Alternate Heating Systems

Project # 24-350
Model: SE110
Type: Wood-Fired Hydronic Heater
April 2, 2025

ASTM E2618-13, Measurement of Particulate Emissions and Heating Efficiency of Solid Fuel-Fired Hydronic Heating Appliances

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Revision Summary

Date: April 2, 2025– Original Issue

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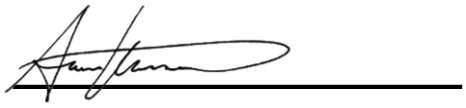
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Affidavit

PFS-TECO was contracted by Alternate Heating Systems to provide testing services for the SE110 Wood-Fired Hydronic Heater per ASTM E2618-13 and 40 CFR Part 60 Subpart QQQQ. All testing and associated procedures were conducted at PFS-TECO's Portland Laboratory beginning on 1/8/2025 and ending on 1/10/2025. PFS-TECO's Portland Laboratory is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed ASTM E2618, *Standard Test Method for Measurement of Particulate Emissions and Heating Efficiency of Solid Fuel-Fired Hydronic Heating Appliances*. Particulate sampling was performed per ASTM E2515, *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel*.

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

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



Aaron Kravitz, Laboratory Manager

Introduction

Alternate Heating contracted with PFS-TECO to perform EPA certification testing on the SE110 Wood-Fired Hydronic Heater. All testing was performed at PFS-TECO's Portland Laboratory. All testing was performed by Aaron Kravitz.

Notes

- Prior to start of testing, 50 hours of conditioning was performed by the manufacturer at a medium burn setting in accordance with ASTM E2780.
- Prior to start of testing, the dilution tunnel was cleaned with a steel brush.
- A separate, independent, third filter train was utilized to determine 1st hour emissions for all test runs.
- A total of 4 test runs were completed - one test run in each of the 4 specified burn rate categories. All runs have been found to be appropriate, no anomalies occurred. See the Run Narrative section for further detail on each run.

Wood Heater Identification and Testing

- Appliance Tested: ***SE110***
- Serial Number: ***PFS Tracking Number 217***
- Manufacturer: ***Alternate Heating Systems***
- Catalyst: ***No***
- Heat exchange blower: ***Integral***
- Type: ***Wood-Fired Hydronic Heater***
- Style: ***Indoor***
- Date Received: ***Friday, January 03, 2025***
- Testing Period – Start: ***Wednesday, January 08, 2025***
  Finish: ***Friday, January 10, 2025***
- Test Location: ***PFS TECO***
  11785 SE Hwy 212
  Clackamas, OR 97015
- Elevation: ***~131 Feet above sea level***
- Test Technician(s): ***Aaron Kravitz***
- Observers: ***None***

Test Procedures and Equipment

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

Equipment List:

Equipment ID#	Equipment Description
50	Digiweigh DWP12i Platform Scale
129	APEX XC-60-ED Digital Emissions Sampling Box A
130	APEX XC-60-ED Digital Emissions Sampling Box B
204	APEX XC-50-DIR Digital Emissions Sampling Box C
55	Apex Ambient Air Sample Box
137	California Analytical ZRE CO2/CO/O2 IR ANALYZER
94	Moisture meter calibration block
95	Anemometer
97	10 lb audit weight
107	Sartorius Analytical Balance
109A/B	Troemner 100mg/200mg Audit Weights
111	Microtector
221	Microtector Micrometer
115	Delmhorst Wood Moisture Meter
199	Mettler 10,000lb floor scale w/digital weight indicator
209	Tape Measure
216	Temperature Logger
184	Water Flow Meter
DT0042934	Gas Analyzer Calibration Span Gas
CC341544	Gas Analyzer Calibration Mid Gas

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

Results

A total of 4 test runs were performed on the SE110. The weighted average year round us emissions rate for the 4 run test series was measured to be **0.08 lb/MBTU heat output** with a delivered efficiency of **67%.** The maximum emissions rate for any one burn was **0.084 lb/MBTU heat output**. The average stack loss efficiency for the 4 tests was **79%**. The SE110 Residential Hydronic Heater meets the cord wood alternative compliance option for particulate matter emission limit of ≤ 0.15 lb/mmBtu heat output per CFR 40 part 60, §60.5474 (b).

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

Table 1A. Data Summary Part A

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						Θ	W_{fuel}	MC_{ave}	Q_{in}	Q_{out}
Category	Run No	Load % Capacity	Target Load BTU/hr	Actual Load BTU/hr	Actual Load % of max	Test Duration hrs	Wood Wt lb	Wood Moisture % DB	Heat Input (HHV) BTU	Heat Output BTU
I	2	≤ 15% of max	<18,750	16,286	13.0%	15.70	55.4	21.6	392,197	255,689
II	3	16-24% of max	20,000 - 30,000	27,597	22.1%	9.48	54.5	21.4	385,961	261,714
III	4	25-50% of max	31,250 - 62,500	43,509	34.8%	6.25	57.2	22.3	402,504	271,934
IV	1	Max capacity	125000	121,291	97.0%	2.52	56.3	22.7	394,233	305,248

Table 1B. Data Summary Part B

			$T2_{Min}$	E_T	E	E	$E_{g/hr}$	$E_{g/kg}$	η_{del}	H_{SLM}
Category	Run No	Load % Capacity	Min Return Temp °F	Total PM Emissions g	PM Output Based lb/mmBTU Out	PM Output Based g/MJ	PM Rate g/hr	PM Factor g/kg	Delivered Efficiency %	Stack Loss Efficiency %
I	2	< 15% of max	151.0	9.8	0.084	0.036	0.62	0.47	65.2%	77.5%
II	3	16-24% of max	149.7	9.6	0.081	0.035	1.02	0.47	67.8%	79.7%
III	4	25-50% of max	146.3	9.7	0.078	0.034	1.55	0.45	67.6%	80.6%
IV	1	Maximum	158.4	8.3	0.060	0.026	3.31	0.40	77.4%	82.2%

Table 1C. Hangtag Information

MANUFACTURER:	Alternate Heating Systems		
MODEL NUMBER:	SE110		
MAXIMUM OUTPUT RATING:	Q_{max}	125,000	BTU/HR
ANNUAL EFFICIENCY RATING:	η_{avg}	67%	(Using higher heating value)
PARTICLE EMISSIONS:	E_{avg}	1.1	GRAMS/HR (average)
		0.08	LBS/MILLION BTU OUTPUT
CARBON MONOXIDE:	$O_{g/MIN}$	2.0	GRAMS/MINUTE

Table 2A. Heating Season Weighting

Category	Weighting Factor (F_i)	$\eta_{del,\,i} \times F_i$	$E_{g/MJ,\,i} \times F_i$	$E_{g/kg,\,i} \times F_i$	$E_{lb/mmBTU\ Out,\,i} \times F_i$	$E_{g/hr,\,i} \times F_i$
I	0.175	11.4%	0.006	0.083	0.015	0.109
II	0.275	18.6%	0.010	0.130	0.022	0.279
III	0.450	30.4%	0.015	0.204	0.035	0.696
IV	0.100	7.7%	0.003	0.040	0.006	0.331
Total	1.000	68.2%	0.034	0.457	**0.078**	1.415

Table 2B. Year-Round Use Weighting

Category	Weighting Factor (F_i)	$\eta_{del,\,i} \times F_i$	$E_{g/MJ,\,i} \times F_i$	$E_{g/kg,\,i} \times F_i$	$E_{lb/mmBTU\ Out,\,i} \times F_i$	$E_{g/hr,\,i} \times F_i$
I	0.437	28.5%	0.016	0.207	0.037	0.273
II	0.238	16.1%	0.008	0.112	0.019	0.242
III	0.275	18.6%	0.009	0.125	0.022	0.425
IV	0.050	3.9%	0.001	0.020	0.003	0.166
Total	1.000	67.1%	0.035	0.464	**0.081**	1.105

Table 3. CO emissions & First Hour PM

Category	CO emissions (g/min)	First Hour Emissions (g/hr)
I	1.7	1.4
II	2.6	2.8
III	2.1	3.7
IV	1.7	7.0

Test Run Narrative

Run 1

Run 1 was performed on 1/8/2025 as a category 4 (maximum output) test per EPA Method 28WHH. The unit was operated for at least one hour at the desired output rate prior to loading the test fuel. The unit did not cycle off during the test and the return water temperature did not drop below 120F, so the test is considered a valid measure of maximum output. Heat output was 121,291 Btu/hr, which is within 10% of the manufacturers rated output of 125,000 Btu/hr. The emissions rate was 0.060 lb/mmBtu heat output. Delivered efficiency was 77.4%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 2

Run 2 was performed on 1/8/2025 as a category 1 test per EPA Method 28WHH. The unit was operated for at least one hour at the desired output rate prior to loading the test fuel. Output was under 15% of maximum rated output and the return water temperature did not drop below 120F, so the test is considered a valid category 1. Heat output was 16,286 Btu/hr, and the emissions rate was 0.084 lb/mmBtu heat output. Delivered efficiency was 65.2%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 3

Run 3 was performed on 1/9/2025 as a category 2 test per EPA Method 28WHH. The unit was operated for at least one hour at the desired output rate prior to loading the test fuel. Output was between 15-24% of maximum rated output and the return water temperature did not drop below 120F, so the test is considered a valid category 2. Heat output was 27,597 Btu/hr, and the emissions rate was 0.081 lb/mmBtu heat output. Delivered efficiency was 67.8%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 4

Run 4 was performed on 1/10/2025 as a category 3 test per EPA Method 28WHH. The unit was operated for at least one hour at the desired output rate prior to loading the test fuel. Output was between 25-49% of maximum rated output and the return water temperature did not drop below 120F, so the test is considered a valid category 3. Heat output was 43,509 Btu/hr, and the emissions rate was 0.078 lb/mmBtu heat output. Delivered efficiency was 67.6%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Test Conditions Summary

Testing conditions for all runs fell within allowable specifications of the ASTM 2618 and ASTM E2515. A summary of facility conditions, fuel burned, and run times are listed below.

Run	Ambient (°F)		Relative Humidity (%)		Average Barometric Pressure (In. Hg.)	Preburn Fuel Weight (lbs)	Test Fuel Weight (lbs)	Test Fuel Moisture (%DB)	Test Run Time (Min)
	Pre	Post	Pre	Post					
1	67	68	31.0	27.7	30.30	55.8	56.3	22.7	151
2	65	62	27.7	32.5	30.29	29.6	55.4	21.6	942
3	67	64	29.7	24.6	30.29	31.4	54.5	21.4	569
4	66	65	35.3	22.8	30.13	42.8	57.2	22.3	375

Appliance Operation and Test Settings

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

Efficiency Discussion

Two methods were used to determine efficiency for each run: delivered output, which measures energy output at the heat load, and stack loss output, which calculates energy lost through the stack and assumes that all other heat output is useful heat. Theoretically, efficiency calculated from the stack loss output should always be higher than that calculated from delivered output.

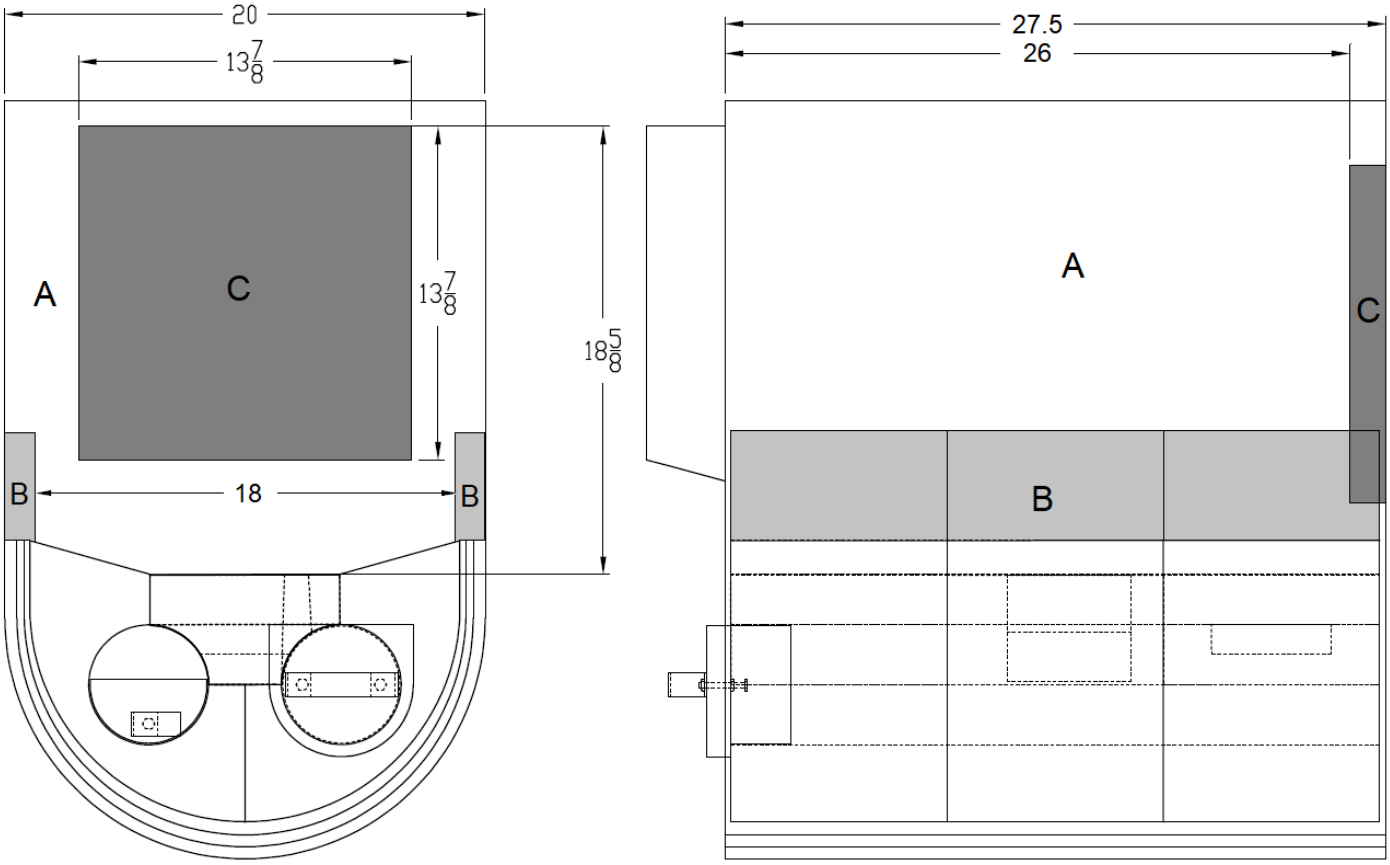
Though delivered efficiency was lower than stack loss for all 4 runs performed, the discrepancy between the two values was notably variable between runs.

While the precise cause of this discrepancy cannot be definitively assessed, it does not indicate a source of excessive measurement uncertainty or error, systemic bias, or any deviation from the test method. Several factors related to specific measurement procedures and calculations specified by ASTM E2618 may contribute to this discrepancy. These are explored in detail in Appendix F.

Low Burn Rate Discussion

The SE110, like all wood-fired hydronic heaters, is functionally a single burn rate appliance. Users have no control of the air settings between “off” and “on;” heat output is varied instead by switching between these two settings. Therefore, all tests conducted on the unit were conducted at a burn rate no higher than that which an end user may achieve.

Firebox Volume Calculation



$$A = 20 * 27.5 * 18.625 = 10243.75$$

$$B = 2 * 1 * 4.5 * 27.5 = 247.5$$

$$C = 13.875 * 13.875 * 1.5 = 288.77$$

$$V = A - (B + C) = 9707.48\ in^3$$

$$\boldsymbol{V = 5.62\ ft^3}$$

Appliance Front



Appliance Left



Appliance Right



Appliance Rear



Test Fuel Properties

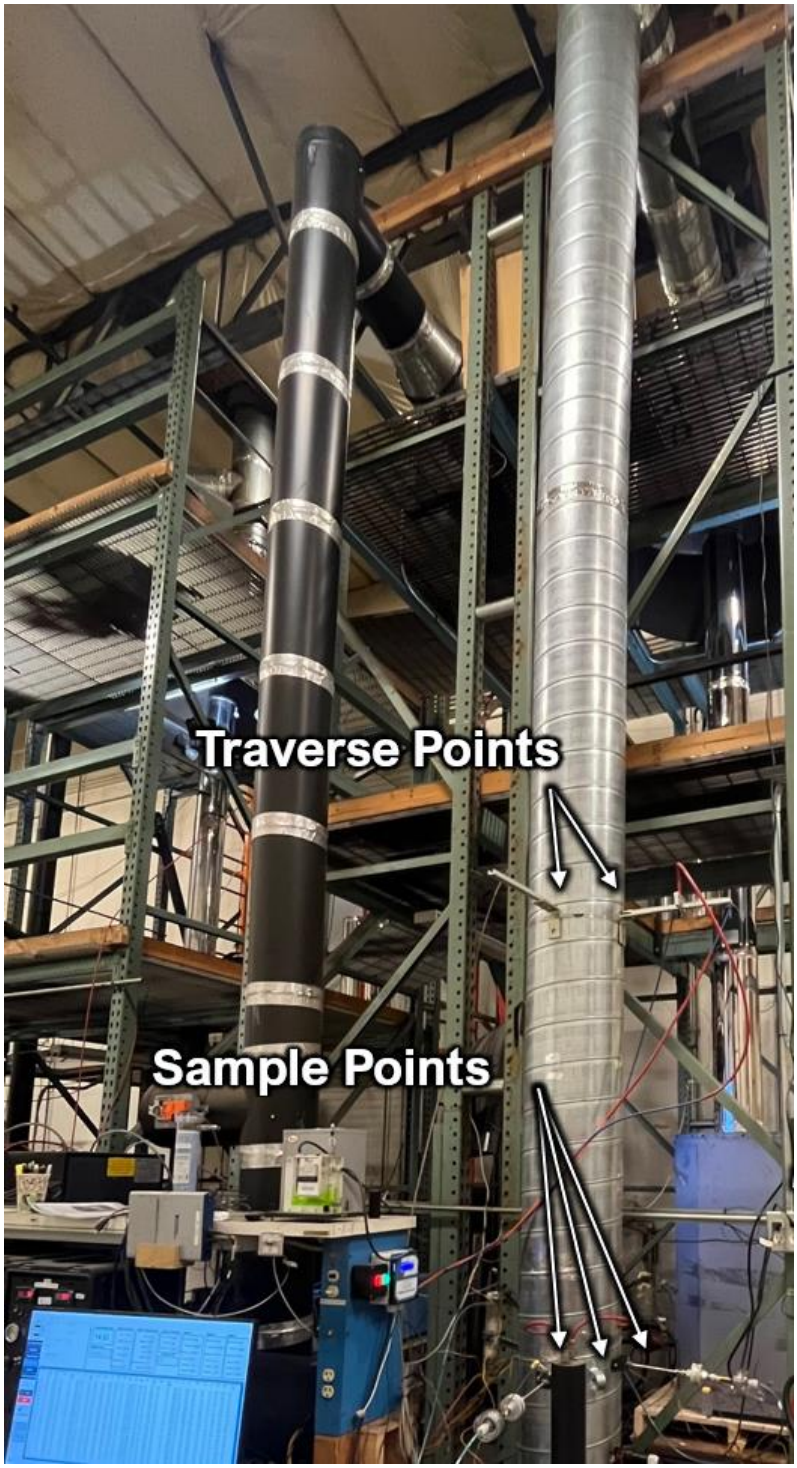
Test fuel used was maple cordwood, air-dried to the specified moisture content range. A typical fuel load is pictured below:

Typical Fuel Load



Sampling Locations and Descriptions

Sample ports are located 16.5 feet downstream from any disturbances and 3.5 feet upstream from any disturbances. Flow rate traverse data was collected 8 feet downstream from any disturbances and 4 feet upstream from any disturbances. (See below).



Sampling Methods

ASTM E2515 was used in collecting particulate samples. The dilution tunnel was 12 inches in diameter. All sampling conditions per ASTM E2515 were followed. No alternate procedures were used.

Analytical Methods Description

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

Calibration, Quality Control and Assurances

Calibration procedures and results were conducted per ASTM E2618-13 and ASTM E2515-11. Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined.

Appliance Sealing and Storage

Upon completion of testing, the appliance was secured with metal strapping and the seal below was applied, the appliance was then returned to the manufacturer's location at: 2395 Little Egypt Rd Harrisonville Pa, 17228, for archival.

Sealing Label

ATTENTION:

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

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

REPORT #_____ DATE SEALED_____

MANUFACTURER_____ MODEL #_____

Sealed Unit



List of Appendices

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

Appendix A – Run Data

Appendix B – Labels and Manuals

Appendix C –Equipment Calibration Records

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

Appendix F – Efficiency Measurement and Calculation Discussion

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 1 Data Summary

Client:	Alternate Heating
Model:	SE110
Job #:	24-350
Tracking #:	217
Test Date:	1/8/2024

Techician Signature

2/24/2025
Date

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	34.252	24.392	23.121	10.179
Average Gas Velocity in Dilution Tunnel (ft/sec)	17.5			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	47553.0			
Average Gas Meter Temperature (°F)	67.0	82.3	82.7	74.4
Total Sample Volume (dscf)	34.740	24.226	23.081	10.325
Average Tunnel Temperature (°F)	84.6			
Total Time of Test (min)	151			
Total Particulate Catch (mg)	0.3	1.8	1.9	1.6
Particulate Concentration, dry-standard (g/dscf)	0.0000086	0.0000743	0.0000823	0.0001550
Total PM Emissions (g)	1.03	7.86	8.82	6.96
Particulate Emission Rate (g/hr)	0.41	3.12	3.50	6.96
Emissions Factor (g/kg)	-	0.38	0.42	-
Difference from Average Total Particulate Emissions (g)	-	0.48	0.48	-
Difference from Average Total Particulate Emissions (%)		5.8%	5.8%	
Difference from Average Emissions Factor (g/kg)	-	0.02	0.02	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	167.8
Appliance Average Final Temperature (F)	166.8
Heat Output (BTU)	305,248
Heat Output Rate (BTU/hr)	121,291
Heat Input - HHV (BTU)	394,233
Heat Input - LHV (BTU)	366,178

Emissions Rates and Factors

Total Particulate Emissions (g)	8.3
Emissions Factor (g/MJ)	0.0259
Emissions Factor (g/kg)	0.4002
Emissions Rate (g/hr)	3.31
Emissions Rate (lb/mmbtu output)	0.060
HHV Delivered Efficiency (%)	77.4%
LHV Delivered Efficiency (%)	83.4%
HHV SLM Efficiency (%)	82.2%
LHV SLM Efficiency (%)	87.9%
CO Emissions (g/min)	1.73

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	75.3	OK
Face Velocity	< 30 ft/min	8.8	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 60 / Max: 68.4	OK
Negative Probe Weight Evaluation	<5% of Total Catch	OK	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Return Temp > 120°F	>120°F	158.4	OK

B415.1 Efficiency Results

Manufacturer: Alternate Heating
Model: SE110
Date: 01/08/24
Run: 1
Control #: 24-350
Test Duration: 151
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	82.2%	87.9%
Combustion Efficiency	99.2%	99.2%
Heat Transfer Efficiency	82.8%	88.6%

Output Rate (kJ/h)	135,412	128,453	**(Btu/h)**
Burn Rate (kg/h)	8.26	18.20	**(lb/h)**
Input (kJ/h)	164,784	156,315	**(Btu/h)**

Test Load Weight (dry kg)	20.78	45.79	**dry lb**
MC wet (%)	18.52		
MC dry (%)	22.73		
Particulate (g)	8.34		
CO (g)	262		
Test Duration (h)	2.52		

Emissions	**Particulate**	**CO**
g/MJ Output	0.02	0.77
g/kg Dry Fuel	0.40	12.60
g/h	3.31	104.05
g/min	0.06	1.73
lb/MM Btu Output	0.06	1.79

Air/Fuel Ratio (A/F)	8.72

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

BOILER CORDWOOD FUEL DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

Firebox Volume (ft^3): 5.62
Target Load Weight (lbs): 56.20

Minimun Piece Weight (lbs): 4.40
Maximun Piece Weight (lbs): 17.60
80% of piece of weight range (lbs): 6.6 to 15.4

Pretest Fuel Information

Length (in)	Weight (lbs)	MC (%DB)	Length (in)	Weight (lbs)	MC (%DB)
24.00	9.61	22.5			
24.00	7.80	24.2			
24.00	7.38	25.8			
24.00	7.91	25.3			
24.00	6.65	21.7			
24.00	7.99	19.1			
24.00	8.42	20.1			

Total Preburn Weight (lbs): 55.76
Averge Preburn Moisture (% DB): 22.67

Test Fuel Information

Length (in)	Weight (lbs)	Moisture Content (%DB)					Avg MC (%DB)	Dry Weight (lbs)
24.00	7.82	19.7	22.1	18.5	18.7	19.9	19.78	6.53
24.00	14.08	24.1	21.5	25.1	22.3	27.9	24.18	11.34
24.00	8.83	19.7	24.6	18.8	19.7	21.0	20.76	7.31
24.00	10.75	19.3	22.0	25.1	26.8	24.1	23.46	8.71
24.00	6.66	21.4	22.4	25.5	26.1	26.3	24.34	5.36
24.00	8.12	25.6	22.5	20.7	27.1	19.4	23.06	6.60

Total (lbs): 56.26
Load Density (lbs/ft3): 10.01

Total Dry Weight (lbs): 45.84

Allowable Coal Bed Range (10-20%): 5.6 - 11.3

Quality checks
Individual Piece Weights: OK
80% Piece weight range: OK

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client:	Alternate Heating	Job #:	24-350
Model:	SE110	Tracking #:	217
Run #:	1	Technician:	AK
Test Start Time:	10:48	Date:	1/8/2024
Manufacturer's Rated Output (BTU/hr):	125,000		

Total Sampling Time (min):	151		
Recording Interval (min):	1		
Meter Box γ Factor:	1.005 (A)		
Meter Box γ Factor:	1.011 (B)		
Meter Box γ Factor:	1.000 (Ambient)		
Meter Box γ Factor:	1.000 (C)		
Induced Draft Check (in. H_2O):	0		
Smoke Capture Check (%):	100%		
Date Flue Pipe Last Cleaned:	1/6/2024		
Boiler Dry Weight (lbs):	1470		
Supply Side Water Weight (lbs):	970		

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.33	30.27	30.30
Relative Humidity (%)	31.0	27.7	
Room Air Velocity (ft/min)	<50	<50	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		34.252	ft^3

Sample Train Post-Test Leak Checks

	Pre-test	Post-test			
(A)	0.000	0.000	cfm @	-7	in. Hg
(B)	0.000	0.000	cfm @	-7	in. Hg
(C)	0.000	0.000	cfm @	-6	in. Hg
(Ambient)	0.000	0.000	cfm @	-13	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.046	83
2	0.074	83
3	0.076	83
4	0.076	83
5	0.072	83
6	0.060	83
7	0.060	83
8	0.070	83
9	0.076	83
10	0.076	83
11	0.074	83
12	0.064	83
Center	0.076	83

Static Pressure: -0.230 in. H_2O

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	12	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.7854	ft^2
V_{strav}:	17.46	ft/sec
V_{scent}:	18.41	ft/sec
F_p:	0.948	[ratio]
Initial Tunnel Flow:	793.7	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

Fuel Type:	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

Actual Fuel Used Properties

Fuel Type:	Maple
HHV (kJ/kg)	19,960
%C	50.64
%H	6.02
%O	41.74
%Ash	1.35
MC (%DB)	22.7%

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.074	0.60	68.2	-0.34		56.2		83	301	68	67
1	0.144	0.144	0.073	1.16	68.0	-1	93	56.8	0.6	82	286	68	67
2	0.308	0.164	0.074	1.17	68.1	-0.9	105	55.3	-1.5	82	283	68	67
3	0.472	0.164	0.072	1.17	67.6	-0.83	107	54.8	-0.5	82	281	69	67
4	0.634	0.162	0.077	1.16	67.5	-0.87	102	54.4	-0.4	83	299	69	67
5	0.798	0.164	0.076	1.16	67.6	-0.95	104	53.9	-0.5	84	309	69	68
6	0.960	0.162	0.074	1.16	68.5	-1.05	104	53.4	-0.5	84	315	69	68
7	1.122	0.162	0.075	1.16	68.6	-1.12	104	52.9	-0.5	84	318	69	68
8	1.285	0.163	0.075	1.13	68.0	-1.16	104	52.2	-0.7	84	323	69	67
9	1.446	0.161	0.075	1.15	68.1	-1.17	103	52.0	-0.2	85	327	69	67
10	1.608	0.162	0.074	1.15	68.3	-1.2	104	51.4	-0.6	85	329	69	67
11	1.769	0.161	0.076	1.17	68.5	-1.21	102	51.0	-0.4	85	331	70	67
12	1.930	0.161	0.072	1.15	68.7	-1.22	105	50.5	-0.5	85	331	70	68
13	2.092	0.162	0.074	1.16	69.4	-1.24	104	50.2	-0.3	85	332	70	68
14	2.252	0.160	0.077	1.16	69.2	-1.26	101	49.3	-0.9	85	331	70	67
15	2.414	0.162	0.076	1.12	70.1	-1.26	103	49.2	-0.1	85	332	70	68
16	2.574	0.160	0.075	1.13	69.5	-1.27	102	48.5	-0.7	85	332	70	67
17	2.736	0.162	0.076	1.13	70.3	-1.28	103	48.0	-0.5	85	331	70	68
18	2.896	0.160	0.076	1.14	70.6	-1.28	101	47.5	-0.5	85	329	70	68
19	3.058	0.162	0.073	1.15	70.4	-1.3	105	47.3	-0.2	85	327	70	68
20	3.218	0.160	0.074	1.14	70.5	-1.31	103	46.7	-0.6	85	329	70	68
21	3.379	0.161	0.077	1.14	71.1	-1.31	101	46.1	-0.6	85	329	70	68
22	3.539	0.160	0.077	1.13	71.1	-1.32	101	45.5	-0.6	85	328	71	68
23	3.700	0.161	0.074	1.16	71.4	-1.31	103	45.1	-0.4	85	329	71	68
24	3.860	0.160	0.076	1.12	71.6	-1.31	101	44.7	-0.4	86	332	71	68
25	4.021	0.161	0.076	1.16	72.6	-1.32	102	44.2	-0.5	86	336	71	68
26	4.181	0.160	0.077	1.12	72.9	-1.3	100	43.6	-0.6	86	337	71	68
27	4.341	0.160	0.075	1.15	72.5	-1.32	102	43.3	-0.3	86	332	71	68
28	4.502	0.161	0.076	1.12	72.9	-1.31	102	42.5	-0.8	85	331	71	68
29	4.661	0.159	0.076	1.13	73.1	-1.31	100	42.4	-0.1	85	329	71	68
30	4.823	0.162	0.075	1.13	73.3	-1.29	103	41.9	-0.5	85	328	71	67
31	4.982	0.159	0.075	1.10	74.2	-1.3	101	41.4	-0.5	85	323	71	68

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	5.144	0.162	0.076	1.13	73.9	-1.31	102	41.0	-0.4	85	322	71	68
33	5.303	0.159	0.076	1.13	74.3	-1.31	100	40.2	-0.8	85	327	71	65
34	5.465	0.162	0.078	1.13	74.9	-1.34	100	40.0	-0.2	85	328	71	63
35	5.624	0.159	0.076	1.13	76.0	-1.3	100	39.4	-0.6	85	331	71	62
36	5.786	0.162	0.078	1.14	75.7	-1.29	100	39.0	-0.4	85	335	71	61
37	5.946	0.160	0.075	1.14	76.4	-1.3	101	38.6	-0.4	85	338	71	60
38	6.108	0.162	0.077	1.14	77.2	-1.3	101	38.3	-0.3	85	338	71	60
39	6.268	0.160	0.076	1.14	77.1	-1.32	100	38.1	-0.2	85	339	71	62
40	6.430	0.162	0.076	1.13	76.8	-1.3	101	37.6	-0.5	85	339	71	62
41	6.590	0.160	0.075	1.14	77.4	-1.33	101	37.1	-0.5	85	338	70	63
42	6.751	0.161	0.076	1.14	77.1	-1.25	101	36.6	-0.5	85	334	70	63
43	6.912	0.161	0.075	1.08	77.8	-1.29	101	36.6	0	85	335	70	64
44	7.072	0.160	0.075	1.12	77.9	-1.3	101	35.7	-0.9	85	335	70	64
45	7.234	0.162	0.075	1.13	77.5	-1.27	102	35.0	-0.7	85	336	70	64
46	7.394	0.160	0.077	1.14	78.5	-1.26	99	34.7	-0.3	85	334	70	65
47	7.556	0.162	0.076	1.14	78.0	-1.3	101	34.3	-0.4	85	335	70	65
48	7.716	0.160	0.076	1.13	78.6	-1.32	100	33.7	-0.6	85	335	70	65
49	7.878	0.162	0.076	1.14	79.1	-1.3	101	33.2	-0.5	86	335	70	65
50	8.038	0.160	0.077	1.13	79.4	-1.28	99	32.8	-0.4	86	335	70	65
51	8.200	0.162	0.076	1.14	79.1	-1.31	101	32.4	-0.4	86	335	70	65
52	8.360	0.160	0.077	1.13	79.1	-1.3	99	31.9	-0.5	85	327	70	66
53	8.521	0.161	0.077	1.12	79.8	-1.28	100	31.4	-0.5	85	328	70	66
54	8.682	0.161	0.073	1.15	80.3	-1.34	102	31.1	-0.3	86	333	70	66
55	8.843	0.161	0.073	1.13	79.8	-1.31	102	30.7	-0.4	86	332	71	66
56	9.005	0.162	0.077	1.15	80.0	-1.3	100	30.2	-0.5	85	330	71	66
57	9.165	0.160	0.075	1.12	80.9	-1.35	100	29.8	-0.4	85	330	71	66
58	9.327	0.162	0.078	1.14	80.6	-1.29	99	29.2	-0.6	85	329	71	66
59	9.487	0.160	0.077	1.14	81.3	-1.31	99	28.9	-0.3	85	330	71	66
60	9.649	0.162	0.075	1.10	80.8	-1.3	101	28.5	-0.4	85	329	71	66
61	9.810	0.161	0.076	1.15	81.8	-1.32	100	27.8	-0.7	85	321	71	66
62	9.972	0.162	0.077	1.14	81.5	-1.32	100	27.7	-0.1	84	317	71	66
63	10.133	0.161	0.076	1.12	82.3	-1.3	100	27.3	-0.4	85	321	71	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	10.294	0.161	0.077	1.13	81.9	-1.32	99	26.9	-0.4	85	323	71	67
65	10.456	0.162	0.076	1.14	82.7	-1.33	100	26.1	-0.8	85	324	71	67
66	10.616	0.160	0.077	1.15	82.2	-1.32	98	26.3	0.2	85	324	71	67
67	10.779	0.163	0.077	1.13	82.5	-1.32	100	25.7	-0.6	85	325	71	67
68	10.939	0.160	0.076	1.15	82.5	-1.32	99	25.2	-0.5	85	324	71	67
69	11.102	0.163	0.079	1.14	83.5	-1.32	99	24.9	-0.3	85	323	71	67
70	11.262	0.160	0.075	1.13	82.8	-1.31	100	24.4	-0.5	84	314	71	67
71	11.424	0.162	0.079	1.12	83.8	-1.32	98	24.2	-0.2	84	315	71	67
72	11.586	0.162	0.077	1.12	83.4	-1.34	99	23.6	-0.6	85	318	71	67
73	11.747	0.161	0.075	1.14	84.2	-1.32	100	23.5	-0.1	84	317	71	67
74	11.909	0.162	0.076	1.13	83.8	-1.32	100	23.2	-0.3	84	313	71	67
75	12.070	0.161	0.077	1.13	83.9	-1.33	99	22.7	-0.5	84	312	71	67
76	12.233	0.163	0.077	1.14	84.8	-1.32	100	22.3	-0.4	84	312	71	67
77	12.394	0.161	0.076	1.13	84.2	-1.33	99	22.0	-0.3	84	306	72	67
78	12.556	0.162	0.080	1.13	85.1	-1.34	97	21.6	-0.4	83	298	71	67
79	12.718	0.162	0.075	1.13	84.5	-1.34	100	21.2	-0.4	83	294	71	67
80	12.879	0.161	0.077	1.13	84.7	-1.32	98	21.0	-0.2	83	292	72	67
81	13.042	0.163	0.076	1.15	85.7	-1.34	100	20.6	-0.4	83	301	71	67
82	13.203	0.161	0.076	1.14	85.6	-1.34	99	20.4	-0.2	84	312	72	67
83	13.366	0.163	0.077	1.14	85.3	-1.37	100	19.8	-0.6	84	319	72	67
84	13.527	0.161	0.076	1.15	85.9	-1.38	99	19.3	-0.5	85	322	72	67
85	13.688	0.161	0.074	1.13	86.3	-1.32	100	19.0	-0.3	85	324	72	67
86	13.851	0.163	0.076	1.14	86.2	-1.37	100	18.6	-0.4	85	323	72	67
87	14.012	0.161	0.078	1.13	85.9	-1.35	98	18.2	-0.4	85	323	72	67
88	14.175	0.163	0.076	1.12	86.1	-1.36	100	17.8	-0.4	85	317	72	68
89	14.336	0.161	0.077	1.14	86.2	-1.35	98	17.4	-0.4	85	317	72	68
90	14.498	0.162	0.075	1.14	87.0	-1.38	100	17.1	-0.3	85	319	72	68
91	14.660	0.162	0.077	1.13	86.4	-1.36	99	16.7	-0.4	85	317	72	68
92	14.821	0.161	0.078	1.13	87.3	-1.37	97	16.4	-0.3	84	311	72	68
93	14.984	0.163	0.076	1.12	87.5	-1.35	100	15.8	-0.6	84	306	72	68
94	15.145	0.161	0.075	1.13	87.0	-1.34	99	15.6	-0.2	84	301	72	68
95	15.309	0.164	0.079	1.14	87.3	-1.38	99	15.3	-0.3	84	302	72	68

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	15.470	0.161	0.078	1.13	87.9	-1.35	97	15.0	-0.3	84	307	72	68
97	15.632	0.162	0.077	1.11	87.3	-1.35	99	14.5	-0.5	84	303	72	68
98	15.795	0.163	0.076	1.14	87.4	-1.39	100	14.3	-0.2	84	301	72	68
99	15.956	0.161	0.077	1.13	88.2	-1.37	98	13.7	-0.6	84	304	72	68
100	16.119	0.163	0.076	1.14	88.4	-1.39	100	13.6	-0.1	84	302	72	68
101	16.280	0.161	0.076	1.11	88.0	-1.37	99	12.9	-0.7	84	302	72	68
102	16.443	0.163	0.077	1.11	87.9	-1.37	99	13.0	0.1	84	302	72	68
103	16.605	0.162	0.076	1.12	88.0	-1.39	99	12.6	-0.4	84	304	72	68
104	16.766	0.161	0.077	1.13	88.8	-1.33	98	12.4	-0.2	84	306	72	68
105	16.930	0.164	0.077	1.12	88.3	-1.4	100	12.0	-0.4	84	310	72	68
106	17.091	0.161	0.076	1.11	88.4	-1.41	99	11.8	-0.2	84	312	72	68
107	17.254	0.163	0.076	1.14	88.4	-1.39	100	11.4	-0.4	85	312	72	68
108	17.415	0.161	0.076	1.13	88.5	-1.4	99	11.3	-0.1	85	313	72	68
109	17.577	0.162	0.077	1.13	88.8	-1.41	98	11.0	-0.3	85	313	72	68
110	17.741	0.164	0.076	1.13	89.3	-1.39	100	10.6	-0.4	85	314	72	68
111	17.902	0.161	0.077	1.13	89.0	-1.44	98	10.2	-0.4	85	314	72	68
112	18.065	0.163	0.076	1.10	88.9	-1.42	100	10.1	-0.1	85	315	72	68
113	18.226	0.161	0.076	1.13	89.1	-1.42	98	9.8	-0.3	85	312	72	68
114	18.388	0.162	0.077	1.13	89.9	-1.42	98	9.4	-0.4	85	309	72	68
115	18.551	0.163	0.077	1.13	89.2	-1.44	99	9.0	-0.4	85	311	72	68
116	18.713	0.162	0.076	1.13	89.4	-1.44	99	8.7	-0.3	85	313	72	68
117	18.876	0.163	0.075	1.14	89.9	-1.42	100	8.5	-0.2	85	314	72	68
118	19.038	0.162	0.076	1.13	90.2	-1.42	99	8.1	-0.4	85	313	72	68
119	19.199	0.161	0.077	1.13	89.5	-1.45	98	7.8	-0.3	85	314	72	68
120	19.363	0.164	0.078	1.13	90.4	-1.42	99	7.4	-0.4	85	314	72	68
121	19.524	0.161	0.076	1.13	89.7	-1.44	98	7.2	-0.2	85	314	72	68
122	19.687	0.163	0.076	1.14	90.3	-1.46	99	6.9	-0.3	85	315	72	68
123	19.849	0.162	0.075	1.14	90.4	-1.48	99	6.5	-0.4	85	315	72	68
124	20.010	0.161	0.076	1.13	90.3	-1.47	98	6.2	-0.3	85	315	72	68
125	20.174	0.164	0.076	1.13	90.0	-1.45	100	6.1	-0.1	85	315	72	68
126	20.335	0.161	0.076	1.13	90.8	-1.47	98	5.7	-0.4	85	315	72	68
127	20.498	0.163	0.074	1.14	90.1	-1.47	101	5.4	-0.3	85	316	72	68

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	20.660	0.162	0.075	1.15	90.6	-1.46	100	5.2	-0.2	85	315	72	68
129	20.822	0.162	0.077	1.13	91.0	-1.46	98	4.8	-0.4	85	313	72	68
130	20.985	0.163	0.077	1.13	90.4	-1.49	99	4.6	-0.2	85	311	72	68
131	21.146	0.161	0.075	1.13	90.9	-1.45	99	4.2	-0.4	84	297	72	68
132	21.310	0.164	0.077	1.13	90.9	-1.45	99	4.0	-0.2	84	290	72	68
133	21.471	0.161	0.076	1.13	91.1	-1.51	98	3.8	-0.2	83	289	72	68
134	21.633	0.162	0.076	1.13	91.2	-1.47	99	3.5	-0.3	84	293	72	68
135	21.796	0.163	0.076	1.13	90.8	-1.5	99	3.3	-0.2	84	300	72	68
136	21.958	0.162	0.076	1.13	90.9	-1.5	99	3.0	-0.3	84	292	73	68
137	22.121	0.163	0.075	1.13	91.6	-1.51	100	2.6	-0.4	84	297	72	68
138	22.283	0.162	0.075	1.16	91.0	-1.5	99	2.6	0	85	303	73	68
139	22.445	0.162	0.078	1.13	91.8	-1.5	97	2.5	-0.1	85	304	73	68
140	22.608	0.163	0.077	1.14	91.1	-1.5	99	2.1	-0.4	85	305	73	68
141	22.769	0.161	0.076	1.12	91.5	-1.51	98	1.9	-0.2	85	304	73	68
142	22.933	0.164	0.076	1.12	91.2	-1.51	100	1.8	-0.1	85	305	73	68
143	23.094	0.161	0.075	1.15	91.5	-1.51	99	1.5	-0.3	86	305	73	68
144	23.257	0.163	0.075	1.13	91.4	-1.51	100	1.2	-0.3	86	305	73	68
145	23.419	0.162	0.074	1.13	91.4	-1.52	100	1.0	-0.2	86	304	73	68
146	23.581	0.162	0.076	1.12	91.6	-1.51	99	1.0	0	86	302	73	68
147	23.744	0.163	0.077	1.13	92.2	-1.55	99	0.6	-0.4	85	299	73	68
148	23.905	0.161	0.077	1.13	92.4	-1.54	97	0.5	-0.1	85	299	73	68
149	24.068	0.163	0.077	1.13	92.3	-1.54	99	0.3	-0.2	86	299	73	68
150	24.231	0.163	0.075	1.16	92.2	-1.57	100	0.2	-0.1	86	299	73	68
151	24.392	0.161	0.076	1.13	92.2	-1.57	98	0.0	-0.2	85	296	73	68
Avg/Tot	24.392	0.162	0.076	1.13	82	-1.34	100			85	317	71	67.0

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	-0.002		0.59	68	-1.35		70	-0.050	12.81	0.07
1	0.135	0.137	1.11	67	-3.62	94	70	-0.040	12.50	0.83
2	0.290	0.155	1.13	67	-7.54	105	71	-0.050	15.19	0.15
3	0.443	0.153	1.11	67	3.26	105	71	-0.050	15.61	0.12
4	0.594	0.151	1.08	68	5.58	101	71	-0.050	16.31	0.13
5	0.747	0.153	1.10	67	5.76	103	71	-0.060	15.93	0.04
6	0.900	0.153	1.10	68	-18.71	104	72	-0.050	16.43	0.06
7	1.052	0.152	1.11	67	-27.07	103	72	-0.060	15.88	0.03
8	1.204	0.152	1.15	67	-0.77	103	72	-0.050	16.36	0.05
9	1.354	0.150	1.09	69	-0.92	101	72	-0.060	16.35	0.05
10	1.506	0.152	1.09	69	-1.09	103	72	-0.060	15.72	0.04
11	1.658	0.152	1.07	68	-2.04	102	73	-0.050	15.98	0.03
12	1.809	0.151	1.08	69	0.3	104	73	-0.060	15.79	0.03
13	1.960	0.151	1.05	69	3.82	103	73	-0.050	15.91	0.04
14	2.111	0.151	1.09	69	-32.93	101	73	-0.060	15.93	0.05
15	2.261	0.150	1.07	70	14.5	100	73	-0.080	15.92	0.04
16	2.411	0.150	1.05	70	-14.97	101	73	-0.060	15.92	0.05
17	2.562	0.151	1.09	70	16.72	101	73	-0.050	15.83	0.04
18	2.713	0.151	1.08	70	18.39	101	73	-0.060	15.65	0.04
19	2.864	0.151	1.04	71	-10.25	103	73	-0.070	15.92	0.05
20	3.015	0.151	1.09	70	-13.96	102	73	-0.070	16.17	0.07
21	3.165	0.150	1.08	71	-13.62	100	73	-0.060	15.72	0.04
22	3.316	0.151	1.10	72	-9.41	100	74	-0.050	15.99	0.05
23	3.465	0.149	1.11	72	-11.57	101	74	-0.070	15.85	0.03
24	3.615	0.150	1.10	73	-8	100	74	-0.080	15.59	0.03
25	3.765	0.150	1.06	72	6.39	100	74	-0.060	16.01	0.03
26	3.916	0.151	1.07	72	5.53	100	74	-0.050	15.71	0.03
27	4.066	0.150	1.06	73	-10.67	100	74	-0.060	15.76	0.04
28	4.217	0.151	1.09	73	-2.57	101	74	-0.050	15.75	0.03
29	4.367	0.150	1.09	74	-13.51	100	74	-0.060	15.60	0.03
30	4.518	0.151	1.08	73	-8.09	101	74	-0.060	15.85	0.04
31	4.667	0.149	1.12	74	-6.8	100	74	-0.060	15.42	0.03

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
32	4.816	0.149	1.08	75	-12.58	99	74	-0.050	15.65	0.04
33	4.967	0.151	1.08	74	2.15	100	74	-0.060	15.82	0.03
34	5.117	0.150	1.10	76	-12.16	98	74	-0.060	15.58	0.03
35	5.268	0.151	1.08	75	6.47	100	74	-0.060	15.64	0.03
36	5.419	0.151	1.08	76	2.7	99	74	-0.060	15.58	0.04
37	5.570	0.151	1.09	77	-11.54	100	74	-0.060	15.63	0.03
38	5.721	0.151	1.09	76	6.49	99	73	-0.060	15.76	0.03
39	5.871	0.150	1.08	77	-11.13	99	73	-0.060	15.67	0.03
40	6.021	0.150	1.07	77	6.1	99	73	-0.050	15.44	0.03
41	6.172	0.151	1.08	78	-11.03	100	73	-0.060	15.83	0.03
42	6.323	0.151	1.08	77	6.28	100	73	-0.050	15.33	0.02
43	6.474	0.151	1.03	77	-5.97	100	73	-0.060	15.52	0.03
44	6.625	0.151	1.07	77	3.52	100	73	-0.060	15.71	0.02
45	6.776	0.151	1.11	79	2.22	100	73	-0.070	15.74	0.02
46	6.926	0.150	1.08	79	-10.45	98	73	-0.050	15.28	0.03
47	7.076	0.150	1.10	79	3.68	99	73	-0.050	15.47	0.02
48	7.227	0.151	1.07	78	-0.35	99	73	-0.050	15.64	0.04
49	7.378	0.151	1.06	79	-10.13	99	73	-0.050	15.55	0.02
50	7.529	0.151	1.08	80	-10.18	99	73	-0.060	15.79	0.03
51	7.681	0.152	1.10	79	-1.55	100	73	-0.040	15.70	0.02
52	7.832	0.151	1.08	80	5.24	98	73	-0.050	15.31	0.02
53	7.982	0.150	1.07	81	-0.65	98	73	-0.050	15.60	0.05
54	8.132	0.150	1.07	80	-10.18	101	73	-0.060	15.60	0.02
55	8.283	0.151	1.08	81	4.75	101	73	-0.050	15.54	0.02
56	8.435	0.152	1.07	80	-4.88	99	74	-0.050	15.70	0.02
57	8.586	0.151	1.09	82	-1.37	100	74	-0.060	15.34	0.02
58	8.737	0.151	1.07	82	5.35	98	74	-0.050	15.53	0.02
59	8.889	0.152	1.05	82	3.44	99	74	-0.060	15.20	0.02
60	9.039	0.150	1.08	81	-4.74	99	74	-0.050	15.23	0.03
61	9.189	0.150	1.03	82	-2.45	98	74	-0.050	14.87	0.23
62	9.341	0.152	1.08	82	-10.37	99	74	-0.050	15.34	0.03
63	9.493	0.152	1.06	83	1.65	99	74	-0.040	14.78	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
64	9.645	0.152	1.08	82	-11.13	99	74	-0.050	15.41	0.01
65	9.796	0.151	1.07	82	-1.95	99	74	-0.060	14.97	0.02
66	9.947	0.151	1.09	83	-9.4	98	74	-0.070	15.36	0.02
67	10.097	0.150	1.09	84	4.95	97	74	-0.050	15.32	0.02
68	10.249	0.152	1.06	84	-8.75	99	74	-0.040	15.40	0.02
69	10.401	0.152	1.08	84	6.02	97	74	-0.050	15.19	0.02
70	10.553	0.152	1.09	84	-11.3	100	74	-0.050	15.63	0.03
71	10.705	0.152	1.07	83	2.3	97	74	-0.060	14.47	0.25
72	10.856	0.151	1.11	85	-7.95	98	74	-0.060	15.44	0.02
73	11.006	0.150	1.08	84	3.16	98	74	-0.040	15.30	0.06
74	11.158	0.152	1.05	86	-9.24	99	74	-0.040	15.38	0.04
75	11.311	0.153	1.09	85	-12.44	99	74	-0.050	15.29	0.07
76	11.463	0.152	1.08	85	6.94	98	74	-0.050	15.26	0.05
77	11.615	0.152	1.09	85	-11.06	99	74	-0.050	15.25	0.05
78	11.765	0.150	1.11	85	5.93	95	74	-0.040	15.25	0.07
79	11.917	0.152	1.09	86	-13.51	99	74	-0.040	15.53	0.05
80	12.070	0.153	1.09	86	-13.55	98	74	-0.050	15.16	0.07
81	12.222	0.152	1.04	87	-3.43	98	74	-0.050	15.32	0.20
82	12.374	0.152	1.08	87	-11.72	98	74	-0.060	15.10	0.10
83	12.525	0.151	1.09	87	-12.72	97	74	-0.050	15.37	0.08
84	12.677	0.152	1.05	87	-12.42	98	74	-0.050	15.31	0.07
85	12.829	0.152	1.08	86	5.82	100	74	-0.050	15.43	0.16
86	12.982	0.153	1.08	86	6.18	99	74	-0.050	15.12	0.09
87	13.134	0.152	1.09	88	-12.92	97	74	-0.050	15.07	0.17
88	13.286	0.152	1.10	88	-3.51	98	74	-0.060	15.22	0.24
89	13.437	0.151	1.09	88	-4.56	97	74	-0.050	15.32	0.13
90	13.589	0.152	1.09	88	-13.72	99	74	-0.050	15.35	0.09
91	13.742	0.153	1.11	87	4.45	98	74	-0.050	15.14	0.30
92	13.895	0.153	1.06	87	-2.83	98	74	-0.040	14.99	0.25
93	14.047	0.152	1.08	88	-12.35	98	74	-0.050	14.77	0.46
94	14.198	0.151	1.09	88	8.57	98	74	-0.040	15.03	0.36
95	14.350	0.152	1.04	89	0.09	96	74	-0.050	14.72	0.31

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
96	14.504	0.154	1.07	88	-12.79	98	74	-0.050	15.00	0.20
97	14.656	0.152	1.07	89	7.82	97	74	-0.050	15.01	0.29
98	14.808	0.152	1.09	89	10	98	74	-0.050	14.68	0.26
99	14.960	0.152	1.08	89	-9.35	97	75	-0.050	14.16	0.24
100	15.112	0.152	1.08	88	-17.17	98	75	-0.040	13.47	0.15
101	15.266	0.154	1.05	88	-10.15	99	75	-0.050	13.39	0.21
102	15.419	0.153	1.09	89	-1.88	98	75	-0.050	13.27	0.22
103	15.570	0.151	1.09	89	-4.72	97	75	-0.040	13.19	0.16
104	15.722	0.152	1.10	90	2.38	97	75	-0.030	12.61	0.11
105	15.875	0.153	1.10	89	-10.93	98	75	-0.060	12.23	0.19
106	16.028	0.153	1.05	89	-13.71	99	75	-0.040	12.01	0.17
107	16.181	0.153	1.09	90	8.91	99	75	-0.050	11.86	0.12
108	16.332	0.151	1.09	90	-3.9	97	75	-0.050	11.64	0.08
109	16.490	0.158	1.14	89	-18.99	101	75	-0.050	12.18	0.06
110	16.648	0.158	1.15	89	-17.07	102	75	-0.050	12.18	0.04
111	16.804	0.156	1.15	89	-18.33	100	75	-0.050	11.99	0.04
112	16.963	0.159	1.14	90	-11.96	102	75	-0.040	11.79	0.03
113	17.120	0.157	1.15	90	-19.36	101	75	-0.050	11.72	0.04
114	17.279	0.159	1.16	90	6.41	102	75	-0.050	11.87	0.09
115	17.436	0.157	1.14	90	-18.02	101	75	-0.050	11.84	0.06
116	17.594	0.158	1.15	90	-16.95	102	75	-0.050	12.16	0.05
117	17.752	0.158	1.14	90	-1.92	103	75	-0.050	11.75	0.05
118	17.909	0.157	1.15	91	8.97	101	75	-0.050	11.92	0.05
119	18.068	0.159	1.15	90	-17.45	102	75	-0.050	12.68	0.05
120	18.224	0.156	1.15	91	8.97	99	75	-0.050	13.16	0.06
121	18.383	0.159	1.15	91	-17.78	102	75	-0.050	13.94	0.08
122	18.541	0.158	1.14	92	-9.9	102	75	-0.040	13.38	0.07
123	18.698	0.157	1.10	92	-10.93	102	75	-0.050	12.60	0.07
124	18.857	0.159	1.19	90	5.07	102	75	-0.040	11.94	0.11
125	19.013	0.156	1.14	91	-1.12	100	75	-0.030	11.68	0.10
126	19.172	0.159	1.15	91	9.13	102	75	-0.050	11.60	0.10
127	19.329	0.157	1.13	91	-2.43	102	75	-0.040	11.21	0.23

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 1
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
128	19.487	0.158	1.17	91	8	102	75	-0.050	10.73	0.22
129	19.645	0.158	1.15	91	8.08	101	75	-0.050	10.51	0.28
130	19.802	0.157	1.17	92	-2.4	100	75	-0.050	10.70	0.31
131	19.962	0.160	1.14	91	9.38	104	75	-0.040	11.38	0.29
132	20.118	0.156	1.14	92	-19.38	99	75	-0.040	12.70	0.19
133	20.277	0.159	1.15	91	9.27	102	75	-0.040	12.25	0.51
134	20.434	0.157	1.15	91	9.31	101	75	-0.040	11.49	0.75
135	20.592	0.158	1.14	91	9.09	102	75	-0.040	10.64	0.52
136	20.751	0.159	1.15	93	-9.6	102	75	-0.040	11.08	0.70
137	20.908	0.157	1.14	92	-15.51	101	75	-0.060	10.57	0.59
138	21.067	0.159	1.10	93	4.58	103	75	-0.030	9.45	0.59
139	21.223	0.156	1.16	92	-19.45	99	75	-0.050	9.28	0.48
140	21.383	0.160	1.16	93	4.17	102	75	-0.060	8.88	0.44
141	21.539	0.156	1.14	91	-3.61	100	75	-0.050	8.88	0.42
142	21.698	0.159	1.17	93	6.65	102	75	-0.040	8.54	0.50
143	21.856	0.158	1.13	93	4.14	102	75	-0.060	8.11	0.45
144	22.014	0.158	1.14	93	8.81	102	75	-0.050	7.75	0.45
145	22.173	0.159	1.15	93	8.6	103	75	-0.050	7.55	0.43
146	22.329	0.156	1.17	92	-4.93	100	75	-0.050	7.30	0.47
147	22.488	0.159	1.14	92	-19.08	102	75	-0.050	7.35	0.56
148	22.645	0.157	1.14	92	-17.39	100	75	-0.050	6.96	0.58
149	22.804	0.159	1.14	92	-18.29	102	75	-0.040	6.49	0.57
150	22.961	0.157	1.19	93	4.85	101	75	-0.050	6.30	0.58
151	23.119	0.158	1.15	92	-24.07	102	75	-0.050	6.84	0.65
Avg/Tot	23.121	0.153	1.10	83	-4.05	100	74	-0.051	13.88	0.15

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
0	1.99		53.5	171.1	173.9	161.7	1.00	16.62	
1	1.98		53.5	171.4	174.5	162.3	1.00	16.54	1952
2	1.98		53.6	172.4	175.4	163.2	1.00	16.55	1968
3	2.04		53.6	171.0	173.9	161.5	1.00	16.99	1997
4	1.92		53.6	170.1	172.8	161.1	1.00	16.03	1870
5	1.94		53.7	169.6	172.2	160.6	1.00	16.14	1873
6	1.92		53.7	169.5	172.1	160.6	1.00	16.03	1859
7	1.93		53.8	169.5	172.1	160.5	1.00	16.12	1867
8	1.86		53.8	169.6	172.2	160.6	1.00	15.54	1802
9	1.94		53.8	169.5	172.1	160.5	1.00	16.13	1869
10	1.83		53.6	170.1	172.2	161.2	1.00	15.24	1777
11	1.76		53.6	170.3	172.3	161.4	1.00	14.64	1711
12	1.67		53.6	170.8	172.6	162.2	1.00	13.96	1638
13	1.96		53.7	170.6	172.9	160.9	1.00	16.36	1915
14	1.92		53.6	170.7	173.2	161.4	1.00	16.00	1876
15	1.95		53.5	171.1	173.4	161.7	1.00	16.28	1916
16	1.94		53.5	171.0	173.5	161.6	1.00	16.18	1903
17	1.93		53.5	171.2	173.5	161.9	1.00	16.09	1896
18	1.91		53.5	171.3	173.7	162.0	1.00	15.93	1878
19	1.93		53.6	171.5	173.9	162.1	1.00	16.07	1896
20	1.89		53.6	171.7	174.1	162.3	1.00	15.78	1866
21	1.94		53.7	171.6	174.2	162.4	1.00	16.17	1909
22	1.90		53.7	171.6	174.2	162.4	1.00	15.88	1875
23	1.89		53.7	171.8	174.5	162.6	1.00	15.76	1863
24	1.89		53.7	171.8	174.5	162.6	1.00	15.79	1867
25	1.94		53.7	171.9	174.7	162.9	1.00	16.15	1912
26	1.90		53.7	172.2	174.8	163.1	1.00	15.80	1875
27	1.88		53.8	172.4	175.0	163.3	1.00	15.66	1860
28	1.90		53.7	172.6	175.3	163.6	1.00	15.80	1881
29	1.90		53.6	172.9	175.5	163.6	1.00	15.86	1895
30	2.11		53.5	172.7	175.7	163.0	1.00	17.57	2096
31	2.07		53.5	172.5	175.9	162.7	1.00	17.27	2058
32	2.11		53.5	172.2	175.6	162.4	1.00	17.61	2093
33	2.14		53.5	172.0	175.4	162.3	1.00	17.82	2114
34	2.11		53.5	171.9	175.3	162.2	1.00	17.63	2090
35	2.12		53.2	171.8	175.3	162.1	1.00	17.64	2094
36	2.13		53.1	171.6	175.1	161.9	1.00	17.73	2104
37	2.14		53.0	171.6	175.1	161.8	1.00	17.81	2115
38	2.10		53.0	171.6	175.0	161.8	1.00	17.50	2078
39	2.11		53.0	171.6	175.0	161.8	1.00	17.61	2091
40	2.15		53.0	171.7	174.9	162.0	1.00	17.90	2127
41	2.06		53.1	171.4	174.9	162.0	1.00	17.21	2038
42	2.11		52.9	171.4	174.9	161.7	1.00	17.60	2088
43	2.14		52.9	171.5	175.0	161.8	1.00	17.86	2121
44	2.17		52.9	171.5	175.1	161.4	1.00	18.06	2144
45	2.22		53.0	171.6	174.9	161.7	1.00	18.50	2197
46	2.14		53.1	171.4	174.7	161.5	1.00	17.83	2112
47	2.19		53.0	171.5	174.7	161.6	1.00	18.22	2162

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
48	2.12		52.9	171.4	174.7	161.5	1.00	17.67	2097
49	2.22		52.7	171.5	174.7	161.6	1.00	18.55	2206
50	2.19		52.6	171.6	175.0	161.4	1.00	18.25	2174
51	2.16		52.5	171.6	174.9	161.4	1.00	18.02	2149
52	2.18		52.6	171.4	174.8	161.2	1.00	18.18	2162
53	2.17		52.6	171.2	174.6	161.1	1.00	18.11	2150
54	2.17		52.6	171.0	174.4	160.9	1.00	18.10	2146
55	2.05		52.7	171.1	174.5	161.1	1.00	17.13	2031
56	2.19		52.8	170.9	174.3	160.9	1.00	18.25	2158
57	2.18		52.8	170.8	174.2	160.8	1.00	18.16	2146
58	2.18		52.9	170.7	174.3	160.8	1.00	18.17	2143
59	2.16		52.9	170.7	174.1	160.8	1.00	18.05	2129
60	2.08		53.0	170.7	174.2	160.7	1.00	17.32	2041
61	2.20		53.1	170.8	174.2	160.8	1.00	18.36	2164
62	2.17		53.2	170.7	174.1	160.7	1.00	18.11	2130
63	2.17		53.3	170.5	173.9	160.5	1.00	18.12	2126
64	2.19		53.3	170.3	173.8	160.4	1.00	18.23	2136
65	2.07		53.4	170.5	173.9	160.5	1.00	17.23	2020
66	2.19		53.4	170.5	173.8	160.5	1.00	18.30	2146
67	2.14		53.4	170.5	173.6	160.6	1.00	17.80	2087
68	2.15		53.5	170.6	173.9	160.7	1.00	17.96	2106
69	2.16		53.5	170.4	173.8	160.4	1.00	18.00	2107
70	2.09		53.5	170.7	173.9	160.5	1.00	17.41	2043
71	2.19		53.1	170.5	173.6	160.3	1.00	18.28	2149
72	2.17		53.1	170.4	173.7	160.4	1.00	18.06	2122
73	2.19		53.2	170.4	173.7	160.2	1.00	18.23	2139
74	2.18		53.2	170.4	173.7	160.3	1.00	18.15	2130
75	2.05		53.3	170.3	173.4	160.1	1.00	17.12	2006
76	2.14		53.2	170.5	173.5	160.5	1.00	17.82	2093
77	2.13		53.2	170.4	173.4	160.4	1.00	17.78	2086
78	2.10		53.2	170.2	173.3	160.3	1.00	17.55	2056
79	2.19		53.2	169.9	173.2	159.9	1.00	18.28	2136
80	2.07		53.3	169.8	173.1	159.9	1.00	17.29	2016
81	2.16		53.3	169.8	172.8	159.9	1.00	18.00	2100
82	2.17		53.4	169.6	172.8	159.7	1.00	18.11	2107
83	2.18		53.5	169.8	173.0	159.7	1.00	18.19	2119
84	2.23		53.5	169.8	173.2	159.7	1.00	18.55	2160
85	2.11		53.5	170.1	173.5	160.2	1.00	17.63	2058
86	2.16		53.5	170.4	173.6	160.3	1.00	18.02	2109
87	2.20		53.4	170.2	173.6	160.2	1.00	18.38	2149
88	2.10		53.3	170.3	173.9	160.3	1.00	17.47	2047
89	2.24		53.3	170.5	173.9	160.2	1.00	18.71	2195
90	2.15		53.1	170.7	174.1	160.6	1.00	17.91	2109
91	2.20		52.9	170.7	174.3	160.5	1.00	18.33	2162
92	2.23		52.9	170.9	174.5	160.7	1.00	18.60	2197
93	2.22		52.8	170.8	174.3	160.6	1.00	18.54	2190
94	2.22		52.6	170.6	174.1	160.5	1.00	18.55	2191
95	2.21		52.6	170.5	174.0	160.3	1.00	18.47	2180

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
96	2.21		52.6	170.2	173.7	160.1	1.00	18.47	2174
97	2.24		52.7	170.3	173.8	160.1	1.00	18.68	2199
98	2.22		52.6	170.2	173.8	160.0	1.00	18.55	2184
99	2.23		52.7	169.9	173.5	159.8	1.00	18.60	2182
100	2.18		52.8	169.9	173.3	159.8	1.00	18.20	2133
101	2.21		52.9	170.1	173.4	160.1	1.00	18.41	2160
102	2.17		53.0	169.7	173.1	159.9	1.00	18.11	2116
103	2.24		53.0	169.6	172.9	159.3	1.00	18.68	2180
104	2.22		53.0	169.2	172.6	159.0	1.00	18.51	2153
105	2.23		53.0	169.0	172.3	158.9	1.00	18.63	2164
106	2.24		53.1	168.7	172.2	158.6	1.00	18.67	2161
107	2.25		53.1	168.5	172.0	158.4	1.00	18.73	2164
108	1.97		53.2	169.2	171.9	159.9	1.00	16.41	1905
109	1.93		53.0	169.3	171.8	160.0	1.00	16.13	1878
110	1.94		52.9	169.6	172.1	160.3	1.00	16.20	1893
111	2.00		52.8	169.6	172.3	160.1	1.00	16.70	1953
112	2.00		52.9	169.7	172.4	160.2	1.00	16.66	1948
113	1.96		53.0	170.0	172.7	160.5	1.00	16.37	1918
114	1.94		53.0	170.2	172.7	160.8	1.00	16.14	1893
115	2.00		53.1	170.3	173.0	160.9	1.00	16.66	1955
116	1.97		53.2	170.7	173.4	161.2	1.00	16.43	1933
117	2.00		53.3	170.9	173.6	161.3	1.00	16.67	1963
118	1.99		53.3	171.4	174.0	161.8	1.00	16.60	1963
119	1.94		53.4	171.7	174.3	162.2	1.00	16.20	1918
120	2.01		53.4	172.0	174.6	162.3	1.00	16.77	1992
121	1.99		53.4	172.3	175.0	162.7	1.00	16.57	1973
122	2.00		53.3	172.4	175.3	162.9	1.00	16.69	1991
123	1.98		53.3	172.7	175.4	163.1	1.00	16.50	1973
124	2.01		53.4	173.0	175.7	163.3	1.00	16.73	2003
125	1.99		53.4	173.1	175.9	163.4	1.00	16.62	1992
126	2.00		53.2	173.2	175.9	163.6	1.00	16.68	2004
127	2.00		53.2	173.3	176.1	163.6	1.00	16.70	2008
128	1.94		53.1	173.3	176.2	163.8	1.00	16.21	1951
129	1.89		53.0	173.4	176.2	164.0	1.00	15.75	1899
130	2.00		53.0	173.4	176.2	163.7	1.00	16.65	2007
131	1.99		52.7	173.7	176.3	163.9	1.00	16.56	2006
132	1.99		52.5	173.7	176.4	163.8	1.00	16.57	2011
133	1.99		52.5	173.4	176.1	163.4	1.00	16.59	2008
134	1.98		52.5	173.4	176.1	163.5	1.00	16.55	2003
135	2.00		52.6	173.1	175.8	163.3	1.00	16.66	2010
136	1.99		52.7	173.0	175.7	163.1	1.00	16.62	2001
137	2.00		52.8	173.1	175.6	163.1	1.00	16.70	2012
138	1.95		52.9	173.1	175.5	163.2	1.00	16.28	1960
139	1.95		53.0	172.8	175.3	163.0	1.00	16.25	1949
140	2.00		53.0	172.5	175.1	162.7	1.00	16.64	1991
141	2.03		53.1	172.7	175.3	162.9	1.00	16.94	2028
142	1.96		53.1	172.5	175.1	162.7	1.00	16.31	1950
143	2.01		53.1	172.2	174.9	162.5	1.00	16.78	2001

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 1

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
144	2.00		53.2	172.3	175.1	162.7	1.00	16.68	1989
145	1.96		53.3	171.9	174.5	162.4	1.00	16.38	1945
146	1.98		53.3	171.7	174.4	162.1	1.00	16.52	1958
147	1.93		53.3	171.7	174.2	162.1	1.00	16.07	1906
148	2.00		53.4	171.2	173.8	161.6	1.00	16.69	1969
149	2.00		53.3	170.9	173.6	161.4	1.00	16.64	1959
150	1.98		53.1	170.5	173.1	161.0	1.00	16.49	1938
151	1.99		52.9	170.2	172.9	160.6	1.00	16.63	1953
Average	2.06	#DIV/0!	53	171	174	161	1.00	17.18	2029
								TOTAL:	**306422**

LAB SAMPLE DATA - ASTM E2515

Client: 0
Model: 0
Run #: 0

Job #: 0
Tracking #: 0
Technician: 0
Date: 1/0/1900

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	**A**	G01193	229.5	231.1	1.6
	B	G01194	228.0	229.9	1.9
	C - 1st Hour	G01195	228.3	229.6	1.3
	Amb	G01196	227.8	228.1	0.3
Probes	**A**	16A	116380.1	116380.1	0.0
	B	16B	115862.7	115862.7	0.0
	C - 1st Hour	16C	114148.0	114148.1	0.1
O-rings	**A**	16A	3572.2	3572.4	0.2
	B	16B	3637.5	3637.5	0.0
	C - 1st Hour	16C	3601.1	3601.3	0.2

Placed in Dessicator on:	1/8/2025

Balance Audit (mg):		200.0		200.0		200.0			
		Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time
Filters	**A**	231.0	1/13 10:45	231.1	1/15 13:00				
	B	229.7	1/13 10:45	229.9	1/15 13:00				
	C - 1st Hour	229.5	1/13 10:45	229.6	1/15 13:00				
	Amb	228.1	1/13 10:45	228.1	1/15 13:00				
Probes	**A**	116380.1	1/13 10:45	116380.1	1/15 13:00				
	B	115862.7	1/13 10:45	115862.7	1/15 13:00				
	C - 1st Hour	114148.1	1/13 10:45	114148.1	1/15 13:00				
O-Rings	**A**	3572.7	1/13 10:45	3572.4	1/15 13:00	3572.4	1/20 10:00		
	B	3637.8	1/13 10:45	3637.5	1/15 13:00	3637.5	1/20 10:00		
	C - 1st Hour	3601.6	1/13 10:45	3601.2	1/15 13:00	3601.3	1/20 10:00		

Train A Aggregate, mg:	**1.8**
Train B Aggregate, mg:	**1.9**
Train C Aggregate, mg:	**1.6**
Ambient, mg:	**0.3**

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 1 Test Date: 1/8/24

Wood Heater Run Notes

Pre-Test Notes
Pre-Test Start Time: 9:18
Target Load (BTU/hr): 125,000

Time	Notes
	-None-

Test Notes
Test Burn Start Time: 10:48
Target Load (BTU/hr): 125,000 (Category 4)

Time	Notes
	-None

Test Burn End Time: 13:19

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 17.00 CO (%): 4.002
Mid Gas CO_2 (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	9:31	9:32	9:33	1/9 9:10	1/9 9:11	1/9 9:12
CO_2	0.00	17.00	10.09	0.01	17.18	10.42
CO	0.000	4.001	2.509	0.003	4.007	2.549

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

Technician Signature:  Date: 1/20/25

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 1 Test Date: 1/8/24

Test Photos



Preburn Fuel Load



Test Fuel Load



Test Fuel Loaded

Technician Signature: _____ Date: 1/20/25

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 2 Data Summary

Client:	Alternate Heating
Model:	SE110
Job #:	24-350
Tracking #:	217
Test Date:	1/8/2024

Technician Signature — Date: 2/24/2025

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	286.931	153.995	149.170	10.204
Average Gas Velocity in Dilution Tunnel (ft/sec)	17.4			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	48695.6			
Average Gas Meter Temperature (°F)	63.7	89.3	89.4	76.7
Total Sample Volume (dscf)	292.725	150.651	145.334	10.180
Average Tunnel Temperature (°F)	70.3			
Total Time of Test (min)	942			
Total Particulate Catch (mg)	0.3	2.2	1.9	0.3
Particulate Concentration, dry-standard (g/dscf)	0.0000010	0.0000146	0.0000131	0.0000295
Total PM Emissions (g)	0.78	10.38	9.21	1.39
Particulate Emission Rate (g/hr)	0.05	0.66	0.59	1.39
Emissions Factor (g/kg)	-	0.50	0.44	-
Difference from Average Total Particulate Emissions (g)	-	0.58	0.58	-
Difference from Average Total Particulate Emissions (%)		6.0%	6.0%	
Difference from Average Emissions Factor (g/kg)	-	0.03	0.03	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	171.7
Appliance Average Final Temperature (F)	185.6
Heat Output (BTU)	255,689
Heat Output Rate (BTU/hr)	16,286
Heat Input - HHV (BTU)	392,197
Heat Input - LHV (BTU)	364,287

Emissions Rates and Factors

Total Particulate Emissions (g)	9.8
Emissions Factor (g/MJ)	0.0363
Emissions Factor (g/kg)	0.4726
Emissions Rate (g/hr)	0.62
Emissions Rate (lb/mmbtu output)	0.084
HHV Delivered Efficiency (%)	65.2%
LHV Delivered Efficiency (%)	70.2%
HHV SLM Efficiency (%)	77.5%
LHV SLM Efficiency (%)	82.9%
CO Emissions (g/min)	1.73

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	71.4	OK
Face Velocity	< 30 ft/min	8.9	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 62.5 / Max: 67.1	OK
Negative Probe Weight Evaluation	<5% of Total Catch	OK	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Return Temp > 120°F	>120°F	151.0	OK

B415.1 Efficiency Results

Manufacturer: Alternate Heating
Model: SE110
Date: 01/08/24
Run: 2
Control #: 24-350
Test Duration: 942
Output Category: 1

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	77.5%	82.9%
Combustion Efficiency	95.8%	95.8%
Heat Transfer Efficiency	80.9%	86.5%

Output Rate (kJ/h)	20,372	19,325	**(Btu/h)**
Burn Rate (kg/h)	1.32	2.90	**(lb/h)**
Input (kJ/h)	26,287	24,936	**(Btu/h)**

Test Load Weight (dry kg)	20.68	45.57	**dry lb**
MC wet (%)	17.74		
MC dry (%)	21.57		
Particulate (g)	9.80		
CO (g)	1,626		
Test Duration (h)	15.70		

Emissions	Particulate	CO
g/MJ Output	0.03	5.08
g/kg Dry Fuel	0.47	78.65
g/h	0.62	103.59
g/min	0.01	1.73
lb/MM Btu Output	0.07	11.82

Air/Fuel Ratio (A/F)	50.99

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

BOILER CORDWOOD FUEL DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

Firebox Volume (ft^3): 5.62
Target Load Weight (lbs): 56.20

Minimun Piece Weight (lbs): 4.40
Maximun Piece Weight (lbs): 17.60
80% of piece of weight range (lbs): 6.6 to 15.4

Pretest Fuel Information

Length (in)	Weight (lbs)	MC (%DB)	Length (in)	Weight (lbs)	MC (%DB)
24.00	6.66	21.7			
24.00	10.40	26.5			
24.00	12.58	25.3			

Total Preburn Weight (lbs): 29.64
Averge Preburn Moisture (% DB): 24.50

Test Fuel Information

Length (in)	Weight (lbs)	Moisture Content (%DB)					Avg MC (%DB)	Dry Weight (lbs)
24.00	9.11	26.1	26.8	19.1	20.9	18.6	22.30	7.45
24.00	8.14	21.8	21.9	18.3	21.2	18.4	20.32	6.77
24.00	7.20	20.5	18.4	20.5	19.1	19.4	19.58	6.02
24.00	7.79	25.3	24.6	26.0	23.5	23.9	24.66	6.25
24.00	10.97	20.6	20.1	18.8	20.5	25.8	21.16	9.05
24.00	12.23	24.0	21.6	18.5	18.6	24.8	21.50	10.07

Total (lbs): 55.44
Load Density (lbs/ft3): 9.86

Total Dry Weight (lbs): 45.60

Quality checks

Individual Piece Weights: OK
80% Piece weight range: OK

Allowable Coal Bed Range (10-20%): 5.5 - 11.1

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client:	Alternate Heating	Job #:	24-350
Model:	SE110	Tracking #:	217
Run #:	2	Technician:	AK
Test Start Time:	15:19	Date:	1/8/2024
Manufacturer's Rated Output (BTU/hr):	125,000		

Total Sampling Time (min):	942		
Recording Interval (min):	1		
Meter Box γ Factor:	1.003 (A)		
Meter Box γ Factor:	0.999 (B)		
Meter Box γ Factor:	1.000 (Ambient)		
Meter Box γ Factor:	1.000 (C)		
Induced Draft Check (in. H_2O):	0		
Smoke Capture Check (%):	100%		
Date Flue Pipe Last Cleaned:	1/6/2024		
Boiler Dry Weight (lbs):	1470		
Supply Side Water Weight (lbs):	970		

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.27	30.31	30.29
Relative Humidity (%)	27.7	32.5	
Room Air Velocity (ft/min)	<50	<50	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		286.931	ft^3

Sample Train Post-Test Leak Checks

	Pre-test	Post-test			
(A)	0.000	0.000	cfm @	-7	in. Hg
(B)	0.000	0.000	cfm @	-8	in. Hg
(C)	0.000	0.001	cfm @	-6	in. Hg
(Ambient)	0.000	0.000	cfm @	-13	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.046	83
2	0.074	83
3	0.076	83
4	0.076	83
5	0.072	83
6	0.060	83
7	0.060	83
8	0.070	83
9	0.076	83
10	0.076	83
11	0.074	83
12	0.064	83
Center	0.076	83

Static Pressure: -0.230 in. H_2O

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	12	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.7854	ft^2
V_{strav}:	17.47	ft/sec
V_{scent}:	18.43	ft/sec
F_p:	0.948	[ratio]
Initial Tunnel Flow:	793.6	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

Fuel Type:	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

Actual Fuel Used Properties

Fuel Type:	Maple
HHV (kJ/kg)	19,960
%C	50.64
%H	6.02
%O	41.74
%Ash	1.35
MC (%DB)	21.6%

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.076	0.57	76.4	-1.31		55.4		70	96	66	65
1	0.141	0.141	0.074	1.19	75.2	-1.98	91	55.0	-0.4	74	156	66	66
2	0.306	0.165	0.075	1.16	74.9	-1.77	106	54.6	-0.4	75	186	66	65
3	0.472	0.166	0.073	1.16	74.8	-1.53	108	54.5	-0.1	72	145	67	66
4	0.635	0.163	0.072	1.17	74.7	-1.34	106	54.4	-0.1	71	123	67	66
5	0.799	0.164	0.076	1.17	74.6	-1.21	104	54.5	0.1	71	109	67	66
6	0.964	0.165	0.076	1.14	74.6	-1.12	105	54.4	-0.1	71	100	67	66
7	1.127	0.163	0.075	1.17	74.5	-1.11	104	54.3	-0.1	71	95	67	66
8	1.290	0.163	0.075	1.14	74.9	-1.11	104	54.3	0	71	90	67	66
9	1.455	0.165	0.073	1.16	75.4	-1.12	107	54.3	0	71	87	67	66
10	1.617	0.162	0.077	1.11	74.9	-1.14	102	54.2	-0.1	71	84	67	66
11	1.780	0.163	0.076	1.16	75.2	-1.16	103	54.1	-0.1	71	82	67	66
12	1.944	0.164	0.075	1.14	75.4	-1.17	105	54.1	0	71	80	67	66
13	2.106	0.162	0.077	1.15	74.8	-1.17	102	54.1	0	71	79	67	66
14	2.269	0.163	0.074	1.15	75.0	-1.2	105	54.2	0.1	71	78	67	66
15	2.432	0.163	0.073	1.15	75.7	-1.21	105	54.2	0	71	77	67	66
16	2.594	0.162	0.075	1.14	75.9	-1.24	103	54.2	0	71	76	67	66
17	2.758	0.164	0.076	1.16	75.9	-1.24	104	54.2	0	71	75	67	66
18	2.919	0.161	0.076	1.16	75.4	-1.25	102	54.2	0	71	75	68	66
19	3.082	0.163	0.074	1.15	75.7	-1.25	105	54.1	-0.1	71	74	68	66
20	3.245	0.163	0.074	1.15	76.5	-1.26	105	54.1	0	71	74	68	66
21	3.406	0.161	0.074	1.15	76.7	-1.27	103	54.1	0	71	74	68	67
22	3.570	0.164	0.073	1.15	76.2	-1.28	106	54.1	0	71	73	68	67
23	3.731	0.161	0.075	1.14	76.7	-1.3	103	54.2	0.1	71	73	68	67
24	3.893	0.162	0.075	1.14	77.2	-1.32	103	54.1	-0.1	71	73	68	67
25	4.056	0.163	0.077	1.14	76.7	-1.33	102	54.0	-0.1	71	73	68	67
26	4.217	0.161	0.077	1.15	77.6	-1.35	101	53.9	-0.1	71	73	68	67
27	4.380	0.163	0.077	1.16	77.8	-1.35	102	54.0	0.1	71	72	68	67
28	4.541	0.161	0.075	1.19	78.0	-1.37	102	54.2	0.2	71	72	68	67
29	4.704	0.163	0.075	1.15	77.6	-1.4	104	54.2	0	71	72	68	67
30	4.866	0.162	0.077	1.14	78.1	-1.42	102	54.2	0	71	72	68	67
31	5.027	0.161	0.076	1.14	78.4	-1.44	102	54.1	-0.1	71	72	68	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	5.191	0.164	0.078	1.13	78.9	-1.45	102	54.1	0	71	72	68	67
33	5.352	0.161	0.075	1.13	79.1	-1.47	102	54.2	0.1	71	72	68	67
34	5.515	0.163	0.077	1.13	79.4	-1.49	102	54.2	0	71	72	68	67
35	5.676	0.161	0.076	1.15	79.6	-1.5	101	54.3	0.1	71	72	68	67
36	5.838	0.162	0.076	1.14	79.2	-1.52	102	54.3	0	71	72	68	67
37	6.001	0.163	0.075	1.16	80.1	-1.52	103	54.4	0.1	71	72	68	67
38	6.162	0.161	0.075	1.12	79.6	-1.55	102	54.3	-0.1	71	72	68	67
39	6.326	0.164	0.076	1.14	80.6	-1.57	103	54.3	0	71	72	68	67
40	6.487	0.161	0.076	1.13	80.0	-1.59	101	54.1	-0.2	71	72	68	67
41	6.649	0.162	0.078	1.13	80.4	-1.61	101	54.1	0	71	72	68	67
42	6.812	0.163	0.075	1.14	80.4	-1.62	103	54.1	0	71	72	68	67
43	6.973	0.161	0.077	1.14	81.4	-1.63	100	54.1	0	71	72	68	67
44	7.137	0.164	0.077	1.14	81.6	-1.64	102	54.1	0	71	72	68	67
45	7.298	0.161	0.075	1.14	81.8	-1.67	102	54.1	0	70	72	68	67
46	7.460	0.162	0.076	1.14	81.8	-1.67	102	54.1	0	70	71	69	67
47	7.623	0.163	0.076	1.15	81.6	-1.69	102	54.1	0	70	72	69	67
48	7.785	0.162	0.077	1.14	82.1	-1.72	101	54.1	0	70	72	69	67
49	7.948	0.163	0.077	1.16	81.8	-1.71	102	54.1	0	70	71	69	67
50	8.110	0.162	0.076	1.14	82.1	-1.72	101	54.2	0.1	70	72	69	67
51	8.272	0.162	0.076	1.15	83.0	-1.75	101	54.1	-0.1	70	72	69	67
52	8.435	0.163	0.077	1.14	82.6	-1.76	101	54.1	0	70	72	69	67
53	8.597	0.162	0.076	1.15	82.8	-1.78	101	54.1	0	70	72	69	67
54	8.760	0.163	0.079	1.14	83.6	-1.79	100	54.0	-0.1	70	71	69	67
55	8.922	0.162	0.075	1.14	83.4	-1.79	102	54.1	0.1	70	72	69	67
56	9.084	0.162	0.076	1.15	83.4	-1.8	101	54.1	0	70	71	69	67
57	9.248	0.164	0.078	1.15	84.2	-1.82	101	54.2	0.1	70	71	69	67
58	9.409	0.161	0.078	1.14	84.5	-1.84	99	54.1	-0.1	70	71	69	67
59	9.573	0.164	0.076	1.15	84.7	-1.85	102	54.1	0	70	71	69	67
60	9.735	0.162	0.077	1.11	84.6	-1.86	100	54.1	0	70	71	69	67
61	9.897	0.162	0.076	1.15	84.3	-1.87	101	54.2	0.1	71	71	69	67
62	10.061	0.164	0.076	1.14	85.2	-1.91	102	54.2	0	71	71	69	67
63	10.223	0.162	0.078	1.14	84.6	-1.89	100	54.2	0	71	71	69	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	10.386	0.163	0.076	1.14	85.0	-1.91	102	54.1	-0.1	71	71	69	67
65	10.549	0.163	0.078	1.14	85.0	-1.88	100	54.1	0	71	71	69	67
66	10.711	0.162	0.077	1.14	85.2	-1.93	100	54.2	0.1	71	71	69	67
67	10.875	0.164	0.079	1.16	85.3	-1.92	100	54.1	-0.1	70	71	69	67
68	11.037	0.162	0.077	1.14	85.4	-1.96	100	54.1	0	71	71	69	67
69	11.200	0.163	0.077	1.14	86.4	-1.99	101	54.1	0	70	71	69	67
70	11.363	0.163	0.078	1.15	86.6	-1.96	100	54.1	0	71	71	69	67
71	11.525	0.162	0.076	1.15	85.9	-1.99	101	54.0	-0.1	70	71	69	67
72	11.689	0.164	0.078	1.13	86.8	-2.01	101	53.9	-0.1	70	71	69	67
73	11.852	0.163	0.078	1.10	86.3	-2	100	53.9	0	70	71	69	67
74	12.014	0.162	0.079	1.14	87.1	-2.03	99	54.1	0.2	70	71	69	67
75	12.178	0.164	0.078	1.14	86.9	-2.02	100	54.1	0	70	71	69	67
76	12.341	0.163	0.077	1.15	87.3	-2	100	54.1	0	70	71	69	67
77	12.503	0.162	0.078	1.14	86.8	-2.04	99	54.1	0	70	71	69	67
78	12.668	0.165	0.077	1.13	86.9	-2.05	102	54.1	0	70	71	69	67
79	12.830	0.162	0.077	1.14	87.5	-2.06	100	54.2	0.1	70	71	69	67
80	12.994	0.164	0.077	1.14	87.9	-2.06	101	54.1	-0.1	70	71	69	67
81	13.157	0.163	0.079	1.14	87.2	-2.09	99	54.1	0	70	71	69	67
82	13.319	0.162	0.076	1.16	87.9	-2.09	100	54.1	0	70	71	69	67
83	13.484	0.165	0.078	1.13	87.6	-2.11	101	54.2	0.1	70	71	69	66
84	13.646	0.162	0.076	1.16	88.3	-2.15	100	54.2	0	70	71	69	66
85	13.809	0.163	0.078	1.15	87.7	-2.15	100	54.2	0	70	71	69	66
86	13.974	0.165	0.077	1.15	88.4	-2.13	101	54.1	-0.1	70	71	69	66
87	14.136	0.162	0.077	1.12	88.7	-2.14	100	54.1	0	70	71	69	66
88	14.299	0.163	0.078	1.14	87.9	-2.14	100	54.1	0	70	71	69	66
89	14.464	0.165	0.076	1.14	88.1	-2.17	102	54.1	0	70	71	69	66
90	14.626	0.162	0.077	1.16	88.3	-2.17	100	54.1	0	70	71	69	66
91	14.790	0.164	0.078	1.15	88.4	-2.19	100	54.2	0.1	70	71	69	66
92	14.954	0.164	0.077	1.15	89.2	-2.2	101	54.1	-0.1	70	70	69	66
93	15.116	0.162	0.075	1.13	88.4	-2.18	101	54.2	0.1	70	70	69	66
94	15.281	0.165	0.079	1.15	89.2	-2.23	100	54.1	-0.1	70	70	69	66
95	15.444	0.163	0.078	1.16	88.6	-2.22	100	54.1	0	70	70	69	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	15.607	0.163	0.077	1.14	88.8	-2.23	100	54.1	0	70	71	69	66
97	15.772	0.165	0.077	1.15	89.3	-2.24	101	54.1	0	70	71	69	66
98	15.934	0.162	0.076	1.14	89.7	-2.26	100	54.1	0	70	70	69	66
99	16.097	0.163	0.078	1.13	89.7	-2.27	99	54.1	0	70	71	69	66
100	16.262	0.165	0.078	1.14	89.5	-2.25	101	54.1	0	70	71	69	66
101	16.425	0.163	0.077	1.14	89.5	-2.26	100	54.1	0	70	71	69	66
102	16.588	0.163	0.077	1.15	90.1	-2.28	100	54.1	0	70	71	69	66
103	16.753	0.165	0.076	1.14	89.5	-2.32	102	54.1	0	70	70	69	66
104	16.916	0.163	0.076	1.14	89.5	-2.31	101	54.0	-0.1	70	71	69	66
105	17.079	0.163	0.077	1.14	89.6	-2.3	100	54.0	0	70	71	69	66
106	17.244	0.165	0.076	1.15	89.7	-2.32	102	54.1	0.1	70	70	69	66
107	17.406	0.162	0.079	1.14	90.2	-2.34	98	54.1	0	70	70	69	66
108	17.570	0.164	0.077	1.15	89.8	-2.34	101	54.2	0.1	70	70	69	66
109	17.734	0.164	0.078	1.15	89.9	-2.34	100	54.0	-0.2	70	70	69	66
110	17.897	0.163	0.077	1.17	90.1	-2.38	100	54.0	0	70	70	69	66
111	18.062	0.165	0.077	1.17	90.7	-2.39	101	54.0	0	69	70	68	66
112	18.226	0.164	0.079	1.15	90.5	-2.35	99	54.1	0.1	69	70	68	66
113	18.388	0.162	0.078	1.14	90.1	-2.4	99	54.1	0	69	70	68	66
114	18.553	0.165	0.076	1.16	90.2	-2.42	102	54.0	-0.1	69	70	68	66
115	18.717	0.164	0.079	1.12	91.0	-2.38	99	54.0	0	69	70	68	66
116	18.879	0.162	0.078	1.14	90.5	-2.39	99	54.0	0	69	70	68	66
117	19.044	0.165	0.078	1.15	90.7	-2.41	100	54.0	0	69	70	68	66
118	19.207	0.163	0.078	1.13	90.3	-2.41	99	54.0	0	69	70	68	66
119	19.371	0.164	0.078	1.14	90.4	-2.39	100	54.0	0	69	70	68	66
120	19.536	0.165	0.077	1.16	90.5	-2.46	101	54.1	0.1	69	70	68	66
121	19.699	0.163	0.077	1.14	90.5	-2.46	100	54.2	0.1	69	70	68	66
122	19.862	0.163	0.076	1.13	91.3	-2.48	100	54.2	0	69	70	68	66
123	20.027	0.165	0.078	1.16	90.8	-2.49	100	54.1	-0.1	69	70	68	66
124	20.190	0.163	0.077	1.15	90.6	-2.47	100	54.0	-0.1	69	70	68	65
125	20.354	0.164	0.078	1.15	90.7	-2.49	100	54.0	0	69	70	68	66
126	20.519	0.165	0.078	1.15	90.8	-2.48	100	54.1	0.1	69	70	68	66
127	20.682	0.163	0.078	1.13	90.9	-2.51	99	54.1	0	69	70	68	65

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	20.845	0.163	0.078	1.15	91.5	-2.52	99	54.1	0	69	70	68	65
129	21.010	0.165	0.077	1.17	91.2	-2.5	101	54.1	0	69	70	68	65
130	21.173	0.163	0.077	1.16	90.9	-2.52	100	54.1	0	69	70	68	65
131	21.337	0.164	0.077	1.14	91.0	-2.55	100	54.1	0	69	70	68	65
132	21.502	0.165	0.078	1.15	90.9	-2.54	100	54.1	0	69	70	68	65
133	21.665	0.163	0.078	1.14	91.4	-2.56	99	54.0	-0.1	69	70	68	65
134	21.829	0.164	0.077	1.15	91.7	-2.57	100	54.0	0	69	70	68	65
135	21.994	0.165	0.078	1.17	91.2	-2.58	100	54.0	0	69	69	68	65
136	22.157	0.163	0.077	1.15	91.1	-2.57	100	54.0	0	68	69	68	65
137	22.321	0.164	0.077	1.16	91.1	-2.6	100	54.0	0	68	69	68	65
138	22.486	0.165	0.078	1.12	91.8	-2.6	100	53.9	-0.1	68	69	68	65
139	22.649	0.163	0.078	1.15	91.8	-2.6	99	53.7	-0.2	71	127	68	65
140	22.812	0.163	0.077	1.15	91.3	-2.61	100	53.4	-0.3	73	168	68	65
141	22.977	0.165	0.079	1.14	92.0	-2.63	100	52.8	-0.6	75	206	68	65
142	23.140	0.163	0.078	1.15	91.4	-2.62	100	52.2	-0.6	77	232	68	65
143	23.303	0.163	0.077	1.15	91.4	-2.63	100	51.6	-0.6	78	252	68	65
144	23.467	0.164	0.077	1.14	92.0	-2.64	101	51.1	-0.5	79	267	68	65
145	23.629	0.162	0.079	1.14	91.5	-2.64	99	50.5	-0.6	78	272	68	65
146	23.793	0.164	0.077	1.15	91.3	-2.62	101	49.9	-0.6	79	278	68	65
147	23.957	0.164	0.078	1.14	91.3	-2.63	101	49.3	-0.6	79	286	68	65
148	24.119	0.162	0.078	1.13	91.3	-2.6	99	48.6	-0.7	80	294	68	65
149	24.284	0.165	0.079	1.15	92.0	-2.58	101	48.0	-0.6	80	301	68	65
150	24.446	0.162	0.076	1.15	91.4	-2.54	101	47.4	-0.6	81	310	68	65
151	24.609	0.163	0.079	1.15	91.8	-2.5	99	46.8	-0.6	82	318	68	65
152	24.773	0.164	0.077	1.15	91.5	-2.45	101	46.3	-0.5	82	321	68	65
153	24.936	0.163	0.078	1.09	91.6	-2.41	100	45.6	-0.7	82	325	68	65
154	25.098	0.162	0.076	1.13	91.5	-2.35	101	45.0	-0.6	82	325	68	65
155	25.254	0.156	0.076	1.15	91.6	-2.27	97	44.4	-0.6	83	329	68	65
156	25.417	0.163	0.076	1.16	91.5	-2.19	102	43.8	-0.6	83	333	68	65
157	25.581	0.164	0.076	1.14	91.5	-2.1	102	43.2	-0.6	83	335	68	65
158	25.743	0.162	0.076	1.12	91.9	-2.01	101	42.7	-0.5	83	336	68	65
159	25.908	0.165	0.077	1.17	92.2	-1.96	102	42.2	-0.5	83	337	68	65

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	26.070	0.162	0.077	1.14	92.3	-1.89	100	41.7	-0.5	84	337	69	65
161	26.233	0.163	0.075	1.14	92.3	-1.76	102	41.0	-0.7	84	341	69	65
162	26.398	0.165	0.078	1.16	92.4	-1.76	101	40.5	-0.5	84	340	69	65
163	26.560	0.162	0.077	1.12	92.4	-1.69	100	40.1	-0.4	76	240	69	65
164	26.724	0.164	0.078	1.14	92.3	-1.67	100	40.0	-0.1	74	198	69	65
165	26.889	0.165	0.078	1.15	92.2	-1.59	100	39.8	-0.2	73	174	69	65
166	27.052	0.163	0.077	1.13	92.3	-1.55	100	39.6	-0.2	72	159	69	65
167	27.215	0.163	0.077	1.16	91.5	-1.54	100	39.5	-0.1	72	148	69	65
168	27.380	0.165	0.080	1.15	92.1	-1.47	99	39.5	0	71	139	68	65
169	27.543	0.163	0.078	1.15	92.2	-1.47	99	39.7	0.2	71	131	69	65
170	27.707	0.164	0.077	1.15	92.3	-1.44	100	39.7	0	71	124	68	65
171	27.872	0.165	0.076	1.16	92.3	-1.43	102	39.6	-0.1	71	117	68	65
172	28.035	0.163	0.077	1.14	91.6	-1.42	100	39.6	0	71	111	68	65
173	28.198	0.163	0.078	1.14	91.8	-1.44	99	39.6	0	71	106	68	65
174	28.364	0.166	0.077	1.15	92.5	-1.43	101	39.5	-0.1	71	102	68	65
175	28.527	0.163	0.079	1.15	91.8	-1.46	98	39.5	0	70	98	68	65
176	28.690	0.163	0.078	1.16	91.8	-1.51	99	39.5	0	70	94	68	65
177	28.856	0.166	0.077	1.15	92.3	-1.46	101	39.5	0	70	91	68	65
178	29.019	0.163	0.079	1.14	91.7	-1.53	98	39.6	0.1	70	89	68	65
179	29.182	0.163	0.079	1.15	92.1	-1.49	98	39.5	-0.1	70	87	68	65
180	29.348	0.166	0.078	1.13	92.4	-1.52	101	39.4	-0.1	70	85	68	65
181	29.511	0.163	0.077	1.17	92.2	-1.61	100	39.4	0	70	83	68	65
182	29.674	0.163	0.077	1.14	91.7	-1.64	100	39.5	0.1	70	82	68	65
183	29.839	0.165	0.078	1.15	92.1	-1.63	100	39.6	0.1	70	81	68	65
184	30.002	0.163	0.078	1.15	91.7	-1.68	99	39.6	0	70	80	68	65
185	30.166	0.164	0.078	1.14	91.8	-1.71	100	39.5	-0.1	70	79	68	65
186	30.331	0.165	0.078	1.15	92.3	-1.75	100	39.5	0	70	78	68	65
187	30.494	0.163	0.078	1.15	91.8	-1.77	99	39.6	0.1	70	78	68	65
188	30.658	0.164	0.078	1.15	92.3	-1.78	99	39.6	0	70	77	68	65
189	30.823	0.165	0.078	1.16	91.6	-1.8	100	39.5	-0.1	70	76	68	65
190	30.986	0.163	0.076	1.15	92.1	-1.87	100	39.5	0	70	76	68	65
191	31.150	0.164	0.079	1.15	92.4	-1.89	99	39.6	0.1	69	76	68	65

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
192	31.315	0.165	0.078	1.15	92.5	-1.9	100	39.6	0	70	75	68	65
193	31.478	0.163	0.076	1.15	92.4	-1.94	100	39.5	-0.1	70	75	68	65
194	31.641	0.163	0.078	1.14	91.8	-1.93	99	39.5	0	70	75	68	65
195	31.806	0.165	0.077	1.16	92.5	-1.98	101	39.5	0	70	74	68	65
196	31.969	0.163	0.076	1.15	91.8	-2	100	39.5	0	70	74	67	65
197	32.133	0.164	0.077	1.15	92.3	-2	100	39.4	-0.1	70	74	67	65
198	32.298	0.165	0.078	1.15	91.8	-2.06	100	39.4	0	70	74	67	65
199	32.461	0.163	0.078	1.14	91.7	-2.07	99	39.6	0.2	69	73	67	65
200	32.625	0.164	0.079	1.15	92.1	-2.1	99	39.6	0	69	73	67	65
201	32.790	0.165	0.077	1.15	91.6	-2.11	101	39.6	0	69	73	67	65
202	32.953	0.163	0.077	1.15	91.9	-2.17	100	39.6	0	69	73	67	65
203	33.117	0.164	0.076	1.16	91.9	-2.17	101	39.6	0	69	73	67	65
204	33.282	0.165	0.078	1.15	91.6	-2.18	100	39.4	-0.2	69	72	67	65
205	33.445	0.163	0.078	1.16	91.5	-2.19	99	39.4	0	69	72	67	65
206	33.609	0.164	0.076	1.18	91.6	-2.21	101	39.5	0.1	70	72	67	65
207	33.774	0.165	0.079	1.13	91.7	-2.24	100	39.6	0.1	69	72	67	65
208	33.937	0.163	0.080	1.15	91.7	-2.23	98	39.6	0	69	72	67	65
209	34.101	0.164	0.077	1.15	92.4	-2.24	100	39.6	0	69	72	67	65
210	34.265	0.164	0.078	1.15	91.6	-2.26	100	39.6	0	69	72	67	65
211	34.428	0.163	0.079	1.15	91.9	-2.28	98	39.6	0	69	72	67	65
212	34.593	0.165	0.078	1.15	92.1	-2.32	100	39.6	0	69	71	67	65
213	34.757	0.164	0.078	1.15	91.7	-2.31	100	39.6	0	69	71	67	65
214	34.920	0.163	0.079	1.14	92.2	-2.33	98	39.6	0	69	71	67	65
215	35.085	0.165	0.078	1.15	92.4	-2.35	100	39.6	0	69	71	67	65
216	35.249	0.164	0.074	1.15	92.2	-2.34	102	39.6	0	69	71	67	65
217	35.412	0.163	0.079	1.15	91.7	-2.37	98	39.6	0	69	71	67	65
218	35.577	0.165	0.079	1.15	92.3	-2.38	99	39.5	-0.1	69	71	67	65
219	35.741	0.164	0.077	1.15	91.7	-2.4	100	39.6	0.1	69	71	67	65
220	35.904	0.163	0.077	1.15	91.6	-2.42	100	39.6	0	69	71	67	65
221	36.069	0.165	0.078	1.17	91.9	-2.41	100	39.6	0	69	71	67	65
222	36.233	0.164	0.077	1.15	91.5	-2.43	100	39.6	0	69	71	67	65
223	36.396	0.163	0.078	1.15	91.5	-2.44	99	39.6	0	69	71	67	65

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
224	36.561	0.165	0.079	1.17	91.6	-2.43	99	39.6	0	69	71	67	65
225	36.725	0.164	0.077	1.15	92.3	-2.43	100	39.6	0	69	70	67	65
226	36.888	0.163	0.078	1.12	91.8	-2.47	99	39.5	-0.1	69	71	67	65
227	37.053	0.165	0.077	1.15	91.7	-2.47	101	39.5	0	69	70	67	65
228	37.217	0.164	0.076	1.15	91.4	-2.49	101	39.5	0	69	70	67	65
229	37.380	0.163	0.078	1.15	92.3	-2.49	99	39.6	0.1	69	70	67	65
230	37.545	0.165	0.078	1.14	91.9	-2.51	100	39.6	0	69	70	67	65
231	37.709	0.164	0.078	1.16	91.7	-2.5	100	39.6	0	69	70	67	65
232	37.872	0.163	0.079	1.14	92.2	-2.49	98	39.6	0	69	70	67	65
233	38.037	0.165	0.078	1.16	91.4	-2.51	100	39.6	0	69	70	67	65
234	38.201	0.164	0.078	1.14	92.2	-2.53	99	39.7	0.1	69	70	67	65
235	38.364	0.163	0.079	1.18	91.4	-2.53	98	39.7	0	69	70	67	64
236	38.529	0.165	0.079	1.15	92.1	-2.55	99	39.7	0	69	70	67	64
237	38.693	0.164	0.079	1.16	92.1	-2.55	99	39.6	-0.1	69	70	67	65
238	38.856	0.163	0.078	1.15	91.6	-2.54	99	39.6	0	69	70	67	64
239	39.021	0.165	0.079	1.15	91.6	-2.56	100	39.6	0	69	70	67	65
240	39.185	0.164	0.076	1.15	91.4	-2.55	101	39.6	0	69	70	67	65
241	39.348	0.163	0.077	1.15	91.8	-2.59	100	39.6	0	69	70	67	65
242	39.513	0.165	0.077	1.13	91.8	-2.58	101	39.6	0	69	70	67	65
243	39.677	0.164	0.079	1.15	92.2	-2.6	99	39.5	-0.1	69	70	67	65
244	39.840	0.163	0.077	1.16	91.6	-2.59	100	39.6	0.1	69	70	67	65
245	40.005	0.165	0.078	1.15	92.2	-2.58	100	39.5	-0.1	69	70	67	65
246	40.169	0.164	0.079	1.15	91.4	-2.59	99	39.6	0.1	69	70	67	64
247	40.332	0.163	0.078	1.15	91.5	-2.6	99	39.7	0.1	69	69	67	64
248	40.497	0.165	0.079	1.15	91.4	-2.61	100	39.6	-0.1	69	69	67	64
249	40.661	0.164	0.077	1.14	92.1	-2.6	100	39.5	-0.1	69	69	67	64
250	40.825	0.164	0.080	1.15	92.2	-2.62	98	39.5	0	69	70	67	64
251	40.989	0.164	0.078	1.14	91.4	-2.62	100	39.6	0.1	69	69	67	64
252	41.153	0.164	0.078	1.14	92.1	-2.65	99	39.6	0	69	69	67	64
253	41.317	0.164	0.076	1.15	91.3	-2.63	101	39.6	0	69	69	67	64
254	41.481	0.164	0.079	1.14	91.7	-2.66	99	39.5	-0.1	69	69	67	64
255	41.646	0.165	0.079	1.14	92.1	-2.65	99	39.5	0	69	69	67	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
256	41.809	0.163	0.078	1.16	92.0	-2.66	99	39.5	0	68	69	66	64
257	41.973	0.164	0.079	1.16	91.3	-2.65	99	39.7	0.2	68	69	67	64
258	42.138	0.165	0.078	1.12	91.2	-2.66	100	39.7	0	69	69	67	64
259	42.301	0.163	0.076	1.15	91.3	-2.68	100	39.8	0.1	69	69	67	64
260	42.465	0.164	0.077	1.15	92.0	-2.67	100	39.7	-0.1	69	69	67	64
261	42.630	0.165	0.078	1.15	91.8	-2.66	100	39.6	-0.1	69	69	67	64
262	42.793	0.163	0.079	1.14	91.2	-2.68	98	39.7	0.1	69	69	67	64
263	42.957	0.164	0.077	1.13	91.3	-2.68	100	39.7	0	69	69	67	64
264	43.122	0.165	0.077	1.12	92.0	-2.69	101	39.6	-0.1	69	69	66	64
265	43.285	0.163	0.078	1.13	92.0	-2.67	99	39.6	0	68	69	66	64
266	43.449	0.164	0.077	1.15	91.2	-2.7	100	39.6	0	68	69	66	64
267	43.614	0.165	0.079	1.15	91.2	-2.72	100	39.6	0	68	69	67	64
268	43.777	0.163	0.079	1.15	91.2	-2.7	98	39.6	0	68	69	66	64
269	43.941	0.164	0.075	1.14	91.9	-2.71	101	39.7	0.1	69	69	66	64
270	44.106	0.165	0.079	1.14	91.2	-2.7	100	39.7	0	69	69	66	64
271	44.269	0.163	0.078	1.15	92.0	-2.69	99	39.7	0	69	69	66	64
272	44.433	0.164	0.079	1.15	91.9	-2.71	99	39.6	-0.1	69	69	66	64
273	44.598	0.165	0.081	1.16	91.8	-2.71	98	39.6	0	69	69	66	64
274	44.761	0.163	0.079	1.14	91.2	-2.72	98	39.7	0.1	69	69	66	64
275	44.925	0.164	0.080	1.15	91.2	-2.71	98	39.6	-0.1	68	69	66	64
276	45.090	0.165	0.078	1.15	91.9	-2.72	100	39.7	0.1	68	69	66	64
277	45.254	0.164	0.078	1.15	91.5	-2.73	99	39.6	-0.1	68	69	66	64
278	45.417	0.163	0.076	1.17	91.4	-2.72	100	39.6	0	69	69	66	64
279	45.582	0.165	0.078	1.15	91.9	-2.74	100	39.5	-0.1	69	69	66	64
280	45.746	0.164	0.078	1.15	91.8	-2.73	100	39.6	0.1	69	69	66	64
281	45.909	0.163	0.076	1.16	92.0	-2.74	100	39.7	0.1	69	69	66	64
282	46.075	0.166	0.078	1.15	91.9	-2.74	101	39.8	0.1	69	69	66	64
283	46.238	0.163	0.080	1.15	91.8	-2.74	98	39.7	-0.1	69	69	66	64
284	46.401	0.163	0.078	1.15	91.4	-2.76	99	39.7	0	69	69	66	64
285	46.567	0.166	0.075	1.17	91.9	-2.75	103	39.7	0	68	69	66	64
286	46.730	0.163	0.077	1.17	91.1	-2.75	100	39.7	0	68	69	66	64
287	46.893	0.163	0.078	1.17	91.8	-2.76	99	39.6	-0.1	68	69	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
288	47.059	0.166	0.079	1.14	91.1	-2.74	100	39.6	0	69	69	66	64
289	47.222	0.163	0.077	1.15	91.8	-2.77	100	39.6	0	69	69	66	64
290	47.385	0.163	0.077	1.16	91.8	-2.77	100	39.6	0	69	69	66	64
291	47.550	0.165	0.078	1.13	91.8	-2.77	100	39.6	0	69	69	66	64
292	47.714	0.164	0.079	1.15	91.1	-2.77	99	39.6	0	69	69	66	64
293	47.877	0.163	0.078	1.15	91.9	-2.78	99	39.7	0.1	68	68	66	64
294	48.042	0.165	0.077	1.13	91.3	-2.77	101	39.7	0	68	69	66	64
295	48.206	0.164	0.078	1.15	91.8	-2.77	99	39.8	0.1	68	69	66	64
296	48.369	0.163	0.077	1.14	91.6	-2.78	100	39.8	0	69	69	66	64
297	48.535	0.166	0.075	1.15	91.1	-2.78	103	39.8	0	69	69	66	64
298	48.698	0.163	0.077	1.15	91.8	-2.79	100	39.6	-0.2	69	69	66	64
299	48.861	0.163	0.078	1.15	91.8	-2.79	99	39.6	0	69	69	66	64
300	49.027	0.166	0.080	1.15	91.8	-2.8	99	39.5	-0.1	69	69	66	64
301	49.190	0.163	0.079	1.15	91.3	-2.77	98	39.5	0	68	68	66	64
302	49.353	0.163	0.079	1.15	91.2	-2.79	98	39.6	0.1	68	69	66	64
303	49.519	0.166	0.078	1.15	91.3	-2.8	101	39.6	0	68	68	66	64
304	49.682	0.163	0.074	1.15	91.8	-2.79	102	39.6	0	69	69	66	64
305	49.845	0.163	0.077	1.15	91.2	-2.79	100	39.5	-0.1	69	68	66	64
306	50.011	0.166	0.077	1.15	91.7	-2.8	101	39.5	0	69	68	66	64
307	50.174	0.163	0.079	1.12	91.8	-2.8	98	39.6	0.1	69	68	66	64
308	50.337	0.163	0.080	1.16	91.0	-2.81	98	39.7	0.1	69	68	66	64
309	50.503	0.166	0.079	1.15	91.2	-2.81	100	39.7	0	68	69	66	64
310	50.666	0.163	0.078	1.14	91.0	-2.81	99	39.7	0	68	68	66	64
311	50.829	0.163	0.078	1.15	91.2	-2.81	99	39.6	-0.1	68	68	66	64
312	50.995	0.166	0.079	1.15	91.1	-2.81	100	39.6	0	68	68	66	64
313	51.158	0.163	0.077	1.15	91.2	-2.81	100	39.6	0	69	68	66	64
314	51.321	0.163	0.078	1.15	90.9	-2.82	99	39.6	0	69	68	66	64
315	51.487	0.166	0.078	1.15	90.9	-2.83	101	39.6	0	69	68	66	64
316	51.650	0.163	0.079	1.15	91.1	-2.83	98	39.6	0	69	68	66	64
317	51.814	0.164	0.078	1.15	91.6	-2.81	100	39.7	0.1	69	68	66	64
318	51.979	0.165	0.079	1.15	91.5	-2.83	99	39.7	0	68	68	66	64
319	52.142	0.163	0.077	1.14	91.0	-2.82	100	39.7	0	68	68	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	52.306	0.164	0.079	1.14	91.3	-2.82	99	39.7	0	68	68	66	64
321	52.471	0.165	0.078	1.15	91.6	-2.81	100	39.7	0	68	68	66	64
322	52.634	0.163	0.080	1.15	91.6	-2.82	98	39.7	0	69	68	66	64
323	52.798	0.164	0.076	1.15	91.6	-2.82	101	39.7	0	69	68	66	64
324	52.963	0.165	0.078	1.14	90.9	-2.83	100	39.7	0	69	68	66	64
325	53.126	0.163	0.078	1.14	91.4	-2.84	99	39.6	-0.1	69	68	66	64
326	53.290	0.164	0.078	1.14	91.0	-2.84	100	39.6	0	69	68	66	64
327	53.455	0.165	0.079	1.15	91.1	-2.85	100	39.6	0	68	68	66	64
328	53.618	0.163	0.077	1.15	91.5	-2.84	100	39.6	0	68	68	66	64
329	53.782	0.164	0.078	1.15	91.4	-2.83	99	39.6	0	68	68	66	64
330	53.947	0.165	0.076	1.12	91.6	-2.84	101	39.6	0	69	68	66	64
331	54.110	0.163	0.077	1.14	91.6	-2.84	100	39.6	0	69	68	66	64
332	54.274	0.164	0.079	1.16	91.6	-2.85	99	39.6	0	69	68	66	64
333	54.439	0.165	0.079	1.15	91.5	-2.86	100	39.7	0.1	69	68	66	64
334	54.602	0.163	0.077	1.15	91.3	-2.86	100	39.8	0.1	69	68	66	64
335	54.765	0.163	0.076	1.14	91.0	-2.84	100	39.8	0	68	68	66	64
336	54.931	0.166	0.077	1.16	91.6	-2.86	101	39.7	-0.1	68	68	66	64
337	55.094	0.163	0.076	1.17	91.0	-2.85	100	39.7	0	68	68	66	64
338	55.257	0.163	0.078	1.15	90.8	-2.85	99	39.7	0	69	68	66	64
339	55.423	0.166	0.079	1.14	91.0	-2.85	100	39.7	0	69	68	66	64
340	55.586	0.163	0.078	1.15	90.7	-2.85	99	39.7	0	69	68	66	64
341	55.749	0.163	0.078	1.15	91.4	-2.86	99	39.7	0	69	68	66	64
342	55.915	0.166	0.076	1.15	91.5	-2.86	102	39.7	0	69	68	66	64
343	56.078	0.163	0.079	1.13	90.9	-2.86	99	39.6	-0.1	71	123	66	64
344	56.241	0.163	0.079	1.14	91.4	-2.86	99	39.3	-0.3	73	151	66	64
345	56.406	0.165	0.079	1.15	90.8	-2.85	100	38.9	-0.4	74	169	66	64
346	56.569	0.163	0.076	1.15	91.3	-2.86	101	38.5	-0.4	74	183	66	64
347	56.732	0.163	0.076	1.14	91.4	-2.87	101	38.1	-0.4	75	197	66	64
348	56.897	0.165	0.078	1.14	91.4	-2.87	101	37.6	-0.5	77	217	66	64
349	57.059	0.162	0.079	1.14	91.4	-2.85	98	37.1	-0.5	77	235	66	64
350	57.223	0.164	0.078	1.13	90.6	-2.85	101	36.5	-0.6	78	250	66	64
351	57.387	0.164	0.080	1.12	91.5	-2.83	99	36.0	-0.5	78	263	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
352	57.549	0.162	0.079	1.14	91.3	-2.81	99	35.4	-0.6	79	272	66	64
353	57.714	0.165	0.076	1.14	90.9	-2.78	103	34.8	-0.6	79	279	66	64
354	57.876	0.162	0.074	1.14	90.8	-2.74	102	34.2	-0.6	79	287	66	64
355	58.039	0.163	0.076	1.14	91.4	-2.71	101	33.6	-0.6	80	294	66	64
356	58.203	0.164	0.078	1.15	90.7	-2.67	101	33.0	-0.6	80	298	67	64
357	58.366	0.163	0.077	1.14	90.8	-2.62	101	32.5	-0.5	80	302	67	64
358	58.528	0.162	0.077	1.13	90.6	-2.56	100	32.0	-0.5	81	307	67	64
359	58.693	0.165	0.078	1.12	91.3	-2.47	101	31.4	-0.6	81	311	67	64
360	58.855	0.162	0.076	1.13	91.3	-2.4	101	30.8	-0.6	81	310	67	64
361	59.019	0.164	0.077	1.14	90.8	-2.34	101	30.2	-0.6	81	308	67	64
362	59.183	0.164	0.078	1.13	90.7	-2.25	101	29.7	-0.5	81	308	67	64
363	59.345	0.162	0.077	1.14	91.3	-2.15	100	29.1	-0.6	81	310	67	64
364	59.509	0.164	0.077	1.14	91.3	-2.06	101	28.6	-0.5	81	311	67	64
365	59.672	0.163	0.076	1.14	90.6	-2.01	102	28.0	-0.6	81	313	67	64
366	59.835	0.163	0.078	1.15	90.6	-1.92	100	27.6	-0.4	81	315	67	64
367	59.999	0.164	0.077	1.14	91.3	-1.82	101	27.1	-0.5	82	316	67	64
368	60.162	0.163	0.076	1.17	90.6	-1.76	101	26.8	-0.3	76	238	67	64
369	60.325	0.163	0.077	1.14	90.6	-1.71	100	26.6	-0.2	73	195	67	64
370	60.490	0.165	0.077	1.15	90.8	-1.64	101	26.3	-0.3	72	175	67	64
371	60.653	0.163	0.079	1.15	90.6	-1.59	99	26.2	-0.1	71	163	67	64
372	60.816	0.163	0.079	1.14	90.7	-1.52	99	26.1	-0.1	71	154	67	64
373	60.981	0.165	0.078	1.14	91.2	-1.48	100	26.1	0	70	146	67	64
374	61.144	0.163	0.078	1.14	91.2	-1.46	99	26.0	-0.1	70	139	67	64
375	61.308	0.164	0.078	1.15	91.1	-1.44	100	25.9	-0.1	70	132	67	64
376	61.473	0.165	0.076	1.15	91.2	-1.41	102	25.9	0	70	126	67	64
377	61.635	0.162	0.079	1.14	90.9	-1.41	98	25.8	-0.1	70	120	67	64
378	61.799	0.164	0.075	1.15	90.6	-1.4	102	25.8	0	70	115	67	64
379	61.964	0.165	0.078	1.14	91.1	-1.41	100	25.9	0.1	70	110	67	64
380	62.127	0.163	0.079	1.15	91.2	-1.42	98	25.9	0	70	105	67	64
381	62.291	0.164	0.078	1.13	90.6	-1.41	100	25.9	0	70	101	67	64
382	62.455	0.164	0.077	1.15	90.6	-1.44	100	25.7	-0.2	70	97	67	64
383	62.618	0.163	0.080	1.13	90.5	-1.44	98	25.7	0	69	93	67	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
384	62.782	0.164	0.078	1.15	90.9	-1.48	100	25.7	0	69	90	67	64
385	62.946	0.164	0.078	1.14	90.5	-1.48	100	25.8	0.1	70	87	67	64
386	63.109	0.163	0.079	1.17	90.5	-1.5	99	25.8	0	70	85	67	64
387	63.274	0.165	0.076	1.13	90.7	-1.54	102	25.8	0	70	83	67	64
388	63.437	0.163	0.079	1.15	90.4	-1.57	99	25.8	0	70	82	67	64
389	63.600	0.163	0.080	1.15	91.2	-1.6	98	25.8	0	70	81	67	64
390	63.765	0.165	0.079	1.14	91.0	-1.63	100	25.8	0	69	79	67	64
391	63.929	0.164	0.078	1.14	90.6	-1.65	100	25.8	0	69	79	67	64
392	64.092	0.163	0.077	1.11	90.5	-1.68	100	25.7	-0.1	69	78	67	64
393	64.257	0.165	0.076	1.16	91.2	-1.71	102	25.7	0	69	77	66	64
394	64.420	0.163	0.075	1.17	90.9	-1.74	101	25.8	0.1	69	76	66	64
395	64.583	0.163	0.078	1.15	90.4	-1.77	99	25.8	0	70	76	67	64
396	64.748	0.165	0.079	1.15	90.5	-1.8	100	25.8	0	70	75	67	64
397	64.911	0.163	0.079	1.14	90.4	-1.82	99	25.7	-0.1	70	75	66	64
398	65.074	0.163	0.079	1.15	90.4	-1.84	99	25.8	0.1	69	74	66	64
399	65.239	0.165	0.079	1.15	90.6	-1.89	100	25.8	0	69	74	66	64
400	65.402	0.163	0.078	1.14	91.1	-1.91	99	25.8	0	69	74	66	64
401	65.565	0.163	0.077	1.17	91.1	-1.92	100	25.7	-0.1	69	73	66	64
402	65.730	0.165	0.076	1.15	90.3	-1.96	102	25.8	0.1	69	73	66	64
403	65.893	0.163	0.078	1.12	91.0	-1.97	99	25.8	0	70	73	66	64
404	66.056	0.163	0.079	1.15	90.5	-2.01	99	25.8	0	70	73	66	64
405	66.221	0.165	0.078	1.14	90.2	-2.04	100	25.8	0	70	72	66	64
406	66.384	0.163	0.080	1.15	90.4	-2.05	98	25.8	0	69	72	66	64
407	66.547	0.163	0.080	1.15	90.3	-2.07	98	25.9	0.1	69	72	66	64
408	66.713	0.166	0.080	1.16	91.0	-2.09	100	25.9	0	69	72	66	64
409	66.876	0.163	0.076	1.17	90.5	-2.11	100	25.9	0	69	72	66	64
410	67.039	0.163	0.078	1.16	90.6	-2.13	99	25.9	0	70	71	66	64
411	67.204	0.165	0.077	1.17	90.2	-2.14	101	25.9	0	70	71	66	64
412	67.367	0.163	0.078	1.12	91.0	-2.16	99	25.8	-0.1	69	71	66	64
413	67.530	0.163	0.078	1.12	90.3	-2.18	99	25.9	0.1	69	71	66	64
414	67.695	0.165	0.079	1.18	90.4	-2.19	100	25.9	0	69	71	66	64
415	67.858	0.163	0.078	1.16	90.4	-2.22	99	25.8	-0.1	69	71	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
416	68.022	0.164	0.076	1.15	90.2	-2.23	101	25.7	-0.1	69	71	66	64
417	68.186	0.164	0.077	1.16	90.3	-2.23	100	25.7	0	70	71	66	64
418	68.349	0.163	0.079	1.14	91.0	-2.26	98	25.9	0.2	70	70	66	64
419	68.514	0.165	0.080	1.10	90.3	-2.26	99	25.9	0	69	70	66	64
420	68.678	0.164	0.077	1.12	90.3	-2.28	100	25.9	0	69	70	66	64
421	68.840	0.162	0.078	1.15	90.2	-2.29	99	25.9	0	69	70	66	64
422	69.005	0.165	0.080	1.15	90.3	-2.31	99	25.9	0	69	70	66	64
423	69.169	0.164	0.077	1.15	90.2	-2.32	100	25.8	-0.1	69	70	66	64
424	69.332	0.163	0.078	1.15	90.7	-2.32	99	25.8	0	70	70	66	64
425	69.497	0.165	0.078	1.15	90.9	-2.35	100	25.8	0	70	70	66	64
426	69.660	0.163	0.077	1.15	90.8	-2.33	100	25.8	0	69	70	66	64
427	69.823	0.163	0.080	1.15	90.2	-2.36	98	25.8	0	69	70	66	64
428	69.988	0.165	0.080	1.14	90.2	-2.37	99	25.8	0	69	70	66	64
429	70.151	0.163	0.078	1.13	90.9	-2.39	99	25.8	0	69	70	66	64
430	70.315	0.164	0.079	1.14	90.7	-2.38	99	25.8	0	69	70	66	64
431	70.480	0.165	0.074	1.16	90.7	-2.38	103	25.8	0	70	69	66	64
432	70.642	0.162	0.078	1.14	90.2	-2.39	99	25.8	0	70	69	66	64
433	70.806	0.164	0.078	1.15	90.1	-2.41	100	25.8	0	69	70	66	64
434	70.971	0.165	0.079	1.15	90.8	-2.41	100	25.8	0	69	69	66	64
435	71.134	0.163	0.079	1.14	90.8	-2.42	98	25.8	0	69	69	66	64
436	71.297	0.163	0.077	1.15	90.8	-2.44	100	25.8	0	68	69	66	63
437	71.462	0.165	0.079	1.15	90.1	-2.42	100	25.7	-0.1	69	69	66	64
438	71.625	0.163	0.079	1.15	90.8	-2.45	99	25.8	0.1	70	69	66	64
439	71.788	0.163	0.078	1.16	90.1	-2.43	99	25.8	0	69	69	66	64
440	71.954	0.166	0.076	1.16	90.3	-2.44	102	25.8	0	69	69	66	64
441	72.117	0.163	0.079	1.16	90.3	-2.46	99	25.8	0	69	69	66	64
442	72.280	0.163	0.080	1.12	90.2	-2.48	98	25.7	-0.1	69	69	66	64
443	72.445	0.165	0.078	1.15	90.1	-2.46	100	25.9	0.2	68	69	66	63
444	72.608	0.163	0.081	1.14	90.1	-2.48	97	25.9	0	69	69	66	64
445	72.771	0.163	0.076	1.15	90.7	-2.5	100	25.9	0	69	69	66	64
446	72.936	0.165	0.078	1.17	90.0	-2.5	100	25.8	-0.1	69	69	66	64
447	73.099	0.163	0.080	1.15	90.5	-2.5	98	25.6	-0.2	69	69	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
448	73.263	0.164	0.078	1.15	90.7	-2.5	100	25.7	0.1	69	69	66	63
449	73.427	0.164	0.078	1.15	90.8	-2.51	100	25.7	0	69	69	66	63
450	73.590	0.163	0.078	1.15	90.7	-2.5	99	25.8	0.1	68	69	66	63
451	73.754	0.164	0.079	1.14	90.1	-2.5	99	25.8	0	69	69	66	63
452	73.919	0.165	0.078	1.14	90.6	-2.53	100	25.8	0	69	69	66	63
453	74.081	0.162	0.079	1.15	90.7	-2.52	98	25.8	0	69	69	66	64
454	74.246	0.165	0.076	1.15	90.3	-2.53	102	25.8	0	69	69	66	63
455	74.410	0.164	0.080	1.15	90.5	-2.53	98	25.9	0.1	69	69	66	64
456	74.573	0.163	0.080	1.13	90.1	-2.55	98	25.8	-0.1	69	69	66	63
457	74.737	0.164	0.077	1.15	90.7	-2.54	100	25.8	0	68	69	66	63
458	74.901	0.164	0.078	1.12	90.7	-2.54	100	25.8	0	68	69	66	63
459	75.064	0.163	0.076	1.12	90.1	-2.55	100	25.8	0	69	69	66	63
460	75.229	0.165	0.078	1.15	90.7	-2.55	100	25.8	0	69	69	66	63
461	75.392	0.163	0.079	1.15	89.9	-2.56	99	25.8	0	69	69	66	63
462	75.555	0.163	0.077	1.15	90.0	-2.57	100	25.8	0	69	69	66	63
463	75.720	0.165	0.080	1.15	90.6	-2.56	99	25.7	-0.1	69	69	66	63
464	75.884	0.164	0.078	1.15	90.0	-2.58	100	25.7	0	68	68	66	63
465	76.047	0.163	0.078	1.16	90.6	-2.57	99	25.7	0	68	69	66	63
466	76.212	0.165	0.078	1.19	90.0	-2.58	100	25.9	0.2	68	68	66	63
467	76.375	0.163	0.076	1.12	89.9	-2.58	100	26.0	0.1	68	68	66	63
468	76.538	0.163	0.078	1.20	90.0	-2.59	99	26.0	0	69	68	66	63
469	76.703	0.165	0.075	1.15	89.9	-2.59	102	25.8	-0.2	69	68	66	63
470	76.866	0.163	0.078	1.16	90.6	-2.6	99	25.8	0	69	68	66	63
471	77.029	0.163	0.076	1.14	89.9	-2.6	101	25.9	0.1	69	68	66	63
472	77.194	0.165	0.075	1.18	90.0	-2.59	102	25.9	0	69	68	66	63
473	77.357	0.163	0.077	1.15	90.5	-2.6	100	25.9	0	68	68	66	63
474	77.520	0.163	0.078	1.15	90.3	-2.61	99	25.8	-0.1	68	68	66	63
475	77.685	0.165	0.077	1.14	89.8	-2.62	101	25.8	0	68	68	66	63
476	77.848	0.163	0.078	1.15	90.3	-2.61	99	25.8	0	69	68	66	63
477	78.011	0.163	0.075	1.15	90.0	-2.62	101	25.8	0	69	68	66	63
478	78.177	0.166	0.077	1.13	90.1	-2.63	102	25.8	0	69	68	66	63
479	78.340	0.163	0.079	1.12	89.9	-2.62	99	25.8	0	69	68	66	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
480	78.503	0.163	0.078	1.15	90.5	-2.63	99	25.7	-0.1	68	68	66	63
481	78.668	0.165	0.078	1.15	90.0	-2.63	100	25.7	0	68	68	66	63
482	78.831	0.163	0.080	1.14	90.1	-2.64	98	25.7	0	68	68	66	63
483	78.994	0.163	0.079	1.15	90.5	-2.64	98	25.8	0.1	68	68	66	63
484	79.159	0.165	0.074	1.15	89.8	-2.64	103	25.8	0	69	68	66	63
485	79.322	0.163	0.075	1.15	90.2	-2.65	101	25.9	0.1	70	68	66	63
486	79.486	0.164	0.080	1.15	90.4	-2.66	99	25.9	0	69	68	66	63
487	79.650	0.164	0.079	1.14	90.0	-2.66	99	26.0	0.1	69	68	66	63
488	79.813	0.163	0.079	1.15	89.8	-2.65	99	25.9	-0.1	68	68	66	63
489	79.977	0.164	0.078	1.15	89.9	-2.66	100	25.9	0	68	68	66	63
490	80.142	0.165	0.078	1.15	90.6	-2.67	100	25.9	0	68	68	66	63
491	80.304	0.162	0.080	1.14	90.5	-2.67	97	25.9	0	68	68	66	63
492	80.469	0.165	0.079	1.15	90.5	-2.66	100	25.9	0	68	68	66	63
493	80.633	0.164	0.076	1.19	90.6	-2.66	101	25.9	0	69	68	66	63
494	80.796	0.163	0.077	1.15	90.5	-2.68	100	25.9	0	69	68	66	63
495	80.960	0.164	0.075	1.15	90.3	-2.67	102	25.9	0	69	68	66	63
496	81.124	0.164	0.077	1.15	89.8	-2.68	100	25.9	0	69	68	66	63
497	81.287	0.163	0.076	1.17	90.5	-2.68	100	25.9	0	68	68	66	63
498	81.452	0.165	0.076	1.15	89.8	-2.69	102	25.9	0	68	68	66	63
499	81.615	0.163	0.077	1.15	90.0	-2.69	100	25.8	-0.1	68	68	66	63
500	81.778	0.163	0.076	1.15	90.1	-2.69	100	25.8	0	68	68	66	63
501	81.943	0.165	0.078	1.16	90.5	-2.69	100	25.8	0	69	68	66	63
502	82.106	0.163	0.078	1.14	90.5	-2.69	99	25.8	0	69	68	66	63
503	82.270	0.164	0.078	1.15	90.5	-2.7	100	25.7	-0.1	69	68	66	63
504	82.435	0.165	0.079	1.17	90.5	-2.7	100	25.8	0.1	69	68	66	63
505	82.597	0.162	0.078	1.18	89.8	-2.7	99	25.9	0.1	68	68	66	63
506	82.761	0.164	0.076	1.15	90.0	-2.71	101	26.0	0.1	68	68	66	63
507	82.926	0.165	0.078	1.15	90.5	-2.7	100	25.9	-0.1	68	68	66	63
508	83.089	0.163	0.080	1.14	90.3	-2.71	98	25.9	0	67	68	66	63
509	83.252	0.163	0.077	1.15	90.5	-2.71	100	25.8	-0.1	68	68	66	63
510	83.417	0.165	0.077	1.15	90.6	-2.72	101	25.8	0	69	68	66	63
511	83.580	0.163	0.076	1.17	90.2	-2.72	100	25.8	0	69	68	66	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
512	83.744	0.164	0.079	1.15	89.8	-2.73	99	25.9	0.1	69	67	66	63
513	83.909	0.165	0.076	1.14	89.8	-2.73	102	25.9	0	68	68	66	63
514	84.072	0.163	0.078	1.16	90.3	-2.73	99	25.9	0	68	68	66	63
515	84.235	0.163	0.079	1.15	89.8	-2.75	99	25.8	-0.1	68	68	66	63
516	84.400	0.165	0.079	1.16	90.1	-2.75	100	25.8	0	67	68	66	63
517	84.563	0.163	0.079	1.12	89.8	-2.74	98	25.9	0.1	68	67	66	63
518	84.726	0.163	0.077	1.15	90.5	-2.76	100	25.9	0	69	67	66	63
519	84.891	0.165	0.079	1.19	90.5	-2.76	100	25.9	0	69	67	66	63
520	85.054	0.163	0.078	1.12	89.6	-2.75	99	25.8	-0.1	69	68	66	63
521	85.218	0.164	0.078	1.17	90.5	-2.76	100	25.8	0	69	67	66	63
522	85.383	0.165	0.076	1.15	89.9	-2.76	102	25.8	0	68	67	66	63
523	85.545	0.162	0.079	1.15	89.7	-2.78	98	25.8	0	68	67	66	63
524	85.709	0.164	0.078	1.16	90.4	-2.78	100	25.8	0	68	67	65	63
525	85.874	0.165	0.079	1.15	90.3	-2.78	100	25.8	0	67	67	65	63
526	86.037	0.163	0.077	1.15	90.5	-2.79	100	25.8	0	68	67	65	63
527	86.201	0.164	0.080	1.15	89.7	-2.78	99	25.8	0	69	67	66	63
528	86.365	0.164	0.078	1.14	90.2	-2.79	100	25.7	-0.1	70	68	65	63
529	86.528	0.163	0.080	1.14	89.7	-2.78	98	25.8	0.1	69	68	66	63
530	86.692	0.164	0.076	1.14	89.8	-2.8	101	25.7	-0.1	72	122	66	63
531	86.856	0.164	0.077	1.13	90.1	-2.81	101	25.5	-0.2	73	152	66	63
532	87.019	0.163	0.076	1.14	89.7	-2.8	101	25.1	-0.4	73	169	66	63
533	87.183	0.164	0.080	1.15	90.3	-2.81	99	24.7	-0.4	73	179	66	63
534	87.346	0.163	0.078	1.14	89.7	-2.81	100	24.3	-0.4	73	191	66	63
535	87.509	0.163	0.078	1.13	90.3	-2.82	100	24.0	-0.3	75	204	66	63
536	87.673	0.164	0.077	1.13	90.3	-2.82	101	23.7	-0.3	76	216	66	63
537	87.836	0.163	0.079	1.13	90.4	-2.81	99	23.3	-0.4	76	227	66	63
538	87.998	0.162	0.078	1.14	90.4	-2.79	99	22.8	-0.5	76	236	66	63
539	88.163	0.165	0.077	1.14	90.4	-2.78	102	22.4	-0.4	76	247	66	63
540	88.325	0.162	0.077	1.14	89.5	-2.74	100	22.0	-0.4	76	255	66	63
541	88.488	0.163	0.076	1.15	89.7	-2.72	101	21.6	-0.4	76	260	66	63
542	88.652	0.164	0.079	1.16	89.7	-2.7	100	21.1	-0.5	76	265	66	63
543	88.814	0.162	0.075	1.15	89.7	-2.65	101	20.6	-0.5	77	269	66	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
544	88.979	0.165	0.076	1.14	90.4	-2.61	103	20.1	-0.5	78	272	66	63
545	89.141	0.162	0.077	1.15	89.7	-2.58	100	19.6	-0.5	78	278	66	63
546	89.304	0.163	0.078	1.14	89.9	-2.51	100	19.2	-0.4	79	284	66	63
547	89.468	0.164	0.080	1.14	89.8	-2.47	100	18.7	-0.5	79	289	66	63
548	89.630	0.162	0.077	1.17	90.4	-2.4	100	18.3	-0.4	79	294	66	63
549	89.793	0.163	0.077	1.15	89.7	-2.33	101	17.8	-0.5	79	296	66	63
550	89.957	0.164	0.077	1.14	90.1	-2.26	101	17.4	-0.4	79	296	66	63
551	90.119	0.162	0.078	1.13	89.9	-2.21	100	16.9	-0.5	79	294	66	63
552	90.283	0.164	0.078	1.12	89.6	-2.14	101	16.5	-0.4	79	294	66	63
553	90.446	0.163	0.077	1.14	89.6	-2.1	101	16.0	-0.5	80	300	66	63
554	90.609	0.163	0.079	1.14	89.6	-2.01	100	15.5	-0.5	79	281	66	63
555	90.774	0.165	0.077	1.14	90.2	-1.93	102	15.2	-0.3	74	206	66	63
556	90.936	0.162	0.077	1.13	90.3	-1.9	99	15.0	-0.2	72	176	66	63
557	91.099	0.163	0.079	1.14	89.5	-1.82	99	14.9	-0.1	71	160	66	63
558	91.264	0.165	0.078	1.14	90.2	-1.76	101	14.8	-0.1	71	150	66	63
559	91.426	0.162	0.077	1.16	89.9	-1.69	99	14.8	0	70	142	66	63
560	91.589	0.163	0.079	1.14	89.7	-1.66	99	14.7	-0.1	70	136	66	63
561	91.754	0.165	0.076	1.16	89.7	-1.62	102	14.6	-0.1	70	130	66	63
562	91.917	0.163	0.076	1.16	90.4	-1.59	101	14.5	-0.1	71	124	66	63
563	92.080	0.163	0.078	1.15	90.0	-1.57	99	14.4	-0.1	70	117	66	63
564	92.245	0.165	0.076	1.14	89.7	-1.54	102	14.5	0.1	70	113	66	63
565	92.407	0.162	0.077	1.14	89.7	-1.53	99	14.6	0.1	70	108	66	63
566	92.571	0.164	0.081	1.14	89.6	-1.54	98	14.5	-0.1	69	103	66	63
567	92.735	0.164	0.080	1.14	90.0	-1.55	99	14.5	0	69	99	66	63
568	92.898	0.163	0.081	1.14	90.1	-1.54	97	14.5	0	69	96	66	63
569	93.063	0.165	0.077	1.15	89.7	-1.57	101	14.5	0	69	92	66	63
570	93.226	0.163	0.076	1.14	90.2	-1.57	101	14.5	0	70	90	66	63
571	93.389	0.163	0.078	1.14	89.8	-1.58	99	14.5	0	70	87	66	63
572	93.554	0.165	0.077	1.14	90.2	-1.6	101	14.5	0	70	85	66	63
573	93.716	0.162	0.076	1.19	90.3	-1.63	100	14.4	-0.1	70	83	66	63
574	93.879	0.163	0.077	1.12	89.5	-1.65	100	14.3	-0.1	69	82	66	63
575	94.044	0.165	0.078	1.14	89.5	-1.66	101	14.4	0.1	69	80	66	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
576	94.207	0.163	0.079	1.14	90.2	-1.71	99	14.5	0.1	69	79	66	63
577	94.370	0.163	0.077	1.13	90.2	-1.75	100	14.4	-0.1	70	78	66	63
578	94.535	0.165	0.077	1.15	89.7	-1.76	101	14.3	-0.1	70	77	66	63
579	94.697	0.162	0.078	1.14	89.5	-1.78	99	14.4	0.1	70	77	66	63
580	94.860	0.163	0.079	1.15	90.3	-1.81	99	14.5	0.1	69	76	66	63
581	95.025	0.165	0.077	1.12	89.5	-1.84	101	14.5	0	69	75	66	63
582	95.188	0.163	0.078	1.15	89.4	-1.86	99	14.4	-0.1	69	75	66	63
583	95.351	0.163	0.077	1.14	89.5	-1.89	100	14.5	0.1	69	74	66	63
584	95.516	0.165	0.079	1.17	89.6	-1.91	100	14.5	0	70	74	66	63
585	95.678	0.162	0.078	1.14	89.4	-1.94	99	14.4	-0.1	70	73	66	63
586	95.843	0.165	0.079	1.13	90.0	-1.98	100	14.4	0	70	73	66	63
587	96.006	0.163	0.078	1.13	90.1	-2.01	99	14.4	0	69	73	66	63
588	96.169	0.163	0.078	1.14	90.3	-2.02	99	14.5	0.1	69	73	66	63
589	96.334	0.165	0.078	1.15	90.2	-2.07	100	14.4	-0.1	69	72	66	63
590	96.496	0.162	0.078	1.14	89.4	-2.07	99	14.4	0	69	72	66	63
591	96.659	0.163	0.078	1.15	90.1	-2.11	99	14.5	0.1	70	72	66	63
592	96.824	0.165	0.076	1.15	89.8	-2.11	102	14.5	0	70	72	66	63
593	96.987	0.163	0.078	1.14	89.5	-2.13	99	14.5	0	69	71	66	63
594	97.150	0.163	0.075	1.13	89.6	-2.16	101	14.4	-0.1	69	71	66	63
595	97.315	0.165	0.080	1.13	90.2	-2.18	99	14.4	0	69	71	66	63
596	97.477	0.162	0.079	1.15	90.1	-2.2	98	14.5	0.1	68	71	66	63
597	97.640	0.163	0.076	1.14	89.5	-2.23	101	14.5	0	69	71	66	63
598	97.805	0.165	0.077	1.14	89.5	-2.25	101	14.5	0	70	71	66	63
599	97.968	0.163	0.079	1.15	90.2	-2.26	99	14.5	0	70	70	66	63
600	98.131	0.163	0.079	1.15	89.5	-2.27	99	14.6	0.1	69	70	66	63
601	98.296	0.165	0.077	1.14	89.4	-2.3	101	14.5	-0.1	69	70	66	63
602	98.458	0.162	0.078	1.13	90.2	-2.3	99	14.5	0	69	70	66	63
603	98.623	0.165	0.079	1.15	89.9	-2.33	100	14.4	-0.1	68	70	66	63
604	98.787	0.164	0.080	1.15	89.6	-2.33	99	14.4	0	68	70	66	63
605	98.949	0.162	0.076	1.16	90.0	-2.37	100	14.4	0	69	70	66	63
606	99.114	0.165	0.080	1.13	89.8	-2.38	99	14.4	0	69	70	66	63
607	99.277	0.163	0.077	1.14	89.5	-2.4	100	14.4	0	70	70	66	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
608	99.440	0.163	0.079	1.16	90.1	-2.4	99	14.4	0	69	70	66	63
609	99.605	0.165	0.077	1.15	89.4	-2.42	101	14.4	0	69	70	66	63
610	99.767	0.162	0.078	1.12	89.8	-2.41	99	14.4	0	69	70	66	63
611	99.930	0.163	0.078	1.16	90.0	-2.44	99	14.4	0	68	70	66	63
612	100.095	0.165	0.077	1.16	89.4	-2.44	101	14.5	0.1	68	69	66	63
613	100.258	0.163	0.074	1.14	90.1	-2.45	102	14.5	0	68	69	66	63
614	100.421	0.163	0.077	1.14	89.6	-2.47	100	14.5	0	69	69	66	63
615	100.586	0.165	0.078	1.14	89.7	-2.47	101	14.5	0	70	69	66	63
616	100.748	0.162	0.076	1.15	90.1	-2.49	100	14.5	0	69	69	66	63
617	100.911	0.163	0.080	1.17	90.0	-2.51	98	14.5	0	69	69	66	63
618	101.076	0.165	0.078	1.14	89.5	-2.48	100	14.5	0	69	69	66	63
619	101.239	0.163	0.078	1.14	89.8	-2.51	99	14.5	0	68	69	66	63
620	101.403	0.164	0.081	1.14	90.1	-2.53	98	14.5	0	68	69	66	63
621	101.567	0.164	0.077	1.15	89.5	-2.53	100	14.5	0	68	69	66	63
622	101.729	0.162	0.074	1.14	89.6	-2.52	101	14.4	-0.1	69	69	66	63
623	101.894	0.165	0.078	1.20	89.5	-2.56	101	14.4	0	70	69	66	63
624	102.057	0.163	0.078	1.14	89.9	-2.55	99	14.4	0	69	69	66	63
625	102.220	0.163	0.079	1.14	89.4	-2.57	99	14.5	0.1	69	69	66	63
626	102.385	0.165	0.076	1.15	90.0	-2.57	102	14.6	0.1	69	69	65	63
627	102.548	0.163	0.079	1.18	89.5	-2.57	99	14.7	0.1	68	69	66	63
628	102.711	0.163	0.078	1.13	89.5	-2.58	99	14.5	-0.2	68	69	66	63
629	102.876	0.165	0.078	1.14	89.4	-2.58	101	14.5	0	69	69	66	63
630	103.038	0.162	0.078	1.14	90.2	-2.6	99	14.4	-0.1	69	69	65	63
631	103.201	0.163	0.078	1.15	89.4	-2.6	99	14.4	0	70	69	66	63
632	103.366	0.165	0.078	1.13	90.0	-2.62	100	14.3	-0.1	69	68	65	63
633	103.529	0.163	0.077	1.15	89.7	-2.61	100	14.2	-0.1	69	68	65	63
634	103.692	0.163	0.079	1.14	89.4	-2.63	99	14.3	0.1	68	68	65	63
635	103.857	0.165	0.081	1.15	89.3	-2.63	99	14.4	0.1	68	68	65	63
636	104.019	0.162	0.077	1.16	89.4	-2.64	99	14.4	0	69	68	66	63
637	104.183	0.164	0.076	1.16	90.1	-2.65	101	14.4	0	70	68	65	63
638	104.347	0.164	0.078	1.14	89.9	-2.64	100	14.5	0.1	69	68	65	63
639	104.510	0.163	0.079	1.13	90.1	-2.64	99	14.5	0	69	68	65	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
640	104.674	0.164	0.077	1.15	89.3	-2.65	101	14.5	0	69	68	65	63
641	104.838	0.164	0.077	1.14	89.3	-2.65	101	14.4	-0.1	68	68	65	63
642	105.001	0.163	0.078	1.14	89.7	-2.67	99	14.4	0	68	68	65	63
643	105.165	0.164	0.077	1.15	89.6	-2.68	100	14.4	0	68	68	65	63
644	105.329	0.164	0.079	1.15	90.0	-2.66	99	14.5	0.1	68	68	65	63
645	105.491	0.162	0.081	1.17	90.1	-2.68	97	14.5	0	69	68	65	63
646	105.656	0.165	0.076	1.17	89.3	-2.69	102	14.5	0	69	68	65	63
647	105.819	0.163	0.078	1.14	89.5	-2.7	99	14.5	0	69	68	65	63
648	105.982	0.163	0.078	1.14	89.4	-2.7	99	14.5	0	69	68	65	63
649	106.147	0.165	0.078	1.15	89.4	-2.71	100	14.4	-0.1	68	68	65	63
650	106.310	0.163	0.078	1.15	89.2	-2.72	99	14.4	0	68	68	65	63
651	106.473	0.163	0.077	1.14	90.0	-2.71	100	14.4	0	68	68	65	63
652	106.638	0.165	0.078	1.15	89.3	-2.71	100	14.4	0	68	68	65	63
653	106.801	0.163	0.080	1.12	89.5	-2.72	98	14.4	0	69	68	65	63
654	106.964	0.163	0.079	1.15	89.2	-2.74	99	14.4	0	70	68	65	63
655	107.129	0.165	0.078	1.14	90.1	-2.72	100	14.5	0.1	69	68	65	63
656	107.291	0.162	0.078	1.14	89.2	-2.73	99	14.4	-0.1	69	68	65	63
657	107.455	0.164	0.079	1.15	89.3	-2.75	99	14.4	0	68	68	65	63
658	107.619	0.164	0.078	1.17	89.8	-2.74	100	14.4	0	68	68	65	63
659	107.782	0.163	0.079	1.14	89.2	-2.75	99	14.4	0	68	68	65	63
660	107.946	0.164	0.080	1.16	89.2	-2.75	99	14.5	0.1	68	68	65	63
661	108.110	0.164	0.079	1.15	90.0	-2.75	99	14.5	0	68	68	65	63
662	108.273	0.163	0.078	1.14	90.0	-2.77	99	14.5	0	70	68	65	63
663	108.437	0.164	0.077	1.15	89.4	-2.78	101	14.5	0	69	68	65	63
664	108.601	0.164	0.077	1.13	89.2	-2.77	101	14.3	-0.2	69	68	65	63
665	108.763	0.162	0.076	1.13	89.3	-2.77	100	14.4	0.1	69	68	65	63
666	108.928	0.165	0.078	1.15	89.5	-2.8	100	14.3	-0.1	68	68	65	63
667	109.092	0.164	0.078	1.12	89.9	-2.79	100	14.4	0.1	68	68	65	63
668	109.254	0.162	0.077	1.15	89.3	-2.78	99	14.4	0	68	68	65	63
669	109.420	0.166	0.076	1.15	89.7	-2.8	102	14.4	0	68	67	65	63
670	109.582	0.162	0.076	1.14	89.4	-2.79	100	14.5	0.1	69	68	65	63
671	109.745	0.163	0.077	1.15	89.1	-2.79	100	14.4	-0.1	69	68	65	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
672	109.910	0.165	0.077	1.15	89.9	-2.81	101	14.4	0	69	67	65	63
673	110.073	0.163	0.076	1.16	89.2	-2.81	101	14.4	0	69	67	65	63
674	110.236	0.163	0.077	1.15	89.1	-2.82	100	14.4	0	68	67	65	63
675	110.401	0.165	0.076	1.15	90.0	-2.82	102	14.4	0	68	67	65	63
676	110.564	0.163	0.078	1.15	90.0	-2.83	99	14.4	0	68	68	65	63
677	110.727	0.163	0.079	1.13	89.5	-2.84	99	14.4	0	69	68	65	63
678	110.892	0.165	0.077	1.15	89.9	-2.83	101	14.4	0	70	67	65	63
679	111.054	0.162	0.079	1.14	90.0	-2.84	98	14.3	-0.1	69	68	65	63
680	111.218	0.164	0.077	1.15	89.7	-2.83	101	14.3	0	69	67	65	63
681	111.382	0.164	0.080	1.15	89.6	-2.86	99	14.4	0.1	68	67	65	63
682	111.545	0.163	0.078	1.12	89.2	-2.84	99	14.5	0.1	68	68	65	63
683	111.709	0.164	0.079	1.14	89.4	-2.84	99	14.5	0	68	67	65	63
684	111.873	0.164	0.078	1.15	89.9	-2.86	100	14.5	0	69	67	65	63
685	112.036	0.163	0.078	1.14	89.8	-2.86	99	14.5	0	69	67	65	63
686	112.200	0.164	0.077	1.13	89.2	-2.88	101	14.4	-0.1	69	67	65	63
687	112.364	0.164	0.079	1.15	89.2	-2.86	99	14.5	0.1	69	67	65	63
688	112.527	0.163	0.077	1.16	89.9	-2.86	100	14.4	-0.1	68	67	65	63
689	112.692	0.165	0.078	1.14	89.1	-2.89	100	14.4	0	68	67	65	63
690	112.854	0.162	0.079	1.13	89.9	-2.87	98	14.4	0	67	67	65	63
691	113.017	0.163	0.080	1.11	89.1	-2.88	98	14.5	0.1	68	67	65	63
692	113.182	0.165	0.082	1.15	89.4	-2.9	98	14.5	0	69	67	65	63
693	113.345	0.163	0.075	1.16	89.0	-2.88	101	14.5	0	69	67	65	62
694	113.508	0.163	0.077	1.15	89.8	-2.88	100	14.5	0	69	67	65	63
695	113.673	0.165	0.076	1.16	89.1	-2.9	102	14.4	-0.1	69	67	65	63
696	113.836	0.163	0.078	1.14	89.8	-2.89	99	14.4	0	68	67	65	63
697	113.999	0.163	0.080	1.15	89.1	-2.9	98	14.5	0.1	68	67	65	62
698	114.164	0.165	0.077	1.15	89.6	-2.89	101	14.5	0	68	67	65	63
699	114.327	0.163	0.078	1.15	89.1	-2.91	99	14.5	0	69	67	65	63
700	114.490	0.163	0.076	1.14	89.4	-2.91	101	14.5	0	70	67	65	63
701	114.655	0.165	0.079	1.14	89.8	-2.9	100	14.4	-0.1	69	67	65	63
702	114.817	0.162	0.081	1.13	89.1	-2.91	97	14.4	0	69	67	65	63
703	114.981	0.164	0.077	1.15	89.7	-2.92	100	14.4	0	68	67	65	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
704	115.145	0.164	0.078	1.15	89.9	-2.91	100	14.4	0	68	67	65	63
705	115.308	0.163	0.076	1.15	89.1	-2.92	101	14.4	0	68	67	65	63
706	115.472	0.164	0.077	1.15	89.9	-2.92	100	14.4	0	67	67	65	63
707	115.636	0.164	0.076	1.15	89.1	-2.95	101	14.4	0	68	67	65	63
708	115.799	0.163	0.077	1.15	89.1	-2.94	100	14.5	0.1	69	67	65	63
709	115.964	0.165	0.079	1.15	89.6	-2.93	100	14.5	0	69	67	65	63
710	116.127	0.163	0.079	1.15	89.1	-2.94	99	14.5	0	69	67	65	63
711	116.290	0.163	0.076	1.17	89.8	-2.94	101	14.5	0	69	67	65	63
712	116.455	0.165	0.077	1.15	89.6	-2.96	101	14.5	0	68	67	65	62
713	116.617	0.162	0.073	1.14	89.3	-2.94	102	14.5	0	68	67	65	62
714	116.780	0.163	0.077	1.15	89.6	-2.95	100	14.4	-0.1	68	67	65	62
715	116.945	0.165	0.078	1.14	89.5	-2.95	100	14.5	0.1	69	67	65	63
716	117.108	0.163	0.077	1.12	89.1	-2.93	100	14.5	0	70	67	65	63
717	117.271	0.163	0.079	1.14	89.4	-2.94	99	14.6	0.1	69	67	65	63
718	117.436	0.165	0.079	1.15	89.3	-2.95	100	14.5	-0.1	69	67	65	63
719	117.599	0.163	0.077	1.14	89.0	-2.94	100	14.5	0	68	67	65	62
720	117.762	0.163	0.078	1.12	89.1	-2.96	99	14.6	0.1	68	67	65	62
721	117.927	0.165	0.076	1.18	89.1	-2.97	102	14.5	-0.1	67	67	65	62
722	118.089	0.162	0.081	1.11	89.8	-2.98	97	14.6	0.1	67	67	65	62
723	118.253	0.164	0.080	1.15	89.8	-2.98	99	14.5	-0.1	68	67	65	63
724	118.417	0.164	0.077	1.16	89.0	-2.98	101	14.5	0	70	67	65	62
725	118.580	0.163	0.079	1.14	89.6	-2.99	99	14.5	0	70	67	65	62
726	118.744	0.164	0.079	1.14	89.7	-2.99	99	14.5	0	70	67	65	63
727	118.908	0.164	0.079	1.14	89.0	-2.98	99	14.4	-0.1	70	113	65	62
728	119.070	0.162	0.075	1.13	89.7	-2.99	101	14.2	-0.2	71	140	65	62
729	119.235	0.165	0.074	1.18	89.3	-3.01	104	13.9	-0.3	72	163	65	62
730	119.398	0.163	0.078	1.15	89.1	-3	100	13.7	-0.2	73	178	65	62
731	119.560	0.162	0.077	1.14	89.2	-2.99	100	13.5	-0.2	75	192	65	63
732	119.725	0.165	0.080	1.12	89.4	-3.01	100	13.1	-0.4	75	205	65	62
733	119.887	0.162	0.077	1.14	89.8	-3	100	12.8	-0.3	76	218	65	63
734	120.050	0.163	0.074	1.14	89.2	-2.99	103	12.4	-0.4	75	212	65	62
735	120.214	0.164	0.078	1.14	89.2	-3	100	12.1	-0.3	74	217	65	62

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
736	120.376	0.162	0.078	1.14	88.9	-2.98	99	11.8	-0.3	75	224	65	62
737	120.540	0.164	0.077	1.14	89.0	-2.96	101	11.5	-0.3	76	231	65	63
738	120.704	0.164	0.077	1.16	89.7	-2.95	101	11.1	-0.4	76	242	65	63
739	120.866	0.162	0.079	1.14	89.3	-2.93	99	10.8	-0.3	77	248	65	63
740	121.030	0.164	0.078	1.14	89.4	-2.91	101	10.5	-0.3	77	256	65	63
741	121.192	0.162	0.078	1.15	89.4	-2.88	99	10.2	-0.3	77	263	65	63
742	121.355	0.163	0.076	1.17	88.9	-2.86	102	9.8	-0.4	77	272	66	63
743	121.519	0.164	0.079	1.14	89.0	-2.82	100	9.4	-0.4	77	275	66	62
744	121.681	0.162	0.078	1.15	89.0	-2.78	100	9.0	-0.4	78	274	66	62
745	121.844	0.163	0.077	1.14	89.1	-2.74	101	8.6	-0.4	78	269	66	63
746	122.008	0.164	0.078	1.13	89.7	-2.69	101	8.2	-0.4	78	267	66	63
747	122.169	0.161	0.079	1.15	88.9	-2.65	98	7.8	-0.4	77	258	66	63
748	122.334	0.165	0.080	1.14	89.6	-2.59	100	7.5	-0.3	77	252	66	63
749	122.496	0.162	0.080	1.14	89.5	-2.55	98	7.2	-0.3	76	246	66	63
750	122.658	0.162	0.079	1.15	89.0	-2.51	99	6.9	-0.3	76	247	66	63
751	122.823	0.165	0.078	1.14	89.7	-2.45	101	6.6	-0.3	77	256	66	63
752	122.985	0.162	0.077	1.14	89.0	-2.4	100	6.3	-0.3	73	190	66	63
753	123.148	0.163	0.077	1.15	89.5	-2.34	100	6.1	-0.2	72	158	66	63
754	123.312	0.164	0.078	1.14	89.6	-2.29	100	6.0	-0.1	71	141	66	63
755	123.475	0.163	0.077	1.15	89.0	-2.25	100	5.9	-0.1	70	131	66	63
756	123.639	0.164	0.077	1.15	88.9	-2.19	101	5.9	0	70	124	66	63
757	123.802	0.163	0.078	1.13	89.6	-2.15	99	5.9	0	70	118	66	63
758	123.965	0.163	0.077	1.11	89.3	-2.12	100	5.9	0	70	113	66	63
759	124.130	0.165	0.077	1.14	88.8	-2.08	101	5.8	-0.1	71	109	66	63
760	124.292	0.162	0.080	1.14	88.9	-2.06	98	5.8	0	70	104	66	63
761	124.455	0.163	0.077	1.15	89.5	-2.02	100	5.8	0	70	100	66	63
762	124.619	0.164	0.076	1.14	89.6	-2	101	5.8	0	70	97	66	63
763	124.782	0.163	0.078	1.15	88.8	-1.99	99	5.8	0	69	94	66	63
764	124.945	0.163	0.076	1.14	88.8	-1.99	101	5.7	-0.1	69	91	66	63
765	125.109	0.164	0.077	1.14	89.0	-1.99	101	5.8	0.1	69	89	66	63
766	125.271	0.162	0.076	1.15	88.8	-1.99	100	5.8	0	70	86	66	63
767	125.435	0.164	0.079	1.16	88.8	-1.99	100	5.8	0	70	85	66	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
768	125.599	0.164	0.078	1.15	89.5	-1.99	100	5.8	0	70	83	66	63
769	125.761	0.162	0.078	1.14	89.4	-2	99	5.6	-0.2	70	81	66	63
770	125.926	0.165	0.079	1.15	88.8	-2.02	100	5.6	0	69	80	66	63
771	126.088	0.162	0.077	1.14	88.9	-2.04	99	5.6	0	69	79	66	63
772	126.251	0.163	0.076	1.14	88.9	-2.04	101	5.6	0	69	78	66	63
773	126.416	0.165	0.079	1.14	88.8	-2.05	100	5.7	0.1	70	77	66	63
774	126.578	0.162	0.078	1.14	89.5	-2.09	99	5.7	0	70	77	66	63
775	126.741	0.163	0.078	1.14	89.1	-2.11	99	5.7	0	70	76	66	63
776	126.905	0.164	0.076	1.13	88.8	-2.13	101	5.7	0	70	75	66	63
777	127.068	0.163	0.079	1.14	88.8	-2.16	99	5.7	0	69	75	66	63
778	127.231	0.163	0.077	1.14	89.5	-2.18	100	5.7	0	69	74	66	63
779	127.395	0.164	0.079	1.14	89.6	-2.19	99	5.7	0	70	74	65	63
780	127.557	0.162	0.078	1.14	89.6	-2.22	99	5.6	-0.1	70	73	66	63
781	127.722	0.165	0.077	1.14	88.8	-2.22	101	5.6	0	70	73	65	63
782	127.884	0.162	0.079	1.12	89.1	-2.25	98	5.6	0	69	73	66	63
783	128.047	0.163	0.080	1.11	89.4	-2.27	98	5.7	0.1	69	72	66	63
784	128.212	0.165	0.078	1.15	88.7	-2.28	101	5.8	0.1	69	72	65	62
785	128.374	0.162	0.077	1.16	89.0	-2.3	99	5.8	0	69	72	65	63
786	128.537	0.163	0.077	1.13	89.3	-2.32	100	5.8	0	70	71	66	63
787	128.701	0.164	0.078	1.11	89.4	-2.33	100	5.7	-0.1	70	71	65	63
788	128.864	0.163	0.079	1.14	88.9	-2.36	99	5.7	0	70	71	65	63
789	129.027	0.163	0.079	1.14	88.8	-2.37	99	5.7	0	69	71	65	63
790	129.191	0.164	0.077	1.14	88.8	-2.39	101	5.8	0.1	69	71	65	63
791	129.353	0.162	0.076	1.15	89.5	-2.42	100	5.7	-0.1	69	70	65	63
792	129.517	0.164	0.076	1.14	89.0	-2.41	101	5.7	0	69	70	65	63
793	129.680	0.163	0.077	1.14	89.3	-2.44	100	5.7	0	70	70	65	63
794	129.843	0.163	0.080	1.14	89.3	-2.45	98	5.7	0	70	70	65	63
795	130.007	0.164	0.077	1.16	88.6	-2.47	101	5.8	0.1	69	70	65	63
796	130.170	0.163	0.077	1.12	88.8	-2.49	100	5.8	0	69	70	65	63
797	130.332	0.162	0.077	1.14	88.7	-2.5	99	5.8	0	68	70	65	63
798	130.497	0.165	0.077	1.14	88.9	-2.5	101	5.7	-0.1	69	69	65	63
799	130.659	0.162	0.077	1.12	89.4	-2.52	99	5.7	0	70	70	65	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
800	130.823	0.164	0.077	1.13	89.4	-2.52	101	5.7	0	70	70	65	63
801	130.987	0.164	0.079	1.14	88.7	-2.55	100	5.7	0	70	69	65	63
802	131.149	0.162	0.078	1.16	89.5	-2.54	99	5.7	0	69	69	65	63
803	131.313	0.164	0.079	1.15	88.7	-2.55	99	5.6	-0.1	69	69	65	63
804	131.476	0.163	0.079	1.13	89.3	-2.56	99	5.7	0.1	69	69	65	63
805	131.639	0.163	0.076	1.14	89.4	-2.57	101	5.7	0	69	69	65	62
806	131.803	0.164	0.077	1.14	88.6	-2.59	101	5.7	0	70	69	65	63
807	131.966	0.163	0.078	1.14	89.4	-2.59	99	5.7	0	70	69	65	63
808	132.128	0.162	0.079	1.15	89.3	-2.61	98	5.7	0	70	69	65	63
809	132.293	0.165	0.079	1.14	89.2	-2.62	100	5.6	-0.1	69	69	65	63
810	132.455	0.162	0.080	1.14	89.5	-2.63	97	5.7	0.1	68	69	65	63
811	132.618	0.163	0.079	1.17	88.8	-2.63	99	5.7	0	69	69	65	63
812	132.782	0.164	0.077	1.12	89.4	-2.65	101	5.7	0	69	69	65	63
813	132.945	0.163	0.075	1.14	88.8	-2.67	102	5.7	0	70	69	65	63
814	133.109	0.164	0.078	1.14	89.2	-2.67	100	5.7	0	70	68	65	63
815	133.272	0.163	0.076	1.14	89.4	-2.67	101	5.8	0.1	69	68	65	63
816	133.434	0.162	0.078	1.14	88.9	-2.68	99	5.8	0	69	68	65	63
817	133.599	0.165	0.076	1.14	88.6	-2.68	102	5.8	0	68	68	65	63
818	133.761	0.162	0.078	1.14	89.4	-2.7	99	5.8	0	68	68	65	63
819	133.924	0.163	0.077	1.16	89.3	-2.7	100	5.8	0	69	68	65	63
820	134.088	0.164	0.076	1.14	88.7	-2.7	101	5.8	0	70	68	65	62
821	134.251	0.163	0.079	1.12	89.5	-2.72	99	5.7	-0.1	70	68	65	62
822	134.414	0.163	0.079	1.14	88.6	-2.71	99	5.7	0	69	68	65	63
823	134.578	0.164	0.080	1.14	89.2	-2.73	99	5.7	0	69	68	65	63
824	134.740	0.162	0.079	1.14	89.2	-2.73	98	5.7	0	68	68	65	63
825	134.904	0.164	0.080	1.14	89.5	-2.75	99	5.7	0	68	68	65	63
826	135.067	0.163	0.081	1.14	88.8	-2.73	98	5.7	0	68	68	65	62
827	135.230	0.163	0.078	1.15	89.3	-2.75	99	5.7	0	69	68	65	62
828	135.394	0.164	0.076	1.14	89.3	-2.76	101	5.7	0	70	68	65	62
829	135.557	0.163	0.075	1.14	89.4	-2.76	101	5.7	0	70	68	65	62
830	135.719	0.162	0.079	1.13	89.3	-2.77	98	5.7	0	69	68	65	63
831	135.884	0.165	0.076	1.16	88.7	-2.78	102	5.7	0	69	68	65	63

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
832	136.046	0.162	0.079	1.14	89.3	-2.77	98	5.7	0	68	68	65	62
833	136.210	0.164	0.074	1.14	88.8	-2.76	103	5.7	0	69	68	65	62
834	136.374	0.164	0.078	1.15	88.5	-2.78	100	5.7	0	70	68	65	63
835	136.536	0.162	0.077	1.11	88.6	-2.78	100	5.7	0	70	68	65	63
836	136.700	0.164	0.078	1.14	89.4	-2.79	100	5.7	0	70	68	65	62
837	136.863	0.163	0.078	1.13	89.3	-2.81	99	5.7	0	69	68	65	62
838	137.026	0.163	0.078	1.14	89.2	-2.81	99	5.7	0	68	68	65	62
839	137.190	0.164	0.079	1.14	88.6	-2.8	99	5.7	0	68	68	65	62
840	137.352	0.162	0.077	1.16	89.3	-2.81	99	5.7	0	69	68	65	62
841	137.515	0.163	0.078	1.14	88.7	-2.81	100	5.7	0	70	68	65	62
842	137.680	0.165	0.078	1.14	88.8	-2.82	101	5.7	0	70	68	65	62
843	137.842	0.162	0.078	1.14	88.6	-2.8	99	5.7	0	69	68	65	63
844	138.005	0.163	0.078	1.12	88.6	-2.83	99	5.7	0	69	68	65	62
845	138.169	0.164	0.078	1.13	89.3	-2.82	100	5.7	0	68	68	65	62
846	138.331	0.162	0.077	1.14	88.5	-2.85	99	5.8	0.1	68	67	65	62
847	138.496	0.165	0.078	1.15	88.9	-2.85	101	5.7	-0.1	68	68	65	62
848	138.659	0.163	0.076	1.14	88.7	-2.86	101	5.7	0	69	67	65	62
849	138.821	0.162	0.077	1.12	88.6	-2.84	100	5.6	-0.1	70	67	65	62
850	138.986	0.165	0.078	1.13	89.0	-2.86	101	5.7	0.1	69	68	65	62
851	139.148	0.162	0.080	1.14	88.4	-2.86	98	5.7	0	69	67	65	62
852	139.311	0.163	0.077	1.14	88.5	-2.85	100	5.7	0	68	67	65	62
853	139.475	0.164	0.076	1.13	89.1	-2.85	101	5.8	0.1	68	68	65	62
854	139.638	0.163	0.078	1.14	88.8	-2.88	99	5.8	0	68	67	65	62
855	139.801	0.163	0.078	1.15	89.1	-2.87	99	5.8	0	69	67	65	62
856	139.965	0.164	0.079	1.13	88.5	-2.88	100	5.7	-0.1	70	67	65	62
857	140.127	0.162	0.078	1.14	89.2	-2.88	99	5.8	0.1	69	67	65	62
858	140.292	0.165	0.077	1.13	89.0	-2.88	101	5.8	0	69	67	65	62
859	140.455	0.163	0.076	1.13	88.6	-2.88	101	5.8	0	68	67	65	62
860	140.617	0.162	0.077	1.15	89.2	-2.89	99	5.7	-0.1	68	67	65	62
861	140.782	0.165	0.077	1.14	89.2	-2.89	101	5.7	0	68	67	65	62
862	140.944	0.162	0.077	1.15	89.2	-2.89	99	5.6	-0.1	69	67	65	62
863	141.107	0.163	0.081	1.15	88.4	-2.9	98	5.7	0.1	69	67	65	62

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
864	141.272	0.165	0.076	1.15	88.6	-2.9	102	5.7	0	69	67	65	62
865	141.434	0.162	0.078	1.14	88.7	-2.91	99	5.7	0	69	67	65	62
866	141.597	0.163	0.080	1.14	88.4	-2.93	98	5.7	0	68	67	65	62
867	141.761	0.164	0.078	1.14	89.0	-2.91	100	5.8	0.1	68	67	65	62
868	141.924	0.163	0.076	1.14	89.1	-2.93	101	5.8	0	67	67	65	62
869	142.088	0.164	0.079	1.14	89.1	-2.93	99	5.7	-0.1	67	67	65	62
870	142.251	0.163	0.078	1.10	88.4	-2.93	99	5.6	-0.1	68	67	65	62
871	142.413	0.162	0.078	1.13	89.1	-2.95	99	5.6	0	69	67	65	62
872	142.578	0.165	0.078	1.15	88.8	-2.95	101	5.7	0.1	69	67	65	62
873	142.740	0.162	0.079	1.14	89.2	-2.95	98	5.6	-0.1	69	67	65	62
874	142.903	0.163	0.081	1.14	89.1	-2.95	97	5.6	0	69	67	65	62
875	143.068	0.165	0.079	1.12	88.9	-2.96	100	5.6	0	68	67	65	62
876	143.230	0.162	0.079	1.15	88.9	-2.96	98	5.7	0.1	68	67	65	62
877	143.393	0.163	0.080	1.11	88.7	-2.99	98	5.7	0	68	67	65	62
878	143.557	0.164	0.077	1.14	89.2	-2.98	101	5.7	0	69	67	65	62
879	143.720	0.163	0.075	1.14	88.4	-2.98	102	5.8	0.1	70	67	65	62
880	143.884	0.164	0.078	1.14	89.1	-2.99	100	5.8	0	69	67	65	62
881	144.047	0.163	0.079	1.14	89.1	-3	99	5.8	0	69	67	65	62
882	144.209	0.162	0.081	1.14	88.4	-2.99	97	5.8	0	68	67	65	62
883	144.374	0.165	0.076	1.14	89.2	-3	102	5.8	0	68	67	65	62
884	144.536	0.162	0.079	1.16	89.2	-3.01	98	5.8	0	69	67	65	62
885	144.699	0.163	0.077	1.14	89.0	-3.03	100	5.8	0	70	67	65	62
886	144.864	0.165	0.076	1.14	89.1	-3.04	102	5.7	-0.1	69	67	65	62
887	145.026	0.162	0.080	1.14	88.8	-3.01	98	5.7	0	69	67	65	62
888	145.189	0.163	0.080	1.14	88.8	-3.02	98	5.7	0	68	67	65	62
889	145.353	0.164	0.079	1.14	88.4	-3.02	99	5.7	0	68	67	65	62
890	145.515	0.162	0.080	1.14	89.0	-3.02	97	5.7	0	68	67	65	62
891	145.679	0.164	0.078	1.14	88.6	-3.04	100	5.7	0	69	67	65	62
892	145.843	0.164	0.077	1.15	88.4	-3.04	101	5.7	0	70	67	65	62
893	146.005	0.162	0.077	1.14	89.0	-3.05	99	5.7	0	70	67	65	62
894	146.170	0.165	0.079	1.14	89.1	-3.06	100	5.7	0	69	67	65	62
895	146.332	0.162	0.078	1.13	89.1	-3.06	99	5.7	0	69	67	65	62

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
896	146.495	0.163	0.078	1.13	89.0	-3.06	99	5.7	0	68	67	65	62
897	146.659	0.164	0.078	1.15	88.9	-3.07	100	5.8	0.1	68	67	65	62
898	146.822	0.163	0.075	1.16	89.0	-3.06	101	5.8	0	69	67	65	62
899	146.985	0.163	0.077	1.14	88.4	-3.09	100	5.8	0	70	67	65	62
900	147.149	0.164	0.078	1.17	88.7	-3.07	100	5.7	-0.1	70	67	65	62
901	147.311	0.162	0.077	1.12	89.0	-3.08	99	5.6	-0.1	69	67	65	62
902	147.475	0.164	0.078	1.11	88.6	-3.08	100	5.6	0	68	67	65	62
903	147.638	0.163	0.079	1.14	89.0	-3.09	99	5.7	0.1	68	67	65	62
904	147.801	0.163	0.077	1.16	88.8	-3.09	100	5.7	0	69	67	65	62
905	147.966	0.165	0.077	1.14	89.1	-3.03	101	5.7	0	70	67	65	62
906	148.128	0.162	0.077	1.14	88.3	-3.1	100	5.6	-0.1	70	67	65	62
907	148.290	0.162	0.079	1.14	88.3	-3.11	98	5.6	0	70	67	65	62
908	148.455	0.165	0.079	1.14	89.0	-3.11	100	5.6	0	69	67	65	62
909	148.617	0.162	0.078	1.14	88.3	-3.13	99	5.7	0.1	68	67	65	62
910	148.780	0.163	0.078	1.14	89.0	-3.1	99	5.7	0	69	67	65	62
911	148.944	0.164	0.080	1.14	88.4	-3.14	99	5.7	0	70	67	65	62
912	149.107	0.163	0.079	1.14	88.3	-3.13	99	5.7	0	70	67	65	62
913	149.271	0.164	0.077	1.13	89.1	-3.13	101	5.7	0	70	67	65	62
914	149.434	0.163	0.077	1.14	88.3	-3.13	100	5.7	0	69	67	65	62
915	149.596	0.162	0.079	1.12	88.3	-3.13	98	5.7	0	68	66	65	62
916	149.761	0.165	0.081	1.14	88.4	-3.15	99	5.7	0	68	67	65	62
917	149.923	0.162	0.078	1.14	88.7	-3.16	99	5.6	-0.1	69	66	65	62
918	150.086	0.163	0.079	1.14	89.1	-3.15	99	5.6	0	70	67	65	62
919	150.250	0.164	0.079	1.14	88.3	-3.15	100	5.6	0	70	67	65	62
920	150.413	0.163	0.077	1.14	88.2	-3.11	100	5.7	0.1	70	104	65	62
921	150.576	0.163	0.079	1.14	88.5	-3.15	99	5.6	-0.1	72	134	65	62
922	150.739	0.163	0.079	1.15	88.2	-3.14	99	5.4	-0.2	71	159	65	62
923	150.901	0.162	0.075	1.14	88.2	-3.15	101	5.1	-0.3	73	178	65	62
924	151.066	0.165	0.077	1.14	88.8	-3.15	102	4.8	-0.3	75	196	65	62
925	151.228	0.162	0.077	1.14	88.3	-3.14	100	4.6	-0.2	76	210	65	62
926	151.390	0.162	0.079	1.13	88.8	-3.16	99	4.3	-0.3	76	220	65	62
927	151.554	0.164	0.078	1.14	88.8	-3.16	101	4.1	-0.2	75	219	65	62

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
928	151.716	0.162	0.078	1.14	88.8	-3.15	99	3.9	-0.2	75	214	65	62
929	151.879	0.163	0.078	1.14	88.3	-3.15	100	3.7	-0.2	75	221	65	62
930	152.043	0.164	0.078	1.14	89.0	-3.15	101	3.4	-0.3	76	226	65	62
931	152.205	0.162	0.077	1.14	88.3	-3.12	100	3.1	-0.3	77	236	65	62
932	152.369	0.164	0.077	1.14	88.9	-3.13	101	2.9	-0.2	78	244	65	62
933	152.531	0.162	0.077	1.14	88.2	-3.12	100	2.7	-0.2	78	252	65	62
934	152.693	0.162	0.079	1.13	88.7	-3.09	99	2.4	-0.3	78	254	65	62
935	152.857	0.164	0.077	1.14	88.2	-3.06	102	2.1	-0.3	78	254	65	62
936	153.019	0.162	0.077	1.14	88.6	-3.05	100	1.7	-0.4	78	249	65	62
937	153.182	0.163	0.075	1.13	88.3	-3.04	102	1.4	-0.3	79	253	66	62
938	153.345	0.163	0.078	1.14	88.2	-3	100	1.1	-0.3	79	256	66	62
939	153.507	0.162	0.078	1.12	88.3	-2.99	100	1.0	-0.1	79	264	66	62
940	153.671	0.164	0.079	1.14	88.1	-2.95	101	0.7	-0.3	79	270	66	62
941	153.833	0.162	0.077	1.12	88.9	-2.94	100	0.4	-0.3	80	274	66	62
942	153.995	0.162	0.075	1.14	88.8	-2.86	102	0.0	-0.4	80	276	66	62
Avg/Tot	153.995	0.163	0.078	1.14	89	-2.43	100			70	98	66	63.7

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.58	75	6.64		67	-0.060	0.60	0.22
1	0.139	0.139	1.19	75	-1.33	93	68	-0.030	7.09	1.57
2	0.298	0.159	1.22	75	3.22	105	68	-0.030	15.44	1.71
3	0.458	0.160	1.17	76	-2.35	107	68	-0.010	10.04	4.13
4	0.616	0.158	1.16	75	-1.38	107	68	-0.030	5.20	4.13
5	0.776	0.160	1.21	74	-1.48	105	68	-0.020	3.81	2.89
6	0.934	0.158	1.18	75	-0.93	104	69	0.000	3.38	2.29
7	1.093	0.159	1.19	75	-1.36	105	69	0.000	3.22	2.02
8	1.250	0.157	1.19	74	-23.29	104	69	-0.010	2.88	1.75
9	1.410	0.160	1.16	75	-20.54	107	69	0.000	2.69	1.55
10	1.566	0.156	1.24	75	18.43	102	69	0.000	2.54	1.41
11	1.725	0.159	1.13	75	12.61	104	69	-0.010	2.37	1.29
12	1.883	0.158	1.17	74	-40.88	104	69	0.000	2.27	1.20
13	2.039	0.156	1.15	75	-18.59	102	69	0.000	2.12	1.11
14	2.198	0.159	1.16	76	6.8	106	69	0.000	1.90	0.99
15	2.354	0.156	1.16	75	-23.71	104	69	0.000	1.91	0.96
16	2.512	0.158	1.16	75	-1.29	104	69	0.000	1.84	0.91
17	2.669	0.157	1.20	76	-1.29	103	69	0.010	1.79	0.84
18	2.825	0.156	1.14	75	-1.29	102	69	0.000	1.78	0.84
19	2.984	0.159	1.15	76	-1.45	105	69	0.000	1.75	0.82
20	3.139	0.155	1.15	75	-1.37	103	69	0.000	1.66	0.76
21	3.297	0.158	1.11	76	-1.45	105	69	-0.010	1.69	0.76
22	3.454	0.157	1.15	77	-1.37	105	69	0.000	1.58	0.69
23	3.610	0.156	1.15	77	-1.35	103	69	0.000	1.58	0.67
24	3.767	0.157	1.17	77	-1.26	103	69	0.000	1.60	0.67
25	3.923	0.156	1.20	78	-1.46	101	70	0.010	1.51	0.64
26	4.080	0.157	1.13	78	-1.25	102	69	0.000	1.51	0.62
27	4.237	0.157	1.14	77	-1.29	102	70	0.000	1.53	0.62
28	4.392	0.155	1.16	77	-1.36	102	70	0.000	1.54	0.61
29	4.550	0.158	1.14	79	-1.44	104	70	-0.010	1.46	0.57
30	4.707	0.157	1.14	78	-1.49	102	70	0.000	1.47	0.56
31	4.862	0.155	1.16	78	-1.37	101	70	0.010	1.45	0.55

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
32	5.020	0.158	1.14	78	-1.37	102	70	0.010	1.45	0.52
33	5.175	0.155	1.14	79	-1.36	102	70	0.000	1.40	0.51
34	5.332	0.157	1.14	79	-1.28	102	70	0.000	1.44	0.52
35	5.490	0.158	1.15	79	-1.33	103	70	0.000	1.43	0.49
36	5.645	0.155	1.15	80	-1.35	101	70	-0.010	1.38	0.48
37	5.802	0.157	1.14	79	-1.36	103	70	0.000	1.30	0.45
38	5.959	0.157	1.12	80	-1.29	103	70	0.010	1.26	0.43
39	6.115	0.156	1.14	81	-1.36	101	70	0.000	1.25	0.40
40	6.273	0.158	1.14	80	-1.28	103	70	0.010	1.21	0.39
41	6.428	0.155	1.13	80	-1.28	99	70	0.000	1.18	0.38
42	6.586	0.158	1.14	82	-1.45	103	70	0.000	1.15	0.35
43	6.743	0.157	1.14	82	-1.33	101	70	0.010	1.20	0.34
44	6.898	0.155	1.11	82	-1.36	100	70	0.000	1.11	0.33
45	7.056	0.158	1.15	81	-1.44	103	70	0.000	1.06	0.30
46	7.212	0.156	1.15	81	-1.41	101	70	0.000	1.03	0.29
47	7.369	0.157	1.15	82	-1.45	102	70	0.000	1.00	0.27
48	7.527	0.158	1.15	83	-1.42	101	70	0.000	0.95	0.25
49	7.682	0.155	1.14	82	-1.41	100	70	0.000	0.96	0.25
50	7.840	0.158	1.10	83	-1.45	102	70	0.020	0.90	0.23
51	7.997	0.157	1.13	83	-1.32	101	70	0.000	0.84	0.22
52	8.153	0.156	1.14	83	-1.24	100	70	0.010	0.84	0.21
53	8.312	0.159	1.07	84	-1.47	102	70	-0.020	0.79	0.20
54	8.467	0.155	1.14	83	-1.45	98	70	0.000	0.75	0.18
55	8.625	0.158	1.15	84	-1.33	103	70	0.000	0.70	0.16
56	8.783	0.158	1.18	85	-1.3	102	70	0.010	0.71	0.16
57	8.939	0.156	1.13	84	-1.36	99	70	0.010	0.69	0.15
58	9.097	0.158	1.14	85	-1.4	100	70	0.000	0.60	0.14
59	9.253	0.156	1.15	85	-1.24	100	70	0.000	0.61	0.14
60	9.411	0.158	1.12	85	-1.27	101	70	0.010	0.62	0.14
61	9.569	0.158	1.14	86	-1.35	102	70	0.000	0.59	0.13
62	9.725	0.156	1.15	86	-1.44	100	70	0.000	0.52	0.10
63	9.884	0.159	1.15	86	-1.48	101	70	0.000	0.50	0.10

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
64	10.040	0.156	1.12	87	-1.36	100	70	0.010	0.53	0.11
65	10.198	0.158	1.14	87	-1.38	100	70	0.000	0.48	0.09
66	10.356	0.158	1.11	86	-1.39	101	70	0.000	0.47	0.09
67	10.513	0.157	1.09	86	-1.41	99	70	-0.010	0.43	0.08
68	10.672	0.159	1.13	86	-1.27	101	70	0.010	0.40	0.08
69	10.828	0.156	1.15	86	-1.38	100	70	0.010	0.40	0.08
70	10.987	0.159	1.12	87	-1.24	101	70	0.010	0.36	0.08
71	11.143	0.156	1.14	87	-1.47	100	70	0.000	0.41	0.07
72	11.301	0.158	1.14	87	-1.41	100	70	0.010	0.37	0.06
73	11.460	0.159	1.20	88	-1.42	100	70	0.000	0.37	0.07
74	11.617	0.157	1.15	87	-1.34	99	70	0.010	0.33	0.05
75	11.776	0.159	1.15	88	-1.29	100	70	0.010	0.36	0.06
76	11.932	0.156	1.15	87	-1.35	99	70	0.000	0.33	0.05
77	12.091	0.159	1.15	87	-1.43	100	70	0.010	0.34	0.06
78	12.248	0.157	1.23	89	-1.3	100	70	-0.010	0.34	0.06
79	12.406	0.158	1.15	89	-1.26	100	70	0.010	0.33	0.05
80	12.565	0.159	1.15	88	-1.33	101	70	0.000	0.31	0.05
81	12.722	0.157	1.15	88	-1.3	98	70	0.010	0.32	0.05
82	12.881	0.159	1.10	89	-1.33	101	70	0.010	0.33	0.05
83	13.038	0.157	1.11	88	-1.3	99	70	0.000	0.35	0.05
84	13.197	0.159	1.15	88	-1.21	102	70	0.000	0.31	0.05
85	13.354	0.157	1.15	89	-1.25	99	70	0.000	0.30	0.04
86	13.513	0.159	1.14	88	-1.44	101	70	0.010	0.30	0.05
87	13.671	0.158	1.16	89	-1.27	100	70	0.000	0.31	0.04
88	13.829	0.158	1.12	89	-1.47	100	70	0.000	0.29	0.04
89	13.988	0.159	1.16	90	-1.32	101	70	0.010	0.28	0.04
90	14.145	0.157	1.15	89	-1.35	100	70	-0.010	0.27	0.04
91	14.305	0.160	1.15	90	-1.32	101	70	0.000	0.27	0.04
92	14.461	0.156	1.13	90	-1.35	99	70	0.010	0.26	0.04
93	14.621	0.160	1.11	89	-1.34	103	70	0.000	0.32	0.04
94	14.778	0.157	1.17	90	-1.24	98	70	0.000	0.28	0.04
95	14.938	0.160	1.15	90	-1.4	101	70	0.000	0.27	0.04

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
96	15.095	0.157	1.17	90	-1.45	99	70	0.010	0.24	0.04
97	15.254	0.159	1.15	89	-1.27	101	70	0.010	0.26	0.04
98	15.413	0.159	1.18	90	-1.4	101	70	0.010	0.23	0.04
99	15.571	0.158	1.16	90	-1.26	99	70	0.000	0.25	0.03
100	15.730	0.159	1.14	91	-1.2	100	70	0.010	0.22	0.03
101	15.887	0.157	1.20	91	-1.34	99	70	0.010	0.20	0.03
102	16.047	0.160	1.16	91	-1.34	101	70	0.000	0.22	0.03
103	16.204	0.157	1.15	90	-1.34	100	70	0.000	0.19	0.03
104	16.364	0.160	1.16	91	-1.42	102	70	0.000	0.20	0.03
105	16.521	0.157	1.15	92	-1.43	99	70	0.010	0.21	0.03
106	16.681	0.160	1.15	91	-1.45	102	70	0.000	0.19	0.03
107	16.839	0.158	1.16	92	-1.24	98	70	0.010	0.17	0.02
108	16.998	0.159	1.15	91	-1.4	101	70	0.000	0.18	0.02
109	17.157	0.159	1.13	91	-1.39	100	70	0.020	0.14	0.04
110	17.315	0.158	1.18	91	-1.33	100	70	0.000	0.19	0.03
111	17.475	0.160	1.16	92	-1.38	101	70	-0.010	0.15	0.03
112	17.632	0.157	1.16	90	-1.47	98	69	0.000	0.13	0.02
113	17.792	0.160	1.15	92	-1.28	100	69	0.010	0.14	0.02
114	17.949	0.157	1.16	92	-1.21	100	69	0.000	0.15	0.02
115	18.109	0.160	1.19	91	-1.38	100	69	0.000	0.13	0.02
116	18.266	0.157	1.15	91	-1.41	99	69	0.010	0.15	0.02
117	18.426	0.160	1.16	92	-1.41	100	69	0.010	0.12	0.02
118	18.583	0.157	1.20	91	-1.29	99	69	0.000	0.16	0.02
119	18.743	0.160	1.13	92	-1.32	100	69	0.010	0.14	0.02
120	18.901	0.158	1.16	91	-1.22	100	69	0.010	0.11	0.02
121	19.061	0.160	1.16	91	-1.42	101	69	0.010	0.12	0.02
122	19.219	0.158	1.12	91	-1.38	100	69	0.000	0.11	0.02
123	19.378	0.159	1.13	93	-1.28	99	69	0.010	0.12	0.02
124	19.538	0.160	1.14	92	-1.32	101	69	0.010	0.10	0.02
125	19.695	0.157	1.16	91	-1.45	98	69	0.000	0.09	0.02
126	19.855	0.160	1.18	92	-1.35	100	69	0.010	0.11	0.02
127	20.013	0.158	1.17	91	-1.36	99	69	0.000	0.11	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
128	20.173	0.160	1.16	92	-1.42	100	69	0.000	0.09	0.01
129	20.330	0.157	1.18	91	-1.31	99	69	0.000	0.11	0.01
130	20.490	0.160	1.14	93	-1.35	101	69	0.010	0.08	0.02
131	20.648	0.158	1.16	93	-1.3	99	69	0.000	0.09	0.01
132	20.808	0.160	1.15	92	-1.31	100	69	0.010	0.08	0.01
133	20.965	0.157	1.18	93	-1.28	98	69	0.000	0.10	0.02
134	21.126	0.161	1.16	92	-1.29	102	69	0.000	0.08	0.01
135	21.283	0.157	1.15	91	-1.47	98	69	0.000	0.11	0.02
136	21.443	0.160	1.14	92	-1.32	101	69	0.010	0.12	0.02
137	21.602	0.159	1.17	92	-1.31	100	68	0.010	0.06	0.02
138	21.761	0.159	1.14	92	-1.33	99	69	0.020	0.09	0.02
139	21.920	0.159	1.15	91	-1.4	100	69	-0.030	4.73	0.42
140	22.078	0.158	1.15	93	-1.39	100	69	-0.030	5.94	1.79
141	22.238	0.160	1.13	91	-1.26	100	69	-0.040	13.35	1.36
142	22.395	0.157	1.14	92	-1.21	99	69	-0.040	14.75	0.26
143	22.554	0.159	1.15	93	-1.39	101	70	-0.040	15.71	0.15
144	22.711	0.157	1.16	93	-1.21	100	70	-0.050	15.31	0.07
145	22.870	0.159	1.15	92	-1.32	100	70	-0.040	15.06	0.06
146	23.027	0.157	1.17	92	-1.38	100	70	-0.050	15.23	0.05
147	23.186	0.159	1.18	92	-1.29	101	70	-0.050	15.50	0.04
148	23.345	0.159	1.14	92	-1.32	101	70	-0.050	14.97	0.04
149	23.502	0.157	1.15	93	-1.34	99	70	-0.050	14.82	0.06
150	23.661	0.159	1.14	92	-1.32	102	70	-0.050	14.71	0.05
151	23.818	0.157	1.13	93	-1.4	99	70	-0.060	15.05	0.04
152	23.977	0.159	1.14	92	-1.37	101	70	-0.060	14.87	0.03
153	24.134	0.157	1.16	92	-1.4	100	70	-0.050	15.06	0.03
154	24.294	0.160	1.19	92	-1.36	103	71	-0.060	14.29	0.03
155	24.444	0.150	1.13	92	-1.33	96	71	-0.060	15.27	0.04
156	24.601	0.157	1.13	92	-1.4	101	71	-0.050	14.78	0.03
157	24.760	0.159	1.15	93	-1.36	102	71	-0.060	14.33	0.03
158	24.917	0.157	1.17	93	-1.25	101	71	-0.050	14.60	0.04
159	25.076	0.159	1.13	93	-1.29	101	71	-0.050	14.53	0.03

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
160	25.235	0.159	1.15	92	-1.2	102	71	-0.060	14.48	0.02
161	25.392	0.157	1.09	92	-1.49	102	71	-0.060	14.87	0.04
162	25.551	0.159	1.14	92	-1.35	101	71	-0.060	14.08	0.03
163	25.708	0.157	1.20	93	-1.35	100	71	-0.040	10.60	3.37
164	25.868	0.160	1.15	92	-1.39	101	71	-0.050	10.81	5.00
165	26.026	0.158	1.15	93	-1.47	99	71	-0.050	8.71	4.39
166	26.186	0.160	1.15	92	-1.4	101	70	-0.030	7.04	3.33
167	26.343	0.157	1.13	92	-1.39	99	70	-0.030	5.57	2.53
168	26.503	0.160	1.15	93	-1.35	99	70	-0.030	4.43	1.94
169	26.661	0.158	1.16	93	-1.48	99	70	-0.030	3.54	1.50
170	26.821	0.160	1.15	93	-1.48	101	70	-0.030	2.84	1.16
171	26.979	0.158	1.16	93	-1.34	100	70	-0.020	2.27	0.90
172	27.138	0.159	1.15	92	-1.44	100	70	-0.010	1.87	0.72
173	27.298	0.160	1.14	92	-1.4	100	70	-0.030	1.53	0.58
174	27.456	0.158	1.15	93	-1.43	100	70	-0.010	1.24	0.46
175	27.616	0.160	1.16	92	-1.32	100	70	-0.010	1.04	0.39
176	27.773	0.157	1.19	93	-1.24	98	70	-0.020	0.85	0.32
177	27.933	0.160	1.15	92	-1.45	101	70	-0.010	0.70	0.25
178	28.091	0.158	1.10	92	-1.41	98	69	-0.010	0.56	0.21
179	28.251	0.160	1.12	92	-1.38	100	69	-0.010	0.51	0.18
180	28.408	0.157	1.18	93	-1.27	98	69	0.000	0.44	0.14
181	28.568	0.160	1.20	93	-1.29	101	69	-0.010	0.40	0.14
182	28.726	0.158	1.16	92	-1.35	100	69	-0.010	0.35	0.12
183	28.886	0.160	1.16	92	-1.41	100	69	-0.010	0.34	0.10
184	29.044	0.158	1.16	93	-1.43	99	69	-0.010	0.31	0.10
185	29.204	0.160	1.17	93	-1.21	100	69	-0.010	0.29	0.09
186	29.362	0.158	1.14	93	-1.42	99	69	0.000	0.27	0.08
187	29.521	0.159	1.16	93	-1.49	99	69	-0.010	0.27	0.08
188	29.680	0.159	1.16	91	-1.22	100	69	0.000	0.23	0.08
189	29.839	0.159	1.16	93	-1.42	99	69	-0.010	0.22	0.07
190	29.998	0.159	1.16	93	-1.39	101	69	0.000	0.21	0.06
191	30.156	0.158	1.09	92	-1.49	98	69	0.000	0.22	0.07

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
192	30.316	0.160	1.15	92	-1.22	100	69	0.010	0.17	0.05
193	30.474	0.158	1.16	93	-1.24	100	69	0.000	0.17	0.06
194	30.634	0.160	1.10	93	-1.31	100	69	0.000	0.13	0.05
195	30.791	0.157	1.16	92	-1.3	99	69	0.000	0.17	0.05
196	30.951	0.160	1.09	93	-1.44	101	69	-0.010	0.17	0.06
197	31.109	0.158	1.16	91	-1.25	100	69	-0.010	0.13	0.05
198	31.269	0.160	1.15	92	-1.23	100	69	0.000	0.12	0.05
199	31.426	0.157	1.18	93	-1.36	98	69	0.000	0.15	0.04
200	31.587	0.161	1.13	91	-1.3	100	69	0.000	0.18	0.04
201	31.744	0.157	1.15	92	-1.44	99	69	0.000	0.15	0.04
202	31.904	0.160	1.13	92	-1.36	101	69	-0.010	0.16	0.03
203	32.063	0.159	1.17	92	-1.28	101	69	-0.010	0.12	0.03
204	32.222	0.159	1.16	93	-1.27	99	69	0.000	0.13	0.04
205	32.381	0.159	1.21	92	-1.31	100	69	-0.010	0.15	0.03
206	32.539	0.158	1.15	92	-1.39	100	69	-0.010	0.14	0.03
207	32.699	0.160	1.12	93	-1.31	100	69	0.000	0.15	0.04
208	32.857	0.158	1.18	92	-1.39	98	69	0.000	0.13	0.03
209	33.017	0.160	1.17	93	-1.37	101	69	0.000	0.13	0.04
210	33.174	0.157	1.15	93	-1.38	98	69	0.000	0.12	0.03
211	33.335	0.161	1.15	93	-1.32	100	69	0.000	0.12	0.03
212	33.492	0.157	1.15	91	-1.35	98	69	0.000	0.13	0.03
213	33.652	0.160	1.15	93	-1.24	100	69	0.000	0.14	0.03
214	33.810	0.158	1.16	91	-1.27	98	69	0.000	0.13	0.03
215	33.970	0.160	1.19	92	-1.38	100	69	0.000	0.15	0.03
216	34.127	0.157	1.15	93	-1.45	101	69	0.000	0.12	0.03
217	34.288	0.161	1.19	93	-1.35	100	69	0.000	0.12	0.03
218	34.445	0.157	1.16	93	-1.35	98	69	0.000	0.13	0.03
219	34.605	0.160	1.15	92	-1.35	101	68	0.000	0.13	0.02
220	34.764	0.159	1.16	92	-1.33	100	68	0.000	0.14	0.02
221	34.923	0.159	1.17	91	-1.29	100	68	0.000	0.15	0.02
222	35.082	0.159	1.16	92	-1.38	100	68	0.000	0.13	0.02
223	35.241	0.159	1.17	93	-1.43	99	68	0.010	0.15	0.03

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
224	35.400	0.159	1.17	92	-1.36	99	68	0.010	0.14	0.03
225	35.558	0.158	1.15	92	-1.24	100	68	0.000	0.13	0.02
226	35.718	0.160	1.17	91	-1.34	100	68	0.010	0.14	0.03
227	35.876	0.158	1.16	93	-1.36	99	68	0.000	0.13	0.02
228	36.036	0.160	1.16	92	-1.37	101	68	0.000	0.12	0.02
229	36.193	0.157	1.15	92	-1.25	98	68	0.010	0.13	0.02
230	36.354	0.161	1.20	93	-1.26	101	68	0.000	0.14	0.01
231	36.511	0.157	1.18	92	-1.42	98	68	0.010	0.14	0.02
232	36.671	0.160	1.19	92	-1.37	100	68	0.000	0.12	0.02
233	36.829	0.158	1.13	92	-1.25	99	68	0.000	0.11	0.01
234	36.989	0.160	1.13	92	-1.31	100	68	0.010	0.13	0.02
235	37.147	0.158	1.15	92	-1.43	98	68	-0.010	0.14	0.02
236	37.307	0.160	1.16	91	-1.42	100	68	0.010	0.14	0.03
237	37.465	0.158	1.15	92	-1.4	98	68	0.000	0.13	0.01
238	37.624	0.159	1.16	91	-1.36	100	68	0.000	0.12	0.02
239	37.783	0.159	1.15	91	-1.37	99	68	0.000	0.12	0.02
240	37.942	0.159	1.16	93	-1.32	101	68	0.010	0.12	0.02
241	38.102	0.160	1.16	93	-1.43	101	68	0.000	0.12	0.02
242	38.260	0.158	1.14	93	-1.37	99	68	0.010	0.13	0.02
243	38.420	0.160	1.16	92	-1.36	100	68	0.000	0.11	0.01
244	38.577	0.157	1.11	93	-1.34	99	68	0.000	0.11	0.02
245	38.737	0.160	1.15	92	-1.26	100	68	0.000	0.12	0.01
246	38.895	0.158	1.16	92	-1.48	98	68	0.000	0.10	0.01
247	39.055	0.160	1.14	93	-1.3	100	68	0.010	0.10	0.02
248	39.213	0.158	1.16	92	-1.41	98	68	0.000	0.11	0.01
249	39.373	0.160	1.14	92	-1.32	101	68	0.000	0.12	0.02
250	39.530	0.157	1.15	92	-1.26	97	68	0.000	0.12	0.01
251	39.691	0.161	1.14	91	-1.4	101	68	0.010	0.09	0.02
252	39.848	0.157	1.22	92	-1.25	98	68	-0.010	0.13	0.02
253	40.008	0.160	1.16	92	-1.33	101	68	0.000	0.11	0.01
254	40.166	0.158	1.16	91	-1.31	98	68	0.010	0.11	0.01
255	40.326	0.160	1.17	92	-1.37	100	68	0.010	0.10	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
256	40.484	0.158	1.15	92	-1.44	99	68	0.020	0.10	0.02
257	40.643	0.159	1.17	91	-1.25	99	68	0.010	0.12	0.02
258	40.803	0.160	1.16	91	-1.45	100	68	0.020	0.13	0.01
259	40.961	0.158	1.18	91	-1.35	100	68	0.000	0.10	0.01
260	41.121	0.160	1.15	91	-1.37	101	68	0.010	0.10	0.01
261	41.278	0.157	1.15	92	-1.44	98	68	0.000	0.10	0.01
262	41.439	0.161	1.17	91	-1.43	100	68	0.010	0.10	0.01
263	41.596	0.157	1.16	92	-1.35	99	68	0.000	0.11	0.01
264	41.757	0.161	1.17	91	-1.37	102	68	-0.010	0.12	0.02
265	41.914	0.157	1.16	91	-1.34	98	68	0.010	0.07	0.02
266	42.074	0.160	1.15	92	-1.36	101	68	0.010	0.10	0.01
267	42.232	0.158	1.16	91	-1.46	98	68	0.000	0.10	0.01
268	42.392	0.160	1.16	91	-1.29	100	68	0.010	0.09	0.01
269	42.550	0.158	1.16	92	-1.27	101	68	0.000	0.09	0.01
270	42.710	0.160	1.15	92	-1.42	100	68	0.000	0.07	0.01
271	42.868	0.158	1.16	91	-1.47	99	68	0.010	0.11	0.02
272	43.027	0.159	1.15	91	-1.42	99	68	0.000	0.08	0.01
273	43.186	0.159	1.14	92	-1.37	98	68	0.020	0.12	0.01
274	43.345	0.159	1.15	92	-1.31	99	68	0.010	0.08	0.01
275	43.504	0.159	1.14	91	-1.43	98	68	0.000	0.09	0.02
276	43.663	0.159	1.16	91	-1.4	100	68	0.000	0.09	0.01
277	43.822	0.159	1.16	92	-1.29	99	68	0.000	0.09	0.01
278	43.980	0.158	1.12	91	-1.31	100	68	0.010	0.09	0.02
279	44.140	0.160	1.15	91	-1.33	100	68	0.010	0.09	0.01
280	44.298	0.158	1.18	92	-1.47	99	68	0.000	0.08	0.01
281	44.458	0.160	1.17	92	-1.33	102	68	0.010	0.09	0.01
282	44.615	0.157	1.19	91	-1.41	98	68	0.000	0.12	0.01
283	44.776	0.161	1.15	91	-1.34	100	68	0.000	0.09	0.01
284	44.933	0.157	1.16	92	-1.46	98	68	0.000	0.08	0.01
285	45.093	0.160	1.09	91	-1.39	102	68	0.000	0.08	0.02
286	45.251	0.158	1.12	92	-1.37	99	68	0.010	0.07	0.01
287	45.411	0.160	1.15	91	-1.33	100	68	0.020	0.11	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
288	45.569	0.158	1.15	91	-1.3	98	68	0.000	0.07	0.01
289	45.729	0.160	1.16	92	-1.35	101	68	0.000	0.08	0.01
290	45.887	0.158	1.18	91	-1.38	100	68	0.000	0.10	0.01
291	46.046	0.159	1.16	91	-1.47	100	68	0.010	0.07	0.01
292	46.205	0.159	1.16	91	-1.4	99	68	0.000	0.08	0.01
293	46.364	0.159	1.16	92	-1.47	100	68	0.010	0.08	0.01
294	46.524	0.160	1.21	92	-1.26	101	68	0.010	0.11	0.01
295	46.682	0.158	1.16	91	-1.26	99	68	0.000	0.08	0.01
296	46.842	0.160	1.11	92	-1.29	101	68	0.000	0.10	0.02
297	46.999	0.157	1.16	92	-1.26	100	68	0.000	0.08	0.01
298	47.160	0.161	1.16	91	-1.34	102	68	0.000	0.08	0.01
299	47.317	0.157	1.16	91	-1.47	99	68	0.010	0.09	0.01
300	47.477	0.160	1.19	92	-1.45	99	68	0.000	0.11	0.00
301	47.635	0.158	1.16	92	-1.32	98	68	0.000	0.08	0.01
302	47.795	0.160	1.16	92	-1.41	100	68	0.000	0.07	0.01
303	47.953	0.158	1.16	91	-1.38	99	67	0.010	0.07	0.01
304	48.113	0.160	1.14	91	-1.43	103	68	0.010	0.08	0.01
305	48.270	0.157	1.15	91	-1.25	99	68	0.010	0.08	0.01
306	48.430	0.160	1.18	91	-1.47	101	68	0.010	0.07	0.01
307	48.588	0.158	1.16	91	-1.35	98	68	0.000	0.09	0.01
308	48.748	0.160	1.21	91	-1.35	99	68	0.020	0.10	0.01
309	48.907	0.159	1.16	91	-1.26	99	68	0.000	0.08	0.01
310	49.066	0.159	1.17	91	-1.26	100	67	0.000	0.07	0.01
311	49.225	0.159	1.15	91	-1.33	100	67	0.010	0.07	0.01
312	49.383	0.158	1.16	91	-1.29	98	67	0.010	0.08	0.01
313	49.543	0.160	1.17	92	-1.36	101	68	0.010	0.10	0.01
314	49.701	0.158	1.15	91	-1.27	99	68	0.000	0.08	0.01
315	49.861	0.160	1.16	91	-1.45	100	68	0.000	0.09	0.01
316	50.018	0.157	1.13	91	-1.35	98	67	0.010	0.07	0.01
317	50.179	0.161	1.15	90	-1.34	101	68	0.000	0.09	0.01
318	50.336	0.157	1.22	92	-1.28	98	68	0.000	0.08	0.01
319	50.496	0.160	1.14	92	-1.25	101	67	0.010	0.11	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	50.654	0.158	1.14	90	-1.27	99	67	0.000	0.10	0.01
321	50.814	0.160	1.15	91	-1.34	100	67	0.010	0.09	0.00
322	50.971	0.157	1.16	90	-1.3	97	67	0.000	0.08	0.01
323	51.132	0.161	1.15	90	-1.43	102	67	0.010	0.08	0.01
324	51.290	0.158	1.14	91	-1.45	99	67	0.010	0.08	0.01
325	51.449	0.159	1.17	92	-1.35	100	68	0.010	0.08	0.01
326	51.608	0.159	1.17	91	-1.37	100	67	0.000	0.10	0.01
327	51.767	0.159	1.16	92	-1.36	99	67	0.000	0.07	0.00
328	51.926	0.159	1.18	92	-1.4	100	68	0.010	0.09	0.01
329	52.085	0.159	1.16	90	-1.37	100	67	0.010	0.09	0.01
330	52.245	0.160	1.18	91	-1.28	102	67	0.000	0.07	0.02
331	52.402	0.157	1.19	91	-1.41	99	68	0.000	0.11	0.02
332	52.562	0.160	1.16	91	-1.34	100	68	0.010	0.09	0.01
333	52.719	0.157	1.15	91	-1.34	98	67	0.010	0.08	0.01
334	52.879	0.160	1.16	92	-1.36	101	68	0.010	0.07	0.01
335	53.037	0.158	1.16	91	-1.25	100	67	0.010	0.09	0.01
336	53.197	0.160	1.16	91	-1.41	101	67	0.000	0.08	0.01
337	53.355	0.158	1.16	92	-1.48	100	67	0.000	0.07	0.01
338	53.515	0.160	1.16	91	-1.34	100	67	0.000	0.09	0.01
339	53.672	0.157	1.17	91	-1.38	98	67	0.010	0.07	0.01
340	53.832	0.160	1.15	91	-1.46	100	67	0.000	0.09	0.01
341	53.990	0.158	1.16	90	-1.24	99	67	0.010	0.07	0.01
342	54.150	0.160	1.16	90	-1.26	102	67	0.000	0.08	0.01
343	54.309	0.159	1.13	90	-1.43	99	68	-0.030	1.16	0.05
344	54.467	0.158	1.16	91	-1.45	99	68	-0.030	1.43	0.19
345	54.627	0.160	1.16	92	-1.41	100	68	-0.030	4.15	0.90
346	54.784	0.157	1.14	90	-1.46	100	68	-0.020	6.40	1.13
347	54.943	0.159	1.15	90	-1.46	102	68	-0.030	8.03	1.04
348	55.100	0.157	1.14	91	-1.46	99	68	-0.040	11.79	1.27
349	55.260	0.160	1.15	90	-1.46	101	68	-0.040	13.03	0.71
350	55.417	0.157	1.15	91	-1.46	99	69	-0.020	13.10	0.40
351	55.576	0.159	1.12	91	-1.36	99	69	-0.040	13.74	0.21

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
352	55.734	0.158	1.15	90	-1.47	100	69	-0.040	13.35	0.09
353	55.892	0.158	1.15	90	-1.47	101	69	-0.050	14.01	0.09
354	56.051	0.159	1.15	92	-1.29	103	69	-0.050	13.72	0.04
355	56.208	0.157	1.17	91	-1.47	101	69	-0.050	13.85	0.03
356	56.367	0.159	1.14	90	-1.46	101	69	-0.050	13.44	0.03
357	56.524	0.157	1.15	90	-1.37	100	69	-0.050	13.85	0.03
358	56.683	0.159	1.14	90	-1.38	102	69	-0.060	13.47	0.03
359	56.840	0.157	1.16	90	-1.47	100	70	-0.060	13.52	0.04
360	56.999	0.159	1.13	90	-1.43	102	70	-0.050	13.56	0.03
361	57.157	0.158	1.16	90	-1.3	101	70	-0.050	13.53	0.03
362	57.314	0.157	1.12	91	-1.37	99	70	-0.050	13.39	0.02
363	57.474	0.160	1.15	91	-1.3	102	70	-0.050	13.42	0.02
364	57.630	0.156	1.15	91	-1.42	100	70	-0.050	13.25	0.03
365	57.790	0.160	1.14	91	-1.38	103	70	-0.050	13.36	0.02
366	57.946	0.156	1.17	92	-1.39	99	70	-0.050	13.35	0.03
367	58.105	0.159	1.15	90	-1.22	102	70	-0.050	13.05	0.02
368	58.263	0.158	1.13	90	-1.47	101	70	-0.060	12.59	0.76
369	58.422	0.159	1.15	91	-1.26	101	69	-0.050	11.52	5.00
370	58.581	0.159	1.16	90	-1.23	101	69	-0.050	11.98	5.00
371	58.739	0.158	1.16	92	-1.32	99	69	-0.040	10.85	5.00
372	58.898	0.159	1.18	90	-1.27	99	69	-0.030	9.29	5.00
373	59.056	0.158	1.15	90	-1.33	99	69	-0.030	8.00	4.25
374	59.216	0.160	1.16	90	-1.41	101	69	-0.030	7.03	3.69
375	59.373	0.157	1.14	91	-1.35	99	69	-0.030	6.06	3.15
376	59.533	0.160	1.15	90	-1.38	102	69	-0.020	5.34	2.75
377	59.690	0.157	1.15	92	-1.45	98	69	-0.020	4.60	2.33
378	59.850	0.160	1.16	90	-1.36	103	69	-0.020	4.21	2.11
379	60.007	0.157	1.15	91	-1.36	99	69	-0.010	3.71	1.84
380	60.167	0.160	1.13	90	-1.37	100	69	-0.020	2.90	1.42
381	60.325	0.158	1.14	91	-1.49	99	69	0.000	2.32	1.16
382	60.484	0.159	1.15	90	-1.37	101	69	-0.010	1.81	0.89
383	60.643	0.159	1.18	91	-1.4	98	68	0.000	1.50	0.74

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
384	60.801	0.158	1.11	92	-1.36	99	68	0.000	1.27	0.62
385	60.960	0.159	1.15	91	-1.48	100	68	0.000	1.07	0.50
386	61.118	0.158	1.12	91	-1.27	99	68	-0.010	1.03	0.48
387	61.278	0.160	1.19	90	-1.44	102	68	0.000	0.83	0.39
388	61.435	0.157	1.15	91	-1.36	98	68	-0.010	0.76	0.35
389	61.595	0.160	1.16	91	-1.35	99	68	-0.010	0.74	0.34
390	61.752	0.157	1.21	90	-1.25	98	68	-0.010	0.66	0.30
391	61.912	0.160	1.11	92	-1.38	100	68	-0.010	0.60	0.28
392	62.069	0.157	1.15	90	-1.34	99	68	-0.010	0.56	0.25
393	62.229	0.160	1.16	91	-1.45	102	68	0.000	0.49	0.21
394	62.387	0.158	1.15	91	-1.44	101	68	0.000	0.41	0.18
395	62.546	0.159	1.15	91	-1.36	100	68	0.000	0.40	0.16
396	62.705	0.159	1.16	91	-1.35	99	68	0.000	0.35	0.14
397	62.862	0.157	1.16	90	-1.27	98	68	0.000	0.32	0.12
398	63.022	0.160	1.15	91	-1.31	100	68	0.000	0.31	0.12
399	63.179	0.157	1.16	90	-1.41	98	68	0.000	0.31	0.11
400	63.339	0.160	1.16	90	-1.34	101	68	-0.010	0.28	0.10
401	63.496	0.157	1.12	90	-1.4	99	68	0.000	0.23	0.08
402	63.656	0.160	1.13	90	-1.33	102	68	0.010	0.19	0.09
403	63.813	0.157	1.20	90	-1.37	99	68	0.000	0.20	0.08
404	63.973	0.160	1.15	90	-1.36	100	68	0.000	0.18	0.07
405	64.131	0.158	1.16	90	-1.33	99	68	0.000	0.18	0.06
406	64.290	0.159	1.16	90	-1.46	99	68	0.000	0.19	0.06
407	64.449	0.159	1.15	90	-1.48	99	68	0.000	0.17	0.05
408	64.607	0.158	1.14	90	-1.46	98	68	0.010	0.18	0.05
409	64.767	0.160	1.18	91	-1.34	102	68	-0.020	0.17	0.04
410	64.924	0.157	1.15	90	-1.27	99	68	0.000	0.15	0.05
411	65.084	0.160	1.15	91	-1.3	101	68	0.000	0.18	0.04
412	65.241	0.157	1.18	90	-1.35	99	68	-0.010	0.14	0.04
413	65.401	0.160	1.18	91	-1.35	100	68	0.010	0.16	0.04
414	65.558	0.157	1.16	90	-1.42	98	68	0.000	0.18	0.03
415	65.718	0.160	1.15	91	-1.37	100	68	0.000	0.13	0.04

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
416	65.876	0.158	1.14	90	-1.28	101	68	0.000	0.13	0.03
417	66.035	0.159	1.15	90	-1.27	101	68	0.010	0.18	0.04
418	66.194	0.159	1.15	90	-1.46	99	68	0.000	0.14	0.03
419	66.352	0.158	1.20	90	-1.34	98	68	0.010	0.10	0.03
420	66.512	0.160	1.21	90	-1.46	101	68	0.000	0.11	0.03
421	66.669	0.157	1.16	91	-1.44	98	68	0.000	0.12	0.03
422	66.829	0.160	1.16	91	-1.43	99	68	0.000	0.12	0.03
423	66.986	0.157	1.15	91	-1.35	99	68	0.000	0.12	0.03
424	67.146	0.160	1.15	91	-1.32	100	68	0.000	0.12	0.02
425	67.303	0.157	1.14	90	-1.34	99	68	0.010	0.12	0.02
426	67.463	0.160	1.16	90	-1.28	101	68	0.000	0.13	0.02
427	67.621	0.158	1.15	91	-1.4	98	68	0.000	0.14	0.03
428	67.781	0.160	1.14	91	-1.29	99	68	0.010	0.16	0.03
429	67.938	0.157	1.16	91	-1.44	99	68	0.000	0.16	0.03
430	68.098	0.160	1.17	90	-1.3	100	68	0.010	0.12	0.03
431	68.256	0.158	1.12	90	-1.44	102	68	0.010	0.14	0.03
432	68.415	0.159	1.15	90	-1.45	100	68	0.000	0.14	0.02
433	68.574	0.159	1.16	90	-1.43	100	68	0.000	0.13	0.02
434	68.732	0.158	1.16	91	-1.39	99	68	0.000	0.13	0.02
435	68.892	0.160	1.16	90	-1.42	100	68	0.000	0.13	0.02
436	69.049	0.157	1.14	90	-1.45	99	67	0.010	0.13	0.02
437	69.209	0.160	1.13	91	-1.27	100	67	0.000	0.14	0.02
438	69.366	0.157	1.15	90	-1.42	98	68	0.000	0.14	0.02
439	69.526	0.160	1.14	91	-1.44	100	68	0.000	0.15	0.02
440	69.684	0.158	1.14	91	-1.4	100	68	-0.010	0.12	0.02
441	69.844	0.160	1.20	90	-1.33	100	68	-0.010	0.17	0.02
442	70.001	0.157	1.13	90	-1.42	97	67	0.030	0.15	0.02
443	70.161	0.160	1.11	90	-1.39	101	67	0.010	0.14	0.02
444	70.319	0.158	1.15	90	-1.32	97	67	-0.010	0.14	0.02
445	70.478	0.159	1.15	90	-1.43	101	67	0.000	0.14	0.02
446	70.637	0.159	1.15	90	-1.29	100	67	0.010	0.14	0.02
447	70.795	0.158	1.16	90	-1.33	98	67	0.000	0.15	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
448	70.955	0.160	1.15	90	-1.34	101	67	0.000	0.12	0.01
449	71.112	0.157	1.15	90	-1.31	99	67	0.000	0.14	0.01
450	71.272	0.160	1.14	90	-1.32	101	67	0.020	0.12	0.02
451	71.429	0.157	1.14	91	-1.36	98	67	0.000	0.13	0.02
452	71.589	0.160	1.15	90	-1.33	101	67	0.010	0.13	0.02
453	71.747	0.158	1.15	91	-1.28	99	67	0.000	0.14	0.01
454	71.907	0.160	1.16	90	-1.39	102	67	0.000	0.14	0.01
455	72.064	0.157	1.16	91	-1.45	97	67	0.010	0.14	0.01
456	72.223	0.159	1.14	91	-1.37	98	67	-0.010	0.14	0.01
457	72.382	0.159	1.17	90	-1.31	100	67	0.000	0.13	0.01
458	72.541	0.159	1.16	90	-1.47	100	67	0.000	0.15	0.01
459	72.700	0.159	1.18	90	-1.32	101	67	0.000	0.13	0.01
460	72.858	0.158	1.16	90	-1.46	99	67	0.000	0.12	0.01
461	73.017	0.159	1.16	90	-1.45	99	67	0.000	0.13	0.01
462	73.175	0.158	1.14	90	-1.42	100	67	0.010	0.13	0.01
463	73.334	0.159	1.16	90	-1.45	99	67	0.000	0.13	0.01
464	73.492	0.158	1.17	91	-1.37	99	67	0.010	0.11	0.01
465	73.652	0.160	1.17	89	-1.25	101	67	0.000	0.12	0.01
466	73.809	0.157	1.10	90	-1.27	99	67	-0.010	0.16	0.01
467	73.969	0.160	1.16	90	-1.36	102	67	0.020	0.13	0.01
468	74.126	0.157	1.13	90	-1.37	99	67	0.010	0.13	0.01
469	74.286	0.160	1.16	91	-1.32	102	67	0.000	0.12	0.01
470	74.444	0.158	1.11	91	-1.35	99	67	0.010	0.16	0.01
471	74.603	0.159	1.16	91	-1.26	101	67	0.000	0.11	0.01
472	74.762	0.159	1.14	90	-1.47	102	67	0.010	0.12	0.01
473	74.920	0.158	1.15	89	-1.42	100	67	0.010	0.12	0.01
474	75.079	0.159	1.15	91	-1.36	100	67	0.010	0.10	0.01
475	75.237	0.158	1.13	90	-1.36	100	67	0.030	0.15	0.02
476	75.397	0.160	1.16	90	-1.32	101	67	0.010	0.10	0.01
477	75.554	0.157	1.16	90	-1.34	101	67	0.010	0.11	0.01
478	75.714	0.160	1.17	91	-1.28	101	67	0.010	0.10	0.01
479	75.871	0.157	1.15	91	-1.28	98	67	0.010	0.12	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
480	76.031	0.160	1.15	89	-1.4	101	67	0.020	0.12	0.01
481	76.189	0.158	1.16	90	-1.41	99	67	0.000	0.11	0.01
482	76.348	0.159	1.21	91	-1.37	98	67	0.010	0.14	0.01
483	76.507	0.159	1.15	91	-1.4	99	67	0.000	0.11	0.01
484	76.665	0.158	1.16	90	-1.31	102	67	0.000	0.11	0.00
485	76.825	0.160	1.14	91	-1.3	102	67	0.000	0.10	0.01
486	76.982	0.157	1.18	90	-1.46	98	67	0.000	0.11	0.01
487	77.142	0.160	1.10	90	-1.34	100	67	0.000	0.10	0.01
488	77.299	0.157	1.16	90	-1.45	98	67	0.000	0.10	0.00
489	77.459	0.160	1.16	91	-1.26	100	67	0.000	0.11	0.01
490	77.617	0.158	1.15	90	-1.27	99	67	0.000	0.11	0.01
491	77.776	0.159	1.15	90	-1.44	99	67	0.000	0.11	0.01
492	77.934	0.158	1.16	89	-1.41	99	67	0.000	0.09	0.01
493	78.094	0.160	1.13	91	-1.39	102	67	-0.010	0.10	0.01
494	78.251	0.157	1.11	90	-1.46	99	67	0.020	0.10	0.01
495	78.411	0.160	1.15	91	-1.36	102	67	0.010	0.11	0.01
496	78.569	0.158	1.16	91	-1.45	100	67	0.000	0.09	0.01
497	78.728	0.159	1.20	90	-1.46	101	67	-0.020	0.12	0.01
498	78.887	0.159	1.14	91	-1.26	101	67	0.000	0.12	0.01
499	79.045	0.158	1.15	91	-1.25	100	67	0.000	0.09	0.01
500	79.205	0.160	1.16	91	-1.33	102	67	0.000	0.09	0.01
501	79.362	0.157	1.15	90	-1.36	99	67	0.000	0.13	0.02
502	79.522	0.160	1.12	90	-1.25	101	67	0.010	0.12	0.01
503	79.679	0.157	1.13	90	-1.35	99	67	0.000	0.13	0.01
504	79.839	0.160	1.14	90	-1.46	100	67	0.000	0.08	0.02
505	79.996	0.157	1.16	91	-1.34	98	67	0.000	0.11	0.01
506	80.156	0.160	1.16	90	-1.26	102	67	0.000	0.08	0.00
507	80.314	0.158	1.16	89	-1.29	99	67	0.000	0.09	0.01
508	80.473	0.159	1.14	89	-1.37	99	67	0.010	0.09	0.01
509	80.632	0.159	1.16	91	-1.36	100	67	0.010	0.08	0.00
510	80.791	0.159	1.16	90	-1.29	101	67	0.000	0.09	0.00
511	80.950	0.159	1.10	89	-1.29	101	67	-0.010	0.08	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
512	81.107	0.157	1.15	91	-1.32	98	67	0.000	0.09	0.01
513	81.267	0.160	1.14	90	-1.44	102	67	0.000	0.07	0.01
514	81.425	0.158	1.16	89	-1.34	99	67	0.010	0.09	0.00
515	81.585	0.160	1.18	90	-1.36	100	67	0.000	0.08	0.00
516	81.742	0.157	1.17	91	-1.35	98	67	0.010	0.09	0.00
517	81.902	0.160	1.22	90	-1.28	100	67	0.010	0.09	0.01
518	82.059	0.157	1.12	91	-1.45	99	67	0.010	0.07	0.01
519	82.219	0.160	1.16	90	-1.45	100	67	0.000	0.08	0.01
520	82.377	0.158	1.14	90	-1.47	99	67	0.000	0.09	0.01
521	82.536	0.159	1.12	91	-1.34	100	67	0.020	0.08	0.00
522	82.695	0.159	1.16	90	-1.28	101	67	0.000	0.07	0.00
523	82.853	0.158	1.16	91	-1.48	98	67	-0.010	0.07	0.00
524	83.013	0.160	1.11	90	-1.36	100	67	0.010	0.10	0.01
525	83.170	0.157	1.16	91	-1.28	98	67	0.000	0.07	0.00
526	83.330	0.160	1.15	90	-1.4	101	67	0.010	0.07	0.00
527	83.487	0.157	1.20	90	-1.37	97	67	0.000	0.07	0.01
528	83.647	0.160	1.15	89	-1.29	101	67	0.010	0.06	0.00
529	83.805	0.158	1.15	91	-1.28	98	67	0.010	0.10	0.00
530	83.964	0.159	1.19	91	-1.28	101	67	-0.030	3.61	0.42
531	84.121	0.157	1.15	89	-1.29	100	67	-0.030	2.58	0.53
532	84.281	0.160	1.15	90	-1.38	102	67	-0.020	6.89	1.56
533	84.439	0.158	1.15	90	-1.43	98	67	-0.020	8.43	1.64
534	84.597	0.158	1.14	90	-1.33	100	67	-0.030	11.35	1.32
535	84.756	0.159	1.14	90	-1.39	100	68	-0.040	9.07	1.05
536	84.913	0.157	1.11	91	-1.3	100	68	-0.030	10.14	0.85
537	85.072	0.159	1.13	89	-1.46	100	68	-0.040	11.81	0.87
538	85.229	0.157	1.15	90	-1.4	99	68	-0.030	13.30	0.49
539	85.388	0.159	1.16	89	-1.44	101	68	-0.040	14.38	0.30
540	85.545	0.157	1.14	90	-1.37	100	68	-0.040	14.09	0.05
541	85.704	0.159	1.12	90	-1.33	102	68	-0.040	14.43	0.05
542	85.862	0.158	1.15	90	-1.43	99	68	-0.040	14.36	0.04
543	86.020	0.158	1.16	91	-1.34	102	68	-0.040	14.45	0.03

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
544	86.179	0.159	1.15	89	-1.27	102	68	-0.040	14.16	0.03
545	86.335	0.156	1.13	91	-1.33	99	69	-0.050	14.47	0.04
546	86.495	0.160	1.15	91	-1.25	101	69	-0.040	13.75	0.02
547	86.651	0.156	1.15	89	-1.35	98	69	-0.050	14.29	0.02
548	86.810	0.159	1.08	89	-1.29	102	69	-0.040	13.87	0.02
549	86.968	0.158	1.15	91	-1.35	101	69	-0.050	14.03	0.02
550	87.126	0.158	1.15	91	-1.38	101	69	-0.050	13.62	0.02
551	87.285	0.159	1.14	91	-1.29	101	69	-0.060	13.85	0.02
552	87.441	0.156	1.15	91	-1.42	99	69	-0.040	13.73	0.02
553	87.601	0.160	1.15	89	-1.43	102	69	-0.050	13.81	0.02
554	87.757	0.156	1.15	90	-1.44	98	69	-0.040	13.31	0.02
555	87.917	0.160	1.15	90	-1.29	102	69	-0.040	10.04	3.37
556	88.074	0.157	1.14	89	-1.27	100	69	-0.040	10.96	5.00
557	88.233	0.159	1.15	90	-1.4	100	68	-0.040	10.86	5.00
558	88.391	0.158	1.15	90	-1.29	99	68	-0.030	10.06	5.00
559	88.550	0.159	1.11	89	-1.38	101	68	-0.030	8.94	4.77
560	88.709	0.159	1.14	91	-1.44	99	68	-0.020	7.99	4.16
561	88.866	0.157	1.14	89	-1.35	100	68	-0.030	6.68	3.40
562	89.026	0.160	1.13	90	-1.39	102	68	-0.020	5.80	2.89
563	89.183	0.157	1.15	91	-1.45	99	68	-0.020	5.18	2.53
564	89.342	0.159	1.15	89	-1.39	101	68	-0.020	4.43	2.12
565	89.500	0.158	1.19	89	-1.33	100	68	-0.020	3.97	1.88
566	89.659	0.159	1.15	91	-1.28	98	68	-0.010	3.45	1.62
567	89.817	0.158	1.16	91	-1.36	98	68	-0.010	2.95	1.37
568	89.976	0.159	1.16	89	-1.33	98	68	-0.010	2.53	1.16
569	90.134	0.158	1.16	91	-1.46	100	68	-0.010	2.19	0.99
570	90.293	0.159	1.15	89	-1.42	101	68	-0.010	1.85	0.83
571	90.452	0.159	1.15	91	-1.41	100	68	-0.010	1.60	0.70
572	90.609	0.157	1.15	89	-1.28	100	68	0.000	1.43	0.61
573	90.769	0.160	1.18	90	-1.31	102	68	-0.010	1.29	0.55
574	90.926	0.157	1.12	91	-1.3	99	68	-0.020	1.15	0.49
575	91.086	0.160	1.16	90	-1.34	101	68	0.000	1.07	0.45

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
576	91.243	0.157	1.15	90	-1.3	98	68	0.000	0.95	0.39
577	91.402	0.159	1.08	89	-1.34	101	68	-0.010	0.89	0.37
578	91.560	0.158	1.08	91	-1.43	100	68	-0.010	0.76	0.32
579	91.719	0.159	1.15	91	-1.34	100	68	-0.010	0.73	0.29
580	91.878	0.159	1.14	89	-1.43	99	68	0.000	0.63	0.24
581	92.035	0.157	1.12	91	-1.39	99	68	0.000	0.58	0.22
582	92.195	0.160	1.15	89	-1.39	101	67	0.000	0.49	0.19
583	92.352	0.157	1.16	89	-1.35	99	67	0.000	0.46	0.18
584	92.512	0.160	1.11	89	-1.44	100	67	0.000	0.44	0.17
585	92.669	0.157	1.16	90	-1.38	99	67	0.000	0.39	0.14
586	92.828	0.159	1.15	90	-1.45	99	68	0.000	0.40	0.14
587	92.985	0.157	1.15	90	-1.31	99	67	-0.010	0.36	0.11
588	93.145	0.160	1.15	90	-1.43	101	67	0.000	0.29	0.11
589	93.303	0.158	1.16	89	-1.43	99	67	0.000	0.28	0.09
590	93.462	0.159	1.15	90	-1.39	100	67	0.000	0.25	0.08
591	93.621	0.159	1.16	89	-1.29	100	67	0.000	0.24	0.08
592	93.778	0.157	1.15	91	-1.39	100	67	0.000	0.22	0.07
593	93.938	0.160	1.15	91	-1.37	100	67	0.000	0.23	0.07
594	94.095	0.157	1.17	89	-1.46	101	67	0.000	0.21	0.06
595	94.254	0.159	1.23	89	-1.34	99	67	0.010	0.20	0.06
596	94.412	0.158	1.14	90	-1.4	99	67	0.000	0.19	0.05
597	94.571	0.159	1.14	89	-1.29	101	67	0.000	0.17	0.05
598	94.728	0.157	1.15	89	-1.3	100	67	0.000	0.18	0.05
599	94.888	0.160	1.12	90	-1.44	100	67	0.000	0.16	0.04
600	95.046	0.158	1.15	89	-1.41	99	67	0.000	0.17	0.04
601	95.205	0.159	1.12	90	-1.29	101	67	0.000	0.17	0.04
602	95.364	0.159	1.15	89	-1.43	100	67	0.000	0.14	0.03
603	95.521	0.157	1.12	89	-1.42	98	67	0.010	0.17	0.03
604	95.681	0.160	1.15	89	-1.34	99	67	0.000	0.15	0.03
605	95.838	0.157	1.13	89	-1.3	100	67	0.010	0.16	0.04
606	95.998	0.160	1.05	91	-1.41	99	67	0.000	0.17	0.03
607	96.155	0.157	1.15	89	-1.45	99	67	0.000	0.15	0.03

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
608	96.314	0.159	1.15	90	-1.46	99	67	0.000	0.10	0.03
609	96.471	0.157	1.13	91	-1.4	99	67	0.000	0.13	0.03
610	96.631	0.160	1.07	89	-1.29	101	67	-0.010	0.13	0.02
611	96.789	0.158	1.20	90	-1.31	99	67	0.010	0.10	0.02
612	96.947	0.158	1.16	89	-1.48	100	67	0.010	0.15	0.03
613	97.107	0.160	1.15	89	-1.43	103	67	0.000	0.12	0.02
614	97.264	0.157	1.16	91	-1.42	99	67	0.010	0.12	0.02
615	97.424	0.160	1.15	89	-1.31	101	67	0.000	0.12	0.02
616	97.581	0.157	1.15	89	-1.3	100	67	0.000	0.14	0.02
617	97.740	0.159	1.16	90	-1.41	99	67	0.000	0.14	0.02
618	97.897	0.157	1.15	89	-1.43	99	67	-0.010	0.12	0.02
619	98.057	0.160	1.15	91	-1.45	100	67	0.000	0.12	0.02
620	98.215	0.158	1.14	89	-1.4	98	67	0.000	0.11	0.02
621	98.374	0.159	1.15	91	-1.41	100	67	0.000	0.13	0.01
622	98.532	0.158	1.16	89	-1.45	102	67	0.000	0.13	0.02
623	98.690	0.158	1.10	90	-1.35	99	67	-0.010	0.13	0.02
624	98.850	0.160	1.18	89	-1.35	101	67	0.000	0.13	0.02
625	99.007	0.157	1.17	90	-1.45	98	67	0.020	0.16	0.02
626	99.167	0.160	1.14	89	-1.32	102	67	0.000	0.13	0.02
627	99.324	0.157	1.10	91	-1.31	98	67	0.000	0.14	0.02
628	99.483	0.159	1.19	91	-1.33	100	67	-0.010	0.11	0.01
629	99.640	0.157	1.15	90	-1.36	99	67	0.000	0.13	0.01
630	99.800	0.160	1.15	90	-1.41	101	67	0.010	0.12	0.02
631	99.958	0.158	1.18	90	-1.46	99	67	0.010	0.13	0.01
632	100.117	0.159	1.15	89	-1.45	100	67	0.010	0.13	0.02
633	100.275	0.158	1.12	89	-1.3	100	67	-0.010	0.12	0.01
634	100.433	0.158	1.17	91	-1.39	99	67	0.000	0.12	0.01
635	100.593	0.160	1.15	90	-1.29	99	67	0.000	0.12	0.01
636	100.750	0.157	1.15	89	-1.32	99	67	0.000	0.17	0.02
637	100.910	0.160	1.16	90	-1.38	102	67	0.000	0.11	0.01
638	101.067	0.157	1.14	90	-1.46	99	67	0.010	0.11	0.01
639	101.226	0.159	1.18	90	-1.35	99	67	0.010	0.11	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
640	101.384	0.158	1.16	90	-1.27	100	67	0.000	0.11	0.01
641	101.543	0.159	1.15	90	-1.33	100	67	0.010	0.11	0.01
642	101.701	0.158	1.16	90	-1.29	99	67	0.010	0.12	0.01
643	101.860	0.159	1.15	89	-1.34	101	67	0.000	0.11	0.01
644	102.019	0.159	1.14	90	-1.39	99	67	0.000	0.11	0.01
645	102.176	0.157	1.15	90	-1.46	97	67	0.000	0.09	0.01
646	102.336	0.160	1.10	90	-1.43	102	67	0.000	0.12	0.01
647	102.493	0.157	1.16	89	-1.3	99	67	0.000	0.10	0.01
648	102.653	0.160	1.14	91	-1.45	100	67	0.010	0.11	0.01
649	102.810	0.157	1.15	89	-1.4	99	67	0.000	0.10	0.01
650	102.970	0.160	1.15	90	-1.3	101	67	0.010	0.12	0.01
651	103.127	0.157	1.16	90	-1.44	99	67	0.000	0.10	0.00
652	103.286	0.159	1.15	89	-1.43	100	67	0.000	0.10	0.01
653	103.444	0.158	1.16	89	-1.33	98	67	0.010	0.12	0.01
654	103.603	0.159	1.15	89	-1.45	99	67	0.000	0.09	0.01
655	103.762	0.159	1.16	90	-1.46	100	67	0.010	0.10	0.00
656	103.920	0.158	1.15	89	-1.39	99	67	0.010	0.10	0.01
657	104.079	0.159	1.16	90	-1.3	99	67	0.000	0.10	0.01
658	104.236	0.157	1.14	90	-1.44	99	67	-0.010	0.11	0.00
659	104.396	0.160	1.16	89	-1.39	100	67	0.010	0.09	0.01
660	104.553	0.157	1.14	89	-1.46	97	67	0.010	0.11	0.01
661	104.713	0.160	1.15	89	-1.3	100	67	0.000	0.09	0.00
662	104.870	0.157	1.16	90	-1.42	99	67	0.010	0.12	0.01
663	105.030	0.160	1.14	91	-1.3	101	67	0.010	0.10	0.01
664	105.188	0.158	1.14	89	-1.34	100	67	0.000	0.11	0.01
665	105.346	0.158	1.19	89	-1.44	101	67	0.010	0.09	0.01
666	105.505	0.159	1.15	90	-1.44	100	67	0.010	0.11	0.00
667	105.663	0.158	1.15	90	-1.33	99	67	0.000	0.11	0.01
668	105.823	0.160	1.13	90	-1.3	101	67	0.000	0.09	0.01
669	105.980	0.157	1.15	90	-1.32	100	67	0.010	0.09	0.00
670	106.140	0.160	1.15	89	-1.44	102	67	0.000	0.10	0.00
671	106.297	0.157	1.13	89	-1.28	99	67	0.010	0.13	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
672	106.456	0.159	1.16	90	-1.29	101	67	0.010	0.09	0.01
673	106.613	0.157	1.13	90	-1.44	100	67	0.010	0.10	0.01
674	106.773	0.160	1.13	89	-1.34	101	67	0.010	0.10	0.01
675	106.931	0.158	1.14	89	-1.4	101	67	0.000	0.09	0.01
676	107.090	0.159	1.16	90	-1.39	100	67	0.000	0.09	0.01
677	107.249	0.159	1.11	90	-1.3	99	67	0.000	0.11	0.01
678	107.406	0.157	1.15	89	-1.4	100	67	0.010	0.09	0.01
679	107.566	0.160	1.15	90	-1.4	100	67	0.010	0.09	0.00
680	107.723	0.157	1.19	89	-1.33	100	67	0.010	0.13	0.01
681	107.883	0.160	1.18	89	-1.34	99	67	0.000	0.11	0.01
682	108.040	0.157	1.17	89	-1.41	99	67	0.010	0.09	0.01
683	108.200	0.160	1.17	89	-1.43	100	67	0.010	0.12	0.01
684	108.357	0.157	1.16	90	-1.36	99	67	0.000	0.08	0.00
685	108.516	0.159	1.16	89	-1.29	100	67	0.010	0.07	0.00
686	108.675	0.159	1.15	89	-1.39	101	67	0.000	0.07	0.02
687	108.833	0.158	1.15	90	-1.27	99	67	0.010	0.09	0.00
688	108.992	0.159	1.14	90	-1.4	101	67	0.000	0.10	0.01
689	109.150	0.158	1.12	89	-1.44	99	67	0.010	0.10	0.01
690	109.309	0.159	1.16	89	-1.39	99	67	0.010	0.10	0.01
691	109.467	0.158	1.18	89	-1.42	98	66	0.010	0.08	0.01
692	109.626	0.159	1.16	89	-1.34	98	67	0.000	0.08	0.00
693	109.784	0.158	1.12	89	-1.28	101	67	0.010	0.10	0.01
694	109.943	0.159	1.16	90	-1.33	101	67	0.010	0.07	0.00
695	110.100	0.157	1.17	90	-1.28	100	67	0.000	0.10	0.01
696	110.260	0.160	1.15	90	-1.3	100	67	0.000	0.09	0.00
697	110.418	0.158	1.16	89	-1.34	98	66	0.000	0.08	0.00
698	110.577	0.159	1.15	90	-1.44	100	67	0.010	0.09	0.00
699	110.736	0.159	1.14	89	-1.43	100	67	0.010	0.08	0.00
700	110.893	0.157	1.17	89	-1.31	100	67	0.000	0.07	0.01
701	111.053	0.160	1.15	90	-1.46	100	67	0.010	0.07	0.00
702	111.210	0.157	1.17	90	-1.3	97	67	0.010	0.07	0.01
703	111.370	0.160	1.14	89	-1.3	101	67	0.010	0.07	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
704	111.527	0.157	1.16	89	-1.3	99	67	0.000	0.07	0.00
705	111.687	0.160	1.15	90	-1.29	102	66	0.010	0.06	0.00
706	111.844	0.157	1.15	90	-1.39	99	66	0.010	0.06	0.00
707	112.003	0.159	1.16	90	-1.39	101	66	0.010	0.07	0.00
708	112.162	0.159	1.16	90	-1.39	101	67	0.010	0.08	0.00
709	112.320	0.158	1.09	89	-1.33	99	67	0.000	0.08	0.00
710	112.479	0.159	1.17	89	-1.44	99	67	0.020	0.08	0.01
711	112.637	0.158	1.14	90	-1.42	101	67	0.010	0.09	0.01
712	112.796	0.159	1.18	90	-1.37	100	67	0.000	0.10	0.01
713	112.954	0.158	1.16	89	-1.36	103	66	0.000	0.09	0.01
714	113.113	0.159	1.15	89	-1.28	101	66	0.000	0.08	0.00
715	113.270	0.157	1.15	89	-1.27	99	66	0.010	0.06	0.00
716	113.430	0.160	1.14	89	-1.38	101	67	-0.010	0.07	0.01
717	113.587	0.157	1.16	89	-1.42	98	67	0.010	0.06	0.00
718	113.747	0.160	1.15	89	-1.28	100	67	0.000	0.06	0.00
719	113.905	0.158	1.16	90	-1.39	100	67	0.000	0.05	0.01
720	114.064	0.159	1.09	90	-1.4	100	66	0.020	0.05	0.01
721	114.223	0.159	1.13	90	-1.41	101	66	0.000	0.07	0.01
722	114.380	0.157	1.18	89	-1.34	97	66	0.010	0.09	0.01
723	114.540	0.160	1.15	90	-1.46	99	66	0.000	0.05	0.00
724	114.697	0.157	1.14	89	-1.27	99	67	0.000	0.05	0.00
725	114.857	0.160	1.16	90	-1.46	100	67	0.010	0.07	0.00
726	115.014	0.157	1.16	90	-1.38	98	67	0.010	0.07	0.00
727	115.174	0.160	1.14	89	-1.41	100	67	-0.020	0.09	0.00
728	115.330	0.156	1.15	89	-1.25	100	67	-0.020	1.72	0.33
729	115.490	0.160	1.10	89	-1.42	104	67	-0.020	6.53	1.91
730	115.648	0.158	1.17	90	-1.33	100	67	-0.020	6.58	1.74
731	115.806	0.158	1.13	89	-1.42	101	67	-0.010	7.54	1.48
732	115.965	0.159	1.16	89	-1.46	100	67	-0.040	9.30	1.22
733	116.121	0.156	1.15	90	-1.27	99	67	-0.030	11.03	0.88
734	116.281	0.160	1.15	90	-1.34	104	67	-0.030	11.90	0.73
735	116.437	0.156	1.13	89	-1.3	99	67	-0.020	12.26	1.33

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
736	116.597	0.160	1.15	90	-1.41	101	67	-0.030	12.73	1.18
737	116.754	0.157	1.15	90	-1.36	100	67	-0.030	13.23	0.62
738	116.912	0.158	1.13	90	-1.46	101	68	-0.040	13.30	0.95
739	117.071	0.159	1.15	90	-1.42	100	68	-0.040	12.64	1.32
740	117.227	0.156	1.14	90	-1.28	99	68	-0.040	12.57	1.24
741	117.387	0.160	1.15	90	-1.35	101	68	-0.040	13.10	0.72
742	117.543	0.156	1.14	89	-1.27	100	68	-0.040	13.50	0.79
743	117.702	0.159	1.14	90	-1.47	100	68	-0.050	13.58	0.61
744	117.859	0.157	1.15	90	-1.23	99	68	-0.040	12.96	0.72
745	118.017	0.158	1.14	89	-1.25	101	68	-0.040	12.91	1.26
746	118.176	0.159	1.15	90	-1.35	101	68	-0.040	13.01	1.10
747	118.332	0.156	1.15	89	-1.34	98	68	-0.040	13.25	0.40
748	118.492	0.160	1.16	89	-1.39	100	68	-0.030	12.83	0.83
749	118.648	0.156	1.16	90	-1.34	97	68	-0.040	12.31	1.14
750	118.807	0.159	1.12	90	-1.35	100	68	-0.040	12.00	1.09
751	118.964	0.157	1.17	89	-1.34	100	68	-0.040	11.99	1.30
752	119.123	0.159	1.15	89	-1.28	101	68	-0.030	10.76	0.83
753	119.281	0.158	1.12	89	-1.35	100	68	-0.030	8.94	4.77
754	119.439	0.158	1.16	89	-1.34	100	68	-0.030	8.88	5.00
755	119.598	0.159	1.13	89	-1.42	101	68	-0.030	8.02	4.49
756	119.755	0.157	1.14	89	-1.45	100	68	-0.030	7.15	3.83
757	119.914	0.159	1.15	88	-1.29	100	68	-0.020	6.34	3.27
758	120.071	0.157	1.14	89	-1.39	100	68	-0.010	5.54	2.76
759	120.231	0.160	1.15	89	-1.36	101	68	-0.020	5.06	2.46
760	120.388	0.157	1.15	90	-1.36	98	68	-0.010	4.76	2.27
761	120.547	0.159	1.11	90	-1.38	101	68	-0.020	4.25	1.99
762	120.705	0.158	1.15	89	-1.45	101	67	-0.010	3.96	1.82
763	120.863	0.158	1.15	89	-1.47	100	67	0.000	3.64	1.66
764	121.022	0.159	1.12	89	-1.3	101	67	-0.010	3.39	1.52
765	121.179	0.157	1.15	90	-1.34	99	67	-0.010	2.99	1.33
766	121.339	0.160	1.15	90	-1.36	102	67	-0.010	2.69	1.19
767	121.495	0.156	1.16	89	-1.48	98	67	0.000	2.53	1.09

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
768	121.655	0.160	1.17	90	-1.37	101	67	0.000	2.47	1.05
769	121.812	0.157	1.15	89	-1.44	99	67	0.000	2.22	0.94
770	121.971	0.159	1.14	90	-1.35	99	67	-0.010	2.13	0.90
771	122.129	0.158	1.15	89	-1.42	100	67	0.000	2.04	0.85
772	122.287	0.158	1.15	89	-1.36	101	67	0.000	1.87	0.77
773	122.446	0.159	1.15	89	-1.39	100	67	0.000	1.64	0.67
774	122.603	0.157	1.15	90	-1.35	99	67	0.000	1.52	0.60
775	122.762	0.159	1.14	89	-1.47	100	67	0.000	1.44	0.57
776	122.919	0.157	1.14	90	-1.32	100	67	0.000	1.29	0.51
777	123.078	0.159	1.13	90	-1.39	99	67	-0.010	1.18	0.45
778	123.236	0.158	1.16	90	-1.36	100	67	0.000	1.08	0.41
779	123.394	0.158	1.15	90	-1.47	99	67	0.000	0.91	0.35
780	123.553	0.159	1.15	90	-1.26	100	67	0.000	0.86	0.32
781	123.710	0.157	1.14	90	-1.4	99	67	0.000	0.78	0.29
782	123.870	0.160	1.18	89	-1.32	100	67	0.000	0.66	0.25
783	124.026	0.156	1.16	90	-1.3	97	67	0.000	0.59	0.22
784	124.186	0.160	1.14	90	-1.33	101	67	0.000	0.57	0.21
785	124.343	0.157	1.16	89	-1.47	100	67	0.010	0.46	0.18
786	124.502	0.159	1.16	89	-1.38	101	67	0.000	0.47	0.17
787	124.660	0.158	1.22	90	-1.46	99	67	0.000	0.47	0.15
788	124.818	0.158	1.12	89	-1.31	99	67	0.000	0.42	0.14
789	124.977	0.159	1.15	90	-1.34	99	67	0.000	0.38	0.13
790	125.134	0.157	1.14	89	-1.41	100	67	0.010	0.36	0.11
791	125.294	0.160	1.15	89	-1.41	102	67	0.000	0.33	0.11
792	125.450	0.156	1.15	90	-1.41	99	67	0.000	0.32	0.09
793	125.610	0.160	1.15	88	-1.46	102	67	0.000	0.29	0.08
794	125.767	0.157	1.15	90	-1.29	98	67	0.000	0.28	0.08
795	125.926	0.159	1.11	89	-1.46	101	67	0.010	0.25	0.07
796	126.084	0.158	1.17	89	-1.28	100	67	0.010	0.25	0.07
797	126.242	0.158	1.14	89	-1.46	100	67	0.000	0.24	0.06
798	126.401	0.159	1.16	89	-1.33	101	67	0.000	0.22	0.05
799	126.558	0.157	1.13	89	-1.26	100	67	0.010	0.18	0.05

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
800	126.718	0.160	1.10	89	-1.35	102	67	0.010	0.21	0.05
801	126.874	0.156	1.15	89	-1.38	98	67	0.000	0.18	0.04
802	127.034	0.160	1.18	88	-1.46	101	67	0.000	0.18	0.04
803	127.191	0.157	1.15	89	-1.43	98	67	0.000	0.17	0.04
804	127.350	0.159	1.15	88	-1.43	100	67	0.010	0.16	0.04
805	127.508	0.158	1.15	90	-1.44	101	67	0.000	0.15	0.03
806	127.666	0.158	1.15	89	-1.36	100	67	0.010	0.15	0.03
807	127.825	0.159	1.15	89	-1.33	100	67	0.000	0.15	0.03
808	127.982	0.157	1.15	88	-1.27	98	67	0.010	0.15	0.03
809	128.141	0.159	1.14	88	-1.47	100	67	0.000	0.15	0.02
810	128.298	0.157	1.16	89	-1.3	97	67	0.010	0.13	0.02
811	128.458	0.160	1.15	89	-1.35	100	67	0.010	0.16	0.02
812	128.614	0.156	1.13	90	-1.25	99	67	0.000	0.15	0.02
813	128.774	0.160	1.15	90	-1.38	103	67	0.000	0.12	0.02
814	128.932	0.158	1.15	90	-1.39	99	67	0.000	0.14	0.02
815	129.090	0.158	1.18	90	-1.47	101	67	0.000	0.10	0.01
816	129.249	0.159	1.15	90	-1.45	100	67	0.000	0.12	0.01
817	129.406	0.157	1.15	89	-1.45	100	67	-0.010	0.12	0.02
818	129.565	0.159	1.12	90	-1.25	100	67	0.000	0.16	0.02
819	129.722	0.157	1.17	89	-1.29	100	67	0.000	0.12	0.01
820	129.881	0.159	1.14	89	-1.28	102	67	0.010	0.10	0.01
821	130.038	0.157	1.18	89	-1.38	98	67	0.010	0.12	0.01
822	130.197	0.159	1.13	89	-1.51	100	67	0.010	0.10	0.01
823	130.356	0.159	1.15	90	-1.3	99	67	0.000	0.09	0.01
824	130.513	0.157	1.16	90	-1.32	98	67	0.000	0.10	0.01
825	130.672	0.159	1.15	90	-1.22	99	67	0.000	0.10	0.00
826	130.829	0.157	1.15	89	-1.37	97	67	0.000	0.10	0.01
827	130.988	0.159	1.16	89	-1.47	100	67	0.010	0.10	0.01
828	131.145	0.157	1.15	90	-1.49	100	67	0.000	0.09	0.01
829	131.305	0.160	1.15	89	-1.41	103	67	0.010	0.08	0.00
830	131.462	0.157	1.15	90	-1.42	98	67	0.000	0.07	0.01
831	131.621	0.159	1.14	89	-1.46	101	67	0.000	0.09	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
832	131.779	0.158	1.15	89	-1.26	99	67	0.000	0.09	0.00
833	131.937	0.158	1.14	90	-1.38	102	67	0.010	0.10	0.01
834	132.096	0.159	1.15	89	-1.29	100	67	0.010	0.08	0.00
835	132.253	0.157	1.19	89	-1.31	100	67	0.000	0.10	0.01
836	132.412	0.159	1.13	89	-1.49	100	67	0.010	0.08	0.01
837	132.569	0.157	1.14	89	-1.3	99	67	0.010	0.09	0.00
838	132.728	0.159	1.16	89	-1.44	100	67	0.000	0.08	0.00
839	132.886	0.158	1.17	90	-1.45	99	67	0.010	0.08	0.00
840	133.044	0.158	1.19	89	-1.23	100	67	0.010	0.09	0.01
841	133.203	0.159	1.17	89	-1.41	100	67	0.010	0.09	0.00
842	133.360	0.157	1.15	89	-1.32	99	67	0.000	0.07	0.00
843	133.519	0.159	1.15	90	-1.33	100	67	0.000	0.07	0.00
844	133.676	0.157	1.16	90	-1.29	99	67	0.000	0.07	0.01
845	133.836	0.160	1.17	88	-1.32	101	67	0.000	0.10	0.01
846	133.992	0.156	1.16	89	-1.37	99	67	0.010	0.07	0.00
847	134.152	0.160	1.13	88	-1.39	101	66	0.000	0.06	0.01
848	134.310	0.158	1.14	90	-1.41	101	67	-0.010	0.07	0.01
849	134.468	0.158	1.16	89	-1.4	100	67	0.000	0.07	0.00
850	134.627	0.159	1.18	90	-1.44	100	67	0.010	0.08	0.00
851	134.784	0.157	1.15	88	-1.43	98	67	0.000	0.06	0.00
852	134.943	0.159	1.14	88	-1.3	101	67	0.000	0.06	0.00
853	135.100	0.157	1.16	90	-1.35	100	67	0.010	0.06	0.00
854	135.259	0.159	1.19	88	-1.4	100	66	0.010	0.08	0.01
855	135.416	0.157	1.12	89	-1.28	99	67	0.000	0.07	0.01
856	135.575	0.159	1.16	88	-1.31	100	67	0.010	0.08	0.00
857	135.734	0.159	1.15	89	-1.34	100	67	0.000	0.06	0.00
858	135.892	0.158	1.14	89	-1.41	100	67	0.000	0.08	0.00
859	136.051	0.159	1.13	88	-1.42	101	66	0.020	0.11	0.01
860	136.208	0.157	1.14	89	-1.4	99	67	0.010	0.07	0.00
861	136.367	0.159	1.15	88	-1.35	101	66	0.000	0.06	0.00
862	136.524	0.157	1.16	89	-1.38	100	66	0.000	0.05	0.00
863	136.684	0.160	1.17	88	-1.47	99	66	0.010	0.05	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
864	136.840	0.156	1.13	88	-1.46	100	66	0.000	0.06	0.01
865	137.000	0.160	1.15	88	-1.42	101	66	0.010	0.07	0.00
866	137.158	0.158	1.14	89	-1.39	98	66	0.010	0.08	0.01
867	137.316	0.158	1.15	88	-1.46	100	66	0.000	0.06	0.00
868	137.475	0.159	1.19	88	-1.33	101	66	0.010	0.08	0.01
869	137.632	0.157	1.15	89	-1.3	98	66	0.000	0.07	0.00
870	137.792	0.160	1.14	89	-1.28	101	66	0.010	0.05	0.01
871	137.948	0.156	1.15	88	-1.26	98	66	0.020	0.08	0.01
872	138.108	0.160	1.15	90	-1.4	101	66	0.010	0.05	0.00
873	138.265	0.157	1.15	89	-1.44	98	66	0.000	0.06	0.00
874	138.424	0.159	1.14	88	-1.44	98	66	0.000	0.07	0.01
875	138.582	0.158	1.16	88	-1.39	99	66	0.000	0.08	0.01
876	138.741	0.159	1.16	90	-1.3	99	66	0.010	0.04	0.00
877	138.900	0.159	1.17	88	-1.42	99	66	0.010	0.05	0.00
878	139.057	0.157	1.15	89	-1.45	99	66	0.000	0.06	0.00
879	139.216	0.159	1.15	89	-1.43	102	66	0.000	0.06	0.00
880	139.373	0.157	1.18	89	-1.28	99	66	0.000	0.04	0.00
881	139.532	0.159	1.15	88	-1.35	100	66	0.010	0.05	0.00
882	139.689	0.157	1.16	89	-1.44	97	66	0.010	0.06	0.00
883	139.848	0.159	1.14	89	-1.44	101	66	0.010	0.06	0.00
884	140.006	0.158	1.12	89	-1.29	99	66	0.010	0.06	0.01
885	140.164	0.158	1.15	88	-1.27	100	66	0.000	0.06	0.00
886	140.323	0.159	1.14	88	-1.3	102	66	0.010	0.05	0.00
887	140.480	0.157	1.13	88	-1.36	98	66	0.010	0.06	0.00
888	140.640	0.160	1.15	88	-1.32	100	66	0.010	0.04	0.00
889	140.796	0.156	1.16	89	-1.44	98	66	0.000	0.06	0.01
890	140.956	0.160	1.15	88	-1.42	100	66	0.010	0.05	0.00
891	141.113	0.157	1.15	90	-1.22	99	66	0.010	0.04	0.00
892	141.272	0.159	1.14	89	-1.45	101	66	0.000	0.04	0.00
893	141.430	0.158	1.16	88	-1.26	100	66	0.000	0.05	0.01
894	141.588	0.158	1.14	89	-1.48	99	66	0.010	0.05	0.00
895	141.747	0.159	1.15	89	-1.46	100	66	-0.010	0.05	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
896	141.904	0.157	1.15	89	-1.46	99	66	0.000	0.05	0.00
897	142.063	0.159	1.12	88	-1.38	100	66	0.010	0.07	0.01
898	142.220	0.157	1.13	88	-1.46	101	66	0.010	0.07	0.00
899	142.380	0.160	1.15	88	-1.38	102	66	0.010	0.04	0.00
900	142.537	0.157	1.17	88	-1.43	99	66	0.000	0.06	0.01
901	142.695	0.158	1.16	88	-1.43	100	66	-0.010	0.07	0.00
902	142.854	0.159	1.18	90	-1.34	100	66	0.010	0.03	0.00
903	143.011	0.157	1.13	88	-1.36	98	66	0.010	0.06	0.00
904	143.170	0.159	1.16	89	-1.32	101	66	0.000	0.10	0.01
905	143.327	0.157	1.15	89	-1.45	100	66	0.010	0.03	0.00
906	143.487	0.160	1.15	89	-1.3	101	66	0.010	0.04	0.00
907	143.643	0.156	1.11	88	-1.29	98	66	0.010	0.05	0.00
908	143.802	0.159	1.16	88	-1.29	100	66	0.010	0.05	0.00
909	143.960	0.158	1.16	90	-1.35	99	66	0.010	0.05	0.00
910	144.119	0.159	1.16	88	-1.28	100	66	0.000	0.04	0.00
911	144.277	0.158	1.15	90	-1.27	98	66	0.010	0.05	0.00
912	144.434	0.157	1.12	89	-1.4	98	66	0.020	0.05	0.00
913	144.594	0.160	1.17	89	-1.41	101	66	0.010	0.06	0.01
914	144.750	0.156	1.17	88	-1.42	99	66	-0.010	0.05	0.01
915	144.910	0.160	1.11	89	-1.32	100	66	0.000	0.05	0.00
916	145.066	0.156	1.16	90	-1.3	96	66	0.010	0.03	0.00
917	145.225	0.159	1.15	90	-1.38	100	66	0.010	0.04	0.00
918	145.384	0.159	1.16	89	-1.4	100	66	0.000	0.04	0.00
919	145.542	0.158	1.14	88	-1.32	99	66	0.000	0.05	0.00
920	145.701	0.159	1.15	89	-1.47	101	66	-0.020	0.05	0.01
921	145.857	0.156	1.14	90	-1.22	98	67	-0.020	2.85	0.53
922	146.016	0.159	1.14	89	-1.27	100	67	-0.020	4.98	1.64
923	146.173	0.157	1.15	88	-1.24	101	67	-0.030	5.62	1.94
924	146.332	0.159	1.15	89	-1.46	101	67	-0.030	5.45	1.39
925	146.489	0.157	1.15	88	-1.31	100	67	-0.030	5.95	1.34
926	146.647	0.158	1.14	89	-1.38	100	67	-0.030	6.30	1.29
927	146.806	0.159	1.15	88	-1.43	101	67	-0.030	6.90	1.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
928	146.962	0.156	1.15	88	-1.37	99	67	-0.040	10.08	0.52
929	147.122	0.160	1.14	89	-1.33	101	67	-0.030	7.36	0.95
930	147.278	0.156	1.14	89	-1.35	99	67	-0.030	7.03	1.02
931	147.437	0.159	1.14	89	-1.26	102	68	-0.040	7.20	0.71
932	147.594	0.157	1.15	88	-1.25	100	68	-0.040	7.34	0.79
933	147.752	0.158	1.14	89	-1.46	101	68	-0.040	7.20	0.68
934	147.910	0.158	1.13	89	-1.25	100	68	-0.030	7.12	0.60
935	148.067	0.157	1.15	89	-1.46	100	68	-0.040	7.66	0.57
936	148.226	0.159	1.13	89	-1.3	102	68	-0.040	8.16	0.54
937	148.382	0.156	1.09	88	-1.38	101	68	-0.040	7.60	0.62
938	148.540	0.158	1.12	89	-1.48	100	68	-0.040	7.28	0.73
939	148.698	0.158	1.15	88	-1.44	101	68	-0.040	6.72	0.76
940	148.855	0.157	1.15	89	-1.49	99	68	-0.050	6.42	0.57
941	149.014	0.159	1.17	88	-1.42	102	68	-0.050	6.21	0.51
942	149.170	0.156	1.14	89	-1.44	101	68	-0.050	6.12	0.47
Avg/Tot	149.170	0.158	1.15	89	-1.43	100	68	-0.005	2.07	0.32

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
0	0.27		59.5	171.9	172.3	171.0	1.00	2.22	
1	0.27		59.6	171.9	172.3	171.0	1.00	2.26	254
2	0.27		59.6	172.2	172.9	171.6	1.00	2.21	249
3	0.27		59.7	173.0	173.6	172.3	1.00	2.24	254
4	0.28		59.8	173.3	173.7	172.4	1.00	2.32	263
5	0.27		59.9	173.3	173.6	172.3	1.00	2.22	252
6	0.27		60.0	173.3	173.6	172.3	1.00	2.28	259
7	0.27		60.1	173.2	173.5	172.2	1.00	2.26	256
8	0.27		60.2	173.1	173.4	172.1	1.00	2.22	251
9	0.27		60.2	173.0	173.3	172.0	1.00	2.25	254
10	0.27		60.3	172.9	173.2	171.9	1.00	2.21	249
11	0.26		60.4	172.8	173.1	171.8	1.00	2.20	248
12	0.26		60.4	172.7	173.0	171.8	1.00	2.16	243
13	0.27		60.4	172.6	172.9	171.7	1.00	2.22	249
14	0.27		60.5	172.5	172.8	171.5	1.00	2.23	250
15	0.26		60.5	172.4	172.7	171.4	1.00	2.20	246
16	0.26		60.6	172.3	172.6	171.3	1.00	2.16	241
17	0.27		60.6	172.2	172.5	171.2	1.00	2.22	248
18	0.27		60.6	172.1	172.4	171.1	1.00	2.22	248
19	0.26		60.7	172.0	172.3	171.0	1.00	2.19	244
20	0.26		60.7	171.9	172.1	170.9	1.00	2.18	243
21	0.27		60.7	171.8	172.0	170.8	1.00	2.21	246
22	0.26		60.7	171.7	171.9	170.7	1.00	2.20	244
23	0.26		60.6	171.5	171.8	170.6	1.00	2.20	244
24	0.26		60.6	171.4	171.7	170.4	1.00	2.18	242
25	0.26		60.5	171.3	171.5	170.3	1.00	2.20	244
26	0.26		60.5	171.2	171.4	170.2	1.00	2.17	241
27	0.26		60.4	171.0	171.3	170.0	1.00	2.19	243
28	0.27		60.4	170.9	171.2	170.0	1.00	2.22	246
29	0.27		60.4	170.8	171.0	169.8	1.00	2.22	246
30	0.27		60.4	170.7	170.9	169.7	1.00	2.22	246
31	0.26		60.4	170.6	170.8	169.6	1.00	2.20	243
32	0.26		60.4	170.4	170.7	169.4	1.00	2.18	240
33	0.27		60.4	170.3	170.6	169.3	1.00	2.22	244
34	0.27		60.4	170.2	170.4	169.2	1.00	2.22	245
35	0.26		60.5	170.1	170.3	169.1	1.00	2.18	240
36	0.26		60.5	170.0	170.2	169.0	1.00	2.17	238
37	0.26		60.6	169.8	170.1	168.9	1.00	2.14	234
38	0.26		60.6	169.7	169.9	168.7	1.00	2.17	237
39	0.24		60.6	169.6	169.8	168.6	1.00	2.02	220
40	0.26		60.6	169.4	169.7	168.5	1.00	2.18	238
41	0.26		60.5	169.3	169.6	168.3	1.00	2.17	237
42	0.26		60.5	169.2	169.4	168.2	1.00	2.19	238
43	0.26		60.5	169.1	169.3	168.1	1.00	2.15	234
44	0.26		60.6	169.0	169.2	168.0	1.00	2.13	231
45	0.26		60.7	168.8	169.1	167.8	1.00	2.18	236
46	0.26		60.8	168.7	169.0	167.7	1.00	2.19	237
47	0.26		60.8	168.6	168.8	167.6	1.00	2.19	236

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
48	0.26		60.9	168.4	168.7	167.5	1.00	2.15	231
49	0.26		61.0	168.3	168.5	167.3	1.00	2.17	234
50	0.26		61.0	168.2	168.4	167.2	1.00	2.17	232
51	0.26		61.0	168.0	168.3	167.0	1.00	2.19	235
52	0.26		61.1	167.9	168.1	166.9	1.00	2.12	227
53	0.26		61.1	167.8	168.0	166.8	1.00	2.14	229
54	0.26		61.1	167.7	167.9	166.7	1.00	2.17	232
55	0.26		61.2	167.5	167.7	166.5	1.00	2.18	232
56	0.26		61.2	167.4	167.6	166.4	1.00	2.16	229
57	0.26		61.2	167.2	167.5	166.3	1.00	2.18	232
58	0.26		61.2	167.1	167.3	166.1	1.00	2.18	231
59	0.26		61.3	167.0	167.2	166.0	1.00	2.16	228
60	0.26		61.4	166.8	167.1	165.9	1.00	2.18	230
61	0.26		61.4	166.7	166.9	165.7	1.00	2.17	229
62	0.26		61.4	166.6	166.8	165.6	1.00	2.17	229
63	0.26		61.5	166.4	166.7	165.5	1.00	2.17	227
64	0.26		61.5	166.3	166.5	165.3	1.00	2.16	226
65	0.26		61.4	166.1	166.4	165.2	1.00	2.16	226
66	0.26		61.3	166.0	166.2	165.0	1.00	2.20	231
67	0.27		61.2	165.9	166.1	164.9	1.00	2.21	231
68	0.26		61.1	165.7	166.0	164.8	1.00	2.16	226
69	0.25		61.1	165.6	165.8	164.7	1.00	2.10	220
70	0.26		61.1	165.4	165.7	164.5	1.00	2.19	229
71	0.26		61.1	165.3	165.5	164.4	1.00	2.18	228
72	0.26		61.1	165.2	165.4	164.2	1.00	2.15	224
73	0.26		61.2	165.0	165.3	164.1	1.00	2.14	222
74	0.30		61.2	164.9	165.1	163.8	1.00	2.49	259
75	0.30		61.2	164.7	164.9	163.5	1.00	2.47	256
76	0.30		61.3	164.5	164.7	163.4	1.00	2.52	260
77	0.29		61.3	164.3	164.5	163.3	1.00	2.37	245
78	0.31		61.4	164.2	164.4	163.0	1.00	2.54	261
79	0.30		61.4	164.0	164.2	162.8	1.00	2.52	259
80	0.29		61.4	163.8	164.0	162.6	1.00	2.39	245
81	0.30		61.5	163.6	163.7	162.4	1.00	2.51	256
82	0.31		61.5	163.4	163.6	162.2	1.00	2.59	264
83	0.34		61.5	163.2	163.4	162.0	1.00	2.83	288
84	0.31		61.6	163.0	163.1	161.8	1.00	2.57	261
85	0.30		61.6	162.7	162.9	161.6	1.00	2.51	254
86	0.30		61.7	162.6	162.7	161.4	1.00	2.50	252
87	0.31		61.7	162.4	162.5	161.1	1.00	2.55	257
88	0.31		61.8	162.1	162.3	160.9	1.00	2.57	258
89	0.31		61.8	161.9	162.1	160.8	1.00	2.54	255
90	0.31		61.9	161.7	161.9	160.5	1.00	2.57	257
91	0.31		61.9	161.5	161.7	160.3	1.00	2.55	254
92	0.31		62.0	161.3	161.5	160.2	1.00	2.54	253
93	0.31		62.0	161.1	161.3	160.0	1.00	2.54	252
94	0.31		62.0	160.9	161.1	159.8	1.00	2.57	255
95	0.30		61.9	160.7	160.9	159.6	1.00	2.52	250

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
96	0.30		61.8	160.5	160.7	159.4	1.00	2.52	249
97	0.31		61.7	160.3	160.5	159.2	1.00	2.55	252
98	0.31		61.6	160.2	160.3	159.0	1.00	2.57	253
99	0.31		61.5	160.0	160.1	158.8	1.00	2.56	252
100	0.31		61.5	159.8	159.9	158.6	1.00	2.56	252
101	0.31		61.5	159.6	159.7	158.4	1.00	2.58	254
102	0.31		61.5	159.4	159.5	158.2	1.00	2.57	252
103	0.31		61.5	159.2	159.3	158.0	1.00	2.57	252
104	0.30		61.5	159.0	159.1	157.8	1.00	2.52	246
105	0.30		61.5	158.8	159.0	157.7	1.00	2.49	243
106	0.29		61.5	158.6	158.8	157.5	1.00	2.39	232
107	0.31		61.5	158.4	158.6	157.3	1.00	2.57	250
108	0.31		61.5	158.2	158.4	157.1	1.00	2.54	246
109	0.30		61.5	158.0	158.2	156.9	1.00	2.52	243
110	0.32		61.5	157.8	158.0	156.7	1.00	2.68	259
111	0.31		61.5	157.6	157.8	156.5	1.00	2.55	245
112	0.31		61.5	157.4	157.6	156.3	1.00	2.57	246
113	0.31		61.5	157.2	157.4	156.1	1.00	2.55	244
114	0.31		61.5	157.1	157.2	156.0	1.00	2.61	250
115	0.31		61.5	156.9	157.1	155.8	1.00	2.55	243
116	0.31		61.5	156.7	156.9	155.6	1.00	2.56	244
117	0.31		61.5	156.5	156.7	155.4	1.00	2.54	242
118	0.31		61.5	156.3	156.5	155.2	1.00	2.57	244
119	0.31		61.5	156.1	156.3	155.0	1.00	2.58	245
120	0.31		61.5	155.9	156.1	154.8	1.00	2.57	243
121	0.31		61.5	155.7	155.9	154.6	1.00	2.57	243
122	0.31		61.5	155.5	155.7	154.4	1.00	2.57	242
123	0.31		61.5	155.4	155.5	154.2	1.00	2.56	240
124	0.31		61.5	155.2	155.3	154.1	1.00	2.57	241
125	0.30		61.5	155.0	155.2	153.9	1.00	2.52	235
126	0.31		61.5	154.8	155.0	153.7	1.00	2.54	237
127	0.31		61.5	154.6	154.8	153.5	1.00	2.58	241
128	0.31		61.5	154.4	154.6	153.3	1.00	2.57	239
129	0.31		61.4	154.3	154.4	153.1	1.00	2.57	239
130	0.31		61.4	154.1	154.2	153.0	1.00	2.56	237
131	0.31		61.3	153.9	154.1	152.8	1.00	2.57	238
132	0.30		61.3	153.7	153.9	152.6	1.00	2.52	233
133	0.31		61.2	153.5	153.7	152.4	1.00	2.56	236
134	0.31		61.2	153.3	153.5	152.2	1.00	2.56	236
135	0.32		61.2	153.1	153.3	152.1	1.00	2.62	241
136	0.31		61.1	153.0	153.1	151.9	1.00	2.55	235
137	0.31		61.1	152.8	152.9	151.7	1.00	2.59	238
138	0.31		61.1	152.6	152.7	151.5	1.00	2.55	234
139	0.31		61.1	152.4	152.6	151.3	1.00	2.58	236
140	0.31		61.1	152.3	152.5	151.3	1.00	2.56	234
141	0.31		61.1	152.5	152.9	151.7	1.00	2.55	233
142	0.31		61.1	153.2	153.9	152.6	1.00	2.54	234
143	0.31		61.0	154.4	155.3	153.9	1.00	2.57	241

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
144	0.31		61.0	155.8	156.8	155.4	1.00	2.55	242
145	0.30		61.0	157.3	158.4	157.0	1.00	2.46	237
146	0.29		61.0	158.9	160.0	158.7	1.00	2.44	239
147	0.29		61.0	160.6	161.7	160.4	1.00	2.41	240
148	0.29		61.0	162.3	163.5	162.2	1.00	2.42	245
149	0.29		61.0	164.2	165.3	163.9	1.00	2.43	251
150	0.29		61.0	165.9	167.2	165.8	1.00	2.42	255
151	0.29		61.0	167.9	169.2	167.8	1.00	2.45	262
152	0.29		61.0	169.9	171.3	169.8	1.00	2.43	265
153	0.30		61.0	171.9	173.2	171.7	1.00	2.46	273
154	0.29		61.0	173.9	175.3	173.8	1.00	2.42	274
155	0.30		60.9	176.0	177.3	175.8	1.00	2.47	285
156	0.29		60.8	178.1	179.6	178.0	1.00	2.41	283
157	0.29		60.6	180.3	181.7	180.1	1.00	2.43	292
158	0.29		60.4	182.4	183.7	182.0	1.00	2.45	299
159	0.29		60.2	184.4	185.8	184.1	1.00	2.42	301
160	0.29		60.2	186.5	187.9	186.2	1.00	2.41	304
161	0.30		60.2	188.5	190.0	188.3	1.00	2.46	316
162	0.29		60.2	190.8	192.2	190.5	1.00	2.37	310
163	0.30		60.2	192.8	194.0	192.3	1.00	2.47	328
164	0.29		60.2	194.0	194.9	193.1	1.00	2.45	328
165	0.29		60.2	194.7	195.3	193.5	1.00	2.42	325
166	0.29		60.2	195.0	195.6	193.8	1.00	2.41	325
167	0.29		60.3	195.3	195.9	194.1	1.00	2.39	323
168	0.29		60.3	195.3	195.8	194.0	1.00	2.41	325
169	0.29		60.3	195.4	195.8	194.1	1.00	2.44	330
170	0.29		60.4	195.3	195.8	194.0	1.00	2.44	330
171	0.28		60.4	195.4	195.8	194.0	1.00	2.37	320
172	0.29		60.5	195.3	195.7	194.0	1.00	2.40	324
173	0.29		60.6	195.2	195.6	193.8	1.00	2.39	322
174	0.29		60.6	195.1	195.5	193.7	1.00	2.42	325
175	0.29		60.7	195.0	195.4	193.6	1.00	2.41	324
176	0.29		60.8	194.8	195.2	193.4	1.00	2.42	325
177	0.29		60.9	194.7	195.1	193.3	1.00	2.42	324
178	0.29		60.9	194.5	194.9	193.1	1.00	2.42	323
179	0.27		61.0	194.3	194.7	193.0	1.00	2.27	304
180	0.29		61.1	194.2	194.5	192.8	1.00	2.40	320
181	0.30		61.1	194.0	194.4	192.6	1.00	2.47	328
182	0.29		61.2	193.8	194.1	192.4	1.00	2.44	324
183	0.29		61.3	193.6	194.0	192.2	1.00	2.42	320
184	0.28		61.3	193.4	193.7	192.0	1.00	2.37	313
185	0.28		61.4	193.2	193.5	191.8	1.00	2.33	308
186	0.28		61.4	192.9	193.3	191.6	1.00	2.29	302
187	0.29		61.5	192.7	193.1	191.4	1.00	2.43	320
188	0.29		61.6	192.5	192.8	191.1	1.00	2.42	317
189	0.29		61.6	192.3	192.6	190.9	1.00	2.37	311
190	0.29		61.7	192.0	192.3	190.6	1.00	2.41	314
191	0.29		61.7	191.8	192.1	190.4	1.00	2.42	316

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
192	0.29		61.8	191.6	191.9	190.2	1.00	2.43	316
193	0.29		61.8	191.3	191.6	189.9	1.00	2.39	310
194	0.29		61.9	191.1	191.3	189.6	1.00	2.43	315
195	0.29		62.0	190.8	191.1	189.4	1.00	2.40	309
196	0.29		62.0	190.6	190.8	189.2	1.00	2.43	313
197	0.29		62.1	190.3	190.6	188.9	1.00	2.40	308
198	0.29		62.1	190.0	190.3	188.6	1.00	2.39	306
199	0.29		62.1	189.8	190.0	188.4	1.00	2.38	305
200	0.29		62.2	189.5	189.8	188.1	1.00	2.42	309
201	0.29		62.2	189.2	189.5	187.8	1.00	2.42	308
202	0.29		62.3	189.0	189.3	187.6	1.00	2.43	309
203	0.29		62.3	188.7	189.0	187.3	1.00	2.41	305
204	0.29		62.3	188.4	188.7	187.1	1.00	2.42	305
205	0.29		62.3	188.2	188.5	186.8	1.00	2.39	301
206	0.29		62.3	187.9	188.2	186.5	1.00	2.45	308
207	0.30		62.3	187.7	187.9	186.3	1.00	2.47	311
208	0.29		62.2	187.4	187.7	186.0	1.00	2.39	300
209	0.29		62.1	187.1	187.4	185.8	1.00	2.41	301
210	0.29		62.1	186.8	187.1	185.4	1.00	2.39	298
211	0.29		62.0	186.6	186.9	185.2	1.00	2.38	297
212	0.29		61.9	186.3	186.6	184.9	1.00	2.42	302
213	0.29		61.8	186.0	186.3	184.7	1.00	2.42	301
214	0.29		61.8	185.7	186.0	184.4	1.00	2.42	300
215	0.29		61.7	185.5	185.8	184.2	1.00	2.38	295
216	0.28		61.6	185.2	185.5	183.9	1.00	2.31	286
217	0.28		61.5	185.0	185.2	183.6	1.00	2.34	289
218	0.29		61.5	184.7	184.9	183.3	1.00	2.39	295
219	0.29		61.4	184.4	184.7	183.1	1.00	2.42	299
220	0.32		61.3	184.1	184.4	182.8	1.00	2.67	328
221	0.30		61.2	183.9	184.1	182.5	1.00	2.52	309
222	0.28		61.1	183.6	183.9	182.3	1.00	2.34	287
223	0.29		61.1	183.3	183.6	182.0	1.00	2.41	295
224	0.29		61.0	183.1	183.3	181.7	1.00	2.40	293
225	0.29		61.0	182.8	183.0	181.5	1.00	2.41	294
226	0.29		61.0	182.5	182.8	181.2	1.00	2.38	290
227	0.29		60.9	182.2	182.5	180.9	1.00	2.42	293
228	0.29		60.9	181.9	182.2	180.6	1.00	2.42	293
229	0.29		60.9	181.7	181.9	180.3	1.00	2.37	287
230	0.29		60.9	181.4	181.6	180.1	1.00	2.40	289
231	0.29		60.9	181.1	181.4	179.8	1.00	2.39	288
232	0.29		60.9	180.8	181.1	179.5	1.00	2.40	288
233	0.29		60.9	180.5	180.8	179.2	1.00	2.41	288
234	0.29		60.9	180.3	180.5	178.9	1.00	2.41	288
235	0.29		60.9	180.0	180.2	178.7	1.00	2.39	285
236	0.29		60.9	179.7	180.0	178.4	1.00	2.42	287
237	0.29		60.9	179.4	179.7	178.1	1.00	2.43	289
238	0.29		61.0	179.2	179.4	177.9	1.00	2.39	283
239	0.29		61.0	178.9	179.1	177.6	1.00	2.37	280

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
240	0.28		61.0	178.6	178.8	177.3	1.00	2.37	279
241	0.30		61.0	178.3	178.6	177.1	1.00	2.50	293
242	0.29		61.1	178.1	178.3	176.8	1.00	2.42	284
243	0.29		61.1	177.8	178.0	176.5	1.00	2.43	284
244	0.29		61.1	177.5	177.8	176.2	1.00	2.42	283
245	0.29		61.2	177.2	177.5	175.9	1.00	2.44	283
246	0.29		61.2	177.0	177.2	175.7	1.00	2.44	283
247	0.29		61.2	176.7	176.9	175.4	1.00	2.41	278
248	0.28		61.2	176.4	176.7	175.2	1.00	2.35	271
249	0.29		61.2	176.1	176.4	174.9	1.00	2.41	277
250	0.29		61.1	175.9	176.1	174.6	1.00	2.41	277
251	0.29		61.1	175.6	175.9	174.4	1.00	2.41	276
252	0.30		61.1	175.3	175.6	174.1	1.00	2.47	283
253	0.28		61.0	175.0	175.3	173.8	1.00	2.33	266
254	0.29		61.0	174.8	175.0	173.6	1.00	2.41	274
255	0.31		61.0	174.5	174.8	173.3	1.00	2.56	291
256	0.29		61.0	174.2	174.5	173.0	1.00	2.42	275
257	0.29		61.0	174.0	174.2	172.7	1.00	2.39	270
258	0.28		61.0	173.7	173.9	172.5	1.00	2.37	267
259	0.30		61.0	173.4	173.7	172.2	1.00	2.52	284
260	0.29		61.0	173.2	173.4	171.9	1.00	2.42	272
261	0.29		61.0	172.9	173.1	171.6	1.00	2.42	272
262	0.29		61.1	172.6	172.8	171.4	1.00	2.42	271
263	0.29		61.1	172.3	172.6	171.1	1.00	2.42	270
264	0.29		61.1	172.1	172.3	170.9	1.00	2.44	271
265	0.29		61.1	171.8	172.0	170.6	1.00	2.42	269
266	0.29		61.2	171.5	171.7	170.3	1.00	2.43	269
267	0.29		61.2	171.3	171.5	170.0	1.00	2.44	269
268	0.29		61.2	171.0	171.2	169.8	1.00	2.43	267
269	0.29		61.3	170.7	170.9	169.5	1.00	2.41	264
270	0.29		61.3	170.5	170.7	169.2	1.00	2.42	265
271	0.29		61.3	170.2	170.4	169.0	1.00	2.41	262
272	0.29		61.3	169.9	170.1	168.7	1.00	2.41	262
273	0.29		61.3	169.7	169.9	168.4	1.00	2.45	266
274	0.29		61.3	169.4	169.6	168.2	1.00	2.43	263
275	0.29		61.3	169.1	169.3	167.9	1.00	2.43	263
276	0.29		61.2	168.9	169.1	167.7	1.00	2.39	258
277	0.29		61.2	168.6	168.8	167.4	1.00	2.44	262
278	0.29		61.2	168.3	168.6	167.2	1.00	2.39	256
279	0.29		61.2	168.1	168.3	166.9	1.00	2.43	260
280	0.29		61.2	167.8	168.0	166.6	1.00	2.42	258
281	0.28		61.2	167.5	167.8	166.4	1.00	2.37	252
282	0.29		61.2	167.3	167.5	166.1	1.00	2.43	258
283	0.29		61.2	167.0	167.2	165.9	1.00	2.44	259
284	0.29		61.2	166.8	167.0	165.6	1.00	2.42	255
285	0.29		61.2	166.5	166.7	165.4	1.00	2.42	255
286	0.29		61.2	166.2	166.5	165.1	1.00	2.42	254
287	0.29		61.2	166.0	166.2	164.8	1.00	2.42	254

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
288	0.29		61.2	165.8	165.9	164.6	1.00	2.43	255
289	0.29		61.2	165.5	165.7	164.4	1.00	2.42	252
290	0.29		61.3	165.2	165.4	164.1	1.00	2.40	250
291	0.29		61.3	165.0	165.2	163.8	1.00	2.42	251
292	0.29		61.3	164.7	164.9	163.6	1.00	2.43	252
293	0.29		61.3	164.4	164.6	163.3	1.00	2.42	250
294	0.29		61.4	164.2	164.4	163.1	1.00	2.42	249
295	0.30		61.4	164.0	164.1	162.8	1.00	2.47	253
296	0.29		61.4	163.7	163.9	162.6	1.00	2.42	247
297	0.29		61.5	163.5	163.6	162.3	1.00	2.45	250
298	0.30		61.5	163.2	163.4	162.1	1.00	2.47	251
299	0.30		61.6	163.0	163.2	161.8	1.00	2.47	250
300	0.29		61.6	162.7	162.9	161.6	1.00	2.45	248
301	0.29		61.6	162.4	162.6	161.3	1.00	2.42	244
302	0.29		61.6	162.2	162.4	161.1	1.00	2.42	244
303	0.29		61.6	161.9	162.1	160.8	1.00	2.43	244
304	0.29		61.7	161.7	161.9	160.6	1.00	2.42	243
305	0.28		61.7	161.4	161.6	160.4	1.00	2.34	234
306	0.31		61.7	161.2	161.4	160.1	1.00	2.59	258
307	0.29		61.7	161.0	161.2	159.9	1.00	2.43	242
308	0.29		61.7	160.7	160.9	159.6	1.00	2.43	241
309	0.29		61.7	160.5	160.7	159.4	1.00	2.43	241
310	0.29		61.6	160.2	160.4	159.1	1.00	2.44	241
311	0.30		61.6	160.0	160.2	158.9	1.00	2.49	245
312	0.29		61.5	159.7	159.9	158.6	1.00	2.42	238
313	0.28		61.5	159.5	159.7	158.4	1.00	2.35	230
314	0.29		61.4	159.3	159.4	158.2	1.00	2.42	238
315	0.29		61.4	159.0	159.2	158.0	1.00	2.42	237
316	0.30		61.3	158.8	159.0	157.7	1.00	2.47	242
317	0.30		61.3	158.6	158.7	157.5	1.00	2.46	239
318	0.29		61.2	158.3	158.5	157.2	1.00	2.42	236
319	0.30		61.2	158.1	158.3	157.0	1.00	2.47	239
320	0.29		61.2	157.8	158.0	156.8	1.00	2.42	234
321	0.29		61.1	157.6	157.8	156.5	1.00	2.44	236
322	0.29		61.1	157.4	157.5	156.3	1.00	2.43	235
323	0.29		61.1	157.1	157.3	156.1	1.00	2.39	230
324	0.29		61.1	156.9	157.1	155.8	1.00	2.43	233
325	0.29		61.1	156.7	156.8	155.6	1.00	2.43	233
326	0.29		61.1	156.4	156.6	155.4	1.00	2.45	234
327	0.29		61.1	156.2	156.4	155.1	1.00	2.42	231
328	0.29		61.1	156.0	156.1	154.9	1.00	2.44	232
329	0.30		61.1	155.7	155.9	154.6	1.00	2.46	233
330	0.29		61.1	155.5	155.6	154.4	1.00	2.43	230
331	0.29		61.1	155.3	155.4	154.2	1.00	2.44	230
332	0.29		61.1	155.0	155.2	153.9	1.00	2.42	228
333	0.29		61.2	154.8	154.9	153.7	1.00	2.43	228
334	0.29		61.2	154.5	154.7	153.5	1.00	2.44	228
335	0.29		61.2	154.3	154.5	153.3	1.00	2.42	225

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
336	0.31		61.2	154.1	154.2	153.1	1.00	2.57	239
337	0.29		61.2	153.9	154.0	152.8	1.00	2.41	223
338	0.29		61.3	153.6	153.8	152.6	1.00	2.40	222
339	0.29		61.3	153.4	153.5	152.3	1.00	2.42	224
340	0.29		61.3	153.2	153.3	152.1	1.00	2.44	225
341	0.29		61.3	152.9	153.1	151.9	1.00	2.42	222
342	0.29		61.3	152.7	152.9	151.7	1.00	2.42	222
343	0.29		61.3	152.5	152.6	151.4	1.00	2.45	224
344	0.29		61.3	152.2	152.3	151.2	1.00	2.45	223
345	0.29		61.3	152.0	152.2	151.0	1.00	2.38	216
346	0.29		61.3	152.0	152.3	151.1	1.00	2.41	219
347	0.30		61.3	152.2	152.7	151.5	1.00	2.47	225
348	0.30		61.3	152.7	153.3	152.1	1.00	2.46	225
349	0.29		61.4	153.5	154.3	153.0	1.00	2.44	225
350	0.29		61.3	154.6	155.5	154.3	1.00	2.37	222
351	0.28		61.3	156.0	156.9	155.7	1.00	2.36	224
352	0.29		61.3	157.5	158.5	157.2	1.00	2.43	234
353	0.29		61.3	159.0	160.1	158.7	1.00	2.44	239
354	0.29		61.3	160.7	161.8	160.5	1.00	2.43	242
355	0.29		61.3	162.4	163.7	162.4	1.00	2.41	244
356	0.29		61.3	164.3	165.6	164.3	1.00	2.42	250
357	0.30		61.3	166.3	167.7	166.3	1.00	2.50	263
358	0.30		61.3	168.3	169.7	168.3	1.00	2.52	270
359	0.31		61.3	170.4	171.8	170.4	1.00	2.54	278
360	0.29		61.3	172.6	173.9	172.5	1.00	2.41	268
361	0.29		61.3	174.7	176.1	174.6	1.00	2.43	276
362	0.29		61.2	176.7	178.1	176.6	1.00	2.39	276
363	0.29		61.1	178.8	180.2	178.6	1.00	2.42	286
364	0.29		61.0	180.8	182.4	180.8	1.00	2.44	293
365	0.29		60.9	183.0	184.5	182.8	1.00	2.45	299
366	0.29		60.8	185.1	186.7	185.1	1.00	2.43	303
367	0.29		60.7	187.4	188.8	187.1	1.00	2.39	303
368	0.29		60.6	189.6	190.9	189.2	1.00	2.42	313
369	0.28		60.5	190.9	191.8	190.1	1.00	2.31	301
370	0.29		60.4	191.6	192.3	190.6	1.00	2.42	318
371	0.28		60.3	192.0	192.7	191.0	1.00	2.33	308
372	0.30		60.3	192.4	192.9	191.2	1.00	2.48	328
373	0.29		60.3	192.4	192.9	191.2	1.00	2.42	320
374	0.29		60.2	192.5	193.0	191.3	1.00	2.44	323
375	0.30		60.2	192.5	193.0	191.3	1.00	2.49	330
376	0.30		60.2	192.5	192.9	191.2	1.00	2.47	327
377	0.29		60.2	192.4	192.9	191.1	1.00	2.42	321
378	0.29		60.2	192.4	192.8	191.0	1.00	2.45	324
379	0.28		60.2	192.2	192.7	191.0	1.00	2.36	312
380	0.29		60.3	192.2	192.6	190.9	1.00	2.45	323
381	0.29		60.3	192.1	192.5	190.7	1.00	2.41	318
382	0.29		60.3	191.9	192.2	190.5	1.00	2.43	321
383	0.28		60.3	191.7	192.1	190.3	1.00	2.37	311

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
384	0.29		60.3	191.5	191.9	190.2	1.00	2.38	313
385	0.28		60.3	191.4	191.7	190.0	1.00	2.32	304
386	0.29		60.4	191.1	191.5	189.8	1.00	2.40	314
387	0.29		60.4	190.9	191.3	189.6	1.00	2.42	317
388	0.28		60.4	190.7	191.1	189.4	1.00	2.36	308
389	0.30		60.4	190.5	190.8	189.2	1.00	2.47	322
390	0.30		60.5	190.3	190.6	188.9	1.00	2.47	322
391	0.28		60.5	190.0	190.4	188.7	1.00	2.35	305
392	0.29		60.5	189.8	190.1	188.4	1.00	2.42	314
393	0.29		60.5	189.6	189.9	188.2	1.00	2.42	313
394	0.29		60.6	189.3	189.6	187.9	1.00	2.42	312
395	0.29		60.6	189.0	189.4	187.7	1.00	2.42	311
396	0.29		60.7	188.8	189.1	187.4	1.00	2.40	308
397	0.29		60.7	188.5	188.8	187.1	1.00	2.40	307
398	0.29		60.7	188.2	188.5	186.8	1.00	2.42	309
399	0.29		60.8	187.9	188.3	186.6	1.00	2.42	308
400	0.29		60.8	187.7	188.0	186.3	1.00	2.40	305
401	0.29		60.8	187.4	187.7	186.0	1.00	2.44	309
402	0.29		60.8	187.1	187.4	185.8	1.00	2.42	305
403	0.29		60.8	186.8	187.1	185.5	1.00	2.41	304
404	0.29		60.7	186.6	186.9	185.2	1.00	2.41	303
405	0.29		60.7	186.3	186.6	184.9	1.00	2.40	302
406	0.28		60.6	186.0	186.3	184.6	1.00	2.37	297
407	0.30		60.6	185.7	186.0	184.3	1.00	2.46	308
408	0.29		60.5	185.4	185.7	184.1	1.00	2.42	303
409	0.29		60.5	185.1	185.4	183.8	1.00	2.42	302
410	0.29		60.4	184.8	185.1	183.5	1.00	2.40	299
411	0.29		60.4	184.5	184.8	183.2	1.00	2.37	295
412	0.29		60.4	184.2	184.5	182.9	1.00	2.43	302
413	0.29		60.4	183.9	184.2	182.6	1.00	2.43	301
414	0.29		60.4	183.6	183.9	182.3	1.00	2.42	299
415	0.29		60.3	183.4	183.6	182.0	1.00	2.39	295
416	0.29		60.4	183.0	183.3	181.7	1.00	2.44	300
417	0.29		60.4	182.8	183.0	181.4	1.00	2.40	294
418	0.29		60.4	182.4	182.7	181.1	1.00	2.40	293
419	0.29		60.4	182.2	182.4	180.8	1.00	2.38	291
420	0.29		60.5	181.9	182.1	180.6	1.00	2.38	290
421	0.30		60.5	181.6	181.8	180.2	1.00	2.49	302
422	0.29		60.5	181.2	181.5	179.9	1.00	2.43	294
423	0.29		60.5	181.0	181.2	179.6	1.00	2.40	289
424	0.29		60.6	180.6	180.9	179.3	1.00	2.41	289
425	0.28		60.6	180.4	180.6	179.1	1.00	2.35	282
426	0.28		60.7	180.1	180.3	178.8	1.00	2.36	282
427	0.29		60.8	179.7	180.0	178.5	1.00	2.40	286
428	0.28		60.8	179.4	179.7	178.2	1.00	2.29	272
429	0.28		60.9	179.1	179.4	177.9	1.00	2.36	279
430	0.28		60.9	178.9	179.1	177.6	1.00	2.36	279
431	0.28		60.9	178.6	178.8	177.3	1.00	2.32	274

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
432	0.29		61.0	178.3	178.5	177.0	1.00	2.40	282
433	0.28		61.0	178.0	178.2	176.7	1.00	2.37	277
434	0.28		61.1	177.7	178.0	176.5	1.00	2.32	270
435	0.28		61.1	177.4	177.7	176.2	1.00	2.37	275
436	0.27		61.1	177.1	177.4	175.9	1.00	2.26	262
437	0.29		61.1	176.9	177.1	175.6	1.00	2.41	279
438	0.29		61.2	176.6	176.8	175.3	1.00	2.37	274
439	0.29		61.2	176.3	176.5	175.0	1.00	2.38	275
440	0.29		61.2	176.0	176.2	174.8	1.00	2.38	274
441	0.29		61.2	175.7	175.9	174.5	1.00	2.38	273
442	0.28		61.3	175.4	175.6	174.2	1.00	2.36	269
443	0.28		61.3	175.1	175.3	173.9	1.00	2.34	267
444	0.28		61.3	174.8	175.0	173.6	1.00	2.33	265
445	0.29		61.4	174.5	174.8	173.3	1.00	2.39	271
446	0.29		61.4	174.3	174.5	173.0	1.00	2.38	269
447	0.28		61.5	174.0	174.2	172.7	1.00	2.37	266
448	0.27		61.5	173.6	173.9	172.5	1.00	2.28	256
449	0.28		61.5	173.4	173.6	172.2	1.00	2.34	262
450	0.29		61.6	173.1	173.3	171.9	1.00	2.37	265
451	0.28		61.6	172.8	173.0	171.6	1.00	2.36	262
452	0.27		61.6	172.5	172.8	171.3	1.00	2.27	252
453	0.28		61.7	172.2	172.5	171.1	1.00	2.32	256
454	0.28		61.7	172.0	172.2	170.8	1.00	2.35	259
455	0.29		61.7	171.7	171.9	170.5	1.00	2.37	261
456	0.29		61.7	171.4	171.6	170.2	1.00	2.37	261
457	0.28		61.7	171.1	171.3	169.9	1.00	2.36	258
458	0.28		61.7	170.8	171.1	169.7	1.00	2.36	257
459	0.28		61.7	170.5	170.8	169.4	1.00	2.37	258
460	0.29		61.7	170.3	170.5	169.1	1.00	2.37	258
461	0.29		61.7	170.0	170.2	168.8	1.00	2.39	259
462	0.29		61.7	169.7	169.9	168.5	1.00	2.37	257
463	0.28		61.6	169.4	169.7	168.3	1.00	2.37	255
464	0.28		61.6	169.1	169.4	168.0	1.00	2.37	255
465	0.28		61.6	168.9	169.1	167.7	1.00	2.36	253
466	0.28		61.6	168.6	168.8	167.4	1.00	2.36	253
467	0.28		61.5	168.3	168.5	167.2	1.00	2.37	253
468	0.28		61.5	168.0	168.3	166.9	1.00	2.34	250
469	0.29		61.5	167.8	168.0	166.6	1.00	2.38	254
470	0.28		61.5	167.5	167.7	166.3	1.00	2.35	249
471	0.28		61.4	167.2	167.4	166.1	1.00	2.35	249
472	0.28		61.4	166.9	167.1	165.8	1.00	2.35	248
473	0.28		61.4	166.6	166.9	165.5	1.00	2.36	248
474	0.29		61.4	166.4	166.6	165.2	1.00	2.38	250
475	0.28		61.4	166.1	166.3	165.0	1.00	2.36	247
476	0.28		61.4	165.8	166.0	164.7	1.00	2.35	246
477	0.29		61.4	165.6	165.8	164.4	1.00	2.38	249
478	0.29		61.4	165.3	165.5	164.2	1.00	2.39	249
479	0.28		61.4	165.0	165.2	163.9	1.00	2.32	240

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
480	0.28		61.5	164.7	165.0	163.7	1.00	2.35	243
481	0.28		61.5	164.5	164.7	163.4	1.00	2.37	244
482	0.28		61.5	164.2	164.4	163.1	1.00	2.37	243
483	0.29		61.5	164.0	164.2	162.9	1.00	2.37	244
484	0.29		61.5	163.7	163.9	162.6	1.00	2.37	243
485	0.28		61.5	163.4	163.6	162.3	1.00	2.37	241
486	0.28		61.5	163.2	163.4	162.1	1.00	2.37	241
487	0.28		61.6	162.9	163.1	161.8	1.00	2.37	240
488	0.28		61.6	162.6	162.8	161.6	1.00	2.33	236
489	0.29		61.6	162.4	162.6	161.3	1.00	2.39	241
490	0.29		61.6	162.1	162.3	161.0	1.00	2.40	241
491	0.28		61.7	161.8	162.0	160.8	1.00	2.33	234
492	0.29		61.7	161.6	161.8	160.5	1.00	2.37	237
493	0.29		61.7	161.3	161.5	160.2	1.00	2.37	237
494	0.29		61.7	161.1	161.3	160.0	1.00	2.37	236
495	0.28		61.8	160.8	161.0	159.7	1.00	2.35	233
496	0.29		61.8	160.6	160.7	159.5	1.00	2.38	236
497	0.28		61.8	160.3	160.5	159.2	1.00	2.35	232
498	0.29		61.8	160.0	160.2	159.0	1.00	2.39	235
499	0.28		61.8	159.8	160.0	158.7	1.00	2.37	232
500	0.28		61.8	159.5	159.7	158.5	1.00	2.36	231
501	0.29		61.8	159.3	159.5	158.2	1.00	2.37	232
502	0.28		61.8	159.0	159.2	158.0	1.00	2.32	226
503	0.29		61.8	158.8	159.0	157.8	1.00	2.41	234
504	0.28		61.8	158.5	158.7	157.5	1.00	2.34	227
505	0.29		61.8	158.3	158.5	157.3	1.00	2.38	230
506	0.28		61.8	158.0	158.2	157.0	1.00	2.35	226
507	0.28		61.8	157.8	158.0	156.8	1.00	2.36	227
508	0.29		61.8	157.5	157.7	156.5	1.00	2.44	234
509	0.28		61.8	157.3	157.5	156.3	1.00	2.33	223
510	0.28		61.8	157.0	157.2	156.0	1.00	2.36	225
511	0.28		61.8	156.8	157.0	155.8	1.00	2.34	223
512	0.28		61.8	156.5	156.8	155.6	1.00	2.31	219
513	0.30		61.8	156.3	156.5	155.3	1.00	2.53	240
514	0.29		61.7	156.1	156.3	155.1	1.00	2.37	224
515	0.28		61.7	155.8	156.0	154.8	1.00	2.34	221
516	0.27		61.6	155.6	155.8	154.6	1.00	2.27	213
517	0.28		61.6	155.4	155.5	154.4	1.00	2.33	219
518	0.29		61.5	155.1	155.3	154.1	1.00	2.38	223
519	0.28		61.5	154.9	155.1	153.9	1.00	2.34	219
520	0.28		61.5	154.7	154.8	153.7	1.00	2.36	220
521	0.28		61.5	154.4	154.6	153.4	1.00	2.32	215
522	0.28		61.5	154.2	154.4	153.2	1.00	2.37	220
523	0.29		61.5	154.0	154.1	152.9	1.00	2.37	220
524	0.28		61.5	153.7	153.9	152.7	1.00	2.33	215
525	0.28		61.4	153.5	153.6	152.5	1.00	2.33	215
526	0.28		61.5	153.2	153.4	152.3	1.00	2.32	213
527	0.28		61.5	153.0	153.2	152.0	1.00	2.36	216

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
528	0.28		61.5	152.8	152.9	151.8	1.00	2.32	212
529	0.28		61.5	152.5	152.7	151.6	1.00	2.34	213
530	0.28		61.5	152.3	152.4	151.3	1.00	2.34	213
531	0.28		61.5	152.0	152.2	151.1	1.00	2.36	214
532	0.29		61.5	151.9	152.2	151.1	1.00	2.37	215
533	0.28		61.6	152.1	152.6	151.4	1.00	2.33	211
534	0.28		61.6	152.5	153.1	151.9	1.00	2.33	212
535	0.29		61.7	153.1	153.8	152.6	1.00	2.37	217
536	0.28		61.7	153.9	154.7	153.5	1.00	2.33	215
537	0.28		61.7	154.9	155.8	154.6	1.00	2.35	219
538	0.28		61.8	156.1	157.2	156.0	1.00	2.33	220
539	0.28		61.8	157.6	158.7	157.5	1.00	2.34	224
540	0.28		61.9	159.2	160.3	159.1	1.00	2.33	227
541	0.28		61.9	161.0	162.3	161.0	1.00	2.34	232
542	0.28		61.9	162.8	164.1	162.8	1.00	2.32	234
543	0.28		62.0	164.8	166.2	164.9	1.00	2.34	241
544	0.28		62.0	167.0	168.3	167.0	1.00	2.35	247
545	0.28		62.0	169.0	170.3	169.0	1.00	2.34	251
546	0.28		62.0	171.0	172.6	171.2	1.00	2.33	255
547	0.28		62.1	173.3	174.8	173.3	1.00	2.31	257
548	0.29		62.1	175.4	177.0	175.5	1.00	2.37	269
549	0.28		62.1	177.8	179.4	177.9	1.00	2.36	273
550	0.28		62.1	180.1	181.7	180.2	1.00	2.34	277
551	0.28		62.1	182.4	184.2	182.6	1.00	2.34	282
552	0.28		62.1	184.5	186.3	184.7	1.00	2.31	283
553	0.28		62.1	186.9	188.5	186.9	1.00	2.37	296
554	0.28		62.1	189.2	190.9	189.3	1.00	2.32	295
555	0.28		62.2	191.3	192.5	190.9	1.00	2.32	299
556	0.28		62.2	192.5	193.4	191.7	1.00	2.32	302
557	0.27		62.2	193.0	193.7	192.0	1.00	2.27	298
558	0.29		62.2	193.2	193.9	192.3	1.00	2.37	311
559	0.28		62.2	193.5	194.1	192.4	1.00	2.35	309
560	0.28		62.2	193.6	194.3	192.6	1.00	2.33	307
561	0.27		62.2	193.7	194.2	192.6	1.00	2.27	299
562	0.26		62.2	193.7	194.2	192.6	1.00	2.18	287
563	0.26		62.3	193.8	194.3	192.7	1.00	2.19	288
564	0.27		62.3	193.7	194.1	192.6	1.00	2.22	293
565	0.27		62.3	193.7	194.1	192.6	1.00	2.22	291
566	0.27		62.3	193.6	194.0	192.5	1.00	2.22	292
567	0.27		62.4	193.5	194.0	192.4	1.00	2.21	290
568	0.26		62.4	193.4	193.8	192.3	1.00	2.20	288
569	0.27		62.4	193.3	193.7	192.1	1.00	2.22	290
570	0.26		62.4	193.1	193.5	192.0	1.00	2.20	288
571	0.27		62.4	193.0	193.4	191.9	1.00	2.21	289
572	0.27		62.4	192.8	193.2	191.7	1.00	2.23	291
573	0.26		62.5	192.7	193.1	191.5	1.00	2.20	287
574	0.27		62.5	192.5	192.9	191.3	1.00	2.23	291
575	0.27		62.5	192.3	192.7	191.1	1.00	2.22	289

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
576	0.26		62.5	192.1	192.5	191.0	1.00	2.19	284
577	0.27		62.6	191.9	192.3	190.7	1.00	2.22	287
578	0.27		62.6	191.7	192.1	190.5	1.00	2.22	286
579	0.27		62.6	191.5	191.8	190.3	1.00	2.22	286
580	0.26		62.6	191.2	191.6	190.1	1.00	2.20	283
581	0.26		62.6	191.0	191.4	189.8	1.00	2.19	282
582	0.27		62.6	190.8	191.2	189.7	1.00	2.22	285
583	0.26		62.6	190.6	190.9	189.4	1.00	2.19	281
584	0.27		62.6	190.4	190.7	189.2	1.00	2.21	282
585	0.27		62.6	190.1	190.4	188.9	1.00	2.23	285
586	0.27		62.6	189.9	190.2	188.7	1.00	2.22	282
587	0.27		62.7	189.6	189.9	188.4	1.00	2.22	283
588	0.27		62.7	189.4	189.7	188.2	1.00	2.22	281
589	0.26		62.7	189.1	189.4	187.9	1.00	2.18	276
590	0.27		62.7	188.8	189.1	187.7	1.00	2.22	280
591	0.26		62.7	188.6	188.9	187.4	1.00	2.19	276
592	0.27		62.7	188.3	188.6	187.1	1.00	2.22	279
593	0.26		62.7	188.1	188.4	186.9	1.00	2.18	274
594	0.26		62.7	187.8	188.0	186.6	1.00	2.17	272
595	0.26		62.7	187.5	187.8	186.3	1.00	2.16	270
596	0.27		62.7	187.2	187.5	186.1	1.00	2.21	275
597	0.26		62.7	187.0	187.2	185.8	1.00	2.13	265
598	0.27		62.7	186.6	187.0	185.5	1.00	2.23	277
599	0.27		62.7	186.4	186.7	185.2	1.00	2.23	276
600	0.27		62.7	186.1	186.4	184.9	1.00	2.23	276
601	0.27		62.7	185.8	186.1	184.6	1.00	2.22	274
602	0.27		62.7	185.5	185.8	184.3	1.00	2.27	280
603	0.27		62.8	185.2	185.5	184.1	1.00	2.26	277
604	0.27		62.8	184.9	185.2	183.8	1.00	2.23	273
605	0.27		62.8	184.7	185.0	183.5	1.00	2.24	273
606	0.27		62.8	184.4	184.6	183.2	1.00	2.27	277
607	0.27		62.8	184.1	184.4	182.9	1.00	2.22	269
608	0.27		62.8	183.8	184.1	182.6	1.00	2.25	272
609	0.27		62.9	183.5	183.8	182.3	1.00	2.24	271
610	0.27		62.9	183.2	183.5	182.1	1.00	2.25	271
611	0.27		62.9	182.9	183.2	181.8	1.00	2.25	270
612	0.27		62.9	182.6	182.9	181.5	1.00	2.27	272
613	0.27		62.9	182.4	182.6	181.2	1.00	2.23	267
614	0.27		62.9	182.1	182.3	180.9	1.00	2.24	267
615	0.27		62.9	181.8	182.0	180.6	1.00	2.21	263
616	0.27		63.0	181.5	181.7	180.3	1.00	2.22	264
617	0.27		63.0	181.2	181.4	180.0	1.00	2.27	268
618	0.27		63.0	180.9	181.1	179.7	1.00	2.25	265
619	0.27		63.1	180.6	180.9	179.5	1.00	2.22	261
620	0.27		63.1	180.3	180.6	179.2	1.00	2.23	262
621	0.27		63.1	180.0	180.3	178.9	1.00	2.25	263
622	0.27		63.1	179.7	180.0	178.6	1.00	2.25	262
623	0.27		63.1	179.4	179.7	178.3	1.00	2.22	258

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
624	0.27		63.2	179.2	179.4	178.0	1.00	2.23	259
625	0.26		63.2	178.9	179.1	177.7	1.00	2.18	253
626	0.27		63.2	178.6	178.8	177.5	1.00	2.22	257
627	0.27		63.2	178.3	178.5	177.2	1.00	2.25	259
628	0.27		63.3	178.0	178.3	176.9	1.00	2.24	257
629	0.27		63.3	177.7	178.0	176.6	1.00	2.25	258
630	0.27		63.3	177.4	177.7	176.3	1.00	2.21	252
631	0.27		63.3	177.1	177.4	176.0	1.00	2.24	255
632	0.27		63.4	176.8	177.1	175.7	1.00	2.26	256
633	0.27		63.4	176.6	176.8	175.5	1.00	2.24	254
634	0.27		63.4	176.3	176.5	175.2	1.00	2.27	256
635	0.27		63.4	176.0	176.2	174.9	1.00	2.23	252
636	0.27		63.4	175.7	175.9	174.6	1.00	2.25	253
637	0.27		63.4	175.4	175.7	174.3	1.00	2.25	252
638	0.26		63.5	175.1	175.4	174.0	1.00	2.16	241
639	0.27		63.5	174.9	175.1	173.8	1.00	2.24	250
640	0.27		63.5	174.6	174.8	173.5	1.00	2.23	248
641	0.27		63.5	174.3	174.5	173.2	1.00	2.22	246
642	0.27		63.5	174.0	174.2	172.9	1.00	2.22	246
643	0.26		63.6	173.7	173.9	172.6	1.00	2.13	235
644	0.27		63.6	173.4	173.7	172.4	1.00	2.22	244
645	0.27		63.6	173.2	173.4	172.1	1.00	2.24	246
646	0.27		63.6	172.9	173.1	171.8	1.00	2.22	243
647	0.27		63.6	172.6	172.8	171.5	1.00	2.24	244
648	0.27		63.6	172.3	172.6	171.3	1.00	2.23	243
649	0.27		63.7	172.0	172.3	171.0	1.00	2.22	241
650	0.27		63.7	171.8	172.0	170.7	1.00	2.23	242
651	0.27		63.7	171.5	171.7	170.4	1.00	2.27	244
652	0.27		63.7	171.2	171.5	170.2	1.00	2.25	242
653	0.27		63.7	171.0	171.2	169.9	1.00	2.26	242
654	0.27		63.7	170.7	170.9	169.6	1.00	2.22	237
655	0.27		63.7	170.4	170.6	169.4	1.00	2.25	240
656	0.27		63.8	170.1	170.3	169.1	1.00	2.22	237
657	0.27		63.8	169.8	170.1	168.8	1.00	2.23	237
658	0.27		63.8	169.6	169.8	168.5	1.00	2.27	240
659	0.27		63.8	169.3	169.5	168.3	1.00	2.25	237
660	0.27		63.8	169.0	169.2	168.0	1.00	2.24	236
661	0.27		63.8	168.8	169.0	167.7	1.00	2.23	235
662	0.27		63.8	168.5	168.7	167.5	1.00	2.22	232
663	0.27		63.8	168.2	168.4	167.2	1.00	2.27	237
664	0.27		63.8	168.0	168.2	166.9	1.00	2.24	234
665	0.27		63.8	167.7	167.9	166.7	1.00	2.24	233
666	0.27		63.8	167.4	167.6	166.4	1.00	2.24	232
667	0.27		63.8	167.2	167.3	166.1	1.00	2.22	229
668	0.27		63.8	166.9	167.1	165.9	1.00	2.21	228
669	0.27		63.8	166.6	166.8	165.6	1.00	2.24	231
670	0.27		63.8	166.4	166.6	165.3	1.00	2.23	229
671	0.27		63.8	166.1	166.3	165.1	1.00	2.25	230

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
672	0.27		63.8	165.8	166.0	164.8	1.00	2.23	228
673	0.27		63.8	165.6	165.8	164.6	1.00	2.22	226
674	0.27		63.8	165.3	165.5	164.3	1.00	2.22	225
675	0.27		63.8	165.0	165.2	164.0	1.00	2.26	229
676	0.27		63.8	164.8	165.0	163.8	1.00	2.22	225
677	0.27		63.8	164.5	164.7	163.5	1.00	2.24	226
678	0.27		63.8	164.3	164.5	163.3	1.00	2.23	225
679	0.27		63.8	164.0	164.2	163.0	1.00	2.22	223
680	0.27		63.7	163.8	163.9	162.8	1.00	2.22	223
681	0.27		63.7	163.5	163.7	162.5	1.00	2.22	221
682	0.27		63.7	163.2	163.4	162.2	1.00	2.26	225
683	0.27		63.7	163.0	163.2	162.0	1.00	2.22	221
684	0.27		63.7	162.7	162.9	161.7	1.00	2.22	220
685	0.27		63.7	162.5	162.7	161.5	1.00	2.23	221
686	0.27		63.7	162.2	162.4	161.2	1.00	2.22	218
687	0.27		63.7	161.9	162.1	161.0	1.00	2.22	219
688	0.27		63.7	161.7	161.9	160.7	1.00	2.22	218
689	0.27		63.7	161.4	161.6	160.5	1.00	2.26	221
690	0.27		63.7	161.2	161.4	160.2	1.00	2.27	221
691	0.27		63.7	160.9	161.1	160.0	1.00	2.23	217
692	0.27		63.7	160.7	160.9	159.7	1.00	2.26	219
693	0.26		63.7	160.4	160.6	159.5	1.00	2.18	211
694	0.27		63.7	160.2	160.4	159.3	1.00	2.26	218
695	0.27		63.7	160.0	160.1	159.0	1.00	2.25	217
696	0.27		63.7	159.7	159.9	158.7	1.00	2.22	214
697	0.27		63.7	159.4	159.6	158.5	1.00	2.22	212
698	0.27		63.7	159.2	159.4	158.2	1.00	2.23	213
699	0.27		63.7	159.0	159.2	158.0	1.00	2.21	211
700	0.27		63.7	158.7	158.9	157.8	1.00	2.22	211
701	0.27		63.7	158.5	158.7	157.5	1.00	2.24	213
702	0.27		63.7	158.2	158.4	157.3	1.00	2.24	212
703	0.27		63.7	158.0	158.2	157.1	1.00	2.24	211
704	0.27		63.7	157.8	157.9	156.8	1.00	2.21	208
705	0.27		63.7	157.5	157.7	156.6	1.00	2.22	209
706	0.27		63.8	157.3	157.4	156.3	1.00	2.26	211
707	0.27		63.8	157.0	157.2	156.1	1.00	2.22	207
708	0.27		63.7	156.8	157.0	155.9	1.00	2.23	208
709	0.27		63.8	156.6	156.7	155.7	1.00	2.22	206
710	0.27		63.8	156.3	156.5	155.4	1.00	2.21	204
711	0.27		63.7	156.1	156.3	155.2	1.00	2.21	204
712	0.27		63.7	155.9	156.0	154.9	1.00	2.25	208
713	0.27		63.7	155.6	155.8	154.7	1.00	2.23	205
714	0.27		63.7	155.4	155.5	154.5	1.00	2.22	203
715	0.27		63.7	155.2	155.3	154.2	1.00	2.21	202
716	0.27		63.7	154.9	155.1	154.0	1.00	2.22	203
717	0.27		63.7	154.7	154.8	153.8	1.00	2.22	203
718	0.27		63.7	154.5	154.6	153.5	1.00	2.22	201
719	0.27		63.6	154.2	154.4	153.3	1.00	2.25	204

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
720	0.27		63.6	154.0	154.2	153.1	1.00	2.22	200
721	0.27		63.6	153.8	153.9	152.9	1.00	2.22	201
722	0.26		63.6	153.5	153.7	152.6	1.00	2.20	198
723	0.27		63.6	153.3	153.4	152.4	1.00	2.22	199
724	0.27		63.6	153.1	153.2	152.2	1.00	2.21	198
725	0.27		63.6	152.8	153.0	152.0	1.00	2.22	198
726	0.27		63.6	152.6	152.8	151.7	1.00	2.23	199
727	0.27		63.6	152.4	152.6	151.5	1.00	2.22	198
728	0.27		63.6	152.1	152.3	151.3	1.00	2.23	198
729	0.26		63.6	152.1	152.4	151.4	1.00	2.20	195
730	0.27		63.6	152.3	152.8	151.7	1.00	2.23	198
731	0.27		63.6	152.7	153.3	152.2	1.00	2.24	200
732	0.27		63.6	153.4	154.1	153.0	1.00	2.22	200
733	0.26		63.6	154.3	155.2	154.1	1.00	2.20	200
734	0.27		63.6	155.5	156.6	155.4	1.00	2.24	206
735	0.27		63.6	156.9	157.9	156.8	1.00	2.24	209
736	0.26		63.6	158.2	159.4	158.2	1.00	2.18	207
737	0.27		63.6	159.9	161.4	160.2	1.00	2.22	214
738	0.27		63.6	161.9	163.4	162.2	1.00	2.22	219
739	0.27		63.6	163.9	165.4	164.2	1.00	2.26	227
740	0.27		63.6	165.9	167.3	166.1	1.00	2.22	227
741	0.27		63.6	167.9	169.5	168.2	1.00	2.23	233
742	0.27		63.6	170.1	171.7	170.4	1.00	2.22	237
743	0.26		63.6	172.4	174.0	172.6	1.00	2.20	239
744	0.27		63.6	174.8	176.5	175.1	1.00	2.22	248
745	0.27		63.6	177.1	178.6	177.3	1.00	2.23	254
746	0.27		63.6	179.3	180.8	179.4	1.00	2.21	256
747	0.26		63.6	181.4	183.3	181.8	1.00	2.20	259
748	0.26		63.6	183.7	185.2	183.8	1.00	2.17	260
749	0.27		63.7	185.6	187.1	185.6	1.00	2.22	271
750	0.27		63.7	187.7	189.1	187.6	1.00	2.25	279
751	0.27		63.7	189.5	191.1	189.6	1.00	2.22	280
752	0.27		63.7	191.7	192.9	191.4	1.00	2.24	287
753	0.27		63.7	192.8	193.5	192.0	1.00	2.21	285
754	0.27		63.7	193.2	193.9	192.3	1.00	2.21	286
755	0.27		63.7	193.4	194.0	192.4	1.00	2.23	290
756	0.27		63.7	193.6	194.2	192.6	1.00	2.23	290
757	0.27		63.7	193.7	194.2	192.6	1.00	2.22	289
758	0.27		63.7	193.7	194.2	192.6	1.00	2.23	290
759	0.27		63.8	193.8	194.3	192.7	1.00	2.22	288
760	0.27		63.8	193.8	194.2	192.7	1.00	2.22	289
761	0.27		63.8	193.7	194.2	192.6	1.00	2.21	287
762	0.27		63.8	193.6	194.1	192.5	1.00	2.22	289
763	0.27		63.9	193.6	194.0	192.5	1.00	2.22	288
764	0.26		63.9	193.4	193.9	192.3	1.00	2.17	282
765	0.27		63.9	193.3	193.7	192.2	1.00	2.22	288
766	0.27		63.9	193.2	193.6	192.0	1.00	2.22	287
767	0.26		63.9	193.0	193.5	191.9	1.00	2.20	284

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
768	0.27		63.9	192.9	193.3	191.7	1.00	2.22	287
769	0.26		64.0	192.7	193.1	191.5	1.00	2.18	281
770	0.27		64.0	192.5	192.9	191.3	1.00	2.21	284
771	0.27		64.0	192.3	192.7	191.1	1.00	2.22	285
772	0.26		64.0	192.1	192.5	190.9	1.00	2.18	280
773	0.27		64.0	191.9	192.3	190.7	1.00	2.22	284
774	0.27		64.0	191.7	192.0	190.5	1.00	2.22	283
775	0.27		64.0	191.4	191.8	190.3	1.00	2.22	284
776	0.27		64.0	191.2	191.6	190.0	1.00	2.22	283
777	0.27		64.1	191.0	191.3	189.8	1.00	2.22	281
778	0.27		64.1	190.7	191.1	189.5	1.00	2.22	282
779	0.26		64.1	190.5	190.8	189.3	1.00	2.19	277
780	0.27		64.1	190.2	190.6	189.0	1.00	2.21	279
781	0.27		64.1	190.0	190.3	188.8	1.00	2.21	278
782	0.27		64.1	189.7	190.1	188.5	1.00	2.21	277
783	0.27		64.1	189.4	189.8	188.3	1.00	2.22	279
784	0.27		64.1	189.2	189.5	188.0	1.00	2.21	276
785	0.26		64.1	188.9	189.3	187.7	1.00	2.20	275
786	0.27		64.0	188.7	189.0	187.4	1.00	2.22	278
787	0.27		64.0	188.4	188.7	187.2	1.00	2.23	278
788	0.27		63.9	188.1	188.4	186.9	1.00	2.22	275
789	0.26		63.9	187.9	188.1	186.6	1.00	2.18	271
790	0.27		63.8	187.6	187.9	186.4	1.00	2.21	274
791	0.27		63.8	187.3	187.6	186.1	1.00	2.21	273
792	0.26		63.7	187.0	187.3	185.8	1.00	2.20	271
793	0.27		63.6	186.7	187.0	185.6	1.00	2.23	275
794	0.27		63.5	186.5	186.8	185.3	1.00	2.22	273
795	0.27		63.5	186.2	186.5	185.0	1.00	2.22	273
796	0.27		63.4	185.9	186.2	184.7	1.00	2.22	272
797	0.27		63.4	185.6	185.9	184.4	1.00	2.22	272
798	0.27		63.4	185.3	185.6	184.1	1.00	2.22	270
799	0.27		63.4	185.0	185.3	183.8	1.00	2.22	270
800	0.26		63.4	184.7	185.0	183.5	1.00	2.20	267
801	0.26		63.4	184.4	184.7	183.2	1.00	2.20	266
802	0.27		63.3	184.2	184.4	183.0	1.00	2.21	267
803	0.26		63.3	183.9	184.1	182.7	1.00	2.19	264
804	0.27		63.4	183.6	183.9	182.4	1.00	2.22	267
805	0.27		63.4	183.3	183.6	182.1	1.00	2.23	268
806	0.27		63.4	183.0	183.3	181.8	1.00	2.22	265
807	0.27		63.4	182.7	183.0	181.5	1.00	2.21	264
808	0.27		63.4	182.4	182.7	181.2	1.00	2.21	263
809	0.27		63.5	182.1	182.4	180.9	1.00	2.21	262
810	0.26		63.5	181.8	182.0	180.6	1.00	2.20	260
811	0.27		63.5	181.5	181.8	180.3	1.00	2.21	261
812	0.27		63.6	181.2	181.5	180.0	1.00	2.22	261
813	0.27		63.6	180.9	181.2	179.7	1.00	2.21	259
814	0.27		63.6	180.6	180.9	179.4	1.00	2.22	259
815	0.27		63.7	180.3	180.6	179.1	1.00	2.22	259

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
816	0.26		63.7	180.0	180.3	178.9	1.00	2.17	253
817	0.27		63.7	179.7	180.0	178.6	1.00	2.21	256
818	0.26		63.7	179.4	179.7	178.3	1.00	2.20	255
819	0.26		63.7	179.2	179.4	178.0	1.00	2.19	253
820	0.27		63.7	178.8	179.1	177.7	1.00	2.22	255
821	0.27		63.8	178.6	178.8	177.4	1.00	2.22	255
822	0.26		63.8	178.3	178.5	177.1	1.00	2.18	250
823	0.27		63.8	178.0	178.2	176.8	1.00	2.23	255
824	0.27		63.8	177.7	177.9	176.5	1.00	2.22	253
825	0.27		63.8	177.4	177.6	176.2	1.00	2.22	252
826	0.26		63.8	177.1	177.4	175.9	1.00	2.20	249
827	0.27		63.9	176.8	177.1	175.7	1.00	2.22	250
828	0.26		63.9	176.5	176.8	175.4	1.00	2.20	248
829	0.27		63.9	176.2	176.5	175.1	1.00	2.24	252
830	0.26		63.9	176.0	176.2	174.8	1.00	2.20	247
831	0.26		63.9	175.7	175.9	174.5	1.00	2.15	240
832	0.27		63.9	175.4	175.6	174.2	1.00	2.21	246
833	0.26		63.9	175.1	175.3	173.9	1.00	2.20	245
834	0.27		63.9	174.8	175.0	173.7	1.00	2.21	245
835	0.27		63.9	174.5	174.7	173.4	1.00	2.22	246
836	0.26		63.8	174.2	174.4	173.1	1.00	2.14	237
837	0.27		63.8	173.9	174.2	172.8	1.00	2.23	246
838	0.27		63.8	173.6	173.9	172.5	1.00	2.22	244
839	0.26		63.8	173.3	173.6	172.2	1.00	2.20	241
840	0.26		63.8	173.1	173.3	172.0	1.00	2.19	240
841	0.26		63.8	172.8	173.0	171.7	1.00	2.14	234
842	0.27		63.8	172.5	172.7	171.4	1.00	2.22	242
843	0.27		63.8	172.2	172.5	171.1	1.00	2.21	239
844	0.27		63.8	171.9	172.2	170.8	1.00	2.28	247
845	0.26		63.8	171.6	171.9	170.6	1.00	2.17	235
846	0.26		63.8	171.4	171.6	170.3	1.00	2.14	231
847	0.26		63.8	171.1	171.3	170.0	1.00	2.18	234
848	0.27		63.7	170.8	171.0	169.7	1.00	2.22	238
849	0.26		63.7	170.5	170.8	169.5	1.00	2.20	235
850	0.27		63.7	170.2	170.5	169.2	1.00	2.22	237
851	0.26		63.8	170.0	170.2	168.9	1.00	2.20	234
852	0.26		63.8	169.7	169.9	168.6	1.00	2.19	232
853	0.27		63.8	169.4	169.7	168.4	1.00	2.21	233
854	0.26		63.8	169.1	169.4	168.1	1.00	2.20	232
855	0.27		63.8	168.9	169.1	167.8	1.00	2.23	235
856	0.27		63.8	168.6	168.8	167.6	1.00	2.21	232
857	0.26		63.8	168.3	168.5	167.3	1.00	2.19	229
858	0.27		63.8	168.1	168.3	167.0	1.00	2.21	230
859	0.26		63.8	167.8	168.0	166.7	1.00	2.17	225
860	0.27		63.8	167.5	167.7	166.5	1.00	2.22	230
861	0.27		63.8	167.2	167.5	166.2	1.00	2.22	229
862	0.26		63.8	167.0	167.2	165.9	1.00	2.20	227
863	0.27		63.8	166.7	166.9	165.7	1.00	2.22	229

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
864	0.26		63.8	166.4	166.6	165.4	1.00	2.20	226
865	0.26		63.8	166.2	166.4	165.1	1.00	2.19	225
866	0.27		63.8	165.9	166.1	164.9	1.00	2.26	231
867	0.27		63.8	165.6	165.8	164.6	1.00	2.22	226
868	0.27		63.8	165.3	165.6	164.4	1.00	2.22	225
869	0.26		63.8	165.1	165.3	164.1	1.00	2.19	222
870	0.27		63.8	164.8	165.0	163.8	1.00	2.21	223
871	0.26		63.8	164.6	164.8	163.6	1.00	2.19	221
872	0.27		63.8	164.3	164.5	163.3	1.00	2.22	223
873	0.26		63.8	164.0	164.3	163.1	1.00	2.17	217
874	0.27		63.8	163.8	164.0	162.8	1.00	2.22	223
875	0.27		63.8	163.5	163.7	162.5	1.00	2.22	221
876	0.26		63.8	163.3	163.5	162.3	1.00	2.18	217
877	0.26		63.7	163.0	163.2	162.0	1.00	2.17	216
878	0.26		63.6	162.7	163.0	161.8	1.00	2.17	215
879	0.26		63.6	162.5	162.7	161.5	1.00	2.17	214
880	0.26		63.5	162.2	162.4	161.2	1.00	2.13	211
881	0.27		63.4	162.0	162.2	161.0	1.00	2.23	220
882	0.27		63.3	161.7	161.9	160.7	1.00	2.21	217
883	0.26		63.3	161.5	161.6	160.4	1.00	2.17	214
884	0.26		63.2	161.2	161.4	160.2	1.00	2.20	216
885	0.27		63.1	160.9	161.1	159.9	1.00	2.21	216
886	0.27		63.0	160.7	160.9	159.7	1.00	2.21	216
887	0.26		62.9	160.4	160.6	159.4	1.00	2.20	215
888	0.27		62.9	160.2	160.4	159.2	1.00	2.22	216
889	0.26		62.8	159.9	160.1	158.9	1.00	2.17	211
890	0.26		62.8	159.7	159.9	158.7	1.00	2.20	213
891	0.27		62.7	159.4	159.6	158.4	1.00	2.22	215
892	0.26		62.7	159.1	159.4	158.2	1.00	2.16	208
893	0.26		62.7	158.9	159.1	158.0	1.00	2.18	210
894	0.27		62.7	158.7	158.9	157.7	1.00	2.27	218
895	0.27		62.7	158.4	158.6	157.5	1.00	2.22	212
896	0.26		62.8	158.2	158.4	157.2	1.00	2.19	209
897	0.27		62.8	157.9	158.1	156.9	1.00	2.22	211
898	0.26		62.8	157.7	157.9	156.7	1.00	2.20	209
899	0.27		62.8	157.4	157.6	156.5	1.00	2.21	209
900	0.27		62.9	157.2	157.4	156.2	1.00	2.22	210
901	0.26		62.9	156.9	157.1	156.0	1.00	2.17	205
902	0.26		62.9	156.7	156.9	155.8	1.00	2.13	200
903	0.28		62.9	156.5	156.7	155.5	1.00	2.32	218
904	0.26		62.9	156.2	156.4	155.3	1.00	2.19	205
905	0.26		62.9	156.0	156.1	155.0	1.00	2.20	205
906	0.26		62.8	155.7	155.9	154.8	1.00	2.15	200
907	0.29		62.8	155.5	155.7	154.6	1.00	2.37	220
908	0.26		62.8	155.3	155.4	154.3	1.00	2.19	203
909	0.27		62.8	155.0	155.2	154.1	1.00	2.22	205
910	0.26		62.8	154.8	155.0	153.9	1.00	2.20	203
911	0.26		62.7	154.5	154.7	153.6	1.00	2.17	199

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 2

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/8/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
912	0.27		62.7	154.3	154.5	153.4	1.00	2.24	205
913	0.27		62.7	154.1	154.3	153.1	1.00	2.21	202
914	0.26		62.7	153.8	154.0	152.9	1.00	2.20	201
915	0.26		62.7	153.6	153.8	152.7	1.00	2.18	199
916	0.26		62.7	153.4	153.5	152.4	1.00	2.19	199
917	0.26		62.7	153.1	153.3	152.2	1.00	2.19	198
918	0.27		62.7	152.9	153.1	152.0	1.00	2.21	199
919	0.27		62.7	152.7	152.8	151.7	1.00	2.22	200
920	0.26		62.7	152.4	152.6	151.5	1.00	2.20	197
921	0.26		62.7	152.2	152.4	151.3	1.00	2.18	196
922	0.26		62.7	152.2	152.6	151.5	1.00	2.19	196
923	0.26		62.7	152.5	153.1	152.0	1.00	2.18	196
924	0.27		62.7	153.0	153.7	152.6	1.00	2.23	202
925	0.27		62.7	153.9	154.7	153.6	1.00	2.23	204
926	0.26		62.7	154.9	155.9	154.8	1.00	2.20	203
927	0.26		62.7	156.2	157.3	156.1	1.00	2.20	206
928	0.27		62.7	157.6	158.7	157.5	1.00	2.22	210
929	0.27		62.7	159.0	160.1	158.9	1.00	2.21	213
930	0.27		62.7	160.4	161.7	160.5	1.00	2.21	216
931	0.27		62.7	162.2	163.5	162.2	1.00	2.22	221
932	0.27		62.7	164.1	165.6	164.3	1.00	2.21	224
933	0.27		62.7	166.1	167.4	166.2	1.00	2.22	229
934	0.27		62.7	167.9	169.4	168.1	1.00	2.24	236
935	0.26		62.7	169.9	171.5	170.2	1.00	2.17	233
936	0.27		62.7	172.2	173.7	172.4	1.00	2.23	245
937	0.27		62.7	174.2	175.8	174.4	1.00	2.22	248
938	0.26		62.7	176.3	177.7	176.3	1.00	2.17	246
939	0.27		62.8	178.1	179.6	178.1	1.00	2.21	255
940	0.26		62.8	180.4	182.0	180.6	1.00	2.17	255
941	0.26		62.8	182.5	184.0	182.5	1.00	2.19	263
942	0.26		62.9	184.7	186.3	184.8	1.00	2.19	267
Average	0.28	#DIV/0!	62	172	172	171	1.00	2.32	255
								TOTAL:	**240152**

LAB SAMPLE DATA - ASTM E2515

Client: 0
Model: 0
Run #: 0

Job #: 0
Tracking #: 0
Technician: 0
Date: 1/0/1900

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	**A**	G01197	228.7	230.6	1.9
	B	G01198	227.7	229.5	1.8
	C - 1st Hour	G01199	228.0	228.3	0.3
	Amb	G01200	228.6	228.9	0.3
Probes	**A**	17A	116810.8	116810.9	0.1
	B	17B	117140.7	117140.8	0.1
	C - 1st Hour	17C	113141.2	113141.2	0.0
O-rings	**A**	17A	3612.4	3612.6	0.2
	B	17B	3568.9	3568.9	0.0
	C - 1st Hour	17C	3597.0	3597.0	0.0

Placed in Dessicator on:	1/9/2025

Balance Audit (mg):		200.0		200.0		200.0			
		Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time
Filters	**A**	230.5	1/13 10:45	230.6	1/15 13:00				
	B	229.5	1/13 10:45	229.5	1/15 13:00				
	C - 1st Hour	228.2	1/13 10:45	228.3	1/15 13:00				
	Amb	228.8	1/13 10:45	228.9	1/15 13:00				
Probes	**A**	116811.0	1/13 10:45	116810.9	1/15 13:00				
	B	117140.7	1/13 10:45	117140.8	1/15 13:00				
	C - 1st Hour	113141.2	1/13 10:45	113141.2	1/15 13:00				
O-Rings	**A**	3612.6	1/13 10:45	3612.6	1/15 13:00				
	B	3569.1	1/13 10:45	3568.8	1/15 13:00	3568.9	1/20 10:00		
	C - 1st Hour	3597.1	1/13 10:45	3597.0	1/15 13:00				

Train A Aggregate, mg:	**2.2**
Train B Aggregate, mg:	**1.9**
Train C Aggregate, mg:	**0.3**
Ambient, mg:	**0.3**

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 2 Test Date: 1/8/24

Wood Heater Run Notes

Pre-Test Notes
Pre-Test Start Time: 13:23
Target Load (BTU/hr): 16,250

Time	Notes
	-None-

Test Notes
Test Burn Start Time: 15:19
Target Load (BTU/hr): 16,250 (Category 1)

Time	Notes
	-None

Test Burn End Time: 1/9 07:01

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 17.00 CO (%): 4.002
Mid Gas CO_2 (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	9:31	9:32	9:33	1/9 9:10	1/9 9:11	1/9 9:12
CO_2	0.00	17.00	10.09	0.01	17.18	10.42
CO	0.000	4.001	2.509	0.003	4.007	2.549

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

Technician Signature:  Date: 1/20/25

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 2 Test Date: 1/8/24

Test Photos



Preburn Fuel Load



Test Fuel Load



Test Fuel Loaded

Technician Signature: _____ Date: 1/20/25

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 3 Data Summary

Client:	Alternate Heating
Model:	SE110
Job #:	24-350
Tracking #:	217
Test Date:	1/9/2024

Techician Signature

2/24/2025
Date

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	120.582	91.046	89.038	10.033
Average Gas Velocity in Dilution Tunnel (ft/sec)	17.9			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	49657.7			
Average Gas Meter Temperature (°F)	65.7	90.4	90.2	74.7
Total Sample Volume (dscf)	122.563	89.074	87.660	10.168
Average Tunnel Temperature (°F)	72.3			
Total Time of Test (min)	569			
Total Particulate Catch (mg)	0.2	1.9	2.0	0.6
Particulate Concentration, dry-standard (g/dscf)	0.0000016	0.0000213	0.0000228	0.0000590
Total PM Emissions (g)	0.77	9.28	9.98	2.85
Particulate Emission Rate (g/hr)	0.08	0.98	1.05	2.85
Emissions Factor (g/kg)	-	0.45	0.49	-
Difference from Average Total Particulate Emissions (g)	-	0.35	0.35	-
Difference from Average Total Particulate Emissions (%)		3.6%	3.6%	
Difference from Average Emissions Factor (g/kg)	-	0.02	0.02	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	158.6
Appliance Average Final Temperature (F)	186.1
Heat Output (BTU)	261,714
Heat Output Rate (BTU/hr)	27,597
Heat Input - HHV (BTU)	385,961
Heat Input - LHV (BTU)	358,495

Emissions Rates and Factors

Total Particulate Emissions (g)	9.6
Emissions Factor (g/MJ)	0.0349
Emissions Factor (g/kg)	0.4719
Emissions Rate (g/hr)	1.02
Emissions Rate (lb/mmbtu output)	0.081
HHV Delivered Efficiency (%)	67.8%
LHV Delivered Efficiency (%)	73.0%
HHV SLM Efficiency (%)	79.7%
LHV SLM Efficiency (%)	85.2%
CO Emissions (g/min)	2.60

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	73.0	OK
Face Velocity	< 30 ft/min	8.8	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 63.7 / Max: 67.3	OK
Negative Probe Weight Evaluation	<5% of Total Catch	OK	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Return Temp > 120°F	>120°F	149.7	OK

B415.1 Efficiency Results

Manufacturer: Alternate Heating
Model: SE110
Date: 01/09/24
Run: 3
Control #: 24-350
Test Duration: 569
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	79.7%	85.2%
Combustion Efficiency	95.0%	95.0%
Heat Transfer Efficiency	83.9%	89.7%

Output Rate (kJ/h)	34,148	32,393	**(Btu/h)**
Burn Rate (kg/h)	2.15	4.73	**(lb/h)**
Input (kJ/h)	42,866	40,663	**(Btu/h)**

Test Load Weight (dry kg)	20.37	44.89	**dry lb**
MC wet (%)	17.64		
MC dry (%)	21.41		
Particulate (g)	9.63		
CO (g)	1,481		
Test Duration (h)	9.48		

Emissions	Particulate	CO
g/MJ Output	0.03	4.57
g/kg Dry Fuel	0.47	72.74
g/h	1.02	156.21
g/min	0.02	2.60
lb/MM Btu Output	0.07	10.63

Air/Fuel Ratio (A/F)	32.33

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

BOILER CORDWOOD FUEL DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

Firebox Volume (ft^3): 5.62
Target Load Weight (lbs): 56.20

Minimun Piece Weight (lbs): 4.40
Maximun Piece Weight (lbs): 17.60
80% of piece of weight range (lbs): 6.6 to 15.4

Pretest Fuel Information

Length (in)	Weight (lbs)	MC (%DB)	Length (in)	Weight (lbs)	MC (%DB)
24.00	6.78	24.9			
24.00	7.54	23.9			
24.00	8.49	24.8			
24.00	8.57	19.6			

Total Preburn Weight (lbs): 31.38
Averge Preburn Moisture (% DB): 23.30

Test Fuel Information

Length (in)	Weight (lbs)	Moisture Content (%DB)					Avg MC (%DB)	Dry Weight (lbs)
24.00	8.60	21.7	22.0	20.7	26.4	27.2	23.60	6.96
24.00	11.65	18.0	18.5	20.1	18.9	21.8	19.46	9.75
24.00	8.32	20.1	19.4	21.3	25.8	22.2	21.76	6.83
24.00	6.34	18.8	22.3	19.8	18.0	19.9	19.76	5.29
24.00	12.81	20.1	19.3	25.1	21.6	18.9	21.00	10.59
24.00	6.77	26.3	24.3	22.4	25.6	21.9	24.10	5.46

Total (lbs): 54.49
Load Density (lbs/ft3): 9.70

Total Dry Weight (lbs): 44.88

Quality checks
Individual Piece Weights: OK
80% Piece weight range: OK

Allowable Coal Bed Range (10-20%): 5.4 - 10.9

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client:	Alternate Heating	Job #:	24-350
Model:	SE110	Tracking #:	217
Run #:	3	Technician:	AK
Test Start Time:	12:35	Date:	1/9/2024
Manufacturer's Rated Output (BTU/hr):	125,000		

Total Sampling Time (min):	569		
Recording Interval (min):	1		
Meter Box γ Factor:	1.005	(A)	
Meter Box γ Factor:	1.011	(B)	
Meter Box γ Factor:	1.000	(Ambient)	
Meter Box γ Factor:	1.000	(C)	
Induced Draft Check (in. H_2O):	0		
Smoke Capture Check (%):	100%		
Date Flue Pipe Last Cleaned:	1/6/2024		
Boiler Dry Weight (lbs):	1470		
Supply Side Water Weight (lbs):	970		

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.31	30.27	30.29
Relative Humidity (%)	29.7	24.6	
Room Air Velocity (ft/min)	<50	<50	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		120.582	ft^3

Sample Train Post-Test Leak Checks

	Pre-test	Post-test			
(A)	0.000	0.000	cfm @	-7	in. Hg
(B)	0.000	0.000	cfm @	-7	in. Hg
(C)	0.000	0.000	cfm @	-6	in. Hg
(Ambient)	0.000	0.000	cfm @	-13	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.068	76
2	0.076	76
3	0.080	76
4	0.076	76
5	0.070	76
6	0.066	76
7	0.060	76
8	0.070	76
9	0.074	76
10	0.080	76
11	0.076	76
12	0.062	76
Center	0.076	76

Static Pressure: -0.230 in. H_2O

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	12	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.7854	ft^2
V_{strav}:	17.73	ft/sec
V_{scent}:	18.29	ft/sec
F_p:	0.969	[ratio]
Initial Tunnel Flow:	816.3	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

Fuel Type:	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

Actual Fuel Used Properties

Fuel Type:	Maple
HHV (kJ/kg)	19,960
%C	50.64
%H	6.02
%O	41.74
%Ash	1.35
MC (%DB)	21.4%

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.076	0.31	69.4	-0.62		54.5		70	73	68	67
1	0.143	0.143	0.074	1.17	69.3	-1.34	95	54.4	-0.1	73	130	68	67
2	0.306	0.163	0.077	1.16	69.2	-1.24	106	54.3	-0.1	73	154	68	67
3	0.468	0.162	0.075	1.17	68.6	-1.01	107	54.1	-0.2	71	131	69	67
4	0.633	0.165	0.075	1.17	69.3	-0.82	109	54.1	0	71	114	69	67
5	0.794	0.161	0.076	1.15	69.3	-0.62	106	54.2	0.1	71	103	69	67
6	0.956	0.162	0.077	1.15	68.7	-0.48	106	54.2	0	71	96	69	67
7	1.119	0.163	0.074	1.17	68.8	-0.35	108	54.2	0	71	91	69	67
8	1.280	0.161	0.074	1.13	69.0	-0.26	107	54.2	0	71	86	69	67
9	1.443	0.163	0.076	1.15	69.5	-0.21	107	54.1	-0.1	71	83	69	67
10	1.604	0.161	0.076	1.15	69.4	-0.18	106	54.1	0	71	81	69	67
11	1.766	0.162	0.076	1.14	70.1	-0.19	106	54.1	0	71	79	69	67
12	1.927	0.161	0.076	1.14	69.7	-0.2	105	54.0	-0.1	71	78	69	67
13	2.088	0.161	0.076	1.14	70.4	-0.23	105	53.9	-0.1	70	77	69	67
14	2.251	0.163	0.075	1.13	70.7	-0.28	107	53.9	0	70	76	69	67
15	2.411	0.160	0.075	1.14	70.2	-0.32	105	54.0	0.1	70	75	69	67
16	2.573	0.162	0.076	1.14	70.3	-0.39	106	54.2	0.2	70	74	69	67
17	2.733	0.160	0.077	1.13	71.2	-0.43	104	54.2	0	70	74	69	67
18	2.896	0.163	0.076	1.13	70.7	-0.47	107	54.2	0	70	73	69	67
19	3.055	0.159	0.077	1.13	71.0	-0.53	103	54.1	-0.1	70	73	69	67
20	3.217	0.162	0.077	1.13	71.9	-0.56	105	54.0	-0.1	70	73	69	67
21	3.377	0.160	0.076	1.15	71.8	-0.6	104	54.0	0	70	73	69	67
22	3.538	0.161	0.077	1.13	72.1	-0.66	104	54.0	0	70	72	69	67
23	3.699	0.161	0.074	1.12	72.7	-0.71	106	54.1	0.1	70	72	69	67
24	3.859	0.160	0.077	1.13	72.6	-0.74	104	54.0	-0.1	70	72	69	67
25	4.021	0.162	0.075	1.14	73.2	-0.79	106	53.7	-0.3	73	133	69	67
26	4.180	0.159	0.077	1.10	73.4	-0.86	103	53.3	-0.4	75	178	69	67
27	4.339	0.159	0.077	1.12	73.1	-0.91	104	52.6	-0.7	78	220	69	67
28	4.497	0.158	0.076	1.09	73.4	-0.93	104	52.1	-0.5	79	242	69	67
29	4.656	0.159	0.076	1.10	73.6	-0.98	104	51.6	-0.5	80	255	69	67
30	4.815	0.159	0.076	1.11	74.6	-1.01	104	51.1	-0.5	80	265	69	67
31	4.972	0.157	0.077	1.10	74.6	-1.04	102	50.6	-0.5	81	273	69	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	5.132	0.160	0.077	1.11	75.0	-1.08	104	50.0	-0.6	81	279	69	67
33	5.289	0.157	0.076	1.11	74.9	-1.1	103	49.4	-0.6	82	283	69	67
34	5.448	0.159	0.076	1.09	75.0	-1.11	104	48.9	-0.5	82	285	69	67
35	5.605	0.157	0.075	1.10	75.6	-1.13	104	48.4	-0.5	83	288	69	67
36	5.764	0.159	0.077	1.10	75.6	-1.12	104	48.0	-0.4	83	292	69	67
37	5.923	0.159	0.075	1.10	75.9	-1.11	105	47.4	-0.6	83	294	69	67
38	6.080	0.157	0.077	1.12	76.8	-1.13	102	46.9	-0.5	84	296	69	67
39	6.240	0.160	0.077	1.11	76.7	-1.1	104	46.4	-0.5	84	298	70	67
40	6.397	0.157	0.076	1.11	76.8	-1.1	103	45.8	-0.6	84	298	70	67
41	6.556	0.159	0.079	1.11	77.1	-1.07	102	45.3	-0.5	84	300	70	67
42	6.714	0.158	0.074	1.10	78.0	-1.05	105	44.7	-0.6	85	301	70	67
43	6.873	0.159	0.076	1.10	77.6	-1.03	104	44.2	-0.5	85	301	70	67
44	7.031	0.158	0.077	1.10	78.6	-1.01	103	43.7	-0.5	85	301	70	67
45	7.190	0.159	0.078	1.10	78.9	-0.99	102	43.2	-0.5	85	299	70	67
46	7.349	0.159	0.077	1.10	78.4	-0.97	103	42.6	-0.6	85	301	70	67
47	7.506	0.157	0.077	1.10	78.9	-0.95	102	42.2	-0.4	85	301	70	67
48	7.666	0.160	0.076	1.10	78.9	-0.94	104	41.8	-0.4	84	287	70	67
49	7.824	0.158	0.077	1.10	80.0	-0.94	102	41.6	-0.2	78	216	70	67
50	7.984	0.160	0.075	1.10	79.4	-0.93	104	41.4	-0.2	76	180	70	67
51	8.142	0.158	0.077	1.10	79.8	-0.94	101	41.3	-0.1	75	158	70	67
52	8.302	0.160	0.077	1.11	80.2	-0.94	102	41.2	-0.1	74	142	70	67
53	8.460	0.158	0.076	1.10	81.1	-0.94	102	41.2	0	74	131	70	67
54	8.621	0.161	0.076	1.13	81.2	-0.95	104	41.2	0	74	122	70	67
55	8.779	0.158	0.078	1.11	81.2	-0.97	100	41.2	0	73	114	70	67
56	8.939	0.160	0.079	1.11	81.0	-1	101	41.2	0	73	108	70	67
57	9.098	0.159	0.077	1.11	81.9	-1	101	41.2	0	73	103	70	67
58	9.258	0.160	0.076	1.12	82.3	-1.02	103	41.1	-0.1	73	99	70	67
59	9.417	0.159	0.076	1.12	82.4	-1.04	102	41.0	-0.1	73	95	70	67
60	9.577	0.160	0.078	1.11	81.9	-1.09	101	41.0	0	72	92	70	67
61	9.737	0.160	0.077	1.11	82.7	-1.11	102	41.1	0.1	72	90	70	67
62	9.896	0.159	0.078	1.10	82.7	-1.15	101	41.2	0.1	72	88	70	67
63	10.056	0.160	0.075	1.10	82.9	-1.17	103	41.2	0	72	86	70	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	10.216	0.160	0.079	1.13	83.4	-1.2	100	41.2	0	72	85	70	67
65	10.376	0.160	0.078	1.11	83.0	-1.24	101	41.3	0.1	72	83	70	67
66	10.535	0.159	0.078	1.11	83.3	-1.28	100	41.3	0	72	82	70	67
67	10.695	0.160	0.076	1.12	84.2	-1.3	102	41.3	0	72	81	70	67
68	10.855	0.160	0.079	1.11	83.8	-1.35	100	41.2	-0.1	72	81	70	67
69	11.015	0.160	0.077	1.11	84.5	-1.37	101	41.2	0	72	80	70	67
70	11.174	0.159	0.078	1.10	84.8	-1.41	100	41.2	0	72	79	70	67
71	11.335	0.161	0.077	1.11	84.2	-1.45	102	41.2	0	72	78	70	67
72	11.494	0.159	0.077	1.11	84.6	-1.48	101	41.2	0	72	78	70	67
73	11.655	0.161	0.078	1.10	84.7	-1.51	101	41.2	0	72	78	70	67
74	11.814	0.159	0.079	1.11	85.0	-1.57	99	41.2	0	72	77	70	67
75	11.975	0.161	0.078	1.11	85.5	-1.6	101	41.2	0	72	77	70	67
76	12.134	0.159	0.076	1.10	85.1	-1.64	101	41.2	0	72	77	70	67
77	12.295	0.161	0.077	1.08	86.0	-1.67	102	41.3	0.1	72	76	70	67
78	12.454	0.159	0.077	1.13	85.4	-1.69	101	41.5	0.2	72	76	70	67
79	12.615	0.161	0.080	1.15	85.7	-1.73	100	41.4	-0.1	72	76	70	67
80	12.775	0.160	0.077	1.10	86.5	-1.76	101	41.4	0	72	76	70	67
81	12.935	0.160	0.077	1.10	86.1	-1.78	101	41.2	-0.2	71	75	70	67
82	13.095	0.160	0.075	1.12	86.1	-1.82	102	41.2	0	71	75	70	67
83	13.255	0.160	0.076	1.11	86.3	-1.84	102	41.2	0	71	75	70	67
84	13.416	0.161	0.078	1.11	87.1	-1.88	101	41.2	0	71	75	70	67
85	13.575	0.159	0.077	1.08	86.6	-1.91	100	41.1	-0.1	71	75	70	67
86	13.737	0.162	0.080	1.11	87.5	-1.93	100	41.1	0	71	75	69	67
87	13.896	0.159	0.076	1.11	86.9	-1.95	101	41.2	0.1	71	74	70	67
88	14.058	0.162	0.076	1.11	87.1	-1.98	103	41.2	0	71	74	70	67
89	14.217	0.159	0.077	1.10	87.2	-2	100	41.2	0	71	74	69	67
90	14.378	0.161	0.080	1.11	87.3	-2.02	100	41.2	0	71	74	69	67
91	14.538	0.160	0.078	1.10	87.7	-2.05	100	41.2	0	71	74	69	67
92	14.700	0.162	0.077	1.11	88.4	-2.09	102	41.1	-0.1	71	74	69	67
93	14.859	0.159	0.079	1.08	88.5	-2.1	99	41.2	0.1	71	74	69	67
94	15.021	0.162	0.076	1.11	88.3	-2.12	103	41.2	0	71	74	69	67
95	15.180	0.159	0.077	1.11	88.7	-2.15	100	41.2	0	71	74	69	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	15.342	0.162	0.079	1.11	88.1	-2.16	101	41.2	0	71	74	69	67
97	15.501	0.159	0.078	1.10	88.4	-2.2	99	41.2	0	71	73	69	67
98	15.663	0.162	0.076	1.10	89.1	-2.23	102	41.2	0	71	73	69	67
99	15.823	0.160	0.078	1.11	88.6	-2.23	100	41.2	0	71	73	69	67
100	15.984	0.161	0.077	1.10	89.4	-2.26	101	41.1	-0.1	71	73	69	67
101	16.144	0.160	0.078	1.09	88.8	-2.27	100	41.1	0	71	73	69	67
102	16.305	0.161	0.077	1.11	89.6	-2.29	101	41.2	0.1	71	73	69	67
103	16.466	0.161	0.079	1.11	89.7	-2.32	100	41.1	-0.1	71	73	69	67
104	16.626	0.160	0.079	1.11	89.2	-2.33	99	41.2	0.1	71	73	69	67
105	16.788	0.162	0.078	1.11	89.9	-2.34	101	41.1	-0.1	71	73	69	67
106	16.948	0.160	0.077	1.11	89.2	-2.37	100	41.2	0.1	71	73	69	67
107	17.110	0.162	0.078	1.10	89.7	-2.39	101	41.2	0	71	73	69	67
108	17.269	0.159	0.078	1.11	89.5	-2.41	99	41.2	0	71	73	69	67
109	17.431	0.162	0.077	1.08	90.2	-2.42	102	41.2	0	71	73	69	67
110	17.591	0.160	0.077	1.11	90.4	-2.44	100	41.1	-0.1	71	73	69	67
111	17.753	0.162	0.077	1.11	89.7	-2.47	102	41.2	0.1	71	73	69	67
112	17.913	0.160	0.075	1.11	89.8	-2.49	102	41.2	0	71	73	69	67
113	18.075	0.162	0.077	1.13	90.1	-2.48	102	41.2	0	71	73	69	67
114	18.235	0.160	0.078	1.11	90.1	-2.5	100	41.2	0	71	73	69	67
115	18.396	0.161	0.076	1.10	90.9	-2.52	101	41.2	0	71	72	69	67
116	18.557	0.161	0.079	1.11	90.2	-2.54	100	41.2	0	71	72	69	67
117	18.717	0.160	0.075	1.12	90.8	-2.56	102	41.2	0	71	72	69	67
118	18.879	0.162	0.078	1.11	90.7	-2.56	101	41.2	0	71	72	69	67
119	19.039	0.160	0.077	1.10	91.2	-2.58	100	41.2	0	71	72	69	67
120	19.201	0.162	0.079	1.11	90.6	-2.61	100	41.2	0	71	72	69	67
121	19.361	0.160	0.076	1.11	90.6	-2.6	101	41.2	0	71	72	69	67
122	19.523	0.162	0.078	1.12	91.4	-2.6	101	41.3	0.1	71	72	69	67
123	19.683	0.160	0.079	1.08	90.7	-2.63	99	41.3	0	71	72	69	67
124	19.845	0.162	0.078	1.11	91.4	-2.67	101	41.3	0	71	72	69	67
125	20.006	0.161	0.077	1.11	90.9	-2.69	101	41.2	-0.1	71	72	69	67
126	20.167	0.161	0.077	1.12	91.6	-2.69	101	41.1	-0.1	71	72	69	67
127	20.328	0.161	0.078	1.10	91.4	-2.68	100	41.1	0	71	72	69	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	20.488	0.160	0.078	1.11	91.1	-2.68	99	41.2	0.1	71	72	69	67
129	20.650	0.162	0.078	1.11	91.3	-2.72	101	41.3	0.1	71	72	69	67
130	20.810	0.160	0.078	1.11	92.0	-2.74	99	41.2	-0.1	71	72	69	67
131	20.973	0.163	0.079	1.11	92.1	-2.73	100	41.2	0	71	72	69	67
132	21.133	0.160	0.077	1.11	91.4	-2.75	100	41.2	0	71	72	69	67
133	21.295	0.162	0.078	1.11	92.1	-2.77	101	41.2	0	71	72	69	67
134	21.455	0.160	0.079	1.11	92.2	-2.76	99	41.2	0	71	72	69	67
135	21.617	0.162	0.077	1.11	92.3	-2.78	101	41.2	0	71	72	69	67
136	21.778	0.161	0.077	1.11	91.6	-2.78	101	41.2	0	71	72	69	67
137	21.938	0.160	0.076	1.12	91.8	-2.81	101	41.2	0	71	72	69	67
138	22.101	0.163	0.077	1.12	92.4	-2.83	102	41.2	0	71	72	69	67
139	22.261	0.160	0.079	1.11	92.2	-2.86	99	41.2	0	70	72	69	67
140	22.423	0.162	0.079	1.11	91.8	-2.82	100	41.2	0	71	72	69	67
141	22.583	0.160	0.077	1.11	91.8	-2.85	100	41.3	0.1	70	72	69	67
142	22.746	0.163	0.078	1.11	92.8	-2.86	101	41.2	-0.1	71	72	69	67
143	22.906	0.160	0.077	1.10	92.7	-2.88	100	41.2	0	70	72	69	67
144	23.068	0.162	0.078	1.11	92.3	-2.89	100	41.2	0	70	72	69	67
145	23.229	0.161	0.078	1.10	92.1	-2.9	100	41.3	0.1	71	72	69	67
146	23.390	0.161	0.079	1.12	92.8	-2.9	99	41.3	0	71	72	69	67
147	23.552	0.162	0.077	1.09	92.4	-2.91	101	41.3	0	71	72	69	67
148	23.712	0.160	0.076	1.12	92.2	-2.92	101	41.2	-0.1	70	72	69	67
149	23.874	0.162	0.078	1.09	93.0	-2.92	100	41.3	0.1	70	72	69	67
150	24.035	0.161	0.078	1.10	92.6	-2.94	100	41.3	0	70	72	69	67
151	24.197	0.162	0.076	1.11	92.2	-2.94	102	41.2	-0.1	70	71	69	67
152	24.358	0.161	0.079	1.11	92.2	-2.95	99	41.2	0	70	71	69	67
153	24.520	0.162	0.078	1.12	92.9	-2.96	100	41.2	0	70	71	69	67
154	24.680	0.160	0.077	1.11	92.5	-2.97	100	41.2	0	70	71	69	67
155	24.841	0.161	0.078	1.11	92.5	-2.98	100	41.3	0.1	71	71	69	67
156	25.004	0.163	0.079	1.12	92.5	-2.99	100	41.3	0	71	71	69	67
157	25.164	0.160	0.079	1.11	93.2	-3	98	41.3	0	71	71	69	67
158	25.327	0.163	0.077	1.11	92.6	-3.02	102	41.2	-0.1	70	71	69	67
159	25.487	0.160	0.077	1.11	93.4	-3	100	41.1	-0.1	72	118	69	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	25.649	0.162	0.078	1.13	93.4	-3.01	101	40.9	-0.2	75	150	69	67
161	25.809	0.160	0.079	1.10	93.5	-3.04	99	40.6	-0.3	76	173	69	67
162	25.971	0.162	0.077	1.12	92.8	-3.04	102	40.2	-0.4	77	187	69	67
163	26.131	0.160	0.077	1.12	93.4	-3.05	100	39.9	-0.3	77	200	69	67
164	26.292	0.161	0.078	1.10	92.8	-3.04	100	39.4	-0.5	77	203	69	67
165	26.453	0.161	0.076	1.11	93.0	-3.05	102	39.1	-0.3	78	210	69	67
166	26.613	0.160	0.077	1.11	92.9	-3.04	101	38.6	-0.5	79	223	69	67
167	26.775	0.162	0.080	1.12	93.6	-3.03	100	38.0	-0.6	79	231	69	67
168	26.935	0.160	0.078	1.10	92.9	-3.02	100	37.4	-0.6	80	241	69	67
169	27.097	0.162	0.078	1.10	93.6	-3.03	101	37.0	-0.4	81	251	69	67
170	27.256	0.159	0.078	1.12	93.6	-3.01	99	36.4	-0.6	82	262	69	67
171	27.418	0.162	0.077	1.10	93.0	-2.97	102	35.8	-0.6	83	274	69	67
172	27.578	0.160	0.076	1.11	93.5	-2.92	101	35.1	-0.7	83	269	69	67
173	27.740	0.162	0.078	1.11	93.0	-2.9	102	34.5	-0.6	83	266	70	67
174	27.900	0.160	0.079	1.11	93.0	-2.86	100	34.0	-0.5	83	262	70	67
175	28.062	0.162	0.078	1.11	93.9	-2.81	101	33.4	-0.6	83	259	70	67
176	28.221	0.159	0.076	1.11	93.1	-2.73	101	32.9	-0.5	84	258	70	67
177	28.382	0.161	0.077	1.10	93.4	-2.65	102	32.2	-0.7	84	257	70	67
178	28.542	0.160	0.077	1.10	93.2	-2.6	101	31.5	-0.7	84	258	70	67
179	28.702	0.160	0.079	1.09	93.9	-2.53	99	31.0	-0.5	83	261	70	67
180	28.862	0.160	0.077	1.10	93.2	-2.47	101	30.5	-0.5	83	268	70	67
181	29.022	0.160	0.079	1.10	93.2	-2.37	100	30.0	-0.5	84	275	70	67
182	29.181	0.159	0.079	1.09	93.9	-2.3	99	29.5	-0.5	84	281	70	67
183	29.342	0.161	0.077	1.10	94.1	-2.24	101	29.0	-0.5	85	287	70	67
184	29.501	0.159	0.077	1.10	93.4	-2.18	100	28.4	-0.6	85	288	70	67
185	29.661	0.160	0.078	1.10	94.1	-2.11	100	28.0	-0.4	81	258	70	67
186	29.822	0.161	0.077	1.10	93.8	-2.05	101	27.7	-0.3	77	201	70	67
187	29.982	0.160	0.077	1.11	93.9	-1.98	100	27.6	-0.1	75	174	70	67
188	30.142	0.160	0.079	1.08	94.1	-1.91	99	27.5	-0.1	75	158	70	67
189	30.302	0.160	0.078	1.10	93.7	-1.89	99	27.5	0	74	147	70	67
190	30.463	0.161	0.078	1.10	93.6	-1.83	100	27.4	-0.1	74	138	70	67
191	30.623	0.160	0.079	1.11	93.5	-1.79	99	27.4	0	73	129	70	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
192	30.784	0.161	0.080	1.10	93.4	-1.78	99	27.3	-0.1	73	122	70	67
193	30.943	0.159	0.078	1.10	93.9	-1.75	99	27.4	0.1	73	115	70	67
194	31.105	0.162	0.078	1.08	93.5	-1.74	100	27.4	0	73	109	70	67
195	31.264	0.159	0.079	1.10	94.2	-1.71	98	27.4	0	73	103	70	67
196	31.426	0.162	0.077	1.10	94.2	-1.72	101	27.3	-0.1	72	99	70	67
197	31.585	0.159	0.079	1.10	94.3	-1.73	98	27.3	0	72	95	70	67
198	31.747	0.162	0.078	1.10	94.3	-1.76	100	27.3	0	72	92	70	67
199	31.906	0.159	0.077	1.10	94.3	-1.75	99	27.3	0	72	89	70	67
200	32.068	0.162	0.079	1.10	94.3	-1.81	100	27.3	0	72	87	70	67
201	32.227	0.159	0.077	1.10	94.3	-1.79	99	27.3	0	72	85	70	67
202	32.388	0.161	0.079	1.06	94.3	-1.86	99	27.3	0	72	84	70	67
203	32.547	0.159	0.078	1.12	94.2	-1.85	98	27.3	0	72	82	70	67
204	32.709	0.162	0.080	1.11	94.3	-1.89	99	27.3	0	72	81	70	67
205	32.868	0.159	0.077	1.10	94.4	-1.93	99	27.3	0	72	80	70	67
206	33.030	0.162	0.078	1.08	93.6	-1.97	100	27.3	0	72	80	70	67
207	33.190	0.160	0.077	1.10	93.6	-1.97	100	27.3	0	71	79	70	67
208	33.350	0.160	0.079	1.10	94.5	-2	98	27.4	0.1	72	78	70	67
209	33.510	0.160	0.077	1.09	94.4	-2.01	100	27.3	-0.1	72	78	70	67
210	33.671	0.161	0.078	1.14	94.4	-2.11	100	27.3	0	72	77	70	67
211	33.831	0.160	0.077	1.10	93.8	-2.12	100	27.3	0	72	77	70	67
212	33.991	0.160	0.077	1.10	93.7	-2.17	100	27.4	0.1	72	77	70	67
213	34.152	0.161	0.078	1.10	93.7	-2.2	100	27.4	0	71	76	70	67
214	34.312	0.160	0.079	1.10	93.7	-2.21	98	27.4	0	71	76	70	67
215	34.474	0.162	0.078	1.12	93.7	-2.24	100	27.4	0	71	76	70	67
216	34.633	0.159	0.077	1.09	94.5	-2.28	99	27.4	0	71	75	70	67
217	34.795	0.162	0.077	1.10	93.9	-2.29	101	27.4	0	71	75	70	67
218	34.954	0.159	0.078	1.09	93.8	-2.34	98	27.3	-0.1	71	75	70	67
219	35.116	0.162	0.077	1.11	94.3	-2.38	101	27.3	0	71	75	70	67
220	35.275	0.159	0.077	1.11	93.9	-2.42	99	27.4	0.1	71	74	70	67
221	35.436	0.161	0.075	1.10	93.7	-2.4	102	27.3	-0.1	71	74	70	67
222	35.596	0.160	0.078	1.11	94.3	-2.45	99	27.3	0	71	74	69	67
223	35.757	0.161	0.076	1.15	94.3	-2.48	101	27.3	0	71	74	69	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
224	35.917	0.160	0.078	1.12	93.8	-2.52	99	27.3	0	71	74	70	67
225	36.078	0.161	0.078	1.10	93.8	-2.5	100	27.3	0	71	74	69	67
226	36.238	0.160	0.076	1.10	93.8	-2.54	100	27.3	0	71	74	69	67
227	36.400	0.162	0.079	1.11	94.4	-2.59	99	27.3	0	71	73	69	67
228	36.559	0.159	0.075	1.13	93.8	-2.62	100	27.3	0	71	73	69	67
229	36.720	0.161	0.077	1.11	93.9	-2.65	100	27.2	-0.1	71	73	69	67
230	36.880	0.160	0.079	1.09	94.6	-2.65	98	27.2	0	71	73	69	67
231	37.041	0.161	0.078	1.10	93.8	-2.7	100	27.3	0.1	71	73	69	67
232	37.201	0.160	0.077	1.08	94.6	-2.69	99	27.4	0.1	71	73	69	67
233	37.361	0.160	0.076	1.09	94.5	-2.69	100	27.5	0.1	71	73	69	67
234	37.522	0.161	0.077	1.10	94.4	-2.73	100	27.4	-0.1	71	73	69	67
235	37.682	0.160	0.078	1.10	93.9	-2.76	99	27.4	0	71	73	69	67
236	37.843	0.161	0.076	1.08	93.7	-2.78	101	27.4	0	71	73	69	67
237	38.003	0.160	0.077	1.10	94.4	-2.79	100	27.4	0	71	72	69	67
238	38.164	0.161	0.078	1.10	94.5	-2.78	99	27.4	0	71	72	69	67
239	38.324	0.160	0.077	1.13	93.8	-2.84	100	27.4	0	71	72	69	67
240	38.485	0.161	0.078	1.10	94.5	-2.84	99	27.4	0	71	72	69	67
241	38.645	0.160	0.077	1.10	94.6	-2.84	99	27.4	0	71	72	69	67
242	38.806	0.161	0.077	1.13	94.2	-2.83	100	27.4	0	71	72	69	67
243	38.966	0.160	0.076	1.11	94.4	-2.9	100	27.4	0	71	72	69	67
244	39.127	0.161	0.078	1.10	94.3	-2.92	99	27.3	-0.1	70	72	69	67
245	39.287	0.160	0.076	1.10	94.5	-2.93	100	27.3	0	70	72	69	67
246	39.448	0.161	0.076	1.11	93.9	-2.92	101	27.4	0.1	70	72	69	67
247	39.608	0.160	0.078	1.10	94.4	-2.94	99	27.4	0	70	72	69	67
248	39.770	0.162	0.079	1.10	93.7	-2.97	100	27.4	0	70	72	69	67
249	39.929	0.159	0.079	1.10	94.3	-2.97	98	27.4	0	70	72	69	67
250	40.090	0.161	0.078	1.10	93.8	-2.99	100	27.4	0	70	72	69	67
251	40.250	0.160	0.078	1.10	94.4	-2.99	99	27.4	0	70	72	69	66
252	40.411	0.161	0.078	1.10	94.5	-3.01	99	27.3	-0.1	70	72	69	66
253	40.571	0.160	0.078	1.10	94.5	-3.02	99	27.3	0	70	72	69	66
254	40.732	0.161	0.078	1.10	94.5	-3.04	99	27.3	0	70	72	69	66
255	40.893	0.161	0.078	1.10	94.5	-3.04	99	27.3	0	70	72	69	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
256	41.052	0.159	0.078	1.09	93.7	-3.05	98	27.3	0	70	71	69	66
257	41.214	0.162	0.077	1.10	94.0	-3.05	101	27.3	0	70	71	69	66
258	41.374	0.160	0.078	1.10	94.6	-3.09	99	27.3	0	70	71	69	66
259	41.535	0.161	0.079	1.10	93.8	-3.09	99	27.4	0.1	70	71	69	66
260	41.695	0.160	0.079	1.10	93.8	-3.12	98	27.4	0	70	71	69	66
261	41.856	0.161	0.077	1.10	94.6	-3.11	100	27.4	0	70	71	69	66
262	42.016	0.160	0.078	1.10	94.5	-3.14	99	27.4	0	70	71	69	66
263	42.178	0.162	0.077	1.10	93.9	-3.08	101	27.3	-0.1	70	71	69	66
264	42.337	0.159	0.077	1.09	94.3	-3.15	99	27.3	0	70	71	69	66
265	42.499	0.162	0.078	1.11	94.5	-3.13	100	27.3	0	70	71	69	66
266	42.658	0.159	0.077	1.09	94.3	-3.15	99	27.4	0.1	70	71	69	66
267	42.820	0.162	0.079	1.13	94.5	-3.15	99	27.4	0	70	71	69	66
268	42.980	0.160	0.078	1.10	94.5	-3.17	99	27.3	-0.1	70	71	69	66
269	43.141	0.161	0.078	1.09	94.4	-3.18	99	27.3	0	70	71	69	66
270	43.301	0.160	0.079	1.12	93.9	-3.19	98	27.3	0	70	71	69	66
271	43.461	0.160	0.078	1.12	93.8	-3.18	99	27.3	0	70	71	69	66
272	43.622	0.161	0.077	1.10	94.5	-3.2	100	27.3	0	70	71	69	66
273	43.782	0.160	0.077	1.10	94.5	-3.2	99	27.3	0	70	71	68	66
274	43.944	0.162	0.078	1.10	93.8	-3.21	100	27.4	0.1	70	70	68	66
275	44.103	0.159	0.078	1.10	94.1	-3.23	98	27.3	-0.1	70	70	68	66
276	44.265	0.162	0.079	1.11	94.4	-3.21	99	27.4	0.1	70	70	68	66
277	44.425	0.160	0.080	1.11	93.8	-3.24	98	27.4	0	70	70	68	66
278	44.586	0.161	0.079	1.10	93.9	-3.26	99	27.3	-0.1	69	70	68	66
279	44.746	0.160	0.079	1.09	94.5	-3.24	98	27.3	0	69	70	68	66
280	44.907	0.161	0.076	1.11	94.5	-3.26	101	27.3	0	69	70	68	66
281	45.067	0.160	0.079	1.10	93.7	-3.27	98	27.3	0	69	70	68	66
282	45.229	0.162	0.076	1.09	93.7	-3.26	101	27.3	0	69	70	68	66
283	45.388	0.159	0.079	1.11	94.4	-3.27	97	27.3	0	69	70	68	66
284	45.550	0.162	0.078	1.12	93.7	-3.3	100	27.3	0	69	70	68	66
285	45.709	0.159	0.079	1.10	93.8	-3.3	98	27.3	0	69	70	68	66
286	45.871	0.162	0.077	1.10	93.8	-3.31	101	27.3	0	69	70	68	66
287	46.031	0.160	0.078	1.11	93.7	-3.27	99	27.3	0	69	70	68	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
288	46.192	0.161	0.078	1.10	93.7	-3.28	99	27.3	0	69	70	68	66
289	46.352	0.160	0.077	1.10	93.6	-3.29	100	27.1	-0.2	72	120	68	66
290	46.512	0.160	0.079	1.10	94.5	-3.32	99	26.9	-0.2	74	153	68	65
291	46.673	0.161	0.077	1.11	93.9	-3.31	101	26.6	-0.3	75	170	68	66
292	46.832	0.159	0.079	1.12	93.8	-3.32	98	26.3	-0.3	76	182	68	65
293	46.993	0.161	0.080	1.12	94.5	-3.36	99	26.0	-0.3	76	192	68	66
294	47.153	0.160	0.078	1.11	93.8	-3.33	100	25.6	-0.4	77	203	68	66
295	47.314	0.161	0.078	1.10	94.0	-3.33	100	25.2	-0.4	77	213	68	66
296	47.472	0.158	0.079	1.10	93.9	-3.34	98	24.8	-0.4	78	222	68	66
297	47.633	0.161	0.077	1.08	93.9	-3.3	101	24.4	-0.4	78	227	68	66
298	47.792	0.159	0.077	1.10	94.5	-3.31	100	23.9	-0.5	79	232	68	66
299	47.953	0.161	0.077	1.10	94.5	-3.31	101	23.4	-0.5	79	241	68	66
300	48.112	0.159	0.078	1.08	94.3	-3.25	99	22.9	-0.5	79	240	68	65
301	48.273	0.161	0.078	1.10	94.4	-3.22	100	22.5	-0.4	78	234	68	66
302	48.432	0.159	0.077	1.10	94.0	-3.18	100	22.1	-0.4	79	241	68	65
303	48.592	0.160	0.078	1.10	94.2	-3.16	100	21.6	-0.5	80	252	68	65
304	48.751	0.159	0.080	1.09	93.7	-3.13	98	21.1	-0.5	80	254	69	65
305	48.912	0.161	0.078	1.09	94.4	-3.08	100	20.7	-0.4	80	257	68	66
306	49.071	0.159	0.081	1.11	94.4	-3.04	97	20.2	-0.5	80	257	68	65
307	49.231	0.160	0.078	1.10	93.7	-2.99	100	19.7	-0.5	80	262	69	66
308	49.390	0.159	0.079	1.09	93.6	-2.91	99	19.3	-0.4	81	269	69	66
309	49.550	0.160	0.078	1.09	94.3	-2.86	100	18.8	-0.5	81	270	69	66
310	49.710	0.160	0.078	1.10	94.4	-2.79	100	18.4	-0.4	81	272	69	65
311	49.870	0.160	0.077	1.10	94.2	-2.73	101	18.0	-0.4	81	275	69	66
312	50.029	0.159	0.079	1.10	93.6	-2.64	99	17.5	-0.5	81	275	69	65
313	50.189	0.160	0.076	1.09	93.7	-2.58	101	17.0	-0.5	82	274	69	66
314	50.349	0.160	0.077	1.12	94.0	-2.51	101	16.6	-0.4	81	273	69	66
315	50.508	0.159	0.077	1.10	93.6	-2.44	100	16.3	-0.3	77	233	69	65
316	50.669	0.161	0.077	1.10	93.6	-2.38	101	16.1	-0.2	74	184	69	65
317	50.828	0.159	0.077	1.10	94.3	-2.33	99	16.1	0	73	160	69	65
318	50.989	0.161	0.079	1.08	93.6	-2.28	99	16.0	-0.1	72	147	69	65
319	51.148	0.159	0.078	1.09	93.5	-2.21	99	15.9	-0.1	72	138	69	65

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	51.309	0.161	0.077	1.10	94.2	-2.12	100	15.9	0	72	130	69	65
321	51.468	0.159	0.076	1.11	94.2	-2.12	100	15.9	0	71	123	69	65
322	51.628	0.160	0.076	1.07	93.6	-2.09	100	15.8	-0.1	71	117	69	65
323	51.788	0.160	0.079	1.09	94.2	-2.05	98	15.8	0	71	111	69	66
324	51.948	0.160	0.079	1.08	94.3	-2.02	98	15.7	-0.1	71	106	69	65
325	52.109	0.161	0.079	1.06	93.5	-2.02	99	15.7	0	70	101	69	65
326	52.268	0.159	0.079	1.10	93.5	-2.01	98	15.7	0	70	97	69	65
327	52.429	0.161	0.078	1.10	94.3	-2.03	99	15.7	0	70	93	68	65
328	52.588	0.159	0.079	1.11	93.8	-2.03	98	15.8	0.1	70	90	68	65
329	52.749	0.161	0.079	1.09	94.1	-2.04	99	15.8	0	70	88	68	65
330	52.908	0.159	0.078	1.10	93.7	-2.07	98	15.8	0	70	85	68	65
331	53.069	0.161	0.078	1.08	93.6	-2.08	100	15.8	0	70	83	68	65
332	53.228	0.159	0.077	1.08	93.6	-2.08	99	15.8	0	70	82	68	65
333	53.389	0.161	0.080	1.09	94.0	-2.11	98	15.8	0	70	81	68	65
334	53.548	0.159	0.078	1.10	93.5	-2.13	98	15.8	0	70	80	68	65
335	53.710	0.162	0.077	1.08	94.0	-2.16	101	15.8	0	70	78	68	65
336	53.867	0.157	0.078	1.09	93.2	-2.22	97	15.8	0	70	78	68	65
337	54.024	0.157	0.079	1.09	93.9	-2.24	96	15.7	-0.1	70	77	68	65
338	54.187	0.163	0.079	1.10	93.1	-2.27	100	15.7	0	70	76	68	65
339	54.347	0.160	0.076	1.10	93.1	-2.31	100	15.7	0	70	76	68	65
340	54.507	0.160	0.079	1.08	93.9	-2.35	98	15.7	0	70	75	68	65
341	54.667	0.160	0.078	1.10	93.1	-2.37	99	15.8	0.1	70	75	68	65
342	54.827	0.160	0.079	1.10	93.9	-2.41	98	15.8	0	69	74	68	65
343	54.987	0.160	0.078	1.11	93.1	-2.43	99	15.7	-0.1	69	74	68	65
344	55.147	0.160	0.077	1.11	93.1	-2.45	100	15.8	0.1	69	74	68	65
345	55.307	0.160	0.079	1.05	93.1	-2.49	98	15.8	0	69	73	68	65
346	55.466	0.159	0.078	1.10	93.1	-2.49	98	15.8	0	69	73	68	65
347	55.627	0.161	0.076	1.09	93.3	-2.56	101	15.8	0	69	73	68	65
348	55.786	0.159	0.078	1.09	93.5	-2.59	98	15.7	-0.1	69	72	68	65
349	55.947	0.161	0.077	1.10	93.9	-2.61	100	15.8	0.1	69	72	67	65
350	56.106	0.159	0.078	1.10	93.1	-2.62	98	15.8	0	70	72	68	65
351	56.268	0.162	0.077	1.10	93.5	-2.67	101	15.7	-0.1	70	72	67	65

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
352	56.426	0.158	0.078	1.13	93.6	-2.68	98	15.7	0	70	72	67	65
353	56.588	0.162	0.079	1.13	93.7	-2.69	99	15.8	0.1	70	72	67	65
354	56.747	0.159	0.076	1.10	93.5	-2.73	100	15.9	0.1	69	72	67	65
355	56.908	0.161	0.077	1.07	93.4	-2.76	100	15.9	0	69	72	67	65
356	57.067	0.159	0.079	1.10	92.8	-2.77	98	15.8	-0.1	69	71	67	65
357	57.228	0.161	0.080	1.10	92.9	-2.8	98	15.7	-0.1	69	71	67	65
358	57.387	0.159	0.077	1.09	93.0	-2.82	99	15.7	0	69	71	67	65
359	57.548	0.161	0.080	1.11	92.7	-2.84	98	15.7	0	69	71	67	65
360	57.707	0.159	0.078	1.11	93.3	-2.85	98	15.7	0	69	71	67	65
361	57.868	0.161	0.076	1.09	93.5	-2.88	101	15.7	0	69	71	67	65
362	58.027	0.159	0.077	1.10	92.7	-2.89	99	15.7	0	69	71	67	65
363	58.188	0.161	0.078	1.12	93.3	-2.91	100	15.8	0.1	69	71	67	65
364	58.348	0.160	0.078	1.10	92.8	-2.93	99	15.7	-0.1	70	71	67	65
365	58.509	0.161	0.079	1.09	93.0	-2.96	99	15.8	0.1	69	71	67	65
366	58.668	0.159	0.079	1.10	92.8	-2.95	98	15.7	-0.1	69	71	67	65
367	58.829	0.161	0.079	1.09	92.7	-2.98	99	15.8	0.1	69	71	67	65
368	58.988	0.159	0.078	1.10	92.7	-3.01	98	15.8	0	69	70	67	65
369	59.149	0.161	0.079	1.09	92.6	-3.02	99	15.8	0	69	70	67	65
370	59.308	0.159	0.079	1.09	93.3	-3.02	98	15.8	0	69	70	67	65
371	59.469	0.161	0.078	1.10	93.3	-3.04	99	15.7	-0.1	69	70	67	65
372	59.628	0.159	0.076	1.10	93.1	-3.05	100	15.8	0.1	69	70	67	65
373	59.789	0.161	0.076	1.09	93.2	-3.07	101	15.8	0	69	70	67	65
374	59.948	0.159	0.078	1.10	93.1	-3.07	98	15.8	0	69	70	67	65
375	60.110	0.162	0.077	1.11	92.6	-3.1	101	15.8	0	69	70	67	65
376	60.268	0.158	0.077	1.09	92.6	-3.12	98	15.8	0	69	70	67	65
377	60.430	0.162	0.078	1.10	93.2	-3.12	100	15.8	0	69	70	67	65
378	60.588	0.158	0.077	1.15	93.3	-3.13	98	15.7	-0.1	69	70	67	65
379	60.750	0.162	0.077	1.10	93.2	-3.14	101	15.7	0	69	70	67	65
380	60.909	0.159	0.077	1.10	93.2	-3.15	99	15.8	0.1	69	70	67	65
381	61.070	0.161	0.078	1.10	92.5	-3.17	100	15.8	0	69	70	67	65
382	61.229	0.159	0.076	1.10	92.4	-3.18	100	15.8	0	68	70	67	65
383	61.390	0.161	0.077	1.09	92.7	-3.19	100	15.8	0	68	70	67	65

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
384	61.549	0.159	0.077	1.08	93.0	-3.2	99	15.8	0	69	69	67	65
385	61.710	0.161	0.079	1.10	92.5	-3.21	99	15.9	0.1	69	69	67	65
386	61.866	0.156	0.076	1.10	93.1	-3.21	98	15.8	-0.1	69	70	67	65
387	62.030	0.164	0.080	1.11	92.4	-3.22	100	15.9	0.1	69	70	67	65
388	62.189	0.159	0.079	1.10	92.4	-3.24	98	15.9	0	69	70	67	65
389	62.351	0.162	0.080	1.10	92.6	-3.25	99	15.9	0	69	69	67	65
390	62.509	0.158	0.078	1.09	92.5	-3.26	98	15.9	0	68	69	67	64
391	62.671	0.162	0.078	1.11	93.1	-3.26	100	15.8	-0.1	68	69	67	64
392	62.830	0.159	0.079	1.10	92.5	-3.27	98	15.8	0	68	69	67	64
393	62.991	0.161	0.078	1.10	92.5	-3.28	100	15.8	0	68	69	67	64
394	63.150	0.159	0.079	1.12	92.4	-3.27	98	15.9	0.1	68	69	67	64
395	63.311	0.161	0.080	1.10	93.0	-3.3	98	15.9	0	68	69	67	64
396	63.470	0.159	0.075	1.11	93.1	-3.31	100	15.9	0	68	69	67	64
397	63.631	0.161	0.077	1.10	92.4	-3.31	100	15.9	0	69	69	67	64
398	63.790	0.159	0.078	1.10	93.1	-3.33	98	15.8	-0.1	69	69	67	64
399	63.951	0.161	0.078	1.10	92.4	-3.32	100	15.9	0.1	69	69	67	65
400	64.110	0.159	0.078	1.08	92.8	-3.34	98	15.9	0	69	69	67	64
401	64.271	0.161	0.077	1.13	93.0	-3.34	100	15.9	0	69	69	67	65
402	64.431	0.160	0.078	1.10	93.0	-3.35	99	15.9	0	69	69	67	65
403	64.591	0.160	0.079	1.10	92.3	-3.36	98	15.9	0	68	69	67	64
404	64.751	0.160	0.078	1.10	92.2	-3.36	99	15.9	0	68	69	67	64
405	64.911	0.160	0.079	1.10	92.9	-3.37	98	15.8	-0.1	68	69	67	64
406	65.071	0.160	0.078	1.09	92.3	-3.37	99	15.8	0	68	69	67	64
407	65.231	0.160	0.078	1.08	92.7	-3.38	99	15.9	0.1	68	69	66	64
408	65.391	0.160	0.078	1.08	92.5	-3.39	99	15.9	0	68	69	67	64
409	65.551	0.160	0.078	1.09	93.0	-3.4	99	15.9	0	68	69	67	64
410	65.711	0.160	0.078	1.08	92.3	-3.4	99	15.8	-0.1	68	69	67	64
411	65.871	0.160	0.078	1.10	92.3	-3.4	99	15.8	0	69	69	67	64
412	66.031	0.160	0.079	1.10	92.5	-3.4	98	15.9	0.1	69	69	66	64
413	66.191	0.160	0.078	1.10	92.2	-3.4	99	15.9	0	69	69	66	64
414	66.351	0.160	0.078	1.09	92.1	-3.41	99	15.8	-0.1	69	69	66	64
415	66.511	0.160	0.080	1.10	92.5	-3.43	98	15.8	0	68	69	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
416	66.672	0.161	0.079	1.10	92.2	-3.42	99	15.9	0.1	68	69	66	64
417	66.831	0.159	0.076	1.09	92.2	-3.42	100	15.8	-0.1	70	116	66	64
418	66.991	0.160	0.077	1.06	92.8	-3.43	100	15.6	-0.2	72	143	66	64
419	67.151	0.160	0.076	1.10	92.6	-3.45	101	15.3	-0.3	74	165	66	64
420	67.311	0.160	0.078	1.09	92.4	-3.45	100	15.0	-0.3	74	179	67	64
421	67.470	0.159	0.078	1.09	92.1	-3.44	99	14.7	-0.3	75	192	67	64
422	67.630	0.160	0.079	1.08	92.1	-3.45	99	14.4	-0.3	75	202	67	64
423	67.790	0.160	0.077	1.10	92.1	-3.46	100	14.1	-0.3	76	205	67	64
424	67.949	0.159	0.077	1.11	92.1	-3.45	100	13.8	-0.3	76	212	67	64
425	68.109	0.160	0.078	1.09	92.7	-3.43	100	13.5	-0.3	76	220	67	64
426	68.268	0.159	0.077	1.09	92.4	-3.41	100	13.2	-0.3	76	216	67	64
427	68.428	0.160	0.077	1.09	92.0	-3.41	100	12.9	-0.3	76	220	67	64
428	68.587	0.159	0.077	1.12	92.4	-3.38	100	12.6	-0.3	77	232	67	64
429	68.747	0.160	0.079	1.08	92.2	-3.37	99	12.2	-0.4	77	238	67	64
430	68.905	0.158	0.079	1.09	91.9	-3.34	98	11.7	-0.5	78	246	67	64
431	69.066	0.161	0.077	1.09	92.0	-3.31	101	11.3	-0.4	79	248	67	64
432	69.224	0.158	0.078	1.10	92.4	-3.3	99	10.9	-0.4	79	251	67	64
433	69.384	0.160	0.079	1.09	92.0	-3.26	99	10.6	-0.3	79	253	67	64
434	69.542	0.158	0.079	1.10	92.2	-3.21	98	10.1	-0.5	79	256	67	64
435	69.702	0.160	0.079	1.09	92.6	-3.18	99	9.7	-0.4	79	253	67	64
436	69.860	0.158	0.077	1.09	92.6	-3.12	99	9.3	-0.4	79	249	67	64
437	70.021	0.161	0.076	1.09	92.3	-3.09	102	9.0	-0.3	78	247	67	64
438	70.179	0.158	0.076	1.10	92.7	-3.03	100	8.5	-0.5	79	252	67	64
439	70.339	0.160	0.077	1.09	92.4	-2.99	101	8.2	-0.3	79	253	67	64
440	70.497	0.158	0.076	1.08	92.6	-2.93	100	7.8	-0.4	79	253	67	64
441	70.657	0.160	0.075	1.09	92.5	-2.88	102	7.4	-0.4	79	258	67	64
442	70.816	0.159	0.077	1.10	92.2	-2.81	100	7.1	-0.3	78	246	67	64
443	70.975	0.159	0.078	1.09	92.3	-2.76	99	6.8	-0.3	74	189	67	64
444	71.135	0.160	0.080	1.10	91.9	-2.69	98	6.7	-0.1	72	159	67	64
445	71.294	0.159	0.078	1.09	92.3	-2.65	99	6.6	-0.1	72	143	67	64
446	71.454	0.160	0.078	1.09	91.8	-2.59	99	6.7	0.1	71	132	67	64
447	71.613	0.159	0.079	1.08	91.9	-2.53	98	6.6	-0.1	71	125	67	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
448	71.773	0.160	0.080	1.08	91.9	-2.47	98	6.6	0	70	118	67	64
449	71.932	0.159	0.076	1.09	92.6	-2.44	100	6.5	-0.1	70	113	67	64
450	72.093	0.161	0.077	1.09	91.9	-2.39	101	6.4	-0.1	70	108	67	64
451	72.251	0.158	0.079	1.07	91.7	-2.35	97	6.4	0	70	104	67	64
452	72.412	0.161	0.079	1.09	92.5	-2.36	99	6.4	0	70	100	67	64
453	72.570	0.158	0.076	1.11	92.1	-2.32	99	6.5	0.1	70	96	67	64
454	72.730	0.160	0.079	1.08	91.8	-2.31	99	6.5	0	70	93	67	64
455	72.889	0.159	0.074	1.08	91.9	-2.31	101	6.4	-0.1	70	91	67	65
456	73.049	0.160	0.077	1.09	91.8	-2.3	100	6.4	0	70	88	67	65
457	73.207	0.158	0.077	1.09	91.7	-2.31	99	6.5	0.1	70	86	67	64
458	73.368	0.161	0.078	1.09	91.8	-2.3	100	6.5	0	70	84	67	64
459	73.526	0.158	0.077	1.10	92.5	-2.33	99	6.5	0	70	82	67	64
460	73.687	0.161	0.078	1.09	92.7	-2.34	100	6.5	0	70	81	67	64
461	73.845	0.158	0.077	1.10	91.8	-2.34	99	6.5	0	70	80	67	64
462	74.006	0.161	0.081	1.10	92.5	-2.35	98	6.5	0	70	79	67	64
463	74.164	0.158	0.079	1.08	92.6	-2.39	97	6.4	-0.1	70	78	67	64
464	74.325	0.161	0.079	1.11	92.6	-2.4	99	6.4	0	70	77	67	64
465	74.483	0.158	0.077	1.10	92.5	-2.43	98	6.4	0	69	77	67	64
466	74.644	0.161	0.078	1.09	92.3	-2.44	100	6.4	0	69	76	67	64
467	74.802	0.158	0.079	1.08	91.9	-2.48	97	6.4	0	70	75	67	64
468	74.962	0.160	0.077	1.09	92.3	-2.49	100	6.4	0	70	75	67	64
469	75.121	0.159	0.077	1.09	92.5	-2.51	99	6.4	0	70	75	67	64
470	75.281	0.160	0.075	1.10	91.7	-2.55	101	6.4	0	70	74	67	64
471	75.440	0.159	0.077	1.10	91.9	-2.58	99	6.4	0	70	74	67	64
472	75.600	0.160	0.080	1.09	92.4	-2.59	98	6.4	0	69	74	67	64
473	75.759	0.159	0.079	1.09	91.7	-2.63	98	6.4	0	69	73	67	64
474	75.919	0.160	0.078	1.11	92.3	-2.65	99	6.4	0	69	73	67	64
475	76.078	0.159	0.074	1.09	92.4	-2.66	101	6.4	0	70	73	67	64
476	76.237	0.159	0.078	1.07	92.0	-2.69	99	6.4	0	70	72	67	64
477	76.398	0.161	0.078	1.09	91.6	-2.71	100	6.4	0	70	72	67	64
478	76.556	0.158	0.078	1.09	91.7	-2.72	98	6.4	0	69	72	67	64
479	76.716	0.160	0.077	1.09	92.5	-2.74	100	6.5	0.1	69	72	67	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
480	76.874	0.158	0.079	1.10	92.4	-2.76	97	6.6	0.1	69	72	67	64
481	77.035	0.161	0.079	1.09	91.7	-2.8	99	6.6	0	69	72	67	64
482	77.193	0.158	0.078	1.09	92.4	-2.8	98	6.6	0	69	71	67	64
483	77.354	0.161	0.078	1.08	91.9	-2.82	100	6.6	0	70	71	67	64
484	77.512	0.158	0.077	1.08	91.7	-2.84	99	6.5	-0.1	70	71	67	64
485	77.673	0.161	0.076	1.09	92.0	-2.86	101	6.4	-0.1	69	71	67	64
486	77.831	0.158	0.075	1.08	91.7	-2.86	100	6.4	0	69	71	67	64
487	77.992	0.161	0.078	1.08	91.7	-2.9	100	6.4	0	69	71	67	64
488	78.150	0.158	0.079	1.09	92.2	-2.91	97	6.4	0	69	71	67	64
489	78.311	0.161	0.078	1.09	91.6	-2.91	100	6.4	0	69	71	67	64
490	78.469	0.158	0.079	1.11	92.3	-2.94	97	6.4	0	69	71	67	64
491	78.629	0.160	0.077	1.06	91.6	-2.94	100	6.4	0	69	71	67	64
492	78.788	0.159	0.079	1.09	91.8	-2.96	98	6.4	0	68	70	67	64
493	78.949	0.161	0.075	1.10	92.3	-2.97	102	6.5	0.1	69	70	66	64
494	79.107	0.158	0.078	1.11	92.0	-2.97	98	6.5	0	69	70	66	64
495	79.267	0.160	0.078	1.09	91.5	-2.99	99	6.6	0.1	69	70	67	64
496	79.424	0.157	0.077	1.11	91.7	-3	98	6.5	-0.1	69	70	66	64
497	79.586	0.162	0.079	1.09	92.0	-3.04	100	6.5	0	69	70	66	64
498	79.745	0.159	0.078	1.11	91.7	-3.02	99	6.5	0	69	70	66	64
499	79.905	0.160	0.078	1.09	92.2	-3.06	99	6.4	-0.1	69	70	66	64
500	80.064	0.159	0.077	1.08	91.6	-3.06	99	6.4	0	69	70	66	64
501	80.224	0.160	0.079	1.10	91.6	-3.08	99	6.4	0	69	70	67	64
502	80.384	0.160	0.080	1.09	92.0	-3.07	98	6.4	0	68	70	66	64
503	80.543	0.159	0.077	1.09	92.4	-3.1	99	6.5	0.1	68	70	66	64
504	80.703	0.160	0.078	1.09	91.7	-3.1	99	6.5	0	68	70	66	64
505	80.862	0.159	0.079	1.08	92.3	-3.1	98	6.5	0	68	69	66	64
506	81.022	0.160	0.078	1.10	92.3	-3.12	99	6.5	0	69	69	66	64
507	81.180	0.158	0.078	1.09	92.2	-3.14	98	6.5	0	70	69	66	64
508	81.341	0.161	0.079	1.09	92.3	-3.14	99	6.4	-0.1	69	69	66	64
509	81.499	0.158	0.078	1.09	91.6	-3.14	98	6.5	0.1	69	69	66	64
510	81.660	0.161	0.080	1.11	92.2	-3.15	98	6.5	0	69	69	66	64
511	81.818	0.158	0.079	1.08	91.4	-3.19	97	6.5	0	69	69	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
512	81.979	0.161	0.078	1.11	92.2	-3.19	100	6.4	-0.1	69	69	66	64
513	82.137	0.158	0.077	1.10	92.0	-3.2	98	6.5	0.1	68	69	66	64
514	82.298	0.161	0.078	1.11	91.4	-3.2	100	6.5	0	68	69	66	64
515	82.456	0.158	0.079	1.09	91.7	-3.21	97	6.5	0	68	69	66	64
516	82.617	0.161	0.078	1.09	91.4	-3.22	100	6.5	0	69	69	66	64
517	82.775	0.158	0.076	1.11	91.6	-3.21	99	6.5	0	69	69	66	64
518	82.936	0.161	0.078	1.09	91.4	-3.24	100	6.4	-0.1	69	69	66	64
519	83.094	0.158	0.076	1.08	91.5	-3.23	99	6.4	0	69	69	66	64
520	83.255	0.161	0.078	1.10	91.3	-3.26	100	6.4	0	69	69	66	64
521	83.413	0.158	0.077	1.10	91.4	-3.24	99	6.5	0.1	69	69	66	64
522	83.574	0.161	0.080	1.11	92.1	-3.26	98	6.4	-0.1	69	69	66	64
523	83.732	0.158	0.078	1.08	91.5	-3.27	98	6.4	0	68	69	66	64
524	83.892	0.160	0.079	1.10	91.8	-3.25	98	6.4	0	68	69	66	64
525	84.051	0.159	0.078	1.10	91.9	-3.26	98	6.5	0.1	68	69	66	64
526	84.211	0.160	0.077	1.09	91.5	-3.29	100	6.5	0	69	69	66	64
527	84.370	0.159	0.078	1.10	91.6	-3.28	99	6.5	0	69	69	66	64
528	84.530	0.160	0.080	1.10	91.3	-3.3	98	6.5	0	69	69	66	64
529	84.689	0.159	0.080	1.09	92.1	-3.3	97	6.5	0	69	69	66	64
530	84.849	0.160	0.077	1.07	92.1	-3.29	100	6.5	0	69	68	66	64
531	85.008	0.159	0.078	1.08	91.4	-3.31	99	6.5	0	69	68	66	64
532	85.168	0.160	0.079	1.09	91.5	-3.3	99	6.4	-0.1	68	68	66	64
533	85.328	0.160	0.078	1.09	91.3	-3.3	99	6.4	0	68	69	66	64
534	85.487	0.159	0.079	1.09	91.4	-3.31	98	6.4	0	68	69	66	64
535	85.647	0.160	0.076	1.07	92.2	-3.35	100	6.4	0	68	68	66	64
536	85.806	0.159	0.079	1.09	92.2	-3.35	98	6.5	0.1	69	68	66	64
537	85.966	0.160	0.077	1.10	92.1	-3.35	100	6.5	0	69	68	66	64
538	86.124	0.158	0.079	1.08	91.3	-3.35	97	6.5	0	69	68	66	64
539	86.285	0.161	0.079	1.09	92.1	-3.34	99	6.5	0	69	68	66	64
540	86.443	0.158	0.079	1.09	91.8	-3.35	97	6.5	0	69	68	66	64
541	86.604	0.161	0.078	1.09	91.9	-3.36	100	6.5	0	68	68	66	64
542	86.762	0.158	0.078	1.08	91.6	-3.38	98	6.4	-0.1	68	68	66	64
543	86.922	0.160	0.079	1.10	92.0	-3.38	99	6.3	-0.1	71	122	66	64

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
544	87.080	0.158	0.078	1.08	91.7	-3.38	98	6.1	-0.2	72	153	66	64
545	87.241	0.161	0.077	1.09	92.1	-3.39	101	5.9	-0.2	73	166	66	64
546	87.399	0.158	0.079	1.09	91.3	-3.36	98	5.6	-0.3	73	174	66	64
547	87.559	0.160	0.074	1.09	92.1	-3.38	102	5.4	-0.2	74	182	66	64
548	87.717	0.158	0.075	1.08	91.3	-3.37	101	5.2	-0.2	75	193	66	64
549	87.877	0.160	0.079	1.09	91.3	-3.38	99	5.0	-0.2	75	200	66	64
550	88.035	0.158	0.078	1.09	92.0	-3.39	99	4.8	-0.2	76	210	66	64
551	88.194	0.159	0.078	1.08	91.5	-3.38	99	4.6	-0.2	77	218	66	64
552	88.353	0.159	0.079	1.08	92.0	-3.38	99	4.3	-0.3	77	220	66	64
553	88.512	0.159	0.079	1.08	91.6	-3.38	99	4.2	-0.1	77	224	66	64
554	88.671	0.159	0.076	1.10	92.0	-3.34	101	3.9	-0.3	77	227	66	64
555	88.829	0.158	0.076	1.09	91.9	-3.35	100	3.6	-0.3	78	234	66	64
556	88.988	0.159	0.077	1.08	91.3	-3.32	100	3.3	-0.3	79	239	66	64
557	89.146	0.158	0.077	1.08	91.9	-3.29	99	3.1	-0.2	79	233	66	64
558	89.305	0.159	0.077	1.08	91.2	-3.28	100	2.8	-0.3	79	235	67	64
559	89.463	0.158	0.076	1.07	91.2	-3.26	100	2.5	-0.3	78	224	67	64
560	89.622	0.159	0.076	1.07	91.3	-3.24	101	2.2	-0.3	77	222	67	64
561	89.781	0.159	0.078	1.09	91.1	-3.21	100	2.0	-0.2	78	232	67	64
562	89.939	0.158	0.076	1.08	91.4	-3.18	100	1.8	-0.2	79	242	67	64
563	90.098	0.159	0.076	1.06	91.2	-3.15	101	1.6	-0.2	80	247	67	64
564	90.255	0.157	0.076	1.08	91.9	-3.11	100	1.2	-0.4	81	250	67	64
565	90.414	0.159	0.077	1.08	91.3	-3.08	100	1.0	-0.2	81	252	67	64
566	90.572	0.158	0.077	1.08	91.1	-3.07	100	0.7	-0.3	81	254	67	64
567	90.731	0.159	0.076	1.08	91.2	-3.04	101	0.4	-0.3	81	254	67	64
568	90.888	0.157	0.075	1.08	91.4	-2.99	100	0.2	-0.2	81	255	67	64
569	91.046	0.158	0.080	1.08	91.9	-2.96	98	0.0	-0.2	81	254	67	64
Avg/Tot	91.046	0.160	0.078	1.10	90	-2.55	100			72	116	68	65.7

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	-0.004		0.32	69	-1.44		70	0.000	0.13	0.01
1	0.141	0.145	1.21	68	-7.19	99	70	-0.020	4.12	0.92
2	0.299	0.158	1.16	68	-4.64	106	70	-0.020	13.31	0.36
3	0.460	0.161	1.20	69	-1.2	109	70	-0.010	9.51	1.87
4	0.617	0.157	1.18	69	-1.12	106	70	-0.010	4.07	1.72
5	0.778	0.161	1.19	69	-1.96	108	70	-0.010	2.32	1.15
6	0.935	0.157	1.16	68	-3.88	105	70	-0.010	1.53	0.76
7	1.095	0.160	1.16	69	-20.88	109	70	-0.010	1.16	0.55
8	1.252	0.157	1.17	69	-1.77	107	70	0.000	0.89	0.44
9	1.411	0.159	1.17	68	-5.66	107	70	-0.010	0.82	0.39
10	1.569	0.158	1.18	70	-1.25	106	70	0.000	0.76	0.36
11	1.726	0.157	1.16	70	-1.17	105	70	0.000	0.69	0.34
12	1.885	0.159	1.16	69	-6.38	107	70	0.000	0.67	0.32
13	2.040	0.155	1.16	70	-1.55	104	70	0.000	0.63	0.30
14	2.199	0.159	1.15	69	-1.35	107	70	0.000	0.60	0.28
15	2.356	0.157	1.14	71	-1.31	106	70	0.000	0.59	0.27
16	2.513	0.157	1.15	70	-1.37	105	70	0.000	0.59	0.26
17	2.671	0.158	1.14	70	-3.36	105	70	0.010	0.60	0.25
18	2.826	0.155	1.15	70	-7.69	104	70	0.000	0.55	0.24
19	2.985	0.159	1.15	71	-12.23	106	70	0.000	0.56	0.25
20	3.141	0.156	1.16	71	-1.5	104	70	0.010	0.56	0.23
21	3.298	0.157	1.16	71	-3	105	70	0.000	0.62	0.24
22	3.456	0.158	1.13	71	-2.82	105	70	0.010	0.60	0.24
23	3.611	0.155	1.15	73	-4.12	105	70	-0.010	0.62	0.22
24	3.769	0.158	1.15	72	-2.61	105	70	0.000	0.60	0.21
25	3.926	0.157	1.14	72	-1.92	106	70	-0.030	5.23	1.47
26	4.080	0.154	1.14	73	-2.38	102	70	-0.040	15.59	3.17
27	4.236	0.156	1.11	74	-2.27	104	71	-0.050	14.79	0.31
28	4.391	0.155	1.09	74	-2.18	104	71	-0.050	15.73	0.03
29	4.543	0.152	1.12	74	-3.49	102	71	-0.040	16.11	0.03
30	4.699	0.156	1.12	74	-0.86	105	71	-0.060	15.90	0.04
31	4.853	0.154	1.12	75	-3.43	102	71	-0.050	15.94	0.03

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
32	5.007	0.154	1.12	74	-0.73	103	71	-0.050	15.58	0.04
33	5.161	0.154	1.14	76	-2.77	103	71	-0.050	15.10	0.03
34	5.316	0.155	1.17	76	-1.38	104	72	-0.040	16.20	0.04
35	5.471	0.155	1.12	75	-0.97	105	72	-0.050	15.27	0.03
36	5.623	0.152	1.12	76	-0.65	101	72	-0.050	15.97	0.03
37	5.779	0.156	1.12	77	-0.9	105	72	-0.050	15.47	0.03
38	5.934	0.155	1.11	76	-1.88	103	72	-0.060	16.00	0.02
39	6.087	0.153	1.11	77	-1.82	102	72	-0.050	15.23	0.03
40	6.241	0.154	1.06	78	-1.63	103	72	-0.050	15.61	0.03
41	6.396	0.155	1.11	78	-1.17	102	72	-0.050	15.75	0.03
42	6.551	0.155	1.08	78	-1.55	105	73	-0.060	15.63	0.03
43	6.704	0.153	1.12	78	-1.27	102	73	-0.050	15.40	0.03
44	6.859	0.155	1.11	78	-1.7	103	73	-0.050	15.78	0.05
45	7.014	0.155	1.13	79	-1.69	102	73	-0.060	15.47	0.05
46	7.168	0.154	1.13	80	-1.28	102	73	-0.050	15.41	0.04
47	7.322	0.154	1.11	80	-1.36	102	73	-0.060	15.96	0.06
48	7.477	0.155	1.12	80	-1.44	103	73	-0.040	15.19	0.03
49	7.633	0.156	1.13	79	-2.17	103	73	-0.050	10.04	3.29
50	7.786	0.153	1.13	81	-1.36	102	73	-0.040	8.69	4.66
51	7.942	0.156	1.10	80	-1.38	102	73	-0.030	6.50	3.21
52	8.098	0.156	1.12	81	-1.31	102	73	-0.030	4.64	2.04
53	8.252	0.154	1.12	81	-1.35	101	72	-0.020	3.52	1.41
54	8.408	0.156	1.12	81	-1.48	103	72	-0.020	2.65	1.00
55	8.564	0.156	1.11	81	-1.64	101	72	-0.030	1.97	0.69
56	8.718	0.154	1.15	82	-1.48	99	72	-0.020	1.32	0.44
57	8.875	0.157	1.13	83	-1.28	102	72	-0.020	0.90	0.27
58	9.031	0.156	1.09	82	-1.43	102	72	-0.010	0.64	0.18
59	9.185	0.154	1.10	82	-1.3	101	72	-0.010	0.47	0.14
60	9.341	0.156	1.12	83	-1.42	101	72	-0.010	0.44	0.11
61	9.498	0.157	1.14	82	-1.3	102	72	-0.020	0.37	0.11
62	9.652	0.154	1.09	84	-1.35	99	72	-0.020	0.39	0.09
63	9.809	0.157	1.17	83	-1.45	103	72	-0.010	0.30	0.08

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
64	9.965	0.156	1.07	84	-1.36	100	72	-0.010	0.33	0.08
65	10.119	0.154	1.13	84	-1.48	99	72	-0.010	0.29	0.07
66	10.276	0.157	1.10	85	-1.28	101	72	-0.010	0.29	0.07
67	10.432	0.156	1.13	85	-1.42	102	72	-0.010	0.28	0.07
68	10.587	0.155	1.14	85	-1.26	99	71	-0.010	0.27	0.07
69	10.744	0.157	1.12	84	-1.26	102	71	-0.010	0.28	0.06
70	10.900	0.156	1.14	85	-1.46	100	71	0.000	0.26	0.05
71	11.055	0.155	1.13	86	-1.36	100	71	-0.010	0.25	0.06
72	11.213	0.158	1.13	85	-1.29	102	71	0.000	0.25	0.06
73	11.368	0.155	1.13	85	-1.4	100	71	-0.010	0.23	0.05
74	11.524	0.156	1.13	87	-1.47	99	71	0.000	0.22	0.05
75	11.681	0.157	1.13	87	-1.36	101	71	0.000	0.22	0.05
76	11.836	0.155	1.11	87	-1.47	101	71	0.010	0.20	0.04
77	11.993	0.157	1.15	86	-1.47	101	71	-0.010	0.20	0.04
78	12.150	0.157	1.16	87	-1.29	101	71	-0.010	0.21	0.04
79	12.305	0.155	1.13	87	-1.29	98	71	0.000	0.18	0.04
80	12.463	0.158	1.11	87	-1.28	102	71	0.000	0.18	0.04
81	12.619	0.156	1.13	88	-1.39	100	71	-0.010	0.18	0.04
82	12.775	0.156	1.12	88	-1.35	102	71	-0.010	0.16	0.04
83	12.932	0.157	1.14	87	-1.32	102	71	0.000	0.16	0.03
84	13.087	0.155	1.14	88	-1.32	99	71	0.010	0.17	0.03
85	13.245	0.158	1.08	89	-1.47	102	71	-0.010	0.16	0.03
86	13.402	0.157	1.14	87	-1.37	99	71	0.000	0.15	0.03
87	13.557	0.155	1.13	88	-1.25	100	71	0.000	0.16	0.03
88	13.715	0.158	1.14	89	-1.43	102	71	0.000	0.14	0.03
89	13.871	0.156	1.13	88	-1.24	100	71	0.000	0.18	0.03
90	14.028	0.157	1.15	88	-1.3	99	71	0.000	0.15	0.03
91	14.186	0.158	1.14	89	-1.43	101	71	0.000	0.14	0.03
92	14.341	0.155	1.14	88	-1.32	100	71	0.000	0.14	0.03
93	14.499	0.158	1.19	89	-1.29	100	71	0.010	0.13	0.02
94	14.656	0.157	1.15	90	-1.37	101	71	0.000	0.14	0.03
95	14.812	0.156	1.13	88	-1.46	100	71	0.000	0.14	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
96	14.970	0.158	1.14	90	-1.44	100	71	0.000	0.13	0.02
97	15.126	0.156	1.15	89	-1.35	100	71	0.000	0.13	0.03
98	15.284	0.158	1.10	90	-1.47	102	71	0.010	0.16	0.03
99	15.441	0.157	1.14	90	-1.35	100	71	0.000	0.13	0.02
100	15.597	0.156	1.16	90	-1.35	100	71	-0.010	0.12	0.02
101	15.755	0.158	1.16	90	-1.41	101	71	0.010	0.13	0.02
102	15.911	0.156	1.14	90	-1.31	100	71	0.000	0.13	0.02
103	16.069	0.158	1.12	89	-1.39	100	71	-0.010	0.13	0.02
104	16.227	0.158	1.14	91	-1.43	100	71	-0.020	0.12	0.02
105	16.383	0.156	1.14	91	-1.27	99	71	0.000	0.12	0.02
106	16.541	0.158	1.14	90	-1.45	101	71	0.000	0.12	0.02
107	16.697	0.156	1.13	90	-1.43	99	71	0.000	0.13	0.01
108	16.855	0.158	1.13	91	-1.38	100	71	0.000	0.12	0.02
109	17.013	0.158	1.13	91	-1.51	101	71	0.010	0.12	0.02
110	17.169	0.156	1.13	90	-1.37	100	71	0.000	0.12	0.02
111	17.328	0.159	1.14	91	-1.55	102	71	0.000	0.12	0.02
112	17.484	0.156	1.14	91	-1.46	101	71	0.000	0.13	0.02
113	17.642	0.158	1.16	90	-1.32	101	71	-0.010	0.12	0.02
114	17.800	0.158	1.14	92	-1.56	100	71	0.000	0.14	0.02
115	17.956	0.156	1.19	91	-1.37	100	71	0.020	0.13	0.02
116	18.115	0.159	1.19	91	-1.49	100	71	0.010	0.11	0.02
117	18.271	0.156	1.14	92	-1.51	101	71	0.000	0.12	0.02
118	18.429	0.158	1.13	91	-1.4	101	71	0.000	0.14	0.02
119	18.586	0.157	1.10	91	-1.5	100	71	-0.010	0.17	0.03
120	18.744	0.158	1.14	92	-1.49	100	71	0.000	0.13	0.01
121	18.902	0.158	1.14	92	-1.35	102	71	0.000	0.13	0.02
122	19.058	0.156	1.14	92	-1.47	99	71	0.000	0.13	0.02
123	19.217	0.159	1.07	92	-1.78	100	71	0.010	0.15	0.02
124	19.373	0.156	1.14	92	-1.89	99	71	0.000	0.14	0.02
125	19.531	0.158	1.15	92	-1.85	101	71	0.010	0.12	0.01
126	19.689	0.158	1.18	91	-1.81	101	71	0.010	0.11	0.02
127	19.845	0.156	1.17	92	-2.14	99	71	0.010	0.13	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
128	20.004	0.159	1.15	92	-1.77	101	71	0.000	0.13	0.01
129	20.160	0.156	1.15	92	-1.72	99	71	0.010	0.10	0.01
130	20.319	0.159	1.13	92	-3.3	101	71	0.000	0.13	0.01
131	20.476	0.157	1.15	92	-3.48	99	71	0.000	0.13	0.01
132	20.634	0.158	1.15	93	-2.48	101	71	0.010	0.13	0.02
133	20.792	0.158	1.14	93	-3.14	100	71	0.010	0.13	0.01
134	20.948	0.156	1.19	92	-3.13	98	71	0.010	0.12	0.02
135	21.107	0.159	1.13	91	-3.19	102	71	0.000	0.13	0.02
136	21.264	0.157	1.14	93	-2.55	100	71	0.000	0.11	0.01
137	21.422	0.158	1.13	92	-3.03	102	71	0.000	0.14	0.02
138	21.580	0.158	1.14	92	-3.16	101	71	0.000	0.12	0.01
139	21.737	0.157	1.14	91	-3.21	99	70	0.010	0.12	0.01
140	21.896	0.159	1.14	93	-1.37	100	70	0.000	0.12	0.01
141	22.052	0.156	1.14	93	-1.25	99	70	0.000	0.12	0.01
142	22.211	0.159	1.14	92	-1.35	101	70	0.000	0.13	0.01
143	22.368	0.157	1.12	92	-1.4	100	70	0.000	0.11	0.01
144	22.526	0.158	1.14	92	-1.44	100	70	0.010	0.12	0.01
145	22.685	0.159	1.13	93	-1.96	101	70	0.030	0.14	0.02
146	22.841	0.156	1.12	92	-2.75	98	70	0.000	0.15	0.01
147	23.000	0.159	1.09	94	-2.6	101	70	0.020	0.10	0.01
148	23.157	0.157	1.15	93	-2.85	101	70	0.000	0.13	0.01
149	23.316	0.159	1.17	92	-2.83	101	70	0.000	0.15	0.02
150	23.473	0.157	1.15	93	-2.64	99	70	0.000	0.13	0.02
151	23.631	0.158	1.14	92	-2.98	101	70	0.000	0.10	0.01
152	23.790	0.159	1.14	93	-2.94	100	70	0.000	0.12	0.01
153	23.946	0.156	1.16	93	-2.63	99	70	0.010	0.10	0.02
154	24.105	0.159	1.14	93	-3.14	101	70	0.000	0.12	0.01
155	24.262	0.157	1.15	93	-3.06	99	70	0.000	0.11	0.01
156	24.421	0.159	1.11	92	-3.01	100	70	0.010	0.12	0.01
157	24.578	0.157	1.15	92	-2.57	99	70	0.000	0.10	0.01
158	24.736	0.158	1.14	94	-3.04	101	70	0.000	0.11	0.01
159	24.895	0.159	1.14	92	-2.59	102	70	-0.040	0.12	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
160	25.051	0.156	1.09	93	-2.39	99	71	-0.030	2.08	0.75
161	25.210	0.159	1.13	94	-2.53	100	71	-0.030	4.66	0.90
162	25.366	0.156	1.14	94	-2.71	100	71	-0.040	7.41	0.89
163	25.524	0.158	1.13	93	-1.74	101	71	-0.030	10.23	0.42
164	25.682	0.158	1.13	93	-1.65	101	71	-0.020	14.96	0.26
165	25.838	0.156	1.13	94	-2.25	101	71	-0.030	14.29	0.47
166	25.997	0.159	1.11	93	-1.23	102	71	-0.040	15.97	0.26
167	26.153	0.156	1.13	93	-1.55	98	71	-0.030	15.80	0.25
168	26.311	0.158	1.14	93	-1.11	101	71	-0.040	15.40	0.16
169	26.468	0.157	1.13	93	-1.66	100	71	-0.050	16.36	0.11
170	26.625	0.157	1.10	93	-1.68	100	72	-0.040	15.79	0.05
171	26.783	0.158	1.10	94	-1.33	102	72	-0.040	15.83	0.33
172	26.939	0.156	1.15	93	-1.79	101	72	-0.050	10.70	2.43
173	27.098	0.159	1.13	93	-1.56	102	72	-0.050	10.84	2.50
174	27.254	0.156	1.14	93	-1.56	99	72	-0.050	10.46	2.33
175	27.411	0.157	1.10	93	-2.02	101	72	-0.050	11.14	2.35
176	27.569	0.158	1.15	94	-1.62	102	72	-0.040	11.14	2.32
177	27.724	0.155	1.14	94	-1.72	100	73	-0.050	11.27	2.34
178	27.881	0.157	1.13	94	-1.63	101	73	-0.050	10.93	2.29
179	28.038	0.157	1.13	94	-1.93	100	73	-0.040	15.33	0.45
180	28.193	0.155	1.12	94	-1.09	100	73	-0.050	15.63	0.08
181	28.351	0.158	1.12	94	-1.33	100	73	-0.050	15.46	0.13
182	28.507	0.156	1.12	93	-2.2	99	73	-0.050	15.79	0.07
183	28.663	0.156	1.12	93	-2.11	101	73	-0.050	15.55	0.05
184	28.820	0.157	1.12	94	-1.14	101	73	-0.050	15.54	0.07
185	28.975	0.155	1.13	93	-1.97	99	73	-0.040	15.87	0.10
186	29.132	0.157	1.12	94	-1.64	100	73	-0.040	10.87	5.00
187	29.290	0.158	1.14	94	-1.95	101	73	-0.040	10.20	5.00
188	29.445	0.155	1.16	94	-2.48	98	73	-0.040	8.41	4.56
189	29.603	0.158	1.12	93	-2.83	100	72	-0.030	6.63	3.46
190	29.759	0.156	1.12	93	-2.89	99	72	-0.020	5.46	2.77
191	29.916	0.157	1.13	94	-2.58	99	72	-0.030	4.44	2.16

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
192	30.074	0.158	1.11	93	-2.81	99	72	-0.020	3.41	1.64
193	30.229	0.155	1.12	94	-2.24	98	72	-0.020	2.57	1.21
194	30.387	0.158	1.13	94	-2.21	100	72	-0.010	1.93	0.89
195	30.544	0.157	1.13	94	-2.37	99	72	-0.010	1.50	0.66
196	30.700	0.156	1.13	94	-2.32	99	72	-0.010	1.10	0.47
197	30.858	0.158	1.12	94	-2.4	99	72	-0.010	0.86	0.35
198	31.013	0.155	1.10	93	-2.53	98	72	-0.010	0.67	0.28
199	31.171	0.158	1.13	94	-2.36	101	72	-0.010	0.55	0.22
200	31.328	0.157	1.12	93	-2.34	99	72	-0.010	0.52	0.20
201	31.483	0.155	1.13	93	-2.48	99	72	-0.010	0.46	0.17
202	31.642	0.159	1.11	94	-2.36	100	72	0.000	0.43	0.15
203	31.797	0.155	1.20	94	-2.65	98	72	-0.010	0.36	0.13
204	31.955	0.158	1.14	94	-2.71	99	72	-0.010	0.34	0.13
205	32.112	0.157	1.13	93	-2.52	100	71	-0.010	0.31	0.11
206	32.268	0.156	1.15	93	-2.78	99	71	-0.010	0.30	0.10
207	32.426	0.158	1.11	94	-2.71	101	71	0.000	0.30	0.10
208	32.582	0.156	1.13	93	-2.52	98	71	0.000	0.26	0.09
209	32.739	0.157	1.14	94	-2.71	100	71	-0.010	0.24	0.08
210	32.897	0.158	1.14	93	-2.59	100	71	0.000	0.25	0.07
211	33.052	0.155	1.13	95	-3	99	71	0.000	0.22	0.07
212	33.210	0.158	1.08	94	-2.49	101	71	-0.010	0.21	0.07
213	33.367	0.157	1.11	95	-2.98	99	71	0.000	0.19	0.05
214	33.523	0.156	1.14	94	-2.3	98	71	0.000	0.19	0.05
215	33.681	0.158	1.15	95	-2.51	100	71	0.000	0.21	0.05
216	33.836	0.155	1.10	93	-2.65	99	71	-0.010	0.18	0.05
217	33.994	0.158	1.13	94	-2.25	101	71	0.000	0.15	0.04
218	34.152	0.158	1.18	95	-2.25	100	71	0.000	0.15	0.04
219	34.308	0.156	1.13	94	-2.87	99	71	0.000	0.15	0.03
220	34.466	0.158	1.09	93	-2.32	101	71	-0.010	0.13	0.04
221	34.622	0.156	1.13	94	-2.37	101	71	0.000	0.14	0.03
222	34.779	0.157	1.07	94	-2.66	99	71	-0.010	0.13	0.04
223	34.937	0.158	1.15	95	-2.55	101	71	0.000	0.14	0.04

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
224	35.092	0.155	1.09	93	-2.57	98	71	0.000	0.12	0.03
225	35.250	0.158	1.13	95	-2.22	100	71	0.000	0.12	0.03
226	35.407	0.157	1.13	95	-2.37	100	71	0.000	0.12	0.03
227	35.563	0.156	1.15	94	-2.55	98	71	0.000	0.11	0.02
228	35.721	0.158	1.07	94	-2.4	102	71	0.000	0.13	0.02
229	35.877	0.156	1.15	94	-2.68	99	71	0.000	0.13	0.03
230	36.035	0.158	1.06	94	-2.37	99	71	0.000	0.12	0.02
231	36.192	0.157	1.13	95	-2.27	99	71	0.000	0.12	0.02
232	36.348	0.156	1.12	94	-2.41	99	71	0.010	0.11	0.02
233	36.506	0.158	1.11	94	-2.49	101	71	0.000	0.12	0.02
234	36.662	0.156	1.13	94	-2.3	99	71	0.000	0.11	0.02
235	36.820	0.158	1.12	93	-2.84	100	71	0.000	0.11	0.02
236	36.977	0.157	1.13	95	-2.38	100	71	0.000	0.12	0.03
237	37.133	0.156	1.10	93	-2.8	99	71	0.000	0.12	0.02
238	37.291	0.158	1.14	94	-2.3	100	71	0.000	0.10	0.02
239	37.446	0.155	1.12	94	-2.96	99	71	0.000	0.13	0.02
240	37.604	0.158	1.12	94	-2.49	100	71	0.000	0.11	0.02
241	37.762	0.158	1.13	94	-2.48	100	71	0.000	0.10	0.02
242	37.918	0.156	1.10	94	-2.39	99	71	0.000	0.14	0.02
243	38.076	0.158	1.10	94	-2.38	101	70	0.010	0.11	0.03
244	38.231	0.155	1.11	94	-2.43	98	70	0.010	0.10	0.02
245	38.389	0.158	1.13	94	-2.18	101	70	0.000	0.10	0.02
246	38.547	0.158	1.13	93	-2.52	101	70	0.010	0.12	0.02
247	38.703	0.156	1.13	93	-2.4	99	70	0.010	0.12	0.02
248	38.861	0.158	1.13	95	-2.72	99	70	0.000	0.11	0.02
249	39.017	0.156	1.12	93	-2.29	98	70	0.000	0.11	0.01
250	39.174	0.157	1.13	95	-2.8	99	70	0.000	0.11	0.01
251	39.332	0.158	1.13	93	-2.28	100	70	0.000	0.11	0.02
252	39.488	0.156	1.13	93	-2.26	99	70	0.000	0.10	0.02
253	39.646	0.158	1.12	93	-2.31	100	70	0.000	0.11	0.01
254	39.802	0.156	1.13	93	-2.32	99	70	0.000	0.10	0.02
255	39.960	0.158	1.14	93	-2.39	100	70	0.000	0.10	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
256	40.117	0.157	1.16	93	-2.64	99	70	0.000	0.11	0.01
257	40.273	0.156	1.13	93	-2.29	99	70	0.000	0.10	0.01
258	40.431	0.158	1.13	94	-3.03	100	70	0.010	0.11	0.01
259	40.588	0.157	1.13	94	-2.53	98	70	0.010	0.08	0.02
260	40.745	0.157	1.15	94	-2.37	99	70	0.000	0.13	0.01
261	40.903	0.158	1.13	94	-2.9	100	70	0.000	0.10	0.01
262	41.058	0.155	1.14	93	-2.87	98	70	0.000	0.12	0.01
263	41.216	0.158	1.14	93	-2.22	101	70	0.010	0.10	0.01
264	41.373	0.157	1.10	94	-2.76	100	70	0.010	0.13	0.02
265	41.530	0.157	1.13	94	-3.05	99	70	0.010	0.11	0.02
266	41.688	0.158	1.15	93	-2.77	101	70	0.000	0.14	0.02
267	41.843	0.155	1.11	94	-2.88	97	70	0.000	0.10	0.01
268	42.002	0.159	1.13	93	-2.91	101	70	0.000	0.12	0.01
269	42.159	0.157	1.11	93	-3.02	99	70	0.010	0.09	0.02
270	42.315	0.156	1.08	93	-2.43	98	70	0.010	0.10	0.01
271	42.473	0.158	1.12	93	-2.8	100	70	0.010	0.10	0.02
272	42.629	0.156	1.13	93	-2.91	99	70	0.010	0.11	0.01
273	42.787	0.158	1.06	94	-2.88	100	70	-0.010	0.10	0.01
274	42.944	0.157	1.13	94	-2.42	99	70	0.000	0.12	0.01
275	43.100	0.156	1.13	93	-3.02	99	70	0.000	0.10	0.01
276	43.259	0.159	1.12	94	-2.37	100	70	0.000	0.11	0.01
277	43.414	0.155	1.14	94	-2.75	97	70	0.020	0.14	0.02
278	43.572	0.158	1.13	93	-3.04	99	70	0.000	0.13	0.01
279	43.730	0.158	1.15	93	-2.79	99	70	0.010	0.13	0.01
280	43.886	0.156	1.08	93	-2.57	100	69	-0.010	0.14	0.02
281	44.044	0.158	1.13	94	-2.78	99	69	0.000	0.10	0.02
282	44.200	0.156	1.17	94	-2.56	100	69	0.000	0.07	0.01
283	44.358	0.158	1.18	93	-2.5	99	69	0.010	0.11	0.01
284	44.515	0.157	1.09	94	-2.92	99	69	0.010	0.11	0.01
285	44.671	0.156	1.13	93	-2.99	98	69	0.010	0.10	0.01
286	44.830	0.159	1.12	94	-2.89	101	69	0.010	0.10	0.01
287	44.985	0.155	1.14	94	-2.94	98	69	0.010	0.11	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
288	45.143	0.158	1.13	93	-2.87	100	69	0.000	0.09	0.01
289	45.301	0.158	1.13	94	-2.63	101	69	-0.040	4.10	0.51
290	45.456	0.155	1.13	94	-2.09	98	69	-0.040	2.24	0.43
291	45.614	0.158	1.13	93	-2.14	101	70	-0.050	4.44	0.75
292	45.770	0.156	1.15	93	-2.09	99	70	-0.040	6.01	0.84
293	45.927	0.157	1.10	94	-2.04	98	70	-0.030	7.30	0.73
294	46.085	0.158	1.08	93	-1.78	101	70	-0.030	10.10	0.61
295	46.240	0.155	1.13	94	-2.14	99	70	-0.040	11.74	0.27
296	46.397	0.157	1.11	93	-1.52	99	70	-0.040	12.52	0.16
297	46.554	0.157	1.12	93	-1.36	101	70	-0.040	14.63	0.10
298	46.709	0.155	1.12	93	-1.18	100	70	-0.040	15.61	0.12
299	46.866	0.157	1.16	94	-1.83	101	70	-0.040	15.37	0.11
300	47.022	0.156	1.12	93	-1.56	100	70	-0.030	15.57	0.16
301	47.178	0.156	1.12	94	-2.02	99	70	-0.040	15.36	0.10
302	47.336	0.158	1.12	94	-2.06	101	70	-0.040	15.39	0.07
303	47.490	0.154	1.12	94	-1.94	98	70	-0.040	15.60	0.07
304	47.647	0.157	1.16	94	-1.46	99	70	-0.050	15.78	0.09
305	47.804	0.157	1.13	94	-2.12	100	71	-0.040	15.43	0.06
306	47.959	0.155	1.12	93	-1.61	97	71	-0.040	15.34	0.13
307	48.116	0.157	1.11	93	-1.29	100	71	-0.050	15.38	0.16
308	48.273	0.157	1.14	94	-1.37	100	71	-0.050	15.83	0.13
309	48.428	0.155	1.11	93	-2.17	99	71	-0.040	15.25	0.05
310	48.585	0.157	1.12	94	-1.89	100	71	-0.050	15.38	0.07
311	48.740	0.155	1.09	94	-1.75	100	71	-0.040	15.55	0.09
312	48.897	0.157	1.10	94	-1.24	100	71	-0.040	14.96	0.08
313	49.054	0.157	1.09	94	-1.22	101	71	-0.050	15.63	0.14
314	49.208	0.154	1.15	94	-1.57	99	71	-0.060	15.14	0.08
315	49.366	0.158	1.14	94	-1.36	101	71	-0.030	14.38	0.18
316	49.523	0.157	1.12	94	-1.65	100	71	-0.040	9.38	4.38
317	49.678	0.155	1.12	93	-2.58	99	71	-0.040	9.20	4.90
318	49.836	0.158	1.16	93	-2.48	100	70	-0.050	8.15	4.18
319	49.992	0.156	1.12	94	-1.97	99	70	-0.030	6.99	3.46

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	50.148	0.156	1.11	94	-2.15	99	70	-0.030	5.81	2.78
321	50.305	0.157	1.15	93	-2.74	101	70	-0.030	4.87	2.26
322	50.460	0.155	1.11	94	-2.57	99	70	-0.020	4.06	1.81
323	50.618	0.158	1.12	94	-2.41	99	70	-0.030	3.33	1.46
324	50.775	0.157	1.16	93	-2.48	99	70	-0.020	2.78	1.19
325	50.930	0.155	1.18	94	-2.6	97	70	-0.020	2.29	0.95
326	51.088	0.158	1.12	93	-2.84	99	70	-0.010	1.89	0.77
327	51.244	0.156	1.12	93	-2.46	99	70	-0.010	1.66	0.66
328	51.400	0.156	1.11	94	-2.3	98	70	-0.010	1.24	0.49
329	51.558	0.158	1.12	93	-2.27	99	70	-0.010	1.05	0.41
330	51.713	0.155	1.10	93	-2.73	98	70	-0.010	0.84	0.32
331	51.870	0.157	1.08	94	-2.46	99	69	0.000	0.76	0.28
332	52.028	0.158	1.12	93	-2.41	101	69	0.000	0.59	0.21
333	52.183	0.155	1.13	94	-2.13	97	69	-0.010	0.56	0.20
334	52.341	0.158	1.12	93	-2.53	100	69	-0.020	0.49	0.18
335	52.497	0.156	1.10	94	-2.19	99	69	-0.010	0.50	0.17
336	52.650	0.153	1.08	93	-2.54	97	69	-0.010	0.41	0.13
337	52.805	0.155	1.18	94	-2.37	97	69	-0.030	0.40	0.12
338	52.964	0.159	1.11	93	-2.7	100	69	0.000	0.38	0.13
339	53.120	0.156	1.12	93	-2.74	100	69	0.000	0.34	0.11
340	53.278	0.158	1.16	94	-2.54	99	69	0.000	0.35	0.09
341	53.433	0.155	1.12	94	-2.56	98	69	0.000	0.30	0.09
342	53.590	0.157	1.11	93	-2.47	99	69	0.000	0.29	0.09
343	53.748	0.158	1.13	94	-2.62	100	69	0.000	0.24	0.07
344	53.903	0.155	1.08	94	-2.53	99	69	0.000	0.25	0.07
345	54.061	0.158	1.07	94	-2.73	99	69	0.010	0.22	0.07
346	54.216	0.155	1.13	94	-2.65	98	69	0.010	0.23	0.06
347	54.373	0.157	1.12	94	-2.88	100	69	0.000	0.19	0.05
348	54.531	0.158	1.12	92	-2.1	100	69	0.000	0.18	0.05
349	54.686	0.155	1.12	93	-2.82	99	69	0.000	0.20	0.04
350	54.843	0.157	1.12	93	-2.18	99	69	0.000	0.18	0.04
351	55.000	0.157	1.13	93	-2.78	100	69	0.000	0.17	0.04

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
352	55.156	0.156	1.03	92	-2.11	99	69	-0.010	0.16	0.05
353	55.313	0.157	1.09	92	-2.48	99	69	-0.010	0.17	0.04
354	55.469	0.156	1.11	92	-2.43	100	69	-0.020	0.16	0.05
355	55.626	0.157	1.15	92	-2.25	100	69	-0.010	0.14	0.04
356	55.783	0.157	1.13	93	-2.14	99	68	0.000	0.13	0.03
357	55.938	0.155	1.13	93	-1.97	97	68	0.000	0.15	0.02
358	56.096	0.158	1.17	92	-2.31	101	68	0.000	0.14	0.02
359	56.253	0.157	1.13	92	-2.06	98	68	0.000	0.14	0.02
360	56.409	0.156	1.11	93	-2.03	99	68	0.010	0.19	0.03
361	56.566	0.157	1.11	93	-2.55	101	68	0.000	0.13	0.02
362	56.722	0.156	1.13	94	-2.09	99	68	0.000	0.13	0.02
363	56.879	0.157	1.12	93	-2.1	99	68	0.010	0.12	0.03
364	57.036	0.157	1.12	94	-1.99	99	68	0.000	0.13	0.02
365	57.191	0.155	1.13	92	-2.58	98	68	0.000	0.13	0.02
366	57.349	0.158	1.12	94	-2.16	99	68	0.000	0.12	0.02
367	57.506	0.157	1.15	93	-2.17	99	68	0.010	0.12	0.02
368	57.661	0.155	1.11	92	-2.77	98	68	0.000	0.12	0.02
369	57.819	0.158	1.12	92	-2.63	99	68	0.000	0.15	0.02
370	57.974	0.155	1.09	92	-2.38	98	68	-0.020	0.14	0.02
371	58.132	0.158	1.12	93	-2.22	100	68	0.000	0.13	0.02
372	58.289	0.157	1.12	93	-2.32	100	68	0.000	0.13	0.02
373	58.444	0.155	1.16	92	-2.57	99	68	0.010	0.12	0.02
374	58.602	0.158	1.13	93	-2.13	100	68	0.000	0.12	0.01
375	58.758	0.156	1.12	93	-2.64	99	68	0.000	0.14	0.02
376	58.915	0.157	1.14	93	-2.7	100	68	0.000	0.10	0.02
377	59.072	0.157	1.12	93	-2.36	99	68	0.010	0.13	0.01
378	59.228	0.156	1.12	92	-2.43	99	68	-0.010	0.12	0.02
379	59.385	0.157	1.13	92	-2.3	100	68	0.000	0.13	0.02
380	59.542	0.157	1.12	92	-2.28	100	68	0.000	0.13	0.02
381	59.697	0.155	1.13	93	-2.69	98	68	0.000	0.12	0.01
382	59.855	0.158	1.12	92	-2.74	101	68	0.000	0.14	0.01
383	60.011	0.156	1.16	92	-2.47	99	68	0.010	0.13	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
384	60.168	0.157	1.12	93	-2.71	100	68	0.010	0.14	0.01
385	60.325	0.157	1.12	93	-2.99	99	68	0.000	0.13	0.01
386	60.478	0.153	1.08	93	-2.7	98	68	0.020	0.15	0.02
387	60.638	0.160	1.09	92	-2.35	100	68	0.010	0.14	0.01
388	60.795	0.157	1.13	93	-2.83	99	68	0.000	0.13	0.01
389	60.951	0.156	1.12	93	-3.16	97	68	0.000	0.13	0.01
390	61.108	0.157	1.11	93	-2.93	99	68	0.020	0.13	0.02
391	61.264	0.156	1.09	92	-2.6	99	68	-0.010	0.13	0.01
392	61.421	0.157	1.12	92	-2.36	99	68	0.000	0.14	0.01
393	61.578	0.157	1.13	92	-2.19	99	68	0.000	0.13	0.01
394	61.734	0.156	1.17	93	-2.47	98	68	-0.010	0.13	0.01
395	61.891	0.157	1.12	93	-2.86	98	68	0.000	0.13	0.01
396	62.048	0.157	1.13	92	-2.61	101	68	0.000	0.16	0.01
397	62.204	0.156	1.12	92	-2.32	99	68	0.000	0.14	0.01
398	62.362	0.158	1.13	92	-2.78	100	68	0.000	0.15	0.01
399	62.517	0.155	1.13	92	-2.23	98	68	0.000	0.13	0.01
400	62.674	0.157	1.14	93	-2.57	99	68	0.000	0.14	0.01
401	62.832	0.158	1.08	92	-2.41	101	68	0.000	0.10	0.01
402	62.987	0.155	1.13	92	-2.83	98	68	0.000	0.12	0.01
403	63.144	0.157	1.12	92	-2.24	99	68	0.000	0.13	0.01
404	63.301	0.157	1.12	92	-2.21	99	68	0.010	0.13	0.01
405	63.457	0.156	1.12	92	-2.72	98	68	0.010	0.13	0.01
406	63.615	0.158	1.13	93	-2.13	100	68	0.000	0.13	0.01
407	63.770	0.155	1.14	93	-2.3	98	68	0.010	0.16	0.01
408	63.927	0.157	1.13	92	-2.5	99	68	-0.020	0.12	0.01
409	64.085	0.158	1.09	93	-2.45	100	68	0.010	0.12	0.02
410	64.240	0.155	1.15	92	-2.5	98	68	0.000	0.13	0.01
411	64.398	0.158	1.13	93	-2.18	100	68	0.010	0.12	0.01
412	64.554	0.156	1.13	93	-2.23	98	68	0.000	0.12	0.01
413	64.710	0.156	1.12	93	-2.26	99	68	0.010	0.12	0.01
414	64.868	0.158	1.13	92	-2.38	100	68	0.000	0.12	0.02
415	65.023	0.155	1.13	91	-2.66	97	68	0.000	0.11	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
416	65.180	0.157	1.13	93	-2.04	99	68	0.010	0.12	0.01
417	65.337	0.157	1.14	93	-2.14	101	68	-0.030	1.91	0.24
418	65.492	0.155	1.14	92	-2.32	99	68	-0.040	3.00	0.57
419	65.650	0.158	1.13	91	-2.49	102	68	-0.030	5.71	1.13
420	65.806	0.156	1.13	92	-2.26	99	68	-0.030	7.38	1.09
421	65.961	0.155	1.12	93	-2.08	99	68	-0.040	8.24	1.10
422	66.119	0.158	1.13	93	-2.21	100	68	-0.030	8.74	0.93
423	66.274	0.155	1.12	92	-2.23	99	68	-0.030	9.54	0.92
424	66.430	0.156	1.11	92	-2.05	100	68	-0.040	12.25	0.69
425	66.587	0.157	1.12	92	-1.48	100	68	-0.030	13.06	0.30
426	66.742	0.155	1.11	91	-1.57	100	68	-0.050	12.81	0.28
427	66.898	0.156	1.12	92	-2.02	100	69	-0.040	13.87	0.27
428	67.055	0.157	1.12	93	-1.78	101	69	-0.060	13.51	0.12
429	67.210	0.155	1.10	93	-1.8	98	69	-0.040	13.47	0.12
430	67.366	0.156	1.12	92	-1.92	99	69	-0.040	14.26	0.11
431	67.523	0.157	1.11	93	-1.91	101	69	-0.040	14.13	0.14
432	67.677	0.154	1.12	93	-1.79	98	69	-0.040	14.49	0.11
433	67.834	0.157	1.12	93	-1.84	100	69	-0.040	14.59	0.09
434	67.990	0.156	1.12	91	-1.34	99	69	-0.040	14.37	0.09
435	68.144	0.154	1.11	92	-1.41	98	69	-0.050	14.88	0.11
436	68.301	0.157	1.10	91	-1.46	101	69	-0.030	14.31	0.14
437	68.457	0.156	1.12	93	-1.96	101	69	-0.040	13.95	0.13
438	68.612	0.155	1.13	91	-1.41	101	69	-0.040	13.42	0.13
439	68.769	0.157	1.12	93	-1.98	101	69	-0.040	13.42	0.13
440	68.924	0.155	1.10	91	-1.65	101	69	-0.030	13.34	0.18
441	69.079	0.155	1.13	91	-1.62	101	69	-0.040	14.47	0.57
442	69.236	0.157	1.11	91	-1.24	101	69	-0.030	14.89	0.46
443	69.391	0.155	1.12	93	-2.4	99	69	-0.040	8.80	1.60
444	69.547	0.156	1.18	93	-2.03	98	69	-0.020	8.51	4.95
445	69.704	0.157	1.13	91	-1.98	100	69	-0.030	7.99	4.62
446	69.859	0.155	1.14	93	-2.2	98	69	-0.040	7.19	3.95
447	70.016	0.157	1.11	92	-1.91	99	69	-0.020	6.52	3.44

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
448	70.173	0.157	1.11	93	-2.14	98	69	-0.020	5.85	3.00
449	70.327	0.154	1.12	92	-2.53	99	69	-0.020	5.15	2.55
450	70.484	0.157	1.13	92	-2.09	100	69	-0.010	4.55	2.20
451	70.641	0.157	1.11	91	-2.01	99	69	-0.010	4.11	1.94
452	70.795	0.154	1.12	91	-2.6	97	69	-0.010	3.60	1.67
453	70.953	0.158	1.10	93	-2.23	101	69	-0.010	3.28	1.51
454	71.109	0.156	1.12	92	-2.3	98	69	0.000	2.96	1.31
455	71.264	0.155	1.11	92	-2.19	101	69	-0.010	2.60	1.15
456	71.421	0.157	1.11	93	-2.19	100	69	-0.010	2.31	0.99
457	71.576	0.155	1.13	92	-2.36	99	69	0.010	2.10	0.88
458	71.732	0.156	1.11	93	-2.07	99	69	-0.010	1.91	0.79
459	71.889	0.157	1.12	91	-2.71	100	68	-0.010	1.71	0.70
460	72.044	0.155	1.12	91	-2.77	98	68	-0.010	1.57	0.63
461	72.201	0.157	1.11	93	-2.28	100	68	-0.010	1.49	0.59
462	72.357	0.156	1.13	92	-2.25	97	68	0.000	1.37	0.55
463	72.512	0.155	1.13	92	-2.28	98	68	-0.010	1.36	0.53
464	72.669	0.157	1.09	92	-2.42	99	68	0.000	1.31	0.49
465	72.826	0.157	1.11	92	-2.14	100	68	0.000	1.18	0.45
466	72.980	0.154	1.12	92	-2.19	98	68	0.000	1.11	0.41
467	73.137	0.157	1.11	93	-2.3	99	68	0.010	0.95	0.37
468	73.294	0.157	1.11	92	-2.1	100	68	0.000	0.90	0.33
469	73.448	0.154	1.12	92	-2.16	98	68	0.000	0.81	0.29
470	73.606	0.158	1.10	93	-2.55	102	68	0.000	0.77	0.27
471	73.761	0.155	1.12	91	-2.74	99	68	0.000	0.70	0.24
472	73.917	0.156	1.15	92	-2.19	98	68	-0.010	0.64	0.21
473	74.074	0.157	1.11	91	-2.68	99	68	0.000	0.63	0.21
474	74.229	0.155	1.08	92	-2.25	98	68	-0.010	0.54	0.18
475	74.385	0.156	1.12	91	-2.28	102	68	0.000	0.49	0.16
476	74.542	0.157	1.11	91	-2.51	100	68	-0.010	0.50	0.15
477	74.696	0.154	1.13	92	-2.7	98	68	0.000	0.46	0.14
478	74.853	0.157	1.15	91	-2.55	100	68	0.000	0.42	0.12
479	75.009	0.156	1.11	91	-2.16	100	68	0.000	0.38	0.11

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
480	75.164	0.155	1.12	91	-2.24	98	68	0.000	0.37	0.09
481	75.321	0.157	1.12	92	-2.79	99	68	0.000	0.35	0.09
482	75.477	0.156	1.12	91	-2.28	99	68	0.000	0.33	0.08
483	75.632	0.155	1.10	91	-2.1	98	68	0.000	0.32	0.07
484	75.789	0.157	1.16	92	-2.48	100	68	0.010	0.29	0.06
485	75.945	0.156	1.12	91	-2.28	100	68	0.000	0.27	0.06
486	76.100	0.155	1.12	92	-2.45	100	68	0.000	0.24	0.06
487	76.257	0.157	1.14	92	-2.38	99	68	0.010	0.23	0.05
488	76.413	0.156	1.13	92	-2.59	98	68	0.000	0.25	0.05
489	76.568	0.155	1.08	92	-2.26	98	68	0.000	0.28	0.06
490	76.726	0.158	1.09	91	-2.41	100	68	-0.010	0.24	0.05
491	76.881	0.155	1.15	92	-2.46	99	68	0.020	0.23	0.04
492	77.037	0.156	1.12	91	-2.21	98	68	0.000	0.20	0.04
493	77.194	0.157	1.12	91	-2.74	102	68	0.000	0.22	0.03
494	77.348	0.154	1.12	92	-2.6	98	68	0.010	0.21	0.03
495	77.505	0.157	1.12	92	-2.11	100	68	0.000	0.20	0.03
496	77.660	0.155	1.13	91	-2.43	99	68	-0.010	0.22	0.03
497	77.817	0.157	1.12	92	-2.22	99	68	-0.020	0.21	0.03
498	77.974	0.157	1.10	91	-2.29	100	68	0.000	0.19	0.04
499	78.131	0.157	1.11	91	-2.51	100	68	0.000	0.18	0.02
500	78.285	0.154	1.09	92	-2.13	98	68	0.010	0.16	0.02
501	78.442	0.157	1.14	91	-2.37	99	68	0.010	0.19	0.03
502	78.598	0.156	1.12	92	-2.38	97	68	0.000	0.16	0.02
503	78.753	0.155	1.10	91	-2.57	99	68	0.000	0.17	0.02
504	78.911	0.158	1.12	92	-2.22	100	68	0.000	0.17	0.02
505	79.066	0.155	1.13	91	-2.67	98	68	0.000	0.18	0.01
506	79.222	0.156	1.10	91	-2.72	99	68	0.000	0.16	0.01
507	79.379	0.157	1.09	92	-2.36	100	68	0.010	0.15	0.01
508	79.533	0.154	1.12	91	-2.75	97	68	0.010	0.16	0.01
509	79.691	0.158	1.13	92	-2.31	100	68	0.000	0.16	0.01
510	79.847	0.156	1.10	91	-2.39	98	68	0.000	0.15	0.02
511	80.002	0.155	1.12	91	-2.74	98	68	0.000	0.15	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
512	80.159	0.157	1.12	91	-2.4	100	68	0.000	0.17	0.01
513	80.316	0.157	1.10	91	-2.79	100	67	0.000	0.15	0.01
514	80.470	0.154	1.06	92	-2.6	97	68	0.020	0.14	0.02
515	80.627	0.157	1.12	91	-2.92	99	67	0.000	0.14	0.01
516	80.783	0.156	1.12	91	-2.69	99	67	0.000	0.15	0.01
517	80.939	0.156	1.11	91	-2.69	100	67	0.000	0.16	0.01
518	81.096	0.157	1.12	91	-2.71	100	67	0.000	0.15	0.01
519	81.251	0.155	1.14	91	-2.63	100	67	-0.010	0.14	0.01
520	81.407	0.156	1.11	92	-2.57	99	67	-0.010	0.14	0.01
521	81.564	0.157	1.11	92	-2.5	100	68	0.000	0.15	0.01
522	81.719	0.155	1.13	92	-2.23	97	67	0.000	0.17	0.02
523	81.876	0.157	1.09	91	-2.5	100	67	0.010	0.17	0.01
524	82.032	0.156	1.11	91	-2.49	98	67	0.010	0.17	0.01
525	82.187	0.155	1.14	91	-2.32	98	67	0.000	0.15	0.01
526	82.344	0.157	1.13	92	-2.76	100	67	0.000	0.14	0.00
527	82.501	0.157	1.14	91	-2.25	100	67	0.000	0.14	0.01
528	82.655	0.154	1.11	91	-2.71	96	67	0.000	0.14	0.01
529	82.812	0.157	1.12	91	-2.31	98	67	0.010	0.14	0.01
530	82.969	0.157	1.13	91	-2.28	100	67	0.000	0.12	0.01
531	83.124	0.155	1.12	91	-2.22	98	67	0.000	0.13	0.01
532	83.281	0.157	1.12	91	-2.24	99	67	0.010	0.14	0.01
533	83.436	0.155	1.10	91	-2.44	98	67	0.000	0.16	0.02
534	83.592	0.156	1.09	91	-2.56	98	67	0.010	0.14	0.01
535	83.749	0.157	1.20	91	-2.56	101	67	0.000	0.13	0.01
536	83.904	0.155	1.09	92	-2.82	98	67	0.000	0.14	0.00
537	84.061	0.157	1.08	91	-2.43	100	67	0.000	0.15	0.01
538	84.218	0.157	1.12	91	-2.19	99	67	-0.010	0.14	0.00
539	84.372	0.154	1.12	92	-2.73	97	67	0.000	0.14	0.00
540	84.529	0.157	1.09	92	-2.63	99	67	0.010	0.13	0.01
541	84.686	0.157	1.12	92	-2.84	99	67	0.010	0.13	0.00
542	84.840	0.154	1.14	91	-2.37	98	67	0.000	0.16	0.01
543	84.997	0.157	1.16	90	-2.2	99	67	-0.040	4.92	1.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
544	85.154	0.157	1.12	91	-2.31	100	67	-0.040	4.17	1.44
545	85.308	0.154	1.12	91	-2.47	99	68	-0.020	6.68	1.92
546	85.465	0.157	1.11	91	-1.76	99	68	-0.030	7.45	1.91
547	85.621	0.156	1.12	90	-2.35	102	68	-0.020	7.38	1.83
548	85.775	0.154	1.15	91	-1.8	100	68	-0.050	8.33	1.92
549	85.932	0.157	1.12	92	-1.72	99	68	-0.030	7.95	1.20
550	86.087	0.155	1.11	90	-2.28	99	68	-0.040	7.37	1.23
551	86.242	0.155	1.12	92	-1.66	99	68	-0.040	7.31	1.06
552	86.398	0.156	1.11	90	-2.39	99	68	-0.030	8.75	1.12
553	86.554	0.156	1.13	91	-2.42	99	68	-0.040	9.80	0.89
554	86.708	0.154	1.11	92	-1.86	100	68	-0.050	9.82	0.88
555	86.864	0.156	1.07	91	-2.33	101	68	-0.040	8.39	0.83
556	87.020	0.156	1.12	92	-1.68	100	69	-0.040	9.54	0.53
557	87.174	0.154	1.11	90	-2.47	99	69	-0.040	9.46	0.49
558	87.330	0.156	1.10	91	-2.22	101	69	-0.040	9.77	0.85
559	87.486	0.156	1.10	91	-1.9	101	69	-0.030	11.16	0.71
560	87.639	0.153	1.15	92	-2.09	99	69	-0.040	10.10	0.97
561	87.795	0.156	1.11	91	-2.59	100	69	-0.040	9.45	0.91
562	87.951	0.156	1.10	91	-2.52	101	69	-0.040	8.71	0.68
563	88.105	0.154	1.14	92	-2.17	100	69	-0.040	8.75	0.65
564	88.260	0.155	1.11	92	-1.76	101	69	-0.050	8.50	0.61
565	88.416	0.156	1.07	91	-2.31	101	69	-0.050	8.26	0.55
566	88.569	0.153	1.11	91	-2.45	99	69	-0.040	8.09	0.46
567	88.724	0.155	1.10	91	-2.48	101	69	-0.050	8.02	0.36
568	88.880	0.156	1.12	90	-2.18	102	70	-0.060	7.83	0.36
569	89.034	0.154	1.10	91	-1.83	98	70	-0.040	7.75	0.35
Avg/Tot	89.038	0.156	1.12	90	-2.26	100	70	-0.012	3.41	0.37

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
0	0.40		60.4	159.4	159.5	157.6	1.00	3.31	
1	0.40		60.4	159.1	159.2	157.3	1.00	3.32	328
2	0.39		60.4	159.0	159.3	157.4	1.00	3.25	321
3	0.40		60.4	159.3	159.6	157.7	1.00	3.30	327
4	0.41		60.4	159.3	159.5	157.5	1.00	3.38	335
5	0.40		60.4	159.0	159.1	157.2	1.00	3.37	332
6	0.41		60.4	158.7	158.8	156.9	1.00	3.42	337
7	0.38		60.4	158.4	158.5	156.6	1.00	3.17	311
8	0.40		60.4	158.1	158.2	156.3	1.00	3.33	326
9	0.40		60.3	157.7	157.8	155.9	1.00	3.37	328
10	0.41		60.2	157.4	157.5	155.6	1.00	3.39	330
11	0.44		60.1	157.1	157.2	155.1	1.00	3.63	353
12	0.45		60.0	156.7	156.8	154.7	1.00	3.72	360
13	0.45		59.8	156.3	156.4	154.3	1.00	3.75	362
14	0.47		59.7	155.9	156.0	153.9	1.00	3.88	374
15	0.45		59.6	155.5	155.6	153.4	1.00	3.72	358
16	0.45		59.6	155.1	155.2	153.1	1.00	3.77	360
17	0.45		59.6	154.7	154.8	152.7	1.00	3.77	359
18	0.45		59.5	154.3	154.4	152.3	1.00	3.77	357
19	0.46		59.5	153.9	154.0	151.9	1.00	3.82	361
20	0.45		59.5	153.5	153.6	151.5	1.00	3.77	355
21	0.45		59.5	153.1	153.2	151.1	1.00	3.76	352
22	0.45		59.5	152.7	152.8	150.7	1.00	3.77	351
23	0.45		59.5	152.4	152.4	150.4	1.00	3.78	352
24	0.44		59.5	152.0	152.1	150.0	1.00	3.65	338
25	0.45		59.4	151.6	151.8	149.7	1.00	3.77	348
26	0.45		59.5	151.7	152.1	150.0	1.00	3.76	347
27	0.45		59.5	152.5	153.1	151.0	1.00	3.76	350
28	0.45		59.5	153.8	154.5	152.4	1.00	3.77	356
29	0.45		59.5	155.3	156.1	153.9	1.00	3.74	359
30	0.46		59.6	156.8	157.6	155.4	1.00	3.81	371
31	0.45		59.6	158.5	159.2	157.0	1.00	3.76	372
32	0.45		59.6	160.1	160.9	158.6	1.00	3.72	375
33	0.45		59.6	161.7	162.5	160.2	1.00	3.73	382
34	0.46		59.6	163.3	164.1	161.7	1.00	3.79	394
35	0.45		59.7	165.0	165.9	163.5	1.00	3.75	395
36	0.45		59.7	166.7	167.6	165.2	1.00	3.77	404
37	0.45		59.8	168.5	169.4	166.9	1.00	3.76	409
38	0.45		59.8	170.3	171.2	168.7	1.00	3.71	410
39	0.45		59.8	172.1	173.0	170.4	1.00	3.77	423
40	0.45		59.8	173.8	174.7	172.1	1.00	3.77	430
41	0.44		59.8	175.7	176.6	174.0	1.00	3.70	429
42	0.42		59.7	177.5	178.5	176.0	1.00	3.49	412
43	0.43		59.7	179.5	180.5	178.0	1.00	3.55	426
44	0.42		59.6	181.4	182.4	179.8	1.00	3.52	429
45	0.42		59.6	183.3	184.3	181.7	1.00	3.46	428
46	0.42		59.5	185.4	186.5	183.8	1.00	3.47	438
47	0.42		59.5	187.5	188.5	185.9	1.00	3.49	447

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
48	0.42		59.5	189.4	190.6	187.9	1.00	3.49	454
49	0.42		59.4	191.3	192.1	189.3	1.00	3.51	463
50	0.42		59.3	192.0	192.6	189.8	1.00	3.48	463
51	0.41		59.2	192.1	192.6	189.8	1.00	3.44	458
52	0.42		59.2	192.2	192.6	189.9	1.00	3.49	465
53	0.42		59.2	192.1	192.5	189.7	1.00	3.47	462
54	0.42		59.2	192.1	192.4	189.6	1.00	3.47	462
55	0.42		59.2	191.8	192.1	189.3	1.00	3.48	462
56	0.41		59.2	191.6	191.9	189.2	1.00	3.45	457
57	0.41		59.2	191.4	191.6	188.8	1.00	3.38	448
58	0.42		59.3	191.0	191.3	188.6	1.00	3.47	458
59	0.42		59.3	190.7	191.0	188.2	1.00	3.49	459
60	0.42		59.4	190.5	190.7	188.0	1.00	3.52	462
61	0.42		59.5	190.1	190.4	187.7	1.00	3.50	458
62	0.41		59.6	189.8	190.0	187.3	1.00	3.38	441
63	0.41		59.6	189.5	189.7	187.0	1.00	3.43	446
64	0.42		59.7	189.1	189.4	186.7	1.00	3.50	453
65	0.42		59.8	188.8	189.0	186.3	1.00	3.49	451
66	0.42		59.9	188.4	188.6	186.0	1.00	3.51	451
67	0.42		60.0	188.0	188.2	185.6	1.00	3.47	445
68	0.42		60.1	187.6	187.9	185.2	1.00	3.46	441
69	0.42		60.1	187.3	187.6	184.9	1.00	3.50	446
70	0.42		60.2	186.8	187.1	184.4	1.00	3.50	444
71	0.42		60.3	186.5	186.8	184.2	1.00	3.48	440
72	0.42		60.4	186.1	186.4	183.8	1.00	3.48	438
73	0.42		60.4	185.7	186.0	183.4	1.00	3.47	436
74	0.42		60.4	185.3	185.6	183.0	1.00	3.48	435
75	0.41		60.4	184.9	185.2	182.6	1.00	3.44	429
76	0.42		60.4	184.5	184.8	182.2	1.00	3.48	433
77	0.42		60.3	184.2	184.4	181.8	1.00	3.47	430
78	0.42		60.0	183.8	184.0	181.4	1.00	3.49	433
79	0.42		59.8	183.4	183.5	181.0	1.00	3.48	431
80	0.41		59.6	183.0	183.2	180.6	1.00	3.42	422
81	0.42		59.6	182.5	182.7	180.2	1.00	3.48	429
82	0.42		59.6	182.2	182.4	179.8	1.00	3.49	429
83	0.43		59.7	181.7	181.9	179.4	1.00	3.59	439
84	0.42		59.7	181.4	181.5	179.0	1.00	3.47	423
85	0.42		59.7	181.0	181.1	178.6	1.00	3.51	426
86	0.43		59.8	180.5	180.7	178.2	1.00	3.54	428
87	0.41		59.8	180.1	180.3	177.8	1.00	3.45	415
88	0.43		59.8	179.7	179.9	177.4	1.00	3.56	427
89	0.42		59.9	179.3	179.5	177.0	1.00	3.51	419
90	0.42		59.9	178.9	179.0	176.5	1.00	3.50	417
91	0.41		60.0	178.5	178.7	176.3	1.00	3.43	407
92	0.42		60.0	178.1	178.3	175.8	1.00	3.52	416
93	0.41		60.0	177.7	177.9	175.4	1.00	3.44	405
94	0.42		60.0	177.3	177.5	175.0	1.00	3.49	410
95	0.42		59.9	176.9	177.1	174.6	1.00	3.49	409

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
96	0.42		59.8	176.5	176.7	174.2	1.00	3.52	412
97	0.42		59.8	176.1	176.3	173.8	1.00	3.52	409
98	0.42		59.7	175.7	175.9	173.4	1.00	3.52	409
99	0.42		59.6	175.3	175.4	173.0	1.00	3.48	403
100	0.42		59.5	174.8	175.0	172.6	1.00	3.50	404
101	0.42		59.5	174.4	174.6	172.2	1.00	3.50	403
102	0.42		59.5	174.0	174.2	171.9	1.00	3.51	402
103	0.42		59.5	173.7	173.8	171.5	1.00	3.48	398
104	0.42		59.6	173.3	173.4	171.1	1.00	3.49	397
105	0.41		59.6	172.9	173.1	170.7	1.00	3.45	391
106	0.41		59.7	172.5	172.7	170.3	1.00	3.45	390
107	0.42		59.7	172.1	172.3	170.0	1.00	3.46	389
108	0.42		59.6	171.7	171.9	169.5	1.00	3.48	391
109	0.42		59.6	171.3	171.5	169.1	1.00	3.51	392
110	0.42		59.7	170.9	171.1	168.8	1.00	3.52	391
111	0.42		59.8	170.5	170.7	168.4	1.00	3.47	384
112	0.42		59.9	170.1	170.3	168.0	1.00	3.49	385
113	0.42		60.0	169.8	169.9	167.6	1.00	3.50	385
114	0.42		60.1	169.4	169.6	167.3	1.00	3.48	381
115	0.42		60.1	169.0	169.1	166.9	1.00	3.50	382
116	0.42		60.2	168.6	168.8	166.5	1.00	3.47	377
117	0.42		60.2	168.2	168.4	166.2	1.00	3.47	376
118	0.42		60.2	167.9	168.0	165.7	1.00	3.48	376
119	0.42		60.3	167.5	167.6	165.4	1.00	3.48	374
120	0.42		60.3	167.1	167.2	165.0	1.00	3.49	373
121	0.41		60.3	166.7	166.8	164.6	1.00	3.39	361
122	0.42		60.3	166.4	166.5	164.3	1.00	3.46	367
123	0.42		60.3	166.0	166.1	163.9	1.00	3.49	369
124	0.42		60.3	165.6	165.7	163.5	1.00	3.49	368
125	0.42		60.3	165.2	165.4	163.2	1.00	3.48	366
126	0.42		60.3	164.9	165.0	162.8	1.00	3.49	366
127	0.42		60.2	164.5	164.6	162.5	1.00	3.48	364
128	0.42		60.2	164.1	164.3	162.1	1.00	3.49	363
129	0.48		60.2	163.7	163.9	161.4	1.00	4.02	416
130	0.48		60.2	163.3	163.4	160.9	1.00	3.96	408
131	0.46		60.2	162.9	163.0	160.7	1.00	3.79	390
132	0.46		60.2	162.4	162.6	160.3	1.00	3.81	390
133	0.46		60.3	162.0	162.2	159.8	1.00	3.80	387
134	0.46		60.3	161.6	161.8	159.4	1.00	3.82	387
135	0.45		60.4	161.2	161.4	159.1	1.00	3.77	381
136	0.45		60.4	160.9	161.0	158.7	1.00	3.75	377
137	0.45		60.5	160.4	160.6	158.3	1.00	3.78	378
138	0.45		60.6	160.1	160.2	157.9	1.00	3.77	376
139	0.45		60.6	159.7	159.8	157.5	1.00	3.78	375
140	0.45		60.6	159.3	159.4	157.2	1.00	3.73	369
141	0.46		60.6	158.9	159.0	156.8	1.00	3.80	374
142	0.46		60.4	158.5	158.6	156.4	1.00	3.85	378
143	0.45		60.2	158.1	158.2	156.0	1.00	3.75	367

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
144	0.45		60.0	157.7	157.8	155.6	1.00	3.78	370
145	0.45		59.8	157.3	157.5	155.3	1.00	3.77	368
146	0.46		59.7	156.9	157.1	154.9	1.00	3.79	369
147	0.45		59.6	156.6	156.7	154.5	1.00	3.77	367
148	0.45		59.6	156.2	156.3	154.1	1.00	3.75	363
149	0.45		59.6	155.8	155.9	153.8	1.00	3.75	361
150	0.45		59.6	155.4	155.6	153.4	1.00	3.77	362
151	0.45		59.6	155.1	155.2	153.1	1.00	3.77	361
152	0.45		59.6	154.7	154.8	152.7	1.00	3.73	355
153	0.45		59.7	154.3	154.5	152.3	1.00	3.77	357
154	0.45		59.7	154.0	154.1	152.0	1.00	3.73	352
155	0.45		59.8	153.6	153.7	151.6	1.00	3.77	354
156	0.45		59.9	153.2	153.4	151.3	1.00	3.76	351
157	0.45		59.9	152.9	153.0	150.9	1.00	3.78	352
158	0.46		60.0	152.5	152.6	150.6	1.00	3.81	353
159	0.45		60.0	152.2	152.3	150.2	1.00	3.77	348
160	0.45		60.1	151.8	151.9	149.9	1.00	3.76	345
161	0.46		60.1	151.6	151.9	149.8	1.00	3.82	350
162	0.45		60.1	151.8	152.1	150.0	1.00	3.74	343
163	0.45		60.0	152.2	152.6	150.5	1.00	3.78	349
164	0.45		59.8	152.9	153.4	151.2	1.00	3.78	353
165	0.45		59.6	153.7	154.3	152.1	1.00	3.75	353
166	0.45		59.4	154.7	155.3	153.1	1.00	3.75	358
167	0.45		59.2	155.7	156.3	154.1	1.00	3.77	365
168	0.45		59.0	157.0	157.8	155.6	1.00	3.77	370
169	0.45		58.9	158.6	159.5	157.2	1.00	3.76	375
170	0.45		58.9	160.5	161.5	159.2	1.00	3.74	381
171	0.45		58.9	162.8	163.7	161.3	1.00	3.75	390
172	0.45		58.9	165.0	166.0	163.6	1.00	3.76	399
173	0.45		58.9	167.0	168.0	165.5	1.00	3.77	408
174	0.45		59.0	169.5	170.4	167.9	1.00	3.77	417
175	0.45		59.0	171.6	172.7	170.1	1.00	3.78	426
176	0.45		59.1	173.6	174.6	171.9	1.00	3.77	433
177	0.45		59.1	175.5	176.5	173.8	1.00	3.75	437
178	0.45		59.2	177.6	178.6	175.8	1.00	3.72	442
179	0.45		59.3	179.5	180.4	177.7	1.00	3.77	454
180	0.45		59.4	181.2	182.1	179.3	1.00	3.76	458
181	0.45		59.5	183.0	184.0	181.2	1.00	3.76	465
182	0.45		59.6	184.7	185.7	182.8	1.00	3.75	470
183	0.45		59.7	186.9	188.1	185.1	1.00	3.76	479
184	0.45		59.8	189.1	190.2	187.2	1.00	3.77	489
185	0.45		59.9	191.0	192.1	189.1	1.00	3.77	495
186	0.45		59.9	192.6	193.2	190.2	1.00	3.72	495
187	0.45		60.0	192.8	193.2	190.2	1.00	3.74	497
188	0.44		60.1	193.0	193.2	190.2	1.00	3.70	492
189	0.44		60.2	192.8	193.1	190.1	1.00	3.69	490
190	0.44		60.3	192.7	193.1	190.1	1.00	3.65	484
191	0.44		60.3	192.5	192.9	190.0	1.00	3.67	486

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
192	0.44		60.4	192.3	192.7	189.8	1.00	3.67	485
193	0.44		60.4	192.0	192.4	189.5	1.00	3.67	483
194	0.44		60.5	191.7	192.1	189.2	1.00	3.64	478
195	0.44		60.5	191.6	191.9	189.0	1.00	3.65	479
196	0.44		60.5	191.2	191.5	188.6	1.00	3.64	476
197	0.44		60.5	190.8	191.0	188.2	1.00	3.68	480
198	0.44		60.5	190.4	190.7	187.8	1.00	3.67	477
199	0.44		60.5	190.1	190.4	187.5	1.00	3.67	477
200	0.41		60.5	189.7	190.0	187.1	1.00	3.37	436
201	0.44		60.4	189.3	189.6	186.7	1.00	3.67	473
202	0.45		60.4	189.0	189.3	186.5	1.00	3.77	485
203	0.44		60.4	188.6	188.8	186.0	1.00	3.67	471
204	0.44		60.4	188.1	188.4	185.6	1.00	3.68	471
205	0.44		60.4	187.7	187.9	185.1	1.00	3.68	469
206	0.44		60.3	187.2	187.5	184.7	1.00	3.66	465
207	0.45		60.4	186.8	187.0	184.2	1.00	3.75	474
208	0.44		60.4	186.4	186.6	183.9	1.00	3.63	458
209	0.44		60.5	186.0	186.2	183.4	1.00	3.67	461
210	0.44		60.5	185.5	185.7	183.0	1.00	3.67	460
211	0.44		60.5	185.1	185.3	182.6	1.00	3.67	458
212	0.44		60.5	184.6	184.8	182.1	1.00	3.66	454
213	0.44		60.5	184.2	184.4	181.7	1.00	3.67	455
214	0.44		60.4	183.7	183.9	181.2	1.00	3.66	451
215	0.44		60.3	183.2	183.4	180.7	1.00	3.67	452
216	0.44		60.2	182.8	183.0	180.3	1.00	3.68	452
217	0.44		60.0	182.4	182.6	179.9	1.00	3.65	447
218	0.44		59.8	181.9	182.1	179.4	1.00	3.66	447
219	0.44		59.7	181.4	181.6	178.9	1.00	3.67	448
220	0.44		59.6	181.0	181.2	178.5	1.00	3.62	441
221	0.44		59.5	180.5	180.7	178.0	1.00	3.66	443
222	0.44		59.5	180.1	180.3	177.6	1.00	3.70	447
223	0.44		59.4	179.6	179.8	177.2	1.00	3.68	443
224	0.44		59.4	179.1	179.3	176.7	1.00	3.66	438
225	0.44		59.5	178.7	178.8	176.2	1.00	3.67	438
226	0.44		59.5	178.2	178.4	175.8	1.00	3.64	433
227	0.44		59.5	177.8	178.0	175.4	1.00	3.67	435
228	0.44		59.4	177.3	177.5	174.9	1.00	3.65	431
229	0.44		59.2	176.8	177.0	174.5	1.00	3.66	431
230	0.44		59.2	176.4	176.5	174.0	1.00	3.66	429
231	0.44		59.0	175.9	176.1	173.6	1.00	3.67	429
232	0.44		59.0	175.5	175.7	173.1	1.00	3.63	424
233	0.44		59.0	175.0	175.2	172.7	1.00	3.67	426
234	0.44		59.1	174.6	174.7	172.2	1.00	3.68	426
235	0.44		59.2	174.1	174.3	171.8	1.00	3.66	421
236	0.44		59.2	173.6	173.8	171.3	1.00	3.68	422
237	0.45		59.3	173.2	173.4	170.9	1.00	3.72	425
238	0.44		59.3	172.7	172.9	170.4	1.00	3.63	412
239	0.44		59.4	172.3	172.5	170.0	1.00	3.65	413

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
240	0.44		59.4	171.8	172.0	169.5	1.00	3.67	414
241	0.44		59.4	171.4	171.6	169.1	1.00	3.65	409
242	0.44		59.4	170.9	171.1	168.7	1.00	3.65	407
243	0.44		59.4	170.5	170.7	168.3	1.00	3.66	407
244	0.44		59.5	170.0	170.2	167.8	1.00	3.66	405
245	0.44		59.5	169.6	169.8	167.4	1.00	3.68	406
246	0.44		59.5	169.2	169.4	167.0	1.00	3.67	404
247	0.44		59.5	168.7	168.9	166.5	1.00	3.68	403
248	0.44		59.6	168.3	168.5	166.1	1.00	3.67	400
249	0.44		59.6	167.9	168.1	165.7	1.00	3.67	398
250	0.44		59.7	167.4	167.6	165.2	1.00	3.68	397
251	0.44		59.7	167.0	167.2	164.8	1.00	3.67	395
252	0.44		59.7	166.6	166.7	164.4	1.00	3.68	394
253	0.44		59.8	166.1	166.3	164.0	1.00	3.67	390
254	0.44		59.8	165.7	165.9	163.6	1.00	3.64	386
255	0.44		59.8	165.3	165.4	163.1	1.00	3.64	385
256	0.44		59.9	164.9	165.0	162.7	1.00	3.63	382
257	0.44		59.9	164.5	164.6	162.3	1.00	3.66	383
258	0.45		60.0	164.0	164.2	161.9	1.00	3.71	386
259	0.44		60.0	163.6	163.7	161.5	1.00	3.66	379
260	0.44		60.1	163.2	163.3	161.1	1.00	3.68	380
261	0.44		60.1	162.8	162.9	160.7	1.00	3.67	377
262	0.44		60.1	162.4	162.5	160.3	1.00	3.69	378
263	0.44		60.2	162.0	162.1	159.9	1.00	3.66	373
264	0.44		60.2	161.6	161.7	159.5	1.00	3.67	373
265	0.44		60.2	161.2	161.3	159.1	1.00	3.67	371
266	0.44		60.2	160.8	160.9	158.7	1.00	3.65	368
267	0.44		60.3	160.3	160.5	158.3	1.00	3.67	368
268	0.44		60.3	159.9	160.1	157.9	1.00	3.64	363
269	0.44		60.3	159.6	159.7	157.5	1.00	3.65	363
270	0.44		60.3	159.2	159.3	157.1	1.00	3.67	363
271	0.44		60.3	158.8	158.9	156.7	1.00	3.67	362
272	0.44		60.4	158.4	158.5	156.4	1.00	3.67	360
273	0.44		60.4	158.0	158.1	156.0	1.00	3.65	357
274	0.44		60.4	157.6	157.7	155.6	1.00	3.62	353
275	0.44		60.4	157.2	157.4	155.3	1.00	3.67	355
276	0.44		60.4	156.8	157.0	154.9	1.00	3.63	351
277	0.44		60.4	156.5	156.6	154.5	1.00	3.62	349
278	0.44		60.4	156.1	156.2	154.2	1.00	3.63	348
279	0.42		60.3	155.7	155.9	153.8	1.00	3.52	337
280	0.43		60.3	155.3	155.5	153.4	1.00	3.60	342
281	0.44		60.3	155.0	155.1	153.1	1.00	3.67	348
282	0.44		60.3	154.6	154.7	152.7	1.00	3.65	345
283	0.44		60.3	154.2	154.4	152.4	1.00	3.64	342
284	0.44		60.3	153.8	154.0	152.0	1.00	3.65	342
285	0.44		60.3	153.5	153.6	151.6	1.00	3.62	338
286	0.44		60.2	153.1	153.3	151.3	1.00	3.63	338
287	0.44		60.2	152.7	152.9	150.9	1.00	3.64	337

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
288	0.44		60.2	152.4	152.5	150.5	1.00	3.65	337
289	0.44		60.2	152.0	152.1	150.1	1.00	3.66	336
290	0.44		60.1	151.6	151.8	149.8	1.00	3.64	334
291	0.44		60.1	151.5	151.8	149.8	1.00	3.64	333
292	0.44		60.1	151.7	152.0	150.0	1.00	3.62	332
293	0.44		60.1	152.1	152.5	150.5	1.00	3.62	334
294	0.44		60.1	152.7	153.2	151.2	1.00	3.64	338
295	0.43		60.1	153.5	154.1	152.0	1.00	3.62	338
296	0.44		60.2	154.5	155.2	153.2	1.00	3.65	345
297	0.44		60.2	156.0	156.7	154.6	1.00	3.67	352
298	0.43		60.2	157.6	158.4	156.3	1.00	3.58	349
299	0.44		60.2	159.3	160.1	157.9	1.00	3.62	360
300	0.44		60.2	161.1	162.0	159.8	1.00	3.68	372
301	0.44		60.2	162.9	163.8	161.5	1.00	3.67	377
302	0.44		60.2	164.6	165.4	163.1	1.00	3.67	383
303	0.44		60.3	166.4	167.4	165.1	1.00	3.63	386
304	0.44		60.3	168.4	169.4	166.9	1.00	3.62	392
305	0.44		60.3	170.3	171.2	168.8	1.00	3.65	402
306	0.44		60.3	172.2	173.2	170.7	1.00	3.65	409
307	0.44		60.4	174.1	175.1	172.5	1.00	3.66	416
308	0.44		60.4	176.0	177.1	174.5	1.00	3.64	421
309	0.44		60.4	178.2	179.2	176.6	1.00	3.64	429
310	0.44		60.4	180.3	181.3	178.6	1.00	3.67	440
311	0.44		60.4	182.4	183.5	180.7	1.00	3.67	449
312	0.44		60.5	184.6	185.8	183.0	1.00	3.68	458
313	0.45		60.4	186.9	188.1	185.2	1.00	3.71	470
314	0.44		60.4	189.0	190.2	187.3	1.00	3.66	471
315	0.44		60.4	191.3	192.4	189.4	1.00	3.67	482
316	0.44		60.3	192.4	193.0	190.1	1.00	3.70	489
317	0.43		60.2	192.6	193.0	190.1	1.00	3.55	470
318	0.43		60.2	192.6	193.0	190.1	1.00	3.62	479
319	0.44		60.1	192.5	192.9	190.0	1.00	3.68	488
320	0.44		60.1	192.2	192.6	189.6	1.00	3.68	487
321	0.44		60.1	192.0	192.3	189.4	1.00	3.66	483
322	0.44		60.0	191.8	192.1	189.2	1.00	3.67	484
323	0.44		60.0	191.6	191.9	189.0	1.00	3.64	480
324	0.44		60.0	191.2	191.5	188.6	1.00	3.67	482
325	0.44		60.0	191.0	191.3	188.4	1.00	3.67	482
326	0.44		60.0	190.6	190.9	188.0	1.00	3.66	478
327	0.44		60.0	190.3	190.6	187.7	1.00	3.67	478
328	0.44		60.0	190.0	190.3	187.4	1.00	3.63	473
329	0.44		60.0	189.6	189.9	187.0	1.00	3.65	474
330	0.44		60.0	189.3	189.5	186.7	1.00	3.67	476
331	0.44		60.0	188.8	189.0	186.2	1.00	3.67	473
332	0.44		60.0	188.5	188.7	185.9	1.00	3.64	468
333	0.44		60.1	188.1	188.3	185.5	1.00	3.67	471
334	0.44		60.1	187.6	188.0	185.1	1.00	3.67	469
335	0.44		60.1	187.2	187.4	184.6	1.00	3.63	462

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
336	0.44		60.1	186.8	187.1	184.3	1.00	3.69	468
337	0.44		60.1	186.4	186.6	183.8	1.00	3.66	462
338	0.44		60.1	186.0	186.2	183.4	1.00	3.70	466
339	0.44		60.1	185.5	185.7	183.0	1.00	3.66	459
340	0.44		60.1	185.1	185.3	182.6	1.00	3.63	455
341	0.44		60.1	184.6	184.8	182.1	1.00	3.67	457
342	0.44		60.1	184.2	184.4	181.7	1.00	3.69	459
343	0.45		60.2	183.8	184.0	181.2	1.00	3.73	462
344	0.44		60.2	183.3	183.5	180.8	1.00	3.67	453
345	0.44		60.2	182.8	183.0	180.3	1.00	3.63	446
346	0.44		60.2	182.4	182.6	179.9	1.00	3.66	447
347	0.44		60.2	181.9	182.1	179.5	1.00	3.64	444
348	0.44		60.2	181.5	181.7	179.0	1.00	3.70	449
349	0.44		60.2	181.0	181.2	178.6	1.00	3.67	444
350	0.44		60.2	180.6	180.8	178.1	1.00	3.65	440
351	0.44		60.2	180.1	180.3	177.6	1.00	3.64	437
352	0.43		60.2	179.6	179.8	177.2	1.00	3.57	427
353	0.43		60.2	179.2	179.4	176.8	1.00	3.57	426
354	0.44		60.2	178.8	179.0	176.3	1.00	3.66	434
355	0.44		60.2	178.3	178.5	175.9	1.00	3.66	432
356	0.44		60.2	177.8	178.0	175.4	1.00	3.67	432
357	0.44		60.2	177.4	177.6	175.0	1.00	3.64	427
358	0.44		60.1	176.9	177.1	174.6	1.00	3.66	428
359	0.44		60.0	176.5	176.6	174.1	1.00	3.64	425
360	0.44		59.9	176.0	176.2	173.6	1.00	3.67	427
361	0.44		59.8	175.6	175.7	173.2	1.00	3.67	426
362	0.44		59.6	175.1	175.3	172.8	1.00	3.64	421
363	0.44		59.5	174.7	174.8	172.3	1.00	3.63	419
364	0.44		59.4	174.2	174.3	171.8	1.00	3.66	420
365	0.43		59.3	173.8	173.9	171.4	1.00	3.61	414
366	0.44		59.2	173.3	173.4	170.9	1.00	3.66	418
367	0.44		59.2	172.9	173.0	170.5	1.00	3.67	417
368	0.44		59.1	172.4	172.5	170.0	1.00	3.68	418
369	0.44		59.0	171.9	172.1	169.6	1.00	3.66	413
370	0.45		58.9	171.5	171.6	169.1	1.00	3.71	418
371	0.44		58.8	171.0	171.2	168.7	1.00	3.65	410
372	0.44		58.7	170.6	170.7	168.3	1.00	3.69	414
373	0.44		58.6	170.1	170.3	167.8	1.00	3.70	413
374	0.43		58.6	169.7	169.8	167.4	1.00	3.61	401
375	0.42		58.5	169.2	169.4	167.0	1.00	3.49	387
376	0.43		58.5	168.8	169.0	166.6	1.00	3.62	399
377	0.44		58.5	168.3	168.5	166.1	1.00	3.63	399
378	0.43		58.4	167.9	168.1	165.7	1.00	3.62	396
379	0.44		58.4	167.4	167.6	165.2	1.00	3.67	400
380	0.44		58.4	167.0	167.2	164.8	1.00	3.65	397
381	0.44		58.4	166.6	166.7	164.4	1.00	3.66	396
382	0.44		58.5	166.1	166.3	164.0	1.00	3.67	396
383	0.44		58.5	165.7	165.9	163.6	1.00	3.66	393

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
384	0.45		58.5	165.3	165.4	163.1	1.00	3.71	397
385	0.44		58.6	164.9	165.0	162.7	1.00	3.67	391
386	0.44		58.6	164.4	164.6	162.3	1.00	3.67	389
387	0.44		58.6	164.0	164.1	161.9	1.00	3.65	385
388	0.44		58.6	163.6	163.7	161.5	1.00	3.67	385
389	0.44		58.7	163.2	163.3	161.0	1.00	3.62	379
390	0.44		58.7	162.7	162.9	160.6	1.00	3.68	384
391	0.44		58.7	162.3	162.4	160.2	1.00	3.67	381
392	0.44		58.6	161.9	162.0	159.8	1.00	3.67	380
393	0.44		58.5	161.5	161.6	159.4	1.00	3.62	374
394	0.44		58.4	161.0	161.2	159.0	1.00	3.69	379
395	0.44		58.2	160.6	160.8	158.5	1.00	3.67	376
396	0.44		58.1	160.2	160.4	158.2	1.00	3.67	375
397	0.44		58.0	159.8	160.0	157.7	1.00	3.68	375
398	0.44		57.9	159.4	159.6	157.4	1.00	3.68	374
399	0.45		57.9	159.0	159.1	156.9	1.00	3.73	377
400	0.44		57.8	158.6	158.7	156.5	1.00	3.65	368
401	0.43		57.7	158.2	158.3	156.1	1.00	3.62	364
402	0.44		57.6	157.8	157.9	155.7	1.00	3.65	366
403	0.44		57.6	157.4	157.5	155.4	1.00	3.70	370
404	0.44		57.5	157.0	157.1	155.0	1.00	3.68	366
405	0.44		57.4	156.6	156.7	154.6	1.00	3.64	362
406	0.43		57.3	156.2	156.3	154.2	1.00	3.59	356
407	0.43		57.3	155.8	155.9	153.8	1.00	3.56	351
408	0.43		57.3	155.4	155.5	153.4	1.00	3.59	353
409	0.43		57.3	155.0	155.1	153.0	1.00	3.62	354
410	0.44		57.3	154.6	154.7	152.7	1.00	3.63	353
411	0.44		57.3	154.2	154.4	152.3	1.00	3.63	352
412	0.44		57.3	153.8	154.0	151.9	1.00	3.63	350
413	0.44		57.4	153.5	153.6	151.5	1.00	3.63	350
414	0.44		57.5	153.1	153.2	151.2	1.00	3.64	349
415	0.43		57.6	152.7	152.8	150.8	1.00	3.62	344
416	0.44		57.7	152.3	152.5	150.4	1.00	3.64	345
417	0.43		57.8	151.9	152.1	150.0	1.00	3.62	341
418	0.44		57.9	151.6	151.7	149.7	1.00	3.67	344
419	0.44		58.0	151.5	151.7	149.7	1.00	3.64	341
420	0.43		58.1	151.7	152.1	150.0	1.00	3.60	337
421	0.44		58.2	152.2	152.7	150.6	1.00	3.68	346
422	0.44		58.3	153.0	153.5	151.5	1.00	3.63	344
423	0.43		58.4	153.9	154.5	152.4	1.00	3.61	345
424	0.44		58.5	154.8	155.5	153.4	1.00	3.63	350
425	0.44		58.7	156.1	156.9	154.8	1.00	3.62	353
426	0.44		58.8	157.6	158.5	156.3	1.00	3.62	359
427	0.44		58.9	159.3	160.0	157.8	1.00	3.65	367
428	0.43		59.0	161.0	161.9	159.6	1.00	3.62	369
429	0.44		59.2	162.6	163.5	161.2	1.00	3.63	376
430	0.44		59.3	164.5	165.5	163.2	1.00	3.66	385
431	0.43		59.4	166.3	167.4	165.1	1.00	3.57	383

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
432	0.44		59.6	168.4	169.3	167.0	1.00	3.67	400
433	0.43		59.7	170.5	171.7	169.2	1.00	3.61	400
434	0.44		59.8	172.7	173.9	171.4	1.00	3.64	412
435	0.44		59.9	175.0	176.0	173.5	1.00	3.63	419
436	0.45		60.1	177.2	178.3	175.7	1.00	3.71	435
437	0.44		60.1	179.3	180.5	177.8	1.00	3.66	436
438	0.44		60.2	181.3	182.4	179.7	1.00	3.65	442
439	0.44		60.3	183.5	184.6	181.8	1.00	3.67	452
440	0.44		60.3	185.6	186.7	183.9	1.00	3.67	460
441	0.44		60.3	187.9	189.0	186.2	1.00	3.65	466
442	0.43		60.4	190.0	191.3	188.4	1.00	3.57	464
443	0.44		60.4	191.7	192.5	189.6	1.00	3.67	483
444	0.44		60.5	192.1	192.6	189.7	1.00	3.67	483
445	0.44		60.5	192.2	192.6	189.7	1.00	3.70	488
446	0.44		60.6	192.2	192.5	189.6	1.00	3.67	483
447	0.43		60.6	191.9	192.3	189.4	1.00	3.60	473
448	0.44		60.7	191.7	192.0	189.1	1.00	3.64	477
449	0.44		60.7	191.5	191.8	188.9	1.00	3.65	478
450	0.44		60.8	191.2	191.5	188.6	1.00	3.65	476
451	0.44		60.9	190.9	191.2	188.4	1.00	3.67	478
452	0.44		60.9	190.6	190.9	188.1	1.00	3.67	476
453	0.44		60.9	190.2	190.5	187.6	1.00	3.65	472
454	0.44		60.9	189.9	190.2	187.3	1.00	3.68	476
455	0.44		60.8	189.6	189.8	187.0	1.00	3.66	472
456	0.44		60.7	189.2	189.4	186.6	1.00	3.67	472
457	0.44		60.7	188.7	189.0	186.2	1.00	3.65	468
458	0.44		60.6	188.4	188.7	185.9	1.00	3.66	468
459	0.44		60.5	188.0	188.3	185.4	1.00	3.67	468
460	0.44		60.5	187.5	187.7	184.9	1.00	3.67	466
461	0.44		60.4	187.1	187.3	184.5	1.00	3.67	466
462	0.44		60.4	186.7	186.9	184.1	1.00	3.63	459
463	0.45		60.4	186.3	186.5	183.7	1.00	3.77	476
464	0.44		60.4	185.8	186.0	183.3	1.00	3.67	461
465	0.44		60.4	185.3	185.6	182.8	1.00	3.67	459
466	0.44		60.5	184.9	185.2	182.4	1.00	3.67	458
467	0.44		60.5	184.5	184.7	182.0	1.00	3.64	452
468	0.45		60.5	184.1	184.3	181.5	1.00	3.72	461
469	0.44		60.6	183.6	183.8	181.1	1.00	3.67	452
470	0.44		60.6	183.2	183.4	180.7	1.00	3.63	446
471	0.44		60.6	182.7	183.0	180.3	1.00	3.67	449
472	0.44		60.6	182.2	182.5	179.8	1.00	3.68	448
473	0.44		60.5	181.8	182.0	179.3	1.00	3.65	443
474	0.44		60.5	181.3	181.6	178.9	1.00	3.66	442
475	0.44		60.5	180.9	181.1	178.5	1.00	3.67	443
476	0.45		60.5	180.4	180.6	178.0	1.00	3.72	446
477	0.44		60.5	179.9	180.1	177.5	1.00	3.67	438
478	0.44		60.5	179.5	179.7	177.1	1.00	3.65	435
479	0.44		60.5	179.0	179.2	176.6	1.00	3.67	435

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
480	0.44		60.5	178.5	178.7	176.1	1.00	3.64	430
481	0.44		60.5	178.1	178.3	175.7	1.00	3.66	431
482	0.45		60.4	177.6	177.8	175.2	1.00	3.72	436
483	0.44		60.4	177.1	177.4	174.8	1.00	3.67	428
484	0.44		60.4	176.7	176.9	174.3	1.00	3.67	428
485	0.44		60.3	176.2	176.4	173.8	1.00	3.64	422
486	0.44		60.3	175.8	176.0	173.4	1.00	3.66	423
487	0.44		60.2	175.3	175.5	173.0	1.00	3.67	423
488	0.44		60.1	174.9	175.0	172.5	1.00	3.67	422
489	0.44		60.0	174.4	174.6	172.1	1.00	3.66	419
490	0.44		59.9	174.0	174.1	171.6	1.00	3.65	417
491	0.44		59.8	173.5	173.7	171.2	1.00	3.66	416
492	0.43		59.7	173.0	173.2	170.7	1.00	3.62	410
493	0.44		59.6	172.6	172.7	170.3	1.00	3.66	414
494	0.43		59.6	172.1	172.3	169.9	1.00	3.59	404
495	0.43		59.6	171.7	171.9	169.4	1.00	3.62	406
496	0.44		59.5	171.2	171.4	169.0	1.00	3.63	406
497	0.44		59.5	170.8	171.0	168.5	1.00	3.65	407
498	0.43		59.5	170.3	170.5	168.1	1.00	3.62	401
499	0.43		59.5	169.9	170.1	167.7	1.00	3.62	400
500	0.43		59.5	169.5	169.6	167.3	1.00	3.61	397
501	0.44		59.5	169.0	169.2	166.8	1.00	3.62	397
502	0.44		59.5	168.6	168.7	166.4	1.00	3.68	402
503	0.44		59.6	168.1	168.3	165.9	1.00	3.64	396
504	0.44		59.6	167.7	167.9	165.5	1.00	3.68	399
505	0.44		59.6	167.3	167.4	165.1	1.00	3.62	391
506	0.44		59.6	166.8	167.0	164.7	1.00	3.64	391
507	0.43		59.7	166.4	166.6	164.3	1.00	3.62	386
508	0.44		59.7	166.0	166.1	163.8	1.00	3.64	388
509	0.44		59.7	165.5	165.7	163.4	1.00	3.64	386
510	0.43		59.7	165.1	165.3	163.0	1.00	3.62	382
511	0.44		59.8	164.7	164.8	162.5	1.00	3.64	382
512	0.43		59.8	164.2	164.4	162.1	1.00	3.62	378
513	0.44		59.8	163.8	164.0	161.7	1.00	3.66	381
514	0.44		59.8	163.4	163.6	161.3	1.00	3.66	379
515	0.44		59.8	163.0	163.1	160.9	1.00	3.67	379
516	0.43		59.8	162.6	162.7	160.5	1.00	3.62	372
517	0.44		59.8	162.2	162.3	160.1	1.00	3.67	377
518	0.44		59.8	161.7	161.9	159.7	1.00	3.67	375
519	0.44		59.7	161.3	161.5	159.3	1.00	3.64	370
520	0.44		59.6	160.9	161.1	158.9	1.00	3.62	368
521	0.43		59.4	160.5	160.7	158.5	1.00	3.62	366
522	0.43		59.2	160.1	160.2	158.1	1.00	3.62	365
523	0.44		58.9	159.7	159.9	157.7	1.00	3.64	367
524	0.44		58.7	159.3	159.4	157.3	1.00	3.66	368
525	0.44		58.5	158.9	159.0	156.8	1.00	3.65	367
526	0.44		58.4	158.5	158.6	156.4	1.00	3.66	367
527	0.44		58.3	158.1	158.2	156.1	1.00	3.63	363

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 3

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/9/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
528	0.44		58.2	157.7	157.8	155.6	1.00	3.70	369
529	0.44		58.1	157.3	157.4	155.2	1.00	3.67	364
530	0.44		58.0	156.9	157.0	154.8	1.00	3.63	359
531	0.44		58.0	156.5	156.6	154.4	1.00	3.65	360
532	0.44		58.0	156.1	156.2	154.1	1.00	3.63	357
533	0.44		58.0	155.7	155.8	153.7	1.00	3.63	355
534	0.44		58.0	155.3	155.4	153.3	1.00	3.67	357
535	0.44		58.1	154.9	155.0	152.9	1.00	3.67	355
536	0.44		58.1	154.5	154.6	152.5	1.00	3.68	356
537	0.44		58.1	154.1	154.2	152.1	1.00	3.68	353
538	0.43		58.2	153.7	153.8	151.7	1.00	3.62	346
539	0.44		58.2	153.3	153.4	151.3	1.00	3.70	352
540	0.44		58.2	152.9	153.0	151.0	1.00	3.64	345
541	0.44		58.2	152.6	152.7	150.6	1.00	3.68	347
542	0.44		58.3	152.2	152.3	150.2	1.00	3.66	344
543	0.44		58.3	151.8	151.9	149.8	1.00	3.63	340
544	0.44		58.3	151.6	151.8	149.7	1.00	3.67	343
545	0.44		58.4	151.7	152.1	150.0	1.00	3.65	341
546	0.43		58.4	152.2	152.6	150.6	1.00	3.58	337
547	0.44		58.4	152.8	153.3	151.3	1.00	3.64	344
548	0.44		58.4	153.6	154.2	152.1	1.00	3.67	350
549	0.44		58.5	154.7	155.3	153.2	1.00	3.69	356
550	0.44		58.5	155.9	156.5	154.4	1.00	3.68	359
551	0.44		58.5	157.1	157.9	155.8	1.00	3.64	359
552	0.44		58.5	158.5	159.1	156.9	1.00	3.66	366
553	0.44		58.6	159.8	160.6	158.4	1.00	3.69	374
554	0.44		58.6	161.4	162.3	160.0	1.00	3.67	378
555	0.44		58.6	162.9	163.8	161.5	1.00	3.69	385
556	0.44		58.7	164.6	165.5	163.1	1.00	3.64	386
557	0.44		58.7	166.2	167.1	164.8	1.00	3.67	395
558	0.44		58.7	167.9	168.8	166.3	1.00	3.65	399
559	0.44		58.7	169.5	170.6	168.1	1.00	3.69	410
560	0.44		58.7	171.3	172.1	169.6	1.00	3.67	413
561	0.44		58.7	172.7	173.6	171.0	1.00	3.69	421
562	0.44		58.7	174.3	175.2	172.6	1.00	3.67	425
563	0.44		58.7	176.2	177.2	174.6	1.00	3.67	431
564	0.44		58.7	177.8	178.7	176.1	1.00	3.67	438
565	0.44		58.7	179.5	180.6	177.9	1.00	3.64	440
566	0.44		58.7	181.2	182.1	179.4	1.00	3.67	451
567	0.44		58.7	183.0	184.0	181.2	1.00	3.67	456
568	0.44		58.7	184.7	185.6	182.8	1.00	3.66	461
569	0.44		58.8	186.4	187.5	184.6	1.00	3.67	468
Average	0.44	#DIV/0!	60	171	171	169	1.00	3.64	406
								TOTAL:	**230975**

LAB SAMPLE DATA - ASTM E2515

Client: 0
Model: 0
Run #: 0

Job #: 0
Tracking #: 0
Technician: 0
Date: 1/0/1900

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	**A**	G01201	228.2	230.1	1.9
	B	G01202	228.0	229.9	1.9
	C - 1st Hour	G01203	228.4	229.0	0.6
	Amb	G01204	229.2	229.4	0.2
Probes	**A**	18A	117500.1	117500.1	0.0
	B	18B	117332.1	117332.1	0.0
	C - 1st Hour	18C	114334.9	114334.9	0.0
O-rings	**A**	18A	3602.4	3602.4	0.0
	B	18B	3545.4	3545.5	0.1
	C - 1st Hour	18C	3527.8	3527.8	0.0

Placed in Dessicator on:	1/10/2025

Balance Audit (mg):		200.0		200.0		200.0			
		Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time
Filters	**A**	230.1	1/13 10:45	230.1	1/15 13:00				
	B	229.9	1/13 10:45	229.9	1/15 13:00				
	C - 1st Hour	228.9	1/13 10:45	229.0	1/15 13:00				
	Amb	229.3	1/13 10:45	229.4	1/15 13:00				
Probes	**A**	117500.1	1/13 10:45	117500.1	1/15 13:00				
	B	117332.1	1/13 10:45	117332.1	1/15 13:00				
	C - 1st Hour	114334.9	1/13 10:45	114334.9	1/15 13:00				
O-Rings	**A**	3602.7	1/13 10:45	3602.3	1/15 13:00	3602.4	1/20 10:00		
	B	3545.8	1/13 10:45	3545.4	1/15 13:00	3545.5	1/20 10:00		
	C - 1st Hour	3528.1	1/13 10:45	3527.7	1/15 13:00	3527.8	1/20 10:00		

Train A Aggregate, mg:	**1.9**
Train B Aggregate, mg:	**2.0**
Train C Aggregate, mg:	**0.6**
Ambient, mg:	**0.2**

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 3 Test Date: 1/9/24

Wood Heater Run Notes

Pre-Test Notes
Pre-Test Start Time: 11:00
Target Load (BTU/hr): 25,000

Time	Notes
	-None-

Test Notes
Test Burn Start Time: 12:35
Target Load (BTU/hr): 25,000 (Category 2)

Time	Notes
	-None

Test Burn End Time: 22:04

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 17.00 CO (%): 4.002
Mid Gas CO_2 (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	9:15	9:17	9:18	1/10 9:00	1/10 9:01	1/10 9:03
CO_2	0.00	17.00	10.52	0.22	16.88	10.21
CO	0.000	4.002	2.569	-0.015	3.915	2.516

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

Technician Signature:  Date: 1/20/25

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 3 Test Date: 1/9/24

Test Photos



Preburn Fuel Load



Test Fuel Load



Test Fuel Loaded

Technician Signature: _____ Date: 1/20/25

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 4 Data Summary

Client:	Alternate Heating
Model:	SE110
Job #:	24-350
Tracking #:	217
Test Date:	1/10/2024

Techician Signature

2/24/2025
Date

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	74.905	61.356	59.849	10.083
Average Gas Velocity in Dilution Tunnel (ft/sec)	17.6			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	48473.0			
Average Gas Meter Temperature (°F)	66.1	88.5	88.5	74.1
Total Sample Volume (dscf)	75.671	59.914	58.788	10.174
Average Tunnel Temperature (°F)	73.9			
Total Time of Test (min)	375			
Total Particulate Catch (mg)	0.2	2.1	2.0	0.8
Particulate Concentration, dry-standard (g/dscf)	0.0000026	0.0000351	0.0000340	0.0000786
Total PM Emissions (g)	0.80	9.82	9.51	3.68
Particulate Emission Rate (g/hr)	0.13	1.57	1.52	3.68
Emissions Factor (g/kg)	-	0.46	0.45	-
Difference from Average Total Particulate Emissions (g)	-	0.16	0.16	-
Difference from Average Total Particulate Emissions (%)		1.6%	1.6%	
Difference from Average Emissions Factor (g/kg)	-	0.01	0.01	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	161.8
Appliance Average Final Temperature (F)	148.5
Heat Output (BTU)	271,934
Heat Output Rate (BTU/hr)	43,509
Heat Input - HHV (BTU)	402,504
Heat Input - LHV (BTU)	373,861

Emissions Rates and Factors

Total Particulate Emissions (g)	9.7
Emissions Factor (g/MJ)	0.0337
Emissions Factor (g/kg)	0.4542
Emissions Rate (g/hr)	1.55
Emissions Rate (lb/mmbtu output)	0.078
HHV Delivered Efficiency (%)	67.6%
LHV Delivered Efficiency (%)	72.7%
HHV SLM Efficiency (%)	80.6%
LHV SLM Efficiency (%)	86.2%
CO Emissions (g/min)	2.14

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	72.8	OK
Face Velocity	< 30 ft/min	9.0	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 64.7 / Max: 66.6	OK
Negative Probe Weight Evaluation	<5% of Total Catch	OK	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Return Temp > 120°F	>120°F	146.3	OK

B415.1 Efficiency Results

Manufacturer: Alternate Heating
Model: SE110
Date: 01/10/24
Run: 4
Control #: 24-350
Test Duration: 375
Output Category: 3

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	80.6%	86.2%
Combustion Efficiency	97.2%	97.2%
Heat Transfer Efficiency	82.9%	88.6%

Output Rate (kJ/h)	54,713	51,901	**(Btu/h)**
Burn Rate (kg/h)	3.40	7.50	**(lb/h)**
Input (kJ/h)	67,912	64,422	**(Btu/h)**

Test Load Weight (dry kg)	21.27	46.87	**dry lb**
MC wet (%)	18.21		
MC dry (%)	22.26		
Particulate (g)	9.66		
CO (g)	801		
Test Duration (h)	6.25		

Emissions	Particulate	CO
g/MJ Output	0.03	2.34
g/kg Dry Fuel	0.45	37.67
g/h	1.55	128.18
g/min	0.03	2.14
lb/MM Btu Output	0.07	5.44

Air/Fuel Ratio (A/F)	24.49

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

BOILER CORDWOOD FUEL DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

Firebox Volume (ft^3): 5.62
Target Load Weight (lbs): 56.20

Minimun Piece Weight (lbs): 4.40
Maximun Piece Weight (lbs): 17.60
80% of piece of weight range (lbs): 6.6 to 15.4

Pretest Fuel Information

Length (in)	Weight (lbs)	MC (%DB)	Length (in)	Weight (lbs)	MC (%DB)
24.00	10.15	24.3			
24.00	9.73	21.2			
24.00	7.33	23.9			
24.00	5.54	20.0			
24.00	10.02	24.8			

Total Preburn Weight (lbs): 42.77
Averge Preburn Moisture (% DB): 22.84

Test Fuel Information

Length (in)	Weight (lbs)	Moisture Content (%DB)					Avg MC (%DB)	Dry Weight (lbs)
24.00	9.63	25.9	26.3	26.9	25.9	19.0	24.80	7.72
24.00	11.98	26.9	24.5	21.5	20.2	22.5	23.12	9.73
24.00	8.71	19.6	23.1	19.5	18.1	18.6	19.78	7.27
24.00	6.51	21.6	18.7	19.7	24.7	26.9	22.32	5.32
24.00	9.13	24.3	27.4	19.7	26.4	25.5	24.66	7.32
24.00	11.26	18.6	18.0	18.8	21.5	19.6	19.30	9.44

Total (lbs): 57.22
Total Dry Weight (lbs): 46.80
Load Density (lbs/ft3): 10.18

Quality checks
Individual Piece Weights: OK
80% Piece weight range: OK

Allowable Coal Bed Range (10-20%): 5.7 - 11.4

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client:	Alternate Heating	Job #:	24-350
Model:	SE110	Tracking #:	217
Run #:	4	Technician:	AK
Test Start Time:	11:24	Date:	1/10/2024
Manufacturer's Rated Output (BTU/hr):	125,000		

Total Sampling Time (min):	375		
Recording Interval (min):	1		
Meter Box γ Factor:	1.005	(A)	
Meter Box γ Factor:	1.011	(B)	
Meter Box γ Factor:	1.000	(Ambient)	
Meter Box γ Factor:	1.000	(C)	
Induced Draft Check (in. H_2O):	0		
Smoke Capture Check (%):	100%		
Date Flue Pipe Last Cleaned:	1/6/2024		
Boiler Dry Weight (lbs):	1470		
Supply Side Water Weight (lbs):	970		

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.15	30.10	30.13
Relative Humidity (%)	35.3	22.8	
Room Air Velocity (ft/min)	<50	<50	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		74.905	ft^3

Sample Train Post-Test Leak Checks

	Pre-test	Post-test			
(A)	0.000	0.000	cfm @	-7	in. Hg
(B)	0.000	0.000	cfm @	-7	in. Hg
(C)	0.000	0.000	cfm @	-6	in. Hg
(Ambient)	0.000	0.000	cfm @	-13	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.064	78
2	0.076	78
3	0.078	78
4	0.078	78
5	0.072	78
6	0.062	78
7	0.064	78
8	0.070	78
9	0.070	78
10	0.072	78
11	0.072	78
12	0.062	78
Center	0.076	78

Static Pressure: -0.230 in. H_2O

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	12	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.7854	ft^2
V_{strav}:	17.62	ft/sec
V_{scent}:	18.38	ft/sec
F_p:	0.959	[ratio]
Initial Tunnel Flow:	804.1	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

Fuel Type:	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

Actual Fuel Used Properties

Fuel Type:	Maple
HHV (kJ/kg)	19,960
%C	50.64
%H	6.02
%O	41.74
%Ash	1.35
MC (%DB)	22.3%

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.074	0.02	67.7	0.22		57.3		70	72	68	66
1	0.142	0.142	0.072	1.19	67.7	-0.7	93	57.3	0	72	134	68	66
2	0.307	0.165	0.076	1.16	67.5	-0.64	105	56.8	-0.5	73	157	68	66
3	0.470	0.163	0.077	1.17	67.7	-0.57	103	56.8	0	71	132	68	66
4	0.635	0.165	0.075	1.15	67.7	-0.53	105	56.7	-0.1	70	115	68	66
5	0.799	0.164	0.072	1.17	68.1	-0.52	107	56.8	0.1	70	104	68	66
6	0.962	0.163	0.076	1.16	68.5	-0.49	103	56.7	-0.1	70	97	68	66
7	1.126	0.164	0.073	1.16	68.4	-0.51	106	56.8	0.1	70	91	68	66
8	1.289	0.163	0.075	1.15	68.4	-0.55	104	56.8	0	70	87	68	66
9	1.452	0.163	0.075	1.16	68.1	-0.58	104	56.8	0	70	84	68	66
10	1.616	0.164	0.073	1.15	68.9	-0.62	106	56.8	0	70	81	68	66
11	1.778	0.162	0.072	1.12	68.6	-0.66	105	57.0	0.2	70	79	68	66
12	1.940	0.162	0.076	1.16	68.6	-0.69	102	56.7	-0.3	70	78	68	66
13	2.104	0.164	0.078	1.15	68.8	-0.74	102	56.8	0.1	70	76	68	66
14	2.266	0.162	0.074	1.15	69.7	-0.75	104	56.9	0.1	70	75	68	66
15	2.430	0.164	0.076	1.15	69.9	-0.79	103	56.8	-0.1	70	75	68	66
16	2.591	0.161	0.074	1.15	69.9	-0.82	103	56.7	-0.1	69	74	68	66
17	2.753	0.162	0.078	1.20	70.4	-0.85	101	56.8	0.1	70	73	68	66
18	2.917	0.164	0.076	1.14	70.4	-0.89	103	56.8	0	70	110	68	66
19	3.078	0.161	0.074	1.16	70.5	-0.91	103	56.4	-0.4	72	141	68	66
20	3.241	0.163	0.074	1.15	71.0	-0.94	104	56.1	-0.3	73	163	68	66
21	3.402	0.161	0.076	1.14	71.1	-0.97	102	55.6	-0.5	76	195	68	66
22	3.563	0.161	0.075	1.13	70.7	-0.98	103	54.9	-0.7	77	212	68	66
23	3.725	0.162	0.074	1.17	71.7	-1.02	104	54.7	-0.2	77	221	68	66
24	3.886	0.161	0.075	1.16	71.3	-1.02	103	54.2	-0.5	78	231	68	66
25	4.045	0.159	0.078	1.14	71.9	-1.05	99	53.6	-0.6	78	239	68	66
26	4.206	0.161	0.079	1.14	71.8	-1.07	100	53.2	-0.4	79	246	68	66
27	4.371	0.165	0.077	1.10	72.1	-1.09	104	52.7	-0.5	79	253	68	66
28	4.528	0.157	0.076	1.13	73.1	-1.09	99	52.0	-0.7	79	258	68	66
29	4.693	0.165	0.075	1.14	72.6	-1.1	105	51.6	-0.4	80	262	68	66
30	4.854	0.161	0.076	1.13	73.7	-1.11	102	51.2	-0.4	80	265	68	66
31	5.015	0.161	0.077	1.12	73.3	-1.11	101	50.4	-0.8	81	271	68	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	5.177	0.162	0.074	1.11	73.4	-1.12	104	50.0	-0.4	81	275	68	66
33	5.337	0.160	0.073	1.14	74.5	-1.12	103	49.5	-0.5	81	279	69	66
34	5.500	0.163	0.077	1.13	74.1	-1.11	102	48.9	-0.6	81	280	69	66
35	5.660	0.160	0.077	1.13	75.1	-1.13	100	48.5	-0.4	82	283	69	66
36	5.822	0.162	0.076	1.13	74.7	-1.11	102	48.0	-0.5	82	283	69	66
37	5.983	0.161	0.076	1.13	75.6	-1.12	102	47.5	-0.5	82	284	69	66
38	6.145	0.162	0.076	1.14	75.2	-1.08	102	47.1	-0.4	82	286	69	66
39	6.305	0.160	0.077	1.12	76.2	-1.11	100	46.5	-0.6	82	286	69	66
40	6.466	0.161	0.077	1.13	75.8	-1.11	101	45.9	-0.6	82	288	69	66
41	6.629	0.163	0.076	1.14	76.3	-1.1	103	45.5	-0.4	82	289	69	66
42	6.789	0.160	0.074	1.13	76.5	-1.1	102	45.0	-0.5	83	291	69	66
43	6.952	0.163	0.076	1.11	76.6	-1.1	103	44.5	-0.5	83	292	69	66
44	7.112	0.160	0.076	1.13	76.8	-1.1	101	44.0	-0.5	83	292	69	66
45	7.275	0.163	0.075	1.14	77.2	-1.11	103	43.4	-0.6	83	293	70	66
46	7.435	0.160	0.077	1.15	78.0	-1.12	100	42.9	-0.5	83	294	70	66
47	7.597	0.162	0.078	1.11	77.6	-1.13	101	42.4	-0.5	83	295	70	66
48	7.758	0.161	0.075	1.11	77.8	-1.1	102	41.8	-0.6	83	295	70	66
49	7.919	0.161	0.076	1.15	78.8	-1.11	101	41.6	-0.2	83	295	70	66
50	8.082	0.163	0.074	1.15	78.3	-1.12	104	40.9	-0.7	84	296	70	66
51	8.242	0.160	0.076	1.14	79.3	-1.12	100	40.7	-0.2	83	296	70	66
52	8.405	0.163	0.076	1.13	79.0	-1.13	102	40.1	-0.6	84	297	70	66
53	8.565	0.160	0.076	1.13	79.8	-1.13	100	39.4	-0.7	84	297	70	66
54	8.728	0.163	0.079	1.15	79.3	-1.16	100	39.1	-0.3	81	269	70	66
55	8.889	0.161	0.074	1.15	79.6	-1.16	102	38.7	-0.4	76	207	70	66
56	9.051	0.162	0.078	1.14	79.9	-1.15	99	38.7	0	75	177	70	66
57	9.215	0.164	0.078	1.14	80.1	-1.17	101	38.8	0.1	74	158	70	66
58	9.376	0.161	0.078	1.14	80.3	-1.18	99	38.5	-0.3	73	144	70	66
59	9.539	0.163	0.077	1.15	81.3	-1.17	100	38.5	0	73	133	70	66
60	9.701	0.162	0.078	1.14	81.4	-1.18	99	38.5	0	72	124	70	66
61	9.863	0.162	0.077	1.13	81.4	-1.19	100	38.5	0	72	116	70	66
62	10.027	0.164	0.075	1.14	81.2	-1.2	102	38.4	-0.1	72	110	70	66
63	10.188	0.161	0.076	1.14	81.5	-1.2	100	38.4	0	72	104	70	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	10.352	0.164	0.072	1.14	81.7	-1.22	104	38.6	0.2	72	100	70	66
65	10.514	0.162	0.076	1.13	82.3	-1.24	100	38.4	-0.2	72	96	70	66
66	10.676	0.162	0.077	1.13	82.8	-1.26	99	38.6	0.2	72	93	70	66
67	10.840	0.164	0.077	1.15	83.0	-1.25	100	38.5	-0.1	72	90	70	66
68	11.002	0.162	0.077	1.14	82.9	-1.28	99	38.5	0	71	88	70	66
69	11.163	0.161	0.077	1.14	82.6	-1.27	99	38.6	0.1	71	86	70	66
70	11.325	0.162	0.076	1.13	83.6	-1.3	100	38.6	0	71	84	70	66
71	11.490	0.165	0.080	1.09	83.1	-1.31	99	38.3	-0.3	71	83	70	65
72	11.654	0.164	0.078	1.14	84.0	-1.34	100	38.6	0.3	71	82	69	66
73	11.816	0.162	0.076	1.14	84.1	-1.33	100	38.5	-0.1	71	81	69	66
74	11.979	0.163	0.077	1.14	84.4	-1.36	100	38.5	0	71	80	69	66
75	12.143	0.164	0.079	1.18	84.4	-1.38	99	38.5	0	71	79	69	66
76	12.305	0.162	0.075	1.15	84.0	-1.39	100	38.6	0.1	70	78	69	66
77	12.466	0.161	0.078	1.14	84.3	-1.41	98	38.5	-0.1	71	78	69	66
78	12.632	0.166	0.077	1.14	84.2	-1.44	101	38.4	-0.1	70	77	69	66
79	12.794	0.162	0.077	1.15	85.1	-1.46	99	38.5	0.1	70	77	69	66
80	12.958	0.164	0.078	1.15	85.3	-1.49	99	38.5	0	70	76	69	66
81	13.121	0.163	0.078	1.14	85.5	-1.49	99	38.5	0	70	76	69	66
82	13.284	0.163	0.076	1.15	84.9	-1.51	100	38.5	0	70	76	69	66
83	13.448	0.164	0.077	1.15	84.9	-1.53	100	38.6	0.1	70	75	69	66
84	13.610	0.162	0.075	1.15	85.3	-1.54	100	38.4	-0.2	70	75	69	66
85	13.773	0.163	0.077	1.15	86.0	-1.57	99	38.4	0	70	75	69	66
86	13.938	0.165	0.077	1.16	86.1	-1.58	100	38.4	0	70	74	69	66
87	14.100	0.162	0.075	1.13	86.2	-1.59	100	38.4	0	70	74	69	66
88	14.264	0.164	0.075	1.12	86.4	-1.61	101	38.5	0.1	70	74	69	66
89	14.428	0.164	0.076	1.16	85.9	-1.63	100	38.4	-0.1	70	74	69	66
90	14.590	0.162	0.078	1.15	86.7	-1.65	98	38.4	0	70	73	69	66
91	14.754	0.164	0.078	1.16	86.9	-1.66	99	38.5	0.1	70	73	69	66
92	14.918	0.164	0.079	1.14	86.5	-1.67	98	38.4	-0.1	70	73	69	66
93	15.077	0.159	0.077	1.15	86.5	-1.69	97	38.4	0	70	73	69	66
94	15.242	0.165	0.075	1.13	86.5	-1.68	102	38.6	0.2	70	73	69	66
95	15.408	0.166	0.072	1.14	87.1	-1.71	104	38.6	0	70	73	69	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	15.571	0.163	0.074	1.14	87.2	-1.72	101	38.6	0	70	72	69	66
97	15.736	0.165	0.078	1.15	87.5	-1.73	99	38.5	-0.1	70	72	69	66
98	15.899	0.163	0.076	1.14	87.7	-1.75	99	38.5	0	70	72	69	66
99	16.062	0.163	0.078	1.16	87.3	-1.76	98	38.2	-0.3	70	72	69	66
100	16.227	0.165	0.072	1.16	87.2	-1.77	104	38.5	0.3	70	72	69	66
101	16.390	0.163	0.078	1.14	87.3	-1.79	98	38.6	0.1	70	72	69	66
102	16.552	0.162	0.075	1.15	88.1	-1.79	99	38.4	-0.2	70	72	68	66
103	16.718	0.166	0.075	1.15	88.2	-1.8	102	38.5	0.1	70	72	69	66
104	16.881	0.163	0.078	1.14	87.7	-1.81	98	38.3	-0.2	70	71	69	66
105	17.044	0.163	0.077	1.14	88.3	-1.81	99	38.5	0.2	70	71	69	66
106	17.209	0.165	0.076	1.16	87.9	-1.82	101	38.3	-0.2	70	71	68	66
107	17.372	0.163	0.078	1.15	87.9	-1.85	98	38.5	0.2	70	71	68	66
108	17.536	0.164	0.078	1.15	88.3	-1.84	99	38.4	-0.1	70	71	68	66
109	17.700	0.164	0.075	1.16	88.4	-1.86	101	38.4	0	73	130	68	66
110	17.863	0.163	0.078	1.13	88.1	-1.86	99	37.9	-0.5	76	169	69	66
111	18.027	0.164	0.078	1.14	88.9	-1.88	99	37.7	-0.2	76	187	68	66
112	18.191	0.164	0.075	1.15	89.0	-1.89	101	37.4	-0.3	76	200	69	66
113	18.353	0.162	0.078	1.14	88.5	-1.88	98	36.9	-0.5	77	213	69	66
114	18.518	0.165	0.077	1.14	88.5	-1.88	101	36.5	-0.4	78	224	69	66
115	18.681	0.163	0.077	1.16	88.5	-1.88	99	36.3	-0.2	78	235	69	66
116	18.844	0.163	0.079	1.14	89.2	-1.89	98	35.7	-0.6	79	248	69	66
117	19.009	0.165	0.075	1.14	89.4	-1.88	102	34.9	-0.8	80	258	69	66
118	19.171	0.162	0.077	1.12	88.6	-1.86	99	34.4	-0.5	80	265	69	66
119	19.331	0.160	0.076	1.11	88.8	-1.85	98	33.8	-0.6	81	271	69	66
120	19.498	0.167	0.075	1.14	89.0	-1.82	103	33.4	-0.4	81	274	69	66
121	19.661	0.163	0.077	1.14	89.6	-1.82	100	32.7	-0.7	81	277	69	66
122	19.824	0.163	0.076	1.15	89.7	-1.78	100	32.3	-0.4	82	281	69	66
123	19.986	0.162	0.075	1.14	89.1	-1.75	100	31.6	-0.7	82	283	69	66
124	20.151	0.165	0.076	1.14	89.8	-1.72	101	31.1	-0.5	82	285	69	66
125	20.315	0.164	0.074	1.14	89.2	-1.68	102	30.5	-0.6	82	286	69	66
126	20.479	0.164	0.078	1.15	89.7	-1.65	100	30.0	-0.5	82	288	69	66
127	20.641	0.162	0.075	1.16	90.0	-1.62	100	29.4	-0.6	82	288	69	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	20.806	0.165	0.075	1.14	89.4	-1.57	102	29.0	-0.4	82	289	69	66
129	20.969	0.163	0.076	1.14	90.2	-1.53	100	28.5	-0.5	82	288	69	66
130	21.132	0.163	0.075	1.13	90.1	-1.51	101	28.0	-0.5	82	288	69	66
131	21.293	0.161	0.075	1.14	90.3	-1.48	100	27.5	-0.5	82	288	69	66
132	21.456	0.163	0.076	1.14	90.4	-1.45	100	27.0	-0.5	82	286	70	66
133	21.622	0.166	0.075	1.14	90.2	-1.43	103	26.5	-0.5	83	287	70	66
134	21.784	0.162	0.075	1.15	89.8	-1.41	100	25.9	-0.6	82	287	70	66
135	21.944	0.160	0.078	1.14	90.3	-1.39	97	25.7	-0.2	82	287	70	66
136	22.109	0.165	0.075	1.14	90.5	-1.38	102	25.2	-0.5	83	287	70	66
137	22.274	0.165	0.075	1.13	90.7	-1.36	102	24.8	-0.4	83	289	70	66
138	22.434	0.160	0.075	1.14	90.8	-1.34	99	24.2	-0.6	83	290	70	66
139	22.599	0.165	0.076	1.14	90.2	-1.34	101	23.8	-0.4	83	290	70	66
140	22.765	0.166	0.078	1.14	90.0	-1.31	101	23.4	-0.4	83	291	70	66
141	22.928	0.163	0.076	1.14	90.2	-1.32	100	22.9	-0.5	81	271	70	66
142	23.093	0.165	0.076	1.13	90.3	-1.31	101	22.5	-0.4	76	207	70	66
143	23.253	0.160	0.077	1.14	90.4	-1.3	97	22.5	0	75	179	70	66
144	23.419	0.166	0.076	1.12	91.1	-1.29	101	22.4	-0.1	74	162	70	66
145	23.582	0.163	0.074	1.20	90.6	-1.28	101	22.3	-0.1	73	150	70	66
146	23.745	0.163	0.075	1.16	90.8	-1.27	100	22.2	-0.1	73	140	70	66
147	23.909	0.164	0.077	1.15	90.4	-1.28	99	22.2	0	72	132	70	66
148	24.074	0.165	0.075	1.15	90.6	-1.27	101	22.1	-0.1	72	124	70	66
149	24.241	0.167	0.074	1.15	91.1	-1.28	103	22.0	-0.1	72	117	70	66
150	24.404	0.163	0.077	1.14	90.8	-1.3	98	22.2	0.2	72	111	70	66
151	24.569	0.165	0.076	1.15	91.5	-1.3	100	22.1	-0.1	72	105	70	67
152	24.733	0.164	0.076	1.15	90.7	-1.31	100	22.1	0	72	101	70	66
153	24.894	0.161	0.077	1.15	91.3	-1.31	97	22.0	-0.1	72	97	70	66
154	25.059	0.165	0.076	1.16	90.9	-1.32	100	22.1	0.1	71	93	70	67
155	25.223	0.164	0.073	1.13	90.8	-1.34	102	22.2	0.1	71	91	70	67
156	25.386	0.163	0.077	1.15	90.9	-1.36	98	22.0	-0.2	71	88	70	66
157	25.552	0.166	0.077	1.11	90.9	-1.38	100	22.1	0.1	71	86	69	66
158	25.715	0.163	0.074	1.14	90.9	-1.39	100	22.0	-0.1	71	84	69	66
159	25.882	0.167	0.073	1.16	91.0	-1.4	103	22.1	0.1	71	83	69	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	26.045	0.163	0.075	1.15	91.4	-1.45	100	22.1	0	71	82	69	66
161	26.211	0.166	0.076	1.14	91.2	-1.46	101	22.0	-0.1	71	80	69	67
162	26.372	0.161	0.075	1.15	91.6	-1.48	98	22.0	0	71	80	69	67
163	26.539	0.167	0.075	1.15	91.7	-1.5	102	22.0	0	71	79	69	67
164	26.701	0.162	0.075	1.14	92.0	-1.52	99	22.0	0	71	78	69	67
165	26.864	0.163	0.077	1.15	91.3	-1.52	98	22.1	0.1	71	77	69	67
166	27.030	0.166	0.075	1.15	91.7	-1.56	101	22.1	0	71	77	69	66
167	27.197	0.167	0.075	1.18	91.7	-1.56	102	22.1	0	71	76	69	66
168	27.357	0.160	0.076	1.15	91.4	-1.57	97	22.2	0.1	71	76	69	66
169	27.522	0.165	0.075	1.14	92.0	-1.6	101	22.1	-0.1	71	76	69	66
170	27.687	0.165	0.076	1.14	91.3	-1.62	100	22.1	0	71	75	69	66
171	27.850	0.163	0.077	1.15	92.3	-1.65	98	22.0	-0.1	71	75	69	67
172	28.015	0.165	0.075	1.15	91.4	-1.65	101	22.2	0.2	70	75	69	66
173	28.180	0.165	0.075	1.17	91.7	-1.67	101	21.9	-0.3	71	74	69	66
174	28.343	0.163	0.076	1.15	92.3	-1.69	99	22.1	0.2	70	74	69	66
175	28.507	0.164	0.076	1.14	91.9	-1.7	99	22.1	0	70	74	69	66
176	28.673	0.166	0.075	1.15	91.6	-1.73	101	22.2	0.1	70	74	69	66
177	28.836	0.163	0.078	1.15	92.3	-1.73	97	22.1	-0.1	70	73	69	66
178	29.000	0.164	0.078	1.12	91.7	-1.75	98	22.1	0	70	73	69	66
179	29.166	0.166	0.074	1.15	91.7	-1.75	102	22.1	0	70	73	69	66
180	29.329	0.163	0.076	1.16	91.8	-1.78	99	22.2	0.1	70	73	69	66
181	29.493	0.164	0.077	1.15	92.1	-1.79	99	22.1	-0.1	70	73	69	66
182	29.659	0.166	0.079	1.14	91.7	-1.8	99	22.2	0.1	70	73	69	66
183	29.822	0.163	0.078	1.15	92.3	-1.81	97	22.1	-0.1	70	73	69	66
184	29.986	0.164	0.078	1.15	91.8	-1.82	98	22.2	0.1	70	73	69	66
185	30.154	0.168	0.076	1.15	91.9	-1.83	102	22.2	0	70	72	69	66
186	30.315	0.161	0.074	1.15	92.5	-1.82	99	22.1	-0.1	70	72	69	66
187	30.479	0.164	0.073	1.16	91.9	-1.84	101	22.3	0.2	70	72	69	66
188	30.645	0.166	0.076	1.15	91.9	-1.86	101	22.1	-0.2	70	72	69	66
189	30.809	0.164	0.077	1.16	92.3	-1.85	99	22.1	0	70	72	69	66
190	30.972	0.163	0.077	1.15	92.1	-1.88	98	22.2	0.1	70	72	69	66
191	31.137	0.165	0.077	1.16	92.0	-1.89	99	22.2	0	70	72	69	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
192	31.302	0.165	0.077	1.15	92.8	-1.88	99	22.1	-0.1	70	72	69	66
193	31.468	0.166	0.078	1.13	92.1	-1.91	99	22.2	0.1	70	72	69	66
194	31.630	0.162	0.075	1.16	92.7	-1.92	99	21.9	-0.3	70	71	69	66
195	31.795	0.165	0.077	1.14	92.0	-1.91	99	22.2	0.3	70	71	69	66
196	31.958	0.163	0.078	1.14	92.1	-1.92	97	22.2	0	70	71	69	66
197	32.123	0.165	0.079	1.15	92.2	-1.9	98	22.0	-0.2	70	89	69	66
198	32.288	0.165	0.077	1.14	92.0	-1.92	100	22.0	0	74	135	69	66
199	32.451	0.163	0.075	1.13	92.5	-1.94	100	21.6	-0.4	75	170	69	66
200	32.615	0.164	0.075	1.15	92.1	-1.96	100	21.4	-0.2	76	186	69	66
201	32.780	0.165	0.075	1.16	92.7	-1.94	101	20.9	-0.5	76	197	69	66
202	32.943	0.163	0.077	1.14	92.7	-1.96	99	20.7	-0.2	76	207	69	66
203	33.107	0.164	0.075	1.12	93.0	-1.95	100	20.5	-0.2	77	215	69	66
204	33.272	0.165	0.076	1.14	92.2	-1.96	101	20.1	-0.4	77	221	69	66
205	33.435	0.163	0.077	1.14	92.3	-1.96	99	19.7	-0.4	78	226	69	66
206	33.599	0.164	0.075	1.15	92.8	-1.94	101	19.3	-0.4	78	232	69	66
207	33.764	0.165	0.075	1.14	92.2	-1.92	101	19.0	-0.3	78	236	69	66
208	33.927	0.163	0.075	1.14	92.4	-1.92	100	18.5	-0.5	79	240	69	67
209	34.091	0.164	0.077	1.14	92.8	-1.9	99	18.1	-0.4	79	246	69	66
210	34.256	0.165	0.076	1.14	92.8	-1.86	101	17.7	-0.4	80	249	69	66
211	34.419	0.163	0.076	1.14	92.3	-1.85	100	17.2	-0.5	80	252	69	66
212	34.585	0.166	0.073	1.17	92.9	-1.83	103	16.6	-0.6	80	255	69	66
213	34.747	0.162	0.075	1.14	93.0	-1.8	100	16.5	-0.1	80	257	69	67
214	34.910	0.163	0.076	1.14	92.3	-1.75	100	15.9	-0.6	80	258	69	67
215	35.074	0.164	0.077	1.14	92.3	-1.73	100	15.6	-0.3	80	260	69	67
216	35.239	0.165	0.076	1.12	92.5	-1.71	101	15.1	-0.5	80	263	69	67
217	35.402	0.163	0.077	1.14	92.4	-1.66	99	14.7	-0.4	80	266	69	67
218	35.566	0.164	0.075	1.15	93.0	-1.64	101	14.3	-0.4	81	268	69	67
219	35.731	0.165	0.076	1.14	93.1	-1.6	101	14.0	-0.3	81	271	69	67
220	35.894	0.163	0.075	1.14	92.3	-1.56	100	13.6	-0.4	81	272	70	67
221	36.058	0.164	0.078	1.12	93.0	-1.55	99	13.3	-0.3	81	271	70	67
222	36.223	0.165	0.075	1.11	92.6	-1.53	101	12.9	-0.4	81	271	70	67
223	36.385	0.162	0.076	1.14	93.1	-1.5	99	12.5	-0.4	81	266	70	67

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
224	36.550	0.165	0.076	1.16	92.4	-1.48	101	12.1	-0.4	80	261	70	67
225	36.714	0.164	0.074	1.12	92.4	-1.45	102	11.9	-0.2	80	257	70	67
226	36.877	0.163	0.076	1.14	93.2	-1.43	99	11.4	-0.5	80	256	70	67
227	37.042	0.165	0.076	1.15	92.5	-1.41	101	11.2	-0.2	80	254	70	67
228	37.206	0.164	0.077	1.13	92.5	-1.41	99	11.0	-0.2	80	252	70	67
229	37.369	0.163	0.076	1.14	93.0	-1.39	99	10.5	-0.5	79	247	70	67
230	37.534	0.165	0.075	1.16	93.2	-1.39	101	10.3	-0.2	76	206	70	67
231	37.699	0.165	0.076	1.15	93.3	-1.38	100	10.0	-0.3	74	167	70	67
232	37.862	0.163	0.077	1.17	93.2	-1.35	98	10.1	0.1	73	147	70	67
233	38.026	0.164	0.077	1.16	93.2	-1.36	99	10.1	0	73	135	70	67
234	38.192	0.166	0.076	1.15	93.1	-1.36	101	10.0	-0.1	72	127	70	66
235	38.355	0.163	0.077	1.15	92.5	-1.37	98	9.9	-0.1	72	121	70	66
236	38.522	0.167	0.076	1.15	92.6	-1.37	101	9.9	0	72	116	70	66
237	38.685	0.163	0.074	1.17	93.2	-1.34	100	10.0	0.1	72	111	70	66
238	38.848	0.163	0.076	1.15	93.2	-1.36	99	9.9	-0.1	72	106	70	67
239	39.012	0.164	0.076	1.15	92.5	-1.39	99	9.9	0	72	102	70	66
240	39.178	0.166	0.078	1.15	92.6	-1.4	99	9.9	0	72	98	70	66
241	39.344	0.166	0.075	1.15	93.3	-1.4	101	9.9	0	71	95	69	66
242	39.505	0.161	0.076	1.17	93.2	-1.43	97	9.8	-0.1	71	92	69	66
243	39.671	0.166	0.076	1.15	92.6	-1.44	101	9.9	0.1	71	89	69	66
244	39.834	0.163	0.077	1.15	93.4	-1.45	98	9.8	-0.1	71	87	69	66
245	40.001	0.167	0.077	1.15	93.5	-1.47	100	9.8	0	71	85	69	67
246	40.166	0.165	0.076	1.15	93.4	-1.49	100	9.8	0	71	84	69	66
247	40.330	0.164	0.078	1.14	93.2	-1.52	98	9.9	0.1	71	82	69	66
248	40.494	0.164	0.077	1.15	92.7	-1.54	99	9.9	0	71	81	69	67
249	40.657	0.163	0.076	1.15	93.5	-1.55	99	9.9	0	71	80	69	66
250	40.824	0.167	0.076	1.14	92.8	-1.58	101	9.7	-0.2	71	79	69	66
251	40.987	0.163	0.077	1.17	92.8	-1.6	98	9.8	0.1	71	78	69	66
252	41.149	0.162	0.075	1.13	92.8	-1.61	99	10.0	0.2	71	78	69	66
253	41.314	0.165	0.077	1.15	93.4	-1.62	99	9.9	-0.1	71	77	69	66
254	41.477	0.163	0.076	1.16	93.5	-1.65	99	9.8	-0.1	71	77	69	66
255	41.642	0.165	0.076	1.16	92.8	-1.66	100	10.1	0.3	71	76	69	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
256	41.807	0.165	0.075	1.16	93.5	-1.69	100	9.8	-0.3	71	76	69	66
257	41.974	0.167	0.078	1.16	92.8	-1.72	100	9.6	-0.2	71	76	69	66
258	42.135	0.161	0.078	1.15	93.5	-1.74	96	9.7	0.1	71	75	69	66
259	42.300	0.165	0.076	1.15	93.6	-1.74	100	9.9	0.2	70	75	69	66
260	42.467	0.167	0.078	1.15	92.8	-1.76	100	9.9	0	70	75	69	66
261	42.631	0.164	0.075	1.15	93.6	-1.77	100	9.9	0	70	74	69	66
262	42.794	0.163	0.076	1.14	93.6	-1.79	98	10.0	0.1	70	74	69	66
263	42.957	0.163	0.076	1.14	93.5	-1.8	98	10.0	0	70	74	69	66
264	43.121	0.164	0.077	1.14	93.6	-1.81	98	9.9	-0.1	70	74	69	66
265	43.289	0.168	0.076	1.15	93.7	-1.83	101	9.9	0	70	73	69	66
266	43.451	0.162	0.075	1.12	93.6	-1.84	99	9.8	-0.1	70	73	69	66
267	43.615	0.164	0.076	1.15	93.0	-1.85	99	10.1	0.3	70	73	69	66
268	43.780	0.165	0.078	1.16	93.4	-1.86	98	10.0	-0.1	70	73	69	66
269	43.944	0.164	0.076	1.15	93.4	-1.87	99	9.9	-0.1	70	73	69	66
270	44.108	0.164	0.076	1.15	93.8	-1.89	99	9.9	0	70	73	69	66
271	44.273	0.165	0.076	1.14	93.4	-1.9	100	10.0	0.1	70	72	69	66
272	44.438	0.165	0.074	1.14	93.2	-1.9	101	10.0	0	70	72	69	66
273	44.601	0.163	0.077	1.16	93.6	-1.91	98	10.0	0	70	72	69	66
274	44.766	0.165	0.077	1.13	93.8	-1.92	99	10.0	0	70	72	69	66
275	44.934	0.168	0.075	1.14	93.7	-1.92	102	9.7	-0.3	70	72	69	66
276	45.095	0.161	0.076	1.19	93.8	-1.93	97	10.0	0.3	70	72	69	66
277	45.262	0.167	0.075	1.15	93.8	-1.97	101	10.0	0	70	72	69	66
278	45.424	0.162	0.078	1.15	93.7	-1.97	97	9.9	-0.1	70	72	69	66
279	45.588	0.164	0.076	1.17	93.1	-1.93	99	10.0	0.1	70	72	69	66
280	45.752	0.164	0.079	1.15	93.5	-1.94	97	10.0	0	70	71	69	66
281	45.917	0.165	0.077	1.14	93.0	-1.97	99	10.1	0.1	70	71	69	66
282	46.084	0.167	0.075	1.19	93.2	-1.97	102	10.3	0.2	70	71	68	66
283	46.245	0.161	0.076	1.15	93.9	-1.97	97	10.0	-0.3	70	71	68	66
284	46.413	0.168	0.077	1.15	93.9	-1.98	101	9.9	-0.1	70	71	68	66
285	46.574	0.161	0.077	1.14	93.7	-1.99	97	9.9	0	70	71	68	66
286	46.738	0.164	0.077	1.15	93.1	-1.98	99	10.0	0.1	71	125	68	66
287	46.904	0.166	0.076	1.15	93.9	-2	100	9.6	-0.4	73	139	68	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
288	47.068	0.164	0.074	1.15	93.8	-1.99	101	9.5	-0.1	74	164	68	66
289	47.231	0.163	0.076	1.15	93.8	-2.01	99	9.1	-0.4	74	176	68	66
290	47.396	0.165	0.076	1.14	93.1	-2.03	100	8.9	-0.2	75	190	69	66
291	47.560	0.164	0.077	1.11	93.3	-2.03	99	8.6	-0.3	75	202	69	66
292	47.723	0.163	0.074	1.14	93.3	-2.01	100	8.4	-0.2	76	213	68	66
293	47.889	0.166	0.074	1.13	93.2	-2.01	102	8.0	-0.4	76	221	68	66
294	48.052	0.163	0.073	1.15	93.6	-1.99	101	7.6	-0.4	77	229	69	66
295	48.216	0.164	0.073	1.15	93.6	-2	102	7.2	-0.4	77	238	69	66
296	48.382	0.166	0.077	1.15	93.7	-1.97	100	6.9	-0.3	77	236	69	66
297	48.545	0.163	0.076	1.12	93.1	-1.98	99	6.7	-0.2	78	240	69	66
298	48.708	0.163	0.075	1.14	93.9	-1.95	100	6.4	-0.3	78	245	69	66
299	48.874	0.166	0.076	1.15	93.2	-1.93	101	6.1	-0.3	78	246	69	66
300	49.037	0.163	0.076	1.13	93.8	-1.9	99	5.7	-0.4	78	246	69	66
301	49.202	0.165	0.077	1.13	93.9	-1.89	100	5.5	-0.2	79	252	69	66
302	49.366	0.164	0.073	1.15	93.2	-1.86	102	5.2	-0.3	79	258	69	66
303	49.528	0.162	0.075	1.14	93.4	-1.85	99	4.8	-0.4	80	261	69	66
304	49.691	0.163	0.076	1.15	93.9	-1.8	99	4.5	-0.3	80	263	69	66
305	49.858	0.167	0.076	1.14	93.7	-1.8	102	4.1	-0.4	80	262	69	66
306	50.023	0.165	0.077	1.15	93.7	-1.76	100	4.0	-0.1	80	265	69	66
307	50.183	0.160	0.078	1.14	93.3	-1.73	96	3.6	-0.4	81	267	69	66
308	50.348	0.165	0.076	1.16	93.5	-1.72	101	3.1	-0.5	80	265	69	66
309	50.512	0.164	0.077	1.13	93.4	-1.66	99	3.0	-0.1	80	268	69	65
310	50.675	0.163	0.076	1.14	93.9	-1.67	99	2.9	-0.1	81	269	69	65
311	50.842	0.167	0.076	1.13	93.2	-1.64	102	2.4	-0.5	81	268	69	66
312	51.007	0.165	0.075	1.16	93.7	-1.64	101	2.1	-0.3	81	268	69	66
313	51.167	0.160	0.077	1.15	93.9	-1.62	97	2.0	-0.1	80	266	69	66
314	51.332	0.165	0.075	1.15	93.9	-1.59	101	1.7	-0.3	80	265	69	66
315	51.496	0.164	0.076	1.16	93.5	-1.58	100	1.3	-0.4	80	264	69	66
316	51.662	0.166	0.076	1.13	93.9	-1.57	101	1.4	0.1	80	255	69	66
317	51.824	0.162	0.076	1.13	93.3	-1.56	99	0.9	-0.5	79	252	69	66
318	51.988	0.164	0.077	1.15	93.6	-1.56	99	0.6	-0.3	79	246	69	66
319	52.154	0.166	0.077	1.15	93.8	-1.54	100	0.6	0	75	188	69	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	52.317	0.163	0.075	1.15	93.8	-1.54	99	0.5	-0.1	74	158	69	66
321	52.481	0.164	0.074	1.17	93.0	-1.51	101	0.5	0	73	139	69	66
322	52.644	0.163	0.075	1.14	93.8	-1.51	99	0.5	0	72	126	69	66
323	52.809	0.165	0.077	1.15	93.5	-1.52	99	0.4	-0.1	72	117	69	66
324	52.974	0.165	0.077	1.15	93.9	-1.5	99	0.4	0	72	110	69	66
325	53.140	0.166	0.076	1.16	93.0	-1.52	101	0.4	0	72	105	69	66
326	53.302	0.162	0.079	1.15	93.7	-1.52	96	0.3	-0.1	72	101	69	66
327	53.467	0.165	0.076	1.15	93.0	-1.53	100	0.3	0	71	97	69	66
328	53.630	0.163	0.077	1.14	93.8	-1.54	98	0.4	0.1	71	94	69	66
329	53.794	0.164	0.074	1.12	93.6	-1.55	100	0.3	-0.1	71	91	69	66
330	53.960	0.166	0.078	1.15	93.2	-1.56	99	0.3	0	71	89	69	66
331	54.123	0.163	0.077	1.14	93.1	-1.56	98	0.3	0	71	87	69	66
332	54.287	0.164	0.077	1.14	93.3	-1.6	99	0.4	0.1	71	85	69	66
333	54.453	0.166	0.076	1.14	93.1	-1.62	100	0.4	0	71	84	69	66
334	54.616	0.163	0.076	1.11	93.1	-1.62	99	0.4	0	71	83	69	66
335	54.783	0.167	0.078	1.13	93.8	-1.65	100	0.3	-0.1	71	82	69	66
336	54.946	0.163	0.077	1.15	93.0	-1.66	98	0.4	0.1	71	81	69	66
337	55.109	0.163	0.076	1.15	93.8	-1.67	98	0.4	0	70	80	69	66
338	55.273	0.164	0.076	1.14	93.8	-1.68	99	0.3	-0.1	70	79	69	66
339	55.439	0.166	0.078	1.15	93.4	-1.72	99	0.5	0.2	70	78	69	66
340	55.602	0.163	0.077	1.15	93.1	-1.72	98	0.4	-0.1	70	78	69	66
341	55.766	0.164	0.075	1.15	93.3	-1.75	100	0.4	0	70	77	68	66
342	55.933	0.167	0.078	1.14	93.6	-1.76	100	0.3	-0.1	70	77	68	66
343	56.095	0.162	0.079	1.14	93.6	-1.79	96	0.4	0.1	70	76	68	65
344	56.259	0.164	0.076	1.12	92.9	-1.79	99	0.5	0.1	70	76	68	66
345	56.424	0.165	0.075	1.14	93.7	-1.81	100	0.4	-0.1	70	75	68	66
346	56.588	0.164	0.074	1.14	93.7	-1.83	100	0.4	0	70	75	68	66
347	56.755	0.167	0.077	1.15	93.4	-1.83	100	0.3	-0.1	70	75	68	66
348	56.917	0.162	0.075	1.16	93.7	-1.85	98	0.4	0.1	70	75	68	65
349	57.084	0.167	0.078	1.15	93.1	-1.86	100	0.4	0	70	74	68	66
350	57.248	0.164	0.076	1.12	93.1	-1.87	99	0.4	0	70	74	68	66
351	57.410	0.162	0.078	1.15	93.7	-1.9	97	0.3	-0.1	70	74	68	66

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
352	57.574	0.164	0.077	1.15	93.0	-1.89	98	0.4	0.1	70	74	68	66
353	57.738	0.164	0.077	1.14	93.8	-1.91	98	0.3	-0.1	70	74	68	66
354	57.902	0.164	0.076	1.15	93.7	-1.93	99	0.4	0.1	69	73	68	65
355	58.070	0.168	0.075	1.14	93.7	-1.93	102	0.4	0	69	73	68	65
356	58.231	0.161	0.078	1.15	93.8	-1.95	96	0.5	0.1	69	73	68	65
357	58.395	0.164	0.076	1.15	93.8	-1.96	99	0.4	-0.1	69	73	68	65
358	58.561	0.166	0.075	1.15	93.1	-1.95	101	0.5	0.1	69	73	68	65
359	58.727	0.166	0.078	1.14	93.7	-1.97	99	0.4	-0.1	69	73	68	65
360	58.888	0.161	0.075	1.15	93.7	-1.98	98	0.4	0	69	73	68	65
361	59.056	0.168	0.075	1.14	93.2	-1.98	102	0.5	0.1	69	72	68	65
362	59.217	0.161	0.078	1.14	92.9	-1.99	96	0.5	0	69	72	68	65
363	59.384	0.167	0.078	1.16	93.6	-2	99	0.7	0.2	69	72	68	65
364	59.547	0.163	0.076	1.16	93.2	-2.01	98	0.4	-0.3	69	72	68	65
365	59.714	0.167	0.076	1.15	93.1	-2.01	101	0.4	0	69	72	68	65
366	59.874	0.160	0.079	1.16	93.7	-2.02	95	0.3	-0.1	69	72	68	65
367	60.042	0.168	0.079	1.15	93.0	-2.01	100	0.4	0.1	69	72	68	65
368	60.204	0.162	0.078	1.15	93.6	-2.02	96	0.4	0	69	72	68	65
369	60.367	0.163	0.077	1.16	92.9	-2.04	98	0.5	0.1	69	71	68	65
370	60.532	0.165	0.077	1.14	93.6	-2.04	99	0.4	-0.1	69	71	68	65
371	60.700	0.168	0.077	1.15	93.5	-2.04	101	0.5	0.1	69	71	68	65
372	60.860	0.160	0.075	1.15	92.8	-2.06	97	0.4	-0.1	69	71	68	65
373	61.027	0.167	0.078	1.15	93.2	-2.05	100	0.4	0	71	118	68	65
374	61.190	0.163	0.079	1.16	93.3	-2.06	97	0.1	-0.3	73	156	68	65
375	61.356	0.166	0.077	1.15	93.7	-2.06	100	0.0	-0.1	74	178	68	65
Avg/Tot	61.356	0.164	0.076	1.14	88	-1.56	100			74	147	69	66.1

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		-0.04	67	-0.93		69	-0.010	0.13	0.03
1	0.137	0.137	1.21	67	-3.57	92	69	-0.030	4.34	1.20
2	0.299	0.162	1.23	67	-1.42	106	69	-0.020	11.22	3.78
3	0.458	0.159	1.20	68	-0.96	103	69	-0.020	7.13	5.00
4	0.619	0.161	1.18	68	-7.15	105	69	-0.030	2.55	2.59
5	0.778	0.159	1.19	67	-11.48	106	69	-0.010	1.26	1.27
6	0.939	0.161	1.19	68	-0.79	104	69	-0.010	0.74	0.71
7	1.097	0.158	1.19	68	-1.35	105	69	-0.010	0.51	0.47
8	1.257	0.160	1.19	68	-4.71	104	69	-0.010	0.45	0.35
9	1.415	0.158	1.19	67	-15.68	103	69	-0.010	0.37	0.30
10	1.575	0.160	1.16	69	-11.23	106	69	-0.010	0.34	0.27
11	1.732	0.157	1.16	68	-1.74	105	69	0.000	0.32	0.26
12	1.892	0.160	1.17	69	-1.67	104	69	0.000	0.30	0.25
13	2.050	0.158	1.17	68	-2.05	101	69	0.000	0.30	0.23
14	2.209	0.159	1.17	68	-2.21	104	69	0.000	0.29	0.22
15	2.368	0.159	1.17	69	-1.89	103	69	0.000	0.27	0.21
16	2.525	0.157	1.16	69	-1.96	103	69	0.000	0.26	0.20
17	2.684	0.159	1.11	70	-2.29	101	69	-0.010	0.26	0.20
18	2.840	0.156	1.22	70	-2.42	101	69	-0.030	0.31	0.19
19	3.000	0.160	1.19	71	-2.18	105	69	-0.020	5.88	1.43
20	3.156	0.156	1.14	71	-1.74	102	69	-0.040	11.93	3.63
21	3.314	0.158	1.15	71	-1.89	103	70	-0.040	8.82	1.10
22	3.472	0.158	1.10	70	-1.64	103	70	-0.030	12.02	0.12
23	3.627	0.155	1.14	71	-1.75	102	70	-0.040	12.76	0.08
24	3.786	0.159	1.14	72	-1.77	104	70	-0.050	12.46	0.06
25	3.940	0.154	1.16	71	-1.51	99	70	-0.040	12.06	0.06
26	4.096	0.156	1.18	72	-1.28	99	70	-0.040	12.44	0.07
27	4.257	0.161	1.20	73	-1.91	104	71	-0.040	12.48	0.11
28	4.409	0.152	1.14	73	-2.16	99	71	-0.050	12.53	0.10
29	4.570	0.161	1.15	74	-1.81	105	71	-0.070	12.75	0.11
30	4.727	0.157	1.16	74	-2.25	102	71	-0.050	12.17	0.05
31	4.883	0.156	1.14	74	-1.71	100	71	-0.050	12.87	0.09

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
32	5.041	0.158	1.11	74	-1.75	104	71	-0.050	12.44	0.05
33	5.196	0.155	1.15	74	-2.05	103	71	-0.050	12.42	0.03
34	5.354	0.158	1.12	74	-1.71	102	71	-0.060	12.46	0.04
35	5.511	0.157	1.15	75	-1.98	101	72	-0.050	12.65	0.03
36	5.667	0.156	1.17	76	-1.44	101	72	-0.050	12.31	0.03
37	5.825	0.158	1.15	75	-2.05	102	72	-0.050	12.89	0.04
38	5.980	0.155	1.15	76	-1.4	100	72	-0.050	12.57	0.03
39	6.138	0.158	1.15	76	-1.73	102	72	-0.050	12.38	0.03
40	6.296	0.158	1.15	77	-1.35	101	72	-0.060	12.99	0.04
41	6.451	0.155	1.16	76	-1.72	100	72	-0.050	12.21	0.03
42	6.609	0.158	1.15	77	-1.31	103	72	-0.050	12.94	0.04
43	6.765	0.156	1.12	78	-1.31	101	72	-0.050	12.81	0.03
44	6.923	0.158	1.14	78	-1.44	102	72	-0.050	12.41	0.02
45	7.080	0.157	1.15	77	-1.45	102	72	-0.050	12.72	0.02
46	7.236	0.156	1.13	77	-1.25	100	72	-0.050	12.64	0.03
47	7.394	0.158	1.11	79	-1.26	101	72	-0.050	12.27	0.03
48	7.551	0.157	1.15	79	-1.3	102	72	-0.050	12.89	0.03
49	7.708	0.157	1.18	78	-1.29	101	73	-0.050	12.24	0.03
50	7.866	0.158	1.14	80	-1.31	103	73	-0.060	12.61	0.05
51	8.021	0.155	1.08	79	-1.22	100	73	-0.070	12.75	0.04
52	8.180	0.159	1.14	79	-1.28	102	73	-0.050	12.15	0.03
53	8.337	0.157	1.15	80	-1.46	101	73	-0.050	12.76	0.03
54	8.494	0.157	1.16	80	-1.45	99	73	-0.040	12.34	0.02
55	8.653	0.159	1.14	81	-1.2	103	72	-0.050	9.07	2.81
56	8.809	0.156	1.15	80	-1.43	98	72	-0.040	8.42	3.43
57	8.968	0.159	1.12	82	-1.42	100	72	-0.040	6.75	2.35
58	9.125	0.157	1.17	81	-1.25	98	72	-0.030	5.19	1.58
59	9.284	0.159	1.17	81	-1.44	100	72	-0.030	4.00	1.11
60	9.442	0.158	1.16	81	-1.21	99	72	-0.020	2.91	0.75
61	9.600	0.158	1.20	83	-1.41	99	72	-0.030	2.13	0.54
62	9.759	0.159	1.16	82	-1.32	101	71	-0.020	1.74	0.40
63	9.916	0.157	1.16	83	-1.35	99	71	-0.010	1.26	0.28

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
64	10.076	0.160	1.16	83	-1.42	104	71	-0.020	0.94	0.20
65	10.233	0.157	1.19	83	-1.36	99	71	-0.020	0.74	0.16
66	10.392	0.159	1.20	84	-1.4	100	71	-0.020	0.53	0.11
67	10.550	0.158	1.17	83	-1.43	99	71	-0.010	0.43	0.09
68	10.709	0.159	1.16	84	-1.46	100	71	-0.010	0.35	0.07
69	10.865	0.156	1.15	84	-1.4	98	71	0.000	0.30	0.06
70	11.023	0.158	1.21	84	-1.27	100	71	-0.010	0.32	0.05
71	11.185	0.162	1.12	85	-1.31	99	71	0.000	0.27	0.05
72	11.344	0.159	1.17	85	-1.32	99	71	-0.010	0.24	0.04
73	11.503	0.159	1.12	84	-1.19	100	71	-0.010	0.27	0.05
74	11.661	0.158	1.16	85	-1.32	99	71	-0.010	0.22	0.04
75	11.821	0.160	1.15	84	-1.42	99	71	-0.010	0.26	0.04
76	11.978	0.157	1.17	86	-1.2	99	71	-0.010	0.23	0.03
77	12.136	0.158	1.16	85	-1.26	98	71	-0.010	0.22	0.04
78	12.296	0.160	1.16	85	-1.4	100	70	-0.010	0.21	0.04
79	12.456	0.160	1.13	85	-1.26	100	70	-0.010	0.20	0.03
80	12.614	0.158	1.16	85	-1.47	98	70	0.000	0.19	0.03
81	12.774	0.160	1.16	86	-1.38	99	70	0.000	0.19	0.03
82	12.932	0.158	1.16	86	-1.31	99	70	-0.010	0.17	0.02
83	13.092	0.160	1.16	86	-1.29	100	70	0.000	0.17	0.02
84	13.250	0.158	1.16	87	-1.34	100	70	-0.010	0.14	0.03
85	13.411	0.161	1.17	86	-1.43	100	70	0.000	0.15	0.03
86	13.568	0.157	1.08	87	-1.44	98	70	0.000	0.14	0.03
87	13.729	0.161	1.22	88	-1.32	101	70	-0.010	0.16	0.03
88	13.887	0.158	1.16	87	-1.23	100	70	0.010	0.11	0.02
89	14.047	0.160	1.17	87	-1.2	100	70	0.000	0.14	0.02
90	14.206	0.159	1.11	88	-1.37	98	70	0.010	0.13	0.02
91	14.366	0.160	1.18	88	-1.29	99	70	0.000	0.14	0.02
92	14.525	0.159	1.17	88	-1.39	97	70	0.000	0.12	0.02
93	14.682	0.157	1.16	87	-1.52	98	70	0.000	0.11	0.02
94	14.842	0.160	1.18	88	-1.28	101	70	0.010	0.11	0.02
95	15.004	0.162	1.17	87	-1.56	104	70	0.000	0.12	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
96	15.163	0.159	1.17	89	-1.35	101	70	0.000	0.11	0.01
97	15.323	0.160	1.17	89	-1.2	99	70	0.000	0.10	0.01
98	15.482	0.159	1.17	89	-1.31	99	70	0.000	0.11	0.02
99	15.642	0.160	1.17	89	-1.32	99	70	-0.020	0.09	0.02
100	15.802	0.160	1.17	88	-1.42	103	70	0.000	0.11	0.01
101	15.962	0.160	1.17	88	-1.4	99	70	0.000	0.09	0.02
102	16.121	0.159	1.18	89	-1.23	100	70	0.000	0.09	0.01
103	16.281	0.160	1.16	89	-1.36	100	70	0.010	0.11	0.01
104	16.440	0.159	1.16	90	-1.3	98	70	0.000	0.11	0.02
105	16.601	0.161	1.16	88	-1.3	100	70	0.000	0.08	0.02
106	16.760	0.159	1.20	88	-1.3	99	70	0.000	0.12	0.01
107	16.921	0.161	1.16	90	-1.33	99	70	0.000	0.10	0.02
108	17.079	0.158	1.19	88	-1.23	97	70	0.000	0.10	0.01
109	17.240	0.161	1.12	90	-1.43	101	70	-0.030	3.48	0.63
110	17.399	0.159	1.19	89	-1.42	99	70	-0.050	4.27	0.79
111	17.560	0.161	1.18	89	-1.34	100	70	-0.030	5.53	0.70
112	17.718	0.158	1.12	90	-1.36	100	70	-0.030	7.39	0.67
113	17.879	0.161	1.17	89	-1.3	100	70	-0.040	8.89	0.32
114	18.037	0.158	1.18	91	-1.42	98	71	-0.040	10.93	0.07
115	18.198	0.161	1.14	90	-1.43	101	71	-0.040	12.80	0.04
116	18.356	0.158	1.16	90	-1.88	97	71	-0.040	12.88	0.04
117	18.516	0.160	1.16	90	-1.56	101	71	-0.040	13.20	0.04
118	18.675	0.159	1.16	90	-1.64	99	71	-0.050	12.66	0.03
119	18.832	0.157	1.13	90	-1.55	99	71	-0.050	13.21	0.02
120	18.994	0.162	1.16	90	-1.5	103	71	-0.050	12.61	0.04
121	19.154	0.160	1.17	91	-2.41	100	72	-0.050	13.26	0.10
122	19.313	0.159	1.16	90	-2.38	100	72	-0.060	12.63	0.03
123	19.470	0.157	1.16	90	-1.35	100	72	-0.050	12.92	0.02
124	19.632	0.162	1.16	90	-2.32	102	72	-0.040	12.46	0.01
125	19.792	0.160	1.17	90	-1.29	102	72	-0.050	12.61	0.02
126	19.951	0.159	1.15	91	-1.67	99	72	-0.060	12.70	0.01
127	20.111	0.160	1.18	90	-2.39	102	72	-0.050	12.35	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
128	20.270	0.159	1.17	91	-1.33	101	72	-0.050	12.64	0.02
129	20.430	0.160	1.16	90	-2.57	101	72	-0.050	12.28	0.01
130	20.589	0.159	1.19	91	-1.69	101	72	-0.050	12.79	0.03
131	20.746	0.157	1.16	90	-2.49	100	72	-0.050	12.16	0.02
132	20.906	0.160	1.17	90	-2.19	101	72	-0.050	12.37	0.02
133	21.068	0.162	1.17	92	-1.66	103	72	-0.040	12.15	0.02
134	21.226	0.158	1.13	90	-1.35	100	72	-0.050	12.31	0.03
135	21.381	0.155	1.16	90	-2.56	96	72	-0.050	12.32	0.02
136	21.542	0.161	1.17	90	-2.44	102	72	-0.050	12.69	0.03
137	21.703	0.161	1.16	91	-1.98	102	72	-0.050	12.20	0.03
138	21.861	0.158	1.10	91	-1.29	100	73	-0.050	12.20	0.02
139	22.019	0.158	1.17	91	-1.24	100	73	-0.050	12.22	0.02
140	22.183	0.164	1.10	91	-1.3	102	73	-0.060	12.32	0.02
141	22.341	0.158	1.17	91	-1.49	99	73	-0.030	11.92	0.02
142	22.503	0.162	1.16	92	-1.27	101	72	-0.060	8.98	2.25
143	22.658	0.155	1.17	91	-2.84	96	72	-0.050	8.86	4.83
144	22.823	0.165	1.14	91	-2.58	103	72	-0.040	8.10	4.12
145	22.979	0.156	1.13	92	-2.51	98	72	-0.040	6.96	3.13
146	23.140	0.161	1.17	91	-2.92	101	72	-0.040	5.73	2.27
147	23.299	0.159	1.17	91	-3.02	98	71	-0.030	4.70	1.69
148	23.461	0.162	1.16	91	-3.2	102	71	-0.030	3.72	1.22
149	23.623	0.162	1.10	92	-2.89	102	71	-0.010	2.93	0.92
150	23.782	0.159	1.15	92	-1.45	98	71	-0.020	2.31	0.68
151	23.944	0.162	1.18	92	-1.42	101	71	-0.010	1.82	0.51
152	24.102	0.158	1.17	92	-1.43	98	71	-0.020	1.44	0.39
153	24.261	0.159	1.17	91	-1.52	98	71	-0.010	1.07	0.27
154	24.421	0.160	1.17	91	-2.88	100	71	-0.030	0.77	0.18
155	24.582	0.161	1.16	92	-3.47	102	71	0.000	0.56	0.14
156	24.741	0.159	1.18	92	-1.57	98	71	-0.010	0.46	0.10
157	24.903	0.162	1.16	91	-1.4	100	71	-0.010	0.42	0.09
158	25.061	0.158	1.14	92	-1.48	100	71	-0.020	0.31	0.06
159	25.226	0.165	1.25	92	-1.3	105	71	0.000	0.29	0.05

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
160	25.382	0.156	1.17	93	-1.36	97	71	-0.010	0.26	0.05
161	25.547	0.165	1.15	93	-1.52	102	71	-0.010	0.25	0.04
162	25.703	0.156	1.17	93	-1.44	97	71	-0.010	0.22	0.04
163	25.867	0.164	1.17	93	-1.25	102	71	-0.010	0.21	0.04
164	26.024	0.157	1.17	92	-2.77	98	71	0.000	0.21	0.03
165	26.185	0.161	1.17	92	-2.53	99	71	0.000	0.21	0.03
166	26.344	0.159	1.17	93	-1.44	99	70	-0.010	0.21	0.03
167	26.508	0.164	1.14	93	-1.35	102	70	0.000	0.23	0.03
168	26.665	0.157	1.17	92	-1.23	98	70	0.000	0.17	0.03
169	26.826	0.161	1.16	93	-1.47	101	70	0.000	0.17	0.04
170	26.986	0.160	1.15	93	-1.27	99	70	-0.010	0.15	0.03
171	27.146	0.160	1.17	92	-1.37	99	70	0.000	0.13	0.03
172	27.307	0.161	1.18	92	-1.36	101	70	0.000	0.14	0.02
173	27.466	0.159	1.16	92	-1.5	99	70	-0.010	0.14	0.02
174	27.628	0.162	1.17	92	-1.43	101	70	0.000	0.13	0.02
175	27.787	0.159	1.17	93	-1.3	99	70	-0.010	0.11	0.03
176	27.949	0.162	1.18	92	-1.27	101	70	-0.010	0.12	0.02
177	28.108	0.159	1.17	92	-3.67	98	70	0.000	0.10	0.02
178	28.270	0.162	1.15	92	-3.13	99	70	0.010	0.12	0.01
179	28.429	0.159	1.17	93	-2.62	100	70	0.000	0.10	0.02
180	28.591	0.162	1.15	92	-3.5	101	70	0.000	0.10	0.01
181	28.750	0.159	1.17	92	-2.75	98	70	0.000	0.10	0.01
182	28.912	0.162	1.20	93	-2.47	98	70	0.000	0.08	0.01
183	29.071	0.159	1.17	92	-3.38	98	70	0.000	0.08	0.01
184	29.232	0.161	1.22	93	-2.75	99	70	0.000	0.14	0.02
185	29.395	0.163	1.17	92	-3.35	101	70	0.000	0.09	0.01
186	29.552	0.157	1.16	93	-2.43	99	70	0.000	0.09	0.01
187	29.713	0.161	1.19	93	-3.3	102	70	-0.020	0.10	0.01
188	29.873	0.160	1.19	93	-3.25	99	70	0.000	0.09	0.01
189	30.034	0.161	1.15	93	-2.45	99	70	0.000	0.09	0.02
190	30.193	0.159	1.17	92	-3.71	98	70	0.000	0.09	0.01
191	30.355	0.162	1.19	93	-3.41	100	70	-0.010	0.06	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
192	30.514	0.159	1.18	93	-2.7	98	70	0.000	0.08	0.01
193	30.679	0.165	1.20	92	-3.74	101	70	0.000	0.09	0.01
194	30.835	0.156	1.12	92	-2.93	98	70	-0.010	0.09	0.02
195	30.997	0.162	1.16	93	-3.73	100	70	0.000	0.08	0.02
196	31.156	0.159	1.20	93	-3.96	97	70	0.000	0.08	0.01
197	31.318	0.162	1.15	92	-3.17	99	70	-0.010	0.10	0.02
198	31.477	0.159	1.17	92	-3.64	98	70	-0.030	3.78	0.63
199	31.638	0.161	1.15	93	-3.25	101	70	-0.030	4.92	0.91
200	31.798	0.160	1.16	93	-3.48	100	70	-0.030	5.86	0.77
201	31.958	0.160	1.12	93	-2.73	100	71	-0.070	6.71	0.61
202	32.118	0.160	1.16	92	-1.35	99	71	-0.040	7.53	0.52
203	32.278	0.160	1.18	93	-2.6	100	71	-0.030	7.49	0.29
204	32.438	0.160	1.17	94	-3.37	100	71	-0.030	8.91	0.19
205	32.598	0.160	1.17	94	-3.11	99	71	-0.040	10.33	0.08
206	32.759	0.161	1.17	92	-1.24	101	71	-0.040	10.84	0.06
207	32.917	0.158	1.17	92	-1.22	99	71	-0.030	10.90	0.04
208	33.079	0.162	1.17	94	-2.94	102	71	-0.040	11.69	0.05
209	33.237	0.158	1.17	93	-2.85	98	71	-0.040	11.73	0.05
210	33.399	0.162	1.17	92	-1.34	101	71	-0.040	12.12	0.05
211	33.557	0.158	1.12	93	-1.96	99	72	-0.050	11.71	0.05
212	33.722	0.165	1.13	92	-2.62	105	72	-0.040	11.83	0.07
213	33.878	0.156	1.17	92	-2.42	98	72	-0.040	12.29	0.05
214	34.039	0.161	1.17	93	-1.01	101	72	-0.040	11.82	0.04
215	34.197	0.158	1.16	93	-0.94	98	72	-0.040	12.19	0.04
216	34.359	0.162	1.21	92	-2.23	102	72	-0.040	11.80	0.09
217	34.517	0.158	1.17	92	-1.15	98	72	-0.050	12.05	0.24
218	34.679	0.162	1.16	92	-3.15	102	72	-0.040	11.81	0.08
219	34.837	0.158	1.16	93	-3.03	99	72	-0.040	11.97	0.05
220	34.999	0.162	1.17	94	-0.9	102	72	-0.050	11.49	0.04
221	35.158	0.159	1.15	93	-2.02	98	72	-0.050	11.57	0.11
222	35.319	0.161	1.19	92	-2.6	102	72	-0.040	11.62	0.17
223	35.478	0.159	1.17	92	-3.31	100	72	-0.050	11.63	0.26

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
224	35.639	0.161	1.07	92	-2.39	101	72	-0.040	11.31	0.17
225	35.798	0.159	1.21	92	-2.56	101	72	-0.050	11.55	0.24
226	35.959	0.161	1.15	93	-2.48	101	72	-0.050	11.44	0.19
227	36.118	0.159	1.17	94	-1.17	99	72	-0.040	11.37	0.18
228	36.279	0.161	1.20	92	-2.64	100	72	-0.030	11.47	0.15
229	36.438	0.159	1.17	92	-3.05	100	72	-0.040	11.51	0.29
230	36.599	0.161	1.21	93	-2.12	101	72	-0.020	10.85	0.36
231	36.759	0.160	1.18	93	-2.38	99	72	-0.030	6.28	2.59
232	36.919	0.160	1.16	92	-2.89	99	72	-0.030	5.98	3.58
233	37.079	0.160	1.15	92	-2.85	99	72	-0.030	5.57	2.99
234	37.239	0.160	1.17	93	-2.32	99	71	-0.030	5.02	2.34
235	37.400	0.161	1.16	92	-4	99	71	-0.030	4.47	1.85
236	37.562	0.162	1.17	93	-4.06	101	71	-0.030	3.87	1.43
237	37.721	0.159	1.14	93	-2.72	100	71	-0.030	3.36	1.15
238	37.880	0.159	1.17	93	-2.39	99	71	-0.020	2.83	0.89
239	38.042	0.162	1.16	93	-4.23	101	71	-0.020	2.33	0.69
240	38.201	0.159	1.18	93	-4.2	97	71	-0.020	1.87	0.53
241	38.366	0.165	1.14	92	-2.58	103	71	-0.020	1.49	0.40
242	38.522	0.156	1.14	94	-3.46	97	71	-0.010	1.11	0.29
243	38.684	0.162	1.17	93	-4.26	101	71	-0.010	0.87	0.21
244	38.843	0.159	1.17	92	-2.31	98	71	-0.010	0.69	0.16
245	39.006	0.163	1.17	93	-2.42	100	71	-0.010	0.58	0.14
246	39.167	0.161	1.17	92	-2.57	100	71	-0.010	0.49	0.11
247	39.326	0.159	1.15	92	-2.45	98	71	-0.010	0.41	0.09
248	39.488	0.162	1.17	94	-4.3	100	71	-0.010	0.40	0.09
249	39.645	0.157	1.16	92	-2.49	98	71	-0.010	0.37	0.08
250	39.809	0.164	1.17	93	-4.08	102	71	-0.020	0.33	0.07
251	39.968	0.159	1.14	93	-3.21	98	71	0.000	0.33	0.06
252	40.127	0.159	1.18	93	-3.68	99	70	-0.010	0.32	0.05
253	40.286	0.159	1.18	92	-2.39	98	70	0.000	0.28	0.06
254	40.448	0.162	1.17	92	-2.78	101	70	0.000	0.28	0.05
255	40.607	0.159	1.19	94	-3.57	98	70	-0.010	0.26	0.05

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
256	40.769	0.162	1.14	93	-3.69	101	70	0.010	0.24	0.03
257	40.931	0.162	1.12	94	-3.26	99	70	0.000	0.22	0.04
258	41.090	0.159	1.15	92	-3.89	97	70	0.000	0.17	0.03
259	41.249	0.159	1.19	93	-4.35	99	70	0.000	0.17	0.04
260	41.413	0.164	1.16	93	-2.18	100	70	0.000	0.16	0.03
261	41.573	0.160	1.17	94	-4.05	100	70	0.000	0.15	0.03
262	41.731	0.158	1.19	92	-3.67	98	70	0.000	0.18	0.02
263	41.892	0.161	1.20	94	-3.98	100	70	0.000	0.16	0.02
264	42.051	0.159	1.19	92	-3.64	98	70	0.000	0.17	0.02
265	42.216	0.165	1.18	93	-4.01	102	70	0.000	0.12	0.02
266	42.372	0.156	1.15	93	-3.55	97	70	0.000	0.08	0.02
267	42.534	0.162	1.17	93	-2.74	101	70	-0.010	0.13	0.02
268	42.693	0.159	1.17	92	-3.69	97	70	0.010	0.11	0.02
269	42.855	0.162	1.15	92	-3.95	101	70	-0.010	0.11	0.02
270	43.014	0.159	1.16	93	-3.85	99	70	0.000	0.11	0.02
271	43.176	0.162	1.18	94	-2.46	100	70	0.000	0.09	0.01
272	43.335	0.159	1.18	93	-3.72	100	70	0.010	0.12	0.02
273	43.497	0.162	1.15	93	-2.84	100	70	0.000	0.09	0.02
274	43.657	0.160	1.23	93	-3.29	98	70	0.000	0.15	0.03
275	43.819	0.162	1.19	94	-3.18	101	70	0.000	0.15	0.01
276	43.978	0.159	1.13	93	-3.14	98	70	0.000	0.10	0.01
277	44.140	0.162	1.17	92	-4.39	101	70	0.000	0.09	0.01
278	44.299	0.159	1.16	94	-2.19	97	70	0.000	0.09	0.01
279	44.458	0.159	1.18	94	-2.66	98	70	0.000	0.09	0.01
280	44.620	0.162	1.17	94	-2.41	98	70	0.000	0.09	0.01
281	44.779	0.159	1.16	93	-4.55	98	70	0.000	0.06	0.01
282	44.943	0.164	1.12	94	-3.25	102	70	0.020	0.08	0.02
283	45.100	0.157	1.17	93	-2.38	97	70	0.000	0.09	0.01
284	45.265	0.165	1.17	94	-2.38	101	70	0.000	0.08	0.01
285	45.421	0.156	1.18	94	-2.17	96	70	0.000	0.06	0.01
286	45.583	0.162	1.18	94	-4.31	100	70	-0.020	0.10	0.02
287	45.742	0.159	1.17	93	-2.23	99	70	-0.020	4.37	0.96

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
288	45.903	0.161	1.16	93	-1.34	102	70	-0.030	6.08	1.20
289	46.062	0.159	1.17	92	-1.13	99	70	-0.020	7.25	0.72
290	46.224	0.162	1.18	93	-3.79	101	70	-0.030	10.25	0.23
291	46.383	0.159	1.11	93	-2.26	98	70	-0.030	9.62	0.17
292	46.543	0.160	1.21	92	-1.67	101	70	-0.030	10.41	0.22
293	46.703	0.160	1.21	92	-1.57	101	70	-0.020	11.43	0.47
294	46.863	0.160	1.17	92	-0.54	102	71	-0.030	11.43	0.47
295	47.023	0.160	1.17	92	-0.58	102	71	-0.040	11.32	0.35
296	47.185	0.162	1.18	92	-0.81	101	71	-0.040	11.29	0.41
297	47.344	0.159	1.15	93	-2.22	99	71	-0.030	11.28	0.26
298	47.503	0.159	1.17	93	-2.58	100	71	-0.040	11.64	0.09
299	47.667	0.164	1.12	93	-0.66	102	71	-0.040	11.54	0.11
300	47.823	0.156	1.16	92	-1.18	98	71	-0.030	11.35	0.20
301	47.987	0.164	1.19	92	-1.46	102	71	-0.040	10.94	0.13
302	48.146	0.159	1.15	93	-0.88	102	71	-0.040	10.78	0.08
303	48.304	0.158	1.17	94	-3.81	99	71	-0.040	10.30	0.08
304	48.463	0.159	1.12	93	-3.1	99	71	-0.050	10.32	0.09
305	48.627	0.164	1.16	94	-3.7	102	72	-0.040	10.35	0.13
306	48.786	0.159	1.16	94	-3.45	99	72	-0.050	10.28	0.11
307	48.944	0.158	1.16	93	-0.73	98	72	-0.040	10.46	0.13
308	49.103	0.159	1.13	92	-1.87	100	72	-0.070	10.28	0.14
309	49.264	0.161	1.13	94	-1.95	100	72	-0.050	10.47	0.20
310	49.423	0.159	1.18	93	-3.83	100	72	-0.040	10.07	0.26
311	49.587	0.164	1.18	93	-0.85	103	72	-0.040	10.49	0.29
312	49.746	0.159	1.19	92	-3.1	100	72	-0.050	10.44	0.31
313	49.904	0.158	1.18	93	-3.81	98	72	-0.040	10.15	0.33
314	50.063	0.159	1.16	93	-3.79	100	72	-0.040	10.39	0.35
315	50.224	0.161	1.17	94	-0.26	101	72	-0.040	12.92	0.55
316	50.386	0.162	1.16	93	-3.16	101	72	-0.040	14.39	0.25
317	50.544	0.158	1.17	93	-3.26	99	72	-0.040	13.79	0.35
318	50.703	0.159	1.17	92	-3.38	99	72	-0.030	11.61	0.76
319	50.866	0.163	1.16	94	-1.39	101	72	-0.020	6.80	0.38

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	51.024	0.158	1.17	92	-4.19	99	71	-0.020	5.04	0.77
321	51.185	0.161	1.18	94	-2.43	101	71	-0.020	4.44	1.51
322	51.345	0.160	1.21	92	-3.79	100	71	-0.020	3.83	1.43
323	51.505	0.160	1.17	92	-4.09	99	71	-0.020	3.26	1.17
324	51.666	0.161	1.16	93	-1.85	99	71	-0.030	2.69	0.91
325	51.828	0.162	1.16	93	-4.67	101	71	-0.010	2.44	0.79
326	51.987	0.159	1.15	92	-3.22	97	71	-0.020	2.13	0.65
327	52.146	0.159	1.18	93	-4.33	99	71	-0.010	1.79	0.52
328	52.307	0.161	1.17	93	-1.84	99	71	-0.020	1.52	0.42
329	52.467	0.160	1.10	93	-2.77	101	71	-0.010	1.24	0.34
330	52.628	0.161	1.20	92	-3.75	99	70	-0.010	0.94	0.24
331	52.787	0.159	1.18	92	-4.46	98	70	-0.010	0.73	0.17
332	52.949	0.162	1.13	92	-3.5	100	70	0.000	0.56	0.14
333	53.108	0.159	1.16	92	-4.78	99	70	-0.010	0.41	0.08
334	53.270	0.162	1.25	92	-3.63	101	70	0.000	0.36	0.07
335	53.432	0.162	1.16	93	-2.89	99	70	-0.010	0.29	0.07
336	53.590	0.158	1.17	94	-4.74	97	70	-0.010	0.27	0.05
337	53.750	0.160	1.17	92	-1.98	99	70	-0.010	0.24	0.05
338	53.911	0.161	1.18	93	-2.38	100	70	-0.010	0.22	0.04
339	54.071	0.160	1.18	94	-4.94	98	70	0.000	0.21	0.04
340	54.231	0.160	1.15	92	-2.44	99	70	-0.010	0.19	0.03
341	54.392	0.161	1.17	94	-5.01	100	70	-0.010	0.19	0.04
342	54.554	0.162	1.16	93	-4.42	99	70	-0.020	0.17	0.03
343	54.713	0.159	1.17	93	-4.01	97	70	0.000	0.19	0.03
344	54.872	0.159	1.20	92	-3.21	99	70	0.000	0.17	0.04
345	55.034	0.162	1.17	93	-4.33	101	70	0.000	0.16	0.03
346	55.193	0.159	1.19	93	-4.49	100	70	0.000	0.16	0.03
347	55.357	0.164	1.17	92	-2.15	101	70	0.000	0.14	0.03
348	55.514	0.157	1.16	92	-3.6	98	70	0.000	0.12	0.02
349	55.678	0.164	1.17	92	-2.28	100	70	0.000	0.14	0.02
350	55.838	0.160	1.17	93	-2.38	99	70	0.000	0.12	0.02
351	55.996	0.158	1.17	93	-4.61	97	70	0.000	0.12	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Alternate Heating
Model: SE110
Run #: 4
Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
352	56.156	0.160	1.17	92	-2.27	99	70	0.000	0.13	0.02
353	56.317	0.161	1.21	92	-4.45	99	70	0.010	0.11	0.02
354	56.477	0.160	1.17	92	-4.33	99	69	0.000	0.10	0.01
355	56.639	0.162	1.20	92	-4.91	101	69	0.000	0.11	0.01
356	56.798	0.159	1.17	93	-5.04	97	69	0.000	0.11	0.02
357	56.957	0.159	1.17	93	-4.8	98	69	0.000	0.11	0.01
358	57.119	0.162	1.16	94	-2.12	101	69	0.000	0.10	0.02
359	57.281	0.162	1.16	92	-4.78	99	69	0.000	0.10	0.01
360	57.440	0.159	1.17	92	-5	99	69	0.000	0.10	0.01
361	57.602	0.162	1.19	94	-2.07	101	69	0.000	0.10	0.02
362	57.761	0.159	1.22	92	-3.58	97	69	0.000	0.10	0.03
363	57.923	0.162	1.19	93	-3.08	99	69	0.010	0.08	0.02
364	58.082	0.159	1.17	92	-4.92	99	69	0.000	0.11	0.02
365	58.244	0.162	1.18	94	-2.14	100	69	0.000	0.09	0.01
366	58.403	0.159	1.14	93	-4.11	97	69	-0.010	0.10	0.02
367	58.565	0.162	1.17	94	-2.2	98	69	0.000	0.07	0.01
368	58.723	0.158	1.15	93	-2.24	97	69	0.000	0.07	0.01
369	58.883	0.160	1.14	92	-4.25	99	69	0.000	0.07	0.01
370	59.043	0.160	1.18	92	-3.41	99	69	-0.010	0.07	0.02
371	59.207	0.164	1.17	93	-2.29	101	69	0.000	0.08	0.01
372	59.364	0.157	1.17	92	-4.96	98	69	0.000	0.06	0.01
373	59.528	0.164	1.16	94	-2.37	100	69	-0.030	2.85	0.37
374	59.684	0.156	1.18	93	-1.7	95	69	-0.030	4.35	1.51
375	59.849	0.165	1.17	93	-1.53	102	69	-0.030	5.07	1.33
Avg/Tot	59.849	0.160	1.16	89	-2.45	100	71	-0.021	4.68	0.32

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
0	0.68		58.6	163.4	163.6	160.0	1.00	5.63	
1	0.68		58.6	162.8	163.0	159.3	1.00	5.69	594
2	0.80		58.6	162.4	162.7	158.8	1.00	6.70	696
3	0.81		58.6	162.2	162.5	158.2	1.00	6.74	699
4	0.81		58.5	161.7	161.9	157.6	1.00	6.73	695
5	0.81		58.5	161.0	161.2	157.0	1.00	6.74	692
6	0.81		58.5	160.2	160.4	156.2	1.00	6.75	687
7	0.81		58.5	159.5	159.7	155.5	1.00	6.76	684
8	0.81		58.4	158.6	158.8	154.7	1.00	6.75	677
9	0.80		58.4	157.8	158.0	153.9	1.00	6.70	667
10	0.81		58.4	157.0	157.3	153.2	1.00	6.73	664
11	0.80		58.3	156.2	156.4	152.3	1.00	6.68	655
12	0.80		58.3	155.4	155.6	151.6	1.00	6.66	648
13	0.80		58.3	154.6	154.8	150.8	1.00	6.70	646
14	0.82		58.2	153.8	154.0	150.0	1.00	6.82	653
15	0.81		58.1	153.0	153.2	149.2	1.00	6.79	645
16	0.82		58.1	152.1	152.4	148.4	1.00	6.82	642
17	0.82		58.0	151.3	151.6	147.7	1.00	6.84	639
18	0.82		57.9	150.6	150.9	147.0	1.00	6.85	636
19	0.82		57.9	149.9	150.3	146.3	1.00	6.86	632
20	0.81		57.9	149.8	150.2	146.3	1.00	6.76	622
21	0.82		57.8	150.1	150.5	146.6	1.00	6.81	629
22	0.82		57.8	150.6	151.1	147.1	1.00	6.81	632
23	0.81		57.8	151.4	151.9	147.9	1.00	6.78	636
24	0.80		57.7	152.3	152.9	148.9	1.00	6.68	633
25	0.80		57.6	153.3	153.9	149.9	1.00	6.67	639
26	0.81		57.6	154.4	155.0	151.0	1.00	6.73	652
27	0.82		57.4	155.5	156.2	152.0	1.00	6.87	674
28	0.82		57.2	156.7	157.3	153.1	1.00	6.83	681
29	0.80		57.0	157.8	158.5	154.3	1.00	6.68	674
30	0.82		56.9	159.1	159.8	155.5	1.00	6.84	700
31	0.81		56.8	160.2	161.0	156.6	1.00	6.78	702
32	0.82		56.7	161.5	162.3	157.8	1.00	6.82	715
33	0.82		56.7	162.8	163.5	159.0	1.00	6.82	725
34	0.81		56.6	164.0	164.8	160.3	1.00	6.75	726
35	0.81		56.5	165.4	166.1	161.5	1.00	6.76	737
36	0.81		56.3	166.7	167.4	162.7	1.00	6.77	748
37	0.82		56.1	168.0	168.7	163.9	1.00	6.83	765
38	0.81		56.1	169.3	170.1	165.2	1.00	6.79	770
39	0.81		56.1	170.6	171.3	166.4	1.00	6.77	777
40	0.80		56.0	172.1	172.7	167.8	1.00	6.70	779
41	0.82		56.0	173.4	174.1	169.1	1.00	6.83	803
42	0.81		56.0	174.8	175.4	170.5	1.00	6.77	805
43	0.82		56.0	176.0	176.7	171.6	1.00	6.81	818
44	0.81		55.8	177.4	178.1	173.0	1.00	6.75	822
45	0.82		55.1	178.6	179.5	174.3	1.00	6.83	844
46	0.82		54.5	179.9	180.7	175.5	1.00	6.81	855
47	0.81		54.3	181.1	181.9	176.5	1.00	6.78	861

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
48	0.81		54.2	182.4	183.1	177.7	1.00	6.77	869
49	0.79		54.2	183.8	184.5	179.1	1.00	6.57	853
50	0.80		54.2	184.9	185.7	180.2	1.00	6.66	871
51	0.81		54.3	186.1	186.8	181.3	1.00	6.75	891
52	0.81		54.3	187.3	188.0	182.4	1.00	6.72	894
53	0.80		54.4	188.4	189.2	183.5	1.00	6.67	895
54	0.80		54.5	189.6	190.3	184.8	1.00	6.71	907
55	0.81		54.7	190.4	191.0	185.3	1.00	6.72	914
56	0.81		54.8	190.3	190.9	185.2	1.00	6.75	916
57	0.79		54.9	190.0	190.6	185.0	1.00	6.62	896
58	0.76		55.0	189.6	190.1	184.8	1.00	6.36	857
59	0.80		55.1	189.2	189.6	184.1	1.00	6.68	897
60	0.81		55.2	188.5	188.9	183.3	1.00	6.74	900
61	0.81		55.3	187.8	188.1	182.6	1.00	6.72	892
62	0.79		55.4	187.1	187.4	182.0	1.00	6.56	865
63	0.80		55.5	186.3	186.7	181.4	1.00	6.67	874
64	0.81		55.5	185.6	186.0	180.6	1.00	6.72	875
65	0.80		55.5	184.7	185.1	179.7	1.00	6.71	868
66	0.80		55.6	183.9	184.2	178.8	1.00	6.63	852
67	0.79		55.5	183.1	183.4	178.2	1.00	6.59	842
68	0.81		55.4	182.5	182.8	177.5	1.00	6.75	859
69	0.82		55.3	181.6	182.0	176.7	1.00	6.83	863
70	0.81		55.2	180.9	181.1	175.9	1.00	6.78	854
71	0.81		55.1	179.9	180.3	175.1	1.00	6.73	841
72	0.81		55.0	179.1	179.5	174.3	1.00	6.75	839
73	0.82		55.0	178.2	178.5	173.4	1.00	6.81	840
74	0.80		55.1	177.4	177.7	172.7	1.00	6.71	821
75	0.81		55.2	176.4	176.8	171.8	1.00	6.78	822
76	0.81		55.2	175.7	176.0	171.0	1.00	6.73	812
77	0.81		55.2	174.8	175.1	170.1	1.00	6.77	810
78	0.80		55.2	174.1	174.4	169.4	1.00	6.70	797
79	0.80		55.3	173.3	173.5	168.6	1.00	6.68	789
80	0.81		55.3	172.4	172.7	167.8	1.00	6.74	790
81	0.81		55.3	171.7	172.0	167.2	1.00	6.75	787
82	0.81		55.4	170.8	171.1	166.3	1.00	6.75	780
83	0.81		55.4	170.0	170.3	165.5	1.00	6.75	774
84	0.81		55.5	169.2	169.5	164.7	1.00	6.73	766
85	0.81		55.5	168.3	168.5	163.7	1.00	6.74	761
86	0.80		55.6	167.5	167.7	163.0	1.00	6.66	747
87	0.81		55.6	166.8	167.0	162.4	1.00	6.76	752
88	0.81		55.7	166.0	166.2	161.6	1.00	6.73	743
89	0.81		55.7	165.2	165.4	160.8	1.00	6.76	741
90	0.81		55.8	164.4	164.7	160.1	1.00	6.75	734
91	0.81		55.8	163.7	164.0	159.5	1.00	6.75	729
92	0.81		55.8	162.9	163.1	158.6	1.00	6.78	727
93	0.81		55.8	162.0	162.4	157.9	1.00	6.73	716
94	0.81		55.9	161.3	161.6	157.2	1.00	6.76	713
95	0.81		55.9	160.6	160.9	156.5	1.00	6.74	707

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
96	0.81		55.9	159.9	160.1	155.8	1.00	6.79	707
97	0.81		55.9	159.2	159.4	155.1	1.00	6.73	696
98	0.80		55.9	158.4	158.7	154.4	1.00	6.66	684
99	0.81		55.9	157.6	157.9	153.7	1.00	6.72	685
100	0.81		56.0	157.0	157.2	153.0	1.00	6.71	679
101	0.82		56.1	156.3	156.6	152.4	1.00	6.83	685
102	0.81		56.1	155.5	155.8	151.6	1.00	6.72	669
103	0.82		56.0	154.8	155.1	151.0	1.00	6.81	673
104	0.80		55.9	154.1	154.5	150.4	1.00	6.68	657
105	0.81		56.0	153.4	153.7	149.7	1.00	6.73	656
106	0.82		56.1	152.7	153.0	149.0	1.00	6.83	660
107	0.80		56.1	152.1	152.3	148.4	1.00	6.69	643
108	0.81		56.1	151.4	151.7	147.8	1.00	6.79	648
109	0.80		56.1	150.7	151.0	147.1	1.00	6.71	635
110	0.81		56.2	150.1	150.4	146.4	1.00	6.75	634
111	0.81		56.3	150.0	150.3	146.4	1.00	6.77	635
112	0.81		56.3	150.1	150.6	146.6	1.00	6.75	634
113	0.81		56.2	150.5	151.0	147.1	1.00	6.79	641
114	0.80		56.2	151.1	151.6	147.6	1.00	6.68	635
115	0.81		56.3	151.8	152.4	148.4	1.00	6.73	644
116	0.81		56.3	153.0	153.6	149.5	1.00	6.72	651
117	0.82		56.4	154.2	154.9	150.8	1.00	6.82	667
118	0.81		56.4	155.5	156.2	152.1	1.00	6.77	672
119	0.81		56.4	156.9	157.6	153.5	1.00	6.71	676
120	0.80		56.5	158.2	158.9	154.7	1.00	6.69	681
121	0.81		56.6	159.7	160.4	156.1	1.00	6.77	699
122	0.81		56.6	161.1	161.8	157.5	1.00	6.78	710
123	0.80		56.7	162.7	163.5	159.0	1.00	6.71	712
124	0.82		56.8	164.3	165.1	160.5	1.00	6.84	736
125	0.81		56.8	166.0	166.7	162.2	1.00	6.71	734
126	0.81		56.9	167.6	168.4	163.7	1.00	6.71	744
127	0.82		57.0	169.2	170.1	165.3	1.00	6.82	766
128	0.81		57.1	171.1	171.9	167.2	1.00	6.75	770
129	0.81		57.1	172.7	173.5	168.7	1.00	6.79	786
130	0.82		57.2	174.3	175.0	170.1	1.00	6.82	799
131	0.82		57.2	175.7	176.5	171.5	1.00	6.83	811
132	0.81		57.3	177.1	177.9	172.9	1.00	6.78	813
133	0.81		57.4	178.6	179.5	174.4	1.00	6.78	823
134	0.80		57.4	180.2	180.9	175.7	1.00	6.67	820
135	0.82		57.5	181.6	182.3	177.1	1.00	6.82	847
136	0.79		57.6	182.9	183.6	178.5	1.00	6.60	828
137	0.81		57.7	184.3	185.1	179.7	1.00	6.74	854
138	0.81		57.7	185.7	186.5	181.2	1.00	6.71	860
139	0.81		57.8	187.1	187.9	182.5	1.00	6.73	871
140	0.81		57.7	188.7	189.4	184.0	1.00	6.77	888
141	0.82		57.6	189.8	190.7	185.2	1.00	6.86	908
142	0.81		57.2	191.1	191.7	186.1	1.00	6.74	904
143	0.81		56.9	191.2	191.7	186.1	1.00	6.76	909

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
144	0.81		56.3	190.9	191.3	185.7	1.00	6.79	915
145	0.81		56.1	190.4	190.9	185.3	1.00	6.77	911
146	0.81		56.0	189.8	190.3	184.7	1.00	6.71	900
147	0.80		55.9	189.2	189.6	184.1	1.00	6.66	889
148	0.81		55.8	188.4	188.9	183.3	1.00	6.76	897
149	0.81		55.8	188.0	188.3	182.8	1.00	6.72	890
150	0.80		55.7	187.1	187.4	181.9	1.00	6.69	880
151	0.81		55.4	186.4	186.8	181.3	1.00	6.76	886
152	0.81		55.2	185.7	186.0	180.7	1.00	6.74	881
153	0.81		55.1	185.0	185.4	180.0	1.00	6.76	879
154	0.81		55.0	184.1	184.5	179.1	1.00	6.74	871
155	0.81		55.1	183.2	183.5	178.2	1.00	6.76	867
156	0.81		55.0	182.4	182.8	177.5	1.00	6.76	862
157	0.81		54.9	181.7	182.2	177.0	1.00	6.73	855
158	0.79		54.8	180.9	181.2	176.0	1.00	6.56	829
159	0.81		54.7	180.2	180.5	175.2	1.00	6.77	850
160	0.81		54.7	179.3	179.6	174.5	1.00	6.78	846
161	0.81		54.6	178.6	178.9	173.8	1.00	6.75	838
162	0.82		54.4	177.7	178.0	172.9	1.00	6.83	843
163	0.81		54.4	176.9	177.2	172.1	1.00	6.78	831
164	0.81		54.5	176.1	176.4	171.4	1.00	6.75	822
165	0.81		54.5	175.2	175.6	170.6	1.00	6.78	819
166	0.81		54.6	174.6	174.8	169.9	1.00	6.72	807
167	0.81		54.7	173.6	173.9	168.9	1.00	6.72	801
168	0.82		54.9	172.8	173.1	168.2	1.00	6.81	804
169	0.81		55.0	172.0	172.3	167.5	1.00	6.72	787
170	0.80		55.2	171.2	171.4	166.6	1.00	6.66	774
171	0.81		55.4	170.4	170.7	165.9	1.00	6.79	782
172	0.81		55.5	169.7	169.9	165.1	1.00	6.77	774
173	0.82		55.8	168.8	169.1	164.4	1.00	6.81	770
174	0.82		55.9	168.1	168.4	163.7	1.00	6.81	765
175	0.80		56.1	167.2	167.6	163.0	1.00	6.64	738
176	0.81		56.3	166.6	166.9	162.3	1.00	6.72	742
177	0.81		56.5	165.7	165.9	161.4	1.00	6.73	736
178	0.80		56.6	165.0	165.2	160.8	1.00	6.70	727
179	0.82		56.8	164.3	164.5	160.2	1.00	6.88	740
180	0.81		56.9	163.5	163.8	159.4	1.00	6.78	724
181	0.82		57.0	162.8	163.1	158.7	1.00	6.86	727
182	0.81		57.0	162.2	162.4	158.0	1.00	6.79	715
183	0.81		57.1	161.3	161.6	157.3	1.00	6.77	706
184	0.82		57.2	160.6	160.9	156.6	1.00	6.82	706
185	0.82		57.3	159.9	160.1	155.9	1.00	6.82	701
186	0.81		57.3	159.2	159.5	155.2	1.00	6.77	691
187	0.82		57.2	158.3	158.6	154.4	1.00	6.82	690
188	0.82		57.0	157.7	157.9	153.7	1.00	6.81	686
189	0.82		56.7	157.0	157.3	153.1	1.00	6.80	683
190	0.81		56.4	156.4	156.6	152.5	1.00	6.78	679
191	0.82		56.3	155.6	155.9	151.8	1.00	6.84	680

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
192	0.79		56.2	154.9	155.1	151.1	1.00	6.58	650
193	0.80		56.2	154.3	154.6	150.5	1.00	6.63	651
194	0.80		56.2	153.6	153.9	149.9	1.00	6.66	650
195	0.82		56.3	153.0	153.2	149.2	1.00	6.82	660
196	0.82		56.4	152.2	152.4	148.4	1.00	6.81	653
197	0.83		56.5	151.6	151.8	147.9	1.00	6.88	656
198	0.81		56.6	150.9	151.1	147.1	1.00	6.71	634
199	0.81		56.7	150.3	150.6	146.7	1.00	6.78	636
200	0.81		56.8	150.3	150.7	146.8	1.00	6.72	629
201	0.80		56.9	150.6	151.1	147.2	1.00	6.68	627
202	0.79		57.0	151.1	151.5	147.7	1.00	6.60	622
203	0.82		57.1	151.6	152.1	148.2	1.00	6.81	644
204	0.80		57.3	152.4	152.9	148.9	1.00	6.65	634
205	0.82		57.4	153.1	153.8	149.8	1.00	6.81	652
206	0.81		57.4	154.2	154.9	150.9	1.00	6.73	652
207	0.81		57.4	155.7	156.4	152.3	1.00	6.77	667
208	0.81		57.4	157.3	157.9	153.7	1.00	6.78	678
209	0.81		57.3	159.0	159.7	155.4	1.00	6.74	686
210	0.81		57.3	160.7	161.5	157.1	1.00	6.76	699
211	0.80		57.3	162.6	163.5	159.1	1.00	6.70	706
212	0.81		57.3	164.5	165.2	160.8	1.00	6.79	729
213	0.82		57.3	166.1	167.0	162.5	1.00	6.84	745
214	0.81		57.2	168.0	168.8	164.2	1.00	6.74	748
215	0.81		57.2	169.6	170.4	165.6	1.00	6.77	762
216	0.82		57.2	171.1	171.9	167.1	1.00	6.85	781
217	0.81		57.2	172.5	173.2	168.3	1.00	6.77	781
218	0.81		57.1	173.9	174.6	169.8	1.00	6.78	793
219	0.80		57.2	175.3	176.1	171.2	1.00	6.65	786
220	0.81		57.2	176.9	177.7	172.7	1.00	6.79	814
221	0.83		57.2	178.4	179.2	174.1	1.00	6.88	835
222	0.81		57.2	180.0	180.8	175.7	1.00	6.72	827
223	0.82		57.1	181.6	182.3	177.1	1.00	6.84	853
224	0.81		57.0	182.9	183.7	178.5	1.00	6.76	852
225	0.81		56.7	184.4	185.2	179.9	1.00	6.78	867
226	0.82		56.3	185.7	186.6	181.2	1.00	6.85	888
227	0.82		56.2	187.0	187.8	182.3	1.00	6.81	892
228	0.81		56.1	188.3	189.1	183.6	1.00	6.77	896
229	0.81		56.2	189.8	190.5	184.8	1.00	6.71	898
230	0.81		56.1	190.7	191.4	185.8	1.00	6.76	911
231	0.81		56.0	191.0	191.6	185.9	1.00	6.77	916
232	0.81		55.9	190.7	191.2	185.6	1.00	6.76	912
233	0.82		55.9	190.3	190.8	185.1	1.00	6.80	915
234	0.81		56.0	189.7	190.2	184.6	1.00	6.74	902
235	0.83		56.2	189.1	189.4	183.9	1.00	6.93	922
236	0.81		56.3	188.5	188.8	183.3	1.00	6.71	889
237	0.81		56.5	187.7	188.0	182.6	1.00	6.77	889
238	0.81		56.7	187.1	187.5	182.1	1.00	6.77	883
239	0.82		56.9	186.4	186.8	181.4	1.00	6.80	882

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
240	0.83		57.0	185.5	185.9	180.5	1.00	6.89	887
241	0.82		57.2	184.6	185.0	179.7	1.00	6.82	870
242	0.80		57.3	183.9	184.3	179.1	1.00	6.65	843
243	0.80		57.4	183.2	183.7	178.4	1.00	6.71	845
244	0.80		57.5	182.4	182.7	177.6	1.00	6.70	837
245	0.81		57.5	181.8	182.1	176.9	1.00	6.76	842
246	0.81		57.5	180.8	181.1	176.0	1.00	6.75	833
247	0.80		57.5	179.9	180.3	175.3	1.00	6.65	815
248	0.80		57.3	179.3	179.7	174.7	1.00	6.71	819
249	0.80		57.3	178.5	178.8	173.9	1.00	6.64	805
250	0.81		57.3	177.7	178.0	173.0	1.00	6.78	818
251	0.80		57.3	177.1	177.4	172.5	1.00	6.70	803
252	0.80		57.2	176.3	176.6	171.7	1.00	6.69	798
253	0.82		57.2	175.5	175.8	170.9	1.00	6.82	807
254	0.81		57.2	174.7	174.9	170.1	1.00	6.76	795
255	0.81		57.2	173.8	174.1	169.2	1.00	6.77	790
256	0.79		57.0	173.0	173.3	168.5	1.00	6.58	764
257	0.81		57.0	172.2	172.5	167.8	1.00	6.71	774
258	0.81		57.0	171.4	171.8	167.1	1.00	6.79	778
259	0.81		57.0	170.6	170.9	166.3	1.00	6.75	768
260	0.81		56.8	169.9	170.2	165.5	1.00	6.77	767
261	0.81		56.6	169.1	169.4	164.8	1.00	6.77	763
262	0.82		56.4	168.4	168.7	164.1	1.00	6.82	764
263	0.81		56.2	167.7	168.0	163.4	1.00	6.76	754
264	0.80		56.0	166.8	167.2	162.6	1.00	6.69	742
265	0.81		55.9	166.0	166.3	161.8	1.00	6.74	743
266	0.81		55.8	165.4	165.6	161.1	1.00	6.77	743
267	0.81		55.7	164.6	164.8	160.3	1.00	6.76	737
268	0.81		55.7	163.9	164.2	159.8	1.00	6.77	734
269	0.80		55.7	163.0	163.3	158.9	1.00	6.65	714
270	0.81		55.7	162.3	162.5	158.2	1.00	6.74	719
271	0.80		55.7	161.6	161.8	157.5	1.00	6.69	709
272	0.81		55.7	160.9	161.2	156.9	1.00	6.73	709
273	0.82		55.8	160.1	160.3	156.1	1.00	6.83	714
274	0.81		55.9	159.4	159.7	155.4	1.00	6.74	698
275	0.81		55.9	158.7	158.9	154.7	1.00	6.73	693
276	0.81		56.0	157.9	158.2	154.0	1.00	6.75	689
277	0.80		56.0	157.2	157.5	153.4	1.00	6.71	680
278	0.80		56.1	156.5	156.8	152.7	1.00	6.69	672
279	0.81		56.1	155.7	156.1	152.0	1.00	6.74	672
280	0.78		56.1	155.1	155.4	151.4	1.00	6.49	644
281	0.81		56.1	154.5	154.7	150.7	1.00	6.72	662
282	0.81		56.0	153.8	154.0	150.0	1.00	6.75	661
283	0.80		56.0	153.1	153.4	149.3	1.00	6.66	648
284	0.81		56.0	152.4	152.6	148.6	1.00	6.77	654
285	0.78		56.0	151.7	152.0	148.1	1.00	6.49	622
286	0.79		56.1	151.1	151.3	147.5	1.00	6.60	628
287	0.82		56.1	150.3	150.6	146.7	1.00	6.81	642

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
288	0.81		56.2	150.0	150.4	146.5	1.00	6.76	635
289	0.79		56.3	150.2	150.6	146.7	1.00	6.59	619
290	0.81		56.4	150.7	151.2	147.3	1.00	6.76	638
291	0.81		56.5	151.4	152.0	148.0	1.00	6.73	640
292	0.82		56.5	152.3	153.0	149.0	1.00	6.81	653
293	0.81		56.6	153.6	154.3	150.3	1.00	6.79	660
294	0.80		56.6	155.1	155.7	151.7	1.00	6.71	661
295	0.82		56.6	156.6	157.3	153.1	1.00	6.83	683
296	0.82		56.4	158.2	159.0	154.8	1.00	6.82	695
297	0.82		56.2	159.6	160.3	156.0	1.00	6.83	707
298	0.80		56.1	161.3	162.0	157.7	1.00	6.70	705
299	0.82		56.0	162.9	163.6	159.2	1.00	6.83	731
300	0.79		55.9	164.5	165.2	160.7	1.00	6.59	716
301	0.82		55.9	166.1	166.8	162.2	1.00	6.83	753
302	0.79		55.7	167.7	168.4	163.8	1.00	6.59	739
303	0.82		55.6	169.3	170.0	165.3	1.00	6.83	777
304	0.81		55.6	170.8	171.7	166.9	1.00	6.74	777
305	0.81		55.3	172.5	173.3	168.4	1.00	6.74	791
306	0.81		54.7	174.2	175.0	170.0	1.00	6.78	811
307	0.81		54.5	175.8	176.6	171.5	1.00	6.76	821
308	0.81		54.3	177.2	178.2	173.0	1.00	6.73	829
309	0.80		54.2	178.8	179.6	174.4	1.00	6.67	833
310	0.81		54.1	180.3	181.1	175.8	1.00	6.79	858
311	0.82		54.1	181.7	182.6	177.2	1.00	6.80	869
312	0.81		54.2	183.5	184.2	178.8	1.00	6.73	872
313	0.81		54.3	184.7	185.4	179.9	1.00	6.79	887
314	0.81		54.4	186.0	186.7	181.2	1.00	6.72	886
315	0.81		54.6	187.2	188.0	182.5	1.00	6.78	900
316	0.81		54.7	188.4	189.2	183.6	1.00	6.74	902
317	0.81		54.9	189.6	190.4	184.8	1.00	6.74	909
318	0.81		54.9	190.6	191.3	185.7	1.00	6.78	922
319	0.81		54.8	191.6	192.2	186.6	1.00	6.78	928
320	0.81		54.7	191.5	191.8	186.3	1.00	6.78	929
321	0.84		54.7	190.9	191.4	185.8	1.00	6.97	951
322	0.81		54.8	190.1	190.7	185.1	1.00	6.75	914
323	0.81		54.9	189.7	190.1	184.5	1.00	6.76	912
324	0.81		55.0	188.9	189.3	183.8	1.00	6.78	909
325	0.82		55.0	188.1	188.3	182.8	1.00	6.80	906
326	0.81		55.1	187.4	187.7	182.2	1.00	6.78	897
327	0.82		55.3	186.6	186.9	181.5	1.00	6.83	898
328	0.81		55.4	185.7	186.0	180.6	1.00	6.74	879
329	0.81		55.5	184.8	185.2	179.9	1.00	6.79	879
330	0.81		55.5	184.2	184.5	179.2	1.00	6.77	873
331	0.81		55.6	183.3	183.6	178.3	1.00	6.74	862
332	0.81		55.5	182.5	182.9	177.7	1.00	6.77	860
333	0.82		55.5	181.5	181.9	176.7	1.00	6.82	860
334	0.81		55.5	180.8	181.1	175.9	1.00	6.78	851
335	0.81		55.5	180.0	180.2	175.1	1.00	6.77	844

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Alternate Heating
Model: SE110
Run #: 4

Job #: 24-350
Tracking #: 217
Technician: AK
Date: 1/10/2024

	Flow (GPM)		Temperature Data (°F)						
Elapsed Time (min)	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out	Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
336	0.81		55.6	179.1	179.4	174.3	1.00	6.76	836
337	0.80		55.6	178.2	178.6	173.6	1.00	6.69	821
338	0.81		55.7	177.5	177.8	172.8	1.00	6.74	822
339	0.81		55.8	176.6	177.0	172.0	1.00	6.76	817
340	0.80		55.8	175.7	176.1	171.2	1.00	6.70	804
341	0.81		55.9	175.0	175.4	170.4	1.00	6.77	808
342	0.82		56.0	174.2	174.3	169.5	1.00	6.80	805
343	0.81		56.1	173.2	173.5	168.7	1.00	6.77	794
344	0.82		56.1	172.5	172.7	167.9	1.00	6.81	793
345	0.82		56.2	171.6	171.9	167.1	1.00	6.83	789
346	0.82		56.2	170.8	171.1	166.3	1.00	6.80	780
347	0.82		56.2	170.1	170.3	165.6	1.00	6.80	775
348	0.81		56.3	169.3	169.4	164.8	1.00	6.77	765
349	0.80		56.3	168.3	168.6	164.0	1.00	6.67	748
350	0.81		56.4	167.5	167.8	163.3	1.00	6.75	751
351	0.82		56.4	166.7	167.1	162.5	1.00	6.83	754
352	0.81		56.4	166.0	166.4	161.9	1.00	6.77	743
353	0.81		56.5	165.2	165.5	161.0	1.00	6.71	731
354	0.81		56.5	164.5	164.8	160.3	1.00	6.78	733
355	0.81		56.6	163.8	164.1	159.6	1.00	6.78	728
356	0.82		56.6	163.0	163.3	158.9	1.00	6.83	727
357	0.81		56.6	162.2	162.5	158.1	1.00	6.72	711
358	0.81		56.4	161.5	161.8	157.5	1.00	6.77	713
359	0.81		56.2	160.8	161.0	156.7	1.00	6.76	708
360	0.81		56.1	160.1	160.3	156.0	1.00	6.71	699
361	0.81		55.9	159.2	159.5	155.3	1.00	6.73	696
362	0.81		55.8	158.6	158.9	154.7	1.00	6.77	696
363	0.82		55.8	157.8	158.0	153.8	1.00	6.80	694
364	0.82		55.7	157.1	157.4	153.2	1.00	6.83	693
365	0.82		55.6	156.4	156.7	152.6	1.00	6.80	686
366	0.81		55.5	155.6	155.9	151.8	1.00	6.77	679
367	0.81		55.5	154.9	155.2	151.1	1.00	6.78	675
368	0.81		55.4	154.2	154.5	150.5	1.00	6.76	668
369	0.81		55.4	153.5	153.8	149.8	1.00	6.79	667
370	0.81		55.4	152.8	153.1	149.2	1.00	6.77	661
371	0.81		55.4	152.2	152.5	148.5	1.00	6.75	654
372	0.81		55.4	151.5	151.7	147.8	1.00	6.72	646
373	0.80		55.4	150.8	151.0	147.1	1.00	6.71	641
374	0.81		55.5	150.2	150.5	146.6	1.00	6.77	642
375	0.82		55.5	150.1	150.5	146.5	1.00	6.80	644
Average	0.81	#DIV/0!	56	169	170	165	1.00	6.75	765
								TOTAL:	**286801**

LAB SAMPLE DATA - ASTM E2515

Client: 0
Model: 0
Run #: 0

Job #: 0
Tracking #: 0
Technician: 0
Date: 1/0/1900

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	**A**	G01205	227.7	229.3	1.6
	B	G01206	227.6	229.3	1.7
	C - 1st Hour	G01207	229.5	230.2	0.7
	Amb	G01208	227.2	227.4	0.2
Probes	**A**	19A	117026.2	117026.3	0.1
	B	19B	117013.1	117013.3	0.2
	C - 1st Hour	19C	114231.0	114231.1	0.1
O-rings	**A**	19A	3585.5	3585.9	0.4
	B	19B	3632.4	3632.5	0.1
	C - 1st Hour	19C	3614.5	3614.5	0.0

Placed in Dessicator on:	1/10/2025

Balance Audit (mg):		200.0		200.0		200.0			
		Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time
Filters	**A**	229.2	1/13 10:45	229.3	1/15 13:00				
	B	229.3	1/13 10:45	229.3	1/15 13:00				
	C - 1st Hour	230.1	1/13 10:45	230.2	1/15 13:00				
	Amb	227.4	1/13 10:45	227.4	1/15 13:00				
Probes	**A**	117026.2	1/13 10:45	117026.3	1/15 13:00				
	B	117013.2	1/13 10:45	117013.3	1/15 13:00				
	C - 1st Hour	114231.0	1/13 10:45	114231.1	1/15 13:00				
O-Rings	**A**	3586.3	1/13 10:45	3585.8	1/15 13:00	3585.9	1/20 10:00		
	B	3632.7	1/13 10:45	3632.5	1/15 13:00				
	C - 1st Hour	3614.6	1/13 10:45	3614.5	1/15 13:00				

Train A Aggregate, mg:	**2.1**
Train B Aggregate, mg:	**2.0**
Train C Aggregate, mg:	**0.8**
Ambient, mg:	**0.2**

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 4 Test Date: 1/10/24

Wood Heater Run Notes

Pre-Test Notes
Pre-Test Start Time: 09:46
Target Load (BTU/hr): 46,875

Time	Notes
	-None-

Test Notes
Test Burn Start Time: 11:24
Target Load (BTU/hr): 46,875 (Category 3)

Time	Notes
	-None

Test Burn End Time: 17:39

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 17.00 CO (%): 4.002
Mid Gas CO_2 (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	9:11	9:21	9:26	1/11 10:15	1/11 10:17	1/11 10:20
CO_2	0.00	17.00	10.16	-0.018	16.76	10.01
CO	0.000	4.002	2.501	-0.039	3.869	2.498

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

Technician Signature:  Date: 1/20/25

ASTM E2618 Hydronic Heater Run Sheets

Client: Alternate Heating Job Number: 24-350 Tracking #: 217
Model: SE110 Run Number: 4 Test Date: 1/10/24

Test Photos



Preburn Fuel Load



Test Fuel Load



Test Fuel Loaded

Technician Signature: _____ Date: 1/20/25

ASTM E2515 - Glass Fiber Filters

Date:	12/23	1/2	-	-			
Time:	12:00	08:30	—	—			
	Weight 1	**Weight 2**	**Weigth 3**	**Weight 4**	**Initial**	**Project**	**Run**
G01189	229.1	229.3	-	-	A	22-791 Alber	#7
G01190	227.0	227.2	-	-	A	↓	↓
G01191	228.2	228.4	-	-	A		
G01192	228.7	228.8	-	-	A		
G01193	229.4	229.5	-	-	A	24-350	#1
G01194	228.0	228.0	-	-	A	↓	↓
G01195	228.4	228.3	-	-	A		
G01196	227.8	227.8	-	-	A		
G01197	228.7	228.7	-	-	A		#2
G01198	227.7	227.7	-	-	A		↓
G01199	228.1	228.0	-	-	A		
G01200	228.4	228.6	-	-	A		
G01201	228.3	228.2	-	-	A		#3
G01202	228.1	228.0	-	-	A		↓
G01203	228.5	228.4	-	-	A		
G01204	229.2	229.2	-	-	A	↓	

Date:	1/6	1/9	-	-			
Time:	13:00	14:00	-	-			
	Weight 1	**Weight 2**	**Weigth 3**	**Weight 4**	**Initial**	**Project**	**Run**
G01205	227.9	227.7	-	-	A	24-350	#4
G01206	227.8	227.6	-	-	A	↓	↓
G01207	229.6	229.5	-	-	A		
G01208	227.2	227.2	-	-	A		
G01209	243.6	243.8	-	-	A	24-367	#1
G01210	245.2	245.1	-	-	A	↓	↓
G01211	244.5	244.3	-	-	A		
G01212	244.9	244.7	-	-	A	↓	↓
G01213	244.7	244.9	-	-	A		#2
G01214	244.5	244.6	-	-	A		↓
G01215	241.9	242.1	-	-	A		
G01216	243.6	243.7	-	-	A		
G01217	243.4	243.3	-	-	A		#3
G01218	244.0	244.0	-	-	A		↓
G01219	243.8	243.9	-	-	A		
G01220	244.5	244.6	-	-	A	↓	↓

ASTM E2515 - Probe Samples 11-20

Date:	12/16 ~~14:30~~	12/17 ~~10:00~~		
Time:	14:30	10:00		

	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
11A	116868.4	116868.2	-	-	A	22-791 Alder	#1
11B	117341.9	117341.9	-	-	A		
11C	116187.6	116187.4	-	-	A		#2
12A	116708.5	116708.5	-	-	A		
12B	117774.4	117774.2	-	-	A		#3
12C	117173.6	117173.4	-	-	A		
13A	117316.2	117316.2	-	-	A		#4
13B	116942.2	116942.2	-	-	A		
13C	115650.9	115650.9	-	-	A		#5
14A	116634.3	116634.2	-	-	A		
14B	116620.7	116620.6	-	-	A		#6
14C	116531.2	116531.2	-	-	A		
15A	117242.2	117242.0	-	-	A		#7
15B	116755.0	116755.0	-	-	A		
15C	116848.3	116846.2	-	-	A		

Date:	1/3 ~~12:15~~	1/6	1/8	-
Time:	12:15	9:00	13:20	-

	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
16A	116380.3	116380.1	-	-	A	24-350	#1
16B	115862.9	115862.7	-	-	A		
16C	114147.9	114148.0	-	-	A		
17A	116810.9	116810.8	-	-	A	24-350	#2
17B	117140.9	117140.7	-	-	A		
17C	113141.4	113141.2	-	-	A		
18A	117500.3	117500.1	-	-	A	24-350	#3
18B	117332.3	117332.1	-	-	A		
18C	114335.0	114334.9	-	-	A		
19A	117026.4	117026.2	-	-	A	24-350	#4
19B	117013.3	117013.1	-	-	A		
19C	114231.2	114231.0	-	-	A		
20A	115627.9	115627.4	115627.4	-	A	24-367	#1
20B	115987.3	115966.9	115987.1	-	A		
20C	113775.8	113775.6	-	-	A		

ASTM E2515 - O-Ring Samples 11-20

Date:	12/16 ~~14:30~~	12/17 ~~12:00~~					
Time:	14:30	10:00					
	Weight 1	**Weight 2**	**Weigth 3**	**Weight 4**	**Initial**	**Project**	**Run**
11A	3423.80	3423.2	-	-	A	22-791 Alder	#1
11B	4233.96	4233.8	-	-	A		
11C	3588.20	3588.1	-	-	A		#2
12A	3585.0	3585.2	-	-	A		
12B	3615.0	3615.2	-	-	A		
12C	3550.4	3550.6	-	-	A		#3
13A	3595.8	3595.8	-	-	A		
13B	3641.4	3641.4	-	-	A		#4
13C	4409.3	4409.5	-	-	A		#5
14A	3342.7	3342.8	-	-	A		
14B	3367.3	3367.4	-	-	A		
14C	3444.01	3444.3	-	-	A		#6
15A	3569.7	3569.8	-	-	A		
15B	3570.7	3570.7	-	-	A		#7
15C	3397.2	3397.3	-	-	A		

Date:	1/3 ~~12:15~~	1/6					
Time:	12:15	19:00					
	Weight 1	**Weight 2**	**Weigth 3**	**Weight 4**	**Initial**	**Project**	**Run**
16A	3572.3	3572.2	-	-	A		
16B	3637.7	3637.5	-	-	A	24-350	#1
16C	3601.3	3601.1	-	-	A		
17A	3612.6	3612.4	-	-	A		
17B	3569.0	3568.9	-	-	A	24-350	#2
17C	3597.4	3597.0	-	-	A		
18A	3602.6	3602.4	-	-	A		
18B	3545.6	3545.4	-	-	A	24-350	#3
18C	3528.0	3527.8	-	-	A		
19A	3585.7	3585.5	-	-	A		
19B	3632.2	3632.74	-	-	A	24-350	#4
19C	3614.7	3614.5	-	-	A		
20A	3558.5	3558.6	-	-	A		
20B	3614.1	3614.1	-	-	A	24-367	#1
20C	3610.6	3610.4	-	-	A		

Pre-Conditioning Data

Client:	Alternate Heating	Job #:	24-350
Model:	SE110	Tracking #:	217
Date(s):	12/1/2024	Technician:	AK

Elapsed Time (hrs)	Flue (°F)	Catalyst Exit (°F)	Notes: Indicate initial air setting and any changes in in setting during conditioning, as well as weight and average moisture content of all fuel additions.
0	179	N/A	+61 lb, maple, 20-28%DB heat draw med high
1	247	N/A	
2	253	N/A	
3	81	N/A	
4	244	N/A	
5	268	N/A	
6	77	N/A	
7	279	N/A	
8	270	N/A	
9	85	N/A	
10	81	N/A	
11	280	N/A	
12	259	N/A	
13	125	N/A	+55 lb, maple, 20-28%DB heat draw med high
14	79	N/A	
15	78	N/A	
16	80	N/A	
17	91	N/A	
18	80	N/A	
19	192	N/A	
20	81	N/A	
21	77	N/A	
22	201	N/A	
23	83	N/A	
24	77	N/A	
25	211	N/A	+56 lb, maple, 20-28%DB heat draw med high
26	309	N/A	
27	78	N/A	
28	276	N/A	
29	297	N/A	
30	77	N/A	
31	176	N/A	
32	78	N/A	
33	107	N/A	
34	168	N/A	+56 lb, maple, 20-28%DB heat draw med low
35	86	N/A	
36	71	N/A	
37	255	N/A	
38	227	N/A	
39	278	N/A	
40	127	N/A	
41	252	N/A	
42	252	N/A	
43	71	N/A	+54 lb, maple, 20-28%DB heat draw med high
44	287	N/A	
45	269	N/A	
46	78	N/A	
47	265	N/A	
48	240	N/A	
49	188	N/A	
50	78	N/A	

Signature/Date:  4/2/2025

Sample Calculations – ASTM E2618 & E2515

Client: Alternate Heating
Model: SE110
Run: 1

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

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

M_{Cdb}– Weight of test fuel crib, excluding nails and spacers, dry basis, kg

D_{Cdb} - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft^3

M_{FTAdb} - Total weight of fuel crib excluding nails, dry basis, kg

BR – Dry burn rate, kg/hr

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

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

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

m_n – Total particulate matter collected, mg

C_s - Concentration of particulate matter in tunnel gas, dry basis, corrected to STP, g/dscf

E_T – Total particulate emissions, g

PR - Proportional rate variation

PM_R – Particulate emissions for test run, g/hr

PM_F – Particulate emission factor for test run, g/dry kg of fuel burned

M_{Sdb} – Weight of test fuel spacers, dry basis, kg
ASTM E2780 equation (1)

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

Where,

FM_S	=	average fuel moisture of test fuel spacers, % dry basis
M_{Swb}	=	weight of test fuel spacers, wet basis, kg

Sample Calculation:

FM_S =	N/A	%
M_{Swb} =	N/A	lbs
0.4536 =	Conversion factor from lbs to kg	

M_{Sdb} = [(N/A x 0.4536) (100/(100 + N/A)

M_{Sdb} = **N/A** kg

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

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

Where,

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

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

Sample Calculation (test fuel piece 1):

MC_{Pnwb} = 7.82

FM_{CPn} = 19.8

= 7.8 (100/(100+ 19.8)

= 6.5 lbs

Total dry crib weight, excluding spacers = 45.84 lbs

M_{Cdb} = **20.79** kg

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

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

Where,

V_C = Volume of fuel crib, ft^3

Sample calculation:

V_C = N/A in^3
1728 = conversion from in^3 to ft^3

D_{Cdb} = 45.84 / N/A * 1728

= **N/A** lbs/ft^3

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

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

Sample calculation:

$$M_{FTAdb} = \text{N/A} + 20.79$$

$$= \textbf{N/A} \text{ kg}$$

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

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

Where,

θ = Total length of test run, min

Sample Calculation:

M_{Bdb} = 20.79 kg
θ = 151 min

$$BR = \frac{60 \times 20.8}{151}$$

BR = **8.26** kg/hr

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

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

Where:

F_p	=	Adjustment factor for pitot tube center point reading = $\frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)
v_{scent}	=	Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
v_{strav}	=	Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
k_p	=	Pitot tube constant, 85.49
C_p	=	Pitot tube coefficient: 0.99, unitless
ΔP*	=	Velocity pressure in the dilution tunnel, in H_2O
T_s	=	Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
P_s	=	Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g , in Hg
P_{bar}	=	Barometric pressure at test site, in. Hg
P_g	=	Static pressure of tunnel, in. H_20; (in Hg = in H_20/13.6)
M_s	=	
		**The dilution tunnel wet molecular weight; M_s = 28.78 assuming a dry weight of 29 lb/lb-mole

Sample calculation:

$$Fp = \frac{17.46}{18.41} = 0.948$$

$$V_s = 0.948 \times 85.49 \times 0.99 \times 0.276 \times \left(\frac{84.6 + 460}{\left(30.30 + \frac{-0.23}{13.6} \right) \times 28.78} \right)^{1/2}$$

V_s = **17.49** ft/s

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

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

Q_{sd} – Average gas flow rate in dilution tunnel, dscf/hr
ASTM E2515 equation (3)

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

Where:

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

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 17.49 \times 0.7854 \times \frac{528}{84.6 + 460} \times \frac{30.30 + \frac{-0.23}{13.6}}{29.92}$$

Q_{sd} = **47553.0** dscf/hr

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

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

Where:

K_1	=	17.64 °R/in. Hg
V_m	=	Volume of gas sample measured at the dry gas meter, dcf
Y	=	Dry gas meter calibration factor, dimensionless
P_{bar}	=	Barometric pressure at the testing site, in. Hg
ΔH	=	Average pressure differential across the orifice meter, in. H_2O
T_m	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 24.392 \times 1.005 \times \frac{\left(30.30 + \frac{1.13}{13.6}\right)}{(82.3 + 460)}$$

$V_{m(std)}$ = **24.226** dscf

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 23.121 \times 1.011 \times \frac{\left(30.30 + \frac{1.10}{13.6}\right)}{(82.7 + 460)}$$

$V_{m(std)}$ = **23.081** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 34.25 \times 1 \times \frac{\left(\underline{30.3} + \frac{0.00}{13.6}\right)}{(67.0 + 460)}$$

$V_{m(std)}$ = **34.740** dscf

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

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

Where:

K_2	=	Constant, 0.001 g/mg
m_n	=	Total mass of particulate matter collected in the sampling train, mg
$V_{m(std)}$	=	Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{1.8}{24.23}$$

C_s = **0.00007** g/dscf

For Train 2

$$C_s = 0.001 \times \frac{1.9}{23.08}$$

C_s = **0.00008** g/dscf

For Ambient Train

$$C_r = 0.001 \times \frac{0.3}{34.74}$$

C_r = **0.000009** g/dscf

E_T – Total Particulate Emissions, g
ASTM E2515 equation (15)

$$E_T = (c_s - c_r) \times Q_{std} \times \theta$$

Where:

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

Sample calculation:

For Train 1

E_T = (0.000074 - 0.000009) x 47553.0 x 151 /60

E_T = **7.86** g

For Train 2

E_T = (0.000082 - 0.000009) x 47553.0 x 151 /60

E_T = **8.82** g

Average

E = **8.34** g

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

7.5% of the average =	**0.63**
Train 1 difference =	**0.48**
Train 2 difference =	**0.48**

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

θ = Total sampling time, min

θ_i = Length of recording interval, min

V_{mi} = Volume of gas sample measured by the dry gas meter during the “ith” time interval, dcf

V_m = Volume of gas sample as measured by dry gas meter, dcf

V_{si} = Average gas velocity in the dilution tunnel during the "ith" time interval, ft/sec

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

T_{mi} = Absolute average dry gas meter temperature during the "ith" time interval, ^oR

T_m = Absolute average dry gas meter temperature, ^oR

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

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

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

$$PR = \left(\frac{151 \times 0.144 \times 17.49 \times (82.1 + 460) \times (82.3 + 460)}{1 \times 24.392 \times 17.10 \times (84.6 + 460) \times (68.2 + 460)} \right) \times 100$$

PR = **93** %

PM_R – Particulate emissions for test run, g/hr
ASTM E2780 equation (6)

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

Where,

E_T = Total particulate emissions, grams

θ = Total length of full integrated test run, min

Sample Calculation:

E_T (Dual train average) = 8.34 g

θ = 151 min

$PM_R = 60 \times (8.34 / 151)$

PM_R = **3.31** g/hr

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

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

Sample Calculation:

E_T (Dual train average)	=	8.34	g
M_{Bdb}	=	20.79	kg
PM_F	=	8.34 / 20.79	
PM_F	=	**0.40**	g/kg

Manufacturer:	Alternate Heating
Model:	SI6110
Date:	01/08/16
Run:	1
Control #:	24-350
Test Duration:	0hr 0min

Note: In the "Input data", "Calc. To (T)", "Fuel Properties", and "Air Properties" columns, [H], [H2], [M], [N], [O], [H2O], [N2], and [Ar] refer to their respective variables in Clausius Clapeyron's 17.3 to 17.7.

Overall Heating Efficiency:	82.18%	Air Fuel Ratio (AR) Dry Molecular Weight (Md_)	30.48
Combustion Efficiency:	99.20%	Dry Molar Exhaust Gas (Nd_)	832.86
Heat Transfer Efficiency:	82.84%	Air Fuel Ratio (AR)	8.72

Heat Output:	129,453 Btu/h	136,412 kJ/h	
Heat Input:	156,215 Btu/h	164,766 kJ/h	
Burn Duration:	2.52	h	
Burn Rate:	18.20 lb/h	8.256 kg/h	
Stack Temp:	316.7 Deg. F	158.2 Deg. C	

Combustion Efficiency:	99.20%	%HC	0.68
Total Input (kJ):	414,705	393,108	(Btu)
Total Output (kJ):	340,787	323,220	(Btu)
Efficiency:	82.18%		
Total CO (g):	261.46		

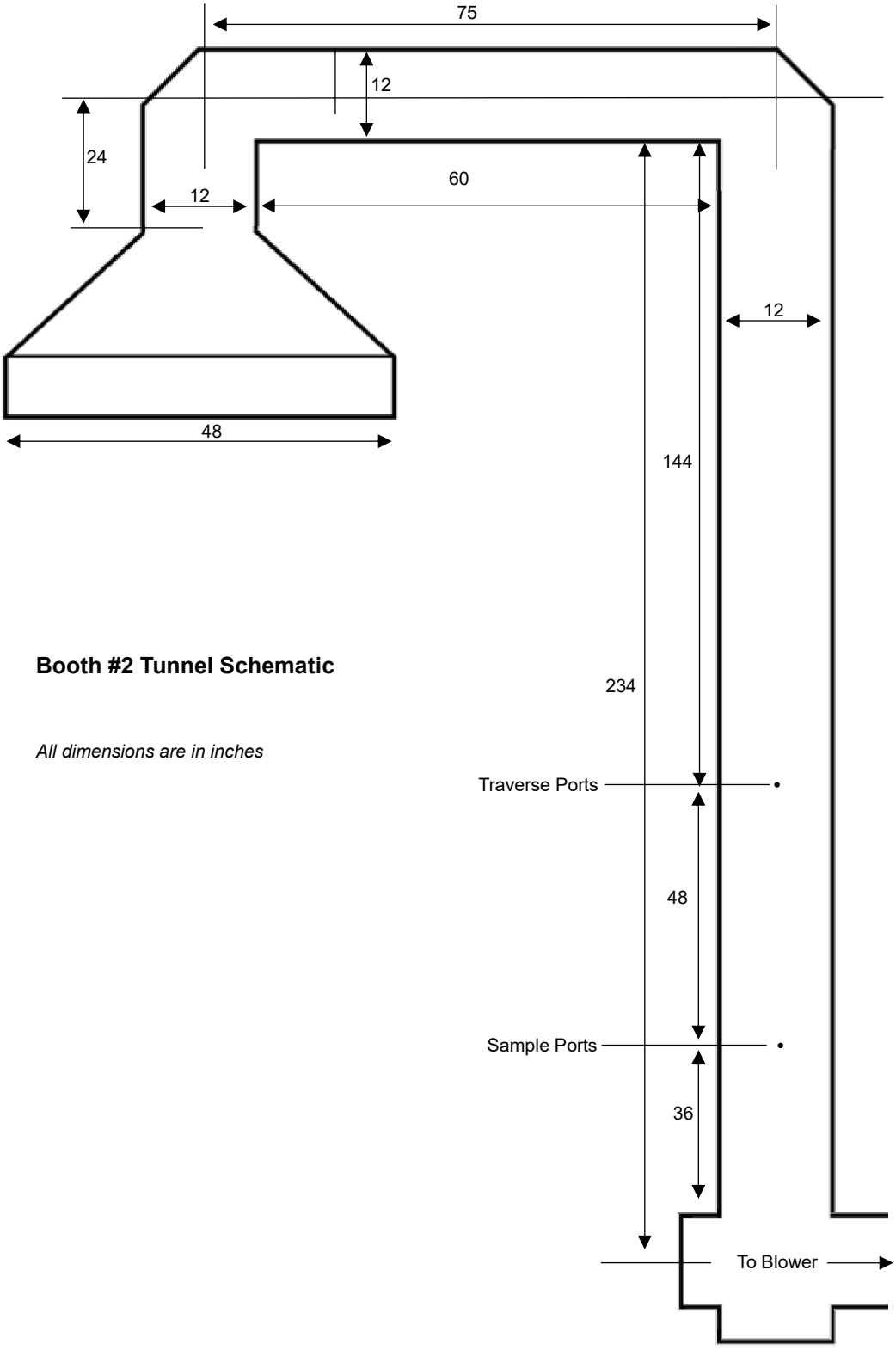
Moisture of Wood fuel basis:	18.516%		
Initial Dry Weight Wt_(kg):	20.79		
Moisture Content Dry	22.73		

Moisture Content M_{wet}: 18.516%

Dry kg:	20.79	
CA:	0	
CB:	0	
CC:	0	
CX:	0	

	HHV	LHV
	90.14%	97.89%
Comb Eff	99.20%	99.20%
HT Eff	82.84%	86.66%
Output	136,412	kJ/h
Burn Rate	8.26	kg/h
Grams CO	262	g
Input	164,765	kJ/h

| | | |



Booth #2 Tunnel Schematic

All dimensions are in inches

Wood Gun Super E110

Manufactured by Economical Energy Consultant INC
DBA Alternate Heating Systems
2395 Little Egypt Road Harrisonville, PA 17228

Certified To: UL 2523, CAN/CSA B366.1-11, ASTM 2515-11, ASTM 2618-13
U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using cordwood.
Certified as an ad-on model: _____
Model: SE110
Serial No. 24843686
Date of Manufacture: February 26, 2025

Installation Clearances to Combustibles:
FRONT – 24in; LEFT – 6in; RIGHT – 6in; REAR – 6in; TOP – 6in; CHIMNEY – 18in
(Only install on a **noncombustible floor.** Concrete, Etc.)
For Supply Connections use 12 AWG or larger wires acceptable for at least 90°C or an equivalent.
For use with copper conductors only.
See installation manual for more detail.

C US
Intertek
W/N _____

Specifications :
Voltage: 120
Amps: 6.0A
Frequency: 60 Hz
Phase: 1
Max. wire temperature: 90°C
Minimum Flue Diameter: 6"

Minimum Circuit Ampacity (MCA): 15A
Max-over Current Protective Device: 15A
Emissions (lb/MMBtu):
Cat 1: 0.07
Cat 2: 0.07
Cat 3: 0.07
Cat 4: 0.06

REFER TO OWNER'S MANUAL
✓ For basic operating and maintenance instructions, see the owner's manual.
✓ This unit burns seasoned logwood.
✓ Maximum -.08 inches of water column draft
✓ Minimum -.04 inches of water column draft
✓ Field assembly of low water cut-off and cyclone (See installation manual for details)

Refer to the Intertek Directory of Building Products (https://bpdirectory.intertek.com) for detailed information.

DANGER: RISK OF FIRE OR EXPLOSION:

WARNING FIRE DANGER:

- **Do NOT use chemicals for starting a fire.**
- **Do NOT burn garbage, gasoline, fuel oils, or other flammable liquids or materials.**
- **Do NOT store combustibles within marked installation clearances.**
- **Do NOT allow explosive vapors to accumulate in boiler room.**
- **Do NOT operate if flue draft exceeds .08 inches of water column.**
- **Do NOT touch during operation.**
- **Do NOT operate with Load door OR Ash door open.**
- **Do NOT interchange chimney manufacturers**
- **DO NOT CONNECT TO A FLUE SERVING ANOTHER APPLIANCE.**

CAUTION:

- **Do not open the loading door even in a power outage, until power is restored, and the green "Purge" turns on.**
- **Keep children away.**
- **Keep Clothing, furniture, and other combustible materials away.**
- **Load wood carefully or damage may result.**
- **Do NOT alter this equipment in any way.**
- **Inspect and clean the flue and chimney regularly.**
- **Unit is HOT while in operation.**
- **This equipment may only be installed by qualified personnel.**

WARNING – FIRE DANGER:

All flue connections must meet all the requirements of NFPA Standard Number 211 and UL 103. The appliance must be connected to an approved chimney made of masonry or manufactured chimney listed for solid fuel.

IMPORTANT:

- For INDOOR use only.
- Unit requires a supply of combustion air.
- This vessel is an ASME-certified boiler. The vessel is not suitable for heating potable water without the use of a domestic water exchanger.
- Unit will not operate without electrical power.
- Disconnect power before servicing. Keep shields and covers in place unless servicing boiler.
- The heat exchanger, flue pipe, and chimney must be in good condition and cleaned regularly to remove accumulated creosote and ash. Clean at the end of the heating season to minimize corrosion during the summer months.
- 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.
- Unit may be connected to an existing boiler system. Do not relocate or bypass any of the safety controls in the original boiler installation.
- Use **CO (carbon monoxide) detector** in any boiler installation to detect the presence of gas that may accumulate in the area around the boiler.

In case of runaway fire:

1. Cut power.
2. Make sure automatic air controls are tightly closed and the draft motor is off.
3. Shut loading and ash removal doors.
4. Maintain continued circulation of boiler water to remove heat from the boiler and if the boiler is equipped with a domestic coil run hot water.

In a case of power loss:

Do not open the loading door even in a power outage, until the power is restored, and the green "Purge" light turns on!

If you lose power the Wood Gun will shut down. If the power is not restored within 4-6hr you will most likely need to restart the fire, with match, paper, and kindling. Still, wait for the green light to turn on even before restarting.

A backup power source may be used to operate the Wood Gun in a power outage. Backup power must support both the controls and circulators. (Do not run a backup generator in the same area with the boiler or in any confined space).

The system must work even when unattended to guard against overheating. Backup power must be provided in a way that satisfies local code requirements and prevents back-feeding of electricity into the power grid.

If no means of dissipating heat exists, close all doors, and verify automatic dampers are closed.

Datalabel

INSTALLATION AND OPERATOR'S MANUAL

WOOD GUN™ WOOD GASIFICATION BOILER

Model: Super E110



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



IMPORTANT: IN ORDER TO ACHIEVE SAFE AND SATISFACTORY RESULTS FROM YOUR ALTERNATE HEATING SYSTEMS BOILER, READ SAFETY RULES AND INSTRUCTIONS CAREFULLY BEFORE INSTALLING AND OPERATING. ALL INSTALLATIONS MUST BE IN ACCORDANCE WITH STATE AND LOCAL CODES. SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE.



Your Alternate Heating Systems Boiler is capable of generating very hot temperatures. Boiler temperatures and flames in the ignition box area are capable of causing ignition or explosion of explosive or flammable products or explosion of the boiler itself if maximum safe water temperature is exceeded. Maximum safe water temperature is 200° Fahrenheit. Flammable or explosive products must never be stored in the same room or in the vicinity of a boiler, and the boiler water temperature must never be allowed to exceed 200° Fahrenheit.

ALTERNATE HEATING SYSTEMS 2395 LITTLE EGYPT RD HARRISONVILLE, PA 17228 717-987-0099 WWW.WOODGUN.COM EMAIL:SERVICE@WOODGUN.COM	**Record Model and Serial Number Below:** **Model: SUPER E110** **Stainless Steel (Yes/No):** **Serial Number:** **Date of Purchase:____/___/_____**

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⚠CAUTIONS AND WARNINGS: RISK OF FIRE, INJURY OR DEATH

WARNING: NEVER FILL A HOT BOILER WITH WATER, IF UNIT IS LOW IN WATER ALLOW UNIT TO COOL BEFORE FILLING WITH WATER. FAILURE TO DO SO COULD RESULT IN DEATH OR SEVERE INJURY AND DAMAGE TO BOILER AND SURROUNDING PROPERTY.

INSTALLATION IS TO BE PERFORMED BY A QUALIFIED INSTALLER AND WILL COMPLY WITH ALL THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION OVER THE INSTALLATION

ALL COVER PLATES, ENCLOSURES, AND GUARDS MUST BE MAINTAINED IN PLACE AT ALL TIMES, EXCEPT DURING MAINTENANCE AND SERVICING.

USE ONLY WITH SEASONED LOG WOOD WITH A MOISTURE CONTENT OF 19%-25%.

THE UNIT IS NOT TO BE CONNECTED TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE!

USE COPPER CONDUCTORS ONLY FOR FIELD WIRING

DANGER! RISK OF FIRE OR EXPLOSION – DO NOT BURN GARBAGE, GASOLINE, DRAIN OIL OR OTHER FLAMMABLE LIQUIDS!

WARNING! RISK OF FIRE – DO NOT OPERATE WITH FLUE DRAFT EXCEEDING -0.08IN WATER COLUMN!

WARNING! RISK OF FIRE – DO NOT USE CHEMICALS TO START UNIT FIRING!

WARNING! RISK OF FIRE – DO NOT BURN GARBAGE, GASOLINE, FUEL OILS OR OTHER FLAMMABLE LIQUIDS OR MATERIALS!

WARNING! RISK OF FIRE – DO NOT OPERATE WITH FUEL LOADING OR ASH REMOVAL DOORS OPEN!

WARNING! RISK OF FIRE – DO NOT STORE FUEL OR OTHER COMBUSTIBLE MATERIAL WITHIN MARKED INSTALLATION CLEARANCES!

WARNING! RISK OF FIRE – INSPECT AND CLEAN FLUES REGULARLY!

CAUTION! HOT SURFACES – KEEP CHILDREN AWAY!

CAUTION! HOT SURFACES – DO NOT TOUCH DURING OPERATION!

CAUTION! HOT SURFACES – MAXIMUM DRAFT MARKED ON NAMEPLATE.

DANGER – TO AVOID INJURY FROM MOVING PARTS, SHUT OFF THE BOILER BEFORE REMOVING/OPENING SERVICE PANELS AND DRAFT INDUCING FAN.

FOR INDOOR INSTALLATION ONLY!

IN THE EVENT OF A RUN-AWAY FIRE… CUT POWER TO UNIT, CLOSE LOADING AND ASH REMOVAL DOORS. IF POSSIBLE TURN ON CIRCULATION PUMPS/ZONE VALVES TO “DUMP” EXCESS HEAT.

USE COPPER CONDUCTORS ONLY

THIS WOOD HEATER NEEDS PERIODIC INSPECTION AND REPAIR FOR PROPER OPERATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH OPERATING INSTRUCTION IN THIS MANUAL

DO NOT TAMPER WITH OR REMOVE ANY COMPONENTS AND FOLLOW ALL INSTALLATION PROCEDURES IN THIS MANUAL.

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

WARNING: DO NOT OVER-FIRE! OVER-FIRING WILL CAUSE DAMAGE TO REFRACTORY AND GREATLY SHORTEN THE LIFE OF THE BOILER.

Introduction

The purpose of this manual is to assist you in the installation, operation and maintenance of your new boiler in order to achieve the best performance possible.

The Super E110 is a wood gasification boiler designed to efficiently and easily burn cord wood. The SE110 was tested by Intertek laboratories according to: UL 2523, CAN/CSA B366.1-11, ASTM 2515-11, ASTM 2618-13. It was found to comply with the EPA 2020 particulate emission limits while burning cord wood. The SE110 is designed to produce 16,250-125,000 btu/hr.

We recommend that the unit be installed by a qualified installer who has a thorough knowledge of hydronic heating boiler systems and will comply with all of the requirements of the authority having jurisdiction over the installation ensuring that the necessary safety controls are installed and properly wired.

Read the entire instruction manual carefully and understand it thoroughly before installing or operating this unit. Save these instructions and review them periodically as an aid to maintaining your boiler and following safe operating practices.

All Wood Gun boilers can be supplied with the Warnock Hershey "WH" and/or the ASME "H" stamp with National Board number for an additional fee when requested prior to purchase. Alternate Heating Systems boilers are built to the most rigid quality control standard. You can be assured that you will receive the highest quality product.

EXPLANATION OF WOOD & BIOMASS COMBUSTION

The burning of wood involves a series of very complex chemical reactions that are time and temperature dependent. The pieces of wood (or particles) may be thought of as containers that store combustible gases that are released when heat is applied. The various gases that emanate from heated wood have ignition temperatures ranging from 540° F to 1125° F. This helps to explain why maintaining a high combustion temperature is so important in achieving "complete" combustion in burning wood. In a conventional wood stove a significant portion of the combustible gases released from the wood goes up the chimney unburned to become deposited on the chimney walls as creosote or escape as visible smoke. In the Wood Gun™ a greater percentage of the combustible elements released from the wood are combusted due to the high temperatures attained, usually within even a few minutes of re-ignition.

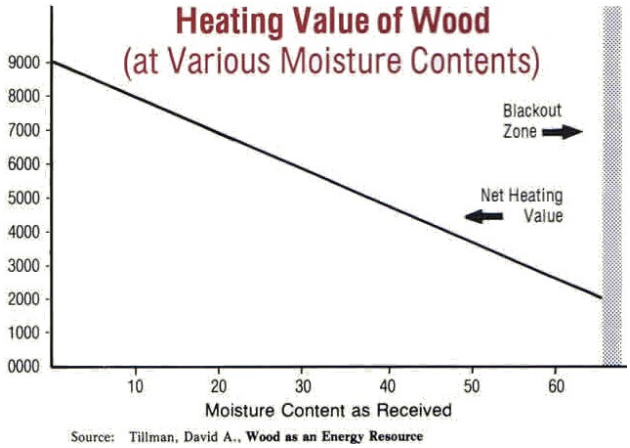
The time it takes for smoke to disappear from boiler exhaust on startup depends largely upon the temperature of the refractory. A boiler being fired from a cold start may emit some smoke for 10-30 minutes. When the boiler is reigniting after an off cycle (hot or warm start) there may be very little to no visible smoke. The length of the last firing cycle and the amount of elapsed time since the boiler last fired will affect refractory temperatures and the amount of visible smoke when the boiler re-fires. A Wood Gun™ operating under normal load will produce only a small amount of smoke on startup and burn cleanly shortly thereafter.

WOOD MOISTURE CONTENT & WOOD GASIFICATION

The moisture content of wood is a critical factor affecting wood gasification, as it determines how rapidly pyrolysis (gasification) can occur. Wood moisture content moderates the rate of gasification by limiting the rate of heat gain in the wood. Wood with higher moisture content will gasify more slowly. Wood with excessive moisture content will not gasify until a large amount of water has been driven out of the wood. This consumes energy that would otherwise be usable heat. The dilemma that faces the boiler operator using higher moisture content wood is that the boiler must be operated so that more heat goes up the stack (in order to drive

water vapor out of the system) or else the operator will be faced with significant and troublesome condensation.

Wood with moisture content higher than 28% is more likely to produce condensation issues and will produce markedly less BTU's per pound of fuel.
You may not burn Unseasoned Wood!



Source: Tillman, David A., **Wood as an Energy Resource**

Very dry wood creates a different problem. With dry wood, pyrolysis temperatures are achieved more quickly and the rate of gasification is accelerated. This may result in the consumption of available oxygen faster than it can enter the boiler. The fire could then begin to release smoke due to a phenomena known as "back puffing"; "Back-puffng" results in smoke being pushed out through the intake in intermittent, and often audible, puffs. Low moisture fuel (< 10% moisture) requires special considerations for a satisfactory burn. Dry sawdust and shavings are less of a problem than kiln-dried solid blocks or logs.

With medium moisture wood, 19-29%, the combustion process is more constant, with pyrolysis and the combustion of gases and charcoal occurring close to a constant rate. This moisture content of 19-28% is optimum for burning wood in the gasification process.

Because of the downdraft design of the Wood Gun™, the rate of air admitted to the unit is fairly constant regardless of the type and amount of fuel being burned.

Most pyrolysis occurs between 540° F (280° C) and about 900° F (500° C). The most abundant gases produced are carbon monoxide, methane, methanol, formaldehyde, and hydrogen as well as formic and acetic acids, water vapor and carbon dioxide. All of these elements must pass through the refractory combustion chamber where, in the presence of high temperatures and oxygen, they are reduced to carbon dioxide and water. By the time the temperature of the fuel reaches 900° F (500° C) pyrolysis is complete and the final solid product is charcoal, which is almost pure carbon.

MODE OF OPERATION

The Wood Gun™ operates on the well known principle of gasification which makes it possible to burn wood at high efficiency and free of creosote formation in the chimney.

The bottom of the fuel chamber is lined with pieces of dense refractory casting, which make up the primary combustion zone. This combustion zone is linked to the fuel chamber by one opening. The gases produced from the pyrolysis of the fuel charge are drawn through the opening into the refractory combustion chamber where a very intense flame exceeding 1800° F (1000° C) is produced.

Heat generated in the combustion chamber radiates throughout the refractory mass heating the fuel charge above. As the fuel charge is subjected to heat, the moisture is driven from the wood and it begins to char, releasing a variety of combustible gases.

The gases produced during pyrolysis would not normally follow a downward path, so a draft-inducing fan is employed to create a partial vacuum that draws the flame through two tunnels in the refractory. These refractory tunnels make up the primary combustion area in the Wood Gun™.

This long flame path provides sufficient retention time for the gases to cause near complete combustion to occur before the hot gases come in contact with the water-backed heat exchanger surface.

The mass of refractory that encompasses the combustion chamber also serves a second important function, acting as a heat store to initiate re-ignition after a period of no demand.

When the air valves close and the draft inducing fan stops, the fire is extinguished by lack of oxygen and becomes dormant. The fire will re-ignite once the air valves open and the draft-inducing fan is powered on, as long as the refractory still retains enough heat to cause combustion to take place. The fuel may remain dormant for periods of four hours or more depending on the temperature of the refractory at shutdown.

By burning wood in this way, fuel is burned at maximum efficiency, only as heat is required, and never as a low smoldering fire. Smoldering fires, and less than optimum fires, produce excessive amounts of creosote and smoke.

When a demand for heat exists, the water temperature will drop below Operating Limit, the air valves will open and the draft induction fan starts. At this time, abundant air is provided for combustion. When the boiler's water temperature reaches the level set on the Operate Limit, the fan stops and the air valve closes.

The fan that creates the negative pressure in the combustion chamber inversely produces positive pressure in the flue so it is very important to seal every joint of the stove pipe with silicone. This will ensure that no smoke or dust will escape into the room.

CAUTION! Positive pressure exists in the flue so it is very important to seal every joint of the stove pipe with silicone. Do not use barometric damper!

The Wood Gun™ is very responsive to heat demand, especially when compared to conventional wood boilers. Because of this responsiveness, providing domestic hot water in the summer may be practical. Alternate Heating Systems cannot promise that summer time use of a Wood Gun will be practical for you.

If summertime hot water requirements are low it may be necessary to turn on the draft cycle timer to make the unit run for 15 minutes every 3.5 hours. This will prevent the fire from going out and more importantly will maintain sufficient temperature in the refractory to ensure complete combustion on start-up. This feature will provide heat until the timer reaches the end of the programmed cycle, or until the boiler temperature High Limit is reached.

Note: Some of the byproducts produced by incomplete combustion of wood are formaldehyde, formic acid and acetic acid, which are mildly corrosive. A Wood Gun™ operating under light demand may never generate refractory temperatures sufficient to reduce these organic compounds to water and carbon dioxide. Any air leak around the doors or air valve may contribute to the formation of corrosive products. Therefore it is important to inspect your Wood Gun™ regularly to ensure that it is being operated in a manner that does not contribute to excessive corrosion of the steel.

It is essential that all combustion air be prevented from entering the Wood Gun™ at shutdown/off-cycle. Where a strong chimney draft is present during the off cycle, a unit with leaking door seals may allow a small amount of air to be pulled through the unit, supporting a low-grade fire. This produces two major undesirable results.

First, incomplete combustion yields creosote and other organic compounds, which are mildly acidic. These condense on the water walls of the load chamber and heat exchanger. If this situation is allowed to continue for any length of time, the heat exchanger will become coated to the extent that airflow and heat transfer are seriously impaired.

The second undesirable result is moisture condensation. This occurs because the low-grade fire produces insufficient heat to carry the water out the stack as water vapor. Water will likely be evident in the ash pan and, in severe cases, may even collect in the heat exchanger. This water comes not only from water moisture in the wood, but is formed as a byproduct of combustion. Excellent combustion will maximize the amount of the main byproducts of

combustion, carbon dioxide and water. More water will be produced by good combustion than that originally contained in well seasoned wood. Severe condensation can result in so much liquid water that it is misinterpreted as a boiler leak. When water is found in the cyclone and/or heat exchanger, attack the issue as one related to condensation.

Note: Condensation in the heat exchanger can be caused by wood that is too wet for the application and/or by low return water temperatures. Recommended return water temperature is operating temperature minus 20º F

Reduce or Prevent Condensation

Condensation has several causes, but can always be attacked systematically and greatly reduced or eliminated. Even in early fall and late spring, condensation can be kept under control. Keep in mind that because the Wood Gun swirl tube heat exchanger extracts so much heat from the exhaust, the gases leaving the system are often not far above temperatures that can lead to condensation, about 250F. Anything that compromises performance or cools stack gases further than normal can trigger condensation. Review this list and make changes that match your circumstances. Be sure to review the installation section of this manual that covers return water temperature.

- ✔ Increase return water temperatures (mixing valve, raise operating temperature)
- ✔ Increase overall boiler water temperature. Maximum recommended temp is 190F.
- ✔ Check for and correct any issues related to leaking door seals or Air Valve leaks
- ✔ Insulate stove pipe and/or chimney to preserve heat
- ✔ Increase heat load on boiler, which will increase run cycle length and decrease off cycle length
- ✔ Use wood that is 19-28% moisture.
- ✔ Clean boiler, or take other measures to improve air flow. Check your stove pipe and chimney.
- ✔ If you are observing back-puffing, take care of this issue promptly, as performance is compromised in a back-puffing boiler, possibly contributing to condensation
- ✔ Keep refractory relatively clear of charcoal and ash. The firebox should never have more than 1 in of ash in bottom. Scrap excess ash into center slot or shovel out.
- ✔ Watch loading technique and other firebox management aspects, making sure that the fire burns properly upside down.
- ✔ Do not overload the firebox. If you are getting more than 14 hr burn-times, lessen the amount of wood you load into the firebox. Fill only 1/4 – 1/3 full.
- ✔ Clean the boiler. Completely remove cyclone fan assembly and stove pipe.
- ✔ If you are experiencing water in the cyclone, removing the air turbulator may help.

Proper Pressurization of the Wood Gun

The Wood Gun™ is designed as a pressurized boiler system. Before leaving the factory, it is pressure tested for safety. Typical hydronic heating applications operate at pressures of about 12-18 psi. A pressurized system causes oxygen to be driven from the water reducing corrosion and oxidation. Rust and mineral buildup is avoided in a pressurized system because extra water is not continuously added to make up for evaporation losses. Keep the boiler and piping properly pressurized for long life. Be sure to review information in the installation section of this manual regarding expansion tank selection.

Boiler Installation

BOILER LOCATION

Indoor wood burning boilers are designed to radiate heat freely, but this heat can be dangerous if the boiler is improperly installed. The Wood Gun™ is designed and certified only for indoor installations and therefore must be protected from the elements by being located in a totally enclosed and insulated shelter. The Wood Gun™ must not be installed anywhere that gasoline, or other flammable vapors are present. Unless special preparations are made to partition off an area for the boiler and to prevent flammable vapors from entering the boiler area, a garage is not an approved location for a Wood Gun™ installation. Check local building codes for restrictions on installation.



The boiler must stand on a noncombustible material such as brick, stone tile or concrete. NEVER place a boiler directly on a wood floor. The noncombustible material upon which the boiler stands should extend at least 6 inches beyond the base of the boiler in the rear and on the sides and at least 24 inches in front. The boiler must be installed in an area dedicated to the boiler and its related equipment. This area must be partitioned or separated from any living area of a residence. The room must have a constant fresh air supply to assure proper combustion of the fuel as well as ventilation of any by-products of combustion.

Boiler Room Requirements

1. The room should be well-lit and should have a source of emergency light.
2. A convenient water supply should be available for boiler flushing and to clean the boiler room floor.
3. Unobstructed floor drains.
4. A boiler must not be installed where there is the possibility of the accumulation of explosive vapors.
5. Must have adequate air supply, which must be kept clear at all times.

   a. Since the combustion process requires a supply of air at all times, it is essential that provisions are made to supply adequate air to the boiler room. This air supply is necessary to insure complete combustion and venting of any gases or smoke that would be emitted from this solid fuel-burning boiler in case boiler malfunctions. If fans are used in the boiler room or in the fuel storage room it is important they are installed in such a way that there is not a negative pressure in the room where the boiler is located.



6. Provide an electrical disconnect at point of entrance to boiler room.
7. Walls and ceiling must be of fire rated construction. Consult local or state codes for requirements.
8. It is recommended to have at least one week worth of fuel inside and kept out of the weather. Do not store fuel within the appliance installation clearances or within the space required for fueling, ash removal, and other routine maintenance operations.

RIGGING AND POSITIONING OF BOILER

Do not attempt to move or off-load the boiler without the aid of a crane or dolly. Your Alternate Heating Systems boiler has a lifting lug in the center of the top.

Once on the floor where it will be installed the unit may be rolled on pipe. Use caution whenever moving a boiler. Be sure to use proper equipment and have sufficient manpower available to prevent injury or damage that can be caused by improper handling heavy equipment. The boiler must be placed on a concrete slab or other rigid pad of non-combustible material with sufficient strength to adequately support the boiler including its contents of water. The boiler should be positioned as closely as possible to the chimney. The smoke pipe must pitch continually upward toward the chimney and be as straight as possible (no more than 2 elbows can be used before the chimney). Level the boiler after it has been positioned.



Before proceeding with installation, inquire with local building officials to confirm compliance with that building, plumbing and electrical codes. Alternate Heating Systems recommends that a qualified technician experienced in boiler installations perform the installation of the Wood Gun™. Wiring on the boiler must be properly grounded.





CLEARANCES TO COMBUSTIBLES REQUIRED FOR SAFETY AND OPERATION

The required minimum clearances to combustibles for all models are:

Clearances to Combustibles

Front	**24 Inches**
Rear	**6 Inches**
Left	**6 Inches**
Right	**6 Inches**
Top	**6 Inches**
Stovepipe	**18 Inches**

Clearances to Combustible Flooring:

The noncombustible material upon which the boiler stands should extend at least 6 inches beyond the base of the boiler in the rear and on the sides and at least 24 inches in front. If the chimney connector runs horizontally, the floor protector must extend 2-in beyond each side of the connector.

Most municipalities require a specified clearance between the flue pipe and combustibles (normally 18 in). The customer/installer must follow all local and state building codes for clearances. The above dimensions are to be regarded as minimums.

Extra clearance is recommended to allow for easy movement around the boiler for cleaning and/or maintenance. Refer to Appendix A for exterior dimensions of the various models.

It is necessary to adhere to the clearances and restrictions that are described in this manual. Extensive research and testing has been conducted to assure that these units are safe when operated according to the instructions included in this manual.

INSTALLATION AND MAINTENANCE OF ELECTRICAL CONTROLS AND GAUGES

- Temperature/pressure Gauge

Insert the temperature/pressure gauge into the tapping located on the top of the boiler at the front right. Refer to Appendix A for details on tapping sizes and locations.

- High Limit Aquastat

The high limit aquastat occupies the tapping on the top-left on the top of the boiler.

- Thermocouples

The boiler has two thermocouples one for the water and one for the exhaust. The water thermocouple will be in the top-right tapping of the rear of the boiler. The Exhaust thermocouple will be mounted on the cyclonic ash seperator along with the O2 sensor.

For detailed wiring and control diagrams, consult Appendix B: Wiring Diagrams. When installing the L.W.C.O. refer to directions in a later section.

Testing the Aquastat

In rare cases it may be necessary to test the controls and gauges. First turn the power off. To test an aquastat. Turn the dial 20° past the boiler water temperature. Use an ohmmeter to test the terminals for continuity. If the contacts are closed before you turn the dial it should open afterward. If it is opened before you turn the dial it should be closed afterward. It can be common that the contacts engage or disengage +/-5° from the reading of the temperature gauge due to slow water circulation in the boiler vessel. If the temperature difference is more than +/-5° than the aqua stat should be replaced. If there is a discrepancy in the temperatures, be sure that the temperature gauge is accurate. This can be done by testing the boiler water temperature with a second thermometer or temperature gauge.

Low Water Cut Off

A low water cutoff (LWCO) is an electrical device that can sense the presence of water, and then activates a switch. This switch will turn the unit off if no water is sensed. In a boiler water keeps the metal cool, if the boiler is low on water the steel, in some cases, can become super heated and will warp and crack. This problem is eliminiated by installing a low water cutoff.

A low water cutoff is not needed in every install. Check you local codes and with your insurance company to see if it is required.

For installation instructions find the Low Water Cutoff section later in this manual.

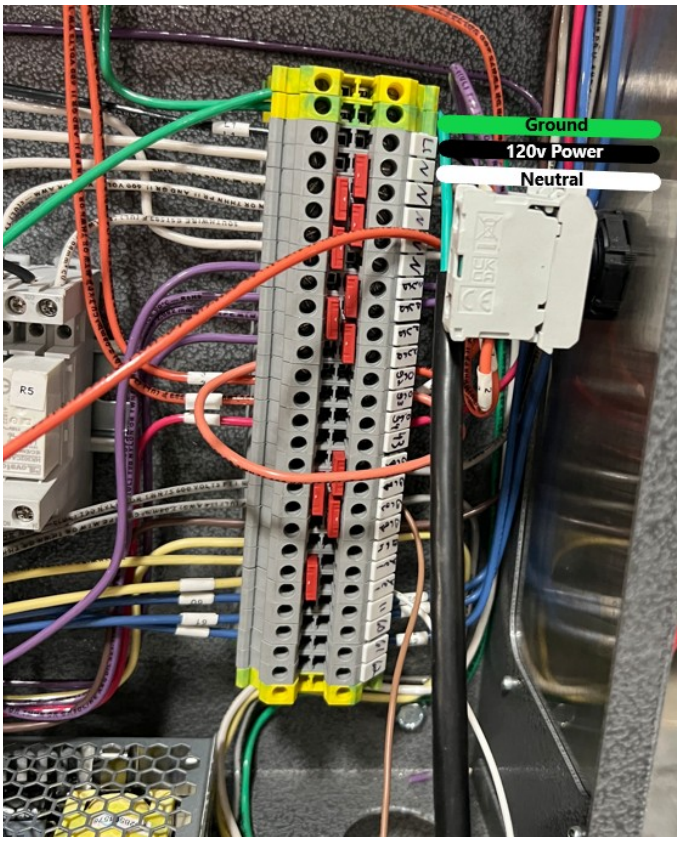
Boiler Controlled Circulator/Zone

The Super E110 has the ability to control a circulator or zone, which will circulate water through the boiler when it is on and only if the water is above the set temperature. The Black 30 in the 4x4 junction box for accessories, pictured in the Smoke Hood Installation seciton, comes from the boilers circulator relay (R5) (amp @ 120vac). Power of your choice will need supplied to terminal #22 of the R5 relay via the Black **31**. Black **30** will then be used to power the pump/zone. This output can be turned on and off and the temperature can be changed from the “Operating Limits” screen.

CONNECTING POWER TO THE BOILER

Connect electrical service of 120VAC with a minimum circuit ampacity of 15 amp. Provide an electrical disconnect at the entrance of the room.

Connect the electrical service to the main control box on the left side of the boiler. You will need to remove both the access panel and the controller panel. Use an empty 7/8 inch knock-out hole to bring the wires into the control box. Land the Input 120vac power on the L1 terminal, land the neutral on the 'N' terminal and land the ground on the Yellow/green terminal.



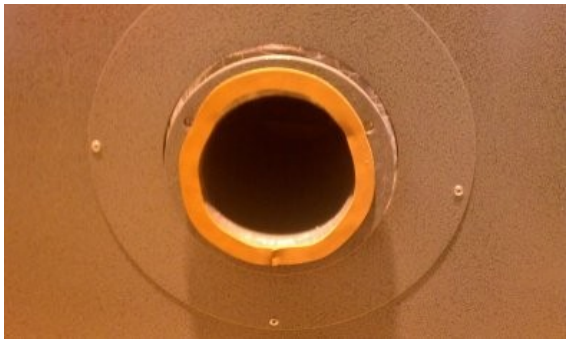
Power Input Wiring

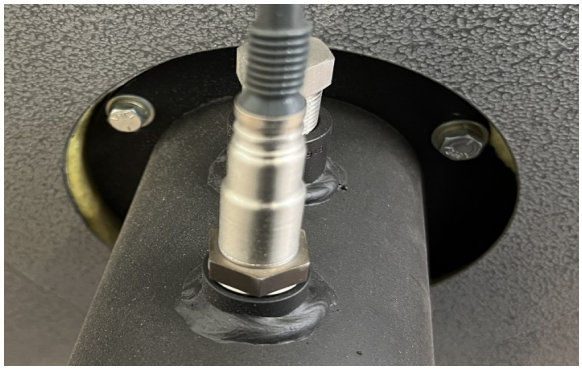
CYCLONE ASH COLLECTOR

Once the Wood Gun™ has been positioned, the cyclone ash collector should be attached to the flange on the left side of the boiler (see Appendix C: Exploded Parts Drawings).



Apply a strip of 1/8 in x 1/2 in self-stick sponge rubber (included with boiler) or a bead of RTV red silicone to the boiler flange inside of the mounting holes before attaching the cyclone to the boiler flange using three 5/16 in x 3/4 in bolts and washers. To apply sponge rubber, carefully remove the paper backing from the rubber strip to expose the adhesive. Overlap the strip approximately 1 inch and cut off the excess material with a knife or scissors. The adhesive will hold the gasket in place until the cyclone assembly is positioned.





Cyclone Installation

Installing the O2 Sensor and Flue Thermocouple

After the Cyclone is installed you can install the O2 sensor and the flue thermocouple. The cyclone has two threaded ports one is 1/2npt fot the thermocouple, the other is M18 x 1.5mm for the O2 Sensor. Befor threading these into their ports use a

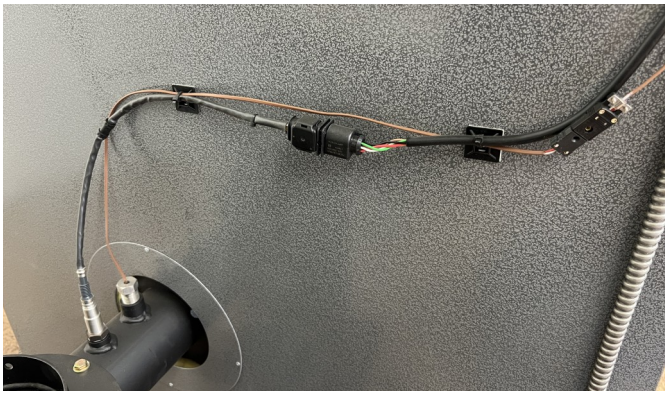
small amount of RTV silicone or nickel antisieze to seal the threads.

Once both are threaded you will need to plug them in. Their plugs will come out of the bottom of the main control box through the 1.25 inch hole.

The polarity of the thermocouple wires are critical.

After the oxygen sensor and the exhaust thermocouple are tightened connect their cables. Use the sticky pads and zip ties to organize the cables.







O2 Sensor and Thermocouple wires

INSTALLATION OF SMOKE HOOD OPTION

AHS recommends the Smoke Hood (exhaust) for most installations inside the home. The Smoke Hood functions in much the same manner as the range hood over a kitchen stove. It vents smoke escaping from an open load door directly to the outside. It must be separate from the chimney vent, and may go through a side wall or ceiling. Use 5 or 6 inch stove pipe and a vent flap to prevent outside air from entering when the smoke hood is turned off. Use of 6 inch stove pipe will require use of an adapter, but venting performance will be better with larger stove pipe.





Smoke Hood

The smoke hood is turned on manually as needed, typically just before opening the load door to add fuel.

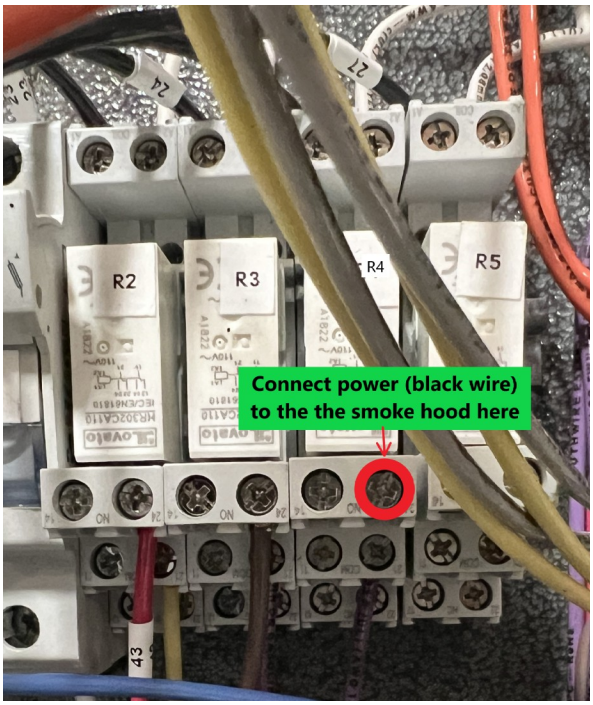
Smoke is most commonly seen when the load door is opened with considerable fuel still left

burning in the firebox. Smoke escape is also common when refractory is at good operating temperature and the firebox is being filled completely.

Installation is easy. First remove the rectangular sheet metal knock-out in the top sheet metal. Using a long knife cut the fiberglass insulation along the newly created hole.

Center the smoke hood assembly over the hole and use the four phillips self-tapping screws to secure the blower assembly in place.

The 6' long conduit (this can be shortened if needed) will run into the top of the main control box. Connect the White into the 'N' terminals, Green into the Green/Yellow terminals, and Black will go to terminal 24 on the R4 Relay. See picture below.



Smoke Hood Wiring

INSTALLATION OF SMOKE DETECTORS AND CO MONITORS

Any fuel burning appliance produces smoke whether or not it is enough to see or not is a different question. The amount of CO and smoke emitted is somewhat dependent on the operator.

The levels emitted will increase if operated incorrectly. For best practices see the Operation Information section.

CO (carbon monoxide) is dangerous byproduct of all fuel burning appliances. CO is a colorless tasteless gas that settles on the ground, as it is heavier than oxygen. You will have absolutely no issues with either smoke or CO getting into your living spaces if you follow this manual entirely. But just to be safe we recommend installing CO monitors and smoke detectors.

Do not install the boiler in a sleeping room!

Install a CO monitor in the room where the heater is located, at about table height.

Install a Smoke detector in the room where the heater is located, if installed too closely to the heater it may false trip when loading the heater. It is also recommended to install smoke detectors inside each bedroom, outside each sleeping area and on every level of the home, including the basement.

General Chimney Introduction

One of the most important considerations in installing a boiler is the type of chimney that will be used. The condition and construction of the chimney is important to providing sufficient draft. It is very important not to connect to a chimney/flue serving another appliance.

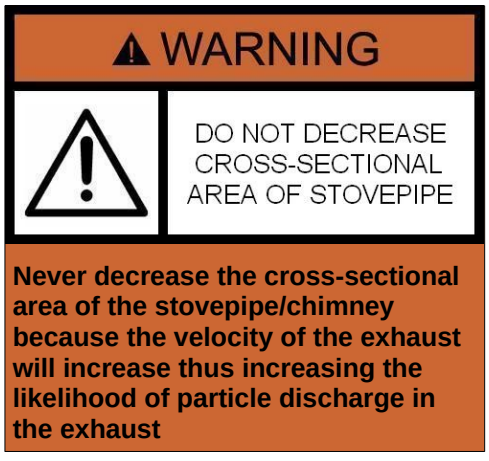
CAUTION: DO NOT TO CONNECT THIS UNIT TO A CHIMNEY/FLUE SERVING ANOTHER APPLIANCE.

Specific Chimney Requirements for the Wood Gun™

The Wood Gun™ creates its own draft; therefore having sufficient height in the chimney is not an issue. Excessive chimney height can allow for more cooling of exhaust gases and lead to condensation issues. Other aspects of chimney construction that lead to condensation include use of a masonry chimney that lacks an insulated liner. Having such a chimney on the outside of the house compounds this problem as well. Because of the high efficiency of the Wood Gun, and resultant low stack temperatures, it is important to try to preserve exhaust heat. Always check with your local building inspector and insurance agent to assure compliance.

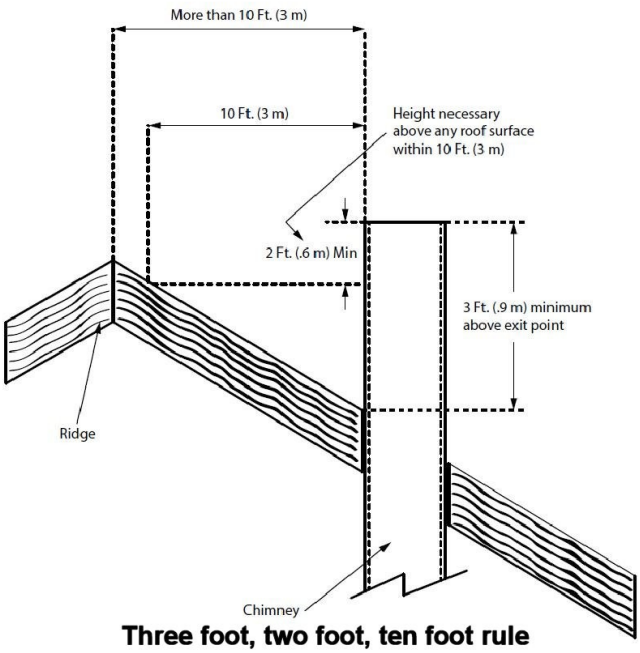
Stovepipe should be sized as follows:

- ✔ Super E110 = 6 IN diameter.



Never decrease the cross-sectional area of the stovepipe/chimney because the velocity of the exhaust will increase thus increasing the likelihood of particle discharge in the exhaust

Technical Aspects of Chimney Performance



Three foot, two foot, ten foot rule

3-2-10 Rule for Chimneys

The chimney should extend several feet above the highest part of the roof to prevent downdrafts. Follow code requirements for your area and consult a chimney professional. Keep in mind the 3-2-10 rule, as depicted below. The chimney must be leak-free from the standpoint of air entering through cracks or other chimney defects or through loose stovepipe fittings.

Draft

Draft is created by a pressure differential between the bottom and the top of the chimney. Chimney height, air moving across the top of the chimney, and warmer air in the chimney than outside will all result in greater pressure differences and stronger draft. A warm chimney drafts better than a cold one. For this reason a chimney drafts best when kept warm. It is more difficult to maintain sufficient temperature in an exposed chimney. A larger chimney, or one with a lot of thermal mass will also present more problems than a chimney that is protected from outside temperature extremes. A chimney must be kept

warm (about 250° F) for proper draft to occur. A chimney's height, expressed as the difference between the top opening and the flue pipe connection on the appliance, contributes to draft because atmospheric pressure is naturally lower at the chimney top than bottom.

⚠ CAUTION

CREOSOTE BUILDUP PROBLEMS

Poor chimneys with cold walls can cause creosote buildup. Sharp bends and horizontal flues should also be avoided. The exhaust must be kept moving through the piping/flue to prevent creosote or fly ash buildup. If a horizontal section must be used, it must rise slightly to prevent dead air space.

Barometric Damper

A barometric damper is a device that allows room air to enter the chimney, bypassing the air intake on the heater. A heater and chimney combination that drafts well will occasionally produce more draft than is desired. Excessive draft can lead to burning out of control and excessive heat production. It will also lead to reduced efficiency, as more heat will end up going up the chimney. A barometric damper is used on a coal fired heater to limit maximum draft to -.08 column inches. However a barometric damper is not ever needed to be used on a Wood Gun. The draft inducer produces the exact draft needed.

Manometer

A device called a manometer is used in measuring the technical performance of a chimney. A manometer is an instrument used for measuring the pressure of liquids and gases. An analog manometer consists of a glass tube filled with a liquid and mounted in front of a measuring scale against which the liquid level can be measured. If a manometer were connected to a leak-free chimney with a leak-free connection, then the draft in the chimney should exert enough pressure (or pull) against the water in the manometer to cause it to move at least -.04 inches in the tube. For units to be operated safely, limit maximum draft to -.08 inches.



Dwyer Manometer

Measuring the draft of the chimney connected to a Wood Gun is not as critical as it is to other types of appliances, but it does ensure there are no major leaks in the chimney where smoke can escape.

To measure the draft, fire the unit until the flue is at least 250F. Drill a hole in the connector pipe and attach a draft meter or manometer. First, check the draft above the barometric damper (if installed). Then check it below the barometric damper and make your damper adjustment to where it opens to prevent the draft from going higher than -.08 inches of water column. If the chimney is incapable of supplying the required draft of at least –0.04inWC, it will need to be improved. See the section on Common Chimney Problems for more information. Completely seal all holes created once finished checking draft.

Masonry Chimneys

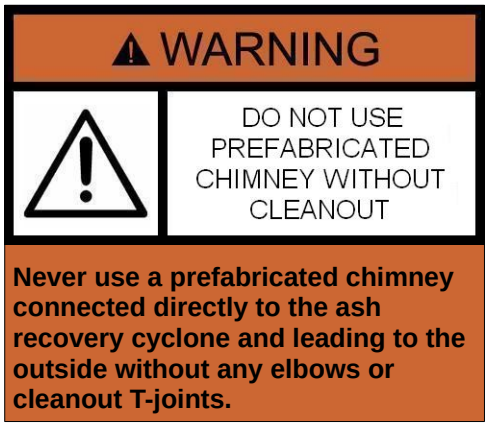
If you plan on using a preexisting masonry chimney, have it thoroughly inspected and cleaned. Any faults which make the chimney unsafe and unusable must be repaired prior to use. These can include improper height, structural defects, blockages, inadequate clearance to combustibles, unsealed openings into other rooms of the house, signs of creosote or smoke leakage, a loose or absent clean-out door, or absence of a liner.

When connecting to a masonry chimney, several provisions are standard. First, whether the chimney

connector is vented to the chimney through a thimble or a breech pipe, neither must pass beyond the inner surface of the chimney liner, and both must be firmly cemented in place with refractory cement. (A thimble is a masonry pipe which is inserted through the chimney wall, and is frequently the preferred method; a breech pipe is a piece of steel pipe used the same way.) In Canada, a breech pipe has ridges or protrusions to lock it firmly into the refractory cement. In either case, the chimney connector vents to the chimney through the thimble or breech pipe. See wall pass-through information in the section on stove pipe.

Prefabricated Chimneys

When venting your boiler using a prefabricated chimney, be sure to contact local building code authorities, and to follow the manufacturer's instructions exactly. Use only the manufacturer's parts; do not use makeshift installation techniques. All prefabricated chimneys must be tested to either the U.S. or Canadian high-temperature standards, UL 103 or ULC-629.

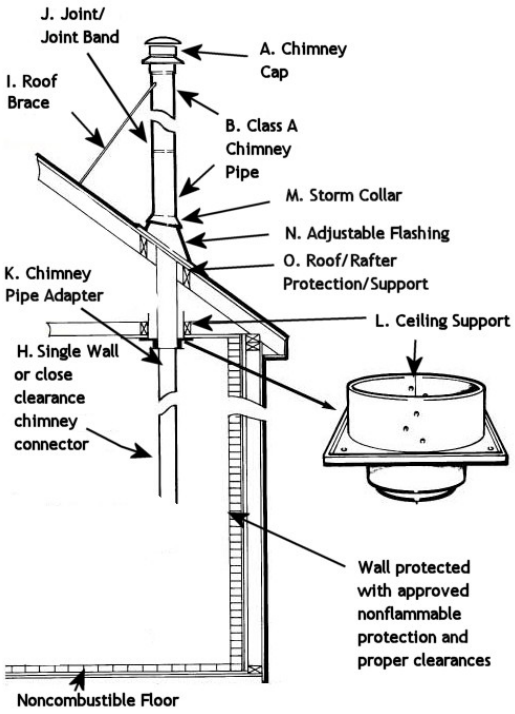


Never use a prefabricated chimney connected directly to the ash recovery cyclone and leading to the outside without any elbows or cleanout T-joints.

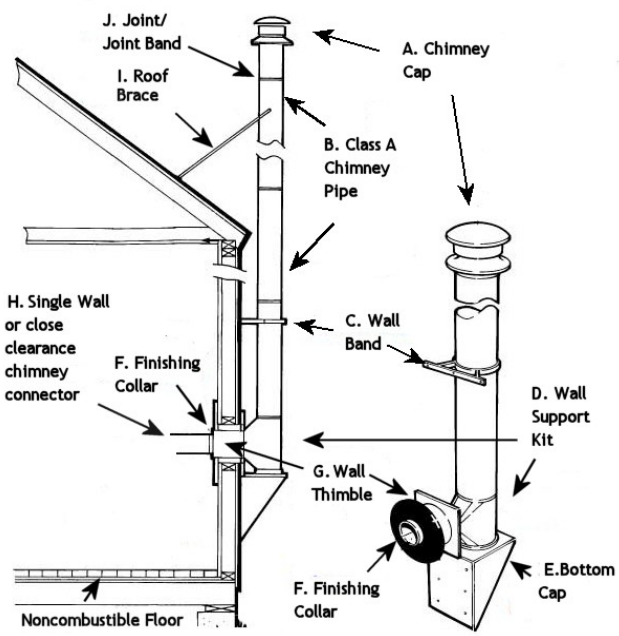
Your manufactured chimney may contain more parts than is shown in the subsequent diagrams. Include all required items in your installation. A chimney cap (A) serves to keep rain and snow from entering the chimney. An approved Class A chimney (B) is required for the Super E110. Wall Bands (C) must be deployed for support per manufacturer's recommendations. A manufacturer's Wall Support Kit (D) will contain required items for supporting the chimney. Such kits will cost less than individual items purchased separately. A Bottom Cap (E, location marked, but actual cap not shown) allows for cleaning. A Finishing Collar (F) provides inside wall protection. A Wall Thimble (G) provides for required clearance between the chimney pipe passing through a flammable wall. The Chimney Connector (H) must be approved single wall, or a low clearance pipe, installed with required clearances in place. A Roof Brace (I) is required for chimneys that extend more than a certain distance, as referenced by the manufacturer's instructions, from the roof. Manufactured chimneys may feature a built in "twist lock" at each joint, but a Joint Band (J) is still normally required to secure pipe at the joint. An approved Chimney Pipe Adapter (K) is required. A Ceiling Support (L) will provide structural support for the chimney and is typically part of a kit that includes items that maintain required clearances to flammables. A Storm Collar (M), and Adjustable Flashing (N) prevent water from entering the home by running down the outside of the chimney. Additional items or a kit (O) provide additional mounting support or fire protection to the roof joists or other roof components.

Note: Do not decrease the diameter of chimney pipe to less than that of the flue collar! Chimney connector and flue must be 6 inches in diameter or greater

Inside Chimney



Outside Chimney



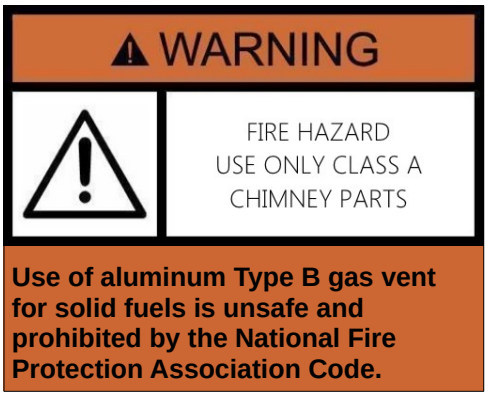
PROPER CHIMNEY CONNECTION

The boiler must be connected to a Class A chimney. Use of aluminum Type B gas vent for solid fuels is unsafe and prohibited by the National Fire Protection Association Code. There are three types of Class A chimneys:

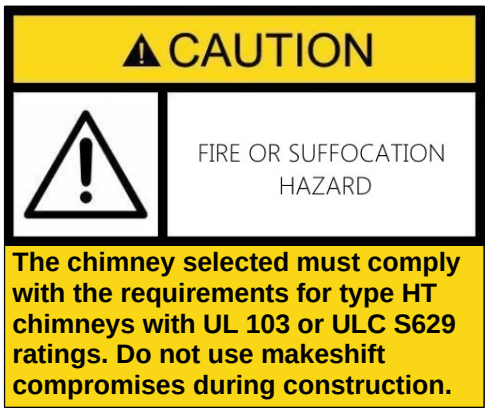
1. Masonry with a tile liner, including brick, block, stone, etc. It must be supported by a ground-level foundation.

2. Insulated "Class A" manufactured chimney, listed and certified by a national test agency (UL 103 or ULC 629).

3. Triple-walled metal "Class A" chimney, listed and certified by a national test agency(UL 103 or ULC 629).



If your masonry chimney has not been used for some time, have it inspected by a qualified person (building inspector, fire department personnel, etc.). If a listed and certified manufactured chimney is to be used, make certain it is installed in accordance with the manufacturers instructions and all local codes. Use only the manufacturer's parts, and use all parts required in order to follow the manufacturer's guidelines. Do not use makeshift installation techniques. A Wood Gun can perform only as well as its venting system allows it to.



STOVEPIPE

It is recommended that overall flue connecting pipe length be kept to a minimum. Any horizontal runs must slope upward towards the chimney, with a minimum rise of 1/4 inch per foot. Use a minimum number of elbows, preferably no more than two, to make the chimney connection.



Particular attention should be paid to the point where a flue passes through a wall or ceiling. The pass-thru should always be made with insulated pipe and the proper accessories or use of a thimble that provides a diameter of not less than three times the diameter of the stovepipe. If the chimney must go through a combustible wall, be sure to use a metal thimble specially designed for this purpose. The proper way to install a thimble is to cut an oversize hole in the Sheetrock about 6 or 7 inches larger than the thimble. However, be sure to follow the manufacturer's directions that come with the thimble. A metal ring shield is used to cover the hole. This way air can circulate and cool the area around the passageway.

Excessive weight of pipe placed on the boiler must be avoided. Utilize ceiling, roof or other supports to avoid adding too much weight to the boiler's flue connection.



Inspect stove pipe at least twice monthly for creosote buildup. Creosote creates a risk of chimney fire, and can obstruct stove pipe. An obstructed stove pipe can result in CO buildup in your boiler room.

Fires of low intensity, or low smoldering fires are likely to produce creosote buildup. Tars and other organic vapors combine with moisture from the fuel and from combustion byproducts to form creosote. The more time the boiler is fired with wood at low fire, the more opportunity for buildup of creosote inside the stove pipe and chimney. Inspect at least twice monthly, and remove if buildup occurs.



Manual Dampers must not be installed in the flue pipe. Improper operation could result in death.

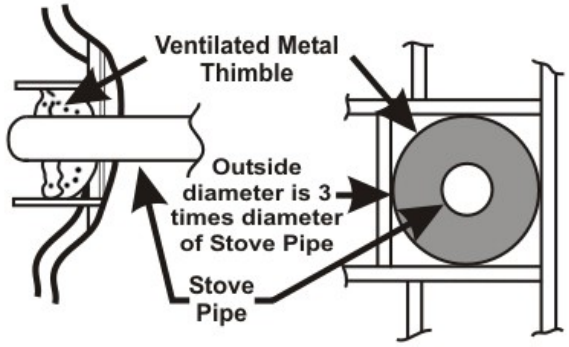
If creosote has accumulated it should be removed to reduce the risk of a chimney fire

Use 24 gauge or heavier single wall stove pipe in open areas no closer than 18 inches from walls or ceiling. If the stovepipe must be closer than 18 inches from the nearest wall or ceiling, or if it must go through walls, closets, or boxed in areas, then UL listed insulated stovepipe must be used. Pipe that runs along the outside walls of a building must also be UL listed insulated pipe, even if it runs along a non-combustible outside wall. This requirement is in place in order to prevent cooling of the stovepipe which in turn cools the rising smoke and causes creosote to form quickly. The diameter of stovepipe must be at least 6 inches.

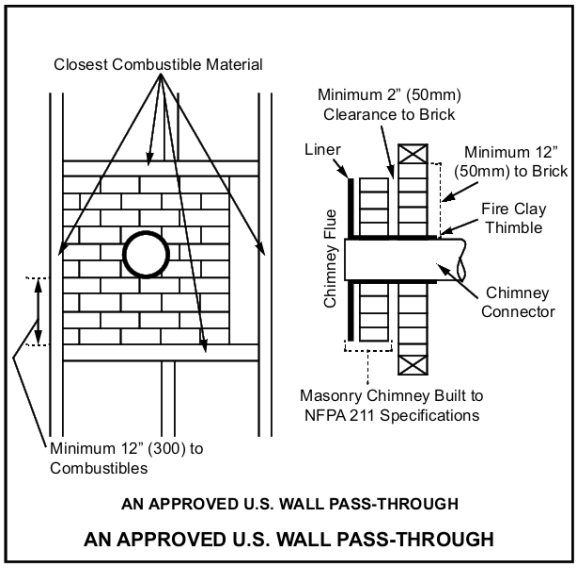
Wall Pass-Through: United States

In the U.S., the national code is NFPA 211. While many localities adopt this standard, be sure to check with local authorities before beginning your installation. The NFPA (National Fire Protection Association) permits four methods for passing through a combustible wall. A commonly used method to pass through a wall directly to a masonry chimney is to clear a minimum 12"(300 mm) around the entire chimney connector, and fill it with brick

masonry which is at least 3.5"(90 mm) thick. A fire-clay liner, minimum 3/8" (9 mm) wall thickness must run through the brick wall to the chimney liner (but not beyond the inner surface of the liner). It must be cemented in place with refractory cement. This method is illustrated. For details on the other three options, refer to the most recent edition of the NFPA 211 code.



Stove pipe passing through wall

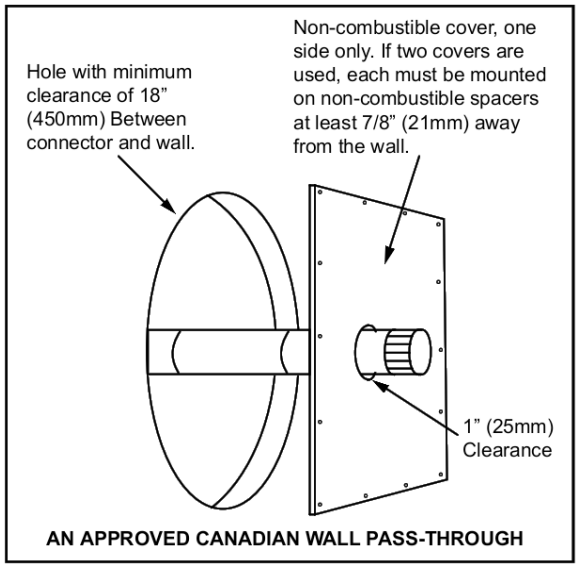


AN APPROVED U.S. WALL PASS-THROUGH

U.S. Wall Pass-Through

Wall Pass-Through: Canada

Three methods are approved by the Canadian Standards Association. The diagram following this paragraph shows one method requiring an 18" (450mm) air space between the connector and the wall. It allows use of one or two covers as described in the diagram. The two other methods are described in detail in the current issue of CAN/CSA B365, the national standard.



Canadian Wall Pass-Through

COMMON CHIMNEY PROBLEMS

In order to have a properly operating heating system, the chimney needs to be capable of providing sufficient, but not excessive draft. The approach to improving draft in an existing chimney may include one or more of the following: raising chimney height, adding or changing the flue liner, or selecting a different style of cap to be placed on the top of the chimney. Reasons for insufficient draft include (but are not limited to) the following:

Note: Chimneys need regular maintenance and cleaning. If a chimney is not cleaned on a frequent basis, it will affect draft, as well as be a contributing factor to a potential chimney fire.

1. Leaking chimney - Air leaking in around a loose fitting clean-out door, joints or seams in connector pipe are not secured properly, cracks or other defects in masonry.
2. Chimney needs to be cleaned.
3. Improper chimney height - Chimney does not extend to a sufficient height above the roof line. (Remember the 3 ft.-2 ft.-10 ft. rule)
4. Obstructions in the chimney - Make sure the chimney has been cleaned. Different animals have been known to build nests in chimneys.
5. Trees or other topographical barriers - Trees that are taller than the house can cause the

air currents to flow downward over the peak of the roof. This would lead to a down draft effect on the chimney. This can also be caused by adjacent buildings or structures. It could even be from a different peak on the same structure.

6. Improperly sized flue - Too small of a chimney is incapable of moving the volume of air necessary. Too large of a flue could have trouble warming up to create the necessary upward flow.
7. Chimney offsets - Offset chimneys should be avoided if possible. Not only can the offset affect draft, it is also a place for debris to collect over time.
8. Too many elbows - The flue connector has more than two elbows in it. Sometimes, depending on overall chimney performance, one elbow could be too many.
9. Vent sharing - No more than one heating appliance shall vent into a single flue.

If smoke is observed puffing out of the stove or connecting pipe, it is likely that there is an issue with draft. Review the above list for potential causes. If draft is excessive, review instructions on installing a barometric damper.

IN CASE OF CHIMNEY FIRE

1. Be sure everyone is out of the house.
2. Call the fire department. (In the event the fire is out before they get there, you will want them to inspect the structure and make sure there is no latent damage or hazard.)
3. Shut the boiler down by turning the main power off.
4. If you have a chimney fire, use a chemical flare type fire extinguisher. If you don't have an extinguisher, go to step 5.
5. Using a water hose, wet down the area of the roof surrounding the chimney. Do not wet the chimney itself or try to put water down the flue as it will very likely damage the flue tiles.
6. Contact a chimney professional to inspect your chimney for damages.

IN CASE OF RUNAWAY FIRE

1. Cut power.
2. Be sure the draft inducer is off, that both Air-Valves are completely closed and/or make sure the barometric damper opens (if equiped). Excessive draft can cause a runaway fire.
3. Shut loading and ash removal doors.
4. Maintain continued circulation of boiler water to remove heat from the boiler and if boiler is equipped with a domestic coil run hot water.

IN CASE OF POWER LOSS

Do not open the loading door even in power outage, until the power is restored and the green “Purge” turns on!



If you loose power the Wood Gun will shutdown, air-valves will close and draft motor will stop. If the power is not restored within 4-6hr you will probably need to restart the fire, with match, paper, and kindling. Still wait for green light to turn on even before restarting.

A backup power source may be used to operate the Wood Gun in a power outage. Backup power must also support both the controls and circulators.

It is important that the system works even when unattended to guard against overheating. Backup power must be provided in a way that satisfies local code requirements and prevents back-feeding of electricity into the power grid.

If no means of dissipating heat exists, close all doors, and verify automatic dampers are closed.

Note: If backup power is provided by a generator, always operate the generator well outside the home to avoid carbon monoxide in the home.

MAKE-UP OR COMBUSTION AIR



The airflow through the system and out the chimney means that oxygen is leaving the home and will create an oxygen deficit if this air is not replaced. Adequate combustion air is critical for the performance of your heater. There is usually sufficient leakage in older homes to provide for this, but in well-insulated homes it may be necessary to provide additional outside air into the home. A louvered vent can also be used.

Adequate supply of combustion air can come from, either natural infiltration through or around a door or window, or by ducting outside. Ducting from outside will require an adapter purchased from Alternate Heating Systems.

When the intake air is ducted from the outside, inspect the opening regularly to be sure that it does not become obstructed by debris. Units that have outside combustion air ducts must have this duct routed close to the floor in the boiler room to prevent the possibility of smoke coming through in the event of a control malfunction.

Boiler Piping for Hydronic Systems

Due to the design requirements of the various Wood Gun™ models, the fittings and burner attachments are not always in the same location on each boiler model. See Appendix A for the location of these attachments. This diagram provides exact locations for all fittings. The flush-out fittings in the bottom of the unit are a requirement of the ASME boiler code and must be closed before filling the unit with water.

Note: Be sure to close all fittings in the unit before filling the unit with water.

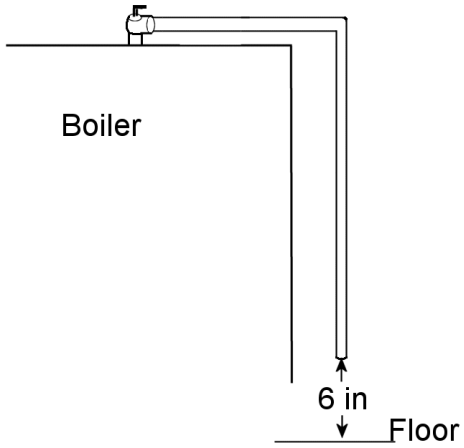
Piping the Boiler in Parallel with Another Boiler

The Wood Gun™ may be connected to a heating system supplied by one or more boilers that are already in place. To connect the boiler to the existing boiler run the supply pipe with a flow check from the Wood gun and Tee into the supply pipe of the existing boiler. This pipe will carry hot water to the existing boiler when there is no heat demand and will in turn keep the existing boiler from turning on. The return pipe with a circulator pushing toward the Wood gun will Tee into the return line of the existing boiler. It is required that the piping be such that excessive pressure will not be developed in any portion of the boiler or system. The circulator will constantly run when the Wood Gun boiler is on. Wire the circulator to the Wood Gun boiler in such a way that when the boiler switch is on the circulator will also run. The power to the Wood gun should then be controlled by an aqua stat located in the supply piping. This aqua stat should be set 10°F above operating temperature of the existing boiler. That will shut the Wood gun down if it runs out of fuel. The aqua stat will need to have a bypass switch that will allow the wood boiler to have power and enable it to be started so that it can be warmed to its operating temperature.

There are many possible configurations that allow for an existing boiler to function as a backup to the Wood Gun™. For sample illustrations of multiple boiler configurations, see Appendix F.

Pressure Relief Valve

A pressure relief valve should be inserted into tapping DD on the Super E110.



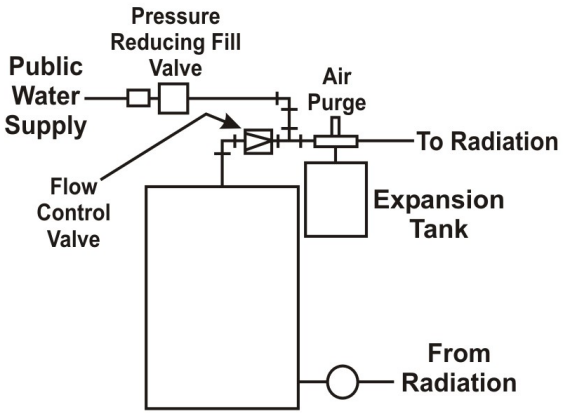
Pressure Relief Valve

Note: A length of ¾" copper pipe must be connected to the pressure relief valve continuing to a point 6 in from the floor as shown in Figure 3 above.

The purpose of extending the pipe to the floor is to direct any blowout of scalding water downward instead of outward. This reduces the likelihood of exposing bystanders to a scald hazard.

Pressure Reducing Fill Valve

If the Wood Gun™ is installed as the primary boiler, it is necessary to provide for water supply using a pressure regulating valve and back-flow prevention valve in the feed water line. Set the pressure regulating valve to 12-18psi.



Pressure regulating valve and back-flow prevention valve configuration

Expansion Tank Selection

Closed loop systems require the use of an expansion tank. The SE110 holds roughly 60 gallons of water. The expansion tank or air cushion tank that was originally installed will not likely be adequate for the additional volume of water added to the system with the inclusion of a Wood Gun™. The tank must be sized based on total water volume and the difference between the low and high temperatures of this water. When properly sized, it will accommodate the thermal expansion of the water being heated without creating an over-pressure situation. Some closed loop systems are isolated from an open (atmospheric) side of the system, or another closed loop, by a heat exchanger. For calculating system volume, only the volume in each respective closed loop is calculated, with each closed loop receiving its own dedicated expansion tank capacity.

If the auto-fill valve engages and adds water to the system when cold, and the boiler subsequently builds too much pressure when hot, you do not have adequate expansion capacity.

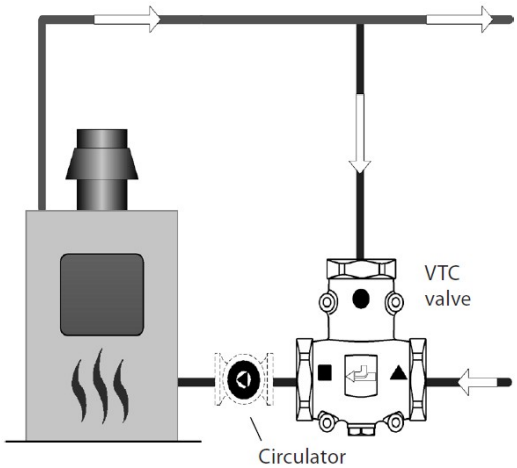
We recommend at minimum to install a #90 expansion tank (14 gallon capacity).

RETURN WATER TEMPERATURE

As a rule, water returning to the boiler should be not more than 20° F less than supply water temperature going to the system. A re-circulation loop is a requirement to maintain optimum return water temperatures. This would optimally include a thermometer on the return line entering the boiler for monitoring purposes, and a mixing valve to maintain minimum return water temperatures. Return water temperature near or below 140° F creates the risk of severe condensation issues. This will often produce unpleasant odors and possible liquid runoff in the boiler room. More seriously, it will lead to creosote formation on heat exchange surfaces and inside the chimney, with accompanying risk of a chimney fire.



View the following diagram for a sample piping layout utilizing a mixing valve on the boiler return. The mixing valve shown is a cartridge type. Water temperature is regulated by the use of a specific cartridge installed in the valve to control temperature of the water returning to the boiler.



Three Mixing Valve: Return Water Protection

ADDITIONAL SPECIFICATIONS

Pressure Drop through Boiler

Pressure Drop (Line Loss) within the boiler is less than the pipe rating of the pipe within the boiler, so there is no appreciable pressure drop.

Explanation of GPM Flow

The following are given as examples of gallons per minute water flow required to deliver hot water in order to provide heating of a given number of degrees and at a certain BTU level:

- 500K BTU's at 20 degrees temperature differential requires 50 gallons per minute.
- 250K BTU's at 20 degrees temperature differential requires 25 gallons per minute
- 1M BTU's at 20 degrees temperature differential requires 100 gallons per minute.

LOW WATER CUTOFF



Photo: Low Water Cutoff Installation

The low water cut off should be installed in the supply riser just above the tapping of the boiler, as shown above. Place a Tee fitting 6" - 15" above the boiler in the supply line. Install the L.W.C.O. so that it is accessible and the indicator lights can be seen.

There will be a piece of conduit coming from the High Limit aquastat with three wires. The wires are: Orange#2, Orange #3, White, green. These wires will terminate in the 200-411.2 LWCO as follows:

1. The orange #2 wire will be terminated with the black wire and one of the Yellow wires.

2. The orange #2 wire will terminate with the remaining yellow wire.

3. The White or neutral wire will terminate with the white wire in the LWCO.

If the conduit is not run from factory. You will need a piece of conduit with 3 wires labeled as above. Run the conduit from the high limit aquastat through the hole in the sheetmetal (the insulation will need to be drilled out) to the LWCO.

Terminate the wires in the aquastat with the corresponding wires as follows.

1. The Orange#2 wire will terminate on the wire marked orange #2.

2. The Orange #3 wire will terminate with the wire marked orange #3.

3. The White wire will terminate with the wire marked white, L2 or neutral.

Low Water Cutoff Testing

After installing the unit operate the system. Carefully observe the operation of all components through at least one complete cycle. Be sure to include a check to the operating limit switch operation (shuts down at operate limit set point). Make any corrections needed then repeat the checkout. Repeat until system operates properly.

Low Water Cutoff Troubleshooting

If the boiler does not shut down when the water drops below the probe:

1. Remove power immediately and re-check wiring.

2. Remove power and check for adequate clearance from the probe to any surface within the boiler or tee.

IF THE BOILER DOES NOT FIRE

(A) Make sure water is at probe and probe lead wire is properly secured to the terminal.

(B) Check for proper ground between probe and boiler shell. Excessive use of Teflon tape or sealing compound may insulate the probe from the boiler shell.

3. Re-check wiring and test for correct incoming voltage. IF THE RED LED LAMP IS ON The red LED lamp indicates that the control is locked-out. This feature will activate if the boiler experiences a low

water condition exceeding 30 seconds in duration. IMPORTANT: Do not reset control until the cause of the low water condition is corrected.

CAUTION: Do not add water until boiler is cool.

Low Water Cutoff Maintenance

To ensure optimum performance, inspect probe annually. Clean any scale or build-up from the probe using a scouring pad or steel wool. Re-install the probe and test .

FORCED HOT AIR SYSTEMS (WATER TO AIR COIL IN DUCT)

The Wood Gun™ boiler may be easily adapted to any forced hot air heating system by installing a heat exchange coil in the supply duct. The size and type of coil required may be determined after several factors are determined. These factors include: the heat output required (BTUH), the capacity of the existing fan blower (CFM) and the size of the duct or plenum where the coil will be installed.

The coil creates increased resistance to air flow, so this factor must be considered when determining the final airflow. Design water temperature is usually 180° F and a desirable output air temperature is 115° - 125° F.

Tip: To increase coil performance, increase boiler water temperature.

The coil is connected in the same manner as in other types of radiation heating equipment. The thermostat should be wired to both the fan blower and the circulator pump or a temperature-sensing switch on the heat exchange coil. If a hole was cut in existing ducting to install the coil, the opening should be closed tightly with a metal cover and sealed with duct tape.

THERMAL STORAGE BASICS

The following section is intended for customers who purchase the CARBON steel SE110.

The carbon steel Wood Gun SE110 CS is intended only for true batch burn operation. This means that mid-burn off cycles are to be prevented whenever possible. **Corrosion from the fire side of the boiler vessel (firebox and heat exchanger) will not be covered under warranty (for carbon steel vessels only)**, however, the stainless steel vessel's warranty does cover corrosion from the fire side of the boiler vessel. Corrosion will occur during off cycles, or when/if poor boiler maintenance and operation lead to condensation issues. Batch burn operation is made possible with the inclusion of thermal mass that will be heated separately from zone requirements, and used as a heat battery, from which heat will later be drawn for space or water heating requirements.

Thermal Storage Types

Thermal storage will most often involve storing heat energy produced by the Wood Gun in water or water/glycol mixtures. The water/mixture can be stored in open or closed (pressurized) tanks. Pressurized tanks normally will accommodate higher water temperatures, and can therefore store more heat energy in smaller tank sizes. Such tanks are built heavier in order to accommodate the higher pressures. Tanks may be purchased new, or pressure-rated recycled tanks may be used. Used propane tanks are sometimes repurposed for use with thermal storage.

There are many types of open (sometimes referred to as "atmospheric") tanks available for thermal storage as well. These include insulated, prefabricated tanks that are site-assembled and made of fiberglass or metal, concrete tanks, recycled tanks of a wide variety, and even used bulk milk tanks. Open storage is subject to a hard limit on water temperatures due to the boiling point of water and is subject to water loss due to evaporation. Because the Wood Gun is designed for use as a pressurized system, use of open storage requires the use of a heat exchanger to isolate the boiler water from the open storage components of the system.

The Wood Gun must be installed and maintained as a pressurized boiler.

Other types of thermal mass can be used to store heat energy from your Wood Gun. Green building designs make use of sand, concrete and sometimes earth, for thermal storage. Such designs can replace or complement water based thermal storage. Whatever combinations of thermal storage are employed, always aim for true batch burn operation, and the elimination of mid-burn off cycles.

Sizing Your Thermal Storage

There are several criteria to keep in mind when sizing thermal storage. These include elimination of mid-burn off cycles for the Wood Gun, the quantity of storage desired beyond this minimum to provide for firing flexibility, the heat load in question, and the cost of the various elements that are combined to meet your storage strategy and goals. This cost will include components and materials, plumbing labor, and the footprint associated with the storage. The amount of temperature spread you can tolerate in your heating and storage system will impact the amount of heat utilized from a given quantity of storage as well.

An individual burn cycle, using high quality fuel that is tightly packed into the Wood Gun SE110 CS firebox, can produce as much as a 700,000 BTUs. As a practical matter, to accommodate a full load of wood, you should be prepared to store 700,000 BTUs. If in consulting the charts that follow, you choose to provide less storage, you should plan on a firing pattern and fuel load amounts that meet the objective of avoiding mid-burn off cycles, even if this means partial loads of fuel. In the chart below, ΔT ° F represents the temperature spread between high and low temperatures in thermal storage.

BTUs Stored Based on Gallons and Δ T ° F

Gallons ➔ Δ T ° F ⬇	500	1000	1500
20º	80,000	160,000	240,000
40º	160,000	320,000	480,000
60º	240,000	480,000	720,000
80º	320,000	640,000	960,000

The chart that follows gives you the number of hours until the next firing cycle, based on a starting temperature for thermal storage of 190° F.

Lowest Usable Water Temp ➔ Heat Load in BTU/hr ⬇	110º F	130º F	150º F
15,000	44.7	34.0	23.3
25,000	27.6	21.2	14.8
35,000	20.3	15.7	11.1
45,000	16.2	12.6	9.1
65,000	11.8	9.4	7.2
100,000	8.4	6.8	6.4
150,000	6.3	5.2	5.0

CONDITIONING OF BOILER WATER

Note: The guidelines in this section are to be used in conjunction with the advice of a water treatment specialist.

Proper treatment of feed water and boiler water is necessary to prevent deposits and corrosion within the boiler. The neglect of adequate external and internal treatments can lead to operation faults or total boiler failure. Where a choice is available, pre-treatment external to the boiler is always preferred and more reliable than treatment within the boiler.

Instructions for feed water treatment as prepared by a competent feed water chemist should be followed. Do not experiment with homemade treatment methods or compounds.

Representative samples of feed water and boiler water need to be analyzed frequently to ensure that they are within specified ranges.

Strict monitoring of boiler water is more important for steam applications (and for open systems) where there is a continuous influx of

makeup water. For hydronic units, typical installations utilize the boiler water in a closed system, which only occasionally requires the addition of makeup water over the lifetime of the boiler.

Note: For hydronic situations where the system is not closed, the following water treatment guidelines still apply and become even more critical!

pH

The pH value of your boiler water is a number between zero and fourteen. Values below seven are acidic while values above seven are basic.

The pH factor is the most important factor influencing scale forming or the corrosive tendencies of boiler water. It should be adjusted to between a minimum of 9.0 and 11.0 to prevent acidic corrosion of boiler tubes and plates and to provide for the precipitation of scale forming salts.

Below a pH of 5.0 the water is acidic enough to dissolve the steel boiler plates. Under these conditions the steel gradually becomes thinner and thinner until it is destroyed. At a pH between 5.0 and 9.0 pitting of steel plates is likely to occur at a rate dependent upon the amount of dissolved oxygen in the boiler.

Dissolved Oxygen

Aeration of city water supply is frequently used to remove noxious gases, however, aeration results in saturation of the water with oxygen. A majority of corrosion problems are directly related to the quantity of dissolved oxygen in the boiler water. Elimination of the corrosive effect of dissolved oxygen can be accomplished either directly or chemically.

Direct or mechanical removal of dissolved oxygen is done through the use of a de-aerator. Chemical de-aeration is done through the introduction of specific chemicals in the boiler to react with the oxygen. The dissolved oxygen content should be maintained at a minimum but at no time should it exceed 0.007 mg/l.

Sodium sulfite is commonly used for the chemical removal of dissolved oxygen within the boiler water. To assure the rapid and complete removal of the oxygen entering the boiler feed water system the concentration of sulfite in the boiler should be maintained at a minimum of 120 ppm.

Solids (Primarily for Steam Boilers)

High boiler solids will lead to foaming, priming, surging, carry over or boiler sludge in steam boilers. Occasional blow downs of the boiler may remedy these conditions. We recommend you utilize the services of a local professional plumbing service for this boiler maintenance task.

Solids can be categorized as either suspended or dissolved. Suspended solids are those that can be removed by filtration while dissolved solids are in solution with the water.

The best way to determine the dissolved solid content of boiler water is a conductance test. The conductance of boiler water varies proportionately with the amount of various ionized solids present.

Another way to determine the dissolved solids content is to measure the chlorides present in the boiler water. The chloride test is less sensitive than the conductance test for measuring small concentrations of dissolved solids. The results of both tests should be averaged for accuracy.

Alkalinity

The alkalinity of boiler water should be sufficiently high to protect boiler steel against acidic corrosion, but not so high as to cause carryover (basic) corrosion. A minimum value for alkalinity for adequate protection is 200 ppm CaCO3.

High boiler alkalinity (in excess of 700 ppm CaCO3) should be avoided. Values higher than this can cause the steel to become brittle.

Phosphates

Phosphates are used to counteract hardness in the boiler water. It is important to maintain a pH of at least 9.5 to not hinder the reaction of the phosphates

with calcium hardness. Try to keep the concentration of phosphates in the water to 30-50 ppm to enable complete reaction.

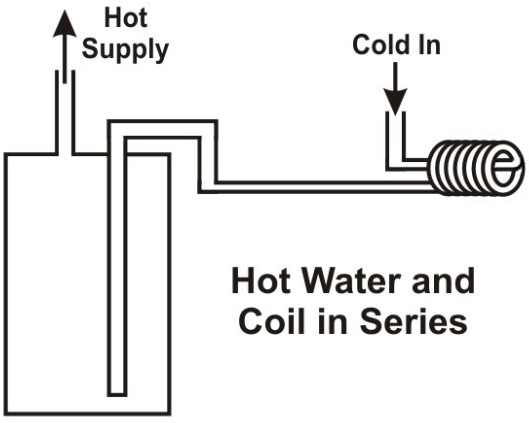
Hardness

The hardness of water is caused by calcium and magnesium ions. Water hardness will vary greatly throughout the country depending on the source of the water. In boilers, hard water can cause the formation of scale and sludge or mud. Total hardness should not exceed 50 ppm.

Oils

Every effort should be made to prevent oils from getting into the boiler water. Oil causes foaming or combines with suspended solids to form a sludge, which can cause the overheating of boiler plates. If oil does get into the boiler, the boiler should immediately be taken out of service and thoroughly cleaned.

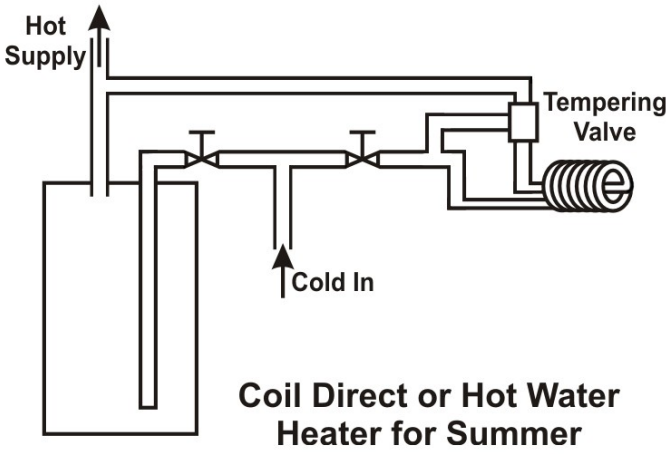
DOMESTIC HOT WATER COIL PIPING



Plumbing – Coil in Series

The Wood Gun™ may be fitted with one domestic hot water coils, which thread into 4 inch tapping in the boiler. There are three methods for plumbing the domestic coil. One way is to connect the coil in series with an existing hot water heater.

A second method of plumbing the domestic coil is to connect the coil in parallel with an existing water heater so that the conventional water heater may be used when the Wood Gun™ is not being fired (for example, in the summer). The diagram below indicates how this can be done.



Plumbing – Coil in Parallel

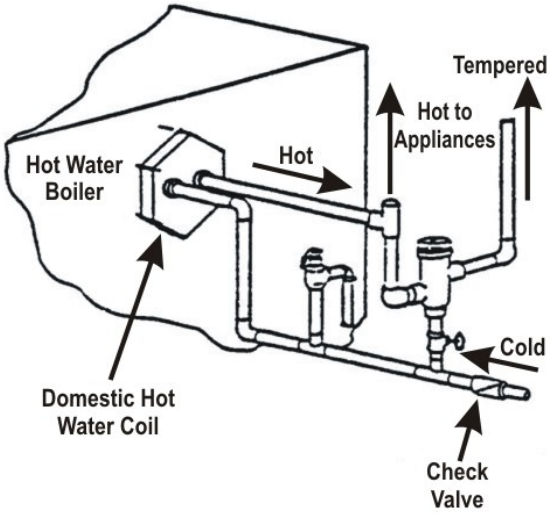
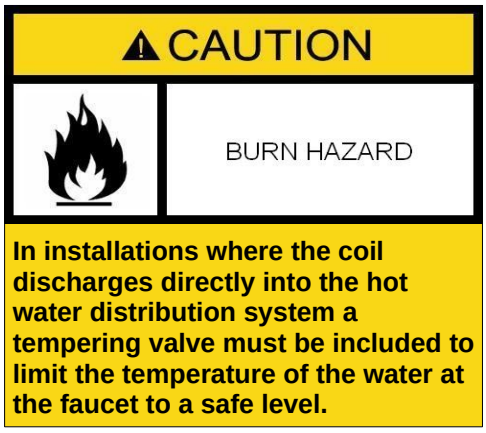
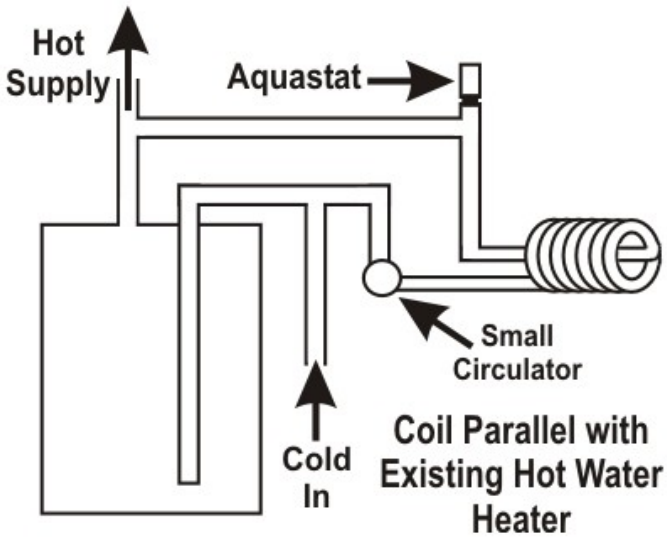


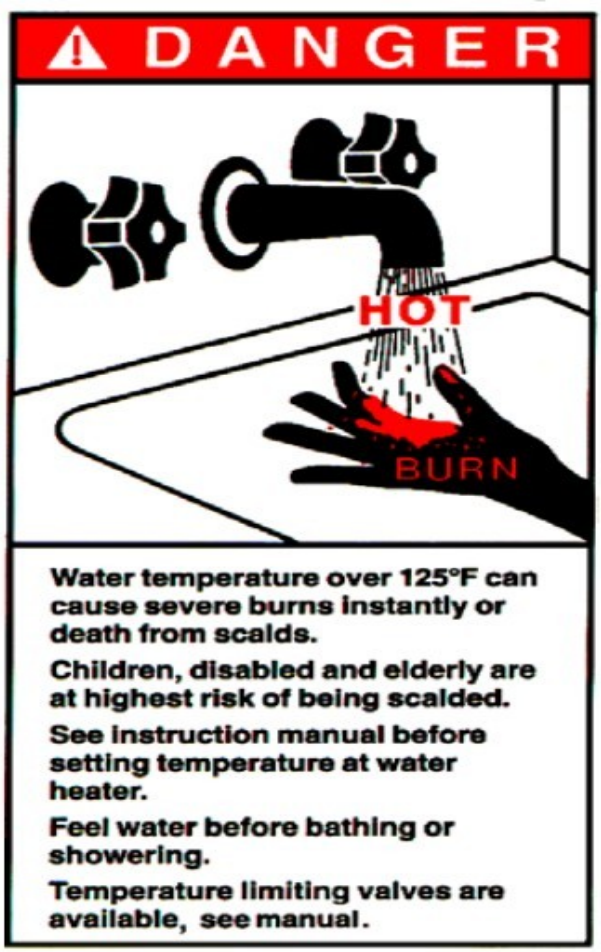
Figure: Domestic Coil Tempering Valve



In installations where the coil discharges directly into the hot water distribution system a tempering valve must be included to limit the temperature of the water at the faucet to a safe level.



Plumbing – Coil with circulator



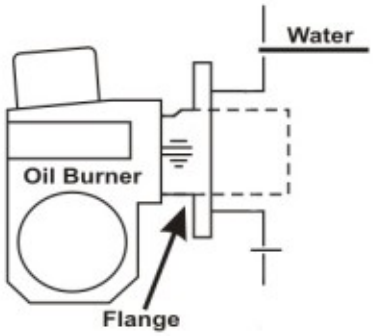
OIL BURNER ASSEMBLY

General Information

This is an OPTIONAL feature and must be added to boiler when placing the order for your Wood Gun.

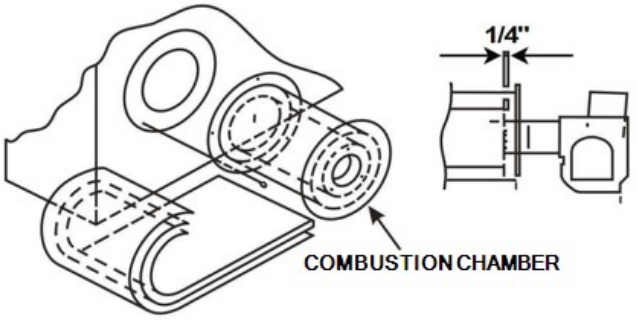
If an oil burner is supplied with the Wood Gun™, connection of fuel lines and the adjustment of the burner should be done by a qualified oil burner technician.

The oil burner is normally shipped detached from the Wood Gun™ in a separate box. Refer to the Riello Burners Installation Manual included with your shipment for instructions on configuring the burner. Particular attention should be paid to the Oil Line Connections section of the Riello Installation Manual. Ensure that the correct size nozzle is in place on the burner before installing on the boiler. The correct nozzle size for the Riello Oil Burners installed in the Super E110 is 0.65 gph, 45°, semi-solid.



Oil/Gas Burner Combustion Chamber

The Super E110 has an oil/gas burner combustion chamber that is needed to use an oil or gas burner, which is exterior to the boiler and located on the right hand side of the boiler when viewed from the front. To mount the combustion chamber, apply the enclosed piece of 1/8 in x 1/2 in self-stick silicone strip to the combustion chamber flange just inside of the bolt holes. Attach the combustion chamber to the flange on the boiler using six 5/16 in x 1 in bolts and washers. The metal jacket cover and insulation on the combustion chamber must be removed to gain access to the holes in the flange as shown below.



Super E110 Combustion Chamber

After securing the combustion chamber to the boiler, replace the insulated jacket. Bolt the burner mounting flange into place using 4, 3/8 x 1 1/4" bolts, washers and lock washers. Ensure that the gasket that is furnished with the burner is placed between the flange of the Wood Gun™ and the mounting flange of the oil burner to prevent air leakage. The burner should be positioned so that the end of the air tube is back approximately ¼ in from the inside of the ceramic lined chamber (see Figure 10)

Oil Burner Electrical Connection

Connect the burner in accordance with wiring diagrams found in Appendix B: Wiring Diagrams.

Oil Burner Fuel Line Connection

The fuel lines should be connected using copper flare fittings or threaded pipe.



Never use compression fittings to connect the fuel lines, since they have a tendency to vibrate loose during operation.

Note: If the oil tank has a two-pipe system, then it is necessary to insert the bypass plug into the burner pump as described in the manual for the oil burner. When using a Riello Burner, always use a two-pipe fuel line system.

Oil Burner Adjustment

For proper oil burner adjustment, refer to the burner installation manual.

Designing a multi-fuel boiler to burn both wood and oil/gas efficiently presents several problems not normally associated with a conventional oil or gas boiler. Wood combustion produces ash, which has a tendency to accumulate on all exposed heat exchange surfaces. Another significant factor is the presence of water, which must be evaporated from the fuel and carried out of the boiler in the exhaust gas stream. In addition, products of incomplete wood combustion, which result from initial start-up, re-ignition after a long "off" cycle, and inadequate or infrequent cleaning, will be deposited within the unit.

Every oil burner contains safety devices that are designed to prevent unsafe operation. When the burner is activated, fuel is pumped through the nozzle in the presence of an ignition arc produced by two electrodes and a high voltage transformer. In order to prevent raw fuel from being discharged into the combustion chamber should ignition fail to occur, a CAD cell is employed to "proof" the flame. If the CAD cell does not "see" a flame within a preset time period, usually 20-30 seconds, a relay will shut down the burner and it cannot attempt to re-fire until the reset button is pressed. When contamination from the wood combustion process coats the CAD cell it interferes with the proper functioning of this safety device.

If the Wood Gun™ is properly cleaned and maintained on a regular basis, then the adverse effects described above are minimized. However, neglect of the unit may result in disappointing performance. It is recommended that in instances where the owner intends to depend upon the oil burner as the primary fuel source, that the oil burner be cleaned and test fired several times to verify that the safety control system is not impaired. If wood is the primary fuel source, with oil a seldom used backup, Alternate Heating Systems strongly recommends the unit be fired on oil periodically (1x

per week for 15min) to assure that the oil burner will function when needed.

Do not assume that a unit operated solely on wood for an extended period of time will fire on oil without attention.

Note: It is a good idea to test fire the oil burner when weekly cleaning and maintenance is performed.

In all Wood Gun™ models, the draft-inducing fan increases the air velocity past the nozzle. Because of this increased air velocity, the Burner Adjustment Tables in the Riello manual are a good starting point for initial firing of the burner; however, fine-tuning of the burner settings is usually needed.

For proper burner adjustment a combination test kit must be used. It is not likely that the CO2 levels suggested in the burner manual can be achieved, but the net stack temperature will be very low, yielding a net efficiency well in excess of 80 %. Refer to the burner manual for information regarding wiring logic and individual components of the burner.

GAS BURNER ASSEMBLY

Refer to the Riello Burners Installation Manual included with your shipment for instructions on configuring the burner. Gas burners must be installed utilizing manual switchover controls only.



The burner must be installed and configured by a certified Gas Burner Technician.

NOTE: The Riello gas burner has an air sensor that senses airflow through the burner. When a Riello gas burner is installed, then the oil fan speed of the fan may need adjusted.

The burner mounts to the flange on the boiler combustion chamber using four 3/8 in x 1½ in bolts provided. Make sure the gasket provided with the burner is placed between the flange on the Wood Gun™ and the mounting flange of the gas burner. Connect the burner according to the wiring diagram included with your boiler or found in Appendix B: Wiring Diagrams

Note: Advice offered in this manual is NOT a substitute for securing the services of a professional installer.

Before allowing gas that is under pressure into the piping, all openings from which gas can escape should be closed.

Immediately after turning on the gas, the system should be checked for leaks. This can be done by watching the ½ cubic foot test dial and allowing five minutes to show any movement or by soaping each pipe connection and watching for bubbles. Use a solution of dishwashing detergent and water for "poor man's" leak detection or use electronic detectors.

Pay attention to any gas odor and follow up any observed odor with a check of all connections for leaks. Remember that ventilating an area when correcting a leak is normally a good idea. Keep in mind that propane is heavier than air and natural gas is lighter than air.

Consult the burner manual for the proper procedure for purging air from the system and for initial start-up of the burner.



All gas piping must comply with local codes and ordinances or the National Fuel Gas Code ANSI Z 223.1-1980 and NFPA No. 54.

Gas Burner Adjustment

Please see the Riello Burner Installation Manual section entitled Setting up the Burner for information on gas burner adjustment.

Operating Information

Please read this entire manual before operating the boiler. It contains important requirements and instructions must be followed for safe and satisfactory operation of the boiler.



All cover plates, enclosures and guards must be maintained in place at all times, except during maintenance and servicing. Always keep fueling and ash doors closed when the boiler is not being tended. Always maintain all seals in good condition.



Be sure the boiler vessel is full of water and pressurized before starting a fire. Never attempt to add water to a hot boiler if found to be only partially full. Allow the unit to cool before adding water to the boiler. Failure to do so could result in death or severe injury along with damage to boiler and surrounding property.

Never attempt to add water to a hot boiler if found to be only partially full. Allow the unit to cool before adding water to the boiler. Failure to do so could result in death or severe injury along with damage to boiler and surrounding property.

NOTE: It is recommended that several small charges of wood be used initially to ensure that maximum durability of the refractory lining is achieved.

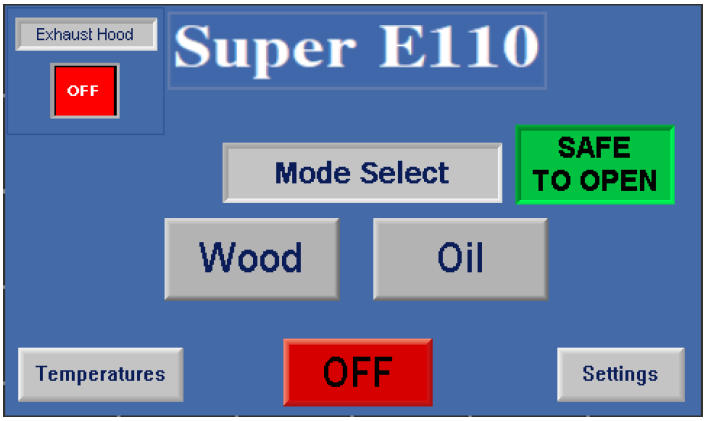
The bottom of the fuel chamber contains dense cast refractory blocks. The refractory is baked in a kiln at the factory to dry out nearly all moisture before it is placed in the boiler, but it does not reach maximum strength unless heated to operating temperature gradually (cured).

EXPLANATION OF SWITCH AND BUTTONS

The SE110 uses a simple easy-to-use touchscreen interface which will be explained below. There is also an ON/OFF switch (the “Main” switch) and the green “Purge” light located in the cabinet to the left of the loading door.



Home Screen



Explanation of Buttons:

Wood: It initially turns on all necessary functions to burn wood. Once the wood function is on, the button simply takes you to the “Wood” screens. It will not be visible if you are burning Oil/Gas.

Oil/Gas: It initially turns on all necessary functions to burn oil/gas. Once the oil/gas function is on, the button simply takes you to the “Oil” or “Gas” screen. It will not be visible if you are burning Wood. If equipped.

Exhaust Hood : When equipped with the exhaust hood. You can turn the blower on and off with this button.

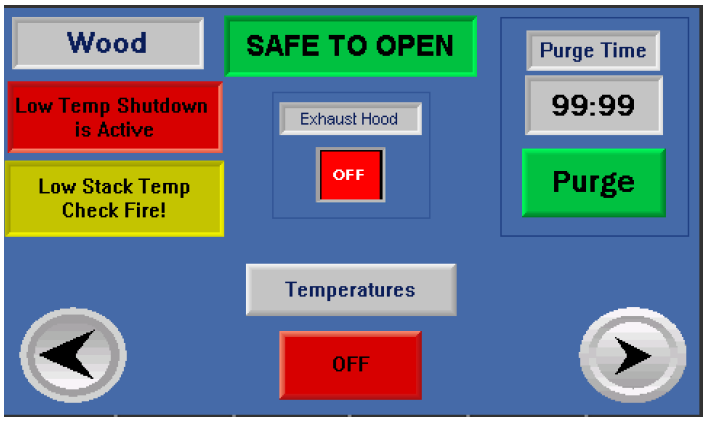
Safe To Open: this is not a button, it simply tells you when you may open the loading door.

Temperatures: This button will take you to the "Temperatures" screen.

OFF: This button will turn off the wood or oil burning functions. It is only visible if the boiler is in wood or oil mode.

Settings: This button will take you to the "Settings" screen.

Wood Screen (first)



Explanation of Buttons:

Safe To Open: this is not a button, it simply tells you when you may open the loading door.

Low Temp Shutdown is Active: this is not a button. It is a notification that the boiler is shutdown based on the Low Temp Shutdown feature.

Low Stack Temp Check Fire!: this is not a button. It is a notification that the boiler is shutdown based on the Low Temp Shutdown feature.

Purge: this green button when pushed will take you to the "Wood Purge" screen and starts the Purge function. This will turn the boiler on if in off-cycle so you may safely check or load more wood into the fire. The timer above shows time remaining before the boiler shuts off.

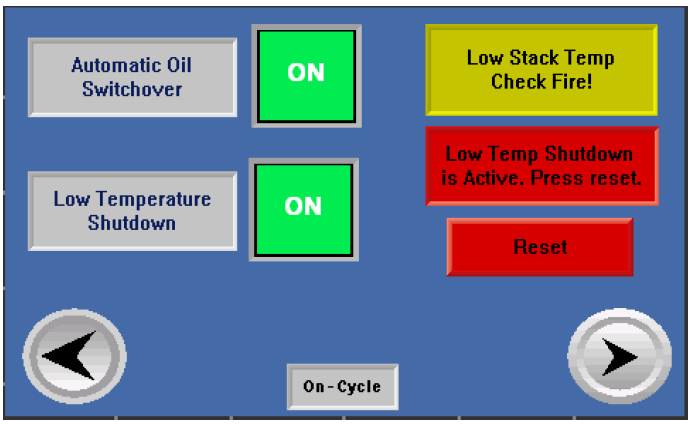
Temperatures: This button will take you to the "Temperatures" screen.

OFF: This button will turn off the wood burning functions, and takes you to the "Home" screen.

Back Arrow: when pushed it will take you back to the "Home" screen.

Forward Arrow: when pushed it will take you to the second "Wood" screen.

Wood Screen (second)



Explanation of buttons:

ON (beside Low Temp Shutdown): this button allows you to turn on or turn off the LTSD function.

Reset: this button resets the LTSD function and allows the boiler to turn on so you may restart the fire. It is only shown when the LTSD function is on and it has been engaged due to the exhaust temperature being too low.

ON (beside Auto Oil Switch): this button allows you to turn on or off the automatic switch over feature, if equipped. Automatic switchover is only available on units equiped with an Oil Burner (not gas)

Back Arrow: when pushed it will take you back to the first "Wood" screen.

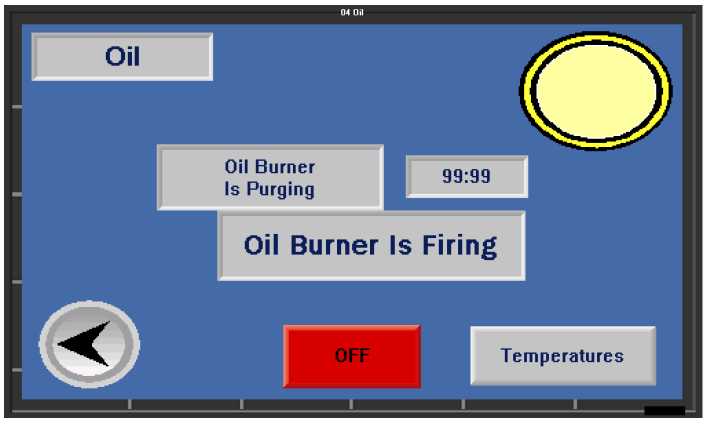
Wood Purge Screen



Safe To Open: this is not a button, it simply tells

Back Arrow: when pushed, it will take you back to the first "Wood" screen.

Oil/gas Screen (if equipped)



Explanation of buttons:

Oil Burner is Purging: This is simply notifying you that the burner is in a wait period and the timer to the right shows the time left until the burner will fire.

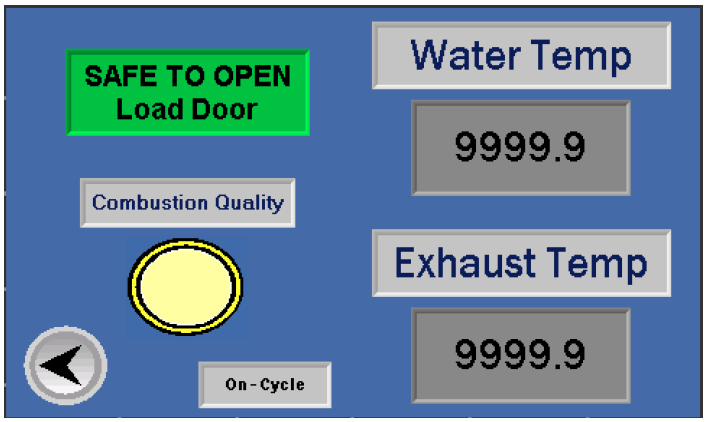
Oil Burner Is Firing: This is also a notification stating that power has been sent to the burner to initiate its start-up sequence.

Temperatures: This button will take you to the "Temperatures" screen.

OFF: This button will turn off the oil burning functions, and takes you to the "Home" screen.

Back Arrow: when pushed it will take you back to the "Home" screen.

Temperatures Screen



Explanation of buttons:

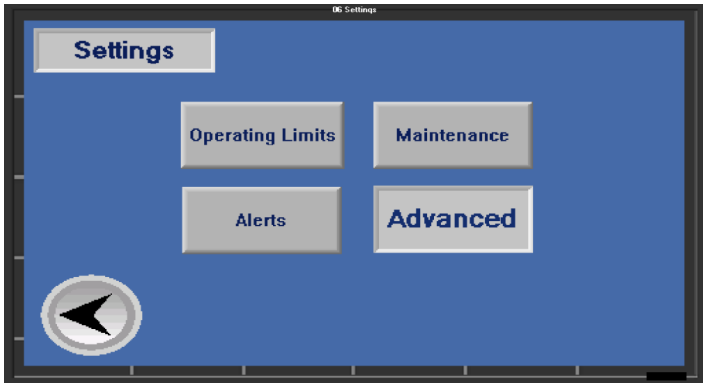
Note: Water and Exhaust temperatures are shown in Fahrenheit.

Safe To Open: this is not a button, it simply tells you when you may open the loading door.

Home: this button takes you to the "Home" screen.

Back Arrow: when pushed, it will take you back to the screen you were on before coming to the "Temperatures" screen.

Setting Screen



Explanation of buttons:

Operating Limits: this button will take you to the screen where you can change the temperatures and fan speeds at which the boiler operates.

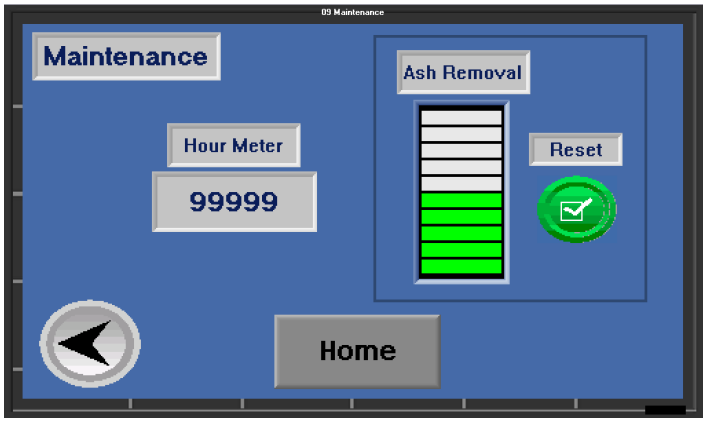
Maintenance: this button takes you to a diagnostic screen that estimates when your boiler may need cleaned, and how many hours are on your boiler.

Alerts: this takes you to another diagnostic screen that shows any problem with the system.

Advanced: This button takes you to the advanced setting that should only be accessed by qualified personnel. It is password protected.

Back Arrow: when pushed it will take you back to the "Home" screen.

Maintenance Screen



Explanation of buttons:

Hour Meter: This show the total run time of the draft inducing motor in hours

Ash Removal: The bar graph shows when the boiler needs to be cleaned. Remove the ashes out of the firebox and both of the upper and lower refractory chambers.

Reset: After you have removed the ashes, press the reset button to reset the bar graph.

Back Arrow: when pushed it will take you back to the "Settings" screen.

Home: this button takes you to the "Home" screen.

SEQUENCE OF OPERATIONS

Now that you have a good understanding on the buttons and what they do lets talk about the different function and how they work together.

The boiler regulates itself to operate in an efficient manner and at the same time is able to keep up with high demand situations. The boiler will shut down at 185F. It will sit dormant until enough demand is used to drop the water temperature to 160F, we call this Off-Cycle. Once below 160F, the boiler will turn on. The actuated dampers will begin to open and the blower motor will turn on. The unit will continue to operate until it overcomes demand and reaches 185F. When it reaches 185F the boiler will go into Off-Cycle.

The green "Safe To Open Load Door" message will appear when the loading door is safe to open. **Never open the loading door unless the green "SAFE TO OPEN Load Door" message is visible.**

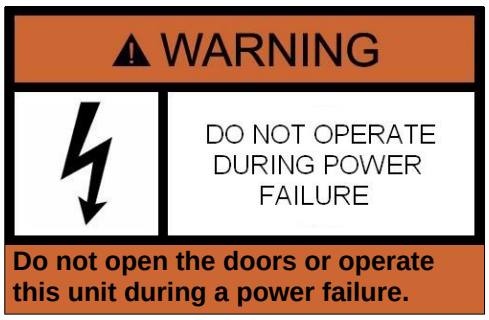


Do not open any of the doors when the message says **DO NOT OPEN Load door.**



If you need to check the fire when the boiler is in Off-cycle and the screen says DO NOT OPEN. You can go to the Wood screen and press the **PURGE** button. This will allow the boiler to come on so you can safely check the fire or load more wood into the firebox.

Note: if the boiler is in Off-Cycle and the "PURGE button is not working, this means the boiler is in a Cool-down Period. Please wait 3 minutes and try the "PURGE" button again.



Low Temperature Shutdown (LTSD)

The E110 is equipped with Low Temp Shutdown, the unit will shut the boiler down because of low exhaust temperature at 220F. This temperature is adjustable.

If this happens press the LTSD reset button. The LTSD can be turned on, off and reset from the second "Wood" screen.

When the Low Temperature Shutdown (LTSD) button is "ON" the low temperature function will allow the boiler to operate normally until the exhaust temperature falls below the set point. When the boiler is running with no fire the cool air moving through the unit will cool the water. This is especially inefficient if there is a backup boiler (in most cases oil or gas fired) is trying to maintain heat in the system.

Other Functions

The SE110 has the capability to control your circulators. R5 relay in the main control box can turn on and off a circulator based on the boilers temperature. Power of your choice will need supplied to terminal #22 of the R5 relay via the Black 31. Black 30 will then be used to power the pump. This output can be turned on and off and the temperature can be changed from the "Operating Limits" screen.

Resetting the Controls

To reset the control system turn the "MAIN" switch to the "OFF" position and wait 4 min, then turn the "MAIN" switch back on.



FUEL TYPE

The Wood Gun is designed to burn split or unsplit wood

The Wood gun is designed to burn log wood. The Wood gun is able to burn both hard wood and soft wood fuel. Keep in mind that hardwood is typically a better fuel. Hardwood will usually give you longer burn times than softwood, due to greater energy density per unit volume. Oak, Maple, and Cherry are a few of the hardwood types that can be burnt. Cedar fir and pine are a few of softwood species that can be burnt. A well managed Wood Gun will not produce creosote from burning softwood.

Wood dimensions

The log wood must be cut and split so that the length is 22"-26" and so that the diameter is less than 10". The log wood must be seasoned to an average moisture level of 19%-25%

Prohibited fuels

No person is permitted to burn any of the following materials in an EPA Step 2 certified wood burning appliance such as the Super E110.

- Residential or commercial garbage.
- Lawn clippings or yard waste
- Materials containing rubber, including tires
- Materials containing plastic
- Wast petroleum product, paints or paint thinners or asphalt products
- Materials containing asbestos
- Construction or demolition debris
- Paper products; cardboard, plywood or particleboard. The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, sawdust, was and similar substances for the purpose of starting a fire.
- Railroad ties or pressure treated lumber
- manure or animal remains
- Salt water driftwood or other previously salt water saturated materials
- Unseasoned wood
- Any materials that are not included in this manual.

- Any materials that were not included in the certification tests

Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke.

Wood Fuel Characteristics and Wood Storage

Although the boiler will burn green or wet wood, this practice is discouraged because of the substantial amount of heat energy required to evaporate the moisture before combustion can take place. When the first cut, the moisture content of wood may range from 40 to 60% as compared with air-dried wood at 25% to 35%. Each extra 25% of moisture represents approximately five gallons of additional water that must be evaporated and passed out of the chimney for each 120 pound charge of wood. The heat that must be used to evaporate any extra water, is heat that is then not available for your heating application. This significantly lowers the maximum heat output of the boiler. It is advantageous to let the sun remove that extra 100 to 250 gallons of water found in a cord of wood. Generally, wood should be stored s in a dry place with only a limited supply kept indoors.

Using wood that has a moisture content of greater than 30%, can be detrimental to the operation of the boiler. Results of using wood with too high of a moisture content are likely to include loss of BTU output, reduced efficiency, and condensation issues. Using high moisture wood will reduce the service life of carbon steel boilers.

Determining wood moisture levels can be tricky without the use of a wood moisture meter. Dry wood will have split or cracks on each end and bark may be loose. For exact wood moisture levels use a wood moisture meter. To use a wood moisture meter you will need to split a piece of wood then stick its probs into the freshly split sides at a few different points. Make sure the probs are running parallel with the grain of the wood. Meters are most accurate when the wood is above 50F.

The best way to season (dry) your wood is to cut and split it to proper length and diameter for your SE110. Once the wood is cut and split, stack it and cover the top of your pile. This needs done 6-12 months before you need to burn it. During the heating season it is recommended to have at least one week worth of fuel inside and kept out of the weather.



Do not store fuel within the appliance installation clearances or within the space required for fueling, ash removal, or other routine maintenance operations.

STARTING A FIRE: PROCEDURE

The “MAIN” switch should be in the “ON” position. Once the “Main” switch is on the touchscreen will power up and will display the “Home” screen.



If you are starting a wood fire. Simply press the “Wood” button. The boiler will start-up and you may begin starting a fire.

Starting a fire in the Wood Gun™ is similar to starting a fire in any wood fired boiler with a few important differences. Because the Wood Gun incorporates a downward draft, successful fire starting requires recognizing that fact and layering kindling accordingly. Place kindling wood on the refractory in a lengthwise orientation. Add a layer of crumpled up newspaper followed by another small layer of kindling. Light the paper. When the kindling is burning well, add more (and larger) pieces of wood.

Note: Always place wood in the Wood Gun™ lengthwise (from front to back).

When firing a cold boiler, it is important to concentrate heat next to the refractory. The Wood Gun™ depends on high refractory temperatures for driving the gasification process. Using drier, smaller wood will help to accomplish this. Add larger pieces only after the fire is well established. Only fill the fuel storage area (firebox) after the refractory has reached good gasification temperature indicated by an exhaust temp above 220F.

Keep in mind that a small intense fire is preferable to a large smoldering one to reduce the amount of creosote deposition. This will be accomplished by building the initial fire with wood no higher than the door frame. When the starting charge is burning hot, add the rest of the charge in sufficient quantity to last for up to 10 to 14 hours.

Longer cycles are possible, but you will want to plan for utilizing shorter burn cycles periodically to provide for good firebox management. Best practices include keeping ash and charcoal build-up to a minimum.

When demand is moderate to low, simply load charges of fuel that are just adequate for the length of the anticipated burn cycle. Do not overfill fuel storage area (firebox).

Charging the Boiler with Wood



Observe the warning label on the load door which cautions that it must not be opened unless the green OPEN message is vissible.

When it is time to reload the Wood Gun™, make certain the green "SAFE TO OPEN" message is on. If the "SAFE TO OPEN" message is off, push the "**PURGE**" button which can be found on the Wood screen. Wait for the Load Door message to say SAFE TO OPEN.

Always open the load door slowly by cracking it open just a bit to allow air to flow in smaller quantities through the opening. After 5-10 seconds, you may open the door fully. This waiting period will allow sufficient time for the fire to become re-activated and burn off any gases that may have accumulated in the fuel chamber during the off cycle. Even if SAFE TO OPEN is visible, **open the door cautiously,** since abruptly introducing air over the glowing fuel particles may cause it to temporarily flame up.

When reloading the Wood Gun™, it is a good idea to use the ash rake to make sure that the center slot is open and free from ash and charcoal before adding more wood. Such raking is required more often when using softwood, or any wood with a high ash content. Wood bark has a very high ash content relative to the centers of wood pieces. When using hardwood, clear the slot at least daily.

Clear the slot by first raking charcoal pieces away from the slot. After raking the charcoal pieces away from the slot, rake all the ash into the slot, thus aiding the process of allowing the induction fan to pull the ash through.

Once the center slot have been cleared and the coal bed leveled you may load wood into the firebox.

Place the wood in the firebox length-wise and centered (front-to-back) and stack the wood neatly and tightly.

Note: Spent ash should not be allowed to build up on or in the refractory. NO MORE THAN 1 INCH OF ASH.
Any ash buildup will restrict the airflow and insulate the fuel charge from the heat generated in the refractory, slowing the rate of gasification, and thereby reducing heat output, and may even produce excess smoke, condensation and creosote!

Best results with fuel loading will be obtained if the charge of wood is limited to the amount needed to produce a 14-hour burn under anticipated heat load conditions. Adding more wood than can be utilized in 14 hours will likely lead to charcoal buildup and potential issues with "back-puffing", smoke, condensation and creosote.

Note: Guard against charcoal and ash accumulation in your Wood Gun™ by keeping burn cycles at less than 14 hours. Utilize occasional short cycles, as short as 4 hours, for good firebox management.

Long burn cycles will also lead to accumulation of charcoal in the fuel storage area. Excess charcoal will tend to block airflow through the slot in the center brick. Furthermore, soft, crumbly charcoal can also be pulled through the refractory, resulting in tiny, live embers being emitted from the boiler.

Very dry wood of 15% moisture content or less is likely to produce back puffing as well. Preferred options follow, as included in this back-puffing prevention/resolution checklist.

Back-Puffing/Condesation Prevention Checklist

- ✔ Use fuel with higher moisture content,
- ✔ Load wetter fuel on the top of your fuel charge
- ✔ Use a good percentage of full rounds, as large as 10 inches.
- ✔ Stack wood tightly, using a combination of full rounds and split pieces to form a more solid block of fuel inside the fuel chamber
- ✔ Utilize shorter burn cycles, to prevent over drying of the fuel charge that occurs with long cycles

Remember, the Wood Gun utilizes a down draft design, and optimum combustion takes place when the flame is properly inverted.

REMOVAL AND 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 noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled.



For instructions on removing ashes see mainenance section.

RECOMMENDED BOILER CONTROL SETTINGS IN HYDRONIC SYSTEMS

The following control settings are recommended for parallel installations:

- ✔ High limit (aquastat on rear of unit) 200° F
- ✔ Operating Limt – 190°F.
- ✔ Low Temperature Shutdown Limit 220° F

Additional settings may include:

- ✔ Optional circulator shutdown control 135° F

WARNING: if the operation procedures and wood requirements are not followed it may result in: poor combustion, low btu output, creosote in chimney, debris buildup in heat exhanger, and very poor efficiency.

***FOR CARBON STEEL BOILERS**

Condensation – Causes and Prevention

Excellent combustion will maximize the amount of the main byproducts of combustion, carbon dioxide and water. Keep in mind that a great deal more water will be produced by good combustion than what was originally contained in your well seasoned wood. These two sources of water, added together, must be removed from the system in the vapor state to avoid condensation. If the exhaust gases cool to the condensation point, you will see liquid water in your chimney and/or cyclone, and possibly even inside the boiler's heat exchanger. Severe condensation can result in so much liquid water that it is misinterpreted as a boiler leak. When water is found in the cyclone and/or heat exchanger, attack the issue as one related to condensation.

Note: Condensation in the heat exchanger can be caused by wood that is too wet for the application and/or by low return water temperatures. Recommended return water temperature is operating temperature minus 20º F. Use a mixing valve for boiler return water temperature protection.

Reduce or Prevent Condensation

Condensation has several causes, but can always be attacked systematically and greatly reduced or eliminated. Properly utilized thermal storage will assure steady load when firing, and assist in keeping condensation under control. Keep in mind that because the Wood Gun swirl tube heat exchanger extracts so much heat from the exhaust, the gases leaving the system are often not far above temperatures that can lead to condensation. Anything that compromises performance or cools stack gases further than normal can trigger condensation. Review the list below and make changes that match your circumstances. Be sure to review the installation section of this manual that covers return water temperature.

- ✔ Increase return water temperatures (mixing valve, raise operating temperature)
- ✔ Check for and correct any issues related to leaking door seals or Air Valve leaks
- ✔ Insulate stove pipe and/or chimney to preserve heat
- ✔ Insulate cyclone
- ✔ Increase load
- ✔ Never allow mid-burn off cycles to occur
- ✔ Use drier fuel
- ✔ Clean boiler, or take other measures to improve air flow
- ✔ If you are observing back-puffing, take care of this issue promptly, as performance is compromised in a back-puffing boiler, possibly contributing to condensation
- ✔ Keep refractory relatively clear of charcoal and ash
- ✔ Watch loading technique and other firebox management aspects, making sure that the fire burns properly upside down
- ✔ If you are experiencing water in the cyclone, removing the air turbulator may help.

Maintenance



The unit must be out or cycle off for at least four hours and the power must be disconnected before attempting to clean or service.

It is important to establish a routine for the storage of fuel, starting the fire, and caring for the unit so as not to overlook important aspects of safety, and to maintain the unit in optimum condition.

Maintaining the load door seal and air valve gasket seal are very important for efficiency, and for safety.

WEEKLY CLEANING PROCEDURE

Following is the recommended procedure for weekly cleaning:

Refractory

1. Allow the Boiler to cool and use gloves.

2. Remove excess ash from fire box.

- You can have the draft fan running and using the scraper push the ashed into the center slot.

3. Open front inspection door.

4. Place an ash receiver under the refractory at the front inspection door opening.

5. Remove the both plug and restrictor plug. Use the ash rake to pull the ash from the both tunnels.

6. Re-insert the plug in the right tunnel and verify that it properly seals the opening.

7. Re-insert the restrictor plug in the left tunnel.

Note: The front of the top combustion chamber must be properly sealed to prevent gas from being drawn directly into the heat exchanger thereby bypassing the refractory.

8. Use a putty knife or scraper to clean ash from the bottom of the door opening.

9. Empty the ash pan located in the bottom of the cyclone.

Air-Valves

The air valve should be inspected and cleaned **weekly** to ensure that it is sealing properly. A leaking air valve or load door can produce a number of undesirable consequences, including a low smoldering fire.

When the air valve is open and the unit is operating, moisture released from the fuel will condense when it comes in contact with cooler combustion air. This moisture and creosote can collect on the gasket disk and on the end of the air valve tube and in time produce a deposit that prevents the gasket from sealing tightly.

If the silicone rubber gasket shows evidence of deterioration it should be replaced. When requesting a replacement, be sure to specify the size (diameter) of disc you require.



The air valve may be inspected during the "run" cycle of the boiler. Any cleaning or service to the air valve should be performed when there is no fire in the combustion chamber and is in the "Cleaning Mode".

To Operate the Air Valves Manually for Cleaning and Service:

1. Remove the air-valve covers and inspect the valve gasket disks for evidence of air leakage. The disk should have some wobble, so it can find its own seal. See below.

2. Scrape condensation and creosote build-up from inside the air-valve boxes using a long handled screw-driver.

3. Make sure the SE110 is not in Wood or Oil mode, that the water temp is below 130F and that the exhaust temp is below 95F.

4. Go to the "Maintenance" screen and press "Cleaning Mode"

- Once in the "Cleaning Mode" you will see buttons for the 1st Air-Valve, 2nd Air-Valve, and the Draft fan. When you turn on the Air-Valves, they will open so you can clean or replace their discs.

5. Clean off any deposit on the gasket disc with a cloth soaked in warm water and detergent. Scraping with a knife or other metal scraper may damage the silicone rubber seal. Be careful.

6. Clean off any deposit on the end of the tube by using a putty knife. Any accumulation in the tube should also be removed by using the long handled scraper as described in Step 10 of Weekly Cleaning Procedure.

To replace the gasket simply remove the center bolt and nut as indicated in the exploded assembly in this manual. Do not firmly tighten the nut on re-installation as the new gasket needs some slight wobble to seal properly over the air inlet tube.

CLEANING

Following is the recommended procedure for cleaning:

Yearly

1) Clean the heat exchanger.
   a. Remove the draft fan assembly.
   b. Use a wire brush or scraper to clean out the heat exchanger.
2) Clean the Cyclone
   a. Unplug the thermocouple and O2 sensor.
   b. Disconnect the stove pipe
   c. Remove the cyclone and disassemble to clean.
3) Clean the Stove Pipe
4) Clean and inspect chimney and rain cap
5) Check all seals on boiler and replace if needed
   a. Load door
   b. Air-Valve Discs (primary and secondary)
   c. Front Inspection Door seal and ceramic board
   d. Draft fan gasket

Every 3 Months

1. Check stove pipe and cyclone for excess ash buildup.
   a. Run the cleaning brush through it, and all the way down to the heat exchanger exit.

AIR VALVE MOTOR REPLACEMENT

Removing Old Damper Motor

1. Turn power off to the unit.

2. Disconnect wiring.

a. Primary (1st) air-valve - Use a #2 phillips screwdriver to remove the screw in the center bottom of the red cap. With the screw out, pull the cap off.

b. Secondary (2nd) air-valve – Disconnect the wires leading to the motor at the 2 x 4 junction box. Once wires are disconnected, also disconnect the conduit.

3. Use a 10 mm wrench to loosen the mounting bolt.

4. Remove Motor. (For 2nd air-valve motor removal only… remove and save the piece of conduit attached to the motor. You will need it for the new one)

Installing the New Damper Motor

Note: Before starting this procedure make sure that the spring return will operate in the correct direction. To change the direction, just remove the clip that holds the clamp in place. Pull the clamp out flip the motor over and reinstall the clamp making sure that the arrow is pointing at the 0º mark. Reinstall the clip.

1. Remove power from the boiler.

2. Remove red cap on new motor (you will not need this as you will use the cap wired to the boiler)

3. Reconnect wiring (if needed). See wiring diagram in the back of this manual.

   a. Primary (1st) air-valve – Carefully align the pins in the red cap with the holes on the bottom of the motor. Use a #2 phillips screwdriver to install screw in the center bottom of the red cap.

Note: Make sure the correct input is selected. Input **#3** needs to be selected (See Figure below)



Primary Air-valve Input Selection

   b. Secondary (2nd) air-valve – Install the conduit that was removed from your old motor. Re-install the conduit connector nut. Reconnect the wires to the 2nd air-valve. Use a #2 phillips screwdriver to reinstall the cover for the 2×4 junction box.

4.Restore power to the Boiler.

5. Using the touchscreen. Enter the "Cleaning Mode", make sure the spring return will operate in the correct direction.

6. Turn on the damper you are working on. Allow the motor to open fully and stop.

7. Once the motor stops opening. Install clamp into the motor, **so that the arrow is pointing at the 80° mark and install the retaining clip**.

8. Place motor onto air valve. Make sure the motor clips on at the bottom.

9. Use your hands to open the air valve disc completely to the stop. Ensure that the jaws on the clamp align with the contour of the shaft.



PRIMARY Air Valve Disk in Open Positioning



SECONDARY Air Valve Disk in Open Position

10. Tighten the 10 mm bolt of the motor's clamp down on the hex shaft.

11. Exit Cleaning Mode.

12. Inspect to insure that the air valve is sealed properly. The disc should have pressure allowing for a complete seal against the air intake collar.

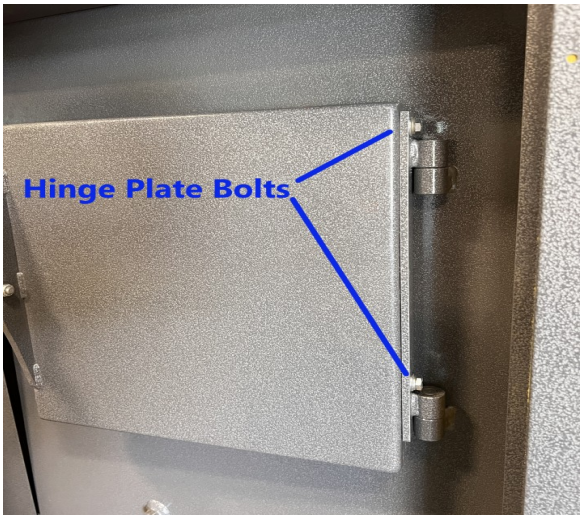
Note: the air-valve disc should '**wobble**' on its mounting arm. The mounting bolt should be loose. Use a lock nut.

CRITICAL: IF THE AIR-VALVE DISCS ARE NOT PROPERLY ADJUSTED YOU WILL GET CREOSOTE IN THE HEAT EXCHANGER AND IN THE AIR-VALVE BOX.

NOTE: For the primary air-valve, it is very important that when placing the red end cap on the motor. The pins must align properly. If the pins do not align properly the valve will not work.

DOOR ADJUSTMENT

For proper operation of the Wood Gun™, it is important to have an effective seal of the loading door and clean-out door. All have a simple adjustment mechanism on the hinge plate and latch keeper that permits the door to be adjusted as the gasket compresses during service. To adjust the hinge, open the door, loosen the bolts that hold the hinge plate, and bump the door toward the door-frame and tighten the bolts. Be careful not to tighten so much as to prevent the latch side from closing properly.



CRITICAL: IF THE LOAD DOOR IS NOT PROPERLY ADJUSTED YOU WILL GET CREOSOTE IN THE HEAT EXCHANGER!

Door Hinge Plate Adjustment

To adjust the latch side of the door, remove the two bolts that secure the latch keeper in place and remove one of the spacer shims. Shims are inserted at assembly. Remove the thin one first and if more adjustment is required at a later time, then it can be used to replace the thicker one to gain the additional adjustment.



Door Latch Shims

A good method to use when trying to determine if the doors are sealing properly is to coat the door-frame edge with chalk or similar marker and close the door against the frame. Any unmarked portion of the gasket indicates a low spot, which can be built up using the high temperature silicone sealant.

LOAD DOOR SEAL REPLACEMENT

1. Allow door to completely cool before you touch or start installation, remove door.

2. Cut flat fiberglass tape (white tape) into 4 equal strips. The tape shall stop 1" from each corner.

3. Insert silicone tube into a Caulking Gun.



Load Door with Old Seal Removed and High Temperature Silicone

4. Run a small bead of silicone into door groove. Place strips of fiberglass tape in grooves only on the straight sides. Lay the strips in as shown below, falling short of reaching into the corners. This is necessary because when the preformed gasket bead is pushed into place, it naturally expands outward away from the door where it is forced to bend around the corners.



Load Door with Fiberglass Braid Tape

5. Run a small bead of silicone on top of the fiberglass tape in the entire length of the door groove.



Load Door with Fiberglass Braid Tape and More High Temperature Silicone

6. Start the gasket in the middle of the hinge side. Squeeze the gasket into place on top of the bead of silicone. The rounded side faces downward towards the silicone. The whole length of the door groove should be filled with gasket. The gasket should have an even plane around the entire top surface. Be sure to squeeze the gasket into the groove evenly around the entire door to prevent any raised or uneven areas. These appear as bumps in the contour of the silicone bead.

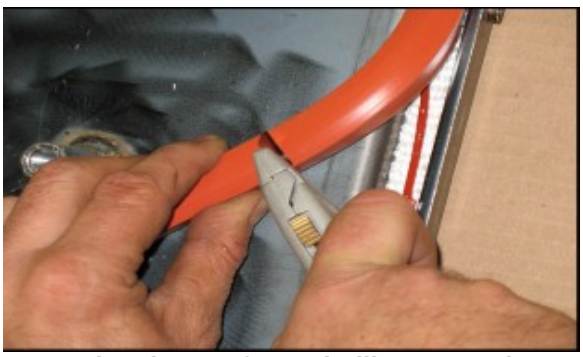


Adding Preformed Silicone Bead to Door

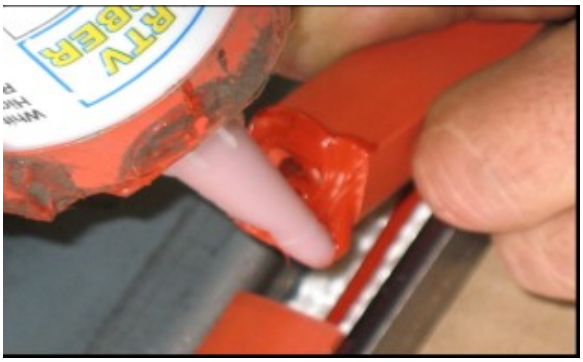
7. The gasket should meet evenly (if it doesn't you may trim excess). Place a small amount of silicone on one of the edges to create a seal.



Marking to Trim



Trimming Preformed Silicone Bead



Adding High Temperature Silicone to Butt Joint of Trimmed Bead

8. Once the gasket is in place put a small amount over top of where the edges meet to create a seal. Smooth with a flat edge tool.

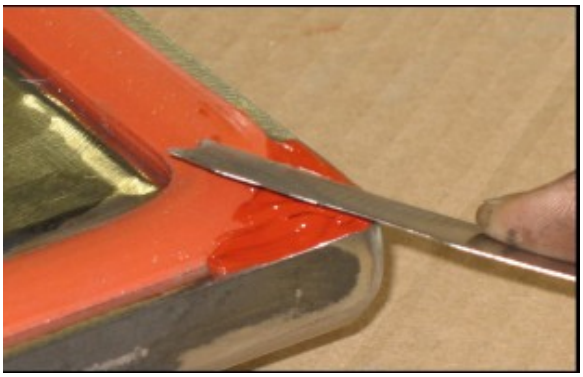


Finished Joint

9. Place a small amount of silicone around the corner edges and smooth with a flat edge tool.

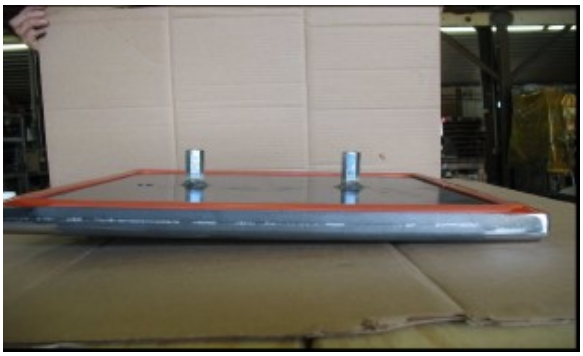


Reinforcing Corners with High Temperature Silicone



Finishing the Corners

10. Allow silicone to dry for at least 2 days before reinstalling.



Finished, Level Bead

FRONT INSPECTION DOOR HIGH TEMPERATURE ROPE INSTALLATION

The high temperature rope is made from fiberglass. You must wear gloves to protect your skin from getting strands of fiberglass embedded under the skin from handling.

1. The first step for installation is to make sure that the rope channel is clean. Remove any rust or loose debris from the channel.

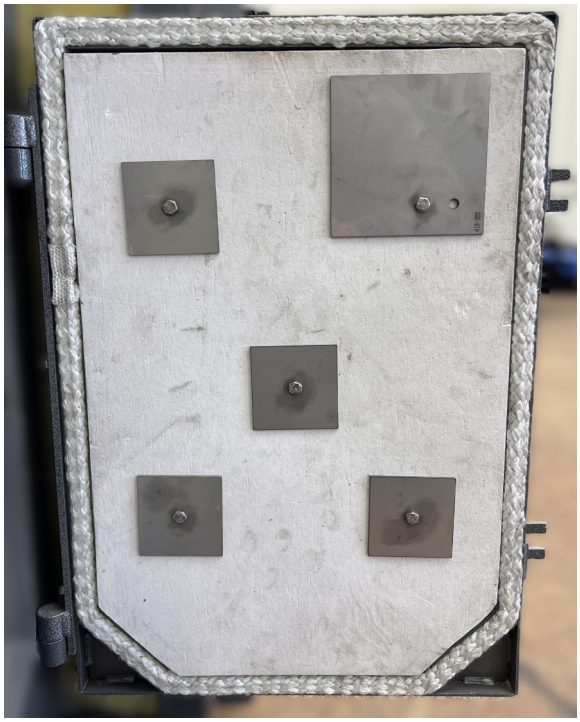
3. The rope sent from the AHS factory will be too long and will need to trimmed to the proper length. This is important because you need to start and finish with a straight end. Use sharp scissors to cut the rope.

4. Start with a clean cut rope end. Place the rope end in the rope channel mid way up on the hinge side of the door. Press the rope in by hand or with a flat-headed screwdriver. Stretch the rope as much as you can while pushing it in. Go from corner to corner until reaching the end. When putting the two ends together tuck all loose ends down inside the

channel. The rope should protrude about 3/8” above the door frame.

6. Look over the door to find any high spots or bumps in the seal. Use the mallet to tap any and all of the high bumps down. This will give an even, straight surface the whole way around the door gasket.

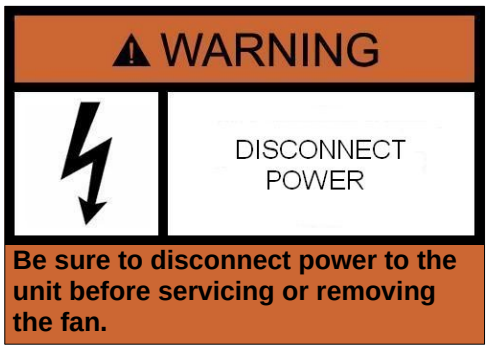
7. The new gasket is now in place. The last step will be placing the door on the boiler and adjusting it as you would in a normal maintenance. The gasket will settle and will need adjustment in the next few weeks. It is recommended that the door adjustment should be checked every three days for the next few weeks.



Front Inspection Door

FAN ASSEMBLY

The fan-motor assembly may be removed by loosening the nuts from the studs.





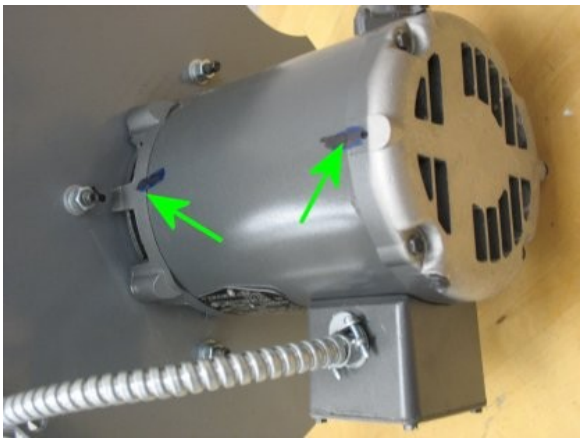
Direct-drive fan attached to boiler

If the fan assembly gasket is damaged, all of the old material must be removed and a new gasket inserted. Use 5/8inch high-density or 1inch low density fiberglass rope.

DIRECT DRIVE FAN BEARING REPLACEMENT PROCEDURE

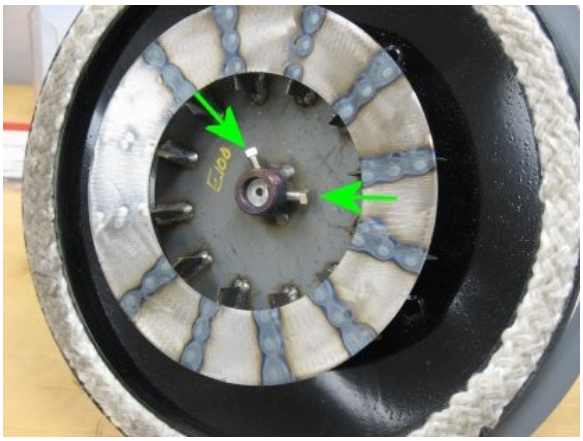
Make sure the power is turned off and/or disconnected. Disconnect the wire from the motor. Remove the motor end cap (3 screws). Remove the motor assembly by removing four 3/8” lock-nuts located along the outer edge of the motor mounting plate.

It is a good idea to mark orientation of components for reassembly.



Mark Assembly Orientation

Place the fan assembly on your workbench with the fan facing up. Remove the two set screws from the fan hub. It might be a good idea to let a good penetrate soak down into the area between the hub and the shaft. Letting it soak in for an hour or longer is recommended.



Fan Hub Set Screws

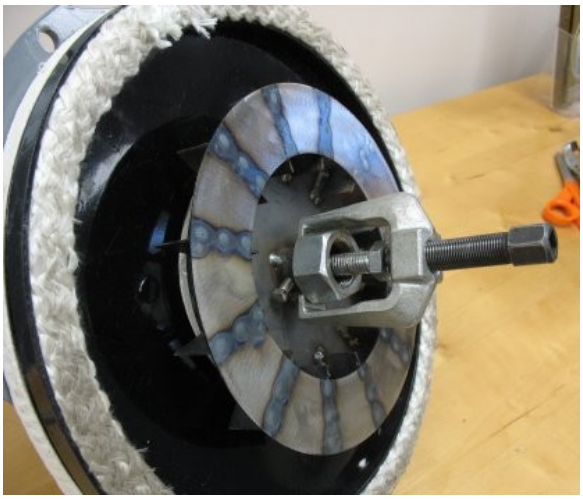
At this point, you have a choice of two methods for removing the fan. You may use a separate nut and jaw type puller, or you may use the economical AHS Fan Puller Tool. The photos below show each in turn, respectively. A bit of heat on the fan hub from a propane torch may be necessary.

Screw a one inch (fine-thread) nut onto the threaded hub of the fan.



One Inch Nut for Pulling Fan

Using a jaw type puller, remove the fan from the motor shaft:



Jaw Puller at the Ready

Or, use the AHS Fan Puller:



AHS Fan Puller Tool



AHS Fan Puller Tool at the Ready

Remove the (4) 5/16” nuts and washers from the motor plate allowing you to remove the abrasion shield and the heat shield from the motor plate. Be careful when removing the ceramic heat shield. It is very fragile. It is advisable to use a putty knife to separate the heat shield from the motor plate.



Separate Heat Shield from Motor Mount Plate

To remove the motor from the motor mounting plate use an allen wrench to remove the four motor mounting bolts that are counter sunk into the motor plate.



Closeup of Motor Mounting Bolts

To separate the motor housing you must remove the four bolts from the end of the motor opposite of the shaft. These bolts have a 5/16 bolt head.



Motor Frame Assembly Bolts

Once these bolts are removed, tap the mounting end of the motor on the side with a rubber mallet, or use a regular hammer along with a block of wood. This will separate the bearing housing (end shield) from the motor body.



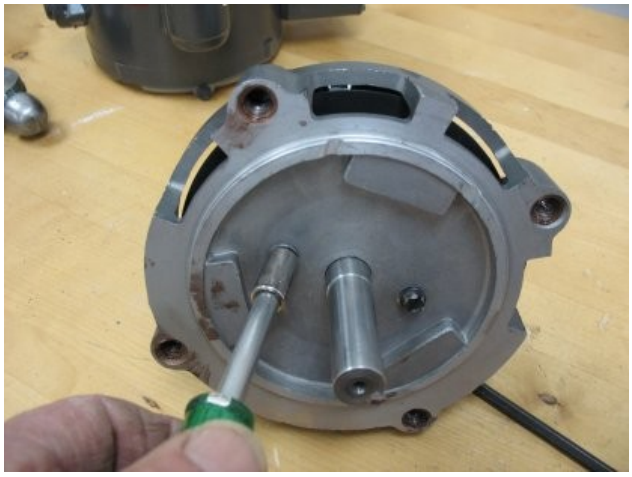
Loosening Motor End Shield from Motor

The end shield, along with the armature, can then be lifted gently out of the motor frame. Be sure that the beveled waster remains inside the motor housing.



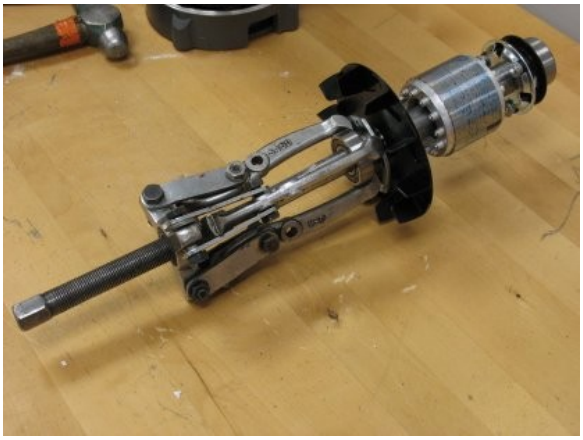
Lifting the End Shield with Armature

Removing the two screws located beside the shaft will allow you to separate the shaft, with the still attached bearing, from the end shield.



Loosening Screws Securing Bearing to End Shield

Use a pulley puller, or our custom bearing puller tool [01-100-80 101] to remove the bearing from the shaft. You can use it on the motor bearing on either end of the shaft. The bearing on the shaft end is the one needing replacement in most instances. You may by routine choose to replace the bearing on the fan end every other time you replace the shaft bearing.



Jaw Puller at the Ready on Motor Bearing

AHS



Bearing Puller

Place the new bearing on the shaft and drive it on with a hammer or mallet and a 3/4" pipe until it is fully seated. Use of the properly sized pipe or tube allows you to drive the bearing onto the shaft by the inner race. Any significant force or impact applied to the seal or the outer race will possibly damage the bearing.

Place the bearing housing over the bearing and replace the two screws that were removed earlier.

Before setting the shaft and bearing housing back into the motor body make sure that the spring washer is still in place. It should be located in the rear bearing cavity.

After assembling the motor, spin the shaft to insure that it spins freely.

REFRACTORY REPLACEMENT

Please wear the proper safety equipment while performing this task. Proper equipment includes, work gloves, safety glasses, and steel toe boots.

Center Brick

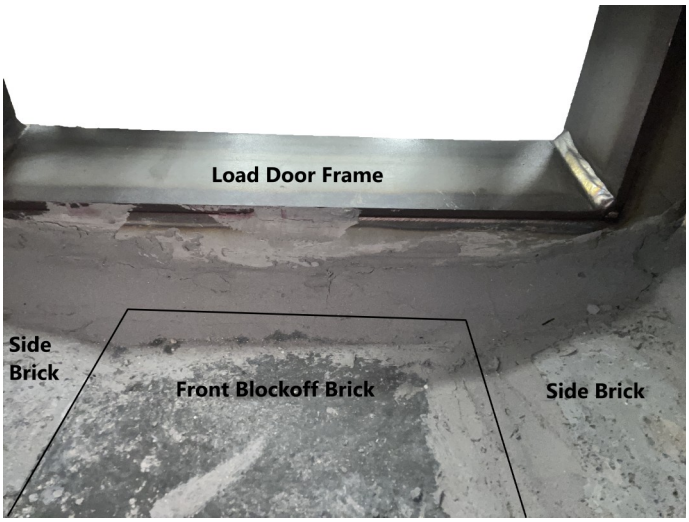
The Center Brick contain the slot through which burning gases are drawn by the induction fan. The center brick is subjected to the most severe flame erosion and highest temperatures and will most likely be the first refractory component to show signs of deterioration. Surface spalling is common under normal conditions and is not reason for concern.

The Center Brick refractory piece should be changed every 20-30 cords of wood and must be ordered from Alternate Heating Systems. Its part number is 492-085. Please order a quart of Trowleze with the Center Brick.

The Center Brick is likely to have become snug, as wood ash will settle into voids around it. They are likely to require just a bit of effort to loosen enough that it may be lifted upward.

To remove the Center Brick

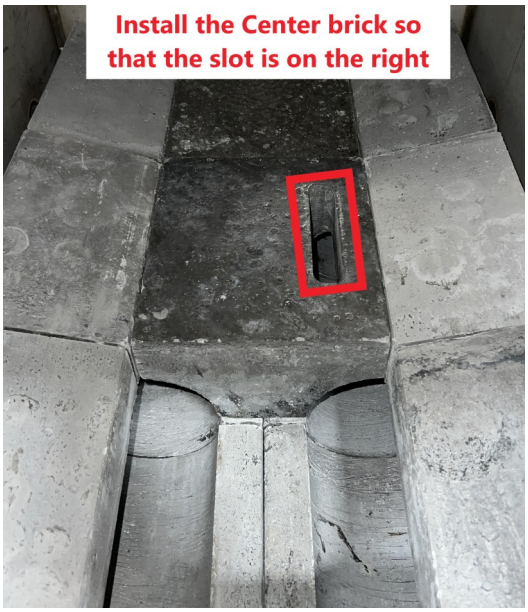
1. Clean out the firebox thoroughly.
2. Loosen morter that holds in the Front Block-off Brick at the front of firebox. Picture below is inside the firebox looking out.



3. Using a large flat headed screw driver, pry the front Block-Off Brick up. Use the side brick under the Block-Off Brick to pry against.
4. Once the Front Block-Off Brick is remove the Center Brick is easily removed.



5. With the Center Brick and the Front Block-off Brick removed. Instal the new Center brick. **Ensure the slot is on the right side of the boiler.**



6. After the Center Brick is installed. Place the Front Block-off Brick in its place.
7. Lastly using Trowleze mortor. Seal the front of the firebox to the steel wall. Also seal and gaps between the bricks. See Picture Below.



Side-Wall Firebrick Replacement

The 1.25 inch firebrick along the left and right sides of the firebox only need replaced if the bricks break so that they fall out. Cracking is normal. You can buy these from Alternate Heating Systems. Each Super E210 take 3 per side. Their part number is 3-40-900 450 125. Please order a quart of Trowleze with the Side-Wall Firebrick.

You will need to remove the broken brick and completely clean out it area of ash, creosot and old Trowleze.

The new brick will fit into place. Use Trowleze as a mortor to hold the bottom of the side-wall firebrick in place.



Side-Wall Firebick Mortored

Complete Refractory Replacement

Complete refracory replacement will need done every 10-15 years. See the Parts diagram below. The refractory may crack but this is normal and of no concern. It is time to replace the refractory when the brick are deteriorated so that there are wholes through the bricks or they are falling apart.

You will need to order the ceramic blanket and two quarts of Trowleze. With the complete set of refractory.

Follow these steps to remove the complete refractory in the Super E110

1. Clean out all ashes from firebox and tunnels
2. Remove the air diverter in back of firebox. Simply push the diverter up.
3. Remove the three side-wall brick on both sides of the firebox. Total of six.
4. Remove the Front Block-Off Brick.
    1. Follow the instructions for replacing the Center Brick above.
    2. Use a flat head screwdriver to pry the brick up
5. Remove the Center Brick
6. Remove the Bypass brick and its spacer.
7. Now remove the all six Side Brick.
8. Remove the 3 layers of ceramic blanket

Follow these steps to Install the complete refractory in the Super E110

da

1. install the 3 layers of Ceramic Blanket.
    1. Each layer will have an eight inch strip.
    2. The eight inch strips will go in between each layer.

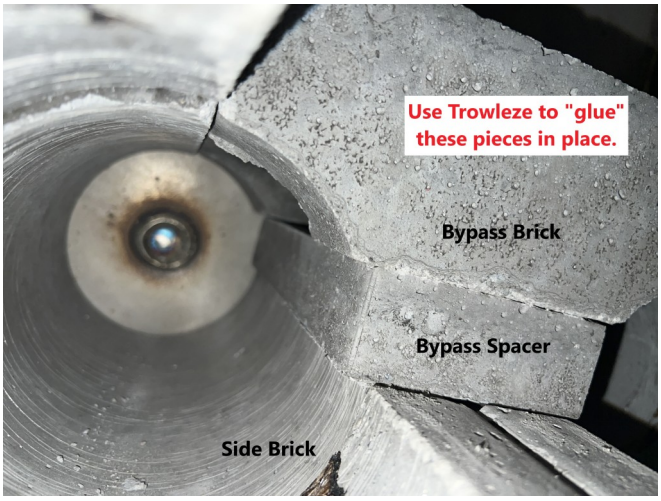


2. Install the six Side Brick.

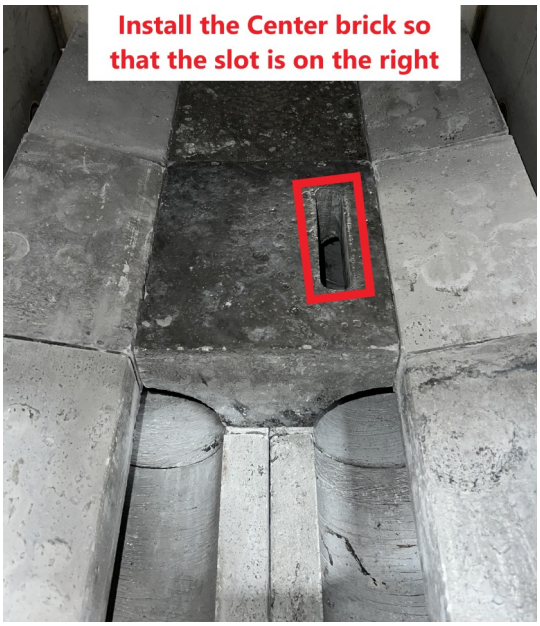
1. Be sure the tunnels are the same height at the front door frame
2. Align the tunnels so there are little to no ledges between the bricks



3. Instal the Bypass spacer and the Bypass Brick in the back of the firebox.
    1. The spacer and brick will need a little Trowleze so that the spacer will not get moved when the boiler is cleaned.



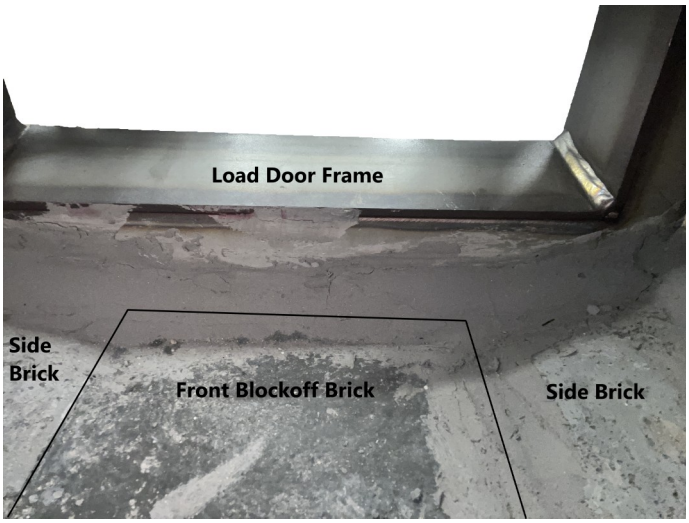
4. Install the Center Brick. Do not mortor this brick in place. You may need to replace it in 3-5 years.



5. Install the Front Block-off Brick.
6. Use Trowleze to seal the bricks to the steel firebox walls
    1. Seal along the left and right sides
    2. Seal the Back wall



    3. Seal the front wall. **This is an important area to seal well!**



4. Open the Front Inspection door and seal the seam where the Block-off brick sits on the Side Brick.
5. Cover the three layers of Ceramic Blanket with Trowleze. You may need to cut the ceramic blanket back so you can get a thick coating of Trowleze over the blanket.



7. Make sure both tunnel plugs fit.
8. Reinstall Air Baffle in back of Firebox.
9. Allow cement to dry for 24-48 hours before firing boiler.

FRONT INSPECTION CERAMIC INSULATION

There is a piece of 1/2 inch ceramic board in the front inspection door area. This board insulates the steel to keep the flame hotter. The board helps with combustion efficiency.

To replace the 1/2 inch ceramic board you will need to remove the clips on the left and right side. Push the clips up and out of their holder.

With the clips removed pull the top of the ceramic board out and lift to remove.

To install a new board you may need to use a wood rasp to shape the board to fit your boiler and around the firetube and around the oil tube. Sit the bottom of the board behind the retaining bar and push the top back against the boiler, Gently! Reinstall the clips.

AIR TURBULATOR

The Super E110 is equipped with an air turbulator in the fire tube. This should be removed for yearly cleaning and then replaced.

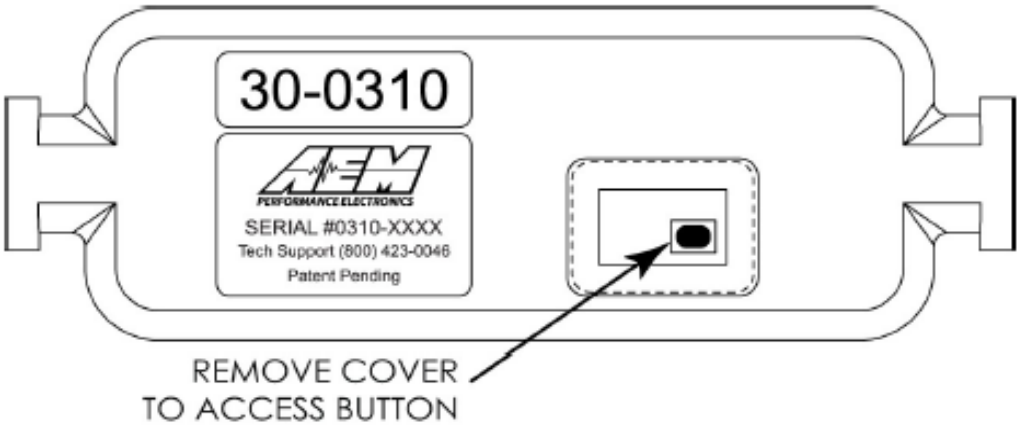
If you are experiencing water in the cyclone, removing the air turbulator may help.

Operation

The minimum wiring connections required to operate the X-Series UEGO Inline are switched +12V, ground, and one of the outputs: 0-5V Analog, AEMnet / CAN, or Serial. There are two LEDs on the top of the unit which describe the present operating status of the device as follows.

RED Status	*GREEN* Ready	Description
OFF	SOLID ON	Normal Operation
MEDIUM	MEDIUM	(Simultaneous flash) Power up, flash count = AEMnet/CAN ID #
SOLID ON	OFF	Fatal Error, Restart Required
SLOW	OFF	Error, No Sensor Detected
OFF	FAST	Warm Up, Stabilize, Equalize the heater
MEDIUM	MEDIUM	(Simultaneous flash) New Free Air Calibration Required
FAST	FAST	(Simultaneous flash) Free Air Calibration in Progress
ALTERNATING	ALTERNATING	(Alternating Flash) While in AEMnet/CAN Learn Mode

A button is located beneath an access cover on the rear of the unit for the following procedures. Carefully pry the cover off with a small screwdriver or similar and replace when done.



Change to Free Air Calibration Mode

1. Remove oxygen sensor from exhaust but keep it connected to controller.
2. Apply power to controller and wait for the sensor to warm up as indicated by a solid green 'Ready' LED.
3. Press and hold the button until both LEDs begin to flash rapidly in unison.
4. The LEDs will stop flashing once the calibration is complete and the unit will return to Normal Operation mode with only the green 'Ready' LED illuminated solidly.

Change to Resistor Calibration Mode (Default)

This is only necessary if you have already performed a free air calibration and wish to return to resistor calibration mode. The units are shipped from the factory in resistor calibration mode as default - this is the recommended mode for most users.

1. Remove power from the controller and verify that both LEDs are off
2. Press and hold button.
3. Apply power to the controller while holding button.
4. The green 'Ready' LED will flash to confirm resistor calibration mode

Fault Code	No.	Description	Suggested Remedy
no-FLt	00	No Fault	Not required.
OI-b	01	Brake channel over current	Check external brake resistor condition and connection wiring.
OL-br	02	Brake resistor overload	The drive has tripped to prevent damage to the brake resistor.
O-I	03	Output Over Current	Instantaneous Over current on the drive output. Excess load or shock load on the motor. **NOTE** Following a trip, the drive cannot be immediately reset. A delay time is inbuilt, which allows the power components of the drive time to recover to avoid damage.
I_t-trP	04	Motor Thermal Overload (I2t)	The drive has tripped after delivering >100% of value in P-08 for a period of time to prevent damage to the motor.
PS-trP	05	Power stage trip	Check for short circuits on the motor and connection cable
O-volt	06	Over voltage on DC bus	Check the supply voltage is within the allowed tolerance for the drive. If the fault occurs on deceleration or stopping, increase the deceleration time in P-04 or install a suitable brake resistor and activate the dynamic braking function with P-34.
U-volt	07	Under voltage on DC bus	The incoming supply voltage is too low. This trip occurs routinely when power is removed from the drive. If it occurs during running, check the incoming power supply voltage and all components in the power feed line to the drive.
O-t	08	Heatsink over temperature	The drive is too hot. Check the ambient temperature around the drive is within the drive specification. Ensure sufficient cooling air is free to circulate around the drive.
U-t	09	Under temperature	Trip occurs when ambient temperature is less than -10°C. Temperature must be raised over -10°C in order to start the drive.
P-dEF	10	Factory Default parameters loaded	
E-trIP	11	External trip	E-trip requested on digital input 3. Normally closed contact has opened for some reason. If motor thermistor is connected check if the motor is too hot.
SC-Obs	12	Optibus comms loss	Check communication link between drive and external devices. Make sure each drive in the network has its unique address.
FLt-dc	13	DC bus ripple too high	Check incoming supply phases are all present and balanced.
P-LOSS	14	Input phase loss trip	Check incoming power supply phases are present and balanced.
h O-I	15	Output Over Current	Check for short circuits on the motor and connection cable. Note: Following a trip, the drive cannot be immediately reset. A delay time is inbuilt, which allows the power components of the drive time to recover to avoid damage.
th-FLt	16	Faulty thermistor on heatsink	
dAtA-F	17	Internal memory fault (IO)	Press the stop key. If the fault persists, consult you supplier.
4-20 F	18	4-20mA Signal Lost	Check the analog input connection(s).
dAtA-E	19	Internal memory fault (DSP)	Press the stop key. If the fault persists, consult you supplier.
F-Ptc	21	Motor PTC thermistor trip	Connected motor thermistor over temperature, check wiring connections and motor.
FAn-F	22	Cooling Fan Fault (IP66 only)	Check / replace the cooling fan.
O-hEAt	23	Drive internal temperature too high	Drive ambient temperature too high, check adequate cooling air is provided.
OUt-F	26	Output Fault	Indicates a fault on the output of the drive, such as one phase missing, motor phase currents not balanced. Check the motor and connections.
AtF-01	40	Autotune Fault	The motor parameters measured through the autotune are not correct. Check the motor cable and connections for continuity. Check all three phases of the motor are present and balanced.
AtF-02	41		
AtF-03	42		
AtF-04	43		
AtF-05	44		
SC-F01	50	Modbus comms loss fault	Check the incoming Modbus RTU connection cable. Check that at least one register is being polled cyclically within the timeout limit set in P-36 index 3.
SC-F02	51	CAN comms loss trip	Check the incoming CAN connection cable. Check that cyclic communications take place within the timeout limit set in P-36 index 3.

NOTE Following an over current or overload trip (3, 4, 5, 15), the drive may not be reset until the reset time delay has elapsed to prevent damage to the drive.

ADDITIONAL INFORMATION

For additional information on using your boiler safely, obtain a copy of the National Fire Prevention Association publication “Using Coal and Wood Stoves Safely”, NFPA No. HS-8-1974. The address of the NFPA is 470 Atlantic Avenue, Boston, Massachusetts 02 210. You may also visit:

http://www.nfpa.org/codes-and-standards/free-access

EXPLANATION OF EFFICIENCY

There are different types of efficiencies, namely, Overall (Delivered) Efficiency and Combustion (Stack Loss) Efficiency.

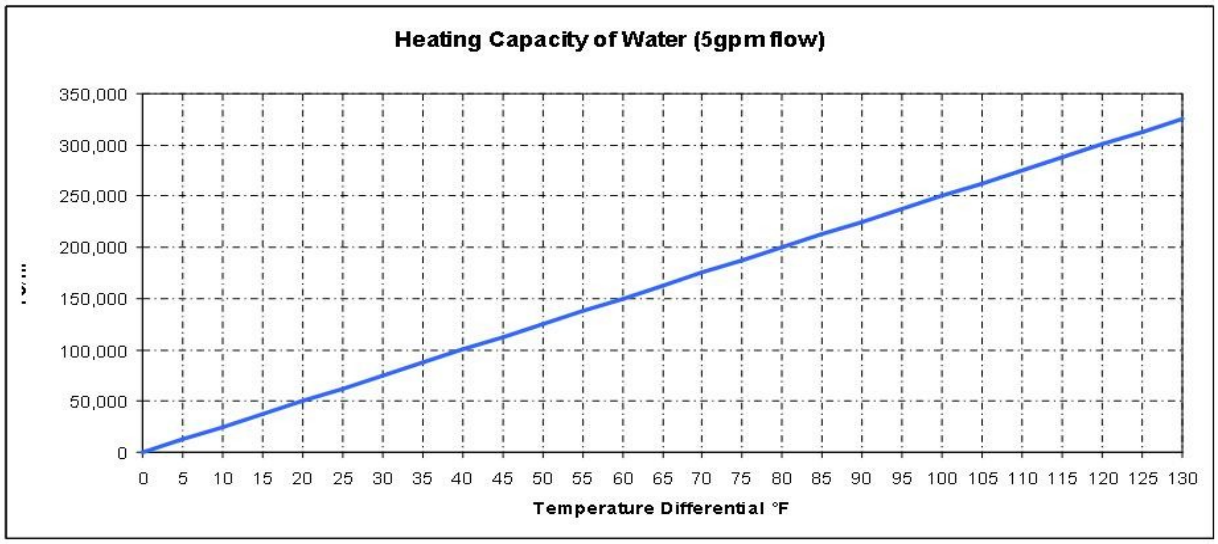
Combustion Efficiency is how well a fuel burning device is converting its fuel into usable heat. It does not reflect how much of the usable heat produced is transferred to the home. For instance when the SE110 is running at 16-100% of its heating capacity the average Combustion efficiency is 96.8% HHV

Overall efficiency is the percentage of heat that is transferred into the space to be heated when a load of fuel is burned. Actual efficiency will vary depending on factors such as wood moisture, appliance operation and installation (e.g., outside piping, chimney height). For instance when the SE110 is running at 16-100% of its heating capacity has an average Overall Efficiency of 80.0% HHV

Overall efficiency is a better measure than combustion efficiency. It more accurate shows the amount of heat that is delivered to the home.

The efficiencies listed in this manual are determined using the higher heating value (HHV). The Lower Heating Value (LHV) may also be used to determine efficiencies. The HHV and LHV are referring to the heating value of wood (BTU/lb). The HHV of wood is 8600 BTU/lb and the LHV of wood is 7988 BTU/lb.

Appendix A: Boiler Specifications

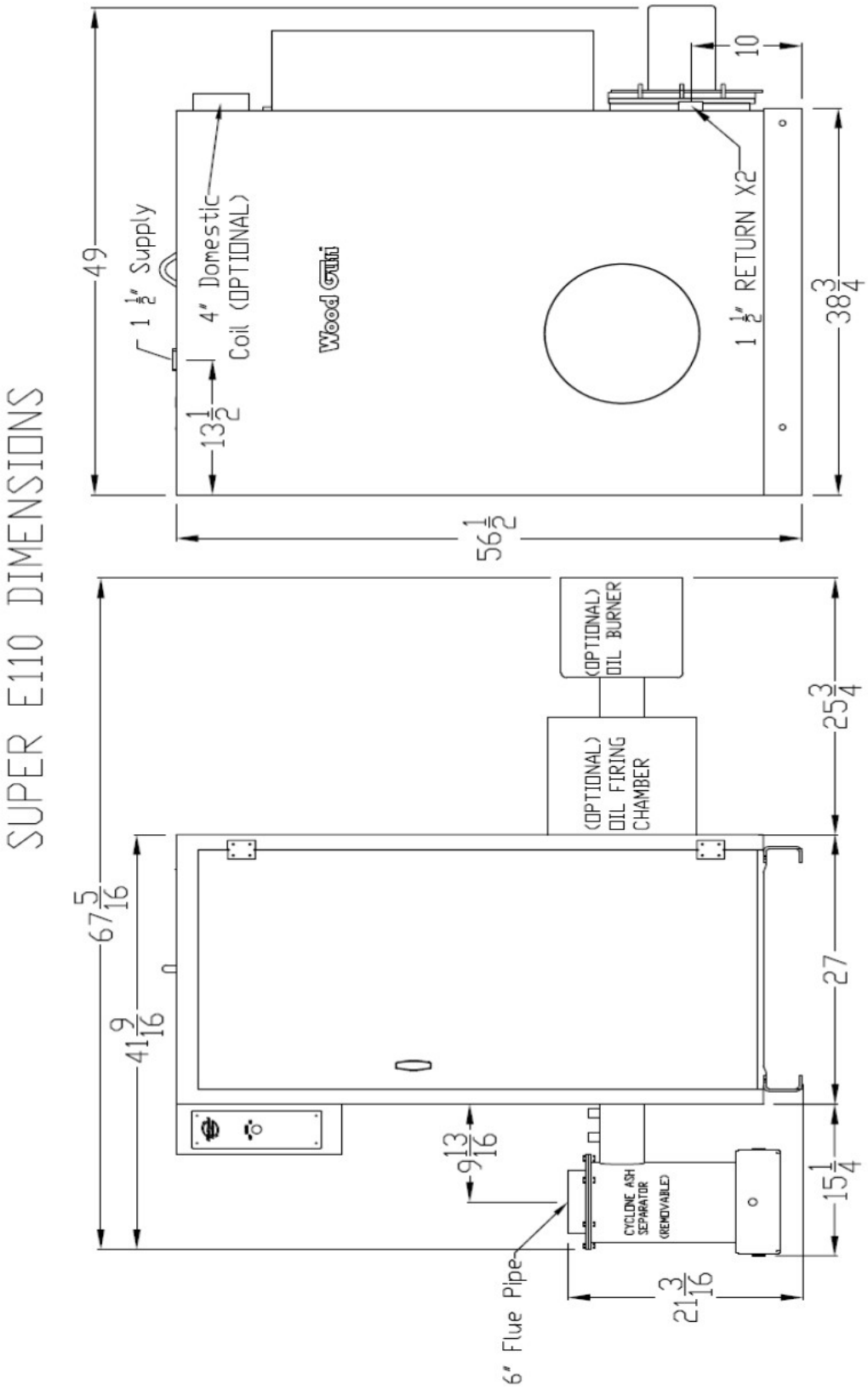


Wood Gun^{tm} Super E110 Specifications

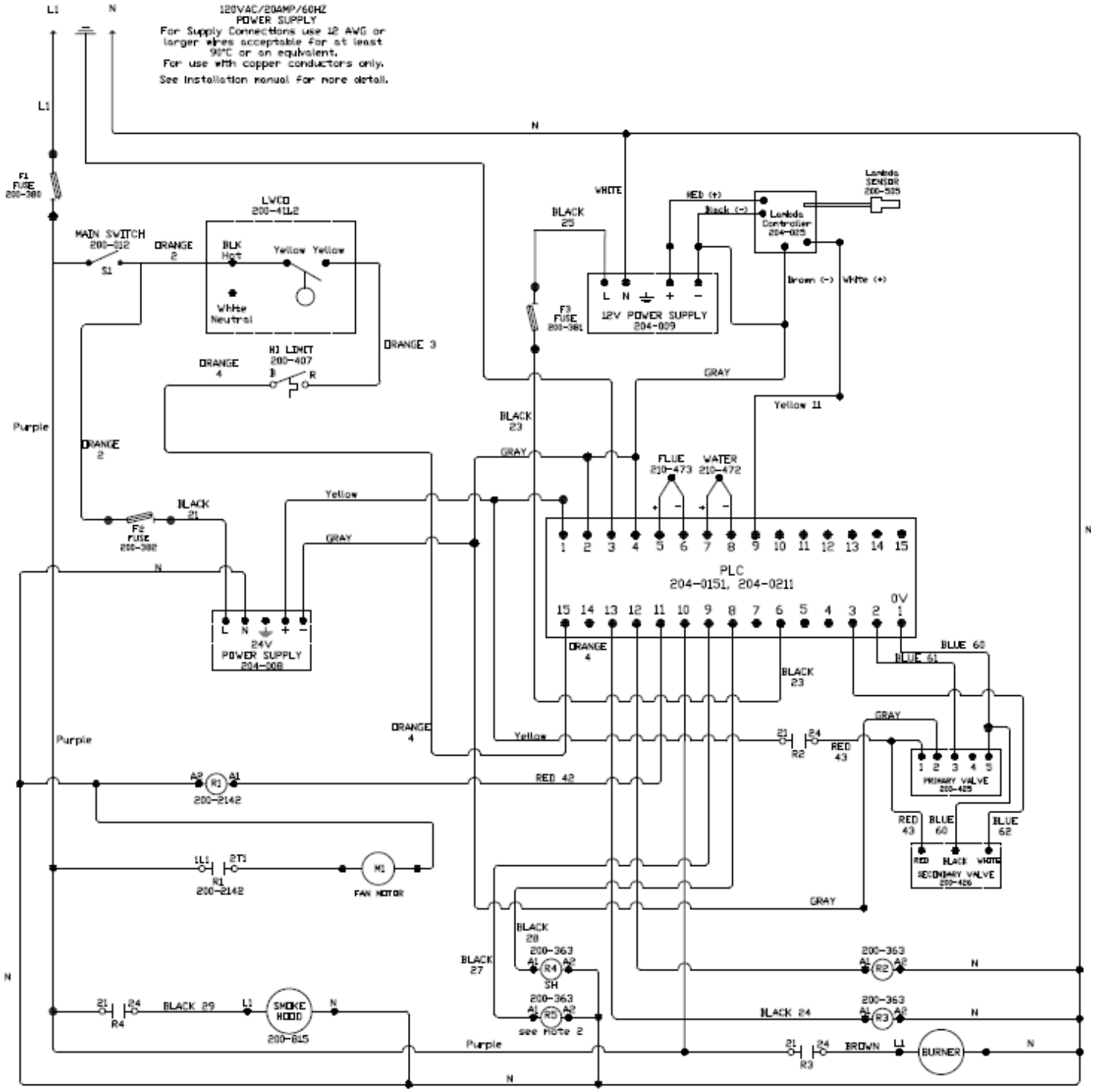
	SE110
BTU/Hour Range	16,250 – 125,000
BTU 8 Hour Avg Output*	50,000
Water Capacity	60 gallons
Fire Box Capacity	5.5 ft^3
Fire Box Length	26"
Standard Door Opening	14" x 14"
Height	58"
Width (without burner)	28"
Depth	49"
Flue Size	6"
Weight (w/o gas/oil)	1,650 lbs
Typical Heating Capacity**	1,000-3,000 ft^2
Heating Efficiency @ high output	82%

*Based on loading firebox with seasoned firewood **Subject to building design/construction

Boiler Dimensions

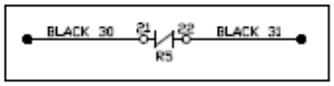


Appendix B: Wiring Diagrams



Note 2: RELAY R5 CAN BE USED TO CONTROL THE BOILER CIRCULATOR. IT IS A DRY CONTACT (6AMP @ 120VAC). BLACK WIRE #30 CAN BE USED TO BRING 24V OR 120V TO THE REAR JUNCTION BOX. YOU WILL NEED TO SUPPLY POWER TO TERMINAL #22 OF THE R5 RELAY

SEE NOTE 2



ALTERNATE HEATING SYSTEMS
CONFIDENTIAL DOCUMENT

MODEL: WOOD GUN E100-E250				
PART: WOOD GUN - SM43 WITH 2ND AV				
DWG. #: 400-UNI	DRWN BY: CWG	DATE: 8/15/24	APRV'D BY: CWG	DATE: 8/15/24
SCALE: NS	SHEET: 1 OF 1	SIZE: A	REVISION: 0	

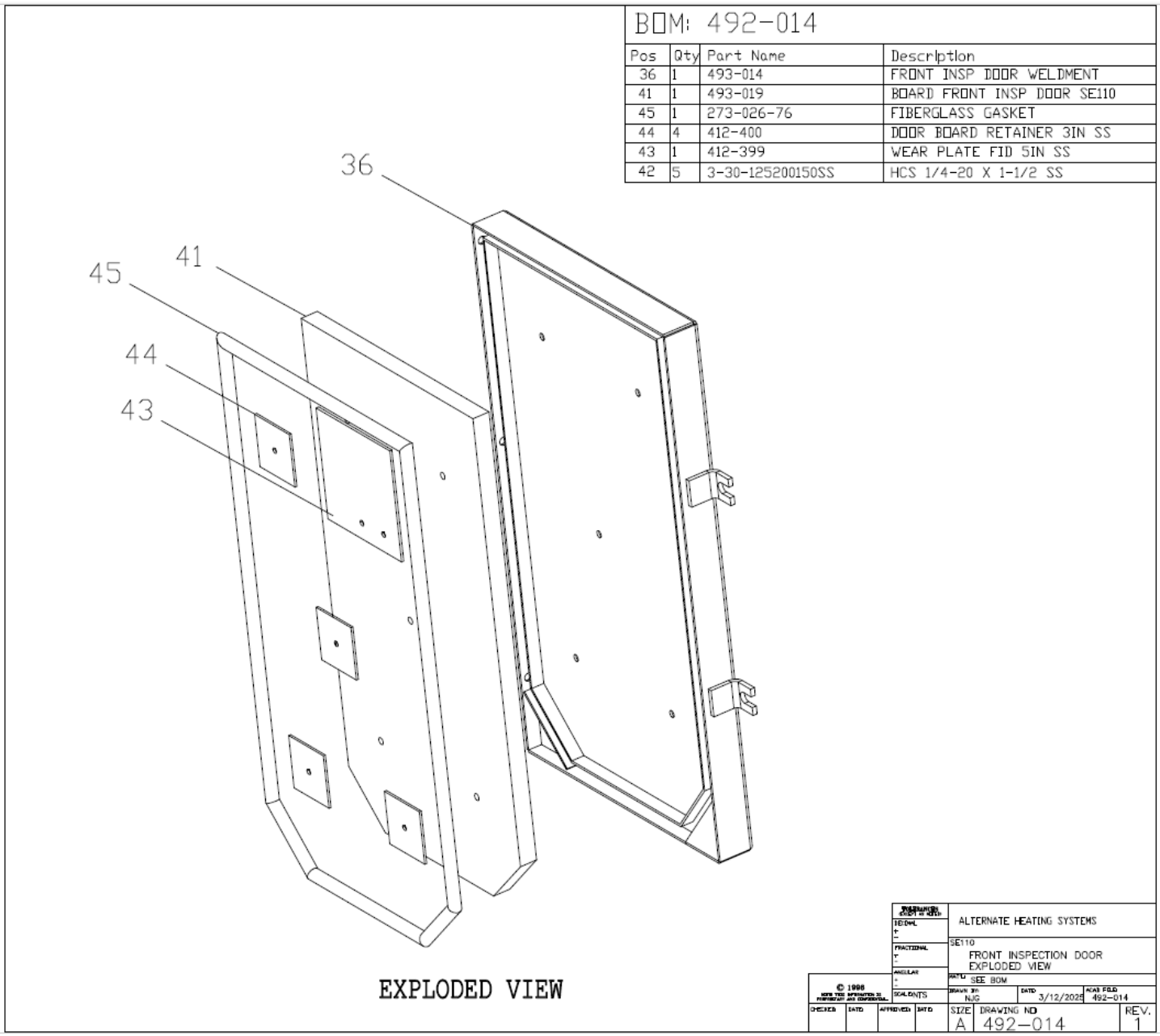
Appendix C: Parts Listing

	Item Description		Item ID	Qty Needed	UNIT
1	SE110 VESSEL SF NC		. 494-001	1.00	pieces
2	FRONT BOTTOM BRACKET SE110		. 492-047	1.00	pieces
3	FRONT TOP BRACKET SE110		. 492-048	1.00	pieces
4	RIGHT INSULATION COVER SE110		. 492-051	1.00	pieces
5	LEFT INSULATION COVER SE110		. 492-052	1.00	pieces
6	REAR INSULATION COVER SE110		. 492-053	1.00	pieces
7	REAR TOP INSULATION CVR SE110		. 492-054	1.00	pieces
8	REAR BTM INSULATION CVR SE110		. 492-055	1.00	pieces
9	FRONT DOOR INNER SE110		. 492-056	1.00	pieces
10	FRONT DOOR OUTER SE110		. 492-057	1.00	pieces
11	REAR COVER SE110		. 492-058	1.00	pieces
12	SE210 OUTER DOOR STRIKER PLATE		. 482-052	1.00	pieces
13	YELLOW INSULATION 1 1/2in BOARD		. 200-901	54.00	sqft
14	TEKS 1/4- #14 X 3/4 (SELF-TAPPING SCREWS)		. 3-30-512514075	8.00	pieces
15	PPH TCS 10-32 X 3/8 IN L (SELF-THREADING SCREWS)		. 3-30-803701032	6.00	pieces
16	RIVET BLIND 1/8 DIA .063-.125		. 200-313R	14.00	pieces
17	REFRACTORY BRICKS			1.00	pieces
18		SIDE BRICK SE110	. 492-083	6.00	pieces
19		BLOCK OFF BRICK SE110	. 492-084	1.00	pieces
20		SLOTTED CENTER BRICK SE110	. 492-085	1.00	pieces
21		BYPASS BRICK SE110 and Spacer	. 492-086	1.00	pieces
22	FAN ASBY COMP DD SE110/E140/180 NEW		. 423-022A	1.00	pieces
23		FAN MOTOR 1/3HP 1PH BALDOR	. . 200-482.1	1.00	pieces
24		FAN COVER PLATE	. . 422-102A	1.00	pieces
25		ABRASION SHIELD 4HOLE	. . 423-023-2	1.00	pieces
26		FAN HEAT SHIELD (1/2IN CERAMIC)	. . 422-125	1.00	pieces
27		HN 5/16-18 Z 5	. . 3-30-80311813	4.00	pieces
28		FHSCS 3/8-16 X 7/8 SS	. . 3-30-7371601	4.00	pieces
29		FW 5/16 Z 11/16OD SAE	. . 3-30-02003113	4.00	pieces
30		HCS 1/4-20 X 1/2 SS SET SCREW	. . 3-30-12520050	2.00	pieces
31		LW 5/16 IN	. . 3-30-010031516	4.00	pieces
32		FAN - SE110/E140/E180 DIRECT DRIVE	. . 423-009A	1.00	pieces
33		GASKET FAN ASBY E100-E200	. . 273-028-42	1.00	pieces
34	FIREBOX AIR DIVERTER SE110		. 492-081	1.00	pieces
35	FRONT INSP DOOR COMP SE110		. 492-014	1.00	pieces
36		FRONT INSP DOOR WLDMT SE110	. . 493-014	1.00	pieces
37		HINGE FRONT INSP DOOR E100-250	. . 413-029A	1.00	pieces
38		HCS 5/16-18 X 3/4	. . 3-30-1311807513	3.00	pieces
39		FW 5/16 Z 11/16OD SAE	. . 3-30-02003113	3.00	pieces
40		LW 5/16 IN	. . 3-30-010031516	3.00	pieces
41		BOARD FRONT INSP DOOR 1IN HS	. . 493-019	1.00	pieces
42		HCS 1/4-20 X 1-1/4 SS	. . 3-30-125200125SS	5.00	pieces
43		WEAR PLATE FRONT INSP DOOR SS	. . 412-399A	1.00	pieces
44		DOOR BOARD RETAINER 3IN SQ SS	. . 412-400A	4.00	pieces
45		GASKET FRONT INSP DOOR SE110	. . 273-026-77	1.00	pieces
46	BOARD INSP INSUL SE110		. 492-091	1.00	pieces
47	FIRE TUBE TURBULATOR SE110		. 492-388	1.00	pieces
48	LOAD DOOR COMP HL OBE/SE210		. 443-140	1.00	pieces
49		LOAD DOOR WLDMT HL CARBON	. . 412-140	1.00	pieces
50		HINGE LOAD DOOR S/A E100/250	. . 413-028	1.00	pieces
51		HOOK LATCH HANDLE FOR WOOD	. . 482-141	1.00	pieces
52		WOODEN HANDLE 1.25 X 6.5	. . 200-386	1.00	pieces
53		HLN 1/2-13 X 3/4W	. . 3-30-8305013075	1.00	pieces
54		LW 5/16 IN	. . 3-30-010031516	2.00	pieces
55		FW 5/16 Z 11/16OD SAE	. . 3-30-02003113	2.00	pieces

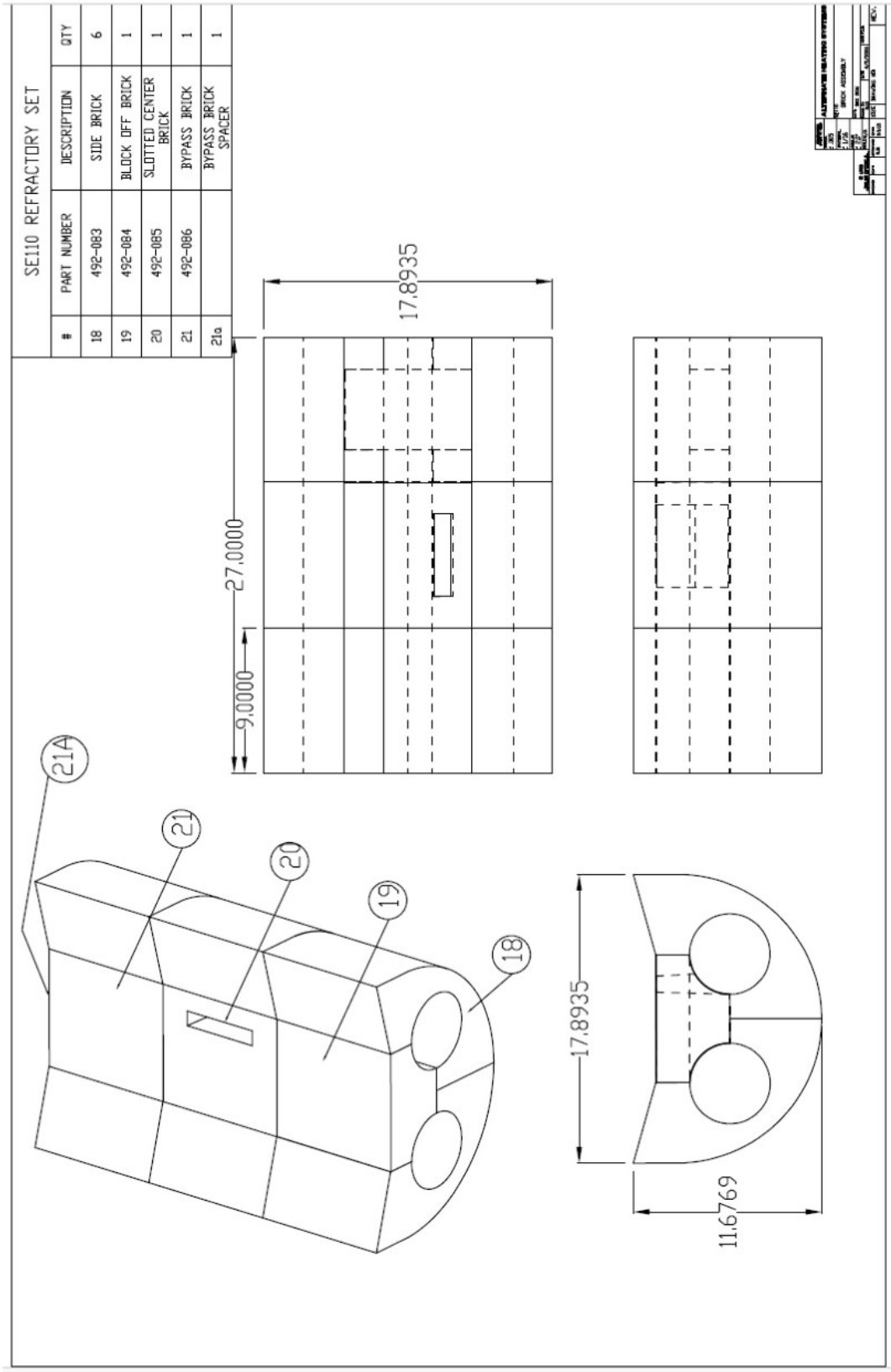
56		HCS 5/16-18 X 3/4	. . 3-30-1311807513	2.00	pieces
57		HCS 3/8-16 X 3/4	. . 3-30-13716075	2.00	pieces
58		UNTHREATHED SPACER 1/2ID 210	. . 412-143-1	1.00	pieces
59		INNER PANEL REMVBLE LOAD DOOR	. . 412-228-14	1.00	pieces
60		FIBERGLASS TAPE 1/2IN W/PSA	. . 273-027	4.00	pieces
61		HCS 1/2-13 X 2 FULLY THREADED	. . 3-30-1501302	1.00	pieces
62		SILICONE CORD 3/4IN	. . 200-054	4.60	per foot
63		HN 1/2-13 JAM NUT	. . 3-30-835013	1.00	pieces
64		SILICONE HI TEMP SEALANT 10OZ	. . 200-802	0.15	per tube
65		FW 1/2IN 1-3/8IN OD	. . 3-30-020500137	1.00	pieces
66	REPLACEMENT LOAD DOOR SEAL				
67		SEAL KIT LOAD DOOR 14IN NEW	200-8011	1.00	pieces
68	Steel Knurled Grip Knob 1/2-13		. 200-910	2.00	pieces
69	EYE BOLT 1/2-13 X 2		. 3-30-150130300	1.00	pieces
70	HCS 3/8-16 X 1-1/2		. 3-30-1371615013	2.00	pieces
71	HLN 3/8-16		. 3-30-8303716	2.00	pieces
72	HOOK LATCHKEEPER SE210		. 482-142	1.00	pieces
73	HCS 1/2-13 X 1-1/2		. 3-30-150130150	1.00	pieces
74	LW 1/2 IN		. 3-30-01005012	1.00	pieces
75	RADIAL BALL BEARING LATCH HAND		. 200-4931616	1.00	pieces
76	HLN 1/2-13 X 3/4W		. 3-30-8305013075	1.00	pieces
77	HCS 5/16-18 X 1/2		. 3-30-1311805013	2.00	pieces
78	CYCLONE ASBLY SE110		. 493-016	1.00	pieces
79	HCS 5/16-18 X 1		. 3-30-131181	3.00	pieces
80	LW 5/16 IN		. 3-30-010031516	3.00	pieces
81	FW 5/16 Z 11/16OD SAE		. 3-30-02003113	3.00	pieces
82	CYCLONE SEAL KITS				
83		CYCLONE TOP FLANGE GASKET	200-052-38A	1.00	pieces
84		CYCLONE ASH SCOOP GASKET	200-052-37	1.00	pieces
85		CYCLONE MOUNTING GASKET	200-052-19A	1.00	pieces
86	CONTROL BOX ASBY WG O2		. 493-230	1.00	pieces
87		12X15 CONTROL BOX LID TOUCH	. . 492-746	1.00	pieces
91		POWDER COATING (Time) GRAY	. . . POWDER COATING	5.00	pieces
97		POWDER COATING (Time) GRAY	. . . POWDER COATING	8.00	pieces
98		POWER SUPPLY 24V/50W	. . 204-008	1.00	pieces
99		POWER SUPPLY 12V/75W	. . 204-009	1.00	pieces
100		PLC SAMBA	. . 204-0151	1.00	pieces
101		FUSE HOLDER 10X38MM 32A	. . 200-2137	3.00	pieces
102		FUSE 20A MIDGET FLM 250V	. . 200-380	1.00	pieces
103		FUSE 2A MIDGET FLM 250V	. . 200-381	1.00	pieces
104		FUSE 1-1/2A MIDGET FLM 250V	. . 200-382	1.00	pieces
105		CONTACTOR NO 3P 12A AC1 120/60	. . 200-2142	1.00	pieces
106		SELECTOR 2 POSITIONS 0-1	. . 200-009	1.00	pieces
107		MOUNTING ADAPTER	. . 200-015	1.00	pieces
108		TERMINAL SCREW AUX CONTACT 1NO	. . 200-012	1.00	pieces
109		RELAY SOCKET FOR HR30	. . 200-362	3.00	pieces
110		MINITURE RELAY FOR SOCKET HR5	. . 200-363	3.00	pieces
111		DIN RAIL 35MM X 7.5 X 2 METERS	. . 201-337	0.25	pieces
112		GROUND TERMINAL BLOCKS	. . 201-349	3.00	pieces
113		TERMINAL BLOCK	. . 201-329	22.00	pieces
114		BRIDGE 2 POSITION	. . 201-332	10.00	pieces
115		TERMINAL BLOCK BLANK MARKER	. . 201-347	22.00	pieces
116		GROMMET 1-1/4 IN SE210	. . 200-227	1.00	pieces
117	SE210 LAMBDA SENSOR CONTROLLER		. 3-20-00964	1.00	pieces
118	REPLACEMENT LAMBDA SENSOR		3-20-00965	1.00	pieces
119	THERMOCOUPLE J TYPE 2.5IN WATER		. 210-472	1.00	pieces
120		THERMOCOUPLE WELL	. 210-471	1.00	pieces
121	THERMOCOUPLE J TYPE 2IN FLUE		. 210-473	1.00	pieces
122		THERMOCOUPLE J TYPE FEMALE CON	. 210-478	1.00	pieces

123		THERMOCOUPLE J TYPE MALE CONN	. 210-477	1.00	pieces
124	AQUASTAT SINGLE L4006A		. 200-403	1.00	pieces
125	AQUASTAT WELL 123869A		. 200-406	1.00	pieces
126	3/8 ALUM FLEX CONDUIT		. 3-20-25043	1.00	pieces
127	FLEX CONNECT 3/8IN STR		. 200-633	10.00	pieces
128	FLEX CONNECT SQZ 3/8-90 DEG		. 3-20-2000	6.00	pieces
129		ANTI SHORT BUSHING	. 200-755	6.00	pieces
130	PLUG 3/4IN NPT		. 200-114	1.00	pieces
131	RELIEF VALVE 3/4 IN 535000		. 3-10-77382	1.00	pieces
132	PRESSURE/TEMP GAUGE (LOWER)		. 200-408	1.00	pieces
133	ASH RAKE E100 E200		. 423-026A	1.00	pieces

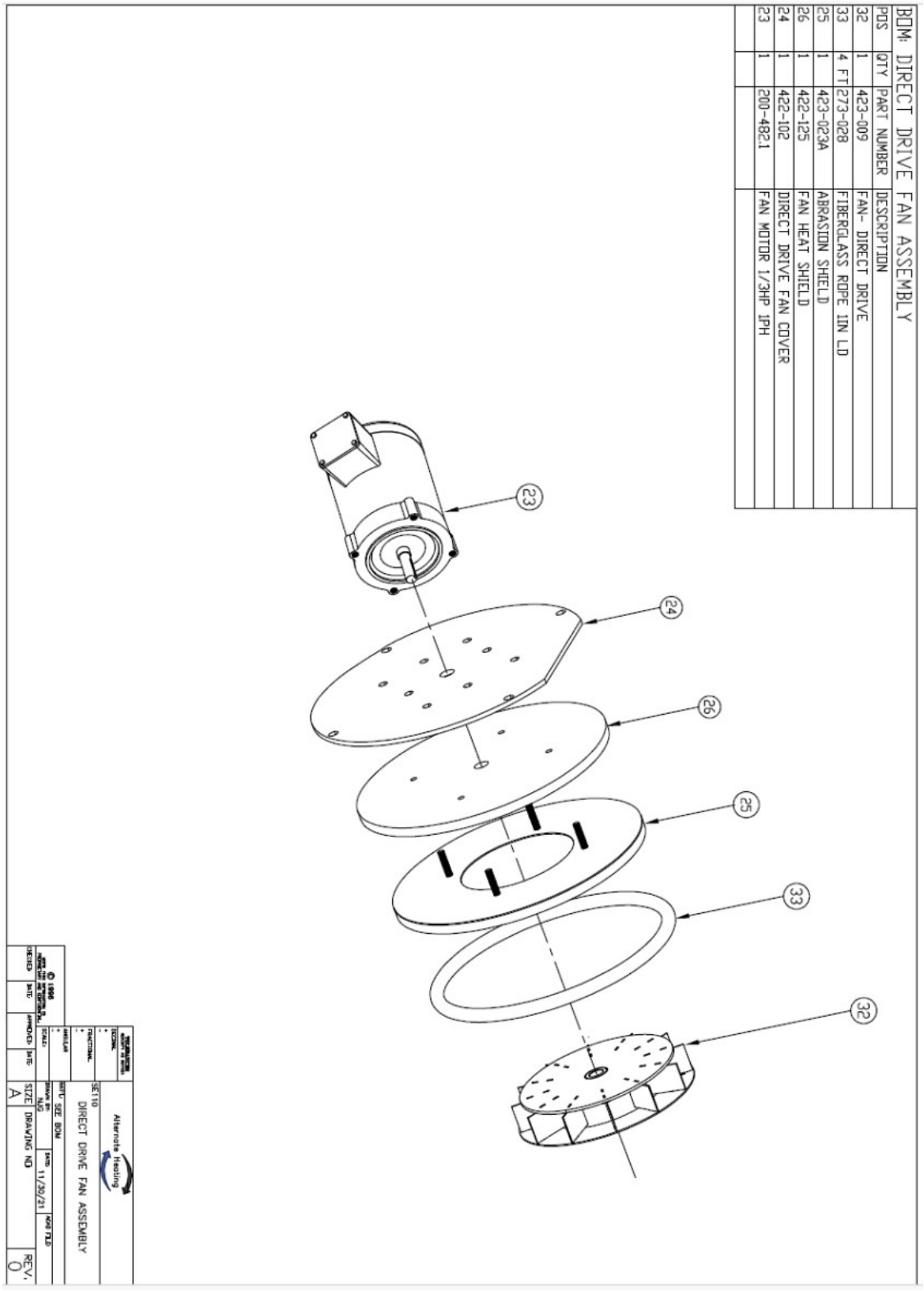
Exploded Parts Diagram – Front Inspection Door



Exploded Parts Diagrams – Refractory



Exploded Parts Diagram – Fan Assembly



BOM: DIRECT DRIVE FAN ASSEMBLY

POS	QTY	PART NUMBER	DESCRIPTION
32	1	423-009	FAN- DIRECT DRIVE
33	4 FT	273-028	FIBERGLASS ROPE IIN LD
25	1	423-023A	ABRASION SHIELD
26	1	422-125	FAN HEAT SHIELD
24	1	422-102	DIRECT DRIVE FAN COVER
23	1	200-482.1	FAN MOTOR 1/3HP 1PH

Appendix E: Troubleshooting Guide

This guide is intended to help you diagnose and repair basic problems with you boiler. If you believe your problem is serious or the problem persists after following all the procedures specified in this guide, contact AHS for support.

Problem	Possible Cause	Solution
1. Boiler overheating	a) Control malfunction b) Incorrect control setting c) Intake air valve not closing properly d) Excessive chimney draft e) Load door not sealing properly	a) Replace malfunctioning control b) Adjust control setting c) Replace gasket or adjust linkage d) Reduce draft or see e) e) Adjust load door for proper seal, replace gasket if necessary
2. Back-puffing (Also see section on Charging Boiler with Wood and the Back-Puffing Checklist)	a) Burn cycle too long/Too much wood b) Wood too small and/or excessively dry c) Improper loading of fire box d) Improper starting of wood	a) Fill with less wood to shorten burn cycle b) Load larger fuel with higher moisture content c) Follow proper loading procedure d) Follow proper starting procedure so as to attain high refractory temperatures
3. Smoke visible at stack	a) Refractory not hot enough b) Refractory not properly sealed in fuel chamber c) Center cleanout plug not properly sealed d) Leaking load door e) Leaking air valve f) Ash or charcoal buildup on or in refractory	a) Allow refractory to come up to operating temperature; refer to instructions for building a fire b) Seal refractory with “Trowleze” refractory cement. c) Replace damaged ceramic pad at center cleanout plug d) Check doors for airtight seal e) Repair/replace air valve gasket disc f) Clean ash from boiler. See “weekly maintenance routine”
4. Fire goes out	a) Boiler not cycling frequently enough (refractory cools to below kindling temperature) b) Wood bridging in fuel chamber	a) Increase heat load or install draft cycle timer (contact AHS) b) Reposition wood (always load wood length-wise front to back in chamber)
5. Smoke leakage at doors	a) Improper gasket seal b) Door not tight enough, or is out of adjustment	a) Repair seal with high temperature RTV sealant added at low point on door gasket b) Adjust door
6. Fan vibration	a) Bearing or motor loose b) Fan out of balance c) Creosote buildup in area of fan impeller	a) Tighten all bolts b) Inspect fan for damage c) Raise return water temperatures or use drier wood
7. Excessive water in the cyclone drawer (Also see condensation checklist)	a) The stack temperature may not be high enough. b) The fire box is being filled too full for the heat demand. c) There may be a blockage in the flue, cyclone, heat exchanger, or refractory. d) The wood logs are too large and/or has high moisture content. e) Load door seal or air valve seal is leaking	a) The boiler should be in an insulated room. The flue stack needs to be insulated (If the room is typically cold.) b) Fill the fire box only half full or enough to burn for eight hours or less (shorten cycles). c) Remove ash from fire box and refractory. Clean the heat exchanger, cyclone, or flue.

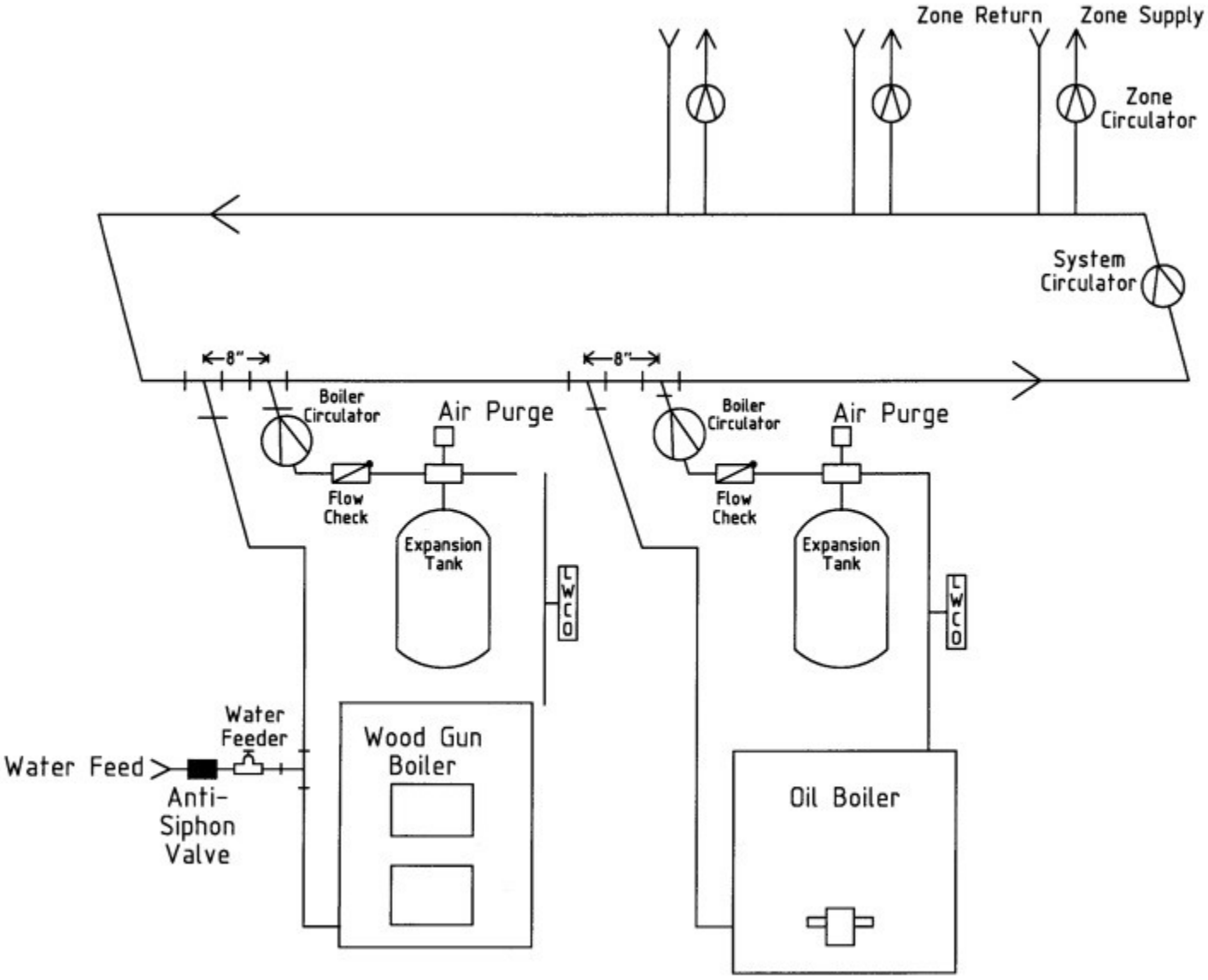
7. continued	f) The boiler water temperature is too low or Water temperature difference between supply and return may be more than 20ºF	d) Burn smaller wood, split wood, and/ or dryer wood. Build a hotter fire. Remember that more wood does not always equate to more heat. e) Adjust and/or replace load door seal and/or Air Valve f) Raise the boiler operating temperature, (Max 200º F)
8. The boiler burns more wood than usual	a) The wood has a higher moisture content level than normal. b) The wood is dry but has less weight per piece of wood (soft wood). c) The heat exchanger needs cleaned.	a) Try burning drier wood. b) Try burning hard wood. c) Clean the heat exchanger.
9. The pressure relief valve is releasing (Boiler pressure keeps rising)	a) Pressure reducing valve is malfunctioning. b) There is not enough expansion capacity. c) The domestic coil is leaking.	a) Replace pressure reducing valve. b) Add an expansion tank or replace a malfunctioning one. c) Replace or isolate the domestic coil.
10. There is smoke or creosote leaking out of air inlet connection.	a) The air valve assembly has been moved of knocked out of position.	a) Reposition and tighten the air valve and reseal the sleeve where enters the boiler. Be careful not to knock the air valve out of position when loading fuel into the boiler.
11. There is excessive creosote buildup on boiler vessel located behind the lower front inspection door area.	a) The fire box is being filled too full for the heat demand. b) There may be a blockage in the flue, cyclone, heat exchanger, or refractory. c) The wood logs are too small and/or have very low moisture content. d) Load door seal or air valve seal is leaking. e) The boiler is operated with water temperature too low. The stack temperature may not be high enough.	a) Fill the fire box only half full or enough to burn for eight hours. b) Remove ash from fire box and refractory. Clean the heat exchanger, cyclone, or flue. c) Burn larger wood, unsplit wood, and/ or green wood. d) Adjust load door, fix, or replace air valve. e) Raise the boiler operating temperature to 180-190 F
12. Steel has etching or pitting	a) Heating domestic water in the summer time with a carbon steel boiler.	a) Increase operating temperature in boiler. Only use small amounts of very dry wood to burn straight through the fuel charge with no cycling.
13. Boiler is not coming to temperature or not keeping house warm	a) The wood is too short. b) Thermocouple malfunction or installed incorrectly.	a) Wood must be 22-28 inches long b) Inspect water and flue thermocouple replace if necessary, verify they are installed correctly.

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Appendix F: Boiler Piping and Ducting Examples

Wood Gun in Primary/Secondary System



Note:

1. A call for heat from any zone activates Boiler Circulators, System Circulator and Zone Circulator.

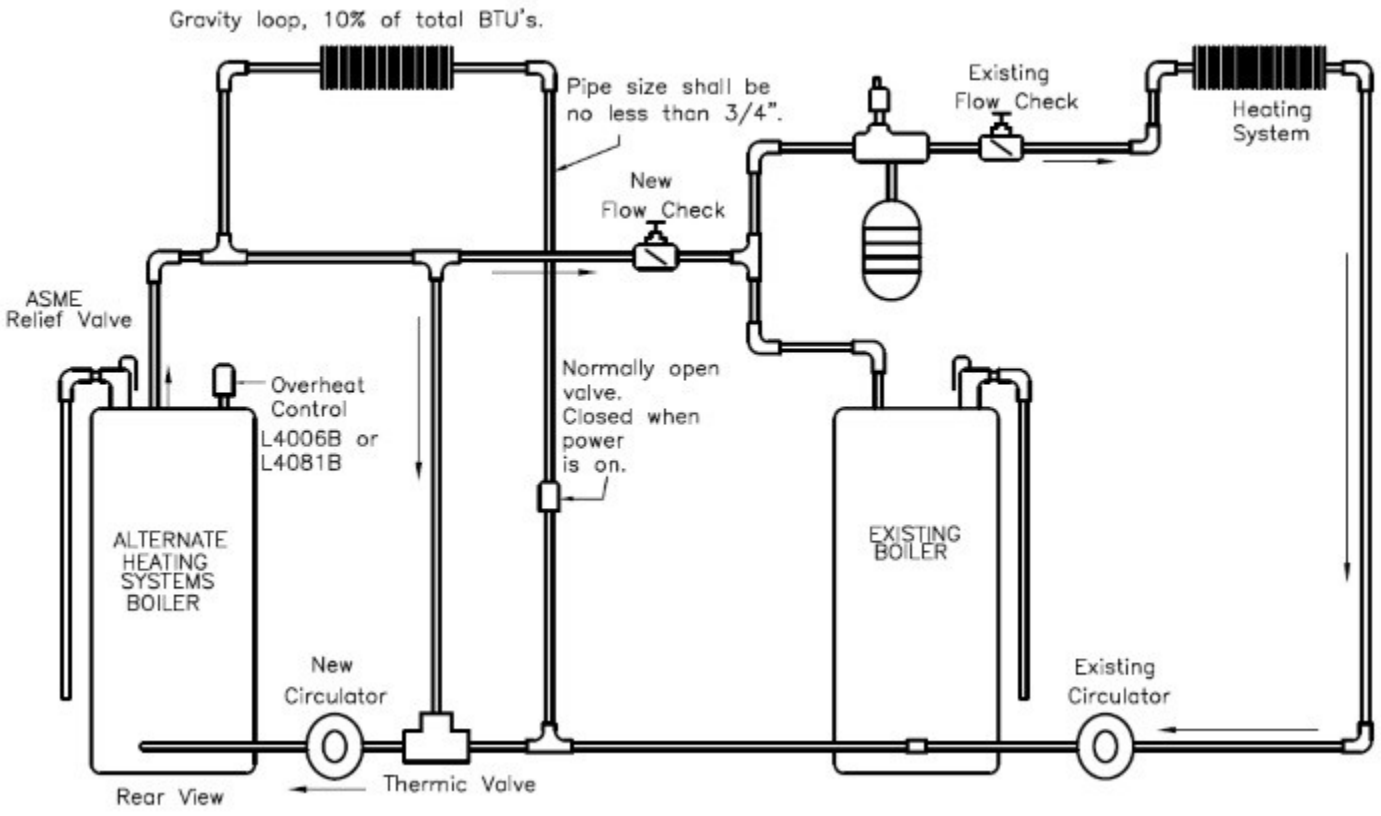
2. Each Boiler Circulator is also controlled by a low limit to prevent operation when the Boiler is cold.

3. Dump zone operation will activate one or more zones, System Circulator and Boiler Circulator.

4. Do not bypass temperature supply control system on radiant heat system. In radiant heat applications, permit activation of a call for heat but allow system controls to regulate water temperature.

Not all system components, valves and devices are shown in this drawing. Actual conditions and application requirements will vary. Please consult a heating expert or your Alternate Heating Systems for additional information.

Operating an Alternate Heating Systems Boiler in Tandem with Existing Boiler



Note: The above illustrates one possible method of connecting the Wood Gun™ with an existing boiler. This connection is as follows: using a small circulator (and with the backup boiler piped into the return tapping) run another pipe from the supply tapping T, of the Wood Gun™ to the supply line, of the existing boiler on the lower side of the flow control valve. A minimum of 1 in diameter pipe should be used for this connection on the model Super E110. The pipe size must be determined by taking into account the distance involved and flow required. The new circulator should be wired to the power for the Wood Gun. When power to the Wood Gun is on, the circulator should be running. An alternate option is to attach a strap on aquastat on the Wood Gun supply line that closes on temperature rise. This will automatically activate the pump at a given temperature. Overheat control (as pictured above) on the Wood Gun is optional

Plumbing an Alternate Heating Systems Boiler

APPENDIX G: Markings

CAUTION

DO NOT OPEN DOOR UNLESS GREEN LIGHT IS ON

INCLUDING A POWER OUTAGE

SUPPLY

⚠ DANGER



Water temperature over 125°F can cause severe burns instantly or death from scalds.

Children, disabled and elderly are at highest risk of being scalded.

See instruction manual before setting temperature at water heater.

Feel water before bathing or showering.

Temperature limiting valves are available, see manual.

WARNING

Never fill a hot boiler with water, if unit is low in water. Allow unit to cool before filling with water. Failure to do so could result in death or severe injury and damage to boiler and surrounding property.

⚠ WARNING

The domestic water heater shall not be connected to any heating system or components(s) previously used with a non-potable water heating appliance. Toxic chemicals such as used for boiler treatment shall not be introduced into the domestic water heater even if used for space heating.

CERTIFIED BY:

Alternate Heating

MAWP 15 PSI–STEAM

MAWP 30 PSI–WATER

MWT _____ °F

HS _____ SQ.FT.

MRVC _____ MBH

MSN _____

Wood Gun Super E110

Manufactured by Economical Energy Consultant INC
DBA Alternate Heating Systems
2395 Little Egypt Road Harrisonville, PA 17228

Certified To: UL 2523, CAN/CSA B366.1-11, ASTM 2515-11, ASTM 2618-13
U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using cordwood.
Certified as an ad-on model: _____
Model: SE110
Serial No. 24843686
Date of Manufacture: February 26, 2025

Installation Clearances to Combustibles:
FRONT – 24in; LEFT – 6in; RIGHT – 6in; REAR – 6in; TOP – 6in; CHIMNEY – 18in
(Only install on a **noncombustible floor.** Concrete, Etc.)
For Supply Connections use 12 AWG or larger wires acceptable for at least 90°C or an equivalent.
For use with copper conductors only.
See installation manual for more detail.

C US
Intertek
W/N _____

Specifications :
Voltage: 120
Amps: 6.0A
Frequency: 60 Hz
Phase: 1
Max. wire temperature: 90°C
Minimum Flue Diameter: 6"

Minimum Circuit Ampacity (MCA): 15A
Max-over Current Protective Device: 15A
Emissions (lb/MMBtu):
Cat 1: 0.07
Cat 2: 0.07
Cat 3: 0.07
Cat 4: 0.06

REFER TO OWNER'S MANUAL
✓ For basic operating and maintenance instructions, see the owner's manual.
✓ This unit burns seasoned logwood.
✓ Maximum -.08 inches of water column draft
✓ Minimum -.04 inches of water column draft
✓ Field assembly of low water cut-off and cyclone (See installation manual for details)

Refer to the Intertek Directory of Building Products (https://bpdirectory.intertek.com) for detailed information.

DANGER: RISK OF FIRE OR EXPLOSION:

WARNING FIRE DANGER:

- **Do NOT use chemicals for starting a fire.**
- **Do NOT burn garbage, gasoline, fuel oils, or other flammable liquids or materials.**
- **Do NOT store combustibles within marked installation clearances.**
- **Do NOT allow explosive vapors to accumulate in boiler room.**
- **Do NOT operate if flue draft exceeds .08 inches of water column.**
- **Do NOT touch during operation.**
- **Do NOT operate with Load door OR Ash door open.**
- **Do NOT interchange chimney manufacturers**
- **DO NOT CONNECT TO A FLUE SERVING ANOTHER APPLIANCE.**

CAUTION:

- **Do not open the loading door even in a power outage, until power is restored, and the green "Purge" turns on.**
- **Keep children away.**
- **Keep Clothing, furniture, and other combustible materials away.**
- **Load wood carefully or damage may result.**
- **Do NOT alter this equipment in any way.**
- **Inspect and clean the flue and chimney regularly.**
- **Unit is HOT while in operation.**
- **This equipment may only be installed by qualified personnel.**

WARNING – FIRE DANGER:

All flue connections must meet all the requirements of NFPA Standard Number 211 and UL 103. The appliance must be connected to an approved chimney made of masonry or manufactured chimney listed for solid fuel.

IMPORTANT:

- For INDOOR use only.
- Unit requires a supply of combustion air.
- This vessel is an ASME-certified boiler. The vessel is not suitable for heating potable water without the use of a domestic water exchanger.
- Unit will not operate without electrical power.
- Disconnect power before servicing. Keep shields and covers in place unless servicing boiler.
- The heat exchanger, flue pipe, and chimney must be in good condition and cleaned regularly to remove accumulated creosote and ash. Clean at the end of the heating season to minimize corrosion during the summer months.
- 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.
- Unit may be connected to an existing boiler system. Do not relocate or bypass any of the safety controls in the original boiler installation.
- Use **CO (carbon monoxide) detector** in any boiler installation to detect the presence of gas that may accumulate in the area around the boiler.

In case of runaway fire:

1. Cut power.
2. Make sure automatic air controls are tightly closed and the draft motor is off.
3. Shut loading and ash removal doors.
4. Maintain continued circulation of boiler water to remove heat from the boiler and if the boiler is equipped with a domestic coil run hot water.

In a case of power loss:

Do not open the loading door even in a power outage, until the power is restored, and the green "Purge" light turns on!

If you lose power the Wood Gun will shut down. If the power is not restored within 4-6hr you will most likely need to restart the fire, with match, paper, and kindling. Still, wait for the green light to turn on even before restarting.

A backup power source may be used to operate the Wood Gun in a power outage. Backup power must support both the controls and circulators. (Do not run a backup generator in the same area with the boiler or in any confined space).

The system must work even when unattended to guard against overheating. Backup power must be provided in a way that satisfies local code requirements and prevents back-feeding of electricity into the power grid.

If no means of dissipating heat exists, close all doors, and verify automatic dampers are closed.

Datalabel

Stainless Steel LIMITED WARRANTY

WOOD GASIFICATION BOILER: Super E110 SS

The manufacturer, ALTERNATE HEATING SYSTEMS, warrants to the original owner, for the periods specified below, that the boiler to which this warranty applies is free from defects in materials and workmanship when installed, operated, and maintained in accordance with the printed instructions supplied with the unit.
This warranty is void if the unit is used to burn materials for which the unit is not certified by the EPA and void if not operated according to the owner's manual.

A. WHAT IS COVERED AND FOR HOW LONG (all from date of original installation)

1) VESSEL:
STAINLESS STEEL BOILER VESSEL, TWENTY (20) years pro-rated (pro-rated as follows: 1st to 10th year – full: 11th year – 40%: 12th year - 30%: 13th year – 20%: 14th year – 10%: 15th – 20th year – 10%). This does not cover any corrosion or deterioration in boiler vessel due to improper pH levels in water or oxidized water (heating systems that have plastic piping).

2) Doors (excluding gaskets, knobs, and ceramic insulation board), draft regulation mechanisms, insulation jacket, draft fan assembly (excluding ceramic heat shield), stack/cyclone assembly, firebox refractory side brick and center brick – ONE (1) year.

3) All electrical and plumbing components and controls such as temperature/pressure gauge, safety relief valve, aqua stat controllers, electric motor, domestic hot water coil, oil burner, fan shaft bearings, timer, draft motor, etc. purchased by Alternate Heating Systems from other manufacturers are Limited to warranties offered by those manufacturers, typically One (1) year.

4) V-belt, pulleys, ceramic board door and fan heat shields, ceramic blanket firebox lining, fasteners, sight glass, smoke flap, door gasket and silicone rubber seal, door handle knobs, paint, wiring, and wiring devices -Thirty (30) days.

B. WHAT WE WILL DO AND NOT DO

1) Alternate Heating Systems will repair and replace, at our option, units or component parts found defective after inspection by Alternate Heating Systems or our authorized representative during the periods outlined above.

2) Alternate Heating Systems SHALL NOT BE LIABLE UNDER THIS WARRANTY IF:

a) the unit or any of its component parts have been subject to misuse, alteration, unauthorized repair, neglect, accident, or damage from handling.

b) the unit is not installed, operated and maintained in accordance with the printed instructions supplied with the unit and in accordance with local plumbing and/or building codes.

c) the unit is operated above its rated output which is shown on the nameplate attached to the unit and listed in Alternate Heating System's printed literature.

d) the unit is fired with fuels other than those recommended by Alternate Heating Systems. This includes fuels recommended by dealers and distributors selling Alternate Heating Systems products if these are not fuels recommended by Alternate Heating Systems.

C. WHAT THE CUSTOMER MUST DO

1) Contact the dealer who sold you the unit.

2) If said dealer cannot be located, contact any other Alternate Heating Systems dealers in your area.

3) If you are unable to locate a dealer, submit your warranty claim directly to Alternate Heating Systems at the address listed below.

4) When you make an inquiry or warranty request, be sure to include the following information:

a) Unit model number
b) Serial number
c) Date of installation
d) Dealer's name
e) Type of fuel burned

5) The OWNER and not Alternate Heating Systems or its dealers will be liable for the following costs involved in repair or replacement of the defective unit or component part

a) All necessary costs in returning the defective unit or component part to the factory or other location designated by Alternate Heating Systems.

b) All freight and delivery costs of shipping a new or required unit or replacement component part to the owner.

c) All labor and other costs incurred in the removal of the defective unit or part and installation of a new or required unit or part.

d) Any material required to complete installation of new or required unit or replacement part.

D. LIMITATIONS AND STATE LAW RIGHTS

1) Alternate Heating Systems neither assumes nor authorizes any representative or other person to assume for it any other obligation or liability in connection with its products other than expressly written here.

2) Implied warranties of merchantability and fitness for a particular purpose are limited to the duration of this LIMITED WARRANTY.

3) Alternate Heating Systems shall not be liable for any incidental or consequential damages such as water, smoke or heat damage to property arising directly or indirectly from any defect in its products or their use.

4) Some states do not allow limitation on how long an implied warranty lasts and the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

5) This warranty gives you specific legal rights. You may also have other rights, which vary from state to state.

6) The remedies set forth herein shall be the exclusive remedies available to the owner.

ALTERNATE HEATING SYSTEMS
2393 Little Egypt Rd
Harrisonville, PA 17228

IMPORTANT: READ AND KEEP IN YOUR POSSESSION!

Carbon Steel LIMITED WARRANTY

WOOD GASIFICATION BOILERS: Super E110 CS

The manufacturer, ALTERNATE HEATING SYSTEMS, warrants to the original owner, for the periods specified below, that the boiler to which this warranty applies is free from defects in materials and workmanship when installed, operated, and maintained in accordance with the printed instructions supplied with the unit.
This warranty is void if the unit is used to burn materials for which the unit is not certified by the EPA and void if not operated according to the owner's manual.

A. WHAT IS COVERED AND FOR HOW LONG (all from date of original installation)

1) VESSEL:
CARBON STEEL BOILER VESSEL, TWENTY (20) years pro-rated (pro-rated as follows: 1st to 10th year – full: 11th year – 40%: 12th year - 30%: 13th year – 20%: 14th year – 10%: 15th – 20th year – 10%). This warranty does not cover any corrosion or deterioration in boiler vessel due to improper pH levels in water or oxidized water (heating systems that have plastic piping, OR are installed and maintained as open systems). This warranty does not cover corrosion from inside the firebox or heat exchanger areas of the vessel.

2) Doors (excluding gaskets, knobs, and ceramic insulation board), draft regulation mechanisms, insulation jacket, draft fan assembly (excluding ceramic heat shield), stack/cyclone assembly, firebox refractory side brick and center brick – ONE (1) year.

3) All electrical and plumbing components and controls such as temperature/pressure gauge, safety relief valve, aqua stat controllers, electric motor, domestic hot water coil, oil burner, fan shaft bearings, timer, draft motor, etc. purchased by Alternate Heating Systems from other manufacturers are Limited to warranties offered by those manufacturers, typically One (1) year.

4) V-belt, pulleys, ceramic board door and fan heat shields, ceramic blanket firebox lining, fasteners, sight glass, smoke flap, door gasket and silicone rubber seal, door handle knobs, paint, wiring, and wiring devices -Thirty (30) days.

B. WHAT WE WILL DO AND NOT DO

1) Alternate Heating Systems will repair and replace, at our option, units or component parts found defective after inspection by Alternate Heating Systems or our authorized representative during the periods outlined above.

2) Alternate Heating Systems SHALL NOT BE LIABLE UNDER THIS WARRANTY IF:

a) the unit or any of its component parts have been subject to misuse, alteration, unauthorized repair, neglect, accident, or damage from handling.

b) the unit is not installed, operated and maintained in accordance with the printed instructions supplied with the unit and in accordance with local plumbing and/or building codes.

c) the unit is operated above its rated output which is shown on the nameplate attached to the unit and listed in Alternate Heating System's printed literature.

d) the unit is fired with fuels other than those recommended by Alternate Heating Systems. This includes fuels recommended by dealers and distributors selling Alternate Heating Systems products if these are not fuels recommended by Alternate Heating Systems.

C. WHAT THE CUSTOMER MUST DO

1) Contact the dealer who sold you the unit.

2) If said dealer cannot be located, contact any other Alternate Heating Systems dealers in your area.

3) If you are unable to locate a dealer, submit your warranty claim directly to Alternate Heating Systems at the address listed below.

4) When you make an inquiry or warranty request, be sure to include the following information:

a) Unit model number
b) Serial number
c) Date of installation
d) Dealer's name
e) Type of fuel burned

5) The OWNER and not Alternate Heating Systems or its dealers will be liable for the following costs involved in repair or replacement of the defective unit or component part

a) All necessary costs in returning the defective unit or component part to the factory or other location designated by Alternate Heating Systems.

b) All freight and delivery costs of shipping a new or required unit or replacement component part to the owner.

c) All labor and other costs incurred in the removal of the defective unit or part and installation of a new or required unit or part.

d) Any material required to complete installation of new or required unit or replacement part.

D. LIMITATIONS AND STATE LAW RIGHTS

1) Alternate Heating Systems neither assumes nor authorizes any representative or other person to assume for it any other obligation or liability in connection with its products other than expressly written here.

2) Implied warranties of merchantability and fitness for a particular purpose are limited to the duration of this LIMITED WARRANTY.

3) Alternate Heating Systems shall not be liable for any incidental or consequential damages such as water, smoke or heat damage to property arising directly or indirectly from any defect in its products or their use.

4) Some states do not allow limitation on how long an implied warranty lasts and the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

5) This warranty gives you specific legal rights. You may also have other rights, which vary from state to state.

6) The remedies set forth herein shall be the exclusive remedies available to the owner.

ALTERNATE HEATING SYSTEMS
2393 Little Egypt Rd
Harrisonville, PA 17228

IMPORTANT: READ AND KEEP IN YOUR POSSESSION!

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

A2LA ACCREDITED
CERTIFICATE #1550.01

PFS Teco
11785 SE Hwy 212 STE#305
Clackamas, OR 97015

Report Number: DIRI0182484A0912013i241204

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Digiweigh	DWP12i 300kg x 0.	82484A0912013i	#050	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
kg	0.01	QC033	12/4/24	12/28/23	12/2025

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 100 / Tol: 0.05	Test Wt: HB44 / Tol: HB44	Test Wt: 100 / Tol: 0.01	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 17.2°C
As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
400	399.98	399.98	0.006
200	200.00	200.00	0.005
100	100.00	100.00	0.005
75	75.00	75.00	0.005
50	50.00	50.00	0.005
25	25.00	25.00	0.005

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	7/26/24	7/2026	20221688

Permanent Information Concerning this Equipment:
12 month calibration cycle. Scale calibrates in kg only.

Comments/Information Concerning this Calibration
12/04/2024: RH-37%

Report prepared/reviewed by: TLP **Date:** 12.04.2024 **Technician:** T.Peterson
Signature:

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

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Dry Gas Meter Calibration

DUT	
Manufacturer:	Apex
Model:	Xc-50-DIR
Lab ID #:	129
Serial #:	
Calibration Date:	12/12/2024
Calibration Expiration:	6/12/2025
Barometric Pressure:	29.67 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	Fluke	Aquatech	
Model:	SK25DA		DBX2	
Lab ID#:	47	196	202	
Calibration Expiration Date:	6/4/2025	1/3/2025	6/17/2025	
Calibration γ Factor:	0.99801214			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	147.396	140.784	139.749
Standard DGM Temperature (°F)	64.0	65.4	66.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	5.171	5.002	5.030
DGM Temperature (°F)	65.8	75.0	80.8
DGM Pressure (in H_2O)	1.86	1.50	1.0
Net Volume for Standard DGM (ft^3)	5.205	4.972	4.935
Net Volume for DGM (ft^3)	5.171	5.002	5.030

Dry Gas Meter γ Factor	1.003	1.006	1.004
γ Factor Deviation From Average	1.003	1.006	1.004

Average Gas Meter γ Factor: 1.005

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. $\gamma = [V_{std} \times (\gamma_{Std}) \times (P_{bar}+P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/ 13.6)]$

Technician

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Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	33086-203315-4525	**Customer PO#:** 1109	
Customer Name:	PFS TECO		
Customer Address:	1507 Matt Pass		
City:	Cottage Grove	**State:** WI	**Zip:** 53527
Contact:	Ethan Frederick		
Service Address:	11785 SE Highway 212, Suite 305	Clackamas, OR 97015	

Calibration Standards

10-01442 | Compound Gauge | Fluke | SN: 4582643 | Cal: 01/26/2024 | Due: 01/31/2025 | Vendor: Fluke | Report #: EVL943251
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date:	February 28, 2024	**Reference:**	ASME B40.100
Recommended Due Date:	February 28, 2025	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Red Lion	**Temperature:**	70 °F
Type:	Pressure Transducer	**Humidity:**	40% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	129B
Capacity:	1 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 1.00 **Range Resolution:** 0.001 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.000	0.000	0.000	0.00	0.000	0.00	0.01	0.0005
0.100	0.100	0.100	0.00	0.097	0.00	0.01	0.0067
0.250	0.247	0.247	0.00	0.247	0.00	0.01	0.0006
0.500	0.496	0.496	0.00	0.495	0.00	0.01	0.0011
0.750	0.743	0.743	-0.01	0.743	-0.01	0.01	0.001
1.000	0.992	0.992	-0.01	0.992	-0.01	0.01	0.0022
0.750	0.745	0.745	-0.01	0.743	-0.01	0.01	0.006
0.500	0.496	0.496	0.00	0.496	0.00	0.01	0.0009
0.250	0.248	0.248	0.00	0.249	0.00	0.01	0.0031
0.100	0.101	0.101	0.00	0.099	0.00	0.01	0.0049
0.000	0.009	0.009	0.01	-0.004	0.00	0.01	0.0005

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Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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Service Engineer: Steven White **Date:** February 28, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-203315-4525

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Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 33086-203316-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

10-01442 | Compound Gauge | Fluke | SN: 4582643 | Cal: 01/26/2024 | Due: 01/31/2025 | Vendor: Fluke | Report #: EVL943251
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date: February 28, 2024
Recommended Due Date: February 28, 2025
Calibration Frequency: 12 Months
Manufacturer: Red Lion
Type: Pressure Transducer
Model Number: Unknown
Serial #: Unknown
Capacity: 5 In H2O
Tolerance: ± 1.00% of Span
Gauge Class: A

Reference: ASME B40.100
Cal-Cert Procedure: CP-003
Indicating System: Digital
Temperature: 70 °F
Humidity: 40% RH
Cal Factor: None
Asset #: 129C
Service Location: Service Address
As Found: Pass
As Left: Pass

Instrument Range: 5.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.49	-0.01	0.05	0.024
1.25	1.23	1.23	-0.02	1.24	-0.01	0.05	0.014
2.50	2.47	2.47	-0.03	2.47	-0.03	0.05	0.017
3.75	3.71	3.71	-0.04	3.71	-0.04	0.05	0.007
5.00	4.96	4.96	-0.04	4.95	-0.05	0.05	0.023
3.75	3.71	3.71	-0.04	3.72	-0.03	0.05	0.041
2.50	2.47	2.47	-0.03	2.47	-0.03	0.05	0.006
1.25	1.24	1.24	-0.01	1.24	-0.01	0.05	0.01
0.50	0.51	0.51	0.01	0.50	0.00	0.05	0.027
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005

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Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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Service Engineer: Steven White **Date:** February 28, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-203316-4525

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Dry Gas Meter Calibration

DUT	
Manufacturer:	Apex
Model:	Xc-50-DIR
Lab ID #:	130
Serial #:	
Calibration Date:	12/12/2024
Calibration Expiration:	6/12/2025
Barometric Pressure:	29.67 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	Fluke	Aquatech	
Model:	SK25DA		DBX2	
Lab ID#:	47	196	202	
Calibration Expiration Date:	6/4/2025	1/3/2025	6/17/2025	
Calibration γ Factor:	0.99801214			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	146.253	143.931	140.414
Standard DGM Temperature (°F)	67.1	67.1	68.9
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	5.090	5.091	5.039
DGM Temperature (°F)	70.0	77.5	83.5
DGM Pressure (in H_2O)	1.79	1.47	1.0
Net Volume for Standard DGM (ft^3)	5.165	5.083	4.959
Net Volume for DGM (ft^3)	5.090	5.091	5.039

Dry Gas Meter γ Factor	1.014	1.012	1.007
γ Factor Deviation From Average	1.014	1.012	1.007

Average Gas Meter γ Factor: 1.011

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. $\gamma = [V_{std} \times (\gamma_{Std}) \times (P_{bar}+P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/ 13.6)]$

Technician

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Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	33086-203317-4525	**Customer PO#:**	1109		
Customer Name:	PFS TECO				
Customer Address:	1507 Matt Pass				
City:	Cottage Grove	**State:**	WI	**Zip:**	53527
Contact:	Ethan Frederick				
Service Address:	11785 SE Highway 212, Suite 305	Clackamas, OR 97015			

Calibration Standards

10-01442 | Compound Gauge | Fluke | SN: 4582643 | Cal: 01/26/2024 | Due: 01/31/2025 | Vendor: Fluke | Report #: EVL943251
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date:	February 28, 2024	**Reference:**	ASME B40.100
Recommended Due Date:	February 28, 2025	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Red Lion	**Temperature:**	70 °F
Type:	Pressure Transducer	**Humidity:**	39% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	130B
Capacity:	1 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 1.00 **Range Resolution:** 0.001 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.000	0.000	0.000	0.00	0.000	0.00	0.01	0.0005
0.100	0.099	0.099	0.00	0.098	0.00	0.01	0.0021
0.250	0.246	0.246	0.00	0.246	0.00	0.01	0.001
0.500	0.493	0.493	-0.01	0.493	-0.01	0.01	0.0009
0.750	0.748	0.748	0.00	0.741	-0.01	0.01	0.0185
1.000	0.991	0.991	-0.01	0.991	-0.01	0.01	0.0026
0.750	0.743	0.743	-0.01	0.742	-0.01	0.01	0.0025
0.500	0.494	0.494	-0.01	0.494	-0.01	0.01	0.0009
0.250	0.247	0.247	0.00	0.248	0.00	0.01	0.0026
0.100	0.098	0.098	0.00	0.100	0.00	0.01	0.0052
0.000	0.000	0.000	0.00	0.000	0.00	0.01	0.0005

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Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

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Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
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This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
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Service Engineer: Steven White **Date:** February 28, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-203317-4525

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A2LA ACCREDITED CERT #4986.01

Report #:	33086-203318-4525	**Customer PO#:** 1109	
Customer Name:	PFS TECO		
Customer Address:	1507 Matt Pass		
City:	Cottage Grove	**State:** WI	**Zip:** 53527
Contact:	Ethan Frederick		
Service Address:	11785 SE Highway 212, Suite 305	Clackamas, OR 97015	

Calibration Standards

10-01442 | Compound Gauge | Fluke | SN: 4582643 | Cal: 01/26/2024 | Due: 01/31/2025 | Vendor: Fluke | Report #: EVL943251
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date:	February 28, 2024	**Reference:**	ASME B40.100
Recommended Due Date:	February 28, 2025	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Red Lion	**Temperature:**	70 °F
Type:	Pressure Transducer	**Humidity:**	39% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	130C
Capacity:	5 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 5.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005
0.50	0.51	0.51	0.01	0.49	-0.01	0.05	0.034
1.25	1.20	1.20	-0.05	1.24	-0.01	0.05	0.083
2.50	2.53	2.53	0.03	2.48	-0.02	0.05	0.127
3.75	3.70	3.70	-0.05	3.73	-0.02	0.05	0.056
5.00	4.97	4.97	-0.03	4.98	-0.02	0.05	0.049
3.75	3.71	3.71	-0.04	3.73	-0.02	0.05	0.061
2.50	2.46	2.46	-0.04	2.49	-0.01	0.05	0.06
1.25	1.21	1.21	-0.04	1.24	-0.01	0.05	0.062
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005

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Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

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Service Engineer: Steven White **Date:** February 28, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-203318-4525

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Dry Gas Meter Calibration

DUT	
Manufacturer:	EKM Metering
Model:	PGM-075
Lab ID #:	204
Serial #:	N/A
Calibration Date:	1/7/2025
Calibration Expiration:	7/7/2025
Barometric Pressure:	30.31 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	Omega	Aquatech	Dwyer
Model:	SK25DA	CL3512A	DBX2	475-00-FM
Lab ID#:	47	39	202	76
Calibration Expiration Date:	6/4/2025	6/11/2025	6/17/2025	9/25/2025
Calibration γ Factor:	0.998			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	141.301	142.460	143.545
Standard DGM Temperature (°F)	71.0	72.0	73.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	5.048	10.318
DGM Final Volume (ft^3)	5.048	10.189	15.549
DGM Temperature (°F)	77.0	87.0	93.0
DGM Pressure (in H_2O)	0.86	1.11	2.0
Net Volume for Standard DGM (ft^3)	4.990	5.031	5.069
Net Volume for DGM (ft^3)	5.048	5.141	5.231

Dry Gas Meter γ Factor	0.996	1.001	0.999
γ Factor Deviation From Average	0.996	1.001	0.999

Average Gas Meter γ Factor: 0.999

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. $\gamma = [V_{std} \times (\gamma_{Std}) \times (P_{bar}+P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/ 13.6)]$

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Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 33086-203321-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

10-01442 | Compound Gauge | Fluke | SN: 4582643 | Cal: 01/26/2024 | Due: 01/31/2025 | Vendor: Fluke | Report #: EVL943251
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date:	February 28, 2024	**Reference:**	ASME B40.100
Recommended Due Date:	February 28, 2025	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Red Lion	**Temperature:**	70 °F
Type:	Pressure Transducer	**Humidity:**	40% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	204B
Capacity:	1 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 1.00 **Range Resolution:** 0.001 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.000	0.000	0.000	0.00	0.000	0.00	0.01	0.0005
0.100	0.102	0.102	0.00	0.101	0.00	0.01	0.0024
0.250	0.252	0.252	0.00	0.247	0.00	0.01	0.0135
0.500	0.496	0.496	0.00	0.498	0.00	0.01	0.0044
0.750	0.742	0.742	-0.01	0.744	-0.01	0.01	0.0063
1.000	0.995	0.995	0.00	0.996	0.00	0.01	0.0018
0.750	0.747	0.747	0.00	0.744	-0.01	0.01	0.0078
0.500	0.496	0.496	0.00	0.496	0.00	0.01	0.0015
0.250	0.247	0.247	0.00	0.249	0.00	0.01	0.0044
0.100	0.102	0.102	0.00	0.108	0.01	0.01	0.0164
0.000	0.000	0.000	0.00	0.000	0.00	0.01	0.0005

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Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

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Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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

Service Engineer: Steven White **Date:** February 28, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-203321-4525

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Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	33086-203322-4525		**Customer PO#:** 1109		
Customer Name:	PFS TECO				
Customer Address:	1507 Matt Pass				
City:	Cottage Grove		**State:** WI	**Zip:** 53527	
Contact:	Ethan Frederick				
Service Address:	11785 SE Highway 212, Suite 305		Clackamas, OR 97015		

Calibration Standards

10-01442 | Compound Gauge | Fluke | SN: 4582643 | Cal: 01/26/2024 | Due: 01/31/2025 | Vendor: Fluke | Report #: EVL943251
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date:	February 28, 2024	**Reference:**	ASME B40.100
Recommended Due Date:	February 28, 2025	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Red Lion	**Temperature:**	70 °F
Type:	Pressure Transducer	**Humidity:**	39% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	204C
Capacity:	5 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 5.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.51	0.01	0.05	0.019
1.25	1.26	1.26	0.01	1.25	0.00	0.05	0.01
2.50	2.53	2.53	0.03	2.52	0.02	0.05	0.038
3.75	3.79	3.79	0.04	3.76	0.01	0.05	0.093
5.00	5.05	5.05	0.05	5.02	0.02	0.05	0.079
3.75	3.80	3.80	0.05	3.79	0.04	0.05	0.018
2.50	2.53	2.53	0.03	2.46	-0.04	0.05	0.172
1.25	1.26	1.26	0.01	1.25	0.00	0.05	0.008
0.50	0.50	0.50	0.00	0.51	0.01	0.05	0.041
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005

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Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

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Service Engineer: Steven White **Date:** February 28, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-203322-4525

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Dry Gas Meter Calibration

DUT	
Manufacturer:	Apex
Model:	XC-60
Lab ID #:	55
Serial #:	810016
Calibration Date:	2/1/2025
Calibration Expiration:	8/1/2025
Barometric Pressure:	30.02 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	NI	Aquatech	Dwyer
Model:	SK25DA	9213	DBX2	W17AE
Lab ID#:	47	215	202	124
Calibration Expiration Date:	5/1/2025	2/26/2025	6/17/2025	6/16/2025
Calibration γ Factor:	0.998			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	148.998	157.125	207.888
Standard DGM Temperature (°F)	70.2	71.1	69.8
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	5.249	5.608	7.444
DGM Temperature (°F)	80.0	82.2	83.8
DGM Pressure (in H_2O)	0.00	0.00	0.00
Net Volume for Standard DGM (ft^3)	5.262	5.549	7.341
Net Volume for DGM (ft^3)	5.249	5.608	7.444

Dry Gas Meter γ Factor	1.019	1.008	1.010
γ Factor Deviation From Average	1.019	1.008	1.010

Average Gas Meter γ Factor: 1.012

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. $\gamma = [V_{std} \times (\gamma_{Std}) \times (P_{bar}+P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/ 13.6)]$

Report and Certificate of Calibration

CAL-CERT
CALIBRATION CERTIFICATION

Portland Laboratory
5777 SE International Way
Milwaukie, OR 97222
800-356-4662
503-654-9620

Anaheim Laboratory
120 S. Chaparral Ct Suite 110
Anaheim Hills, CA 92808
888-700-4100
714-696-5300

www.Cal-Cert.com

Report #: 36866-28785-3646 **Customer PO#:** 1122
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Ethan Frederick
Service Address: 5777 SE International Way Milwaukie, OR 97222

Calibration Standards

10-00391 | Thermo-Hygrometer | Comark | SN: 6217150001 | Cal: 05/02/2024 | Due: 04/30/2025 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 34722-30759-4525
LP-01158 | Electrical Meter | Keithley | SN: 1388607 | Cal: 07/24/2023 | Due: 07/31/2025 | Vendor: Techmaster Electronics | Report #: TSV-0-545118

Instrument Data

Calibration Date: September 25, 2024
Recommended Due Date: September 25, 2025
Calibration Frequency: 12 Months
Manufacturer: Delmhorst
Type: Resistivity Meter
Model Number: MCS-1
Serial #: #094
Capacity: 120 Megaohms
Tolerance: 1.00 % of indication

Reference: Manufactures Tolerances
Cal-Cert Procedure: CP-080
Indicating System: Digital
Temperature: 72 °F
Humidity: 49% RH
Asset #: #094
Service Location: Cal-Cert Lab
As Found: Pass
As Left: Pass

Instrument Range: 120 Megaohms **Resolution:** 0.001 **Mode Verified:** Resistance

Standard Reading	UUT As Found	UUT Reading #1	Error	UUT Reading #2	Error	
0.000	0.000	0.000	0.000	0.000	0.000	
1,100,000	1,095,000	1,095,000	-5,000.000	1,095,000	-5,000.000	
120,000,000	120,830,000	120,830,000	830,000.000	120,830,000	830,000.000	OUT OF TOLERANCE OUT OF TOLERANCE

Expanded Uncertainty± **2.50 Megaohms**

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
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Service Engineer: Brent Enbysk **Date:** September 25, 2024

Quality Manager: Jason Wimmer **Signature:** 

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Certificate of Calibration

Certificate Number: 743892

JJ Calibrations, Inc.
7724 SE Aspen Summit Drive
Portland, OR 97266-9217
Phone 503.786.3005
FAX 503.786.2994

PFS TECO
11785 SE Hwy 212
Suite 305
Clackamas, OR 97015

ACCREDITED
0723.01
Calibration

PO: 1033
Order Date: 03/08/2021
Authorized By: N/A

Property #: 097
User: N/A
Department: N/A
Make: Unknown
Model: 10 Lbs.
Serial #: 097
Description: Mass
Procedure: DCN 500901
Accuracy: Raw Data

Calibrated on: 03/18/2021
*Recommended Due: 03/18/2026
Environment: 19 °C 41 % RH
* As Received: Other - See Remarks
* As Returned: Other - See Remarks
Action Taken: Calibrated
Technician: 126

Remarks: * Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

Data is provided for your determination of acceptability. Received/returned without accessories.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
484A	Rice Lake	1kg-10kg (Class ASTM 1)	Mass Set,	05/28/2021	699197
503A	Rice Lake	1mg-200g (Class 0)	Mass Set,	09/11/2021	729241
550A	And (A&D) Co.	HP-30K	Balance 30 Kg	12/31/2021	739307
723A	Rice Lake	1mg-200g (Class 0)	Mass Set,	06/09/2021	723431

Measurement Data

Parameter / Measurement Description	Range	Unit	Reference	Min	Max	*Error	UUT	Uncertainty
Before/After								Accredited = ü
Mass								
Raw Data		g	4535.92370000	0.0000000	0.0000000	0.1785299	4536.1022299 g	3.5E-01 ü

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to either the SI or to National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2017, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless stated in the comments, certificates reflect the "Simple Acceptance Rule" as specified by JCGM 106:2012. Unless otherwise stated, a test accuracy ratio (TAR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without written approval of JJ Calibrations.

Reviewer

3 Issued 03/25/2021 Rev # 15

Inspector

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A2LA ACCREDITED

CERTIFICATE #1550.01

PFS Teco
11785 SE Hwy 212 STE#305
Clackamas, OR 97015

Report Number: DIRI0134307497241204

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	ENTRIS224-1S	34307497	#107	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	12/4/24	6/12/24	6/2025

FUNCTIONAL CHECKS

ECCENTRICITY
Test Wt: 100 Tol: 0.0003
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

LINEARITY
Test Wt: 50 x 4 Tol: 0.0002
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

STANDARD DEVIATION
Test Wt: 100 Tol: 0.0001

1. 100.0000	5. 99.9999	9. 99.9999
2. 100.0000	6. 100.0000	10. 100.0000
3. 100.0000	7. 100.0000	Result
4. 99.9999	8. 99.9999	0.00005

ENVIRONMENTAL CONDITIONS
☐ Good ☑ Fair ☐ Poor
Temperature: 20.8°C

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	200.0007	199.9999	0.00017
100	100.0006	99.9999	0.00016
50	50.0004	50.0000	0.00015
20	20.0003	20.0000	0.00015
0.1	0.0999	0.0999	0.00015
0.05	0.0498	0.0499	0.00015

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	20 kg to 1mg	2831W	3/31/24	3/2025	20240774

Permanent Information Concerning this Equipment:
6 month calibration cycle

Comments/Info Concerning this Calibration:
12/04/2024: Adjusted span. RH=36%

Report prepared/reviewed by: TLP **Date:** 12-04-2024 **Technician:** E.J. Vasko

Signature:

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

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards. Results relate only to the item(s) tested. Unless otherwise noted, statements of conformity do not include measurement

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ACCREDITED
CERTIFICATE #1550.01

Report of Calibration

Firm: PFS-TECO
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 05/09/22
Purchase Order: 1067
Traceable Number: 20220682

Test Item: 200 mg and 100 mg Individual Weights
Serial No.: Listed in Table

Manufacturer: Troemner
Customer ID: Listed in Table

Material	Assumed Density	Range	Tolerance Class
Stainless Steel	7.95 g/cm^3	200 mg & 100 mg	ASTM Class 1

Method and Traceability
The procedure used for this calibration is NIST IR 6969 SOP 4 Double Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:
100 g to 1 mg Working Standards Were Calibrated: 07/02/21 Due: 07/31/22 Standards ID: 723318
Mass Comparators Used: MET-05 **Tested by:** D. Thompson

Conventional Mass: "The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). "Conventional Value of the Result of Weighing in Air" **(Previously known as "Apparent Mass vs. 8.0 g/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: 05/09/22

Signature David S. Thompson

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ACCREDITED
CERTIFICATE #1550.01

Report of Calibration

Firm: PFS-TECO
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 05/09/22
Purchase Order: 1067
Traceable Number: 20220682

Test Item: 200 mg and 100 mg Individual Weights
Serial No.: Listed in Table

Manufacturer: Troemner
Customer ID: Listed in Table

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.93 to 21.94	760.7 to 760.8	47.8 to 47.9

Conventional Mass Value

Nominal Value	As Found Value (g)	As Found Correction* (mg)	As Left Value (g)	As Left Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
200 mg, 1000101395, #109-B	0.2000082	0.0082	0.2000082	0.0082	0.0014	0.010
100 mg, 1000126267, #109-A	0.1000065	0.0065	0.1000065	0.0065	0.0014	0.010

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

Comments: These weights were received in good condition and were within ASTM Class 1 tolerances As Found.

Recalibration Due: The customer has requested a 5-year calibration cycle. The calibration due date for these weights is 05/09/27. The values listed above were found at the time of calibration. Any number of factors may cause these items to drift out of calibration before the calibration interval has expired.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2017 *General Requirements for the Competence of Testing and Calibration Laboratories.* This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

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

Date: 05/09/22

Signature David S. Thompson

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Report and Certificate of Calibration

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Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 34220-232033-4847 **Customer PO#:** 1114
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Ethan Frederick
Service Address: 5777 SE International Way Milwaukie, OR 97222

Calibration Standards

LP-00397 | Gage Block Set | Mitutoyo | SN: 509020 | Cal: 12/28/2022 | Due: 12/28/2024 | Vendor: BHD Test and Measurement | Report #: 99826
LP-00693 | Surface Plate | Starrett | SN: 863629 | Cal: 01/19/2024 | Due: 01/31/2025 | Vendor: Cal-Cert | Range: 12 sq ft | Report #: 32565-31044-14
LP-01346 | Thermo-Hygrometer | Comark | SN: 06210350198 | Cal: 03/08/2024 | Due: 03/31/2025 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 33563-67215-3616

Instrument Data

Calibration Date:	April 3, 2024	**Reference:**	NAVAIR 17-20MD-06
Calibration Due Date:	April 3, 2025	**Cal-Cert Procedure:**	CP-010
Calibration Frequency:	12 Months	**Indicating System:**	Vernier
Manufacturer:	Dwyer Instruments	**Temperature:**	68 °F
Type:	Depth Micrometer	**Humidity:**	36% RH
Model Number:	Unknown	**Asset #:**	221
Serial #:	Unknown	**Service Location:**	Cal-Cert Lab
Minimum Capacity:	0.0 Inches	**As Found:**	PASS
Maximum Capacity:	1 Inches	**As Left:**	PASS
Resolution:	0.001 Inches		

Instrument Range: 1.000 Inches **Range Resolution:** 0.001 Inches

Calibration Standard Inches	As Found Inches	As Left Reading 1 Inches	As Left Reading 2 Inches	Tolerance ± Inches
0.000	0.000	0.000	0.000	0.001
0.200	0.200	0.200	0.200	0.001
0.400	0.401	0.401	0.401	0.001
0.600	0.601	0.601	0.601	0.001
0.800	0.800	0.800	0.800	0.001
1.000	1.000	1.000	1.000	0.001

Expanded Uncertainty ± 0.00115 Inches

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

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Service Engineer: Justin Roye **Date:** April 3, 2024

Quality Manager: Jason Wimmer **Signature:**

Micrometer with additional anvils or rods CF-010-03

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Report #: 34220-232033-4847 **Revision 10** **7/22/2017**

Calibration Certificate ID
NA1898-033-092524-ACC-USI

Mettler Toledo
Service Business Unit Industrial
1900 Polaris Parkway
Columbus, OH 43240
1-800-523-5123

METTLER TOLEDO

Accredited by the American Association for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1902.01

ISO 17025 Registered
ANSI/NCSL Z540-1 Accredited

Accuracy Calibration Certificate

Customer

Company:	PFS-TECO		
Address:	11785 SE Hwy 212; Ste 305		
City:	Clackamas	**Contact:**	Ethan Federick
Zip / Postal:	97015-9050		
State / Province:	Oregon		

Weighing Device

Manufacturer:	Mettler Toledo	**Instrument Type:**	Weighing Instrument
Model:	Floor Scale PFD774 US11	**Asset Number:**	N/A
Serial No.:	C149108036	**Terminal Model:**	IND 570
Building:	N/A	**Terminal Serial No.:**	C133380080
Floor:	N/A	**Terminal Asset No.:**	N/A
Room:	N/A		

Range	Max. Capacity	Readability (d)
1	10000 lb	0.2 lb

Procedure

Calibration Guideline: ASTM E898 - 20
METTLER TOLEDO Work Instruction: 30260953

This calibration certificate including procedures and uncertainty estimation also complies with EURAMET cg-18 v 4.0.

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The calibration was agreed with the user below the maximum capacity of the balance.

	Temperature		Humidity	
As Found	Start: 68.0 °F	End: 68.0 °F	Start: 71.0 %	End: 72.0 %

Environmental conditions have been verified to ensure the accuracy of the calibration.

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

As Found Calibration Date:	25-Sep-2024
As Left Calibration Date:	N/A
Issue Date:	25-Sep-2024
Date of next calibration by customer request:	31-Mar-2025

Authorized A2LA Signatory:

Xavier Orange

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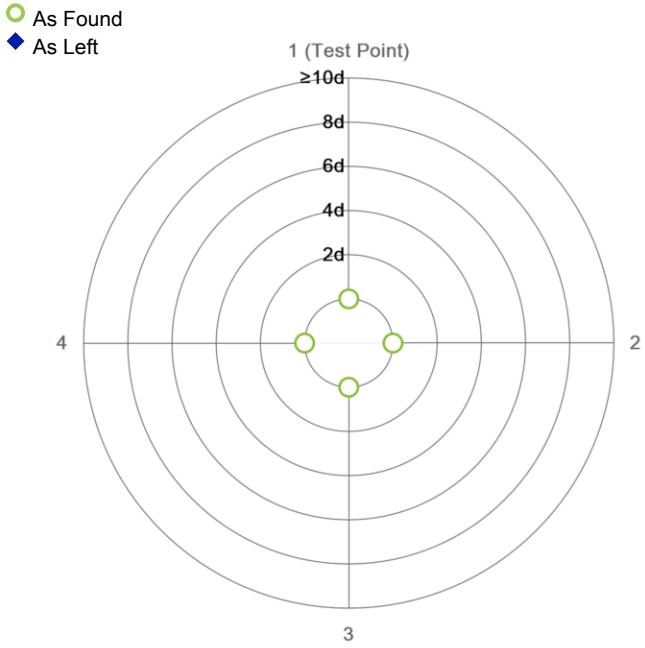
Measurement Results

Repeatability

Test Load: 2000 lb

	As Found	As Left
1	2000.0 lb	N/A
2	2000.0 lb	N/A
3	2000.0 lb	N/A
4	2000.0 lb	N/A

Standard Deviation	**0.00 lb**	**N/A**



The "d" in the graph represents the readability of the range/interval in which the test was performed.

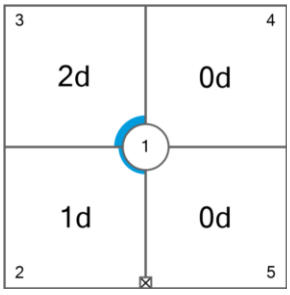
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 2000 lb

Position	As Found	As Left
1	1999.8 lb	N/A
2	2000.0 lb	N/A
3	2000.2 lb	N/A
4	1999.8 lb	N/A
5	1999.8 lb	N/A

Maximum Deviation	**0.4 lb**	**N/A**



As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

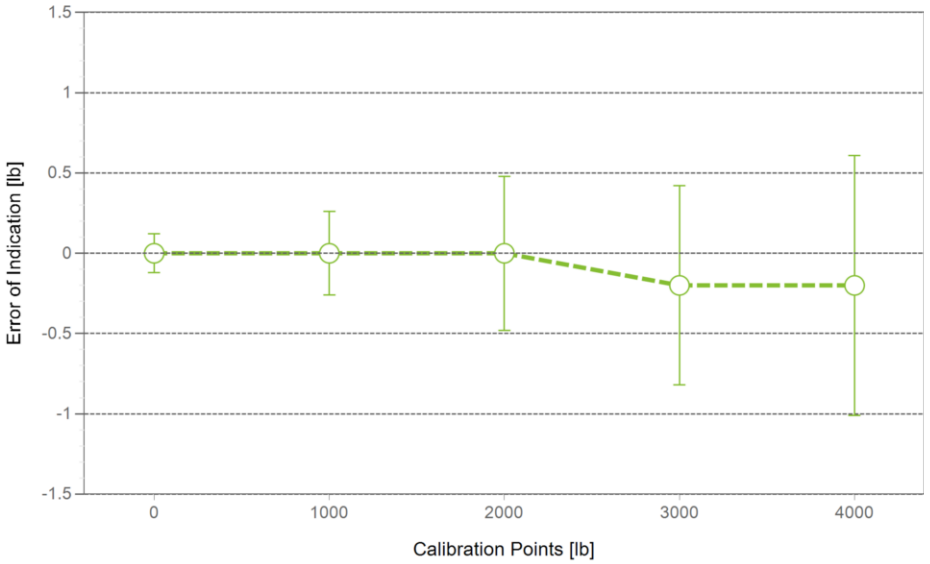
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0 lb	0.0 lb	0.0 lb	0.12 lb	2
2	1000 lb	1000.0 lb	0.0 lb	0.26 lb	2
3 [1]	2000 lb	2000.0 lb	0.0 lb	0.48 lb	2
4	3000 lb	2999.8 lb	-0.2 lb	0.62 lb	2
5	4000 lb	3999.8 lb	-0.2 lb	0.81 lb	2

[1]The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.

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As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: NIST NIST-F

Weight Set No.:	big 580	Date of Issue:	01-May-2024
Certificate Number:	OR-19-170-F	Calibration Due Date:	31-May-2025

Remarks

N/A

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $10.0 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 18 °F

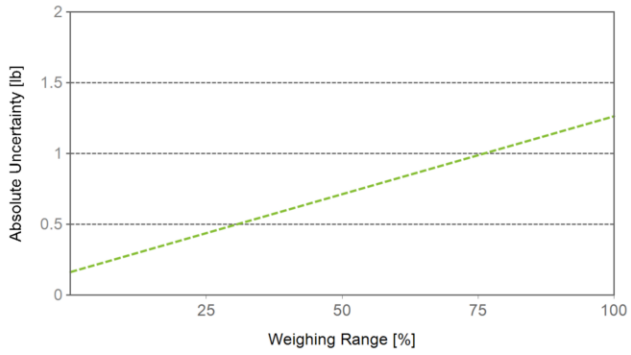
Linearization of Uncertainty Equation

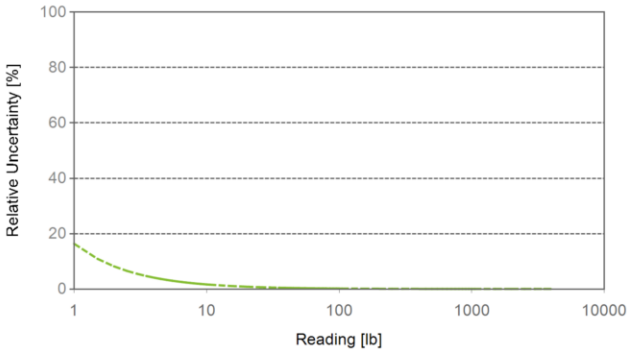
Range			As Found	As Left
	d	Max		
1	0.2 lb	4000 lb	U_1 = 0.16 lb + 0.000275 lb/lb · R	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
4.0 lb	0.16 lb	4.0%	N/A	N/A
40.0 lb	0.17 lb	0.43%	N/A	N/A
400.0 lb	0.27 lb	0.068%	N/A	N/A
2000.0 lb	0.71 lb	0.036%	N/A	N/A
4000.0 lb	1.3 lb	0.032%	N/A	N/A





As Found As Left

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METTLER TOLEDO Service

Handbook 44 Tolerance Assessment (Maintenance)

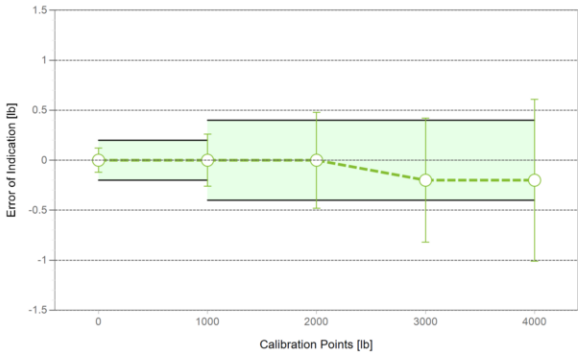
Assessment done without considering measurement uncertainty.
The measurements from the attached calibration certificate were assessed against the Tolerances defined by NIST Handbook 44.
The range of measurements for both Eccentricity and Repeatability (if performed) tests is assessed against Maintenance Tolerances.

	As Found	As Left
Overall	✓	N/A

✓ = Passed
✗ = Failed

Weighing Device

Range	Max. Capacity	Readability (d)	Verification Scale Interval (e)	Class
1	10000 lb	0.2 lb	0.2 lb	II



Tolerances according to NIST Handbook 44

Test Load		Tolerance
From	To	
0.0 lb	0.0 lb	0.05 lb
0.2 lb	1000.0 lb	0.2 lb
1000.2 lb	4000.0 lb	0.4 lb

○ As Found
◆ As Left
— Tolerance

Eccentricity and Repeatability

Test	Test Load	Tolerance	As Found		As Left	
			Max. Error / Range	Result	Max. Error / Range	Result
Eccentricity (Max. Error)	2000 lb	0.4 lb	0.2 lb	✓	N/A	N/A
Eccentricity (Range)	2000 lb	0.4 lb	0.4 lb	✓	N/A	N/A
Repeatability (Max. Error)	2000 lb	0.4 lb	0.0 lb	✓	N/A	N/A
Repeatability (Range)	2000 lb	0.4 lb	0.0 lb	✓	N/A	N/A

Max. Error: Maximum of the absolute values of the individual errors.
Range: Difference between largest and smallest measurement value.

Error of Indication

	Reference Value	Tolerance	As Found		As Left	
			Error of Indication	Result	Error of Indication	Result
1	0 lb	0.2 lb	0.0 lb	✓	N/A	N/A
2	1000 lb	0.2 lb	0.0 lb	✓	N/A	N/A
3	2000 lb	0.4 lb	0.0 lb	✓	N/A	N/A
4	3000 lb	0.4 lb	-0.2 lb	✓	N/A	N/A
5	4000 lb	0.4 lb	-0.2 lb	✓	N/A	N/A

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Certificate of Calibration

Certificate Number: 809185

JJ Calibrations, Inc.
7724 SE Aspen Summit Drive
Portland, OR 97266-9217
Phone 503.786.3005
FAX 503.786.2994

PFS TECO
11785 SE Hwy 212
Suite 305
Clackamas, OR 97015

PO: 1110
Order Date: 02/02/2024
Authorized By: N/A

Property #: 209
User: N/A
Department: N/A
Make: Craftsman
Model: CMHT37365
Serial #: 209
Description: Tape Measure, 25'
Procedure: 500614
Accuracy: ± 0.0625"

Calibrated on: 02/15/2024
*Recommended Due: 02/15/2025
Environment: 19 °C 40 % RH
* As Received: Within Tolerance
* As Returned: Within Tolerance
Action Taken: Calibrated
Technician: 126

Remarks: * Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
591A	Mitutoyo	PH-3500	Optical Comparator	09/19/2024	801238

Measurement Data

Parameter / Measurement Description	Range	Unit	Reference	Min	Max	*Error	UUT	Uncertainty	Accredited = ü
Before/After									
Length									
0-1"		Inch	1.000000	0.93750	1.06250	0.00175	0.99825 Inch	1.1E-02	ü
299-300"		Inch	1.00000	0.9375	1.0625	0.0012	0.9988 Inch	1.1E-02	ü

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to the SI through an NMI such as but not limited to National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2017, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless stated in the comments, certificates reflect the "Simple Acceptance Rule" as specified by ILAC G8:2019. Unless otherwise stated, a test uncertainty ratio (TUR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above.
This report may not be reproduced, except in full, without written approval of JJ Calibrations.

Reviewer

3 Issued 02/15/2024 Rev # 15

Inspector

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 33086-206392-4525 **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

13-01811 | Thermocouple Meter/Calibrator | Tegam | SN: 2454186 | Cal: 10/04/2023 | Due: 02/28/2024 | Range: 2400 °F | Report #: 31363-217443-3646
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date:	February 26, 2024	**Reference:**	Navair 17-20ST-95
Recommended Due Date:	February 26, 2025	**Cal-Cert Procedure:**	CP-013
Calibration Frequency:	12 Months	**Indicating System:**	Computer
Manufacturer:	National Instruments	**Temperature:**	70 °F
Type:	Data Logger	**Humidity:**	42% RH
Model Number:	NI 9213	**Asset #:**	216 Booth 2
Serial #:	1E286FA	**Service Location:**	Service Address
Resolution:	0.1 °F	**As Found:**	Pass
Capacity:	2,500 °F	**As Left:**	Pass
Tolerance:	± 2.0 °F		
Thermocouple Type:	K		

Thermocouple LOGGING FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Tunnel	0.00	-0.10	-0.10	-0.10	0.10	0.346
	500.00	499.80	499.80	499.80	-0.20	
	1000.00	1000.00	1000.00	1000.00	0.00	
	1500.00	1499.90	1499.90	1499.90	-0.10	
	2000.00	1999.90	1999.90	1999.90	-0.10	
	2400.00	2399.90	2399.90	2399.90	-0.10	
	0.00	-0.20	-0.20	-0.20	0.20	

Thermocouple LOGGING FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Flue	0.00	-0.30	-0.30	-0.30	0.30	0.346
	500.00	499.70	499.70	499.70	-0.30	
	1000.00	999.80	999.80	999.80	-0.20	
	1500.00	1499.80	1499.80	1499.80	-0.20	
	2000.00	1999.80	1999.80	1999.80	-0.20	
	2400.00	2399.70	2399.70	2399.70	-0.30	
	0.00	-0.30	-0.30	-0.30	0.30	

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	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter A	0.00	-0.50	-0.50	-0.50	0.50	
	500.00	499.50	499.50	499.50	-0.50	
	1000.00	999.70	999.70	999.70	-0.30	
	1500.00	1499.60	1499.60	1499.60	-0.40	0.346
	2000.00	1999.50	1999.50	1999.50	-0.50	
	2400.00	2399.50	2399.50	2399.50	-0.50	
	0.00	-0.50	-0.50	-0.50	0.50	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Back	0.00	-0.60	-0.60	-0.60	0.60	
	500.00	499.40	499.40	499.40	-0.60	
	1000.00	999.50	999.50	999.50	-0.50	
	1500.00	1499.50	1499.50	1499.50	-0.50	0.346
	2000.00	1999.40	1999.40	1999.40	-0.60	
	2400.00	2399.40	2399.40	2399.40	-0.60	
	0.00	-0.60	-0.60	-0.60	0.60	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Catalyst	0.00	-0.8	-0.8	-0.8	0.80	
	500.00	499.30	499.30	499.30	-0.70	
	1000.00	999.40	999.40	999.40	-0.60	
	1500.00	1499.30	1499.30	1499.30	-0.70	0.346
	2000.00	1999.30	1999.30	1999.30	-0.70	
	2400.00	2399.20	2399.20	2399.20	-0.80	
	0.00	-0.7	-0.7	-0.7	0.70	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter A	0.00	-0.90	-0.90	-0.90	0.90	
	500.00	499.20	499.20	499.20	-0.80	
	1000.00	999.30	999.30	999.30	-0.70	
	1500.00	1499.20	1499.20	1499.20	-0.80	0.346
	2000.00	1999.20	1999.20	1999.20	-0.80	
	2400.00	2399.10	2399.10	2399.10	-0.90	
	0.00	-0.90	-0.90	-0.90	0.90	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Left	0.00	-0.80	-0.80	-0.80	0.80	
	500.00	499.20	499.20	499.20	-0.80	
	1000.00	999.40	999.40	999.40	-0.60	
	1500.00	1499.30	1499.30	1499.30	-0.70	0.346
	2000.00	1999.20	1999.20	1999.20	-0.80	
	2400.00	2399.20	2399.20	2399.20	-0.80	
	0.00	-0.80	-0.80	-0.80	0.80	

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Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1E286FA

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Right	0.00	-0.90	-0.90	-0.90	0.90	
	500.00	499.10	499.10	499.10	-0.90	
	1000.00	999.20	999.20	999.20	-0.80	
	1500.00	1499.20	1499.20	1499.20	-0.80	0.346
	2000.00	1999.10	1999.10	1999.10	-0.90	
	2400.00	2399.00	2399.00	2399.00	-1.00	
	0.00	-1.00	-1.00	-1.00	1.00	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter B	0.00	0.00	0.00	0.00	0.00	
	500.00	500.50	500.50	500.50	0.50	
	1000.00	1000.20	1000.20	1000.20	0.20	
	1500.00	1499.80	1499.80	1499.80	-0.20	0.346
	2000.00	1999.40	1999.40	1999.40	-0.60	
	2400.00	2399.00	2399.00	2399.00	-1.00	
	0.00	0.00	0.00	0.00	0.00	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Top	0.00	-1.20	-1.20	-1.20	1.20	
	500.00	498.90	498.90	498.90	-1.10	
	1000.00	999.00	999.00	999.00	-1.00	
	1500.00	1498.90	1498.90	1498.90	-1.10	0.346
	2000.00	1998.90	1998.90	1998.90	-1.10	
	2400.00	2398.70	2398.70	2398.70	-1.30	
	0.00	-1.20	-1.20	-1.20	1.20	

Remarks:

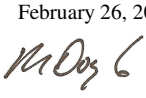
We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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

Service Engineer: Steven White **Date:** February 26, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-206392-4525

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Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 33086-206392-4525-B **Customer PO#:** 1109
Customer Name: PFS TECO
Customer Address: 1507 Matt Pass
City: Cottage Grove **State:** WI **Zip:** 53527
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

13-01811 | Thermocouple Meter/Calibrator | Tegam | SN: 2454186 | Cal: 10/04/2023 | Due: 02/28/2024 | Range: 2400 °F | Report #: 31363-217443-3646
LP-01782 | Thermo-Hygrometer | Comark | SN: 06247790052 | Cal: 01/24/2024 | Due: 01/31/2025 | Range: 122 °F 95 %RH | Report #: 32568-205513-3646

Instrument Data

Calibration Date:	February 26, 2024	**Reference:**	Navair 17-20ST-95
Recommended Due Date:	February 26, 2025	**Cal-Cert Procedure:**	CP-013
Calibration Frequency:	12 Months	**Indicating System:**	Computer
Manufacturer:	National Instruments	**Temperature:**	70 °F
Type:	Data Logger	**Humidity:**	42% RH
Model Number:	NI 9213	**Asset #:**	216 Booth 2
Serial #:	1E286FA	**Service Location:**	Service Address
Resolution:	0.1 °F	**As Found:**	Pass
Capacity:	2,500 °F	**As Left:**	Pass
Tolerance:	± 2.0 °F		
Thermocouple Type:	K		

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Bottom	0.00	-1.30	-1.30	-1.30	1.30	0.346
	500.00	498.80	498.80	498.80	-1.20	
	1000.00	998.90	998.90	998.90	-1.10	
	1500.00	1498.90	1498.90	1498.90	-1.10	
	2000.00	1998.70	1998.70	1998.70	-1.30	
	2400.00	2398.60	2398.60	2398.60	-1.40	
	0.00	-1.30	-1.30	-1.30	1.30	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter B	0.00	-1.30	-1.30	-1.30	1.30	0.346
	500.00	498.80	498.80	498.80	-1.20	
	1000.00	998.90	998.90	998.90	-1.10	
	1500.00	1498.90	1498.90	1498.90	-1.10	
	2000.00	1998.70	1998.70	1998.70	-1.30	
	2400.00	2398.60	2398.60	2398.60	-1.40	
	0.00	-1.30	-1.30	-1.30	1.30	

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Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1E286FA

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter C	0.00	-1.50	-1.50	-1.50	1.50	0.346
	500.00	498.60	498.60	498.60	-1.40	
	1000.00	998.70	998.70	998.70	-1.30	
	1500.00	1498.70	1498.70	1498.70	-1.30	
	2000.00	1998.60	1998.60	1998.60	-1.40	
	2400.00	2398.40	2398.40	2398.40	-1.60	
	0.00	-1.50	-1.50	-1.50	1.50	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter C	0.00	-1.50	-1.50	-1.50	1.50	0.346
	500.00	498.70	498.70	498.70	-1.30	
	1000.00	998.80	998.80	998.80	-1.20	
	1500.00	1498.70	1498.70	1498.70	-1.30	
	2000.00	1998.60	1998.60	1998.60	-1.40	
	2400.00	2398.50	2398.50	2398.50	-1.50	
	0.00	-1.40	-1.40	-1.40	1.40	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Ambient	0.00	-1.2	-1.2	-1.2	1.20	0.346
	20.00	18.90	18.90	18.90	-1.10	
	40.00	39.00	39.00	39.00	-1.00	
	60.00	58.90	58.90	58.90	-1.10	
	80.00	79.00	79.00	79.00	-1.00	
	100.00	98.90	98.90	98.90	-1.10	
	0.00	-1.1	-1.1	-1.1	1.10	

Remarks:

15 Channels, Ambient is Type-T calibrated from 0 to 100°F per customer request.

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

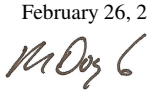
This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.

Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.

All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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

Service Engineer: Steven White **Date:** February 26, 2024

Technical Manager: Marshall Doyle **Signature:** 

Report #: 33086-206392-4525-B

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Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

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Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 38860-206392-21 **Customer PO#:** 1126
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

14-00235 | Thermocouple Meter | Tegam | SN: T-276988 | Cal: 08/23/2024 | Due: 08/31/2025 | Vendor: Cal-Cert | Range: 2400 °F | Report #: 36408-30865-3646
14-01349 | Thermo-Hygrometer | Comark | SN: 06210350162 | Cal: 08/23/2024 | Due: 08/31/2025 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 36408-71148-5

Instrument Data

Calibration Date:	February 26, 2025	**Reference:**	Navair 17-20ST-95
Recommended Due Date:	February 26, 2026	**Cal-Cert Procedure:**	CP-013
Calibration Frequency:	12 Months	**Indicating System:**	Computer
Manufacturer:	National Instruments	**Temperature:**	70 °F
Type:	Data Logger	**Humidity:**	32% RH
Model Number:	NI 9213	**Asset #:**	216 Booth 2
Serial #:	1E286FA	**Service Location:**	Service Address
Resolution:	0.1 °F	**As Found:**	Pass
Capacity:	2,500 °F	**As Left:**	Pass
Tolerance:	± 2.0 °F		
Thermocouple Type:	K		

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Tunnel	0.00	0.00	0.00	0.00	0.00	0.436
	500.00	500.00	500.00	500.00	0.00	
	1000.00	999.90	999.90	999.90	-0.10	
	1500.00	1499.80	1499.80	1499.90	-0.15	
	2000.00	1999.70	1999.70	1999.80	-0.25	
	2400.00	2399.60	2399.60	2399.70	-0.35	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Flue	0.00	-0.20	-0.20	-0.20	0.20	0.436
	500.00	499.80	499.80	499.90	-0.15	
	1000.00	999.80	999.80	999.80	-0.20	
	1500.00	1499.80	1499.80	1499.80	-0.20	
	2000.00	1999.50	1999.50	1999.50	-0.50	
	2400.00	2399.50	2399.50	2399.50	-0.50	

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Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1E286FA

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter A	0.00	0.00	0.00	0.00	0.00	0.436
	500.00	499.90	499.90	499.90	-0.10	
	1000.00	999.90	999.90	999.90	-0.10	
	1500.00	1499.80	1499.80	1499.80	-0.20	
	2000.00	1999.80	1999.80	1999.80	-0.20	
	2400.00	2399.60	2399.60	2399.70	-0.35	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Back	0.00	-0.40	-0.40	-0.40	0.40	0.436
	500.00	499.50	499.50	499.50	-0.50	
	1000.00	999.60	999.60	999.50	-0.45	
	1500.00	1499.50	1499.50	1499.40	-0.55	
	2000.00	1999.20	1999.20	1999.30	-0.75	
	2400.00	2399.20	2399.20	2399.20	-0.80	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Catalyst	0.00	(0.60)	(0.60)	(0.60)	0.60	0.436
	500.00	499.40	499.40	499.40	-0.60	
	1000.00	999.40	999.40	999.40	-0.60	
	1500.00	1499.30	1499.30	1499.20	-0.75	
	2000.00	1999.10	1999.10	1999.10	-0.90	
	2400.00	2398.80	2398.80	2398.90	-1.15	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter A	0.00	-0.70	-0.70	-0.90	0.80	0.511
	500.00	499.20	499.20	499.10	-0.85	
	1000.00	999.20	999.20	999.20	-0.80	
	1500.00	1499.00	1499.00	1499.10	-0.95	
	2000.00	1999.00	1999.00	1998.90	-1.05	
	2400.00	2398.80	2398.80	2398.70	-1.25	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Left	0.00	-0.80	-0.80	-0.80	0.80	0.436
	500.00	499.10	499.10	499.10	-0.90	
	1000.00	999.20	999.20	999.10	-0.85	
	1500.00	1499.00	1499.00	1499.10	-0.95	
	2000.00	1998.90	1998.90	1998.90	-1.10	
	2400.00	2398.60	2398.60	2398.70	-1.35	

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Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1E286FA

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Right	0.00	-1.00	-1.00	-1.00	1.00	0.436
	500.00	499.00	499.00	498.90	-1.05	
	1000.00	999.00	999.00	999.00	-1.00	
	1500.00	1498.80	1498.80	1498.90	-1.15	
	2000.00	1998.70	1998.70	1998.80	-1.25	
	2400.00	2398.50	2398.50	2398.60	-1.45	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter B	0.00	0.00	0.00	0.00	0.00	0.511
	500.00	500.40	500.40	500.50	0.45	
	1000.00	1000.10	1000.10	1000.20	0.15	
	1500.00	1499.80	1499.80	1499.60	-0.30	
	2000.00	1999.30	1999.30	1999.20	-0.75	
	2400.00	2398.60	2398.60	2398.80	-1.30	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Top	0.00	-1.20	-1.20	-1.20	1.20	0.511
	500.00	498.80	498.80	498.70	-1.25	
	1000.00	998.80	998.80	998.80	-1.20	
	1500.00	1498.70	1498.70	1498.60	-1.35	
	2000.00	1998.60	1998.60	1998.40	-1.50	
	2400.00	2398.30	2398.30	2398.30	-1.70	

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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

Service Engineer: Samuel Owens **Date:** February 26, 2025

Quality Manager: Tony Lewandowski **Signature:**

Report #: 38860-206392-21

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Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

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Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 38860-206392-21-B **Customer PO#:** 1126
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Ethan Frederick
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

14-00235 | Thermocouple Meter | Tegam | SN: T-276988 | Cal: 08/23/2024 | Due: 08/31/2025 | Vendor: Cal-Cert | Range: 2400 °F | Report #: 36408-30865-3646
14-01349 | Thermo-Hygrometer | Comark | SN: 06210350162 | Cal: 08/23/2024 | Due: 08/31/2025 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 36408-71148-5

Instrument Data

Calibration Date:	February 27, 2025	**Reference:**	Navair 17-20ST-95
Recommended Due Date:	February 27, 2026	**Cal-Cert Procedure:**	CP-013
Calibration Frequency:	12 Months	**Indicating System:**	Computer
Manufacturer:	National Instruments	**Temperature:**	65 °F
Type:	Data Logger	**Humidity:**	40% RH
Model Number:	NI 9213	**Asset #:**	216 Booth 2
Serial #:	1E286FA	**Service Location:**	Service Address
Resolution:	0.1 °F	**As Found:**	Pass
Capacity:	2,400 °F	**As Left:**	Pass
Tolerance:	± 3.0 °F		
Thermocouple Type:	K		

Thermocouple LOGGING FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Bottom	0.00	-1.50	-1.50	-1.50	1.50	
	500.00	498.50	498.50	498.60	-1.45	
	1000.00	998.50	998.50	998.60	-1.45	
	1500.00	1498.40	1498.40	1498.40	-1.60	0.511
	2000.00	1998.20	1998.20	1998.00	-1.90	
	2400.00	2397.90	2397.90	2397.80	-2.15	
	0.00	-1.50	-1.50	-1.50	1.50	

Thermocouple LOGGING FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Meter B	0.00	-1.60	-1.60	-1.60	1.60	
	500.00	498.50	498.50	498.50	-1.50	
	1000.00	998.60	998.60	998.50	-1.45	
	1500.00	1498.40	1498.40	1498.30	-1.65	0.436
	2000.00	1998.10	1998.10	1998.00	-1.95	
	2400.00	2397.70	2397.70	2397.70	-2.30	
	0.00	-1.50	-1.50	-1.60	1.55	

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Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1E286FA

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter C	0.00	-1.70	-1.70	-1.70	1.70	0.436
	500.00	498.20	498.20	498.30	-1.75	
	1000.00	998.30	998.30	998.30	-1.70	
	1500.00	1498.20	1498.20	1498.10	-1.85	
	2000.00	1997.90	1997.90	1997.90	-2.10	
	2400.00	2397.50	2397.50	2397.60	-2.45	
	0.00	-1.70	-1.70	-1.70	1.70	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter C	0.00	-1.50	-1.50	-1.50	1.50	0.436
	500.80	498.50	498.50	498.50	-2.30	
	1000.40	998.50	998.50	998.40	-1.95	
	1500.00	1498.30	1498.30	1498.20	-1.75	
	1999.40	1998.00	1998.00	1998.00	-1.40	
	2399.10	2397.70	2397.70	2397.60	-1.45	
	0.00	-1.50	-1.50	-1.60	1.55	

	Thermocouple LOGGING FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Ambient	0.00	(1.90)	(1.90)	(1.80)	1.85	0.576
	20.00	18.30	18.30	18.50	-1.60	
	40.00	38.40	38.40	38.60	-1.50	
	60.00	58.40	58.40	58.40	-1.60	
	80.00	78.50	78.50	78.60	-1.45	
	100.00	98.50	98.50	98.60	-1.45	
	0.00	(1.80)	(1.80)	(1.50)	1.65	

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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Service Engineer: Samuel Owens **Date:** February 27, 2025

Quality Manager: Tony Lewandowski **Signature:**

Report #: 38860-206392-21-B

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DICK MUNNS COMPANY
LIQUID & GAS FLOW CALIBRATION

ISO 17025:2017
ACCREDITED LABORATORY
Cert# CL-122

IAS ACCREDITED
Calibration Laboratory

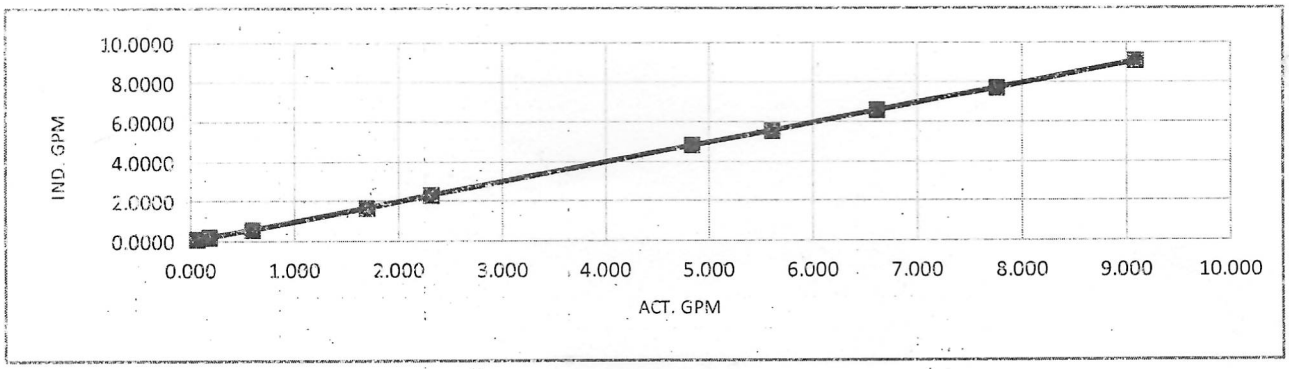
CERTIFICATE OF CALIBRATION

CUSTOMER:	**PFS – TECO** CLACKAMAS, OR	**CALIBRATION DATE:**	05/06/24
PO NUMBER:	1112	**CALIBRATION DUE:**	05/06/25
INST. MANUFACTURER:	ENDRESS + HAUSER	**PROCEDURE:**	NAVAIR17-20MG,NIST250
INST. DESCRIPTION:	MAGNETIC FLOW METER	**CALIBRATION FLUID:**	H2O @ 70°F
MODEL NUMBER:	DMA20-AAAA1	**ARRIVAL CONDITIONS:**	WITHIN MFG SPEC.
SERIAL NUMBER:	RA296019000 (ID# 184)	**RETURNED CONDITIONS:**	WITHIN MFG. SPEC.
RATED ACCURACY:	+/- .8% RD + 2% F.S.	**AMBIENT CONDITIONS:**	764mmHGA 57%RH 70°F
UNCERTAINTY GIVEN:	TOTAL measurement uncertainty +/- .168%RD k=2	**CERTIFICATE FILE #:**	501342.2024

NOTES: DECISION RULE: SIMPLE ACCEPTANCE. MEASUREMENT UNCERTAINTIES NOT TAKEN INTO CONSIDERATION WHEN DETERMINING PASS/FAIL

METER SPAN: 2 – 10 VDC = 0.026 – 9 GPM

TEST POINT NUMBER	UUT INDICATED VDC OUT	UUT INDICATED GPM	DM.STD. ACTUAL GPM	LOWER LIMITS GPM	UPPER LIMITS GPM
1	2.032	0.062	0.0701	-0.2185	0.3425
2	2.141	0.184	0.1754	-0.0972	0.4652
3	2.509	0.597	0.5421	0.3134	0.8806
4	3.490	1.697	1.6344	1.4093	1.9847
5	4.041	2.315	2.2937	2.0180	2.6120
6	6.289	4.837	4.8180	4.5223	5.1517
7	6.975	5.607	5.5450	5.2730	5.9410
8	7.875	6.616	6.5762	6.2534	6.9786
9	8.895	7.760	7.7024	7.3804	8.1396
10	10.080	9.090	9.0724	8.6914	9.4886



STANDARDS USED:

A28 VOL.PROVER .03-5GPM (.1-19LPM).02%RD. TRACE# 1615794932,1615795146	*DUE*	*05/17/24*
A33 VOL.PROVER 0-50GPM (1-189LPM).05%RD TRACE# 1615794932,1615795146	*DUE*	*05/19/24*
A450 DATA AQ CART .008%RD HZ,VDC,MADC,DEG.F TRACE# 161683031933,1553509490	DUE	06/12/24

All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) and the Unit Under Test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed according to the shown procedure. The use of IAS/ILAC logo indicates calibrations are in accordance to ISO/IEC 17025:2017.

Dick Munns Company · 11133 Winners Circle, Los Alamitos, CA 90720
Phone: 714-827-1215 · www.dickmunns.com

This Calibration Certificate shall not be reproduced except, in full, without approval by Dick Munns Company. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Issuing Date: 05/06/2024

Approved By:

Cal. Technician: E.A

Calibrated at: ✓ Lab
___ On-Site (Customer's)

IN CASE OF EMERGENCY: CALL 1-800-645-4633 SDS ID: P-18-0301-H DO NOT REMOVE THIS LABEL

Lot No. 70086426104
Cylinder No. DT0042934
Part No. NI CD17CO8E-AS
Volume: 99 ft3
Fill Date: 09/17/2024
Expiration Date: 09/26/2032

ProSpec
By Linde

Linde Gas & Equipment Inc.
6700 S. Alameda...
Los Angeles, ... 8

UN1956 Compressed gas, n.o.s. (Nitrogen, Oxygen)



EPA Protocol

Molar Concentration	Component	CAS
17.32 %	Carbon dioxide	124-38-9
4.35 %	Carbon monoxide	630-08-0
16.96 %	Oxygen	7782-44-7
Balance	Nitrogen	7727-37-9

Danger



CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED. MAY DAMAGE FERTILITY OR THE UNBORN CHILD. CAUSES DAMAGE TO ORGANS THROUGH PROLONGED OR REPEATED EXPOSURE. MAY INCREASE RESPIRATION AND HEART RATE. ASPHYXIATING EVEN WITH ADEQUATE OXYGEN.

TLV:

Carbon dioxide 5000 ppm
Carbon monoxide 25 ppm

Obtain special instructions before use; Do not handle until all safety precautions have been read and understood; Do not breathe gas/vapours; Wash exposed skin thoroughly after handling; Do not eat, drink or smoke when using this product; Wear protective gloves/protective clothing/eye protection/face protection; IF EXPOSED OR CONCERNED: Get medical advice/attention; Get medical advice/attention if you feel unwell; Store locked up; Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements; Use and store only outdoors or in a well-ventilated place; Use a back flow preventive device in the piping; Use only with equipment rated for cylinder pressure; Do not open valve until connected to equipment prepared for use; Close valve after each use and when empty. Protect from sunlight when ambient temperature exceeds 52°C (125°F); Avoid breathing gas, vapors; IF INHALED: Remove person to fresh air and keep comfortable for breathing. ; Call a POISON CENTER or doctor/physician.

FIRST AID

IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, trained personnel should give oxygen. Call a physician.

IF IN EYES: Immediately ... minutes.Hold the eyelids open and away from the eyeballs to ensure that all surfaces ...



Compressed gas, n.o.s.
(Carbon Monoxide, Carbon Dioxide, Oxygen, Nitrogen)
UN1956

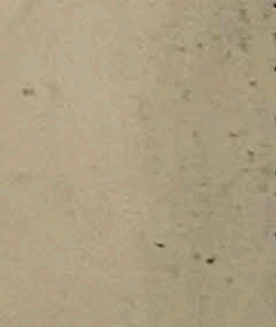
SPG 5P10162.5VM2
Part Number

Primary Standard, +/- 0.02% Absolute

2.500 % Carbon Monoxide	CAS:	630-08-0
10.00 % Carbon Dioxide	CAS:	124-38-9
10.00 % Oxygen	CAS:	7782-44-7
Balance Nitrogen	CAS:	7727-37-9

DANGER: CAUSES DAMAGE TO ORGANS THROUGH PROLONGED OR REPEATED EXPOSURE. CONTAINS GAS UNDER PRESSURE; MAY EXPLODE WHEN HEATED. MAY DAMAGE FERTILITY OR THE UNBORN CHILD. MAY INCREASE RESPIRATION AND HEARTRATE. Use only with equipment of compatible materials of construction and rated for cylinder pressure. Protect from sunlight when ambient temperature exceeds 52C (125F). Use a back flow preventive device in the piping. Close valve after each use and when empty. Do not open valve until connected to equipment prepared for use. Obtain special instructions before use. Protect from sunlight. Store in a well-ventilated place. IF exposed or concerned: Get medical advice. Store locked up. Dispose of contents/container in accordance with container/supplier owner instructions. Do not handle until all safety precautions have been read and understood. Do not breathe gas. Wash hands throroughly after handling. Do not eat, drink, or smoke when using this product. Wear protective gloves, protective clothing, eye protection, and/or face protection. Read and follow the Safety Data Sheet (SDS) before use.

FIRST AID: IF ON SKIN: wash with plenty of water. IF INHALED: Remove person to fresh air and keep comfortable for breathing.IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing. IF exposed or concerned: Get medical advice.





WARNING: This product can expose you to Carbon Monoxide which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Lot No : 1-053-122
Serial Number: CC341544
SPG 5P10162.5VM2
Part Number
PO # 206493
Expires: 2-2024

NorLAB

To Order Call: 800-657-6672

In Emergency Call: 1-800-424-9300

NorLAB, Inc.
698 W Gowen Road
Boise, Idaho, 83705

Appendix F - Efficiency Measurement and Calculation Discussion

When hydronic heaters are tested to ASTM E2618, a discrepancy between efficiency results has been repeatedly observed.

Efficiency is calculated two ways. The first is delivered efficiency, which measures the flow rate and temperature of load water to determine energy output, and the weight, moisture content, and specific energy content of the fuel load to determine input.

The second is the stack loss method, which uses the same method to determine energy input. Output, however, is calculated by measuring energy lost up the flue rather than output energy directly.

Because the stack loss method (SLM) accounts only for energy lost in flue gasses, it does not account for energy lost through the jacket of the appliance or piping system. Delivered efficiency does account for these sources of loss, as it measures only the useful heat extracted from the heat exchanger. Therefore, if both methods are measured with perfect accuracy, SLM efficiency should always be higher than delivered efficiency. In testing, however, this is not always the case. In some instances, delivered efficiency has been measured as up to 5 percentage points higher than SLM.

This discrepancy is not well understood and may simply be due to the realities of measurement uncertainty and variability in testing. However, we have identified some issues with the test method that could contribute to systemic errors that may, alone or in combination, be the source of this discrepancy.

Moisture Content Readings

One possible cause of the issue is over-reporting of fuel moisture content. Fuel moisture measurement techniques are generally intended for use with dimensional lumber, and may not account for the more irregular properties of cordwood.

ASTM E2618 specifies that moisture meter electrode reading depth “shall be 1/4 the thickness of the fuel piece or 3/4 in. (19 mm), whichever is greater.” This language is pulled directly from EPA Method 28, a method that uses dimensional Douglas fir lumber. While this standard is appropriate for milled lumber with smooth, flat faces, it may not accurately account for moisture variation in the cross section of cordwood pieces, which, due to their irregular shape, can have a much higher ratio of surface area to volume.

Accurate moisture measurement for dimensional lumber has been studied extensively and is well understood. Research on measurement of cordwood pieces, however, is very limited. Therefore moisture measurement uncertainty cannot be definitively identified as the source of efficiency calculation discrepancy, but it cannot be ruled out. More study on this issue is recommended.

A brief explanation of why over-reported fuel moisture can cause a higher delivered efficiency result as compared for SLM efficiency:

Delivered efficiency calculation accounts for fuel moisture in determining total input. Higher fuel moisture readings mean lower dry fuel weight. Dry fuel weight is directly proportional to total BTU input. Therefore, any overstatement fuel moisture content will cause a proportional understatement of BTU input.

Fuel moisture is not used for determining output. Only heat exchanger load flow rate and temperature differential are used. Therefore total output is fixed with respect to fuel moisture content, and any error therein will not affect that side of the efficiency calculation. Lower input with a fixed output of course means higher efficiency result.

Stack loss method, conversely, accounts for fuel moisture on both sides of the efficiency equation. Input is calculated in the same way as in the delivered efficiency method. However, the output calculation uses that same fuel moisture data in its chemical balance to determine stack flow rate and energy content.

The two moisture terms do not fully cancel in the final efficiency calculation, but output will still scale with respect to moisture content, unlike with delivered efficiency. This dramatically reduces the effect of systemic error in moisture content readings.

Fuel Higher Heating Value

ASTM E2618 specifies that all fuel shall have an assumed BTU content of 8600 BTU/lb. While this may be an acceptable average value, actual BTU content can vary significantly.

Delivered efficiency results are directly proportional to the fuel HHV, so a 5% error in HHV value would translate to a 5% error in delivered efficiency result.

Like moisture content as described above, SLM calculations are significantly less sensitive to fuel HHV. For example, a 5% change to HHV results in less than 1% change in stack loss efficiency result

Appliance Heat Capacity

Another possible source of the discrepancy is assumptions made in calculating the energy stored in the appliance. ASTM E2618 specifies that the heat retained in the body of the appliance, for the purposes of efficiency calculation, is determined by multiplying the weight of the dry appliance, by the heat capacity of steel, by the average temperature of the input and output water.

This assumes that the entire appliance is constructed of steel and that its average temperature is equal to that of the water it contains. Both assumptions can cause an underreporting of delivered efficiency.

Modern appliances are not entirely steel- most notably, they can contain up to several hundred pounds of refractory material. Refractory material has a heat capacity approximately double that of steel. This means that the heat capacity of a given appliance may be substantially higher than the value used by the delivered efficiency calculation.

Compounding the issue is that refractory temperatures can be far, far higher than the temperature of the water. While water in a hydronic heater will not exceed 100C, when a modern downdraft heater is in an on-cycle, its refractory can exceed 800C.

Taken together, these factors mean that energy content stored in the body of the appliance can be substantially underreported. If the appliance is operating at a high temperature at the start of a run, this can cause delivered efficiency to be over-reported. This is because the large amount of “free,” un-accounted energy stored in the appliance will be transferred to the heat exchanger over the course of the run. Conversely, if the appliance starts the run at a low temperature and ends at a high temperature, this stored energy is not accounted for and delivered efficiency would therefore be under reported.

Stack Loss Method Interval Calculations

The stack loss method was not designed for cycling appliances. Its calculations make several assumptions that do not apply to hydronic heaters.

It should be noted that the efficiency discrepancy has been observed for maximum output runs, during which appliances do not cycle, so it is unlikely that these issues with the SLM account for the entirety of the issue. They are, however, a likely contributory factor. These include:

- That fuel moisture is constant until 43 minutes into the test run, and decays exponentially from there. This does not hold for a cycling appliance, for which test fuel moisture will only drop during on cycles. This means that actual fuel moisture (and therefore actual dry weight) will increasingly deviate from assumed moisture content over the course of the run, affecting mass balance and energy loss calculations.
- That combustion is continuous. Stack loss calculation requires a precise determination of stack flow, for which a mass balance based on weight loss and flue gas constituents are used. This breaks down, however, when an appliance is cycled off. SLM calculations are proportional to fuel mass loss for a given interval, so off-cycles are somewhat accounted for, but actual off cycles do not perfectly correspond with observed periods of zero weight loss. In fact, due to extreme changes in draft pressure, weight fluctuations (both up and down) unrelated to actual fuel combustion are frequently recorded during cycling behavior. These fluctuations do not simply “cancel out” as stack conditions would have to be held constant for all noise to be averaged out – when an appliance cycles, stack conditions of course change substantially.