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# Thelin Hearth Products, Inc.

Project # 22-826

Model: Gnome

Type: Pellet-Fired Room Heater

October 26, 2022

**Revised January 9, 2023**

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**ASTM E2779 Standard Test Method for  
Determining Particulate Matter  
Emissions from Pellet Heaters (EPA  
ALT-146)**

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Contact: Mr. Robert Beck  
Thelin Hearth Products, Inc.  
63 Lexalt Dr.  
Carson City, NV 89706  
(775)-241-2586 ext. 105

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Prepared by: Aaron Kravitz, Testing  
Supervisor

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

## **Revision History:**

Date: October 26, 2022 – Original Issue

Date: January 9, 2023 – The following change was made per request from EPA:

- Alternate test method approval letter added to Appendix A, see page 68 of Non-CBI report.

## Contents

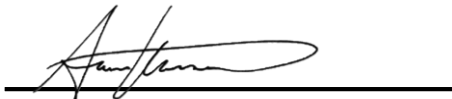
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## Affidavit

PFS-TECO was contracted by Thelin Hearth Products, Inc. to provide testing services for the Gnome Pellet-Fired Room Heater per ASTM E2779, *Determining PM Emissions from Pellet Heaters*. All testing and associated procedures were conducted at PFS-TECO's Portland Laboratory on 10/5/2022. PFS-TECO's Portland Laboratory is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed EPA ALT-146 / ASTM E2779. Particulate sampling was performed per ASTM E2515, *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel*.

PFS-TECO is accredited by the U.S. Environmental Protection Agency for the certification and auditing of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards for Residential Wood Heaters and subpart QQQQ of 40 CFR Part 60, Standards of Performance for New Hydronic Heaters and Forced Air Furnaces, Methods 28R, 28WHH, 28 WHH-PTS, and all methods listed in Sections 60.534 and 60.5476. PFS-TECO holds EPA Accreditation Certificate Numbers 4 and 4M (mobile). PFS-TECO is accredited by IAS to ISO 17020:2012 "Criteria for Bodies Performing Inspections", and ISO 17025:2005 "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, Testing Supervisor

## Introduction

Theelin Hearth Products, Inc. of Carson City, NV, contracted with PFS-TECO to perform EPA certification testing on Gnome Pellet-Fired Room Heater. All testing was performed at PFS-TECO's Portland Laboratory. Testing was performed by Mr. Aaron Kravitz.

## Notes

- Prior to start of testing, 50 hours of conditioning was performed by the manufacturer at a medium heat setting, per ASTM E2779
- Prior to start of testing, the dilution tunnel was cleaned with a steel brush.
- Front filters were changed on sample train A at one hour after the test began.
- A single test was performed in accordance with EPA ALT-146 burn rate settings:
  - 1 Hour at Maximum Burn Setting
  - 2 Hours at Medium Burn Setting (less than the mid-point of the high and low rates)
  - 3 Hours at Minimum Burn Setting

## Pellet Heater Identification and Testing

- Appliance Tested: **Gnome**
- Serial Number: **N/A – Prototype Unit; PFS Tracking #0127**
- Manufacturer: **TheLin Hearth Products, Inc.**
- Catalyst: **No**
- Heat exchange blower: **Integral**
- Type: **Pellet Stove**
- Style: **Free Standing**
- Date Received: **Monday, September 19, 2022**
- Testing Period – Start: **Wednesday, October 05, 2022**      Finish:  
**Wednesday, October 05, 2022**
- Test Location: **PFS-TECO Portland Laboratory, 11785 SE HWY 212 - Suite 305, Clackamas, OR 97015**
- Elevation: **≈131 Feet above sea level**
- Test Technician(s): **Aaron Kravitz**
- Observers: **N/A**

## Test Procedures and Equipment

All Sampling and analytical procedures were performed by Aaron Kravitz. All procedures used are directly from ASTM E2779 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
189	Mettler Toledo 3'x3' floor scale w/digital weight indicator
053	APEX XC-60 Digital Emissions Sampling Box A
054	APEX XC-60 Digital Emissions Sampling Box B
203	APEX XC-50-DIR Digital Emissions Sampling Box C
055	APEX Ambient sampling box
057	California Analytical ZRE CO2/CO/O2 IR ANALYZER
202	Digital Barometer
109A/B	Troemner 100mg/200mg Audit Weights
107	Sartorius Analytical Balance
097	10 lb audit weight
095	Anemometer
111	Microtector
CC106574	Gas Analyzer Calibration Span Gas
CC139173	Gas Analyzer Calibration Mid Gas

## Results

The integrated test run emission rate for test Run 1 was measured to be **0.98 g/hr** with a Higher Heating Values efficiency of **75%** and a CO emission rate of **0.12 g/min**. The calculated first hour particulate emission rate was **1.6 g/hr**. The Thelin Hearth Products, Inc. Model Gnome Pellet-Fired Room Heater meets the 2020 PM emission standard of ≤ 2.0 g/hr per CFR 40 part 60, §60.532 (b).

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

### Summary Table

EPA Application Table											
Run Number	Date	Segments		Run Time (min)	Heat Output (BTU/hr)	1st Hr Emissions (g/hr)	Integrated Total (g/hr)	CO Emissions (g/min)	Overall CO Emissions (g/min)	Heating Efficiency (%HHV)	Overall Heating Efficiency (%HHV)
		Setting	BR								
1	10/5/2022	H	1.21	60	16532	1.6	0.98	0.10	0.12	73%	75%
		M	1.01	120	13857			0.11		74%	
		L	0.82	180	11523			0.13		76%	
		OA	0.95	360	13151			0.12		75%	

### Test Run Narrative

#### *Run 1*

Run 1 was performed on 10/5/2022 as an attempted integrated test run per EPA ALT-146/ ASTM E2779. The overall test duration was 360 minutes. The particulate emissions rate for the integrated test run was 0.98 g/hr. The run had an overall HHV efficiency of 75%. A separate filter train C was run for the first hour of the run only. All test results were appropriate and valid and the burn rate requirement for the integrated test run were achieved. There were no anomalies and all criteria were met.



## Test Conditions Summary

Testing conditions for all runs fell within allowable specifications of ASTM E2779 and ASTM E2515. A summary of facility conditions, fuel burned, and run times is listed below.

Runs	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	72	68	42.6	54.8	30.00	2.8	13.0	3.78	360

## 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.

## Settings & Run Notes

	Pre-Burn	Test Run
<b>Run 1</b>	"High" selected Trim pot at 1:00	High Segment: "High" selected, Trim pot at 1:00 Medium Segment: "Med" selected, Trim pot at 1:00 Low Segment: "Low" selected, Trim pot at 1:00

## Appliance Description

**Model(s):** Gnome

**Appliance Type:** Pellet-Fired Room Heater

**Air Introduction System:** A variable speed combustion fan forces air into the firebox through holes in the bottom of the firepot.

**Combustion Control:** A control panel on the side of the unit is used to select burn rates, which are varied by automatic modulation of the combustion fan and feed system. An automatically controlled distribution bower is also installed.

**Fueling System:** A horizontal auger driven by a gear motor, meters pellets through a drop tube (over feed) to a fire pot in the firebox.

**Baffles:** N/A

**Flue Outlet:** Venting is through a 3" diameter steel pipe, which exits through the back of the unit. The venting system is to be 3" nominal diameter listed type L or type PL vent pipe with all the joints sealed.

## Appliance Dimensions

GNOME Dimensions

Height	Width	Depth	Firebox Volume	Weight
34"	18.5"	18.5"	N/A – Pellet Stove	129 lbs

Appliance design drawings can be found in Appendix D submitted with the CBI copy of this report.

Appliance Front



Appliance Left



Appliance Right



Appliance Rear



# Test Fuel Properties



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

# Pellet Fuel Analysis



Twin Ports Testing, Inc.  
 1301 North 3rd Street  
 Superior, WI 54880  
 p: 715-392-7114  
 p: 800-373-2562  
 f: 715-392-7163  
 www.twinportstesting.com

**Report No:** USR:W222-0658-01  
**Issue No:** 1

## Analytical Test Report

**Client:** PFS-TECO  
 11785 SE Hwy 212 Ste 305  
 Clackamas, OR 97015  
**Attention:** Sebastian Button  
**PO No:**

**Signed:**  
  
 Amber Anderson  
 Chemist  
**Date of Issue:** 10/17/2022  
THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL

**Sample Details**  
**Sample Log No:** W222-0658-01  
**Sample Designation:** Wood Pellets  
**Sample Recognized As:** Biomass Pellets  
**Sample Date:**  
**Sample Time:**  
**Arrival Date:** 10/6/2022

	METHOD	UNITS	MOISTURE	
			FREE	AS RECEIVED
Moisture Total	ASTM E871	wt. %		3.64
Ash	ASTM D1102	wt. %	0.52	0.50
Volatile Matter	ASTM D3175	wt. %		
Fixed Carbon by Difference	ASTM D3172	wt. %		
Sulfur	ASTM D4239	wt. %	0.014	0.014
SO <sub>2</sub>	Calculated	lb/mmbtu		0.034
Net Cal. Value at Const. Pressure	ISO 1928	GJ/tonne	18.12	17.37
Gross Cal. Value at Const. Vol.	ASTM E711	Btu/lb	8442	8135
Carbon	ASTM D5373	wt. %	44.90	43.26
Hydrogen*	ASTM D5373	wt. %	6.96	6.70
Nitrogen	ASTM D5373	wt. %	0.57	0.55
Oxygen*	ASTM D3176	wt. %	47.04	45.33

\*Note: As received values do not include hydrogen and oxygen in the total moisture.

Chlorine	ASTM D6721	mg/kg		
Fluorine	ASTM D3761	mg/kg		
Mercury	ASTM D6722	mg/kg		
Bulk Density	ASTM E873	lbs/ft <sup>3</sup>		
Fines (Less than 1/8")	TPT CH-P-06	wt. %		
Durability Index	Kansas State	PDI		
Sample Above 1.50"	TPT CH-P-06	wt. %		
Maximum Length (Single Pellet)	TPT CH-P-06	inch		
Diameter, Range	TPT CH-P-05	inch		to
Diameter, Average	TPT CH-P-05	inch		
Stated Bag Weight	TPT CH-P-01	lbs		
Actual Bag Weight	TPT CH-P-01	lbs		

**Comments:**

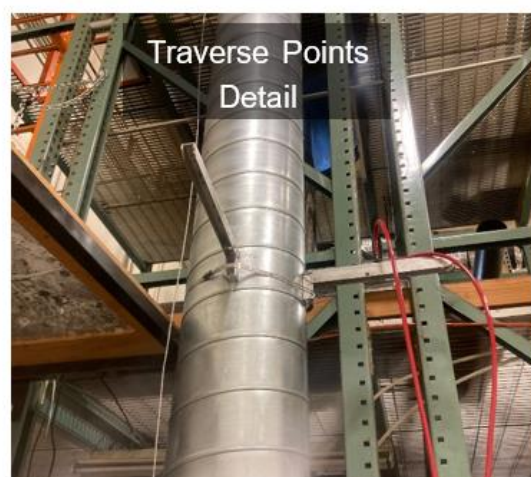
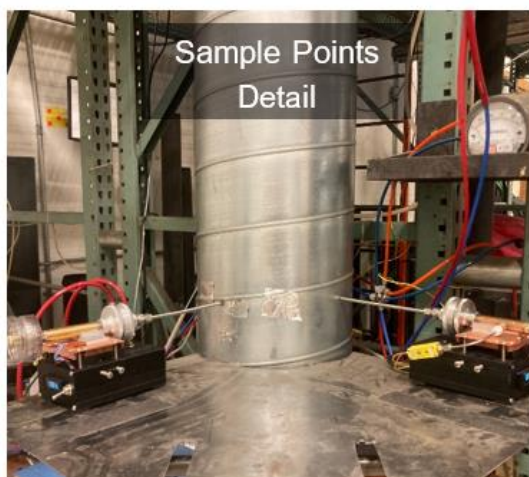


Accreditation #60243

Results issued on this report only reflect the analysis of the sample submitted. Our reports and letters are for the exclusive and confidential use of our clients and may not be reproduced, except in their entirety, without the written approval of Twin Ports Testing. Twin Ports Testing Laboratory is accredited to the ISO/IEC 17025:2017 standard by PJLA.

## Sampling Locations and Descriptions

Sample ports are located 16.5 feet downstream from any disturbances and 2 feet upstream from any disturbances. Flow rate traverse data was collected 8 feet downstream from any disturbances and 4 feet upstream from any disturbances. (See below).



## Sampling Methods

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

## Analytical Methods Description

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

## Calibration, Quality Control and Assurances

Calibration procedures and results were conducted per EPA Method 28R, ASTM E2515-11 and ASTM E2780-10. Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined.

## Appliance Sealing and Storage

Upon completion of testing, the appliance was secured with metal strapping and the seal below was applied, the appliance was then returned to the manufacturer’s location at: 63 Lexalt Dr, Carson City, NV 89706 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, Sample Analysis, and Alternate Test Method Approval

Appendix B – Labels and Manuals

Appendix C – Equipment Calibration Records

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

**PELLET TEST DATA PACKET**  
**ASTM E2779/E2515**



**Run 1 Data Summary**

Client: Thelin  
Model: Gnome  
Job #: 22-826  
Tracking #: 127  
Test Date: 10/5/2022

  
\_\_\_\_\_  
Technician Signature

10/26/2022  
\_\_\_\_\_  
Date

## TEST RESULTS - ASTM E2779 / ASTM E2515

Client: Thelin \_\_\_\_\_  
 Model: Gnome \_\_\_\_\_  
 Run #: 1 \_\_\_\_\_

Job #: 22-826 \_\_\_\_\_  
 Tracking #: 127 \_\_\_\_\_  
 Technician: AK \_\_\_\_\_  
 Date: 10/5/2022 \_\_\_\_\_

Burn Rate Summary	
High Burn Rate (dry kg/hr)	1.21
Medium Burn Rate (dry kg/hr)	1.01
Low Burn Rate (dry kg/hr)	0.82
Overall Burn Rate (dry kg/hr)	0.95

Medium Burn Rate Target: < 1.01 dry kg/hr

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft <sup>3</sup> )	50.312	52.372	51.939	8.865
Average Gas Velocity in Dilution Tunnel (ft/sec)	7.1			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	19223.4			
Average Gas Meter Temperature (°F)	67.8	94.1	94.2	82.7
Total Sample Volume (dscf)	51.850	50.268	49.836	8.680
Average Tunnel Temperature (°F)	80.0			
Total Time of Test (min)	360			
Total Particulate Catch (mg)	0.0	2.7	2.4	0.7
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000537	0.0000482	0.0000806
Total PM Emissions (g)	0.00	6.20	5.55	1.55
Particulate Emission Rate (g/hr)	0.00	1.03	0.93	1.55
Emissions Factor (g/kg)	-	1.09	0.98	1.28
Difference from Average Total Particulate Emissions (g)	-	0.32	0.32	-
Difference from Average Total Particulate Emissions (%)	-	5.5%	5.5%	-
Difference from Average Emissions Factor (g/kg)	-	0.06	0.06	-

Final Average Results	
Total Particulate Emissions (g)	5.87
Particulate Emission Rate (g/hr)	0.98
Emissions Factor (g/kg)	1.03
HHV Efficiency (%)	74.6%
LHV Efficiency (%)	80.8%
CO Emissions (g/min)	0.12

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	OK
Face Velocity	< 30 ft/min	8.2	OK
Leakage Rate	Less than 4% of average sample rate	0.001 cfm	OK
Ambient Temp	55-90 °F	66.3 / 72.1	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
Medium Burn Rate	< midpoint of the high and low burn rates	1.01	OK

## Overall Pellet Test Efficiency Results

**Manufacturer:** Thelin  
**Model:** Gnome  
**Date:** 10/05/22  
**Run:** 1  
**Control #:** 22-826  
**Test Duration:** 360  
**Output Category:** Integrated

### Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
<b>Overall Efficiency</b>	74.6%	80.8%
<b>Combustion Efficiency</b>	99.5%	99.5%
<b>Heat Transfer Efficiency</b>	75.0%	81.2%

<b>Output Rate (kJ/h)</b>	13,863	13,151	<b>(Btu/h)</b>
<b>Burn Rate (kg/h)</b>	0.95	2.09	<b>(lb/h)</b>
<b>Input (kJ/h)</b>	18,588	17,633	<b>(Btu/h)</b>

<b>Test Load Weight (dry kg)</b>	5.68	12.53	<b>dry lb</b>
<b>MC wet (%)</b>	3.64		
<b>MC dry (%)</b>	3.78		
<b>Particulate (g )</b>	5.87		
<b>CO (g)</b>	42		
<b>Test Duration (h)</b>	6.00		

Emissions	Particulate	CO
<b>g/MJ Output</b>	0.07	0.50
<b>g/kg Dry Fuel</b>	1.03	7.37
<b>g/h</b>	0.98	6.99
<b>g/min</b>	0.02	0.12
<b>lb/MM Btu Output</b>	0.16	1.17

<b>Air/Fuel Ratio (A/F)</b>	21.47
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VERSION:

2.2

12/14/2009

## Max Burn Rate Segment Efficiency Results

**Manufacturer:** Thelin  
**Model:** Gnome  
**Date:** 10/05/22  
**Run:** 1  
**Control #:** 22-826  
**Test Duration:** 60  
**Output Category:** Maximum

### Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
<b>Overall Efficiency</b>	73.3%	79.4%
<b>Combustion Efficiency</b>	99.5%	99.5%
<b>Heat Transfer Efficiency</b>	73.7%	79.8%

<b>Output Rate (kJ/h)</b>	17,428	16,532	<b>(Btu/h)</b>
<b>Burn Rate (kg/h)</b>	1.21	2.67	<b>(lb/h)</b>
<b>Input (kJ/h)</b>	23,765	22,543	<b>(Btu/h)</b>

<b>Test Load Weight (dry kg)</b>	1.21	2.67	<b>dry lb</b>
<b>MC wet (%)</b>	3.64		
<b>MC dry (%)</b>	3.78		
<b>Particulate (g )</b>	N/A		
<b>CO (g)</b>	6		
<b>Test Duration (h)</b>	1.00		

Emissions	Particulate	CO
<b>g/MJ Output</b>	N/A	0.35
<b>g/kg Dry Fuel</b>	N/A	5.02
<b>g/h</b>	N/A	6.08
<b>g/min</b>	N/A	0.10
<b>lb/MM Btu Output</b>	N/A	0.81

<b>Air/Fuel Ratio (A/F)</b>	19.67
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VERSION:

2.2

12/14/2009

## Medium Burn Rate Segment Efficiency Results

**Manufacturer:** Thelin  
**Model:** Gnome  
**Date:** 10/05/22  
**Run:** 1  
**Control #:** 22-826  
**Test Duration:** 120  
**Output Category:** Medium

### Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
<b>Overall Efficiency</b>	73.9%	80.0%
<b>Combustion Efficiency</b>	99.5%	99.5%
<b>Heat Transfer Efficiency</b>	74.2%	80.4%

<b>Output Rate (kJ/h)</b>	14,607	13,857	<b>(Btu/h)</b>
<b>Burn Rate (kg/h)</b>	1.01	2.22	<b>(lb/h)</b>
<b>Input (kJ/h)</b>	19,775	18,759	<b>(Btu/h)</b>

<b>Test Load Weight (dry kg)</b>	2.02	4.44	<b>dry lb</b>
<b>MC wet (%)</b>	3.64		
<b>MC dry (%)</b>	3.78		
<b>Particulate (g )</b>	N/A		
<b>CO (g)</b>	13		
<b>Test Duration (h)</b>	2.00		

Emissions	Particulate	CO
<b>g/MJ Output</b>	N/A	0.45
<b>g/kg Dry Fuel</b>	N/A	6.49
<b>g/h</b>	N/A	6.54
<b>g/min</b>	N/A	0.11
<b>lb/MM Btu Output</b>	N/A	1.04

<b>Air/Fuel Ratio (A/F)</b>	21.39
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VERSION:

2.2

12/14/2009

## Minimum Burn Rate Segment Efficiency Results

**Manufacturer:** Thelin  
**Model:** Gnome  
**Date:** 10/05/22  
**Run:** 1  
**Control #:** 22-826  
**Test Duration:** 180  
**Output Category:** Minimum

### Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
<b>Overall Efficiency</b>	75.6%	81.8%
<b>Combustion Efficiency</b>	99.5%	99.5%
<b>Heat Transfer Efficiency</b>	76.0%	82.3%

<b>Output Rate (kJ/h)</b>	12,147	11,523	<b>(Btu/h)</b>
<b>Burn Rate (kg/h)</b>	0.82	1.81	<b>(lb/h)</b>
<b>Input (kJ/h)</b>	16,072	15,246	<b>(Btu/h)</b>

<b>Test Load Weight (dry kg)</b>	2.46	5.42	<b>dry lb</b>
<b>MC wet (%)</b>	3.64		
<b>MC dry (%)</b>	3.78		
<b>Particulate (g )</b>	N/A		
<b>CO (g)</b>	23		
<b>Test Duration (h)</b>	3.00		

Emissions	Particulate	CO
<b>g/MJ Output</b>	N/A	0.62
<b>g/kg Dry Fuel</b>	N/A	9.22
<b>g/h</b>	N/A	7.55
<b>g/min</b>	N/A	0.13
<b>lb/MM Btu Output</b>	N/A	1.44

<b>Air/Fuel Ratio (A/F)</b>	22.20
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VERSION:

2.2

12/14/2009



## PELLET STOVE PREBURN DATA - ASTM E2779

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Recording Interval (min): 1  
 Run Time (min): 60

Elapsed Time (min)	Scale Reading (lbs)	Weight Change (lbs)	Average:	-0.061	397	71
			Flue Draft (in H <sub>2</sub> O)	Flue (°F)	Ambient (°F)	
0	2.8	-	-0.063	392	70	
1	2.8	-0.07	-0.063	407	70	
2	2.7	-0.06	-0.063	410	70	
3	2.7	-0.05	-0.063	410	70	
4	2.6	-0.05	-0.061	407	70	
5	2.6	-0.05	-0.063	408	70	
6	2.5	-0.04	-0.061	406	70	
7	2.5	-0.07	-0.063	413	70	
8	2.4	-0.06	-0.063	418	70	
9	2.3	-0.06	-0.064	423	70	
10	2.3	-0.05	-0.062	422	71	
11	2.2	-0.05	-0.061	421	71	
12	2.2	-0.04	-0.060	430	71	
13	2.1	-0.05	-0.061	415	71	
14	2.1	-0.06	-0.063	415	71	
15	2.0	-0.05	-0.063	415	71	
16	2.0	-0.05	-0.065	417	71	
17	1.9	-0.06	-0.061	416	71	
18	1.9	-0.04	-0.060	417	71	
19	1.9	-0.03	-0.064	418	71	
20	1.8	-0.04	-0.059	412	71	
21	1.8	-0.03	-0.059	401	71	
22	1.7	-0.06	-0.061	402	71	
23	1.7	-0.05	-0.059	400	71	
24	1.6	-0.03	-0.058	391	71	
25	1.6	-0.04	-0.059	382	71	
26	1.6	-0.04	-0.058	383	71	
27	1.5	-0.06	-0.063	388	71	
28	1.4	-0.06	-0.064	399	71	
29	1.4	-0.06	-0.064	406	71	
30	1.3	-0.05	-0.063	405	71	
31	1.3	-0.02	-0.062	396	71	
32	1.3	-0.06	-0.062	400	71	
33	1.2	-0.05	-0.062	401	71	
34	1.1	-0.06	-0.062	404	71	
35	1.1	-0.05	-0.063	404	71	
36	1.1	-0.04	-0.062	397	71	
37	1.0	-0.04	-0.060	394	71	
38	1.0	-0.03	-0.058	385	71	
39	1.0	-0.03	-0.061	375	72	
40	0.9	-0.05	-0.061	376	72	
41	0.9	-0.05	-0.058	378	72	
42	0.8	-0.04	-0.062	380	72	
43	0.8	-0.05	-0.061	386	72	
44	0.7	-0.05	-0.062	389	72	
45	0.7	-0.05	-0.060	387	72	
46	0.6	-0.04	-0.063	390	72	



## DILUTION TUNNEL & MISC. DATA - ASTM E2779 / E2515

Client: **Thelin**  
 Model: **Gnome**  
 Run #: **1**  
 Test Start Time: **8:30**

Job #: **22-826**  
 Tracking #: **127**  
 Technician: **AK**  
 Date: **10/5/2022**

High Burn End Time (min): **60**  
 Medium Burn End Time (min): **180**  
 Total Sampling Time (min): **360**  
 Recording Interval (min): **1**

Meter Box  $\gamma$  Factor: **1.000** (A)  
 Meter Box  $\gamma$  Factor: **1.000** (B)  
 Meter Box  $\gamma$  Factor: **0.999** (C)  
 Meter Box  $\gamma$  Factor: **1.028** (Ambient)  
 Induced Draft Check (in. H<sub>2</sub>O): **0**  
 Smoke Capture Check (%): **100%**  
 Date Flue Pipe Last Cleaned: **10/4/2022**

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.99	30	30.00
Relative Humidity (%)	42.6	54.8	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:	50.312		ft <sup>3</sup>

**Sample Train Post-Test Leak Checks**

(A)	0.000	cfm @	-5	in. Hg
(B)	0.001	cfm @	-4	in. Hg
(C)	0.000	cfm @	-5	in. Hg
(Ambient)	0.000	cfm @	-12	in. Hg

## DILUTION TUNNEL FLOW

### Traverse Data

Point	dP (in H <sub>2</sub> O)	Temp (°F)
1	0.004	85
2	0.012	84
3	0.014	84
4	0.014	84
5	0.012	84
6	0.010	84
7	0.010	84
8	0.014	84
9	0.012	84
10	0.014	84
11	0.012	84
12	0.006	84
Center	0.014	84

Dilution Tunnel H<sub>2</sub>O: **2.00** percent  
 Tunnel Diameter: **12** inches  
 Pitot Tube C<sub>p</sub>: **0.99** [unitless]  
 Dilution Tunnel MW(dry): **29.00** lb/lb-mole  
 Dilution Tunnel MW(wet): **28.78** lb/lb-mole  
 Tunnel Area: **0.7854** ft<sup>2</sup>

$V_{strav}$ : **7.013** ft/sec  
 $V_{scent}$ : **7.952** ft/sec  
 $F_p$ : **0.882** [ratio]  
 Initial Tunnel Flow: **314.9** scf/min

Static Pressure: **-0.170** in. H<sub>2</sub>O

## 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**

Pellet Brand:	Bear Mtn
Pellet Fuel Grade:	PFI Premium
HHV (BTU/lb)	8442
%C	44.9
%H	6.96
%O	47.62
%Ash	0.52
MC (%WB)	3.64

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.014	1.50	76.2	0.73		13.0		85	395	72	71.9
1	0.141	0.141	0.014	2.07	76	0.81	102	12.9	-0.1	85	398	72	71.8
2	0.286	0.145	0.014	2.07	76	0.79	105	12.9	-0.1	85	402	72	71.7
3	0.428	0.142	0.014	2.08	76.1	0.84	103	12.8	0.0	85	400	73	71.8
4	0.571	0.143	0.014	2.09	76.2	0.86	103	12.8	0.0	85	388	73	71.9
5	0.717	0.146	0.014	2.10	76.3	0.78	106	12.8	0.0	85	377	73	72
6	0.858	0.141	0.014	2.11	76.4	0.79	102	12.7	-0.1	85	381	73	71.9
7	1.005	0.147	0.014	2.10	76.6	0.82	106	12.7	0.0	85	382	73	71.9
8	1.146	0.141	0.014	2.11	76.7	0.81	102	12.7	0.0	84	377	73	71.8
9	1.295	0.149	0.014	2.12	76.9	0.84	108	12.6	-0.1	84	380	73	72
10	1.438	0.143	0.014	2.13	77.1	0.81	103	12.6	0.0	84	381	73	71.8
11	1.583	0.145	0.014	2.13	77.2	0.89	105	12.5	0.0	84	381	73	72
12	1.728	0.145	0.014	2.14	77.5	0.88	105	12.5	0.0	84	383	73	72
13	1.872	0.144	0.014	2.14	77.7	0.88	104	12.4	-0.1	84	383	73	72
14	2.021	0.149	0.014	2.15	78	0.85	107	12.4	0.0	84	387	74	72
15	2.164	0.143	0.014	2.15	78.2	0.84	103	12.3	0.0	84	385	74	72.1
16	2.313	0.149	0.014	2.17	78.5	0.83	107	12.3	0.0	84	385	74	72
17	2.456	0.143	0.014	2.16	78.7	0.88	103	12.2	-0.1	84	384	74	72
18	2.604	0.148	0.014	2.16	79	0.85	106	12.2	0.0	84	379	74	71.9
19	2.748	0.144	0.014	2.17	79.3	0.83	103	12.2	0.0	84	372	74	72.1
20	2.898	0.150	0.014	2.18	79.5	0.9	108	12.1	0.0	84	375	74	71.7
21	3.043	0.145	0.014	2.19	79.8	0.9	104	12.1	-0.1	84	381	74	71.8
22	3.194	0.151	0.014	2.20	80.1	0.91	108	12.0	0.0	84	377	74	71.8
23	3.338	0.144	0.014	2.18	80.4	0.88	103	12.0	0.0	84	379	74	71.8
24	3.488	0.150	0.014	2.20	80.7	0.9	108	11.9	-0.1	84	383	74	71.9
25	3.634	0.146	0.014	2.19	81.1	0.91	105	11.9	0.0	85	386	74	72.1
26	3.782	0.148	0.014	2.20	81.3	0.89	106	11.8	0.0	85	387	74	71.9
27	3.929	0.147	0.014	2.20	81.7	0.86	105	11.8	-0.1	85	386	74	72
28	4.077	0.148	0.014	2.20	82	0.88	106	11.7	0.0	85	388	74	72
29	4.225	0.148	0.015	2.20	82.3	0.9	102	11.7	0.0	84	384	74	71.4
30	4.373	0.148	0.014	2.21	82.7	0.9	106	11.6	-0.1	84	387	74	70.2
31	4.523	0.150	0.014	2.21	83.1	0.88	107	11.6	-0.1	84	390	74	70
32	4.670	0.147	0.014	2.22	83.4	0.9	105	11.5	0.0	84	389	74	69.9

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
33	4.820	0.150	0.014	2.21	83.8	0.86	107	11.5	0.0	84	386	74	69.5
34	4.968	0.148	0.015	2.22	84	0.93	102	11.5	0.0	84	382	74	68.9
35	5.119	0.151	0.014	2.24	84.4	0.9	107	11.4	-0.1	84	381	74	69.3
36	5.266	0.147	0.014	2.23	84.7	0.91	105	11.4	0.0	84	383	74	69
37	5.418	0.152	0.014	2.23	85	0.92	108	11.3	-0.1	84	385	74	68.6
38	5.565	0.147	0.014	2.23	85.3	0.93	104	11.3	0.0	84	385	74	68.8
39	5.717	0.152	0.015	2.24	85.6	0.9	104	11.2	0.0	83	384	74	68.5
40	5.864	0.147	0.014	2.23	85.9	0.93	104	11.2	0.0	84	388	74	68.5
41	6.016	0.152	0.014	2.23	86.2	0.91	108	11.1	-0.1	84	394	74	68.3
42	6.163	0.147	0.014	2.23	86.4	0.91	104	11.1	0.0	84	395	74	68.3
43	6.315	0.152	0.014	2.23	86.6	0.92	108	11.0	-0.1	84	393	74	67.8
44	6.462	0.147	0.014	2.24	86.9	0.91	104	11.0	0.0	84	394	74	68.5
45	6.615	0.153	0.014	2.24	87.1	0.93	108	10.9	0.0	84	391	74	68
46	6.762	0.147	0.014	2.23	87.3	0.92	104	10.9	0.0	83	382	73	67.9
47	6.914	0.152	0.015	2.24	87.5	0.94	104	10.9	-0.1	83	383	73	68.2
48	7.062	0.148	0.014	2.24	87.8	0.9	105	10.8	0.0	83	385	73	67.7
49	7.214	0.152	0.014	2.24	88	0.91	107	10.8	0.0	83	386	73	67.9
50	7.362	0.148	0.014	2.24	88.2	0.93	105	10.7	0.0	83	384	73	67.7
51	7.515	0.153	0.014	2.25	88.4	0.94	108	10.7	-0.1	83	388	73	68
52	7.663	0.148	0.014	2.24	88.6	0.95	104	10.6	0.0	83	391	73	67.6
53	7.815	0.152	0.014	2.24	88.8	0.93	107	10.6	0.0	83	388	73	67.4
54	7.963	0.148	0.014	2.24	89	0.94	104	10.5	0.0	84	384	73	67.6
55	8.116	0.153	0.014	2.25	89.2	0.93	108	10.5	0.0	84	383	73	67.8
56	8.264	0.148	0.014	2.24	89.4	0.94	104	10.4	-0.1	84	388	73	67.4
57	8.416	0.152	0.014	2.25	89.6	0.93	107	10.4	0.0	84	392	73	67.6
58	8.564	0.148	0.014	2.25	89.8	0.93	104	10.3	-0.1	84	394	73	67.9
59	8.716	0.152	0.015	2.25	90	0.94	103	10.3	0.0	84	396	73	67.7
60	8.865	0.149	0.014	2.25	90.1	0.93	105	10.2	-0.1	84	398	73	67.7
61	9.015	0.150	0.014	2.11	90.3	0.91	106	10.2	-0.1	83	392	73	67.7
62	9.158	0.143	0.014	2.10	90.4	0.89	101	10.2	0.0	83	382	73	67.4
63	9.307	0.149	0.014	2.11	90.6	0.9	105	10.1	0.0	83	376	73	67.6
64	9.449	0.142	0.014	2.11	90.8	0.87	100	10.1	0.0	83	373	73	67.5
65	9.598	0.149	0.014	2.11	90.9	0.91	105	10.0	0.0	82	366	72	67.2

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
66	9.741	0.143	0.014	2.11	91.1	0.92	100	10.0	0.0	82	366	72	67.3
67	9.891	0.150	0.014	2.12	91.2	0.92	105	10.0	0.0	82	365	72	67.3
68	10.035	0.144	0.014	2.11	91.4	0.9	101	9.9	-0.1	82	362	72	67.2
69	10.183	0.148	0.014	2.11	91.5	0.88	104	9.9	0.0	82	362	72	67.3
70	10.328	0.145	0.014	2.10	91.7	0.92	102	9.8	0.0	82	364	72	67.2
71	10.473	0.145	0.014	2.11	91.8	0.92	102	9.8	-0.1	82	365	72	67.3
72	10.620	0.147	0.014	2.10	91.9	0.9	103	9.7	0.0	82	365	72	67.3
73	10.765	0.145	0.014	2.11	92	0.91	102	9.7	0.0	82	366	72	67.3
74	10.915	0.150	0.014	2.13	92.1	0.88	105	9.7	0.0	82	359	72	67.4
75	11.059	0.144	0.014	2.12	92.2	0.87	101	9.6	0.0	82	354	72	67.4
76	11.208	0.149	0.014	2.13	92.4	0.91	104	9.6	-0.1	82	361	72	67.2
77	11.351	0.143	0.014	2.11	92.5	0.91	100	9.6	0.0	82	360	72	67
78	11.501	0.150	0.014	2.11	92.6	0.93	105	9.5	0.0	82	358	72	66.9
79	11.644	0.143	0.014	2.13	92.7	0.9	100	9.5	0.0	81	358	72	67.2
80	11.794	0.150	0.014	2.12	92.8	0.89	105	9.4	0.0	81	358	72	67
81	11.938	0.144	0.014	2.11	92.9	0.92	101	9.4	0.0	82	359	72	67.4
82	12.088	0.150	0.014	2.13	93	0.93	105	9.4	0.0	82	358	72	67.3
83	12.233	0.145	0.014	2.12	93	0.97	101	9.3	-0.1	81	364	72	67.3
84	12.381	0.148	0.014	2.12	93.2	0.88	103	9.3	-0.1	81	369	72	67.2
85	12.527	0.146	0.015	2.12	93.3	0.95	99	9.2	0.0	82	371	72	67.1
86	12.673	0.146	0.014	2.11	93.3	0.93	102	9.2	-0.1	82	371	72	67.4
87	12.820	0.147	0.014	2.11	93.4	0.93	103	9.1	0.0	82	373	72	67.5
88	12.966	0.146	0.014	2.12	93.6	0.93	102	9.1	-0.1	82	377	72	67.7
89	13.114	0.148	0.014	2.12	93.6	0.92	103	9.0	-0.1	82	379	72	67.4
90	13.260	0.146	0.014	2.12	93.8	0.95	102	9.0	-0.1	82	379	72	67.1
91	13.409	0.149	0.014	2.11	93.8	0.89	104	8.9	0.0	82	378	72	67.2
92	13.553	0.144	0.014	2.12	93.9	0.92	101	8.9	0.0	82	377	72	67.1
93	13.703	0.150	0.014	2.11	94	0.92	105	8.9	0.0	82	372	72	67.2
94	13.845	0.142	0.014	2.11	94.1	0.88	99	8.8	0.0	82	368	72	67.1
95	13.995	0.150	0.014	2.11	94	0.92	105	8.8	0.0	82	366	71	67.2
96	14.140	0.145	0.014	2.12	94.2	0.93	101	8.8	0.0	81	361	71	67.1
97	14.289	0.149	0.014	2.11	94.3	0.91	104	8.7	0.0	81	364	71	67
98	14.434	0.145	0.014	2.10	94.3	0.96	101	8.7	0.0	81	358	71	67.1

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
99	14.583	0.149	0.014	2.11	94.4	0.93	104	8.6	0.0	81	358	71	67.1
100	14.728	0.145	0.014	2.10	94.4	0.91	101	8.6	0.0	81	351	71	67.2
101	14.876	0.148	0.014	2.11	94.5	0.93	103	8.6	0.0	81	347	71	67.3
102	15.021	0.145	0.014	2.11	94.5	0.9	101	8.6	0.0	81	341	71	67.2
103	15.168	0.147	0.014	2.10	94.6	0.94	102	8.5	-0.1	81	344	71	66.9
104	15.316	0.148	0.014	2.11	94.7	0.91	103	8.5	0.0	81	342	71	67
105	15.461	0.145	0.014	2.11	94.8	0.93	101	8.4	0.0	81	342	71	67.1
106	15.611	0.150	0.014	2.10	94.8	0.96	104	8.4	0.0	81	346	71	67
107	15.755	0.144	0.014	2.11	94.9	0.9	100	8.4	-0.1	81	350	71	66.8
108	15.905	0.150	0.014	2.11	94.9	0.91	104	8.3	0.0	81	353	71	67.1
109	16.048	0.143	0.014	2.11	95.1	0.92	100	8.3	0.0	81	355	71	67
110	16.198	0.150	0.014	2.11	95	0.96	104	8.2	0.0	81	346	71	67.1
111	16.341	0.143	0.014	2.10	95.1	0.95	99	8.2	0.0	81	345	71	66.8
112	16.492	0.151	0.014	2.10	95.2	0.95	105	8.2	0.0	81	343	71	66.8
113	16.636	0.144	0.014	2.11	95.2	0.92	100	8.1	0.0	80	341	71	67.1
114	16.786	0.150	0.014	2.11	95.2	0.93	104	8.1	0.0	80	338	71	67
115	16.931	0.145	0.014	2.11	95.3	0.93	101	8.1	0.0	80	342	71	67.1
116	17.080	0.149	0.014	2.10	95.4	0.93	104	8.0	0.0	80	342	71	66.9
117	17.225	0.145	0.014	2.12	95.4	0.97	101	8.0	0.0	80	344	71	67
118	17.372	0.147	0.014	2.10	95.5	0.93	102	8.0	0.0	80	344	71	66.9
119	17.518	0.146	0.014	2.10	95.5	0.92	101	7.9	0.0	80	343	71	66.7
120	17.664	0.146	0.014	2.10	95.5	0.96	101	7.9	-0.1	80	348	71	67
121	17.812	0.148	0.014	2.09	95.6	0.94	103	7.8	0.0	80	351	71	66.9
122	17.958	0.146	0.015	2.11	95.7	0.93	98	7.8	0.0	81	351	71	66.9
123	18.108	0.150	0.014	2.12	95.7	0.91	104	7.8	0.0	81	344	71	67.1
124	18.251	0.143	0.014	2.11	95.7	0.93	99	7.7	0.0	81	346	71	67.2
125	18.401	0.150	0.015	2.11	95.8	0.95	101	7.7	0.0	81	349	71	67
126	18.544	0.143	0.014	2.10	95.8	0.94	99	7.7	0.0	81	350	71	66.9
127	18.693	0.149	0.015	2.09	95.8	0.94	100	7.6	0.0	80	343	71	66.7
128	18.837	0.144	0.014	2.10	95.8	0.94	100	7.6	0.0	80	341	71	66.7
129	18.987	0.150	0.014	2.10	95.9	0.94	104	7.6	0.0	80	340	71	66.5
130	19.132	0.145	0.014	2.10	95.9	0.93	101	7.5	0.0	80	335	71	66.3
131	19.282	0.150	0.014	2.11	96	0.94	104	7.5	0.0	80	335	71	66.5

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
132	19.426	0.144	0.014	2.10	96	0.95	100	7.5	0.0	80	341	71	66.7
133	19.574	0.148	0.014	2.11	96	0.94	103	7.4	0.0	80	341	71	66.7
134	19.719	0.145	0.014	2.09	96.1	0.97	101	7.4	0.0	80	345	71	66.6
135	19.865	0.146	0.014	2.08	96.1	0.97	101	7.3	0.0	80	348	71	66.7
136	20.013	0.148	0.014	2.10	96.1	0.98	103	7.3	-0.1	80	354	71	66.6
137	20.159	0.146	0.014	2.10	96.1	0.91	101	7.2	0.0	80	357	71	66.6
138	20.308	0.149	0.015	2.10	96.2	0.95	100	7.2	0.0	81	360	71	66.6
139	20.453	0.145	0.014	2.10	96.2	0.95	101	7.2	0.0	81	358	71	67
140	20.602	0.149	0.014	2.10	96.2	0.95	103	7.1	0.0	80	353	71	66.7
141	20.745	0.143	0.014	2.09	96.2	0.96	99	7.1	-0.1	80	356	71	66.7
142	20.895	0.150	0.014	2.09	96.3	0.97	104	7.1	0.0	80	353	71	66.8
143	21.038	0.143	0.015	2.10	96.3	0.93	96	7.0	0.0	80	351	71	66.4
144	21.188	0.150	0.014	2.10	96.3	0.95	104	7.0	0.0	80	354	71	66.5
145	21.332	0.144	0.014	2.09	96.3	0.95	100	6.9	0.0	80	352	71	66.8
146	21.482	0.150	0.014	2.09	96.3	0.95	104	6.9	0.0	80	350	71	66.5
147	21.627	0.145	0.014	2.10	96.3	0.96	101	6.9	0.0	80	351	71	66.8
148	21.775	0.148	0.015	2.10	96.4	0.94	99	6.8	-0.1	81	354	71	66.9
149	21.920	0.145	0.015	2.09	96.4	0.97	97	6.8	0.0	80	357	71	66.8
150	22.066	0.146	0.015	2.09	96.4	0.94	98	6.7	0.0	80	358	71	66.9
151	22.213	0.147	0.014	2.10	96.4	0.95	102	6.7	0.0	80	354	71	66.7
152	22.359	0.146	0.014	2.09	96.4	0.95	101	6.7	0.0	81	352	71	66.7
153	22.507	0.148	0.014	2.10	96.4	0.93	103	6.6	0.0	81	351	71	66.7
154	22.653	0.146	0.015	2.10	96.5	0.97	98	6.6	0.0	81	354	71	66.6
155	22.801	0.148	0.014	2.08	96.4	0.95	103	6.6	-0.1	81	359	71	66.5
156	22.945	0.144	0.015	2.08	96.5	0.95	97	6.5	0.0	81	358	71	66.4
157	23.093	0.148	0.014	2.09	96.5	1	103	6.5	0.0	81	358	71	66.5
158	23.236	0.143	0.014	2.08	96.5	0.93	99	6.4	0.0	81	358	71	66.7
159	23.386	0.150	0.014	2.09	96.5	0.96	104	6.4	0.0	81	357	71	66.8
160	23.530	0.144	0.014	2.09	96.5	0.97	100	6.4	0.0	81	355	71	66.9
161	23.680	0.150	0.014	2.09	96.5	0.98	104	6.3	0.0	80	350	71	66.5
162	23.824	0.144	0.015	2.08	96.6	0.95	96	6.3	0.0	80	344	71	66.7
163	23.972	0.148	0.014	2.08	96.6	0.93	103	6.3	0.0	80	337	71	66.8
164	24.117	0.145	0.014	2.09	96.5	0.98	101	6.2	0.0	80	338	71	66.9



# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
165	24.262	0.145	0.015	2.08	96.6	0.98	97	6.2	0.0	80	339	71	66.8
166	24.410	0.148	0.014	2.09	96.6	0.95	103	6.2	0.0	80	343	71	66.6
167	24.555	0.145	0.014	2.08	96.6	0.94	101	6.1	0.0	80	345	71	66.5
168	24.704	0.149	0.014	2.09	96.6	0.96	103	6.1	0.0	80	342	71	66.5
169	24.848	0.144	0.014	2.08	96.7	1	100	6.0	0.0	80	351	71	66.6
170	24.997	0.149	0.014	2.08	96.6	0.97	103	6.0	0.0	80	352	71	66.7
171	25.140	0.143	0.014	2.09	96.7	0.99	99	6.0	0.0	80	349	71	66.7
172	25.288	0.148	0.014	2.07	96.7	0.94	103	5.9	0.0	80	350	71	66.7
173	25.432	0.144	0.014	2.08	96.7	0.98	100	5.9	0.0	80	354	71	66.4
174	25.581	0.149	0.015	2.08	96.7	0.96	100	5.8	0.0	80	359	71	66.6
175	25.726	0.145	0.014	2.09	96.7	0.97	101	5.8	0.0	80	357	71	66.7
176	25.873	0.147	0.014	2.08	96.7	0.95	102	5.8	0.0	80	355	71	66.8
177	26.018	0.145	0.014	2.07	96.6	0.98	101	5.7	0.0	80	360	71	66.5
178	26.163	0.145	0.014	2.07	96.7	0.97	101	5.7	0.0	80	359	71	66.5
179	26.310	0.147	0.014	2.07	96.7	0.98	102	5.6	0.0	80	358	71	66.6
180	26.455	0.145	0.014	2.07	96.7	0.99	101	5.6	0.0	80	352	71	66.7
181	26.603	0.148	0.014	2.08	96.7	1	103	5.6	0.0	80	344	71	66.6
182	26.747	0.144	0.015	2.07	96.7	1	96	5.6	0.0	80	335	71	66.8
183	26.896	0.149	0.015	2.07	96.8	0.97	100	5.5	0.0	80	325	71	66.8
184	27.038	0.142	0.015	2.07	96.7	0.98	95	5.5	0.0	79	317	70	66.6
185	27.187	0.149	0.015	2.07	96.8	0.97	100	5.5	0.0	79	315	70	66.6
186	27.330	0.143	0.015	2.07	96.7	0.96	96	5.5	0.0	79	309	70	66.8
187	27.479	0.149	0.015	2.07	96.7	0.98	100	5.5	0.0	79	304	70	66.7
188	27.624	0.145	0.014	2.07	96.8	0.97	100	5.4	0.0	79	301	70	66.9
189	27.771	0.147	0.014	2.07	96.7	0.94	102	5.4	0.0	78	295	70	66.9
190	27.916	0.145	0.015	2.07	96.8	0.97	97	5.4	0.0	78	289	70	66.8
191	28.061	0.145	0.015	2.07	96.7	0.97	97	5.4	0.0	78	287	70	66.9
192	28.208	0.147	0.014	2.07	96.8	0.98	102	5.3	0.0	78	290	70	66.8
193	28.352	0.144	0.014	2.07	96.8	1	100	5.3	0.0	78	289	70	66.8
194	28.501	0.149	0.014	2.07	96.8	0.98	103	5.3	0.0	78	290	70	66.7
195	28.645	0.144	0.015	2.06	96.8	0.96	96	5.2	0.0	78	298	70	66.8
196	28.793	0.148	0.015	2.07	96.8	0.98	99	5.2	0.0	78	304	70	66.8
197	28.935	0.142	0.014	2.06	96.9	0.97	98	5.2	0.0	78	306	70	66.9

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
198	29.084	0.149	0.014	2.07	96.9	0.96	103	5.1	0.0	78	311	70	66.9
199	29.227	0.143	0.014	2.06	96.9	1	99	5.1	0.0	78	313	70	66.9
200	29.377	0.150	0.014	2.07	96.9	1.03	104	5.1	0.0	78	317	70	66.8
201	29.521	0.144	0.015	2.07	96.9	0.98	96	5.0	0.0	78	317	70	66.8
202	29.668	0.147	0.015	2.07	96.9	0.96	98	5.0	0.0	78	312	70	66.9
203	29.812	0.144	0.014	2.07	97	1.03	100	5.0	0.0	78	311	70	67.2
204	29.957	0.145	0.014	2.06	96.9	0.96	100	5.0	0.0	78	309	70	67.1
205	30.105	0.148	0.015	2.06	97	1	99	4.9	0.0	78	307	70	67
206	30.249	0.144	0.015	2.07	96.9	1	96	4.9	0.0	78	303	70	66.9
207	30.398	0.149	0.015	2.06	97	1	100	4.9	0.0	78	300	70	66.9
208	30.541	0.143	0.014	2.06	97	0.98	99	4.9	0.0	78	298	70	67
209	30.689	0.148	0.014	2.06	96.9	1	102	4.8	0.0	78	302	70	67
210	30.831	0.142	0.015	2.06	97	0.98	95	4.8	0.0	78	303	70	67.2
211	30.980	0.149	0.014	2.07	97	0.98	103	4.8	0.0	78	300	70	67.3
212	31.124	0.144	0.014	2.07	97	1.01	100	4.7	0.0	78	301	70	67.4
213	31.272	0.148	0.015	2.07	97	0.98	99	4.7	0.0	78	305	70	67.1
214	31.416	0.144	0.015	2.07	97	1.02	96	4.7	0.0	78	311	70	67.3
215	31.562	0.146	0.015	2.06	97	0.98	98	4.6	-0.1	78	318	70	67.2
216	31.707	0.145	0.015	2.06	97	0.99	97	4.6	0.0	78	319	70	67
217	31.852	0.145	0.015	2.06	97	1.02	97	4.6	0.0	78	323	70	67.3
218	32.000	0.148	0.014	2.06	97.1	1.01	102	4.5	0.0	78	322	70	67.2
219	32.144	0.144	0.014	2.06	97	1.01	100	4.5	0.0	78	319	70	67.3
220	32.292	0.148	0.014	2.06	97.1	1.01	102	4.5	0.0	78	324	70	67.3
221	32.434	0.142	0.015	2.05	97.1	0.98	95	4.4	0.0	78	327	70	67.3
222	32.582	0.148	0.015	2.05	97	1.01	99	4.4	0.0	78	328	70	67.5
223	32.725	0.143	0.014	2.05	97	1.01	99	4.4	0.0	78	325	70	67.6
224	32.874	0.149	0.015	2.06	97.1	0.97	100	4.3	0.0	78	320	70	67.4
225	33.017	0.143	0.015	2.05	97.1	1.03	96	4.3	0.0	78	318	70	67.6
226	33.164	0.147	0.015	2.05	97.1	1.04	98	4.3	0.0	78	322	70	67.5
227	33.308	0.144	0.015	2.05	97	1.03	96	4.2	0.0	78	324	70	67.6
228	33.453	0.145	0.015	2.05	97	0.99	97	4.2	0.0	78	324	70	67.6
229	33.600	0.147	0.015	2.05	97.1	1	98	4.2	0.0	78	322	70	67.6
230	33.744	0.144	0.015	2.05	97.1	1.01	96	4.1	0.0	78	320	70	67.4

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
231	33.892	0.148	0.015	2.05	97.1	1	99	4.1	0.0	78	318	70	67.5
232	34.033	0.141	0.015	2.04	97.2	1.01	94	4.1	0.0	78	314	70	67.5
233	34.181	0.148	0.015	2.04	97.1	1.02	99	4.1	0.0	78	308	70	67.4
234	34.324	0.143	0.014	2.04	97.1	1.04	99	4.1	0.0	78	303	70	67.6
235	34.473	0.149	0.015	2.04	97.1	1.01	100	4.0	0.0	78	307	70	67.5
236	34.616	0.143	0.014	2.04	97.2	0.98	99	4.0	0.0	78	311	70	67.4
237	34.762	0.146	0.015	2.04	97.2	1.03	98	4.0	0.0	78	309	70	67.4
238	34.906	0.144	0.015	2.04	97.2	1.02	96	3.9	0.0	78	311	70	67.7
239	35.050	0.144	0.015	2.05	97.2	1.03	96	3.9	0.0	78	315	70	67.8
240	35.198	0.148	0.015	2.04	97.2	1.03	99	3.9	0.0	78	319	70	67.6
241	35.341	0.143	0.015	2.04	97.2	1.01	95	3.8	0.0	78	323	70	67.6
242	35.488	0.147	0.015	2.03	97.2	1.03	98	3.8	-0.1	78	326	70	67.5
243	35.629	0.141	0.015	2.03	97.2	1.04	94	3.7	0.0	78	331	70	67.4
244	35.777	0.148	0.015	2.04	97.3	1.04	99	3.7	0.0	78	330	70	67.9
245	35.920	0.143	0.015	2.04	97.2	1.04	96	3.7	0.0	78	326	70	67.9
246	36.067	0.147	0.015	2.04	97.2	1.01	98	3.6	0.0	78	324	70	67.7
247	36.210	0.143	0.014	2.03	97.2	1.03	99	3.6	0.0	78	323	70	67.7
248	36.354	0.144	0.015	2.02	97.3	1.03	96	3.6	0.0	78	326	70	67.5
249	36.501	0.147	0.014	2.04	97.2	1.01	102	3.5	0.0	78	324	70	67.6
250	36.644	0.143	0.014	2.03	97.3	1.02	99	3.5	0.0	78	321	70	67.7
251	36.791	0.147	0.015	2.03	97.2	1	98	3.5	0.0	78	317	70	67.7
252	36.933	0.142	0.014	2.02	97.2	1.07	98	3.5	0.0	78	316	70	67.4
253	37.080	0.147	0.015	2.03	97.3	1.05	98	3.4	0.0	78	315	70	67.8
254	37.222	0.142	0.015	2.04	97.3	1.02	95	3.4	0.0	78	312	70	67.5
255	37.370	0.148	0.015	2.03	97.3	1.01	99	3.4	0.0	78	313	70	67.3
256	37.513	0.143	0.015	2.03	97.3	1.04	95	3.4	0.0	78	307	70	67.6
257	37.658	0.145	0.014	2.03	97.3	1.04	100	3.3	0.0	78	305	70	67.6
258	37.802	0.144	0.015	2.03	97.3	1.02	96	3.3	0.0	78	311	70	67.5
259	37.945	0.143	0.015	2.02	97.3	1.03	95	3.3	0.0	78	314	70	67.5
260	38.093	0.148	0.015	2.03	97.3	1.04	99	3.2	0.0	78	313	70	67.5
261	38.235	0.142	0.015	2.03	97.3	1.02	95	3.2	0.0	78	316	70	67.4
262	38.381	0.146	0.015	2.02	97.3	1.01	97	3.2	0.0	78	319	70	67.7
263	38.523	0.142	0.015	2.02	97.3	1.02	95	3.1	0.0	78	319	70	67.7

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
264	38.671	0.148	0.015	2.03	97.3	1	99	3.1	0.0	78	321	70	67.6
265	38.813	0.142	0.015	2.02	97.4	1.05	95	3.1	0.0	78	321	70	67.7
266	38.959	0.146	0.015	2.03	97.4	1.03	97	3.0	0.0	78	318	70	67.7
267	39.102	0.143	0.015	2.02	97.3	1.06	95	3.0	0.0	78	318	70	67.8
268	39.245	0.143	0.015	2.02	97.4	1.02	95	3.0	0.0	78	319	70	67.6
269	39.393	0.148	0.015	2.03	97.4	1.07	99	2.9	0.0	78	320	70	67.7
270	39.534	0.141	0.014	2.02	97.4	1.06	97	2.9	0.0	78	320	70	67.6
271	39.680	0.146	0.015	2.02	97.4	1.03	97	2.9	0.0	78	319	70	67.5
272	39.822	0.142	0.015	2.01	97.4	1.02	95	2.8	0.0	78	320	70	67.5
273	39.969	0.147	0.015	2.02	97.4	1.05	98	2.8	0.0	78	324	70	67.8
274	40.111	0.142	0.015	2.01	97.4	1.03	95	2.8	0.0	78	321	70	67.7
275	40.256	0.145	0.014	2.02	97.4	1.03	100	2.7	0.0	78	317	70	67.6
276	40.399	0.143	0.014	2.03	97.4	1.05	99	2.7	0.0	78	315	70	67.4
277	40.543	0.144	0.015	2.03	97.4	1.05	96	2.7	0.0	78	313	70	67.6
278	40.689	0.146	0.015	2.01	97.4	1.04	97	2.7	0.0	78	309	70	67.4
279	40.830	0.141	0.015	2.01	97.4	1.05	94	2.6	0.0	78	307	70	67.6
280	40.976	0.146	0.015	2.02	97.4	1.04	97	2.6	0.0	78	307	70	67.7
281	41.118	0.142	0.015	2.01	97.4	1.05	95	2.6	0.0	78	308	70	67.8
282	41.265	0.147	0.014	2.01	97.4	1.07	102	2.6	0.0	78	307	70	67.9
283	41.407	0.142	0.014	2.01	97.4	1.04	98	2.5	0.0	78	310	70	67.9
284	41.550	0.143	0.015	1.99	97.4	1.04	95	2.5	0.0	78	311	70	67.8
285	41.695	0.145	0.015	2.01	97.4	1.03	97	2.5	0.0	78	312	70	67.7
286	41.838	0.143	0.015	2.02	97.4	1.04	95	2.4	0.0	78	313	70	67.6
287	41.984	0.146	0.015	2.02	97.4	1.07	97	2.4	0.0	78	314	70	67.5
288	42.124	0.140	0.015	2.00	97.5	1.05	93	2.4	0.0	78	314	70	67.5
289	42.270	0.146	0.014	2.01	97.5	1.02	101	2.3	0.0	78	314	70	67.4
290	42.414	0.144	0.015	2.01	97.5	1.08	96	2.3	0.0	78	315	70	67.7
291	42.559	0.145	0.015	2.01	97.5	1.08	97	2.3	0.0	78	317	70	67.6
292	42.700	0.141	0.015	1.99	97.5	1.05	94	2.2	0.0	78	319	70	67.7
293	42.842	0.142	0.015	2.01	97.5	1.1	95	2.2	0.0	78	323	70	67.9
294	42.990	0.148	0.015	2.01	97.4	1.07	99	2.2	0.0	78	325	70	67.7
295	43.130	0.140	0.015	2.01	97.5	1.08	93	2.1	0.0	78	322	70	67.8
296	43.276	0.146	0.015	2.00	97.5	1.04	97	2.1	0.0	78	321	70	68.1

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
297	43.415	0.139	0.015	2.00	97.6	1.07	93	2.1	0.0	78	322	70	68.1
298	43.564	0.149	0.015	2.00	97.5	1.06	99	2.0	0.0	78	322	70	68
299	43.705	0.141	0.015	1.99	97.5	1.06	94	2.0	0.0	78	322	70	67.8
300	43.847	0.142	0.014	1.99	97.5	1.05	98	2.0	-0.1	78	325	70	67.9
301	43.992	0.145	0.015	2.00	97.5	1.1	97	1.9	0.0	78	331	70	67.9
302	44.134	0.142	0.014	1.99	97.5	1.09	98	1.9	0.0	78	333	70	68.2
303	44.280	0.146	0.015	1.98	97.6	1.04	97	1.9	0.0	78	332	70	67.9
304	44.419	0.139	0.014	1.98	97.5	1.07	96	1.8	0.0	78	325	70	68
305	44.566	0.147	0.015	1.99	97.5	1.1	98	1.8	0.0	78	323	70	68.1
306	44.707	0.141	0.015	1.98	97.5	1.07	94	1.8	0.0	78	322	70	68
307	44.849	0.142	0.015	1.98	97.5	1.07	95	1.7	0.0	78	322	70	68.1
308	44.993	0.144	0.015	1.99	97.5	1.09	96	1.7	0.0	78	322	70	68.2
309	45.135	0.142	0.015	1.98	97.5	1.09	95	1.7	0.0	78	321	70	67.8
310	45.281	0.146	0.015	1.99	97.6	1.07	97	1.7	0.0	78	321	70	67.7
311	45.420	0.139	0.014	1.98	97.6	1.07	96	1.6	0.0	78	324	70	68.1
312	45.566	0.146	0.015	1.98	97.6	1.07	97	1.6	0.0	78	326	70	68
313	45.707	0.141	0.014	1.99	97.6	1.09	97	1.6	0.0	78	324	70	68.1
314	45.850	0.143	0.014	1.98	97.6	1.11	99	1.5	0.0	78	320	70	68
315	45.994	0.144	0.015	1.99	97.6	1.09	96	1.5	0.0	78	319	70	67.9
316	46.136	0.142	0.015	1.98	97.6	1.07	95	1.5	0.0	78	318	71	68
317	46.280	0.144	0.015	1.98	97.6	1.07	96	1.4	0.0	78	320	70	68.2
318	46.419	0.139	0.015	1.97	97.6	1.1	93	1.4	0.0	78	319	70	68
319	46.566	0.147	0.014	1.98	97.6	1.1	102	1.4	0.0	78	319	70	68.1
320	46.707	0.141	0.015	1.98	97.7	1.09	94	1.3	0.0	78	323	70	68.1
321	46.849	0.142	0.014	1.96	97.6	1.07	98	1.3	0.0	78	325	70	68.1
322	46.992	0.143	0.015	1.97	97.7	1.08	95	1.3	0.0	78	324	70	67.9
323	47.134	0.142	0.015	1.98	97.7	1.12	95	1.2	0.0	78	322	70	67.8
324	47.279	0.145	0.015	1.97	97.6	1.11	97	1.2	0.0	78	321	70	67.6
325	47.418	0.139	0.014	1.96	97.7	1.09	96	1.2	0.0	78	325	71	68
326	47.564	0.146	0.014	1.97	97.7	1.1	101	1.1	0.0	78	326	71	67.9
327	47.704	0.140	0.015	1.96	97.7	1.11	93	1.1	-0.1	78	333	71	67.8
328	47.846	0.142	0.015	1.95	97.8	1.13	95	1.1	0.0	78	334	71	67.8
329	47.990	0.144	0.014	1.96	97.7	1.12	99	1.0	0.0	78	333	71	67.8

# BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Dilution Tunnel dP (in H <sub>2</sub> O)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
330	48.130	0.140	0.014	1.96	97.7	1.11	97	1.0	0.0	78	335	71	67.9
331	48.274	0.144	0.015	1.95	97.7	1.11	96	0.9	0.0	78	335	71	67.8
332	48.413	0.139	0.015	1.95	97.7	1.09	93	0.9	0.0	79	337	71	67.8
333	48.559	0.146	0.014	1.94	97.7	1.15	101	0.9	0.0	79	338	71	67.9
334	48.699	0.140	0.014	1.95	97.7	1.13	97	0.8	0.0	79	340	71	68
335	48.840	0.141	0.014	1.96	97.7	1.13	97	0.8	0.0	78	341	71	67.9
336	48.985	0.145	0.014	1.96	97.7	1.12	100	0.8	0.0	79	340	71	68
337	49.123	0.138	0.015	1.95	97.8	1.12	92	0.7	0.0	79	336	71	68
338	49.268	0.145	0.015	1.95	97.8	1.12	97	0.7	0.0	78	334	71	68
339	49.408	0.140	0.015	1.95	97.7	1.1	93	0.7	0.0	78	333	71	68
340	49.550	0.142	0.014	1.94	97.7	1.13	98	0.6	0.0	78	332	70	68
341	49.692	0.142	0.014	1.95	97.7	1.13	98	0.6	0.0	78	334	70	67.8
342	49.832	0.140	0.014	1.94	97.7	1.11	97	0.6	0.0	78	334	70	67.7
343	49.976	0.144	0.014	1.94	97.7	1.13	100	0.5	0.0	78	332	71	67.9
344	50.114	0.138	0.015	1.95	97.7	1.16	92	0.5	0.0	79	330	71	67.9
345	50.259	0.145	0.014	1.94	97.8	1.15	100	0.5	0.0	79	327	71	67.9
346	50.398	0.139	0.014	1.93	97.8	1.12	96	0.4	0.0	79	325	71	67.9
347	50.538	0.140	0.014	1.94	97.7	1.12	97	0.4	0.0	79	328	71	68
348	50.682	0.144	0.015	1.93	97.8	1.14	96	0.4	0.0	79	329	71	68.1
349	50.819	0.137	0.015	1.93	97.7	1.15	91	0.3	0.0	78	331	71	67.9
350	50.963	0.144	0.015	1.94	97.7	1.13	96	0.3	0.0	78	329	71	68
351	51.103	0.140	0.014	1.93	97.8	1.18	97	0.3	-0.1	79	332	71	67.7
352	51.243	0.140	0.015	1.91	97.8	1.14	93	0.2	0.0	78	331	71	67.8
353	51.386	0.143	0.014	1.92	97.8	1.17	99	0.2	0.0	78	333	71	68
354	51.525	0.139	0.015	1.93	97.7	1.17	93	0.2	0.0	78	329	70	68.2
355	51.668	0.143	0.014	1.92	97.8	1.15	99	0.2	0.0	78	325	71	67.9
356	51.808	0.140	0.015	1.92	97.7	1.16	93	0.1	0.0	78	321	71	67.7
357	51.949	0.141	0.015	1.92	97.8	1.17	94	0.1	0.0	78	317	71	67.9
358	52.090	0.141	0.014	1.92	97.8	1.14	97	0.1	0.0	78	320	71	68
359	52.229	0.139	0.014	1.92	97.8	1.18	96	0.0	0.0	78	320	71	67.9
360	52.372	0.143	0.015	1.92	97.8	1.14	95	0.0	0.0	78	319	71	67.9
Avg/Tot	52.372	0.145	0.014	2.07	94	0.98	100			80	342	71	68

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
0	0.000		1.57	76.4	1.7		74	-0.064	6.81	0.03
1	0.141	0.141	2.14	76.3	1.55	103	74	-0.064	7.73	0.06
2	0.287	0.146	2.13	76.3	1.44	106	74	-0.064	7.61	0.03
3	0.427	0.140	2.13	76.3	1.47	102	74	-0.062	6.98	0.03
4	0.572	0.145	2.13	76.4	1.78	106	74	-0.058	4.95	0.03
5	0.713	0.141	2.14	76.6	1.55	103	74	-0.060	3.88	0.03
6	0.859	0.146	2.14	76.5	1.67	106	74	-0.062	6.23	0.03
7	1.001	0.142	2.14	76.7	1.58	103	74	-0.064	6.31	0.03
8	1.143	0.142	2.14	76.9	1.76	103	74	-0.060	5.12	0.03
9	1.288	0.145	2.13	77	1.57	106	74	-0.062	5.80	0.02
10	1.430	0.142	2.14	77.2	1.7	103	75	-0.060	7.01	0.03
11	1.576	0.146	2.13	77.3	1.6	106	75	-0.061	5.65	0.03
12	1.717	0.141	2.14	77.6	1.69	102	75	-0.061	6.17	0.03
13	1.862	0.145	2.13	77.7	1.66	105	75	-0.061	6.24	0.02
14	2.004	0.142	2.14	78	1.72	103	75	-0.062	6.92	0.03
15	2.150	0.146	2.15	78.2	1.71	106	75	-0.061	6.18	0.03
16	2.293	0.143	2.14	78.5	1.6	104	75	-0.060	6.66	0.03
17	2.437	0.144	2.14	78.8	1.63	104	75	-0.060	6.35	0.03
18	2.580	0.143	2.13	79.1	1.66	104	75	-0.062	5.07	0.03
19	2.724	0.144	2.14	79.3	1.65	104	75	-0.061	4.57	0.03
20	2.870	0.146	2.15	79.5	1.62	106	75	-0.062	5.83	0.03
21	3.012	0.142	2.15	79.9	1.65	103	75	-0.059	7.83	0.04
22	3.159	0.147	2.15	80.2	1.68	106	76	-0.058	5.38	0.03
23	3.300	0.141	2.15	80.4	1.61	102	76	-0.061	6.84	0.03
24	3.447	0.147	2.14	80.8	1.64	106	76	-0.061	6.35	0.02
25	3.589	0.142	2.14	81.1	1.64	103	76	-0.063	6.76	0.03
26	3.736	0.147	2.15	81.4	1.66	106	76	-0.061	6.21	0.03
27	3.879	0.143	2.14	81.8	1.65	103	76	-0.061	6.81	0.03
28	4.024	0.145	2.15	82.1	1.67	105	76	-0.062	6.36	0.02
29	4.169	0.145	2.15	82.5	1.62	101	76	-0.063	5.37	0.03
30	4.312	0.143	2.14	82.8	1.67	103	76	-0.063	7.07	0.04
31	4.459	0.147	2.15	83.3	1.63	106	76	-0.062	6.82	0.03

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
32	4.602	0.143	2.15	83.7	1.6	103	76	-0.061	6.03	0.03
33	4.750	0.148	2.15	84	1.67	106	76	-0.063	6.18	0.02
34	4.892	0.142	2.15	84.3	1.66	98	76	-0.059	5.36	0.03
35	5.040	0.148	2.15	84.5	1.65	106	76	-0.059	5.57	0.02
36	5.182	0.142	2.14	84.9	1.66	102	76	-0.063	5.97	0.03
37	5.329	0.147	2.15	85.3	1.65	105	76	-0.065	5.83	0.02
38	5.473	0.144	2.15	85.5	1.64	103	76	-0.060	6.12	0.02
39	5.620	0.147	2.15	85.8	1.66	102	76	-0.061	6.13	0.03
40	5.765	0.145	2.15	86	1.65	104	76	-0.065	6.08	0.02
41	5.911	0.146	2.15	86.3	1.67	104	76	-0.063	7.55	0.06
42	6.056	0.145	2.15	86.6	1.65	104	76	-0.063	7.05	0.03
43	6.200	0.144	2.15	86.8	1.65	103	76	-0.063	5.56	0.03
44	6.346	0.146	2.14	87.1	1.67	104	76	-0.061	6.96	0.03
45	6.491	0.145	2.15	87.3	1.68	103	76	-0.065	5.39	0.03
46	6.638	0.147	2.15	87.6	1.66	105	75	-0.061	5.29	0.03
47	6.783	0.145	2.15	87.7	1.67	100	75	-0.062	5.42	0.03
48	6.930	0.147	2.14	88.1	1.68	105	75	-0.061	6.60	0.03
49	7.074	0.144	2.14	88.3	1.68	103	75	-0.063	6.27	0.04
50	7.222	0.148	2.14	88.5	1.65	105	75	-0.060	6.08	0.03
51	7.364	0.142	2.15	88.7	1.65	101	75	-0.063	7.26	0.03
52	7.512	0.148	2.14	88.9	1.67	105	75	-0.062	6.55	0.02
53	7.656	0.144	2.14	89.1	1.65	102	75	-0.063	5.95	0.03
54	7.804	0.148	2.14	89.4	1.69	105	75	-0.060	4.74	0.03
55	7.949	0.145	2.15	89.6	1.67	103	75	-0.061	5.45	0.03
56	8.096	0.147	2.15	89.8	1.69	104	75	-0.064	6.30	0.03
57	8.241	0.145	2.14	90	1.67	103	75	-0.061	6.63	0.03
58	8.387	0.146	2.15	90.2	1.65	104	75	-0.060	6.17	0.03
59	8.533	0.146	2.14	90.4	1.69	100	75	-0.063	6.94	0.04
60	8.678	0.145	2.13	90.5	1.66	103	75	-0.064	6.75	0.04
61	8.824	0.146	2.14	90.8	1.69	104	75	-0.066	7.11	0.03
62	8.970	0.146	2.14	90.9	1.69	103	75	-0.061	5.25	0.03
63	9.117	0.147	2.14	91.1	1.68	104	75	-0.061	5.25	0.03



## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
64	9.261	0.144	2.15	91.2	1.7	102	75	-0.062	6.01	0.02
65	9.410	0.149	2.14	91.4	1.67	105	75	-0.062	4.59	0.03
66	9.553	0.143	2.14	91.6	1.65	101	75	-0.061	5.96	0.02
67	9.702	0.149	2.14	91.7	1.68	105	75	-0.062	6.00	0.03
68	9.845	0.143	2.13	91.9	1.63	101	75	-0.060	5.36	0.03
69	9.993	0.148	2.14	92.1	1.67	105	75	-0.060	5.95	0.03
70	10.137	0.144	2.13	92.2	1.62	102	75	-0.062	6.24	0.03
71	10.285	0.148	2.14	92.3	1.73	104	75	-0.060	6.38	0.04
72	10.429	0.144	2.14	92.5	1.74	102	75	-0.062	5.41	0.03
73	10.577	0.148	2.15	92.6	1.72	104	75	-0.063	6.07	0.02
74	10.723	0.146	2.15	92.7	1.65	103	75	-0.057	5.17	0.03
75	10.869	0.146	2.14	92.8	1.75	103	74	-0.061	4.30	0.04
76	11.015	0.146	2.14	93	1.72	103	75	-0.062	7.02	0.06
77	11.161	0.146	2.14	93	1.66	103	75	-0.058	5.87	0.03
78	11.308	0.147	2.14	93.2	1.69	104	74	-0.060	5.27	0.03
79	11.452	0.144	2.14	93.3	1.71	101	74	-0.063	5.59	0.03
80	11.600	0.148	2.14	93.4	1.66	104	74	-0.062	5.62	0.03
81	11.745	0.145	2.14	93.5	1.77	102	74	-0.060	5.80	0.02
82	11.893	0.148	2.14	93.6	1.71	104	74	-0.060	4.96	0.03
83	12.038	0.145	2.15	93.6	1.77	102	74	-0.063	6.99	0.04
84	12.187	0.149	2.14	93.7	1.77	105	74	-0.064	6.61	0.03
85	12.331	0.144	2.14	93.9	1.62	98	74	-0.065	6.94	0.04
86	12.479	0.148	2.14	94	1.64	104	74	-0.061	6.62	0.03
87	12.623	0.144	2.13	94.1	1.71	101	74	-0.062	6.43	0.03
88	12.771	0.148	2.13	94.3	1.69	104	74	-0.063	6.65	0.03
89	12.914	0.143	2.13	94.4	1.73	101	74	-0.066	7.36	0.04
90	13.063	0.149	2.13	94.4	1.65	105	74	-0.064	6.79	0.03
91	13.208	0.145	2.14	94.5	1.76	102	74	-0.064	5.67	0.03
92	13.355	0.147	2.13	94.6	1.63	103	74	-0.063	6.48	0.02
93	13.501	0.146	2.14	94.7	1.65	103	74	-0.065	5.05	0.03
94	13.649	0.148	2.14	94.8	1.75	104	74	-0.059	4.98	0.03
95	13.793	0.144	2.13	94.8	1.68	101	74	-0.061	5.35	0.03

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
96	13.940	0.147	2.13	94.9	1.74	103	74	-0.062	4.72	0.03
97	14.086	0.146	2.13	94.9	1.67	103	74	-0.064	7.04	0.03
98	14.232	0.146	2.14	95	1.69	103	74	-0.060	4.73	0.04
99	14.378	0.146	2.13	95.1	1.74	103	74	-0.059	5.68	0.03
100	14.523	0.145	2.13	95.2	1.69	102	74	-0.062	4.14	0.04
101	14.671	0.148	2.13	95.2	1.75	104	74	-0.061	4.62	0.04
102	14.815	0.144	2.13	95.2	1.69	101	74	-0.059	4.44	0.03
103	14.964	0.149	2.13	95.3	1.65	105	74	-0.059	5.79	0.03
104	15.109	0.145	2.13	95.4	1.69	102	74	-0.059	4.91	0.03
105	15.257	0.148	2.13	95.4	1.77	104	74	-0.060	4.76	0.03
106	15.401	0.144	2.12	95.5	1.77	101	74	-0.061	6.02	0.03
107	15.549	0.148	2.13	95.5	1.65	104	74	-0.062	6.20	0.03
108	15.693	0.144	2.13	95.5	1.65	101	74	-0.062	6.11	0.03
109	15.841	0.148	2.12	95.7	1.77	104	74	-0.059	6.52	0.03
110	15.985	0.144	2.13	95.7	1.65	101	74	-0.060	4.25	0.04
111	16.133	0.148	2.13	95.7	1.76	104	74	-0.057	4.68	0.03
112	16.278	0.145	2.13	95.8	1.78	102	74	-0.059	5.47	0.03
113	16.426	0.148	2.13	95.8	1.73	104	74	-0.059	5.16	0.03
114	16.571	0.145	2.13	95.8	1.71	102	74	-0.059	4.17	0.04
115	16.718	0.147	2.12	95.9	1.7	103	74	-0.062	6.35	0.03
116	16.864	0.146	2.12	95.9	1.72	102	74	-0.060	5.49	0.03
117	17.009	0.145	2.12	96.1	1.72	102	74	-0.061	5.70	0.04
118	17.155	0.146	2.12	96	1.76	102	74	-0.060	5.56	0.03
119	17.300	0.145	2.12	96.1	1.72	102	74	-0.060	4.87	0.03
120	17.448	0.148	2.12	96.1	1.73	104	73	-0.062	6.37	0.03
121	17.592	0.144	2.12	96.1	1.71	101	73	-0.062	6.09	0.03
122	17.741	0.149	2.13	96.2	1.74	101	73	-0.060	5.71	0.04
123	17.885	0.144	2.12	96.3	1.69	101	74	-0.060	4.52	0.04
124	18.033	0.148	2.12	96.3	1.73	104	73	-0.064	5.67	0.03
125	18.177	0.144	2.11	96.3	1.74	97	73	-0.063	5.85	0.03
126	18.325	0.148	2.11	96.3	1.69	104	73	-0.061	6.27	0.03
127	18.469	0.144	2.12	96.3	1.74	97	73	-0.060	4.70	0.04

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
128	18.616	0.147	2.11	96.3	1.7	103	73	-0.059	4.78	0.04
129	18.761	0.145	2.12	96.4	1.73	101	73	-0.058	5.17	0.03
130	18.909	0.148	2.12	96.4	1.72	104	73	-0.060	4.42	0.03
131	19.053	0.144	2.12	96.4	1.73	101	73	-0.059	5.06	0.03
132	19.201	0.148	2.12	96.4	1.7	104	73	-0.061	6.41	0.03
133	19.346	0.145	2.11	96.5	1.74	101	73	-0.061	4.93	0.03
134	19.493	0.147	2.11	96.5	1.72	103	73	-0.061	5.82	0.03
135	19.638	0.145	2.12	96.5	1.7	101	73	-0.063	6.40	0.03
136	19.784	0.146	2.11	96.5	1.76	102	73	-0.064	7.19	0.05
137	19.930	0.146	2.11	96.6	1.72	102	73	-0.063	6.56	0.04
138	20.075	0.145	2.11	96.6	1.71	98	73	-0.064	6.42	0.04
139	20.222	0.147	2.12	96.6	1.72	103	73	-0.061	5.79	0.04
140	20.366	0.144	2.11	96.6	1.71	101	73	-0.058	4.40	0.03
141	20.515	0.149	2.11	96.6	1.77	104	73	-0.062	6.25	0.04
142	20.658	0.143	2.11	96.7	1.76	100	73	-0.061	5.16	0.03
143	20.807	0.149	2.11	96.6	1.67	101	73	-0.060	4.97	0.03
144	20.950	0.143	2.11	96.7	1.73	100	73	-0.061	6.03	0.04
145	21.097	0.147	2.11	96.6	1.78	103	73	-0.064	5.66	0.04
146	21.241	0.144	2.10	96.6	1.71	101	73	-0.063	5.70	0.04
147	21.389	0.148	2.11	96.7	1.69	104	73	-0.064	5.08	0.05
148	21.533	0.144	2.11	96.7	1.7	97	73	-0.064	6.23	0.04
149	21.681	0.148	2.11	96.7	1.71	100	73	-0.065	6.29	0.03
150	21.826	0.145	2.11	96.8	1.69	98	73	-0.065	6.06	0.04
151	21.972	0.146	2.10	96.7	1.78	102	73	-0.061	5.94	0.04
152	22.117	0.145	2.11	96.7	1.76	101	73	-0.064	4.58	0.04
153	22.262	0.145	2.11	96.7	1.81	101	73	-0.062	5.26	0.04
154	22.408	0.146	2.09	96.8	1.8	99	73	-0.067	5.73	0.04
155	22.553	0.145	2.10	96.7	1.75	101	73	-0.063	6.69	0.05
156	22.700	0.147	2.11	96.8	1.7	99	73	-0.063	5.72	0.04
157	22.844	0.144	2.11	96.8	1.8	101	73	-0.064	5.63	0.04
158	22.993	0.149	2.10	96.9	1.8	104	73	-0.065	6.03	0.04
159	23.135	0.142	2.09	96.8	1.79	99	73	-0.067	5.74	0.04

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
160	23.283	0.148	2.10	96.8	1.76	104	73	-0.061	6.11	0.04
161	23.426	0.143	2.10	96.8	1.76	100	73	-0.062	4.77	0.04
162	23.573	0.147	2.10	96.9	1.7	99	73	-0.060	5.00	0.04
163	23.717	0.144	2.10	96.8	1.75	101	73	-0.058	4.15	0.05
164	23.864	0.147	2.10	96.9	1.69	103	73	-0.057	4.91	0.04
165	24.009	0.145	2.10	96.8	1.81	98	73	-0.061	5.43	0.04
166	24.156	0.147	2.10	96.9	1.79	103	73	-0.061	5.92	0.04
167	24.300	0.144	2.10	96.8	1.71	101	73	-0.061	6.30	0.05
168	24.446	0.146	2.09	96.9	1.68	102	73	-0.061	4.44	0.05
169	24.591	0.145	2.10	96.9	1.82	101	73	-0.064	7.41	0.05
170	24.735	0.144	2.09	96.8	1.72	101	73	-0.065	6.32	0.04
171	24.882	0.147	2.10	96.9	1.77	103	73	-0.061	5.23	0.04
172	25.026	0.144	2.09	96.9	1.8	101	73	-0.064	5.72	0.04
173	25.174	0.148	2.09	96.8	1.77	104	73	-0.060	6.25	0.04
174	25.317	0.143	2.09	96.9	1.8	97	73	-0.063	7.54	0.08
175	25.464	0.147	2.09	96.9	1.82	103	73	-0.063	5.68	0.04
176	25.607	0.143	2.09	96.9	1.69	100	73	-0.064	5.61	0.04
177	25.754	0.147	2.08	96.9	1.82	103	73	-0.069	7.05	0.05
178	25.897	0.143	2.09	96.9	1.79	100	73	-0.063	6.15	0.04
179	26.044	0.147	2.08	96.9	1.77	103	73	-0.063	5.32	0.04
180	26.189	0.145	2.08	96.9	1.85	101	73	-0.062	4.91	0.04
181	26.334	0.145	2.08	96.9	1.74	101	73	-0.059	5.62	0.04
182	26.479	0.145	2.08	96.8	1.72	98	73	-0.062	3.88	0.05
183	26.623	0.144	2.09	96.8	1.86	97	73	-0.060	3.62	0.05
184	26.769	0.146	2.08	96.9	1.81	99	73	-0.058	3.24	0.06
185	26.913	0.144	2.09	96.9	1.82	97	73	-0.056	4.81	0.04
186	27.060	0.147	2.09	96.9	1.76	99	73	-0.057	3.95	0.04
187	27.204	0.144	2.09	97	1.72	97	73	-0.055	3.83	0.05
188	27.350	0.146	2.08	97	1.74	102	73	-0.054	4.06	0.04
189	27.493	0.143	2.08	97	1.88	100	73	-0.053	3.33	0.04
190	27.640	0.147	2.08	96.9	1.8	99	73	-0.053	3.06	0.04
191	27.783	0.143	2.08	96.9	1.65	96	73	-0.054	3.89	0.05

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
192	27.930	0.147	2.08	96.9	1.7	103	73	-0.053	4.76	0.04
193	28.074	0.144	2.08	97	1.68	100	73	-0.054	4.17	0.05
194	28.220	0.146	2.08	97	1.68	102	73	-0.057	4.49	0.04
195	28.364	0.144	2.08	97	1.72	97	73	-0.058	5.71	0.04
196	28.509	0.145	2.08	97	1.77	98	73	-0.057	6.34	0.04
197	28.654	0.145	2.07	97.1	1.8	101	73	-0.056	4.80	0.05
198	28.798	0.144	2.08	97	1.74	100	73	-0.061	5.65	0.04
199	28.944	0.146	2.08	97	1.72	102	72	-0.061	5.33	0.04
200	29.088	0.144	2.07	97	1.78	100	73	-0.061	6.31	0.04
201	29.235	0.147	2.07	97	1.69	99	73	-0.056	5.65	0.04
202	29.378	0.143	2.08	97	1.71	96	72	-0.059	3.37	0.06
203	29.524	0.146	2.08	97.1	1.69	102	73	-0.058	5.51	0.05
204	29.667	0.143	2.07	97.1	1.69	100	72	-0.060	3.89	0.05
205	29.814	0.147	2.08	97.1	1.7	99	73	-0.060	4.55	0.04
206	29.958	0.144	2.08	97	1.71	97	72	-0.059	3.86	0.05
207	30.104	0.146	2.07	97.1	1.81	98	72	-0.058	3.96	0.05
208	30.248	0.144	2.07	97	1.83	100	72	-0.054	3.86	0.05
209	30.392	0.144	2.07	97	1.84	100	72	-0.057	5.48	0.05
210	30.537	0.145	2.07	97.1	1.82	98	72	-0.057	5.37	0.04
211	30.681	0.144	2.08	97.1	1.72	100	72	-0.055	3.98	0.05
212	30.827	0.146	2.07	97.1	1.79	102	72	-0.056	4.33	0.05
213	30.971	0.144	2.08	97.2	1.71	97	72	-0.057	5.32	0.04
214	31.117	0.146	2.07	97.2	1.71	98	72	-0.059	5.56	0.05
215	31.260	0.143	2.07	97.1	1.8	96	72	-0.061	7.21	0.05
216	31.406	0.146	2.06	97.1	1.74	98	72	-0.064	6.02	0.04
217	31.549	0.143	2.07	97.1	1.69	96	72	-0.060	7.01	0.05
218	31.695	0.146	2.07	97.2	1.82	102	72	-0.058	5.97	0.05
219	31.839	0.144	2.07	97.1	1.71	100	72	-0.059	4.39	0.05
220	31.984	0.145	2.07	97.2	1.82	101	72	-0.058	6.63	0.04
221	32.128	0.144	2.06	97.2	1.79	97	72	-0.062	6.23	0.04
222	32.271	0.143	2.06	97.2	1.82	96	72	-0.062	5.86	0.04
223	32.417	0.146	2.06	97.2	1.7	102	72	-0.060	4.97	0.05

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
224	32.560	0.143	2.07	97.2	1.81	96	72	-0.060	4.80	0.04
225	32.708	0.148	2.06	97.3	1.77	100	72	-0.059	4.81	0.05
226	32.849	0.141	2.06	97.2	1.75	95	72	-0.060	6.12	0.05
227	32.996	0.147	2.06	97.2	1.71	99	72	-0.062	6.54	0.05
228	33.137	0.141	2.06	97.2	1.86	95	72	-0.062	5.42	0.04
229	33.284	0.147	2.06	97.3	1.87	99	72	-0.060	5.15	0.05
230	33.427	0.143	2.06	97.2	1.7	96	72	-0.058	4.68	0.05
231	33.573	0.146	2.06	97.2	1.81	98	72	-0.060	5.61	0.04
232	33.716	0.143	2.06	97.2	1.74	96	72	-0.057	4.75	0.04
233	33.859	0.143	2.05	97.2	1.75	96	72	-0.059	4.07	0.04
234	34.005	0.146	2.05	97.2	1.74	102	72	-0.057	3.02	0.06
235	34.147	0.142	2.06	97.2	1.77	96	72	-0.058	6.09	0.04
236	34.295	0.148	2.06	97.2	1.82	103	72	-0.061	5.82	0.05
237	34.436	0.141	2.05	97.2	1.77	95	72	-0.059	4.91	0.04
238	34.582	0.146	2.05	97.3	1.87	98	72	-0.059	5.32	0.04
239	34.724	0.142	2.05	97.4	1.86	96	72	-0.061	6.15	0.05
240	34.870	0.146	2.05	97.3	1.72	98	72	-0.060	5.86	0.04
241	35.013	0.143	2.05	97.3	1.87	96	72	-0.060	6.43	0.04
242	35.158	0.145	2.04	97.2	1.74	98	72	-0.064	5.91	0.05
243	35.302	0.144	2.04	97.2	1.73	97	72	-0.062	6.52	0.05
244	35.444	0.142	2.04	97.3	1.71	96	72	-0.063	5.70	0.05
245	35.590	0.146	2.05	97.3	1.71	98	72	-0.062	4.57	0.04
246	35.732	0.142	2.05	97.2	1.73	96	72	-0.061	5.11	0.04
247	35.878	0.146	2.04	97.3	1.74	102	72	-0.062	5.30	0.05
248	36.020	0.142	2.04	97.3	1.9	96	72	-0.066	6.37	0.05
249	36.165	0.145	2.04	97.3	1.75	101	72	-0.061	5.25	0.04
250	36.307	0.142	2.04	97.2	1.75	99	72	-0.060	4.67	0.05
251	36.453	0.146	2.05	97.2	1.79	98	72	-0.059	4.44	0.04
252	36.596	0.143	2.04	97.2	1.83	100	72	-0.059	4.49	0.04
253	36.740	0.144	2.04	97.3	1.76	97	72	-0.059	5.31	0.04
254	36.883	0.143	2.03	97.3	1.84	96	72	-0.058	4.42	0.05
255	37.026	0.143	2.04	97.3	1.79	96	72	-0.058	5.97	0.05

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
256	37.172	0.146	2.04	97.3	1.79	98	72	-0.057	4.12	0.05
257	37.313	0.141	2.03	97.2	1.74	98	72	-0.061	4.10	0.05
258	37.459	0.146	2.04	97.3	1.79	98	72	-0.060	6.36	0.05
259	37.600	0.141	2.03	97.2	1.84	95	72	-0.059	6.69	0.05
260	37.746	0.146	2.04	97.2	1.74	98	72	-0.058	4.40	0.05
261	37.888	0.142	2.04	97.2	1.77	96	72	-0.062	5.92	0.05
262	38.032	0.144	2.03	97.2	1.75	97	72	-0.063	5.90	0.05
263	38.176	0.144	2.03	97.3	1.93	97	72	-0.061	6.05	0.05
264	38.317	0.141	2.03	97.3	1.88	95	72	-0.061	5.94	0.05
265	38.463	0.146	2.03	97.2	1.72	98	72	-0.060	5.43	0.04
266	38.605	0.142	2.03	97.3	1.74	96	72	-0.061	4.58	0.05
267	38.751	0.146	2.03	97.3	1.73	98	72	-0.060	5.40	0.04
268	38.892	0.141	2.03	97.3	1.7	95	72	-0.059	5.75	0.05
269	39.037	0.145	2.03	97.4	1.83	98	72	-0.064	5.88	0.04
270	39.179	0.142	2.03	97.3	1.75	99	72	-0.061	5.81	0.05
271	39.324	0.145	2.02	97.3	1.85	98	72	-0.060	5.19	0.05
272	39.466	0.142	2.03	97.3	1.75	96	72	-0.062	5.78	0.04
273	39.608	0.142	2.02	97.4	1.8	96	72	-0.063	7.03	0.05
274	39.753	0.145	2.03	97.4	1.9	98	72	-0.060	5.75	0.05
275	39.895	0.142	2.02	97.3	1.73	99	72	-0.061	4.23	0.06
276	40.040	0.145	2.02	97.3	1.91	101	72	-0.062	5.28	0.04
277	40.181	0.141	2.03	97.4	1.9	95	72	-0.057	4.62	0.05
278	40.326	0.145	2.02	97.3	1.77	98	72	-0.055	4.44	0.05
279	40.467	0.141	2.02	97.3	1.89	95	72	-0.062	4.13	0.05
280	40.612	0.145	2.02	97.3	1.75	98	72	-0.058	5.13	0.04
281	40.755	0.143	2.02	97.4	1.76	96	72	-0.059	5.02	0.04
282	40.896	0.141	2.01	97.5	1.85	98	72	-0.062	4.85	0.05
283	41.041	0.145	2.02	97.5	1.83	101	72	-0.059	5.87	0.05
284	41.183	0.142	2.02	97.5	1.88	96	72	-0.060	5.40	0.04
285	41.328	0.145	2.01	97.4	1.91	98	72	-0.061	5.69	0.04
286	41.468	0.140	2.02	97.4	1.79	94	72	-0.062	5.36	0.05
287	41.613	0.145	2.02	97.3	1.85	98	72	-0.061	6.07	0.05

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
288	41.755	0.142	2.02	97.3	1.84	96	72	-0.062	5.42	0.04
289	41.899	0.144	2.01	97.4	1.93	100	72	-0.062	5.81	0.04
290	42.041	0.142	2.01	97.3	1.76	96	72	-0.060	5.59	0.05
291	42.183	0.142	2.01	97.3	1.78	96	72	-0.060	5.89	0.05
292	42.327	0.144	2.01	97.4	1.89	97	72	-0.063	6.38	0.05
293	42.468	0.141	2.00	97.3	1.8	95	72	-0.063	6.91	0.06
294	42.613	0.145	2.00	97.3	1.87	98	72	-0.063	6.35	0.05
295	42.753	0.140	2.00	97.3	1.76	94	72	-0.060	4.97	0.05
296	42.898	0.145	2.00	97.4	1.86	98	72	-0.064	4.66	0.05
297	43.038	0.140	2.00	97.5	1.9	94	72	-0.066	5.89	0.04
298	43.182	0.144	2.00	97.4	1.9	97	72	-0.061	6.01	0.05
299	43.325	0.143	2.00	97.4	1.89	96	72	-0.063	5.24	0.05
300	43.466	0.141	2.00	97.4	1.85	98	72	-0.063	6.32	0.05
301	43.611	0.145	2.00	97.4	1.81	98	72	-0.064	7.61	0.08
302	43.751	0.140	1.99	97.4	1.94	98	72	-0.063	6.46	0.04
303	43.895	0.144	1.99	97.5	1.81	97	72	-0.064	6.04	0.05
304	44.036	0.141	2.00	97.5	1.82	98	72	-0.062	4.33	0.05
305	44.179	0.143	1.99	97.5	1.79	96	72	-0.063	5.01	0.04
306	44.321	0.142	1.99	97.6	1.81	96	72	-0.062	5.51	0.05
307	44.462	0.141	1.99	97.5	1.87	95	72	-0.063	5.60	0.04
308	44.607	0.145	2.00	97.5	1.81	98	72	-0.062	6.04	0.05
309	44.746	0.139	1.99	97.5	1.85	94	72	-0.060	5.56	0.05
310	44.890	0.144	1.99	97.5	1.82	97	72	-0.064	5.23	0.05
311	45.030	0.140	1.99	97.5	1.92	98	72	-0.063	6.44	0.05
312	45.175	0.145	1.99	97.6	1.91	98	72	-0.063	6.65	0.05
313	45.316	0.141	1.99	97.5	1.82	98	72	-0.061	5.20	0.05
314	45.456	0.140	1.98	97.6	1.88	98	72	-0.062	4.50	0.05
315	45.600	0.144	1.99	97.5	1.78	97	72	-0.060	5.83	0.04
316	45.740	0.140	1.98	97.6	1.82	94	72	-0.062	4.84	0.04
317	45.884	0.144	1.98	97.6	1.88	97	72	-0.065	6.50	0.05
318	46.024	0.140	1.98	97.6	1.91	94	72	-0.059	5.29	0.05
319	46.168	0.144	1.99	97.6	1.86	100	72	-0.063	5.41	0.04



## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
320	46.309	0.141	1.99	97.6	1.81	95	72	-0.064	6.37	0.05
321	46.449	0.140	1.98	97.5	1.9	98	72	-0.064	6.43	0.05
322	46.592	0.143	1.98	97.5	1.87	96	72	-0.065	6.29	0.05
323	46.733	0.141	1.98	97.6	1.94	95	72	-0.063	4.92	0.05
324	46.877	0.144	1.98	97.4	1.95	97	72	-0.063	5.53	0.05
325	47.016	0.139	1.98	97.5	1.85	97	72	-0.063	6.35	0.05
326	47.159	0.143	1.98	97.5	1.82	100	72	-0.065	6.12	0.05
327	47.300	0.141	1.97	97.6	1.94	95	72	-0.066	8.23	0.11
328	47.440	0.140	1.96	97.6	1.92	94	73	-0.065	6.91	0.06
329	47.583	0.143	1.97	97.6	1.94	100	72	-0.065	5.20	0.04
330	47.723	0.140	1.96	97.5	1.93	98	72	-0.066	6.72	0.05
331	47.866	0.143	1.97	97.5	1.9	96	72	-0.066	6.58	0.05
332	48.005	0.139	1.97	97.6	1.82	94	72	-0.064	7.19	0.07
333	48.149	0.144	1.97	97.6	1.8	100	72	-0.063	5.98	0.05
334	48.288	0.139	1.96	97.6	1.81	97	72	-0.065	7.10	0.06
335	48.428	0.140	1.96	97.5	1.96	98	72	-0.065	6.77	0.05
336	48.572	0.144	1.96	97.6	1.97	100	72	-0.063	6.30	0.04
337	48.710	0.138	1.96	97.6	1.99	93	72	-0.067	5.19	0.04
338	48.852	0.142	1.96	97.7	1.85	96	72	-0.065	6.44	0.05
339	48.992	0.140	1.96	97.7	1.99	94	72	-0.067	5.72	0.04
340	49.134	0.142	1.95	97.6	1.87	99	72	-0.067	5.81	0.05
341	49.274	0.140	1.95	97.5	1.85	98	72	-0.066	6.57	0.05
342	49.413	0.139	1.95	97.6	1.92	97	72	-0.062	6.56	0.05
343	49.556	0.143	1.95	97.6	1.85	100	72	-0.064	5.49	0.04
344	49.694	0.138	1.94	97.5	1.91	93	72	-0.061	5.46	0.04
345	49.837	0.143	1.95	97.5	1.96	100	72	-0.061	5.78	0.05
346	49.977	0.140	1.94	97.5	1.94	98	72	-0.062	5.03	0.04
347	50.115	0.138	1.94	97.5	1.83	96	72	-0.064	6.49	0.04
348	50.258	0.143	1.95	97.5	1.98	96	72	-0.062	6.84	0.05
349	50.396	0.138	1.94	97.5	1.98	93	73	-0.060	6.95	0.07
350	50.538	0.142	1.94	97.5	2.02	96	72	-0.063	5.53	0.05
351	50.677	0.139	1.94	97.5	1.91	97	73	-0.067	7.03	0.08

## BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft <sup>3</sup> )	Sample Rate (cfm)	Orifice dH (in H <sub>2</sub> O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
352	50.818	0.141	1.94	97.5	1.97	95	73	-0.066	5.92	0.05
353	50.958	0.140	1.93	97.5	1.86	98	73	-0.062	7.05	0.07
354	51.097	0.139	1.93	97.4	1.98	94	72	-0.061	5.66	0.05
355	51.239	0.142	1.93	97.5	1.96	99	73	-0.064	4.89	0.04
356	51.377	0.138	1.93	97.5	1.95	93	73	-0.064	4.84	0.04
357	51.519	0.142	1.94	97.4	1.98	96	73	-0.061	4.29	0.05
358	51.658	0.139	1.93	97.5	2	97	73	-0.063	6.55	0.05
359	51.796	0.138	1.93	97.5	2.03	96	73	-0.063	6.04	0.05
360	51.939	0.143	1.92	97.5	1.87	96	73	-0.064	5.19	0.04
Avg/Tot	51.939	0.144	2.07	94	1.76	100			5.67	0.04

## LAB SAMPLE DATA - ASTM E2515

Client: Thelin  
 Model: Gnome  
 Run #: 1

Job #: 22-826  
 Tracking #: 127  
 Technician: AK  
 Date: 10/5/2022

		Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
<b>Filters</b>	<b>A - 1st Hour</b>	G00345	124.3	247.8	250.2	2.4
		G00346	123.5			
	<b>B</b>	G00347	123.1	246.9	249.3	2.4
		G00348	123.8			
	<b>C - Post 1st Hour</b>	G00349	123.4	247.1	247.7	0.6
		G00350	123.7			
<b>Amb</b>	G00351	123.6	123.6	123.6	0.0	
<b>Probes</b>	<b>A - 1st Hour</b>	14A	116633.3	116633.3	116633.4	0.1
	<b>B</b>	14B	116618.9	116618.9	116618.9	0.0
	<b>C - Post 1st Hour</b>	14C	116530.8	116530.8	116530.8	0.0
<b>O-rings</b>	<b>A - 1st Hour</b>	14A	3367.5	3367.5	3367.7	0.2
	<b>B</b>	14B	3342.8	3342.8	3342.8	0.0
	<b>C - Post 1st Hour</b>	14C	3447.8	3447.8	3447.9	0.1

**Placed in Dessicator on:** 10/5/2022

<b>Filters</b>	<b>A</b>	250.0	10/7 13:25	250.2	10/13 10:31			
	<b>B</b>	249.5	10/7 13:25	249.3	10/13 10:31			
	<b>C - 1st Hour</b>	247.9	10/7 13:25	247.7	10/13 10:31			
	<b>Amb</b>	123.6	10/7 13:25	123.6	10/13 10:31			
			10/5 14:53					
<b>Probes</b>	<b>A</b>	116633.5	10/7 13:28	116633.4	10/13 10:32			
	<b>B</b>	116618.9	10/7 13:28	116618.9	10/13 10:32			
	<b>C - 1st Hour</b>	116530.7	10/7 13:27	116530.8	10/13 10:32			
<b>O-Rings</b>	<b>A</b>	3367.5	10/7 13:27	3367.7	10/13 10:32			
	<b>B</b>	3342.8	10/7 13:27	3342.8	10/13 10:32			
	<b>C - 1st Hour</b>	3447.9	10/7 13:27	3447.9	10/13 10:32			

<b>Train A Aggregate, mg:</b>	<b>2.7</b>
<b>Train B Aggregate, mg:</b>	<b>2.4</b>
<b>Train C Aggregate, mg:</b>	<b>0.7</b>
Ambient Aggregate, mg:	0.0

## ASTM E2779 Wood Heater Run Sheets

Client: Thelin Job Number: 22-826 Tracking #: 127  
 Model: Gnome Run Number: 1 Test Date: 10/5/2022

### Pellet Heater Control Settings

High Burn Rate Settings: Setting: High, trim pot @ 1:00  
 Medium Burn Rate Settings: Setting: Med, trim pot @ 1:00  
 Low Burn Rate Settings: Setting: Low, trim pot @ 1:00

### Preburn Notes

Preburn Start Time: 7:30

Time	Notes
0:00	Began PB, trim pot set to 1 o'clock position
60:00	PB end

### Test Notes

Test Burn Start Time: 8:30

Time	Notes
60:00	Changed setting to Medium
180:00	Changed setting to Low
360:00	Test end

Test Burn End Time: 14:30

### Flue Gas Concentration Measurement

**Calibration Gas Values:** Span Gas CO<sub>2</sub> (%): 17.00 CO (%): 4.31  
 Mid Gas CO<sub>2</sub> (%): 10.09 CO (%): 2.53

### Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	7:20	7:26	7:22	15:05	15:01	15:03
CO <sub>2</sub>	0.00	10.14	17.00	0.07	10.03	16.95
CO	0.000	2.512	4.310	0.038	2.511	4.343

**Flue Gas Probe Leak Check:** Initial: 0 Final: 0

Technician Signature: 

Date: 10/26/2022  
Page 1 of 1




Twin Ports Testing, Inc.  
 1301 North 3rd Street  
 Superior, WI 54880  
 p: 715-392-7114  
 p: 800-373-2562  
 f: 715-392-7163  
 www.twinportstesting.com

**Report No:** USR:W222-0658-01  
**Issue No:** 1

# Analytical Test Report

**Client:** PFS-TECO  
 11785 SE Hwy 212 Ste 305  
 Clackamas, OR 97015  
**Attention:** Sebastian Button  
**PO No:**

Signed:   
 Amber Anderson  
 Chemist  
 Date of Issue: 10/17/2022  
THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL

**Sample Details**  
**Sample Log No:** W222-0658-01      **Sample Date:**  
**Sample Designation:** Wood Pellets      **Sample Time:**  
**Sample Recognized As:** Biomass Pellets      **Arrival Date:** 10/6/2022

Test Results				
	METHOD	UNITS	MOISTURE FREE	AS RECEIVED
Moisture Total	ASTM E871	wt. %		3.64
Ash	ASTM D1102	wt. %	0.52	0.50
Volatile Matter	ASTM D3175	wt. %		
Fixed Carbon by Difference	ASTM D3172	wt. %		
Sulfur	ASTM D4239	wt. %	0.014	0.014
SO <sub>2</sub>	Calculated	lb/mmbtu		0.034
Net Cal. Value at Const. Pressure	ISO 1928	GJ/tonne	18.12	17.37
Gross Cal. Value at Const. Vol.	ASTM E711	Btu/lb	8442	8135
Carbon	ASTM D5373	wt. %	44.90	43.26
Hydrogen*	ASTM D5373	wt. %	6.96	6.70
Nitrogen	ASTM D5373	wt. %	0.57	0.55
Oxygen*	ASTM D3176	wt. %	47.04	45.33
*Note: As received values do not include hydrogen and oxygen in the total moisture.				
Chlorine	ASTM D6721	mg/kg		
Fluorine	ASTM D3761	mg/kg		
Mercury	ASTM D6722	mg/kg		
Bulk Density	ASTM E873	lbs/ft <sup>3</sup>		
Fines (Less than 1/8")	TPT CH-P-06	wt. %		
Durability Index	Kansas State	PDI		
Sample Above 1.50"	TPT CH-P-06	wt. %		
Maximum Length (Single Pellet)	TPT CH-P-06	inch		
Diameter, Range	TPT CH-P-05	inch		to
Diameter, Average	TPT CH-P-05	inch		
Stated Bag Weight	TPT CH-P-01	lbs		
Actual Bag Weight	TPT CH-P-01	lbs		

**Comments:**



Accreditation #60243

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## Equations and Sample Calculations – ASTM E2779 & E2515

Client Thelin  
 Model: Gnome  
 Tracking #: 127  
 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.

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

$M_{BSidb}$  – Weight of test fuel burned during test run segment  $i$ , dry basis, kg

BR – Average dry burn rate over full integrated test run, kg/hr

$BR_{Si}$  – Average dry burn rate over test run segment  $i$ , kg/hr

$V_s$  – Average gas velocity 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

$PM_R$  – Average particulate emissions for full integrated test run, g/hr

$PM_F$  – Average particulate emission factor for full integrated test run, g/dry kg of fuel burned

**M<sub>Bdb</sub> – Weight of test fuel burned during test run, dry basis, kg**

ASTM E2779 equation (1)

$$M_{Bdb} = (M_{Swb} - M_{Ewb})(100/(100 + FM))$$

Where,

FM = average fuel moisture of test fuel, % dry basis

M<sub>Swb</sub> = weight of test fuel in hopper at start of test run, wet basis, kg

M<sub>Ewb</sub> = weight of test fuel in hopper at end of test run, wet basis, kg

Sample Calculation:

$$FM = 3.78 \%$$

$$M_{Swb} = 13.0 \text{ lbs}$$

$$M_{Ewb} = 0.0 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{Bdb} = [(13.0 \times 0.4536) - (0.0 \times 0.4536)] (100/(100 + 3.778))$$

$$M_{Bdb} = 5.68 \text{ kg}$$

**$M_{BSidb}$  – Weight of test fuel burned during test run segment  $i$ , dry basis, kg**

ASTM E2779 equation (2)

$$M_{BSidb} = (M_{SSiwb} - M_{ESiwb})(100/(100 + FM))$$

Where,

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

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

Sample Calculation (from medium burn rate segment):

$$FM = 3.78 \%$$

$$M_{SSiwb} = 10.2 \text{ lbs}$$

$$M_{ESiwb} = 5.6 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{BSidb} = [(10.2 \times 0.4536) - (5.6 \times 0.4536)] (100/(100 + 3.78))$$

$$M_{BSidb} = \mathbf{2.01 \text{ kg}}$$



**BR – Average dry burn rate over full integrated test run, kg/hr**

ASTM E2779 equation (3)

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

Where,

$\theta$  = Total length of full integrated test run, min

Sample Calculation:

$$M_{Bdb} = 5.68 \quad \text{kg}$$
$$\theta = 360 \quad \text{min}$$

$$BR = \frac{60 \times 5.68}{360}$$

$$BR = \mathbf{0.95} \quad \text{kg/hr}$$

**BR<sub>Si</sub> – Average dry burn rate over test run segment *i*, kg/hr**

ASTM E2779 equation (4)

$$BR_{Si} = \frac{60 M_{BSidb}}{\theta_{Si}}$$

Where,

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

Sample Calculation (from medium burn rate segment):

$$M_{BSidb} = 2.01 \text{ kg}$$

$$\theta = 120 \text{ min}$$

$$BR = \frac{60 \times 2.01}{120}$$

$$BR = 1.01 \text{ kg/hr}$$

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

ASTM E2515 equations (9)

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

Where:

- $F_p$  = Adjustment factor for center of tunnel pitot tube placement,  $F_p = \frac{V_{strav}}{V_{scent}}$ , ASTM E2515 Equation (1)
- $V_{scent}$  = Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
- $V_{strav}$  = Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
- $k_p$  = Pitot tube constant, 85.49
- $C_p$  = Pitot tube coefficient: 0.99, unitless
- $\Delta P^*$  = Velocity pressure in the dilution tunnel, in  $H_2O$
- $T_s$  = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- $P_s$  = Absolute average gas static pressure in dilution tunnel, =  $P_{bar} + P_g$ , in Hg
- $P_{bar}$  = Barometric pressure at test site, in. Hg
- $P_g$  = Static pressure of tunnel, in.  $H_2O$ ; (in Hg = in  $H_2O$ /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:

$$F_p = \frac{7.01}{7.95} = 0.882$$

$$V_s = 0.882 \times 85.49 \times 0.99 \times 0.120 \times \left( \frac{80.0 + 460}{30.00 + \frac{-0.17}{13.6}} \right)^{1/2} \times 28.78$$

$$V_s = \mathbf{7.08 \text{ ft/s}}$$

\*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<sub>sd</sub> – Average gas flow rate in dilution tunnel, dscf/hr**

ASTM E2515 equation (3)

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

Where:

- 3600 = Conversion from seconds to hours (ASTM method uses 60 to convert in minutes)
- B<sub>ws</sub> = Water vapor in gas stream, proportion by volume; assume 2%
- A = Cross sectional area of dilution tunnel, ft<sup>2</sup>
- T<sub>std</sub> = Standard absolute temperature, 528 °R
- P<sub>s</sub> = Absolute average gas static pressure in dilution tunnel, = P<sub>bar</sub> + P<sub>g</sub>, in Hg
- T<sub>s</sub> = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P<sub>std</sub> = Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 7.08 \times 0.7854 \times \frac{528}{80.0 + 460} \times \frac{30 + \frac{-0.17}{13.6}}{29.92}$$

**Q<sub>sd</sub> = 19223.4 dscf/hr**

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

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

Where:

- $K_1$  = 17.64 °R/in. Hg  
 $V_m$  = Volume of gas sample measured at the dry gas meter, dcf  
 $Y$  = Dry gas meter calibration factor, dimensionless  
 $P_{bar}$  = Barometric pressure at the testing site, in. Hg  
 $\Delta H$  = Average pressure differential across the orifice meter, in. H<sub>2</sub>O  
 $T_m$  = Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train A:

$$V_{m(std)} = 17.64 \times 52.372 \times 1 \times \frac{\left( 30 + \frac{2.07}{13.6} \right)}{\left( 94.1 + 460 \right)}$$

$$V_{m(std)} = \mathbf{50.268} \text{ dscf}$$

Using equation for Train B:

$$V_{m(std)} = 17.64 \times 51.939 \times 1 \times \frac{\left( 30.00 + \frac{2.07}{13.6} \right)}{\left( 94.2 + 460 \right)}$$

$$V_{m(std)} = \mathbf{49.836} \text{ dscf}$$

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 50.31 \times 0.999 \times \frac{\left( \underline{30} + \frac{0.00}{13.6} \right)}{\left( 67.8 + 460 \right)}$$

$$V_{m(std)} = \mathbf{50.388} \text{ dscf}$$

**$m_n$  – 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 (first hour):

$$m_n = 0.1 + 2.4 + 0.2$$

$$m_n = 2.7 \text{ mg}$$

Using equation for Train A (remainder):

$$m_n = 0.0 + 0.6 + 0.1$$

$$m_n = 0.7 \text{ mg}$$

Train A Aggregate = **3.4 mg**

Using equation for Train B:

$$m_n = 0.0 + 2.4 + 0.0$$

$$m_n = 2.4 \text{ mg}$$

**C<sub>s</sub> - Concentration of particulate matter in tunnel gas, dry basis, corrected to standard conditions, g/dscf**  
 ASTM E2515 equation (13)

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

Where:

- K<sub>2</sub> = Constant, 0.001 g/mg  
 m<sub>n</sub> = Total mass of particulate matter collected in the sampling train, mg  
 V<sub>m(std)</sub> = Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train A:

$$C_s = 0.001 \times \frac{3.4}{50.27}$$

$$C_s = \mathbf{0.00007} \text{ g/dscf}$$

For Train B:

$$C_s = 0.001 \times \frac{2.4}{49.84}$$

$$C_s = \mathbf{0.00005} \text{ g/dscf}$$

For Ambient Train

$$C_r = 0.001 \times \frac{0.0}{50.39}$$

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

**E<sub>T</sub> – Total Particulate Emissions, g**

ASTM E2515 equation (15)

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

Where:

- C<sub>s</sub> = Concentration of particulate matter in tunnel gas, g/dscf
- C<sub>r</sub> = Concentration particulate matter room air, g/dscf
- Q<sub>std</sub> = Average dilution tunnel gas flow rate, dscf/hr
- θ = Total time of test run, minutes

Sample calculation:

For Train A

$$E_T = ( \underline{0.000068} - 0.000000 ) \times \underline{19223.4} \times \underline{360} / 60$$
$$E_T = \underline{7.80} \text{ g}$$

For Train B

$$E_T = ( \underline{0.000048} - 0.000000 ) \times \underline{19223.4} \times \underline{360} / 60$$
$$E_T = \underline{5.55} \text{ g}$$

Average

$$E = \underline{6.68} \text{ g}$$

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

- 7.5% of the average = 0.50
- Train A difference = 1.12
- Train B difference = 1.12



**PR - Proportional Rate Variation**

ASTM E2515 equation (16)

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

Where:

- $\theta$  = Total sampling time, min
- $\theta_i$  = 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 A):

$$PR = \left( \frac{360 \times 0.141 \times 7.08 \times (94.1 + 460) \times (84.9 + 460)}{1 \times 52.372 \times 7.02 \times (80.0 + 460) \times (76.0 + 460)} \right) \times 100$$

$$PR = \underline{102} \%$$

**PM<sub>R</sub> – Average particulate emissions for full integrated test run, g/hr**  
ASTM E2779 equation (5)

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

Where,

$E_T$  = Total particulate emissions, grams

$\theta$  = Total length of full integrated test run, min

Sample Calculation:

$$E_T \text{ (Dual train average)} = 6.68 \text{ g}$$

$$\theta = 360 \text{ min}$$

$$PM_R = 60 \times ( 6.68 / 360 )$$

$$PM_R = 1.11 \text{ g/hr}$$

**PM<sub>F</sub> – Average particulate emission factor for full integrated test run, g/dry kg of fuel burned**  
ASTM E2779 equation (6)

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

Where,

E<sub>T</sub> = Total particulate emissions, grams

M<sub>Bdb</sub> = Weight of test fuel burned during test run, dry basis, kg

Sample Calculation:

$$E_T \text{ (Dual train average)} = 6.68 \text{ g}$$

$$M_{Bdb} = 5.68 \text{ kg}$$

$$PM_F = 6.68 / 5.68 )$$

$$PM_F = 1.18 \text{ g/kg}$$



MODEL No. No. DE MODELE	MAX. BTU INPUT CONSUM. MAX. EN BTU
Parlour 3000	40,000
Gnome	27,000

DATE OF MFG. / DATE DE FABRICATION
SERIAL NUMBER / NO. DE SÉRIE



Listed Room Heater, Pellet Type.

This pellet fire appliance has been tested and listed for use in manufactured homes in accordance with Oregon Administrative Rules 814-23-900 through 814-23-909 ASTM 1509-04, UL6 S627-00, UL 1482-00.

Install and use only in accordance with manufacturer's installation and operating instructions. Contact local building officials about restrictions and installation inspection in your area. Above approved.

**CAUTION:** Special methods are required when passing chimney through a wall or ceiling. Refer to local building codes. Do not connect this unit to a chimney flue serving another appliance.

Fire use with pelletized wood fuels only! Use of other fuels will cause a hazardous condition.

NOTE: Replace glass only with 5mm ceramic.

**WARNING:** (Mobile Home) An outside air inlet must be provided for combustion and be unrestricted while unit is in use. The structural integrity of the mobile home floor, walls, ceiling, and roof must be maintained.

**DANGER:** Risk of electrical shock. Disconnect power before servicing unit. Do not run power cord under appliance.

VENT TYPE: Use only type "PL" pellet vent and connectors (Size 3"/75mm or 4"/100mm).

ELECTRICAL RATING: 120 Volts/2.0 Amps/60Hz/1 Phase - U.K. 24V

Install per H.U.D. 24CFR SEC. 3280.

Appareil de chauffages certifié, de type granulés de bois.

Cet appareil à granulés de bois a été testé et certifié pour être utilisé dans des maisons préfabriquées conformément aux règlements <<Oregon Administrative Rules>> 814-23-900 à 814-23-909, ASTM 1509-04, UL6 S627-00, UL 1482-00.

À installer et utiliser uniquement conformément aux consignes d'installation et d'utilisation du fabricant. Contacter les autorités locales en matière de construction concernant les restrictions et les inspections de montage propres à votre région. Approuvé pour une alcôve.

**ATTENTION:** Des techniques spéciales sont nécessaires en cas de passage de la cheminée à travers un mur ou un plafond. Consulter les codes locaux du bâtiment. Ne pas reconnector cet appareil à un conduit de cheminée servant un autre appareil.

À utiliser uniquement avec des bois de chauffage en granulés! Tout autre combustible causera un danger.

REMARQUE: Remplacer la vitre avec un verre en céramique de 5mm uniquement.

**AVERTISSEMENT:** (Maison mobile) Une arrivée d'air extérieur pour la combustion doit être installée et dégagée lorsque l'appareil est en marche. L'intégrité structurelle du plancher, des murs, du plafond et du toit de la maison mobile doit être maintenue.

**DANGER:** Risque de choc électrique. Débrancher l'appareil avant tout entretien ou réparation. Ne pas acheminer le cordon d'alimentation sous l'appareil.

TYPE D'ÉVENT: Utiliser seulement un conduit d'évacuation et des raccords de type «PL» (Taille 3"/75mm ou 4"/100mm).

CARACTÉRISTIQUES ÉLECTRIQUES: 120 Volts/2.0 Amps/60Hz/1 Phase - G.B. 24V

Installer conformément à H.U.D. 24CFR SEC. 3280.

Emission of CO in combustion products: nominal heat output <0.04%  
Reduce heat output <0.06%



Émission de CO dans les produits de combustion: Puissance calorifique nominale <0,04%  
Puissance calorifique réduite <0,06%

Fuel Gas Temperature: 174 Deg. C

Température du gaz de cheminée: 174 Deg. C

Thermal Output: 6.9 KW

Puissance Thermique: 6.9 KW

Energy Efficiency: Nominal heat output 6.9KW 85%  
Reduced heat output 3.7KW 80%

EN 14785:2007  
Residential Space Heating appliance  
fired by wood pellets

Rendement Énergétique: Puissance calorifique nominale 6.9KW 85%  
Puissance calorifique réduite 3.7KW 80%

Fuel Types: Wood Pellets, 6mm diameter,  
12mm to 25mm long

Appareil de chauffage domestique  
alimenté en granulés de bois

Types de Combustible: Granulés de bois, 6mm de diamètre,  
12mm à 25mm de long

CLEARANCES TO COMBUSTIBLES - FREESTANDING HEATER / DÉGAGEMENT AUX COMBUSTIBLES - APPAREIL DE CHAUFFAGE AUTONOME

- A. UNIT TO BACKWALL 1.5" / 40mm
- B. UNIT TO SIDEWALLS 5" / 125mm
- C. UNIT TO DIAGONAL WALL 5" / 125mm
- UNIT TO ALCOVE CEILING 1" / 25mm



- A. APPAREIL AU MUR ARRIÈRE 1.5" / 40mm
- B. APPAREIL AUX MURS LATÉRAUX 5" / 125mm
- C. APPAREIL AU MUR EN DIAGONALE 5" / 125mm
- APPAREIL AU PLAFOND DE L'ALCÔVE 1" / 25mm

INSTALL ON A NON-COMBUSTIBLE FLOOR PROTECTOR EXTENDING 6" IN FRONT OF THE APPLIANCE.

PLACER SUR UN PROTECTEUR DE PLANCHER NON-COMBUSTIBLE, QUI D'ÉPASSE DE 6 PO A L'AVANT DE L'APPAREIL.

U.S. ENVIRONMENTAL PROTECTION AGENCY  
Certified to comply with EPA NSPS 2020 emission standards.

DATE OF MANUFACTURE	MODEL	EMISSION RATE (G/Hr)
	Parlour 3000	0.92
	Gnome	0.98

SERIAL NO.	Efficiency	HHV
	81%	81%
	85%	85%

**FOR USE WITH PELLETIZED WOOD FUEL ONLY**

ASTM E2779-10/WEPA ALT-148

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.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

Mr. John Steinert  
Vice President  
PFS TECO  
11785 SE Hwy 212  
Suite 305  
Clackamas, OR 97015

02/04/2022

Dear Mr. Steinert,

I am writing you in response to your correspondence dated February 3, 2022, in which you request the use of an alternative testing procedure to demonstrate compliance with 40 CFR part 60, Subpart AAA – Standards of Performance for New Residential Wood Heaters (Subpart AAA). 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.

According to the information provided, you seek an alternative test method for use when conducting testing on the United States Stove Company, Model KP5517 pellet heater. Currently, as required by section 60.534(a)(1)(i) of Subpart AAA, a manufacturer has the option to test their appliance in accordance with 40 CFR part 60, Appendix B, Method 28R for a crib fuel appliance or ASTM E2779-10 “Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters” (ASTM E2779-10) for a pellet fuel appliance. This request seeks an alternative to section 9.4.1.2 of ASTM E2779-10 which specifies test conditions for pellet heaters including the determination of the Medium Burn Rate Category and states that the medium burn rate must be  $\leq 50\%$  of the maximum burn rate.

In your request, you state that the specification for determining the medium burn rate found in ASTM E2779-10 is incorrect, and the Medium Burn Rate Category should be defined as less than 50% of the midpoint point (this is defined in the attached Memo as 50% of the span between the Maximum Burn Rate and the Low Burn Rate) between the high and low burn rates. Furthermore, your request includes a memorandum dated February 2, 2022, titled “Appropriate Calculation of Medium Burn Rate Category in ASTM E-2779 Testing” (attached) which was sent to the EPA’s Office of Enforcement and Compliance Assurance. This memorandum states that an error had been uncovered in determining the appropriate Medium Burn Rate Category in ASTM E2779-10 for compliance pursuant to Subpart AAA. Specifically, section 9.4.1.2 of ASTM E2779-10 states that “the pellet heater shall be operated with the control or controls set in

the position(s) as needed to achieve a burn rate that is  $\leq 50\%$  of the maximum burn rate.” Table 1 of ASTM E2779-10 also notes that the Medium Burn Rate Category test must be  $\leq 50\%$  of the maximum burn rate. The memorandum states that this is incorrect as it assumes that zero is the other bound for determining half of the maximum burn rate, and that the correct approach in determining the Medium Burn Rate Category should be at a level below 50% of the span between the Maximum Burn Rate and the Low Burn Rate (a non-zero value).

We have reviewed your request and agree that the Medium Burn Rate Category should be defined as less than 50% of the span between the high and low burn rates. Meaning that the Medium Burn Rate Category should be at a level below 50% of the span between the Maximum Burn Rate and the Low Burn Rate (a non-zero value).

Based on the information provided and with the caveats set forth below, we are approving your request for an alternative methodology used when calculating the Medium Burn Rate Category to conduct certification testing as required by Subpart AAA, section 60.534(a)(1)(i) on pellet heaters. This approval is based on the understanding that the Medium Burn Rate Category is defined as less than 50% of the span between the high and low burn rates. Additionally, this approval is based on the understanding that the lowest heat output (Btu/hr) setting available to the user, and corresponds to the lowest burn rate to be evaluated during certification testing; this is consistent with Subpart AAA, section 60.534(a)(1), which states: “The burn rate for the low burn category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer.”

With this Alternate Test Method, the following changes to ASTM E2779-10 must be followed for certification testing:

1. Medium Burn Rate Category burn rate is defined as:

*Nomenclature:*

*Max* = Maximum burn rate (kg/h)

*Min* = Minimum burn rate (kg/h)

$$\frac{Max+Min}{2} \quad \text{Eq.1}$$

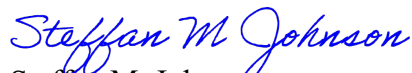
All other requirements of ASTM E-2779-10 must be followed during the testing, and all requirements of 40 CFR part 60, Subpart AAA must be satisfied as described in your test report. A copy of this letter must be included in each certification test report where this alternative test method is utilized.

Because this alternative method may be of use to others, we feel that it is reasonable that this approval be broadly applicable to all pellet heaters tested in accordance with ASTM E2779-10 “Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters” and subject to the requirements of §60.534(a)(1)(i) of Subpart AAA. For this reason, we will post this

letter as ALT-146 on our website at <https://www.epa.gov/emc/broadly-applicable-approved-alternative-test-methods> for use by other interested parties. This alternative method approval is valid until such time that Subpart AAA is revised or replaced to require a different pellet heater certification method, and at such time, this alternative will be reconsidered and possibly withdrawn.

If you have additional questions regarding this approval, please contact Angelina Brashear of my staff at 919-541-4746 or [brashear.angelina@epa.gov](mailto:brashear.angelina@epa.gov).

Sincerely,



Steffan M. Johnson  
Group Leader  
Measurement Technology Group

cc: Angelina Brashear – EPA/OAQPS/AQAD  
Chuck French – EPA/OAQPS/SPPD  
Rafael Sanchez – EPA/OECA  
Robert Scinta – EPA/OECA  
Michael Toney – EPA/OAQPS/AQAD  
Nathan Topham – EPA/OAQPS/SPPD  
John Voorhees – United States Stove Company  
Chet Wayland – EPA/OAQPS/AQAD



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

MEMORANDUM

02/02/2022

**SUBJECT:** Appropriate calculation of Medium Burn Rate Category in ASTM E-2779 Testing

**FROM:** Steffan Johnson  
Group Leader  
Measurement Technology Group  
Air Quality Assessment Division

**STEFFAN  
JOHNSON** Digitally signed by  
STEFFAN JOHNSON  
Date: 2022.02.02  
08:28:07 -05'00'

**TO:** Robert Scinta, P.E.  
Chief, Air Branch  
Monitoring, Assistance, and Media Programs Division  
Office of Compliance, Office of Enforcement and Compliance Assurance

During a recent review of pellet heater compliance test reports, the Measurement Technology Group has uncovered an error in determining the appropriate Medium Burn Rate Category when using ASTM E-2779 for compliance pursuant to 40 CFR 60, subpart AAA. Specifically, the method requirements in section 9.4.1.2 and Table 1 of that test method incorrectly require that the Medium Burn Rate Category must fall below 50% of the maximum burn rate. This is not correct as this requirement assumes then that zero is the other bound for determining half of the maximum.

9.4.1.2 *Medium Burn Rate Category*—For burn rates in the medium segment, except as allowed in 9.4.1.4 or 9.4.1.5, the pellet heater shall be operated with the control or controls set in the position(s) as needed to achieve a burn rate that is  $\leq 50\%$  of the maximum burn rate.

TABLE 1

Burn Rate Segment	Maximum	Medium	Minimum
Description	Maximum achievable	$\leq 50\%$ of Maximum	Minimum achievable
Time at Burn Rate	60 +5 / - 0 minutes	120 +5 / - 0 minutes	180 +5 / - 0 minutes



The correct application of this requirement would be to determine the Medium Burn Rate Category at a level below 50% of the span between the Maximum Burn Rate and the Low Burn Rate (a non-zero value). Ergo, the correct calculation for finding that midpoint of 50% is defined as  $\frac{Max+M}{2}$ .

For example, if the Maximum Burn rate of an appliance is 1.79 kg/hr and the minimum is 1.23 kg/hr, the method would currently place the 50% requirement at 0.895 kg/hr. This is unachievable on this appliance and presents an impossible compliance requirement. Applying the equation laid out above the value of 1.51 is derived and, therefore, presents an appropriate and likely attainable emissions test requirement for the Medium Burn Rate Category.

During your reviews of such emissions tests, as reported to OECA and intended for compliance certification purposes, MTG recommends applying the above procedure in order to ascertain if a Medium Burn Rate was appropriately established during a compliance test.

CC:

Sarah Ayres - OECA

Angelina Brashear – OAQPS

Alice Edwards – Alaska DEC

Chuck French – OAQPS

Robert Lischinsky - OECA

Theresa Lowe - OAQPS

Rafael Sanchez – OECA

Robert Scinta - OECA

Mike Toney – OAQPS

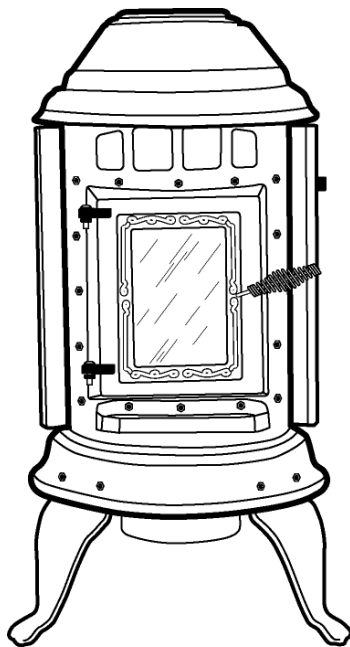
Nathan Topham - OAQPS

Chet Wayland – OAQPS



# GNOME™ PELLET STOVE

## Owner's Manual



**MADE IN THE USA**



**NATIONAL FIREPLACE INSTITUTE**  
**NFI**  
**CERTIFIED**  
[www.nficertified.org](http://www.nficertified.org)

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

**Wood Energy Technical Training**  
[www.wettinc.com](http://www.wettinc.com)

### SAFETY NOTICE

- STOVE MUST BE PROPERLY INSTALLED AND MAINTAINED OR A HOUSE FIRE MAY RESULT.
- FOR YOUR SAFETY, FOLLOW THE INSTALLATION INSTRUCTIONS.
- CONTACT LOCAL BUILDING OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION AND PERMIT.
- FAILURE TO COMPLY WITH OWNER'S MANUAL INSTRUCTIONS AND INSTALLATION GUIDELINES WILL VOID WARRANTY. SAVE THESE INSTRUCTIONS.

Leave this manual with the owner. Please read this entire manual before installation and use of the pellet fuel-burning stove. Failure to follow these instructions could result in property damage, bodily injury or even death.

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## Introduction

Congratulations on your purchase of Theelin™ Hearth Products Gnome™ pellet stove! In this manual you will find information on stove specifications, installation instructions, operating guide, how to perform scheduled maintenance, a troubleshooting guide, a detailed parts list and associated diagrams. Also included is your warranty information. Please take the time to read this manual and become familiar with your pellet stove.

If you have any questions or comments, please contact your local Theelin authorized dealer. Theelin dealers are qualified industry professionals who are able to address any questions or comments you might have regarding Theelin product. Thank you for choosing Theelin.

## Safety Information

### FIRE RISK

Do not operate appliance before reading and understanding operating instructions. Failure to operate appliance properly may result in a house fire.

Inspect appliance and components for damage. Damaged parts may impair safe operation. DO NOT install damaged components.

DO NOT install incomplete components. DO NOT install substitute components. Report damaged parts to dealer.

DO NOT connect this unit into a chimney flue servicing another appliance. DO NOT connect to any air distribution or duct system.

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. PROPER OPERATION WILL MINIMIZE VISIBLE EMISSIONS. IF VISIBLE EMISSIONS ARE PRESENT DURING OPERATION HAVE THE APPLIANCE CLEANED AND INSPECTED.

## WARNING

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THELIN HEARTH PRODUCTS DISCLAIMS ANY RESPONSIBILITY FOR, AND THE WARRANTY WILL BE VOIDED BY THE FOLLOWING ACTIONS:

- MODIFICATION OF APPLIANCE
  - INSTALLATION OTHER THAN AS INSTRUCTED IN THIS MANUAL BY THELIN HEARTH PRODUCTS.
  - INSTALLATION AND/OR USE OF ANY COMPONENT PART NOT APPROVED BY THELIN HEARTH PRODUCTS.
  - OPERATING APPLIANCE WITHOUT FULLY ASSEMBLING ALL COMPONENTS CORRECTLY
-

DO NOT overfire. If any external part starts to glow, you are over firing. Reduce feed rate.

Overfiring or any such action that may cause a fire hazard including failure to perform regular maintenance as outlined in these instructions will void warranty.

DO NOT store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

INSTALL and use a smoke detector and carbon monoxide monitor in the vicinity of this appliance.

## **CAUTION**

TESTED AND APPROVED FOR PFI APPROVED PREMIUM WOOD PELLETS OF HIGHEST BTU OUTPUT AND LOWEST % OF ASH CONTENT ONLY. BURNING ANY OTHER TYPE OF FUEL WILL VOID YOUR WARRANTY.

## **Fire Safety**

Maintain the designated clearances to combustibles as diagramed in this manual. Insulation must not touch the chimney or venting system. You must maintain the designated airspace clearance around the chimney. This space around the chimney is necessary to allow heat to flow away from the chimney area. Insulation in this area will cause heat buildup, which could ignite wood framing.

The following should be considered when installing any solid fuel appliance:

1. Install at least one smoke detector and carbon monoxide monitor on each floor of your home to ensure safety. They should be located away from the heating appliance and near the sleeping area.
2. Conveniently locate a Class A fire extinguisher near the appliance.
3. Write down and practice an evacuation plan with two escape routes.

Check with your local building code department before you begin your installation. Obtain a building permit in order to meet local building code requirements.

Contact your local dealer if assistance is required before, during and after installation.

## **Before Start-Up Check List**

1. All Safety Warnings have been read and followed.
2. The Owner's Manual has been read.
3. Floor protection requirements have been adhered to.
4. All venting has been properly installed.

5. The proper clearances from the stove and chimney to combustible materials have been followed.
6. The masonry chimney has been inspected by a professional and is clean, or the factory built (metal) fireplace is installed according to the manufacturer's instructions.
7. A grounded power outlet with a surge protector is available nearby without having to use an extension cord.

Laboratory Listing Label

	MODEL No. No. DE MODÈLE	MAX. BTU INPUT CONSOM. MAX. EN BTU	DATE OF MFG. / DATE DE FABRICATION	
	Parlour 3000	40,000	SERIAL NUMBER / NO. DE SÉRIE	
	Gnome	27,000		

<p>Listed Room Heater, Pellet Type.</p> <p>This pellet fire appliance has been tested and listed for use in manufactured homes in accordance with Oregon Administrative Rules 814-23-900 through 814-23-909 ASTM 1509-04, ULC S627-00, UL 1482-00.</p> <p>Install and use only in accordance with manufacturer's installation and operating instructions. Contact local building officials about restrictions and installation inspection in your area. Alcove approved.</p> <p>CAUTION: Special methods are required when passing chimney through a wall or ceiling. Refer to local building codes. Do not connect this unit to a chimney flue serving another appliance.</p> <p>Do not use with pelletized wood fuels only! Use of other fuels will cause a hazardous condition.</p> <p>NOTE: Replace glass only with 5mm ceramic.</p> <p>WARNING: (Mobile Home) An outside air inlet must be provided for combustion and be unrestricted while unit is in use. The structural integrity of the mobile home floor, walls, ceiling, and roof must be maintained.</p> <p>DANGER: Risk of electrical shock. Disconnect power before servicing unit. Do not run power cord under appliance.</p> <p>VENT TYPE: Use only type "PL" pellet vent and connectors (Size 3" / 75mm or 4" / 100mm).</p> <p>ELECTRICAL RATING: 120 Volts/2.0 Amps/60Hz/1 Phase - U.K. 24V</p> <p>Install per H.U.D. 24CFR SEC. 3280.</p>	<p>Appareil de chauffages certifié, de type granulés de bois.</p> <p>Cet appareil à granulés de bois a été testé et certifié pour être utilisé dans des maisons préfabriquées conformément aux règlements &lt;&lt;Oregon Administrative Rules&gt;&gt; 814-23-900 à 814-23-909, ASTM 1509-04, ULC S627-00, UL 1482-00.</p> <p>À installer et utiliser uniquement conformément aux consignes d'installation et d'utilisation du fabricant. Contacter les autorités locales en matière de construction concernant les restrictions et les inspections de montage propres à votre région. Approuvé pour une alcôve.</p> <p>ATTENTION: Des techniques spéciales sont nécessaires en cas de passage de la cheminée à travers un mur ou un plafond. Consulter les codes locaux du bâtiment. Ne pas reconnector cet appareil à un conduit de cheminée servant un autre appareil.</p> <p>À utiliser uniquement avec des bois de chauffage en granulés! Tout autre combustible causera un danger.</p> <p>REMARQUE: Remplacer la vitre avec un verre en céramique de 5mm uniquement.</p> <p>AVERTISSEMENT: (Maison mobile) Une arrivée d'air extérieur pour la combustion doit être installée et dégagée lorsque l'appareil est en marche. L'intégrité structurelle du plancher, des murs, du plafond et du toit de la maison mobile doit être maintenue.</p> <p>DANGER: Risque de choc électrique. Débrancher l'appareil avant tout entretien ou réparation. Ne pas acheminer le cordon d'alimentation sous l'appareil.</p> <p>TYPE D'ÉVENT: Utiliser seulement un conduit d'évacuation et des raccords de type «PL» (Taille 3" / 75mm ou 4" / 100mm).</p> <p>CARACTÉRISTIQUES ÉLECTRIQUES: 120 Volts/2.0 Amps/60Hz/1 Phase - G.B. 24V</p> <p>Installer conformément à H.U.D. 24CFR SEC. 3280.</p>
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<p>Emission of CO in combustion products: nominal heat output &lt;0.04% Reduce heat output &lt;0.06%</p> <p>Fuel Gas Temperature: 174 Deg. C</p> <p>Thermal Output: 6.9 kW</p> <p>Energy Efficiency: Nominal heat output 6.9kW 85% Reduced heat output 3.7kW 80%</p> <p>Fuel Types: Wood Pellets, 6mm diameter, 12mm to 25mm long</p>	 <b>EN 14785:2007</b> Residential Space Heating appliance fired by wood pellets Appareil de chauffage domestique alimenté en granulés de bois	<p>Émission de CO dans les produits de combustion: Puissance calorifique nominale &lt;0.04% Puissance calorifique réduite &lt;0.06%</p> <p>Température du gaz de cheminée: 174 Deg. C</p> <p>Puissance Thermique: 6.9 kW</p> <p>Rendement Énergétique: Puissance calorifique nominale 6.9kW 85% Puissance calorifique réduite 3.7kW 80%</p> <p>Types de Combustible: Granulés de bois, 6mm de diamètre, 12mm à 25mm de long</p>
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CLEARANCES TO COMBUSTIBLES - FREESTANDING HEATER / DÉGAGEMENT AUX COMBUSTIBLES - APPAREIL DE CHAUFFAGE AUTONOME		
<p>A. UNIT TO BACKWALL 1.5" / 40mm</p> <p>B. UNIT TO SIDEWALLS 5" / 125mm</p> <p>C. UNIT TO DIAGONAL WALL 5" / 125mm</p> <p>UNIT TO ALCOVE CEILING 1" / 25mm</p> <p>INSTALL ON A NON-COMBUSTIBLE FLOOR PROTECTOR EXTENDING 6" IN FRONT OF THE APPLIANCE.</p>		<p>A. APPAREIL AU MUR ARRIÈRE 1.5" / 40mm</p> <p>B. APPAREIL AUX MURS LATÉRAUX 5" / 125mm</p> <p>C. APPAREIL AU MUR EN DIAGONALE 5" / 125mm</p> <p>APPAREIL AU PLAFOND DE L'ALCÔVE 1" / 25mm</p> <p>PLACER SUR UN PROTECTEUR DE PLANCHER NON-COMBUSTIBLE, QUI DÉPASSE DE 6 PO À L'AVANT DE L'APPAREIL.</p>

<p>U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with EPA NSPS 2020 emission standards.</p> <p><b>FOR USE WITH PELLETIZED WOOD FUEL ONLY</b></p>	<p>DATE OF MANUFACTURE</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>MODEL</th> <th>EMISSION RATE (G/HR)</th> </tr> <tr> <td>Parlour 3000</td> <td>0.92</td> </tr> <tr> <td>Gnome</td> <td>0.99</td> </tr> </table> <p>ASTM E2779-10/WIEPA ALT-146</p>	MODEL	EMISSION RATE (G/HR)	Parlour 3000	0.92	Gnome	0.99	<p>SERIAL NO.</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>Efficiency</th> <th>HHV</th> </tr> <tr> <td>81%</td> <td>75%</td> </tr> </table>	Efficiency	HHV	81%	75%
MODEL	EMISSION RATE (G/HR)											
Parlour 3000	0.92											
Gnome	0.99											
Efficiency	HHV											
81%	75%											

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. PAN: 00.0075.02061

## WARNINGS

HOT SURFACES! HOT GLASS WILL CAUSE BURNS. SURFACES AND GLASS ARE HOT DURING OPERATION AND DURING COOL-DOWN PERIOD.

DO NOT TOUCH GLASS UNTIL IT IS COOLED.

NEVER ALLOW CHILDREN TO TOUCH GLASS. ALERT CHILDREN TO HAZARDS OF HIGH TEMPERATURES.

HIGH TEMPERATURES MAY IGNITE CLOTHING OR OTHER FLAMMABLE MATERIALS. KEEP CLOTHING, FURNITURE, DRAPERIES AND OTHER FLAMMABLE MATERIALS AWAY FROM STOVE.

## General Information

Installation and repair should be done by a qualified service professional. The stove should be inspected before use and at least annually by a service professional. More frequent cleaning may be required due to fuel quality, excessive lint from carpeting, bedding material, etc. It is imperative that control compartments, burn pot and potholder, and circulating air passageways of the stove be kept clean and free of ash buildup, lint, and dust.

Under EPA Emission test conditions as calculated per CSA B415.1-22 this heater has shown to deliver heat output at rates ranging from 11,523 to 16,532 Btu/hr.

The Gnome pellet stove has been designed and approved for burning **PFI PREMIUM WOOD PELLETS OF HIGHEST BTU OUTPUT AND LOWEST % OF ASH CONTENT ONLY.**

Burning bio mass fuels in other forms or poor quality pellet fuel is not permitted and will void your warranty and/or could cause a burn back or house fire. **FOR BEST RESULTS THE WOOD PELLET FUEL SHOULD BE ¼" DIAMETER AND APPROXIMATELY 1" LONG.**

Store fuel in a covered, dry area. Pellet bags can absorb moisture and must be kept dry. Never place bags of fuel next to the heater. Keep fuel away from combustible materials and moisture. **NEVER** use gasoline, gasoline type lantern fuels, kerosene, charcoal lighter fluid, or similar liquids to start or "freshen up" a fire. Keep all such liquids well away from the stove while it is in use.

Pellet ashes should be placed in a metal container with a tight-fitting lid. The closed container of ashes should be placed on a non-combustible floor or the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally disbursed, they should be retained in the closed container until all cinders have been thoroughly extinguished.



**NOTE:** During the first few burns (up to 2 – 4 hours) the high-temperature paint and sealant used in the manufacture will emit some odor and smoke. Open doors and windows to the outside for proper ventilation during the first burn cycle and the curing of the paint. **SEE INITIAL FIRING PROCESS PAMPHLET WITH STOVE.**

This stove must be electrically grounded according to local codes or, in the absence of local codes, with the National Electrical Code, **ANSI/NFPA 70-2020**.

Provide adequate clearances around air openings into the combustion chamber and provide adequate accessibility clearance for servicing and proper operation. Never obstruct the front opening of the stove.

The stove may be installed as a free-standing unit mounted on a non-combustible protective floor pad or hearth. Non-combustible floor protection is required and must be used when placing the stove on any combustible material.

**CAUTION:** Do not connect this unit to a chimney flue serving another appliance. Do not install flue damper in the exhaust venting system of the unit.

U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using PFI APPROVED wood pellet fuel.

## Vent Information

Install vent clearances as specified in this Owner's Manual.

### **USE TYPE L 3" OR 4" PELLET VENT PIPE DEPENDING ON YOUR INSTALLATION.**

Secure pipe adapter to rear flange with 500 degree HIGH-TEMP RTV silicone and using at least three sheet metal screws. Subsequent sections must be attached with three screws also. Each pipe section should be sealed with hi-temp silicone and/or follow vent manufacturer's instructions **Use only Type L 3" or 4" venting systems depending on your installation requirements.**

### **DO NOT INSTALL A FLUE DAMPER IN THE EXHAUST VENTING SYSTEM OF THIS UNIT.**

## Termination

DO NOT terminate vent in any enclosed or semi-enclosed area such as carport, garage, attic, crawl space, under a sun deck or porch, narrow walkway or closely fenced area or any location where fumes can build up and concentrate such as stairwell, covered breezeway, etc.

## Distance to openings

1. 3 feet minimum above any forced air inlet located within 10 feet.
2. 4 ft. minimum below, or 4 ft. horizontally from, or 1 foot minimum above any door, window, or gravity air inlet into any building.
3. Permanently closed windows – not less than 1 foot below, horizontally from, or above the permanently closed window.
4. 2 feet minimum to an adjacent building and 7 feet minimum above grade when located adjacent to public walkways
5. Distance to bottom of termination cap and grade should be 12".
6. Grade surface must be non-combustible material such as rock, dirt, gravel. Beware of plants, lawn, bushes, and shrubs, which are considered combustible material.
7. Consult local building, fire or other official codes. Local codes may be different and require other clearances than described here.

## MOBILE HOME INSTALLATION

Mobile home installation should be in accordance with the manufactured home and safety standard (HUD), CFR 3280, PART 24.

1. Outside combustion air is mandatory in mobile or modular home installations. An outside air inlet **MUST** be provided for combustion and ventilation air. The air inlet must remain unrestricted while unit is in use. Outside air connection is made at the air intake located on the rear of the stove (see **FIGURE 2 and 3**). The kit contains 2" flex tubing (part #43000-270). Outside air kit includes flex tube, hose clamp, and rodent screen/cap.
2. Unit must be electrically grounded to steel frame of mobile home.
3. The stove must be grounded with #8 solid copper grounding wire or equivalent, terminated at each end with an NEC-approved grounding device.
4. A grounded power outlet with a surge protector is recommended.
5. Clearance to combustibles and floor protection is exactly the same for mobile homes as residential installs.

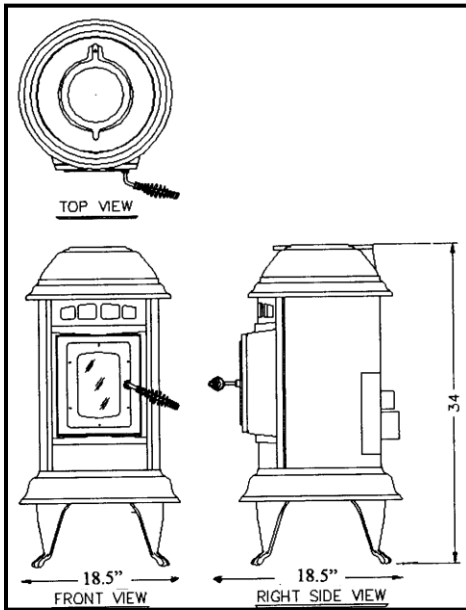
**WARNING: THE STRUCTURAL INTEGRITY OF THE MOBILE HOME FLOORS, WALL, CEILING, AND ROOF MUST BE MAINTAINED. DO NOT INSTALL IN SLEEPING ROOM.**

# Installation

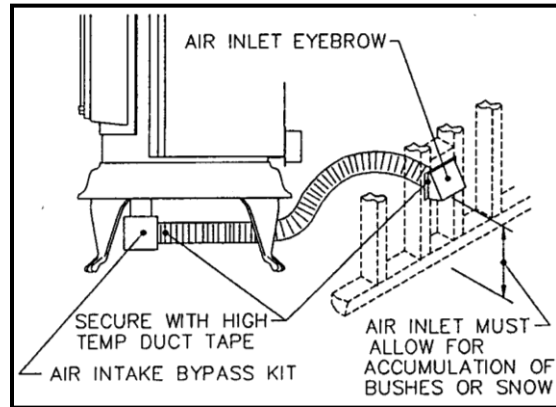
## Unpacking and Inspecting your Stove

Theelin Hearth Products packages your stove to ensure safe delivery. Each stove is surrounded by impact absorbent material as well as load shift indicators. However, damage can still occur while the stove is in transit. It is imperative that you carefully inspect your stove immediately after you receive it. If you notice any damage or missing parts, contact your Theelin dealer immediately.

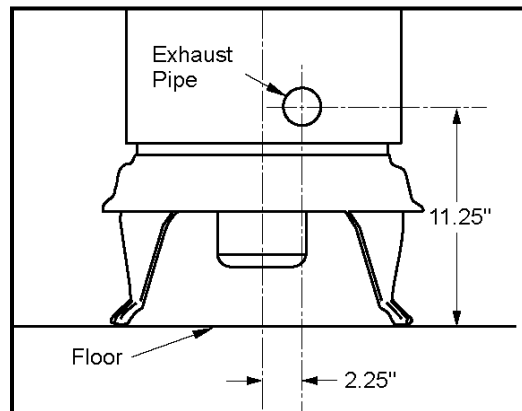
1. When deciding on the location of your stove and vent pipe, try to minimize the alteration and reframing of structural components of the building. Vent pipe must be installed so that access is provided for inspection and cleaning.
2. Failure to follow these installation instructions may affect warranty.
3. Avoid installing stove in high-traffic areas. Keep children well away from the stove when in operation or cool down period. Never allow children to touch glass. Alert children to hazards of high temperature.
4. **Venting clearance of 3" clearance to combustibles must be maintained for horizontal and vertical venting.** When passing through ceilings or walls use a listed wall thimble. Ensure all combustible materials and insulation products are a minimum of 3" away from the pellet vent pipe.
5. A 5-inch clearance to combustibles must be maintained between unit and sidewall. A 2- inch clearance to combustibles must be maintained between unit and back wall. If installed in a corner, clearance must be 5" to combustibles. See **FIGURE 4**.
6. A non-combustible hearth pad must be used if installed on a carpet, wood floor, or other combustible material (see **FIGURE 4**). Maintain 6" (152mm) beyond the front and beyond each side of the fuel loading and ash removal opening.
7. Keep front door of appliance thirty-six (36) inches from combustibles (drapery, furniture).
8. When installing the exhaust vent into an existing chimney, the chimney should be relined with a 4" stainless steel liner or a 4" TYPE L pipe. A clean out tee must be installed behind the heater before going up into the chimney. This is necessary in order to remove the fly ash accumulation.
9. All installations have a maximum of two 90 degree elbows including the tee. NOTE - two 45 degree elbows = one 90 degree elbow.
10. The pellet stove must be operated with a power source and will not operate using natural draft. If there is a power failure the stove will shut down. If the 12-volt back-up system is installed, the stove will automatically switch to the 12-volt power.
11. Route the power supply cord so it does not touch any of the exterior components of the stove.



**FIGURE 1**



**FIGURE 2**



**FIGURE 3**

CHECK WITH LOCAL BUILDING CODE OFFICIALS FOR SPECIFIC REQUIREMENTS.

Clearance to Combustibles

Unit to Sidewall.....	5"	(125 mm)
Unit to Back wall .....	1.5"	(40 mm)
Unit to Diagonal Wall.....	5"	(125 mm)
Unit to Alcove Ceiling.....	1"	(25 mm)

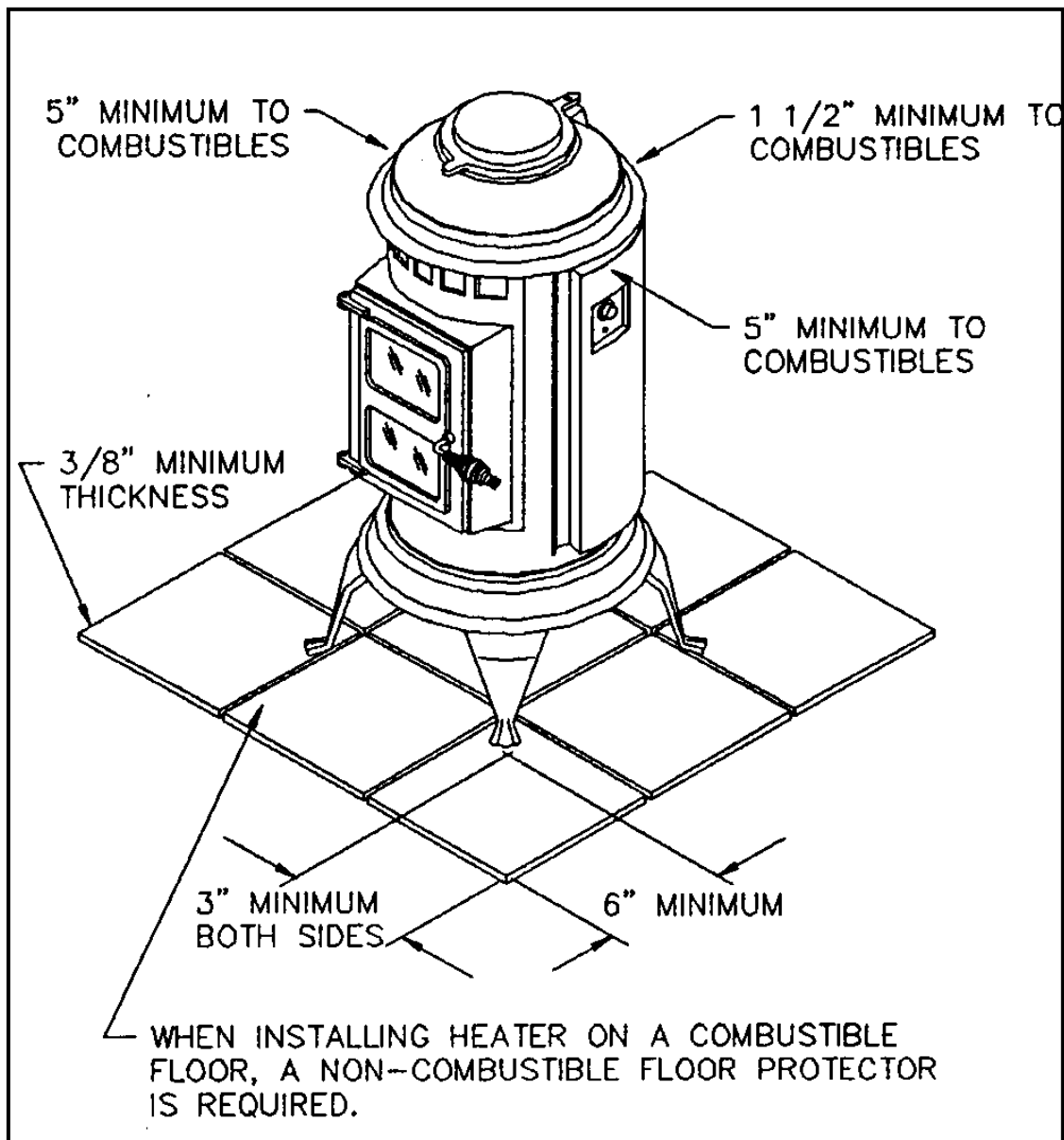


FIGURE 4

## HORIZONTAL INSTALLATION WITH VERTICAL RISE

1. Hook up the pipe adapter to the rear exhaust flange of the stove, and silicone with 500 degree HIGH-TEMP RTV silicone. Screw together with at least three sheet metal screws.
2. When exiting through the wall an approved wall thimble **MUST** be used. A **MAXIMUM HORIZONTAL RUN** of two feet is allowed.
3. Connect a pellet vent tee with clean out cap and extend the vent pipe a **MINIMUM OF 5 FT VERTICALLY** maintaining a **MINIMUM 3"** clearance to combustibles with a square horizontal cap as shown in **FIGURE 5**.
4. When the vertical pipe run in any installation is 5 feet or more, the use of 4-inch Type L vent pipe is required on the entire run from back of stove to vent termination.
5. On vertical runs on an exterior wall, a wall band is required every 4 feet.
6. All vent pipe connections including exit at the rear of the stove should be secured and sealed with 500 degree HIGH-TEMP silicone and at least three sheet metal screws. If this is not done, there is a possibility that the room fan will pick up any leakage and blow it into the room. This requirement is waived if Dura Vent Pellet Pro pipe is used. However, rear connection of the stove still requires 500 degree HIGH-TEMP RTV silicone. Screw together with at least three sheet metal screws.
7. Installation per **FIGURE 6** requires 4" Type L pipe with a minimum 5 foot vertical rise with a square horizontal cap.
8. Connect a 3" to 4" appliance adapter/increaser on the rear exhaust flange and sealed with 500 degree HIGH-TEMP silicone screwed together with 3 sheet metal screws.
9. Connect a vent tee with clean out cap and extend the vent pipe a **MINIMUM OF 5 FT VERTICALLY** maintaining a **MINIMUM 3"** clearance to combustibles.
10. A **MAXIMUM HORIZONTAL RUN** of two feet is allowed.
11. An approved wall thimble must be used.

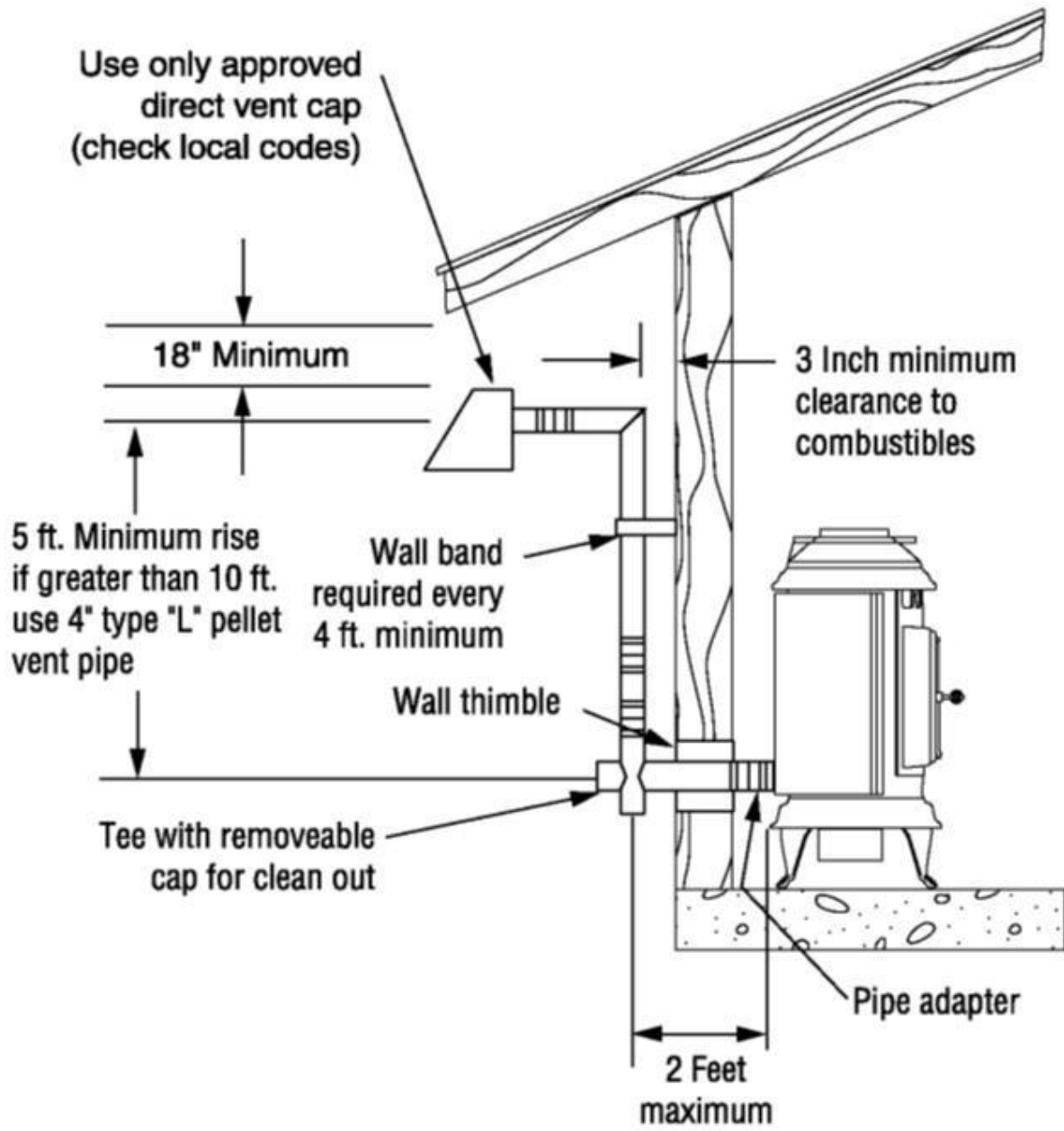


FIGURE 5



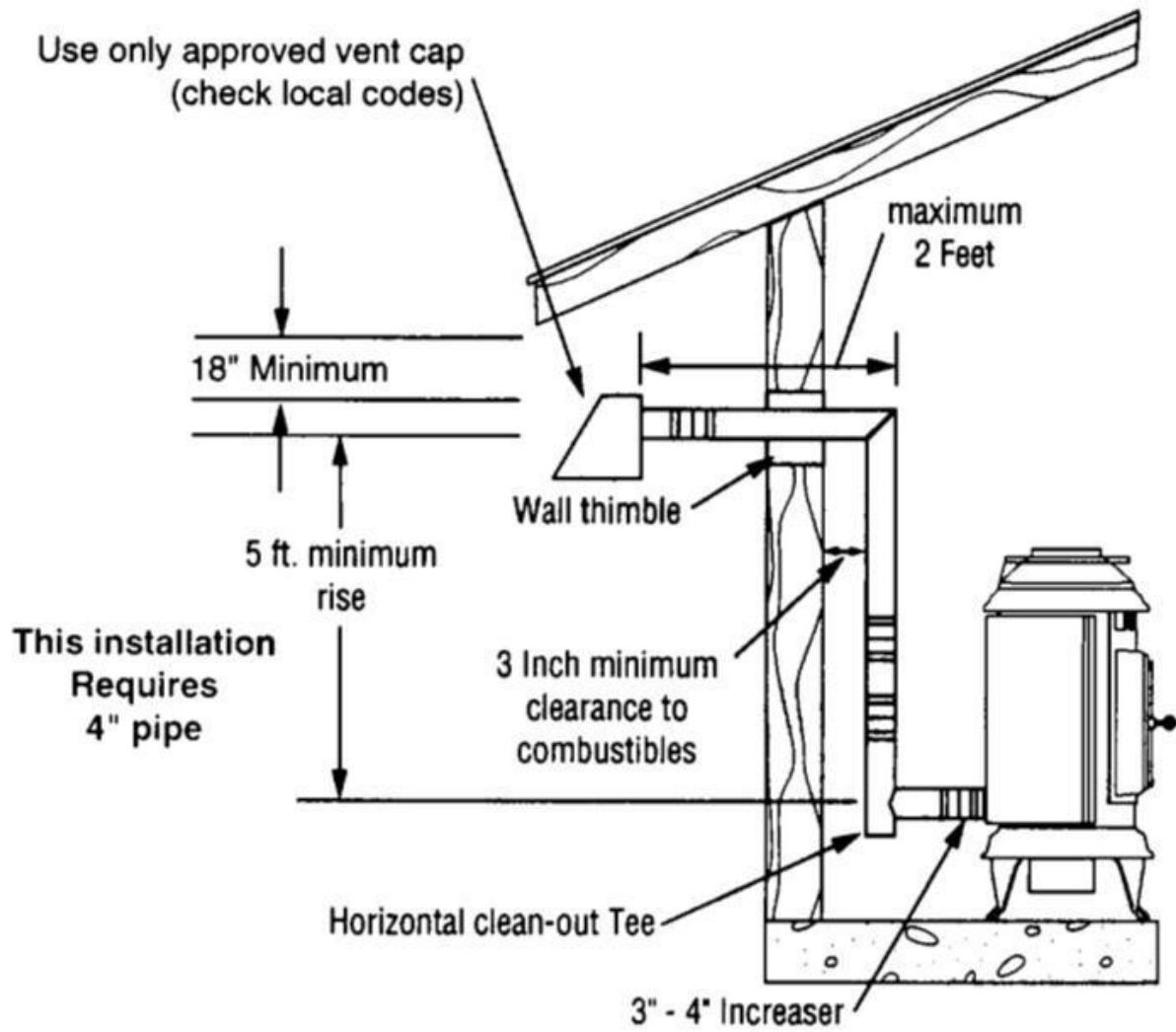


FIGURE 6

## VERTICAL INSTALLATION

- a. **ALL VERTICAL RUNS REQUIRE 4" TYPE L PIPE (FIGURE 7 and 8).**
- b. Connect a vent tee with clean out cap and maintain a Minimum 3" clearance to combustibles.
- c. When exiting through the roof, a minimum of at least 12" clearance is required, depending on roof pitch. Always adhere to local building codes.

A high wind cap is recommended on all vertical installations.

### VERTICAL INSTALLATION INTO AN EXISTING CHIMNEY

1. We recommend a chimney be relined with a 4" stainless steel flex liner with an approved chimney adapter.
2. All vent pipe connections including exit at the rear of the stove should be secured and sealed with 500 degree HIGH-TEMP RTV silicone and at least three sheet metal screws. If this is not done, there is a possibility that the room fan will pick up any leakage and blow it into the room. This requirement is waived if Dura Vent Pellet Pro pipe is used. However, rear connection of the stove still requires 500 degree HIGH-TEMP RTV silicone. Screw together with at least three sheet metal screws.
3. Outside Air Hook-up: An aluminum flex pipe can be used to bring combustion air into the stove. See 2 ¼" round pipe with air shutter located on the rear of the stove. Use a stainless hose clamp to attach flex pipe to the stove air intake flange.
4. Theelin Hearth Products recommends using a Dura Vent Wall Thimble Kit part # 60-0070-0003. Call your authorized Theelin Hearth Products dealer for this item.

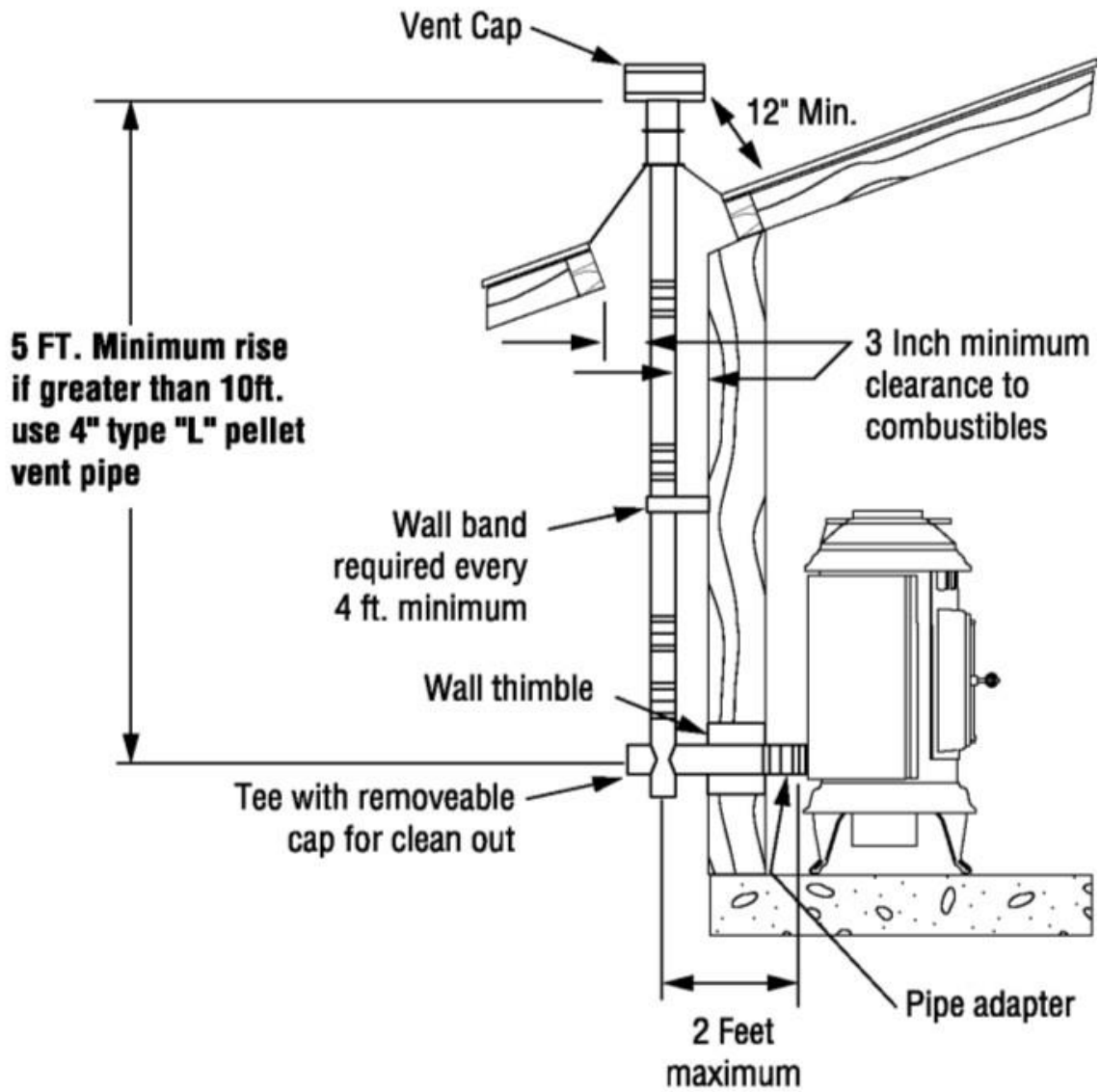


FIGURE 7

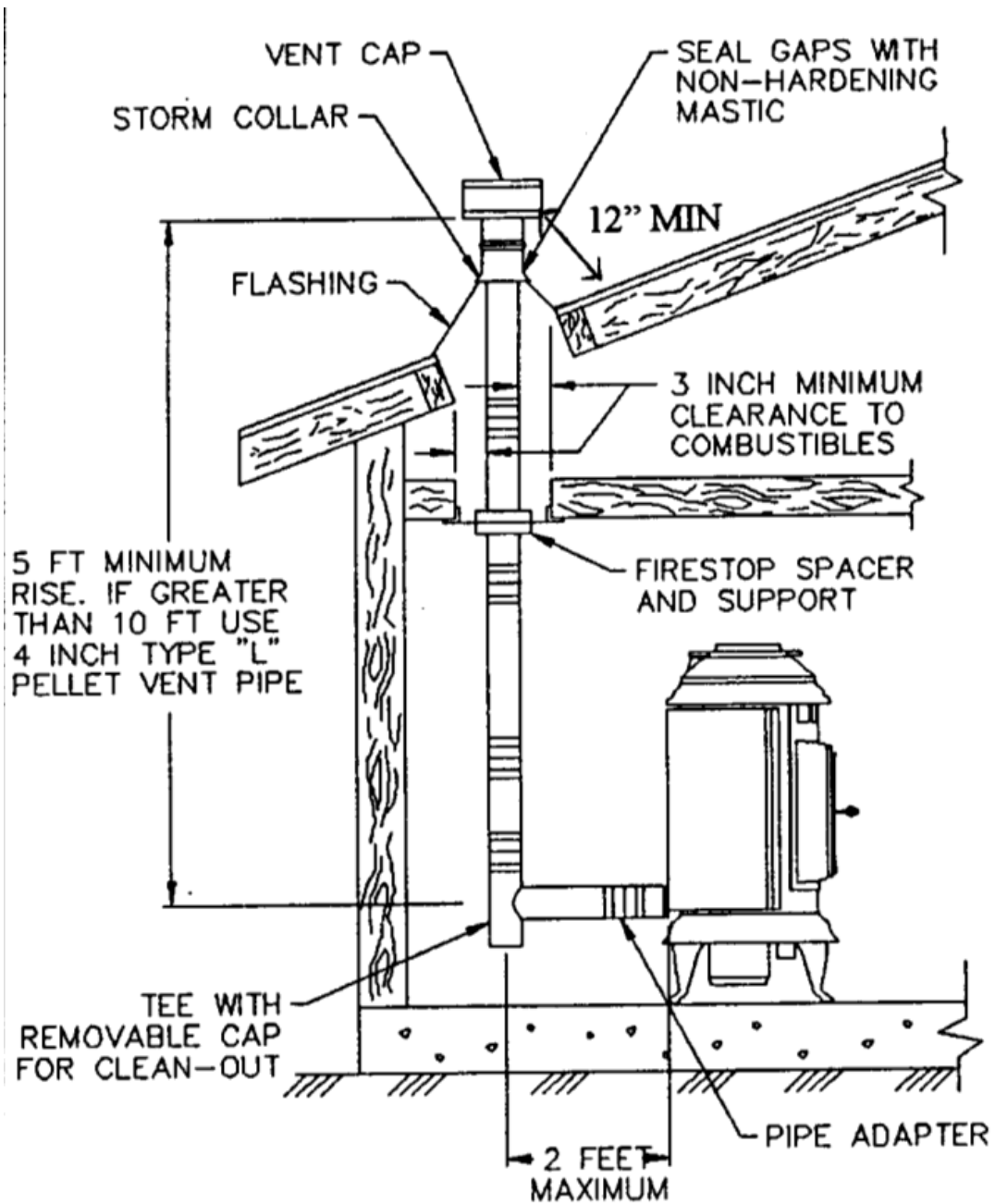


FIGURE 8

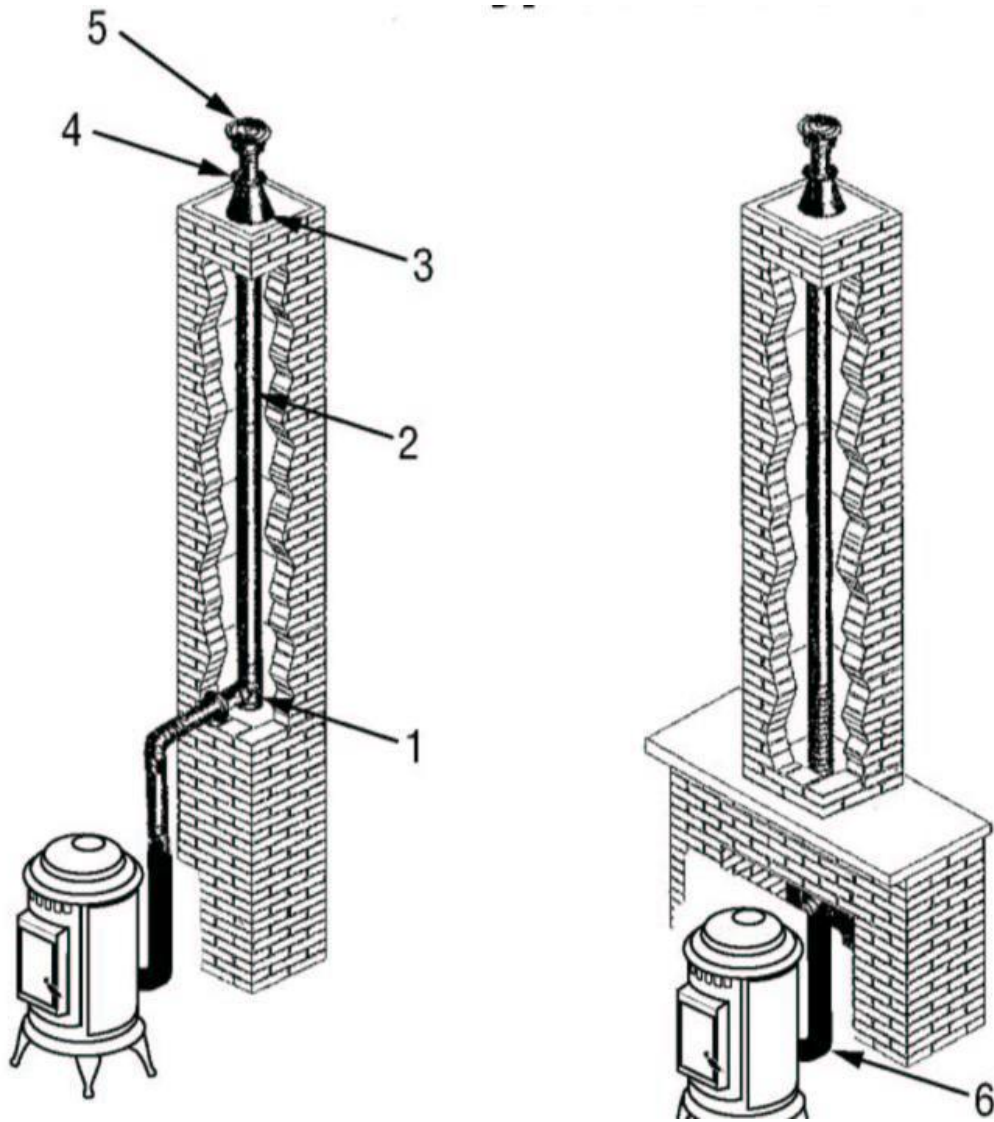
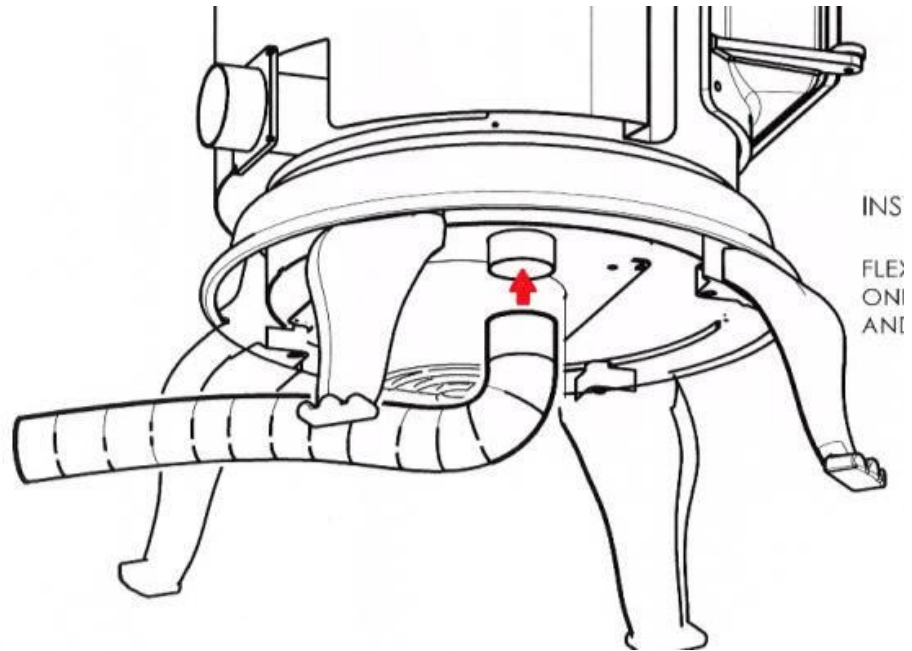
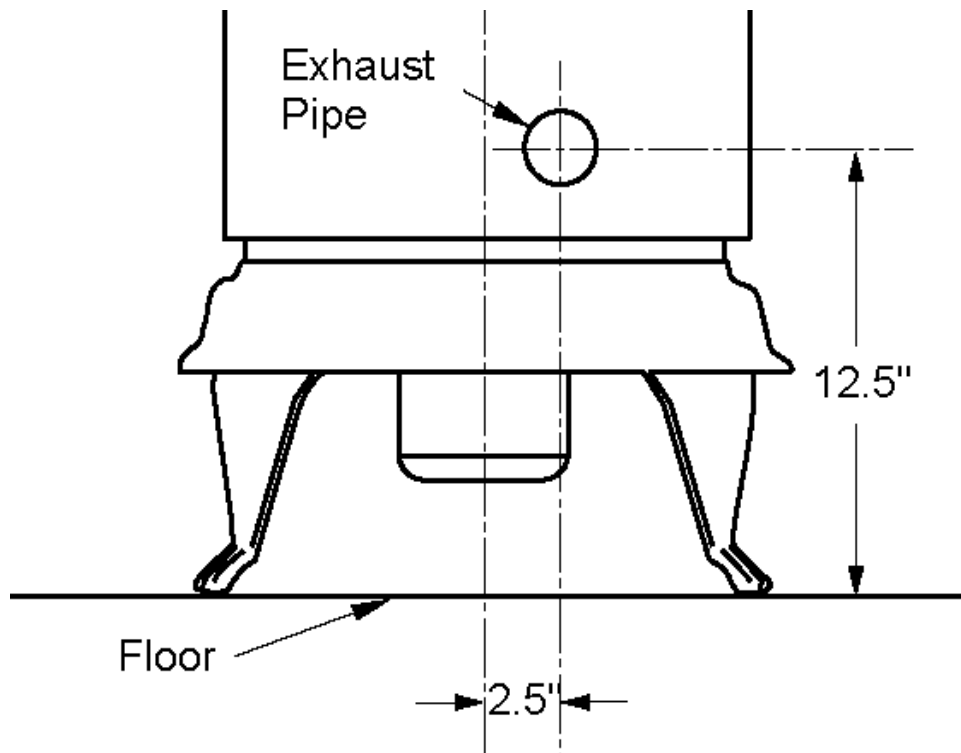


FIGURE 9



**FIGURE 10**



**FIGURE 11**

## Proper Venting

Occasionally, the vent configuration can create a noisy, harmonic condition. This sound can be eliminated by closing the air damper located on the air intake tube on the rear of the stove.

The Gnome pellet stove is equipped with a blocked flue/high temp safety sensor that will shut the stove off if there is a down draft, blocked flue, or high temperature condition.

If you install the stove on the side of the house that is hit by prevailing winds (usually 30 to 40 mph or greater) there is a chance that the sensor will be activated and the stove will shut off. Should this occur is, run the pipe up vertically through the eave and use a high wind cap on the vertical termination (see diagram).

Please contact your Dealer if you have any questions about this potential problem.

## Combustion air adjustment

Combustion air can be adjusted by rotating the air shutter to close / open the air duct. Air adjustment is critical for proper combustion and stove efficiency.

Adjust the shutter so the flame is bright yellow in appearance and is actively moving (not lazy). Dark flames, smoke or black tips on the flame is an indication of too little air.

If the flue configuration is tall, over 15 feet, the shutter should be closed more than a shorter vent since the higher flue will naturally draft the stove and increase the intake air velocity and volume. This can cause the pellets to be blown out of the firepot and the efficiency of the stove will decrease due to the heat going up the flue instead of through the heat exchanger.

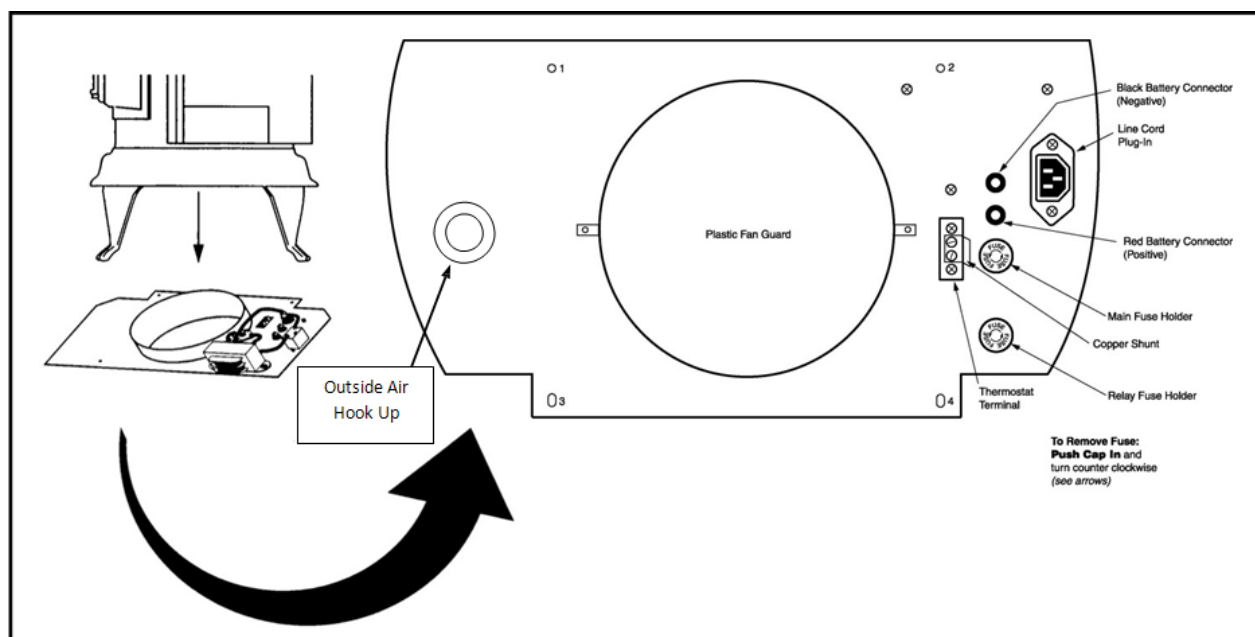


FIGURE 12

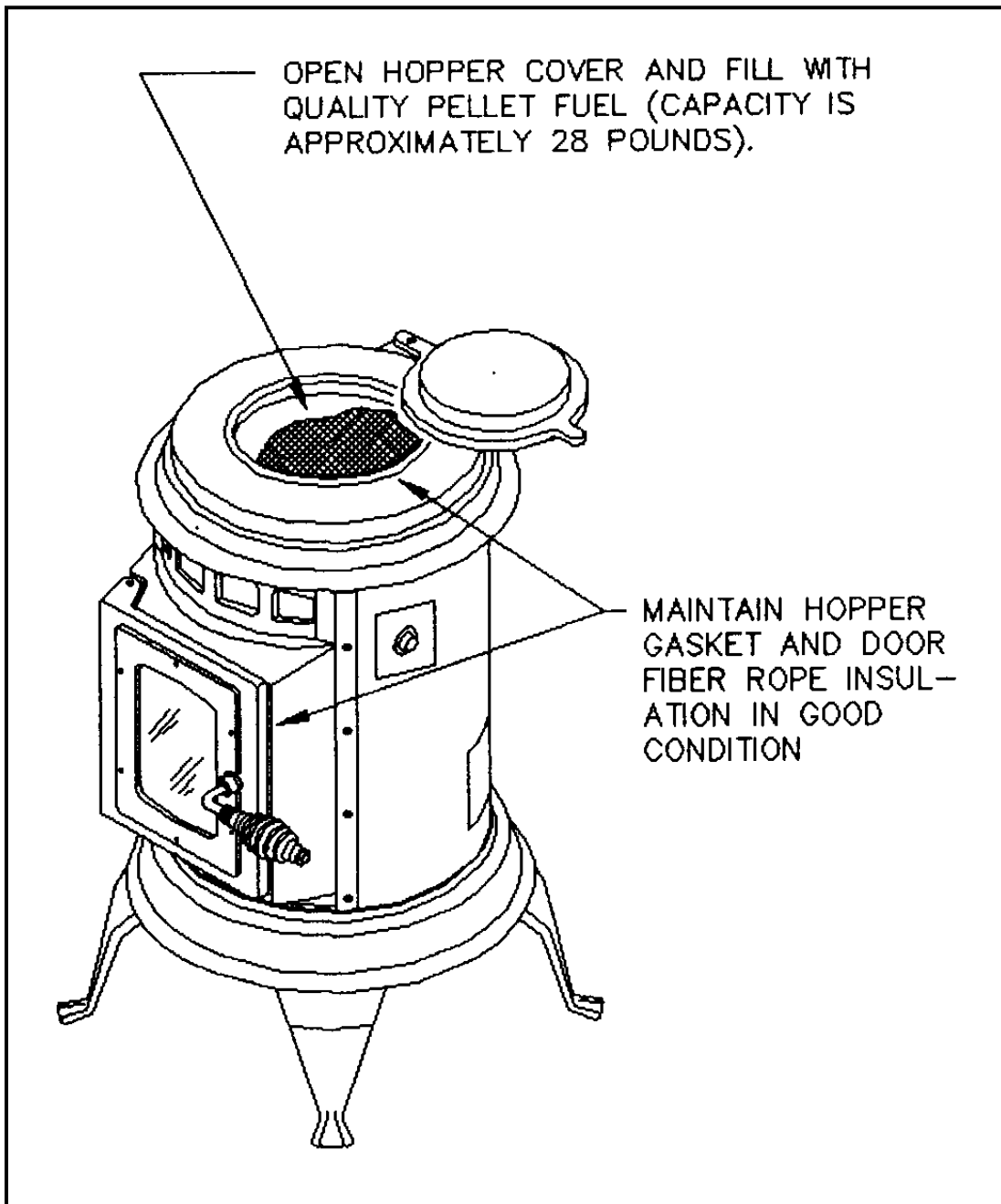


FIGURE 13



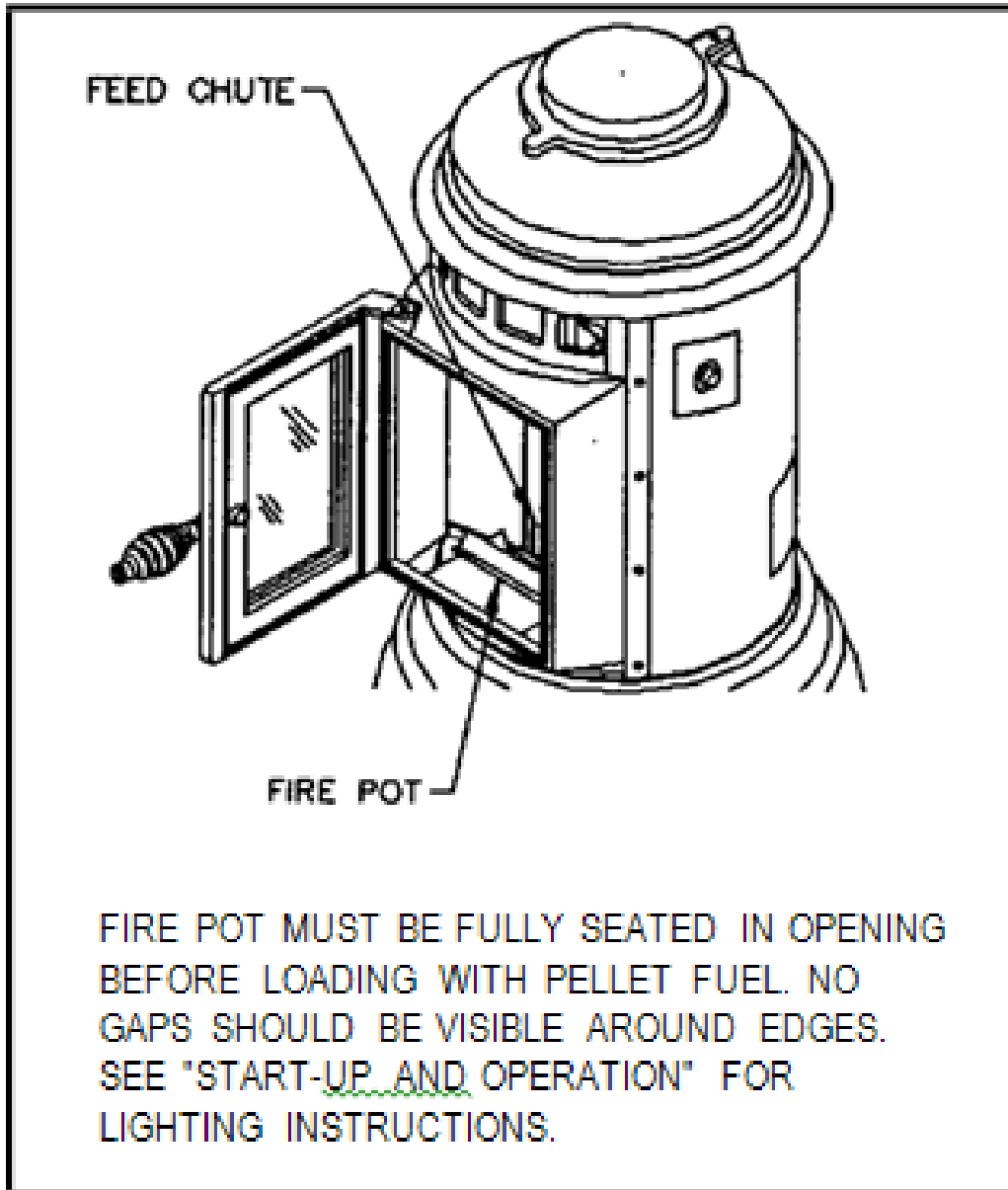


FIGURE 14

## Operation

### Start-Up and Operation – CONTROL PANEL

Open hopper lid and REMOVE all manuals and materials shipped with stove. Open front door and remove contents. Fill hopper with pellets. The Gnome pellet stove will hold approximately 28 pounds of pellets. The hopper lid must be closed before operating the unit. The feed motor will not work if the hopper lid is open. Open front door and remove contents. Make certain firepot is seated flush and must sit even in the fire pot holder. Air leakage around the fire pot will create a poor burn.

Make sure power cord is connected both into the rear of the stove and is connected into a surge protector or a grounded power outlet.

**Pellet quality** is crucial for proper burn, efficiency, and overall performance. The Gnome pellet stove is tested and approved for PFI premium wood pellets of **HIGHEST BTU OUTPUT AND LOWEST % OF ASH CONTENT** only. Good pellets will give you a bright yellow, vibrant flame. Poorer quality pellets will burn rich (orange flame) and dirty, black soot and ash will accumulate quickly. Expect premium pellets to provide a clean and efficient burn.

**Cleaning and Polishing Plated Parts:** Gold is a soft metal and, therefore, a fragile surface. It will not discolor from heat, but it can easily be scratched. Prior to the first burn it is important to use Kel Kem Spray Gold Cleaner or Flitz Faucet & Fixture Wax or a similar product and a soft clean cloth to wipe any fingerprints off all gold and nickel surfaces or the heat will cause the oil in the fingerprint to remain in the surface permanently. **Always clean the gold surface when the heater is cool.**

### Lighting Instructions

Located on the right side, is the push button Control Panel. Push the Medium, or High button and the stove will go into the start-up mode feeding pellets into the firepot. The fan and feed will start in Low mode and the light next to the button selected will start blinking.

Shortly thereafter, the automatic igniter will light the pellets in the firepot. Initially, the Startup mode will take up to 10 – 20 minutes. The unit will then automatically go into your selected Medium or High selection.

After Start-up mode the light next to the Medium or High will be solid and the stove will be in run mode. At this time, you now have the three distinct fan speeds: Low, Medium, and High to choose from.

We recommend that you run the stove on Medium for about 30 minutes to get the heat exchanger hot before turning it to Low. You will have to burn the Gnome pellet stove for a few hours in order to determine the best setting for your particular needs.

When you wish to turn off your Gnome pellet stove, simply push the OFF button and the feed will immediately cease. The fan will continue to run until the stove cools down and then it will shut off automatically. This might take up to 30 minutes depending upon ambient room temperature.

## START UP AND OPERATION - HANDHELD REMOTE AND THERMOSTAT

A wall thermostat or remote thermostat can be used to automatically control the Gnome pellet stove. The thermostat or handheld remote provides the option of turning the stove on and off.

Here is the step-by-step procedure for setting up the thermostat or handheld remote option:

1. Unplug stove from power supply (both AC and DC).
2. Locate thermostat terminal at the bottom of the stove (see **FIGURE 9**).
3. Remove metal shunt or known as “jumper”, and save for future use. Hook up thermostat wires to the two terminals. For handheld remote thermostat, hook up the two receiver wires to the terminals.
4. Locate wall thermostat approximately 10 to 12 feet from the stove using 18-2 gauge thermostat wire.
5. Make sure all the wiring is complete and batteries are installed into remote receiver and handheld remote before plugging the stove into the wall outlet.
6. Open hopper lid and REMOVE all manuals and materials shipped with stove. Open front door and remove contents. Fill hopper with pellets. The Gnome pellet hopper will hold approximately 40 pounds of pellets. The hopper lid must be closed before operating the unit. The feed motor will not work if the hopper lid is open. Open front door and remove contents. Make certain firepot is seated flush and must sit even in the fire pot holder. Air leakage around the fire pot will create a poor burn (See **FIGURE 9**).

**Pellet quality** is crucial for proper burn, efficiency, and overall performance. The Gnome pellet stove is tested and approved for PFI premium wood pellets of **HIGHEST BTU OUTPUT AND LOWEST % OF ASH CONTENT** only. Good pellets will give you a bright yellow, vibrant flame. Poorer quality pellets will burn rich (orange flame) and dirty, black soot and ash will accumulate quickly. Expect premium pellets to provide a clean and efficient burn.

1. Make sure power cord is connected both into the rear of the stove and into a surge protector or a grounded power outlet.
2. Put hand-held remote into “ON” or the wall thermostat into “HEAT” position. For the Skytech hand-held remote, you will hear a “beep” when “ON” button is pushed.
3. Push the Medium, or High button and the stove will go into the start-up mode feeding pellets into the firepot. The fan and feed will start in Low mode and the light next to the button selected will start blinking.

Shortly thereafter, the automatic igniter will light the pellets in the firepot. Initially, the Startup mode will take up to 10 – 20 minutes. The unit will then automatically go into your selected Medium or High selection.

After Start-up mode the light next to the Medium or High will be solid and the stove will be in run mode. At this time, you now have the three distinct fan speeds: Low, Medium, and High to choose from.

We recommend that you run the stove on Medium for about 30 minutes to get the heat exchanger hot before turning it to Low. You will have to burn the Gnome pellet stove for a few hours in order to determine the best setting for your particular needs.

4. When you wish to turn off your Gnome pellet stove simply push the OFF button on the handheld remote or the wall thermostat and the feed will immediately cease. The fan will continue to run until the stove cools down and then it will shut off automatically. Sometimes this might take 25 to 30 minutes depending upon ambient temperature.

**NOTE: Whenever power is unplugged from the stove, the hand held remote or wall thermostat must be reprogrammed. This will involve following Steps 7 through 10 to activate once again.**

**BATTERY REPLACEMENT: Theelin Hearth Products recommends consideration be given to replacing all batteries at a minimum of every 6 months. There are batteries both in the handheld remote, and the black receiver located in the rear of the stove.**

## Control Functions

The push-button control settings on the Gnome pellet stove are as follows: OFF, FAN, LOW, MED, HIGH, and CLEAN (see **FIGURE 12**).



**FIGURE 12**

1. In the LOW position, the Gnome pellet stove will feed approximately 1 to 1.5 pounds of pellets per hour. Feed rate will depend upon size of the pellets, quality of pellets and the feed trim setting.
2. In the MED position, the Gnome pellet stove will feed approximately 3.0 pounds of pellets per hour. Feed rate will depend upon size and quality of pellets and the feed trim setting.
3. In the HIGH position, the Gnome pellet stove will feed approximately 5 pounds of pellets per hour. In each setting the fan speed will increase along with the feed rate. Feed rate will depend upon size and quality of pellets and the feed trim setting
4. The CLEAN position is to be used only when the stove is not burning and has cooled down for maintenance and cleaning. See “Clean Out” section under maintenance for explanation of this function.
5. The FAN position is used for manual start during power outages when the electronic ignition cannot function. If the firepot should overflow it is usually because it is clogged. Using the FAN position will enable you to burn these pellets before cleaning the firepot and allowing the startup procedure to take place once again.

6. When you wish to turn off your Gnome pellet stove, simply push the OFF button and the feed will immediately cease. The fan will continue to run until the stove cools down and then it will shut off automatically. This may take up to 30 minutes depending upon ambient room temperature.

## High Temperature / Flue, Trim, and Battery Indicators

### HIGH TEMP/FLUE INDICATOR

There is a small red light to the top left of the FAN button on the Control Panel.

This indicator light will **blink red** if there is a blocked flue due to ash buildup or high wind conditions creating back draft.

The indicator light will come on **steady red** if there is a Hi-Temp condition such as lint and dust build-up on the fan blade, hindering air flow through the stove.

If any of these conditions exist, the stove will shut down and the red light will remain on until the OFF button is pushed. Maintenance and cleaning should be performed before the stove is used again.

### TRIM ADJUSTMENT

The TRIM control dial will allow you to adjust the feed rate of the pellets on Low, Medium and High settings. Clockwise will increase the feed rate, counter clockwise will reduce feed rate. This button is designed to allow the user to adjust the feed to a particular brand of pellet. Find the best feed rate for your pellet brand preference and the room's heating needs.

### Battery Light

If you utilize the Thelin Hearth Products battery backup option, and the battery is plugged into the stove:

The indicator light will come on **blinking yellow** when the battery is charging.

The indicator light will come on **steady yellow** when the battery is fully charged.

### External Battery Backup Operation

The Gnome pellet stove is equipped with a 12V battery option. To set up the battery and engage the 12V backup system, follow these steps in order:

1. Unplug the stove from the wall outlet.
2. Place the external battery at least 4 ft away from unit.
2. Connect the positive (+) red battery cable to the positive terminal on the battery.
3. Connect the negative (-) black battery cable to the negative side of the battery.

4. Plug the power cord to the grounded wall outlet.
5. Plug the 2 banana plugs (red and black) into the corresponding (red and black) receptacles on the bottom of the stove (See **FIGURE 12**).

**NOTE: It is not recommended to leave stove unplugged, as the battery will lose its' charge.**

---

### **WARNING**

Make sure the red cable goes to the red terminal and the black cable goes to the black terminal. If you hook these up correctly the BATT light will glow green. If you hook them up backward the BATT light will glow red and the backup will not work. **DO NOT** let the battery terminals touch the metal stove. Failure to install correctly could cause physical harm and short out circuit board and will void the warranty on the stove.

---

When the battery is properly connected, the following will happen automatically:

1. If the stove is running and there is a power failure, it will instantaneously switch to battery backup power.
2. When power is restored, the stove will switch back to AC power automatically and trickle-charge the battery. As long as the stove is plugged into the wall outlet it will keep the battery charged. If you unplug the stove during the summer and leave the battery attached, it will run down the battery and shorten its life **(NOT RECOMMENDED)**.
3. Run time on the battery will depend upon the amperage of the battery. See your local battery store for details.
4. If you wish to place the battery beyond 4 ft from the stove you will need to increase the wire size of the cable. Check with your local electrical professional to make sure you have used the proper gauge wire/cable.
5. The electronic ignition feature will not work on battery mode. If the stove is off and the power fails, you will have to light the stove manually with a jelled alcohol pellet fuel fire starter.

## Maintenance

The Gnome pellet stove requires routine maintenance for maximum performance and prolonged life of parts and components. Maintenance is mandatory for warranty to remain in effect.

**ALWAYS DISCONNECT POWER CORD BEFORE SERVICING. RISK OF ELECTRICAL SHOCK IF NOT DISCONNECTED.**

Always turn your stove off and let it cool before servicing or cleaning the stove.

---

The following procedures should be performed regularly and may require more frequent attention if a low-quality pellet is used. We recommend the purchase of an ash vacuum for maintenance work.

### Daily Maintenance

#### Firepot -

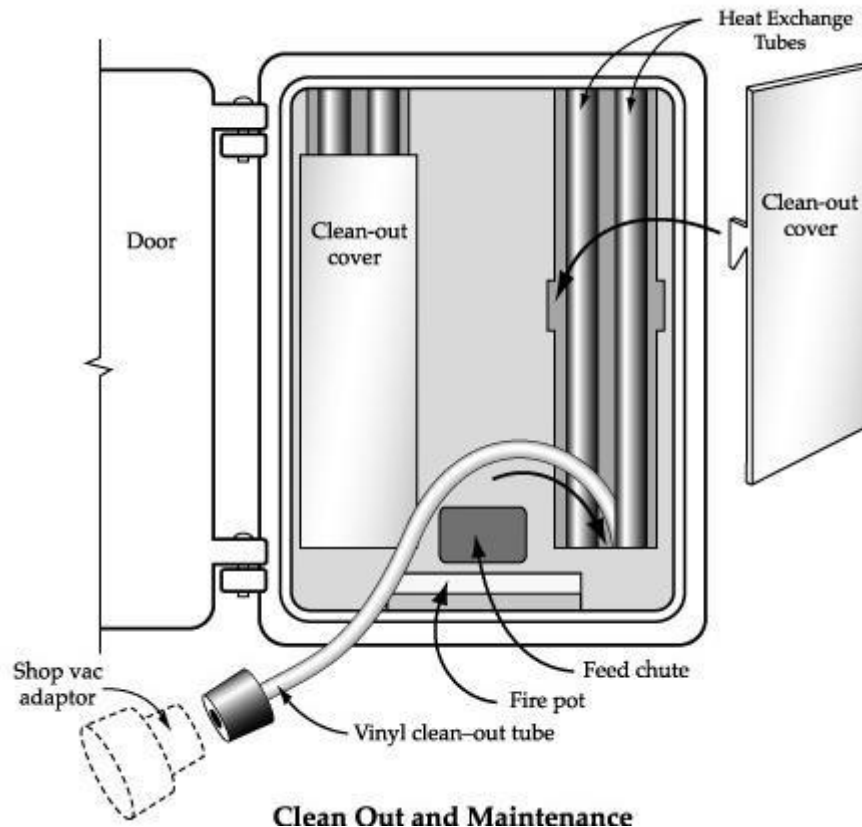
1. Soot and ash build up in the firepot or surrounding area will affect the quality of burn and can cause ignition issues.
2. Scrape the firepot with a wire brush every 1-2 days to be certain the holes are clear. This will allow airflow to freely circulate to achieve a bright yellow flame.
3. It is recommended the firepot be cleaned before each startup, and more frequent cleaning may be necessary if low-quality pellets are used.

#### Glass cleaning -

1. Clean glass every 3 to 4 days with stove glass cleaner. A more frequent quick wipe with a paper towel is recommended during the daily firepot maintenance.



## Weekly Maintenance



**FIGURE 13**

The following is a step-by-step procedure to clean out and maintain your pellet stove.

1. **Stove must be shut off and completely cold before performing this maintenance.**
2. Open door; remove fire pot and clean-out covers.
3. Vacuum entire inside area, including heat exchanger tubes, using a pellet vac or shop vac.

**CAUTION: Do not use a household vacuum cleaner.**

4. Connect vinyl clean-out tube to pellet vac or shop vac. (An adaptor must be used to connect to a shop vac. These can be purchased at hardware stores or home centers.) Insert the clean-out tube down between the heat exchange tubes (approx. 4" to 6") as shown in the picture, and vacuum up the debris. Reposition the tube several times to get as much debris as possible. Repeat the procedure on the other set of tubes. **Remove vinyl clean-out tube.**
5. Turn control knob to "clean" position for about 45 seconds.

6. Replace clean-out covers and fire pot. The stove is now ready to use.

### **Ash removal**

1. Vacuum firebox and inside of door frame of ash build up and soot weekly or more often as needed.
2. Remove the two rear left and right clean out covers and clean with a wire brush. See **Figure 13**.
3. Remove firepot from holder and clear all holes using vacuum or steel brush.
4. While clean out covers are removed, vacuum and wire brush heat exchangers. Connect the supplied vinyl clean out tube to ash vacuum or Shop Vac (an adapter may be needed, which can be purchased at a home center) for a more thorough clean up of the heat exchangers and inside the tight spots around the firepot & area around the igniter.
5. Vacuum the entire inside bottom around the firepot holder and the side walls.
6. Vacuum the plastic fan guard located on the bottom of stove of all lint and dust.
7. With the door open, push the CLEAN button and allow the fan to run at least 45 seconds to blow excess ash out of firebox and into the flue.
8. Replace parts previously removed.

### **Polishing Of Exterior Parts**

1. All Gold or Nickel plating can be cleaned with a soft cloth and a non-abrasive cleaner.

## **Monthly Maintenance**

### **Hopper**

1. Vacuum hopper to remove excess sawdust. Excessive sawdust can cause feeding issues.

### **Pellet feed chute**

1. With a putty knife, scrape and remove soot build-up. Build-up on the feed chute will prevent pellets from falling freely into the firepot.
2. Remove cleanout cap from exhaust tee and clean out excess soot and ash.

## Yearly Maintenance

**NOTE: THE FOLLOWING SHOULD ONLY BE PERFORMED BY SERVICE AND MAINTENANCE PERSONNEL FAMILIAR WITH BOTH PELLET STOVES AND IN PARTICULAR THELIN'S PRODUCT-LINE. WE RECOMMEND YOU CONSULT A THELIN HEARTH PRODUCT'S DEALER FOR A PROFESSIONAL SERVICE TECHNICIAN.**

**Soot and Fly Ash – The products of combustion will contain small particles of fly ash. The fly ash will collect in the exhaust venting system and restrict the flow of flue gasses. The exhaust venting system should be inspected at least once every year.**

### Combustion blower fan

1. Make certain stove is unplugged from power outlet.
2. Stove will need to be disconnected from the Exhaust Vent and Outside Air Intake to remove fan assembly underneath stove.
3. Remove the cast iron firepot and the 2 cleanout covers.
4. With the door latched closed, lay the stove down on the opposite side of the door handle on a soft blanket or cardboard to keep it from being damaged.
5. Remove 4 screws holding the plate bottom and set panel aside. **Note: Do not disconnect any wires from this panel.**
6. Unplug the electrical connections to the motor.
7. Remove 3 flange nuts, and remove entire fan assembly from the combustion housing. The fan assembly is installed with high temperature silicone sealant and will need to be gently worked loose from the fan housing.
8. Using a soft vacuum brush attachment, remove any dust and ash buildup on the motor, the exhaust blade, and entire housing. Ensure all ash is removed evenly from exhaust blade since uneven removal can cause a blade balancing issue and possible noise. **Note: Extreme care should be taken to avoid bending fan exhaust blade.**
9. Reinstall fan motor assembly back in place and tighten the 3 flange nuts on combustion housing. Apply high temperature silicone sealant around the flange housing. Flange must be fully sealed with silicone having a temperature rating of at least 500 degrees F.
10. Reattach electrical connections to the motor.
11. Vacuum surrounding stove areas around cabinet and ducts to remove any accumulated dust, ash, and pet hair.

12. Reinstall previously removed bottom plate making certain the air intake is aligned and tighten the 4 screws.
13. Reinstall stove to Exhaust Vent and Outside Air Intake making certain to fully seal Exhaust Vent with HIGH TEMPERATURE SILICONE having a temperature rating of at least 500 degrees F. with at least 3 sheet metal screws.
14. Check door and window gaskets for tight seal. Door gasket should contact completely around perimeter. Replacement gaskets are available from your dealer or Thelin Hearth.

#### **HANDHELD REMOTE (if applicable)**

**BATTERY REPLACEMENT:** THP recommends consideration be given to replacing all batteries at a minimum of every 6 months. There are batteries both in the handheld remote, and the black receiver located at the rear of the stove.

**Venting system – We recommend a certified chimney sweep to clean entire vent system.**

1. Vent system should be cleaned using chimney sweep brushes.
2. Check vent cap for any blockages.
3. Remove the exhaust vent tee clean-out cover – Brush the vertical flue pipe to remove ash and buildup.
4. Reinstall vent tee clean-out cover.

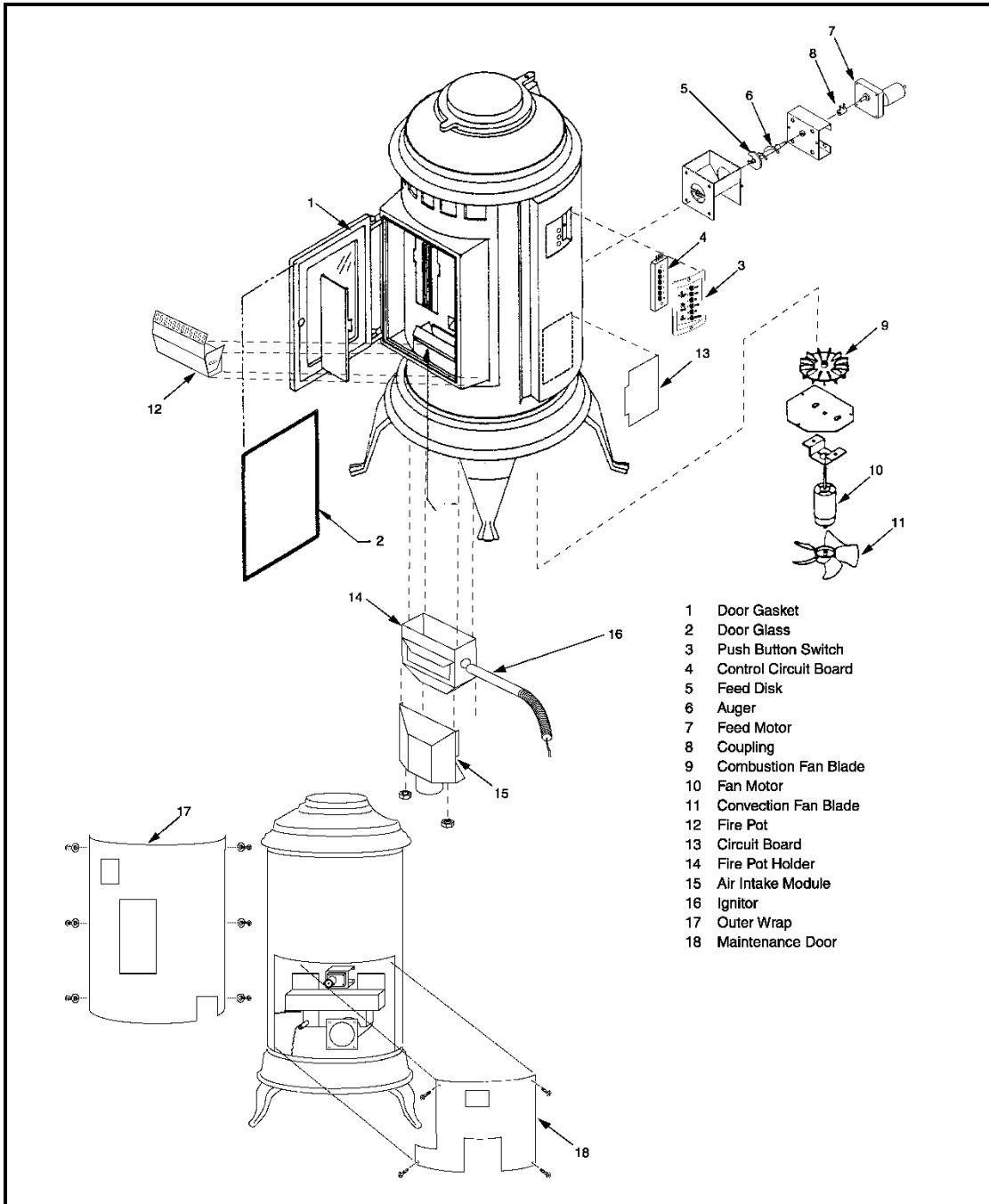
## Troubleshooting Guide

### Pellet Stove Troubleshooting Guide

Problem	Possible Cause	Solution
Pellets feed but do not ignite	Damp pellet Igniter fuse blown Bad igniter	Replace with dry pellets Replace igniter fuse Replace igniter
Pellets stop feeding.	Hopper out of pellets Obstruction in auger  Hopper Switch bad Feed motor not spinning	Add pellets to hopper <b>*TURN POWER OFF* *DISCONNECT POWER*</b> . Clean out any remaining pellets from hopper. Could be foreign object or excessive sawdust.  Replace Hopper Switch Replace Feed Motor
Pellets are overfeeding.	Holes are blocked in firepot Firepot not seated properly Gasket on Door is worn Air intake not adjusted Vent pipe obstructed Pellets or ash stuck behind Ash Drawer	Clean out entire firepot and keep holes clear Reseat firepot in firepot holder Replace Door gasket Adjust butterfly valve on intake air Cleanout vent pipe Cleanout behind or below Ash Drawer
Soot is forming on the door glass.	Air intake fully closed Poor pellet quality Firepot dirty	Open air intake and adjust for bright vibrant yellow flame Recommend low ash/high btu pellets Clean out Firepot and clear holes
Stove continues to run after button is pushed to "Off"	Stove is cooling down  T2 Sensor is bad	This is normal. The Fan will remain on for 25-30 minutes to allow stove to cool  Replace T2 Sensor
Fan Motor speed surges or slows down	Brushes in Fan Motor are bad	Replace Fan Motor brushes in motor
Stove shuts off on low	Feed rate is too low	Adjust feed trim button, turning clockwise, to allow more feed
Fan motor speed surges or slows	Brushes in Fan Motor are failing	Replace brushes in Fan Motor
Hi Temp/Flue light comes on and stove stops working. (Blinking = blockage. Solid = overheating).	Restriction in exhaust or blockage.  Down draft or windy condition. Restriction in Fan Guard	Clean out vent pipe or any obstruction.  Change Vent cap. High wind for vertical/shielded horizontal cap Over heat condition, block in vent pipe. Clean Fan Guard of lint or dust
No power to stove when any button is pushed	Main Fuse blown  No voltage to Fan Motor	Replace Main Fuse  Replace Fan Motor Assembly
Pellets overfeeding	Restriction in Fan Guard	Clean Fan Guard of lint or dust

# Parts List

**FIGURE 14 – Replacement Parts List**



# Diagrams

## Circuit Board Diagram

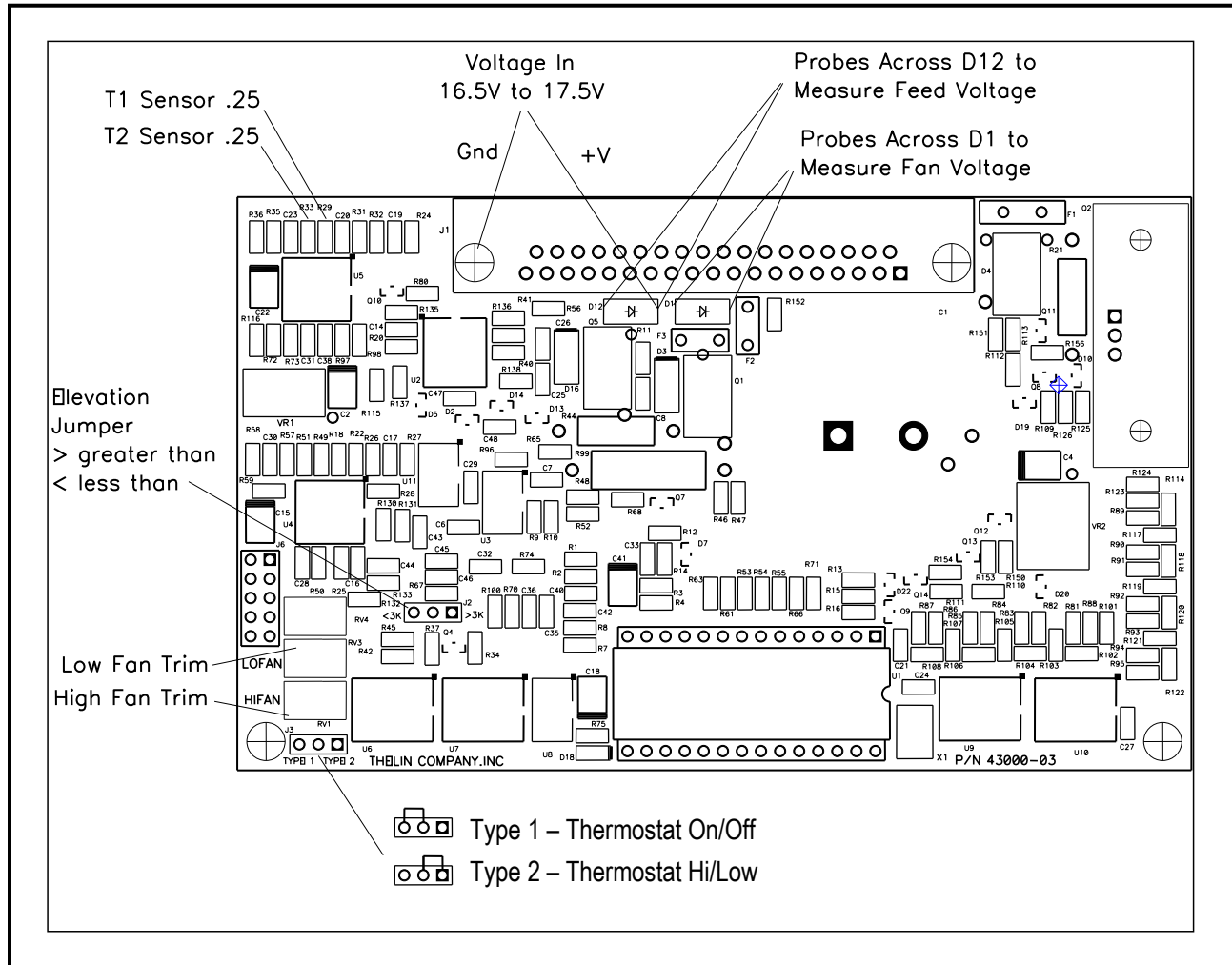


FIGURE 15

### ELECTRICAL SCHEMATIC/WIRING DIAGRAM

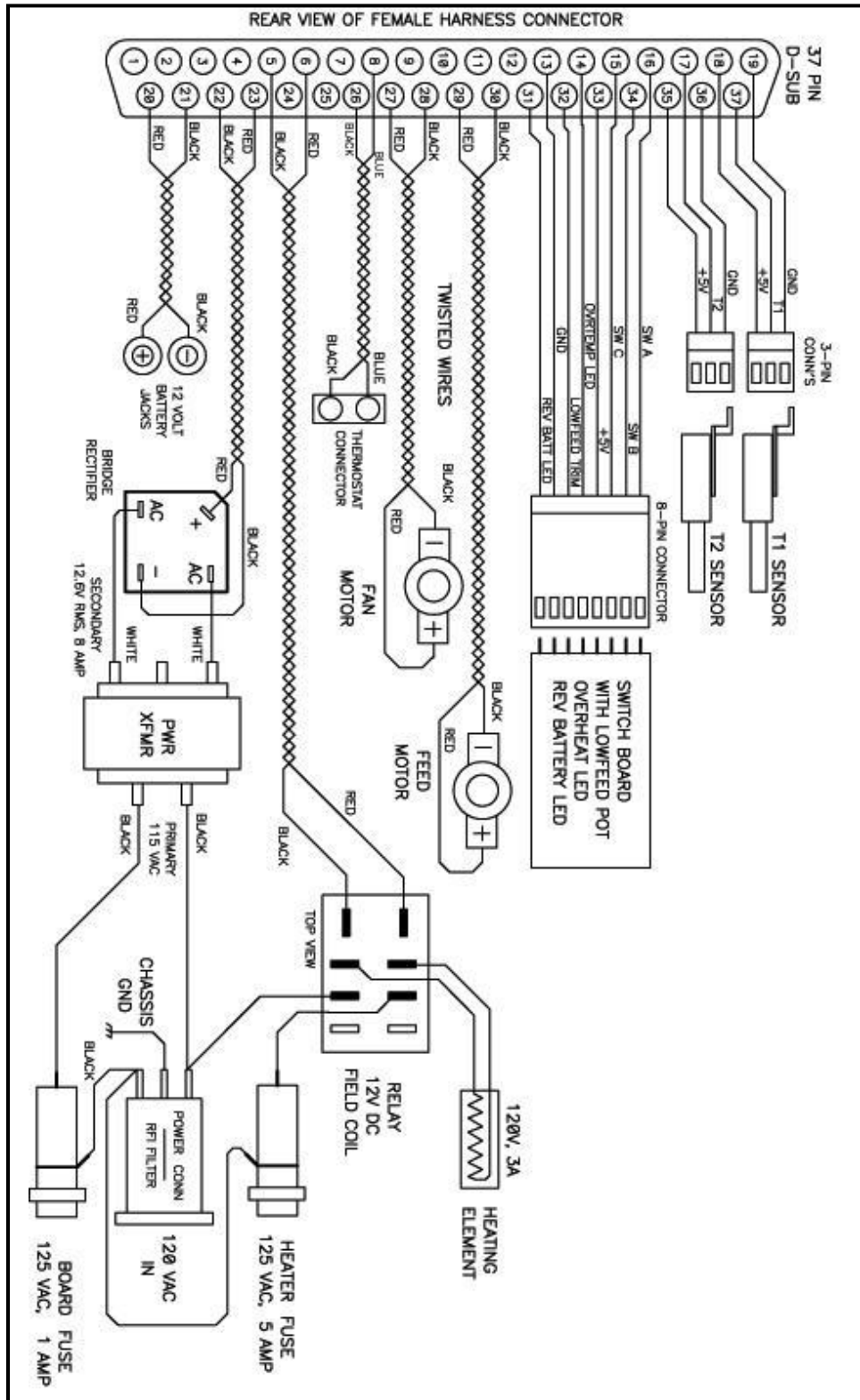
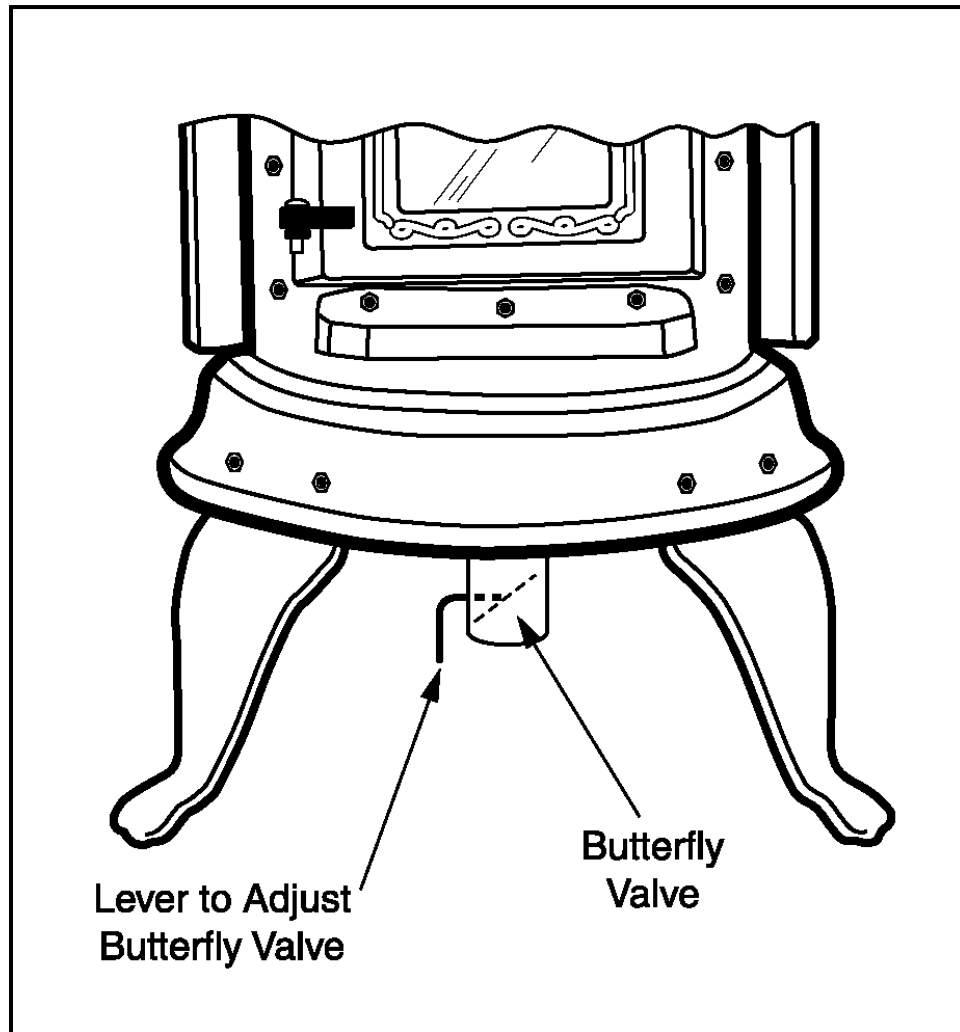


FIGURE 16



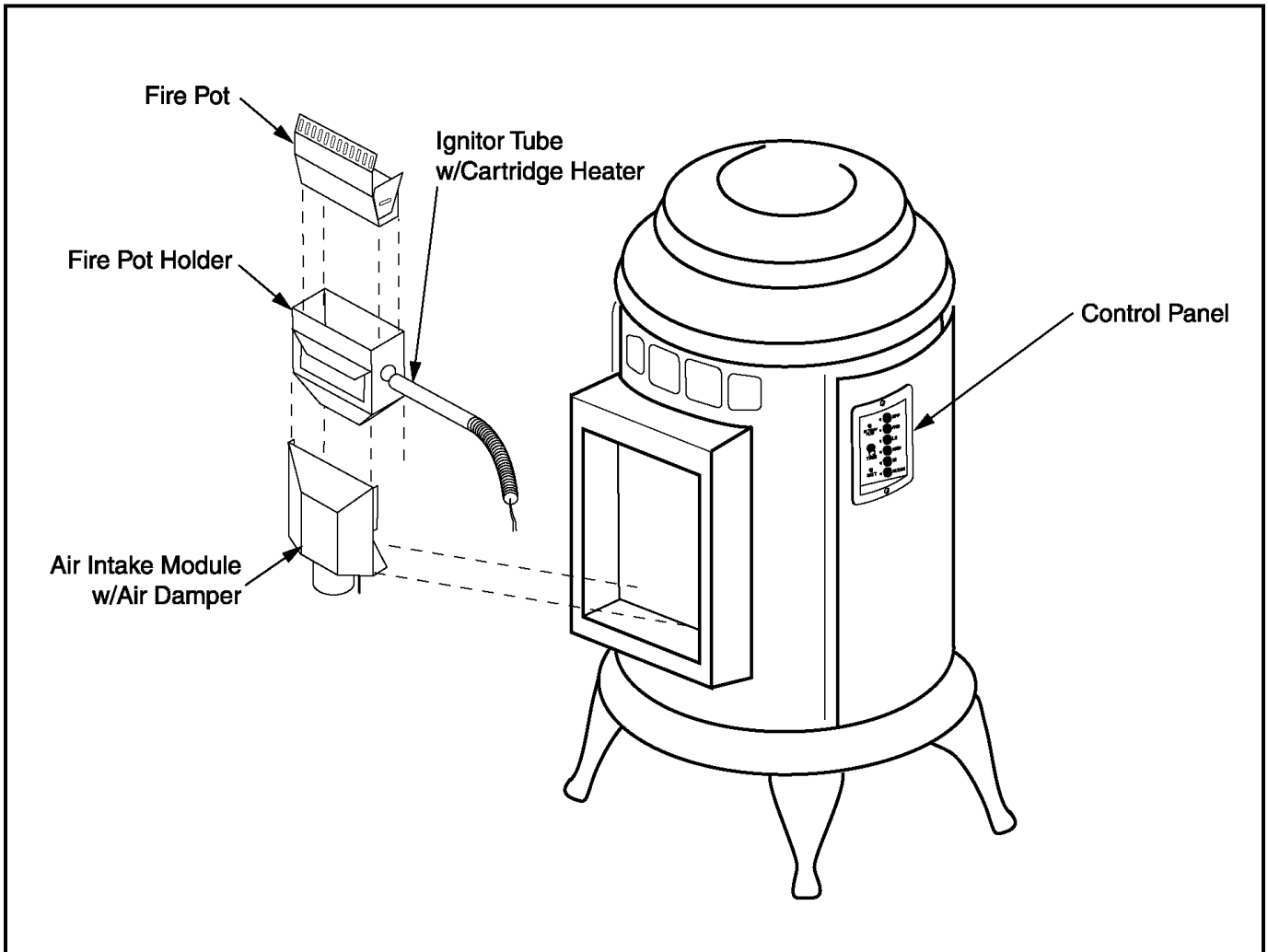


**FIGURE 17**

**Air Damper (Butterfly Valve)**

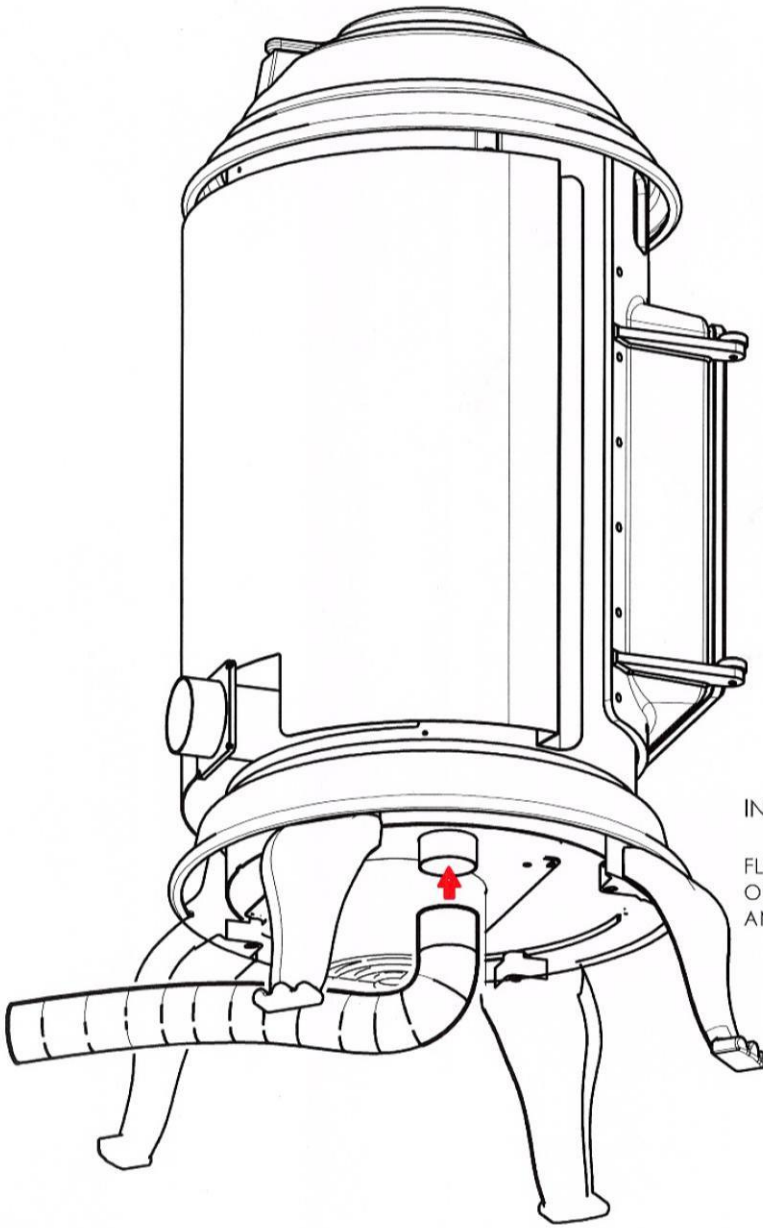
Occasionally, the vent configuration can create a noisy, harmonic condition. This sound can be eliminated by closing the air damper located on the bottom front of the stove under the bottom ring.

This Pellet Stove is equipped with a blocked flue/high temp safety sensor that will shut the stove off if there is a down draft, blocked flue, or high temperature condition.



**FIGURE 18**

E.I. Firepot Assembly



INSTALLING THE OUTSIDE AIR INTAKE TUBE.

FLEXIBLE TUBING IS SECURED WITH HOSE CLAMPS. ONE END SLIPS OVER THE 2 1/4 O.D. TUBE, UNDER THE STOVE, AND THE OTHER END IS SECURED TO THE OUTSIDE AIR SOURCE .

**FIGURE 19**

# WARRANTY

## THELIN HEARTH PRODUCTS PELLET STOVE WARRANTY REPLACEMENT PROGRAM

EFFECTIVE April 1, 2013

NOTE: PLEASE READ THIS WARRANTY REPLACEMENT PROGRAM CAREFULLY BEFORE APPLYING FOR WARRANTY REPLACEMENTS OR CREDIT.

**WARRANTY COVERAGE – This warranty only covers Theelin Hearth Products that are purchased through an authorized dealer.**

### Covered

Warranted for five years from the date of retail purchase against defects in material and workmanship. THP will remedy the defect or replace the specified part. This does not include shipping costs. This warranty is only valid while the stove remains at the site of the original installation.

Limited Warranty for one year from date of retail purchase to include electrical components, gaskets, logs, moving parts, gas valve control, enamel finish, paint and burner. Only the original purchaser of a new THP stove is covered by the warranty and it is non-transferable. Retain your dated sales receipt as proof of purchase. Contact your original installing dealer for warranty service. Check with your installing dealer in advance if they require you to pay a service call for any warranty work. Travel and shipping charges are not covered by this warranty. If the installing dealer is unable to provide parts or service, contact the nearest Theelin Hearth Products dealer located on our website. [www.theelinco.com](http://www.theelinco.com).

### Not covered

Damages caused by abuse or failure to perform normal maintenance and any related expense. This warranty shall not apply to any faulty installation or the failure to observe the manual installation instructions. This warranty is void if stove has been over-fired or operated in atmospheres contaminated by chlorine, fluorine or other damaging chemicals. Over-firing can be identified by, but not limited to, warped plates or tubes, rust colored cast iron, bubbling, cracking and discoloration of steel. This warranty shall not apply due to use of fuels other than those specified in operating instructions. This warranty is void if stove has been operated in atmospheres for prolonged periods of time of dampness or condensation. This warranty is void if there is any damage to the stove or other components due to water or weather damage which is the result of, not limited to, improper chimney or venting installation. This warranty shall not apply due to unreasonable use by purchaser, consequential damages, incidental damages, improper installation, alteration or adjustment of the manufacturers' settings, lack of proper and regular maintenance; damage incurred while in transit, acts of Mother Nature.

The limited warranty does not extend to or include surface finish on the appliance, paint, gold or nickel plating, door gaskets, glass gaskets, glass, or firebricks. It does not cover installation or operational-related problems such as over firing, use of corrosive driftwood, downdrafts or spillage caused by environmental conditions, nearby trees, buildings, hilltops, mountains, inadequate venting or ventilation, excessive offsets, or negative air pressures caused by mechanical systems such as furnaces, fans, clothes dryers, etc. Any installation, construction, transportation, or other related costs or expenses arising from defective part(s), repair, replacement, etc., will not be covered by this warranty, nor will Theelin assume responsibility for them.

Some states do not allow the exclusions or limitation or incidental consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights that vary from state to state.

Changes in the exterior surface as a result of normal use are common, some changes in the color of interior and exterior surfaces may occur. This is NOT covered under warranty.

The movement of certain structural parts causing noise due to expansion or contraction is a normal condition and is not covered by this warranty. The warranty does not cover any shipping costs.

### Warranty Work

If you find this unit to be defective in material and/or workmanship within a period of five (5) years from the date of purchase, contact your local dealer from whom you purchased the stove. All warranty work must be authorized by the factory in advance of the repair and an authorization number assigned. A warranty claim form must be completed and signed by both the repair person and the customer. For prompt warranty service, please contact the authorized dealer in your area. Have the following information available to assist the repair person.

### Stove purchase information

Date Purchased: \_\_\_\_\_ Serial Number: \_\_\_\_\_

Dealer/Retailer where Purchased: \_\_\_\_\_

Installer/Contractor used for Installation: \_\_\_\_\_

### Qualification for warranty performance

Return product or defective part with proof of purchase and narrative description of defect together with your name and address, to: Theelin Hearth Products, Warranty Division, 63 Laxalt Dr. Carson City, NV 89706. Returned part or product will be repaired or replaced at Theelin Hearth Products option and will be returned to you freight prepaid by you as soon as practical, but not later than 30 days after receipt.



THELIN HEARTH PRODUCTS  
63 Laxalt Dr.  
Carson City, NV 89706  
[www.thelinco.com](http://www.thelinco.com)

# Dry Gas Meter Calibration

Meter Manufacturer: Apex  
 Model: XC-60  
 Lab ID #: 53  
 Serial #: 1902130  
 Calibration Date: 7/25/2022  
 Calibration Expiration: 1/25/2023  
 Barometric Pressure: 29.74 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/30/2023
Calibration $\gamma$ Factor:	0.9978

Unit Under Test Previous Calibration	
Date	3/21/2022
$\gamma$ Factor:	1.015
Allowable Deviation ( $\pm 5\%$ ):	0.05075
Actual Deviation:	0.02
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	143.588	142.845	142.939
Standard DGM Temperature ( $^{\circ}$ F)	80.0	80.0	80.0
Standard DGM Pressure (in H <sub>2</sub> O)	0.00	0.00	0.0
DGM Initial Volume (ft <sup>3</sup> )	0.000	0.000	0.000
DGM Final Volume (ft <sup>3</sup> )	5.232	5.241	5.261
DGM Temperature ( $^{\circ}$ F)	105.0	105.0	105.0
DGM Pressure (in H <sub>2</sub> O)	4.58	1.95	1.06
Time (min)			
Net Volume for Standard DGM (ft <sup>3</sup> )	5.071	5.045	5.048
Net Volume for DGM (ft <sup>3</sup> )	5.232	5.241	5.261
Dry Gas Meter $\gamma$ Factor	1.000	1.000	0.999
$\gamma$ Factor Deviation From Average	1.000	1.000	0.999

Average Gas Meter  $\gamma$  Factor 1.000

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is  $\pm 0.5\%$ .

# Pressure Gauge Calibration Work Sheet

Gauge Manufacturer: Apex  
 Maximum Range (inH<sub>2</sub>O): 1  
 Instrument ID #: 053 (dP)  
 Calibration Date: 7/26/2022  
 Calibration Expiration: 7/26/2023  
 Barometric Pressure: 29.74 in. Hg



Reference Standard Gauge	
Manufacturer:	Dwyer
Model:	475-000
Instrument ID#:	76
Calibration Expiration Date:	8/3/2022

Calibration Point (inH <sub>2</sub> O)	Reference Gauge Reading (inH <sub>2</sub> O)	Pressure Gauge Reading (inH <sub>2</sub> O)	Difference (Reference - UUT)	% Error of Full Range
0.0 - 0.2	0.14	0.15	0.009	0.9%
0.2 - 0.4	0.30	0.32	0.018	1.8%
0.4 - 0.6	0.46	0.48	0.027	2.7%
0.6 - 0.8	0.62	0.66	0.034	3.4%
0.8 - 1.0	0.82	0.85	0.033	3.3%

**Acceptable tolerance is 4%**

Technican Signature:

Date: 7/26/2022

# Emissions Sampling System Thermocouple Calibration Check

*Calibration based on NIST Monograph 175 per ASTM E2515-11  
All thermocouples are type "K"*

Date: 07/25/2022

Sampling System ID Numbers: 053/054

Performed By: S. Button

Calibration Instrument ID Number: 165

Reference Temperature (F)	Acceptable Error (F)	Thermocouple Location						
		FB Left	FB Right	FB Back	FB Top	FB Bottom	Catalyst Exit	Flue
0	± 4.0	1.3	1.3	1.7	1.2	1.2	1.5	2.0
200	± 4.0	201.1	201.0	201.5	200.9	201.0	201.3	201.7
400	± 4.0	401.2	401.0	401.5	400.8	401.0	401.3	401.7
600	± 4.5	601.9	600.9	601.4	600.8	600.9	601.3	601.6
800	± 6.0	801.0	800.9	801.3	800.8	800.8	801.2	801.6

Reference Temperature (F)	Acceptable Error (F)	Thermocouple Location					
		Ambient*	Filter A	Filter B	Meter A	Meter B	Dilution Tunnel
0	± 4.0	0.1	2.2	1.3	1.5	1.6	2.3
200	± 4.0	200.0	201.9	202.5	201.2	201.2	201.9
400	± 4.0	399.9	401.9	402.4	401.2	401.2	402.0
600	± 4.5	600.0	601.9	602.2	601.1	601.2	601.8
800	± 6.0	-	801.8	801.9	801.0	801.0	801.6

\*Ambient Probe is a Type T, Error Limit is ± 0.9 F

Technician Signature: 

Date: 7/25/2022



# Dry Gas Meter Calibration

Meter Manufacturer: Apex  
 Model: XC-60  
 Lab ID #: 54  
 Serial #: 1902133  
 Calibration Date: 7/25/2022  
 Calibration Expiration: 1/25/2023  
 Barometric Pressure: 29.70 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/30/2023
Calibration $\gamma$ Factor:	0.9978

Unit Under Test Previous Calibration	
Date	3/21/2022
$\gamma$ Factor:	0.985
Allowable Deviation ( $\pm 5\%$ ):	0.04925
Actual Deviation:	0.01
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	146.661	157.228	144.674
Standard DGM Temperature ( $^{\circ}$ F)	81.0	81.0	82.0
Standard DGM Pressure (in H <sub>2</sub> O)	0.00	0.00	0.0
DGM Initial Volume (ft <sup>3</sup> )	0.000	0.000	0.000
DGM Final Volume (ft <sup>3</sup> )	5.390	5.750	5.339
DGM Temperature ( $^{\circ}$ F)	108.0	108.0	109.0
DGM Pressure (in H <sub>2</sub> O)	2.75	4.77	1.28
Time (min)			
Net Volume for Standard DGM (ft <sup>3</sup> )	5.179	5.552	5.109
Net Volume for DGM (ft <sup>3</sup> )	5.390	5.750	5.339
Dry Gas Meter $\gamma$ Factor	1.000	1.000	0.999
$\gamma$ Factor Deviation From Average	1.000	1.000	0.999

Average Gas Meter  $\gamma$  Factor 1.000

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is  $\pm 0.5\%$ .

Technician:

# Pressure Gauge Calibration Work Sheet

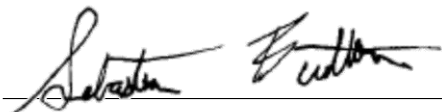
Gauge Manufacturer: Apex  
 Maximum Range (inH<sub>2</sub>O): 1  
 Instrument ID #: 054 (dP)  
 Calibration Date: 7/26/2022  
 Calibration Expiration: 7/26/2023  
 Barometric Pressure: 29.74 in. Hg



Reference Standard Gauge	
Manufacturer:	Dwyer
Model:	475-000
Instrument ID#:	76
Calibration Expiration Date:	8/3/2022

Calibration Point (inH <sub>2</sub> O)	Reference Gauge Reading (inH <sub>2</sub> O)	Pressure Gauge Reading (inH <sub>2</sub> O)	Difference (Reference - UUT)	% Error of Full Range
0.0 - 0.2	0.13	0.15	0.019	1.9%
0.2 - 0.4	0.36	0.38	0.027	2.7%
0.4 - 0.6	0.50	0.51	0.012	1.2%
0.6 - 0.8	0.62	0.65	0.028	2.8%
0.8 - 1.0	0.91	0.94	0.028	2.8%

Acceptable tolerance is 4%

Technican Signature: 

Date: 7/26/2022

# Dry Gas Meter Calibration

Meter Manufacturer: Apex  
 Model: XC-50-DIR  
 Lab ID #: 203  
 Serial #: A2204292  
 Calibration Date: 7/25/2022  
 Calibration Expiration: 1/25/2023  
 Barometric Pressure: 29.77 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/30/2023
Calibration $\gamma$ Factor:	0.9978

Unit Under Test Previous Calibration	
Date	N/A
$\gamma$ Factor:	1.000
Allowable Deviation ( $\pm 5\%$ ):	0.05
Actual Deviation:	0.00
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	146.097	151.718	144.533
Standard DGM Temperature ( $^{\circ}$ F)	78.5	79.0	80.0
Standard DGM Pressure (in H <sub>2</sub> O)	0.00	0.00	0.0
DGM Initial Volume (ft <sup>3</sup> )	0.000	0.000	0.000
DGM Final Volume (ft <sup>3</sup> )	5.340	5.541	5.316
DGM Temperature ( $^{\circ}$ F)	100.0	104.0	105.0
DGM Pressure (in H <sub>2</sub> O)	1.00	3.64	1.95
Time (min)			
Net Volume for Standard DGM (ft <sup>3</sup> )	5.159	5.358	5.104
Net Volume for DGM (ft <sup>3</sup> )	5.340	5.541	5.316
Dry Gas Meter $\gamma$ Factor	1.000	1.001	0.998
$\gamma$ Factor Deviation From Average	1.000	1.001	0.998

Average Gas Meter  $\gamma$  Factor

0.999

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is  $\pm 0.5\%$ .

# Dry Gas Meter Calibration

Meter Manufacturer: Apex  
 Model: Apex-AK-600  
 Lab ID #: 55  
 Serial #: 810016  
 Calibration Date: 7/27/2022  
 Calibration Expiration: 7/27/2023  
 Barometric Pressure: 29.86 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/30/2023
Calibration $\gamma$ Factor:	0.9978

Unit Under Test Previous Calibration	
Date	10/8/2021
$\gamma$ Factor:	0.997
Allowable Deviation ( $\pm 5\%$ ):	0.04985
Actual Deviation:	0.03
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	165.822	145.728	160.540
Standard DGM Temperature ( $^{\circ}$ F)	75.0	75.0	77.0
Standard DGM Pressure (in H <sub>2</sub> O)	0.00	0.00	0.0
DGM Initial Volume (ft <sup>3</sup> )	0.000	0.000	0.000
DGM Final Volume (ft <sup>3</sup> )	5.745	5.045	5.556
DGM Temperature ( $^{\circ}$ F)	80.0	81.0	82.0
DGM Pressure (in H <sub>2</sub> O)	0.00	0.00	0.0
Time (min)			
Net Volume for Standard DGM (ft <sup>3</sup> )	5.856	5.146	5.669
Net Volume for DGM (ft <sup>3</sup> )	5.745	5.045	5.556
Dry Gas Meter $\gamma$ Factor	1.027	1.029	1.028
$\gamma$ Factor Deviation From Average	1.027	1.029	1.028

Average Gas Meter  $\gamma$  Factor 1.028

Calculations:

1. Deviation = |Average value for all runs - current run value|
2.  $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is  $\pm 0.5\%$ .

Technician:

# 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



Property #: 097  
 User: N/A  
 Department: N/A  
 Make: Unknown  
 Model: 10 Lbs.  
 Serial #: 097  
 Description: Mass  
 Procedure: DCN 500901  
 Accuracy: Raw Data

Calibrated on: 03/18/2021  
 \*Recommended Due: 03/18/2026  
 Environment: 19 °C 41 % RH  
 \* As Received: Other - See Remarks  
 \* As Returned: Other - See Remarks  
 Action Taken: Calibrated  
 Technician: 126

Remarks: \* Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

Data is provided for your determination of acceptability. Received/returned without accessories.

### Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
484A	Rice Lake	1kg-10kg (Class ASTM 1)	Mass Set,	05/28/2021	699197
503A	Rice Lake	1mg-200g (Class 0)	Mass Set,	09/11/2021	729241
550A	And (A&D) Co.	HP-30K	Balance 30 Kg	12/31/2021	739307
723A	Rice Lake	1mg-200g (Class 0)	Mass Set,	06/09/2021	723431

Parameter

### Measurement Data

Measurement Description	Range	Unit	Reference	Min	Max	*Error	UUT	Uncertainty
<b>Before/After</b>								Accredited = $\bar{U}$
<b>Mass</b>								
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



# CERTIFICATE OF CALIBRATION

<b>CUSTOMER:</b>	<b>PFS-TECO :</b> CLACKAMAS, OR	<b>CALIBRATION DATE:</b>	05/03/2022
<b>PO NUMBER:</b>	1071	<b>CALIBRATION DUE:</b>	05/03/2023
<b>INST. MANUFACTURER:</b>	DWYER	<b>PROCEDURE:</b>	T.O.33K6-4-1769-1
<b>INST. DESCRIPTION:</b>	VELOMETER	<b>CALIBRATION FLUID:</b>	AIR @ 14.7 PSIA 70°F
<b>MODEL NUMBER:</b>	471	<b>RECEIVED CONDITION:</b>	WITHIN MFG. SPECS.
<b>SERIAL NUMBER:</b>	CP288559 ID# 095	<b>LEFT CONDITION:</b>	WITHIN MFG. SPECS.
<b>RATED ACCURACY:</b>	SEE NOTES BELOW.	<b>AMBIENT CONDITIONS:</b>	763mm HGA 51% RH 72°F
<b>UNCERTAINTY GIVEN:</b>	± 0.43% RD ; k=2	<b>CERTIFICATE FILE #:</b>	490265.2021
<b>NOTES:</b>	± 3% FS (0-500 / 0-1500) *** ± 4% F.S. (0-5000) ***± 5% F.S. (0-15000) *** ± 2 °F		

**Q.MANUAL IM 2.0 REV 2020.2 DATED 7-27-2020 \*\*\*\* DECISION RULE : NO PFA%**

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
129	133	45.1	44.2
260	266	71.7	70.9
498	509	99.3	98.5
526	534		
1039	1058		
1484	1517		
523	534		
3076	3151		
4998	5127		
6752	6907		
14679	15068		

**STANDARDS USED:**

A24: HART SCIENTIFIC TEMP. STANDARD   ± 0.024 F   TRACE# 1617259390	DUE	04/12/2023
A800: FLOW-DYNE SONIC NOZZLE SYSTEM   0 - 1086 CFM ± 0.46% RD.   TRACE# 1329407628, 89576, 152043238	DUE	12/10/2022

All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) and the Unit Under Test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed according to the shown procedure. The use of IAS/ILAC logo indicates calibrations are in accordance to ISO/IEC 17025:2017.

**Dick Munns Company · 11133 Winners Circle, Los Alamitos, CA 90720**  
**Phone: 714-827-1215 · www.dickmunns.com**

This Calibration Certificate shall not be reproduced except, in full, without approval by Dick Munns Company. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Issuing Date:

Approved By:

Cal. Technician:

Calibrated at:  Lab

On-Site (Customer's)

05/03/2022

*Richard [Signature]*

*D.C.*

Page 1 of 1



# QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS  
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(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



PFS Teco  
11785 SE Hwy 212 STE#305  
Clackamas, OR 97015

Report Number: DIRI0134307497220609

## A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

### INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	ENTRIS224-1S	34307497	#107	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
g	0.0001	QC012	6/9/22	1/27/22	1/2023

### FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		STANDARD DEVIATION			ENVIRONMENTAL CONDITIONS
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:		
100	0.0003	50 x 4	0.0002	100	0.0001		<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
<b>As-Found:</b>		<b>As-Found:</b>		1. 100.0000	5. 100.0000	9. 100.0001	Good Fair Poor
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	2. 100.0001	6. 100.0001	10. 100.0000	
<b>As-Left:</b>		<b>As-Left:</b>		3. 100.0001	7. 100.0000	<b>Result</b>	Temperature: 22.3°C
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	4. 100.0000	8. 100.0001	0.00005	

### A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	199.9988	200.0000	0.00017
100	99.9989	100.0000	0.00016
50	49.9994	49.9999	0.00016
20	19.9999	20.0000	0.00015
1	1.0000	1.0000	0.00015
0.1	0.1000	0.1000	0.00015

### CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	10kg to 1mg	G782	4/14/22	4/2023	20220751

#### Permanent Information Concerning this Equipment:

6 month calibration cycle  
1/22 Extra checkpoint to encapsulate user range 0.05g.  
AF= 0.0500g A/L= 0.0500

#### Comments/Info Concerning this Calibration:

6/22: Adjusted Span, RH- 45.3%

Report prepared/reviewed by: KD Date: 6/19/22

Technician: K. Dexter

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.



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## Report of Calibration

Firm: PFS-TECO  
Address: 11785 SE Hwy 212, Ste 305  
City/State/Zip: Clackamas, OR 97015

Test Completed: 05/09/22  
Purchase Order: 1067  
Traceable Number: 20220682

Test Item: 200 mg and 100 mg Individual Weights  
Serial No.: Listed in Table

Manufacturer: Troemner  
Customer ID: Listed in Table

<u>Material</u>	<u>Assumed Density</u>	<u>Range</u>	<u>Tolerance Class</u>
Stainless Steel	7.95 g/cm <sup>3</sup>	200 mg & 100 mg	ASTM Class 1

### Method and Traceability

The procedure used for this calibration is NIST IR 6969 SOP 4 Double Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

### Standards Used:

100 g to 1 mg Working Standards Were Calibrated: 07/02/21 Due: 07/31/22 Standards ID: 723318  
Mass Comparators Used: MET-05 Tested by: D. Thompson

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


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

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

page 1 of 2

Quality Control Services, Inc.  
Metrology Laboratory Manager  
E-mail [dthompson@qc-services.com](mailto:dthompson@qc-services.com)

Date: 05/09/22

  
Signature David S. Thompson

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Member: National Conference of Standards Laboratories and Weights & Measures





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## Report of Calibration

Firm: PFS-TECO  
Address: 11785 SE Hwy 212, Ste 305  
City/State/Zip: Clackamas, OR 97015

Test Completed: 05/09/22  
Purchase Order: 1067  
Traceable Number: 20220682

Test Item: 200 mg and 100 mg Individual Weights  
Serial No.: Listed in Table

Manufacturer: Troemner  
Customer ID: Listed in Table

### Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.93 to 21.94	760.7 to 760.8	47.8 to 47.9

### Conventional Mass Value

Nominal Value	As Found Value (g)	As Found Correction* (mg)	As Left Value (g)	As Left Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
200 mg, 1000101395, #109-B	0.2000082	0.0082	0.2000082	0.0082	0.0014	0.010
100 mg, 1000126267, #109-A	0.1000065	0.0065	0.1000065	0.0065	0.0014	0.010

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

**Comments:** These weights were received in good condition and were within ASTM Class 1 tolerances As Found.


**Recalibration Due:** The customer has requested a 5-year calibration cycle. The calibration due date for these weights is 05/09/27. The values listed above were found at the time of calibration. Any number of factors may cause these items to drift out of calibration before the calibration interval has expired.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2017 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 to 2

Quality Control Services, Inc.  
Metrology Laboratory Manager  
E-mail [dthompson@qc-services.com](mailto:dthompson@qc-services.com)

Date: 05/09/22

  
Signature David S. Thompson

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PFS Teco  
11785 SE Hwy 212 STE#305  
Clackamas, OR 97015

Report Number: DIRI01C101887027220127

## A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

### INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Mettler	IND570 - 1000lbx0.	C101887027	#189	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.02	QC033	1/27/22	N/A	1/2023

### FUNCTIONAL CHECKS

SHIFT TEST		LINEARITY		REPEATABILITY		ENVIRONMENTAL CONDITIONS		
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
400	0.10	HB44	HB44	200	0.04	Good	Fair	Poor
As-Found:		As-Found:		As-Found:		Temperature: 20.4°C		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>			
As-Left:		As-Left:		As-Left:				
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>			

### CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	999.46	999.96	0.012
600	599.68	599.96	0.011
400	399.80	399.98	0.011
200	199.92	199.98	0.011
100	99.98	99.98	0.011
50	49.98	50.00	0.011

### CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	3/13/20	3/2022	202000041

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

1/22 RH= 28%. Adjusted span.

Report prepared/reviewed by: JC

Date: 1/27/22

Technician: J. Colacchio

Signature: [Signature]

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

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Member: National Conference of Standards Laboratories and Weights & Measures

# Aquatech Scientific Instruments LLC

680 Heacock Rd, Suite 204A, Yardley, PA. 19067

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PHONE: 215-428-9400 FAX: 267-790-0404

## PRESSURE CALIBRATION TEST REPORT

PREPARED FOR	MODEL	SERIAL #	SB #	DATE	TEMP
SEBASTIAN BUTTON	DBX2	118222	X1177	4/16/2022	68

PRESSURE WHEN SET	INIT OFFSET
997.5	-1.2

**118222**

DRUCK DPI-740	TEST UNIT	CORRECTION	ADJUSTMENT	ZONE	RANGE
1080.0	1080.2	-0.2	-0.20	ZONE 11	>1075
1060.0	1060.1	-0.1	-0.10	ZONE 10	1070
1040.0	1040.1	-0.1	-0.10	ZONE 9	1050
1020.0	1020.1	-0.1	-0.10	ZONE 8	1030
1000.0	1000.1	-0.1	-0.10	ZONE 7	1010
980.0	980.1	-0.1	-0.10	ZONE 6	990
960.0	960.1	-0.1	-0.10	ZONE 5	970
940.0	940.0	0.0	0.00	ZONE 4	950
920.0	920.0	0.0	0.00	ZONE 3	930
900.0	900.0	0.0	0.00	ZONE 2	910
880.0	880.0	0.0	0.00	ZONE 1	890
860.0	860.0	0.0	0.00	ZONE 0	<865

Values represent actual (mb) data of test unit, prior to unit adjustment (calibration)  
Pressure standard used is a NIST traceable instrument GE Druck DPI-740 S/N 74003994  
Pressure standard used is rated at +/-0.15hPa (mb) of true pressure.  
GE Druck DPI-740 S/N 74003994 Calibration Due Date: May 31st, 2022

NOTE: Calibration Due Date of test unit: 1 YEAR FROM TEST DATE



# Model 1430 Microtector® Electronic Point Gage

## Installation and Operating Instructions



**Model 1430 Microtector® Portable Electronic Point Gage** combines modern, solid-state integrated circuit electronics with a time-proven point gage manometer to provide fast, accurate pressure measurements.

### SPECIFICATIONS AND FEATURES

- Accurate and repeatable to  $\pm .00025$  inches water column
- Pressure range: 0 - 2" w.c., positive, negative, or differential pressures
- Non-toxic and inexpensive gage fluid consists of distilled water mixed with a small amount of fluorescein green color concentrate
- Convenient, portable, lightweight and self-contained, the unit requires no external power connections and is operated by a 1.5 volt penlight cell
- A.C. detector current eliminates point plating, fouling and erosion
- Micrometers are manufactured in accordance with ASME B89.1.13-2001, and are traceable to a standard at the National Institute of Standards and Technology

- Three-point mounting, dual leveling adjustment, and circular level vial assure rapid setup
- Durablock® precision-machined acrylic gage body
- Sensitive 0 - 50 microamp D.C. meter acts as a detector and also indicates battery and probe condition
- Heavy 2" thick steel base plate provides steady mounting
- Top-quality glass epoxy circuit board and solid-state, integrated circuit electronics
- Electronic enclosure of tough, molded styrene acrylonitrile provides maximum protection to components yet allows easy access to battery compartment
- Rugged sheet steel cover and carrying case protects the entire unit when not in use
- Accessories included are (2) 3-foot lengths Tygon® tubing, (2) 1/8" pipe thread adapters and 3/4 oz. bottle of fluorescein green color concentrate with wetting agent

**Maximum pressure: 100 psig with optional pipe thread connections.**

Tygon® is a registered trademark of Saint-Gobain Corporation

**DWYER INSTRUMENTS, INC.**

P.O. BOX 373

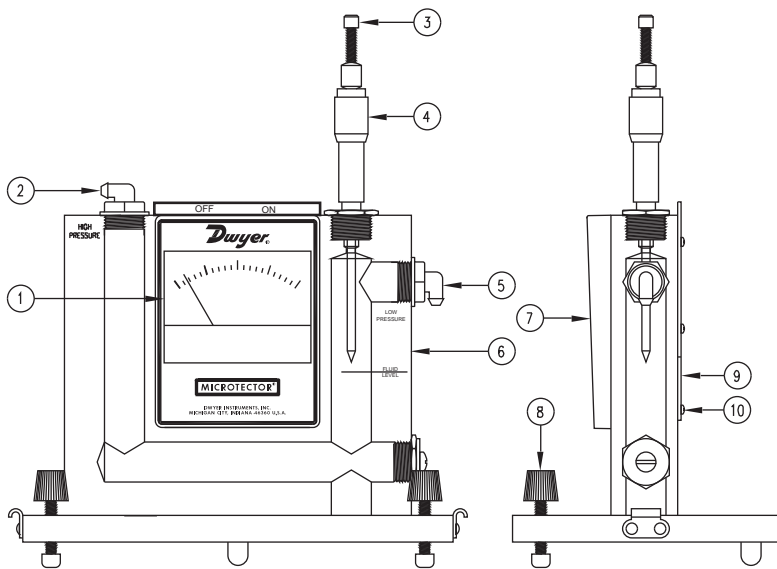
MICHIGAN CITY, INDIANA 46361, U.S.A.

Phone: 219/879-8000

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www.dwyer-inst.com

e-mail: info@dwyer-inst.com



**Microtector® Gage**

### Precision Pressure Measurement

The Microtector® Gage combines the time-proven principles of the Hook Gage type manometer and modern solid-state integrated circuit electronics. It provides an inexpensive means of achieving accuracy and repeatability within  $\pm .00025$  inches water column throughout its 0 to 2 inches w.c. range. It is truly a new standard in precision measuring devices.

### Principles of Operation

A pressure to be measured is applied to the manometer fluid which is displaced in each leg of the manometer by an amount equal to  $1/2$  the applied pressure. A micrometer mounted point is then lowered until it contacts the manometer gage fluid. The instant of contact is detected by completion of a low-power A.C. circuit. Current for this circuit is supplied by a 1.5 volt penlight cell feeding two semiconductor amplifiers which act as a free-running multivibrator operating at a frequency of approximately two kilohertz. Completion of the A.C. circuit activates a bridge rectifier which provides the signal for indication on a sensitive (0 to 50 microamps) D.C. microammeter.

On indication of contact, the operator stops lowering the point and reads the micrometer which indicates one half the applied pressure. By interpolating eight divisions (each being  $.000125$  w.c.) between  $.001$  micrometer graduations, a total accuracy of  $.00025$  can easily be achieved. The micrometer complies with Federal Specification GGG-C-105A and is traceable to a master at the NIST.

### Locating and Opening

Stand the Microtector® Gage and case on a firm flat level surface. Remove cover by releasing the latches and lifting it straight up. If it is necessary to move the gage without case, handle only the base plate or clear acrylic block. **(CAUTION: Do not handle gage by grasping meter-electronic package housing Item 7 on drawing.)**

## Fluid Level

Level the gage by adjusting the two front leveling screws (Item 8 on drawing) until the bubble in the spirit level is centered in the small circle. After leveling the gage, open both rapid shut-off valve tube connectors (Items 2 and 5). Back off the micrometer (Item 4), if necessary, to make sure that the point is not immersed in the gage fluid. The fluid level in the gage should now coincide with the mark on the right hand bore (Item 6) plus or minus approximately 1/32 inch. If the level of fluid is too high, fluid can be removed with an eye dropper pipette or carefully poured out of the right connection (Item 5).

If the level is too low, remove the top left rapid shut-off valve tube connector (Item 2) and add distilled water pre-mixed with the proper amount of green concentrate. (See maintenance instructions for proportions. After correcting the fluid level, re-install the rapid shut-off connectors and, with these in the open position, re-level the Microtector® Gage. The gage is now ready to be zeroed.

## Zeroing

Turn the Micrometer barrel (Item 4) until its lower end just coincides with the zero mark on the scale and the zero on the barrel scale coincides with the vertical line on the internal scale. Note that the internal scale is graduated every .025" from 0 to 1.00 inch and the barrel scale is graduated in one thousandths from 0 to .025". Turn the meter circuit switch at the top of gage to the "on" position. While holding the barrel at the zero position (and with gage level), raise or lower the point by turning the knurled knob (Item 3) until the point is above, but near, the fluid.

Check to be sure that the meter registers zero. Watch the meter, hold the barrel, and lower the point slowly by turning the top knurled knob. As the knob is turned, the point will contact the fluid and the meter pointer will move from zero to some upscales position.

After making contact, turn the point out of the fluid by turning the micrometer barrel counter-clockwise to a reading of .010 or more. Again, watch the meter and, this time, lower the point by turning the micrometer barrel. The point position where the meter pointer begins to move up scale is the zero position. This position should correspond to the zero reading on the micrometer. Adjust the point in relation to the micrometer barrel by turning the top knob while holding the barrel steady. Repeat lowering the point, watching the meter for contact, and adjusting the point until the zero position and zero reading exactly coincide. The gage is now zeroed and should not be moved.

An alternative method of zeroing and reading can be used wherein, instead of zeroing the gage completely, a zero correction reading is taken and recorded, then subtracted from the final reading. Comparable results can be obtained with either method.

## Positive Pressure Measurement

With the fluid at its proper level, a pressure of 2.0" water column maximum can be measured. Positive pressure should be applied to the top left connection (Item 2) with the micrometer zeroed as described above. This will permit a simple direct reading to be taken.

After an unknown pressure has been applied at the top left connection, the fluid level will drop in the left bore and rise over the point in the right bore. Note that the indicating meter point has moved upscales because the point is immersed in the fluid. Turn the micrometer counter-clockwise until the point leaves the fluid as indicated by the meter pointer dropping to zero on its scale. Then slowly turn the micrometer down until its point just touches the fluid surface, causing movement of the meter pointer. Withdraw the point and repeat several times, noting each time the micrometer reading where the meter pointer begins. The average of these readings multiplied by two is the pressure applied to the gage. (Avg. reading x 2 = pressure applied in inches w.c. The degree of uncertainty for the operator is indicated by the difference in these readings.

When the readings are complete, the pressure should be removed and the zero setting of Microtector® Gage rechecked. Any change in the zero position will indicate inaccurate readings. Should this happen, the zero-set and pressure measurement procedure should be repeated.

## Negative Pressure or Vacuum Measurement

Zero the gage. Connect the source of vacuum or negative pressure to the right-side gage connection (Item 5) and proceed as described under Positive Pressure Measurement section. Remember that the pressure measured in this way is negative.

## Differential Pressure Measurement

Differential pressures may be measured by connecting the higher (more positive) pressure to the left connection (Item 2) and the lower pressure to the right connection (Item 5).

## Storage

Turn meter circuit switch to "off" position and withdraw the point well clear of fluid (by turning micrometer clockwise) when gage is not in use. This will conserve the batteries and minimize build-up of oxides, etc., on the point. Keep the unit covered and in an area free of strong solvent fumes.

## Maintenance

When the meter reading becomes reduced or the pointer movement gets sluggish (with the circuit on and the point in fluid), the following should be done:

(1) Remove the point (by unscrewing) and clean the tip lightly using fine crocus cloth. Wipe off all grit and dirt with a clean rag; reassemble and recheck meter operation.

(2) If the meter operation continues to be sluggish, replace the size AA, 1.5 volt battery. (Replace the battery at least once a year to avoid deterioration of battery and damage to gage. Leakproof alkaline battery is recommended.)

To replace the battery, remove center screw (Item 10) located in the back of the electronic enclosure. Cover (Item 9) will come off, exposing the battery. Pull the old battery out and push a new battery into the battery holder with the positive (center) terminal to the right (to the end marked with + on the holder).

If the fluid becomes contaminated and requires replacement: empty old fluid from gage; flush out with clear water and replace with distilled water and A-126 fluorescein green color concentrate mixed with 3/4 oz. concentrate to each quart of water.

## CAUTION:

1. Do not substitute other gage fluids, as proper gage operation depends on use of the specified gage fluid to provide proper surface tension, wetting ability and electrolyte capability with unity specific gravity.

If the gage bore is very dirty, a mild soap solution may be used to aid in cleaning prior to flushing with clear water.

2. Do not clean with liquid soaps, special solvent, de-greasers, aromatic hydrocarbons, etc. Such cleaners and solvents may contain chlorine, fluorine, acetone and related compounds that will permanently damage the gage and prevent proper operation.



# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

**Customer & Order Information**

PXPKG TUALATIN OR H  
10450 SW TUALATIN SHERWOOD ROAD  
TUALATIN OR 97062-9547

Certificate Issuance Date: 10/16/2019  
Praxair Order Number: 71120745  
Part Number: NI CD17CO8E-AS  
Customer PO Number: 79106732

Fill Date: 10/07/2019  
Lot Number: 70086928009  
Cylinder Style & Outlet: AS CGA 590  
Cylinder Pressure and Volume: 1300 psig 99 ft3

**Certified Concentration**

Expiration Date:	10/16/2027	NIST Traceable
Cylinder Number:	CC106574	Expanded Uncertainty
17.00 %	Carbon dioxide	± 0.5 %
4.31 %	Carbon monoxide	± 0.6 %
16.95 %	Oxygen	± 0.2 %
Balance	Nitrogen	

**ProSpec EZ Cert**



**Certification Information:**

Certification Date: 10/16/2019    Term: 96 Months    Expiration Date: 10/16/2027

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1.  
Do Not Use this Standard if Pressure is less than 100 PSIG.  
CO2 responses have been corrected for Oxygen IR Broadening effect. O2 responses have been corrected for CO2 interference.

**Analytical Data:**

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

**1. Component:**

**Carbon dioxide**

Requested Concentration: 17 %  
Certified Concentration: 17.00 %  
Instrument Used: Horiba VIA-510 S/N 20C194WK  
Analytical Method: NDIR  
Last Multipoint Calibration: 09/18/2019

First Analysis Data:				Date
Z: 0	R: 19.98	C: 17	Conc: 17	10/16/2019
R: 19.98	Z: 0	C: 17	Conc: 17	
Z: 0	C: 17.01	R: 19.99	Conc: 17.01	
UOM: %				Mean Test Assay: 17 %

**Reference Standard:**

Type / Cylinder #: GMIS / CC149981  
Concentration / Uncertainty: 19.98 % ±0.279%  
Expiration Date: 06/07/2026

**Traceable to:**

SRM # / Sample # / Cylinder #: RGM#CC28033 / N/A / RGM#CC28033  
SRM Concentration / Uncertainty: 19.67% / ±0.04%  
SRM Expiration Date: 07/15/2021

Second Analysis Data:				Date
Z: 0	R: 0	C: 0	Conc: 0	
R: 0	Z: 0	C: 0	Conc: 0	
Z: 0	C: 0	R: 0	Conc: 0	
UOM: %				Mean Test Assay: %

**2. Component:**

**Carbon monoxide**

Requested Concentration: 4.25 %  
Certified Concentration: 4.31 %  
Instrument Used: Horiba VIA-510 S/N UB9UCSYX  
Analytical Method: NDIR  
Last Multipoint Calibration: 09/19/2019

First Analysis Data:				Date
Z: 0	R: 5	C: 4.31	Conc: 4.31	10/16/2019
R: 5	Z: 0	C: 4.31	Conc: 4.31	
Z: 0	C: 4.32	R: 5.01	Conc: 4.32	
UOM: %				Mean Test Assay: 4.31 %

**Reference Standard:**

Type / Cylinder #: GMIS / CC242633  
Concentration / Uncertainty: 5.00 % ±0.543%  
Expiration Date: 04/03/2025

**Traceable to:**

SRM # / Sample # / Cylinder #: SRM 2642a / 51-D-23 / FF23106  
SRM Concentration / Uncertainty: 7.859% / ±0.039%  
SRM Expiration Date: 07/15/2019

Second Analysis Data:				Date
Z: 0	R: 0	C: 0	Conc: 0	
R: 0	Z: 0	C: 0	Conc: 0	
Z: 0	C: 0	R: 0	Conc: 0	
UOM: %				Mean Test Assay: %

**3. Component:**

**Oxygen**

Requested Concentration: 17 %  
Certified Concentration: 16.95 %  
Instrument Used: OXYMAT 5E  
Analytical Method: Paramagnetic  
Last Multipoint Calibration: 09/18/2019

First Analysis Data:				Date
Z: 0	R: 20.88	C: 16.96	Conc: 16.95	10/16/2019
R: 20.88	Z: 0	C: 16.96	Conc: 16.95	
Z: 0	C: 16.97	R: 20.9	Conc: 16.96	
UOM: %				Mean Test Assay: 16.95 %

**Reference Standard:**

Type / Cylinder #: GMIS / CC506521  
Concentration / Uncertainty: 20.87 % ±0.108%  
Expiration Date: 12/14/2026

**Traceable to:**

SRM # / Sample # / Cylinder #: SRM 2659a / 71-E-19 / FF22331  
SRM Concentration / Uncertainty: 20.863% / ±0.021%  
SRM Expiration Date: 08/23/2021

Second Analysis Data:				Date
Z: 0	R: 0	C: 0	Conc: 0	
R: 0	Z: 0	C: 0	Conc: 0	
Z: 0	C: 0	R: 0	Conc: 0	
UOM: %				Mean Test Assay: %

Analyzed By

Jose Vasquez

Certified By

Jenna Lockman





# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

**Customer & Order Information**

PXPKG TUALATIN OR H  
10450 SW TUALATIN SHERWOOD ROAD  
TUALATIN OR 97062-9547

Certificate Issuance Date: 10/16/2019  
Praxair Order Number: 71120745  
Part Number: NI CD10CO33E-AS  
Customer PO Number: 79106732

Fill Date: 10/08/2019  
Lot Number: 70086928102  
Cylinder Style & Outlet: AS CGA 590  
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration		
Expiration Date:	10/16/2027	NIST Traceable
Cylinder Number:	CC139173	Expanded Uncertainty
10.09 %	Carbon dioxide	± 0.4 %
2.53 %	Carbon monoxide	± 0.6 %
10.48 %	Oxygen	± 0.4 %
Balance	Nitrogen	

**ProSpec EZ Cert**



**Certification Information:**

Certification Date: 10/16/2019    Term: 96 Months    Expiration Date: 10/16/2027

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1.  
Do Not Use this Standard if Pressure is less than 100 PSIG.  
CO2 responses have been corrected for Oxygen IR Broadening effect. O2 responses have been corrected for CO2 interference.

**Analytical Data:**

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

**1. Component: Carbon dioxide**

Requested Concentration: 10 %  
Certified Concentration: 10.09 %  
Instrument Used: Horiba VIA-510 S/N 20C194WK  
Analytical Method: NDIR  
Last Multipoint Calibration: 09/18/2019

First Analysis Data:				Date
Z:	0	R:	14	10/16/2019
C:	10.09	Conc:	10.09	
R:	14	Z:	0	
C:	10.1	Conc:	10.1	
Z:	0	R:	14.01	
C:	10.1	Conc:	10.1	
UOM:	%	Mean Test Assay:	10.09 %	

**Reference Standard:** Type / Cylinder #: GMIS / CC164230  
Concentration / Uncertainty: 14.00 % ±0.265%  
Expiration Date: 04/16/2027

**Traceable to:** SRM # / Sample # / Cylinder #: SRM 1675b / 6-F-51 / CAL014538  
SRM Concentration / Uncertainty: 13.963% / ±0.034%  
SRM Expiration Date: 05/16/2022

Second Analysis Data:				Date
Z:	0	R:	0	
C:	0	Conc:	0	
R:	0	Z:	0	
C:	0	Conc:	0	
Z:	0	R:	0	
C:	0	Conc:	0	
UOM:	%	Mean Test Assay:	%	

**2. Component: Carbon monoxide**

Requested Concentration: 2.5 %  
Certified Concentration: 2.53 %  
Instrument Used: Horiba VIA-510 S/N UB9UCSYX  
Analytical Method: NDIR  
Last Multipoint Calibration: 09/19/2019

First Analysis Data:				Date
Z:	0	R:	5	10/16/2019
C:	2.53	Conc:	2.53	
R:	5	Z:	0	
C:	2.53	Conc:	2.53	
Z:	0	R:	5.01	
C:	2.54	Conc:	2.54	
UOM:	%	Mean Test Assay:	2.53 %	

**Reference Standard:** Type / Cylinder #: GMIS / CC242633  
Concentration / Uncertainty: 5.00 % ±0.543%  
Expiration Date: 04/03/2025

**Traceable to:** SRM # / Sample # / Cylinder #: SRM 2642a / 51-D-23 / FF23106  
SRM Concentration / Uncertainty: 7.859% / ±0.039%  
SRM Expiration Date: 07/15/2019

Second Analysis Data:				Date
Z:	0	R:	0	
C:	0	Conc:	0	
R:	0	Z:	0	
C:	0	Conc:	0	
Z:	0	R:	0	
C:	0	Conc:	0	
UOM:	%	Mean Test Assay:	%	

**3. Component: Oxygen**

Requested Concentration: 10.5 %  
Certified Concentration: 10.48 %  
Instrument Used: OXYMAT 5E  
Analytical Method: Paramagnetic  
Last Multipoint Calibration: 09/18/2019

First Analysis Data:				Date
Z:	0	R:	9.88	10/16/2019
C:	10.49	Conc:	10.48	
R:	9.88	Z:	0	
C:	10.49	Conc:	10.48	
Z:	0	R:	9.89	
C:	10.5	Conc:	10.49	
UOM:	%	Mean Test Assay:	10.48 %	

**Reference Standard:** Type / Cylinder #: NTRM / DT0010384  
Concentration / Uncertainty: 9.875 % ±0.4%  
Expiration Date: 11/18/2022

**Traceable to:** SRM # / Sample # / Cylinder #: NTRM / 170701 / NTRM DT0010384  
SRM Concentration / Uncertainty: 9.875% / ±0.040%  
SRM Expiration Date: 11/18/2022

Second Analysis Data:				Date
Z:	0	R:	0	
C:	0	Conc:	0	
R:	0	Z:	0	
C:	0	Conc:	0	
Z:	0	R:	0	
C:	0	Conc:	0	
UOM:	%	Mean Test Assay:	%	

Analyzed By

Jose Vasquez

Certified By

*Jerina Lockman*  
Jerina Lockman

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