Laminox Srl

Project # 23-210
Model: Giulia Air
AKA: Valentina Air N
Type: Pellet-Fired Room Heater
November 22, 2023
Revised: April 24, 2024

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

Contact: Luigi Rafaiani
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Prepared by: Aaron Kravitz, Testing Supervisor

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Revision History

11/22/2023 – Original Issue

3/13/2024 – The following changes were made per request from EPA:

-Added additional information regarding tunnel velocity measurement equipment, see page 7.

-Added updated manual to Appendix B with additional information on replacement parts.

4/22/2024 – Revised Run 1 Data to correct ambient sample volume, see Appendix A

4/24/2024 – Corrected manufacturer name on page 8. Corrected issue date on Certificate of Conformity.

Contents

Affidavit

PFS-TECO was contracted by Laminox Srl to provide testing services for the Giulia Air 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 10/18/2023. 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

Laminox Srl of Sarnano, MC, Italy contracted with PFS-TECO to perform EPA certification testing on Giulia Air 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.
- A separate, independent sample train was utilized to determine 1st hour emissions.
- 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: ***Giulia Air***
- Serial Number: ***N/A – Prototype Unit; PFS Tracking #0164***
- Manufacturer*:* ***Laminox Srl***
- Catalyst: ***No***
- Heat exchange blower: ***None***
- Type: ***Pellet Stove***
- Style: ***Free Standing***
- Date Received: ***Monday, September 18, 2023***
- Testing Period – Start: ***Wednesday, October 18, 2023*** Finish: ***Wednesday, October 18, 2023***
- 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
215	NI Temperature DAQ
057	California Analytical ZRE CO2/CO/O2 IR ANALYZER
109A/B	Troemner 100mg/200mg Audit Weights
107	Sartorius Analytical Balance
097	10 lb audit weight
095	Anemometer
111	Microtector
CC121798	Gas Analyzer Calibration Span Gas
CC139173	Gas Analyzer Calibration Mid Gas

Dilution Tunnel Velocity Measurement

In accordance with test method ASTM E2515, dilution tunnel velocity was measured prior to each run by performing a velocity traverse, and monitored throughout each run by measuring pitot pressure at the tunnel centroid. Traverses were performed using a Dwyer Model 1430 Microtector in accordance with the instrument owners' manual. This includes leveling and zeroing the instrument prior to each use and performing pre- and post-test leak checks on the pitot tubing. To monitor and log centroid pitot pressure, the pressure transducer of an Apex Instruments XC-60-DIR sample box was used. This piece of equipment, #203B, is calibrated annually and its certificate may be found in Appendix C. Both pieces of equipment offer precision in excess of the +/-0.001" specified in section 6.1.5 of ASTM E2515, and are therefore suitable for use with flows under 800 ft/min. Both pieces of equipment are plumbed to the same pitot tube.

Results

The integrated test run emission rate for test Run 1 was measured to be **1.6 g/hr** with a Higher Heating Value efficiency of **84%** and a CO emission rate of **0.74 g/min**. The calculated first hour particulate emission rate was **5.3 g/hr**. The Laminox Model Giulia Air 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	10/18/2023	OA	2.01	360	32292	5.3	1.6	0.74	0.74	84%	84%
		H	3.11	60	48694			1.78		82%	
		M	2.00	120	32068			0.55		84%	
		L	1.66	180	26918			0.53		85%	

Test Run Narrative

Run 1

Run 1 was performed on 10/18/2023 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 1.6 g/hr. The run had an overall HHV efficiency of 84%. 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	62	72	45.8	49.9	29.87	6.9	27.3	2.6%	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		
Run 1	Heat Setting 5 (max)	**Maximum Segment** Heat Setting 5 (max)	**Medium Segment** Heat Setting 2	**Minimum Segment** Heat Setting 1 (min)

Appliance Description

Model(s): Giulia Air

Appliance Type: Pellet-Fired Room Heater

Additional Models: One additional model, the Valentina Air N, is available. It differs only in external cladding; it is identical in all respects that may affect emissions performance to the Giulia Air.

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 top 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: An inclined 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.

Appliance Dimensions

Giulia Air Dimensions

Height	Width	Depth	Firebox Volume
49”	22”	26”	N/A – Pellet Stove

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 Golden Fire 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

Analytical Test Report

Report No: USR:W223-0426-01
Issue No: 2
Revised Report. Previous report is USR:W223-0426-01 Issue number 1

Client: PFS-TECO
11785 SE Hwy 212 Ste 305
Clackamas, OR 97015
Attention: Sebastian Button

PO No:

Signed: Katy Jahr
Katy Jahr
Chemistry Lab Supervisor
Date of Issue: 8/23/2023

Sample Details

Sample Log No:	W223-0426-01	**Sample Date:**	
Sample Designation:	Pellets	**Sample Time:**	
Sample Recognized As:		**Arrival Date:**	8/1/2023

Test Results

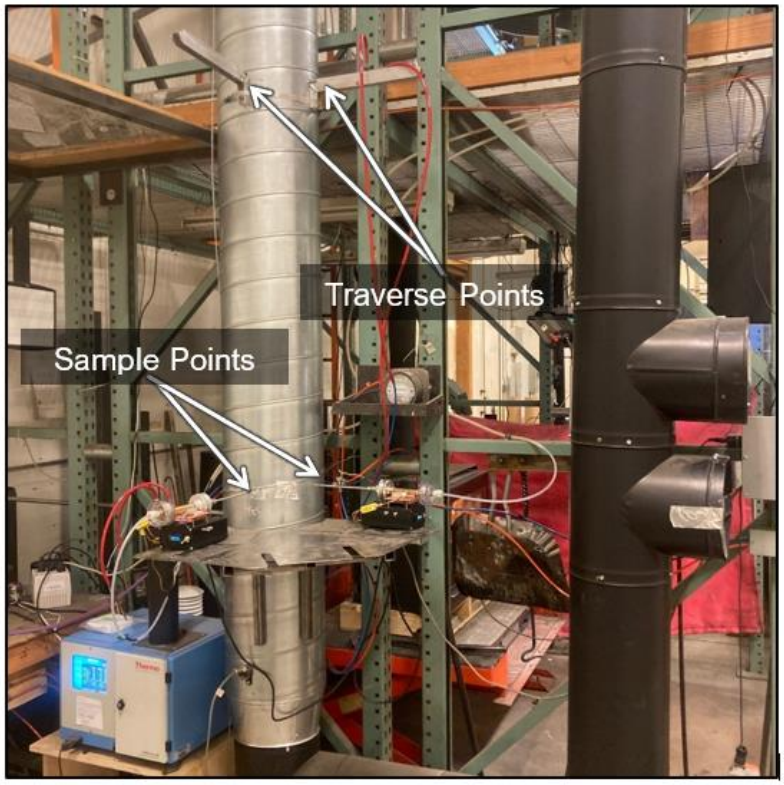
	METHOD	UNITS	MOISTURE FREE	AS RECEIVED
Moisture Total	ASTM E871	wt. %		2.54
Ash	ASTM D1102	wt. %	0.20	0.19
Volatile Matter	ASTM D3175	wt. %		
Fixed Carbon by Difference	ASTM D3172	wt. %		
Sulfur	ASTM D4239	wt. %	0.009	0.009
SO_2	Calculated	lb/mmbtu		0.020
Net Cal. Value at Const. Pressure	ISO 1928	GJ/tonne	18.29	17.77
Gross Cal. Value at Const. Vol.	ASTM E711	Btu/lb	8702	8481
Carbon	ASTM D5373	wt. %	47.19	46.00
Hydrogen*	ASTM D5373	wt. %	9.01	8.79
Nitrogen	ASTM D5373	wt. %	< 0.20	< 0.20
Oxygen*	ASTM D3176	wt. %	> 43.39	> 42.29
*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^3		
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		

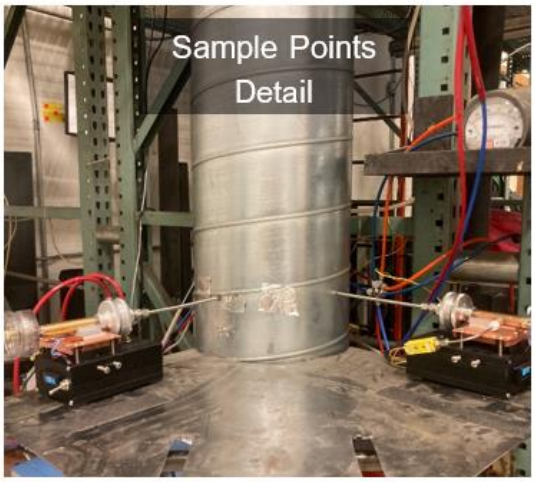
Comments:

PJLA Testing
Accreditation #60243

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: Zona Industrial Callarella 261/263, 62028 Sarnano, MC, Italy for archival.

Sealing Label

ATTENTION:

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

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

REPORT #_____ DATE SEALED_____

MANUFACTURER_____ MODEL #_____

Sealed Unit

List of Appendices

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

Appendix A – Test Run Data, Technician Notes, and Sample Analysis

Appendix B – Labels and Manuals

Appendix C –Equipment Calibration Records

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

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)(l)(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 ≤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 ≤ 50% of the maximum burn rate." Table 1 of ASTM E2779-10 also notes that the Medium Burn Rate Category test must be ≤ 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)

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

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.*

Sincerely,

Steffan M Johnson

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 ≤50 % of the maximum burn rate.

TABLE 1

Burn Rate Segment	Maximum	Medium	Minimum
Description	Maximum achievable	≤ 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

Equations and Sample Calculations – ASTM E2779 & E2515

Client: Laminox
Model: Giulia
Tracking #: 164
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_{Bdb} – 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_{Swb} = weight of test fuel in hopper at start of test run, wet basis, kg
M_{Ewb} = weight of test fuel in hopper at end of test run, wet basis, kg

Sample Calculation:

FM = 2.61 %
M_{Swb} = 27.3 lbs
M_{Ewb} = 0.0 lbs
0.4536 = Conversion factor from lbs to kg

M_{Bdb} = [(27.3 x 0.4536) - (0.0 x 0.4536)] (100/(100 + 2.606)

M_{Bdb} = **12.1** kg

M_{BSidb} – Weight of test fuel burned during test run segment *i* , dry basis, kg
ASTM E2779 equation (2)

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

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 = 2.61 %

M_{SSiwb} = 20.3 lbs

M_{ESiwb} = 11.2 lbs

0.4536 = Conversion factor from lbs to kg

M_{BSidb} = [(20.3 x 0.4536) - (11.2 x 0.4536)] (100/(100 + 3)

M_{BSidb} = **3.99** kg

BR – Average dry burn rate over full integrated test run, kg/hr
ASTM E2779 equation (3)

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

Where,

θ = Total length of full integrated test run, min

Sample Calculation:

M_{Bdb} = 12.07 kg
θ = 360 min

$$BR = \frac{60 \times 12.1}{360}$$

BR = **2.01** kg/hr

BR_{Si} – Average dry burn rate over test run segment *i* , kg/hr
ASTM E2779 equation (4)

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

Where,

θ_{Si} = Total length of test run segment *i* , min

Sample Calculation (from medium burn rate segment):

M_{BSidb} = 3.99 kg
θ = 120 min

$$BR = \frac{60 \times 3.99}{120}$$

BR = **2.00** kg/hr

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

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

Where:

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

Sample calculation:

$$Fp = \frac{7.61}{8.96} = 0.850$$

$$V_s = 0.850 \times 85.49 \times 0.99 \times 0.131 \times \left(\frac{80.7 + 460}{\left(29.87 + \frac{-0.10}{13.6}\right) \times 28.78} \right)^{1/2}$$

V_s = **7.49** ft/s

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

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

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

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

Where:

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

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 7.49 \times 0.7854 \times \frac{528}{80.7 + 460} \times \frac{29.87 + \frac{-0.10}{13.6}}{29.92}$$

Q_{sd} = **20228.7** dscf/hr

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

ASTM E2515 equation (6)

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

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
ΔH	=	Average pressure differential across the orifice meter, in. H_2O
T_m	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train A:

$$V_{m(std)} = 17.64 \times 56.015 \times 1.004 \times \frac{\left(29.87 + \frac{2.39}{13.6}\right)}{(90.7 + 460)}$$

$V_{m(std)}$ = **54.113** dscf

Using equation for Train B:

$$V_{m(std)} = 17.64 \times 55.044 \times 1.004 \times \frac{\left(29.87 + \frac{2.36}{13.6}\right)}{(89.7 + 460)}$$

$V_{m(std)}$ = **53.275** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 0.00 \times 1.003 \times \frac{\left(29.87 + \frac{0.00}{13.6}\right)}{(67.4 + 460)}$$

$V_{m(std)}$ = **0.000** dscf

m_n – Total Particulate Matter Collected, mg
ASTM E2515 Equation (12)

$$m_n = m_p + m_f + m_g$$

Where:

m_p = mass of particulate matter from probe, mg

m_f = mass of particulate matter from filters, mg

m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train A:

m_n = 1.0 + 2.7 + 0.7

m_n = **4.4** mg

Using equation for Train B:

m_n = 1.0 + 2.1 + 0.9

m_n = **4.0** mg

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

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

Where:

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

Sample calculation:

For Train A:

$$C_s = 0.001 \times \frac{4.4}{54.113}$$

C_s = **0.00008** g/dscf

For Train B:

$$C_s = 0.001 \times \frac{4.0}{53.275}$$

C_s = **0.00008** g/dscf

For Ambient Train

$$C_r = 0.001 \times \frac{0.1}{0.000}$$

C_r = **0.000000** g/dscf

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

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

Where:

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

Sample calculation:

For Train A

E_T = (0.000081 - 0.000000) x 20228.7 x 360 /60

E_T = **9.87** g

For Train B

E_T = (0.000075 - 0.000000) x 20228.7 x 360 /60

E_T = **9.11** g

Average

E = **9.49** g

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

7.5% of the average =	0.71
Train A difference (%) =	**4.0%**
Train B difference (%)=	**4.0%**

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

θ = Total sampling time, min

θ_i = Length of recording interval, min

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

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

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

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

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

T_m = Absolute average dry gas meter temperature, ^oR

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

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

Sample calculation (for the first 10 minute interval of Train A):

$$PR = \left(\frac{360 \times 1.424 \times 7.49 \times (90.7 + 460) \times (80.6 + 460)}{10 \times 56.015 \times 7.21 \times (80.7 + 460) \times (66.8 + 460)} \right) \times 100$$

PR = **99** %

PM_R – 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

θ = Total length of full integrated test run, min

Sample Calculation:

E_T (Dual train average) = 9.49 g

θ = 360 min

$PM_R = 60 \times (9.49 / 360)$

PM_R = **1.58** g/hr

PM_F – 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_T = Total particulate emissions, grams

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

Sample Calculation:

E_T (Dual train average) = 9.49 g

M_{Bdb} = 12.07 kg

PM_F = 9.49 / 12.07)

PM_F = **0.79** g/kg

Stack Loss Efficiency and CO emissions calculations are done in accordance with CSA B415.1, using the password protected excel spreadsheet provided with the test standard. No alterations or alternative calculations are used for determining efficiency or CO emissions. The following pages are a sample of the calculations page from the B415.1 Spreadsheet (V2_4 - Dated April 15, 2010).

Manufacturer: Laminox
Model: Giulia
Date: 10/18/23
Run: 1
Control #: 23-210
Test Duration: 360 min

Note: In the "Input data", "Calc. % O_2", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a]. [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses 13.7.3 to 13.7.5.

	HHV	LHV
Eff	83.62%	92.50%
Comb Eff	98.42%	98.42%
HT Eff	84.95%	93.98%
Output	34,042	kJ/h
Burn Rate	2.01	kg/h
Grams CO	266	g
Input	40,712	kJ/h
MC wet	2.54	

Ultimate CO_2
$CO_{2\text{-ult}}$ 17.78
F_0 1.174

Overall Heating Efficiency:	83.62%	Air Fuel Ratio (A/F)			
Combustion Efficiency:	98.42%	Dry Molecular Weight (M_d)	30.28		
Heat Transfer Efficiency:	84.95%	Dry Moles Exhaust Gas (N_d):	325.07	%HC	
		Air Fuel Ratio (A/F)	9.33	0.8	

Heat Output:	32,292	Btu/h	34,042	kJ/h
Heat Input:	38,620	Btu/h	40,712	kJ/h
Burn Duration:	6.00	h		
Burn Rate:	4.44	lb/h	2.013	kg/h
Stack Temp:	222.6	Deg. F	105.9	Deg. C

Averages	**0.26**	**12.81**	**0.38**	**18.62**	**5.68**	**105.96**	**19.68**	**98.6%**	**85.1%**	**83.9%**	**9.05**	**5.49**	**55.72**	**5.39**	**55.33**	**244591**	**3.93**
INPUT DATA			**Oxygen Calculation**			**Input Data**		**Combust**	**Heat**	**Net**	**Air**	**Wet Wt**	**% Wet**	**Dry Wt.**	**% Dry**		
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO_2 [d]**	**Excess Air EA**	**Total O_2**	**Calc. % O_2 [g]**	**Flue Gas (°C)**	**Room Temp (°C)**	**Eff %**	**Transfer %**	**Eff %**	**Fuel Ratio**	**Now Wt**	**Consumed x**	**Now Wt_{dn}**	**Comsumed y**	**Total Input**	**Carbon /12= [a]**
0	12.39	0.78	15.47	9.5%	18.06	2.20	136.7	16.7	96.0%	84.1%	80.7%	7.2	12.39	0.00	12.08	0.00	0	3.93
1	12.34	0.25	14.12	23.7%	18.39	4.14	136.9	16.7	98.6%	83.8%	82.6%	8.1	12.34	0.40	12.03	0.40	1521	3.93
2	12.29	0.54	15.56	10.5%	18.08	2.26	137.5	16.6	97.2%	84.1%	81.8%	7.3	12.29	0.84	11.97	0.84	1029	3.93
3	12.24	0.25	14.46	20.9%	18.33	3.75	137.6	16.5	98.6%	83.9%	82.7%	8.0	12.24	1.24	11.93	1.24	939	3.93
4	12.19	0.18	13.73	27.9%	18.47	4.65	137.2	16.7	99.0%	83.7%	82.8%	8.4	12.19	1.61	11.88	1.61	1029	3.93
5	12.13	0.51	15.60	10.4%	18.08	2.22	137.7	16.7	97.4%	84.1%	81.9%	7.2	12.13	2.09	11.82	2.09	1118	3.93
6	12.08	0.26	14.74	18.6%	18.28	3.42	137.5	16.6	98.6%	84.0%	82.8%	7.8	12.08	2.53	11.77	2.53	1073	3.93
7	12.02	0.37	15.15	14.6%	18.19	2.86	138.0	16.6	98.1%	84.0%	82.4%	7.5	12.02	2.97	11.72	2.97	1029	3.93
8	11.97	0.67	15.36	11.0%	18.09	2.40	137.7	16.7	96.5%	84.0%	81.1%	7.3	11.97	3.37	11.67	3.37	939	3.93
9	11.93	0.27	14.56	19.9%	18.31	3.62	137.6	16.7	98.5%	83.9%	82.7%	7.9	11.93	3.73	11.63	3.73	1029	3.93
10	11.87	0.98	16.28	3.1%	17.88	1.11	137.9	16.7	95.2%	84.2%	80.2%	6.7	11.87	4.21	11.57	4.21	1073	3.93
11	11.82	0.44	14.53	18.8%	18.28	3.53	138.1	16.8	97.6%	83.8%	81.8%	7.8	11.82	4.61	11.52	4.61	984	3.93
12	11.77	0.34	15.35	13.3%	18.15	2.63	138.2	16.8	98.2%	84.1%	82.6%	7.5	11.77	5.02	11.47	5.02	1073	3.93
13	11.71	0.70	16.01	6.4%	17.97	1.61	139.1	16.6	96.5%	84.1%	81.2%	7.0	11.71	5.49	11.41	5.49	1073	3.93
14	11.66	0.42	14.88	16.2%	18.22	3.13	139.1	16.6	97.7%	83.9%	82.0%	7.6	11.66	5.90	11.36	5.90	1029	3.93
15	11.61	0.64	15.50	10.2%	18.08	2.25	139.3	16.6	96.7%	84.0%	81.2%	7.2	11.61	6.33	11.31	6.33	1073	3.93
16	11.55	0.40	15.33	13.0%	18.15	2.61	139.7	16.8	97.9%	84.0%	82.2%	7.4	11.55	6.77	11.26	6.77	1073	3.93
17	11.50	0.49	15.53	11.0%	18.10	2.32	140.2	16.8	97.5%	84.0%	81.9%	7.3	11.50	7.21	11.21	7.21	1073	3.93
18	11.44	0.71	15.49	9.8%	18.06	2.22	140.7	16.7	96.3%	83.9%	80.8%	7.2	11.44	7.65	11.15	7.65	1029	3.93
19	11.39	0.28	15.05	16.0%	18.22	3.03	140.9	16.8	98.5%	83.9%	82.7%	7.6	11.39	8.06	11.10	8.06	984	3.93
20	11.34	0.22	13.91	25.9%	18.43	4.42	140.9	16.9	98.8%	83.5%	82.5%	8.3	11.34	8.46	11.05	8.46	984	3.93
21	11.29	0.65	15.38	10.9%	18.09	2.38	140.7	16.7	96.6%	83.9%	81.0%	7.3	11.29	8.86	11.01	8.86	1073	3.93
22	11.23	0.36	14.38	20.7%	18.32	3.77	146.7	16.9	98.0%	83.4%	81.7%	7.9	11.23	9.34	10.95	9.34	1029	3.93
23	11.19	0.26	11.64	49.4%	18.83	7.06	146.2	16.7	98.3%	82.2%	80.8%	9.8	11.19	9.70	10.90	9.70	984	3.93
24	11.13	0.55	15.35	11.8%	18.12	2.49	143.8	16.9	97.1%	83.8%	81.4%	7.3	11.13	10.14	10.85	10.14	1118	3.93
25	11.08	0.72	15.62	8.8%	18.04	2.06	142.9	16.8	96.3%	83.8%	80.8%	7.1	11.08	10.62	10.79	10.62	1029	3.93
26	11.03	0.39	15.31	13.3%	18.15	2.65	141.7	16.8	97.9%	83.9%	82.2%	7.4	11.03	10.98	10.75	10.98	984	3.93
27	10.98	0.23	14.52	20.6%	18.32	3.69	141.0	16.7	98.8%	83.7%	82.7%	7.9	10.98	11.42	10.70	11.42	1118	3.93
28	10.92	0.83	16.06	5.3%	17.94	1.47	141.1	16.8	95.9%	84.0%	80.6%	6.9	10.92	11.90	10.64	11.90	1029	3.93
29	10.87	0.35	14.43	20.3%	18.32	3.71	140.7	16.7	98.1%	83.7%	82.1%	7.9	10.87	12.27	10.60	12.27	1029	3.93
30	10.81	0.84	16.14	4.8%	17.93	1.37	140.8	16.7	95.9%	84.0%	80.6%	6.9	10.81	12.74	10.54	12.74	1073	3.93
31	10.76	0.34	14.57	19.3%	18.29	3.55	141.2	16.7	98.2%	83.7%	82.2%	7.8	10.76	13.15	10.49	13.15	1029	3.93
32	10.71	0.58	15.46	10.9%	18.09	2.35	140.9	16.8	97.0%	83.9%	81.4%	7.3	10.71	13.58	10.44	13.58	1073	3.93

Moisture Content M_{Cwb}: 2.54

Combustion Efficiency:	98.42%		Moisture of Wood (wet basis):	2.54	Dry kg :	12.08
Total Input (kJ):	244,272	231,680 (Btu)	Initial Dry Weight Wt_{do} (kg):	12.08	CA:	47
Total Output (kJ):	204,250	193,722 (Btu)	Moisture Content Dry	2.61	HY:	9
Efficiency:	83.62%				OX:	43.6
Total CO (g):	266.30					

Load Weight (kg):	**12.39**				
Fuel Heating	**HHV**	**LHV**		**HHV**	**LHV**
Value in kj/kg - CV:	**20,227**	**18,285**	Btu/lb	**8702.0**	**7866.2**

9.01	2.73	20227.28	2.54	81.25	21.55	3.33	14.95	0.03	0.33	38.58	18.06	0.74	0.09	248.16	44.96	1.45	379.11	3394.56	2573.37	2507.02	2478.26
Fuel Properties			**Mw**	**Mass Balance**					**kg Wood per**								**Stack**	**Heat Content Change - Ambient to Stack T**			
Hydrogen	**Oxygen**	**Calorific**	**Moisture**	**(moles/100 mole dry flue gas)**					**100 mole dfp**	**Moles per kg of Dry Wood**						**Moisture**	**Temp**	**Flue Gas Constituent**			
/1= [b]	**/16= [c]**	**Value**	**Fuel Burnt**	**[h]**	**[u]**	**[w]**	**[j]**	**[k]**	**Nk**	**CO_2**	**O_2**	**CO**	**HC**	**N_2**	**H_2O**	**Present**	**K**	**CO_2**	**O_2**	**CO**	**N_2**
9.01	2.73	20227.28	2.54	81.55	21.63	4.16	18.49	0.13	0.42	37.22	5.31	1.87	0.31	196.30	44.52	1.45	409.87	4764.46	3593.33	3496.15	3457.00
9.01	2.73	20227.28	2.54	81.49	21.61	3.66	16.44	0.04	0.37	38.62	11.31	0.69	0.10	222.80	44.95	1.45	410.09	4773.67	3600.11	3502.70	3463.49
9.01	2.73	20227.28	2.54	81.65	21.66	4.12	18.36	0.09	0.41	37.88	5.50	1.31	0.22	198.80	44.71	1.45	410.65	4800.91	3620.30	3522.26	3482.85
9.01	2.73	20227.28	2.54	81.55	21.63	3.75	16.82	0.04	0.37	38.64	10.02	0.67	0.10	217.94	44.95	1.45	410.76	4807.62	3625.32	3527.14	3487.67
9.01	2.73	20227.28	2.54	81.44	21.60	3.54	15.91	0.02	0.35	38.82	13.17	0.52	0.06	230.35	45.01	1.45	410.32	4782.88	3606.88	3509.25	3469.97
9.01	2.73	20227.28	2.54	81.66	21.66	4.12	18.39	0.08	0.41	37.96	5.41	1.24	0.20	198.69	44.73	1.45	410.87	4805.90	3623.81	3525.61	3486.17
9.01	2.73	20227.28	2.54	81.59	21.64	3.82	17.14	0.04	0.38	38.64	8.96	0.67	0.10	213.93	44.94	1.45	410.65	4798.80	3618.67	3520.67	3481.27
9.01	2.73	20227.28	2.54	81.63	21.65	3.96	17.72	0.06	0.40	38.33	7.23	0.93	0.15	206.56	44.85	1.45	411.15	4819.53	3633.91	3535.40	3495.86
9.01	2.73	20227.28	2.54	81.57	21.64	4.10	18.27	0.11	0.41	37.49	5.87	1.64	0.27	199.15	44.60	1.45	410.82	4803.60	3622.12	3523.98	3484.55
9.01	2.73	20227.28	2.54	81.56	21.63	3.78	16.95	0.04	0.38	38.59	9.58	0.71	0.10	216.17	44.93	1.45	410.76	4801.30	3620.42	3522.34	3482.93
9.01	2.73	20227.28	2.54	81.63	21.65	4.43	19.63	0.17	0.44	36.81	2.51	2.21	0.38	184.62	44.39	1.45	411.04	4812.81	3628.89	3530.52	3491.04
9.01	2.73	20227.28	2.54	81.50	21.62	3.82	17.09	0.07	0.38	38.06	9.25	1.16	0.18	213.49	44.78	1.45	411.21	4815.51	3630.70	3532.24	3492.74
9.01	2.73	20227.28	2.54	81.68	21.66	4.00	17.93	0.05	0.40	38.42	6.59	0.85	0.13	204.41	44.87	1.45	411.37	4822.42	3635.79	3537.15	3497.60
9.01	2.73	20227.28	2.54	81.68	21.66	4.28	19.04	0.12	0.43	37.49	3.78	1.64	0.28	191.25	44.59	1.45	412.21	4863.31	3666.09	3566.50	3526.66
9.01	2.73	20227.28	2.54	81.57	21.64	3.91	17.48	0.07	0.39	38.15	8.02	1.08	0.17	209.08	44.80	1.45	412.26	4867.72	3669.42	3569.74	3529.86
9.01	2.73	20227.28	2.54	81.61	21.65	4.13	18.40	0.11	0.41	37.61	5.47	1.54	0.26	197.97	44.63	1.45	412.48	4874.84	3674.56	3574.69	3534.76
9.01	2.73	20227.28	2.54	81.65	21.66	4.02	17.97	0.06	0.40	38.24	6.52	1.00	0.16	203.64	44.82	1.45	412.87	4884.66	3681.52	3581.35	3541.38
9.01	2.73	20227.28	2.54	81.66	21.66	4.10	18.29	0.08	0.41	38.00	5.67	1.20	0.20	199.79	44.75	1.45	413.37	4903.31	3695.14	3594.49	3554.39
9.01	2.73	20227.28	2.54	81.58	21.64	4.15	18.46	0.12	0.41	37.40	5.35	1.71	0.29	196.96	44.57	1.45	413.82	4928.09	3713.60	3612.39	3572.10
9.01	2.73	20227.28	2.54	81.64	21.66	3.91	17.52	0.04	0.39	38.58	7.78	0.71	0.11	209.33	44.92	1.45	414.09	4933.31	3717.17	3615.78	3575.47
9.01	2.73	20227.28	2.54	81.46	21.61	3.60	16.16	0.03	0.36	38.72	12.30	0.60	0.08	226.80	44.98	1.45	414.04	4928.89	3713.84	3612.54	3572.27
9.01	2.73	20227.28	2.54	81.58	21.64	4.11	18.28	0.11	0.41	37.54	5.81	1.60	0.26	199.09	44.61	1.45	413.87	4928.29	3713.66	3612.43	3572.14
9.01	2.73	20227.28	2.54	81.50	21.62	3.76	16.83	0.05	0.38	38.31	10.04	0.95	0.14	217.17	44.85	1.45	419.82	5169.43	3890.26	3782.97	3741.05
9.01	2.73	20227.28	2.54	81.04	21.50	3.03	13.61	0.03	0.30	38.43	23.31	0.87	0.10	267.61	44.93	1.45	419.32	5154.90	3879.88	3773.01	3731.17
9.01	2.73	20227.28	2.54	81.61	21.65	4.07	18.14	0.09	0.41	37.82	6.14	1.36	0.22	201.07	44.69	1.45	416.93	5049.04	3802.02	3697.73	3656.63
9.01	2.73	20227.28	2.54	81.60	21.65	4.19	18.62	0.12	0.42	37.40	4.92	1.72	0.29	195.33	44.57	1.45	416.09	5016.46	3778.21	3674.75	3633.87
9.01	2.73	20227.28	2.54	81.65	21.66	4.01	17.93	0.06	0.40	38.27	6.63	0.98	0.16	204.17	44.83	1.45	414.82	4963.32	3739.21	3637.07	3596.56
9.01	2.73	20227.28	2.54	81.56	21.64	3.76	16.87	0.03	0.38	38.71	9.83	0.61	0.09	217.44	44.97	1.45	414.15	4939.83	3722.13	3620.62	3580.25
9.01	2.73	20227.28	2.54	81.64	21.66	4.33	19.23	0.14	0.43	37.17	3.40	1.91	0.32	188.95	44.49	1.45	414.26	4942.34	3723.89	3622.29	3581.92
9.01	2.73	20227.28	2.54	81.51	21.62	3.77	16.89	0.05	0.38	38.33	9.85	0.93	0.14	216.49	44.86	1.45	413.87	4928.29	3713.66	3612.43	3572.14
9.01	2.73	20227.28	2.54	81.65	21.66	4.35	19.33	0.14	0.43	37.15	3.15	1.93	0.33	187.96	44.49	1.45	413.93	4930.60	3715.35	3614.07	3573.77
9.01	2.73	20227.28	2.54	81.54	21.63	3.81	17.04	0.05	0.38	38.38	9.35	0.89	0.14	214.71	44.87	1.45	414.37	4949.07	3728.91	3627.17	3586.74
9.01	2.73	20227.28	2.54	81.62	21.65	4.10	18.29	0.10	0.41	37.76	5.74	1.41	0.23	199.39	44.68	1.45	414.09	4935.42	3718.80	3617.38	3577.05

			SUMS							AVERAGE	SUMS						
3226.79	3001.51	292.83	47216.24	15959.89	75877.57	218959.03	29840.96	762260.68	24551.09	3253.92	39979.86	3805.87	36174.0	204611.3	3847.8	266.3	20.0
emperature		Room Temp	Energy Losses (kJ/kg of Dry Fuel) Flue Gas Constituent							Total Loss	Total	Chemical	Sensible and	Total	Chem	Grams Produced	
CH_4	H_2O	K	CO_2	O_2	CO	N_2	CH_4	H_2O Comb	H_2O Fuel MC	Rate	Loss	Loss 1	Latent Loss	Output	Loss 2	CO	HC
4569.59	4184.31	289.82	177.35	19.06	535.04	678.62	279.04	2143.62	69.72	3902.45	0.00	0	0.00	0	0	0.00	0.00
4578.80	4192.13	289.82	184.35	40.73	197.40	771.65	87.01	2164.64	69.73	3515.51	264.27	21	243.11	1256	21	1.45	0.12
4605.68	4215.52	289.71	181.85	19.90	375.32	692.38	192.68	2154.31	69.77	3686.20	187.45	29	158.85	841	29	1.87	0.18
4612.22	4221.35	289.65	185.75	36.32	192.21	760.12	86.42	2166.02	69.77	3496.60	162.35	13	149.54	777	13	0.87	0.07
4588.01	4199.95	289.82	185.68	47.49	148.30	799.31	57.42	2168.18	69.74	3476.12	176.77	10	166.42	852	10	0.74	0.05
4611.04	4219.51	289.82	182.42	19.60	356.21	692.65	182.54	2155.58	69.77	3658.78	202.24	29	172.75	916	29	1.92	0.18
4603.75	4213.60	289.76	185.41	32.41	191.56	744.76	87.87	2165.51	69.76	3477.29	184.52	15	169.84	889	15	0.99	0.08
4624.49	4231.20	289.76	184.71	26.26	266.81	722.10	131.32	2161.62	69.79	3562.62	181.17	20	161.12	847	20	1.33	0.12
4608.74	4217.55	289.82	180.11	21.25	469.39	693.96	242.69	2149.02	69.77	3826.17	177.65	33	144.92	762	33	2.13	0.20
4606.43	4215.60	289.82	185.26	34.70	204.28	752.90	93.65	2164.98	69.77	3505.54	178.27	15	163.27	850	15	1.02	0.09
4617.96	4225.37	289.82	177.17	9.10	634.37	644.50	337.21	2139.18	69.78	4011.32	212.85	51	161.81	860	51	3.29	0.32
4621.01	4227.41	289.93	183.28	33.59	332.51	745.67	163.24	2158.01	69.78	3686.10	179.30	24	155.42	805	24	1.58	0.14
4627.93	4233.27	289.93	185.27	23.97	243.81	714.94	120.02	2162.93	69.79	3520.73	186.82	19	167.71	887	19	1.26	0.11
4668.33	4268.36	289.76	182.31	13.86	470.38	674.48	246.75	2150.85	69.84	3808.46	202.09	38	164.42	871	38	2.44	0.23
4672.56	4272.24	289.71	185.71	29.43	309.99	738.04	153.20	2161.10	69.85	3647.32	185.48	23	162.16	843	23	1.54	0.14
4679.87	4278.15	289.76	183.33	20.10	441.44	699.77	228.29	2153.27	69.86	3796.06	201.43	35	166.25	872	35	2.29	0.22
4690.26	4286.09	289.93	186.79	23.99	287.32	721.17	143.55	2162.77	69.87	3595.46	190.79	23	168.15	883	23	1.49	0.14
4709.13	4301.78	289.98	186.34	20.94	344.98	710.12	176.03	2159.97	69.89	3668.27	194.65	27	167.28	879	27	1.79	0.17
4733.42	4323.18	289.82	184.33	19.87	491.28	703.56	255.31	2152.37	69.92	3876.63	197.14	38	159.55	831	38	2.44	0.23
4739.20	4327.21	289.98	190.34	28.90	204.29	748.45	96.71	2169.67	69.93	3508.29	170.65	14	156.16	813	14	0.97	0.08
4734.96	4323.34	290.04	190.86	45.67	172.36	810.17	71.83	2172.18	69.92	3532.99	171.85	12	160.10	812	12	0.82	0.06
4733.80	4323.22	289.87	185.03	21.59	457.44	711.18	236.30	2154.42	69.92	3835.88	203.55	36	167.11	870	36	2.37	0.22
4976.58	4526.92	290.04	198.06	39.08	271.29	812.45	128.86	2175.16	70.22	3695.10	187.91	20	167.78	841	20	1.35	0.12
4961.38	4515.05	289.87	198.12	90.42	248.10	998.51	93.80	2178.42	70.20	3877.57	188.61	16	172.16	795	16	1.18	0.08
4855.54	4425.10	290.04	190.96	23.34	389.92	735.24	199.38	2162.96	70.07	3771.87	208.49	32	176.25	910	32	2.10	0.20
4822.64	4397.66	289.98	187.61	18.60	492.68	709.79	256.75	2155.53	70.03	3890.99	197.87	38	160.15	831	38	2.45	0.23
4769.31	4352.65	289.98	189.95	24.81	280.24	734.30	139.52	2166.19	69.96	3604.97	175.35	20	155.14	809	20	1.33	0.12
4745.38	4333.00	289.87	191.24	36.58	173.44	778.48	76.62	2172.10	69.94	3498.38	193.37	14	179.69	925	14	0.94	0.08
4748.08	4335.00	289.93	183.72	12.65	547.23	676.80	288.74	2149.29	69.94	3928.36	199.77	42	157.69	829	42	2.72	0.26
4733.80	4323.22	289.87	188.91	36.59	266.44	773.35	126.63	2166.26	69.92	3628.10	184.50	20	164.71	844	20	1.32	0.12
4736.12	4325.18	289.87	183.16	11.71	552.87	671.73	292.19	2148.48	69.93	3930.07	208.54	44	164.15	865	44	2.87	0.28
4754.64	4340.83	289.87	189.92	34.86	255.86	770.12	121.79	2167.57	69.95	3610.07	183.58	19	164.57	845	19	1.27	0.11
4741.13	4329.13	289.93	186.36	21.34	404.71	713.23	208.05	2157.73	69.93	3761.36	199.59	32	167.41	874	32	2.10	0.20

Pre-Conditioning Data

Client:	Laminox	Job #:	23-210
Model:	Giulia	Tracking #:	164
Date(s):	10/6/23 - 10/10/23	Technician:	AK

Elapsed Time (hrs)	Flue (°F)	Catalyst Exit (°F)	Notes: Indicate initial air setting and any changes in in setting during conditioning, as well as weight and average moisture content of all fuel additions.
0	102		+57.1 lb, Golden Fire premium pellet; burn setting 2
1	215		+16.0 lb, Golden Fire premium pellets; burn setting 2
2	234		
3	248		
4	239		
5	240		
6	239		
7	270		
8	240		
9	240		
10	241		
11	238		
12	239		
13	242		
14	242		
15	240		
16	243		
17	242		
18	245		
19	238		
20	239		
21	239		
22	248		
23	235		
24	235		
25	234		
26	235		
27	230		
28	197		
29	141		
30	212		+45.8 lb, Golden Fire premium pellets; burn setting 2
31	223		
32	228		
33	228		
34	232		
35	232		+36.8 lb, Golden Fire premium pellets; burn setting 2
36	236		
37	231		
38	241		
39	233		
40	253		
41	232		
42	231		
43	233		
44	230		
45	229		
46	229		
47	202		
48	128		
49	191		+10.6 lb, Golden Fire premium pellets; burn setting 2
50	223		

Signature/Date:_____ 11/22/2023

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

Analytical Test Report

Report No: USR:W223-0426-01
Issue No: 2
Revised Report. Previous report is USR:W223-0426-01 issue number 1

Client: PFS-TECO
11785 SE Hwy 212 Ste 305
Clackamas, OR 97015
Attention: Sebastian Button

PO No:

Signed: Katy Jahr
Katy Jahr
Chemistry Lab Supervisor
Date of Issue: 8/23/2023

Sample Details

Sample Log No:	W223-0426-01	**Sample Date:**	
Sample Designation:	Pellets	**Sample Time:**	
Sample Recognized As:		**Arrival Date:**	8/1/2023

Test Results

	METHOD	UNITS	MOISTURE FREE	AS RECEIVED
Moisture Total	ASTM E871	wt. %		2.54
Ash	ASTM D1102	wt. %	0.20	0.19
Volatile Matter	ASTM D3175	wt. %		
Fixed Carbon by Difference	ASTM D3172	wt. %		
Sulfur	ASTM D4239	wt. %	0.009	0.009
SO_2	Calculated	lb/mmbtu		0.020
Net Cal. Value at Const. Pressure	ISO 1928	GJ/tonne	18.29	17.77
Gross Cal. Value at Const. Vol.	ASTM E711	Btu/lb	8702	8481
Carbon	ASTM D5373	wt. %	47.19	46.00
Hydrogen*	ASTM D5373	wt. %	9.01	8.79
Nitrogen	ASTM D5373	wt. %	< 0.20	< 0.20
Oxygen*	ASTM D3176	wt. %	> 43.39	> 42.29
*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^3		
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:

PJLA Testing
Accreditation #60243

PELLET TEST DATA PACKET
ASTM E2779/E2515

Run 1 Data Summary

Client: Laminox
Model: Giulia
Job #: 23-210
Tracking #: 164
Test Date: 10/18/2023

Technician Signature

4/22/2024
Date

TEST RESULTS - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

Burn Rate Summary	
High Burn Rate (dry kg/hr)	3.11
Medium Burn Rate (dry kg/hr)	2.00
Low Burn Rate (dry kg/hr)	1.66
Overall Burn Rate (dry kg/hr)	2.01

Medium Burn Rate Target: < 2.38 dry kg/hr

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter - Train C
Total Sample Volume (ft^3)	84.694	56.015	55.044	8.663
Average Gas Velocity in Dilution Tunnel (ft/sec)	7.5			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	20228.7			
Average Gas Meter Temperature (°F)	67.4	90.7	89.7	69.3
Total Sample Volume (dscf)	84.848	54.113	53.275	8.738
Average Tunnel Temperature (°F)	80.7			
Total Time of Test (min)	360			
Total Particulate Catch (mg)	0.1	4.4	4.0	2.3
Particulate Concentration, dry-standard (g/dscf)	0.0000012	0.0000813	0.0000751	0.0002632
Total PM Emissions (g)	0.14	9.73	8.97	5.30
Particulate Emission Rate (g/hr)	0.02	1.62	1.49	5.30
Emissions Factor (g/kg)	-	0.81	0.74	1.70
Difference from Average Total Particulate Emissions (g)	-	0.38	0.38	-
Difference from Average Total Particulate Emissions (%)	-	4.0%	4.0%	-
Difference from Average Emissions Factor (g/kg)	-	0.03	0.03	-

Final Average Results	
Total Particulate Emissions (g)	9.35
Particulate Emission Rate (g/hr)	1.56
Emissions Factor (g/kg)	0.77
HHV Efficiency (%)	83.6%
LHV Efficiency (%)	92.5%
CO Emissions (g/min)	0.74

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	76.8	OK
Face Velocity	< 30 ft/min	8.8	OK
Leakage Rate	Less than 4% of average sample rate	0.001 cfm	OK
Ambient Temp	55-90 °F	61.7 / 71.7	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	2.00	OK

Overall Pellet Test Efficiency Results

Manufacturer: Laminox
Model: Giulia
Date: 10/18/23
Run: 1
Control #: 23-210
Test Duration: 360
Output Category: Integrated

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	83.6%	92.5%
Combustion Efficiency	98.4%	98.4%
Heat Transfer Efficiency	85.0%	94.0%

Output Rate (kJ/h)	34,042	32,292	**(Btu/h)**
Burn Rate (kg/h)	2.01	4.44	**(lb/h)**
Input (kJ/h)	40,712	38,620	**(Btu/h)**

Test Load Weight (dry kg)	12.08	26.62	**dry lb**
MC wet (%)	2.54		
MC dry (%)	2.61		
Particulate (g)	9.35		
CO (g)	266		
Test Duration (h)	6.00		

Emissions	**Particulate**	**CO**
g/MJ Output	0.05	1.30
g/kg Dry Fuel	0.77	22.05
g/h	1.56	44.38
g/min	0.03	0.74
lb/MM Btu Output	0.11	3.03

Air/Fuel Ratio (A/F)	9.33

VERSION: **2.4** **4/15/2010**

Max Burn Rate Segment Efficiency Results

Manufacturer: Laminox
Model: Giulia
Date: 10/18/23
Run: 1
Control #: 23-210
Test Duration: 60
Output Category: Maximum

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	81.5%	90.2%
Combustion Efficiency	97.4%	97.4%
Heat Transfer Efficiency	83.7%	92.6%

Output Rate (kJ/h)	51,332	48,694	**(Btu/h)**
Burn Rate (kg/h)	3.11	6.86	**(lb/h)**
Input (kJ/h)	62,969	59,733	**(Btu/h)**

Test Load Weight (dry kg)	3.11	6.86	**dry lb**
MC wet (%)	2.54		
MC dry (%)	2.61		
Particulate (g)	N/A		
CO (g)	107		
Test Duration (h)	1.00		

Emissions	**Particulate**	**CO**
g/MJ Output	N/A	2.08
g/kg Dry Fuel	N/A	34.24
g/h	N/A	106.59
g/min	N/A	1.78
lb/MM Btu Output	N/A	4.83

Air/Fuel Ratio (A/F)	7.80

VERSION: **2.4** **4/15/2010**

Medium Burn Rate Segment Efficiency Results

Manufacturer: Laminox
Model: Giulia
Date: 10/18/23
Run: 1
Control #: 23-210
Test Duration: 120
Output Category: Medium

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	83.7%	92.6%
Combustion Efficiency	98.9%	98.9%
Heat Transfer Efficiency	84.7%	93.6%

Output Rate (kJ/h)	33,806	32,068	**(Btu/h)**
Burn Rate (kg/h)	2.00	4.40	**(lb/h)**
Input (kJ/h)	40,384	38,309	**(Btu/h)**

Test Load Weight (dry kg)	3.99	8.80	**dry lb**
MC wet (%)	2.54		
MC dry (%)	2.61		
Particulate (g)	N/A		
CO (g)	66		
Test Duration (h)	2.00		

Emissions	**Particulate**	**CO**
g/MJ Output	N/A	0.97
g/kg Dry Fuel	N/A	16.49
g/h	N/A	32.92
g/min	N/A	0.55
lb/MM Btu Output	N/A	2.26

Air/Fuel Ratio (A/F)	9.66

VERSION: **2.4** **4/15/2010**

Minimum Burn Rate Segment Efficiency Results

Manufacturer: Laminox
Model: Giulia
Date: 10/18/23
Run: 1
Control #: 23-210
Test Duration: 180
Output Category: Minimum

Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	84.7%	93.7%
Combustion Efficiency	98.7%	98.7%
Heat Transfer Efficiency	85.8%	94.9%

Output Rate (kJ/h)	28,376	26,918	**(Btu/h)**
Burn Rate (kg/h)	1.66	3.65	**(lb/h)**
Input (kJ/h)	33,512	31,790	**(Btu/h)**

Test Load Weight (dry kg)	4.97	10.95	**dry lb**
MC wet (%)	2.54		
MC dry (%)	2.61		
Particulate (g)	N/A		
CO (g)	96		
Test Duration (h)	3.00		

Emissions	Particulate	CO
g/MJ Output	N/A	1.13
g/kg Dry Fuel	N/A	19.27
g/h	N/A	31.93
g/min	N/A	0.53
lb/MM Btu Output	N/A	2.62

Air/Fuel Ratio (A/F)	9.73

VERSION: **2.4** **4/15/2010**

DILUTION TUNNEL & MISC. DATA - ASTM E2779 / E2515

Client:	Laminox	Job #:	23-210
Model:	Giulia	Tracking #:	164
Run #:	1	Technician:	AK
Test Start Time:	10:00	Date:	10/18/2023

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

Meter Box γ Factor:	1.004	(A)
Meter Box γ Factor:	1.004	(B)
Meter Box γ Factor:	1.011	(C)
Meter Box γ Factor:	1.003	(Ambient)
Induced Draft Check (in. H_2O):	0	
Smoke Capture Check (%):	100%	
Date Flue Pipe Last Cleaned:	10/13/2023	
Platform Scale Audit (lbs)	10.0	

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.86	29.87	29.87
Relative Humidity (%)	45.8	49.9	
Room Air Velocity (ft/min)	<50	<50	
Pitot Tube Leak Check	0	0	
Ambient Sample Volume:		84.694	ft^3

Sample Train Leak Checks

	Pre-test	Post-test			
(A)	0.000	0.000	cfm @	-5	in. Hg
(B)	0.000	0.001	cfm @	-5	in. Hg
(C)	0.000	0.000	cfm @	-6	in. Hg
(Ambient)	0.000	0.000	cfm @	-12	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.010	73
2	0.014	73
3	0.014	73
4	0.016	73
5	0.014	73
6	0.008	74
7	0.010	74
8	0.014	74
9	0.014	74
10	0.018	74
11	0.014	75
12	0.012	75
Center	0.018	75

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	12	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.7854	ft^2
V_{strav}:	7.614	ft/sec
V_{scent}:	8.960	ft/sec
F_p:	0.850	[ratio]
Initial Tunnel Flow:	347.1	scf/min

Static Pressure: -0.100 in. H_2O

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:	Golden Fire
Pellet Fuel Grade:	PFI Premium
HHV (BTU/lb)	8702
%C	47.19
%H	9.01
%O	43.6
%Ash	0.2
MC (%WB)	2.54

PELLET STOVE PREBURN DATA - ASTM E2779

Client: Laminox
Job #: 23-210
Model: Giulia
Tracking #: 164
Run #: 1
Technician: AK
Date: 10/18/2023

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

		Average:	-0.046	247	60
Elapsed Time (min)	**Scale Reading (lbs)**	**Weight Change (lbs)**	**Flue Draft (in H_2O)**	**Flue (°F)**	**Ambient (°F)**
0	51.0	-	-0.026	187	59
1	50.9	-0.06	-0.031	177	59
2	50.8	-0.11	-0.031	183	59
3	50.7	-0.11	-0.031	188	59
4	50.6	-0.12	-0.033	193	59
5	50.4	-0.11	-0.035	197	59
6	50.3	-0.11	-0.037	201	59
7	50.2	-0.13	-0.035	205	59
8	50.1	-0.11	-0.038	208	59
9	50.0	-0.11	-0.037	211	59
10	49.9	-0.12	-0.037	214	59
11	49.8	-0.11	-0.039	217	59
12	49.6	-0.11	-0.039	220	59
13	49.5	-0.12	-0.042	223	59
14	49.4	-0.12	-0.041	226	59
15	49.3	-0.1	-0.043	228	59
16	49.2	-0.11	-0.041	229	59
17	49.1	-0.12	-0.042	231	59
18	49.0	-0.12	-0.045	234	59
19	48.8	-0.12	-0.043	237	59
20	48.7	-0.11	-0.044	238	59
21	48.6	-0.12	-0.047	241	59
22	48.5	-0.12	-0.041	242	59
23	48.4	-0.11	-0.045	243	59
24	48.3	-0.11	-0.047	245	60
25	48.1	-0.13	-0.046	247	60
26	48.0	-0.11	-0.048	250	60
27	47.9	-0.1	-0.047	250	60
28	47.8	-0.11	-0.047	251	60
29	47.7	-0.14	-0.046	254	60
30	47.6	-0.12	-0.046	255	60
31	47.4	-0.11	-0.049	257	60
32	47.3	-0.12	-0.048	258	60
33	47.2	-0.12	-0.049	260	60
34	47.1	-0.12	-0.047	261	60
35	47.0	-0.12	-0.053	263	60
36	46.8	-0.12	-0.050	264	60
37	46.7	-0.13	-0.050	265	60
38	46.6	-0.11	-0.050	267	60
39	46.5	-0.13	-0.052	268	60
40	46.3	-0.13	-0.048	270	60
41	46.2	-0.11	-0.047	271	60
42	46.1	-0.14	-0.055	287	60
43	46.0	-0.11	-0.052	279	61
44	45.9	-0.1	-0.052	276	60
45	45.8	-0.13	-0.052	276	60
46	45.6	-0.11	-0.053	275	60

PELLET STOVE PREBURN DATA - ASTM E2779

Client: Laminox
Job #: 23-210
Model: Giulia
Tracking #: 164
Run #: 1
Technician: AK
Date: 10/18/2023

47	45.5	-0.1	-0.054	275	61
48	45.4	-0.12	-0.055	276	61
49	45.3	-0.11	-0.053	276	61
50	45.2	-0.13	-0.053	276	61
51	45.1	-0.11	-0.055	277	61
52	45.0	-0.11	-0.052	277	61
53	44.8	-0.12	-0.053	278	61
54	44.8	-0.09	-0.054	277	61
55	44.6	-0.12	-0.053	277	61
56	44.5	-0.12	-0.055	278	61
57	44.4	-0.11	-0.051	277	61
58	44.3	-0.1	-0.057	277	62
59	44.2	-0.12	-0.055	277	62
60	44.1	-0.12	-0.054	278	62

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.017	0.18	66.5	0.29		27.3		80	278	65	62
1	0.132	0.132	0.016	2.03	66.3	0.77	-	27.2	-0.1	80	279	66	61.8
2	0.277	0.145	0.016	2.06	66.3	0.82	-	27.1	-0.1	80	280	66	61.7
3	0.417	0.140	0.017	2.10	66.2	0.82	-	27.0	-0.1	80	280	66	62
4	0.560	0.143	0.017	2.12	66.3	0.81	-	26.9	-0.1	80	279	66	62
5	0.703	0.143	0.017	2.13	66.3	0.82	-	26.7	-0.1	80	280	66	61.9
6	0.846	0.143	0.017	2.16	66.3	0.81	-	26.6	-0.1	80	280	66	61.9
7	0.993	0.147	0.017	2.17	66.4	0.83	-	26.5	-0.1	80	280	66	62
8	1.134	0.141	0.017	2.19	66.5	0.82	-	26.4	-0.1	80	280	66	62
9	1.281	0.147	0.017	2.20	66.7	0.8	-	26.3	-0.1	81	280	67	62
10	1.424	0.143	0.016	2.20	66.8	0.81	98	26.2	-0.1	81	280	67	62.2
11	1.574	0.150	0.017	2.23	67	0.8	-	26.1	-0.1	81	281	67	62.2
12	1.718	0.144	0.017	2.23	67.1	0.84	-	25.9	-0.1	81	281	67	61.9
13	1.866	0.148	0.018	2.24	67.4	0.83	-	25.8	-0.1	81	282	67	61.8
14	2.012	0.146	0.018	2.25	67.4	0.84	-	25.7	-0.1	81	282	67	61.9
15	2.159	0.147	0.017	2.27	67.7	0.84	-	25.6	-0.1	81	283	67	62.2
16	2.306	0.147	0.017	2.27	67.9	0.86	-	25.5	-0.1	81	284	67	62.3
17	2.454	0.148	0.017	2.27	68.2	0.87	-	25.3	-0.1	81	284	67	62
18	2.603	0.149	0.017	2.29	68.5	0.86	-	25.2	-0.1	81	285	67	62.3
19	2.751	0.148	0.017	2.29	68.7	0.85	-	25.1	-0.1	81	286	67	62.4
20	2.901	0.150	0.017	2.30	68.9	0.89	101	25.0	-0.1	81	286	68	62.1
21	3.048	0.147	0.017	2.31	69.2	0.85	-	24.9	-0.1	81	285	68	62.4
22	3.199	0.151	0.017	2.31	69.5	0.88	-	24.8	-0.1	82	296	68	62.1
23	3.347	0.148	0.016	2.33	69.8	0.87	-	24.7	-0.1	82	295	68	62.4
24	3.499	0.152	0.016	2.32	70.2	0.89	-	24.5	-0.1	82	291	68	62.3
25	3.647	0.148	0.017	2.33	70.4	0.85	-	24.4	-0.1	81	289	68	62.3
26	3.799	0.152	0.017	2.34	70.8	0.85	-	24.3	-0.1	81	287	68	62.1
27	3.949	0.150	0.017	2.35	71.1	0.86	-	24.2	-0.1	81	286	68	62.2
28	4.101	0.152	0.016	2.36	71.4	0.88	-	24.1	-0.1	81	286	68	62.1
29	4.251	0.150	0.017	2.35	71.7	0.91	-	24.0	-0.1	81	285	68	62.1
30	4.402	0.151	0.017	2.36	72	0.91	101	23.8	-0.1	81	285	68	62.1
31	4.553	0.151	0.017	2.36	72.5	0.9	-	23.7	-0.1	81	286	68	62.2
32	4.705	0.152	0.017	2.36	72.8	0.89	-	23.6	-0.1	81	286	68	62.3

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
33	4.857	0.152	0.017	2.38	73.1	0.88	-	23.5	-0.1	82	286	68	62
34	5.009	0.152	0.016	2.37	73.4	0.88	-	23.4	-0.1	82	286	68	62.2
35	5.162	0.153	0.017	2.39	73.8	0.94	-	23.3	-0.1	82	287	68	62.7
36	5.313	0.151	0.016	2.38	74.1	0.92	-	23.1	-0.1	82	287	68	62.5
37	5.467	0.154	0.016	2.39	74.5	0.93	-	23.0	-0.1	82	286	68	62.3
38	5.618	0.151	0.016	2.40	74.7	0.94	-	22.9	-0.1	82	286	68	62.6
39	5.772	0.154	0.017	2.39	75.1	0.9	-	22.8	-0.1	82	285	68	62.9
40	5.922	0.150	0.017	2.40	75.4	0.94	102	22.7	-0.1	82	285	68	63
41	6.078	0.156	0.016	2.39	75.8	0.96	-	22.5	-0.1	82	287	68	62.7
42	6.227	0.149	0.017	2.39	76.1	0.93	-	22.4	-0.1	82	286	68	62.5
43	6.384	0.157	0.016	2.40	76.4	0.94	-	22.3	-0.1	82	285	68	63
44	6.535	0.151	0.017	2.40	76.7	0.97	-	22.2	-0.1	82	286	68	62.8
45	6.691	0.156	0.017	2.41	77	0.94	-	22.1	-0.1	82	287	69	63
46	6.842	0.151	0.016	2.41	77.3	0.97	-	21.9	-0.1	82	287	69	63
47	6.996	0.154	0.016	2.41	77.5	0.97	-	21.8	-0.1	82	286	69	63.2
48	7.148	0.152	0.017	2.40	77.8	0.96	-	21.7	-0.1	82	286	69	63.4
49	7.302	0.154	0.017	2.40	78.1	0.93	-	21.6	-0.1	82	287	69	63.4
50	7.457	0.155	0.016	2.41	78.4	0.93	104	21.5	-0.1	83	287	69	63.5
51	7.611	0.154	0.017	2.42	78.7	0.97	-	21.4	-0.1	83	288	69	63.6
52	7.767	0.156	0.017	2.42	79.1	0.95	-	21.2	-0.1	83	287	69	64
53	7.917	0.150	0.018	2.42	79.3	0.98	-	21.1	-0.1	83	287	69	63.8
54	8.074	0.157	0.018	2.42	79.5	0.94	-	21.0	-0.1	83	287	69	63.9
55	8.225	0.151	0.017	2.41	79.8	0.98	-	20.9	-0.1	83	287	69	64.1
56	8.383	0.158	0.017	2.41	80.1	0.95	-	20.8	-0.1	83	287	69	63.8
57	8.535	0.152	0.017	2.43	80.4	0.97	-	20.6	-0.1	83	287	69	64
58	8.692	0.157	0.017	2.43	80.6	1.01	-	20.5	-0.1	83	288	69	63.9
59	8.843	0.151	0.017	2.41	81	1.01	-	20.4	-0.1	83	288	69	63.9
60	8.999	0.156	0.017	2.42	81.2	1.03	104	20.3	-0.1	83	288	69	64.2
61	9.154	0.155	0.016	2.43	81.4	0.99	-	20.2	-0.1	82	274	69	64
62	9.309	0.155	0.017	2.43	81.6	1.02	-	20.1	-0.1	81	266	69	64.1
63	9.466	0.157	0.018	2.43	81.9	1.01	-	20.0	-0.1	83	285	69	63.8
64	9.617	0.151	0.017	2.43	82.1	1.03	-	19.9	-0.1	82	274	69	64
65	9.773	0.156	0.018	2.44	82.3	1	-	19.9	-0.1	81	266	69	64.1

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
66	9.928	0.155	0.017	2.43	82.5	0.99	-	19.8	-0.1	80	259	69	64.2
67	10.086	0.158	0.017	2.44	82.7	1.01	-	19.7	-0.1	80	254	69	64.2
68	10.240	0.154	0.017	2.45	82.9	1	-	19.7	-0.1	80	251	69	64
69	10.396	0.156	0.017	2.44	83.2	1	-	19.6	-0.1	80	248	69	64.3
70	10.551	0.155	0.017	2.44	83.4	0.98	102	19.5	-0.1	79	247	69	64.4
71	10.707	0.156	0.017	2.45	83.6	1	-	19.4	-0.1	79	247	69	64.4
72	10.865	0.158	0.018	2.45	83.8	0.98	-	19.4	-0.1	79	244	69	64.5
73	11.017	0.152	0.017	2.44	84	0.98	-	19.3	-0.1	79	244	69	64.4
74	11.176	0.159	0.017	2.44	84.2	1.01	-	19.2	-0.1	80	243	69	64.2
75	11.330	0.154	0.017	2.45	84.4	0.99	-	19.2	-0.1	79	242	69	64.5
76	11.489	0.159	0.017	2.46	84.6	1.02	-	19.1	-0.1	80	240	70	64.8
77	11.642	0.153	0.018	2.45	84.7	1.01	-	19.0	-0.1	79	240	69	64.6
78	11.799	0.157	0.017	2.45	85	1	-	18.9	-0.1	80	239	70	65
79	11.957	0.158	0.017	2.45	85.2	1	-	18.9	-0.1	79	238	70	65.1
80	12.113	0.156	0.016	2.46	85.3	1.01	104	18.8	-0.1	79	236	70	65.1
81	12.270	0.157	0.017	2.45	85.5	1.02	-	18.7	-0.1	79	236	70	65
82	12.424	0.154	0.018	2.45	85.7	1.02	-	18.7	-0.1	79	235	70	65.1
83	12.584	0.160	0.017	2.46	85.9	1.01	-	18.6	-0.1	79	234	70	64.6
84	12.739	0.155	0.018	2.47	86.1	1.02	-	18.5	-0.1	79	234	70	64.8
85	12.896	0.157	0.016	2.46	86.2	1	-	18.4	-0.1	79	233	70	64.6
86	13.054	0.158	0.018	2.46	86.4	0.98	-	18.4	-0.1	79	233	69	64.6
87	13.210	0.156	0.018	2.47	86.5	0.98	-	18.3	-0.1	79	232	69	64.8
88	13.368	0.158	0.018	2.46	86.7	1	-	18.2	-0.1	79	231	69	64.5
89	13.522	0.154	0.017	2.46	86.9	1.01	-	18.1	-0.1	79	230	70	64.6
90	13.683	0.161	0.018	2.47	87	1.03	102	18.1	-0.1	79	230	70	64.5
91	13.838	0.155	0.018	2.48	87.2	1.03	-	18.0	-0.1	79	229	69	64.6
92	13.995	0.157	0.018	2.47	87.3	1.03	-	17.9	-0.1	79	229	69	64.8
93	14.153	0.158	0.018	2.46	87.5	1.02	-	17.8	-0.1	79	230	69	64.7
94	14.310	0.157	0.018	2.48	87.7	0.99	-	17.8	-0.1	79	229	69	64.8
95	14.468	0.158	0.018	2.47	87.8	1.01	-	17.7	-0.1	79	228	70	64.8
96	14.622	0.154	0.017	2.47	87.9	1.03	-	17.6	-0.1	79	228	70	64.9
97	14.784	0.162	0.018	2.46	88	1.01	-	17.6	-0.1	79	227	70	65.3
98	14.938	0.154	0.017	2.47	88.2	1	-	17.5	-0.1	79	227	70	65.5

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
99	15.096	0.158	0.017	2.46	88.4	1.01	-	17.4	-0.1	79	226	70	65.5
100	15.255	0.159	0.018	2.47	88.5	1.05	99	17.4	-0.1	79	225	70	65.4
101	15.411	0.156	0.017	2.48	88.6	1.01	-	17.3	-0.1	79	225	70	65.5
102	15.570	0.159	0.017	2.48	88.7	1.04	-	17.2	-0.1	79	225	70	65.6
103	15.725	0.155	0.017	2.47	88.8	1.02	-	17.1	-0.1	79	225	70	65.6
104	15.887	0.162	0.017	2.48	89	1.01	-	17.0	-0.1	82	254	70	65.8
105	16.041	0.154	0.017	2.48	89.1	1.02	-	17.0	-0.1	80	241	70	65.9
106	16.200	0.159	0.017	2.48	89.2	1.06	-	16.9	-0.1	79	236	70	66
107	16.359	0.159	0.017	2.47	89.3	1.02	-	16.8	-0.1	79	232	70	66
108	16.514	0.155	0.017	2.48	89.4	1.05	-	16.8	-0.1	79	230	70	65.8
109	16.674	0.160	0.017	2.48	89.6	1.05	-	16.7	-0.1	79	229	70	65.6
110	16.830	0.156	0.017	2.47	89.7	1.04	101	16.6	-0.1	79	228	70	66.2
111	16.989	0.159	0.017	2.48	89.8	1.04	-	16.5	-0.1	79	227	70	66.3
112	17.146	0.157	0.017	2.47	89.9	1.01	-	16.4	-0.1	79	227	70	66.1
113	17.305	0.159	0.017	2.47	90	1.06	-	16.4	-0.1	79	227	70	66.1
114	17.464	0.159	0.018	2.47	90.2	1.03	-	16.3	-0.1	80	227	70	66.2
115	17.618	0.154	0.018	2.46	90.3	1.01	-	16.2	-0.1	79	226	70	66.2
116	17.781	0.163	0.018	2.48	90.4	1.03	-	16.2	-0.1	79	225	70	66.1
117	17.936	0.155	0.017	2.48	90.4	1.04	-	16.1	-0.1	79	224	70	66.4
118	18.094	0.158	0.017	2.48	90.6	1.02	-	16.0	-0.1	80	224	70	66.4
119	18.254	0.160	0.017	2.48	90.7	1.05	-	15.9	-0.1	80	224	70	66.2
120	18.410	0.156	0.018	2.49	90.8	1.04	101	15.9	-0.1	79	224	70	66.3
121	18.570	0.160	0.017	2.47	91	1.05	-	15.8	-0.1	79	224	71	66.5
122	18.726	0.156	0.018	2.48	91	1.01	-	15.7	-0.1	79	222	71	66.4
123	18.886	0.160	0.017	2.48	91.2	1.05	-	15.6	-0.1	79	223	71	66.6
124	19.042	0.156	0.017	2.47	91.2	1.08	-	15.6	-0.1	80	223	71	66.4
125	19.201	0.159	0.017	2.47	91.4	1.01	-	15.5	-0.1	80	223	71	66.5
126	19.361	0.160	0.018	2.48	91.4	1.03	-	15.4	-0.1	80	223	71	66.3
127	19.515	0.154	0.017	2.46	91.5	1.05	-	15.3	-0.1	80	224	71	66.4
128	19.678	0.163	0.018	2.47	91.6	1.05	-	15.3	-0.1	80	224	71	66.3
129	19.833	0.155	0.017	2.48	91.7	1.06	-	15.2	-0.1	80	223	71	66.4
130	19.992	0.159	0.017	2.47	91.7	1.05	101	15.1	-0.1	80	223	71	66.4
131	20.148	0.156	0.018	2.47	91.8	1.05	-	15.0	-0.1	80	222	71	66.5

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
132	20.306	0.158	0.018	2.47	91.8	1.05	-	15.0	-0.1	80	222	71	66.7
133	20.468	0.162	0.017	2.47	91.9	1.06	-	14.9	-0.1	80	223	71	66.5
134	20.621	0.153	0.017	2.46	92	1.05	-	14.8	-0.1	80	225	71	66.6
135	20.782	0.161	0.017	2.47	92.1	1.05	-	14.7	-0.1	80	224	71	66.8
136	20.937	0.155	0.017	2.46	92.1	1.07	-	14.7	-0.1	80	223	71	67
137	21.099	0.162	0.017	2.46	92.3	1.08	-	14.6	-0.1	80	222	71	66.8
138	21.259	0.160	0.018	2.47	92.3	1.06	-	14.5	-0.1	80	223	71	66.8
139	21.413	0.154	0.016	2.47	92.4	1.06	-	14.4	-0.1	80	223	71	66.9
140	21.575	0.162	0.017	2.47	92.5	1.08	102	14.3	-0.1	80	224	71	66.7
141	21.731	0.156	0.017	2.46	92.6	1.08	-	14.3	-0.1	80	224	71	66.8
142	21.889	0.158	0.017	2.46	92.6	1.08	-	14.2	-0.1	80	224	71	66.5
143	22.047	0.158	0.017	2.45	92.7	1.08	-	14.1	-0.1	80	224	71	67
144	22.205	0.158	0.017	2.46	92.8	1.07	-	14.0	-0.1	81	230	71	67.1
145	22.364	0.159	0.018	2.47	92.9	1.08	-	13.9	-0.1	82	247	71	67
146	22.519	0.155	0.017	2.45	92.9	1.05	-	13.9	-0.1	81	237	71	67
147	22.680	0.161	0.016	2.45	93	1.09	-	13.8	-0.1	81	233	71	67
148	22.835	0.155	0.018	2.45	93.1	1.09	-	13.7	-0.1	81	230	71	66.8
149	22.993	0.158	0.017	2.45	93.1	1.09	-	13.6	-0.1	80	229	72	67.1
150	23.153	0.160	0.018	2.45	93.2	1.08	100	13.6	-0.1	80	228	71	67.1
151	23.308	0.155	0.017	2.46	93.2	1.08	-	13.5	-0.1	80	227	72	67
152	23.468	0.160	0.017	2.44	93.3	1.11	-	13.4	-0.1	80	226	72	67.1
153	23.624	0.156	0.017	2.45	93.3	1.1	-	13.3	-0.1	80	226	72	67.3
154	23.784	0.160	0.017	2.46	93.4	1.09	-	13.2	-0.1	81	228	72	67.2
155	23.940	0.156	0.016	2.44	93.4	1.11	-	13.2	-0.1	80	227	72	67.4
156	24.098	0.158	0.017	2.45	93.5	1.09	-	13.1	-0.1	80	226	72	67.3
157	24.258	0.160	0.016	2.45	93.5	1.09	-	13.0	-0.1	80	225	72	67.5
158	24.412	0.154	0.017	2.44	93.7	1.11	-	12.9	-0.1	81	225	72	67.4
159	24.573	0.161	0.017	2.44	93.7	1.09	-	12.9	-0.1	81	226	72	67.4
160	24.728	0.155	0.017	2.45	93.6	1.11	100	12.8	-0.1	81	226	72	67.2
161	24.887	0.159	0.017	2.44	93.7	1.09	-	12.7	-0.1	80	226	72	67.2
162	25.044	0.157	0.017	2.44	93.7	1.09	-	12.6	-0.1	80	226	72	67.5
163	25.201	0.157	0.017	2.43	93.8	1.12	-	12.5	-0.1	80	226	72	67.5
164	25.360	0.159	0.017	2.44	93.8	1.13	-	12.5	-0.1	80	225	72	67.4

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
165	25.514	0.154	0.016	2.43	94	1.11	-	12.4	-0.1	81	225	72	67.5
166	25.675	0.161	0.018	2.43	94	1.12	-	12.3	-0.1	81	225	72	67.4
167	25.830	0.155	0.017	2.44	94.1	1.12	-	12.2	-0.1	80	225	72	67.5
168	25.988	0.158	0.017	2.44	94.1	1.13	-	12.2	-0.1	81	225	72	67.5
169	26.147	0.159	0.017	2.44	94.2	1.11	-	12.1	-0.1	81	226	72	67.6
170	26.303	0.156	0.017	2.44	94.2	1.12	101	12.0	-0.1	81	225	72	67.7
171	26.462	0.159	0.017	2.43	94.2	1.1	-	11.9	-0.1	81	225	72	67.7
172	26.617	0.155	0.017	2.43	94.3	1.11	-	11.9	-0.1	81	225	72	67.9
173	26.777	0.160	0.018	2.43	94.4	1.13	-	11.8	-0.1	81	225	72	67.9
174	26.931	0.154	0.017	2.42	94.4	1.13	-	11.7	-0.1	81	225	72	68
175	27.089	0.158	0.017	2.42	94.4	1.14	-	11.6	-0.1	81	225	72	68
176	27.248	0.159	0.018	2.43	94.5	1.13	-	11.5	-0.1	81	225	72	68
177	27.404	0.156	0.018	2.43	94.5	1.11	-	11.5	-0.1	81	225	72	68.2
178	27.563	0.159	0.018	2.43	94.5	1.15	-	11.4	-0.1	81	224	72	68.2
179	27.718	0.155	0.016	2.42	94.6	1.13	-	11.3	-0.1	81	225	72	68.2
180	27.876	0.158	0.017	2.51	94.7	1.15	101	11.2	-0.1	80	220	72	68.1
181	28.032	0.156	0.016	2.50	94.7	1.17	-	11.2	-0.1	80	215	72	68.1
182	28.193	0.161	0.017	2.49	94.8	1.15	-	11.1	-0.1	80	211	72	68.2
183	28.356	0.163	0.017	2.49	94.8	1.16	-	11.1	-0.1	80	209	72	68.3
184	28.512	0.156	0.017	2.46	94.8	1.08	-	11.0	-0.1	79	207	72	68.3
185	28.674	0.162	0.018	2.47	94.8	1.09	-	10.9	-0.1	81	226	72	68.1
186	28.830	0.156	0.018	2.47	94.9	1.2	-	10.8	-0.1	81	231	72	68.3
187	28.990	0.160	0.016	2.49	95	1.19	-	10.8	0.0	80	220	72	68.7
188	29.152	0.162	0.017	2.49	95	1.15	-	10.7	-0.1	80	215	72	68.4
189	29.307	0.155	0.017	2.48	95.1	1.18	-	10.7	0.0	80	211	72	68.6
190	29.470	0.163	0.017	2.49	95.1	1.2	102	10.6	-0.1	80	208	72	68.5
191	29.627	0.157	0.017	2.49	95.1	1.16	-	10.6	-0.1	80	206	72	68.6
192	29.786	0.159	0.017	2.47	95.1	1.17	-	10.5	-0.1	80	205	72	68.6
193	29.947	0.161	0.018	2.48	95.2	1.17	-	10.5	0.0	79	204	72	68.6
194	30.103	0.156	0.018	2.48	95.3	1.2	-	10.4	-0.1	79	202	72	68.6
195	30.266	0.163	0.017	2.47	95.3	1.15	-	10.3	-0.1	80	201	72	68.5
196	30.423	0.157	0.017	2.47	95.3	1.18	-	10.3	-0.1	79	200	72	68.5
197	30.583	0.160	0.017	2.48	95.3	1.21	-	10.2	-0.1	79	199	72	68.6

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
198	30.742	0.159	0.017	2.47	95.3	1.2	-	10.2	-0.1	80	198	72	68.7
199	30.900	0.158	0.018	2.48	95.3	1.19	-	10.1	-0.1	80	198	72	68.8
200	31.061	0.161	0.017	2.47	95.4	1.2	102	10.0	-0.1	80	198	72	68.8
201	31.218	0.157	0.017	2.47	95.4	1.19	-	10.0	-0.1	80	198	73	68.5
202	31.378	0.160	0.017	2.47	95.5	1.2	-	9.9	-0.1	80	197	73	68.7
203	31.535	0.157	0.017	2.46	95.5	1.2	-	9.9	-0.1	80	196	73	68.7
204	31.695	0.160	0.018	2.46	95.5	1.2	-	9.8	-0.1	80	195	72	69
205	31.855	0.160	0.018	2.46	95.5	1.2	-	9.7	-0.1	80	196	72	69
206	32.010	0.155	0.018	2.46	95.5	1.2	-	9.7	-0.1	80	196	72	69
207	32.173	0.163	0.017	2.46	95.6	1.21	-	9.6	-0.1	80	195	73	69.1
208	32.329	0.156	0.018	2.47	95.6	1.18	-	9.5	-0.1	80	195	73	69.1
209	32.489	0.160	0.018	2.45	95.7	1.22	-	9.5	-0.1	80	195	73	69.1
210	32.649	0.160	0.018	2.46	95.7	1.24	100	9.4	-0.1	80	194	72	69.2
211	32.804	0.155	0.018	2.46	95.8	1.21	-	9.4	-0.1	79	194	72	69.2
212	32.966	0.162	0.018	2.45	95.8	1.2	-	9.3	-0.1	79	194	72	69.1
213	33.122	0.156	0.018	2.46	95.8	1.2	-	9.2	-0.1	80	194	73	69.2
214	33.281	0.159	0.017	2.45	95.9	1.2	-	9.2	-0.1	80	194	73	68.9
215	33.440	0.159	0.017	2.44	95.9	1.23	-	9.1	0.0	80	193	73	69.1
216	33.598	0.158	0.018	2.45	96	1.23	-	9.1	-0.1	80	193	73	69.1
217	33.757	0.159	0.018	2.44	96	1.22	-	9.0	-0.1	80	194	73	69.2
218	33.913	0.156	0.018	2.44	96.1	1.25	-	8.9	-0.1	80	193	73	69.3
219	34.074	0.161	0.017	2.43	96	1.21	-	8.9	-0.1	80	193	73	69.3
220	34.229	0.155	0.018	2.44	96.1	1.25	98	8.8	-0.1	80	192	73	69.3
221	34.388	0.159	0.018	2.43	96.1	1.25	-	8.8	-0.1	80	192	73	69.3
222	34.549	0.161	0.018	2.44	96.2	1.25	-	8.7	-0.1	80	193	73	69.3
223	34.703	0.154	0.018	2.44	96.1	1.23	-	8.6	-0.1	80	192	73	69.5
224	34.864	0.161	0.018	2.42	96.2	1.23	-	8.6	-0.1	80	193	73	69.3
225	35.020	0.156	0.018	2.43	96.3	1.23	-	8.5	-0.1	80	192	73	69.6
226	35.179	0.159	0.017	2.43	96.3	1.26	-	8.5	-0.1	82	218	73	69.4
227	35.336	0.157	0.017	2.43	96.3	1.26	-	8.4	-0.1	81	213	73	69.3
228	35.494	0.158	0.018	2.42	96.3	1.27	-	8.3	-0.1	81	206	73	69.1
229	35.653	0.159	0.017	2.42	96.3	1.24	-	8.3	-0.1	81	202	73	69.2
230	35.807	0.154	0.017	2.42	96.4	1.27	100	8.2	-0.1	80	200	73	69.1

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
231	35.969	0.162	0.017	2.41	96.4	1.27	-	8.1	-0.1	81	198	73	69.2
232	36.123	0.154	0.017	2.41	96.5	1.27	-	8.1	-0.1	81	196	73	69.4
233	36.282	0.159	0.018	2.41	96.5	1.27	-	8.0	-0.1	80	196	73	69.6
234	36.441	0.159	0.018	2.42	96.5	1.26	-	8.0	-0.1	80	195	73	69.6
235	36.596	0.155	0.017	2.42	96.5	1.29	-	7.9	-0.1	80	194	73	69.6
236	36.756	0.160	0.018	2.41	96.5	1.28	-	7.8	-0.1	80	193	73	69.4
237	36.911	0.155	0.017	2.41	96.5	1.26	-	7.8	-0.1	80	193	73	69.3
238	37.071	0.160	0.017	2.41	96.6	1.28	-	7.7	-0.1	80	192	73	69.4
239	37.226	0.155	0.017	2.41	96.6	1.26	-	7.7	-0.1	80	192	73	69.4
240	37.384	0.158	0.018	2.40	96.7	1.29	100	7.6	-0.1	80	191	73	69.5
241	37.543	0.159	0.018	2.40	96.7	1.26	-	7.5	-0.1	80	191	73	69.7
242	37.697	0.154	0.017	2.40	96.8	1.26	-	7.5	-0.1	80	191	73	69.3
243	37.856	0.159	0.017	2.40	96.8	1.29	-	7.4	-0.1	80	191	73	69.3
244	38.012	0.156	0.017	2.41	96.8	1.29	-	7.4	-0.1	80	191	73	69.4
245	38.171	0.159	0.017	2.40	96.9	1.29	-	7.3	-0.1	81	191	73	69.5
246	38.325	0.154	0.016	2.40	96.9	1.3	-	7.2	-0.1	80	191	73	69.4
247	38.480	0.155	0.016	2.38	97	1.3	-	7.2	-0.1	81	191	73	69.2
248	38.641	0.161	0.018	2.38	97	1.3	-	7.1	-0.1	81	191	73	69.5
249	38.795	0.154	0.018	2.39	97	1.32	-	7.0	-0.1	80	190	73	69.5
250	38.954	0.159	0.018	2.38	97	1.31	98	7.0	-0.1	80	191	73	69.6
251	39.108	0.154	0.018	2.38	97	1.31	-	6.9	-0.1	80	190	73	69.5
252	39.267	0.159	0.018	2.37	97.1	1.31	-	6.9	-0.1	80	190	73	69.6
253	39.421	0.154	0.018	2.38	97.1	1.32	-	6.8	0.0	80	189	73	69.7
254	39.578	0.157	0.017	2.37	97.1	1.32	-	6.7	-0.1	80	190	73	69.6
255	39.735	0.157	0.018	2.37	97.2	1.3	-	6.7	-0.1	80	190	73	69.5
256	39.890	0.155	0.017	2.36	97.2	1.34	-	6.6	-0.1	81	190	73	69.6
257	40.048	0.158	0.018	2.37	97.2	1.35	-	6.5	-0.1	80	190	73	69.5
258	40.198	0.150	0.017	2.37	97.2	1.32	-	6.5	-0.1	80	190	73	69.7
259	40.356	0.158	0.017	2.36	97.2	1.35	-	6.4	-0.1	80	190	73	69.7
260	40.510	0.154	0.018	2.36	97.3	1.35	97	6.4	-0.1	80	190	73	69.7
261	40.671	0.161	0.017	2.35	97.3	1.34	-	6.3	-0.1	81	190	73	69.6
262	40.824	0.153	0.017	2.35	97.4	1.34	-	6.2	-0.1	81	190	74	69.6
263	40.980	0.156	0.018	2.34	97.4	1.37	-	6.2	-0.1	81	190	74	69.7

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
264	41.137	0.157	0.018	2.35	97.4	1.34	-	6.1	-0.1	81	190	74	69.7
265	41.292	0.155	0.018	2.35	97.4	1.35	-	6.0	-0.1	81	191	74	69.8
266	41.448	0.156	0.016	2.34	97.4	1.37	-	6.0	-0.1	81	191	74	69.7
267	41.600	0.152	0.017	2.34	97.5	1.34	-	5.9	-0.1	84	223	74	69.8
268	41.759	0.159	0.018	2.34	97.5	1.35	-	5.8	-0.1	82	211	74	69.9
269	41.909	0.150	0.017	2.34	97.5	1.34	-	5.8	0.0	81	205	74	69.9
270	42.067	0.158	0.017	2.33	97.6	1.36	98	5.7	-0.1	81	201	74	69.8
271	42.221	0.154	0.018	2.40	97.5	1.4	-	5.7	-0.1	81	198	74	69.7
272	42.382	0.161	0.017	2.40	97.6	1.42	-	5.6	-0.1	81	197	74	69.8
273	42.540	0.158	0.018	2.40	97.7	1.39	-	5.5	-0.1	81	196	74	70
274	42.694	0.154	0.018	2.40	97.6	1.4	-	5.5	-0.1	81	195	74	70
275	42.853	0.159	0.018	2.39	97.8	1.39	-	5.4	-0.1	81	194	74	70
276	43.008	0.155	0.017	2.39	97.8	1.41	-	5.3	-0.1	81	193	74	70
277	43.168	0.160	0.017	2.39	97.7	1.39	-	5.3	-0.1	81	192	74	69.8
278	43.322	0.154	0.017	2.39	97.8	1.43	-	5.2	-0.1	81	192	74	70
279	43.479	0.157	0.017	2.37	97.8	1.41	-	5.2	-0.1	81	192	74	70
280	43.637	0.158	0.018	2.39	97.8	1.42	99	5.1	-0.1	81	192	74	70.1
281	43.790	0.153	0.018	2.38	97.8	1.4	-	5.0	-0.1	81	191	74	70.1
282	43.950	0.160	0.017	2.38	97.8	1.44	-	5.0	-0.1	81	191	74	70.3
283	44.101	0.151	0.017	2.37	97.9	1.44	-	4.9	-0.1	81	191	74	70.1
284	44.259	0.158	0.018	2.37	97.9	1.44	-	4.9	-0.1	81	191	74	70.1
285	44.417	0.158	0.018	2.38	97.9	1.44	-	4.8	-0.1	81	192	74	70.3
286	44.574	0.157	0.017	2.37	98	1.43	-	4.7	-0.1	81	192	74	70.3
287	44.731	0.157	0.018	2.36	98	1.44	-	4.7	-0.1	81	191	74	70.3
288	44.886	0.155	0.017	2.37	98.1	1.44	-	4.6	-0.1	81	191	74	70.2
289	45.044	0.158	0.018	2.37	98.1	1.43	-	4.5	-0.1	81	191	74	70.5
290	45.197	0.153	0.017	2.37	98.1	1.41	98	4.5	-0.1	81	191	74	70.3
291	45.353	0.156	0.016	2.36	98.2	1.46	-	4.4	-0.1	81	191	74	70.2
292	45.510	0.157	0.017	2.35	98.1	1.43	-	4.4	-0.1	81	191	74	70.1
293	45.668	0.158	0.018	2.36	98.2	1.48	-	4.3	0.0	81	190	74	70.2
294	45.818	0.150	0.017	2.35	98.2	1.48	-	4.2	-0.1	81	191	74	70.5
295	45.977	0.159	0.017	2.34	98.2	1.48	-	4.2	-0.1	81	191	74	70.3
296	46.134	0.157	0.018	2.35	98.3	1.49	-	4.1	-0.1	81	191	74	70.5

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
297	46.283	0.149	0.017	2.34	98.3	1.49	-	4.0	-0.1	81	191	74	70.3
298	46.443	0.160	0.017	2.35	98.3	1.49	-	4.0	-0.1	81	191	74	70.1
299	46.597	0.154	0.018	2.33	98.3	1.48	-	3.9	-0.1	81	191	74	70.3
300	46.753	0.156	0.018	2.34	98.3	1.5	98	3.9	-0.1	81	191	74	70.4
301	46.903	0.150	0.017	2.33	98.4	1.47	-	3.8	0.0	81	190	74	70.5
302	47.063	0.160	0.017	2.34	98.4	1.48	-	3.7	-0.1	81	190	74	70.4
303	47.218	0.155	0.016	2.33	98.4	1.48	-	3.7	-0.1	82	190	74	70.3
304	47.372	0.154	0.016	2.33	98.4	1.47	-	3.6	-0.1	82	190	74	70.3
305	47.526	0.154	0.018	2.32	98.5	1.49	-	3.5	-0.1	82	191	74	70.6
306	47.681	0.155	0.017	2.32	98.5	1.48	-	3.5	-0.1	81	190	74	70.5
307	47.837	0.156	0.017	2.31	98.5	1.5	-	3.4	-0.1	82	196	74	70.6
308	47.989	0.152	0.017	2.32	98.5	1.51	-	3.4	-0.1	84	218	74	70.7
309	48.146	0.157	0.018	2.32	98.5	1.51	-	3.3	-0.1	82	208	74	70.7
310	48.296	0.150	0.018	2.30	98.5	1.53	96	3.2	-0.1	82	203	74	70.7
311	48.458	0.162	0.018	2.30	98.6	1.52	-	3.2	-0.1	82	200	74	70.9
312	48.609	0.151	0.018	2.30	98.6	1.53	-	3.1	-0.1	82	198	74	70.9
313	48.761	0.152	0.018	2.30	98.6	1.52	-	3.0	-0.1	81	197	74	70.8
314	48.913	0.152	0.018	2.31	98.7	1.52	-	3.0	-0.1	82	195	74	71
315	49.072	0.159	0.017	2.30	98.6	1.54	-	2.9	-0.1	82	194	74	70.7
316	49.223	0.151	0.018	2.30	98.7	1.54	-	2.8	-0.1	82	195	74	70.6
317	49.381	0.158	0.017	2.30	98.7	1.53	-	2.8	-0.1	82	195	75	70.6
318	49.531	0.150	0.017	2.29	98.7	1.53	-	2.7	-0.1	82	194	75	70.6
319	49.683	0.152	0.017	2.29	98.8	1.53	-	2.7	-0.1	82	193	75	70.6
320	49.841	0.158	0.018	2.29	98.8	1.53	96	2.6	-0.1	82	193	75	70.6
321	49.992	0.151	0.018	2.30	98.8	1.55	-	2.5	-0.1	82	193	75	70.8
322	50.151	0.159	0.018	2.29	98.8	1.55	-	2.5	-0.1	82	193	75	70.8
323	50.296	0.145	0.018	2.28	98.8	1.55	-	2.4	-0.1	82	194	75	70.9
324	50.453	0.157	0.017	2.28	98.9	1.54	-	2.3	-0.1	82	193	75	70.8
325	50.607	0.154	0.017	2.27	98.9	1.56	-	2.3	-0.1	82	192	75	70.7
326	50.765	0.158	0.018	2.34	99	1.61	-	2.2	-0.1	82	192	75	70.8
327	50.916	0.151	0.017	2.35	99	1.58	-	2.2	-0.1	82	192	75	71
328	51.076	0.160	0.017	2.34	99	1.59	-	2.1	-0.1	82	192	75	70.9
329	51.230	0.154	0.018	2.35	99	1.6	-	2.0	-0.1	82	192	75	70.9

BOX A TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
330	51.384	0.154	0.018	2.34	99.1	1.61	96	2.0	-0.1	82	191	75	71
331	51.540	0.156	0.018	2.33	99.1	1.6	-	1.9	-0.1	82	192	75	71.2
332	51.690	0.150	0.018	2.33	99.2	1.6	-	1.8	-0.1	82	192	75	71.1
333	51.854	0.164	0.018	2.33	99.1	1.61	-	1.8	-0.1	82	192	75	71.2
334	52.004	0.150	0.017	2.33	99.2	1.61	-	1.7	-0.1	82	192	75	71.3
335	52.162	0.158	0.017	2.33	99.2	1.65	-	1.6	-0.1	82	193	75	71.3
336	52.313	0.151	0.017	2.32	99.2	1.61	-	1.6	-0.1	82	193	75	71.2
337	52.469	0.156	0.017	2.33	99.2	1.62	-	1.5	-0.1	82	192	75	71.3
338	52.625	0.156	0.017	2.31	99.3	1.62	-	1.4	-0.1	82	192	75	71.2
339	52.779	0.154	0.017	2.32	99.3	1.63	-	1.4	-0.1	82	192	75	71.2
340	52.936	0.157	0.017	2.32	99.3	1.64	98	1.3	-0.1	82	192	75	71.3
341	53.087	0.151	0.017	2.31	99.3	1.64	-	1.2	-0.1	83	193	75	71.2
342	53.244	0.157	0.017	2.31	99.4	1.63	-	1.2	-0.1	83	193	75	71.3
343	53.396	0.152	0.017	2.31	99.4	1.63	-	1.1	-0.1	82	193	75	71
344	53.554	0.158	0.018	2.31	99.4	1.64	-	1.1	-0.1	82	193	75	71.4
345	53.706	0.152	0.018	2.30	99.4	1.63	-	1.0	-0.1	82	192	75	71.3
346	53.860	0.154	0.017	2.31	99.4	1.62	-	0.9	-0.1	83	193	75	71.5
347	54.017	0.157	0.018	2.30	99.5	1.64	-	0.8	-0.1	82	193	75	71.4
348	54.167	0.150	0.018	2.29	99.5	1.65	-	0.8	-0.1	84	209	75	71.5
349	54.324	0.157	0.017	2.30	99.4	1.65	-	0.7	-0.1	84	217	75	71.4
350	54.478	0.154	0.016	2.29	99.6	1.65	100	0.6	-0.1	83	210	75	71.5
351	54.634	0.156	0.017	2.30	99.5	1.66	-	0.6	-0.1	83	205	75	71.4
352	54.783	0.149	0.017	2.30	99.6	1.67	-	0.5	0.0	83	202	75	71.4
353	54.941	0.158	0.018	2.29	99.6	1.68	-	0.5	-0.1	83	200	75	71.4
354	55.091	0.150	0.018	2.28	99.6	1.68	-	0.4	-0.1	83	198	75	71.7
355	55.250	0.159	0.018	2.28	99.7	1.67	-	0.3	-0.1	83	197	75	71.7
356	55.401	0.151	0.018	2.29	99.6	1.7	-	0.3	-0.1	83	196	75	71.6
357	55.554	0.153	0.018	2.28	99.7	1.67	-	0.2	-0.1	83	196	75	71.6
358	55.708	0.154	0.018	2.29	99.8	1.69	-	0.1	-0.1	83	195	75	71.6
359	55.863	0.155	0.017	2.28	99.7	1.69	-	0.1	-0.1	83	195	75	71.6
360	56.015	0.152	0.018	2.28	99.8	1.68	98	0.0	-0.1	83	195	75	71.5
Avg/Tot	56.015	0.156	0.017	2.39	91	1.19	100			81	223	72	67

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.25	66.4	1.08		67	-0.055	15.47	0.78
1	0.147	0.147	2.42	66.2	1.47	-	67	-0.051	14.12	0.25
2	0.299	0.152	2.42	66.2	1.96	-	68	-0.054	15.56	0.54
3	0.447	0.148	2.41	66.4	1.52	-	68	-0.054	14.46	0.25
4	0.598	0.151	2.41	66.5	1.98	-	68	-0.055	13.73	0.18
5	0.746	0.148	2.41	66.5	2.02	-	68	-0.054	15.60	0.51
6	0.897	0.151	2.40	66.5	1.53	-	68	-0.054	14.74	0.26
7	1.045	0.148	2.40	66.7	1.93	-	69	-0.052	15.15	0.37
8	1.196	0.151	2.41	66.9	1.6	-	69	-0.053	15.36	0.67
9	1.345	0.149	2.41	66.9	1.49	-	69	-0.053	14.56	0.27
10	1.496	0.151	2.42	67.2	2.04	104	69	-0.054	16.28	0.98
11	1.645	0.149	2.42	67.3	1.5	-	69	-0.053	14.53	0.44
12	1.796	0.151	2.42	67.3	1.47	-	69	-0.053	15.35	0.34
13	1.947	0.151	2.42	67.5	1.81	-	69	-0.053	16.01	0.70
14	2.096	0.149	2.42	67.9	2.05	-	69	-0.052	14.88	0.42
15	2.247	0.151	2.41	68.1	1.57	-	69	-0.054	15.50	0.64
16	2.397	0.150	2.42	68.3	1.64	-	69	-0.052	15.33	0.40
17	2.549	0.152	2.42	68.6	1.7	-	69	-0.055	15.53	0.49
18	2.697	0.148	2.42	68.8	1.99	-	69	-0.054	15.49	0.71
19	2.849	0.152	2.41	69.1	1.55	-	69	-0.053	15.05	0.28
20	2.997	0.148	2.42	69.4	1.78	104	69	-0.053	13.91	0.22
21	3.150	0.153	2.42	69.7	1.56	-	69	-0.056	15.38	0.65
22	3.298	0.148	2.42	69.8	1.93	-	69	-0.049	14.38	0.36
23	3.451	0.153	2.41	70.3	1.59	-	70	-0.054	11.64	0.26
24	3.599	0.148	2.42	70.6	1.68	-	70	-0.056	15.35	0.55
25	3.753	0.154	2.42	71	1.85	-	70	-0.053	15.62	0.72
26	3.902	0.149	2.43	71.3	1.89	-	70	-0.053	15.31	0.39
27	4.055	0.153	2.42	71.5	1.59	-	70	-0.055	14.52	0.23
28	4.204	0.149	2.42	72	1.68	-	70	-0.054	16.06	0.83
29	4.358	0.154	2.43	72.4	1.68	-	70	-0.051	14.43	0.35
30	4.506	0.148	2.43	72.6	1.87	103	70	-0.053	16.14	0.84
31	4.659	0.153	2.42	73	2.03	-	70	-0.053	14.57	0.34

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
32	4.809	0.150	2.42	73.3	1.76	-	70	-0.053	15.46	0.58
33	4.961	0.152	2.42	73.5	1.67	-	70	-0.053	14.76	0.42
34	5.111	0.150	2.42	73.8	1.59	-	70	-0.055	14.75	0.37
35	5.264	0.153	2.42	74.2	1.92	-	70	-0.054	15.33	0.47
36	5.416	0.152	2.42	74.5	1.88	-	70	-0.053	15.51	0.52
37	5.567	0.151	2.42	74.8	2.03	-	70	-0.055	14.23	0.34
38	5.720	0.153	2.43	75.2	1.77	-	70	-0.054	15.13	0.43
39	5.870	0.150	2.43	75.5	1.78	-	70	-0.056	14.50	0.26
40	6.023	0.153	2.42	75.9	1.52	103	70	-0.053	15.96	1.10
41	6.173	0.150	2.42	76.1	2	-	70	-0.053	16.44	1.50
42	6.326	0.153	2.42	76.4	1.68	-	70	-0.053	14.00	0.21
43	6.477	0.151	2.42	76.7	2.04	-	71	-0.054	14.46	0.26
44	6.631	0.154	2.42	77.1	1.59	-	71	-0.054	16.28	1.08
45	6.781	0.150	2.41	77.4	1.69	-	71	-0.056	14.99	0.35
46	6.936	0.155	2.42	77.6	1.94	-	71	-0.053	16.10	0.76
47	7.084	0.148	2.42	78	1.59	-	71	-0.054	14.69	0.32
48	7.239	0.155	2.42	78.2	2.09	-	71	-0.054	13.94	0.16
49	7.389	0.150	2.41	78.6	1.86	-	71	-0.053	15.97	0.64
50	7.542	0.153	2.42	78.8	1.82	104	71	-0.054	14.53	0.43
51	7.695	0.153	2.42	79	1.55	-	71	-0.055	15.08	0.44
52	7.847	0.152	2.41	79.3	1.65	-	71	-0.055	14.86	0.40
53	8.001	0.154	2.42	79.5	1.64	-	71	-0.053	15.06	0.35
54	8.151	0.150	2.41	79.8	1.68	-	71	-0.054	15.16	0.24
55	8.305	0.154	2.42	80.1	2.06	-	71	-0.053	15.65	0.45
56	8.455	0.150	2.40	80.3	2.06	-	71	-0.055	15.93	0.66
57	8.611	0.156	2.42	80.5	1.82	-	71	-0.053	15.95	0.70
58	8.761	0.150	2.41	80.8	1.62	-	71	-0.054	16.12	0.88
59	8.916	0.155	2.42	81	1.95	-	71	-0.055	14.43	0.24
60	9.066	0.150	2.42	81.3	1.62	104	71	-0.057	16.23	0.73
61	9.220	0.154	2.41	81.4	2.08	-	71	-0.056	15.46	0.32
62	9.371	0.151	2.41	81.6	2.05	-	71	-0.054	13.45	0.12
63	9.524	0.153	2.41	81.9	1.54	-	71	-0.048	12.13	0.13

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
64	9.678	0.154	2.42	82.1	2.06	-	71	-0.055	12.31	0.19
65	9.828	0.150	2.41	82.4	1.86	-	71	-0.056	11.91	0.36
66	9.984	0.156	2.42	82.5	1.84	-	71	-0.052	11.27	0.38
67	10.135	0.151	2.42	82.7	1.94	-	71	-0.054	12.35	0.44
68	10.290	0.155	2.41	83	2.02	-	71	-0.051	12.22	0.59
69	10.440	0.150	2.42	83.3	1.67	-	71	-0.052	11.33	0.14
70	10.597	0.157	2.42	83.5	1.82	102	71	-0.051	12.19	0.25
71	10.747	0.150	2.42	83.7	1.55	-	71	-0.052	12.86	0.60
72	10.903	0.156	2.42	83.9	2.08	-	71	-0.050	12.70	0.32
73	11.053	0.150	2.42	84	1.59	-	71	-0.050	11.95	0.17
74	11.208	0.155	2.41	84.3	1.62	-	71	-0.050	13.17	0.31
75	11.361	0.153	2.42	84.4	1.62	-	71	-0.049	11.86	0.16
76	11.515	0.154	2.42	84.6	2.1	-	71	-0.049	11.05	0.07
77	11.669	0.154	2.42	84.7	1.7	-	71	-0.049	12.33	0.21
78	11.820	0.151	2.42	84.9	2.13	-	71	-0.052	12.81	0.26
79	11.976	0.156	2.42	85.2	1.98	-	71	-0.050	13.45	0.35
80	12.127	0.151	2.42	85.3	1.62	103	71	-0.053	11.65	0.11
81	12.284	0.157	2.42	85.5	1.58	-	71	-0.050	11.24	0.07
82	12.435	0.151	2.43	85.8	2.13	-	71	-0.048	12.46	0.10
83	12.590	0.155	2.42	85.8	1.86	-	71	-0.048	11.17	0.08
84	12.742	0.152	2.42	85.9	1.91	-	71	-0.046	12.51	0.25
85	12.897	0.155	2.42	86.1	1.58	-	71	-0.050	12.21	0.21
86	13.051	0.154	2.42	86.4	1.85	-	71	-0.049	11.34	0.11
87	13.205	0.154	2.43	86.4	1.84	-	71	-0.048	12.12	0.14
88	13.359	0.154	2.42	86.5	1.55	-	71	-0.049	13.00	0.19
89	13.510	0.151	2.42	86.5	1.83	-	71	-0.051	11.88	0.07
90	13.667	0.157	2.42	86.7	1.55	102	71	-0.048	11.86	0.16
91	13.819	0.152	2.42	86.8	2.12	-	71	-0.048	12.39	0.11
92	13.975	0.156	2.42	87	2.12	-	71	-0.047	12.29	0.14
93	14.126	0.151	2.42	87	2	-	71	-0.048	13.52	0.38
94	14.281	0.155	2.42	87.1	2.07	-	71	-0.046	11.76	0.13
95	14.435	0.154	2.42	87.1	1.84	-	71	-0.047	11.64	0.11

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
96	14.589	0.154	2.42	87.4	1.57	-	71	-0.048	11.55	0.09
97	14.744	0.155	2.42	87.6	1.62	-	71	-0.047	10.69	0.07
98	14.896	0.152	2.42	87.7	1.86	-	72	-0.047	12.24	0.19
99	15.052	0.156	2.42	87.9	1.56	-	72	-0.045	12.77	0.12
100	15.204	0.152	2.41	87.9	1.61	99	72	-0.045	12.28	0.11
101	15.361	0.157	2.42	88.1	1.63	-	72	-0.049	11.39	0.05
102	15.512	0.151	2.41	88.4	1.63	-	72	-0.047	12.45	0.10
103	15.667	0.155	2.42	88.4	1.57	-	72	-0.046	12.74	0.32
104	15.821	0.154	2.42	88.6	2.14	-	72	-0.051	10.52	0.05
105	15.975	0.154	2.42	88.8	2.12	-	72	-0.050	11.99	0.07
106	16.131	0.156	2.42	88.9	1.97	-	72	-0.048	11.61	0.07
107	16.282	0.151	2.42	89	1.93	-	72	-0.047	11.63	0.07
108	16.438	0.156	2.41	89.1	1.92	-	72	-0.048	10.33	0.06
109	16.591	0.153	2.41	89.2	1.71	-	72	-0.048	12.84	0.12
110	16.747	0.156	2.42	89.4	1.92	100	72	-0.047	13.31	0.20
111	16.899	0.152	2.42	89.5	1.86	-	72	-0.049	11.74	0.13
112	17.055	0.156	2.41	89.6	1.67	-	72	-0.049	12.21	0.20
113	17.208	0.153	2.42	89.5	1.82	-	72	-0.046	13.30	0.28
114	17.363	0.155	2.42	89.6	1.96	-	72	-0.046	12.54	0.18
115	17.518	0.155	2.41	89.6	1.77	-	72	-0.049	11.39	0.07
116	17.670	0.152	2.41	89.7	1.75	-	72	-0.048	12.22	0.11
117	17.826	0.156	2.41	89.8	1.93	-	72	-0.046	10.43	0.05
118	17.978	0.152	2.41	89.9	2.14	-	72	-0.046	10.98	0.06
119	18.135	0.157	2.42	90.1	1.69	-	72	-0.046	13.82	0.20
120	18.287	0.152	2.42	90.1	1.57	100	72	-0.047	13.61	0.34
121	18.442	0.155	2.41	90.2	2.14	-	72	-0.047	12.30	0.20
122	18.595	0.153	2.41	90.2	1.91	-	72	-0.048	10.11	0.04
123	18.751	0.156	2.41	90.3	1.75	-	72	-0.046	11.65	0.08
124	18.906	0.155	2.41	90.3	2.08	-	72	-0.047	13.33	0.20
125	19.057	0.151	2.40	90.4	2.15	-	72	-0.048	13.10	0.15
126	19.213	0.156	2.40	90.4	1.61	-	72	-0.048	13.52	0.21
127	19.366	0.153	2.40	90.5	1.92	-	72	-0.047	12.49	0.10

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
128	19.522	0.156	2.40	90.6	1.98	-	72	-0.045	12.53	0.10
129	19.674	0.152	2.41	90.8	1.72	-	72	-0.047	11.56	0.05
130	19.830	0.156	2.40	90.8	1.84	100	72	-0.048	13.67	0.25
131	19.979	0.149	2.40	90.8	2.13	-	72	-0.047	13.02	0.15
132	20.135	0.156	2.40	90.9	2.11	-	72	-0.048	10.65	0.07
133	20.293	0.158	2.40	91	1.99	-	72	-0.046	13.37	0.43
134	20.443	0.150	2.40	91	1.87	-	73	-0.048	13.86	0.37
135	20.598	0.155	2.40	91	1.85	-	73	-0.050	10.93	0.08
136	20.749	0.151	2.39	91.1	1.69	-	73	-0.048	11.28	0.06
137	20.909	0.160	2.40	91.1	1.84	-	73	-0.049	12.61	0.14
138	21.061	0.152	2.40	91.2	1.87	-	73	-0.047	12.65	0.19
139	21.215	0.154	2.40	91.3	1.6	-	73	-0.047	12.21	0.09
140	21.367	0.152	2.39	91.4	2.05	101	73	-0.048	14.01	0.36
141	21.523	0.156	2.39	91.5	2.14	-	73	-0.047	12.87	0.23
142	21.677	0.154	2.38	91.5	1.62	-	73	-0.047	13.02	0.22
143	21.830	0.153	2.39	91.7	2.04	-	73	-0.048	11.01	0.07
144	21.984	0.154	2.39	91.7	2.13	-	73	-0.042	12.84	0.21
145	22.136	0.152	2.38	91.8	1.63	-	73	-0.048	8.68	0.02
146	22.293	0.157	2.38	91.9	2.06	-	73	-0.049	11.36	0.06
147	22.444	0.151	2.38	91.9	1.76	-	73	-0.049	12.10	0.12
148	22.600	0.156	2.39	91.8	1.63	-	73	-0.050	11.61	0.10
149	22.751	0.151	2.38	91.8	1.89	-	73	-0.049	13.70	0.52
150	22.906	0.155	2.38	91.9	1.63	100	73	-0.048	11.35	0.05
151	23.060	0.154	2.38	91.9	2.06	-	73	-0.048	13.40	0.24
152	23.213	0.153	2.37	92	1.8	-	73	-0.048	12.33	0.09
153	23.368	0.155	2.38	92	2.14	-	73	-0.048	13.30	0.28
154	23.519	0.151	2.38	92.2	1.64	-	73	-0.047	14.97	0.70
155	23.674	0.155	2.37	92.2	1.62	-	73	-0.049	13.60	0.27
156	23.826	0.152	2.38	92.1	1.61	-	73	-0.047	11.04	0.06
157	23.982	0.156	2.37	92.1	1.68	-	73	-0.049	12.77	0.17
158	24.134	0.152	2.37	92.2	1.96	-	73	-0.047	13.41	0.27
159	24.288	0.154	2.37	92.2	1.73	-	73	-0.049	14.42	0.50

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
160	24.439	0.151	2.37	92.3	2.16	99	73	-0.049	14.32	0.44
161	24.594	0.155	2.37	92.4	2.14	-	73	-0.047	13.23	0.22
162	24.748	0.154	2.36	92.5	1.84	-	73	-0.049	12.76	0.27
163	24.900	0.152	2.36	92.5	2.05	-	73	-0.050	13.28	0.30
164	25.055	0.155	2.37	92.4	1.86	-	73	-0.050	11.38	0.09
165	25.206	0.151	2.37	92.6	1.66	-	73	-0.051	13.36	0.22
166	25.360	0.154	2.35	92.6	1.7	-	73	-0.046	12.57	0.11
167	25.512	0.152	2.36	92.6	1.72	-	73	-0.046	12.82	0.17
168	25.668	0.156	2.36	92.6	1.65	-	73	-0.047	12.49	0.14
169	25.819	0.151	2.36	92.6	2.12	-	73	-0.048	13.38	0.24
170	25.973	0.154	2.35	92.8	1.7	101	73	-0.047	11.43	0.08
171	26.124	0.151	2.36	92.8	1.7	-	73	-0.048	13.33	0.31
172	26.278	0.154	2.35	92.8	1.75	-	74	-0.048	13.00	0.22
173	26.431	0.153	2.35	92.8	2.03	-	74	-0.047	13.44	0.28
174	26.584	0.153	2.34	92.9	1.63	-	74	-0.047	13.68	0.16
175	26.738	0.154	2.36	92.9	1.78	-	74	-0.048	12.84	0.27
176	26.889	0.151	2.35	92.9	2.16	-	74	-0.047	11.17	0.05
177	27.043	0.154	2.35	92.9	1.65	-	74	-0.049	12.56	0.13
178	27.194	0.151	2.34	93.1	1.77	-	74	-0.048	12.75	0.24
179	27.349	0.155	2.34	93.1	2.18	-	74	-0.049	14.69	0.57
180	27.498	0.149	2.41	93	1.65	100	74	-0.049	13.78	0.32
181	27.655	0.157	2.41	93.2	2.15	-	74	-0.049	11.79	0.09
182	27.806	0.151	2.41	93.3	2.18	-	74	-0.045	11.33	0.08
183	27.965	0.159	2.41	93.3	2.04	-	74	-0.047	12.99	0.23
184	28.120	0.155	2.39	93.4	1.9	-	74	-0.044	12.72	0.15
185	28.274	0.154	2.39	93.5	1.88	-	74	-0.039	12.91	0.29
186	28.428	0.154	2.39	93.5	1.96	-	74	-0.050	10.13	0.03
187	28.580	0.152	2.39	93.4	1.82	-	74	-0.048	8.43	0.03
188	28.738	0.158	2.40	93.3	2.06	-	74	-0.048	11.85	0.10
189	28.890	0.152	2.40	93.4	2.18	-	74	-0.047	12.27	0.14
190	29.046	0.156	2.40	93.5	1.72	101	74	-0.047	10.11	0.04
191	29.199	0.153	2.40	93.4	2.04	-	74	-0.044	12.28	0.18

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
192	29.355	0.156	2.39	93.4	2.21	-	74	-0.047	12.79	0.15
193	29.510	0.155	2.39	93.6	2.1	-	74	-0.044	12.50	0.11
194	29.663	0.153	2.40	93.7	2.01	-	74	-0.046	11.58	0.06
195	29.819	0.156	2.39	93.8	1.97	-	74	-0.043	11.62	0.05
196	29.971	0.152	2.39	93.8	1.82	-	74	-0.048	12.15	0.11
197	30.128	0.157	2.39	93.9	2.21	-	74	-0.046	13.03	0.21
198	30.281	0.153	2.39	93.9	1.89	-	74	-0.043	11.09	0.05
199	30.436	0.155	2.39	94	2.2	-	74	-0.042	13.46	0.29
200	30.588	0.152	2.38	93.9	1.74	101	74	-0.044	12.23	0.13
201	30.744	0.156	2.38	93.8	2.22	-	74	-0.043	13.31	0.38
202	30.898	0.154	2.37	93.8	1.67	-	74	-0.044	10.50	0.04
203	31.051	0.153	2.38	94	1.71	-	74	-0.042	12.55	0.18
204	31.206	0.155	2.37	94.1	2	-	74	-0.042	10.46	0.04
205	31.358	0.152	2.38	94.2	2.08	-	74	-0.041	13.01	0.14
206	31.515	0.157	2.38	94.1	2.02	-	74	-0.042	13.58	0.41
207	31.666	0.151	2.37	94.2	1.8	-	74	-0.042	11.37	0.09
208	31.822	0.156	2.38	94.3	1.79	-	74	-0.043	13.63	0.40
209	31.973	0.151	2.37	94.5	1.69	-	74	-0.042	12.32	0.22
210	32.128	0.155	2.37	94.5	1.84	99	74	-0.041	12.09	0.10
211	32.283	0.155	2.37	94.5	2.13	-	74	-0.041	11.77	0.12
212	32.436	0.153	2.37	94.5	1.71	-	74	-0.044	11.41	0.07
213	32.590	0.154	2.36	94.5	1.98	-	74	-0.042	12.00	0.06
214	32.742	0.152	2.36	94.4	2.23	-	74	-0.041	12.33	0.23
215	32.897	0.155	2.36	94.4	2.22	-	74	-0.044	12.04	0.11
216	33.049	0.152	2.35	94.5	1.73	-	74	-0.042	11.84	0.12
217	33.205	0.156	2.35	94.5	1.91	-	74	-0.040	13.20	0.37
218	33.356	0.151	2.36	94.5	1.91	-	74	-0.042	12.63	0.18
219	33.511	0.155	2.35	94.5	1.86	-	74	-0.041	11.12	0.08
220	33.662	0.151	2.34	94.6	2.01	97	74	-0.041	11.92	0.10
221	33.817	0.155	2.35	94.6	2.22	-	74	-0.040	13.53	0.34
222	33.970	0.153	2.35	94.6	2.03	-	74	-0.042	10.89	0.05
223	34.123	0.153	2.34	94.6	2.09	-	74	-0.040	12.21	0.32

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
224	34.276	0.153	2.34	94.6	1.74	-	74	-0.042	12.60	0.10
225	34.427	0.151	2.34	94.7	1.84	-	74	-0.042	11.51	0.09
226	34.582	0.155	2.34	94.8	1.9	-	74	-0.038	9.76	0.02
227	34.733	0.151	2.34	94.8	2.27	-	74	-0.044	10.92	0.06
228	34.889	0.156	2.33	94.8	1.8	-	74	-0.047	10.63	0.03
229	35.039	0.150	2.34	94.9	2.19	-	74	-0.044	11.71	0.13
230	35.193	0.154	2.33	94.8	2.13	98	74	-0.044	12.30	0.08
231	35.344	0.151	2.33	94.8	2.22	-	75	-0.042	12.96	0.39
232	35.498	0.154	2.32	94.8	1.81	-	74	-0.043	11.43	0.07
233	35.650	0.152	2.32	94.9	1.8	-	74	-0.043	12.58	0.14
234	35.803	0.153	2.32	95	2.17	-	75	-0.042	11.64	0.09
235	35.957	0.154	2.33	95	2.1	-	74	-0.041	11.88	0.06
236	36.107	0.150	2.33	95	1.91	-	75	-0.042	12.72	0.13
237	36.261	0.154	2.33	95	2.25	-	75	-0.041	12.25	0.14
238	36.411	0.150	2.31	95	1.73	-	75	-0.042	12.45	0.24
239	36.566	0.155	2.32	95	1.8	-	75	-0.042	12.70	0.15
240	36.716	0.150	2.31	95.1	1.85	98	75	-0.042	10.98	0.04
241	36.871	0.155	2.31	95.2	2.09	-	75	-0.042	12.43	0.11
242	37.021	0.150	2.31	95	1.83	-	75	-0.040	11.35	0.11
243	37.175	0.154	2.32	95	1.83	-	75	-0.040	11.81	0.11
244	37.324	0.149	2.31	95	1.89	-	75	-0.040	12.77	0.34
245	37.478	0.154	2.30	95.1	2.29	-	75	-0.040	11.41	0.07
246	37.628	0.150	2.29	95	2.3	-	75	-0.042	13.37	0.49
247	37.778	0.150	2.29	95	1.81	-	75	-0.041	12.94	0.27
248	37.933	0.155	2.29	95.2	2.03	-	75	-0.040	13.23	0.47
249	38.084	0.151	2.28	95.2	1.97	-	75	-0.041	11.25	0.07
250	38.237	0.153	2.29	95.2	2.26	96	75	-0.043	12.50	0.16
251	38.387	0.150	2.29	95.2	2.18	-	75	-0.042	12.10	0.21
252	38.539	0.152	2.28	95.3	2.24	-	75	-0.040	10.81	0.05
253	38.688	0.149	2.29	95.3	2.32	-	75	-0.042	11.57	0.07
254	38.841	0.153	2.28	95.4	2.05	-	75	-0.042	12.40	0.22
255	38.990	0.149	2.27	95.3	2.31	-	75	-0.039	13.60	0.61

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
256	39.143	0.153	2.27	95.3	1.82	-	75	-0.039	11.84	0.19
257	39.292	0.149	2.27	95.4	2	-	75	-0.042	13.34	0.54
258	39.443	0.151	2.27	95.5	1.85	-	75	-0.043	12.74	0.34
259	39.592	0.149	2.27	95.5	1.76	-	75	-0.040	11.74	0.08
260	39.745	0.153	2.26	95.6	1.84	96	75	-0.042	12.52	0.29
261	39.896	0.151	2.26	95.4	1.78	-	75	-0.042	12.10	0.15
262	40.049	0.153	2.26	95.5	2.19	-	75	-0.043	12.51	0.41
263	40.196	0.147	2.26	95.6	1.93	-	75	-0.042	14.01	0.59
264	40.349	0.153	2.25	95.7	1.78	-	75	-0.039	11.96	0.11
265	40.497	0.148	2.25	95.6	2.25	-	75	-0.041	12.30	0.26
266	40.649	0.152	2.25	95.7	1.85	-	75	-0.041	14.55	0.65
267	40.798	0.149	2.25	95.6	1.92	-	75	-0.049	9.46	0.03
268	40.949	0.151	2.24	95.6	2.34	-	75	-0.044	9.31	0.01
269	41.095	0.146	2.25	95.8	1.8	-	75	-0.043	12.34	0.14
270	41.247	0.152	2.24	95.8	1.92	96	75	-0.040	12.89	0.23
271	41.404	0.157	2.47	95.8	2.25	-	75	-0.045	12.12	0.07
272	41.563	0.159	2.47	95.9	1.9	-	75	-0.041	12.84	0.20
273	41.723	0.160	2.47	95.9	2.07	-	75	-0.042	13.52	0.51
274	41.877	0.154	2.38	95.9	2.27	-	75	-0.041	12.33	0.21
275	42.033	0.156	2.38	95.9	1.86	-	75	-0.044	11.94	0.17
276	42.185	0.152	2.37	95.8	1.87	-	75	-0.041	12.92	0.22
277	42.341	0.156	2.37	95.8	1.91	-	75	-0.040	10.61	0.07
278	42.495	0.154	2.37	95.8	2.08	-	75	-0.042	12.48	0.22
279	42.649	0.154	2.37	95.8	2.43	-	75	-0.043	13.58	0.39
280	42.804	0.155	2.37	95.9	2.18	100	75	-0.040	12.74	0.19
281	42.953	0.149	2.36	96.1	1.94	-	75	-0.042	12.04	0.17
282	43.112	0.159	2.36	96	2.44	-	75	-0.043	12.96	0.32
283	43.261	0.149	2.35	96	1.91	-	75	-0.042	12.56	0.09
284	43.415	0.154	2.35	96	2.06	-	75	-0.041	12.75	0.12
285	43.571	0.156	2.36	96	2.27	-	75	-0.046	13.35	0.44
286	43.726	0.155	2.34	96.1	2.02	-	75	-0.043	11.86	0.07
287	43.880	0.154	2.35	96.1	1.93	-	75	-0.039	11.70	0.20

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
288	44.034	0.154	2.34	96.2	1.91	-	75	-0.041	12.56	0.32
289	44.188	0.154	2.35	96.1	1.92	-	75	-0.040	12.83	0.20
290	44.339	0.151	2.35	96.1	2.34	99	75	-0.042	12.37	0.12
291	44.492	0.153	2.34	96.1	2.35	-	75	-0.043	13.61	0.56
292	44.646	0.154	2.34	96.2	2.29	-	75	-0.042	13.98	0.58
293	44.801	0.155	2.34	96.4	2.44	-	75	-0.038	10.75	0.04
294	44.950	0.149	2.32	96.3	2.43	-	75	-0.043	12.94	0.57
295	45.107	0.157	2.33	96.2	2.27	-	75	-0.043	13.09	0.42
296	45.258	0.151	2.33	96.2	2.49	-	75	-0.041	12.56	0.30
297	45.407	0.149	2.33	96.2	2.48	-	75	-0.043	13.19	0.41
298	45.561	0.154	2.32	96.3	2.43	-	75	-0.042	12.72	0.35
299	45.718	0.157	2.31	96.3	2	-	75	-0.042	13.95	0.38
300	45.868	0.150	2.31	96.4	2.15	98	75	-0.042	11.18	0.11
301	46.018	0.150	2.31	96.3	1.95	-	75	-0.042	11.79	0.13
302	46.173	0.155	2.31	96.4	2.12	-	75	-0.041	11.70	0.09
303	46.326	0.153	2.30	96.4	1.94	-	75	-0.044	12.61	0.21
304	46.478	0.152	2.30	96.5	1.96	-	75	-0.045	12.76	0.54
305	46.629	0.151	2.30	96.5	2.15	-	75	-0.042	12.59	0.46
306	46.783	0.154	2.30	96.5	2.49	-	75	-0.041	12.30	0.29
307	46.933	0.150	2.29	96.5	2	-	76	-0.040	11.59	0.07
308	47.087	0.154	2.30	96.6	2.03	-	76	-0.045	8.64	0.01
309	47.236	0.149	2.29	96.6	2.12	-	76	-0.045	9.98	0.02
310	47.390	0.154	2.29	96.7	2.49	96	76	-0.045	12.60	0.39
311	47.543	0.153	2.29	96.7	2.51	-	76	-0.043	12.11	0.23
312	47.696	0.153	2.28	96.7	2.04	-	76	-0.044	12.29	0.20
313	47.841	0.145	2.28	96.9	2.09	-	76	-0.044	13.88	0.56
314	47.994	0.153	2.28	96.8	2.07	-	76	-0.044	12.23	0.24
315	48.152	0.158	2.28	96.8	1.99	-	76	-0.043	10.78	0.06
316	48.300	0.148	2.28	96.8	2.52	-	76	-0.045	14.61	0.73
317	48.453	0.153	2.27	96.8	2.1	-	76	-0.043	13.98	0.42
318	48.599	0.146	2.28	96.8	1.98	-	76	-0.042	11.36	0.04
319	48.751	0.152	2.27	96.8	2.17	-	76	-0.040	12.01	0.14

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	48.903	0.152	2.26	96.9	2.08	96	76	-0.042	13.76	0.41
321	49.056	0.153	2.26	96.9	2.49	-	76	-0.042	10.82	0.02
322	49.208	0.152	2.26	97	2.26	-	76	-0.041	13.82	0.35
323	49.356	0.148	2.26	96.9	2.05	-	76	-0.042	14.05	0.68
324	49.505	0.149	2.26	96.9	2.54	-	76	-0.043	11.82	0.20
325	49.661	0.156	2.25	96.9	2.44	-	76	-0.040	11.33	0.14
326	49.812	0.151	2.38	96.9	2.19	-	76	-0.043	13.46	0.35
327	49.966	0.154	2.39	96.9	2.19	-	76	-0.042	11.53	0.26
328	50.122	0.156	2.40	96.9	2.13	-	76	-0.043	12.39	0.34
329	50.276	0.154	2.39	97	2.6	-	76	-0.042	13.32	0.40
330	50.432	0.156	2.39	97.1	2.64	97	76	-0.043	11.81	0.16
331	50.584	0.152	2.38	97	2.26	-	76	-0.042	13.47	0.59
332	50.738	0.154	2.38	97.2	2.12	-	76	-0.043	13.32	0.46
333	50.896	0.158	2.37	97.2	2.12	-	76	-0.043	12.87	0.21
334	51.051	0.155	2.37	97.2	2.65	-	76	-0.042	12.26	0.16
335	51.202	0.151	2.37	97.2	2.29	-	76	-0.043	14.36	0.49
336	51.358	0.156	2.37	97.3	2.65	-	76	-0.040	13.66	0.26
337	51.512	0.154	2.36	97.3	2.18	-	76	-0.045	12.47	0.21
338	51.666	0.154	2.36	97.3	2.18	-	76	-0.041	12.68	0.31
339	51.821	0.155	2.37	97.3	2.32	-	76	-0.042	13.10	0.26
340	51.974	0.153	2.36	97.4	2.64	99	76	-0.042	13.43	0.26
341	52.129	0.155	2.35	97.4	2.41	-	76	-0.042	13.58	0.36
342	52.282	0.153	2.36	97.4	2.55	-	76	-0.043	12.40	0.22
343	52.438	0.156	2.35	97.4	2.18	-	76	-0.042	12.59	0.09
344	52.589	0.151	2.35	97.6	2.35	-	76	-0.041	12.02	0.23
345	52.745	0.156	2.35	97.5	2.49	-	76	-0.044	13.30	0.43
346	52.894	0.149	2.35	97.6	2.64	-	77	-0.043	13.13	0.20
347	53.054	0.160	2.34	97.6	2.19	-	77	-0.042	13.24	0.28
348	53.203	0.149	2.34	97.5	2.7	-	77	-0.041	12.29	0.22
349	53.358	0.155	2.34	97.5	2.18	-	77	-0.045	8.70	0.01
350	53.513	0.155	2.34	97.6	2.39	102	77	-0.044	11.74	0.20
351	53.664	0.151	2.34	97.6	2.53	-	77	-0.045	11.71	0.13

BOX B TEST DATA - ASTM E2779 / ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
352	53.818	0.154	2.34	97.7	2.47	-	77	-0.041	12.15	0.17
353	53.972	0.154	2.33	97.7	2.22	-	77	-0.044	13.38	0.35
354	54.127	0.155	2.34	97.8	2.34	-	77	-0.044	11.92	0.17
355	54.278	0.151	2.33	97.8	2.69	-	77	-0.047	13.55	0.51
356	54.432	0.154	2.32	97.8	2.55	-	77	-0.043	13.10	0.47
357	54.581	0.149	2.32	97.8	2.57	-	77	-0.041	13.28	0.31
358	54.739	0.158	2.32	97.9	2.22	-	77	-0.042	12.83	0.36
359	54.893	0.154	2.32	97.9	2.22	-	77	-0.042	12.58	0.33
360	55.044	0.151	2.32	97.7	2.23	100	77	-0.042	14.43	0.38
Avg/Tot	55.044	0.153	2.36	90	1.97	100			12.81	0.26

LAB SAMPLE DATA - ASTM E2515

Client: Laminox
Model: Giulia
Run #: 1

Job #: 23-210
Tracking #: 164
Technician: AK
Date: 10/18/2023

		Sample ID	Tare, mg	Final, mg	Catch, mg
Filters	**A**	G00703	249.3	252.0	2.7
	B	G00704	247.4	249.5	2.1
	C - 1st Hour	G00705	247.3	247.6	0.3
	Amb	G00706	248.7	248.8	0.1
Probes	**A**	9A	116529.8	116530.8	1.0
	B	9B	117737.5	117738.5	1.0
	C - 1st Hour	9C	116602.6	116603.6	1.0
O-rings	**A**	9A	3581.5	3582.2	0.7
	B	9B	3524.1	3525.0	0.9
	C - 1st Hour	9C	3431.8	3432.8	1.0

Placed in Dessicator on:	10/18/2023

Balance Audit (mg):		200.0		200.0		200.0			
		Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time
Filters	**A**	251.9	10/20 10:45	252.0	10/23 14:15				
	B	249.3	10/20 10:45	249.5	10/23 14:15				
	C - 1st Hour	247.6	10/20 10:45	247.6	10/23 14:15				
	Amb	248.8	10/20 10:45	248.8	10/23 14:15				
Probes	**A**	116530.7	10/20 10:45	116530.8	10/23 14:15				
	B	117738.6	10/20 10:45	117738.5	10/23 14:15				
	C - 1st Hour	116603.5	10/20 10:45	116603.6	10/23 14:15				
O-Rings	**A**	3582.4	10/20 10:45	3582.1	10/23 14:15	3582.2	10/24 9:30		
	B	3525.3	10/20 10:45	3524.9	10/23 14:15	3525.0	10/24 9:30		
	C - 1st Hour	3433.1	10/20 10:45	3432.7	10/23 14:15	3432.8	10/24 9:30		

Train A Aggregate, mg:	**4.4**
Train B Aggregate, mg:	**4.0**
Train C Aggregate, mg:	**2.3**
Ambient Aggregate, mg:	**0.1**

ASTM E2779 Wood Heater Run Sheets

Client: Laminox Job Number: 23-210 Tracking #: 164
Model: Giulia Run Number: 1 Test Date: 10/18/23

Pellet Heater Control Settings

High Burn Rate Settings: Burn setting #5 (max)

Medium Burn Rate Settings: Burn setting #2

Low Burn Rate Settings: Burn setting #1 (min)

Preburn Notes

Preburn Start Time: 9:00

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 10:00

Time	Notes
60:00	Changed to medium setting
180:00	Changed to low setting
360:00	Test end

Test Burn End Time: 16:00

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 17.10 CO (%): 4.306

Mid Gas CO_2 (%): 10.09 CO (%): 2.530

Calibration Results:

	Pre Test			Post Test		
	Zero	Span	Mid	Zero	Span	Mid
Time	9:21	9:28	9:30	16:02	16:03	16:04
CO_2	0.00	17.00	10.09	0.00	16.96	9.96
CO	0.000	4.309	2.497	-0.041	4.227	2.431

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

Technician Signature: Date: 11/22/2023

LAMINOX IDRO

LAMINOX S.r.l.
Zona Industriale Callarella, 261-263
62028 SARNANO (MC)
ITALY

Pellet Stove
Giulia Air

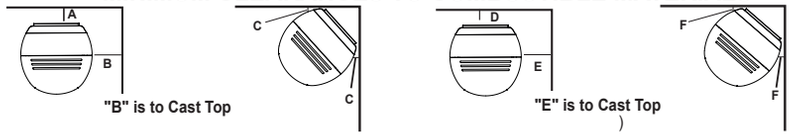
serial number

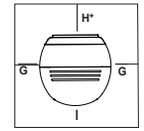
Listed solid fuel room heater/pellet type insert. Also suitable for mobile home installation. This appliance has been tested and listed for use in Manufactured Homes in accordance with OAR 814-23-9000 throught 814-23-909.
Tested to: ASTM 1509, ORD-C-1482-M1990 Room Heating Pellet Burning Type, APFI, (UM) 84-HUD FOR USE ONLY WITH PELLETIZED WOOD OR SHELLED FIELD CORN FUEL.
This wood heater needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's
manual.
Route power cord away from unit. Do not route cord under or in front of appliance.
DANGER: Risk of electrical shock. Disconnect power supply before servicing. Replace glass only with 5 mm ceramic available from your dealer. To start, set thermostat above room temperature, the stove will light automatically. To shutdown, set thermostat to below room temperature. For further instruction refer to owner's manual. Keep viewing and ash removal doors tightly closed during operation.

PREVENT HOUSE FIRES

Install and use only in accordance with manufacturer's installation and operating instructions. Contact local building or fire officials about restrictions and inspection in our area.
WARNING - FOR MOBILE HOMES: Do not install appliance in a sleeping room. An outside combustion air inlet must be provided. The structural integrity of the mobile home floor, ceiling and walls must be maintained. Refer to manufacturer's instructions and local codes for precautions required for passing chimney througth a combustible wall or ceiling. Inspect and clean vent system frequently in accordance with manufacturer's instructions.
DO NOT CONNECT THIS UNIT TO A CHMNEY SERVING ANOTHER APPLIANCE
Use a 3" or 4" diameter type "L" or "PL" venting system.

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS





FLOOR PROTECTION
*Non-combustible floor protection must extend beneath the flue pipe when installed with horizontal venting or under the Top Vent Adapter with vertical Installation.
RECOMMENDED IN USA
Floor protector must be non combustible material, extending beneath heater and to the front/sides/rear as indicated. Measure front distance (I) from the surfaceof the glass door.

Note 1: In residential installations, when using parts 811-0890, (3"-3" Top vent adapter) and 812-3570 (3"-6" offset adapter), 24 gauge 6" single wall flue connector may be used.
Note 2: In manufactured home installation, when using Part 811-0890, (3"-3" Top Vent Adapter) and 812-3570 (3"-6" offset adapter), use listed double wall flue connector. An Outside Air Kit (Part 811-0872), must be used with manufactured home installation.

A Back wall to stove	8"/200 mm
B Side wall to Cast Top	20"/500 mm
CORNER INSTALLATION	
C Side wall	8"/200 mm
VERTICAL 3"-6" ADAPTER KIT (PART 812-3570)Installation:	
D Back wall to Flue Pipe	21"/550 mm
E Side wall to Cast Top	20"/500 mm

CORNER INSTALLATION WITH VERTICAL ADAPTER KIT:	
F Side wall:	8"/200 mm
ALCOVE INSTALLATION	
Min Alcove Height:	43"/1092 mm
Min Alcove Side Wall:	6"/152 mm
Max Alcove Depth:	36"/914 mm

U.S. ENVIROMENTAL PROTECTION AGENCY
Certified to comply with 2020 particulate emission standards using pellet wood.

Emission Rate (g/hr)	Heating Efficiency (% Overall)	1st hour Emission Rate (g/hr)	CO emission (g/hr)
1,6	**84,0**	**5,3**	**4,4**

2023	2024	2025	Jan.	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

DO NOT REMOVE THIS LABEL Made in Italy

LAMINOX IDRO

LAMINOX S.r.l.
Zona Industriale Callarella, 261-263
62028 SARNANO (MC)
ITALY

Pellet Stove
Valentina Air N

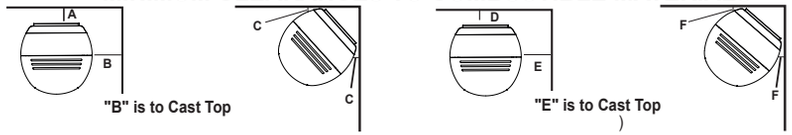
serial number

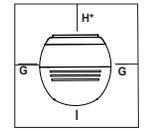
Listed solid fuel room heater/pellet type insert. Also suitable for mobile home installation. This appliance has been tested and listed for use in Manufactured Homes in accordance with OAR 814-23-9000 throught 814-23-909.
Tested to: ASTM 1509, ORD-C-1482-M1990 Room Heating Pellet Burning Type, APFI, (UM) 84-HUD FOR USE ONLY WITH PELLETIZED WOOD OR SHELLED FIELD CORN FUEL.
This wood heater needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's
manual.
Route power cord away from unit. Do not route cord under or in front of appliance.
DANGER: Risk of electrical shock. Disconnect power supply before servicing. Replace glass only with 5 mm ceramic available from your dealer. To start, set thermostat above room temperature, the stove will light automatically. To shutdown, set thermostat to below room temperature. For further instruction refer to owner's manual. Keep viewing and ash removal doors tightly closed during operation.

PREVENT HOUSE FIRES

Install and use only in accordance with manufacturer's installation and operating instructions. Contact local building or fire officials about restrictions and inspection in our area.
WARNING - FOR MOBILE HOMES: Do not install appliance in a sleeping room. An outside combustion air inlet must be provided. The structural integrity of the mobile home floor, ceiling and walls must be maintained. Refer to manufacturer's instructions and local codes for precautions required for passing chimney througth a combustible wall or ceiling. Inspect and clean vent system frequently in accordance with manufacturer's instructions.
DO NOT CONNECT THIS UNIT TO A CHMNEY SERVING ANOTHER APPLIANCE
Use a 3" or 4" diameter type "L" or "PL" venting system.

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS





FLOOR PROTECTION
*Non-combustible floor protection must extend beneath the flue pipe when installed with horizontal venting or under the Top Vent Adapter with vertical Installation.
RECOMMENDED IN USA
Floor protector must be non combustible material, extending beneath heater and to the front/sides/rear as indicated. Measure front distance (I) from the surfaceof the glass door.

Note 1: In residential installations, when using parts 811-0890, (3"-3" Top vent adapter) and 812-3570 (3"-6" offset adapter), 24 gauge 6" single wall flue connector may be used.
Note 2: In manufactured home installation, when using Part 811-0890, (3"-3" Top Vent Adapter) and 812-3570 (3"-6" offset adapter), use listed double wall flue connector. An Outside Air Kit (Part 811-0872), must be used with manufactured home installation.

A Back wall to stove	8"/200 mm
B Side wall to Cast Top	20"/500 mm
CORNER INSTALLATION	
C Side wall	8"/200 mm
VERTICAL 3"-6" ADAPTER KIT (PART 812-3570)Installation:	
D Back wall to Flue Pipe	21"/550 mm
E Side wall to Cast Top	20"/500 mm

CORNER INSTALLATION WITH VERTICAL ADAPTER KIT:	
F Side wall:	8"/200 mm
ALCOVE INSTALLATION	
Min Alcove Height:	43"/1092 mm
Min Alcove Side Wall:	6"/152 mm
Max Alcove Depth:	36"/914 mm

U.S. ENVIROMENTAL PROTECTION AGENCY
Certified to comply with 2020 particulate emission standards using pellet wood.

Emission Rate (g/hr)	Heating Efficiency (% Overall)	1st hour Emission Rate (g/hr)	CO emission (g/hr)
1,6	**84,0**	**5,3**	**4,4**

2023	2024	2025	Jan.	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

DO NOT REMOVE THIS LABEL **Made in Italy**

CAUTION: HOT WHILE IN OPERATION DO NOT TOUCH, KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS. Operate this unit only with fuel hopper lid closed. Failure to do so may result in emissions of products of combustion from the hopper under certain conditions. Maintain hopper seal in good condition. Do not over fill the hopper.

ATTENTION: CHAUD LORS DE L'OPÉRATION. NE PAS TOUCHER. GARDEZ LES ENFANTS ET LES VÊTEMENTS LOIN DE L'ESPACE DÉSIGNÉ DE L'INSTALLATION. LE CONTACT PEUT CAUSER DES BRÛLURES À LA PEAU. VOIR L'ÉTIQUETTE ET LES INSTRUCTIONS. Opérez cet appareil uniquement avec le couvercle de la trémie fermé. Le défaut de ne pas suivre les instructions peut résulter, sous certaines conditions, en une combustion des émissions des produits venant de la trémie. Ne pas remplir la trémie trop pleine.

7014-197C

CAUTION: HOT WHILE IN OPERATION DO NOT TOUCH, KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS. Operate this unit only with fuel hopper lid closed. Failure to do so may result in emissions of products of combustion from the hopper under certain conditions. Maintain hopper seal in good condition. Do not over fill the hopper.

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7014-197C

LAMINOX IDRO

C UL US LISTED

USE AND MAINTENANCE INSTRUCTIONS

PELLET STOVE

Valentina air N

SAVE THIS INSTRUCTIONS

WARNING: Please read this entire manual before installation and use of this pellet fuel-burning room heater.
Failure to follow these instructions could result in property damage, bodily injury or even death

CAUTION: Contact local building of fire official about restrictions and installation inspection requirement in your area

Dear Customer, thank you for choosing one of our products, which is a result of technological expertise and our continuous quest for superior products in terms of safety, reliability and performance. This manual contains all the information and helpful tips for using your product with maximum safety and efficiency.

IMPORTANT INFORMATION

This manual has been prepared by the manufacturer and is an integral and essential part of the product. In the event of sale or transfer of the product, always ensure the presence of the manual as the information it contains is addressed to the purchaser and to all those various people involved in the installation, use and maintenance of the product. Carefully read the instructions and information contained in this manual before installation, operation and maintenance of the product. The instructions contained in this instruction manual guarantee the safety of persons and property and ensure efficient operation and a longer service life. The manufacturer declines all responsibility for damage caused by failure to observe instructions regarding installation, use and maintenance listed in the instruction manual, for unauthorized modifications or non-original replacement parts. Product installation and use must be carried out in accordance with the manufacturer's instructions and in compliance with European, national and local regulations. Installation, electrical connection, functional testing, maintenance and repairs are operations that must be performed by qualified and licensed personnel who must have appropriate knowledge of the product. Product installation must not be carried out close to walls made of wood or combustible material. For proper installation, you must observe the following "Safety distances" section. Verify the exact flatness of the floor where you will install the product. When handling the steel parts of the cladding, use clean cotton gloves to avoid leaving difficult to remove fingerprints for the first cleaning. Stove installation must be performed by at least two people. Connect the stove to the mains only after proper professional connection to the chimney flue. The power cable plug must remain accessible after installation of the stove. Only operate the stove with regulation wood pellets (refer to the "FUEL" chapter). Never use liquid fuels to operate the pellet stove or to stoke the embers present. Provide adequate ventilation in the installation area throughout the year. In the presence of operation failures, fuel supply will be interrupted. Re-start the unit after removing the cause of the failure. Discontinue use of the product in the event of failure or malfunction. Do not remove the safety guard located in the pellet tank. Any accumulated unburned pellets in the burner as a result of repeated "failed ignitions must be removed prior to ignition." Pellet stove operation can cause very hot heating of the handles, the chimney flue and glass surfaces. Only touch these parts during operation when wearing protective clothing or with adequate aids. Because of the creation of heat on the glass, make sure that no persons unfamiliar with stove operation stand in the installation area. Inform children of the precautions to be observed during product operation and of possible dangers. In the event of problems or misunderstanding of the instruction manual, contact your dealer. Placing objects which cannot withstand heat on the stove or within the minimum required safety range is prohibited. Do not open the door during operation or operate the stove with its glass broken. For product terms, limitations and exclusions, please refer to the warranty included with the product. In order to pursue a policy of constant product development and renewal, the manufacturer may make changes to it as deems appropriate without notice. This document is the property of the manufacturer and cannot be disclosed in whole or in part to any third party without the written consent of the company, which reserves all rights to the rigor of the law.

1 GENERAL STANDARDS

1.1 Fireplace or Chimney flue

Each device must have a vertical duct, called a chimney flue, for outside release of combustion fumes produced by a natural draft.
The chimney flue must meet the following requirements:

- It should not be connected to any other fireplace, stove, boiler, or hood of any kind (Fig. 1).
- It must be properly spaced from combustible or flammable materials through an air gap or suitable insulating material.
- The internal section must be uniform, preferably circular: the square or rectangular sections must have rounded corners with a radius of no less than 20 mm, maximum ratio between the sides of 1.5, walls as smooth as possible and without restrictions, curves must be regular and seamless, deviations from the axis no greater than 45° (Fig-2).
- Each device must have its own chimney flue with a section equal to or greater than the diameter of the fume exhaust pipe of the stove and a height no less than the one stated (see table 2).
- Never use two stoves, a fireplace and a stove, a stove and a wood stove, etc. in the same room since the draft of one could damage the draft of the other. In addition, collective ventilation ducts that can cause a vacuum in the installation environment are not permitted, even if installed in adjacent rooms and communicating with the installation room.
- Creating fixed or mobile apertures on the chimney flue to connect equipment other than auxiliary devices is prohibited.
- Passing other air supply channels and piping for utilities through the chimney flue, however large, is prohibited.
- The chimney flue should be equipped with a collection chamber for solid materials and any condensate, located below the mouth of the flue, so as to be easily opened and inspected from an airtight door.
- Whenever using parallel output chimneys, it is advisable to raise a bracing element. (Fig.3)

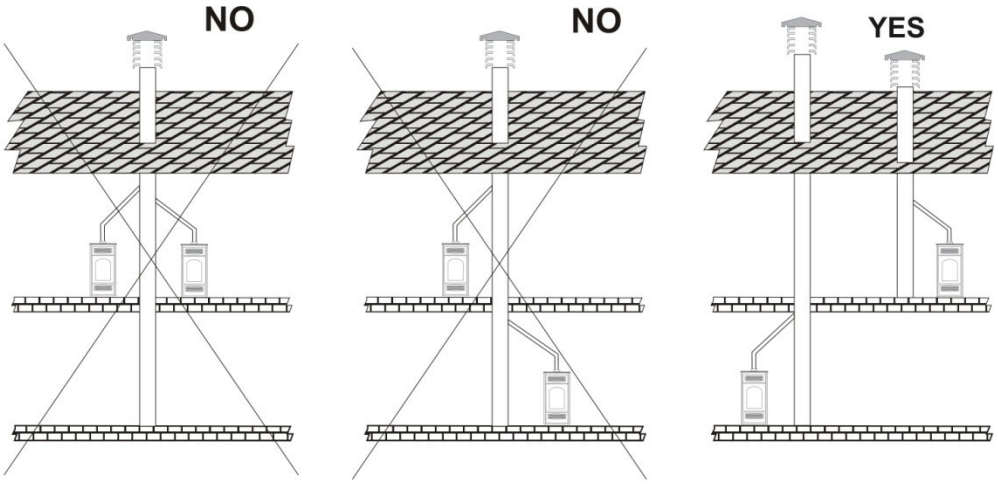


Fig 1

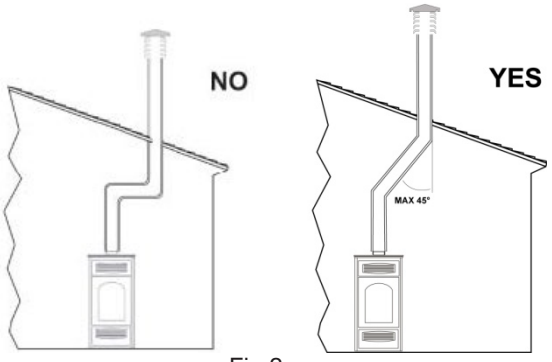


Fig 2

1.2 Chimney cap

The top of the chimney flue must be equipped with a device, called a chimney cap, which facilitates dispersion into the atmosphere of combustion products.
The chimney cap must meet the following requirements:

- Its internal section and shape must be equivalent to that of the chimney flue.
- Have a useful outlet section no less than double that of the chimney flue.
- Chimney caps that emerge from the roof or which remain in contact with the outside (for example in the case of an open loft), must be covered with brick elements and well isolated. It must be constructed so as to prevent penetration into the flue of rain, snow, or foreign bodies and so that, in the event of winds in any direction and at any angle, it assures the discharge of combustion products (windproof chimney cap).
- The chimney cap must be positioned so as to guarantee an adequate dispersion and dilution of combustion products and, in any case, outside the zone of reflux. This zone can be different sizes and shapes depending on the angle of slope of the roof, so it is necessary to adopt the minimum heights shown in Fig.4 and Fig.5.
- The chimney cap must be of windproof and exceed the height of the ridge, Fig.4 and Fig.5.
- Any buildings or other obstacles that exceed the height of the chimney cap must not be close to the chimney cap itself (Fig.4).

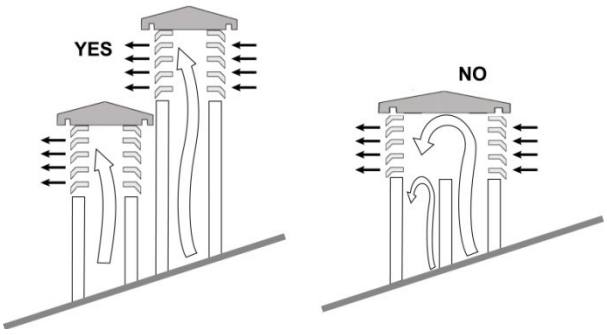


Fig.3

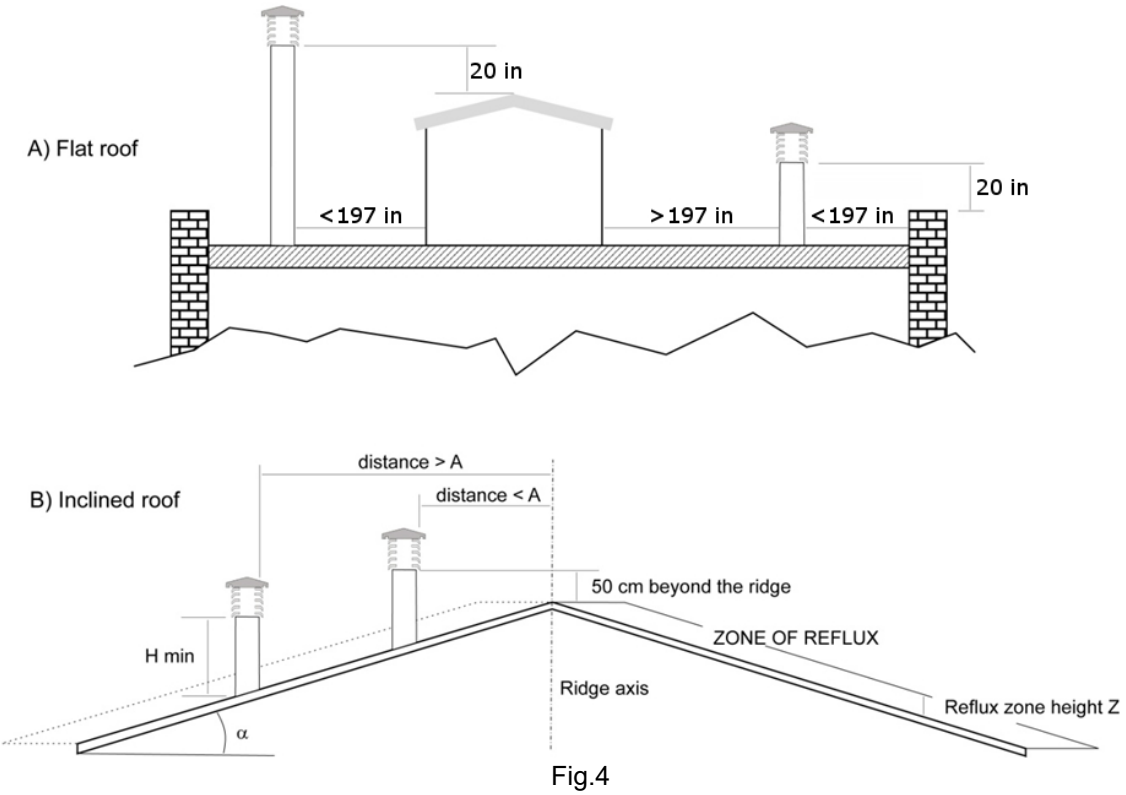


Fig.4

Roof pitch ? [°]	Horizontal width of the zone of reflux from the axis of the ridge A	Minimum height of the outlet from the roof	Height of the reflux zone Z
15	6 feet (1.85m)	3 feet (1.00m)	1 foot (0.50m)
30	5 feet (1.50m)	4 feet (1.30m)	2 feet (0.80m)
45	4 feet (1.30m)	6 feet (2.00m)	5 feet (1.50m)
60	4 feet (1.20m)	8 feet (2.60m)	7 feet (2.10m)

Table 2

1.3 External air intake vent

- The stove must have the air necessary to ensure smooth combustion operation and good environmental well-being.
- Make sure that the room where the stove is installed offers sufficient ventilation and install an air supply duct from the outside with the recommended minimum section of 15 in².
- The air intake vent must communicate directly with the installation room of the stove, positioned so as to prevent it from being blocked and protected with a permanent non-lockable grid or other suitable protection provided that it does not reduce the minimum section.
- Air flow can also be obtained from a room adjacent to the installation room, provided that this flow can be carried out freely through permanent, non-closable openings communicating with the outside.
- With respect to the installation room, the adjacent room should not be put under vacuum with respect to the external environment as a result of a reverse draft caused by the presence in this space of another utility device or suction device. The room adjacent to the permanent openings must meet the requirements set out in the paragraphs above. The adjacent room cannot be used as a garage, for storage of combustible material or for activities involving a risk of fire.

1.4 Connection to the chimney flue

(See paragraph 4.5)

1.5 Preventing house fires

Installation and use of the stove must be in accordance with the manufacturer's instructions and with local habitability regulations.
CAUTION: when a fume exhaust pipe passes through a wall or ceiling, particular installation methods must be applied (protection, thermal insulation, distances from heat sensitive materials, etc.).

- The fireplace connecting tube must never pass through a combustible surface.
- Do not connect this unit to a chimney flue already being used by another device.
- It is also advisable to maintain all combustible elements or flammable material such as beams, wooden furniture, curtains, flammable liquids, etc. outside the radiation area of the furnace and at a distance of at least 1 m from the heating block.
- In the event that the surrounding space has coverings in combustible or heat-sensitive material, a protective membrane made of non-combustible insulating material must be interposed. If the flooring is made of combustible material, a non-combustible protective material must be provided at the mouth of the furnace.
- For further information, refer to local requirements.

2 SPECIFICATIONS AND TECHNICAL DATA

2.1 Specifications

Stoves and pellet stoves are devices built to work with good quality wood pellets only (see par. 3 fuel).

2.2 Compliance status

The heaters described in this manual meet the 2020 U.S. Environmental Protection Agency's wood pellet emission limit for wood heaters sold after May 15th 2015.

	Emission Rate (g/hr)	**Heating Efficiency (% Overall)**	**1st hour Emission Rate (g/hr)**	**CO emission (gr/h)**
Valentina Air N	1,6	84	5,3	44,4

** Efficiency Calculated Per CSA B415.1*

2.3 Technical data

[3]

Model of type	**Valentina Air N**
Pellet hourly consumption (min/max)	2,6-7,9 lb/h
Efficiency (based on LHV)	> 87 %
Hopper capacity	50 lb
Smoke outlet ø	3,15 in
Weight	320 lb
Dimension (DxWxH)	14,7 x 14,5 x 31,5 in

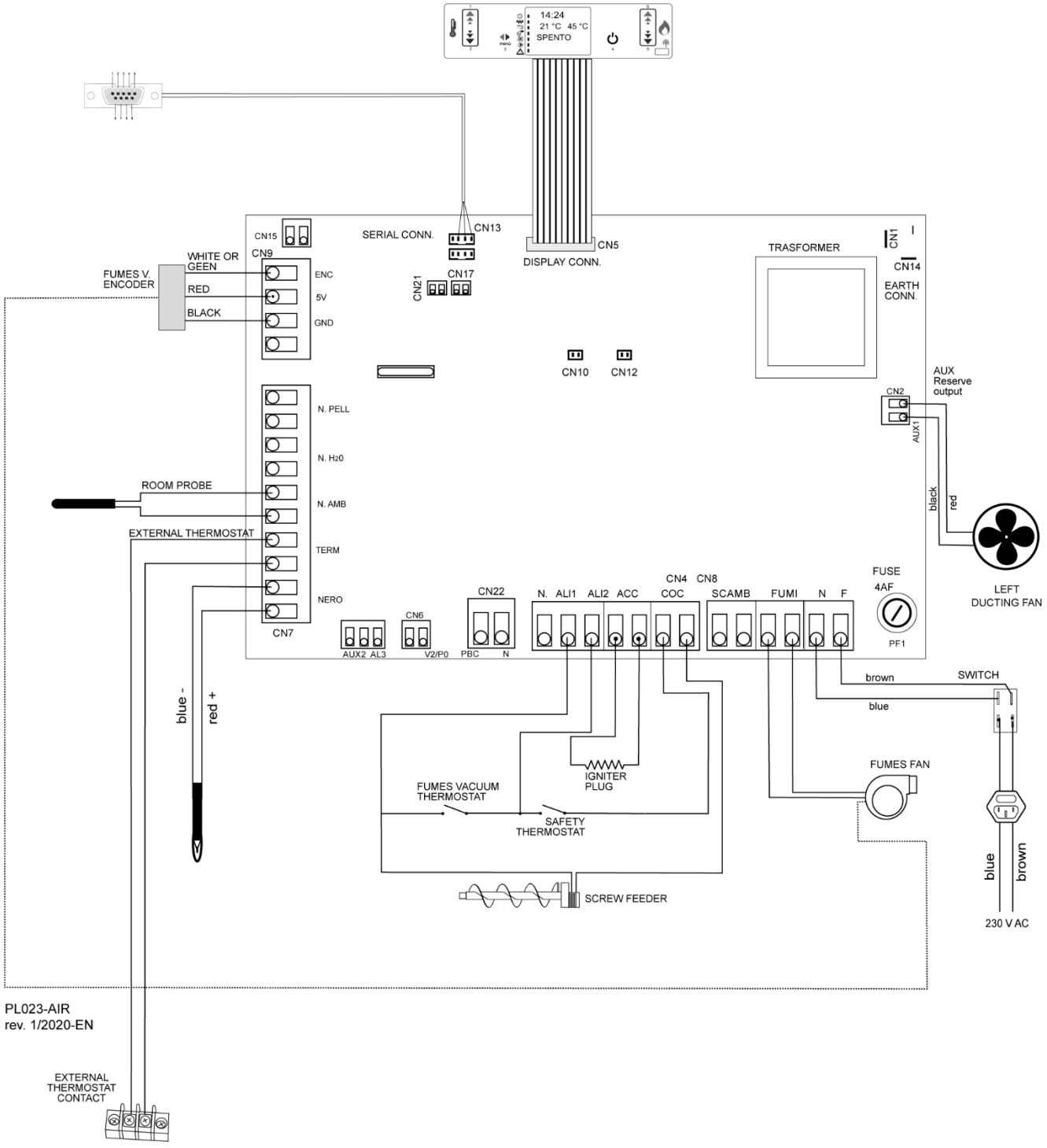
[4]

**Pellet size may affect actual rate of fuel feed and burn times. Fuel feed rates may vary by as much as 20%. Follow Manufacturer instructions and Use PFI certified pellet fuels to maximize efficiency.*

2.4 Product identification data

The technical label shows device data and performance. Tampering with, removing or lack of a technical label makes installation and maintenance operations difficult, due to the lack of product identification. In the event of damage, request a duplicate from our service centre. Given the importance of the data label, we recommend installing the stove at a distance at which it is always visible.

2.5 Wiring diagrams



5 FUEL

3.1 General notes

The pellet stove is designed to burn wood pellets only.
Wood pellets are a fuel obtained from the pressing of sawdust timber, extracted from the processing and transformation residues of dried wood material. The compactness of the product over time is guaranteed by a natural origin substance contained in the wood: lignin. The typical small cylinder form is obtained by extrusion.
Various types of pellets with quality and characteristics that vary depending on the processing and type of wood species used are available on the market.

CAUTION: Always use certified quality wood pellets: i.e. DIN, DIN PLUS, ÖM 7135, Pellet Gold, Catas etc. The company does not guarantee proper stove functioning with the use of low-quality pellets.
Stoves and heating stoves are tested and programmed to ensure good performance and perfect quality operation with specific characteristic pellets:

components:	wood
length:	< 30 mm
diameter:	6-6.5 mm
lower calorific value:	≥ 4.8 kWh/kg (≥ 7500 BTU/lb)
humidity rate:	< 8 %
residual ash:	< 0.5 %

GOOD QUALITY pellets are smooth, shiny, slightly dusty and with regular length. LOW QUALITY pellets are of varied lengths, dusty with vertical and horizontal splits.

Since pellet characteristics and quality greatly influence the autonomy, efficiency and proper operation of the stove, we recommend:

AVOID using pellets with dimensions different from that described by the manufacturer.
AVOID using low quality pellets or pellets containing dispersed sawdust powder, resins or chemicals, additives or adhesives.
AVOID using moist pellets.

The use of unsuitable pellets causes:
- clogging of the brazier and fume discharge ducts
- increased consumption of fuel
- decreased efficiency
- no guarantee of normal stove operation
- dirtying of glass
- production of unburned granules and heavy ash

The presence of moisture in pellets increases the volume of the capsules and crumbles, causing
- feeding system malfunctions
- poor combustion

Pellets should be stored in a dry and sheltered place. Particular attention should be given to the handling of the bags to prevent their crushing, resulting in the formation of sawdust.
Stove operation parameters may have to be altered when using quality pellets with dimensional and calorific characteristics different from those indicated. Contact an authorized service centre if necessary.
he use of poor-quality pellets not in accordance with manufacturer's instructions not only damage the stove and compromise performance but may result in forfeiture of the warranty and company liability.

Follow Manufacturer instructions and Use PFI certified pellet fuels to maximize efficiency.
.

6 INSTALLATION

4.1 General notes

CAUTION: DO NOT INSTALL IN SLEEPING ROOM

The stove requires a UL listed pellet vent. So, the venting system shall be approved for pellet stoves by a certified testing Laboratory

4.1.1 Installation in the presence of several appliances.

The presence of several appliances powered with different fuels, as well as hoods with or without extractor, must be evaluated during preventive checks and during the start up test in order to detect any variation compared to the design conditions or any aspect that cannot be detected during the design phase. The room must be well-ventilated according to the instructions of every single device. The external air intake vent must meet the requirements of paragraphs 1.3 and 4.4

The stove must not be used simultaneously with other generators that collect air from the environment even if installed in adjoining or communicating rooms

4.1.2 Suitability of the installation rooms

- Installing the device inside garage, store for combustible materials or rooms at risk of fire is prohibited.
- If the flooring is made of wood, provide a floor protection surface in compliance with current national standards
- Outdoor installation is prohibited, as well as exposure to atmospheric agents or humid areas.
- Locating the stove in a room with an explosive atmosphere is prohibited

4.1.3 Fume discharge system

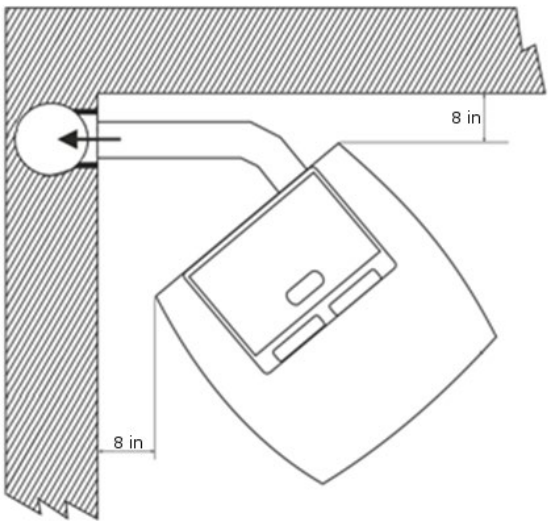
Every device must be connected to a fume discharge system, which ensures dispersion of combustion products into the atmosphere.
The combustion products must be discharged from the roofs. Direct wall discharge or towards closed spaces, even in open air, is prohibited.
The components must be made of material with A1 fire reaction class. In particular, the use of metal extendible and flexible hoses is prohibited.

CAUTION: ensure that the plug for electrical connection remains accessible after the stove installation.

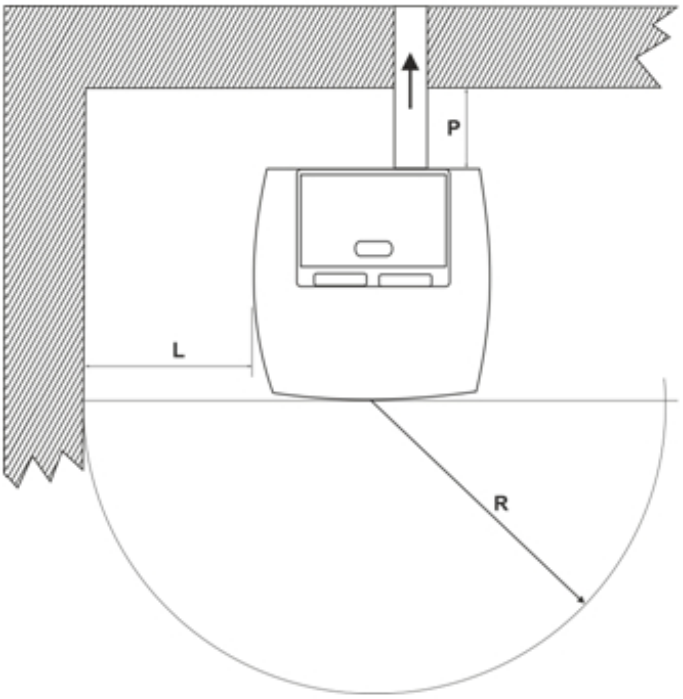
4.2 Minimum safety distances

The following figures show the minimum safety distances, which must always be guaranteed.

4.2.1 Corner installation



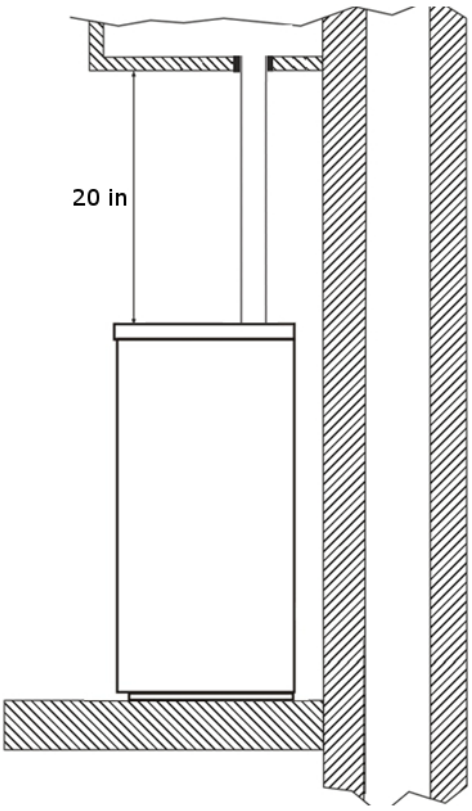
4.2.2 Wall installation



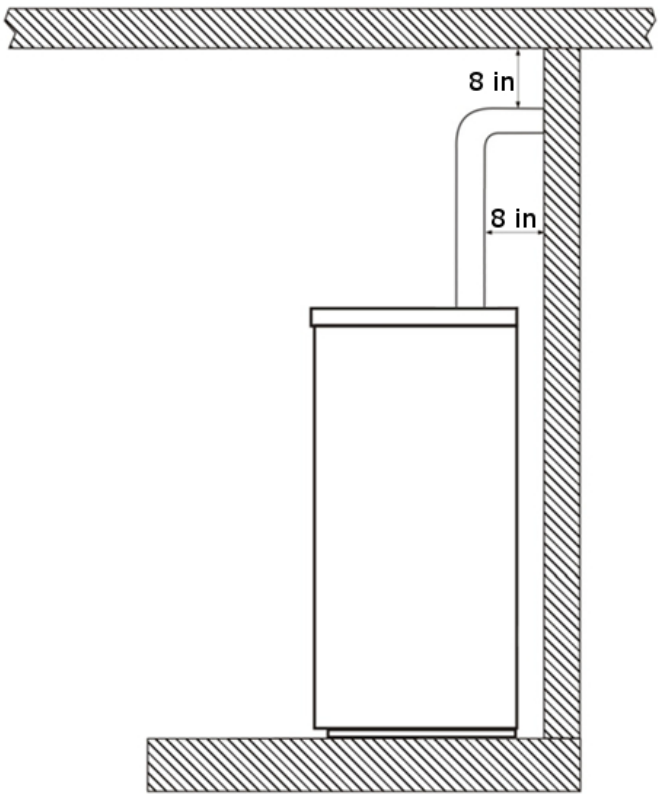
Safety distances from flammable material:

Minimum distance in air from the flammable rear wall	**P**= 8 in
Minimum distance in air from the flammable side wall	**L**= 8 in
Frontal distance from flammable material	**R** = 40 in

4.2.3 Distance from flammable ceilings and false ceilings



4.2.4 Distance of fume exhaust system from flammable walls



4.3 Flooring protection

In the event of valuable flooring or flooring that is sensitive to heat, moisture or is flammable, a floor protection must be used (i.e. sheet steel, marble or tile slabs).
Whichever type of protection selected, it must protrude at least 300 mm from the front, at least 150 mm from the sides of the stove, must withstand the weight of the stove and have a thickness of at least 2 mm (Fig. 5 and 6).

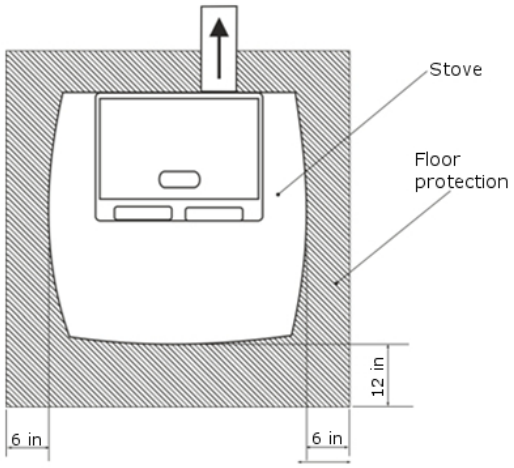


Fig. 5

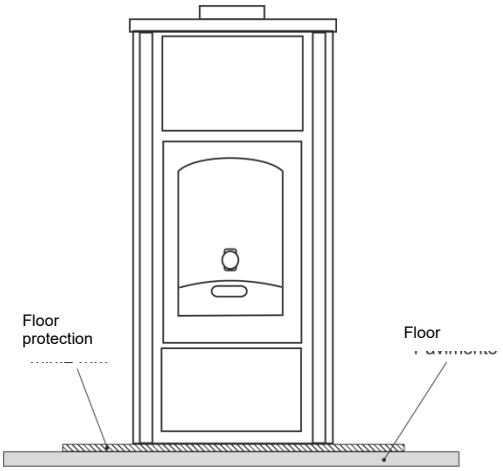


Fig. 6

4.4 Minimum distances for positioning air intake vents

Pellet stove combustion air intake vents cannot be connected to an air distribution system or directly to a wall-mounted air intake vent.
Correct and safe positioning of the air intake vent must comply with the measures and requirements described in paragraph 1.3.
There are distances to be respected in order to avoid that combustion air be removed by another source; for example, a window opening can suck the air outside, making it miss the stove.

The air intake vent must be located at least:		
5 feet (1.5 m)	**Under**	**Doors, windows, fume exhaust outlets, air gaps, etc.**
5 feet (1.5 m)	**Horizontally away**	
1 foot (0.3 m)	**Over**	
5 feet (1.5 m)	**Away from**	**Fume output**

4.5 Vent exhaust duct

4.5.1 General notes

The stove requires a UL listed pellet vent, so the venting system shall be approved for pellet stoves by a certified testing Laboratory

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

DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE

INSTALL VENT AT CLEAREANCES SPECIFIED BY THE VENT MANUFACTURER

CAUTION: the pellet stove is not like other stoves. Fume draft is forced thanks to a fan that maintains the pressure in the combustion chamber and slight pressure around the exhaust duct. Therefore, you must verify that the latter is completely watertight and properly installed, both from the point of view of function and safety.

Draft us the force which moves air from the appliance un through the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors.
Too much draft may cause excessive temperature in the appliance and may damage the appliance.
Inadequate draft may cause back puffing into the room ad ‘plugging’ of the chimney

Construction of the exhaust duct must be done by specialized personnel or companies, as reported in the following manual. Always create the exhaust system so that periodic cleaning is assured without having to dismantle any parts.

4.5.2 Tubes and maximum usable lengths

Painted aluminized steel tubes, stainless steel tubes (Aisi 316) or porcelain tubes can be used.
Flexible hoses are permitted if they fall within the limits prescribed by law (in stainless steel with smooth inner wall).

TYPE OF SYSTEM	WITH DOUBLE-WALL TUBE
Minimum length	6 feet (2 m)
Maximum length (with 3 90° curves)	26 feet (8 m)
Maximum number of curves	4
Horizontal sections with min. 5% incline	6 feet (2m)

NOTE: load losses of a 90° curve can be equated with those of 1 meter of tube; the serviceable T- connection is to be considered as a 90° curve.

4.5.3 Holes for exhaust tube passage on walls or roof

Once the location of the stove has been decided (section 4.1), you will have to drill the hole for passage of the fume exhaust tube. This varies depending on the type of installation (therefore on the exhaust tube diameter, see 4.5.2) and on the type of wall or roof to be crossed (table 3).
The insulator must be of mineral origin (rock wool, ceramic fiber) with a nominal density greater than 80 kg/m3.

	Insulation thickness	Diameter of holes to be created [mm]
Wooden wall, or wall which is flammable or has flammable parts	4 in	12 in
Concrete wall or roof	2 in	9in
Brick wall or roof	1,5 in	7 in

4.5.4 Using a traditional type chimney flue

If you wish to use an already existing chimney flue, it is advisable to have it checked by a professional chimney sweep to ensure that it is watertight. This is because fumes, being slightly pressurized, could infiltrate cracks in the chimney flue and invade living spaces. If an inspection finds that the chimney flue is not perfectly intact, it is advisable to intubate it with new material. If the existing chimney is large, we recommend inserting a tube with a maximum diameter of 6 in

It is also advisable to insulate the vent exhaust duct. Figs. 7 and 8 demonstrate the solutions to adopt if you want to use an existing chimney flue.

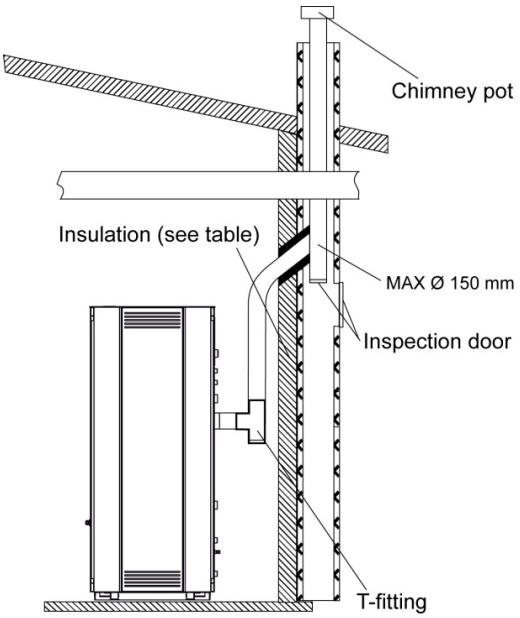


Fig. 7

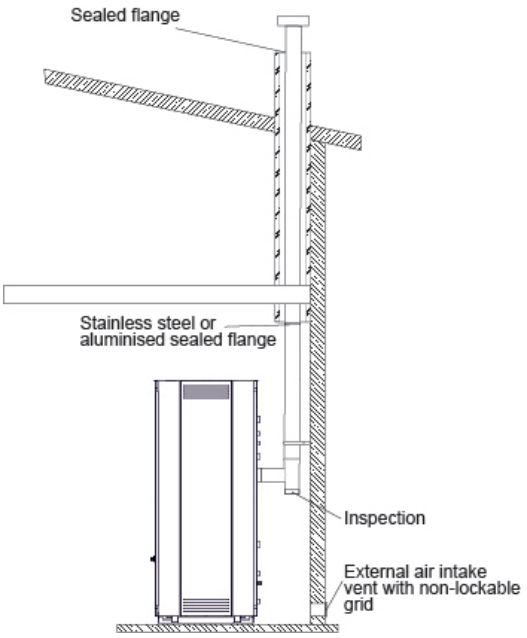


Fig. 8

4.6 Using an external fume duct

An external fume duct can be used only if it meets the following requirements:

- Only insulated tubes (double wall) in stainless steel, secured to the building (Fig.9) should be used.
- An inspection area should be created at the base of the duct for performing periodic checks and maintenance.
- It should be equipped with a windproof chimney cap and observe the distance "d" from the ridge of the building as described in par. 1.2.
- Fig. 9 shows the solution to be utilized when using external fume ducts.

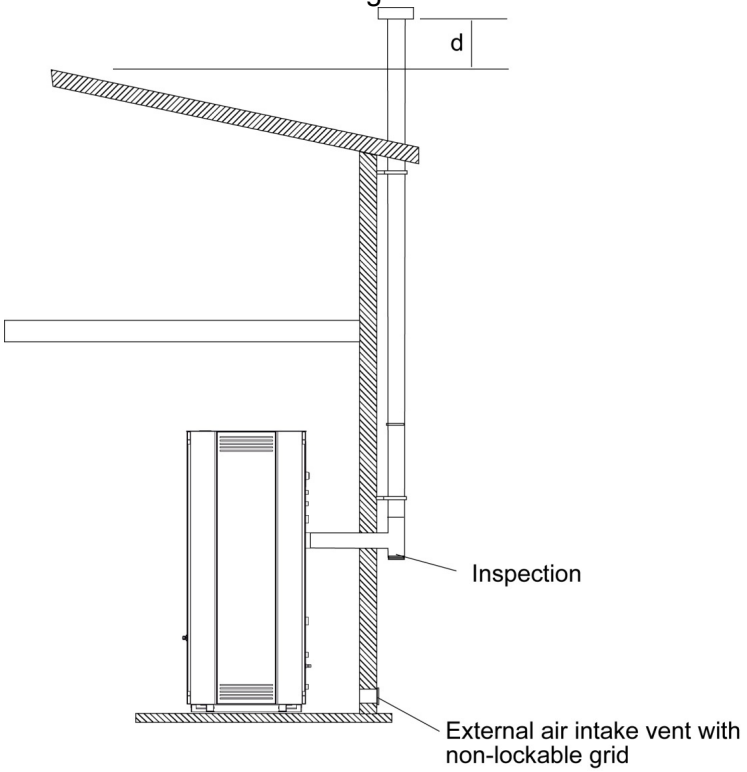


Fig. 9

5 ASSEMBLY

5.1 General notes

Here are some general recommendations to follow in order to prevent accidents or damage to the product:

- Unpacking and installation must be performed by at least two people.
- **All handling operations must be carried out using appropriate means and in full compliance with safety regulations.**
- The positioning of the packed product must be maintained in accordance with the guidelines supplied by pictograms and written on the packaging.
- If using ropes, straps, chains, etc., make sure they are suitable for the weight to be unloaded and are in good condition.
- When moving the package, move with slow and continuous movements to avoid tearing the ropes, chains, etc.
- Do not tilt excessively in order to avoid overturning.
- Do not stand within range of the loading/unloading means (forklifts, cranes, etc.).

5.2 Unpacking

Unpack the product being careful not to damage or scratch it. Remove the accessory package and any pieces of polystyrene or cardboard used to block removable parts, etc. from the stove furnace. Also remember not to leave packaging components (plastic bags, polystyrene, etc.) within the reach of children, as they could be potential sources of danger. Dispose of them according to regulations.

5.3 Electrical connection

The stove is supplied with a power cable that must be plugged into a 120V 60Hz outlet.
Absorbed power is indicated in the "SPECIFICATIONS AND TECHNICAL DATA" chapter of this manual.
By law, the system must be properly grounded and with a differential circuit-breaker.
Make sure that the electrical power cable does not come into contact with hot parts when set in its final position.

CAUTION: ensure that the plug for electrical connection remains accessible after stove installation.

5.4 External thermostat installation

Stove operation can be adjusted to any external room thermostat connected to the circuit board (see electrical diagram).
This operation should be performed by qualified personnel.
The external thermostat works in parallel to the internal thermostat of the stove. To work the external thermostat exclusively, set room temperature to minimum (44° F). At this point, stove modulation will be controlled by the external thermostat.
During the working phase, if the room temperature is lower than the set temperature and the external thermostat is active (closed contact), the stove will operate at the set power level. When the room temperature reaches the set temperature, (external thermostat contact open), the stove will go to minimum power and the display will show the message "MODULATE". This modulation has been completed only if the room temperature returns to being lower than the set temperature in the external thermostat.

6 USE

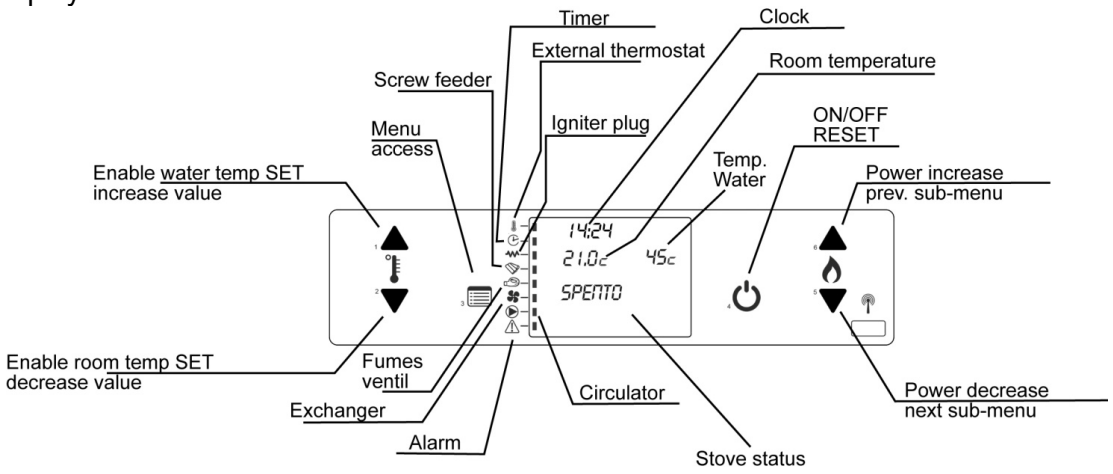
- All local regulations, must be observed when installing the unit.
- Improper installation or use of the device can result in forfeiture of the warranty.
- Do not use the unit as an incinerator or in any other way other than that for which it was designed. No other fuel besides wood pellets must be used.
- Do not use liquid fuels.
- The device, especially the external surfaces, gets very hot to the touch when in use. Handle with care to avoid burns.
- Do not make any unauthorized modifications to the device.
- Only use original replacement parts recommended by the manufacturer.
- This wood heater needs periodic inspection and repair for proper operation. It is against federal regulation to operate this wood heater in a manner inconsistent with operating instructions in this manual.
- This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulation to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instruction in this manual
- Flues gases contain carbon monoxide (CO), it is recommended to install smoke monitors and CO monitors for areas that are expected to generated CO. Inspect the chimney to minimize visible emissions.
- - Soot and Flyash: Formation and Need for Removal—The products of combustion will contain small particles of flyash. The flyash will collect in the exhaust venting system and restrict the flow of the flue gases. Incomplete combustion, such as occurs during startup, shutdown, or incorrect operation of the room heater will lead to some soot formation which will collect in the exhaust venting system. The exhaust venting system should be inspected at least once every year to determine if cleaning is necessary.

In general

- Make sure that the room where the stove is to be installed offers sufficient ventilation (see section "1.3 External air intake vent").
- Periodically check (or have someone check) the cleanliness of exhaust fumes.
- When the stove is in operation, remove the extractable handle and place it in the appropriate compartment located at the rear of the stove
- **CAUTION: keep all flammable products well away from the stove when it operating (MINIMUM: 100 cm from the front wall).**
- **CAUTION: to prevent the escape of fumes, the combustion chamber must be kept closed except during cleaning operations, to be carried out with the stove off.**
- **CAUTION: removing the safety guard inside the tank is strictly prohibited.**
- **CAUTION: in the event of pellet supply while the stove is on, make sure that pellets are not finished and that the flame remains present in the brazier. Also avoid the fuel sack from coming into contact with hot surfaces.**
- **CAUTION: remove any residue of unburned pellets caused by failed ignitions before you start the stove again.**
- **CAUTION: if during the ignition phase, the stove does not start and you notice a lot of smoke in the combustion chamber, immediately turn off the stove and replace pellets in use, as these may be too high in moisture. Forcing ignition could make your stove a hazard.**
- **CAUTION: if during cleaning, you find traces of spongy or hard (though not ash) pellets, replace the pellets being used as this residue may come from scraps of low-quality sawdust not usable in this type of stove. Forcing ignition can cause a fire or strong production of fumes in the chimney.**
- **CAUTION: monitor proper combustion of the pellets in the brazier. If you should detect accumulations of unburned pellets, IMMEDIATELY TURN OFF the stove and contact the service centre.**
- **CAUTION: exercise extreme caution in the presence of children, to prevent them from standing in front of the stove.**

6.1 Console description

The console displays information about stove operating status. Access the menu to view various types of displays and adjust the settings available depending on the level of access.
Depending on the operating mode, the displays may have different meanings based on their position on the display.



Below is a list of meanings of LEDs found on control panels:

	Room thermostat LED	The LED is on when it is connected to an external room thermostat and it is closed.
	Chrono LED	The LED switches on when the programmable thermostat is activated; meaning, if user parameter 03-01-01 enables chrono, it is different from off.
	Glow plug LED	The LED switches on when the glow plug is powered.
	Feed screw on LED	The LED switches on in the time intervals in which the pellet feed screw is in operation.
	Smoke fan LED	The LED switches on when the smoke fan is on.
	Exchanger LED	The LED switches on when the fan is in operation (air version)
	Pump on LED	The LED switches on when the pump/circulator is in operation (only with Hydro and boiler models)
	Alarms LED	The LED switches on when there is an alarm activated on the stove.

6.1.1 Console button functions

4	BUTTON 4 ON/OFF	• Manual on/off of the stove • Exit from a sub-menu • Exit from a shutdown or alarm (and passage to off status)
5	BUTTON 5 POWER REDUCTION	• Reduction in set power value • Passage from a sub-menu to the previous one
6	BUTTON 6 POWER INCREASE	• Increase in set power value • Passage from a sub-menu to the next one
3	BUTTON 3 MENU SELECTION	• Passage to sub-menus • Passage from programmable thermostat and clock programming • Passage to technical parameters programming
1	BUTTON 1 PARAMETER ADJUSTMENT (INCREASE)	• In temperature setting mode, increases the set value. • In technical parameter setting mode, increases the set value.
2	BUTTON 2 PARAMETER ADJUSTMENT (DECREASE)	• Passage to room temperature setting mode. • In temperature setting mode, reduces the set value. • In technical parameter setting mode, reduces the set value. • In work mode, activates room temperature setting.

6.2 First ignition

Before igniting the stove, you MUST have a qualified technician perform "FIRST START-UP" and calibration. For this purpose, we advise you to contact personnel part of our network of authorized service centres.
The company assumes no responsibility for malfunctions due to improper installation, failure to install, incorrect first ignition, or improper use.
Make sure that electrical connections have been performed properly.
Before lighting the stove, also check that the brazier is pushed back towards the rear wall of the combustion chamber.
The first few times you light the stove, it may give off odors due to the evaporation of paint or grease. Simply ventilate the room to make the odor go away, avoiding prolonged exposure as vapors can be harmful to people or animals. Do not allow children to stay in the room during this first phase.
When the tank is loaded for the first time, the feed screw must fill up for a given period. During this time, pellets will not be distributed within the combustion chamber. To overcome this difficulty, use the command "initial load" in menu 7 of the control panel (*see further details to follow*).

6.3 Ignition and normal operation

Before igniting the stove:

- **Check that the furnace door is locked.**
- Make sure that the pellet tank is full or contains such enough so that the stove will function for the desired amount of time.
- **Make sure that the brazier is clean**, free of ashes, combustion residue or unburned pellets (if necessary, remove the brazier and thoroughly clean it, then replace it with care in its housing).
- In the event or start-up with the programmable thermostat, make sure that the brazier is in the indicated conditions after last use.

When the stove is connected to the electrical system but not in work mode, the display will show the message "OFF".

6.3.1 Stove start-up

To start up the stove, hold and press the start button (4) for 2 seconds
If you start the stove during the final cleaning phase, the display may show the message "WAIT COOLING." In this case, wait for a minute before retrying ignition.

First phase. Preparation

The message "START" will appear on the display. In this phase, which lasts for about one minute, the pellet glow plug activates and combustion chamber forced ventilation starts along with activation of the fume extraction fan.

Second phase. Ignition

After the preparation phase, the display will show the message "LOAD PELLETS" and ignition will begin. This second phase is divided in two parts: pre-loading and actual ignition. First, the pellet feed screw is activated (the Feed screw ON LED lights up) for a variable time interval, depending on the model, and pellets begin to fall inside the brazier. **(Remember that the brazier must be perfectly clean at this beginning of this stage).** Once this "pre-loading" phase is completed, the pellet feed screw will stop for a variable amount of time depending on the model (from two to three minutes). After this waiting phase, the pellet feed screw will start to switch on at regular intervals and pellets will then continue falling inside the stove brazier, while the glow plug and then fume exhaust fan will both remain activated.
As soon as the pellets cover the glow plug hole, you will notice first a reddening and then the onset of a small flame in the brazier.
If pellets continue to fill the brazier without this happening, manually stop the ignition process without waiting for the stove to set off an alarm: "AL 5 NO START".
This second phase is completed when the stove detects successful triggering of the combustion process, or rather after 4-5 minutes from the triggering of the first flame.
If combustion is not detected within a given amount of time, the no start-up alarm will be activated ("AL 5 NO START" message).

Third phase. Stabilization

Once combustion triggering has been detected, the third phase will start and the display will show the message "FIRE PRESENT". Pellet feeding is reduced and ventilation increased in order to allow a stabilization of the flame and disposal of excess pellets accumulated in the brazier during the ignition phase. This phase lasts about 5 minutes.

Once the stabilization phase has been completed ("FIRE PRESENT"), the stove passes to the normal working phase.

6.3.2 No start-up

As said, if the onset of combustion is not detected, the no start-up alarm will be set off. The display will show the message "AL 5 NO START" and an acoustic signal will be heard at regular intervals (if the buzzer function is active in Menu 6).
To disable the alarm, hold and press the ON-OFF (4) (about 2 seconds). The acoustic alarm will stop and the stove will return to "FINAL CLEANING" status and then to "OFF."

Before starting another ignition cycle Verify the cause of the alarm. In particular:

- **Verify that the pellet tank is not empty.**
- **Verify that the brazier is in the right position.**
- **Remove the unburned pellets from the brazier (VERY IMPORTANT).**

CAUTION: An excessive quantity of pellets in the brazier, a humid pellet or dirty brazier make the ignition stage difficult. If these critical conditions are present a dense white smoke capable of causing an explosion in the combustion chamber may form. The explosion can be of such intensity as to break the glass of the dire door. Therefore, pay attention to never stay in front of the boiler during ignition stage if the fuel releases a dense smoke.

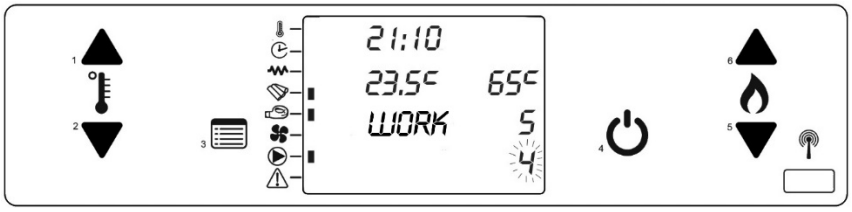
The boiler is however equipped with all safety systems required to minimize this risk.

<u>If the device does not ignite regularly, the main cause may be insufficient maintenance or poor pellet quality</u>**.**

6.3.3 Normal Operation

As soon as the ignition phase is over, the stove will go into normal working mode. During this phase, the display will show the following information:

- The first line shows the time.
- The second line to the left shows the room temperature while the line on the right shows set power (from P1 to P5).
- The third line shows the message "WORKING".
- The fourth line shows the message "MODULATE" when room temperature reaches the set temperature (see corresponding paragraph).



During normal working mode, the following operations can be performed:

- Stove power setting, choosing from one of the five available levels. Power setting is carried out via BUTTONS "5" and "6".
- Programmable thermostat parameter setting (see later section).
- Desired room temperature setting, choosing an interval from 7°C to 40°C. Set the temperature with button "1" to increase and "2" to decrease.

Periodic brazier cleaning is also active during working mode. Brazier cleaning mode is activated at regular intervals of about one hour. In this way, the smoke extractor works at maximum power while pellet feeding is reduced to minimum. This operation is necessary for eliminating ash deposits inside the brazier and for ensuring proper aeration and combustion. During brazier cleaning, the display

will show the message "BRAZIER CLEANING".

If you notice excessive accumulation of pellets in the brazier during normal operation, turn off the stove immediately and contact a service centre. Forcing could make your stove a hazard.

6.3.4 Modulation based on room temperature

The stove is equipped with an internal temperature sensor that allows it to modulate its power according to the desired room temperature.
For correct environment sensor operation, verify that the thermostat sensor positioned in the rear of the stove under the outlet is away from the fume exhaust pipe and is not in contact with objects or walls.
Press button "2" to set room temperature. The message " SET ROOM TEMP" will appear on the bottom of the display, while the upper part will show the set temperature.
To modify this value, use buttons "1" and "2" until you reach desired temperature (44°C to 104°C).
If the room temperature reaches the set temperature, the stove goes into minimum power and the last line of the display shows "MODULATE." This modulation has been completed only if the room temperature returns to being lower than the set temperature. In this case, the stove will return to the power set by the user and the display will show the message "MODULATE" and standard working indications will return.

6.3.5 Ventilation

Air models provide ventilation which diffuses the heat generated from by the stove into the surrounding environment. Activation of the ventilation occurs based on the temperature of fumes. Therefore, it starts up after ignition and switches off with a delay compared to stove shutdown. Ventilation speed is proportional to operating power and cannot be modified independently with respect to stove power.

In channeled air models, the stove has two rear hot air outputs, one on the right and the other on the left, under the pellet tank. Each of the two outputs has an independent control menu (see chapter 7 menu).

6.3.6 Brazier cleaning

During normal operation in work mode, "BRAZIER CLEANING" is activated at set intervals for a duration of about 45 seconds. During this time, the display will show the message "BRAZIER CLEANING", stove ventilation increases and the flame lowers in the brazier. This operation is necessary to decrease the likelihood of ash accumulation of ash inside the brazier.
If you notice an excessive accumulation of pellets in the brazier (over half the level of the brazier itself), immediately switch off the stove and clean the brazier. Promptly contact a service centre.

6.3.7 Shutdown

To turn off the stove, hold button 4 for a few seconds.
Once the shutdown signal has been received, the display will show a "FINAL CLEANING" message and the fume exhaust fan will continues to run at full speed for a minimum time of about 10 minutes to ensure complete cooling of the stove. The hot air fan will also continue to run until the stove cools down.

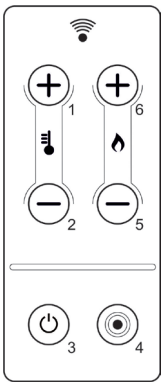
CAUTION: Never disconnect the power supply at this stage, as this may create problems for the stove and compromise the subsequent phases of ignition.

6.3.8 Interruption of power supply

In the event of a brief interruption in the power supply (under 10 seconds), the stove will automatically re-start without any alarms.
If power is lost for a longer time and the stove was in work mode, an "AL 1 - BLACK OUT" alarm will be generated. The stove will therefore not start back up automatically, but first the alarm will need to be manually removed.

6.3.9 Remote control.

The stove control panel has been designed to receive all the functions via remote control. *(Insert a CR 2025 3V battery)*



BUTTON 1	• In temperature setting mode, increases the set value. • In technical parameter setting mode, increases the set value.
BUTTON 2	• Passage to room temperature setting mode. • In temperature setting mode, reduces the set value. • In technical parameter setting mode, reduces the set value. • In work mode, activates room temperature setting.
BUTTON 3	• Passage to sub-menus • Passage from programmable thermostat and clock programming • Passage to technical parameters programming
BUTTON 4	• Manual on/off of the stove • Exit from a sub-menu • Exit from a shutdown or alarm (and passage to off status)
BUTTON 5	• Reduction in set power value • Passage from a sub-menu to the previous one
BUTTON 6	• Increase in set power value • Passage from a sub-menu to the next one

7 MENU

Press button "3" (MENU) to access the menu.
The menu is divided into different items and levels that allow you to access board settings and programming. Menu items that allow you to access technical programming are protected by an access key.

User menu

The following table briefly describes the structure of the menu, focusing only on selections available to the user in this section.
To operate from the menu, follow the guidelines below:

- Use button"3" to enter into the selected menu or sub-menu (you go down a level).
- Use button "4" to do the reverse and exit the menu or sub-menu in which you are located (you go up a level).
- Use buttons "1" and "2" to modify a parameter value (temperature, time, etc.).
- Use buttons "5" and "6" to move horizontally between different menus or sub-menus or parameters.

7.1 Menu 01 "FANS ADJUSTMENT"

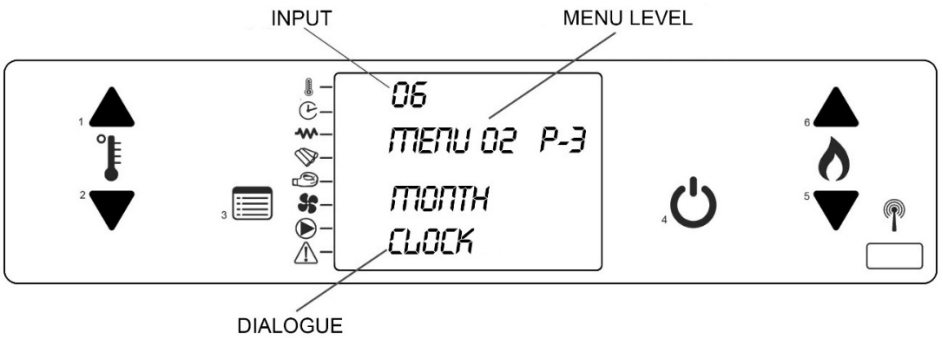
Menu item 01 "FANS ADJUSTMENT" is present only on channeled air models and allows you to modify the ventilation of the two channeled outputs. The choices shown in the table below are possible for each of the two fans. Press button "1" (fan 2) and "2" (fan 3) to select.

Setting	Fan 2	Fan 3
AUTO	corresponding to the selected power	corresponding to selected power
0	fan off	fan off
1	speed 1	speed 1
2	speed 2	speed 2
3	speed 3	speed 3
4	speed 4	speed 4
5	speed 5	speed 5

7.2 Menu 02 "CLOCK SET"

You can set the current time and date in this menu. The board is equipped with a lithium battery that allows internal clock autonomy over 3/5 years.
Enter into MENU and set, in order:

01	Day of the week	(Monday… Sunday)
02	Hour	(0..23)
03	Minutes	(0..59)
04	Day of the month	(1..31)
05	Month of the year	(1..12)
06	Current year	(2000.. 2099)

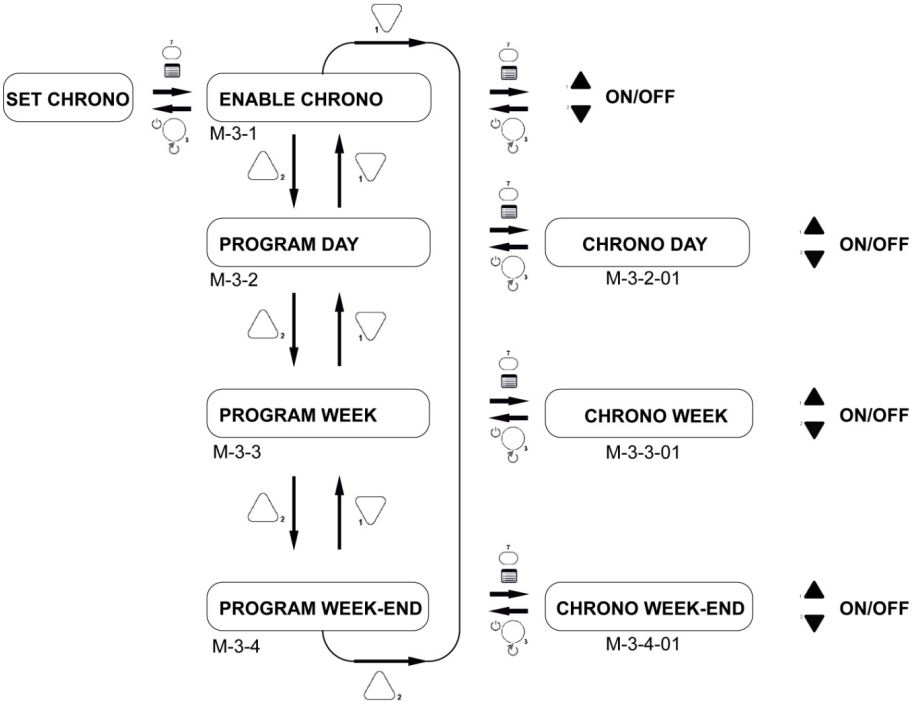


7.3 Menu 03 "CHRONO SET"

Use this menu to enable and program start-ups and shutdowns. There are eight different possibilities divided into three groups:

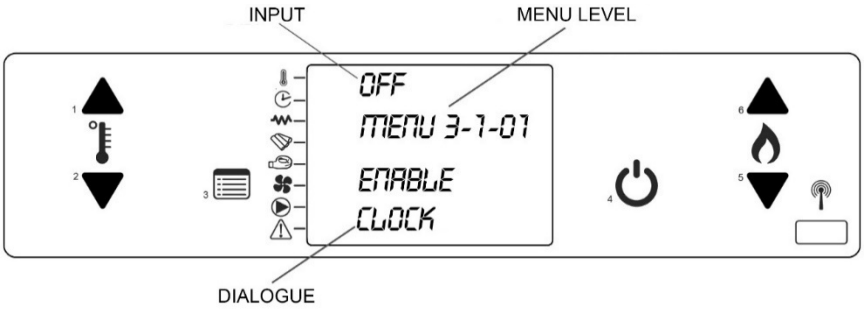
- **Daily program**: 2 start-ups and shutdowns valid each day
- **Weekly program**: 4 start-ups and shutdowns, for which you can decide which days of the week they must be active.
- **Weekend program**: 2 start-ups and shutdowns valid only for Saturday and Sunday.

Below is the diagram of the various Menu levels. Access the menu by pressing “3”, return to the previous menu by pressing “4”, scroll through the menu by pressing “5” and “6” and change the value by using keys “1” and “2”.



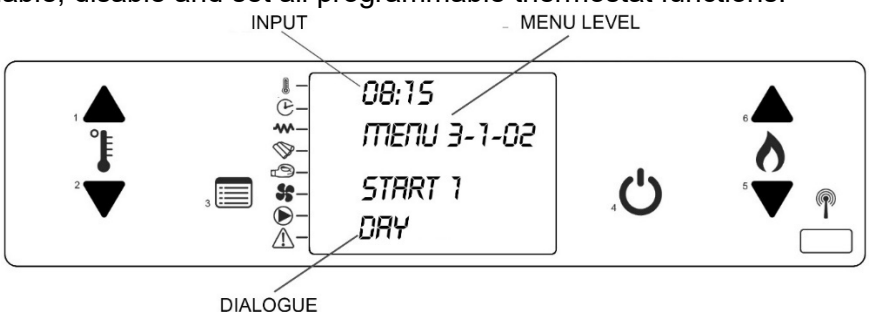
7.3.1 Menu 3-1 “ENABLE CHRONO”

Allows you to enable and disable all programmable thermostat functions. If the value is "off", all set programs are disabled.



7.3.2 Menu 3-2 “DAILY PROGRAM”

Allows you to enable, disable and set all programmable thermostat functions.

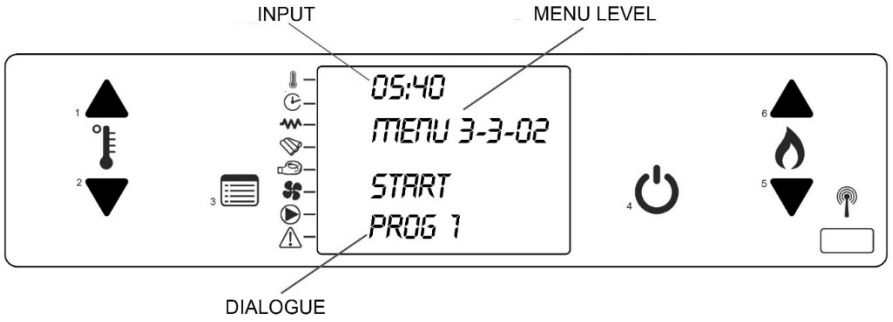


After having set the first parameter (M-3-2-01) “DAILY CHRONO” to "on", you can set two start-ups and two shutdowns. For each parameter, you can either set the value "off", if you do not wish to activate, or the time of start-up or shutdown.

Menu level	*Selection*	*Meaning*	*Possible values*
03-02-02	START 1	Activation time	00:00-23:50 -OFF
03-02-03	STOP 1	Disable time	00:00-23:50 -OFF
03-02-04	START 2	Activation time	00:00-23:50 -OFF
03-02-05	STOP 2	Disable time	00:00-23:50 -OFF

7.3.3 Menu 3-3 “WEEKLY PROG-“

The weekly programming group includes 4 start-ups and 4 shutdowns. For each on-off pair, you can decide which day of the week to activate the corresponding pair controls.
The first parameter, M-3-3-01 “WEEKLY CHRONO”, you can enable or disable all weekly programmable thermostat settings.



After having set the first parameter (M-3-2-01) “WEEKLY CHRONO” to "on", you can set 4 start- ups and 4 shutdowns. For each parameter, you can either set the value "off", if you do not wish to activate, or the time of start-up or shutdown. After each pair of on and off times, there are 7 parameters corresponding to the 7 days of the week. Each of these parameters can be set to "on" or "off" based on which programming you wish to activate corresponding to that day of the week. (See following tables).

PROGRAMME 1			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-02	START PROG 1	on time	00:00-23:50 -OFF
03-03-03	STOP PROG 1	off time	00:00-23:50 -OFF
03-03-04	MONDAY PROG 1	reference day	on/off
03-03-05	TUESDAY PROG 1		on/off
03-03-06	WEDNES-PROG 1		on/off
03-03-07	THURSDAY PROG 1		on/off
03-03-08	FRIDAY PROG 1		on/off
03-03-09	SATURDAY PROG 1		on/off
03-03-10	SUNDAY PROG 1		on/off

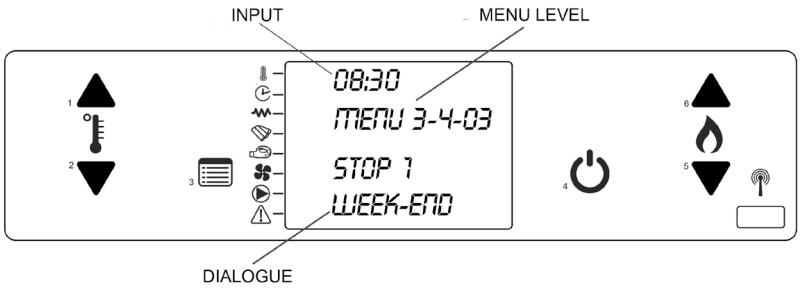
PROGRAMME 2			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-11	START PROG 2	On time	00:00-23:50 -OFF
03-03-12	STOP PROG 2	Off time	00:00-23:50 -OFF
03-03-13	MONDAY PROG 2	reference day	on/off
03-03-14	TUESDAY PROG 2		on/off
03-03-15	WEDNES-PROG 2		on/off
03-03-16	THURSDAY PROG 2		on/off
03-03-17	FRIDAY PROG 2		on/off
03-03-18	SATURDAY PROG 2		on/off
03-03-19	SUNDAY PROG 2		on/off

PROGRAMME 3			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-20	START PROG 3	On time	00:00-23:50 -OFF
03-03-21	STOP PROG 3	Off time	00:00-23:50 -OFF
03-03-22	MONDAY PROG 3	reference day	on/off
03-03-23	TUESDAY PROG 3		on/off
03-03-24	WEDNES- PROG 3		on/off
03-03-25	THURSDAY PROG 3		on/off
03-03-26	FRIDAY PROG 3		on/off
03-03-27	SATURDAY PROG 3		on/off
03-03-28	SUNDAY PROG 3		on/off

PROGRAMME 4			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-29	START PROG 4	On time	00:00-23:50 -OFF
03-03-30	STOP PROG 4	Off time	00:00-23:50 -OFF
03-03-31	MONDAY PROG 4	reference day	on/off
03-03-32	TUESDAY PROG 4		on/off
03-03-33	WEDNES- PROG 4		on/off
03-03-34	THURSDAY PROG 4		on/off
03-03-35	FRIDAY PROG 4		on/off
03-03-36	SATURDAY PROG 4		on/off
03-03-37	SUNDAY PROG 4		on/off

7.3.4 Menu 3-4 “WEEKEND PROG-“

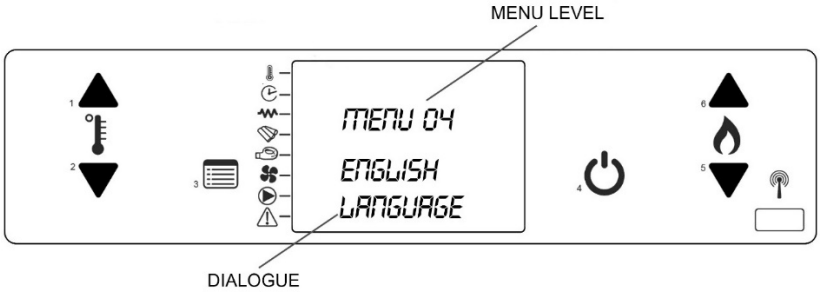
Allows you to enable, disable and set programmable thermostat functions for the weekend (Saturday and Sunday). As per daily programs, we have an enabling parameter and 2 pairs of start-up and shutdown times. Programming will be active as stated only on Saturday and Sunday.



TIP: to avoid confusion and unwanted start-up and shutdown, activate only one program at a time if you do not know exactly what your desired programming is.
Disable the daily program if you want to use weekly programming. Always disable the weekend program if you are using weekly programs 1,2,3 and 4.
Activate the weekend program only after having disabled weekly programming.

7.4 Menu 04 "CHOOSE LANGUAGE"

Allows you to select the dialogue language among those available.



7.5 Menu 05 "STAND-BY MODE"

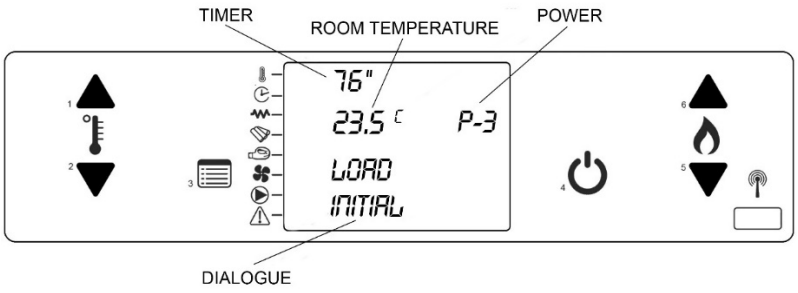
This menu allows you to activate or deactivate "STAND-BY".
Stand-by mode indicates a condition in which the stove shuts off but where it automatically re- ignites as soon as the room temperature and the water temperature fall below the set value and the flue gas temperature drops below its threshold (stove is cold). Default setting is "OFF".
Once the stand-by Menu is set to a value between 1'-120', if the water temperature or room temperature exceed a certain amount, set values (2°F for room temperature and 4°F for water temperature), an alternating message "MODULATE / OK STD BY" appears on the screen. At this point, after a pre-set time, if temperatures do not return under the set values, the stove shuts off and goes into stand-by mode.
During shutdown, the display shows the message "WAIT COOLING." This display message remains until re-lighting conditions are verified.

7.6 Menu 06 "BUZZER MODE"

When "off," acoustic signal disabled in the event of an alarm. When "on," sets off a buzzer when an alarm is activated.

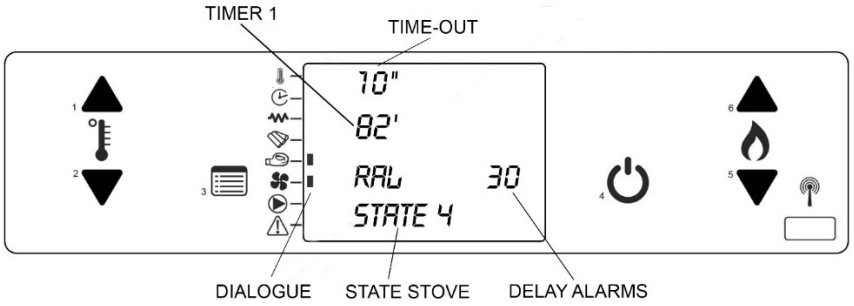
7.7 Menu 07 "INITIAL LOAD"

When the display shows the message "OFF," allows you to preload pellets for a time equal to 90 min. Start by pressing button "1" and stop if desired by pressing button "4." Once preloading is completed, remove the loaded pellets from the brazier.



7.8 Menu 08 "STOVE STATUS"

The stove status menu shows the current state of the stove, showing some sensor values and other variables inside the stove. Four pages displayed in succession are available. This menu is for qualified service personnel use.

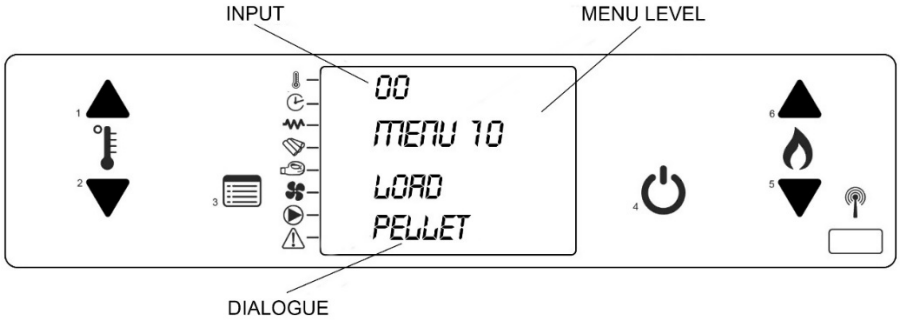


7.9 Menu 09 "TECHNICAL CALIBRATIONS"

This menu is protected by an access key and is intended for qualified service personnel.

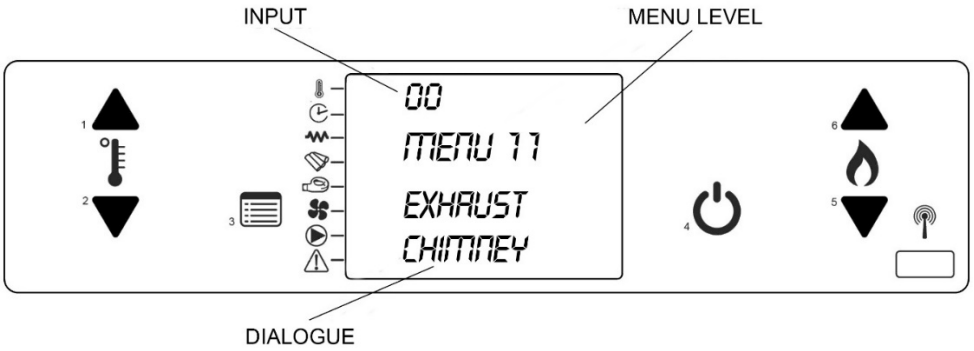
7.10 Menu 10 "PELLET TYPE"

This menu allows you to simultaneously increase or decrease all pellet lowering parameters (quantity of pellets and brazier loading).
The set default value is 00. Press keys (1) and (2) to modify said value from -9 to +9. For each unit, pellet load times are increased or decreased by 2.5 %.



7.11 Menu 11 "FIREPLACE TYPE"

This menu allows users to simultaneously increase or decrease all smoke fan parameters (draft). The set default value is 00. Press keys (1) and (2) to modify said value from -9 to +9.
For each unit, smoke motor revs are increased or decreased by 2.5%.



8 SAFETY AND ALARMS

8.1 Safety devices

CAUTION: during operation, some parts of the stove (door, handle, ceramic parts) can reach very high temperatures.
Remember to keep at the previously mentioned safe distance. Be careful, **use caution** and always follow the instructions.
If during operations any part of the stove or the exhaust pipe leak smoke, immediately turn off the stove **without** removing the power supply and ventilate the room. Then, once cooled down, verify the reason for the leak and, if necessary, call service personnel.
The stove is equipped with several devices which intervene in order to ensure safe operation.
CAUTION: safety devices are designed to eliminate any risk of damage to persons, animals or things, and tampering with or servicing by unauthorized personnel could compromise their safety.
Safety devices on the stove include the following:

8.1.1 Fume exhaust pressure sensor

This sensor is connected to the fume exhaust pressure duct. It controls internal pressure to the duct, monitoring any occlusion of the chimney flue and allowing use of the stove in total safety.

When it activates

If proper operation conditions in the vent exhaust duct are altered (improper installation, the presence of obstacles or impediments in the exhaust tube, negligent maintenance, adverse weather conditions such as persistent wind, etc.), the pressure sensor (pressure gauge) stops electrical power supply to the pellet feed screw, thus blocking pellet feeding to the brazier and sending an alarm signal to the board.
The alarm can also be caused by clogging in the stove, by improper combustion or lack of annual stove cleaning.
When the alarm goes off, the display shows the message **"AL 8 – LOW PRESSURE".**

What to do

- Put the stove in stand-by by pressing the off button for a few seconds (4). (The acoustic alarm stops).
- Wait and make sure that the combustion of pellets left in the brazier has been completed.
- Wait for the stove to cool down, then verify and remove the causes which caused the safety devices to go off. Finally, after having cleaned the brazier, re-start the stove by pressing the ON/OFF button (4).
- In the event of a repeated alarm, call a service centre.

8.1.2 Structure temperature sensor

The stove is equipped with a manual reset bulb thermostat whose function is to preserve the boiler, pellet tank and, consequently, the whole structure from excessive temperature changes.

When it activates

If the pellet loading tube reaches the threshold of 85°C.
In this situation, the thermostat interrupts electrical power to the feed screw, thus blocking pellet feeding to the brazier and sending an alarm signal to the board.
The display will show the message "**AL 7 – Thermal safety**".

What to do

- Put the stove in stand-by by pressing the off button for a few seconds
- Wait and make sure that the combustion of pellets left in the brazier has been completed.
- RESET THE SAFETY THERMOSTAT located on the rear of the stove under the outlet (*see Fig.14)*.

Before resetting the safeties, make sure that the stove is **off and completely cooled down,** then proceed as follows:

1 Unscrew the cap located on the rear lower right of the stove.
2 Press the red button with slight pressure.
3 Replace the cap in its housing.
4 **After having cleaned the brazier,** re-start the stove by pressing button (4).

8.1.3 Smoke temperature sensor

The smoke sensor is directly connected to the circuit board and keeps operating temperature of exhaust fumes from the stove under constant control, allowing safe use of the stove.

How it works

If fume temperature exceeds the first pre-set temperature limit, the board passes into modulation mode. The display will show the message "**MODULATE / MAX SMOKE**". At the same time if, despite passage to modulation, the fume temperature continues to increase and exceeds the second pre-set safety limit, the stove will pass into alarm mode. Pellet flow is interrupted and fume exhaust speed is set to maximum.
The display will show the message "**AL 3 – SMOKE TEMP**".

What to do

- Put the stove in stand-by by pressing the off button for a few seconds (4).
- Wait and make sure that the combustion of pellets left in the brazier has been completed.
- Verify and remove the causes which caused the safety devices to go off.
- After having cleaned the brazier, re-start the stove by pressing button (4).

8.1.4 Smoke sensor fault

The stove constantly controls smoke sensor functioning.

When it activates

If the sensor is momentarily and/or accidentally removed from its housing, or the connector is not correctly positioned on the circuit board or the sensor fails for any reason. The fault is signaled via display message **AL 2 – "SMOKE SENSOR**".

What to do

1 Put the stove in stand-by by pressing the off button for a few seconds (4).
2 Wait and make sure that the combustion of pellets left in the brazier has been completed.
3 If necessary, call a service centre to replace the sensor.

8.2 Alarms

In the event that an operating anomaly occurs, the board intervenes and signals the irregularities, operating in different modes depending on the type of alarm. The following alarms can occur:

Cause of alarm	Display message
No power	AL1 BLACK-OUT
Smoke temperature sensor	AL2 SMOKE SENSOR
Smoke overtemperature	AL3 SMOKE TEMP
Smoke fan fault	AL4 EXTRACT FAULT
No start-up	AL5 NO START
Shutdown during work mode	AL6 NO PELLET
General safety thermostat	AL7 THERMAL SAFETY
Safety pressure switch	AL8 LOW PRESSURE
No or low water sensor	AL9 WATER SENSOR
Water overtemperature	ALa WATER TEMP
Water press. outside allowed values	ALb WATER PRESS

ALL ALARM CONDITIONS CAUSE IMMEDIATE STOVE SHUTDOWN

To exit from an alarm condition, always press button "4" until the message "FINAL CLEANING" appears. You will also need to take additional steps, depending on the type of alarm generated. If you do not exit from the alarm condition within a given time (a few hours), the alarm will be sent into stove memory and the display will show the message "ALARM MEMORY." To exit from this condition, press button "4" as per above.

AL 1 - Black-out

This alarm is activated when the stove is disconnected from the mains.

What to do

Put the stove in stand-by by pressing the off button for a few seconds (4).

AL 2 - Smoke sensor

This alarm signals breakage of the smoke sensor (see safety devices)

AL 3 – Smoke temp

This alarm signals excessive smoke exhaust temperature (see safety devices)

AL 4 – Extract fault

This alarm indicates a failure to read the revs of the smoke expulsion motor by the control board. It may have been activated due to motor fault or due to a lack of connection between the rev reader (encoder) in the motor and the board.

What to do

Put the stove in stand-by by pressing the off button for a few seconds (4). Try switching the stove back on.

Contact your service centre if the problem persists.

AL 5 – No start

This alarm signals an ignition failure. This alarm is activated when, during the start-up phase, a maximum waiting time (about 20 minutes) is exceeded without the machine switching on successfully. (See ignition)

AL 6 – No pellet

This alarm indicates a flame failure in the brazier during normal stove operation. The main causes are: no pellets in the hopper or blocking of the pellet feed screw.

What to do

Put the stove in stand-by by pressing the off button for a few seconds (4).

Empty the brazier of all unburned accumulated pellets.

In the event of pellet exhaustion in the tank, refuel the stove and ignite it again. Do not insert pellets until the stove has cooled completely. **Pellet refilling must be performed with the stove off** or with the stove working with the flame present.

In the case of a pellet feed screw block, empty the tank and remove any foreign bodies present in the feed screw. Then refill with pellets and start the stove back up.

In the case of repeated feed screw blocks, call a service centre.

AL 7 – Thermal safety

This alarm is activated by intervention of the stove boiler safety thermostat (see safety devices).

AL 8 – Low pressure

This alarm is activated by intervention of the pressure sensor (pressure gauge) (see safety devices).

9 WARNINGS AND MAINTENANCE

WARNING

The maintenance and care must be carried out only with cold device.

You should only use spare parts approved and supplied by Laminox Idro Srl please contact your specialized retailer if you require spare parts. You must not make any changes to the device!!!.

The periodic maintenance, as indicated in this Installation and Operating Instruction, must be performed with the utmost care after reading the instructions, procedures and frequency described in this manual. Check the external air intake, by cleaning it, at least once a year. The flue must be regularly swept by the chimney sweeper. Let your chimney sweeper in charge of your area check the regular installation of the device, the connection to the flue and the aeration.
All maintenance operations (cleaning, replacements, etc.) should be carried out when the fire is out and the stove is cold. In addition, do not use any abrasive substances.

CAUTION: FAILURE TO CLEAN AFFECTS SAFETY

9.1 Opening the door

The door must remain closed during operation. The door should be opened only with the stove off and cooled down to perform maintenance and routine cleaning.

9.2 Ashes cleaning and disposal

Check the ash drawer every two days to see if it needs emptying
The ash collection compartment must be emptied regularly so as to impede combustion residue from arriving at the brazier support

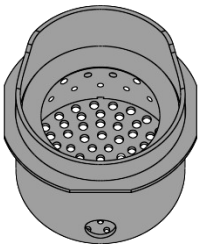
WARNING

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

CAUTION: ashes keep embers on for a long time!!!

9.3 Brazier cleaning

When the flame becomes a red color or is weak accompanied by black smoke, it may mean that there are ash deposits or incrustations which are not allowing correct stove operation and which must be removed.
Every two days, remove the brazier by simply lifting it from its housing, then clean it of ash and any incrustations which could have formed, with particular attention to freeing clogged holes using a pointed tool.
This operation is necessary in particular the first few ignitions, especially when using different quality pellets. The timing of this operation is determined by the frequency of use and the choice of fuel. It is advisable to also check the brazier support, emptying it of any ashes.
CAUTION: before igniting the stove, check that the brazier is pushed back toward the deflector and that the glow plug tube is inserted in the corresponding brazier hole.



9.4 Combustion chamber cleaning

Clean the combustion chamber weekly, removing ashes accumulated in the chamber using a vacuum cleaner.
Note: Use a vacuum cleaner designed for the suction of ashes for this type of cleaning.

9.5 Smoke chamber cleaning

Generally, clean the smoke chamber once a year (preferably at the beginning of the season) for best stove operation. The frequency of this operation depends on the type of pellet used and the frequency of use. Contact a Technical Assistance Centre for this type of cleaning.

9.6 Exhaust system cleaning

Until you are reasonably experienced regarding operating conditions, it is advisable to perform this service at least monthly. Remove the T-fitting cap and proceed with duct cleaning. If necessary, at least the first few times, request assistance from a qualified technician.

9.7 Cleaning metal and ceramic parts

Use a soft cloth moistened with water to clean metal stove parts.
Never clean metal or ceramic parts with alcohol, thinners, petrol, ketones or other degreasers.
Use of these substances frees the company from all liability. Discoloration of metal parts can be the result of improper use of the stove.

9.8 Cleaning glass

Door glass must be clean (cold) with ammonia-based and non-corrosive degreasers as a diluent. Prevent corrosive substances from coming into contact with the paint on the stove as these can cause damage. If glass is hot, before proceeding with cleaning, keep the door open as long as necessary until it cools down. Do not use any material that can scratch or damage the glass.

9.9 Broken glass

The stove is equipped with 5 mm thick ceramic glass that is resistant to a thermal shock of 1350°F. This glass can break only due to a strong impact or misuse. Do not slam the door or hit the glass. In case of breakage, replace with an original replacement part only. (See paragraph 9.15)

WARNING
Break of glasses: ceramic-based glasses can resist up to a heat shock of 1350°F, therefore they are not affected by thermal shock issues. Their break can be caused by mechanic shocks, such as striking or slamming shut of the door. Therefore, their replacement is not included in the warranty
Do not operate this unit with broken glasses
Broken or damaged glass components shall be removed and reinstalled taking care about using proper gaskets, cushioning devices and other accessories, maintaining edge clearances (See paragraph 7.15)
Replace glass only with glass supplied from the manufacturer or distributor of this appliance

9.10 Replacing the remote-control battery

Replace the old battery with a new CR 2025 3V battery, taking care not to invert polarity (polarity is indicated on the remote-control data sheet). Then close the remote control and dispose of the used battery in compliance with regulations. The installed battery must be the type specified above. Failure to comply with these instructions may create an explosion hazard.

9.11 Cleaning fans

CAUTION: all cleaning and/or maintenance operations must be performed with the POWER OFF.

The stove is equipped with fans (room and fumes) located at the lower rear of the stove. Any deposits of dust or ash on fan blades lead to an imbalance which causes noise during operation. Fans must therefore be cleaned at least once annually. As this operation involves the removal of some stove parts, have the fan cleaned by Technical Assistance Centre or qualified personnel only.

9.12 Stove inactivity

At the end of the season, perform the following operations:

- Remove all pellets from the tank and from the feed screw.
- Thoroughly clean the brazier, the support brazier, the combustion chamber and the ash drawer.
- Thoroughly clean the smoke exhaust system: contact a professional chimney sweep for this purpose.

- Clean all dust, spider webs, etc. from the area behind the panels of the inner cladding once a year.
- Clean fans thoroughly.
- Disconnect the power cable.

9.13 Routine and special maintenance

These operations should be programmed ANNUALLY with a Technical Assistance Centre and are necessary to ensure the maintenance of product efficiency and ensure safe operation.

- Thoroughly clean the combustion chamber and the heat exchanger.
- Smoke motor, dismantling and cleaning of the smoke exhaust duct, new silicone where required.
- Inspection and verification of gaskets, springs and replacement and application of the silicone where required.
- Tank, emptying and cleaning.
- Check of electrical and electronic parts.
- Cleaning and check of the tube and pressure gauge.
- Check and replacement, if necessary, of components that are subject to wear: brazier, resistance, ash drawers, etc.

9.14 Routine maintenance performed by qualified technicians

Using wood as solid fuel, the generator requires annual routine maintenance, which must be performed by a qualified technician, using only original spare parts.

Failure to comply can jeopardize the safety of the appliance and make the warranty null and void.

Respecting the frequencies of cleaning reserved for the user described in the use and maintenance manual, the generator is guaranteed correct combustion over time, preventing any anomalies and/or malfunctioning that could require more interventions of the technician. Requests for routine maintenance are not contemplated in the product warranty.

WARNING
Routine maintenance must be performed at least once a year.
The annual routine maintenance must be performed by a qualified technician.
Using only original spare parts. Failure to comply can jeopardize the safety of the appliance and make the warranty null and void.

9.15 Spare parts replacement

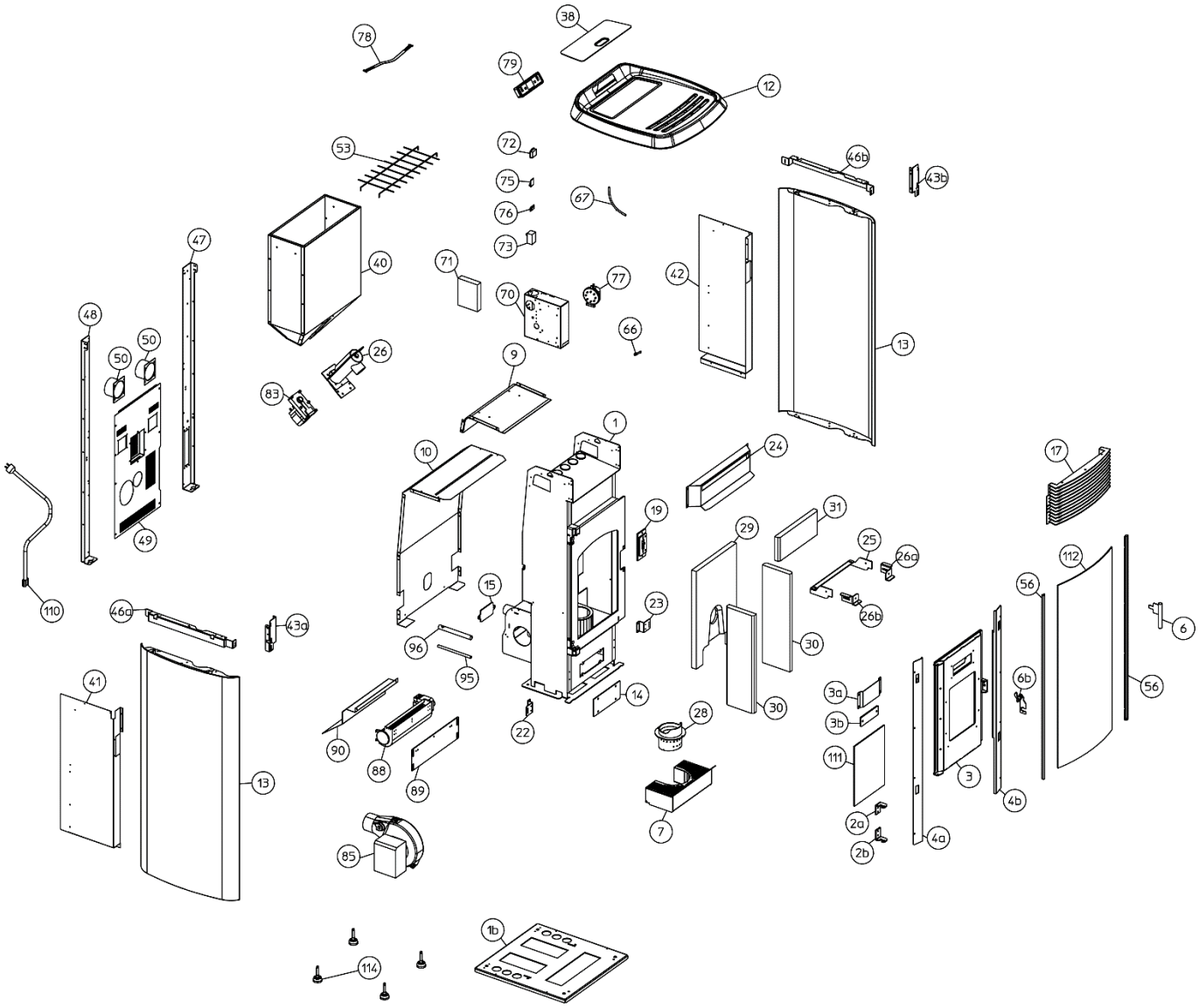
Use only ceramic type glass

The gaskets guarantee the tightness of the product and its consequent good functioning. They must be controlled periodically. They must be replaced immediately if they are worn or damaged. These operations must be carried out by a qualified technician.

Ceramic Glass dimensions: *306 x239 mm (12” x 9,4”);* Thickness 5 mm
Door tricovet gasket: *Diam. 10 mm (0,39”); L. 1570 mm / (62”)*

For all other spare parts please contact your dealer using the list on the following pages as a reference.

Spare parts replacement operations must always be carried out by a qualified technician



Ref. Drawing	Product code	Laminox description	N° Per Kit
1	**ERB-STR**	Structure	1
1b	**ERB-FND**	Bottom	1
28	**STP-BAC102**	Circular Steel Brazier	1
7	**ERB-CC**	Ash drawer	1
9	**ERB-CAS**	Upper air conveyor	1
10	**ERB-CAP**	Rear air conveyor	1
24	**ERB-CAF**	Front air conveyor	1
90	**ERB-CAI**	Lower air conveyor	1
14	**ERB-TIF**	Front inspection cap	1
15	**ERB-TSF**	Fume box cap	1
29	**ERB-SV**	Rear combustion chamber insulation	1
30	**ERB-LV**	Combustion chamber side insulation	1
31	**ERB-SSV**	Upper combustion chamber insulation	1

25	**ERB-BVC**	Central insulator block	1
26a	**ERB-BVDX**	Right insulator block	1
26b	**ERB-BVSX**	Left insulator block	1
67	**STP-TDEP**	Rubber tube vacuum thermostat	1
66	**STP-PGD**	Hose connector vacuum thermostat	1
47	**ERB-APDX**	Rear right angle bracket	1
48	**ERB-APSX**	Rear left angle bracket	1
46b	**ERB-AODX**	Right horizontal angle bracket	1
46a	**ERB-AOSX**	Left horizontal angle bracket	1
42	**ERB-CADX**	Right air carter	1
41	**ERB-CASX**	Left air carter	1
89	**ERB-SVT**	Air fan support	1
96	**STP-TPC-180**	Ignition plug tube	1
43b	**ERB-SCDX**	Upper right front panel support	1
23	**ERB-SCIDX**	Lower right front panel support	1
22	**ERB-SCISX**	Lower left front panel support	1
19	**ERB-PN**	Pawl holder	1
2a	**EOBL-CERS**	Upper hinge door	1
2b	**EOBL-CERI**	Lower hinge door	1
3	**STP-AO-SPR**	Fire door	1
3a	**SIB-CTAS**	Anti-explosion cap cover	1
3b	**SIB-TASS**	Anti-explosion cap	1
4a	**EOBL-FSS**	Left side of the door	1
4b	**SIB-FDS**	Right side of the door	1
6	**STP-MCE**	removable handle	1
6b	**SIB-MAN-IN**	Internal door handle	1
56	**SBL-935-GPV**	External glass guide	2
111	**STP-VTR-232**	Internal glass door	1
112	**LMX-C-935**	Tempered external glass	1
26	**STP-KCPA**	Assembled Pellet Auger Kit	1
--	**STP-BFM**	Gearmotor fixing bush	1
--	**STP-CP**	Pellet screw	1
--	**STP-PCH**	Closing plate	1
--	**STP-BRO**	Bushing	1
--	**STP-CSA**	Welded body	1
--	**STP-FMT**	Stopper for gearmotor	1
40	**S195-74-SP**	Pellet tank	1
53	**S195-74-GP**	Protection grid	1

12	**STP-L-TOP**	Top	1
38	**STP-L-TP**	Upper lid	1
13	**FN-L-1230**	Lateral panel	1
17	**VLT-L-CS**	Front grill	1
5	**VLT-L-CI**	Calotta Inferiore	1
49	**ERB-DPZ**	Back panel	1
114	**STP-PIE**	Adjustable foot	4
85	**PL21-FUM**	Flue gas motor ø80	1
79	**PF047**	LCD Display	1
95	**STP-RA-180**	Ignition plug	1
--	**PG005**	Remote control	1
88	**65-300-VENT**	Tangential Fan	1
83	**STP-MOT-2.0**	Gearmotor	1
110	**STP-CAVO**	Cable with plug	1
71	**STP-PL023**	Electronic board	1
78	**STP-FLAT**	Display cable	1
70	**STP-SAS**	Electronic board box	1
77	**STP-DEP-1020**	Smoke pressure switch	1
73	**STP-TSS**	Safety thermostat with probe	1
76	**STP-SER**	Serial port	1
75	**STP-INT**	Light Switch	1

10 WARRANTY

10.1 Certificate of warranty

The purchaser is invited to:
- Examine the instructions for the installation, use and maintenance of the stove.
- Examine the conditions of warranty shown below and the "*Limited Warranty certificate"* included in this manual

10.2 Condition of warranty

The limited warranty covers defects of manufacturing materials, on condition that the product has not been broken due to an incorrect use, carelessness, wrong connections or errors of installation.

The following are not covered by guarantee:

- vermiculite (Firex 600);
- the glass of the door;
- the fiber gaskets;
- the painting;
- the fire pot;
- ignitor;
- the cast majolica;
- any damage caused by inappropriate installation and/or handling of the stove and/or shortcomings by the consumer
. The use of poor-quality pellets or of any other material could damage components of the stove causing the termination of their guarantee and the annexed responsibility of the manufacturer.

The pellets which meet the requisites listed in the chapter on them should be used.

All damage caused by transport are not acknowledged, therefore please carefully check the goods on receipt, immediately advising the dealer of any damage.

All the manufacturer's guarantees are shown here and no complaint may be made to the manufacturer according to any other guarantee, report or request.

For guarantee claims and instructions for return shipments please refer to your local dealer.

10.3 Information and problems

For any information or problems, please contact your dealer or service centre, the only people who can meet any request you may have end, if necessary, who can intervene directly

Limited Warranty certificate

Subject matter

Laminox Srl, provides a warranty on all product marketed under the *Laminox Idro* brand and installed professionally by authorized personnel within the North American territory: subject to limitations set out below mentioned.
The manufacturer's warranty allows customers to request the free of charge replacement or repair of product parts solely, in case where non-conformance due to manufacturing defects is detected and acknowledged by trained personnel.
During the warranty period, Laminox undertakes to correct defects caused by manufacturing defects, at no cost to the Customer, through its network of customer services, which the Customer can contact by contacting the dealer. In any case, Laminox points out that the appliance must be installed in an easily accessible place in accordance with current legislation. Otherwise, the costs necessary to intervene will be entirely borne by the Customer.

Warranty period

Laminox S.r.l. guarantees its products for 24 months (two years) from the date of purchase by the end customer (hereinafter Customer), proven by a valid fiscal document issued by the authorized reseller (receipt, invoice) that identifies the product purchased and the date of purchase and/or delivery of the same.

Validity

This warranty is valid exclusively for products installed in North America
The warranty includes the free repair or replacement of the component parts of the appliance which are defective at the origin due to manufacturing defects, with the exception of the hypotheses listed in the "Exclusions" paragraph.

The right to the guarantee will be proven by this original certificate, from which the model, the serial number of the product, the date of purchase and the company name of the retailer can be deduced and by a document valid for tax purposes, issued by the retailer at the time of purchase.

The warranty is recognized as valid provided that:
1) The appliance has been installed by qualified personnel in compliance with the regulations in force on the matter, respecting the instructions contained in this use and maintenance instructions;
2) The appliance is used according to the methods described in this use and maintenance instructions;
3) The lack of conformity is reported;
4) This certificate is accompanied by a purchase document certifying payment for the goods and showing the retailer's company name, model and purchase price.

Exclusions

The warranty is not recognized in the following cases:

1) The terms of validity have not been respected;
2) The installation has not been carried out in compliance with the regulations in force on the matter, respecting the prescriptions contained in this use and maintenance instructions. Installations that do not comply with current standards will void the product warranty, as will improper use and lack of maintenance as foreseen by the manufacturer;
3) It is found by the customer service that conditions external to the functioning of the product have caused it;
4) For interventions aimed at explaining the functioning of the product, periodic checks and maintenance and all that, at the time of sale, had been brought to the attention of the Customer or that the latter could not reasonably ignore;
5) Negligence in maintenance, carelessness, tampering, accidental breakage, damage in transport,

incorrect handling, as well as improper use and maintenance by the Customer is found;
6) Combustion of materials that do not comply with the types indicated in the use and maintenance manual;
7) Damage caused to the equipment by atmospheric and natural events (such as lightning, floods, fires, earthquakes) or by acts of vandalism;
8) Operational alterations due to climatic, atmospheric, environmental or other conditions;
9) Acknowledgment by the customer service of the presence of non-compliant electrical and/or hydraulic systems or fume ducts;
10) For which an insufficient or non-compliant flow rate of the electrical systems is found;
11) No defect has been found, as reported by the Customer, or for generic operating problems deriving from a wrong impression by the user (problems with noise, heating, timer programming, etc.);
12) Interventions for calibration or adjustment of the product in relation to the type of fuel used or the particularities of the installation;
13) Transport damage not dependent on the manufacturer. In this regard, it is recommended to carefully check the material upon receipt, immediately notifying the retailer and reporting the annotation both in the transport document and on the carrier's copy.

Laminox S.r.l. declines all responsibility for any damage that may directly or indirectly be caused to people, things or animals as a result of failure to observe all the instructions indicated in the specific instruction booklet and concerning installation, use, operation and maintenance of the appliance.
For the period of inefficiency and for direct or indirect damage due to or dependence on the product, no compensation is recognized.

The interventions carried out for the replacement of components subject to wear and/or removable are also excluded from the guarantee, unless their breakage and/or their malfunctioning are not attributable to original defects: - v*ermiculite (Firex 600);*
- the glass of the door;
- the fiber gaskets;
- the painting;
- the fire pot;
- the cast majolica;
- any damage caused by inappropriate installation and/or handling of the stove and/or shortcomings by the consumer

First ignition test (for a fee)

This product requires first start-up testing by an authorized customer service which will regulate the operating parameters and provide all the information for correct use.
It is essential to have the product function tested before completing any wall finishes (smoke duct covers, coverings, painting, etc.). The company assumes no responsibility for any damage and consequent costs of restoring the finishes mentioned even if they were to result from the replacement or repair of non-functioning parts.

Downtime period

In case of product malfunction, the customer service shall arrange to repair the product as quickly as possible, without prejudice to the fact that no compensation will be granted for the downtime period

Important: The assistance interventions must be carried out by the customer service, in total safety according to the current provisions of the law on the subject. The means necessary for the safe execution of the assignment (scaffolding, handling equipment, etc.) will be procured by the Client and the consequent expenses will be borne exclusively by him. If the technician recognizes the defect as prescribed by the laws in force regarding safety. He may legitimately refuse to carry out the requested intervention. by charging the Client the cost of the exit.

1. The technician has the task of restoring the conformity of the product on the basis of the provisions of the guarantee conditions;
2. The technician is the only person competent to establish the correct functionality of the product and evaluate its possible irreparability on site. In this second hypothesis, the product must be sent, with suitable packaging, to the Laminox company for repair and general testing with costs to be borne by the customer. In cases of irreparability, the replacement can be carried out only following the written consent of the manufacturer, leaving unchanged the expiry date and the terms of guarantee acquired at the time of purchase of the product;
3. The technician will process requests for intervention for repairs under warranty promptly, compatibly with organizational requirements. In any case, however, the manufacturer cannot be held responsible for any inconvenience caused by any delays in carrying out the intervention.

Once the warranty period stipulated in the contract has expired, the costs for any restoration work must be borne by the Customer. In this case, the Customer can contact the TAC network, from which he can obtain, in addition to a high professional service, original, tested and guaranteed spare parts.1.

REFERENCES STANDARDS:

ASTM E1509
UL 1482
ULC S627
UL 181
UL 641
ULC S609
NFDA (Fire) 211

Laminox S.r.l. reserves the right to change the characteristics and data reported in the following document at any time and without warning in order to improve their products. This manual, therefore, cannot be considered as a contract with third parties.
Updated manuals and drawings are available at website www.laminox.com.

PLEASE CONTACT YOUR DEALER FOR ANY SERVIC OR QUESTION

Appliance information:

SERIAL NUMBER _____

DATE PURCHASED _____

DATE INSTALLED _____

Laminox S.r.l. Hydro Division
Zona Industriale Callarella, 261/263 – 62028 SARNANO (MC) Italy Tel. +39 0733.657.622 – Fax +39 0733.657.494
www.laminox.com e-mail: idro@laminox.com

rev 03/2024

LAMINOX IDRO

C UL US LISTED

USE AND MAINTENANCE INSTRUCTIONS

PELLET STOVE

Giulia air

SAVE THIS INSTRUCTIONS

WARNING: Please read this entire manual before installation and use of this pellet fuel-burning room heater.
Failure to follow these instructions could result in property damage, bodily injury or even death

CAUTION: Contact local building of fire official about restrictions and installation inspection requirement in your area

Dear Customer, thank you for choosing one of our products, which is a result of technological expertise and our continuous quest for superior products in terms of safety, reliability and performance. This manual contains all the information and helpful tips for using your product with maximum safety and efficiency.

IMPORTANT INFORMATION

This manual has been prepared by the manufacturer and is an integral and essential part of the product. In the event of sale or transfer of the product, always ensure the presence of the manual as the information it contains is addressed to the purchaser and to all those various people involved in the installation, use and maintenance of the product. Carefully read the instructions and information contained in this manual before installation, operation and maintenance of the product. The instructions contained in this instruction manual guarantee the safety of persons and property and ensure efficient operation and a longer service life. The manufacturer declines all responsibility for damage caused by failure to observe instructions regarding installation, use and maintenance listed in the instruction manual, for unauthorized modifications or non-original replacement parts. Product installation and use must be carried out in accordance with the manufacturer's instructions and in compliance with European, national and local regulations. Installation, electrical connection, functional testing, maintenance and repairs are operations that must be performed by qualified and licensed personnel who must have appropriate knowledge of the product. Product installation must not be carried out close to walls made of wood or combustible material. For proper installation, you must observe the following "Safety distances" section. Verify the exact flatness of the floor where you will install the product. When handling the steel parts of the cladding, use clean cotton gloves to avoid leaving difficult to remove fingerprints for the first cleaning. Stove installation must be performed by at least two people. Connect the stove to the mains only after proper professional connection to the chimney flue. The power cable plug must remain accessible after installation of the stove. Only operate the stove with regulation wood pellets (refer to the "FUEL" chapter). Never use liquid fuels to operate the pellet stove or to stoke the embers present. Provide adequate ventilation in the installation area throughout the year. In the presence of operation failures, fuel supply will be interrupted. Re-start the unit after removing the cause of the failure. Discontinue use of the product in the event of failure or malfunction. Do not remove the safety guard located in the pellet tank. Any accumulated unburned pellets in the burner as a result of repeated "failed ignitions must be removed prior to ignition." Pellet stove operation can cause very hot heating of the handles, the chimney flue and glass surfaces. Only touch these parts during operation when wearing protective clothing or with adequate aids. Because of the creation of heat on the glass, make sure that no persons unfamiliar with stove operation stand in the installation area. Inform children of the precautions to be observed during product operation and of possible dangers. In the event of problems or misunderstanding of the instruction manual, contact your dealer. Placing objects which cannot withstand heat on the stove or within the minimum required safety range is prohibited. Do not open the door during operation or operate the stove with its glass broken. For product terms, limitations and exclusions, please refer to the warranty included with the product. In order to pursue a policy of constant product development and renewal, the manufacturer may make changes to it as deems appropriate without notice. This document is the property of the manufacturer and cannot be disclosed in whole or in part to any third party without the written consent of the company, which reserves all rights to the rigor of the law.

1 GENERAL STANDARDS

1.1 Fireplace or Chimney flue

Each device must have a vertical duct, called a chimney flue, for outside release of combustion fumes produced by a natural draft.
The chimney flue must meet the following requirements:

- It should not be connected to any other fireplace, stove, boiler, or hood of any kind (Fig. 1).
- It must be properly spaced from combustible or flammable materials through an air gap or suitable insulating material.
- The internal section must be uniform, preferably circular: the square or rectangular sections must have rounded corners with a radius of no less than 20 mm, maximum ratio between the sides of 1.5, walls as smooth as possible and without restrictions, curves must be regular and seamless, deviations from the axis no greater than 45° (Fig-2).
- Each device must have its own chimney flue with a section equal to or greater than the diameter of the fume exhaust pipe of the stove and a height no less than the one stated (see table 2).
- Never use two stoves, a fireplace and a stove, a stove and a wood stove, etc. in the same room since the draft of one could damage the draft of the other. In addition, collective ventilation ducts that can cause a vacuum in the installation environment are not permitted, even if installed in adjacent rooms and communicating with the installation room.
- Creating fixed or mobile apertures on the chimney flue to connect equipment other than auxiliary devices is prohibited.
- Passing other air supply channels and piping for utilities through the chimney flue, however large, is prohibited.
- The chimney flue should be equipped with a collection chamber for solid materials and any condensate, located below the mouth of the flue, so as to be easily opened and inspected from an airtight door.
- Whenever using parallel output chimneys, it is advisable to raise a bracing element. (Fig.3)

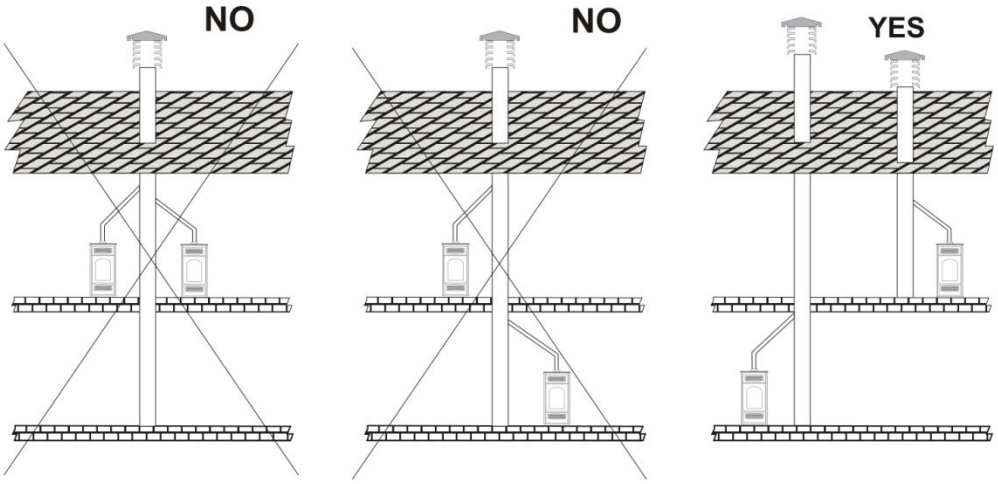


Fig 1

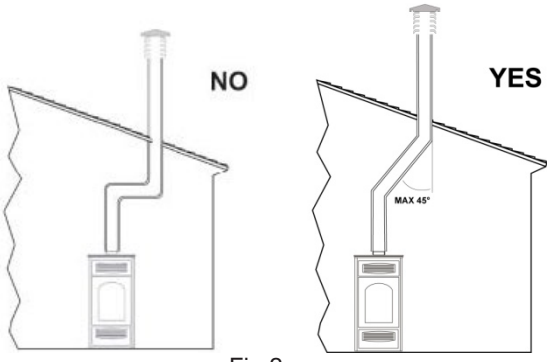


Fig 2

1.2 Chimney cap

The top of the chimney flue must be equipped with a device, called a chimney cap, which facilitates dispersion into the atmosphere of combustion products.
The chimney cap must meet the following requirements:

- Its internal section and shape must be equivalent to that of the chimney flue.
- Have a useful outlet section no less than double that of the chimney flue.
- Chimney caps that emerge from the roof or which remain in contact with the outside (for example in the case of an open loft), must be covered with brick elements and well isolated. It must be constructed so as to prevent penetration into the flue of rain, snow, or foreign bodies and so that, in the event of winds in any direction and at any angle, it assures the discharge of combustion products (windproof chimney cap).
- The chimney cap must be positioned so as to guarantee an adequate dispersion and dilution of combustion products and, in any case, outside the zone of reflux. This zone can be different sizes and shapes depending on the angle of slope of the roof, so it is necessary to adopt the minimum heights shown in Fig.4 and Fig.5.
- The chimney cap must be of windproof and exceed the height of the ridge, Fig.4 and Fig.5.
- Any buildings or other obstacles that exceed the height of the chimney cap must not be close to the chimney cap itself (Fig.4).

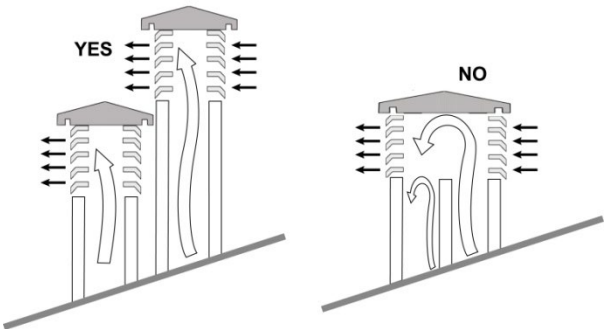


Fig.3

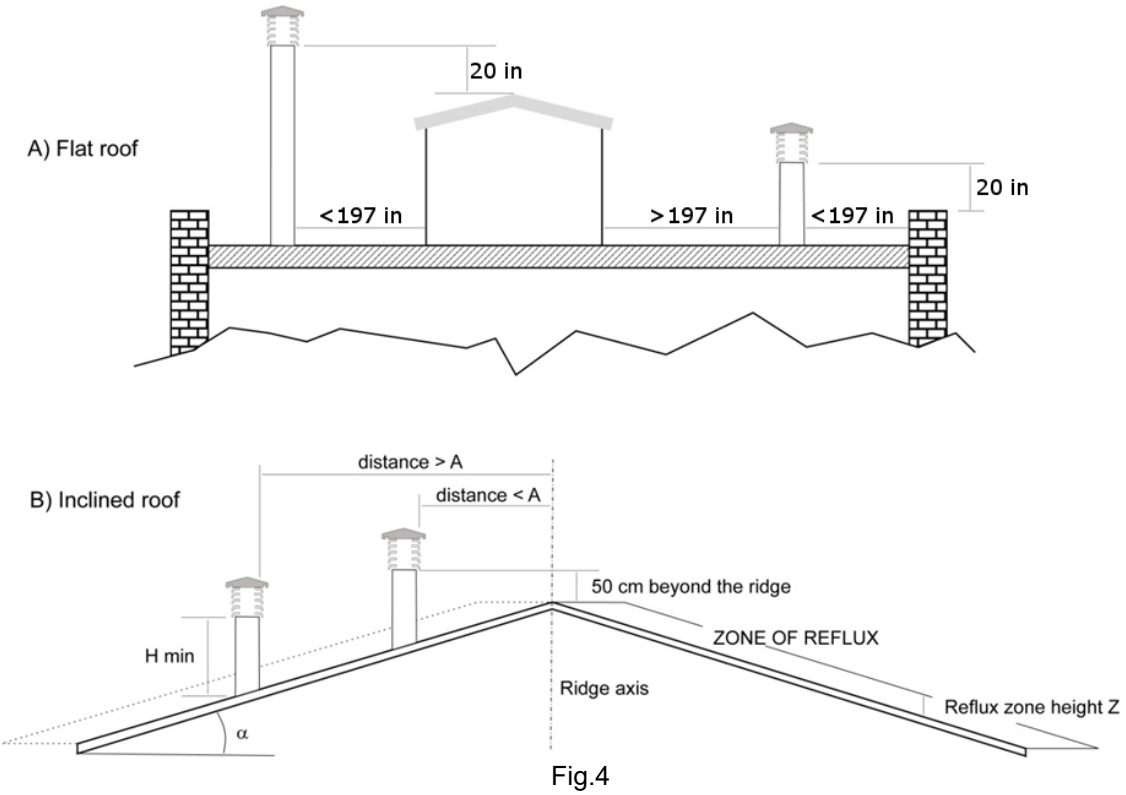


Fig.4

Roof pitch ? [°]	Horizontal width of the zone of reflux from the axis of the ridge A	Minimum height of the outlet from the roof	Height of the reflux zone Z
15	6 feet (1.85m)	3 feet (1.00m)	1 foot (0.50m)
30	5 feet (1.50m)	4 feet (1.30m)	2 feet (0.80m)
45	4 feet (1.30m)	6 feet (2.00m)	5 feet (1.50m)
60	4 feet (1.20m)	8 feet (2.60m)	7 feet (2.10m)

Table 2

1.3 External air intake vent

- The stove must have the air necessary to ensure smooth combustion operation and good environmental well-being.
- Make sure that the room where the stove is installed offers sufficient ventilation and install an air supply duct from the outside with the recommended minimum section of 15 in².
- The air intake vent must communicate directly with the installation room of the stove, positioned so as to prevent it from being blocked and protected with a permanent non-lockable grid or other suitable protection provided that it does not reduce the minimum section.
- Air flow can also be obtained from a room adjacent to the installation room, provided that this flow can be carried out freely through permanent, non-closable openings communicating with the outside.
- With respect to the installation room, the adjacent room should not be put under vacuum with respect to the external environment as a result of a reverse draft caused by the presence in this space of another utility device or suction device. The room adjacent to the permanent openings must meet the requirements set out in the paragraphs above. The adjacent room cannot be used as a garage, for storage of combustible material or for activities involving a risk of fire.

1.4 Connection to the chimney flue

(See paragraph 4.5)

1.5 Preventing house fires

Installation and use of the stove must be in accordance with the manufacturer's instructions and with local habitability regulations.
CAUTION: when a fume exhaust pipe passes through a wall or ceiling, particular installation methods must be applied (protection, thermal insulation, distances from heat sensitive materials, etc.).

- The fireplace connecting tube must never pass through a combustible surface.
- Do not connect this unit to a chimney flue already being used by another device.
- It is also advisable to maintain all combustible elements or flammable material such as beams, wooden furniture, curtains, flammable liquids, etc. outside the radiation area of the furnace and at a distance of at least 1 m from the heating block.
- In the event that the surrounding space has coverings in combustible or heat-sensitive material, a protective membrane made of non-combustible insulating material must be interposed. If the flooring is made of combustible material, a non-combustible protective material must be provided at the mouth of the furnace.
- For further information, refer to local requirements.

2 SPECIFICATIONS AND TECHNICAL DATA

2.1 Specifications

Stoves and pellet stoves are devices built to work with good quality wood pellets only (see par. 3 fuel).

2.2 Compliance status

The heaters described in this manual meet the 2020 U.S. Environmental Protection Agency's wood pellet emission limit for wood heaters sold after May 15th 2015.

	Emission Rate (g/hr)	**Heating Efficiency (% Overall)**	**1st hour Emission Rate (g/hr)**	**CO emission (gr/h)**
Giulia Air	1,6	84	5,3	44,4

** Efficiency Calculated Per CSA B415.1*

2.3 Technical data

[3]

Model of type	**Giulia Air**
Pellet hourly consumption (min/max)	2,6-7,9 lb/h
Efficiency (based on LHV)	> 87 %
Hopper capacity	50 lb
Smoke outlet ø	3,15 in
Weight	342 lb
Dimension (DxWxH)	14,3 x 15,5 x 31,8 in

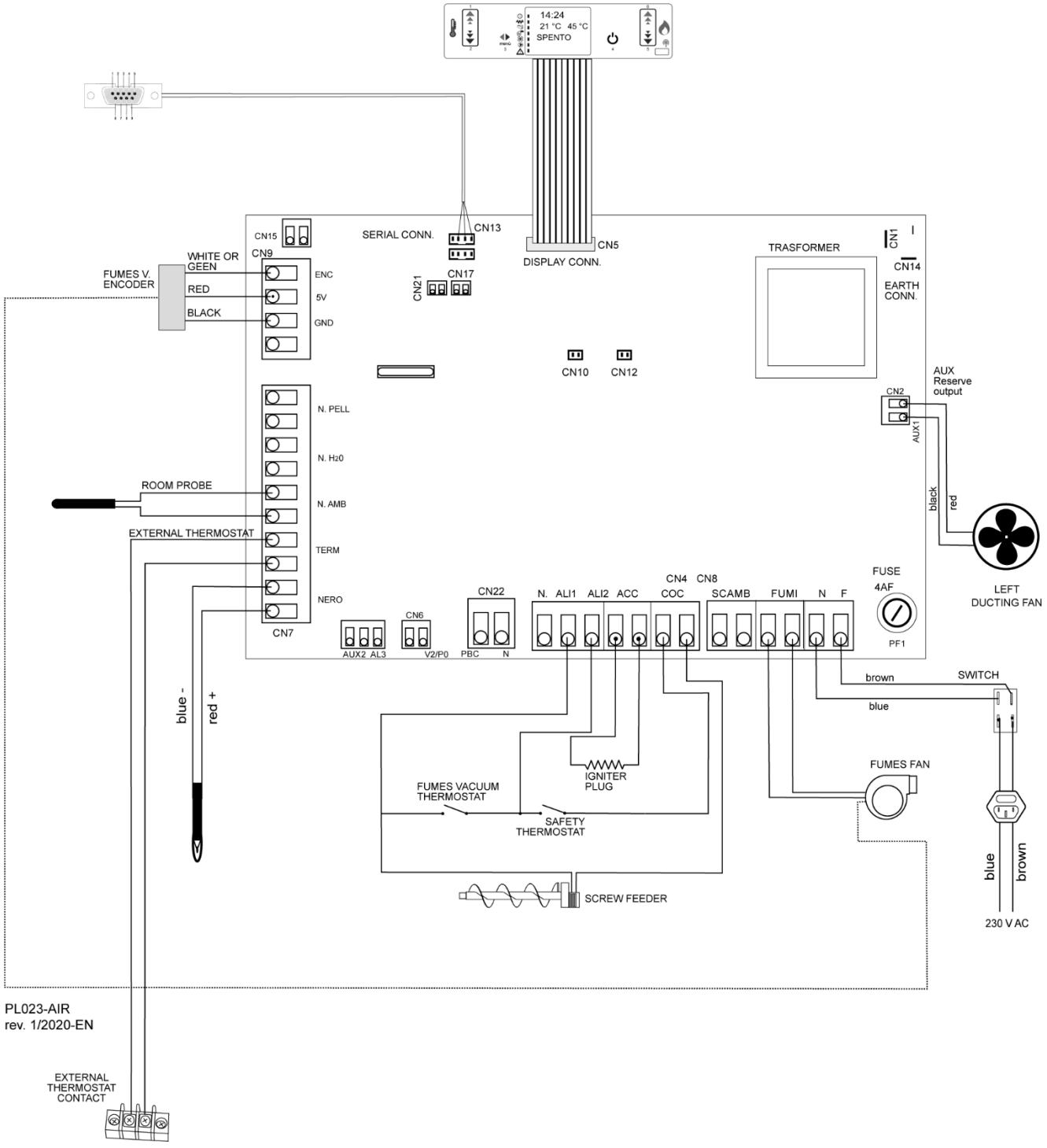
[4]

**Pellet size may affect actual rate of fuel feed and burn times. Fuel feed rates may vary by as much as 20%. Follow Manufacturer instructions and Use PFI certified pellet fuels to maximize efficiency.*

2.4 Product identification data

The technical label shows device data and performance. Tampering with, removing or lack of a technical label makes installation and maintenance operations difficult, due to the lack of product identification. In the event of damage, request a duplicate from our service centre. Given the importance of the data label, we recommend installing the stove at a distance at which it is always visible.

2.5 Wiring diagrams



5 FUEL

3.1 General notes

The pellet stove is designed to burn wood pellets only.
Wood pellets are a fuel obtained from the pressing of sawdust timber, extracted from the processing and transformation residues of dried wood material. The compactness of the product over time is guaranteed by a natural origin substance contained in the wood: lignin. The typical small cylinder form is obtained by extrusion.
Various types of pellets with quality and characteristics that vary depending on the processing and type of wood species used are available on the market.

CAUTION: Always use certified quality wood pellets: i.e. DIN, DIN PLUS, ÖM 7135, Pellet Gold, Catas etc. The company does not guarantee proper stove functioning with the use of low-quality pellets.
Stoves and heating stoves are tested and programmed to ensure good performance and perfect quality operation with specific characteristic pellets:

components:	wood
length:	< 30 mm
diameter:	6-6.5 mm
lower calorific value:	≥ 4.8 kWh/kg (≥ 7500 BTU/lb)
humidity rate:	< 8 %
residual ash:	< 0.5 %

GOOD QUALITY pellets are smooth, shiny, slightly dusty and with regular length. LOW QUALITY pellets are of varied lengths, dusty with vertical and horizontal splits.

Since pellet characteristics and quality greatly influence the autonomy, efficiency and proper operation of the stove, we recommend:

AVOID using pellets with dimensions different from that described by the manufacturer.
AVOID using low quality pellets or pellets containing dispersed sawdust powder, resins or chemicals, additives or adhesives.
AVOID using moist pellets.

The use of unsuitable pellets causes:
- clogging of the brazier and fume discharge ducts
- increased consumption of fuel
- decreased efficiency
- no guarantee of normal stove operation
- dirtying of glass
- production of unburned granules and heavy ash

The presence of moisture in pellets increases the volume of the capsules and crumbles, causing
- feeding system malfunctions
- poor combustion

Pellets should be stored in a dry and sheltered place. Particular attention should be given to the handling of the bags to prevent their crushing, resulting in the formation of sawdust.
Stove operation parameters may have to be altered when using quality pellets with dimensional and calorific characteristics different from those indicated. Contact an authorized service centre if necessary.
he use of poor-quality pellets not in accordance with manufacturer's instructions not only damage the stove and compromise performance but may result in forfeiture of the warranty and company liability.

Follow Manufacturer instructions and Use PFI certified pellet fuels to maximize efficiency.
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6 INSTALLATION

4.1 General notes

CAUTION: DO NOT INSTALL IN SLEEPING ROOM

The stove requires a UL listed pellet vent. So, the venting system shall be approved for pellet stoves by a certified testing Laboratory

4.1.1 Installation in the presence of several appliances.

The presence of several appliances powered with different fuels, as well as hoods with or without extractor, must be evaluated during preventive checks and during the start up test in order to detect any variation compared to the design conditions or any aspect that cannot be detected during the design phase. The room must be well-ventilated according to the instructions of every single device. The external air intake vent must meet the requirements of paragraphs 1.3 and 4.4

The stove must not be used simultaneously with other generators that collect air from the environment even if installed in adjoining or communicating rooms

4.1.2 Suitability of the installation rooms

- Installing the device inside garage, store for combustible materials or rooms at risk of fire is prohibited.
- If the flooring is made of wood, provide a floor protection surface in compliance with current national standards
- Outdoor installation is prohibited, as well as exposure to atmospheric agents or humid areas.
- Locating the stove in a room with an explosive atmosphere is prohibited

4.1.3 Fume discharge system

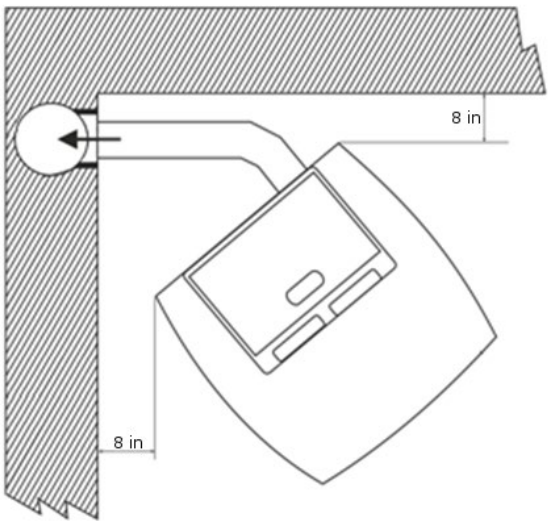
Every device must be connected to a fume discharge system, which ensures dispersion of combustion products into the atmosphere.
The combustion products must be discharged from the roofs. Direct wall discharge or towards closed spaces, even in open air, is prohibited.
The components must be made of material with A1 fire reaction class. In particular, the use of metal extendible and flexible hoses is prohibited.

CAUTION: ensure that the plug for electrical connection remains accessible after the stove installation.

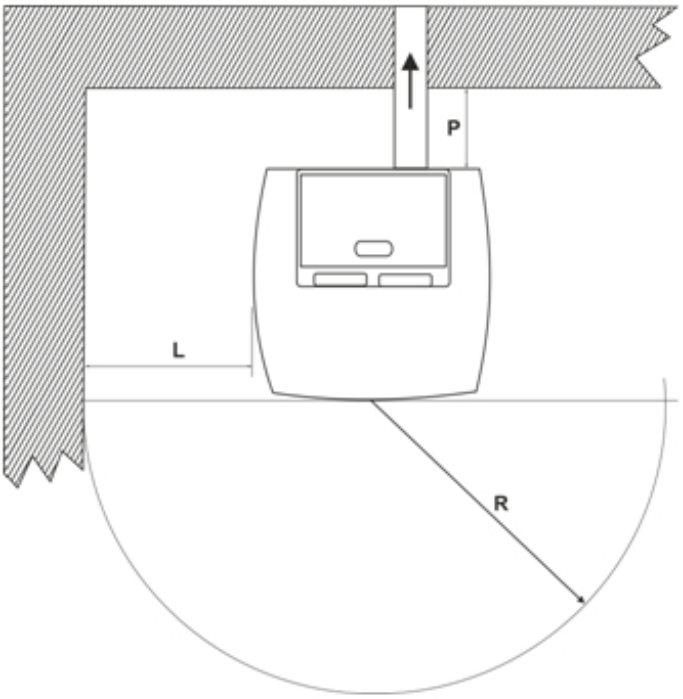
4.2 Minimum safety distances

The following figures show the minimum safety distances, which must always be guaranteed.

4.2.1 Corner installation



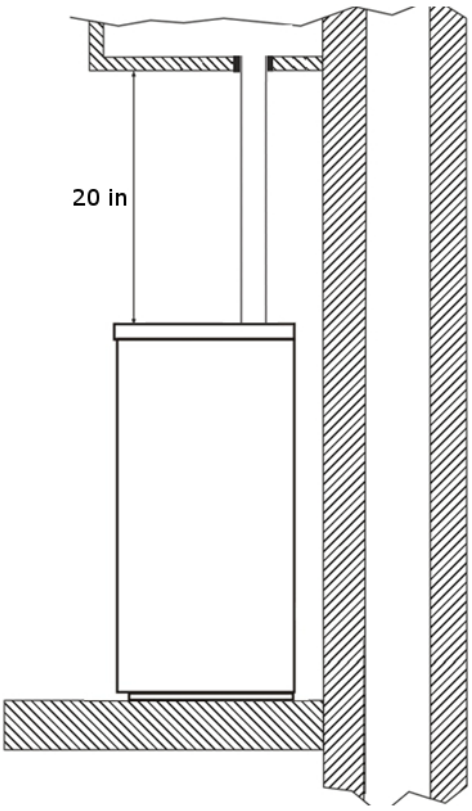
4.2.2 Wall installation



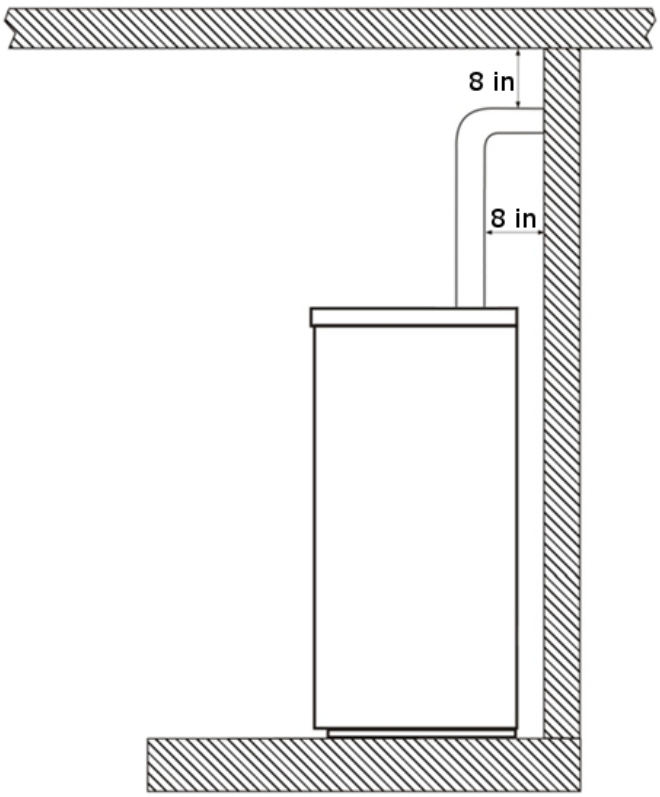
Safety distances from flammable material:

Minimum distance in air from the flammable rear wall	**P**= 8 in
Minimum distance in air from the flammable side wall	**L**= 8 in
Frontal distance from flammable material	**R** = 40 in

4.2.3 Distance from flammable ceilings and false ceilings



4.2.4 Distance of fume exhaust system from flammable walls



4.3 Flooring protection

In the event of valuable flooring or flooring that is sensitive to heat, moisture or is flammable, a floor protection must be used (i.e. sheet steel, marble or tile slabs).
Whichever type of protection selected, it must protrude at least 300 mm from the front, at least 150 mm from the sides of the stove, must withstand the weight of the stove and have a thickness of at least 2 mm (Fig. 5 and 6).

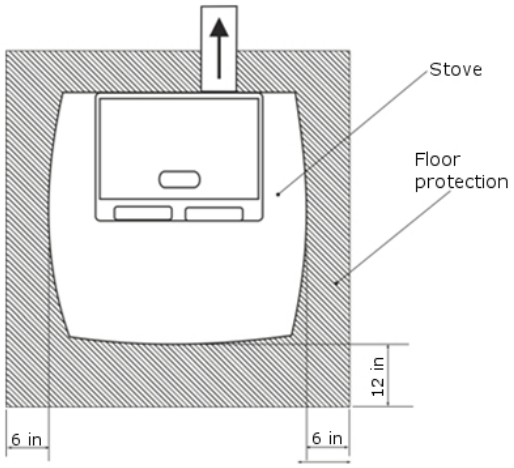


Fig. 5

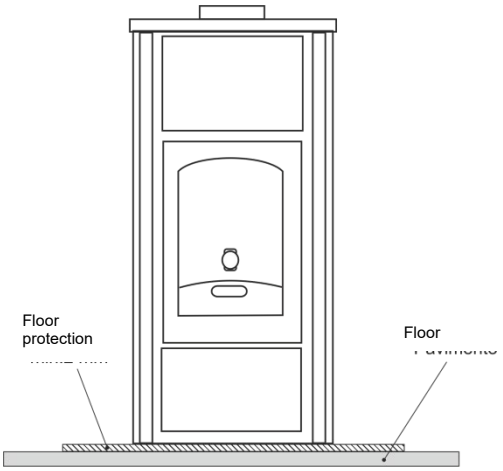


Fig. 6

4.4 Minimum distances for positioning air intake vents

Pellet stove combustion air intake vents cannot be connected to an air distribution system or directly to a wall-mounted air intake vent.
Correct and safe positioning of the air intake vent must comply with the measures and requirements described in paragraph 1.3.
There are distances to be respected in order to avoid that combustion air be removed by another source; for example, a window opening can suck the air outside, making it miss the stove.

The air intake vent must be located at least:		
5 feet (1.5 m)	**Under**	**Doors, windows, fume exhaust outlets, air gaps, etc.**
5 feet (1.5 m)	**Horizontally away**	
1 foot (0.3 m)	**Over**	
5 feet (1.5 m)	**Away from**	**Fume output**

4.5 Vent exhaust duct

4.5.1 General notes

The stove requires a UL listed pellet vent, so the venting system shall be approved for pellet stoves by a certified testing Laboratory

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

DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE

INSTALL VENT AT CLEAREANCES SPECIFIED BY THE VENT MANUFACTURER

CAUTION: the pellet stove is not like other stoves. Fume draft is forced thanks to a fan that maintains the pressure in the combustion chamber and slight pressure around the exhaust duct. Therefore, you must verify that the latter is completely watertight and properly installed, both from the point of view of function and safety.

Draft us the force which moves air from the appliance un through the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors.
Too much draft may cause excessive temperature in the appliance and may damage the appliance.
Inadequate draft may cause back puffing into the room ad ‘plugging’ of the chimney

Construction of the exhaust duct must be done by specialized personnel or companies, as reported in the following manual. Always create the exhaust system so that periodic cleaning is assured without having to dismantle any parts.

4.5.2 Tubes and maximum usable lengths

Painted aluminized steel tubes, stainless steel tubes (Aisi 316) or porcelain tubes can be used.
Flexible hoses are permitted if they fall within the limits prescribed by law (in stainless steel with smooth inner wall).

TYPE OF SYSTEM	WITH DOUBLE-WALL TUBE
Minimum length	6 feet (2 m)
Maximum length (with 3 90° curves)	26 feet (8 m)
Maximum number of curves	4
Horizontal sections with min. 5% incline	6 feet (2m)

NOTE: load losses of a 90° curve can be equated with those of 1 meter of tube; the serviceable T- connection is to be considered as a 90° curve.

4.5.3 Holes for exhaust tube passage on walls or roof

Once the location of the stove has been decided (section 4.1), you will have to drill the hole for passage of the fume exhaust tube. This varies depending on the type of installation (therefore on the exhaust tube diameter, see 4.5.2) and on the type of wall or roof to be crossed (table 3).
The insulator must be of mineral origin (rock wool, ceramic fiber) with a nominal density greater than 80 kg/m3.

	Insulation thickness	Diameter of holes to be created [mm]
Wooden wall, or wall which is flammable or has flammable parts	4 in	12 in
Concrete wall or roof	2 in	9in
Brick wall or roof	1,5 in	7 in

4.5.4 Using a traditional type chimney flue

If you wish to use an already existing chimney flue, it is advisable to have it checked by a professional chimney sweep to ensure that it is watertight. This is because fumes, being slightly pressurized, could infiltrate cracks in the chimney flue and invade living spaces. If an inspection finds that the chimney flue is not perfectly intact, it is advisable to intubate it with new material. If the existing chimney is large, we recommend inserting a tube with a maximum diameter of 6 in

It is also advisable to insulate the vent exhaust duct. Figs. 7 and 8 demonstrate the solutions to adopt if you want to use an existing chimney flue.

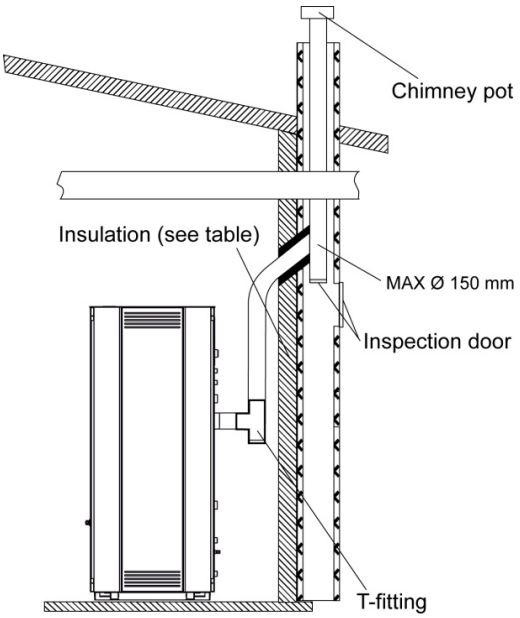


Fig. 7

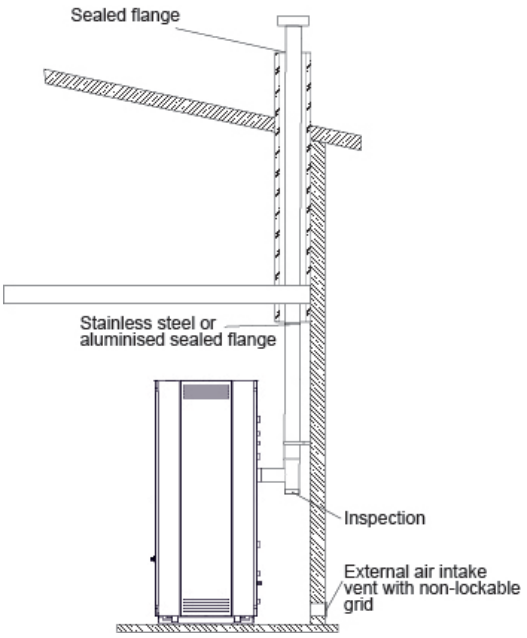


Fig. 8

4.6 Using an external fume duct

An external fume duct can be used only if it meets the following requirements:

- Only insulated tubes (double wall) in stainless steel, secured to the building (Fig.9) should be used.
- An inspection area should be created at the base of the duct for performing periodic checks and maintenance.
- It should be equipped with a windproof chimney cap and observe the distance "d" from the ridge of the building as described in par. 1.2.
- Fig. 9 shows the solution to be utilized when using external fume ducts.

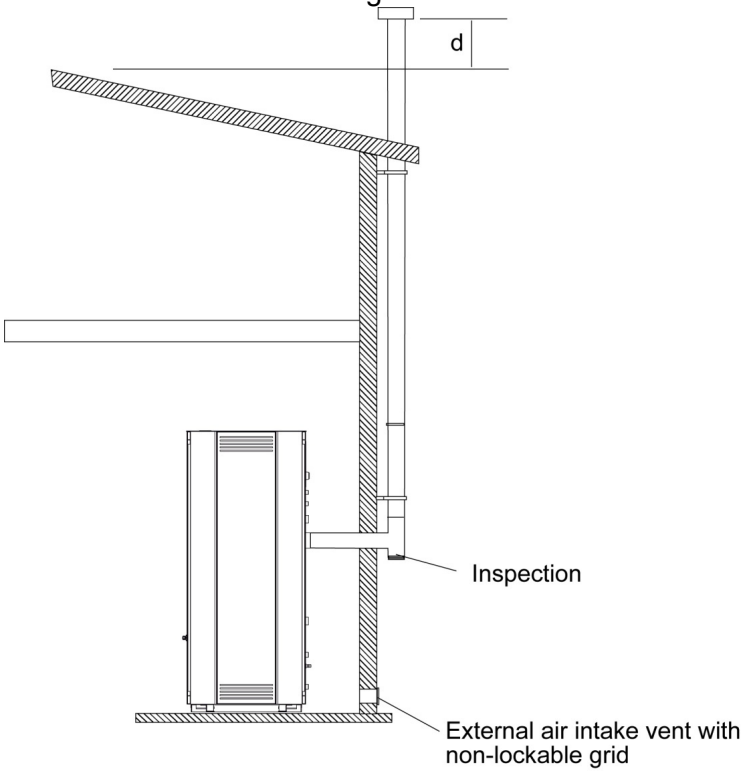


Fig. 9

5 ASSEMBLY

5.1 General notes

Here are some general recommendations to follow in order to prevent accidents or damage to the product:

- Unpacking and installation must be performed by at least two people.
- **All handling operations must be carried out using appropriate means and in full compliance with safety regulations.**
- The positioning of the packed product must be maintained in accordance with the guidelines supplied by pictograms and written on the packaging.
- If using ropes, straps, chains, etc., make sure they are suitable for the weight to be unloaded and are in good condition.
- When moving the package, move with slow and continuous movements to avoid tearing the ropes, chains, etc.
- Do not tilt excessively in order to avoid overturning.
- Do not stand within range of the loading/unloading means (forklifts, cranes, etc.).

5.2 Unpacking

Unpack the product being careful not to damage or scratch it. Remove the accessory package and any pieces of polystyrene or cardboard used to block removable parts, etc. from the stove furnace. Also remember not to leave packaging components (plastic bags, polystyrene, etc.) within the reach of children, as they could be potential sources of danger. Dispose of them according to regulations.

5.3 Electrical connection

The stove is supplied with a power cable that must be plugged into a 120V 60Hz outlet.
Absorbed power is indicated in the "SPECIFICATIONS AND TECHNICAL DATA" chapter of this manual.
By law, the system must be properly grounded and with a differential circuit-breaker.
Make sure that the electrical power cable does not come into contact with hot parts when set in its final position.

CAUTION: ensure that the plug for electrical connection remains accessible after stove installation.

5.4 External thermostat installation

Stove operation can be adjusted to any external room thermostat connected to the circuit board (see electrical diagram).
This operation should be performed by qualified personnel.
The external thermostat works in parallel to the internal thermostat of the stove. To work the external thermostat exclusively, set room temperature to minimum (44° F). At this point, stove modulation will be controlled by the external thermostat.
During the working phase, if the room temperature is lower than the set temperature and the external thermostat is active (closed contact), the stove will operate at the set power level. When the room temperature reaches the set temperature, (external thermostat contact open), the stove will go to minimum power and the display will show the message "MODULATE". This modulation has been completed only if the room temperature returns to being lower than the set temperature in the external thermostat.

6 USE

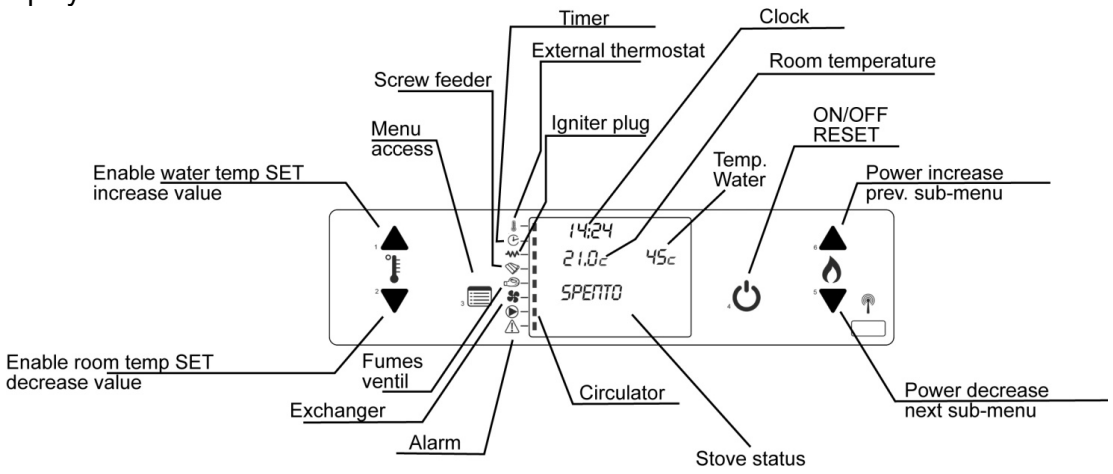
- All local regulations, must be observed when installing the unit.
- Improper installation or use of the device can result in forfeiture of the warranty.
- Do not use the unit as an incinerator or in any other way other than that for which it was designed. No other fuel besides wood pellets must be used.
- Do not use liquid fuels.
- The device, especially the external surfaces, gets very hot to the touch when in use. Handle with care to avoid burns.
- Do not make any unauthorized modifications to the device.
- Only use original replacement parts recommended by the manufacturer.
- This wood heater needs periodic inspection and repair for proper operation. It is against federal regulation to operate this wood heater in a manner inconsistent with operating instructions in this manual.
- This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulation to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instruction in this manual
- Flues gases contain carbon monoxide (CO), it is recommended to install smoke monitors and CO monitors for areas that are expected to generated CO. Inspect the chimney to minimize visible emissions.
- - Soot and Flyash: Formation and Need for Removal—The products of combustion will contain small particles of flyash. The flyash will collect in the exhaust venting system and restrict the flow of the flue gases. Incomplete combustion, such as occurs during startup, shutdown, or incorrect operation of the room heater will lead to some soot formation which will collect in the exhaust venting system. The exhaust venting system should be inspected at least once every year to determine if cleaning is necessary.

In general

- Make sure that the room where the stove is to be installed offers sufficient ventilation (see section "1.3 External air intake vent").
- Periodically check (or have someone check) the cleanliness of exhaust fumes.
- When the stove is in operation, remove the extractable handle and place it in the appropriate compartment located at the rear of the stove
- **CAUTION: keep all flammable products well away from the stove when it operating (MINIMUM: 100 cm from the front wall).**
- **CAUTION: to prevent the escape of fumes, the combustion chamber must be kept closed except during cleaning operations, to be carried out with the stove off.**
- **CAUTION: removing the safety guard inside the tank is strictly prohibited.**
- **CAUTION: in the event of pellet supply while the stove is on, make sure that pellets are not finished and that the flame remains present in the brazier. Also avoid the fuel sack from coming into contact with hot surfaces.**
- **CAUTION: remove any residue of unburned pellets caused by failed ignitions before you start the stove again.**
- **CAUTION: if during the ignition phase, the stove does not start and you notice a lot of smoke in the combustion chamber, immediately turn off the stove and replace pellets in use, as these may be too high in moisture. Forcing ignition could make your stove a hazard.**
- **CAUTION: if during cleaning, you find traces of spongy or hard (though not ash) pellets, replace the pellets being used as this residue may come from scraps of low-quality sawdust not usable in this type of stove. Forcing ignition can cause a fire or strong production of fumes in the chimney.**
- **CAUTION: monitor proper combustion of the pellets in the brazier. If you should detect accumulations of unburned pellets, IMMEDIATELY TURN OFF the stove and contact the service centre.**
- **CAUTION: exercise extreme caution in the presence of children, to prevent them from standing in front of the stove.**

6.1 Console description

The console displays information about stove operating status. Access the menu to view various types of displays and adjust the settings available depending on the level of access.
Depending on the operating mode, the displays may have different meanings based on their position on the display.



Below is a list of meanings of LEDs found on control panels:

	Room thermostat LED	The LED is on when it is connected to an external room thermostat and it is closed.
	Chrono LED	The LED switches on when the programmable thermostat is activated; meaning, if user parameter 03-01-01 enables chrono, it is different from off.
	Glow plug LED	The LED switches on when the glow plug is powered.
	Feed screw on LED	The LED switches on in the time intervals in which the pellet feed screw is in operation.
	Smoke fan LED	The LED switches on when the smoke fan is on.
	Exchanger LED	The LED switches on when the fan is in operation (air version)
	Pump on LED	The LED switches on when the pump/circulator is in operation (only with Hydro and boiler models)
	Alarms LED	The LED switches on when there is an alarm activated on the stove.

6.1.1 Console button functions

4	BUTTON 4 ON/OFF	• Manual on/off of the stove • Exit from a sub-menu • Exit from a shutdown or alarm (and passage to off status)
5	BUTTON 5 POWER REDUCTION	• Reduction in set power value • Passage from a sub-menu to the previous one
6	BUTTON 6 POWER INCREASE	• Increase in set power value • Passage from a sub-menu to the next one
3	BUTTON 3 MENU SELECTION	• Passage to sub-menus • Passage from programmable thermostat and clock programming • Passage to technical parameters programming
1	BUTTON 1 PARAMETER ADJUSTMENT (INCREASE)	• In temperature setting mode, increases the set value. • In technical parameter setting mode, increases the set value.
2	BUTTON 2 PARAMETER ADJUSTMENT (DECREASE)	• Passage to room temperature setting mode. • In temperature setting mode, reduces the set value. • In technical parameter setting mode, reduces the set value. • In work mode, activates room temperature setting.

6.2 First ignition

Before igniting the stove, you MUST have a qualified technician perform "FIRST START-UP" and calibration. For this purpose, we advise you to contact personnel part of our network of authorized service centres.
The company assumes no responsibility for malfunctions due to improper installation, failure to install, incorrect first ignition, or improper use.
Make sure that electrical connections have been performed properly.
Before lighting the stove, also check that the brazier is pushed back towards the rear wall of the combustion chamber.
The first few times you light the stove, it may give off odors due to the evaporation of paint or grease. Simply ventilate the room to make the odor go away, avoiding prolonged exposure as vapors can be harmful to people or animals. Do not allow children to stay in the room during this first phase.
When the tank is loaded for the first time, the feed screw must fill up for a given period. During this time, pellets will not be distributed within the combustion chamber. To overcome this difficulty, use the command "initial load" in menu 7 of the control panel (*see further details to follow*).

6.3 Ignition and normal operation

Before igniting the stove:

- **Check that the furnace door is locked.**
- Make sure that the pellet tank is full or contains such enough so that the stove will function for the desired amount of time.
- **Make sure that the brazier is clean**, free of ashes, combustion residue or unburned pellets (if necessary, remove the brazier and thoroughly clean it, then replace it with care in its housing).
- In the event or start-up with the programmable thermostat, make sure that the brazier is in the indicated conditions after last use.

When the stove is connected to the electrical system but not in work mode, the display will show the message "OFF".

6.3.1 Stove start-up

To start up the stove, hold and press the start button (4) for 2 seconds
If you start the stove during the final cleaning phase, the display may show the message "WAIT COOLING." In this case, wait for a minute before retrying ignition.

First phase. Preparation

The message "START" will appear on the display. In this phase, which lasts for about one minute, the pellet glow plug activates and combustion chamber forced ventilation starts along with activation of the fume extraction fan.

Second phase. Ignition

After the preparation phase, the display will show the message "LOAD PELLETS" and ignition will begin. This second phase is divided in two parts: pre-loading and actual ignition. First, the pellet feed screw is activated (the Feed screw ON LED lights up) for a variable time interval, depending on the model, and pellets begin to fall inside the brazier. **(Remember that the brazier must be perfectly clean at this beginning of this stage).** Once this "pre-loading" phase is completed, the pellet feed screw will stop for a variable amount of time depending on the model (from two to three minutes). After this waiting phase, the pellet feed screw will start to switch on at regular intervals and pellets will then continue falling inside the stove brazier, while the glow plug and then fume exhaust fan will both remain activated.
As soon as the pellets cover the glow plug hole, you will notice first a reddening and then the onset of a small flame in the brazier.
If pellets continue to fill the brazier without this happening, manually stop the ignition process without waiting for the stove to set off an alarm: "AL 5 NO START".
This second phase is completed when the stove detects successful triggering of the combustion process, or rather after 4-5 minutes from the triggering of the first flame.
If combustion is not detected within a given amount of time, the no start-up alarm will be activated ("AL 5 NO START" message).

Third phase. Stabilization

Once combustion triggering has been detected, the third phase will start and the display will show the message "FIRE PRESENT". Pellet feeding is reduced and ventilation increased in order to allow a stabilization of the flame and disposal of excess pellets accumulated in the brazier during the ignition phase. This phase lasts about 5 minutes.

Once the stabilization phase has been completed ("FIRE PRESENT"), the stove passes to the normal working phase.

6.3.2 No start-up

As said, if the onset of combustion is not detected, the no start-up alarm will be set off. The display will show the message "AL 5 NO START" and an acoustic signal will be heard at regular intervals (if the buzzer function is active in Menu 6).
To disable the alarm, hold and press the ON-OFF (4) (about 2 seconds). The acoustic alarm will stop and the stove will return to "FINAL CLEANING" status and then to "OFF."

Before starting another ignition cycle Verify the cause of the alarm. In particular:

- **Verify that the pellet tank is not empty.**
- **Verify that the brazier is in the right position.**
- **Remove the unburned pellets from the brazier (VERY IMPORTANT).**

CAUTION: An excessive quantity of pellets in the brazier, a humid pellet or dirty brazier make the ignition stage difficult. If these critical conditions are present a dense white smoke capable of causing an explosion in the combustion chamber may form. The explosion can be of such intensity as to break the glass of the dire door. Therefore, pay attention to never stay in front of the boiler during ignition stage if the fuel releases a dense smoke.

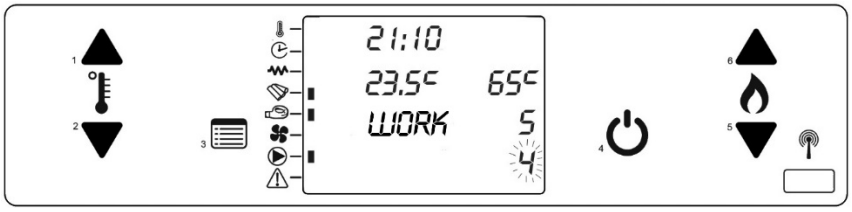
The boiler is however equipped with all safety systems required to minimize this risk.

<u>If the device does not ignite regularly, the main cause may be insufficient maintenance or poor pellet quality</u>**.**

6.3.3 Normal Operation

As soon as the ignition phase is over, the stove will go into normal working mode. During this phase, the display will show the following information:

- The first line shows the time.
- The second line to the left shows the room temperature while the line on the right shows set power (from P1 to P5).
- The third line shows the message "WORKING".
- The fourth line shows the message "MODULATE" when room temperature reaches the set temperature (see corresponding paragraph).



During normal working mode, the following operations can be performed:

- Stove power setting, choosing from one of the five available levels. Power setting is carried out via BUTTONS "5" and "6".
- Programmable thermostat parameter setting (see later section).
- Desired room temperature setting, choosing an interval from 7°C to 40°C. Set the temperature with button "1" to increase and "2" to decrease.

Periodic brazier cleaning is also active during working mode. Brazier cleaning mode is activated at regular intervals of about one hour. In this way, the smoke extractor works at maximum power while pellet feeding is reduced to minimum. This operation is necessary for eliminating ash deposits inside the brazier and for ensuring proper aeration and combustion. During brazier cleaning, the display

will show the message "BRAZIER CLEANING".

If you notice excessive accumulation of pellets in the brazier during normal operation, turn off the stove immediately and contact a service centre. Forcing could make your stove a hazard.

6.3.4 Modulation based on room temperature

The stove is equipped with an internal temperature sensor that allows it to modulate its power according to the desired room temperature.
For correct environment sensor operation, verify that the thermostat sensor positioned in the rear of the stove under the outlet is away from the fume exhaust pipe and is not in contact with objects or walls.
Press button "2" to set room temperature. The message " SET ROOM TEMP" will appear on the bottom of the display, while the upper part will show the set temperature.
To modify this value, use buttons "1" and "2" until you reach desired temperature (44°C to 104°C).
If the room temperature reaches the set temperature, the stove goes into minimum power and the last line of the display shows "MODULATE." This modulation has been completed only if the room temperature returns to being lower than the set temperature. In this case, the stove will return to the power set by the user and the display will show the message "MODULATE" and standard working indications will return.

6.3.5 Ventilation

Air models provide ventilation which diffuses the heat generated from by the stove into the surrounding environment. Activation of the ventilation occurs based on the temperature of fumes. Therefore, it starts up after ignition and switches off with a delay compared to stove shutdown. Ventilation speed is proportional to operating power and cannot be modified independently with respect to stove power.

In channeled air models, the stove has two rear hot air outputs, one on the right and the other on the left, under the pellet tank. Each of the two outputs has an independent control menu (see chapter 7 menu).

6.3.6 Brazier cleaning

During normal operation in work mode, "BRAZIER CLEANING" is activated at set intervals for a duration of about 45 seconds. During this time, the display will show the message "BRAZIER CLEANING", stove ventilation increases and the flame lowers in the brazier. This operation is necessary to decrease the likelihood of ash accumulation of ash inside the brazier.
If you notice an excessive accumulation of pellets in the brazier (over half the level of the brazier itself), immediately switch off the stove and clean the brazier. Promptly contact a service centre.

6.3.7 Shutdown

To turn off the stove, hold button 4 for a few seconds.
Once the shutdown signal has been received, the display will show a "FINAL CLEANING" message and the fume exhaust fan will continues to run at full speed for a minimum time of about 10 minutes to ensure complete cooling of the stove. The hot air fan will also continue to run until the stove cools down.

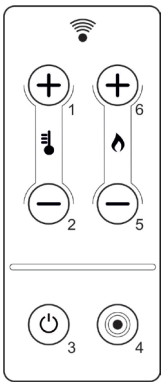
CAUTION: Never disconnect the power supply at this stage, as this may create problems for the stove and compromise the subsequent phases of ignition.

6.3.8 Interruption of power supply

In the event of a brief interruption in the power supply (under 10 seconds), the stove will automatically re-start without any alarms.
If power is lost for a longer time and the stove was in work mode, an "AL 1 - BLACK OUT" alarm will be generated. The stove will therefore not start back up automatically, but first the alarm will need to be manually removed.

6.3.9 Remote control.

The stove control panel has been designed to receive all the functions via remote control. *(Insert a CR 2025 3V battery)*



BUTTON 1	• In temperature setting mode, increases the set value. • In technical parameter setting mode, increases the set value.
BUTTON 2	• Passage to room temperature setting mode. • In temperature setting mode, reduces the set value. • In technical parameter setting mode, reduces the set value. • In work mode, activates room temperature setting.
BUTTON 3	• Passage to sub-menus • Passage from programmable thermostat and clock programming • Passage to technical parameters programming
BUTTON 4	• Manual on/off of the stove • Exit from a sub-menu • Exit from a shutdown or alarm (and passage to off status)
BUTTON 5	• Reduction in set power value • Passage from a sub-menu to the previous one
BUTTON 6	• Increase in set power value • Passage from a sub-menu to the next one

7 MENU

Press button "3" (MENU) to access the menu.
The menu is divided into different items and levels that allow you to access board settings and programming. Menu items that allow you to access technical programming are protected by an access key.

User menu

The following table briefly describes the structure of the menu, focusing only on selections available to the user in this section.
To operate from the menu, follow the guidelines below:

- Use button"3" to enter into the selected menu or sub-menu (you go down a level).
- Use button "4" to do the reverse and exit the menu or sub-menu in which you are located (you go up a level).
- Use buttons "1" and "2" to modify a parameter value (temperature, time, etc.).
- Use buttons "5" and "6" to move horizontally between different menus or sub-menus or parameters.

7.1 Menu 01 "FANS ADJUSTMENT"

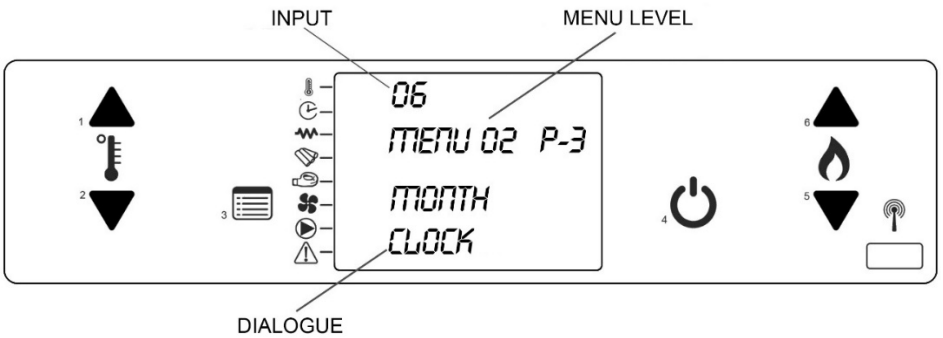
Menu item 01 "FANS ADJUSTMENT" is present only on channeled air models and allows you to modify the ventilation of the two channeled outputs. The choices shown in the table below are possible for each of the two fans. Press button "1" (fan 2) and "2" (fan 3) to select.

Setting	Fan 2	Fan 3
AUTO	corresponding to the selected power	corresponding to selected power
0	fan off	fan off
1	speed 1	speed 1
2	speed 2	speed 2
3	speed 3	speed 3
4	speed 4	speed 4
5	speed 5	speed 5

7.2 Menu 02 "CLOCK SET"

You can set the current time and date in this menu. The board is equipped with a lithium battery that allows internal clock autonomy over 3/5 years.
Enter into MENU and set, in order:

01	Day of the week	(Monday… Sunday)
02	Hour	(0..23)
03	Minutes	(0..59)
04	Day of the month	(1..31)
05	Month of the year	(1..12)
06	Current year	(2000.. 2099)

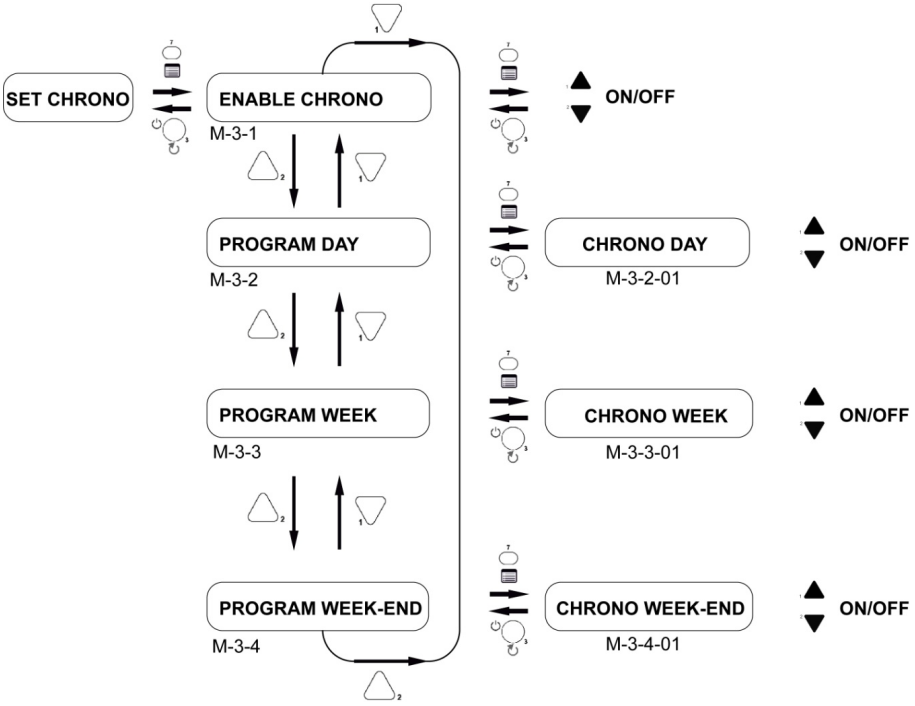


7.3 Menu 03 "CHRONO SET"

Use this menu to enable and program start-ups and shutdowns. There are eight different possibilities divided into three groups:

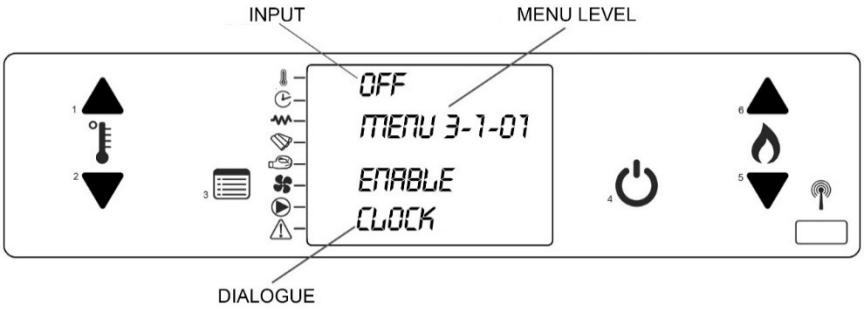
- **Daily program**: 2 start-ups and shutdowns valid each day
- **Weekly program**: 4 start-ups and shutdowns, for which you can decide which days of the week they must be active.
- **Weekend program**: 2 start-ups and shutdowns valid only for Saturday and Sunday.

Below is the diagram of the various Menu levels. Access the menu by pressing “3”, return to the previous menu by pressing “4”, scroll through the menu by pressing “5” and “6” and change the value by using keys “1” and “2”.



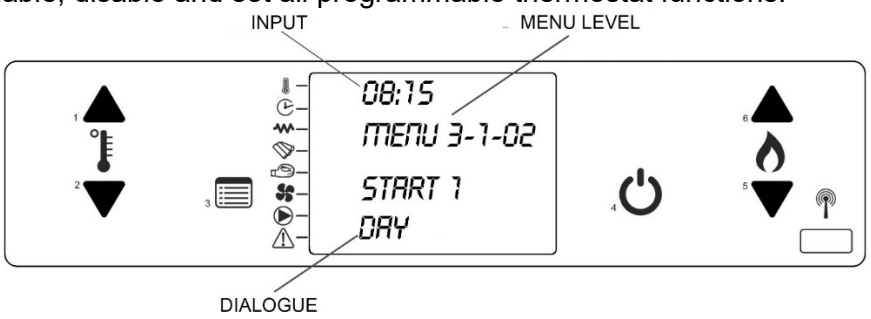
7.3.1 Menu 3-1 “ENABLE CHRONO”

Allows you to enable and disable all programmable thermostat functions. If the value is "off", all set programs are disabled.



7.3.2 Menu 3-2 “DAILY PROGRAM”

Allows you to enable, disable and set all programmable thermostat functions.

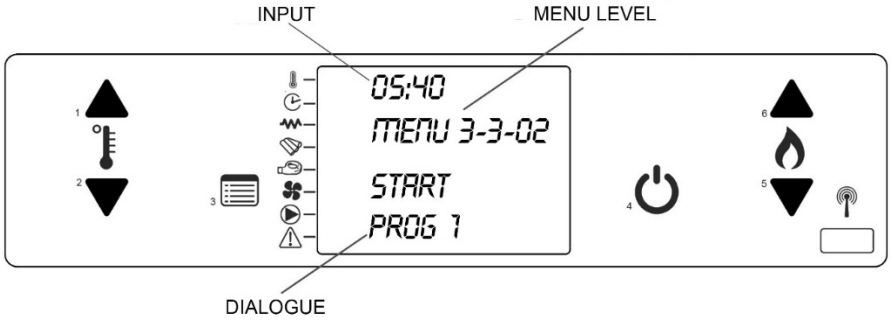


After having set the first parameter (M-3-2-01) “DAILY CHRONO” to "on", you can set two start-ups and two shutdowns. For each parameter, you can either set the value "off", if you do not wish to activate, or the time of start-up or shutdown.

Menu level	*Selection*	*Meaning*	*Possible values*
03-02-02	START 1	Activation time	00:00-23:50 -OFF
03-02-03	STOP 1	Disable time	00:00-23:50 -OFF
03-02-04	START 2	Activation time	00:00-23:50 -OFF
03-02-05	STOP 2	Disable time	00:00-23:50 -OFF

7.3.3 Menu 3-3 “WEEKLY PROG-“

The weekly programming group includes 4 start-ups and 4 shutdowns. For each on-off pair, you can decide which day of the week to activate the corresponding pair controls.
The first parameter, M-3-3-01 “WEEKLY CHRONO”, you can enable or disable all weekly programmable thermostat settings.



After having set the first parameter (M-3-2-01) “WEEKLY CHRONO” to "on", you can set 4 start- ups and 4 shutdowns. For each parameter, you can either set the value "off", if you do not wish to activate, or the time of start-up or shutdown. After each pair of on and off times, there are 7 parameters corresponding to the 7 days of the week. Each of these parameters can be set to "on" or "off" based on which programming you wish to activate corresponding to that day of the week. (See following tables).

PROGRAMME 1			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-02	START PROG 1	on time	00:00-23:50 -OFF
03-03-03	STOP PROG 1	off time	00:00-23:50 -OFF
03-03-04	MONDAY PROG 1	reference day	on/off
03-03-05	TUESDAY PROG 1		on/off
03-03-06	WEDNES-PROG 1		on/off
03-03-07	THURSDAY PROG 1		on/off
03-03-08	FRIDAY PROG 1		on/off
03-03-09	SATURDAY PROG 1		on/off
03-03-10	SUNDAY PROG 1		on/off

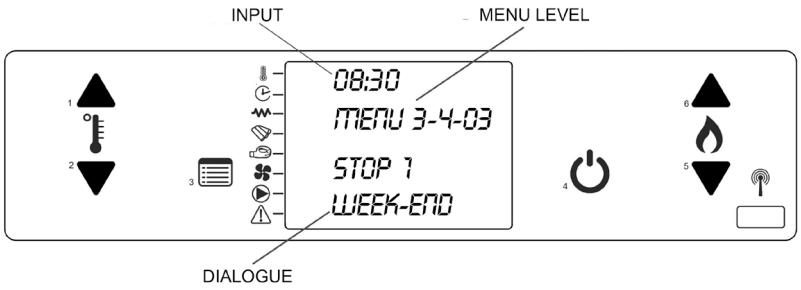
PROGRAMME 2			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-11	START PROG 2	On time	00:00-23:50 -OFF
03-03-12	STOP PROG 2	Off time	00:00-23:50 -OFF
03-03-13	MONDAY PROG 2	reference day	on/off
03-03-14	TUESDAY PROG 2		on/off
03-03-15	WEDNES-PROG 2		on/off
03-03-16	THURSDAY PROG 2		on/off
03-03-17	FRIDAY PROG 2		on/off
03-03-18	SATURDAY PROG 2		on/off
03-03-19	SUNDAY PROG 2		on/off

PROGRAMME 3			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-20	START PROG 3	On time	00:00-23:50 -OFF
03-03-21	STOP PROG 3	Off time	00:00-23:50 -OFF
03-03-22	MONDAY PROG 3	reference day	on/off
03-03-23	TUESDAY PROG 3		on/off
03-03-24	WEDNES- PROG 3		on/off
03-03-25	THURSDAY PROG 3		on/off
03-03-26	FRIDAY PROG 3		on/off
03-03-27	SATURDAY PROG 3		on/off
03-03-28	SUNDAY PROG 3		on/off

PROGRAMME 4			
Menu level	***Selection***	***Meaning***	***Possible values***
03-03-29	START PROG 4	On time	00:00-23:50 -OFF
03-03-30	STOP PROG 4	Off time	00:00-23:50 -OFF
03-03-31	MONDAY PROG 4	reference day	on/off
03-03-32	TUESDAY PROG 4		on/off
03-03-33	WEDNES- PROG 4		on/off
03-03-34	THURSDAY PROG 4		on/off
03-03-35	FRIDAY PROG 4		on/off
03-03-36	SATURDAY PROG 4		on/off
03-03-37	SUNDAY PROG 4		on/off

7.3.4 Menu 3-4 “WEEKEND PROG-“

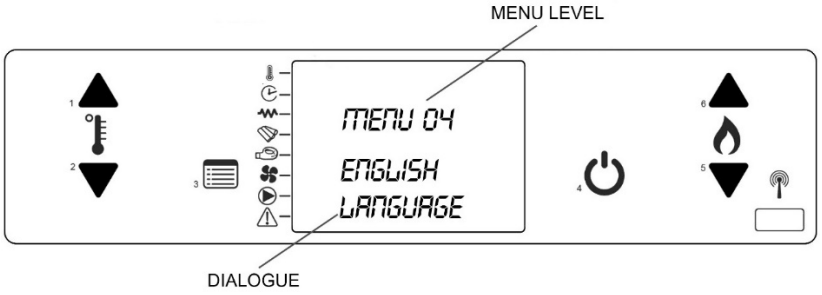
Allows you to enable, disable and set programmable thermostat functions for the weekend (Saturday and Sunday). As per daily programs, we have an enabling parameter and 2 pairs of start-up and shutdown times. Programming will be active as stated only on Saturday and Sunday.



TIP: to avoid confusion and unwanted start-up and shutdown, activate only one program at a time if you do not know exactly what your desired programming is.
Disable the daily program if you want to use weekly programming. Always disable the weekend program if you are using weekly programs 1,2,3 and 4.
Activate the weekend program only after having disabled weekly programming.

7.4 Menu 04 "CHOOSE LANGUAGE"

Allows you to select the dialogue language among those available.



7.5 Menu 05 "STAND-BY MODE"

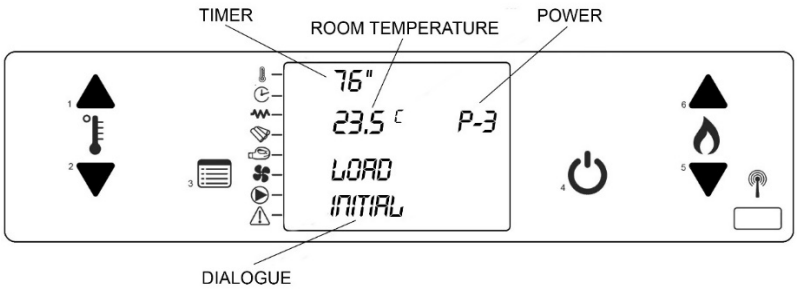
This menu allows you to activate or deactivate "STAND-BY".
Stand-by mode indicates a condition in which the stove shuts off but where it automatically re- ignites as soon as the room temperature and the water temperature fall below the set value and the flue gas temperature drops below its threshold (stove is cold). Default setting is "OFF".
Once the stand-by Menu is set to a value between 1'-120', if the water temperature or room temperature exceed a certain amount, set values (2°F for room temperature and 4°F for water temperature), an alternating message "MODULATE / OK STD BY" appears on the screen. At this point, after a pre-set time, if temperatures do not return under the set values, the stove shuts off and goes into stand-by mode.
During shutdown, the display shows the message "WAIT COOLING." This display message remains until re-lighting conditions are verified.

7.6 Menu 06 "BUZZER MODE"

When "off," acoustic signal disabled in the event of an alarm. When "on," sets off a buzzer when an alarm is activated.

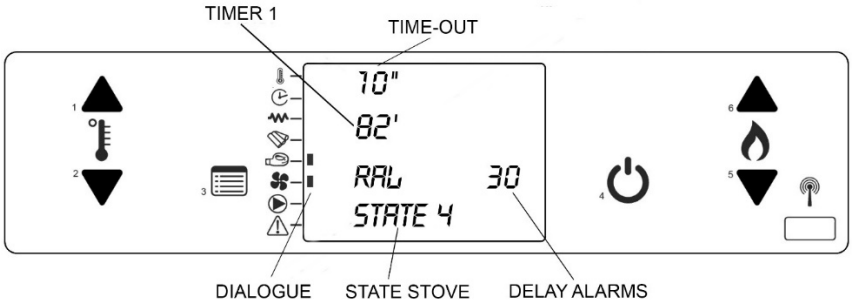
7.7 Menu 07 "INITIAL LOAD"

When the display shows the message "OFF," allows you to preload pellets for a time equal to 90 min. Start by pressing button "1" and stop if desired by pressing button "4." Once preloading is completed, remove the loaded pellets from the brazier.



7.8 Menu 08 "STOVE STATUS"

The stove status menu shows the current state of the stove, showing some sensor values and other variables inside the stove. Four pages displayed in succession are available. This menu is for qualified service personnel use.

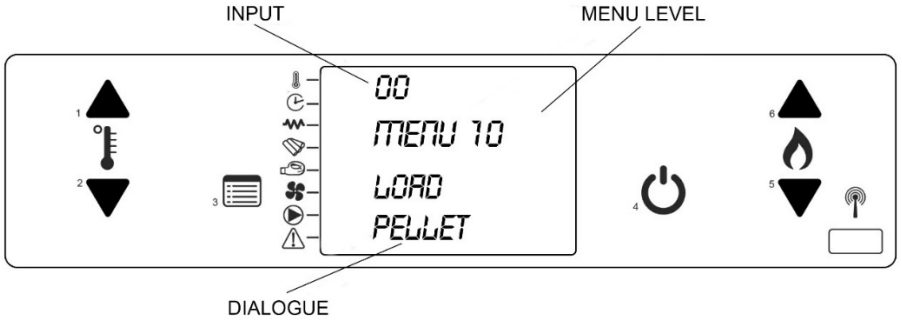


7.9 Menu 09 "TECHNICAL CALIBRATIONS"

This menu is protected by an access key and is intended for qualified service personnel.

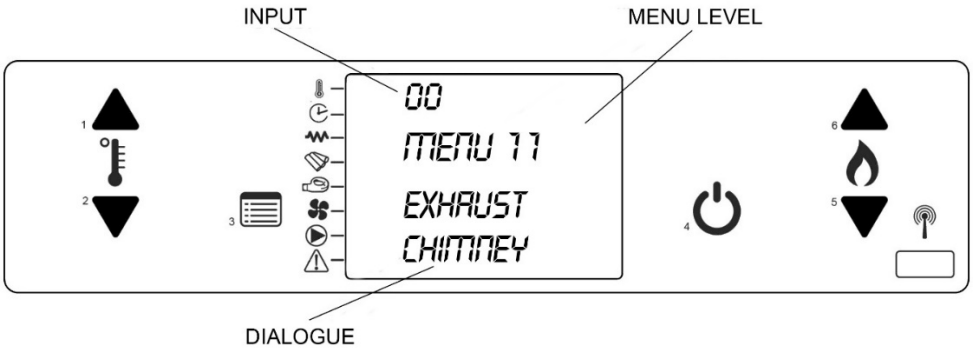
7.10 Menu 10 "PELLET TYPE"

This menu allows you to simultaneously increase or decrease all pellet lowering parameters (quantity of pellets and brazier loading).
The set default value is 00. Press keys (1) and (2) to modify said value from -9 to +9. For each unit, pellet load times are increased or decreased by 2.5 %.



7.11 Menu 11 "FIREPLACE TYPE"

This menu allows users to simultaneously increase or decrease all smoke fan parameters (draft). The set default value is 00. Press keys (1) and (2) to modify said value from -9 to +9.
For each unit, smoke motor revs are increased or decreased by 2.5%.



8 SAFETY AND ALARMS

8.1 Safety devices

CAUTION: during operation, some parts of the stove (door, handle, ceramic parts) can reach very high temperatures.
Remember to keep at the previously mentioned safe distance. Be careful, **use caution** and always follow the instructions.
If during operations any part of the stove or the exhaust pipe leak smoke, immediately turn off the stove **without** removing the power supply and ventilate the room. Then, once cooled down, verify the reason for the leak and, if necessary, call service personnel.
The stove is equipped with several devices which intervene in order to ensure safe operation.
CAUTION: safety devices are designed to eliminate any risk of damage to persons, animals or things, and tampering with or servicing by unauthorized personnel could compromise their safety.
Safety devices on the stove include the following:

8.1.1 Fume exhaust pressure sensor

This sensor is connected to the fume exhaust pressure duct. It controls internal pressure to the duct, monitoring any occlusion of the chimney flue and allowing use of the stove in total safety.

When it activates

If proper operation conditions in the vent exhaust duct are altered (improper installation, the presence of obstacles or impediments in the exhaust tube, negligent maintenance, adverse weather conditions such as persistent wind, etc.), the pressure sensor (pressure gauge) stops electrical power supply to the pellet feed screw, thus blocking pellet feeding to the brazier and sending an alarm signal to the board.
The alarm can also be caused by clogging in the stove, by improper combustion or lack of annual stove cleaning.
When the alarm goes off, the display shows the message **"AL 8 – LOW PRESSURE".**

What to do

- Put the stove in stand-by by pressing the off button for a few seconds (4). (The acoustic alarm stops).
- Wait and make sure that the combustion of pellets left in the brazier has been completed.
- Wait for the stove to cool down, then verify and remove the causes which caused the safety devices to go off. Finally, after having cleaned the brazier, re-start the stove by pressing the ON/OFF button (4).
- In the event of a repeated alarm, call a service centre.

8.1.2 Structure temperature sensor

The stove is equipped with a manual reset bulb thermostat whose function is to preserve the boiler, pellet tank and, consequently, the whole structure from excessive temperature changes.

When it activates

If the pellet loading tube reaches the threshold of 85°C.
In this situation, the thermostat interrupts electrical power to the feed screw, thus blocking pellet feeding to the brazier and sending an alarm signal to the board.
The display will show the message "**AL 7 – Thermal safety**".

What to do

- Put the stove in stand-by by pressing the off button for a few seconds
- Wait and make sure that the combustion of pellets left in the brazier has been completed.
- RESET THE SAFETY THERMOSTAT located on the rear of the stove under the outlet (*see Fig.14)*.

Before resetting the safeties, make sure that the stove is **off and completely cooled down,** then proceed as follows:

1 Unscrew the cap located on the rear lower right of the stove.
2 Press the red button with slight pressure.
3 Replace the cap in its housing.
4 **After having cleaned the brazier,** re-start the stove by pressing button (4).

8.1.3 Smoke temperature sensor

The smoke sensor is directly connected to the circuit board and keeps operating temperature of exhaust fumes from the stove under constant control, allowing safe use of the stove.

How it works

If fume temperature exceeds the first pre-set temperature limit, the board passes into modulation mode. The display will show the message "**MODULATE / MAX SMOKE**". At the same time if, despite passage to modulation, the fume temperature continues to increase and exceeds the second pre-set safety limit, the stove will pass into alarm mode. Pellet flow is interrupted and fume exhaust speed is set to maximum.
The display will show the message "**AL 3 – SMOKE TEMP**".

What to do

- Put the stove in stand-by by pressing the off button for a few seconds (4).
- Wait and make sure that the combustion of pellets left in the brazier has been completed.
- Verify and remove the causes which caused the safety devices to go off.
- After having cleaned the brazier, re-start the stove by pressing button (4).

8.1.4 Smoke sensor fault

The stove constantly controls smoke sensor functioning.

When it activates

If the sensor is momentarily and/or accidentally removed from its housing, or the connector is not correctly positioned on the circuit board or the sensor fails for any reason. The fault is signaled via display message **AL 2 – "SMOKE SENSOR**".

What to do

1 Put the stove in stand-by by pressing the off button for a few seconds (4).
2 Wait and make sure that the combustion of pellets left in the brazier has been completed.
3 If necessary, call a service centre to replace the sensor.

8.2 Alarms

In the event that an operating anomaly occurs, the board intervenes and signals the irregularities, operating in different modes depending on the type of alarm. The following alarms can occur:

Cause of alarm	Display message
No power	AL1 BLACK-OUT
Smoke temperature sensor	AL2 SMOKE SENSOR
Smoke overtemperature	AL3 SMOKE TEMP
Smoke fan fault	AL4 EXTRACT FAULT
No start-up	AL5 NO START
Shutdown during work mode	AL6 NO PELLET
General safety thermostat	AL7 THERMAL SAFETY
Safety pressure switch	AL8 LOW PRESSURE
No or low water sensor	AL9 WATER SENSOR
Water overtemperature	ALa WATER TEMP
Water press. outside allowed values	ALb WATER PRESS

ALL ALARM CONDITIONS CAUSE IMMEDIATE STOVE SHUTDOWN

To exit from an alarm condition, always press button "4" until the message "FINAL CLEANING" appears. You will also need to take additional steps, depending on the type of alarm generated. If you do not exit from the alarm condition within a given time (a few hours), the alarm will be sent into stove memory and the display will show the message "ALARM MEMORY." To exit from this condition, press button "4" as per above.

AL 1 - Black-out

This alarm is activated when the stove is disconnected from the mains.

What to do

Put the stove in stand-by by pressing the off button for a few seconds (4).

AL 2 - Smoke sensor

This alarm signals breakage of the smoke sensor (see safety devices)

AL 3 – Smoke temp

This alarm signals excessive smoke exhaust temperature (see safety devices)

AL 4 – Extract fault

This alarm indicates a failure to read the revs of the smoke expulsion motor by the control board. It may have been activated due to motor fault or due to a lack of connection between the rev reader (encoder) in the motor and the board.

What to do

Put the stove in stand-by by pressing the off button for a few seconds (4). Try switching the stove back on.

Contact your service centre if the problem persists.

AL 5 – No start

This alarm signals an ignition failure. This alarm is activated when, during the start-up phase, a maximum waiting time (about 20 minutes) is exceeded without the machine switching on successfully. (See ignition)

AL 6 – No pellet

This alarm indicates a flame failure in the brazier during normal stove operation. The main causes are: no pellets in the hopper or blocking of the pellet feed screw.

What to do

Put the stove in stand-by by pressing the off button for a few seconds (4).

Empty the brazier of all unburned accumulated pellets.

In the event of pellet exhaustion in the tank, refuel the stove and ignite it again. Do not insert pellets until the stove has cooled completely. **Pellet refilling must be performed with the stove off** or with the stove working with the flame present.

In the case of a pellet feed screw block, empty the tank and remove any foreign bodies present in the feed screw. Then refill with pellets and start the stove back up.

In the case of repeated feed screw blocks, call a service centre.

AL 7 – Thermal safety

This alarm is activated by intervention of the stove boiler safety thermostat (see safety devices).

AL 8 – Low pressure

This alarm is activated by intervention of the pressure sensor (pressure gauge) (see safety devices).

9 WARNINGS AND MAINTENANCE

WARNING

The maintenance and care must be carried out only with cold device.

You should only use spare parts approved and supplied by Laminox Idro Srl please contact your specialized retailer if you require spare parts. You must not make any changes to the device!!!.

The periodic maintenance, as indicated in this Installation and Operating Instruction, must be performed with the utmost care after reading the instructions, procedures and frequency described in this manual. Check the external air intake, by cleaning it, at least once a year. The flue must be regularly swept by the chimney sweeper. Let your chimney sweeper in charge of your area check the regular installation of the device, the connection to the flue and the aeration.
All maintenance operations (cleaning, replacements, etc.) should be carried out when the fire is out and the stove is cold. In addition, do not use any abrasive substances.

CAUTION: FAILURE TO CLEAN AFFECTS SAFETY

9.1 Opening the door

The door must remain closed during operation. The door should be opened only with the stove off and cooled down to perform maintenance and routine cleaning.

9.2 Ashes cleaning and disposal

Check the ash drawer every two days to see if it needs emptying
The ash collection compartment must be emptied regularly so as to impede combustion residue from arriving at the brazier support

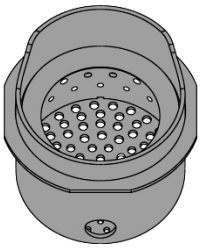
WARNING

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

CAUTION: ashes keep embers on for a long time!!!

9.3 Brazier cleaning

When the flame becomes a red color or is weak accompanied by black smoke, it may mean that there are ash deposits or incrustations which are not allowing correct stove operation and which must be removed.
Every two days, remove the brazier by simply lifting it from its housing, then clean it of ash and any incrustations which could have formed, with particular attention to freeing clogged holes using a pointed tool.
This operation is necessary in particular the first few ignitions, especially when using different quality pellets. The timing of this operation is determined by the frequency of use and the choice of fuel. It is advisable to also check the brazier support, emptying it of any ashes.
CAUTION: before igniting the stove, check that the brazier is pushed back toward the deflector and that the glow plug tube is inserted in the corresponding brazier hole.



9.4 Combustion chamber cleaning

Clean the combustion chamber weekly, removing ashes accumulated in the chamber using a vacuum cleaner.
Note: Use a vacuum cleaner designed for the suction of ashes for this type of cleaning.

9.5 Smoke chamber cleaning

Generally, clean the smoke chamber once a year (preferably at the beginning of the season) for best stove operation. The frequency of this operation depends on the type of pellet used and the frequency of use. Contact a Technical Assistance Centre for this type of cleaning.

9.6 Exhaust system cleaning

Until you are reasonably experienced regarding operating conditions, it is advisable to perform this service at least monthly. Remove the T-fitting cap and proceed with duct cleaning. If necessary, at least the first few times, request assistance from a qualified technician.

9.7 Cleaning metal and ceramic parts

Use a soft cloth moistened with water to clean metal stove parts.
Never clean metal or ceramic parts with alcohol, thinners, petrol, ketones or other degreasers.
Use of these substances frees the company from all liability. Discoloration of metal parts can be the result of improper use of the stove.

9.8 Cleaning glass

Door glass must be clean (cold) with ammonia-based and non-corrosive degreasers as a diluent. Prevent corrosive substances from coming into contact with the paint on the stove as these can cause damage. If glass is hot, before proceeding with cleaning, keep the door open as long as necessary until it cools down. Do not use any material that can scratch or damage the glass.

9.9 Broken glass

The stove is equipped with 5 mm thick ceramic glass that is resistant to a thermal shock of 1350°F. This glass can break only due to a strong impact or misuse. Do not slam the door or hit the glass. In case of breakage, replace with an original replacement part only. (See paragraph 9.15)

WARNING
Break of glasses: ceramic-based glasses can resist up to a heat shock of 1350°F, therefore they are not affected by thermal shock issues. Their break can be caused by mechanic shocks, such as striking or slamming shut of the door. Therefore, their replacement is not included in the warranty
Do not operate this unit with broken glasses
Broken or damaged glass components shall be removed and reinstalled taking care about using proper gaskets, cushioning devices and other accessories, maintaining edge clearances (See paragraph 7.15)
Replace glass only with glass supplied from the manufacturer or distributor of this appliance

9.10 Replacing the remote-control battery

Replace the old battery with a new CR 2025 3V battery, taking care not to invert polarity (polarity is indicated on the remote-control data sheet). Then close the remote control and dispose of the used battery in compliance with regulations. The installed battery must be the type specified above. Failure to comply with these instructions may create an explosion hazard.

9.11 Cleaning fans

CAUTION: all cleaning and/or maintenance operations must be performed with the POWER OFF.

The stove is equipped with fans (room and fumes) located at the lower rear of the stove. Any deposits of dust or ash on fan blades lead to an imbalance which causes noise during operation. Fans must therefore be cleaned at least once annually. As this operation involves the removal of some stove parts, have the fan cleaned by Technical Assistance Centre or qualified personnel only.

9.12 Stove inactivity

At the end of the season, perform the following operations:

- Remove all pellets from the tank and from the feed screw.
- Thoroughly clean the brazier, the support brazier, the combustion chamber and the ash drawer.
- Thoroughly clean the smoke exhaust system: contact a professional chimney sweep for this purpose.

- Clean all dust, spider webs, etc. from the area behind the panels of the inner cladding once a year.
- Clean fans thoroughly.
- Disconnect the power cable.

9.13 Routine and special maintenance

These operations should be programmed ANNUALLY with a Technical Assistance Centre and are necessary to ensure the maintenance of product efficiency and ensure safe operation.

- Thoroughly clean the combustion chamber and the heat exchanger.
- Smoke motor, dismantling and cleaning of the smoke exhaust duct, new silicone where required.
- Inspection and verification of gaskets, springs and replacement and application of the silicone where required.
- Tank, emptying and cleaning.
- Check of electrical and electronic parts.
- Cleaning and check of the tube and pressure gauge.
- Check and replacement, if necessary, of components that are subject to wear: brazier, resistance, ash drawers, etc.

9.14 Routine maintenance performed by qualified technicians

Using wood as solid fuel, the generator requires annual routine maintenance, which must be performed by a qualified technician, using only original spare parts.

Failure to comply can jeopardize the safety of the appliance and make the warranty null and void.

Respecting the frequencies of cleaning reserved for the user described in the use and maintenance manual, the generator is guaranteed correct combustion over time, preventing any anomalies and/or malfunctioning that could require more interventions of the technician. Requests for routine maintenance are not contemplated in the product warranty.

WARNING
Routine maintenance must be performed at least once a year.
The annual routine maintenance must be performed by a qualified technician.
Using only original spare parts. Failure to comply can jeopardize the safety of the appliance and make the warranty null and void.

9.15 Spare parts replacement

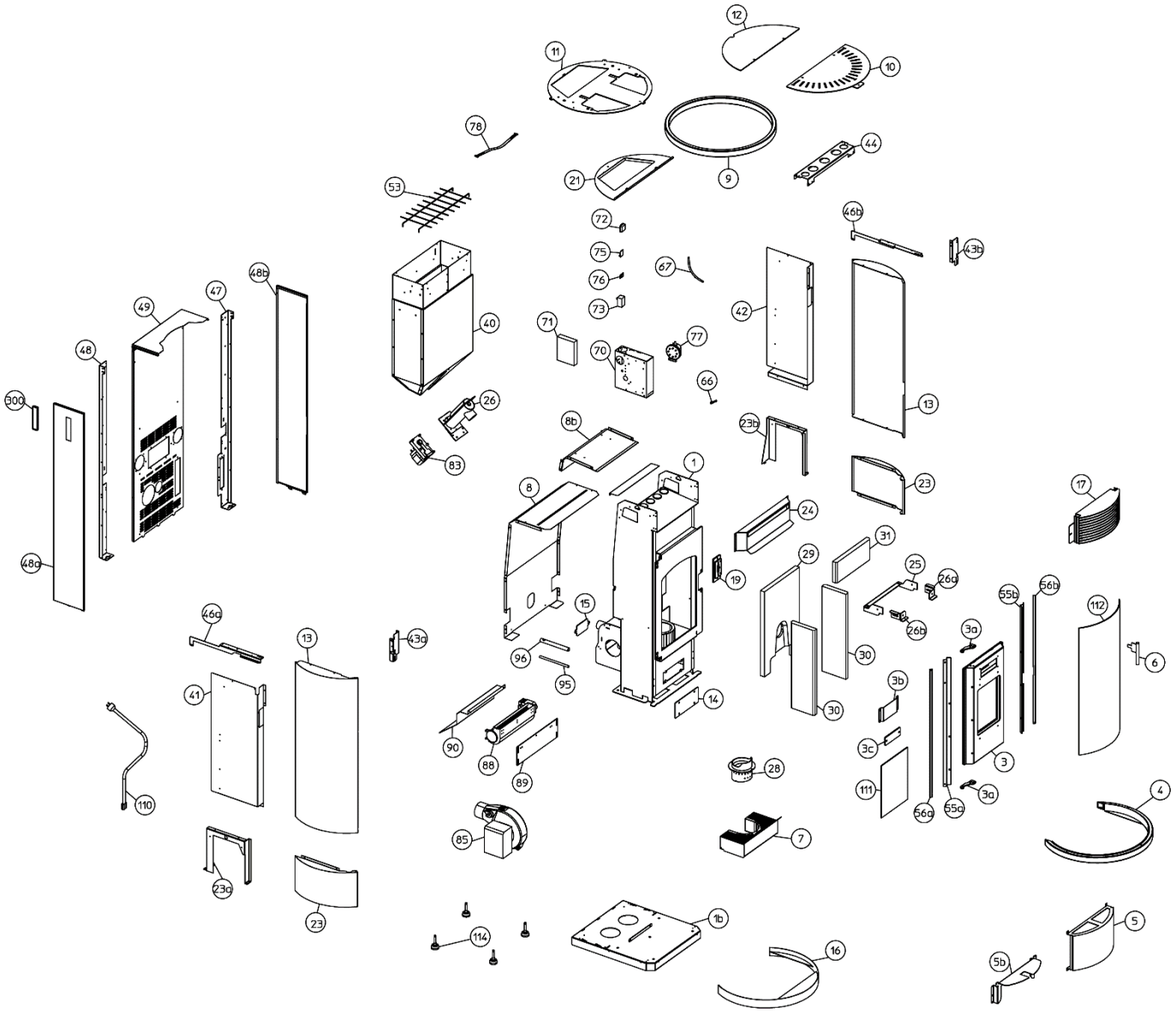
Use only ceramic type glass

The gaskets guarantee the tightness of the product and its consequent good functioning. They must be controlled periodically. They must be replaced immediately if they are worn or damaged. These operations must be carried out by a qualified technician.

Ceramic Glass dimensions: *306 x239 mm (12" x 9,4");* Thickness 5 mm
Door tricovet gasket: *Diam. 10 mm (0,39"); L. 1570 mm / (62")*

For all other spare parts please contact your dealer using the list on the following pages as a reference.

Spare parts replacement operations must always be carried out by a qualified technician



Ref. Drawing	Product code	Laminox description	N° Per Kit
28	**VLT-L-BRA**	Steel burner	1
1	**ERB-STR**	Structure	1
1b	**ERB-FND**	Bottom	1
28	**STP-BAC102**	Circular Steel Brazier	1
7	**ERB-CC**	Ash drawer	1
8b	**ERB-CAS**	Upper air conveyor	1
8	**ERB-CAP**	Rear air conveyor	1
24	**ERB-CAF**	Front air conveyor	1
90	**ERB-CAI**	Lower air conveyor	1
14	**ERB-TIF**	Front inspection cap	1
15	**ERB-TSF**	Fume box cap	1
29	**ERB-SV**	Rear combustion chamber insulation	1
30	**ERB-LV**	Combustion chamber side insulation	2

31	**ERB-SSV**	Upper combustion chamber insulation	1
25	**ERB-BVC**	Central insulator block	1
26a	**ERB-BVDX**	Right insulator block	1
26b	**EOBL-BVSX**	Left insulator block	1
67	**STP-TDEP**	Rubber tube vacuum thermostat	1
66	**STP-PGD**	Hose connector vacuum thermostat	1
42	**ERB-CADX**	Right air carter	1
41	**ERB-CASX**	Left air carter	1
89	**ERB-SVT**	Air fan support	1
96	**STP-TPC-180**	Ignition plug tube	1
19	**ERB-PN**	Pawl holder	1
21	**GIN-CBS**	Upper tank casing	1
44	**GIN-ST**	Top Support	1
23a	**GIN-SFSX**	Left side support	1
23b	**BRF-BL-SFDX**	Supporto fiancata destra	1
46a	**GIN-AOSX**	Left horizontal angle bracket	1
46b	**GIN-AODX**	Right horizontal angle bracket	1
47	**GIN-APDX**	Rear right angle bracket	1
48	**GIN-APSX**	Rear left angle bracket	1
43a	**ERB-SCSX**	Upper left front panel support	1
43b	**ERB-SCDX**	Upper right front panel support	1
5b	**GIU-SCL**	Lower front panel support	0
3	**GIN-CPS**	Fire door	1
6	**STP-MCE**	removable handle	1
3b	**SIB-CTAS**	Anti-explosion cap cover	1
3c	**SIB-TASS**	Anti-explosion cap	1
112	**LMX-C-745**	External curved glass	1
56b	**GIU-BVDX**	right glass blocker	1
55b	**GIU-PVDX**	Right glass holder	1
55a	**GIU-PVSX**	Left glass holder	1
56a	**GIU-BVSX**	Left glass blocker	1
3a	**GIU-CER**	Hinge door	2
26	**STP-KCPA**	Assembled Pellet Auger Kit	1
--	**STP-BFM**	Gearmotor fixing bush	1
--	**STP-CP**	Pellet screw	1
--	**STP-PCH**	Closing plate	1
--	**STP-BRO**	Bushing	1
--	**STP-CSA**	Welded body	1

--	**STP-FMT**	Stopper for gearmotor	1
40	**S215-74-SP**	Pellet tank	1
53	**S215-74-GPP**	Protection grid	1
114	**STP-PIE**	Adjustable foot	4
13	**GIN-FNC**	Upper side panel	2
23	**GIN-FNCH**	Lower side panel	2
5	**GIN-CI**	Lower front panel	1
16	**GIN-FNE**	Aesthetic base	1
48a	**GIN-FPSX**	Left rear side	1
48b	**GIN-FPDX**	Right rear side	1
4	**GIN-TBA**	Open tubular	1
10	**GIN-TS**	Top	1
11	**GIN-STT**	Undermount	1
12	**GIN-SPP**	Pellet tank door	1
9	**GIN-TBT**	Upper tubular	1
49	**GIU-SP**	Rear diaphragm	1
17	**GIU-GRI**	Front grid	1
85	**PL21-FUM**	Flue gas motor ø80	1
79	**PF047**	LCD Display	1
95	**STP-RA-180**	Ignition plug	1
88	**65-300-VENT**	Tangential Fan	1
83	**STP-MOT-2.0**	Gearmotor	1
300	**PG015**	radio remote control with temperature sensor	1
71	**STP-PL023**	Electronic board	1
78	**STP-FLAT**	Display cable	1
70	**STP-SAS**	Electronic board box	1
77	**STP-DEP-1020**	Smoke pressure switch	1
73	**STP-TSS**	Safety thermostat with probe	1
76	**STP-SER**	Serial port	1
72	**STP-INT**	Light Switch	1
75	**STP-VASCH**	Tray With Fuse	1

10 WARRANTY

10.1 Certificate of warranty

The purchaser is invited to:
- Examine the instructions for the installation, use and maintenance of the stove.
- Examine the conditions of warranty shown below and the "*Limited Warranty certificate"* included in this manual

10.2 Condition of warranty

The limited warranty covers defects of manufacturing materials, on condition that the product has not been broken due to an incorrect use, carelessness, wrong connections or errors of installation.

The following are not covered by guarantee:

- vermiculite (Firex 600);
- the glass of the door;
- the fiber gaskets;
- the painting;
- the fire pot;
- ignitor;
- the cast majolica;
- any damage caused by inappropriate installation and/or handling of the stove and/or shortcomings by the consumer
. The use of poor-quality pellets or of any other material could damage components of the stove causing the termination of their guarantee and the annexed responsibility of the manufacturer.

The pellets which meet the requisites listed in the chapter on them should be used.

All damage caused by transport are not acknowledged, therefore please carefully check the goods on receipt, immediately advising the dealer of any damage.

All the manufacturer's guarantees are shown here and no complaint may be made to the manufacturer according to any other guarantee, report or request.

For guarantee claims and instructions for return shipments please refer to your local dealer.

10.3 Information and problems

For any information or problems, please contact your dealer or service centre, the only people who can meet any request you may have end, if necessary, who can intervene directly

Limited Warranty certificate

Subject matter

Laminox Srl, provides a warranty on all product marketed under the *Laminox Idro* brand and installed professionally by authorized personnel within the North American territory: subject to limitations set out below mentioned.
The manufacturer's warranty allows customers to request the free of charge replacement or repair of product parts solely, in case where non-conformance due to manufacturing defects is detected and acknowledged by trained personnel.
During the warranty period, Laminox undertakes to correct defects caused by manufacturing defects, at no cost to the Customer, through its network of customer services, which the Customer can contact by contacting the dealer. In any case, Laminox points out that the appliance must be installed in an easily accessible place in accordance with current legislation. Otherwise, the costs necessary to intervene will be entirely borne by the Customer.

Warranty period

Laminox S.r.l. guarantees its products for 24 months (two years) from the date of purchase by the end customer (hereinafter Customer), proven by a valid fiscal document issued by the authorized reseller (receipt, invoice) that identifies the product purchased and the date of purchase and/or delivery of the same.

Validity

This warranty is valid exclusively for products installed in North America
The warranty includes the free repair or replacement of the component parts of the appliance which are defective at the origin due to manufacturing defects, with the exception of the hypotheses listed in the "Exclusions" paragraph.

The right to the guarantee will be proven by this original certificate, from which the model, the serial number of the product, the date of purchase and the company name of the retailer can be deduced and by a document valid for tax purposes, issued by the retailer at the time of purchase.

The warranty is recognized as valid provided that:
1) The appliance has been installed by qualified personnel in compliance with the regulations in force on the matter, respecting the instructions contained in this use and maintenance instructions;
2) The appliance is used according to the methods described in this use and maintenance instructions;
3) The lack of conformity is reported;
4) This certificate is accompanied by a purchase document certifying payment for the goods and showing the retailer's company name, model and purchase price.

Exclusions

The warranty is not recognized in the following cases:

1) The terms of validity have not been respected;
2) The installation has not been carried out in compliance with the regulations in force on the matter, respecting the prescriptions contained in this use and maintenance instructions. Installations that do not comply with current standards will void the product warranty, as will improper use and lack of maintenance as foreseen by the manufacturer;
3) It is found by the customer service that conditions external to the functioning of the product have caused it;
4) For interventions aimed at explaining the functioning of the product, periodic checks and maintenance and all that, at the time of sale, had been brought to the attention of the Customer or that the latter could not reasonably ignore;
5) Negligence in maintenance, carelessness, tampering, accidental breakage, damage in transport,

incorrect handling, as well as improper use and maintenance by the Customer is found;
6) Combustion of materials that do not comply with the types indicated in the use and maintenance manual;
7) Damage caused to the equipment by atmospheric and natural events (such as lightning, floods, fires, earthquakes) or by acts of vandalism;
8) Operational alterations due to climatic, atmospheric, environmental or other conditions;
9) Acknowledgment by the customer service of the presence of non-compliant electrical and/or hydraulic systems or fume ducts;
10) For which an insufficient or non-compliant flow rate of the electrical systems is found;
11) No defect has been found, as reported by the Customer, or for generic operating problems deriving from a wrong impression by the user (problems with noise, heating, timer programming, etc.);
12) Interventions for calibration or adjustment of the product in relation to the type of fuel used or the particularities of the installation;
13) Transport damage not dependent on the manufacturer. In this regard, it is recommended to carefully check the material upon receipt, immediately notifying the retailer and reporting the annotation both in the transport document and on the carrier's copy.

Laminox S.r.l. declines all responsibility for any damage that may directly or indirectly be caused to people, things or animals as a result of failure to observe all the instructions indicated in the specific instruction booklet and concerning installation, use, operation and maintenance of the appliance.
For the period of inefficiency and for direct or indirect damage due to or dependence on the product, no compensation is recognized.

The interventions carried out for the replacement of components subject to wear and/or removable are also excluded from the guarantee, unless their breakage and/or their malfunctioning are not attributable to original defects: - v*ermiculite (Firex 600);*
- the glass of the door;
- the fiber gaskets;
- the painting;
- the fire pot;
- the cast majolica;
- any damage caused by inappropriate installation and/or handling of the stove and/or shortcomings by the consumer

First ignition test (for a fee)

This product requires first start-up testing by an authorized customer service which will regulate the operating parameters and provide all the information for correct use.
It is essential to have the product function tested before completing any wall finishes (smoke duct covers, coverings, painting, etc.). The company assumes no responsibility for any damage and consequent costs of restoring the finishes mentioned even if they were to result from the replacement or repair of non-functioning parts.

Downtime period

In case of product malfunction, the customer service shall arrange to repair the product as quickly as possible, without prejudice to the fact that no compensation will be granted for the downtime period

Important: The assistance interventions must be carried out by the customer service, in total safety according to the current provisions of the law on the subject. The means necessary for the safe execution of the assignment (scaffolding, handling equipment, etc.) will be procured by the Client and the consequent expenses will be borne exclusively by him. If the technician recognizes the defect as prescribed by the laws in force regarding safety. He may legitimately refuse to carry out the requested intervention. by charging the Client the cost of the exit.

1. The technician has the task of restoring the conformity of the product on the basis of the provisions of the guarantee conditions;
2. The technician is the only person competent to establish the correct functionality of the product and evaluate its possible irreparability on site. In this second hypothesis, the product must be sent, with suitable packaging, to the Laminox company for repair and general testing with costs to be borne by the customer. In cases of irreparability, the replacement can be carried out only following the written consent of the manufacturer, leaving unchanged the expiry date and the terms of guarantee acquired at the time of purchase of the product;
3. The technician will process requests for intervention for repairs under warranty promptly, compatibly with organizational requirements. In any case, however, the manufacturer cannot be held responsible for any inconvenience caused by any delays in carrying out the intervention.

Once the warranty period stipulated in the contract has expired, the costs for any restoration work must be borne by the Customer. In this case, the Customer can contact the TAC network, from which he can obtain, in addition to a high professional service, original, tested and guaranteed spare parts.1.

REFERENCES STANDARDS:

ASTM E1509
UL 1482
ULC S627
UL 181
UL 641
ULC S609
NFDA (Fire) 211

Laminox S.r.l. reserves the right to change the characteristics and data reported in the following document at any time and without warning in order to improve their products. This manual, therefore, cannot be considered as a contract with third parties.
Updated manuals and drawings are available at website www.laminox.com.

PLEASE CONTACT YOUR DEALER FOR ANY SERVIC OR QUESTION

Appliance information:

SERIAL NUMBER _____

DATE PURCHASED _____

DATE INSTALLED _____

Laminox S.r.l. Hydro Division
Zona Industriale Callarella, 261/263 – 62028 SARNANO (MC) Italy Tel. +39 0733.657.622 – Fax +39 0733.657.494
www.laminox.com e-mail: idro@laminox.com

rev 03/2024

Dry Gas Meter Calibration

DUT	
Manufacturer:	APEX
Model:	XC-60
Lab ID #:	53
Serial #:	1902130
Calibration Date:	8/2/2023
Calibration Expiration:	2/2/2024
Barometric Pressure:	29.96 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	Fluke	Aquatech	Dwyer
Model:	SK25DA	52 II	DBX2	475
Lab ID#:	47	196	202	174
Calibration Expiration Date:	4/17/2024	11/29/2023	5/23/2024	4/21/2024
Calibration γ Factor:	0.9988			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	177.098	365.328	139.901
Standard DGM Temperature (°F)	75.0	78.0	78.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	6.200	13.217	5.120
DGM Temperature (°F)	81.0	97.0	99.0
DGM Pressure (in H_2O)	3.09	2.25	1.9
Net Volume for Standard DGM (ft^3)	6.254	12.901	4.941
Net Volume for DGM (ft^3)	6.200	13.217	5.120

Dry Gas Meter γ Factor	1.011	1.004	0.997
γ Factor Deviation From Average	1.011	1.004	0.997

Average Gas Meter γ Factor: 1.004

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

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

Dry Gas Meter Calibration

DUT	
Manufacturer:	APEX
Model:	XC-60
Lab ID #:	54
Serial #:	1902133
Calibration Date:	8/2/2023
Calibration Expiration:	2/2/2024
Barometric Pressure:	29.88 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	Fluke	Aquatech	Dwyer
Model:	SK25DA	52 II	DBX2	475
Lab ID#:	47	196	202	174
Calibration Expiration Date:	4/17/2024	11/29/2023	5/23/2024	4/21/2024
Calibration γ Factor:	0.9988			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	359.264	410.313	150.574
Standard DGM Temperature (°F)	73.0	75.0	77.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	12.737	14.948	5.485
DGM Temperature (°F)	85.0	93.0	101.0
DGM Pressure (in H_2O)	2.98	1.57	2.3
Net Volume for Standard DGM (ft^3)	12.687	14.490	5.317
Net Volume for DGM (ft^3)	12.737	14.948	5.485

Dry Gas Meter γ Factor	1.010	0.997	1.006
γ Factor Deviation From Average	1.010	0.997	1.006

Average Gas Meter γ Factor: 1.004

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

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

Dry Gas Meter Calibration

DUT	
Manufacturer:	APEX
Model:	XC-60
Lab ID #:	55
Serial #:	1902130
Calibration Date:	8/4/2023
Calibration Expiration:	2/4/2024
Barometric Pressure:	30.02 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	Fluke	Aquatech	Dwyer
Model:	SK25DA	52 II	DBX2	475
Lab ID#:	47	196	202	174
Calibration Expiration Date:	4/17/2024	11/29/2023	5/23/2024	4/21/2024
Calibration γ Factor:	0.9988			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	234.129	172.446	304.050
Standard DGM Temperature (°F)	73.0	73.0	75.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	8.380	6.176	10.856
DGM Temperature (°F)	83.0	82.0	83.0
DGM Pressure (in H_2O)	0.00	0.00	0.0
Net Volume for Standard DGM (ft^3)	8.268	6.090	10.737
Net Volume for DGM (ft^3)	8.380	6.176	10.856

Dry Gas Meter γ Factor	1.004	1.001	1.003
γ Factor Deviation From Average	1.004	1.001	1.003

Average Gas Meter γ Factor: 1.003

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

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

Dry Gas Meter Calibration

DUT	
Manufacturer:	APEX
Model:	XC-50-DIR
Lab ID #:	203
Serial #:	A2204292
Calibration Date:	8/2/2023
Calibration Expiration:	2/2/2024
Barometric Pressure:	29.95 in. Hg

Equipment Used:	Ref. Std. DGM	Thermometer	Barometer	Manometer
Manufacturer:	Apex	Fluke	Aquatech	Dwyer
Model:	SK25DA	52 II	DBX2	475
Lab ID#:	47	196	202	174
Calibration Expiration Date:	4/17/2024	11/29/2023	5/23/2024	4/21/2024
Calibration γ Factor:	0.9988			

Use in accordance with EPA Method 5, sections 10.3 and 16.1. Use only calibrated, NIST traceable reference standard DGM. Caibrate over expected operating flow range of DUT.

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	145.280	144.545	148.847
Standard DGM Temperature (°F)	78.0	79.0	79.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	5.087	5.161	5.355
DGM Temperature (°F)	85.0	93.0	96.0
DGM Pressure (in H_2O)	2.33	1.17	0.9
Net Volume for Standard DGM (ft^3)	5.131	5.105	5.256
Net Volume for DGM (ft^3)	5.087	5.161	5.355

Dry Gas Meter γ Factor	1.015	1.011	1.009
γ Factor Deviation From Average	1.015	1.011	1.009

Average Gas Meter γ Factor: 1.011

Measurement Uncertainty: Total measurement uncertainty +/- 0.748% RD, K=2

Calculations:

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

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	28140-203326-14	**Customer PO#:** 1090	
Customer Name:	PFS TECO		
Customer Address:	11785 SE Highway 212 Ste 305		
City:	Clackamas	**State:** OR	**Zip:** 97015
Contact:	Aaron Kravitz		
Service Address:	11785 SE Highway 212 Ste 305	Clackamas, OR 97015	

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
LA-01776 | Pressure Transducer | Fluke | SN: 5956001 | Cal: 11/25/2022 | Due: 11/25/2023 | Range: 10 in H2O | Report #: EVL846346

Instrument Data

Calibration Date:	March 1, 2023	**Reference:**	ASME B40.100
Recommended Due Date:	March 1, 2024	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Newport	**Temperature:**	73 °F
Type:	Pressure Transducer	**Humidity:**	30% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	54C
Capacity:	5 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 5.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
5.00	5.00	5.00	0.00	5.00	0.00	0.05	0.008
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005

Manufacturer: Newport **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** March 1, 2023

Technical Manager: Marshall Doyle **Signature:** 

Report #: 28140-203326-14

Report and Certificate of Calibration

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Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620

ACCREDITED
CERT #4986.01

Report #:	28140-203325-14	**Customer PO#:** 1090	
Customer Name:	PFS TECO		
Customer Address:	11785 SE Highway 212 Ste 305		
City:	Clackamas	**State:** OR	**Zip:** 97015
Contact:	Aaron Kravitz		
Service Address:	11785 SE Highway 212 Ste 305	Clackamas, OR 97015	

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
LA-01776 | Pressure Transducer | Fluke | SN: 5956001 | Cal: 11/25/2022 | Due: 11/25/2023 | Range: 10 in H2O | Report #: EVL846346

Instrument Data

Calibration Date:	March 1, 2023	**Reference:**	ASME B40.100
Recommended Due Date:	March 1, 2024	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Newport	**Temperature:**	68 °F
Type:	Pressure Transducer	**Humidity:**	37% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	54B
Capacity:	1 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 1.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.005
0.10	0.10	0.10	0.00	0.10	0.00	0.01	0.005
0.25	0.25	0.25	0.00	0.25	0.00	0.01	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.01	0.005
0.75	0.75	0.75	0.00	0.75	0.00	0.01	0.005
1.00	0.99	0.99	-0.01	0.99	-0.01	0.01	0.005
0.75	0.75	0.75	0.00	0.75	0.00	0.01	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.01	0.005
0.25	0.25	0.25	0.00	0.25	0.00	0.01	0.005
0.10	0.10	0.10	0.00	0.10	0.00	0.01	0.005
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.005

Manufacturer: Newport **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** March 1, 2023

Technical Manager: Marshall Doyle **Signature:** 

Report #: 28140-203325-14

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

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Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	28140-203324-14	**Customer PO#:**	1090		
Customer Name:	PFS TECO				
Customer Address:	11785 SE Highway 212 Ste 305				
City:	Clackamas	**State:**	OR	**Zip:**	97015
Contact:	Aaron Kravitz				
Service Address:	11785 SE Highway 212 Ste 305	Clackamas, OR 97015			

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
LA-01776 | Pressure Transducer | Fluke | SN: 5956001 | Cal: 11/25/2022 | Due: 11/25/2023 | Range: 10 in H2O | Report #: EVL846346

Instrument Data

Calibration Date:	March 1, 2023	**Reference:**	ASME B40.100
Recommended Due Date:	March 1, 2024	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Newport	**Temperature:**	73 °F
Type:	Pressure Transducer	**Humidity:**	30% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	53C
Capacity:	5 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 5.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
5.00	5.00	5.00	0.00	5.00	0.00	0.05	0.008
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005

Manufacturer: Newport **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
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All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** March 1, 2023

Technical Manager: Marshall Doyle **Signature:** 

Report #: 28140-203324-14

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	28140-203324-14	**Customer PO#:**	1090		
Customer Name:	PFS TECO				
Customer Address:	11785 SE Highway 212 Ste 305				
City:	Clackamas	**State:**	OR	**Zip:**	97015
Contact:	Aaron Kravitz				
Service Address:	11785 SE Highway 212 Ste 305	Clackamas, OR 97015			

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
LA-01776 | Pressure Transducer | Fluke | SN: 5956001 | Cal: 11/25/2022 | Due: 11/25/2023 | Range: 10 in H2O | Report #: EVL846346

Instrument Data

Calibration Date:	March 1, 2023	**Reference:**	ASME B40.100
Recommended Due Date:	March 1, 2024	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Newport	**Temperature:**	73 °F
Type:	Pressure Transducer	**Humidity:**	30% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	53C
Capacity:	5 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 5.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
5.00	5.00	5.00	0.00	5.00	0.00	0.05	0.008
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005

Manufacturer: Newport **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** March 1, 2023

Technical Manager: Marshall Doyle **Signature:** 

Report #: 28140-203324-14

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #: 28134-206391-14 **Customer PO#:** 1090
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212 Ste 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Aaron Kravitz
Service Address: 11785 SE Highway 212 Ste 305 Clackamas, OR 97015

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
19-01135 | Thermocouple Meter | Tegam | SN: T-312250 | Cal: 08/01/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 2,450 °F | Report #: 25315-30977-3646

Instrument Data

Calibration Date:	February 28, 2023	**Reference:**	NAVAIR 17-20.ST-95
Recommended Due Date:	February 28, 2024	**Cal-Cert Procedure:**	CP-013
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	National Instruments	**Temperature:**	70 °F
Type:	Data Logger	**Humidity:**	31% RH
Model Number:	NI 9213	**Asset #:**	215 Booth 1
Serial #:	1B182FB	**Service Location:**	Service Address
Resolution:	0.1 °F	**As Found:**	Pass
Capacity:	2500 °F	**As Left:**	Pass
Tolerance:	± 3.0 °F		
Additional Error	± - °F		

Type K Thermocouple
METER FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Tunnel	0.00	0.20	0.20	0.20	0.20	0.346
	500.00	500.30	500.30	500.30	0.30	
	1000.00	1000.40	1000.40	1000.40	0.40	
	1500.00	1500.40	1500.40	1500.40	0.40	
	2000.00	2000.50	2000.50	2000.50	0.50	
	2400.00	2400.70	2400.70	2400.70	0.70	

Type K Thermocouple
METER FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Flue	0.00	0.10	0.10	0.10	0.10	0.346
	500.00	500.30	500.30	500.30	0.30	
	1000.00	1000.30	1000.30	1000.30	0.30	
	1500.00	1500.30	1500.30	1500.30	0.30	
	2000.00	2000.50	2000.50	2000.50	0.50	
	2400.00	2400.60	2400.60	2400.60	0.60	

Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1B182FB

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter A	0.00	0.10	0.10	0.10	0.10	0.346
	500.00	500.10	500.10	500.10	0.10	
	1000.00	1000.20	1000.20	1000.20	0.20	
	1500.00	1500.30	1500.30	1500.30	0.30	
	2000.00	2000.30	2000.30	2000.30	0.30	
	2400.00	2400.40	2400.40	2400.40	0.40	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Back	0.00	0.10	0.10	0.10	0.10	0.346
	500.00	500.00	500.00	500.00	0.00	
	1000.00	1000.20	1000.20	1000.20	0.20	
	1500.00	1500.50	1500.50	1500.50	0.50	
	2000.00	2000.60	2000.60	2000.60	0.60	
	2400.00	2400.70	2400.70	2400.70	0.70	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Catgalyst	0.00	-0.30	-0.30	-0.30	-0.30	0.346
	500.00	499.90	499.90	499.90	-0.10	
	1000.00	1000.10	1000.10	1000.10	0.10	
	1500.00	1500.10	1500.10	1500.10	0.10	
	2000.00	2000.10	2000.10	2000.10	0.10	
	2400.00	2400.20	2400.20	2400.20	0.20	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter A	0.00	-0.50	-0.50	-0.50	-0.50	0.346
	500.00	499.70	499.70	499.70	-0.30	
	1000.00	999.90	999.90	999.90	-0.10	
	1500.00	1500.00	1500.00	1500.00	0.00	
	2000.00	2000.00	2000.00	2000.00	0.00	
	2400.00	2400.00	2400.00	2400.00	0.00	

Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1B182FB

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Left	0.00	-0.50	-0.50	-0.50	-0.50	0.346
	500.00	499.70	499.70	499.70	-0.30	
	1000.00	999.70	999.70	999.70	-0.30	
	1500.00	1500.00	1500.00	1500.00	0.00	
	2000.00	2000.10	2000.10	2000.10	0.10	
	2400.00	2400.20	2400.20	2400.20	0.20	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Right	0.00	-0.60	-0.60	-0.60	-0.60	0.346
	500.00	499.70	499.70	499.70	-0.30	
	1000.00	999.80	999.80	999.80	-0.20	
	1500.00	1499.80	1499.80	1499.80	-0.20	
	2000.00	1999.90	1999.90	1999.90	-0.10	
	2400.00	2400.00	2400.00	2400.00	0.00	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter B	0.00	0.00	0.00	0.00	0.00	0.346
	500.00	500.80	500.80	500.80	0.80	
	1000.00	1000.60	1000.60	1000.60	0.60	
	1500.00	1500.20	1500.20	1500.20	0.20	
	2000.00	2000.00	2000.00	2000.00	0.00	
	2400.00	2399.70	2399.70	2399.70	-0.30	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Top	0.00	-0.80	-0.80	-0.80	-0.80	0.346
	500.00	499.30	499.30	499.30	-0.70	
	1000.00	999.50	999.50	999.50	-0.50	
	1500.00	1499.60	1499.60	1499.60	-0.40	
	2000.00	1999.60	1999.60	1999.60	-0.40	
	2400.00	2399.70	2399.70	2399.70	-0.30	

Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1B182FB

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Bottom	0.00	-1.00	-1.00	-1.00	-1.00	0.346
	500.00	499.20	499.20	499.20	-0.80	
	1000.00	999.50	999.50	999.50	-0.50	
	1500.00	1499.50	1499.50	1499.50	-0.50	
	2000.00	1999.60	1999.60	1999.60	-0.40	
	2400.00	2399.60	2399.60	2399.60	-0.40	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter B	0.00	-0.80	-0.80	-0.80	-0.80	0.346
	500.00	499.30	499.30	499.30	-0.70	
	1000.00	999.50	999.50	999.50	-0.50	
	1500.00	1499.50	1499.50	1499.50	-0.50	
	2000.00	1999.60	1999.60	1999.60	-0.40	
	2400.00	2399.50	2399.50	2399.50	-0.50	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter C	0.00	-1.20	-1.20	-1.20	-1.20	0.346
	500.00	499.00	499.00	499.00	-1.00	
	1000.00	999.20	999.20	999.20	-0.80	
	1500.00	1499.30	1499.30	1499.30	-0.70	
	2000.00	1999.30	1999.30	1999.30	-0.70	
	2400.00	2399.30	2399.30	2399.30	-0.70	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter C	0.00	-1.00	-1.00	-1.00	-1.00	0.346
	500.00	499.20	499.20	499.20	-0.80	
	1000.00	999.40	999.40	999.40	-0.60	
	1500.00	1499.50	1499.50	1499.50	-0.50	
	2000.00	1999.50	1999.50	1999.50	-0.50	
	2400.00	2399.50	2399.50	2399.50	-0.50	

Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1B182FB

	Type T Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Ambient	0.00	0.00	0.00	0.00	0.00	0.346
	20.00	17.70	17.70	17.70	-2.30	
	40.00	37.80	37.80	37.80	-2.20	
	60.00	57.70	57.70	57.70	-2.30	
	80.00	77.90	77.90	77.90	-2.10	
	100.00	97.90	97.90	97.90	-2.10	

Remarks:

15 Channels tested. Ambient is Type T, tested from 0 to 100 °F per customer request.

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated. All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** February 28, 2023

Technical Manager Marshall Doyle **Signature:** 

Report #: 28134-206391-14

Report and Certificate of Calibration

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A2LA ACCREDITED
CERT #4986.01

Report #:	28134-206391-14	**Customer PO#:**	1090		
Customer Name:	PFS TECO				
Customer Address:	11785 SE Highway 212 Ste 305				
City:	Clackamas	**State:**	OR	**Zip:**	97015
Contact:	Aaron Kravitz				
Service Address:	11785 SE Highway 212 Ste 305	Clackamas, OR 97015			

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
19-01135 | Thermocouple Meter | Tegam | SN: T-312250 | Cal: 08/01/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 2,450 °F | Report #: 25315-30977-3646

Instrument Data

Calibration Date:	February 28, 2023		**Reference:**	NAVAIR 17-20.ST-95	
Recommended Due Date:	February 28, 2024		**Cal-Cert Procedure:**	CP-013	
Calibration Frequency:	12 Months		**Indicating System:**	Digital	
Manufacturer:	National Instruments		**Temperature:**	72	°F
Type:	Data Logger		**Humidity:**	30%	RH
Model Number:	NI 9213		**Asset #:**	215 Booth 1	
Serial #:	1B182FB		**Service Location:**	Service Address	
Resolution:	0.1	°F	**As Found:**	Pass	
Capacity:	2500	°F	**As Left:**	Pass	
Tolerance:	± 2.0	°F			
Additional Error	± -	°F			

Type K Thermocouple
METER FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Tunnel	0.00	-0.20	-0.20	-0.20	-0.20	0.346
	500.00	499.80	499.80	499.80	-0.20	
	1000.00	1000.00	1000.00	1000.00	0.00	
	1500.00	1500.10	1500.10	1500.10	0.10	
	2000.00	2000.10	2000.10	2000.10	0.10	
	2400.00	2400.10	2400.10	2400.10	0.10	

Type K Thermocouple
METER FUNCTION

Channel	Calibration Standard	UUT As Found	UUT As Left Reading 1	UUT As Left Reading 2	As Left Error	Expanded Uncertainty±
Flue	0.00	-0.40	-0.40	-0.40	-0.40	0.346
	500.00	499.60	499.60	499.60	-0.40	
	1000.00	999.70	999.70	999.70	-0.30	
	1500.00	1499.90	1499.90	1499.90	-0.10	
	2000.00	1999.80	1999.80	1999.80	-0.20	
	2400.00	2400.00	2400.00	2400.00	0.00	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter A	0.00	-0.60	-0.60	-0.60	-0.60	0.346
	500.00	499.50	499.50	499.50	-0.50	
	1000.00	999.60	999.60	999.60	-0.40	
	1500.00	1499.70	1499.70	1499.70	-0.30	
	2000.00	1999.80	1999.80	1999.80	-0.20	
	2400.00	2399.80	2399.80	2399.80	-0.20	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Back	0.00	-0.70	-0.70	-0.70	-0.70	0.346
	500.00	499.50	499.50	499.50	-0.50	
	1000.00	999.50	999.50	999.50	-0.50	
	1500.00	1499.60	1499.60	1499.60	-0.40	
	2000.00	1999.70	1999.70	1999.70	-0.30	
	2400.00	2399.60	2399.60	2399.60	-0.40	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Catgalyst	0.00	-0.70	-0.70	-0.70	-0.70	0.346
	500.00	499.40	499.40	499.40	-0.60	
	1000.00	999.60	999.60	999.60	-0.40	
	1500.00	1499.60	1499.60	1499.60	-0.40	
	2000.00	1999.70	1999.70	1999.70	-0.30	
	2400.00	2399.70	2399.70	2399.70	-0.30	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter A	0.00	-1.30	-1.30	-1.30	-1.30	0.346
	500.00	498.80	498.80	498.80	-1.20	
	1000.00	999.10	999.10	999.10	-0.90	
	1500.00	1499.10	1499.10	1499.10	-0.90	
	2000.00	1999.10	1999.10	1999.10	-0.90	
	2400.00	2399.10	2399.10	2399.10	-0.90	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Left	0.00	-1.30	-1.30	-1.30	-1.30	0.346
	500.00	498.90	498.90	498.90	-1.10	
	1000.00	999.00	999.00	999.00	-1.00	
	1500.00	1499.20	1499.20	1499.20	-0.80	
	2000.00	1999.20	1999.20	1999.20	-0.80	
	2400.00	2399.20	2399.20	2399.20	-0.80	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Right	0.00	-1.40	-1.40	-1.40	-1.40	0.346
	500.00	498.90	498.90	498.90	-1.10	
	1000.00	999.00	999.00	999.00	-1.00	
	1500.00	1499.00	1499.00	1499.00	-1.00	
	2000.00	1999.00	1999.00	1999.00	-1.00	
	2400.00	2399.10	2399.10	2399.10	-0.90	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter B	0.00	0.00	0.00	0.00	0.00	0.346
	500.00	500.60	500.60	500.60	0.60	
	1000.00	1000.30	1000.30	1000.30	0.30	
	1500.00	1500.10	1500.10	1500.10	0.10	
	2000.00	1999.80	1999.80	1999.80	-0.20	
	2400.00	2399.50	2399.50	2399.50	-0.50	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Top	0.00	-1.40	-1.40	-1.40	-1.40	0.346
	500.00	498.90	498.90	498.90	-1.10	
	1000.00	999.00	999.00	999.00	-1.00	
	1500.00	1499.10	1499.10	1499.10	-0.90	
	2000.00	1999.00	1999.00	1999.00	-1.00	
	2400.00	2399.00	2399.00	2399.00	-1.00	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Bottom	0.00	-1.50	-1.50	-1.50	-1.50	0.346
	500.00	498.80	498.80	498.80	-1.20	
	1000.00	999.00	999.00	999.00	-1.00	
	1500.00	1499.00	1499.00	1499.00	-1.00	
	2000.00	1999.00	1999.00	1999.00	-1.00	
	2400.00	2399.00	2399.00	2399.00	-1.00	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter B	0.00	-1.30	-1.30	-1.30	-1.30	0.346
	500.00	499.00	499.00	499.00	-1.00	
	1000.00	999.00	999.00	999.00	-1.00	
	1500.00	1499.20	1499.20	1499.20	-0.80	
	2000.00	1999.20	1999.20	1999.20	-0.80	
	2400.00	2399.10	2399.10	2399.10	-0.90	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Meter C	0.00	-1.20	-1.20	-1.20	-1.20	0.346
	500.00	498.90	498.90	498.90	-1.10	
	1000.00	999.10	999.10	999.10	-0.90	
	1500.00	1499.20	1499.20	1499.20	-0.80	
	2000.00	1999.20	1999.20	1999.20	-0.80	
	2400.00	2399.20	2399.20	2399.20	-0.80	

	Type K Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Filter C	0.00	-1.20	-1.20	-1.20	-1.20	0.346
	500.00	499.10	499.10	499.10	-0.90	
	1000.00	999.20	999.20	999.20	-0.80	
	1500.00	1499.30	1499.30	1499.30	-0.70	
	2000.00	1999.30	1999.30	1999.30	-0.70	
	2400.00	2399.20	2399.20	2399.20	-0.80	

Manufacturer: National Instruments **Type:** Data Logger **Serial #:** 1B182FB

	Type T Thermocouple METER FUNCTION					
Channel	**Calibration Standard**	**UUT As Found**	**UUT As Left Reading 1**	**UUT As Left Reading 2**	**As Left Error**	**Expanded Uncertainty±**
Ambient	0.00	-1.40	-1.40	-1.40	-1.40	0.346
	20.00	18.80	18.80	18.80	-1.20	
	40.00	38.80	38.80	38.80	-1.20	
	60.00	58.70	58.70	58.70	-1.30	
	80.00	78.80	78.80	78.80	-1.20	
	100.00	98.70	98.70	98.70	-1.30	

Remarks:

15 Channels tested. Ambient is Type T, tested from 0 to 100 °F per customer request.

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated. All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** February 28, 2023

Technical Manager Marshall Doyle **Signature:** MDoyle

Report #: 28134-206391-14

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	28140-203320-14	**Customer PO#:** 1090	
Customer Name:	PFS TECO		
Customer Address:	11785 SE Highway 212 Ste 305		
City:	Clackamas	**State:** OR	**Zip:** 97015
Contact:	Aaron Kravitz		
Service Address:	11785 SE Highway 212 Ste 305	Clackamas, OR 97015	

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
LA-01776 | Pressure Transducer | Fluke | SN: 5956001 | Cal: 11/25/2022 | Due: 11/25/2023 | Range: 10 in H2O | Report #: EVL846346

Instrument Data

Calibration Date:	March 1, 2023	**Reference:**	ASME B40.100
Recommended Due Date:	March 1, 2024	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Red Lion	**Temperature:**	73 °F
Type:	Pressure Transducer	**Humidity:**	30% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	203C
Capacity:	5 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 5.00 **Range Resolution:** 0.01 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
5.00	5.00	5.00	0.00	5.00	0.00	0.05	0.008
3.75	3.75	3.75	0.00	3.75	0.00	0.05	0.007
2.50	2.50	2.50	0.00	2.50	0.00	0.05	0.006
1.25	1.25	1.25	0.00	1.25	0.00	0.05	0.005
0.50	0.50	0.50	0.00	0.50	0.00	0.05	0.005
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.005

Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

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Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** March 1, 2023

Technical Manager: Marshall Doyle **Signature:** 

Report #: 28140-203320-14

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free 800-356-4662

Address 5777 SE International Way Milwaukie, OR 97222

Local 503-654-9620

A2LA ACCREDITED CERT #4986.01

Report #:	28140-203319-14	**Customer PO#:** 1090	
Customer Name:	PFS TECO		
Customer Address:	11785 SE Highway 212 Ste 305		
City:	Clackamas	**State:** OR	**Zip:** 97015
Contact:	Aaron Kravitz		
Service Address:	11785 SE Highway 212 Ste 305	Clackamas, OR 97015	

Calibration Standards

19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 09/14/2022 | Due: 08/31/2023 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 25699-30694-3486
LA-01776 | Pressure Transducer | Fluke | SN: 5956001 | Cal: 11/25/2022 | Due: 11/25/2023 | Range: 10 in H2O | Report #: EVL846346

Instrument Data

Calibration Date:	March 1, 2023	**Reference:**	ASME B40.100
Recommended Due Date:	March 1, 2024	**Cal-Cert Procedure:**	CP-003
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Red Lion	**Temperature:**	69 °F
Type:	Pressure Transducer	**Humidity:**	35% RH
Model Number:	Unknown	**Cal Factor:**	None
Serial #:	Unknown	**Asset #:**	203B
Capacity:	1 In H2O	**Service Location:**	Service Address
Tolerance:	± 1.00% of Span	**As Found:**	Pass
Gauge Class:	A	**As Left:**	Pass

Instrument Range: 1.00 **Range Resolution:** 0.001 **Mode Verified:** Pressure

UUT Reading In H2O	Standard As Found In H2O	Standard Verification Reading #1 In H2O	Error In H2O	Standard Verification Reading #2 In H2O	Error In H2O	Tolerance In H2O	Expanded Uncertainty ± In H2O
0.000	0.000	0.000	0.00	0.000	0.00	0.01	0.0005
0.100	0.100	0.100	0.00	0.100	0.00	0.01	0.0005
0.250	0.250	0.250	0.00	0.250	0.00	0.01	0.0006
0.500	0.500	0.500	0.00	0.500	0.00	0.01	0.0008
0.750	0.750	0.750	0.00	0.750	0.00	0.01	0.001
1.000	1.000	1.000	0.00	1.000	0.00	0.01	0.0012
0.750	0.750	0.750	0.00	0.750	0.00	0.01	0.001
0.500	0.500	0.500	0.00	0.500	0.00	0.01	0.0008
0.250	0.250	0.250	0.00	0.250	0.00	0.01	0.0006
0.100	0.100	0.100	0.00	0.100	0.00	0.01	0.0005
0.000	0.000	0.000	0.00	0.000	0.00	0.01	0.0005

Manufacturer: Red Lion **Type:** Pressure Transducer **Serial #:** Unknown

Remarks:

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

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Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** March 1, 2023

Technical Manager: Marshall Doyle **Signature:** 

Report #: 28140-203319-14

Certificate of Calibration

Certificate Number: 743892

JJ Calibrations, Inc.
7724 SE Aspen Summit Drive
Portland, OR 97266-9217
Phone 503.786.3005
FAX 503.786.2994

PFS TECO
11785 SE Hwy 212
Suite 305
Clackamas, OR 97015

ACCREDITED
0723.01
Calibration

PO: 1033
Order Date: 03/08/2021
Authorized By: N/A

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

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

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

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

Standards Used

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

Measurement Data

Parameter / Measurement Description	Range	Unit	Reference	Min	Max	*Error	UUT	Uncertainty
Before/After								Accredited = ü
Mass								
Raw Data		g	4535.92370000	0.0000000	0.0000000	0.1785299	4536.1022299 g	3.5E-01 ü

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to either the SI or to National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2017, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless stated in the comments, certificates reflect the "Simple Acceptance Rule" as specified by JCGM 106:2012. Unless otherwise stated, a test accuracy ratio (TAR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without written approval of JJ Calibrations.

Reviewer

3 Issued 03/25/2021 Rev # 15

Inspector

DICK MUNNS COMPANY
LIQUID & GAS FLOW CALIBRATION

ISO 17025:2017
ACCREDITED LABORATORY
Cert# CL-122

IAS ACCREDITED Calibration Laboratory

CERTIFICATE OF CALIBRATION

CUSTOMER:	**PFS-TECO :** CLACKAMAS, OR	**CALIBRATION DATE:**	05/23/2023
PO NUMBER:	1097	**CALIBRATION DUE:**	05/23/2024
INST. MANUFACTURER:	DWYER	**PROCEDURE:**	T.O.33K6-4-1769-1
INST. DESCRIPTION:	VELOMETER	**CALIBRATION FLUID:**	AIR @ 14.7 PSIA 70°F
MODEL NUMBER:	471	**RECEIVED CONDITION:**	WITHIN MFG. SPECS.
SERIAL NUMBER:	CP288559 ID# 095	**LEFT CONDITION:**	WITHIN MFG. SPECS.
RATED ACCURACY:	SEE NOTES BELOW.	**AMBIENT CONDITIONS:**	763mm HGA 53% RH 71°F
UNCERTAINTY GIVEN:	± 0.43% RD ; k=2	**CERTIFICATE FILE #:**	490265.2023

NOTES: ± 3.0% FS (0-500 / 0-1500) ** ± 4.0% F.S. (0-5000) **± 5.0% F.S. (0-15000) ** ± 2 °F

Q.MANUAL IM 2.0 REV 2020.2 DATED 7-27-2020

DECISION RULE: SIMPLE ACCEPTANCE. MEASUREMENT UNCERTAINTIES NOT TAKEN INTO CONSIDERATION WHEN DETERMINING PASS/FAIL

UUT INDICATED FT/MIN	DM.STD. ACTUAL FT/MIN	UUT INDICATED DEG. F	DM STD. ACTUAL DEG. F
74	77	0 TO 200°F	0 TO 200°F
118	121	45.0	44.5
253	259	73.9	73.2
491	502	100.3	99.8
515	525		
1028	1049		
1492	1526		
502	514		
3145	3224		
4993	5135		
6892	7061		
14821	15229		

STANDARDS USED:		
A310: TEMP. STANDARD | ± 0.024 F | TRACE# 1649766843	DUE	02/09/2024
A800: FLOW-DYNE SONIC NOZZLE SYSTEM | 0 – 1086 CFM ± 0.46% RD. | TRACE# 144613547, 1424683640, 1583314714	DUE	12/10/2023

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

Issuing Date: 5-23-2023

Approved By:

Cal. Technician: DC

Calibrated at: ✓ Lab
___ On-Site (Customer's)

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS

2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293

(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

A2LA ACCREDITED
CERTIFICATE #1550.01

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

Report Number: DIRI01C101887027221214

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	12/14/22	1/27/22	12/2023

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 400 Tol: 0.10	Test Wt: HB44 Tol: HB44	Test Wt: 200 Tol: 0.04	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 16.7°C
As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	1000.84	1000.02	0.012
600	600.32	600.00	0.011
400	400.10	400.00	0.011
200	200.00	199.98	0.011
100	100.00	99.98	0.011
50	50.00	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	7/18/22	7/2024	20221688

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

12/14 As-Found Failed Linearity. Performed 3 point Linearity adjustment. As-Left Passed Linearity. Adjusted span.

Report prepared/reviewed by: JC **Date:** 12/14/22 **Technician:** J. Colacchio **Signature:**

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

Established 1974

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(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
CERTIFICATE #1550.01

Report of Calibration

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

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

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

Manufacturer: Troemner
Customer ID: Listed in Table

Material	Assumed Density	Range	Tolerance Class
Stainless Steel	7.95 g/cm^3	200 mg & 100 mg	ASTM Class 1

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

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

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

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

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

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

Date: 05/09/22

Signature David S. Thompson

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
CERTIFICATE #1550.01

Report of Calibration

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

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

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

Manufacturer: Troemner
Customer ID: Listed in Table

Laboratory Environment at time of test

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

Conventional Mass Value

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

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

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

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

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

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

Date: 05/09/22

Signature David S. Thompson

Report and Certificate of Calibration

CAL-CERT
CALIBRATION CERTIFICATION

www.Cal-Cert.com

Toll Free
800-356-4662

Address
5777 SE International Way
Milwaukie, OR 97222

Local
503-654-9620

ACCREDITED
CERT #4986.01

Report #:	31538-218157-14	**Customer PO#:**	
Customer Name:	PFS TECO		
Customer Address:	11785 SE Highway 212, Suite 305		
City:	Clackamas	**State:** OR	**Zip:** 97015
Contact:	Aaron Kravitz		
Service Address:	11785 SE Highway 212, Suite 305	Clackamas, OR 97015	

Calibration Standards

10-00209 | Weight | Rice Lake | SN: 43334 | Cal: 02/02/2022 | Due: 02/28/2024 | Vendor: Oregon Dept of Ag | Report #: 20220092
19-00269 | Thermo-Hygrometer | Comark | SN: 6237360167 | Cal: 08/14/2023 | Due: 08/31/2024 | Vendor: Cal-Cert | Range: 122 °F 95 %RH | Report #: 30530-30694-3646

Instrument Data

Calibration Date:	October 12, 2023	**Reference:**	ASTM E898-20, D4753-15
Calibration Due Date:	April 12, 2024	**Cal-Cert Procedure:**	CP-002
Calibration Frequency:	6 Months	**Indicating System:**	Digital
Manufacturer:	Sartorius	**Temperature:**	73 °F
Model Number:	ENTRIS224	**Humidity:**	52% RH
Type:	Digital Balance	**Asset #:**	107
Serial #:	34307497	**Service Location:**	Service Address
Scale Capacity:	200 grams	**As Found:**	PASS
		As Left:	PASS

Scale Linear Test

Instrument Range: 200.0000 grams **Resolution:** 0.0001 grams

Calibration Standard grams	As Found UUT grams	As Found Error grams	As Left UUT grams	As Left Error grams	As Left % of Error	Tolerance (As Left) Allowable Error		
						Error	Condition	Expanded Unc. (grams)
0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.0000	PASS	0.00000
20.0000	19.9998	-0.0002	19.9998	-0.0002	0.00	0.0200	PASS	0.00463
40.0000	39.9997	-0.0003	40.0000	0.0000	0.00	0.0400	PASS	0.00924
60.0000	59.9996	-0.0004	60.0001	0.0001	0.00	0.0600	PASS	0.01386
80.0000	79.9995	-0.0005	80.0001	0.0001	0.00	0.0800	PASS	0.01848
100.0000	99.9994	-0.0006	99.9999	-0.0001	0.00	0.1000	PASS	0.02310
120.0000	119.9993	-0.0007	119.9999	-0.0001	0.00	0.1200	PASS	0.02771
140.0000	139.9991	-0.0009	140.0000	0.0000	0.00	0.1400	PASS	0.03233
160.0000	159.9990	-0.0010	160.0001	0.0001	0.00	0.1600	PASS	0.03695
180.0000	179.9990	-0.0010	180.0000	0.0000	0.00	0.1800	PASS	0.03926
200.0000	199.9989	-0.0011	200.0000	0.0000	0.00	0.2000	PASS	0.04619
100.0000	99.9994	-0.0006	99.9999	-0.0001	0.00	0.1000	PASS	0.02310
0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0.0000	PASS	0.00000

Manufacturer: Sartorius **Type:** Digital Balance **Serial #:** 34307497

FUNCTIONAL CHECKS					
ECCENTRIC LOAD TEST:		**HYSTERESIS: Load Increments**		**REPEATABILITY:**	
Loading position	100.0000	Test Weight Applied. % of load	Readings	Test Weight Applied	100.0000
Right	99.9999	0%	0.0000	1st	99.9999
Left	99.9998	(R1) 50%	99.9999	2nd	100.0000
Front	99.9998	100%	200.0000	3rd	99.9999
Back	99.9999	(R2)50%	99.9999	4th	100.0000
Center	99.9999	0%	0.0000	5th	100.0000
As Left	PASS	As Left	PASS	As Left	PASS
Tolerance: The maximum error of the eccentric loading must be less than .1% of center load value.		Tolerance: The Difference of R1 and R2 must be within 0.1%		Tolerance: Deviation of lowest and highest reading within 0.1%	

Remarks:

The scale was adjusted prior to taking the As Left readings.

We sincerely thank you for your business. Please call us at 503-654-9620 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.01.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated. All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: Jon Rau **Date:** October 12, 2023

Technical Manager: Marshall Doyle **Signature:** 

REPORT#: 31538-218157-14

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
11711 S. Alameda Street
Los Angeles, CA 90059
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E04NI61E15A0574	Reference Number:	48-402546580-1
Cylinder Number:	CC121798	Cylinder Volume:	143.7 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2016 PSIG
PGVP Number:	B32022	Valve Outlet:	590
Gas Code:	CO,CO2,O2,BALN	Certification Date:	Sep 23, 2022

Expiration Date: Sep 23, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	4.250 %	4.306 %	G1	+/- 0.6% NIST Traceable	09/23/2022
CARBON DIOXIDE	17.00 %	17.01 %	G1	+/- 0.6% NIST Traceable	09/23/2022
OXYGEN	17.00 %	17.11 %	G1	+/- 0.7% NIST Traceable	09/23/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061520	CC354777	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024
NTRM	98051002	SG9150866BAL	12.05 % OXYGEN/NITROGEN	+/- 0.7%	Dec 14, 2023
NTRM	08061402	CC267714	1.959 %W CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jul 02, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Sep 16, 2022
SIEMENS 6E CO HIGH	NDIR	Sep 06, 2022
SIEMENS OXYMAT 6	PARAMAGNETIC	Sep 12, 2022

Triad Data Available Upon Request

Approved for Release

PRAXAIR
Making our planet more productive

DocNumber: 271687

Praxair Distribution, Inc.
5700 S. Alameda Street
Los Angeles CA 90058
Tel: 323-585-2154
Fax: 714-542-6689
PGVP ID: F22019

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

ProSpec EZ Cert

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	

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	10/16/2019
Z:	0	R:	14	C:	10.09	Conc:	10.09
R:	14	Z:	0	C:	10.1	Conc:	10.1
Z:	0	C:	10.1	R:	14.01	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	C:	0	R:	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	10/16/2019
Z:	0	R:	5	C:	2.53	Conc:	2.53
R:	5	Z:	0	C:	2.53	Conc:	2.53
Z:	0	C:	2.54	R:	5.01	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	C:	0	R:	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	10/16/2019
Z:	0	R:	9.88	C:	10.49	Conc:	10.48
R:	9.88	Z:	0	C:	10.49	Conc:	10.48
Z:	0	C:	10.5	R:	9.89	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	C:	0	R:	0	Conc:	0
UOM:	%				Mean Test Assay:		%

Analyzed By: Jose Vasquez

Certified By: Jenna Lockman

Report and Certificate of Calibration

CAL-CERT CALIBRATION CERTIFICATION
"Measure the Difference"

www.Cal-Cert.com

Toll Free 888-700-4100
Address 120 S. Chaparral Ct Suite 110 Anaheim Hills, CA 92808
Local 714-696-5300

A2LA ACCREDITED CERT #4986.02

Report #: 31678-218361-1546 **Customer PO#:** 1102
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212, Suite 305
City: Clackamas **State:** OR **Zip:** 97015
Contact: Ethan Frederick
Service Address: 120 S. Chaparral Court, Suite 110 Anaheim Hills, CA 92808

Calibration Standards

ACS374 | Thermo-Hygrometer | Vaisala | SN: D0140002 | Cal: 03/09/2023 | Due: 03/31/2024 | Vendor: Vaisala | Range: 356 °F | Report #: 230309-HMP77B-D0140002

Instrument Data

Calibration Date:	October 27, 2023	**Reference:**	ASTM E-104
Recommended Due Date:	October 27, 2024	**Cal-Cert Procedure:**	CP-012 / CP-031
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	Traceable	**Temperature:**	70 °F
Type:	Temperature & Humidity	**Humidity:**	50% RH
Model Number:	653718004-13	**Asset #:**	201
Serial #:	210735280	**Service Location:**	Cal-Cert Lab
Temperature Capacity:	158 °F	**As Found:**	PASS
Temperature Resolution:	0.1 °F	**As Left:**	PASS
RH Capacity:	95 %RH		
RH Resolution:	0.1 %RH		

TEMPERATURE READINGS

Tolerance: ± 0.7 °F

CALIBRATION STANDARD °F	UUT AS FOUND °F	UUT VERIFICATION READING #1 °F	UUT VERIFICATION READING #2 °F
70.31	70.9	70.9	70.9
Expanded Uncertainty ± 0.18 °F			

HUMIDITY READINGS

Tolerance: ± 3 %RH

CALIBRATION STANDARD %RH	UUT AS FOUND %RH	UUT VERIFICATION READING #1 %RH	UUT VERIFICATION READING #2 %RH
50.51	51.7	51.7	51.7
Expanded Uncertainty ± 1.9 %RH			

Manufacturer: Traceable **Type:** Temperature & Humidity **Serial #:** 210735280

Remarks:

We sincerely thank you for your business. Please call us at 714-696-5300 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by A2LA under Calibration Laboratory Code #4986.02.
A2LA is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.1, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer: John Story **Date:** October 27, 2023

Technical Manager: Marshall Doyle **Signature:** 

Report #: 31678-218361-1546

DICK MUNNS COMPANY
LIQUID & GAS FLOW CALIBRATION

ISO 17025:2017
ACCREDITED LABORATORY
Cert# CL-122

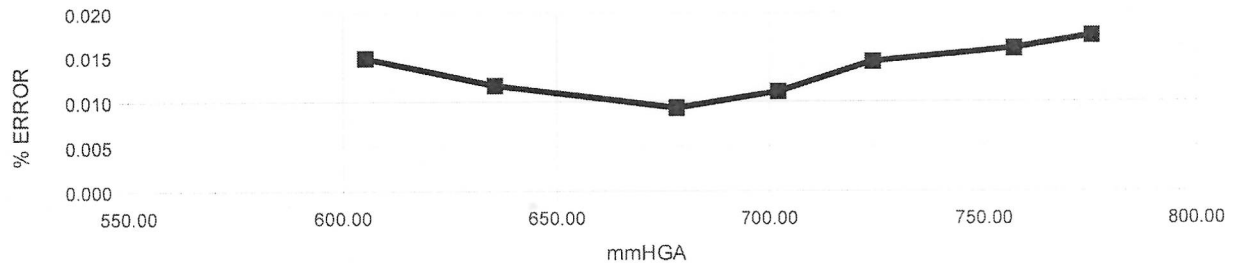
IAS ACCREDITED
Calibration Laboratory

CERTIFICATE OF CALIBRATION

CUSTOMER:	PFS-TECO; CLACKAMAS, OR	**CALIBRATION DATE:**	05/23/2023
PO NUMBER:	1096	**CALIBRATION DUE:**	05/23/2024
INST. MANUFACTURER:	AQUATECH SCIENTIFIC INSTRUMENTS	**PROCEDURE:**	NAVAIR-17-20MP-03
INST. DESCRIPTION:	DIGITAL BAROMETER	**CALIBRATION FLUID:**	AIR @ 70F
MODEL NUMBER:	DBX2	**STANDARD(S) USED:**	A321, A22 DUE 3-2024
SERIAL NUMBER:	118222	**NIST TRACE #' S:**	1236086968,1583142077
RATED ACCURACY:	+/- .18 mmHGA	**AMBIENT CONDITIONS:**	757 mmHGA, 60% RH, 68F
UNCERTAINTY GIVEN:	+/- ..03mmHGA.;k=2	**CERTIFICATE FILE #:**	533813

NOTES: AS REC./AS LEFT WITHIN SPECS. ** DECISION RULE: PFA NOT USED TO DETERMINE CONFORMITY **

TEST POINT NUMBER	UUT INDICATED mmHGA	DM.STD. ACTUAL mmHGA	% RD. ERROR
1	605.24	605.330	0.015
2	635.45	635.525	0.012
3	678.24	678.303	0.009
4	702.18	702.258	0.011
5	724.19	724.295	0.014
6	757.11	757.231	0.016
7	775.39	775.525	0.017



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

Issuing Date: 5-23-2023

Approved By:

Cal. Technician:

Calibrated at: ✓ Lab
___ On-Site (Customer's)