
Innovative Hearth Products, LLC

Project # 18-452

Model: GV300GL

AKA: ML300GL

Type: Residential Non-catalytic Wood
Fired Heater

February 1, 2019

Revised December 20, 2023

EPA Test Method 28R for Certification and Auditing of Wood Heaters

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Revision Summary

2/1/2019– Original Issue

12/20/2023 – The following changes were made to the report to conform with EPA requirements for 5 year renewal:

- Added a comment in the Notes section, page 4, that conditioning was performed at a medium burn setting.
- Added commentary to the Run Narrative section addressing negative filter weights and reported the “adjusted” emissions rate when negative weights are treated as zero, see page 11.
- Train precision data as percentage added to test narrative section, see page 12
- Note added regarding usable and overall firebox volumes, see page 14
- Firebox volume drawing added, see page 15

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Affidavit

PFS-TECO was contracted by Innovative Hearth Products, LLC (IHP) to provide testing services for the GV300GL Non-Catalytic Wood-Fired Room Heater per EPA Method 28R, *Certification and Auditing of Wood Heaters*. All testing and associated procedures were conducted at PFS-TECO's Portland Laboratory beginning on 1/7/2019 and ending on 1/11/2019. PFS-TECO's Portland Laboratory is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed EPA Method 28R and ASTM E2780, *Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters*. 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, By A2LA to ISO 17025:2005 "Requirements for Testing Laboratories", and 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.

A handwritten signature in black ink, appearing to read "Sebastian Button", is written over a horizontal line.

Sebastian Button, Laboratory Supervisor

Introduction

Innovative Hearth Products of Auburn, WA, contracted with PFS-TECO to perform EPA certification testing on GV300GL Non-Catalytic Wood-Fired Room Heater. All testing was performed at PFS-TECO's Portland Laboratory. Testing was performed by Mr. Sebastian Button.

Notes

- Prior to start of testing, 50 hours of conditioning was performed at a medium burn setting per ASTM E2780.
- Prior to start of testing, the dilution tunnel was cleaned with a steel brush.
- Front filters were changed on sample train A at one hour for all 7 test runs.
- A total of 7 test runs were performed in accordance with EPA Method 28R, 1 at the maximum burn rate category, 1 at the medium high burn rate category, 4 at the medium low burn rate category, three of which was meets the 1.00 kg/hr or less requirement for stoves operating at minimum air setting, and 1 fan confirmation test, see Run Narrative section for further detail on each run.

Wood Heater Identification and Testing

- Appliance Tested: **GV300GL**
- Serial Number: **Un-serialized Prototype – PFS Tracking Number 0018**
- Manufacturer: **Innovative Hearth Products, LLC**
- Catalyst: **No**
- Heat exchange blower: **Optional**
- Type: **Wood Stove**
- Style: **Free Standing**
- Date Received: **Monday, January 07, 2019**
- Wood Heater Aging: **August 1, 2018 – December 12, 2018**
- Testing Period – Start: **Monday, January 07, 2019** Finish: **Friday, January 11, 2019**
- Test Location: **PFS-TECO Portland Laboratory, 11785 SE HWY 212 - Suite 305, Clackamas, OR 97015**
- Elevation: **≈131 Feet above sea level**
- Test Technician(s): **Sebastian Button**
- Observers: **Bob Wayman of IHP**

Test Procedures and Equipment

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

Equipment List:

Equipment ID#	Equipment Description
040	Delmhorst J-2000 Wood Moisture Meter
041	Rice Lake 3'x3' floor scale w/digital weight indicator
050	Digiweigh DWP12i Platform Scale
053	APEX XC-60 Digital Emissions Sampling Box A
054	APEX XC-60 Digital Emissions Sampling Box B
055	APEX Ambient sampling box
057	California Analytical ZRE CO2/CO/O2 IR ANALYZER
109A/B	Troemner 100mg/200mg Audit Weights
107	Sartorius Analytical Balance
051	10 lb audit weight
064	Digital Barometer
090	Dewalt Tape Measure
092	Digital Calipers
095	Anemometer
111	Microtector
CC144992	Gas Analyzer Calibration Span Gas
CC332147	Gas Analyzer Calibration Mid Gas

Results

A total of 7 test runs were performed on the GV300GL. Run #1 was excluded from the weighted average on a 2-for-1 basis (see Runs 3 & 5). Run #2 failed average surface temperature delta requirements, and Run #6, a fan confirmation test, were not used in any weighted average results calculations. The weighted average emissions rate for the 4 run test series was measured to be **1.8 g/hr** with a Higher Heating Value efficiency of **74.1%**. The average CO emission rate for the 4 tests was **2.5 g/min.** The IHP GV300GL Non-Catalytic Wood-Fired Room Heater meets the 2020 crib wood 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

	Cat. 2 ≤ 1.00 kg/hr. ¹	Cat. 2 ≤ 1.00 kg/hr. ²	Cat. 2 ≤ 1.00 kg/hr.	Cat. 2 0.80 - 1.25 kg/hr.	Cat. 3 1.25 - 1.90 kg/hr.	Cat. 4 Max Burn Rate	Fan Confirmation (Cat. 2) ³
Date	1/7/2019	1/8/2019	1/9/2019	1/10/2019	1/10/2019	1/11/2019	1/11/2019
Run Number	1	2	3	5	4	6	7
Emission Rate (g/hr).	5.73	1.26	1.40	1.21	2.24	4.39	0.65
Burn Rate (kg/hr)	0.95	0.86	0.99	1.08	1.86	3.10	1.25
Heat Output (Btu/hr)	13,040	12,065	13,693	14,835	25,364	39,232	17,270
Overall Efficiency (% HHV)	74.3	75.5	75.3	74.6	73.7	68.6	74.9
CO Emissions (g/MJ Output)	7.9	6.4	6.7	7.3	5.8	5.5	4.2
CO Emissions (g/kg Dry Fuel)	116.8	96.4	99.7	107.9	84.5	74.4	62.0
CO Emissions (g/min)	1.82	1.4	1.6	1.9	2.6	3.8	1.3
ASTM E2515 Emissions – First Hour (g/hr)	35.5	8.2	7.4	6.1	6.8	8.5	2.2
Weighted particulate emission average of 4 test runs: 1.8 grams per hour.							
Weighted average HHV efficiency of 4 test runs: 74.1%.							

¹Test not included in weighted average calculation on 2-for-1 basis, runs 3 and 5 are also category 2 burn rates.

²Test not included in weighed average, delta T exceeded 126°F (151°F).

³Fan Confirmation test not included in weighted average calculations.

Weighted Average Calculation Summary

28R Weighted Average.xlsm

EPA Method 28R Weighted Average Emissions

Client: IHP
 Stove Model: GV300GL
 Test Dates: 1/7/19 - 1/11/19
 Job Number: 18-452

Signature/Date:



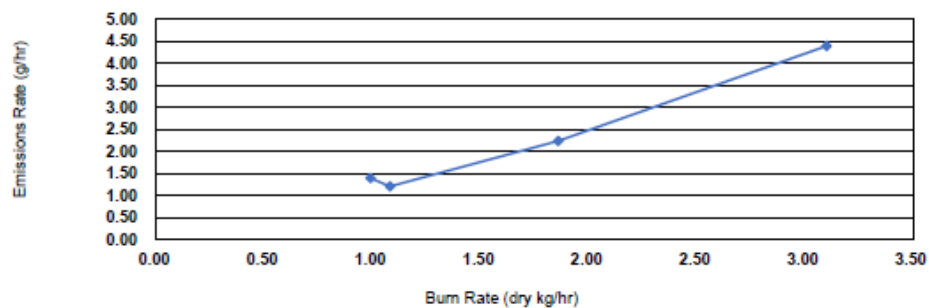
1/15/2019

Weighted Average Particulate Emissions (g/hr):	1.84
Weighted Average HHV Efficiency (%):	74.1%
Weighted Average LHV Efficiency (%):	80.0%
Average CO Emissions (g/min):	2.5

Individual Run Summaries

Run Number:	3	Run Number:	5
Burn Rate (dry kg/hr):	0.99	Burn Rate (dry kg/hr):	1.08
Emissions Rate (g/hr):	1.40	Emissions Rate (g/hr):	1.21
HHV Efficiency (%):	75.3%	HHV Efficiency (%):	74.6%
LHV Efficiency (%):	81.4%	LHV Efficiency (%):	80.6%
Weighting Percentage (%):	27.15%	Weighting Percentage (%):	31.86%
Run Number:	4	Run Number:	6
Burn Rate (dry kg/hr):	1.86	Burn Rate (dry kg/hr):	3.10
Emissions Rate (g/hr):	2.24	Emissions Rate (g/hr):	4.39
HHV Efficiency (%):	73.7%	HHV Efficiency (%):	68.6%
LHV Efficiency (%):	79.7%	LHV Efficiency (%):	74.1%
Weighting Percentage (%):	33.85%	Weighting Percentage (%):	7.14%

Emission Rate vs Burn Rate Plot



Test Run Narrative

Run 1

Run 1 was performed on 1/7/2019 as a category 2 test, per EPA Method 28R. The total test time was 470 minutes. The particulate emissions rate for the test was 5.73 g/hr, the burn rate was 0.95 kg/hr with an HHV efficiency of 74.3%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

This test was excluded from the weighted average calculation on accordance with ASTM E2780 Section 9.5.13, "If more than one test run is conducted at a specified burn rate, the results from at least two thirds of the test runs in that burn rate category shall be used in calculating the weighted average emissions rate." Test runs 3 and 5 were used in calculating the weighted average in lieu of this test run.

Run 2

Run 2 was performed on 1/8/2019 as a category 2 test, per EPA Method 28R. The total test time was 570 minutes. The particulate emissions rate for the test was 1.26 g/hr, the burn rate was 0.86 kg/hr with an HHV efficiency of 75.5%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. Per ASTM E2780 Section 9.5.10, the average of the wood heater surface temperatures at the end of the test shall agree with the average surface temperature at the start of the test run within 126°F, or the test is invalid. The difference in surface temperature between the beginning and end of this test was 151°F, therefore this test is invalid and is not included in the weighted average calculations.

Run 3

Run 3 was performed on 1/9/2019 as a category 2 test, per EPA Method 28R. The total test time was 490 minutes. The particulate emissions rate for the test was 1.40 g/hr, the burn rate was 0.99 kg/hr with an HHV efficiency of 75.3%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

This test meets the burn rate requirements described in EPA Method 28 Section 8.1.1.3.2 as a category 2 test with a burn rate of 1.00 kg/hr or less for wood stoves that cannot be operated at burn rates less than 0.8 kg/hr. This test was performed with the air control set to its lowest setting, it is not possible to operate the stove at a lower air setting. Therefore, this test will be used in lieu of a category 1 test.

Run 4

Run 4 was performed on 1/10/2019 as a category 3 test, per EPA Method 28R. The total test time was 260 minutes. The particulate emissions rate for the test was 2.24 g/hr, the burn rate was 1.86 kg/hr with an HHV efficiency of 73.7%. The Train A front

filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. A negative filter weight was observed on train A's rear filter, which is the result of low filter catch and transfer of filter material to the O-rings. This mass was not adjusted to zero as the mass is accounted for on the O-ring weights. Adjusting negative filter weights to zero results in an emissions rate of 2.25 g/hr. There were no anomalies and all test criteria were met.

Run 5

Run 5 was performed on 1/10/2019 as a category 2 test, per EPA Method 28R. The total test time was 450 minutes. The particulate emissions rate for the test was 1.21 g/hr, the burn rate was 1.08 kg/hr with an HHV efficiency of 74.6%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 6

Run 6 was performed on 1/11/2019 as a category 4 test, per EPA Method 28R. The total test time was 160 minutes. The particulate emissions rate for the test was 4.39 g/hr, the burn rate was 3.10 kg/hr with an HHV efficiency of 68.6%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. A negative filter weight was observed on train A's rear filter, which is the result of low filter catch and transfer of filter material to the O-rings. This mass was not adjusted to zero as the mass is accounted for on the O-ring weights. Adjusting negative filter weights to zero results in an emissions rate of 4.42 g/hr. There were no anomalies and all test criteria were met.

Run 7

Run 7 was performed on 1/11/2019 as a category 2 fan confirmation test, per EPA Method 28R. The total test time was 380 minutes. The particulate emissions rate for the test was 0.65 g/hr with a burn rate of 1.25 kg/hr. All test results were appropriate and valid. There were no anomalies and all test criteria were met. Since the particulate emissions rate is within 1.0 g/hr of another category 2 test (run 5, 1.08 g/hr) the blower is determined not to have a significant impact on emissions performance and may therefore be approved as an optional accessory. This test run is not included in the weighted average calculations presented in the results summary.

Dual Train Precision – Percent Difference from Average Total Particulate Emissions – All Runs

Run	Train A	Train B
1	6.7%	6.7%
2	2.0%	2.0%
3	5.4%	5.4%
4	4.8%	4.8%
5	5.1%	5.1%
6	1.8%	1.8%
7	7.4%	7.4%

Test Conditions Summary

Testing conditions for all runs fell within allowable specifications of ASTM E2780 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	68	66	37.7	42.9	30.02	16.7	19.6	21.5	470
2	69	67	27.8	32.9	29.69	16.9	21.6	21.4	570
3	71	70	26.0	27.6	29.69	15.1	21.1	21.2	490
4	72	73	36.6	28.3	29.97	16.4	21.3	21.8	260
5	75	69	28.3	24.9	29.89	15.7	21.5	22.8	450
6	74	71	19.7	23.9	29.80	15.3	21.1	23.3	380

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 Air Setting	Test Run Air and Fan Settings
Run 1	Adjustable Primary Air Control (PAC) fully closed.	Adjustable PAC fully closed, fan turned on to low setting 30 minutes after loading, per manufacturer's instructions
Run 2	Adjustable PAC fully closed.	Adjustable PAC fully closed, fan turned on to low setting 30 minutes after loading, per manufacturer's instructions
Run 3	Adjustable PAC fully closed.	Adjustable PAC fully closed, fan turned on to low setting 25 minutes after loading, per manufacturer's instructions
Run 4	Adjustable PAC open 0.75" from bottom of channel to bottom of control rod	Adjustable PAC open 0.75", fan turned on to high setting 5 minutes after loading, per manufacturer's instructions.
Run 5	Adjustable PAC open 0.0625" from bottom of channel to bottom of control rod	Adjustable PAC open 0.0625", fan turned on to low setting 15 minutes after loading, per manufacturer's instructions.
Run 6	Adjustable PAC fully open.	Adjustable PAC fully open, fan turned on to high setting immediately after loading, per manufacturer's instructions
Run 7	Adjustable PAC fully closed	Adjustable PAC fully closed, fan off for duration of test, fan confirmation test.

Appliance Description

Model(s): GV300GL

Additional Models Discussion: In addition to the GV300GL, the manufacturer also offers the model ML300GL, which is identical in firebox construction and air intake/control. The difference between the two models is that the GV300GL is a free-standing appliance, while the ML300GL is designed to be a fireplace insert. The difference between the two models is not expected to cause the appliance to exceed the required emissions limit.

Appliance Type: Non-Catalytic Wood-Fired Room Heater

Firebox Volume: 2.92 ft³. Overall and usable firebox volumes are identical for this heater.

Air Introduction System: Primary Air enters the firebox from the rear bottom of the appliance and is channeled up the sides on the appliance and down through the air wash. Primary air is controlled via a damper arm located on the side of the stove, which moves up (open) to down (closed). In addition to the primary air the stove utilizes a startup air system in which, upon opening of the door, a bypass flapper allows additional air into the primary air stream adjacent to the control damper, a mechanical timer slowly closes the bypass damper over a period of approximately 25 minutes. Secondary air is pulled through a fixed opening in the rear bottom of the appliance and channeled up through 4 secondary air tubes. Dimensions on all these features can be found in Appendix D.

Baffles: A pair of mating 8.73" x 17.87" x 0.50" C-Cast baffle boards mate together to form a baffle which rests on top of the secondary air tubes.

Refractory Insulation: The firebox is lined with 1" thick firebrick.

Flue Outlet: 6-inch exhaust outlet located on the top of the appliance.

Catalytic Combustor: N/A

Fan: The appliance is optionally offered with a convection fan that attached to the rear of the appliance.

Gasketing: 7/8" fiberglass rope gasket seals the door against the firebox, 1" x 1/8" "u" channel gasket is used to seal the 5mm ceramic glass against the door frame.

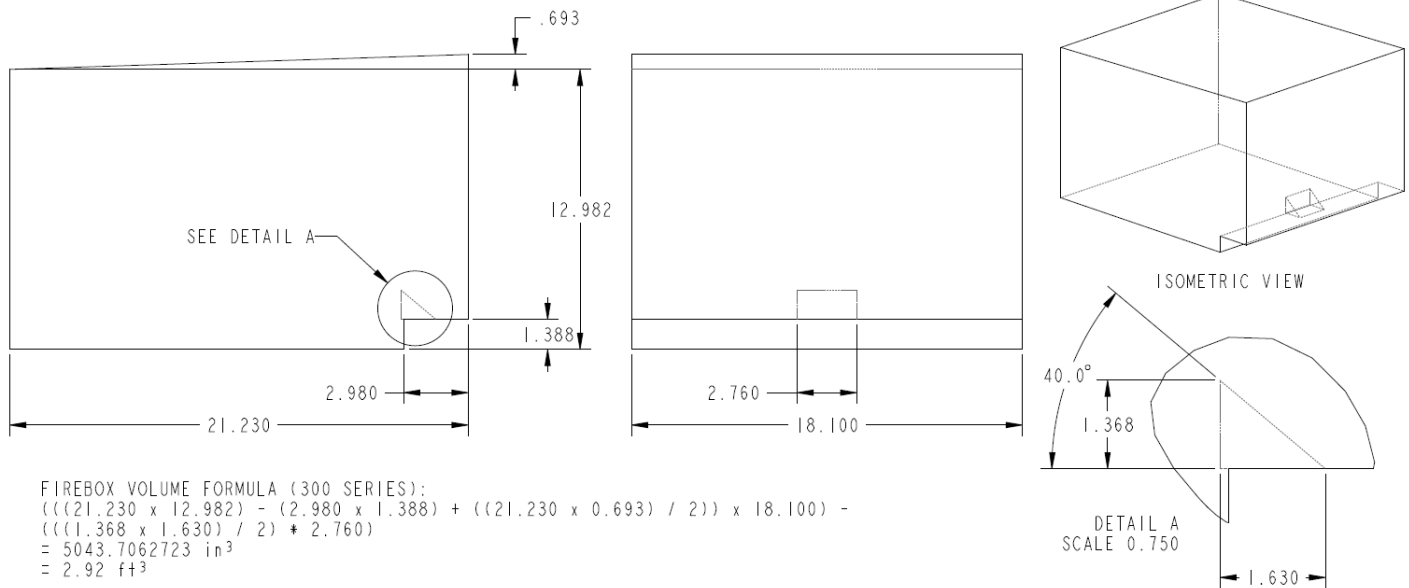
Appliance Dimensions

GV300GL Unit Dimensions

Height	Width	Depth	Firebox Volume	Weight
36.125"	26.5"	27.375"	2.92 ft ³	445 lbs

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

Firebox Volume



Appliance Front



Appliance Left



Appliance Right



Appliance Rear



Test Fuel Properties

Test fuel used was dimensional Doug fir lumber, air-dried to the specified moisture content range. Typical fuel loads are pictured below:

Typical Test Fuel Load Configuration



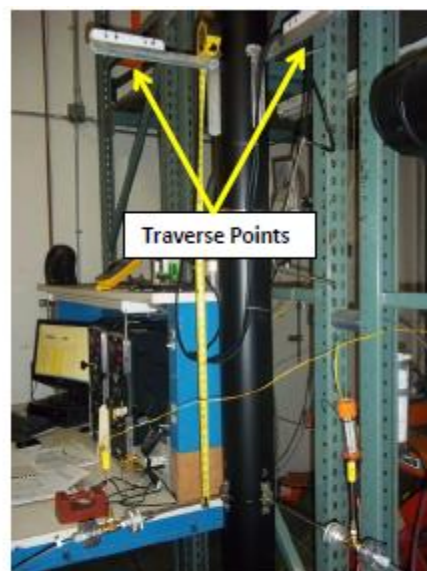
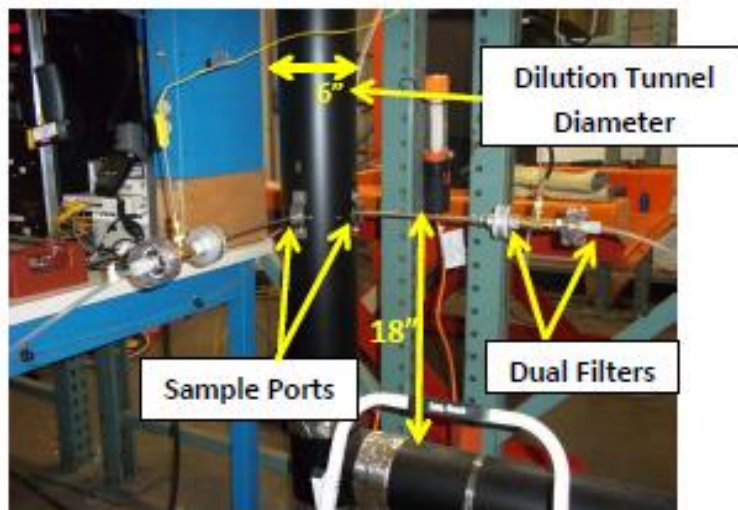
Typical Test Fuel Loaded in Test Stove



Sampling Locations and Descriptions

Sample ports are located 16.5 feet downstream from any disturbances and 1 foot upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 5.5 feet upstream from any disturbances. (See below).

Sample Points



Sampling Methods

ASTM E2515 was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per ASTM E2515 were followed. No alternate procedures were used, and no sampling intervals fell outside of proportional rates of +/- 10%.

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. 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: 1502 14th St. NW Auburn, WA 98001, for archival.

Sealing Label

ATTENTION:

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

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

REPORT # _____

DATE SEALED _____

MANUFACTURER _____

MODEL # _____

Sealed Unit



List of Appendices

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

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

Appendix B – Labels and Manuals

Appendix C –Equipment Calibration Records

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

EPA Method 28R Weighted Average Emissions

Client: IHP
 Stove Model: GV300GL
 Test Dates: 1/7/19 - 1/11/19
 Job Number: 18-452

Signature/Date:



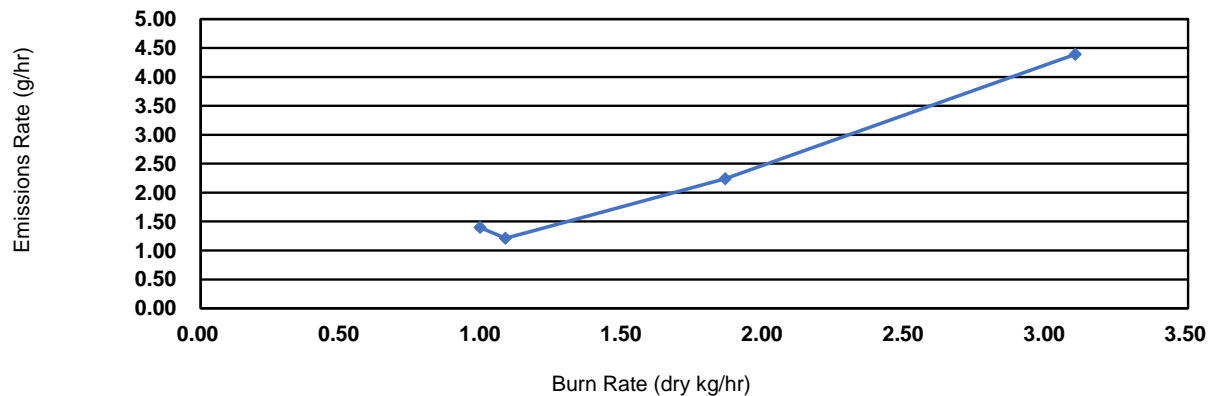
1/15/2019

Weighted Average Particulate Emissions (g/hr):	1.84
Weighted Average HHV Efficiency (%):	74.1%
Weighted Average LHV Efficiency (%):	80.0%
Average CO Emissions (g/min):	2.5

Individual Run Summaries

Run Number:	3	Run Number:	5
Burn Rate (dry kg/hr):	0.99	Burn Rate (dry kg/hr):	1.08
Emissions Rate (g/hr):	1.40	Emissions Rate (g/hr):	1.21
HHV Efficiency (%):	75.3%	HHV Efficiency (%):	74.6%
LHV Efficiency (%):	81.4%	LHV Efficiency (%):	80.6%
Weighting Percentage (%):	27.15%	Weighting Percentage (%):	31.86%
Run Number:	4	Run Number:	6
Burn Rate (dry kg/hr):	1.86	Burn Rate (dry kg/hr):	3.10
Emissions Rate (g/hr):	2.24	Emissions Rate (g/hr):	4.39
HHV Efficiency (%):	73.7%	HHV Efficiency (%):	68.6%
LHV Efficiency (%):	79.7%	LHV Efficiency (%):	74.1%
Weighting Percentage (%):	33.85%	Weighting Percentage (%):	7.14%

Emission Rate vs Burn Rate Plot



Conditioning Data

Client: IHP	Job #: 18-452
Model: GV300GL	Tracking #: 0018
Date(s): 8/1/2018 - 12/12/2018	Technician: SJB'

Elapsed Time (hrs)	Scale Reading (lbs)	Average: Weight Change (lbs)	211.7	65.3	N/A
			Flue (°F)	Ambient (°F)	Catalyst Exit (°F)
0	22.1	-	361	78	N/A
1	15.8	-6.3	323	81	N/A
2	10.8	-5.0	347	80	N/A
3	6.8	-4.0	259	79	N/A
4	5.9	-0.9	107	81	N/A
5	12.7	6.7	327	69	N/A
6	6.4	-6.2	231	69	N/A
7	4.2	-2.2	151	69	N/A
8	3.2	-1.0	127	69	N/A
9	2.9	-0.3	116	68	N/A
10	1.8	-1.1	110	68	N/A
11	1.2	-0.6	103	68	N/A
12	0.7	-0.6	95	67	N/A
13	0.1	-0.6	96	67	N/A
14	21.1	21.0	394	71	N/A
15	6.1	-15.1	525	71	N/A
16	1.4	-4.7	354	70	N/A
17	21.6	20.2	172	58	N/A
18	11.3	-10.3	341	62	N/A
19	5.8	-5.5	227	63	N/A
20	4.0	-1.8	152	65	N/A
21	3.0	-1.0	134	62	N/A
22	2.2	-0.8	130	68	N/A
23	1.4	-0.8	121	64	N/A
24	0.7	-0.7	109	62	N/A
25	21.9	21.3	174	62	N/A
26	12.6	-9.3	336	69	N/A
27	6.5	-6.2	251	64	N/A
28	4.7	-1.8	161	65	N/A
29	3.5	-1.2	135	64	N/A
30	2.7	-0.8	125	62	N/A
31	1.8	-0.8	120	65	N/A
32	1.0	-0.8	115	65	N/A
33	0.3	-0.8	117	62	N/A
34	21.1	20.8	257	58	N/A
35	9.3	-11.8	429	63	N/A
36	3.8	-5.5	276	61	N/A
37	2.4	-1.4	188	59	N/A
38	1.2	-1.2	176	59	N/A
39	0.1	-1.1	159	60	N/A
40	21.3	21.2	260	56	N/A
41	11.0	-10.2	398	56	N/A
42	4.6	-6.4	279	58	N/A
43	3.3	-1.3	157	58	N/A
44	2.3	-1.0	135	62	N/A
45	1.4	-0.9	139	62	N/A
46	0.1	-1.3	129	63	N/A
47	17.4	17.3	305	61	N/A
48	7.6	-9.8	282	63	N/A
49	3.9	-3.7	170	63	N/A
50	2.7	-1.2	114	63	N/A

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 1 Data Summary

Client:	IHP
Model:	GV300GL
Job #:	18-452
Tracking #:	0018
Test Date:	1/7/2019

Technician Signature

1/10/2019

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: IHP

Model: GV300GL

Run #: 1

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/7/2019

Burn Rate (kg/hr):	0.95
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	58.959	71.159	70.057	8.823
Average Gas Velocity in Dilution Tunnel (ft/sec)	13.7			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9356.9			
Average Gas Meter Temperature (°F)	67.9	93.3	92.1	78.7
Total Sample Volume (dscf)	59.085	68.759	67.559	10.386
Average Tunnel Temperature (°F)	78.8			
Total Time of Test (min)	470			
Total Particulate Catch (mg)	0.0	44.9	38.6	39.4
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0006530	0.0005714	0.0037934
Total PM Emissions (g)	0.00	47.86	41.88	35.49
Particulate Emission Rate (g/hr)	0.00	6.11	5.35	35.49
Emissions Factor (g/kg)	-	6.43	5.63	-
Difference from Average Total Particulate Emissions (g)	-	2.99	2.99	-
Difference from Average Emissions Factor (g/kg)	-	0.40	0.40	-

Final Average Results	
Total Particulate Emissions (g)	44.87
Particulate Emission Rate (g/hr)	5.73
Emissions Factor (g/kg)	6.03
HHV Efficiency (%)	74.3%
LHV Efficiency (%)	80.3%
CO Emissions (g/min)	1.82

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	87.0	OK
Face Velocity	< 30 ft/min	8.2	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 65 / Max: 69	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
Stove Surface ΔT	<126°F	97.8	OK

B415.1 Efficiency Results

Manufacturer: IHP
Model: GV300GL
Date: 01/07/19
Run: 1
Control #: 18-452
Test Duration: 470
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	74.3%	80.3%
Combustion Efficiency	91.6%	91.6%
Heat Transfer Efficiency	81.0%	87.6%

Output Rate (kJ/h)	13,746	13,040	(Btu/h)
Burn Rate (kg/h)	0.93	2.06	(lb/h)
Input (kJ/h)	18,513	17,561	(Btu/h)

Test Load Weight (dry kg)	7.32	16.13	dry lb
MC wet (%)	17.68		
MC dry (%)	21.48		
Particulate (g)	44.87		
CO (g)	855		
Test Duration (h)	7.83		

Emissions	Particulate	CO
g/MJ Output	0.42	7.94
g/kg Dry Fuel	6.13	116.78
g/h	5.73	109.13
g/min	0.10	1.82
lb/MM Btu Output	0.97	18.45

Air/Fuel Ratio (A/F)	12.62
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 1

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/7/2019

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	23.7		2x4	16.00	24.7
2x4	16.00	23.1		2x4	16.00	24.1
2x4	16.00	20.1				
2x4	16.00	21.9				
2x4	16.00	20.3				
2x4	16.00	20.6				
2x4	16.00	20.4				
2x4	16.00	21.8				
Total Fuel Weight (lbs):		16.7	Average Moisture (%DB):		22.1	

Firebox Volume (ft³): 2.92
 Total 2x4 Crib Weight, with spacers (lbs): 11.88
 Total 4x4 Crib Weight, with spacers (lbs): 7.76
 Total Wet Fuel Weight, with spacers (lbs): 19.64

Coal Bed Range (20-25%):

Min (lbs): 3.93
 Max (lbs): 4.91

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
2x4	17.00	1.63	20.0	20.1	19.8	1.36
2x4	17.00	1.68	21.7	22.1	22.3	1.38
2x4	17.00	1.72	21.2	23.0	20.9	1.41
2x4	17.00	1.54	20.4	20.3	20.6	1.28
2x4	17.00	1.68	22.0	22.4	21.7	1.38
2x4	17.00	1.72	21.9	21.4	20.5	1.42
4x4	17.00	3.51	22.6	21.2	23.1	2.87
4x4	17.00	3.53	20.9	22.3	23.2	2.89
Total Dry Weight, no spacers (lbs):						13.98
Total Dry Weight, with spacers (lbs):						16.40

Spacer Moisture Readings (%DB)							
10.0	8.0	8.2	8.4	9.4	9.8	8.2	
10.1	8.8	7.4	8.8	9.2	7.1	9.0	
10.3	8.4	7.9	7.6	10.2	9.1	8.4	
8.0	7.6	8.9	8.0	9.2	8.4	8.7	

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	25.4	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	6.73	OK
2x4 Fuel Mix	35 - 65 % of total weight	60%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: IHP
 Model: GV300GL
 Run #: 1
 Test Start Time: 11:36

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/7/2019

Total Sampling Time (min): 470
 Recording Interval (min): 10

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.000 (B)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 1/4/2019

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.02	30.02	30.02
Relative Humidity (%)	37.7	42.9	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		58.959	ft ³

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-11 in. Hg
(B)	0.000	cfm @	-12 in. Hg
(Ambient)	0.001	cfm @	-14 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.038	90
2	0.046	90
3	0.048	90
4	0.038	90
5	0.034	89
6	0.044	89
7	0.044	89
8	0.040	89
Center	0.050	90

Dilution Tunnel H₂O: 2.00 percent
 Tunnel Diameter: 6 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: 0.1963 ft²

V_{strav} : 13.88 ft/sec
 V_{scent} : 15.10 ft/sec
 F_p : 0.919 [ratio]

Initial Tunnel Flow: 152.8 scf/min

Static Pressure: -0.160 in. H₂O

TEST FUEL PROPERTIES

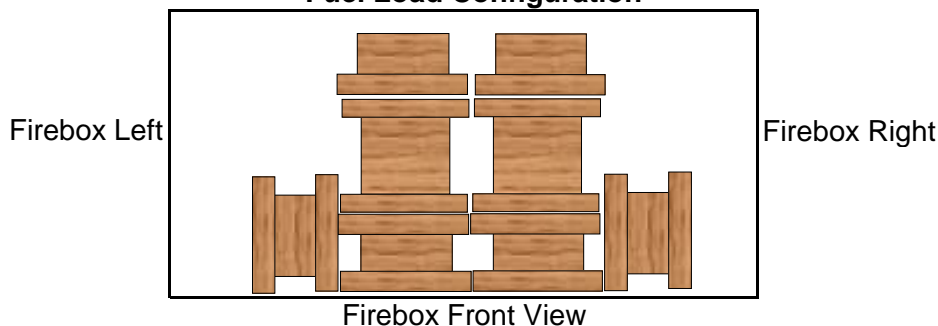
Default Fuel Values

Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	21.5

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 1

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/7/2019

Recording Interval (min): 10
 Run Time (min): 110

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	10.2	-0.091	466	555	494	990	241	549.2	743	67
10	8.3	-0.075	483	606	258	653	314	462.8	348	66
20	6.8	-0.061	474	589	231	560	313	433.4	323	66
30	5.7	-0.049	460	549	252	587	285	426.6	300	65
40	5.2	-0.049	452	523	249	500	268	398.4	245	64
50	5.0	-0.040	439	507	250	417	262	375.0	210	64
60	4.7	-0.023	428	494	248	351	254	355.0	189	63
70	4.6	-0.021	420	478	244	322	255	343.8	177	63
80	4.4	-0.030	411	461	238	311	252	334.6	168	63
90	4.3	-0.019	401	444	232	294	254	325.0	161	63
100	4.1	-0.025	390	428	227	279	262	317.2	154	63
110	3.9	-0.030	381	413	224	265	259	308.4	148	63

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 1

Technician: SJB

Date: 1/7/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.050	0.00	71	-0.11		19.6		93	222	82	68
10	1.425	0.143	0.050	2.26	72	0	99	18.7	-0.9	89	274	84	67
20	2.882	0.146	0.050	2.21	75	-0.57	100	17.5	-1.2	89	281	85	67
30	4.349	0.147	0.050	2.30	79	-1.14	100	16.5	-1	87	258	85	67
40	5.842	0.149	0.050	2.29	82	-0.21	101	15.6	-0.9	80	194	86	67
50	7.333	0.149	0.050	2.27	85	-1.34	100	14.7	-0.9	84	264	86	67
60	8.823	0.149	0.050	2.27	87	-2.55	100	13.0	-1.7	89	335	86	68
70	10.340	0.152	0.050	2.31	89	-1.54	102	11.6	-1.4	90	346	82	65
80	11.848	0.151	0.050	2.32	90	-2.49	101	10.2	-1.4	90	341	83	67
90	13.362	0.151	0.050	2.32	91	0	101	9.0	-1.2	90	334	84	68
100	14.872	0.151	0.050	2.31	92	-1.21	101	7.9	-1.1	89	311	85	69
110	16.389	0.152	0.050	2.31	93	-0.77	101	7.0	-0.9	88	304	86	69
120	17.901	0.151	0.050	2.30	94	-0.34	100	6.1	-0.9	87	292	87	69
130	19.418	0.152	0.050	2.33	94	-1.01	101	5.4	-0.7	85	265	87	69
140	20.931	0.151	0.050	2.31	95	-1.7	100	4.8	-0.6	85	268	86	69
150	22.449	0.152	0.050	2.31	95	-1.07	100	4.2	-0.6	83	233	85	69
160	23.964	0.152	0.050	2.29	96	-2.25	100	3.8	-0.4	81	204	85	69
170	25.486	0.152	0.050	2.32	96	-1.16	100	3.6	-0.2	80	185	84	69
180	27.003	0.152	0.050	2.31	96	0	100	3.4	-0.2	79	171	84	69
190	28.526	0.152	0.050	2.32	96	-2.46	100	3.2	-0.2	78	162	83	69
200	30.045	0.152	0.050	2.31	96	0	100	3.0	-0.2	77	154	83	69
210	31.567	0.152	0.050	2.32	97	0	100	2.9	-0.1	77	151	82	69
220	33.090	0.152	0.050	2.30	97	-0.71	100	2.7	-0.2	77	147	83	69
230	34.611	0.152	0.050	2.31	97	-2.32	100	2.6	-0.1	76	142	83	68
240	36.135	0.152	0.050	2.33	97	-0.52	100	2.4	-0.2	76	139	84	69
250	37.655	0.152	0.050	2.33	97	-1.92	99	2.3	-0.1	76	136	86	69
260	39.181	0.153	0.050	2.31	97	0	100	2.1	-0.2	75	133	87	69
270	40.700	0.152	0.050	2.30	97	-1.02	99	2.0	-0.1	75	130	86	69
280	42.224	0.152	0.050	2.32	97	0	100	1.9	-0.1	75	127	85	68
290	43.749	0.153	0.050	2.31	97	-2.43	100	1.7	-0.2	75	124	84	68
300	45.269	0.152	0.050	2.30	97	-2.37	99	1.6	-0.1	74	122	84	68
310	46.793	0.152	0.050	2.32	97	-2.49	100	1.5	-0.1	74	120	83	68

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 1

Technician: SJB

Date: 1/7/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	48.313	0.152	0.050	2.31	97	-2.46	99	1.4	-0.1	74	119	84	68
330	49.837	0.152	0.050	2.32	97	0	100	1.3	-0.1	74	117	84	68
340	51.359	0.152	0.050	2.33	97	0	99	1.2	-0.1	74	116	83	68
350	52.883	0.152	0.050	2.31	97	0	99	1.1	-0.1	73	114	83	68
360	54.407	0.152	0.050	2.32	97	0	99	1.0	-0.1	73	113	83	68
370	55.927	0.152	0.050	2.29	97	-2.46	99	1.0	0	73	112	83	67
380	57.454	0.153	0.050	2.31	97	-1.89	100	0.9	-0.1	73	110	82	67
390	58.974	0.152	0.050	2.31	97	-2.59	99	0.7	-0.2	72	110	82	67
400	60.497	0.152	0.050	2.31	97	-1.86	99	0.6	-0.1	72	108	82	67
410	62.021	0.152	0.050	2.31	97	-0.26	99	0.5	-0.1	72	107	82	67
420	63.542	0.152	0.050	2.30	96	-2.55	99	0.3	-0.2	72	107	83	67
430	65.067	0.152	0.050	2.31	96	-0.76	100	0.3	0	72	105	84	67
440	66.589	0.152	0.050	2.31	96	-2.42	99	0.2	-0.1	71	101	85	67
450	68.113	0.152	0.050	2.32	96	0	99	0.1	-0.1	71	101	85	67
460	69.636	0.152	0.050	2.30	96	0	99	0.1	0	71	101	86	66
470	71.159	0.152	0.050	2.32	96	-2.49	99	0.0	-0.1	71	101	86	66
Avg/Tot	71.159	0.151	0.050	2.26	93	-1.16	100			79	179	84	67.9

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 1

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/7/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	70	-1		86	0.000	5.14	2.25
10	1.428	0.143	2.34	71	-2.26	101	85	-0.050	4.99	0.66
20	2.900	0.147	2.32	74	-2.35	103	86	-0.040	6.01	0.67
30	4.372	0.147	2.30	78	-2.79	102	84	-0.050	5.43	1.08
40	5.849	0.148	2.29	81	-0.64	101	86	-0.040	3.21	2.06
50	7.324	0.148	2.26	84	-2.66	101	84	-0.050	12.52	1.22
60	8.803	0.148	2.27	86	-2.74	101	85	-0.060	13.49	0.35
70	10.284	0.148	2.27	88	-1.14	101	85	-0.060	13.66	0.65
80	11.767	0.148	2.27	89	-0.67	101	85	-0.060	13.87	0.29
90	13.251	0.148	2.26	90	-1.95	101	86	-0.060	13.63	0.17
100	14.735	0.148	2.26	91	-1.69	101	84	-0.050	12.73	0.19
110	16.223	0.149	2.26	91	-2.76	101	86	-0.060	13.08	0.56
120	17.713	0.149	2.27	92	-2.08	101	84	-0.050	12.26	0.38
130	19.203	0.149	2.26	93	-1.53	100	86	-0.040	10.79	0.48
140	20.692	0.149	2.26	93	-0.92	100	84	-0.050	11.60	0.51
150	22.183	0.149	2.26	94	-2.55	100	85	-0.040	8.29	1.85
160	23.677	0.149	2.27	94	-1.99	100	85	-0.040	8.60	1.25
170	25.170	0.149	2.26	95	-2.26	100	85	-0.020	8.16	0.98
180	26.663	0.149	2.26	95	-1.11	100	86	-0.040	8.30	0.99
190	28.158	0.150	2.26	95	-0.71	100	84	-0.020	8.33	1.19
200	29.655	0.150	2.26	95	-2.32	100	85	-0.020	8.16	1.34
210	31.147	0.149	2.27	95	-2.33	99	85	-0.020	8.12	1.47
220	32.642	0.150	2.27	96	-1.53	99	84	-0.020	7.91	1.26
230	34.140	0.150	2.26	96	-2.76	100	85	-0.020	8.30	1.21
240	35.635	0.150	2.27	96	-1.07	99	84	-0.020	8.14	1.34
250	37.130	0.150	2.27	96	-0.87	99	85	-0.010	7.63	1.47
260	38.626	0.150	2.27	96	-2.28	99	86	-0.020	7.70	1.52
270	40.122	0.150	2.26	96	-1.07	99	84	0.000	7.47	1.77
280	41.617	0.150	2.26	96	-2.18	99	85	-0.020	7.60	1.74
290	43.115	0.150	2.27	96	-0.67	99	85	-0.030	7.51	1.80
300	44.612	0.150	2.27	96	-1.44	99	84	-0.010	7.69	1.80
310	46.106	0.149	2.27	96	-2.38	99	85	-0.020	7.33	1.96

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 1

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/7/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
320	47.602	0.150	2.26	96	-2.73	99	85	-0.020	7.31	2.22
330	49.101	0.150	2.27	96	-0.96	99	85	-0.020	6.51	2.19
340	50.597	0.150	2.26	96	-1.91	99	86	-0.020	6.38	2.29
350	52.093	0.150	2.28	96	-2.74	99	84	-0.010	6.51	2.48
360	53.592	0.150	2.27	96	-0.82	99	85	-0.010	6.61	2.10
370	55.088	0.150	2.27	96	-2.66	99	84	0.000	6.35	2.36
380	56.584	0.150	2.26	96	-2.19	99	85	-0.010	5.89	2.52
390	58.083	0.150	2.27	96	-2.66	99	85	-0.030	5.80	2.61
400	59.579	0.150	2.28	95	-0.65	99	84	0.000	6.16	2.38
410	61.075	0.150	2.27	95	-1.91	99	85	-0.020	6.00	2.40
420	62.574	0.150	2.28	95	-1.99	99	85	-0.020	5.74	2.80
430	64.071	0.150	2.27	95	-2.85	99	84	-0.010	6.03	2.35
440	65.567	0.150	2.26	95	-2.18	99	85	0.000	7.21	1.63
450	67.066	0.150	2.27	95	-2.62	99	86	-0.010	6.85	1.99
460	68.563	0.150	2.28	95	-1.88	99	84	-0.010	6.57	1.89
470	70.057	0.149	2.27	95	-0.87	99	85	-0.010	5.89	2.12
Avg/Tot	70.057	0.149	2.22	92	-1.84	100	85	-0.027	8.11	1.52

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 1

Technician: SJB

Date: 1/7/2019

Stove ΔT: 98

Elapsed Time (min)	Temperature Data (°F)						
	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	373	403	224	237	267	300.8	N/A
10	351	381	324	324	236	323.2	N/A
20	322	356	308	415	234	327.0	N/A
30	300	346	284	424	226	316.0	N/A
40	287	341	172	295	226	264.2	N/A
50	272	327	147	316	218	256.0	N/A
60	285	327	149	450	202	282.6	N/A
70	305	342	154	584	191	315.2	N/A
80	335	361	161	601	187	329.0	N/A
90	361	381	170	606	182	340.0	N/A
100	381	399	179	580	178	343.4	N/A
110	394	413	193	552	174	345.2	N/A
120	406	424	204	542	173	349.8	N/A
130	413	432	216	502	172	347.0	N/A
140	417	436	227	490	172	348.4	N/A
150	416	436	238	457	173	344.0	N/A
160	408	436	249	388	178	331.8	N/A
170	400	434	261	346	178	323.8	N/A
180	392	428	262	316	186	316.8	N/A
190	385	421	259	297	191	310.6	N/A
200	379	412	256	282	195	304.8	N/A
210	373	403	252	273	198	299.8	N/A
220	366	394	245	264	198	293.4	N/A
230	359	385	238	255	202	287.8	N/A
240	353	377	233	249	206	283.6	N/A
250	349	370	229	243	205	279.2	N/A
260	344	362	223	237	207	274.6	N/A
270	338	352	214	231	209	268.8	N/A
280	332	343	204	226	212	263.4	N/A
290	328	335	198	222	214	259.4	N/A
300	324	328	192	218	214	255.2	N/A
310	321	321	187	214	214	251.4	N/A
320	319	315	184	210	213	248.2	N/A
330	315	309	181	206	212	244.6	N/A
340	311	303	178	202	210	240.8	N/A
350	306	297	175	198	208	236.8	N/A
360	302	292	172	195	206	233.4	N/A
370	298	287	170	192	202	229.8	N/A
380	294	282	167	189	199	226.2	N/A
390	290	277	164	186	196	222.6	N/A
400	287	273	162	184	193	219.8	N/A
410	285	269	160	181	190	217.0	N/A
420	282	265	160	178	186	214.2	N/A
430	279	261	160	175	182	211.4	N/A
440	275	257	162	173	178	209.0	N/A
450	273	254	163	172	175	207.4	N/A
460	270	251	164	170	171	205.2	N/A
470	267	248	164	169	167	203.0	N/A

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP
 Model: GV300GL
 Run #: 1

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/7/2019

Stove ΔT : 98

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
Average	334	347	203	305	198	277	N/A

LAB SAMPLE DATA - ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 1

Technician: SJB

Date: 1/7/2019

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3411	161.9	122.5	39.4
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total

Total Particulate, mg:

39.4

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3412	120.9	117.6	3.3
B. Rear filter catch	Filter	3413	123.1	122.3	0.8
C. Probe catch*	Probe	8A	116830.8	116829.9	0.9
D. O-Ring catch*	O-Ring	8A	3552.0	3551.5	0.5

Sub-Total

Total Particulate, mg:

5.5

Train A Aggregate

Total Particulate, mg:

44.9

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3414	153.2	117.3	35.9
B. Rear filter catch	Filter	3415	124.1	122.8	1.3
C. Probe catch*	Probe	8B	116826.3	116825.6	0.7
D. O-Ring catch*	O-Ring	8B	3585.7	3585.0	0.7

Total Particulate, mg:

38.6

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	3416	118.1	118.1	0.0

Total Particulate, mg:

0.0

*Particulate catch that results in a negative number, is assumed to be zero for probes and O-rings, negative numbers for filters are assumed to be part of the O-Ring weight. Negative ambient filter weights are assumed to be zero.

ASTM E2780 Wood Heater Run Sheets

Client: IHP Job Number: 18-452 Tracking #: 0018
 Model: GV300GL Run Number: 1 Test Date: 1/7/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Fully Closed
 Targeted Burn Category: Med. Low (<1.0 kg/hr)

Preburn Notes

Time	Notes
8:05	Loaded 11.2 lbs of kindling, lit with propane torch, fan off, air fully open.
8:40	@ 3.0 lbs, added 4.5 additional lbs of kindling
9:08	@ 2.0 lbs, scooped coals and zeroed scale, loaded preburn fuel load
9:39	@ 10.2 lbs, set air to test setting, fan turned on low
11:35	@ 3.9 lbs, leveled coal bed, zeroed scale, turned fan off in preparation of fuel loading.

Test Notes

Test Burn Start Time: 11:36 Test Fuel Loaded by: 50 seconds
 Door Closed: 120 seconds Air Control Set at: 300 seconds
 Other Loading Notes: N/A

Time	Notes
30 min	Turned fan on to low setting, per manufacturer's instructions
60 min	Changed 1-hour filter
470 min	End of Test

Test Burn End Time: 19:26

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.93 CO (%): 4.33
 Mid Gas CO₂ (%): 10.0 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	9:24	9:29	9:27	1/8 – 9:59	1/8 – 9:57	1/8 – 10:01
CO ₂	0.00	10.09	16.93	0.00	9.95	16.81
CO	0.000	2.500	4.330	-0.035	2.440	4.245

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

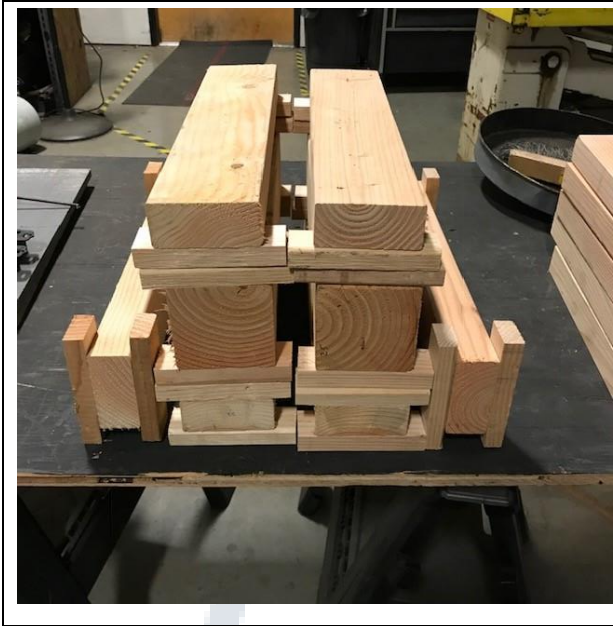
Technician Signature: _____ Date: 1/8/2019

ASTM E2780 Wood Heater Run Sheets

Client: IHP
Model: GV300GL

Job Number: 18-452
Run Number: 1

Tracking #: 0018
Test Date: 1/7/2019



Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: _____

Date: 1/8/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 2 Data Summary

Client:	IHP
Model:	GV300GL
Job #:	18-452
Tracking #:	0018
Test Date:	1/8/2019

A handwritten signature in dark ink, appearing to be "JL" or similar, written over a horizontal line.

Techician Signature

1/11/2019

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: IHP

Model: GV300GL

Run #: 2

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/8/2019

Burn Rate (kg/hr):	0.86
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	71.217	85.655	85.066	8.849
Average Gas Velocity in Dilution Tunnel (ft/sec)	14.4			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9707.4			
Average Gas Meter Temperature (°F)	69.3	95.4	93.9	80.6
Total Sample Volume (dscf)	70.403	81.527	80.870	10.325
Average Tunnel Temperature (°F)	79.3			
Total Time of Test (min)	570			
Total Particulate Catch (mg)	0.0	10.8	10.3	8.7
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0001325	0.0001274	0.0008426
Total PM Emissions (g)	0.00	12.22	11.75	8.18
Particulate Emission Rate (g/hr)	0.00	1.29	1.24	8.18
Emissions Factor (g/kg)	-	1.49	1.44	-
Difference from Average Total Particulate Emissions (g)	-	0.24	0.24	-
Difference from Average Emissions Factor (g/kg)	-	0.03	0.03	-

Final Average Results	
Total Particulate Emissions (g)	11.98
Particulate Emission Rate (g/hr)	1.26
Emissions Factor (g/kg)	1.46
HHV Efficiency (%)	75.5%
LHV Efficiency (%)	81.7%
CO Emissions (g/min)	1.37

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	86.0	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 67 / Max: 72	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
Stove Surface ΔT	<126°F	151.0	Not Acceptable

B415.1 Efficiency Results

Manufacturer: IHP
Model: GV300GL
Date: 01/08/19
Run: 2
Control #: 18-452
Test Duration: 570
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.5%	81.7%
Combustion Efficiency	93.1%	93.1%
Heat Transfer Efficiency	81.1%	87.7%

Output Rate (kJ/h)	12,719	12,065	(Btu/h)
Burn Rate (kg/h)	0.85	1.87	(lb/h)
Input (kJ/h)	16,836	15,971	(Btu/h)

Test Load Weight (dry kg)	8.07	17.79	dry lb
MC wet (%)	17.62		
MC dry (%)	21.38		
Particulate (g)	11.98		
CO (g)	778		
Test Duration (h)	9.50		

Emissions	Particulate	CO
g/MJ Output	0.10	6.44
g/kg Dry Fuel	1.48	96.41
g/h	1.26	81.94
g/min	0.02	1.37
lb/MM Btu Output	0.23	14.97

Air/Fuel Ratio (A/F)	11.83
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 2

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/8/2019

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	19.8		2x4	16.00	20.2
2x4	16.00	20.5		2x4	16.00	22.0
2x4	16.00	19.8		2x4	16.00	19.7
2x4	16.00	18.9				
2x4	16.00	20.3				
2x4	16.00	22.3				
2x4	16.00	21.2				
2x4	16.00	22.0				
Total Fuel Weight (lbs):		16.93	Average Moisture (%DB):		20.6	

Firebox Volume (ft³): 2.92
 Total 2x4 Crib Weight, with spacers (lbs): 12.70
 Total 4x4 Crib Weight, with spacers (lbs): 8.88
 Total Wet Fuel Weight, with spacers (lbs): 21.58

Coal Bed Range (20-25%):

Min (lbs): 4.32
 Max (lbs): 5.40

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
2x4	17.00	1.72	19.6	19.3	19.2	1.44
2x4	17.00	1.65	21.2	23.8	22.6	1.35
2x4	17.00	1.59	21.2	21.9	20.1	1.31
2x4	17.00	1.63	23.0	22.3	23.2	1.33
2x4	17.00	1.81	20.9	20.6	22.5	1.49
2x4	17.00	2.18	20.3	19.1	20.2	1.82
4x4	17.00	3.99	23.8	22.1	21.7	3.26
4x4	17.00	4.08	23.8	22.1	18.7	3.36
Total Dry Weight, no spacers (lbs):						15.35
Total Dry Weight, with spacers (lbs):						18.03

Spacer Moisture Readings (%DB)							
8.7	8.5	9.5	8.9	8.7	11.4	9.3	
9.5	10.7	10.7	9.0	7.8	10.0	8.8	
9.2	9.2	9.9	11.2	8.0	10.0	7.3	
8.4	8.8	8.5	9.0	10.1	9.8	9.9	

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	27.9	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	7.39	OK
2x4 Fuel Mix	35 - 65 % of total weight	59%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: IHP
 Model: GV300GL
 Run #: 2
 Test Start Time: 11:59

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/8/2019

Total Sampling Time (min): 570
 Recording Interval (min): 10

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.000 (B)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 1/4/2019

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.76	29.62	29.69
Relative Humidity (%)	27.8	32.9	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:	71.217		ft ³

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-11	in. Hg
(B)	0.000	cfm @	-12	in. Hg
(Ambient)	0.001	cfm @	-14	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.040	92
2	0.050	92
3	0.048	92
4	0.042	92
5	0.046	91
6	0.050	91
7	0.048	91
8	0.042	91
Center	0.050	93

Dilution Tunnel H₂O: 2.00 percent
 Tunnel Diameter: 6 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: 0.1963 ft²

V_{strav} : 14.59 ft/sec
 V_{scent} : 15.21 ft/sec
 F_p : 0.960 [ratio]

Initial Tunnel Flow: 159.4 scf/min

Static Pressure: -0.160 in. H₂O

TEST FUEL PROPERTIES

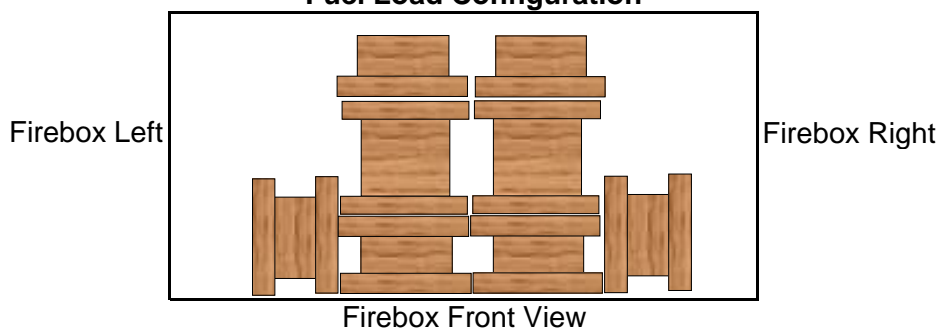
Default Fuel Values

Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	21.4

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 2

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/8/2019

Recording Interval (min): 10
 Run Time (min): 110

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	10.9	-0.083	461	568	501	997	215	548.4	721	68
10	8.9	-0.073	466	601	328	795	260	490.0	405	67
20	7.2	-0.070	461	582	287	711	258	459.8	376	66
30	6.1	-0.050	458	551	269	660	248	437.2	330	67
40	5.6	-0.048	456	527	259	558	245	409.0	261	67
50	5.3	-0.044	449	506	257	454	245	382.2	219	66
60	5.1	-0.037	440	492	255	389	247	364.6	194	65
70	4.9	-0.028	431	478	252	347	250	351.6	179	65
80	4.7	-0.025	423	465	248	321	243	340.0	169	64
90	4.7	-0.023	414	452	243	303	255	333.4	162	63
100	4.4	-0.028	405	440	238	290	245	323.6	157	63
110	4.3	-0.028	397	428	232	278	252	317.4	153	63

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 2

Technician: SJB

Date: 1/8/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.006		0.050	0.00	73	-0.03		21.6		98	229	83	69
10	1.450	0.144	0.050	2.29	74	-2.53	102	20.3	-1.3	98	357	85	69
20	2.923	0.147	0.050	2.24	77	-0.06	104	18.7	-1.6	103	403	86	70
30	4.400	0.148	0.050	2.24	80	-1.65	103	17.2	-1.5	98	354	84	69
40	5.879	0.148	0.050	2.24	84	-0.46	102	15.7	-1.5	97	367	83	69
50	7.365	0.149	0.050	2.22	87	-0.99	102	14.3	-1.4	95	345	83	70
60	8.855	0.149	0.050	2.23	89	-0.94	102	12.9	-1.4	94	335	84	70
70	10.354	0.150	0.050	2.24	91	-1.56	102	11.7	-1.2	94	342	86	71
80	11.850	0.150	0.050	2.24	93	-1.76	101	10.3	-1.4	94	338	85	71
90	13.351	0.150	0.050	2.24	94	-2.37	101	9.2	-1.1	93	327	83	71
100	14.848	0.150	0.050	2.22	95	-0.52	101	8.0	-1.2	93	324	83	71
110	16.348	0.150	0.050	2.22	96	-2.45	101	7.0	-1	91	304	83	71
120	17.841	0.149	0.050	2.22	96	-2.51	100	6.2	-0.8	89	284	85	71
130	19.337	0.150	0.050	2.24	97	-0.42	100	5.5	-0.7	87	260	86	71
140	20.837	0.150	0.050	2.22	97	0	100	4.9	-0.6	85	236	84	71
150	22.344	0.151	0.050	2.23	98	-0.12	100	4.5	-0.4	83	209	83	71
160	23.847	0.150	0.050	2.23	98	-0.12	100	4.2	-0.3	82	188	83	72
170	25.351	0.150	0.050	2.23	98	0	100	4.0	-0.2	80	170	85	71
180	26.860	0.151	0.050	2.23	98	-1.67	100	3.8	-0.2	79	160	86	71
190	28.363	0.150	0.050	2.21	99	0	99	3.6	-0.2	79	154	84	71
200	29.873	0.151	0.050	2.24	99	0	100	3.5	-0.1	78	149	83	70
210	31.378	0.151	0.050	2.23	99	-1.26	99	3.4	-0.1	77	145	84	71
220	32.887	0.151	0.050	2.22	99	-2.33	100	3.2	-0.2	77	141	86	70
230	34.393	0.151	0.050	2.23	99	-2.55	99	3.0	-0.2	77	138	85	70
240	35.900	0.151	0.050	2.23	99	-1.68	99	2.9	-0.1	77	135	83	70
250	37.411	0.151	0.050	2.21	99	-2.41	100	2.8	-0.1	76	132	83	70
260	38.916	0.151	0.050	2.25	99	-2.5	99	2.6	-0.2	76	130	84	69
270	40.426	0.151	0.050	2.23	99	-2.17	100	2.5	-0.1	76	128	85	70
280	41.932	0.151	0.050	2.22	99	0	99	2.4	-0.1	76	126	85	70
290	43.441	0.151	0.050	2.22	99	-0.18	99	2.2	-0.2	75	126	83	69
300	44.947	0.151	0.050	2.22	99	-1.42	99	2.1	-0.1	75	124	83	69
310	46.454	0.151	0.050	2.23	99	-0.23	99	2.0	-0.1	75	121	84	70

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: <u>IHP</u>	Job #: <u>18-452</u>
Model: <u>GV300GL</u>	Tracking #: <u>0018</u>
Run #: <u>2</u>	Technician: <u>SJB</u>
	Date: <u>1/8/2019</u>

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	47.965	0.151	0.050	2.23	98	-1.92	100	1.9	-0.1	75	120	86	69
330	49.469	0.150	0.050	2.21	98	-2.6	99	1.7	-0.2	74	118	85	69
340	50.980	0.151	0.050	2.27	98	0	100	1.7	0	74	115	83	69
350	52.486	0.151	0.050	2.24	98	-2.1	99	1.6	-0.1	74	113	83	69
360	53.995	0.151	0.050	2.22	98	-1.92	99	1.5	-0.1	73	111	83	69
370	55.502	0.151	0.050	2.24	98	0	99	1.4	-0.1	73	110	85	69
380	57.009	0.151	0.050	2.26	98	0	99	1.3	-0.1	73	107	85	69
390	58.520	0.151	0.050	2.22	98	-0.81	100	1.3	0	73	105	84	69
400	60.025	0.151	0.050	2.24	98	-0.17	99	1.1	-0.2	73	103	83	68
410	61.535	0.151	0.050	2.24	98	-2.2	99	1.0	-0.1	72	101	83	68
420	63.042	0.151	0.050	2.24	98	-0.49	99	1.0	0	72	99	84	68
430	64.551	0.151	0.050	2.22	98	-0.16	99	0.9	-0.1	72	97	85	68
440	66.057	0.151	0.050	2.23	98	-0.74	99	0.8	-0.1	72	96	85	68
450	67.564	0.151	0.050	2.23	97	0	99	0.7	-0.1	72	94	85	68
460	69.075	0.151	0.050	2.24	97	0	100	0.7	0	72	93	84	68
470	70.579	0.150	0.050	2.24	97	-2.4	99	0.6	-0.1	71	92	83	68
480	72.090	0.151	0.050	2.23	97	-0.56	100	0.5	-0.1	71	91	83	68
490	73.600	0.151	0.050	2.22	97	0	99	0.5	0	71	92	85	68
500	75.109	0.151	0.050	2.22	97	-1.34	99	0.4	-0.1	71	89	86	68
510	76.615	0.151	0.050	2.24	97	-2.51	99	0.4	0	71	87	85	67
520	78.121	0.151	0.050	2.22	97	-0.14	99	0.3	-0.1	71	85	84	67
530	79.631	0.151	0.050	2.21	97	0	99	0.3	0	70	83	83	67
540	81.133	0.150	0.050	2.21	97	0	99	0.1	-0.2	70	84	83	67
550	82.644	0.151	0.050	2.24	97	-2.29	99	0.1	0	70	81	85	67
560	84.149	0.151	0.050	2.23	97	-1.15	99	0.1	0	70	83	86	67
570	85.655	0.151	0.050	2.22	96	-0.19	99	0.0	-0.1	70	83	85	67
Avg/Tot	85.655	0.150	0.050	2.19	95	-1.04	100			79	169	84	69.3

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 2

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/8/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	72	-1		86	0.000	5.63	2.91
10	1.432	0.143	2.31	73	-1.48	101	85	-0.060	9.07	0.41
20	2.901	0.147	2.27	76	-2.83	104	86	-0.060	10.12	0.68
30	4.372	0.147	2.25	80	-0.88	103	85	-0.070	8.77	0.96
40	5.846	0.147	2.25	83	-0.7	102	86	-0.070	13.92	0.61
50	7.322	0.148	2.25	86	-0.62	102	85	-0.070	12.71	0.19
60	8.801	0.148	2.25	88	-2.74	102	86	-0.060	13.09	0.36
70	10.283	0.148	2.25	90	-2.75	101	85	-0.060	13.74	0.49
80	11.768	0.149	2.23	91	-2.53	101	86	-0.060	13.49	0.73
90	13.258	0.149	2.23	93	-0.72	101	85	-0.070	13.34	0.79
100	14.748	0.149	2.24	94	-2.38	101	86	-0.050	13.40	1.40
110	16.237	0.149	2.23	94	-1.5	101	85	-0.060	12.64	0.42
120	17.728	0.149	2.22	95	-2.63	101	86	-0.050	11.63	0.67
130	19.223	0.150	2.23	96	-2.64	101	85	-0.050	10.71	0.97
140	20.716	0.149	2.24	96	-0.64	100	85	-0.040	9.87	1.25
150	22.209	0.149	2.25	96	-2.74	100	86	-0.030	8.47	1.48
160	23.704	0.150	2.24	97	-1.29	100	85	-0.030	8.48	1.27
170	25.202	0.150	2.24	97	-2.22	100	86	-0.020	8.55	0.97
180	26.697	0.150	2.24	97	-2.59	100	85	-0.020	8.75	1.12
190	28.192	0.150	2.24	97	-0.9	100	85	-0.030	8.70	1.20
200	29.690	0.150	2.23	97	-2.77	100	86	-0.020	8.89	1.23
210	31.186	0.150	2.24	97	-2.69	99	85	-0.020	8.94	1.43
220	32.681	0.150	2.24	97	-2.2	99	85	-0.020	8.73	1.42
230	34.180	0.150	2.24	97	-0.71	100	85	-0.020	8.28	1.70
240	35.676	0.150	2.24	97	-2.51	99	85	-0.030	8.01	1.49
250	37.171	0.150	2.23	97	-1.08	99	86	-0.020	8.17	1.52
260	38.669	0.150	2.24	97	-2.04	100	85	-0.030	8.45	1.61
270	40.167	0.150	2.23	97	-2.65	100	85	-0.020	8.34	1.73
280	41.662	0.150	2.24	97	-2.61	99	86	-0.010	8.14	2.02
290	43.158	0.150	2.23	97	-1.57	99	85	0.000	7.54	2.42
300	44.657	0.150	2.24	97	-1.2	99	86	-0.010	7.66	2.14
310	46.152	0.150	2.24	97	-1.03	99	85	-0.030	8.07	1.82

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 2

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/8/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
320	47.648	0.150	2.24	97	-1.08	99	85	-0.010	7.71	2.02
330	49.147	0.150	2.23	97	-0.83	99	86	0.010	7.26	1.97
340	50.643	0.150	2.25	97	-2.55	99	85	-0.020	7.16	1.99
350	52.139	0.150	2.24	97	-1.27	99	85	-0.010	6.90	1.96
360	53.638	0.150	2.24	96	-1.95	99	85	-0.020	6.99	2.22
370	55.134	0.150	2.24	96	-1.95	99	85	-0.010	6.85	2.14
380	56.630	0.150	2.24	96	-0.81	99	86	-0.010	6.55	2.38
390	58.129	0.150	2.24	96	-2.27	99	85	-0.020	6.75	2.32
400	59.625	0.150	2.25	96	-2.71	99	85	-0.010	7.06	2.35
410	61.120	0.150	2.24	96	-2.16	99	86	-0.020	6.81	2.14
420	62.618	0.150	2.24	96	-1.47	99	84	-0.030	6.70	2.26
430	64.116	0.150	2.24	96	-0.81	99	85	-0.020	7.43	2.18
440	65.610	0.149	2.26	96	-0.62	99	86	-0.010	7.11	2.54
450	67.107	0.150	2.24	96	-1.02	99	84	-0.020	7.39	2.26
460	68.606	0.150	2.25	96	-1.22	99	86	-0.020	7.21	2.00
470	70.102	0.150	2.25	96	-0.62	99	85	-0.010	7.13	2.22
480	71.597	0.149	2.25	96	-1.83	99	85	-0.010	6.99	2.21
490	73.096	0.150	2.24	96	-1.82	99	86	-0.020	6.20	2.34
500	74.592	0.150	2.24	95	-1.77	99	85	0.000	7.13	2.25
510	76.088	0.150	2.24	95	-2.31	99	85	-0.010	6.83	2.59
520	77.586	0.150	2.25	95	-2.6	99	86	-0.020	6.81	2.65
530	79.081	0.150	2.24	95	-1.64	99	85	-0.010	7.18	2.87
540	80.577	0.150	2.24	95	-0.96	99	84	-0.020	6.26	2.94
550	82.076	0.150	2.25	95	-1.03	99	85	-0.020	7.15	3.07
560	83.571	0.150	2.24	95	-1.34	99	85	-0.010	5.11	3.87
570	85.066	0.150	2.24	95	-0.65	99	84	0.000	5.04	4.00
Avg/Tot	85.066	0.149	2.20	94	-1.69	100	85	-0.027	8.48	1.78

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 2

Technician: SJB

Date: 1/8/2019

Stove ΔT: 151

Elapsed Time (min)	Temperature Data (°F)						
	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	393	424	235	265	252	313.8	N/A
10	378	404	334	428	227	354.2	N/A
20	349	374	322	618	225	377.6	N/A
30	331	360	301	652	220	372.8	N/A
40	326	354	183	624	217	340.8	N/A
50	336	357	165	619	217	338.8	N/A
60	346	368	163	598	208	336.6	N/A
70	358	381	167	610	203	343.8	N/A
80	375	394	174	623	197	352.6	N/A
90	390	407	183	609	191	356.0	N/A
100	401	418	191	605	187	360.4	N/A
110	410	429	199	583	186	361.4	N/A
120	416	440	208	549	184	359.4	N/A
130	421	446	216	507	185	355.0	N/A
140	427	449	224	464	187	350.2	N/A
150	428	447	230	409	189	340.6	N/A
160	422	443	234	363	193	331.0	N/A
170	412	439	235	329	199	322.8	N/A
180	401	433	233	304	205	315.2	N/A
190	391	426	232	291	206	309.2	N/A
200	382	418	230	280	206	303.2	N/A
210	375	411	229	271	206	298.4	N/A
220	368	404	224	263	208	293.4	N/A
230	363	395	219	257	210	288.8	N/A
240	358	386	213	249	211	283.4	N/A
250	349	377	208	244	212	278.0	N/A
260	341	369	205	239	210	272.8	N/A
270	335	364	204	233	210	269.2	N/A
280	329	359	203	230	210	266.2	N/A
290	324	354	202	226	209	263.0	N/A
300	320	349	199	216	209	258.6	N/A
310	315	343	195	211	207	254.2	N/A
320	312	337	190	211	205	251.0	N/A
330	310	329	186	209	206	248.0	N/A
340	306	320	181	205	206	243.6	N/A
350	302	312	176	199	205	238.8	N/A
360	298	305	171	195	205	234.8	N/A
370	295	298	167	191	203	230.8	N/A
380	292	291	163	189	201	227.2	N/A
390	287	284	161	182	198	222.4	N/A
400	282	278	160	177	197	218.8	N/A
410	278	273	157	173	195	215.2	N/A
420	274	268	154	170	193	211.8	N/A
430	270	264	152	170	191	209.4	N/A
440	265	259	149	169	189	206.2	N/A
450	260	255	148	167	187	203.4	N/A
460	257	252	147	164	184	200.8	N/A
470	253	248	146	161	181	197.8	N/A

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP
 Model: GV300GL
 Run #: 2

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/8/2019

Stove ΔT: 151

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	249	243	144	159	177	194.4	N/A
490	244	238	142	158	174	191.2	N/A
500	239	233	140	154	171	187.4	N/A
510	234	228	138	151	168	183.8	N/A
520	229	224	136	148	165	180.4	N/A
530	225	219	134	144	162	176.8	N/A
540	220	214	131	141	159	173.0	N/A
550	216	209	129	137	157	169.6	N/A
560	212	204	127	134	154	166.2	N/A
570	208	199	125	132	150	162.8	N/A
Average	322	336	188	299	196	268	N/A

LAB SAMPLE DATA - ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 2

Technician: SJB

Date: 1/8/2019

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3417	130.2	121.5	8.7
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total

Total Particulate, mg:	8.7
------------------------	-----

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3418	118.8	117.6	1.2
B. Rear filter catch	Filter	3419	122.2	122.2	0.0
C. Probe catch*	Probe	9A	116713.4	116713.3	0.1
D. O-Ring catch*	O-Ring	9A	3582.3	3581.5	0.8

Sub-Total

Total Particulate, mg:	2.1
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Train A Aggregate

Total Particulate, mg:	10.8
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TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3420	127.8	118.7	9.1
B. Rear filter catch	Filter	3421	120.9	120.8	0.1
C. Probe catch*	Probe	9B	117135.9	117135.5	0.4
D. O-Ring catch*	O-Ring	9B	3525.1	3524.4	0.7

Total Particulate, mg:	10.3
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AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	3422	117.5	117.6	0.0

Total Particulate, mg:	0.0
------------------------	------------

*Particulate catch that results in a negative number, is assumed to be zero for probes and O-rings, negative numbers for filters are assumed to be part of the O-Ring weight. Negative ambient filter weights are assumed to be zero.

ASTM E2780 Wood Heater Run Sheets

Client: IHP Job Number: 18-452 Tracking #: 0018
 Model: GV300GL Run Number: 2 Test Date: 1/8/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Fully Closed
 Targeted Burn Category: Med. Low (<1.0 kg/hr)

Preburn Notes

Time	Notes
8:42	Loaded 12.8 lbs of kindling, lit with propane torch, fan off, air fully open.
9:05	@ 4.0 lbs, added 5.2 additional lbs of kindling
9:48	@ 2.0 lbs, scooped coals and zeroed scale, loaded preburn fuel load
10:06	@ 11.0 lbs, set air to test setting, fan turned on low
11:58	@ 4.3 lbs, leveled coal bed, zeroed scale, turned fan off in preparation of fuel loading.

Test Notes

Test Burn Start Time: 11:59 Test Fuel Loaded by: 50 seconds
 Door Closed: 120 seconds Air Control Set at: 300 seconds
 Other Loading Notes: N/A

Time	Notes
30 min	Turned fan on to low setting, per manufacturer's instructions
60 min	Changed 1-hour filter
570 min	End of Test

Test Burn End Time: 21:29

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.93 CO (%): 4.33
 Mid Gas CO₂ (%): 10.0 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	10:05	10:09	10:04	1-9 9:30	1-9 9:26	1-9 9:28
CO ₂	0.00	10.02	16.93	-0.03	9.95	16.80
CO	0.000	2.524	4.330	-0.001	2.521	4.380

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

Technician Signature:  Date: 1/9/2019

ASTM E2780 Wood Heater Run Sheets

Client: IHP
Model: GV300GL

Job Number: 18-452
Run Number: 2

Tracking #: 0018
Test Date: 1/8/2019



Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: _____

A handwritten signature in black ink, appearing to be "JL", written over a horizontal line.

Date: 1/9/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 3 Data Summary

Client:	IHP
Model:	GV300GL
Job #:	18-452
Tracking #:	0018
Test Date:	1/9/2019

Technician Signature

1/14/2019

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: IHP

Model: GV300GL

Run #: 3

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/9/2019

Burn Rate (kg/hr):	0.99
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	61.222	73.744	73.380	8.863
Average Gas Velocity in Dilution Tunnel (ft/sec)	14.0			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9392.9			
Average Gas Meter Temperature (°F)	71.2	96.8	95.5	82.0
Total Sample Volume (dscf)	60.305	70.019	69.566	10.345
Average Tunnel Temperature (°F)	82.6			
Total Time of Test (min)	490			
Total Particulate Catch (mg)	0.0	11.0	9.8	8.1
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0001571	0.0001409	0.0007830
Total PM Emissions (g)	0.00	12.05	10.81	7.35
Particulate Emission Rate (g/hr)	0.00	1.48	1.32	7.35
Emissions Factor (g/kg)	-	1.50	1.34	-
Difference from Average Total Particulate Emissions (g)	-	0.62	0.62	-
Difference from Average Emissions Factor (g/kg)	-	0.08	0.08	-

Final Average Results	
Total Particulate Emissions (g)	11.43
Particulate Emission Rate (g/hr)	1.40
Emissions Factor (g/kg)	1.42
HHV Efficiency (%)	75.3%
LHV Efficiency (%)	81.4%
CO Emissions (g/min)	1.61

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	86.0	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0.001 cfm	OK
Ambient Temp	55-90 °F	Min: 70 / Max: 73	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
Stove Surface ΔT	<126°F	84.0	OK

B415.1 Efficiency Results

Manufacturer: IHP
Model: GV300GL
Date: 01/09/19
Run: 3
Control #: 18-452
Test Duration: 490
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.3%	81.4%
Combustion Efficiency	92.7%	92.7%
Heat Transfer Efficiency	81.3%	87.8%

Output Rate (kJ/h)	14,435	13,693	(Btu/h)
Burn Rate (kg/h)	0.97	2.13	(lb/h)
Input (kJ/h)	19,168	18,183	(Btu/h)

Test Load Weight (dry kg)	7.90	17.42	dry lb
MC wet (%)	17.46		
MC dry (%)	21.15		
Particulate (g)	11.43		
CO (g)	788		
Test Duration (h)	8.17		

Emissions	Particulate	CO
g/MJ Output	0.10	6.68
g/kg Dry Fuel	1.45	99.70
g/h	1.40	96.46
g/min	0.02	1.61
lb/MM Btu Output	0.23	15.53

Air/Fuel Ratio (A/F)	11.62
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 3

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/9/2019

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	19.1		2x4	16.00	18.9
2x4	16.00	22.3		2x4	16.00	20.9
2x4	16.00	22.4				
2x4	16.00	19.4				
2x4	16.00	22.6				
2x4	16.00	21.0				
2x4	16.00	18.9				
2x4	16.00	18.9				
Total Fuel Weight (lbs):		15.12	Average Moisture (%DB):		20.4	

Firebox Volume (ft³): 2.92
 Total 2x4 Crib Weight, with spacers (lbs): 12.43
 Total 4x4 Crib Weight, with spacers (lbs): 8.69
 Total Wet Fuel Weight, with spacers (lbs): 21.12

Coal Bed Range (20-25%):

Min (lbs): 4.22
 Max (lbs): 5.28

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
2x4	17.00	1.79	22.1	22.0	21.7	1.47
2x4	17.00	1.96	19.0	18.9	19.4	1.65
2x4	17.00	1.63	21.9	21.2	23.8	1.33
2x4	17.00	1.61	21.2	22.6	22.3	1.32
2x4	17.00	1.68	20.1	21.2	21.7	1.39
2x4	17.00	1.59	22.3	24.2	23.2	1.29
4x4	17.00	4.08	19.4	19.2	18.8	3.42
4x4	17.00	3.79	19.7	21.5	20.3	3.15
Total Dry Weight, no spacers (lbs):						15.01
Total Dry Weight, with spacers (lbs):						17.77

Spacer Moisture Readings (%DB)							
8.5	10.6	8.8	7.8	8.3	8.3	8.9	
7.8	7.7	10.2	7.0	10.1	7.0	10.5	
7.7	7.0	10.2	8.6	8.4	8.2	8.4	
8.6	7.5	7.6	9.2	10.1	8.8	7.6	

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	27.3	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	7.23	OK
2x4 Fuel Mix	35 - 65 % of total weight	59%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: IHP
 Model: GV300GL
 Run #: 3
 Test Start Time: 12:05

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/9/2019

Total Sampling Time (min): 490
 Recording Interval (min): 10

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.000 (B)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 1/4/2019

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.63	29.75	29.69
Relative Humidity (%)	26.0	27.6	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		61.222	ft ³

Sample Train Post-Test Leak Checks

(A)	0.001	cfm @	-12 in. Hg
(B)	0.000	cfm @	-13 in. Hg
(Ambient)	0.001	cfm @	-14 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.036	81
2	0.046	81
3	0.050	81
4	0.040	81
5	0.042	81
6	0.048	81
7	0.046	81
8	0.034	81
Center	0.050	81

Dilution Tunnel H₂O: 2.00 percent

Tunnel Diameter: 6 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: 0.1963 ft²

V_{strav} : 14.04 ft/sec

V_{scent} : 15.08 ft/sec

F_p : 0.931 [ratio]

Initial Tunnel Flow: 155.3 scf/min

Static Pressure: -0.160 in. H₂O

TEST FUEL PROPERTIES

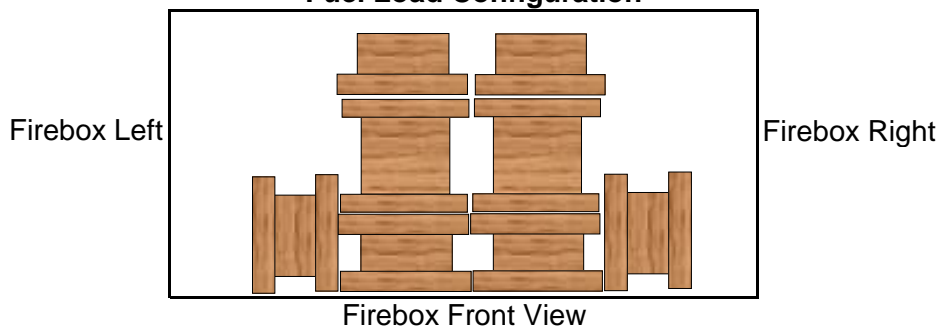
Default Fuel Values

Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	21.2

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 3

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/9/2019

Recording Interval (min): 10
 Run Time (min): 120

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	11.5	-0.096	485	577	511	999	245	563.4	738	69
10	9.4	-0.069	484	604	322	800	277	497.4	404	69
20	7.8	-0.067	474	586	281	708	278	465.4	379	70
30	6.3	-0.050	467	557	262	667	266	443.8	341	69
40	5.8	-0.040	465	532	254	573	255	415.8	273	69
50	5.4	-0.046	458	510	253	471	243	387.0	226	69
60	5.1	-0.021	450	491	253	397	245	367.2	197	70
70	5.0	-0.031	441	474	250	352	242	351.8	180	69
80	4.8	-0.034	430	458	244	321	245	339.6	169	69
90	4.8	-0.040	415	440	233	294	253	327.0	157	68
100	4.6	-0.017	398	420	220	275	248	312.2	149	67
110	4.5	-0.026	384	402	213	261	262	304.4	143	66
120	4.3	-0.027	372	387	205	250	255	293.8	138	66

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 3

Technician: SJB

Date: 1/9/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.050	0.00	74	-0.19		21.1		95	201	86	71
10	1.443	0.144	0.050	2.28	76	-1.02	101	19.8	-1.3	100	356	85	71
20	2.923	0.148	0.050	2.23	79	0	103	18.3	-1.5	103	384	84	71
30	4.406	0.148	0.050	2.23	82	-2.64	103	16.7	-1.6	97	339	84	71
40	5.890	0.148	0.050	2.21	85	-0.78	102	15.3	-1.4	98	355	84	71
50	7.374	0.148	0.050	2.21	88	-0.51	102	13.8	-1.5	97	350	84	71
60	8.863	0.149	0.050	2.21	90	0	102	12.3	-1.5	98	356	84	72
70	10.370	0.151	0.050	2.22	92	-1.87	102	10.8	-1.5	97	345	83	72
80	11.866	0.150	0.050	2.23	94	-1.37	101	9.6	-1.2	96	330	83	72
90	13.365	0.150	0.050	2.21	95	-1.09	101	8.5	-1.1	94	313	83	73
100	14.868	0.150	0.050	2.22	96	-1.1	101	7.5	-1	93	309	84	73
110	16.369	0.150	0.050	2.23	97	-2.47	101	6.5	-1	92	294	85	72
120	17.872	0.150	0.050	2.21	98	-2.5	100	5.8	-0.7	90	266	85	73
130	19.379	0.151	0.050	2.22	98	0	100	5.2	-0.6	87	234	84	73
140	20.881	0.150	0.050	2.21	99	-0.05	100	4.8	-0.4	85	208	83	72
150	22.391	0.151	0.050	2.23	99	-0.13	100	4.5	-0.3	83	184	84	72
160	23.897	0.151	0.050	2.24	99	0	100	4.3	-0.2	82	169	86	72
170	25.405	0.151	0.050	2.23	99	-0.41	100	4.1	-0.2	81	158	85	72
180	26.914	0.151	0.050	2.24	100	-2.13	100	3.9	-0.2	81	151	83	72
190	28.422	0.151	0.050	2.25	100	-0.8	99	3.7	-0.2	80	145	83	72
200	29.933	0.151	0.050	2.23	100	0	99	3.6	-0.1	79	140	84	72
210	31.438	0.151	0.050	2.23	100	0	99	3.5	-0.1	79	137	86	72
220	32.950	0.151	0.050	2.24	100	-1.42	100	3.3	-0.2	79	134	84	72
230	34.458	0.151	0.050	2.23	100	-0.04	99	3.2	-0.1	78	133	83	71
240	35.971	0.151	0.050	2.21	100	-2.51	100	3.0	-0.2	78	131	84	71
250	37.479	0.151	0.050	2.24	100	0	99	2.9	-0.1	78	130	86	71
260	38.989	0.151	0.050	2.21	100	-2.29	99	2.7	-0.2	78	130	84	71
270	40.499	0.151	0.050	2.23	100	0	99	2.6	-0.1	77	128	83	71
280	42.009	0.151	0.050	2.24	100	-1.31	99	2.5	-0.1	77	129	83	71
290	43.522	0.151	0.050	2.22	100	-0.59	99	2.3	-0.2	77	129	85	71
300	45.030	0.151	0.050	2.23	100	-1.12	99	2.2	-0.1	77	129	86	71
310	46.543	0.151	0.050	2.23	100	-1.48	99	2.0	-0.2	77	129	84	71

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 3

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/9/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	48.050	0.151	0.050	2.23	100	-2.12	99	1.9	-0.1	77	128	83	71
330	49.564	0.151	0.050	2.24	100	0	100	1.8	-0.1	77	128	84	70
340	51.072	0.151	0.050	2.25	100	-2.24	99	1.6	-0.2	77	128	86	71
350	52.587	0.152	0.050	2.23	100	-2.34	100	1.5	-0.1	77	127	85	70
360	54.095	0.151	0.050	2.24	100	-0.93	99	1.4	-0.1	77	127	84	71
370	55.607	0.151	0.050	2.22	100	-2.4	99	1.2	-0.2	77	126	83	71
380	57.118	0.151	0.050	2.25	100	-2.48	99	1.1	-0.1	76	121	84	70
390	58.628	0.151	0.050	2.24	100	-2	99	1.0	-0.1	76	120	86	71
400	60.141	0.151	0.050	2.25	100	-1.27	99	0.9	-0.1	76	118	85	70
410	61.651	0.151	0.050	2.26	100	-2.33	99	0.7	-0.2	76	116	84	70
420	63.166	0.151	0.050	2.24	100	-1.48	99	0.6	-0.1	76	114	83	70
430	64.674	0.151	0.050	2.25	100	0	99	0.5	-0.1	76	113	84	70
440	66.189	0.151	0.050	2.24	100	-0.9	99	0.4	-0.1	76	111	85	70
450	67.697	0.151	0.050	2.24	100	-0.83	99	0.4	0	75	109	86	70
460	69.210	0.151	0.050	2.25	100	0	99	0.3	-0.1	75	106	84	70
470	70.720	0.151	0.050	2.24	100	0	99	0.2	-0.1	75	105	83	70
480	72.234	0.151	0.050	2.22	100	-2.34	99	0.2	0	75	103	83	70
490	73.744	0.151	0.050	2.25	100	-1.96	99	0.0	-0.2	75	102	84	70
Avg/Tot	73.744	0.150	0.050	2.19	97	-1.11	100			83	183	84	71.2

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 3

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/9/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	74	-1		84	0.000	6.11	2.30
10	1.437	0.144	2.30	75	-1.89	101	86	-0.070	8.82	0.68
20	2.914	0.148	2.27	78	-2.79	104	85	-0.060	9.06	0.58
30	4.388	0.147	2.26	81	-2.76	102	86	-0.060	10.02	0.83
40	5.866	0.148	2.25	84	-2.69	102	85	-0.070	12.94	0.26
50	7.347	0.148	2.25	87	-2.7	102	86	-0.070	14.06	0.53
60	8.833	0.149	2.24	89	-2.18	102	85	-0.060	14.47	1.09
70	10.323	0.149	2.23	91	-2.51	102	86	-0.060	14.06	0.60
80	11.814	0.149	2.22	93	-1.63	101	85	-0.060	13.46	0.40
90	13.305	0.149	2.24	94	-0.68	101	86	-0.050	13.12	0.27
100	14.797	0.149	2.24	95	-0.83	101	85	-0.050	13.49	0.75
110	16.295	0.150	2.23	96	-2.55	101	85	-0.040	12.78	0.44
120	17.791	0.150	2.23	96	-0.78	100	86	-0.050	11.17	0.92
130	19.288	0.150	2.22	97	-2.28	100	85	-0.040	9.14	1.22
140	20.788	0.150	2.22	97	-2.31	100	86	-0.030	8.13	1.73
150	22.288	0.150	2.24	98	-0.65	100	85	-0.030	8.13	1.37
160	23.788	0.150	2.24	98	-1.59	100	86	-0.030	8.10	1.45
170	25.290	0.150	2.24	98	-0.89	100	85	-0.030	8.32	1.28
180	26.791	0.150	2.24	99	-2.55	99	85	-0.030	8.76	1.43
190	28.292	0.150	2.26	99	-0.67	99	86	-0.020	8.44	1.20
200	29.796	0.150	2.24	99	-2.52	99	84	-0.020	8.37	1.37
210	31.296	0.150	2.25	99	-0.84	99	85	-0.020	8.63	1.53
220	32.800	0.150	2.24	99	-1.05	99	86	-0.020	8.56	1.73
230	34.303	0.150	2.24	99	-2.39	99	85	-0.020	8.67	1.57
240	35.804	0.150	2.25	99	-1.19	99	85	0.000	8.48	1.57
250	37.308	0.150	2.24	99	-0.66	99	86	-0.020	8.54	1.69
260	38.810	0.150	2.24	99	-1.02	99	85	-0.020	8.57	1.82
270	40.310	0.150	2.25	99	-0.88	99	85	-0.010	9.04	1.88
280	41.815	0.151	2.25	99	-1.15	99	86	-0.010	8.55	1.80
290	43.316	0.150	2.26	99	-0.73	99	84	-0.020	8.76	1.92
300	44.819	0.150	2.26	99	-2.37	99	86	-0.020	8.52	1.97
310	46.323	0.150	2.26	99	-2.06	99	85	-0.020	8.37	2.09

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 3

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/9/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
320	47.822	0.150	2.25	99	-2.59	99	85	-0.020	8.12	2.15
330	49.328	0.151	2.25	99	-2.75	99	86	0.000	7.92	2.17
340	50.829	0.150	2.25	98	-1.36	99	85	-0.020	7.81	2.42
350	52.331	0.150	2.26	98	-1.1	99	85	-0.020	7.58	2.46
360	53.836	0.151	2.26	98	-0.7	100	86	-0.030	7.18	2.73
370	55.338	0.150	2.26	98	-1.08	99	84	-0.020	6.59	3.13
380	56.840	0.150	2.25	98	-0.67	99	85	-0.020	7.31	2.34
390	58.346	0.151	2.26	98	-1.36	99	85	-0.020	6.93	2.50
400	59.846	0.150	2.26	98	-2.46	99	84	-0.020	6.82	2.29
410	61.352	0.151	2.26	98	-2.71	99	86	-0.010	6.62	2.31
420	62.854	0.150	2.26	98	-2.42	99	85	-0.010	6.38	2.26
430	64.356	0.150	2.26	98	-2.74	99	85	-0.010	6.18	2.60
440	65.862	0.151	2.27	98	-2.69	99	86	-0.010	5.60	2.86
450	67.363	0.150	2.26	98	-0.68	99	85	-0.020	6.05	2.41
460	68.867	0.150	2.26	98	-2.65	99	85	-0.020	6.30	2.47
470	70.371	0.150	2.27	98	-1.65	99	86	-0.020	5.85	2.55
480	71.874	0.150	2.26	98	-2.62	99	85	-0.010	6.41	2.39
490	73.380	0.151	2.26	98	-2.15	99	85	0.000	6.17	2.61
Avg/Tot	73.380	0.150	2.21	95	-1.74	100	85	-0.028	8.75	1.70

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 3

Technician: SJB

Date: 1/9/2019

Stove ΔT: 84

Elapsed Time (min)	Temperature Data (°F)						
	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	371	387	208	251	252	293.8	N/A
10	354	372	303	442	221	338.4	N/A
20	331	350	296	610	221	361.6	N/A
30	322	346	209	619	222	343.6	N/A
40	321	345	164	603	222	331.0	N/A
50	329	347	154	618	213	332.2	N/A
60	346	360	155	630	210	340.2	N/A
70	363	377	158	631	202	346.2	N/A
80	380	391	163	618	202	350.8	N/A
90	393	405	170	595	198	352.2	N/A
100	404	416	175	576	195	353.2	N/A
110	413	427	182	565	193	356.0	N/A
120	420	436	189	517	192	350.8	N/A
130	423	442	197	463	193	343.6	N/A
140	420	439	204	404	195	332.4	N/A
150	412	431	209	352	200	320.8	N/A
160	401	423	215	321	205	313.0	N/A
170	392	414	218	297	209	306.0	N/A
180	385	406	219	283	212	301.0	N/A
190	379	397	220	271	212	295.8	N/A
200	374	387	221	261	215	291.6	N/A
210	369	378	222	254	215	287.6	N/A
220	365	370	225	244	216	284.0	N/A
230	360	363	229	239	216	281.4	N/A
240	353	358	231	233	205	276.0	N/A
250	348	352	235	232	212	275.8	N/A
260	344	349	238	232	211	274.8	N/A
270	342	346	240	230	209	273.4	N/A
280	340	343	240	229	209	272.2	N/A
290	341	340	240	229	208	271.6	N/A
300	342	336	240	229	206	270.6	N/A
310	344	333	238	228	206	269.8	N/A
320	346	329	236	226	205	268.4	N/A
330	346	326	233	225	203	266.6	N/A
340	345	323	230	223	202	264.6	N/A
350	343	320	227	223	202	263.0	N/A
360	341	317	222	223	201	260.8	N/A
370	338	314	217	220	199	257.6	N/A
380	335	310	211	216	198	254.0	N/A
390	333	305	205	208	199	250.0	N/A
400	329	300	198	207	198	246.4	N/A
410	325	295	191	202	198	242.2	N/A
420	320	290	184	200	197	238.2	N/A
430	313	285	179	197	198	234.4	N/A
440	306	279	173	192	197	229.4	N/A
450	298	273	168	187	196	224.4	N/A
460	291	268	165	184	194	220.4	N/A
470	285	263	163	180	191	216.4	N/A

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP
 Model: GV300GL
 Run #: 3

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/9/2019

Stove ΔT : 84

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	279	259	161	177	189	213.0	N/A
490	273	255	160	174	187	209.8	N/A
Average	351	350	207	323	205	287	N/A

LAB SAMPLE DATA - ASTM E2515

Client: IHP

Model: GV300GL

Run #: 3

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/9/2019

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3423	125.0	116.9	8.1
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total

Total Particulate, mg:

8.1

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3424	123.8	122.2	1.6
B. Rear filter catch	Filter	3425	124.8	124.7	0.1
C. Probe catch*	Probe	10A	116826.9	116826.6	0.3
D. O-Ring catch*	O-Ring	10A	3432.8	3431.9	0.9

Sub-Total

Total Particulate, mg:

2.9

Train A Aggregate

Total Particulate, mg:

11.0

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3426	126.8	118.3	8.5
B. Rear filter catch	Filter	3427	124.1	123.9	0.2
C. Probe catch*	Probe	10B	117167.9	117167.8	0.1
D. O-Ring catch*	O-Ring	10B	3571.6	3570.6	1.0

Total Particulate, mg:

9.8

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	3428	118.9	118.9	0.0

Total Particulate, mg:

0.0

*Particulate catch that results in a negative number, is assumed to be zero for probes and O-rings, negative numbers for filters are assumed to be part of the O-Ring weight. Negative ambient filter weights are assumed to be zero.

ASTM E2780 Wood Heater Run Sheets

Client: IHP Job Number: 18-452 Tracking #: 0018
Model: GV300GL Run Number: 3 Test Date: 1/9/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Fully Closed
Targeted Burn Category: Med. Low (<1.0 kg/hr)

Preburn Notes

Time	Notes
8:33	Loaded 12.2 lbs of kindling, lit with propane torch, fan off, air fully open.
9:05	@ 2.0 lbs, added 10.0 additional lbs of kindling
9:48	@ 2.0 lbs, scooped coals and zeroed scale, loaded preburn fuel load
10:04	@ 11.5 lbs, set air to test setting, fan turned on low
12:04	@ 4.3 lbs, leveled coal bed, zeroed scale, turned fan off in preparation of fuel loading.

Test Notes

Test Burn Start Time: 12:05 Test Fuel Loaded by: 55 seconds
Door Closed: 210 seconds Air Control Set at: 300 seconds
Other Loading Notes: N/A

Time	Notes
25 min	Turned fan on to low setting, per manufacturer's instructions
60 min	Changed 1-hour filter
490 min	End of Test

Test Burn End Time: 20:15

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.93 CO (%): 4.33
Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	9:32	9:36	9:34	20:43	20:45	20:48
CO ₂	0.00	10.03	16.93	-0.03	10.15	17.11
CO	0.000	2.496	4.330	-0.005	2.529	4.387

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

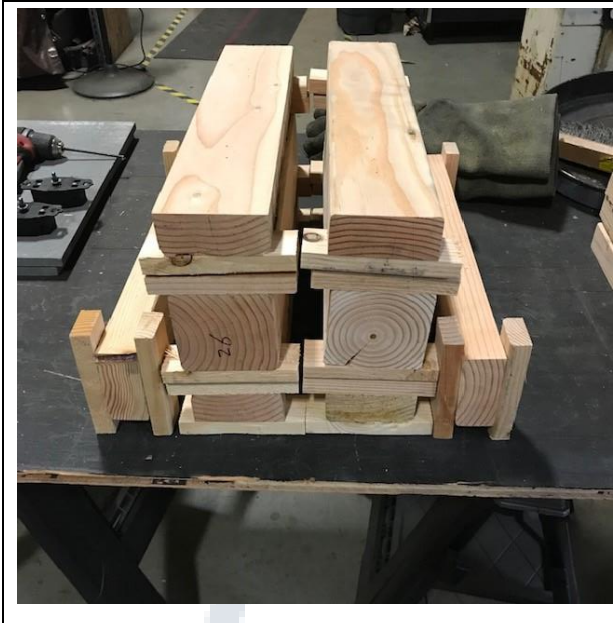
Technician Signature:  Date: 1/10/2019

ASTM E2780 Wood Heater Run Sheets

Client: IHP
Model: GV300GL

Job Number: 18-452
Run Number: 3

Tracking #: 0018
Test Date: 1/9/2019



Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: _____



Date: 1/10/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 4 Data Summary

Client:	IHP
Model:	GV300GL
Job #:	18-452
Tracking #:	0018
Test Date:	1/10/2019

A handwritten signature in black ink, appearing to be "JL", is written over a horizontal line.

Techician Signature

1/15/2019

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: IHP

Model: GV300GL

Run #: 4

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/10/2019

Burn Rate (kg/hr):	1.86
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	32.323	39.137	38.738	8.872
Average Gas Velocity in Dilution Tunnel (ft/sec)	17.3			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	11381.9			
Average Gas Meter Temperature (°F)	73.7	95.4	94.4	81.7
Total Sample Volume (dscf)	31.986	37.605	37.134	10.436
Average Tunnel Temperature (°F)	95.0			
Total Time of Test (min)	260			
Total Particulate Catch (mg)	0.0	7.7	7.0	6.2
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0002048	0.0001885	0.0005941
Total PM Emissions (g)	0.00	10.10	9.30	6.76
Particulate Emission Rate (g/hr)	0.00	2.33	2.15	6.76
Emissions Factor (g/kg)	-	1.25	1.15	-
Difference from Average Total Particulate Emissions (g)	-	0.40	0.40	-
Difference from Average Emissions Factor (g/kg)	-	0.05	0.05	-

Final Average Results	
Total Particulate Emissions (g)	9.70
Particulate Emission Rate (g/hr)	2.24
Emissions Factor (g/kg)	1.20
HHV Efficiency (%)	73.7%
LHV Efficiency (%)	79.7%
CO Emissions (g/min)	2.58

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	86.0	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 72 / Max: 75	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
Stove Surface ΔT	<126°F	62.4	OK

B415.1 Efficiency Results

Manufacturer: IHP
Model: GV300GL
Date: 01/10/19
Run: 4
Control #: 18-452
Test Duration: 260
Output Category: 3

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	73.7%	79.7%
Combustion Efficiency	93.9%	93.9%
Heat Transfer Efficiency	78.5%	84.9%

Output Rate (kJ/h)	26,738	25,364	(Btu/h)
Burn Rate (kg/h)	1.83	4.04	(lb/h)
Input (kJ/h)	36,272	34,408	(Btu/h)

Test Load Weight (dry kg)	7.93	17.49	dry lb
MC wet (%)	17.90		
MC dry (%)	21.80		
Particulate (g)	9.70		
CO (g)	671		
Test Duration (h)	4.33		

Emissions	Particulate	CO
g/MJ Output	0.08	5.79
g/kg Dry Fuel	1.22	84.53
g/h	2.24	154.77
g/min	0.04	2.58
lb/MM Btu Output	0.19	13.45

Air/Fuel Ratio (A/F)	11.22
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 4

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	20.1		2x4	16.00	21.1
2x4	16.00	22.4		2x4	16.00	21.6
2x4	16.00	18.6				
2x4	16.00	19.7				
2x4	16.00	21.5				
2x4	16.00	20.9				
2x4	16.00	19.0				
2x4	16.00	18.4				
Total Fuel Weight (lbs):		16.38	Average Moisture (%DB):		20.3	

Firebox Volume (ft³): 2.92
 Total 2x4 Crib Weight, with spacers (lbs): 12.39
 Total 4x4 Crib Weight, with spacers (lbs): 8.91
 Total Wet Fuel Weight, with spacers (lbs): 21.30

Coal Bed Range (20-25%):

Min (lbs): 4.26
 Max (lbs): 5.33

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
2x4	17.00	1.65	21.0	20.0	20.2	1.37
2x4	17.00	1.83	21.2	18.9	19.5	1.53
2x4	17.00	1.68	23.2	23.2	22.6	1.37
2x4	17.00	1.65	19.3	19.9	19.0	1.38
2x4	17.00	1.63	23.8	23.8	25.1	1.31
2x4	17.00	1.72	23.8	23.8	23.8	1.39
4x4	17.00	4.19	22.5	23.8	23.8	3.40
4x4	17.00	3.88	20.4	20.5	20.2	3.22
Total Dry Weight, no spacers (lbs):						14.97
Total Dry Weight, with spacers (lbs):						17.78

Spacer Moisture Readings (%DB)							
9.0	10.9	11.0	7.8	8.5	8.7	8.1	
9.2	8.3	7.6	9.2	7.8	6.8	9.3	
9.9	8.3	10.4	9.3	8.8	9.4	9.3	
9.3	8.8	8.6	9.3	9.5	10.9	7.1	

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	27.2	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	7.29	OK
2x4 Fuel Mix	35 - 65 % of total weight	58%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: IHP	Job #: 18-452
Model: GV300GL	Tracking #: 0018
Run #: 4	Technician: SJB
Test Start Time: 10:34	Date: 1/10/2019

Total Sampling Time (min): 260
Recording Interval (min): 10

Meter Box γ Factor: 1.004 (A)
Meter Box γ Factor: 1.000 (B)
Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
Smoke Capture Check (%): 100%
Date Flue Pipe Last Cleaned: 1/4/2019

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.00	29.94	29.97
Relative Humidity (%)	36.6	28.3	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		32.323	ft ³

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-14 in. Hg
(B)	0.000	cfm @	-13 in. Hg
(Ambient)	0.001	cfm @	-14 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.056	102
2	0.068	102
3	0.072	102
4	0.054	102
5	0.060	101
6	0.072	101
7	0.068	101
8	0.054	101
Center	0.080	102

Dilution Tunnel H₂O: 2.00 percent
Tunnel Diameter: 6 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: 0.1963 ft²

V_{strav} : 17.35 ft/sec
 V_{scent} : 19.32 ft/sec
 F_p : 0.898 [ratio]

Initial Tunnel Flow: 186.0 scf/min

Static Pressure: -0.240 in. H₂O

TEST FUEL PROPERTIES

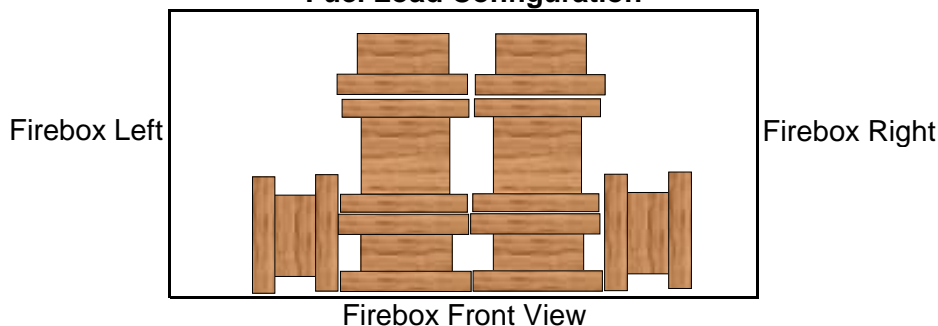
Default Fuel Values

Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	21.8

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 4

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Recording Interval (min): 10
 Run Time (min): 70

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	15.0	-0.087	344	427	358	898	124	430.2	710	66
10	11.7	-0.081	366	487	263	796	161	414.6	540	65
20	9.1	-0.080	390	547	210	641	189	395.4	460	65
30	7.1	-0.066	409	573	204	605	202	398.6	431	65
40	5.5	-0.074	428	574	204	586	209	400.2	402	65
50	5.6	-0.079	448	576	216	587	216	408.6	500	65
60	4.9	-0.051	461	568	220	468	228	389.0	316	65
70	4.6	-0.033	451	538	211	341	235	355.2	236	65

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 4

Technician: SJB

Date: 1/10/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.001		0.080	0.00	73	-0.2		21.3		104	263	85	72
10	1.444	0.144	0.080	2.30	75	-2.53	101	19.4	-1.9	117	506	85	72
20	2.923	0.148	0.080	2.27	78	0	104	16.8	-2.6	123	538	84	72
30	4.400	0.148	0.080	2.25	82	-1.76	102	14.3	-2.5	116	478	83	73
40	5.891	0.149	0.080	2.26	85	0	103	12.0	-2.3	113	453	83	74
50	7.382	0.149	0.080	2.26	88	-2.44	102	10.1	-1.9	111	434	84	73
60	8.873	0.149	0.080	2.26	91	-0.42	101	8.4	-1.7	107	410	85	74
70	10.381	0.151	0.080	2.28	93	-1.65	102	7.0	-1.4	105	397	84	74
80	11.886	0.151	0.080	2.27	95	-1.28	101	5.9	-1.1	103	378	85	74
90	13.391	0.151	0.080	2.26	97	-1.53	100	4.9	-1	99	347	86	74
100	14.903	0.151	0.080	2.27	98	0	100	4.2	-0.7	97	323	85	74
110	16.412	0.151	0.080	2.26	99	-1.09	100	3.6	-0.6	94	287	84	75
120	17.923	0.151	0.080	2.26	99	0	99	3.2	-0.4	92	262	84	75
130	19.434	0.151	0.080	2.26	100	-0.14	99	2.9	-0.3	90	240	83	75
140	20.946	0.151	0.080	2.27	101	-1.66	99	2.6	-0.3	88	220	83	74
150	22.460	0.151	0.080	2.28	101	-2.19	99	2.3	-0.3	87	214	83	74
160	23.973	0.151	0.080	2.28	101	-0.57	99	2.1	-0.2	86	203	83	74
170	25.489	0.152	0.080	2.26	101	-2.23	99	1.9	-0.2	85	200	83	74
180	27.003	0.151	0.080	2.28	102	-2.41	98	1.6	-0.3	85	201	83	74
190	28.520	0.152	0.080	2.29	102	0	99	1.3	-0.3	85	200	85	74
200	30.035	0.152	0.080	2.27	102	-0.9	98	1.1	-0.2	84	192	85	74
210	31.551	0.152	0.080	2.27	102	-2.48	98	1.0	-0.1	83	184	85	73
220	33.067	0.152	0.080	2.25	102	-2.49	98	0.8	-0.2	83	180	85	74
230	34.585	0.152	0.080	2.26	102	-2.43	99	0.6	-0.2	83	177	85	74
240	36.103	0.152	0.080	2.26	102	-1.17	98	0.4	-0.2	82	177	84	74
250	37.619	0.152	0.080	2.28	102	0	98	0.2	-0.2	82	177	83	73
260	39.137	0.152	0.080	2.24	102	-0.01	98	0.0	-0.2	82	179	83	73
Avg/Tot	39.137	0.151	0.080	2.18	95	-1.17	100			95	290	84	73.7

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 4

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.002		0.00	72	-1		85	0.000	6.62	1.47
10	1.430	0.143	2.32	74	-0.72	101	85	-0.080	12.62	0.59
20	2.896	0.147	2.27	77	-2.8	104	85	-0.090	15.16	0.90
30	4.364	0.147	2.27	81	-2.82	103	86	-0.070	14.77	1.71
40	5.836	0.147	2.24	84	-1.96	102	85	-0.070	14.64	1.56
50	7.311	0.148	2.25	88	-2.81	102	86	-0.070	14.26	1.23
60	8.793	0.148	2.27	90	-2.62	101	85	-0.060	13.48	0.87
70	10.279	0.149	2.27	92	-2.54	101	86	-0.070	13.04	0.57
80	11.767	0.149	2.25	94	-2.78	101	85	-0.060	12.78	0.48
90	13.257	0.149	2.26	96	-1.41	100	86	-0.060	11.87	0.41
100	14.748	0.149	2.24	97	-1.29	100	85	-0.070	11.59	0.28
110	16.244	0.150	2.26	98	-2.78	100	85	-0.040	9.82	0.79
120	17.741	0.150	2.25	98	-2.41	100	85	-0.040	9.09	1.00
130	19.235	0.149	2.25	99	-0.64	99	86	-0.030	7.59	1.47
140	20.733	0.150	2.24	100	-2.33	99	85	-0.040	7.73	1.29
150	22.234	0.150	2.26	100	-0.78	99	86	-0.040	7.85	1.18
160	23.731	0.150	2.26	100	-0.72	99	85	-0.040	7.94	1.14
170	25.232	0.150	2.24	101	-2.83	99	85	-0.040	8.24	1.07
180	26.734	0.150	2.25	101	-2.06	99	86	-0.030	8.61	0.98
190	28.231	0.150	2.24	101	-2.81	98	85	-0.030	8.14	0.87
200	29.734	0.150	2.25	101	-2.73	99	86	-0.030	6.79	1.12
210	31.234	0.150	2.24	101	-1.13	98	85	-0.030	6.94	1.16
220	32.734	0.150	2.25	101	-2.68	98	85	-0.030	7.09	1.04
230	34.237	0.150	2.25	101	-0.93	99	86	-0.030	7.01	1.18
240	35.736	0.150	2.26	101	-2.23	98	85	-0.030	7.12	1.24
250	37.236	0.150	2.25	101	-1.3	98	86	-0.030	7.12	1.17
260	38.738	0.150	2.25	101	-1.69	98	85	-0.030	7.37	1.06
Avg/Tot	38.738	0.149	2.17	94	-1.96	100	85	-0.046	9.83	1.03

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 4

Technician: SJB

Date: 1/10/2019

Stove ΔT : 62

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	438	513	217	296	233	339.4	N/A
10	412	474	226	529	216	371.4	N/A
20	394	452	161	677	221	381.0	N/A
30	396	455	148	661	221	376.2	N/A
40	406	469	144	636	218	374.6	N/A
50	421	488	145	608	213	375.0	N/A
60	437	507	149	576	212	376.2	N/A
70	451	522	158	560	210	380.2	N/A
80	465	531	169	533	209	381.4	N/A
90	476	535	176	491	209	377.4	N/A
100	484	530	181	446	210	370.2	N/A
110	484	521	186	401	214	361.2	N/A
120	473	510	190	356	217	349.2	N/A
130	457	496	192	318	221	336.8	N/A
140	436	479	191	286	223	323.0	N/A
150	420	464	195	270	221	314.0	N/A
160	409	453	206	258	219	309.0	N/A
170	400	444	218	250	217	305.8	N/A
180	395	438	233	249	213	305.6	N/A
190	394	436	245	249	210	306.8	N/A
200	392	436	237	242	209	303.2	N/A
210	385	429	224	230	210	295.6	N/A
220	376	419	218	224	207	288.8	N/A
230	368	409	214	219	207	283.4	N/A
240	362	402	215	217	205	280.2	N/A
250	358	396	215	216	203	277.6	N/A
260	358	391	216	219	201	277.0	N/A
Average	417	467	195	378	214	334	N/A

LAB SAMPLE DATA - ASTM E2515

Client: IHP

Model: GV300GL

Run #: 4

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/10/2019

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3429	130.4	124.2	6.2
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total

Total Particulate, mg:

6.2

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3430	118.3	117.6	0.7
B. Rear filter catch	Filter	3431	117.3	117.4	-0.1
C. Probe catch*	Probe	11A	117035.2	117035.0	0.2
D. O-Ring catch*	O-Ring	11A	3425.2	3424.5	0.7

Sub-Total

Total Particulate, mg:

1.5

Train A Aggregate

Total Particulate, mg:

7.7

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3432	130.1	124.8	5.3
B. Rear filter catch	Filter	3433	124.1	123.8	0.3
C. Probe catch*	Probe	11B	116674.2	116674.1	0.1
D. O-Ring catch*	O-Ring	11B	4235.8	4234.5	1.3

Total Particulate, mg:

7.0

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	3434	117.9	117.9	0.0

Total Particulate, mg:

0.0

*Particulate catch that results in a negative number, is assumed to be zero for probes and O-rings, negative numbers for filters are assumed to be part of the O-Ring weight. Negative ambient filter weights are assumed to be zero.

ASTM E2780 Wood Heater Run Sheets

Client: IHP Job Number: 18-452 Tracking #: 0018
 Model: GV300GL Run Number: 4 Test Date: 1/10/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Open 0.75" from fully closed
 Targeted Burn Category: Med. High

Preburn Notes

Time	Notes
8:35	Loaded 12.0 lbs of kindling, lit with propane torch, fan off, air fully open.
9:09	@ 2.0 lbs, scooped coals and zeroed scale, loaded preburn fuel load
9:18	@ 15.0 lbs, set air to test setting, fan turned on high
10:03	@ 5.2 lbs, stirred coals, added 2.0 lbs of fuel to ensure coal bed will be within range at 60 minute mark
10:33	@ 4.6 lbs, leveled coal bed, zeroed scale, turned fan off in preparation of fuel loading.

Test Notes

Test Burn Start Time: 10:34 Test Fuel Loaded by: 55 seconds
 Door Closed: 150 seconds Air Control Set at: 300 seconds
 Other Loading Notes: N/A

Time	Notes
5 min	Turned fan on to high setting, per manufacturer's instructions
60 min	Changed 1-hour filter
260 min	End of Test

Test Burn End Time: 14:54

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.93 CO (%): 4.33
 Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	9:33	9:38	9:35	15:55	15:53	15:58
CO ₂	0.00	10.07	16.93	0.01	10.02	16.87
CO	0.000	2.502	4.330	-0.033	2.446	4.255

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

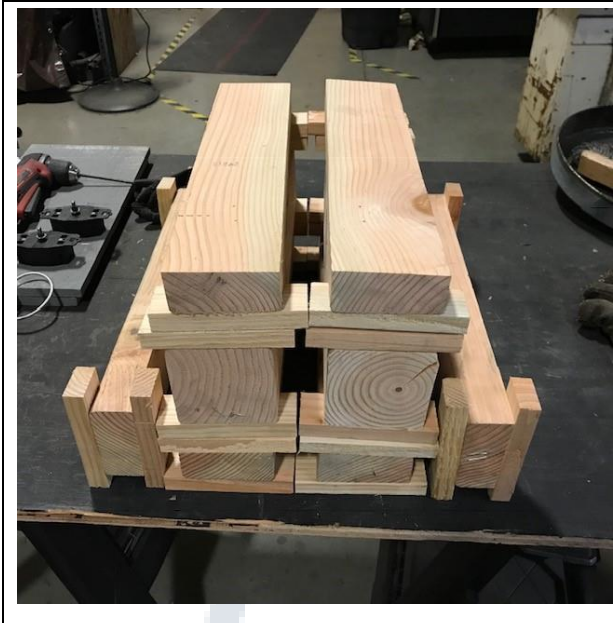
Technician Signature:  Date: 1/11/2019

ASTM E2780 Wood Heater Run Sheets

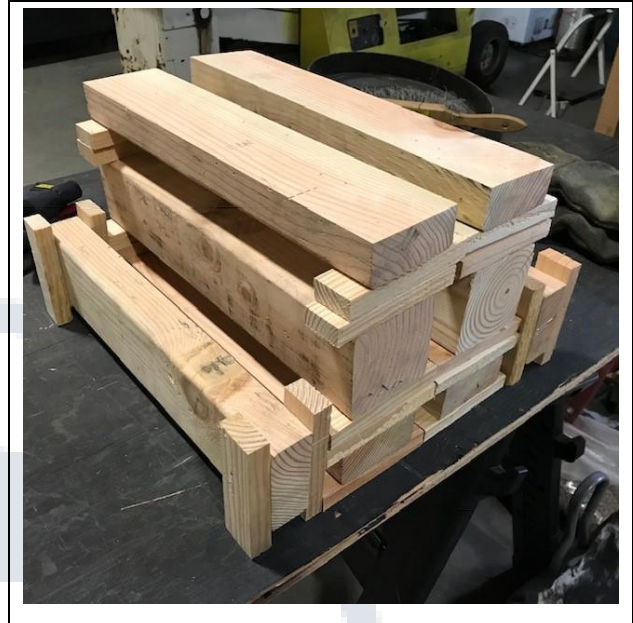
Client: IHP
Model: GV300GL

Job Number: 18-452
Run Number: 4

Tracking #: 0018
Test Date: 1/10/2019



Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: _____



Date: 1/11/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 5 Data Summary

Client:	IHP
Model:	GV300GL
Job #:	18-452
Tracking #:	0018
Test Date:	1/10/2019

A handwritten signature in dark ink, appearing to be "JL" or similar, written over a horizontal line.

Techician Signature

1/15/2019

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: IHP

Model: GV300GL

Run #: 5

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/10/2019

Burn Rate (kg/hr):	1.08
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	56.370	67.983	67.518	8.932
Average Gas Velocity in Dilution Tunnel (ft/sec)	14.4			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9679.6			
Average Gas Meter Temperature (°F)	72.4	98.5	97.8	88.7
Total Sample Volume (dscf)	55.766	64.792	64.169	10.498
Average Tunnel Temperature (°F)	84.2			
Total Time of Test (min)	450			
Total Particulate Catch (mg)	0.0	8.5	7.6	6.6
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0001312	0.0001184	0.0006287
Total PM Emissions (g)	0.00	9.52	8.60	6.09
Particulate Emission Rate (g/hr)	0.00	1.27	1.15	6.09
Emissions Factor (g/kg)	-	1.18	1.06	-
Difference from Average Total Particulate Emissions (g)	-	0.46	0.46	-
Difference from Average Emissions Factor (g/kg)	-	0.06	0.06	-

Final Average Results	
Total Particulate Emissions (g)	9.06
Particulate Emission Rate (g/hr)	1.21
Emissions Factor (g/kg)	1.12
HHV Efficiency (%)	74.6%
LHV Efficiency (%)	80.6%
CO Emissions (g/min)	1.90

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	87.0	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 69 / Max: 76	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Stove Surface ΔT	<126°F	69.6	OK

B415.1 Efficiency Results

Manufacturer: IHP
Model: GV300GL
Date: 01/10/19
Run: 5
Control #: 18-452
Test Duration: 450
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	74.6%	80.6%
Combustion Efficiency	92.2%	92.2%
Heat Transfer Efficiency	80.9%	87.4%

Output Rate (kJ/h)	15,639	14,835	(Btu/h)
Burn Rate (kg/h)	1.06	2.33	(lb/h)
Input (kJ/h)	20,977	19,899	(Btu/h)

Test Load Weight (dry kg)	7.94	17.50	dry lb
MC wet (%)	18.59		
MC dry (%)	22.83		
Particulate (g)	9.06		
CO (g)	857		
Test Duration (h)	7.50		

Emissions	Particulate	CO
g/MJ Output	0.08	7.31
g/kg Dry Fuel	1.14	107.89
g/h	1.21	114.24
g/min	0.02	1.90
lb/MM Btu Output	0.18	16.98

Air/Fuel Ratio (A/F)	11.70
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 5

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	18.6		2x4	16.00	20.2
2x4	16.00	19.3		2x4	16.00	21.5
2x4	16.00	19.9				
2x4	16.00	19.0				
2x4	16.00	19.3				
2x4	16.00	18.7				
2x4	16.00	19.3				
2x4	16.00	22.5				
Total Fuel Weight (lbs):		15.65	Average Moisture (%DB):		19.8	

Firebox Volume (ft³): 2.92
 Total 2x4 Crib Weight, with spacers (lbs): 12.63
 Total 4x4 Crib Weight, with spacers (lbs): 8.91
 Total Wet Fuel Weight, with spacers (lbs): 21.54

Coal Bed Range (20-25%):

Min (lbs): 4.31
 Max (lbs): 5.39

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
2x4	17.00	1.68	23.8	23.3	22.8	1.36
2x4	17.00	1.76	23.3	22.8	22.8	1.43
2x4	17.00	2.05	22.5	23.2	24.0	1.66
2x4	17.00	1.54	21.9	20.0	21.7	1.27
2x4	17.00	1.70	24.5	24.7	24.9	1.36
2x4	17.00	1.72	21.1	22.3	20.8	1.42
4x4	17.00	3.99	24.6	21.9	23.3	3.24
4x4	17.00	4.12	23.3	22.0	22.4	3.36
Total Dry Weight, no spacers (lbs):						15.11
Total Dry Weight, with spacers (lbs):						17.84

Spacer Moisture Readings (%DB)							
8.8	7.4	8.8	8.8	11.4	10.1	9.6	
9.5	9.8	8.8	8.9	10.6	9.4	8.4	
9.5	9.4	7.7	7.6	9.3	8.8	8.0	
10.2	11.0	9.5	9.2	9.4	8.8	7.9	

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	27.4	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	7.38	OK
2x4 Fuel Mix	35 - 65 % of total weight	59%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: IHP
 Model: GV300GL
 Run #: 5
 Test Start Time: 17:01

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Total Sampling Time (min): 450
 Recording Interval (min): 10

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.000 (B)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 1/4/2019

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.91	29.87	29.89
Relative Humidity (%)	28.3	24.9	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:	56.370		ft ³

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-13	in. Hg
(B)	0.000	cfm @	-13	in. Hg
(Ambient)	0.001	cfm @	-14	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.042	87
2	0.050	87
3	0.048	87
4	0.042	87
5	0.044	86
6	0.048	86
7	0.050	86
8	0.040	86
Center	0.050	87

Dilution Tunnel H₂O: 2.00 percent
 Tunnel Diameter: 6 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: 0.1963 ft²

V_{strav} : 14.45 ft/sec
 V_{scent} : 15.09 ft/sec
 F_p : 0.958 [ratio]

Initial Tunnel Flow: 160.2 scf/min

Static Pressure: -0.160 in. H₂O

TEST FUEL PROPERTIES

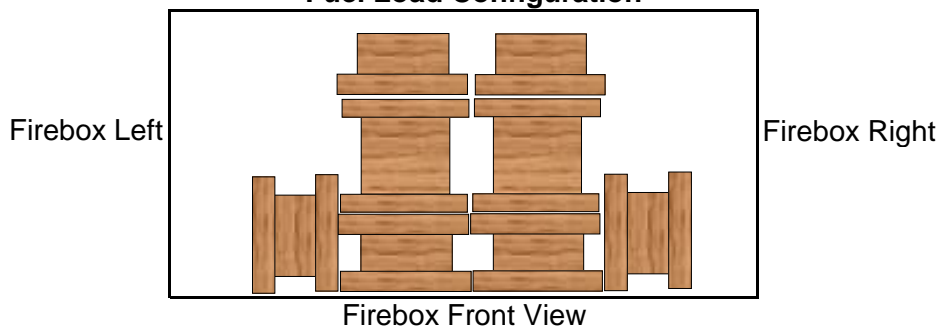
Default Fuel Values

Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	22.8

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 5

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Recording Interval (min): 10
 Run Time (min): 80

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	11.1	-0.076	406	464	439	947	178	486.8	715	68
10	9.5	-0.075	424	509	305	732	226	439.2	384	68
20	7.8	-0.065	419	514	271	674	232	422.0	389	69
30	6.0	-0.064	424	507	253	666	226	415.2	366	69
40	5.2	-0.052	432	496	245	614	221	401.6	301	68
50	4.8	-0.044	429	480	240	467	215	366.2	228	68
60	4.6	-0.027	415	455	231	366	220	337.4	193	68
70	4.4	-0.032	402	431	222	312	239	321.2	172	67
80	4.3	-0.021	391	410	214	281	253	309.8	160	67

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 5

Technician: SJB

Date: 1/10/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.050	0.03	84	-0.1		21.5		103	223	84	75
10	1.481	0.148	0.050	2.30	84	-2.52	103	19.7	-1.8	113	420	83	75
20	2.968	0.149	0.050	2.24	86	-0.48	103	18.0	-1.7	108	396	86	75
30	4.455	0.149	0.050	2.23	88	0	102	16.7	-1.3	100	332	84	75
40	5.947	0.149	0.050	2.23	91	-0.55	102	15.2	-1.5	102	355	83	75
50	7.440	0.149	0.050	2.24	93	-1.73	101	13.6	-1.6	101	355	84	75
60	8.932	0.149	0.050	2.23	95	0	101	12.0	-1.6	101	352	85	75
70	10.447	0.152	0.050	2.25	97	-2.55	102	10.7	-1.3	100	349	86	75
80	11.952	0.151	0.050	2.26	98	-2.39	101	9.5	-1.2	98	332	86	75
90	13.459	0.151	0.050	2.26	99	-1.34	101	8.4	-1.1	96	310	85	76
100	14.969	0.151	0.050	2.23	100	-2.57	101	7.5	-0.9	95	299	84	75
110	16.478	0.151	0.050	2.25	101	-0.67	100	6.6	-0.9	93	291	84	75
120	17.991	0.151	0.050	2.25	101	0	100	5.8	-0.8	92	272	84	75
130	19.501	0.151	0.050	2.25	101	-2.54	100	5.2	-0.6	89	243	83	75
140	21.016	0.152	0.050	2.27	102	-0.44	100	4.7	-0.5	87	218	83	75
150	22.527	0.151	0.050	2.26	102	0	100	4.3	-0.4	86	199	83	75
160	24.044	0.152	0.050	2.26	102	0	100	4.1	-0.2	84	180	83	74
170	25.556	0.151	0.050	2.25	102	-2.58	99	3.9	-0.2	83	170	83	74
180	27.074	0.152	0.050	2.25	102	0	100	3.7	-0.2	82	162	84	73
190	28.586	0.151	0.050	2.27	102	-2.54	99	3.5	-0.2	81	156	85	73
200	30.104	0.152	0.050	2.26	102	-2.22	99	3.4	-0.1	80	150	86	73
210	31.617	0.151	0.050	2.26	102	-0.67	99	3.2	-0.2	80	145	86	73
220	33.136	0.152	0.050	2.26	102	-2.11	99	3.1	-0.1	79	141	85	73
230	34.650	0.151	0.050	2.28	102	-2.43	99	2.9	-0.2	79	139	83	72
240	36.169	0.152	0.050	2.26	101	-0.64	100	2.9	0	78	136	83	72
250	37.682	0.151	0.050	2.27	101	-1.49	99	2.7	-0.2	78	134	85	72
260	39.200	0.152	0.050	2.24	101	0	99	2.5	-0.2	77	133	86	72
270	40.714	0.151	0.050	2.26	101	-2.53	99	2.4	-0.1	77	130	85	72
280	42.232	0.152	0.050	2.28	101	-1.12	99	2.2	-0.2	77	129	84	71
290	43.746	0.151	0.050	2.28	101	-1.24	99	2.1	-0.1	76	128	83	71
300	45.263	0.152	0.050	2.27	100	-2.58	99	2.0	-0.1	76	127	85	71
310	46.778	0.152	0.050	2.27	100	-0.26	99	1.9	-0.1	76	125	87	71

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHPJob #: 18-452Model: GV300GLTracking #: 0018Run #: 5Technician: SJBDate: 1/10/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	48.295	0.152	0.050	2.27	100	-2.21	99	1.8	-0.1	76	126	86	71
330	49.810	0.152	0.050	2.27	100	-0.18	99	1.6	-0.2	76	126	84	70
340	51.326	0.152	0.050	2.26	100	-1.77	99	1.4	-0.2	75	126	83	70
350	52.841	0.152	0.050	2.26	99	-1.41	99	1.3	-0.1	75	125	84	70
360	54.357	0.152	0.050	2.28	99	-1.16	99	1.1	-0.2	75	126	85	70
370	55.872	0.152	0.050	2.26	99	0	99	1.0	-0.1	75	126	86	70
380	57.386	0.151	0.050	2.26	99	-1.05	99	0.8	-0.2	75	128	86	70
390	58.899	0.151	0.050	2.27	99	-0.04	99	0.7	-0.1	75	128	84	69
400	60.413	0.151	0.050	2.25	99	0	99	0.5	-0.2	75	128	83	69
410	61.925	0.151	0.050	2.24	99	-0.09	99	0.4	-0.1	74	126	83	69
420	63.441	0.152	0.050	2.27	98	0	99	0.3	-0.1	74	125	83	69
430	64.954	0.151	0.050	2.27	98	-1.17	99	0.2	-0.1	74	124	85	69
440	66.470	0.152	0.050	2.25	98	-0.83	99	0.1	-0.1	74	121	85	69
450	67.983	0.151	0.050	2.27	98	-2.28	99	0.0	-0.1	74	120	86	69
Avg/Tot	67.983	0.151	0.050	2.21	98	-1.14	100			84	195	84	72.4

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 5

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	83	-1		85	0.000	6.93	1.33
10	1.464	0.146	2.30	83	-1.92	103	86	-0.070	10.68	0.53
20	2.947	0.148	2.27	85	-0.73	103	86	-0.070	10.92	0.50
30	4.430	0.148	2.27	88	-0.77	102	86	-0.060	9.96	0.67
40	5.917	0.149	2.26	91	-2.78	102	85	-0.060	13.94	1.55
50	7.408	0.149	2.26	93	-2.71	102	86	-0.060	13.62	1.26
60	8.900	0.149	2.25	95	-2.12	101	85	-0.070	13.93	0.88
70	10.392	0.149	2.25	96	-2.63	101	86	-0.060	13.99	0.86
80	11.887	0.150	2.26	98	-2.07	101	85	-0.050	13.63	0.39
90	13.387	0.150	2.26	99	-2.46	101	85	-0.050	12.40	0.58
100	14.884	0.150	2.26	99	-1.39	101	86	-0.070	12.41	0.63
110	16.382	0.150	2.25	100	-2.6	100	85	-0.050	12.36	0.50
120	17.885	0.150	2.23	100	-2.63	100	86	-0.050	11.57	0.65
130	19.383	0.150	2.27	101	-2.54	100	85	-0.040	9.50	1.07
140	20.885	0.150	2.25	101	-2.68	100	86	-0.040	8.51	1.57
150	22.389	0.150	2.27	101	-2.73	100	86	-0.040	8.50	1.33
160	23.890	0.150	2.26	101	-2.41	99	85	-0.040	8.00	1.35
170	25.395	0.151	2.26	101	-2.67	100	86	-0.040	7.95	1.52
180	26.899	0.150	2.25	101	-2.6	99	85	-0.030	7.51	1.78
190	28.401	0.150	2.26	101	-2.51	99	85	-0.030	7.32	2.04
200	29.908	0.151	2.26	101	-0.82	99	86	-0.020	7.14	2.28
210	31.410	0.150	2.27	101	-2.75	99	84	-0.030	7.27	1.99
220	32.917	0.151	2.25	101	-2.77	99	85	-0.020	7.74	1.95
230	34.421	0.150	2.25	101	-1.67	99	86	-0.030	7.48	2.25
240	35.925	0.150	2.27	101	-2.28	99	85	-0.030	7.21	2.43
250	37.433	0.151	2.26	101	-0.64	99	85	-0.010	7.59	2.33
260	38.935	0.150	2.27	101	-2.74	99	86	-0.020	6.92	2.77
270	40.442	0.151	2.27	100	-2.01	99	85	-0.020	7.02	2.55
280	41.946	0.150	2.27	100	-0.67	99	85	-0.020	6.98	2.62
290	43.451	0.151	2.26	100	-2.75	99	86	-0.030	6.94	2.47
300	44.958	0.151	2.27	100	-1.44	99	85	-0.020	6.77	2.53
310	46.460	0.150	2.27	100	-0.88	99	84	-0.040	6.60	2.48

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 5

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/10/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
320	47.966	0.151	2.27	99	-2.61	99	86	-0.010	6.99	2.63
330	49.471	0.151	2.27	99	-2.71	99	85	-0.020	7.07	2.93
340	50.974	0.150	2.28	99	-0.69	99	85	-0.020	7.12	2.87
350	52.480	0.151	2.27	99	-2.69	99	86	-0.020	7.45	2.47
360	53.984	0.150	2.27	99	-1.22	99	84	-0.010	7.24	2.28
370	55.488	0.150	2.27	98	-2.69	99	85	-0.010	7.75	1.83
380	56.993	0.151	2.27	98	-2.72	99	85	-0.020	7.95	1.77
390	58.495	0.150	2.27	98	-1.27	99	84	-0.010	7.45	1.87
400	60.000	0.151	2.29	98	-2.65	99	86	-0.020	7.28	2.02
410	61.504	0.150	2.27	98	-2	99	84	-0.020	7.02	1.76
420	63.006	0.150	2.26	98	-2.79	99	86	-0.020	6.05	1.77
430	64.512	0.151	2.27	98	-1.19	99	84	-0.010	6.02	2.05
440	66.013	0.150	2.28	97	-0.82	99	85	-0.020	6.09	2.13
450	67.518	0.151	2.27	97	-1.14	100	86	-0.010	6.32	2.06
Avg/Tot	67.518	0.150	2.22	98	-2.01	100	85	-0.032	8.63	1.74

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 5

Technician: SJB

Date: 1/10/2019

Stove ΔT: 70

Elapsed Time (min)	Temperature Data (°F)						Catalyst Exit
	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	
0	389	406	216	262	254	305.4	N/A
10	381	392	303	539	227	368.4	N/A
20	364	380	227	641	240	370.4	N/A
30	353	374	178	585	242	346.4	N/A
40	342	364	161	594	234	339.0	N/A
50	351	367	161	621	227	345.4	N/A
60	366	379	166	631	218	352.0	N/A
70	381	393	173	634	210	358.2	N/A
80	396	406	181	621	208	362.4	N/A
90	407	420	190	591	204	362.4	N/A
100	414	430	197	562	202	361.0	N/A
110	420	436	204	556	201	363.4	N/A
120	426	440	209	525	200	360.0	N/A
130	431	441	214	478	201	353.0	N/A
140	429	438	218	415	203	340.6	N/A
150	426	433	223	372	205	331.8	N/A
160	418	430	226	338	208	324.0	N/A
170	406	426	227	313	209	316.2	N/A
180	396	418	227	296	211	309.6	N/A
190	389	408	224	282	211	302.8	N/A
200	382	396	221	270	210	295.8	N/A
210	375	384	218	260	211	289.6	N/A
220	369	374	214	253	210	284.0	N/A
230	363	365	210	248	209	279.0	N/A
240	359	357	208	242	206	274.4	N/A
250	354	350	205	237	205	270.2	N/A
260	350	343	203	233	203	266.4	N/A
270	347	335	201	229	201	262.6	N/A
280	344	329	198	226	200	259.4	N/A
290	341	323	197	223	199	256.6	N/A
300	338	318	195	220	198	253.8	N/A
310	334	314	194	217	197	251.2	N/A
320	330	312	194	216	196	249.6	N/A
330	326	312	194	216	193	248.2	N/A
340	325	312	196	215	191	247.8	N/A
350	324	312	199	215	189	247.8	N/A
360	323	310	202	215	188	247.6	N/A
370	323	308	204	216	187	247.6	N/A
380	324	307	206	217	185	247.8	N/A
390	325	306	206	216	184	247.4	N/A
400	327	305	208	216	184	248.0	N/A
410	327	304	208	216	183	247.6	N/A
420	326	303	205	214	183	246.2	N/A
430	322	300	199	211	183	243.0	N/A
440	316	296	192	207	185	239.2	N/A
450	310	293	188	203	185	235.8	N/A
Average	362	362	204	341	204	295	N/A

LAB SAMPLE DATA - ASTM E2515

Client: IHP

Model: GV300GL

Run #: 5

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/10/2019

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3435	130.8	124.2	6.6
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total

Total Particulate, mg:

6.6

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3436	118.5	117.2	1.3
B. Rear filter catch	Filter	3437	123.9	123.8	0.1
C. Probe catch*	Probe	12A	116888.6	116888.3	0.3
D. O-Ring catch*	O-Ring	12A	3432.7	3432.5	0.2

Sub-Total

Total Particulate, mg:

1.9

Train A Aggregate

Total Particulate, mg:

8.5

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3438	124.5	118.1	6.4
B. Rear filter catch	Filter	3439	123.1	122.8	0.3
C. Probe catch*	Probe	12B	117052.2	117051.9	0.3
D. O-Ring catch*	O-Ring	12B	3405.1	3404.5	0.6

Total Particulate, mg:

7.6

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	3440	119.2	119.2	0.0

Total Particulate, mg:

0.0

*Particulate catch that results in a negative number, is assumed to be zero for probes and O-rings, negative numbers for filters are assumed to be part of the O-Ring weight. Negative ambient filter weights are assumed to be zero.

ASTM E2780 Wood Heater Run Sheets

Client: IHP Job Number: 18-452 Tracking #: 0018
Model: GV300GL Run Number: 5 Test Date: 1/10/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): 1/16" open from fully closed

Targeted Burn Category: Med. Low

Preburn Notes

Time	Notes
15:03	Loaded 8.2 lbs of kindling, lit with propane torch, fan off, air fully open.
15:25	@ 2.3 lbs, scooped coals and zeroed scale, loaded preburn fuel load
15:39	@ 11.3 lbs, set air to test setting, fan turned on low
17:00	@ 4.3 lbs, leveled coal bed, zeroed scale, turned fan off in preparation of fuel loading.

Test Notes

Test Burn Start Time: 17:01 Test Fuel Loaded by: 55 seconds
Door Closed: 220 seconds Air Control Set at: 300 seconds
Other Loading Notes: N/A

Time	Notes
15 min	Turned fan on to low setting, per manufacturer's instructions
60 min	Changed 1-hour filter
450 min	End of Test

Test Burn End Time: 1/11/19 - 00:31

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.93 CO (%): 4.33
Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	16:01	16:03	16:00	1/11 - 6:34	1/11 - 6:32	1/11 - 6:36
CO ₂	0.00	9.99	16.93	-0.03	9.96	16.80
CO	0.000	2.521	4.330	0.031	2.577	4.413

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

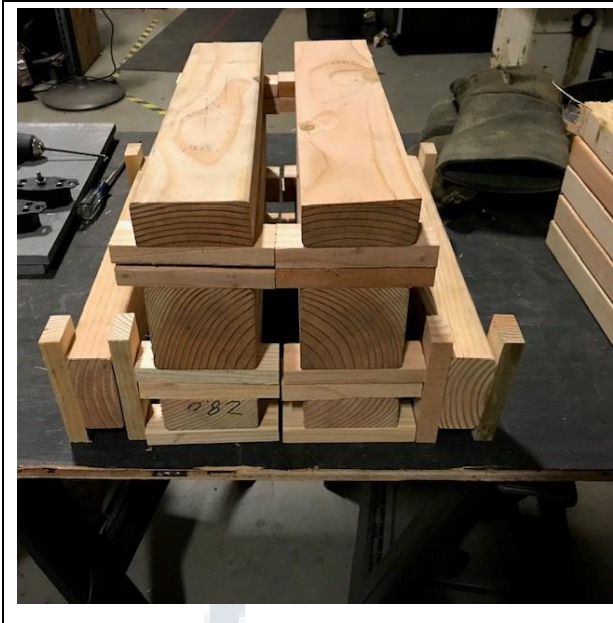
Technician Signature:  Date: 1/11/2019

ASTM E2780 Wood Heater Run Sheets

Client: IHP
Model: GV300GL

Job Number: 18-452
Run Number: 5

Tracking #: 0018
Test Date: 1/10/2019



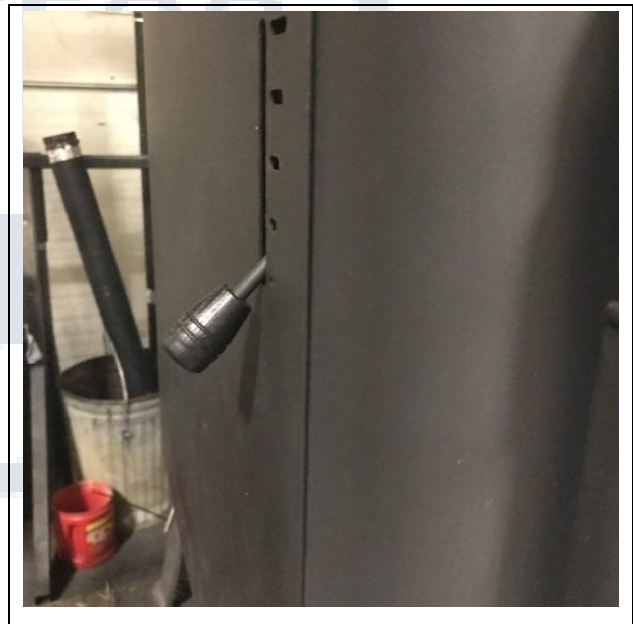
Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: _____

Date: 1/11/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 6 Data Summary

Client:	IHP
Model:	GV300GL
Job #:	18-452
Tracking #:	0018
Test Date:	1/11/2019

A handwritten signature in black ink, appearing to be "RZ", is written over a horizontal line.

Techician Signature

1/15/2019

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: IHP

Model: GV300GL

Run #: 6

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/11/2019

Burn Rate (kg/hr):	3.10
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	20.063	23.893	23.686	8.817
Average Gas Velocity in Dilution Tunnel (ft/sec)	19.4			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	12060.4			
Average Gas Meter Temperature (°F)	74.1	91.6	90.6	81.4
Total Sample Volume (dscf)	19.756	23.013	22.764	10.334
Average Tunnel Temperature (°F)	124.9			
Total Time of Test (min)	160			
Total Particulate Catch (mg)	0.1	8.6	8.3	7.3
Particulate Concentration, dry-standard (g/dscf)	0.0000051	0.0003737	0.0003646	0.0007064
Total PM Emissions (g)	0.16	11.86	11.56	8.46
Particulate Emission Rate (g/hr)	0.06	4.45	4.34	8.46
Emissions Factor (g/kg)	-	1.43	1.40	-
Difference from Average Total Particulate Emissions (g)	-	0.15	0.15	-
Difference from Average Emissions Factor (g/kg)	-	0.02	0.02	-

Final Average Results	
Total Particulate Emissions (g)	11.71
Particulate Emission Rate (g/hr)	4.39
Emissions Factor (g/kg)	1.42
HHV Efficiency (%)	68.6%
LHV Efficiency (%)	74.1%
CO Emissions (g/min)	3.77

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	87.0	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0.002 cfm	OK
Ambient Temp	55-90 °F	Min: 72 / Max: 75	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
Stove Surface ΔT	<126°F	60.0	OK

B415.1 Efficiency Results

Manufacturer: IHP
Model: GV300GL
Date: 01/11/19
Run: 6
Control #: 18-452
Test Duration: 160
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	68.6%	74.1%
Combustion Efficiency	94.6%	94.6%
Heat Transfer Efficiency	72.5%	78.4%

Output Rate (kJ/h)	41,357	39,232	(Btu/h)
Burn Rate (kg/h)	3.04	6.71	(lb/h)
Input (kJ/h)	60,283	57,185	(Btu/h)

Test Load Weight (dry kg)	8.11	17.88	dry lb
MC wet (%)	18.70		
MC dry (%)	23.01		
Particulate (g)	11.71		
CO (g)	604		
Test Duration (h)	2.67		

Emissions	Particulate	CO
g/MJ Output	0.11	5.48
g/kg Dry Fuel	1.44	74.42
g/h	4.39	226.47
g/min	0.07	3.77
lb/MM Btu Output	0.25	12.73

Air/Fuel Ratio (A/F)	11.77
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 6

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	19.4		2x4	16.00	20.4
2x4	16.00	18.7		2x4	16.00	24.6
2x4	16.00	19.2		2x4	16.00	22.8
2x4	16.00	20.9		2x4	16.00	21.9
2x4	16.00	19.7				
2x4	16.00	22.4				
2x4	16.00	21.4				
2x4	16.00	23.8				
Total Fuel Weight (lbs):		21.23	Average Moisture (%DB):		21.3	

Firebox Volume (ft³): 2.92
 Total 2x4 Crib Weight, with spacers (lbs): 12.87
 Total 4x4 Crib Weight, with spacers (lbs): 9.13
 Total Wet Fuel Weight, with spacers (lbs): 22.00

Coal Bed Range (20-25%):

Min (lbs): 4.40
 Max (lbs): 5.50

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
2x4	17.00	1.76	24.4	23.8	23.8	1.42
2x4	17.00	1.83	21.7	23.1	22.6	1.49
2x4	17.00	1.76	23.2	20.9	22.8	1.44
2x4	17.00	1.81	23.0	20.0	22.1	1.49
2x4	17.00	1.79	24.2	23.8	24.6	1.44
2x4	17.00	1.70	23.0	22.3	23.8	1.38
4x4	17.00	4.06	19.3	22.4	23.8	3.33
4x4	17.00	4.06	23.8	24.6	25.2	3.26
Total Dry Weight, no spacers (lbs):						15.26
Total Dry Weight, with spacers (lbs):						18.23

Spacer Moisture Readings (%DB)							
7.8	8.9	8.0	7.3	8.5	9.1	8.7	
7.6	8.5	8.5	7.8	8.2	11.0	8.9	
8.4	8.5	10.3	8.3	8.4	9.1	9.0	
9.2	7.9	9.4	10.3	9.4	8.5	9.5	

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	27.7	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	7.53	OK
2x4 Fuel Mix	35 - 65 % of total weight	59%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: IHP
 Model: GV300GL
 Run #: 6
 Test Start Time: 8:57

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Total Sampling Time (min): 160
 Recording Interval (min): 10

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.000 (B)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 1/4/2019

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.85	29.84	29.85
Relative Humidity (%)	26.0	18.5	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		20.063	ft ³

Sample Train Post-Test Leak Checks

(A)	0.002	cfm @	-12 in. Hg
(B)	0.000	cfm @	-13 in. Hg
(Ambient)	0.001	cfm @	-14 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.065	121
2	0.084	120
3	0.094	119
4	0.074	118
5	0.068	117
6	0.082	116
7	0.080	115
8	0.062	115
Center	0.088	121

Dilution Tunnel H₂O: 2.00 percent
 Tunnel Diameter: 6 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: 0.1963 ft²

V_{strav} : 19.28 ft/sec
 V_{scent} : 20.66 ft/sec
 F_p : 0.934 [ratio]

Initial Tunnel Flow: 201.1 scf/min

Static Pressure: -0.330 in. H₂O

TEST FUEL PROPERTIES

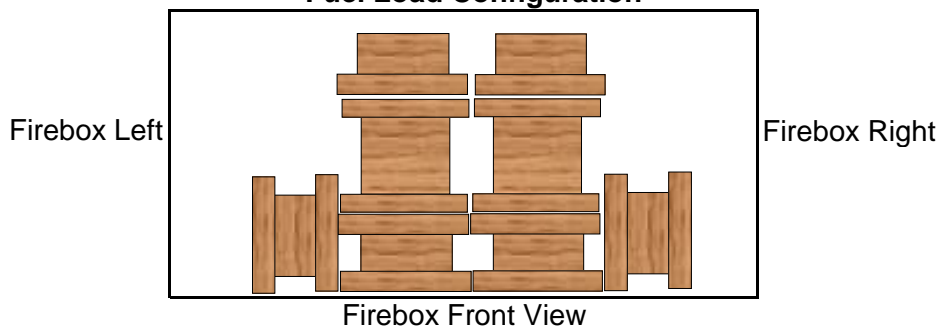
Default Fuel Values

Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	23.0

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 6

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Recording Interval (min): 10
 Run Time (min): 60

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	22.9	-0.069	335	416	340	804	113	401.6	490	63
10	18.2	-0.095	381	485	211	715	145	387.4	639	64
20	12.8	-0.096	387	556	216	714	160	406.6	632	65
30	8.1	-0.083	406	622	242	710	172	430.4	612	66
40	5.6	-0.081	446	664	262	763	183	463.6	593	67
50	4.8	-0.069	495	668	277	572	202	442.8	448	68
60	4.5	-0.050	497	624	257	425	209	402.4	374	68

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 6

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.001		0.088	0.00	73	-0.05		22.0		125	366	83	73
10	1.443	0.144	0.088	2.30	74	-2.65	102	19.3	-2.7	154	688	83	72
20	2.914	0.147	0.088	2.24	78	-1.99	104	15.6	-3.7	157	662	84	73
30	4.386	0.147	0.088	2.22	81	0	103	11.9	-3.7	155	652	84	74
40	5.858	0.147	0.088	2.19	85	-0.06	102	9.3	-2.6	147	611	85	75
50	7.334	0.148	0.088	2.23	88	-2.54	101	7.2	-2.1	142	591	84	74
60	8.818	0.148	0.088	2.23	91	-0.16	100	5.6	-1.6	134	542	84	74
70	10.326	0.151	0.088	2.25	94	0	101	4.3	-1.3	128	499	85	75
80	11.824	0.150	0.088	2.27	95	0	100	3.3	-1	124	477	83	75
90	13.331	0.151	0.088	2.24	97	0	99	2.5	-0.8	119	447	86	75
100	14.835	0.150	0.088	2.25	98	0	99	2.0	-0.5	113	409	83	75
110	16.342	0.151	0.088	2.24	99	-0.94	98	1.6	-0.4	109	377	86	75
120	17.851	0.151	0.088	2.24	100	-2.18	98	1.3	-0.3	106	356	83	74
130	19.357	0.151	0.088	2.24	101	0	97	0.9	-0.4	104	348	84	74
140	20.870	0.151	0.088	2.26	101	-2.37	98	0.6	-0.3	103	343	85	74
150	22.378	0.151	0.088	2.25	101	-1.73	97	0.2	-0.4	102	343	83	74
160	23.893	0.152	0.088	2.25	102	-0.33	98	0.0	-0.2	101	332	83	74
Avg/Tot	23.893	0.149	0.088	2.11	92	-0.88	100			125	473	84	74.1

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 6

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.002		0.00	72	-1		86	0.000	5.60	0.85
10	1.432	0.143	2.31	73	-2.13	102	85	-0.090	15.62	1.13
20	2.898	0.147	2.29	77	-2.79	104	86	-0.090	15.47	1.88
30	4.363	0.147	2.25	81	-2.68	103	87	-0.110	15.24	2.03
40	5.830	0.147	2.24	84	-2.74	102	86	-0.090	13.72	0.65
50	7.302	0.147	2.21	88	-2.12	101	85	-0.080	12.80	0.24
60	8.779	0.148	2.25	90	-2.67	101	86	-0.080	11.53	0.09
70	10.260	0.148	2.23	93	-1.08	100	86	-0.080	10.28	0.14
80	11.743	0.148	2.23	94	-0.7	99	85	-0.070	9.88	0.07
90	13.230	0.149	2.23	96	-2.81	99	86	-0.070	9.13	0.11
100	14.721	0.149	2.23	97	-2.73	99	85	-0.060	7.72	0.32
110	16.212	0.149	2.23	98	-1.81	98	86	-0.060	7.04	0.54
120	17.704	0.149	2.24	99	-1.87	98	85	-0.070	6.08	0.73
130	19.200	0.150	2.23	99	-0.78	98	86	-0.060	6.40	0.66
140	20.697	0.150	2.21	100	-1.9	98	85	-0.070	6.17	0.67
150	22.190	0.149	2.24	100	-1.38	97	86	-0.060	6.20	0.54
160	23.686	0.150	2.23	100	-2.24	97	85	-0.050	5.93	0.79
Avg/Tot	23.686	0.148	2.11	91	-1.97	100	86	-0.070	9.69	0.67

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP
 Model: GV300GL
 Run #: 6

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Stove ΔT : 60

Elapsed Time (min)	Temperature Data (°F)						
	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	494	615	284	437	207	407.4	N/A
10	471	572	231	682	204	432.0	N/A
20	453	557	189	798	200	439.4	N/A
30	458	573	177	804	194	441.2	N/A
40	475	591	180	784	192	444.4	N/A
50	498	605	193	739	192	445.4	N/A
60	516	612	211	657	190	437.2	N/A
70	525	611	227	590	188	428.2	N/A
80	531	605	250	544	189	423.8	N/A
90	540	598	274	512	190	422.8	N/A
100	543	588	282	457	195	413.0	N/A
110	530	570	280	404	199	396.6	N/A
120	510	550	277	370	201	381.6	N/A
130	494	527	272	349	202	368.8	N/A
140	483	509	268	340	200	360.0	N/A
150	477	495	267	339	198	355.2	N/A
160	474	485	258	327	193	347.4	N/A
Average	498	568	242	537	196	408	N/A

LAB SAMPLE DATA - ASTM E2515

Client: IHP

Model: GV300GL

Run #: 6

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/11/2019

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3441	128.5	121.2	7.3
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total

Total Particulate, mg:

7.3

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3442	118.7	118.3	0.4
B. Rear filter catch	Filter	3443	121.1	121.2	-0.1
C. Probe catch*	Probe	13A	117455.7	117455.4	0.3
D. O-Ring catch*	O-Ring	13A	3461.0	3460.3	0.7

Sub-Total

Total Particulate, mg:

1.3

Train A Aggregate

Total Particulate, mg:

8.6

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3444	124.7	118.0	6.7
B. Rear filter catch	Filter	3445	121.9	122.0	-0.1
C. Probe catch*	Probe	13B	117054.3	117054.0	0.3
D. O-Ring catch*	O-Ring	13B	3501.9	3500.5	1.4

Total Particulate, mg:

8.3

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	3446	117.9	117.8	0.1

Total Particulate, mg:

0.1

*Particulate catch that results in a negative number, is assumed to be zero for probes and O-rings, negative numbers for filters are assumed to be part of the O-Ring weight. Negative ambient filter weights are assumed to be zero.

ASTM E2780 Wood Heater Run Sheets

Client: IHP Job Number: 18-452 Tracking #: 0018
 Model: GV300GL Run Number: 6 Test Date: 1/11/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Fully open
 Targeted Burn Category: High

Preburn Notes

Time	Notes
7:21	Loaded 12.4 lbs of kindling, lit with propane torch, fan off, air fully open.
7:56	@ 2.1 lbs, scooped coals and zeroed scale, loaded preburn fuel load, turned fan on high
8:36	@5.6 lbs, stirred coal bed to ensure uniform charcoalization
8:56	@4.5 lbs, leveled coal bed, zeroed scale, turned fan off in preparation of fuel loading.

Test Notes

Test Burn Start Time: 8:57 Test Fuel Loaded by: 50 seconds
 Door Closed: 60 seconds Air Control Set at: 0 seconds
 Other Loading Notes: N/A

Time	Notes
1 min	Turned fan on to high setting, per manufacturer's instructions
60 min	Changed 1-hour filter
160 min	End of Test

Test Burn End Time: 11:37

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.93 CO (%): 4.33
 Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	6:41	6:46	6:43	12:19	12:17	12:23
CO ₂	0.00	10.05	16.93	-0.05	9.98	16.85
CO	0.000	2.477	4.330	-0.034	2.425	4.205

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

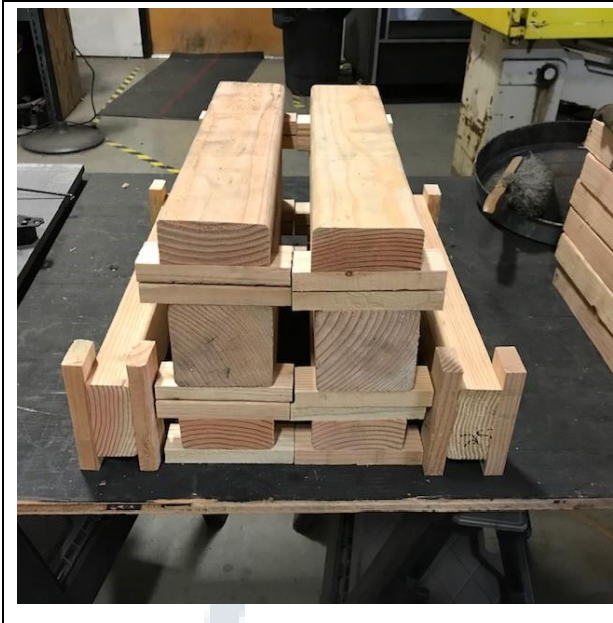
Technician Signature:  Date: 1/11/2019

ASTM E2780 Wood Heater Run Sheets

Client: IHP
Model: GV300GL

Job Number: 18-452
Run Number: 6

Tracking #: 0018
Test Date: 1/11/2019



Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: _____

A handwritten signature in black ink, appearing to be "JL" or similar, written over a horizontal line.

Date: 1/11/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 7 Data Summary

Client:	IHP
Model:	GV300GL
Job #:	18-452
Tracking #:	0018
Test Date:	1/11/2019

Technician Signature

1/16/2019

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: IHP

Model: GV300GL

Run #: 7

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/11/2019

Burn Rate (kg/hr):	1.25
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	47.748	57.463	56.861	8.955
Average Gas Velocity in Dilution Tunnel (ft/sec)	14.6			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9560.5			
Average Gas Meter Temperature (°F)	73.6	98.8	98.1	89.1
Total Sample Volume (dscf)	46.982	54.556	53.837	10.498
Average Tunnel Temperature (°F)	96.1			
Total Time of Test (min)	380			
Total Particulate Catch (mg)	0.0	4.0	3.4	2.4
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000733	0.0000632	0.0002286
Total PM Emissions (g)	0.00	4.44	3.82	2.19
Particulate Emission Rate (g/hr)	0.00	0.70	0.60	2.19
Emissions Factor (g/kg)	-	0.56	0.48	-
Difference from Average Total Particulate Emissions (g)	-	0.31	0.31	-
Difference from Average Emissions Factor (g/kg)	-	0.04	0.04	-

Final Average Results	
Total Particulate Emissions (g)	4.13
Particulate Emission Rate (g/hr)	0.65
Emissions Factor (g/kg)	0.52
HHV Efficiency (%)	74.9%
LHV Efficiency (%)	81.0%
CO Emissions (g/min)	1.27

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	86.0	OK
Face Velocity	< 30 ft/min	8.1	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 71 / Max: 76	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Stove Surface ΔT	<126°F	105.2	OK

B415.1 Efficiency Results

Manufacturer: IHP
Model: GV300GL
Date: 01/11/19
Run: 7
Control #: 18-452
Test Duration: 380
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	74.9%	81.0%
Combustion Efficiency	95.6%	95.6%
Heat Transfer Efficiency	78.4%	84.7%

Output Rate (kJ/h)	18,205	17,270	(Btu/h)
Burn Rate (kg/h)	1.23	2.70	(lb/h)
Input (kJ/h)	24,291	23,043	(Btu/h)

Test Load Weight (dry kg)	7.77	17.12	dry lb
MC wet (%)	18.88		
MC dry (%)	23.28		
Particulate (g)	4.13		
CO (g)	482		
Test Duration (h)	6.33		

Emissions	Particulate	CO
g/MJ Output	0.04	4.18
g/kg Dry Fuel	0.53	62.02
g/h	0.65	76.05
g/min	0.01	1.27
lb/MM Btu Output	0.08	9.71

Air/Fuel Ratio (A/F)	13.36
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 7

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	20.2		2x4	16.00	22.7
2x4	16.00	19.3		2x4	16.00	20.4
2x4	16.00	19.2				
2x4	16.00	19.5				
2x4	16.00	19.5				
2x4	16.00	21.1				
2x4	16.00	21.9				
2x4	16.00	21.9				
Total Fuel Weight (lbs):		15.32	Average Moisture (%DB):		20.6	

Firebox Volume (ft³): 2.92
 Total 2x4 Crib Weight, with spacers (lbs): 12.43
 Total 4x4 Crib Weight, with spacers (lbs): 8.67
 Total Wet Fuel Weight, with spacers (lbs): 21.10

Coal Bed Range (20-25%):

Min (lbs): 4.22
 Max (lbs): 5.28

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
2x4	17.00	1.59	24.3	24.6	25.0	1.28
2x4	17.00	1.74	22.8	22.9	23.3	1.41
2x4	17.00	1.68	23.8	22.7	23.8	1.36
2x4	17.00	1.70	22.8	21.6	21.9	1.39
2x4	17.00	1.70	24.2	24.4	24.6	1.37
2x4	17.00	1.81	21.7	22.7	22.2	1.48
4x4	17.00	4.20	24.4	23.3	24.2	3.39
4x4	17.00	3.66	23.1	23.0	21.3	2.99
Total Dry Weight, no spacers (lbs):						14.67
Total Dry Weight, with spacers (lbs):						17.45

Spacer Moisture Readings (%DB)							
8.4	9.0	8.4	8.0	8.5	7.8	8.3	
8.2	7.9	9.0	8.2	8.0	8.2	7.8	
10.7	8.2	7.9	8.7	7.9	9.1	7.9	
9.3	8.4	8.2	7.4	10.2	9.4	7.3	

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	26.6	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	7.23	OK
2x4 Fuel Mix	35 - 65 % of total weight	59%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: IHP
 Model: GV300GL
 Run #: 7
 Test Start Time: 13:28

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Total Sampling Time (min): 380
 Recording Interval (min): 10

Meter Box γ Factor: 1.004 (A)
 Meter Box γ Factor: 1.000 (B)
 Meter Box γ Factor: 0.999 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 1/4/2019

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.80	29.79	29.80
Relative Humidity (%)	19.7	23.9	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:	47.748 ft ³		

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-14 in. Hg
(B)	0.000	cfm @	-13 in. Hg
(Ambient)	0.001	cfm @	-14 in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.040	99
2	0.048	99
3	0.048	99
4	0.044	99
5	0.042	98
6	0.050	98
7	0.050	98
8	0.042	98
Center	0.050	99

Dilution Tunnel H₂O: 2.00 percent
 Tunnel Diameter: 6 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: 0.1963 ft²

V_{strav} : 14.64 ft/sec
 V_{scent} : 15.28 ft/sec
 F_p : 0.958 [ratio]

Initial Tunnel Flow: 158.2 scf/min

Static Pressure: -0.160 in. H₂O

TEST FUEL PROPERTIES

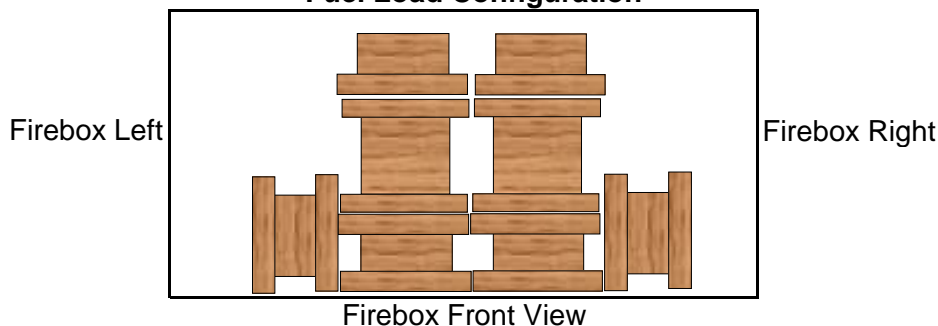
Default Fuel Values

Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	23.3

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: IHP
 Model: GV300GL
 Run #: 7

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Recording Interval (min): 10
 Run Time (min): 60

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	12.0	-0.091	393	473	420	785	211	456.4	666	67
10	9.3	-0.085	402	517	425	867	233	488.8	523	68
20	7.2	-0.080	417	548	439	884	240	505.6	467	68
30	5.5	-0.069	433	544	449	863	241	506.0	409	68
40	4.8	-0.055	445	527	456	793	239	492.0	346	68
50	4.4	-0.057	444	510	467	664	237	464.4	296	68
60	4.2	-0.042	436	493	475	577	239	444.0	269	68

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 7

Technician: SJB

Date: 1/11/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.050	0.01	84	0		21.1		119	310	84	74
10	1.480	0.148	0.050	2.27	84	-1.13	103	19.5	-1.6	125	484	86	74
20	2.970	0.149	0.050	2.26	86	-0.69	103	17.3	-2.2	124	493	85	75
30	4.464	0.149	0.050	2.23	89	-0.31	102	15.5	-1.8	115	429	83	74
40	5.961	0.150	0.050	2.24	91	-1.07	102	13.8	-1.7	112	417	84	75
50	7.456	0.150	0.050	2.22	94	-2.48	101	12.5	-1.3	110	400	85	74
60	8.955	0.150	0.050	2.24	96	0	101	11.1	-1.4	109	395	83	75
70	10.470	0.152	0.050	2.26	97	-1.86	102	9.8	-1.3	108	389	85	74
80	11.978	0.151	0.050	2.25	98	-0.8	101	8.6	-1.2	108	388	85	75
90	13.489	0.151	0.050	2.25	99	-0.03	101	7.4	-1.2	107	380	84	75
100	14.997	0.151	0.050	2.25	100	-2.44	100	6.5	-0.9	105	361	84	75
110	16.511	0.151	0.050	2.26	100	-0.11	101	5.7	-0.8	103	341	85	75
120	18.021	0.151	0.050	2.24	101	0	100	5.2	-0.5	100	315	85	75
130	19.537	0.152	0.050	2.27	101	-2.31	100	4.7	-0.5	98	298	84	76
140	21.049	0.151	0.050	2.26	102	0	99	4.3	-0.4	96	276	83	75
150	22.566	0.152	0.050	2.28	102	-0.02	100	4.1	-0.2	94	260	83	75
160	24.079	0.151	0.050	2.25	102	-0.01	99	3.8	-0.3	93	250	83	75
170	25.597	0.152	0.050	2.23	102	-0.46	99	3.6	-0.2	92	242	83	74
180	27.110	0.151	0.050	2.26	102	-2.15	99	3.4	-0.2	91	237	83	74
190	28.631	0.152	0.050	2.26	102	-1.08	99	3.2	-0.2	90	233	83	74
200	30.145	0.151	0.050	2.25	102	-0.57	99	2.9	-0.3	90	230	83	74
210	31.665	0.152	0.050	2.24	102	-1.88	99	2.7	-0.2	90	228	84	74
220	33.180	0.152	0.050	2.27	102	-0.81	99	2.6	-0.1	89	224	84	73
230	34.699	0.152	0.050	2.25	102	0	99	2.4	-0.2	88	221	85	73
240	36.214	0.152	0.050	2.25	102	-1.92	99	2.2	-0.2	88	216	85	73
250	37.733	0.152	0.050	2.26	102	-2.31	99	2.0	-0.2	88	212	86	73
260	39.250	0.152	0.050	2.28	101	-0.7	99	1.9	-0.1	88	209	85	73
270	40.768	0.152	0.050	2.29	101	-1.37	99	1.7	-0.2	87	208	85	73
280	42.287	0.152	0.050	2.27	101	-0.68	99	1.5	-0.2	87	206	84	73
290	43.805	0.152	0.050	2.25	101	-1.54	99	1.4	-0.1	86	205	84	73
300	45.323	0.152	0.050	2.26	101	-0.06	99	1.2	-0.2	86	203	83	72
310	46.839	0.152	0.050	2.25	101	0	99	1.1	-0.1	86	202	83	72

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 7

Technician: SJB

Date: 1/11/2019

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	48.358	0.152	0.050	2.28	101	-1.78	99	0.9	-0.2	86	202	85	72
330	49.873	0.152	0.050	2.28	101	0	99	0.7	-0.2	85	201	86	72
340	51.392	0.152	0.050	2.26	101	0	99	0.5	-0.2	85	200	85	72
350	52.907	0.151	0.050	2.29	101	-2.02	99	0.4	-0.1	85	199	84	72
360	54.427	0.152	0.050	2.29	100	-0.72	99	0.2	-0.2	85	198	83	72
370	55.942	0.152	0.050	2.25	100	-0.22	99	0.1	-0.1	85	198	84	71
380	57.463	0.152	0.050	2.25	100	-2.32	99	0.0	-0.1	85	197	85	71
Avg/Tot	57.463	0.151	0.050	2.20	99	-0.92	100			96	278	84	73.6

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 7

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	84	-1		86	0.000	0.02	0.00
10	1.458	0.146	2.29	83	-2.4	103	85	-0.080	10.31	0.20
20	2.938	0.148	2.26	85	-0.64	104	86	-0.080	13.12	0.38
30	4.418	0.148	2.24	88	-2.78	102	85	-0.080	12.13	0.47
40	5.899	0.148	2.23	91	-2.3	102	86	-0.070	13.79	0.56
50	7.383	0.148	2.23	93	-1.72	101	85	-0.070	12.72	0.36
60	8.870	0.149	2.24	95	-2.84	101	86	-0.070	13.17	0.53
70	10.362	0.149	2.23	96	-2.68	101	86	-0.070	13.15	0.36
80	11.854	0.149	2.23	97	-1.64	101	85	-0.070	13.64	0.53
90	13.345	0.149	2.24	98	-1.63	101	86	-0.060	13.58	0.38
100	14.840	0.150	2.24	99	-2.27	101	85	-0.070	12.65	0.22
110	16.339	0.150	2.24	100	-0.76	100	86	-0.060	11.76	0.32
120	17.834	0.150	2.23	100	-2.67	100	85	-0.060	9.33	0.68
130	19.331	0.150	2.24	101	-0.79	100	85	-0.050	8.88	0.76
140	20.831	0.150	2.25	101	-0.67	100	86	-0.050	7.62	0.95
150	22.330	0.150	2.23	101	-2.53	99	85	-0.050	7.47	0.99
160	23.829	0.150	2.23	101	-2.11	99	86	-0.050	7.53	0.97
170	25.332	0.150	2.24	101	-2.67	100	85	-0.050	7.45	0.91
180	26.831	0.150	2.24	101	-0.9	99	86	-0.050	7.70	0.88
190	28.331	0.150	2.24	101	-2.18	99	85	-0.040	7.63	0.97
200	29.834	0.150	2.24	101	-0.66	99	85	-0.040	8.18	0.70
210	31.333	0.150	2.25	101	-0.62	99	86	-0.030	7.72	0.68
220	32.836	0.150	2.24	101	-1.37	99	85	-0.040	7.14	0.96
230	34.337	0.150	2.24	101	-0.69	99	86	-0.040	6.72	1.00
240	35.837	0.150	2.25	101	-1.16	99	85	-0.040	5.82	1.25
250	37.341	0.150	2.24	101	-1.05	99	85	-0.040	6.18	1.17
260	38.841	0.150	2.24	101	-1.62	99	86	-0.030	6.28	1.23
270	40.342	0.150	2.23	101	-0.7	99	85	-0.040	6.27	1.27
280	41.846	0.150	2.25	101	-0.83	99	85	-0.040	6.25	1.17
290	43.347	0.150	2.24	101	-0.93	99	86	-0.030	6.10	1.26
300	44.847	0.150	2.26	100	-2	99	85	-0.040	5.97	1.12
310	46.351	0.150	2.25	100	-2.7	99	85	-0.030	6.28	1.20

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: IHP
 Model: GV300GL
 Run #: 7

Job #: 18-452
 Tracking #: 0018
 Technician: SJB
 Date: 1/11/2019

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
320	47.851	0.150	2.27	100	-2.5	99	86	-0.040	6.32	1.07
330	49.353	0.150	2.25	100	-1.15	99	85	-0.040	6.07	1.15
340	50.856	0.150	2.25	100	-1.07	99	86	-0.040	5.71	1.27
350	52.355	0.150	2.24	100	-1.25	99	85	-0.040	5.52	1.29
360	53.860	0.151	2.24	100	-0.82	99	85	-0.040	5.84	1.26
370	55.360	0.150	2.25	100	-1.35	99	86	-0.040	5.49	1.17
380	56.861	0.150	2.25	100	-2.63	99	85	-0.040	5.54	1.19
Avg/Tot	56.861	0.150	2.19	98	-1.60	100	85	-0.049	8.28	0.84

WOODSTOVE SURFACE TEMPERATURE DATA

Client: IHP

Job #: 18-452

Model: GV300GL

Tracking #: 0018

Run #: 7

Technician: SJB

Date: 1/11/2019

Stove ΔT: 105

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	436	493	475	555	241	440.0	N/A
10	427	480	456	704	235	460.4	N/A
20	401	451	404	843	240	467.8	N/A
30	391	443	371	847	239	458.2	N/A
40	391	438	352	831	231	448.6	N/A
50	397	438	347	828	223	446.6	N/A
60	405	440	349	821	217	446.4	N/A
70	413	447	356	813	209	447.6	N/A
80	422	453	364	818	202	451.8	N/A
90	434	458	373	813	198	455.2	N/A
100	444	466	384	782	196	454.4	N/A
110	451	472	397	744	195	451.8	N/A
120	456	472	406	693	195	444.4	N/A
130	455	463	411	639	196	432.8	N/A
140	452	453	412	592	198	421.4	N/A
150	447	442	411	548	200	409.6	N/A
160	441	434	412	516	202	401.0	N/A
170	434	428	416	494	204	395.2	N/A
180	429	423	422	477	206	391.4	N/A
190	424	419	428	467	207	389.0	N/A
200	421	415	433	460	208	387.4	N/A
210	418	410	432	454	210	384.8	N/A
220	415	405	429	448	213	382.0	N/A
230	410	399	427	440	216	378.4	N/A
240	404	392	421	430	218	373.0	N/A
250	396	384	409	418	219	365.2	N/A
260	387	376	396	410	219	357.6	N/A
270	381	370	389	404	219	352.6	N/A
280	375	364	387	399	220	349.0	N/A
290	371	360	389	394	220	346.8	N/A
300	367	356	394	390	219	345.2	N/A
310	362	354	399	386	218	343.8	N/A
320	360	353	405	384	216	343.6	N/A
330	358	352	411	381	215	343.4	N/A
340	356	351	413	377	211	341.6	N/A
350	354	350	411	375	209	339.8	N/A
360	352	350	409	372	208	338.2	N/A
370	350	349	407	371	206	336.6	N/A
380	349	347	405	369	204	334.8	N/A
Average	403	412	403	551	213	396	N/A

LAB SAMPLE DATA - ASTM E2515

Client: IHP

Model: GV300GL

Run #: 7

Job #: 18-452

Tracking #: 0018

Technician: SJB

Date: 1/11/2019

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3447	123.6	121.2	2.4
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total

Total Particulate, mg:

2.4

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3448	119.6	118.6	1.0
B. Rear filter catch	Filter	3449	118.6	118.2	0.4
C. Probe catch*	Probe	14A	116816.9	116816.8	0.1
D. O-Ring catch*	O-Ring	14A	3367.5	3367.4	0.1

Sub-Total

Total Particulate, mg:

1.6

Train A Aggregate

Total Particulate, mg:

4.0

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	3450	119.4	116.8	2.6
B. Rear filter catch	Filter	3451	124.9	124.7	0.2
C. Probe catch*	Probe	14B	116771.0	116770.7	0.3
D. O-Ring catch*	O-Ring	14B	3341.7	3341.4	0.3

Total Particulate, mg:

3.4

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	3452	121.9	121.9	0.0

Total Particulate, mg:

0.0

*Particulate catch that results in a negative number, is assumed to be zero for probes and O-rings, negative numbers for filters are assumed to be part of the O-Ring weight. Negative ambient filter weights are assumed to be zero.

ASTM E2780 Wood Heater Run Sheets

Client: IHP Job Number: 18-452 Tracking #: 0018
Model: GV300GL Run Number: 7 Test Date: 1/11/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Fully Closed
Targeted Burn Category: Med. Low – Fan Confirmation Test

Preburn Notes

Time	Notes
11:51	Loaded 5.5 lbs of kindling, lit with propane torch, fan off, air fully open. @ 1.5 lbs, scooped coals and zeroed scale, loaded preburn fuel load @ 12.0 lbs, set air to test setting @ 4.2 lbs, leveled coal bed, zeroed scale in preparation of fuel loading.
12:05	
12:27	
13:27	

Test Notes

Test Burn Start Time: 13:28 Test Fuel Loaded by: 45 seconds
Door Closed: 150 seconds Air Control Set at: 270 seconds
Other Loading Notes: Fan Confirmation Test – Fan off for duration of test

Time	Notes
60 min 380 min	Changed 1-hour filter End of Test

Test Burn End Time: 19:48

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.93 CO (%): 4.33
Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	12:31	12:34	12:29	1-12 9:15	1-12 9:13	1/12 9:18
CO ₂	0.00	10.00	16.93	-0.04	9.92	16.86
CO	0.000	2.524	4.330	-0.016	2.503	4.297

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

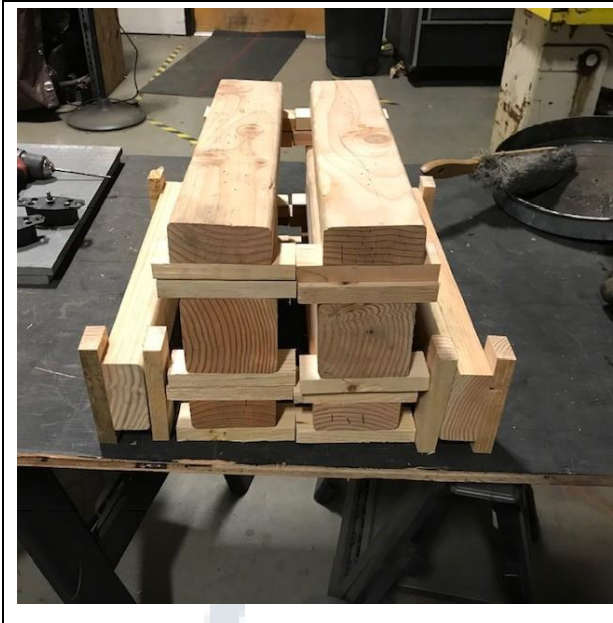
Technician Signature:  Date: 1/14/2019

ASTM E2780 Wood Heater Run Sheets

Client: IHP
Model: GV300GL

Job Number: 18-452
Run Number: 7

Tracking #: 0018
Test Date: 1/11/2019



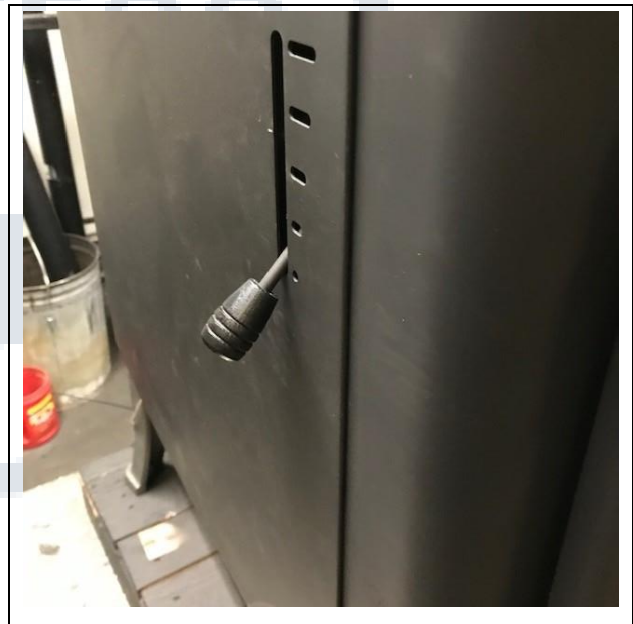
Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: _____



Date: 1/14/2019

Sample Calculations – ASTM E2780 & E2515

Client: IHP
 Model: GV300GL
 Run: 7

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

M_{Sdb} – Weight of test fuel spacers, dry basis, kg
 M_{Cdb} – Weight of test fuel crib, excluding nails and spacers, dry basis, kg
 D_{Cdb} - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft³
 M_{FTAdb} - Total weight of fuel crib excluding nails, dry basis, kg
 BR – Dry burn rate, kg/hr
 V_s – Average gas velocity in the dilution tunnel, ft/sec
 Q_{sd} – Average gas flow rate in dilution tunnel, dscf/hr
 $V_{m(std)}$ – Volume of gas sampled, corrected to dry standard conditions, dscf
 m_n – Total particulate matter collected, mg
 C_s - Concentration of particulate matter in tunnel gas, dry basis, corrected to STP, g/dscf
 E_T – Total particulate emissions, g
 PR - Proportional rate variation
 PM_R – Particulate emissions for test run, g/hr
 PM_F – Particulate emission factor for test run, g/dry kg of fuel burned

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

ASTM E2780 equation (1)

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

Where,

FM_S = average fuel moisture of test fuel spacers, % dry basis

M_{Swb} = weight of test fuel spacers, wet basis, kg

Sample Calculation:

$$FM_S = 8.4 \%$$

$$M_{Swb} = 3.0 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{Sdb} = [(3.0 \times 0.4536) (100/(100 + 8.4))]$$

$$M_{Sdb} = 1.26 \text{ kg}$$

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

ASTM E2780 equation (2)

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

Where,

M_{CPnwb} = weight of each test fuel piece n in fuel crib, excluding nails and spacers, wet basis, kgFM_{CPn} = Average fuel moisture of test fuel n in fuel crib, % dry basis

Sample Calculation (test fuel piece 1):

$$M_{CPnwb} = 1.59$$

$$FM_{CPn} = 24.6$$

$$= 1.6 \quad (100/(100 + 24.6))$$

$$= 1.3 \text{ lbs}$$

Total dry crib weight, excluding spacers = 14.67 lbs

$$M_{Cdb} = \mathbf{6.65 \text{ kg}}$$

D_{Cdb} - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft³
ASTM E2780 equation (3)

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

Where,

$$V_C = \text{Volume of fuel crib, ft}^3$$

Sample calculation:

$$V_C = 952 \text{ in}^3$$

$$1728 = \text{conversion from in}^3 \text{ to ft}^3$$

$$D_{Cdb} = 14.67 / 952 * 1728$$

$$= \mathbf{26.62 \text{ lbs/ft}^3}$$

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

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

Sample calculation:

$$M_{FTAdb} = 1.26 + 6.65$$

$$= 7.92 \text{ kg}$$

BR – dry burn rate, kg/hr

ASTM E2780 equation (5)

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

Where,

$$\theta = \text{Total length of test run, min}$$

Sample Calculation:

$$M_{Bdb} = 7.92 \quad \text{kg}$$

$$\theta = 380 \quad \text{min}$$

$$BR = \frac{60 \times 7.92}{380}$$

$$BR = 1.25 \quad \text{kg/hr}$$

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

ASTM E2515 equations (9)

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

Where:

- F_p = Adjustment factor for pitot tube center point reading = $\frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)
 V_{scent} = Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
 V_{strav} = Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
 k_p = Pitot tube constant, 85.49
 C_p = Pitot tube coefficient: 0.99, unitless
 ΔP^* = Velocity pressure in the dilution tunnel, in H₂O
 T_s = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
 P_s = Absolute average gas static pressure in dilution tunnel, = $P_{bar} + P_g$, in Hg
 P_{bar} = Barometric pressure at test site, in. Hg
 P_g = Static pressure of tunnel, in. H₂O; (in Hg = in H₂O/13.6)
 M_s =

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

Sample calculation:

$$F_p = \frac{14.64}{15.28} = 0.958$$

$$V_s = 0.958 \times 85.49 \times 0.99 \times 0.224 \times \left(\frac{96.1 + 460}{29.80 + \frac{-0.16}{13.6}} \times 28.78 \right)^{1/2}$$

$$V_s = 14.60 \text{ ft/s}$$

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

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

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

ASTM E2515 equation (3)

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

Where:

- 3600 = Conversion from seconds to hours (ASTM method uses 60 to convert in minutes)
- B_{ws} = Water vapor in gas stream, proportion by volume; assume 2%
- A = Cross sectional area of dilution tunnel, ft²
- T_{std} = Standard absolute temperature, 528 °R
- P_s = Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g, in Hg
- T_{s(avg)} = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P_{std} = Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 14.60 \times 0.1963 \times \frac{528}{96.1 + 460} \times \frac{29.80 + \frac{-0.16}{13.6}}{29.92}$$

Q_{sd} = 9560.5 dscf/hr

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

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

Where:

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

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 57.463 \times 1.004 \times \frac{\left(29.80 + \frac{2.20}{13.6} \right)}{\left(98.8 + 460 \right)}$$

$$V_{m(std)} = \mathbf{54.556} \text{ dscf}$$

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 56.861 \times 1 \times \frac{\left(29.80 + \frac{2.19}{13.6} \right)}{\left(98.1 + 460 \right)}$$

$$V_{m(std)} = \mathbf{53.837} \text{ dscf}$$

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 47.75 \times 0.999 \times \frac{\left(\underline{29.795} + \frac{0.00}{13.6} \right)}{\left(73.6 + 460 \right)}$$

$$V_{m(std)} = \mathbf{46.982} \text{ dscf}$$

m_n – Total Particulate Matter Collected, mg

ASTM E2515 Equation (12)

$$m_n = m_p + m_f + m_g$$

Where:

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

Sample Calculation:

Using equation for Train A (first hour):

$$m_n = 0.0 + 2.4 + 0.0$$

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

Using equation for Train A (post-first hour):

$$m_n = 0.1 + 1.4 + 0.1$$

$$m_n = 1.6 \text{ mg}$$

Train A aggregate:

$$m_n = 2.4 + 1.6$$

$$m_n = 4.0 \text{ mg}$$

Using equation for Train B:

$$m_n = 0.3 + 2.8 + 0.3$$

$$m_n = 3.4 \text{ mg}$$

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

ASTM E2515 equation (13)

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

Where:

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

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{4.0}{54.56}$$

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

For Train 2

$$C_s = 0.001 \times \frac{3.4}{53.84}$$

$$C_s = \mathbf{0.00006} \text{ g/dscf}$$

For Ambient Train

$$C_r = 0.001 \times \frac{0.0}{46.98}$$

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

E_T – Total Particulate Emissions, g

ASTM E2515 equation (15)

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

Where:

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

Sample calculation:

For Train 1

$$E_T = (0.000073 - 0.000000) \times 9560.5 \times 380 / 60$$

$$E_T = \mathbf{4.44} \text{ g}$$

For Train 2

$$E_T = (0.000063 - 0.000000) \times 9560.5 \times 380 / 60$$

$$E_T = \mathbf{3.82} \text{ g}$$

Average

$$E = \mathbf{4.13} \text{ g}$$

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

$$7.5\% \text{ of the average} = \mathbf{0.31}$$

$$\text{Train 1 difference} = \mathbf{0.31}$$

$$\text{Train 2 difference} = \mathbf{0.31}$$

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

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

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

$$PR = \left(\frac{380 \times 1.48 \times 14.60 \times (125.0 + 460) \times (98.8 + 460)}{10 \times 57.463 \times 14.98 \times (96.1 + 460) \times (84.0 + 460)} \right) \times 100$$

$$PR = 103 \%$$

PM_R – Particulate emissions for test run, g/hr

ASTM E2780 equation (6)

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

Where,

E_T = Total particulate emissions, grams

θ = Total length of full integrated test run, min

Sample Calculation:

$$E_T \text{ (Dual train average)} = 4.13 \text{ g}$$

$$\theta = 380 \text{ min}$$

$$PM_R = 60 \times (4.13 / 380)$$

$$PM_R = 0.65 \text{ g/hr}$$

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

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

Sample Calculation:

$$E_T \text{ (Dual train average)} = 4.13 \text{ g}$$

$$M_{Bdb} = 7.92 \text{ kg}$$

$$PM_F = 4.13 / 7.92$$

$$PM_F = \mathbf{0.52} \text{ g/kg}$$

Sample Pre-Test Tare Sheet: ☐ Probes☒ Filters☐ O-RingsDate/Time In Desiccator: 10/5 - 15:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109A-100mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
3411	12/4-8:00	122.5	1/3/2019-8:00	122.5	-	-	-	-	SB	18-452 #1
3412		117.6		117.6	-	-	-	-	SB	
3413		122.3		122.3	-	-	-	-	SB	
3414		117.2		117.3	-	-	-	-	SB	
3415		122.7		122.8	-	-	-	-	SB	
3416		118.0		118.1	-	-	-	-	SB	
3417		121.5		121.5	-	-	-	-	SB	18-452 #2
3418		117.5		117.6	-	-	-	-	SB	
3419		122.1		122.2	-	-	-	-	SB	
3420		118.7		118.7	-	-	-	-	SB	
3421		120.8		120.8	-	-	-	-	SB	
3422		117.5		117.6	-	-	-	-	SB	
3423		116.7		116.9	-	-	-	-	SB	18-452 #3
3424		122.1		122.2	-	-	-	-	SB	
3425	1/4 - 8:00	124.9	1/7 - 7:00	124.6	1/8 - 8:00	124.7	-	-	SB	
3426		118.5		118.3	-	-	-	-	SB	
3427		124.0		123.9	-	-	-	-	SB	
3428		119.0		118.9	-	-	-	-	SB	
3429		124.2		124.2	-	-	-	-	SB	18-452 #4
3430		117.6		117.6	-	-	-	-	SB	
3431		117.5		117.2	1/8 - 8:00	117.4	-	-	SB	
3432		124.8		124.8	-	-	-	-	SB	
3433		123.8		123.8	-	-	-	-	SB	
3434		117.9		117.9	-	-	-	-	SB	
3435		124.4		124.2	-	-	-	-	SB	18-452 #5
3436		117.3		117.2	-	-	-	-	SB	
3437		123.9		123.8	-	-	-	-	SB	
3438		118.3		118.0	1/8 - 8:00	118.1	-	-	SB	
3439		123.0		122.6	1/8 - 8:00	122.8	-	-	SB	
3440		119.2		119.2	-	-	-	-	SB	

Sample Post-Test Analysis Sheet: ☐ Probes☒ Filters☐ O-RingsBalance ID#: 107 Audit Weight ID# / Weight (mg): 109A-100mg

Sample ID	Tare (mg)	Date/Time in Desiccator	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials
3411	122.5	1/8/10 - 8:30	1/9 - 10:20	162.3	1/9 - 11:30	161.8	1/10 - 9:00	161.9	-	-	SB
3412	117.6	↓	↓	121.0	↓	120.9	-	-	-	-	SB
3413	122.3	↓	↓	123.1	↓	123.1	-	-	-	-	SB
3414	117.3	↓	↓	153.3	↓	153.2	-	-	-	-	SB
3415	122.8	↓	↓	124.0	↓	124.1	-	-	-	-	SB
3416	118.1	↓	↓	118.1	↓	118.1	-	-	-	-	SB
3417	121.5	1/9 - 8:30	1/10 - 9:00	130.1	1/11 - 7:00	130.2	-	-	-	-	SB
3418	117.6	↓	↓	118.8	↓	118.8	-	-	-	-	SB
3419	122.2	↓	↓	126.3	↓	122.2	-	-	-	-	SB
3420	118.7	↓	↓	127.7	↓	127.8	-	-	-	-	SB
3421	120.8	↓	↓	120.8	↓	120.9	-	-	-	-	SB
3422	117.6	↓	↓	117.5	↓	117.5	-	-	-	-	SB
3423	116.9	1/9 - 20:30	1/11 - 7:00	125.0	1/12 - 9:30	125.0	-	-	-	-	SB
3424	122.2	↓	↓	123.7	↓	123.8	-	-	-	-	SB
3425	124.7	↓	↓	124.9	↓	124.8	-	-	-	-	SB
3426	118.3	↓	↓	126.9	↓	126.8	-	-	-	-	SB
3427	118.3 124.9	↓	↓	124.1	↓	124.1	-	-	-	-	SB
3428	118.9	↓	↓	119.0	↓	118.9	-	-	-	-	SB
3429	124.2	1/10 - 15:00	1/12 - 9:30	130.5	1/14 - 6:30	130.4	-	-	-	-	SB
3430	117.6	↓	↓	118.4	↓	118.3	-	-	-	-	SB
3431	117.4	↓	↓	117.4	↓	117.3	-	-	-	-	SB
3432	124.8	↓	↓	130.1	↓	130.1	-	-	-	-	SB
3433	123.8	↓	↓	124.3	↓	124.1	-	-	-	-	SB
3434	117.9	↓	↓	117.8	↓	117.9	-	-	-	-	SB
3435	124.2	1/11 - 7:10	1/12 - 9:30	130.9	1/14 - 6:30	130.8	-	-	-	-	SB
3436	117.2	↓	↓	118.4	↓	118.5	-	-	-	-	SB
3437	123.8	↓	↓	124.0	↓	123.9	-	-	-	-	SB
3438	118.1	↓	↓	124.4	↓	124.5	-	-	-	-	SB
3439	122.8	↓	↓	123.0	↓	123.1	-	-	-	-	SB
3440	119.2	↓	↓	114.3	↓	114.2	-	-	-	-	SB

Sample Pre-Test Tare Sheet: ☐ Probes☒ Filters☐ O-RingsDate/Time In Desiccator: 12/5/2018 - 15:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109A-100mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
3441	1/10 - 9:00	121.2	1/10 - 17:30	121.2	-	-	-	-	SB	18-452 #6
3442		118.3		118.3	-	-	-	-	SB	
3443		121.3		121.2	-	-	-	-	SB	
3444		117.9		118.0 118.0	-	-	-	-	SB	
3445		122.0		122.0	-	-	-	-	SB	
3446		117.7		117.8	-	-	-	-	SB	
3447		121.2		121.2	-	-	-	-	SB	18-452 #7
3448		118.5		118.6	-	-	-	-	SB	
3449		118.4		118.2	-	-	-	-	SB	
3450		116.6		116.8	-	-	-	-	SB	
3451		124.6		124.7	-	-	-	-	SB	
3452		122.0		121.9	-	-	-	-	SB	
3453		118.0		118.1	-	-	-	-	SB	
3454		123.2		123.4	-	-	-	-	SB	
3455		117.4		117.3	-	-	-	-	SB	
3456										
3457										
3458										
3459										
3460										
3461										
3462										
3463										
3464										
3465										
3466										
3467										
3468										
3469										
3470										

Sample Post-Test Analysis Sheet: ☐ Probes☒ Filters☐ O-RingsBalance ID#: 107 Audit Weight ID# / Weight (mg): 109A-100mg

Sample ID	Tare (mg)	Date/ Time in Desiccator	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Tech. Initials
3441	121.2	1/11-11:50	1/14-6:30	128.6	1/15-8:00	128.5	-	-	-	-	JB
3442	118.3	↓	↓	118.6	↓	118.7	-	-	-	-	JB
3443	121.2	↓	↓	122.0	↓	121.1	-	-	-	-	JB
3444	118.0	↓	↓	124.7	↓	124.7	-	-	-	-	JB
3445	122.0	↓	↓	122.0	↓	121.9	-	-	-	-	JB
3446	117.8	↓	↓	117.9	↓	117.9	-	-	-	-	JB
3447	121.2	1/12-10:00	1/14-6:30	124.1	1/15-8:00	123.8	1/16-8:00	123.6	-	-	JB
3448	118.6	↓	↓	119.8	↓	119.6	-	-	-	-	JB
3449	118.2	↓	↓	119.1	↓	118.7	1/16-8:00	118.6	-	-	JB
3450	116.8	↓	↓	JB 124.119.7	↓	119.3	1/16-8:00	119.4	-	-	JB
3451	124.7	↓	↓	124.9	↓	124.9	-	-	-	-	JB
3452	121.9	↓	↓	122.1	↓	121.9	-	-	-	-	JB
3453											
3454											
3455											
3456											
3457											
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3459											
3460											
3461											
3462											
3463											
3464											
3465											
3466											
3467											
3468											
3469											
3470											

Sample Pre-Test Tare Sheet: ☒ Probes☐ Filters☐ O-RingsDate/Time In Desiccator: 10/22/2018 - 8:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109A/B - 100/200mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
1A	10/25-8:00	115628.5	10/26-8:30	115628.6	-	-	-	-	SB	18-434 #1
1B	↓	115902.7	↓	115902.8	-	-	-	-	SB	18-434 #1
2A	↓	116240.2	↓	116240.2	-	-	-	-	SB	18-434 #2
2B	↓	116330.3	↓	116330.3	-	-	-	-	SB	18-434 #2
3A	↓	116073.5	↓	116073.6	-	-	-	-	SB	18-434 #3
3B	↓	116340.3	↓	116340.3	-	-	-	-	SB	18-434 #3
4A	12/4-8:00	116183.4	12/6-8:00	116183.2	-	-	-	-	SB	18-438 #1
4B	↓	116366.0	12/6-8:00	116365.9	-	-	-	-	SB	18-438 #1
5A	↓	116768.6	12/7-8:30	116768.6	-	-	-	-	SB	18-446 #1
5B	↓	116880.5	↓	116880.6	-	-	-	-	SB	18-446 #1
6A	↓	116564.9	↓	116565.0	-	-	-	-	SB	18-446 #2
6B	↓	116117.0	↓	116117.1	-	-	-	-	SB	18-446 #2
7A	↓	116739.7	↓	116739.8	-	-	-	-	SB	18-446 #3
7B	↓	117304.7	↓	117304.8	-	-	-	-	SB	18-446 #3
8A	1/3/2019-8:00	116829.6	1/4/2019-8:00	116829.9	-	-	-	-	SB	18-452 #1
8B	↓	116825.6	↓	116825.6	-	-	-	-	SB	18-452 #1
9A	↓	116713.2	↓	116713.3	-	-	-	-	SB	18-452 #2
9B	↓	117135.6	↓	117135.5	-	-	-	-	SB	18-452 #2
10A	↓	116826.6	↓	116826.6	-	-	-	-	SB	18-452 #3
10B	↓	117167.7	↓	117167.8	-	-	-	-	SB	18-452 #3
11A	↓	117034.9	↓	117035.0	-	-	-	-	SB	18-452 #4
11B	↓	116674.1	↓	116674.1	-	-	-	-	SB	18-452 #4
12A	↓	116888.4	↓	116888.3	-	-	-	-	SB	18-452 #5
12B	↓	117052.0	↓	117051.9	-	-	-	-	SB	18-452 #5
13A	1/9-10:20	117455.6	1/10-9:00	117455.4	-	-	-	-	SB	18-452 #6
13B	↓	117054.1	↓	117054.0	-	-	-	-	SB	18-452 #6
14A	↓	116816.9	↓	116816.8	-	-	-	-	SB	18-452 #7
14B	↓	116771.0	↓	116770.6	1/11-7:00	116770.7	-	-	SB	18-452 #7

Sample Post-Test Analysis Sheet: ☒ Probes☐ Filters☐ O-Rings

Balance ID#: 107 Audit Weight ID# / Weight (mg): 109A/B 110/20mg

Sample ID	Tare (mg)	Date/ Time in Desiccator	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Tech. Initials
1A	115628.6	10/29-13:50	10/30-18:00	115628.7	10/31-6:00	115628.8	-	-	-	-	SB
1B	115902.8	10/29-17:50	10/30-18:00	115903.0	10/31-6:00	115903.0	-	-	-	-	SB
2A	116240.2	10/30-19:10	11/1-8:00	116240.5	11/2-7:30	116240.5	-	-	-	-	SB
2B	116330.3	10/30-19:10	11/1-8:00	116330.7	11/2-7:30	116330.7	-	-	-	-	SB
3A	116073.6	10/31-16:30	11/2-7:30	116073.9	11/2-15:30	116073.9	-	-	-	-	SB
3B	116340.3	10/31-16:30	11/2-7:30	116340.7	11/2-15:30	116340.6	-	-	-	-	SB
4A	116183.2	12/6-18:00	12/10-10:00	116183.4	12/11-8:00	116183.4	-	-	-	-	SB
4B	116365.9	12/5-18:00	12/10-10:00	116366.0	12/11-8:00	116366.1	-	-	-	-	SB
5A	116769.6	12/10-14:20	12/12-9:00	116769.4	12/18-8:15	116769.3	-	-	-	-	SB
5B	116880.6	12/10-14:20	12/12-9:00	116881.3	12/13-8:15	116881.2	-	-	-	-	SB
6A	116565.0	12/12-9:15	12/14-9:45	116565.3	12/17-8:00	116565.0	12/18-8:00	116565.1	-	-	SB
6B	116117.1	12/12-9:15	12/14-9:45	116117.5	12/17-8:00	116117.1	12/18-8:00	116117.1	-	-	SB
7A	116740.8	12/13-8:30	12/14-9:45	116740.5	12/17-8:00	116740.2	12/18-8:00	116740.2	-	-	SB
7B	117304.8	12/13-8:30	12/14-9:45	117305.4	12/17-8:00	117305.3	-	-	-	-	SB
8A	116829.9	1/8-8:30	1/9-10:20	116831.0	1/9-19:30	116830.6	-	-	-	-	SB
8B	116829.6	1/8-8:30	1/9-10:20	116826.4	1/9-19:30	116826.3	-	-	-	-	SB
9A	116713.3	1/9-8:30	1/10-9:00	116713.5	1/11-7:00	116713.4	-	-	-	-	SB
9B	117135.5	1/9-8:30	1/10-9:00	117136.0	1/11-7:00	117135.9	-	-	-	-	SB
10A	116826.6	1/9-20:30	1/11-7:00	116826.9	1/12-9:30	116826.9	-	-	-	-	SB
10B	117167.8	1/9-20:30	1/11-7:00	117168.0	1/12-9:30	117167.9	-	-	-	-	SB
11A	117035.0	1/10-15:00	1/12-9:30	117035.3	1/14-6:30	117035.2	-	-	-	-	SB
11B	116674.1	1/10-15:00	1/12-9:30	116674.7	1/14-6:30	116674.3	1/15-8:00	116674.2	-	-	SB
12A	116888.3	1/11-7:10	1/12-9:30	116888.5	1/14-6:30	116888.6	-	-	-	-	SB
12B	117051.9	1/11-7:10	1/12-9:30	117052.5	1/14-6:30	117052.1	1/15-8:00	117052.2	-	-	SB
13A	117455.4	1/11-11:50	1/14-6:30	117455.6	1/15-8:00	117455.7	-	-	-	-	SB
13B	117054.0	1/11-11:50	1/14-6:30	117054.3	1/15-8:00	117054.3	-	-	-	-	SB
14A	116816.8	1/12-10:00	1/14-6:30	116816.9	1/15-8:00	116816.9	-	-	-	-	SB
14B	116770.7	1/12-10:00	1/14-6:30	116771.2	1/15-8:00	116771.0	-	-	-	-	SB

Sample Pre-Test Tare Sheet: ☐ Probes☐ Filters☒ O-RingsDate/Time In Desiccator: 10/22/2018-8:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109B-200mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
1A	10/25-8:00	3566.2	10/26-8:50	3566.1	-	-	-	-	SB	18-434 #1
1B		3554.5		3554.4	-	-	-	-	SB	18-434 #1
2A		3552.4		3552.6	-	-	-	-	SB	18-434 #2
2B		3570.8		3570.8	-	-	-	-	SB	18-434 #2
3A		3579.6		3579.7	-	-	-	-	SB	18-434 #3
3B		3567.8		3567.8	-	-	-	-	SB	18-434 #3
4A	12/4-8:00	3593.8	12/6-8:00	3593.8	-	-	-	-	SB	18-438 #1
4B		3581.6	12/6-8:00	3581.5	-	-	-	-	SB	18-438 #1
5A		3534.3	12/7-8:30	3534.1	-	-	-	-	SB	18-446 #1
5B		3530.6		3530.5	-	-	-	-	SB	18-446 #1
6A		3615.2		3615.3	-	-	-	-	SB	18-446 #2
6B		3396.6		3396.6	-	-	-	-	SB	18-446 #2
7A		3573.8		3573.8	-	-	-	-	SB	18-446 #3
7B		3522.0		3522.0	-	-	-	-	SB	18-446 #3
8A	11/3/2019-8:00	3551.3	11/4/2019-8:00	3551.5	-	-	-	-	SB	18-452 #1
8B		3585.2		3585.0	-	-	-	-	SB	18-452 #1
9A		3581.7		3581.5	-	-	-	-	SB	18-452 #2
9B		3524.4		3524.4	-	-	-	-	SB	18-452 #2
10A		3431.9		3431.9	-	-	-	-	SB	18-452 #3
10B		3570.5		3570.6	-	-	-	-	SB	18-452 #3
11A		3424.5		3424.5	-	-	-	-	SB	18-452 #4
11B		4234.5		4234.5	-	-	-	-	SB	18-452 #4
12A		3432.3		3432.5	-	-	-	-	SB	18-452 #5
12B		3404.4		3404.5	-	-	-	-	SB	18-452 #5
13A	1/9-10:20	3460.5	1/10-9:00	3460.1	1/11-7:00	3460.3	-	-	SB	18-452 #6
13B		3500.6		3500.5	-	-	-	-	SB	18-452 #6
14A		3367.3		3367.4	-	-	-	-	SB	18-452 #7
14B		3341.3		3341.4	-	-	-	-	SB	18-452 #7

Sample Post-Test Analysis Sheet: ☐ Probes☐ Filters☒ O-Rings

Balance ID#: 107 Audit Weight ID# / Weight (mg): 109B-200mg

Sample ID	Tare (mg)	Date/ Time in Desiccator	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Tech. Initials
1A	3566.1	10/29-13:50	10/30-18:00	3566.4	10/31-6:00	3566.5	-	-	-	-	SB
1B	3554.4	10/29-13:50	10/30-18:00	3556.6	10/31-6:00	3556.7	-	-	-	-	SB
2A	3552.6	10/30-19:10	10/31-8:00	3552.8	11/2-7:30	3552.9	-	-	-	-	SB
2B	3570.9	10/30-19:10	11/1-8:00	3570.9	11/2-7:30	3571.0	-	-	-	-	SB
3A	3579.7	10/31-16:30	11/2-7:30	3579.9	11/2-15:30	3580.0	-	-	-	-	SB
3B	3567.8	10/31-16:30	11/2-7:30	3568.4	11/2-15:30	3568.3	-	-	-	-	SB
4A	3593.8	12/1-18:00	12/10-10:00	3594.1	12/11-8:00	3594.1	-	-	-	-	SB
4B	3581.5	12/1-18:00	12/10-10:00	3582.0	12/11-8:00	3582.0	-	-	-	-	SB
5A	3534.1	12/10-14:20	12/12-9:10	3534.2	12/13-8:15	3534.1	-	-	-	-	SB
5B	3530.5	12/10-14:20	12/12-9:10	3530.7	12/13-8:15	3530.7	-	-	-	-	SB
6A	3615.3	12/12-9:15	12/14-9:45	3617.3	12/17-8:00	3617.4	-	-	-	-	SB
6B	3396.6	12/12-9:15	12/14-9:45	3396.7	12/17-8:00	3396.7	-	-	-	-	SB
7A	3573.8	12/13-8:30	12/14-9:45	3573.6	12/17-8:00	3573.7	-	-	-	-	SB
7B	3522.0	12/13-8:30	12/14-9:45	3522.2	12/17-8:00	3522.1	-	-	-	-	SB
8A	3551.5	1/8-8:30	1/9-10:20	3552.0	1/9-19:30	3552.0	-	-	-	-	SB
8B	3585.6	1/8-8:30	1/9-10:20	3585.7	1/9-19:30	3585.7	-	-	-	-	SB
9A	3581.5	1/9-8:30	1/10-9:00	3582.2	1/11-7:00	3582.3	-	-	-	-	SB
9B	3524.4	1/9-8:30	1/10-9:00	3525.1	1/11-7:00	3525.1	-	-	-	-	SB
10A	3431.9	1/9-20:30	1/11-7:00	3432.7	1/12-9:30	3432.8	-	-	-	-	SB
10B	3570.6	1/9-20:30	1/11-7:00	3571.6	1/12-9:30	3571.6	-	-	-	-	SB
11A	3424.5	1/10-15:00	1/12-9:30	3425.1	1/14-6:30	3425.2	-	-	-	-	SB
11B	4234.5	1/10-15:00	1/12-9:30	4236.1	1/14-6:30	4235.8	1/15-8:00	4235.8	-	-	SB
12A	3432.5	1/11-7:10	1/12-9:30	3432.7	1/14-6:30	3432.7	-	-	-	-	SB
12B	3404.5	1/11-7:10	1/12-9:30	3405.1	1/14-6:30	3405.1	-	-	-	-	SB
13A	3460.3	1/11-11:50	1/14-6:30	3460.9	1/15-8:00	3461.0	-	-	-	-	SB
13B	3500.5	1/11-11:50	1/14-6:30	3502.0	1/15-8:00	3501.9	-	-	-	-	SB
14A	3367.4	1/12-10:00	1/14-6:30	3367.7	1/15-8:00	3367.5	-	-	-	-	SB
14B	3341.4	1/12-10:00	1/14-6:30	3341.6	1/15-8:00	3341.7	-	-	-	-	SB

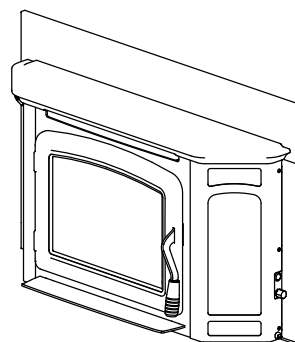


INSTALLATION AND OPERATION MANUAL

EPA Certified Wood-Burning Fireplace Inserts

Save These Instructions
For Future Reference

P/N 900962-00, Rev. NC, 02/2019



Montlake™ 300GL



ML300GL - Report # 14-194

Wood-Burning Fireplace Inserts Model Montlake™ ML300GL

With Innovative Thermal Fin Technology (TFT™)

A French manual is available upon request. Order P/N 900962-01.

Ce manuel d'installation est disponible en français, simplement en faire la demande. Numéro de la pièce 900962-01.

This appliance must be properly installed and operated in order to prevent the possibility of a house fire. Please read this entire installation and operation manual before installing and using your wood fireplace insert. Failure to follow these instructions could result in property damage, bodily injury or even death. Contact your local building or fire officials to obtain a permit and information on any installation requirements and inspection requirements in your area.



	⚠ WARNING <ul style="list-style-type: none">• Hot! Do not touch! The glass and surfaces of this appliance will be hot during operation and will retain heat for a while after shutting off the appliance. Severe burns may result.• Carefully supervise children in the same room as appliance.
--	---

CONGRATULATIONS!

When you purchased your new wood-burning fireplace insert, you joined the ranks of thousands of individuals whose answer to their home heating needs reflects their concern for aesthetics, efficiency and our environment. We extend our continued support to help you achieve the maximum benefit and enjoyment available from your new wood-burning fireplace insert.

Thank you for selecting an Innovative Hearth Products, LLC (IHP) wood-burning fireplace insert as the answer to your home heating needs.

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USING THIS MANUAL

Please read and carefully follow all of the instructions found in this manual. Please pay special attention to the safety instructions provided in this manual.

PRODUCT IS SUBJECT TO CHANGE WITHOUT NOTICE

IMPORTANT SAFETY AND WARNING INFORMATION

READ THIS MANUAL IN ITS ENTIRETY AND UNDERSTAND THESE RULES TO FOLLOW FOR SAFETY.

1. When this room heater is not properly installed, a house fire may result. To reduce the risk of fire, follow the installation instructions. Contact local building or fire officials about restrictions and installation inspection requirements in your area.
2. Wear gloves during installation to avoid injury from sharp edges on the insert and/or its parts.
3. This unit is designed and engineered to burn only dry, well-seasoned wood. Burning wet wood will greatly reduce your inserts efficiency, produce excessive amounts of smoke and can cause dangerous chimney fires due to creosote build-up.
4. Before opening the door, the draft control must be fully open to avoid possible combustion flash (ignition of hot volatile gases as the door is opened).
5. Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or 'freshen up' a fire in this heater. Keep all such liquids well away from the heater while it is in use. **DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.**
6. While burning, fuel utilizes oxygen from the air in the room. Be sure to allow an adequate amount of fresh air into the room where the insert is burning.
7. The outside surface of the insert will be hot while burning properly and can set items like clothing and curtains on fire. Keep furnishings and other combustible materials away from the insert. Using the heat from the insert to dry wet clothing can be hazardous if clothes are placed too near the surface of the insert.
8. **HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING FURNISHINGS AND COMBUSTIBLE MATERIAL A CONSIDERABLE DISTANCE AWAY. CONTACT MAY CAUSE SKIN BURNS.** Do not allow children to play near the appliance without close supervision. Do not touch the appliance while it is burning. Use extreme caution while the unit is in use. Surface temperatures become dangerously hot and can cause serious burns.
9. Do not allow anyone to operate the insert who is not familiar with the operating instructions.
10. Attempts to achieve heat output rates that exceed insert design specifications can result in permanent damage to the insert. Never leave your insert unattended on high burn rates. This may cause overfiring. Overfiring the insert may cause a house fire. If the insert glows, you are overfiring.
11. Keep a water hose or hand-operated fire extinguisher close for safety.
12. **Smoke Detectors** - Since there are always several potential sources of fire in any home, we recommend installing smoke detectors. If possible, install the smoke detector in a hallway adjacent to the room (to reduce the possibility of occasional false activation from the heat produced by the insert). If your local code requires a smoke detector be installed within the same room, you must follow the requirements of your local code. Check with your local building department for requirements in your area.
13. Inspect your chimney at least once a month during the burning season to check for soot and creosote accumulations. Any accumulations over 1/8" thick should be removed by a professional chimney sweep. Do not attempt to burn out heavy creosote accumulations with a hot fire. If large accumulations are occurring, review your burning procedures.
14. If a creosote fire should develop, the fire department should be called immediately and then attempts should be made to control the fire until assistance arrives. If a "runaway" fire should develop causing over-heating of the insert, the door and draft regulators should be closed immediately. The fire should die down once deprived of oxygen. After a severe chimney fire, the complete chimney system should be checked before further use.
15. **Do Not Use Grate Or Elevate Fire - Build Wood Fire Directly On Hearth (firebrick).** Do not use andirons or other methods of supporting the fuel.
16. Please read this entire manual before you install and use your new room heater. Failure to follow instructions may result in property damage, bodily injury, or even death.
17. Check all local building and safety codes before installation. The installation instructions and appropriate code requirements must be followed exactly and without compromise. In the absence of local codes the following standards and codes must be followed.
18. In the U.S.A, install in accordance with the National Fire Protection Association's Code, NFPA 211, Standards for Chimneys, Fireplaces, Vents and Solid-Fuel-Burning Appliances, or similar regulations, may apply to the installation of a Solid-Fuel-Burning appliance in your area. In Canada, the guideline is established by the CSA Standard, CAN/CSA-B365-M93, Installation Code for Solid-Fuel-Burning Appliances and Equipment.
19. **DO NOT CONNECT TO OR USE IN CONJUNCTION WITH ANY AIR DISTRIBUTION DUCTWORK UNLESS SPECIFICALLY APPROVED FOR SUCH INSTALLATIONS.**
20. **WARNING: BURNING IMPROPER FUEL (I.E. CHARCOAL) CAN RESULT IN CARBON MONOXIDE POISONING, WHICH MAY LEAD TO DEATH!**
21. **Carbon Monoxide Poisoning** – early signs of carbon monoxide poisoning resemble the flu with headaches, dizziness, or nausea. If you have these signs, get fresh air at once! Have the heater inspected by a qualified service technician. Some people are more affected by carbon monoxide than others. These include pregnant women, people with heart or lung disease or anemia, those under the influence of alcohol, and those at high altitudes.
22. Failure to use manufacturer provided parts, variations in techniques and construction materials or practices other than those described in this manual may create a fire hazard and void the limited warranty.
23. Do not make any make-shift compromises during installation. Any modification or alteration may result in damage to the appliance or dwelling and will void the warranty, certification and listings of this unit.
24. These appliances are designed as supplemental heaters. Therefore, it is advisable to have an alternate heat source when installed in a dwelling.
25. **Do Not Overfire** – If Heater or Chimney Connector Glows, You Are Overfiring.
26. **DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.**
27. **DO NOT BURN GARBAGE OR FLAMMABLE FLUIDS SUCH AS GASOLINE, NAPHTHA OR ENGINE OIL.**

28. This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

WARNING

This product can expose you to chemicals including Carbon Black, which is known to the State of California to cause cancer, and Carbon Monoxide, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

TESTING INFORMATION

This manual describes the installation and operation of the Montlake™ 300GL non-catalytic wood heaters. These heaters meet the U.S. Environmental Protection Agency's emissions limits, and are compliant with 2020 EPA NSPS particulate emission standards. This heater has been developed, tested and constructed in accordance with the requirements of UL 1482, ULC S628 and HUD standards and is listed by PFS Corporation. It has been approved for residential installations.

Model	Emission Rate	BTU/hr Output Range	Max. Output BTU/hr	Tested Average Efficiency
ML300GL	1.8 g/hr	13,693 – 39,232	100,000	74.1% HHV

* Default - Category rating as assigned by the EPA. The estimated efficiency is as follows: 63% (non-catalyst equipped), 72% (catalyst-equipped), and 78% (wood pellets). See § 60.536(i)(3) at www.epa.gov.

DRAFT REQUIREMENTS

Your wood fireplace insert is dependent upon a properly functioning chimney for optimum performance. It is a high efficiency appliance that loses much less heat up the chimney than older appliances and fireplaces. For this reason it is important to match the fireplace insert to the chimney. The chimney has two functions:

1. It draws combustion air into the appliance (without air, no fuel will burn) and
2. It exhausts combustion by-products. Your new appliance is what is known as a “natural draft” appliance.

The appliance depends solely on the natural draft of the chimney system to draw combustion air into the unit. Draft is the force that moves air from the appliance up into 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 temperatures in the appliance (overfiring). Slow or inadequate draft equals poor combustion and possible smoking problems. The following are some conditions that may contribute to poor chimney draft:

1. A chimney too large for your appliance.
2. A chimney with not enough height to produce adequate draft.
3. A chimney with excessive height (this may allow exhaust to cool too much before exiting, which will stall the rate the exhaust exits).
4. Offsets in the venting system are too restrictive (see *Chimney Guidelines*).

Inadequate draft will cause the appliance to leak smoke into the room through the fireplace insert and the chimney connector joints.

Excessive draft may cause an uncontrollable burn or a glowing red fireplace insert or chimney part.

Overfiring Damage - If the heater or chimney connector glows, you are overfiring. Other symptoms may include: Cracking, warping or burning out of components, plated accessories may turn color, stove or insert glass may develop a haze, which will not come off with cleaning.

Overfiring of a stove or fireplace insert is a condition where excessive temperatures are reached, beyond the design capabilities of the appliance. The damage that occurs from overfiring is not covered under the manufacturer's limited warranty.

Also see *Troubleshooting* on **Page 25**.

SELECTING THE PROPER VENTING SYSTEM

The appliance is merely one component of a larger system. The other equally important component is the venting system. This is necessary for achieving the required flow of combustion air to the fire chamber and for safely removing unwanted combustion by-products from the appliance. If the venting system's design does not promote these ends, the system may not function properly. Poorly functioning venting systems may create performance problems as well as be a safety hazard. **A draft test should read greater than .04" W.C. (inches water column) and less than .08" W.C.** As per NFPA-211 standard (see paragraph below), the installer must take into account all variables within the installation and install the appliance in such a manner that satisfies the draft requirements of the appliance. See *Chimney Guidelines* below to assist you in selecting the proper venting system for your installation.

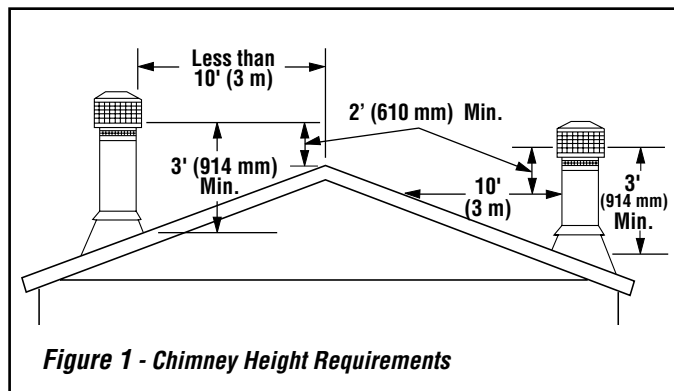
American National Standards Institute ANSI/NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances - See Draft Section: A chimney or vent shall be so designed and constructed to develop a flow sufficient to completely remove all flue and vent gases to the outside atmosphere. The venting system shall satisfy the draft requirements of the connected appliance in accordance with the manufacturer's instructions.

Chimney Guidelines:

- This appliance requires approximately 12 feet minimum of “effective draw” provided by the venting system. As a rule of thumb, every 90 degree total direction change in the venting will result in a loss of approximately 5 feet of “effective draw.” Example: If two 45 degree offsets are used, subtract 5 feet from the actual vertical vent height to determine your “effective draw.” In this case if you had 14 feet of vertical vent, the effective draw would only be approximately 9 feet (14 ft. - 5 ft. = 9 ft.), therefore it may be necessary to add additional height to the venting system.
- In well insulated and weather tight homes, it may be difficult to establish a good draft up your chimney. The poor draft is caused by a shortage of air in the house (see *Negative Pressure Warning* on **Page 5**).

CHIMNEY HEIGHT REQUIREMENTS

The chimney must extend 3' (.92m) above the level of roof penetration and a minimum of 2' (.61m) higher than any roof surface within 10' (3m) (see below). Check with your local building officials for additional requirements for your area.



To pass inspection in nearly any jurisdiction, the chimney must meet both safety and exhaust flow requirements. The (3' by) 2' by 10' rule applies to both masonry and factory-built chimneys.

*** Ref. USA - National Standard, NFPA 211-latest edition and Canada National Standard CSA B365-01-latest edition. Vents installed with a listed cap shall terminate in accordance with the terms of the cap's listings.**

NEGATIVE PRESSURE WARNING

This appliance is not designed to be operated in a negative pressure. In very airtight homes with large kitchen exhaust fans, furnace cold air returns, fresh air exchange systems and any other air system in close proximity to the heating appliance may create a negative pressure in the same room as the heating appliance. This can create dangerous back drafting of the fireplace insert and chimney joints, drawing combustion by-products into the home. Be sure your home has adequate makeup air to eliminate negative pressures caused by the above-mentioned sources. IHP accepts no liability for damages resulting from negative pressures described above.

Ventilation Requirements - Provide adequate air for combustion. The fresh air requirements of this appliance must be met within the space where it will be installed. Ventilation is essential when using a Solid-Fuel-Burning heater. In well insulated and weather tight homes, it may be difficult to establish a good draft up the chimney (caused by a shortage of air in the home). The lack of air is caused by many common household appliances which exhaust air from the home (such as a furnace, heat pump, air conditioner, clothes dryer, exhaust fans, fireplaces, and other fuel burning appliances). Also, the combustion process of this heater uses oxygen from inside the dwelling. If the available fresh air delivery in the dwelling is insufficient to support the demands of these appliances, problems can result (i.e. excessive negative pressure can develop in the dwelling which will affect the rate at which this appliance can draft thus resulting in performance problems. To correct this problem it may help to open a window (preferably on the windward side of the house).

Montlake™ ML300GL

REQUIRED CLEARANCES

WARNING: BE ABSOLUTELY SURE THE DISTANCE BETWEEN THE HEATER AND THE SURFACE OF ANY COMBUSTIBLE CONSTRUCTION IS NOT LESS THAN SHOWN ON THIS PAGE.

Model	A*	B*	C*	D*	E(1)
ML300GL	USA-26" CAN-660mm	USA-24" CAN-610mm	8" 203mm	8" 203mm	USA-8" CAN-203mm
Model	F (1)	G	H	J(2)	M
ML300GL	USA-18" CAN-450mm	USA-15" CAN-381mm	22-5/8" 575mm	5-3/8" 137mm	USA-48-3/4" CAN-1238mm

Table 4 - Clearances

* Reduced clearances may be available for A, B, C and D dimensions per NFPA 211 - latest edition, Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances (in Canada CSA B365 - latest edition). See section on "Reduction of Appliance Clearance with Specified Forms of Protection."

(1) (USA) 18" minimum hearth extension on all stoves and inserts as measured from the door opening of the unit. (Canada) 18" (450 mm) minimum hearth extension on all stoves and inserts as measured from the door opening of the unit. Minimum distance of floor protection to the side = 8" (200 mm). This is measured from the sides of the door opening in the USA and from the sides of the insert in Canada.

(2) J = Maximum lintel depth without flue offset or smoke deflector.

NOTES:

- Facing material that projects more than 3/4" (19 mm) from the wall is considered a mantel or side wall.

Montlake™ 300GL		ZC Fireplace UL 127	Masonry Fireplace UBC Chapter 37
G	Depth Min.	16-1/2" (419mm)	16-1/2" (419mm)
H	Height Min.	23-1/2" (597mm)	23-1/2" (597mm)
J	Lintel Max. Depth ①	5-3/8" (137mm)	5-3/8" (137mm)
K	Front Width Min.	36" (914mm)	29-1/2" (749mm)
L	Rear Width Min.	26-1/4" (667mm)	27-1/4" (692mm)

① Without use of adjustable offset box or smoke deflector

Table 5 - Fireplace Sizing

Also see appliance dimensional views on **Page 9** (see **Figure 9**).

Bottom Clearance	Thermal Protection Thickness	Hearth Extension Depth	
		USA	Canada
0" (0mm)	2-1/2" (64mm)	18" (450mm)	18" (450mm)
8" (203mm)	0" (0mm)	18" (450mm)	18" (450mm)

Table 6 - Hearth Extension / Thermal Protection Requirements

*Distance between hearth and the bottom of the appliance

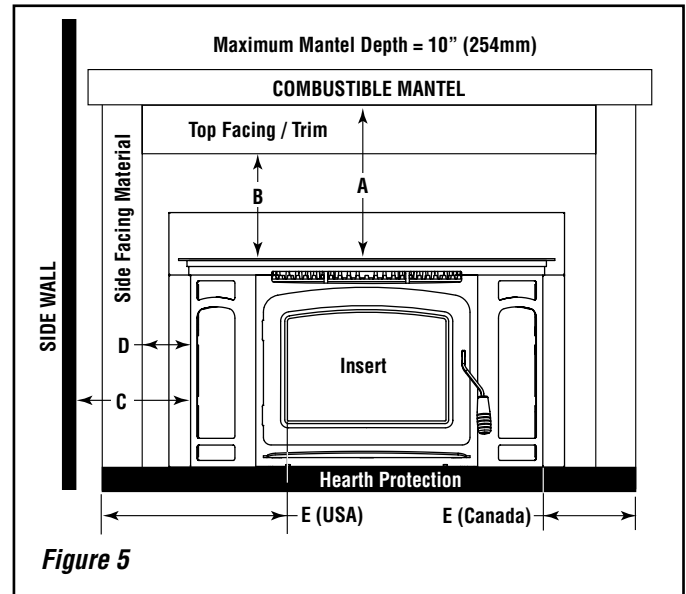


Figure 5

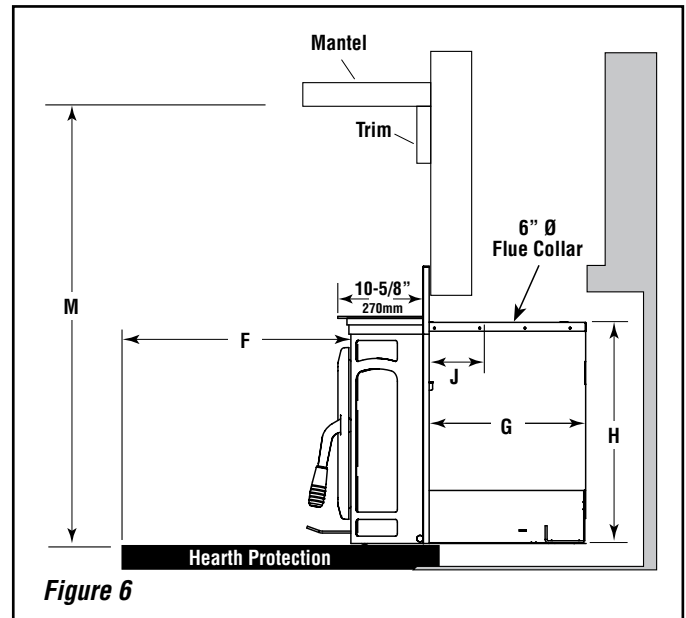


Figure 6

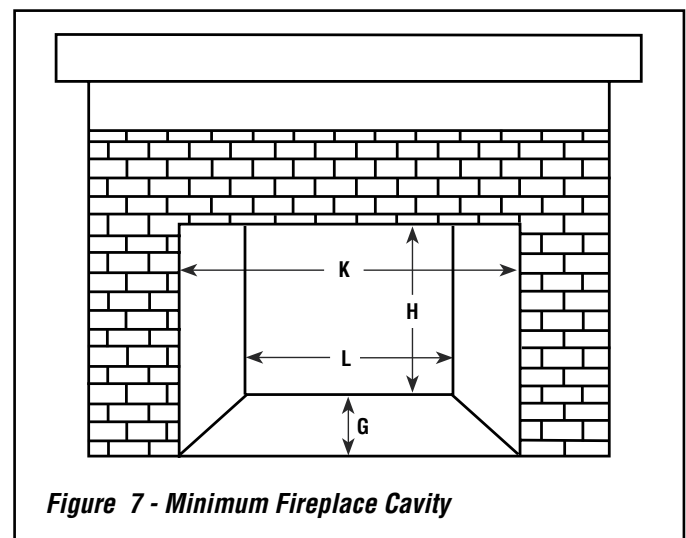


Figure 7 - Minimum Fireplace Cavity

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

Montlake™ ML300GL

SPECIFICATIONS

Product Reference Information			
Cat. No.	Description	Ship. Weight	Ship. Volume
TBD	Montlake 300GL Wood-Burning Insert	428 lb.	31 cu. ft.

NOTES:

- Dimensions shown are approximations only (+/- 1/4")
- Diagrams, illustrations and photographs are not to scale – consult installation instructions. Product designs, materials, dimensions, specifications, colors and prices are subject to change or discontinuance without notice.
- Approved for residential installations.
- Optional Kits Available:
Door Trim Kit

❶ Square-foot heating capacities and burn times are approximations only. Actual performance may vary depending upon home design and insulation, ceiling heights, climate, condition and type of wood used, appliance location, burn rate, accessories chosen, chimney installation and how the appliance is operated.

Specifications

Listing

Flue Size	6" (152 mm)
Log Length	17" W x 21" D Max. (431.8mm W x 533mm D Max.)
Firebox	18.2" W x 21.23" D x 13" H Max. (462mm W x 539.24mm D x 330.2mm H Max.) Volume = 2.91 cu. ft.
Glass Viewing Area	16-1/2" W x 11-5/16" H (419mm W x 287mm H)
EPA Test Load: Cord Wood: ❶	29,181 BTUs/hr. 100,000 BTUs/hr.
Maximum Burn Times ❶	14 hours
Heating Capacity ❶	2000 to 3000 sq. ft.
EPA Grams Per Hour	3.09 gr/hr

EPA Phase II and Washington State Approved

The Montlake™ Model ML300GL wood-burning fireplace insert is safety listed with the following agency:

- PFS Corporation, Tested to UL 1482, ULC S628



Dimensions

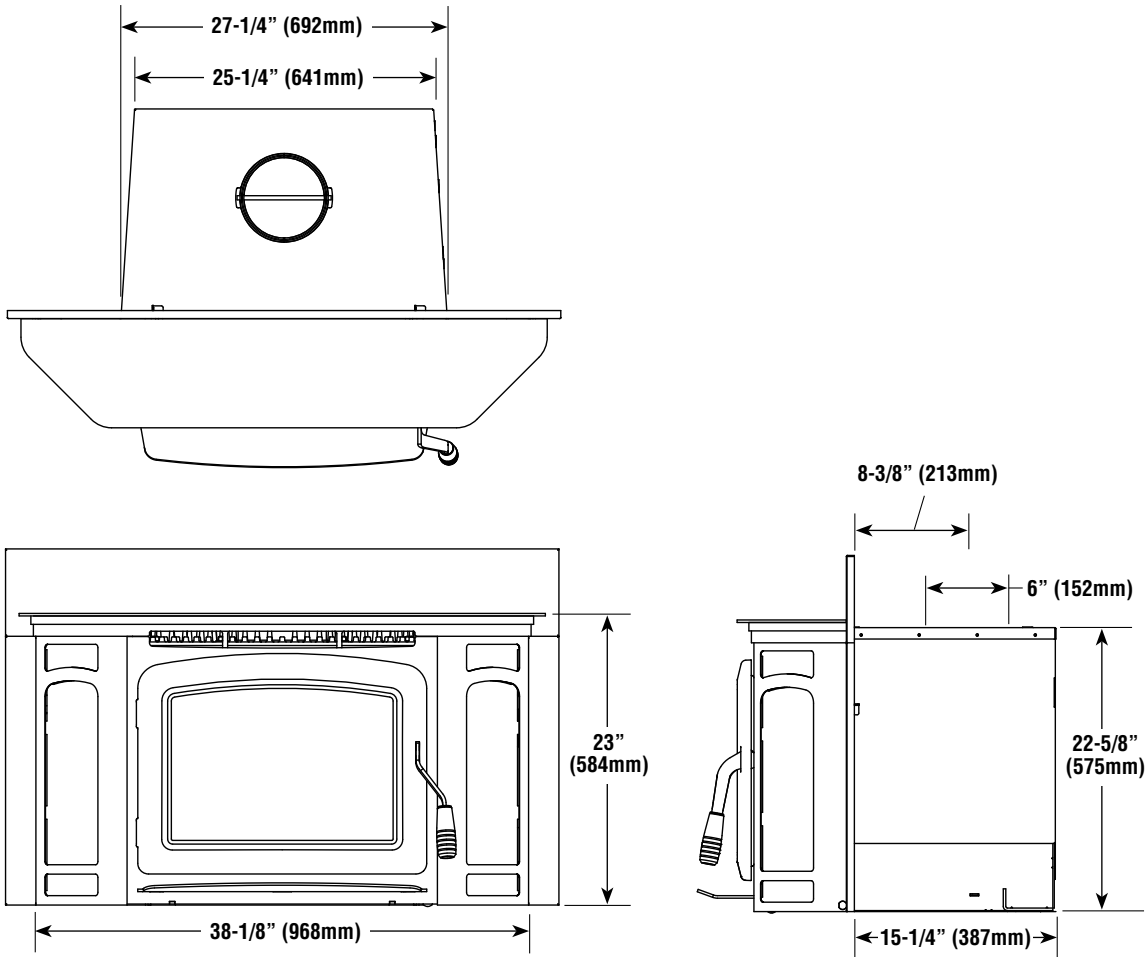


Figure 9

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

Montlake™ ML300GL

HEARTH PROTECTION

The hearth/floor protection must be a thermally rated type II UL 1618 listed floor protection with a minimum R value of 5.2, or 2.08 per inch with a minimum thickness of 2-1/2" (64mm). The covering must extend to the front, a minimum of 18" (450mm) in the USA and Canada. It must extend to the sides a minimum of 8" (200mm) in the USA and Canada (measured from the door opening in the USA and measured from the side of the unit in Canada).

To calculate the minimum thickness required for alternate material use either the **k formula** or **r formula** shown below.

Reference information

k_M = k value per inch of **alternate** material
 r_M = r value per inch of **alternate** material
 T_M = minimum thickness required for **alternate** material
 T_L = standard thickness of the **alternate** material

k_L = k value per inch of **listed** material
 r_L = r value per inch of **listed** material
 T_L = minimum thickness of **listed** material

NOTE: An asterisk "*" in formula below indicates it is a value taken from **Table 8**.

k formula:

Example using k formula: If Micore 160 Mineral Fiber Board is to be used for the floor protection, what is the minimum thickness required?

Minimum thickness of alternate material (T_M)	=	$\frac{\text{k-value (per Inch) of alternate material } (k_M)}{\text{k-value (per inch) of listed material } (k_L)}$	x	Specified min. thickness of listed material (T_L)
T_M (inches)	=	$\frac{* k_M}{* k_L}$	x	* T_L
T_M (inches)	=	$\frac{* .35}{* .48}$	x	* 2.5"
1.823 (inches)	=	.729	x	* 2.5"

Answer - The minimum required thickness of the Micore 160 is 1.823" therefore round up to nearest standard thickness available which is 1.875" (1-7/8")

r formula:

Example using r formula: If Micore 160 Mineral Fiber Board is to be used for the floor protection, what is the minimum thickness required?

Minimum thickness of alternate material (T_M)	=	$\frac{\text{r-value (per Inch) of listed material } (r_L)}{\text{r-value (per inch) of alternate material } (r_M)}$	x	Specified min. thickness of listed material (T_L)
T_M (inches)	=	$\frac{* r_L}{* r_M}$	x	* T_L
T_M (inches)	=	$\frac{* 2.08}{* 2.86}$	x	* 2.5"
1.823 (inches)	=	.729	x	* 2.5"

Answer - The minimum required thickness of the Micore 160 is 1.823" therefore round up to nearest standard thickness available which is 1.875" (1-7/8")

Listed Material				
	k (per inch)	r (per inch)	Listed Min. Thickness	R-Value
Listed Material	.48 k_L	2.08 r_L	2.5" (2-1/2") T_L	5.2
* Approved Alternate Materials for Floor/Hearth Protection				
Alternative Materials	Thermal Values		Minimum Thickness (rounded to nearest 1/8 inch)	
	k (per inch) k_M	r (per inch) r_M	Min. Thickness T_M	
Kaowool M Board	.48	2.08	2.5" (2-1/2")	
Micore 160™ U.S. Gypsum	.35	2.86	1.823" (1-7/8")	

Table 8

INSERT INSTALLATION

NOTE: IHP RECOMMENDS PROFESSIONAL INSTALLATION BY A LICENSED AND BONDED INSTALLER. SEE YOUR DEALER FOR RECOMMENDATIONS. IMPROPER INSTALLATION OR MIS-USE WILL VOID YOUR WARRANTY AND CREATE A SERIOUS SAFETY HAZARD.

This appliance is approved for use in a masonry fireplace built to UBC Chapter 37 or equivalent with a minimum 25" (635mm) opening at the front of the fireplace.

In residential applications, this appliance may be installed in a bedroom in the United States.

These heaters are designed to be installed into an existing masonry fireplace (built to UBC 37 or ULC S628 standards) or factory-built, solid-fuel and wood-burning fireplaces (listed to UL 127 or ULC S610) only.

Approved with or without positive flue connection. Approved with minimum 6" (152 mm) diameter stainless steel listed reline system. IronStrike® wood-burning inserts are tested to UL 1482 / ULC S628 and listed by PFS Corporation.

MASONRY FIREPLACE PRE-INSTALLATION PREPARATION

Remove any doors or screen materials from the fireplace opening. Remove the damper mechanism completely. Also remove grates or ember catches inside the fireplace hearth. If your fireplace is equipped with a smoke shelf or baffle and if it interferes with the installation it may be removed. Do not remove brick or mortar from masonry fireplace to accommodate insert.

Check all clearances for the flue connection prior to starting the install to ensure proper alignment. If there is an alignment problem, connection can be made using a short piece of stainless flex or a stainless steel offset box (available from your dealer). Before installing the liner, make any attachment brackets or drill any holes in the liner, offset box, or insert. Once installed, it may be difficult or impossible to drill additional holes.

FACTORY-BUILT ZERO CLEARANCE FIREPLACES – INSTALLATION PREPARATION

Fireplace and Chimney Requirements

This appliance must only be installed in a zero clearance factory-built fireplace using 6" (152mm) stainless steel pipe extending from the insert's flue into the chimney of the fireplace. For optimum safety and performance we recommend a full length stainless steel liner directly connected to the insert's flue outlet. This appliance must only be installed in a zero clearance factory-built fireplace that is structurally sound. Fireboxes or chimneys that have flaws, burn-outs, or warping must be replaced or repaired prior to installation. Check with your fireplace manufacturer if any problems exist. All convection vents and louvers must be left unmodified and unobstructed.

This appliance can only be installed in the factory-built fireplaces listed to UL 127 or CSA S610.

See **Page 6** (ML230) for the minimum fireplace cavity size requirements. Installations into other brands of the same size is permissible only with approval from local building officials.

Modifications allowed to the factory-built fireplace are as follows:

- Remove the damper
- Remove the smoke shelf or smoke baffle
- Remove ember catches
- Remove viewing screen/curtain
- Remove side and rear bricks
- Remove the fire grate
- Remove doors

The factory built chimney must be listed per UL 127 (US), and meet type HT requirements of UL 103 (US). Factory built fireplace chimneys tested to UL 127-1998 (or later), may be at the fireplace manufacturer's option, tested to the same criteria as UL 103HT requirements. If the chimney is not listed as meeting HT requirements, or if the factory built fireplace was tested prior to 1998, a full height listed chimney liner must be installed from the appliance flue collar to the chimney top. The liner must meet type HT requirements (2100°F) per UL 1777 (US). The liner must be securely attached to the insert flue collar and the chimney top. To prevent room air passage to the chimney cavity of the fireplace, seal either the damper area around the chimney liner with high temperature sealant or the fireplace with fiberglass batting.

FACTORY BUILT FIREPLACE WARNING TAG

The fireplace must not be altered, except for the exceptions listed above. The permanent metal warning label provided must be attached to the back of the fireplace, stating that the fireplace may have been altered to accommodate the insert, and must be returned to original condition for use as a conventional fireplace.

NOTE: Secure the tag using screws or nails to the fireplace

This fireplace has been altered to accommodate a fireplace insert and should be inspected by a qualified person prior to re-use as a conventional fireplace.

Figure 10 - Fireplace Warning Label

CHIMNEY LINER INSTALLATION

IMPORTANT NOTE: See Draft Requirements and Selecting a Proper Venting System on **Page 4** to assist you in choosing the proper venting system for your installation.

WARNING: CHIMNEY CONNECTOR MUST BE IN GOOD CONDITION AND KEPT CLEAN. DO NOT INSTALL DAMAGED PARTS.

Remove the existing chimney cap and install a stainless steel liner into the chimney (if a special section has been used or drilled to attach to the insert, it must be the bottom piece). The next piece should be a dripless slip joint, followed by the rest of the chimney liner. Fasten the chimney at the top when it is positioned so that the slip joint will allow the lowest piece to slide up enough to clear the insert during installation. Insulate the top four to six feet between the liner and the chimney to prevent heat loss. Install the cap and flash if necessary to prevent water or creosote from entering the chimney's venting system.

From inside the fireplace firebox, attach any adaptors or flue offsets and slide the liner up as far as necessary for the bottom piece to clear the insert during installation.

In Canada, This fireplace insert must be installed with a continuous chimney liner of 6" diameter extending from the fireplace insert to the top of the chimney. The chimney liner must conform to the Class 3 requirements of CAN/ULC-S635, Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents, or CAN/ULC S640, Standard for Lining Systems for New Masonry Chimneys.

POSITIVE FLUE CONNECTION (REQUIRED IN CANADA)

A positive flue connection is providing a seal between the vent pipe or liner and the existing fireplace chimney for the purpose of preventing room air passage to the chimney cavity of the fireplace. There are different approved methods to achieve this. See *Direct Connect Positive Flue Connection* on this page.

Direct Connect Positive Flue Connection

See the following instructions for approved methods of achieving a positive flue connection - See **Figure 12**.

A qualified installer should evaluate the existing fireplace to determine the best method for achieving a positive flue connection between the vent pipe or liner and the existing fireplace chimney. The most common method for achieving a positive flue connection in masonry fireplaces is to secure a seal-off plate (i.e. 22-gage sheet steel) in the fireplace throat using masonry screws. Other acceptable methods include packing noncombustible material (i.e. high temp fiberglass or ceramic insulation) around the vent pipe or using a flue adaptor. Whatever "seal off" method is used, it must effectively seal the area to prevent room air passage to the chimney cavity of the fireplace.

Alternate Flue Liner Attachment Method (for short fireplace installations)

For shorter fireplace firebox installations, where it may be difficult to attach the liner to the flue collar on top of the insert, you can complete the final liner attachment from within the insert firebox as follows:

1. Remove the screw, bracket and inner collar as shown below.
2. Using 3 screws, secure the liner to the inner collar.
3. From within the insert firebox, pull down the inner collar (with liner attached).
4. Reassemble the components as shown below.

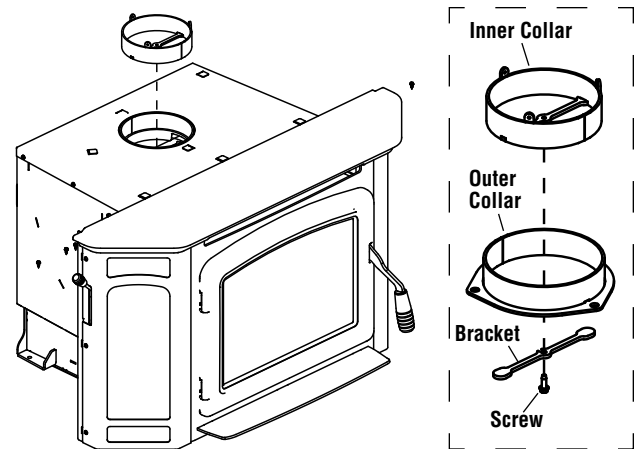
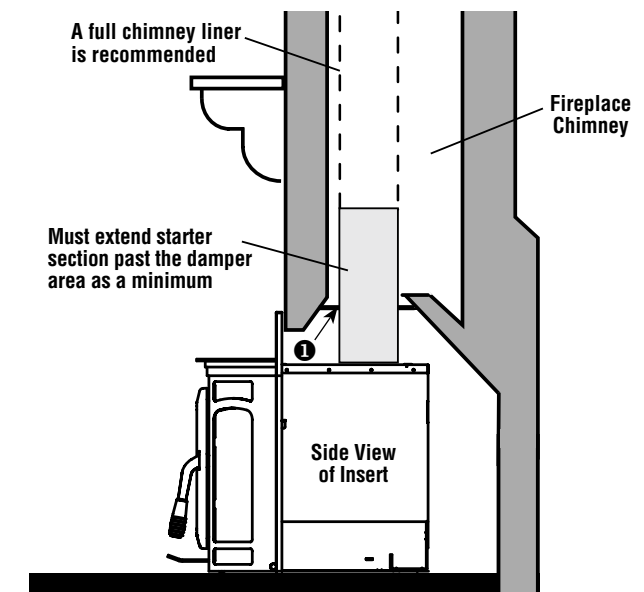


Figure 11

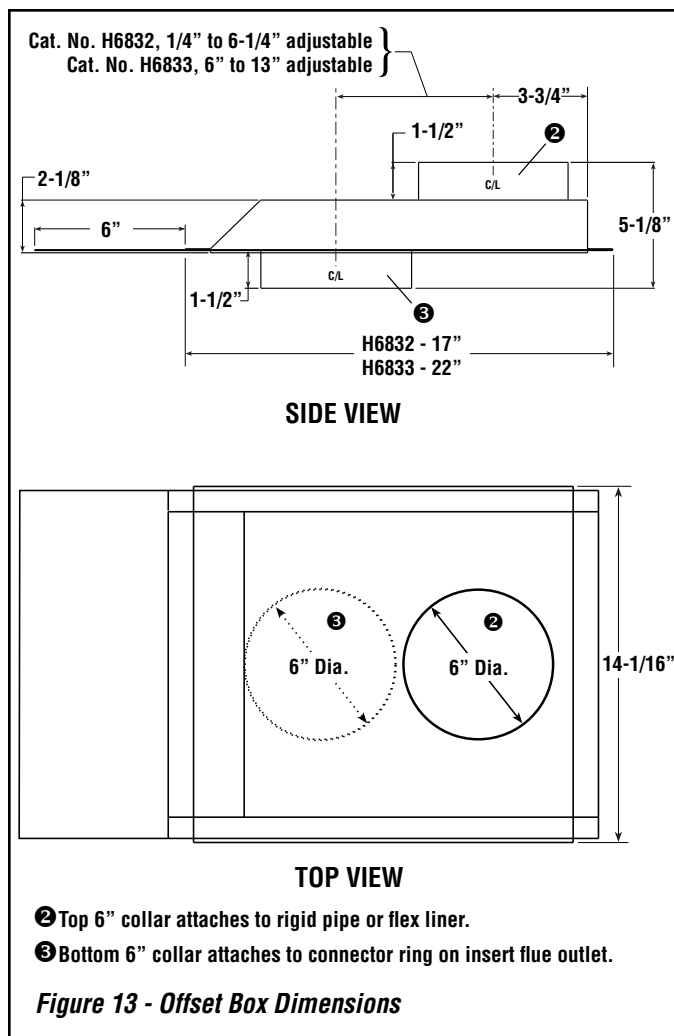


① A non-combustible seal is required at the damper area (to prevent dilution air from entering the chimney). See *Direct Connect Positive Flue Connection* on this page. A seal-off plate method is shown here.

Figure 12 - Positive Flue Connection

Offset Boxes

Offsets can be handled using an offset box (it aligns flue outlet of insert with the fireplace flue (see **Figures 12 and 13**). Care should be used to ensure that this adjustable offset box is oriented so it does not angle down when positioned on the insert flue outlet (level or slightly up at the outbound end is recommended).



INSTALLATION PROCEDURE FOR MASONRY AND FACTORY-BUILT FIREPLACES

READ THE ENTIRE INSTALLATION INSTRUCTIONS AND CHECK ALL REQUIRED CLEARANCES PRIOR TO INSTALLING THIS APPLIANCE.

WEAR GLOVES DURING INSTALLATION IN CASE OF SHARP EDGES ON THE FIREPLACE.

⚠ CAUTION

SHARP EDGES - WATCH YOUR FINGERS

Wear gloves to guard against any sharp metal edges.

Position Insert and Connect Venting

Place the insert into the fireplace, making sure to center it side to side. Slide the insert in until the surround mounts are approximately 1/2" (13 mm) from the face of the fireplace where the surround panels cover. Lower the chimney and make attachment to the insert.

Leveling the Insert in the Fireplace

The leveling leg access holes are accessible from inside the firebox. Break away both cover plates and insert the leveling bolts (provided in manual pack). Level the fireplace insert by using a 9/16" socket to adjust the bolts. The leveling bolts are 1" in length and combined with minimal clearance in the firebox, only allows for 1/2" adjustment. If more adjustment is needed, longer 3/8-16 UNC bolts can be used at the appropriate lengths. For installs where the fireplace bottom is sloped down toward the back, refractory brick can be used to first level the fireplace floor prior to installing the insert.

Installing Surround Panels and Insert Top

Once the insert is in place and the venting has been connected, install a surround panel kit to cover the exposed fireplace opening. For factory-built fireplace installations, you must leave 1/4" space between the surround panels and the fireplace front. After installing the surround panels, install the insert top warming surface.

Installing Front Support

If front support is necessary, use a front support kit (Part# H8675 for model ML300GL) to support the front of the insert and fill the space between the hearth and the insert bottom. Leveling legs can be used to support the front of the insert and can be inserted into two 3/8-16 holes located under the front of the firebox.

NOTES:

- Although not required, a full-length stainless steel liner is recommended for optimum safety and performance. If a full-length liner is not used and a consistent draft cannot be maintained during operation, it may be necessary to use a full-length liner. See your IHP dealer for details.
- When installing Your appliance with a positive flue connection into a factory-built fireplace, be sure to leave the insulation off the surround panels (flanges) and leave a 1/4" (6 mm) airspace insulation off the surround panels and the facing of your fireplace.
- This appliance may be vented into a code-approved masonry chimney with flue liner.
- It is necessary to permanently seal any opening between the masonry of the fireplace and the facing masonry.

MANUFACTURED HOME INSTALLATIONS (ML300GL ONLY)

This appliance is approved for installation into a manufactured (mobile) home. Installation should be in accordance with the Mobile Home Construction and Safety Standard, Title 24 CFR, Part 3280 (in Canada CAN/CSA Z240 MH), or, when such a standard is not applicable, the Standard for Mobile Home Installations, ANSI A225.1.

The appliance must be secured to the floor of the fireplace and grounded to the chassis of the mobile home.

WARNING: DO NOT INSTALL IN SLEEPING ROOM OF A MOBILE HOME.

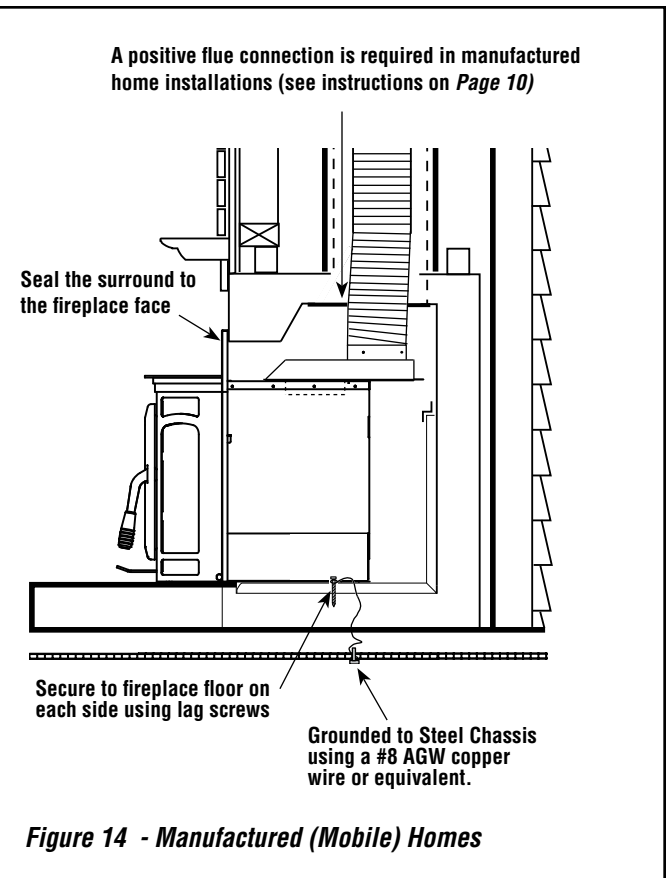
CAUTION: THE STRUCTURAL INTEGRITY OF THE MOBILE HOME FLOOR, WALL AND CEILING/ROOF MUST BE MAINTAINED.

Approved Chimney Liner - Flexible or Rigid 6" Stainless Steel 2100°F HT Liner listed to UL-1777 (US) or ULC-S635 (Canada).

YOUR CHIMNEY LINER INSTALLATION MUST COMPLY WITH LOCAL BUILDING AND FIRE CODES.

Outside Combustion Air

In Manufactured (mobile) Home installations, outside combustion air is required. This can be achieved by sealing the surround assembly to the fireplace face (and anywhere else that room air may enter the firebox of the fireplace). A positive flue connection is also required (see instructions on **Page 10**). This will ensure combustion air is drawn through the existing fireplace air duct from outside the house and into the air intake on the lower back of the appliance.



Factory Built (ZC) Fireplace
Built to UL-127 (US) or ULC-S610 (Canada) Standards

Requires a minimum of a positive flue connection (*Figure 12*) in the USA. In Canada, a full length stainless steel flue liner is required.

Approved Liner -
6" - 2100°F HT Liner listed to
UL-1777 (US) or ULC-S635
(Canada)

Flexible or Rigid 6"
Stainless Steel
Liner

Remove Fireplace
Damper Or
Secure Open

Secure liner to flue
outlet using three
sheet metal screws

Shown with offset
box installed (see
Offset Boxes on
Page 11)

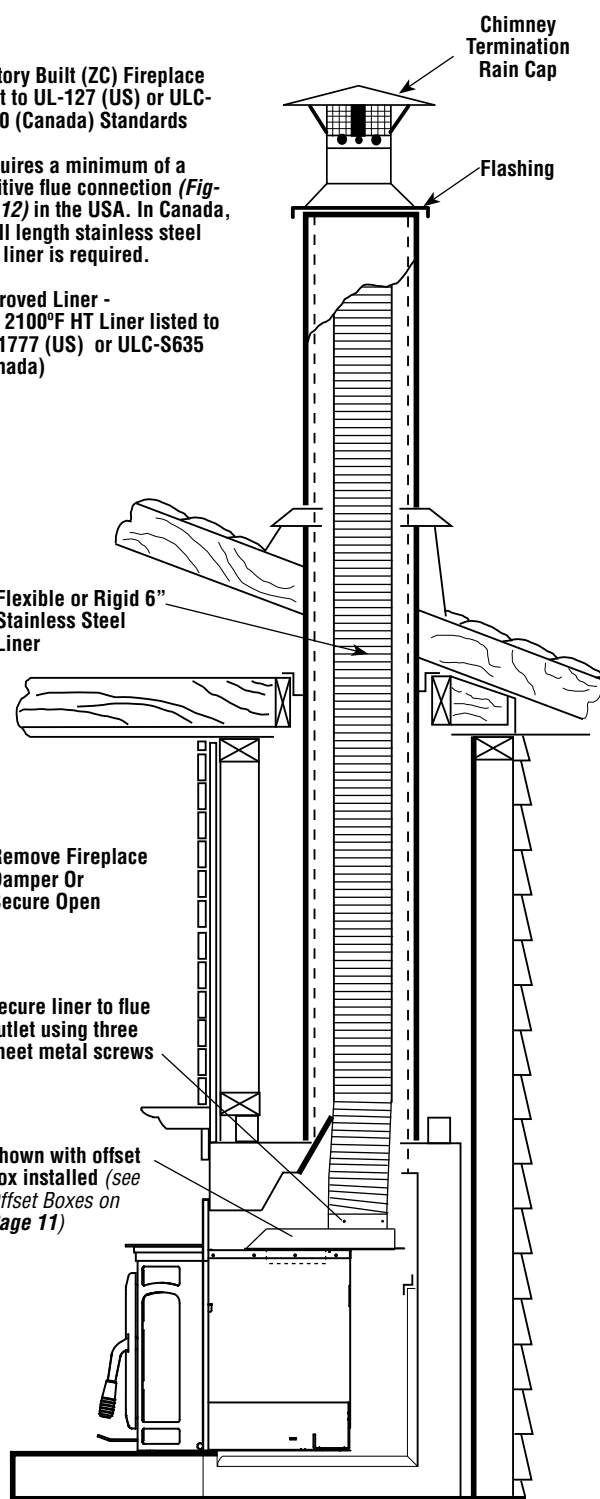


Figure 15 - Typical Installation - Factory Built Fireplace

Masonry Fireplace -
Built to UBC Chapter 37
Standards

Requires a minimum of a positive flue connection (*Figure 12*) in the USA. In Canada, a full length stainless steel flue liner is required.

Approved Liner -
6" - 2100°F HT Liner listed to
UL 1777 (US) or ULC S635
(Canada)

Flexible or Rigid 6"
Stainless Steel
Liner

Remove Fireplace
Damper Or
Secure Open

Secure liner to flue
outlet using three
sheet metal screws

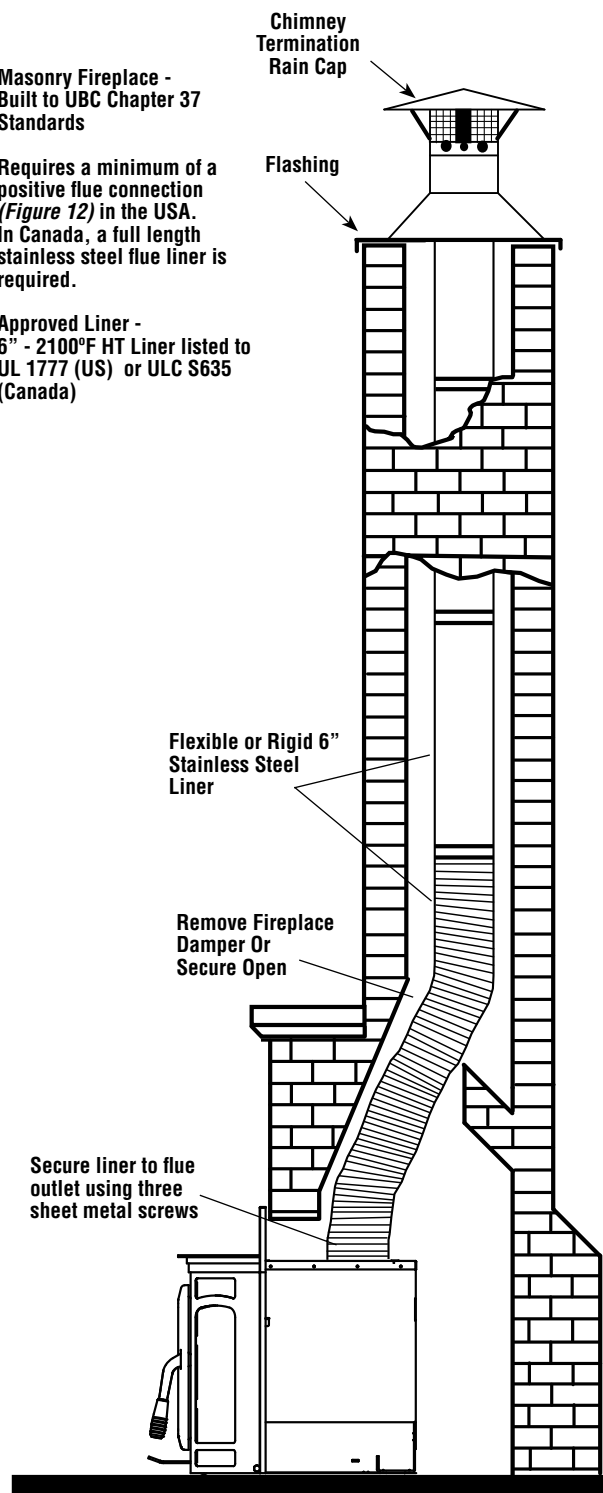


Figure 16 - Typical Installation - Masonry Fireplace

**YOUR CHIMNEY INSTALLATION MUST COMPLY WITH LOCAL BUILDING AND FIRE CODES.
INSTALL VENTING SYSTEM PER VENT MANUFACTURERS INSTRUCTIONS!**

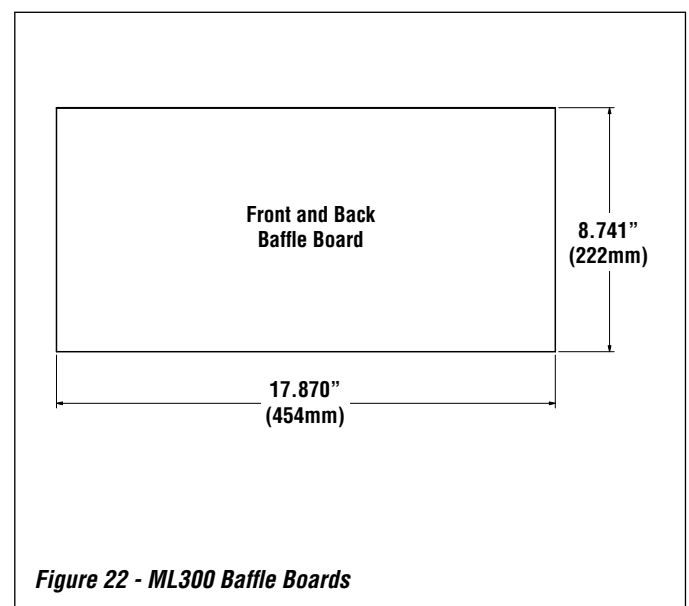
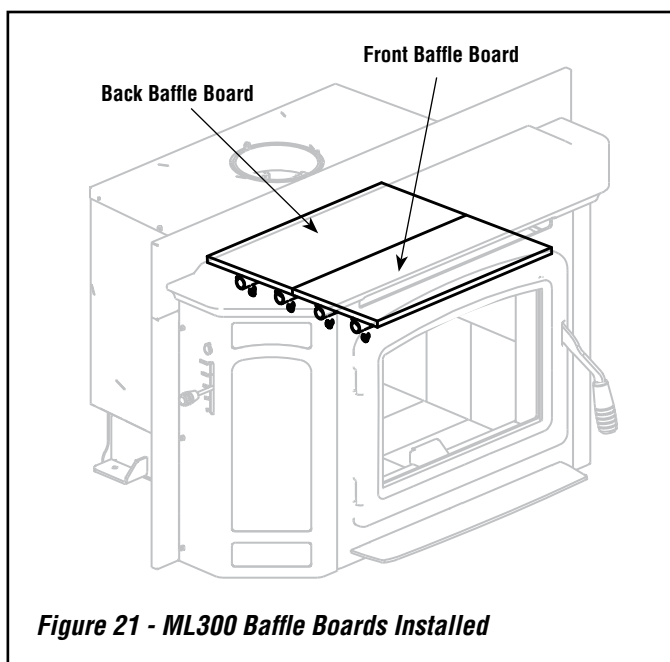
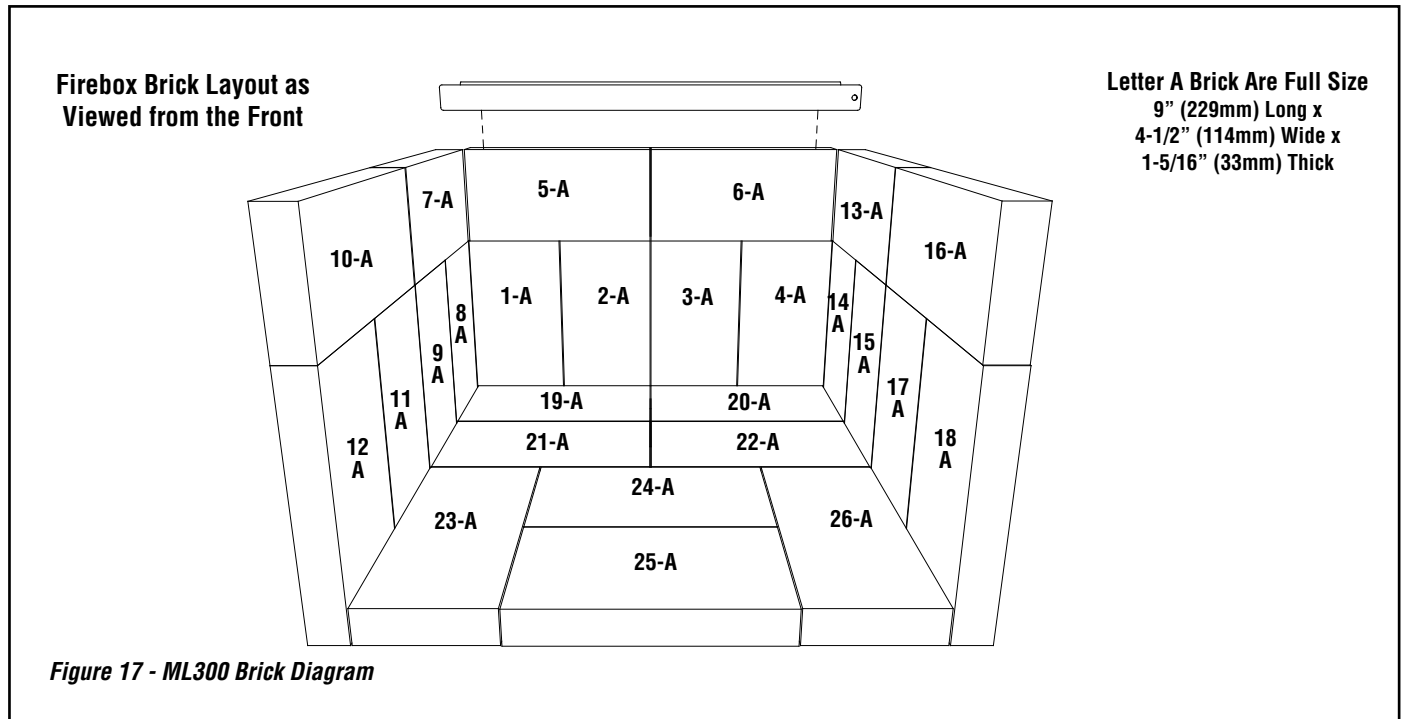
Montlake™ ML300GL

BRICK AND BAFFLE INSTALLATION

CAUTION: Wear gloves during brick installation in case of sharp edges inside the stove.

WARNING: IF THE BRICKS ARE NOT INSTALLED EXACTLY AS SHOWN BELOW, THEY COULD FALL OUT OF PLACE DURING REFUELING OR BURNING OF THE STOVE CAUSING SERIOUS INJURY.

1. Install brick #1-6 in the numbered sequence shown in **Figure 17**.
2. Install rear brick support which is included in the firebox on top of #5 and #6 brick. This support will be locked into place when the remainder of side brick are installed.
3. Install remaining brick #7-26 in the numbered sequence shown in **Figure 17**.
4. Once all the bricks are installed confirm that the already installed baffle boards are in their correct location and resting on the secondary burn tubes.



SECONDARY TUBE AND BAFFLE BOARD REPLACEMENT

- Gently lift front baffle board upward and place on rear baffle board.
- Starting front to rear, locate secondary tube retaining pin and rotate counter clockwise; pull pin toward front of stove, allowing capturing end to slide through retaining pin notches as shown.
- Slide secondary tube to the right, releasing it from the left side. Angle left side upward, and slide left to release from right side. Remove tube from stove
- Repeat process for secondary tube number two
- Gently lift top baffle board and slide forward; tilt left side up and left slightly, allowing the right side to drop into the firebox area for removal. Repeat process for rear baffle board
- Secondary tubes three and four can now be removed in same fashion as tubes one and two
- Reinstall baffle boards and secondary tubes in reverse order. *Note- Secondary tube number one has larger holes, as the remainder of the tubes are the same.

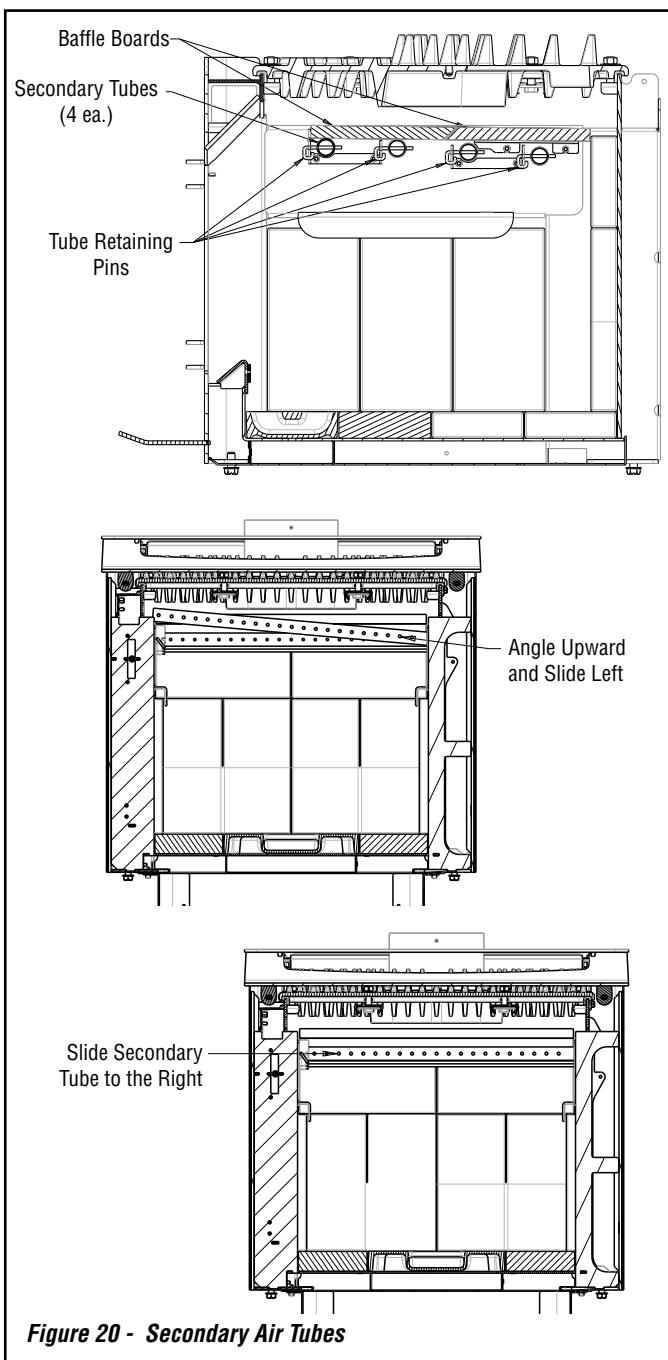


Figure 20 - Secondary Air Tubes

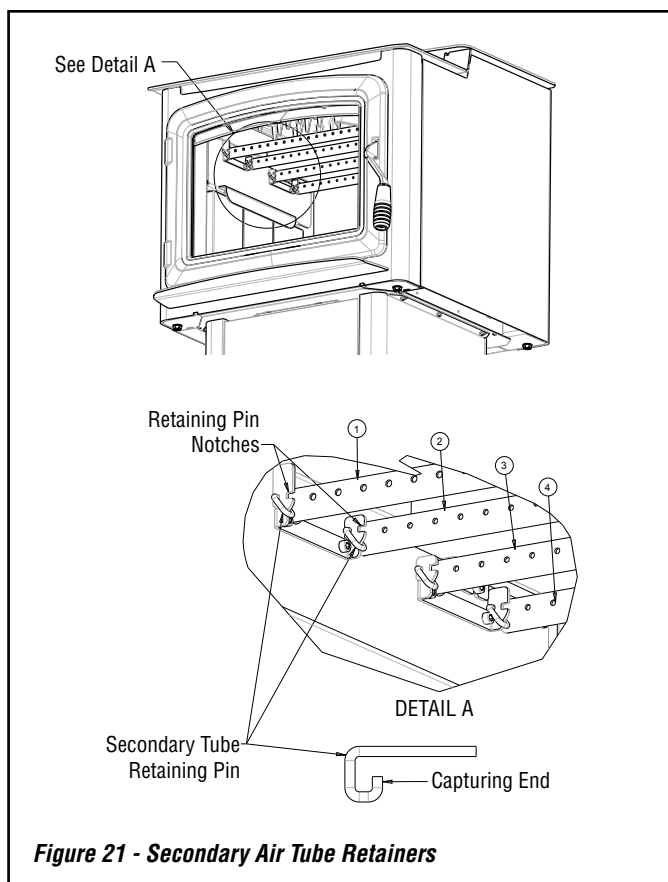


Figure 21 - Secondary Air Tube Retainers

TIMER REPLACEMENT:

- Turn damper lever counter clockwise and remove from stove
- Remove thermostat bracket (if equipped) by removing the two mounting screws and sliding rearward through the opening; set aside
- Loosen the top and bottom left heat shield mounting screws, leaving loose but in place; fully remove center mounting screw
- Lift left heat shield upward, while pulling rearward to release heat shield from rear mounting screws and front capturing tabs; set aside
- Lift upward on vertical timer link to engage timer and gain access to vertical timer link mounting screw; remove screw
- Remove timer mounting screws and timer
- Replacement timer will come equipped with timer engagement link
- Reinstall timer in reverse order; it may be necessary to rotate timer engagement link slightly to properly mount timer and align with vertical timer link (do not rotate more than 180 degrees)
- To reattach timer engagement link, lift upward slightly to align mounting hole with vertical timer link mounting hole. Tighten screw until tight and loosen slightly so timer linkage can operate freely.

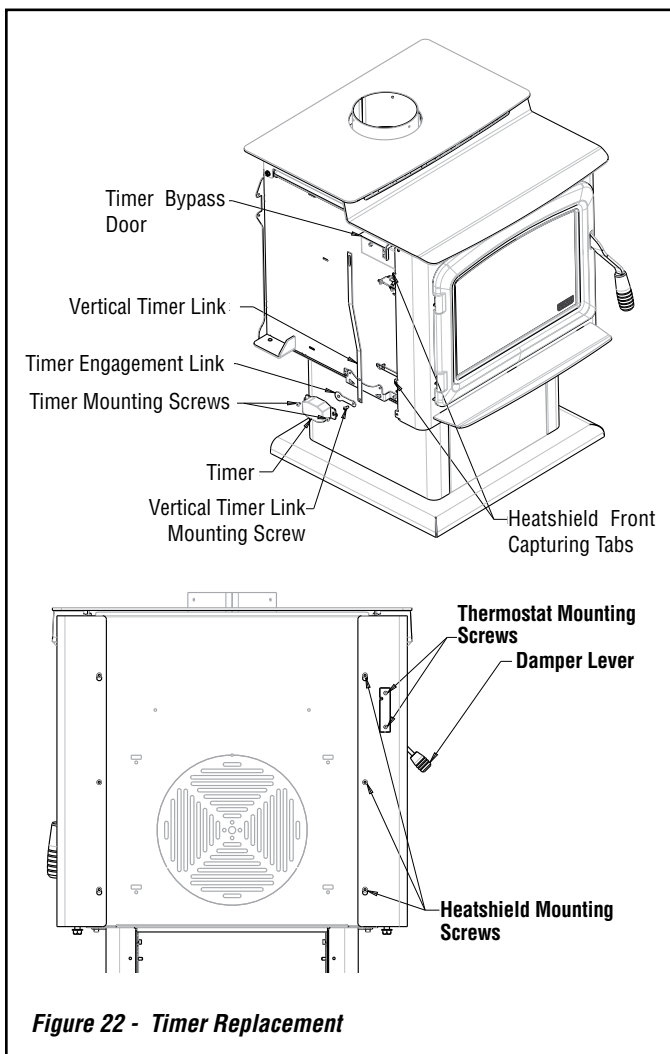


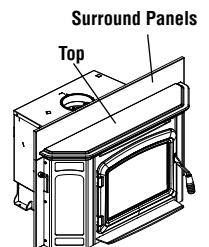
Figure 22 - Timer Replacement

CHECK:

- Inspect timer linkage to ensure it can move freely and is not binding. Vertical timer link can be lifted in an upward and downward motion (manually engaging and disengaging timer), which will open and close the timer bypass door near the top of the unit. This should operate freely with only slight tension from the torque of the timer. Now manually slide vertical timer link downward, disengaging timer. Open door; timer should reengage, lifting timer bypass door, which will then close in approx. 25-30 minutes. If functioning properly, proceed to reassemble stove. If timer is not functioning properly, check all mounting points within linkage to ensure they are moving freely. A small amount of antisieze or high temp lithium grease may be applied to moving linkage parts for lubrication.
- Reinstall left heat shield in reverse order, ensuring slots on front edge of heat shield slots are captured on the front capturing tabs.
- Reinstall thermostat in reverse order
- Reinstall damper lever; if damper lever is misaligned with slot and/or mounting point, the heat shield is not captured properly on the front capturing tabs. Loosen rear mounting screws and ensure proper alignment.

POST INSTALLATION CHECKS

- ☐ Check that one of the required surround kits is properly installed per the instructions provided in kit (Instr. # 506033-76). See Page 28 for ordering information.
- ☐ Check that one of the required top warming surface kits is properly installed per the instructions provided in kit (Instr. # 506033-75). See Page 28 for ordering information.
- ☐ Check that all chimney pipe joints are secured and installed according to the manufacturers instruction.
- ☐ Be sure all roof flashings are watertight (if applicable).
- ☐ Ensure baffle and brick are properly installed (see Page 14).



FOR YOUR OWN PROTECTION AND INSURANCE PURPOSES, HAVE YOUR CHIMNEY AND CONNECTOR PIPE INSTALLATION INSPECTED BY YOUR LOCAL BUILDING CODE AUTHORITY OR FIRE MARSHAL BEFORE STARTING A FIRE IN YOUR STOVE OR INSERT. NOTIFY YOUR INSURANCE COMPANY.

ATTACHING CONTROL LABELS

Once the surround panels are in place, apply the included control labels as shown in **Figure 23**.

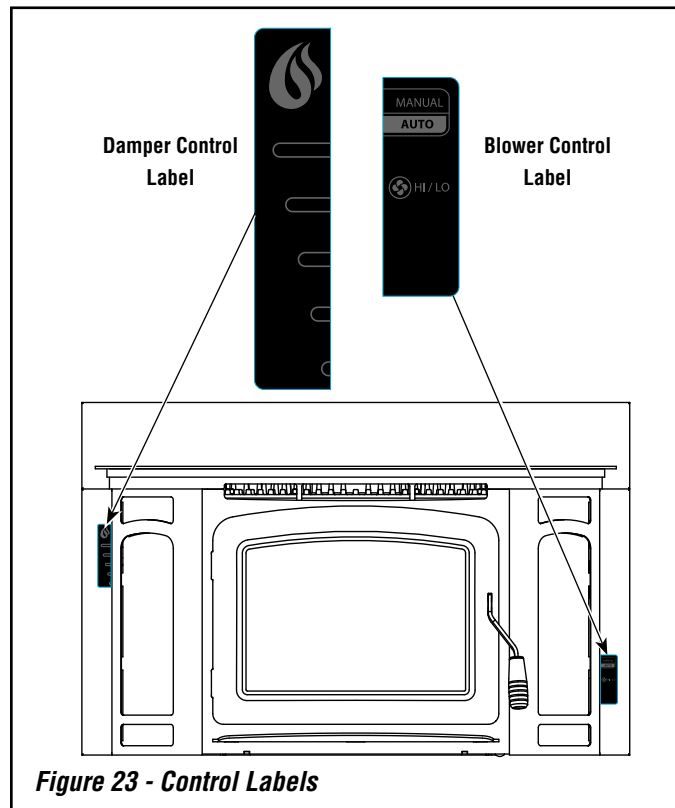


Figure 23 - Control Labels

PAINT CURING

If your appliance has plated accessories, be sure to clean it with a household type glass cleaner and a very soft cloth to remove any fingerprints and residues prior to the first fire and before any fire if the plated accessory has been handled or soiled. Do not close the door tightly during the "Burn-In Period." Also, open the door frequently (every 5-10 minutes) to keep the gasket from adhering to the curing paint. Ventilate the house well during these first firings as the paint gives off carbon dioxide and unpleasant odors. It is recommended that persons sensitive to an imbalance in the indoor air quality avoid the appliance during the curing process.

Your new appliance is painted with a high temperature paint that cures during the first few firings. We recommend that you put your stove or fireplace insert through a regimen of three burns. The first two should last for 20 minutes each at 250 degrees (the appliance should be allowed to cool completely between each burn). The third should be a burn of at least 450 degrees F. for 45-60 minutes. The paint will become soft, gummy and emit non-toxic smoke during these burns. During these first burns, open the appliance door frequently to help prevent the door gasket from adhering to the appliance. After the appliance cools down for the third time, the paint will harden. **DO NOT BUILD A LARGE ROARING FIRE UNTIL THIS CURING EFFECT IS COMPLETE OR YOU MAY DAMAGE THE FINISH OF YOUR STOVE OR INSERT.** Spray can touch-ups should be done only with a high temperature stove paint (cat. no. H8159), available from all IHP dealers.

BURN-IN PERIOD

Please be patient with the heat output of your appliance for the first few weeks. The steel will go through a curing process that eliminates mois-

ture, which is deep in the steel and firebrick. This moisture will reduce initial heat output of your appliance and may make it difficult to start. **(DO NOT OVERFIRE THE STOVE OR INSERT DURING THIS PROCESS. IF THE STOVE OR INSERT OR CHIMNEY BECOMES RED, REDUCE THE AMOUNT OF AIR ENTERING THE STOVE OR INSERT IMMEDIATELY).**

OPERATING HINTS

1. Burn only dry, well-seasoned cord wood. In some states it is illegal to burn wet wood or anything other than clean, dry wood products.
2. Your stove or fireplace insert is designed to operate with the door closed! Operate only with the door shut tightly at all times except when loading wood and possibly on start up to establish a draft. Never leave the unit unattended while the front door is opened.
3. **DO NOT** hit or move the baffle board while loading wood. Occasionally check the baffle. Loading oversized logs may dislodge the baffle boards.
4. **CAUTION: THE DRAFT CONTROL MUST BE FULLY OPEN BEFORE OPENING THE DOOR TO AVOID POSSIBLE COMBUSTION FLASH!!** (Ignition of hot volatile gases as the door is opened).
5. Feeding excessive amounts of fuel to the appliance should be avoided. It is important to supply it with sufficient draft and fuel to maintain a moderately hot fire. If, during overnight burns, heavy creosote deposits develop inside your stove or fireplace insert and on the door, the draft is set too low - review your burning habits!

DOOR OPERATION

Do not operate the appliance with the door open or ajar other than possibly during start up to create a draft (Do not leave the unit unattended while the front door is slightly open during start up). Operating the appliance with the door open other than in initial start up if needed will produce extreme temperatures within the appliance. Damage caused from over-firing is not covered under the manufacturers limited warranty.

WARNING

Be careful not to abuse door assembly by striking or slamming it. If the door assembly or glass is broken or damaged, they must be replaced with factory original parts before heater can be safely operated. Use only components provided by the manufacturer as replacement parts.

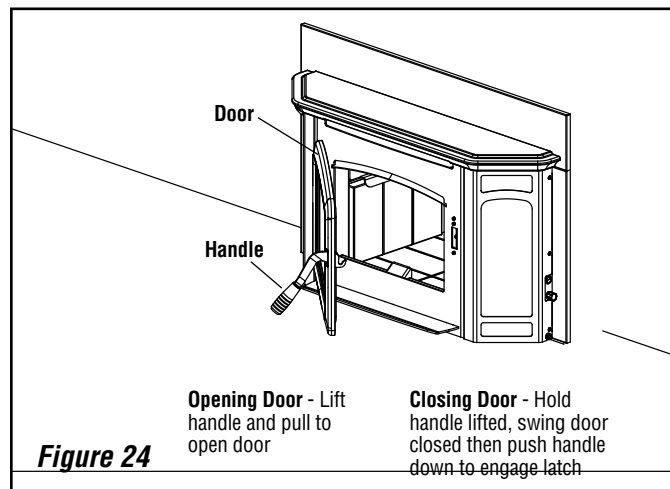


Figure 24

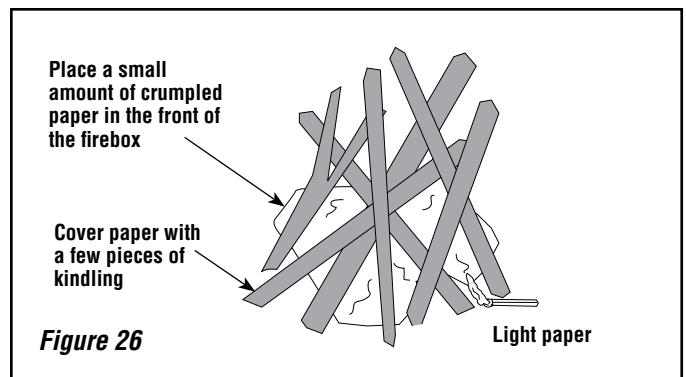
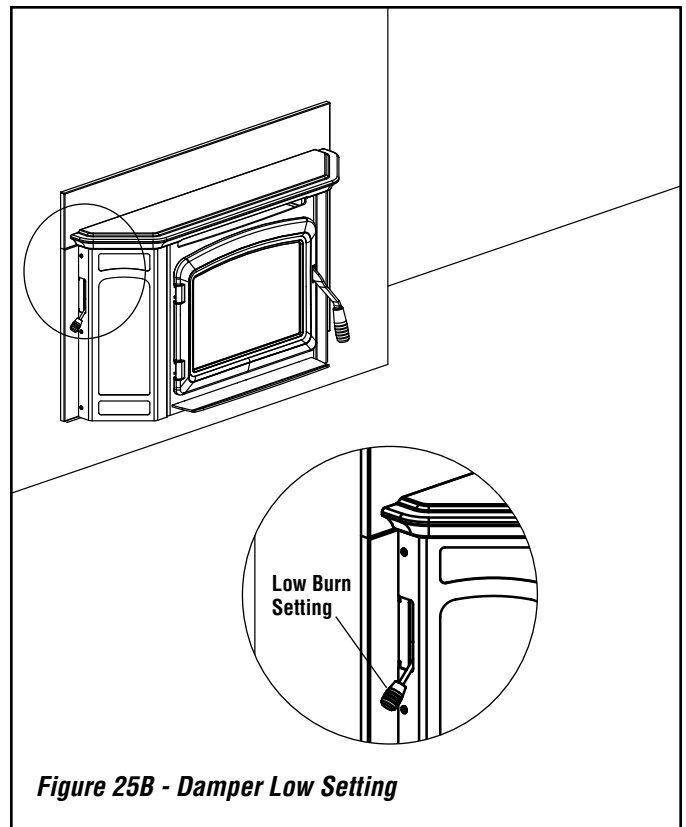
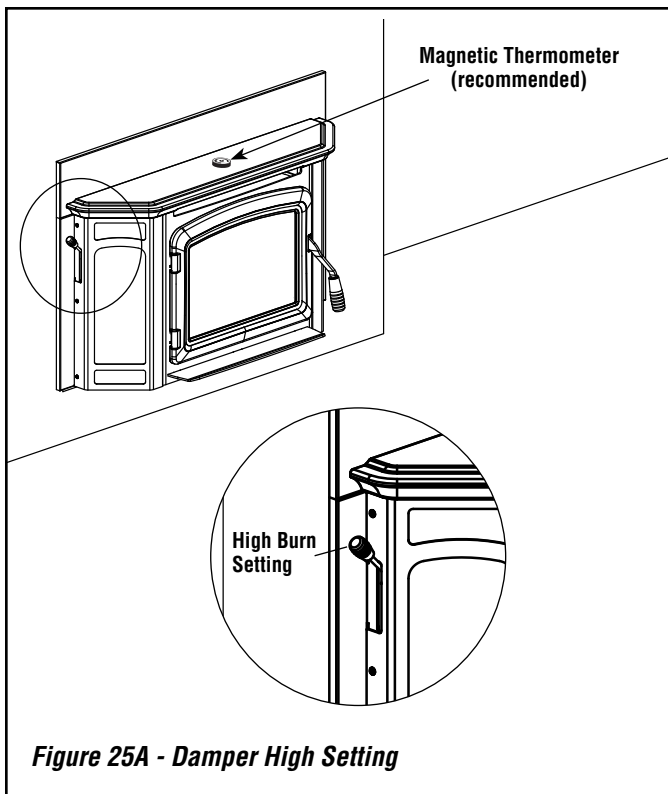
STARTING AND MAINTAINING A FIRE

1. **NEVER USE FLAMMABLE LIQUIDS TO START OR REKINDLE A SOLID FUEL FIRE!!**
2. Fully open the primary draft control by placing draft control (wood handle located on left side of the stove) in the highest position. This control determines the amount of air entering the stove. Lowering this control reduces the burn rate of the stove. For your convenience, the control is marked with five positions to assist you in obtaining repeatable burn rates.
3. Place a small amount of crumpled paper in the front of the firebox and cover it with a few pieces of kindling.
4. Light the paper and allow sufficient time for the kindling to become fully engulfed in flames. You will now close the wood units front door. Your wood units front door may or may not need to be left slightly open during this start up process, this depends on the appliance model and the amount of draft present.
5. When operating any wood burning appliance, it is important to become familiar with how the damper control affects heat output and the overall temperature of the appliance. A stove thermometer can be a helpful tool to help ensure you are not over-firing your appliance and it will also ensure you are burning fuel at a rate that is most efficient. Place a stove thermometer on the top of the appliance as shown in **Figure 25A**. Monitor the temperature every 15 minutes or so until you become more familiar with your appliance. Close the damper all the way down if you begin to reach 400 degrees, as this is a sign that you are operating your appliance at too high a temperature.

DO NOT LEAVE THE APPLIANCE UNATTENDED WHILE THE FRONT DOOR IS SLIGHTLY OPEN.

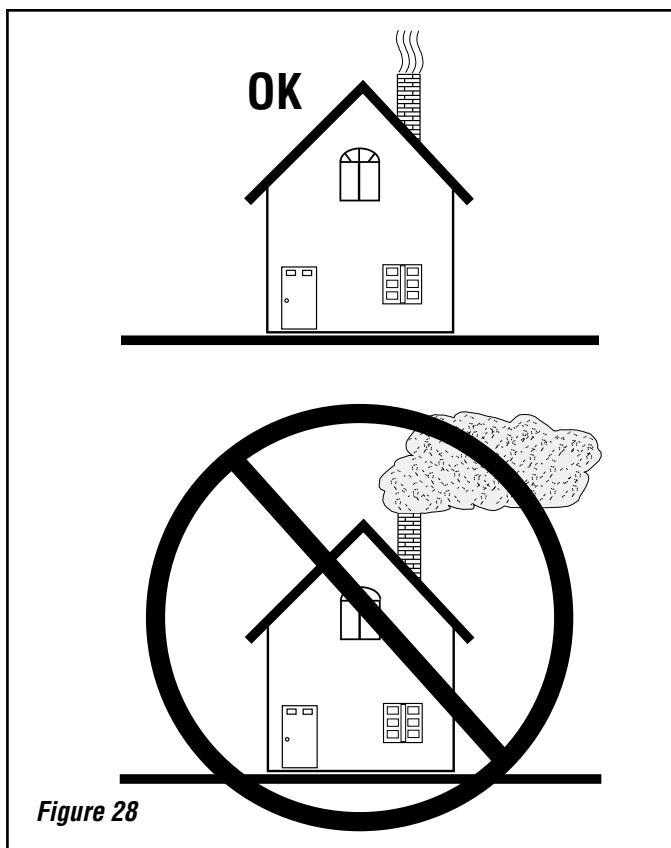
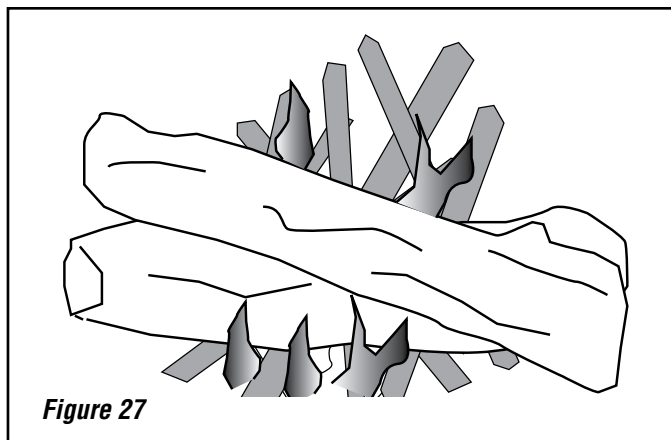
CAUTION: Do Not alter the adjustment range of the draft control for increased firing for any reason.

Operate only with fuel door closed. Maintain all seals in good condition. Do not operate with broken glass.



SEE MAINTENANCE SECTION FOR GLASS CLEANING GUIDELINES AND TIPS FOR KEEPING THE GLASS CLEAN (Page 24).

6. Once kindling is burning well, larger pieces of wood may be added, then the door should be fully closed if there was the need to keep it slightly open during start up.
7. For best results, use smaller pieces of wood to get the appliance temperature very high before loading larger wood for sustained burns. If necessary, crack the door to allow ignition of the fuel charge. Do not leave the unit unattended while the front door is slightly open. Now you can add larger pieces of wood and after several minutes of high burn, set the left control for the desired heat output. Check the exhaust in about 15 to 20 minutes (see **Figure 27**). Large amounts of smoke indicate an improper burn setting (either too high or too low). Adjust and recheck in 5 to 10 minutes.



FUEL

This appliance is designed to burn dry seasoned natural wood only (see Page 22 for a list of prohibited fuels). Failure to burn proper fuels only will void the certification and the warranty of the appliance.

Dry, seasoned wood is that which has been cut, split and allowed to dry under a covered area where air is free to flow and circulate under and around the wood (not under a tarp or plastic). Make sure wood is not stacked directly on the ground, it may absorb moisture from the ground. It should be allowed to dry in these conditions for a minimum of six months, preferably one year or more. **IT MUST BE UNDERSTOOD THAT WOOD CANNOT BE LEFT IN ANY KIND OF WET OR DAMP AREA OR IT WILL NEVER BECOME COMPLETELY SEASONED.**

Do Not store fuel within space heater installation clearances or within the space required for refueling and ash removal.

DO NOT OVERFIRE THIS HEATER

Attempts to achieve heat output rates that exceed heater design specifications can result in permanent damage to the heater.

What does "Well-Seasoned" mean?

When a tree is cut down, the wood is green, full of sap and moisture. This moisture content can exceed 80%, which must be reduced to less than 20%. Wood properly seasoned is then capable of generating the heat the stove or insert was designed to provide.

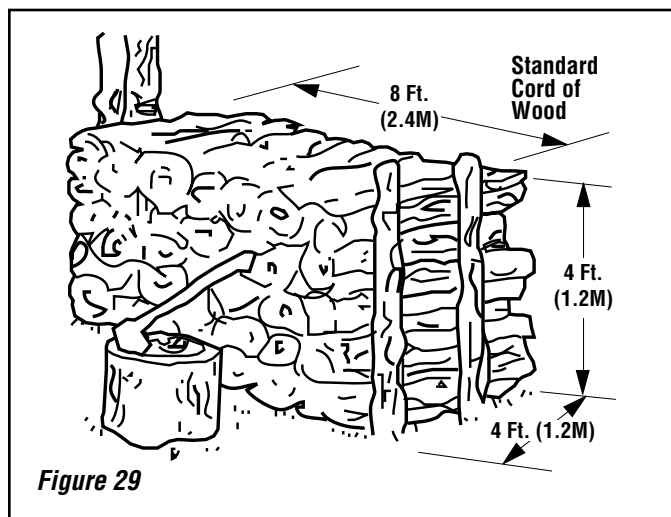
Green wood does not burn easily. Attempting to burn green wood often results in a lot of smoke and very little fire. Time is the most important factor in seasoning wood. Ideally the moisture content should be reduced to 11-20%. **NOTE: The use of a firewood moisture meter is recommended to ensure the firewood contains less than 20% moisture.**

Seasoning Guide

Softwoods – 6 months to 18 months

Hardwoods – 12 months to 24 months

Logs that are 5" diameter across or larger should be split in half, three pieces if over 8 inches, and four pieces when over a foot across. If a tree has been dead for 2 – 4 years it still needs to be cut, split, and seasoned for 6 to 24 months depending on the wood.



GETTING THE MOST OUT OF YOUR APPLIANCE

Recent developments in wood-burning technology have made wood-burning a cleaner and more convenient way to heat your home. Overall efficiency in a wood-burning appliance is a combination of combustion efficiency and heat transfer efficiency. Whether heating your entire home or just a room or two, your understanding of how to best operate your stove or insert will enhance its overall efficiency and performance. What this can mean to you is longer, cleaner burns, less wood use and more heat.

The following sections will outline techniques you can use to “get the most out of your stove or insert.” Please read them carefully.

MAXIMIZING YOUR APPLIANCE'S OVERALL EFFICIENCY

It is important to know that for high, combustion efficient, clean burns, you will need to have sufficient temperatures inside the firebox for thorough combustion. The best method for determining if you have sufficient temperatures is to watch the brick lining in your firebox. When you first light your stove or fireplace insert, the firebrick will turn a dark brown or black. After 20 to 30 minutes of a hot fire, most of the bricks should return to near their original beige color. This means the firebrick have reached a high enough temperature for your appliance to achieve high combustion efficiency and you are ready to adjust the draft control to a lower setting.

Second and just as important, is achieving a high level of heat transfer efficiency. Slowing the rate of flow through the stove or insert enhances heat transfer, thus allowing more time for heat to be transferred into your home. To do this, be sure to thoroughly preheat your stove or insert and then reduce the amount of primary air by closing the draft control down to a lower setting. (More air may produce a slightly greater amount of heat, but will greatly increase wood consumption).

To get the most out of your appliance, you will need to combine good combustion efficiency with good heat transfer practices. The following are some tips on how to operate your appliance to achieve the highest overall efficiency.

1. Thoroughly preheat your appliance before slowing the burn rate by closing the draft control.
2. When loading wood into a preheated stove or fireplace insert, allow a vigorous fire to build before lowering the draft control.
3. Operate your stove or fireplace insert as much as possible in the low to medium burn ranges.
4. Do not lower the draft setting so low as to completely extinguish the flames in the firebox. Check for at least some small flames twenty minutes after setting the draft control.
5. Do not continually operate your stove or fireplace insert in the high (wide open) setting. This wastes wood by carrying a great deal of heat up the chimney and can damage your stove or fireplace insert and chimney.
6. Go outside and check your chimney. More than a very small amount of smoke indicates wasted heat, creosote build up and pollution (*see Figure 28*).

ACHIEVING CLEAN, LONG BURNS

To achieve long burn times, after having thoroughly preheated the appliance, let the appliance top cool down to 250 to 325 degrees. Now load the firebox and set the draft control. At this point, you may need to burn the fireplace insert with the draft open for a few minutes to ignite the wood. All IHP stoves and inserts are EPA tested for emissions at low burn with the air control completely closed. Whether or not you should burn Your appliance with the air control completely closed will depend on the following factors:

- How you load your wood
- Your chimney type, height and draft
- Your wood type and its moisture content
- The temperature of the appliance or fireplace insert
- Which model stove or insert you have

In order to maximize the burn time of your stove or insert you may need to experiment to get the right balance of starting temperature, wood type, and draft control setting for your particular venting configuration. Do not reload the stove or insert for long burns when the stainless secondary tubes or baffles are glowing red, or when the stove or insert is uncomfortably hot to load. This indicates the stove or insert is too hot to load for a long burn.

BLOWER OPERATION

Blower Operation - The blower can be operated manually or automatically (blower will turn on when the stove or insert is hot and turn off when the stove or insert is cool).

The rocker switch on the control panel allows you to select between manual operation or automatic operation as follows (see **Figure 30**):

MANUAL OPERATION: Turn rocker switch to the manual position (up) and adjust rheostat knob to the desired speed. The blower will have to be manually turned "OFF" by rotating the rheostat knob counterclockwise until it clicks.

AUTO OPERATION: Turn rocker switch to the "AUTO" position and the rheostat to the ON position (rotate rheostat knob clockwise until it clicks). When the stove or insert warms up, the blower will automatically turn on (adjust rheostat knob to the desired speed setting). When the stove or insert cools down, the blower will automatically turn off.

Rheostat Operation - The highest blower speed is obtained by turning the rheostat knob clockwise until it clicks "ON", then rotate towards "HIGH" to increase blower speed. Rotate the knob clockwise for a lower speed. To turn off, continue to rotate the knob counterclockwise until it clicks "OFF."

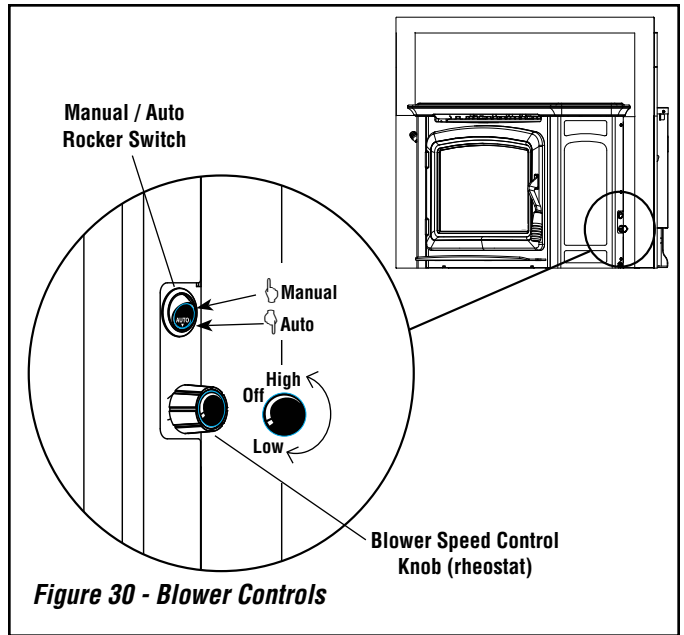


Figure 30 - Blower Controls

Blower Operation Guidelines

While in auto operation mode, the blower will turn off and on based on the temperature of the appliance. Auto operation ensures there is sufficient heat build-up to warm the air being moved by the blower before the blower is turned on. Likewise, when the appliance cools off, the blower is turned off to prevent circulating cool air. Depending on the size and intensity of the fire it may be necessary to adjust the blower speed accordingly to ensure uninterrupted blower operation. For example a small fire may require a slower blower speed to keep the heat output by the blower consistent. If the blower is operated in manual mode, it may be necessary to adjust the blower speed as the fire begins to burn down and the appliance is no longer hot enough to effectively heat the air moved by the blower. If the air coming from the blower feels cool, one should either decrease the blower speed or stoke the fire to build up more heat.

NOTE: Turn blower off before opening the door to load the fuel.

WARNING

The blower must be plugged directly into a properly grounded three-prong receptacle, 120 VAC, 60 Hz, single phase. Do not cut or remove the grounding prong from this plug. Do not route power cord under or in front of appliance.

Installation must be in accordance with National Electrical Code, ANSI/NFPA 70 - latest edition. In Canada, the current CSA C22.1 Canadian Electrical Code - latest edition.

DANGER: Disconnect power before servicing blower.

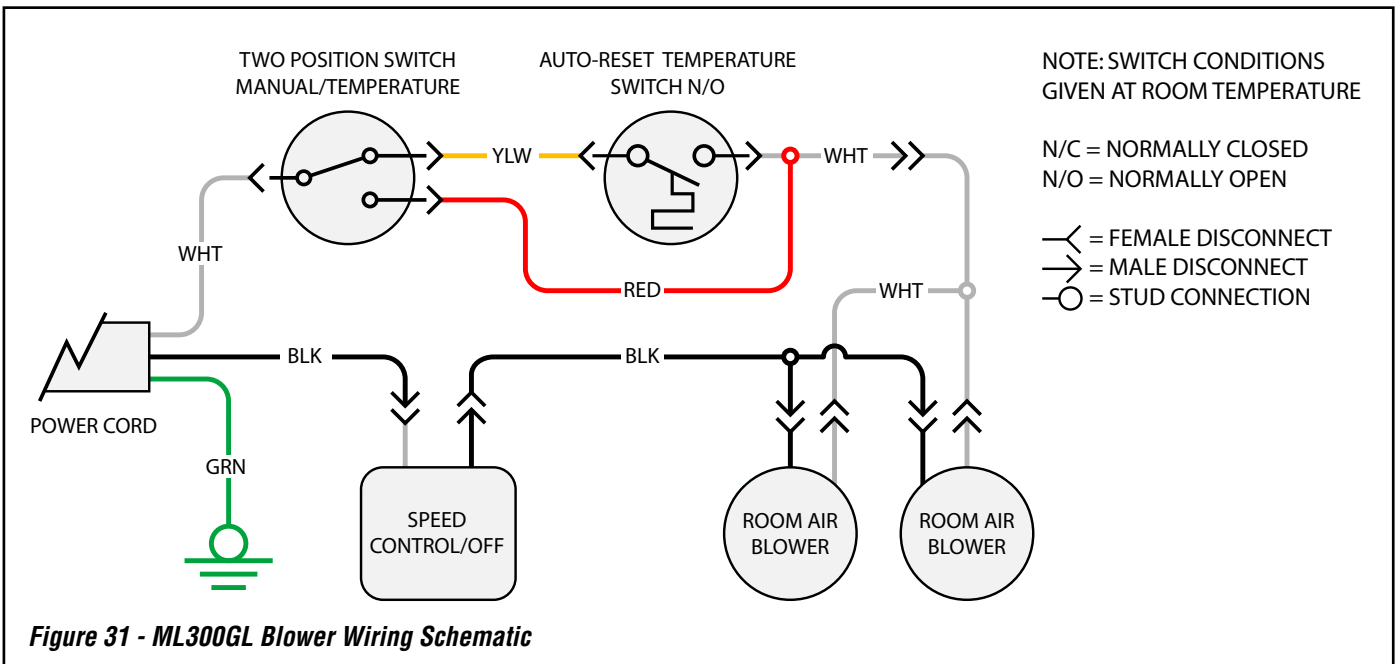


Figure 31 - ML300GL Blower Wiring Schematic

DO'S AND DON'TS

- DO NOT:** Install or operate the appliance before reading this manual.
- DO NOT:** Close the draft beyond the point at which the flames are completely extinguished.
- DO NOT:** Open the appliance door without fully opening the draft first.
- DO NOT:** Burn driftwood or wood that has been in salt water. This includes mill ends and scrap lumber that has been floated in salt water on the way to the mill. (This will void your warranty).
- DO NOT:** Handle the Nickel Door Trim unnecessarily. Do not push or pull the stove door by any other means other than the handle.
- DO NOT:** Force oversized logs into the firebox as this may dislodge the baffle assembly.
- DO NOT:** Close the door tightly during Burn-In period.
- DO:** Be sure to clean any fingerprints from optional accessories that have plated surfaces before burning the appliance. Clean the plated surfaces only with household type glass cleaner and a very soft cloth.
- DO:** Consult local building department if other than recommended clearances are desired.
- DO:** Read instructions for the baffle boards occasionally to ensure you have not bumped or moved them out of place when loading wood.
- DO:** Check the chimney and baffle monthly to make sure they are clean.
- DO:** Burn seasoned, dry wood only! (RAIN = WET WOOD)
- DO:** Open the door frequently during Burn-In period to keep gasket from adhering to the curing paint.
- DO:** Enjoy the warm feeling of your new IHP appliance.

Smoke Detector Recommended

Since there are always several potential sources of fire in any home, we recommend installing smoke detectors. If possible, install the smoke detector in a hallway adjacent to the room (to reduce the possibility of occasional false activation from the heat produced by these appliances). If your local code requires a smoke detector be installed within the same room, you must follow the requirements of your local code. Check with your local building department for requirements in your area.

Carbon Monoxide Monitor Recommended

Carbon Monoxide Poisoning: Early signs of carbon monoxide poisoning are similar to the flu with headaches, dizziness and/or nausea. If you have these signs, obtain fresh air immediately. Some people are more affected by carbon monoxide than others, including pregnant women, people with heart or lung disease or anemia, those under the influence of alcohol, and those at high altitudes.

It is against federal regulations to operate wood heaters in a manner inconsistent with operating instructions in the manual.

PROHIBITED FUELS

This heater is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or to green or freshly cut hardwoods. **DO NOT BURN:**

- Garbage;
- Lawn clippings or yard waste;
- Materials containing rubber, including tires;
- Materials containing plastic;
- Waste petroleum products, paints or paint thinners, or asphalt products;
- Materials containing asbestos;
- Construction or demolition debris;
- Railroad ties or pressure-treated wood;
- Manure or animal remains;
- Salt water driftwood or other previously salt water saturated materials;
- Unseasoned wood;
- Christmas tree branches;
- Paper products, colored paper, cardboard, plywood, or particleboard;
- gasoline;
- naphtha;
- engine oil;
- flammable liquids;
- solvents;
- grease; or
- coal

The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater.

Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke. Intense firing with these materials may overheat the fireplace, causing damage to the unit, a fire or even possibly igniting a chimney fire if the chimney is creosoted. Burning unapproved fuel, resulting in excessive pollutants being emitted, may be prohibited and subject to a fine or other penalty by the authority having jurisdiction in your area.

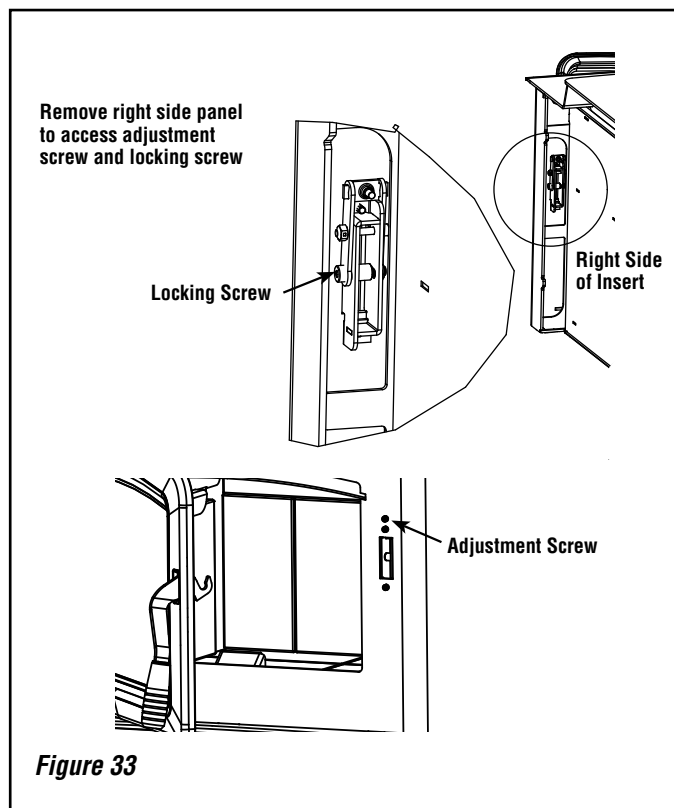
MAINTENANCE

Have your product inspected at least once a year by a qualified service technician to ensure gaskets, air tubes, baffles, and venting are in good repair to ensure proper performance. Have degraded items replaced by a qualified service technician.

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

DOOR HINGES: If door hinges need lubricating, use an anti-seize compound (never use oil) available from your IHP dealer.

DOOR LATCH: Adjustment Instructions - Remove the right side heat shield by loosening the 3 screws located on the side of the insert. Using a "L" shaped 5/32" allen wrench, loosen the locking screw in the latch assembly as shown in **Figure 33**. With the locking screw loosened, adjust the top 5/32" allen screw (**Figure 33**) in the front of the insert to adjust the door tension. Turning the screw to the right will tighten the door, turning the screw to the left will loosen the door. When you loosen the door it will be easiest to pull the roller pin to the full forward position and make slight adjustments to tighten to the desired tension. Assure that the tension on the front door creates a good seal between the gasket on the front door and the firebox front. After adjusting the door tension, re-tighten the lock screw and replace the side panel.



DOOR GASKET: Periodically check gasket to make sure it is not over-compressed. If compressed, replace with a special woven door rope. (Don't try substituting rope, only use special IHP door rope).

PLATED ACCESSORIES: Clean only with a household type glass cleaner and a very soft cotton cloth. Other products may damage plated finish, paint and gaskets.

BAFFLE BOARDS: Your baffle boards should be inspected during every chimney cleaning. If either board is damaged then replace baffle boards.

CREOSOTE FORMATION AND NEED FOR REMOVAL

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire. The chimney and chimney connector should be inspected at least once monthly during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated (1/8" [3mm] or more), it should be removed to reduce the risk of a chimney fire.

Establish a routine for the fuel, wood burner and firing technique. Check daily for creosote build-up until experience shows how often you need to clean to be safe. Be aware that the hotter the fire the less creosote is deposited, and weekly cleaning may be necessary in mild weather even though monthly cleaning may be enough in the coldest months. Contact your local municipal or provincial fire authority for information on how to handle a chimney fire. Have a clearly understood plan to handle a chimney fire.

DISPOSAL OF ASHES

Whenever ashes get 3 to 4 inches deep in your firebox, and when the fire has burned down and cooled, remove excess ashes. Leave an ash bed approximately 1 inch deep on the firebox bottom to help maintain a hot charcoal bed.

Ashes should be scooped out of a cool stove or fireplace insert with a small metal shovel. Ashes should be placed in a steel container with a tight fitting lid and moved outdoors immediately. Other waste shall not be placed in this container. 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 the cinders have thoroughly cooled. Ashes can ignite up to 72 hours after removal from the fireplace insert.

WARNING

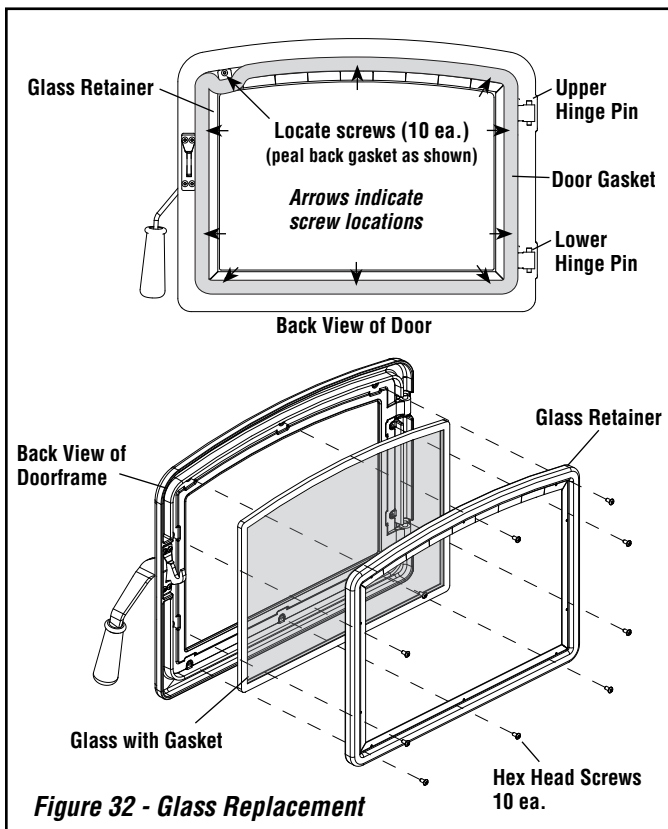
Inspect and clean chimney and connector frequently. Under certain conditions of use, creosote buildup may occur rapidly.

MAINTENANCE

GLASS REPLACEMENT INSTRUCTIONS

(Refer to *Figure 32*)

- Step 1. Remove Door Assembly** - Remove the upper and lower hinge pins by pressing the bottom of each hinge pin up, then pull out from the top. Lift off door and place face down on a soft surface.
- Step 2. Remove Glass Retainer Screws (10 ea.)** - Using an 1/8" allen wrench remove the ten glass retainer screws. To locate screws, peel back the door gasket as necessary. The screws are located by the holes in the stainless steel glass retainer strips.
- Step 3. Remove Glass** - Carefully remove broken glass one piece at a time (protective leather gloves are recommended).
- Step 4. Clean Door Frame** - Clean the area of the door frame where the new glass with gasket will be installed.
- Step 5. Install New Glass Assembly** - Install the new glass with gasket (use only factory supplied 5mm ceramic glass with gasket. **Do not substitute**).
- Step 6. Reinstall Retainer and Screws** - Carefully reinstall the glass retainer and screws. Be very careful not to overtighten the screws (this could result in glass breakage when the stove or insert is hot).
- Step 7. Reinstall Door** - Align hinges on door frame with corresponding hinge holes on the face of stove or insert. Reinstall the upper and lower hinge pins from the top.



GLASS CLEANING GUIDELINES

WARNING: DO NOT CLEAN GLASS WHEN APPLIANCE IS HOT!

Glass on any wood stove or fireplace insert will not stay perfectly clean. Here are some guidelines for cleaning and caring for the glass:

- Ensure the appliance is cold prior to cleaning glass.
- This appliance is designed to provide a flow of air over the inside of the glass, where along with high heat helps inhibit build-up on the glass. When build-up occurs, a commercial glass cleaner designed for stoves is recommended. Regular household glass cleaners will not clean creosote.
- Do not use abrasives such as steel pads, steel wool or oven cleaner as they will scratch the glass. Never scrape glass with a razor blade as this may pit the glass and make it impossible to clean in the future.
- Do not use chemical glass cleaners as they may damage the gaskets or painted surfaces.

TIPS FOR KEEPING THE GLASS CLEAN

- Burn only dry seasoned cord wood. Wet wood = Dirty glass.
- A short, hot fire (15 - 20 minutes) may help to clean off some of the normal buildup. Lower burns = more build-up. Higher burns = less build-up.
- Keep freshly loaded wood away from the glass.
- After reloading, allow all the wood to catch flame before dampering down the appliance.

Removal of the fireplace insert for the purpose of inspecting the fireplace insert and fireplace - See Page 11, Reverse installation instructions.

CAUTION

Cleaning Glass: Ensure appliance is cold prior to cleaning glass. A commercial glass cleaner designed for stoves is recommended. Do not use abrasive cleaners. Do not clean with any materials, which may scratch or otherwise damage the glass. Scratches on the glass can develop into cracks or break. Inspect the glass regularly. If you detect a crack, extinguish the fire and contact your dealer for a replacement.

TROUBLESHOOTING

Problem	Solution
POOR DRAFT:	Extend chimney in length or have the chimney realigned to the proper size flue. Oversized chimneys normally have poor drafts. Remember, the appliances' draft depends solely on the natural draft of the chimney (See Draft Requirements on Page 4). If your stove or fireplace insert is not drafting properly, your chimney is the problem. All stoves and fireplace inserts are thoroughly tested to ensure proper draft with the correct size chimney flue.
EXCESSIVE DRAFT:	With better chimneys being more common, excessive draft can be an issue. Alleviate excessive draft by slowing the burn rate of the appliance once it has reached proper operating temperature (See Maximizing Your appliances Overall Efficiency on Page 20).
DIRTY GLASS:	<ol style="list-style-type: none"> 1) Burn smaller, hotter fires and check to make sure you are not setting the draft down too far with the draft control. 2) Make sure your wood is well seasoned and dry (not open to rain - see Creosote (Page 23) and Fuel (Page 22) sections. 3) See Poor Draft section (above) and Clean Glass (above).
SMOKES WHEN DOOR IS OPEN:	<ol style="list-style-type: none"> 1) If smoke is entering the room, check to make sure your baffle boards are properly installed. 2) Check the chimney for blockage due to creosote (see Creosote section on Page 23). 3) Check draft (See POOR DRAFT section above).
WOOD BURNS TOO FAST:	<ol style="list-style-type: none"> 1) The draft control must be closed further. 2) Add fuel at lower firebox temperatures. 3) Load wood side to side and reduce the flow of air under wood. 4) The door seal may need replacing, check for leakage. 5) See "Excessive Draft."
POOR HEAT OUTPUT:	<ol style="list-style-type: none"> 1) Check your wood. Wet, moist, unseasoned wood will not produce heat. 2) Your stove or fireplace insert needs to be seasoned (moisture removed from the steel and brick). Continue to burn a fire. It normally takes from one to three weeks of burning to season your stove or fireplace insert (See Burn-In Period on Page 17). 3) See Excessive Draft section above.
PAINT GIVES OFF ODOR (smoke):	Paint is tempering-in. Burn only moderately hot for the first few days until paint is fully cured. Then burn a very hot fire to cure any paint that may not easily cure. Open windows or door to ventilate (See Burn-In Period on Page 17).

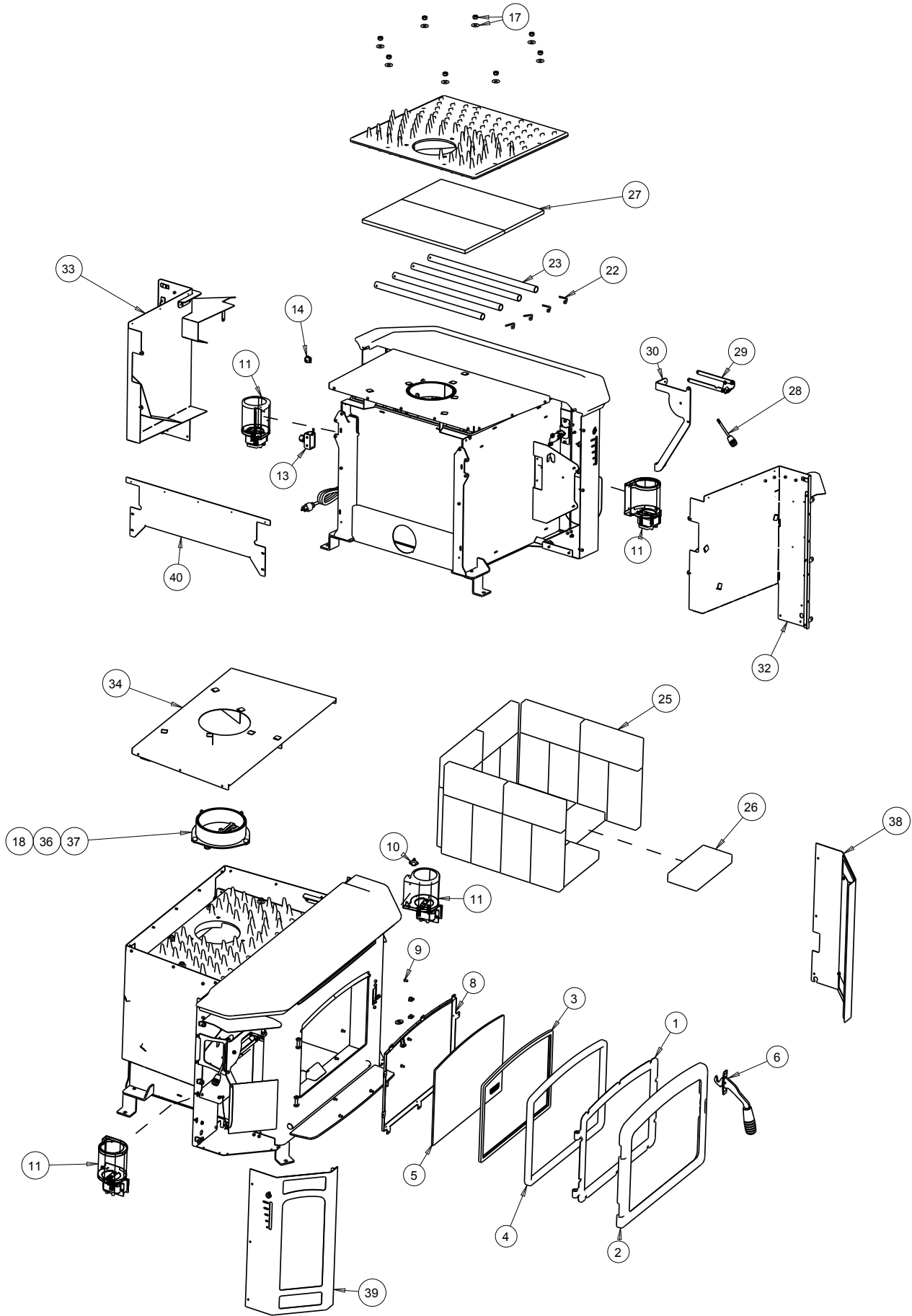
REPLACEMENT PARTS - MODEL MONTLAKE™ 300GL

Contact an IHP dealer to obtain any of these parts. Never use substitute materials. Use of non-approved parts can result in poor performance and safety hazards.

FRONT DOOR PARTS LIST		
Item #	Description	ML300
1	Inner Door Frame, Cast Iron	H8365
2	Outer Door Frame, Cast Iron	H8366
3	Glass Gasket 1"	H8380
4	Door Gasket 7/8"	H5639
5	Ceramic Glass With Gasket	H8392
6	Door Handle Kit	H8395
7	Door Latch Assembly (4 button head screws and latch)	H8397
8	Glass, Retainer Kit	H8394
9	Door Hardware Kit (includes 2 pins, door roller and 10 button head screws and door set screw)	H8398
BLOWER PARTS		
10	Snap switch	H8682
11	Blower Kits	F3223
---	Wire Harness	H8684
---	Wire Harness, RH to LH Blower	F2030
13	Rheostat	H5742
14	Toggle Switch	H8066
MISCELLANEOUS PARTS		
---	Dry Graphite (apply to door handle bushing)	71052
---	Anti Seize, 2 Gram Pouch	H5633
17	Heat Exchanger Bolt Kit	H8387
18	Flue Ring Bolt Kit	H8388

MISCELLANEOUS PARTS (continued)		
Item #	Description	ML300
---	Taptite Qty 8 (34055)	H8390
---	Button Head Screw Qty 8 (34027)	H8391
---	Control Labels	H8685
FIREBOX PARTS		
22	Secondary Tube Retainer Clips (4 required)	H8367
23	Replacement Secondary Air Tube Kit	H9081
24	Back Brick Retainer	J7602
25	Complete Firebrick Kit (GV300 - 26 bricks included)	H9082
26	Firebrick 4-1/2" X 9", Each	H5612
27	Baffle Board Kit	H9083
BODY PARTS		
28	Damper Rod	H8393
29	Damper Assembly	H8396
30	Damper Assembly Linkage	F2031
31	Cast Iron Heat Exchanger (hardware included)	H8369
32	Left Side Heat Shield Assy (hardware included)	F2032
33	Right Side Heat Shield Assy (hardware included)	F2033
34	Top Heat Shield (hardware included)	F2034
35	Heat Exchanger Gasket	H8377
36	Flue collar base (hardware included)	F2035
37	Flue collar insert (hardware included)	F2036
38	Right side front panel	F2037
39	Left side front panel	F2038
40	Rear Heat Shield (hardware included)	F2039

REPLACEMENT PARTS - MODEL MONTLAKE™ 300GL



NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

ACCESSORIES - MODEL MONTLAKE™ 300GL

Model	Description	ML300
TOP WARMING SURFACE KITS (ONE REQUIRED)		
TOP-STEEL-ML300	Steel Top - Montlake™ 300	F2028
TOP-CASTIRON-ML300	Cast Top - Montlake 300	F2029
DOOR TRIM KITS		
DRTRM-ML230-NKL	Door Trim, Nickel	H8346
DRTRM-ML230-BRNKL	Door Trim, Brushed Nickel	H8347
SURROUND KITS (ONE REQUIRED)		
ML300-FP2942	Surround Kit, 29" X 42-1/2" Black - Montlake 300	F2021
ML300-FP2949	Surround Kit, 29" X 49-1/2" Black - Montlake 300	F2022
ML300-FP3342	Surround Kit, 33" X 42-1/2" Black - Montlake 300	F2023
ML300-FP3349	Surround Kit, 33" X 49-1/2" Black - Montlake 300	F2024
ML300-FPTRIM3450	Surround Kit, 34" X 50" Black Trimmable - Montlake 300	F2025
MISC.		
ZC-SUPPRT-ML300	ZC Support - Montlake 300	F2026
TSPK-B	Touch-up Spray Paint Kit, Black	H8159

CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA
Listed Factory-built or Masonry Fireplace Accessory/Insert



Manufactured By / Fabriqué Par:
INNOVATIVE HEARTH PRODUCTS
1502 14th Street NW
Auburn, WA 98001 USA



"PREVENT HOUSE FIRES"

Install and use only in accordance with manufacturer's installation instructions and your local building codes. Do not connect this unit to a chimney flue serving another appliance.

Blower Electrical Rating: 120V, 60 Hz, .8 Amp

Do not route power cord under or in front of appliance.

Replace glass only with 5mm ceramic. Operate only with doors closed.

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.

Certification test emissions value 1.8 g/hr per EPA Method 28R.

Report No./Numéro de Rapport: 14-194

Serial No.
Numéro de série **ML300GL-**

Model / Modèle: Montlake™ ML300GL

Tested to/Testé à: UL 1482, ULC S628

Room Heater, Solid Fuel Type

Minimum Clearance to Combustible Materials - Inches (millimeters)

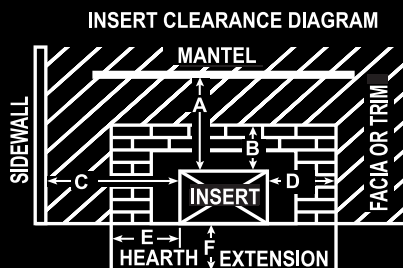
- (A) Clearance from Insert top to Mantel = USA-26", CAN-660mm. Maximum mantel depth = 10" (254mm).
(B) Clearance from insert top to combustible = USA-24", CAN-610mm.
(C) Minimum clearance to combustible sidewall = 8" (203mm)
(D) Minimum clearance to combustible side trim = 2" (51mm)
(E) Minimum distance of floor protection to the side = 8" (203mm). This is measured from the sides of the door opening in the USA and from the sides of the insert in Canada.
(F) Minimum distance from front of insert to combustible = USA-18", CAN-450mm.

The hearth/floor protection must be a thermally rated type II UL 1618 listed floor protection with a minimum R value of 5.2, or 2.08 per inch with a minimum thickness of 2-1/2" (64mm).

Install only in a masonry fireplace, built to UBC Chapter 37 or approved factory-built fireplace (USA only - see owner's manual). Do not remove brick or mortar from masonry fireplace to accommodate insert. Approved with minimum 6" (152mm) diameter stainless steel listed reline system. Remove and clean behind unit frequently, as creosote build up may occur rapidly. See owner's manual for reductions on mantel, trim and floor protection.



CAUTION: HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING, FURNISHINGS AND COMBUSTIBLE MATERIAL A CONSIDERABLE DISTANCE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS. DO NOT OVERFIRE. IF HEATER OR CHIMNEY CONNECTOR GLOWS, YOU ARE OVERFIRING. INSPECT AND CLEAN CHIMNEY AND CONNECTOR FREQUENTLY. UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY. DO NOT USE GRATE OR ELEVATE FIRE - BUILD WOOD FIRE DIRECTLY ON HEARTH. FEED DOOR MUST BE CLOSED DURING FIRING EXCEPT WHEN ADDING FUEL. KEEP ASH DOOR CLOSED TO AVOID EXCESS HEAT. DANGER: RISK OF ELECTRICAL SHOCK. DISCONNECT POWER BEFORE SERVICING UNIT. TYPE OF FUEL: SOLID WOOD ONLY.



HEARTH EXTENSION			
Height	Thermal Protection Thickness	Hearth Extension Depth	
		USA	Canada
0"	2-1/2"	18"	18"
8"	0"	18"	18"

Date of Manufacture / Date De Fabrication

2019	2020	2021	JAN. JANV	FEB. FEVR	MAR. MARS	APR. AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOÛT	SEP SEPT	OCT OCT	NOV NOV	DEC DEC
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U.S. ENVIRONMENTAL PROTECTION AGENCY

Certified to comply with 2020 particulate emission standards using crib wood.

Part No./ No. pièce #900964-00 Rev. 0, 02/2019

DO NOT REMOVE THIS LABEL

Made in U.S.A.

NOTES

[illegible]

Innovative Hearth Products IronStrike® Brand Wood Burning Stove and Insert Limited Lifetime Warranty

THE WARRANTY

Innovative Hearth Products ("IHP") Limited Lifetime Warranty warrants your IronStrike® Brand Wood Burning Stove or Insert ("Product") to be free from defects in materials and workmanship at the time of manufacture. The Product body, firebox and ceramic glass carry the Limited Lifetime Warranty. Ceramic glass carries the Limited Lifetime Warranty against thermal breakage only. After installation, if covered components manufactured by IHP are found to be defective in materials or workmanship during the Limited Lifetime Warranty period and while the Product remains at the site of the original installation, IHP will, at its option, repair or replace the covered components. If repair or replacement is not commercially practical, IHP will, at its option, refund the purchase price or wholesale price of the IHP product, whichever is applicable. IHP will also pay IHP prevailing labor rates, as determined in its sole discretion, incurred in repairing or replacing such components for up to five years. THERE ARE EXCLUSIONS AND LIMITATIONS to this Limited Lifetime Warranty as described herein.

COVERAGE COMMENCEMENT DATE

Warranty coverage begins on the date of purchase. In the case of new home construction, warranty coverage begins on the date of first occupancy of the dwelling or six months after the sale of the Product by an independent IHP dealer/distributor, whichever occurs earlier. The warranty shall commence no later than 24 months following the date of product shipment from IHP, regardless of the installation or occupancy date.

EXCLUSIONS AND LIMITATIONS

This Limited Lifetime Warranty applies only if the Product is installed in the United States or Canada and only if operated and maintained in accordance with the printed instructions accompanying the Product and in compliance with all applicable installation and building codes and good trade practices.

This warranty is non-transferable and extends to the original owner only. The Product must be purchased through a listed supplier of IHP and proof of purchase must be provided. The Product body and firebox carry the Limited Lifetime Warranty from the date of installation. Vent components, trim components and paint are excluded from this Limited Lifetime Warranty. The following do not carry a Limited Lifetime Warranty but are warranted as follows:

Cast Iron Heat Exchanger – Replacement for five years from the date of installation

Cast iron parts – Replacement for one year from the date of installation

Catalyst – Carries a separate warranty. Refer to the warranty certificate provided for that part

Electrical components – Repair or replacement for one year from date of installation

Gaskets – Replacement for one year from the date of installation.

Gold & nickel plating – Replacement for two years from date of installation. Excludes tarnishing

Refractory & screens – Replacement for two years from date of installation. Excludes hairline cracks

Removable air tubes – Repair or replacement for seven years from date of installation. IHP prevailing labor rates for years one through five.

Labor coverage – Prevailing IHP labor rates apply for the warranty period of the component, unless otherwise noted

Parts not otherwise listed carry a 90 day warranty from the date of installation.

Whenever practicable, IHP will provide replacement parts, if available, for a period of 10 years from the last date of manufacture of the Product.

IHP will not be responsible for: (a) damages caused by normal wear and tear, accident, riot, fire, flood or acts of God; (b) damages caused by abuse, negligence, misuse, or unauthorized alteration or repair of the Product affecting its stability or performance. (The Product must be subject to normal use with approved fuels listed in the Operation Manual provided with the product. Fuel products with abnormal burning characteristics, including but not limited to fuel such as driftwood, coal or plywood and wood products using a binder may burn at excessive temperatures and may cause damage to the Product or may cause it to function improperly; IHP stoves, inserts and high efficiency EPA fireplaces are approved for burning dry seasoned wood only.); (c) damages caused by failing to provide proper maintenance and service in accordance with the instructions provided with the Product; (d) damages, repairs or inefficiency resulting from faulty installation or application of the Product.

Coverage of this Limited Lifetime Warranty is conditional upon the appliance being operated without the use of grates, irons or any other method to elevate the fire.

IHP is not responsible for inadequate system draft caused by air conditioning and heating systems, mechanical ventilation systems, or general construction conditions which may generate negative air pressure in the room in which the appliance is installed. Additionally IHP assumes no responsibility for smoking conditions caused by inadequate chimney height, adjoining trees or buildings, adverse wind conditions or unusual environmental factors and conditions. Certain IHP Products are listed for use with Security Chimneys International, Ltd. chimney systems only. Use of chimney components other than that specified in the Product manual will void the Product warranty.

This Limited Lifetime Warranty covers only parts and labor as provided herein. In no case shall IHP be responsible for materials, components or construction which are not manufactured or supplied by IHP or for the labor necessary to install, repair or remove such materials, components or construction. Additional utility bills incurred due to any malfunction or defect in equipment are not covered by this Limited Lifetime Warranty. All replacement or repair components will be shipped F.O.B. from the nearest stocking IHP factory.

LIMITATION ON LIABILITY

It is expressly agreed and understood that IHP's sole obligation and the purchaser's exclusive remedy under this warranty, under any other warranty, expressed or implied, or in contract, tort or otherwise, shall be limited to replacement, repair, or refund, as specified herein.

In no event shall IHP be liable for any incidental or consequential damages caused by defects in the Product, whether such damage occurs or is discovered before or after replacement or repair, and whether such damage is caused by IHP's negligence. IHP has not made and does not make any representation or warranty of fitness for a particular use or purpose, and there is no implied condition of fitness for a particular use or purpose.

IHP makes no expressed warranties except as stated in this Limited Lifetime Warranty. The duration of any implied warranty is limited to the duration of this expressed warranty.

No one is authorized to change this Limited Lifetime Warranty or to create for IHP any other obligation or liability in connection with the Product. Some states and provinces do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. The provisions of this Limited Lifetime Warranty are in addition to and not a modification of or subtraction from any statutory warranties and other rights and remedies provided by law.

INVESTIGATION OF CLAIMS AGAINST WARRANTY

IHP reserves the right to investigate any and all claims against this Limited Lifetime Warranty and to decide, in its sole discretion, upon the method of settlement.

To receive the benefits and advantages described in this Limited Lifetime Warranty, the appliance must be installed and repaired by a licensed contractor approved by IHP.

Contact IHP at the address provided herein to obtain a listing of approved dealers/distributors. **IHP shall in no event be responsible for any warranty work done by a contractor that is not approved without first obtaining IHP's prior written consent.**

HOW TO REGISTER A CLAIM AGAINST WARRANTY

In order for any claim under this warranty to be valid, you must contact the IHP dealer/distributor from which you purchased the product. If you cannot locate the dealer/distributor, then you must notify IHP in writing. IHP must be notified of the claimed defect in writing within 90 days of the date of failure. Notices should be directed to the IHP Warranty Department at 1508 Elm Hill Pike, Suite 108; Nashville, TN 37210 or visit our website at WWW.IRONSTRIKE.US.COM.

WARRANTY

Your wood appliance is covered by a limited warranty (provided with the appliance). Please read the warranty to be familiar with its coverage.

Retain this manual. File it with your other documents for future reference.

REPLACEMENT PARTS

See **Pages 26-27** for a complete replacement parts list. Use only parts supplied from the manufacturer.

Normally, all parts should be ordered through your IHP distributor or dealer. Parts will be shipped at prevailing prices at time of order.

When ordering repair parts, always give the following information:

1. The model number of the appliance.
2. The Serial Number of the appliance.

3. The part number.
4. The description of the part.
5. The quantity required.
6. The installation date of the appliance.

If you encounter any problems or have any questions concerning the installation or application of this system, please contact your dealer.

Innovative Hearth Products, LLC (IHP)
1769 East Lawrence Street
Russellville, AL 35654
IronStrike.us.com

PRODUCT REFERENCE INFORMATION

We recommend that you record the following important information about your appliance. If you did not purchase your appliance directly from an IHP dealer, then contact us at IronStrike.us.com to find your nearest IHP dealer who will answer your questions or address your concerns.

Model Number _____

Serial Number _____

Date Installed _____

Your Dealer's Name _____



Innovative Hearth Products (IHP) reserves the right to make changes at any time, without notice, in design, materials, specifications, and prices, and also to discontinue colors, styles, and products. Consult your local distributor for fireplace code information.



P900962-00

1508 Elm Hill Pike, Suite 108 • Nashville, TN 37210



CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA

Listed Factory-built or Masonry Fireplace Accessory/Insert



Manufactured By / Fabriqué Par:
INNOVATIVE HEARTH PRODUCTS
1502 14th Street NW
Auburn, WA 98001 USA



"PREVENT HOUSE FIRES"

Install and use only in accordance with manufacturer's installation instructions and your local building codes. Do not connect this unit to a chimney flue serving another appliance.

Blower Electrical Rating: 120V, 60 Hz, .8 Amp

Do not route power cord under or in front of appliance.

Replace glass only with 5mm ceramic. Operate only with doors closed.

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.

Certification test emissions value 1.8 g/hr per EPA Method 28R.

Report No./Numéro de Rapport: 14-194

Serial No.

Numéro de série

ML300GL-

Model / Modèle: Montlake™ ML300GL

Tested to/Testé à: UL 1482, ULC S628

Room Heater, Solid Fuel Type

Minimum Clearance to Combustible Materials - Inches (millimeters)

(A) Clearance from Insert top to Mantel = USA-26", CAN-660mm. Maximum mantel depth = 10" (254mm).

(B) Clearance from insert top to combustible = USA-24", CAN-610mm.

(C) Minimum clearance to combustible sidewall = 8" (203mm)

(D) Minimum clearance to combustible side trim = 2" (51mm)

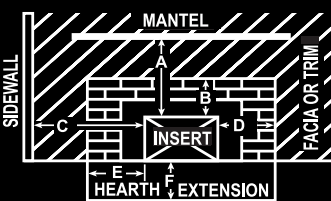
(E) Minimum distance of floor protection to the side = 8" (203mm).

This is measured from the sides of the door opening in the USA and from the sides of the insert in Canada.

(F) Minimum distance from front of insert to combustible = USA-18", CAN-450mm.

The hearth/floor protection must be a thermally rated type II UL 1618 listed floor protection with a minimum R value of 5.2, or 2.08 per inch with a minimum thickness of 2-1/2" (64mm).

INSERT CLEARANCE DIAGRAM



HEARTH EXTENSION

Height	Thermal Protection Thickness	Hearth Extension Depth	
		USA	Canada
0"	2-1/2"	18"	18"
8"	0"	18"	18"

Install only in a masonry fireplace, built to UBC Chapter 37 or approved factory-built fireplace (USA only - see owner's manual). Do not remove brick or mortar from masonry fireplace to accommodate insert. Approved with minimum 6" (152mm) diameter stainless steel listed reline system. Remove and clean behind unit frequently, as creosote build up may occur rapidly. See owner's manual for reductions on mantel, trim and floor protection.



CAUTION: HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING, FURNISHINGS AND COMBUSTIBLE MATERIAL A CONSIDERABLE DISTANCE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS. DO NOT OVERFIRE. IF HEATER OR CHIMNEY CONNECTOR GLOWS, YOU ARE OVERFIRING. INSPECT AND CLEAN CHIMNEY AND CONNECTOR FREQUENTLY. UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY. DO NOT USE GRATE OR ELEVATE FIRE - BUILD WOOD FIRE DIRECTLY ON HEARTH. FEED DOOR MUST BE CLOSED DURING FIRING EXCEPT WHEN ADDING FUEL. KEEP ASH DOOR CLOSED TO AVOID EXCESS HEAT. DANGER: RISK OF ELECTRICAL SHOCK. DISCONNECT POWER BEFORE SERVICING UNIT.

TYPE OF FUEL: SOLID WOOD ONLY.

Date of Manufacture / Date De Fabrication

2019	2020	2021	JAN. JANV	FEB. FEVR	MAR. MARS	APR. AVR	MAY MAI	JUN JUIN	JUL JUL	AUG AOÛT	SEP SEPT	OCT OCT	NOV NOV	DEC DEC
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U.S. ENVIRONMENTAL PROTECTION AGENCY

Certified to comply with 2020 particulate emission standards using crib wood.

Part No./ No. pièce #900964-00 Rev. 0, 02/2019

DO NOT REMOVE THIS LABEL

Made in U.S.A.



Fabriqué Par:
INNOVATIVE HEARTH PRODUCTS
1502 14th Street NW
Auburn, WA 98001 USA



"PRÉVENTION DES INCENDIES"

Installer et utiliser l'appareil en conformité avec les directives d'installation du fabricant et des autorités locales en bâtiment ou le service de prévention des incendies. Ne pas brancher cette unité à un conduit de fumée raccordé à un autre appareil.

Spécification Électrique Du Ventilateur: 120V, 60 Hz, .8 Amp

Ne pas faire passer le fil électrique sous ou en avant de l'appareil

Remplacez la vitre seulement avec la céramique de 5 millimètres.

Faire fonctionner uniquement lorsque les portes sont fermées.

Cet appareil de chauffage au bois doit être inspecté et entretenu périodiquement pour fonctionner correctement. Voir le manuel du propriétaire pour plus d'information. L'utilisation de cet appareil de chauffage au bois de manière incompatible avec les instructions du manuel du propriétaire constitue une infraction aux réglementations fédérales. Valeur d'émission du test d'homologation 1,8 g/h (EPA Method 28R).

Numéro de Rapport: 14-194

Le numéro de série est indiqué dans la section anglophone de cette étiquette

Model / Modèle: Montlake™ ML300GL

Testé à: UL 1482, ULC S628

Appareil de chauffage certifié pour combustible solide

Dégagements Minimums Aux Matériaux Combustibles - En Pouces (millimètres)

(A) Espace entre l'encastrable et le manteau de cheminée = USA-26", CAN-660mm. Profondeur maximum de la tablette du manteau de cheminée 10" (254mm).

(B) Espace entre l'encastrable et les matériaux combustibles du haut = USA -24" CAN-610mm.

(C) Espace minimum entre l'encastrable et le mur de côté combustible = 8" (203mm).

(D) Espace minimum entre l'encastrable et les matériaux combustibles du côté = 2" (51mm)

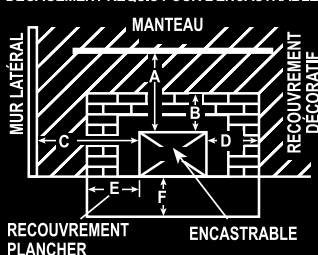
(E) Minimum requis de matériel non combustible au plancher, de chaque côté de l'ouverture de l'appareil = 8" (203mm)

(F) Minimum requis de matériel non combustible à l'avant de l'appareil = USA-18", CAN-450mm.

La protection du foyer/sol doit être homologuée UL 1618 type II avec une valeur R minimum de 5,2, ou 2,08 par pouce avec une épaisseur minimum de 64 mm (2,5 po).

Installer seulement dans un foyer de maçonnerie construit selon UBC Chapitre 37 ou dans un foyer approuvé par le fabricant (référez-vous au manuel). Ne pas enlever de ciment ou de briques pour installer l'encastrable. Approuvé pour raccordement avec un conduit de tubage certifié en acier inoxydable de 6" (152mm) de diamètre. Tirer l'appareil et nettoyer l'arrière fréquemment car le crésote peut s'y accumuler rapidement.

DÉGAGEMENT REQUIS POUR L'ENCASTRABLE



RECOUVREMENT PLANCHER

Hauteur	Épaisseur de la protection thermique	Largeur extension d'âtre	
		USA	Canada
0"	2-1/2"	18"	18"
8"	0"	18"	18"



ATTENTION: L'APPAREIL EST CHAUD LORS DE L'OPÉRATION. NE PAS Y TOUCHER. RISQUE DE BRÛLURES CUTANÉES. TENIR LES ENFANTS, LES MATÉRIAUX COMBUSTIBLES, LES VÊTEMENTS ET LES MEUBLES ÉLOIGNÉS DE L'APPAREIL. VOIR LA PLAQUE SIGNALÉTIQUE ET LES DIRECTIVES. NE PAS SURCHAUFFER L'APPAREIL. SI L'APPAREIL OU LE TUYAU DE CHEMINÉE ROUGIT, VOUS SURCHAUFFEZ. INSPECTER ET NETTOYER LA CHEMINÉE ET LE TUYAU CONNECTEUR FRÉQUEMMENT. SOUS CERTAINES CONDITIONS, IL SE PEUT QUE LE CRÉOSOTE S'ACCUMULE RAPIDEMENT. NE SURÉLEVER PAS LE FEU À L'AIDE D'UN CHENET. DÉPOSER LES BÛCHES DE BOIS DIRECTEMENT SUR L'ÂTRE. LA PORTE DOIT ÊTRE FERMÉE PENDANT L'USAGE SAUF POUR ALIMENTER LE FEU.

GARDER LA PORTE "BY-PASS" (CENDRES) FERMÉE POUR ÉVITER DE SURCHAUFFER. DANGER: RISQUES DE DÉCHARGE ÉLECTRIQUE. DÉCONNECTER LE FIL ÉLECTRIQUE DE LA PRISE DE CONTACT AVANT LE SERVICE. NE PAS FAIRE PASSER LE FIL ÉLECTRIQUE SOUS OU EN AVANT DE L'APPAREIL. TYPE DE COMBUSTIBLE: BOIS SEULEMENT



INSTALLATION AND OPERATION MANUAL

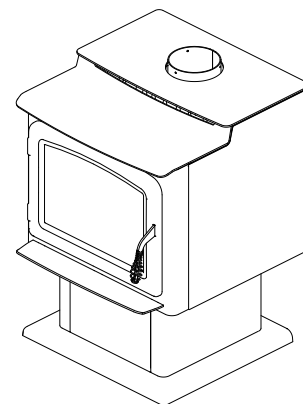
Free-Standing EPA Certified Wood-Burning Stoves

Save These Instructions
For Future Reference

P/N 900961-00, Rev. NC, 02/2019



P900961-00



Wood-Burning Stoves Model Grandview™ GV300GL

With Innovative Thermal Fin Technology (TFT™)



Report # 14-194

A French manual is available upon request. Order P/N 900961-01.

Ce manuel d'installation est disponible en français, simplement en faire la demande. Numéro de la pièce 900961-01.

This appliance must be properly installed and operated in order to prevent the possibility of a house fire. Please read this entire installation and operation manual before installing and using your wood stove. Failure to follow these instructions could result in property damage, bodily injury or even death. Contact your local building or fire officials to obtain a permit and information on any installation requirements and inspection requirements in your area.



	! WARNING
	<ul style="list-style-type: none">• Hot! Do not touch! The glass and surfaces of this appliance will be hot during operation and will retain heat for a while after shutting off the appliance. Severe burns may result.• Carefully supervise children in the same room as appliance.

CONGRATULATIONS!

When you purchased your new wood stove, you joined the ranks of thousands of individuals whose answer to their home heating needs reflects their concern for aesthetics, efficiency and our environment. We extend our continued support to help you achieve the maximum benefit and enjoyment available from your new wood stove.

Thank you for selecting an Innovative Hearth Products, LLC (IHP) wood stove as the answer to your home supplemental heating needs.

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USING THIS MANUAL

Please read and carefully follow all of the instructions found in this manual. Please pay special attention to the safety instructions provided in this manual.

PRODUCT IS SUBJECT TO CHANGE WITHOUT NOTICE

IMPORTANT SAFETY AND WARNING INFORMATION

READ THIS MANUAL IN ITS ENTIRETY AND UNDERSTAND THESE RULES TO FOLLOW FOR SAFETY.

1. When this room heater is not properly installed, a house fire may result. To reduce the risk of fire, follow the installation instructions. Contact local building or fire officials about restrictions and installation inspection requirements in your area.
2. Wear gloves during installation to avoid injury from sharp edges on the stove and/or its parts.
3. This unit is designed and engineered to burn only dry, well-seasoned wood. Burning wet wood will greatly reduce the stove's efficiency, produce excessive amounts of smoke and can cause dangerous chimney fires due to creosote build-up.
4. Before opening the door, the draft control must be fully open to avoid possible combustion flash (ignition of hot volatile gases as the door is opened).
5. Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or 'freshen up' a fire in this heater. Keep all such liquids well away from the heater while it is in use. **DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.**
6. While burning, fuel utilizes oxygen from the air in the room. Be sure to allow an adequate amount of fresh air into the room where the stove is burning.
7. The outside surface of the stove will be hot while burning properly and can set items like clothing and curtains on fire. Keep furnishings and other combustible materials away from the stove. Using the heat from the stove to dry wet clothing can be hazardous if clothes are placed too near the surface of the stove.
8. **HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING, FURNISHINGS AND COMBUSTIBLE MATERIAL A CONSIDERABLE DISTANCE AWAY. CONTACT MAY CAUSE SKIN BURNS.** Do not allow children to play near the stove without close supervision. Do not touch the stove while it is burning. Use extreme caution while the unit is in use. Surface temperatures become dangerously hot and can cause serious burns.
9. Do not allow anyone to operate the stove who is not familiar with the operating instructions.
10. Attempts to achieve heat output rates that exceed stove design specifications can result in permanent damage to the stove. Never leave your stove unattended on high burn rates. This may cause overfiring. Overfiring the stove may cause a house fire. If the stove glows, you are overfiring.
11. Keep a water hose or hand-operated fire extinguisher close for safety.
12. **Smoke Detectors** - Since there are always several potential sources of fire in any home, we recommend installing smoke detectors. If possible, install the smoke detector in a hallway adjacent to the room (to reduce the possibility of occasional false activation from the heat produced by the stove). If your local code requires a smoke detector be installed within the same room, you must follow the requirements of your local code. Check with your local building department for requirements in your area.
13. Inspect your chimney at least once a month during the burning season to check for soot and creosote accumulations. Any accumulations over 1/8" thick should be removed by a professional chimney sweep. Do not attempt to burn out heavy creosote accumulations with a hot fire. If large accumulations are occurring, review your burning procedures.
14. If a creosote fire should develop, the fire department should be called immediately and then attempts should be made to control the fire until assistance arrives. If a "runaway" fire should develop causing over-heating of the stove, the door and draft regulators should be closed immediately. The fire should die down once deprived of oxygen. After a severe chimney fire, the complete chimney system should be checked before further use.
15. **Do Not Use Grate Or Elevate Fire - Build Wood Fire Directly On Hearth (firebrick).** Do not use andirons or other methods of supporting the fuel.
16. Please read this entire manual before you install and use your new room heater. Failure to follow instructions may result in property damage, bodily injury, or even death.
17. Check all local building and safety codes before installation. The installation instructions and appropriate code requirements must be followed exactly and without compromise. In the absence of local codes the following standards and codes must be followed.
18. In the U.S.A, install in accordance with the National Fire Protection Association's Code, NFPA 211, Standards for Chimneys, Fireplaces, Vents and Solid-Fuel-Burning Appliances, or similar regulations, may apply to the installation of a Solid-Fuel-Burning appliance in your area. In Canada, the guideline is established by the CSA Standard, CAN/CSA-B365-M93, Installation Code for Solid-Fuel-Burning Appliances and Equipment.
19. **DO NOT CONNECT TO OR USE IN CONJUNCTION WITH ANY AIR DISTRIBUTION DUCTWORK UNLESS SPECIFICALLY APPROVED FOR SUCH INSTALLATIONS.**
20. **WARNING: BURNING IMPROPER FUEL (I.E. CHARCOAL) CAN RESULT IN CARBON MONOXIDE POISONING, WHICH MAY LEAD TO DEATH!**
21. **Carbon Monoxide Poisoning** - Early signs of carbon monoxide poisoning resemble the flu with headaches, dizziness, or nausea. If you have these signs, get fresh air at once! Have the heater inspected by a qualified service technician. Some people are more affected by carbon monoxide than others. These include pregnant women, people with heart or lung disease or anemia, those under the influence of alcohol, and those at high altitudes.
22. Failure to use manufacturer provided parts, variations in techniques and construction materials or practices other than those described in this manual may create a fire hazard and void the limited warranty.
23. Do not make any make-shift compromises during installation. Any modification or alteration may result in damage to the appliance or dwelling and will void the warranty, certification and listings of this unit.
24. These appliances are designed as supplemental heaters. Therefore, it is advisable to have an alternate heat source when installed in a dwelling.
25. **Do Not Overfire** - If Heater or Chimney Connector Glows, You Are Overfiring.
26. **DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.**
27. **DO NOT BURN GARBAGE OR FLAMMABLE FLUIDS SUCH AS GASOLINE, NAPHTHA OR ENGINE OIL.**

28. This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

WARNING

This product can expose you to chemicals including Carbon Black, which is known to the State of California to cause cancer, and Carbon Monoxide, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

TESTING INFORMATION

This manual describes the installation and operation of the Grandview™ 300GL non-catalytic wood heaters. These heaters meet the U.S. Environmental Protection Agency's emissions limits, and are compliant with 2020 EPA NSPS particulate emission standards. These heaters have been developed, tested and constructed in accordance with the requirements of UL 1482, ULC S627 and HUD standards and are listed by PFS Corporation. These heaters have been approved for residential, mobile home and alcove installations.

Model	Emission Rate	BTU/hr Output Range	Max. Output BTU/hr	Tested Average Efficiency
GV300GL	1.8 g/hr	13,693 – 39,232	100,000	74.1% HHV

DRAFT REQUIREMENTS

This appliance is dependent upon a properly functioning chimney for optimum performance. It is a high efficiency appliance that loses much less heat up the chimney than older appliances and fireplaces. For this reason it is important to match the stove to the chimney. The chimney has two functions:

1. It draws combustion air into the appliance (without air, no fuel will burn) and
2. It exhausts combustion by-products. Your new stove is what is known as a "natural draft" appliance.

The appliance depends solely on the natural draft of the chimney system to draw combustion air into the unit. Draft is the force that moves air from the appliance up into 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 temperatures in the appliance (overfiring). Slow or inadequate draft equals poor combustion and possible smoking problems. The following are some conditions that may contribute to poor chimney draft:

1. A chimney too large for your appliance.
2. A chimney with not enough height to produce adequate draft.
3. A chimney with excessive height (this may allow exhaust to cool too much before exiting, which will stall the rate the exhaust exits).
4. Offsets in the venting system are too restrictive (see *Chimney Guidelines*).

Inadequate draft will cause the appliance to leak smoke into the room through the stove and the chimney connector joints.

Excessive draft may cause an uncontrollable burn or a glowing red stove or chimney part.

Overfiring Damage - If the heater or chimney connector glows, you are overfiring. Other symptoms may include: Cracking, warping or burning out of components, plated accessories may turn color, stove glass may develop a haze, which will not come off with cleaning.

Overfiring of a stove is a condition where excessive temperatures are reached, beyond the design capabilities of the appliance. The damage that occurs from overfiring is not covered under the manufacturer's limited warranty.

Also see *Troubleshooting* on **Page 27**.

SELECTING THE PROPER VENTING SYSTEM

The appliance is merely one component of a larger system. The other equally important component is the venting system. This is necessary for achieving the required flow of combustion air to the fire chamber and for safely removing unwanted combustion by-products from the appliance. If the venting system's design does not promote these ends, the system may not function properly. Poorly functioning venting systems may create performance problems as well as be a safety hazard. **A draft test should read greater than .04' W.C. (inches water column) and less than .08' W.C.** As per NFPA-211 standard (see paragraph below), the installer must take into account all variables within the installation and install the appliance in such a manner that satisfies the draft requirements of the appliance. See *Chimney Guidelines* below to assist you in selecting the proper venting system for your installation.

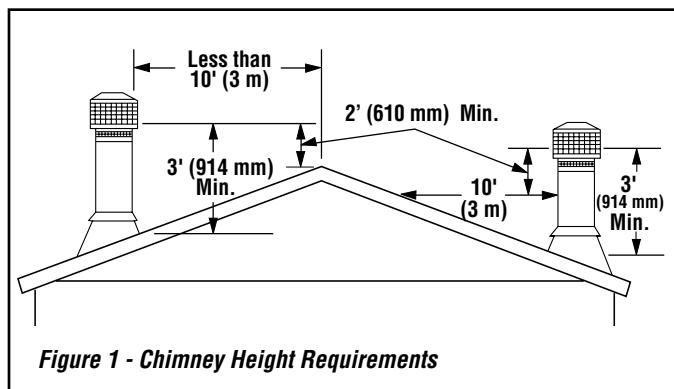
American National Standards Institute ANSI/NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances - See Draft Section: A chimney or vent shall be so designed and constructed to develop a flow sufficient to completely remove all flue and vent gases to the outside atmosphere. The venting system shall satisfy the draft requirements of the connected appliance in accordance with the manufacturer's instructions.

Chimney Guidelines:

- This appliance requires approximately 12 feet minimum of "effective draw" provided by the venting system. As a rule of thumb, every 90 degree total direction change in the venting will result in a loss of approximately 5 feet of "effective draw." Example: If two 45 degree offsets are used, subtract 5 feet from the actual vertical vent height to determine your "effective draw." In this case if you had 14 feet of vertical vent, the effective draw would only be approximately 9 feet (14 ft. - 5 ft. = 9 ft.), therefore it may be necessary to add additional height to the venting system.
- Do not install an offset within the first two feet above the flue outlet on the appliance.
- In well insulated and weather tight homes, it may be difficult to establish a good draft up your chimney. The poor draft is caused by a shortage of air in the house. In this situation an Outside Air Kit may need to be installed (See *Negative Pressure Warning* on **Page 5** and *Outside Combustion Air* on **Page 15**).

CHIMNEY HEIGHT REQUIREMENTS

The chimney must extend 3' (.92m) above the level of roof penetration and a minimum of 2' (.61m) higher than any roof surface within 10' (3m) (see below). Check with your local building officials for additional requirements for your area.



To pass inspection in nearly any jurisdiction, the chimney must meet both safety and exhaust flow requirements. The (3' by) 2' by 10' rule applies to both masonry and factory-built chimneys.

*** Ref. USA - National Standard, NFPA 211-latest edition and Canada National Standard CSA B365-01-latest edition. Vents installed with a listed cap shall terminate in accordance with the terms of the cap's listings.**

NEGATIVE PRESSURE WARNING

This appliance is not designed to be operated in a negative pressure. In very airtight homes with large kitchen exhaust fans, furnace cold air returns, fresh air exchange systems and any other air system in close proximity to the heating appliance may create a negative pressure in the same room as the heating appliance. This can create dangerous back drafting of the stove and chimney joints, drawing combustion by-products into the home. Be sure your home has adequate makeup air to eliminate negative pressures caused by the above-mentioned sources. Outside air connected to the appliance probably will not resolve such a problem as the appliance is not the source of negative pressure. IHP accepts no liability for damages resulting from negative pressures described here.

Ventilation Requirements - Provide adequate air for combustion. The fresh air requirements of this appliance must be met within the space where it will be installed. Ventilation is essential when using a Solid-Fuel-Burning heater. In well insulated and weather tight homes, it may be difficult to establish a good draft up the chimney (caused by a shortage of air in the home). The lack of air is caused by many common household appliances which exhaust air from the home (such as a furnace, heat pump, air conditioner, clothes dryer, exhaust fans, fireplaces, and other fuel burning appliances). Also, the combustion process of this heater uses oxygen from inside the dwelling. If the available fresh air delivery in the dwelling is insufficient to support the demands of these appliances, problems can result (e.g. excessive negative pressure can develop in the dwelling which will affect the rate at which this appliance can draft thus resulting in performance problems). To correct this problem it may help to open a window (preferably on the windward side of the house) or install an optional outside air kit.

CLEARANCES TO COMBUSTIBLES

WARNING: BE ABSOLUTELY SURE THE DISTANCE BETWEEN THE HEATER AND THE SURFACE OF ANY COMBUSTIBLE CONSTRUCTION IS NOT LESS THAN SHOWN IN THE FIGURES ON PAGE 7 FOR MODEL GV230 WOODSTOVE AND ON PAGE 8 FOR MODEL GV300GL WOODSTOVE.

Floor Protection

USA - The floor in front and under the heater must be protected with noncombustible material. The covering must extend 16" in front of the door opening of the heater and 8" to either side of the door opening.

Canada - The floor in front and under the heater must be protected with noncombustible material. The covering must extend 450 mm in front of the door opening of the heater and 200 mm to either side of the stove body and 200 mm to the rear or to the wall, whichever is smaller.

USA and Canada - A chimney connector / venting extends horizontally over the floor, protection must also cover the floor under the connector / venting and at least 2" (51 mm) to either side.

Alcove Installations USA and Canada - The floor protection must be a thermally rated non-combustible floor protector. See **Page 10** for GV300GL stoves for details on determining acceptable floor protection materials or hearth pads for alcove installations.

Alcove Installation

Clearances - In alcove installations, only 6" double wall connector pipe can be used (single wall or single wall pipe with shield is not allowed).

Minimum alcove width between combustible materials:
GV300GL - 54" (1372 mm)

Maximum alcove depth:
GV300GL - 48" (1219 mm)

Minimum alcove height:
GV300GL - 72" (1829 mm)

Thermal Floor Protection

GV300GL - Thermal floor protection is required in all installations.

Chimney and Connector

Minimum 6" diameter, minimum 24 MSG black steel connector pipe with UL103HT listed factory-built chimney suitable for use with solid fuels or masonry chimney. Horizontal connection not tested, refer to local building codes for installation. See installation instructions for details. Restrictions apply! Read instructions before installing.

Residential chimney systems must be from the same brands as listed for mobile homes but connector pipe may be double wall, single wall, or single wall with shield as listed.

This appliance may be vented into a code-approved masonry chimney with flue liner.

WARNING: CHIMNEY CONNECTOR MUST BE IN GOOD CONDITION AND KEPT CLEAN. DO NOT INSTALL DAMAGED PARTS.

All of the stove connector pipe used must be of the same brand. The chimney that the stove pipe transitions into may be a different brand. Other than the transition of the stove pipe into the chimney, do Not mix different brand vent components. Install all vent components per vent manufacturer's instructions.

The chimney connector shall not pass through an attic or roof space, closet or similar concealed space, or a floor, or ceiling. Where passage through a wall, or partition of combustible construction is desired, the installation shall conform to CAN/CSA-B365, Installation Code for Solid-Fuel-Burning Appliances and Equipment.

There must be an effective vapor barrier at the location where the chimney or other component penetrates to the exterior of the structure. Follow the vent manufacturer's detailed instructions.

IMPORTANT NOTE: See *Draft Requirements* and *Selecting a Proper Venting System* on **Page 4** to assist you in choosing the proper venting system for your installation.

Clearance dimensions are to flue collar. If a single wall connector pipe with shield is used, a 1 inch air space is needed between pipe and shield. Shield attaches to rear of stove pipe and must run from stove top to ceiling. Pipe shield shall be UL listed.

Components Required For Installations

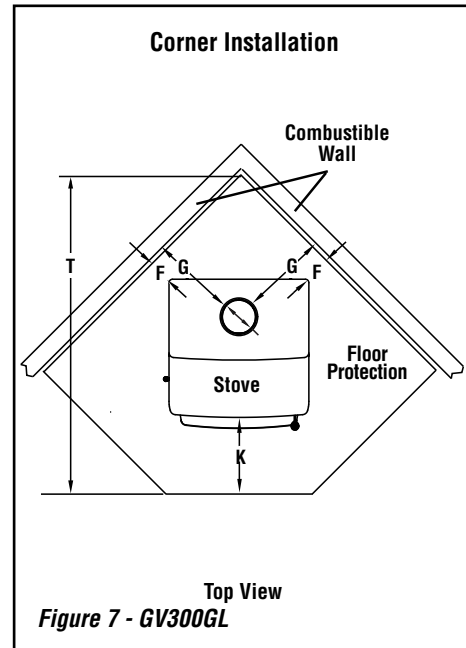
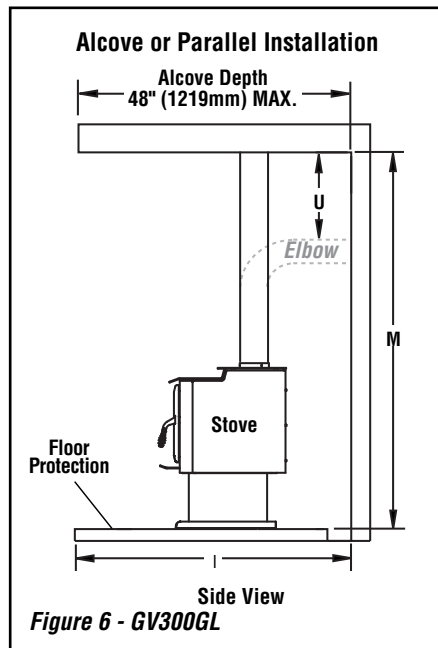
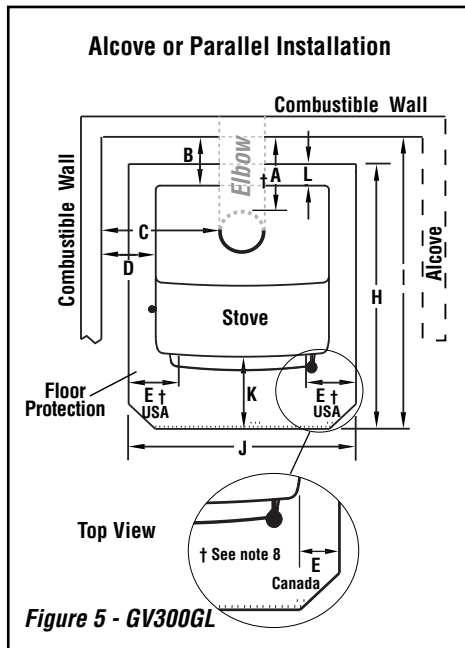
Legs OR Pedestal Assembly.

Use all required components specified for this appliance. Do not substitute.

WARNING: In the event that you remove the blower for any reason, make sure a cover plate (available from IHP) is installed before using the heater. *Note: The cover plate is not necessary if a blower has never been installed because a knock-out will be in place to act as the cover.*

Grandview™ GV300GL

INSTALLATION CLEARANCES - REFER TO FIGURES 5, 6 AND 7



USA - inches (millimeters)



PIPE	INSTALLATION	A (3)	B (1)	C (3)	D (1)	E (8)	F (1,4)	G (3,4)	H (2)	I (6)	J (2)	K (7)	L (5)	M	T (6)	U
Single Wall	Residential-Vertical Vent	16 (406)	12-3/8 (314)	25-1/8 (635)	15 (381)	8 (200)	6 (152)	17 (432)	41-1/8 (1045)	53-1/2 (1359)	33 (838)	16 (406)	0 (0)	84 (2134)	62-7/8 (1597)	N/A N/A
Single Wall	Residential-With Elbow	19-5/8 (499)	16 (406)	26-1/8 (664)	16 (406)	8 (200)	6 (152)	17 (432)	41-1/8 (1045)	57-1/8 (1451)	33 (838)	16 (406)	0 (0)	84 (2134)	62-7/8 (1597)	19 N/A
Double Wall	Residential or Mobile Home-Vertical Vent	11-5/8 (295)	8 (203)	23-1/8 (587)	13 (330)	8 (200)	5 (127)	16 (406)	41-1/8 (1045)	49-1/8 (1248)	33 (838)	16 (406)	0 (0)	84 (2134)	61-1/2 (1562)	N/A N/A
Double Wall	Residential or Mobile Home-With Elbow	11-5/8 (295)	8 (203)	24-1/8 (613)	14 (356)	8 (200)	5 (127)	16 (406)	41-1/8 (1045)	49-1/8 (1248)	33 (838)	16 (406)	0 (0)	84 (2134)	61-1/2 (1562)	10 N/A
Double Wall	Alcove-Vertical Vent	13-5/8 (346)	10 (254)	26-1/8 (664)	16 (406)	8 (200)	N/A N/A	N/A N/A	41-1/8 (1045)	51-1/8 (1299)	33 (838)	16 (406)	0 (0)	72 (1829)	N/A N/A	N/A N/A

CANADA - inches (millimeters)



PIPE	INSTALLATION	A (3)	B (1)	C (3)	D (1)	E (8)	F (1,4)	G (3,4)	H (2)	I (6)	J (2)	K (7)	L (5)	M	T (6)	U
Single Wall	Residential-Vertical Vent	16 (406)	12-3/8 (314)	25-1/8 (635)	15 (381)	8 (200)	6 (152)	17 (432)	51-1/8 (1299)	55-1/2 (1410)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	64-7/8 (1648)	N/A N/A
Single Wall	Residential-With Elbow	19-5/8 (499)	16 (406)	26-1/8 (664)	16 (406)	8 (200)	6 (152)	17 (432)	51-1/8 (1299)	59-1/8 (1502)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	64-7/8 (1648)	19 (483)
Double Wall	Residential or Mobile Home-Vertical Vent	11-5/8 (295)	8 (203)	23-1/8 (587)	13 (330)	8 (200)	5 (127)	16 (406)	51-1/8 (1299)	51-1/8 (1299)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	63-1/2 (1613)	N/A N/A
Double Wall	Residential or Mobile Home-With Elbow	11-5/8 (295)	8 (203)	24-1/8 (613)	14 (356)	8 (200)	5 (127)	16 (406)	51-1/8 (1299)	51-1/8 (1299)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	63-1/2 (1613)	10 (254)
Double Wall	Alcove-Vertical Vent	13-5/8 (346)	10 (254)	26-1/8 (664)	16 (406)	8 (200)	N/A N/A	N/A N/A	51-1/8 (1299)	53-1/8 (1349)	41-1/8 (1045)	18 (450)	8 (200)	72 (1829)	N/A N/A	N/A N/A

Footnotes:

- These dimensions to the stove body are for reference only. Actual distances should be measured from the stove's flue collar.
- Minimum noncombustible hearth pad dimensions.
- Clearances to connector pipe shall be measured from the flue collar of the stove.
- Not applicable to alcove installations.

- In corner applications, when installed at minimum back wall clearances, the required floor protection is dimensioned off the back plane of the stove, therefore the floor protection required off the back corners (at a 45 degree angle) only needs to extend to the wall. This situation will only occur in CANADA installations.

- Reference dimension only, to assist in planning the installation.
- Measured from front of floor protection to the front of firebox.
- USA=8" (200mm) from door opening, Canada=8" (200mm) from sides and back of unit.

Grandview™ GV300

FLOOR PROTECTION

The Grandview™ 300 floor protection must be a thermally rated non-combustible floor protector meeting or exceeding a thermal rating of $k=.47$ or equivalent with a listed thickness of 1-1/2" (38.1mm) minimum in the USA and Canada. The thermal protection must extend 16" in front of the heater (measuring from the front of the firebox) and the the width of the heater (26-1/2").

Using Alternate Material As Floor Protection

The floor protection or alternate material used as a floor protector must be constructed of a durable noncombustible material having an equal or better thermal conductivity value (lower k value) of $k=.47$ BTU/IN FT2 HR °F or a thermal resistance that equals or exceeds $r = 2.13$ HR °F FT2 IN/BTU with a minimum thickness of 1-1/2". With these values, determine the minimum thickness of the alternate material required using the formula(s) and shown in **Table 2**.

Note: Any noncombustible material having a minimum thickness of 1-1/2" (38.1 mm) whose k value is less than .47 or whose r value is more than 2.13 is acceptable. If the alternate material used has a higher k value or lower r value will require a greater thickness of the material used. In some cases, if the k value is less or the r value higher, a thinner material may be used.

Methods of determining floor protection equivalents:

To determine the thickness required for the alternate material when either the "k" value or "r" value is known, use either the **k formula** or **r formula**.

Example: If Micore 160 Mineral Fiber Board is to be used for the floor protection, how thick must this material be?

k_m = k value per inch of **alternate** material
 r_m = r value per inch of **alternate** material
 T_m = minimum thickness required for **alternate** material
 T_s = standard thickness of the **alternate** material

k_L = k value per inch of **listed** material
 r_L = r value per inch of **listed** material
 T_L = minimum thickness of **listed** material

Note: An asterisk "*" indicates, it is a value taken from **Table 2**.
Using the k formula:

k formula:

$$\begin{aligned} \text{Minimum thickness of alternate material (T}_m\text{)} &= \frac{\text{k-value (per Inch) of alternate material (k}_m\text{)}}{\text{k-value (per inch) of listed material (k}_L\text{)}} \times \text{Specified min. thickness of listed material (T}_L\text{)} \\ T_m \text{ (inches)} &= \frac{k_m}{*.47} \times T_L \\ T_m \text{ (inches)} &= \frac{*.35}{*.47} \times 1.50" \\ 1.117 \text{ (inches)} &= .745 \times 1.50" \end{aligned}$$

Answer - The minimum required thickness of the Micore 160 is 1.117" therefore round up to nearest total standard thickness - Example: Use two 5/8" (.625") boards for a total thickness of 1-1/4" (1.250").

Using the r formula:

$$\begin{aligned} \text{Minimum thickness of alternate material} &= \frac{\text{r-value (per Inch) of listed material}}{\text{r-value (per inch) of alternate material}} \times \text{Specified min. thickness of listed material} \\ T_m \text{ (inches)} &= \frac{r_L}{r_m} \times T_L \\ T_m \text{ (inches)} &= \frac{2.13}{*2.86} \times 1.50" \\ 1.117 \text{ (inches)} &= .745 \times 1.50" \end{aligned}$$

Answer - The minimum required thickness of the Micore 160 is 1.117" therefore round up to nearest total standard thickness - Example: Use two 5/8" (.625") boards for a total thickness of 1-1/4" (1.250").

Listed Material			
	k (per inch)	r (per inch)	Listed Min. Thickness
Listed Material	.47 k_L	2.13 r_L	1-1/2" (1.5") T_L
** Approved Alternate Materials for Floor/Hearth Protection			
Alternative Materials	Thermal Values		Minimum Thickness (rounded to nearest 1/8 inch)
	k (per inch) k_m	r (per inch) r_m	Min. Thickness T_m
Kaowool M Board	.47	2.13	1.5" (1-1/2")
Micore 160™ U.S. Gypsum	.35	2.86	1.12" (1-1/8")
Micore 300™ U.S. Gypsum	.46	2.17	1.47" (1-1/2")
Durock™ Cement Board U.S. Gypsum	1.92	.52	6.13" (6-1/8")
Hardibacker™	1.95	.51	6.22" (6-1/4")
Hardibacker 500™	2.30	.43	7.34" (7-3/8")
Cultured Stone Hearth-stone™	2.82	.35	9" (9")
Wonderboard	3.23	.31	10.3" (10-3/8")
Super Firetemp M Johns-Manville	.61	1.64	1.95" (2")
Super Firetemp L Johns-Manville	.54	1.85	1.72" (1-3/4")
Face brick	9.00	.111	28.72" (28-3/4")
Common brick	5.00	.20	15.96" (16")
Cement mortar	5.00	.20	15.96" (16")
Ceramic tile	12.5	.08	39.89" (39-7/8")
Marble	~11	~.09	35.12" (35-1/8")

Table 2 - USA AND CANADA REQUIREMENTS - GV300

**** If the hearth extension material(s) that is intended to be used is NOT listed on Table 2, the material can still be used if the material(s) is non-combustible. However, the manufacturer of the material must provide either the listed k-value per inch or r-value per inch with listed thickness so that the minimum thickness required for the hearth can be calculated (per instructions here or as specified in the NFI Certification Manuals).**

NOTE: Also see NFI (National Fireplace Institute) Certification Manuals showing other acceptable calculation methods and acceptable alternate materials which can be used.

SPECIFICATIONS - GV300GL

GV300GL Specifications

Stove Pipe Diameter

Single Wall or

Double Wall 6" (152 mm)

Log Length 17" W x 21" D Max.
(431.8mm W x 533mm D Max.)

Firebox 18.2" W x 21.23" D x 13" H Max.
(462.28mm W x 539.25mm D x
330.2mm H Max.) Volume=2.91 cu. ft.

Glass Viewing Area 16-1/2" W x 11-5/16" H
(419mm W x 287mm H)

EPA Test Load: 29,181 BTUs/hr.

Cord Wood: ① 100,000 BTUs/hr.

Maximum Burn Times ① 14 hours

Heating Capacity ① 2000 to 3000 sq. ft.

EPA Grams Per Hour 1.8 gr/hr

EPA Certified and Washington State Approved

Product Reference Information			
Cat. No.	Description	Ship. Wt.	Ship. Volume
TBD	Grandview 300GL	445 lb.	20.09 cu. ft.

NOTES

- Dimensions shown are approximations only (+/- 1/4")
- Diagrams, illustrations and photographs are not to scale - consult installation instructions. Product designs, materials, dimensions, specifications, colors and prices are subject to change or discontinuance without notice.
- Optional Kits Available:
Door Trim Kit
Blower
Outside Air Kit
Louvers
Legs (choice of three styles)
Pedestal
Ash Drawer for legs or for pedestal

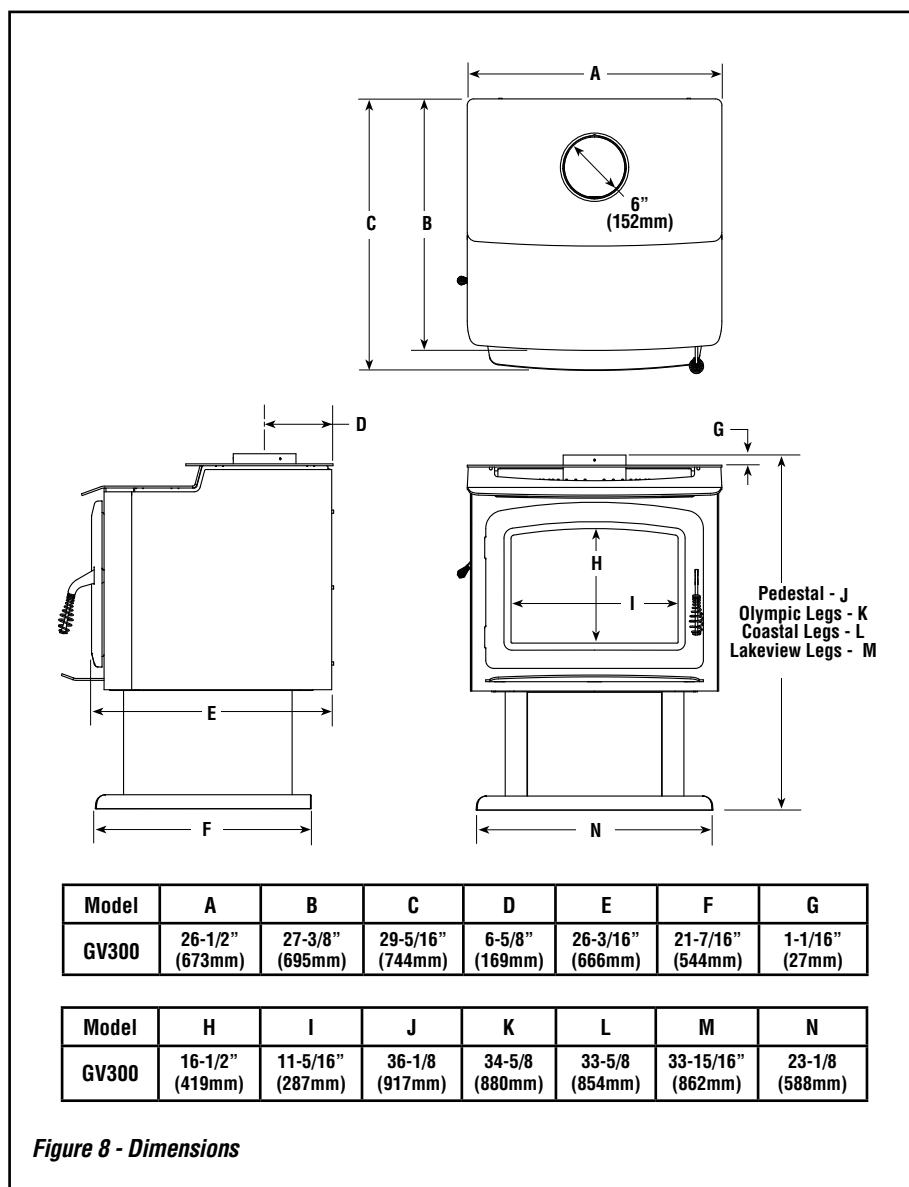
① Square-foot heating capacities and burn times are approximations only. Actual performance may vary depending upon home design and insulation, ceiling heights, climate, condition and type of wood used, appliance location, burn rate, accessories chosen, chimney installation and how the appliance is operated.

The Grandview™ Model GV300GL woodstoves are safety listed with the following agency:

- PFS Corporation, Tested to UL 1482, ULC S627



GV300GL - Report # 14-182



NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

Single Wall Pipe
Using 6" Diameter Single Wall Connector Pipe

INSTALL VENTING SYSTEM PER VENT MANUFACTURERS INSTRUCTIONS!

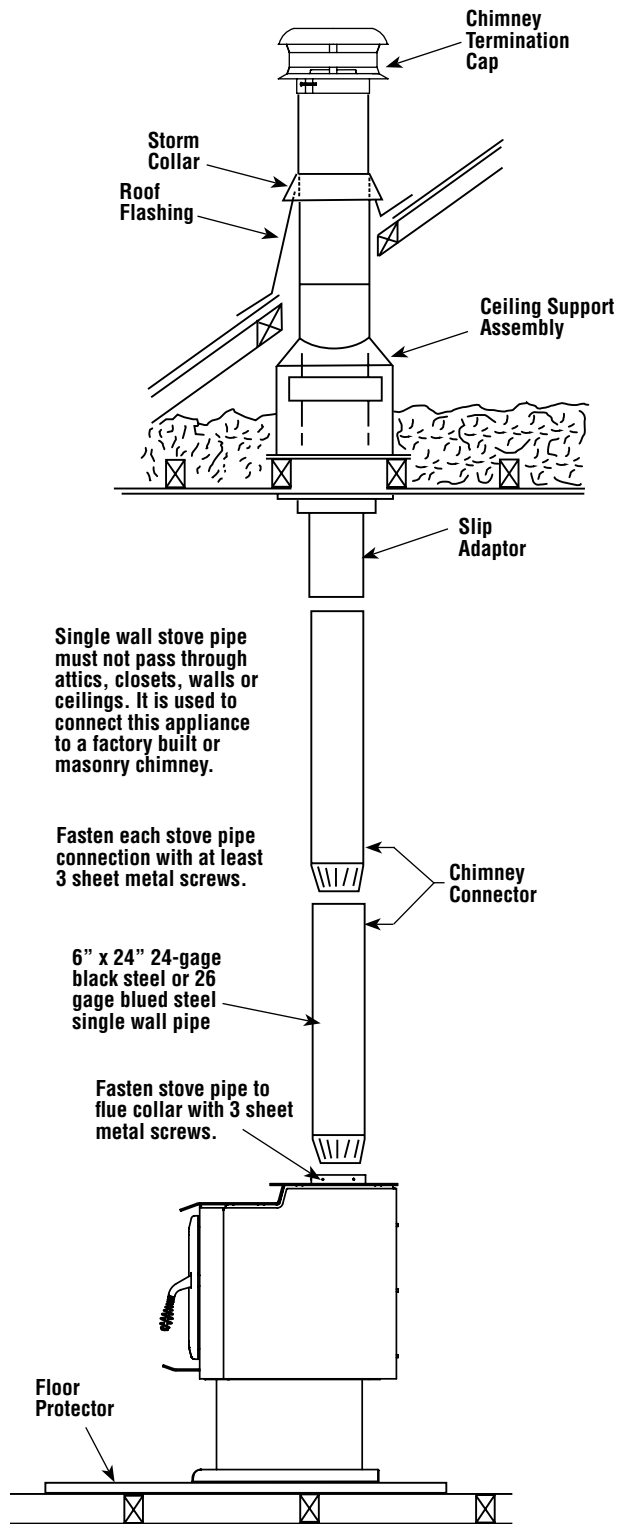


Figure 9 - Typical Installation

STAINLESS STEEL LINER
Using 6" Diameter Rigid Stainless Steel Liner

INSTALL VENTING SYSTEM PER VENT MANUFACTURERS INSTRUCTIONS!

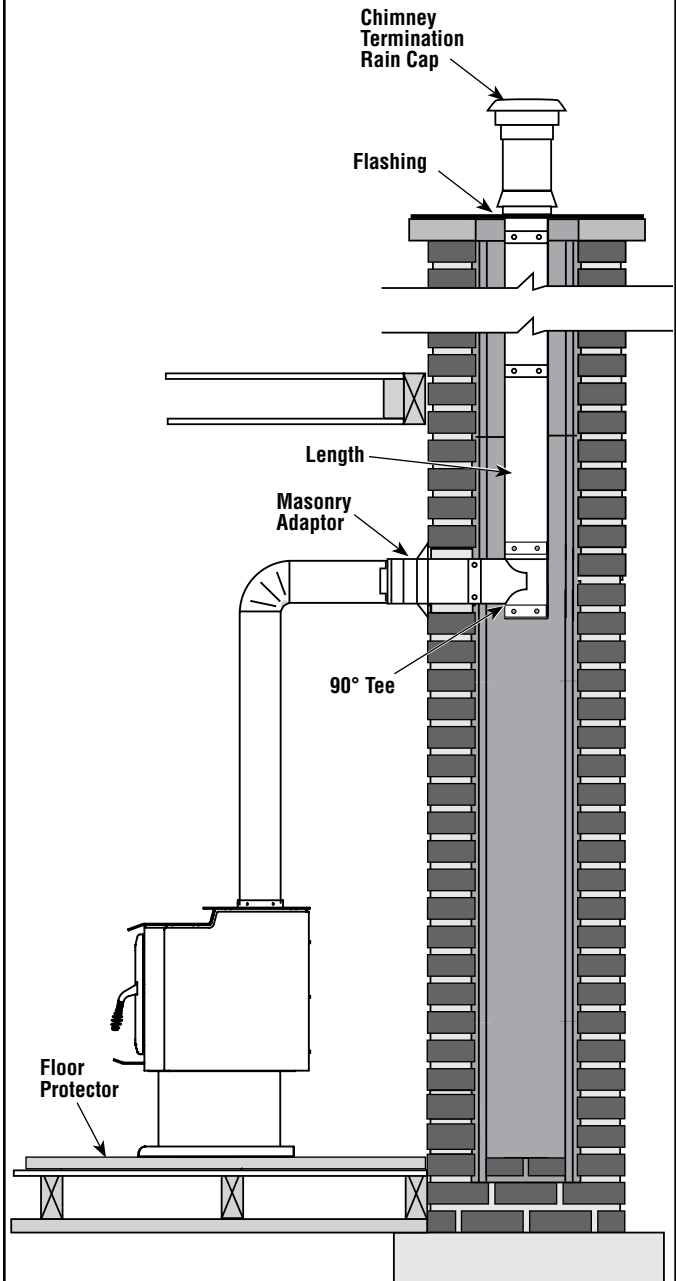
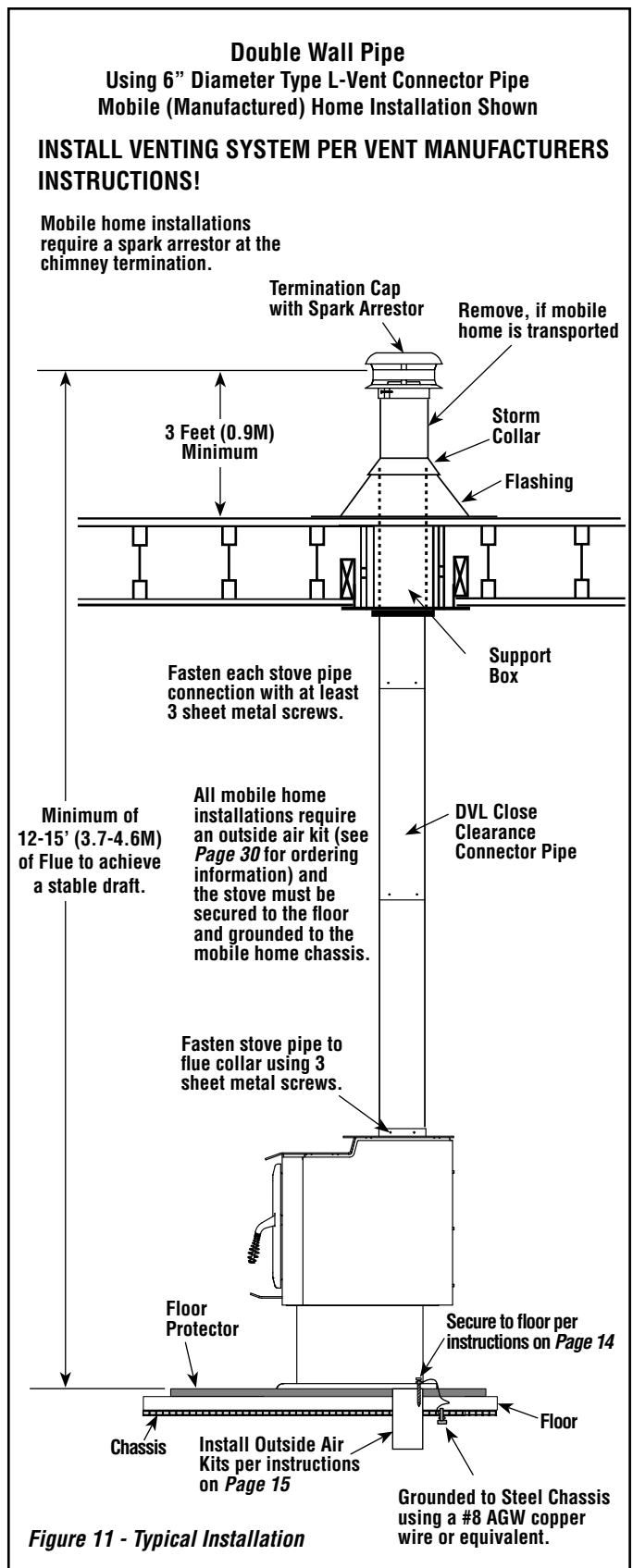


Figure 10 - Connected to a Masonry Chimney

YOUR CHIMNEY INSTALLATION MUST COMPLY WITH LOCAL BUILDING AND FIRE CODES.

CHIMNEY INSTALLATION

- Install chimney as per manufacturer's instructions. Some brands of pipe may require removal of the spacer ring in the flue collar.
- All horizontal runs of pipe should be as short as possible and are required by NFPA No. 211 to have an upward pitch or rise in the same direction the smoke travels of no less than 1/4" to the linear foot. The connector pipe must meet minimum clearances in any direction to walls or other combustible materials. It must attach to a listed double wall metal chimney at least 6" in diameter or to a masonry chimney with a flue passage of at least 48 square inches.
- It is required that a chimney connector pipe not extend further than the inner wall of the flue when it is connected to a masonry chimney and that it either be cemented to the masonry or be installed without cement in a thimble connected to the masonry wall. When the connector is inserted into a thimble, the joint must be tight enough so that it will not be dislodged in normal use. Install connector at no less than the minimum clearances from the ceiling when using a 90-degree elbow to pass through combustible constructions.
- Chimney connector pipes should never pass through a floor, ceiling, fire wall, partition, or combustible construction of any type unless certain precautions are taken. The best method is to use a listed thimble and a listed chimney in accordance with the manufacturer's directions. NFPA No. 211 gives approved methods for passing a flue pipe through combustible constructions (see **Page 12**).



Chimney Connector Systems and Clearances from Combustible Walls for Residential Heating Appliances (NFPA 211) Refer to Figure 12.

System A. Minimum 3.5 in. (90 mm) thick brick masonry wall framed into combustible wall with a minimum of 12 in. (305 mm) brick separation from clay liner to combustibles. Fireclay liner (ASTM C 315, Standard Specification for Clay Flue Linings, or equivalent), minimum 5/8 in. (16 mm) wall thickness, shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.

Clearance: 12 in. (305 mm)

System B. Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1 in. (25.4 mm) or more of insulation with a minimum 9 in. (229 mm) air space between the outer wall of the chimney length and combustibles.

The inner end of the chimney length shall be flush with the inside of the masonry chimney flue and shall be sealed to the flue and to the brick masonry penetration with non-water-soluble refractory cement. Supports shall be securely fastened to wall surfaces on all sides.

Fasteners between supports and the chimney length shall not penetrate the chimney liner.

Clearance: 9 in. (229 mm)

System C. Sheet steel chimney connector, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, with a ventilated thimble, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, having two 1 in. (25.4 mm) air channels, separated from combustibles by a minimum of 6 in. (152 mm) of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness.

Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

Clearance: 6 in. (152 mm)

System D. Solid-insulated, listed factory-built chimney length with an inside diameter 2 in. (51 mm) larger than the chimney connector and having 1 in. (25.4 mm) or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gauge [0.024 in. (0.61 mm)] thickness, with a minimum 2 in. (51 mm) air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12 in. (305 mm). Chimney section concentric with and spaced 1 in. (25.4 mm) away from connector by means of sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports of minimum 24 gauge [0.024 in. (0.61 mm)] thickness.

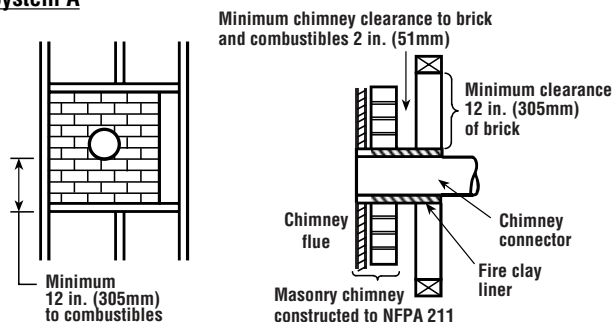
Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

Clearance: 2 in. (51 mm)

Additional requirements:

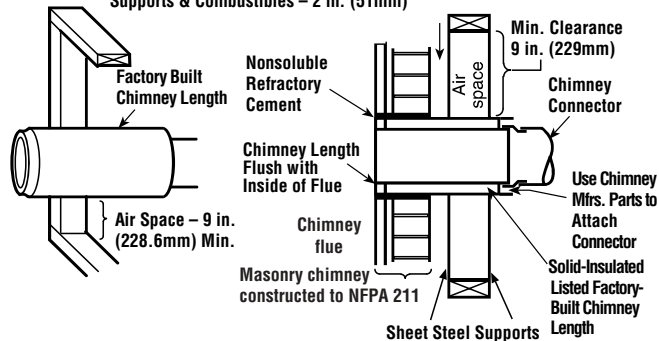
1. Insulation material used as part of wall pass-through system shall be of noncombustible material and shall have a thermal conductivity of 1.0 Btu-in./hr-ft² - °F (4.88 kg-cal/hr-m² - °C) or less.
2. All clearances and thicknesses are minimums; larger clearances and thicknesses shall be permitted.
3. Any material used to close up an opening for the connector shall be of noncombustible material.
4. A connector to a masonry chimney, except for System B, shall extend in one continuous piece through the wall pass-through system and the chimney wall to the inner face of the flue liner, but not beyond.

System A



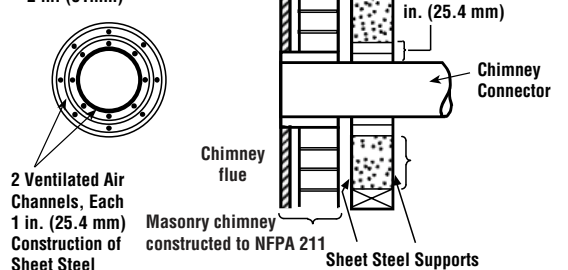
System B

Minimum Chimney Clearance from Masonry to Sheet Steel Supports & Combustibles – 2 in. (51mm)



System C

Minimum chimney clearance to sheet steel supports and combustibles 2 in. (51mm)



System D

Minimum chimney clearance to sheet steel supports and combustibles 2 in. (51mm)

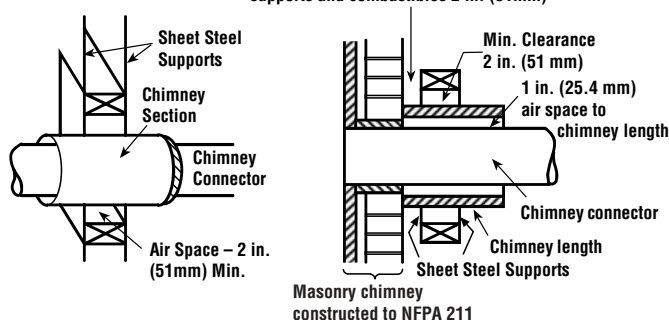


Figure 12 - Chimney Connector Systems and Clearances from Combustible Walls

LEG INSTALLATION

Residential and Mobile Homes

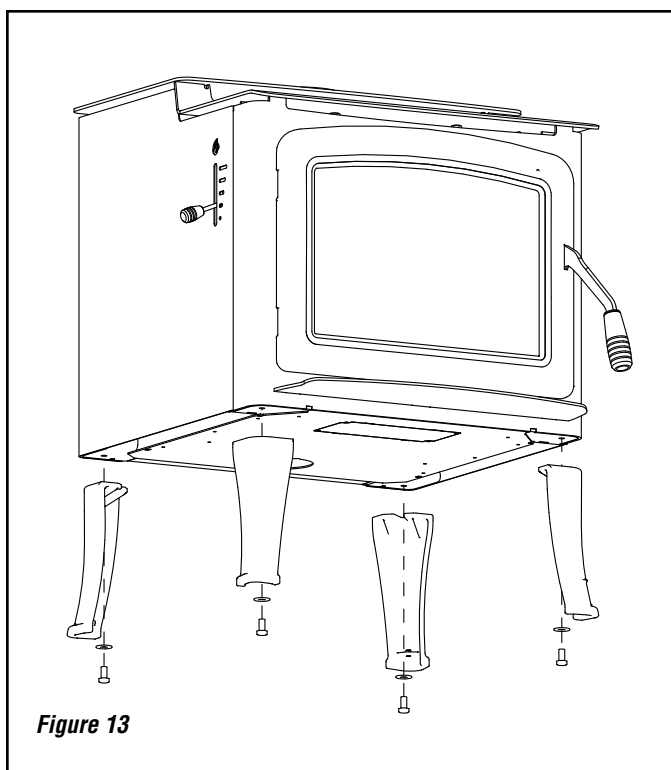
(Tying down and grounding are required only in mobile homes)

Open all cartons, if any and remove the contents upon receipt and check for any damaged or missing parts. If there is hidden damage, notify your freight company or IHP dealer immediately.

CAUTION: Wear gloves during installation in case of sharp edges on the stove.

Leg Installation

1. Carefully place stove on it's back. Be careful not to scratch the stove, use a piece of cardboard or carpet to protect the back of the stove.
2. Using a 9/16" wrench or socket remove the bolt in each of the four corners along with the attached shipping brackets.
3. Remove legs from the packaging and using the bolts and washers that come with the legs install each leg in each corner with one bolt and one washer.
4. Before the legs are fully tightened down make sure that they are aligned correctly to match the front and side planes of the stove.
5. The stove can now be set up on the legs making sure that all baffle boards and bricks are set back in place. These items may have shifted when the stove was placed on it's back.
6. If it is necessary to level, secure, or ground your stove, use the holes in the bottom of the leg for those applications. To level the stove use leg leveling kit (P/N H8407). Level by adjusting the bolt or leveling pad down on each leg that is not in full contact with the hearth or surface below that the stove is located on.



PEDESTAL INSTALLATION

Residential and Mobile Homes

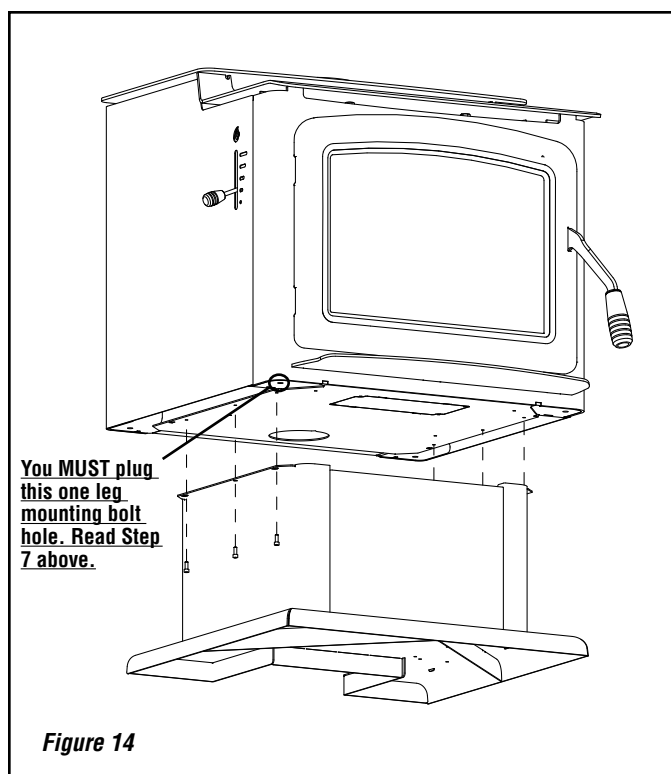
(Tying down and grounding are required only in mobile homes)

Open all cartons, if any and remove the contents upon receipt and check for any damaged or missing parts. If there is hidden damage, notify your freight company or IHP dealer immediately.

CAUTION: Wear gloves during installation in case of sharp edges on the stove.

Pedestal Installation

1. Remove the heater from the carton, if packaged, upon receipt and check for any damaged or missing parts.
2. Install the 10-24 screws included with the pedestal kit to the bottom of the stove as seen in **Figure 14**. You will need a 5/32" allen wrench to complete this.
3. Carefully place stove on it's back. Be careful not to scratch the stove, use a piece of cardboard or carpet to protect the back of the stove.
4. The pedestal will have key hole slots that line up with the screws that were placed in the bottom of the stove. Carefully install pedestal on the installed screws with the open end of the pedestal towards the rear of the stove.
5. Assuring that the pedestal is placed correctly in slots then tighten all six screws.
6. The stove can now be set up on the pedestal making sure that all baffle boards and bricks are set back in place. These items may have shifted when the stove was placed on it's back.
7. When installing a pedestal on this stove you **MUST** plug the one leg mounting bolt hole, located on the bottom of the stove in the front left corner, with the bolt that was used to mount the shipping legs. **FAILURE TO INSTALL THIS BOLT PROPERLY WILL RESULT IN REDUCED CONTROL OF THE STOVE'S COMBUSTION SYSTEM!**



OUTSIDE COMBUSTION AIR KIT INSTALLATION - GV300GL

Outside Air Kits

Order:

1 ea. P/N UZIAD Outside Air Coupler Kit (connects outside air ducting, UZI, to stove)

AND

1 ea. P/N UZI Outside Air Ducting Kit (includes 4" insulated flex x 10' long)

An outside air kit is required in Manufactured (mobile) Home installations. For residential installations, check with local authorities having jurisdiction in your area, it may be mandatory.

Outside Air Kit Coupler

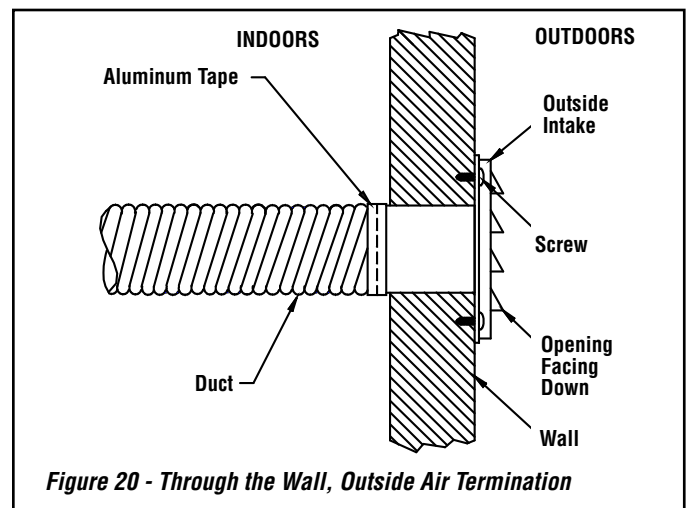
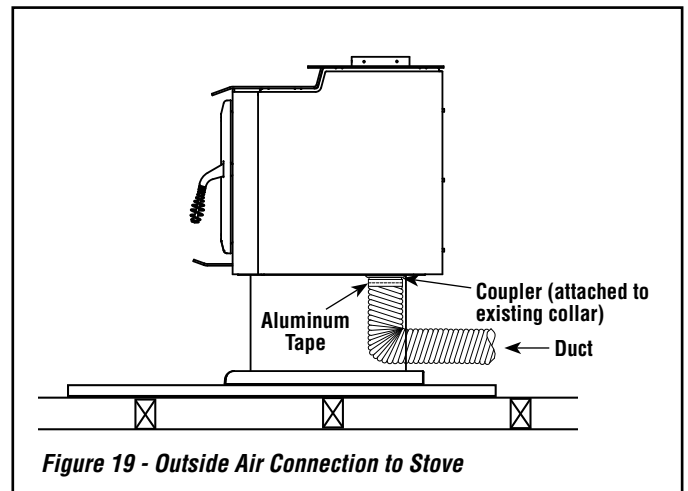
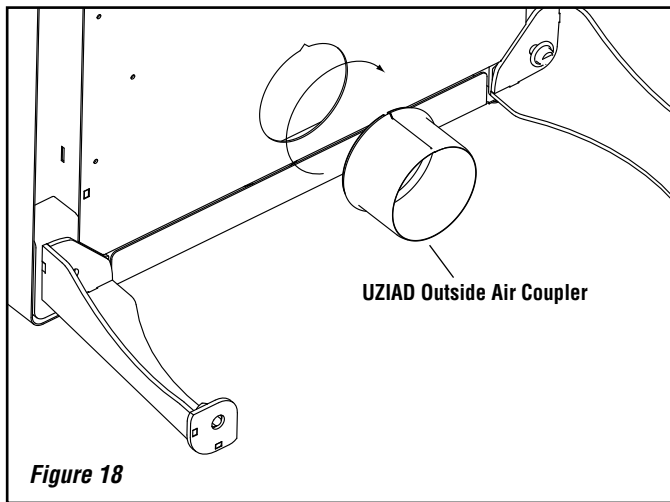
To install the outside air kit coupler onto the stove, line up the "V" notch in the coupler with the "V" notch in the open on the bottom of the stove. Push and twist so the rolled edge catches the bottom of the stove and continue turning full 360° to lock the coupler in place.

Through the Wall Outside Air Kit Installation (refer to Figures 18, 19 and 20)

The outside air assembly may be installed according to the following requirements:

- A) Duct length should be kept to a minimum.
- B) The air intake register must not be installed more than ten (10) feet (3050 mm) above the base of the stove.
- C) The fresh air must come from outside the house. The air intake must not draw air from the attic, from the basement or garage.
- D) The air intake should be installed where it is not likely to be blocked by snow or exposed to extreme wind and away from automobile exhaust fumes, gas meters and other vents.
- E) The duct and register may be installed above or below floor level.

- Make a 4-1/4" (110 mm) hole in the outside wall of the house at the chosen location. From outside, place the outside air register in the hole (open side down) and fasten the register to the wall, with screws as shown (see **Figure 20**).
- Install the coupler onto the existing collar on stove (see **Figure 18**).
- Attach the duct to the coupler on stove (see **Figure 19**). Using the aluminium tape provided, wrap the tape around the joint between the flexible duct and the air inlet.



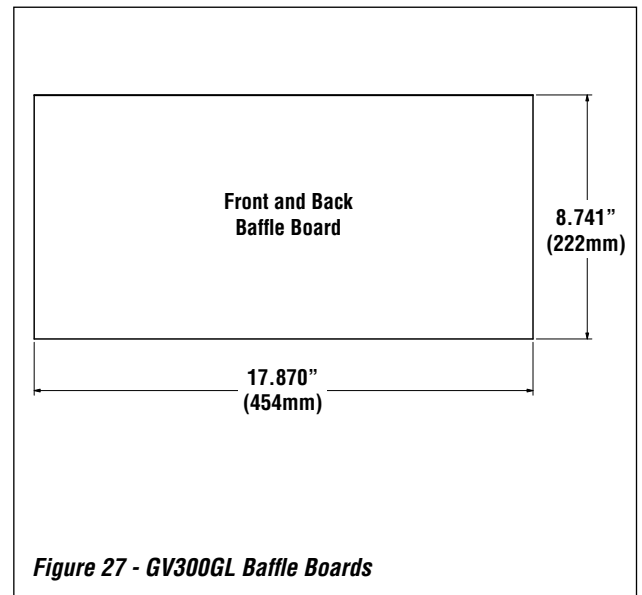
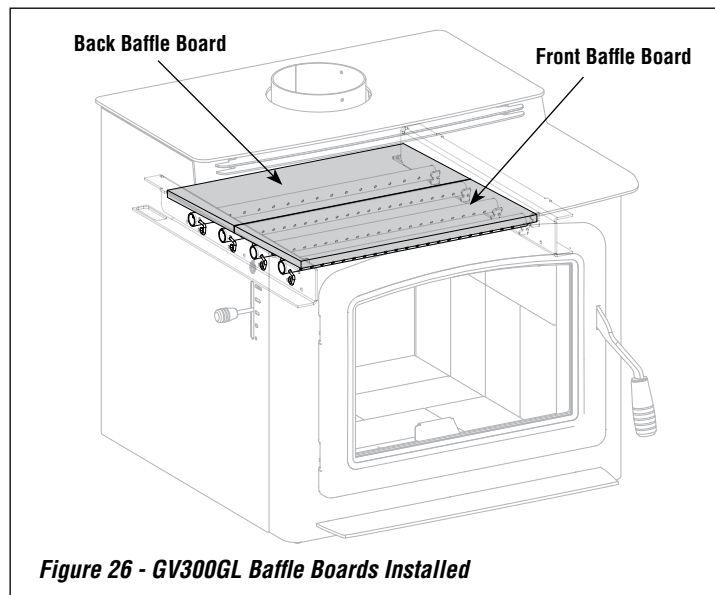
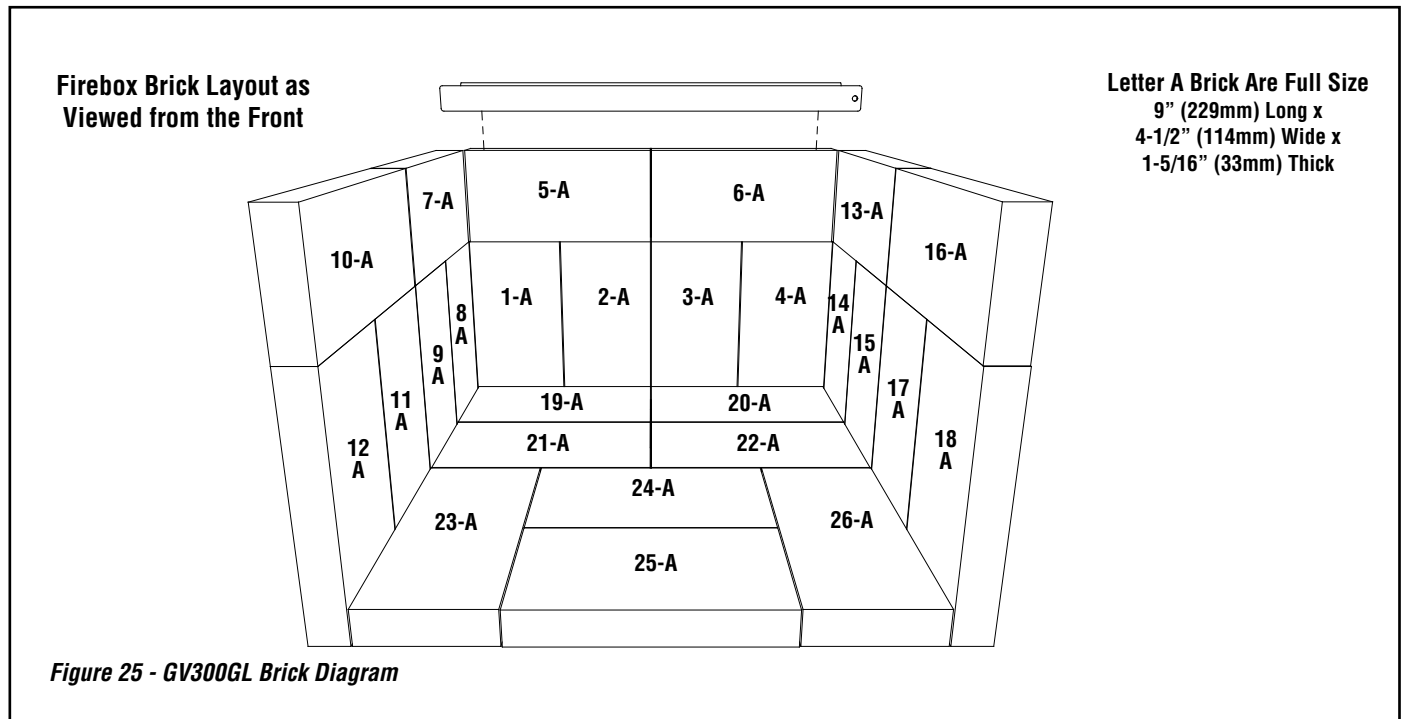
Grandview™ GV300

BRICK AND BAFFLE INSTALLATION

CAUTION: Wear gloves during brick installation in case of sharp edges inside the stove.

WARNING: IF THE BRICKS ARE NOT INSTALLED EXACTLY AS SHOWN BELOW, THEY COULD FALL OUT OF PLACE DURING REFUELING OR BURNING OF THE STOVE CAUSING SERIOUS INJURY.

1. Install brick #1-6 in the numbered sequence shown in **Figure 25**.
2. Install rear brick support which is included in the firebox on top of #5 and #6 brick. This support will be locked into place when the remainder of side brick are installed.
3. Install remaining brick #7-26 in the numbered sequence shown in **Figure 25**.
4. Once all the bricks are installed confirm that the already installed baffle boards are in their correct location and resting on the secondary burn tubes.



SECONDARY TUBE AND BAFFLE BOARD REPLACEMENT

- Gently lift front baffle board upward and place on rear baffle board.
- Starting front to rear, locate secondary tube retaining pin and rotate counter clockwise; pull pin toward front of stove, allowing capturing end to slide through retaining pin notches as shown.
- Slide secondary tube to the right, releasing it from the left side. Angle left side upward, and slide left to release from right side. Remove tube from stove
- Repeat process for secondary tube number two
- Gently lift top baffle board and slide forward; tilt left side up and left slightly, allowing the right side to drop into the firebox area for removal. Repeat process for rear baffle board
- Secondary tubes three and four can now be removed in same fashion as tubes one and two
- Reinstall baffle boards and secondary tubes in reverse order. *Note- Secondary tube number one has larger holes, as the remainder of the tubes are the same.

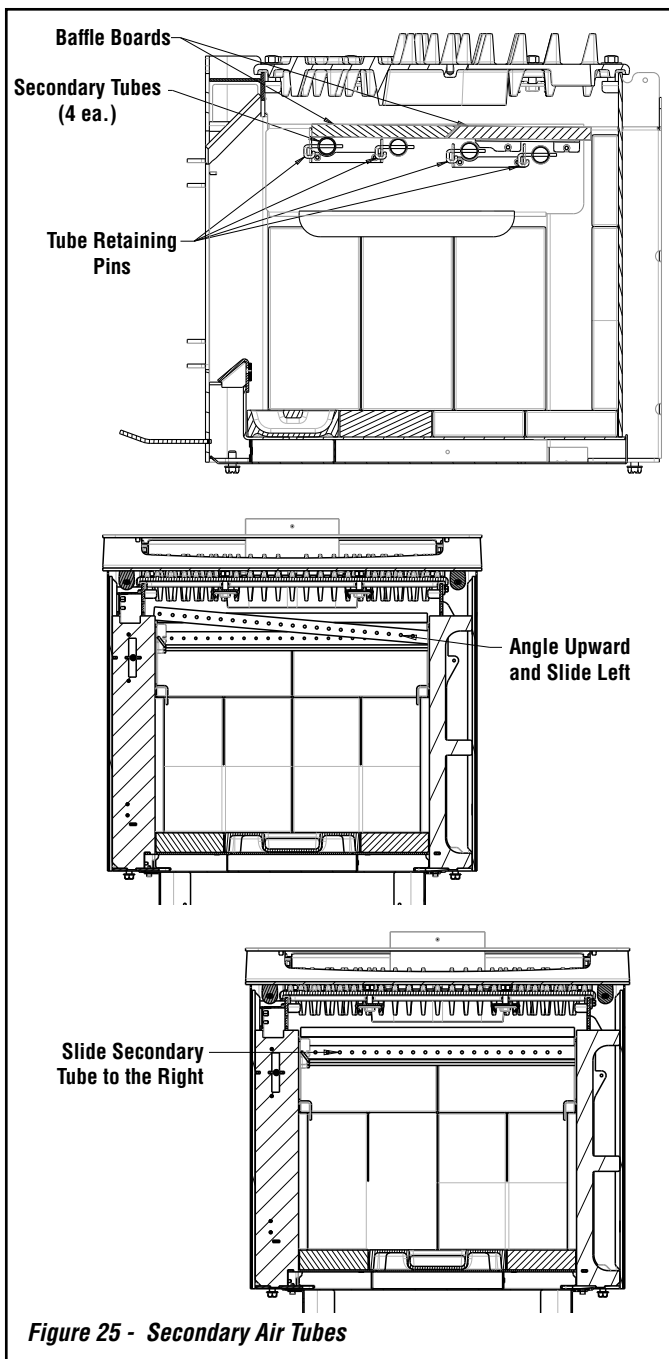


Figure 25 - Secondary Air Tubes

See Detail A

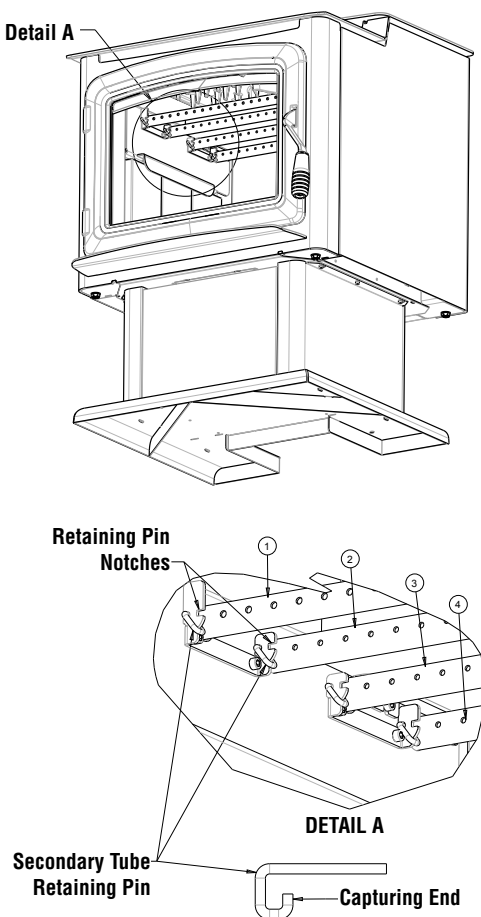


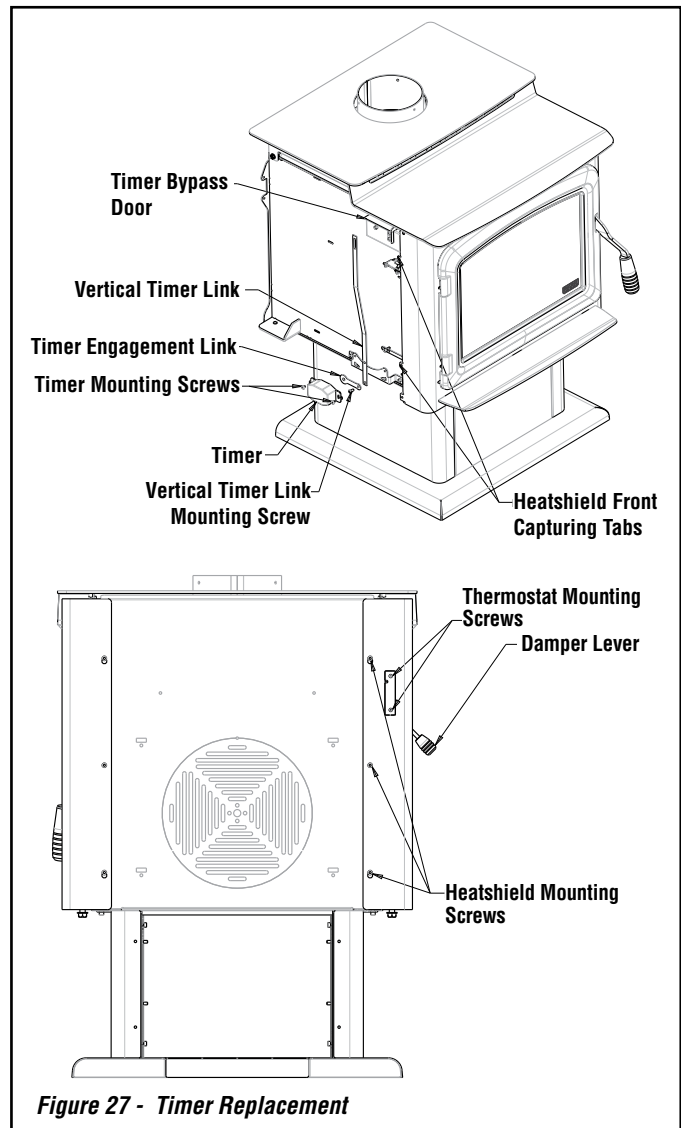
Figure 26 - Secondary Air Tube Retainers

TIMER REPLACEMENT:

- Turn damper lever counter clockwise and remove from stove
- Remove thermostat bracket (if equipped) by removing the two mounting screws and sliding rearward through the opening; set aside
- Loosen the top and bottom left heat shield mounting screws, leaving loose but in place; fully remove center mounting screw
- Lift left heat shield upward, while pulling rearward to release heat shield from rear mounting screws and front capturing tabs; set aside
- Lift upward on vertical timer link to engage timer and gain access to vertical timer link mounting screw; remove screw
- Remove timer mounting screws and timer
- Replacement timer will come equipped with timer engagement link
- Reinstall timer in reverse order; it may be necessary to rotate timer engagement link slightly to properly mount timer and align with vertical timer link (do not rotate more than 180 degrees)
- To reattach timer engagement link, lift upward slightly to align mounting hole with vertical timer link mounting hole. Tighten screw until tight and loosen slightly so timer linkage can operate freely.

CHECK:

- Inspect timer linkage to ensure it can move freely and is not binding. Vertical timer link can be lifted in an upward and downward motion (manually engaging and disengaging timer), which will open and close the timer bypass door near the top of the unit. This should operate freely with only slight tension from the torque of the timer. Now manually slide vertical timer link downward, disengaging timer. Open door; timer should reengage, lifting timer bypass door, which will then close in approx. 25-30 minutes. If functioning properly, proceed to reassemble stove. If timer is not functioning properly, check all mounting points within linkage to ensure they are moving freely. A small amount of antisieze or high temp lithium grease may be applied to moving linkage parts for lubrication.
- Reinstall left heat shield in reverse order, ensuring slots on front edge of heat shield slots are captured on the front capturing tabs.
- Reinstall thermostat in reverse order
- Reinstall damper lever; if damper lever is misaligned with slot and/or mounting point, the heat shield is not captured properly on the front capturing tabs. Loosen rear mounting screws and ensure proper alignment.



POST INSTALLATION CHECKS

- ☐ Check that all chimney pipe joints are secured and installed according to the manufacturers instruction.
- ☐ If used, make sure the outside air kit is properly installed and unobstructed.
- ☐ Double check all stove clearances.
- ☐ Be sure bricks and baffle boards are properly installed.
- ☐ If plated accessories are used, be sure surfaces are clean prior to firing the stove. See Page 20



FOR YOUR OWN PROTECTION AND INSURANCE PURPOSES, HAVE YOUR CHIMNEY AND CONNECTOR PIPE INSTALLATION INSPECTED BY YOUR LOCAL BUILDING CODE AUTHORITY OR FIRE MARSHAL BEFORE STARTING A FIRE IN YOUR STOVE. NOTIFY YOUR INSURANCE COMPANY.

PAINT CURING

If your stove has plated accessories, be sure to clean it with a household type glass cleaner and a very soft cloth to remove any fingerprints and residues prior to the first fire and before any fire if the plated surfaces have been handled or soiled. Do not close the door tightly during the "Burn-In Period." Also, open the door frequently (every 5-10 minutes) to keep the gasket from adhering to the curing paint. Ventilate the house well during these first firings as the paint gives off carbon dioxide and unpleasant odors. It is recommended that persons sensitive to an imbalance in the indoor air quality avoid the appliance during the curing process.

Your new stove is painted with a high temperature paint that cures during the first few firings. We recommend that you put your stove or fireplace insert through a regimen of three burns. The first two should last for 20 minutes each at 250 degrees (the appliance should be allowed to cool completely between each burn). The third should be a burn of at least 450 degrees F. for 45-60 minutes. The paint will become soft, gummy and emit non-toxic smoke during these burns. During these first burns, open the appliance door frequently to help prevent the door gasket from adhering to the appliance. After the appliance cools down for the third time, the paint will harden. **DO NOT BUILD A LARGE ROARING FIRE UNTIL THIS CURING EFFECT IS COMPLETE OR YOU MAY DAMAGE THE FINISH OF YOUR STOVE.** Spray can touch-ups should be done only with a high temperature stove paint (cat. no. H8159), available from all IHP dealers.

BURN-IN PERIOD

Please be patient with the heat output of your appliance for the first few weeks. The steel will go through a curing process that eliminates moisture, which is deep in the steel and firebrick. This moisture will reduce initial heat output of your appliance and may make it difficult to start. **(DO NOT OVERFIRE THE STOVE DURING THIS PROCESS. IF THE STOVE OR CHIMNEY BECOMES RED, REDUCE THE AMOUNT OF AIR ENTERING THE STOVE IMMEDIATELY).**

OPERATING HINTS

1. Burn only dry, well-seasoned cord wood. In some states it is illegal to burn wet wood or anything other than clean, dry wood products.
2. Your stove or fireplace insert is designed to operate with the door closed! Operate only with the door shut tightly at all times except when loading wood and possibly on start up to establish a draft. Never leave the unit unattended while the front door is opened.
3. **DO NOT** contact or move the baffle boards while loading wood. Occasionally check the baffle to assure that the boards are in their correct location.

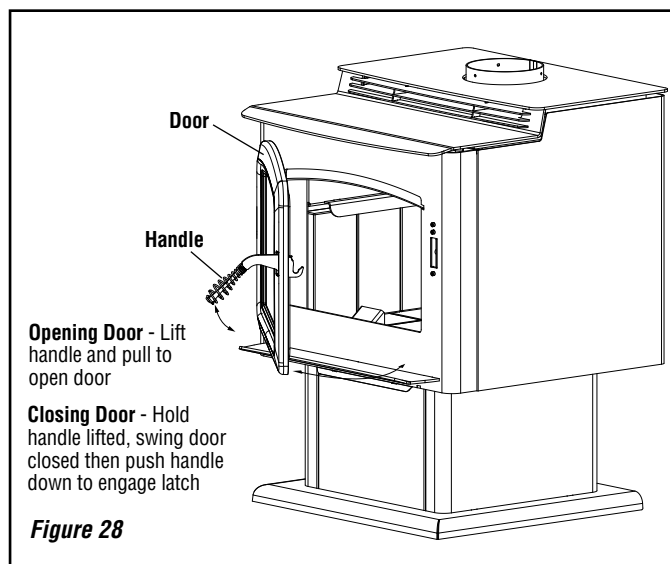
4. **CAUTION: THE DRAFT CONTROL MUST BE FULLY OPEN BEFORE OPENING THE DOOR TO AVOID POSSIBLE COMBUSTION FLASH!!** (Ignition of hot volatile gases as the door is opened).
5. Feeding excessive amounts of fuel to the appliance should be avoided. It is important to supply it with sufficient draft and fuel to maintain a moderately hot fire. If, during overnight burns, heavy creosote deposits develop inside your stove and on the door, the draft is set too low - review your burning habits!

DOOR OPERATION

Do not operate the appliance with the door open or ajar other than possibly during start up to create a draft (Do not leave the unit unattended while the front door is slightly open during start up). Operating the appliance with the door open other than in initial start up if needed will produce extreme temperatures within the appliance. Damage caused from over-firing is not covered under the manufacturers limited warranty.

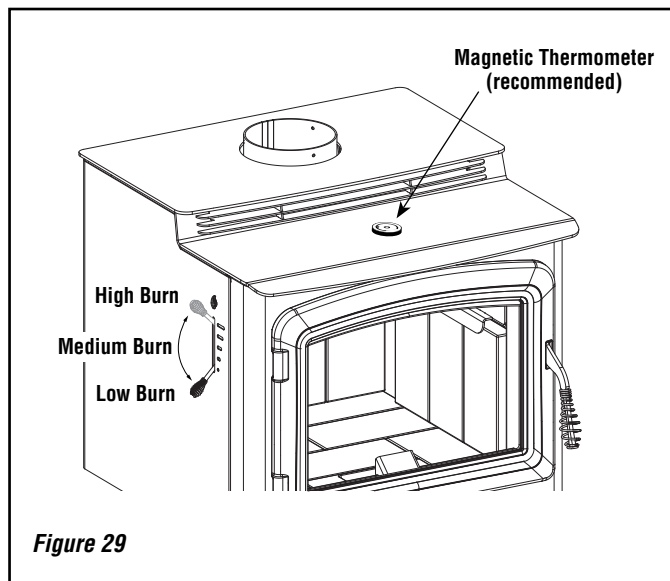
! WARNING

Be careful not to abuse door assembly by striking or slamming it. If the door assembly or glass is broken or damaged, they must be replaced with factory original parts before heater can be safely operated. Use only components provided by the manufacturer as replacement parts.



STARTING AND MAINTAINING A FIRE

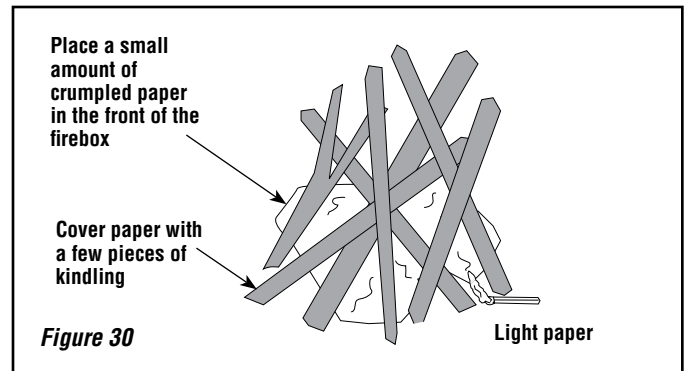
1. **NEVER USE FLAMMABLE LIQUIDS TO START OR REKINDLE A SOLID FUEL FIRE!!**
2. Fully open the primary draft control by placing draft control (wood handle located on left side of the stove) in the highest position. This control determines the amount of air entering the stove. Lowering this control reduces the burn rate of the stove. For your convenience, the control is marked with five positions to assist you in obtaining repeatable burn rates.
3. Place a small amount of crumpled paper in the front of the firebox and cover it with a few pieces of kindling.
4. Light the paper and allow sufficient time for the kindling to become fully engulfed in flames. You will now close the wood units front door. Your wood units front door may or may not need to be left slightly open during this start up process, this depends on the stove model and the amount of draft present.
5. **When operating any wood burning appliance, it is important to become familiar with how the damper control affects heat output and the overall temperature of the appliance. A stove thermometer can be a helpful tool to help ensure you are not over-firing your appliance and it will also ensure you are burning fuel at a rate that is most efficient. Place a stove thermometer on the top of the appliance as shown in *Figure 29*. Monitor the temperature every 15 minutes or so until you become more familiar with your appliance. Close the damper all the way down if you begin to reach 500 degrees, as this is a sign that you are operating your appliance at too high a temperature.**



DO NOT LEAVE THE STOVE UNATTENDED WHILE THE FRONT DOOR IS SLIGHTLY OPEN.

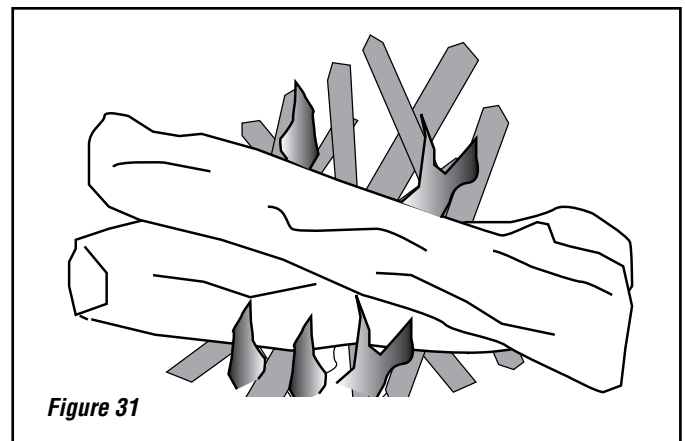
CAUTION: Do Not alter the adjustment range of the draft control for increased firing for any reason.

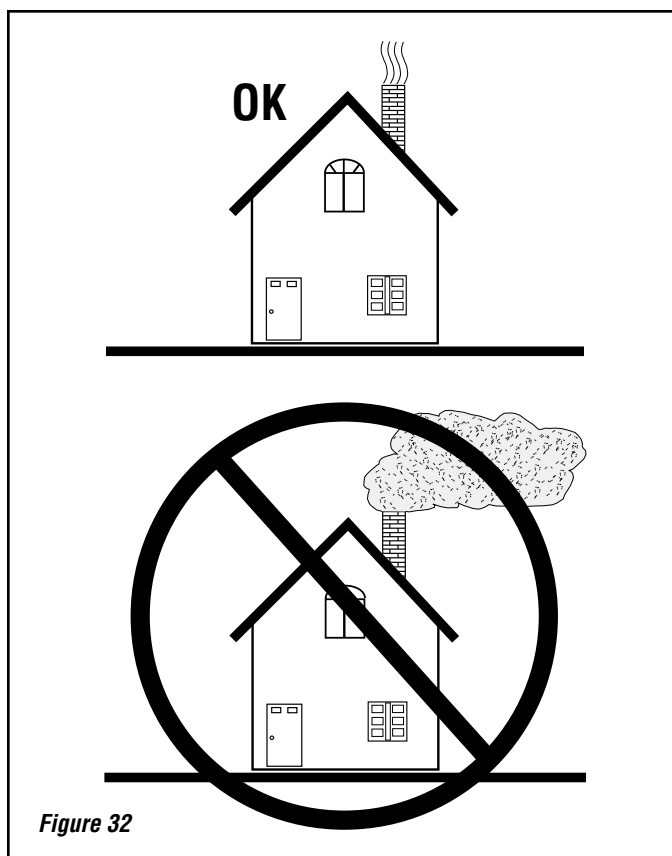
Operate only with fuel door and ash drawer closed. Maintain all seals in good condition. Do not operate with broken glass.



SEE MAINTENANCE SECTION FOR GLASS CLEANING GUIDELINES AND TIPS FOR KEEPING THE GLASS CLEAN (*Page 33*).

6. Once kindling is burning well, larger pieces of wood may be added, then the door should be fully closed if there was the need to keep it slightly open during start up.
7. For best results, use smaller pieces of wood to get the appliance temperature very high before loading larger wood for sustained burns. If necessary, crack the door to allow ignition of the fuel charge. Now you can add larger pieces of wood and after several minutes of high burn, set the left control for the desired heat output. Check the exhaust in about 15 to 20 minutes (*see Figure 32*). Large amounts of smoke indicate an improper burn setting (either too high or too low). Adjust and recheck in 5 to 10 minutes.





FUEL

This appliance is designed to burn dry seasoned natural wood only (see Page 26 for a list of prohibited fuels). Failure to burn proper fuels only will void the certification and the warranty of the appliance.

Dry, seasoned wood is that which has been cut, split and allowed to dry under a covered area where air is free to flow and circulate under and around the wood (not under a tarp or plastic). Make sure wood is not stacked directly on the ground, it may absorb moisture from the ground. It should be allowed to dry in these conditions for a minimum of six months, preferably one year or more. **IT MUST BE UNDERSTOOD THAT WOOD CANNOT BE LEFT IN ANY KIND OF WET OR DAMP AREA OR IT WILL NEVER BECOME COMPLETELY SEASONED.**

Do Not store fuel within space heater installation clearances or within the space required for refueling and ash removal.

DO NOT OVERFIRE THIS HEATER

Attempts to achieve heat output rates that exceed heater design specifications can result in permanent damage to the heater.

What does “Well-Seasoned” mean?

When a tree is cut down, the wood is green, full of sap and moisture. This moisture content can exceed 80%, which must be reduced to less than 20%. Wood properly seasoned is then capable of generating the heat the stove was designed to provide.

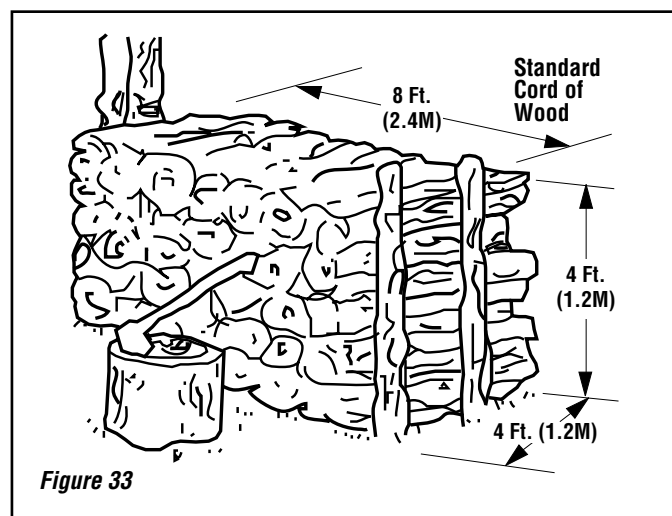
Green wood does not burn easily. Attempting to burn green wood often results in a lot of smoke and very little fire. Time is the most important factor in seasoning wood. Ideally the moisture content should be reduced to 11-20%. **NOTE: The use of a firewood moisture meter is recommended to ensure the firewood contains less than 20% moisture.**

Seasoning Guide

Softwoods - 6 months to 18 months

Hardwoods - 12 months to 24 months

Logs that are 5” diameter across or larger should be split in half, three pieces if over 8 inches, and four pieces when over a foot across. If a tree has been dead for 2 - 4 years it still needs to be cut, split, and seasoned for 6 to 24 months depending on the wood.



GETTING THE MOST OUT OF YOUR STOVE

Recent developments in wood-burning technology have made wood-burning a cleaner and more convenient way to heat your home. Overall efficiency in a wood-burning appliance is a combination of combustion efficiency and heat transfer efficiency. Whether heating your entire home or just a room or two, your understanding of how to best operate your stove or insert will enhance its overall efficiency and performance. What this can mean to you is longer, cleaner burns, less wood use and more heat.

The following sections will outline techniques you can use to “get the most out of your stove.” Please read them carefully.

MAXIMIZING YOUR STOVE’S OVERALL EFFICIENCY

It is important to know that for clean highly efficient burns you will need to have sufficient temperatures inside the firebox for thorough combustion. The best method for determining if you have sufficient temperatures is to watch the brick lining in your firebox. When you first light your stove or fireplace insert, the firebrick will turn a dark brown or black. After 20 to 30 minutes of a hot fire, most of the bricks should return to near their original beige color. This means the firebrick have reached a high enough temperature for your stove to achieve high combustion efficiency and you are ready to adjust the draft control to a lower setting.

Second and just as important, is achieving a high level of heat transfer efficiency. Slowing the rate of flow through the stove or insert enhances heat transfer, thus allowing more time for heat to be transferred into your home. To do this, be sure to thoroughly preheat your stove and then reduce the amount of primary air by closing the draft control down to a lower setting. (More air may produce a slightly greater amount of heat, but will greatly increase wood consumption).

To get the most out of your appliance, you will need to combine good combustion efficiency with good heat transfer practices. The following are some tips on how to operate your stove to achieve the highest overall efficiency.

1. Thoroughly preheat your stove before slowing the burn rate by closing the draft control.
2. When loading wood into a preheated stove or fireplace insert, allow a vigorous fire to build before lowering the draft control.
3. Operate your stove as much as possible in the low to medium burn ranges.
4. Do not lower the draft setting so low as to completely extinguish the flames in the firebox. Check for at least some small flames twenty minutes after setting the draft control.
5. Do not continually operate your stove or fireplace insert in the high (wide open) setting. This wastes wood by carrying a great deal of heat up the chimney and can damage your stove or fireplace insert and chimney.
6. Go outside and check your chimney. More than a very small amount of smoke indicates wasted heat, creosote build up and pollution (*see Figure 32*).

ACHIEVING CLEAN, LONG BURNS

To achieve long burn times, after having thoroughly preheated the stove, load the firebox without blocking the small air opening found in the center front of the firebox. At this point, you may need to burn the stove with the draft open for a few minutes to ignite the wood. All IHP stoves are EPA tested for emissions at low burn with the air control completely closed. Whether or not you should burn your stove with the air control completely closed will depend on the following factors:

- How you load your wood
- Your chimney type, height and draft
- Your wood type and its moisture content
- The temperature of the appliance
- Which model stove or insert you have

In order to maximize the burn time of your stove you may need to experiment to get the right balance of starting temperature, wood type, and draft control setting for your particular venting configuration. Do not reload the stove for long burns when the stainless secondary tubes or baffles are glowing red, or when the stove is uncomfortably hot to load. This indicates the stove is too hot to load for a long burn.

BLOWER OPERATION (OPTIONAL KIT)

Blower Operation

The blower can be operated in either manual or automatic mode. When operated automatically, the blower will turn on when the stove is hot, and turn off when the stove is cool.

— **MANUAL OPERATION:** Flip blower mode switch to the manual position (up) and adjust blower speed dial to desired setting. To turn blower off, rotate blower speed dial counter clockwise until it clicks “off.”

— **AUTO OPERATION:** Flip blower mode switch to auto position and turn blower speed dial clockwise until it clicks out of the “off” position. When the stove warms up (approx. 15-20 Mins), the blower will automatically turn on (adjust blower speed dial to desired speed setting). When the stove or insert cools down, the blower will automatically turn off.

Blower Operation Guidelines

While in auto operation mode, the blower will turn off and on based on The temperature of the appliance. Auto operation ensures there is sufficient heat build-up to warm the air being moved by the blower before the blower is turned on. Likewise, when the stove cools off, the blower is turned off to prevent circulating cool air. Depending on the size and intensity of the fire it may be necessary to adjust the fan speed accordingly to ensure uninterrupted fan operation. For example a small fire may require a slower fan speed to keep the heat output by the fan consistent. If the blower is operated in manual mode, it may be necessary to adjust the blower speed as the fire begins to burn down and the stove is no longer hot enough to effectively heat the air moved by the blower. If the air coming from the blower feels cool, one should either decrease the blower speed or stoke the fire to build up more heat.

NOTE: Turn blower off before opening the door to load the fuel.



Figure 35 - Blower Controls

⚠ WARNING

The blower must be plugged directly into a properly grounded three-prong receptacle, 120 VAC, 60 Hz, single phase. Do not cut or remove the grounding prong from this plug. Do not route power cord under or in front of appliance.

Installation must be in accordance with National Electrical Code, ANSI/NFPA 70 - latest edition. In Canada, the current CSA C22.1 Canadian Electrical Code - latest edition.

DANGER: Disconnect power before servicing blower.

In the event that you remove the blower for any reason, make sure a cover plate (available from IHP) is installed before using the heater. Excessive rear wall temperatures will result if the stove is burned without the cover plate. The cover plate is not necessary if a blower has never been installed because a knock-out will be in place to act as the cover.

NOTE: SWITCH CONDITIONS
GIVEN AT ROOM TEMPERATURE

N/C = NORMALLY CLOSED
N/O = NORMALLY OPEN

— = FEMALE DISCONNECT
—> = MALE DISCONNECT
—○— = STUD CONNECTION

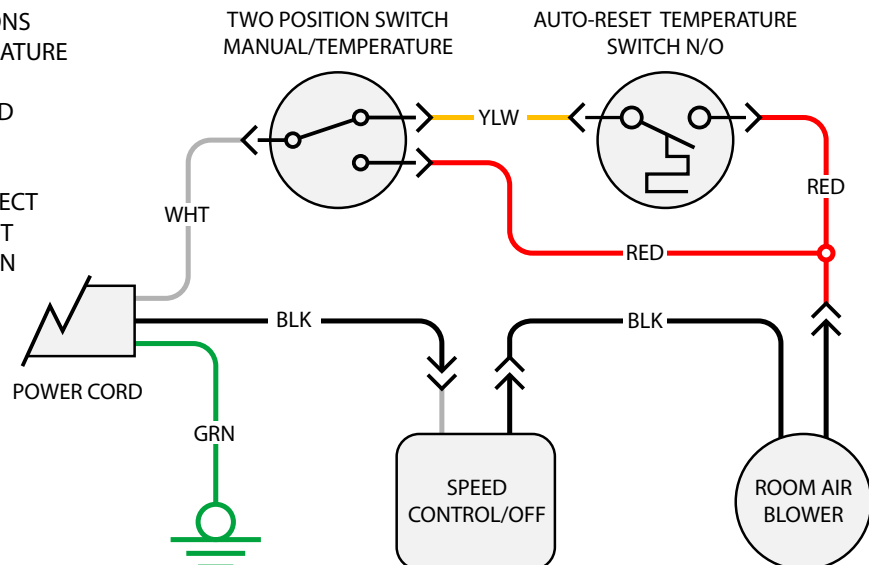


Figure 34 - Blower Wiring Schematic

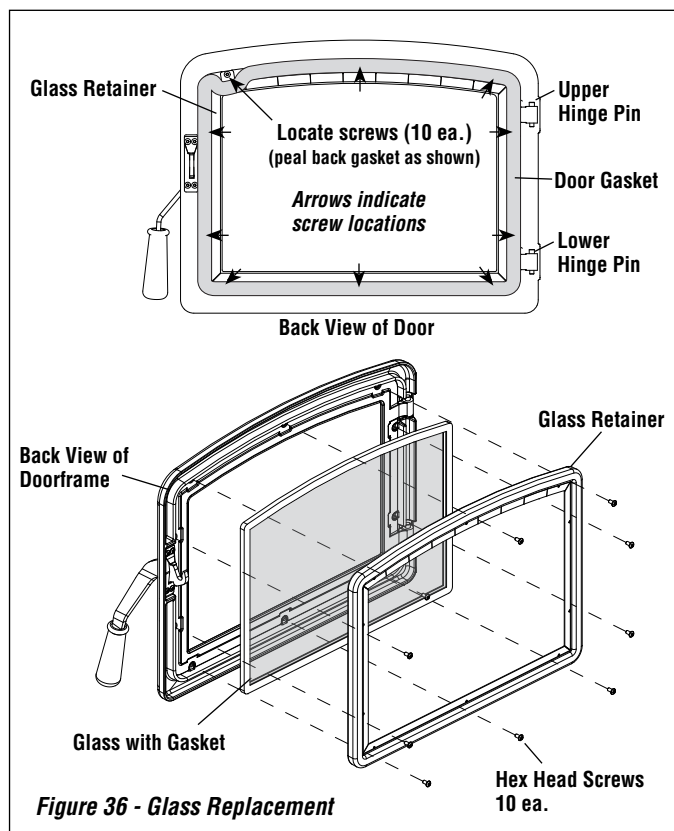
NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

MAINTENANCE

GLASS REPLACEMENT INSTRUCTIONS

(Refer to *Figure 36*)

- Step 1. Remove Door Assembly** - Remove the upper and lower hinge pins by pressing the bottom of each hinge pin up, then pull out from the top. Lift off door and place face down on a soft surface.
- Step 2. Remove Glass Retainer Screws (10 ea.)** - Using an 1/8" allen wrench remove the ten glass retainer screws. To locate screws, peel back the door gasket as necessary. The screws are located by the holes in the stainless steel glass retainer strips.
- Step 3. Remove Glass** - Carefully remove broken glass one piece at a time (protective leather gloves are recommended).
- Step 4. Clean Door Frame** - Clean the area of the door frame where the new glass with gasket will be installed.
- Step 5. Install New Glass Assembly** - Install the new glass with gasket (use only factory supplied 5mm ceramic glass with gasket. **Do not substitute**).
- Step 6. Reinstall Retainer and Screws** - Carefully reinstall the glass retainer and screws. Be very careful not to overtighten the screws (this could result in glass breakage when the stove is hot).
- Step 7. Reinstall Door** - Align hinges on door frame with corresponding hinge holes on the face of stove. Reinstall the upper and lower hinge pins from the top.



GLASS CLEANING GUIDELINES

WARNING: DO NOT CLEAN GLASS WHEN APPLIANCE IS HOT!

Glass on any wood stove will not stay perfectly clean. Here are some guidelines for cleaning and caring for the glass:

- **Ensure the stove is cold prior to cleaning glass.**
- This appliance is designed to provide a flow of air over the inside of the glass, where along with high heat helps inhibit build-up on the glass. When build-up occurs, a commercial glass cleaner designed for stoves is recommended. Regular household glass cleaners will not clean creosote.
- Do not use abrasives such as steel pads, steel wool or oven cleaner as they will scratch the glass. Never scrape glass with a razor blade as this may pit the glass and make it impossible to clean in the future.
- Do not use chemical glass cleaners as they may damage the gaskets or painted surfaces.

TIPS FOR KEEPING THE GLASS CLEAN

- Burn only dry seasoned cord wood. **Wet wood = Dirty glass.**
- A short, hot fire (15 - 20 minutes) may help to clean off some of the normal buildup. **Lower burns = more build-up. Higher burns = less build-up.**
- Keep freshly loaded wood away from the glass.
- After reloading, allow all the wood to catch flame before dampering down the stove.

⚠ CAUTION

Cleaning Glass: Ensure appliance is cold prior to cleaning glass. A commercial glass cleaner designed for stoves is recommended. Do not use abrasive cleaners. Do not clean with any materials, which may scratch or otherwise damage the glass. Scratches on the glass can develop into cracks or break. Inspect the glass regularly. If you detect a crack, extinguish the fire and contact your dealer for a replacement.

MAINTENANCE

Have your product inspected at least once a year by a qualified service technician to ensure gaskets, air tubes, baffles, and venting are in good repair to ensure proper performance. Have degraded items replaced by a qualified service technician.

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

DOOR HINGES: If door hinges need lubricating, use an anti-seize compound (never use oil) available from your IHP dealer.

DOOR LATCH: Adjustment Instructions - Remove the right side heat shield by loosening the 3 screws located on the back of the stove. Using a "L" shaped 5/32" allen wrench, loosen the locking screw in the latch assembly as shown in **Figure 37**. With the locking screw loosened, adjust the top 5/32" allen screw (**Figure 37**) in the front of the stove to adjust the door tension. Turning the screw to the right will tighten the door, turning the screw to the left will loosen the door. When you loosen the door it will be easiest to pull the roller pin to the full forward position and make slight adjustments to tighten to the desired tension. Assure that the tension on the front door creates a good seal between the gasket on the front door and the firebox front. After adjusting the door tension, re-tighten the lock screw and replace the heat shield.

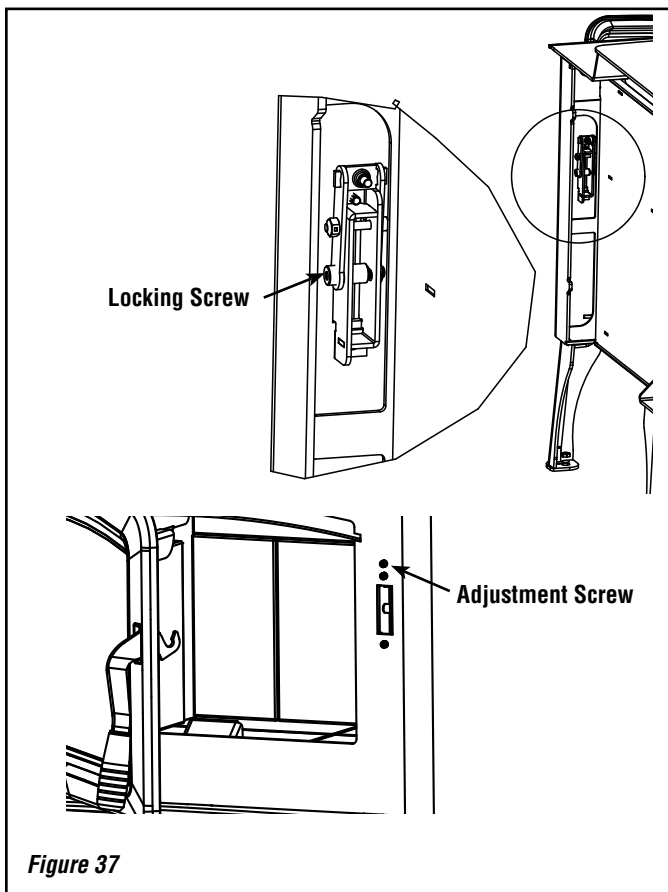


Figure 37

DOOR GASKET: Periodically check gasket to make sure it is not over-compressed. If compressed, replace with a special woven door rope. (Don't try substituting rope, only use IHP door rope).

PLATED ACCESSORIES: Clean only with household type glass cleaner and a very soft cotton cloth. Other products may damage plated finish, paint and gaskets.

BAFFLE BOARDS: Your baffle boards should be inspected during every chimney cleaning. If either board is damaged then replace baffle boards.

CREOSOTE FORMATION AND NEED FOR REMOVAL

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire.

The chimney and chimney connector should be inspected at least once monthly during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated (1/8" [3 mm] or more), it should be removed to reduce the risk of a chimney fire.

Establish a routine for the fuel, wood burner and firing technique. Check daily for creosote build-up until experience shows how often you need to clean to be safe. Be aware that the hotter the fire the less creosote is deposited, and weekly cleaning may be necessary in mild weather even though monthly cleaning may be enough in the coldest months. Contact your local municipal or provincial fire authority for information on how to handle a chimney fire. Have a clearly understood plan to handle a chimney fire.

DISPOSAL OF ASHES

Whenever ashes get 3 to 4 inches deep in your firebox, and when the fire has burned down and cooled, remove excess ashes. Leave an ash bed approximately 1 inch deep on the firebox bottom to help maintain a hot charcoal bed.

Ashes should be scooped out of a cool stove or fireplace insert with a small metal shovel. Ashes should be placed in a steel container with a tight fitting lid and moved outdoors immediately. Other waste shall not be placed in this container. 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 the cinders have thoroughly cooled. Ashes can ignite up to 72 hours after removal from the appliance.



WARNING

Inspect and clean chimney and connector frequently. Under certain conditions of use, creosote buildup may occur rapidly.

DO'S AND DON'TS

- DO NOT:** Install or operate the appliance before reading this manual.
- DO NOT:** Close the draft beyond the point at which the flames are completely extinguished.
- DO NOT:** Open the appliance door without **fully opening** the draft first.
- DO NOT:** Burn driftwood or wood that has been in salt water. This includes some mill ends and scrap lumber that has been floated in salt water on the way to the mill. (This will void your warranty).
- DO NOT:** Handle the Nickel Door Trim unnecessarily. Use the door handle only.
- DO NOT:** Force oversized logs into the firebox as this may dislodge the baffle assembly.
- DO NOT:** Close the door tightly during Burn-In Period.

- DO:** Be sure to clean any fingerprints from optional accessories that have plated surfaces before burning the appliance. Clean the plated surfaces only with household type glass cleaner and a very soft cloth.
- DO:** Consult local building department if other than recommended clearances are desired.
- DO:** Read instructions for the baffle boards occasionally to ensure you have not bumped or moved them out of place when loading wood.
- DO:** Check the chimney and baffle monthly to make sure they are clean.
- DO:** Burn seasoned, dry wood only! (RAIN = WET WOOD)
- DO:** Open the door frequently during Burn-In Period to keep gasket from adhering to the curing paint.
- DO:** Enjoy the warm feeling of your new IronStrike® stove.

Smoke Detector Recommended

Since there are always several potential sources of fire in any home, we recommend installing smoke detectors. If possible, install the smoke detector in a hallway adjacent to the room (to reduce the possibility of occasional false activation from the heat produced by these appliances). If your local code requires a smoke detector be installed within the same room, you must follow the requirements of your local code. Check with your local building department for requirements in your area.

Carbon Monoxide Monitor Recommended

Carbon Monoxide Poisoning: Early signs of carbon monoxide poisoning are similar to the flu with headaches, dizziness and/or nausea. If you have these signs, obtain fresh air immediately. Some people are more affected by carbon monoxide than others, including pregnant women, people with heart or lung disease or anemia, those under the influence of alcohol, and those at high altitudes.

It is against federal regulations to operate wood heaters in a manner inconsistent with operating instructions in the manual.

PROHIBITED FUELS

This heater is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or to green or freshly cut hardwoods. **DO NOT BURN:**

- Garbage;
- Lawn clippings or yard waste;
- Materials containing rubber, including tires;
- Materials containing plastic;
- Waste petroleum products, paints or paint thinners, or asphalt products;
- Materials containing asbestos;
- Construction or demolition debris;
- Railroad ties or pressure-treated wood;
- Manure or animal remains;
- Salt water driftwood or other previously salt water saturated materials;
- Unseasoned wood;
- Christmas tree branches;
- Paper products, colored paper, cardboard, plywood, or particle-board;
- gasoline;
- naphtha;
- engine oil;
- flammable liquids;
- solvents;
- grease; or
- coal

The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater.

Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke. Intense firing with these materials may overheat the fireplace, causing damage to the unit, a fire or even possibly igniting a chimney fire if the chimney is creosoted. Burning unapproved fuel, resulting in excessive pollutants being emitted, may be prohibited and subject to a fine or other penalty by the authority having jurisdiction in your area.

TROUBLESHOOTING

Problem	Solution
POOR DRAFT:	Extend chimney in length or have the chimney realigned to the proper size flue. Oversized chimneys normally have poor drafts. Remember, the appliances' draft depends solely on the natural draft of the chimney (See Draft Requirements on Page 4). If your stove or fireplace insert is not drafting properly, your chimney is the problem. All stoves are thoroughly tested to ensure proper draft with the correct size chimney flue.
EXCESSIVE DRAFT:	With better chimneys being more common, excessive draft can be an issue. Alleviate excessive draft by slowing the burn rate of the appliance once it has reached proper operating temperature (See Maximizing Your Stoves Overall Efficiency on Page 22).
DIRTY GLASS:	<ol style="list-style-type: none"> 1) Burn smaller, hotter fires and check to make sure you are not setting the draft down too far with the draft control. 2) Make sure your wood is well-seasoned and dry (not open to rain - see Creosote [Page 25] and Fuel [Page 21] sections). 3) See Poor Draft section (above) and Cleaning Glass on Page 24.
SMOKES WHEN DOOR IS OPEN:	<ol style="list-style-type: none"> 1) If smoke is entering the room, check to make sure your baffle boards are properly installed. 2) Check the chimney for blockage due to creosote (see Chimney [Page 11] and Creosote [Page 25] sections). 3) Check draft (See POOR DRAFT section above).
WOOD BURNS TOO FAST:	<ol style="list-style-type: none"> 1) The draft control must be closed further. 2) Add fuel at lower firebox temperatures. 3) Load wood side to side and reduce the flow of air under wood. 4) The door seal may need replacing, check for leakage. 5) See "Excessive Draft."
POOR HEAT OUTPUT:	<ol style="list-style-type: none"> 1) Check your wood. Wet, moist, unseasoned wood will not produce heat. 2) Your stove or fireplace insert needs to be seasoned (moisture removed from the steel and brick). Continue to burn a fire. It normally takes from one to three weeks of burning to season your stove (See Burn-In procedures on Page 19). 3) See Excessive Draft section above.
PAINT GIVES OFF ODOR (smoke):	Paint is tempering-in. Burn only moderately hot for the first few days until paint is fully cured. Then burn a very hot fire to cure any paint that may not easily cure. Open windows or door to ventilate (See Burn-In Period on Page 19).

REPLACEMENT PARTS - MODEL GRANDVIEW™ 300GL

Contact an IHP dealer to obtain any of these parts. Never use substitute materials. Use of non-approved parts can result in poor performance and safety hazards.

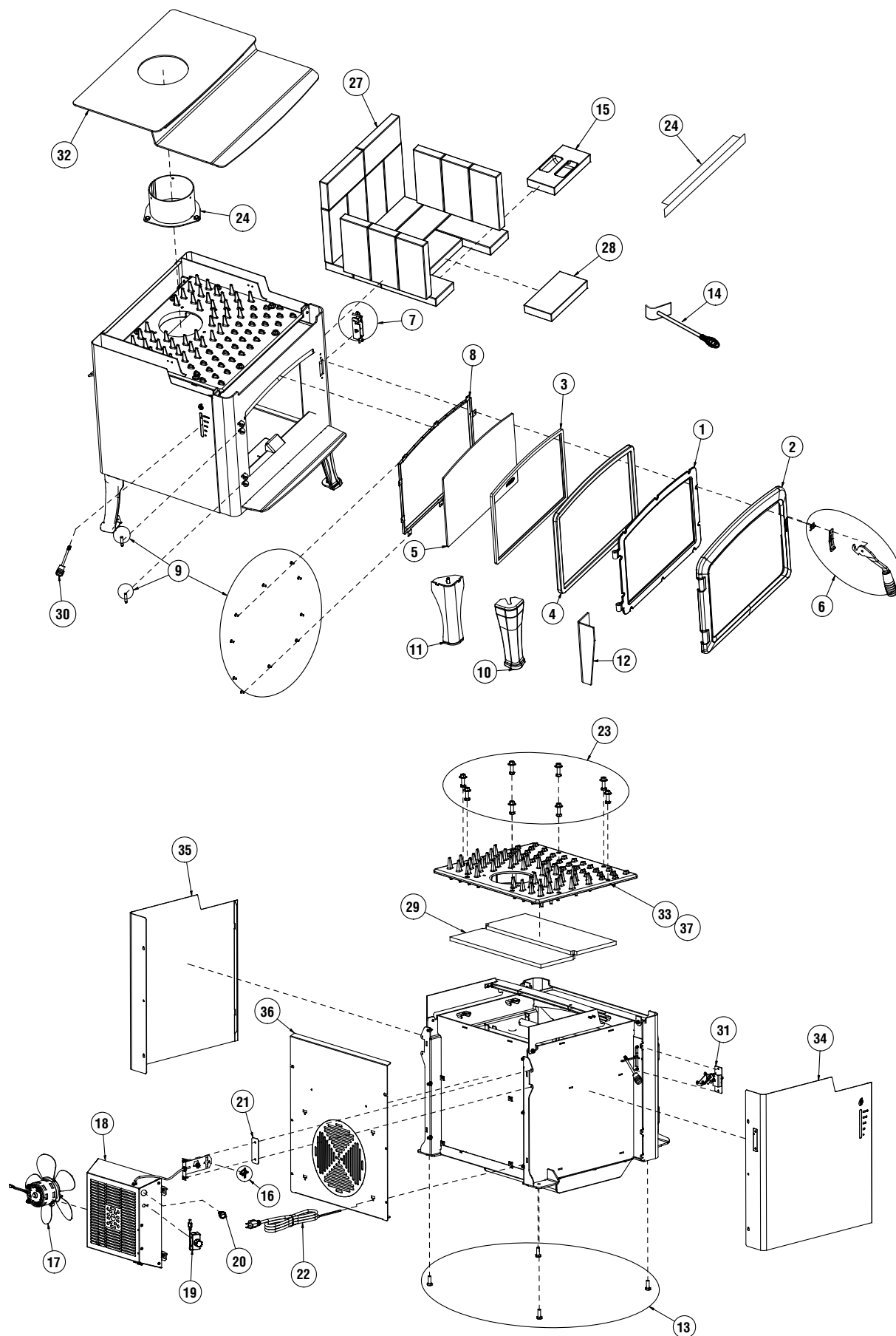
FRONT DOOR PARTS LIST

Item #	Description	GV300
1	Inner Door Frame, Cast Iron	H8365
2	Outer Door Frame, Cast Iron	H8366
3	Glass Gasket 1"	H8380
4	Door Gasket 7/8"	H5639
5	Ceramic Glass With Gasket	H8392
6	Door Handle Kit	H8395
7	Door Latch Assembly (4 button head screws and latch)	H8397
8	Glass, Retainer Kit	H8394
9	Door Hardware Kit (includes 2 pins, door roller and 10 button head screws and door set screw)	H8398
LEG PARTS		
10	Coastal Brushed Nickel Leg - single leg	H8383
10	Coastal, Nickel Leg - single leg	H8384
10	Coastal, Black Leg - single leg	H8385
11	Lakeview, Steel Black Leg - single leg	H8386
---	Olympic, Brushed Nickel Cast Leg - single leg	H5619
---	Olympic, Nickel Cast Leg - single leg	H5621
---	Olympic, Black Cast Leg - single leg	H5669
---	Leg, Hardware, Bolt, Kit	H8382
PEDESTAL PARTS		
14	Ash Plug Remover and Rake	H5564
15	Removable Ash Plug	H8381

BLOWER PARTS

Item #	Description	GV300
16	Blower Snap Switch	H8374
17	Blower Blade	H8375
18	Blower Cover	H8376
19	Speed Control - High Temperature	H5742
20	Blower Rocker Switch	H8066
---	Blower Opening Cover Plate	H8399
22	Blower Power Cord	H5660
MISCELLANEOUS PARTS		
---	Dry Graphite (apply to door handle bushing)	71052
---	Anti Seize, 2 Gram Pouch	H5633
23	Heat Exchanger Bolt Kit	H8387
---	Flue Ring Bolt Kit	H8388
---	Ash Drawer Hardware Kit	H8389
---	Taptite Qty 8 (34055)	H8390
---	Button Head Screw Qty 8 (34027)	H8391
FIREBOX PARTS		
---	Secondary Tube Retainer Clips	H8367
---	Replacement Secondary Air Tube Kit	H9081
24	Back Brick Retainer	J7602
27	Complete Firebrick Kit (GV230 - 20 bricks included, GV300GL - 26 bricks included)	H9082
28	Firebrick 4-1/2" X 9", Each	H5612
29	Baffle Board Kit	H9083
BODY PARTS		
30	Damper Rod	H8393
31	Damper Assembly	H8396
32	Stove Top Replacement	H9084
33	Cast Iron Heat Exchanger (hardware included)	H9085
35	Left Side Heat Shield (hardware included)	H9086
34	Right Side Heat Shield (hardware included)	H9087
36	Rear, Heat, Shield (hardware included)	H9088
37	Heat Exchanger Gasket	H8377

REPLACEMENT PARTS - MODELS GRANDVIEW™ 300GL

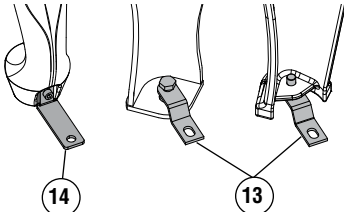
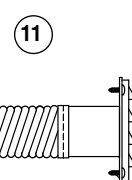
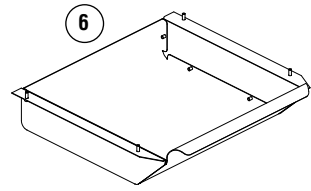
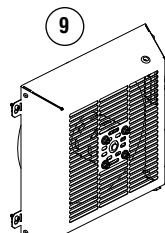
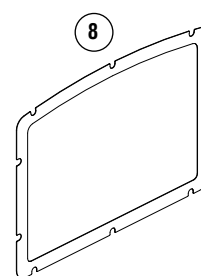
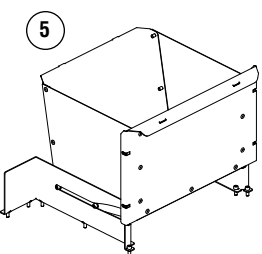
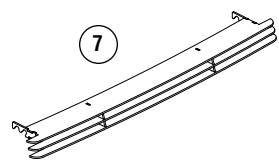
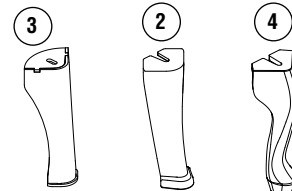
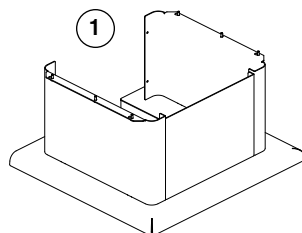
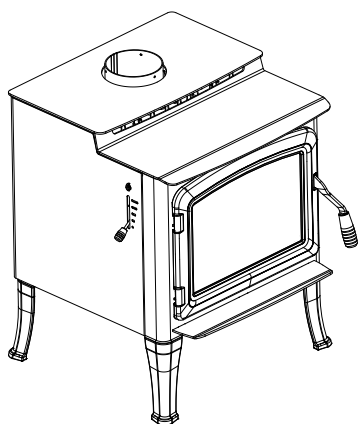


NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

ACCESSORIES - MODEL GRANDVIEW™ 300GL

PEDESTAL (REQUIRED)			
Item #	Model	Description	GV300
1	PED-GV	Pedestal, Black	H8343
OR LEGS (REQUIRED)			
2	LEG-COSTL-BLK	Coastal Legs, Black	H8339
2	LEG-COSTL-BRNKL	Coastal Legs, Brushed Nickel	H8340
3	LEG-LKVIEW-BLK	Lakeview Legs, Black	H8342
4	LEG-OLY-B	Olympic Sculptured Black	70000
4	LEG-OLY-N	Olympic Sculptured Nickel	70002
4	LEG-OLY-BRN	Olympic Sculptured Brushed Nickel	70008
ASH DRAWERS			
5	ASHDR-KIT-PED-GV	Pedestal, Ash Drawer Kit	H8344
6	ASHDR-KIT-LEG-GV	Leg, Ash Drawer Kit	H8345
LOUVERS			
7	LVP-GV230-BLK	Louvers, Black	H8959
7	LVR-GV230-BRNKL	Louvers, Brushed Nickel	H8960

DOOR TRIM			
Item #	Model	Description	GV300
8	DRTRM-GV230-NKL	Door Trim, Nickel	H8346
8	DRTRM-GV230-BRNKL	Door Trim, Brushed Nickel	H8347
BLOWER			
9	BLWR-GV-700-SS	Blower	H8350
OUTSIDE AIR KITS			
10	UZIAD	Outside Air Coupler for Connection of UZI to Fireplace	UZIAD
11	UZI	Outside Air Kit (4" I.D. x 10 ft. long insulated flex)	UZI
COMMON ACCESSORIES			
12	TSPK-B	Touch-up Spray Paint Kit, Black	H8159
13	WP-LEGF-LBRKT	Leg Tie Down Kit, Coastal & Lakeview Legs, Mobile Homes	H7665
14	W-LEGF-LBRKT	Leg Tie Down Kit, Olympic Legs, Mobile Homes	H5308
----	W-LLK	Leg Leveling Bolt Kit	H8407



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Innovative Hearth Products

IronStrike® Brand Wood Burning Stove and Insert

Limited Lifetime Warranty

THE WARRANTY

Innovative Hearth Products ("IHP") Limited Lifetime Warranty warrants your IronStrike® Brand Wood Burning Stove or Insert ("Product") to be free from defects in materials and workmanship at the time of manufacture. The Product body, firebox and ceramic glass carry the Limited Lifetime Warranty. Ceramic glass carries the Limited Lifetime Warranty against thermal breakage only. After installation, if covered components manufactured by IHP are found to be defective in materials or workmanship during the Limited Lifetime Warranty period and while the Product remains at the site of the original installation, IHP will, at its option, repair or replace the covered components. If repair or replacement is not commercially practical, IHP will, at its option, refund the purchase price or wholesale price of the IHP product, whichever is applicable. IHP will also pay IHP prevailing labor rates, as determined in its sole discretion, incurred in repairing or replacing such components for up to five years. THERE ARE EXCLUSIONS AND LIMITATIONS to this Limited Lifetime Warranty as described herein.

COVERAGE COMMENCEMENT DATE

Warranty coverage begins on the date of purchase. In the case of new home construction, warranty coverage begins on the date of first occupancy of the dwelling or six months after the sale of the Product by an independent IHP dealer/distributor, whichever occurs earlier. The warranty shall commence no later than 24 months following the date of product shipment from IHP, regardless of the installation or occupancy date.

EXCLUSIONS AND LIMITATIONS

This Limited Lifetime Warranty applies only if the Product is installed in the United States or Canada and only if operated and maintained in accordance with the printed instructions accompanying the Product and in compliance with all applicable installation and building codes and good trade practices.

This warranty is non-transferable and extends to the original owner only. The Product must be purchased through a listed supplier of IHP and proof of purchase must be provided. The Product body and firebox carry the Limited Lifetime Warranty from the date of installation. Vent components, trim components and paint are excluded from this Limited Lifetime Warranty. The following do not carry a Limited Lifetime Warranty but are warranted as follows:

- Cast Iron Heat Exchanger** – Replacement for five years from the date of installation
- Cast iron parts** – Replacement for one year from the date of installation
- Catalyst** – Carries a separate warranty. Refer to the warranty certificate provided for that part
- Electrical components** – Repair or replacement for one year from date of installation
- Gaskets** – Replacement for one year from the date of installation.
- Gold & nickel plating** – Replacement for two years from date of installation. Excludes tarnishing
- Refractory & screens** – Replacement for two years from date of installation. Excludes hairline cracks
- Removable air tubes** – Repair or replacement for seven years from date of installation. IHP prevailing labor rates for years one through five.
- Labor coverage** – Prevailing IHP labor rates apply for the warranty period of the component, unless otherwise noted

Parts not otherwise listed carry a 90 day warranty from the date of installation.

Whenever practicable, IHP will provide replacement parts, if available, for a period of 10 years from the last date of manufacture of the Product.

IHP will not be responsible for: (a) damages caused by normal wear and tear, accident, riot, fire, flood or acts of God; (b) damages caused by abuse, negligence, misuse, or unauthorized alteration or repair of the Product affecting its stability or performance. (The Product must be subject to normal use with approved fuels listed in the Operation Manual provided with the product. Fuel products with abnormal burning characteristics, including but not limited to fuel such as driftwood, coal or plywood and wood products using a binder may burn at excessive temperatures and may cause damage to the Product or may cause it to function improperly; IHP stoves, inserts and high efficiency EPA fireplaces are approved for burning dry seasoned wood only.); (c) damages caused by failing to provide proper maintenance and service in accordance with the instructions provided with the Product; (d) damages, repairs or inefficiency resulting from faulty installation or application of the Product.

Coverage of this Limited Lifetime Warranty is conditional upon the appliance being operated without the use of grates, irons or any other method to elevate the fire.

IHP is not responsible for inadequate system draft caused by air conditioning and heating systems, mechanical ventilation systems, or general construction conditions which may generate negative air pressure in the room in which the appliance is installed. Additionally IHP assumes no responsibility for smoking conditions caused by inadequate chimney height, adjoining trees or buildings, adverse wind conditions or unusual environmental factors and conditions. Certain IHP Products are listed for use with Security Chimneys International, Ltd. chimney systems only. Use of chimney components other than that specified in the Product manual will void the Product warranty.

This Limited Lifetime Warranty covers only parts and labor as provided herein. In no case shall IHP be responsible for materials, components or construction which are not manufactured or supplied by IHP or for the labor necessary to install, repair or remove such materials, components or construction. Additional utility bills incurred due to any malfunction or defect in equipment are not covered by this Limited Lifetime Warranty. All replacement or repair components will be shipped F.O.B. from the nearest stocking IHP factory.

LIMITATION ON LIABILITY

It is expressly agreed and understood that IHP's sole obligation and the purchaser's exclusive remedy under this warranty, under any other warranty, expressed or implied, or in contract, tort or otherwise, shall be limited to replacement, repair, or refund, as specified herein.

In no event shall IHP be liable for any incidental or consequential damages caused by defects in the Product, whether such damage occurs or is discovered before or after replacement or repair, and whether such damage is caused by IHP's negligence. IHP has not made and does not make any representation or warranty of fitness for a particular use or purpose, and there is no implied condition of fitness for a particular use or purpose.

IHP makes no expressed warranties except as stated in this Limited Lifetime Warranty. The duration of any implied warranty is limited to the duration of this expressed warranty.

No one is authorized to change this Limited Lifetime Warranty or to create for IHP any other obligation or liability in connection with the Product. Some states and provinces do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. The provisions of this Limited Lifetime Warranty are in addition to and not a modification of or subtraction from any statutory warranties and other rights and remedies provided by law.

INVESTIGATION OF CLAIMS AGAINST WARRANTY

IHP reserves the right to investigate any and all claims against this Limited Lifetime Warranty and to decide, in its sole discretion, upon the method of settlement.

To receive the benefits and advantages described in this Limited Lifetime Warranty, the appliance must be installed and repaired by a licensed contractor approved by IHP.

Contact IHP at the address provided herein to obtain a listing of approved dealers/distributors. **IHP shall in no event be responsible for any warranty work done by a contractor that is not approved without first obtaining IHP's prior written consent.**

HOW TO REGISTER A CLAIM AGAINST WARRANTY

In order for any claim under this warranty to be valid, you must contact the IHP dealer/distributor from which you purchased the product. If you cannot locate the dealer/distributor, then you must notify IHP in writing. IHP must be notified of the claimed defect in writing within 90 days of the date of failure. Notices should be directed to the IHP Warranty Department at 1769 East Lawrence Street; Russellville, AL 35654 or visit our website at WWW.IRONSTRIKE.US.COM.

WARRANTY

Your wood appliance is covered by a limited warranty (provided with the appliance). Please read the warranty to be familiar with its coverage.

Retain this manual. File it with your other documents for future reference.

REPLACEMENT PARTS

See **Pages 28 and 29** for a complete replacement parts list. Use only parts supplied from the manufacturer.

Normally, all parts should be ordered through your IHP distributor or dealer. Parts will be shipped at prevailing prices at time of order.

When ordering repair parts, always give the following information:

1. The model number of the appliance.
2. The Serial Number of the appliance.

3. The part number.
4. The description of the part.
5. The quantity required.
6. The installation date of the appliance.

If you encounter any problems or have any questions concerning the installation or application of this system, please contact your dealer.

Innovative Hearth Products, LLC (IHP)
1769 East Lawrence Street
Russellville, AL 35654
IronStrike.us.com

PRODUCT REFERENCE INFORMATION

We recommend that you record the following important information about your appliance. If you did not purchase your appliance directly from an IHP dealer, then contact us at IronStrike.us.com to find your nearest IHP dealer who will answer your questions or address your concerns.

Model Number _____

Serial Number _____

Date Installed _____

Your Dealer's Name _____



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



Innovative Hearth Products (IHP) reserves the right to make changes at any time, without notice, in design, materials, specifications, and prices, and also to discontinue colors, styles, and products. Consult your local distributor for fireplace code information.



CONTACT LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA. ROOM HEATER, SOLID FUEL TYPE, ALSO FOR USE IN MOBILE HOMES PURSUANT TO (UM) 84-HUD.

COMMUNIQUEZ AVEC LES AUTORITÉS LOCALES EN BÂTIMENT OU LE SERVICE DE PRÉVENTION DES INCENDIES POUR CONNAÎTRE LES NORMES D'INSTALLATION ET D'INSPECTION DE VOTRE RÉGION. APPAREIL DE CHAUFFAGE CERTIFIÉ POUR COMBUSTIBLE SOLIDE PEUT-ÊTRE INSTALLÉ DANS UNE MAISON MOBILE SELON (UM) 84-HUD.

Report No./Numéro de Rapport	Model / Modèle	Serial No./Numéro de série:
14-194	Grandview™ 300GL	GV300GL-

Tested to: UL 1482, ULC S627
Type Of Fuel: Solid Wood Only
Optional Blower, Part No. H8350, Model BLWR-GV700-SS
Blower Electrical Rating: 120V, 60 Hz, 1 Amp
Do not route power cord under or in front of appliance.
Replace glass only with 5mm ceramic.
Operate only with doors closed.

Do not obstruct the space beneath the heater.

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.

Certification test emissions value 1.8 g/hr per EPA Method 28R

"PREVENT HOUSE FIRES"
Install and use only in accordance with manufacturer's installation and operating instructions and your local building codes.

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

CHIMNEY & CONNECTOR: Minimum 6" diameter, minimum 24 MSG black steel connector pipe with UL103HT listed factory-built chimney suitable for use with solid fuels or masonry chimney. Horizontal connection not tested, refer to local building codes for installation. Clearances to connector shall be measured from 6" flue collar. Restrictions apply! Read instructions before installing.

Approved Class A - UL 103HT chimney and double wall connectors:
• Security • Projet • Jakes Evans/GSW • Dura-Vent
• Metal Fab • Ameri-Tec • Metalbestos • IndustrialChimney

RESIDENTIAL chimney systems must be from the same brands but connector pipe may be double wall, single wall, or single wall with shield as listed above.

Connector pipe and chimney must be of the same brand.

COMPONENTS REQUIRED FOR INSTALLATIONS: Legs AND Bottom Heat Shield or Pedestal Base. Attach as shown in the installation instructions.

If optional blower is NOT used, Rear Heat Shield Block Off Plate shall be installed.

Made in U.S.A. Fabriqué aux U.S.A.				Date of Manufacture / Date De Fabrication															
				2019	2020	2021	JAN JANV	FEB FEVR	MAR MARS	APR AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOÛT	SEP SEPT	OCT OCT	NOV NOV	DEC DEC	
DO NOT REMOVE THIS LABEL NE PAS ENLEVER OU RECOUVRIR CETTE ÉTIQUETTE				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
				U.S. ENVIRONMENTAL PROTECTION AGENCY															
				Certified to comply with 2020 particulate emission standards using crib wood.															
Part No./No. Pièce 900963-00 Rev. 0, 02/2019																			



Manufactured By / Fabriqué Par:
INNOVATIVE HEARTH PRODUCTS
1502 14th St. NW
Auburn, WA 98001 USA

Tested to/Testé selon: UL 1482, ULC S627
Type de combustible: Bois seulement
Ventilateur Optionnel, No. De Pièces: H8350, Modèle BLWR-GV700-SS
Spécification Électrique Du Ventilateur: 120V, 60 Hz, 1 Amp
Ne pas faire passer le fil électrique sous ou en avant de l'appareil
Remplacez la vitre seulement avec la céramique de 5 millimètres.
Faire fonctionner uniquement lorsque les portes sont fermées.
Ne pas obstruer l'espace sous la bouche de chaleur.

Cet appareil de chauffage au bois doit être inspecté et entretenu périodiquement pour fonctionner correctement. Voir le manuel du propriétaire pour plus d'information. L'utilisation de cet appareil de chauffage au bois de manière incompatible avec les instructions du manuel du propriétaire constitue une infraction aux réglementations fédérales.

Valeur d'émission du test d'homologation 1,8 g/h (EPA Method 28R).

"PREVENTION DES INCENDIES"
Installer et utiliser l'appareil en conformité avec les directives d'installation du fabricant et des autorités locales en bâtiment ou le service de prévention des incendies.

ATTENTION: Prenez des précautions spéciales lorsque vous faites passer une cheminée à travers un mur ou un plafond, référez-vous aux instructions d'installation et aux codes locaux de la construction. Ne pas brancher cette unité à un conduit de fumée raccordé à un autre appareil.

CHEMINÉE ET TUYAU CONNECTEUR : Approuvé pour raccordement avec un conduit de raccordement en acier noir 24 jauges minimum de 6" de diamètre et une cheminée préfabriquée certifiée pour combustible solide ou une cheminée de maçonnerie. Non certifié pour installation horizontale, référez-vous aux autorités locales en bâtiment. Des restrictions s'appliquent! Lisez les directives avant d'effectuer l'installation.

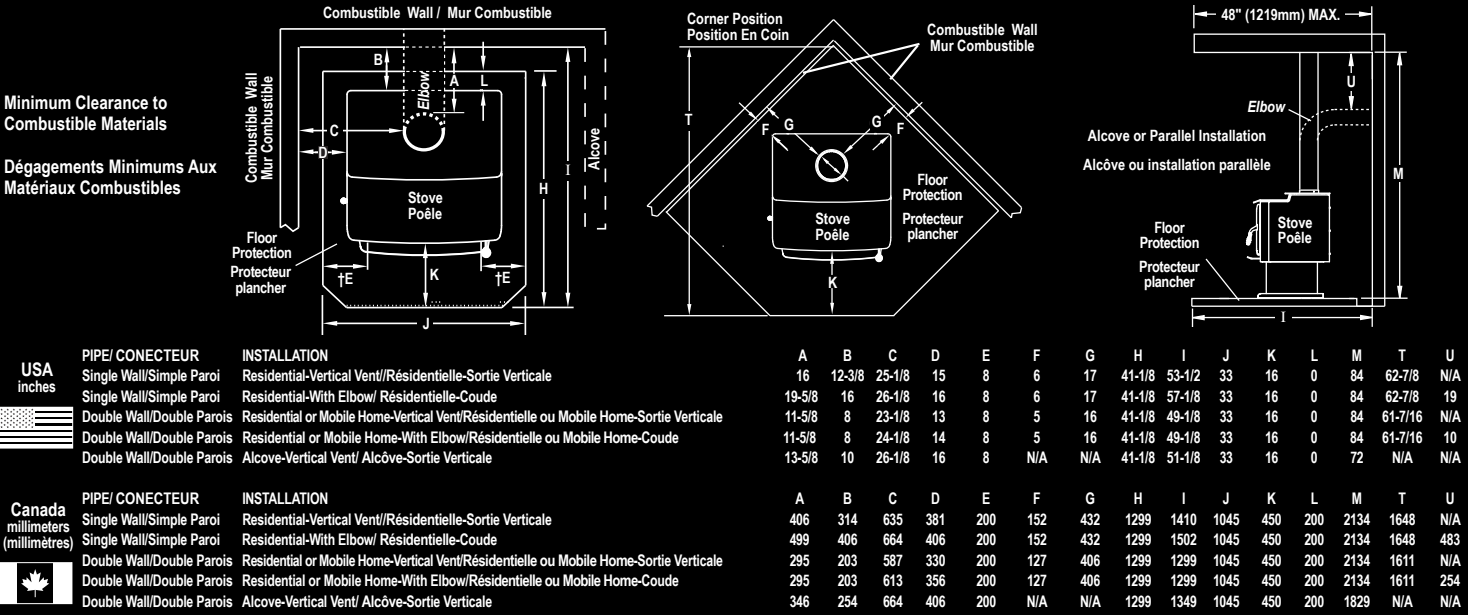
Cheminée certifiée Classe A – UL103HT et tuyaux connecteurs doubles parois :
• Security • Projet • Jakes Evans/GSW • Dura-Vent
• Metal Fab • Ameri-Tec • Metalbestos • Industrial Chimney

RÉSIDENTIEL: Cheminée de la même marque de commerce mais le tuyau connecteur peut-être à double ou simple parois ou à simple parois avec protecteur tel que définit ci-dessus.

Le tuyau connecteur et la cheminée doivent être de la même marque de commerce.

COMPOSANTES REQUISES POUR L'INSTALLATION : Pattes ou socle inférieur ET protecteur radiant inférieur. Attacher tel que démontré dans le manuel d'installation.

Si le ventilateur optionnel n'est pas utilisé, une plaque coupe-feu protectrice doit être installée à l'arrière.



† USA=8" (200mm) from door opening, Canada=8" (200mm) from sides and back of unit

ALCOVE DIMENSIONS (double wall pipe only): Minimum 54" (1372mm) Width, Maximum 48" (1219mm) Depth.

FLOOR PROTECTOR: The hearth and/or floor protection must be a non-combustible hearth/floor protector with a minimum thickness of 3/8" (9.5mm), extending beneath the heater and to the front, sides, and rear as indicated.

NOTICE: All mobile home installations require outside air kits (OAK).

Clearance dimensions are to flue collar. If a single wall connector pipe with shield is used, a 1 inch air space is needed between pipe and shield. Shield attaches to rear of stove pipe and must run from stove top to ceiling. Pipe shield shall be UL listed.

† USA= 8" (200mm) à l'avant de la porte, Canada 8" de chaque côté de l'appareil * Maison
DIMENSIONS DE L'ALCÔVE (paroi double): Largeur Minimum 48" (1219mm) , Profondeur Maximum 48" (1219mm).

PANNEAU PROTECTEUR PLANCHER : Les panneaux protecteurs doivent être non combustible, dont l'épaisseur minimale est de 3/8" (9.5mm) et doivent s'étendre sous l'appareil, à l'avant des portes, à l'arrière et de chaque côté tel qu'indiqué.

AVIS: USA SEULEMENT - Toutes les installations dans une maison mobile requièrent un ensemble de prise d'air extérieur (OAK).

Les distances de dégagement sont pour un conduit de 6" Si un tuyau connecteur à simple paroi et un protecteur sont utilisés, un espace d'air de 1" est requis entre le tuyau et le protecteur. Le protecteur s'attache à l'arrière du tuyau de poêle et doit couvrir le tuyau à partir du dessus du poêle jusqu'au plafond. Le protecteur de tuyau doit être certifié UL.

CAUTION

HOT WHILE IN OPERATION. DO NOT TOUCH, KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAME-PLATE AND INSTRUCTIONS. DO NOT OVERFIRE - IF HEATER OR CHIMNEY CONNECTOR GLOWS, YOU ARE OVERFIRING. INSPECT AND CLEAN CHIMNEY FREQUENTLY - UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY. DO NOT USE GRATE OR ELEVATE FIRE - BUILD WOOD FIRE DIRECTLY ON HEARTH. FEED DOOR MUST BE CLOSED DURING FIRING EXCEPT WHEN ADDING FUEL. KEEP ASH DOOR CLOSED TO AVOID EXCESS HEAT. DANGER: RISK OF ELECTRICAL SHOCK. DISCONNECT POWER BEFORE SERVICING UNIT. FOR USE WITH SOLID WOOD FUEL ONLY.



ATTENTION

L'APPAREIL EST CHAUD LORS DE L'OPÉRATION. NE PAS Y TOUCHER. RISQUE DE BRÛLURES CUTANÉES. TENIR LES ENFANTS, LES MATÉRIAUX COMBUSTIBLES, LES VÊTEMENTS ET LES MEUBLES ÉLOIGNÉS DE L'APPAREIL. VOIR LA PLAQUE SIGNALÉTIQUE ET LES DIRECTIVES. NE PAS SURCHAUFFER L'APPAREIL. SI L'APPAREIL OU LE TUYAU DE CHEMINÉE ROUGIT, VOUS SURCHAUFFEZ. INSPECTER ET NETTOYER LA CHEMINÉE ET LE TUYAU CONNECTEUR FRÉQUEMMENT. SOUS CERTAINES CONDITIONS, IL SE PEUT QUE LE CRÉOSOTE S'ACCUMULE RAPIDEMENT. NE SURÉLEVER PAS LE FEU À L'AIDE D'UN CHENET. DÉPOSER LES BÛCHES DE BOIS DIRECTEMENT SUR L'ÂTRE. LA PORTE DOIT ÊTRE FERMÉE PENDANT L'USAGE SAUF POUR ALIMENTER LE FEU. GARDER LA PORTE "BY-PASS" (CENDRES) FERMÉE POUR ÉVITER DE SURCHAUFFER. DANGER: RISQUES DE DÉCHARGE ÉLECTRIQUE. DÉCONNECTER LE FIL ÉLECTRIQUE DE LA PRISE DE CONTACT AVANT LE SERVICE. NE PAS FAIRE PASSER LE FIL ÉLECTRIQUE SOUS OU EN AVANT DE L'APPAREIL. POUR USAGE AVEC LE BOIS SEULEMENT.



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

Report Number: DIR101A05026181218

A2LA ACCREDITED **CERTIFICATE OF CALIBRATION WITH DATA**

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Rice Lake	IQ+355E-2A x 100l	A05026	#041	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.1	QC033	12/18/18	6/13/18	12/2019

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 250 Tol: 1 As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/> As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	Test Wt: HB44 Tol: HB44 As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/> As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	Test Wt: 100 Tol: 1 As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/> As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	<input type="checkbox"/> Good <input checked="" type="checkbox"/> Fair <input type="checkbox"/> Poor Temperature: 16.9°C

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	999.3	1000.2	0.12
700	699.7	700.1	0.12
500	499.7	500.1	0.08
300	299.8	300.1	0.08
100	99.9	100.0	0.05
50	50.0	50.0	0.05

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	11/24/17	11/2019	20172265

Permanent Information Concerning this Equipment:

12 month calibration cycle. 2000lb platform.

Comments/Information Concerning this Calibration

12/18 - RH = 67%. Adjusted span.

Report prepared/reviewed by: ServiceTech Date: 12/28/18

Technician: R. Kauble

Signature: [Signature]

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

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



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

Report Number: DIRI0182484A0912013i181218

A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Digiweigh	DWP12i 400x.01	82484A0912013i	#050	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.01	QC033	12/18/18	6/13/18	12/2019

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: Tol: 50 0.05	Test Wt: Tol: HB44 HB44	Test Wt: Tol: 50 0.01	
As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> Good Fair Poor
As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	Temperature: 16.4°C

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
400	399.99	399.99	0.058
300	300.00	300.00	0.058
200	200.03	200.03	0.058
100	100.01	100.01	0.012
50	50.00	50.00	0.012
20	20.00	20.00	0.012

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	11/24/17	11/2019	20172265

Permanent Information Concerning this Equipment:
12 month calibration cycle.

Comments/Information Concerning this Calibration
12/18 - RH = 64%. Adjusted span.

Report prepared/reviewed by: Service Tech DC Date: 12/28/18

Technician: R. Kauble
Signature: [Signature]

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

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

Dry Gas Meter Calibration

Meter Manufacturer: Apex
 Model: XC-60-ED
 Lab ID #: 53
 Serial #: 1902130
 Calibration Date: 12/17/2018
 Calibration Expiration: 6/17/2019
 Barometric Pressure: 29.87 in. Hg



Reference Standard DGM

Manufacturer: Apex
 Model: SK25DA
 Lab ID#: 47
 Serial #: 1101001
 Calibration Expiration Date: 3/5/2019
 Calibration γ Factor: 0.998

Unit Under Test Previous Calibration

Date: 12/13/2018
 γ Factor: 1.002
 Allowable Deviation ($\pm 5\%$): 0.0501
 Actual Deviation: 0.00
 Result: PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	166.180	147.027	169.354
Standard DGM Temperature ($^{\circ}\text{F}$)	71.7	72.5	73.0
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)	5.950	5.296	6.132
DGM Temperature ($^{\circ}\text{F}$)	83.0	91.0	93.0
DGM Pressure (in H_2O)	2.60	2.00	1.5
Time (min)	37.0	37.0	49.0
Net Volume for Standard DGM (ft^3)	5.869	5.192	5.981
Net Volume for DGM (ft^3)	5.950	5.296	6.132
Dry Gas Meter γ Factor	0.999	1.007	1.006
γ Factor Deviation From Average	0.999	1.007	1.006

Average Gas Meter γ Factor

1.004

Calculations:

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

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

[Signature] 12/17/2018

Dry Gas Meter Calibration

Meter Manufacturer: Apex
 Model: XC-60-ED
 Lab ID #: 54
 Serial #: 1902133
 Calibration Date: 12/17/2018
 Calibration Expiration: 6/17/2019
 Barometric Pressure: 29.87 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/5/2019
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	12/13/2018
γ Factor:	0.997
Allowable Deviation ($\pm 5\%$):	0.04985
Actual Deviation:	0.00
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	153.596	138.287	193.022
Standard DGM Temperature ($^{\circ}\text{F}$)	73.0	73.0	74.0
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)	5.594	5.047	7.058
DGM Temperature ($^{\circ}\text{F}$)	94.5	95.0	96.0
DGM Pressure (in H_2O)	2.60	2.00	1.5
Time (min)	35.0	36.0	57.0
Net Volume for Standard DGM (ft^3)	5.424	4.884	6.816
Net Volume for DGM (ft^3)	5.594	5.047	7.058

Dry Gas Meter γ Factor	1.000	1.001	1.000
γ Factor Deviation From Average	1.000	1.001	1.000

Average Gas Meter γ Factor

1.000

Calculations:

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

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

Dry Gas Meter Calibration

Meter Manufacturer: Apex
 Model: Apex-AK-600
 Lab ID #: 055
 Serial #: 810016
 Calibration Date: 6/15/2018
 Calibration Expiration: 6/15/2019
 Barometric Pressure: 29.83 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	047
Serial #:	1101001
Calibration Expiration Date:	3/5/2019
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	1/18/2017
γ Factor:	0.997
Allowable Deviation ($\pm 5\%$):	0.04985
Actual Deviation:	0.00
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	145.479	148.058	143.802
Standard DGM Temperature ($^{\circ}\text{F}$)	71.0	71.0	71.0
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)	5.146	5.254	5.114
DGM Temperature ($^{\circ}\text{F}$)	75.0	76.5	77.5
DGM Pressure (in H_2O)	1.80	1.80	1.8
Time (min)			
Net Volume for Standard DGM (ft^3)	5.138	5.229	5.078
Net Volume for DGM (ft^3)	5.146	5.254	5.114

Dry Gas Meter γ Factor	0.999	0.999	0.999
γ Factor Deviation From Average	0.999	0.999	0.999

Average Gas Meter γ Factor

0.999

Calculations:

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

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



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Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 03/21/17
Submitted By: John Steiner
Traceable Number: 20170468

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

Manufacturer: Troemner

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

100g to 1mg Working Standards Were Calibrated: 03/03/17 Due: 03/31/18 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. 8.0g/cm³).

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

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

page 1 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 03/21/17

Signature David S. Thompson

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Member: National Conference of Standards Laboratories and Weights & Measures



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Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 03/21/17
Submitted By: John Steiner
Traceable Number: 20170468

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

Manufacturer: Troemner

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.967	753.44	49.44

Conventional Mass Value

Nominal Value	As Found grams	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
200mg SN 1000101395	0.2000061	0.0061	0.0026	0.01
100mg SN 1000126267	0.1000046	0.0046	0.0028	0.01

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

Comments: These weights were new from the manufacturer and were within ASTM Class 1 tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

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 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 03/21/17

Signature David S. Thompson



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



Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 01/15/16
Purchase Order: 1001
Traceable Number: 20152489

Test Item: 20lb and 10lb Individual Grip Handle Weights
Serial No.: Listed in Table

Manufacturer: Unknown

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.448	760.64	44.58

Conventional Mass Value

Nominal Value	As Found pounds	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
20lb #098	19.9995450	-206.4	6.4	910
10lb #097	10.0006510	295.3	5.1	450
10lb #051	10.0003421	155.2	5.1	450

*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 NIST Handbook 105-1 Class F tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

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 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCCL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16


Signature David S. Thompson



Established 1974

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(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



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

Report Number: DIRI0134307497181218

A2LA ACCREDITED **CERTIFICATE OF CALIBRATION WITH DATA**

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	ENTRIS224-1S	34307497	#107	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
g	0.0001	QC012	12/18/18	6/13/18	12/2019

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		STANDARD DEVIATION			ENVIRONMENTAL CONDITIONS		
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:		<div><input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/></div> <div>Good Fair Poor</div> <div>Temperature: 21.3°C</div>		
100	0.0003	50 x 4	0.0002	100	0.0001				
As-Found:		As-Found:		1. 100.0001	5. 100.0002	9. 100.0001	<div>Result</div> <div>0.00004</div>		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	2. 100.0001	6. 100.0001	10. 100.0001			
As-Left:		As-Left:		3. 100.0001	7. 100.0001				
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	4. 100.0001	8. 100.0002				

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	200.0002	200.0001	0.00014
100	100.0001	100.0001	0.00014
50	50.0003	50.0001	0.00014
20	20.0001	20.0001	0.00014
1	1.0001	1.0000	0.00014
0.1	0.1000	0.1000	0.00014

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	10kg to 1mg	G782	1/3/18	1/2019	20172421

Permanent Information Concerning this Equipment:

12 month calibration cycle.

Comments/Info Concerning this Calibration:

12/18 - RH = 56%. Adjusted span.

Report prepared/reviewed by: ServiceTech X Date: 12/28/18

Technician: R. Kauble

Signature:

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

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

NIST Traceable Calibration Report



Reference Number: 1200788
PO Number: JSTEINERT013118

PFS-TECO
11785 SE Highway 212
Suite 305

Clackamas, OR 97015 United States

Manufacturer: Dwyer Instruments Inc.
Model Number: 471
Description: Air Velocity, Digital Thermo Anemometer
Asset Number: #095
Serial Number: #095
Procedure: DS Universal Speed/Time/Temperature

Calibration Date: 02/14/2018
Calibration Due Date: 02/14/2019
Condition As Found: Limited In Tol See Comments
Condition As Left: Limited See Comments

Remarks:

NIST-traceable calibration performed on the unit referenced above in accordance with customer requirements, published specifications and the lab's standard operating procedures. No adjustments were made to the unit.

This calibration is considered limited due to the requested test range.

Standards Utilized

Asset No.	Manufacturer	Model No.	Description	Cal. Date	Due Date
CP105979	Kanomax	X5602	Air Velocity, Wind Tunnel, Open Jet	01/06/2018	01/31/2019
CP144554	Fluke Corporation	1551A EX	Temperature, Stik Thermometer	01/08/2018	01/31/2019

Calibration Data

FUNCTION TESTED	Nominal Value	As Found	Out of Tol	As Left	Out of Tol	CALIBRATION TOLERANCE
Speed Accuracy Air Velocity	50 ft/min	43		Same		35 to 65 ft/min [EMU 1.3 ft/min][TUR 12:1]
Speed Accuracy Air Velocity	100 ft/min	90		Same		85 to 115 ft/min [EMU 1.5 ft/min][TUR 9.8:1]
Speed Accuracy Air Velocity	150 ft/min	140		Same		135 to 165 ft/min [EMU 1.8 ft/min][TUR 8.3:1]
Speed Accuracy Air Velocity	200 ft/min	192		Same		185 to 215 ft/min [EMU 2.1 ft/min][TUR 7.1:1]
Speed Accuracy Air Velocity	250 ft/min	240		Same		235 to 265 ft/min [EMU 2.4 ft/min][TUR 6.2:1]
Speed Accuracy Air Velocity	300 ft/min	288		Same		285 to 315 ft/min [EMU 2.7 ft/min][TUR 5.6:1]
Speed Accuracy Air Velocity	400 ft/min	395		Same		385 to 415 ft/min [EMU 3.3 ft/min][TUR 4.5:1]
Speed Accuracy Air Velocity	500 ft/min	485		Same		485 to 515 ft/min [EMU 3.9 ft/min][TUR 3.8:1]
Temperature Accuracy	72.0 °F	71.9		Same		70.0 to 74.0 °F [EMU 0.11 °F][TUR 18:1]

Temperature: 23° C
Humidity: 20% RH
Rpt. No.: 1375092

Calibration Performed By:				Quality Reviewer:	
Mathews, Rich	314	Metrologist	847-327-5314	Szplit, Tony	02/14/2018
Name	ID #	Title	Phone	Name	Date

This report may not be reproduced, except in full, without written permission of Innocal. The results stated in this report relate only to the items tested or calibrated. Measurements reported herein are traceable to SI units via national standards maintained by NIST and were performed in compliance with MIL-STD-45662A, ANSI/NCSL Z540-1-1994, 10CFR50, Appendix B, ISO 9002-94, and ISO 17025:2005. Guard Banding, if reported on this certificate, is applied at a Z-factor of 30% for test points with a test uncertainty ratio (TUR) below 4:1. In Tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The estimated measurement uncertainty (EMU), if reported on this certificate, is being reported at a confidence level of 95% or K=2 unless otherwise noted in the remarks section.



Model 1430 Microtector® Electronic Point Gage

Installation and Operating Instructions



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

SPECIFICATIONS AND FEATURES

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

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

Maximum pressure: 100 psig with optional pipe thread connections.

Tygon® is a registered trademark of Saint-Gobain Corporation

DWYER INSTRUMENTS, INC.

P.O. BOX 373

MICHIGAN CITY, INDIANA 46361, U.S.A

Phone: 219/879-8000

Fax: 219/872-9057

www.dwyer-inst.com

e-mail: info@dwyer-inst.com



DocNumber: 000113537

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Tel: (323) 585-2154 Fax: (714) 542-6689
PGVPID: F22017

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PXPKG TUALATIN OR H
10450 SW TUALATIN SHERWOOD
TUALATIN OR 97062

Praxair Order Number: 70337802
Customer P. O. Number:
Customer Reference Number:

Fill Date: 8/7/2017
Part Number: NI CD17CO8E-AS
Lot Number: 70086721903
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 1290 psig 99 cu ft.

Certified Concentration:

Expiration Date:	8/11/2025	NIST Traceable
Cylinder Number:	CC700832	Analytical Uncertainty:
4.33 %	CARBON MONOXIDE	± 0.5 %
16.93 %	CARBON DIOXIDE	± 0.3 %
16.99 %	OXYGEN	± 0.2 %
Balance	NITROGEN	

Certification Information:

Certification Date: 8/11/2017

Term: 96 Months

Expiration Date: 8/11/2025

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 O2 IR boardening effect. O2 responses have been corrected for CO2 interference.

Analytical Data:

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

1. Component: CARBON MONOXIDE

Requested Concentration: 4.25 %
Certified Concentration: 4.33 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 7/23/2017

First Analysis Data:
Date: 8/11/2017
Z: 0 R: 5 C: 4.33 Conc: 4.333
R: 4.99 Z: 0 C: 4.33 Conc: 4.333
Z: 0 C: 4.32 R: 5 Conc: 4.323
UOM: %
Mean Test Assay: 4.33 %

2. Component: CARBON DIOXIDE

Requested Concentration: 17 %
Certified Concentration: 16.93 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 7/20/2017

First Analysis Data:
Date: 8/11/2017
Z: 0 R: 20.08 C: 16.99 Conc: 16.936
R: 20.08 Z: 0 C: 16.99 Conc: 16.936
Z: 0 C: 16.98 R: 20.09 Conc: 16.926
UOM: %
Mean Test Assay: 16.933 %

Reference Standard Type: GMIS
Ref. Std. Cylinder #: CC242633
Ref. Std. Conc: 5.00%
Ref. Std. Traceable to SRM #: 2642a
SRM Sample #: 51-D-23
SRM Cylinder #: FF23106

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: 0 %

Reference Standard Type: GMIS
Ref. Std. Cylinder #: SA10234
Ref. Std. Conc: 20.02%
Ref. Std. Traceable to SRM #: RGM#CC28
SRM Sample #: N/A
SRM Cylinder #: RGM#CC28033

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: 0 %

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.



CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

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

Certificate Modification Date: 09/05/2018

Praxair Order Number: 70716136

Part Number: NI CD10CO33E-AS

Fill Date: 08/31/2018

Lot Number: 70086824308

Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

Expiration Date:	09/05/2026	NIST Traceable
Cylinder Number:	CC170624	Expanded Uncertainty
10.00 %	Carbon dioxide	± 0.3 %
2.51 %	Carbon monoxide	± 0.7 %
10.50 %	Oxygen	± 0.6 %
Balance	Nitrogen	

ProSpec EZ Cert



Certification Information:

Certification Date: 09/05/2018

Term: 96 Months

Expiration Date: 09/05/2026

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.

CO responses have been corrected for CO2 interference. 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: 10.00 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 08/20/2018

First Analysis Data:				Date
Z: 0	R: 14.02	C: 10	Conc: 10	09/05/2018
R: 14.02	Z: 0	C: 10	Conc: 10	
Z: 0	C: 10	R: 14.02	Conc: 10	
UOM: %				
Mean Test Assay:				10 %

Reference Standard: Type / Cylinder #: GMIS / CC141375

Concentration / Uncertainty: 14.02 % ± 0.3%

Expiration Date: 06/11/2026

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: 2.51 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 08/20/2018

First Analysis Data:				Date
Z: 0	R: 2.48	C: 2.51	Conc: 2.51	09/05/2018
R: 2.48	Z: 0	C: 2.51	Conc: 2.51	
Z: 0	C: 2.51	R: 2.48	Conc: 2.51	
UOM: %				
Mean Test Assay:				2.51 %

Reference Standard: Type / Cylinder #: GMIS / CC102045

Concentration / Uncertainty: 2.48 % ± 0.448%

Expiration Date: 04/03/2025

Traceable to: SRM # / Sample # / Cylinder #: SRM 2641a / 52-D-30 / CAL017193

SRM Concentration / Uncertainty: 4.009% / ± 0.017%

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: 10.50 %
Instrument Used: OXYMAT 5E
Analytical Method: Paramagnetic
Last Multipoint Calibration: 09/04/2018

First Analysis Data:				Date
Z: 0	R: 9.88	C: 10.49	Conc: 10.49	09/05/2018
R: 9.88	Z: 0	C: 10.5	Conc: 10.5	
Z: 0	C: 10.5	R: 9.88	Conc: 10.5	
UOM: %				
Mean Test Assay:				10.5 %

Reference Standard: Type / Cylinder #: NTRM / DT0010402

Concentration / Uncertainty: 9.88 % ± 0.4%

Expiration Date: 11/18/2022

Traceable to: SRM # / Sample # / Cylinder #: NTRM #170701 / NIA / NTRM #DT0010402

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

Danielle Burns

Certified By

José Vasquez

Report and Certificate of Calibration

CAL-CERT
CALIBRATION CERTIFICATION



6709 SE Lake Road
Milwaukie, OR 97222
1-800-356-4662
CL-108

www.Cal-Cert.com

"Measure The Difference"

14 Inverness Drive East, Ste B-128
Englewood, CO 80112
1-800-983-7832
CL-157



ACCREDITED
Calibration
Laboratory

Report #: 2260-28789-46
Customer Name: PFS TECO
Customer Address: 11785 Southeast Highway 212
City: Clackamas
Contact: John Steinert
Service Address: 6709 Southeast Lake Road
Customer PO#:
State: OR
Zip: 97015
Milwaukie, OR 97222

Calibration Standards

10-RH/00192 Comark Thermohygrometer S/N 6217150049 Cal Date 11/17/17 Due Date 11/30/18 Vendor Cal-Cert REPORT # 1573-C-01
10-SR1/00515 SPI Steel Rule S/N 00515 Cal Date 3/21/17 Due Date 3/21/18 Vendor Cal-Cert REPORT# 59499-C-07

Instrument Data

Calibration Date:	January 25, 2018	Reference:	Manufacturer's Spec
Calibration Due Date:	January 25, 2019	Cal-Cert Procedure:	CP-115
Calibration Frequency:	12 Months	Indicating System:	Scaling
Manufacturer:	Dewalt	Temperature:	71 °F
Type:	Tape Measure	Humidity:	29% RH
Model Number:	DWHT33372	Asset #:	#090
Serial #:	#1 TAPE	Service Location:	Cal-Cert Lab
Capacity:	192 Inches	As Found:	Pass
		As Left:	Pass

Instrument Range:	192.000 Inches	Range Resolution:	0.0625 Inches
--------------------------	----------------	--------------------------	---------------

Calibration Standard	As Found Reading	Verification Reading #1	Verification Reading #2
0.000	0.000	0.000	0.000
0.063	0.063	0.063	0.063
1.000	1.000	1.000	1.000
12.000	12.000	12.000	12.000
48.000	48.000	48.000	48.000
96.000	96.000	96.000	96.000
192.000	192.000	192.000	192.000

Expanded Uncertainty ± 0.07217 Inches

Remarks:

We sincerely thank you for your business. Please call us at 1-800-356-4662 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by the International Accreditation Service, Inc. (IAS) under Calibration Laboratory Code CL-108 & CL-157.
IAS 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 Z540.3, and meets the requirements of all applicable references and Cal-Cert procedures listed above. Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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Service Engineer: TYSON MORAN
Technical Manager: MARSHALL DOYLE

Date: January 25, 2018
Signature: *M. Doyle*

Report and Certificate of Calibration



6709 SE Lake Road
Milwaukie, OR 97222
1-800-356-4662
CL-108

www.Cal-Cert.com

14 Inverness Drive East, Ste B-128
Englewood, CO 80112
1-800-983-7832
CL-157



"Measure The Difference"

Report #: 2260-28781-66 Customer PO#:
Customer Name: PFS TECO
Customer Address: 11785 SE Highway 212
City: Clackamas State: OR Zip: 97015
Contact: John Steinert
Service Address: 6709 SE Lake Road, Milwaukie, OR 97222

Calibration Standards

10-RH/00192 Comark Thermohygrometer S/N 6217150049 Cal Date: 11/17/17 Due Date: 11/30/18 Vendor: CC REPORT # 1573-C-01
L-GB-0/00397 Mitutoyo 83 Piece Gage Block Set S/N 0509020 Cal Date: 9/8/16 Due Date: 9/30/18 Vendor: American Gage REPORT# 83181-2-354224

Instrument Data

Calibration Date:	January 23, 2018	Reference:	NAVAIR 17-20MD-07
Calibration Due Date:	January 23, 2019	Cal-Cert Procedure:	CP-008
Calibration Frequency:	12 Months	Indicating System:	Digital
Manufacturer:	General	Temperature:	72 °F
Type:	Digital Caliper	Humidity:	31% RH
Model Number:	147	Asset #:	#092
Serial #:	#092	Service Location:	Cal-Cert Lab
Capacity:	6 Inches	As Found:	PASS
Resolution:	0.0005 Inches	As Left:	PASS

Instrument Range:	6 Inches	Range Resolution:	0.0005 Inches
-------------------	----------	-------------------	---------------

Outside Jaws / Linearity				
Calibration Standard Inches	As Found Inches	As Left Reading 1 Inches	As Left Reading 2 Inches	Tolerance ± Inches
0.0000	0.0000	0.0000	0.0000	0.0000
0.0500	0.0500	0.0500	0.0500	0.0010
0.3000	0.3000	0.3000	0.3005	0.0010
0.6000	0.6000	0.6000	0.6000	0.0010
1.2000	1.2005	1.2005	1.2000	0.0010
2.4000	2.4000	2.4000	2.4005	0.0010
3.5000	3.5000	3.5000	3.5000	0.0010
5.0000	5.0000	5.0000	5.0000	0.0010
6.0000	6.0000	6.0000	6.0000	0.0010

Expanded Uncertainty ± 0.00129 Inches

Verifications (for information only)			
	Target	Measured	Tolerance ±
Resolution Check	0.10050	0.10050	N/A
Depth	1.000	1.00000	N/A
Step	1.000	1.00000	N/A
Inside Jaws	1.000	1.00000	N/A

Inspections	
Jaws Parallel	Acceptable

Remarks:

We sincerely thank you for your business. Please call us at 1-800-356-4662 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by the International Accreditation Service, Inc. (IAS) under Calibration Laboratory Code CL-108 & CL-157.
IAS 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 Z540.3, and meets the requirements of all applicable references and Cal-Cert procedures listed above.

Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.

All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

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Service Engineer: NICOLAS ILLA Date: January 23, 2018
Technical Manager: MARSHALL DOYLE Signature: *M Doyle*

Caliper CF-008-01

Revision 13 6/29/2017

J-2000

owner's manual



DELMHORST[®]
INSTRUMENT CO.
WHEN ACCURACY IS THE POINT.[™]



Calibration complies with ISO/IEC
17025, ANSI/NCSL Z540-1, and 9001



Cert. No.: 4198-9765787

Traceable® Certificate of Calibration for Hand Held Barometer

Customer : PFS TECO Suite 305 , 11785 SE Highway 212 , Clackamas , OR-97015 , U.S.A.

Instrument Identification:

Model: 4198,

S/N: 80531676

Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	09 Oct 2018	1000415948
Digital Thermometer	111879345	09 Apr 2019	4000-9377595

Certificate Information:

Technician: 57

Procedure: CAL-32

Cal Date: 29 Aug 2018

Cal Due Date: 29 Aug 2019

Test Conditions: 62.73%RH 23.92°C 1018mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	24.10	24.1	Y	23.51	23.9	Y	22.01	25.01	0.05	>4:1
mb/hPa	551.55	552	Y	551.62	546	Y	544	560	0.62	>4:1
mb/hPa	751.22	744	Y	748.87	746	Y	741	757	0.62	>4:1
mb/hPa	1015.90	1011	Y	1018.22	1017	Y	1010	1026	0.62	>4:1

This certificate indicates Traceability to standards provided by (NIST) National Institute of Standards and Technology and/or a National Standards Laboratory.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement : (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min=As Left Nominal(Rounded) - Tolerance; Max= As Left Nominal(Rounded) + Tolerance;

Nicol Rodriguez

Nicol Rodriguez, Quality Manager

Aaron Judice

Aaron Judice, Technical Manager

Note :

Maintaining Accuracy:

In our opinion once calibrated your Hand Held Barometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Hand Held Barometer change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 12554 Galveston RD Suite B230 Webster TX USA 77598
Phone 281 482-1714 Fax 281 482-9448 sales@control3.com www.control3.com

Control Company is an ISO/IEC 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by DNV GL, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).