

Certification Test Report

Monessen Hearth Systems

Insert Wood Stove

Model: Merrimack/Essex

Prepared for: Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032

Prepared by: OMNI-Test Laboratories, Inc.
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Test Period: June 25-30, 2009

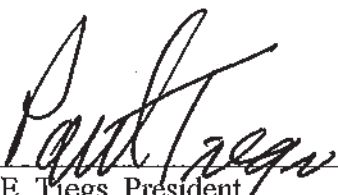
Report Date: September 2009

Report Number: 227-S-37-3

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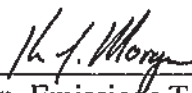
This report has been reviewed and approved by the following authorized signatories:



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OMNI-Test Laboratories, Inc.



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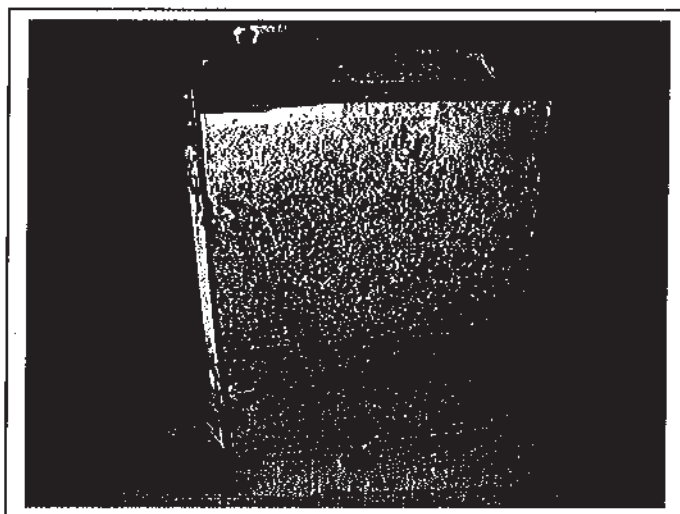
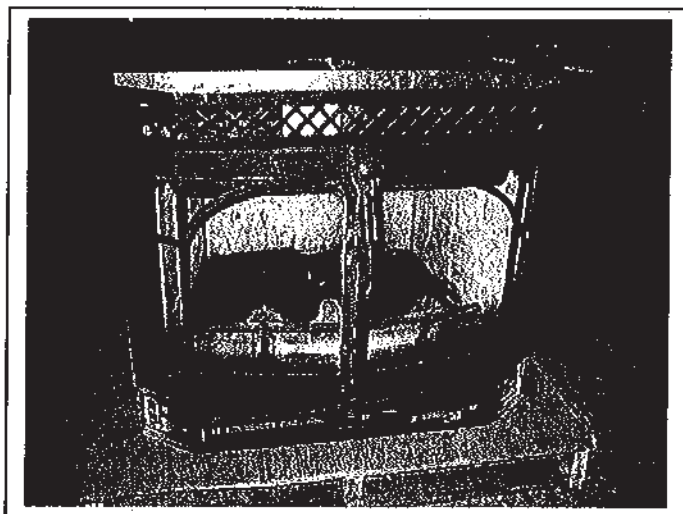
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Section 1

Fuel Photographs/Appliance Description/Drawings

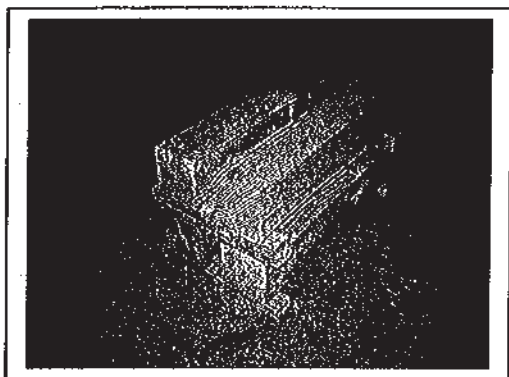
Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032

Monessen Hearth Systems
Merrimack/Essex
Test Dates: June 25-30, 2009

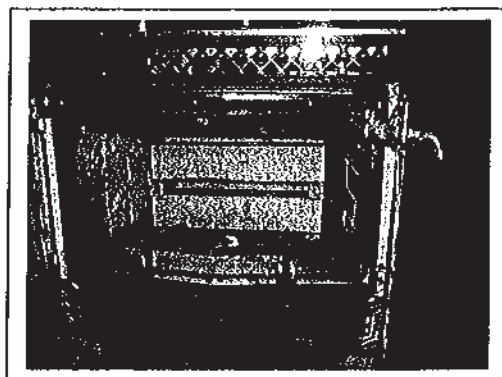


Monessen Hearth Systems Merrimack/Essex

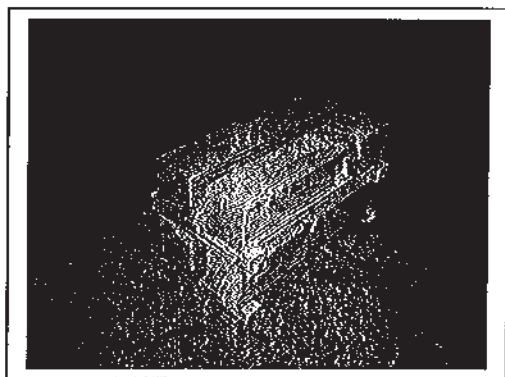
Run 1 -- Fuel



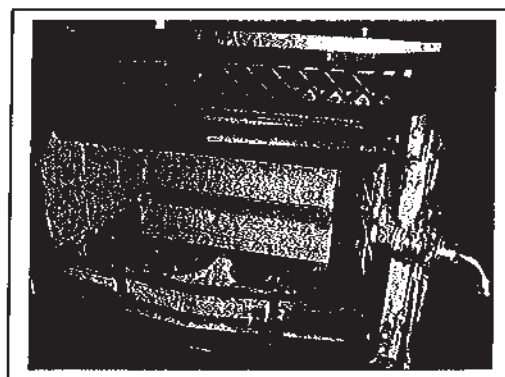
Run 1 -- Newly Loaded Stove



Run 2 -- Fuel

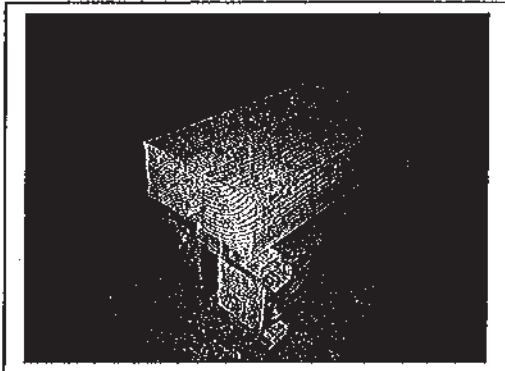


Run 2 -- Newly Loaded Stove

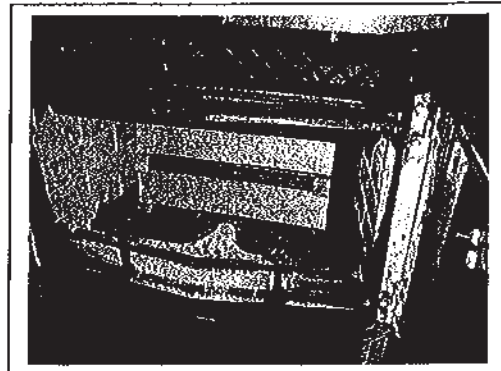


Monessen Hearth Systems Merrimack/Essex

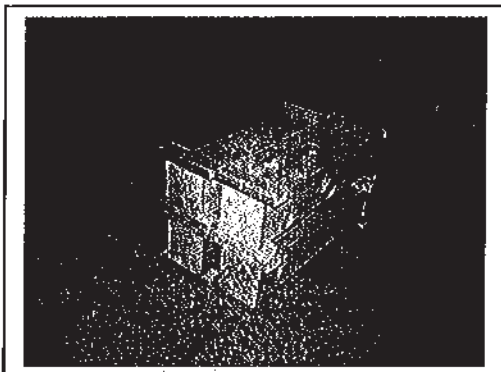
Run 3 – Fuel



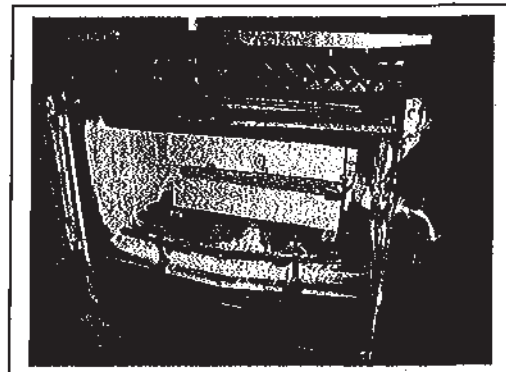
Run 3 – Newly Loaded Stove



Run 4 – Fuel

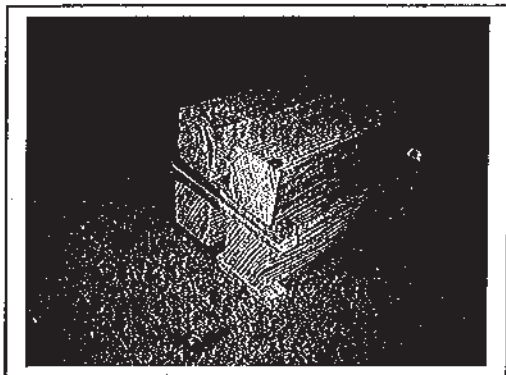


Run 4 – Newly Loaded Stove

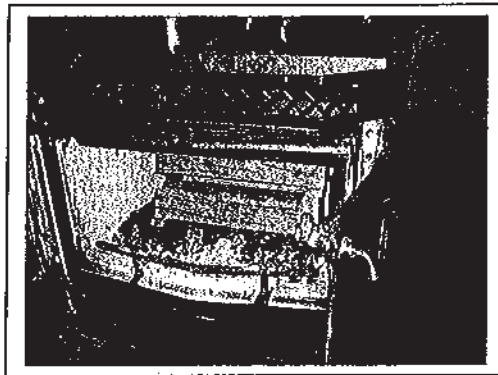


Monessen Hearth Systems Merrimack/Essex

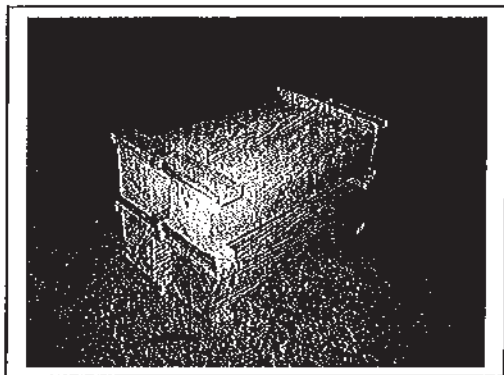
Run 5 – Fuel



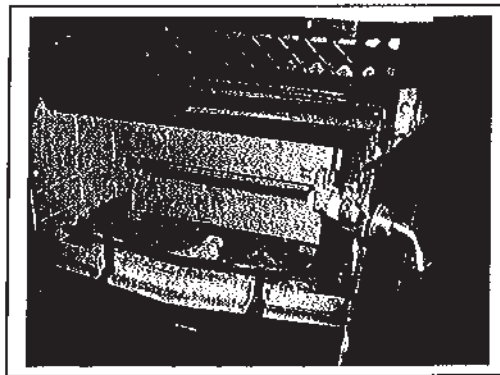
Run 5 – Newly Loaded Stove



Run 6 – Fuel



Run 6 – Newly Loaded Stove



WOOD HEATER DESCRIPTION

Appliance Manufacturer: Monessen Hearth Systems

Wood Stove Model: Merrimack/Essex

Type: Insert, radiant-type room heater

WOOD HEATER INFORMATION

Materials of Construction: The unit is constructed primarily of cast iron. The firebox is lined with refractory firebrick.

Air Introduction System: Air enters the firebox through an opening located at the front/top of the appliance above the fuel-loading door. The primary air inlet is bi-metallically controlled. Secondary air enters the appliance through the bottom/sides and is channeled internally to both sides of the firebox supplying four 3/4-inch diameter tubes.

Combustion Control Mechanisms: The combustion air inlet is controlled by a handle located above the fuel-loading door to the left of the appliance.

Combustor: N/A.

Internal Baffles: A refractory baffle is mounted in the upper portion of the firebox. The flame path is forced to the front of the firebox where it travels up through the opening between the baffle and primary air manifold.

Other Features: Fan is standard.

Flue Outlet: The 6-inch diameter flue outlet is located in the top of the unit.

WOOD HEATER OPERATING INSTRUCTIONS

Specific Written Instructions: See Section 3 of this report. All markings and instruction materials were reviewed for content prior to printing.

*Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032*

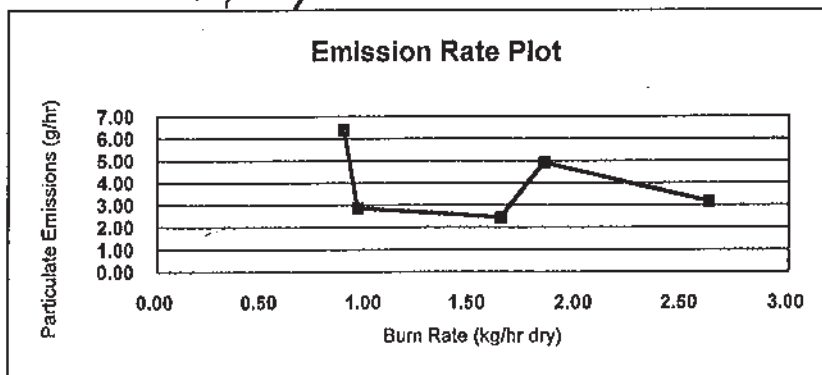
Section 4

Test Data by Run

EPA Weighted Average Emissions EPA Method 28

Client: Monessen Status: Final
 Stove Model: Merrimack / Essex Stove Type: Non-Catalytic Stove
 Test Dates: 6/25/09 - 6/30/09
 Project Number: 227-S-37-3
 Tracking Number: 1425
 Signature/Date: *H. J. Morgan* 9-04-09

Weighted Average (g/hr) 3.6



Run #	1	
Burn Rate (dry kg/hr)	0.89	
Category	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	6.39	
Cap (g/hr)	15	
Weighting Factor	0.338	20.11%
Heat Output (BTU/hr)	10754	

Run #	4	
Burn Rate (dry kg/hr)	2.63	
Category	4	
Overall Efficiency (%)	63%	
Emissions (g/hr)	3.16	
Cap (g/hr)	18	
Weighting Factor	0.118	7.01%
Heat Output (BTU/hr)	31780	

Run #	3	
Burn Rate (dry kg/hr)	0.96	
Category	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	2.86	
Cap (g/hr)	15	
Weighting Factor	0.534	31.74%
Heat Output (BTU/hr)	11600	

Run #	6	
Burn Rate (dry kg/hr)	1.65	
Category	3	
Overall Efficiency (%)	63%	
Emissions (g/hr)	2.44	
Cap (g/hr)	18	
Weighting Factor	0.544	32.30%
Heat Output (BTU/hr)	19938	

Run #	5	
Burn Rate (dry kg/hr)	1.85	
Category	3	
Overall Efficiency (%)	63%	
Emissions (g/hr)	4.9	
Cap (g/hr)	18	
Weighting Factor	0.149	8.84%
Heat Output (BTU/hr)	22355	

*Model: Merrimack/Essex
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Run 1

Wood Heater Test Data - EPA Method 5G

Manufacturer: Monessen
 Model: Merrimack/Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425
 Run: 1
 Test Date: 06/25/09

Burn Rate	0.89 kg/hr dry
Average Tunnel Temperature	98 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	14.1 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8831.7 dscf/hour
Average Delta p	0.041 inches H2O
Average Delta H	0.10 inches H2O
Total Time of Test	500 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	81.78 cubic feet	85.15 cubic feet	78.42 cubic feet
Average Gas Meter Temperature	79 degrees Fahrenheit	79 degrees Fahrenheit	79 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	79.0 dscf	81.1 dscf	77.0 dscf
Total Particulates - mn		41.3 mg	39.9 mg
Particulate Concentration (dry-standard)	0.00051 grams/dscf	0.00051 grams/dscf	0.00052 grams/dscf
Particulate Emission Rate	4.54 grams/hour	4.50 grams/hour	4.58 grams/hour
Adjusted Emissions	6.39 grams/hour	6.34 grams/hour	6.43 grams/hour
Difference from Average		0.05 grams/hour	0.05 grams/hour
7.5% of the average emission rate	0.48		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		
Results Are Acceptable			

Wood Heater Test Data - EPA Method 5G

Run: _____
Manufacturer: Monsoon
Model: Monsoon Elite
Tracking No.: 1429
Project No.: 2275-373
Test Date: 25-Jun-09
Beginning Clock Time: 12:03
Recording Interval: 10 min
Total Sampling Time: 300 min

Velocity Traverse Data									
P1.1	P1.2	P1.3	P1.4	P1.5	P1.6	P1.7	P1.8		
0.014	0.010	0.038	0.028	0.018	0.010	0.010	0.010	0.010	0.010
97	97	97	97	96	96	96	96	96	96

PM Corrosion Module: 10.20
Dilution Tunnel MW(dry): 29.00
Dilution Tunnel MW(wet): 28.56
Dilution Tunnel I2O: 4.00 percent
Dilution Tunnel Static: 0.09
Plot Tube Cx: 0.92 (1)
Meter Box V Factor: 1.021
Barometric Pressure: 29.35

Signature Date: K. J. McGee 7-01-09
Tunnel Velocity: 14.66
Initial Tapped Flow: 138.7
Average Tapped Flow: 137.2
Tunnel Area: 0.1863 ft²
Post Test Leak Check (1): 0.00 g/hg
Post Test Leak Check (2): 0.00 g/hg
Fuel Moisture (dry basis %): 21.46
Total Particulate (1): 41.3
Total Particulate (2): 39.9

Particulate Sampling Data									
Elapsed Time	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Onflow dft (1)	Onflow dft (2)	Outlet dft (1)	Outlet dft (2)	Meter of (1)
0	363.000	38.000	0.18	0.16	0.10	0.10	0.10	0.10	75
10	363.150	39.600	0.18	0.16	0.10	0.10	0.10	0.10	75
20	366.815	41.142	0.17	0.15	0.10	0.10	0.10	0.10	75
30	368.500	42.670	0.17	0.15	0.10	0.10	0.10	0.10	75
40	370.160	44.185	0.17	0.15	0.10	0.10	0.10	0.10	75
50	371.810	45.705	0.16	0.15	0.10	0.10	0.10	0.10	75
60	373.450	47.220	0.17	0.16	0.10	0.10	0.10	0.10	76
70	375.090	48.735	0.17	0.16	0.10	0.10	0.10	0.10	76
80	376.730	50.250	0.17	0.16	0.10	0.10	0.10	0.10	76
90	378.370	51.765	0.17	0.16	0.10	0.10	0.10	0.10	77
100	380.010	53.280	0.17	0.16	0.10	0.10	0.10	0.10	77
110	381.650	54.795	0.17	0.16	0.10	0.10	0.10	0.10	77
120	383.290	56.310	0.17	0.16	0.10	0.10	0.10	0.10	77
130	384.930	57.825	0.17	0.16	0.10	0.10	0.10	0.10	77
140	386.570	59.340	0.17	0.16	0.10	0.10	0.10	0.10	78
150	388.210	60.855	0.17	0.16	0.10	0.10	0.10	0.10	78
160	389.850	62.370	0.17	0.16	0.10	0.10	0.10	0.10	78
170	391.490	63.885	0.17	0.16	0.10	0.10	0.10	0.10	78
180	393.130	65.400	0.17	0.16	0.10	0.10	0.10	0.10	78
190	394.770	66.915	0.17	0.16	0.10	0.10	0.10	0.10	78
200	396.410	68.430	0.17	0.16	0.10	0.10	0.10	0.10	79
210	398.050	69.945	0.17	0.16	0.10	0.10	0.10	0.10	79
220	399.690	71.460	0.17	0.16	0.10	0.10	0.10	0.10	79
230	401.330	72.975	0.17	0.16	0.10	0.10	0.10	0.10	79
240	402.970	74.490	0.17	0.16	0.10	0.10	0.10	0.10	79
250	404.610	76.005	0.17	0.16	0.10	0.10	0.10	0.10	79
260	406.250	77.520	0.17	0.16	0.10	0.10	0.10	0.10	79
270	407.890	79.035	0.17	0.16	0.10	0.10	0.10	0.10	79
280	409.530	80.550	0.17	0.16	0.10	0.10	0.10	0.10	79
290	411.170	82.065	0.17	0.16	0.10	0.10	0.10	0.10	79
300	412.810	83.580	0.17	0.16	0.10	0.10	0.10	0.10	79
310	414.450	85.095	0.17	0.16	0.10	0.10	0.10	0.10	79
320	416.090	86.610	0.17	0.16	0.10	0.10	0.10	0.10	79
330	417.730	88.125	0.17	0.16	0.10	0.10	0.10	0.10	79
340	419.370	89.640	0.17	0.16	0.10	0.10	0.10	0.10	79
350	421.010	91.155	0.17	0.16	0.10	0.10	0.10	0.10	79
360	422.650	92.670	0.17	0.16	0.10	0.10	0.10	0.10	79
370	424.290	94.185	0.17	0.16	0.10	0.10	0.10	0.10	79
380	425.930	95.700	0.17	0.16	0.10	0.10	0.10	0.10	79
390	427.570	97.215	0.17	0.16	0.10	0.10	0.10	0.10	79
400	429.210	98.730	0.17	0.16	0.10	0.10	0.10	0.10	79
410	430.850	100.245	0.17	0.16	0.10	0.10	0.10	0.10	79
420	432.490	101.760	0.17	0.16	0.10	0.10	0.10	0.10	79

Fuel Weight, lb									
Fuelbox Top	Fuelbox Bottom	Fuelbox Left	Fuelbox Right	Catalyst Exit	Average Surface	Stack	Fiber (1)	Fiber (2)	Impinger exit (1)
377	323	324	431	404	372.6	236	75	75	74
352	324	394	417	394	376.2	237	75	76	74
334	313	267	391	373	333.6	234	75	74	74
303	307	247	377	361	319.0	221	75	74	74
270	294	215	347	335	299.6	203	75	74	74
257	284	205	325	323	278.8	193	74	74	74
231	262	196	305	297	276.6	187	75	74	74
204	251	182	316	303	316.4	437	80	78	75
187	246	232	318	313	315.8	432	80	78	75
161	240	238	317	316	322.6	310	79	78	75
135	240	238	317	316	320.6	307	78	79	75
108	242	242	321	316	321.0	333	78	79	75
82	236	236	319	320	332.2	334	79	77	75
56	227	224	327	330	341.0	361	79	77	75
30	223	292	326	335	331.2	366	79	77	75
4	220	334	343	343	338.2	372	79	78	76
-0.8	218	312	342	353	364.2	372	79	78	76
-0.8	217	326	352	361	370.4	378	80	78	76
-0.8	217	343	363	370	378.0	364	80	78	76
-0.8	217	358	373	377	379.2	337	79	78	76
-0.8	217	375	382	384	374.4	320	79	78	76
-0.8	217	368	381	384	370.4	310	80	78	76
-0.8	218	375	382	384	368.0	300	80	77	76
-0.8	218	383	383	383	364.4	280	80	77	76
-0.8	219	401	382	380	359.4	260	81	77	76
-0.8	219	395	377	375	350.8	246	80	76	76
-0.8	219	388	371	368	343.0	235	80	76	76
-0.8	219	383	367	358	338.4	231	81	76	76
-0.8	218	382	361	358	335.4	228	80	75	76
-0.8	218	379	356	354	331.4	224	80	75	75
-0.8	219	371	352	350	327.2	220	80	75	75
-0.8	219	361	348	347	322.2	216	80	74	75
-0.8	219	352	344	344	318.0	214	80	75	75
-0.8	221	342	340	342	316.6	210	81	76	78
-0.8	221	336	337	341	311.0	208	81	77	79
-0.8	222	334	340	340	308.0	206	82	78	80
-0.8	222	316	331	339	304.8	204	79	79	80
-0.8	223	307	329	337	301.8	202	83	79	80
-0.8	223	300	325	334	298.2	200	83	80	80
-0.8	224	293	321	330	294.4	196	83	80	80
-0.8	224	289	319	328	291.8	193	83	80	81
-0.8	224	281	315	324	287.4	192	84	80	81
-0.8	224	278	314	320	283.8	191	84	80	81

Wood Heater Test Data - EPA Method 5G

Reactor	Manufacturer	Model	Manufacturer
		Model	Manufacturer
		Tracking No.	225-5373
		Test Date	25-Jun-09
		Beginning Clock Time	12:05
		Recording Interval	min.
		Total Sampling Time	min.

Velocity Traverse Data									
	P1.1	P1.2	P1.3	P1.4	P1.5	P1.6	P1.7	P1.8	
Initial dP	0.034	0.040	0.038	0.036	0.038	0.038	0.040	0.040	1120
Initial Temp	97	97	97	97	96	96	96	96	dP

QMSH Equipment Numbers:

Signature Date:	10/20
Turned Velocity:	11.06 ft/sec
Initial Turned Flow:	138.2 scfm
Average Turned Flow:	147.2 scfm
Initial Area:	0.1963 ft ²
Post-Test Leak Check (1):	0.060 g/Hg
Post-Test Leak Check (2):	0.060 g/Hg
Post-Test Leak Check (3):	0.060 g/Hg
Fuel Moisture (dry basis %):	21.46
Fuel Moisture (wet basis %):	41.3
Total Particulate (1):	39.9
Total Particulate (2):	39.9

PM Control Module:	10/20
Dilution Tunnel MW (dry):	29.00
Dilution Tunnel MW (wet):	28.96
Dilution Tunnel H ₂ O:	4.00 percent
Dilution Tunnel Sulfate:	0.00
Post Tube Cp:	0.002 (1)
Meter Box V Factor:	1.021 (1)
Barometric Pressure:	29.33
Begin:	29.33
Middle:	29.32
End:	29.32
Average:	29.32

Particulate Sampling Data									
Elapsed Time	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Offline dH (1)	Offline dH (2)	Offline dP (1)	Offline dP (2)	Offline dP (3)
430	636.655	125.359	0.17	0.16	0.10	0.10	0.10	0.10	0.10
440	638.315	126.930	0.17	0.16	0.10	0.10	0.10	0.10	0.10
450	640.015	128.512	0.17	0.16	0.10	0.10	0.10	0.10	0.10
460	641.720	130.090	0.17	0.16	0.10	0.10	0.10	0.10	0.10
470	643.425	131.670	0.17	0.16	0.10	0.10	0.10	0.10	0.10
480	645.125	133.253	0.17	0.16	0.10	0.10	0.10	0.10	0.10
490	646.840	134.840	0.17	0.16	0.10	0.10	0.10	0.10	0.10
500	648.545	136.416	0.17	0.16	0.10	0.10	0.10	0.10	0.10
Avg/Total	83.146	78.416	0.17	0.16	0.10	0.10	0.10	0.10	0.10

Fuel Weight, lb									
Elapsed Time	Scale Reading	Weight Change	Freebox Top	Freebox Bottom	Freebox Back	Freebox Left	Freebox Right	Catalyst Exit	Average Surface
430	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
440	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
450	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
460	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
470	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
480	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
490	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
500	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68
Avg/Total	97.81	0.041	100.68	100.68	100.68	100.68	100.68	100.68	100.68

Wood Heater Temperature Data, °F									
Elapsed Time	Freebox Top	Freebox Bottom	Freebox Back	Freebox Left	Freebox Right	Catalyst Exit	Average Surface	Stack	Drift to H ₂ O
430	291	225	276	314	316	316	284.4	193	81
440	291	225	274	313	313	313	281.0	192	81
450	287	225	272	312	307	307	280.6	190	81
460	284	226	269	310	306	306	279.0	187	81
470	276	226	260	306	301	301	271.8	182	81
480	271	225	254	303	298	298	270.2	180	81
490	266	225	247	300	294	294	266.4	177	81
500	259	225	241	295	289	289	261.8	173	81
Avg/Total	271.59	229.33	261.8	301.5	297.5	297.5	271.59	180.68	81

Final Laboratory Report - Method 5G Dual Train Dilution Tunnel Particulate Calculations

Client Name: Monessen
 Model: Merrimack / Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425

Equipment Numbers: _____

Run #: 1
 Train #: A
 Date: 06/25/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E960	145.7	109.5	36.2
B. Rear filter catch	Filter	E962	113.8	110.0	3.8
C. Probe catch	Probe	A	76440.7	76439.4	1.3

Total Particulate, mg :	41.3
-------------------------	------

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

Analyst: L. J. Morgan

Date: 7-14-09

Final Laboratory Report - Method 5G Dual Train Dilution Tunnel Particulate Calculations

Client Name: Monessen
 Model: Merrimack / Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425

Equipment Numbers: _____

Run #: 1
 Train #: B
 Date: 06/25/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E961	146.2	109.9	36.3
B. Rear filter catch	Filter	E963	112.4	110.4	2.0
C. Probe catch	Probe	B	84219.3	84217.7	1.6

Total Particulate, mg :	39.9
-------------------------	------

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

Analyst: *H. J. Morgan*

Date: 7-14-09

Prelim:

189 @ 6.88
-6.39-

STOVE TEMPERATURE TEST DATA - METHOD 5G

Page of

Client/Model: Monessen Hearth Systems - Memmack/Essex Project #: 227-S-37-3 Tracking #: 1425

Date: 6-25-09 Test Crew: K. Morgan

Run #: 1

OMNI Equipment ID #:

Preburn [X]		Coal Bed:		Data:		0 =		Range: 4.0 - 4.9		Actual:	
Test	[]	Coal Bed:		Data:		0 =		Range: 4.0 - 4.9		Actual:	
Time	Fuel Weight	Delta Weight	Stack Draft	1 Ambient	4 Top	8 Bottom	Back 7	TEMPERATURES (oF)		5 Right	3 Flue
								Left 6			Not Used Catalyst
0	10.4		-0.065	73	677	275	285	341	310	459	
10	8.8	1.6	-0.068	73	759	273	305	359	325	470	
20	7.5	1.3	-0.065	74	751	272	332	376	341	446	
30	6.3	1.2	-0.063	74	664	274	374	387	364	448	
40	5.3	1.0	-0.063	74	596	278	384	405	373	444	
50	4.9	0.4	-0.053	74	497	288	381	416	387	333	
60	4.7	0.2	-0.045	74	453	279	360	428	377	292	
70	4.4	0.3	-0.043	74	409	307	345	434	402	275	
80	4.1	0.3	-0.038	74	384	321	338	438	405	290	
82-90	4.1	0	-0.038	74	377	325	324	433	404	236	
90											
AVG											

Technician signature: K. Morgan

Date: 6-25-09

FUEL DATA

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3 Tracking #: 1425Date: 6-25-09Test Crew: K. MorganRun #: 1OMNI Equipment ID #: MHS 109FUEL LOAD PREPARED BY: K. MorganFUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER,
DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER -- DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
 Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings	Type
1	<u>8</u> ft	<u>20.3</u>	<u>2x4</u>
2	<u>8</u> ft	<u>20.4</u>	<u>2x4</u>
3	<u>8</u> ft	<u>23.1</u>	<u>2x4</u>

Length of cut pieces: 410 K inches
3706" Pre-Burn Fuel Average Moisture: 21.18

Time (clock): 09:30 Room Temperature (F): 75 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 x 4 0 4 x 4 4
 CALCULATED LOAD WEIGHT: _____ ACTUAL LOAD WEIGHT: 0 (2 x 4)
19.8 (4 x 4)
 FUEL PIECE LENGTH: 17.5" 19.8 Total

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS	TYPE
1	<u>21.3</u> <u>21.1</u> <u>21.1</u>	<u>4x4</u>
2	<u>21.9</u> <u>19.5</u> <u>19.9</u>	<u>4x4</u>
3	<u>22.5</u> <u>22.3</u> <u>21.7</u>	<u>4x4</u>
4	<u>21.9</u> <u>21.2</u> <u>23.1</u>	<u>4x4</u>
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____
10	_____	_____

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 21.46%

Time (clock): 09:15 Room Temperature (F): 75 Initials: K

Technician signature: K. MorganDate: 6-25-09

Run Notes

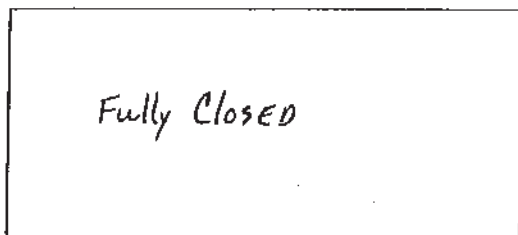
Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Run #: 1 Date: 6-25-09Test Crew: K. Morgan

OMNI Equipment ID #(s): _____

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

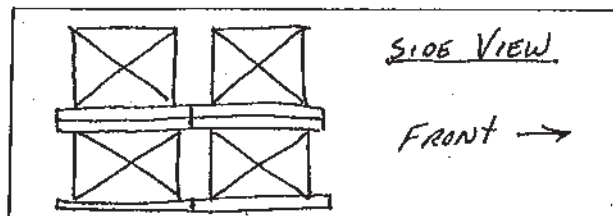
PRIMARY:

SECONDARY: FixedTERTIARY: NoneFAN: ON - Low

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	<u>test setting</u>					
37					X	<u>stir</u>
82					X	<u>Levelled</u>

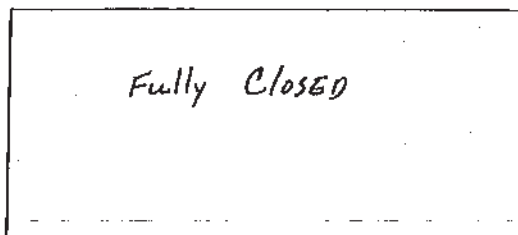
TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)

START UP PROCEDURES

BYPASS: N/AFUEL LOADING By 20 sec.DOOR: 27 sec.PRIMARY AIR: 3/4 open until 5.0 min.OTHER: Auto set back ActuatedDESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SECONDARY: FixedTERTIARY: NoneFAN: ON - Low DURATION
of test.Technician signature: K. J. MorganDate: 6-25-09

Supplemental Data EPA 5G/5H

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-25-09 Run #: 1 Booth: _____Test Crew: K. Morgan Start Time: 12:05 Stop Time: 20:25

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack:

Dilution Tunnel (Method 5G Only):

Initial: _____

Initial: _____

Final: N/AFinal: N/ACalibrations: Span Gas CO₂: N/A O₂: N/A CO: N/A CO₂(DT): N/A

	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span
Time							
O ₂			<u>N/A</u>				
CO ₂							
CO							
CO ₂ (DT)							

Stack Diameter (inches): 6.0Air Velocity (ft/min): Initial: 250 Final: 250Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0Induced Draft: 0 %Smoke Capture: 100Pitot Tube Leak Test: Pre: 0 @ 3.1" U.C. Post: 0 @ 3.1" W.C.Flue Pipe Cleaned Prior to First Test in Series: Date: 6-23-09 Initials: /K

	Initial	Middle	Ending
Pb (in/Hg)	<u>29.35</u>	<u>29.33</u>	<u>29.29</u>
Room Temp (°F)	<u>74</u>	<u>76</u>	<u>81</u>

Technician signature: K. Morgan Date: 6-25-09

*Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032*

Run 2

Wood Heater Test Data - EPA Method 5G

Manufacturer: Monessen
 Model: Merrimack/Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425
 Run: 2
 Test Date: 06/26/09

Burn Rate	1.04 kg/hr dry
Average Tunnel Temperature	98 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	14.0 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8805.1 dscf/hour
Average Delta p	0.041 inches H2O
Average Delta H	0.10 inches H2O
Total Time of Test	430 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	71.67 cubic feet	74.23 cubic feet	69.11 cubic feet
Average Gas Meter Temperature	76 degrees Fahrenheit	75 degrees Fahrenheit	77 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	69.5 dscf	71.1 dscf	67.8 dscf
Total Particulates - mn		11.7 mg	11.3 mg
Particulate Concentration (dry-standard)	0.00017 grams/dscf	0.00016 grams/dscf	0.00017 grams/dscf
Particulate Emission Rate	1.46 grams/hour	1.45 grams/hour	1.47 grams/hour
Adjusted Emissions	2.49 grams/hour	2.48 grams/hour	2.50 grams/hour
Difference from Average		0.01 grams/hour	0.01 grams/hour
7.5% of the average emission rate	0.19		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		
Results Are Acceptable			

Wood Heater Test Data - EPA Method 5G

Base 2

Manufacturer: Merrimack Essex
 Model: 1425
 Tracking No.: 227-5-17-3
 Project No.: 26-Jun-09
 Test Date: 10-10
 Beginning Check Time: 10
 Recording Interval: 10 min
 Total Sampling Time: 410 min

Velocity Traverse Data									
Pt. 1	Pt. 2	Pt. 3	Pt. 4	Pt. 5	Pt. 6	Pt. 7	Pt. 8		
Initial DP	0.028	0.056	0.040	0.038	0.010	0.036	0.036	0.036	0.036
Initial Temp	99	99	99	99	98	98	98	98	98

OMNI Equipment Numbers:

PM Control Module: 10.20
 Dilution Tunnel MWD (dry): 28.60 in/s-mole
 Dilution Tunnel MWD (wet): 28.55 in/s-mole
 Dilution Tunnel H₂O: 4.00 percent
 Dilution Tunnel Static: -0.120 "H₂O
 Pilot Tube Cp: 0.99
 Meter Box Y Factor: 0.992 (1)
 Barometric Pressure: 29.26 29.23 29.23 29.24 "Hg

Signature/Date: K. H. H. 9-04-09

Tunnel Velocity: 14.04 ft/sec
 Initial Tunnel Flow: 138.0
 Average Tunnel Flow: 146.8
 Tunnel Area: 0.1963 ft²
 Post-Test Leak Check (1): 1.021
 Post-Test Leak Check (2): 0.992
 Fuel Measure (dry basis %): 21.33
 Total Particulate (1): 11.7
 Total Particulate (2): 11.3

Particulate Sampling Data									
Elapsed Time	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Offset, min (1)	Offset, min (2)	Meter of (1)	Meter of (2)	Fuel Weight, lb
410	723.273	206.658	0.17	0.16	0.10	0.10	80	81	0.0
Avg/Total	74.223	69.106	0.17	0.16	0.10	0.10	74.37	76.84	100.66

Wood Heater Temperature Data, °F									
Stack	Drift In H ₂ O	Ambient	Impinger exit (2)	Impinger exit (1)	Filter (2)	Filter (1)	Stack	Average Surface	Clayton Exit
74	-0.018	79	82.00	82.00	76	80	184	274.2	310
75.23	74.23	75.23	75.23	75.23	75.23	75.23	75.23	75.23	75.23

Final Laboratory Report - Method 5G Dual Train Dilution Tunnel Particulate Calculations

Client Name: Monessen

Equipment Numbers: _____

Run #: 2Model: Merrimack / EssexTrain #: AProject No.: 227-S-37-3Date: 06/26/09Tracking No.: 1425

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	B964	120.1	109.3	10.8
B. Rear filter catch	Filter	B966	109.5	108.8	0.7
C. Probe catch	Probe	M	78209.1	78208.9	0.2

Total Particulate, mg :	11.7
-------------------------	------

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

Analyst: L. J. MorganDate: 7-14-09

Final Laboratory Report - Method 5G Dual Train Dilution Tunnel Particulate Calculations

Client Name: Monessen
 Model: Merrimack / Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425

Equipment Numbers: _____

Run #: 2
 Train #: B
 Date: 06/26/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E965	119.9	109.5	10.4
B. Rear filter catch	Filter	E967	109.1	108.1	1.0
C. Probe catch	Probe	N	77898.6	77898.7	-0.1

Total Particulate, mg :	11.3
-------------------------	------

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

Analyst: L. J. Morgan

Date: 7-14-09

STOVE TEMPERATURE TEST DATA - METHOD 5G

Page ___ of ___

Client/Model: Monessen Hearth Systems - Merrimack/Essex Project #: 227-S-37-3 Tracking #: 1425

Date: 6-26-09 Test Crew: K. Morgan Run #: 2

OMNI Equipment ID #: _____

Preburn ☒ Test ☐		Coal Bed:		Data: 0 =		Range: 4.0-5.0		Actual: Coal Bed: 4.1			
Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF)						Not Used Catalyst	
				Ambient	Top	Bottom	Back	Left	Right		Flue
0	12.4		-.075	71	709	247	284	281	284	497	
10	10.5	1.9	-.075	71	785	263	290	319	290	537	
20	8.7	1.8	-.073	71	768	269	309	352	309	498	
30	7.3	1.4	-.070	72	766	271	333	377	333	472	
40	6.2	1.1	-.068	71	733	274	351	396	351	442	
50	5.3	0.9	-.063	72	726	282	385	415	385	436	
60	4.9	0.4	-.058	72	637	296	385	429	378	369	
70	4.6	0.3	-.053	71	550	311	378	437	371	331	
80	4.3	0.3	-.048	72	471	334	371	441	368	316	
88 90	4.1	0.2	-.045	72	449	343	365	442	365	283	
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: K. Morgan Date: 6-26-09

FUEL DATA

Client: Monessen Hearth Systems

Model: Merrimack/Essex

Project #: 227-S-37-3

Tracking #: 1425

Date: 6-26-09

Test Crew: K. Morgan

Run #: 2

OMNI Equipment ID #:

FUEL LOAD PREPARED BY: K. Morgan

FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER -- DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
 Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings	Type
1	8 ft	21.2	2x4
2	8 ft	21.1	2x4
3	8 ft	21.1	2x4

Length of cut pieces: 3806" inches

Pre-Burn Fuel Average Moisture: 20.62%

Time (clock): 07:30 Room Temperature (F): 75 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 x 4 4 x 4

CALCULATED LOAD WEIGHT: ACTUAL LOAD WEIGHT: 20.0 (2 x 4)

FUEL PIECE LENGTH: 17.5" 20.0 (4 x 4)

Total

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS	TYPE
1	21.6	4 x 4
2	22.2	4 x 4
3	20.9	4 x 4
4	21.6	4 x 4
5	21.3	4 x 4
6		
7		
8		
9		
10		

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 21.42%, 21.33%

Time (clock): 07:20

Room Temperature (F): 75

Initials: K

Technician signature: K. Morgan

Date: 6-26-09

Run Notes

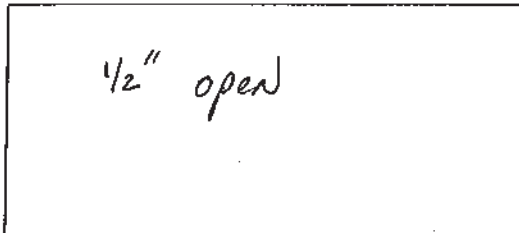
Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Run #: 2 Date: 6-26-09Test Crew: K. Morgan

OMNI Equipment ID #(s): _____

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

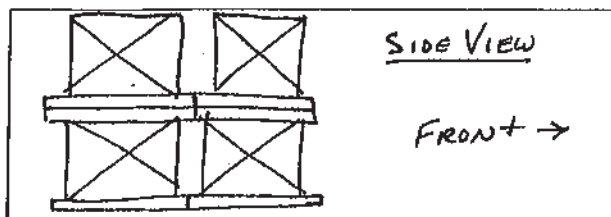
PRIMARY:

SECONDARY: FIXEDTERTIARY: NONEFAN: ON - Low

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	<u>test setting</u>					
44					X	STIR
80					X	LEVELLED

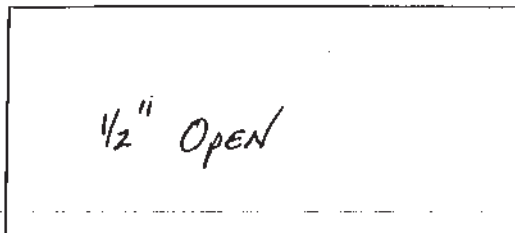
TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)

START UP PROCEDURES

BYPASS: N/AFUEL LOADING By 25 sec.DOOR: Closed at 30 sec.PRIMARY AIR: 1/4 inch open until 5.0 min.
test setting at 5.0 min.OTHER: NONEDESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SECONDARY: FIXEDTERTIARY: NONEFAN: ON - LowTechnician signature: K. MorganDate: 6-26-09

Supplemental Data EPA 5G/5H

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-26-09Run #: 2

Booth: _____

Test Crew: K. MorganStart Time: 10:10Stop Time: 17:20

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack:

Dilution Tunnel (Method 5G Only):

Initial: _____

Final: _____

Initial: _____

Final: _____

Calibrations: Span Gas

CO₂: N/AO₂: N/ACO: N/ACO₂(DT): N/A

	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span
Time							
O ₂							
CO ₂							
CO							
CO ₂ (DT)							

Stack Diameter (inches): 6.0Air Velocity (ft/min): Initial: <50 Final: <50Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0Induced Draft: 0 %Smoke Capture: 100Pitot Tube Leak Test: Pre: 8 @ 3.2" w.c. Post: 8 @ 3.1" w.c.Flue Pipe Cleaned Prior to First Test in Series: Date: 6-23-09 Initials: K

	Initial	Middle	Ending
Pb (in/Hg)	<u>29.26</u>	<u>29.23</u>	<u>29.23</u>
Room Temp (°F)	<u>72</u>	<u>70</u>	<u>79</u>

Technician signature: _____

Date: _____

Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032

Run 3

Wood Heater Test Data - EPA Method 5G

Manufacturer: Monessen
 Model: Merrimack/Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425
 Run: 3
 Test Date: 06/27/09

Burn Rate	0.86 kg/hr dry
Average Tunnel Temperature	95 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	13.6 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8584.2 dscf/hour
Average Delta p	0.039 inches H2O
Average Delta H	0.10 inches H2O
Total Time of Test	480 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	74.88 cubic feet	77.86 cubic feet	71.85 cubic feet
Average Gas Meter Temperature	75 degrees Fahrenheit	74 degrees Fahrenheit	76 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	72.8 dscf	74.8 dscf	70.9 dscf
Total Particulates - mn		14.3 mg	14.9 mg
Particulate Concentration (dry-standard)	0.00020 grams/dscf	0.00019 grams/dscf	0.00021 grams/dscf
Particulate Emission Rate	1.72 grams/hour	1.64 grams/hour	1.80 grams/hour
Adjusted Emissions	2.86 grams/hour	2.75 grams/hour	2.97 grams/hour
Difference from Average		0.11 grams/hour	0.11 grams/hour
7.5% of the average emission rate	0.21		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		
Results Are Acceptable			

Wood Heater Test Data - EPA Method 5G

Signature: *K. H. H. 9-24-19*

Bar: 3 Manufacturer: Mossburn Model: Mossburn/Exerc
 Tracking No.: 1423
 Project No.: 275-S-37-3
 Test Date: 27-Jun-09
 Beginning Clock Time: 10:20
 Recording Interval: 10 min
 Total Sampling Time: 160 min

PM Control Module: 10/20
 Dilution Tunnel MW (dry): 29.00 lbs/mole
 Dilution Tunnel MW (wet): 38.56 lbs/mole
 Dilution Tunnel H₂O: 4.00 percent
 Dilution Tunnel Static: 43.16 "H₂O"
 Fuel Tube Cp: 0.19
 Meter Box Y Factor: 0.993 (1)
 Barometric Pressure: 29.30 "Hg
 Fuel Moisture (dry basis %): 23.95
 Total Particulate (1): 34.3
 Total Particulate (2): 14.9

Turned Velocity: 11.58 ft/sec
 Initial Turned Flow: 135.7 scfm
 Average Turned Flow: 143.1 scfm
 Turned Area: 0.1963 ft²
 Post-Test Leak Check (1): 0.000 "Hg
 Post-Test Leak Check (2): 0.000 "Hg
 Fuel Moisture (dry basis %): 23.95
 Total Particulate (1): 34.3
 Total Particulate (2): 14.9

OMMI Equipment Numbers

Elapsed Time	Particulate Sampling Data										Fuel Weights, lb			Wood Heater Temperature Data, °F										Stack						
	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Orifice dH (1)	Orifice dH (2)	Mean dP (1)	Mean dP (2)	Mean Vac in Hg (1)	Mean Vac in Hg (2)	Dilution Tunnel Temp dP	Pro. Rate (100%) (1)	Pro. Rate (100%) (2)	Scale Reading	Weight Change	Firbox Top	Firbox Bottom	Firbox Back	Firbox Left	Firbox Right	Catalyst Exit	Average Surface	Stack	Fiber (1)	Fiber (2)	Ingrater exit (1)	Ingrater exit (2)	Ambient	Dead In H2O	
0	723.530	200.250	0.17	0.16	0.10	0.10	71	72	0	0	94	0.035	104	102	19.3	-0.4	399	318	338	428	413		383.8	254	72	72			71	-0.040
10	725.160	207.810	0.17	0.16	0.10	0.10	71	72	1	1	96	0.038	104	102	19.3	-0.4	399	318	340	428	407		387.8	274	72	75			71	-0.043
20	726.835	209.330	0.17	0.15	0.10	0.10	71	72	1	1	91	0.038	101	100	19.0	-0.3	334	336	290	395	387		341.6	239	77	76			71	-0.038
30	728.490	210.860	0.17	0.16	0.10	0.10	72	72	1	1	87	0.036	102	101	18.5	-0.3	332	352	254	374	368		327.8	218	77	76			71	-0.035
40	730.140	212.400	0.16	0.16	0.10	0.10	72	73	1	1	87	0.036	101	105	18.5	-0.2	276	309	279	354	351		303.8	204	76	76			71	-0.033
50	731.785	214.035	0.17	0.16	0.10	0.10	72	73	1	1	92	0.038	100	103	17.7	-0.8	311	295	207	333	331		295.4	331	78	76			71	-0.050
60	733.425	215.575	0.16	0.16	0.10	0.10	72	73	1	1	112	0.038	101	104	16.1	-1.6	529	281	204	317	318		329.8	428	83	79			71	-0.060
70	735.065	217.115	0.17	0.16	0.10	0.10	73	74	1	1	123	0.038	103	105	14.4	-1.7	634	268	222	315	321		352.0	506	84	81			71	-0.055
80	736.705	218.770	0.17	0.16	0.10	0.10	73	74	1	1	103	0.038	102	103	13.4	-1	601	259	242	326	333		352.2	460	82	80			71	-0.055
90	738.345	220.295	0.17	0.16	0.10	0.10	73	74	1	1	102	0.038	102	103	12.4	-1	566	248	250	335	342		346.2	363	81	80			71	-0.055
100	740.130	221.860	0.17	0.16	0.10	0.10	73	74	1	1	102	0.038	102	103	11.3	-0.9	578	242	256	338	342		351.8	373	81	79			71	-0.055
110	741.990	223.500	0.17	0.16	0.10	0.10	73	74	1	1	104	0.040	103	105	10.3	-1.2	601	238	264	341	351		359.0	387	81	79			71	-0.055
120	743.800	225.050	0.16	0.16	0.10	0.10	73	74	1	1	104	0.038	98	102	9.3	-1	623	233	274	348	358		367.6	397	81	79			71	-0.055
130	745.240	226.620	0.17	0.16	0.10	0.10	73	74	1	1	106	0.040	103	101	8.7	-1.1	656	250	296	356	367		381.0	405	81	80			71	-0.055
140	746.940	228.220	0.17	0.16	0.10	0.10	73	74	1	1	103	0.038	103	105	7.3	-0.9	635	227	316	364	375		383.4	388	81	79			71	-0.055
150	748.655	229.755	0.17	0.15	0.10	0.10	73	74	1	1	103	0.040	100	99	6.5	-0.8	616	226	344	376	384		389.2	360	81	79			71	-0.055
160	750.310	231.323	0.17	0.16	0.10	0.10	73	75	1	1	101	0.038	103	103	5.8	-0.7	617	224	394	387	393		403.0	375	81	79			71	-0.055
170	752.025	232.900	0.17	0.16	0.10	0.10	73	75	1	1	99	0.038	103	103	5.3	-0.5	579	224	417	394	400		402.8	344	80	79			71	-0.055
180	753.325	234.470	0.17	0.16	0.10	0.10	73	75	1	1	97	0.038	103	103	4.8	-0.5	543	221	459	399	406		400.4	328	80	79			71	-0.050
190	755.420	236.035	0.17	0.16	0.10	0.10	73	75	1	1	96	0.040	100	100	4.4	-0.4	513	225	445	401	409		398.6	316	80	79			72	-0.045
200	757.115	237.605	0.17	0.16	0.10	0.10	74	75	1	1	96	0.038	102	103	4.0	-0.4	499	226	453	401	411		399.0	312	80	78			72	-0.045
210	758.810	239.125	0.17	0.16	0.10	0.10	74	76	1	1	95	0.038	102	102	3.6	-0.4	489	227	464	398	413		398.2	301	80	79			72	-0.045
220	760.510	240.735	0.17	0.16	0.10	0.10	74	76	1	1	94	0.040	100	99	3.4	-0.2	474	227	464	398	413		395.2	294	79	78			71	-0.043
230	762.220	242.320	0.17	0.16	0.10	0.10	74	76	1	1	93	0.040	100	100	3.1	-0.3	453	226	462	395	417		390.0	382	79	78			72	-0.043
240	763.905	243.870	0.17	0.16	0.10	0.10	74	76	1	1	93	0.040	99	98	2.9	-0.2	440	229	458	393	411		386.2	276	79	78			72	-0.040
250	765.610	245.440	0.17	0.16	0.10	0.10	75	76	1	1	92	0.042	97	97	2.7	-0.2	420	230	453	392	409		382.8	270	78	78			71	-0.040
260	767.310	247.010	0.17	0.16	0.10	0.10	75	76	1	1	91	0.040	99	99	2.5	-0.2	419	230	446	390	407		378.4	265	78	77			71	-0.040
270	769.015	248.595	0.17	0.16	0.10	0.10	74	76	1	1	92	0.040	100	100	2.3	-0.2	401	232	432	388	404		372.0	256	78	77			72	-0.040
280	770.710	250.160	0.17	0.16	0.10	0.10	74	76	1	1	89	0.038	101	101	2.1	-0.2	393	233	406	387	401		364.0	260	78	77			72	-0.038
290	772.415	251.723	0.17	0.16	0.10	0.10	74	76	1	1	89	0.038	102	101	1.9	-0.2	379	234	378	395	393		354.4	243	77	76			71	-0.038
300	774.115	253.290	0.17	0.16	0.10	0.10	75	76	1	1	89	0.040	99	99	1.8	-0.1	369	236	362	385	389		348.2	236	77	77			72	-0.035
310	775.815	254.850	0.17	0.16	0.10	0.10	75	76	1	1	87	0.040	99	98	1.7	-0.1	355	238	349	380	389		340.4	230	77	76			71	-0.035
320	777.515	256.410	0.17	0.16	0.10	0.10	75	76	1	1	87	0.040	99	98	1.5	-0.2	344	238	342	374	372		334.0	223	77	76			72	-0.033
330	779.220	257.965	0.17	0.16	0.10	0.10	75	76	1	1	87	0.038	102	101	1.4	-0.1	339	239	339	371	368		331.2	221	77	76			72	-0.033
340	780.925	259.525	0.17	0.16	0.10	0.10	75	76	1	1	86	0.038	102	101	1.2	-0.2	332	239	332	364	360		325.4	217	77	76			72	-0.031
350	782.630	261.080	0.17	0.16	0.10	0.10	75	76	1	1	86	0.040	99	98	1.1	-0.1	324	238	322	358	352		318.8	212	76	76			71	-0.033
360	784.335	262.635	0.17	0.16	0.10	0.10	75	76	1	1	84	0.038	102	101	1.0	-0.1	317	239	310	342	344		312.4	209	78	77			73	-0.030
370	786.035	264.180	0.17	0.15	0.10	0.10	75	76	1	1	81	0.040	99	98	0.9	-0.1	313	241	300	347	339		308.0	207	79	79			73	-0.030
380	787.725	265.725	0.17	0.16	0.10	0.10	76	77	1	1	81	0.040	99	98	0.7	-0.2	298	242	290	342	334		301.2	204	80	80			75	-0.030
390	789.425	267.280	0.17	0.16	0.10	0.10	76	77	1	1	81	0.040	98	98	0.6	-0.1	300	243	284	343	329		288.8	199	81	80			76	-0.028
400	791.115	268.820	0.17	0.15	0.10	0.10	77	78	1	1	92	0.040	98	97	0.5	-0.1	292	243	279	333	325		281.0	196	82	81			76	-0.028
410	792.815	270.370	0.17	0.16	0.10	0.10	77	79	1	1	92	0.040	99	98	0.4	-0.1	284	241	276	328	317		289.2	191	82	82			77	-0.028
420	794.509	271.920	0.17	0.16	0.10	0.10	78	79	1	1	92	0.040	98	98	0.4	0	275	238	273	321	305		283.0	187	82	82			77	-0.025

Wood Heater Test Data - EPA Method 5G

Rev. 3

Manufacturer: Morrison
 Model: Mettler-John
 Tracking No.: 2275-373
 Project No.: 27-For-09
 Test Date: 10/20
 Beginning Clock Time: 10:20
 Recording Interval: 10
 Total Sampling Time: 460
 mm
 mm

Velocity Traverse Data									
Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Pt.9	Pt.10
0.010	0.018	0.018	0.018	0.028	0.038	0.040	0.036	0.036	0.036
Initial Temp	91	94	94	94	94	94	94	94	94

GMH Equipment Numbers:

PM Control Model: 10.20
 Dilution Tunnel MW (dry): 29.60 lb/hr-mole
 Dilution Tunnel MW (wet): 28.50 lb/hr-mole
 Dilution Tunnel H₂O: 4.00 percent
 Dilution Tunnel Static: -0.135 "H₂O
 P-Test Tube Cp: 0.99
 Meter Box Y Factor: 0.992 (1)
 Barometric Pressure: 29.30 29.3 29.32 29.31 "Hg

Signature Date: 11/1/09 9:04:01
 Tunnel Velocity: 12.58 ft/sec
 Initial Tunnel Flow: 135.7 scfm
 Average Tunnel Flow: 133.1 scfm
 Tunnel Area: 0.1883 ft²
 Post-Test Leak Check (1): 0.446 g/Hg
 Post-Test Leak Check (2): 0.446 g/Hg
 Fuel Moisture (dry basis %): 20.93
 Total Particulate (1): 14.3
 Total Particulate (2): 14.9

Particulate Sampling Data									
Elapsed Time	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Outlet dH (1)	Outlet dH (2)	Meter orifice dF (1)	Meter orifice dF (2)	Meter Vac. In. Hg (1)
430	796.210	271.460	0.17	0.15	0.10	0.10	78	80	1
440	797.905	275.005	0.17	0.15	0.10	0.10	78	80	1
450	799.610	276.555	0.17	0.16	0.10	0.10	79	80	1
460	801.313	278.104	0.17	0.15	0.10	0.10	79	80	1
Avg/Total	77.863	27.854	0.17	0.16	0.10	0.10	78.21	75.33	94.96
Fuel Weight, lb									
Scale Reading Change									
Pro Rate (10%) (1)									
Pro Rate (10%) (2)									
Dilution Tunnel dP									
Dilution Tunnel Temp									
Meter Vac. In. Hg (1)									
Meter Vac. In. Hg (2)									
Firebox Top									
Firebox Bottom									
Firebox Back									
Firebox Left									
Firebox Right									
Catalyst Exit									
Average Surface									
Stack									
Filter (1)									
Filter (2)									
Impinger exit (1)									
Impinger exit (2)									
Ambient									
Drain to H ₂ O									

Final Laboratory Report - Method 5G Dual Train Dilution Tunnel Particulate Calculations

Client Name: Monessen
 Model: Merrimack / Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425

Equipment Numbers: _____

Run #: 3
 Train #: A
 Date: 06/27/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E968	122.4	109.2	13.2
B. Rear filter catch	Filter	E970	110.4	109.1	1.3
C. Probe catch	Probe	R	78917.9	78918.1	-0.2

Total Particulate, mg :	14.3
-------------------------	------

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

Analyst: H. J. Morgan

Date: 7-14-09

**Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations**

Client Name: Monessen
Model: Merrimack / Essex
Project No.: 227-S-37-3
Tracking No.: 1425

Equipment Numbers:

Run #: 3
Train #: B
Date: 06/27/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E969	123.3	109.9	13.4
B. Rear filter catch	Filter	E971	110.6	109.3	1.3
C. Probe catch	Probe	S	73572.9	73572.7	0.2

Total Particulate, mg :	14.9
-------------------------	------

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

Analyst: *H. J. Morgan*

Date: 7-14-09

STOVE TEMPERATURE TEST DATA - METHOD 5G

Page of

Client/Model: Monessen Hearth Systems - Merrimack/Essex Project #: 227-S-37-3 Tracking #: 1425

Date: 6-27-09

Test Crew: H. Morgan

Run #: 3

OMNI Equipment ID #:

Preburn [X]		Coal Bed:		0 =		Range: 4.0 - 4.9		Actual:			
Test []		Data:						Coal Bed: 4.5			
Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF)							
				Ambient	Top	Bottom	Back	Left	Right	Flue	
0	12.2		-1.068	70	662	289	260	314	275	445	Not Used
10	10.8	1.3	-1.068	71	680	287	273	343	306	455	
20	9.6	1.2	-1.065	71	700	282	291	364	329	438	
30	8.5	1.1	-1.065	71	692	280	311	383	352	428	
40	7.5	1.0	-1.060	71	655	281	351	402	375	396	
50	6.7	0.8	-1.058	71	624	287	389	415	390	381	
60	6.1	0.6	-1.055	71	622	294	397	423	399	377	
70	5.5	0.6	-1.053	71	561	310	390	429	409	333	
80	4.9	0.6	-1.053	71	532	326	376	432	416	319	
90	4.7	0.2	-1.050	71	491	332	386	434	417	295	
00	4.6	0.1	-1.050	71	445	341	351	432	416	299	
108 10	4.5	0.1	-1.040	71	399	349	338	428	415	254	
108 20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: H. J. Morgan

Date: 6-27-09

FUEL DATA

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3 Tracking #: 1425Date: 6-27-09Test Crew: K. MorganRun #: 3

OMNI Equipment ID #:

FUEL LOAD PREPARED BY: K. MorganFUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER,
DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER -- DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
 Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings		Type
1	<u>8</u> ft	<u>20.6</u>	<u>18.8</u> <u>21.5</u>	<u>2x4</u>
2	<u>8</u> ft	<u>21.5</u>	<u>20.8</u> <u>22.0</u>	<u>2x4</u>
3	<u>8</u> ft	<u>19.5</u>	<u>20.0</u> <u>19.9</u>	<u>2x4</u>

Length of cut pieces: 38 @ 6 inchesPre-Burn Fuel Average Moisture: 20.51%Time (clock): 07:30 Room Temperature (F): 73 Initials: KL

TEST FUEL

FUEL TYPE AND AMOUNT: 2x4 0 4x4 4
 CALCULATED LOAD WEIGHT: _____ ACTUAL LOAD WEIGHT: 0 (2x4)
19.7 (4x4)
19.7 Total
 FUEL PIECE LENGTH: 17.5"

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS			TYPE
1	<u>18.8</u>	<u>22.0</u>	<u>22.0</u>	<u>4x4</u>
2	<u>21.6</u>	<u>21.9</u>	<u>21.9</u>	<u>4x4</u>
3	<u>20.6</u>	<u>19.2</u>	<u>19.3</u>	<u>4x4</u>
4	<u>22.0</u>	<u>19.7</u>	<u>22.4</u>	<u>4x4</u>
5	_____	_____	_____	_____
6	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.95%Time (clock): 07:35 Room Temperature (F): 73 Initials: KLTechnician signature: K. MorganDate: 6-27-09

Run Notes

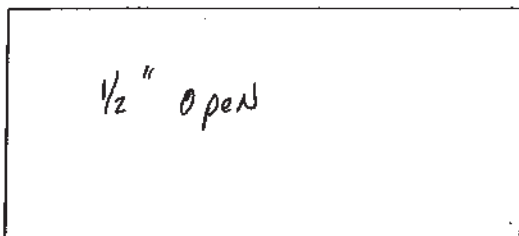
Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Run #: 3Date: 6-27-09Test Crew: K. Morgan

OMNI Equipment ID #(s): _____

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

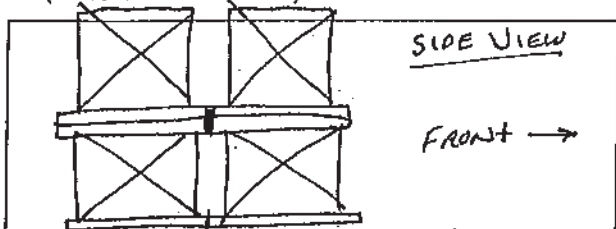
PRIMARY:

SECONDARY: FIXEDTERTIARY: NONEFAN: ON - Low

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	test setting					
71					X	still
99					X	Levalled

TEST

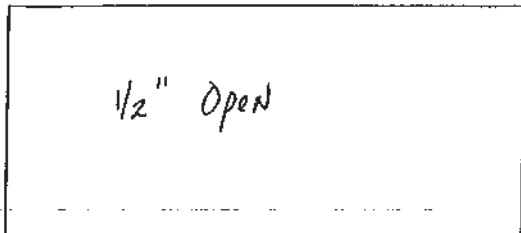
TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)

START UP PROCEDURES

BYPASS: N/A
 FUEL LOADING: By 25 sec.
 DOOR: Closed at 30 sec.
 PRIMARY AIR: Full open (3/4 open)
inst? 5.0 min.
 OTHER: - Bi metallic trap door
Activated at 5.0 min.

DESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SECONDARY: FIXEDTERTIARY: NONEFAN: ON - LowTechnician signature: K. MorganDate: 6-27-09

Supplemental Data EPA 5G/5H

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-27-09 Run #: 3 Booth: _____Test Crew: K. Morgan Start Time: 10:20 Stop Time: 13:00

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack:

Dilution Tunnel (Method 5G Only):

Initial: _____

Initial: _____

Final: N/AFinal: N/ACalibrations: Span Gas CO₂: N/A O₂: _____ CO: _____ CO₂(DT): ✓

	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span
Time							
O ₂							
CO ₂							
CO							
CO ₂ (DT)							

Stack Diameter (inches): 6.0Air Velocity (ft/min): Initial: <50 Final: <50Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0Induced Draft: 0 %Smoke Capture: 100Pitot Tube Leak Test: Pre: 0 @ 3.1" W.C. Post: 0 @ 3.1" W.C.Flue Pipe Cleaned Prior to First Test in Series: Date: 6-23-09 Initials: K

	Initial	Middle	Ending
Pb (in/Hg)	<u>29.30</u>	<u>29.30</u>	<u>29.32</u>
Room Temp (°F)	<u>71</u>	<u>72</u>	<u>78</u>

Technician signature: K. P. Morgan Date: 6-27-09

*Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032*

Run 4

Wood Heater Test Data - EPA Method 5G

Manufacturer: Monessen
 Model: Merrimack/Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425
 Run: 4
 Test Date: 06/28/09

Burn Rate	2.63 kg/hr dry
Average Tunnel Temperature	154 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	16.2 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9270.8 dscf/hour
Average Delta p	0.050 inches H2O
Average Delta H	0.09 inches H2O
Total Time of Test	170 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	24.08 cubic feet	25.11 cubic feet	23.05 cubic feet
Average Gas Meter Temperature	73 degrees Fahrenheit	73 degrees Fahrenheit	74 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	23.5 dscf	24.2 dscf	22.8 dscf
Total Particulates - mn		5.6 mg	4.3 mg
Particulate Concentration (dry-standard)	0.00021 grams/dscf	0.00023 grams/dscf	0.00019 grams/dscf
Particulate Emission Rate	1.94 grams/hour	2.14 grams/hour	1.75 grams/hour
Adjusted Emissions	3.16 grams/hour	3.43 grams/hour	2.89 grams/hour
Difference from Average		0.27 grams/hour	0.27 grams/hour
7.5% of the average emission rate	0.24		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		
Results Are Acceptable			

Wood Heater Test Data - EPA Method 5G

P. J. Morgan

[illegible]

	P.1	P.2	P.3	P.4	P.5	P.6	P.7	P.8
Initial DP	0.040	0.048	0.050	0.032	0.042	0.032	0.050	0.046
Initial Temp	162	161	160	159	159	158	157	156

ON ENI Equipment Numbers:

Recording Interval	min
10	

Parameter	Unit
Total Sampling Time	170 min

100

Particle Size Sampling Data

Elapsed Time	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Outlet dht(1)	Outlet dht(2)	Meter in Hg (1)	Meter in Hg (2)	Dilution Temp	Dilution Temp dht	Pro. Rate (10%) (1)	Pro. Rate (10%) (2)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Coolant Exit	Average Surface	Stack	Filter (1)	Filter (2)	Ingoing rad(1)	Ingoing rad(2)	Ambient	Dust in H2O	
0	801.650	278.350			0.00	0.00	70	70	0	159	0.046		19.9		487	287	371	465	306		441.2	510	71	71			71	-0.073	
10	803.185	279.240	0.15	0.14	0.10	0.10	71	71	1	141	0.050	106	18.1	-1.8	504	299	373	490	429		437.0	586	82	77			71	-0.080	
20	804.690	281.100	0.15	0.14	0.10	0.10	71	72	1	185	0.050	106	15.6	-2.5	772	292	263	487	432		449.2	692	85	78			71	-0.089	
30	806.185	283.410	0.15	0.13	0.10	0.10	72	73	1	192	0.050	105	10.3	-3.6	873	284	253	491	438		457.8	716	87	78			72	-0.088	
40	807.670	284.800	0.15	0.14	0.10	0.10	72	73	1	192	0.052	103	10.2	-3.3	905	277	264	504	448		470.6	705	86	78			72	-0.088	
50	809.125	285.170	0.15	0.14	0.10	0.10	72	74	1	184	0.052	100	10.2	-2.2	876	270	283	526	457		482.4	673	85	77			72	-0.088	
60	810.550	286.510	0.14	0.13	0.10	0.10	73	74	1	162	0.040	99	10.1	-1.8	818	266	303	548	487		484.4	624	84	76			72	-0.085	
70	811.970	287.840	0.14	0.13	0.10	0.10	73	74	1	162	0.050	98	10.0	5.7	-1.4	717	262	311	570	513		478.6	573	81	74			72	-0.083
80	813.390	289.130	0.14	0.13	0.10	0.10	73	74	1	157	0.050	97	99	4.1	-1.2	700	260	315	581	528		476.8	553	80	72			72	-0.078
90	814.800	290.500	0.14	0.13	0.10	0.10	73	75	1	153	0.050	96	98	3.1	-1	671	258	330	583	538		476.2	559	79	72			73	-0.075
100	816.200	291.833	0.15	0.14	0.10	0.10	73	75	1	145	0.050	101	100	2.4	-0.7	640	259	337	580	542		479.6	508	80	71			73	-0.073
110	817.780	292.220	0.15	0.14	0.10	0.10	73	75	1	142	0.050	101	100	1.8	-0.6	587	258	379	571	542		467.8	484	79	72			73	-0.070
120	819.275	294.585	0.15	0.14	0.10	0.10	74	75	1	136	0.050	100	100	1.4	-0.4	561	258	399	563	537		463.6	459	86	81			73	-0.068
130	820.770	295.930	0.15	0.14	0.10	0.10	74	78	1	132	0.050	100	99	1.1	-0.3	520	238	404	550	529		452.2	437	86	83			73	-0.064
140	822.260	297.313	0.15	0.14	0.10	0.10	74	75	1	129	0.050	99	99	0.7	-0.4	493	250	401	538	520		441.6	423	86	83			73	-0.063
150	823.760	298.670	0.15	0.14	0.10	0.10	74	75	1	125	0.050	100	98	0.4	-0.3	458	254	388	519	507		425.8							

Final Laboratory Report - Method 5G Dual Train **Dilution Tunnel Particulate Calculations**

Client Name: <u>Monessen</u>	Equipment Numbers: _____	Run #: <u>4</u>
Model: <u>Merrimack / Essex</u>	_____	Train #: <u>Λ</u>
Project No.: <u>227-S-37-3</u>	_____	Date: <u>06/28/09</u>
Tracking No.: <u>1425</u>	_____	

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E972	112.9	108.7	4.2
B. Rear filter catch	Filter	E974	110.0	109.1	0.9
C. Probe catch	Probe	H	69299.9	69299.4	0.5

Total Particulate, mg :	5.6
-------------------------	-----

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

Analyst: H. J. MorganDate: 7-14-09

**Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations**

Client Name: Monessen
Model: Merrimack / Essex
Project No.: 227-S-37-3
Tracking No.: 1425

Equipment Numbers: _____

Run #: 4
Train #: B
Date: 06/28/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E973	112.5	108.7	3.8
B. Rear filter catch	Filter	E975	109.4	109.4	0.0
C. Probe catch	Probe	1	77918.5	77918.0	0.5

Total Particulate, mg :	4.3
-------------------------	-----

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

Analyst: *H. J. Morgan*

Date: 7-14-09

STOVE TEMPERATURE TEST DATA - METHOD 5G

Page of

Client/Model: Monessen Hearth Systems - Merrimack/Essex Project #: 227-S-37-3 Tracking #: 1425

Date: 6-23-09 Test Crew: K. Morgan Run #: 4

OMNI Equipment ID #:

Preburn [X]		Coal Bed:		Data:		0 =		Range: 4.0 - 4.9		Actual: 4.9	
Test []								TEMPERATURES (oF)		Coal Bed:	
Time	Fuel Weight	Delta Weight	Stack Draft	Ambient	Top	Bottom	Back	Left	Right	Flue	Catalyst
0	20.0		-.095	69	580	159	207	146	131	843	Not Used
10	17.2	2.8	-.080	69	550	194	225	187	163	578	
20	14.5	2.7	-.080	70	611	222	225	239	192	602	
30	13.1	1.4	-.088	70	744	241	240	307	223	694	
40	8.8	4.3	-.088	71	773	245	250	332	242	686	
50	6.4	2.4	-.085	71	790	255	293	384	280	636	
60	4.9	1.5	-.080	71	780	272	378	435	362	596	
66.70	4.9	0	-.075	71	687	287	371	465	396	510	
80											
90											
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: K. Morgan Date: 6-28-09

FUEL DATA

Client: Monessen Hearth SystemsModel: Merimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-28-09Test Crew: K. MorganRun #: 4

OMNI Equipment ID #:

FUEL LOAD PREPARED BY: K. MorganFUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER,
DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER -- DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
 Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings			Type
1	<u>8</u> ft	<u>21.7</u>	<u>22.1</u>	<u>20.3</u>	<u>2x4</u>
2	<u>8</u> ft	<u>21.0</u>	<u>22.4</u>	<u>22.8</u>	<u>2x4</u>
3	<u>8</u> ft	<u>22.1</u>	<u>21.9</u>	<u>20.2</u>	<u>2x4</u>

Length of cut pieces: 3506 inchesPre-Burn Fuel Average Moisture: 21.72%Time (clock): 07:20 Room Temperature (F): 70 Initials: LM

TEST FUEL

FUEL TYPE AND AMOUNT: 2x4 0 4x4 4
 CALCULATED LOAD WEIGHT: ACTUAL LOAD WEIGHT: 0 (2x4)
19.9 (4x4)
 FUEL PIECE LENGTH: 17.5" 19.9 Total

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS			TYPE
1	<u>20.1</u>	<u>19.8</u>	<u>19.5</u>	<u>4x4</u>
2	<u>19.5</u>	<u>21.2</u>	<u>21.2</u>	<u>4x4</u>
3	<u>23.0</u>	<u>22.0</u>	<u>22.7</u>	<u>4x4</u>
4	<u>19.7</u>	<u>22.0</u>	<u>20.9</u>	<u>4x4</u>
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.97%Time (clock): 07:25Room Temperature (F): 70Initials: LMTechnician signature: K. MorganDate: 6-28-09

Run Notes

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Run #: 4 Date: 6-28-09Test Crew: R. Morgan

OMNI Equipment ID #(s): _____

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

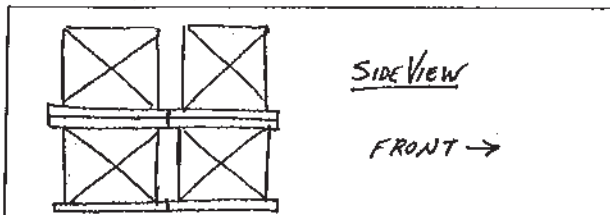
Full open
(open 1/2" less than
original full)

SECONDARY: FixedTERTIARY: NONEFAN: ON - High

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	test setting					
50					X	STIR
66					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)

START UP PROCEDURES

BYPASS: N/A
 FUEL LOADING: Loaded by 18 sec.
 DOOR: Closed at 25 sec.
 PRIMARY AIR: Full open Duration of
Test.

OTHER: NONEDESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SAME AS ABOVE

SECONDARY: FIXEDTERTIARY: NONEFAN: ON - HighTechnician signature: R. MorganDate: 6-28-09

Supplemental Data EPA 5G/5H

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-28-09 Run #: 4 Booth: _____Test Crew: K. Morgan Start Time: 09:12 Stop Time: 12:02

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack:

Dilution Tunnel (Method 5G Only):

Initial: _____

Initial: _____

Final: N/AFinal: N/ACalibrations: Span Gas CO₂: N/A O₂: N/A CO: N/A CO₂(DT): N/A

	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span
Time							
O ₂							
CO ₂							
CO							
CO ₂ (DT)							

Stack Diameter (inches): 6.0Air Velocity (ft/min): Initial: <50 Final: <50Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0Induced Draft: 0 %Smoke Capture: 100Pitot Tube Leak Test: Pre: 0 @ 3.2" W.C. Post: 0 @ 3.2" W.C.Flue Pipe Cleaned Prior to First Test in Series: Date: 6-23-09 Initials: K

	Initial	Middle	Ending
Pb (in/Hg)	<u>29.36</u>	<u>29.36</u>	<u>29.36</u>
Room Temp (°F)	<u>71</u>	<u>73</u>	<u>72</u>

Technician signature: K. Morgan Date: 6-28-09

*Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032*

Run 5

Wood Heater Test Data - EPA Method 5G

Manufacturer: Monessen
 Model: Merrimack/Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425
 Run: 5
 Test Date: 06/29/09

Burn Rate	1.85 kg/hr dry
Average Tunnel Temperature	120 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	15.5 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9246.5 dscf/hour
Average Delta p	0.048 inches H2O
Average Delta H	0.10 inches H2O
Total Time of Test	240 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	37.18 cubic feet	38.48 cubic feet	35.87 cubic feet
Average Gas Meter Temperature	74 degrees Fahrenheit	73 degrees Fahrenheit	74 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	35.9 dscf	36.6 dscf	35.1 dscf
Total Particulates - mn		12.9 mg	12.7 mg
Particulate Concentration (dry-standard)	0.00036 grams/dscf	0.00035 grams/dscf	0.00036 grams/dscf
Particulate Emission Rate	3.30 grams/hour	3.25 grams/hour	3.35 grams/hour
Adjusted Emissions	4.90 grams/hour	4.85 grams/hour	4.98 grams/hour
Difference from Average		0.06 grams/hour	0.06 grams/hour
7.5% of the average emission rate	0.37		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		
Results Are Acceptable			

Final Laboratory Report - Method 5G Dual Train **Dilution Tunnel Particulate Calculations**

Client Name: Monessen
 Model: Merrimack / Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425

Equipment Numbers: _____

Run #: 5
 Train #: A
 Date: 06/29/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E976	121.0	109.3	11.7
B. Rear filter catch	Filter	E978	109.6	109.0	0.6
C. Probe catch	Probe	C	85528.5	85527.9	0.6

Total Particulate, mg :	12.9
-------------------------	------

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

Analyst: H. J. Morgan

Date: 7-14-09

Final Laboratory Report - Method 5G Dual Train Dilution Tunnel Particulate Calculations

Client Name: Monessen
 Model: Merrimack / Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425

Equipment Numbers: _____

Run #: 5
 Train #: B
 Date: 06/29/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E977	121.1	109.6	11.5
B. Rear filter catch	Filter	E979	109.4	108.6	0.8
C. Probe catch	Probe	D	82871.4	82871.0	0.4

Total Particulate, mg :	12.7
-------------------------	------

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

Analyst: *H. J. Morgan*

Date: 7-14-09

Page ___ of ___

Date: 6-29-07 Test Crew: K. Morgan

OMNI Equipment ID #:

Technician signature: *[Signature]* Date: 6-29-09

FUEL DATA

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-29-09Test Crew: K. MorganRun #: 5

OMNI Equipment ID #:

FUEL LOAD PREPARED BY: K. MorganFUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER,
DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER -- DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
 Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings			Type
1	<u>8</u> ft	<u>20.14</u>	<u>22.0</u>	<u>23.8</u>	<u>2 x 4</u>
2	<u>8</u> ft	<u>25.2</u>	<u>23.1</u>	<u>23.3</u>	<u>2 x 4</u>
3	<u>8</u> ft	<u>21.4</u>	<u>23.8</u>	<u>22.5</u>	<u>2 x 4</u>

Length of cut pieces: 36 @ 6" inchesPre-Burn Fuel Average Moisture: 22.83%Time (clock): 08:15 Room Temperature (F): 70 Initials: /K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 x 4 8 4 x 4 4
 CALCULATED LOAD WEIGHT: _____ ACTUAL LOAD WEIGHT: 8 (2 x 4)
19.7 (4 x 4)
 FUEL PIECE LENGTH: 17.5" 19.7 Total

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS			TYPE
1	<u>19.7</u>	<u>21.4</u>	<u>23.0</u>	<u>4 x 4</u>
2	<u>20.2</u>	<u>24.2</u>	<u>21.4</u>	<u>4 x 4</u>
3	<u>20.3</u>	<u>19.7</u>	<u>21.7</u>	<u>4 x 4</u>
4	<u>19.4</u>	<u>20.1</u>	<u>20.3</u>	<u>4 x 4</u>
5	_____	_____	_____	_____
6	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.97%Time (clock): 08:00Room Temperature (F): 70Initials: /KTechnician signature: K. MorganDate: 6-29-09

Run Notes

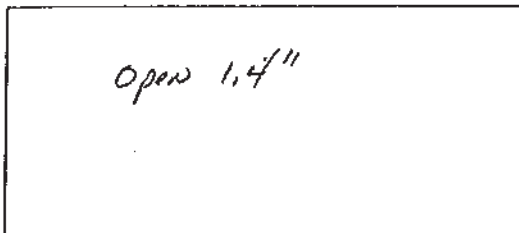
Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Run #: 5 Date: 6-29-09Test Crew: K. Morgan

OMNI Equipment ID #(s): _____

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMETER SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

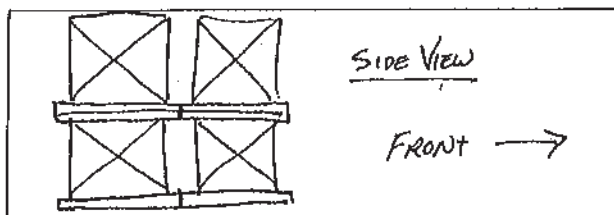
PRIMARY:

SECONDARY: FIXEDTERTIARY: NONEFAN: ON-High

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	test setting					
75					X	Levelled

TEST

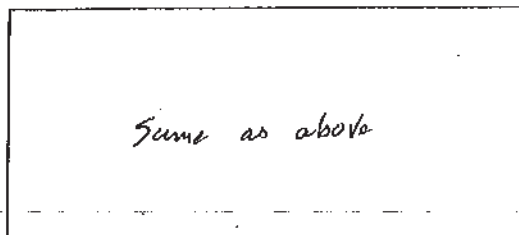
TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)

START UP PROCEDURES

BYPASS: N/A
 FUEL LOADING: Loaded by 20 sec
 DOOR: Closed at 30 sec
 PRIMARY AIR: Fully open until 30 min

OTHER: NONEDESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SECONDARY: FixedTERTIARY: NONEFAN: ON-HighTechnician signature: K. MorganDate: 6-29-09

Supplemental Data EPA 5G/5H

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-29-09Run #: 5

Booth: _____

Test Crew: K. MorganStart Time: 10:01Stop Time: 14:01

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack:

Dilution Tunnel (Method 5G Only):

Initial: _____

Initial: _____

Final: N/AFinal: N/ACalibrations: Span Gas CO₂: N/A O₂: N/A CO: N/A CO₂(DT): N/A

	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span
Time							
O ₂							
CO ₂							
CO							
CO ₂ (DT)							

Stack Diameter (inches): 6.0Air Velocity (ft/min): Initial: <50 Final: <50Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0Induced Draft: 0 %Smoke Capture: 100Pitot Tube Leak Test: Pre: 0 @ 3.2" w.c. Post: 0 @ 3.0" w.c.Flue Pipe Cleaned Prior to First Test in Series: Date: 6-23-09 Initials: K

	Initial	Middle	Ending
Pb (in/Hg)	<u>28.98</u>	<u>29.00</u>	<u>29.00</u>
Room Temp (°F)	<u>71</u>	<u>71</u>	<u>75</u>

Technician signature: K. MorganDate: 6-29-09

*Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032*

Run 6

Wood Heater Test Data - EPA Method 5G

Manufacturer: Monessen
 Model: Merrimack/Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425
 Run: 6
 Test Date: 06/30/09

Burn Rate	1.65 kg/hr dry
Average Tunnel Temperature	115 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	15.4 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9329.7 dscf/hour
Average Delta p	0.048 inches H2O
Average Delta H	0.10 inches H2O
Total Time of Test	270 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	41.63 cubic feet	42.29 cubic feet	40.96 cubic feet
Average Gas Meter Temperature	75 degrees Fahrenheit	74 degrees Fahrenheit	75 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	40.4 dscf	40.5 dscf	40.3 dscf
Total Particulates - mm		5.9 mg	6.4 mg
Particulate Concentration (dry-standard)	0.00015 grams/dscf	0.00015 grams/dscf	0.00016 grams/dscf
Particulate Emission Rate	1.42 grams/hour	1.36 grams/hour	1.48 grams/hour
Adjusted Emissions	2.44 grams/hour	2.35 grams/hour	2.52 grams/hour
Difference from Average		0.09 grams/hour	0.09 grams/hour
7.5% of the average emission rate	0.18		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		
Results Are Acceptable			

Manufacturer:	Mountain
Model:	MiniMarkT200
Tracking No.:	1425
Project No.:	222-537-3
Test Date:	30-Jun-09
Beginning Clock Time:	09:33
Recording Interval:	10 min
Total Sampling Time:	270 min

Wood Heater Test Data - EPA Method 5G

Velocity Traverse Data									
	Pt. 1	Pt. 2	Pt. 3	Pt. 4	Pt. 5	Pt. 6	Pt. 7	Pt. 8	
Inlet dP	0.012	0.014	0.018	0.018	0.040	0.018	0.048	0.044	
Static Temp	131	131	130	129	129	129	129	128	

CASE# Equipment Number.

Total Sampling Time:	270	min
----------------------	-----	-----

PM Control Module	10.20
Dilation Tunnel MW (dry)	27.00 30th-mile
Dilation Tunnel MW (wet)	38.56 30th-mile
Dilation Tunnel H2O	1.00 percent
Dilation Tunnel Static	-0.160 H2O
Pilot Tube Cp	0.99
Master Box V Factor	0.992 (1)
Barometric Pressure	Begin Middle
	29.19 29.19

Signature: _____ Date: _____

Tunnel Velocity	15.36	ft/sec
Initial Tunnel Flow	147.2	scfm
Average Tunnel Flow	135.5	scfm
Tunnel Area	0.1943	ft ²
Pre-Test Leak Check (1)	0	cfm @ 14g
4-T-Test Leak Check (2)	0	cfm @ 14g
Fuel Mixture (dry basis %)	20.95	
Total Particulate (1)	3.9	%H ₂
Total Particulate (2)	6.4	

Elapsed Time	Particulate Sampling Data										Fuel Weight, lb				Wood Heater Temperature Data, °F										Stack						
	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Outflow dH(1)	Outflow dH(2)	Moist off (1)	Moist off (2)	Moist Vse In Hg (1)	Moist Vse In Hg (2)	Dilution Tunnel Temp	Dilution Tunnel dP	Pro Rate (10%) (1)	Pro Rate (10%) (2)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyt Exit	Average Surface	Stack		Flare (1)	Flare (2)	Impinger exit(1)	Impinger exit(2)	Ambient	Stack HXO
0	863.660	337.550			0.00	0.00	72	72	0	0	129	0.044			19.8		445	268	332	459	433	374.0	337	75	76					72	-0.653
10	867.310	339.125	0.17	0.16	0.10	0.10	72	72	1	1	107	0.048	106	104	19.2	-0.6	379	272	331	455	433	384.0	303	78	75					72	-0.648
20	868.925	340.660	0.16	0.15	0.10	0.10	72	73	1	1	124	0.046	107	103	17.7	-1.5	430	265	242	430	411	365.6	459	80	78					72	-0.663
30	870.525	342.180	0.16	0.15	0.10	0.10	72	73	1	1	135	0.048	105	103	15.7	-2	639	255	228	413	392	344.6	531	83	83					72	-0.073
40	872.100	343.680	0.16	0.15	0.10	0.10	73	74	1	1	136	0.046	105	104	13.8	-1.9	681	245	224	413	387	399.8	529	88	81					72	-0.073
50	873.675	345.195	0.16	0.15	0.10	0.10	73	74	1	1	135	0.048	103	102	12.2	-1.2	686	217	244	434	389	396.0	516	84	81					72	-0.073
60	875.250	346.710	0.16	0.15	0.10	0.10	74	75	1	1	133	0.048	103	102	10.5	-1.7	686	218	240	441	388	388.8	504	84	83					72	-0.070
70	876.810	348.255	0.16	0.15	0.10	0.10	74	75	1	1	133	0.048	103	104	9.1	-1.4	693	223	252	452	405	405.9	502	84	82					72	-0.073
80	878.405	349.785	0.16	0.15	0.10	0.10	74	75	1	1	131	0.048	102	103	7.7	-1.4	681	218	266	464	417	469.2	488	84	82					72	-0.070
90	879.980	351.320	0.16	0.15	0.10	0.10	74	76	1	1	129	0.048	102	103	6.5	-1.2	652	214	280	473	430	459.8	478	84	81					72	-0.070
100	881.560	352.840	0.16	0.15	0.10	0.10	74	76	1	1	125	0.048	102	101	5.6	-0.9	630	210	269	432	444	403.9	459	83	81					73	-0.068
110	883.110	354.365	0.16	0.15	0.10	0.10	74	76	1	1	122	0.048	102	101	4.7	-0.9	604	208	310	466	451	411.4	441	82	80					72	-0.063
120	884.700	355.885	0.16	0.15	0.10	0.10	75	76	1	1	118	0.048	101	101	4.0	-0.7	569	208	314	489	461	408.2	445	81	80					72	-0.063
130	886.270	357.405	0.16	0.15	0.10	0.10	75	76	1	1	114	0.048	100	100	3.1	-0.5	517	206	345	488	462	404.6	389	81	79					72	-0.060
140	887.825	358.915	0.16	0.15	0.10	0.10	75	76	1	1	114	0.048	100	100	3.1	-0.4	497	206	372	484	466	406.0	379	80	78					72	-0.058
150	889.375	360.420	0.15	0.15	0.10	0.10	75	76	1	1	112	0.048	99	99	2.7	-0.4	482	206	414	480	465	409.4	374	80	78					72	-0.058
160	890.920	361.925	0.15	0.15	0.10	0.10	75	76	1	1	110	0.048	99	99	2.4	-0.3	467	207	437	474	461	409.2	362	79	77					72	-0.055
170	892.465	363.430	0.15	0.15	0.10	0.10	75	76	1	1	107	0.048	98	99	2.1	-0.3	441	207	442	456	452	380.6	347	79	77					72	-0.053
180	894.010	364.940	0.15	0.15	0.10	0.10	75	76	1	1	105	0.048	98	99	1.8	-0.3	421	208	422	437	440	391.6	339	78	76					72	-0.053
190	895.560	366.455	0.15	0.15	0.10	0.10	75	76	1	1	106	0.048	99	99	1.6	-0.2	406	208	401	448	444	381.4	327	80	79					73	-0.050
200	897.105	367.955	0.15	0.15	0.10	0.10	75	76	1	1	102	0.048	98	98	1.3	-0.3	388	208	384	438	437	371.6	316	80	79					72	-0.048
210	898.650	369.460	0.15	0.15	0.10	0.10	75	76	1	1	100	0.048	98	98	1.1	-0.2	371	207	364	422	428	358.4	306	80	79					72	-0.048
220	900.200	370.970	0.16	0.15	0.10	0.10	75	76	1	1	101	0.048	98	99	0.9	-0.2	360	206	354	411	420	330.2	299	80	79					72	-0.045
230	901.750	372.490	0.15	0.15	0.10	0.10	75	76	1	1	98	0.048	98	99	0.7	-0.2	331	204	346	401	412	342.8	292	80	79					72	-0.045
240	903.295	373.985	0.15	0.15	0.10	0.10	75	76	1	1	97	0.048	97	97	0.5	-0.2	342	202	334	385	403	333.8	288	79	79					72	-0.045
250	904.845	375.490	0.16	0.15	0.10	0.10	73	76	1	1	98	0.048	98	98	0.3	-0.2	337	201	325	379	396	327.6	284	79	78					72	-0.045
260	906.395	376.990	0.15	0.15	0.10	0.10	75	76	1	1	98	0.048	98	97	0.1	-0.2	328	199	315	369	388	319.8	278	79	78					72	-0.043
270	907.941	378.510	0.15	0.15	0.10	0.10	75	76	1	1	98	0.048	98	99	0.0	-0.1	323	197	303	359	380	312.8	277	79	78					72	-0.043
777968	42.291	40.960	0.16	0.15	0.10	0.10	74.21	75.25			114.91	0.048	100.38	100.56								75			79.00					72	-0.048

Final Laboratory Report - Method 5G Dual Train Dilution Tunnel Particulate Calculations

Client Name: Monessen
 Model: Merrimack / Essex
 Project No.: 227-S-37-3
 Tracking No.: 1425

Equipment Numbers: _____

Run #: 6
 Train #: A
 Date: 06/30/09

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E980	115.6	109.5	6.1
B. Rear filter catch	Filter	E982	109.2	108.9	0.3
C. Probe catch	Probe	E	82977.7	82978.2	-0.5

Total Particulate, mg :	5.9
-------------------------	-----

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

Analyst: *L. J. Morgan*

Date: 7-14-09

**Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations**

Client Name: Monessen
Model: Merrimack / Essex
Project No.: 227-S-37-3
Tracking No.: 1425

Equipment Numbers: _____

Run #: 6
Train #: B
Date: 06/30/09

Sample Component	Reagent	Filter # or Probe #.	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E981	116.0	109.3	6.7
B. Rear filter catch	Filter	E983	109.6	109.2	0.4
C. Probe catch	Probe	F	78331.5	78332.2	-0.7

Total Particulate, mg :	6.4
-------------------------	-----

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

Analyst: 1h f. Morgan

Date: 7-14-09

STOVE TEMPERATURE TEST DATA - METHOD 5G

Page of

Client/Model: Monessen Hearth Systems - Merrimack/Essex Project #: 227-S-37-3 Tracking #: 1425

Date: 6-30-07 Test Crew: K. Morgan Run #: 6

OMNI Equipment ID #:

Preburn ☒		Coal Bed:		Data:		0 =		Range: 4.0 - 4.9		Actual: 4.6	
Test ☐										Coal Bed:	
								TEMPERATURES (of)			
Time	Fuel Weight	Delta Weight	Stack Draft	Ambient	Top	Bottom	Back	Left	Right	Flue	Catalyst
0	17.0		-.090	71	651	166	185	168	167	760	Not Used
10	14.8	2.2	-.078	71	642	198	188	221	214	536	
20	12.7	2.1	-.078	71	642	221	187	264	252	549	
30	10.7	2.0	-.075	71	696	227	191	299	287	544	
40	8.7	2.0	-.078	71	759	224	205	334	321	578	
50	7.1	1.6	-.075	72	739	224	227	370	352	533	
60	5.8	1.3	-.073	72	688	228	255	405	383	492	
70	4.9	0.9	-.065	72	605	249	337	435	410	434	
80	4.7	0.2	-.058	72	506	263	342	456	426	364	
85-90	4.6	0.1	-.053	72	445	268	332	459	433	337	
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Adjusted at 7 min.
levelled @ 83
stair @ 67

Technician signature: K. Morgan Date: 6-30-07

FUEL DATA

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-30-09Test Crew: K. MorganRun #: 6

OMNI Equipment ID #: _____

FUEL LOAD PREPARED BY: K. MorganFUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER,
DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER -- DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
 Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings			Type
1	<u>8</u> ft	<u>20.4</u>	<u>20.0</u>	<u>22.1</u>	<u>2x4</u>
2	<u>8</u> ft	<u>19.1</u>	<u>19.9</u>	<u>22.4</u>	<u>2x4</u>
3	<u>8</u> ft	<u>19.4</u>	<u>21.9</u>	<u>20.2</u>	<u>2x4</u>

Length of cut pieces: 36@6 inchesPre-Burn Fuel Average Moisture: 20.60%Time (clock): 07:20 Room Temperature (F): 70 Initials: /K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 x 4 2 4 x 4 4
 CALCULATED LOAD WEIGHT: _____ ACTUAL LOAD WEIGHT: 0 (2 x 4)
19.8 (4 x 4)
 FUEL PIECE LENGTH: 17.5" 19.8 Total

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS			TYPE
1	<u>21.7</u>	<u>20.4</u>	<u>21.9</u>	<u>4x4</u>
2	<u>21.9</u>	<u>21.7</u>	<u>21.6</u>	<u>4x4</u>
3	<u>20.2</u>	<u>21.0</u>	<u>20.4</u>	<u>4x4</u>
4	<u>18.7</u>	<u>20.5</u>	<u>21.4</u>	<u>4x4</u>
5	_____	_____	_____	_____
6	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.95%Time (clock): 07:15 Room Temperature (F): 70 Initials: /KTechnician signature: K. MorganDate: 6-30-09

Run Notes

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Run #: 6 Date: 6-30-09Test Crew: K. Morgan

OMNI Equipment ID #(s): _____

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

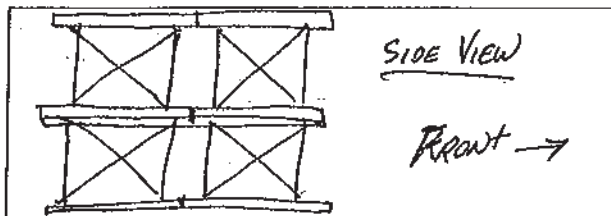
Open 1.125" / 1.250"

SECONDARY: FixedTERTIARY: NONEFAN: ON - High

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0 67	test setting				X	STIR

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)

START UP PROCEDURES

BYPASS: N/A
 FUEL LOADING: Loaded by 20 sec.
 DOOR: Closed at 25 sec.
 PRIMARY AIR: At test setting Duration of Run.
 OTHER: NONE

DESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SAME AS ABOVE

SECONDARY: FixedTERTIARY: NONEFAN: ON - HighTechnician signature: K. MorganDate: 6-30-09

Supplemental Data EPA 5G/5H

Client: Monessen Hearth SystemsModel: Merrimack/EssexProject #: 227-S-37-3Tracking #: 1425Date: 6-30-09 Run #: 6 Booth: _____Test Crew: H. Morgan Start Time: 09:37 Stop Time: 14:07

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack:

Dilution Tunnel (Method 5G Only):

Initial: N/AInitial: N/AFinal: N/AFinal: N/ACalibrations: Span Gas CO₂: N/A O₂: N/A CO: N/A CO₂(DT): N/A

	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span	N ₂ Span
Time							
O ₂			N/A				
CO ₂							
CO							
CO ₂ (DT)							

Stack Diameter (inches): 6.0Air Velocity (ft/min): Initial: <50 Final: <50Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0Induced Draft: 0 %Smoke Capture: 100Pitot Tube Leak Test: Pre: 0 @ 3.1" W.C. Post: 0 @ 3.0" W.C.Flue Pipe Cleaned Prior to First Test in Series: Date: 6-23-09 Initials: KL

	Initial	Middle	Ending
Pb (in/Hg)	<u>29.19</u>	<u>29.19</u>	<u>29.18</u>
Room Temp (°F)	<u>72</u>	<u>72</u>	<u>72</u>

Technician signature: H. Morgan Date: 6-30-09

*Model: Merrimack/Essex
Monessen Hearth Systems
P.O. Box 501
Bethel, VT 05032*

Section 5

Sampling Procedures and Test Results

INTRODUCTION

Monessen Hearth Systems retained *OMNI* to perform U.S. Environmental Protection Agency (EPA) certification testing on the Merrimack/Essex wood stove. The Merrimack/Essex wood stove is a non-catalytic, insert, radiant-type room heater. The firebox is constructed of cast iron. Usable firebox volume was measured to be 3.1 cubic feet and the stove is vented through a 6-inch diameter flue collar located at the top of the unit.

Testing was performed at Monessen Hearth Systems' facility in Bethel, Vermont. The unit was observed to be in good condition and assigned and labeled with *OMNI* ID #1425. *OMNI* representative Ken Morgan witnessed the certification testing and completed all testing by June 30, 2009. The EPA was notified of the testing dates in a letter dated June 26, 2009. A testing contract, including provisions for Random Compliance Audit (RCA) testing, has been signed by Mark Champion of Monessen Hearth Systems and is on file at *OMNI*'s testing facility.

The Merrimack/Essex wood stove was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standard of Performance for Residential Wood Heaters (Appendix A, Methods 28 and 5G). Particulate emissions were measured using a Method 5G sampling train consisting of two filters (front and back). The weighted average emissions of the five test runs included in the results indicate a particulate emission level of 3.6 grams per hour. Run #2 was exempted from the weighted average emissions results on a two-for-one basis. Test runs were conducted in each of three burn rate categories (0.80-1.25 kg/hr, 1.25-1.90 kg/hr, and maximum). Emissions for each of their individual test runs did not exceed the cap. The Merrimack/Essex results are within the emission limit of 7.5 grams per hour for non-catalytic affected facilities manufactured on or after July 1, 1990, or sold at retail on or after July 1, 1992.

The wood heater was sealed after completion of testing in compliance with the EPA regulation as follows:

- “DO NOT TAMPER” labels were placed on the door and on all other openings.
- Plastic material sealed with “DO NOT TAMPER” labels and tape was wrapped around the unit.
- The unit was sealed in a wood box constructed for the unit and secured with steel banding.
- “DO NOT TAMPER” labels were placed on all outer surfaces of the box.

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

Table 1.1 – Particulate Emissions

Run	Burn Rate (kg/hr dry)	Method 5G Emissions (g/hr)
1	0.89	6.39
3	0.96	2.86
4	2.63	3.16
5	1.85	4.90
6	1.65	2.44
Weighted particulate emission average of five test runs: 3.6 grams per hour.		

Table 1.2 – Test Facility Conditions

Run	Room Temperature (°F)		Barometric Pressure (Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	74	81	29.35	29.29	<50	<50
3	71	78	29.30	29.32	<50	<50
4	71	72	29.36	29.36	<50	<50
5	71	75	28.98	29.00	<50	<50
6	72	72	29.19	29.18	<50	<50

Table 1.3.1 – Fuel Measurement and Crib Description Summary – PRETEST

Run	Pretest Fuel Weight (Starting weight in lbs)	Pretest Moisture (Dry basis - %)	Coal Bed Weight (lbs)
1	10.4	21.2	4.1
3	12.2	20.5	4.5
4	20.0	21.7	4.9
5	16.0	22.8	4.1
6	17.0	20.6	4.6

Table 1.3.2 – Fuel Measurement and Crib Description Summary – TEST

Run	Test Fuel Wet Basis (lbs)	Firebox Volume (ft ³)	Fuel Loading Density Wet Basis (lbs/ft ³)	Fuel Moisture Content Dry (%)	Piece Length (in)	2x4s Used	4x4s Used
1	19.8	3.1	6.39	21.5	17.5	0	4
3	19.7	3.1	6.35	21.0	17.5	0	4
4	19.9	3.1	6.42	21.0	17.5	0	4
5	19.7	3.1	6.35	21.0	17.5	0	4
6	19.8	3.1	6.39	21.0	17.5	0	4

Table 1.4 – Dilution Tunnel Gas Measurements and Sampling Data Summary

Run	Length of Test (min)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
1	500	14.06	147.2	97.8
3	460	13.58	143.1	95.0
4	170	16.20	154.5	153.9
5	240	15.45	154.1	119.8
6	270	15.36	155.5	114.9

Table 1.5 - Heater Operation Data (Average Temperature Data)

Run	Beginning Surface Temperature Average ^a	Ending Surface Temperature Average ^a	Surface Delta T ^b
1	372.6	261.8	111
3	385.8	267.4	118
4	441.2	398.8	42
5	407.0	346.2	61
6	387.4	312.8	75
a. All temperatures are in degrees F.			
b. Represents the difference between beginning and ending average surface temperatures.			

Table 1.6 – Pretest Configuration

Run	Combustion Air (in)	Fuel Added	Fuel Removed	Time (min)
1	Fully Closed	10.4 lbs at start; no addition; coal bed 4.1 lbs	0.0	82
3	Open 0.5"	12.2 lbs at start; no addition; coal bed 4.5 lbs	0.0	108
4	Fully Open	20.0 lbs at start; no addition; coal bed 4.9 lbs	0.0	66
5	Open 1.4"	16.0 lbs at start; no addition; coal bed 4.1 lbs	0.0	75
6	Open 1.250"	17.0 lbs at start; no addition; coal bed 4.6 lbs	0.0	85

Table 1.7 – Run Data

Run	Average Dry Burn Rate (kg/hr)	Initial (Induced) Draft (H ₂ O)	Primary Air Setting (in)	Run Time (min)	Average Draft (H ₂ O)
1	0.89	0	Fully Closed	500	-0.037
3	0.96	0	Open 0.5"	460	-0.040
4	2.63	0	Fully Open	170	-0.075
5	1.85	0	Open 1.4"	240	-0.059
6	1.65	0	Open 1.250"	270	-0.058

Table 1.8 – Test Configurations

Run	Five-Minute Startup	Combustion Air
1	<u>Bypass:</u> N/A. <u>Fuel Loading:</u> Loaded by 20 seconds. <u>Door:</u> Closed at 27 seconds. <u>Primary Air:</u> ¾ open until 5.0 minutes. <u>Other:</u> Auto set-back actuated. <u>Secondary:</u> Fixed. <u>Tertiary:</u> None. <u>Fan:</u> On low for duration of test.	Fully Closed
3	<u>Bypass:</u> N/A. <u>Fuel Loading:</u> Loaded by 25 seconds. <u>Door:</u> Closed at 30 seconds. <u>Primary Air:</u> Fully open (¾ open) until 5.0 minutes. <u>Other:</u> Bi-metallic trap door actuated at 5.0 minutes. <u>Secondary:</u> Fixed. <u>Tertiary:</u> None. <u>Fan:</u> On low for duration of test.	Open 0.5"
4	<u>Bypass:</u> N/A. <u>Fuel Loading:</u> Loaded by 18 seconds. <u>Door:</u> Closed at 25 seconds. <u>Primary Air:</u> Fully open for duration of test. <u>Other:</u> None. <u>Secondary:</u> Fixed. <u>Tertiary:</u> None. <u>Fan:</u> On high for duration of test.	Fully Open
5	<u>Bypass:</u> N/A. <u>Fuel Loading:</u> Loaded by 20 seconds. <u>Door:</u> Closed at 30 seconds. <u>Primary Air:</u> Fully open until 4.8 minutes. <u>Other:</u> None. <u>Secondary:</u> Fixed. <u>Tertiary:</u> None. <u>Fan:</u> On high for duration of test.	Open 1.4"
6	<u>Bypass:</u> N/A. <u>Fuel Loading:</u> Loaded by 20 seconds. <u>Door:</u> Closed at 25 seconds. <u>Primary Air:</u> At test setting for duration of test. <u>Other:</u> None. <u>Secondary:</u> Fixed. <u>Tertiary:</u> None. <u>Fan:</u> On high for duration of test.	Open 1.250"

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TEST RESULTS AND DISCUSSION

A total of six test runs were performed on the Merrimack/Essex wood stove. Five test runs were conducted in the following categories and included in the weighted average emission level results: two in the 0.80 to 1.25 kg/hr dry category; two in the 1.25 to 1.90 kg/hr dry category; and one at maximum. Run #2 was omitted due to three runs being conducted in Category II. Only 2/3 of the data was used.

The weighted particulate emission level was measured to be **3.6 g/hr**.

The proportionality results for all five test runs were acceptable. Quality check results for each test run are presented in Section 2 of this report.