045.40	31008.79	10258.97	7240.14	57356	9745	47611.66	99545	9745	673.65	52.77
nge - Ambient to Stack Temperature				Room	Energy Losses (kJ/kg of Dry Fuel)							Total							
lue Gas Constituent				Temp	Flue Gas Constituent							Loss	Total	Chemical	Sensible and	Total	Chem	Grams Produced	
CO	N2	CH4	H2O	K	CO2	O2	CO	N2	CH4	H2O Comb	H2O Fuel MC	Rate	Loss	Loss 1	Latent Loss	Output	Loss 2	CO	HC
11474.81	11381.29	17567.04	13680.54	295.37	676.14	602.50	144.78	4051.05	-8.46	1991.29	650.16	8107.46	0	0	0.00	0	0	0.00	0.00
12181.60	12085.31	18868.73	14518.66	295.37	684.98	130.85	656.84	2407.81	279.81	1983.14	659.62	6803.04	9750	1295	8454.88	18642	1295	89.30	7.06
12891.29	12792.54	20199.47	15359.74	295.37	710.80	128.52	901.93	2480.97	390.54	1997.28	669.10	7279.14	7413	1267	6145.22	12760	1267	86.92	6.99
13134.29	13034.77	20660.53	15647.62	295.37	673.18	81.42	1597.20	2258.78	707.42	1965.51	672.35	7955.87	8102	2258	5843.29	12071	2258	153.79	12.65
12253.25	12156.98	19022.72	14603.18	296.48	598.85	74.70	1954.91	2057.95	868.98	1910.10	660.57	8126.05	7509	2518	4991.17	10796	2518	171.31	14.13
12079.24	11983.47	18688.97	14397.10	295.93	633.45	91.46	1314.91	2170.15	579.76	1940.49	658.25	7388.46	6131	1518	4613.01	10307	1518	103.53	8.47
11991.69	11896.11	18516.64	14293.51	295.37	670.81	129.91	693.41	2369.75	296.18	1973.39	657.08	6790.53	4354	613	3741.31	8348	613	42.20	3.34
11853.70	11758.66	18261.89	14129.89	295.37	687.45	200.55	324.16	2645.78	121.88	1990.14	655.23	6625.19	3123	203	2920.44	6216	203	14.51	1.01
11113.93	11021.95	16911.57	13252.40	295.37	660.95	318.70	9.98	2986.19	-35.67	1979.93	645.34	6565.42	2600	-10	2610.07	5245	-10	0.38	-0.25
10481.02	10392.07	15786.18	12501.06	295.93	619.87	370.74	21.72	3068.18	-39.75	1954.45	636.86	6632.06	2001	-5	2006.53	3976	-5	0.63	-0.21
9866.37	9780.49	14702.66	11771.19	295.93	580.08	456.06	36.90	3273.37	-48.09	1930.22	628.63	6857.18	1552	-3	1554.38	2931	-3	0.80	-0.19
9389.86	9306.53	13875.40	11205.10	295.93	547.88	494.68	78.85	3330.76	-38.20	1909.42	622.25	6945.63	1310	7	1302.50	2426	7	1.42	-0.13
8999.45	8918.33	13206.01	10741.12	295.93	520.09	609.83	151.34	3676.17	-26.59	1891.96	617.01	7439.81	1263	20	1242.24	2099	20	2.46	-0.08
8677.63	8598.40	12659.93	10358.54	295.93	497.77	614.94	201.80	3638.19	-8.12	1876.51	612.70	7433.79	981	25	956.51	1634	25	2.56	-0.02
8356.44	8279.17	12120.08	9976.59	295.93	476.95	642.55	228.38	3683.96	-4.50	1862.88	608.39	7498.61	990	29	961.16	1625	29	2.90	-0.01
8136.17	8060.20	11745.76	9714.75	295.37	461.95	624.21	260.35	3579.76	10.21	1852.09	605.44	7394.00	279	10	268.95	468	10	0.94	0.01

Dirigo Laboratories, Inc.

Manufacturer:	**IHP**
Model:	**Montecito Estate**
Date:	**6/26/2016**
Run:	**4**
Control #:	**036-S-063-1**
Test Duration:	**150**
Output Category:	**4**

	HHV Basis	LHV Basis
Overall Efficiency	63.3%	68.4%
Combustion Efficiency	93.8%	93.8%
Heat Transfer Efficiency	67.5%	72.9%

HHV Output Rate (kJ/h)	39,519	37,488	**(Btu/h)**
Burn Rate (kg/h)	3.15	6.95	**(lb/h)**
Input (kJ/h)	62,462	59,252	**(Btu/h)**

Test Load Weight (dry kg)	7.9	17.4	**dry lb**
MC wet (%)	16.87		
MC dry (%)	20.30		
Particulate (g)	9.80		
CO (g)	674		
Test Duration (h)	2.5		

Emissions	**Particulate**	**CO**
g/MJ Output	0.10	6.82
g/kg Dry Fuel	1.24	85.46
g/h	3.92	269.46
lb/MM Btu Output	0.23	15.85

Air/Fuel Ratio (A/F)	9.13

Test Results in Accordance with CSA B415.1-10

Technician: ______________________________

EPA Method 28 - Weighted Average

DIRIGO LABORATORIES INC.

Weighted Average: 1.3 (g/hr)

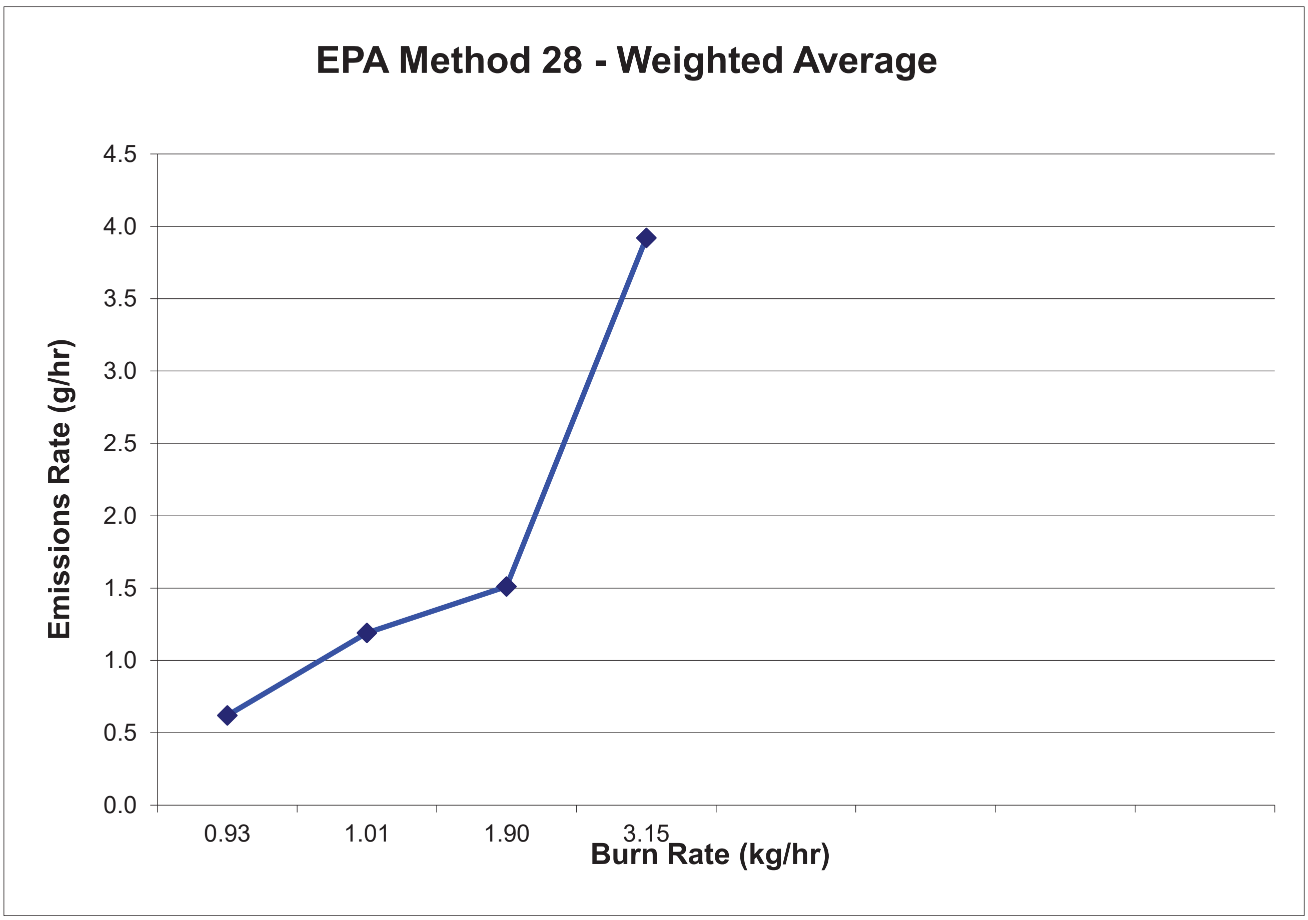
Client:	IHP
Model:	Montecito Estate
Tracking No.:	63
Project No.:	036-S-063-1
Test Dates:	6/21/16 - 6/24/16

Burn Rate Category	2	Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.93	Burn Rate (kg/hr-dry)	1.01
Emissions Rate (g/hr)	0.6	Emissions Rate (g/hr)	1.2
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	23.08%	Weighting Factor	34.62%
Run Number	1	Run Number	2

Burn Rate Category	3	Burn Rate Category	4
Burn Rate (kg/hr-dry)	1.90	Burn Rate (kg/hr-dry)	3.15
Emissions Rate (g/hr)	1.5	Emissions Rate (g/hr)	3.9
Emissions Rate Cap (g/hr)	18	Emissions Rate Cap (g/hr)	18
Weighting Factor	36.02%	Weighting Factor	6.29%
Run Number	3	Run Number	4

EPA Method 28 - Weighted Average

Client: IHP
Model: Montecito Estate
Tracking No.: 63
Project No.: 036-S-063-1
Test Dates: 6/21/16 - 6/24/16



IHP Estate Filter Catch Run#1

Project #	036-S-063-1	MFG	IHP
Run #	1	Model	Montecito Estate
Date	6/24/16		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		2752	0.119	0.1206	0.0016
☐	☑	2753			
☑	☐	2757	0.2363	0.2389	
☑	☐	O Ring			
☐	☑	O Ring	3.5875	3.5885	0.0036
					5.2 mg

Nozzle

#	TARE	FINAL	Net	
13A	117.455	117.4553	0.0003	0.3

Train A Total Catch: 5.5

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	2754			
☐	☑	2755	0.2368	0.2412	
☑	☐	O ring			
☐	☑	O ring	3.5732	3.5742	0.0054
					5.4 mg

Nozzle

#	TARE	FINAL	Net	
13B	117.0657	117.0657	0.0	0.0

Train B Total Catch: 5.4

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
2756		0.1185	0.1187	0.0002	2611.312
O ring		1.6729	1.6734	0.0005	
			Total	0.0007 mg	

Notes: Train A Total: 5.5mg Train B Total: 5.4mg Ambient Total: 0.7mg 1 Hour Catch: 1.6mg

Project #	036-S-063-1	MFG	IHP
Run #	2	Model	Montecito Estate
Date	6/24/16		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		2758	0.1192	0.1223	0.0031
☐	☑	2759			
☑	☐	2763	0.2377	0.2427	
☑	☐	O Ring			
☐	☑	O Ring	3.5518	3.5526	0.0058
					8.9 mg

Nozzle

#	TARE	FINAL	Net	
1A	115.6607	115.6607	0.0	0.0

Train A Total Catch: 8.9

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	2760			
☐	☑	2761	0.2364	0.2441	
☑	☐	O ring			
☐	☑	O ring	3.6015	3.6025	0.0087
					8.7 mg

Nozzle

#	TARE	FINAL	Net	
1B	115.9027	115.9027	0.0	0.0

Train B Total Catch: 8.7

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
2762		0.1198	0.12	0.0002	2338.128
O ring		1.6963	1.6967	0.0004	
			Total	0.0006 mg	

Notes: Train A Total: 8.9mg Train B Total: 8.7mg Ambient Total: 0.6mg 1 Hour Catch: 3.1mg

IHP Estate Filter Catch Run#3

Project #	036-S-063-1	MFG	IHP
Run #	3	Model	Montecito Estate
Date	6/26/16		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		2764	0.1189	0.1235	0.0046
☐	☑	2765			
☑	☐	2769	0.2385	0.2396	
☑	☐	O Ring			
☐	☑	O Ring	3.5482	3.5486	0.0015
					6.1 mg

Nozzle

#	TARE	FINAL	Net	
2A	116.2354	116.2356	0.0002	0.2

Train A Total Catch: 6.3

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	2766			
☐	☑	2767	0.2371	0.2425	
☐	☐	O ring			
☐	☐	O ring	3.555	3.5557	0.0061
					6.1 mg

Nozzle

#	TARE	FINAL	Net	
2A	116.3299	116.33	0.0001	0.1

Train B Total Catch: 6.2

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
2768		0.1182	0.1183	0.0001	1282.928
O ring		1.6911	1.6915	0.0004	
			Total	0.0005 mg	

Notes: Train A Total: 6.3mg Train B Total: 6.2mg Ambient Total: 0.5mg 1 Hour Catch: 4.6mg

Project #	036-S-063-1	MFG	IHP
Run #	4	Model	Montecito Estate
Date	6/26/16		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		2770	0.1193	0.1272	0.0079
☐	☑	2771			
☑	☐	2775	0.2374	0.2386	
☑	☐	O Ring			
☐	☑	O Ring	3.5911	3.5918	0.0019
					9.8 mg

Nozzle

#	TARE	FINAL	Net	
3A	116.071	116.0713	0.0003	0.3

Train A Total Catch: 10.1

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	2772			
☐	☑	2773	0.2365	0.2446	
☑	☐	O ring			
☐	☑	O ring	3.5797	3.5807	0.0091
					9.1 mg

Nozzle

#	TARE	FINAL	Net	
3B	116.34	116.3402	0.0002	0.2

Train B Total Catch: 9.3

Ambient ☐

Filter #		Tare	Final	Net	Vol (liter)
2774		0.1199	0.1199	0	806.341
O ring		1.6797	1.6798	0.0001	
			Total	0.0001 mg	

Notes: Train A Total: 10.1mg Train B Total: 9.3mg Ambient Total: 0.1mg 1 Hour Catch: 7.9mg

Weather Conditions June 21, 2016

Time (PDT)	Temp.	Dew Point	Humidity	Pressure	Wind Dir	Wind Speed	Precip	Conditions
12:53 AM	61.0 °F	48.9 °F	64%	30.27 in	WSW	3.5 mph	N/A	Overcast
1:53 AM	60.1 °F	48.9 °F	67%	30.27 in	Calm	Calm	N/A	Mostly Cloudy
2:53 AM	59.0 °F	48.9 °F	69%	30.28 in	WSW	3.5 mph	N/A	Mostly Cloudy
3:53 AM	57.9 °F	51.1 °F	78%	30.29 in	WSW	5.8 mph	N/A	Overcast
4:53 AM	59.0 °F	50.0 °F	72%	30.30 in	SW	4.6 mph	N/A	Overcast
5:53 AM	59.0 °F	50.0 °F	72%	30.30 in	South	4.6 mph	N/A	Overcast
6:53 AM	59.0 °F	50.0 °F	72%	30.30 in	ESE	5.8 mph	N/A	Overcast
7:53 AM	60.1 °F	51.1 °F	72%	30.32 in	South	4.6 mph	N/A	Overcast
8:53 AM	63.0 °F	48.9 °F	60%	30.32 in	Calm	Calm	N/A	Mostly Cloudy
9:53 AM	64.0 °F	48.9 °F	58%	30.31 in	Calm	Calm	N/A	Overcast
10:53 AM	66.0 °F	48.0 °F	52%	30.30 in	ESE	3.5 mph	N/A	Mostly Cloudy
11:53 AM	66.0 °F	48.0 °F	52%	30.30 in	Variable	3.5 mph	N/A	Overcast
12:53 PM	68.0 °F	48.0 °F	49%	30.29 in	Variable	5.8 mph	N/A	Overcast
1:53 PM	71.1 °F	48.0 °F	44%	30.27 in	WNW	6.9 mph	N/A	Clear
2:53 PM	71.1 °F	48.0 °F	44%	30.23 in	NNW	4.6 mph	N/A	Clear
3:53 PM	73.0 °F	48.0 °F	41%	30.20 in	NW	4.6 mph	N/A	Clear
4:53 PM	75.0 °F	48.9 °F	40%	30.17 in	NNW	4.6 mph	N/A	Clear
5:53 PM	75.0 °F	50.0 °F	41%	30.14 in	WNW	4.6 mph	N/A	Clear
6:53 PM	75.0 °F	50.0 °F	41%	30.12 in	Variable	4.6 mph	N/A	Clear
7:53 PM	72.0 °F	51.1 °F	48%	30.11 in	Variable	4.6 mph	N/A	Clear
8:53 PM	69.1 °F	52.0 °F	54%	30.10 in	West	3.5 mph	N/A	Clear
9:53 PM	68.0 °F	51.1 °F	55%	30.12 in	Variable	5.8 mph	N/A	Clear
10:53 PM	64.0 °F	50.0 °F	60%	30.12 in	Variable	3.5 mph	N/A	Clear
11:53 PM	62.1 °F	50.0 °F	65%	30.12 in	Calm	Calm	N/A	Clear

Weather Conditions June 22, 2016

Time (PDT)	Temp.	Dew Point	Humidity	Pressure	Wind Dir	Wind Speed	Precip	Conditions
12:53 AM	60.1 °F	50.0 °F	69%	30.12 in	Variable	3.5 mph	N/A	Clear
1:53 AM	57.9 °F	50.0 °F	75%	30.11 in	Calm	Calm	N/A	Clear
2:53 AM	55.9 °F	50.0 °F	80%	30.11 in	Calm	Calm	N/A	Clear
3:53 AM	53.1 °F	50.0 °F	89%	30.11 in	Calm	Calm	N/A	Clear
4:53 AM	52.0 °F	48.9 °F	89%	30.11 in	Calm	Calm	N/A	Clear
5:53 AM	52.0 °F	48.9 °F	89%	30.11 in	ESE	3.5 mph	N/A	Clear
6:53 AM	55.0 °F	50.0 °F	83%	30.13 in	Calm	Calm	N/A	Clear
7:51 AM	59.0 °F	51.8 °F	77%	30.12 in	Variable	3.5 mph	N/A	Mostly Cloudy
7:53 AM	59.0 °F	51.1 °F	75%	30.12 in	Calm	Calm	N/A	Mostly Cloudy
8:48 AM	60.8 °F	51.8 °F	72%	30.11 in	Calm	Calm	N/A	Scattered Clouds
8:53 AM	59.0 °F	52.0 °F	78%	30.11 in	West	3.5 mph	N/A	Scattered Clouds
9:53 AM	63.0 °F	53.1 °F	70%	30.11 in	Variable	4.6 mph	N/A	Clear
10:53 AM	64.9 °F	52.0 °F	63%	30.09 in	Variable	4.6 mph	N/A	Clear
11:53 AM	69.1 °F	53.1 °F	57%	30.07 in	WSW	8.1 mph	N/A	Clear
12:53 PM	72.0 °F	53.1 °F	51%	30.04 in	Variable	3.5 mph	N/A	Clear
1:53 PM	73.0 °F	50.0 °F	44%	30.03 in	Variable	4.6 mph	N/A	Clear
2:53 PM	75.9 °F	50.0 °F	40%	30.01 in	Variable	4.6 mph	N/A	Clear
3:53 PM	78.1 °F	50.0 °F	37%	29.99 in	NW	5.8 mph	N/A	Clear
4:53 PM	78.1 °F	50.0 °F	37%	29.96 in	Variable	3.5 mph	N/A	Clear
5:53 PM	78.1 °F	48.9 °F	36%	29.94 in	Variable	3.5 mph	N/A	Clear
6:53 PM	77.0 °F	50.0 °F	39%	29.94 in	Calm	Calm	N/A	Mostly Cloudy
7:53 PM	73.9 °F	45.0 °F	35%	29.94 in	NW	3.5 mph	N/A	Scattered Clouds
8:53 PM	70.0 °F	48.0 °F	46%	29.96 in	Calm	Calm	N/A	Partly Cloudy
9:53 PM	66.0 °F	46.9 °F	50%	29.99 in	West	5.8 mph	N/A	Clear
10:53 PM	64.9 °F	46.9 °F	52%	30.01 in	Calm	Calm	N/A	Clear
11:53 PM	63.0 °F	46.0 °F	54%	30.01 in	SW	4.6 mph	N/A	Overcast

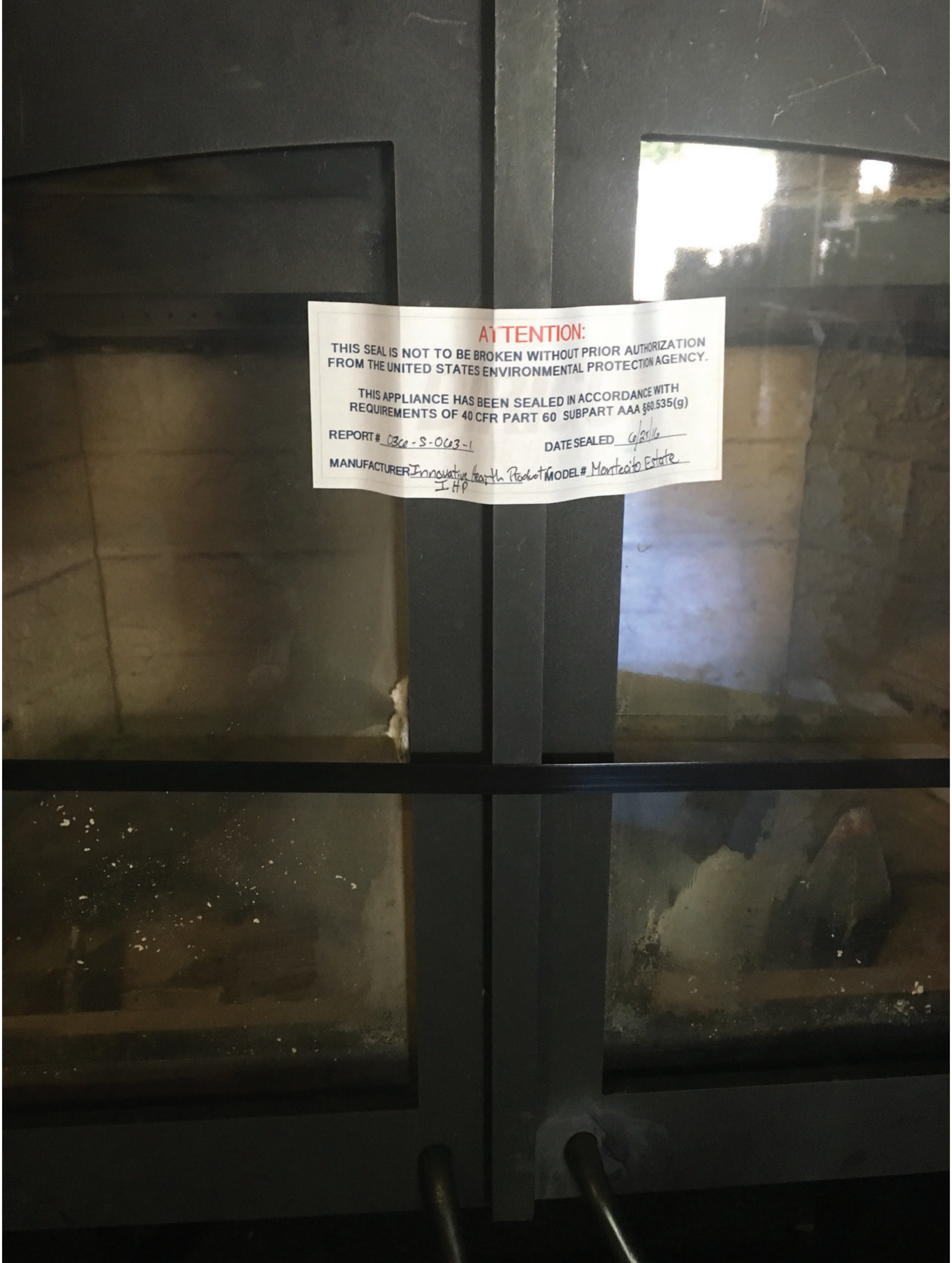
Weather Conditions June 23, 2016

Time (PDT)	Temp.	Dew Point	Humidity	Pressure	Wind Dir	Wind Speed	Precip	Conditions
12:53 AM	63.0 °F	45.0 °F	52%	30.02 in	SW	6.9 mph	N/A	Mostly Cloudy
1:53 AM	62.1 °F	45.0 °F	53%	30.03 in	WSW	9.2 mph	N/A	Overcast
2:53 AM	61.0 °F	48.9 °F	64%	30.04 in	West	4.6 mph	0.00 in	Overcast
3:53 AM	57.9 °F	52.0 °F	81%	30.04 in	Calm	Calm	0.00 in	Light Rain
4:53 AM	57.0 °F	52.0 °F	83%	30.04 in	SSW	4.6 mph	0.02 in	Light Rain
5:00 AM	57.0 °F	52.0 °F	83%	30.05 in	SSW	4.6 mph	0.01 in	Light Rain
5:53 AM	55.9 °F	53.1 °F	90%	30.05 in	ENE	4.6 mph	0.05 in	Light Rain
6:05 AM	55.9 °F	54.0 °F	93%	30.05 in	ENE	3.5 mph	0.01 in	Light Rain
6:49 AM	55.4 °F	53.6 °F	94%	30.05 in	East	3.5 mph	0.01 in	Light Rain
6:53 AM	55.9 °F	54.0 °F	93%	30.06 in	East	3.5 mph	0.02 in	Light Rain
7:49 AM	55.4 °F	53.6 °F	94%	30.06 in	East	3.5 mph	0.01 in	Light Rain
7:53 AM	55.9 °F	54.0 °F	93%	30.06 in	East	4.6 mph	0.01 in	Light Rain
8:00 AM	55.9 °F	54.0 °F	93%	30.06 in	East	3.5 mph	0.01 in	Light Rain
8:24 AM	55.9 °F	54.0 °F	93%	30.07 in	East	4.6 mph	0.04 in	Light Rain
8:34 AM	55.9 °F	54.0 °F	93%	30.07 in	East	4.6 mph	0.06 in	Light Rain
8:41 AM	55.9 °F	54.0 °F	93%	30.07 in	East	4.6 mph	0.06 in	Light Rain
8:53 AM	57.0 °F	55.0 °F	93%	30.07 in	ENE	3.5 mph	0.07 in	Light Rain
9:06 AM	57.0 °F	55.0 °F	93%	30.07 in	ENE	3.5 mph	0.02 in	Light Rain
9:25 AM	57.0 °F	55.0 °F	93%	30.07 in	East	3.5 mph	0.03 in	Light Rain
9:40 AM	57.0 °F	55.0 °F	93%	30.07 in	Variable	6.9 mph	0.04 in	Light Rain
9:53 AM	57.0 °F	55.0 °F	93%	30.07 in	Calm	Calm	0.05 in	Light Rain
10:02 AM	57.0 °F	55.0 °F	93%	30.07 in	Calm	Calm	0.01 in	Light Rain
10:21 AM	57.9 °F	55.0 °F	90%	30.07 in	Calm	Calm	0.02 in	Light Rain
10:53 AM	57.9 °F	55.9 °F	93%	30.07 in	ENE	4.6 mph	0.04 in	Light Rain
11:19 AM	60.1 °F	55.9 °F	86%	30.07 in	SW	8.1 mph	0.02 in	Overcast
11:53 AM	60.1 °F	57.0 °F	90%	30.08 in	Calm	Calm	0.03 in	Light Rain
12:53 PM	63.0 °F	57.0 °F	81%	30.07 in	South	6.9 mph	0.00 in	Light Rain
1:42 PM	62.1 °F	57.9 °F	86%	30.07 in	WSW	5.8 mph	0.03 in	Light Rain
1:53 PM	63.0 °F	57.9 °F	84%	30.07 in	SW	8.1 mph	0.03 in	Light Rain
2:04 PM	63.0 °F	57.9 °F	84%	30.07 in	SSW	8.1 mph	0.00 in	Light Rain

2:15 PM	64.0 °F	59.0 °F	84%	30.06 in	SSW	8.1 mph	0.00 in	Overcast
2:53 PM	64.9 °F	57.9 °F	78%	30.06 in	SSW	8.1 mph	0.00 in	Overcast
3:11 PM	64.0 °F	57.9 °F	80%	30.06 in	SW	6.9 mph	0.03 in	Rain
3:23 PM	64.0 °F	59.0 °F	84%	30.06 in	SW	6.9 mph	0.04 in	Light Rain
3:53 PM	64.9 °F	57.9 °F	78%	30.05 in	SSW	8.1 mph	0.04 in	Overcast
4:53 PM	64.0 °F	59.0 °F	84%	30.04 in	SW	8.1 mph	0.04 in	Rain
5:35 PM	62.1 °F	59.0 °F	90%	30.05 in	NW	11.5 mph	0.03 in	Light Rain
5:38 PM	61.0 °F	57.0 °F	87%	30.06 in	NW	9.2 mph	0.07 in	Rain
5:44 PM	60.1 °F	57.0 °F	90%	30.06 in	WNW	5.8 mph	0.14 in	Heavy Rain
5:49 PM	60.8 °F	55.4 °F	82%	30.06 in	Variable	4.6 mph	0.15 in	Light Rain
5:53 PM	60.1 °F	57.0 °F	90%	30.07 in	Variable	5.8 mph	0.15 in	Light Rain
6:00 PM	60.1 °F	57.0 °F	90%	30.07 in	West	4.6 mph	0.01 in	Light Rain
6:39 PM	60.1 °F	57.9 °F	93%	30.07 in	Variable	3.5 mph	0.03 in	Light Rain
6:53 PM	60.1 °F	57.9 °F	93%	30.08 in	WSW	5.8 mph	0.04 in	Light Rain
7:06 PM	60.1 °F	57.9 °F	93%	30.08 in	West	3.5 mph	0.01 in	Light Rain
7:14 PM	60.1 °F	57.9 °F	93%	30.08 in	Calm	Calm	0.07 in	Rain
7:34 PM	60.1 °F	57.0 °F	90%	30.08 in	Calm	Calm	0.18 in	Light Rain
7:41 PM	59.0 °F	57.0 °F	93%	30.09 in	Variable	3.5 mph	0.28 in	Heavy Rain
7:49 PM	59.0 °F	55.4 °F	88%	30.09 in	Variable	4.6 mph	0.44 in	Heavy Rain
7:53 PM	59.0 °F	55.9 °F	90%	30.09 in	WSW	6.9 mph	0.51 in	Heavy Rain
8:00 PM	59.0 °F	57.0 °F	93%	30.10 in	Variable	3.5 mph	0.02 in	Light Rain
8:07 PM	59.0 °F	57.0 °F	93%	30.10 in	West	4.6 mph	0.06 in	Rain
8:18 PM	59.0 °F	57.0 °F	93%	30.10 in	Calm	Calm	0.09 in	Light Rain
8:25 PM	59.0 °F	55.9 °F	90%	30.10 in	Variable	3.5 mph	0.09 in	Light Rain
8:32 PM	59.0 °F	57.0 °F	93%	30.11 in	WSW	6.9 mph	0.09 in	Light Rain
8:53 PM	57.9 °F	55.9 °F	93%	30.11 in	SW	3.5 mph	0.11 in	Light Rain
9:13 PM	57.9 °F	55.9 °F	93%	30.11 in	Calm	Calm	0.10 in	Light Rain
9:22 PM	59.0 °F	55.9 °F	90%	30.12 in	South	3.5 mph	0.10 in	Light Rain
9:34 PM	59.0 °F	57.0 °F	93%	30.12 in	SW	8.1 mph	0.14 in	Light Rain
9:53 PM	57.0 °F	53.1 °F	87%	30.13 in	Variable	4.6 mph	0.24 in	Rain
10:01 PM	57.9 °F	53.1 °F	84%	30.14 in	Variable	3.5 mph	0.00 in	Light Rain
10:53 PM	57.0 °F	53.1 °F	87%	30.14 in	Calm	Calm	0.03 in	Overcast
11:53 PM	57.0 °F	54.0 °F	89%	30.15 in	Calm	Calm	0.01 in	Overcast

Weather Conditions June 24, 2016

Time (PDT)	Temp.	Dew Point	Humidity	Pressure	Wind Dir	Wind Speed	Precip	Conditions
1:53 AM	55.9 °F	53.1 °F	90%	30.17 in	Calm	Calm	0.00 in	Light Rain
2:03 AM	55.9 °F	53.1 °F	90%	30.17 in	WSW	3.5 mph	0.00 in	Overcast
2:34 AM	55.9 °F	53.1 °F	90%	30.17 in	SW	6.9 mph	0.00 in	Light Rain
2:53 AM	55.9 °F	53.1 °F	90%	30.18 in	West	5.8 mph	0.00 in	Light Rain
3:53 AM	55.0 °F	53.1 °F	93%	30.19 in	SSW	5.8 mph	0.01 in	Overcast
4:53 AM	55.0 °F	52.0 °F	89%	30.21 in	SW	4.6 mph	N/A	Overcast
5:53 AM	55.0 °F	52.0 °F	89%	30.22 in	WSW	4.6 mph	N/A	Overcast
6:53 AM	55.9 °F	52.0 °F	87%	30.23 in	SW	3.5 mph	N/A	Overcast
7:53 AM	55.9 °F	52.0 °F	87%	30.25 in	SW	9.2 mph	N/A	Overcast
8:53 AM	57.9 °F	53.1 °F	84%	30.26 in	SW	8.1 mph	N/A	Overcast
9:39 AM	61.0 °F	53.1 °F	75%	30.26 in	SW	10.4 mph	N/A	Mostly Cloudy
9:53 AM	62.1 °F	52.0 °F	70%	30.26 in	WSW	10.4 mph	N/A	Overcast
10:53 AM	63.0 °F	51.1 °F	65%	30.26 in	Variable	6.9 mph	N/A	Overcast
11:53 AM	64.0 °F	50.0 °F	60%	30.26 in	SW	8.1 mph	N/A	Overcast
12:53 PM	62.1 °F	53.1 °F	72%	30.27 in	WSW	8.1 mph	0.00 in	Light Rain
1:53 PM	64.9 °F	51.1 °F	61%	30.28 in	NNW	5.8 mph	0.00 in	Light Rain
2:53 PM	66.9 °F	50.0 °F	54%	30.29 in	Calm	Calm	0.00 in	Overcast
3:53 PM	64.0 °F	54.0 °F	70%	30.29 in	SSW	9.2 mph	N/A	Overcast
4:53 PM	66.9 °F	52.0 °F	59%	30.29 in	SW	10.4 mph	N/A	Overcast
5:53 PM	66.9 °F	52.0 °F	59%	30.28 in	SW	6.9 mph	0.00 in	Overcast
6:53 PM	64.9 °F	53.1 °F	65%	30.28 in	North	5.8 mph	N/A	Overcast
7:53 PM	63.0 °F	55.0 °F	75%	30.29 in	Calm	Calm	N/A	Overcast
8:53 PM	62.1 °F	55.0 °F	78%	30.29 in	ENE	3.5 mph	N/A	Overcast
9:53 PM	61.0 °F	55.9 °F	83%	30.29 in	Calm	Calm	N/A	Mostly Cloudy
10:53 PM	57.9 °F	54.0 °F	87%	30.30 in	Calm	Calm	N/A	Clear
11:53 PM	57.9 °F	51.1 °F	78%	30.30 in	Calm	Calm	N/A	Partly Cloudy


ATTENTION:
THIS SEAL IS NOT TO BE BROKEN WITHOUT PRIOR AUTHORIZATION FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.
THIS APPLIANCE HAS BEEN SEALED IN ACCORDANCE WITH REQUIREMENTS OF 40 CFR PART 60 SUBPART AAA §60.535(g)
REPORT # 036-S-063-1
DATE SEALED 6/25/16
MANUFACTURER Innovative Hearth Product IHP
MODEL # Montecito Estate

PFS® C US

Report No. / Rapport nº
14-198

LISTED FACTORY BUILT FIREPLACE
FOYER PRÉFABRIQUE HOMOLOGUÉ

astria FIREPLACES®

Serial No.
Numéro de série

Manufactured by / Fabriqué par:
INNOVATIVE HEARTH PRODUCTS
1502 14th St. NW
Auburn, WA 98001 USA

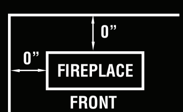
Model / Modèle: MontecitoEstateCAT

Conforms to / Conforme au : UL STD 127
Certified to / Certifié au : ULC STD S610

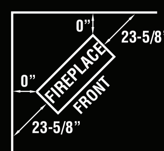
Certification test emission value 1.3 g/hr per 2020 standard
Valeur d'émission du test d'homologation 1,3 g/h selon la norme 2020

CLEARANCES TO COMBUSTIBLES:		DÉGAGEMENTS AUX COMBUSTIBLES:	
SIDE WALL (FROM DOOR EDGE)	24 in. (610 mm)	MUR LATÉRAL (DE L'OUVERTURE DE LA PORTE)	24 po.(610 mm)
MANTEL (ABOVE FIREPLACE'S BASE)	56 in. (1422 mm)	LINTEAU (AU-DESSUS DE LA BASE DU FOYER)	56 po.(1422 mm)
BACK WALL AND FIREPLACE SIDE (FROM SPACERS)	0 in. (0 mm)	MUR ARRIÈRE ET CÔTÉ DU FOYER (DES ESPACEURS)	0 po. (0 mm)
CEILING HEIGHT (ABOVE FIREPLACE'S BASE)	6 ft. 8 in. (2032 mm)	HAUTEUR PLAFOND (AU-DESSUS DE LA BASE DU FOYER)	6 pi. 8 po. (2032 mm)
CHIMNEY	2 in. (51 mm)	CHEMINÉE	2 po. (51 mm)

INSTALL WITH MINIMUM CLEARANCES TO WALL
AS SHOWN IN INCHES.

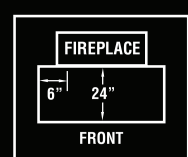


SIDEWALL - BACKWALL
INSTALLATION



CORNER INSTALLATION

FLOOR PROTECTOR MINIMUM DISTANCE
FROM OPENING IN INCHES



HEARTH EXTENSION MATERIAL :
- 1 in. THICKNESS NON COMBUSTIBLE MATERIAL
- OR EQUIVALENT

U.S. ENVIRONMENTAL PROTECTION AGENCY
Certified to comply with 2020 particulate emission standards
using crib wood.

DATE OF MFG. 1 2 3 4 5 6 7 8 9 10 11 12
2016-17-18-19-20-21-22

P/N 900440-00, REV. 1, 07/2016

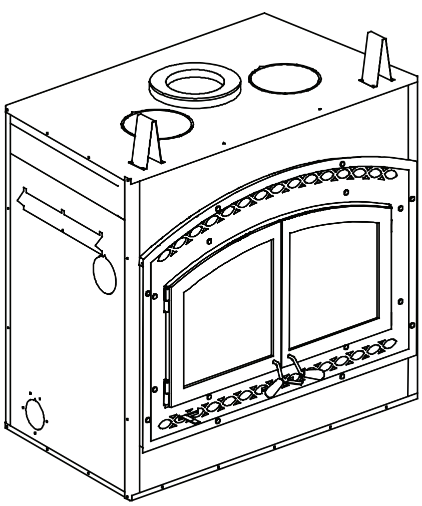
- USE WOOD FUEL ONLY
- NON COMBUSTIBLE HEARTH EXTENSION MUST BE INSTALLED AT FRONT OF UNIT EXTENDING 24 in. (610 mm) AT FRONT AND 6 in. (152 mm) TO SIDES OF DOOR OPENING.
- THIS FIREPLACE HAS NOT BEEN TESTED WITH UNVENTED GAS LOG SET. TO REDUCE RISK OF FIRE OR INJURY DO NOT INSTALL AN UNVENTED GAS LOG SET INTO THE FIREPLACE.
- ELECTRICAL RATING: 120 V, 60 Hz
- CHIMNEY TYPE: USE ONLY WITH LISTED 7 in. DIAMETER CHIMNEY, CERTIFIED MODEL GX (U.S.A. ONLY), S2100+, HT6000+, ACBI.
- CAN BE CONNECTED TO A MASONRY CHIMNEY AS DESCRIBED IN THE INSTALLATION INSTRUCTIONS.
- COMPONENTS USED WITH THE FIREPLACE MUST BE LISTED. SEE LIST IN THE INSTALLATION INSTRUCTIONS.
- REPLACE GLASS WITH CERAMIC GLASS 5 mm THICK.
- FOR SAFE OPERATION INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- CAUTION: COMBUSTION AIR OPENING MUST NOT BE OBSTRUCTED.
- DO NOT OVERFIRE THE FIREPLACE.
- OPERATE THE FIREPLACE WITH DOOR FULLY CLOSED ONLY.
- DO NOT USE A FIREPLACE INSERT OR OTHER PRODUCTS NOT SPECIFIED FOR USE WITH THIS PRODUCT

- POUR USAGE AVEC LE BOIS SEULEMENT
- UN TABLIER NON COMBUSTIBLE DOIT ÊTRE INSTALLÉ À L'AVANT DU FOYER EXCÉDANT DE 24 po. (610 mm) À L'AVANT ET 6 po. (152 mm) DES CÔTÉS DE L'OUVERTURE DES PORTES.
- CE FOYER N'EST PAS HOMOLOGUÉ POUR ÊTRE UTILISÉ AVEC UN ENSEMBLE DE BÛCHES À GAZ SANS CONDUIT D'ÉVACUATION. AFIN DE RÉDUIRE LES RISQUES D'INCENDIE OU DE BLESSURES, N'INSTALLEZ PAS DE BÛCHES À GAZ SANS CONDUIT D'ÉVACUATION À L'INTÉRIEUR DE CE FOYER.
- ALIMENTATION ÉLECTRIQUE: 120V, 60 Hz
- UTILISER SEULEMENT AVEC UNE CHEMINÉE 7 po. (178 mm) DE DIAMÈTRE, MODÈLE S2100+, HT6000+, ACBI HOMOLOGUÉE.
- PEUT ÊTRE RACCORDÉ SUR UNE CHEMINÉE DE MAÇONNERIE TEL QUE DÉCRIT DANS LE MANUEL D'INSTALLATION.
- LES COMPOSANTES UTILISÉES AVEC LE FOYER DOIVENT ÊTRE HOMOLOGUÉES. VOIR LA LISTE DANS LE MANUEL D'INSTALLATION.
- REMPLACER LA VITRE AVEC UN VERRE CÉRAMIQUE DE 5mm D'ÉPAISSEUR.
- POUR UNE UTILISATION SÉCURITAIRE, INSTALLER CONFORMÉMENT AUX DIRECTIVES DU FABRICANT.
- ATTENTION : NE PAS OBSTRUER LES ARRIVÉES D'AIR COMBURANT.
- NE PAS FAIRE SURCHAUFFER LE FOYER.
- LA PORTE DU FOYER DOIT DEMEURER TOTALEMENT FERMÉE LORSQUE LE FOYER FONCTIONNE.
- NE PAS UTILISER DE POÊLE ENCASTRABLE OU D'AUTRES PRODUITS NON SPÉCIFIÉS COMME ÉTANT UTILISABLES AVEC CE PRODUIT.

- CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTIONS IN YOUR AREA.
- CONTACTEZ LES RESPONSABLES DE VOTRE REGION A PROPOS DES RESTRICTIONS ET INSPECTIONS D'INSTALLATION.
- SEE IHP INSTALLATION AND OPERATING INSTRUCTIONS FOR THIS MODEL.
- INSTALL AND USE ONLY IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND LOCAL BUILDING CODES.
- SPECIAL METHODS ARE REQUIRED WHEN PASSING THROUGH A WALL OR CEILING. SEE INSTRUCTIONS AND BUILDING CODES.
- PREVENT CREOSOTE FIRE: INSPECT CHIMNEY CONNECTOR AND CHIMNEY FLUE MONTHLY AND CLEAN IF NECESSARY.
- DO NOT OVERFIRE. IF DOME OR CHIMNEY CONNECTOR GLOWS YOU ARE OVERFIRING.
- KEEP FURNISHINGS AND OTHER COMBUSTIBLE MATERIALS A CONSIDERABLE DISTANCE AWAY FROM APPLIANCE.
- MAINTENIR LES MEUBLES ET AUTRES OBJETS À UNE DISTANCE SÉCURITAIRE DU FOYER.
- THIS WOOD HEATER NEEDS PERIODIC INSPECTION AND REPAIR FOR PROPER OPERATION. CONSULT THE OWNER'S MANUAL FOR FURTHER INFORMATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH THE OPERATING INSTRUCTIONS IN THE OWNER'S MANUAL.
- CET APPAREIL DE CHAUFFAGE AU BOIS DOIT ÊTRE INSPECTE ET ENTRETENU PÉRIODIQUEMENT POUR FONCTIONNER CORRECTEMENT. VOIR LE MANUEL DU PROPRIÉTAIRE POUR PLUS D'INFORMATION. L'UTILISATION DE CET APPAREIL DE CHAUFFAGE AU BOIS DE MANIÈRE INCOMPATIBLE AVEC LES INSTRUCTIONS DU MANUEL DU PROPRIÉTAIRE CONSTITUE UNE INFRACTION AUX RÉGULATIONS FÉDÉRALES.

INSTALLATION AND OPERATION INSTRUCTIONS

MONTECITO ESTATE™ CAT



SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE

A French manual is available upon request. Order P/N 901004-02.

Ce manuel d'installation est disponible en francais, simplement en faire la demande. Numéro de la pièce 901004-02.

⚠ WARNING

- Hot! Do not touch! The glass and surfaces of this appliance will be hot during operation and will retain heat for a while after shutting off the appliance. Severe burns may result.
- Carefully supervise children in the same room as appliance.
- If small children are present in the home, it is recommended that this appliance be fitted with an adjustable safety gate or barrier screen.

Listed to standards:
ULC-S610 and UL-127
Report # 16-150

EPA Wood-Burning Fireplace
P/N 901004-00 Rev. NC 07/2019

MODEL

MontecitoEstateCAT

This installation manual will enable you to obtain a safe, efficient and dependable installation of your fireplace system. Please read and understand these instructions before beginning your installation.

Do not alter or modify the fireplace or its components under any circumstances. Any modification or alteration of the fireplace system, including but not limited to the fireplace, chimney components and accessories, may void the warranty, listings and approvals of this system and could result in an unsafe and potentially dangerous installation.

IHP wood-burning fireplaces are designed for use as a supplemental heater. They are not intended for continuous use as a primary heat source.

⚠ WARNING

- The fireplace cannot be operated without doors. Consult your dealer to select the correct replacement door.
- The fireplace is equipped with a blower, electrical connection must be made prior to fireplace installation
- Important! To assure proper alignment of glass doors: Install this fireplace in a square and plumb condition, using shims as necessary at sides and/or bottom.
- Install the fireplace only as described in these instructions.

⚠ WARNING

This product can expose you to chemicals including Carbon Black, which is known to the State of California to cause cancer, and Carbon Monoxide, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

P901004-00

CONGRATULATIONS!

When you purchased your new fireplace, you joined the ranks of thousands of individuals whose answer to their home heating needs reflects their concern for aesthetics, efficiency and our environment. We extend our continued support to help you achieve the maximum benefit and enjoyment available from your new fireplace.

Thank you for selecting a IHP fireplace as the answer to your home supplemental heating needs.

TABLE OF CONTENTS

THE FIREPLACE

INTRODUCTION

The Montecito Estate™ CAT wood-burning fireplace is an energy efficient, heat circulating, closed combustion fireplace. You will receive a lifetime of comfort and enjoyment from your fireplace provided it is installed, maintained and operated properly.

- Please read these instructions and retain this manual for future reference.
- Before beginning the fireplace installation, consult the appropriate local authorities to obtain your building permit and check your local building codes. Install the fireplace only as described in these instructions and using only IHP components.
- This fireplace has been tested for CAN/ULC S610-M87 and ANSI/UL 127. It has also been tested for EPA 40 C.F.R Part 60, section 60.532(b).
- The Montecito Estate CAT fireplace is not intended for use with a gas log set. Do not use a fireplace insert or any other product with this fireplace unless it is specified by IHP for use with this appliance. Failure to follow these instructions will void the certification and the warranty of the fireplace and may result in an unsafe installation.
- These appliances are designed to provide supplemental heat to the immediate area only. Therefore, it is advisable to have an alternate heat source when installed in a dwelling.
- These appliances are not approved for Manufactured Home installations.

CAUTION: BURN UNTREATED WOOD ONLY. OTHER MATERIALS SUCH AS WOOD PRESERVATIVES, METAL FOILS, COAL, PLASTIC, GARBAGE, SULPHUR OR OIL MAY DAMAGE THE CATALYST.

CAUTION: DO NOT OPERATE WITHOUT THE CATALYTIC COMBUSTOR IN PLACE.

CAUTION: NEVER BURN WITH THE BY-PASS OPENED EXCEPT FOR FIRE START-UP AND WHEN RELOADING THE STOVE.

PARTS REQUIRED

Fireplace model: Montecito Estate CAT

- **7” diameter chimney - United States**
  Model IHP Snap-Pak, including:
  - Chimney lengths
  - Elbows (where necessary)
  - Associated components as per these installation instructions and vent manufacturer’s instructions.
- **7” diameter chimney - Canada**
  Models ASHT® & S2100 manufacture by Security Chimneys® or DuraTech Canada (DTC) manufactured by DuraVent only, including:
  - Chimney lengths
  - Elbows (where necessary)
  - Associated components as per these installation instructions and vent manufacturer’s instructions.

- **Decorative Doors** - Required
  (Order Separately - See ***Page 26***)
- **Front Facade kit - Required**
  (Order Separately - See ***Page 26***)
- **UZY5 Blowers** (included in the fireplace).
- **VRUW Blower Speed Control** (included in literature package)
- **Outside air kit (Included w/Fireplace)**
- **Forced Air Kit**

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

IMPORTANT! GENERAL SAFETY PRECAUTIONS. READ AND UNDERSTAND THESE SAFETY RULES BEFORE YOUR FIRST FIRE.

⚠ WARNING

The Montecito Estate™ CAT fireplace must be installed with an outside air kit, which is included with fireplace.

⚠ WARNING

THE FIREPLACE MUST BE OPERATED WITH THE DOORS FULLY CLOSED. IF THE DOORS ARE LEFT PARTLY OPENED, GAS AND FLAME MAY BE DRAWN OUT OF THE FIREPLACE OPENING, CREATING RISKS OF BOTH FIRE AND SMOKE.

⚠ WARNING

NEVER use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, naphtha, engine oil or similar liquids to start or "freshen up" a fire in this fireplace. Keep any flammable liquids a safe distance from the fireplace at all times.

⚠ WARNING

THIS FIREPLACE HAS NOT BEEN TESTED WITH AN UNVENTED GAS OR A FIREPLACE INSERT. TO REDUCE RISK OF FIRE OR INJURY, DO NOT INSTALL AN UNVENTED GAS LOG SET OR FIREPLACE INSERT OR OTHER PRODUCTS NOT SPECIFIED FOR USE WITH THIS FIREPLACE.

⚠ WARNING

Never leave your fireplace unattended while it is burning.

⚠ WARNING

Use care when selecting window treatments for windows located near the fireplace. Avoid using combustible flowing window treatments such as curtains on nearby windows that are of sufficient length to be blown in front of an open flame when the window is opened.

Keep any combustible furniture, materials or decorative pillows at least 48" (1219 mm) from the front fireplace opening.

⚠ WARNING

Never leave children unattended when there is a fire burning in the fireplace.

⚠ IMPORTANT

When burning wood, use SOLID NATURAL DRY WELL-SEASONED WOOD ONLY. Hardwoods are recommended (soft woods tend to burn very quickly).

- **DO NOT burn treated wood, charcoal, coal, trash, cardboard, driftwood, woods dipped in tar, Christmas tree greens, pitch, pine tar, creosote, chemical chimney cleaners, flame colorants, polystyrene packaging, wood products with synthetic binders (e.g. plywood). Plywood, lumber and other misc. materials can produce abnormally high temperatures, sputtering and smoking fires and may contain hazardous chemicals to treat insects and fungus.**
- **Burning unapproved fuels can produce excessive temperatures, beyond the design capabilities of the fireplace and may produce excess sparks or may contain hazardous chemicals. Burning unapproved fuels can result in a chimney fire, a house fire, personal injury, death or loss of property.**

⚠ WARNING

To avoid the risk of damaging fireplace materials and increasing the risk of fire, do not use the fireplace to cook or warm food.

⚠ WARNING

Be careful adding wood fuel to the fire or handling fireplace tools such as shovels, tongs or pokers.

⚠ WARNING

Never modify or alter your fireplace system in any way. To do so may create a potential fire hazard and void the limited warranty, listings and approvals of this system.

⚠ WARNING

The bottom refractory can be cracked by excessive abuse such as tossing heavy logs onto the grate or gouging with fireplace tools. Exercise caution when adding wood to your fireplace.

⚠ WARNING

Neither the manufacturer nor the seller warrants "smoke free" operation nor are we responsible for inadequate system draft caused by mechanical systems, general construction conditions, inadequate chimney heights, adverse wind conditions and/or unusual environmental factors or conditions beyond our control.

⚠ WARNING

Always ensure that the air inlet to the fireplace is free from debris and any other obstructions that can block the entrance of air.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

OPERATING THE FIREPLACE

Fuel - USE SOLID NATURAL WOOD FUEL ONLY. This appliance is designed to burn dry seasoned natural wood only (see *Page 9* for a list of prohibited fuels). Failure to burn proper fuels only will void the certification and the warranty of the appliance. Hardwoods are preferred to softwoods since the energy content of wood is relative to its density. Hardwoods will result in a longer burning fire and less frequent refueling.

A moisture content of 15% to 20% (seasoned) is recommended. Wood that has been cut and split and let to dry under a cover for a period of one year will usually meet that criteria. The required drying time will vary depending on the climate. Wood that is packed tight together will take longer to dry. Seasoned wood is darker in color than wet wood and will have visible cracks in the grain on the ends. Excessively wet wood will be difficult to burn and will result in lower efficiency, increased creosoting and plugging of the catalytic combustor. Excessively dry wood will burn well but will also have higher emissions and shorter burning time.

Overheating the unit above 1000° C (1800° F) is harmful for the catalytic combustor, it can damage the catalyst coating and can cause cracking of the substrate. Looking through the top front of the decorative facade, if the top of the firebox is glowing, the unit is overheating.

DO NOT OVERFIRE THIS HEATER

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

First Fires

Make sure the doors are properly adjusted, thus avoiding color change to finish due to overheating.

The first five or six fires should be small fires of short duration (about 30 to 60 minutes). This will help cure the refractory bricks. During the first few fires of this appliance there may be some odor and smoke due to the curing of the paint, dust accumulation and burning off of lubricants used in the manufacturing process. It may set off a smoke alarm located in the same room. For this reason the room should be well ventilated for the first few fires.

Catalytic Combustor

This fireplace is equipped with a catalytic combustor. Unburned by-products of the wood fire are burned at lower temperatures as they pass through the combustor resulting in less pollution, reduced creosote and higher efficiency. In order to have the catalyst working, temperatures of the flue gases entering the combustor have to be higher than 400° F (200° C). That is why the unit is equipped with a bypass damper that allows the draft air to bypass the catalytic combustor. Opening the bypass damper control increases the draft allowing the unit to achieve proper operating temperatures during a cold start-up. It also provides more draft to prevent smoke spillage when the door is opened.

Catalytic Bypass Gauge

To determine when to close the bypass, the unit is equipped with a gauge *(see **Figure 1**)*. The gauge is located behind the decorative facade in the lower right corner. Once you can see the gauge needle in the catalytic combustor operating range, you may push to close the bypass lever.

When the catalyst light-off conditions are achieved, the combustor will keep on going until it runs out of smoke. Note that the catalyst does not need to be glowing to be working, it can work very well at temperatures well below the 538° C (1000° F) level at which it will begin to glow. The best way to see if the catalyst is active is to take a look at what is coming out of the chimney. If the catalytic combustor is working you will see some white water vapor coming out, compared to a more brown/gray smoke when the bypass is opened. Do not burn any chemical chimney cleaner; it can make the catalyst inactive.

Combustion Control

Primary Air
There is no flue damper in the fireplace. As is common with air tight appliance, the combustion air control sets the flow of air entering the firebox. This allows for a more precise control of the fire. The combustion air control is located below the door on the left side. The main source of air (primary air) entering the firebox can be diminished by moving the air combustion control from left to right. The primary air is fully opened when the air control is completely moved to the left.

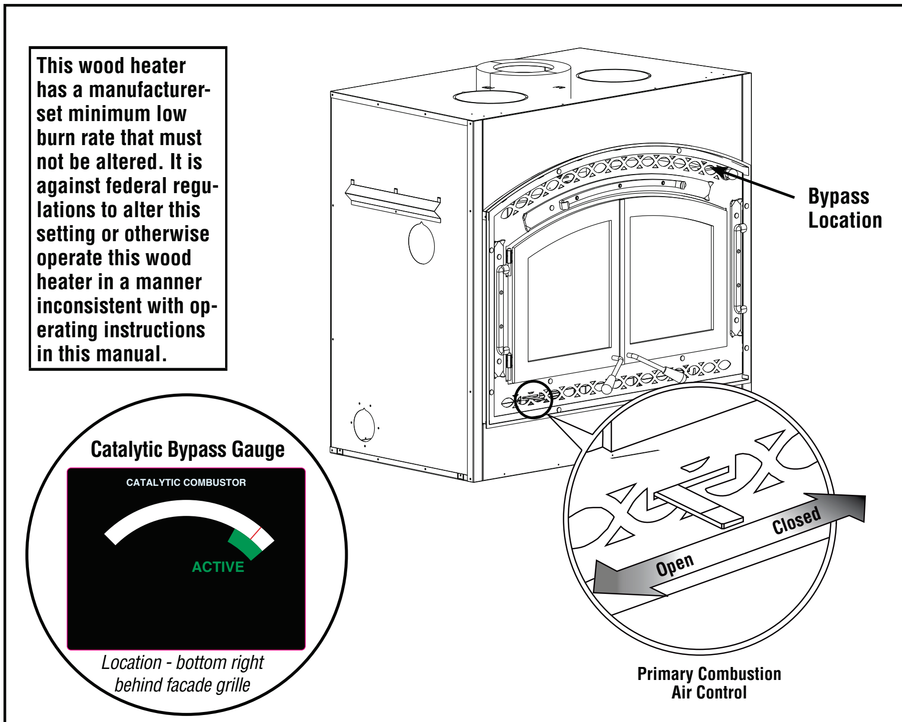


Figure 1

This manual describes the installation and operation of the IHP model Montecito Estate™ CAT catalytic equipped wood heater. This heater meets the 2020 U.S. Environmental Protection Agency's certified to comply with 2020 particulate emission standards using crib wood. Under specific test conditions this heater has been shown to deliver heat at rates ranging from 10,900 to 40,000 Btu/hr.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

The air combustion control should be in the closed position when the fireplace is not in operation. This will minimize air leakage up the chimney. **The combustion air control and the bypass damper control must be opened before opening the door to minimize the possibility of back draft coming into the room *(Figure 1)*.** More details are available in *Refueling For Best Performance* on ***Page 6***.

Heat Output

The Montecito Estate™ CAT fireplace is the largest member of the IHP high efficiency fireplaces. The heat generated from its fire is more efficiently captured and distributed. In spite of the large amount of heat that the Montecito Estate CAT fireplace can deliver, it should not replace the main source of heat in your home. This fireplace will bring extra warmth and ambiance to your home by distributing its heat as described further in the manual.

Accelerated Combustion

The maximum heat output for the Montecito Estate fireplace is achieved by burning with the door closed and the combustion air opened and pulled out. Through this method, the Montecito Estate fireplace can produce up to 80,000 BTU of heat per hour. However, it will be necessary to reload with wood every one or two hours. This is the least efficient method of burning the Montecito Estate CAT fireplace.

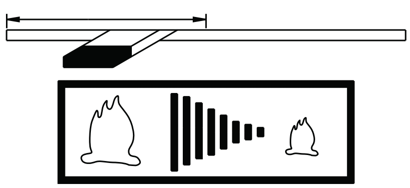


Figure 2 - Accelerated Combustion Setting

Use caution when firing with the combustion air control wide open. Only burn cord wood in this manner. Small dry pieces of softwood and construction scraps will burn very intensely using this method and may damage the firebox as well as the catalytic combustor.

Medium Combustion

This is the recommended mode of operating the Montecito Estate CAT fireplace and should be the one normally used since it will deposit the least amount of creosote on the glass and in the chimney. The combustion air control must be 3/4 closed. The precise setting will depend on many factors, including chimney length and the moisture content of the wood.

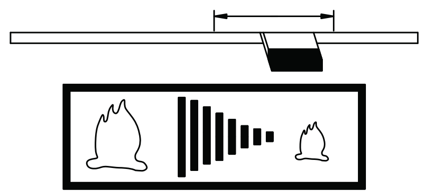


Figure 3 - Medium Combustion Setting

For instance, a long chimney will necessitate closing the damper more. To obtain the proper combustion, close the damper completely, then open it about 1/2" to 3/4". Three medium size pieces of cord wood-burning on a bed of hot coals will generate an approximate heat output will of 35,000 BTU per hour and the loading time will be about every 3-4 hours.

Softwoods may also be burned using this method but the combustion time will be substantially reduced.

Slow Combustion

When the air combustion control is completely closed, the fireplace is in a slow combustion phase. If the hearth is hot enough, slow combustion will not extinguish the fire, but there will be a noticeable change in the flame pattern. The flames will be slow and may appear dirty if the wood is too wet (moisture content of 20% and more).

Do not allow the wood to burn without flame, since this will produce excessive creosote in the unit. Creosote may accumulate on the glass door. This method of burning should be used only after operating the Montecito Estate CAT fireplace with the air control opened to produce a hot fire for about an hour or at medium pace for at least three (3) hours. Slow combustion can be used at night in order to reduce the heat output and to prolong the burn. The burn time will be between 6-8 hours and this combustion rate, while the output level of BTU's will be at their lowest.

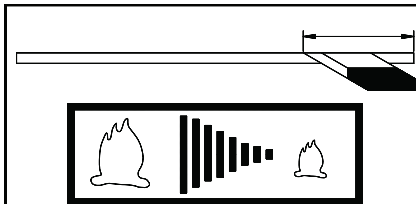


Figure 4 - Slow Combustion Setting

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

STARTING AND MAINTAINING A FIRE

Step 1. Place several crumpled up balls of newspaper in the firebox. Place small dry pieces of kindling on top of the paper, criss-crossing the kindling so that there are air spaces in between. The kindling should be placed at the center of the firebox so as to allow for sufficient air circulation.

Step 2. Adjust the primary air control and pull the bypass damper control towards you to put it in the OPEN position. Light the newspaper. Leave the doors partially opened to facilitate the start-up.

Step 3. Once the kindling fire is well established, cord wood can be added. Close the door and maintain an accelerated combustion air set up in order to achieve combustor light-off conditions (See Primary Air Control Section).

Step 4. When the fire is burning well, close the bypass damper control by pushing the control rod in. It takes about 15 – 30 minutes with the bypass opened to reach proper light-off temperatures for the catalytic combustor.

Step 5. Set the primary control to the desired burn level. The fireplace will automatically go to that level after the fire is fully established.

The unit will burn best with 2-3 pieces of cord wood spaced 1 to 2 inches apart and allowing air to get under the fuel. Criss-crossing or arranging the fuel so that air can get underneath will help the fire to get started easily. The unit should be operated with the air control fully open long enough to get the cord wood well ignited.

REFUELING FOR BEST PERFORMANCE

To refuel the fireplace at the end of a burn cycle when only hot embers remain and flames are gone (not enough heat to maintain catalyst operating temperatures):

Step 1. Open the bypass and air controls fully *(see **Figure 1**)*.
Step 2. Completely open the primary air control. See ***Figure 2***.

REFUELING: During the refueling and rekindling of a cool fire, or a fire that has burned down to the charcoal phase, operate the stove at a medium to high firing rate for about 10 minutes to ensure that the catalyst reaches approximately 400°F.

Step 3. Open the doors about 1" and wait 5 seconds until the air flow has stabilized. Then open the doors completely, put the logs in and close the doors.
Step 4. Set the primary air control to the desired burn level. Open the bypass damper for 10 minutes before closing it. It will ensure sufficient temperatures for combustor light-off.

To refuel the Montecito Estate™ CAT fireplace when the unit is still hot (Some burning fuel remaining or a glowing combustor)

A. Fully open the primary air control and the bypass completely.
B. Open the doors about 1" and wait 5 seconds until the air flow has stabilized. Load the fuel, close the doors and bypass (temperatures within the firebox should be enough to maintain catalytic operation).
C. Set the primary air control to the desired burn level.

NOTES:
- *For spectacular fire and optimization of the fireplace efficiency, we recommend that the wood load be placed as far back as possible.*
- *It may be necessary to turn off any blower(s) in operation during the refueling process in order to minimise smoking in the room. It is recommended to wait 15 to 30 minutes before turning the blower(s) back on to ensure successful rekindling.*

SMOKING – CAUSES AND TROUBLESHOOTING

To reduce the likelihood of smoke coming into the room when opening the doors, set the combustion air controls to the left ("Accelerated Combustion") and open the bypass before opening the doors. Your fireplace has been designed and tested to provide smoke free operation.

As the fire burns, air goes up the chimney. This air must be replaced through the outside air duct. When operating the fireplace, open a nearby window temporarily to check if there is adequate replacement air supply. Occasionally, there may be a small amount of smoking upon lighting the fire, until the chimney heats up but this should not last. If the fireplace continues to smoke it is probably for one of the following reasons:

A. The doors are partially opened - When you close the doors, close them completely.
B. Negative pressure in the house - As the fire burns, air goes up the chimney. This air must be replaced through leakage into the house or through the outside air duct (optional). When operating the fireplace, open a nearby window temporarily to check if there is adequate replacement air supply.
C. Fans operating (e.g.: range hood) - These fans draw air out of the house and may actually cause a negative pressure in the house. Turn off all fans and open a nearby window to determine if this is the cause of the problem.
D. Wet wood - Wet or tarred wood will smoulder and smoke instead of burning properly. Your dealer can help you determine if you have properly seasoned wood for burning.
E. Dirty or blocked chimney - Check to make sure the chimney is clear and clean. If dirty call a certified chimney sweep or use a properly sized chimney brush to clean.
F. Chimney not long enough - The minimum chimney height is 12 feet not including the fireplace height. The chimney must extend at least three (3) feet (915 mm) above its point of contact with the roof and at least two (2) feet (610 mm) higher than any roof or wall within ten (10) feet (3 m) of it. When installed with offsets, the minimum chimney height is 15 feet. Additional height will increase draft and will decrease the tendency to smoke.
G. Poor chimney draft
With no fire, there should be sufficient draft to exhaust cigarette smoke introduced under the baffle. Chimneys installed against an outside wall without protection may generate back draft problems which will cause start-up problems. To prevent this, open a nearby window; roll up a piece of paper, light it and hold it in the upper part of the firebox to warm up the chimney. Wait until the draft is sufficient, then start the fire.
H. Blower for forced air kit operating - Make sure that the blower is at the "off" position when you open the fireplace door for reloading.

IMPORTANT CAUTIONS

A. Do not block the openings at the top of the fireplace as this will cause the fireplace to overheat.
B. Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or 'freshen up' a fire in this fireplace. Keep all such liquids well away from the fireplace while it is in use.
C. Do not burn coal. The sulphur in coal will corrode the firebox and chimney.
D. Do not burn driftwood which has been in the ocean or salt water. The salt will corrode the firebox and chimney.
E. Do not operate the unit with the door(s) partly open since this may cause smoke to be drawn into the room.
F. Do not burn wood in the area in front of the grate.
G. Do not abuse the unit by burning paper, or cardboard or construction material such as pressed wood, plywood or lumber. Wood protectors, metallic paper, coal, plastic, waste, sulphur and/or oil will damage the fireplace.
H. Do not allow the wood to smoulder or burn without flame, since this will produce excessive creosote in the unit as well as increased particulate emissions.

CATALYTIC COMBUSTOR TROUBLESHOOTING GUIDE		
Problem	**Condition**	**Solution**
Ash Build-up on Combustor Surface	Normal	Ash, a fluffy light gray powder, and soot, accumulate on the combustor surfaces in normal use. Ashes accumulate as a result of the smoke being burned within the combustor and carried out of the firebox by the chimney draft. Soot is the result of previous creosote deposits having been burned off or foreign materials being burned in the firebox. This is normal and will be eliminated during the next burn.
Combustor Clogging	Creosote	Combustor should be cleaned *(see **Page 10**)*. Do not use air pressure or sharp objects to clean combustor.
Broken Combustor	Crack or Break	The combustor is manufactured from a ceramic material and therefore can crack or break. However, the combustor will still function if cracked. If combustor is broken into pieces and dis-lodged from the housing, it will need to be replaced.
Combustor Malfunction	Not Working	The combustor should last a minimum of 10,000 hours of operation. The combustor will lose catalytic capability over time. When you see continuous smoke coming from the chimney, the combustor should be cleaned. If the smoking persists, the combustor should be replaced.
Combustor Problem	Thermal Erosion	This combustor does NOT experience thermal erosion. “Not applicable.” Applies to honeycomb combustors only.
Combustor Problem	Thermal Cracking	This combustor does NOT experience thermal cracking. “Not applicable.” Applies to honeycomb combustors only.
Combustor Problem	Combustor Peeling	This combustor does NOT experience combustor peeling. “Not applicable.” Applies to honeycomb combustors only.
Reduced Combustor Performance	Combustor Clogging or Fatigue	Signs of combustor fatigue include reduced heat output and sluggish performance. Inspect and clean combustor. Replacement may be required. Monitor performance and smoke coming from chimney.
Combustor not glowing	Late stage of burn	Combustor does not need to be glowing to be working. Check smoke exiting chimney to help determine if combustor is working properly.
Appliance burning too hot or fast	Doors are not properly closed.	Close doors securely. Check door gasket.
	Excessive draft	Adjust primary air control to lower setting.
Back-puffing or sudden internal ignitions	Operating technique	Open bypass and primary air control before opening to reload and keep it open a few minutes after reloading.
	Burn rate too low	Open air damper to allow for hotter burn.
	Chimney down draft	In high wind areas, a specially designed wind cap may be necessary.
	Combustor or louvered housing plugged	Clean combustor / louvered housing of accumulated fly ash.
Appliance Smokes	Operating technique	Open bypass and air damper prior to reloading appliance.
	Blocked Chimney	Examine chimney and vent pipe for blockage and creosote accumulations. Check spark arrestor screen on your cap, if you have one.
	Blocked outside air duct	Check the outside air inlet for blockage caused by snow, debris, or insects.

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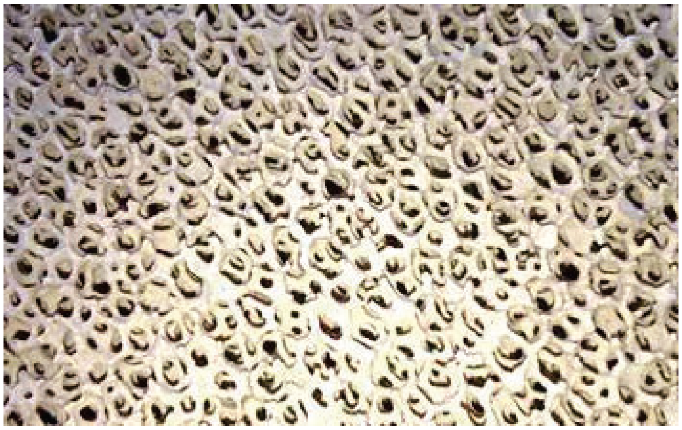


Healthy Combustor - Unused

Combustor Problem - Broken Combustor

Combustor Problem - Ash, a fluffy light grey powder, and soot, accumulate on the combustor surfaces in normal use. In extreme situations combustor can become clogged and should be cleaned.

Combustor Problem - Cracked Combustor

SMOKE DETECTORS RECOMMENDED

Since there are always several potential sources of fire in any home, we recommend installing smoke detectors. If possible, install the smoke detector in a hallway adjacent to the room (to reduce the possibility of occasional false activation from the heat produced by these appliances). If your local code requires a smoke detector be installed within the same room, you must follow the requirements of your local code. Check with your local building department for requirements in your area.

CARBON MONOXIDE MONITOR RECOMMENDED

Carbon Monoxide Poisoning: Early signs of carbon monoxide poisoning are similar to the flu with headaches, dizziness and/or nausea. If you have these signs, obtain fresh air immediately. Some people are more affected by carbon monoxide than others, including pregnant women, people with heart or lung disease or anemia, those under the influence of alcohol, and those at high altitudes.

It is against federal regulations to operate wood heaters in a manner inconsistent with operating instructions in the manual.

DEALING WITH A CHIMNEY FIRE

Regular chimney maintenance and inspection can prevent chimney fires. If you have a chimney fire, follow these steps:

1. **IMPORTANT:** Close the fireplace door and the combustion air controls; this will stifle the fire.
2. Alert your family of the possible danger.
3. If you require assistance, alert your fire department.
4. If possible, use a dry chemical fire extinguisher, baking soda or sand to control the fire. Do not use water as it may cause a dangerous steam explosion.
5. Ensure that sparks and hot embers coming out of the chimney are not igniting the roof.
6. Do not use the fireplace again until your chimney and fireplace have been inspected by a qualified chimney sweep or a fire department inspector.

ACHIEVING CLEAN BURNS

Check the exhaust in about 15 to 20 minutes *(see **Figure 5**)*. Large amounts of smoke indicate an improper burn setting (either too high or too low). Adjust and recheck in 5 to 10 minutes.

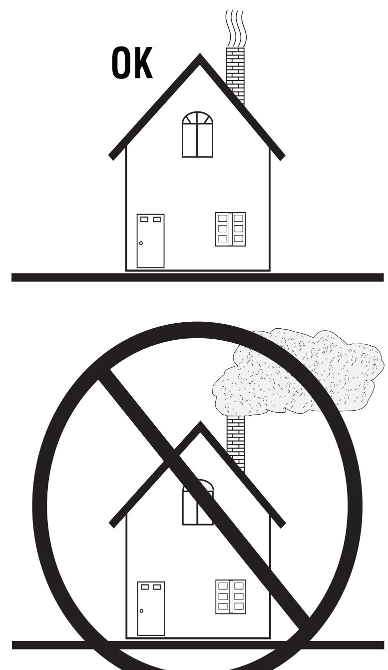


Figure 5

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

FUEL

WHAT DOES "WELL-SEASONED" MEAN?

When a tree is cut down, the wood is green, full of sap and moisture. This moisture content can exceed 80%, which must be reduced to less than 20%. Wood properly seasoned is then capable of generating the heat the stove was designed to provide.

Green wood does not burn easily. Attempting to burn green wood often results in a lot of smoke and very little fire. Time is the most important factor in seasoning wood. Ideally the moisture content should be reduced to 11-20%. ***NOTE: The use of a firewood moisture meter is recommended to ensure the firewood contains less than 20% moisture.***

Seasoning Guide
Softwoods - 6 months to 18 months
Hardwoods - 12 months to 24 months

Logs that are 5" diameter across or larger should be split in half, three pieces if over 8 inches, and four pieces when over a foot across. If a tree has been dead for 2 - 4 years it still needs to be cut, split, and seasoned for 6 to 24 months depending on the wood.

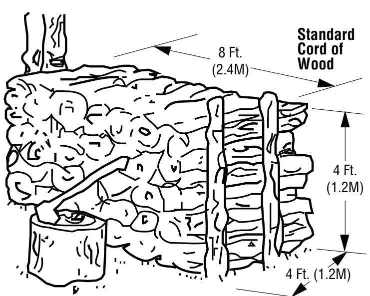


Figure 6

Prohibited Fuels

This heater is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or to green or freshly cut hardwoods. DO NOT BURN:

- Garbage;
- Lawn clippings or yard waste;
- Materials containing rubber, including tires;
- Materials containing plastic;
- Waste petroleum products, paints or paint thinners, or asphalt products;
- Materials containing asbestos;
- Construction or demolition debris;
- Railroad ties or pressure-treated wood;
- Manure or animal remains;
- Salt water driftwood or other previously salt water saturated materials;
- Unseasoned wood;
- Christmas tree branches;
- Paper products, colored paper, cardboard, plywood, or particleboard;
- gasoline;
- naphtha;
- engine oil;
- flammable liquids;
- solvents;
- grease; or
- coal

Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke. Intense firing with these materials may overheat the fireplace, causing damage to the unit, a fire or even possibly igniting a chimney fire if the chimney is creosoted. Burning unapproved fuel, resulting in excessive pollutants being emitted, may be prohibited and subject to a fine or other penalty by the authority having jurisdiction in your area.

The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater.

MAINTAINING YOUR FIREPLACE

Have your product inspected at least once a year by a qualified service technician to ensure gaskets, air tubes, baffles, and venting are in good repair to ensure proper performance. Have degraded items replaced by a qualified service technician.

This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed.

Creosote - Formation and Need for Removal
When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited this creosote makes an extremely hot fire.

The chimney shall be inspected at least twice a year during the heating season to determine when a creosote buildup has occurred.

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

When the creosote accumulation is large, a creosote fire in the chimney can damage the chimney and overheat the surrounding wood framing. Creosote formation in a chimney can be minimized by making sure there is always visible flame burning, avoid smoldering fires and by proper refueling techniques.

Chimney Maintenance

Regular chimney inspection and maintenance combined with proper operation will prevent chimney fires. Keep your chimney clean. Do not allow more than 1/16" (1.6 mm) creosote build up in your chimney.

The amount of creosote will depend on variables such as frequency of use and type of fire. We recommend that you:

A. Initially inspect the chimney system weekly. From this, you will learn how often it will be necessary to clean your chimney.
B. Have your chimney cleaned by a qualified chimney sweep. If you wish to clean it yourself, we recommend using a stiff plastic or non-metallic brush. If a metal brush is used, its size should be slightly smaller than the flue to avoid damaging the chimney. Do not use a brush that will scratch the stainless steel interior of the chimney.
C. Do not expect chemical cleaners to keep your chimney clean. The rain cap can be removed for inspection and/or cleaning of the chimney.

CAUTION: It is necessary to remove the deflector from the top of the firebox before cleaning the chimney.

Before performing chimney sweep, open the bypass and remove the combustor. Remove dust accumulation after chimney sweep and put the combustor back in place.

CATALYTIC COMBUSTOR

This fireplace is designed with a catalytic combustor which will reduce pollution emissions and creosote build up while improving thermal efficiency. In order to optimize and maintain the combustor performance, it is important to visually check the combustor at least 3 times during the heating season to determine if physical degradation has occurred.

⚠ WARNING

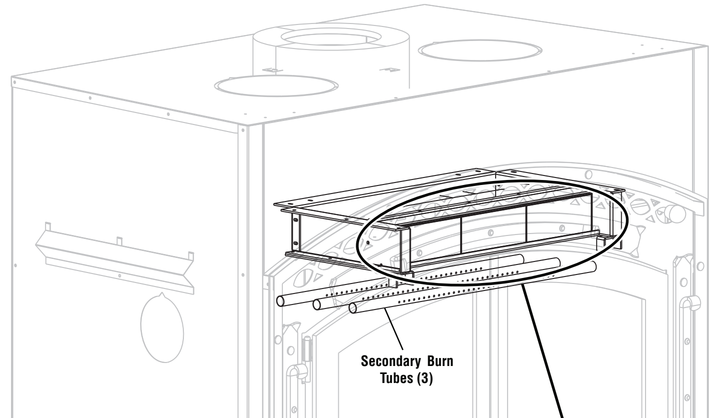
To prevent damage to your combustor, do not:

- **Drop the combustor (which is fragile compared to the rest of the unit – so handle with care)**
- **Run water or compressed air through the combustor**
- **Try to clean the combustor with any sharp tool**

The combustor supplied with this heater is an Innovative Hearth Products Combustor. Consult the catalytic combustor warranty also supplied with this wood heater. Warranty claims should be addressed to:
Innovative Hearth Products
1769 East Lawrence Street,
Russelville, AL 35654
Phone: 800-655-2008

The packaging of the combustor must be robust enough to protect against any shipping damage that may occur.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.



COMBUSTOR ASSEMBLY REMOVAL INSTRUCTIONS

1. Remove the left and right baffles which are resting on top of the (3) secondary Burn Tubes.
2. Rotate each of the (2) Combustor Assembly support brackets (underneath the assembly tray) towards the front of the appliance, being careful not to drop the assembly
3. Rotate the assembly forwards and down, until it may be removed from the tray.
4. Installation is reverse of removal. Before re-installing the combustor assembly, a bead of mill-pack should be applied to the rear surface of the box, so that when it is rotated up and into position it seals to the bracket behind it.

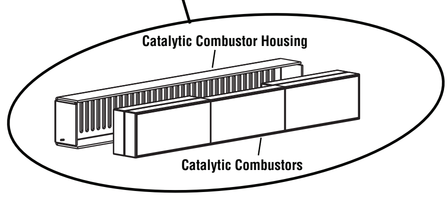


Figure 7

CLEANING THE COMBUSTOR *(Figure 7)*:

Catalytic combustors require little maintenance. Cleaning the combustor once a year, preferably when your flue system is serviced, is sufficient for most users.

CAUTION: BOILING WATER MUST BE USED TO CLEAN THE COMBUSTOR.

Prepare a mixture of white vinegar and distilled water for cleaning of the combustor. A gallon of distilled water should be available for rinsing of the combustor after cleaning.

White vinegar – 1 QUART enough to make a 50/50 solution with the distilled water to cover the combustor.

Distilled Water – 1 QUART enough make a 50/50 solution with the white vinegar to cover the combustor.

Rinse Water – 1 GALLON of distilled water.

Combine the white vinegar and the distilled water in a pot large enough to soak the combustor.

Bring the solution to a boil.

Soak the combustor in the solution for approximately 30 MINUTES. The solution may need to be reheated for maximum cleaning effectiveness.

Rinse the combustor – Thoroughly rinse the combustor in the distilled water.

Remove the combustor from the rinse water and gently shake out the excess water. ***NOTE: THE COMBUSTOR MUST BE COMPLETELY DRY PRIOR TO USE.***

SECONDARY AIR TUBE REMOVAL INSTRUCTIONS

1. Remove the two ceramic baffles, gently pulling them forward and down.
2. To remove the burn tubes first remove the bracket which position and secures the tubes in place. This is done be removing the (2) screws *(see **Figure 8**)* which hold this bracket in place (upper left side, inside the firebox).
3. Once the bracket is removed, each tube may be removed by sliding it to the left and dropping the right, and the sliding the tube to the right.
4. Re-installation is in reverse order.

Catalyst Monitoring

It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions. Following is a list of items that should be checked on a periodic basis:

- Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Actual removal of the combustor is not recommended unless more detailed inspection is warranted because of decreased performance.

  If any of these conditions exists, refer to Catalyst Troubleshooting section of this owner's manual.
- This catalytic heater is equipped with a temperature probe to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 500°F, and often reach temperatures in excess of 1,000°F. If catalyst temperatures are not in excess of 500°F, refer to Catalyst Troubleshooting section of this owner's manual.
- You can get an indication of whether the catalyst is working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalyst light-off has been achieved, to the amount of smoke leaving the chimney when the smoke is not routed through the combustor (bypass mode).

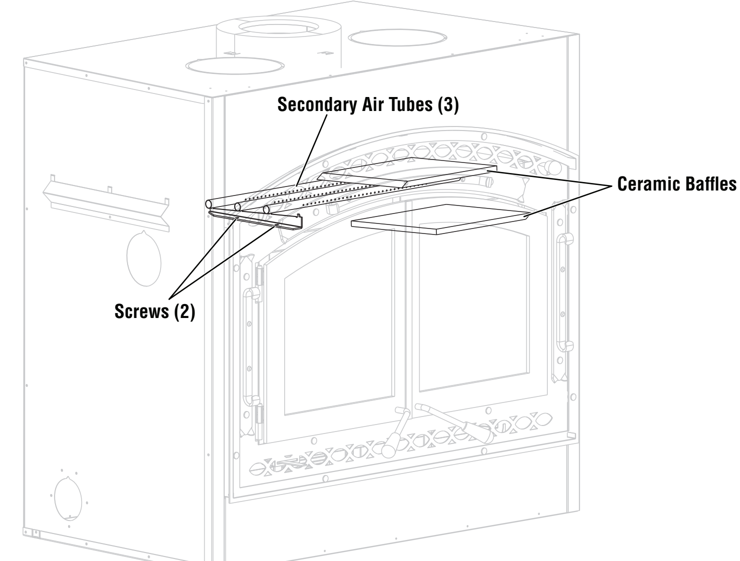


Figure 8

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

REFRACTORY REPLACEMENT

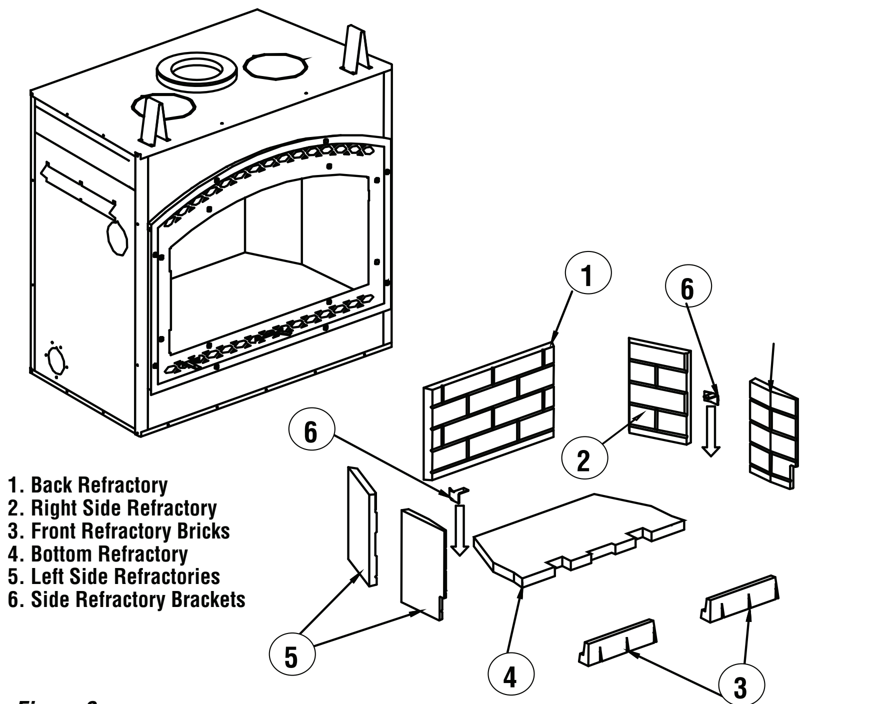


Figure 9

The intense heat of the fire will normally cause hairline cracks in the refractory brick. These cracks can be minimized by proper curing as described in section *First Fires*. They will not normally diminish the effectiveness of the refractory brick. If large cracks develop, then the refractory should be replaced. To replace the refractory bricks, follow these steps:

1. Remove the side refractory brackets (6)
2. Remove the front refractory bricks (3)
3. Remove the bottom refractory brick (4)
4. Remove the left side refractory bricks (5)
5. Remove the right side refractory bricks (2)
6. Remove the back refractory brick (1)

To install the new refractory bricks, follow the above steps in reverse.

DISPOSING OF ASHES

Whenever ashes get 3 to 4 inches deep in your firebox, and when the fire has burned down and cooled, remove excess ashes. Leave an ash bed approximately 1 inch deep on the firebox bottom to help maintain a hot charcoal bed.

Remove ashes only when the fire is out and the ashes are cold (24 to 48 hours after the fire is out).

Do not leave the ashes in the house as they give off carbon monoxide and other toxic gases.

⚠ WARNING

Disposal of Ashes: Ashes should be placed in a metal 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.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

DOOR INSTALLATION

The doors must be put in place only when the installation of the fireplace is completed. All you have to do is fit the male part of the hinge, already on the door, to the female part, which is on the fireplace. To remove the doors, simply pull them up from the hinges. The door adjustment has been set at the factory. If the fit is still not perfect, you can adjust the door using the hinge screws (See ***Figure 11-1***)

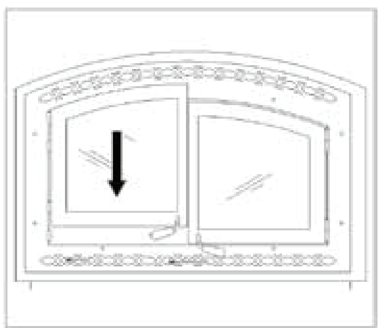


Figure 10 **- Door Installation**

DOOR ADJUSTMENT

The doors may need to be adjusted to be completely airtight. The gaskets' air-tightness can be adjusted using the adjustment screw located on the right side of the fireplace facade (An Allen key #1/8 – not supplied - will be necessary for this adjustment) (see ***Figure 11-2***).

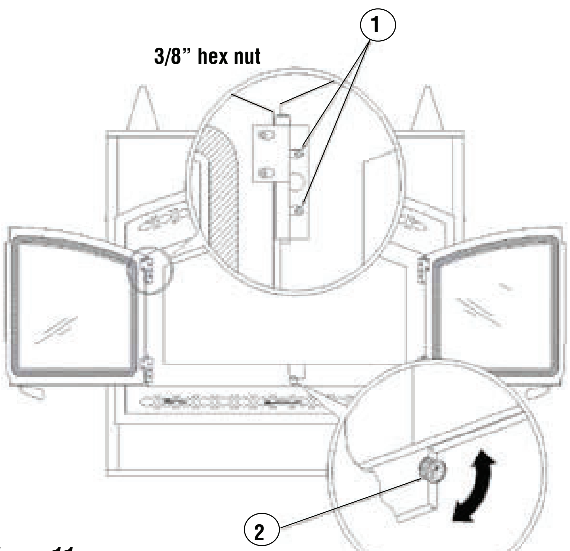


Figure 11

⚠ WARNING

- **Use only a IHP glass doors, specifically designed for the Montecito Estate™ CAT fireplace.**
- **The fireplace cannot be operated without both doors. Consult your dealer to select the correct replacement door.**
- **Important! To assure proper alignment of glass doors: Install this fireplace in a square and plumb condition, using shims as necessary at sides and/or bottom.**

Checking Door Seal

A one-inch strip of paper may be used to perform a test of the integrity of the door seal. Close the door on the paper in at least eight points. It is normal to feel only a slight amount of friction. The door gasket does not need to be "tight" in all areas, since a small amount of leakage is not hazardous or detrimental to the performance of your fireplace.

GLASS CARE

Glass Replacement

The glass used for the fireplace is a high temperature ceramic glass (1,400° F). If the glass breaks or cracks, it must be replaced with an identical ceramic glass. Tempered glass or ordinary glass will not with-stand the high temperatures of the fireplace. Replacement glass should be purchased from a IHP dealer (see *"Replacement Parts"* on ***Page 27***).

DO NOT OPERATE THE UNIT WITH CRACKED OR BROKEN GLASS.

Glass Cleaning

The fireplace is designed to keep the glass clean under normal operating conditions. If the fireplace is operated continuously with the primary air control closed, the glass will tend to get dirty unless the fuel, firebox and glass are maintained at hot temperatures (see section *Refueling For Best Performance)*. To clean the glass, there are a number of specially designed cleaners to remove creosote. Your IHP Dealer can recommend a suiTable 5leaner. Regular household glass cleaners will not clean creosote. **Do not use abrasives such as steel pads, steel wool or oven cleaner as they will scratch the glass.**

DO NOT USE CHEMICAL GLASS CLEANERS ON PAINTED SURFACES AS IT MAY CAUSE THE PAINT TO PEEL.

CAUTION : DO NOT ALLOW WINDOW CLEANER TO GET IN CONTACT WITH DOOR GASKET OR PAINT ON FACADE OR DOOR. ONCE CLOSED, CONTACT OF GLASS CLEANER WITH THE FIREPLACE FACADE CAN LEAD TO PAINT PEELING OFF.

Gasket Replacement

Remove the doors from the unit (see section *Door Installation)* and lay them on a clean nonabrasive surface. To replace the gasket, first remove all of the old gasket and gasket cement. Make sure that the surface is totally clean before applying new cement (a high temperature silicone caulking rated at 500° F (260° C), is suitable) or adhesion problems may result. Apply gasket cement to the gasket channel and install the new gasket. This replacement part is available from your IHP dealer in the following dimensions:

Gasket	Part #	Length	Qty	Dimensions
Around the glass	PR-SR1685C	61-3/4" (1569 mm)	2	1" width x 3/16" thick (26 mm x 5 mm)
On the door frame	PR-SR1823I	48-3/8" (1229 mm)	2	3/4" diameter (19 mm)
Between the doors	PR-SR1823J	17-5/8" (448 mm)	2	5/8" diameter (16 mm)

Table 1

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

FIREPLACE INSTALLATION

Locating The Fireplace

The best location to install your fireplace is determined by considering the location of windows, doors, and the traffic flow in the room where the fireplace is located, allowing space in front of the unit for the hearth extension and the mantel, and taking into consideration the location of the hot air ducts (optional), outside air kit and chimney. If possible, you should choose a location where the chimney will pass through the house without cutting floor or roof joists (see fireplace dimensions on ***Page 15***).

Usually, no additional floor support is needed for the fireplace. The adequacy of the floor can be checked by first estimating the weight of the fireplace system. Weights are given in the appendix. Next, measure the area occupied by the fireplace. Note the floor construction and consult your local building code to determine if additional support is needed.

This fireplace must be installed on a 1/2" minimum non-combustible surface and at a minimum of 80" measured from the base of the appliance to the ceiling is required.

When selecting the location, the chimney outlet position and the direction of the wind are important factor affecting the chimney performance. To allow a maximum draft and to reduce wind turbulence, the chimney must:

- Penetrate the highest part of the roof.
- Be installed as far as possible of roof offsets, trees or any other obstructions that may cause wind turbulence and back drafts in the chimney.
- The least amount of offsets (elbows) possible. ***NOTE:*** *A maximum of 2 offsets is allowed.*

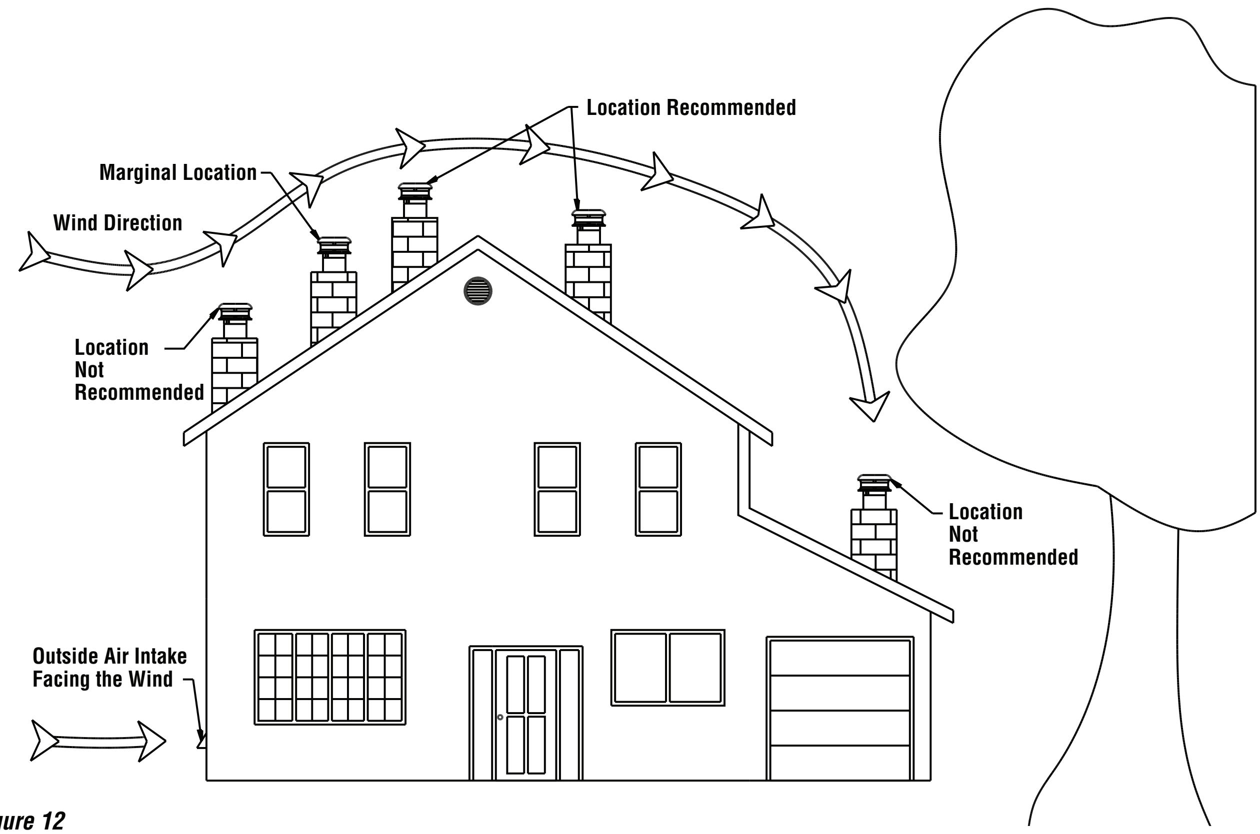


Figure 12

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

Facade Installation

Install the Facade per instructions provided in Facade Kit (ordered separately - see ***Page 26***).

Framing, Facing And Mantel

The construction of the framing, facing, and mantel must be in accordance with the standards and the following illustrations ***(Figure 15 and 16)***:

A. Frame the fireplace using 2" x 3" or heavier lumber.

B. WARNING: Combustible materials cannot be used in the space directly above the fireplace, except for the studs above the facade that support the facing and mantel. This area must remain empty for a height of 80" (2,032 mm) measured from the base of the appliance.

C. Frame the fireplace with vertical studs at the sides of the fireplace running from floor to ceiling (see ***Figure 15***). If combustible facing is to be used, position the studs back, from the front edge of the fireplace (a space that is the thickness of the facing material, so that the facing can be installed flush with the fireplace facing). Frame headers between the vertical studs only as follows:
   - Place 2" x 3" or 2" x 4" headers, only along the upper part of the front, side and back faces (some codes may require a 2" x 6" on an outside bearing wall). Do not put wood or any combustible material within the area above the fireplace except on the front facing.
   - Place headers only as required to support the facing and mantel.

D. WARNING: The fireplace must not be in contact with any insulation or loose filling material. Cover the insulation with Drywall panels around the fireplace.

Hearth Extension Requirements

This fireplace must be installed on a 1/2" minimum non-combustible surface. The supplied safety metal strip must be positioned as follows: One half under the front of the fireplace and the other half must extend on the floor over which the hearth extension will be built (see ***Figure 13***).

* The safety metal strip must cover the entire width of the fireplace

The combustible floor in front of the fireplace must be covered with a non-combustible material (tile, marble, stone, etc). See ***Figure 14***.

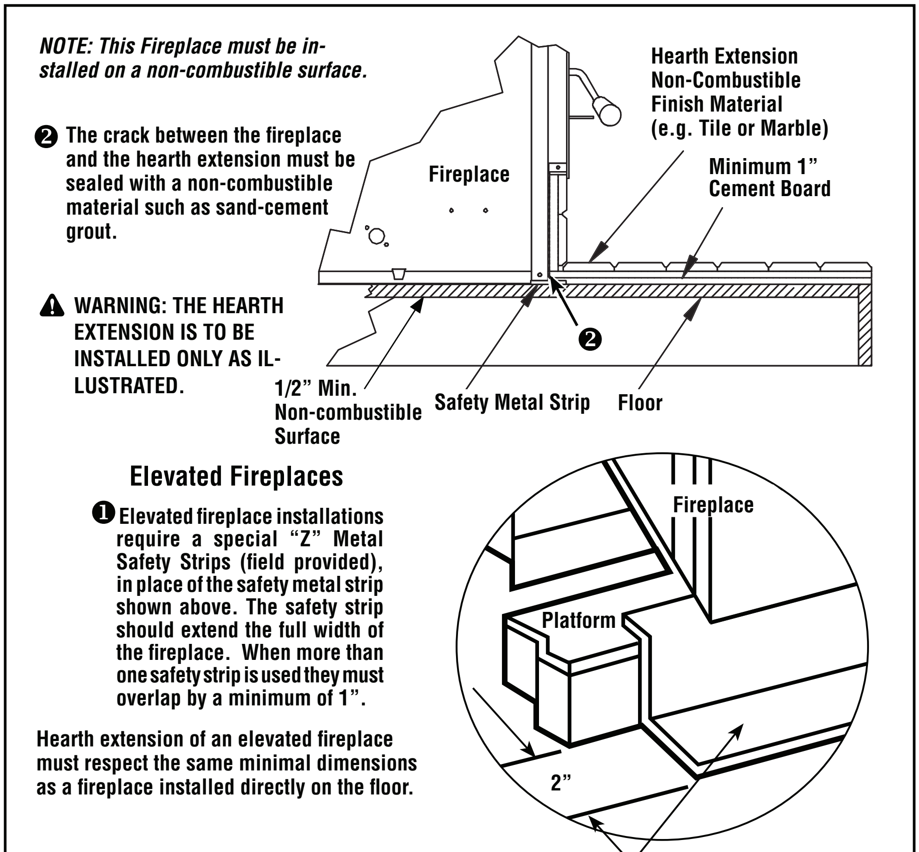


Figure 13

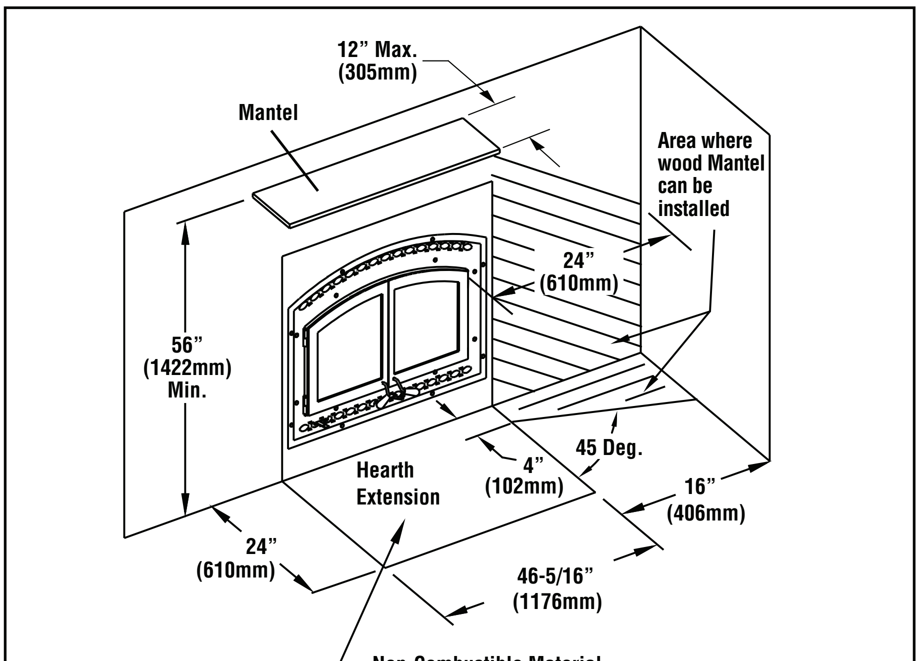


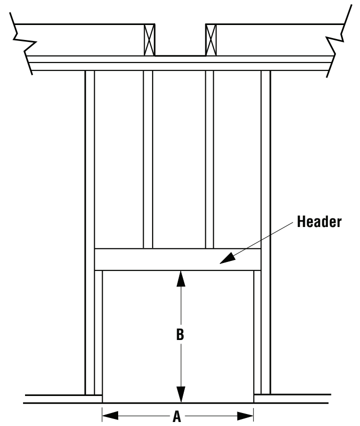
Figure 14

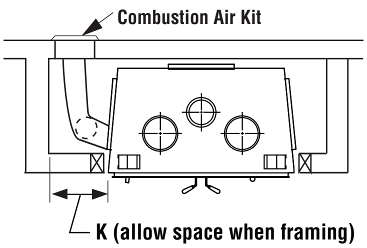
COLD CLIMATE INSTALLATIONS

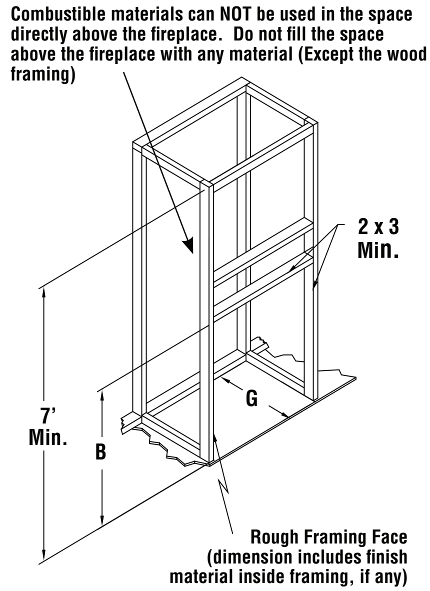
Climates where temperatures will fall below 32°F (0°C).

The heating performance of the appliance will vary depending upon the level of insulation, house design, how the appliance is operated, etc. If this fireplace is being installed in a cold climate, it is especially important to seal all cracks around the fireplace and wherever cold air could enter the room with noncombustible material. Also, the outside air inlet duct should be wrapped with noncombustible insulation to minimize the formation of condensation. Do not place insulation materials directly against the chimney sections. We recommend that you use the insulated wall radiation shield since it will maintain the home's thermal barrier. AC chimney is NOT recommended in very cold climates (in areas with temperatures below 32°F (0°C).

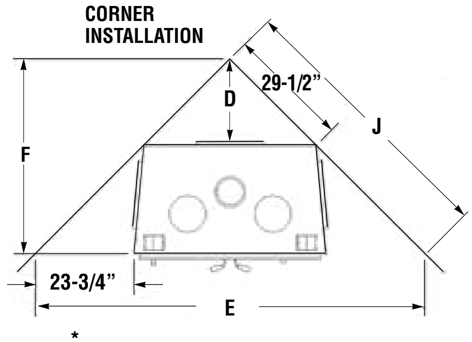
NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

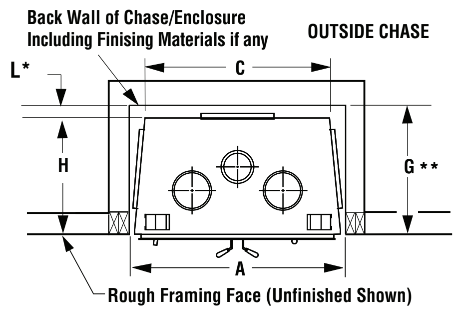






** Total depth is 28-1/4" including the back standoff minus 1/2 inch for drywall to be flush with the facing.



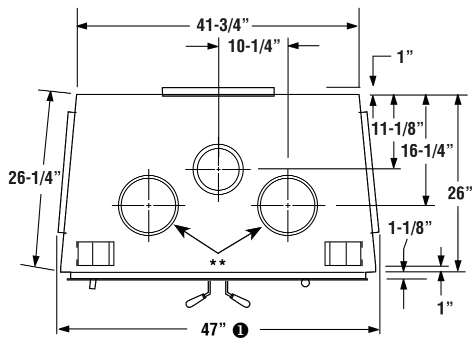


* Zero Clearance From Back Spacer to Wall

FRAMING DIMENSIONS Fireplace Opening Width		
A ❶	46-1/4"	1175 mm
B	50"	1270 mm
C	42-3/4"	1086 mm
D	20-7/8"	530 mm
E	93-7/8"	2384 mm
F	47"	1194 mm
G**	28-1/4"	718 mm
H	26-3/4"	680 mm
J	66-3/8"	1686 mm
K	8"	203 mm
L*	1"	26 mm

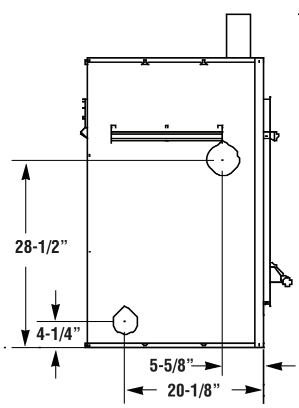
❶ The front framing width (A= 46-1/4") will need to be 47" **before** pushing the fireplace into framing.

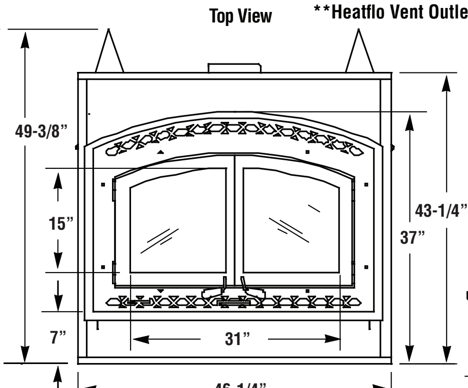
Notes
Diagrams, illustrations and photographs are not to scale – consult installation instructions. Product designs, materials, dimensions, specifications, colors and prices are subject to change or discontinuance without notice.
All framing dimensions calculated for 1/2" dry wall at the fireplace face. If sheathing the chase or finishing with other thickness materials, calculations will need to be made.
** The fireplace must not be in contact with any insulation or loose filling material. Cover the insulation with Drywall panels around the fireplace.*



Top View

**Heatflo Vent Outlets





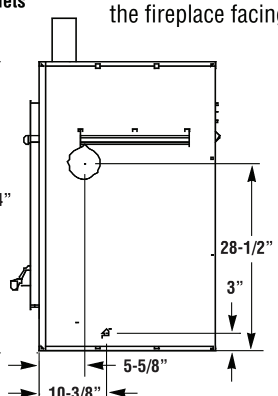


Figure 15 Left Side View

Front View

Right Side View

FACING

⚠ IMPORTANT

The facade must be removable once installed. The facade is designed to overlap any facing material installed on the front of the fireplace. If thicker material is installed, use the facade as a template and make sure it can be easily removed for servicing.

1. Combustible material must be installed flush with the fireplace. It may not project in front of and on the fireplace (e.g. the steel facade of the fireplace) *(**Figure 20**)*.
2. Non-combustible materials such as brick, stone or ceramic tile may project in front of and onto the fireplace facing *(**Figure 18**)*.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

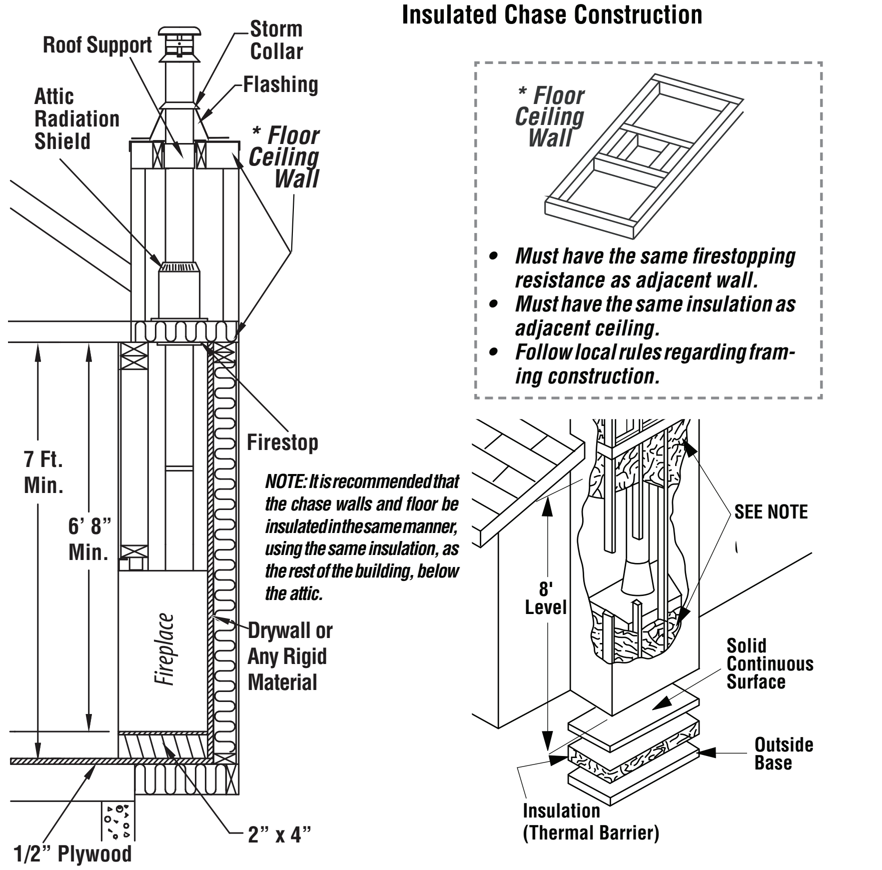


Figure 16

Nailing Flanges

Four nailing flanges are provided to secure the fireplace to the floor *(see **Figure 27**)*. Bend the nailing flanges down so that each flange is flush with the floor, then using nails or screws, secure the fireplace to the floor (2 places each side). The heads of the screws or nails must be large enough to completely cover the holes in the nailing flanges.

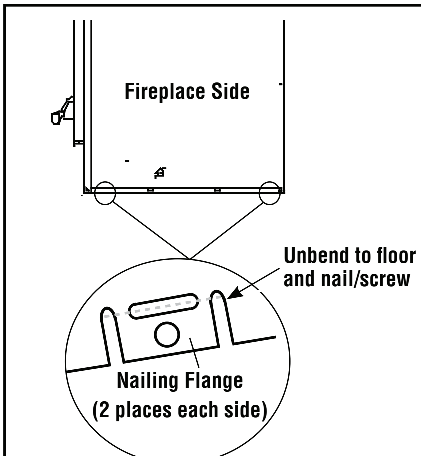
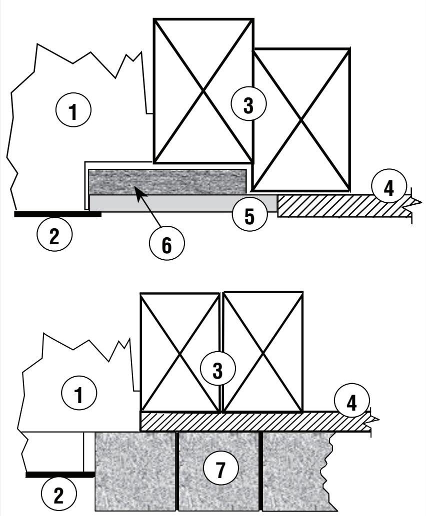


Figure 17

MANTEL and FACING

The mantel must be installed at least 56" (1143 mm) above the base of the fireplace *(**Figure 19**)*.

Fireplace Frame Section (Top View)



1. Fireplace
2. Front of fireplace
3. Wood frame (2" x 3" min)
4. Drywall
5. Tiles
6. Rock board or other
7. Brick

Figure 18

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

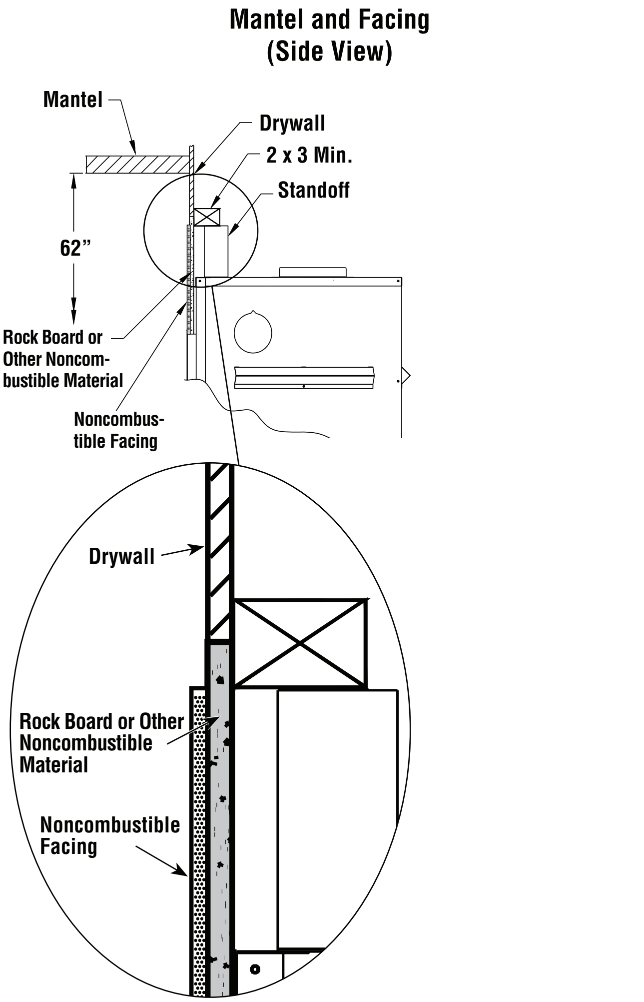


Figure 19

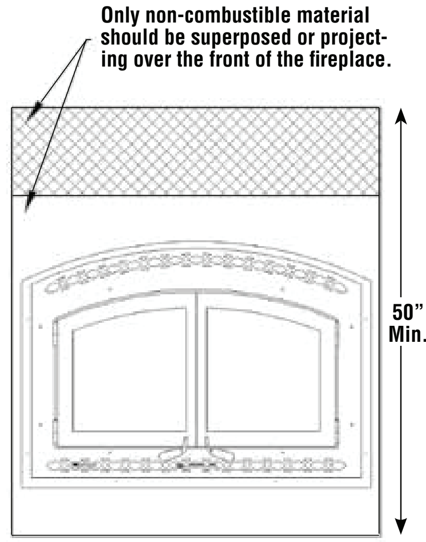


Figure 20

Fireplace Blower

The fireplace comes equipped with a heat activated blower. It is located in the bottom of the fireplace, towards the back. It uses 120 V and must be connected to the main electrical circuit by a qualified electrician. For connection, use the electrical box supplied with the unit located on the bottom right corner of the fireplace.

If you wish to adjust the blower speed, the variable speed control (VRUW) provided must be installed in line with the wiring. Again, use a qualified electrician for installation.

If the blower requires servicing,
1- Remove the doors and decorative facade.
2- Remove the screw located below the blower motor that holds it to the back of fireplace.
3- Pull the blower out of the unit through the square hole located in the front bottom right corner.

OUTSIDE AIR KIT

It is mandatory to install an outside air connection to the fireplace. The following components are required and are included with the fireplace:

- Outside air kit (includes 4 inch flex that goes up to ten (10) feet long)
- 4" Adaptor for fireplace connection

Outside Air Installation

The outside air assembly may be installed according to the following requirements:

A) Duct length should be kept to a minimum. The maximum length of a 4" interior diameter (100 mm) insulated flexible duct is 20 feet (6.1 m). The duct can be extended to a maximum of 40 feet (12 m) using a 6" interior diameter (150 mm) insulated flexible duct (See note below).
B) The air intake register must not be installed more than ten (10) feet (3050 mm) above the base of the fireplace.
C) The fresh air must come from outside the house. The air intake must not draw air from the attic, basement or garage.
D) The air intake should be installed where it is not likely to be blocked by snow or exposed to extreme wind and away from automobile exhaust fumes, gas meters and other vents.
E) The duct and register may be installed above or below floor level.

***NOTE:** We recommend not to exceed 20 feet of 4" flexible pipe. If you require a longer length we recommend that you use a 5" diameter flexible pipe for the complete run up to 30 feet and a 6" diameter pipe for a run of up to 40 feet.*

Make a 4-1/4" (110 mm) hole in the outside wall of the house at the chosen location. From outside, place the outside air register in the hole (open side down) and fasten the register to the wall with screws as shown (see ***Figure 24***). Slip the pipe into the insulated sleeve. Place the insulated pipe over the register tube and over the fireplace's outside air connector (see ***Figure 25***). At each end, carefully pull back the insulation and plastic cover exposing the flexible pipe. Using the aluminium tape provided, wrap the tape around the joint between the flexible pipe and the air inlets. Carefully push the insulation and plastic cover back over the pipe. Using aluminium tape, fasten the plastic cover in place.

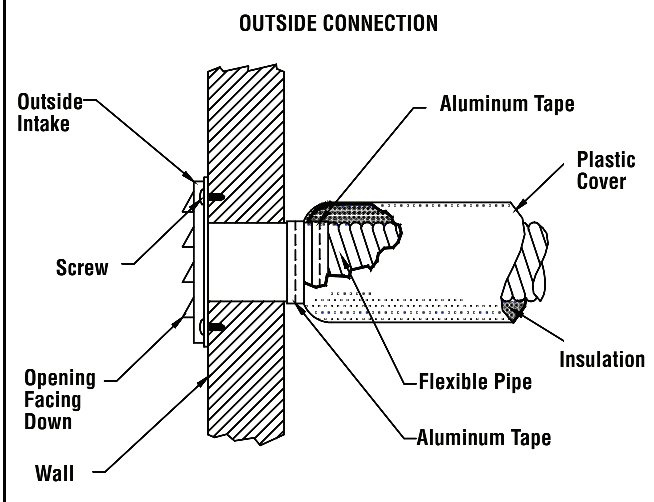


Figure 24

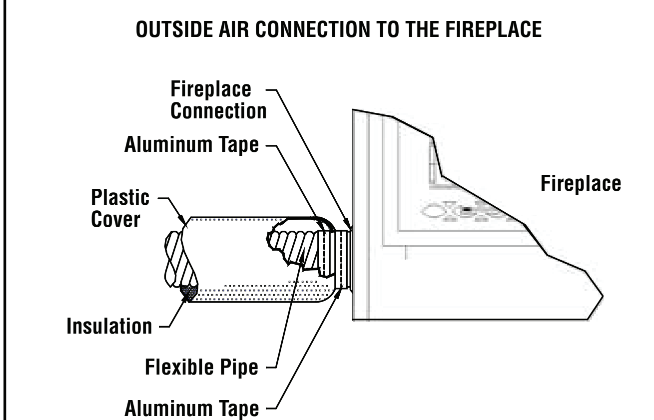


Figure 25

DRAFT REQUIREMENTS

Draft is the force which moves air from the appliance up through the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors. Too much draft may cause excessive temperatures in the appliance and may damage the catalytic combustor. Inadequate draft may cause backpuffing into the room and `plugging' of the chimney or the catalyst.

Inadequate draft will cause the appliance to leak smoke into the room through appliance and chimney connector joints.

An uncontrollable burn or excessive temperature indicates excessive draft.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

THE CHIMNEY SYSTEM

Chimney Installation Notes

1. This appliance may be installed only with IHP 7" Snap-Pak chimney in the United States or Security Chimney models ASHT & S2100 or DuraVent model DuraTech Canada (DTC) in Canada. The 7" Security systems are approved in Canada with the use of an adaptor. See ***Page 28*** for approved venting components.
2. If possible, install an interior chimney as it will provide better performance. In areas with continuous temperatures below 0°F (-18°C), the use of an exterior chimney increases the likelihood of operating problems such as low draft, high rate of creosoting, and poor start-up characteristics. Exterior chimneys are also prone to down-drafting and flow reversal. Installations which are located on lower floors in the house, such as in a basement, in combination with an outside chimney, are especially prone to flow reversal.
3. A chimney venting a fireplace shall not vent any other appliance.
4. The minimum chimney height is 12 feet (3.7 m) excluding the fireplace. To compensate for altitude, add 18" (450 mm) to the chimney for every 2,000 feet (600 m) above sea level.
5. **All chimney installations must include at least one support.** Reducing the amount of chimney weight on the fireplace will help avoid the noise created when the fireplace expands. This can be achieved by having the chimney supported by the supports. The maximum chimney length that can be supported by the fireplace is nine (9) feet (2.75 m).
6. The chimney must extend at least three (3) feet (915 mm) above its point of contact with the roof and at least two (2) feet (610 mm) higher than any wall, roof or building within ten (10) feet (3 m) of it *(**Figure 31**)*.
7. If the chimney extends higher than five (5) feet (1,500 mm) above its point of contact with the roof, it must be secured using a roof brace and guy wires.
8. A rain cap must be installed on top of the chimney. Failure to install a rain cap may cause corrosion problems.
9. Cut and frame square holes in all floors, ceilings, and roof that the chimney will go through to provide a 2" (50 mm) clearance between the chimney and any combustible materials. Do not fill this 2" space with insulation or any other combustible material.
10. Portions of the chimney which may extend through accessible spaces must be enclosed to avoid contact with combustible materials or damage to the chimney.
11. When offsets are used, the pipe may not penetrate a ceiling or floor unless it is running vertical (no 30° offsets).

NOTE: *2" clearance to combustibles around chimney components required.*

NOTE: *Blown or fill type insulation materials must not be in contact with the fireplace or in the enclosure frame as described in "Enclosure" section.*

NOTE: *Local codes may not require firestopping at the ceiling levels for outside chase installations. However, it is recommended for safety and the reduction of heat loss.*

UNITED STATES ONLY CHIMNEY INSTALLATION INSTRUCTIONS USING IHP SNAP PAK (SP)

UNITED STATES APPROVED VENTING SYSTEMS:

7" diameter chimney: Model IHP Snap-Pak, including:
- Chimney lengths
- Elbows *(where necessary)*
- Associated components as per these installation instructions

INSTALLATION THROUGH FLAT CEILING(S)

1. Using framing lumber equal to ceiling joist size, frame ceiling opening as shown in ***Figure 31*** and ***Table 3***.

Chimney Flue Diameter	
	7"
A	13-7/16"
B	13-7/16"

Table 3

If the area above the ceiling is an attic, go to step 5.

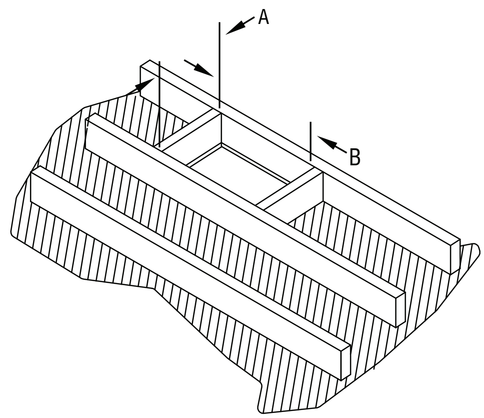
2. Install SNAP-PAK chimney sections starting at the top of the appliance. Leave the first section loose until the installation is complete to allow the chimney to be rotated, easing the installation of any offsets if they are used. Secure subsequent sections by pushing together until stop-locked *(see **Figure 32**)*.
3. **If IHP Elbows are to be used because the chimney is to be offset, refer to "Installation of Elbows" section.** Directly above the Center of the flue in the ceiling support, mark the ceiling. A plumb bob is normally used to find the center. Cut an opening in the ceiling using ***Figure 32*** and ***Table 3***.
4. At each ceiling penetration, a firestop (SPFS) is required. Insert the SPFS into the joist area prepared in ***Figure 31***.

NOTE: When the chimney extends between floors-which can be occupied-the chimney must be enclosed to prevent contact. As previously noted, 2" minimum clearance to combustibles is to be maintained at all times.

5. The first chimney section through the joist area into attic is to be approximately two (2) feet. If the pipe sections in the attic are not enclosed, an insulation shield (SPIS) must be installed. Lower the insulation shield (SPIS) over the SP pipe until the SPIS flange is resting on the joist. Secure the SPIS in place by nailing the flange to the joist. See ***Figure 33***. If the section within the attic area is to be chase enclosed, the SPIS is not required.

   WARNING: Do not place any type of insulation in the required clearance spaces surrounding the chimney.

6. Continue the chimney to the roof. See "Flashing Installation"and "Termination" sections.



Framing lumber of equal size to the joist should be used.

Figure 31

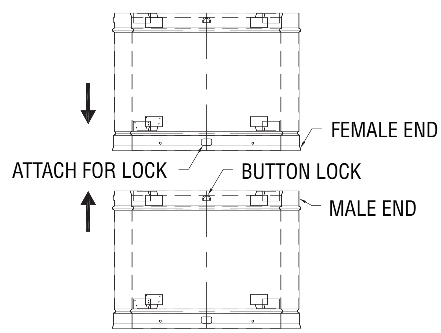


Figure 32

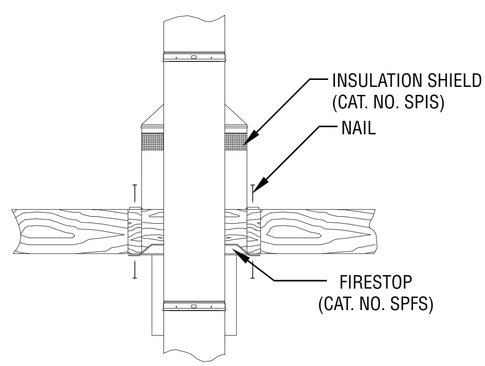


Figure 33

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

INSTALLATION THROUGH A SIDE WALL

1. It is recomended that exterior mounted chimneys be enclosed below the roof line in geographical areas experiencing sustained low ambient temperatures to help reduce or limit condensation, creosote buildup and poor draft.
2. Locate the area where the chimney section is to penetrate the vertical wall studs. Cut and frame an opening so that the flue is centered between the vertical wall studs. Frame opening per ***Figure 34*** and ***Table 4***.

Chimney Flue Diameter	
	7"
A	13-7/16"
B	14"

Table 4

3. A 2-piece wall firestop (SPWF) must be installed in the framed opening from outside. The stainless portion is first installed from th outside of the opening. Push the remaining half through the opening from the inside until the plate is flush with stud. Use four (4) # 10 x 2-1/2" wood screws to attach opening *(see* ***Figure 35****)*. Seal the outside plate with RTV sealant or similar.

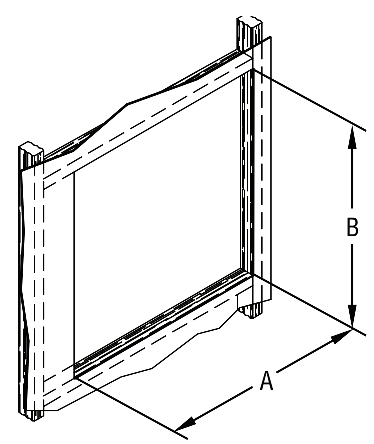


Figure 34

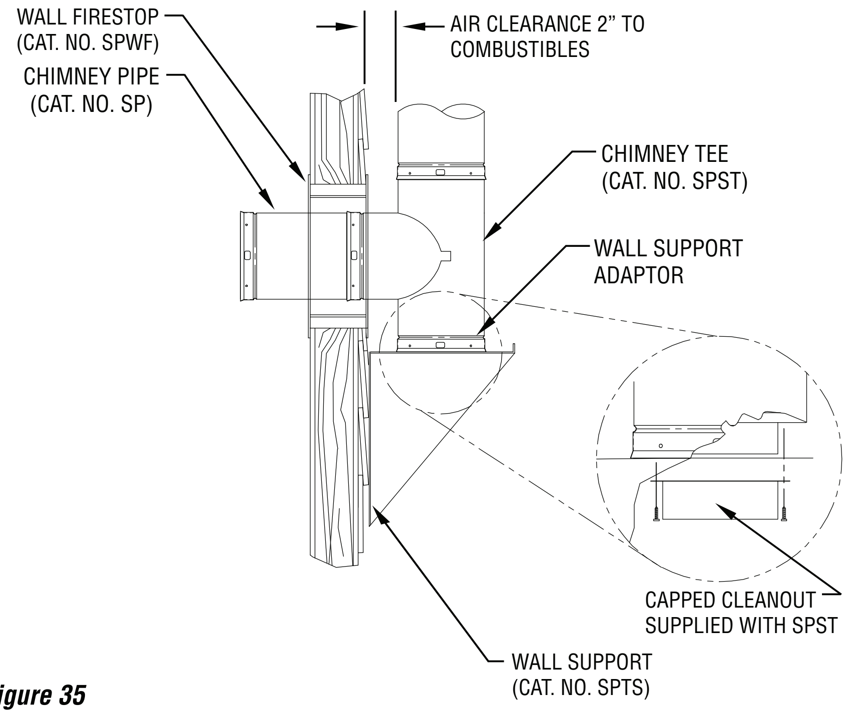


Figure 35

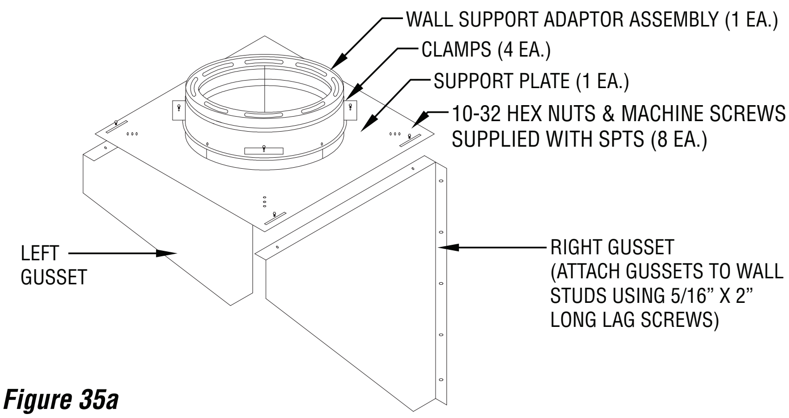


Figure 35a

4. Remove the wall support adaptor pieces from the SPTS box and attach the adaptor to the bottom of the tee by inserting it into the bottom of the tee and push to lock.
5. Push the side portion of the tee into the opening in the wall firestop.
6. Assemble the right and left gussets to the support plate using the hardware provided.
7. Attach wall support plate to wall support adaptor using 4 clamps provided. Do not tighten. *(See* ***Figure 35a****)*.
8. Align the wall support with the wall and secure it to the wall studs using 5/16" x 2" lag screws (not provided). **DO NOT SECURE TO SIDING.** For masonry walls, use 5/16" x 2" masonry lag bolts.
9. Install the tee cap to the bottom of the wall support adaptor with a minimum of two (2) #10 x 1/2" sheet metal screws.
10. Position the tee and the adaptor on wall support to maintain 2" clearance to combustibles. AT THIS POINT TIGHTEN CLAMPS.
11. Slide IHP chimney pipe into top of tee. Align male and female ends. Push down on pipe sections until locked. As sections are added, it will be necessary to secure them to the outside wall with bands (SPWB) at eight foot intervals and 2" from combustibles. Wall Bands (SPWB) are secured to the chimney by placing band around the chimney and tightening clamping bolt. The assembly is anchored to the wall studs (not the siding) with 5/8" x 2" lag bolts. To complete the chimney installation, see "Flashing Installation" and "Termination" sections.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

ELBOW INSTALLATION

1. IHP provides a 15˚ (SPSE15) and 30˚ (SPSE30) Elbow to allow chimneys to avoid framing members or roof peaks. A maximum of 30˚ from the vertical is allowed, and a total of four elbows (two pair) for each chimney installation. Maintain 2” clearance to combustibles.

2. Attach the elbow(s) to the chimney pipe or other support part and push to lock. Using the offset chart, add chimney sections between the elbows. A support band (SPSB) is required at the upper elbow of the pair to support the load, as shown in ***Figure 36***. Attach the upper elbow to bring the chimney back to vertical.

Offset combinations: see *Table 5* and illustration, *Figure 37*.

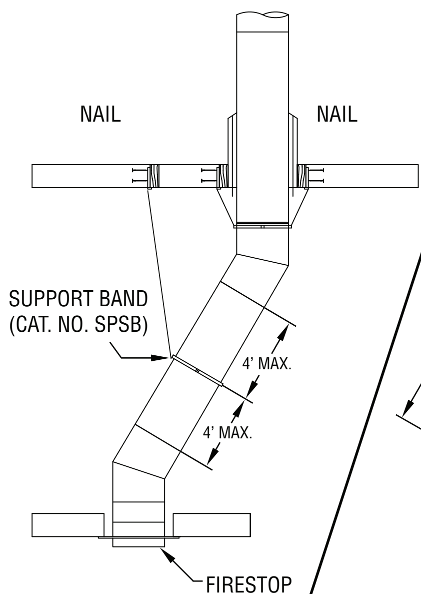


Figure 36

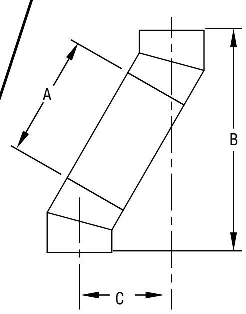


Figure 37

6” DIAMETER CENTER LINE OFFSET TABLE					
A		**15° Angle**		**30° Angle**	
Length	No. Pcs.	B	C	B	C
0	0	18-7/16”	2-1/4”	20-3/16”	5”
6”	1	22-13/16”	3-3/8”	24-1/16”	7-1/4”
12”	1	28-5/8”	4-15/16”	29-1/4”	10-1/4”
18”	1	34-3/8”	6-1/2”	34-7/16”	13-1/4”
24”	1	40-3/16”	8-1/16”	39-5/8”	16-1/4”
30”	2	44-1/2”	9-1/4”	43-1/2”	18-1/2”
36”	1	51-3/4”	11-3/16”	50-1/16”	22-1/4”
42	2	56-1/8”	12-3/8”	53-15/16”	24-1/2”
48”*	1	63-3/8”	14-1/4”	60-7/16”	28-1/4”
54”*	2	67-3/4”	15-7/16”	64-3/8”	30-1/2”
60”*	2	73-1/2”	17”	69-1/2”	33-1/2”
66”*	2	79-11/16”	18-1/2”	74-3/4”	36-1/2”
72”*	2	85-1/2”	20-1/16”	79-15/16”	39-1/2”
78”*	3	89-7/16”	21-1/4”	83-13/16”	41-3/4”
84”*	2	96-11/16”	23-3/16”	90-5/16”	45-1/2”
90”*	3	102-3/8”	24-3/8”	94-3/16”	47-1/2”
96”*	2	108-1/4”	26-5/16”	100-11/16”	51-1/2”

Table 5

FLASHING INSTALLATION

1. Continue the SP chimney to the roof. Cut the roof opening, centered over the chimney. A 2 inch-airspace around the chimney is required as it penetrates the roof. The size of hole in the roof will vary depending on the roof pitch.

2. Install the next SP chimney section through the roof. See ***Figure 38***.

NOTE*: If your roof is already shingled, be sure to slide the upper edge under the shingles to prevent leakage.*

3. Install a bead of caulk around the pipe at the top edge of the flashing. Wrap the storm collar around the pipe and imbed the edge in the caulk to prevent leakage around the pipe.

4. Continue to install pipe sections until the proper termination height is reached. See termination section.

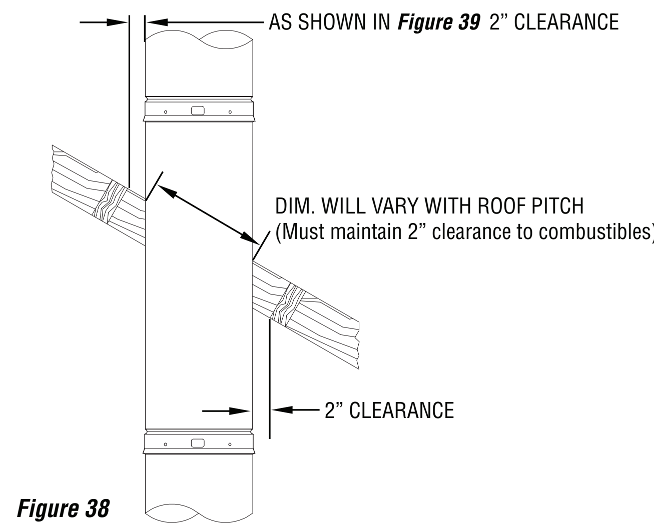


Figure 38

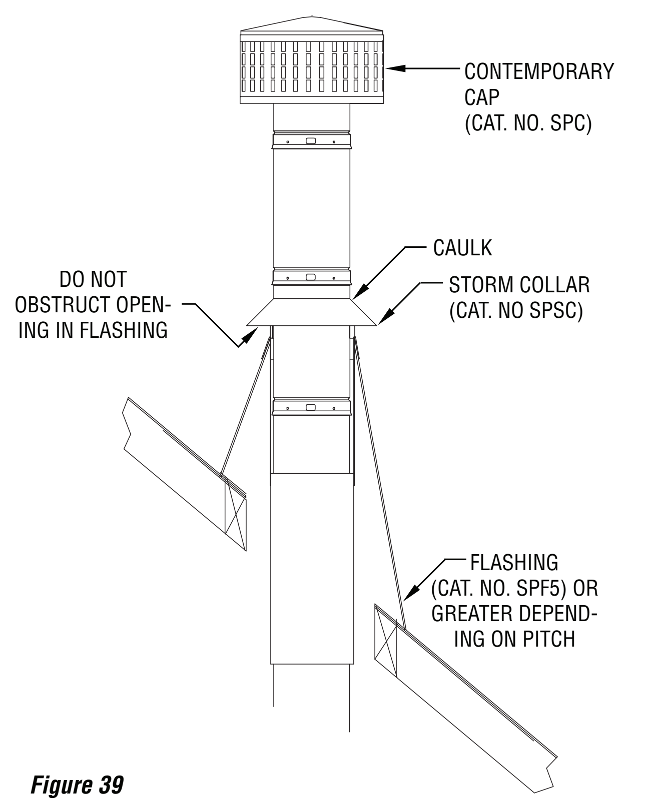


Figure 39

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

TERMINATION

Many building codes specify a minimum chimney heights above the roof top. These specifications are summarized in what is known as the “Ten Foot Rule”. This rule states:

If the horizontal distance from the side of the chimney to the peak of the roof is 10 feet or less, the top of the chimney must be at least 2 feet above the peak of the roof, but never less than 3 feet in overall height above the highest point where it passes through the roof ***(Figure 40)***.

If the horizontal distance from the side of the chimney to the peak of the roof is more than 10 feet, a chimney height reference point is established on the surface of the roof a distance of 10 feet from the side of the chimney in a horizontal plane. The top of the chimney must be at least 2 feet above this reference point, but never less than 3 feet in height above the highest point where it passes through the roof ***(Figure 41)***.

These chimney heights are necessary in the interest of safety and do not ensure smoke free operation. Trees, buildings, adjoining roof lines, adverse wind conditions-etc., may create a need for a taller chimney, should smoking occur.

Additional support is required above the roof if the chimney height exceeds four (4) feet.

Select the proper support for your application-using either a roof brace ***(Figure 42)***, or a support band with guy wires ***(Figure 43)***

SP ROOF BRACE INSTALLATION

1. Assemble the attachment support band (SPSB) around the chimney, and clamp it in place at the desired height using the nut and bolt provided.
2. Loosely attach the support legs to the bolts on the attachment band using hardware provided.
3. Position the support legs as shown in ***Figure 42***. The length of the support legs can be adjusted by loosening the bolt on the leg clamp.
4. Secure legs to roof using screws provided. Seal screw holes to prevent roof leaks.
5. Tighten all hardware.

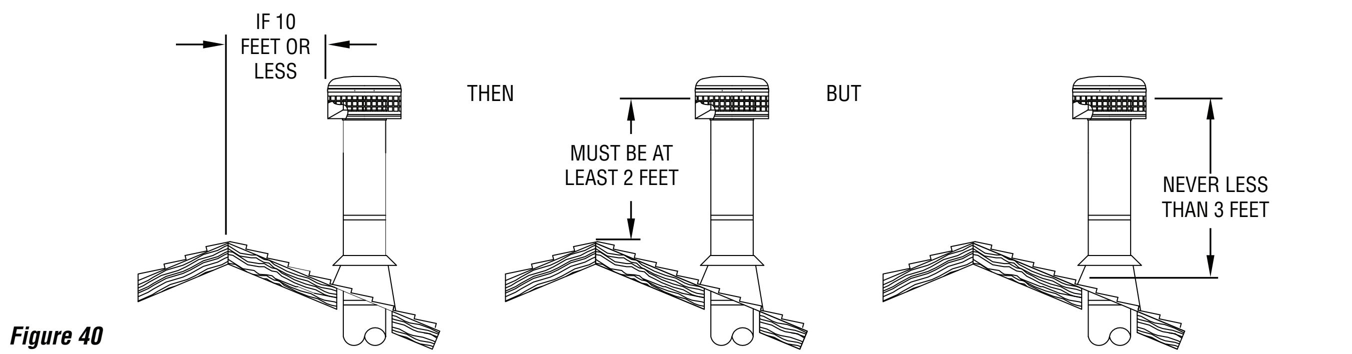


Figure 40

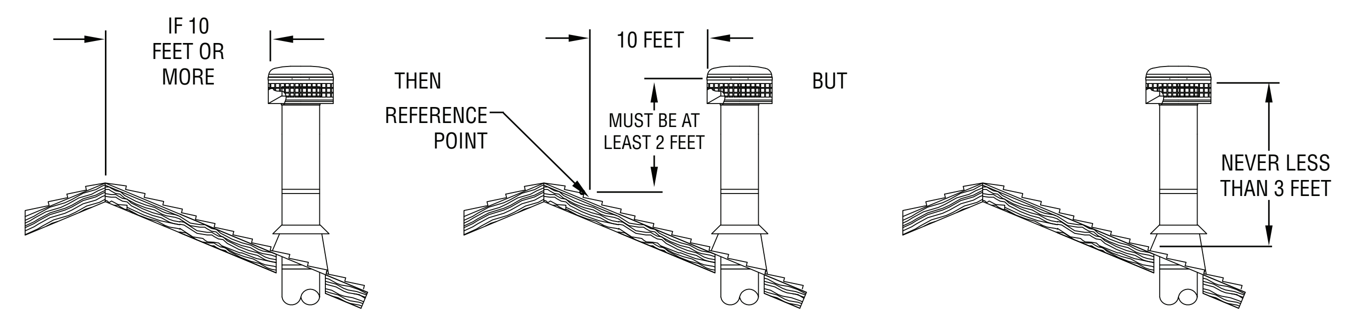


Figure 41

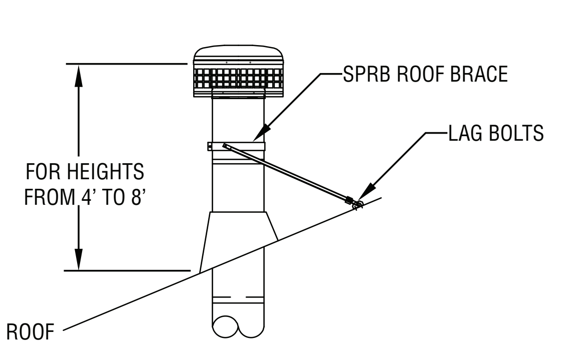


Figure 42

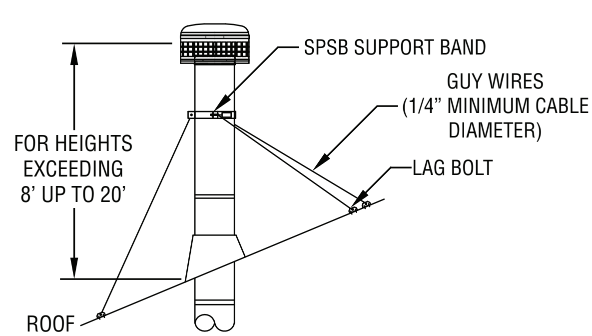


Figure 43

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

CANADA ONLY CHIMNEY INSTALLATION INSTRUCTIONS USING SECURITY CHIMNEYS ASHT

CANADA APPROVED VENTING SYSTEMS:
7" diameter chimney - Canada
Models ASHT® & S2100 manufacture by Security Chimneys® or DuraTech Canada (DTC) manufactured by DuraVent only, including:
- Chimney lengths
- Elbows *(where necessary)*
- Associated components as per these installation instructions and instructions provided by the venting Manufacturer

Reference the installation instructions provided by venting manufacturer.

CHIMNEY ADAPTOR-CANADA ONLY

The fireplace is normally supplied with a chimney adaptor suitable for use with IHP SnapPak venting. In Canada, the use of Security Chimneys ASHT adaptor is required (Security part number 7IHP2*).
* Two inch wall

Chimney Adaptor* - Canada only

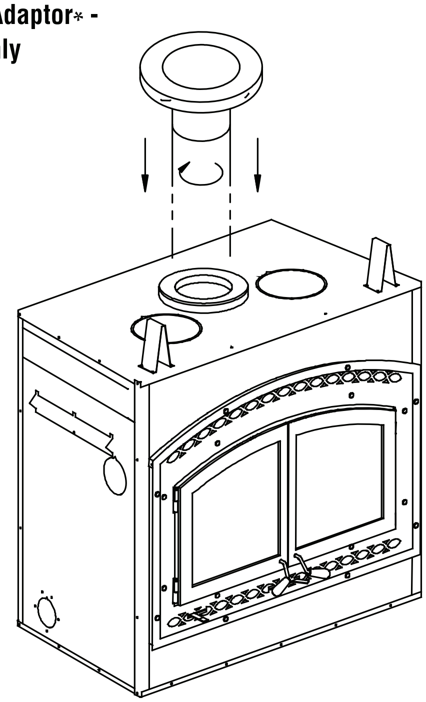


Figure 44

CHIMNEY CHASE AND MULTIPLE TERMINATIONS

For the purpose of this manual, a chimney chase is considered a part of the chimney system rather than part of a building. The termination must be placed a minimum of 18" (460 mm) above the chase.

For installations where more than one chimney is located in the same chase or within the same area, we suggest that their terminations be separated by at least 16" (410 mm) horizontally, and 18" (460 mm) vertically. This separation is to prevent smoke migrating from one chimney to another (see ***Figure 45).***

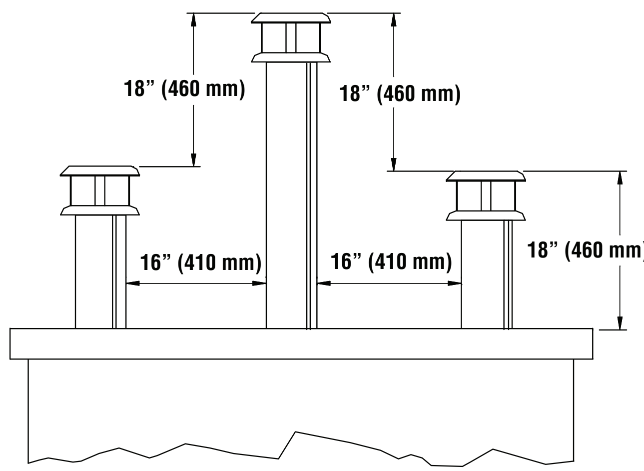


Figure 45

INSTALLATION INSTRUCTIONS FOR MASONRY APPLICATION

WARNING: Before starting the installation, the masonry chimney must be inspected by a qualified chimney sweep.

The following requirements must be respected:

1. The chimney must be absolutely clear of any soot residue or creosote. Check for cracks, loose or missing bricks that could inhibit correct installation of the liner.
2. The clearance to combustible must be a minimum of 1" between the outside of the masonry and any wood framing or loose insulation.
3. The chimney must be built in accordance with the current building code.
4. No other appliance can be connected to the same chimney.
5. The clearances to combustible for these fireplace connectors are 2" on the side and bottom and 16" at the top.
6. The connector parts are not necessary if the connection between the insulated length and the stainless steel liner is done within the masonry chimney.

Installation:

Rigid stainless liner or stainless flex must be used and listed to UL-1777 for US applications and ULC-S635 for existing masonry or ULC-S640M for new masonry applications in Canada. The steel rigid or flex liner must be rated at 2100º F (1100º C).

Follow these steps:

1- Position the fireplace in its location. Temporarily install the 30° insulated elbow on the top of the fireplace and, using a level, mark with an oval the location where the flue liner will enter the masonry chimney.
2- In the middle of the oval, drill a hole in the masonry chimney at 30º.
3- Increase the size of the hole until a 30º liner elbow can be easily slipped through.
4- Slide the liner down from the top of the masonry chimney until you reach the hole level.
5- Slip through the hole a 30º liner elbow and connect it to the liner.
6- Add a small liner section to the liner elbow which will allow the liner to extend at least 12" (measured at the top of the liner) from the masonry chimney.
7- Seal the opening around the liner with high temperature refractory cement.
8- The next steps must be done in the following order:

See typical installation illustrated below.

A. Select the insulated pipe length that will fit between the 30° insulated elbow on top of the appliance and the exposed liner so that it will slide at least 2" over the liner section (You may need to cut the liner for a better fit).
B. Take that section and attach the pipe to the insulated liner connector and slide it over the liner. Make sure you have enough opening to be able to install the elbow without difficulty.
C. Install the 30º elbow on the fireplace.
D. Slide the length section back down on the elbow and twist lock the two together.
E. Pull the cover down over the length and install the insulation pad over the liner; be careful to cover the liner completely.
F. Slide back the cover over the insulation and fix it in place using the 3 metal screws supplied.

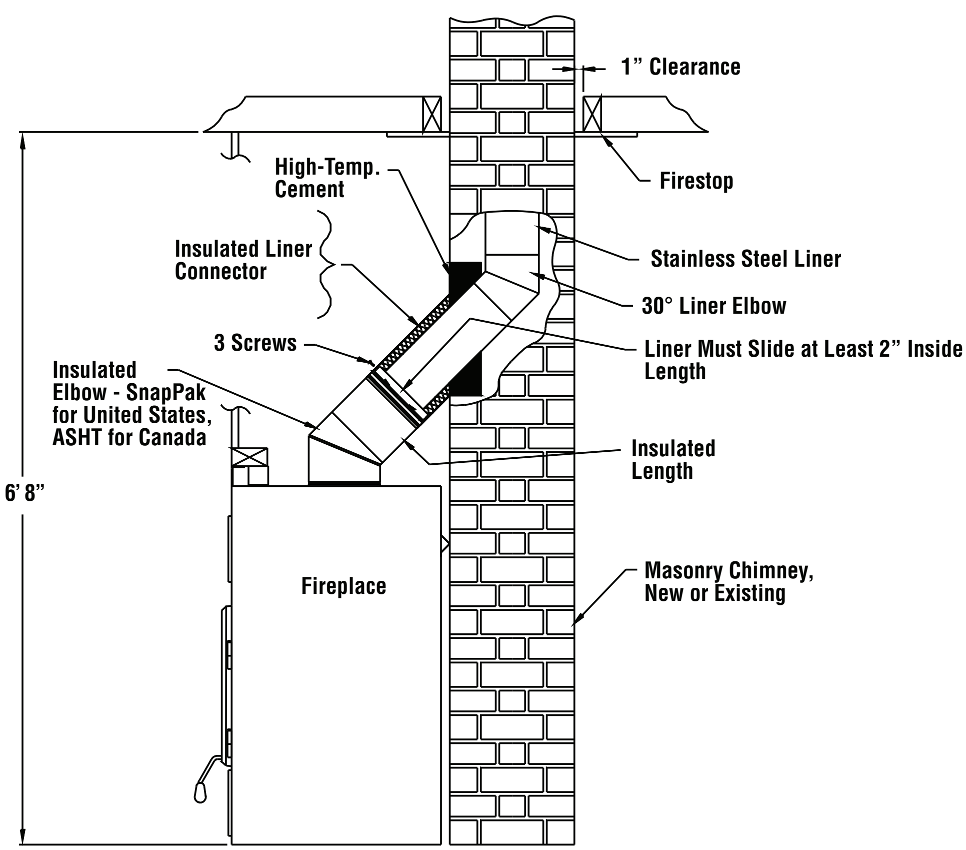


Figure 46

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

OPTIONAL INSTALLATION ACCESSORIES

Installation Accessories	
Description	**Cat./Part No.**
Facades *(Required - Order Separately) **	
Montecito Estate™ CAT Facade Black, MONEST-FAC-BLK	F2859
Montecito Estate CAT Facade Hammered Steel, MONEST-FAC-HMRD	F3611
Doors - *(Required - Order Separately) **	
Montecito Estate CAT Doors Black, MONEST-DOOR-BLK	F2855
Montecito Estate CAT Doors Hammered Steel, MONEST-DOOR-HMRD	F3612
Outside Air Kit *(included with fireplace)*	
Outside Air Coupler To Connect Outside Air (UZI) To Fireplace, UZIAD	UZIAD
Outside Air Ducting - includes 4" insulated flex x 10' long, UZI	UZI

** Compatible with catalytic models only.*

Fireplace Kits	
Description	**Cat./Part No.**
Central Forced Air Kit Accessories	
Central Forced Air Kit, Central forced air kit including: blower (BISZY), flex adaptor (BISAF), 2 clamps, variable speed control (VRUW), thermo-disk (VTU), fan to flexible pipe adapter (BISAVF), back draft damper (BISBD), aluminium tape, BISFWK-1	BISFWK-1
Flexible pipe 5" I.D. x 15 ft. Long, 5FLEX15	5FLEX15
Flexible pipe 5" I.D. x 30 ft. Long, 5FLEX25	5FLEX25
Heating and cooling thermostat, 24V, HCTW	HCTW

REPLACEMENT PARTS LIST

Montecito Estate™ CAT - Replacement Parts	
Description	**Cat./Part No.**
Fireplace Blower	UZY5
Blower Motor Speed Control	VRUW
Snap Disc, Blower	VTU
Refractory Baffle Kit	F3017
Top Hearth Insulation	PR-ISO2521
Front Refractory Bricks	PR-SR2421
Back Refractory Brick	PR-SR2415
Right Side Refractory Bricks - Back	PR-SR2417
Right Side Refractory Bricks - Front	PR-SR2419
Left Side Refractory Bricks - Back	PR-SR2416
Left Side Refractory Bricks - Front	PR-SR2418
Bottom Refractory ME CAT	F3020
Thermopile, gauge and label replacement	J8004
Catalytic Combustor with Gasket	F3015
Complete Catalytic Combustor Assembly	F3016
Burn Tube Kit (3)	F3018
Tube, Air 3/4 X 24 1/8 91TR 2L	F3019
Wooden Handle, Bypass	PR-SR2072
Wooden Door Handle	PR-SR1787
Door Latch (top and bottom)	PR-SR2543
Hinge Assembly, Fireplace and Door	PR-SR1800T
Decorative Screw Caps, Black (2)	PR-SACMEFBK
Decorative Screw Caps, Brushed Nickel (2)	PR-SACMEFBN
Ceramic Glass Left	PR-SR2356G
Ceramic Glass Right	PR-SR2356D
Log Retainers (2)	PR-B2CH
Around the Glass Gasket (61-3/4”)	PR-SR1685C
On the Door Frame Gasket (48-3/8”)	PR-SR1823I
Between the Doors Gasket (17-5/8”)	PR-SR1823J
Touch-up Paint, Aerosol, Black Metallic SBMB6309	H8159
Touch-up Paint, Charcoal (for hammered steel facade)	PR-P6201
Outside Air Coupler For AC Chimney 4” ID, UACZI	H3274
Outside Air Coupler To Connect Outside Air (UZI) To Fireplace, UZIAD	UZIAD
Blower 250 CFM for central forced air kit, BISZY	BISZY
Blower variable speed control with decorative wall plate for (BISZY), VRUW	VRUW
Thermo-disk, on/off blower control (for BISZY), VTU	VTU
Blower to flexible pipe adaptor, BISAVF	BISAVF
Backdraft damper, BISBD	BISBD
Fireplace to Flex adaptor and 2 clamps, BISAF	BISAF
Clevis Pin and Cotter Pin Kit	F3714
Montecito Estate Metal Fab Collar and Sleeve	F4191

Contact an IHP dealer to obtain any of these parts. Never use substitute materials not approved by IHP. Use of non-approved parts can result in poor performance and safety hazards.

SPECIFICATIONS

Cat. No.	Model
F2845	MontecitoEstateCAT

Model	Emission Rate	Heat Output	Efficiency
MontecitoEstateCAT	1.3 g/hr	11,500-40,000 btu/hr	70%

Product Reference Information	
Weight	520 lbs
Height	49-3/8”
Width	46-1/4”
Depth	27”
Firebox W x H x D measured in front	31” x 14-1/2” x 14”
Chimney weight - Secure Temp® GX (7” dia)	9.5 lb per linear foot
Chimney weight - ACBI	3.75 lb per linear foot

CLEARANCE TO COMBUSTIBLES

The following clearances meet the minimum requirements for a safe installation:

Side wall (fireplace front): 24” (457 mm) measured from the fireplace side.

Ceiling: 6’ 8” (2,032 mm) measured from the base of the fireplace

Fireplace enclosure:
- **Bottom:** 0” to Non-combustible floor
- **Side:** 0” to Standoff
- **Back:** 0” to Standoff
- **Top:** Do not fill the space above the fireplace with any material (Except the wood framing. See ***Figure 15***)

Chimney: 2” (50 mm), except for through ceiling application.

Mantel: 56” (1422 mm) measured from the base of the fireplace.

SECURITY CHIMNEYS® AND DURA VENT® - PARTS AND COMPONENTS

The components listed below must be ordered from Security Chimneys® or DuraVent®. Contact the chimney manufacturer Distributor or Dealer for ordering information.

Security Chimneys® **2125 Monterey, Laval, Quebec** **Canada, H7L 3T6** **securitychimneys.com**	**450-973-9999** **1-800-361-4909 (USA)** **1-800-667-3387 (Canada)**

Secure Temp® GX - 2" Insulated Galvanized Chimney System (Recommended Insulated System) *Galvanized (7" ID and 11" OD) U.S.A. ONLY*	
Description	**Cat./Part No.**
Lengths and Misc. Chimney Components	
Length 8", 7GXL8	7GXL8
Length 12", 7GXL12	7GXL12
Length 18", 7GXL18	7GXL18
Length 24", 7GXL24	7GXL24
Length 24" (stainless steel exterior flue), 7XL24	7XL24
Length 36", 7GXL36	7GXL36
Length 36" (stainless steel exterior flue), 7XL36	7XL36
Length 48", 7GXL48	7GXL48
Length 48" (stainless steel exterior flue), 7XL48	7XL48
15º Elbow, 7GXE15	7GXE15
30º Elbow, 7GXE30	7GXE30
Rain Termination Cap, 7CC (stainless steel)	7CC
Wall Band, XBM	XBM
Supports	
Offset Support, XSO	XSO
Roof / Floor support, XST	XST
Roof Brace, XBS2	XBS2
Roof Flashings	
Roof Flashing, Flat (includes spacer and collar), 7XF	7XF
Roof Flashing, Adjustable (5º to 30º) (includes spacer and collar), 7XFA	7XFA
Roof Flashing, Adjustable (30º to 45º) (includes spacer and collar), 7XFB	7XFB
Storm Collar (spacer included), 7XFC	7XFC
Firestops and Braces	
Firestop, 7XBF	7XBF
Radiation shield, 7XRS	7XRS
Insulated attic radiation shield, 7XRSA	7XRSA2
30º Insulated wall radiation shield, 7XRSMI30	7XRSMI30
Wall Band, XBM	XBM

M&G DuraVent **877 Cotting Court, Vacaville,** **California, 95688** **duravent.com**	**1-800-835-4429**

DuraVent® Model DuraTech Premium 7" Diameter Chimney System *2" insulated double wall chimney system.* *Listed to: UL 103HT (United States), and ULC S629 (Canada)*

Fireplace Model Montecito Estate™ CAT - Approved Venting Components manufactured by Security Chimneys® or DuraVent®.

- **7" diameter chimney -** Secure Temp® GX (U.S. only), Secure Temp S-2100+ (or Nova Temp® HT6000+) or DuraVent® DuraTech Premium.

NOTES:

① *Nova Temp HT6000+ and DuraTech Premium are equivalent to S-2100+.*

PFS C US

Report No. / Rapport nº 16-150

LISTED FACTORY BUILT FIREPLACE
FOYER PRÉFABRIQUE HOMOLOGUÉ

astria FIREPLACES®

Manufactured by / Fabriqué par:
INNOVATIVE HEARTH PRODUCTS
1502 14th St. NW
Auburn, WA 98001 USA

Serial No.
Numéro de série

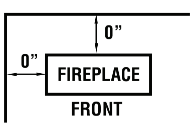
Model / Modèle: MontecitoEstateCAT

Conforms to / Conforme au : UL STD 127
Certified to / Certifié au : ULC STD S610

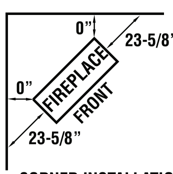
Certification test emission value 1.3 g/hr per 2020 standard
Valeur d'émission du test d'homologation 1,3 g/h selon la norme 2020

CLEARANCES TO COMBUSTIBLES:		DÉGAGEMENTS AUX COMBUSTIBLES:	
SIDE WALL (FROM DOOR EDGE)	24 in. (610 mm)	MUR LATÉRAL (DE L'OUVERTURE DE LA PORTE)	24 po. (610 mm)
MANTEL (ABOVE FIREPLACE'S BASE)	56 in. (1422 mm)	LINTEAU (AU-DESSUS DE LA BASE DU FOYER)	56 po. (1422 mm)
BACK WALL AND FIREPLACE SIDE (FROM SPACERS)	0 in. (0 mm)	MUR ARRIÈRE ET CÔTÉ DU FOYER (DES ESPACEURS)	0 po. (0 mm)
CEILING HEIGHT (ABOVE FIREPLACE'S BASE)	6 ft. 8 in. (2032 mm)	HAUTEUR PLAFOND (AU-DESSUS DE LA BASE DU FOYER)	6 pi. 8 po. (2032 mm)
CHIMNEY	2 in. (51 mm)	CHEMINÉE	2 po. (51 mm)

INSTALL WITH MINIMUM CLEARANCES TO WALL AS SHOWN IN INCHES.

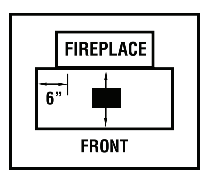


SIDEWALL - BACKWALL INSTALLATION



CORNER INSTALLATION

FLOOR PROTECTOR MINIMUM DISTANCE FROM OPENING IN INCHES



HEARTH EXTENSION MATERIAL :
- 1 in. THICKNESS NON COMBUSTIBLE MATERIAL
- OR EQUIVALENT

U.S. ENVIRONMENTAL PROTECTION AGENCY
Certified to comply with 2020 particulate emission standards using crib wood.

DATE OF MFG. 1 2 3 4 5 6 7 8 9 10 11 12
2019-20-21-22-23-24-25

P/N 900440-00, REV. 1, 07/2016

- USE WOOD FUEL ONLY
- NON COMBUSTIBLE HEARTH EXTENSION MUST BE INSTALLED AT FRONT OF UNIT EXTENDING 24 in. (610 mm) AT FRONT AND 6 in. (152 mm) TO SIDES OF DOOR OPENING.
- THIS FIREPLACE HAS NOT BEEN TESTED WITH UNVENTED GAS LOG SET. TO REDUCE RISK OF FIRE OR INJURY DO NOT INSTALL AN UNVENTED GAS LOG SET INTO THE FIREPLACE.
- ELECTRICAL RATING: 120 V, 60 Hz
- CHIMNEY TYPE: USE ONLY WITH LISTED 7 in. DIAMETER CHIMNEY, CERTIFIED MODEL GX (U.S.A. ONLY), S2100+, HT6000+, ACBI.
- CAN BE CONNECTED TO A MASONRY CHIMNEY AS DESCRIBED IN THE INSTALLATION INSTRUCTIONS.
- COMPONENTS USED WITH THE FIREPLACE MUST BE LISTED. SEE LIST IN THE INSTALLATION INSTRUCTIONS.
- REPLACE GLASS WITH CERAMIC GLASS 5 mm THICK.
- FOR SAFE OPERATION INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- CAUTION: COMBUSTION AIR OPENING MUST NOT BE OBSTRUCTED.
- DO NOT OVERFIRE THE FIREPLACE.
- OPERATE THE FIREPLACE WITH DOOR FULLY CLOSED ONLY.
- DO NOT USE A FIREPLACE INSERT OR OTHER PRODUCTS NOT SPECIFIED FOR USE WITH THIS PRODUCT

- POUR USAGE AVEC LE BOIS SEULEMENT
- UN TABLIER NON COMBUSTIBLE DOIT ÊTRE INSTALLÉ À L'AVANT DU FOYER EXCÉDANT DE 24 po. (610 mm) À L'AVANT ET 6 po. (152 mm) DES CÔTÉS DE L'OUVERTURE DES PORTES.
- CE FOYER N'EST PAS HOMOLOGUÉ POUR ÊTRE UTILISÉ AVEC UN ENSEMBLE DE BÛCHES À GAZ SANS CONDUIT D'ÉVACUATION. AFIN DE RÉDUIRE LES RISQUES D'INCENDIE OU DE BLESSURES, N'INSTALLEZ PAS DE BÛCHES À GAZ SANS CONDUIT D'ÉVACUATION À L'INTÉRIEUR DE CE FOYER.
- ALIMENTATION ÉLECTRIQUE: 120V, 60 Hz
- UTILISER SEULEMENT AVEC UNE CHEMINÉE 7 po. (178 mm) DE DIAMÈTRE, MODÈLE S2100+, HT6000+, ACBI HOMOLOGUÉE.
- PEUT ÊTRE RACCORDÉ SUR UNE CHEMINÉE DE MAÇONNERIE TEL QUE DÉCRIT DANS LE MANUEL D'INSTALLATION.
- LES COMPOSANTES UTILISÉES AVEC LE FOYER DOIVENT ÊTRE HOMOLOGUÉES. VOIR LA LISTE DANS LE MANUEL D'INSTALLATION.
- REMPLACER LA VITRE AVEC UN VERRE CÉRAMIQUE DE 5mm D'ÉPAISSEUR.
- POUR UNE UTILISATION SÉCURITAIRE, INSTALLER CONFORMÉMENT AUX DIRECTIVES DU FABRICANT.
- ATTENTION : NE PAS OBSTRUER LES ARRIVÉES D'AIR COMBURANT.
- NE PAS FAIRE SURCHAUFFER LE FOYER.
- LA PORTE DU FOYER DOIT DEMEURER TOTALEMENT FERMÉE LORSQUE LE FOYER FONCTIONNE.
- NE PAS UTILISER DE POÊLE ENCASTRABLE OU D'AUTRES PRODUITS NON SPÉCIFIÉS COMME ÉTANT UTILISABLES AVEC CE PRODUIT.

- CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTIONS IN YOUR AREA.
- CONTACTEZ LES RESPONSABLES DE VOTRE REGION A PROPOS DES RESTRICTIONS ET INSPECTIONS D'INSTALLATION.
- SEE IHP INSTALLATION AND OPERATING INSTRUCTIONS FOR THIS MODEL.
- INSTALL AND USE ONLY IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND LOCAL BUILDING CODES.
- SPECIAL METHODS ARE REQUIRED WHEN PASSING THROUGH A WALL OR CEILING. SEE INSTRUCTIONS AND BUILDING CODES.
- PREVENT CREOSOTE FIRE: INSPECT CHIMNEY CONNECTOR AND CHIMNEY FLUE MONTHLY AND CLEAN IF NECESSARY.
- DO NOT OVERFIRE. IF DOME OR CHIMNEY CONNECTOR GLOWS YOU ARE OVERFIRING.
- KEEP FURNISHINGS AND OTHER COMBUSTIBLE MATERIALS A CONSIDERABLE DISTANCE AWAY FROM APPLIANCE.
- MAINTENIR LES MEUBLES ET AUTRES OBJETS À UNE DISTANCE SÉCURITAIRE DU FOYER.
- THIS WOOD HEATER NEEDS PERIODIC INSPECTION AND REPAIR FOR PROPER OPERATION. CONSULT THE OWNER'S MANUAL FOR FURTHER INFORMATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH THE OPERATING INSTRUCTIONS IN THE OWNER'S MANUAL.
- CET APPAREIL DE CHAUFFAGE AU BOIS DOIT ÊTRE INSPECTE ET ENTRETENU PÉRIODIQUEMENT POUR FONCTIONNER CORRECTEMENT. VOIR LE MANUEL DU PROPRIÉTAIRE POUR PLUS D'INFORMATION. L'UTILISATION DE CET APPAREIL DE CHAUFFAGE AU BOIS DE MANIÈRE INCOMPATIBLE AVEC LES INSTRUCTIONS DU MANUEL DU PROPRIÉTAIRE CONSTITUE UNE INFRACTION AUX RÉGULATIONS FÉDÉRALES.

Limited Three Year Warranty - Innovative Hearth Products Combustor

THE WARRANTY

Innovative Hearth Products Limited Three Year Warranty ("IHP") warrants your Catalyst ("Product") to be free from defects in materials and workmanship at the time of manufacture. After installation, if the Product is found to be defective in materials or workmanship during the Limited Three Year Warranty period and while the Product remains at the site of the original installation, IHP will, at its option, repair or replace the covered component. If repair or replacement is not commercially practical, IHP will, at its option, refund the purchase price or wholesale price of the IHP product, whichever is applicable. IHP will also pay IHP prevailing labor rates, as determined in its sole discretion, incurred in repairing or replacing such components. THERE ARE EXCLUSIONS AND LIMITATIONS to this Limited Three Year Warranty as described herein.

COVERAGE COMMENCEMENT DATE

Warranty coverage begins on the date of 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 IHP dealer, whichever occurs earlier. The warranty shall commence no later than 24 months following the date of product shipment from IHP, regardless of the installation or occupancy date.

EXCLUSIONS AND LIMITATIONS

This Limited Three Year Warranty applies only if the Product is installed in the United States or Canada and only if operated and maintained in accordance with the printed instructions accompanying the Product and in compliance with all applicable installation and building codes and good trade practices.
This warranty is non-transferable and extends to the original owner only. The Product must be purchased through a listed supplier of IHP and proof of purchase must be provided.

Labor coverage – Prevailing IHP labor rates apply for the warranty period of the Product.

Whenever practicable, IHP will provide replacement parts, if available, for a period of 10 years from the last date of manufacture of the product.

IHP will not be responsible for:

(a) damages caused by normal wear and tear, accident, riot, fire, flood or acts of God;

(b) damages caused by abuse, negligence, misuse, or unauthorized alteration or repair of the Product affecting its stability or performance. (The Product must be subject to normal use with approved fuels listed in the Operation Manual provided with the product. Fuel products with abnormal burning characteristics, including but not limited to fuel such as driftwood, coal or plywood and wood products using a binder may burn at excessive temperatures and may cause damage to the Product or may cause it to function improperly; IHP stoves, inserts and high efficiency EPA fireplaces are approved for burning dry seasoned wood only);

(c) damages caused by failing to provide proper maintenance and service in accordance with the instructions provided with the Product;

(d) damages, repairs or inefficiency resulting from faulty installation or application of the Product.

IHP is not responsible for inadequate system draft caused by air conditioning and heating systems, mechanical ventilation systems, or general construction conditions which may generate negative air pressure in the room in which the appliance is installed. Additionally IHP assumes no responsibility for smoking conditions caused by inadequate chimney height, adjoining trees or buildings, adverse wind conditions or unusual environmental factors and conditions. Certain IHP Products are listed for use with Security Chimneys International, Ltd. chimney systems only. Use of chimney components other than that specified in the Product manual will void the Product warranty.

LIMITATION ON LIABILITY

It is expressly agreed and understood that IHP's sole obligation and the purchaser's exclusive remedy under this warranty, under any other warranty, expressed or implied, or in contract, tort or otherwise, shall be limited to replacement, repair, or refund, as specified herein.

In no event shall IHP be liable for any incidental or consequential damages caused by defects in the Product, whether such damage occurs or is discovered before or after replacement or repair, and whether such damage is caused by IHP's negligence. IHP has not made and does not make any representation or warranty of fitness for a particular use or purpose, and there is no implied condition of fitness for a particular use or purpose.

IHP makes no expressed warranties except as stated in this Limited Three Year Warranty. The duration of any implied warranty is limited to the duration of this expressed warranty.

No one is authorized to change this Limited Three Year Warranty or to create for IHP any other obligation or liability in connection with the Product. Some states and provinces do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. The provisions of this Limited Three Year Warranty are in addition to and not a modification of or subtraction from any statutory warranties and other rights and remedies provided by law.

INVESTIGATION OF CLAIMS AGAINST WARRANTY

IHP reserves the right to investigate any and all claims against this Limited Three Year Warranty and to decide, in its sole discretion, upon the method of settlement.

To receive the benefits and advantages described in this Limited Three Year Warranty, the appliance must be installed and repaired by a licensed contractor approved by IHP.

Contact IHP at the address provided herein to obtain a listing of approved dealers/distributors. **IHP shall in no event be responsible for any warranty work done by a contractor that is not approved without first obtaining IHP's prior written consent.**

HOW TO REGISTER A CLAIM AGAINST WARRANTY

In order for any claim under this warranty to be valid, you must contact the IHP dealer/distributor from which you purchased the product. If you cannot locate the dealer/distributor, then you must notify IHP in writing. IHP must be notified of the claimed defect in writing within 90 days of the date of failure. Notices should be directed to the IHP Warranty Department at 1769 East Lawrence Street; Russellville, AL 35654 or visit our website at WWW.IHP.US.COM.

P/N 900943-00, Rev. NC, 10/2018

Innovative Hearth Products
1769 East Lawrence Street • Russellville, AL 35654

Innovative Hearth Products
Astria® Brand EPA Wood Burning Fireplace
Limited Lifetime Warranty

THE WARRANTY

Innovative Hearth Products ("IHP") Limited Lifetime Warranty warrants your Astria® Brand EPA Wood Burning Fireplace ("Product") to be free from defects in materials and workmanship at the time of manufacture. The Product body, firebox and ceramic glass carry the Limited Lifetime Warranty. Ceramic glass carries the Limited Lifetime Warranty against thermal breakage only. After installation, if covered components manufactured by IHP are found to be defective in materials or workmanship during the Limited Lifetime Warranty period and while the Product remains at the site of the original installation, IHP will, at its option, repair or replace the covered components. If repair or replacement is not commercially practical, IHP will, at its option, refund the purchase price or wholesale price of the IHP product, whichever is applicable. IHP will also pay IHP prevailing labor rates, as determined in its sole discretion, incurred in repairing or replacing such components for up to five years. THERE ARE EXCLUSIONS AND LIMITATIONS to this Limited Lifetime Warranty as described herein.

COVERAGE COMMENCEMENT DATE

Warranty coverage begins on the date of 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 IHP dealer/distributor, whichever occurs earlier. The warranty shall commence no later than 24 months following the date of product shipment from IHP, regardless of the installation or occupancy date.

EXCLUSIONS AND LIMITATIONS

This Limited Lifetime Warranty applies only if the Product is installed in the United States or Canada and only if operated and maintained in accordance with the printed instructions accompanying the Product and in compliance with all applicable installation and building codes and good trade practices.

This warranty is non-transferable and extends to the original owner only. The Product must be purchased through a listed supplier of IHP and proof of purchase must be provided. The Product body and firebox carry the Limited Lifetime Warranty from the date of installation. Vent components, trim components and paint are excluded from this Limited Lifetime Warranty. The following do not carry a Limited Lifetime Warranty but are warranted as follows:

Cast Iron Heat Exchanger – Replacement for five years from the date of installation
Cast iron parts – Replacement for one year from the date of installation
Catalyst – Carries a separate warranty. Refer to the warranty certificate provided for that part
Electrical components– Repair or replacement for one year from date of installation
Gaskets – Replacement for one year from the date of installation.
Gold & nickel plating – Replacement for two years from date of installation. Excludes tarnishing
Refractory & screens – Replacement for two years from date of installation. Excludes hairline cracks
Removable air tubes – Repair or replacement for seven years from date of installation. IHP prevailing labor rates for years one through five.
Labor coverage – Prevailing IHP labor rates apply for the warranty period of the component, unless otherwise noted

Parts not otherwise listed carry a 90 day warranty from the date of installation.

Whenever practicable, IHP will provide replacement parts, if available, for a period of 10 years from the last date of manufacture of the Product.

IHP will not be responsible for: (a) damages caused by normal wear and tear, accident, riot, fire, flood or acts of God; (b) damages caused by abuse, negligence, misuse, or unauthorized alteration or repair of the Product affecting its stability or performance. (The Product must be subject to normal use with approved fuels listed in the Operation Manual provided with the product. Fuel products with abnormal burning characteristics, including but not limited to fuel such as driftwood, coal or plywood and wood products using a binder may burn at excessive temperatures and may cause damage to the Product or may cause it to function improperly; IHP stoves, inserts and high efficiency EPA fireplaces are approved for burning dry seasoned wood only.); (c) damages caused by failing to provide proper maintenance and service in accordance with the instructions provided with the Product; (d) damages, repairs or inefficiency resulting from faulty installation or application of the Product.

Coverage of this Limited Lifetime Warranty is conditional upon the appliance being operated without the use of grates, irons or any other method to elevate the fire.

IHP is not responsible for inadequate system draft caused by air conditioning and heating systems, mechanical ventilation systems, or general construction conditions which may generate negative air pressure in the room in which the appliance is installed. Additionally IHP assumes no responsibility for smoking conditions caused by inadequate chimney height, adjoining trees or buildings, adverse wind conditions or unusual environmental factors and conditions. Certain IHP Products are listed for use with Security Chimneys International, Ltd. chimney systems only. Use of chimney components other than that specified in the Product manual will void the Product warranty.

This Limited Lifetime Warranty covers only parts and labor as provided herein. In no case shall IHP be responsible for materials, components or construction which are not manufactured or supplied by IHP or for the labor necessary to install, repair or remove such materials, components or construction. Additional utility bills incurred due to any malfunction or defect in equipment are not covered by this Limited Lifetime Warranty. All replacement or repair components will be shipped F.O.B. from the nearest stocking IHP factory.

LIMITATION ON LIABILITY

It is expressly agreed and understood that IHP's sole obligation and the purchaser's exclusive remedy under this warranty, under any other warranty, expressed or implied, or in contract, tort or otherwise, shall be limited to replacement, repair, or refund, as specified herein.

In no event shall IHP be liable for any incidental or consequential damages caused by defects in the Product, whether such damage occurs or is discovered before or after replacement or repair, and whether such damage is caused by IHP's negligence. IHP has not made and does not make any representation or warranty of fitness for a particular use or purpose, and there is no implied condition of fitness for a particular use or purpose.

IHP makes no expressed warranties except as stated in this Limited Lifetime Warranty. The duration of any implied warranty is limited to the duration of this expressed warranty.

No one is authorized to change this Limited Lifetime Warranty or to create for IHP any other obligation or liability in connection with the Product. Some states and provinces do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. The provisions of this Limited Lifetime Warranty are in addition to and not a modification of or subtraction from any statutory warranties and other rights and remedies provided by law.

INVESTIGATION OF CLAIMS AGAINST WARRANTY

IHP reserves the right to investigate any and all claims against this Limited Lifetime Warranty and to decide, in its sole discretion, upon the method of settlement.

To receive the benefits and advantages described in this Limited Lifetime Warranty, the appliance must be installed and repaired by a licensed contractor approved by IHP.

Contact IHP at the address provided herein to obtain a listing of approved dealers/distributors. **IHP shall in no event be responsible for any warranty work done by a contractor that is not approved without first obtaining IHP's prior written consent.**

HOW TO REGISTER A CLAIM AGAINST WARRANTY

In order for any claim under this warranty to be valid, you must contact the IHP dealer/distributor from which you purchased the product. If you cannot locate the dealer/distributor, then you must notify IHP in writing. IHP must be notified of the claimed defect in writing within 90 days of the date of failure. Notices should be directed to the IHP Warranty Department at 1769 East Lawrence Street; Russellville, AL 35654 or visit our website at WWW.ASTRIA.US.COM.

P/N 900200-00, Rev. B 02/2018

Innovative Hearth Products
1769 East Lawrence Street • Russellville, AL 35654

WARRANTY

Your fireplace is covered by a limited warranty. Please read the warranty to be familiar with its coverage.

Retain this manual. File it with your other documents for future reference.

PRODUCT REFERENCE INFORMATION

We recommend that you record the following important information about your fireplace. Please contact your IHP dealer for any questions or concerns.

REPLACEMENT PARTS

See ***Page 27*** for a complete replacement parts list. Use only parts supplied from the manufacturer.

Normally, all parts should be ordered through your IHP distributor or dealer. Parts will be shipped at prevailing prices at time of order.

When ordering repair parts, always give the following information:

1. The model number of the appliance.
2. The serial number of the appliance.
3. The part number.
4. The description of the part.
5. The quantity required.
6. The installation date of the appliance.

If you encounter any problems or have any questions concerning the installation or IHP application of this system, please contact your dealer.

IHP
1769 East Lawrence Street
Russellville, AL 35654
Visit us at Astria.us.com

Model Number ____________________

Serial Number ____________________

Date Installed ____________________

Dealer's Name ____________________

Dealer's Phone Number ____________________

NATIONAL FIREPLACE INSTITUTE® NFI CERTIFIED www.nficertified.org

We recommend that our woodburning hearth products be installed and serviced by professionals who are certified in the U.S. by the National Fireplace Institute® (NFI) as NFI Woodburning Specialists or who are certified in Canada by Wood Energy Technical Training (WETT).

Wood Energy Technical Training www.wettinc.ca

Innovative Hearth Products (IHP) reserves the right to make changes at any time, without notice, in design, materials, specifications, prices and also to discontinue colors, styles and products. Consult your local distributor for fireplace code information.

P901004-00

INNOVATIVE HEARTH PRODUCTS

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Established 1974

ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Dirigo Laboratories
11785 SE Hwy 212, Ste 305
Clackamas, OR 97015

Report Number: DIRI01167102161221

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Rice Lake	IQ+355-2A 10000	167102	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	1	QC033	12/21/16	6/27/16	6/2017

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 1000 Tol: 1	Test Wt: HB44 Tol: HB44	Test Wt: 500 Tol: 1	☐ Good ☑ Fair ☐ Poor
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	Temperature: 16.7°C

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	1000	1000	0.5
700	700	700	0.5
500	500	500	0.5
300	300	300	0.5
100	100	100	0.5
50	50	50	0.5

CALIBRATION STANDARDS

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

Permanent Information Concerning this Equipment:

10000 lb scale with a built-on furnace.

Comments/Information Concerning this Calibration

12/21/2016: Large Furnace on balance. Customer weighs difference in fuel at a load of around 100lbs. 6/16 Added woodstove(deadload) of 622 lbs. Check range from 1000-1622 on top of the 0-1000 lbs. Values had no count of errors.

Report prepared/reviewed by: N. KILMER **Date:** 12-21-16

Technician: N.Kilmer
Signature: N. Kilmer

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.

DICK MUNNS COMPANY
LIQUID & GAS FLOW CALIBRATION

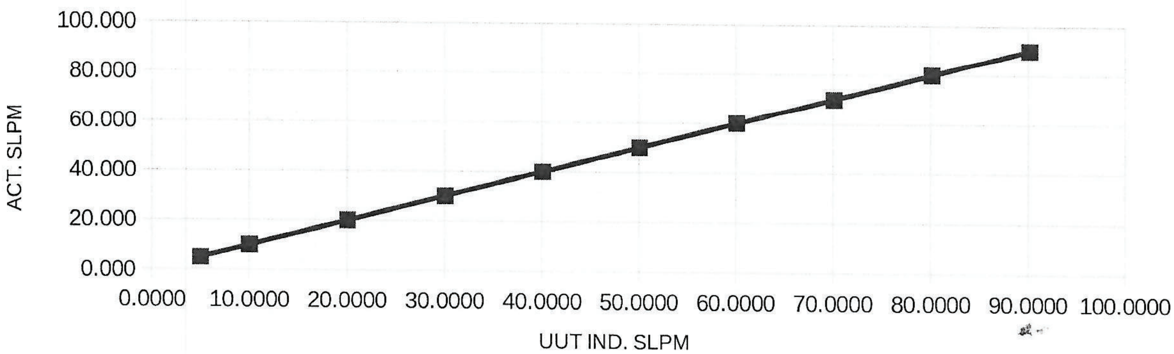
ISO 17025 — IAS ACCREDITED CL-122

CERTIFICATE OF CALIBRATION

CUSTOMER:	**DIRIGO LABORATORIES INC.** CLACKAMAS OR	**CALIBRATION DATE:**	02/04/16
PO NUMBER:	1009	**CALIBRATION DUE:**	02/04/17
INST. MANUFACTURER:	APEX	**PROCEDURE:**	NAVAIR 17-20MG-02
INST. DESCRIPTION:	DIGITAL DGM STANDARD	**CALIBRATION FLUID:**	AIR @ 14.7 PSIA 70 F
MODEL NUMBER:	SK25DA	**STANDARD(S) USED:**	A4, A24 DUE 06-2016
SERIAL NUMBER:	1101001	**NIST TRACE #' S:**	1331545884, 1390386562, 1424683640
RATED UNCERTAINTY:	+/- .5 % RD.	**AMBIENT CONDITIONS:**	769 mm HGA 34 % RH 68 F
UNCERTAINTY GIVEN:	TOTAL measurement uncertainty: +/- .190 % RD. K=2	**CERTIFICATE FILE #:**	449362.16

NOTES: AS RECEIVED/AS LEFT WITHIN SPECS. REFERENCE CONDITIONS ARE: 760 mm HGA 70 F

TEST POINT NUMBER	UUT INDICATED SLPM	DM.STD. ACTUAL SLPM	CORRECTION SLPM	K FACTOR
1	5.0128	5.008	0.99905	60.057
2	10.0236	9.997	0.99735	60.159
3	20.0431	20.003	0.99800	60.120
4	30.0586	30.013	0.99848	60.091
5	40.0721	40.009	0.99842	60.095
6	50.0826	49.972	0.99779	60.133
7	60.0911	59.993	0.99837	60.098
8	70.1133	70.012	0.99855	60.087
9	80.1376	80.028	0.99863	60.082
10	90.1653	89.984	0.99799	60.121
		AVERAGE (Y)=	0.99826376	



All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) used and the unit under test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the shown procedure number, in accordance with ISO 10012:2003, ISO 17025:2005, ANSI/NCSL-Z-540.3, and/or MIL-STD-45662A. Test methods: API2530-92 & ASME MFC-3M-1989.

Dick Munns Company • 10572 Calle Lee #130 • Los Alamitos, CA 90720
Phone (714) 827-1215 • Fax (714) 827-0823

Date: 2/4/2016

Approved By:

Calibration Technician: AT

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Dirigo Laboratories
11785 SE Hwy 212, Ste 305
Clackamas, OR 97015

Report Number: DIRI0182484A0912013i151211

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Digiweigh	DWP12i 400x.01	82484A0912013i	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	0.01	QC033	12/11/15	N/A	6/2016

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 50 Tol: 0.05	Test Wt: HB44 Tol: HB44	Test Wt: 50 Tol: 0.01	☐ Good ☑ Fair ☐ Poor
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	Temperature: 19.7°C
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
400	881.80	399.96	0.058
300	661.43	300.00	0.058
200	440.99	200.00	0.058
100	220.53	100.00	0.012
50	110.28	100.00	0.012
20	55.14	20.00	0.012

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	11/4/15	11/2017	20152112
Weight Set	R.L./Troemner	10kg to 1mg	G782	11/3/15	11/2016	20152098

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

12/15: Kg and Lbs were swapped. As-Found readings are in the Lbs setting. Customer was using the Kg setting for pounds. Those readings As-Found were within HB44 tolerances. Adjusted span with an external calibration to match proper unit settings.

Report prepared/reviewed by: S.King **Date:** 12-14-15

Technician: S. King
Signature:

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

PT ID: DIRI01

Member: National Conference of Standards Laboratories and Weights & Measures

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 01/15/16
Purchase Order: 1001
Traceable Number: 20152489

Test Item: 20lb and 10lb Individual Grip Handle Weights
Serial No.: Listed in Table

Manufacturer: Unknown

Material	Assumed Density	Range	Tolerance Class
Cast Iron	7.2 g/cm^3	20lb to 10lb	NIST HB 105-1 (F)

Method and Traceability

The procedure used for this calibration is NIST IR 6969 SOP 7 Single Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:

Avoirdupois Working Standards were calibrated: 06/18/2014 Due: 06/18/2016 Standards ID: 34AA

Mass Comparators Used: MET-09, 20 **Tested by:** D. Thompson

Conventional Mass: "The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). "Conventional Value of the Result of Weighing in Air" **(Previously known as "Apparent Mass vs. 8.0g/cm^3).**

Uncertainty Statement: The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor K=2 for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16

Signature David S. Thompson

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Certificate Number: 1550.01
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Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 01/15/16
Purchase Order: 1001
Traceable Number: 20152489

Test Item: 20lb and 10lb Individual Grip Handle Weights
Serial No.: Listed in Table

Manufacturer: Unknown

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.448	760.64	44.58

Conventional Mass Value

Nominal Value	As Found pounds	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
20lb #098	19.9995450	-206.4	6.4	910
10lb #097	10.0006510	295.3	5.1	450
10lb #051	10.0003421	155.2	5.1	450

*Correction is the difference between the conventional mass value of a weight and its nominal value.

Comments: These weights were received in good condition and were within NIST Handbook 105-1 Class F tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16

Signature David S. Thompson

DIRIGO LABORATORIES INC.

EPA Method 5 Dry Gas Meter Calibration for γ and ΔH@

Average DGM γ factor = **1.001**

Average Meter Orifice ΔH@ = **59.917**

Manufacturer / Model:	XC-60-ED
ID:	Box B
Serial Number	1902133
Equipment No.:	Dirigo 054
Calibration Date:	3/8/2016
Next Calibration Due:	9/8/2016
Barometric Pressure:	29.94 inHg
Signature/Date:	

	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	149.796	171.388	148.937
Standard Ave. Meter Temperature (°F), (Tstd)	69.2	68.9	68.6
DGM Initial Volume (cuft)	0.000	0.000	0.000
DGM Final Volume (cuft)	5.460	6.299	5.485
DGM Average Temperature (°F), (T_{DGM})	92.8	93.7	94.0
Time (min)	35.0	45.0	45.0
Orifice ΔH ("H2O)	2.49	1.99	1.51
Vacuum ("H2O)	0.00	0.00	0.00
Total Volume for Standard DGM (Vstd) (cuft)	5.290	6.052	5.260
Total Volume for DGM (V_{DGM}) (cuft)	5.460	6.299	5.485

Dry Gas Meter γ Factor	1.004	0.999	0.999
γ Factor Deviation From Average	0.003	0.002	0.002
Meter Orifice ΔH@	59.791	59.885	60.076
Orifice ΔH@ Deviation From Average	0.126	0.033	0.159

Standard Meter Data

Date	2/4/2016
γ Factor	0.998
Model	SK25DA
Serial Number	1101001

Pre-Calibration Data

Date	9/24/2016
γ Factor	1.004
ΔH@	60.267
Tolerance (5%)	0.050
Deviation	0.003

Pass

DGM Calibration Data

γ Deviation Tolerance	0.020
Maximum γ Deviation	0.003
ΔH@ Deviation Tolerance	0.200
Maximum dH@ Deviation	0.159

Pass

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. $\gamma = (V_{std} \times (\text{Std } \gamma \text{ factor}) \times (P_{bar}) \times (T_{DGM} + 460) / (V_{DGM} \times (T_{std} + 460) \times (P_{bar} + (dH / 13.6)))$
3. $\Delta H@ = 0.0319 \times \Delta H\ (((T_{DGM} + 460) \times (Time^2)) / (P_{bar} \times (\gamma\ factor^2) \times (V_{DGM}^2)))$

Measurement of uncertainty = +/- 0.14 cfm

DIRIGO LABORATORIES INC.

EPA Method 5 Dry Gas Meter Calibration for γ and ΔH@

Average DGM γ factor = **1.002**

Average Meter Orifice ΔH@ = **58.685**

Manufacturer / Model:	XC-60-ED
ID:	Box-A
Serial Number	1902130
Equipment No.:	Dirigo 053
Calibration Date:	3/8/2016
Next Calibration Due:	9/8/2016
Barometric Pressure:	29.94 inHg
Signature/Date:	[signature]

	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	151.652	154.728	150.555
Standard Ave. Meter Temperature (°F), (Tstd)	69.0	69.4	69.6
DGM Initial Volume (cuft)	0.000	0.000	0.000
DGM Final Volume (cuft)	5.508	5.689	5.583
DGM Average Temperature (°F), (T_{DGM})	92.3	96.0	97.7
Time (min)	35.0	40.0	45.0
Orifice ΔH ("H2O)	2.51	2.01	1.51
Vacuum ("H2O)	0.00	0.00	0.00
Total Volume for Standard DGM (Vstd) (cuft)	5.356	5.464	5.317
Total Volume for DGM (V_{DGM}) (cuft)	5.508	5.689	5.583

Dry Gas Meter γ Factor	1.007	1.002	0.997
γ Factor Deviation From Average	0.005	0.000	0.005
Meter Orifice ΔH@	58.805	58.650	58.602
Orifice ΔH@ Deviation From Average	0.119	0.036	0.083

Standard Meter Data

Date	2/4/2016
γ Factor	0.998
Model	SK25DA
Serial Number	1101001

Pre-Calibration Data

Date	9/24/2015
γ Factor	0.998
ΔH@	58.536
Tolerance (5%)	0.050
Deviation	0.004

Pass

DGM Calibration Data

γ Deviation Tolerance	0.020
Maximum γ Deviation	0.005
ΔH@ Deviation Tolerance	0.200
Maximum dH@ Deviation	0.119

Pass

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. $\gamma = (V_{std} \times (\text{Std } \gamma \text{ factor}) \times (P_{bar}) \times (T_{DGM} + 460) / (V_{DGM} \times (Tstd + 460) \times (Pbar + (dH / 13.6)))$
3. $\Delta H@ = 0.0319 \times \Delta H (((T_{DGM} + 460) \times (Time\text{^}2)) / (P_{bar} \times (\gamma\ factor\text{^}2) \times (V_{DGM}\text{^}2)))$

Measurement of uncertainty = +/- 0.14 cfm

DIRIGO LABORATORIES INC.

EPA Method 5 Dry Gas Meter Calibration for γ and ΔH@

Average DGM γ factor = **0.999**

Average Meter Orifice ΔH@ = **30.755**

Manufacturer / Model:	Apex-AK-600
ID:	Ambient Box
Serial Number	810016
Equipment No.:	Dirigo 055
Calibration Date:	1/19/2016
Next Calibration Due:	7/19/2016
Barometric Pressure:	29.79 inHg
Signature/Date:	1/19/16

	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	181.723	164.612	162.714
Standard Ave. Meter Temperature (°F), (Tstd)	72.0	69.0	69.0
DGM Initial Volume (cuft)	0.000	0.000	0.000
DGM Final Volume (cuft)	6.505	5.810	5.784
DGM Average Temperature (°F), (T_{DGM})	76.6	76.6	76.9
Time (min)	30.0	35.0	30.0
Orifice ΔH ("H2O)	2.45	1.50	2.00
Vacuum ("H2O)	0.00	0.00	0.00
Total Volume for Standard DGM (Vstd) (cuft)	6.417	5.813	5.746
Total Volume for DGM (V_{DGM}) (cuft)	6.505	5.810	5.784

Dry Gas Meter γ Factor	0.987	1.009	1.001
γ Factor Deviation From Average	0.012	0.010	0.002
Meter Orifice ΔH@	30.720	30.704	30.841
Orifice ΔH@ Deviation From Average	0.035	0.051	0.087

Standard Meter Data

Date	2/19/2015
γ Factor	0.998
Model	SK25DA
Serial Number	1101001

Pre-Calibration Data

Date	7/30/2015
γ Factor	1.016
ΔH@	32.841
Tolerance (5%)	0.051
Deviation	0.017

Pass

DGM Calibration Data

γ Deviation Tolerance	0.020
Maximum γ Deviation	0.012
ΔH@ Deviation Tolerance	0.200
Maximum dH@ Deviation	0.087

Pass

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. γ = (V_{std} x (Std γ factor) x (P_{bar}) x (T_{DGM} + 460) / (V_{DGM} x (Tstd + 460) x (Pbar + (dH / 13.6)))
3. ΔH@ = 0.0319 x ΔH (((T_{DGM}+ 460) x (Time^2)) / (P_{bar} x (γ factor^2) x (V_{DGM}^2)))

Measurement of uncertainty = +/- 0.14 cfm

Report and Certificate of Calibration

by

Cal-Cert

CAL-CERT
CALIBRATION CERTIFICATION

6709 S.E. Lake Road Milwaukie, OR 97222 (800)356-4662 Fax (503)654-9670

ACCREDITED
Laboratory Code: CL-108

Revision to Report #: 53550-D-004 to add expanded uncertainty calculations.

Date: 11/23/15

Report #: 53550-D-0004 **Customer PO#:** 76
Customer Name: Dirigo Laboratories
Customer Address: 11785 Southeast Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: John Steinert
Service Address: 6709 Southeast Lake Road Milwaukie, OR 97222

Calibration Standards

LP-M-5500A/00050 Fluke Electronic Calibrator S/N: 6725008 Cal Date: 11/11/14 Due Date: 11/11/15 Vendor: Fluke REPORT#: 87079
LP-8845A/00051 Fluke Bench Multimeter S/N: 9663004 Cal Date: 11/10/14 Due Date: 11/10/15 Vendor: Fluke REPORT#: 83718
10-RH4/00699 Comark Thermohygrometer S/N: 06216410287 Cal Date: 4/28/15 Due Date: 4/28/16 Vendor: CC REPORT#: 52034-C-01

Instrument Data

Calibration Date: September 3, 2015
Recommended Due Date: September 3, 2016
Calibration Frequency: 12 Months
Manufacturer: Delmhorst
Type: Resistance Artifact
Model Number: MCS-1
Serial #: #094
Capacity: 120,000,000 Ohms
Tolerance: 10.00 % of indication

Method Used: CP-080
Number of Ranges: Two
Indicating System: None
Temperature: 70 °F
Humidity: 54% RH
Cal Factor: None
Asset #: #094
Service Location: Cal-Cert Lab
As Found: Pass
As Left: Pass

Instrument Range: 120 MΩ **Range Resolution:** N/A **Mode Verified:** Resistance

Standard Reading	Instrument As Found	Instrument Reading #1	Error	Instrument Reading #2	Error	Uncertainty k=2
0.00	0.00	0.00	0.00	0.00	0.00	0.00 MΩ
1,100,000.00	1,095,000.00	1,095,000.00	-5,000.00	1,095,000.00	-5,000.00	0.0023 MΩ
120,000,000.00	120,772,946.00	120,772,946.00	772,946.00	120,772,946.00	772,946.00	0.00091 MΩ

Remarks:

We sincerely thank you for your business.
Please call us at 1-800-356-4662 for all your calibration needs.
Cleaning and preventive maintenance were preformed before calibration of this equipment.

The above system (Instrument, Load Cell, Integral Software and Output Device(s), and accessories has been calibrated in accordance with standard practice for Calibration of Pressure Measuring Instruments traceable to NIST (National Institute of Standards and Technology). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC Guide 17025, ANSI/NCSL Z540.3, and Cal-Cert Procedure CP-080.

Accredited by the International Accreditation Service, Inc. (IAS) under Calibration Laboratory Code CL-108.
This Laboratory meets the requirements of ISO/IEC 17025 AND ANSI/NCSL Z540.3

This Certificate is issued as a statement of the fact that on this date the above instrument(s) had an accuracy as indicated. It should not be construed or regarded as a Guarantee or Warranty of any kind (in favor of the client, the client's customers, or the public at large) that the instrument(s) will continue to retain the same percentage (%) of accuracy or efficiency as determined on the date when the calibration, and adjustments if required, was performed and reported by "CAL-CERT", since the calibrator has absolutely no control over the future operation, damage, maintenance, repairs, and overall condition of the instrument(s) and hereby expressly disclaims any and all liability for damage or loss sustained by all parties arising or resulting from deterioration, obsolescence, malfunction, or substandard performance of said instrument(s); which shall be deemed to be and which shall remain the sole responsibility of the machines regular custodian, owner, and/or manufacturer.

This report shall not be reproduced except in full, without written approval from Cal-Cert.

Service Engineer: CAMERON WALLING **Date:** September 3, 2015

Technical Manager: MARSHALL DOYLE **Signature:** M Doyle

Certificate of Calibra n

Certificate Number: **605874**

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

Dirigo Laboratories, Inc.
11785 SE Hwy. 212
Suite 305
Clackamas, OR 97015

PO: **Reverse Trace No Charge**
Order Date: 10/29/2015
Authorized By: N/A

Property #: #095
User: N/A
Department: N/A
Make: Dwyer
Model: 471
Serial #: #095
Description: Anemometer (a)
Procedure: 403648 / 400331
Accuracy: Refer to Mfg. Specs.

Calibrated on: 11/04/2015
*Recommended Due: 11/04/2016
Environment: 22 °C 50 % RH
As Received: Other - See Remarks
As Returned: Within Tolerance
Action Taken: Calibrated
Technician: 127

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.

Returned for recalibration with new standard. Received & returned with probes & case.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
654A	Control Company	90080-02	BAROMETER	08/10/2016	597506
799	TSI	5815 DP-Calc	Micromanometer	10/15/2016	604458

Measurement Data

Parameter / Measurement Description	Range Unit	Reference	Min	Max	*Error	UUT
Before/After						
Air Velocity						
0-1500 Range	ft/min	538.0	493	583	11	527 ft/min
0-1500 Range	ft/min	905.0	860	950	15	920 ft/min
0-5000 Range	ft/min	1835.0	1635	2035	85	1750 ft/min
Temperature / Ambient						
	°F	67.50	65.5	69.5	1.7	65.8 °F

JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (NMI's), or by using natural physical constants, intrinsic standards or ratio calibration techniques. The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2005, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless otherwise stated, a test accuracy ratio (TAR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without prior written consent of JJ Calibrations, Inc.
JJ Calibrations, Inc. quality system has been assessed and accredited to ISO/IEC 17025:2005.

Reviewer

Issued 11/04/2015 Rev # 15

Inspector

PRAXAIR

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Tel: (323) 585-2154 Fax:(714) 542-6689
PGVPID: F22015

DocNumber: 000085245

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PRAXAIR WHSE VANCOUVER WA
603 SE VICTORY AVE
VANCOUVER WA 986610

Praxair Order Number: 32589283
Customer P. O. Number: 05749997
Customer Reference Number:

Fill Date: 10/5/2015
Part Number: NI CD17CO8E-AS
Lot Number: 109527801
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 1290 psig 99 cu. ft.

Certified Concentration:

Expiration Date: **10/9/2023**
Cylinder Number: **CC246162**

NIST Traceable Analytical Uncertainty:

16.76	**%**	**CARBON DIOXIDE**	± 0.2 %
4.26	**%**	**CARBON MONOXIDE**	± 0.4 %
17.04	**%**	**OXYGEN**	± 0.2 %
	Balance	**NITROGEN**	

Certifcation Information: *Certification Date:* 10/9/2015 *Term:* 96 Months *Expiration Date:* 10/9/2023

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

O2 resopnses have been corrected for CO2 interference.

Analytical Data: *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

1 . **Component: CARBON DIOXIDE**

Requested Concentration: 17 %
Certified Concentration: 16.76 %
Instrument Used: Horiba VIA-510 S/N 2807014
Analytical Method: NDIR
Last Multipoint Calibration: 9/10/2015

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC158146
Ref. Std. Conc: 19.79%
Ref. Std. Traceable to SRM # : 2745
SRM Sample # : 9-C-36
SRM Cylinder # : CAL016135

First Analysis Data: **Date:** 10/9/2015

Z: 0	**R:** 19.75	**C:** 16.71	**Conc:** 16.738
R: 19.75	**Z:** 0	**C:** 16.73	**Conc:** 16.758
Z: 0	**C:** 16.75	**R:** 19.77	**Conc:** 16.778

UOM: % **Mean Test Assay:** 16.758 %

Second Analysis Data: **Date:**

Z: 0	**R:** 0	**C:** 0	**Conc:** 0
R: 0	**Z:** 0	**C:** 0	**Conc:** 0
Z: 0	**C:** 0	**R:** 0	**Conc:** 0

UOM: % **Mean Test Assay:** 0 %

2 . **Component: CARBON MONOXIDE**

Requested Concentration: 4.25 %
Certified Concentration: 4.26 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 10/5/2015

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC257812
Ref. Std. Conc: 3.96%
Ref. Std. Traceable to SRM # : 2641a
SRM Sample # : 59-C-02
SRM Cylinder # : FF13690

First Analysis Data: **Date:** 10/9/2015

Z: 0	**R:** 3.95	**C:** 4.26	**Conc:** 4.264
R: 3.96	**Z:** 0	**C:** 4.27	**Conc:** 4.274
Z: 0	**C:** 4.25	**R:** 3.96	**Conc:** 4.254

UOM: % **Mean Test Assay:** 4.264 %

Second Analysis Data: **Date:**

Z: 0	**R:** 0	**C:** 0	**Conc:** 0
R: 0	**Z:** 0	**C:** 0	**Conc:** 0
Z: 0	**C:** 0	**R:** 0	**Conc:** 0

UOM: % **Mean Test Assay:** 0 %

PRAXAIR

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5700 South Alameda Street
Los Angeles, CA 90058
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PGVPID: F22015

DocNumber: 000085245

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

3. Component: OXYGEN

Requested Concentration:	17 %
Certified Concentration:	17.04 %
Instrument Used:	OXYMAT 5E
Analytical Method:	PARAMAGNETIC
Last Multipoint Calibration:	10/8/2015

Reference Standard Type:	GMIS
Ref. Std. Cylinder #:	CC243259
Ref. Std. Conc:	20.03%
Ref. Std. Traceable to SRM #:	2659a
SRM Sample #:	71-E-19
SRM Cylinder #:	FF22331

First Analysis Data: **Date:** 10/9/2015

Z:	0	**R:**	20.04	**C:** 17.05		**Conc:**	17.036
R:	20.04	**Z:**	0	**C:** 17.05		**Conc:**	17.036
Z:	0	**C:**	17.05	**R:** 20.06		**Conc:**	17.036
UOM:	%			**Mean Test Assay:**			17.036 %

Second Analysis Data: **Date:**

Z:	0	**R:**	0	**C:**	0	**Conc:**	0
R:	0	**Z:**	0	**C:**	0	**Conc:**	0
Z:	0	**C:**	0	**R:**	0	**Conc:**	0
UOM:	%			**Mean Test Assay:**			0 %

Analyzed by:

Jacquelyne Fiero

Certified by:

Jack Fu

Airgas

CERTIFICATE OF BATCH ANALYSIS

NITROGEN - ULTRA HIGH PURITY-PURE

Airgas Nor Pac
11900 NE 95th St., Ste. 400
Vancouver, Washington 98682
(360) 944-4000 Fax: (360) 944-4100
www.airgas.com

Part Number:	NI UHP200BA	Reference Number:	16-101518687-3
Cylinder Analyzed:	6564&	Cylinder Volume:	230 Cubic Feet
Laboratory:	NOR - Portland - OR	Cylinder Pressure:	2200 PSIG
Analysis Date:	May 10, 2011	Valve Outlet:	580
Lot #:	16-101518687-3		

ANALYTICAL RESULTS

Component	Requested Purity	Certified Concentration
NitrogenUltraHighPurity	99.999%	99.999%
CO + CO2	< 1 PPM	< 1 PPM
Moisture	< 1 PPM	< 1 PPM
Oxygen	< 1 PPM	< 1 PPM
THC	< 0.5 PPM	< 0.5 PPM

Cylinders in Batch:

CAI2175778Y, CG969822, N-459011

Notes:

Impurities verified against analytical standards traceable to NIST by weight and/or analysis.

Approved for Release

PRAXAIR

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Tel: (323) 585-2154 Fax:(714) 542-6689
PGVPID: F22016

DocNumber: 000091012

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PRAXAIR WHSE VANCOUVER WA
603 SE VICTORY AVE
VANCOUVER WA 986610

Praxair Order Number: 33855113
Customer P. O. Number: 05949702
Customer Reference Number:

Fill Date: 2/25/2016
Part Number: NI CD10CO33E-AS
Lot Number: 109605601
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

Certified Concentration:

Expiration Date: **3/1/2024**
Cylinder Number: **CC199294**

			NIST Traceable Analytical Uncertainty:
9.91	**%**	**CARBON DIOXIDE**	± 0.5 %
2.51	**%**	**CARBON MONOXIDE**	± 0.8 %
10.50	**%**	**OXYGEN**	± 0.4 %
	Balance	**NITROGEN**	

Certifcation Information: *Certification Date:* 3/1/2016 *Term:* 96 Months *Expiration Date:* 3/1/2024

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

O2 responses have been corrected for CO2 interference.

Analytical Data: *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

1. Component: CARBON DIOXIDE

Requested Concentration: 10 %
Certified Concentration: 9.91 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 2/26/2016

Reference Standard Type: GMIS
Ref. Std. Cylinder # : SA17695
Ref. Std. Conc: 9.87%
Ref. Std. Traceable to SRM # : 1674b
SRM Sample # : 7-H-07
SRM Cylinder # : FF10631

First Analysis Data: **Date:** 3/1/2016

Z: 0	**R:** 9.87	**C:** 9.91	**Conc:** 9.91
R: 9.87	**Z:** 0	**C:** 9.91	**Conc:** 9.91
Z: 0	**C:** 9.92	**R:** 9.87	**Conc:** 9.92

UOM: % **Mean Test Assay:** 9.913 %

Second Analysis Data: **Date:**

Z: 0	**R:** 0	**C:** 0	**Conc:** 0
R: 0	**Z:** 0	**C:** 0	**Conc:** 0
Z: 0	**C:** 0	**R:** 0	**Conc:** 0

UOM: % **Mean Test Assay:** 0 %

2. Component: CARBON MONOXIDE

Requested Concentration: 2.5 %
Certified Concentration: 2.51 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 2/26/2016

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC103175
Ref. Std. Conc: 2.017%
Ref. Std. Traceable to SRM # : 2640a
SRM Sample # : 53-C-38
SRM Cylinder # : CAL013925

First Analysis Data: **Date:** 3/1/2016

Z: 0	**R:** 2.01	**C:** 2.5	**Conc:** 2.5
R: 2.02	**Z:** 0	**C:** 2.51	**Conc:** 2.51
Z: 0	**C:** 2.51	**R:** 2.02	**Conc:** 2.51

UOM: % **Mean Test Assay:** 2.507 %

Second Analysis Data: **Date:**

Z: 0	**R:** 0	**C:** 0	**Conc:** 0
R: 0	**Z:** 0	**C:** 0	**Conc:** 0
Z: 0	**C:** 0	**R:** 0	**Conc:** 0

UOM: % **Mean Test Assay:** 0 %

PRAXAIR

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Los Angeles, CA 90058
Tel: (323) 585-2154 Fax:(714) 542-6689
PGVPID: F22016

DocNumber: 000091012

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

3. Component: OXYGEN

Requested Concentration:	10.5 %
Certified Concentration:	10.50 %
Instrument Used:	OXYMAT 5E
Analytical Method:	PARAMAGNETIC
Last Multipoint Calibration:	2/26/2016

Reference Standard Type:	GMIS
Ref. Std. Cylinder # :	CC243259
Ref. Std. Conc:	20.03%
Ref. Std. Traceable to SRM # :	2659a
SRM Sample # :	71-E-19
SRM Cylinder # :	FF22331

First Analysis Data: **Date:** 3/1/2016

Z:	0	R:	20.04	C:	10.51	Conc:	10.501
R:	20.04	Z:	0	C:	10.51	Conc:	10.501
Z:	0	C:	10.51	R:	20.06	Conc:	10.501

UOM: % **Mean Test Assay:** 10.501 %

Second Analysis Data: **Date:**

Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0

UOM: % **Mean Test Assay:** 0 %

Analyzed by:
Xing Yu

Certified by:
Jose Vasquez

QUALITY CONTROL SERVICES

Established 1974

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
CERTIFICATE #1550.01

PFS Teco
11785 SE Hwy 212 STE#305
Clackamas, OR 97015

Report Number: DIRI0128095201208

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Scientech	ZSA 210	28095	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	12/8/20	6/27/16	6/2021

FUNCTIONAL CHECKS

ECCENTRICITY
Test Wt: 100 Tol: 0.0004
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

LINEARITY
Test Wt: 50x4 Tol: 0.0003
As-Found: Pass: ☐ Fail: ☑
As-Left: Pass: ☑ Fail: ☐

STANDARD DEVIATION
Test Wt: 100 Tol: 0.0002

1. 100.0001	5. 100.0001	9. 100.0001
2. 100.0001	6. 100.0001	10. 100.0001
3. 100.0002	7. 100.0000	**Result**
4. 99.9999	8. 100.0002	0.00008

ENVIRONMENTAL CONDITIONS
☐ Good ☑ Fair ☐ Poor
Temperature: 19.1°C

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	199.9780	200.0002	0.00022
100	99.9890	100.0001	0.00022
50	49.9942	50.0001	0.00021
10	9.9988	10.0000	0.00021
1	0.9997	1.0000	0.00021
0.1	0.1000	0.1000	0.00021

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	10 kg to 1 mg	10565	6/26/20	6/2021	20191192

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:
12/20 - Cleaned, leveled, & adjusted span. RH = 56%

Report prepared/reviewed by: ______ **Date:** 12.8.20

Technician: D.Oudeans
Signature: ______

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

PT ID: DIRI01

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