
Greentech Manufacturing Inc.

Project # F25-436

Model: BIO200

Type: Residential Pellet-Fired Hydronic
Heater

Original Report Date: 11/17/2025

Revision Date: 09/03/2026

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

Contact: Ryan Horne
Greentech Manufacturing, Inc.
2716 Crescent Dr.
International Falls, MN 56649

Prepared by: Aaron Kravitz
Revision by: Lyrik Pitzman



**11785 SE Highway 212 – Suite 305
Clackamas, OR 97015-9050
(503) 650-0088
WWW.PFSTECO.COM**

Revision Summary

11/17/2025 – Original Issue

9/3/2026 – Revision 1 prepared based on clients request

- Filled out latest EPA checklist
- Fixed a few minor errors in the report picked up during the review.
- Replaced calibration certificates with the correct documents.

Contents

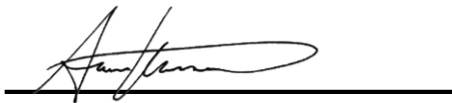
Affidavit.....	3
Introduction	4
Notes	4
Wood Heater Identification and Testing.....	5
Test Procedures and Equipment	6
Results	7
Table 1A. Data Summary Part A.....	7
Table 1B. Data Summary Part B.....	7
Table 1C. Hangtag Information.....	8
Table 2A. Heating Season Weighting	8
Table 2B. Year-Round Use Weighting	8
Table 3. CO emissions & First Hour PM.....	8
Test Run Narrative.....	9
Run 1	9
Run 2	9
Run 3.....	9
Run 4	9
Efficiency Discussion.....	10
Test Conditions Summary	11
Appliance Operation and Test Settings.....	11
Low Burn Rate Discussion.....	11
Appliance Rear.....	13
Appliance Installed in Test Booth	14
Test Fuel Properties.....	15
Sample Collection.....	17
Reagents and Standards.....	19
Calibration and Standardization	19
Procedures.....	20
Appliance Sealing and Storage.....	22
Sealing Label.....	22
Sealed Unit	22
List of Appendices	23

Affidavit

PFS-TECO was contracted by Greentech Manufacturing Inc. to provide testing services for the BIO200 Pellet 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 9/24/2025 and ending on 9/29/2025. PFS-TECO's Portland Laboratory is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed ASTM E2618-13, *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 Laboratory Accreditation Certificate Number 4. PFS-TECO is accredited by ANAB 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

Greentech Manufacturing Inc. contracted with PFS-TECO to perform EPA certification testing on the BIO200 Pellet 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 heat draw in accordance with ASTM E2618.
- 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 was performed. All runs have been found to be appropriate, no anomalies occurred. See the Run Narrative section for further detail on each run.
- Gasket and filter samples were tared and weighted post testing in pairs per EPA Alt-154 - see attached letter in Appendix A.
- Delivered efficiency and stack loss efficiency were calculated for each run. Delivered efficiency is computed by comparing total fuel energy input to delivered heat energy output in accordance with ASTM E2618. Stack loss efficiency is calculated according to CSA B415.1. Complete data and calculations are shown in Appendix A.

Wood Heater Identification and Testing

- Appliance Tested: **BIO200**
- PFS Tracking Number: **230**
- Manufacturer: **Greentech Manufacturing, Inc.**
- Catalyst: **No**
- Type: **Pellet-Fired Hydronic Heater**
- Style: **Outdoor**
- Date Received: **Monday, September 22, 2025**
- Testing Period – Start: **Wednesday, September 24, 2025**
Finish: **Monday, September 29, 2025**
- Test Location: **PFS TECO**
11785 SE Hwy 212
Clackamas, OR 97015
- Elevation: **~131 Feet above sea level**
- Test Technician(s): **Aaron Kravitz**
- Observers: **Cody Holmestead of Greentech**

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
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
204B	Dilution Tunnel centroid transducer
55	Apex Ambient Air Sample Box
137	California Analytical ZRE CO2/CO/O2 IR ANALYZER
95	Anemometer
97	10 lb audit weight
239	Ohaus Analytical Balance
109A/B	Troemner 100mg/200mg Audit Weights
141	Microtector
199	Mettler 10,000lb floor scale w/digital weight indicator
197	Omega Water Flow Meter
216	Temperature Logger
DT0042934	Gas Analyzer Calibration Span Gas
CC341544	Gas Analyzer Calibration Mid Gas

Barometric Pressure data was taken from a local National Weather Service station, corrected for altitude differences in accordance with ASTM E2515 6.1.2.

Results

A total of 4 test runs were performed on the BIO200. The weighted average year-round use emissions rate for the 4 run test series was measured to be **0.082 g/lb/mmBTU heat output** with year-round average delivered efficiency of **89%**. The maximum emissions rate for any one burn was **0.089 lb/mmBTU heat output**. The average CO emission rate for the 4 tests was **0.08 g/min**. The Greentech Manufacturing Inc. BIO200 Pellet fired hydronic heater meets the compliance limit for particulate matter emission limit of ≤ 0.10 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

Category	Run No	Load % Capacity	Target Load	Actual Load	Actual Load	Θ	W_{fuel}	MC_{ave}	Q_{in}	Q_{out}
			BTU/hr	BTU/hr	% of max	Test Duration	Wood Wt	Wood Moisture	Heat Input (HHV)	Heat Output
			BTU/hr	BTU/hr	% of max	hrs	lb	% DB	BTU	BTU
I	2	$\leq 15\%$ of max	<31,800	23,599	11.1%	4.00	13.3	5.1%	105,502	94,396
II	3	16-24% of max	33,920 - 50,880	42,350	20.0%	4.00	23.9	5.1%	189,587	169,402
III	4	25-50% of max	53,000 - 106,000	87,905	41.5%	4.00	49.9	5.1%	395,832	351,621
IV	1	Max capacity	212,000	193,021	91.0%	4.00	110.6	5.1%	877,335	772,085

Table 1B. Data Summary Part B

Category	Run No	Load % Capacity	T_{2Min}	E_T	E	E	$E_{g/hr}$	$E_{g/kg}$	η_{del}	H_{SLM}
			Min Return Temp	Total PM Emissions	PM Output Based	PM Output Based	PM Rate	PM Factor	Delivered Efficiency	Stack Loss Efficiency
			$^{\circ}F$	g	lb/mmBTU Out	g/MJ	g/hr	g/kg	%	%
I	2	< 15% of max	165.7	3.7	0.087	0.038	0.94	0.65	89.5%	88.2%
II	3	16-24% of max	173.6	5.7	0.075	0.032	1.43	0.56	89.4%	88.1%
III	4	25-50% of max	162.2	13.1	0.082	0.035	3.28	0.61	88.8%	87.7%
IV	1	Maximum	136.6	21.0	0.060	0.026	5.25	0.44	88.0%	87.2%

Table 1C. Hangtag Information

MANUFACTURER:	Greentech		
MODEL NUMBER:	BIO200		
MAXIMUM OUTPUT RATING:	Q_{max}	212,000	BTU/HR
ANNUAL EFFICIENCY RATING:	η_{avg}	89%	(Using higher heating value)
PARTICLE EMISSIONS:	E_{avg}	1.9	GRAMS/HR (average)
		0.08	LBS/MILLION BTU OUTPUT
CARBON MONOXIDE:	$O_{g/MIN}$	0.06	GRAMS/MINUTE

Table 2A. Heating Season Weighting

Category	Weighting Factor (F_i)	$\eta_{del, i} \times F_i$	$E_{g/MJ, i} \times F_i$	$E_{g/kg, i} \times F_i$	$E_{lb/mmBTU Out, i} \times F_i$	$E_{g/hr, i} \times F_i$	$CO_{g/min, i} \times F_i$
I	0.175	15.7%	0.007	0.114	0.015	0.164	0.009
II	0.275	24.6%	0.009	0.153	0.021	0.394	0.020
III	0.450	40.0%	0.016	0.274	0.037	1.478	0.025
IV	0.100	8.8%	0.003	0.044	0.006	0.525	0.015
Total	1.000	89.0%	0.034	0.585	0.079	2.561	0.068

Table 2B. Year-Round Use Weighting

Category	Weighting Factor (F_i)	$\eta_{del, i} \times F_i$	$E_{g/MJ, i} \times F_i$	$E_{g/kg, i} \times F_i$	$E_{lb/mmBTU Out, i} \times F_i$	$E_{g/hr, i} \times F_i$	$CO_{g/min, i} \times F_i$
I	0.437	39.1%	0.016	0.285	0.038	0.409	0.023
II	0.238	21.3%	0.008	0.132	0.018	0.341	0.017
III	0.275	24.4%	0.010	0.168	0.023	0.903	0.015
IV	0.050	4.4%	0.001	0.022	0.003	0.263	0.007
Total	1.000	89.2%	0.035	0.607	0.082	1.916	0.063

Table 3. CO emissions & First Hour PM

Run	CO emissions (g/min)	First Hour Emissions (g/hr)
1	0.15	5.8
2	0.05	1.0
3	0.07	3.0
4	0.06	0.32

Test Run Narrative

Run 1

Run 1 was performed on 9/24/25 as a category 4 (maximum output) test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. 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 193,021 BTU/hr, which is within 10% of the manufacturers rated output of 212,000 BTU/hr. The emissions rate was 0.060 lb/mmBtu heat output. Delivered efficiency was 88.0%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 2

Run 2 was performed on 9/25/25 as a category 1 test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. 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 23,599 BTU/hr. The emissions rate was 0.087 lb/mmBtu heat output. Delivered efficiency was 89.5%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 3

Run 3 was performed on 9/26/25 as a category 2 test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. Output was between 16-24% 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 42,350 BTU/hr. The emissions rate was 0.075 lb/mmBtu heat output. Delivered efficiency was 89.4%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 4

Run 4 was performed on 9/29/25 as a category 3 test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. Output was between 25-50% 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 87,905 BTU/hr. The emissions rate was 0.082 lb/mmBtu heat output. Delivered efficiency was 88.8%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

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.

However, calculations for all four runs showed a resulting stack-loss efficiency approximately 1 percentage point lower than delivered efficiency.

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.

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 is 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	73.4	77.4	30.6	35.7	29.85	53.6	110.6	5.1	240
2	66.6	72.6	32.4	38.7	30.06	11.4	13.3	5.1	240
3	68.7	75.3	35.0	29.4	30.03	13.5	23.9	5.1	240
4	69.7	71.5	46.2	49.0	29.68	28.2	49.9	5.1	240

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.

Low Burn Rate Discussion

The BIO200 does not have any user-controllable burn settings beyond its initial configuration settings, which are set upon installation and not for use in regulating heat output. The unit is simply on or off and when on, will respond to heat demand per its programming. Users cannot manually adjust the burn rate, rather, the burn rate is a response to the heat load applied. Therefore, the lowest achievable burn rate should be considered equivalent to that observed during the lowest heat load test – category 1.

Appliance Front



Appliance Left



Appliance Right



Appliance Rear



Appliance Installed in Test Booth



Test Fuel Properties

Test fuel used was Black Hills Wood Pellet Fuel, a PFI Certified Premium Pellet Brand. A sample of pellets was sent to Alfred H Knight (AHK) for analysis, see report below.



CERTIFICATE OF ANALYSIS



ALFRED H KNIGHT

LYRIK.PITZMAN
PFS TECO
11785 SE HIGHWAY 212
CLACKAMAS
OREGON
97015
USA

Location: ALFRED H KNIGHT (AHK) GONZALES, GONZALES,
LOUISIANA, USA, NORTH AMERICA
Vessel: PFS TECO
Date Received: 16-Oct-2025

Test Date(s): 16-Oct-2025 to 17-Oct-2025
Date of Report: 17-Oct-2025

AHK Ref: **GB/432054**
Client Ref: **PFS TECO- PELLET FUEL SAMPLE**

Material Described As: WOOD PELLETS

Client Ref.	Test	Unit	As Received	Dry Basis	Dry Ash-Free
<u>Pellet Fuel Sample</u>					
	Total Moisture	%	5.1		
	Total Ash Content	%	0.3	0.3	
	Volatile Matter	%	80.4	84.7	85.0
	Total Sulphur	%	0.01	0.01	0.01
	Chlorine	%	< 0.01	< 0.01	< 0.01
	Carbon	%	48.2	50.8	51.0
	Hydrogen	%	5.82	6.13	6.15
	Nitrogen	%	0.09	0.10	0.10
	Oxygen By Difference	%	40.4	42.6	42.7
	Gross Calorific Value	BTU/lb	8331	8779	8805
	Gross Calorific Value	MJ/kg	19.379	20.420	20.481
	Net Calorific Value	BTU/lb	7726		
	Net Calorific Value	MJ/kg	17.970		

John McIndoe
General Manager

For and on behalf of Alfred H Knight Energy Services Ltd

Doc Id: GB/432054/1

Alfred H Knight Energy Services Ltd

Page 1 of 1

Unit 1 Palermount Industrial Estate, Bypass Road, Dundonald Kilmarnock, Ayrshire, KA2 9BL

Tel: +44 1563 850 375 Email: solidfuels@ahkgroup.com

ALL WORK IS UNDERTAKEN SUBJECT TO OUR STANDARD TRADING TERMS AND CONDITIONS OF BUSINESS
This certificate shall not be reproduced except in full without written approval of Alfred H Knight Energy Services Ltd

Sample Collection

Verified – Yes: ☒ No: ☐ (if No Explain)

ASTM E2515-11

Four separate, complete particulate sampling trains were used for each run. Filter face velocity at no time exceeded 150mm/sec during any test run. The dry gas meters were calibrated for the flow rates encountered during the test runs.

The 47mm filter holder assemblies consist of an aluminum front housing and polycarbonate rear housing, with the rear housing located 75mm downstream from the front housing. The front filter support frit is stainless steel.

Probe assemblies are constructed from 316 grade stainless steel tubing with an outside diameter of 6.35mm and 310mm length.

A type K thermocouple filter temperature monitor probe is installed behind the front filter housing with its tip directly exposed to the sample gas.

Sample gas drying systems are located prior to each metering system and include temperature sensors.

The metering systems include vacuum gauges, leak-free diaphragm-type pumps, and type K thermocouple temperature sensors. The gas meters have a resolution of 0.001 cubic feet.

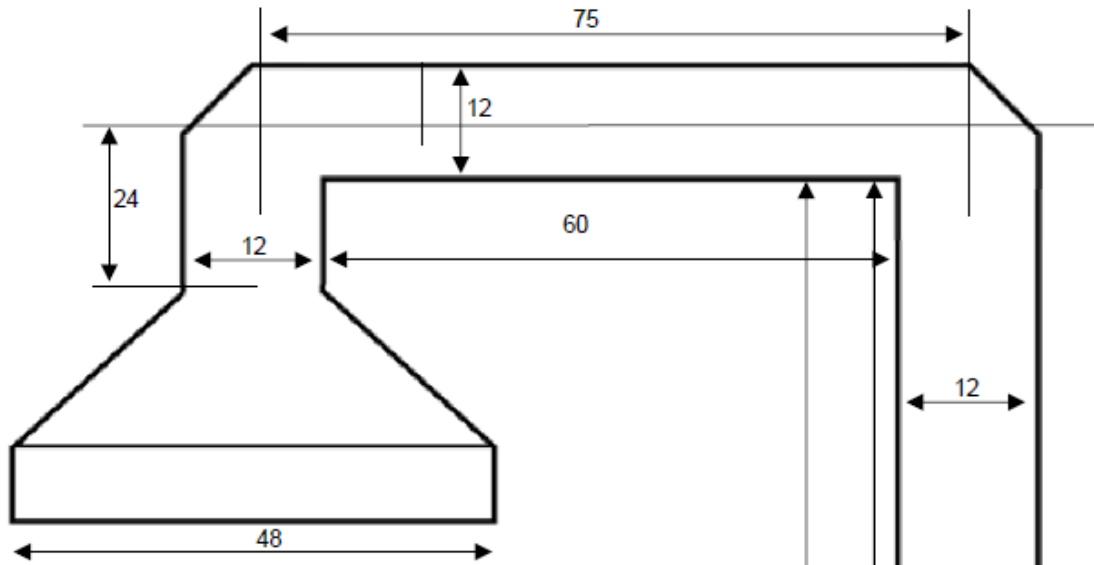
Barometric pressure data was taken from local National Weather Service station KPDX. As PFS and KPDX are at the same altitude, the correction for altitude per ASTM E2515-11 6.1.2 is 1:1.

Dilution tunnel temperature was measured by a type K thermocouple probe.

Dilution tunnel velocity was measured prior to each run by performing a velocity traverse and monitored throughout each run by measuring pitot pressure at the tunnel centroid. Traverses were performed using a Dwyer Model 1430 Microtector in accordance with the instrument owners' manual. This includes leveling and zeroing the instrument prior to each use and performing pre- and post-test leak checks on the pitot tubing.

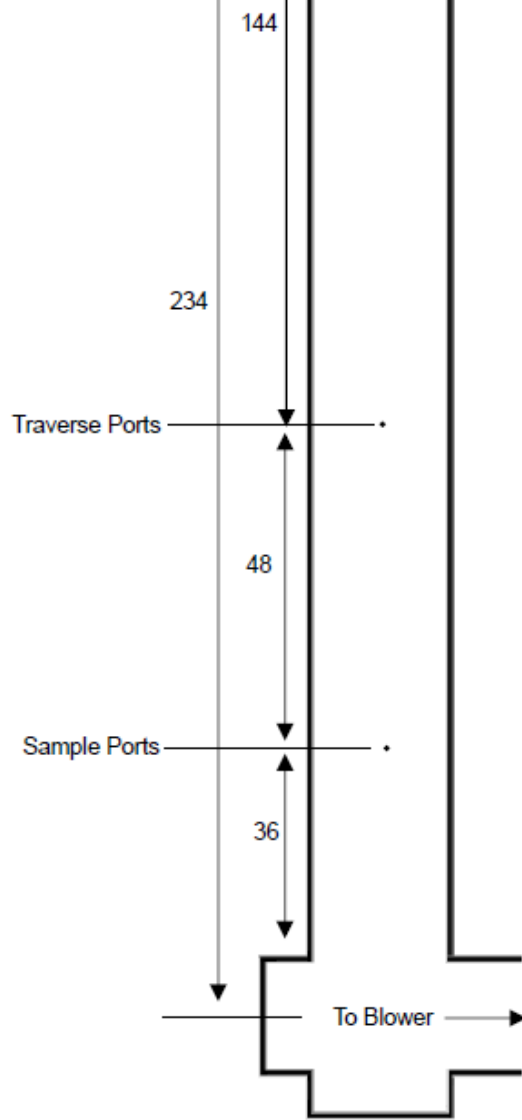
To monitor and log centroid pitot pressure, the pressure transducer of an Apex Instruments XC-60-DIR sample box was used. Both pieces of equipment offer precision in excess of the +/- 0.001" specified in section 6.1.5 of ASTM E2515-11, and are therefore suitable for use with flows under 800 ft/min. Both pieces of equipment are plumbed to the same pitot tube, which is in accordance with the design shown in Appendix X2 of ASTM E2515-11.

The dilution tunnel is constructed in accordance with the requirements of ASTM E2515-11, as shown below:



Booth #2 Tunnel Schematic

All dimensions are in inches



Sample ports are located 16 feet downstream from any disturbances and 3 feet upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 4 feet upstream from any disturbances. (See below). Flow is induced and maintained by a centrifugal-type blower.

Test facility temperature is monitored by a type T thermocouple probe, located in a 150mm long, 50mm diameter pipe shield located in the 90-degree arc in front of the test unit, between 1-2m away, and in the horizontal plane of the test unit air intake.

Test facility airflow was measured with an anemometer capable of measuring velocities less than 20 ft/min located within 2 feet of the appliance.

Reagents and Standards

Verified – Yes:☒ No:☐ (if No Explain)

Pall Type A/E Glass fiber 47mm filters having at least 99.95% efficiency at 0.3-micron particles were used.

Test samples were conditioned in an airtight desiccator containing calcium sulfate desiccant, with specific humidity of less than 0.005 g/liter prior to and after the testing.

Acetone was used to clean probe assemblies both prior to pretest desiccation and prior to post-test desiccation.

Calibration and Standardization

Verified – Yes:☒ No:☐ (if No Explain)

The gas metering system is calibrated every six months traceable to NIST and demonstrating an uncertainty of +/- 0.75% of the measured volume. Calibration flow rate range is from 0.05 to 0.30 scfm.

All thermocouples discussed in this report are calibrated traceable to NIST every six months. Both Type T (ambient) and Type K (all others) TCs are monitored by the same piece of equipment, a National Instruments 9213.

The analytical balance has a resolution of 0.1mg and is calibrated traceable to NIST every six months. Before each test and before each weighing of samples (both for tare and final analysis), the balance is audited with a calibrated 200mg weight.

All other measurement equipment used for this test is calibrated traceable to NIST at an appropriate interval. See Appendix C for all calibration records.

Procedures

Verified – Yes: ☒ No: ☐ (if No Explain)

The following procedures were performed and/or observed prior to testing:

- The dilution tunnel was cleaned with an appropriately sized steel brush.
- Induced draft was evaluated by measuring flue static pressure with the dilution tunnel blower operating and no fire in the appliance. No induced static pressure was observed (all readings $<0.005''$ H₂O) in any appliance door/air damper configuration.
- Smoke capture was evaluated by operating the appliance at a high burn rate and visually monitoring smoke collection by the hood. No less than 100% smoke collection was observed at the minimum tunnel flow rate.

Prior to ignition for each run, a velocity traverse was conducted to determine dilution tunnel velocity. Traverse points were determined in accordance with Figures 5 and 6 of ASTM E2515-11, which for a 6" diameter tunnel are 0.5" and 1.5" from either side of the duct, on two axes located at 90° from each other. Velocity calculated in accordance with section 9.3.2, excluding center readings. The pitot tube was placed in the center of the tunnel for the duration of each test run.

Prior to tare analysis, probes were cleaned with acetone, O-rings cleaned of any residue, and filters were visually check for pinhole leaks or irregularities. Filters, O-rings, and probes were desiccated at 20+/-5C for at least 24 hours and weighed at intervals of not less than 6 hours until constant weight was attained. Filters and O-rings were both weighed in pairs.

Tared samples were assembled into three dual filter holder assemblies (A, B, and first hour) and the single ambient filter assembly. Blunt tweezers and surgical gloves were used to avoid damage or contamination of the samples. The three dual filter assemblies were inserted to the appropriate depth in the tunnel (within the 2" diameter centroid, no closer than 1" apart). The ambient filter holder was installed within 10' of the centroid of the dilution tunnel inlet hood, in the same plane and the hood inlet.

Leak checks were performed on sampling systems as follows:

- Leak checks were performed on the pitot tube lines before and after each test run by applying a pressure differential of at least 3" H₂O and sealing the pitot tube opening. Pressure remained stable for at least 15 seconds all checks of both the pressure and suction sides, confirming that no leaks were present.
- All four sampling trains were leak-checked before and after each test run. Pre-test leak checks were conducted at the vacuum level corresponding to each sample pump's flow setting, in accordance with Note 5 of ASTM E2515-11. Post-test checks were conducted at the highest vacuum level encountered during the test, or the pre-test vacuum level, whichever was greater. Of the leak rate limits (0.01 cfm or 4% of sample rate), 4% of the sample rate is lower, and at no point was the measured leakage rate greater than this.

- The portion of the sampling trains from the pumps to the dry gas meters (that is, the positive pressure section of the metering system) was leak checked semiannually during calibration. This check was performed by closing the main inlet valve and pressurizing the outlet of the dry gas meter to at least 7" H₂O, and ensuring the pressure remained stable for at least 1 minute.

Sampling began at the start of each test run as defined by the applicable procedure and continued until the defined end of the test run. Readings were collected at 1-minute intervals. During all test runs, the following conditions were maintained:

- Firebox dimensions were checked against engineering drawings.
-
- Test facility temperature was between 55 and 90 F.
- Air velocities were less than 50ft/min within 2ft of the appliance
- Filter holder temperatures were no greater than 90 F.
- Sample flow rates were maintained within 10% of the initial proportionality ratio.
- Ambient / room air sample flow rate maintained within 20% of the initial flow rate.

Following each test run and its associated leak checks, samples were recovered by disassembling the filter holder components and replacing them in the desiccator. The outside of the probes was cleaned with acetone prior to desiccation.

Sample weights were determined using the same analytical balance and procedures used for tare weights. Filters, O-rings, and probes were desiccated at 20+/-5C for at least 24 hours and weighed at intervals of not less than 6 hours until constant weight was attained. Filters and O-rings were both weighed in pairs. Components were not exposed to laboratory atmosphere for more than 2 minutes per weighing.

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: 2716 Crescent Dr, International Falls, MN 56649, 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 – Test Run Data, Technician Notes, and Sample Analysis

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

Introduction

Greentech Manufacturing Inc. contracted with PFS-TECO to perform EPA certification testing on the BIO200 Pellet 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 heat draw in accordance with ASTM E2618.
- 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 was performed. All runs have been found to be appropriate, no anomalies occurred. See the Run Narrative section for further detail on each run.
- Gasket and filter samples were tared and weighted post testing in pairs per EPA Alt-154 - see attached letter in Appendix A.
- Delivered efficiency and stack loss efficiency were calculated for each run. Delivered efficiency is computed by comparing total fuel energy input to delivered heat energy output in accordance with ASTM E2618. Stack loss efficiency is calculated according to CSA B415.1. Complete data and calculations are shown in Appendix A.

Wood Heater Identification and Testing

- Appliance Tested: **BIO200**
- PFS Tracking Number: **230**
- Manufacturer: **Greentech Manufacturing, Inc.**
- Catalyst: **No**
- Type: **Pellet-Fired Hydronic Heater**
- Style: **Outdoor**
- Date Received: **Monday, September 22, 2025**
- Testing Period – Start: **Wednesday, September 24, 2025**
Finish: **Monday, September 29, 2025**
- Test Location: **PFS TECO**
11785 SE Hwy 212
Clackamas, OR 97015
- Elevation: **~131 Feet above sea level**
- Test Technician(s): **Aaron Kravitz**
- Observers: **Cody Holmestead of Greentech**

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
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
204B	Dilution Tunnel centroid transducer
55	Apex Ambient Air Sample Box
137	California Analytical ZRE CO ₂ /CO/O ₂ IR ANALYZER
95	Anemometer
97	10 lb audit weight
239	Ohaus Analytical Balance
109A/B	Troemner 100mg/200mg Audit Weights
141	Microtector
199	Mettler 10,000lb floor scale w/digital weight indicator
197	Omega Water Flow Meter
216	Temperature Logger
DT0042934	Gas Analyzer Calibration Span Gas
CC341544	Gas Analyzer Calibration Mid Gas

Barometric Pressure data was taken from a local National Weather Service station, corrected for altitude differences in accordance with ASTM E2515 6.1.2.

Results

A total of 4 test runs were performed on the BIO200. The weighted average year-round use emissions rate for the 4 run test series was measured to be **0.082 g/lb/mmBTU heat output** with year-round average delivered efficiency of **89%**. The maximum emissions rate for any one burn was **0.089 lb/mmBTU heat output**. The average CO emission rate for the 4 tests was **0.08 g/min**. The Greentech Manufacturing Inc. BIO200 Pellet fired hydronic heater meets the compliance limit for particulate matter emission limit of ≤ 0.10 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

Category	Run No	Load % Capacity	Target Load	Actual Load	Actual Load	Θ	W_{fuel}	MC_{ave}	Q_{in}	Q_{out}
			BTU/hr	BTU/hr	% of max	Test Duration	Wood Wt	Wood Moisture	Heat Input (HHV)	Heat Output
			BTU/hr	BTU/hr	% of max	hrs	lb	% DB	BTU	BTU
I	2	$\leq 15\%$ of max	<31,800	23,599	11.1%	4.00	13.3	5.1%	105,502	94,396
II	3	16-24% of max	33,920 - 50,880	42,350	20.0%	4.00	23.9	5.1%	189,587	169,402
III	5	25-50% of max	53,000 - 106,000	87,905	41.5%	4.00	49.9	5.1%	395,832	351,621
IV	1	Max capacity	212,000	193,021	91.0%	4.00	110.6	5.1%	877,335	772,085

Table 1B. Data Summary Part B

Category	Run No	Load % Capacity	T_{2Min}	E_T	E	E	$E_{g/hr}$	$E_{g/kg}$	η_{del}	H_{SLM}
			Min Return Temp	Total PM Emissions	PM Output Based	PM Output Based	PM Rate	PM Factor	Delivered Efficiency	Stack Loss Efficiency
			$^{\circ}F$	g	lb/mmBTU Out	g/MJ	g/hr	g/kg	%	%
I	2	< 15% of max	165.7	3.7	0.087	0.038	0.94	0.65	89.5%	88.2%
II	3	16-24% of max	173.6	5.7	0.075	0.032	1.43	0.56	89.4%	88.1%
III	5	25-50% of max	162.2	13.1	0.082	0.035	3.28	0.61	88.8%	87.7%
IV	1	Maximum	136.6	21.0	0.060	0.026	5.25	0.44	88.0%	87.2%

Table 1C. Hangtag Information

MANUFACTURER:	Greentech		
MODEL NUMBER:	BIO200		
MAXIMUM OUTPUT RATING:	Q_{max}	212,000	BTU/HR
ANNUAL EFFICIENCY RATING:	η_{avg}	89%	(Using higher heating value)
PARTICLE EMISSIONS:	E_{avg}	1.9	GRAMS/HR (average)
		0.08	LBS/MILLION BTU OUTPUT
CARBON MONOXIDE:	$O_{g/MIN}$	0.06	GRAMS/MINUTE

Table 2A. Heating Season Weighting

Category	Weighting Factor (F_i)	$\eta_{del, i} \times F_i$	$E_{g/MJ, i} \times F_i$	$E_{g/kg, i} \times F_i$	$E_{lb/mmBTU Out, i} \times F_i$	$E_{g/hr, i} \times F_i$	$CO_{g/min, i} \times F_i$
I	0.175	15.7%	0.007	0.114	0.015	0.164	0.009
II	0.275	24.6%	0.009	0.153	0.021	0.394	0.020
III	0.450	40.0%	0.016	0.274	0.037	1.478	0.025
IV	0.100	8.8%	0.003	0.044	0.006	0.525	0.015
Total	1.000	89.0%	0.034	0.585	0.079	2.561	0.068

Table 2B. Year-Round Use Weighting

Category	Weighting Factor (F_i)	$\eta_{del, i} \times F_i$	$E_{g/MJ, i} \times F_i$	$E_{g/kg, i} \times F_i$	$E_{lb/mmBTU Out, i} \times F_i$	$E_{g/hr, i} \times F_i$	$CO_{g/min, i} \times F_i$
I	0.437	39.1%	0.016	0.285	0.038	0.409	0.023
II	0.238	21.3%	0.008	0.132	0.018	0.341	0.017
III	0.275	24.4%	0.010	0.168	0.023	0.903	0.015
IV	0.050	4.4%	0.001	0.022	0.003	0.263	0.007
Total	1.000	89.2%	0.035	0.607	0.082	1.916	0.063

Table 3. CO emissions & First Hour PM

Run	CO emissions (g/min)	First Hour Emissions (g/hr)
1	0.05	5.8
2	0.07	1.0
3	0.06	3.0
4	0.15	0.32

Test Run Narrative

Run 1

Run 1 was performed on 9/24/25 as a category 4 (maximum output) test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. 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 193,021 BTU/hr, which is within 10% of the manufacturers rated output of 212,000 BTU/hr. The emissions rate was 0.060 lb/mmBtu heat output. Delivered efficiency was 88.0%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 2

Run 2 was performed on 9/25/25 as a category 1 test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. 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 23,599 BTU/hr. The emissions rate was 0.087 lb/mmBtu heat output. Delivered efficiency was 89.5%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 3

Run 3 was performed on 9/26/25 as a category 2 test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. Output was between 16-24% 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 42,350 BTU/hr. The emissions rate was 0.075 lb/mmBtu heat output. Delivered efficiency was 89.4%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 4

Run 4 was performed on 9/29/25 as a category 3 test per ASTM E2618. The unit was operated for at least two hours at the desired output rate prior to starting the test. Output was between 25-50% 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 87,905 BTU/hr. The emissions rate was 0.082 lb/mmBtu heat output. Delivered efficiency was 88.8%. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

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.

However, calculations for all four runs showed a resulting stack-loss efficiency approximately 1 percentage point lower than delivered efficiency.

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.

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 is 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	73.4	77.4	30.6	35.7	29.85	53.6	110.6	5.1	240
2	66.6	72.6	32.4	38.7	30.06	11.4	13.3	5.1	240
3	68.7	75.3	35.0	29.4	30.03	13.5	23.9	5.1	240
4	69.7	71.5	46.2	49.0	29.68	28.2	49.9	5.1	240

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.

Low Burn Rate Discussion

The BIO200 does not have any user-controllable burn settings beyond its initial configuration settings, which are set upon installation and not for use in regulating heat output. The unit is simply on or off and when on, will respond to heat demand per its programming. Users cannot manually adjust the burn rate, rather, the burn rate is a response to the heat load applied. Therefore, the lowest achievable burn rate should be considered equivalent to that observed during the lowest heat load test – category 1.

Appliance Front



Appliance Left



Appliance Right



Appliance Rear



Appliance Installed in Test Booth



Test Fuel Properties

Test fuel used was Black Hills Wood Pellet Fuel, a PFI Certified Premium Pellet Brand. A sample of pellets was sent to Twin Ports Testing for analysis, see report below.



CERTIFICATE OF ANALYSIS



ALFRED H KNIGHT

LYRIK.PITZMAN
PFS TECO
11785 SE HIGHWAY 212
CLACKAMAS
OREGON
97015
USA

Location: ALFRED H KNIGHT (AHK) GONZALES, GONZALES,
LOUISIANA, USA, NORTH AMERICA

Vessel: PFS TECO

Date Received: 16-Oct-2025

Test Date(s): 16-Oct-2025 to 17-Oct-2025
Date of Report: 17-Oct-2025

AHK Ref: GB/432054

Client Ref: PFS TECO- PELLET FUEL SAMPLE

Material Described As: WOOD PELLETS

Client Ref.	Test	Unit	As Received	Dry Basis	Dry Ash-Free
<u>Pellet Fuel Sample</u>					
	Total Moisture	%	5.1		
	Total Ash Content	%	0.3	0.3	
	Volatile Matter	%	80.4	84.7	85.0
	Total Sulphur	%	0.01	0.01	0.01
	Chlorine	%	< 0.01	< 0.01	< 0.01
	Carbon	%	48.2	50.8	51.0
	Hydrogen	%	5.82	6.13	6.15
	Nitrogen	%	0.09	0.10	0.10
	Oxygen By Difference	%	40.4	42.6	42.7
	Gross Calorific Value	BTU/lb	8331	8779	8805
	Gross Calorific Value	MJ/kg	19.379	20.420	20.481
	Net Calorific Value	BTU/lb	7726		
	Net Calorific Value	MJ/kg	17.970		

John McIndoe
General Manager

For and on behalf of Alfred H Knight Energy Services Ltd

Doc Id: GB/432054/1

Alfred H Knight Energy Services Ltd

Page 1 of 1

Unit 1 Palmemount Industrial Estate, Bypass Road, Dundonald Kilmarnock, Ayrshire, KA2 9BL

Tel: +44 1563 850 375 Email: solidfuels@ahkgroup.com

ALL WORK IS UNDERTAKEN SUBJECT TO OUR STANDARD TRADING TERMS AND CONDITIONS OF BUSINESS
This certificate shall not be reproduced except in full without written approval of Alfred H Knight Energy Services Ltd

Sample Collection

Verified – Yes: ☒ No: ☐ (if No Explain)

ASTM E2515-11

Four separate, complete particulate sampling trains were used for each run. Filter face velocity at no time exceeded 150mm/sec during any test run. The dry gas meters were calibrated for the flow rates encountered during the test runs.

The 47mm filter holder assemblies consist of an aluminum front housing and polycarbonate rear housing, with the rear housing located 75mm downstream from the front housing. The front filter support frit is stainless steel.

Probe assemblies are constructed from 316 grade stainless steel tubing with an outside diameter of 6.35mm and 310mm length.

A type K thermocouple filter temperature monitor probe is installed behind the front filter housing with its tip directly exposed to the sample gas.

Sample gas drying systems are located prior to each metering system and include temperature sensors.

The metering systems include vacuum gauges, leak-free diaphragm-type pumps, and type K thermocouple temperature sensors. The gas meters have a resolution of 0.001 cubic feet.

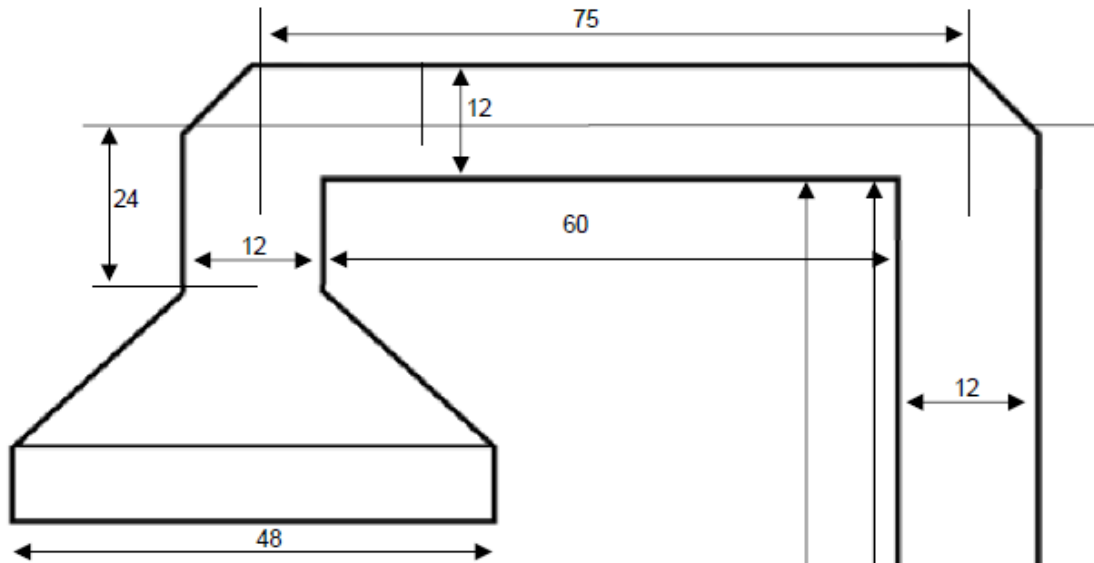
Barometric pressure data was taken from local National Weather Service station KPDX. As PFS and KPDX are at the same altitude, the correction for altitude per ASTM E2515-11 6.1.2 is 1:1.

Dilution tunnel temperature was measured by a type K thermocouple probe.

Dilution tunnel velocity was measured prior to each run by performing a velocity traverse and monitored throughout each run by measuring pitot pressure at the tunnel centroid. Traverses were performed using a Dwyer Model 1430 Microtector in accordance with the instrument owners' manual. This includes leveling and zeroing the instrument prior to each use and performing pre- and post-test leak checks on the pitot tubing.

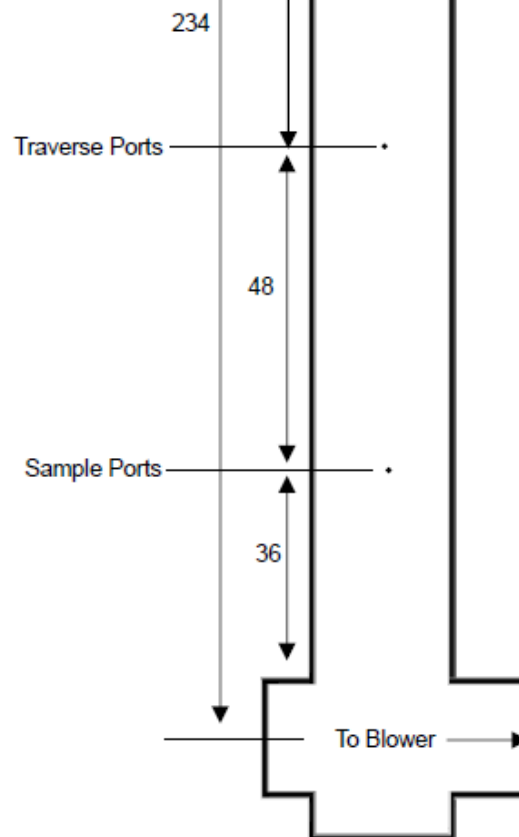
To monitor and log centroid pitot pressure, the pressure transducer of an Apex Instruments XC-60-DIR sample box was used. Both pieces of equipment offer precision in excess of the +/- 0.001" specified in section 6.1.5 of ASTM E2515-11, and are therefore suitable for use with flows under 800 ft/min. Both pieces of equipment are plumbed to the same pitot tube, which is in accordance with the design shown in Appendix X2 of ASTM E2515-11.

The dilution tunnel is constructed in accordance with the requirements of ASTM E2515-11, as shown below:



Booth #2 Tunnel Schematic

All dimensions are in inches



Sample ports are located 16 feet downstream from any disturbances and 3 feet upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 4 feet upstream from any disturbances. (See below). Flow is induced and maintained by a centrifugal-type blower.

Test facility temperature is monitored by a type T thermocouple probe, located in a 150mm long, 50mm diameter pipe shield located in the 90-degree arc in front of the test unit, between 1-2m away, and in the horizontal plane of the test unit air intake.

Test facility airflow was measured with an anemometer capable of measuring velocities less than 20 ft/min located within 2 feet of the appliance.

Reagents and Standards

Verified – Yes: ☒ No: ☐ (if No Explain)

Pall Type A/E Glass fiber 47mm filters having at least 99.95% efficiency at 0.3-micron particles were used.

Test samples were conditioned in an airtight desiccator containing calcium sulfate desiccant, with specific humidity of less than 0.005 g/liter prior to and after the testing.

Acetone was used to clean probe assemblies both prior to pretest desiccation and prior to post-test desiccation.

Calibration and Standardization

Verified – Yes: ☒ No: ☐ (if No Explain)

The gas metering system is calibrated every six months traceable to NIST and demonstrating an uncertainty of +/- 0.75% of the measured volume. Calibration flow rate range is from 0.05 to 0.30 scfm.

All thermocouples discussed in this report are calibrated traceable to NIST every six months. Both Type T (ambient) and Type K (all others) TCs are monitored by the same piece of equipment, a National Instruments 9213.

The analytical balance has a resolution of 0.1mg and is calibrated traceable to NIST every six months. Before each test and before each weighing of samples (both for tare and final analysis), the balance is audited with a calibrated 200mg weight.

All other measurement equipment used for this test is calibrated traceable to NIST at an appropriate interval. See Appendix C for all calibration records.

Procedures

Verified – Yes: ☒ No: ☐ (if No Explain)

The following procedures were performed and/or observed prior to testing:

- The dilution tunnel was cleaned with an appropriately sized steel brush.
- Induced draft was evaluated by measuring flue static pressure with the dilution tunnel blower operating and no fire in the appliance. No induced static pressure was observed (all readings $<0.005''$ H₂O) in any appliance door/air damper configuration.
- Smoke capture was evaluated by operating the appliance at a high burn rate and visually monitoring smoke collection by the hood. No less than 100% smoke collection was observed at the minimum tunnel flow rate.

Prior to ignition for each run, a velocity traverse was conducted to determine dilution tunnel velocity. Traverse points were determined in accordance with Figures 5 and 6 of ASTM E2515-11, which for a 6" diameter tunnel are 0.5" and 1.5" from either side of the duct, on two axes located at 90° from each other. Velocity calculated in accordance with section 9.3.2, excluding center readings. The pitot tube was placed in the center of the tunnel for the duration of each test run.

Prior to tare analysis, probes were cleaned with acetone, O-rings cleaned of any residue, and filters were visually check for pinhole leaks or irregularities. Filters, O-rings, and probes were desiccated at 20+/-5C for at least 24 hours and weighed at intervals of not less than 6 hours until constant weight was attained. Filters and O-rings were both weighed in pairs.

Tared samples were assembled into three dual filter holder assemblies (A, B, and first hour) and the single ambient filter assembly. Blunt tweezers and surgical gloves were used to avoid damage or contamination of the samples. The three dual filter assemblies were inserted to the appropriate depth in the tunnel (within the 2" diameter centroid, no closer than 1" apart). The ambient filter holder was installed within 10' of the centroid of the dilution tunnel inlet hood, in the same plane and the hood inlet.

Leak checks were performed on sampling systems as follows:

- Leak checks were performed on the pitot tube lines before and after each test run by applying a pressure differential of at least 3" H₂O and sealing the pitot tube opening. Pressure remained stable for at least 15 seconds all checks of both the pressure and suction sides, confirming that no leaks were present.
- All four sampling trains were leak-checked before and after each test run. Pre-test leak checks were conducted at the vacuum level corresponding to each sample pump's flow setting, in accordance with Note 5 of ASTM E2515-11. Post-test checks were conducted at the highest vacuum level encountered during the test, or the pre-test vacuum level, whichever was greater. Of the leak rate limits (0.01 cfm or 4% of sample rate), 4% of the sample rate is lower, and at no point was the measured leakage rate greater than this.

- The portion of the sampling trains from the pumps to the dry gas meters (that is, the positive pressure section of the metering system) was leak checked semiannually during calibration. This check was performed by closing the main inlet valve and pressurizing the outlet of the dry gas meter to at least 7" H₂O, and ensuring the pressure remained stable for at least 1 minute.

Sampling began at the start of each test run as defined by the applicable procedure and continued until the defined end of the test run. Readings were collected at 1-minute intervals. During all test runs, the following conditions were maintained:

- Test facility temperature was between 55 and 90 F.
- Air velocities were less than 50ft/min within 2ft of the appliance
- Filter holder temperatures were no greater than 90 F.
- Sample flow rates were maintained within 10% of the initial proportionality ratio.
- Ambient sample flow rate maintained within 20% of the initial flow rate.

Following each test run and its associated leak checks, samples were recovered by disassembling the filter holder components and replacing them in the desiccator. The outside of the probes was cleaned with acetone prior to desiccation.

Sample weights were determined using the same analytical balance and procedures used for tare weights. Filters, O-rings, and probes were desiccated at 20+/-5C for at least 24 hours and weighed at intervals of not less than 6 hours until constant weight was attained. Filters and O-rings were both weighed in pairs. Components were not exposed to laboratory atmosphere for more than 2 minutes per weighing.

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: 2716 Crescent Dr, International Falls, MN 56649, 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 – Test Run Data, Technician Notes, and Sample Analysis

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

Appendix A: Test Run Data

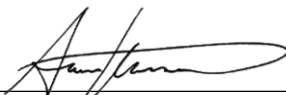
HYDRONIC HEATER TEST DATA PACKET

ASTM E2618/E2515



Run 1 Data Summary

Client:	Greentech
Model:	BIO 200
Job #:	25-436
Tracking #:	230
Test Date:	9/24/2025



Technician Signature

11/7/2025

Date

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 1

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/24/2025

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	27.230	34.876	35.612	9.900
Average Gas Velocity in Dilution Tunnel (ft/sec)	13.4			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	34807.7			
Average Gas Meter Temperature (°F)	75.5	92.2	90.9	81.5
Total Sample Volume (dscf)	26.743	33.463	34.427	9.621
Average Tunnel Temperature (°F)	101.0			
Total Time of Test (min)	240			
Total Particulate Catch (mg)	0.3	5.7	5.3	1.7
Particulate Concentration, dry-standard (g/dscf)	0.0000112	0.0001703	0.0001539	0.0001767
Total PM Emissions (g)	1.56	22.15	19.87	5.76
Particulate Emission Rate (g/hr)	0.39	5.54	4.97	5.76
Emissions Factor (g/kg)	-	0.46	0.42	-
Difference from Average Total Particulate Emissions (g)	-	1.14	1.14	-
Difference from Average Total Particulate Emissions (%)	-	5.4%	5.4%	-
Difference from Average Emissions Factor (g/kg)	-	0.02	0.02	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	161.6
Appliance Average Final Temperature (F)	159.8
Heat Output (BTU)	772,085
Heat Output Rate (BTU/hr)	193,021
Heat Input - HHV (BTU)	877,335
Heat Input - LHV (BTU)	817,496

Emissions Rates and Factors

Total Particulate Emissions (g)	21.0
Emissions Factor (g/MJ)	0.0258
Emissions Factor (g/kg)	0.4401
Emissions Rate (g/hr)	5.25
Emissions Rate (lb/mmBtu output)	0.060
HHV Delivered Efficiency (%)	88.0%
LHV Delivered Efficiency (%)	94.4%
HHV SLM Efficiency (%)	87.2%
LHV SLM Efficiency (%)	93.6%
CO Emissions (g/min)	0.15

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	81.7	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 73.4 / Max: 77.6	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	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	136.6	OK

B415.1 Efficiency Results

Manufacturer: Greentech
Model: BIO 200
Date: 09/24/25
Run: 1
Control #: 25-436
Test Duration: 240
Output Category: 4

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	87.2%	93.6%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	87.7%	94.1%

Output Rate (kJ/h)	201,809	191,438	(Btu/h)
Burn Rate (kg/h)	11.94	26.31	(lb/h)
Input (kJ/h)	231,319	219,432	(Btu/h)

Test Load Weight (dry kg)	47.75	105.23	dry lb
MC wet (%)	4.85		
MC dry (%)	5.10		
Particulate (g)	21.01		
CO (g)	35		
Test Duration (h)	4.00		

Emissions	Particulate	CO
g/MJ Output	0.03	0.04
g/kg Dry Fuel	0.44	0.73
g/h	5.25	8.75
g/min	0.09	0.15
lb/MM Btu Output	0.06	0.10

Air/Fuel Ratio (A/F)	7.79
-----------------------------	------

VERSION:

2.4

4/15/2010

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client: Greentech
 Model: BIO 200
 Run #: 1
 Test Start Time: 12:08
 Manufacturer's Rated Output
 (BTU/hr): 200,000

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/24/2025

Total Sampling Time (min): 240
 Recording Interval (min): 1

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.009 (B)
 Meter Box γ Factor: 0.997 (C)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 9/23/2025
 Test Fuel Scale Audit (lbs): N/A
 Platform Scale Audit (lbs): 10.0
 Boiler Dry Weight (lbs): 2222
 Supply Side Water Weight (lbs): 1112

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.89	29.80	29.85
Relative Humidity (%)	30.6	35.7	
Room Air Velocity (ft/min)	<50	<50	
Pitot Tube Leak Check	0.0	0.0	
Ambient Sample Volume:		27.230	ft ³

Sample Train Leak Checks

	Pre-test	Post-test		
(A)	0.000	0.000	cfm @	-5 in. Hg
(B)	0.000	0.000	cfm @	-5 in. Hg
(C)	0.001	0.001	cfm @	-5 in. Hg
(Ambient)	0.000	0.000	cfm @	-13 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.032	100
2	0.044	100
3	0.044	100
4	0.046	100
5	0.042	100
6	0.030	100
7	0.038	100
8	0.042	100
9	0.046	99
10	0.046	99
11	0.044	99
12	0.030	99
Center	0.042	99

Dilution Tunnel H₂O: 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 ft²

V_{strav}: 13.67 ft/sec

V_{scent}: 13.98 ft/sec

F_p: 0.978 [ratio]

Initial Tunnel Flow: 594.4 scf/min

Static Pressure: -0.120 in. H₂O

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:	Black Hills Gold
HHV (kJ/kg)	19,379
%C	50.8
%H	6.13
%O	49.88
%Ash	0.3
MC (%DB)	5.1%

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 1

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/24/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
0	279.7	-0.03	182.70	140.50	69.70	130.30	6.21	278	70	188,094
1	279.3	-0.03	182.60	140.60	69.60	130.60	6.21	278	69	189,217
2	278.9	-0.03	182.70	140.50	69.60	130.30	6.18	278	70	187,619
3	278.3	-0.03	183.00	140.80	69.60	130.50	6.23	278	70	189,485
4	277.9	-0.03	183.20	140.70	69.60	130.50	6.22	278	70	189,393
5	277.4	-0.03	183.50	140.80	69.60	130.50	6.21	278	70	188,967
6	276.9	-0.03	183.50	140.90	69.60	130.50	6.17	279	70	187,871
7	276.5	-0.03	183.60	140.90	69.60	130.70	6.21	280	70	189,679
8	276.0	-0.03	183.70	141.10	69.60	130.90	6.18	277	70	189,381
9	275.6	-0.03	183.70	141.30	69.50	131.10	6.16	279	70	189,572
10	275.3	-0.03	183.40	140.40	69.50	129.90	6.30	262	70	190,136
11	274.8	-0.03	182.80	139.90	69.50	129.30	6.38	264	70	190,638
12	274.6	-0.03	182.80	139.80	69.50	129.30	6.33	269	70	189,233
13	274.2	-0.03	182.50	139.60	69.50	129.10	6.38	274	70	190,149
14	273.7	-0.03	182.50	139.70	69.50	129.10	6.38	275	70	190,090
15	273.1	-0.03	182.70	139.80	69.50	129.20	6.36	276	70	189,842
16	272.9	-0.03	182.50	139.70	69.50	129.20	6.45	277	70	192,319
17	272.4	-0.03	182.30	139.60	69.50	129.00	6.40	277	70	190,247
18	271.8	-0.03	182.50	139.70	69.50	129.10	6.34	277	70	188,779
19	271.6	-0.03	182.70	140.50	69.50	130.10	6.06	278	70	183,617
20	270.6	-0.02	182.80	140.70	69.50	130.50	6.11	280	70	186,384
21	270.7	-0.03	182.80	140.00	69.50	129.60	6.38	280	70	191,655
22	272.3	-0.02	182.80	139.80	69.40	129.20	6.41	279	70	191,687
23	269.7	-0.04	183.00	140.10	69.40	129.70	6.30	280	70	189,824
24	269.4	-0.02	183.20	140.60	69.40	130.20	6.25	280	70	190,061
25	268.6	-0.03	183.10	140.50	69.40	130.30	6.45	279	70	196,187
26	268.3	-0.03	183.00	139.80	69.40	129.30	6.32	279	70	189,313
27	267.5	-0.03	183.10	139.90	69.40	129.30	6.45	280	70	193,056
28	267.7	-0.03	183.20	141.10	69.40	130.80	6.11	281	70	187,547
29	267.0	-0.03	183.30	140.50	69.40	130.00	6.34	280	70	192,071
30	266.4	-0.03	183.40	140.30	69.40	129.90	6.42	281	70	193,991
31	266.1	-0.03	183.60	140.70	69.40	130.30	6.44	281	70	196,157
32	265.3	-0.03	183.70	141.50	69.40	131.40	6.18	281	70	191,364

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 1

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/24/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
33	265.1	-0.03	183.60	140.50	69.40	130.10	6.46	281	70	195,907
34	264.1	-0.03	184.00	140.50	69.40	129.80	6.44	282	70	194,275
35	264.7	-0.03	183.90	140.40	69.40	129.80	6.31	281	70	190,471
36	263.9	-0.02	184.00	140.50	69.40	129.90	6.44	281	70	194,687
37	263.4	-0.03	184.00	140.50	69.40	130.00	6.18	282	70	187,133
38	262.7	-0.03	184.00	140.90	69.30	130.40	6.26	282	71	191,276
39	262.8	-0.03	184.10	140.40	69.40	129.80	6.47	283	71	195,301
40	262.2	-0.03	184.00	140.80	69.40	130.10	6.41	282	70	194,511
41	261.5	-0.03	184.00	140.70	69.30	130.20	6.27	283	70	190,741
42	261.1	-0.03	184.20	141.20	69.30	130.80	6.15	282	71	189,024
43	260.5	-0.03	184.30	142.00	69.30	131.80	6.14	283	70	191,660
44	260.2	-0.03	184.60	141.70	69.30	131.60	6.13	283	70	190,829
45	259.8	-0.03	184.30	141.30	69.30	131.10	6.00	281	71	185,312
46	259.4	-0.03	184.70	141.20	69.20	130.70	6.36	281	71	195,421
47	258.9	-0.03	184.60	140.90	69.20	130.40	6.07	281	71	185,718
48	258.6	-0.03	184.50	141.00	69.10	130.30	6.37	281	71	194,746
49	258.2	-0.04	184.40	140.80	69.10	130.20	6.34	281	71	193,511
50	257.6	-0.03	184.30	141.40	69.10	131.20	6.17	281	71	191,556
51	257.2	-0.03	184.30	141.40	69.10	131.10	6.09	282	71	188,676
52	256.8	-0.03	184.40	141.80	69.10	131.60	6.05	282	71	189,104
53	256.3	-0.03	184.50	143.30	69.10	133.60	6.08	282	71	195,929
54	255.7	-0.03	184.70	141.40	69.10	131.00	5.72	282	71	176,892
55	255.3	-0.03	184.70	141.20	69.00	130.60	5.95	282	71	183,274
56	254.9	-0.03	184.70	141.50	69.00	131.10	6.02	282	71	186,748
57	254.5	-0.02	185.10	142.30	69.00	132.20	6.05	273	71	191,130
58	254.0	-0.03	184.40	141.20	69.00	130.70	5.93	258	71	182,893
59	253.9	-0.03	184.00	141.00	69.00	130.50	6.04	268	71	185,558
60	253.4	-0.03	183.40	140.40	69.00	129.80	6.26	273	71	190,345
61	253.0	-0.03	183.50	140.60	68.90	130.20	6.04	276	71	185,019
62	252.4	-0.03	183.50	141.20	68.90	131.10	6.23	278	71	193,643
63	252.0	-0.03	183.70	140.40	68.90	129.90	6.38	279	71	194,542
64	251.5	-0.03	183.70	140.30	68.90	129.70	6.42	280	71	195,180
65	251.2	-0.03	183.70	140.60	68.90	130.10	6.33	281	72	193,772

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 1

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/24/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
66	250.6	-0.03	183.70	141.20	68.80	130.90	6.04	281	71	187,436
67	250.4	-0.04	183.60	140.30	68.80	129.60	6.28	281	72	190,807
68	249.8	-0.03	183.80	140.00	68.80	129.40	6.46	282	72	195,632
69	249.3	-0.03	183.90	140.10	68.80	129.20	6.44	282	72	194,352
70	248.7	-0.03	183.80	140.20	68.80	129.50	6.35	282	72	192,738
71	248.1	-0.03	184.20	140.20	68.80	129.60	6.54	282	72	198,770
72	247.8	-0.03	184.10	140.10	68.80	129.30	6.45	283	72	195,128
73	247.4	-0.03	184.20	140.20	68.80	129.40	6.46	282	72	195,692
74	246.9	-0.03	184.20	140.10	68.70	129.30	6.49	283	72	196,483
75	246.5	-0.03	184.20	140.50	68.70	129.80	6.45	283	72	196,852
76	246.1	-0.03	184.20	140.30	68.70	129.30	6.59	284	72	199,633
77	245.7	-0.04	184.20	141.20	68.70	130.70	6.45	283	72	199,751
78	245.2	-0.03	184.20	140.00	68.60	129.00	6.55	283	72	197,740
79	244.5	-0.03	184.30	140.20	68.60	129.30	6.49	285	72	196,871
80	244.3	-0.03	184.50	140.20	68.60	129.20	6.51	285	72	197,273
81	243.9	-0.03	184.20	139.80	68.50	128.90	6.55	284	72	197,833
82	400.0	-0.03	184.20	139.90	68.50	128.90	6.53	284	72	197,048
83	242.9	-0.03	184.30	140.00	68.40	128.90	6.53	283	72	197,559
84	242.4	-0.03	184.50	140.90	68.40	130.10	6.25	284	72	192,748
85	241.9	-0.03	184.40	141.00	68.40	130.40	6.24	283	72	193,499
86	241.4	-0.03	184.30	139.80	68.50	128.90	6.50	282	72	196,112
87	241.4	-0.03	184.20	139.90	68.40	128.80	6.39	283	72	192,975
88	240.7	-0.03	184.30	139.90	68.40	128.90	6.50	283	72	196,439
89	240.2	-0.03	184.10	140.10	68.40	129.20	6.20	283	72	188,447
90	239.8	-0.03	184.40	140.20	68.30	129.30	6.48	284	72	197,547
91	239.4	-0.03	184.60	139.90	68.40	128.90	6.56	284	73	198,405
92	238.7	-0.03	184.50	139.40	68.40	128.10	6.70	283	73	199,960
93	238.5	-0.03	184.40	140.20	68.30	129.10	6.50	283	73	197,599
94	237.8	-0.04	184.00	139.20	68.30	128.00	6.69	283	72	199,694
95	237.6	-0.03	184.00	139.40	68.30	128.20	6.41	284	73	191,889
96	237.0	-0.03	184.10	139.20	68.30	127.80	6.78	283	73	201,613
97	236.5	-0.04	183.90	139.00	68.30	127.70	6.68	284	73	198,305
98	235.9	-0.03	184.00	139.20	68.30	128.00	6.82	283	73	203,425

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 1

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/24/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
99	235.6	-0.02	183.80	138.90	68.30	127.60	6.47	284	73	191,864
100	235.2	-0.03	183.90	139.00	68.30	127.80	6.60	283	73	196,348
101	234.9	-0.03	183.80	138.90	68.20	127.60	6.67	284	73	198,189
102	234.4	-0.03	183.70	138.80	68.20	127.50	6.73	284	73	199,367
103	234.1	-0.03	183.80	139.00	68.20	127.60	6.76	284	73	200,802
104	233.5	-0.03	183.60	138.70	68.20	127.40	6.71	284	73	198,646
105	233.0	-0.02	183.60	138.90	68.20	127.50	6.69	284	73	198,419
106	232.3	-0.03	183.60	138.70	68.10	127.40	6.72	284	73	199,074
107	232.2	-0.03	183.40	139.10	68.10	128.10	6.44	284	73	193,265
108	231.7	-0.03	183.60	139.60	68.10	128.80	6.48	284	73	196,551
109	231.2	-0.03	183.60	139.20	68.10	128.00	6.71	285	73	200,998
110	230.9	-0.03	183.50	138.80	68.10	127.50	6.10	285	73	181,117
111	230.4	-0.03	183.50	138.40	68.10	127.00	6.84	284	73	201,382
112	229.7	-0.04	183.60	138.30	68.00	126.80	6.84	284	73	200,984
113	229.3	-0.03	183.50	138.30	68.00	126.80	6.87	284	73	201,808
114	229.2	-0.02	183.70	138.30	68.10	126.80	6.85	285	73	200,904
115	228.7	-0.04	183.30	138.10	68.10	126.60	6.82	284	73	199,400
116	228.1	-0.03	183.40	139.30	68.10	128.20	6.50	286	73	195,299
117	227.3	-0.03	183.70	140.10	68.10	129.40	6.31	285	73	193,346
118	227.0	-0.03	183.70	138.50	68.10	127.00	6.88	285	73	202,678
119	226.6	-0.03	183.80	138.30	68.10	126.90	6.90	285	74	202,951
120	226.1	-0.03	183.70	138.40	68.00	126.90	6.50	285	73	191,314
Avg/Tot	-	-0.03	183.8	140.2	68.9	129.5	6.382	280.8	71.3	193218

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.040	0.54	74	-0.58		110.6		99	244	72	73
1	0.132	0.132	0.040	0.99	74	-1.17	-	110.0	-0.6	99	244	74	73
2	0.281	0.149	0.039	0.98	75	-1.07	-	109.5	-0.5	100	244	76	74
3	0.429	0.148	0.040	0.98	75	-1	-	109.0	-0.5	99	243	76	74
4	0.576	0.147	0.039	0.97	74	-0.96	-	108.6	-0.4	99	244	74	74
5	0.724	0.148	0.039	0.97	75	-0.94	-	108.1	-0.5	99	243	76	73
6	0.870	0.146	0.040	0.97	75	-0.93	-	107.8	-0.3	99	243	76	73
7	1.017	0.147	0.038	0.96	75	-0.93	-	107.4	-0.4	100	244	77	74
8	1.164	0.147	0.038	0.96	75	-0.93	-	106.9	-0.5	99	244	76	74
9	1.310	0.146	0.039	0.95	75	-0.93	-	106.4	-0.5	99	243	77	74
10	1.456	0.146	0.039	0.96	75	-0.93	105	106.0	-0.4	99	243	76	74
11	1.602	0.146	0.040	0.94	75	-0.96	-	105.2	-0.8	99	244	75	74
12	1.747	0.145	0.040	0.95	75	-0.95	-	105.1	-0.1	100	245	76	74
13	1.893	0.146	0.041	0.95	75	-0.98	-	104.5	-0.6	99	244	76	74
14	2.038	0.145	0.041	0.94	76	-0.97	-	104.0	-0.5	99	243	77	74
15	2.184	0.146	0.040	0.96	75	-1.01	-	103.5	-0.5	99	244	75	74
16	2.329	0.145	0.041	0.95	77	-1.01	-	103.2	-0.3	99	243	77	74
17	2.474	0.145	0.039	0.94	77	-1.02	-	102.6	-0.6	100	243	77	74
18	2.620	0.146	0.039	0.94	77	-1.03	-	102.4	-0.2	100	243	77	74
19	2.766	0.146	0.040	0.95	77	-1.04	-	102.0	-0.4	100	243	77	74
20	2.911	0.145	0.039	0.92	77	-1.05	104	101.2	-0.8	100	244	77	74
21	3.056	0.145	0.042	0.94	77	-1.08	-	100.8	-0.4	100	244	76	74
22	3.200	0.144	0.040	0.95	77	-1.08	-	100.0	-0.8	100	244	77	74
23	3.345	0.145	0.040	0.96	78	-1.07	-	99.9	-0.1	100	244	78	74
24	3.489	0.144	0.041	0.91	78	-1.12	-	99.5	-0.4	100	244	77	74
25	3.634	0.145	0.039	0.94	79	-1.1	-	99.0	-0.5	100	244	78	74
26	3.778	0.144	0.039	0.94	79	-1.13	-	98.5	-0.5	100	243	77	74
27	3.924	0.146	0.041	0.94	78	-1.14	-	98.1	-0.4	100	244	76	74
28	4.069	0.145	0.039	0.93	79	-1.13	-	97.7	-0.4	100	245	76	74
29	4.213	0.144	0.039	0.94	79	-1.15	-	97.2	-0.5	100	244	76	75
30	4.357	0.144	0.041	0.94	80	-1.14	100	96.9	-0.3	100	244	77	75
31	4.502	0.145	0.039	0.92	80	-1.17	-	96.2	-0.7	100	244	78	75

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.646	0.144	0.041	0.97	81	-1.17	-	95.7	-0.5	100	244	78	75
33	4.790	0.144	0.040	0.92	80	-1.18	-	95.5	-0.2	100	245	76	75
34	4.934	0.144	0.040	0.93	81	-1.18	-	94.8	-0.7	100	245	77	75
35	5.080	0.146	0.041	0.93	82	-1.2	-	94.5	-0.3	100	244	78	75
36	5.225	0.145	0.040	0.93	82	-1.22	-	93.9	-0.6	100	244	77	75
37	5.369	0.144	0.040	0.93	82	-1.17	-	93.5	-0.4	100	244	78	75
38	5.512	0.143	0.042	0.93	81	-1.2	-	92.8	-0.7	100	245	76	75
39	5.657	0.145	0.042	0.93	83	-1.23	-	92.5	-0.3	100	244	78	75
40	5.801	0.144	0.040	0.95	82	-1.22	101	92.1	-0.4	100	244	77	75
41	5.945	0.144	0.044	0.94	83	-1.23	-	91.6	-0.5	100	244	79	75
42	6.090	0.145	0.042	0.93	83	-1.22	-	91.2	-0.4	100	245	77	75
43	6.235	0.145	0.041	0.95	83	-1.21	-	91.0	-0.2	100	244	77	75
44	6.379	0.144	0.038	0.93	84	-1.2	-	90.2	-0.8	100	244	78	75
45	6.524	0.145	0.040	0.93	84	-1.25	-	89.7	-0.5	100	244	78	75
46	6.667	0.143	0.040	0.97	84	-1.27	-	89.3	-0.4	100	245	78	75
47	6.812	0.145	0.041	0.94	84	-1.26	-	89.0	-0.3	100	245	77	75
48	6.956	0.144	0.040	0.93	85	-1.26	-	88.4	-0.6	100	244	79	75
49	7.100	0.144	0.043	0.93	85	-1.25	-	87.8	-0.6	100	243	78	75
50	7.245	0.145	0.042	0.93	85	-1.26	98	87.5	-0.3	100	244	77	75
51	7.391	0.146	0.042	0.93	85	-1.21	-	87.1	-0.4	100	244	77	75
52	7.535	0.144	0.041	0.93	86	-1.25	-	86.8	-0.3	100	244	77	75
53	7.679	0.144	0.039	0.93	86	-1.27	-	86.1	-0.7	100	244	78	75
54	7.823	0.144	0.039	0.93	86	-1.24	-	85.8	-0.3	100	245	77	75
55	7.967	0.144	0.042	0.93	86	-1.27	-	85.2	-0.6	100	244	77	75
56	8.112	0.145	0.039	0.93	86	-1.26	-	84.8	-0.4	100	245	77	75
57	8.256	0.144	0.039	0.93	86	-1.26	-	84.4	-0.4	100	245	77	75
58	8.402	0.146	0.042	0.93	87	-1.27	-	83.9	-0.5	100	244	79	75
59	8.547	0.145	0.041	0.93	87	-1.31	-	83.5	-0.4	100	245	78	75
60	8.691	0.144	0.041	0.92	87	-1.28	99	83.1	-0.4	100	245	77	75
61	8.836	0.145	0.041	0.93	88	-1.31	-	82.4	-0.7	100	244	78	75
62	8.980	0.144	0.041	0.93	88	-1.27	-	82.0	-0.4	100	244	78	75
63	9.124	0.144	0.040	0.96	88	-1.32	-	81.6	-0.4	100	245	77	75

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	9.269	0.145	0.040	0.93	88	-1.32	-	81.1	-0.5	100	245	77	75
65	9.413	0.144	0.041	0.92	89	-1.29	-	80.6	-0.5	100	245	79	75
66	9.558	0.145	0.040	0.95	89	-1.3	-	80.5	-0.1	100	246	78	75
67	9.704	0.146	0.041	0.93	90	-1.3	-	79.7	-0.8	100	245	79	75
68	9.849	0.145	0.040	0.91	89	-1.3	-	79.4	-0.3	100	245	77	75
69	9.994	0.145	0.041	0.93	89	-1.3	-	78.9	-0.5	100	245	77	75
70	10.138	0.144	0.042	0.93	90	-1.3	98	78.5	-0.4	100	245	78	75
71	10.283	0.145	0.040	0.93	90	-1.32	-	78.1	-0.4	100	244	78	75
72	10.428	0.145	0.039	0.91	89	-1.28	-	77.6	-0.5	100	245	77	75
73	10.572	0.144	0.040	0.93	91	-1.31	-	77.0	-0.6	100	245	79	75
74	10.717	0.145	0.039	0.94	91	-1.33	-	76.5	-0.5	100	245	79	75
75	10.862	0.145	0.039	0.89	91	-1.3	-	75.9	-0.6	100	245	79	75
76	11.008	0.146	0.043	0.94	90	-1.3	-	75.6	-0.3	100	246	77	75
77	11.154	0.146	0.039	0.93	91	-1.32	-	75.2	-0.4	100	245	78	75
78	11.299	0.145	0.038	0.93	91	-1.33	-	74.7	-0.5	100	245	78	75
79	11.444	0.145	0.039	0.93	91	-1.3	-	73.9	-0.8	100	245	77	75
80	11.588	0.144	0.039	0.93	92	-1.32	101	73.7	-0.2	100	245	78	75
81	11.733	0.145	0.040	0.93	91	-1.3	-	73.3	-0.4	100	246	77	75
82	11.878	0.145	0.040	0.93	92	-1.31	-	72.8	-0.5	100	246	78	75
83	12.023	0.145	0.043	0.92	91	-1.31	-	71.9	-0.9	100	246	77	75
84	12.168	0.145	0.041	0.92	91	-1.3	-	72.0	0.1	100	246	77	75
85	12.314	0.146	0.039	0.94	92	-1.32	-	71.5	-0.5	100	245	78	75
86	12.460	0.146	0.040	0.93	93	-1.31	-	70.9	-0.6	100	245	79	75
87	12.605	0.145	0.042	0.93	93	-1.31	-	70.5	-0.4	101	245	79	75
88	12.750	0.145	0.041	0.93	92	-1.33	-	70.1	-0.4	100	246	77	75
89	12.895	0.145	0.039	0.94	92	-1.31	-	69.6	-0.5	100	246	77	75
90	13.040	0.145	0.040	0.92	93	-1.32	100	69.1	-0.5	101	245	78	75
91	13.185	0.145	0.038	0.97	93	-1.31	-	68.8	-0.3	100	245	78	75
92	13.330	0.145	0.038	0.94	93	-1.32	-	68.2	-0.6	101	245	78	75
93	13.475	0.145	0.042	0.93	94	-1.34	-	67.7	-0.5	101	245	79	75
94	13.621	0.146	0.042	0.90	93	-1.35	-	67.1	-0.6	101	246	77	75
95	13.766	0.145	0.041	0.93	93	-1.31	-	67.1	0	101	245	78	76

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	13.912	0.146	0.041	0.91	93	-1.36	-	66.4	-0.7	101	245	78	75
97	14.058	0.146	0.042	0.94	94	-1.37	-	66.0	-0.4	101	245	78	75
98	14.203	0.145	0.042	0.96	94	-1.34	-	65.7	-0.3	101	245	79	75
99	14.349	0.146	0.042	0.92	94	-1.35	-	64.9	-0.8	101	246	79	76
100	14.494	0.145	0.040	0.91	95	-1.35	100	64.3	-0.6	101	245	79	76
101	14.638	0.144	0.041	0.92	95	-1.32	-	63.9	-0.4	101	246	79	76
102	14.784	0.146	0.040	0.93	94	-1.32	-	63.5	-0.4	101	246	79	75
103	14.929	0.145	0.040	0.95	94	-1.31	-	63.1	-0.4	101	246	78	75
104	15.074	0.145	0.042	0.93	94	-1.34	-	62.4	-0.7	101	246	77	75
105	15.220	0.146	0.042	0.94	94	-1.36	-	62.1	-0.3	101	246	78	75
106	15.365	0.145	0.040	0.93	95	-1.32	-	61.8	-0.3	101	245	79	75
107	15.511	0.146	0.041	0.93	95	-1.37	-	61.2	-0.6	101	245	78	75
108	15.657	0.146	0.037	0.93	94	-1.36	-	60.9	-0.3	101	246	77	75
109	15.803	0.146	0.039	0.93	95	-1.32	-	60.5	-0.4	101	246	79	75
110	15.948	0.145	0.037	0.94	95	-1.35	104	59.9	-0.6	101	245	79	75
111	16.093	0.145	0.040	0.93	94	-1.35	-	59.6	-0.3	101	246	78	75
112	16.239	0.146	0.041	0.93	95	-1.34	-	59.0	-0.6	101	246	77	75
113	16.384	0.145	0.040	0.94	96	-1.33	-	58.4	-0.6	101	245	79	75
114	16.529	0.145	0.042	0.93	95	-1.35	-	58.0	-0.4	101	246	77	75
115	16.674	0.145	0.041	0.93	95	-1.35	-	57.6	-0.4	101	246	78	75
116	16.820	0.146	0.039	0.92	95	-1.35	-	57.2	-0.4	101	247	77	75
117	16.965	0.145	0.039	0.93	96	-1.34	-	56.5	-0.7	101	246	78	75
118	17.111	0.146	0.039	0.94	96	-1.34	-	56.2	-0.3	101	246	79	76
119	17.257	0.146	0.039	0.93	95	-1.35	-	55.7	-0.5	101	246	78	75
120	17.403	0.146	0.039	0.90	96	-1.33	101	55.2	-0.5	101	246	79	75
121	17.548	0.145	0.039	0.91	96	-1.33	-	54.7	-0.5	101	246	79	76
122	17.694	0.146	0.040	0.94	95	-1.34	-	54.3	-0.4	101	247	78	76
123	17.839	0.145	0.040	0.92	97	-1.34	-	54.0	-0.3	101	246	79	76
124	17.984	0.145	0.039	0.93	96	-1.36	-	53.5	-0.5	101	246	79	76
125	18.130	0.146	0.040	0.94	96	-1.34	-	53.0	-0.5	101	246	78	76
126	18.275	0.145	0.041	0.93	96	-1.34	-	52.6	-0.4	101	246	78	76
127	18.421	0.146	0.038	0.92	97	-1.35	-	52.2	-0.4	101	246	80	76

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	18.566	0.145	0.041	0.93	97	-1.33	-	51.2	-1	101	246	79	76
129	18.712	0.146	0.043	0.93	96	-1.33	-	51.2	0	101	247	77	76
130	18.857	0.145	0.040	0.93	97	-1.34	99	50.7	-0.5	101	246	80	76
131	19.004	0.147	0.039	0.93	96	-1.34	-	50.3	-0.4	101	246	78	76
132	19.150	0.146	0.041	0.93	96	-1.33	-	49.8	-0.5	101	247	78	76
133	19.296	0.146	0.040	0.93	96	-1.33	-	49.3	-0.5	101	247	77	76
134	19.441	0.145	0.042	0.93	97	-1.36	-	49.0	-0.3	101	246	79	76
135	19.587	0.146	0.041	0.96	97	-1.34	-	48.4	-0.6	101	247	79	76
136	19.732	0.145	0.038	0.95	96	-1.34	-	48.1	-0.3	101	246	77	76
137	19.877	0.145	0.040	0.92	97	-1.34	-	47.6	-0.5	101	246	79	76
138	20.023	0.146	0.037	0.93	96	-1.34	-	47.1	-0.5	101	247	78	76
139	20.169	0.146	0.041	0.93	97	-1.34	-	46.6	-0.5	101	246	78	76
140	20.309	0.140	0.042	0.94	97	-1.34	97	46.3	-0.3	101	246	79	76
141	20.455	0.146	0.043	0.93	96	-1.36	-	45.6	-0.7	101	246	78	76
142	20.602	0.147	0.043	0.94	97	-1.35	-	45.5	-0.1	101	247	78	76
143	20.748	0.146	0.040	0.96	98	-1.35	-	44.8	-0.7	101	246	80	76
144	20.894	0.146	0.040	0.93	97	-1.34	-	44.4	-0.4	101	245	79	76
145	21.040	0.146	0.041	0.93	97	-1.35	-	44.1	-0.3	101	247	78	76
146	21.185	0.145	0.042	0.93	98	-1.33	-	43.5	-0.6	101	245	79	76
147	21.331	0.146	0.041	0.94	97	-1.34	-	43.0	-0.5	101	246	78	76
148	21.477	0.146	0.043	0.93	97	-1.35	-	42.6	-0.4	101	247	78	76
149	21.623	0.146	0.039	0.92	97	-1.33	-	41.9	-0.7	101	246	78	76
150	21.768	0.145	0.041	0.92	97	-1.34	98	42.1	0.2	101	246	78	76
151	21.914	0.146	0.042	0.95	98	-1.35	-	41.3	-0.8	102	246	79	76
152	22.060	0.146	0.040	0.94	98	-1.36	-	41.1	-0.2	101	246	79	76
153	22.206	0.146	0.042	0.95	97	-1.34	-	40.5	-0.6	101	247	78	76
154	22.352	0.146	0.040	0.94	97	-1.35	-	39.9	-0.6	101	246	78	76
155	22.498	0.146	0.040	0.94	98	-1.34	-	39.6	-0.3	101	246	79	76
156	22.644	0.146	0.040	0.94	98	-1.33	-	38.9	-0.7	101	246	79	76
157	22.791	0.147	0.042	0.93	98	-1.33	-	38.6	-0.3	102	246	80	76
158	22.937	0.146	0.040	0.93	98	-1.33	-	38.0	-0.6	101	246	80	76
159	23.082	0.145	0.037	0.94	97	-1.34	-	37.5	-0.5	102	247	78	76

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	23.228	0.146	0.039	0.94	98	-1.34	101	37.0	-0.5	102	246	79	76
161	23.374	0.146	0.039	0.92	97	-1.33	-	36.7	-0.3	102	247	78	76
162	23.519	0.145	0.042	0.93	98	-1.34	-	36.3	-0.4	102	247	79	76
163	23.665	0.146	0.040	0.93	98	-1.32	-	35.7	-0.6	102	246	79	76
164	23.811	0.146	0.043	0.94	97	-1.34	-	35.3	-0.4	102	247	78	76
165	23.956	0.145	0.040	0.93	97	-1.32	-	34.8	-0.5	102	247	78	76
166	24.102	0.146	0.042	0.94	98	-1.32	-	34.6	-0.2	102	247	79	76
167	24.248	0.146	0.037	0.93	99	-1.36	-	33.8	-0.8	102	247	80	76
168	24.394	0.146	0.041	0.93	98	-1.32	-	33.4	-0.4	102	248	79	76
169	24.540	0.146	0.040	0.92	98	-1.34	-	32.7	-0.7	102	247	79	76
170	24.686	0.146	0.039	0.93	99	-1.33	101	32.5	-0.2	102	246	79	76
171	24.833	0.147	0.041	0.94	98	-1.32	-	31.6	-0.9	102	247	79	76
172	24.979	0.146	0.039	0.93	99	-1.31	-	31.5	-0.1	102	246	79	76
173	25.124	0.145	0.041	0.92	98	-1.31	-	31.2	-0.3	102	247	78	76
174	25.270	0.146	0.041	0.91	98	-1.32	-	30.5	-0.7	102	247	79	76
175	25.416	0.146	0.041	0.93	98	-1.32	-	30.3	-0.2	102	247	79	76
176	25.561	0.145	0.040	0.92	99	-1.32	-	29.3	-1	102	246	80	76
177	25.707	0.146	0.040	0.93	99	-1.32	-	29.2	-0.1	102	247	80	76
178	25.853	0.146	0.040	0.93	99	-1.32	-	28.8	-0.4	102	246	80	76
179	25.998	0.145	0.038	0.94	98	-1.32	-	28.4	-0.4	102	246	79	76
180	26.144	0.146	0.041	0.93	98	-1.3	98	28.0	-0.4	102	246	79	76
181	26.290	0.146	0.037	0.91	99	-1.33	-	27.5	-0.5	102	246	80	76
182	26.436	0.146	0.039	0.93	99	-1.31	-	27.1	-0.4	102	246	79	76
183	26.581	0.145	0.040	0.93	98	-1.32	-	26.5	-0.6	102	247	79	76
184	26.728	0.147	0.040	0.93	98	-1.34	-	26.0	-0.5	102	246	79	76
185	26.874	0.146	0.038	0.94	99	-1.32	-	25.4	-0.6	102	247	80	76
186	27.020	0.146	0.041	0.94	98	-1.27	-	25.1	-0.3	102	248	78	76
187	27.166	0.146	0.040	0.93	99	-1.29	-	24.4	-0.7	102	247	79	76
188	27.312	0.146	0.041	0.91	99	-1.3	-	24.0	-0.4	102	248	80	76
189	27.457	0.145	0.038	0.94	98	-1.32	-	23.8	-0.2	102	248	79	76
190	27.603	0.146	0.040	0.92	99	-1.29	99	23.2	-0.6	102	247	80	76
191	27.748	0.145	0.041	0.95	98	-1.31	-	22.8	-0.4	102	247	79	76

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
192	27.894	0.146	0.040	0.89	99	-1.31	-	22.0	-0.8	102	248	79	76
193	28.039	0.145	0.038	0.93	98	-1.32	-	21.9	-0.1	102	247	79	76
194	28.185	0.146	0.038	0.93	99	-1.31	-	21.4	-0.5	102	247	79	76
195	28.331	0.146	0.041	0.93	99	-1.32	-	20.8	-0.6	102	247	80	76
196	28.476	0.145	0.036	0.92	98	-1.32	-	20.3	-0.5	102	248	79	76
197	28.622	0.146	0.038	0.93	99	-1.29	-	19.8	-0.5	102	248	79	76
198	28.769	0.147	0.039	0.93	99	-1.3	-	19.4	-0.4	102	247	81	76
199	28.915	0.146	0.038	0.94	99	-1.3	-	18.9	-0.5	102	247	80	76
200	29.061	0.146	0.040	0.92	99	-1.31	99	18.4	-0.5	102	247	80	76
201	29.206	0.145	0.038	0.95	99	-1.31	-	17.7	-0.7	103	247	80	76
202	29.352	0.146	0.040	0.93	99	-1.29	-	17.5	-0.2	103	248	80	76
203	29.498	0.146	0.043	0.94	99	-1.29	-	17.2	-0.3	103	248	80	76
204	29.643	0.145	0.041	0.91	100	-1.28	-	17.0	-0.2	102	248	80	76
205	29.789	0.146	0.042	0.91	98	-1.28	-	15.9	-1.1	103	248	78	76
206	29.934	0.145	0.040	0.91	98	-1.3	-	15.5	-0.4	103	249	78	76
207	30.079	0.145	0.039	0.93	99	-1.28	-	15.1	-0.4	102	248	79	76
208	30.225	0.146	0.037	0.95	99	-1.29	-	14.6	-0.5	103	248	79	77
209	30.370	0.145	0.040	0.93	99	-1.28	-	13.9	-0.7	103	248	80	77
210	30.516	0.146	0.041	0.94	100	-1.29	98	14.1	0.2	103	248	81	77
211	30.662	0.146	0.037	0.93	100	-1.28	-	13.4	-0.7	103	247	80	77
212	30.808	0.146	0.039	0.92	100	-1.31	-	13.0	-0.4	103	248	81	77
213	30.953	0.145	0.040	0.92	99	-1.29	-	12.4	-0.6	103	248	79	77
214	31.099	0.146	0.041	0.91	99	-1.28	-	12.1	-0.3	103	248	79	77
215	31.244	0.145	0.040	0.93	99	-1.26	-	11.5	-0.6	103	249	79	77
216	31.389	0.145	0.037	0.93	100	-1.32	-	11.1	-0.4	103	248	81	77
217	31.534	0.145	0.037	0.92	100	-1.27	-	10.5	-0.6	103	248	80	77
218	31.679	0.145	0.043	0.92	99	-1.28	-	10.1	-0.4	103	249	80	77
219	31.825	0.146	0.037	0.93	99	-1.29	-	9.7	-0.4	103	249	79	77
220	31.970	0.145	0.040	0.93	99	-1.29	99	9.2	-0.5	103	248	79	77
221	32.116	0.146	0.039	0.95	100	-1.26	-	8.6	-0.6	103	247	80	77
222	32.262	0.146	0.038	0.89	100	-1.3	-	8.8	0.2	103	247	81	77
223	32.408	0.146	0.039	0.90	99	-1.28	-	8.0	-0.8	103	248	79	77

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
224	32.553	0.145	0.040	0.93	100	-1.3	-	7.4	-0.6	103	247	81	77
225	32.698	0.145	0.040	0.92	99	-1.27	-	6.9	-0.5	103	248	79	77
226	32.843	0.145	0.039	0.92	99	-1.26	-	6.6	-0.3	103	248	80	77
227	32.988	0.145	0.039	0.91	100	-1.31	-	6.1	-0.5	103	248	81	77
228	33.133	0.145	0.041	0.92	100	-1.31	-	5.8	-0.3	103	248	81	77
229	33.278	0.145	0.039	0.92	100	-1.27	-	5.3	-0.5	103	248	80	77
230	33.424	0.146	0.039	0.95	99	-1.28	100	4.9	-0.4	103	247	80	77
231	33.569	0.145	0.042	0.91	100	-1.28	-	4.5	-0.4	103	248	80	77
232	33.714	0.145	0.040	0.94	99	-1.28	-	3.9	-0.6	103	248	80	77
233	33.860	0.146	0.037	0.92	99	-1.29	-	3.3	-0.6	103	249	79	78
234	34.006	0.146	0.042	0.88	100	-1.29	-	3.1	-0.2	103	248	81	78
235	34.151	0.145	0.040	0.92	100	-1.3	-	2.3	-0.8	103	248	82	78
236	34.296	0.145	0.040	0.92	100	-1.33	-	2.0	-0.3	103	248	82	77
237	34.441	0.145	0.042	0.92	99	-1.3	-	1.4	-0.6	103	248	80	78
238	34.586	0.145	0.038	0.92	100	-1.26	-	0.8	-0.6	103	248	81	77
239	34.731	0.145	0.040	0.92	99	-1.3	-	0.5	-0.3	103	248	79	77
240	34.876	0.145	0.039	0.92	100	-1.3	100	0.0	-0.5	103	248	80	77
Avg/Tot	34.876	0.145	0.040	0.93	92	-1.27	100			101	246	78	75.5

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.57	75	-1.27		74	-0.030	15.59	0.01
1	0.136	0.136	1.08	76	-1.33	-	76	-0.030	15.03	0.00
2	0.287	0.151	1.07	76	-1.32	-	76	-0.030	15.58	0.01
3	0.436	0.149	1.06	75	-1.32	-	77	-0.030	16.42	0.02
4	0.585	0.149	1.06	76	-1.32	-	77	-0.030	14.57	0.00
5	0.735	0.150	1.06	76	-1.32	-	77	-0.030	13.81	0.00
6	0.885	0.150	1.04	76	-1.33	-	77	-0.030	15.32	0.00
7	1.034	0.149	1.05	76	-1.32	-	77	-0.030	15.61	0.01
8	1.184	0.150	1.04	76	-1.32	-	77	-0.030	16.53	0.03
9	1.332	0.148	1.02	77	-1.38	-	78	-0.040	14.94	0.01
10	1.481	0.149	1.04	78	-1.3	103	78	-0.030	15.03	0.00
11	1.630	0.149	1.05	77	-1.27	-	78	-0.030	15.04	0.01
12	1.779	0.149	1.04	77	-1.35	-	78	-0.030	15.95	0.01
13	1.927	0.148	1.04	78	-1.37	-	78	-0.030	15.93	0.01
14	2.075	0.148	1.04	79	-1.32	-	78	-0.030	15.52	0.01
15	2.223	0.148	1.04	79	-1.32	-	78	-0.040	15.16	0.01
16	2.371	0.148	1.05	78	-1.31	-	78	-0.040	15.47	0.01
17	2.519	0.148	1.03	79	-1.27	-	79	-0.030	16.14	0.01
18	2.666	0.147	1.02	80	-1.33	-	79	-0.020	14.98	0.01
19	2.814	0.148	1.04	80	-1.25	-	79	-0.030	16.37	0.01
20	2.961	0.147	1.04	79	-1.37	103	79	-0.010	15.08	0.01
21	3.109	0.148	1.03	81	-1.32	-	79	-0.030	16.13	0.01
22	3.256	0.147	1.00	80	-1.29	-	79	-0.030	15.27	0.01
23	3.404	0.148	1.03	80	-1.31	-	79	-0.030	15.10	0.01
24	3.551	0.147	1.05	81	-1.32	-	79	-0.040	15.74	0.01
25	3.698	0.147	1.02	81	-1.3	-	79	-0.030	15.28	0.01
26	3.845	0.147	0.98	82	-1.35	-	79	-0.030	15.76	0.01
27	3.993	0.148	1.02	82	-1.31	-	79	-0.030	16.20	0.01
28	4.140	0.147	0.99	82	-1.34	-	79	-0.030	16.21	0.02
29	4.287	0.147	1.02	83	-1.26	-	79	-0.030	15.71	0.01
30	4.434	0.147	0.99	83	-1.31	99	79	-0.030	15.91	0.01
31	4.581	0.147	1.05	83	-1.32	-	79	-0.010	16.07	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.728	0.147	1.05	83	-1.34	-	79	-0.030	15.84	0.00
33	4.875	0.147	1.03	84	-1.26	-	79	-0.020	15.93	0.02
34	5.023	0.148	1.02	83	-1.28	-	79	-0.030	15.21	0.00
35	5.170	0.147	1.05	83	-1.34	-	79	-0.040	16.36	0.01
36	5.317	0.147	1.02	84	-1.24	-	79	-0.030	15.52	0.01
37	5.464	0.147	1.02	85	-1.26	-	79	-0.030	15.87	0.00
38	5.611	0.147	1.05	85	-1.34	-	79	-0.020	15.87	0.01
39	5.758	0.147	1.02	85	-1.24	-	79	-0.030	15.07	0.00
40	5.905	0.147	1.02	86	-1.25	100	79	-0.020	15.64	0.02
41	6.052	0.147	1.02	85	-1.24	-	79	-0.020	15.32	0.00
42	6.200	0.148	1.02	85	-1.36	-	79	-0.030	15.89	0.01
43	6.347	0.147	1.01	85	-1.33	-	79	-0.030	15.02	0.01
44	6.494	0.147	1.02	86	-1.36	-	79	-0.030	16.01	0.00
45	6.641	0.147	1.02	86	-1.27	-	79	-0.020	15.92	0.00
46	6.788	0.147	1.00	86	-1.33	-	79	-0.030	16.36	0.03
47	6.936	0.148	1.01	87	-1.22	-	79	-0.020	15.18	0.00
48	7.083	0.147	1.02	86	-1.24	-	79	-0.030	15.20	0.00
49	7.230	0.147	0.96	87	-1.22	-	79	-0.030	15.21	0.01
50	7.378	0.148	0.93	87	-1.22	98	79	-0.010	15.08	0.01
51	7.525	0.147	1.02	88	-1.27	-	79	-0.030	15.64	0.01
52	7.672	0.147	1.03	88	-1.3	-	79	-0.030	15.86	0.01
53	7.820	0.148	1.02	87	-1.36	-	79	-0.030	15.89	0.01
54	7.967	0.147	1.02	87	-1.22	-	79	-0.020	16.12	0.01
55	8.115	0.148	1.02	89	-1.33	-	79	-0.030	15.89	0.00
56	8.262	0.147	1.02	89	-1.22	-	79	-0.020	16.49	0.01
57	8.410	0.148	1.03	88	-1.33	-	79	-0.020	15.74	0.01
58	8.558	0.148	0.99	88	-1.23	-	79	-0.020	15.10	0.01
59	8.705	0.147	1.02	88	-1.27	-	79	-0.030	15.65	0.00
60	8.853	0.148	1.03	89	-1.21	98	79	-0.020	15.05	0.02
61	9.001	0.148	1.02	89	-1.23	-	79	-0.030	16.07	0.01
62	9.148	0.147	1.03	89	-1.37	-	79	-0.030	15.70	0.00
63	9.296	0.148	0.98	90	-1.29	-	79	-0.030	16.14	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	9.444	0.148	1.02	89	-1.23	-	79	-0.030	15.78	0.00
65	9.592	0.148	1.03	89	-1.23	-	79	-0.030	16.04	0.01
66	9.740	0.148	0.96	89	-1.35	-	79	-0.030	15.67	0.01
67	9.888	0.148	1.03	89	-1.23	-	79	-0.030	15.89	0.01
68	10.035	0.147	1.04	90	-1.36	-	79	-0.020	15.59	0.01
69	10.183	0.148	1.03	91	-1.25	-	79	-0.030	15.00	0.00
70	10.331	0.148	1.02	89	-1.28	97	79	-0.030	14.89	0.00
71	10.479	0.148	1.02	91	-1.3	-	79	-0.020	15.23	0.00
72	10.627	0.148	1.02	90	-1.25	-	79	-0.020	15.59	0.01
73	10.774	0.147	1.00	90	-1.22	-	79	-0.020	16.04	0.01
74	10.922	0.148	1.03	90	-1.25	-	79	-0.020	16.09	0.01
75	11.070	0.148	1.10	91	-1.34	-	79	-0.020	16.18	0.02
76	11.219	0.149	1.02	90	-1.33	-	79	-0.020	16.33	0.01
77	11.367	0.148	1.04	91	-1.24	-	79	-0.030	16.01	0.01
78	11.515	0.148	1.03	91	-1.32	-	79	-0.030	15.49	0.00
79	11.663	0.148	1.01	92	-1.3	-	79	-0.040	16.05	0.02
80	11.812	0.149	1.02	91	-1.27	101	79	-0.030	15.24	0.00
81	11.960	0.148	1.03	91	-1.27	-	79	-0.030	16.10	0.01
82	12.108	0.148	1.03	91	-1.26	-	79	-0.030	16.34	0.01
83	12.257	0.149	1.04	92	-1.31	-	79	-0.040	15.81	0.01
84	12.406	0.149	1.05	92	-1.25	-	79	-0.030	16.10	0.02
85	12.554	0.148	1.03	92	-1.33	-	79	-0.030	16.00	0.01
86	12.702	0.148	1.03	92	-1.24	-	79	-0.020	15.50	0.00
87	12.851	0.149	1.04	91	-1.26	-	79	-0.030	15.55	0.00
88	13.000	0.149	1.03	93	-1.23	-	79	-0.030	16.02	0.01
89	13.148	0.148	1.03	92	-1.33	-	79	-0.030	16.15	0.01
90	13.297	0.149	1.07	92	-1.23	100	79	-0.030	15.64	0.01
91	13.445	0.148	1.01	92	-1.36	-	79	-0.030	15.75	0.01
92	13.594	0.149	1.03	93	-1.31	-	79	-0.030	15.13	0.00
93	13.742	0.148	1.06	93	-1.24	-	79	-0.030	15.62	0.01
94	13.891	0.149	1.04	92	-1.24	-	79	-0.020	15.73	0.01
95	14.039	0.148	1.06	92	-1.24	-	79	-0.020	14.37	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	14.187	0.148	1.04	92	-1.3	-	79	-0.030	14.70	0.01
97	14.335	0.148	1.03	92	-1.33	-	79	-0.030	15.28	0.00
98	14.484	0.149	1.05	92	-1.23	-	79	-0.020	15.70	0.01
99	14.632	0.148	1.01	92	-1.34	-	79	-0.020	17.04	0.03
100	14.781	0.149	1.06	92	-1.32	100	79	-0.040	16.32	0.01
101	14.929	0.148	1.03	92	-1.35	-	79	-0.020	17.20	0.04
102	15.078	0.149	1.02	93	-1.35	-	79	-0.030	16.18	0.01
103	15.227	0.149	0.99	93	-1.25	-	79	-0.030	16.09	0.01
104	15.376	0.149	1.02	93	-1.35	-	79	-0.020	15.73	0.01
105	15.525	0.149	1.03	93	-1.37	-	79	-0.020	15.72	0.01
106	15.673	0.148	1.03	93	-1.36	-	79	-0.030	14.86	0.00
107	15.822	0.149	1.06	94	-1.32	-	79	-0.030	15.73	0.01
108	15.971	0.149	1.03	94	-1.25	-	79	-0.020	15.30	0.01
109	16.120	0.149	1.01	92	-1.25	-	79	-0.030	15.65	0.01
110	16.269	0.149	0.99	93	-1.24	104	79	-0.030	15.56	0.01
111	16.418	0.149	1.01	94	-1.32	-	79	-0.020	16.53	0.01
112	16.567	0.149	1.03	94	-1.29	-	79	-0.030	15.71	0.01
113	16.715	0.148	1.02	93	-1.24	-	79	-0.030	15.85	0.00
114	16.863	0.148	1.03	94	-1.32	-	79	-0.020	15.06	0.00
115	17.011	0.148	1.03	94	-1.34	-	80	-0.020	15.98	0.00
116	17.160	0.149	1.06	93	-1.22	-	79	-0.040	16.79	0.04
117	17.308	0.148	1.03	94	-1.28	-	79	-0.030	16.85	0.03
118	17.457	0.149	1.01	94	-1.21	-	80	-0.030	16.05	0.01
119	17.606	0.149	1.03	94	-1.34	-	79	-0.030	15.51	0.00
120	17.755	0.149	1.05	94	-1.29	101	79	-0.020	15.56	0.01
121	17.904	0.149	1.00	93	-1.23	-	79	-0.010	15.69	0.01
122	18.053	0.149	1.05	93	-1.35	-	79	-0.020	14.89	0.00
123	18.202	0.149	1.02	93	-1.36	-	79	-0.030	14.94	0.01
124	18.351	0.149	1.03	94	-1.24	-	80	-0.030	15.50	0.01
125	18.500	0.149	1.02	94	-1.29	-	80	-0.030	15.58	0.01
126	18.649	0.149	1.03	94	-1.37	-	80	-0.020	15.27	0.01
127	18.798	0.149	1.02	93	-1.28	-	79	-0.020	15.22	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
128	18.947	0.149	1.04	93	-1.36	-	79	-0.020	16.07	0.02
129	19.095	0.148	1.03	94	-1.19	-	80	-0.030	16.31	0.01
130	19.244	0.149	1.03	94	-1.26	100	79	-0.020	15.27	0.00
131	19.392	0.148	1.04	93	-1.29	-	79	-0.030	15.28	0.01
132	19.541	0.149	1.03	94	-1.36	-	79	-0.020	15.06	0.00
133	19.689	0.148	1.03	94	-1.24	-	79	-0.020	15.53	0.00
134	19.838	0.149	1.01	93	-1.27	-	79	-0.030	15.59	0.00
135	19.987	0.149	1.04	94	-1.33	-	79	-0.030	15.59	0.01
136	20.136	0.149	1.02	94	-1.18	-	79	-0.020	15.31	0.01
137	20.285	0.149	1.02	95	-1.32	-	80	-0.020	15.64	0.01
138	20.435	0.150	1.03	95	-1.36	-	80	-0.020	14.93	0.00
139	20.584	0.149	1.02	94	-1.34	-	79	-0.020	15.32	0.00
140	20.727	0.143	1.07	95	-1.3	97	80	-0.020	16.00	0.01
141	20.877	0.150	1.01	94	-1.21	-	80	-0.020	15.24	0.01
142	21.025	0.148	1.05	95	-1.27	-	80	-0.010	15.76	0.02
143	21.175	0.150	1.02	94	-1.23	-	80	-0.020	16.00	0.01
144	21.324	0.149	1.03	95	-1.27	-	80	-0.020	14.56	0.00
145	21.473	0.149	1.02	94	-1.27	-	80	-0.030	15.99	0.01
146	21.622	0.149	1.03	95	-1.29	-	80	-0.020	15.62	0.00
147	21.771	0.149	1.04	95	-1.35	-	80	-0.030	15.36	0.01
148	21.920	0.149	1.04	94	-1.25	-	80	-0.030	15.57	0.00
149	22.068	0.148	1.01	95	-1.24	-	80	-0.020	15.64	0.02
150	22.217	0.149	0.98	95	-1.22	99	80	-0.030	16.23	0.01
151	22.365	0.148	1.01	95	-1.35	-	80	-0.030	14.83	0.01
152	22.514	0.149	0.99	95	-1.34	-	80	-0.030	14.75	0.01
153	22.663	0.149	0.99	94	-1.31	-	80	-0.020	15.61	0.01
154	22.812	0.149	1.02	95	-1.2	-	80	-0.030	15.56	0.00
155	22.961	0.149	1.01	95	-1.18	-	80	-0.030	15.96	0.01
156	23.110	0.149	1.03	95	-1.26	-	80	-0.040	15.73	0.02
157	23.259	0.149	1.03	94	-1.32	-	80	-0.020	15.37	0.00
158	23.408	0.149	1.02	94	-1.18	-	80	-0.030	15.39	0.00
159	23.558	0.150	1.04	94	-1.18	-	80	-0.030	15.36	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
160	23.707	0.149	1.05	95	-1.27	101	80	-0.030	15.93	0.00
161	23.856	0.149	1.02	94	-1.35	-	80	-0.010	16.23	0.02
162	24.005	0.149	1.03	94	-1.18	-	80	-0.030	15.21	0.00
163	24.154	0.149	1.02	94	-1.21	-	80	-0.030	16.05	0.00
164	24.302	0.148	1.03	95	-1.23	-	80	-0.030	16.53	0.03
165	24.451	0.149	1.04	94	-1.26	-	80	-0.030	16.60	0.02
166	24.599	0.148	1.02	94	-1.31	-	80	-0.020	16.06	0.01
167	24.748	0.149	1.01	94	-1.21	-	80	-0.020	16.19	0.01
168	24.897	0.149	1.02	95	-1.28	-	80	-0.020	16.31	0.01
169	25.046	0.149	1.03	95	-1.26	-	80	-0.030	16.69	0.04
170	25.195	0.149	1.02	95	-1.37	101	80	-0.030	15.32	0.01
171	25.344	0.149	1.03	94	-1.31	-	80	-0.040	15.62	0.01
172	25.493	0.149	1.01	95	-1.21	-	80	-0.030	15.96	0.02
173	25.642	0.149	1.03	95	-1.3	-	80	-0.030	15.20	0.01
174	25.791	0.149	1.01	94	-1.27	-	80	-0.020	15.58	0.01
175	25.940	0.149	1.00	94	-1.2	-	80	-0.030	15.06	0.00
176	26.089	0.149	1.03	95	-1.31	-	80	-0.030	14.62	0.01
177	26.238	0.149	1.02	94	-1.22	-	80	-0.020	16.10	0.01
178	26.387	0.149	1.02	94	-1.35	-	80	-0.020	15.31	0.00
179	26.536	0.149	1.02	95	-1.35	-	80	-0.020	14.80	0.00
180	26.685	0.149	1.03	95	-1.23	99	80	-0.030	15.09	0.01
181	26.833	0.148	1.04	95	-1.32	-	80	-0.030	15.26	0.01
182	26.981	0.148	1.03	95	-1.23	-	80	-0.030	16.24	0.00
183	27.130	0.149	1.02	96	-1.32	-	80	-0.030	16.49	0.01
184	27.279	0.149	1.02	95	-1.24	-	80	-0.030	16.43	0.01
185	27.428	0.149	1.05	94	-1.25	-	80	-0.030	16.24	0.01
186	27.577	0.149	1.03	95	-1.32	-	80	-0.030	16.66	0.03
187	27.726	0.149	1.02	95	-1.31	-	80	-0.030	16.50	0.01
188	27.875	0.149	1.10	94	-1.26	-	80	-0.030	16.09	0.02
189	28.024	0.149	0.97	96	-1.23	-	80	-0.030	16.07	0.01
190	28.174	0.150	1.05	94	-1.37	100	80	-0.020	16.28	0.02
191	28.323	0.149	0.94	96	-1.35	-	80	-0.020	15.09	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
192	28.472	0.149	1.14	95	-1.33	-	80	-0.020	15.91	0.01
193	28.621	0.149	1.03	96	-1.27	-	80	-0.010	17.23	0.06
194	28.769	0.148	1.05	95	-1.31	-	80	-0.020	16.20	0.02
195	28.918	0.149	1.04	96	-1.26	-	80	-0.040	16.23	0.01
196	29.067	0.149	1.03	96	-1.34	-	80	-0.020	16.35	0.01
197	29.215	0.148	0.96	95	-1.31	-	80	-0.020	16.35	0.01
198	29.363	0.148	1.03	95	-1.23	-	80	-0.030	15.64	0.01
199	29.512	0.149	0.99	95	-1.29	-	80	-0.020	15.94	0.01
200	29.661	0.149	1.00	96	-1.37	100	80	-0.020	15.08	0.02
201	29.810	0.149	1.02	95	-1.27	-	80	-0.020	16.15	0.02
202	29.959	0.149	1.01	95	-1.33	-	80	-0.030	15.97	0.02
203	30.108	0.149	1.02	95	-1.26	-	80	-0.020	16.37	0.01
204	30.257	0.149	1.02	95	-1.36	-	80	-0.020	15.91	0.01
205	30.406	0.149	1.05	96	-1.21	-	80	-0.020	15.08	0.01
206	30.555	0.149	1.02	96	-1.27	-	80	-0.030	16.88	0.03
207	30.704	0.149	1.02	95	-1.33	-	80	-0.030	15.74	0.01
208	30.853	0.149	1.02	96	-1.35	-	81	-0.020	14.25	0.01
209	31.002	0.149	1.03	95	-1.19	-	80	-0.050	16.28	0.03
210	31.151	0.149	1.05	95	-1.3	99	81	-0.030	15.67	0.01
211	31.300	0.149	1.02	96	-1.36	-	81	-0.030	16.11	0.01
212	31.448	0.148	1.06	95	-1.31	-	81	-0.020	15.43	0.01
213	31.596	0.148	1.07	96	-1.25	-	81	-0.030	15.97	0.01
214	31.745	0.149	1.01	96	-1.22	-	81	-0.020	15.64	0.01
215	31.893	0.148	1.02	96	-1.31	-	81	-0.020	15.27	0.01
216	32.042	0.149	1.03	95	-1.33	-	81	-0.030	15.62	0.01
217	32.191	0.149	0.98	95	-1.34	-	81	-0.020	16.27	0.02
218	32.340	0.149	1.02	95	-1.24	-	81	-0.030	15.70	0.02
219	32.489	0.149	1.02	96	-1.23	-	81	-0.030	16.25	0.01
220	32.638	0.149	1.02	96	-1.24	100	81	-0.020	14.81	0.00
221	32.787	0.149	1.02	96	-1.25	-	81	-0.040	14.27	0.01
222	32.936	0.149	1.02	95	-1.24	-	81	-0.030	15.10	0.01
223	33.085	0.149	1.07	96	-1.34	-	81	-0.030	15.17	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 1

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
224	33.234	0.149	1.03	95	-1.23	-	81	-0.030	14.82	0.00
225	33.382	0.148	1.02	96	-1.35	-	81	-0.020	15.25	0.01
226	33.531	0.149	1.01	95	-1.23	-	81	-0.020	16.52	0.01
227	33.680	0.149	1.00	95	-1.24	-	81	-0.020	15.65	0.01
228	33.829	0.149	1.04	96	-1.25	-	81	-0.030	15.83	0.00
229	33.977	0.148	1.02	96	-1.23	-	81	-0.030	15.74	0.00
230	34.125	0.148	1.01	96	-1.22	101	82	-0.020	15.77	0.01
231	34.273	0.148	1.01	96	-1.34	-	81	-0.010	15.55	0.01
232	34.422	0.149	1.04	96	-1.33	-	81	-0.020	15.87	0.01
233	34.570	0.148	1.03	96	-1.24	-	82	-0.020	16.13	0.01
234	34.719	0.149	0.98	96	-1.31	-	82	-0.030	16.91	0.03
235	34.868	0.149	1.02	96	-1.23	-	82	-0.020	15.94	0.00
236	35.016	0.148	1.02	96	-1.24	-	82	-0.020	16.56	0.01
237	35.165	0.149	1.02	96	-1.27	-	82	-0.020	15.55	0.01
238	35.314	0.149	1.01	95	-1.35	-	82	-0.020	15.91	0.01
239	35.463	0.149	1.02	96	-1.34	-	81	-0.020	15.56	0.01
240	35.612	0.149	1.04	96	-1.27	101	82	-0.030	15.51	0.01
Avg/Tot	35.612	0.148	1.02	91	-1.29	100	79	-0.026	15.70	0.01

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 1

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
0	0.000		0.59	75	-1.8		72
1	0.136	0.136	1.03	75	-1.7	-	72
2	0.292	0.156	1.01	75	-1.7	-	72
3	0.450	0.158	1.02	75	-1.7	-	73
4	0.610	0.160	1.03	76	-1.8	-	73
5	0.768	0.158	1.02	75	-1.7	-	73
6	0.926	0.158	1.03	75	-1.9	-	73
7	1.086	0.160	1.03	76	-1.9	-	73
8	1.247	0.161	1.03	76	-1.9	-	73
9	1.407	0.160	1.04	76	-1.9	-	74
10	1.566	0.159	1.04	76	-1.9	97	74
11	1.725	0.159	1.06	76	-1.8	-	74
12	1.889	0.164	1.06	76	-1.8	-	74
13	2.051	0.162	1.06	76	-1.9	-	74
14	2.213	0.162	1.07	77	-1.7	-	74
15	2.375	0.162	1.03	77	-1.8	-	74
16	2.537	0.162	1.05	77	-1.8	-	74
17	2.700	0.163	1.07	78	-1.9	-	74
18	2.863	0.163	1.07	78	-1.7	-	75
19	3.027	0.164	1.09	78	-1.8	-	75
20	3.191	0.164	1.06	78	-1.8	100	75
21	3.357	0.166	1.09	79	-1.8	-	75
22	3.523	0.166	1.09	79	-2.0	-	75
23	3.688	0.165	1.09	79	-1.8	-	75
24	3.854	0.166	1.10	79	-1.7	-	75
25	4.021	0.167	1.11	79	-1.8	-	75
26	4.187	0.166	1.12	80	-1.9	-	75
27	4.353	0.166	1.11	80	-1.8	-	75
28	4.520	0.167	1.09	80	-1.9	-	75
29	4.686	0.166	1.11	81	-1.9	-	75
30	4.852	0.166	1.11	82	-1.9	99	75
31	5.018	0.166	1.12	82	-1.8	-	75

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 1

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
32	5.186	0.168	1.12	82	-1.9	-	75
33	5.353	0.167	1.13	82	-1.8	-	75
34	5.521	0.168	1.12	82	-1.9	-	75
35	5.688	0.167	1.12	82	-1.8	-	75
36	5.857	0.169	1.11	84	-1.9	-	75
37	6.024	0.167	1.11	84	-1.8	-	75
38	6.192	0.168	1.10	84	-1.8	-	75
39	6.361	0.169	1.11	84	-1.9	-	75
40	6.529	0.168	1.10	85	-1.8	101	75
41	6.698	0.169	1.12	84	-1.8	-	75
42	6.866	0.168	1.13	84	-1.9	-	75
43	7.034	0.168	1.12	85	-1.7	-	75
44	7.202	0.168	1.13	86	-1.7	-	75
45	7.371	0.169	1.13	86	-1.8	-	75
46	7.538	0.167	1.13	86	-1.8	-	75
47	7.705	0.167	1.13	87	-1.9	-	76
48	7.874	0.169	1.13	87	-1.9	-	75
49	8.042	0.168	1.13	87	-1.9	-	75
50	8.212	0.170	1.11	87	-1.9	99	76
51	8.380	0.168	1.13	88	-1.8	-	76
52	8.550	0.170	1.12	88	-1.8	-	75
53	8.720	0.170	1.13	88	-1.9	-	75
54	8.888	0.168	1.13	88	-1.9	-	76
55	9.057	0.169	1.14	89	-1.9	-	76
56	9.226	0.169	1.15	89	-1.8	-	76
57	9.393	0.167	1.13	88	-1.8	-	76
58	9.562	0.169	1.12	89	-1.9	-	76
59	9.730	0.168	1.14	89	-1.9	-	76
60	9.900	0.170	1.10	90	-1.9	99	76
Avg/Tot	9.900	0.165	1.09	81.5	-1.8	99	74.6

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
0	6.42	N/A	67.90	128.00	184	139	1.00	53.47	
1	6.33	N/A	67.90	128.10	184	139	1.00	52.71	3177
2	6.70	N/A	68.00	126.80	184	138	1.00	55.76	3283
3	6.74	N/A	68.10	126.40	184	138	1.00	56.11	3275
4	6.66	N/A	68.00	126.60	184	138	1.00	55.39	3249
5	6.53	N/A	67.90	127.70	184	139	1.00	54.37	3255
6	6.72	N/A	68.00	126.60	183	138	1.00	55.95	3282
7	6.74	N/A	68.00	126.30	183	138	1.00	56.07	3273
8	6.72	N/A	68.00	126.90	184	138	1.00	55.90	3297
9	6.70	N/A	67.80	126.50	184	138	1.00	55.77	3278
10	6.77	N/A	67.80	126.00	183	138	1.00	56.37	3285
11	6.69	N/A	67.80	126.10	183	138	1.00	55.66	3249
12	6.65	N/A	67.90	126.10	183	138	1.00	55.38	3227
13	6.70	N/A	67.90	126.20	184	138	1.00	55.77	3255
14	6.76	N/A	67.80	126.10	183	138	1.00	56.23	3282
15	6.61	N/A	67.80	126.00	183	138	1.00	55.03	3207
16	6.62	N/A	67.80	126.10	183	138	1.00	55.06	3214
17	6.74	N/A	67.80	126.10	183	138	1.00	56.08	3273
18	6.73	N/A	67.70	126.00	183	138	1.00	55.97	3267
19	6.67	N/A	67.70	125.90	183	138	1.00	55.47	3232
20	6.68	N/A	67.70	126.00	183	138	1.00	55.60	3245
21	6.76	N/A	67.70	126.10	183	138	1.00	56.26	3289
22	6.72	N/A	67.70	126.00	183	138	1.00	55.92	3264
23	6.68	N/A	67.70	125.90	183	138	1.00	55.57	3238
24	6.66	N/A	67.70	126.10	183	138	1.00	55.46	3243
25	6.60	N/A	67.70	126.10	183	138	1.00	54.92	3211
26	6.63	N/A	67.70	126.40	183	138	1.00	55.16	3241
27	6.39	N/A	67.70	127.30	183	139	1.00	53.18	3173
28	6.40	N/A	67.70	127.30	183	139	1.00	53.28	3179
29	6.67	N/A	67.70	126.00	183	138	1.00	55.47	3238
30	6.72	N/A	67.60	126.00	183	138	1.00	55.93	3270
31	6.40	N/A	67.60	126.80	183	138	1.00	53.28	3158
32	6.66	N/A	67.60	126.90	183	138	1.00	55.40	3289
33	6.67	N/A	67.70	126.40	183	138	1.00	55.55	3264
34	6.67	N/A	67.70	126.00	183	138	1.00	55.54	3242
35	6.40	N/A	67.70	126.10	183	138	1.00	53.29	3116
36	6.38	N/A	67.70	127.50	183	139	1.00	53.11	3180
37	6.66	N/A	67.70	126.50	183	138	1.00	55.41	3262
38	6.67	N/A	67.70	126.20	183	138	1.00	55.48	3249
39	6.66	N/A	67.70	126.10	183	138	1.00	55.39	3239
40	6.70	N/A	67.70	126.00	183	138	1.00	55.78	3256
41	6.69	N/A	67.70	126.00	183	138	1.00	55.68	3250
42	6.68	N/A	67.70	125.90	183	138	1.00	55.63	3242
43	6.63	N/A	67.80	126.00	183	138	1.00	55.19	3216
44	6.64	N/A	67.70	125.90	183	138	1.00	55.28	3221
45	6.69	N/A	67.70	126.10	183	138	1.00	55.67	3255
46	6.61	N/A	67.70	126.30	183	138	1.00	54.99	3226
47	6.70	N/A	67.70	126.00	183	138	1.00	55.80	3257

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
48	6.65	N/A	67.70	126.10	183	138	1.00	55.32	3235
49	6.56	N/A	67.70	126.10	183	138	1.00	54.57	3191
50	6.18	N/A	67.70	128.40	182	139	1.00	51.41	3124
51	6.27	N/A	67.60	128.10	183	139	1.00	52.16	3159
52	6.31	N/A	67.60	128.10	183	139	1.00	52.52	3181
53	6.57	N/A	67.60	126.80	183	138	1.00	54.69	3242
54	6.48	N/A	67.60	127.20	183	139	1.00	53.91	3217
55	6.63	N/A	67.70	126.50	183	138	1.00	55.17	3248
56	6.61	N/A	67.70	126.40	183	138	1.00	55.02	3234
57	6.65	N/A	67.70	126.30	183	138	1.00	55.32	3246
58	6.63	N/A	67.70	126.20	183	138	1.00	55.20	3233
59	6.08	N/A	67.70	128.50	183	140	1.00	50.60	3080
60	6.22	N/A	67.80	128.20	183	139	1.00	51.77	3130
61	6.56	N/A	67.80	128.20	183	139	1.00	54.63	3304
62	6.63	N/A	67.70	126.80	183	138	1.00	55.22	3267
63	6.64	N/A	67.70	126.50	183	138	1.00	55.22	3251
64	6.19	N/A	67.80	127.40	183	139	1.00	51.51	3074
65	6.29	N/A	67.80	128.30	183	139	1.00	52.34	3170
66	5.76	N/A	67.80	128.10	183	139	1.00	47.92	2893
67	6.58	N/A	67.70	126.50	183	138	1.00	54.79	3225
68	6.45	N/A	67.60	126.30	183	138	1.00	53.68	3154
69	6.38	N/A	67.70	128.00	183	139	1.00	53.09	3205
70	6.19	N/A	67.70	128.50	183	139	1.00	51.55	3138
71	6.58	N/A	67.70	127.20	183	138	1.00	54.76	3262
72	6.58	N/A	67.70	126.80	183	138	1.00	54.75	3239
73	6.48	N/A	67.60	126.70	183	138	1.00	53.96	3193
74	6.58	N/A	67.70	126.60	183	138	1.00	54.74	3228
75	6.58	N/A	67.70	126.60	183	138	1.00	54.74	3228
76	6.47	N/A	67.60	127.40	183	139	1.00	53.82	3222
77	6.59	N/A	67.60	126.50	183	138	1.00	54.82	3233
78	6.59	N/A	67.60	126.60	183	138	1.00	54.83	3239
79	6.59	N/A	67.60	126.60	183	138	1.00	54.85	3240
80	6.59	N/A	67.60	126.30	183	138	1.00	54.84	3223
81	6.65	N/A	67.60	126.20	183	138	1.00	55.34	3247
82	6.68	N/A	67.60	126.30	183	138	1.00	55.63	3269
83	6.47	N/A	67.50	126.70	183	138	1.00	53.83	3190
84	6.61	N/A	67.60	127.40	183	139	1.00	55.01	3293
85	6.61	N/A	67.60	126.50	183	138	1.00	55.01	3244
86	6.49	N/A	67.50	126.70	183	138	1.00	54.00	3201
87	6.58	N/A	67.50	126.50	183	138	1.00	54.78	3236
88	6.56	N/A	67.50	126.40	183	138	1.00	54.63	3222
89	6.37	N/A	67.60	126.80	183	138	1.00	53.01	3142
90	6.25	N/A	67.50	128.00	183	139	1.00	52.02	3151
91	6.55	N/A	67.50	130.00	183	141	1.00	54.51	3411
92	6.60	N/A	67.50	126.20	183	138	1.00	54.89	3226
93	6.46	N/A	67.50	127.20	183	139	1.00	53.80	3216
94	6.51	N/A	67.50	127.50	183	139	1.00	54.21	3256
95	6.67	N/A	67.60	126.40	183	138	1.00	55.55	3270

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
96	6.61	N/A	67.60	126.20	183	138	1.00	55.02	3228
97	6.62	N/A	67.50	126.10	183	138	1.00	55.10	3233
98	6.32	N/A	67.50	127.40	183	139	1.00	52.57	3153
99	6.63	N/A	67.50	126.70	183	138	1.00	55.17	3270
100	6.45	N/A	67.50	126.90	183	138	1.00	53.66	3191
101	6.61	N/A	67.50	127.00	183	138	1.00	55.01	3277
102	6.59	N/A	67.50	127.30	183	139	1.00	54.86	3284
103	6.65	N/A	67.50	126.90	183	138	1.00	55.31	3289
104	6.72	N/A	67.50	126.40	183	138	1.00	55.97	3300
105	6.61	N/A	67.50	126.50	183	138	1.00	55.05	3252
106	6.65	N/A	67.50	126.60	183	138	1.00	55.37	3276
107	6.49	N/A	67.50	126.40	183	138	1.00	54.04	3187
108	6.63	N/A	67.50	126.20	183	138	1.00	55.17	3242
109	6.58	N/A	67.50	126.20	183	138	1.00	54.78	3220
110	6.49	N/A	67.50	126.60	183	138	1.00	54.05	3198
111	6.57	N/A	67.50	126.40	183	138	1.00	54.70	3226
112	6.19	N/A	67.50	127.50	183	139	1.00	51.55	3097
113	6.29	N/A	67.50	128.00	183	139	1.00	52.31	3169
114	6.29	N/A	67.50	127.70	183	139	1.00	52.35	3155
115	6.65	N/A	67.50	126.70	183	138	1.00	55.32	3279
116	6.73	N/A	67.40	126.70	183	138	1.00	56.02	3326
117	6.63	N/A	67.50	126.20	183	138	1.00	55.16	3242
118	6.47	N/A	67.50	126.70	184	138	1.00	53.86	3192
119	6.66	N/A	67.50	126.30	183	138	1.00	55.44	3264
120	6.51	N/A	67.50	127.10	183	139	1.00	54.22	3235
121	6.27	N/A	67.50	127.60	183	139	1.00	52.21	3142
122	6.20	N/A	67.50	128.10	183	139	1.00	51.61	3131
123	6.67	N/A	67.50	127.40	183	139	1.00	55.52	3330
124	6.56	N/A	67.50	127.50	183	139	1.00	54.56	3277
125	6.57	N/A	67.50	126.10	183	138	1.00	54.64	3206
126	6.15	N/A	67.50	128.60	183	140	1.00	51.19	3131
127	6.25	N/A	67.50	127.90	183	139	1.00	51.98	3143
128	6.62	N/A	67.50	126.80	183	138	1.00	55.07	3269
129	6.64	N/A	67.50	127.20	183	139	1.00	55.24	3302
130	6.60	N/A	67.50	126.20	183	138	1.00	54.91	3227
131	6.24	N/A	67.50	127.50	183	139	1.00	51.96	3121
132	6.52	N/A	67.50	127.00	183	138	1.00	54.23	3231
133	6.67	N/A	67.50	126.40	183	138	1.00	55.52	3274
134	6.65	N/A	67.50	126.00	183	138	1.00	55.34	3241
135	6.61	N/A	67.40	126.00	183	138	1.00	55.01	3227
136	6.60	N/A	67.50	125.90	183	138	1.00	54.89	3209
137	6.67	N/A	67.50	126.40	183	138	1.00	55.49	3272
138	6.60	N/A	67.50	126.20	183	138	1.00	54.97	3230
139	6.64	N/A	67.40	125.80	183	138	1.00	55.28	3232
140	6.66	N/A	67.40	125.80	183	138	1.00	55.45	3242
141	6.67	N/A	67.40	125.90	183	138	1.00	55.51	3251
142	6.69	N/A	67.50	125.70	182	137	1.00	55.64	3242
143	6.61	N/A	67.50	125.70	182	137	1.00	55.05	3208

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
144	6.64	N/A	67.50	125.60	182	137	1.00	55.23	3213
145	6.61	N/A	67.50	125.70	182	137	1.00	55.00	3205
146	6.68	N/A	67.50	126.10	182	138	1.00	55.63	3264
147	6.69	N/A	67.50	125.60	182	137	1.00	55.64	3237
148	6.66	N/A	67.50	125.60	182	137	1.00	55.43	3224
149	6.68	N/A	67.50	126.50	182	138	1.00	55.60	3284
150	6.68	N/A	67.50	125.70	182	137	1.00	55.61	3240
151	6.66	N/A	67.50	125.70	182	137	1.00	55.41	3229
152	6.66	N/A	67.50	125.50	182	137	1.00	55.47	3221
153	6.19	N/A	67.40	126.40	182	138	1.00	51.56	3045
154	6.71	N/A	67.50	125.70	182	137	1.00	55.87	3255
155	5.88	N/A	67.40	126.70	182	138	1.00	48.91	2904
156	6.70	N/A	67.40	125.30	182	137	1.00	55.80	3235
157	6.77	N/A	67.40	125.10	182	137	1.00	56.36	3256
158	6.74	N/A	67.40	125.10	182	137	1.00	56.09	3240
159	6.74	N/A	67.40	125.00	182	137	1.00	56.11	3236
160	6.44	N/A	67.40	125.30	182	137	1.00	53.59	3106
161	6.57	N/A	67.40	125.80	182	137	1.00	54.69	3198
162	6.60	N/A	67.40	125.60	182	137	1.00	54.89	3198
163	6.57	N/A	67.30	125.60	182	137	1.00	54.67	3191
164	6.64	N/A	67.30	125.00	182	137	1.00	55.28	3193
165	6.65	N/A	67.30	125.40	182	137	1.00	55.35	3220
166	6.69	N/A	67.30	125.50	182	137	1.00	55.72	3247
167	6.75	N/A	67.30	125.10	182	137	1.00	56.17	3250
168	6.56	N/A	67.30	126.30	182	138	1.00	54.61	3226
169	6.74	N/A	67.30	125.50	182	137	1.00	56.07	3267
170	6.72	N/A	67.30	125.40	183	137	1.00	55.94	3254
171	6.69	N/A	67.30	125.30	182	137	1.00	55.68	3233
172	6.63	N/A	67.30	125.10	182	137	1.00	55.15	3191
173	6.71	N/A	67.30	125.20	182	137	1.00	55.88	3239
174	6.72	N/A	67.30	125.20	182	137	1.00	55.92	3241
175	6.44	N/A	67.30	125.30	182	137	1.00	53.63	3114
176	6.74	N/A	67.30	125.40	182	137	1.00	56.08	3262
177	6.74	N/A	67.30	125.00	182	137	1.00	56.13	3242
178	6.65	N/A	67.30	125.50	182	137	1.00	55.38	3227
179	6.80	N/A	67.30	124.90	182	137	1.00	56.57	3262
180	6.72	N/A	67.30	124.90	182	137	1.00	55.90	3224
181	6.78	N/A	67.30	124.90	182	137	1.00	56.45	3255
182	6.74	N/A	67.30	125.20	182	137	1.00	56.08	3251
183	6.80	N/A	67.30	125.20	182	137	1.00	56.62	3282
184	6.72	N/A	67.30	124.80	182	137	1.00	55.94	3220
185	6.74	N/A	67.30	125.00	182	137	1.00	56.12	3242
186	6.88	N/A	67.30	124.80	182	137	1.00	57.27	3297
187	6.73	N/A	67.30	124.80	182	137	1.00	55.98	3222
188	6.73	N/A	67.30	125.00	182	137	1.00	55.99	3235
189	6.76	N/A	67.30	125.00	182	137	1.00	56.26	3250
190	6.70	N/A	67.30	125.30	182	137	1.00	55.78	3239
191	6.66	N/A	67.30	125.20	182	137	1.00	55.44	3214

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 1

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
192	6.79	N/A	67.30	124.90	182	137	1.00	56.51	3259
193	6.76	N/A	67.30	125.10	182	137	1.00	56.29	3257
194	6.35	N/A	67.30	125.50	182	137	1.00	52.89	3082
195	6.63	N/A	67.30	126.00	183	138	1.00	55.15	3241
196	6.66	N/A	67.30	125.60	183	137	1.00	55.45	3237
197	6.67	N/A	67.30	125.80	183	138	1.00	55.51	3251
198	6.66	N/A	67.30	127.10	183	139	1.00	55.42	3318
199	6.55	N/A	67.30	126.30	183	138	1.00	54.49	3219
200	6.10	N/A	67.20	127.30	183	139	1.00	50.75	3054
201	6.34	N/A	67.20	126.70	183	138	1.00	52.75	3142
202	6.75	N/A	67.20	126.60	183	138	1.00	56.15	3339
203	6.67	N/A	67.20	127.10	183	138	1.00	55.49	3327
204	6.67	N/A	67.20	125.90	183	138	1.00	55.50	3262
205	6.62	N/A	67.20	126.40	183	138	1.00	55.10	3266
206	6.66	N/A	67.20	125.70	183	138	1.00	55.44	3247
207	6.68	N/A	67.20	125.90	183	138	1.00	55.59	3267
208	6.70	N/A	67.20	125.70	183	137	1.00	55.78	3267
209	6.69	N/A	67.20	125.80	183	138	1.00	55.71	3268
210	6.65	N/A	67.20	125.50	183	137	1.00	55.39	3233
211	6.28	N/A	67.20	127.00	183	139	1.00	52.24	3128
212	6.63	N/A	67.20	125.70	183	137	1.00	55.21	3234
213	6.67	N/A	67.20	125.70	183	137	1.00	55.53	3252
214	6.61	N/A	67.20	125.60	183	137	1.00	55.01	3216
215	6.66	N/A	67.20	125.60	183	137	1.00	55.39	3239
216	6.69	N/A	67.20	125.60	183	137	1.00	55.71	3257
217	6.69	N/A	67.20	125.50	183	137	1.00	55.64	3248
218	6.74	N/A	67.20	125.40	183	137	1.00	56.10	3269
219	6.68	N/A	67.20	125.30	182	137	1.00	55.58	3233
220	6.72	N/A	67.20	125.50	183	137	1.00	55.90	3263
221	6.72	N/A	67.20	125.40	183	137	1.00	55.95	3260
222	6.77	N/A	67.20	125.60	182	137	1.00	56.32	3293
223	6.60	N/A	67.10	125.20	182	137	1.00	54.97	3197
224	6.65	N/A	67.10	125.40	182	137	1.00	55.39	3233
225	6.72	N/A	67.10	125.10	182	137	1.00	55.95	3249
226	6.71	N/A	67.10	125.00	182	137	1.00	55.86	3238
227	6.32	N/A	67.10	125.80	182	137	1.00	52.64	3094
228	6.48	N/A	67.10	125.40	182	137	1.00	53.91	3147
229	6.69	N/A	67.10	125.30	182	137	1.00	55.69	3245
230	6.73	N/A	67.00	125.10	182	137	1.00	56.00	3258
231	6.64	N/A	67.00	125.20	182	137	1.00	55.23	3218
232	6.61	N/A	67.00	125.20	182	137	1.00	55.04	3207
233	6.64	N/A	67.00	125.20	182	137	1.00	55.29	3221
234	6.72	N/A	67.00	125.20	182	137	1.00	55.91	3258
235	6.67	N/A	67.00	125.40	182	137	1.00	55.50	3245
236	6.57	N/A	67.00	125.60	182	137	1.00	54.65	3206
237	6.67	N/A	67.00	125.80	182	137	1.00	55.52	3268
238	6.66	N/A	66.90	125.60	182	137	1.00	55.43	3257
239	6.66	N/A	66.90	125.50	182	137	1.00	55.45	3253

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Model: BIO 200

Run #: 1

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/24/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
240	6.65	N/A	66.90	125.50	182	137	1.00	55.37	3249
Average	7	#DIV/0!	67	126	183	138	1	55	3227
								TOTAL:	774421

LAB SAMPLE DATA - ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 1

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/24/2025

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	A	G01365	244.4	249.3	4.9
	B	G01366	242.7	247.9	5.2
	C - 1st Hour	G01367	241.6	242.9	1.3
	Amb	G01368	243.3	243.6	0.3
Probes	A	14A	116637.5	116638.1	0.6
	B	14B	116628.1	116628.2	0.1
	C - 1st Hour	14C	116536.9	116537.2	0.3
O-rings	A	14A	3341.7	3341.9	0.2
	B	14B	3366.1	3366.1	0.0
	C - 1st Hour	14C	3442.3	3442.4	0.1

Placed in Dessicator on:

9/29/2025

Balance Audit (mg):

200.0

100.0

100.0

		Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time
Filters	A	249.1	10/3 16:00	249.3	10/6 14:00				
	B	247.8	10/3 16:00	247.9	10/6 14:00				
	C - 1st Hour	242.7	10/3 16:00	242.9	10/6 14:00				
	Amb	243.4	10/3 16:00	243.6	10/6 14:00				
Probes	A	116638.0	10/3 16:00	116638.1	10/6 14:00				
	B	116628.2	10/3 16:00	116628.2	10/6 14:00				
	C - 1st Hour	116538.0	10/3 16:00	116537.2	10/6 14:00	116537.2	10/7 8:30		
O-Rings	A	3342.0	10/3 16:00	3341.9	10/6 14:00				
	B	3366.1	10/3 16:00	3366.1	10/6 14:00				
	C - 1st Hour	3442.6	10/3 16:00	3442.4	10/6 14:00				

Train A Aggregate, mg: 5.7

Train B Aggregate, mg: 5.3

Train C Aggregate, mg: 1.7

Ambient, mg: 0.3

ASTM E2618 Hydronic Heater Run Sheets

Client: Greentech Job Number: 25-436 Tracking #: 230
Model: Bio 200 Run Number: 1 Test Date: 9/24/25

Wood Heater Run Notes

Pre-Test Notes

Pre-Test Start Time: 10:08
Target Load (BTU/hr): 212,000

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 12:08
Target Load (BTU/hr): 212,000 (Category 4)

Time	Notes
0 min	Started test sampling
240 min	End of Test

Test Burn End Time: 16:08

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 17.32 CO (%): 4.340
Mid Gas CO₂ (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	10:12	10:13	10:14	16:11	16:13	16:14
CO ₂	0.22	17.32	10.26	0.23	17.06	10.16
CO	-0.014	4.342	2.541	-0.012	4.262	2.501

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

Technician Signature: 

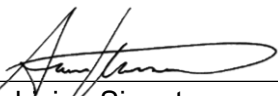
Date: 11/7/25

HYDRONIC HEATER TEST DATA PACKET
ASTM E2618/E2515



Run 2 Data Summary

Client:	Greentech
Model:	BIO 200
Job #:	25-436
Tracking #:	230
Test Date:	9/25/2025



Technician Signature

11/7/2025

Date

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 2

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/25/2025

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	26.836	35.716	35.871	9.146
Average Gas Velocity in Dilution Tunnel (ft/sec)	13.0			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	35455.9			
Average Gas Meter Temperature (°F)	69.9	89.8	88.2	76.9
Total Sample Volume (dscf)	26.797	34.629	35.059	9.019
Average Tunnel Temperature (°F)	80.2			
Total Time of Test (min)	240			
Total Particulate Catch (mg)	0.1	1.1	1.0	0.3
Particulate Concentration, dry-standard (g/dscf)	0.0000037	0.0000318	0.0000285	0.0000333
Total PM Emissions (g)	0.53	3.98	3.52	1.05
Particulate Emission Rate (g/hr)	0.13	0.99	0.88	1.05
Emissions Factor (g/kg)	-	0.69	0.61	-
Difference from Average Total Particulate Emissions (g)	-	0.23	0.23	-
Difference from Average Total Particulate Emissions (%)	-	6.1%	6.1%	-
Difference from Average Emissions Factor (g/kg)	-	0.04	0.04	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	181.0
Appliance Average Final Temperature (F)	173.8
Heat Output (BTU)	94,396
Heat Output Rate (BTU/hr)	23,599
Heat Input - HHV (BTU)	105,502
Heat Input - LHV (BTU)	98,306

Emissions Rates and Factors

Total Particulate Emissions (g)	3.7
Emissions Factor (g/MJ)	0.0376
Emissions Factor (g/kg)	0.6524
Emissions Rate (g/hr)	0.94
Emissions Rate (lb/mmBtu output)	0.087
HHV Delivered Efficiency (%)	89.5%
LHV Delivered Efficiency (%)	96.0%
HHV SLM Efficiency (%)	88.2%
LHV SLM Efficiency (%)	94.6%
CO Emissions (g/min)	0.05

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	76.6	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 66.5 / Max: 72.8	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	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	165.7	OK

B415.1 Efficiency Results

Manufacturer: Greentech
Model: BIO 200
Date: 09/25/25
Run: 2
Control #: 25-436
Test Duration: 240
Output Category: 1

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	88.2%	94.6%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	88.6%	95.1%

Output Rate (kJ/h)	24,532	23,272	(Btu/h)
Burn Rate (kg/h)	1.44	3.16	(lb/h)
Input (kJ/h)	27,817	26,387	(Btu/h)

Test Load Weight (dry kg)	5.74	12.65	dry lb
MC wet (%)	4.85		
MC dry (%)	5.10		
Particulate (g)	3.75		
CO (g)	13		
Test Duration (h)	4.00		

Emissions	Particulate	CO
g/MJ Output	0.04	0.13
g/kg Dry Fuel	0.65	2.19
g/h	0.94	3.14
g/min	0.02	0.05
lb/MM Btu Output	0.09	0.30

Air/Fuel Ratio (A/F)	25.12
-----------------------------	-------

VERSION:

2.4

4/15/2010

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client: Greentech
 Model: BIO 200
 Run #: 2
 Test Start Time: 11:34
 Manufacturer's Rated Output
 (BTU/hr): 212,000

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/25/2025

Total Sampling Time (min): 240
 Recording Interval (min): 1

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.009 (B)
 Meter Box γ Factor: 0.997 (C)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 9/23/2025
 Test Fuel Scale Audit (lbs): N/A
 Platform Scale Audit (lbs): 10.0
 Boiler Dry Weight (lbs): 2222
 Supply Side Water Weight (lbs): 1112

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.99	30.06	30.03
Relative Humidity (%)	32.4	38.7	
Room Air Velocity (ft/min)	<50	<50	
Pitot Tube Leak Check	0.0	0.0	
Ambient Sample Volume:		26.836	ft ³

Sample Train Leak Checks

	Pre-test	Post-test	
(A)	0.000	0.000	cfm @ -5 in. Hg
(B)	0.000	0.000	cfm @ -5 in. Hg
(C)	0.000	0.000	cfm @ -5 in. Hg
(Ambient)	0.000	0.000	cfm @ -13 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.028	77
2	0.036	77
3	0.042	77
4	0.040	77
5	0.040	77
6	0.032	77
7	0.036	77
8	0.040	77
9	0.042	77
10	0.042	77
11	0.038	77
12	0.034	77
Center	0.042	77

Dilution Tunnel H₂O: 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 ft²

V_{strav} : 12.91 ft/sec
 V_{scent} : 13.68 ft/sec
 F_p : 0.943 [ratio]

Initial Tunnel Flow: 587.6 scf/min

Static Pressure: -0.120 in. H₂O

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:	Black Hills Gold
HHV (kJ/kg)	19,379
%C	50.8
%H	6.13
%O	42.77
%Ash	0.3
MC (%DB)	5.1%

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 2

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/25/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
0	96.1	-0.01	173.2	166.1	68.7	159.6	0.59	209.8	62.8	26673
1	96.0	-0.02	173.6	168.1	68.8	162.4	0.59	207.5	62.7	27372
2	95.8	-0.02	174.3	168.7	68.8	164.2	0.58	205.9	62.7	27850
3	95.6	-0.01	174.8	169.2	68.8	164.9	0.58	205.1	62.7	27959
4	95.6	-0.02	175.3	169.7	68.9	165.4	0.59	203.8	63.0	28219
5	95.1	-0.02	176.0	170.4	68.9	165.8	0.59	202.7	62.9	28482
6	95.4	-0.02	176.6	170.9	69.0	166.3	0.58	202.3	62.8	28307
7	95.1	-0.02	177.0	171.4	69.0	166.6	0.58	201.9	62.8	28345
8	95.0	-0.02	177.6	171.9	69.0	167.2	0.58	200.6	63.0	28618
9	94.8	-0.02	178.2	172.4	69.1	167.8	0.59	199.0	63.1	29207
10	94.5	-0.02	178.6	172.9	69.1	168.0	0.60	199.1	63.3	29464
11	94.2	-0.03	179.1	173.3	69.1	168.3	0.59	198.6	63.3	29058
12	94.1	-0.01	179.6	173.8	69.1	168.8	0.59	198.1	63.4	29254
13	94.2	-0.01	180.1	174.3	69.1	169.0	0.62	198.4	63.4	30761
14	95.4	-0.01	180.6	174.7	69.1	169.5	0.59	198.6	63.2	29509
15	93.7	-0.02	181.1	175.1	69.1	170.0	0.59	198.4	63.1	29606
16	93.6	-0.02	181.5	175.5	69.1	170.6	0.58	199.2	63.0	29427
17	93.4	0.00	182.0	176.0	69.1	171.0	0.59	199.6	62.9	30001
18	93.2	-0.02	182.4	176.4	69.2	171.4	0.58	197.6	62.9	29578
19	92.9	-0.01	182.8	176.8	69.1	171.8	0.59	197.1	62.9	30185
20	93.0	-0.02	183.2	177.1	69.1	172.3	0.58	196.6	62.9	30126
21	92.9	-0.02	183.6	177.5	69.2	172.7	0.58	196.0	62.9	29748
22	92.6	-0.02	184.0	177.9	69.2	173.0	0.59	195.7	62.8	30560
23	92.5	-0.02	184.3	178.2	69.2	173.2	0.59	195.8	62.6	30619
24	92.4	-0.02	184.7	178.6	69.2	173.6	0.58	195.7	62.5	30476
25	92.4	-0.02	185.1	179.0	69.2	174.2	0.59	195.2	62.6	30913
26	92.1	-0.02	185.6	179.7	69.2	174.7	0.52	195.4	62.5	27264
27	92.0	-0.01	186.1	180.4	69.2	175.4	0.53	195.2	62.5	28188
28	91.9	-0.02	186.4	180.9	69.2	175.9	0.53	195.4	62.5	28054
29	91.9	-0.01	186.8	181.2	69.2	176.3	0.53	191.7	62.5	28213
30	91.8	-0.01	186.8	181.3	69.2	176.4	0.53	187.8	62.5	28132
31	91.4	-0.02	186.7	181.2	69.2	176.4	0.52	184.9	62.6	27917
32	91.9	-0.02	186.5	181.1	69.3	176.3	0.52	182.6	62.7	27598

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 2

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
33	91.9	-0.01	186.3	180.9	69.3	176.1	0.52	180.7	62.7	27920
34	91.9	-0.01	186.1	180.6	69.3	176.0	0.52	179.3	62.8	27733
35	92.1	-0.01	185.9	180.4	69.3	175.6	0.52	177.6	62.9	27576
36	92.1	-0.02	185.6	180.2	69.4	175.4	0.52	176.2	63.1	27551
37	92.1	-0.01	185.3	180.0	69.4	175.3	0.52	174.9	63.2	27419
38	92.1	-0.02	185.1	179.8	69.4	175.1	0.52	173.7	63.5	27526
39	92.4	-0.03	184.8	179.5	69.5	175.0	0.52	172.9	63.8	27632
40	91.9	-0.02	184.6	179.2	69.6	174.6	0.52	172.6	63.8	27080
41	92.0	-0.01	184.3	178.9	69.6	174.4	0.52	171.7	63.5	27343
42	92.0	-0.01	184.0	178.7	69.6	174.2	0.51	171.0	63.7	26873
43	92.0	-0.01	183.7	178.4	69.6	174.2	0.51	169.8	63.8	26768
44	92.1	-0.02	183.4	178.1	69.5	174.0	0.51	169.6	63.7	26639
45	92.0	-0.01	183.1	177.9	69.5	173.8	0.51	168.6	63.8	26692
46	92.1	-0.01	182.9	177.8	69.5	173.7	0.49	168.4	64.0	25364
47	92.0	-0.01	182.6	177.5	69.5	173.6	0.51	167.9	63.9	26537
48	92.4	-0.01	182.3	177.2	69.5	173.4	0.48	167.4	64.1	24824
49	92.1	-0.02	182.0	176.9	69.6	173.2	0.50	166.6	64.3	26098
50	92.5	-0.01	181.7	176.6	69.6	172.8	0.50	165.5	64.4	25843
51	92.2	-0.01	181.4	176.4	69.6	172.5	0.51	165.3	64.4	26179
52	92.3	-0.01	181.1	176.2	69.6	172.3	0.50	164.9	64.6	25461
53	92.0	-0.01	180.9	175.8	69.6	172.1	0.51	164.0	64.8	26180
54	92.3	-0.01	180.6	175.5	69.6	171.8	0.52	164.2	64.9	26307
55	92.5	-0.02	180.2	175.2	69.6	171.5	0.51	163.7	65.2	25975
56	92.3	-0.01	179.9	174.8	69.6	171.2	0.51	163.1	65.5	25899
57	92.2	-0.01	179.6	174.6	69.7	170.9	0.52	162.2	65.5	26151
58	92.3	-0.01	179.3	174.3	69.7	170.6	0.50	162.7	65.2	25367
59	92.3	-0.01	179.0	174.0	69.6	170.3	0.51	162.1	64.9	25569
60	92.2	-0.01	178.6	173.6	69.6	170.0	0.51	161.8	64.6	25693
61	92.3	-0.01	178.4	173.4	69.6	169.8	0.51	161.2	64.6	25542
62	92.4	-0.01	178.0	173.0	69.6	169.4	0.51	160.5	64.7	25340
63	92.6	-0.01	177.7	172.7	69.6	169.1	0.52	160.8	64.4	25712
64	92.4	-0.01	177.4	172.4	69.6	168.9	0.50	160.7	64.7	24568
65	92.4	-0.01	177.1	172.1	69.6	168.5	0.51	160.2	64.6	25359

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 2

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/25/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
66	92.5	-0.01	176.7	171.9	69.6	168.3	0.50	159.8	64.5	24716
67	92.1	-0.01	176.4	171.5	69.6	167.9	0.51	158.9	64.6	25107
68	92.3	-0.01	176.1	171.2	69.6	167.7	0.52	159.0	64.5	25301
69	92.4	-0.01	175.8	170.9	69.6	167.4	0.51	158.0	64.5	24881
70	92.5	-0.01	175.5	170.6	69.6	167.2	0.52	157.6	64.6	25465
71	92.6	-0.01	175.1	170.3	69.6	166.8	0.51	158.0	64.5	24583
72	92.6	0.00	174.8	169.9	69.6	166.6	0.52	157.3	64.5	24969
73	92.5	-0.01	174.5	169.7	69.6	166.3	0.51	157.3	64.6	24843
74	92.4	-0.01	174.1	169.3	69.6	166.0	0.51	156.6	64.5	24573
75	92.5	-0.01	173.8	169.0	69.6	165.7	0.51	156.8	64.6	24305
76	92.5	-0.01	173.5	168.7	69.7	165.4	0.51	156.3	64.5	24586
77	92.5	-0.01	173.2	168.5	69.7	165.2	0.50	155.6	64.8	23962
78	92.5	-0.01	172.9	168.1	69.7	164.8	0.52	155.3	64.5	24622
79	92.5	-0.01	172.5	167.8	69.6	164.5	0.51	154.7	64.4	24333
80	92.5	0.00	172.2	167.5	69.6	164.2	0.51	155.1	64.5	24256
81	92.9	-0.02	171.9	167.1	69.6	163.9	0.52	154.7	64.6	24274
82	92.3	0.00	171.6	166.8	69.6	163.6	0.51	153.7	64.5	23821
83	92.8	-0.02	171.3	166.6	69.6	163.3	0.51	154.2	64.5	23979
84	92.6	-0.01	171.0	166.3	69.5	163.1	0.52	153.2	64.9	24141
85	92.6	0.00	170.6	166.0	69.5	162.8	0.52	153.3	65.0	24203
86	92.7	-0.02	170.2	165.6	69.6	162.4	0.51	152.3	65.2	23841
87	93.2	-0.01	170.0	165.4	69.6	162.2	0.52	156.1	65.5	23929
88	92.5	-0.02	169.6	165.0	69.7	161.9	0.52	158.6	65.6	23733
89	92.5	-0.02	169.3	164.7	69.7	161.6	0.51	163.1	65.7	23426
90	92.7	-0.01	169.1	164.5	69.7	161.4	0.51	163.8	65.8	23512
91	92.4	-0.02	168.9	164.3	69.7	161.3	0.51	164.3	65.7	23533
92	93.6	-0.02	168.7	164.1	69.6	161.0	0.51	166.6	65.8	23390
93	94.1	-0.02	168.5	164.0	69.7	160.8	0.50	167.7	65.4	22903
94	92.1	-0.01	168.5	163.9	69.6	160.8	0.51	169.4	65.2	23385
95	92.0	-0.01	168.5	163.9	69.6	160.8	0.51	171.5	65.3	23339
96	91.6	-0.01	168.7	164.1	69.6	160.8	0.51	174.0	65.3	23385
97	91.5	-0.01	169.1	164.5	69.6	161.1	0.50	174.4	65.2	23050
98	91.5	-0.01	169.5	164.9	69.7	161.5	0.52	173.6	65.2	23630

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 2

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/25/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
99	91.1	-0.01	170.0	165.4	69.7	161.9	0.51	176.2	65.5	23502
100	90.8	-0.03	170.5	165.8	69.7	162.3	0.51	178.0	65.6	23512
101	90.6	-0.02	171.0	166.3	69.7	162.8	0.51	179.1	65.2	23778
102	90.5	-0.01	171.6	166.8	69.7	163.2	0.51	180.3	65.6	23927
103	90.3	-0.01	172.2	167.5	69.7	163.6	0.51	181.4	66.0	24123
104	89.9	-0.02	172.8	168.0	69.8	164.2	0.51	181.9	65.9	23968
105	92.3	-0.02	173.3	168.6	69.8	164.7	0.51	184.1	65.9	23953
106	89.4	-0.01	173.8	169.1	69.8	165.2	0.51	185.2	65.9	24175
107	89.4	-0.02	174.2	169.4	69.7	165.5	0.50	187.4	65.9	24133
108	89.6	-0.02	174.7	169.9	69.8	165.9	0.50	190.1	66.1	24064
109	87.8	-0.02	175.1	170.4	69.8	166.3	0.50	192.3	65.8	24068
110	87.7	-0.02	175.6	170.7	69.8	166.7	0.50	191.1	65.9	24313
111	87.6	-0.02	175.9	171.1	69.8	167.0	0.50	188.3	66.3	24242
112	88.6	-0.02	176.1	171.3	69.8	167.3	0.50	185.5	66.0	24414
113	87.4	-0.02	176.5	171.6	69.8	167.5	0.50	186.7	65.8	24611
114	87.0	-0.02	176.8	171.9	69.8	167.8	0.51	185.7	66.0	24883
115	87.2	-0.02	177.4	172.5	69.8	168.3	0.50	185.7	65.8	24763
116	87.3	-0.02	177.8	172.9	69.8	168.6	0.51	185.2	66.0	25086
117	86.7	-0.02	178.2	173.3	69.8	169.0	0.51	185.2	66.2	25187
118	86.4	-0.01	178.5	173.6	69.8	169.3	0.51	185.1	66.4	25114
119	86.8	-0.01	179.0	174.0	69.8	169.7	0.50	185.7	66.2	25115
120	85.9	-0.02	179.4	174.5	69.8	170.1	0.51	186.6	66.4	25416
Avg/Tot	-	-0.01	177.7	172.5	69.5	168.5	0.527	176.9	64.3	26089

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.040	0.57	71	-0.53		13.3		81	163	68	67
1	0.134	0.134	0.042	1.01	72	-1.07	-	12.8	-0.5	81	162	68	67
2	0.284	0.150	0.042	0.99	71	-0.95	-	12.5	-0.3	81	163	69	67
3	0.435	0.151	0.041	1.01	71	-0.92	-	12.4	-0.1	81	163	69	67
4	0.586	0.151	0.040	1.02	71	-0.92	-	12.3	-0.1	81	164	69	67
5	0.736	0.150	0.040	0.99	72	-0.93	-	12.3	0	81	163	69	67
6	0.886	0.150	0.042	0.98	71	-0.93	-	12.3	0	81	164	69	67
7	1.036	0.150	0.041	1.00	71	-0.93	-	12.3	0	81	164	69	67
8	1.186	0.150	0.041	1.00	71	-0.96	-	12.3	0	81	163	69	67
9	1.335	0.149	0.042	1.00	72	-0.96	-	12.3	0	79	158	69	67
10	1.485	0.150	0.042	1.00	72	-0.98	104	12.3	0	78	155	69	67
11	1.634	0.149	0.042	1.01	72	-1	-	12.3	0	77	153	69	67
12	1.783	0.149	0.041	1.00	72	-1.02	-	12.3	0	77	152	69	67
13	1.931	0.148	0.041	0.98	72	-1.04	-	12.3	0	77	151	69	67
14	2.080	0.149	0.041	0.99	73	-1.06	-	12.3	0	76	149	70	67
15	2.228	0.148	0.042	0.99	72	-1.1	-	12.3	0	76	149	69	67
16	2.377	0.149	0.042	0.99	72	-1.1	-	12.3	0	76	148	69	67
17	2.525	0.148	0.040	0.97	73	-1.11	-	12.3	0	76	146	69	67
18	2.674	0.149	0.041	0.97	73	-1.14	-	12.3	0	76	146	69	67
19	2.822	0.148	0.041	0.96	73	-1.15	-	12.3	0	76	145	69	67
20	2.971	0.149	0.040	0.96	74	-1.16	106	12.3	0	76	144	70	67
21	3.119	0.148	0.042	1.00	74	-1.19	-	12.3	0	76	144	70	67
22	3.267	0.148	0.039	0.99	74	-1.19	-	12.3	0	76	144	69	67
23	3.415	0.148	0.042	0.98	75	-1.2	-	12.3	0	76	143	70	67
24	3.564	0.149	0.041	0.98	74	-1.24	-	12.3	0	76	143	70	68
25	3.712	0.148	0.041	0.97	75	-1.24	-	12.3	0	76	142	70	68
26	3.860	0.148	0.043	0.97	75	-1.25	-	12.3	0	76	142	70	67
27	4.008	0.148	0.042	1.00	75	-1.26	-	12.3	0	76	141	70	68
28	4.156	0.148	0.042	0.98	76	-1.27	-	12.3	0	76	141	70	68
29	4.304	0.148	0.042	0.97	75	-1.32	-	12.3	0	76	140	70	68
30	4.452	0.148	0.045	0.95	77	-1.33	99	12.3	0	76	140	70	68
31	4.600	0.148	0.043	0.98	77	-1.34	-	12.3	0	77	139	70	68

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.748	0.148	0.043	0.98	76	-1.36	-	12.3	0	77	139	70	68
33	4.896	0.148	0.042	0.98	77	-1.37	-	12.3	0	77	139	70	68
34	5.045	0.149	0.041	0.98	77	-1.39	-	12.3	0	77	138	70	68
35	5.193	0.148	0.043	0.98	77	-1.41	-	12.3	0	76	138	70	68
36	5.341	0.148	0.043	0.97	77	-1.43	-	12.3	0	76	138	70	68
37	5.489	0.148	0.043	0.96	78	-1.46	-	12.3	0	76	137	70	68
38	5.638	0.149	0.043	0.97	79	-1.47	-	12.3	0	77	137	70	68
39	5.786	0.148	0.042	1.02	79	-1.51	-	12.3	0	77	136	70	68
40	5.934	0.148	0.044	0.99	79	-1.51	100	12.3	0	77	137	70	68
41	6.082	0.148	0.043	0.98	80	-1.55	-	12.3	0	77	136	70	68
42	6.230	0.148	0.045	0.97	79	-1.57	-	12.3	0	77	136	70	68
43	6.379	0.149	0.044	0.97	81	-1.6	-	12.3	0	77	135	71	68
44	6.527	0.148	0.044	0.98	81	-1.63	-	12.3	0	77	135	70	68
45	6.675	0.148	0.042	0.98	80	-1.64	-	12.3	0	77	135	70	68
46	6.823	0.148	0.042	0.97	81	-1.67	-	12.3	0	77	134	70	68
47	6.972	0.149	0.042	0.98	82	-1.69	-	12.3	0	77	134	71	68
48	7.120	0.148	0.044	0.97	81	-1.73	-	12.3	0	77	134	70	68
49	7.268	0.148	0.044	0.97	81	-1.73	-	12.3	0	77	134	71	68
50	7.416	0.148	0.042	0.98	81	-1.74	102	12.3	0	77	134	70	68
51	7.564	0.148	0.044	0.98	82	-1.78	-	12.3	0	77	134	71	68
52	7.712	0.148	0.044	0.98	82	-1.81	-	12.3	0	77	133	71	68
53	7.860	0.148	0.043	0.98	82	-1.81	-	12.3	0	76	133	71	69
54	8.008	0.148	0.043	0.99	83	-1.84	-	12.3	0	77	132	71	68
55	8.156	0.148	0.043	0.99	83	-1.88	-	12.3	0	76	133	71	69
56	8.305	0.149	0.042	0.97	84	-1.89	-	12.3	0	77	133	71	69
57	8.453	0.148	0.044	0.97	83	-1.94	-	12.3	0	79	137	71	69
58	8.602	0.149	0.043	0.97	84	-1.95	-	12.3	0	81	138	71	69
59	8.750	0.148	0.043	0.96	85	-1.97	-	12.3	0	82	143	71	69
60	8.898	0.148	0.043	0.98	84	-1.99	100	12.3	0	82	143	71	69
61	9.047	0.149	0.042	0.97	84	-2	-	12.2	-0.1	82	146	71	69
62	9.195	0.148	0.041	0.98	85	-2.04	-	12.1	-0.1	82	148	72	69
63	9.343	0.148	0.042	0.97	85	-2.07	-	11.8	-0.3	82	150	71	69

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	9.492	0.149	0.043	0.94	85	-2.09	-	11.6	-0.2	82	151	71	69
65	9.640	0.148	0.042	1.00	86	-2.1	-	11.4	-0.2	82	152	72	69
66	9.788	0.148	0.043	0.97	86	-2.13	-	11.3	-0.1	82	152	72	69
67	9.937	0.149	0.043	0.97	85	-2.17	-	11.2	-0.1	82	154	71	69
68	10.085	0.148	0.044	0.97	86	-2.17	-	11.0	-0.2	82	155	71	69
69	10.233	0.148	0.043	0.98	87	-2.21	-	10.8	-0.2	82	155	72	69
70	10.382	0.149	0.042	0.97	87	-2.19	101	10.6	-0.2	82	156	72	69
71	10.530	0.148	0.043	0.97	87	-2.21	-	10.5	-0.1	82	156	72	69
72	10.679	0.149	0.043	0.97	86	-2.23	-	10.5	0	82	157	72	69
73	10.827	0.148	0.043	0.99	87	-2.22	-	10.4	-0.1	82	157	72	69
74	10.976	0.149	0.044	0.97	87	-2.2	-	10.3	-0.1	81	157	72	69
75	11.124	0.148	0.043	0.97	88	-2.19	-	9.9	-0.4	82	157	72	69
76	11.273	0.149	0.044	0.98	87	-2.2	-	9.8	-0.1	82	158	72	69
77	11.421	0.148	0.045	0.97	88	-2.19	-	9.6	-0.2	82	158	72	69
78	11.570	0.149	0.043	0.98	88	-2.19	-	9.6	0	82	159	72	69
79	11.719	0.149	0.042	0.99	89	-2.18	-	9.5	-0.1	82	159	72	69
80	11.867	0.148	0.042	0.97	88	-2.16	101	9.4	-0.1	82	160	72	69
81	12.016	0.149	0.041	0.98	88	-2.18	-	9.3	-0.1	82	160	72	69
82	12.164	0.148	0.042	0.97	89	-2.18	-	9.1	-0.2	82	160	72	69
83	12.312	0.148	0.043	0.97	89	-2.19	-	8.9	-0.2	82	159	71	69
84	12.461	0.149	0.041	0.98	89	-2.21	-	9.0	0.1	81	160	71	69
85	12.609	0.148	0.044	0.98	90	-2.18	-	8.8	-0.2	81	159	72	69
86	12.758	0.149	0.045	0.98	90	-2.19	-	8.7	-0.1	81	159	72	69
87	12.907	0.149	0.043	0.97	90	-2.2	-	8.2	-0.5	81	159	72	69
88	13.056	0.149	0.042	0.96	89	-2.2	-	8.1	-0.1	81	160	72	69
89	13.205	0.149	0.043	1.00	89	-2.18	-	8.0	-0.1	81	160	71	69
90	13.354	0.149	0.044	0.98	91	-2.2	98	8.0	0	81	160	72	69
91	13.503	0.149	0.043	0.97	91	-2.21	-	7.9	-0.1	82	160	72	69
92	13.652	0.149	0.044	0.97	91	-2.24	-	7.6	-0.3	82	160	72	69
93	13.801	0.149	0.042	0.94	91	-2.22	-	7.5	-0.1	81	160	72	69
94	13.950	0.149	0.042	0.97	90	-2.25	-	7.4	-0.1	82	161	72	69
95	14.099	0.149	0.045	0.97	90	-2.25	-	7.4	0	82	161	72	69

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	14.248	0.149	0.042	0.96	90	-2.28	-	7.3	-0.1	82	161	72	70
97	14.397	0.149	0.046	0.98	91	-2.32	-	7.2	-0.1	82	162	72	70
98	14.546	0.149	0.042	0.97	91	-2.29	-	6.9	-0.3	82	161	72	70
99	14.695	0.149	0.042	0.97	91	-2.29	-	6.7	-0.2	82	163	72	69
100	14.844	0.149	0.043	0.96	92	-2.28	100	6.6	-0.1	82	162	72	69
101	14.992	0.148	0.043	0.97	92	-2.3	-	6.6	0	82	163	72	69
102	15.141	0.149	0.043	0.98	92	-2.31	-	6.6	0	82	163	72	70
103	15.289	0.148	0.042	0.97	92	-2.31	-	6.6	0	82	163	72	69
104	15.438	0.149	0.040	1.00	92	-2.33	-	6.6	0	82	163	72	69
105	15.587	0.149	0.045	0.96	91	-2.33	-	6.6	0	81	163	72	69
106	15.737	0.150	0.045	0.96	93	-2.33	-	6.6	0	80	158	72	69
107	15.886	0.149	0.043	0.97	92	-2.34	-	6.6	0	79	155	71	69
108	16.035	0.149	0.043	0.97	93	-2.36	-	6.6	0	78	153	72	69
109	16.185	0.150	0.044	0.98	92	-2.38	-	6.6	0	78	152	71	69
110	16.334	0.149	0.044	0.97	92	-2.39	98	6.6	0	78	151	71	69
111	16.484	0.150	0.043	0.98	93	-2.4	-	6.6	0	78	149	72	70
112	16.633	0.149	0.045	0.97	92	-2.43	-	6.6	0	77	149	72	70
113	16.782	0.149	0.042	0.94	93	-2.46	-	6.6	0	77	147	72	70
114	16.932	0.150	0.041	1.01	92	-2.48	-	6.6	0	77	147	72	70
115	17.081	0.149	0.043	0.97	92	-2.5	-	6.6	0	77	146	72	70
116	17.230	0.149	0.043	1.00	92	-2.51	-	6.6	0	77	146	72	70
117	17.379	0.149	0.043	0.98	93	-2.54	-	6.6	0	77	145	72	70
118	17.528	0.149	0.042	0.98	93	-2.57	-	6.6	0	77	144	72	70
119	17.677	0.149	0.044	1.00	93	-2.56	-	6.6	0	77	144	72	70
120	17.827	0.150	0.044	0.98	93	-2.66	98	6.6	0	77	143	72	70
121	17.976	0.149	0.043	0.97	94	-2.65	-	6.6	0	77	142	72	70
122	18.126	0.150	0.045	0.98	93	-2.7	-	6.6	0	77	142	72	70
123	18.276	0.150	0.042	0.98	94	-2.73	-	6.6	0	77	141	72	70
124	18.425	0.149	0.044	0.97	94	-2.76	-	6.6	0	77	141	72	70
125	18.576	0.151	0.042	0.98	93	-2.83	-	6.6	0	77	141	72	70
126	18.726	0.150	0.044	0.98	94	-2.87	-	6.6	0	77	140	72	70
127	18.875	0.149	0.047	0.94	93	-2.86	-	6.6	0	77	141	72	70

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	19.025	0.150	0.045	0.99	93	-2.93	-	6.6	0	77	140	72	70
129	19.174	0.149	0.044	0.98	94	-2.97	-	6.6	0	77	139	72	70
130	19.323	0.149	0.042	0.97	94	-2.96	100	6.6	0	77	139	72	70
131	19.472	0.149	0.042	0.98	94	-3.04	-	6.6	0	77	139	72	70
132	19.621	0.149	0.041	0.97	94	-3.08	-	6.6	0	77	138	72	70
133	19.771	0.150	0.041	0.98	94	-3.11	-	6.6	0	77	138	72	70
134	19.920	0.149	0.043	0.97	94	-3.12	-	6.6	0	77	138	72	70
135	20.070	0.150	0.041	0.95	94	-3.17	-	6.6	0	77	138	72	70
136	20.219	0.149	0.043	1.00	95	-3.23	-	6.6	0	77	137	72	70
137	20.369	0.150	0.044	0.97	94	-3.24	-	6.6	0	77	137	72	70
138	20.519	0.150	0.041	0.98	95	-3.28	-	6.6	0	77	136	72	70
139	20.668	0.149	0.042	0.97	95	-3.31	-	6.6	0	77	136	72	70
140	20.818	0.150	0.043	0.97	95	-3.36	99	6.6	0	77	136	72	70
141	20.967	0.149	0.043	0.97	95	-3.38	-	6.6	0	77	136	72	70
142	21.117	0.150	0.042	0.98	95	-3.4	-	6.6	0	77	135	72	70
143	21.266	0.149	0.045	0.96	94	-3.44	-	6.6	0	77	136	72	70
144	21.414	0.148	0.045	0.97	94	-3.46	-	6.6	0	77	135	72	70
145	21.564	0.150	0.041	0.98	95	-3.5	-	6.6	0	77	135	72	70
146	21.713	0.149	0.044	0.96	95	-3.5	-	6.6	0	77	134	72	70
147	21.863	0.150	0.043	0.97	95	-3.54	-	6.6	0	77	134	72	70
148	22.012	0.149	0.043	1.00	95	-3.59	-	6.6	0	77	133	72	70
149	22.162	0.150	0.043	0.97	95	-3.6	-	6.6	0	77	133	72	70
150	22.311	0.149	0.044	0.97	95	-3.63	98	6.6	0	77	133	72	70
151	22.461	0.150	0.045	0.97	95	-3.66	-	6.6	0	77	133	72	71
152	22.611	0.150	0.044	0.98	95	-3.7	-	6.6	0	77	133	72	70
153	22.760	0.149	0.042	0.97	96	-3.73	-	6.6	0	77	133	72	70
154	22.910	0.150	0.042	0.98	95	-3.74	-	6.6	0	77	133	72	70
155	23.057	0.147	0.043	0.97	96	-3.79	-	6.6	0	79	135	73	70
156	23.206	0.149	0.043	0.96	96	-3.81	-	6.6	0	81	137	72	71
157	23.355	0.149	0.041	0.96	95	-3.85	-	6.6	0	82	142	72	71
158	23.504	0.149	0.042	0.97	96	-3.88	-	6.5	-0.1	83	143	73	71
159	23.653	0.149	0.042	0.98	96	-3.88	-	6.4	-0.1	83	144	73	71

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	23.802	0.149	0.042	0.99	95	-3.92	100	6.1	-0.3	83	148	73	71
161	23.951	0.149	0.044	0.96	96	-3.96	-	5.9	-0.2	83	149	73	71
162	24.100	0.149	0.042	0.94	96	-3.98	-	5.7	-0.2	83	150	73	71
163	24.250	0.150	0.044	0.97	96	-3.97	-	5.6	-0.1	83	151	73	71
164	24.399	0.149	0.044	0.96	95	-4.04	-	5.4	-0.2	83	153	73	71
165	24.548	0.149	0.044	0.98	96	-4.05	-	5.2	-0.2	83	153	73	71
166	24.697	0.149	0.044	0.96	96	-4.03	-	5.0	-0.2	83	154	73	71
167	24.846	0.149	0.044	1.00	96	-4.1	-	4.7	-0.3	83	154	73	71
168	24.995	0.149	0.043	0.97	96	-4.09	-	4.5	-0.2	83	154	73	71
169	25.144	0.149	0.043	0.96	97	-4.09	-	4.4	-0.1	83	155	74	71
170	25.294	0.150	0.041	0.96	96	-4.09	101	4.3	-0.1	83	155	73	71
171	25.443	0.149	0.042	0.97	97	-4.05	-	4.1	-0.2	83	156	74	71
172	25.592	0.149	0.042	0.97	97	-4.02	-	3.8	-0.3	84	156	74	71
173	25.741	0.149	0.043	0.98	97	-4.04	-	3.7	-0.1	84	157	74	71
174	25.889	0.148	0.043	0.97	96	-4.02	-	3.6	-0.1	84	158	74	71
175	26.038	0.149	0.044	0.97	97	-3.99	-	3.6	0	83	158	74	71
176	26.186	0.148	0.043	0.97	97	-3.96	-	3.5	-0.1	84	158	74	71
177	26.335	0.149	0.043	0.97	96	-3.96	-	3.4	-0.1	84	159	74	71
178	26.484	0.149	0.043	0.96	97	-3.92	-	3.2	-0.2	83	158	74	71
179	26.633	0.149	0.042	0.99	96	-3.92	-	3.1	-0.1	83	159	74	72
180	26.782	0.149	0.042	0.97	97	-3.92	100	2.9	-0.2	84	158	74	72
181	26.931	0.149	0.043	0.97	97	-3.89	-	2.9	0	84	158	74	72
182	27.080	0.149	0.041	0.96	96	-3.89	-	2.7	-0.2	84	159	74	72
183	27.229	0.149	0.042	0.96	96	-3.86	-	2.6	-0.1	84	159	74	72
184	27.378	0.149	0.043	0.96	97	-3.84	-	2.4	-0.2	84	158	74	72
185	27.527	0.149	0.043	0.96	97	-3.84	-	2.3	-0.1	84	159	74	72
186	27.676	0.149	0.043	0.97	96	-3.86	-	2.0	-0.3	84	160	74	71
187	27.825	0.149	0.042	0.97	97	-3.81	-	1.9	-0.1	84	159	74	72
188	27.974	0.149	0.042	0.96	98	-3.86	-	1.8	-0.1	84	159	74	71
189	28.123	0.149	0.043	0.96	98	-3.83	-	1.8	0	84	159	74	72
190	28.272	0.149	0.044	0.94	97	-3.84	98	1.7	-0.1	84	160	74	72
191	28.420	0.148	0.042	0.99	97	-3.82	-	1.4	-0.3	84	160	74	72

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
192	28.569	0.149	0.044	0.96	98	-3.83	-	1.4	0	84	161	74	72
193	28.718	0.149	0.043	0.94	97	-3.84	-	1.2	-0.2	84	161	74	72
194	28.866	0.148	0.045	0.98	97	-3.82	-	1.1	-0.1	84	161	74	72
195	29.014	0.148	0.044	0.97	98	-3.83	-	0.9	-0.2	85	161	75	72
196	29.163	0.149	0.043	0.97	98	-3.86	-	0.8	-0.1	85	161	75	72
197	29.311	0.148	0.043	0.96	97	-3.84	-	0.6	-0.2	85	162	74	72
198	29.460	0.149	0.043	0.97	97	-3.85	-	0.5	-0.1	85	162	74	72
199	29.609	0.149	0.043	0.98	98	-3.84	-	0.4	-0.1	85	162	75	72
200	29.758	0.149	0.043	0.97	97	-3.85	99	0.3	-0.1	85	163	74	72
201	29.906	0.148	0.043	0.96	97	-3.86	-	0.2	-0.1	85	163	74	72
202	30.055	0.149	0.042	0.97	98	-3.83	-	0.1	-0.1	85	163	75	72
203	30.205	0.150	0.045	0.95	97	-3.86	-	0.0	-0.1	85	163	74	72
204	30.354	0.149	0.043	0.97	97	-3.87	-	0.0	0	84	161	74	72
205	30.503	0.149	0.044	0.96	98	-3.83	-	0.0	0	83	157	75	72
206	30.652	0.149	0.043	0.97	98	-3.85	-	0.0	0	82	154	75	72
207	30.801	0.149	0.043	0.99	97	-3.84	-	0.0	0	82	153	74	72
208	30.950	0.149	0.041	0.98	97	-3.85	-	0.0	0	82	152	74	72
209	31.099	0.149	0.043	0.96	97	-3.85	-	0.0	0	82	151	74	72
210	31.248	0.149	0.043	0.95	98	-3.85	98	0.0	0	82	149	74	72
211	31.397	0.149	0.043	0.96	97	-3.88	-	0.0	0	82	149	74	72
212	31.546	0.149	0.041	0.96	98	-3.88	-	0.0	0	82	147	75	72
213	31.695	0.149	0.042	0.96	98	-3.85	-	0.0	0	82	146	75	72
214	31.843	0.148	0.042	0.97	99	-3.92	-	0.0	0	82	145	75	72
215	31.992	0.149	0.043	0.97	97	-3.92	-	0.0	0	82	146	74	72
216	32.141	0.149	0.046	0.97	98	-3.95	-	0.0	0	82	144	75	72
217	32.290	0.149	0.043	0.99	98	-3.96	-	0.0	0	82	144	74	72
218	32.439	0.149	0.044	0.97	98	-3.99	-	0.0	0	82	144	75	72
219	32.588	0.149	0.043	0.98	98	-3.99	-	0.0	0	82	143	75	73
220	32.737	0.149	0.042	0.96	98	-4.04	100	0.0	0	82	143	75	73
221	32.886	0.149	0.044	0.96	99	-4.06	-	0.0	0	82	142	75	72
222	33.035	0.149	0.040	0.96	99	-4.06	-	0.0	0	82	141	75	72
223	33.184	0.149	0.044	0.95	99	-4.08	-	0.0	0	82	141	75	72

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
224	33.333	0.149	0.043	0.97	99	-4.16	-	0.0	0	82	141	75	73
225	33.482	0.149	0.043	0.96	99	-4.16	-	0.0	0	82	140	75	73
226	33.631	0.149	0.041	0.96	98	-4.15	-	0.0	0	82	141	75	73
227	33.780	0.149	0.042	0.98	99	-4.23	-	0.0	0	82	139	75	73
228	33.929	0.149	0.043	0.98	99	-4.26	-	0.0	0	82	139	75	73
229	34.078	0.149	0.043	0.96	99	-4.27	-	0.0	0	83	139	75	73
230	34.227	0.149	0.042	0.97	98	-4.29	100	0.0	0	83	139	75	73
231	34.376	0.149	0.042	0.96	99	-4.3	-	0.0	0	83	138	75	73
232	34.524	0.148	0.042	0.96	99	-4.35	-	0.0	0	83	138	75	73
233	34.673	0.149	0.042	0.96	99	-4.35	-	0.0	0	83	138	75	73
234	34.821	0.148	0.043	0.97	98	-4.34	-	0.0	0	83	138	75	73
235	34.970	0.149	0.044	0.95	99	-4.39	-	0.0	0	83	137	75	73
236	35.119	0.149	0.042	0.96	98	-4.38	-	0.0	0	83	137	75	73
237	35.268	0.149	0.043	0.97	99	-4.43	-	0.0	0	83	136	75	73
238	35.417	0.149	0.043	0.96	98	-4.43	-	0.0	0	83	137	75	73
239	35.566	0.149	0.041	0.96	99	-4.47	-	0.0	0	83	136	75	73
240	35.716	0.150	0.043	0.96	98	-4.47	98	0.0	0	83	136	75	73
Avg/Tot	35.716	0.149	0.043	0.97	90	-2.79	100			80	148	72	69.9

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.61	71	-1.41		69	-0.020	11.19	0.01
1	0.134	0.134	1.08	73	-1.28	-	70	-0.030	9.82	0.02
2	0.286	0.152	1.07	73	-1.31	-	70	-0.010	11.84	0.01
3	0.437	0.151	1.07	73	-1.32	-	70	-0.020	11.40	0.01
4	0.588	0.151	1.06	73	-1.33	-	71	-0.010	11.78	0.02
5	0.739	0.151	1.06	72	-1.3	-	71	-0.020	11.89	0.01
6	0.888	0.149	1.08	73	-1.29	-	71	-0.010	11.10	0.01
7	1.037	0.149	1.08	73	-1.31	-	71	-0.020	11.44	0.01
8	1.186	0.149	1.06	73	-1.35	-	71	-0.010	5.96	0.05
9	1.336	0.150	1.10	73	-1.26	-	71	-0.020	2.11	0.20
10	1.485	0.149	1.04	74	-1.37	103	71	-0.010	1.92	0.20
11	1.635	0.150	1.05	73	-1.31	-	71	0.000	1.75	0.15
12	1.784	0.149	1.05	75	-1.31	-	71	-0.020	1.45	0.09
13	1.933	0.149	1.05	74	-1.31	-	71	-0.010	1.19	0.06
14	2.083	0.150	1.04	75	-1.27	-	71	-0.010	1.05	0.04
15	2.231	0.148	1.04	75	-1.28	-	71	-0.010	0.90	0.02
16	2.380	0.149	1.05	76	-1.32	-	71	-0.010	0.80	0.01
17	2.529	0.149	1.06	76	-1.32	-	71	-0.020	0.76	0.01
18	2.677	0.148	1.02	76	-1.34	-	71	-0.020	0.74	0.01
19	2.825	0.148	1.05	76	-1.36	-	71	-0.020	0.65	0.01
20	2.974	0.149	1.09	76	-1.37	105	71	-0.010	0.61	0.01
21	3.121	0.147	1.03	77	-1.32	-	71	-0.020	0.61	0.01
22	3.269	0.148	1.04	77	-1.36	-	71	-0.010	0.58	0.01
23	3.417	0.148	1.04	77	-1.28	-	71	-0.010	0.60	0.00
24	3.565	0.148	1.05	78	-1.29	-	71	-0.010	0.59	0.00
25	3.713	0.148	1.04	78	-1.3	-	71	-0.010	0.58	0.00
26	3.860	0.147	1.02	78	-1.35	-	71	-0.010	0.56	0.00
27	4.009	0.149	1.00	78	-1.34	-	71	-0.020	0.53	0.01
28	4.156	0.147	1.04	78	-1.35	-	71	-0.010	0.54	0.00
29	4.304	0.148	1.02	79	-1.27	-	71	0.000	0.49	0.00
30	4.452	0.148	1.02	79	-1.25	98	71	0.000	0.53	0.00
31	4.600	0.148	1.04	79	-1.24	-	72	-0.010	0.52	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.748	0.148	1.03	79	-1.34	-	72	-0.010	0.52	0.00
33	4.896	0.148	1.03	80	-1.34	-	72	-0.010	0.52	0.00
34	5.044	0.148	1.04	80	-1.29	-	72	-0.010	0.51	0.00
35	5.193	0.149	1.07	80	-1.27	-	72	-0.020	0.49	0.00
36	5.341	0.148	1.05	81	-1.29	-	71	0.000	0.51	0.01
37	5.489	0.148	1.02	81	-1.33	-	72	-0.010	0.49	0.00
38	5.637	0.148	1.03	81	-1.25	-	72	-0.010	0.47	0.00
39	5.785	0.148	0.99	81	-1.27	-	72	-0.010	0.47	0.01
40	5.934	0.149	1.03	81	-1.33	99	72	0.000	0.50	0.00
41	6.082	0.148	1.04	82	-1.34	-	72	-0.010	0.48	0.00
42	6.230	0.148	1.03	82	-1.24	-	72	-0.010	0.47	0.00
43	6.379	0.149	1.03	82	-1.3	-	72	-0.010	0.48	0.00
44	6.527	0.148	1.04	83	-1.26	-	72	-0.010	0.48	0.00
45	6.675	0.148	1.04	83	-1.24	-	72	-0.010	0.48	0.00
46	6.824	0.149	1.04	83	-1.31	-	72	-0.010	0.47	0.00
47	6.972	0.148	1.04	83	-1.34	-	72	-0.010	0.47	0.00
48	7.120	0.148	1.05	83	-1.27	-	72	-0.020	0.53	0.01
49	7.269	0.149	1.04	84	-1.28	-	72	-0.010	0.48	0.00
50	7.417	0.148	1.04	84	-1.34	101	72	-0.010	0.46	0.00
51	7.565	0.148	1.03	84	-1.36	-	72	0.000	0.44	0.00
52	7.713	0.148	1.04	85	-1.32	-	72	-0.010	0.46	0.00
53	7.861	0.148	1.04	84	-1.32	-	72	-0.010	0.46	0.00
54	8.010	0.149	1.01	84	-1.27	-	72	-0.020	0.47	0.00
55	8.158	0.148	1.02	84	-1.22	-	72	-0.020	0.47	0.00
56	8.306	0.148	1.05	85	-1.28	-	72	-0.010	0.50	0.00
57	8.455	0.149	1.07	85	-1.34	-	72	-0.020	0.43	0.00
58	8.604	0.149	1.06	85	-1.36	-	73	-0.010	0.45	0.01
59	8.752	0.148	1.01	86	-1.24	-	73	-0.010	1.59	0.01
60	8.901	0.149	1.04	85	-1.38	100	73	-0.010	2.46	0.01
61	9.050	0.149	1.03	86	-1.23	-	73	-0.020	2.31	0.03
62	9.199	0.149	1.03	85	-1.24	-	73	-0.020	4.54	0.06
63	9.347	0.148	1.03	86	-1.37	-	73	-0.010	8.35	0.03

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	9.496	0.149	1.06	87	-1.35	-	73	0.000	12.36	0.02
65	9.645	0.149	0.98	86	-1.3	-	73	-0.020	13.16	0.01
66	9.793	0.148	1.04	86	-1.31	-	73	-0.010	13.21	0.02
67	9.942	0.149	1.03	87	-1.33	-	73	-0.020	14.02	0.01
68	10.091	0.149	1.03	87	-1.29	-	73	-0.010	14.32	0.02
69	10.239	0.148	1.03	86	-1.34	-	73	-0.010	12.94	0.01
70	10.388	0.149	1.05	86	-1.36	101	73	-0.010	10.99	0.03
71	10.537	0.149	1.04	86	-1.22	-	73	-0.010	11.64	0.01
72	10.685	0.148	1.04	88	-1.31	-	73	-0.010	10.35	0.02
73	10.833	0.148	1.05	87	-1.23	-	73	-0.010	10.63	0.02
74	10.982	0.149	1.04	88	-1.28	-	73	-0.010	10.48	0.01
75	11.131	0.149	1.04	87	-1.33	-	73	-0.010	10.27	0.02
76	11.280	0.149	1.02	87	-1.27	-	73	0.000	10.82	0.02
77	11.429	0.149	1.03	87	-1.21	-	74	-0.010	10.45	0.01
78	11.578	0.149	1.05	87	-1.35	-	74	-0.010	9.27	0.02
79	11.728	0.150	1.00	88	-1.25	-	74	-0.020	10.45	0.01
80	11.877	0.149	1.05	89	-1.36	101	73	-0.020	10.08	0.01
81	12.026	0.149	1.03	89	-1.32	-	73	-0.010	9.76	0.02
82	12.175	0.149	1.04	89	-1.37	-	73	-0.010	10.33	0.01
83	12.325	0.150	1.04	89	-1.26	-	73	-0.010	10.70	0.01
84	12.474	0.149	1.03	89	-1.35	-	73	-0.010	10.31	0.01
85	12.623	0.149	1.06	88	-1.23	-	73	-0.020	10.53	0.01
86	12.772	0.149	1.04	89	-1.32	-	73	-0.010	11.81	0.00
87	12.921	0.149	1.05	89	-1.32	-	73	-0.010	11.27	0.00
88	13.070	0.149	1.09	89	-1.24	-	73	-0.020	11.89	0.01
89	13.219	0.149	1.07	89	-1.32	-	73	-0.010	10.85	0.01
90	13.369	0.150	1.03	88	-1.3	98	73	-0.010	10.98	0.01
91	13.518	0.149	1.05	89	-1.24	-	73	-0.010	11.03	0.01
92	13.668	0.150	1.04	89	-1.34	-	74	-0.010	11.27	0.01
93	13.818	0.150	1.06	89	-1.25	-	74	-0.020	11.13	0.01
94	13.968	0.150	1.04	89	-1.3	-	73	-0.010	12.56	0.00
95	14.117	0.149	1.04	89	-1.23	-	73	-0.010	10.92	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	14.267	0.150	1.06	90	-1.3	-	74	-0.010	11.23	0.01
97	14.416	0.149	1.04	89	-1.21	-	74	-0.030	11.59	0.01
98	14.565	0.149	1.05	89	-1.25	-	74	-0.010	11.62	0.00
99	14.714	0.149	1.05	90	-1.23	-	74	-0.010	12.05	0.00
100	14.863	0.149	1.07	90	-1.34	99	74	-0.010	12.10	0.01
101	15.013	0.150	1.06	90	-1.33	-	74	-0.010	12.23	0.01
102	15.163	0.150	1.03	89	-1.25	-	73	-0.010	11.24	0.00
103	15.313	0.150	1.04	89	-1.22	-	73	-0.010	10.87	0.01
104	15.463	0.150	1.05	90	-1.36	-	74	-0.020	10.63	0.01
105	15.613	0.150	1.02	90	-1.26	-	73	0.000	7.72	0.05
106	15.763	0.150	1.04	90	-1.21	-	73	-0.010	2.68	0.15
107	15.912	0.149	1.04	91	-1.35	-	73	-0.010	2.13	0.21
108	16.062	0.150	1.08	90	-1.2	-	73	0.000	1.68	0.17
109	16.211	0.149	1.06	90	-1.35	-	73	-0.010	1.49	0.11
110	16.361	0.150	1.05	90	-1.22	98	73	-0.010	1.28	0.07
111	16.510	0.149	1.02	90	-1.29	-	73	0.000	1.15	0.05
112	16.660	0.150	1.02	91	-1.35	-	73	-0.020	1.03	0.03
113	16.811	0.151	1.02	91	-1.32	-	73	0.000	0.89	0.03
114	16.961	0.150	1.01	91	-1.28	-	73	-0.010	0.89	0.03
115	17.111	0.150	1.05	91	-1.24	-	73	-0.010	0.74	0.01
116	17.262	0.151	1.05	91	-1.34	-	73	-0.010	0.68	0.01
117	17.412	0.150	1.03	90	-1.35	-	73	-0.020	0.64	0.02
118	17.561	0.149	1.05	90	-1.25	-	73	-0.010	0.58	0.00
119	17.710	0.149	1.00	90	-1.23	-	73	-0.010	0.56	0.01
120	17.860	0.150	1.06	91	-1.32	98	73	-0.010	0.61	0.01
121	18.011	0.151	1.06	90	-1.23	-	73	-0.010	0.55	0.00
122	18.161	0.150	1.05	91	-1.24	-	73	-0.010	0.52	0.00
123	18.311	0.150	1.04	90	-1.23	-	73	-0.010	0.51	0.00
124	18.462	0.151	0.98	92	-1.33	-	74	-0.010	0.50	0.01
125	18.612	0.150	1.01	91	-1.26	-	73	-0.020	0.51	0.01
126	18.762	0.150	1.06	91	-1.27	-	73	-0.010	0.45	0.00
127	18.912	0.150	1.04	91	-1.31	-	73	0.000	0.51	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
128	19.061	0.149	1.05	91	-1.26	-	73	0.000	0.48	0.00
129	19.211	0.150	1.05	92	-1.33	-	74	-0.010	0.45	0.00
130	19.361	0.150	1.05	90	-1.22	101	73	-0.010	0.46	0.01
131	19.512	0.151	1.04	91	-1.22	-	74	-0.010	0.46	0.00
132	19.663	0.151	1.04	92	-1.32	-	74	-0.010	0.46	0.00
133	19.813	0.150	1.04	91	-1.31	-	73	-0.010	0.43	0.00
134	19.963	0.150	1.05	91	-1.32	-	74	-0.010	0.46	0.00
135	20.113	0.150	1.06	92	-1.26	-	73	-0.010	0.42	0.00
136	20.262	0.149	1.04	91	-1.29	-	73	-0.010	0.44	0.00
137	20.412	0.150	1.04	91	-1.24	-	73	-0.010	0.44	0.00
138	20.563	0.151	1.03	91	-1.27	-	73	-0.010	0.36	0.01
139	20.713	0.150	1.05	92	-1.25	-	74	-0.010	0.43	0.00
140	20.864	0.151	1.05	92	-1.27	99	74	-0.010	0.41	0.00
141	21.015	0.151	1.02	92	-1.33	-	74	-0.010	0.39	0.00
142	21.165	0.150	1.04	92	-1.32	-	74	0.000	0.41	0.01
143	21.316	0.151	1.05	91	-1.25	-	74	-0.010	0.40	0.00
144	21.465	0.149	1.05	92	-1.23	-	73	0.000	0.42	0.00
145	21.614	0.149	1.05	92	-1.23	-	73	-0.010	0.40	0.00
146	21.765	0.151	1.06	92	-1.28	-	74	0.000	0.41	0.00
147	21.915	0.150	1.01	91	-1.24	-	73	-0.020	0.43	0.01
148	22.066	0.151	1.01	92	-1.24	-	74	0.010	0.37	0.00
149	22.217	0.151	1.02	93	-1.2	-	74	-0.010	0.39	0.00
150	22.367	0.150	1.04	93	-1.26	98	74	-0.010	0.41	0.00
151	22.518	0.151	1.04	93	-1.24	-	74	-0.010	0.40	0.00
152	22.667	0.149	1.02	92	-1.36	-	74	-0.010	0.37	0.00
153	22.817	0.150	1.05	92	-1.33	-	74	-0.010	0.39	0.00
154	22.967	0.150	1.03	92	-1.23	-	74	0.000	0.46	0.00
155	23.115	0.148	1.01	92	-1.36	-	74	-0.010	0.38	0.01
156	23.265	0.150	1.03	92	-1.24	-	74	-0.010	0.37	0.00
157	23.416	0.151	1.10	92	-1.32	-	74	-0.010	0.40	0.00
158	23.566	0.150	1.05	92	-1.26	-	74	-0.010	2.68	0.01
159	23.717	0.151	1.03	93	-1.31	-	75	-0.010	2.43	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
160	23.867	0.150	1.07	93	-1.31	101	74	-0.020	3.78	0.04
161	24.017	0.150	1.03	92	-1.22	-	75	0.000	6.81	0.04
162	24.167	0.150	1.07	92	-1.32	-	75	0.000	10.73	0.02
163	24.316	0.149	1.04	92	-1.29	-	75	-0.010	12.48	0.02
164	24.466	0.150	1.04	93	-1.24	-	75	-0.010	14.62	0.02
165	24.616	0.150	0.99	93	-1.21	-	75	-0.010	17.62	0.07
166	24.767	0.151	1.06	92	-1.29	-	75	-0.010	14.82	0.02
167	24.917	0.150	1.02	92	-1.33	-	75	-0.020	12.02	0.01
168	25.067	0.150	1.04	93	-1.32	-	75	-0.020	12.53	0.02
169	25.218	0.151	1.04	92	-1.24	-	75	-0.010	11.07	0.02
170	25.368	0.150	1.04	93	-1.32	102	75	-0.010	11.80	0.01
171	25.517	0.149	1.05	92	-1.3	-	75	-0.010	10.76	0.02
172	25.666	0.149	1.05	92	-1.29	-	75	-0.010	10.79	0.01
173	25.816	0.150	1.07	92	-1.22	-	75	-0.020	10.98	0.02
174	25.966	0.150	1.04	93	-1.32	-	75	-0.010	10.66	0.01
175	26.117	0.151	1.06	93	-1.22	-	75	-0.010	10.69	0.01
176	26.267	0.150	1.03	92	-1.31	-	75	-0.010	9.81	0.02
177	26.417	0.150	1.03	92	-1.23	-	75	-0.010	10.36	0.01
178	26.568	0.151	0.98	92	-1.29	-	75	-0.020	9.81	0.02
179	26.718	0.150	1.01	93	-1.33	-	75	0.010	8.42	0.02
180	26.867	0.149	1.06	93	-1.33	101	76	-0.010	9.78	0.02
181	27.016	0.149	1.04	93	-1.23	-	76	-0.010	10.07	0.01
182	27.166	0.150	1.03	93	-1.23	-	75	-0.010	10.21	0.02
183	27.317	0.151	1.03	94	-1.24	-	75	0.000	10.31	0.02
184	27.467	0.150	1.04	93	-1.29	-	76	-0.010	10.51	0.01
185	27.617	0.150	1.04	93	-1.33	-	76	-0.010	11.43	0.01
186	27.768	0.151	1.05	94	-1.26	-	76	-0.010	11.21	0.01
187	27.918	0.150	1.04	93	-1.24	-	75	-0.020	10.36	0.01
188	28.068	0.150	1.04	93	-1.34	-	76	-0.010	10.89	0.00
189	28.217	0.149	1.07	93	-1.27	-	75	-0.020	11.47	0.01
190	28.366	0.149	1.03	93	-1.26	98	76	-0.020	10.17	0.02
191	28.515	0.149	1.01	93	-1.3	-	76	-0.010	11.05	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
192	28.665	0.150	1.04	93	-1.22	-	76	-0.010	10.80	0.01
193	28.815	0.150	1.02	93	-1.27	-	76	-0.010	10.68	0.01
194	28.965	0.150	1.05	93	-1.25	-	76	-0.020	9.81	0.01
195	29.115	0.150	1.04	93	-1.22	-	76	-0.010	10.52	0.01
196	29.265	0.150	1.04	93	-1.32	-	76	-0.010	11.47	0.01
197	29.415	0.150	1.03	94	-1.31	-	76	-0.010	12.07	0.01
198	29.565	0.150	1.04	93	-1.22	-	76	-0.010	10.76	0.01
199	29.715	0.150	1.01	93	-1.23	-	76	-0.010	11.26	0.01
200	29.864	0.149	1.02	94	-1.22	99	76	-0.010	11.64	0.01
201	30.014	0.150	1.05	94	-1.23	-	76	-0.010	11.55	0.01
202	30.164	0.150	1.04	93	-1.32	-	76	-0.010	11.95	0.01
203	30.314	0.150	1.06	94	-1.33	-	76	-0.010	10.79	0.00
204	30.465	0.151	1.04	93	-1.22	-	76	-0.010	5.78	0.06
205	30.615	0.150	1.03	93	-1.34	-	76	-0.010	2.32	0.18
206	30.766	0.151	1.03	94	-1.23	-	76	-0.010	1.97	0.20
207	30.916	0.150	1.05	94	-1.24	-	76	-0.020	1.64	0.14
208	31.066	0.150	1.07	94	-1.34	-	76	-0.020	1.45	0.11
209	31.215	0.149	1.04	94	-1.33	-	76	-0.010	1.30	0.08
210	31.365	0.150	1.04	94	-1.35	99	76	-0.010	1.16	0.05
211	31.515	0.150	1.04	94	-1.32	-	76	-0.010	1.05	0.04
212	31.666	0.151	1.04	93	-1.22	-	76	0.000	0.91	0.03
213	31.816	0.150	1.04	93	-1.34	-	76	-0.010	0.80	0.02
214	31.967	0.151	1.04	94	-1.24	-	76	-0.010	0.74	0.01
215	32.117	0.150	1.04	94	-1.26	-	76	-0.010	0.67	0.01
216	32.267	0.150	1.05	94	-1.22	-	76	-0.010	0.62	0.01
217	32.417	0.150	1.09	94	-1.33	-	76	-0.010	0.57	0.01
218	32.566	0.149	1.05	95	-1.23	-	76	-0.010	0.51	0.00
219	32.716	0.150	1.06	94	-1.33	-	76	-0.020	0.48	0.00
220	32.867	0.151	1.04	95	-1.26	100	76	-0.010	0.47	0.00
221	33.017	0.150	1.04	94	-1.32	-	76	-0.020	0.51	0.01
222	33.168	0.151	1.06	94	-1.35	-	76	0.000	0.45	0.00
223	33.318	0.150	1.05	94	-1.23	-	76	-0.010	0.45	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 2

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
224	33.468	0.150	1.05	93	-1.24	-	76	-0.010	0.44	0.00
225	33.618	0.150	1.04	93	-1.24	-	76	-0.010	0.45	0.00
226	33.768	0.150	1.05	94	-1.29	-	76	-0.010	0.44	0.00
227	33.917	0.149	1.04	94	-1.35	-	76	-0.010	0.41	0.01
228	34.068	0.151	1.05	94	-1.32	-	76	0.000	0.44	0.00
229	34.218	0.150	1.05	94	-1.26	-	76	0.000	0.45	0.00
230	34.369	0.151	1.03	95	-1.35	100	77	-0.010	0.41	0.01
231	34.519	0.150	1.07	94	-1.24	-	76	-0.020	0.39	0.00
232	34.669	0.150	1.05	94	-1.28	-	76	-0.010	0.39	0.00
233	34.820	0.151	1.03	94	-1.24	-	76	-0.010	0.44	0.00
234	34.969	0.149	1.04	95	-1.29	-	77	-0.010	0.41	0.00
235	35.119	0.150	1.09	95	-1.33	-	77	0.000	0.37	0.01
236	35.269	0.150	1.07	95	-1.24	-	76	-0.010	0.40	0.00
237	35.419	0.150	1.05	94	-1.24	-	76	-0.010	0.39	0.00
238	35.570	0.151	1.05	94	-1.26	-	76	-0.010	0.40	0.00
239	35.720	0.150	1.03	95	-1.24	-	77	0.000	0.40	0.00
240	35.871	0.151	1.04	95	-1.31	99	76	0.000	0.38	0.00
Avg/Tot	35.871	0.149	1.04	88	-1.29	100	74	-0.011	4.86	0.02

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 2

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
0	0.000		0.99	70	-1.7		66
1	0.125	0.125	1.01	72	-1.7	-	66
2	0.269	0.144	1.02	71	-1.7	-	67
3	0.413	0.144	1.07	72	-1.8	-	67
4	0.561	0.148	1.04	71	-1.8	-	67
5	0.707	0.146	1.07	70	-1.8	-	67
6	0.852	0.145	1.09	71	-1.8	-	67
7	0.998	0.146	1.09	71	-1.8	-	67
8	1.145	0.147	1.08	71	-1.8	-	67
9	1.294	0.149	0.96	71	-1.6	-	67
10	1.442	0.148	1.10	72	-1.8	96	67
11	1.589	0.147	1.09	71	-1.8	-	67
12	1.737	0.148	0.99	73	-1.7	-	68
13	1.885	0.148	1.01	72	-1.7	-	68
14	2.034	0.149	1.12	73	-1.9	-	68
15	2.184	0.150	0.98	72	-1.7	-	68
16	2.334	0.150	1.03	73	-1.7	-	68
17	2.485	0.151	0.97	74	-1.6	-	68
18	2.635	0.150	1.06	74	-1.8	-	68
19	2.786	0.151	1.07	74	-1.8	-	68
20	2.937	0.151	1.08	73	-1.8	102	68
21	3.089	0.152	1.11	75	-1.9	-	68
22	3.240	0.151	1.07	74	-1.8	-	68
23	3.392	0.152	0.97	74	-1.6	-	68
24	3.545	0.153	1.08	75	-1.8	-	68
25	3.697	0.152	1.11	76	-1.9	-	68
26	3.850	0.153	1.10	75	-1.8	-	68
27	4.003	0.153	1.09	75	-1.8	-	68
28	4.157	0.154	1.07	75	-1.8	-	68
29	4.310	0.153	1.12	77	-1.9	-	68
30	4.463	0.153	1.13	76	-1.9	97	69
31	4.616	0.153	1.03	76	-1.7	-	69

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 2

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
32	4.771	0.155	1.01	76	-1.7	-	69
33	4.927	0.156	1.12	77	-1.9	-	69
34	5.082	0.155	1.04	77	-1.7	-	68
35	5.238	0.156	0.98	78	-1.6	-	68
36	5.393	0.155	1.09	79	-1.8	-	69
37	5.547	0.154	1.04	78	-1.7	-	69
38	5.703	0.156	1.05	78	-1.8	-	69
39	5.857	0.154	1.07	79	-1.8	-	69
40	6.013	0.156	1.01	79	-1.7	99	69
41	6.169	0.156	1.08	80	-1.8	-	69
42	6.326	0.157	1.13	79	-1.9	-	69
43	6.482	0.156	1.13	80	-1.9	-	69
44	6.638	0.156	1.05	81	-1.8	-	69
45	6.792	0.154	1.06	81	-1.8	-	69
46	6.949	0.157	1.01	82	-1.7	-	69
47	7.106	0.157	1.05	82	-1.8	-	69
48	7.263	0.157	1.02	81	-1.7	-	69
49	7.420	0.157	1.02	83	-1.7	-	69
50	7.576	0.156	1.10	83	-1.9	102	69
51	7.731	0.155	1.02	82	-1.7	-	69
52	7.889	0.158	1.04	84	-1.7	-	69
53	8.047	0.158	1.05	84	-1.8	-	69
54	8.204	0.157	1.13	84	-1.9	-	69
55	8.361	0.157	1.14	83	-1.9	-	69
56	8.516	0.155	1.05	84	-1.8	-	69
57	8.674	0.158	1.05	85	-1.8	-	69
58	8.833	0.159	1.04	84	-1.7	-	69
59	8.990	0.157	1.05	86	-1.8	-	69
60	9.146	0.156	1.04	85	-1.8	101	70
Avg/Tot	9.146	0.152	1.06	76.9	-1.8	100	68.2

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
0	0.50	N/A	69.90	174.10	184	178	1.00	4.14	
1	0.52	N/A	69.90	174.40	184	179	1.00	4.31	451
2	0.52	N/A	69.90	174.50	184	179	1.00	4.29	449
3	0.52	N/A	70.00	174.80	185	179	1.00	4.32	453
4	0.52	N/A	70.00	175.20	185	180	1.00	4.34	457
5	0.52	N/A	70.00	175.60	186	180	1.00	4.32	457
6	0.52	N/A	70.00	176.00	186	181	1.00	4.35	462
7	0.52	N/A	70.00	176.20	186	181	1.00	4.31	458
8	0.52	N/A	70.00	176.50	187	181	1.00	4.33	461
9	0.52	N/A	69.90	176.60	187	181	1.00	4.30	460
10	0.52	N/A	70.00	176.60	187	181	1.00	4.34	464
11	0.52	N/A	70.00	176.40	186	181	1.00	4.35	464
12	0.53	N/A	70.00	176.30	186	181	1.00	4.40	468
13	0.52	N/A	70.10	176.00	186	180	1.00	4.36	462
14	0.53	N/A	70.10	175.70	186	180	1.00	4.39	464
15	0.53	N/A	70.10	175.40	185	180	1.00	4.38	461
16	0.52	N/A	70.10	175.20	185	180	1.00	4.35	458
17	0.53	N/A	70.00	175.00	185	179	1.00	4.41	464
18	0.53	N/A	70.00	174.70	184	179	1.00	4.39	460
19	0.53	N/A	70.00	174.40	184	179	1.00	4.40	460
20	0.53	N/A	70.00	174.20	184	178	1.00	4.38	457
21	0.52	N/A	70.10	173.90	183	178	1.00	4.34	451
22	0.51	N/A	70.10	173.60	183	178	1.00	4.25	441
23	0.52	N/A	70.10	173.50	183	178	1.00	4.35	450
24	0.52	N/A	70.10	173.20	183	177	1.00	4.33	447
25	0.52	N/A	70.10	173.00	182	177	1.00	4.33	446
26	0.52	N/A	70.10	172.50	182	177	1.00	4.30	441
27	0.52	N/A	70.10	172.30	182	176	1.00	4.33	443
28	0.52	N/A	70.10	172.00	181	176	1.00	4.34	443
29	0.52	N/A	70.20	171.80	181	176	1.00	4.33	440
30	0.53	N/A	70.20	171.50	181	175	1.00	4.39	446
31	0.53	N/A	70.20	171.30	180	175	1.00	4.38	443
32	0.53	N/A	70.20	171.00	180	175	1.00	4.38	442
33	0.53	N/A	70.20	170.70	180	175	1.00	4.38	441
34	0.52	N/A	70.20	170.30	179	174	1.00	4.35	436
35	0.53	N/A	70.20	170.10	179	174	1.00	4.37	437
36	0.52	N/A	70.20	169.90	179	174	1.00	4.33	433
37	0.52	N/A	70.10	169.60	178	173	1.00	4.35	433
38	0.51	N/A	70.10	169.30	178	173	1.00	4.26	423
39	0.52	N/A	70.10	168.90	178	173	1.00	4.34	430
40	0.52	N/A	70.00	168.80	177	172	1.00	4.34	430
41	0.52	N/A	70.00	168.50	177	172	1.00	4.32	426
42	0.53	N/A	69.90	168.20	177	172	1.00	4.38	431
43	0.53	N/A	69.90	167.70	176	171	1.00	4.39	430
44	0.52	N/A	69.90	167.50	176	171	1.00	4.34	424
45	0.52	N/A	69.80	167.20	176	171	1.00	4.34	424
46	0.53	N/A	69.90	166.90	175	170	1.00	4.37	424
47	0.53	N/A	69.90	166.70	175	170	1.00	4.38	424

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
48	0.53	N/A	69.90	166.40	175	170	1.00	4.37	422
49	0.52	N/A	69.90	166.10	174	169	1.00	4.33	418
50	0.52	N/A	70.00	165.80	174	169	1.00	4.35	417
51	0.53	N/A	70.00	165.40	174	169	1.00	4.37	417
52	0.53	N/A	70.00	165.10	173	168	1.00	4.37	416
53	0.52	N/A	70.00	164.90	173	168	1.00	4.33	412
54	0.53	N/A	70.00	164.60	173	168	1.00	4.37	414
55	0.53	N/A	70.00	164.30	172	167	1.00	4.38	413
56	0.53	N/A	70.00	164.00	172	167	1.00	4.38	412
57	0.53	N/A	70.00	163.70	172	167	1.00	4.39	412
58	0.52	N/A	70.00	163.40	171	167	1.00	4.29	401
59	0.52	N/A	70.00	163.20	171	166	1.00	4.33	404
60	0.52	N/A	70.10	162.90	171	166	1.00	4.29	399
61	0.52	N/A	70.10	162.80	171	166	1.00	4.35	404
62	0.52	N/A	70.10	162.70	171	166	1.00	4.30	399
63	0.52	N/A	70.10	162.60	171	166	1.00	4.35	403
64	0.52	N/A	70.10	162.60	171	166	1.00	4.34	402
65	0.52	N/A	70.10	162.90	171	166	1.00	4.33	402
66	0.52	N/A	70.10	163.30	172	167	1.00	4.29	401
67	0.52	N/A	70.10	163.70	172	167	1.00	4.34	407
68	0.52	N/A	70.10	164.10	173	168	1.00	4.34	409
69	0.52	N/A	70.10	164.50	173	168	1.00	4.31	407
70	0.52	N/A	70.10	165.00	174	169	1.00	4.34	413
71	0.52	N/A	70.00	165.40	174	169	1.00	4.33	414
72	0.52	N/A	70.10	165.80	174	169	1.00	4.30	412
73	0.52	N/A	70.10	166.10	175	170	1.00	4.32	415
74	0.51	N/A	70.10	166.40	175	170	1.00	4.28	412
75	0.52	N/A	70.10	166.80	176	170	1.00	4.35	421
76	0.52	N/A	70.10	167.10	176	171	1.00	4.34	422
77	0.52	N/A	70.10	167.40	176	171	1.00	4.33	422
78	0.52	N/A	70.10	167.70	177	171	1.00	4.35	425
79	0.52	N/A	70.10	168.00	177	172	1.00	4.34	426
80	0.52	N/A	70.10	168.30	177	172	1.00	4.32	425
81	0.52	N/A	70.10	168.50	178	173	1.00	4.29	423
82	0.52	N/A	70.10	168.90	178	173	1.00	4.36	431
83	0.52	N/A	70.20	169.30	178	173	1.00	4.30	427
84	0.51	N/A	70.20	169.70	179	174	1.00	4.28	426
85	0.52	N/A	70.20	170.00	179	174	1.00	4.34	434
86	0.52	N/A	70.20	170.30	179	174	1.00	4.33	434
87	0.52	N/A	70.20	170.60	180	175	1.00	4.33	435
88	0.52	N/A	70.20	170.90	180	175	1.00	4.28	432
89	0.52	N/A	70.20	171.30	181	175	1.00	4.32	437
90	0.52	N/A	70.20	171.70	181	176	1.00	4.31	438
91	0.52	N/A	70.20	172.00	181	176	1.00	4.35	443
92	0.52	N/A	70.20	172.30	182	176	1.00	4.33	442
93	0.52	N/A	70.20	172.60	182	177	1.00	4.33	444
94	0.52	N/A	70.20	173.00	183	177	1.00	4.33	445
95	0.52	N/A	70.20	173.40	183	178	1.00	4.33	447

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
96	0.51	N/A	70.30	173.70	183	178	1.00	4.28	443
97	0.52	N/A	70.30	174.00	184	178	1.00	4.29	446
98	0.52	N/A	70.30	174.40	184	179	1.00	4.32	450
99	0.52	N/A	70.30	174.80	185	179	1.00	4.35	455
100	0.52	N/A	70.40	175.00	185	179	1.00	4.35	456
101	0.52	N/A	70.40	175.50	185	180	1.00	4.29	452
102	0.50	N/A	70.40	175.90	186	180	1.00	4.19	443
103	0.51	N/A	70.40	176.20	186	181	1.00	4.26	451
104	0.53	N/A	70.40	176.60	187	181	1.00	4.37	464
105	0.52	N/A	70.40	176.70	187	181	1.00	4.32	460
106	0.52	N/A	70.50	176.90	187	181	1.00	4.36	464
107	0.51	N/A	70.50	176.80	187	181	1.00	4.26	453
108	0.52	N/A	70.50	176.70	187	181	1.00	4.34	462
109	0.52	N/A	70.50	176.60	186	181	1.00	4.30	457
110	0.52	N/A	70.50	176.40	186	181	1.00	4.29	455
111	0.52	N/A	70.60	176.10	186	180	1.00	4.33	457
112	0.52	N/A	70.60	175.90	186	180	1.00	4.33	457
113	0.51	N/A	70.70	175.70	185	180	1.00	4.27	449
114	0.52	N/A	70.70	175.40	185	180	1.00	4.30	451
115	0.52	N/A	70.70	175.20	185	179	1.00	4.31	451
116	0.52	N/A	70.70	175.00	184	179	1.00	4.34	453
117	0.52	N/A	70.60	174.70	184	179	1.00	4.31	449
118	0.53	N/A	70.60	174.40	184	179	1.00	4.42	459
119	0.53	N/A	70.60	174.10	184	178	1.00	4.37	453
120	0.52	N/A	70.60	173.90	183	178	1.00	4.33	447
121	0.51	N/A	70.60	173.70	183	178	1.00	4.23	436
122	0.52	N/A	70.60	173.30	183	177	1.00	4.33	445
123	0.50	N/A	70.60	173.10	182	177	1.00	4.13	424
124	0.52	N/A	70.60	172.80	182	177	1.00	4.33	443
125	0.52	N/A	70.60	172.50	182	176	1.00	4.33	442
126	0.52	N/A	70.60	172.20	181	176	1.00	4.33	441
127	0.52	N/A	70.50	171.90	181	176	1.00	4.32	438
128	0.51	N/A	70.50	171.70	181	176	1.00	4.27	432
129	0.52	N/A	70.50	171.40	180	175	1.00	4.32	436
130	0.51	N/A	70.50	171.00	180	175	1.00	4.28	430
131	0.52	N/A	70.50	170.70	180	175	1.00	4.34	436
132	0.52	N/A	70.60	170.50	179	174	1.00	4.29	429
133	0.52	N/A	70.60	170.20	179	174	1.00	4.32	431
134	0.52	N/A	70.60	169.90	179	174	1.00	4.30	428
135	0.52	N/A	70.60	169.60	179	173	1.00	4.35	431
136	0.53	N/A	70.60	169.40	178	173	1.00	4.38	434
137	0.52	N/A	70.60	168.90	178	173	1.00	4.33	426
138	0.52	N/A	70.60	168.70	177	172	1.00	4.35	427
139	0.52	N/A	70.50	168.30	177	172	1.00	4.29	420
140	0.52	N/A	70.50	168.00	177	172	1.00	4.30	420
141	0.52	N/A	70.50	167.70	176	171	1.00	4.31	419
142	0.52	N/A	70.50	167.40	176	171	1.00	4.30	417
143	0.52	N/A	70.60	167.10	176	171	1.00	4.35	420

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
144	0.52	N/A	70.60	166.80	175	171	1.00	4.31	415
145	0.53	N/A	70.60	166.50	175	170	1.00	4.37	419
146	0.52	N/A	70.60	166.20	175	170	1.00	4.30	412
147	0.52	N/A	70.70	165.90	174	170	1.00	4.34	414
148	0.52	N/A	70.70	165.70	174	169	1.00	4.32	411
149	0.53	N/A	70.70	165.30	174	169	1.00	4.42	418
150	0.53	N/A	70.80	165.00	173	169	1.00	4.38	413
151	0.52	N/A	70.80	164.60	173	168	1.00	4.36	409
152	0.53	N/A	70.80	164.40	173	168	1.00	4.43	415
153	0.53	N/A	70.70	164.10	172	168	1.00	4.37	408
154	0.53	N/A	70.70	163.70	172	167	1.00	4.40	410
155	0.53	N/A	70.60	163.40	172	167	1.00	4.43	411
156	0.53	N/A	70.60	163.10	171	167	1.00	4.38	405
157	0.53	N/A	70.60	162.90	171	166	1.00	4.41	407
158	0.53	N/A	70.60	162.70	171	166	1.00	4.44	410
159	0.52	N/A	70.50	162.50	171	166	1.00	4.32	398
160	0.53	N/A	70.50	162.30	171	166	1.00	4.43	408
161	0.53	N/A	70.60	162.30	171	166	1.00	4.39	403
162	0.53	N/A	70.60	162.20	171	166	1.00	4.43	406
163	0.52	N/A	70.60	162.50	171	166	1.00	4.33	398
164	0.53	N/A	70.60	162.80	171	167	1.00	4.39	405
165	0.53	N/A	70.60	163.40	172	167	1.00	4.42	410
166	0.53	N/A	70.60	163.80	173	168	1.00	4.38	409
167	0.53	N/A	70.70	164.30	173	168	1.00	4.43	416
168	0.53	N/A	70.70	164.60	173	168	1.00	4.44	418
169	0.53	N/A	70.70	165.00	174	169	1.00	4.41	416
170	0.51	N/A	70.70	165.40	174	169	1.00	4.27	405
171	0.53	N/A	70.70	165.70	175	170	1.00	4.39	418
172	0.52	N/A	70.80	166.10	175	170	1.00	4.33	414
173	0.52	N/A	70.80	166.60	176	171	1.00	4.34	417
174	0.52	N/A	70.80	166.90	176	171	1.00	4.32	415
175	0.52	N/A	70.80	167.20	176	171	1.00	4.34	419
176	0.52	N/A	70.80	167.50	177	172	1.00	4.34	420
177	0.52	N/A	70.80	167.90	177	172	1.00	4.34	422
178	0.52	N/A	70.80	168.30	177	172	1.00	4.33	422
179	0.52	N/A	70.80	168.50	178	173	1.00	4.36	426
180	0.51	N/A	70.80	168.80	178	173	1.00	4.26	418
181	0.52	N/A	70.80	169.10	178	173	1.00	4.36	429
182	0.52	N/A	70.80	169.30	179	174	1.00	4.34	428
183	0.53	N/A	70.80	169.60	179	174	1.00	4.37	432
184	0.52	N/A	70.90	170.00	179	174	1.00	4.31	428
185	0.52	N/A	70.90	170.30	180	175	1.00	4.36	434
186	0.52	N/A	70.90	170.60	180	175	1.00	4.32	431
187	0.53	N/A	70.90	171.10	181	175	1.00	4.37	438
188	0.52	N/A	70.90	171.40	181	176	1.00	4.33	436
189	0.52	N/A	70.90	171.60	181	176	1.00	4.33	436
190	0.52	N/A	70.90	172.00	182	176	1.00	4.33	438
191	0.52	N/A	70.90	172.30	182	177	1.00	4.34	441

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 2

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
192	0.52	N/A	70.90	172.60	182	177	1.00	4.36	444
193	0.50	N/A	71.00	172.90	183	177	1.00	4.13	422
194	0.52	N/A	71.00	173.40	183	178	1.00	4.34	445
195	0.52	N/A	71.00	173.60	183	178	1.00	4.33	445
196	0.52	N/A	71.00	173.90	184	178	1.00	4.35	448
197	0.53	N/A	71.00	174.10	184	179	1.00	4.39	453
198	0.52	N/A	70.90	174.60	185	179	1.00	4.36	453
199	0.53	N/A	70.90	174.90	185	180	1.00	4.38	456
200	0.52	N/A	71.00	175.30	185	180	1.00	4.30	449
201	0.53	N/A	71.00	175.60	186	180	1.00	4.38	458
202	0.52	N/A	71.00	176.00	186	181	1.00	4.33	456
203	0.52	N/A	71.00	176.30	187	181	1.00	4.31	454
204	0.52	N/A	71.00	176.60	187	181	1.00	4.30	455
205	0.52	N/A	71.00	176.70	187	181	1.00	4.33	459
206	0.52	N/A	71.10	176.40	187	181	1.00	4.35	459
207	0.53	N/A	71.10	176.40	186	181	1.00	4.37	460
208	0.52	N/A	71.10	176.10	186	181	1.00	4.34	456
209	0.52	N/A	71.10	175.90	186	180	1.00	4.34	456
210	0.53	N/A	71.00	175.60	186	180	1.00	4.37	457
211	0.52	N/A	71.00	175.40	185	180	1.00	4.33	452
212	0.52	N/A	71.00	175.20	185	180	1.00	4.34	453
213	0.51	N/A	71.00	174.90	185	180	1.00	4.28	445
214	0.53	N/A	71.10	174.80	185	179	1.00	4.42	459
215	0.52	N/A	71.10	174.50	184	179	1.00	4.33	448
216	0.53	N/A	71.10	174.30	184	179	1.00	4.38	453
217	0.52	N/A	71.20	174.00	184	178	1.00	4.34	447
218	0.52	N/A	71.20	173.70	183	178	1.00	4.29	440
219	0.52	N/A	71.20	173.50	183	178	1.00	4.34	445
220	0.53	N/A	71.30	173.20	183	178	1.00	4.38	446
221	0.52	N/A	71.30	172.90	183	177	1.00	4.33	441
222	0.52	N/A	71.30	172.60	182	177	1.00	4.34	440
223	0.52	N/A	71.40	172.40	182	177	1.00	4.34	439
224	0.53	N/A	71.40	172.10	182	176	1.00	4.38	442
225	0.52	N/A	71.40	171.90	181	176	1.00	4.33	436
226	0.52	N/A	71.40	171.60	181	176	1.00	4.36	437
227	0.52	N/A	71.40	171.30	181	175	1.00	4.36	436
228	0.52	N/A	71.40	171.10	180	175	1.00	4.35	434
229	0.53	N/A	71.40	170.80	180	175	1.00	4.37	435
230	0.53	N/A	71.40	170.40	180	174	1.00	4.38	435
231	0.53	N/A	71.30	170.10	179	174	1.00	4.37	432
232	0.52	N/A	71.30	169.80	179	174	1.00	4.33	427
233	0.52	N/A	71.30	169.50	179	174	1.00	4.34	427
234	0.53	N/A	71.30	169.30	178	173	1.00	4.38	430
235	0.52	N/A	71.30	168.90	178	173	1.00	4.34	424
236	0.53	N/A	71.30	168.60	178	173	1.00	4.37	425
237	0.52	N/A	71.40	168.40	177	172	1.00	4.35	422
238	0.52	N/A	71.40	168.10	177	172	1.00	4.33	419
239	0.52	N/A	71.40	167.80	177	172	1.00	4.35	420

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Model: BIO 200

Run #: 2

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/25/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
240	0.53	N/A	71.40	167.50	176	171	1.00	4.38	421
Average	1	#DIV/0!	71	170	179	174	1	4	434
								TOTAL:	104075

LAB SAMPLE DATA - ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 2

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/25/2025

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	A	G01369	242.3	243.2	0.9
	B	G01370	243.7	244.7	1.0
	C - 1st Hour	G01371	243.9	243.9	0.0
	Amb	G01372	244.3	244.4	0.1
Probes	A	15A	117249.5	117249.7	0.2
	B	15B	116762.2	116762.2	0.0
	C - 1st Hour	15C	116848.5	116848.6	0.1
O-rings	A	15A	3569.2	3569.2	0.0
	B	15B	3570.7	3570.7	0.0
	C - 1st Hour	15C	3395.8	3396.0	0.2

Placed in Dessicator on:

9/25/2025

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	243.3	10/3 16:00	243.2	10/6 14:00				
	B	245.0	10/3 16:00	244.7	10/6 14:00	244.7	10/7 8:30		
	C - 1st Hour	244.5	10/3 16:00	243.9	10/6 14:00				
	Amb	244.5	10/3 16:00	244.4	10/6 14:00				
Probes	A	117250.8	10/3 16:00	117249.9	10/6 14:00	117249.7	10/7 8:30		
	B	116763.3	10/3 16:00	116762.3	10/6 14:00	116762.2	10/7 8:30		
	C - 1st Hour	116849.6	10/3 16:00	116848.6	10/6 14:00	116848.6	10/7 8:30		
O-Rings	A	3569.1	10/3 16:00	3569.2	10/6 14:00				
	B	3570.8	10/3 16:00	3570.7	10/6 14:00				
	C - 1st Hour	3396.1	10/3 16:00	3396.0	10/6 14:00				

Train A Aggregate, mg: 1.1

Train B Aggregate, mg: 1.0

Train C Aggregate, mg: 0.3

Ambient, mg: 0.1

ASTM E2618 Hydronic Heater Run Sheets

Client: Greentech Job Number: 25-436 Tracking #: 230
Model: Bio 200 Run Number: 2 Test Date: 9/25/25

Wood Heater Run Notes

Pre-Test Notes

Pre-Test Start Time: 09:25
Target Load (BTU/hr): <31,800

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 11:34
Target Load (BTU/hr): <31,800 (Category 1)

Time	Notes
0 min	Started test sampling
240 min	End of Test

Test Burn End Time: 15:34

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 17.32 CO (%): 4.340
Mid Gas CO₂ (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	9:16	9:19	9:21	15:45	15:46	15:47
CO ₂	0.16	17.33	10.38	0.19	17.26	10.03
CO	-0.008	4.343	2.522	-0.010	4.308	2.477

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

Technician Signature: 

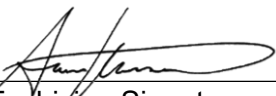
Date: 11/7/25

HYDRONIC HEATER TEST DATA PACKET
ASTM E2618/E2515



Run 3 Data Summary

Client:	Greentech
Model:	BIO 200
Job #:	25-436
Tracking #:	230
Test Date:	9/26/2025



Technician Signature

11/7/2025

Date

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 3

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/26/2025

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	27.040	34.922	34.952	9.091
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.9			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	35014.4			
Average Gas Meter Temperature (°F)	72.5	89.5	87.9	76.5
Total Sample Volume (dscf)	26.871	33.877	34.179	8.879
Average Tunnel Temperature (°F)	81.5			
Total Time of Test (min)	240			
Total Particulate Catch (mg)	0.4	1.9	1.9	0.9
Particulate Concentration, dry-standard (g/dscf)	0.0000149	0.0000561	0.0000556	0.0001014
Total PM Emissions (g)	2.08	5.77	5.70	3.03
Particulate Emission Rate (g/hr)	0.52	1.44	1.43	3.03
Emissions Factor (g/kg)	-	0.56	0.55	-
Difference from Average Total Particulate Emissions (g)	-	0.03	0.03	-
Difference from Average Total Particulate Emissions (%)	-	0.6%	0.6%	-
Difference from Average Emissions Factor (g/kg)	-	0.00	0.00	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	178.1
Appliance Average Final Temperature (F)	178.1
Heat Output (BTU)	169,402
Heat Output Rate (BTU/hr)	42,350
Heat Input - HHV (BTU)	189,587
Heat Input - LHV (BTU)	176,656

Emissions Rates and Factors

Total Particulate Emissions (g)	5.7
Emissions Factor (g/MJ)	0.0321
Emissions Factor (g/kg)	0.5559
Emissions Rate (g/hr)	1.43
Emissions Rate (lb/mmBtu output)	0.075
HHV Delivered Efficiency (%)	89.4%
LHV Delivered Efficiency (%)	95.9%
HHV SLM Efficiency (%)	88.1%
LHV SLM Efficiency (%)	94.5%
CO Emissions (g/min)	0.07

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	76.0	OK
Face Velocity	< 30 ft/min	8.0	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 68.4 / Max: 76	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	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	173.6	OK

B415.1 Efficiency Results

Manufacturer: Greentech
Model: BIO 200
Date: 09/26/25
Run: 3
Control #: 25-436
Test Duration: 240
Output Category: 2

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	88.1%	94.5%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	88.5%	95.0%

Output Rate (kJ/h)	44,019	41,757	(Btu/h)
Burn Rate (kg/h)	2.58	5.69	(lb/h)
Input (kJ/h)	49,987	47,418	(Btu/h)

Test Load Weight (dry kg)	10.32	22.74	dry lb
MC wet (%)	4.85		
MC dry (%)	5.10		
Particulate (g)	5.74		
CO (g)	17		
Test Duration (h)	4.00		

Emissions	Particulate	CO
g/MJ Output	0.03	0.10
g/kg Dry Fuel	0.56	1.68
g/h	1.43	4.34
g/min	0.02	0.07
lb/MM Btu Output	0.08	0.23

Air/Fuel Ratio (A/F)	11.35
-----------------------------	-------

VERSION:

2.4

4/15/2010

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client: Greentech
 Model: BIO 200
 Run #: 3
 Test Start Time: 10:36
 Manufacturer's Rated Output
 (BTU/hr): 212,000

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/26/2025

Total Sampling Time (min): 240
 Recording Interval (min): 1

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.009 (B)
 Meter Box γ Factor: 0.997 (C)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 9/23/2025
 Test Fuel Scale Audit (lbs): N/A
 Platform Scale Audit (lbs): 10.0
 Boiler Dry Weight (lbs): 2222
 Supply Side Water Weight (lbs): 1112

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.08	29.98	30.03
Relative Humidity (%)	35.0	29.4	
Room Air Velocity (ft/min)	<50	<50	
Pitot Tube Leak Check	0.0	0.0	
Ambient Sample Volume:		27.040	ft ³

Sample Train Leak Checks

	Pre-test	Post-test		
(A)	0.000	0.000	cfm @	-5 in. Hg
(B)	0.000	0.000	cfm @	-5 in. Hg
(C)	0.000	0.000	cfm @	-5 in. Hg
(Ambient)	0.000	0.000	cfm @	-13 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.030	75
2	0.036	75
3	0.042	75
4	0.042	75
5	0.038	75
6	0.030	75
7	0.034	75
8	0.040	75
9	0.042	75
10	0.042	75
11	0.040	75
12	0.032	75
Center	0.042	75

Dilution Tunnel H₂O: 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 ft²

V_{strav}: 12.83 ft/sec

V_{scent}: 13.64 ft/sec

F_p: 0.941 [ratio]

Initial Tunnel Flow: 587.3 scf/min

Static Pressure: -0.120 in. H₂O

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:	Black Hills Gold
HHV (kJ/kg)	19,379
%C	50.8
%H	6.13
%O	42.77
%Ash	0.3
MC (%DB)	5.1%

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 3

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/26/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
0	180.9	-0.03	175.0	164.7	68.5	155.8	0.96	246.5	60.9	41722
1	180.4	-0.03	176.6	167.2	68.5	162.0	0.96	247.9	60.8	44638
2	292.8	-0.02	178.3	168.9	68.4	164.1	0.96	242.0	60.9	46024
3	180.1	-0.02	179.6	170.0	68.4	165.3	0.96	226.6	60.8	46552
4	179.4	-0.01	180.5	171.0	68.5	166.1	0.97	218.6	60.9	47083
5	179.5	-0.01	181.3	171.6	68.6	166.8	0.97	213.1	60.9	47470
6	179.3	-0.02	182.0	173.0	68.7	167.6	0.88	209.2	60.9	43605
7	177.8	-0.02	182.4	173.3	68.7	168.6	0.91	205.4	61.0	45295
8	178.4	-0.02	183.0	173.9	68.8	169.1	0.89	203.2	61.2	44623
9	178.7	-0.02	183.4	174.2	68.8	169.5	0.91	201.2	61.1	45606
10	178.4	-0.01	183.6	174.4	69.0	169.6	0.90	197.9	61.5	45057
11	178.6	-0.03	183.8	174.5	69.2	169.9	0.90	196.9	61.5	45201
12	178.8	-0.01	183.9	174.6	69.3	170.0	0.89	195.2	61.4	44949
13	178.4	-0.02	183.8	174.7	69.4	170.0	0.89	194.7	61.4	44501
14	178.4	-0.02	183.8	174.8	69.4	170.1	0.90	193.4	61.4	45351
15	178.3	-0.02	183.8	174.6	69.4	169.9	0.90	191.1	61.3	45261
16	178.0	-0.02	183.6	174.5	69.4	169.9	0.89	191.7	61.2	44608
17	178.0	-0.01	183.6	174.5	69.4	169.8	0.89	190.4	61.4	44664
18	177.9	-0.02	183.4	174.3	69.3	169.6	0.89	189.1	61.6	44770
19	178.2	-0.02	183.2	174.1	69.3	169.5	0.90	185.7	61.7	45176
20	363.6	-0.02	183.0	173.9	69.2	169.3	0.89	186.5	61.4	44381
21	178.2	-0.01	182.8	173.7	69.2	168.9	0.90	186.7	61.6	44653
22	180.9	-0.01	182.6	173.6	69.2	168.8	0.90	185.7	61.6	44608
23	177.9	-0.02	182.5	173.4	69.2	168.6	0.89	186.1	61.6	44369
24	177.8	-0.02	182.4	173.3	69.2	168.6	0.90	185.8	61.6	44469
25	300.8	-0.02	182.4	173.4	69.2	168.5	0.89	187.2	61.7	44076
26	177.4	-0.02	182.4	173.4	69.2	168.5	0.89	184.9	61.5	44225
27	177.5	-0.01	182.3	173.3	69.2	168.5	0.89	185.5	61.6	44325
28	177.1	-0.03	182.4	173.4	69.2	168.6	0.88	185.8	61.6	43574
29	177.2	-0.01	182.6	173.5	69.2	168.7	0.88	185.5	61.9	43966
30	177.4	-0.02	182.6	173.7	69.2	168.7	0.89	185.4	61.9	44165
31	177.2	-0.02	182.8	173.8	69.2	168.8	0.89	184.8	61.7	44508
32	176.8	-0.01	182.9	173.9	69.2	168.9	0.89	184.3	62.0	44553

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 3

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/26/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
33	176.5	-0.02	183.1	174.0	69.2	168.9	0.89	183.5	62.1	44204
34	177.3	-0.02	183.1	174.0	69.2	169.0	0.89	183.6	62.3	44598
35	176.4	-0.01	183.1	174.0	69.2	169.0	0.89	182.4	62.1	44498
36	176.4	-0.03	183.0	173.9	69.2	168.9	0.90	182.3	61.9	44902
37	176.8	-0.02	182.8	173.7	69.2	168.7	0.89	183.3	61.9	44165
38	176.2	-0.01	182.6	173.7	69.2	168.7	0.89	180.8	62.0	44066
39	176.0	-0.02	182.4	173.4	69.2	168.4	0.89	182.2	61.8	44280
40	175.9	-0.01	182.3	173.4	69.2	168.2	0.90	181.0	62.0	44290
41	175.8	-0.02	182.4	173.4	69.2	168.3	0.89	181.9	62.1	44235
42	175.5	-0.01	182.5	173.5	69.2	168.3	0.89	182.5	62.2	44285
43	175.6	-0.01	182.7	173.6	69.2	168.5	0.89	181.6	62.0	44076
44	175.4	-0.01	182.8	173.8	69.2	168.6	0.90	181.2	62.1	44518
45	176.1	-0.02	183.0	174.0	69.2	168.7	0.89	181.1	62.0	44265
46	175.1	-0.01	183.0	174.0	69.2	168.7	0.88	180.2	62.0	43966
47	174.9	-0.02	183.0	173.9	69.2	168.7	0.89	179.1	61.9	44414
48	174.9	-0.01	182.9	173.9	69.2	168.8	0.88	178.9	61.8	43712
49	177.0	-0.01	182.9	173.9	69.2	168.7	0.88	179.1	61.8	43916
50	174.7	-0.02	182.8	173.8	69.2	168.6	0.89	179.9	62.1	44369
51	174.7	-0.01	182.7	173.8	69.2	168.5	0.88	179.4	62.0	43679
52	174.7	-0.02	182.6	173.7	69.2	168.5	0.89	180.9	61.9	44076
53	174.6	-0.01	182.6	173.6	69.2	168.4	0.88	180.9	61.8	43586
54	174.3	-0.01	182.6	173.7	69.2	168.5	0.89	181.4	61.8	43927
55	174.1	-0.01	182.7	173.8	69.2	168.6	0.89	181.1	61.6	43972
56	174.1	-0.02	182.8	173.9	69.2	168.6	0.88	180.4	61.7	43922
57	174.5	-0.01	183.0	174.1	69.2	168.7	0.88	180.8	61.6	43767
58	173.8	-0.01	183.1	174.2	69.2	168.9	0.89	179.5	61.7	44154
59	173.6	-0.02	183.2	174.3	69.2	168.9	0.89	180.1	61.9	44453
60	175.0	-0.02	183.3	174.4	69.3	169.0	0.89	179.1	62.0	44203
61	173.6	-0.01	183.2	174.3	69.3	168.9	0.90	177.0	62.1	44607
62	173.4	-0.02	183.1	174.1	69.3	168.7	0.89	176.6	62.0	44021
63	173.3	-0.01	182.9	174.0	69.3	168.6	0.89	176.6	62.1	44274
64	173.4	-0.02	182.8	173.8	69.3	168.4	0.88	176.2	61.9	43739
65	173.2	-0.02	182.6	173.8	69.3	168.3	0.88	175.9	62.0	43596

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
66	173.2	-0.01	182.5	173.6	69.3	168.2	0.89	177.5	62.0	44096
67	173.0	-0.02	182.4	173.6	69.3	168.1	0.88	177.5	61.8	43508
68	172.9	-0.01	182.4	173.5	69.3	168.0	0.89	177.5	61.8	43957
69	172.8	0.00	182.5	173.6	69.3	168.2	0.89	178.0	62.0	44096
70	172.7	-0.02	182.5	173.6	69.3	168.0	0.89	178.6	62.2	43760
71	172.5	-0.01	182.6	173.8	69.4	168.1	0.88	178.4	62.2	43315
72	172.4	-0.01	182.6	173.7	69.4	168.2	0.89	178.1	62.3	43902
73	172.5	-0.02	182.8	173.8	69.4	168.2	0.89	178.7	62.3	43902
74	172.1	-0.01	182.9	174.0	69.4	168.3	0.89	177.1	62.5	43799
75	172.2	-0.01	182.9	174.0	69.4	168.3	0.89	176.4	62.7	43996
76	171.8	-0.01	183.0	174.1	69.4	168.3	0.89	176.7	62.6	43897
77	171.9	-0.01	183.1	174.1	69.4	168.3	0.89	176.2	62.6	43799
78	171.6	-0.01	183.0	174.1	69.4	168.4	0.89	175.7	62.7	43991
79	171.6	-0.02	183.0	174.2	69.4	168.3	0.89	174.1	62.9	43897
80	171.5	-0.02	183.0	174.1	69.4	168.2	0.89	173.8	62.9	43705
81	171.8	-0.02	182.9	174.0	69.4	168.2	0.89	173.3	62.8	43853
82	171.3	-0.01	182.8	174.0	69.4	168.1	0.89	173.3	62.9	43710
83	170.9	-0.01	182.8	173.9	69.4	167.9	0.89	174.7	62.9	43917
84	171.1	-0.02	182.7	173.9	69.5	167.9	0.89	175.5	62.9	43872
85	171.0	-0.01	182.7	173.9	69.5	167.8	0.89	175.1	63.2	43680
86	170.7	0.01	182.7	173.8	69.5	167.8	0.89	176.2	63.2	43581
87	170.8	-0.01	182.7	173.9	69.5	167.9	0.89	176.5	63.4	43872
88	170.5	-0.01	182.9	174.1	69.5	167.9	0.89	175.2	63.2	43626
89	170.5	-0.02	182.9	174.1	69.5	167.8	0.89	175.2	63.2	43483
90	170.7	-0.01	182.9	174.1	69.5	167.8	0.89	174.0	63.2	43778
91	170.3	-0.01	183.0	174.1	69.5	167.8	0.89	174.3	63.2	43827
92	171.9	-0.01	182.9	174.1	69.5	167.8	0.89	173.6	63.4	43532
93	170.4	-0.02	182.8	174.0	69.5	167.6	0.89	174.4	63.4	43591
94	170.1	-0.01	182.7	173.9	69.5	167.5	0.89	174.3	63.6	43448
95	169.8	-0.02	182.6	173.8	69.5	167.4	0.89	175.5	63.6	43355
96	169.9	-0.01	182.6	173.7	69.5	167.3	0.89	175.2	63.6	43457
97	169.6	-0.01	182.6	173.8	69.5	167.3	0.89	175.8	63.8	43457
98	169.5	-0.01	182.7	173.9	69.5	167.5	0.95	176.4	63.7	46289

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 3

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/26/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
99	169.3	-0.01	182.9	174.1	69.5	167.6	0.89	175.6	63.5	43640
100	169.6	-0.02	183.0	174.2	69.5	167.8	0.88	174.5	63.5	43385
101	169.4	-0.01	183.0	174.2	69.5	167.8	0.89	174.4	63.5	43483
102	169.2	-0.01	183.0	174.1	69.5	167.8	0.89	173.3	63.4	43483
103	169.1	-0.01	182.9	174.0	69.5	167.9	0.89	173.8	63.4	43675
104	169.0	-0.01	182.8	174.0	69.5	167.7	0.89	174.0	63.5	43782
105	168.7	-0.01	182.7	173.9	69.5	167.6	0.89	174.5	63.6	43640
106	168.8	-0.01	182.7	173.9	69.5	167.7	0.89	174.1	63.9	43488
107	168.7	-0.01	182.7	173.9	69.5	167.7	0.88	175.0	63.9	43095
108	168.7	-0.01	182.8	174.0	69.5	167.8	0.90	174.6	64.0	44073
109	168.3	-0.01	182.8	173.9	69.5	167.7	0.87	174.6	64.2	42752
110	168.7	-0.01	182.8	174.0	69.5	167.7	0.89	174.7	64.4	43439
111	168.1	-0.01	182.9	174.0	69.5	167.7	0.88	174.9	64.4	43292
112	168.0	-0.02	182.9	174.0	69.5	167.8	0.89	174.0	64.6	43581
113	168.0	-0.02	183.0	174.1	69.5	167.9	0.89	172.9	64.6	43527
114	167.9	-0.01	183.0	174.1	69.5	167.9	0.88	172.6	64.8	43085
115	167.7	-0.01	183.0	174.2	69.5	168.0	0.88	172.4	64.8	43473
116	167.8	-0.01	182.9	174.1	69.5	167.6	0.89	172.9	64.7	43444
117	167.7	-0.01	182.8	173.9	69.5	167.8	0.89	173.0	64.6	43680
118	167.5	-0.01	182.7	173.8	69.5	167.8	0.89	172.6	64.6	43729
119	167.6	-0.01	182.6	173.8	69.5	167.6	0.89	173.3	64.6	43444
120	167.4	-0.01	182.5	173.7	69.5	167.6	0.89	175.1	64.6	43738
Avg/Tot	-	-0.01	182.6	173.7	69.3	168.1	0.893	182.9	62.4	44113

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.041	0.32	70	-0.91		23.9		80	174	70	69
1	0.133	0.133	0.042	1.00	69	-1.57	-	23.9	0	80	176	69	69
2	0.282	0.149	0.043	0.99	69	-1.39	-	23.7	-0.2	80	176	69	69
3	0.431	0.149	0.042	0.98	70	-1.21	-	23.5	-0.2	80	175	70	69
4	0.579	0.148	0.039	0.99	69	-1.04	-	23.4	-0.1	80	175	70	69
5	0.727	0.148	0.040	1.00	70	-0.89	-	23.4	0	80	175	70	69
6	0.875	0.148	0.040	0.97	69	-0.81	-	23.5	0.1	80	174	70	69
7	1.023	0.148	0.040	0.96	70	-0.74	-	23.1	-0.4	80	174	71	69
8	1.170	0.147	0.041	0.97	71	-0.68	-	23.0	-0.1	80	173	71	69
9	1.317	0.147	0.041	0.97	71	-0.66	-	23.1	0.1	80	172	71	69
10	1.464	0.147	0.041	0.97	70	-0.62	105	22.9	-0.2	80	173	71	69
11	1.611	0.147	0.039	0.99	70	-0.62	-	23.1	0.2	80	174	71	69
12	1.758	0.147	0.040	0.97	70	-0.64	-	22.7	-0.4	80	174	70	69
13	1.904	0.146	0.040	0.96	71	-0.62	-	22.5	-0.2	80	175	71	69
14	2.051	0.147	0.041	0.97	72	-0.63	-	22.4	-0.1	81	175	71	68
15	2.197	0.146	0.041	0.96	71	-0.66	-	22.3	-0.1	81	175	71	69
16	2.342	0.145	0.040	0.98	72	-0.69	-	22.3	0	81	174	71	69
17	2.489	0.147	0.042	0.99	71	-0.69	-	22.1	-0.2	80	175	70	69
18	2.635	0.146	0.043	0.97	72	-0.74	-	22.5	0.4	80	174	70	69
19	2.780	0.145	0.042	0.95	72	-0.74	-	21.9	-0.6	80	173	70	69
20	2.926	0.146	0.041	0.96	73	-0.78	105	22.0	0.1	80	173	71	69
21	3.072	0.146	0.041	0.95	73	-0.8	-	21.9	-0.1	80	172	71	69
22	3.218	0.146	0.042	0.94	74	-0.85	-	21.8	-0.1	80	172	71	69
23	3.364	0.146	0.041	0.96	74	-0.86	-	21.8	0	80	171	71	69
24	3.510	0.146	0.041	0.97	73	-0.88	-	21.7	-0.1	80	172	71	69
25	3.656	0.146	0.041	0.96	73	-0.91	-	21.5	-0.2	80	173	71	69
26	3.802	0.146	0.041	0.94	74	-0.93	-	21.3	-0.2	81	173	70	69
27	3.947	0.145	0.041	0.96	75	-0.97	-	21.3	0	81	173	71	69
28	4.093	0.146	0.041	0.95	75	-1	-	21.2	-0.1	81	173	72	69
29	4.238	0.145	0.040	0.95	75	-1.04	-	21.0	-0.2	81	175	70	69
30	4.383	0.145	0.042	0.95	76	-1.07	103	20.9	-0.1	81	174	72	69
31	4.528	0.145	0.040	0.95	76	-1.09	-	20.7	-0.2	81	174	71	69

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.673	0.145	0.042	0.98	76	-1.13	-	20.6	-0.1	81	175	72	69
33	4.819	0.146	0.041	0.95	77	-1.15	-	20.4	-0.2	81	174	72	69
34	4.964	0.145	0.042	0.95	77	-1.18	-	20.4	0	81	174	71	69
35	5.110	0.146	0.042	0.95	77	-1.21	-	20.3	-0.1	81	174	71	69
36	5.256	0.146	0.042	0.95	78	-1.24	-	20.2	-0.1	81	173	71	69
37	5.402	0.146	0.043	0.95	78	-1.25	-	20.2	0	81	172	72	69
38	5.547	0.145	0.042	0.92	77	-1.28	-	20.2	0	81	173	71	69
39	5.692	0.145	0.042	0.95	78	-1.29	-	20.0	-0.2	81	172	71	69
40	5.837	0.145	0.040	0.94	78	-1.33	104	19.9	-0.1	81	172	71	69
41	5.982	0.145	0.042	0.95	79	-1.33	-	19.8	-0.1	81	171	71	69
42	6.127	0.145	0.042	0.95	79	-1.35	-	19.6	-0.2	81	172	71	69
43	6.272	0.145	0.041	0.94	80	-1.37	-	19.6	0	81	171	71	69
44	6.418	0.146	0.041	0.94	80	-1.42	-	19.6	0	81	172	71	70
45	6.563	0.145	0.041	0.93	80	-1.41	-	19.3	-0.3	81	172	72	70
46	6.709	0.146	0.040	0.93	80	-1.44	-	19.5	0.2	82	173	71	70
47	6.855	0.146	0.043	0.95	80	-1.46	-	19.1	-0.4	82	174	71	69
48	7.000	0.145	0.043	0.94	81	-1.47	-	19.2	0.1	82	173	72	69
49	7.145	0.145	0.042	0.95	80	-1.51	-	19.1	-0.1	82	174	70	69
50	7.290	0.145	0.041	0.94	81	-1.52	103	18.9	-0.2	81	174	71	69
51	7.435	0.145	0.042	0.97	81	-1.54	-	18.8	-0.1	81	173	72	69
52	7.580	0.145	0.042	0.94	81	-1.56	-	18.6	-0.2	81	173	70	69
53	7.726	0.146	0.042	0.94	83	-1.55	-	18.5	-0.1	81	172	71	69
54	7.871	0.145	0.044	0.95	82	-1.6	-	18.5	0	81	173	70	69
55	8.016	0.145	0.041	0.94	83	-1.59	-	18.3	-0.2	81	171	71	70
56	8.161	0.145	0.042	0.94	83	-1.61	-	18.2	-0.1	81	171	71	70
57	8.308	0.147	0.041	0.94	83	-1.64	-	18.2	0	81	172	70	70
58	8.454	0.146	0.041	0.95	84	-1.65	-	18.1	-0.1	81	171	71	70
59	8.599	0.145	0.042	0.94	83	-1.67	-	18.0	-0.1	82	172	70	70
60	8.745	0.146	0.040	0.94	83	-1.67	104	17.9	-0.1	82	174	71	70
61	8.890	0.145	0.042	0.94	84	-1.69	-	17.8	-0.1	82	173	70	69
62	9.036	0.146	0.044	0.94	84	-1.7	-	17.7	-0.1	82	173	70	70
63	9.181	0.145	0.042	0.94	85	-1.71	-	17.5	-0.2	81	172	70	70

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	9.327	0.146	0.043	0.94	85	-1.72	-	17.4	-0.1	82	173	71	70
65	9.472	0.145	0.042	0.95	84	-1.75	-	17.3	-0.1	81	173	70	70
66	9.617	0.145	0.042	0.96	86	-1.76	-	17.3	0	81	172	71	70
67	9.763	0.146	0.042	0.94	85	-1.77	-	17.2	-0.1	81	172	70	70
68	9.909	0.146	0.042	0.94	85	-1.77	-	16.9	-0.3	81	172	70	70
69	10.055	0.146	0.041	0.95	85	-1.79	-	16.9	0	81	172	70	70
70	10.201	0.146	0.042	0.95	86	-1.8	101	16.8	-0.1	81	172	71	70
71	10.347	0.146	0.042	0.95	86	-1.81	-	16.7	-0.1	82	173	71	70
72	10.493	0.146	0.042	0.95	86	-1.81	-	15.9	-0.8	82	173	70	70
73	10.638	0.145	0.042	0.94	86	-1.81	-	16.5	0.6	82	173	70	70
74	10.784	0.146	0.042	0.96	87	-1.84	-	16.3	-0.2	82	172	71	70
75	10.930	0.146	0.044	0.93	87	-1.84	-	16.0	-0.3	82	171	71	70
76	11.075	0.145	0.042	0.94	87	-1.84	-	16.3	0.3	82	172	70	70
77	11.221	0.146	0.043	0.96	87	-1.86	-	16.1	-0.2	81	172	71	70
78	11.366	0.145	0.044	0.96	87	-1.86	-	16.2	0.1	81	171	70	70
79	11.512	0.146	0.042	0.95	88	-1.88	-	15.8	-0.4	81	170	71	70
80	11.658	0.146	0.042	0.95	88	-1.89	100	15.9	0.1	81	171	71	71
81	11.803	0.145	0.042	0.94	89	-1.9	-	15.8	-0.1	82	171	71	71
82	11.949	0.146	0.043	0.93	88	-1.89	-	15.5	-0.3	82	172	71	71
83	12.096	0.147	0.044	0.94	89	-1.93	-	15.6	0.1	82	172	71	71
84	12.242	0.146	0.042	0.93	88	-1.91	-	15.5	-0.1	82	173	71	71
85	12.388	0.146	0.045	0.94	89	-1.94	-	15.3	-0.2	82	172	71	71
86	12.534	0.146	0.042	0.94	88	-1.93	-	15.1	-0.2	82	174	70	71
87	12.680	0.146	0.045	0.95	89	-1.96	-	14.9	-0.2	82	173	71	71
88	12.825	0.145	0.042	0.94	89	-1.95	-	14.9	0	82	173	72	71
89	12.971	0.146	0.042	0.94	89	-1.94	-	14.8	-0.1	82	173	71	71
90	13.116	0.145	0.042	0.94	89	-1.96	100	14.7	-0.1	82	173	71	71
91	13.262	0.146	0.044	0.94	90	-1.91	-	14.5	-0.2	82	172	71	71
92	13.407	0.145	0.043	0.94	90	-1.95	-	14.1	-0.4	82	171	72	71
93	13.553	0.146	0.043	0.96	89	-1.98	-	14.4	0.3	82	172	71	71
94	13.699	0.146	0.043	0.94	90	-1.98	-	14.3	-0.1	82	171	71	71
95	13.844	0.145	0.042	0.94	90	-2	-	14.2	-0.1	82	171	71	71

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	13.990	0.146	0.041	0.96	90	-1.99	-	14.2	0	82	171	71	71
97	14.137	0.147	0.043	0.93	91	-1.98	-	14.1	-0.1	82	170	72	71
98	14.283	0.146	0.042	0.95	91	-1.98	-	14.0	-0.1	82	170	72	71
99	14.429	0.146	0.041	0.94	90	-1.99	-	13.9	-0.1	82	172	72	72
100	14.575	0.146	0.043	0.94	91	-1.98	99	13.8	-0.1	82	172	72	72
101	14.720	0.145	0.045	0.96	91	-1.99	-	13.6	-0.2	83	173	71	71
102	14.866	0.146	0.040	0.94	91	-2.02	-	13.6	0	83	173	72	72
103	15.011	0.145	0.042	0.96	91	-2.01	-	13.5	-0.1	83	174	71	72
104	15.157	0.146	0.042	0.94	92	-2.02	-	13.4	-0.1	83	173	72	72
105	15.303	0.146	0.043	0.95	91	-2.03	-	13.1	-0.3	83	173	71	72
106	15.448	0.145	0.041	0.94	91	-2.05	-	13.1	0	83	173	72	72
107	15.594	0.146	0.041	0.94	92	-2.03	-	13.1	0	82	172	72	72
108	15.740	0.146	0.043	0.96	91	-2.05	-	12.9	-0.2	82	172	72	72
109	15.885	0.145	0.043	0.93	92	-2.06	-	12.6	-0.3	82	172	72	72
110	16.032	0.147	0.042	0.94	92	-2.06	100	12.8	0.2	82	172	72	72
111	16.178	0.146	0.043	0.94	93	-2.05	-	12.7	-0.1	82	171	72	72
112	16.325	0.147	0.043	0.96	92	-2.05	-	12.5	-0.2	82	171	72	72
113	16.470	0.145	0.042	0.94	93	-2.06	-	12.6	0.1	82	171	72	72
114	16.616	0.146	0.041	0.94	93	-2.03	-	12.3	-0.3	82	171	72	72
115	16.762	0.146	0.042	0.94	93	-2.05	-	12.3	0	83	171	72	72
116	16.907	0.145	0.039	0.94	93	-2.05	-	12.1	-0.2	83	172	72	72
117	17.053	0.146	0.044	0.94	93	-2.04	-	12.1	0	83	173	72	72
118	17.199	0.146	0.042	0.94	93	-2.06	-	12.1	0	83	173	72	72
119	17.344	0.145	0.041	0.94	93	-2.07	-	11.9	-0.2	83	173	72	73
120	17.490	0.146	0.042	0.93	93	-2.06	100	11.7	-0.2	83	173	72	73
121	17.635	0.145	0.043	0.94	93	-2.08	-	11.5	-0.2	83	173	72	73
122	17.781	0.146	0.041	0.95	94	-2.08	-	11.8	0.3	82	172	72	73
123	17.927	0.146	0.042	0.94	93	-2.06	-	11.3	-0.5	82	172	72	73
124	18.073	0.146	0.042	0.95	93	-2.08	-	11.4	0.1	82	172	72	73
125	18.220	0.147	0.042	0.95	93	-2.06	-	11.2	-0.2	82	172	72	73
126	18.366	0.146	0.044	0.94	93	-2.07	-	11.1	-0.1	81	172	72	74
127	18.511	0.145	0.042	0.93	94	-2.07	-	10.9	-0.2	81	171	72	74

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	18.657	0.146	0.042	0.93	93	-2.06	-	10.9	0	81	172	71	73
129	18.802	0.145	0.043	0.94	93	-2.07	-	10.9	0	81	172	72	74
130	18.948	0.146	0.044	0.94	94	-2.09	97	10.8	-0.1	81	171	72	74
131	19.093	0.145	0.044	0.91	94	-2.08	-	10.8	0	81	171	72	76
132	19.239	0.146	0.043	0.93	94	-2.06	-	10.6	-0.2	81	172	72	75
133	19.384	0.145	0.042	0.94	95	-2.09	-	10.5	-0.1	81	171	73	75
134	19.530	0.146	0.043	0.94	95	-2.05	-	10.4	-0.1	81	172	73	75
135	19.676	0.146	0.042	0.93	95	-2.09	-	10.3	-0.1	81	172	73	75
136	19.821	0.145	0.043	0.92	94	-2.07	-	10.2	-0.1	81	173	73	75
137	19.967	0.146	0.042	0.94	94	-2.05	-	10.0	-0.2	81	174	72	74
138	20.114	0.147	0.041	0.94	94	-2.07	-	9.9	-0.1	81	173	72	74
139	20.260	0.146	0.042	0.95	94	-2.07	-	9.7	-0.2	81	173	72	74
140	20.405	0.145	0.041	0.91	94	-2.07	100	9.6	-0.1	80	172	72	75
141	20.551	0.146	0.044	0.92	94	-2.07	-	9.7	0.1	80	172	72	75
142	20.696	0.145	0.042	0.95	95	-2.07	-	9.2	-0.5	80	171	73	75
143	20.841	0.145	0.041	0.93	96	-2.07	-	9.3	0.1	81	171	73	75
144	20.987	0.146	0.040	0.93	95	-2.06	-	9.4	0.1	81	170	72	75
145	21.132	0.145	0.041	0.93	95	-2.06	-	9.0	-0.4	80	171	72	75
146	21.278	0.146	0.043	0.93	96	-2.09	-	9.1	0.1	80	170	73	75
147	21.424	0.146	0.042	0.93	95	-2.08	-	8.9	-0.2	80	171	73	75
148	21.569	0.145	0.043	0.93	95	-2.06	-	8.9	0	81	171	73	75
149	21.715	0.146	0.043	0.93	95	-2.07	-	8.7	-0.2	81	172	73	75
150	21.861	0.146	0.041	0.93	96	-2.07	100	8.7	0	81	172	73	75
151	22.007	0.146	0.043	0.92	96	-2.07	-	8.6	-0.1	81	172	73	75
152	22.153	0.146	0.043	0.93	95	-2.06	-	8.4	-0.2	81	173	72	75
153	22.298	0.145	0.042	0.93	96	-2.08	-	8.4	0	81	173	72	75
154	22.444	0.146	0.044	0.94	95	-2.09	-	8.2	-0.2	81	173	72	75
155	22.589	0.145	0.040	0.94	95	-2.08	-	8.1	-0.1	81	173	72	75
156	22.734	0.145	0.041	0.93	96	-2.08	-	8.0	-0.1	80	171	73	75
157	22.880	0.146	0.043	0.96	96	-2.1	-	7.7	-0.3	80	171	73	75
158	23.025	0.145	0.043	0.92	96	-2.05	-	7.6	-0.1	80	171	73	75
159	23.170	0.145	0.041	0.93	95	-2.09	-	7.5	-0.1	81	173	73	75

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	23.316	0.146	0.041	0.93	96	-2.08	100	7.5	0	81	173	73	75
161	23.461	0.145	0.041	0.93	96	-2.08	-	7.4	-0.1	81	173	73	75
162	23.607	0.146	0.041	0.93	97	-2.08	-	7.4	0	81	171	73	75
163	23.753	0.146	0.043	0.92	96	-2.09	-	7.1	-0.3	81	171	73	75
164	23.899	0.146	0.043	0.93	97	-2.09	-	7.2	0.1	81	172	73	75
165	24.044	0.145	0.042	0.92	96	-2.09	-	7.0	-0.2	81	172	72	75
166	24.190	0.146	0.040	0.93	97	-2.1	-	7.1	0.1	81	171	73	75
167	24.335	0.145	0.041	0.93	96	-2.12	-	6.9	-0.2	81	172	73	75
168	24.480	0.145	0.042	0.93	96	-2.1	-	6.8	-0.1	81	173	73	75
169	24.625	0.145	0.044	0.93	97	-2.1	-	6.8	0	81	173	73	75
170	24.770	0.145	0.043	0.90	96	-2.12	98	6.8	0	81	174	73	75
171	24.916	0.146	0.041	0.93	96	-2.11	-	6.7	-0.1	82	174	73	75
172	25.061	0.145	0.042	0.93	97	-2.13	-	6.5	-0.2	82	174	73	75
173	25.207	0.146	0.041	0.93	96	-2.12	-	6.5	0	82	175	73	75
174	25.353	0.146	0.042	0.93	97	-2.14	-	6.3	-0.2	82	175	73	75
175	25.499	0.146	0.041	0.93	97	-2.13	-	6.1	-0.2	82	175	73	75
176	25.644	0.145	0.043	0.92	96	-2.16	-	6.0	-0.1	82	175	73	75
177	25.789	0.145	0.041	0.92	96	-2.16	-	6.1	0.1	82	175	73	75
178	25.934	0.145	0.044	0.93	97	-2.16	-	5.8	-0.3	82	174	73	75
179	26.079	0.145	0.041	0.93	96	-2.15	-	5.5	-0.3	82	175	73	75
180	26.224	0.145	0.043	0.91	98	-2.18	97	5.4	-0.1	82	174	73	75
181	26.369	0.145	0.040	0.92	97	-2.15	-	5.8	0.4	82	174	73	75
182	26.514	0.145	0.043	0.93	98	-2.18	-	5.4	-0.4	82	173	73	75
183	26.659	0.145	0.044	0.93	98	-2.18	-	5.4	0	82	173	73	75
184	26.806	0.147	0.043	0.96	97	-2.17	-	5.0	-0.4	82	173	73	75
185	26.952	0.146	0.043	0.93	97	-2.15	-	5.2	0.2	82	174	73	75
186	27.097	0.145	0.043	0.91	98	-2.18	-	5.1	-0.1	82	173	73	75
187	27.242	0.145	0.042	0.93	97	-2.19	-	5.1	0	82	174	73	75
188	27.388	0.146	0.043	0.93	97	-2.19	-	4.6	-0.5	82	174	73	75
189	27.532	0.144	0.041	0.93	98	-2.2	-	4.9	0.3	82	174	73	75
190	27.677	0.145	0.041	0.95	98	-2.18	100	4.8	-0.1	82	174	73	75
191	27.822	0.145	0.042	0.91	97	-2.21	-	4.8	0	82	175	73	75

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
192	27.967	0.145	0.044	0.92	98	-2.22	-	4.4	-0.4	83	175	74	75
193	28.113	0.146	0.042	0.91	97	-2.22	-	4.4	0	83	176	73	75
194	28.258	0.145	0.041	0.95	98	-2.23	-	4.2	-0.2	83	175	73	75
195	28.404	0.146	0.040	0.92	97	-2.23	-	4.0	-0.2	83	177	73	75
196	28.550	0.146	0.041	0.93	98	-2.24	-	4.0	0	83	176	73	75
197	28.694	0.144	0.040	0.91	97	-2.24	-	3.5	-0.5	82	176	73	75
198	28.839	0.145	0.041	0.93	98	-2.24	-	3.8	0.3	82	175	73	75
199	28.984	0.145	0.045	0.93	98	-2.22	-	3.5	-0.3	82	174	73	75
200	29.129	0.145	0.041	0.93	98	-2.26	99	3.6	0.1	82	175	73	75
201	29.274	0.145	0.042	0.93	97	-2.24	-	3.4	-0.2	82	175	73	75
202	29.419	0.145	0.040	0.93	97	-2.26	-	3.5	0.1	82	175	73	76
203	29.564	0.145	0.042	0.92	98	-2.24	-	3.4	-0.1	82	173	74	76
204	29.709	0.145	0.042	0.93	98	-2.25	-	3.2	-0.2	82	174	74	76
205	29.855	0.146	0.044	0.93	98	-2.25	-	3.2	0	82	174	74	76
206	30.001	0.146	0.043	0.93	99	-2.25	-	3.1	-0.1	82	173	74	76
207	30.145	0.144	0.042	0.92	98	-2.26	-	3.0	-0.1	82	174	74	76
208	30.290	0.145	0.042	0.91	98	-2.25	-	3.3	0.3	82	174	74	76
209	30.435	0.145	0.042	0.94	98	-2.25	-	2.7	-0.6	82	173	74	76
210	30.580	0.145	0.041	0.92	98	-2.26	99	2.8	0.1	82	174	74	76
211	30.724	0.144	0.042	0.94	98	-2.29	-	2.9	0.1	82	174	74	76
212	30.870	0.146	0.043	0.93	99	-2.25	-	2.8	-0.1	82	174	74	76
213	31.012	0.142	0.041	0.93	98	-2.28	-	2.4	-0.4	83	176	74	76
214	31.158	0.146	0.042	0.92	98	-2.27	-	2.4	0	83	176	73	76
215	31.303	0.145	0.044	0.92	99	-2.28	-	2.3	-0.1	83	176	74	76
216	31.448	0.145	0.042	0.90	98	-2.3	-	2.0	-0.3	83	177	73	76
217	31.593	0.145	0.044	0.93	99	-2.29	-	2.1	0.1	83	176	74	76
218	31.737	0.144	0.043	0.92	99	-2.3	-	1.8	-0.3	83	176	74	76
219	31.882	0.145	0.041	0.93	98	-2.31	-	1.8	0	83	176	73	76
220	32.026	0.144	0.043	0.92	99	-2.34	97	1.7	-0.1	82	175	73	76
221	32.171	0.145	0.042	0.92	98	-2.31	-	1.1	-0.6	82	175	73	76
222	32.316	0.145	0.042	0.92	99	-2.32	-	1.4	0.3	82	174	74	76
223	32.462	0.146	0.042	0.93	99	-2.33	-	1.3	-0.1	82	174	74	76

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
224	32.607	0.145	0.045	0.92	98	-2.31	-	1.3	0	82	174	73	76
225	32.752	0.145	0.041	0.92	98	-2.32	-	1.2	-0.1	82	174	74	76
226	32.896	0.144	0.041	0.92	99	-2.34	-	1.1	-0.1	82	173	74	76
227	33.041	0.145	0.043	0.91	99	-2.34	-	1.1	0	82	173	73	76
228	33.185	0.144	0.041	0.93	99	-2.34	-	1.2	0.1	82	173	74	76
229	33.330	0.145	0.042	0.93	98	-2.35	-	0.7	-0.5	82	175	74	76
230	33.474	0.144	0.042	0.95	98	-2.36	98	0.6	-0.1	83	176	73	76
231	33.620	0.146	0.042	0.92	99	-2.36	-	0.9	0.3	83	175	74	76
232	33.765	0.145	0.044	0.92	99	-2.37	-	0.9	0	83	176	74	76
233	33.910	0.145	0.043	0.90	99	-2.35	-	0.6	-0.3	83	176	74	76
234	34.054	0.144	0.045	0.91	99	-2.38	-	0.4	-0.2	83	176	74	76
235	34.198	0.144	0.041	0.92	99	-2.38	-	0.5	0.1	84	177	74	76
236	34.343	0.145	0.041	0.92	98	-2.38	-	0.4	-0.1	84	178	73	76
237	34.487	0.144	0.043	0.93	99	-2.38	-	0.3	-0.1	84	178	74	76
238	34.632	0.145	0.040	0.94	99	-2.39	-	0.3	0	84	178	73	76
239	34.777	0.145	0.042	0.91	100	-2.4	-	0.1	-0.2	84	177	74	76
240	34.922	0.145	0.041	0.92	100	-2.42	99	0.0	-0.1	84	177	74	75
Avg/Tot	34.922	0.146	0.042	0.94	90	-1.85	100			82	173	72	72.5

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.35	70	-1.43		70	-0.010	9.26	0.00
1	0.131	0.131	1.06	71	-1.32	-	71	-0.010	11.32	0.01
2	0.280	0.149	1.05	72	-1.36	-	71	-0.010	12.52	0.01
3	0.428	0.148	1.05	71	-1.4	-	71	-0.010	12.86	0.01
4	0.576	0.148	1.04	72	-1.37	-	71	-0.010	13.26	0.01
5	0.724	0.148	1.04	71	-1.34	-	72	-0.020	12.72	0.02
6	0.871	0.147	1.00	72	-1.36	-	72	-0.020	12.84	0.01
7	1.018	0.147	1.06	72	-1.38	-	72	-0.010	10.75	0.01
8	1.165	0.147	1.03	72	-1.34	-	72	-0.010	11.55	0.01
9	1.311	0.146	0.99	73	-1.37	-	72	-0.010	10.77	0.02
10	1.458	0.147	1.02	73	-1.35	104	72	-0.010	9.25	0.01
11	1.605	0.147	0.98	73	-1.36	-	72	-0.010	8.88	0.01
12	1.752	0.147	1.02	74	-1.35	-	72	-0.010	8.56	0.01
13	1.898	0.146	1.03	73	-1.34	-	72	-0.010	10.63	0.00
14	2.045	0.147	1.02	74	-1.38	-	72	-0.020	11.86	0.00
15	2.191	0.146	1.02	74	-1.38	-	72	-0.010	12.19	0.00
16	2.336	0.145	1.02	74	-1.32	-	71	-0.020	12.18	0.01
17	2.482	0.146	1.03	75	-1.33	-	72	-0.010	12.08	0.01
18	2.627	0.145	0.96	75	-1.35	-	72	-0.010	12.60	0.01
19	2.772	0.145	1.01	76	-1.38	-	72	-0.010	13.80	0.02
20	2.917	0.145	1.01	76	-1.36	104	72	-0.020	12.09	0.01
21	3.062	0.145	1.00	76	-1.35	-	72	-0.010	10.54	0.00
22	3.207	0.145	1.03	76	-1.33	-	72	-0.010	9.27	0.01
23	3.352	0.145	1.01	76	-1.34	-	72	-0.010	9.73	0.01
24	3.497	0.145	0.97	76	-1.3	-	72	0.000	9.14	0.01
25	3.643	0.146	1.01	77	-1.38	-	72	-0.010	8.98	0.00
26	3.789	0.146	0.99	78	-1.36	-	72	-0.010	8.14	0.00
27	3.934	0.145	1.01	77	-1.3	-	72	-0.010	8.85	0.00
28	4.079	0.145	1.01	77	-1.34	-	72	-0.010	8.90	0.01
29	4.224	0.145	1.01	79	-1.34	-	72	-0.010	10.86	0.00
30	4.368	0.144	1.00	78	-1.34	101	73	-0.010	11.95	0.01
31	4.513	0.145	0.97	79	-1.34	-	73	-0.020	12.31	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.657	0.144	1.00	79	-1.33	-	73	-0.010	12.83	0.01
33	4.802	0.145	1.04	79	-1.29	-	73	-0.010	13.50	0.01
34	4.947	0.145	1.01	79	-1.3	-	72	-0.010	12.89	0.01
35	5.092	0.145	0.99	79	-1.3	-	72	-0.010	12.90	0.01
36	5.237	0.145	1.01	79	-1.36	-	72	-0.010	12.80	0.01
37	5.383	0.146	1.01	80	-1.34	-	72	-0.010	11.91	0.01
38	5.528	0.145	1.02	81	-1.34	-	72	-0.020	10.78	0.00
39	5.672	0.144	0.99	81	-1.37	-	72	-0.010	11.11	0.01
40	5.817	0.145	1.00	81	-1.28	103	72	-0.010	10.77	0.00
41	5.962	0.145	0.99	82	-1.35	-	72	-0.010	10.35	0.01
42	6.106	0.144	1.00	82	-1.29	-	72	-0.010	8.15	0.01
43	6.251	0.145	1.00	81	-1.34	-	72	-0.010	9.11	0.01
44	6.396	0.145	1.01	82	-1.38	-	72	-0.010	8.88	0.01
45	6.541	0.145	1.00	82	-1.38	-	72	-0.010	9.50	0.01
46	6.686	0.145	1.01	83	-1.28	-	72	-0.020	10.10	0.01
47	6.832	0.146	1.00	82	-1.28	-	72	-0.010	11.44	0.00
48	6.977	0.145	1.00	83	-1.4	-	72	-0.010	12.26	0.01
49	7.121	0.144	0.99	83	-1.28	-	72	-0.010	11.96	0.02
50	7.266	0.145	1.00	83	-1.29	102	72	-0.010	12.06	0.01
51	7.411	0.145	0.98	83	-1.3	-	72	-0.010	12.23	0.01
52	7.555	0.144	0.98	84	-1.38	-	72	-0.010	11.99	0.01
53	7.700	0.145	1.00	84	-1.37	-	72	-0.010	11.35	0.01
54	7.845	0.145	1.01	84	-1.37	-	72	-0.010	11.19	0.01
55	7.990	0.145	1.01	84	-1.29	-	72	-0.010	11.43	0.00
56	8.136	0.146	1.00	84	-1.34	-	72	-0.010	11.31	0.01
57	8.282	0.146	1.00	85	-1.38	-	72	-0.010	10.91	0.01
58	8.427	0.145	1.01	84	-1.35	-	72	-0.010	9.87	0.01
59	8.572	0.145	1.03	85	-1.29	-	72	-0.020	9.72	0.01
60	8.718	0.146	1.02	85	-1.3	103	72	0.000	10.83	0.01
61	8.863	0.145	1.02	86	-1.29	-	72	-0.010	11.10	0.00
62	9.008	0.145	1.01	86	-1.31	-	72	-0.010	11.17	0.00
63	9.153	0.145	1.01	85	-1.33	-	71	-0.010	10.91	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	9.298	0.145	1.00	85	-1.29	-	72	-0.010	12.38	0.01
65	9.443	0.145	0.96	85	-1.38	-	72	-0.010	11.95	0.01
66	9.589	0.146	0.98	86	-1.34	-	72	-0.010	11.73	0.01
67	9.734	0.145	1.01	86	-1.34	-	72	-0.010	11.31	0.00
68	9.880	0.146	1.01	86	-1.35	-	72	-0.010	10.70	0.00
69	10.026	0.146	1.05	87	-1.39	-	72	-0.010	9.64	0.01
70	10.172	0.146	0.98	86	-1.38	100	72	-0.010	10.12	0.00
71	10.318	0.146	1.01	86	-1.38	-	72	-0.010	10.27	0.01
72	10.464	0.146	1.02	87	-1.3	-	72	-0.010	10.89	0.01
73	10.609	0.145	0.98	87	-1.35	-	72	-0.010	12.26	0.01
74	10.755	0.146	0.97	86	-1.38	-	72	-0.010	13.40	0.01
75	10.900	0.145	0.98	87	-1.33	-	72	0.000	13.54	0.02
76	11.045	0.145	1.02	88	-1.29	-	72	-0.010	13.05	0.01
77	11.191	0.146	1.05	87	-1.35	-	72	-0.020	12.70	0.01
78	11.336	0.145	1.00	88	-1.3	-	72	-0.010	10.32	0.01
79	11.482	0.146	1.00	87	-1.32	-	72	-0.010	10.15	0.01
80	11.627	0.145	1.03	87	-1.39	100	72	-0.010	9.68	0.01
81	11.773	0.146	1.00	87	-1.32	-	72	-0.010	9.79	0.01
82	11.919	0.146	0.99	87	-1.27	-	72	0.000	9.52	0.02
83	12.065	0.146	1.01	87	-1.28	-	72	-0.010	9.12	0.01
84	12.211	0.146	1.01	87	-1.3	-	72	-0.020	10.22	0.02
85	12.358	0.147	1.01	87	-1.27	-	72	-0.010	10.74	0.01
86	12.504	0.146	1.01	88	-1.38	-	72	-0.010	12.15	0.01
87	12.649	0.145	1.00	88	-1.27	-	72	-0.010	12.89	0.01
88	12.795	0.146	1.00	88	-1.28	-	72	-0.010	13.91	0.01
89	12.941	0.146	1.00	89	-1.33	-	73	-0.010	14.27	0.02
90	13.086	0.145	1.00	89	-1.36	100	73	-0.010	14.62	0.02
91	13.232	0.146	1.00	89	-1.39	-	73	-0.010	13.37	0.02
92	13.377	0.145	0.99	89	-1.39	-	73	-0.010	11.50	0.01
93	13.523	0.146	0.98	89	-1.27	-	73	0.000	10.45	0.01
94	13.669	0.146	0.99	89	-1.31	-	73	-0.010	10.43	0.01
95	13.814	0.145	1.00	89	-1.3	-	73	-0.010	9.93	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	13.960	0.146	1.02	89	-1.37	-	73	-0.010	9.88	0.01
97	14.106	0.146	1.01	89	-1.36	-	73	-0.010	8.87	0.01
98	14.252	0.146	1.00	90	-1.31	-	73	-0.010	8.64	0.01
99	14.398	0.146	1.00	89	-1.32	-	73	-0.010	9.20	0.00
100	14.544	0.146	1.00	90	-1.36	99	73	-0.010	9.57	0.00
101	14.691	0.147	1.03	90	-1.3	-	73	0.010	10.14	0.02
102	14.837	0.146	1.00	90	-1.31	-	73	-0.010	11.76	0.01
103	14.983	0.146	0.95	90	-1.27	-	73	-0.020	12.46	0.01
104	15.129	0.146	0.97	89	-1.35	-	73	-0.010	13.35	0.02
105	15.275	0.146	1.00	90	-1.29	-	73	0.000	14.15	0.02
106	15.421	0.146	1.00	89	-1.28	-	73	-0.010	13.75	0.02
107	15.566	0.145	0.99	89	-1.38	-	73	-0.020	14.05	0.03
108	15.712	0.146	0.99	89	-1.29	-	72	-0.010	13.71	0.01
109	15.858	0.146	1.02	90	-1.38	-	73	-0.010	11.65	0.01
110	16.004	0.146	1.00	90	-1.35	100	73	-0.010	10.99	0.01
111	16.149	0.145	1.00	90	-1.28	-	73	-0.010	10.15	0.01
112	16.295	0.146	0.98	90	-1.3	-	73	-0.020	9.87	0.02
113	16.441	0.146	0.98	91	-1.4	-	73	-0.010	8.92	0.02
114	16.587	0.146	1.01	90	-1.32	-	73	-0.010	9.45	0.01
115	16.733	0.146	1.00	91	-1.39	-	73	-0.010	9.49	0.01
116	16.879	0.146	0.99	90	-1.39	-	73	-0.020	9.29	0.01
117	17.025	0.146	1.00	90	-1.37	-	73	-0.010	9.98	0.01
118	17.172	0.147	1.01	91	-1.38	-	73	-0.010	10.60	0.01
119	17.318	0.146	1.01	91	-1.38	-	73	-0.010	11.05	0.01
120	17.465	0.147	1.00	91	-1.38	100	73	-0.010	12.33	0.02
121	17.611	0.146	1.00	91	-1.38	-	74	-0.010	13.90	0.02
122	17.757	0.146	1.03	90	-1.34	-	73	0.000	14.13	0.01
123	17.903	0.146	1.00	90	-1.28	-	73	-0.010	13.23	0.02
124	18.049	0.146	1.00	91	-1.39	-	73	-0.010	12.51	0.02
125	18.195	0.146	0.95	91	-1.28	-	73	-0.010	13.62	0.01
126	18.340	0.145	1.00	90	-1.29	-	74	-0.010	11.44	0.01
127	18.486	0.146	1.00	91	-1.31	-	74	-0.010	9.86	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
128	18.632	0.146	1.00	91	-1.34	-	74	-0.010	9.31	0.01
129	18.777	0.145	1.00	91	-1.33	-	74	-0.010	9.93	0.01
130	18.923	0.146	0.96	90	-1.37	97	74	-0.020	9.71	0.02
131	19.069	0.146	1.01	91	-1.33	-	74	-0.010	8.86	0.01
132	19.215	0.146	0.99	92	-1.3	-	74	-0.010	9.19	0.02
133	19.361	0.146	1.00	91	-1.37	-	74	-0.010	8.78	0.02
134	19.507	0.146	1.00	92	-1.37	-	74	-0.010	9.40	0.03
135	19.653	0.146	1.05	92	-1.42	-	75	0.000	11.31	0.02
136	19.799	0.146	1.01	92	-1.33	-	74	-0.010	12.99	0.02
137	19.946	0.147	0.98	92	-1.32	-	74	-0.010	12.84	0.03
138	20.092	0.146	1.01	92	-1.27	-	74	-0.010	14.07	0.03
139	20.238	0.146	0.96	91	-1.41	-	74	-0.010	14.08	0.03
140	20.384	0.146	1.03	91	-1.42	101	74	-0.010	13.03	0.03
141	20.530	0.146	0.96	91	-1.35	-	74	-0.020	13.55	0.02
142	20.675	0.145	1.00	92	-1.39	-	74	-0.010	12.36	0.02
143	20.821	0.146	1.00	91	-1.38	-	74	-0.010	11.84	0.01
144	20.967	0.146	1.00	92	-1.39	-	75	-0.010	10.67	0.01
145	21.113	0.146	1.02	92	-1.29	-	74	-0.010	10.02	0.01
146	21.259	0.146	0.97	91	-1.35	-	74	-0.010	9.36	0.02
147	21.405	0.146	1.00	92	-1.32	-	74	-0.010	8.84	0.02
148	21.550	0.145	1.00	91	-1.33	-	74	-0.010	9.54	0.01
149	21.696	0.146	0.99	93	-1.29	-	75	-0.020	9.44	0.03
150	21.842	0.146	1.01	91	-1.3	101	74	-0.010	9.57	0.02
151	21.988	0.146	1.05	91	-1.39	-	74	-0.010	11.15	0.02
152	22.134	0.146	1.00	92	-1.38	-	75	-0.010	11.54	0.03
153	22.280	0.146	1.00	92	-1.31	-	75	-0.010	13.06	0.02
154	22.427	0.147	1.01	93	-1.3	-	75	0.000	13.91	0.04
155	22.573	0.146	1.00	92	-1.3	-	74	-0.010	14.51	0.05
156	22.719	0.146	0.99	92	-1.38	-	75	-0.010	13.98	0.03
157	22.865	0.146	0.98	92	-1.37	-	74	-0.010	13.87	0.02
158	23.011	0.146	1.01	92	-1.35	-	75	-0.010	12.60	0.02
159	23.157	0.146	1.00	92	-1.38	-	75	-0.010	11.96	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
160	23.303	0.146	1.00	93	-1.39	101	75	-0.010	11.15	0.00
161	23.448	0.145	1.00	93	-1.28	-	75	-0.010	10.10	0.01
162	23.594	0.146	1.00	92	-1.29	-	75	-0.010	9.66	0.01
163	23.740	0.146	1.01	93	-1.38	-	75	-0.010	9.44	0.01
164	23.886	0.146	1.00	92	-1.28	-	75	-0.010	8.82	0.02
165	24.031	0.145	0.98	92	-1.4	-	74	-0.010	8.80	0.02
166	24.177	0.146	0.99	92	-1.38	-	75	-0.010	8.07	0.02
167	24.323	0.146	0.99	93	-1.38	-	75	-0.010	8.38	0.01
168	24.469	0.146	0.97	92	-1.29	-	75	0.010	8.51	0.02
169	24.615	0.146	1.02	93	-1.38	-	75	-0.020	9.45	0.01
170	24.761	0.146	1.02	93	-1.31	98	75	-0.010	9.26	0.02
171	24.907	0.146	1.00	92	-1.38	-	75	-0.010	10.53	0.01
172	25.053	0.146	1.00	93	-1.35	-	75	-0.010	11.02	0.02
173	25.200	0.147	0.98	93	-1.38	-	75	-0.010	11.45	0.03
174	25.345	0.145	1.00	93	-1.32	-	75	-0.010	11.67	0.03
175	25.491	0.146	0.99	92	-1.34	-	75	-0.010	12.04	0.03
176	25.637	0.146	1.00	92	-1.34	-	75	-0.010	12.82	0.02
177	25.783	0.146	0.99	93	-1.34	-	75	0.000	13.76	0.04
178	25.928	0.145	0.99	92	-1.38	-	75	-0.010	12.81	0.03
179	26.074	0.146	1.00	93	-1.37	-	75	-0.010	11.67	0.01
180	26.220	0.146	1.00	93	-1.38	98	75	-0.010	10.92	0.01
181	26.365	0.145	1.04	94	-1.39	-	75	-0.010	10.31	0.01
182	26.511	0.146	1.00	93	-1.34	-	75	-0.010	9.00	0.02
183	26.656	0.145	0.99	93	-1.29	-	75	-0.010	8.80	0.02
184	26.802	0.146	0.94	94	-1.31	-	75	0.010	8.52	0.02
185	26.948	0.146	1.00	93	-1.29	-	75	-0.010	8.44	0.01
186	27.094	0.146	1.00	93	-1.33	-	75	0.000	7.59	0.02
187	27.240	0.146	1.00	93	-1.38	-	75	-0.010	7.41	0.02
188	27.386	0.146	0.98	93	-1.33	-	75	0.000	7.83	0.02
189	27.533	0.147	1.00	93	-1.29	-	75	-0.010	9.17	0.01
190	27.679	0.146	0.96	93	-1.34	100	75	-0.010	8.63	0.02
191	27.824	0.145	1.00	93	-1.3	-	75	-0.010	9.81	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
192	27.970	0.146	0.99	93	-1.4	-	75	0.000	10.50	0.02
193	28.116	0.146	1.00	93	-1.32	-	75	-0.020	12.00	0.02
194	28.261	0.145	0.98	93	-1.31	-	75	0.000	12.35	0.03
195	28.407	0.146	0.99	93	-1.3	-	75	-0.010	13.06	0.02
196	28.552	0.145	0.99	94	-1.3	-	75	-0.010	13.14	0.03
197	28.698	0.146	0.99	94	-1.29	-	75	-0.010	12.98	0.03
198	28.843	0.145	0.99	93	-1.29	-	75	-0.010	13.77	0.03
199	28.989	0.146	1.01	93	-1.3	-	75	-0.010	12.50	0.02
200	29.134	0.145	1.00	93	-1.39	100	75	-0.010	11.59	0.01
201	29.280	0.146	1.08	94	-1.3	-	75	0.000	11.00	0.02
202	29.426	0.146	0.98	94	-1.38	-	75	-0.010	9.02	0.02
203	29.572	0.146	0.99	94	-1.35	-	75	-0.010	8.85	0.02
204	29.718	0.146	0.99	93	-1.4	-	75	-0.010	9.14	0.01
205	29.864	0.146	0.99	93	-1.35	-	75	-0.010	9.30	0.01
206	30.010	0.146	0.99	93	-1.3	-	76	-0.010	8.67	0.01
207	30.155	0.145	0.94	94	-1.39	-	76	-0.010	8.13	0.02
208	30.301	0.146	0.95	94	-1.38	-	76	0.000	8.29	0.01
209	30.446	0.145	0.98	94	-1.36	-	76	0.000	8.41	0.02
210	30.592	0.146	0.99	94	-1.39	100	75	-0.010	8.18	0.02
211	30.738	0.146	0.99	94	-1.36	-	76	-0.010	7.73	0.02
212	30.883	0.145	0.99	94	-1.31	-	76	-0.010	7.57	0.02
213	31.026	0.143	0.98	95	-1.3	-	76	-0.010	8.36	0.02
214	31.171	0.145	1.00	94	-1.37	-	76	-0.010	9.85	0.02
215	31.317	0.146	1.00	94	-1.37	-	76	-0.010	11.11	0.03
216	31.463	0.146	1.05	94	-1.38	-	75	-0.020	12.47	0.03
217	31.609	0.146	0.99	93	-1.37	-	76	0.000	12.74	0.03
218	31.755	0.146	0.99	94	-1.28	-	76	-0.010	13.32	0.03
219	31.900	0.145	1.00	95	-1.31	-	76	-0.010	13.07	0.03
220	32.045	0.145	1.00	94	-1.39	97	76	-0.010	11.88	0.02
221	32.191	0.146	1.01	93	-1.33	-	75	-0.010	10.93	0.02
222	32.336	0.145	0.97	94	-1.32	-	75	-0.010	9.73	0.02
223	32.481	0.145	0.97	93	-1.41	-	75	0.000	9.06	0.02

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 3

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
224	32.626	0.145	0.98	94	-1.41	-	76	-0.010	8.20	0.02
225	32.772	0.146	1.03	95	-1.43	-	76	-0.020	8.35	0.01
226	32.917	0.145	0.99	95	-1.39	-	76	-0.010	8.12	0.02
227	33.062	0.145	0.98	95	-1.33	-	76	-0.010	8.56	0.01
228	33.208	0.146	0.95	93	-1.42	-	75	0.000	8.37	0.02
229	33.354	0.146	0.97	95	-1.35	-	76	-0.010	8.35	0.02
230	33.500	0.146	0.98	95	-1.3	99	75	-0.010	8.86	0.01
231	33.645	0.145	0.98	94	-1.27	-	75	-0.010	8.85	0.01
232	33.791	0.146	1.00	93	-1.42	-	75	-0.010	9.15	0.01
233	33.936	0.145	1.00	93	-1.35	-	75	0.000	8.08	0.02
234	34.081	0.145	0.99	94	-1.44	-	75	-0.010	8.29	0.01
235	34.226	0.145	0.99	95	-1.28	-	76	-0.010	8.12	0.01
236	34.371	0.145	0.99	94	-1.29	-	75	-0.010	7.56	0.01
237	34.516	0.145	0.98	95	-1.29	-	76	-0.010	7.87	0.01
238	34.661	0.145	0.95	94	-1.26	-	76	-0.010	8.03	0.01
239	34.807	0.146	0.97	94	-1.39	-	76	-0.010	7.83	0.01
240	34.952	0.145	0.98	94	-1.42	100	75	-0.010	7.29	0.01
Avg/Tot	34.952	0.146	1.00	88	-1.34	100	73	-0.010	10.77	0.01

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 3

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
0	0.000		-3.92	70	-1.8		67
1	0.125	0.125	-3.02	70	-1.6	-	67
2	0.267	0.142	-3.00	70	-1.7	-	68
3	0.412	0.145	-3.57	70	-1.7	-	68
4	0.558	0.146	-3.18	70	-1.7	-	68
5	0.703	0.145	-3.36	69	-1.8	-	68
6	0.847	0.144	-3.39	70	-1.8	-	68
7	0.993	0.146	-3.54	70	-1.7	-	68
8	1.141	0.148	-3.39	70	-1.7	-	68
9	1.287	0.146	-3.23	72	-1.7	-	68
10	1.432	0.145	-3.85	70	-1.6	97	68
11	1.579	0.147	-3.61	70	-1.7	-	68
12	1.727	0.148	-3.00	72	-1.7	-	68
13	1.876	0.149	-3.91	71	-1.9	-	68
14	2.025	0.149	-3.68	71	-1.7	-	68
15	2.173	0.148	-3.83	72	-1.6	-	68
16	2.321	0.148	-3.31	72	-1.7	-	68
17	2.470	0.149	-3.41	73	-1.7	-	68
18	2.618	0.148	-3.45	73	-1.7	-	68
19	2.768	0.150	-3.25	73	-1.8	-	68
20	2.918	0.150	-2.90	74	-1.8	100	68
21	3.069	0.151	-2.87	74	-1.7	-	68
22	3.221	0.152	-2.77	73	-1.9	-	68
23	3.372	0.151	-2.79	74	-1.7	-	68
24	3.524	0.152	-3.20	74	-1.8	-	68
25	3.675	0.151	-3.58	74	-1.8	-	68
26	3.827	0.152	-3.44	75	-1.8	-	69
27	3.980	0.153	-2.81	74	-1.9	-	69
28	4.132	0.152	-2.81	75	-1.7	-	69
29	4.284	0.152	-3.61	76	-1.9	-	69
30	4.437	0.153	-2.90	77	-1.9	100	69
31	4.589	0.152	-3.21	77	-1.8	-	69

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 3

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
32	4.742	0.153	-2.91	76	-1.7	-	69
33	4.895	0.153	-3.08	77	-1.7	-	69
34	5.049	0.154	-2.81	77	-1.7	-	69
35	5.203	0.154	-3.04	77	-1.7	-	69
36	5.357	0.154	-2.76	77	-1.8	-	69
37	5.512	0.155	-2.79	78	-1.7	-	69
38	5.667	0.155	-2.98	78	-1.8	-	69
39	5.822	0.155	-3.49	80	-1.7	-	69
40	5.976	0.154	-2.77	79	-1.8	104	68
41	6.131	0.155	-3.48	80	-1.9	-	68
42	6.285	0.154	-3.50	80	-1.9	-	68
43	6.439	0.154	-2.90	80	-1.8	-	69
44	6.595	0.156	-3.54	81	-1.9	-	69
45	6.750	0.155	-3.47	82	-1.7	-	69
46	6.906	0.156	-3.14	82	-1.9	-	69
47	7.063	0.157	-2.76	81	-1.9	-	69
48	7.218	0.155	-3.52	83	-1.8	-	68
49	7.373	0.155	-3.08	83	-1.9	-	68
50	7.528	0.155	-2.76	83	-1.7	102	68
51	7.684	0.156	-3.06	82	-1.9	-	68
52	7.840	0.156	-2.68	83	-1.9	-	68
53	7.997	0.157	-3.27	84	-1.7	-	68
54	8.153	0.156	-2.60	84	-1.9	-	68
55	8.309	0.156	-3.37	84	-1.8	-	68
56	8.464	0.155	-3.44	85	-1.9	-	68
57	8.620	0.156	-2.68	85	-1.8	-	68
58	8.777	0.157	-3.44	85	-1.8	-	68
59	8.935	0.158	-2.64	85	-1.8	-	68
60	9.091	0.156	-3.06	85	-1.7	104	68
Avg/Tot	9.091	0.152	-3.19	76.5	-1.8	101	68.3

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
0	0.87	N/A	69.50	167.60	183	174	1.00	7.26	
1	0.88	N/A	69.60	167.40	183	174	1.00	7.31	715
2	0.87	N/A	69.60	167.20	183	174	1.00	7.26	709
3	0.88	N/A	69.60	167.20	183	174	1.00	7.30	713
4	0.88	N/A	69.60	167.40	183	174	1.00	7.29	714
5	0.87	N/A	69.70	167.50	183	174	1.00	7.26	710
6	0.88	N/A	69.70	167.60	183	174	1.00	7.31	716
7	0.87	N/A	69.70	167.70	183	174	1.00	7.21	708
8	0.88	N/A	69.70	167.70	183	174	1.00	7.32	718
9	0.87	N/A	69.70	167.70	183	174	1.00	7.25	711
10	0.86	N/A	69.70	167.60	183	174	1.00	7.17	703
11	0.88	N/A	69.70	167.70	183	174	1.00	7.28	714
12	0.88	N/A	69.70	167.80	183	174	1.00	7.28	715
13	0.87	N/A	69.70	167.60	183	174	1.00	7.26	712
14	0.87	N/A	69.70	167.60	183	174	1.00	7.23	709
15	0.88	N/A	69.70	167.70	183	174	1.00	7.28	714
16	0.88	N/A	69.60	167.90	183	174	1.00	7.28	717
17	0.88	N/A	69.60	168.00	183	174	1.00	7.32	721
18	0.88	N/A	69.50	168.00	183	174	1.00	7.29	719
19	0.88	N/A	69.50	168.20	183	174	1.00	7.28	719
20	0.88	N/A	69.50	168.20	183	174	1.00	7.35	726
21	0.88	N/A	69.50	168.10	183	174	1.00	7.35	725
22	0.86	N/A	69.50	168.20	183	174	1.00	7.19	710
23	0.88	N/A	69.50	168.10	183	174	1.00	7.36	726
24	0.87	N/A	69.50	168.00	183	174	1.00	7.25	715
25	0.89	N/A	69.60	168.00	183	174	1.00	7.38	727
26	0.88	N/A	69.60	167.80	183	174	1.00	7.31	719
27	0.87	N/A	69.60	167.80	183	174	1.00	7.20	708
28	0.87	N/A	69.70	167.80	183	174	1.00	7.23	710
29	0.88	N/A	69.70	167.80	183	174	1.00	7.28	715
30	0.88	N/A	69.70	167.80	183	174	1.00	7.31	718
31	0.87	N/A	69.70	167.70	183	174	1.00	7.23	709
32	0.88	N/A	69.70	167.80	183	174	1.00	7.33	720
33	0.88	N/A	69.70	167.70	183	174	1.00	7.31	718
34	0.85	N/A	69.70	168.10	183	174	1.00	7.07	697
35	0.88	N/A	69.70	168.10	183	174	1.00	7.31	721
36	0.87	N/A	69.80	168.30	183	174	1.00	7.20	710
37	0.87	N/A	69.70	168.30	183	174	1.00	7.27	718
38	0.88	N/A	69.70	168.20	183	174	1.00	7.34	724
39	0.88	N/A	69.70	168.20	183	174	1.00	7.30	720
40	0.88	N/A	69.70	168.20	183	174	1.00	7.34	724
41	0.87	N/A	69.70	168.20	183	174	1.00	7.26	716
42	0.87	N/A	69.70	168.20	183	174	1.00	7.21	711
43	0.87	N/A	69.70	168.10	183	174	1.00	7.26	716
44	0.88	N/A	69.70	168.00	183	174	1.00	7.28	717
45	0.88	N/A	69.70	167.90	183	174	1.00	7.30	717
46	0.88	N/A	69.70	167.90	183	174	1.00	7.29	717
47	0.87	N/A	69.70	168.00	183	174	1.00	7.27	716

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
48	0.87	N/A	69.70	167.90	183	174	1.00	7.21	709
49	0.88	N/A	69.70	168.00	183	174	1.00	7.31	719
50	0.87	N/A	69.70	168.10	183	174	1.00	7.26	716
51	0.86	N/A	69.70	168.10	183	174	1.00	7.17	707
52	0.88	N/A	69.80	168.00	183	174	1.00	7.32	720
53	0.88	N/A	69.80	167.90	183	174	1.00	7.29	716
54	0.88	N/A	69.80	167.90	183	174	1.00	7.29	716
55	0.88	N/A	69.80	167.80	183	174	1.00	7.31	717
56	0.88	N/A	69.80	167.80	183	174	1.00	7.34	720
57	0.88	N/A	69.80	167.70	183	174	1.00	7.33	718
58	0.86	N/A	69.80	167.70	183	174	1.00	7.13	699
59	0.86	N/A	69.80	167.80	183	174	1.00	7.19	705
60	0.88	N/A	69.80	167.80	183	174	1.00	7.31	718
61	0.87	N/A	69.80	167.70	183	174	1.00	7.26	712
62	0.88	N/A	69.80	167.60	183	174	1.00	7.29	714
63	0.83	N/A	69.80	167.70	183	174	1.00	6.86	673
64	0.85	N/A	69.80	168.00	183	174	1.00	7.09	697
65	0.87	N/A	69.80	167.80	183	174	1.00	7.25	711
66	0.88	N/A	69.80	167.70	183	174	1.00	7.29	714
67	0.88	N/A	69.80	167.70	183	174	1.00	7.32	718
68	0.86	N/A	69.80	167.80	183	174	1.00	7.15	701
69	0.86	N/A	69.80	167.80	183	174	1.00	7.19	705
70	0.87	N/A	69.80	167.70	183	174	1.00	7.26	711
71	0.88	N/A	69.90	167.50	183	174	1.00	7.31	715
72	0.88	N/A	69.90	167.50	183	174	1.00	7.30	713
73	0.88	N/A	69.90	167.40	183	174	1.00	7.33	716
74	0.88	N/A	69.90	167.30	183	174	1.00	7.31	713
75	0.88	N/A	69.90	167.50	183	174	1.00	7.36	719
76	0.87	N/A	69.90	167.60	183	174	1.00	7.24	708
77	0.88	N/A	69.80	167.60	183	174	1.00	7.33	718
78	0.88	N/A	69.80	167.50	183	174	1.00	7.33	717
79	0.88	N/A	69.90	167.50	183	174	1.00	7.32	715
80	0.88	N/A	69.90	167.40	183	174	1.00	7.32	715
81	0.88	N/A	69.90	167.40	183	174	1.00	7.33	716
82	0.88	N/A	69.90	167.30	183	174	1.00	7.35	716
83	0.88	N/A	69.90	167.20	183	174	1.00	7.33	714
84	0.88	N/A	69.90	167.00	183	174	1.00	7.32	712
85	0.88	N/A	69.90	167.10	183	174	1.00	7.31	712
86	0.88	N/A	69.90	167.10	183	174	1.00	7.31	711
87	0.89	N/A	69.90	167.00	183	174	1.00	7.36	716
88	0.87	N/A	69.90	167.30	183	174	1.00	7.24	706
89	0.87	N/A	69.90	167.30	183	174	1.00	7.27	709
90	0.88	N/A	69.90	167.40	183	174	1.00	7.28	711
91	0.87	N/A	69.90	167.40	183	174	1.00	7.23	706
92	0.88	N/A	70.00	167.50	183	174	1.00	7.28	711
93	0.88	N/A	70.00	167.60	183	174	1.00	7.31	715
94	0.88	N/A	70.00	167.60	183	174	1.00	7.31	714
95	0.88	N/A	70.00	167.40	183	174	1.00	7.31	712

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
96	0.88	N/A	70.00	167.50	183	174	1.00	7.31	714
97	0.88	N/A	70.00	167.30	183	174	1.00	7.28	709
98	0.87	N/A	70.00	167.20	183	174	1.00	7.26	707
99	0.88	N/A	70.00	167.10	183	174	1.00	7.31	711
100	0.88	N/A	70.00	167.10	183	174	1.00	7.28	708
101	0.87	N/A	70.00	166.90	183	174	1.00	7.27	705
102	0.87	N/A	70.00	166.90	183	174	1.00	7.21	700
103	0.87	N/A	70.00	167.00	183	174	1.00	7.21	701
104	0.88	N/A	70.00	167.20	183	174	1.00	7.30	710
105	0.88	N/A	70.00	167.20	183	174	1.00	7.31	711
106	0.88	N/A	70.00	167.30	183	174	1.00	7.31	712
107	0.88	N/A	70.00	167.20	183	174	1.00	7.29	709
108	0.88	N/A	70.00	167.40	183	174	1.00	7.29	711
109	0.88	N/A	70.00	167.50	183	174	1.00	7.29	711
110	0.86	N/A	70.00	167.50	183	174	1.00	7.16	698
111	0.87	N/A	70.10	167.50	183	174	1.00	7.26	708
112	0.88	N/A	70.10	167.40	183	174	1.00	7.30	711
113	0.88	N/A	70.10	167.40	183	174	1.00	7.30	711
114	0.88	N/A	70.10	167.20	183	174	1.00	7.31	711
115	0.87	N/A	70.10	167.10	183	174	1.00	7.24	703
116	0.87	N/A	70.10	167.10	183	174	1.00	7.27	706
117	0.87	N/A	70.10	166.90	183	174	1.00	7.27	705
118	0.88	N/A	70.10	166.90	183	174	1.00	7.28	706
119	0.88	N/A	70.20	166.90	183	174	1.00	7.29	706
120	0.87	N/A	70.20	167.00	183	174	1.00	7.26	703
121	0.88	N/A	70.20	167.20	183	174	1.00	7.30	709
122	0.87	N/A	70.20	167.20	183	174	1.00	7.27	706
123	0.86	N/A	70.20	167.30	183	174	1.00	7.14	694
124	0.87	N/A	70.20	167.40	183	175	1.00	7.25	705
125	0.87	N/A	70.20	167.30	183	175	1.00	7.27	707
126	0.89	N/A	70.20	167.40	183	174	1.00	7.38	718
127	0.87	N/A	70.20	167.40	183	174	1.00	7.21	701
128	0.88	N/A	70.10	167.40	183	174	1.00	7.31	712
129	0.87	N/A	70.10	167.30	183	174	1.00	7.25	705
130	0.88	N/A	70.10	167.30	183	174	1.00	7.30	710
131	0.87	N/A	70.10	167.40	183	174	1.00	7.22	704
132	0.88	N/A	70.10	167.10	183	174	1.00	7.29	708
133	0.87	N/A	70.10	167.10	183	174	1.00	7.20	699
134	0.87	N/A	70.20	167.00	183	174	1.00	7.27	705
135	0.87	N/A	70.20	166.90	183	174	1.00	7.24	701
136	0.87	N/A	70.20	167.00	183	174	1.00	7.24	701
137	0.88	N/A	70.20	167.20	183	174	1.00	7.31	709
138	0.88	N/A	70.20	167.10	183	174	1.00	7.29	707
139	0.88	N/A	70.20	167.20	183	174	1.00	7.30	709
140	0.87	N/A	70.20	167.20	183	174	1.00	7.26	705
141	0.87	N/A	70.20	167.20	183	174	1.00	7.27	706
142	0.88	N/A	70.20	167.20	183	174	1.00	7.31	709
143	0.88	N/A	70.20	167.20	183	174	1.00	7.33	712

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
144	0.87	N/A	70.10	167.20	183	174	1.00	7.27	707
145	0.88	N/A	70.10	167.50	183	175	1.00	7.31	713
146	0.86	N/A	70.10	167.40	183	174	1.00	7.13	695
147	0.88	N/A	70.10	167.20	183	174	1.00	7.29	709
148	0.87	N/A	70.20	167.00	183	174	1.00	7.27	705
149	0.88	N/A	70.20	166.90	183	174	1.00	7.34	710
150	0.87	N/A	70.20	166.90	183	174	1.00	7.26	702
151	0.88	N/A	70.20	166.90	183	174	1.00	7.32	709
152	0.87	N/A	70.20	166.90	183	174	1.00	7.20	697
153	0.85	N/A	70.20	167.00	183	174	1.00	7.05	683
154	0.87	N/A	70.30	167.10	183	174	1.00	7.25	703
155	0.87	N/A	70.30	167.20	183	174	1.00	7.21	699
156	0.85	N/A	70.30	167.20	183	174	1.00	7.10	688
157	0.88	N/A	70.30	167.40	183	174	1.00	7.31	711
158	0.90	N/A	70.30	167.30	183	175	1.00	7.48	726
159	0.88	N/A	70.30	167.30	183	175	1.00	7.29	708
160	0.86	N/A	70.20	167.40	183	175	1.00	7.14	695
161	0.88	N/A	70.20	167.50	183	175	1.00	7.29	710
162	0.87	N/A	70.30	167.20	183	175	1.00	7.25	704
163	0.87	N/A	70.20	167.10	183	175	1.00	7.26	705
164	0.87	N/A	70.20	167.00	183	175	1.00	7.21	698
165	0.87	N/A	70.20	166.80	183	174	1.00	7.25	701
166	0.87	N/A	70.20	166.70	183	174	1.00	7.22	698
167	0.87	N/A	70.20	166.60	183	174	1.00	7.27	702
168	0.88	N/A	70.20	166.50	183	174	1.00	7.28	702
169	0.87	N/A	70.20	166.40	183	174	1.00	7.25	698
170	0.88	N/A	70.30	166.40	183	174	1.00	7.30	702
171	0.87	N/A	70.20	166.30	183	174	1.00	7.23	696
172	0.87	N/A	70.20	166.30	183	174	1.00	7.22	695
173	0.88	N/A	70.20	166.30	183	174	1.00	7.30	702
174	0.88	N/A	70.20	166.40	183	174	1.00	7.28	701
175	0.87	N/A	70.30	166.50	183	174	1.00	7.25	699
176	0.88	N/A	70.30	166.50	183	174	1.00	7.30	703
177	0.87	N/A	70.30	166.50	183	175	1.00	7.23	696
178	0.88	N/A	70.30	166.60	183	175	1.00	7.29	703
179	0.85	N/A	70.30	166.80	183	175	1.00	7.10	686
180	0.89	N/A	70.30	166.80	183	175	1.00	7.38	713
181	0.87	N/A	70.30	166.60	183	175	1.00	7.27	701
182	0.87	N/A	70.30	166.60	183	175	1.00	7.27	701
183	0.88	N/A	70.30	167.10	183	175	1.00	7.29	706
184	0.86	N/A	70.30	166.80	183	175	1.00	7.18	694
185	0.88	N/A	70.40	166.70	183	175	1.00	7.32	706
186	0.88	N/A	70.30	166.60	183	174	1.00	7.30	703
187	0.87	N/A	70.30	166.40	183	174	1.00	7.25	698
188	0.86	N/A	70.30	166.40	183	174	1.00	7.17	690
189	0.88	N/A	70.40	166.40	183	174	1.00	7.29	700
190	0.88	N/A	70.30	166.10	183	174	1.00	7.28	698
191	0.87	N/A	70.30	165.90	183	174	1.00	7.22	691

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
192	0.87	N/A	70.30	165.80	183	174	1.00	7.20	688
193	0.86	N/A	70.30	166.20	183	174	1.00	7.19	690
194	0.87	N/A	70.30	165.80	183	174	1.00	7.26	694
195	0.88	N/A	70.30	166.00	183	174	1.00	7.30	700
196	0.87	N/A	70.30	166.00	183	175	1.00	7.25	694
197	0.87	N/A	70.30	166.00	183	175	1.00	7.23	693
198	0.87	N/A	70.40	166.30	183	175	1.00	7.23	694
199	0.87	N/A	70.40	166.40	183	175	1.00	7.26	698
200	0.87	N/A	70.30	166.30	183	175	1.00	7.27	699
201	0.88	N/A	70.30	166.20	184	175	1.00	7.30	701
202	0.87	N/A	70.40	166.30	184	175	1.00	7.25	697
203	0.87	N/A	70.40	166.20	184	175	1.00	7.25	695
204	0.87	N/A	70.40	166.20	183	175	1.00	7.25	696
205	0.87	N/A	70.40	166.20	183	175	1.00	7.24	694
206	0.88	N/A	70.40	166.10	183	175	1.00	7.31	701
207	0.87	N/A	70.40	166.00	183	175	1.00	7.25	694
208	0.87	N/A	70.40	165.90	183	175	1.00	7.24	692
209	0.87	N/A	70.40	165.90	183	175	1.00	7.20	689
210	0.87	N/A	70.40	165.80	183	175	1.00	7.23	691
211	0.87	N/A	70.40	165.90	183	174	1.00	7.26	694
212	0.87	N/A	70.40	165.70	183	174	1.00	7.25	692
213	0.87	N/A	70.40	165.70	183	174	1.00	7.25	691
214	0.87	N/A	70.40	165.50	183	174	1.00	7.23	688
215	0.87	N/A	70.50	165.60	183	174	1.00	7.24	689
216	0.87	N/A	70.50	165.50	183	174	1.00	7.23	688
217	0.86	N/A	70.50	165.70	183	175	1.00	7.11	678
218	0.86	N/A	70.50	166.00	183	175	1.00	7.12	681
219	0.87	N/A	70.50	166.00	183	175	1.00	7.25	694
220	0.87	N/A	70.50	165.90	183	175	1.00	7.24	691
221	0.87	N/A	70.50	165.90	183	175	1.00	7.25	693
222	0.87	N/A	70.50	166.00	183	175	1.00	7.24	692
223	0.87	N/A	70.50	166.10	183	175	1.00	7.27	696
224	0.87	N/A	70.50	166.10	183	175	1.00	7.25	694
225	0.88	N/A	70.40	165.90	183	175	1.00	7.29	697
226	0.86	N/A	70.40	165.80	183	175	1.00	7.19	687
227	0.87	N/A	70.40	165.70	183	175	1.00	7.23	690
228	0.87	N/A	70.30	165.60	183	175	1.00	7.23	690
229	0.87	N/A	70.30	165.60	183	174	1.00	7.27	694
230	0.87	N/A	70.30	165.50	183	174	1.00	7.21	687
231	0.87	N/A	70.30	165.30	183	174	1.00	7.24	688
232	0.87	N/A	70.30	165.10	183	174	1.00	7.25	688
233	0.87	N/A	70.40	165.30	183	174	1.00	7.21	685
234	0.87	N/A	70.40	165.40	183	174	1.00	7.26	691
235	0.91	N/A	70.40	165.30	183	174	1.00	7.55	718
236	0.91	N/A	70.40	164.70	183	174	1.00	7.55	713
237	0.91	N/A	70.40	164.80	183	174	1.00	7.58	716
238	0.91	N/A	70.40	164.70	183	174	1.00	7.59	716
239	0.91	N/A	70.40	164.60	183	174	1.00	7.56	713

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 3

Technician: AK

Date: 9/26/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
240	0.88	N/A	70.40	164.50	182	174	1.00	7.34	691
Average	1	#DIV/0!	70	167	183	174	1	7	706
								TOTAL:	169402

LAB SAMPLE DATA - ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 3

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/26/2025

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	A	G01373	243.1	244.7	1.6
	B	G01374	242.0	243.6	1.6
	C - 1st Hour	G01375	241.7	242.0	0.3
	Amb	G01376	243.2	243.6	0.4
Probes	A	16A	116380.2	116380.3	0.1
	B	16B	115863.9	115864.0	0.1
	C - 1st Hour	16C	114148.4	114148.6	0.2
O-rings	A	16A	3571.5	3571.7	0.2
	B	16B	3636.6	3636.8	0.2
	C - 1st Hour	16C	3600.1	3600.5	0.4

Placed in Dessicator on:

9/26/2025

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	245.1	10/3 16:00	244.8	10/6 14:00	244.7	10/7 8:30		
	B	243.7	10/3 16:00	243.4	10/6 14:00	243.6	10/7 8:30		
	C - 1st Hour	242.1	10/3 16:00	242.0	10/6 14:00				
	Amb	243.4	10/3 16:00	243.6	10/6 14:00				
Probes	A	116380.2	10/3 16:00	116380.3	10/6 14:00				
	B	115864.0	10/3 16:00	115864.0	10/6 14:00				
	C - 1st Hour	114148.6	10/3 16:00	114148.6	10/6 14:00				
O-Rings	A	3571.8	10/3 16:00	3571.7	10/6 14:00				
	B	3636.6	10/3 16:00	3636.8	10/6 14:00				
	C - 1st Hour	3600.3	10/3 16:00	3600.5	10/6 14:00				

Train A Aggregate, mg: 1.9

Train B Aggregate, mg: 1.9

Train C Aggregate, mg: 0.9

Ambient, mg: 0.4

ASTM E2618 Hydronic Heater Run Sheets

Client: Greentech Job Number: 25-436 Tracking #: 230
Model: Bio 200 Run Number: 3 Test Date: 9/26/25

Wood Heater Run Notes

Pre-Test Notes

Pre-Test Start Time: 08:36
Target Load (BTU/hr): 33,920 – 50,880

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 10:36
Target Load (BTU/hr): 33,920 – 50,880 (Category 2)

Time	Notes
0 min	Started test sampling
240 min	End of Test

Test Burn End Time: 14:36

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 17.32 CO (%): 4.340
Mid Gas CO₂ (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	8:49	8:50	8:52	14:59	15:00	15:02
CO ₂	0.30	17.51	10.39	0.24	17.33	10.29
CO	-0.006	4.409	2.530	-0.013	4.355	2.498

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

Technician Signature: 

Date: 11/7/25

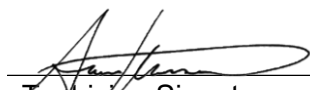
HYDRONIC HEATER TEST DATA PACKET

ASTM E2618/E2515



Run 4 Data Summary

Client:	Greentech
Model:	BIO 200
Job #:	25-436
Tracking #:	230
Test Date:	9/29/2025



Technician Signature

11/7/2025

Date

TEST RESULTS - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 4

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/29/2025

Particulate Data

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	27.119	35.045	35.597	80.009
Average Gas Velocity in Dilution Tunnel (ft/sec)	13.2			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	35114.8			
Average Gas Meter Temperature (°F)	71.2	90.8	89.0	78.8
Total Sample Volume (dscf)	26.698	33.518	34.331	77.703
Average Tunnel Temperature (°F)	83.8			
Total Time of Test (min)	240			
Total Particulate Catch (mg)	0.1	3.2	3.4	1.0
Particulate Concentration, dry-standard (g/dscf)	0.0000037	0.0000955	0.0000990	0.0000129
Total PM Emissions (g)	0.53	12.88	13.38	0.32
Particulate Emission Rate (g/hr)	0.13	3.22	3.35	0.32
Emissions Factor (g/kg)	-	0.60	0.62	-
Difference from Average Total Particulate Emissions (g)	-	0.25	0.25	-
Difference from Average Total Particulate Emissions (%)	-	1.9%	1.9%	-
Difference from Average Emissions Factor (g/kg)	-	0.01	0.01	-

Boiler/ HEX Data

Appliance Average Start Temperature (F)	172.4
Appliance Average Final Temperature (F)	172.1
Heat Output (BTU)	351,621
Heat Output Rate (BTU/hr)	87,905
Heat Input - HHV (BTU)	395,832
Heat Input - LHV (BTU)	368,834

Emissions Rates and Factors

Total Particulate Emissions (g)	13.1
Emissions Factor (g/MJ)	0.0354
Emissions Factor (g/kg)	0.6097
Emissions Rate (g/hr)	3.28
Emissions Rate (lb/mmBtu output)	0.082
HHV Delivered Efficiency (%)	88.8%
LHV Delivered Efficiency (%)	95.3%
HHV SLM Efficiency (%)	87.7%
LHV SLM Efficiency (%)	94.1%
CO Emissions (g/min)	0.06

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	76.0	OK
Face Velocity	< 30 ft/min	8.0	OK
Leakage Rate	Less than 4% of average sample rate	0.001 cfm	OK
Ambient Temp	55-90 °F	Min: 69.6 / Max: 73.1	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	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	162.2	OK

B415.1 Efficiency Results

Manufacturer: Greentech
Model: BIO 200
Date: 09/29/25
Run: 4
Control #: 25-436
Test Duration: 240
Output Category: 3

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	87.7%	94.1%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	88.1%	94.6%

Output Rate (kJ/h)	91,516	86,812	(Btu/h)
Burn Rate (kg/h)	5.39	11.87	(lb/h)
Input (kJ/h)	104,366	99,002	(Btu/h)

Test Load Weight (dry kg)	21.54	47.48	dry lb
MC wet (%)	4.85		
MC dry (%)	5.10		
Particulate (g)	13.13		
CO (g)	13		
Test Duration (h)	4.00		

Emissions	Particulate	CO
g/MJ Output	0.04	0.04
g/kg Dry Fuel	0.61	0.61
g/h	3.28	3.31
g/min	0.05	0.06
lb/MM Btu Output	0.08	0.08

Air/Fuel Ratio (A/F)	9.46
-----------------------------	------

VERSION:

2.4

4/15/2010

DILUTION TUNNEL & MISC. DATA - ASTM E2618 / E2515

Client: Greentech
 Model: BIO 200
 Run #: 4
 Test Start Time: 11:28
 Manufacturer's Rated Output
 (BTU/hr): 212,000

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/29/2025

Total Sampling Time (min): 240
 Recording Interval (min): 1

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.009 (B)
 Meter Box γ Factor: 0.997 (C)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 9/23/2025
 Test Fuel Scale Audit (lbs): N/A
 Platform Scale Audit (lbs): 10.0
 Boiler Dry Weight (lbs): 2222
 Supply Side Water Weight (lbs): 1112

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.67	29.68	29.68
Relative Humidity (%)	46.2	49.0	
Room Air Velocity (ft/min)	<50	<50	
Pitot Tube Leak Check	0.0	0.0	
Ambient Sample Volume:		27.119	ft ³

Sample Train Leak Checks

	Pre-test	Post-test		
(A)	0.000	0.000	cfm @	-5 in. Hg
(B)	0.000	0.001	cfm @	-5 in. Hg
(C)	0.001	0.000	cfm @	-5 in. Hg
(Ambient)	0.000	0.000	cfm @	-13 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.030	73
2	0.036	73
3	0.040	73
4	0.042	73
5	0.042	73
6	0.034	73
7	0.034	73
8	0.042	73
9	0.042	73
10	0.040	73
11	0.038	73
12	0.032	73
Center	0.041	73

Dilution Tunnel H₂O: 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 ft²

V_{strav}: 12.96 ft/sec

V_{scent}: 13.54 ft/sec

F_p: 0.957 [ratio]

Initial Tunnel Flow: 587.8 scf/min

Static Pressure: -0.120 in. H₂O

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:	Black Hills Gold
HHV (kJ/kg)	19,379
%C	50.8
%H	6.13
%O	42.77
%Ash	0.3
MC (%DB)	5.1%

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 4

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
0	164.0	-0.02	176.3	157.9	70.1	150.8	2.11	222.6	69.3	85102
1	163.6	-0.02	176.5	158.1	70.0	151.1	2.10	221.9	69.2	84958
2	163.6	-0.03	176.8	158.4	69.9	151.3	2.10	222.1	69.4	85233
3	163.1	-0.02	177.2	158.8	69.9	151.6	2.10	221.4	69.5	85751
4	162.9	-0.02	177.5	159.1	70.4	151.9	2.11	221.5	69.6	85942
5	162.4	-0.02	177.8	159.4	70.7	152.2	2.10	222.1	69.6	85409
6	162.3	-0.02	178.3	159.8	70.7	152.7	2.10	221.9	69.6	86056
7	162.0	-0.02	178.6	159.9	70.6	152.8	2.09	222.9	69.6	86020
8	161.7	-0.02	179.1	160.4	70.7	153.3	2.10	223.1	69.6	86850
9	161.4	-0.02	179.4	160.7	70.8	153.6	2.12	223.2	69.7	87597
10	161.2	-0.02	179.6	160.9	70.8	153.7	2.11	223.2	69.7	87413
11	160.9	-0.02	179.9	161.2	70.9	154.1	2.09	223.5	69.8	86813
12	160.8	-0.02	180.2	161.4	70.9	154.3	2.11	224.0	69.6	87939
13	161.3	-0.01	180.4	161.5	70.9	154.5	2.11	217.8	69.7	88025
14	160.2	-0.02	180.5	161.6	70.9	154.6	2.11	214.6	69.8	88130
15	160.1	-0.02	180.7	161.9	71.0	154.8	2.09	211.6	69.8	87480
16	159.8	-0.03	180.6	161.7	71.0	154.6	2.11	209.4	69.8	88190
17	159.8	-0.02	180.3	161.5	71.0	154.3	2.11	213.3	69.9	87707
18	159.8	-0.02	180.2	161.3	71.0	154.3	2.11	215.8	69.8	87749
19	159.2	-0.02	180.4	161.5	71.0	154.4	2.11	217.9	69.8	87771
20	159.1	-0.02	180.4	161.4	71.0	154.4	2.11	219.8	69.8	88063
21	158.8	-0.02	180.7	161.8	71.0	154.6	2.10	220.4	69.8	87647
22	158.8	-0.03	180.8	161.8	71.0	154.7	2.09	221.1	69.9	87459
23	158.2	-0.03	180.9	161.9	71.0	154.9	2.11	221.3	69.8	88549
24	157.9	-0.02	181.3	162.3	71.0	155.1	2.10	222.6	69.8	88340
25	157.8	-0.02	181.4	162.4	71.0	155.3	2.10	222.6	69.9	88508
26	157.3	-0.01	181.7	162.7	71.0	155.4	2.02	223.3	69.9	85112
27	157.1	-0.02	182.0	162.8	71.1	155.7	2.09	222.2	69.9	88272
28	156.9	-0.02	182.2	163.1	71.1	155.9	2.11	219.6	69.9	89243
29	156.5	-0.01	182.4	163.1	71.1	156.1	2.10	215.8	69.9	89156
30	156.5	-0.01	182.3	163.1	71.1	156.1	2.11	213.0	69.9	89004
31	156.3	-0.02	182.3	163.1	71.1	156.0	2.09	212.9	70.0	88585
32	156.2	-0.03	182.2	163.0	71.1	155.9	2.11	212.8	70.0	89201

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech
 Model: BIO 200
 Run #: 4

Job #: 25-436
 Tracking #: 230
 Technician: AK
 Date: 9/29/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
33	155.6	-0.03	182.0	162.9	71.1	155.7	2.10	214.2	70.0	88948
34	155.8	-0.02	182.1	162.9	71.1	155.7	2.11	216.0	70.0	89033
35	155.7	-0.02	181.9	163.2	71.1	155.9	2.06	217.8	70.0	87124
36	155.4	-0.02	181.9	162.9	71.1	155.8	2.09	219.0	70.0	88418
37	155.0	-0.01	182.0	162.9	71.1	155.7	2.10	221.0	70.1	88863
38	154.8	-0.02	182.1	163.0	71.1	155.7	2.10	220.1	70.0	88906
39	154.3	-0.03	182.2	163.1	71.1	155.8	2.10	215.8	70.1	88757
40	154.4	-0.02	182.3	163.1	71.1	155.8	2.10	215.7	70.1	88926
41	154.2	-0.02	182.2	163.3	71.1	156.1	2.09	213.3	70.1	88944
42	154.0	-0.02	182.1	163.0	71.1	155.6	2.11	215.7	70.0	89054
43	153.8	-0.03	182.3	163.1	71.1	155.7	2.09	217.4	70.1	88483
44	153.6	-0.02	182.1	163.1	71.1	155.7	2.12	217.2	70.1	89413
45	153.4	-0.02	182.2	163.1	71.2	155.6	2.11	216.0	70.0	88905
46	153.0	-0.03	182.1	163.0	71.2	155.5	2.11	212.3	70.0	88715
47	153.1	-0.02	181.9	162.9	71.2	155.5	2.11	214.4	70.0	89010
48	152.8	-0.02	181.9	162.9	71.1	155.5	2.10	217.4	70.1	88485
49	152.6	-0.02	182.0	162.9	71.1	155.4	2.11	218.6	70.1	89054
50	152.3	-0.03	182.0	163.0	71.1	155.5	2.09	219.7	70.1	88021
51	152.0	-0.02	182.1	163.0	71.2	155.3	2.10	218.9	70.1	88295
52	151.8	-0.02	182.2	163.2	71.2	155.4	2.10	214.9	70.0	88484
53	151.5	-0.02	182.2	163.1	71.2	155.4	2.11	216.5	70.0	88779
54	151.4	-0.02	182.3	163.2	71.1	155.4	2.09	212.7	69.9	87916
55	151.2	-0.02	182.1	163.2	71.1	155.5	2.10	213.1	69.9	88527
56	151.3	-0.02	181.9	163.0	71.2	155.3	2.11	215.1	70.0	88757
57	150.8	-0.02	182.0	163.0	71.1	155.2	2.09	217.4	69.9	87834
58	150.7	-0.02	181.9	162.8	71.1	155.3	2.11	219.6	70.0	88612
59	150.1	-0.02	182.1	163.0	71.1	155.3	2.11	219.6	69.9	88696
60	150.1	-0.02	182.3	163.2	71.1	155.3	2.11	215.8	70.1	88906
61	150.0	-0.02	182.1	163.3	71.1	155.5	2.06	213.8	70.0	86966
62	149.6	-0.02	182.3	163.3	71.1	155.5	2.11	212.9	70.1	89159
63	149.6	-0.01	182.1	163.1	71.1	155.3	2.07	213.4	70.1	87265
64	149.2	-0.02	182.1	163.1	71.1	155.3	2.10	216.0	70.1	88191
65	149.1	-0.02	182.0	163.0	71.1	155.2	2.12	218.2	70.1	88969

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
66	148.6	-0.02	182.1	163.0	71.2	155.2	2.11	219.6	70.0	88736
67	148.5	-0.02	182.2	163.1	71.2	155.4	2.11	215.8	70.1	88694
68	148.4	-0.02	182.1	163.1	71.1	155.4	2.07	212.7	70.0	87032
69	148.3	-0.01	182.1	163.1	71.1	155.5	2.10	212.7	70.1	88611
70	147.9	-0.01	182.0	163.0	71.1	155.3	2.11	210.8	70.0	88864
71	147.9	-0.02	181.9	162.9	71.1	155.3	2.11	213.9	70.0	88696
72	147.7	-0.02	181.7	162.7	71.1	155.1	2.11	216.6	69.9	88527
73	147.4	-0.02	181.9	163.1	71.1	155.5	2.09	218.7	69.9	88316
74	146.8	-0.02	182.0	163.1	71.1	155.4	2.06	219.5	69.8	86905
75	147.0	-0.02	182.2	163.3	71.1	155.6	2.06	217.5	69.9	86900
76	146.7	-0.02	182.3	163.2	71.1	155.6	2.11	213.9	69.9	89054
77	146.6	-0.01	182.2	163.1	71.2	155.4	2.09	211.7	69.9	88063
78	146.4	-0.02	182.1	163.0	71.2	155.3	2.11	210.5	69.9	88673
79	146.2	-0.02	182.0	163.0	71.2	155.2	2.10	209.0	69.9	87980
80	146.0	-0.02	181.8	162.7	71.2	155.0	2.12	212.9	69.8	88608
81	146.0	-0.02	181.6	162.7	71.1	154.9	2.11	215.2	69.8	88358
82	145.5	-0.02	181.6	162.7	71.1	154.9	2.10	217.0	69.8	88023
83	145.4	-0.02	181.7	162.8	71.1	154.9	2.10	219.2	69.8	88065
84	145.1	-0.02	181.8	162.9	71.2	155.0	2.11	219.8	69.8	88441
85	144.8	-0.02	182.0	162.9	71.2	155.0	2.11	219.1	69.8	88273
86	144.6	-0.03	182.2	163.1	71.2	155.3	2.09	214.2	69.7	87875
87	144.5	-0.01	182.1	163.1	71.2	155.2	2.11	212.1	69.7	88610
88	144.2	-0.02	182.3	163.2	71.1	155.4	2.12	209.6	69.7	89180
89	144.1	-0.02	182.2	163.2	71.1	155.3	2.11	207.7	69.8	88696
90	143.8	-0.01	182.1	163.1	71.1	155.1	2.11	207.2	69.7	88485
91	143.7	-0.01	181.9	163.1	71.1	155.0	2.11	206.9	69.7	88506
92	143.3	-0.03	181.8	162.9	71.1	155.1	2.09	210.7	69.8	87730
93	143.4	-0.02	181.7	162.9	71.1	154.9	2.11	213.3	69.8	88233
94	143.1	-0.02	181.5	162.6	71.1	154.7	1.97	214.5	69.8	82173
95	142.8	-0.02	181.6	162.8	71.1	154.9	2.09	215.3	69.8	87646
96	142.6	-0.02	181.8	162.8	71.1	154.8	2.12	216.1	69.8	88462
97	142.6	-0.02	181.9	162.9	71.1	154.9	2.12	216.0	69.9	88819
98	142.0	-0.02	182.1	163.1	71.1	155.0	2.09	213.1	69.9	87709

PREBURN TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 4

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H2O)	App HEX In (°F)	App HEX Out (°F)	Load HEX In (°F)	Load HEX Out (°F)	Load Flow (GPM)	Flue (°F)	Ambient (°F)	Heat Out (BTU/hr)
99	141.7	-0.03	182.2	163.2	71.1	155.0	2.11	210.1	69.8	88506
100	141.7	-0.02	182.2	163.3	71.1	155.1	2.10	208.7	69.9	87939
101	141.7	-0.02	182.0	163.0	71.1	154.9	2.10	206.6	69.9	88023
102	141.5	-0.03	181.8	162.9	71.1	154.6	2.11	209.1	69.9	88084
103	141.5	-0.02	181.7	162.8	71.1	154.5	2.12	210.3	69.9	88353
104	141.1	-0.02	181.6	162.7	71.1	154.5	2.12	213.0	69.9	88145
105	140.6	-0.02	181.8	163.0	71.1	154.8	2.09	215.5	69.9	87500
106	140.6	-0.02	182.1	163.1	71.1	154.9	2.11	213.4	70.0	88358
107	140.2	-0.02	182.3	163.3	71.1	155.0	2.10	210.1	70.0	88044
108	139.8	-0.03	182.3	163.3	71.1	155.2	2.10	208.8	69.9	88422
109	139.8	0.00	182.3	163.3	71.1	155.1	2.12	206.3	70.0	88779
110	139.7	-0.02	182.1	163.2	71.0	155.1	2.10	205.8	69.9	88298
111	139.6	-0.02	181.9	162.9	71.0	154.7	2.11	206.4	69.9	88087
112	139.5	-0.02	181.7	162.8	71.0	154.6	2.11	208.9	69.9	88232
113	139.1	-0.01	181.6	162.8	71.0	154.7	2.10	212.1	69.9	87752
114	139.0	-0.01	181.5	162.6	71.0	154.5	2.12	213.9	69.7	88544
115	138.8	-0.03	181.7	162.8	71.0	154.7	2.11	215.5	69.7	88129
116	138.5	-0.02	181.7	162.7	71.0	154.8	2.10	216.0	69.7	88108
117	138.2	-0.02	181.9	162.9	71.0	154.9	2.11	216.3	69.7	88507
118	138.0	-0.02	182.2	163.0	71.0	155.0	2.12	214.7	69.8	88990
119	137.9	-0.02	182.4	163.4	71.0	155.1	2.11	211.4	69.6	88760
120	137.7	-0.01	182.5	163.5	71.0	155.1	2.10	209.5	69.7	88382
121	137.3	-0.02	182.5	163.4	70.9	155.0	2.11	207.3	69.7	88551
122	136.9	-0.02	182.4	163.4	70.9	154.9	2.11	206.6	69.8	88362
123	137.0	-0.02	182.2	163.2	70.9	154.7	2.11	205.3	69.8	88445
124	136.9	-0.02	182.1	163.1	70.9	154.7	2.11	204.5	69.7	88277
125	136.7	-0.02	181.7	162.9	70.9	154.5	2.10	207.6	69.7	87649
126	136.5	-0.02	181.7	162.8	70.9	154.3	2.11	211.1	69.6	87814
127	136.4	-0.01	181.5	162.6	70.9	154.2	2.11	212.8	69.6	87917
128	135.9	-0.01	181.6	162.8	70.9	154.3	2.12	215.2	69.6	88397
129	135.8	-0.03	181.8	162.9	70.8	154.4	2.12	216.7	69.7	88527
Avg/Tot	-	-0.02	181.5	162.6	71.0	154.9	2.101	215.2	69.9	88065

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.041	0.01	73	-0.6		49.9		84	206	71	70
1	0.132	0.132	0.041	0.99	73	-1.44	-	49.6	-0.3	84	205	72	70
2	0.281	0.149	0.040	0.97	73	-1.29	-	45.5	-4.1	84	202	72	70
3	0.430	0.149	0.037	0.97	73	-1.17	-	49.4	3.9	83	200	72	70
4	0.578	0.148	0.040	0.99	73	-1.1	-	49.5	0.1	83	197	72	70
5	0.726	0.148	0.042	0.96	74	-1.05	-	49.2	-0.3	82	197	72	70
6	0.874	0.148	0.041	0.96	73	-1.04	-	48.9	-0.3	82	195	72	70
7	1.021	0.147	0.038	0.96	73	-1.01	-	48.8	-0.1	82	196	72	70
8	1.168	0.147	0.042	0.96	73	-1.02	-	48.6	-0.2	83	198	72	70
9	1.315	0.147	0.039	0.97	74	-1.01	-	48.4	-0.2	83	201	72	70
10	1.462	0.147	0.041	0.94	74	-1.04	104	48.1	-0.3	84	203	72	70
11	1.608	0.146	0.039	0.93	74	-1.04	-	48.0	-0.1	84	205	72	70
12	1.754	0.146	0.041	0.94	75	-1.07	-	47.7	-0.3	84	205	72	70
13	1.901	0.147	0.039	0.94	74	-1.06	-	47.2	-0.5	85	206	72	70
14	2.046	0.145	0.040	0.95	74	-1.08	-	47.1	-0.1	84	205	72	70
15	2.192	0.146	0.041	0.95	74	-1.07	-	46.9	-0.2	83	201	72	70
16	2.338	0.146	0.042	0.95	75	-1.11	-	46.7	-0.2	83	199	72	70
17	2.484	0.146	0.041	0.95	74	-1.11	-	46.7	0	82	197	72	70
18	2.630	0.146	0.041	0.95	75	-1.09	-	46.4	-0.3	82	196	72	70
19	2.776	0.146	0.041	0.93	75	-1.12	-	46.6	0.2	82	195	72	70
20	2.922	0.146	0.045	0.96	76	-1.13	99	46.0	-0.6	83	199	72	70
21	3.068	0.146	0.038	0.93	76	-1.14	-	46.0	0	83	201	72	70
22	3.213	0.145	0.040	0.94	75	-1.16	-	45.7	-0.3	84	203	72	70
23	3.358	0.145	0.041	0.96	76	-1.15	-	45.6	-0.1	84	205	73	70
24	3.503	0.145	0.041	0.91	76	-1.16	-	44.9	-0.7	84	202	73	70
25	3.648	0.145	0.043	0.94	77	-1.16	-	45.1	0.2	83	200	73	70
26	3.793	0.145	0.040	0.94	78	-1.16	-	45.0	-0.1	83	199	73	70
27	3.938	0.145	0.041	0.94	77	-1.18	-	44.6	-0.4	83	197	72	70
28	4.084	0.146	0.044	0.96	77	-1.19	-	44.5	-0.1	83	196	72	70
29	4.229	0.145	0.040	0.94	78	-1.19	-	44.3	-0.2	83	198	73	70
30	4.375	0.146	0.042	0.91	78	-1.2	101	44.2	-0.1	83	198	73	70
31	4.521	0.146	0.040	0.93	79	-1.22	-	43.7	-0.5	84	201	73	70

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.665	0.144	0.040	0.93	79	-1.21	-	43.6	-0.1	83	200	73	70
33	4.810	0.145	0.041	0.93	79	-1.2	-	43.4	-0.2	83	198	73	70
34	4.955	0.145	0.041	0.93	79	-1.21	-	43.2	-0.2	83	197	73	70
35	5.100	0.145	0.041	0.94	79	-1.22	-	43.0	-0.2	82	195	73	70
36	5.245	0.145	0.043	0.93	80	-1.23	-	42.9	-0.1	82	194	73	70
37	5.390	0.145	0.042	0.93	80	-1.24	-	42.7	-0.2	82	193	73	70
38	5.535	0.145	0.041	0.94	80	-1.22	-	42.8	0.1	83	198	73	70
39	5.680	0.145	0.042	0.94	80	-1.24	-	42.3	-0.5	83	200	73	70
40	5.826	0.146	0.041	0.92	81	-1.25	102	41.9	-0.4	84	202	73	70
41	5.972	0.146	0.042	0.94	82	-1.24	-	41.9	0	84	203	73	70
42	6.116	0.144	0.041	0.93	82	-1.23	-	41.6	-0.3	84	201	73	70
43	6.261	0.145	0.042	0.94	82	-1.25	-	41.2	-0.4	83	198	73	70
44	6.406	0.145	0.041	0.95	82	-1.28	-	41.3	0.1	83	198	73	70
45	6.551	0.145	0.041	0.93	82	-1.28	-	40.9	-0.4	82	195	73	70
46	6.696	0.145	0.041	0.96	82	-1.26	-	40.9	0	83	197	73	70
47	6.841	0.145	0.043	0.93	83	-1.26	-	40.5	-0.4	83	199	73	70
48	6.987	0.146	0.042	0.91	83	-1.26	-	40.5	0	84	201	73	71
49	7.132	0.145	0.044	0.91	83	-1.29	-	40.1	-0.4	84	202	73	70
50	7.278	0.146	0.042	0.93	84	-1.28	100	39.7	-0.4	84	204	73	70
51	7.424	0.146	0.042	0.93	84	-1.26	-	39.6	-0.1	85	205	73	70
52	7.569	0.145	0.043	0.94	84	-1.27	-	39.4	-0.2	84	204	73	70
53	7.714	0.145	0.041	0.93	84	-1.28	-	39.0	-0.4	84	201	73	70
54	7.859	0.145	0.041	0.94	84	-1.28	-	38.7	-0.3	83	199	73	70
55	8.004	0.145	0.039	0.93	84	-1.28	-	38.9	0.2	82	197	73	70
56	8.149	0.145	0.043	0.93	85	-1.29	-	38.8	-0.1	82	195	72	70
57	8.294	0.145	0.040	0.93	86	-1.3	-	38.5	-0.3	82	194	73	70
58	8.440	0.146	0.040	0.94	86	-1.3	-	38.4	-0.1	82	193	72	70
59	8.586	0.146	0.040	0.94	86	-1.31	-	38.2	-0.2	82	194	73	70
60	8.731	0.145	0.041	0.93	85	-1.31	101	37.9	-0.3	83	197	73	70
61	8.877	0.146	0.043	0.93	86	-1.32	-	37.8	-0.1	84	200	73	70
62	9.023	0.146	0.043	0.93	87	-1.31	-	37.5	-0.3	84	203	73	70
63	9.169	0.146	0.040	0.93	86	-1.29	-	37.2	-0.3	84	203	73	70

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	9.314	0.145	0.041	0.93	87	-1.31	-	37.1	-0.1	85	205	73	70
65	9.459	0.145	0.040	0.93	87	-1.32	-	36.7	-0.4	84	203	73	71
66	9.604	0.145	0.039	0.93	87	-1.33	-	36.6	-0.1	84	200	73	71
67	9.749	0.145	0.042	0.93	87	-1.31	-	36.3	-0.3	83	197	73	71
68	9.895	0.146	0.043	0.95	88	-1.31	-	36.1	-0.2	83	195	73	71
69	10.040	0.145	0.042	0.94	87	-1.32	-	36.1	0	82	195	73	71
70	10.186	0.146	0.040	0.92	88	-1.32	102	35.9	-0.2	82	193	73	71
71	10.331	0.145	0.041	0.94	89	-1.32	-	35.6	-0.3	83	197	73	71
72	10.477	0.146	0.039	0.93	88	-1.32	-	35.6	0	84	199	73	71
73	10.623	0.146	0.041	0.93	89	-1.32	-	34.8	-0.8	85	202	73	71
74	10.769	0.146	0.040	0.97	89	-1.34	-	34.8	0	85	203	73	72
75	10.915	0.146	0.041	0.92	89	-1.32	-	34.7	-0.1	85	204	73	72
76	11.061	0.146	0.041	0.93	89	-1.32	-	34.1	-0.6	84	201	73	72
77	11.206	0.145	0.043	0.93	90	-1.31	-	34.2	0.1	84	198	73	72
78	11.352	0.146	0.040	0.93	89	-1.34	-	34.0	-0.2	83	196	73	72
79	11.497	0.145	0.040	0.93	90	-1.32	-	34.0	0	83	195	73	72
80	11.643	0.146	0.041	0.97	90	-1.34	100	33.7	-0.3	83	196	73	72
81	11.788	0.145	0.040	0.94	89	-1.33	-	33.6	-0.1	84	199	73	72
82	11.934	0.146	0.042	0.93	90	-1.32	-	33.3	-0.3	85	201	74	72
83	12.080	0.146	0.041	0.93	90	-1.33	-	33.0	-0.3	85	203	74	72
84	12.225	0.145	0.040	0.94	90	-1.34	-	33.2	0.2	85	203	74	72
85	12.371	0.146	0.041	0.93	91	-1.33	-	32.6	-0.6	84	200	74	72
86	12.517	0.146	0.043	0.93	90	-1.34	-	32.2	-0.4	84	198	74	72
87	12.664	0.147	0.042	0.93	90	-1.35	-	32.3	0.1	83	195	74	72
88	12.810	0.146	0.040	0.94	91	-1.35	-	32.2	-0.1	83	197	74	72
89	12.956	0.146	0.039	0.95	90	-1.35	-	31.7	-0.5	84	199	74	72
90	13.102	0.146	0.042	0.93	91	-1.35	99	31.7	0	84	200	74	72
91	13.247	0.145	0.038	0.94	92	-1.34	-	31.5	-0.2	85	203	74	72
92	13.393	0.146	0.039	0.95	91	-1.35	-	30.9	-0.6	85	203	74	72
93	13.539	0.146	0.036	0.94	92	-1.33	-	31.1	0.2	85	202	74	72
94	13.685	0.146	0.041	0.93	91	-1.36	-	30.8	-0.3	85	202	74	72
95	13.830	0.145	0.040	0.93	92	-1.34	-	30.5	-0.3	84	199	74	72

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	13.976	0.146	0.042	0.96	92	-1.36	-	30.4	-0.1	84	197	74	73
97	14.122	0.146	0.041	0.94	93	-1.34	-	30.0	-0.4	83	195	74	73
98	14.268	0.146	0.042	0.95	92	-1.36	-	29.9	-0.1	83	194	74	73
99	14.414	0.146	0.041	0.93	92	-1.35	-	29.9	0	83	195	74	73
100	14.560	0.146	0.039	0.93	93	-1.36	103	29.6	-0.3	84	198	74	73
101	14.707	0.147	0.043	0.93	92	-1.34	-	29.3	-0.3	85	200	74	73
102	14.853	0.146	0.040	0.93	93	-1.34	-	29.1	-0.2	85	201	74	73
103	15.000	0.147	0.040	0.94	93	-1.35	-	29.0	-0.1	85	202	74	73
104	15.146	0.146	0.041	0.94	93	-1.35	-	28.7	-0.3	84	199	74	73
105	15.292	0.146	0.038	0.94	93	-1.35	-	28.4	-0.3	84	200	74	73
106	15.438	0.146	0.041	0.93	93	-1.35	-	28.4	0	84	199	74	73
107	15.584	0.146	0.038	0.94	93	-1.35	-	28.2	-0.2	85	200	74	73
108	15.730	0.146	0.040	0.91	94	-1.35	-	27.9	-0.3	84	199	74	73
109	15.876	0.146	0.042	0.93	94	-1.35	-	27.3	-0.6	84	197	74	73
110	16.022	0.146	0.041	0.93	93	-1.37	100	27.3	0	84	197	74	73
111	16.168	0.146	0.040	0.93	93	-1.36	-	27.3	0	84	198	74	73
112	16.313	0.145	0.041	0.93	94	-1.37	-	27.2	-0.1	84	196	74	73
113	16.459	0.146	0.042	0.94	94	-1.35	-	26.9	-0.3	84	198	74	73
114	16.606	0.147	0.037	0.94	94	-1.37	-	26.7	-0.2	84	199	74	73
115	16.752	0.146	0.039	0.93	94	-1.38	-	26.4	-0.3	85	201	74	73
116	16.898	0.146	0.039	0.93	94	-1.36	-	26.2	-0.2	85	201	74	73
117	17.044	0.146	0.039	0.93	94	-1.37	-	25.8	-0.4	85	200	74	73
118	17.191	0.147	0.041	0.94	95	-1.37	-	25.7	-0.1	84	198	74	73
119	17.337	0.146	0.040	0.93	94	-1.34	-	25.6	-0.1	84	196	74	73
120	17.484	0.147	0.041	0.94	94	-1.33	100	25.4	-0.2	83	194	74	73
121	17.630	0.146	0.042	0.95	94	-1.36	-	25.2	-0.2	83	193	74	73
122	17.776	0.146	0.043	0.92	95	-1.35	-	25.0	-0.2	83	195	74	73
123	17.922	0.146	0.044	0.93	95	-1.34	-	24.7	-0.3	84	197	74	73
124	18.068	0.146	0.041	0.95	94	-1.36	-	24.1	-0.6	85	199	74	73
125	18.214	0.146	0.041	0.93	95	-1.36	-	24.3	0.2	85	201	74	73
126	18.360	0.146	0.040	0.93	95	-1.35	-	24.1	-0.2	85	202	74	73
127	18.506	0.146	0.040	0.93	95	-1.36	-	23.8	-0.3	85	203	74	72

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	18.653	0.147	0.042	0.93	96	-1.37	-	23.8	0	84	199	74	73
129	18.799	0.146	0.040	0.94	96	-1.35	-	23.4	-0.4	84	198	74	72
130	18.945	0.146	0.043	0.93	96	-1.35	97	23.2	-0.2	83	196	74	72
131	19.091	0.146	0.044	0.92	95	-1.38	-	23.1	-0.1	83	194	73	72
132	19.238	0.147	0.040	0.92	96	-1.39	-	22.9	-0.2	83	193	74	72
133	19.384	0.146	0.045	0.93	96	-1.37	-	22.8	-0.1	83	196	73	72
134	19.530	0.146	0.042	0.95	96	-1.37	-	22.6	-0.2	84	198	73	72
135	19.677	0.147	0.041	0.93	95	-1.37	-	22.3	-0.3	84	200	73	72
136	19.823	0.146	0.042	0.95	96	-1.38	-	22.1	-0.2	85	201	73	72
137	19.970	0.147	0.042	0.93	96	-1.38	-	21.8	-0.3	85	203	73	72
138	20.117	0.147	0.043	0.92	95	-1.37	-	21.4	-0.4	85	202	73	72
139	20.263	0.146	0.042	0.95	96	-1.34	-	21.2	-0.2	84	198	73	72
140	20.409	0.146	0.042	0.93	95	-1.36	99	21.2	0	83	196	73	72
141	20.556	0.147	0.041	0.93	96	-1.37	-	21.1	-0.1	83	194	73	72
142	20.702	0.146	0.041	0.92	95	-1.38	-	20.7	-0.4	83	196	73	72
143	20.848	0.146	0.042	0.93	96	-1.37	-	21.0	0.3	84	198	73	72
144	20.995	0.147	0.041	0.93	96	-1.37	-	20.3	-0.7	84	200	73	72
145	21.141	0.146	0.042	0.93	96	-1.37	-	20.1	-0.2	84	201	73	72
146	21.287	0.146	0.043	0.95	97	-1.37	-	19.9	-0.2	84	199	73	72
147	21.434	0.147	0.042	0.93	96	-1.35	-	19.2	-0.7	83	196	73	72
148	21.580	0.146	0.039	0.92	96	-1.34	-	19.3	0.1	83	194	73	71
149	21.726	0.146	0.044	0.93	96	-1.35	-	19.3	0	83	196	73	71
150	21.873	0.147	0.042	0.94	97	-1.36	98	19.2	-0.1	83	195	73	71
151	22.019	0.146	0.041	0.93	96	-1.37	-	18.8	-0.4	83	197	73	71
152	22.166	0.147	0.042	0.93	96	-1.36	-	18.7	-0.1	84	199	73	71
153	22.312	0.146	0.042	0.92	97	-1.36	-	18.3	-0.4	84	201	73	71
154	22.458	0.146	0.041	0.93	96	-1.36	-	18.1	-0.2	84	202	73	71
155	22.605	0.147	0.042	0.92	97	-1.37	-	17.7	-0.4	84	202	73	71
156	22.751	0.146	0.042	0.94	96	-1.35	-	17.8	0.1	84	199	73	71
157	22.898	0.147	0.043	0.92	96	-1.36	-	17.4	-0.4	83	197	73	71
158	23.045	0.147	0.042	0.92	96	-1.35	-	17.4	0	83	196	73	71
159	23.192	0.147	0.042	0.92	97	-1.36	-	17.0	-0.4	83	194	73	71

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	23.339	0.147	0.044	0.91	97	-1.36	96	16.6	-0.4	83	193	73	71
161	23.483	0.144	0.043	0.93	97	-1.36	-	16.7	0.1	82	192	73	71
162	23.629	0.146	0.043	0.93	96	-1.36	-	16.6	-0.1	82	191	73	71
163	23.776	0.147	0.041	0.95	97	-1.37	-	16.5	-0.1	82	193	73	71
164	23.922	0.146	0.042	0.95	97	-1.36	-	16.5	0	83	196	73	71
165	24.068	0.146	0.043	0.93	97	-1.36	-	16.0	-0.5	84	198	73	71
166	24.215	0.147	0.041	0.94	97	-1.35	-	15.7	-0.3	84	200	73	71
167	24.361	0.146	0.042	0.93	97	-1.37	-	15.5	-0.2	84	201	73	71
168	24.507	0.146	0.043	0.93	97	-1.38	-	15.2	-0.3	85	202	73	71
169	24.653	0.146	0.043	0.95	96	-1.37	-	14.6	-0.6	84	200	73	71
170	24.800	0.147	0.042	0.93	97	-1.37	98	14.8	0.2	84	197	73	71
171	24.946	0.146	0.041	0.91	97	-1.36	-	14.3	-0.5	83	196	73	71
172	25.093	0.147	0.043	0.94	97	-1.36	-	14.4	0.1	83	193	73	71
173	25.239	0.146	0.042	0.93	97	-1.35	-	14.2	-0.2	83	193	73	71
174	25.386	0.147	0.042	0.93	97	-1.35	-	14.1	-0.1	83	192	73	71
175	25.532	0.146	0.043	0.93	97	-1.35	-	13.8	-0.3	84	195	73	71
176	25.679	0.147	0.043	0.92	97	-1.35	-	13.9	0.1	84	197	73	71
177	25.825	0.146	0.043	0.93	97	-1.34	-	13.5	-0.4	84	198	73	71
178	25.972	0.147	0.042	0.93	98	-1.34	-	13.5	0	85	200	73	71
179	26.119	0.147	0.042	0.93	97	-1.35	-	13.1	-0.4	85	202	73	71
180	26.266	0.147	0.043	0.93	97	-1.35	98	12.6	-0.5	85	203	73	71
181	26.412	0.146	0.042	0.90	98	-1.32	-	12.5	-0.1	85	203	73	71
182	26.558	0.146	0.040	0.92	98	-1.35	-	12.1	-0.4	85	199	73	71
183	26.704	0.146	0.042	0.93	98	-1.33	-	11.9	-0.2	84	197	73	71
184	26.850	0.146	0.042	0.95	97	-1.34	-	11.7	-0.2	84	195	73	71
185	26.997	0.147	0.044	0.92	98	-1.35	-	11.5	-0.2	83	194	73	71
186	27.143	0.146	0.044	0.93	97	-1.36	-	11.4	-0.1	83	192	73	71
187	27.289	0.146	0.041	0.95	97	-1.34	-	11.1	-0.3	84	196	73	71
188	27.436	0.147	0.043	0.94	97	-1.35	-	11.5	0.4	84	197	73	71
189	27.582	0.146	0.043	0.92	98	-1.34	-	11.0	-0.5	85	200	73	71
190	27.728	0.146	0.038	0.93	98	-1.33	103	10.5	-0.5	85	200	73	71
191	27.874	0.146	0.041	0.94	97	-1.33	-	10.2	-0.3	85	201	73	71

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
192	28.021	0.147	0.044	0.92	98	-1.35	-	10.1	-0.1	84	198	73	71
193	28.167	0.146	0.044	0.89	98	-1.33	-	10.1	0	84	197	73	71
194	28.313	0.146	0.044	0.93	97	-1.35	-	10.0	-0.1	84	197	73	71
195	28.460	0.147	0.044	0.93	98	-1.33	-	9.5	-0.5	84	197	73	71
196	28.606	0.146	0.043	0.93	98	-1.33	-	9.4	-0.1	84	196	73	71
197	28.753	0.147	0.041	0.93	97	-1.34	-	9.1	-0.3	85	199	73	71
198	28.900	0.147	0.042	0.93	98	-1.33	-	8.9	-0.2	85	198	73	71
199	29.046	0.146	0.040	0.92	97	-1.34	-	8.7	-0.2	85	199	73	71
200	29.193	0.147	0.041	0.91	98	-1.34	100	8.5	-0.2	85	200	73	71
201	29.339	0.146	0.042	0.93	97	-1.32	-	8.3	-0.2	85	201	73	71
202	29.485	0.146	0.043	0.92	97	-1.33	-	8.1	-0.2	85	199	73	71
203	29.632	0.147	0.041	0.94	98	-1.32	-	7.7	-0.4	84	196	73	71
204	29.778	0.146	0.041	0.94	98	-1.33	-	7.6	-0.1	84	194	73	71
205	29.924	0.146	0.044	0.94	97	-1.33	-	7.5	-0.1	83	193	73	71
206	30.070	0.146	0.044	0.95	98	-1.32	-	7.4	-0.1	84	195	73	71
207	30.216	0.146	0.042	0.93	98	-1.33	-	7.1	-0.3	85	197	73	71
208	30.363	0.147	0.041	0.95	98	-1.34	-	6.9	-0.2	85	198	73	71
209	30.509	0.146	0.041	0.93	98	-1.33	-	6.6	-0.3	85	200	73	71
210	30.655	0.146	0.041	0.93	98	-1.34	99	6.3	-0.3	85	201	73	71
211	30.801	0.146	0.042	0.94	98	-1.33	-	6.0	-0.3	85	198	73	71
212	30.948	0.147	0.043	0.92	98	-1.31	-	5.8	-0.2	84	196	73	71
213	31.094	0.146	0.044	0.95	98	-1.32	-	5.7	-0.1	84	194	73	71
214	31.240	0.146	0.043	0.93	98	-1.32	-	5.6	-0.1	84	193	73	71
215	31.387	0.147	0.043	0.96	99	-1.32	-	5.5	-0.1	84	192	73	72
216	31.533	0.146	0.044	0.93	98	-1.34	-	5.3	-0.2	84	195	73	71
217	31.680	0.147	0.044	0.94	99	-1.31	-	5.0	-0.3	85	197	73	72
218	31.827	0.147	0.041	0.95	99	-1.32	-	4.6	-0.4	85	199	73	72
219	31.973	0.146	0.043	0.90	98	-1.32	-	4.3	-0.3	86	200	73	71
220	32.119	0.146	0.042	0.93	98	-1.32	99	4.2	-0.1	86	201	73	72
221	32.266	0.147	0.043	0.93	98	-1.31	-	4.1	-0.1	85	200	73	71
222	32.412	0.146	0.041	0.93	98	-1.3	-	3.6	-0.5	84	197	73	71
223	32.558	0.146	0.043	0.94	98	-1.31	-	3.5	-0.1	84	195	73	71

BOX A TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
224	32.704	0.146	0.043	0.92	98	-1.31	-	3.3	-0.2	84	193	73	71
225	32.850	0.146	0.038	0.94	98	-1.32	-	3.1	-0.2	83	191	73	71
226	32.996	0.146	0.042	0.91	98	-1.32	-	2.9	-0.2	83	191	73	71
227	33.143	0.147	0.043	0.94	99	-1.3	-	2.9	0	84	194	73	71
228	33.289	0.146	0.043	0.93	98	-1.32	-	2.5	-0.4	84	196	73	71
229	33.435	0.146	0.042	0.93	98	-1.32	-	2.4	-0.1	85	198	73	71
230	33.581	0.146	0.043	0.91	99	-1.32	97	2.2	-0.2	85	200	73	71
231	33.727	0.146	0.044	0.92	99	-1.31	-	2.0	-0.2	85	200	73	71
232	33.874	0.147	0.043	0.93	99	-1.31	-	1.6	-0.4	86	202	73	71
233	34.020	0.146	0.041	0.92	98	-1.3	-	1.3	-0.3	86	202	73	71
234	34.166	0.146	0.042	0.90	99	-1.3	-	1.3	0	85	199	73	71
235	34.312	0.146	0.041	0.93	98	-1.3	-	0.9	-0.4	84	196	73	71
236	34.459	0.147	0.043	0.93	98	-1.31	-	0.7	-0.2	84	195	73	71
237	34.606	0.147	0.042	0.92	99	-1.31	-	0.4	-0.3	83	193	73	71
238	34.753	0.147	0.042	0.94	99	-1.29	-	0.6	0.2	83	191	74	72
239	34.899	0.146	0.044	0.93	99	-1.29	-	0.4	-0.2	83	190	73	71
240	35.045	0.146	0.044	0.93	98	-1.28	96	0.0	-0.4	84	193	73	72
Avg/Tot	35.045	0.146	0.041	0.93	91	-1.30	100			84	198	73	71.2

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		-0.04	73	-0.52		72	-0.020	14.40	0.01
1	0.135	0.135	1.04	74	-1.33	-	73	-0.030	14.48	0.01
2	0.285	0.150	1.07	74	-1.33	-	73	-0.020	14.90	0.00
3	0.434	0.149	1.07	74	-1.33	-	73	-0.010	15.59	0.00
4	0.583	0.149	1.06	74	-1.33	-	73	-0.020	13.10	0.00
5	0.733	0.150	1.04	75	-1.33	-	74	-0.020	11.00	0.01
6	0.882	0.149	1.06	75	-1.34	-	74	-0.020	10.53	0.00
7	1.032	0.150	1.04	75	-1.32	-	74	-0.020	8.76	0.01
8	1.181	0.149	1.02	75	-1.32	-	74	-0.030	8.69	0.01
9	1.329	0.148	1.03	76	-1.32	-	74	-0.020	9.52	0.01
10	1.477	0.148	1.01	75	-1.31	103	74	-0.020	12.25	0.01
11	1.626	0.149	1.01	76	-1.33	-	74	-0.020	13.24	0.01
12	1.774	0.148	0.99	76	-1.27	-	74	-0.010	14.03	0.00
13	1.922	0.148	1.01	76	-1.32	-	74	-0.020	13.84	0.00
14	2.069	0.147	1.03	77	-1.31	-	74	-0.020	15.65	0.00
15	2.217	0.148	1.02	76	-1.31	-	74	-0.020	16.17	0.01
16	2.364	0.147	1.02	77	-1.29	-	74	-0.020	15.64	0.00
17	2.511	0.147	1.03	77	-1.31	-	74	-0.010	11.56	0.00
18	2.659	0.148	1.02	77	-1.31	-	74	-0.020	11.19	0.00
19	2.806	0.147	1.03	77	-1.31	-	74	-0.020	10.34	0.01
20	2.953	0.147	1.01	78	-1.32	97	74	-0.020	10.42	0.01
21	3.100	0.147	0.99	78	-1.33	-	74	-0.030	9.19	0.01
22	3.247	0.147	1.02	78	-1.32	-	74	-0.020	12.30	0.00
23	3.394	0.147	1.01	79	-1.36	-	75	-0.010	13.16	0.00
24	3.541	0.147	1.06	79	-1.33	-	74	-0.020	13.98	0.01
25	3.688	0.147	1.02	79	-1.24	-	74	-0.020	14.81	0.00
26	3.834	0.146	0.98	80	-1.26	-	74	-0.010	13.64	0.00
27	3.981	0.147	1.01	80	-1.24	-	74	-0.020	12.06	0.00
28	4.128	0.147	1.05	80	-1.26	-	74	-0.030	13.52	0.01
29	4.275	0.147	1.04	80	-1.29	-	74	-0.010	13.49	0.00
30	4.422	0.147	1.05	81	-1.26	100	74	-0.030	12.90	0.00
31	4.568	0.146	1.02	80	-1.26	-	74	-0.020	13.64	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.715	0.147	1.02	81	-1.3	-	74	-0.020	12.32	0.00
33	4.862	0.147	1.02	81	-1.31	-	74	-0.020	14.13	0.00
34	5.008	0.146	1.02	82	-1.31	-	74	-0.010	14.77	0.00
35	5.155	0.147	1.02	82	-1.31	-	74	-0.010	12.35	0.00
36	5.302	0.147	1.02	82	-1.34	-	74	-0.020	11.45	0.00
37	5.449	0.147	1.02	82	-1.33	-	74	-0.020	11.00	0.00
38	5.596	0.147	1.02	83	-1.26	-	74	-0.010	11.24	0.01
39	5.742	0.146	1.02	82	-1.35	-	74	-0.020	12.78	0.00
40	5.889	0.147	1.02	83	-1.29	101	74	-0.020	11.61	0.01
41	6.036	0.147	1.01	83	-1.23	-	74	-0.020	13.85	0.00
42	6.183	0.147	1.02	84	-1.24	-	74	-0.010	15.01	0.00
43	6.330	0.147	1.02	84	-1.32	-	74	-0.020	14.94	0.00
44	6.477	0.147	1.08	84	-1.25	-	74	-0.010	14.47	0.01
45	6.624	0.147	1.02	84	-1.26	-	74	-0.020	11.70	0.00
46	6.771	0.147	0.98	85	-1.36	-	74	-0.010	10.83	0.01
47	6.918	0.147	1.01	85	-1.23	-	74	-0.020	10.11	0.01
48	7.065	0.147	1.06	85	-1.29	-	75	-0.010	9.37	0.01
49	7.212	0.147	1.02	84	-1.31	-	74	-0.030	11.19	0.01
50	7.359	0.147	1.02	85	-1.34	99	75	-0.020	12.82	0.00
51	7.506	0.147	1.01	85	-1.3	-	74	-0.020	14.37	0.00
52	7.653	0.147	1.01	85	-1.31	-	74	-0.010	15.10	0.00
53	7.800	0.147	0.99	86	-1.35	-	74	0.000	15.48	0.01
54	7.948	0.148	1.04	85	-1.29	-	74	-0.020	16.28	0.01
55	8.095	0.147	1.02	86	-1.27	-	74	-0.020	14.32	0.00
56	8.242	0.147	1.02	86	-1.26	-	74	-0.010	11.10	0.00
57	8.390	0.148	1.00	86	-1.28	-	74	-0.030	10.24	0.01
58	8.537	0.147	1.00	86	-1.25	-	74	-0.010	9.94	0.00
59	8.685	0.148	1.02	86	-1.3	-	74	-0.020	9.99	0.00
60	8.832	0.147	1.03	87	-1.25	100	74	-0.020	9.45	0.01
61	8.980	0.148	1.02	86	-1.29	-	74	-0.020	10.40	0.00
62	9.127	0.147	1.02	87	-1.29	-	75	-0.020	13.39	0.00
63	9.275	0.148	1.02	87	-1.29	-	75	-0.010	15.18	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	9.422	0.147	1.02	88	-1.29	-	75	-0.020	14.68	0.01
65	9.570	0.148	1.00	88	-1.27	-	75	0.000	14.33	0.01
66	9.718	0.148	1.02	87	-1.31	-	75	-0.010	16.48	0.02
67	9.865	0.147	1.02	87	-1.25	-	75	-0.010	15.10	0.00
68	10.013	0.148	1.02	87	-1.26	-	75	0.000	14.04	0.00
69	10.161	0.148	0.98	88	-1.35	-	75	-0.010	10.60	0.00
70	10.308	0.147	1.03	87	-1.26	102	75	-0.020	10.14	0.01
71	10.456	0.148	1.02	88	-1.31	-	75	-0.010	9.46	0.01
72	10.604	0.148	1.03	88	-1.31	-	75	-0.020	9.32	0.01
73	10.752	0.148	1.00	88	-1.3	-	75	-0.020	12.93	0.00
74	10.900	0.148	1.05	88	-1.31	-	75	-0.010	14.23	0.00
75	11.047	0.147	1.02	89	-1.31	-	75	-0.010	14.48	0.00
76	11.195	0.148	1.00	89	-1.29	-	75	0.010	14.67	0.00
77	11.343	0.148	1.00	89	-1.3	-	75	-0.020	15.53	0.00
78	11.491	0.148	1.03	89	-1.33	-	75	-0.010	12.09	0.00
79	11.640	0.149	1.02	90	-1.24	-	75	-0.010	11.23	0.00
80	11.788	0.148	1.04	89	-1.25	100	75	-0.020	10.66	0.01
81	11.936	0.148	1.03	90	-1.33	-	75	-0.010	9.71	0.00
82	12.084	0.148	1.00	90	-1.35	-	76	-0.010	10.72	0.01
83	12.232	0.148	0.99	90	-1.26	-	76	-0.030	13.79	0.01
84	12.380	0.148	1.02	90	-1.25	-	76	-0.030	15.13	0.00
85	12.528	0.148	1.03	90	-1.24	-	76	-0.010	14.59	0.00
86	12.676	0.148	0.97	90	-1.25	-	75	-0.020	15.63	0.01
87	12.825	0.149	1.02	89	-1.29	-	75	-0.010	13.73	0.00
88	12.973	0.148	1.01	91	-1.25	-	75	-0.010	11.31	0.01
89	13.121	0.148	1.03	91	-1.24	-	76	-0.010	9.32	0.01
90	13.269	0.148	1.01	90	-1.33	99	76	-0.010	10.20	0.00
91	13.417	0.148	1.00	91	-1.33	-	76	-0.020	13.24	0.00
92	13.566	0.149	0.98	91	-1.32	-	76	-0.010	13.29	0.01
93	13.714	0.148	1.01	90	-1.33	-	76	-0.020	13.85	0.01
94	13.862	0.148	1.03	92	-1.25	-	76	-0.020	14.74	0.00
95	14.010	0.148	1.02	90	-1.33	-	76	-0.020	15.53	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	14.158	0.148	1.02	91	-1.29	-	76	-0.010	16.51	0.02
97	14.306	0.148	1.02	90	-1.23	-	76	-0.010	14.25	0.00
98	14.454	0.148	1.02	91	-1.35	-	76	-0.020	10.27	0.01
99	14.602	0.148	1.02	92	-1.3	-	76	-0.010	10.39	0.00
100	14.751	0.149	1.05	91	-1.25	103	76	-0.020	10.00	0.01
101	14.899	0.148	1.02	91	-1.31	-	76	-0.020	10.60	0.00
102	15.048	0.149	1.02	91	-1.33	-	76	-0.010	12.87	0.00
103	15.196	0.148	1.04	92	-1.25	-	76	-0.010	13.95	0.01
104	15.345	0.149	1.02	91	-1.24	-	76	-0.020	14.87	0.00
105	15.493	0.148	1.03	91	-1.25	-	76	-0.010	14.43	0.00
106	15.642	0.149	1.02	92	-1.25	-	76	-0.010	11.12	0.00
107	15.791	0.149	1.02	91	-1.24	-	76	-0.030	13.17	0.01
108	15.939	0.148	0.98	91	-1.24	-	76	-0.010	12.83	0.00
109	16.088	0.149	1.02	92	-1.32	-	76	-0.010	13.07	0.01
110	16.237	0.149	1.02	91	-1.33	100	76	-0.010	13.99	0.00
111	16.385	0.148	1.05	92	-1.29	-	76	0.000	14.93	0.01
112	16.534	0.149	1.03	91	-1.33	-	76	-0.010	11.80	0.00
113	16.682	0.148	0.96	91	-1.32	-	76	-0.030	12.72	0.01
114	16.831	0.149	1.05	91	-1.32	-	76	-0.020	11.02	0.00
115	16.980	0.149	1.03	92	-1.34	-	76	-0.020	11.14	0.00
116	17.128	0.148	1.02	92	-1.29	-	76	-0.020	13.27	0.00
117	17.276	0.148	1.01	91	-1.33	-	76	0.000	14.19	0.02
118	17.424	0.148	1.04	91	-1.33	-	76	-0.020	15.64	0.00
119	17.573	0.149	1.03	92	-1.27	-	76	-0.010	15.02	0.00
120	17.721	0.148	1.06	92	-1.23	100	76	-0.020	12.66	0.00
121	17.870	0.149	1.02	92	-1.34	-	76	0.000	11.62	0.00
122	18.019	0.149	1.03	93	-1.35	-	76	-0.010	11.24	0.00
123	18.167	0.148	1.02	92	-1.34	-	76	-0.020	10.06	0.00
124	18.316	0.149	0.97	92	-1.24	-	76	-0.030	9.94	0.02
125	18.465	0.149	1.03	93	-1.34	-	76	-0.010	13.53	0.00
126	18.614	0.149	1.02	92	-1.24	-	76	-0.020	13.57	0.00
127	18.763	0.149	1.02	92	-1.34	-	76	-0.010	15.36	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
128	18.912	0.149	1.02	92	-1.29	-	76	-0.010	15.62	0.01
129	19.061	0.149	1.03	93	-1.33	-	75	-0.010	15.74	0.01
130	19.210	0.149	1.02	93	-1.28	98	75	-0.010	14.06	0.00
131	19.359	0.149	1.00	93	-1.27	-	75	0.000	11.95	0.00
132	19.508	0.149	1.03	92	-1.34	-	75	0.000	10.52	0.00
133	19.657	0.149	1.03	93	-1.33	-	75	-0.010	10.23	0.00
134	19.805	0.148	0.99	92	-1.26	-	75	-0.010	10.58	0.01
135	19.954	0.149	1.02	93	-1.34	-	75	-0.010	11.95	0.00
136	20.102	0.148	1.06	92	-1.34	-	75	0.000	13.71	0.01
137	20.250	0.148	1.02	93	-1.22	-	75	-0.010	14.68	0.00
138	20.399	0.149	1.00	93	-1.23	-	75	0.000	14.65	0.01
139	20.548	0.149	1.05	93	-1.26	-	75	-0.010	14.51	0.01
140	20.697	0.149	1.03	92	-1.28	99	75	-0.010	12.53	0.00
141	20.847	0.150	1.02	93	-1.25	-	75	-0.010	11.63	0.00
142	20.996	0.149	1.01	93	-1.23	-	75	-0.010	11.13	0.00
143	21.145	0.149	1.05	92	-1.25	-	75	-0.010	12.17	0.00
144	21.294	0.149	1.03	93	-1.3	-	75	-0.020	11.82	0.00
145	21.443	0.149	1.03	93	-1.31	-	75	-0.020	14.20	0.01
146	21.592	0.149	1.00	93	-1.24	-	75	-0.010	14.85	0.01
147	21.741	0.149	1.01	92	-1.27	-	75	0.000	14.93	0.01
148	21.890	0.149	1.04	93	-1.33	-	75	-0.030	15.06	0.01
149	22.039	0.149	1.02	94	-1.29	-	75	-0.010	12.05	0.00
150	22.188	0.149	1.02	93	-1.32	99	75	0.000	11.02	0.01
151	22.336	0.148	1.02	94	-1.32	-	75	-0.010	10.87	0.00
152	22.485	0.149	1.02	92	-1.27	-	75	-0.010	12.85	0.00
153	22.634	0.149	1.01	93	-1.31	-	75	-0.030	12.91	0.01
154	22.783	0.149	1.02	93	-1.31	-	75	-0.010	13.96	0.00
155	22.932	0.149	1.04	92	-1.32	-	75	-0.020	14.47	0.01
156	23.082	0.150	1.03	93	-1.3	-	75	-0.010	13.95	0.00
157	23.231	0.149	1.02	93	-1.26	-	75	-0.030	13.73	0.00
158	23.380	0.149	1.00	94	-1.28	-	74	-0.020	15.52	0.01
159	23.530	0.150	1.06	92	-1.28	-	74	-0.020	14.99	0.01

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
160	23.679	0.149	1.00	92	-1.3	97	74	-0.010	15.27	0.01
161	23.825	0.146	1.03	92	-1.33	-	74	-0.010	13.21	0.00
162	23.975	0.150	1.02	93	-1.24	-	74	-0.010	11.18	0.00
163	24.124	0.149	1.08	92	-1.3	-	74	-0.010	10.58	0.01
164	24.273	0.149	1.05	93	-1.26	-	75	-0.020	9.48	0.01
165	24.422	0.149	1.02	93	-1.34	-	75	-0.010	11.61	0.00
166	24.570	0.148	1.02	93	-1.31	-	75	-0.010	13.25	0.01
167	24.719	0.149	1.02	92	-1.31	-	75	-0.010	14.82	0.00
168	24.868	0.149	1.04	92	-1.26	-	75	-0.020	15.62	0.02
169	25.017	0.149	1.06	92	-1.3	-	75	-0.010	15.62	0.03
170	25.166	0.149	1.05	92	-1.33	99	75	0.000	14.82	0.01
171	25.315	0.149	0.98	93	-1.28	-	75	-0.030	14.30	0.01
172	25.465	0.150	1.02	92	-1.33	-	74	-0.010	13.00	0.00
173	25.614	0.149	1.04	93	-1.32	-	75	-0.010	11.25	0.00
174	25.764	0.150	1.03	94	-1.28	-	75	-0.010	10.22	0.00
175	25.913	0.149	1.03	93	-1.28	-	75	-0.020	10.63	0.00
176	26.062	0.149	0.99	93	-1.25	-	75	-0.010	9.41	0.02
177	26.211	0.149	1.02	92	-1.26	-	75	-0.020	10.64	0.00
178	26.360	0.149	1.00	92	-1.27	-	75	-0.030	13.53	0.00
179	26.509	0.149	1.02	93	-1.26	-	75	-0.010	14.69	0.00
180	26.657	0.148	1.02	93	-1.29	98	75	-0.010	13.95	0.01
181	26.806	0.149	1.06	93	-1.27	-	75	0.000	15.05	0.02
182	26.955	0.149	1.02	92	-1.32	-	75	-0.020	16.06	0.03
183	27.104	0.149	1.02	93	-1.23	-	75	-0.010	16.24	0.06
184	27.253	0.149	1.03	93	-1.3	-	75	0.000	16.13	0.04
185	27.402	0.149	1.05	94	-1.27	-	75	0.000	12.53	0.01
186	27.552	0.150	1.02	93	-1.24	-	75	-0.010	10.51	0.00
187	27.701	0.149	1.00	94	-1.29	-	75	0.000	10.21	0.00
188	27.850	0.149	1.02	93	-1.3	-	75	-0.010	10.54	0.00
189	27.999	0.149	1.06	94	-1.28	-	75	-0.020	11.88	0.00
190	28.148	0.149	1.03	93	-1.31	104	75	-0.010	13.44	0.00
191	28.297	0.149	0.99	94	-1.33	-	75	-0.010	14.91	0.00

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
192	28.447	0.150	1.08	93	-1.24	-	75	-0.010	14.70	0.01
193	28.595	0.148	1.00	94	-1.24	-	75	-0.020	13.95	0.01
194	28.744	0.149	1.01	93	-1.28	-	75	-0.020	12.97	0.01
195	28.892	0.148	1.02	93	-1.34	-	75	-0.010	11.94	0.00
196	29.041	0.149	1.03	93	-1.3	-	75	-0.010	12.11	0.00
197	29.190	0.149	1.02	94	-1.31	-	75	-0.010	12.47	0.00
198	29.339	0.149	1.02	92	-1.25	-	75	-0.010	11.13	0.00
199	29.488	0.149	1.03	93	-1.24	-	75	-0.030	12.10	0.01
200	29.638	0.150	1.03	93	-1.27	101	75	-0.010	13.92	0.00
201	29.787	0.149	1.02	93	-1.27	-	75	-0.010	13.67	0.00
202	29.936	0.149	1.04	94	-1.28	-	75	-0.010	14.85	0.01
203	30.086	0.150	1.05	94	-1.29	-	75	-0.010	14.46	0.02
204	30.235	0.149	1.04	93	-1.26	-	75	-0.010	14.32	0.00
205	30.384	0.149	1.04	94	-1.33	-	75	-0.010	12.57	0.00
206	30.533	0.149	0.95	94	-1.28	-	75	-0.010	12.09	0.01
207	30.682	0.149	1.02	93	-1.32	-	75	-0.010	10.83	0.01
208	30.831	0.149	1.01	93	-1.24	-	75	-0.010	12.20	0.01
209	30.979	0.148	1.02	93	-1.29	-	75	-0.020	13.40	0.01
210	31.128	0.149	1.00	93	-1.28	101	75	-0.010	13.89	0.00
211	31.277	0.149	0.97	94	-1.33	-	75	-0.010	13.89	0.02
212	31.426	0.149	1.02	94	-1.34	-	75	-0.020	14.91	0.01
213	31.575	0.149	1.01	94	-1.31	-	75	-0.010	14.30	0.00
214	31.724	0.149	1.03	95	-1.3	-	75	-0.010	13.36	0.00
215	31.874	0.150	1.09	94	-1.26	-	75	-0.010	11.25	0.01
216	32.023	0.149	1.03	93	-1.33	-	75	-0.010	12.01	0.00
217	32.172	0.149	1.00	94	-1.25	-	75	-0.020	11.89	0.00
218	32.321	0.149	1.07	93	-1.3	-	75	-0.020	11.63	0.01
219	32.470	0.149	1.06	93	-1.28	-	75	-0.020	14.23	0.01
220	32.619	0.149	1.00	93	-1.24	99	75	0.000	15.83	0.02
221	32.768	0.149	1.02	94	-1.29	-	75	-0.010	15.14	0.02
222	32.917	0.149	1.04	94	-1.26	-	75	-0.010	16.12	0.06
223	33.065	0.148	0.98	94	-1.33	-	75	0.000	16.41	0.07

BOX B TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
224	33.214	0.149	1.00	94	-1.31	-	75	-0.020	14.72	0.01
225	33.363	0.149	1.05	93	-1.34	-	75	-0.010	12.33	0.00
226	33.512	0.149	1.12	94	-1.3	-	75	-0.020	10.47	0.01
227	33.661	0.149	0.99	93	-1.33	-	75	-0.020	9.88	0.00
228	33.810	0.149	1.01	94	-1.28	-	75	-0.010	9.51	0.01
229	33.959	0.149	1.03	94	-1.27	-	75	-0.010	11.61	0.00
230	34.109	0.150	1.05	94	-1.33	98	75	-0.010	13.62	0.01
231	34.257	0.148	1.03	93	-1.29	-	75	-0.010	15.07	0.01
232	34.407	0.150	1.03	94	-1.24	-	75	-0.010	14.94	0.01
233	34.556	0.149	1.02	94	-1.33	-	75	-0.010	15.46	0.03
234	34.705	0.149	1.02	94	-1.33	-	75	-0.030	15.51	0.01
235	34.854	0.149	1.01	93	-1.32	-	75	-0.020	15.63	0.02
236	35.003	0.149	1.02	94	-1.3	-	75	-0.010	14.98	0.00
237	35.152	0.149	1.05	94	-1.25	-	75	-0.010	11.94	0.01
238	35.300	0.148	1.01	93	-1.31	-	75	-0.010	10.97	0.01
239	35.449	0.149	1.04	93	-1.24	-	75	-0.010	10.61	0.01
240	35.597	0.148	1.02	94	-1.27	96	75	-0.010	10.44	0.00
Avg/Tot	35.597	0.148	1.02	89	-1.29	100	75	-0.014	12.94	0.01

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 4

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
0	0.000		0.03	73	-0.5		70
1	1.090	1.090	1.03	72	-1.8	-	70
2	2.377	1.287	1.00	72	-1.8	-	70
3	3.644	1.267	1.00	72	-1.7	-	70
4	4.908	1.264	1.02	73	-1.8	-	70
5	6.200	1.292	1.02	74	-1.8	-	70
6	7.488	1.288	1.02	74	-1.8	-	70
7	8.763	1.275	1.02	74	-1.9	-	70
8	10.041	1.278	1.04	73	-1.8	-	70
9	11.336	1.295	1.03	75	-1.7	-	70
10	12.639	1.303	1.05	74	-1.8	96	70
11	13.940	1.301	1.04	75	-1.7	-	70
12	15.230	1.290	1.03	74	-1.6	-	70
13	16.528	1.298	1.04	74	-1.9	-	71
14	17.823	1.295	1.06	75	-1.9	-	71
15	19.140	1.317	1.07	74	-1.9	-	71
16	20.464	1.324	1.06	76	-1.9	-	71
17	21.778	1.314	1.07	75	-1.9	-	71
18	23.099	1.321	1.07	75	-1.8	-	71
19	24.421	1.322	1.06	75	-1.8	-	71
20	25.744	1.323	1.07	77	-1.7	95	71
21	27.065	1.321	1.08	75	-1.7	-	71
22	28.393	1.328	1.09	75	-1.9	-	71
23	29.724	1.331	1.06	77	-1.7	-	71
24	31.058	1.334	1.10	76	-1.8	-	71
25	32.396	1.338	1.09	77	-1.8	-	71
26	33.737	1.341	1.08	78	-1.8	-	71
27	35.079	1.342	1.10	77	-1.7	-	71
28	36.425	1.346	1.10	77	-1.7	-	71
29	37.773	1.348	1.10	78	-1.7	-	71
30	39.125	1.352	1.11	78	-1.8	100	71
31	40.475	1.350	1.11	79	-1.9	-	71

BOX C TEST DATA - ASTM E2618 / ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 4

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Particulate Sampling Data						
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)
32	41.826	1.351	1.10	79	-1.8	-	71
33	43.175	1.349	1.11	79	-1.8	-	71
34	44.528	1.353	1.12	80	-1.9	-	71
35	45.882	1.354	1.11	79	-1.7	-	71
36	47.229	1.347	1.12	80	-1.7	-	71
37	48.581	1.352	1.12	80	-1.7	-	71
38	49.940	1.359	1.11	81	-1.8	-	71
39	51.305	1.365	1.12	81	-1.9	-	71
40	52.668	1.363	1.12	81	-1.9	102	71
41	54.033	1.365	1.11	82	-1.7	-	71
42	55.403	1.370	1.12	83	-1.8	-	71
43	56.765	1.362	1.13	83	-1.7	-	71
44	58.126	1.361	1.11	83	-1.9	-	71
45	59.485	1.359	1.12	83	-1.7	-	71
46	60.839	1.354	1.13	84	-2.0	-	71
47	62.207	1.368	1.11	84	-1.9	-	71
48	63.578	1.371	1.12	85	-1.7	-	71
49	64.950	1.372	1.10	83	-1.9	-	71
50	66.326	1.376	1.12	85	-1.7	101	71
51	67.692	1.366	1.13	85	-1.7	-	71
52	69.059	1.367	1.15	85	-1.9	-	71
53	70.416	1.357	1.14	85	-1.8	-	71
54	71.779	1.363	1.14	85	-1.8	-	71
55	73.158	1.379	1.14	85	-1.9	-	71
56	74.533	1.375	1.14	86	-1.9	-	71
57	75.913	1.380	1.12	86	-1.8	-	71
58	77.282	1.369	1.13	88	-1.8	-	71
59	78.652	1.370	1.14	87	-1.9	-	71
60	80.009	1.357	1.14	87	-1.7	102	71
Avg/Tot	80.009	1.333	1.07	78.8	-1.8	99	70.6

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
0	2.05	N/A	70.80	154.30	182	163	1.00	17.07	
1	2.07	N/A	70.80	154.70	182	163	1.00	17.25	1449
2	2.08	N/A	70.80	154.70	182	163	1.00	17.31	1454
3	2.08	N/A	70.80	154.80	182	163	1.00	17.30	1455
4	2.07	N/A	70.80	154.90	182	163	1.00	17.25	1453
5	2.05	N/A	70.80	154.80	182	163	1.00	17.01	1431
6	2.08	N/A	70.80	154.60	182	163	1.00	17.34	1455
7	2.08	N/A	70.80	154.30	182	163	1.00	17.30	1446
8	2.08	N/A	70.80	154.20	182	163	1.00	17.34	1448
9	2.08	N/A	70.80	154.10	181	163	1.00	17.34	1446
10	2.08	N/A	70.80	154.10	181	163	1.00	17.26	1440
11	2.09	N/A	70.70	154.10	182	163	1.00	17.39	1452
12	2.08	N/A	70.80	154.20	182	163	1.00	17.30	1445
13	2.08	N/A	70.70	154.50	182	163	1.00	17.32	1453
14	2.07	N/A	70.70	154.50	182	163	1.00	17.23	1446
15	2.08	N/A	70.70	154.70	182	163	1.00	17.33	1457
16	2.09	N/A	70.70	154.70	182	163	1.00	17.35	1459
17	2.08	N/A	70.70	154.70	182	163	1.00	17.28	1453
18	2.09	N/A	70.70	154.70	182	163	1.00	17.39	1462
19	2.08	N/A	70.60	154.50	182	163	1.00	17.31	1454
20	2.09	N/A	70.60	154.30	182	163	1.00	17.35	1454
21	2.07	N/A	70.60	154.30	182	163	1.00	17.25	1445
22	2.07	N/A	70.60	154.20	182	163	1.00	17.20	1440
23	2.08	N/A	70.60	154.20	182	163	1.00	17.30	1448
24	2.10	N/A	70.60	154.30	182	163	1.00	17.49	1465
25	2.08	N/A	70.60	154.30	182	163	1.00	17.29	1449
26	2.08	N/A	70.60	154.30	182	163	1.00	17.31	1451
27	2.07	N/A	70.60	154.40	182	163	1.00	17.25	1448
28	2.07	N/A	70.60	154.30	182	163	1.00	17.23	1444
29	2.08	N/A	70.60	154.30	182	163	1.00	17.32	1451
30	2.09	N/A	70.50	154.30	182	163	1.00	17.40	1460
31	2.09	N/A	70.50	154.30	182	163	1.00	17.39	1459
32	2.08	N/A	70.50	154.50	182	163	1.00	17.30	1455
33	2.08	N/A	70.50	154.50	182	163	1.00	17.27	1452
34	2.08	N/A	70.50	154.60	182	163	1.00	17.30	1456
35	2.09	N/A	70.50	154.50	182	163	1.00	17.35	1459
36	2.09	N/A	70.50	154.50	182	163	1.00	17.39	1462
37	2.08	N/A	70.50	154.50	182	163	1.00	17.29	1454
38	2.08	N/A	70.50	154.20	182	163	1.00	17.28	1448
39	2.08	N/A	70.50	154.50	182	163	1.00	17.28	1453
40	2.07	N/A	70.50	154.20	182	163	1.00	17.20	1441
41	2.08	N/A	70.50	154.40	182	163	1.00	17.32	1455
42	2.07	N/A	70.40	154.40	182	163	1.00	17.19	1446
43	2.08	N/A	70.40	154.60	182	163	1.00	17.34	1462
44	2.08	N/A	70.40	154.40	182	163	1.00	17.34	1458
45	2.06	N/A	70.40	154.50	182	163	1.00	17.16	1444
46	2.08	N/A	70.40	154.50	182	163	1.00	17.26	1454
47	2.09	N/A	70.50	154.30	182	163	1.00	17.35	1455

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
48	2.08	N/A	70.50	154.20	182	163	1.00	17.33	1452
49	2.08	N/A	70.50	154.20	182	163	1.00	17.30	1450
50	2.08	N/A	70.50	154.20	182	163	1.00	17.32	1451
51	2.06	N/A	70.50	154.40	182	163	1.00	17.16	1442
52	2.06	N/A	70.40	154.80	182	163	1.00	17.14	1448
53	2.05	N/A	70.40	154.70	182	163	1.00	17.08	1442
54	2.05	N/A	70.40	154.90	182	163	1.00	17.04	1441
55	2.06	N/A	70.40	155.30	182	164	1.00	17.17	1460
56	2.06	N/A	70.40	155.00	182	163	1.00	17.11	1449
57	2.05	N/A	70.40	154.90	182	163	1.00	17.06	1444
58	2.08	N/A	70.40	154.60	182	163	1.00	17.34	1462
59	2.07	N/A	70.40	154.40	182	163	1.00	17.21	1448
60	2.09	N/A	70.40	154.20	182	163	1.00	17.36	1457
61	2.08	N/A	70.30	154.00	181	163	1.00	17.32	1452
62	2.07	N/A	70.30	154.10	182	163	1.00	17.22	1445
63	2.08	N/A	70.30	154.10	182	163	1.00	17.32	1453
64	2.09	N/A	70.30	154.30	182	163	1.00	17.39	1462
65	2.07	N/A	70.30	154.50	182	163	1.00	17.21	1450
66	2.08	N/A	70.30	154.50	182	163	1.00	17.27	1456
67	2.08	N/A	70.30	154.70	182	163	1.00	17.30	1462
68	2.07	N/A	70.20	154.60	182	163	1.00	17.24	1457
69	2.08	N/A	70.20	154.60	182	163	1.00	17.26	1459
70	2.08	N/A	70.20	154.40	182	163	1.00	17.34	1462
71	2.07	N/A	70.20	154.40	182	163	1.00	17.25	1454
72	2.07	N/A	70.20	154.20	182	163	1.00	17.23	1449
73	2.07	N/A	70.20	154.20	182	163	1.00	17.22	1448
74	2.07	N/A	70.20	154.30	182	163	1.00	17.26	1453
75	2.04	N/A	70.20	154.50	182	163	1.00	16.96	1431
76	2.07	N/A	70.20	154.60	182	163	1.00	17.26	1458
77	2.09	N/A	70.20	155.00	182	164	1.00	17.41	1478
78	2.09	N/A	70.20	154.70	182	163	1.00	17.37	1470
79	2.08	N/A	70.20	154.50	182	163	1.00	17.30	1460
80	2.09	N/A	70.10	154.40	182	163	1.00	17.38	1467
81	2.09	N/A	70.00	154.30	182	163	1.00	17.38	1467
82	2.07	N/A	69.90	154.30	182	163	1.00	17.23	1456
83	2.07	N/A	69.90	154.20	182	163	1.00	17.21	1453
84	2.04	N/A	69.90	154.40	182	163	1.00	16.99	1437
85	2.08	N/A	69.80	154.60	182	163	1.00	17.27	1466
86	2.08	N/A	69.80	154.70	182	163	1.00	17.33	1473
87	2.07	N/A	69.70	154.60	182	163	1.00	17.23	1465
88	2.08	N/A	69.70	154.40	182	163	1.00	17.27	1464
89	2.09	N/A	69.60	154.30	182	163	1.00	17.37	1473
90	2.07	N/A	69.60	154.10	182	163	1.00	17.23	1458
91	2.08	N/A	69.60	154.10	182	163	1.00	17.28	1462
92	2.06	N/A	69.50	154.30	182	163	1.00	17.15	1456
93	2.07	N/A	69.50	154.30	182	163	1.00	17.20	1460
94	2.06	N/A	69.50	154.40	182	163	1.00	17.16	1458
95	2.09	N/A	69.50	154.60	182	163	1.00	17.38	1481

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
96	2.07	N/A	69.50	154.70	182	163	1.00	17.22	1468
97	2.07	N/A	69.50	154.70	182	163	1.00	17.20	1467
98	2.06	N/A	69.50	154.60	182	163	1.00	17.13	1460
99	2.06	N/A	69.50	154.50	182	163	1.00	17.10	1455
100	2.08	N/A	69.50	154.40	182	163	1.00	17.34	1474
101	2.07	N/A	69.50	154.50	182	163	1.00	17.24	1467
102	2.04	N/A	69.50	154.70	182	163	1.00	16.98	1449
103	2.07	N/A	69.50	154.50	182	163	1.00	17.24	1467
104	2.06	N/A	69.50	154.60	182	163	1.00	17.13	1460
105	2.08	N/A	69.50	154.40	182	163	1.00	17.31	1471
106	2.08	N/A	69.50	154.60	182	163	1.00	17.32	1475
107	2.07	N/A	69.50	154.60	182	163	1.00	17.25	1470
108	2.06	N/A	69.50	154.50	182	163	1.00	17.12	1457
109	2.09	N/A	69.50	154.70	182	163	1.00	17.41	1485
110	2.08	N/A	69.50	154.50	182	163	1.00	17.28	1471
111	2.02	N/A	69.50	154.40	182	163	1.00	16.83	1431
112	2.07	N/A	69.50	154.60	182	163	1.00	17.26	1470
113	2.07	N/A	69.60	154.60	182	163	1.00	17.19	1463
114	2.06	N/A	69.60	154.40	182	163	1.00	17.11	1452
115	2.07	N/A	69.60	154.50	182	163	1.00	17.26	1467
116	2.03	N/A	69.60	154.40	182	163	1.00	16.88	1433
117	2.07	N/A	69.60	154.40	182	163	1.00	17.24	1464
118	2.09	N/A	69.60	154.50	182	163	1.00	17.38	1477
119	2.08	N/A	69.60	154.50	182	163	1.00	17.32	1472
120	2.09	N/A	69.70	154.70	182	163	1.00	17.36	1477
121	2.03	N/A	69.70	154.50	182	163	1.00	16.87	1432
122	2.12	N/A	69.70	154.50	182	163	1.00	17.63	1497
123	2.07	N/A	69.70	154.50	182	163	1.00	17.23	1463
124	2.09	N/A	69.70	154.40	182	163	1.00	17.38	1474
125	2.08	N/A	69.70	154.20	182	163	1.00	17.33	1466
126	2.08	N/A	69.70	154.40	182	163	1.00	17.33	1470
127	2.09	N/A	69.70	154.50	182	163	1.00	17.42	1479
128	2.07	N/A	69.70	154.60	182	163	1.00	17.19	1461
129	2.08	N/A	69.80	154.80	182	163	1.00	17.27	1469
130	2.08	N/A	69.80	154.90	182	163	1.00	17.28	1472
131	2.08	N/A	69.80	154.80	182	163	1.00	17.33	1475
132	2.09	N/A	69.80	154.60	182	163	1.00	17.38	1476
133	2.08	N/A	69.80	154.60	182	163	1.00	17.34	1472
134	2.10	N/A	69.80	154.20	182	163	1.00	17.46	1476
135	2.09	N/A	69.80	154.10	182	162	1.00	17.41	1470
136	2.10	N/A	69.80	154.30	182	163	1.00	17.51	1481
137	2.09	N/A	69.90	154.40	182	163	1.00	17.36	1468
138	2.07	N/A	70.00	154.70	182	163	1.00	17.26	1463
139	2.06	N/A	69.90	154.70	182	163	1.00	17.12	1454
140	2.07	N/A	69.80	154.50	182	163	1.00	17.22	1461
141	2.09	N/A	69.80	154.40	182	163	1.00	17.36	1470
142	2.10	N/A	69.80	154.50	182	163	1.00	17.43	1478
143	2.08	N/A	69.90	154.20	182	162	1.00	17.32	1462

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
144	2.10	N/A	69.90	154.20	182	162	1.00	17.43	1471
145	2.09	N/A	69.90	154.30	182	163	1.00	17.42	1472
146	2.09	N/A	69.90	154.30	182	163	1.00	17.36	1467
147	2.08	N/A	69.80	154.40	182	163	1.00	17.27	1462
148	2.09	N/A	69.80	154.50	182	163	1.00	17.40	1475
149	2.07	N/A	69.70	154.50	182	163	1.00	17.25	1464
150	2.09	N/A	69.60	154.60	182	163	1.00	17.42	1483
151	2.09	N/A	69.60	154.40	182	162	1.00	17.42	1479
152	2.08	N/A	69.50	154.50	182	162	1.00	17.33	1475
153	2.09	N/A	69.40	154.50	182	162	1.00	17.38	1481
154	2.10	N/A	69.40	154.50	182	163	1.00	17.47	1488
155	2.09	N/A	69.50	154.80	182	163	1.00	17.37	1484
156	2.08	N/A	69.50	155.00	182	163	1.00	17.34	1484
157	2.10	N/A	69.50	154.90	182	163	1.00	17.43	1490
158	2.11	N/A	69.40	154.90	182	163	1.00	17.56	1503
159	2.09	N/A	69.50	154.80	182	163	1.00	17.42	1487
160	2.08	N/A	69.50	154.90	182	163	1.00	17.31	1480
161	2.09	N/A	69.60	154.80	182	163	1.00	17.38	1483
162	2.08	N/A	69.60	154.60	182	163	1.00	17.34	1476
163	2.10	N/A	69.50	154.50	182	163	1.00	17.51	1490
164	2.08	N/A	69.50	154.40	182	162	1.00	17.30	1470
165	2.07	N/A	69.60	154.40	182	163	1.00	17.26	1465
166	2.09	N/A	69.60	154.30	182	162	1.00	17.39	1475
167	2.10	N/A	69.60	154.50	182	162	1.00	17.47	1485
168	2.11	N/A	69.60	154.60	182	163	1.00	17.53	1492
169	2.09	N/A	69.70	154.90	182	163	1.00	17.35	1480
170	2.08	N/A	69.80	155.00	182	163	1.00	17.31	1476
171	2.09	N/A	69.80	155.00	182	163	1.00	17.35	1480
172	2.11	N/A	69.90	155.00	182	163	1.00	17.51	1492
173	2.08	N/A	69.90	154.90	182	163	1.00	17.31	1473
174	2.08	N/A	70.00	154.70	182	163	1.00	17.31	1468
175	2.09	N/A	70.00	154.60	182	162	1.00	17.35	1469
176	2.09	N/A	69.90	154.40	182	162	1.00	17.41	1473
177	2.09	N/A	69.90	154.50	182	162	1.00	17.42	1476
178	2.09	N/A	69.90	154.70	182	162	1.00	17.42	1479
179	2.09	N/A	69.90	154.60	182	162	1.00	17.41	1477
180	2.11	N/A	69.90	155.00	182	163	1.00	17.54	1494
181	2.10	N/A	69.90	154.90	182	163	1.00	17.51	1490
182	2.09	N/A	69.80	155.00	182	163	1.00	17.36	1481
183	2.09	N/A	69.80	155.20	182	163	1.00	17.36	1484
184	2.09	N/A	69.70	155.20	182	163	1.00	17.42	1491
185	2.09	N/A	69.80	155.20	182	163	1.00	17.38	1486
186	2.09	N/A	69.80	155.10	182	163	1.00	17.42	1488
187	2.10	N/A	69.80	154.90	182	163	1.00	17.48	1489
188	2.09	N/A	69.80	154.80	182	163	1.00	17.40	1481
189	2.09	N/A	69.70	154.70	182	163	1.00	17.42	1483
190	2.09	N/A	69.50	154.60	182	163	1.00	17.37	1480
191	2.10	N/A	69.40	154.70	182	163	1.00	17.51	1495

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Job #: 25-436

Model: BIO 200

Tracking #: 230

Run #: 4

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
192	2.09	N/A	69.40	154.80	182	163	1.00	17.35	1483
193	2.09	N/A	69.30	154.70	182	163	1.00	17.38	1486
194	2.08	N/A	69.30	154.60	182	163	1.00	17.33	1480
195	2.09	N/A	69.40	154.60	182	163	1.00	17.37	1481
196	2.09	N/A	69.40	154.50	182	163	1.00	17.36	1479
197	2.07	N/A	69.30	154.50	182	163	1.00	17.24	1471
198	2.14	N/A	69.30	154.40	182	163	1.00	17.82	1519
199	2.09	N/A	69.30	154.30	182	162	1.00	17.39	1480
200	2.08	N/A	69.40	154.40	182	163	1.00	17.34	1476
201	2.10	N/A	69.50	154.40	182	163	1.00	17.44	1482
202	2.09	N/A	69.60	154.80	182	163	1.00	17.35	1480
203	2.13	N/A	69.60	154.70	182	163	1.00	17.73	1511
204	2.10	N/A	69.70	154.60	182	163	1.00	17.45	1483
205	2.10	N/A	69.70	154.50	182	163	1.00	17.50	1486
206	2.10	N/A	69.80	154.40	182	163	1.00	17.50	1482
207	2.10	N/A	69.70	154.50	182	163	1.00	17.43	1480
208	2.13	N/A	69.70	154.30	182	162	1.00	17.72	1501
209	2.10	N/A	69.70	154.40	182	162	1.00	17.48	1482
210	2.11	N/A	69.70	154.40	182	163	1.00	17.51	1485
211	2.09	N/A	69.70	154.50	182	163	1.00	17.39	1476
212	2.06	N/A	69.70	154.60	182	163	1.00	17.10	1453
213	2.09	N/A	69.70	154.60	182	163	1.00	17.37	1477
214	2.10	N/A	69.60	154.50	182	163	1.00	17.45	1483
215	2.08	N/A	69.70	154.40	182	163	1.00	17.30	1467
216	2.09	N/A	69.80	154.20	182	162	1.00	17.38	1469
217	2.10	N/A	69.90	154.20	182	162	1.00	17.45	1473
218	2.09	N/A	69.90	154.00	182	162	1.00	17.37	1463
219	2.10	N/A	69.90	154.20	182	162	1.00	17.46	1473
220	2.09	N/A	70.00	154.30	182	162	1.00	17.41	1469
221	2.11	N/A	69.90	154.60	182	163	1.00	17.53	1487
222	2.10	N/A	69.70	154.70	182	163	1.00	17.48	1488
223	2.09	N/A	69.60	154.60	182	163	1.00	17.37	1478
224	2.09	N/A	69.60	154.70	182	163	1.00	17.37	1480
225	2.10	N/A	69.70	154.70	182	163	1.00	17.45	1485
226	2.11	N/A	69.70	154.50	182	163	1.00	17.52	1488
227	2.11	N/A	69.60	154.50	182	163	1.00	17.57	1494
228	2.10	N/A	69.50	154.10	182	162	1.00	17.44	1477
229	2.03	N/A	69.60	154.10	181	162	1.00	16.85	1425
230	2.06	N/A	69.60	154.50	182	163	1.00	17.11	1454
231	2.11	N/A	69.60	154.50	182	163	1.00	17.53	1490
232	2.10	N/A	69.70	154.60	182	163	1.00	17.44	1482
233	2.10	N/A	69.70	154.40	182	163	1.00	17.47	1481
234	2.09	N/A	69.80	154.80	182	163	1.00	17.36	1477
235	2.10	N/A	69.80	154.70	182	163	1.00	17.45	1483
236	2.10	N/A	69.90	154.80	182	163	1.00	17.44	1482
237	2.02	N/A	69.90	155.00	182	163	1.00	16.83	1434
238	2.05	N/A	69.90	154.90	182	163	1.00	17.07	1452
239	2.11	N/A	69.90	154.90	182	163	1.00	17.51	1490

WATER FLOW AND TEMPERATURE DATA - ASTM E2618

Client: Greentech

Model: BIO 200

Run #: 4

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/29/2025

Elapsed Time (min)	Flow (GPM)		Temperature Data (°F)				Specific Heat of Inlet Water (BTU/lb-°F)	Mass Flow Rate of Inlet Water (lb/min)	Heat Output (Btu)
	Load Side Flow	Appliance Flow (optional)	HEX Load In	HEX Load Out	HEX Supply In	HEX Supply Out			
240	2.10	N/A	69.50	154.40	182	163	1.00	17.43	1482
Average	2	#DIV/0!	70	155	182	163	1	17	1467
								TOTAL:	352021

LAB SAMPLE DATA - ASTM E2515

Client: Greentech

Model: BIO 200

Run #: 4

Job #: 25-436

Tracking #: 230

Technician: AK

Date: 9/29/2025

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	A	G01377	241.8	244.6	2.8
	B	G01378	243.3	245.8	2.5
	C - 1st Hour	G01379	244.6	244.6	0.0
	Amb	G01380	242.6	242.7	0.1
Probes	A	17A	116811.6	116812.0	0.4
	B	17B	117141.7	117142.2	0.5
	C - 1st Hour	17C	113141.9	113142.3	0.4
O-rings	A	17A	3611.2	3611.2	0.0
	B	17B	3567.6	3568.0	0.4
	C - 1st Hour	17C	3596.0	3596.6	0.6

Placed in Dessicator on:

9/29/2025

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	245.3	10/3 16:00	244.7	10/6 14:00	244.6	10/7 8:30		
	B	246.7	10/3 16:00	246.0	10/6 14:00	245.8	10/7 8:30		
	C - 1st Hour	245.1	10/3 16:00	244.5	10/6 14:00	244.6	10/7 8:30		
	Amb	243.1	10/3 16:00	242.6	10/6 14:00	242.7	10/7 8:30		
Probes	A	116812.0	10/3 16:00	116812.0	10/6 14:00				
	B	117142.1	10/3 16:00	117142.2	10/6 14:00				
	C - 1st Hour	113142.3	10/3 16:00	113142.3	10/6 14:00				
O-Rings	A	3611.4	10/3 16:00	3611.1	10/6 14:00	3611.2	10/7 8:30		
	B	3568.0	10/3 16:00	3568.0	10/6 14:00				
	C - 1st Hour	3596.7	10/3 16:00	3596.6	10/6 14:00				

Train A Aggregate, mg: 3.2

Train B Aggregate, mg: 3.4

Train C Aggregate, mg: 1.0

Ambient, mg: 0.1

ASTM E2618 Hydronic Heater Run Sheets

Client: Greentech Job Number: 25-436 Tracking #: 230
Model: Bio 200 Run Number: 4 Test Date: 9/29/25

Wood Heater Run Notes

Pre-Test Notes

Pre-Test Start Time: 09:18
Target Load (BTU/hr): 53,000 – 106,000

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 11:28
Target Load (BTU/hr): 53,000 – 106,000 (Category 3)

Time	Notes
0 min	Started test sampling
240 min	End of Test

Test Burn End Time: 15:28

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 17.32 CO (%): 4.340
Mid Gas CO₂ (%): 10.00 CO (%): 2.500

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	10:12	10:13	10:14	15:35	15:36	17:37
CO ₂	0.15	17.32	10.25	0.25	17.09	10.12
CO	-0.011	4.345	2.494	-0.023	4.289	2.485

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

Technician Signature: 

Date: 11/7/25

ASTM E2515 - Glass Fiber Filters

Date:	7/23/25	7/28/25					
Time:	14:30	11:00					
	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
G01349	240.1	240.9	-	-	A	25-422	#3
G01350	243.2	243.1	-	-	A		
G01351	242.3	242.3	-	-	A		
G01352	243.2	243.3	-	-	A		
G01353	241.8	241.6	-	-	A		#4
G01354	242.0	242.1	-	-	A		
G01355	243.9	243.8	-	-	A		
G01356	244.6	244.7	-	-	A		
G01357	242.0	241.8	-	-	A	25-443	#3
G01358	243.3	243.3	-	-	A		
G01359	241.7	241.7	-	-	A		
G01360	243.0	242.8	-	-	A		
G01361	242.2	242.2	-	-	A		#4
G01362	243.3	243.4	-	-	A		
G01363	243.6	243.8	-	-	A		
G01364	244.0	244.0	-	-	A		

Date:	9/10/25	9/22/25	9/23/25				
Time:	0900	16:30	0800				
	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
G01365	244.6	244.4	-	-	A	25-436	#1
G01366	242.6	242.7	-	-	A		
G01367	241.7	241.6	-	-	A		
G01368	243.4	243.3	-	-	A		
G01369	242.1	242.3	-	-	A		#2
G01370	243.7	243.7	-	-	A		
G01371	243.9	243.9	-	-	A		
G01372	244.0	244.4	244.3	-	A		
G01373	242.9	243.1	-	-	A		#3
G01374	241.9	242.0	-	-	A		
G01375	241.5	241.7	-	-	A		
G01376	243.4	243.2	-	-	A		
G01377	241.7	241.8	-	-	A		#4
G01378	243.3	243.3	-	-	A		
G01379	244.8	244.6	-	-	A		
G01380	243.0	242.5	242.6	-	A		

ASTM E2515 - Probe Samples 11-20

Date:	8/25/25	9/10/25	9/11/25	-			
Time:	10:45	08:00	08:00	-			
	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
11A	116198.2	116876.1	116876.3	-	A	25-448	#2
11B	117349.5	117349.4	-	-	A		
11C	116198.0	116198.3	116198.3	-	A		
12A	116720.1	116719.7	116719.6	-	A	25-443	#3
12B	117782.7	117782.3	117782.3	-	A		
12C	117181.1	117180.6	117180.5	-	A		
13A	117321.9	117321.3	117321.5	-	A	25-443	#4
13B	116947.5	116947.3	-	-	A		
13C	115654.3	115654.1	-	-	A		
14A	116637.7	116637.5	-	-	A	25-436	#1
14B	116628.3	116628.1	-	-	A		
14C	116537.3	116536.8	116536.9	-	A		
15A	117250.1	117249.6	117249.5	-	B	25-436	#2
15B	116762.5	116762.1	116762.2	-	A		
15C	116848.9	116848.5	116848.5	-	A		

Date:	9/22/25	9/24/25	-	-			
Time:	17:00	10:00	-	-			
	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
16A	116380.4	116380.2	-	-	A	25-436	#3
16B	115863.7	115863.9	-	-	A		
16C	114148.6	114148.4	-	-	A		
17A	116811.8	116811.6	-	-	A	25-436	#4
17B	117141.9	117141.7	-	-	A		
17C	113141.9	113141.9	-	-	A		
18A	117501.1	117500.9	-	-	A	25-448	#1
18B	117333.0	117332.9	-	-	A		
18C	114335.8	114335.6	-	-	A		
19A	117027.1	117026.9	-	-	A	25-448	#2
19B	117014.4	117014.2	-	-	A		
19C	114231.8	114231.7	-	-	A		
20A	115628.4	115628.3	-	-	A	25-446	#1
20B	115967.7	115967.7	-	-	A		
20C	113776.4	113776.2	-	-	A		#2

ASTM E2515 - O-Ring Samples 11-20

Date:	8/25/25	9/10/25	9/11/25	-			
Time:	10:36	0830	08:00	-			
	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
11A	3422.7	3422.6	-	-	A	25-443	#2
11B	4233.7	4233.7	-	-	A		
11C	3587.5	3587.3	-	-	A		
12A	3584.7	3584.6	-	-	A	25-443	#3
12B	3614.3	3614.3	-	-	A		
12C	3549.9	3549.9	-	-	A		
13A	3595.0	3595.0	-	-	A	25-443	#4
13B	3640.2	3640.4	-	-	A		
13C	4408.2	4408.3	-	-	A		
14A	3341.6	3341.7	-	-	A	25-436	#1
14B	3365.9	3366.1	-	-	A		
14C	3442.1	3442.4	3442.3	-	A		
15A	3569.1	3569.4	3569.2	-	A	25-436	#2
15B	3570.6	3570.7	-	-	A		
15C	3395.9	3395.8	-	-	1		

Date:	9/22/25	9/24/25	-	-			
Time:	16:00	10:30	-	-			
	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
16A	3571.6	3571.5	-	-	A	25-436	#3
16B	3636.8	3636.6	-	-	A		
16C	3599.9	3500.1	-	-	A		
17A	3611.2	3611.2	-	-	A	25-436	#4
17B	3567.5	3567.6	-	-	A		
17C	3596.1	3596.0	-	-	A		
18A	3601.2	3601.1	-	-	A	25-448	#1
18B	3544.0	3543.9	-	-	A		
18C	3526.8	3526.6	-	-	A		
19A	3584.6	3584.4	-	-	A	25-448	#2
19B	3630.2	3630.1	-	-	A		
19C	3612.7	3612.7	-	-	A		
20A	3557.5	3557.5	-	-	A	25-446	#1
20B	3612.7	3612.5	-	-	A		
20C	3608.5	3608.3	-	-	A		

Load Flow Rate Verification

[illegible]

CERTIFICATE OF ANALYSIS



ALFRED H KNIGHT

LYRIK.PITZMAN
PFS TECO
11785 SE HIGHWAY 212
CLACKAMAS
OREGON
97015
USA

Location: ALFRED H KNIGHT (AHK) GONZALES, GONZALES,
LOUISIANA, USA, NORTH AMERICA

Vessel: PFS TECO

Date Received: 16-Oct-2025

Test Date(s): 16-Oct-2025 to 17-Oct-2025

Date of Report: 17-Oct-2025

AHK Ref: GB/432054

Material Described As: WOOD PELLETS

Client Ref: PFS TECO- PELLET FUEL SAMPLE

Client Ref.	Test	Unit	As Received	Dry Basis	Dry Ash-Free
<u>Pellet Fuel Sample</u>					
	Total Moisture	%	5.1		
	Total Ash Content	%	0.3	0.3	
	Volatile Matter	%	80.4	84.7	85.0
	Total Sulphur	%	0.01	0.01	0.01
	Chlorine	%	< 0.01	< 0.01	< 0.01
	Carbon	%	48.2	50.8	51.0
	Hydrogen	%	5.82	6.13	6.15
	Nitrogen	%	0.09	0.10	0.10
	Oxygen By Difference	%	40.4	42.6	42.7
	Gross Calorific Value	BTU/lb	8331	8779	8805
	Gross Calorific Value	MJ/kg	19.379	20.420	20.481
	Net Calorific Value	BTU/lb	7726		
	Net Calorific Value	MJ/kg	17.970		

John McIndoe

General Manager

For and on behalf of Alfred H Knight Energy Services Ltd

Pre-Conditioning Data

Client: Greentech Mfg.

Model: Bio200

Date(s): 9/13/2025-9/15/2025

Job #: 50 hour conditioning

Tracking #:

Technician: Cody Holmestad

Medium Burn rate used☒

Catalyst: Yes ☐ No ☒

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	164		A 50 hour continuous burn was conducted at a rate of 33,569 btu's per hour. Black Hills Gold premium wood pellets were used with a moisture content of 7.1%. The draft inducer was set at 44% and no changes were made throughout the duration of the 50 hour conditioning. The total ammount of fuel consumed was 232.6 pounds.
1	172		
2	209		
3	208		
4	197		
5	166		
6	152		
7	155		
8	162		
9	172		
10	206		
11	206		
12	187		
13	149		
14	153		
15	157		
16	163		
17	176		
18	210		
19	200		
20	177		
21	149		
22	153		
23	158		
24	161		
25	169		
26	193		
27	208		
28	199		
29	177		
30	148		
31	151		
32	153		
33	158		
34	178		
35	168		
36	192		
37	210		
38	205		
39	168		
40	159		
41	174		
42	194		
43	206		
44	195		
45	178		

Pre-Conditioning Data

Client: Greentech Mfg.

Job #: 50 hour conditioning

Model: Bio200

Tracking #:

Date(s): 9/13/2025-9/15/2025

Technician: Cody Holmestad

Medium Burn rate used☒

Catalyst: Yes ☐ No ☒

46	166		
47	199		
48	210		
49	201		
50	179		

Sample Calculations – ASTM E2618 & E2515

Client: Greentech
 Model: BIO 200
 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/ft³

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

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:

$$M_{Bdb} = 47.75 \quad \text{kg}$$

$$\theta = 240 \quad \text{min}$$

$$BR = \frac{60 \times 47.7}{240}$$

$$BR = \mathbf{11.94} \quad \text{kg/hr}$$

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

ASTM E2515 equations (9)

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

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 H₂O
 T_s = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
 P_s = Absolute average gas static pressure in dilution tunnel, = $P_{bar} + P_g$, in Hg
 P_{bar} = Barometric pressure at test site, in. Hg
 P_g = Static pressure of tunnel, in. H₂O; (in Hg = in H₂O/13.6)
 M_s =

**The dilution tunnel wet molecular weight; $M_s = 28.78$ assuming a dry weight of 29 lb/lb-mole

Sample calculation:

$$F_p = \frac{13.67}{13.98} = 0.978$$

$$V_s = 0.978 \times 85.49 \times 0.99 \times 0.200 \times \left(\left(\frac{101.0}{29.85} + \frac{460}{-0.12} \right) \times 28.78 \right)^{1/2}$$

$$V_s = 13.38 \text{ ft/s}$$

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

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

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

ASTM E2515 equation (3)

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

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, ft²
- T_{std} = Standard absolute temperature, 528 °R
- P_s = Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g, in Hg
- T_{s(avg)} = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P_{std} = Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 13.38 \times 0.7854 \times \frac{528}{101.0 + 460} \times \frac{29.85 + \frac{-0.12}{13.6}}{29.92}$$

Q_{sd} = 34807.7 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 ₂ O
T_m	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 34.876 \times 1.004 \times \frac{\left(29.85 + \frac{0.93}{13.6} \right)}{\left(92.2 + 460 \right)}$$

$$V_{m(std)} = \mathbf{33.463} \text{ dscf}$$

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 35.612 \times 1.009 \times \frac{\left(29.85 + \frac{1.02}{13.6} \right)}{\left(90.9 + 460 \right)}$$

$$V_{m(std)} = \mathbf{34.427} \text{ dscf}$$

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 27.23 \times 0.999 \times \frac{\left(\underline{29.845} + \frac{0.00}{13.6} \right)}{\left(75.5 + 460 \right)}$$

$$V_{m(std)} = \mathbf{26.743} \text{ dscf}$$

m_n – Total Particulate Matter Collected, mg

ASTM E2515 Equation (12)

$$m_n = m_p + m_f + m_g$$

Where:

- m_p = mass of particulate matter from probe, mg
 m_f = mass of particulate matter from filters, mg
 m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train A:

$$m_n = 4.9 + 0.6 + 0.2$$

$$m_n = 5.7 \text{ mg}$$

Using equation for Train B:

$$m_n = 5.2 + 0.1 + 0$$

$$m_n = 5.3 \text{ mg}$$

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

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

Where:

K₂ = Constant, 0.001 g/mg
 m_n = Total mass of particulate matter collected in the sampling train, mg
 V_{m(std)} = Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{0.0}{33.46}$$

$$C_s = \mathbf{0.00000} \text{ g/dscf}$$

For Train 2

$$C_s = 0.001 \times \frac{5.3}{34.43}$$

$$C_s = \mathbf{0.00015} \text{ g/dscf}$$

For Ambient Train

$$C_r = 0.001 \times \frac{0.3}{26.74}$$

$$C_r = \mathbf{0.000011} \text{ g/dscf}$$

E_T – Total Particulate Emissions, g

ASTM E2515 equation (15)

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

Where:

C _s	=	Concentration of particulate matter in tunnel gas, g/dscf
C _r	=	Concentration particulate matter room air, g/dscf
Q _{std}	=	Average dilution tunnel gas flow rate, dscf/hr
θ	=	Total time of test run, minutes

Sample calculation:

For Train 1

$$E_T = (0.000000 - 0.000011) \times 34807.7 \times 240 / 60$$

$$E_T = -1.56 \text{ g}$$

For Train 2

$$E_T = (0.000154 - 0.000011) \times 34807.7 \times 240 / 60$$

$$E_T = 19.87 \text{ g}$$

Average

$$E = 9.16 \text{ g}$$

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

$$7.5\% \text{ of the average} = 0.69$$

$$\text{Train 1 difference} = 10.72$$

$$\text{Train 2 difference} = 10.72$$

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

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

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

$$PR = \left(\frac{240 \times 0.132 \times 13.38 \times (99.4 + 460) \times (92.2 + 460)}{1 \times 34.876 \times 13.36 \times (101.0 + 460) \times (73.9 + 460)} \right) \times 100$$

$$PR = 94 \%$$

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:

$$E_T (\text{Dual train average}) = 9.16 \text{ g}$$

$$\theta = 240 \text{ min}$$

$$PM_R = 60 \times (9.16 / 240)$$

$$PM_R = \mathbf{2.29} \text{ g/hr}$$

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:

$$E_T \text{ (Dual train average)} = 9.16 \text{ g}$$

$$M_{Bdb} = 47.75 \text{ kg}$$

$$PM_F = 9.16 / 47.75$$

$$PM_F = \mathbf{0.19} \text{ g/kg}$$

PFS TECO
 Proj 25-236 R1 Greentech BIO200 Solid Fuel Fired Hydronic Heater

210	0.00	0.01	15.47	14.4%	20.85	5.15	100.0	87.0%	87.7%	8.1	2.00	88.86	8.14	88.84	4305	4.20	8.15	2.07	10070.00	4.00	76.80	21.11	2.85	11.07	-0.01	0.36	42.45	15.26	0.10	-0.00	201.31	30.70	2.81	300.43	2760.00	2008.61	2760.45	2614.62	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	-4	0.17	-0.06
210	0.00	0.01	15.50	14.4%	20.86	5.16	100.0	87.0%	87.7%	7.9	2.00	88.86	8.08	88.81	4301	4.20	8.15	2.07	10070.00	4.00	76.80	21.12	2.86	11.02	-0.01	0.37	42.46	15.26	0.10	-0.00	201.36	30.71	2.81	300.44	2760.00	2008.60	2760.46	2614.61	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	-1	0.17	-0.06
210	0.00	0.01	15.53	14.4%	20.87	5.17	100.0	87.0%	87.7%	7.8	2.00	88.86	8.01	88.73	4297	4.20	8.15	2.07	10070.00	4.00	76.80	21.13	2.87	10.96	-0.00	0.38	42.47	15.26	0.10	-0.00	201.41	30.72	2.81	300.45	2760.00	2008.59	2760.47	2614.60	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	0	0.17	-0.06
210	0.00	0.01	15.56	14.4%	20.88	5.18	100.0	87.0%	87.7%	7.6	2.00	88.86	7.94	88.65	4293	4.20	8.15	2.07	10070.00	4.00	76.80	21.14	2.88	10.89	-0.00	0.39	42.48	15.26	0.10	-0.00	201.46	30.73	2.81	300.46	2760.00	2008.58	2760.48	2614.59	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	1	0.17	-0.06
210	0.00	0.01	15.59	14.4%	20.89	5.19	100.0	87.0%	87.7%	7.4	2.00	88.86	7.87	88.56	4289	4.20	8.15	2.07	10070.00	4.00	76.80	21.15	2.89	10.82	-0.00	0.40	42.49	15.26	0.10	-0.00	201.51	30.74	2.81	300.47	2760.00	2008.57	2760.49	2614.58	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	2	0.17	-0.06
210	0.00	0.01	15.62	14.4%	20.90	5.20	100.0	87.0%	87.7%	7.2	2.00	88.86	7.80	88.47	4285	4.20	8.15	2.07	10070.00	4.00	76.80	21.16	2.90	10.75	-0.00	0.41	42.50	15.26	0.10	-0.00	201.56	30.75	2.81	300.48	2760.00	2008.56	2760.50	2614.57	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	3	0.17	-0.06
210	0.00	0.01	15.65	14.4%	20.91	5.21	100.0	87.0%	87.7%	7.0	2.00	88.86	7.73	88.38	4281	4.20	8.15	2.07	10070.00	4.00	76.80	21.17	2.91	10.68	-0.00	0.42	42.51	15.26	0.10	-0.00	201.61	30.76	2.81	300.49	2760.00	2008.55	2760.51	2614.56	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	4	0.17	-0.06
210	0.00	0.01	15.68	14.4%	20.92	5.22	100.0	87.0%	87.7%	6.8	2.00	88.86	7.66	88.29	4277	4.20	8.15	2.07	10070.00	4.00	76.80	21.18	2.92	10.61	-0.00	0.43	42.52	15.26	0.10	-0.00	201.66	30.77	2.81	300.50	2760.00	2008.54	2760.52	2614.55	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	5	0.17	-0.06
210	0.00	0.01	15.71	14.4%	20.93	5.23	100.0	87.0%	87.7%	6.6	2.00	88.86	7.59	88.20	4273	4.20	8.15	2.07	10070.00	4.00	76.80	21.19	2.93	10.54	-0.00	0.44	42.53	15.26	0.10	-0.00	201.71	30.78	2.81	300.51	2760.00	2008.53	2760.53	2614.54	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	6	0.17	-0.06
210	0.00	0.01	15.74	14.4%	20.94	5.24	100.0	87.0%	87.7%	6.4	2.00	88.86	7.52	88.11	4269	4.20	8.15	2.07	10070.00	4.00	76.80	21.20	2.94	10.47	-0.00	0.45	42.54	15.26	0.10	-0.00	201.76	30.79	2.81	300.52	2760.00	2008.52	2760.54	2614.53	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	7	0.17	-0.06
210	0.00	0.01	15.77	14.4%	20.95	5.25	100.0	87.0%	87.7%	6.2	2.00	88.86	7.45	88.02	4265	4.20	8.15	2.07	10070.00	4.00	76.80	21.21	2.95	10.40	-0.00	0.46	42.55	15.26	0.10	-0.00	201.81	30.80	2.81	300.53	2760.00	2008.51	2760.55	2614.52	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	8	0.17	-0.06
210	0.00	0.01	15.80	14.4%	20.96	5.26	100.0	87.0%	87.7%	6.0	2.00	88.86	7.38	87.93	4261	4.20	8.15	2.07	10070.00	4.00	76.80	21.22	2.96	10.33	-0.00	0.47	42.56	15.26	0.10	-0.00	201.86	30.81	2.81	300.54	2760.00	2008.50	2760.56	2614.51	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	9	0.17	-0.06
210	0.00	0.01	15.83	14.4%	20.97	5.27	100.0	87.0%	87.7%	5.8	2.00	88.86	7.31	87.84	4257	4.20	8.15	2.07	10070.00	4.00	76.80	21.23	2.97	10.26	-0.00	0.48	42.57	15.26	0.10	-0.00	201.91	30.82	2.81	300.55	2760.00	2008.49	2760.57	2614.50	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	10	0.17	-0.06
210	0.00	0.01	15.86	14.4%	20.98	5.28	100.0	87.0%	87.7%	5.6	2.00	88.86	7.24	87.75	4253	4.20	8.15	2.07	10070.00	4.00	76.80	21.24	2.98	10.19	-0.00	0.49	42.58	15.26	0.10	-0.00	201.96	30.83	2.81	300.56	2760.00	2008.48	2760.58	2614.49	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	11	0.17	-0.06
210	0.00	0.01	15.89	14.4%	20.99	5.29	100.0	87.0%	87.7%	5.4	2.00	88.86	7.17	87.66	4249	4.20	8.15	2.07	10070.00	4.00	76.80	21.25	2.99	10.12	-0.00	0.50	42.59	15.26	0.10	-0.00	202.01	30.84	2.81	300.57	2760.00	2008.47	2760.59	2614.48	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	12	0.17	-0.06
210	0.00	0.01	15.92	14.4%	21.00	5.30	100.0	87.0%	87.7%	5.2	2.00	88.86	7.10	87.57	4245	4.20	8.15	2.07	10070.00	4.00	76.80	21.26	3.00	10.05	-0.00	0.51	42.60	15.26	0.10	-0.00	202.06	30.85	2.81	300.58	2760.00	2008.46	2760.60	2614.47	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	13	0.17	-0.06
210	0.00	0.01	15.95	14.4%	21.01	5.31	100.0	87.0%	87.7%	5.0	2.00	88.86	7.03	87.48	4241	4.20	8.15	2.07	10070.00	4.00	76.80	21.27	3.01	9.98	-0.00	0.52	42.61	15.26	0.10	-0.00	202.11	30.86	2.81	300.59	2760.00	2008.45	2760.61	2614.46	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	14	0.17	-0.06
210	0.00	0.01	15.98	14.4%	21.02	5.32	100.0	87.0%	87.7%	4.8	2.00	88.86	6.96	87.39	4237	4.20	8.15	2.07	10070.00	4.00	76.80	21.28	3.02	9.91	-0.00	0.53	42.62	15.26	0.10	-0.00	202.16	30.87	2.81	300.60	2760.00	2008.44	2760.62	2614.45	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	15	0.17	-0.06
210	0.00	0.01	16.01	14.4%	21.03	5.33	100.0	87.0%	87.7%	4.6	2.00	88.86	6.89	87.30	4233	4.20	8.15	2.07	10070.00	4.00	76.80	21.29	3.03	9.84	-0.00	0.54	42.63	15.26	0.10	-0.00	202.21	30.88	2.81	300.61	2760.00	2008.43	2760.63	2614.44	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	16	0.17	-0.06
210	0.00	0.01	16.04	14.4%	21.04	5.34	100.0	87.0%	87.7%	4.4	2.00	88.86	6.82	87.21	4229	4.20	8.15	2.07	10070.00	4.00	76.80	21.30	3.04	9.77	-0.00	0.55	42.64	15.26	0.10	-0.00	202.26	30.89	2.81	300.62	2760.00	2008.42	2760.64	2614.43	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	17	0.17	-0.06
210	0.00	0.01	16.07	14.4%	21.05	5.35	100.0	87.0%	87.7%	4.2	2.00	88.86	6.75	87.12	4225	4.20	8.15	2.07	10070.00	4.00	76.80	21.31	3.05	9.70	-0.00	0.56	42.65	15.26	0.10	-0.00	202.31	30.90	2.81	300.63	2760.00	2008.41	2760.65	2614.42	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	18	0.17	-0.06
210	0.00	0.01	16.10	14.4%	21.06	5.36	100.0	87.0%	87.7%	4.0	2.00	88.86	6.68	87.03	4221	4.20	8.15	2.07	10070.00	4.00	76.80	21.32	3.06	9.63	-0.00	0.57	42.66	15.26	0.10	-0.00	202.36	30.91	2.81	300.64	2760.00	2008.40	2760.66	2614.41	2328.10	207.27	90.00	40.11	7.05	608.36	-16.16	1663.15	100.01	2390.06	633.04	-1.66	208.86	2767	19	0.17	-0.06
210	0.00	0.01	16.13	14.4%	21.07	5.37	100.0	87.0%	87.7%	3.																																													



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Mr. Ken Morgan
Technical Services Director
OMNI-Test Laboratories, INC
Post Office Box 301367
Portland, Oregon, 97294

01/21/2025

Dear Mr. Morgan,

This letter is a modification of my original response letter dated December 13, 2024. This modification is made to include approval to use this alternative 40 CFR part 60, Subpart QQQQ - Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces (Subpart QQQQ). The approval to also use this alternative on central heaters under Subpart QQQQ should have been included in the original response letter. These letters are written in response to your emails and letter dated November 20, 2023, requesting that the Environmental Protection Agency approve for use an alternative test method (ATM) for demonstrating compliance with New Source Performance Standard (NSPS) Subpart AAA, Standards of Performance for New Residential Wood Heaters (Subpart AAA). Specifically, the filter weighing procedures as outlined in ASTM E2515-11 to determine compliance for wood heaters under 40 CFR Part 60. The Office of Air Quality Planning and Standards, as the delegated authority, must make the determination on any major alternatives to test methods and procedures required under 40 CFR parts 59, 60, 61, 63, and 65. Your proposed alternative test method and our approval decisions are discussed below.

Your letter outlines concerns with the gravimetric analysis of the pair of filters used to capture particulate during each compliance test. Specifically, you state that the method suggests that weighing filters and filter assemblies in pairs will reduce measurement error, but that the method provides direction inconsistent with achieving error reduction.

As detailed in your letter ASTM E2515-11 section 9.4.4 states:

"9.4.4 Desiccate the filters, filter gaskets, and the probe assemblies at 20 +/- 5.6°C (68 +/- 10°F) and ambient pressure for at least 24 h. Weigh each component at intervals of not less than 6 h until a constant weight is achieved. Record results to the nearest 0.1 mg. During each weighing, the period for which the components are exposed to the laboratory environment shall be less than 2 min. The filter gaskets can be weighed in sets to be used in each filter holder and kept in an identified container at all times except during sampling and weighing. The filter holder assembly after the front filter need not

be desiccated or weighed.”

As shown above, section 9.4.4 states that “...the filter gaskets may be weighed in pairs”, however it does not say that you may do so for the filter tares.

In contrast, section 10.2.1 of ASTM E2515-11 states:

“10.2.1 Desiccate the filters and filter gaskets at 20 +/- 5.6°C (68 +/-10°F) and ambient pressure for at least 24 h. Weigh each component at intervals of at least 6 h until a constant weight is achieved. Report the results to the nearest 0.1 mg. Filters and filter gaskets may be weighed directly without a Petri dish. They may be weighed in pairs (front and back filters and front and back filter gaskets from same filter train) to reduce handling and weighing errors. During each weighing, the components shall not be exposed to the laboratory atmosphere for longer than 2 min. For the room air background sample filter and filter gasket, treat negative particulate catch weights as “zero” when determining total room air particulate weight in accordance with 10.2.”

Additionally, you point out that section 10.2.1 allows, during post-test analysis, the filters to be weighed in pairs. You also assert that not only does this section state that filters may be weighed in pairs, but it also expresses that it is advantageous to do in order to reduce handling and weighing errors.

Furthermore, during our recent discussions of this issue, you pointed out that since ASTM E2515-11 does not specify that filters may be weighed in pairs during pre-test processing, doing so would likely lead to concerns regarding whether proper procedures were being followed. Also, in response to our inquiry of whether ASTM E2515-11 could be followed as written, where one would weigh both filters independently during pre-test processing (clause 9.4.4) and in pairs during post-test processing (section 10.2.1), you point out that this defeats the intent of section 10.2.1 in that more measurements are being performed than necessary and this goes against the stated intent of reducing handling and weighing errors.

It is your opinion, given the language in ASTM E2515-11 discussed above, that the authors originally intended that both filter gaskets and filters should be weighed in pairs during both pre-test and post-test procedures in order to reduce such errors (as evidenced by the language in section 10.2.1). Based on this, you are asking for consideration and approval of an alternative test method that would allow pre-test processing (taring) of filters in pairs as is currently allowed for filter gaskets in section 9.4.4. As you state, you seek this alternative because the errors imposed by the extra weighing of independent filters can account for a very high degree of error on today’s cleaner stoves where a ± 0.1 mg of measured catch can mean ± 0.2 grams of emissions under ordinary conditions. In light of these circumstances, we agree that appropriate paired weighings must be done during both pre and post test weighings.

We have reviewed your request to perform the pre-test processing (taring) of filters in pairs as is currently allowed for filter gaskets in section 9.4.4 when conducting testing of wood heaters under Subpart AAA. Because of the similarities in the requirements, we are also approving this alternative for use on central heaters under Subpart QQQQ. This approval is contingent on the following conditions:

- All of the pieces of the filter and filter assemblies that are tared together during pre-test assessment must also be weighed together when the post-test gravimetric assessment is made and the results of these assessments must be recorded to the nearest 0.1 mg. Please note that this alternative method approval is valid until such time that Subpart AAA and QQQQ are revised or replaced to require a different certification method, and at such time, this alternative will be reconsidered and possibly withdrawn. A copy of this letter must be included in each certification test report where this alternative test method is utilized.

Since this alternative test method may be of interest to others performing testing as described in ASTM2515-11 on wood heaters subject to 40 CFR 60, Subpart AAA or central heaters subject to Subpart QQQQ, we believe it is reasonable to make it broadly applicable. Therefore, we will post this letter as ALT-154 on the EPA website at <https://www.epa.gov/emc/broadly-applicable-approved-alternative-test-methods> for use by other interested parties.

If you have additional questions regarding this approval, please contact Michael Toney of my staff at 919-541-5247 or toney.mike@epa.gov.

Sincerely,

Steffan M. Johnson, Group Leader
Measurement Technology Group

cc: Shannon Banner, EPA/OAQPS/SPPD
Lessard, Patrick, EPA/OAQPS/SPPD
Rafael Sanchez, EPA/OECA
Robert Scinta, EPA/OECA
Michael Toney, EPA/OAQPS/AQAD
Mark Turner, EPA/OAQPS/SPPD
Richard Wayland, EPA/OAQPS/AQAD

Appendix B: Labels & Manuals



MODEL BIO200
CENTRAL/SUPPLEMENTARY BOILER
LISTED TO ANSI/UL 2523-2018 AND CSA B366.1-11(R2015)

MODÈLES BIO200
CHAUDIÈRE CENTRALE/SUPPLÉMENTAIRE HOMOLOGUÉE
SELON LA NORME UL 2523-2018 ET CSA B366.1-11(R2015)

ELECTRICAL RATING: 115 V, 60 H, 20 AMPS
PUISSANCE ÉLECTRIQUE : 115 V, 60 H, 20 AMPÈRES

INSTALLATION: USE ONLY CHIMNEYS SUITABLE FOR SOLID FUEL. DO NOT CONNECT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE. PLACE ONLY ON NON-COMBUSTIBLE FLOORING WITH ADEQUATE SUPPORT. INDOOR OR OUTDOOR USE. MAINTAIN THE FOLLOWING CLEARANCES TO COMBUSTIBLES:

SIDES=36IN. FRONT=60IN. BACK=36IN. TOP=12IN. CHIM.CONN.=60IN.

THIS APPLIANCE MAY BE CONNECTED TO AN EXISTING BOILER SYSTEM. DO NOT RELOCATE OR BYPASS ANY OF THE SAFETY CONTROLS IN THE ORIGINAL BOILER INSTALLATION.

CAUTION: THIS EQUIPMENT MAY ONLY BE INSTALLED BY QUALIFIED PERSONNEL.

OPERATION: REFER TO OWNERS MANUAL SUPPLIED WITH THIS APPLIANCE. BURN APPROVED FUELS ONLY. LOAD FUEL CAREFULLY OR MAY RESULT IN DAMAGE. IN CASE OF A "RUN-AWAY" FIRE, DISCONNECT FROM ELECTRICAL SUPPLY AND BE SURE ALL DOORS ARE CLOSED TIGHTLY. DANGER- RISK OF FIRE OR EXPLOSION; DO NOT USE CHEMICAL FLUIDS TO START THE FIRE. DO NOT BURN GARBAGE, GASOLINE, NAPHTHA, ENGINE OIL, OR OTHER INAPPROPRIATE MATERIALS. DO NOT STORE FUEL WITHIN THE ABOVE CLEARANCES. DO NOT OPERATE WITH FUEL DOOR, ASH REMOVAL DOOR, OR CLEAN-OUT DOORS OPEN. DO NOT OPERATE THIS APPLIANCE DURING AN ELECTRICAL POWER FAILURE. DISCONNECT ELECTRICAL POWER BEFORE SERVICING. PREMIUM WOOD PELLETS IS THE ONLY AUTHORIZED CONSUMABLE.

CAUTION- HOT SURFACES: KEEP CHILDREN AWAY. DO NOT TOUCH DURING OPERATION.

CAUTION- LOAD FUEL CAREFULLY OR DAMAGE MAY RESULT.

THE HEAT EXCHANGER, FLUE PIPE, AND CHIMNEY MUST BE CLEANED REGULARLY TO REMOVE ACCUMULATED CREOSOTE AND ASH. TO ENSURE THAT THE HEAT EXCHANGER, FLUE PIPE, DRAFT INDUCER, AND CHIMNEY ARE CLEANED AT THE END OF THE HEATING SEASON TO MINIMIZE CORROSION DURING THE SUMMER MONTHS. THE APPLIANCE, FLUE PIPE, AND CHIMNEY MUST BE IN GOOD CONDITION.

THIS APPLIANCE NEEDS PERIODIC INSPECTION AND REPAIR FOR PROPER OPERATION. CONSULT OWNER'S MANUAL FOR FURTHER INFORMATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS APPLIANCE IN A MANNER INCONSISTENT WITH OPERATING INSTRUCTIONS IN THE OWNER'S MANUAL.

U.S. ENVIRONMENTAL PROTECTION AGENCY CERTIFIED TO COMPLY WITH THE 2020 PARTICULATE STANDARDS USING WOOD PELLETS.

TESTED TO ASTM E2618-13

BIO200: AVERAGE EMISSION RATE .08 LBS/MMBTU, MAXIMUM EMISSION RATE 0.088 LBS/MMBTU

INSTALLATION : UTILISER UNIQUEMENT DES CHEMINÉES ADAPTÉES AU COMBUSTIBLE SOLIDE. NE PAS RELIER À UN CONDUIT DE FUMÉE SERVANT UN AUTRE APPAREIL. PLACER UNIQUEMENT SUR UN PLANCHER NON COMBUSTIBLE AVEC UN SOUTIEN ADEQUAT. PEUT ÊTRE UTILISÉ À L'INTÉRIEUR OU À L'EXTÉRIEUR. ASSURER LES DÉGAGEMENTS SUIVANTS ENTRE LES MATIÈRES COMBUSTIBLES :

CÔTES : 91,4 cm AVANT ; 152,4 cm ARRIÈRE ; 91,4 cm DESSUS ; 307,3 cm CONN. DE CHEMINÉE ; 152,4 cm

CET APPAREIL PEUT ÊTRE RELIÉ À UN SYSTÈME DE CHAUDIÈRE EXISTANT. NE PAS DÉPLACER OU CONTOURNER L'UN OU L'AUTRE DES CONTRÔLES DE SÉCURITÉ DANS L'INSTALLATION D'ORIGINE DE LA CHAUDIÈRE.

MISE EN GARDE : CET ÉQUIPEMENT NE PEUT ÊTRE INSTALLÉ QUE PAR DES PERSONNES QUALIFIÉES.

FONCTIONNEMENT : SE REPORTER AU MANUEL D'UTILISATION FOURNI AVEC LE PRÉSENT APPAREIL. NE BRÛLER QUE DES COMBUSTIBLES APPRouvÉS. CHARGER LE COMBUSTIBLE SOIGNEUSEMENT POUR ÉVITER TOUT DOMMAGE. EN CAS D'INCENDIE « INCONTRÔLÉ », DÉBRANCHER DE L'ALIMENTATION ÉLECTRIQUE ET CONFIRMER QUE TOUTES LES PORTES SONT FERMÉES HERMÉTIQUEMENT. DANGER - RISQUE D'INCENDIE OU D'EXPLOSION : NE PAS UTILISER DE FLUIDES CHIMIQUES POUR ALLUMER LE FEU. NE PAS FAIRE BRÛLER DE DÉCHETS, DE L'ESSENCE, DE LA LIGROÏNE, DE L'HUILE À MOTEUR OU D'AUTRES MATIÈRES INAPPROPRIÉES. NE PAS RANGER LE COMBUSTIBLE À L'INTÉRIEUR DES DÉGAGEMENTS INDiquÉS CI-DESSUS. NE PAS FAIRE FONCTIONNER LORSQUE LA PORTE DU COMBUSTIBLE, LA PORTE DE RETRAIT DES CENDRES OU LES PORTES DE RAMONAGE SONT OUVERTES. NE PAS FAIRE FONCTIONNER CET APPAREIL DURANT UNE PANNE D'ÉLECTRICITÉ. DÉBRANCHER L'ALIMENTATION ÉLECTRIQUE AVANT D'EFFECTUER TOUT SERVICE. LES PASTILLES DE BOIS SONT LE SEUL CONSOMMABLE AUTORISÉ.

MISE EN GARDE - SURFACES CHAUDES : TENIR LES ENFANTS À L'ÉCART. NE PAS TOUCHER DURANT LE FONCTIONNEMENT.

MISE EN GARDE - CHARGER LE COMBUSTIBLE SOIGNEUSEMENT POUR ÉVITER TOUT DOMMAGE. L'ÉCHANGEUR DE CHALEUR, LE CARNEAU ET LA CHEMINÉE DOIVENT ÊTRE NETTOYÉS RÉGULIÈREMENT POUR ÉLIMINER TOUTE ACCUMULATION DE CRÉOSOTE ET DE CENDRE. VÉRIFIER QUE L'ÉCHANGEUR DE CHALEUR, LE CARNEAU, LE TIRAGE À INDUIT ET LA CHEMINÉE SONT NETTOYÉS À LA FIN DE LA SAISON DE CHAUFFAGE POUR MINIMISER LA CORROSION DURANT LES MOIS D'ÉTÉ. L'APPAREIL, LE CARNEAU ET LA CHEMINÉE DOIVENT ÊTRE EN BON ÉTAT. CET APPAREIL A BESOIN D'UNE INSPECTION PÉRIODIQUE ET D'UNE RÉPARATION POUR FONCTIONNER CORRECTEMENT. CONSULTER LE MANUEL D'UTILISATION POUR DE PLUS AMPLES INFORMATIONS. LES RÈGLEMENTS FÉDÉRAUX INTERDISENT L'UTILISATION DE CET APPAREIL D'UNE MANIÈRE INCOMPATIBLE AVEC LE MODE D'EMPLOI DU MANUEL D'UTILISATION. CERTIFIÉ PAR L'AGENCE DE PROTECTION DE L'ENVIRONNEMENT DES ÉTATS-UNIS COMME ÉTANT CONFORME AUX NORMES SUR LES PARTICULES DE 2020 EN UTILISANT DES PASTILLES DE BOIS.

TESTÉ EN VERTU DE LA NORME ASTM E2618-13

BIO200 : TAUX D'ÉMISSION MOYEN DE 0,0362 kg/MMBTU, TAUX D'ÉMISSION MAXIMAL DE 0,0399 kg/MMBTU

MODEL/ MODÈLES: BIO200 ☐

DATE MANUFACTURED / DATE DE FABRICATION DE LA CHAUDIÈRE COMPLÉMENTAIRE:

JAN. / JAN. ☐ FEB. / FÉVR. ☐ MARCH / MARS ☐ APR. / AVR. ☐ MAY / MAI ☐ JUNE / JUIN ☐

JULY / JUIL. ☐ AUG. / AOÛT ☐ SEP. / SEPT. ☐ OCT. / OCT. ☐ NOV. / NOV. ☐ DEC. / DÉC. ☐

YEAR / ANNÉE: 2025 ☐ 2026 ☐ 2027 ☐ 2028 ☐ 2029 ☐ 2030 ☐

PFS TECO

Page 206 of 316



**THE MOST
TRUSTED
OUTDOOR
BOILERS**

AUTOMATED BIOMASS SERIES

OWNER'S MANUAL

SAVE THESE INSTRUCTIONS

INSTALLATION, OPERATION & MAINTENANCE | VERSION 2026.1



2716 CRESCENT DR | PO BOX 1237
INTERNATIONAL FALLS, MN 56649
866-361-7355 | WWW.CROWNROYALSTOVES.COM



UL 2523 AND
CSA B366.1



PROTECT YOUR INVESTMENT

COMPLETE YOUR WARRANTY BY REGISTERING YOUR CROWN ROYAL STOVE TODAY

Greentech Manufacturing Inc. offers to the original owner from date of purchase a limited twenty (20) year warranty from date of purchase, with a lifetime commitment guarantee. **To validate this warranty, without exception, you must:**

1. Complete the online warranty form within thirty (30) days of purchase, accessible by the QR code or by visiting www.crownroyalstoves.com/warranty-registration
2. Perform yearly water samples, the first to be received within thirty (30) days of warranty registration (information below)
3. Maintain water quality and strictly comply with the requirements of the owners manual

If, for any reason, you are unable to fill out your stove registration online please contact your dealer or call the factory at 866-361-7355 and we will provide you with a warranty registration form. Please consult <https://www.crownroyalstoves.com/warranty> for the most current warranty information.

ONLINE WARRANTY REGISTRATION FORM



YEARLY WATER TESTS REQUIRED FOR WARRANTY

SIGN UP FOR REMINDERS

Owners must use Crown Royal Stove's approved chemical treatment, available exclusively through your dealer or the factory, and mail water samples to our third party testing facility within 30 days of registration. **Warranty is void if Crown Royal Stoves' approved chemical treatment is not used, if the boiler water is not tested upon installation and at least annually, and sample report recommendations are not followed.** You will get notification of test results by email (if listed) or mail within 3 - 6 weeks. If you are not notified within 30 days please contact your dealer or the factory. If test results come back unsatisfactory, you are required to follow the instructions and retest within 30 days. If you add water to your system for any reason add ½ ounce of inhibitor per gallon of water added and send a new sample of water to the testing laboratory. If in doubt, test. For further information visit www.crownroyalstoves.com/water-treatment

WATER TEST REMINDERS



_____ **RECORD AND KEEP THIS INFORMATION FOR FUTURE REFERENCE** _____

Model: _____ Serial Number: _____ Installation Date: _____

Dealership Name: _____ Dealership Phone Number: _____

Dealership Address: _____

Dealership City: _____ Dealership State: _____ Dealership Zip: _____

Other Dealership Information: _____

CONTENTS

INTRODUCTION.....	5
Specifications.....	6
Dimensions.....	7
Floor Plan.....	7
SAFETY PRECAUTIONS.....	8
PRECAUTIONARY LABELING.....	10
HOW IT WORKS.....	12
Combustion Airflow and Heat Exchanger Process.....	14
COMPONENTS DIAGRAM.....	15
INSTALLATION.....	16
Prohibited Fuels.....	16
Location.....	16
Clearances.....	17
Combustion Air Requirements.....	17
Foundation.....	18
Chimney.....	18
Transfer Lines.....	20
Piping Connections.....	21
Connections Illustration.....	22
Electrical Connections.....	23
CONNECTING TO AN EXISTING SYSTEM.....	24
Recommendations.....	24
Forced Air Furnace Systems.....	25
Hot Water Boiler Systems.....	26
START UP AND OPERATION.....	27
Filling The Water Jacket.....	27
Water Treatment and Testing.....	28
TEMPERATURE SENSOR AND CONTROL OVERVIEW.....	30
Boiler Modes.....	31
Main Keys & Parameters.....	33
Combustion Control Parameters.....	34
Fan Speeds.....	34
Metering Auger Speeds.....	34
Control Panel Screens.....	36
Safety Devices & Alarms.....	39
OPERATING INSTRUCTIONS.....	41
Loading the Fuel Hopper.....	41
Fuel Quality: Why Premium Wood Pellets Matter.....	42
Prohibited Fuels.....	43

Fuel Storage.....	43
STARTUP AND OPERATING INSTRUCTIONS.....	44
Power Up.....	44
Priming.....	44
Ignition.....	44
Combustion Control.....	44
Operating Precautions:.....	45
Prolonged Power Outage.....	46
CARE AND MAINTENANCE.....	47
General Maintenance.....	47
Section 1 : Water Levels.....	47
Section 2 : Firebox Area.....	48
Section 3: Burn Pot Removal, Inspection and Cleaning.....	48
Section 5 : Primary Heat Exchangers.....	49
Section 4 : Ash Container Area.....	49
Section 5 : Heat Exchanger/Turbulator Top Access.....	49
Section 6 : Secondary Heat Exchanger Cleaners.....	49
Section 7 : Ash Removal & Disposal.....	50
Section 8 : Door Seals.....	50
Section 9 : Door Adjustments.....	51
Section 10: Exterior Cleaning.....	51
MAINTENANCE CHECKLIST.....	52
REPLACEMENT PARTS LIST.....	54
TROUBLESHOOTING.....	55
WIRING DIAGRAM.....	60
WATER CARE AND TREATMENT.....	62
WARRANTY.....	65

INTRODUCTION

Welcome and Thank You

Greentech Manufacturing and your dealer would like to express our sincere gratitude for your recent purchase of a Crown Royal Stove. We are honored by the trust you have placed in us and remain committed to providing you with exceptional service and support. Crown Royal Stoves are proudly manufactured in America using domestically sourced, Titanium-Enhanced 409 stainless steel. All welding and assembly are performed in-house at our state-of-the-art facility located in International Falls, MN - proudly known as the *“Icebox of the Nation.”*

Each boiler undergoes multiple pressure tests throughout construction and is assembled with the highest quality materials and meticulous workmanship. Before leaving our facility, every unit is carefully inspected by our quality control experts to ensure superior reliability, safety, and comfort for your family. We are so confident in the quality of our products that every Crown Royal Stove comes with a 20-year limited warranty and our Lifetime Commitment Guarantee.

To ensure the maximum efficiency and life expectancy from your boiler, please read and familiarize yourself with this manual prior to installing, operating, or servicing your boiler. **Always keep this manual for future reference.**

The BIO200 Biomass Boiler was designed as a modern, automated alternative to traditional wood heating. Unlike conventional systems that require manual loading and wood splitting, the BIO200 features an onboard fuel hopper and automatic feed system that delivers consistent fuel to the burn pot as needed.

Equipped with self-ignition, advanced PLC interface, and high-efficiency gasification, this boiler provides clean-burning, reliable heat with minimal effort. Its design emphasizes easy fueling, low maintenance, fuel efficiency, and cost savings. The BIO200 is ideal for heating a single home but is also capable of expanding into multiple buildings or commercial applications.

Key Benefits

- **Extended Burn Times:** A large onboard hopper and automated feed system minimize handling and extend burn durations—lasting from several days to weeks between refueling, depending on load, fuel type, and outdoor temperature. The hopper also includes an interior light and dual “EZ-Fill” loading doors for easy, convenient refueling.
- **High-Efficiency Combustion:** The Omni-O.2 burn pot introduces combustion air 360° around the fuel for complete primary combustion, while also facilitating secondary gasification—achieving cleaner burns and higher thermal efficiency.

- **Enhanced Monitoring:** The firebox door is equipped with a sight glass, allowing live visual inspection of combustion characteristics during operation.
- **Versatile Heating Applications:** Provides dependable heat for homes, garages, workshops, barns, businesses, greenhouses, swimming pools, spas, domestic hot water, radiant in-floor heating, and snow-melt systems.
- **Convenience and Sustainability:** Combines the efficiency and eco-friendliness of biomass heating with the ease and automation of a modern system—delivering dependable warmth without the labor of traditional wood-burning methods.

Specifications

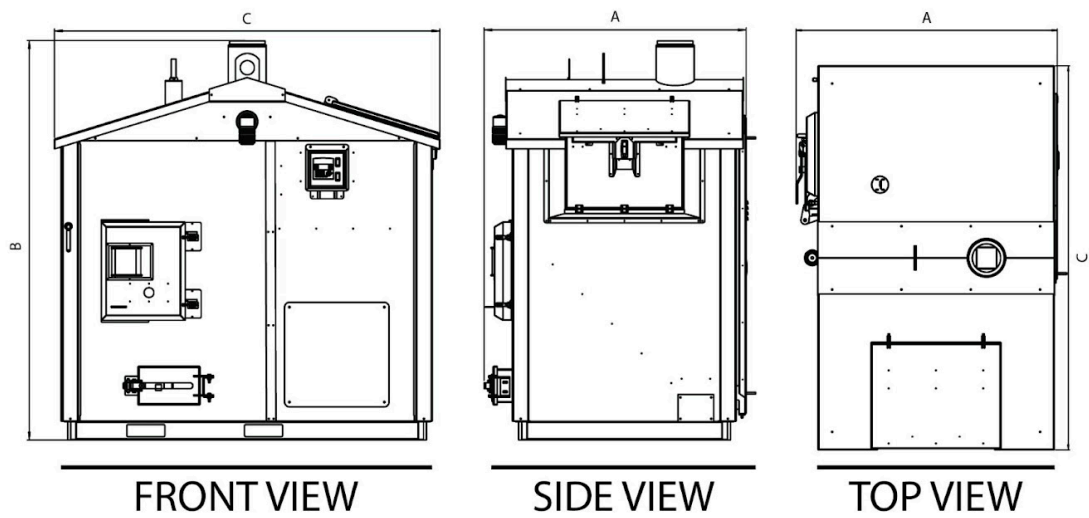
	BIO200
Heat Output Range	20,000 - 212,000 BTUs/hr
Approximate Heating Capacity **	5,000 Sq.Ft.
Weight (Empty)	2,250 lbs
Chimney Size	6"
Burn Pot Size (D" x W" x H")	12.75" x 7.5" x 8"
Firebox Door (L" x H")	16" x 16"
Approximate Water Capacity	135 gal.
Approximate Fuel Capacity	1,400 lbs (with augers full)
Overall Efficiency LHV (lower heating value)*	TBD
Overall Efficiency HHV (higher heating value)*	89.2%
Supply/Return Size	1-1/4" (2 Sets)
Electrical Rating	20 Amp
Average Emissions Rate	.08 lbs/mmmbtu
Maximum Emissions Rate	.088 lbs/mmmbtu
Annual Efficiency Rating	89.2%

*The performance of your BIO200 depends on the quality of fuel, fuel feed rate, combustion efficiency, and how effectively heat is transferred into your home's heating system. These factors are measured using a single hopper load, without refueling, under standardized testing conditions (AFEU method). Real-world results may vary based on fuel quality, quantity loaded, and moisture content. **For best results, always use high-quality, low-moisture (<10%) pellets** approved by the manufacturer, and follow recommended maintenance and loading procedures.

**Listed as capacity in square feet. Be sure to properly size the boiler based on the heating demands of the attached system(s).

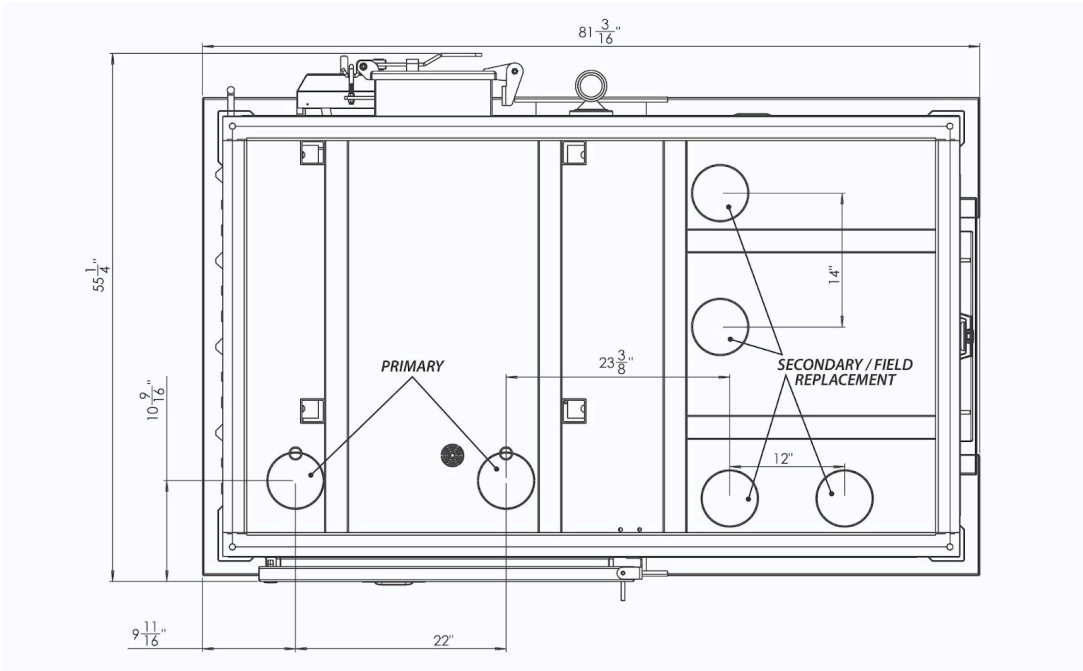
***Total height includes the pre-installed chimney connection. Additional chimney length(s) not included.

Dimensions



	BIO200
Width (C)	81"
Length (A)	55"
Height (B) ***	84"

Floor Plan



SAFETY PRECAUTIONS

Be sure to familiarize each user with the following precautions before operation. All warnings should be taken seriously to protect your safety. Retain this manual and review at the start and end of each heating season and as necessary.

!! DANGER !!	Indicates an immediately dangerous situation which, if ignored, can result in serious injury, death, and/or equipment damage.
WARNING	Indicates a hazardous situation which can result in injury or death to the operator and/or equipment damage.
!! CAUTION !!	Indicates a hazard which can cause harm to the operator and/or equipment.

!! DANGER !!

- DO NOT OPEN ANY DOORS WHILE THE BOILER IS IN OPERATION! The BIO200 operates under negative (draft) pressure; if any of the doors are opened, required air flow will be interrupted and can cause dangerous conditions. Serious injury or damage may result!
- DO NOT OVERFIRE THIS BOILER. Attempts to achieve heat output rates that exceed boiler design specifications can result in permanent damage to the boiler.
- DO NOT start a fire with chemicals, volatile fluids, rubber, plastics or garbage. Some processed wood can contain resins and should NOT be used.
- Only qualified and competent persons with a sound understanding of this heating system should operate this boiler.
- Improper operation could result in property damage, personal injury and/or damage to the heating system, as well as invalidate warranty coverage.
- DO NOT burn garbage, gasoline, drain/waste oil, naphtha, engine oil, railroad ties, particle board, leaves, or any other flammable liquids.
- DO NOT operate the boiler unless all access doors are securely closed.
- DO NOT store fuel or other combustible materials (straw, hay or wood, etc) within the minimum installation clearances. Keep all sides of the boiler clean and clear of obstructions.
- Follow the regular maintenance schedules outlined in this manual.
- All coverplates, enclosures, and guards must always be in place and in good working order during normal operation.
- DANGER: Death can result if you do not disconnect electrical power before accessing the electrical control panel, opening any electrical covers, or replacing any electrical components.
- The automated feed system(s) have moving parts that start and stop automatically when the unit is on. Always use caution around these components (augers, motors, fans, blowers, etc), and never remove any protective guardings during operation.

WARNING

- This boiler needs periodic inspection and maintenance for proper operation. It is against federal regulations to operate this boiler in a manner inconsistent with operating instructions found in this manual.
- All models operate at atmospheric pressure. The water level gauge must fit loosely on the vent opening. Do not obstruct, block or plug the vent tube in any way. **DO NOT ALLOW THE BOILER TO BECOME PRESSURIZED.**
- This boiler cannot be hooked to a chimney that is already serving another appliance. When installing a chimney that is higher than twelve feet, guidelines must be used.
- Hot Surfaces: Keep children and incompetent persons away. Do not touch during operation.
- Be sure the boiler is filled with water before firing. Never fire without the water level being at ½ mark, or higher, on the gauge.
- Load fuel carefully to avoid injury to head, arms, hands, fingers, and any other body parts in close proximity to the hopper and fuel loading doors.
- Follow regular maintenance schedules, including cleaning of all airflow pathways and related mechanical components, including but not limited to firebox, ash chamber, heat exchangers, chimney/flue systems, actuator assemblies, fan blades, motors, blowers, and damper plates.
- Allow the boiler to cool before performing any maintenance or cleaning.
- When cleaning, all ash and coals must be placed in a fire-retardant, closed container, on a noncombustible floor, faraway from all combustible materials, until final disposal. Ashes should remain in the fire-retardant closed container until all cinders have cooled.
- The button “F2: Stop Boiler” is the proper method to shut down the boiler for any reason, as this will initiate a cooldown cycle and attempt to purge/burn off any remaining fuel in the burn chamber. Simply turning off the boiler may leave combustible materials inside that could ignite at random.

!! CAUTION !!

- Local and state building codes, and residential insurance providers, may prohibit the use of solid fuel burning appliances as a primary heat source. An alternative heating system should always be installed.
- Do not install this unit on any combustible surface.
- Check the water level before loading the boiler with fresh fuel.
- Use only premium-quality wood pellets with moisture content below 10%.
- Central Heating (CH) Circulator(s) must run continuously for proper operation of the boiler.
- Ensure no debris or foreign objects enter the fuel hopper (ex. pellet bags) to obstruct the fuel delivery system.
- The firebox sightglass window should be closed when not in use.
- Never attempt to manually ignite the fuel in the burn chamber.

PRECAUTIONARY LABELING



WARNING

BEFORE OPENING HEAT EXCHANGER DOOR FAN MUST BE COMPLETELY STOPPED. HEAT EXCHANGER DOOR IS EQUIPPED WITH A FAN HOUSING AND WHEEL ASSEMBLY. NEVER PLACE HANDS OR OBJECTS IN THE FAN HOUSING OR PERSONAL INJURY MAY RESULT. HEAT EXCHANGER CLEAN-OUT AREA WILL BE VERY HOT. ALWAYS USE HEAT PROTECTED GLOVES WHEN REMOVING TURBULATORS AND CLEANING HEAT EXCHANGER TUBES OR PERSONAL INJURY MAY RESULT.

AVERTISSEMENT

AVANT D'OUVRIR LA PORTE DE L'ÉCHANGEUR DE CHALEUR, LE VENTILATEUR DOIT ÊTRE COMPLÈTEMENT ARRÊTÉ. LA PORTE DE L'ÉCHANGEUR DE CHALEUR EST ÉQUIPÉE D'UN CARTER DE VENTILATEUR ET D'UNE ROUE. NE PLACEZ JAMAIS LES MAINS NI AUCUN OBJET DANS LE CARTER DU VENTILATEUR, SOUS PEINE DE BLESSURES. LA ZONE DE NETTOYAGE DE L'ÉCHANGEUR DE CHALEUR SERA TRÈS CHAUDE. UTILISEZ TOUJOURS DES GANTS DE PROTECTION THERMIQUE POUR RETIRER LES TURBULATEURS ET NETTOYER LES TUBES DE L'ÉCHANGEUR DE CHALEUR, SOUS PEINE DE BLESSURES.

!! CAUTION !!

**AUTOMATED
EQUIPMENT MAY
START UP WITHOUT
WARNING**

!! DANGER !!

**RISK OF FALLING
AND INJURY. NO
ACCESS OR ENTRY.**



**POSSIBLE PINCH POINT. COULD
RESULT IN LOSS OF LIMBS OR DEATH.**

HOW IT WORKS

The **BIO200** is a versatile, fully automated, wood pellet-fired outdoor boiler engineered for simplicity, durability, and long-term reliability. Designed with the user in mind, it delivers extended burn times ranging from several days to weeks between refueling, depending on usage and demand. Built with high-quality components and robust construction, the BIO200 ensures dependable performance for years of operation.

Advanced PLC (Programmable Logic Controller) technology and self-igniting capabilities enable the BIO200 to achieve high-efficiency burn cycles with variable heat output levels up to 212,000 BTU/hr.

Fuel System and Hopper Design

The BIO200 features a large onboard 32 ft³ fuel hopper with a storage capacity of approximately 1,400 pounds of wood pellets. This generously sized hopper allows for extended run times and reduced maintenance intervals. The hopper includes an interior light for convenient loading and dual access doors to simplify refueling.

A unique “EZ-Fill” lower loading door enables users to easily fill the hopper to roughly 60% capacity. Once the “EZ-Fill” door is closed, additional fuel can be loaded through the top access lid to reach full capacity. This design enhances user safety and accessibility while minimizing spillage during loading.

Fuel Delivery and Ignition Process

Fuel is automatically metered and delivered from the hopper into the firebox via dual augers, precisely controlled by the PLC. Once in the burn pot, the fuel awaits ignition. When a call for heat is detected, the system’s electronic ignition activates, rapidly igniting the pellets. After the PLC confirms a successful ignition, it continuously feeds fuel as needed to maintain the desired operating setpoints.

Combustion and Gasification Process

Combustion air is regulated through an actuated damper plate and a variable-speed negative pressure draft fan. Fresh air enters the boiler through the rear damper and is evenly distributed by the “Omni-O.2” burn pot, introducing combustion air 360° around the fuel.

Primary air is drawn upward through orifices in the burn pot, supporting the main combustion. As the burn progresses, the fuel releases gases such as hydrogen, carbon monoxide, and carbon dioxide. Additional secondary air, introduced from above and around the flame, ignites these gases in a process known as gasification. This results in hotter, cleaner combustion, reaching temperatures up to 1,800°F, which maximizes thermal efficiency and minimizes emissions.

Heat Exchange and Exhaust Path

Heat generated in the firebox is transferred directly to the boiler's internal water jacket through two water-filled crossover tubes and the firebox walls. The variable-speed draft fan maintains negative pressure, drawing hot gases downward through a series of heat exchanger tubes beneath the burn pot, where additional heat is extracted.

Exhaust gases then pass through the lower cleanout area, moving across the base of the firebox to further transfer heat before rising through a secondary set of heat exchanger tubes. By the time the exhaust exits through the chimney, temperatures are reduced to as low as 220°F, ensuring optimal energy recovery and efficiency.

Operating Sequence and Firing Stages

During normal operation, once the stove confirms a successful ignition, it initially operates at a low setting for several minutes to establish a stable coal bed in the burn pot. This controlled startup phase ensures consistent combustion and smooth system performance before full operation begins.

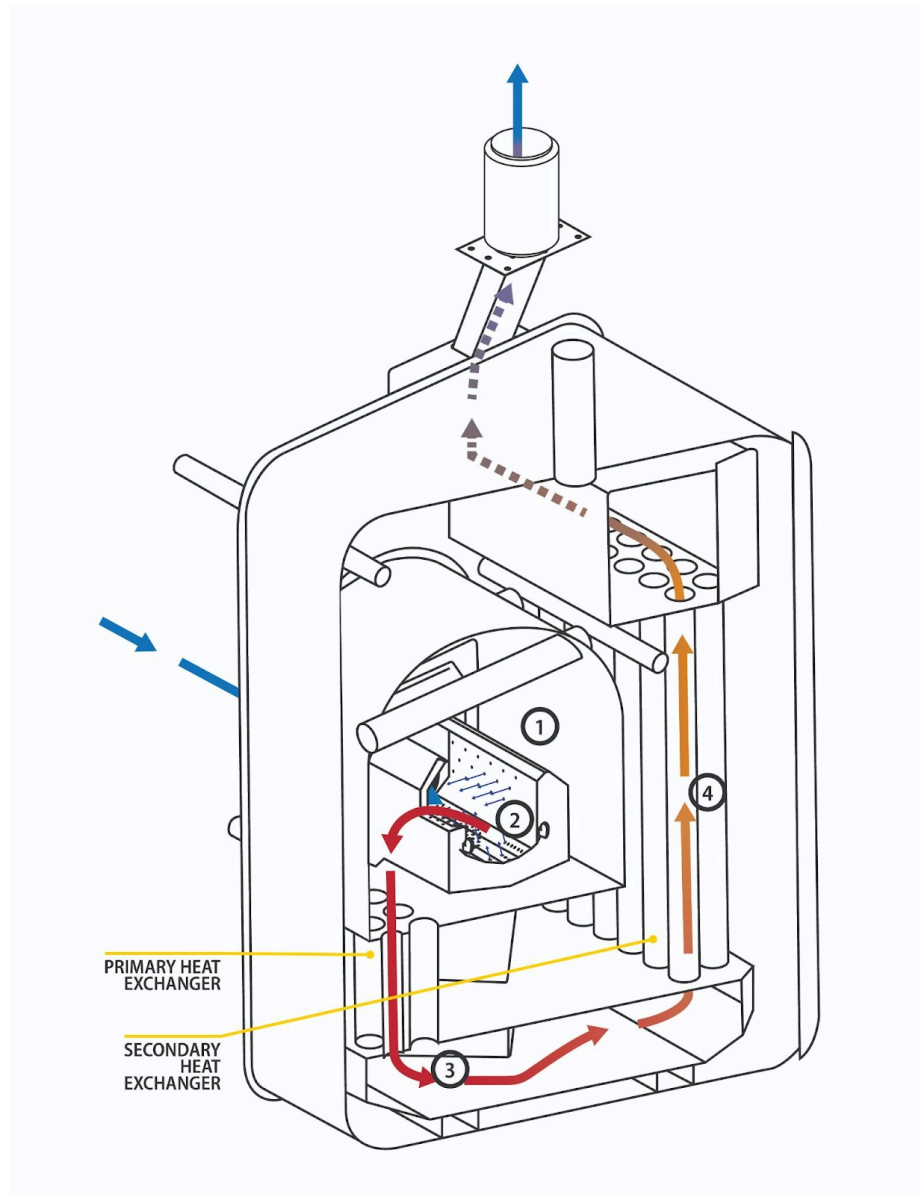
After the startup phase, the stove automatically transitions through three firing stages—High Fire, Medium Fire, and Low Fire—based on the system's water temperature and heating demand.

- **High Fire:** The stove begins in High Fire mode, operating at maximum output to quickly raise the water temperature. Once the PLC detects a designated temperature increase, the unit automatically reduces output and shifts to Medium Fire.
- **Medium Fire:** In this stage, the stove maintains steady combustion at a reduced fuel feed rate and airflow, allowing the water temperature to continue rising in a controlled manner. Medium Fire provides a balance between performance and efficiency during moderate heating demand.
- **Low Fire:** When the water temperature approaches the High Set Point, the stove transitions to Low Fire mode. Here, it continues burning at a low rate to sustain the target temperature while conserving fuel. The established coal bed remains active, enabling rapid response to any subsequent heating demand.

Throughout this process, the system continuously monitors water temperature and automatically modulates between firing stages as needed. If a temperature drop is detected—such as during heavy hot water usage or increased heating load—the stove will adjust upward, returning from Low Fire to Medium Fire, or from Medium Fire to High Fire, to restore the programmed temperature range.

For example, a sudden demand for hot water—such as during peak usage periods in a home's heating or domestic water system—may trigger the stove to temporarily increase its burn rate to maintain the desired water temperature and ensure uninterrupted system performance.

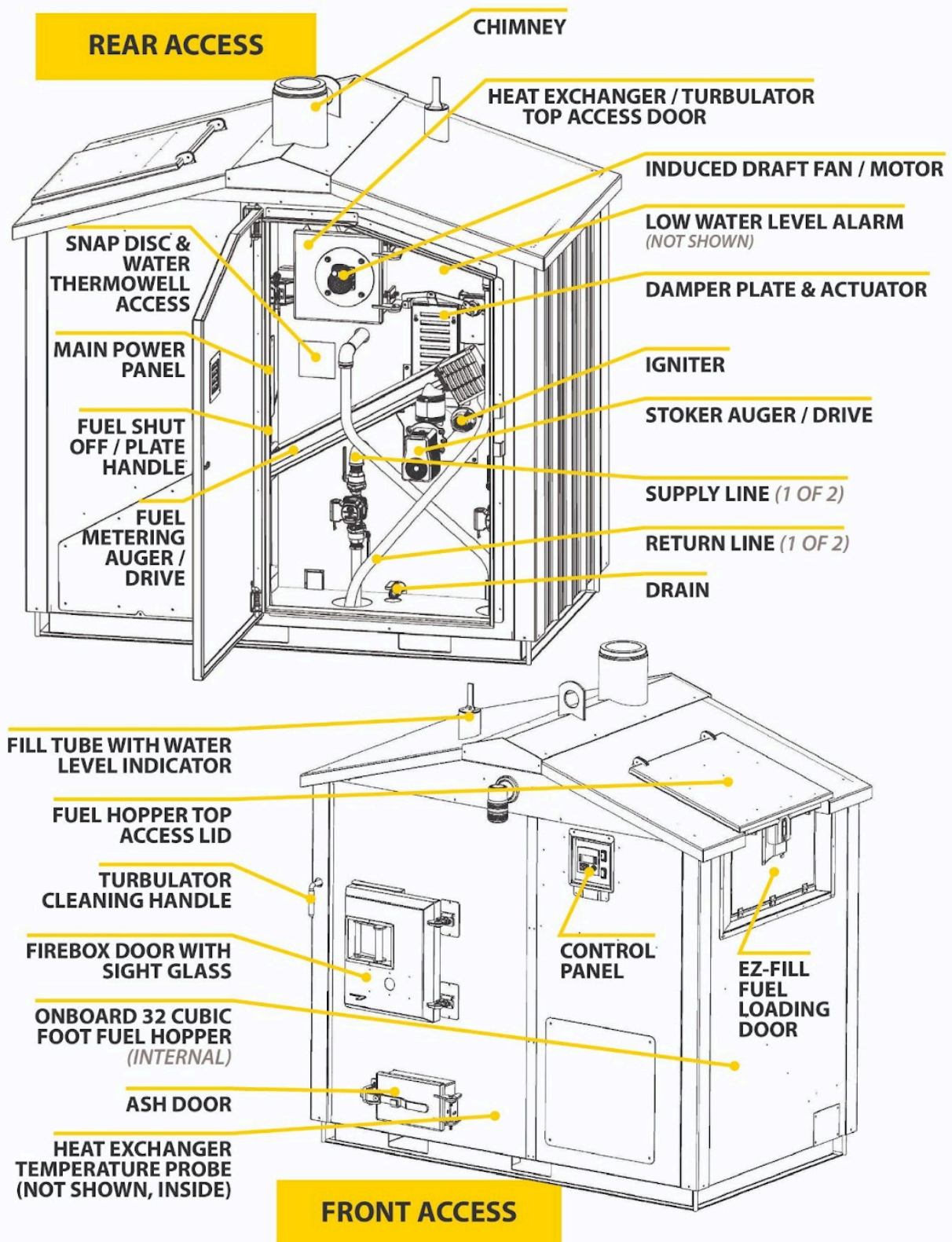
Combustion Airflow and Heat Exchanger Process



Ambient combustion air enters the rear of the stove through a PLC-controlled actuated damper. The negative draft fan draws the combustion air through the Omni-O.2 burn pot, supporting both primary and secondary combustion processes.

The resulting super-heated air passes through a series of primary heat exchanger tubes and across the bottom of the boiler, providing substantial heat transfer. The hot exhaust air then flows through a series of secondary exchanger tubes for additional thermal efficiency before the low-temperature exhaust gases exit through the Class-A chimney.

COMPONENTS DIAGRAM



INSTALLATION

Important: All users must comply with state, federal, and provincial requirements, including but not limited to local ordinances and applicable laws. Refer to the higher level of care and the authority having jurisdiction for piping, electrical wiring, and chimney installation. All work must be performed by qualified personnel only. The operation of the existing heating system must be verified for acceptable operation before and after installation of the Crown Royal Stove by a gas fitter who is recognized by the regulatory authority.

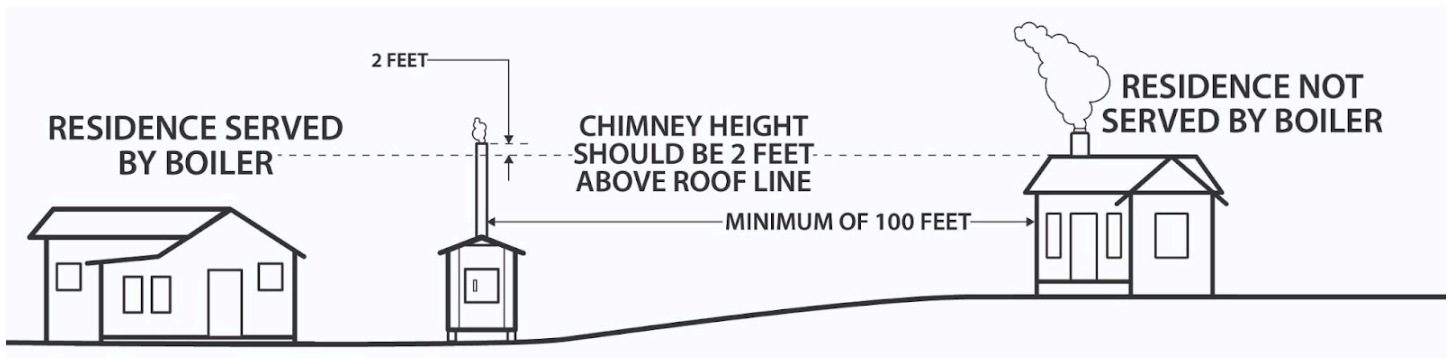
For units installed in Canada: Ensure the installation complies with the requirements of CAN/SCA-B365. Any changes to the installation should comply with CSA B139 (for oil-fire), C22.1 (for electric), or CAN/CGA-B149.1 or CAN/CGA-B149.2 (for gas-fired).

Prohibited Fuels

The EPA's list of prohibited fuels include: garbage, yard waste, rubber, tires, plastic, petroleum products, paints or paint thinners, asphalt products, asbestos, construction debris, paper products and cardboard, plywood, particleboard, railroad ties, pressure-treated wood, animal remains, or salt water saturated materials.

Location

When choosing the location of your boiler you should consider prevailing wind direction, distance from home for refueling and storage, and give consideration for any effect on your neighbors. Check your local code requirements and homeowner's insurance company to ensure they will approve the proposed location relative to the distance from building and combustibles. We recommend a minimum of 25 feet from any inhabited building and 100 feet from a residence not served by the boiler..



All users are also responsible for operation in a manner that does not create public or private nuisance conditions. The distance and stack height Greentech Manufacturing recommends and the requirements in any applicable laws or other requirements may not always be adequate to prevent nuisance conditions due to terrain or other factors.

Clearances

Minimum Clearances to Combustibles				
Side	Front	Back	Top	Chimney Connections
36 Inches	60 Inches	36 Inches	12 Inches	60 Inches

WARNING

DO NOT STORE FUEL OR OTHER COMBUSTIBLE MATERIALS WITHIN MARKED INSTALLATION CLEARANCES.

Combustion Air Requirements

When installing a fuel burning appliance in a building, review the IMC (International Mechanical Code) and NFPA 54 definitions of “confined” and “unconfined” spaces. Unconfined simply means that the area in which the appliance is located is sufficient to provide the combustion air requirements of the appliance. All Crown Royal Stove models must be installed in “unconfined” spaces.

To determine if a space can adequately support proper combustion:

1. Calculate the volume of the space: Length (ft) x Width (ft) x Height (ft) = Volume (CF)
2. Calculate the BTU requirements of every appliance located in the space (to the nearest 1,000 BTU per hour)
3. Divide the total combustion air requirements (step 2) by 50 CF
4. Compare the result of step 3 with step 1

If the requirement of step 3 is higher than the room volume in step 1, additional combustion air must be added. Consult your local dealer or other industry professional for approved methods to ensure proper operation.

!! CAUTION !!

WORKING SMOKE AND CARBON MONOXIDE DETECTORS MUST BE INSTALLED AND MAINTAINED FOR ANY INDOOR INSTALLATION. DO NOT INSTALL THIS BOILER IN ANY INHABITED BUILDING, INCLUDING, BUT NOT LIMITED TO, AN ATTACHED GARAGE TO A HOME.

Foundation

Inspect the ground conditions that you intend to install your boiler on. If the area is unstable or has a history of staying wet, you will need to improve the sub-soil with gravel as well as raising the elevation. The preferred installation is on a concrete pad of 4" – 6" inches, reinforced with rebar and wire mesh. At a minimum, the slab should be 2" wider than the perimeter of the boiler base, but extra working area is beneficial. We recommend adding a 32" apron to the fuel-loading side of the boiler as a work area. If needed, this provides a safe, level surface for a ladder while re-fueling. Place the rear of the boiler base 2" from the back edge of concrete to give 12" for your underground lines to come up.

Minimum & Recommended Pad Dimensions (width x length)
BIO200
Minimum: 86" x 60"
Recommended: 118" x 60"

WARNING

DO NOT EVER INSTALL THIS BOILER ON A COMBUSTIBLE SURFACE, INCLUDING BUT NOT LIMITED TO TIMBERS OR PRESSURE TREATED LUMBER.

Chimney

The chimney size and termination height all depends on the unit you have purchased and where the unit will be located. Contact your local dealer or Greentech Manufacturing, Inc. for chimney design and purchase information.

Your boiler was designed and tested using Selkirk Chimney Systems. It is required to use Class A Selkirk brand chimney type HT (High-Temperature) Ultra Temp Series. This assembly meets the requirements of UL103 and ULC-S629, as well as complies with Chapter 11 of NFPA 211 (Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances). Install each section of piping by placing male and female sections together then twisting them to lock sections together. Be sure to install a locking band on every section. Selkirk recommends bracing every eight feet, with a maximum chimney height of no more than forty (40) ft.

Chimney termination caps are required for warranty coverage. Installation of spark arresters must be used in high fire risk areas. Clover leaf caps are an excellent choice as an alternative for spark arrestors, and can eliminate down draft issues.

WARNING

ADHERE TO LOCAL BUILDING CODES AND NFPA 31, 54 AND 211. FOLLOW ALL CHIMNEY MANUFACTURES INSTALLATION REQUIREMENTS. THIS UNIT CAN NOT BE HOOKED TO A CHIMNEY ALREADY SERVING ANOTHER APPLIANCE.

Refer to the manufacturer's recommendations and requirements for proper clearances. Each model is equipped with a Selkirk brand anchor plate and a 12-inch chimney length, preinstalled as standard. Additional chimney components and extensions are recommended and are available from your local dealer or by contacting Greentech Manufacturing directly at 866-361-7355.

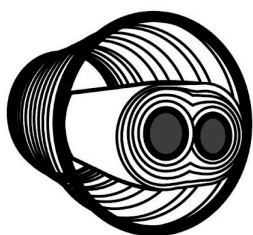
WARNING

NEVER ATTEMPT TO FABRICATE YOUR OWN CHIMNEY COMPONENTS. NEVER MIX SELKIRK CHIMNEY WITH OTHER MANUFACTURED BRANDS. INSPECTIONS OF CHIMNEYS NEED TO BE PERFORMED AT LEAST ANNUALLY TO ENSURE THEY ARE FREE OF ANY OBSTRUCTIONS DUE TO CREOSOTE BUILDUP. PERFORM REGULAR CLEANING OF CHIMNEY TO PREVENT CHIMNEY FIRES.

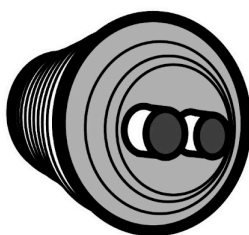
NOTE: It is recommended that at least one 4' section of chimney be installed on every boiler.

Transfer Lines

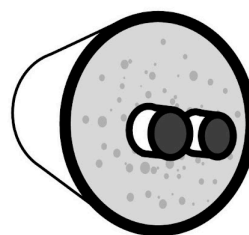
Piping System	Advantages	Disadvantages
Multi-wrap foil faced EPE Insulation A	Entry level system designed as a low cost option. Tight bend radius capabilities.	High cost of ground prep for proper installation. Single layer drain pipe susceptible to damage and failure. Typically carrier pipe type PEXb.
Multi-layer crosslinked micro-cellular PEX foam B	High quality product designed for tight installation. Bending radius comparable to entry level option. PEXa tubing. Double-wall pipe jacket.	Higher cost than entry level. Site prep and sand bed required. Pipe jacket more robust than entry level, but still susceptible to physical damage.
Rigid Foam Filled Tubing System C	Heavy outside jacket. Water resistant closed cell foam insulation. Comparable in price to mid-level option. Designed for intensive environments and climates.	Heaviest product, making installation more difficult. Very stiff. Long bend radius required.
NOTE:	Transfer line should be at least 1" nominal diameter, rated for 100 PSI at 180°F continuous flow. Splices and repairs underground create a fail point for possible future leaks, so should be avoided if at all possible. Insulated underground piping systems must remain watertight. Ground water intrusion can double a systems heat load, so failed underground systems required immediate replacement. Refer to the manufactures installation requirements for the piping system that is chosen for your installation.	



A

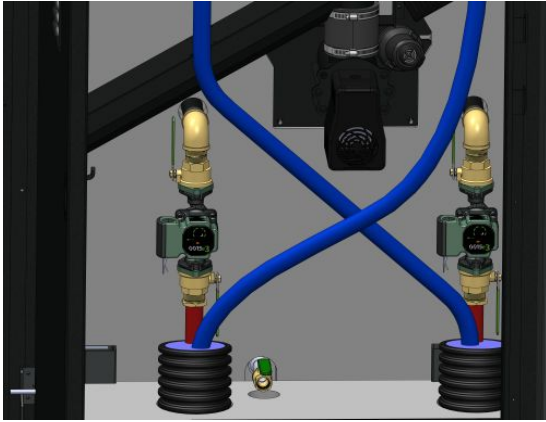


B



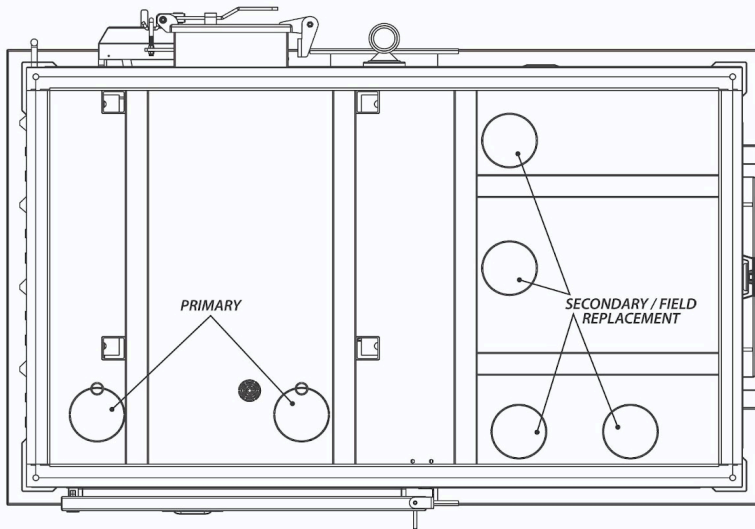
C

Piping Connections



Underground transfer lines should be installed through one or more of the knockouts located in the rear of the boiler. Be sure to install the assembly so that the outside casing and pipe insulation terminates inside the boiler.

Connections to the boiler are clearly marked: lower connections are for hot supply water leaving the boiler, and upper connections are for cool return water coming back to the boiler. If multiple locations are heated by the boiler, tees may be added on both the supply and return lines. (See page 21 for illustrations)

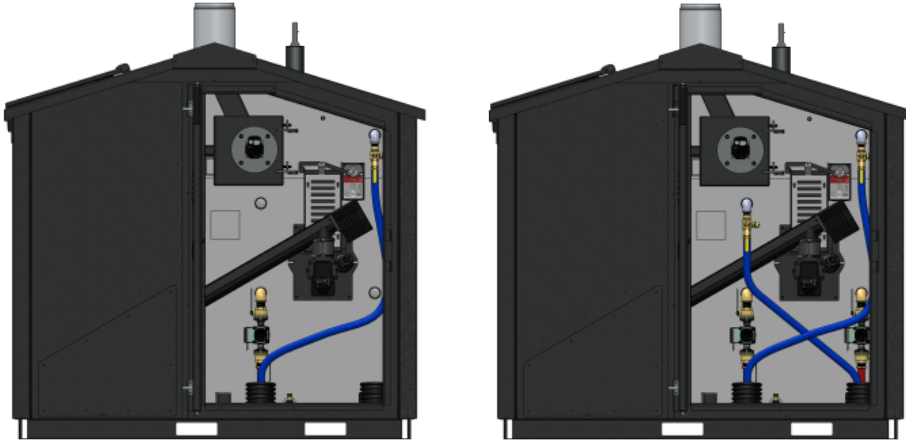


Note: There are multiple locations where supply and return water lines can be brought into the boiler from below. The primary knockouts are located inside the rear access door behind the boiler. Additional secondary locations (for retrofitting in existing locations) can be found beneath the fuel hopper, accessible via removable panels on the boiler exterior cladding (front or back).

Connections Illustration

WARNING

FIRST FITTING CONNECTIONS ON THE BOILER MUST BE STAINLESS STEEL OR BRASS. THE USE OF ANY OTHER MATERIALS WILL INVALIDATE THE WARRANTY.



Circulators should always be installed on the supply line, as close to the boiler as possible. Do not install flow checks (or IFC). A circulator is needed for each building or zone for independent heat control. Install an isolation flange on the suction side, and an isolation flange with drain on the discharge side. A ball valve with a drain should be installed on the return line at the boiler. The illustrations above show the proper configurations. Installing the system this way allows for easy air purge and future servicing, and the supply side loop creates a safety for the circulator and boiler in the case of a system leak.

NOTE: ALWAYS cross return lines. If zone A supply is on the lower left of the boiler, the upper right will be zone A return. Piping crossed returns will promote better water jacket mixing to increase efficiency and prevent stratification.

Electrical Connections

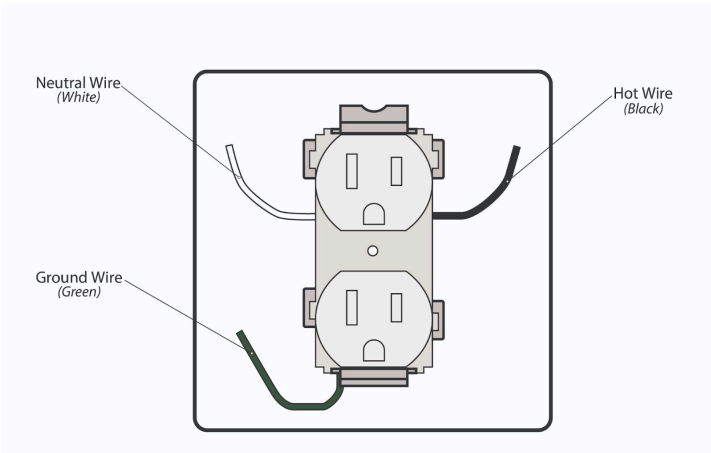
WARNING

All wiring must conform to local codes. Use an electrical wire rated and approved for underground installations. This wiring may be placed in the same trench, below the transfer lines. Use a minimum of 12 AWG, such as 12-2 UF or 12 AWG THHN in a conduit, to provide power to the combustion blower, aquastat, night light, etc. Heavier gauge wire may be necessary based on distance of run. Romex (NM-B) cable can NOT be used. Electrical wire assemblies must include a ground that is firmly bonding the boiler to the building’s grounding system in accordance with applicable electrical codes to ensure electrical continuity and safety.

It was once believed that driving a ground rod at an outdoor boiler would help prevent galvanic corrosion or electrolysis. Do NOT install a ground rod for the boiler system. Safety grounding is accomplished through the electrical wire supplying the boiler. Adding a ground rod can actually increase galvanic corrosion or induce stray voltage. If additional corrosion protection is needed, a sacrificial anode can be buried next to the trench and connected to the boiler frame. Corrosion prevention items can be found in the from your local dealer or by contacting Greentech Manufacturing directly at 866-361-7355. Instructions for installation are included with the kit.

The boiler has been pre-wired for operation at the factory. The main power connection is located in the back of the boiler, behind the duplex receptacle.

- Use a knockout located on the side of the junction box with an appropriate box connector.
- Connect the ground (bare copper or green) wire to the green pigtail.
- Connect the neutral (L2 white wire) wire to the white pigtail or silver neutral terminal screw.
- Connect the power (L1 Black) wire to the black pigtail or gold power terminal screw.



NOTE: USE COPPER CONDUCTORS ONLY

Electrical Rating	60Hz/1PH
Nominal Volts	115vAC
FLA (Full Load Amp)	12a
RLA (Run Load Amp)	6a
Max Fuse/Breaker	20a

CH Circulator (s) should be plugged in to the receptacle for continuous operation.

CONNECTING TO AN EXISTING SYSTEM

All installations and operations involving the Crown Royal Stove outdoor boiler must be carried out in full compliance with federal, provincial, state, and local codes regulating wiring, plumbing, and chimney systems. Installations must be performed only by qualified professionals, such as licensed plumbers, HVAC technicians, or contractors familiar with hydronic heating systems.

It is strongly recommended that users consult with their dealer or a licensed plumber to design a system that best fits their specific application. The proper selection and placement of heat exchangers, pumps, valves, and controls is critical for system safety, efficiency, and longevity.

Recommendations

- Piping used inside any building must be rated for a minimum of 100 PSI at 180°F. A minimum diameter of 1 inch is required, with 1¼ inch or larger recommended for larger or higher-demand systems.
- Each building or zone must be equipped with its own circulation pump, typically located on the supply (hot water) side.
- A filtering device must be installed before each circulation pump to prevent debris from damaging the pump and to extend its service life.
- It is recommended to install ball valves, isolation flanges, and other service fittings to allow for easier maintenance or replacement of system components.
- A bleeder valve should be placed at the highest point in the system to allow air removal and ensure proper water circulation.



Visit crownroyalstoves.com for a wide range of installation recommendations for existing heating systems and other heating applications.

Forced Air Furnace Systems

For homes heated with a forced air furnace, a water-to-air heat exchanger is required. The heat exchanger coil must be installed inside the furnace plenum, preferably in a horizontal position with all four sides level. If there is an air conditioning evaporator coil already in the plenum, the water-to-air coil must be installed downstream (after) the A/C coil. The hot water supply line from the outdoor boiler should enter the bottom fitting of the exchanger and exit through the top fitting, returning the cooled water to the boiler.

If the plenum size does not match the coil, it must be modified to ensure proper airflow and coil fit. Once installed, the airflow of the furnace may need to be increased to support the new heat exchanger:

- Belt Drive Systems: Blower and motor pulleys may be changed as long as the motor's electrical load does not exceed its nameplate rating. A higher-power motor may be used if necessary.
- Direct Drive Systems: The motor must not be replaced, but its speed can be increased where applicable.

The heat exchanger operates by drawing air through its finned coil. Heat is transferred from the hot water running through the coil to the passing air, which is then distributed through your existing ductwork.

!! CAUTION !!

Never tamper with the furnace's original controls during heat exchanger installation. Thermostat wiring should be completed exactly according to the manufacturer's instructions. Existing blowers can be triggered using a line-voltage or low-voltage thermostat.

Hot Water Boiler Systems

For homes with a hot water boiler, a water-to-water heat exchanger is required to keep the pressurized indoor boiler system separated from the non-pressurized outdoor boiler system. If these waters mix, contamination and corrosion can occur.

The most common types of water-to-water exchangers used in these applications are:

- Flat Plate Heat Exchangers (more responsive to demand)
- Tube and Shell Heat Exchangers (more durable with hard water)

These devices safely transfer heat from one water system to the other while keeping the fluids separate. The indoor boiler can serve as a backup heat source and must remain operational. Installations must ensure that:

- The Crown Royal Stove does not interfere with the normal heat delivery of the existing boiler.
- Electrical and mechanical safety controls on the original boiler remain fully functional and unaltered.
- The system has adequate water capacity or provisions to prevent damage from loss of circulation during power failure.
- No rewiring or functional changes are made to the existing boiler.
- Wiring interconnection is permitted, but both systems must be powered from a single branch circuit—without exception.

Boiler Safety Note:

The existing boiler must be tested before and after installation by a qualified gas fitter to confirm safe operation. Safety controls cannot be relocated or bypassed. Installations must also comply with all applicable standards, including:

- CAN/CSA-B365 for general installation requirements
- CSA B139 for oil-fired systems
- C22.1 for electric systems
- CAN/CGA-B149.1 or B149.2 for gas-fired systems
- The outdoor boiler must not share a chimney or vent with any gas appliance.

Domestic Hot Water

To pre-heat domestic water, a flat plate heat exchanger is generally recommended due to its rapid thermal response. However, if hard water is present, a tube and shell exchanger is typically more durable and better suited for long-term use.

START UP AND OPERATION

Filling The Water Jacket

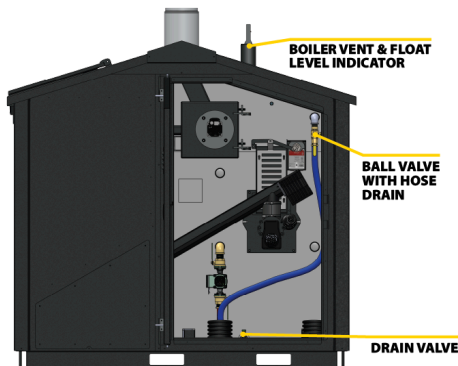
(see also “Water Treatment” Section page 60)



It is widely recognized that the water used to protect a boiler from corrosion should be of at least the same quality as drinking water. If consuming the water is not advisable, it should not be used in a boiler. When selecting a water source, the following guidelines should be adhered to:

pH	5-7
TDS	Up to 500 ppm
Hardness	<0.3 ppm
Iron	<0.1-0.3 ppm
Manganese	<0.05 ppm
Conductivity	As low as possible, typically between 0.01 and 0.07
Sodium Nitrate	0
Chlorides	As low as possible, but no greater than 50 ppm

If in doubt, TEST. Your dealer has access to water sample tests, and can send samples out to be tested if necessary.



Your boiler is equipped with a vent pipe, which holds the float level indicator, located next to the chimney and extending through the roof. To fill the furnace to the proper water level, simply place a garden hose into this pipe. For added convenience, a ball valve with a hose drain may be installed in the return furnace line. Boilers also come standard with a drain valve located on the bottom of the water jacket, which can be used for filling and adding water as needed. This setup allows you to connect a double-female hose, such as an automatic washing machine hose, between the furnace and your domestic water supply. During the initial filling, carefully inspect all system connections for leaks, and confirm that a bleeder valve has

been installed at the highest point of the system to release any trapped air. At this stage, add the initial dose of Control Chemical Inhibitor into the boiler vent with the float level indicator to ensure the steel is protected as soon as possible.

Note: This boiler is an open-to-atmosphere system, it is normal to add water annually, with 5 to 10 gallons being typical depending on conditions.

WARNING

DO NOT ADD WATER TO YOUR BOILER IF YOU CANNOT TREAT WITH CONTROL CHEMICAL INHIBITOR WITHIN IMMEDIATELY. DO NOT FIRE BOILER UNTIL IT HAS BEEN FILLED WITH WATER. DO NOT FILL THE BOILER WITH WATER FROM A SOFTENER.



When the float level indicator is at about the 1/2 mark, stop adding water to the system. As the water is heated, the indicator will rise.

As soon as water has been added as detailed above, plug the circulator in to the receptacle and be sure to raise the temperature to at least 180°F. When the boiler has reached a set temperature, recheck the water level and add fresh water if necessary. After 48 hours of starting the circulator, pull a water sample to be tested and to activate your warranty.

Water Treatment and Testing

All Crown Royal Stove owners are required to purchase authorized Control Chemical, for initial start-up and ongoing maintenance. Initial Control Chemical inhibitor dosages are based on your models water jacket capacity, estimated average piping, and standard heat exchanger capacity.

INITIAL INHIBITOR DOSAGE
BIO200
3/4 Gallon

Annual water testing is FREE. To collect a water sample:

- Circulate your water for 48 hours prior to taking a sample.
- Connect your double female (washing machine) hose to one of the purge valves in the back of the boiler. Alternative collections points would be boiler drain valve, a system drain valve or fill tube.
- With the circulator still running, slowly crack open the purge valve and allow the fluid to drain for approximately 30 sec.
- While still flowing, begin filling the sample bottle provided.
- Close purge valve when the sample has been collected.
- Complete the boiler information form, attaching one section to the sample bottle and the other half to the shipping container.

IMPORTANT: Be sure that your information is clear and legible.

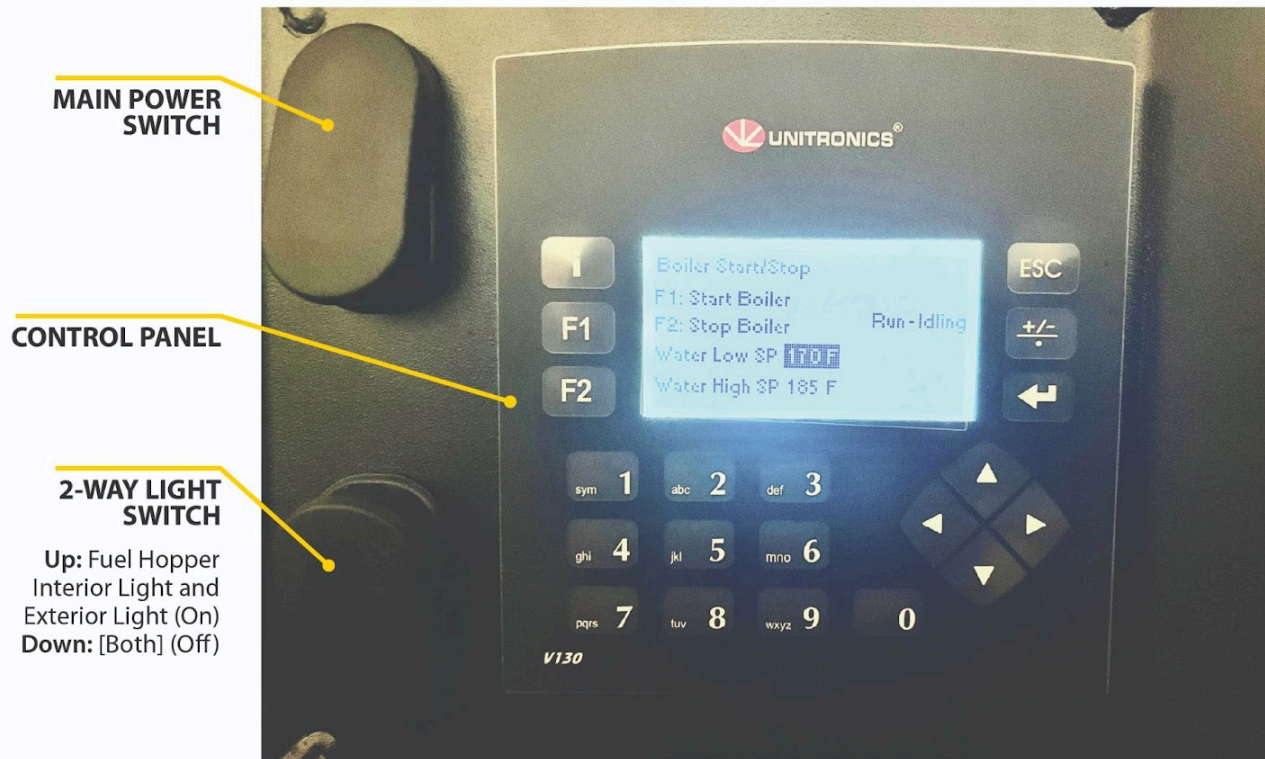
WARNING

HOT WATER AND HOT SURFACES MAY CAUSE BURNS. USE EXTREME CARE WITH THE COLLECTION OF A WATER SAMPLE.

Test results are provided on all samples within 4-6 weeks. Be sure to check your email spam folder. If you don't receive a copy of your test report, contact your dealer or call 866-361-7355. To maintain your warranty, it is required to only treat with authorized Control Chemical inhibitor, send water samples at least once every 12 months, and maintain water chemistry. The testing facility will be verifying the following requirements:

pH	9.5-14
Conductivity	6 Max
Sodium Nitrite	900 ppm Minimum
Chlorides	Less than 50 ppm
Other	Proprietary markers, appearance, biological growth, etc.

TEMPERATURE SENSOR AND CONTROL OVERVIEW



An RTD temperature sensor, inserted into a thermowell located at the rear of the boiler, is wired directly into the control panel. This sensor serves as the primary control instrument, as all other boiler control functions operate to maintain the user-defined internal water temperature and differential—referred to as the Water High Set Point (High SP) and Water Low Set Point (Low SP).

The majority of PLC functions are governed by factory presets and default parameters. However, users may need to adjust the fan and auger speeds to suit their specific application, fuel type, and ambient temperature conditions.

A properly operating fire should appear bright white when viewed through the firebox door sight glass, with no visible emissions exiting the chimney.

If additional adjustments beyond those available in the following control screens are required, please contact your Dealer or Crown Royal Stoves directly for technical support.

OFF Mode

When main power is turned on, the PLC initializes in this mode. All control panel pages and parameters are accessible, but no boiler functions will start automatically.

This is the correct mode to prime the fuel augers and/or load the initial fuel into the burn pot.

Pressing “F2” during any operation will initiate the Stop Boiler command, activating automated purge functions and returning the boiler to this mode.

The boiler will also enter OFF Mode during any alarm condition, remaining in this state until the issue is resolved and the alarm is cleared by pressing “F2.”

Note: If, at any time during normal operation, the main power switch is turned off without first pressing “F2”, the PLC will interpret this action as a power interruption. As a result, the system will automatically initiate the ignition sequence once power is restored.

ON - Ignition Mode / Ignition Confirm

Pressing “F1: Start Boiler” initiates the Ignition Mode. The PLC automatically starts the draft fan, metering auger, and stoker auger to deliver fuel to the burn pot.

The automatic igniter then ignites the fuel, and the system monitors the heat exchanger temperature over a preset duration.

- If ignition parameters are met, the control panel displays “Ignition Confirm” and transitions to Run – Firing Mode.
 - If ignition fails, the boiler will attempt ignition two additional times (default) before entering an alarm state.
In this case, verify the fuel supply, burn pot cleanliness, fan speeds, and igniter condition before retrying.
-

ON - Run - Firing

In this mode, the boiler actively maintains internal water temperature within the range defined by the Water Low SP and Water High SP setpoints.

The PLC automatically modulates the fuel feed rate and fan speed based on the difference between the current water temperature and the desired High SP.

These parameters can be adjusted on the Auger Controls and Fan Controls screens to optimize combustion performance.

Example of operation:

- When water temperature reaches the Water Low SP, the augers and fan activate in High Fire mode for rapid heating.
- As temperature rises, the system transitions to Medium Fire mode, reducing auger and fan speeds.
- Near the Water High SP, it enters Low Fire mode to gently approach the target temperature without overshooting.

This automated modulation prevents over-firing, conserves fuel, and enhances efficiency. Once the High SP is reached, the PLC ends the burn cycle and transitions to Idle Mode.

If heating demand increases while still in “Run Firing”, the system will automatically re-enter Medium or High Fire modes to maintain the required temperature.

ON - Run - Idling Mode

This is the boiler’s most common operational state while powered ON.

When the current water temperature remains between the Water Low SP and Water High SP, the augers and fan remain off, and no fuel is delivered.

During this mode, the PLC continuously monitors water temperature to maintain it within the specified range.

OFF - Boiler Purge Mode

After pressing “F2: Stop Boiler”, the boiler automatically enters Purge Mode for a preset duration.

In this sequence:

- The metering auger stops fuel delivery.
- The stoker auger continues running to clear remaining fuel from the trough into the burn pot.
- The draft fan continues operating to maintain combustion until all fuel in the burn pot is consumed.

This purge process prevents potential burn-back.

Once complete, the stoker auger and draft fan shut down, and the boiler transitions to OFF Mode.

It is normal to see a slight increase in water temperature during this purge, due to residual fuel burning off.

Main Keys & Parameters

Control Navigation

- **Up/Down Arrows:** Navigate between (to and from) control panel pages.
- **Left/Right Arrows:** Navigate within a control panel page.
- **Return Arrow:** Acts as “Enter” key to accept parameter adjustments/changes.
- **F1-Start Boiler:** Initiates *ON – Ignition Mode* from any screen (if not in alarm state).
- **F2-Stop Boiler:** Initiates *OFF – Boiler Purge* from any screen.

Auto Prime Timer

Default: 5 min. 30 sec.

During initial startup, priming may be required to fill the fuel delivery augers with fuel for the burn pot. While in *OFF* mode:

- Press “3” on the Auto Priming screen to run the metering and stoker augers for the set duration.
- It is acceptable to leave the firebox door open to observe fuel delivery.
- Once fuel reaches the burn pot, stop the Auto Prime sequence by pressing “1”.

If no fuel arrives after the set time, use the Manual Prime function (#2) to deliver more fuel. Once the augers are primed, this process should not need repeating unless the hopper runs completely empty.

Note: Priming is only intended to fill the delivery system. Stop priming as soon as fuel begins entering the burn pot — the PLC controller automatically introduces the proper amount of fuel for ignition during normal startup.

Temperature Setpoints

- **Water Low SP:** *Default:* 170 °F (*Range:* 150 °F – 190 °F)
Defines the temperature at which the system enters *Run – Firing* mode. When water temperature drops below this value (or starts below it), the boiler fires to raise the temperature to the *Water High SP*.
- **Water High SP:** *Default:* 180 °F (*Range:* 170 °F – 195 °F)
Defines the target boiler water temperature. When reached, the boiler exits *Run – Firing* mode and enters *Run – Idling* mode.

Combustion Control Parameters

Proper adjustment of these parameters ensures optimal combustion. In general, increasing fuel delivery requires more oxygen (Fan Speed Low-Med-High). An ideal burn appears as a bright white flame visible through the sightglass located on the firebox door, with little to no visible exhaust coming from the chimney.

If optimal burn conditions cannot be achieved, contact your Dealer or Crown Royal Stoves for assistance.

Fan Speeds

- **Low Fire Fan Speed**

Default: 50% **Range:** 35-70%

Defines the draft fan speed in *Low Fire* mode as the boiler approaches the Water High SP. This value should be lower than the *Med* or *High* fan speed settings, allowing the PLC to gradually reduce flame intensity in the burn pot as the internal water temperature nears the target value.

- **Med Fire Fan Speed**

Default: 64% **Range:** 50-85%

Controls the draft fan speed in *Med Fire* mode as the boiler maintains water temperature between the Water High SP and Water Low SP. The PLC modulates fan speed to keep the temperature within these limits. Depending on heat demand, the boiler may transition between *High Fire* and *Low Fire* modes to maintain optimal operation.

- **High Fire Fan Speed**

Default: 88% **Range:** 50-99%

Sets the draft fan speed in *High Fire* mode as the boiler starts up or approaches the Water Low SP. This value should be higher than the *Low* or *Med* settings, allowing the PLC to increase combustion intensity for rapid heating and recovery. *High Fire* mode produces the most aggressive burn characteristics for quick temperature gains.

Metering Auger Speeds

The Metering Auger Speeds determine the rate of fuel delivery to the burn pot. These values work in coordination with the fan speeds to maintain optimal combustion and steady boiler operation. As the system temperature changes, the PLC automatically modulates the auger speeds to match combustion demand.

- **Low Fire Metering Auger Speeds**

Default: 14% **Range:** 10-20%

Defines the fuel delivery rate in *Low Fire* mode as the boiler approaches the Water High SP. This setting should be lower than the *Med* or *High* auger speeds, allowing the PLC to gradually reduce fuel feed and flame intensity as the internal water temperature nears the target level.

- **Med Fire Metering Auger Speeds:**

Default: 20% **Range:** 10-30%

Controls fuel delivery in *Med Fire* mode as the boiler operates between the Water High SP and Water Low SP. The PLC modulates this speed to maintain water temperature within these setpoints.

Depending on the system's heat load, the boiler may transition between *Low Fire* and *High Fire* modes to sustain efficient operation.

- **High Fire Metering Auger Speeds:**

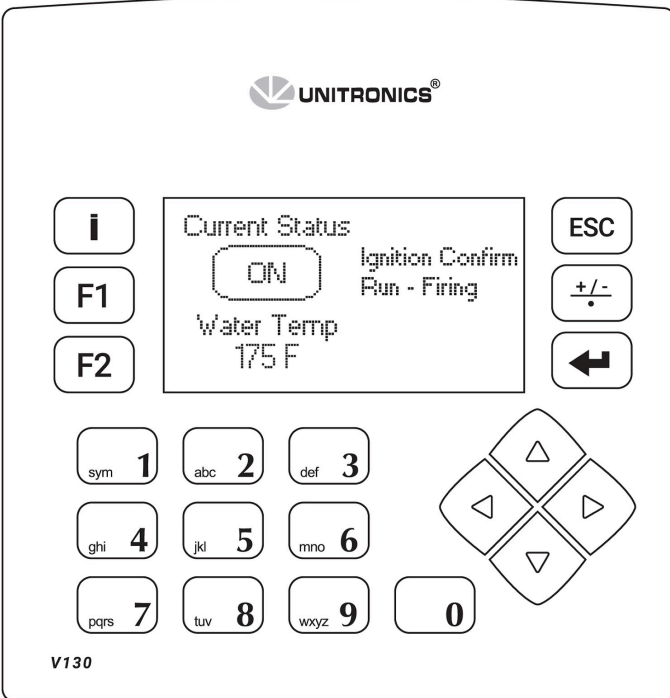
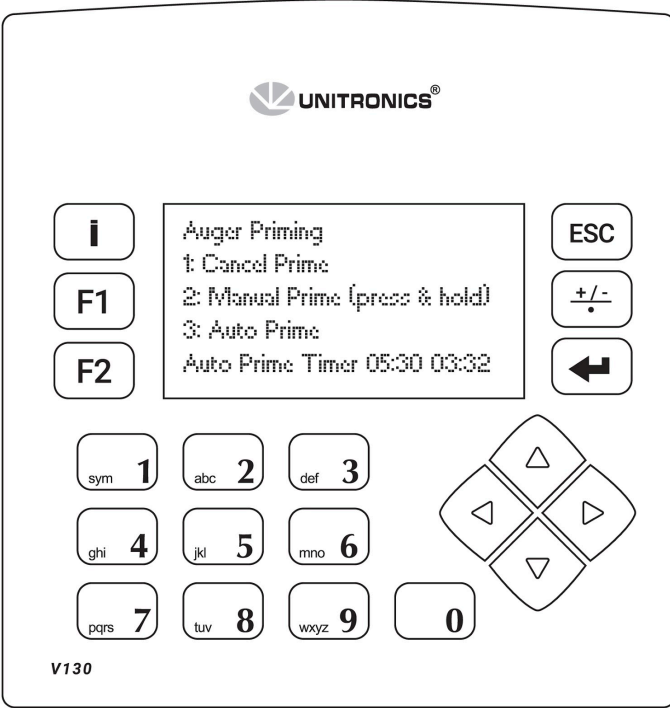
Default: 34% **Range:** 20-40%

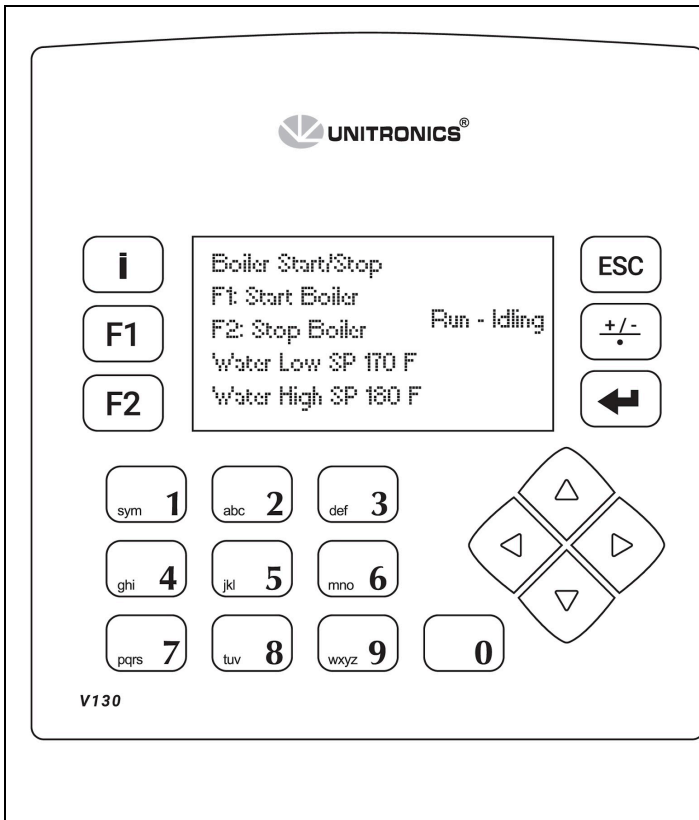
Defines the fuel delivery rate in *High Fire* mode as the boiler starts up or approaches the Water Low SP. This setting should be higher than the *Low* or *Med* auger speeds, allowing the PLC to increase the burn rate and raise water temperature efficiently. *High Fire* mode provides the most aggressive combustion for rapid temperature recovery.

WARNING

ONLY QUALIFIED PERSONNEL SHOULD ADJUST THESE PARAMETERS.

Control Panel Screens

 The Main Status Screen displays the following information: Current Status: ON Water Temp: 175 F Ignition Confirm: Run - Firing The interface includes a keypad with function keys (i, F1, F2), a numeric keypad (1-0), and navigation buttons (ESC, +/-, and a four-way arrow pad).	<u>Main Status Screen</u> Displays: - Current Status (ON, or OFF) - Current Water Temperature (175 F) - Ignition Confirm (if true, <i>shown</i>) - Current Mode (Run – Firing, <i>shown</i>) Other “ON” mode options: Ignition Mode, Run - Idling, Boiler Purge (<i>not displayed</i>)
 The Auger Priming Screen displays the following information: Auger Priming Options: 1: Cancel Prime 2: Manual Prime (press & hold) 3: Auto Prime Auto Prime Timer: 05:30 03:32 The interface includes a keypad with function keys (i, F1, F2), a numeric keypad (1-0), and navigation buttons (ESC, +/-, and a four-way arrow pad).	<u>Auger Priming Screen</u> Select: - Press “3” to initiate Auto Prime mode for set time - Press and hold “2” to manually prime/run augers - Press “1” to cancel/stop Auto Prime Adjust: - Auto Prime run timer (05:30) Displays: - Remaining time in Auto Prime cycle (03:32)



Boiler Start/Stop Screen

Select:

- Press "F1" to Start Boiler
- Press "F2" to Stop Boiler

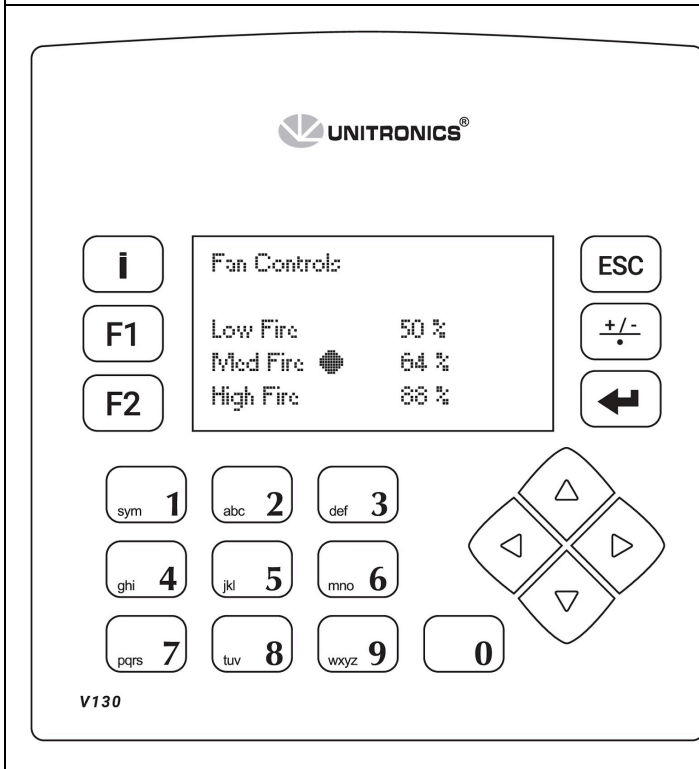
Adjust:

- Water Low SP [Set Point] (170 F)
- Water High SP [Set Point] (180 F)

Displays:

- Current Mode (Run – Idling, *shown*)

Other "ON" mode options: Ignition Mode, Ignition confirm Run-Firing, Boiler Purge (*not displayed*)

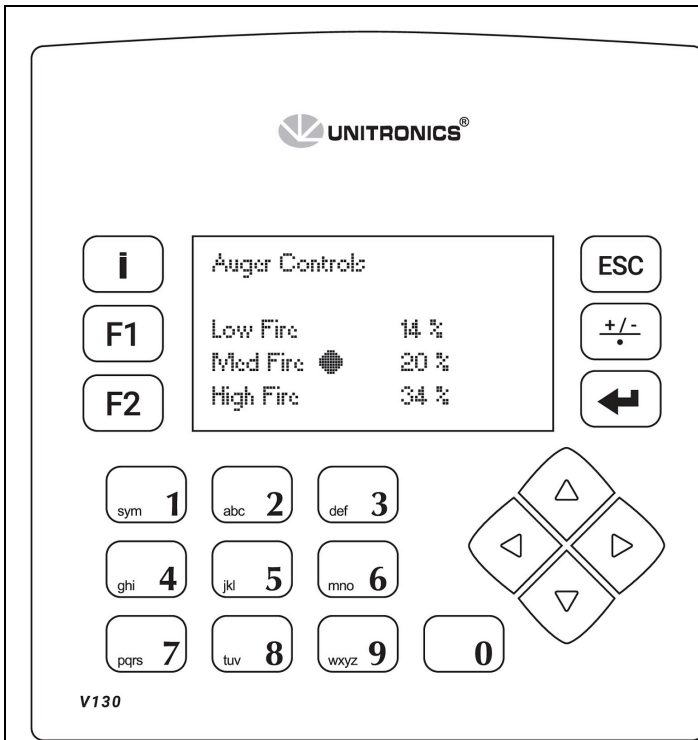


Fan Controls Screen

Adjust:

- Low Fire Fan Speed (50%)
- Med Fire Fan Speed (64%)
- High Fire Fan Speed (88%)

The bullet indicates current control mode, in this case, "Med Fire"



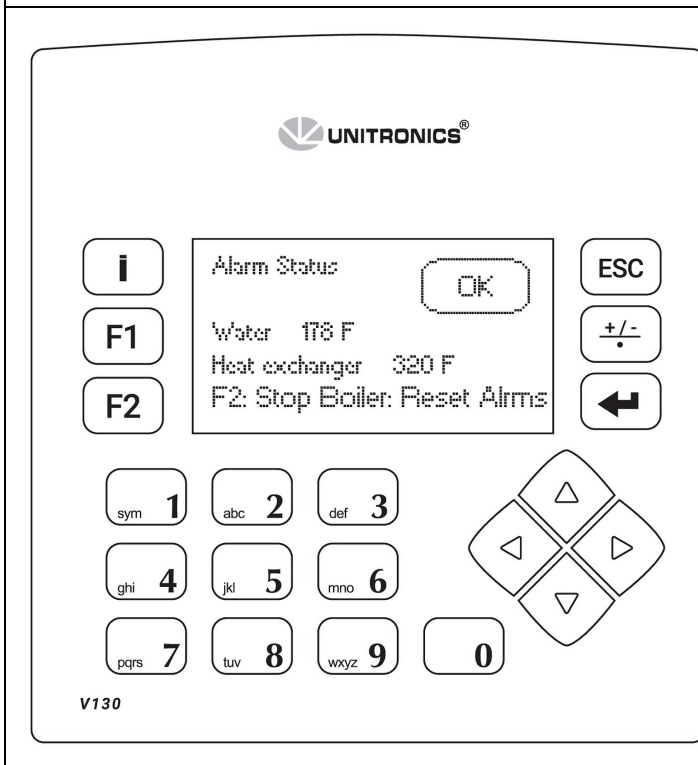
Auger Controls Screen

Adjust:

- Low Fire Metering Auger Speed (14%)
- Med Fire Metering Auger Speed (20%)
- High Fire Metering Auger Speed (34%)

The bullet indicates current control mode, in this case, "Med Fire"

Note: Auger percentages are based on a full, 30 second cycle. If set at 20% the auger will be on for 6 seconds off for 24 seconds.



Alarm Status Screen

Displays:

- Current Alarm Status (OK, *shown - or* ALARM)
- Current Water Temperature (178 F)
- Current Heat Exchanger Temperature (320 F)

Select:

- Press "F2" to Stop Boiler: Reset Alarms

Other Alarm Statuses: Ignition Fault, H2O Level Low, H2O Temp High, Exchanger Temp High, Exchanger Temp Low, General Fan Alarm

Safety Devices & Alarms

Snap Disc

This boiler is equipped with a snap disc as a protective measure against extreme or rapid over-temperature conditions. If the boiler water temperature reaches 200°F, an over-temperature fault condition will shut down boiler functions. Should the temperature continue to rise and reach 205°F, the snap disc will interrupt all power to the boiler and the automatic feed system. Power will remain off until the water temperature decreases below 160°F.

ALARMS

The following alarms may appear on the Alarm Status screen for various reasons that need to be addressed. If the boiler encounters any alarm state below, the boiler will automatically enter “Stop Boiler” mode to shut down and display the Alarm Status. In the event of any alarm, the boiler needs to be inspected for the cause, and will not restart until the alarm is remedied and manually cleared by pressing “F2: Stop Boiler: Reset Alarms”.

Low Water Level Alarm

The low water level alarm is a critical safety device that prevents the boiler from operating without adequate water. It continuously monitors the water level, and if it falls below a safe point, the switch shuts down the burner or fuel feed system to stop operation. This protects the boiler from overheating or running dry, which could cause severe damage or create unsafe conditions. The switch will reset automatically once water is restored.

High Water Temperature Alarm

This alarm appears if the water temperature increases beyond the “Water High SP” and reaches 200°F. The alarm screen will appear and display “H2O Temp High” until manually cleared (the water temperature must be below 200°F to clear). This alarm suggests that the fire in the burn pot is burning too hot, or for too long (excess fuel or excess fan speeds).

Exchanger Temperature Alarm High

This alarm appears if the heat exchanger temperature probe reaches the set parameter “Heat Ex Max Temp” [Pr35]. This alarm suggests that the fire in the burn pot is burning too hot (excess fuel or excess fan speeds), or that the boiler airways are dirty and not transferring heat efficiently.

Exchanger Temperature Alarm Low)

This alarm appears if the heat exchanger temperature probe drops below the set parameter “Heat Ex Low Temp” [Pr36]. This alarm suggests loss of fire in the burn pot, likely due to lack of fuel in the burn pot.

General Fan Alarm

This alarm appears if there is an issue with the Induced Draft Fan Motor/Blower in the upper heat exchanger access door. The PLC has lost control of the fan signal due to a faulty motor, wiring, or some other issue.

Ignition Fault Alarm

This alarm appears if the PLC does not confirm ignition within the defined time and attempts parameters. During Ignition mode, the PLC monitors the heat exchanger temperature for an increase in temperature (to confirm the fuel is burning). A preset temperature deviation must be met within the preset time and ignition attempts to confirm ignition. If these conditions are not met, this alarm appears and suggests lack of sufficient fuel or an issue with the igniter.

OPERATING INSTRUCTIONS

Loading the Fuel Hopper

The BIO200 includes a large onboard 32 ft³ capacity fuel hopper to store approximately 1,400 pounds of wood pellets and extended burn times between refueling. To add fuel, initially open the top access lid of the hopper. Fuel can be added directly into this top access door to reach the full fuel capacity level, or for easier convenience the lower height “EZ-Fill” fuel loading door can be opened and used to fill the hopper to approximately 60% capacity. This dual hatch design makes refueling simple and flexible, allowing users to choose the method that best suits their needs.

The hopper is equipped with an interior light if desired, it can be turned on via the bottom switch on the left side of the control panel. Before loading, always inspect the hopper. Open the top access lid to check for any foreign objects, debris, or packaging material that could interfere with the auger system. Lock out power and remove anything that does not belong before adding fuel.



Once the hopper is clear, carefully load the selected fuel. Pour or transfer the fuel into the hopper. Ensure that pieces of fuel bags or packaging do not fall into the hopper, as these can cause damage or blockages. After loading, always close the doors in the correct order: shut the EZ-Fill side door first, followed by the top access lid. This ensures a proper seal, prevents moisture entry, and keeps the system operating safely and efficiently.

!! DANGER !!

- Risk of fire.
- Do not operate the unit with the fuel hopper top access lid, EZ-Fill fuel loading door, ash door, or rear heat exchanger cleanout door open.
- Do not store fuel or other combustible materials within the marked installation clearances.
- Only Wood pellets can only be loaded into the fuel hopper.
- Do not use the firebox door to manually load fuel directly into the burn pot. Doing so may cause damage or create unsafe conditions.
- NEVER ENTER the fuel hopper. The bottom of the hopper is equipped with an automated auger that can start and stop at random.

WARNING

- Inspect and clean flues and chimney regularly.
- Perform regular cleaning of airflow pathways.
- Remove ashes regularly.
- Always ensure the hopper has an adequate supply of fuel while the boiler is burning to maintain consistent, reliable operation.

!! CAUTION !!

- Hot surfaces. Do not touch during operation.
- Keep children, incompetent, and unauthorized persons away from the unit while in operation.

Fuel Quality: Why Premium Wood Pellets Matter

Using premium-quality wood pellets is essential for the safe, efficient, and reliable operation of your pellet-burning appliance. High-grade fuel ensures maximum performance, reduces emissions, and minimizes maintenance. Choosing the right pellets will help protect your investment and provide the best heating experience.

Benefits of Premium Pellets

Premium wood pellets offer several advantages compared to lower-quality fuel:

- **Efficiency:** High-quality pellets burn hotter and more consistently, providing more heat output per bag.
- **Clean Combustion:** Low ash and moisture levels ensure cleaner burns, reducing smoke and harmful emissions.
- **Reduced Maintenance:** Less ash and fewer impurities mean less frequent cleaning and reduced wear on your appliance.
- **Extended Appliance Life:** Consistent, clean-burning fuel reduces stress on mechanical parts, helping your system last longer.

Fuel Standards and Requirements

To qualify as premium-grade, wood pellets should meet these specifications:

- **Moisture Content:** Less than 10%
- **Ash Content:** Less than 0.7%
- **Must comply with CAN/CSA-ISO 17225-2 Standards**

Use of wood pellets outside these specifications may result in reduced performance, increased emissions, and can void the warranty.

Important Notes

- Alternative fuels or low-grade pellets are not supported and will not be covered under warranty.
- Pellets with excess sawdust content may lead to feed rate interruptions. This can cause:
 - Irregular fuel delivery rates.
 - Increased burnback potential as the fuel delivery augers cannot convey fine particles.

Key Quality Indicators

When selecting wood pellets, look for the following indicators of quality:

- **Ash Content:** Less ash means less residue and easier cleaning.
- **Moisture Content:** Low moisture ensures steady, efficient combustion.
- **Durability:** Pellets should be dense and resist crumbling or breaking.
- **Fines and Clumps:** Bags should not contain excessive dust or clumped pellets, which indicate poor quality.
- **Consistency:** A trusted, consistent brand ensures your appliance can be set and operated without constant adjustment.

Prohibited Fuels

The EPA's list of prohibited fuels include: garbage, yard waste, rubber, tires, plastic, petroleum products, paints or paint thinners, asphalt products, asbestos, construction debris, paper products and cardboard (other than as fire starters), plywood, particleboard, railroad ties, pressure-treated wood, manure or animal remains, salt water saturated materials, or unseasoned wood.

WARNING

Burning any of the above materials can lead to severe damage, unsafe conditions, excessive creosote buildup, and increased risk of chimney fire or toxic exposure.

Fuel Storage

To ensure optimal performance of your BIO200 boiler, proper fuel storage is essential. Exposure to moisture can severely degrade fuel quality, causing inefficient combustion, increased emissions, and potential damage to the unit.

- Store fuel in a sealed container or building that fully protects them from rain, humidity, and ground moisture.
- Do not store bags directly on concrete or soil; use pallets or shelves to raise them off the ground.

WARNING

Do not store fuel or other combustible materials within marked installation clearances.

STARTUP AND OPERATING INSTRUCTIONS

Power Up

Ensure there is an adequate amount of fuel inside the fuel hopper. Turn on your boiler with the top switch on the left side of the control panel. A home page will appear and direct you to press down to continue. Navigate to the 'Boiler Start/Stop' page to set your target water temperature (Water High SP) and differential (Water Low SP) as operating parameters.

Priming

Prior to initial start-ups, the BIO200 automated fuel system and burn pot need to be primed with fuel. If the fuel delivery system is completely empty, the auto-prime function can be used to automatically run the metering and stoker augers to deliver fuel for the duration defined as the "Auto Prime Timer". Navigate the control panel to find the "Auger Priming" page. Pressing '3' will initiate an Auto Prime cycle that turns on these augers for approximately 5 minutes to fill the fuel troughs and deliver fuel into the firebox burn chamber. After the auto-prime time elapses, if more fuel is required, press and hold the Manual Prime '2' button to deliver additional fuel into the burn pot. During this process, the boiler is in OFF mode, with no ignition intended. The firebox door can remain open to monitor the delivery of a desired amount of initial fuel in the burn pot. Once enough fuel is present, the "Cancel Prime" button can be pressed to stop fuel delivery. If the auto prime timer times out and no fuel has reached the burn pot, it's recommended to use the "Manual Prime" button to deliver additional/adequate fuel.

Ignition

After adequate fuel has been delivered into the burn pot, close the firebox door and press "F1: Start Boiler" to begin the ignition sequence. The boiler will enter ON "Ignition Mode" and the augers and draft fan will start. Pre-set internal parameters will turn the igniter on and monitor the heat exchanger temperature to confirm fuel ignition (or not). Once confirmed, "Ignition Confirm" will appear on the main status screen and the boiler will advance to Run - Firing mode to reach the set Water High SP. If ignition is not confirmed within the pre-set duration, the controller will automatically re-attempt ignition up to two more times.

Combustion Control

The Firebox door is equipped with a sight glass to visually observe the burning characteristics in the burn pot. Ideal combustion should appear as a bright white flame, with little to no emissions visible coming out of the chimney. Various fuels may need different fan and auger speeds adjusted through each of the 'Run - Firing' modes; Low Fire, Med Fire and High Fire. Not enough fuel may cause the fire to go out or not reach the target water temperature setpoint. Too much fuel will reduce the boiler efficiency and potentially waste unburnt fuel and dirty the boiler as this excess fuel (not ash) gets pushed out of the burn pot. The draft fan and metering auger speeds can be adjusted on the 'Fan Controls' and 'Auger Controls' screens. The stoker auger runs at a constant speed, regardless of the fire mode as the metering auger adjusts the fuel delivery rate. Defaults for these parameters are as follows:

	Fan Speed	Auger Speed
Low Fire	50%	14%
Med Fire	64%	20%
High Fire	88%	34%

DO NOT OPEN ANY DOORS WHILE THE BOILER IS IN OPERATION! The BIO200 operates under negative (draft) pressure; if any of the doors are opened, required air flow will be interrupted and can cause dangerous conditions. Serious injury or damage may result!

Note: Additional fuel can be added to the fuel hopper during any boiler status. However, do not leave the fuel hopper doors open for an extended period of time as this can introduce moisture to the fuel, or excess air into the fuel delivery system.

Operating Precautions:

Upon initial start-up, the water jacket can reach a normal condition called “dew point”. This creates condensation buildup inside the firebox, which may last a couple of days. Condensation may come out of all the doors until the unit reaches operational temperature. As the water is heating, it expands and may also cause excess system water volume to come out of the top fill tube. All are normal occurrences.

WARNING

DO NOT OPERATE WITHOUT ALL ACCESS DOORS (FIREBOX, ASH DOOR & REAR HEAT EXCHANGER CLEANOUT DOOR) PROPERLY CLOSED AND LATCHED.

!! CAUTION !!

HOT SURFACES: KEEP CHILDREN AWAY. DO NOT TOUCH DURING OPERATION.

Prolonged Power Outage

Power is required to maintain safe and adequate combustion. The temperature control, combustion fan, damper actuator, and safety controls all operate when the proper electrical supply is connected. It is important not to open the load door, reaction chamber door, clean out door, or fan access door when there is no power to the boiler. Do not attempt to load new fuel, or start a new fire, during a power outage.

!! DANGER !!

OPENING ANY DOOR ON THE BOILER WHEN POWER IS DISCONNECTED CAN ALLOW FRESH AIR TO START AN UNCONTROLLED FIRE, POTENTIALLY CAUSING DAMAGE TO THE USER AND EQUIPMENT. REMOVAL OF UNBURNED FUEL FROM THE FIREBOX CAN BE VERY DANGEROUS. USE EXTREME CAUTION AND PAY SPECIAL ATTENTION TO HOT COALS AND SURFACES. REMOVE FUEL ONLY WHEN ABSOLUTELY NECESSARY.

The utilization of generators and battery backup systems is permitted for integration with your system, provided that the generator is appropriately sized to accommodate the system's requirements, maintains consistent voltage and hertz (as outlined in the Electrical Connections section on page 23), and is properly grounded. The generator should be sized to operate the boiler, the circulator(s), and the indoor heating system, ensuring proper heat distribution according to your designed heating system. For sizing of backup electrical systems, please contact your dealer or a local electrical contractor specializing in backup power systems.

When electrical power is restored to the boiler, the PLC will automatically resume operation in the same state it was in prior to the power interruption. If the water temperature has dropped below the Low Set Point (Low SP), the boiler will initiate the ignition sequence automatically—no user intervention is required.

CARE AND MAINTENANCE

General Maintenance

Crown Royal Stoves are designed to be easy to operate and simple to maintain.

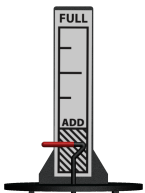
Safety Precautions for Maintenance

- Always disconnect and lock out power before performing any maintenance, service, or repair on the boiler.
- Allow the fuel to burn down in the firebox and ensure the boiler is in OFF mode or powered down before performing any maintenance. Wait at least 3 minutes for the boiler to complete a shutdown or purge cycle to clear remaining fuel and combustible gases.
Failure to do so may result in serious injury or death.
- Exercise extreme caution, as internal components may remain hot for an extended period after shutdown. Allow sufficient cooling time before performing any maintenance or inspection.
- Make sure all covers and guards are securely in place at all times, except during maintenance.
- Always have a clear plan to handle a chimney fire (see “Runaway Chimney Fire” in the next section).

Ash Accumulation

When burning wood pellets and other biomass fuels, ash accumulation is a normal byproduct of combustion. The amount of ash that builds up inside the boiler depends on several factors. Fuel quality plays a major role, as lower-grade pellets with higher bark, dust, or moisture content will produce more ash than premium-grade, clean, dry fuels. Ash levels also increase when burning biomass materials that contain impurities, such as additives, dirt, or non-wood content, since these leave behind more residue after combustion. Cleaning and removal of ash buildup is critical to maintain airflow, allow for complete gasification and ideal combustion, allowing for the greatest heat transfer.

Section 1 : Water Levels



Always check for adequate water using the water level indicator that is supplied with your boiler. This indicator is placed in the vent tube and can be easily checked daily to ensure the proper water level. The water level will fluctuate on the gauge as the water temperature changes in the boiler. Normal water level is anywhere between ADD and FULL when the internal water temperature is up to the High Water SP temp. There is no need to add water until the water level indicator is on ADD or just entering the hashed marks. Over-filling the boiler promotes evaporation, which increases water and authorized Control Chemical inhibitor usage.

In addition, this boiler is equipped with a low-water alarm that is integrated into the PLC system. If the water level drops below the required amount, the alarm will activate and automatically shut down the boiler to prevent unsafe operation and potential damage. If significant amounts of water needs to be added or replaced, ensure the proper amount of Control chemical is included.

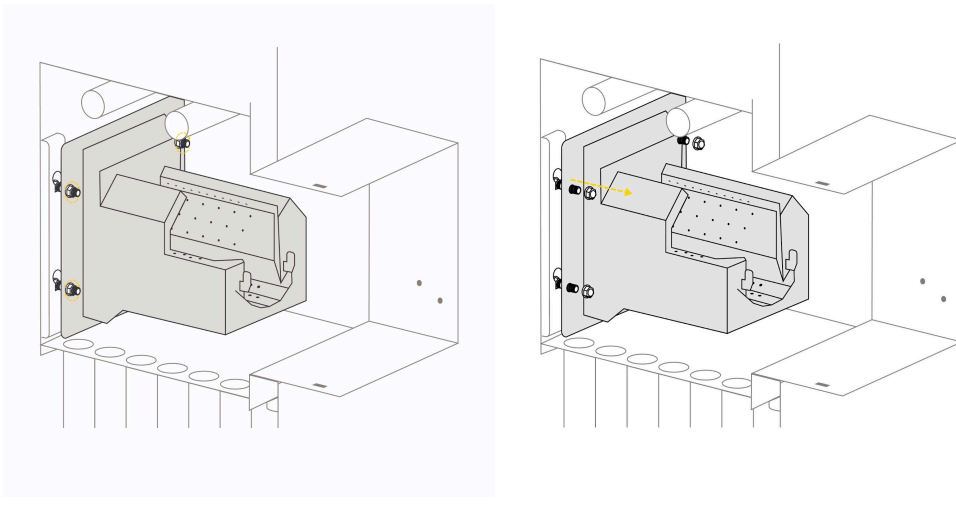
Section 2 : Firebox Area

Prior to removing any ash, ensure that it is cool and disposed of in a non-combustible container.

Ash buildup is most prominent in the firebox, as the fly ash produced during combustion is often too heavy and dense to pass through the primary heat exchangers into the ash container. The 360° directional change in combustion flow also causes gases to swirl, which results in ash particles settling in this area. The burn pot, located inside the firebox, should be included in routine firebox maintenance, as mineral deposits or fly ash can restrict airflow and reduce performance. Inspect and clean the firebox and burn pot on a weekly basis during the heating season, extending to every other week if buildup is minimal.

When cleaning, use the included ash rake (or an approved ash vacuum) to scrape and remove ash from the bottom and edges of the firebox, as well as from the burn pot where buildup collects. Scrape the inner firebox door and door frame to maintain a proper seal and extend the life of the door rope gasket. Regular attention to these areas ensures efficient combustion and reliable boiler performance.

Section 3: Burn Pot Removal, Inspection and Cleaning



During annual maintenance, and whenever deemed necessary, the burn pot should be cooled, removed, inspected, and cleaned. The burn pot is secured inside the firebox with four nuts. To remove it, simply remove the nuts and carefully pull the burn pot outward until it is free from the firebox. The burn pot is equipped with a silicone rope gasket that ensures proper sealing when the unit is reinstalled.

Once removed, clean away any buildup of mineral deposits and make sure the combustion air holes are clear. A round wire brush is recommended for cleaning, but take care not to damage, deform, or enlarge the holes, as this may reduce airflow and affect combustion efficiency. Inspect both the burn pot and the silicone rope gasket for signs of wear or damage, and replace components as needed before reinstalling.

Section 5 : Primary Heat Exchangers

To ensure proper air flow, the primary heat exchanger tubes located inside the bottom of the firebox need to be manually cleaned periodically using the tool/brush provided with the stove. Any ash build-up or accumulation can be pushed down into the ash container area where it can be removed.

Section 4 : Ash Container Area

Following the air path down through the primary heat exchangers leads into the ash container, which is easily accessed from the front of the stove through the ash door. This is the second most common area for ash accumulation, as the combustion flow changes direction again at this point. It is also the starting point of the secondary heat exchanger tubes, where ash loosened by the turbulators during operation will often collect. Special attention should be given to the area where the second-stage heat exchangers begin, as ash buildup tends to accumulate here and can restrict airflow if not removed regularly.

During your first heating season, inspect the ash container weekly to establish how quickly buildup occurs under normal use. If little accumulation is found, the inspection interval may be safely extended to once every three to four weeks. Regular cleaning of this area, especially near the secondary heat exchanger entry, helps maintain proper airflow and supports efficient boiler performance.

Please note that a temperature probe is located in the ash container area and will require periodic cleaning. Exercise extreme caution when performing maintenance in this area to prevent damage to the probe from ash-cleaning tools.

Section 5 : Heat Exchanger/Turbulator Top Access

Ash accumulation can often be found behind the heat exchanger/turbulator top access door, particularly around the top of the heat exchanger tubes. This area should be inspected monthly, with the interval extended to every third month if buildup is consistently minimal.

Whenever the heat exchanger/turbulator top access door is open, also check and clean the fan blade of the induced draft motor and the fan guard mounted on the access door, as ash and debris can collect here and restrict airflow. This is also a good time to look upward through the chimney opening and check for buildup. If creosote has accumulated, it must be removed immediately to reduce the risk of chimney fire and maintain safe, efficient boiler operation.

Section 6 : Secondary Heat Exchanger Cleaners

The heat exchanger cleaners (turbulators), located in the secondary heat exchanger tubes, should be checked regularly to ensure they have full movement up and down via the cleaning rod at the front of the boiler. Restricted movement may indicate ash buildup, binding, or mechanical wear. During inspection, carefully examine the linkage and connections for any signs of wear, bending, or damage, and repair or replace components if necessary.

The cleaners are easily accessible from a handle at the front of the stove. Simply push and pull the Heat Exchanger Cleaner handle to remove any buildup of fly ash from the exchanger tubes. Regular use of the cleaner handle during the heating season helps keep the tubes clear and ensures consistent boiler performance. The cleaner your heat exchanger pipe are, the more efficient the boiler will operate.

Section 7 : Ash Removal & Disposal

The easiest way to remove ash from the boiler is by using a dedicated ash vacuum, as only light fly ash should typically be present. The included ash rake is specially designed to fit into the air passages and can also be used to assist with ash removal.

Ash must always be handled with care, as it may contain hot embers even after extended periods of time. All ash should be placed in a non-combustible metal container with a tight-fitting lid. This container must be set on a non-combustible surface and kept far away from combustible materials. The container should remain in this safe location until final disposal is completed.

WARNING

Never place ash in combustible containers or near flammable materials, as this creates a serious fire hazard.

Section 8 : Door Seals

Crown Royal Stoves use a large diameter high quality coated rope gasket. It is designed to perform for many seasons with proper care. When opening doors, be sure that they are fully opened. This will limit the seal exposure to unnecessary heat and flames. Loose fitting doors will not only lead to ambient air intrusion, and excessive moisture accumulation in the firebox, but the heat moving across the breach can lead to seal failure. If the outer coating becomes damaged, or the rope gasket no longer has any spring (it becomes hard), replacement is immediately necessary.

Replacing the Door Rope Gasket:

1. Remove the old gasket with a 1" putty knife.
2. Clean the channel with a wire brush.
3. Test fit the new seal, then remove.
4. Apply a bead of high-temp silicone (P/N: 50-050) approximately 1" wide and ½" thick.
5. Press the rope gasket firmly into the channel.
6. Seal corners and seams with silicone, smoothing flat with a putty knife.
7. Leave the door open for 24 hours to cure.
8. Position the seam on the vertical hinge side of the door.
9. Adjust the door as necessary to restore a proper seal.

Section 9 : Door Adjustments



Door adjustment can change based on the water temperature. Setting a door on a cold stove may need slight adjustment after it has reached a set temperature. Be sure to check and adjust doors as needed. A video showing how to properly adjust your doors can be found on our website.

Section 10: Exterior Cleaning

The exterior cladding of the boiler does not require special care. Outside components may be cleaned using a mild, non-abrasive cleaner and water suitable for painted surfaces. The black steel components are powder coated for durability. Avoid direct water contact with all electrical components and connections, as any water exposure can cause damage. Do not use high-powered pressure washers.

DANGER

BE SURE ALL ELECTRICAL POWER IS DISCONNECTED PRIOR TO CLEANING OR SERVICING ANY COMPONENTS. HOT COALS CAN LAST FOR SEVERAL DAYS OR MORE. DISPOSE OF HOT COALS IN A NON-COMBUSTIBLE CLOSED CONTAINER PLACED ON A NON-COMBUSTIBLE FLOOR AWAY FROM ANY COMBUSTIBLE MATERIALS. DISPOSING OF THEM IMPROPERLY OR TOO SOON CAN CAUSE A FIRE. BOILER COMPONENTS AND COALS MAY BE EXTREMELY HOT. USE CAUTION WHEN PERFORMING ANY MAINTENANCE.

WARNING

BURNING PELLETS WITH A MOISTURE CONTENT GREATER THAN 10% WILL LEAD TO INCREASED MAINTENANCE REQUIREMENTS, EXCESSIVE FIREBOX CONDENSATION, AND EXCESS CREOSOTE BUILDUP IN THE FIREBOX, HEAT EXCHANGERS, OR CHIMNEY. DOORS SHOULD NOT BE LEFT OPEN, EXCEPT FOR REGULAR MAINTENANCE. NEVER LEAVE THE BOILER UNATTENDED WITH DOORS ADJAR. NEVER ADD USED/WASTE OIL FOR FIRE STARTING, BURNING, OR MAINTENANCE AS A COATING. ONLY UNUSED LIGHTWEIGHT OIL CAN BE USED FOR END OF SEASON MAINTENANCE. NEVER USE A SHOP VAC FOR MAINTENANCE. ONLY A METALLIC LINED ASH VAC SHOULD BE USED. ASH VACS SHOULD BE EMPTIED AS SOON AS EACH TASK IS COMPLETED. DO NOT STORE ASH IN YOUR ASH VAC.

MAINTENANCE CHECKLIST

Before performing any maintenance, ensure that power is fully isolated and the boiler has completely cooled down. Failure to do so may result in serious injury or equipment damage.

FUELING CHECK LIST

- ☐ Check water level, add water if necessary
- ☐ Verify adequate fuel supply; add if needed
- ☐ Inspect and clean firebox and burn pot; remove ash as necessary
- ☐ Scrape inner firebox door and door frame
- ☐ Operate heat exchanger/turbulator cleaning rod (pull/push)

WEEKLY CHECK LIST

- ☐ Inspect system connections for leaks
- ☐ Operate heat exchanger/turbulator cleaning rod (pull/push)
- ☐ Inspect and clean firebox and burn pot (by-weekly depending on buildup)
- ☐ Clean ash buildup in combustion chamber (three to four weeks depending on buildup)
- ☐ Inspect door seals
- ☐ Check door alignment and adjust if needed

MONTHLY CHECK LIST

- ☐ Inspect and clean chimney
- ☐ Clean ash in heat exchanger/turbulator top access door area
 - ☐ Heat exchanger cleaners full movement up and down
 - ☐ Inspect Heat exchanger cleaner linkage
 - ☐ Clean fan guard and blade of induced draft motor
 - ☐ Verify proper fan operation
- ☐ Inspect damper assembly for correct operation
- ☐ Check air openings in burn pot for obstructions

END OF SEASON ANNUAL CHECKLIST

- ☐ Inspect system connections for leaks
- ☐ Check water level and add water if necessary
- ☐ Send water sample for testing (can be completed at start of season)
- ☐ Adjust water quality per test report recommendations
- ☐ Confirm water test report satisfactory
- ☐ Log next due date, one year later from satisfactory report
- ☐ Thoroughly clean ash and creosote from:
 - ☐ Firebox Area
 - ☐ Primary heat exchangers
 - ☐ Ash container

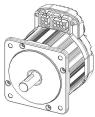
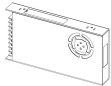
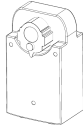
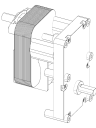
- ☐ Rear heat exchanger/turbulator top access door
- ☐ Inner firebox door and door frame
- ☐ Thoroughly clean:
 - ☐ Secondary heat exchanger tubes
 - ☐ Fan wheel & guard
- ☐ Lubricate actuator assembly
- ☐ Remove burn pot, inspect, clean, and reinstall
- ☐ Cover chimney to prevent rainwater from entering the boiler when not in use
- ☐ Inspect door seals
- ☐ Unplug CH circulators

START OF SEASON ANNUAL CHECKLIST

- ☐ Read Owner's Manual
- ☐ Remove chimney cover and replace chimney cap prior to start-up
- ☐ Test all safety controls and verify proper system operations
- ☐ Inspect system connections for leaks
- ☐ Power up CH Circulators
- ☐ Check water level; add water if necessary
- ☐ Send water sample for testing (can be completed at end of season)
- ☐ Adjust water quality per test report recommendations
- ☐ Confirm water test report satisfactory
- ☐ Log next due date, one year later from satisfactory report
- ☐ Recheck and adjust door alignment after 24 hours of operation

Note: Circulators may need off season exercise. Taco recommends at least 30 seconds, once, every two weeks.

REPLACEMENT PARTS LIST

Image	Description	Part Number	Image	Description	Part Number
	Factory Programed Induced Draft Motor	50-115		RTD, Dual Wire, Temperature Probe, 6mm x 20mm, 320 mm Cable	50-124
	24VDC Power Supply	50-118		RTD, 3 Wire, Temperature Probe, 3/16" x 6", 6ft Cable	50-129
	Variable Actuator, 44 lb	50-119		Factory Programed PLC (Programmable Logic Controller)	50-125
	Ignitor Relay	50-120		Low Water Float Switch, 1/2 NPT Male	50-126
	Stoker/Metering Drive Motor	50-121		Auto Reset Snap Disk, 200 Deg F	50-107
	Igniter	50-122		Door Rope, Silicone Covered, 1" Required Lengths: Firebox Door, 5.5' Ash Container Door, 4' Rear Heat Exchanger Door, 4.5' Burn Pot Gasket 4.5'	50-053
	AC Switch	50-128		Silicone, Black, 10.2 Tube	50-050
	Brass Thermowell, 1/2"	50-038		Control Chemical Inhibitor, 1 Gallon	Control Chemical
				PH+ Builder	Control PH+

TROUBLESHOOTING

Maintain Efficient Combustion and Proper Air Flow

Poor combustion occurs when fuel, air, and ignition are not balanced, leading to reduced heat efficiency, visible (dark) smoke exhausting out of the chimney, or incomplete burning of pellets. Common symptoms include low heat output, excessive ash buildup, weak or irregular flames, ignition failures, unburned pellets, irregular fuel feed, smoke during operation, and longer heat cycles.

Why Proper Combustion Matters:

- **Efficiency:** Maximizes heat output, reduces fuel costs, and minimizes wasted energy.
- **Safety:** Prevents incomplete burning, which can produce harmful gases such as carbon monoxide and increase the risk of smoke or fire hazards.
- **Longevity:** Reduces wear on components, allowing the boiler to operate smoothly for years.
- **Lower Maintenance:** Produces less ash, requiring less frequent cleaning and easier upkeep.

Key Checks:

- Is the PLC calling for heat?
- Is the induced draft motor running?
- Are the fuel metering auger and stoker auger operating properly?
- Is the fuel hopper full?
- Is the igniter functioning correctly?
- Are the actuator and damper opening and closing as they should?
- Is there adequate airflow when the damper is open?
- Are all access doors closed and sealing properly?

Airflow Inspection and Cleaning:

Follow the boiler airflow pathways and check for blockages. Inspect and clean the following areas:

- Burn pot
- Primary heat exchangers
- Secondary heat exchangers
- Ash container area
- Rear heat exchanger/turbulator top access door area
- Chimney system

Backburn in the Boiler

A backburn occurs when fire travels backward from the burn pot into the augers and fuel hopper. This is a serious hazard that must be addressed immediately. If the boiler is operated under these conditions for extended periods, it can lead to damage of internal components and reduced performance.

Causes of a Backburn:

- Restricted airflow or poor draft (dirty burn pot, clogged system air flow, or creosote buildup).
- Improper fuel distribution rates (too much fuel).
- Failure of properly sealing access points in the system.
- Power outages that stop fans and auger motors, allowing smoke or embers to migrate backward.
- Access doors left open.

Risks of Backburn:

- Smoldering fuel in the hopper.
- Potential fire in the fuel delivery systems and/or hopper.
- Increased smoke and safety hazards.

Prevention Measures:

- Properly adjust auger and fan controls settings.
- Regularly clean the firebox, burn pot, secondary combustion chamber, primary and secondary heat exchangers, and chimney system.
- Inspect access door gaskets, burn pot gasket, and adjust doors to ensure airtight integrity.
- Confirm proper draft with correct chimney installation.
- Use only manufacturer-approved fuels.
- Avoid running the hopper completely empty.

Runaway Chimney Fire

A runaway chimney fire occurs when creosote deposits inside the chimney ignite and burn out of control, creating extreme heat and flames that can damage the stove, chimney, or even spread to the building.

- Follow all daily, weekly, monthly, and annual maintenance procedures to prevent chimney fires.
- If a chimney fire occurs:
 - Close all dampers.
 - Shut down power to the unit.
 - Ensure the firebox, ash container door, and heat exchanger doors are securely shut.
 - These steps cut off oxygen supply, extinguishing both the chamber and chimney fires.

Boiler Fails to Heat up:

- Check that the water level is adequate.
- Confirm that the temperature settings are correct.
- Ensure the boiler has power and is in an ON mode.
- Ensure there is no excessive ash build-up in the burn pot.
- Check that the fuel hopper contains an adequate supply.
- Inspect the fuel metering auger for obstructions and that it is delivering fuel to the stoker auger.
- Inspect the stoker auger for obstructions and that it is delivering fuel to the burn pot.
- Check that the burn pot has adequate fuel being delivered.
- Check that the induced draft fan motor is running without errors on controls.
- Check that the hot air igniter is functioning correctly.
- Verify that the actuator damper is open to allow sufficient air velocity.
- Inspect all airflow pathways to ensure they are clear and unobstructed.
- Check that the heat exchanger tubes aren't plugged and the heat exchanger cleaning handle is being pulled regularly.

Boiler Water Hot, No Heat in Buildings:

- Check that the circulation pumps are operating.
- Ensure all valves are open.
- Inspect the filter or Y-strainer for flow restrictions.
- Bleed the system remove trapped air.

Boiler Overheating:

- Retrieve as much heat as possible from the system by turning up the thermostats and opening windows until the boiler cools down.
- Verify that all access doors and the actuator damper are securely closed and that the door gaskets are properly sealed.
- Confirm the actuator damper plate is moving freely without sticking. It should be closed completely when the boiler temperature is over the water setpoint.
- Check that the heat exchanger cleaning rod moves freely.
- Ensure temperature settings and water levels are correct.
- Ensure that all pumps in the system are running.

Boiler Stops Running:

- Confirm that the unit has electrical power (e.g., check if the exterior light is functioning).
- Ensure that the control switches are in the on position.
- Check for power at the electrical box.
- Check the water temperature (furnace is equipped with a high-temperature cut-out at 200°F).
- If these steps do not resolve the issue, contact a qualified technician to inspect the control panel.

Boiler will not Start:

- Check if the high-limit switches have shut off due to water temperature exceeding the aquastat setting.
- Allow the water to cool down.
- Reset the snap disc before restarting.

- It is not possible to initiate the ignition sequence while the boiler is in a **Run–Idling** state and the water temperature has not dropped below the Low Set Point (Low SP).

Power Failure:

During a power outage, the boiler will shut down because the auger, fans, pumps, and PLC require electricity. Without circulation pumps running, hot water in the boiler can overheat and cause extreme safety risks.

- Allow the fire in the burn pot to die out naturally.
- Monitor water temperature.
- Do not open doors.
- When power is restored:
 - Inspect boiler for signs of overheating or damage.
 - Bleed system of trapped air from pumps and line.
- Consider installing a backup power supply to keep circulation pumps and control systems operating during outages.
- **NOTE:** When the power is restored, the boiler will resume in the operating state it was in prior to outage.

Smoke Leaking from Access Door:

- Ensure the door is properly sealed.
- Replace the door seal if it is worn or damaged.
- Adjust the door alignment as needed.

Causes of Excessive Creosote:

- Confirm that the boiler is properly sized to match the heat demand.
- Low combustion temperatures (burning on a low setting too often).
- Poor quality wood pellets.
- Restricted air flow from dirty burn pot, primary and secondary heat exchangers, or chimney.
- Induced draft motor issues.
- Air setting or damper motor issues.
- Infrequent cleaning or missed maintenance schedule.

Low Water:

Frequent water loss may indicate an underlying issue. If the boiler requires adding water more than once a week, or several gallons per week without an obvious explanation, further inspection is necessary.

- Evaporation: Verify that the temperature setpoint is not set higher than 180°F.
- Overheating: Inspect all gaskets for air leaks.
- Check for leaks around the boiler and throughout the plumbing system.

Burning Excess Fuel/ Improper Combustion:

- Could be caused from incorrect fuel feed rate.
- Poor airflow/draft issue.
- Dirty or blocked burn pot.
- Incorrect air settings.
- Poor quality fuel.
- Control, draft motor, auger motors, or ignitor problems.

Poor Water Circulation

- Could be caused from circulation pump issues.
- Air in the system.
- Closed or partially closed valves.
- Blockages in the pumping system.
- Low water level or pressure.
- Improper piping or system design.

Fuel Metering Auger / Stoker Auger not Working

- Check for power supply.
- Inspect the auger shafts for jams, buildup or foreign objects blocking rotation.
- Check that auger motors and drive assemblies are operating correctly, listen for unusual noises or grinding.
- Ensure that auger shafts are not seized
- Clean auger shafts if needed.
- Verify that the PLC and feed signals are functioning and calling for pellet delivery.
- Check connection between motor shaft and auger.

Incorrect Water or Heat Exchanger Temperature Reading

- Inspect and clean temperature probes, ensure properly installed and replace if faulty.
- Confirm that circulation pumps are running and valves are open; bleed system of air if necessary.
- Ensure all air flow pathways are clear of ash and creosote build up.
- Check for adequate fuel and ensure high quality fuel is being used.
- Use an external thermometer at the supply port to verify actual temperature and verify if the controller is in working order.

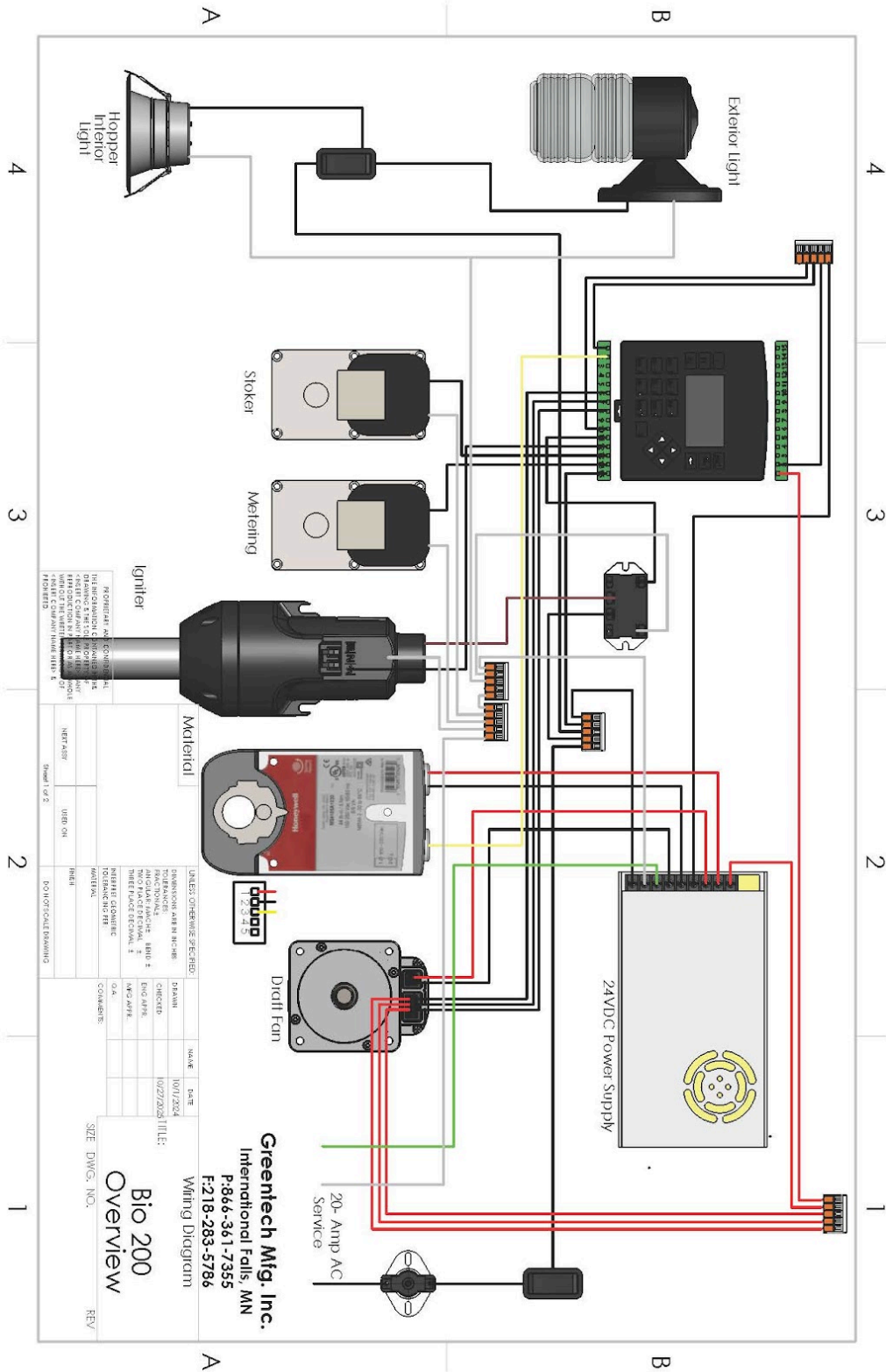
Corrosion in Boiler

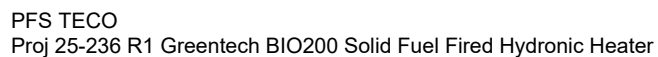
Corrosion in a boiler occurs when moisture, oxygen, and acidic byproducts of combustion interact with metal surfaces inside the unit. Over time, this weakens components, reduces efficiency, and may lead to metal failure.

Common Causes:

- Operating the boiler at low temperatures for extended periods.
- Burning low-quality or high-moisture fuel.
- Low return water temperatures that allow condensation to form.
- Improperly sealed doors or failure to replace worn gaskets.
- Inadequate cleaning and poor maintenance schedules.
- Failure to annually test water and take the necessary actions.
- Insufficient or improper chemical levels.

WIRING DIAGRAM





WATER CARE AND TREATMENT

As outlined on pages 27-29, water quality is crucial to the longevity of your boiler.

Control Treatment & Water Quality Requirements

Greentech Manufacturing, Inc. requires that only Control Treatment be used in all Crown Royal Stoves. Each stove must be shipped with the recommended initial dosage of the authorized treatment. Do not fire the boiler until it has been completely filled with water. Do not fill the boiler with water from a softener. Do not add water to the boiler unless it can be immediately treated with Control Chemical Inhibitor. Always shake the Control Chemical thoroughly before use.

To ensure proper operation and to maintain warranty coverage, water quality must be kept at satisfactory levels in accordance with the instructions provided on the official water sample reports. Water samples must be submitted for analysis to our designated testing facility at the time of installation and at least once every year thereafter, on or near the anniversary of the stove's installation.

Authorized Chemicals		
Control Chemical Inhibitor	1 Gallon	CONTROL
PH Plus Low pH Builder	1 Quart	PH+
Magic Germicide Sanitizer	1 Gallon	200020

Each gallon of Control Chemical includes two sample bottles and labels.

Mandatory Yearly Maintenance Dosage & Free Water Testing

To maintain warranty coverage, the following steps are required each year:

- Submit a water sample to our authorized testing facility.
- Follow instructions provided by authorized testing facility.

Water testing and sample kits are free of charge to all Crown Royal Stove customers for the life of the stove.

Failure to maintain treatment at the recommended levels and submit annual water samples will result in a voided warranty.

Yearly Maintenance Requirements:

Follow the provided instructions for water sample collection, and mail the sample to our authorized testing facility each year. Follow any instructions recommended by the testing facility.

Additional Dosage Requirements

- If the boiler system experiences a leak or requires water to be added, add treatment at the rate of ½ oz per gallon of water added.
- If the system is drained for any reason, follow the Initial Start-up Procedure for Water Treatment.

Purchasing Authorized Control Chemical

Control Chemical is specially formulated for Crown Royal Stoves. To uphold warranty coverage, no other chemical may be substituted. Customers are encouraged to contact their local dealership or call 866-361-7355 to purchase additional water treatment when needed.

An online form is available on our website to request free sample bottles and labels.

Important Notice

Submitting a water sample within the required timeframe that fails water quality standards will not affect your warranty coverage. However, failure to submit a sample, or failure to correct a water quality issue within 30 days of notification, will void the warranty.

Safety Warning

- Always read the full label before using any chemical.
- Safety Data Sheets (SDS) for Control Chemical are available on our website.
- Avoid contact with skin, eyes, and clothing.
- Keep all chemicals out of the reach of children.

Storage Guidelines

- Store chemicals in their original, closed containers when not in use.
- Some boiler treatments may thicken or separate during storage; this does not affect performance.
- Before use, bring the product to room temperature and shake thoroughly.
- Do not allow chemicals to freeze.



Additional Information

For more information, please visit our website to order test bottle kits, access mailing labels, sign up for annual water test reminder emails, and download SDS documents. If you need further assistance with ordering, you may contact your local dealer or call Greentech Manufacturing at **866-361-7355**.

EMERGENCY PROCEDURE FOR CHEMICAL

EMERGENCY FIRST AID PROCEDURES FOR BOILER TREATMENT

EMERGENCY PHONE NUMBER

1-800-424-9300

INHALATION:

Remove from the area to fresh air. If not breathing, clear the airway and start mouth to mouth artificial respiration. GET IMMEDIATE MEDICAL ATTENTION.

EYE CONTACT:

Immediately rinse the eyes with water. Remove any contact lens and continue flushing for at least 15 minutes. Hold the eyelids apart to ensure rinsing of the entire surface of the eyes and lids with water. GET IMMEDIATE MEDICAL ATTENTION.

SKIN CONTACT:

Wash affected areas with large amounts of soap and water for 15 minutes. Remove contaminated clothing and shoes. GET IMMEDIATE MEDICAL ATTENTION.

INGESTION:

Give 3 to 4 glasses of water, but do not induce vomiting. If vomiting occurs, give fluids again. GET IMMEDIATE MEDICAL ATTENTION. DO NOT GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS OR CONVULSING PERSON.

NOTE TO PHYSICIAN:

Introduction into the body may lead to the formation of Methemoglobin which in sufficient concentration causes Cyanosis. Since reversion of the Methemoglobin to Hemoglobin occurs spontaneously after termination of exposure, moderate degrees of Cyanosis should be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of all contaminated areas of the body including scalp and nails is of utmost importance. If Cyanosis is severe, intravenous injection of Methylene blue, 1MG/KG of body weight may be of value. Cyanocobalamin (Vitamin B-12).

WARRANTY

Greentech Manufacturing, Inc. ("Crown Royal Stoves") warrants to the original owner that the water jacket, firebox, and heat exchangers are free from defects in material and workmanship for a period of twenty (20) years from the date of purchase, subject to the prorated schedule set forth below. Parts manufactured by others, and certain other items specified herein, are excluded from this coverage. To validate and maintain this warranty, registration and a water sample must be completed within thirty (30) days of purchase and the owner must strictly comply with all requirements in the Owner's Manual. Additionally, annual water samples must be submitted, and water condition must be maintained as directed in each water test report. Failure to meet these requirements will void this warranty.

Year One Warranty

- Access doors, door gaskets, and refractory moldings are covered for one (1) year from the date of purchase.
- In the event of failure of the firebox, water jacket, or heat exchangers, Crown Royal Stoves will replace the unit with a functionally equivalent model, manufactured from new or operational used parts, at no cost to the original owner. The owner is responsible for removal of the old unit and installation of the replacement unit.

Years Two Through Five Warranty

- Repairs to the firebox, water jacket, and heat exchangers are covered 100%.
- If the unit cannot be repaired and must be replaced, the customer shall pay the difference between the original purchase price and the current purchase price of the replacement unit, plus freight and installation costs.

Years Six and Beyond (Prorated Coverage)

Year 6:	70% of the total weld repair cost.
Year 7:	50% of the total weld repair cost.
Years 8–9:	30% of the total weld repair cost.
Years 10–20:	20% of the total weld repair cost.
Year 21-Beyond	10% discount on the purchase of a new Crown Royal Stove, provided you are the original owner, removing a Crown Royal Stove from service, and replacing it with a brand new Crown Royal Stove from your authorized dealer.

Limited Component Warranty

- Electrical components factory-installed but manufactured by others (including but not limited to aquastats, temperature sensors, limit switches, and fans) are warranted by the original manufacturer for one (1) year from the date of purchase.
- Fuel auger assemblies and flighting have a one (1) year warranty from manufacturer's defects, not improper use.
- Cast iron shaker grates and actuators are components factory-installed but manufactured by others are warranted by the original manufacturer for five (5) years from manufacture date.
- New or refurbished replacement parts will be provided on an exchange basis. Shipping charges and labor are not included.

Exclusions and Limitations

Greentech Manufacturing, Inc. does not warranty:

- Damages caused by: improper installation, improper maintenance, operation outside of design or specifications, acts of God, accidents, abuse, misuse, misapplication, service performed by anyone other than an authorized dealer unless authorized in writing, modifications other than those authorized in writing, or if any serial number has been removed or defaced, by freezing, overheating, pressurization, warping and/or use of unauthorized fuels, negligence, deterioration due to lack of proper or ongoing maintenance, or damage caused by power surges or brown-outs.
- The cost of plumbing, replacement of antifreeze, shipping, labor or any other cost.
- The cost of maintenance, care, or parts identified as “wear items”.
- Unless otherwise stated here, replacement items are “parts only”, and do not include shipping, service calls, mileage, diagnostic, or labor.
- Any damage or cost which may occur from or during the operation of the stove, or damage incurred due to any heating system failure. Crown Royal Stoves cannot be used as the only source of heat; therefore, it is recommended that a back-up system is in place to prevent damages caused by mechanical failures.
- Exterior paint or finish.
- Corrosion failure caused by neglect or unauthorized fuel use.
- Ash corrosion on the inside fire drum and/or heat exchanger chambers.
- Omni-O firebed and upper air distributor components.
- The chimney must be covered when the unit is not in use. It is mandatory to install a chimney cap before operating the unit.
- When plumbing the back of the Crown Royal Stove, the first fitting connection must be stainless steel or brass. The use of any other materials will invalidate this warranty.

Replacement items (parts, components, or boilers) assume the remaining warranty of the original item, or ninety (90) days from the date of receipt of the part, whichever coverage is longer. Replacement items may be required to be returned to Greentech Manufacturing, Inc. or to your dealer, at Greentech’s sole discretion, for testing, inspection, recycling, returning to the original manufacturer, or disposal. Equipment registration and required water sample testing must be on file prior to approval of any warranty claim. If an on-site repair is made, the customer is responsible for the transportation costs and labor. If the furnace needs to be repaired at the factory, it is the consumer’s responsibility to pay all shipping charges to and from the factory. Greentech Manufacturing, Inc. specifically disavows any other representation, warranty, or liability related to the condition or use of this product, whether oral or written, expressed or implied. The purchaser assumes all responsibility and cost for the care, maintenance, and safe operation of the furnace, including the monitoring and adding of Control Chemical. Greentech Manufacturing, Inc. always has the right to decide if the stove will be repaired or replaced.

Important: Failure to use Crown Royal Stoves approved Control Chemical and submit annual water samples will void this warranty. Control Chemical can be purchased either from your authorized dealer or directly from Crown Royal Stoves.

This warranty is subject to change. For the most current information, please consult our website or your local authorized dealer

Obtaining Warranty Service

For assistance with warranty paperwork or claims, please contact your authorized Crown Royal Stoves dealer.



Warranty Claim Forms are available online at:

<https://www.crownroyalstoves.com/parts-warranty-and-return/>

If you suspect a leak, please note that a warranty claim cannot be filed until the leak has been identified and supporting photos and videos have been provided.

If additional support is needed, you may contact the Service Department at Greentech Manufacturing, Inc.:

- **Phone:** 866-361-7355
- **Mail:** Greentech Manufacturing, Inc.
PO Box 1237
International Falls, MN 56649

NOTES

Appendix C: Calibrations

Dry Gas Meter Calibration

DUT

Manufacturer: Apex
 Model:
 Lab ID #: 129
 Serial #:
 Calibration Date: 6/13/2025
 Calibration Expiration: 12/13/2025
 Barometric Pressure: 29.94 in. Hg



Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer: Apex		Fluke	Aquatech	Apex
Model:				
Lab ID#: 47		196	202	129c
Calibration Expiration Date: 6/4/2025		2/11/2025	6/17/2025	2/27/2026
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. Calibrate 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)	107.399	60.166	125.330
Standard DGM Temperature (°F)	69.3	70.0	70.3
Standard DGM Pressure (in H ₂ O)	0.00	0.00	0.00
DGM Initial Volume (ft ³)	0.000	0.000	0.000
DGM Final Volume (ft ³)	3.729	2.106	4.391
DGM Temperature (°F)	70.1	70.3	70.5
DGM Pressure (in H ₂ O)	1.69	1.09	4.25
Net Volume for Standard DGM (ft ³)	3.793	2.125	4.426
Net Volume for DGM (ft ³)	3.729	2.106	4.391
Dry Gas Meter γ Factor	1.012	1.005	0.996
γ Factor Deviation From Average	1.012	1.005	0.996

Average Gas Meter γ Factor

1.004

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Report and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 38860-203315-21 **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

10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/24/2025 Due: 01/31/2026 Vendor: Fluke Report #: EVL1027223
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:	ASME B40.100
Recommended Due Date:	February 27, 2026	Cal-Cert Procedure:	CP-003
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	Red Lion	Temperature:	69 °F
Type:	Pressure Transducer	Humidity:	32% 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:		Range Resolution:		Mode Verified:		Pressure		
UUT Reading	Standard As Found	Standard Verification Reading #1	Error	Standard Verification Reading #2	Error	Tolerance	Expanded Uncertainty ±	
In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	
0.000	0.00	0.00	0.00	0.00	0.00	0.01	0.0005	
0.100	0.1059	0.1059	0.01	0.1019	0.00	0.01	0.0104	
0.250	0.2575	0.2575	0.01	0.2545	0.00	0.01	0.0078	
0.500	0.5012	0.5012	0.00	0.5047	0.00	0.01	0.0091	
0.750	0.7511	0.7511	0.00	0.7435	-0.01	0.01	0.0198	
1.000	1.0092	1.0092	0.01	0.9934	-0.01	0.01	0.0411	
0.750	0.7546	0.7546	0.00	0.7446	-0.01	0.01	0.026	
0.500	0.5054	0.5054	0.01	0.4943	-0.01	0.01	0.0288	
0.250	0.2545	0.2545	0.00	0.2521	0.00	0.01	0.0062	
0.100	0.0941	0.0941	-0.01	0.1009	0.00	0.01	0.0177	
0.000	0.0000	0.0000	0.00	0.0000	0.00	0.01	0.0005	

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.

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

Service Engineer: Samuel Owens

Date: February 27, 2025

Quality Manager: Tony Lewandowski

Signature:



Report and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 38860-203316-21 **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

10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/24/2025 Due: 01/31/2026 Vendor: Fluke Report #: EVL1027223
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:	ASME B40.100
Recommended Due Date:	February 27, 2026	Cal-Cert Procedure:	CP-003
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	Red Lion	Temperature:	69 °F
Type:	Pressure Transducer	Humidity:	35% RH
Model Number:	Unknown	Cal Factor:	None
Serial #:	Unknown	Asset #:	129C
Capacity:	5 In H2O	Service Location:	Service Address
Tolerance:	± 1.00% of Span	As Found:	Pass
Gauge Class:	A	As Left:	Pass

Instrument Range:		Range Resolution:		Mode Verified:		Pressure	
UUT Reading	Standard As Found	Standard Verification Reading #1	Error	Standard Verification Reading #2	Error	Tolerance	Expanded Uncertainty ±
In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O
0.00	0.0000	0.0000	0.00	0.0000	0.00	0.05	0.005
0.50	0.4730	0.4730	-0.03	0.4903	-0.01	0.05	0.045
1.25	1.2178	1.2178	-0.03	1.2325	-0.02	0.05	0.038
2.50	2.4830	2.4830	-0.02	2.4763	-0.02	0.05	0.018
3.75	3.7075	3.7075	-0.04	3.7267	-0.02	0.05	0.05
5.00	4.9570	4.9570	-0.04	4.9676	-0.03	0.05	0.028
3.75	3.7411	3.7411	-0.01	3.7101	-0.04	0.05	0.08
2.50	2.4715	2.4715	-0.03	2.4686	-0.03	0.05	0.009
1.25	1.2346	1.2346	-0.02	1.2180	-0.03	0.05	0.043
0.50	0.4994	0.4994	0.00	0.4811	-0.02	0.05	0.047
0.00	0.0000	0.0000	0.00	0.0000	0.00	0.05	0.005

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.

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

Service Engineer: Samuel Owens

Date: February 27, 2025

Quality Manager: Tony Lewandowski

Signature:



Dry Gas Meter Calibration

DUT

Manufacturer: Apex
 Model:
 Lab ID #: 130
 Serial #:
 Calibration Date: 6/13/2025
 Calibration Expiration: 12/13/2025
 Barometric Pressure: 29.95 in. Hg



Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer: Apex		Fluke	Aquatech	Apex
Model:				
Lab ID#: 47		196	202	129c
Calibration Expiration Date: 6/4/2025		2/11/2025	6/17/2025	2/27/2026
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. Calibrate 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)	67.836	90.653	121.304
Standard DGM Temperature (°F)	70.7	71.0	71.5
Standard DGM Pressure (in H ₂ O)	0.00	0.00	0.00
DGM Initial Volume (ft ³)	0.000	0.000	0.000
DGM Final Volume (ft ³)	2.353	3.174	4.258
DGM Temperature (°F)	74.0	74.0	74.0
DGM Pressure (in H ₂ O)	1.77	0.95	4.09
Net Volume for Standard DGM (ft ³)	2.396	3.201	4.284
Net Volume for DGM (ft ³)	2.353	3.174	4.258
Dry Gas Meter γ Factor	1.018	1.010	0.999
γ Factor Deviation From Average	1.018	1.010	0.999

Average Gas Meter γ Factor

1.009

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Report and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 38860-203317-21 **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

10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/24/2025 Due: 01/31/2026 Vendor: Fluke Report #: EVL1027223
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:	ASME B40.100
Recommended Due Date:	February 27, 2026	Cal-Cert Procedure:	CP-003
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	Red Lion	Temperature:	69 °F
Type:	Pressure Transducer	Humidity:	33% 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:		Range Resolution:		Mode Verified:		Pressure		
UUT Reading	Standard As Found	Standard Verification Reading #1	Error	Standard Verification Reading #2	Error	Tolerance	Expanded Uncertainty ±	
In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	
0.000	0.00	0.00	0.00	0.00	0.00	0.01	0.0005	
0.100	0.0982	0.0982	0.00	0.1012	0.00	0.01	0.0078	
0.250	0.2523	0.2523	0.00	0.2554	0.01	0.01	0.008	
0.500	0.5071	0.5071	0.01	0.5033	0.00	0.01	0.0099	
0.750	0.7544	0.7544	0.00	0.7510	0.00	0.01	0.0089	
1.000	0.9942	0.9942	-0.01	1.0026	0.00	0.01	0.0218	
0.750	0.7548	0.7548	0.00	0.7517	0.00	0.01	0.0081	
0.500	0.5044	0.5044	0.00	0.4925	-0.01	0.01	0.0309	
0.250	0.2422	0.2422	-0.01	0.2540	0.00	0.01	0.0307	
0.100	0.0978	0.0978	0.00	0.1019	0.00	0.01	0.0106	
0.000	0.0000	0.0000	0.00	0.0000	0.00	0.01	0.0005	

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.

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

Service Engineer: Samuel Owens

Date: February 27, 2025

Quality Manager: Tony Lewandowski

Signature:



Report and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 38860-203318-21 **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

10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/24/2025 Due: 01/31/2026 Vendor: Fluke Report #: EVL1027223
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:	ASME B40.100
Recommended Due Date:	February 27, 2026	Cal-Cert Procedure:	CP-003
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	Red Lion	Temperature:	68 °F
Type:	Pressure Transducer	Humidity:	36% 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:		Range Resolution:		Mode Verified:		Pressure		
UUT Reading	Standard As Found	Standard Verification Reading #1	Error	Standard Verification Reading #2	Error	Tolerance	Expanded Uncertainty ±	
In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005	
0.50	0.4838	0.4838	-0.02	0.4885	-0.01	0.05	0.013	
1.25	1.2024	1.2024	-0.05	1.2281	-0.02	0.05	0.067	
2.50	2.4684	2.4684	-0.03	2.4855	-0.01	0.05	0.044	
3.75	3.7132	3.7132	-0.04	3.7348	-0.02	0.05	0.056	
5.00	4.9555	4.9555	-0.04	4.9530	-0.05	0.05	0.01	
3.75	3.7299	3.7299	-0.02	3.7069	-0.04	0.05	0.06	
2.50	2.4683	2.4683	-0.03	2.4679	-0.03	0.05	0.006	
1.25	1.2380	1.2380	-0.01	1.2357	-0.01	0.05	0.008	
0.50	0.4920	0.4920	-0.01	0.4858	-0.01	0.05	0.017	
0.00	0.0000	0.0000	0.00	0.0000	0.00	0.05	0.005	

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.

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

Service Engineer: Samuel Owens

Date: February 27, 2025

Quality Manager: Tony Lewandowski

Signature:



Dry Gas Meter Calibration

DUT

Manufacturer: Apex
 Model:
 Lab ID #: 204
 Serial #:
 Calibration Date: 6/15/2025
 Calibration Expiration: 12/15/2025
 Barometric Pressure: 30.00 in. Hg



Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer: Apex		Fluke	Aquatech	Apex
Model:				
Lab ID#: 47		196	202	129c
Calibration Expiration Date: 6/4/2025		2/11/2025	6/17/2025	2/27/2026
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. Calibrate 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)	82.909	173.718	81.231
Standard DGM Temperature (°F)	70.0	70.4	71.7
Standard DGM Pressure (in H ₂ O)	0.00	0.00	0.00
DGM Initial Volume (ft ³)	0.000	0.000	0.000
DGM Final Volume (ft ³)	2.930	6.178	2.942
DGM Temperature (°F)	72.0	78.0	86.0
DGM Pressure (in H ₂ O)	1.77	3.71	0.67
Net Volume for Standard DGM (ft ³)	2.928	6.135	2.869
Net Volume for DGM (ft ³)	2.930	6.178	2.942
Dry Gas Meter γ Factor	0.997	0.996	0.998
γ Factor Deviation From Average	0.997	0.996	0.998

Average Gas Meter γ Factor

0.997

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Report and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 38860-203321-21 **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

10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/24/2025 Due: 01/31/2026 Vendor: Fluke Report #: EVL1027223
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:	ASME B40.100
Recommended Due Date:	February 26, 2026	Cal-Cert Procedure:	CP-003
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	Red Lion	Temperature:	73 °F
Type:	Pressure Transducer	Humidity:	26% 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:		Range Resolution:		Mode Verified:		Pressure		
UUT Reading	Standard As Found	Standard Verification Reading #1	Error	Standard Verification Reading #2	Error	Tolerance	Expanded Uncertainty ±	
In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	
0.000	0.00	0.00	0.00	0.00	0.00	0.01	0.0005	
0.100	0.1002	0.1002	0.00	0.0997	0.00	0.01	0.0014	
0.250	0.2413	0.2413	-0.01	0.2510	0.00	0.01	0.0252	
0.500	0.4951	0.4951	0.00	0.5037	0.00	0.01	0.0223	
0.750	0.7482	0.7482	0.00	0.7516	0.00	0.01	0.0089	
1.000	0.9973	0.9973	0.00	1.0020	0.00	0.01	0.0122	
0.750	0.7535	0.7535	0.00	0.7424	-0.01	0.01	0.0289	
0.500	0.5029	0.5029	0.00	0.5019	0.00	0.01	0.0027	
0.250	0.2515	0.2515	0.00	0.2541	0.00	0.01	0.0067	
0.100	0.1003	0.1003	0.00	0.1007	0.00	0.01	0.0011	
0.000	0.0000	0.0000	0.00	0.0000	0.00	0.01	0.0005	

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.

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 and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 38860-203322-21 **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

10-01442 Compound Gauge Fluke SN: 4582643 Cal: 01/24/2025 Due: 01/31/2026 Vendor: Fluke Report #: EVL1027223
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:	ASME B40.100
Recommended Due Date:	February 26, 2026	Cal-Cert Procedure:	CP-003
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	Red Lion	Temperature:	74 °F
Type:	Pressure Transducer	Humidity:	29% 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:		Range Resolution:		Mode Verified:		Pressure		
UUT Reading	Standard As Found	Standard Verification Reading #1	Error	Standard Verification Reading #2	Error	Tolerance	Expanded Uncertainty ±	
In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O	In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005	
0.50	0.5011	0.5011	0.00	0.5040	0.00	0.05	0.009	
1.25	1.2522	1.2522	0.00	1.2541	0.00	0.05	0.007	
2.50	2.5116	2.5116	0.01	2.5097	0.01	0.05	0.008	
3.75	3.7589	3.7589	0.01	3.7573	0.01	0.05	0.008	
5.00	4.9905	4.9905	-0.01	4.9750	-0.03	0.05	0.041	
3.75	3.7383	3.7383	-0.01	3.7527	0.00	0.05	0.038	
2.50	2.4902	2.4902	-0.01	2.5049	0.00	0.05	0.038	
1.25	1.2419	1.2419	-0.01	1.2591	0.01	0.05	0.045	
0.50	0.4995	0.4995	0.00	0.5015	0.00	0.05	0.007	
0.00	0.0000	0.0000	0.00	0.0000	0.00	0.05	0.005	

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.

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:



Dry Gas Meter Calibration

DUT

Manufacturer: Apex
 Model: XC-60
 Lab ID #: 55
 Serial #: 810016
 Calibration Date: 8/11/2025
 Calibration Expiration: 2/11/2026
 Barometric Pressure: 30.02 in. Hg



Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer: Apex		Fluke	Aquatech	
Model: SK25Da		52II	DBX2	
Lab ID#: 47		196	202	
Calibration Expiration Date: 6/30/2026		2/11/2026	7/1/2026	
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. Calibrate 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)	111.833	85.340	79.311
Standard DGM Temperature (°F)	76.7	76.9	77.1
Standard DGM Pressure (in H ₂ O)	0.00	0.00	0.0
DGM Initial Volume (ft ³)	0.000	0.000	0.000
DGM Final Volume (ft ³)	3.988	3.043	2.850
DGM Temperature (°F)	83.4	84.1	84.4
DGM Pressure (in H ₂ O)	0.00	0.00	0.00
Net Volume for Standard DGM (ft ³)	3.949	3.014	2.801
Net Volume for DGM (ft ³)	3.988	3.043	2.850
Dry Gas Meter γ Factor	1.001	1.002	0.994
γ Factor Deviation From Average	1.001	1.002	0.994

Average Gas Meter γ Factor

0.999

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$



CERTIFICATE OF CALIBRATION

CUSTOMER:	PFS-TECO : CLACKAMAS, OR	CALIBRATION DATE:	07/01/2025
PO NUMBER:	1130	CALIBRATION DUE:	07/01/2026
INST. MANUFACTURER:	DWYER	PROCEDURE:	T.O.33K6-4-1769-1
INST. DESCRIPTION:	VELOMETER	CALIBRATION FLUID:	AIR @ 14.7 PSIA 70°F
MODEL NUMBER:	471	RECEIVED CONDITION:	WITHIN MFG. SPECS.
SERIAL NUMBER:	CP288559 ID# 095	LEFT CONDITION:	WITHIN MFG. SPECS.
RATED ACCURACY:	SEE NOTES BELOW.	AMBIENT CONDITIONS:	763mm HGA 45% RH 72°F
UNCERTAINTY GIVEN:	± 0.69% RD ; k=2	CERTIFICATE FILE #:	490265.2025
NOTES:	± 3.0% FS (0-500 / 0-1500) ** ± 4.0% F.S. (0-5000) ** ± 5.0% F.S. (0-15000) ** ± 2 °F		

Q.MANUAL IM 2.0 REV 2020.2 DATED 7-27-2020

DECISION RULE: SIMPLE ACCEPTANCE. MEASUREMENT UNCERTAINTIES NOT TAKEN INTO CONSIDERATION WHEN DETERMINING PASS/FAIL

UUT INDICATED FT/MIN	DM.STD. ACTUAL FT/MIN	UUT INDICATED DEG. F	DM STD. ACTUAL DEG. F
65	68	0 TO 200°F	0 TO 200°F
149	154	42.8	44.3
280	289	70.6	72.1
491	504	97.5	99.0
543	557		
1017	1044		
1495	1535		
528	552		
3242	3327		
4990	5130		
6986	7220		
14859	15348		

STANDARDS USED:

A312 ± .02% RD -140 TO 1372 DEG °C TRACE# DMCA1328	DUE	04/24/26
A69 12INCH AIR FLOW 50 - 8000FPM +/- 0.69 % RD TRACE#1649766843,06290041521,1616396227	DUE	03/31/26

All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). Unless otherwise directed by the customer, **Dick Munns uses a decision rule of Simple Acceptance as defined in ILAC G8 with a TUR of 1:1 or better.** 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:

Approved By:

Cal. Technician:

Calibrated at: ☒ Lab

☐ On-Site (Customer's)

07/01/2025

[Signature]

A.V.

Page 1 of 1
Page 292 of 316

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

PO: 1033

Order Date: 03/08/2021

Authorized By: N/A

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



0723.01

Calibration

Property #: 097

User: N/A

Department: N/A

Make: Unknown

Model: 10 Lbs.

Serial #: 097

Description: Mass

Procedure: DCN 500901

Accuracy: Raw Data

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

Parameter

Measurement Data

Measurement Description	Range	Unit	Reference	Min	Max	*Error	UUT	Uncertainty
Before/After								Accredited = $\bar{U}$
Mass								
Raw Data		g	4535.92370000	0.0000000	0.0000000	0.1785299	4536.1022299 g	3.5E-01 $\bar{U}$

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

PFS Teco
11785 SE Hwy 212 STE#305
Clackamas, OR 97015

Report Number: DIRI01C525207572251205

A2LA ACCREDITED **CERTIFICATE OF CALIBRATION WITH DATA**

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Ohaus	PR224/E	C525207572	N/A	Office
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
g	0.0001	QC012	12/5/25	N/A	6/2026

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		STANDARD DEVIATION			ENVIRONMENTAL CONDITIONS		
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:		☐ ☒ ☐ Good Fair Poor	Temperature: 19.1°C	
100	0.0003	50 x 4	0.0002	50	0.0001				
As-Found:		As-Found:		1. 50.0003	5. 50.0002	9. 50.0002			
Pass: ☒	Fail: ☐	Pass: ☒	Fail: ☐	2. 50.0002	6. 50.0002	10. 50.0002			
As-Left:		As-Left:		3. 50.0002	7. 50.0001	<u>Result</u>			
Pass: ☒	Fail: ☐	Pass: ☒	Fail: ☐	4. 50.0001	8. 50.0002	0.00005			

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	200.0020	200.0004	0.00018
100	100.0014	100.0002	0.00017
50	50.0007	50.0003	0.00016
10	10.0003	10.0001	0.00016
1	1.0001	1.0000	0.00016
0.1	0.0998	0.1000	0.00016

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	10 kg to 1 mg	11040	7/3/25	7/2026	20251640

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

12/5/25: Adjusted span. RH 50%

Report prepared/reviewed by: CC Date: 12-5-25

Technician: C.Call

Signature: [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

Report and Certificate of Calibration



www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620



Report #: 42818-1223707-4239 **Customer PO#:**
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Aaron Kravitz
Service Address: 11785 SE Highway 212, Suite 305 Clackamas, OR 97015

Calibration Standards

17-01019 Weight Troemner SN: 50384 Cal: 08/20/2025 Due: 08/30/2030 Vendor: CO Dept of Agriculture Report #: 20251741
17-01616 Thermo-Hygrometer Comark SN: 06210350346 Cal: 07/10/2025 Due: 06/30/2026 Report #: 41434-183372-5539

Instrument Data

Calibration Date:	October 2, 2025	Reference:	ASTM E898-20, D4753-15
Calibration Due Date:	October 2, 2026	Cal-Cert Procedure:	CP-002
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	Ohaus	Temperature:	68 °F
Model Number:	PR224	Humidity:	42% RH
Type:	Digital Balance	Asset #:	None
Serial #:	C525207572	Service Location:	Service Address
Scale Capacity:	200 grams	As Found:	PASS
		As Left:	PASS

Scale Linear Test								
Instrument Range:			Resolution:			0.0001 grams		
Calibration Standard	As Found UUT	As Found Error	As Left UUT	As Left Error	As Left % of Error	Tolerance (As Left) Allowable Error		
grams	grams	grams	grams	grams		Error	Condition	Expanded Unc. (grams)
0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.0000	PASS	0.00000
20.0000	20.0052	0.0052	20.0052	0.0052	0.03	0.0200	PASS	0.00466
40.0000	40.0083	0.0083	40.0083	0.0083	0.02	0.0400	PASS	0.00926
60.0000	60.0110	0.0110	60.0110	0.0110	0.02	0.0600	PASS	0.01387
80.0000	80.0143	0.0143	80.0143	0.0143	0.02	0.0800	PASS	0.01849
100.0000	100.0021	0.0021	100.0021	0.0021	0.00	0.1000	PASS	0.02310
120.0000	120.0056	0.0056	120.0056	0.0056	0.00	0.1200	PASS	0.02772
140.0000	140.0088	0.0088	140.0088	0.0088	0.01	0.1400	PASS	0.03234
160.0000	160.0133	0.0133	160.0133	0.0133	0.01	0.1600	PASS	0.03696
180.0000	180.0167	0.0167	180.0167	0.0167	0.01	0.1800	PASS	0.03926
200.0000	200.0188	0.0188	200.0188	0.0188	0.01	0.2000	PASS	0.04619
100.0000	100.0024	0.0024	100.0024	0.0024	0.00	0.1000	PASS	0.02310
0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.0000	PASS	0.00000

FUNCTIONAL CHECKS					
ECCENTRIC LOAD TEST:		HYSTERESIS: Load Increments		REPEATABILITY:	
Loading position	100.0000	Test Weight Applied. % of load	Readings	Test Weight Applied	100.0000
Right	100.0028	0%	0.0000	1st	100.0023
Left	100.0023	(R1) 50%	100.0021	2nd	100.0024
Front	100.0023	100%	200.0188	3rd	100.0023
Back	100.0031	(R2) 50%	100.0024	4th	100.0023
Center	100.0021	0%	0.0000	5th	100.0023
As Left	PASS	As Left	PASS	As Left	PASS
Tolerance: The maximum error of the eccentric loading must be less than .1% of center load value.		Tolerance: The Difference of R1 and R2 must be within 0.1%		Tolerance: Deviation of lowest and highest reading within 0.1%	

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:

Ryan Wills

Date:

October 2, 2025

Quality Manager:

Tony Lewandowski

Signature:

REPORT#: 42818-1223707-4239

Mettler Toledo

Service Business Unit Industrial
1900 Polaris Parkway
Columbus, OH 43240
1-800-523-5123



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 Frederick
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 and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Left calibration with an external weight.

The calibration was agreed with the user below the maximum capacity of the balance.

	Temperature		Humidity	
As Found	Start: 59.0 °F	End: 59.0 °F	Start: 44.0 %	End: 44.0 %
As Left	Start: 57.0 °F	End: 58.0 °F	Start: 49.0 %	End: 49.0 %

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:	01-Apr-2025	Authorized A2LA Signatory:	
As Left Calibration Date:	01-Apr-2025		
Issue Date:	01-Apr-2025		Xavier Orange
Date of next calibration by customer request:	30-Sep-2025		

Measurement Results

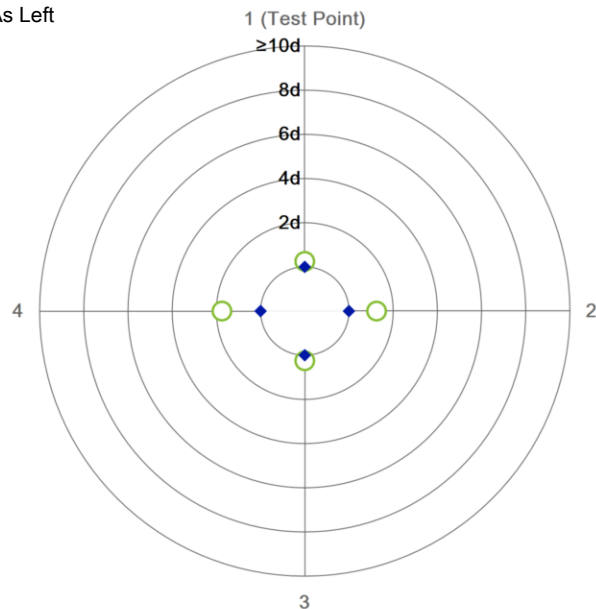
Repeatability

Test Load: 2000 lb

	As Found	As Left
1	1998.8 lb	2000.0 lb
2	1998.6 lb	2000.0 lb
3	1998.8 lb	2000.0 lb
4	1999.2 lb	2000.0 lb

Standard Deviation	0.25 lb	0.00 lb
--------------------	---------	---------

○ As Found
◆ As Left



The "d" in the graph represents the readability of the range/interval in which the test was performed.

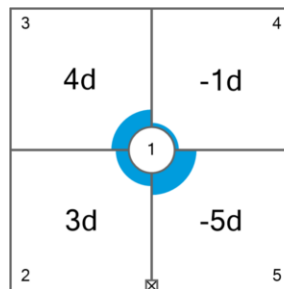
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

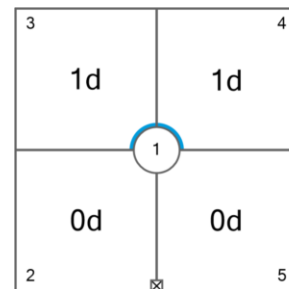
Test Load: 2000 lb

Position	As Found	As Left
1	1998.8 lb	2000.0 lb
2	1999.4 lb	2000.0 lb
3	1999.6 lb	2000.2 lb
4	1998.6 lb	2000.2 lb
5	1997.8 lb	2000.0 lb

Maximum Deviation	1.0 lb	0.2 lb
-------------------	--------	--------



As Found



As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

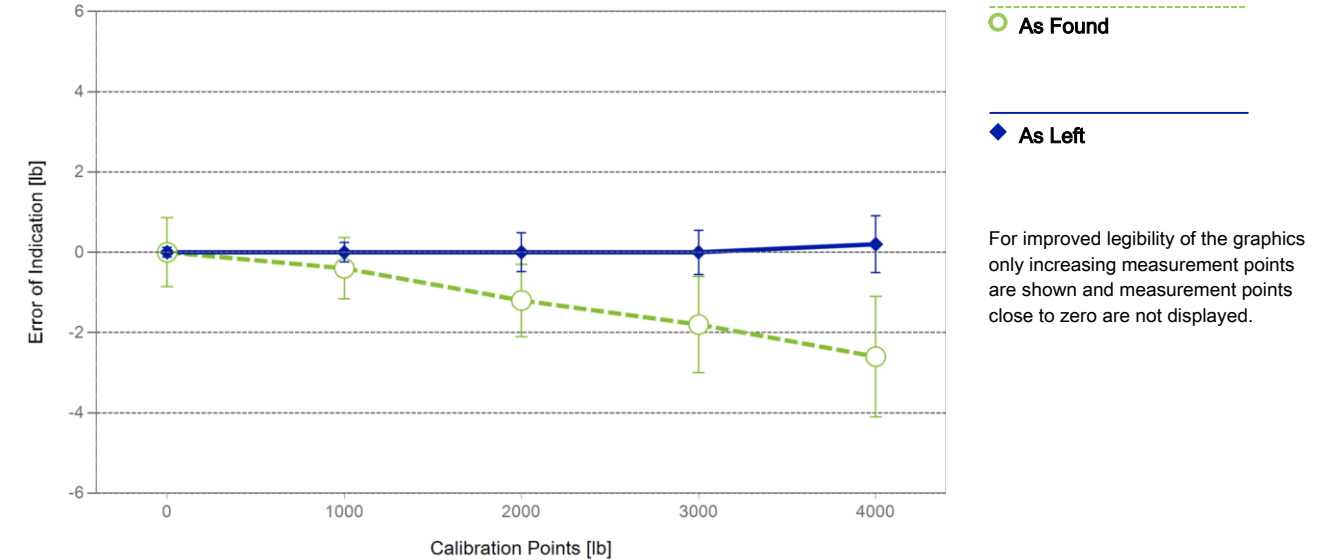
As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0 lb	0.0 lb	0.0 lb	0.86 lb	3.31
2	1000 lb	999.6 lb	-0.4 lb	0.76 lb	2.43
3	2000 lb	1998.8 lb	-1.2 lb	0.90 lb	2.13
4	3000 lb	2998.2 lb	-1.8 lb	1.2 lb	2.05
5	4000 lb	3997.4 lb	-2.6 lb	1.5 lb	2.05

As Left

	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	0.24 lb	2
3 ¹	2000 lb	2000.0 lb	0.0 lb	0.48 lb	2
4 ¹	3000 lb	3000.0 lb	0.0 lb	0.55 lb	2
5	4000 lb	4000.2 lb	0.2 lb	0.71 lb	2

¹The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



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

The recording of false fictitious or fraudulent statements or entries on this document may be punishable as a felony under federal statute.

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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 · 10⁻⁶ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 18 °F

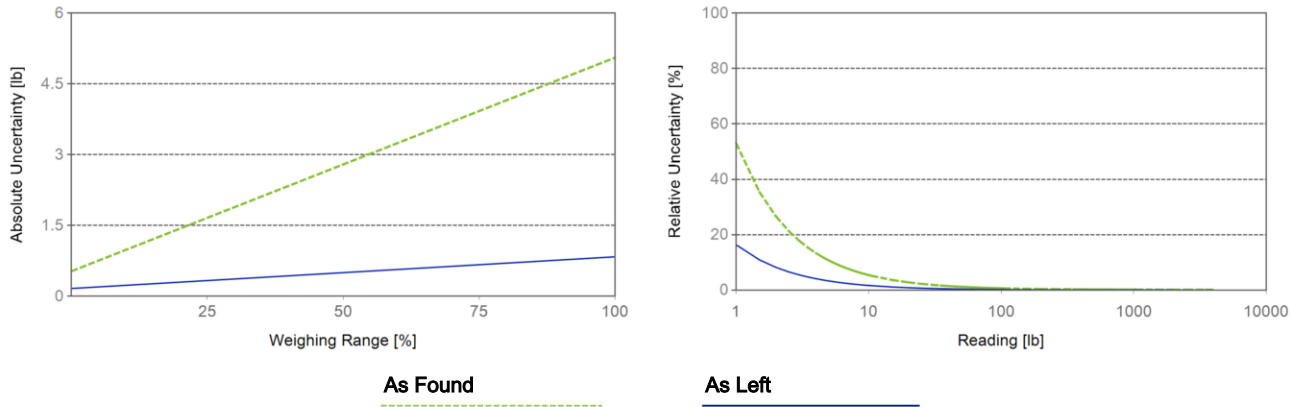
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.2 lb	4000 lb	$U_1 = 0.53 \text{ lb} + 0.00113 \text{ lb/lb} \cdot R$	$U_1 = 0.16 \text{ lb} + 0.000168 \text{ lb/lb} \cdot R$

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	0.53 lb	13%	0.16 lb	4.0%
40.0 lb	0.58 lb	1.4%	0.17 lb	0.42%
400.0 lb	0.98 lb	0.25%	0.23 lb	0.057%
2000.0 lb	2.8 lb	0.14%	0.50 lb	0.025%
4000.0 lb	5.1 lb	0.13%	0.83 lb	0.021%



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.

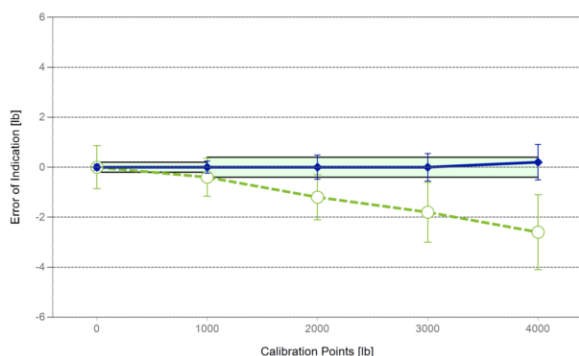
The range of measurements for both Eccentricity and Repeatability (if performed) tests is assessed against Maintenance Tolerances.

Overall
As Found ✗
As Left ✓

✓ = 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	2.2 lb	✗	0.2 lb	✓
Eccentricity (Range)	2000 lb	0.4 lb	1.8 lb	✗	0.2 lb	✓
Repeatability (Max. Error)	2000 lb	0.4 lb	1.4 lb	✗	0.0 lb	✓
Repeatability (Range)	2000 lb	0.4 lb	0.6 lb	✗	0.0 lb	✓

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	✓	0.0 lb	✓
2	1000 lb	0.2 lb	-0.4 lb	✗	0.0 lb	✓
3	2000 lb	0.4 lb	-1.2 lb	✗	0.0 lb	✓
4	3000 lb	0.4 lb	-1.8 lb	✗	0.0 lb	✓
5	4000 lb	0.4 lb	-2.6 lb	✗	0.2 lb	✓

Mettler Toledo

Service Business Unit Industrial
1900 Polaris Parkway
Columbus, OH 43240
1-800-523-5123



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 Frederick
Zip / Postal:	97015-9050		
State / Province:	Oregon		

Weighing Device

Manufacturer:	Mettler Toledo	Terminal Model:	IND 570
Model:	Floor Scale PFD774 US11	Terminal Serial No.:	C133380080
Serial No.:	C149108036	Terminal Asset No.:	N/A
Instrument Type:	Weighing Instrument	Building:	N/A
Asset Number:	N/A	Floor:	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:	SVC-WI-LABTEC-063

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.

As Found	Temperature		Humidity		Environmental conditions have been verified to ensure the accuracy of the calibration.
	Start: 64.0 °F	End: 64.0 °F	Start: 65.0 %	End: 65.0 %	

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:	02-Oct-2025	Authorized A2LA Signatory:	
As Left Calibration Date:	N/A		
Issue Date:	02-Oct-2025		Xavier Orange
Date of next calibration by customer request:	30-Apr-2026		

Measurement Results

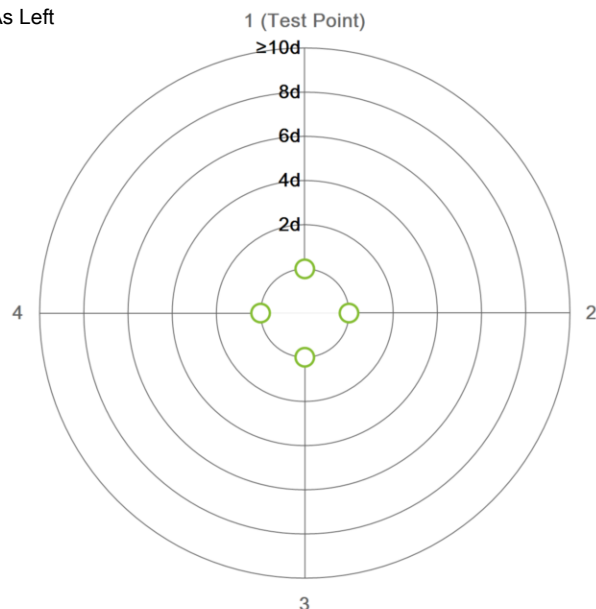
Repeatability

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

○ As Found
◆ As Left

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.

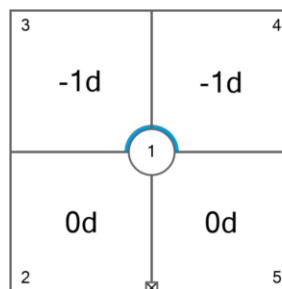
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 2000 lb

Position	As Found	As Left
1	2000.0 lb	N/A
2	2000.0 lb	N/A
3	1999.8 lb	N/A
4	1999.8 lb	N/A
5	2000.0 lb	N/A

Maximum Deviation	0.2 lb	N/A
-------------------	--------	-----



As Found

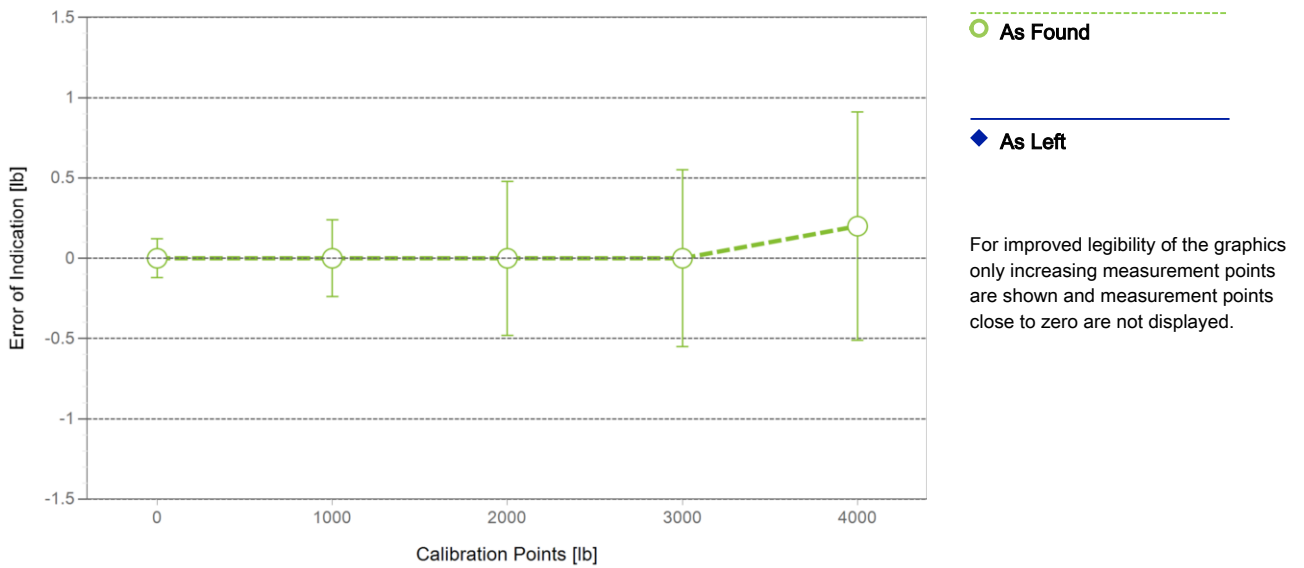
The "d" in the graph represents the readability of the range/interval in which the test was performed.

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	0.24 lb	2
3 ¹	2000 lb	2000.0 lb	0.0 lb	0.48 lb	2
4 ¹	3000 lb	3000.0 lb	0.0 lb	0.55 lb	2
5	4000 lb	4000.2 lb	0.2 lb	0.71 lb	2

¹The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



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:	20-May-2025
Certificate Number:	OR-25-150-F	Calibration Due Date:	31-May-2026

Remarks

N/A

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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: $0 ^\circ F$

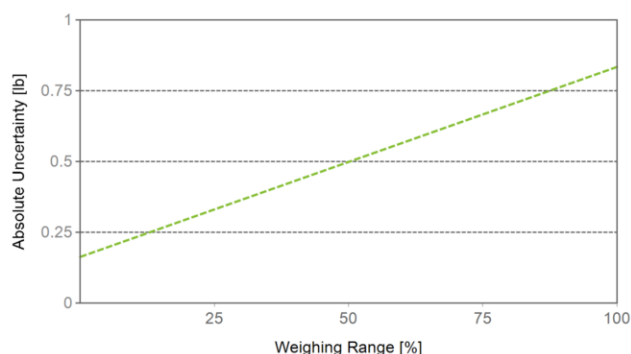
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.2 lb	4000 lb	$U_1 = 0.16 \text{ lb} + 0.000168 \text{ lb/lb} \cdot R$	N/A

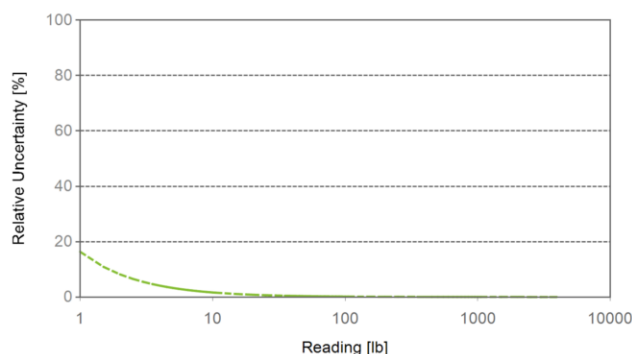
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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	0.42%	N/A	N/A
400.0 lb	0.23 lb	0.057%	N/A	N/A
2000.0 lb	0.50 lb	0.025%	N/A	N/A
4000.0 lb	0.83 lb	0.021%	N/A	N/A



As Found



As Left



Are you looking for some clarifications on the terms and graphs in your ACC calibration certificate? Do you know how to leverage its full value?

More information at:
► www.mt.com/ACC-Cert-Info



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.

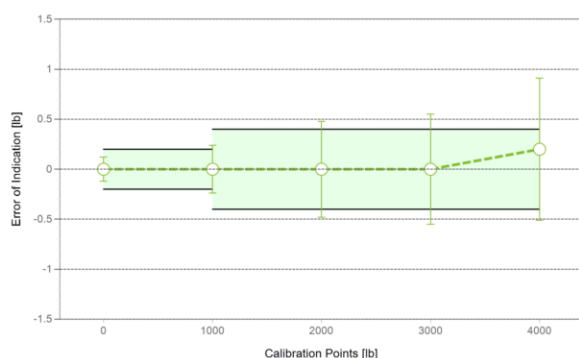
The range of measurements for both Eccentricity and Repeatability (if performed) tests is assessed against Maintenance Tolerances.

Overall
As Found
As Left 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	0.2 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	0.0 lb		N/A	N/A
5	4000 lb	0.4 lb	0.2 lb		N/A	N/A



CERTIFICATE OF CALIBRATION

CUSTOMER: PFS-TECO CLACKAMAS OR
PO NUMBER: 1130
INST. MANUFACTURER: OMEGA
INST. DESCRIPTION: MASS FLOWMETER
MODEL NUMBER: FMA-1608A
SERIAL NUMBER: 285467
RATED ACCURACY: +/- .8 % RD. + .2 % F.S.
UNCERTAINTY GIVEN: TOTAL measurement uncertainty: +/- .31 % RD. K = 2
NOTES: REFERENCE CONDITIONS: 760mmHGA & 70 DEG. F QM.IM 2.0 REV. DATED 7-27-2020
DECISION RULE: SIMPLE ACCEPTANCE. MEASUREMENT UNCERTAINTIES NOT TAKEN INTO CONSIDERATION WHEN DETERMINING PASS/FAIL

CALIBRATION DATE: 06/30/25
CALIBRATION DUE: 06/30/26
PROCEDURE: NAVAIR-17-20MG-20
CALIBRATION FLUID: AIR
AS RECEIVED: WITHIN SPECS.
AS RETURNED: WITHIN SPECS.
AMBIENT CONDITIONS: 761 mm HGA 45 % RH 73 F
CERTIFICATE FILE #: 531513.2025

TEST POINT NUMBER	UUT INDICATED SLPM	DM.STD. ACTUAL SLPM	LOWER LIMITS SLPM	UPPER LIMITS SLPM
1	2.002	1.972	1.946	2.058
2	3.985	3.938	3.913	4.057
3	6.001	5.960	5.913	6.089
4	7.967	7.921	7.863	8.071
5	10.045	9.998	9.925	10.165
6	12.023	11.976	11.887	12.159
7	13.991	13.958	13.839	14.143
8	16.034	15.975	15.866	16.202
9	18.034	17.976	17.850	18.218
10	19.985	19.905	19.785	20.185

STANDARDS USED:

A24 TEMP.STD.:HART SCIENTIFIC +/- .19 F (+/- .04 C) TRACE# 1683031933	DUE	04/28/26
A290 VOLUME PROVER +/- .12% RD 0-50 LPM TRACE# 1682664031,1683031933	DUE	05/09/26

All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). Unless otherwise directed by the customer, Dick Munns uses a decision rule of Simple Acceptance as defined in ILAC G8 with a TUR of 1:1 or better. 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:

Approved By:

Cal. Technician:

Calibrated at: ☒ Lab
☐ On-Site (Customer's)

06/30/2025
PFS-TECO

[Signature]

JA

Page 307 of 316

Thermocouple Readout Calibration

DUT

Manufacturer:	National Instruments
Model:	NI 9213
Lab ID #:	216
Serial #:	
Calibration Date:	8/26/2025
Calibration Expiration:	2/26/2026
Barometric Pressure:	29.91 in. Hg



Equipment Used:	Ref. Std. TC Signal Generator
Manufacturer:	Omega
Model:	CL23A
Lab ID#:	165
Cal. Expiration Date:	2/11/2026

Calibrate in accordance with EA-10/11 • EA Guidelines on the Calibration of Temperature Indicators and Simulators by Electrical Simulation and Measurement. Use procedure specified for thermocouple indicators without cold junction compensation.

Use only calibrated, NIST traceable reference standard signal generator.

Stated uncertainty calculated with RSS method with k=2 for a 95% confidence interval.

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.8	0.8	0.906
	500	499.2	0.8	
Tunnel	1000	998.8	1.2	
Type K	1500	1498.8	1.2	
	2000	1998.4	1.6	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.8	0.8	0.906
	500	499.2	0.8	
Flue	1000	998.8	1.2	
Type K	1500	1498.8	1.2	
	2000	1998.4	1.6	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.8	0.8	0.906
	500	499.2	0.8	
Filter A	1000	998.8	1.2	
Type K	1500	1498.8	1.2	
	2000	1998.4	1.6	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.8	0.8	0.906
	500	499.2	0.8	
Filter B	1000	998.8	1.2	
Type K	1500	1498.8	1.2	
	2000	1998.4	1.6	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.8	0.8	0.906
	500	499.2	0.8	
Filter C	1000	998.8	1.2	
Type K	1500	1498.8	1.2	
	2000	1998.4	1.6	

Thermocouple Readout Calibration

DUT

Manufacturer:	National Instruments
Model:	NI 9213
Lab ID #:	216
Serial #:	
Calibration Date:	8/26/2025
Calibration Expiration:	2/26/2026
Barometric Pressure:	29.91 in. Hg



Equipment Used:	Ref. Std. TC Signal Generator
Manufacturer:	Omega
Model:	CL23A
Lab ID#:	165
Cal. Expiration Date:	2/11/2026

Calibrate in accordance with EA-10/11 • EA Guidelines on the Calibration of Temperature Indicators and Simulators by Electrical Simulation and Measurement. Use procedure specified for thermocouple indicators without cold junction compensation.

Use only calibrated, NIST traceable reference standard signal generator.

Stated uncertainty calculated with RSS method with k=2 for a 95% confidence interval.

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.8	0.8	0.906
	500	499.2	0.8	
Meter A	1000	998.8	1.2	
Type K	1500	1498.8	1.2	
	2000	1998.4	1.6	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.4	0.4	0.906
	500	499.6	0.4	
Meter B	1000	999.5	0.5	
Type K	1500	1499.2	0.8	
	2000	1999.1	0.9	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.4	0.4	0.906
	500	499.6	0.4	
Meter C	1000	999.5	0.5	
Type K	1500	1499.2	0.8	
	2000	1999.1	0.9	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.4	0.4	0.906
	500	499.6	0.4	
FB Top	1000	999.5	0.5	
Type K	1500	1499.2	0.8	
	2000	1999.1	0.9	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.4	0.4	0.906
	500	499.6	0.4	
FB Bottom	1000	999.5	0.5	
Type K	1500	1499.2	0.8	
	2000	1999.1	0.9	

Thermocouple Readout Calibration

DUT

Manufacturer:	National Instruments
Model:	NI 9213
Lab ID #:	216
Serial #:	
Calibration Date:	8/26/2025
Calibration Expiration:	2/26/2026
Barometric Pressure:	29.91 in. Hg



Equipment Used:	Ref. Std. TC Signal Generator
Manufacturer:	Omega
Model:	CL23A
Lab ID#:	165
Cal. Expiration Date:	2/11/2026

Calibrate in accordance with EA-10/11 • EA Guidelines on the Calibration of Temperature Indicators and Simulators by Electrical Simulation and Measurement. Use procedure specified for thermocouple indicators without cold junction compensation.

Use only calibrated, NIST traceable reference standard signal generator.

Stated uncertainty calculated with RSS method with k=2 for a 95% confidence interval.

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-0.4	0.4	0.906
	500	499.6	0.4	
FB Back	1000	999.5	0.5	
Type K	1500	1499.2	0.8	
	2000	1999.1	0.9	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-1.0	1	0.906
	500	498.9	1.1	
FB Left	1000	999.1	0.9	
Type K	1500	1498.7	1.3	
	2000	1998.6	1.4	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-1.0	1	0.906
	500	498.9	1.1	
FB Right	1000	999.1	0.9	
Type K	1500	1498.7	1.3	
	2000	1998.6	1.4	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	-1.0	1	0.906
	500	498.9	1.1	
Catalyst	1000	999.1	0.9	
Type K	1500	1498.7	1.3	
	2000	1998.6	1.4	

Channel	Std. TC Signal	DUT	Error	Expanded Uncertainty
	0	0.2	0.2	0.906
	50	50.3	0.3	
Ambient	100	100.3	0.3	
Type T	150	150.3	0.3	
	200	200.4	0.4	



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 thoroughly 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 #: 206483
Expires: 2-2024

NorLAB

To Order Call: 800-657-6672

In Emergency Call: 1-800-424-6300
Norco, Inc.
808 W. Gowen Road
Boise, Idaho 83705

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.
4760 S. Alameda
Los Angeles, CA 90008

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 50 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/vapors; Vapor 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; Contact supplier for any special requirements; Dispose of contents/container in accordance with local/regional/national/international regulations. 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 flush eyes with plenty of water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are washed.

Appendix F – Efficiency Measurement and Calculation Discussion

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.