Valley Comfort Systems, Inc.

AKA: Blaze King Industries, Inc.

Project # 19-509
Model: KE40
Type: Residential Catalytic Wood Fired Heater
August 21, 2019
Revised Date June 25, 2021

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

Contact: Mr. Ashnil Reddy
1290 Commercial Way
Penticton, BC, V2A 3H5, Canada
areddy@blazeking.com
250-493-7444

Prepared by: Sebastian Button,
Laboratory Supervisor

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

Revision Summary

Date: August 21, 2019 – Original Issue

Date: April 19, 2021 – The following revisions were made per request from EPA:

-A drawing of the firebox and volume calculations were added to the main test report, see page 15.
-The “Notes” section was edited to clarify several points regarding pre-test conditioning, ambient filters, and the low burn rate air setting, see page 5.
-In relation to the above points, conditioning data in appendix A was reformatted to provide more clarity and a lengthier discussion of the low burn rate setting was also added to the appendix.
-The owner’s manual was updated to better reflect air settings used during testing to provide more clarity, see page 31 of owner’s manual.

Date: June 25, 2021 – The following revisions were made to the report:

-Additional data was added the low burn rate setting documentation in Appendix A to further explain the setting used for testing, see pages 140-144 of Non-CBI Test report.

Contents

Affidavit

PFS-TECO was contracted by Valley Comfort Systems, Inc. (Valley Comfort), also known as Blaze King Industries, Inc. (Blaze King) to provide testing services for the King KE40 Catalytic Wood-Fired Room Heater per EPA Method 28R, *Certification and Auditing of Wood Heaters*. All testing and associated procedures were conducted at Blaze King's Walla Walla, WA Laboratory beginning on 7/29/2019 and ending on 8/2/2019. Blaze King's Walla Walla Laboratory is located at 146 A Street, Walla Wala, Washington 99362. 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", and ISO 17025:2005 "Requirements for Testing Laboratories." PFS-TECO is also accredited by Standards Council of Canada to ISO 17065:2012 "Requirements for Bodies Operating Product Certification Systems."

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

Sebastian Button, Laboratory Supervisor

Introduction

Valley Comfort of Penticton, BC, contracted with PFS-TECO to perform EPA certification testing on the KE40 Catalytic Wood-Fired Room Heater. All testing was performed at Blaze King's Walla Walla Laboratory. Testing was performed by Mr. Sebastian Button and Mr. Aaron Kravitz.

Notes

- Prior to start of testing, 50 hours of conditioning was performed by Blaze King lab staff at a medium air 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.
- 5 certification 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, 1 at the medium low burn rate category, 1 at the low burn rate category, and 1 fan confirmation test. All 5 test runs met validity requirements, and all but the 1 fan confirmation test are included in the weighted average. See Run Narrative section for further detail on each run.
- In addition to the 5 tests described above, an additional 2 test runs were performed to demonstrate catalyst equivalency in accordance with EPA guidelines. These 2 tests were performed with a different catalyst, which was also aged for 50 hours prior to testing, in the same test model as the certification tests. The 2 tests, 1 at the high burn rate category, the other at the low burn rate category, had emissions results within 0.5 g/hr as their certification test counterparts and therefore the catalyst is deemed to be a suitable replacement. See Run Narrative and Appliance Description Sections for further details.
- Except for test run 4, due to ideal laboratory conditions during testing (i.e., no other fires present in shop, no ambient air quality issues) a room ambient sample was not collected. Since the only possible effect of a room ambient sample is a lower emissions value, there is no impact when determining compliance with EPA emissions limits. Additionally, it should be noted that for test run 4, where there was a concern for ambient air quality, the measured amount was not significant enough to lower the reported emissions value by a meaningful amount.
- See appendix A for further discussion about the air setting used for the category 1 low burn rate test.

Wood Heater Identification and Testing

- Appliance Tested: ***King KE40***
- Serial Number: ***Un-serialized Prototype – PFS Tracking Number 0032***
- Manufacturer*:* ***Valley Comfort Systems, Inc***
- Catalyst: ***Yes***
- Heat exchange blower: ***Optional***
- Type: ***Wood Stove***
- Style: ***Free Standing***
- Date Received: ***Monday, July 29, 2019***
- Wood Heater Aging: ***February 27, 2019 – March 5, 2019***
- Testing Period – Start: ***Monday, July 29, 2019*** Finish: ***Friday, August 02, 2019***
- Test Location: ***Blaze King's Walla Walla Laboratory, 146 A Street, Walla Walla, WA 99362***
- Elevation: ***≈1,168 Feet above sea level***
- Test Technician(s): ***Sebastian Button and Aaron Kravitz***
- Observers: ***Charlie Bishop and Aaron Saxton of Blaze King.***

Test Procedures and Equipment

All Sampling and analytical procedures were performed by Sebastian Button and Aaron Kravtiz. 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
BK-2	Weigh-Tronix 3'x3' floor scale w/digital weight indicator
BK-04	Adams Bench Scale
129	Apex Sample Box
130	Apex Sample Box
057	Infrared Industries IR-208 CO_2/CO Analyzer
109A/B	Troemner 100mg/200mg Audit Weights
107	Sartorius Analytical Balance
051	10 lb audit weight
090	Dewalt Tape Measure
095	Anemometer
111	Microtector
CC700026	Gas Analyzer Calibration Span Gas
CC167526	Gas Analyzer Calibration Mid Gas

Results

A total of 5 certification test runs where performed on the KE40. Run 5, a fan confirmation test was not used in any weighted average results calculations. The weighted average emissions rate for the 4 run test series was measured to be **1.1 g/hr** with a Higher Heating Value efficiency of **80.8%.** The average CO emission rate for the 4 tests was **0.6 g/min.** The Blaze King KE40 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.

Certification Test Summary Table

	Cat. 1 <0.8 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)*
Date	7/29/2019	7/30/2019	7/31/2019	7/29/19	7/31/2019
Run Number	2	3	4	1	5
Emission Rate (g/hr).	0.42	0.65	1.41	2.51	0.67
Burn Rate (kg/hr)	0.75	0.92	1.55	2.48	1.05
Heat Output (Btu/hr)	11,690	14,350	23,101	34,985	16,134
Overall Efficiency (% HHV)	83.6	82.9	79.5	75.3	82.0
CO Emissions (g/MJ Output)	1.01	1.51	0.81	2.34	0.37
CO Emissions (g/kg Dry Fuel)	16.78	24.86	12.78	34.9	5.95
CO Emissions (g/min)	0.21	0.38	0.33	1.44	0.10
ASTM E2515 Emissions – First Hour (g/hr)	0.95	2.41	3.18	2.88	1.93
Weighted particulate emission average of 4 test runs: 1.1 grams per hour.					
Weighted average HHV efficiency of 4 test runs: 80.8%.					

*Fan Confirmation tests not included in weighted average calculations

In addition to the certification tests described above, 2 additional tests were performed with a different catalyst to demonstrate equivalency in accordance with EPA guidelines. Upon completion of the certification tests described above, the Applied Ceramics combustor (Manufacturer Part No. 115-1510-C2) used for testing was removed and individually sealed in accordance with testing procedures. An alternately formulated Applied Ceramics combustor (Manufacturer Part No. 115-1510-V3) was then installed in the same test stove. Results of the 2 equivalency tests are summarized below, detailed individual run data can be found in Appendix A submitted with this report.

Equivalency Test Summary Table

	Cat. 1 <0.8 kg/hr.*	**Cat. 2 Max Burn Rate***
Date	8/1/2019	8/1/2019
Run Number	7	6
Emission Rate (g/hr).	0.26	2.77
Burn Rate (kg/hr)	0.68	2.54
Heat Output (Btu/hr)	10,645	35,856
Overall Efficiency (% HHV)	84.0	75.4
CO Emissions (g/MJ Output)	0.11	3.05
CO Emissions (g/kg Dry Fuel)	1.75	45.57
CO Emissions (g/min)	0.02	1.92
ASTM E2515 Emissions – First Hour (g/hr)	0.90	4.15

*Equivalency tests not included in weighed average calculations.

Weighted Average Calculation Summary

28R Weighted Average.xlsm

EPA Method 28R Weighted Average Emissions

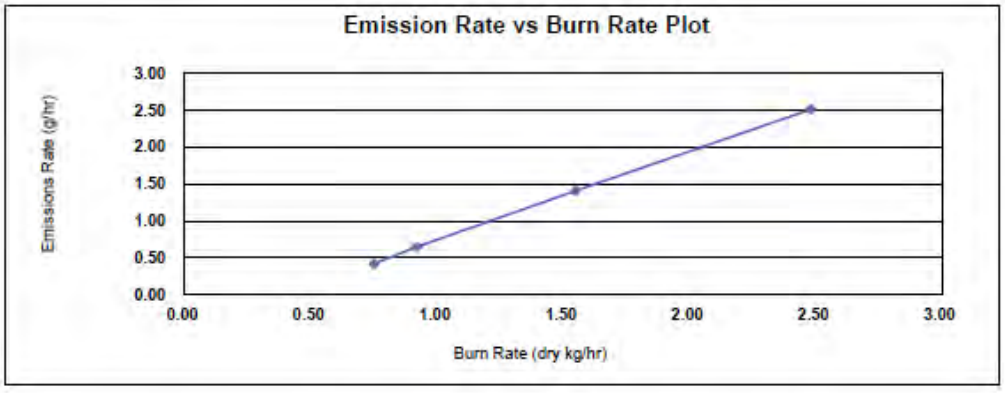
Client: Valley Comfort [Blaze King]
Stove Model: KE40
Test Dates: 7/29/19 - 7/31/19
Job Number: 19-509

Signature/Date: 8/7/2019

Weighted Average Particulate Emissions (g/hr):	**1.1**
Weighted Average HHV Efficiency (%):	**80.8%**
Weighted Average LHV Efficiency (%):	**87.3%**
Average CO Emissions (g/min):	**0.6**

Individual Run Summaries

Run Number:	2	Run Number:	3
Burn Rate (dry kg/hr):	0.75	Burn Rate (dry kg/hr):	0.92
Emissions Rate (g/hr):	0.42	Emissions Rate (g/hr):	0.65
HHV Efficiency (%):	83.6%	HHV Efficiency (%):	82.9%
LHV Efficiency (%):	90.3%	LHV Efficiency (%):	89.6%
Weighting Percentage (%):	17.51%	Weighting Percentage (%):	33.43%
Run Number:	4	Run Number:	1
Burn Rate (dry kg/hr):	1.55	Burn Rate (dry kg/hr):	2.48
Emissions Rate (g/hr):	1.41	Emissions Rate (g/hr):	2.51
HHV Efficiency (%):	79.5%	HHV Efficiency (%):	75.3%
LHV Efficiency (%):	85.9%	LHV Efficiency (%):	81.4%
Weighting Percentage (%):	36.62%	Weighting Percentage (%):	12.44%



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Test Run Narrative

Run 1

Run 1 was performed on 7/29/2019 as a category 4 test, per EPA Method 28R. The total test time was 250 minutes. The particulate emissions rate for the test was 2.51 g/hr, the burn rate was 2.48 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.

Run 2

Run 2 was performed on 7/29/2019 as a category 1 test, per EPA Method 28R. The total test time was 850 minutes. The particulate emissions rate for the test was 0.42 g/hr, the burn rate was 0.75 kg/hr with an HHV efficiency of 83.6%. 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 3

Run 3 was performed on 7/30/2019 as a category 2 test, per EPA Method 28R. The total test time was 693 minutes. The particulate emissions rate for the test was 0.65 g/hr, the burn rate was 0.92 kg/hr with an HHV efficiency of 82.9%. 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 4

Run 4 was performed on 7/31/2019 as a category 3 test, per EPA Method 28R. The total test time was 398 minutes. The particulate emissions rate for the test was 1.41 g/hr, the burn rate was 1.55 kg/hr with an HHV efficiency of 79.5%. 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 5

Run 5 was performed on 7/31/2019 as a targeted category 2 fan confirmation test, per EPA Method 28R. The total test time was 589 minutes. The particulate emissions rate for the test was 0.67 g/hr with a burn rate of 1.05 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 the other category 2 test (Run 3, 0.65 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.

Run 6

Run 6 was performed on 8/1/2019 as a category 4 catalyst equivalency test, per EPA Method 28R and EPA catalyst equivalency determination guidelines. The total test time was 249 minutes. The particulate emissions rate for the test was 2.77 g/hr, the burn rate was 2.54 kg/hr with an HHV efficiency of 75.4%. 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. A catalyst is deemed equivalent if both the low and high burn tests are within 0.5 g/hr of the certification test result. This test run, in comparison to run 1 (2.51 g/hr) meets the high burn rate test requirement. This test run is not included in the weighted average calculations presented in the results summary.

Run 7

Run 7 was performed on 8/1/2019 as a category 1 catalyst equivalency test, per EPA Method 28R and EPA catalyst equivalency determination guidelines. The total test time was 920 minutes. The particulate emissions rate for the test was 0.26 g/hr with a burn rate of 0.68 kg/hr with an HHV efficiency of 84.0%. All test results were appropriate and valid. There were no anomalies and all test criteria were met. A catalyst is deemed equivalent if both the low and high burn tests are within 0.5 g/hr of the certification test result. This test run, in comparison to run 2 (0.42 g/hr) meets the low burn rate test requirement. This test run is not included in the weighted average calculations presented in the results summary.

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	77	79	16.4	10.5	28.64	25.42	28.02	23.4	250
2	76	72	12.1	20.9	28.65	26.32	27.92	20.1	850
3	78	68	14.4	16.7	28.68	25.76	28.24	20.2	693
4	73	81	12.4	10.3	28.71	25.16	27.88	23.3	398
5	78	73	9.2	15.4	28.69	25.8	27.44	21.2	589
6	76	78	14.5	12.7	28.76	24.78	28.46	22.9	249
7	78	72	12.0	14.9	28.74	25.88	27.56	21.0	920

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) Knob Fully Open	Adjustable PAC same as pre-burn setting, fan on turned on to high setting from beginning of test.
Run 2	Adjustable Primary Air Control (PAC) Knob Rotated up 88° from Fully Open	Adjustable PAC same as pre-burn setting, fan on turned on to low setting from beginning of test.
Run 3	Adjustable Primary Air Control (PAC) Knob Rotated up 80° from Fully Open	Adjustable PAC same as pre-burn setting, fan on turned on to medium low setting from beginning of test.
Run 4	Adjustable Primary Air Control (PAC) Knob Rotated up 50° from Fully Open	Adjustable PAC same as pre-burn setting, fan on turned on to medium high setting from beginning of test.
Run 5	Adjustable Primary Air Control (PAC) Knob Rotated up 72° from Fully Open	Adjustable PAC same as pre-burn setting, fan confirmation test, fan off for duration of test.
Run 6	Adjustable Primary Air Control (PAC) Knob Fully Open	Adjustable PAC same as pre-burn setting, fan on turned on to high setting from beginning of test.
Run 2	Adjustable Primary Air Control (PAC) Knob Rotated up 88° from Fully Open	Adjustable PAC same as pre-burn setting, fan on turned on to low setting from beginning of test.

Appliance Description

Model(s): King KE40

Additional Models Discussion: None

Appliance Type: Catalytic Wood-Fired Room Heater

Firebox Volume: 4.35 ft^3

Air Introduction System: Primary Air enters the firebox from the rear bottom of the appliance and is channeled up the back and to the front of the appliance via tubes located in the firebox. Air then flows into the firebox down through the air wash. No secondary or pilot air ports are utilized in the design. Primary air is controlled via a control knob located on the side of the appliance, towards the back of the unit, which turns clockwise from fully closed to fully open. Dimensions on all these features can be found in Appendix D.

Baffles: A 5.5" wide, 0.135" thick Stainless-Steel smoke baffle hangs behind the combustor.

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

Flue Outlet: 8-inch exhaust outlet located on the top of the appliance.

Catalytic Combustor: Certification testing was performed with an Applied Ceramics ceramic combustor (Manufacturer Part No. 115-1510-C2), as part of this test series, an alternately formulated Applied Ceramics ceramic combustor (Manufacturer Part No. 115-1510-V3) was determined to be a suitable replacement. Both combustor models measure 10.650"x4.950"x 2".

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

Gasketing: 7/8" fiberglass rope gasket seals the door against the firebox, 1/8" x 3/4" gasket is used to seal the 5mm ceramic glass against the door frame. 1/16" x 2" paper gasket is used between the combustor can the its housing in the top of the firebox.

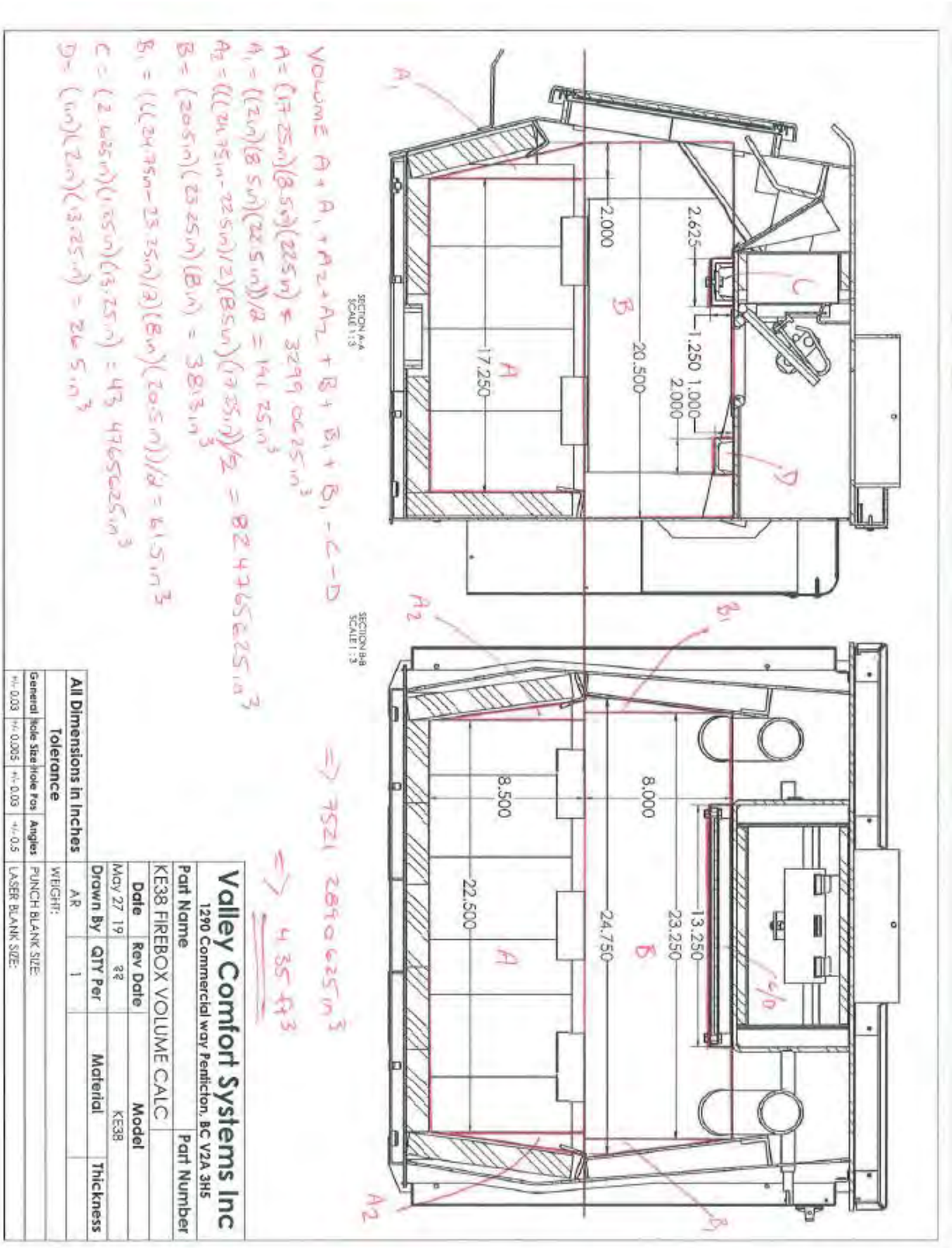
Appliance Dimensions

KE40 Unit Dimensions (with pedestal base)

Height	Width	Depth	Firebox Volume
38.375"	31"	29.875"	4.35ft^3

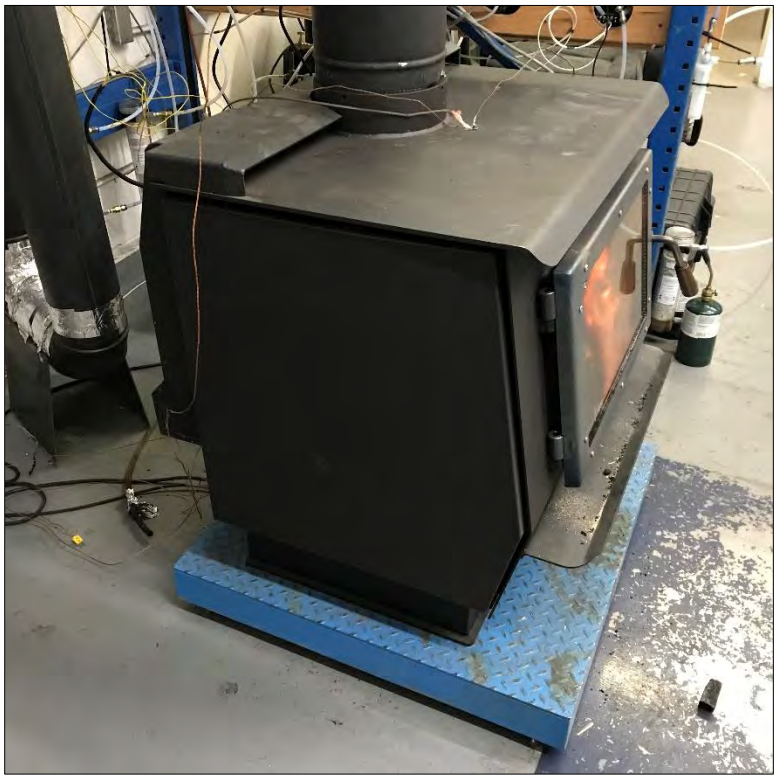
Appliance design drawings can be found in Appendix D submitted with the CBI copy of this report.

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:

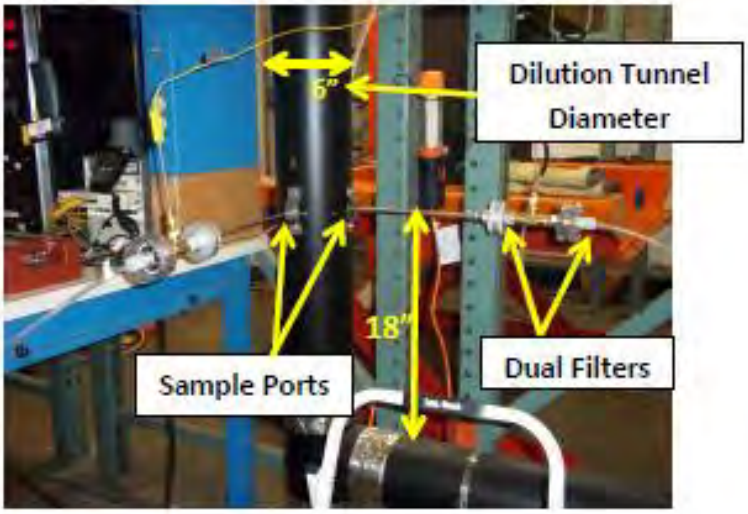
Typical Test Fuel Load Configuration

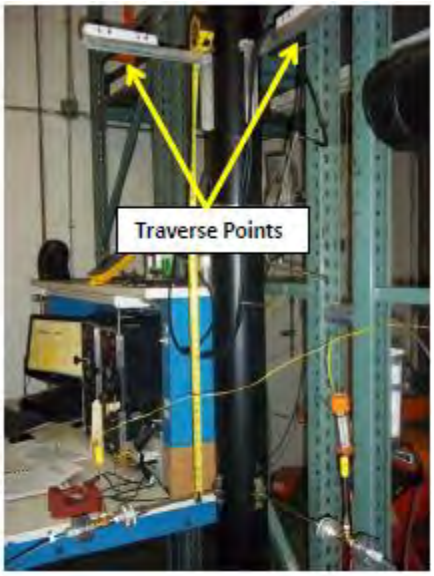
Typical Test Fuel Loaded in Test Stove

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: 146 A Street, Walla Wala, Washington 99362, 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 Applied Ceramics, 115-1510-C2, Catalyst (Certification Catalyst)

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)

KE40 Conditioning data with Applied Ceramics V3 Ceramic Combustor

Date	Time	[1]Ambient	[2]Combustor	[3]Flue	
2/27/2019	6:49:06 AM	63.22	72.64	102.05	**Added 14 lbs of fuel**
2/27/2019	7:49:10 AM	65.69	1088.2	527.89	
2/27/2019	8:15:12 AM	64.06	733.75	476	**Added 24 lbs of fuel**
2/27/2019	9:15:17 AM	62.16	1192.53	556.35	
2/27/2019	10:15:22 AM	65.41	693.46	203.64	
2/27/2019	10:44:24 AM	67.26	559.88	216.75	**Added 19 lbs of fuel**
2/27/2019	11:44:28 AM	68.27	904.31	292.78	
2/27/2019	12:44:33 PM	67.65	975.8	300.29	
2/27/2019	1:44:38 PM	69.16	850.01	241.35	
2/27/2019	2:44:42 PM	68.99	1034.97	270.65	
2/27/2019	3:44:47 PM	68.99	739.86	192.88	
2/27/2019	4:44:52 PM	68.38	941.62	237.54	
2/27/2019	5:44:57 PM	67.87	628.3	167.55	
2/27/2019	6:44:01 PM	67.03	882.01	246	
2/27/2019	7:44:06 PM	66.19	591.99	161.28	
2/27/2019	8:44:10 PM	65.13	859.59	256.87	
2/27/2019	9:44:14 PM	65.02	775.04	193.94	
2/27/2019	10:44:19 PM	65.02	555.68	169.18	
2/27/2019	11:44:24 PM	65.02	847.6	247.73	
2/28/2019	12:44:29 AM	64.96	621.07	180.1	
2/28/2019	1:44:33 AM	64.96	778.85	238.32	
2/28/2019	8:11:35 AM	61.65	89	121.72	**Added 15 lbs of fuel**
2/28/2019	9:11:40 AM	66.31	975.07	444.74	
2/28/2019	10:02:44 AM	69.44	819.92	515.17	**Added 12 lbs of fuel**
2/28/2019	11:02:48 AM	68.77	1233.21	573.16	
2/28/2019	12:02:52 PM	70.06	724.45	208.18	
2/28/2019	12:28:54 PM	70.62	595.58	228.46	**Added 23 lbs of fuel**
2/28/2019	1:28:58 PM	70.51	965.16	351.67	
2/28/2019	2:28:02 PM	70.06	956.42	349.15	
2/28/2019	3:28:06 PM	69.55	975.07	277.43	
2/28/2019	4:28:10 PM	69.22	1124.9	322.09	
2/28/2019	5:28:14 PM	68.49	838.64	235.8	
2/28/2019	6:28:18 PM	67.59	1066.63	338.5	
2/28/2019	7:28:22 PM	66.64	834.32	216.47	
2/28/2019	8:28:26 PM	65.63	1038.56	315.2	
2/28/2019	9:28:31 PM	65.02	676.76	182.12	
2/28/2019	10:28:35 PM	64.74	637.82	221.23	
2/28/2019	11:28:39 PM	63.95	807.09	260.56	
3/1/2019	12:28:43 AM	63.78	737.61	245.55	
3/1/2019	1:28:47 AM	63.45	663.82	237.98	
3/1/2019	7:42:21 AM	65.58	981.29	424.57	**Added 11 lbs of fuel**
3/1/2019	8:42:25 AM	65.13	1067.08	494.89	
3/1/2019	8:56:26 AM	66.7	739.13	469.17	**Added 24 lbs of fuel**
3/1/2019	9:56:30 AM	65.41	1137.96	568.18	
3/1/2019	10:56:34 AM	68.66	812.58	347.08	

3/1/2019	11:08:35 AM	70.45	736.44	378.23	**Added 23 lbs of fuel**
3/1/2019	12:08:39 PM	69.16	1078.34	480.49	
3/1/2019	1:08:43 PM	69.39	1148.43	470.4	
3/1/2019	2:08:46 PM	68.21	1090.67	413.03	
3/1/2019	3:08:50 PM	68.83	1102.54	420.65	
3/1/2019	4:08:54 PM	68.38	868.17	356.99	
3/1/2019	5:08:58 PM	67.37	796.17	345.68	
3/4/2019	8:29:08 AM	59.97	386.19	176.63	**Added 13.5 lbs of fuel**
3/4/2019	9:29:12 AM	68.15	1130.84	543.58	
3/4/2019	9:54:14 AM	69.16	750.78	485.53	**Added 23 lbs of fuel**
3/4/2019	10:54:17 AM	69.44	1177.51	574.9	
3/4/2019	11:54:21 AM	68.15	720.8	242.07	
3/4/2019	12:08:22 PM	67.87	836.17	365.85	**Added 20 lbs of fuel**
3/4/2019	1:08:27 PM	67.87	1095.93	439.86	
3/4/2019	2:08:31 PM	65.74	1118.96	425.02	
3/4/2019	3:08:35 PM	65.74	1147.59	408.94	
3/4/2019	4:08:39 PM	65.35	968.41	359.68	
3/4/2019	5:08:43 PM	64.34	870.52	324.16	
3/4/2019	6:08:46 PM	64.12	809.73	312.11	
3/4/2019	7:08:50 PM	63.45	773.92	300.63	
3/5/2019	7:00:25 AM	58.74	841.16	403.72	**Added 11 lbs of fuel**
3/5/2019	8:00:30 AM	62.83	969.13	500.99	
3/5/2019	8:05:30 AM	62.21	783	521	**Added 25 lbs of fuel**
3/5/2019	9:05:34 AM	66.59	1029.42	402.77	
3/5/2019	10:05:39 AM	66.19	773.92	240.45	
3/5/2019	10:16:39 AM	65.24	777	360.3	**Added 20 lb of fuel**
3/5/2019	11:16:43 AM	66.31	1060.91	428.1	
3/5/2019	12:16:47 PM	67.03	1071.67	399.75	
3/5/2019	1:16:51 PM	67.2	949.24	263.53	
3/5/2019	2:16:55 PM	64.4	994.4	356.32	
3/5/2019	3:16:59 PM	64.68	851.69	289.2	
3/5/2019	4:16:03 PM	64.4	754.31	304.05	
3/5/2019	5:16:06 PM	64.01	821.44	308.53	
3/5/2019	6:16:10 PM	63.28	768.32	297.55	

KE40 Conditioning data with Applied Ceramics C2 Ceramic Combustor

Date	Time	[1]Ambient	[2]Combustor	[3]Flue	
7/17/2019	6:25:59 AM	69.22	118.97	125.98	**Loaded 14.7 lbs of fuel**
7/17/2019	7:25:01 AM	73.31	1073.52	495.56	
7/17/2019	8:03:03 AM	72.64	692.17	434.88	**Added 14 lbs of fuel**
7/17/2019	9:03:07 AM	72.69	1075.09	496.57	
7/17/2019	10:03:10 AM	74.15	712.06	200.11	
7/17/2019	10:27:12 AM	73.59	574.28	210.08	
7/17/2019	10:44:13 AM	73.81	476.17	181.06	**Added 22 lb of fuel**
7/17/2019	11:44:15 AM	72.75	729.21	251.15	
7/17/2019	12:44:18 PM	73.2	796.28	248.52	
7/17/2019	1:44:21 PM	74.04	704.78	200.56	
7/17/2019	2:44:25 PM	74.37	580.56	163.97	
7/17/2019	3:44:28 PM	74.49	731.9	185.26	
7/17/2019	4:44:32 PM	74.37	665.73	188	
7/17/2019	5:44:35 PM	74.6	645.55	175.57	
7/17/2019	6:44:39 PM	74.77	639.67	169.23	
7/17/2019	7:44:43 PM	74.88	609.19	166.99	
7/17/2019	8:44:46 PM	74.88	591.32	165.93	
7/17/2019	9:44:50 PM	73.98	562.35	166.66	
7/17/2019	10:44:54 PM	73.2	569.63	170.47	
7/17/2019	11:44:57 PM	73.25	556.8	173.04	
7/18/2019	12:44:01 AM	72.92	512.37	165.65	
7/18/2019	1:44:04 AM	72.08	505.81	170.64	
7/18/2019	2:44:07 AM	71.96	550.86	183.8	
7/18/2019	3:44:12 AM	71.12	541.22	185.54	
7/18/2019	4:44:15 AM	69.84	430.68	163.86	
7/18/2019	5:44:17 AM	69.84	418.46	143.74	
7/19/2019	6:32:26 AM	65.52	403.05	184.53	**Added 13lbs of fuel**
7/19/2019	7:32:30 AM	67.26	1045.62	481.1	
7/19/2019	7:50:31 AM	67.48	828.22	485.36	**Add 13 lbs of fuel**
7/19/2019	8:50:34 AM	69.33	1097.39	506.32	
7/19/2019	9:50:38 AM	67.87	652.89	178.26	
7/19/2019	10:22:40 AM	67.37	551.25	234.34	**Added 21 lbs of fuel**
7/19/2019	11:22:45 AM	67.54	680.13	276.31	
7/19/2019	12:22:49 PM	68.38	911.76	321.69	
7/19/2019	1:22:53 PM	69.55	811.01	258.94	
7/19/2019	2:22:58 PM	69.72	756.27	224.65	
7/19/2019	3:22:02 PM	70.4	852.81	236.36	
7/19/2019	4:22:07 PM	71.52	884.3	254.96	
7/19/2019	5:22:11 PM	72.08	738.73	211.93	
7/19/2019	6:22:15 PM	72.58	723.94	216.13	
7/19/2019	7:22:20 PM	72.97	669.48	215.8	
7/19/2019	8:22:24 PM	72.97	703.72	221.79	
7/19/2019	9:22:29 PM	72.3	658.89	214.45	
7/22/2019	6:38:45 AM	67.2	676.6	249.75	**Added 14 lbs of fuel**
7/22/2019	7:38:48 AM	71.74	1076.71	477.24	

7/22/2019	8:15:51 AM	71.52	639.39	418.18	**Added 14 lbs of fuel**
7/22/2019	9:15:55 AM	71.68	1058.17	479.76	
7/22/2019	10:15:00 AM	72.75	766.25	308.47	
7/22/2019	10:39:01 AM	74.37	682.82	326.46	**Added 21 lbs of fuel**
7/22/2019	11:39:05 AM	76.11	973	427.82	
7/22/2019	12:39:09 PM	78.41	1012.45	394.87	
7/22/2019	1:39:14 PM	80.14	890.35	348.14	
7/22/2019	2:39:18 PM	80.31	790.84	323.32	
7/22/2019	3:39:21 PM	79.47	724.39	301.64	
7/22/2019	4:39:25 PM	79.08	667.18	286	
7/23/2019	6:27:08 AM	66.7	83.28	79.81	**Added 14 lbs of fuel**
7/23/2019	7:27:12 AM	69.5	1031.11	475.11	
7/23/2019	7:56:14 AM	72.64	716.49	444.96	**Added 23 lbs of fuel**
7/23/2019	8:56:18 AM	72.92	1049.32	477.8	
7/23/2019	9:56:22 AM	74.77	797.06	262.13	
7/23/2019	10:49:26 AM	72.19	554.62	240.62	**Added 21 lbs of fuel**
7/23/2019	11:49:30 AM	71.91	914.17	356.55	
7/23/2019	12:49:34 PM	73.25	946.22	295.14	
7/23/2019	1:49:39 PM	74.32	946.95	282.98	
7/23/2019	2:49:43 PM	76.73	813.76	247.51	
7/23/2019	3:49:47 PM	77.12	723.27	225.83	
7/23/2019	4:49:51 PM	76.78	761.82	261.91	
7/23/2019	5:49:55 PM	77.46	723.38	249.53	
7/23/2019	6:49:00 PM	77.74	731	247.68	
7/23/2019	7:49:03 PM	76.61	729.21	247.62	
7/24/2019	6:52:48 AM	65.74	330.27	156.4	**Added 14 lbs of fuel**
7/24/2019	7:52:53 AM	68.43	825.75	349.6	
7/24/2019	8:51:57 AM	70.06	670.6	431.52	**Added 15 lbs of fuel**
7/24/2019	9:51:01 AM	72.02	1064.95	488.16	
7/24/2019	10:51:05 AM	72.92	769.1	301.19	
7/24/2019	11:17:07 AM	72.58	656.82	321.86	**Adde 21 lbs of fuel**
7/24/2019	12:17:11 PM	73.48	1060.02	437.85	
7/24/2019	1:17:15 PM	75.72	1020.8	379.07	
7/24/2019	2:17:20 PM	71.74	948.68	389.16	
7/24/2019	3:17:24 PM	71.18	755.54	329.37	
7/24/2019	4:17:29 PM	70.62	739.18	321.13	
7/25/2019	6:41:59 AM	66.02	81.66	69.22	**Added 14 lbs of fuel**
7/25/2019	7:41:02 AM	71.4	1089.21	470.68	
7/25/2019	8:24:04 AM	72.3	782.89	504.75	**Added 19 lbs of fuel**
7/25/2019	9:24:07 AM	74.04	1011.83	454.21	
7/25/2019	10:24:11 AM	75.77	988.41	407.03	
7/25/2019	10:25:11 AM	75.72	932.77	577.93	**Added 19 lbs of fuel**
7/25/2019	11:25:15 AM	72.3	1052	435.61	
7/25/2019	12:25:19 PM	73.31	936.75	383.95	
7/25/2019	1:25:23 PM	74.6	923.64	376.16	
7/25/2019	2:25:27 PM	75.27	763.33	322.09	

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 1 Data Summary

Client:	Valley Comfort [Blaze King]
Model:	KE40
Job #:	19-509
Tracking #:	0032
Test Date:	7/29/2019

8/7/2019

Techician Signature Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 1

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Burn Rate (kg/hr):	2.48

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	0.000	39.085	38.650	9.229
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.7			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	7678.5			
Average Gas Meter Temperature (°F)	78.0	100.2	98.1	89.9
Total Sample Volume (dscf)	0.000	35.270	35.160	10.415
Average Tunnel Temperature (°F)	121.0			
Total Time of Test (min)	250			
Total Particulate Catch (mg)	0.0	11.7	11.3	3.9
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0003317	0.0003214	0.0003745
Total PM Emissions (g)	0.00	10.61	10.28	2.88
Particulate Emission Rate (g/hr)	0.00	2.55	2.47	2.88
Emissions Factor (g/kg)	-	1.03	1.00	-
Difference from Average Total Particulate Emissions (g)	-	0.17	0.17	-
Difference from Average Emissions Factor (g/kg)	-	0.02	0.02	-

Final Average Results	
Total Particulate Emissions (g)	10.45
Particulate Emission Rate (g/hr)	2.51
Emissions Factor (g/kg)	1.01
HHV Efficiency (%)	75.3%
LHV Efficiency (%)	81.4%
CO Emissions (g/min)	1.44

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	88.0	OK
Face Velocity	< 30 ft/min	8.5	OK
Leakage Rate	Less than 4% of average sample rate	0.003 cfm	OK
Ambient Temp	55-90 °F	Min: 76 / Max: 80	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	37.2	OK

B415.1 Efficiency Results

Manufacturer: Valley Comfort [Blaze King]
Model: KE40
Date: 07/29/19
Run: 1
Control #: 19-509
Test Duration: 250
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.3%	81.4%
Combustion Efficiency	97.6%	97.6%
Heat Transfer Efficiency	77.2%	83.4%

Output Rate (kJ/h)	36,881	34,985	**(Btu/h)**
Burn Rate (kg/h)	2.47	5.45	**(lb/h)**
Input (kJ/h)	48,969	46,452	**(Btu/h)**

Test Load Weight (dry kg)	10.30	22.70	**dry lb**
MC wet (%)	18.98		
MC dry (%)	23.43		
Particulate (g)	10.45		
CO (g)	359		
Test Duration (h)	4.17		

Emissions	Particulate	CO
g/MJ Output	0.07	2.34
g/kg Dry Fuel	1.01	34.90
g/h	2.51	86.26
g/min	0.04	1.44
lb/MM Btu Output	0.16	5.44

Air/Fuel Ratio (A/F)	10.82

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

WOODSTOVE FUEL DATA - ASTM E2780

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 1

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Preburn Fuel Information

Size	Length (in)	Moisture Content (% DB)	Size	Length (in)	Moisture Content (% DB)
2x4	17.00	22.7	2x4	17.00	20.9
2x4	17.00	23.2	2x4	17.00	23.8
2x4	17.00	21.7	2x4	17.00	24.6
2x4	17.00	18.3	2x4	17.00	19.1
2x4	17.00	20.3	2x4	17.00	20.3
2x4	17.00	21.5	2x4	17.00	19.7
2x4	17.00	20.6			
2x4	17.00	22.5			
Total Fuel Weight (lbs):		25.42	Average Moisture (%DB):		21.4

Firebox Volume (ft^3):	4.35
Total 2x4 Crib Weight, with spacers (lbs):	0.00
Total 4x4 Crib Weight, with spacers (lbs):	28.02
Total Wet Fuel Weight, with spacers (lbs):	28.02

Coal Bed Range (20-25%):
Min (lbs): 5.60
Max (lbs): 7.01

Test Fuel Information

Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	17.75	3.72	23.8	22.1	23.7	3.02
4x4	17.75	4.30	23.8	22.0	23.8	3.49
4x4	17.75	4.22	23.8	22.7	22.7	3.43
4x4	17.75	4.38	23.8	23.8	23.1	3.54
4x4	17.75	4.20	23.2	22.5	23.0	3.42
4x4	17.75	4.48	23.8	25.4	24.8	3.59
					Total Dry Weight, no spacers (lbs):	20.49
					Total Dry Weight, with spacers (lbs):	22.75

Spacer Moisture Readings (%DB)

15.0	19.5	16.7	23.3	22.3	21.1		
21.9	21.1	19.9	21.7	22.6	23.1		
15.9	19.1	23.0	15.4	21.5	23.8		
22.0	20.0	23.8	22.1	22.0	20.5		

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft^3, DB)	27.1	OK
Loading Density	6.3 - 7.7 (lbs/ft^3, WB)	6.44	OK
2x4 Fuel Mix	35 - 65 % of total weight	N/A	N/A

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client:	Valley Comfort [Blaze King]	Job #:	19-509
Model:	KE40	Tracking #:	0032
Run #:	1	Technician:	SJB
Test Start Time:	12:03	Date:	7/29/2019

Total Sampling Time (min):	250
Recording Interval (min):	10

Meter Box γ Factor:	0.998	(A)
Meter Box γ Factor:	1.002	(B)
Meter Box γ Factor:	1.000	(Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	28.67	28.61	28.64
Relative Humidity (%)	16.4	10.5	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		0.000	ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	7/26/2019

Sample Train Post-Test Leak Checks

(A)	0.002	cfm @	-6	in. Hg
(B)	0.003	cfm @	-6	in. Hg
(Ambient)	0.000	cfm @	0	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.034	126
2	0.030	126
3	0.038	126
4	0.042	126
5	0.038	126
6	0.028	126
7	0.022	126
8	0.032	126
Center	0.028	126

Static Pressure: -0.170 in. H_2O

Dilution Tunnel H_2O:	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	ft^2
V_{strav}:	12.80	ft/sec
V_{scent}:	11.94	ft/sec
F_p:	1.072	[ratio]
Initial Tunnel Flow:	128.5	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

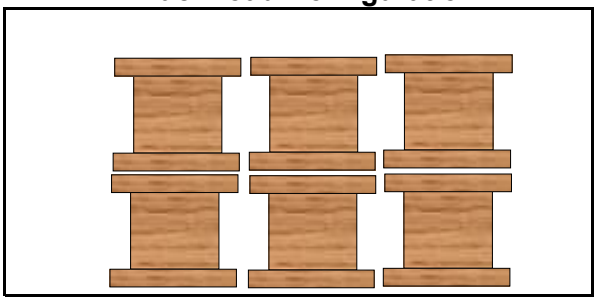
Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	23.4

Fuel Load Configuration

Firebox Front



Firebox Back

Firebox Side View

WOODSTOVE PREBURN DATA - ASTM E2780

Client: Valley Comfort [Blaze Kir
Model: KE40
Run #: 1

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Recording Interval (min): 10
Run Time (min): 83

			Temperatures (°F)							
Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H_2O)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	27.5	0.011	579	564	383	574	480	516.0	80	75
10	27.0	-0.044	479	454	264	505	484	437.2	81	76
20	23.8	-0.066	483	439	264	465	464	423.0	81	76
30	19.3	0.007	482	442	249	585	450	441.6	82	77
40	16.5	-0.051	506	460	261	646	440	462.6	83	78
50	13.6	-0.020	529	493	278	671	432	480.6	84	79
60	11.7	-0.020	550	525	299	667	429	494.0	445	80
70	8.5	-0.054	566	544	316	658	430	502.8	437	78
80	7.3	-0.031	597	563	346	641	432	515.8	417	77
83	7.0	-0.031	597	563	346	641	432	515.8	417	77

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 1

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.001		0.028	-0.06	84	1.16		28.0		155	485	77	77
10	1.473	0.147	0.028	0.92	85	3.03	97	26.0	-2.04	127	450	84	76
20	2.982	0.151	0.028	1.09	88	1.16	99	24.3	-1.66	125	434	85	76
30	4.548	0.157	0.028	1.10	90	1.64	103	22.5	-1.79	127	451	85	76
40	6.110	0.156	0.028	1.09	92	3.15	102	20.7	-1.85	128	451	85	76
50	7.670	0.156	0.028	1.11	94	1.27	102	18.7	-1.97	129	457	85	76
60	9.230	0.156	0.028	1.01	96	2.99	101	16.9	-1.82	127	445	85	76
70	10.826	0.160	0.028	1.01	98	2.43	103	15.1	-1.79	127	438	86	77
80	12.395	0.157	0.028	1.16	99	1.67	101	13.5	-1.62	125	434	87	77
90	13.968	0.157	0.028	1.04	100	3.25	101	11.9	-1.55	125	429	87	78
100	15.524	0.156	0.028	0.98	102	2.94	99	10.5	-1.42	123	421	88	78
110	17.089	0.157	0.028	1.15	102	2.9	100	9.2	-1.35	123	418	88	78
120	18.654	0.157	0.028	0.97	103	3.25	100	7.9	-1.28	122	419	88	78
130	20.219	0.157	0.028	1.05	104	1.82	100	6.7	-1.17	122	421	87	79
140	21.791	0.157	0.028	1.05	104	1.09	100	5.7	-0.98	120	405	87	79
150	23.360	0.157	0.028	1.04	105	1.12	99	4.9	-0.79	117	386	87	79
160	24.927	0.157	0.028	1.05	105	3.23	99	4.2	-0.76	117	383	87	80
170	26.488	0.156	0.028	1.17	106	2.23	98	3.5	-0.64	117	378	87	80
180	28.060	0.157	0.028	1.13	106	3.19	99	3.1	-0.49	114	354	86	80
190	29.626	0.157	0.028	0.96	106	1.17	98	2.6	-0.44	113	346	86	80
200	31.205	0.158	0.028	0.99	106	1.19	99	2.2	-0.43	112	340	86	79
210	32.781	0.158	0.028	1.01	106	1.27	99	1.8	-0.41	112	335	85	79
220	34.353	0.157	0.028	1.15	106	1.34	99	1.4	-0.41	111	334	85	79
230	35.930	0.158	0.028	1.14	106	2.94	99	0.9	-0.43	110	329	85	78
240	37.505	0.158	0.028	1.03	106	1.11	99	0.5	-0.41	109	322	85	79
250	39.085	0.158	0.028	1.11	106	1.24	99	0.0	-0.52	109	321	84	79
Avg/Tot	39.085	0.156	0.028	1.02	100	2.07	100			121	399	86	78.0

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 1

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.001		0.00	81	1		78	-0.040	7.55	0.12
10	1.483	0.148	1.09	82	0.33	99	84	-0.030	10.28	0.17
20	2.990	0.151	1.27	84	3.61	100	84	-0.030	10.97	0.16
30	4.529	0.154	1.19	87	0.54	102	84	-0.030	12.06	0.51
40	6.067	0.154	1.26	89	0.14	102	85	-0.030	12.70	0.59
50	7.612	0.155	1.21	92	5.03	102	85	-0.030	12.83	0.82
60	9.153	0.154	1.14	94	-0.41	101	85	-0.030	12.39	0.50
70	10.697	0.154	1.12	96	2.18	101	82	-0.030	13.00	0.72
80	12.243	0.155	1.25	97	4.13	101	82	-0.030	12.18	0.57
90	13.787	0.154	1.22	98	-1.62	100	82	-0.030	12.31	0.69
100	15.335	0.155	1.24	99	4.4	100	82	-0.030	12.29	0.50
110	16.882	0.155	1.27	100	-1.13	100	83	-0.030	12.09	0.74
120	18.433	0.155	1.13	101	4.13	100	83	-0.030	12.23	0.34
130	19.985	0.155	1.23	102	-2.07	100	83	-0.030	11.96	0.34
140	21.541	0.156	1.24	102	6.92	100	83	-0.030	11.20	0.12
150	23.090	0.155	1.10	103	6.21	99	83	-0.030	10.76	0.02
160	24.638	0.155	1.13	103	-0.17	99	82	-0.030	10.59	0.00
170	26.189	0.155	1.25	104	2.52	99	82	-0.030	10.82	0.00
180	27.746	0.156	1.14	104	0.21	99	82	-0.030	10.02	0.02
190	29.307	0.156	1.26	104	-0.17	99	82	-0.030	9.97	0.02
200	30.859	0.155	1.18	104	3.89	99	82	-0.030	9.89	0.02
210	32.416	0.156	1.26	105	4.25	99	81	-0.030	9.57	0.02
220	33.973	0.156	1.20	105	-2.11	99	81	-0.030	10.05	0.00
230	35.530	0.156	1.27	105	-2.46	99	81	-0.030	10.04	0.00
240	37.091	0.156	1.18	105	4.14	99	81	-0.030	9.38	0.00
250	38.650	0.156	1.25	105	3.48	99	81	-0.020	9.74	0.00
Avg/Tot	38.650	0.155	1.16	98	1.81	100	82	-0.030	11.03	0.27

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 1

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Stove ΔT: 37

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	611	570	367	636	434	523.6	999
10	506	478	248	602	442	455.2	992
20	452	420	221	559	439	418.2	1004
30	444	394	217	560	431	409.2	1061
40	462	388	223	580	427	416.0	1077
50	505	391	233	601	425	431.0	1091
60	547	400	242	603	426	443.6	1065
70	586	411	253	605	427	456.4	1074
80	614	422	263	611	427	467.4	1065
90	631	432	275	611	427	475.2	1067
100	644	442	284	610	426	481.2	1073
110	650	458	300	609	425	488.4	1064
120	654	478	310	604	425	494.2	1061
130	637	512	330	609	426	502.8	1049
140	624	549	344	594	432	508.6	987
150	616	567	344	564	441	506.4	944
160	616	584	342	552	451	509.0	946
170	606	580	331	550	461	505.6	947
180	595	567	323	522	473	496.0	868
190	587	559	318	496	482	488.4	839
200	575	548	316	482	487	481.6	842
210	566	545	324	473	489	479.4	826
220	558	552	342	464	489	481.0	820
230	551	577	393	456	488	493.0	808
240	550	577	379	449	488	488.6	794
250	546	565	389	443	489	486.4	783
Average	574	499	304	556	449	476	967

LAB SAMPLE DATA - ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 1

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	3541	121.8	121.8	125.7	3.9
Train A Filters - Remainder	3542	123.7	240.4	245.9	5.5
	3543	116.7			
Train A Probe	11A	117035.7	117035.7	117036.4	0.7
Train A O-Rings	11A	3422.3	3422.3	3423.9	1.6
Train B Filters	3544	122.6	237.8	245.5	7.7
	3545	115.2			
Train B Probe	11B	117489.9	117489.9	117490.6	0.7
Train B O-Rings	11B	4232.8	4232.8	4235.7	2.9
Background Filter			0.0	0.0	

Placed in Dessicator on:	8/5 - 8:00

Train A Filters - First Hour	125.8	8/6 15:55	125.7	8/7 15:54				
Train A Filters - Remainder	245.9	8/6 16:04	245.9	8/7 15:54				
Train A Probe	117036.4	8/6 15:55	117036.4	8/7 15:54				
Train A O-Rings	3424.0	8/6 15:55	3423.9	8/7 15:54				
Train B Filters	245.6	8/6 15:55	245.5	8/7 15:55				
Train B Probe	117490.6	8/6 15:55	117490.6	8/7 15:55				
Train B O-Rings	4235.8	8/6 15:57	4235.7	8/7 15:55				
Background Filter								

1st hour Sub-Total, mg:	3.9
Remainder Sub-Total, mg:	7.8
Train 1 Aggregate, mg:	**11.7**
Train 2 Aggregate, mg:	**11.3**
Ambient Aggregate, mg:	0.0

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 1 Test Date: 7/29/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Fully Open (Dial indicator straight down)
Targeted Burn Category: IV

Preburn Notes

Time	Notes
- 83 min	Started with 15.0 lbs of kindling fire, burned down to 2.0 lbs, scooped and zeroed, then loaded preburn test load, 25.4 lbs, started logging preburn data. @ 7.0 lbs, raked coal bed, zeroed scale, turned off fan in preparation of test fuel loading

Test Notes

Test Burn Start Time: 12:03 Test Fuel Loaded by: 30 seconds
Door Closed: 40 seconds Air Control Set at: 0 seconds
Other Loading Notes: Bypass closed @ 0 sec

Time	Notes
0 min	Loaded test fuel load
60 min	Changed 1-hr filter
250 min	End of test

Test Burn End Time: 16:13

Flue Gas Concentration Measurement

Calibration Gas Values:
Span Gas CO_2 (%): 16.89 CO (%): 4.33
Mid Gas CO_2 (%): 10.07 CO (%): 2.53

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	11:28	11:34	11:30	17:15	17:21	17:19
CO_2	0.00	10.36	16.87	0.00	10.28	16.88
CO	0.00	2.56	4.33	0.00	2.55	4.32

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

Technician Signature: Date: 7/30/2019

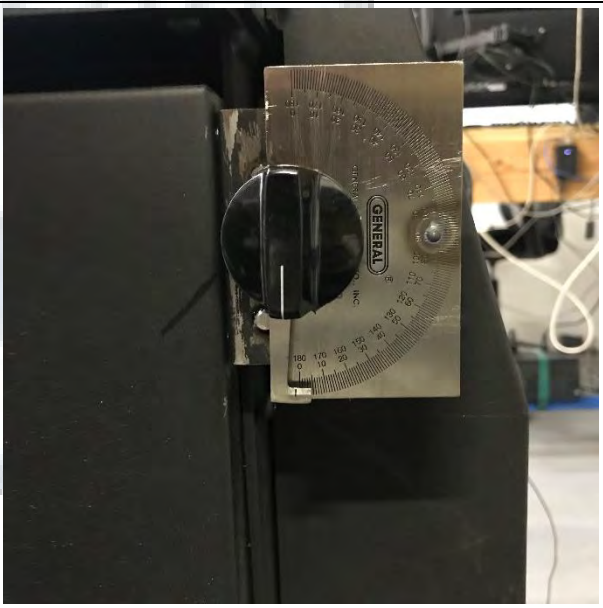
ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 1 Test Date: 7/29/2019

Test Fuel Side View

Test Fuel Iso View

Test Fuel Loaded in Stove



Air Setting

Technician Signature: Date: 7/30/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 2 Data Summary

Client:	Valley Comfort [Blaze King]
Model:	KE40
Job #:	19-509
Tracking #:	0032
Test Date:	7/29/2019

8/7/2019

Techician Signature Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Burn Rate (kg/hr):	0.75

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	0.000	129.943	134.727	9.066
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.7			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	8116.1			
Average Gas Meter Temperature (°F)	72.5	98.1	98.2	93.1
Total Sample Volume (dscf)	0.000	117.719	122.587	10.241
Average Tunnel Temperature (°F)	86.3			
Total Time of Test (min)	850			
Total Particulate Catch (mg)	0.0	5.8	6.6	1.2
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000493	0.0000538	0.0001172
Total PM Emissions (g)	0.00	5.66	6.19	0.95
Particulate Emission Rate (g/hr)	0.00	0.40	0.44	0.95
Emissions Factor (g/kg)	-	0.54	0.59	-
Difference from Average Total Particulate Emissions (g)	-	0.26	0.26	-
Difference from Average Emissions Factor (g/kg)	-	0.02	0.02	-

Final Average Results	
Total Particulate Emissions (g)	5.93
Particulate Emission Rate (g/hr)	0.42
Emissions Factor (g/kg)	0.56
HHV Efficiency (%)	83.6%
LHV Efficiency (%)	90.3%
CO Emissions (g/min)	0.21

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	85.0	OK
Face Velocity	< 30 ft/min	8.7	OK
Leakage Rate	Less than 4% of average sample rate	0.003 cfm	OK
Ambient Temp	55-90 °F	Min: 69 / Max: 79	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	5.8	OK

B415.1 Efficiency Results

Manufacturer: Valley Comfort [Blaze King]
Model: KE40
Date: 07/29/19
Run: 2
Control #: 19-509
Test Duration: 850
Output Category: 1

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	83.6%	90.3%
Combustion Efficiency	99.2%	99.2%
Heat Transfer Efficiency	84.3%	91.1%

Output Rate (kJ/h)	12,323	11,690	**(Btu/h)**
Burn Rate (kg/h)	0.74	1.64	**(lb/h)**
Input (kJ/h)	14,744	13,986	**(Btu/h)**

Test Load Weight (dry kg)	10.54	23.24	**dry lb**
MC wet (%)	16.77		
MC dry (%)	20.14		
Particulate (g)	5.93		
CO (g)	177		
Test Duration (h)	14.17		

Emissions	Particulate	CO
g/MJ Output	0.03	1.01
g/kg Dry Fuel	0.56	16.78
g/h	0.42	12.49
g/min	0.01	0.21
lb/MM Btu Output	0.08	2.36

Air/Fuel Ratio (A/F)	15.41

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

WOODSTOVE FUEL DATA - ASTM E2780

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Preburn Fuel Information

Size	Length (in)	Moisture Content (% DB)	Size	Length (in)	Moisture Content (% DB)
2x4	17.00	18.6	2x4	17.00	24.3
2x4	17.00	21.4	2x4	17.00	23.8
2x4	17.00	19.2	2x4	17.00	18.9
2x4	17.00	22.2	2x4	17.00	19.3
2x4	17.00	21.9	2x4	17.00	19.3
2x4	17.00	17.4	2x4	17.00	21.4
2x4	17.00	21.7			
2x4	17.00	19.9			
Total Fuel Weight (lbs):		26.32	Average Moisture (%DB):		20.7

Firebox Volume (ft^3):	4.35
Total 2x4 Crib Weight, with spacers (lbs):	0.00
Total 4x4 Crib Weight, with spacers (lbs):	27.92
Total Wet Fuel Weight, with spacers (lbs):	27.92

Coal Bed Range (20-25%):
Min (lbs): 5.58
Max (lbs): 6.98

Test Fuel Information

Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	17.75	4.14	20.3	20.4	19.7	3.45
4x4	17.75	4.18	19.5	20.4	19.4	3.49
4x4	17.75	4.08	20.5	20.9	20.3	3.38
4x4	17.75	4.20	19.7	20.6	20.3	3.49
4x4	17.75	4.10	20.3	20.1	19.9	3.41
4x4	17.75	4.04	19.9	20.6	19.8	3.36
					Total Dry Weight, no spacers (lbs):	20.59
					Total Dry Weight, with spacers (lbs):	23.27

Spacer Moisture Readings (%DB)

19.5	19.1	20.9	20.1	18.7	17.5		
17.2	14.9	18.7	15.9	15.9	19.9		
19.1	22.1	19.7	20.0	17.3	19.4		
19.2	21.9	15.9	16.9	21.4	20.3		

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)	6.42	OK
2x4 Fuel Mix	35 - 65 % of total weight	N/A	N/A

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client:	Valley Comfort [Blaze King]	Job #:	19-509
Model:	KE40	Tracking #:	0032
Run #:	2	Technician:	SJB
Test Start Time:	19:23	Date:	7/29/2019

Total Sampling Time (min):	850
Recording Interval (min):	10

Meter Box γ Factor:	0.998	(A)
Meter Box γ Factor:	1.002	(B)
Meter Box γ Factor:	1.000	(Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	28.57	28.72	28.65
Relative Humidity (%)	12.1	20.9	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		0.000	ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	7/26/2019

Sample Train Post-Test Leak Checks

(A)	0.001	cfm @	-5	in. Hg
(B)	0.003	cfm @	-6	in. Hg
(Ambient)	0.000	cfm @	0	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.026	82
2	0.032	82
3	0.038	82
4	0.030	82
5	0.038	82
6	0.034	82
7	0.036	82
8	0.028	82
Center	0.044	82

Static Pressure: -0.170 in. H_2O

Dilution Tunnel H_2O:	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	ft^2
V_{strav}:	12.63	ft/sec
V_{scent}:	14.42	ft/sec
F_p:	0.876	[ratio]
Initial Tunnel Flow:	133.4	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

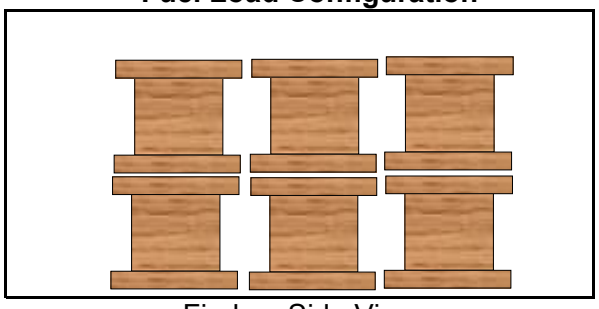
Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	20.1

Fuel Load Configuration

Firebox Front



Firebox Back

Firebox Side View

WOODSTOVE PREBURN DATA - ASTM E2780

Client: Valley Comfort [Blaze Kir
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

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

			Temperatures (°F)							
Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H_2O)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	7.1	-0.030	558	587	370	587	429	506.2	369	83
10	7.0	-0.020	504	529	378	546	442	479.8	189	80
20	7.0	-0.010	445	462	344	485	440	435.2	164	79
30	7.0	-0.010	399	409	314	434	428	396.8	149	78
40	7.0	-0.010	361	367	287	393	414	364.4	141	77
50	7.1	-0.010	329	333	265	360	398	337.0	139	76
60	7.1	-0.010	301	305	242	329	382	311.8	126	76

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.044	-0.05	91	1.21		27.9		90	128	82	76
10	1.535	0.154	0.044	0.97	90	3.12	102	27.6	-0.36	91	142	83	78
20	3.052	0.152	0.044	1.01	91	1.31	101	27.3	-0.26	91	159	83	78
30	4.564	0.151	0.044	1.06	92	1.05	101	26.8	-0.47	92	184	83	78
40	6.067	0.150	0.044	0.91	94	2.2	100	26.2	-0.64	94	218	83	78
50	7.566	0.150	0.044	1.07	96	1.13	99	25.4	-0.82	96	235	84	78
60	9.066	0.150	0.044	1.03	98	3.18	99	24.5	-0.83	96	229	84	78
70	10.576	0.151	0.044	1.06	99	3.19	99	23.9	-0.67	95	218	85	78
80	12.083	0.151	0.044	1.06	101	1.25	99	23.2	-0.65	95	217	85	78
90	13.592	0.151	0.044	1.01	102	3.05	99	22.6	-0.63	94	219	85	79
100	15.104	0.151	0.044	1.01	102	1.58	99	21.9	-0.71	95	224	85	78
110	16.617	0.151	0.044	1.01	103	1.06	99	21.1	-0.74	95	226	85	78
120	18.125	0.151	0.044	1.00	103	3.15	98	20.6	-0.56	94	214	85	78
130	19.640	0.152	0.044	1.03	104	1.34	99	20.0	-0.58	93	213	85	77
140	21.150	0.151	0.044	1.02	104	1.49	98	19.4	-0.58	93	208	84	75
150	22.666	0.152	0.044	1.05	104	2.98	99	18.9	-0.56	92	208	82	75
160	24.185	0.152	0.044	0.88	103	1.41	99	18.3	-0.55	92	209	82	74
170	25.715	0.153	0.044	1.05	103	2.89	100	17.8	-0.5	91	206	81	74
180	27.236	0.152	0.044	0.97	102	2.61	99	17.4	-0.46	90	199	81	73
190	28.754	0.152	0.044	0.97	102	1.18	99	16.9	-0.41	89	195	80	73
200	30.277	0.152	0.044	0.94	101	1.71	99	16.5	-0.42	89	196	80	72
210	31.797	0.152	0.044	0.98	101	2.31	99	16.1	-0.46	89	198	79	72
220	33.318	0.152	0.044	1.04	100	1.18	99	15.6	-0.51	89	203	79	72
230	34.834	0.152	0.044	0.99	100	3.02	99	14.8	-0.74	89	207	79	72
240	36.352	0.152	0.044	1.07	100	1.16	99	14.1	-0.7	89	202	79	71
250	37.875	0.152	0.044	0.89	99	1.09	100	13.5	-0.6	88	191	78	72
260	39.388	0.151	0.044	0.97	99	2.43	99	13.0	-0.51	87	183	78	71
270	40.908	0.152	0.044	0.95	99	3.18	99	12.6	-0.44	86	175	78	71
280	42.439	0.153	0.044	1.07	98	1.1	100	12.2	-0.32	85	168	77	71
290	43.962	0.152	0.044	1.08	98	2.96	99	12.0	-0.21	84	166	77	71
300	45.490	0.153	0.044	0.93	98	1.2	100	11.8	-0.2	84	165	77	70
310	47.013	0.152	0.044	0.90	98	1.66	99	11.6	-0.2	84	170	77	70

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	48.536	0.152	0.044	0.99	97	1.06	100	11.4	-0.24	84	177	77	70
330	50.056	0.152	0.044	1.08	97	2.18	99	11.2	-0.22	84	178	76	70
340	51.586	0.153	0.044	1.04	97	2.95	100	11.0	-0.21	84	179	77	72
350	53.108	0.152	0.044	1.01	97	3.11	100	10.8	-0.19	85	180	78	72
360	54.631	0.152	0.044	1.05	97	1.17	100	10.6	-0.16	84	174	77	70
370	56.156	0.153	0.044	1.07	97	1.19	100	10.5	-0.15	84	174	77	71
380	57.678	0.152	0.044	1.07	97	2.17	100	10.3	-0.15	84	176	77	70
390	59.198	0.152	0.044	0.89	97	1.16	99	10.2	-0.15	83	176	76	69
400	60.721	0.152	0.044	0.91	97	3.21	100	10.0	-0.17	83	178	76	72
410	62.240	0.152	0.044	0.90	97	1.2	99	9.8	-0.22	84	182	77	72
420	63.761	0.152	0.044	1.05	97	3.1	99	9.5	-0.26	84	188	77	71
430	65.294	0.153	0.044	0.96	97	2.83	100	9.2	-0.33	84	196	76	69
440	66.819	0.153	0.044	0.97	97	1.21	100	8.9	-0.32	84	197	76	71
450	68.333	0.151	0.044	0.99	97	2.73	99	8.5	-0.34	85	193	77	71
460	69.860	0.153	0.044	0.99	97	2.88	100	8.2	-0.3	84	186	77	71
470	71.389	0.153	0.044	0.89	97	2.93	100	7.9	-0.28	84	180	77	70
480	72.916	0.153	0.044	0.95	97	2.91	100	7.7	-0.24	83	177	76	70
490	74.449	0.153	0.044	1.09	97	2.95	100	7.5	-0.19	83	168	77	70
500	75.982	0.153	0.044	0.89	97	3.2	100	7.3	-0.22	82	167	76	69
510	77.518	0.154	0.044	0.88	97	3.17	100	7.1	-0.19	82	167	76	71
520	79.046	0.153	0.044	0.87	97	1.15	100	6.9	-0.21	82	168	76	69
530	80.564	0.152	0.044	1.03	97	1.11	99	6.7	-0.2	82	173	76	70
540	82.086	0.152	0.044	1.05	97	3.15	99	6.5	-0.19	82	167	76	69
550	83.606	0.152	0.044	0.97	97	3.02	99	6.3	-0.17	82	166	76	70
560	85.149	0.154	0.044	1.11	97	1.2	101	6.2	-0.17	82	165	76	70
570	86.699	0.155	0.044	1.07	97	2.53	101	6.0	-0.17	81	168	76	70
580	88.252	0.155	0.044	1.07	97	2.91	101	5.9	-0.14	82	171	77	72
590	89.797	0.155	0.044	1.08	97	3.08	101	5.7	-0.16	83	170	77	70
600	91.346	0.155	0.044	0.91	97	1.34	101	5.6	-0.13	83	173	77	71
610	92.891	0.155	0.044	1.08	97	1.37	101	5.4	-0.12	83	170	77	71
620	94.437	0.155	0.044	1.07	97	3.02	101	5.3	-0.13	83	168	77	70
630	95.988	0.155	0.044	0.91	97	1.07	101	5.2	-0.13	83	168	77	72

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
640	97.535	0.155	0.044	1.09	97	2.91	101	5.0	-0.15	83	168	78	73
650	99.079	0.154	0.044	0.92	98	2.62	101	4.8	-0.21	84	171	78	73
660	100.616	0.154	0.044	0.99	98	1.73	100	4.6	-0.22	84	170	78	73
670	102.163	0.155	0.044	1.07	98	1.89	101	4.4	-0.22	83	172	78	71
680	103.708	0.155	0.044	0.91	98	3.05	101	4.1	-0.3	84	182	77	70
690	105.246	0.154	0.044	1.00	98	3.22	100	3.8	-0.31	84	191	77	71
700	106.796	0.155	0.044	1.00	97	2.67	101	3.5	-0.31	84	191	77	71
710	108.339	0.154	0.044	0.91	97	1.46	101	3.1	-0.41	85	198	77	71
720	109.885	0.155	0.044	0.94	97	2.29	101	2.7	-0.4	86	203	77	73
730	111.420	0.154	0.044	0.92	97	1.1	101	2.3	-0.34	87	194	79	74
740	112.959	0.154	0.044	1.04	98	3.1	101	2.1	-0.26	87	181	79	74
750	114.503	0.154	0.044	0.99	98	3.08	101	1.9	-0.19	86	173	80	74
760	116.050	0.155	0.044	1.08	99	3.07	101	1.7	-0.19	85	169	80	73
770	117.593	0.154	0.044	0.93	99	2.91	101	1.5	-0.17	84	169	78	72
780	119.136	0.154	0.044	0.96	99	2.58	101	1.3	-0.18	84	168	78	72
790	120.686	0.155	0.044	0.90	98	1.26	101	1.2	-0.16	84	173	77	72
800	122.226	0.154	0.044	0.97	98	2.97	101	1.0	-0.18	84	177	77	72
810	123.775	0.155	0.044	1.11	98	2.92	101	0.8	-0.19	84	175	77	71
820	125.320	0.154	0.044	1.00	98	1.13	101	0.7	-0.14	84	176	77	72
830	126.857	0.154	0.044	0.97	98	3.2	100	0.5	-0.2	85	177	77	72
840	128.395	0.154	0.044	1.06	98	1.54	100	0.3	-0.19	84	172	77	72
850	129.943	0.155	0.044	1.10	98	3.23	101	0.0	-0.26	85	170	78	72
Avg/Tot	129.943	0.153	0.044	0.98	98	2.20	100			86	184	79	72.5

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.001		0.00	88	1		81	-0.010	4.72	0.01
10	1.504	0.150	1.19	88	11.63	97	82	-0.010	5.21	0.01
20	3.025	0.152	1.23	89	7.28	98	82	-0.010	6.42	0.00
30	4.541	0.152	1.15	91	1.53	97	82	-0.010	8.02	0.01
40	6.048	0.151	1.11	93	2.94	97	83	-0.020	8.65	0.05
50	7.557	0.151	1.21	95	2.67	97	83	-0.020	9.08	0.08
60	9.067	0.151	1.15	97	1.38	96	83	-0.020	7.95	0.00
70	10.593	0.153	1.24	99	2.84	97	83	-0.020	8.06	0.00
80	12.138	0.155	1.17	100	2.51	98	83	-0.020	8.55	0.00
90	13.687	0.155	1.07	101	2.48	98	83	-0.020	8.64	0.00
100	15.236	0.155	1.25	102	3.06	98	83	-0.020	9.67	0.00
110	16.785	0.155	1.22	103	2.64	98	84	-0.020	7.99	0.00
120	18.335	0.155	1.19	103	2.6	98	83	-0.020	8.38	0.00
130	19.883	0.155	1.19	104	1.71	97	83	-0.020	8.53	0.00
140	21.430	0.155	1.10	104	1.41	97	81	-0.020	9.01	0.00
150	22.985	0.156	1.10	104	3.15	98	80	-0.020	9.32	0.00
160	24.535	0.155	1.27	103	1.49	97	79	-0.020	9.43	0.00
170	26.093	0.156	1.15	103	3.17	98	79	-0.020	9.13	0.00
180	27.650	0.156	1.23	102	2.65	98	79	-0.020	8.99	0.00
190	29.205	0.156	1.24	102	2.99	98	78	-0.020	9.17	0.00
200	30.759	0.155	1.21	102	1.85	98	78	-0.020	9.19	0.00
210	32.315	0.156	1.24	101	1.38	98	77	-0.020	9.74	0.00
220	33.869	0.155	1.18	101	3.09	98	77	-0.020	11.04	0.21
230	35.418	0.155	1.08	100	2.91	98	77	-0.020	9.67	2.54
240	36.967	0.155	1.14	100	1.39	98	77	-0.020	9.54	1.93
250	38.516	0.155	1.25	100	2.6	98	77	-0.020	9.34	1.47
260	40.066	0.155	1.17	99	1.91	98	76	-0.020	9.35	1.10
270	41.618	0.155	1.26	99	1.64	98	76	-0.020	9.44	0.24
280	43.170	0.155	1.18	99	1.15	98	76	-0.010	8.65	0.00
290	44.718	0.155	1.20	99	1.08	97	76	-0.010	8.17	0.00
300	46.271	0.155	1.17	98	2.71	98	75	-0.010	8.40	0.00
310	47.827	0.156	1.27	98	3.2	98	75	-0.010	8.35	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	49.442	0.162	1.28	98	1.63	102	75	-0.010	8.67	0.00
330	51.057	0.162	1.21	98	3.25	102	75	-0.010	8.10	0.00
340	52.672	0.161	1.37	98	2.98	102	76	-0.010	7.80	0.00
350	54.285	0.161	1.29	98	1.36	102	77	-0.010	6.81	0.00
360	55.899	0.161	1.36	98	1.63	102	76	-0.010	6.69	0.00
370	57.516	0.162	1.35	98	2.94	102	76	-0.010	6.06	0.00
380	59.129	0.161	1.31	98	1.74	102	76	-0.010	6.04	0.00
390	60.742	0.161	1.33	98	2.73	101	75	-0.010	6.55	0.00
400	62.354	0.161	1.27	98	2.96	101	76	-0.010	6.84	0.00
410	63.965	0.161	1.25	98	1.06	101	77	-0.010	7.15	0.00
420	65.579	0.161	1.28	98	1.44	102	77	-0.020	7.79	0.00
430	67.195	0.162	1.29	98	3.22	102	76	-0.020	8.76	0.00
440	68.805	0.161	1.32	97	1.41	102	76	-0.020	9.04	0.00
450	70.418	0.161	1.20	97	2.08	102	77	-0.020	8.92	0.00
460	72.030	0.161	1.29	97	3.12	102	77	-0.020	8.76	0.00
470	73.639	0.161	1.29	97	1.49	102	77	-0.020	8.21	0.00
480	75.248	0.161	1.20	97	2.89	101	76	-0.010	7.93	0.00
490	76.858	0.161	1.21	97	2.69	101	77	-0.010	7.70	0.00
500	78.471	0.161	1.30	97	2.58	102	76	-0.010	7.82	0.00
510	80.082	0.161	1.35	97	1.5	101	76	-0.010	7.72	0.00
520	81.691	0.161	1.29	97	3.11	101	76	-0.010	7.89	0.00
530	83.303	0.161	1.26	97	3.11	102	76	-0.010	7.19	0.00
540	84.914	0.161	1.27	97	2.62	101	76	-0.010	7.13	0.00
550	86.526	0.161	1.27	97	3.19	102	76	-0.010	6.83	0.00
560	88.137	0.161	1.26	97	1.39	101	76	-0.010	6.71	0.00
570	89.748	0.161	1.21	97	1.39	101	76	-0.010	6.68	0.00
580	91.358	0.161	1.33	97	2.18	101	77	-0.010	6.62	0.00
590	92.965	0.161	1.25	97	1.15	101	76	-0.010	6.28	0.00
600	94.572	0.161	1.31	97	2.03	101	76	-0.010	6.02	0.00
610	96.183	0.161	1.35	97	1.47	102	77	-0.010	5.56	0.00
620	97.791	0.161	1.28	97	1.33	101	76	-0.010	5.40	0.00
630	99.400	0.161	1.26	98	1.35	101	77	-0.010	5.94	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
640	101.007	0.161	1.34	98	3.1	101	78	-0.010	6.14	0.00
650	102.619	0.161	1.28	98	1.78	102	78	-0.010	7.75	0.00
660	104.225	0.161	1.19	98	1.03	101	79	-0.010	7.61	0.00
670	105.831	0.161	1.20	98	1.49	101	78	-0.010	7.52	0.00
680	107.436	0.161	1.27	98	2.83	101	77	-0.020	8.26	0.00
690	109.044	0.161	1.24	98	1.32	101	77	-0.020	8.09	0.00
700	110.650	0.161	1.30	98	1.42	101	77	-0.020	8.17	0.00
710	112.261	0.161	1.33	98	1.83	102	77	-0.020	9.06	0.00
720	113.867	0.161	1.24	98	2.43	101	77	-0.020	9.24	0.00
730	115.472	0.160	1.30	98	1.38	101	79	-0.020	8.37	0.00
740	117.073	0.160	1.30	98	2.92	101	80	-0.020	7.65	0.00
750	118.676	0.160	1.21	98	1.56	101	80	-0.010	7.23	0.00
760	120.273	0.160	1.29	99	2.73	100	80	-0.010	6.96	0.00
770	121.878	0.161	1.20	99	1.09	101	78	-0.010	6.91	0.00
780	123.488	0.161	1.21	99	3.21	101	77	-0.010	7.01	0.00
790	125.091	0.160	1.30	99	2.85	101	77	-0.010	7.23	0.00
800	126.702	0.161	1.33	99	2.54	101	77	-0.010	7.69	0.00
810	128.311	0.161	1.30	99	1.72	101	77	-0.010	7.47	0.00
820	129.913	0.160	1.34	98	2.83	101	77	-0.010	7.52	0.00
830	131.519	0.161	1.24	98	2.95	101	77	-0.010	7.02	0.00
840	133.122	0.160	1.28	98	1.47	101	77	-0.010	7.72	0.00
850	134.727	0.160	1.34	98	1.15	101	77	0.020	7.62	0.00
Avg/Tot	134.727	0.159	1.23	98	2.33	100	78	-0.014	7.86	0.09

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Stove ΔT: 6

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	299	303	241	328	381	310.4	469
10	258	262	193	300	366	275.8	464
20	235	233	176	290	354	257.6	519
30	229	219	175	297	349	253.8	643
40	232	221	184	325	349	262.2	733
50	241	231	193	359	355	275.8	823
60	261	248	191	402	363	293.0	777
70	267	256	189	409	366	297.4	754
80	272	262	191	423	368	303.2	772
90	277	270	194	436	370	309.4	796
100	290	278	198	451	373	318.0	828
110	302	291	203	472	375	328.6	835
120	307	293	203	461	374	327.6	792
130	311	298	204	459	371	328.6	799
140	310	305	207	468	368	331.6	819
150	311	308	208	473	365	333.0	834
160	314	311	209	488	364	337.2	855
170	315	313	209	487	364	337.6	841
180	313	309	208	494	364	337.6	852
190	312	308	209	492	365	337.2	844
200	312	309	208	493	367	337.8	845
210	313	310	208	497	368	339.2	863
220	314	312	210	516	369	344.2	908
230	318	315	218	541	371	352.6	902
240	322	320	223	538	373	355.2	879
250	323	323	224	530	373	354.6	853
260	322	324	223	519	373	352.2	836
270	321	325	222	509	372	349.8	822
280	318	323	220	499	369	345.8	818
290	314	320	219	465	366	336.8	742
300	310	316	215	439	361	328.2	720
310	309	312	213	431	356	324.2	729
320	311	310	212	433	352	323.6	741
330	312	308	211	432	348	322.2	738
340	314	307	212	428	345	321.2	729
350	314	303	212	421	342	318.4	711
360	311	299	212	408	339	313.8	688
370	307	295	210	395	336	308.6	670
380	305	289	207	386	333	304.0	654
390	304	283	205	380	331	300.6	664
400	304	280	204	382	330	300.0	676
410	305	278	204	384	330	300.2	687
420	308	278	206	397	330	303.8	733
430	317	281	209	423	329	311.8	793
440	332	285	212	454	329	322.4	827
450	345	289	217	465	327	328.6	809
460	353	291	220	463	325	330.4	793
470	359	291	221	455	320	329.2	771

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

Stove ΔT: 6

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	357	289	221	442	315	324.8	747
490	355	287	221	429	309	320.2	722
500	351	283	219	417	305	315.0	710
510	350	278	220	411	300	311.8	713
520	348	274	221	409	294	309.2	721
530	343	271	219	412	289	306.8	719
540	338	267	219	400	284	301.6	687
550	335	263	217	390	280	297.0	674
560	328	260	215	386	278	293.4	674
570	323	256	213	382	280	290.8	673
580	321	254	213	379	282	289.8	666
590	319	252	211	374	283	287.8	657
600	315	250	209	368	284	285.2	647
610	310	247	207	359	285	281.6	627
620	302	245	205	350	286	277.6	620
630	292	247	204	343	290	275.2	614
640	282	253	203	344	293	275.0	621
650	278	267	204	344	299	278.4	609
660	276	296	208	344	308	286.4	597
670	273	321	210	346	316	293.2	607
680	272	338	213	363	322	301.6	685
690	273	351	221	387	327	311.8	719
700	276	369	227	397	331	320.0	711
710	279	378	237	408	336	327.6	754
720	284	387	244	432	342	337.8	795
730	289	391	249	443	350	344.4	776
740	291	388	251	435	357	344.4	728
750	289	378	247	418	359	338.2	689
760	284	367	243	402	361	331.4	671
770	277	356	237	393	361	324.8	666
780	272	348	233	390	361	320.8	674
790	269	343	230	392	360	318.8	686
800	266	341	228	394	359	317.6	691
810	265	342	228	397	358	318.0	700
820	265	345	230	397	357	318.8	697
830	265	347	230	397	355	318.8	695
840	266	350	232	381	353	316.4	635
850	266	358	233	368	356	316.2	632
Average	301	300	214	417	340	314	727

LAB SAMPLE DATA - ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 2

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/29/2019

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	3546	117.1	117.1	118.3	1.2
Train A Filters - Remainder	3547	114.3	236.3	239.2	2.9
	3548	122.0			
Train A Probe	12A	116889.1	116889.1	116889.3	0.2
Train A O-Rings	12A	3394.0	3394.0	3395.5	1.5
Train B Filters	3549	124.0	239.6	244.4	4.8
	3550	115.6			
Train B Probe	12B	117957.2	117957.2	117957.2	0.0
Train B O-Rings	12B	3404.1	3404.1	3405.9	1.8
Background Filter			0.0	0.0	

Placed in Dessicator on:	8/5 - 8:00

Train A Filters - First Hour	118.5	8/6 16:05	118.3	8/7 15:58				
Train A Filters - Remainder	239.1	8/6 16:05	239.2	8/7 15:58				
Train A Probe	116889.2	8/6 16:05	116889.3	8/7 15:58				
Train A O-Rings	3395.5	8/6 16:05	3395.5	8/7 15:58				
Train B Filters	244.4	8/6 16:05	244.4	8/7 15:58				
Train B Probe	117957.2	8/6 16:05	117957.2	8/7 15:58				
Train B O-Rings	3405.8	8/6 16:05	3405.9	8/7 15:58				
Background Filter								

1st hour Sub-Total, mg:	1.2
Remainder Sub-Total, mg:	4.6
Train 1 Aggregate, mg:	**5.8**
Train 2 Aggregate, mg:	**6.6**
Ambient Aggregate, mg:	0.0

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 2 Test Date: 7/29/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Low Test Setting (88° Counterclockwise from fully open)
Targeted Burn Category: I

Preburn Notes

Time	Notes
-	Loaded 26 lbs of preburn, fan on high, bypass closed, burn down to target weight before turn down.
0 min	@7.0 lbs, turned air down to test setting, fan turned down to low.
45 min	@7.0 lbs, raked coal bed.
60 min	@7.0 lbs, zeroed scale in preparation of test fuel loading.

Test Notes

Test Burn Start Time: 19:23 Test Fuel Loaded by: 20 seconds
Door Closed: 25 seconds Air Control Set at: 0 seconds
Other Loading Notes: Bypass closed @ 0 sec

Time	Notes
0 min	Loaded test fuel load
60 min	Changed 1-hr filter
850 min	End of test

Test Burn End Time: 7/30 – 8:33

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 16.89 CO (%): 4.33
Mid Gas CO_2 (%): 10.07 CO (%): 2.53

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	17:15	17:21	17:19	7/30 - 13:25	7/30 -13:33	7/30 - 13:30
CO_2	0.00	10.28	16.88	0.00	10.25	16.85
CO	0.00	2.55	4.32	0.00	2.54	4.41

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

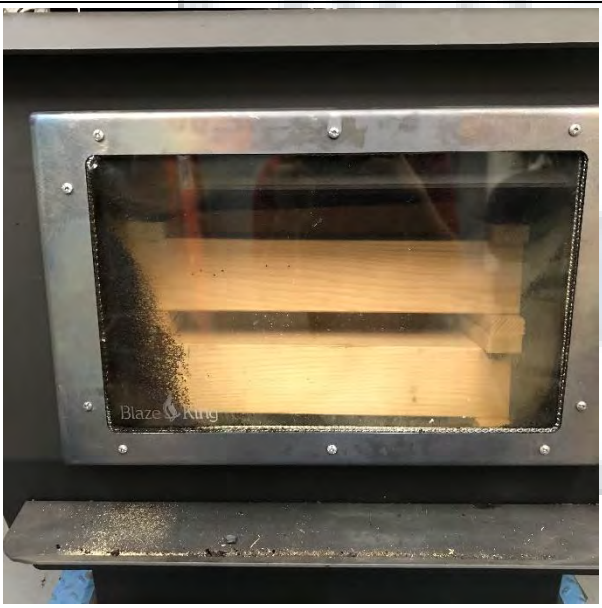
Technician Signature: Date: 7/30/2019

ASTM E2780 Wood Heater Run Sheets

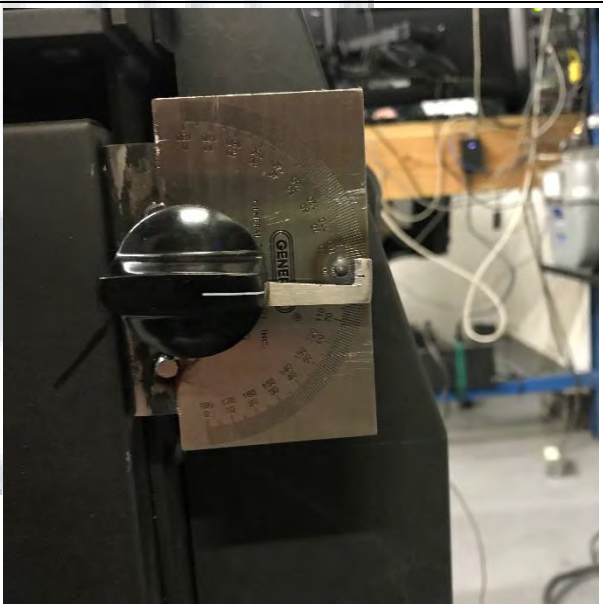
Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 2 Test Date: 7/29/2019

Test Fuel Side View

Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: Date: 7/30/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 3 Data Summary

Client:	Valley Comfort [Blaze King]
Model:	KE40
Job #:	19-509
Tracking #:	0032
Test Date:	7/30/2019

8/7/2019

Techician Signature | Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

Burn Rate (kg/hr):	0.92

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	0.000	109.176	109.756	9.336
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.5			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	7948.3			
Average Gas Meter Temperature (°F)	72.7	98.1	98.7	93.0
Total Sample Volume (dscf)	0.000	99.035	99.905	10.556
Average Tunnel Temperature (°F)	89.0			
Total Time of Test (min)	693			
Total Particulate Catch (mg)	0.0	8.0	8.3	3.2
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000808	0.0000831	0.0003031
Total PM Emissions (g)	0.00	7.42	7.63	2.41
Particulate Emission Rate (g/hr)	0.00	0.64	0.66	2.41
Emissions Factor (g/kg)	-	0.69	0.71	-
Difference from Average Total Particulate Emissions (g)	-	0.11	0.11	-
Difference from Average Emissions Factor (g/kg)	-	0.01	0.01	-

Final Average Results	
Total Particulate Emissions (g)	7.52
Particulate Emission Rate (g/hr)	0.65
Emissions Factor (g/kg)	0.70
HHV Efficiency (%)	82.9%
LHV Efficiency (%)	89.6%
CO Emissions (g/min)	0.38

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	85.0	OK
Face Velocity	< 30 ft/min	8.6	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 68 / Max: 78	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	11.2	OK

B415.1 Efficiency Results

Manufacturer: Valley Comfort [Blaze King]
Model: KE40
Date: 07/30/19
Run: 3
Control #: 19-509
Test Duration: 693
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	82.9%	89.6%
Combustion Efficiency	98.5%	98.5%
Heat Transfer Efficiency	84.1%	90.9%

Output Rate (kJ/h)	15,128	14,350	**(Btu/h)**
Burn Rate (kg/h)	0.92	2.03	**(lb/h)**
Input (kJ/h)	18,253	17,315	**(Btu/h)**

Test Load Weight (dry kg)	10.64	23.46	**dry lb**
MC wet (%)	16.82		
MC dry (%)	20.23		
Particulate (g)	7.52		
CO (g)	265		
Test Duration (h)	11.55		

Emissions	Particulate	CO
g/MJ Output	0.04	1.51
g/kg Dry Fuel	0.71	24.86
g/h	0.65	22.91
g/min	0.01	0.38
lb/MM Btu Output	0.10	3.52

Air/Fuel Ratio (A/F)	13.20

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

WOODSTOVE FUEL DATA - ASTM E2780

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

Preburn Fuel Information

Size	Length (in)	Moisture Content (% DB)	Size	Length (in)	Moisture Content (% DB)
2x4	17.00	25.2	2x4	17.00	23.3
2x4	17.00	21.9	2x4	17.00	23.8
2x4	17.00	23.1	2x4	17.00	25.5
2x4	17.00	24.6	2x4	17.00	21.9
2x4	17.00	22.1	2x4	17.00	22.4
2x4	17.00	23.1	2x4	17.00	21.6
2x4	17.00	21.1			
2x4	17.00	22.4			
Total Fuel Weight (lbs):		25.76	Average Moisture (%DB):		23.0

Firebox Volume (ft^3):	4.35
Total 2x4 Crib Weight, with spacers (lbs):	0.00
Total 4x4 Crib Weight, with spacers (lbs):	28.24
Total Wet Fuel Weight, with spacers (lbs):	28.24

Coal Bed Range (20-25%):
Min (lbs): 5.65
Max (lbs): 7.06

Test Fuel Information

Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	17.75	4.14	19.5	21.0	20.1	3.44
4x4	17.75	4.22	19.8	19.9	18.8	3.53
4x4	17.75	4.20	20.4	18.8	18.9	3.52
4x4	17.75	4.18	20.6	19.3	19.1	3.49
4x4	17.75	4.46	19.1	21.3	22.5	3.69
4x4	17.75	4.42	24.7	20.5	19.8	3.63
					Total Dry Weight, no spacers (lbs):	21.31
					Total Dry Weight, with spacers (lbs):	23.55

Spacer Moisture Readings (%DB)

17.2	19.7	17.9	16.6	18.8	12.4		
12.3	20.0	12.0	16.8	12.2	17.2		
19.0	17.8	17.1	14.9	17.5	17.5		
18.0	19.1	17.7	15.4	16.4	18.8		

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft^3, DB)	28.2	OK
Loading Density	6.3 - 7.7 (lbs/ft^3, WB)	6.49	OK
2x4 Fuel Mix	35 - 65 % of total weight	N/A	N/A

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client:	Valley Comfort [Blaze King]	Job #:	19-509
Model:	KE40	Tracking #:	0032
Run #:	3	Technician:	SJB
Test Start Time:	13:57	Date:	7/30/2019

Total Sampling Time (min):	693
Recording Interval (min):	10
Meter Box γ Factor:	0.998 (A)
Meter Box γ Factor:	1.002 (B)
Meter Box γ Factor:	1.000 (Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	28.67	28.69	28.68
Relative Humidity (%)	14.4	16.7	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		0.000	ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	7/26/2019

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-5	in. Hg
(B)	0.000	cfm @	-6	in. Hg
(Ambient)	0.000	cfm @	0	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.018	97
2	0.036	97
3	0.044	97
4	0.028	97
5	0.030	97
6	0.040	97
7	0.034	97
8	0.024	97
Center	0.044	97

Static Pressure: -0.170 in. H_2O

Dilution Tunnel H_2O:	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	ft^2
V_{strav}:	12.54	ft/sec
V_{scent}:	14.59	ft/sec
F_p:	0.860	[ratio]
Initial Tunnel Flow:	128.8	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

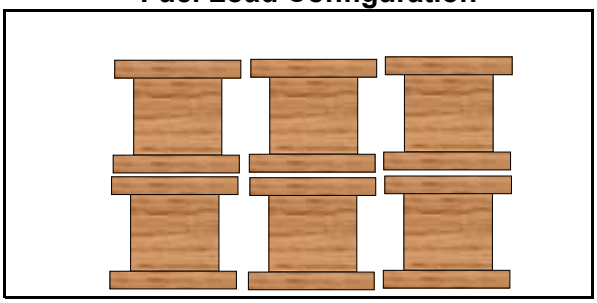
Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	20.2

Fuel Load Configuration

Firebox Front



Firebox Back

Firebox Side View

WOODSTOVE PREBURN DATA - ASTM E2780

Client: Valley Comfort [Blaze Kir
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

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

			Temperatures (°F)							
Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H_2O)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	7.1	-0.030	600	550	352	645	441	517.6	387	82
10	6.7	-0.020	537	508	365	615	444	493.8	207	82
20	6.7	-0.020	469	453	336	539	435	446.4	175	82
30	6.7	-0.010	416	407	311	462	424	404.0	157	81
40	6.8	-0.010	374	369	289	410	414	371.2	143	79
50	6.8	-0.010	339	339	266	371	402	343.4	146	79
60	6.8	-0.010	311	314	245	341	388	319.8	150	79

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.044	0.06	90	1.22		28.2		90	151	84	78
10	1.547	0.155	0.044	1.04	90	3.16	100	27.7	-0.47	91	175	84	78
20	3.113	0.157	0.044	1.08	91	2.27	101	27.1	-0.65	94	227	84	78
30	4.662	0.155	0.044	1.00	93	3.22	100	26.2	-0.87	97	248	84	77
40	6.222	0.156	0.044	1.04	94	2.99	100	25.4	-0.81	96	243	84	77
50	7.777	0.156	0.044	1.11	96	1.45	100	24.5	-0.86	98	250	84	77
60	9.336	0.156	0.044	1.11	97	2.82	100	23.6	-0.92	98	255	84	77
70	10.905	0.157	0.044	1.05	98	1.23	100	22.8	-0.87	98	257	85	76
80	12.480	0.158	0.044	1.09	99	3.12	101	21.8	-0.92	98	253	84	76
90	14.050	0.157	0.044	1.03	100	3.16	100	21.1	-0.78	96	236	84	77
100	15.621	0.157	0.044	0.96	101	2.92	100	20.3	-0.74	96	234	84	77
110	17.187	0.157	0.044	1.11	101	1.65	100	19.5	-0.8	96	237	84	76
120	18.761	0.157	0.044	1.03	101	3.1	100	18.7	-0.77	95	225	83	75
130	20.337	0.158	0.044	1.14	101	2.16	100	18.1	-0.61	93	207	83	75
140	21.908	0.157	0.044	1.07	102	2.99	99	17.6	-0.51	93	197	82	75
150	23.492	0.158	0.044	1.09	101	3.08	100	17.1	-0.48	92	202	82	75
160	25.070	0.158	0.044	0.96	101	1.54	100	16.6	-0.57	93	208	82	74
170	26.654	0.158	0.044	1.01	101	3.24	100	15.9	-0.65	93	219	82	74
180	28.232	0.158	0.044	1.12	101	2.8	100	15.2	-0.73	93	224	82	74
190	29.804	0.157	0.044	0.94	101	1.55	100	14.4	-0.75	93	219	82	74
200	31.379	0.158	0.044	0.96	101	3	100	13.7	-0.7	93	215	82	74
210	32.955	0.158	0.044	1.14	101	2.93	100	13.2	-0.59	92	207	82	74
220	34.529	0.157	0.044	1.09	101	3.22	100	12.7	-0.5	92	205	82	74
230	36.110	0.158	0.044	0.96	101	3.26	100	12.1	-0.52	92	200	81	73
240	37.685	0.158	0.044	1.09	101	2.96	100	11.7	-0.48	91	198	81	74
250	39.269	0.158	0.044	1.14	101	1.48	100	11.2	-0.49	91	195	81	74
260	40.845	0.158	0.044	0.95	101	3.16	100	10.7	-0.43	91	194	81	74
270	42.416	0.157	0.044	1.13	100	1.13	100	10.4	-0.34	91	187	81	74
280	43.990	0.157	0.044	1.12	100	1.13	100	10.1	-0.34	90	187	81	74
290	45.572	0.158	0.044	1.14	100	1.11	100	9.7	-0.36	90	189	81	73
300	47.149	0.158	0.044	1.04	100	2.14	100	9.3	-0.4	90	190	81	73
310	48.727	0.158	0.044	1.13	100	1.46	100	9.0	-0.34	90	196	81	74

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	50.312	0.159	0.044	0.97	100	2.79	100	8.6	-0.34	90	191	80	73
330	51.892	0.158	0.044	1.12	100	1.37	100	8.3	-0.31	89	188	80	73
340	53.472	0.158	0.044	1.08	100	1.31	100	8.0	-0.3	89	184	80	73
350	55.047	0.158	0.044	1.13	100	3.25	100	7.7	-0.28	89	182	80	73
360	56.626	0.158	0.044	0.96	99	3.23	100	7.5	-0.27	89	182	80	73
370	58.213	0.159	0.044	1.13	99	1.64	101	7.2	-0.24	89	184	80	73
380	59.788	0.158	0.044	1.03	99	1.11	100	7.0	-0.24	88	182	80	73
390	61.374	0.159	0.044	0.94	99	3.27	100	6.7	-0.26	88	184	79	72
400	62.953	0.158	0.044	0.97	99	2.94	100	6.5	-0.24	88	182	79	72
410	64.538	0.158	0.044	1.13	99	1.48	100	6.3	-0.22	88	183	79	72
420	66.121	0.158	0.044	0.98	99	1.43	100	6.0	-0.22	87	183	79	72
430	67.701	0.158	0.044	1.02	99	3.19	100	5.8	-0.2	86	182	79	71
440	69.278	0.158	0.044	1.03	98	1.12	100	5.6	-0.19	86	181	79	72
450	70.857	0.158	0.044	0.97	98	3.27	100	5.4	-0.22	86	175	79	71
460	72.435	0.158	0.044	0.98	98	2.36	100	5.2	-0.2	86	178	78	72
470	74.023	0.159	0.044	1.14	98	1.18	100	5.0	-0.2	85	177	78	71
480	75.597	0.157	0.044	0.97	98	3.16	100	4.8	-0.23	85	178	78	71
490	77.173	0.158	0.044	0.95	98	2.98	100	4.6	-0.19	85	183	78	71
500	78.751	0.158	0.044	1.13	97	1.42	100	4.4	-0.23	85	185	78	71
510	80.326	0.157	0.044	1.12	97	2.94	100	4.2	-0.22	85	182	78	70
520	81.898	0.157	0.044	1.06	97	2.97	100	3.9	-0.24	85	185	78	70
530	83.470	0.157	0.044	1.15	97	2.29	100	3.7	-0.22	85	188	77	70
540	85.043	0.157	0.044	1.14	97	1.4	100	3.5	-0.24	85	183	77	70
550	86.625	0.158	0.044	1.12	97	3.27	100	3.2	-0.25	85	188	77	70
560	88.195	0.157	0.044	1.05	97	1.19	99	3.0	-0.24	84	188	77	70
570	89.773	0.158	0.044	1.07	97	3.01	100	2.7	-0.28	85	188	77	70
580	91.355	0.158	0.044	1.14	96	2.88	100	2.4	-0.29	85	189	77	70
590	92.935	0.158	0.044	1.09	96	1.23	100	2.1	-0.27	84	184	77	69
600	94.516	0.158	0.044	1.14	96	1.45	100	1.9	-0.21	84	180	77	69
610	96.092	0.158	0.044	0.97	96	3.28	100	1.7	-0.21	84	178	77	70
620	97.669	0.158	0.044	1.01	96	1.18	100	1.5	-0.21	83	174	76	69
630	99.246	0.158	0.044	0.98	96	1.84	100	1.3	-0.2	83	170	76	69

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
640	100.833	0.159	0.044	1.15	96	3.17	101	1.1	-0.18	83	171	76	69
650	102.410	0.158	0.044	1.00	96	3	100	0.9	-0.19	83	173	76	69
660	103.981	0.157	0.044	1.11	95	3.08	100	0.7	-0.2	83	175	76	69
670	105.555	0.157	0.044	1.15	95	2.58	100	0.6	-0.16	83	175	76	69
680	107.135	0.158	0.044	1.13	95	1.13	100	0.4	-0.21	83	176	76	69
690	108.704	0.157	0.044	1.07	95	1.1	100	0.1	-0.22	83	180	76	69
693	109.176	0.047	0.044	1.05	95	1.49	100	0.0	-0.13	83	181	76	68
Avg/Tot	109.176	0.156	0.044	1.05	98	2.30	100			89	196	80	72.7

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.00	88	1		83	-0.010	5.84	0.00
10	1.519	0.152	1.21	88	15.14	98	84	-0.020	7.13	0.00
20	3.046	0.153	1.11	89	11.8	99	83	-0.020	8.54	0.01
30	4.561	0.152	1.13	91	3.25	98	84	-0.020	8.92	0.16
40	6.063	0.150	1.11	93	-0.9	96	84	-0.020	7.84	0.06
50	7.571	0.151	1.15	95	-2.16	97	84	-0.020	9.00	0.12
60	9.081	0.151	1.12	96	4.64	97	84	-0.020	9.08	0.00
70	10.624	0.154	1.27	98	6.98	98	84	-0.020	9.90	0.00
80	12.191	0.157	1.28	99	6.65	100	84	-0.020	9.41	0.00
90	13.764	0.157	1.20	99	3.26	100	83	-0.020	8.81	0.00
100	15.336	0.157	1.23	100	0.86	100	83	-0.020	9.58	0.00
110	16.912	0.158	1.26	101	0.54	100	83	-0.020	10.51	0.02
120	18.485	0.157	1.12	101	-0.75	99	83	-0.020	9.99	0.16
130	20.063	0.158	1.30	101	0.45	100	82	-0.020	9.33	0.05
140	21.645	0.158	1.30	102	0.96	100	82	-0.020	9.24	0.01
150	23.227	0.158	1.30	102	-1.25	100	81	-0.020	9.80	0.00
160	24.810	0.158	1.14	102	0.8	100	81	-0.020	10.76	0.28
170	26.393	0.158	1.14	102	3.2	100	81	-0.020	10.59	1.22
180	27.973	0.158	1.25	101	1.85	100	81	-0.020	10.14	1.97
190	29.557	0.158	1.19	101	2.19	100	81	-0.020	9.92	2.28
200	31.141	0.158	1.21	101	6.59	100	81	-0.020	9.91	1.79
210	32.722	0.158	1.29	101	-0.27	100	81	-0.020	10.03	1.00
220	34.307	0.159	1.30	101	2.1	100	81	-0.020	10.13	0.64
230	35.893	0.159	1.21	101	-1.76	100	81	-0.020	10.34	0.55
240	37.480	0.159	1.24	101	0.58	100	80	-0.020	10.34	0.37
250	39.065	0.159	1.20	101	4.34	100	80	-0.020	10.24	0.25
260	40.651	0.159	1.27	101	1.45	100	80	-0.020	9.88	0.00
270	42.242	0.159	1.32	101	7.87	100	80	-0.020	9.06	0.00
280	43.830	0.159	1.14	101	-0.87	100	80	-0.020	9.28	0.00
290	45.420	0.159	1.26	101	-0.3	100	80	-0.020	10.05	0.00
300	47.013	0.159	1.31	101	4.77	100	80	-0.020	10.04	0.00
310	48.606	0.159	1.22	101	-0.6	100	80	-0.020	9.77	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	50.201	0.160	1.29	101	5.94	100	80	-0.020	9.44	0.00
330	51.792	0.159	1.23	101	0.05	100	80	-0.020	9.11	0.00
340	53.386	0.159	1.26	101	7.19	100	80	-0.020	9.13	0.00
350	54.980	0.159	1.30	101	-1.53	100	79	-0.010	9.07	0.00
360	56.573	0.159	1.24	101	4.01	100	79	-0.010	9.03	0.00
370	58.166	0.159	1.31	100	6.79	100	79	-0.010	9.35	0.00
380	59.759	0.159	1.28	100	4.6	100	79	-0.010	9.23	0.00
390	61.354	0.160	1.22	100	5.95	100	79	-0.010	9.16	0.00
400	62.946	0.159	1.26	100	0.1	100	79	-0.010	9.20	0.00
410	64.541	0.160	1.25	100	-0.57	100	78	-0.010	8.96	0.00
420	66.139	0.160	1.28	100	7.17	100	78	-0.010	8.83	0.00
430	67.735	0.160	1.31	100	1.32	100	78	-0.010	8.58	0.00
440	69.333	0.160	1.20	100	0.27	100	78	-0.010	8.92	0.00
450	70.927	0.159	1.27	99	7.09	100	78	-0.010	8.86	0.00
460	72.523	0.160	1.29	99	0.95	100	78	-0.010	8.51	0.00
470	74.120	0.160	1.28	99	-0.3	100	77	-0.010	8.51	0.00
480	75.716	0.160	1.34	99	5.62	100	77	-0.010	8.92	0.00
490	77.316	0.160	1.20	99	2.25	101	77	-0.020	8.87	0.00
500	78.913	0.160	1.31	99	0.18	100	77	-0.010	8.94	0.00
510	80.511	0.160	1.27	99	5.18	100	77	-0.020	8.70	0.00
520	82.107	0.160	1.26	98	6.02	101	77	-0.020	8.78	0.00
530	83.705	0.160	1.31	98	5.99	101	77	-0.020	8.76	0.00
540	85.302	0.160	1.25	98	4.55	101	77	-0.020	8.69	0.00
550	86.898	0.160	1.34	98	-0.04	101	77	-0.010	9.20	0.00
560	88.499	0.160	1.17	98	0.32	101	76	-0.020	9.26	0.00
570	90.097	0.160	1.27	98	4.41	101	76	-0.020	9.99	0.00
580	91.694	0.160	1.18	98	6.59	101	76	-0.020	9.87	0.00
590	93.290	0.160	1.24	97	3.68	101	76	-0.020	9.58	0.00
600	94.890	0.160	1.28	97	0.58	101	76	-0.010	9.23	0.00
610	96.487	0.160	1.34	97	2.93	101	76	-0.010	8.70	0.00
620	98.085	0.160	1.20	97	7.85	101	76	-0.010	8.38	0.00
630	99.686	0.160	1.33	97	-1.28	101	76	-0.010	8.18	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
640	101.288	0.160	1.29	97	-2.21	101	75	-0.010	8.15	0.00
650	102.882	0.159	1.17	97	6.52	100	75	-0.010	8.06	0.00
660	104.480	0.160	1.29	97	5.24	101	75	-0.010	7.99	0.00
670	106.076	0.160	1.21	96	7.9	101	75	-0.010	7.67	0.00
680	107.674	0.160	1.28	96	2.26	101	75	-0.010	7.83	0.00
690	109.274	0.160	1.27	96	8.27	101	75	-0.020	7.86	0.00
693	109.756	0.048	1.28	96	6.86	101	75	-0.020	8.09	0.00
Avg/Tot	109.756	0.157	1.23	99	3.11	100	79	-0.016	9.11	0.15

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

Stove ΔT: 11

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	311	314	245	341	388	319.8	535
10	270	274	199	320	377	288.0	552
20	250	256	193	355	370	284.8	774
30	250	258	199	394	368	293.8	799
40	255	263	203	412	368	300.2	777
50	261	268	208	432	370	307.8	852
60	268	274	211	458	374	317.0	873
70	278	280	215	484	379	327.2	930
80	289	291	222	511	386	339.8	934
90	295	299	225	505	391	343.0	882
100	300	306	230	497	394	345.4	890
110	305	315	237	518	393	353.6	936
120	308	324	244	531	391	359.6	931
130	306	324	242	534	386	358.4	911
140	302	321	238	527	381	353.8	877
150	299	318	236	514	377	348.8	867
160	299	320	239	522	373	350.6	906
170	303	325	243	542	371	356.8	929
180	309	331	245	555	368	361.6	923
190	313	336	250	554	366	363.8	909
200	317	340	251	552	363	364.6	899
210	319	344	251	550	360	364.8	891
220	320	347	253	547	357	364.8	888
230	321	348	256	544	355	364.8	893
240	321	350	258	542	353	364.8	893
250	321	350	258	541	350	364.0	902
260	321	351	258	536	348	362.8	887
270	320	350	258	515	345	357.6	841
280	318	348	258	494	343	352.2	822
290	316	347	261	487	342	350.6	829
300	316	349	262	490	342	351.8	839
310	318	351	265	492	345	354.2	839
320	318	352	267	488	347	354.4	825
330	318	353	270	480	349	354.0	807
340	318	353	272	470	349	352.4	794
350	317	352	275	462	348	350.8	784
360	316	352	277	454	347	349.2	770
370	315	352	281	449	346	348.6	769
380	315	353	283	448	346	349.0	770
390	315	355	285	447	346	349.6	770
400	317	356	285	447	347	350.4	776
410	319	356	285	446	350	351.2	766
420	320	355	284	441	354	350.8	755
430	320	354	283	435	357	349.8	747
440	319	357	285	431	358	350.0	741
450	320	367	289	414	358	349.6	701
460	318	369	290	410	358	349.0	705
470	316	367	289	409	357	347.6	712

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

Stove ΔT: 11

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	315	361	287	420	357	348.0	747
490	315	358	288	429	358	349.6	758
500	315	358	288	433	358	350.4	760
510	315	358	289	433	356	350.2	758
520	317	353	289	434	355	349.6	761
530	320	347	289	435	353	348.8	766
540	324	342	288	437	353	348.8	768
550	329	338	287	440	353	349.4	776
560	336	335	285	448	354	351.6	791
570	343	332	282	457	356	354.0	809
580	348	332	283	466	362	358.2	816
590	349	333	284	469	370	361.0	803
600	348	332	283	460	376	359.8	781
610	348	330	282	449	380	357.8	762
620	358	326	277	415	382	351.6	674
630	364	320	270	392	383	345.8	657
640	367	314	263	383	384	342.2	651
650	374	309	257	375	383	339.6	643
660	380	305	253	372	380	338.0	643
670	383	301	247	371	377	335.8	646
680	386	297	241	370	372	333.2	647
690	390	295	237	369	367	331.6	649
693	391	294	236	370	364	331.0	650
Average	320	330	259	459	364	346	793

LAB SAMPLE DATA - ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 3

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/30/2019

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	3551	121.8	121.8	125.0	3.2
Train A Filters - Remainder	3552	115.9	231.9	234.6	2.7
	3553	116.0			
Train A Probe	13A	117455.8	117455.8	117456.4	0.6
Train A O-Rings	13A	3359.0	3359.0	3360.5	1.5
Train B Filters	3554	122.6	246.4	252.6	6.2
	3555	123.8			
Train B Probe	13B	117054.9	117054.9	117055.3	0.4
Train B O-Rings	13B	3443.6	3443.6	3445.3	1.7
Background Filter			0.0	0.0	

Placed in Dessicator on:	8/5 - 8:00

Train A Filters - First Hour	124.9	8/6 16:06	125.0	8/7 15:59				
Train A Filters - Remainder	234.6	8/6 16:06	234.6	8/7 16:00				
Train A Probe	117456.3	8/6 16:06	117456.4	8/7 16:01				
Train A O-Rings	3360.5	8/6 16:06	3360.5	8/7 16:01				
Train B Filters	252.6	8/6 16:06	252.6	8/7 16:01				
Train B Probe	117055.3	8/6 16:06	117055.3	8/7 16:01				
Train B O-Rings	3445.3	8/6 16:06	3445.3	8/7 16:01				
Background Filter								

1st hour Sub-Total, mg:	3.2
Remainder Sub-Total, mg:	4.8
Train 1 Aggregate, mg:	**8.0**
Train 2 Aggregate, mg:	**8.3**
Ambient Aggregate, mg:	0.0

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 3 Test Date: 7/30/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Medium Low Test Setting (80° Counterclockwise from fully open)
Targeted Burn Category: II

Preburn Notes

Time	Notes
-	Loaded 26 lbs of preburn, fan on high, bypass closed, burn down to target weight before turn down.
0 min	@7.0 lbs, turned air down to test setting, fan turned down to medium low.
45 min	@6.8 lbs, raked coal bed.
60 min	@7.8 lbs, zeroed scale in preparation of test fuel loading.

Test Notes

Test Burn Start Time: 13:57 Test Fuel Loaded by: 25 seconds
Door Closed: 30 seconds Air Control Set at: 0 seconds
Other Loading Notes: Bypass closed @ 0 sec

Time	Notes
0 min	Loaded test fuel load
60 min	Changed 1-hr filter
693 min	End of test

Test Burn End Time: 7/31 - 01:30

Flue Gas Concentration Measurement

Calibration Gas Values:
Span Gas CO_2 (%): 16.89 CO (%): 4.33
Mid Gas CO_2 (%): 10.07 CO (%): 2.53

Calibration Results:

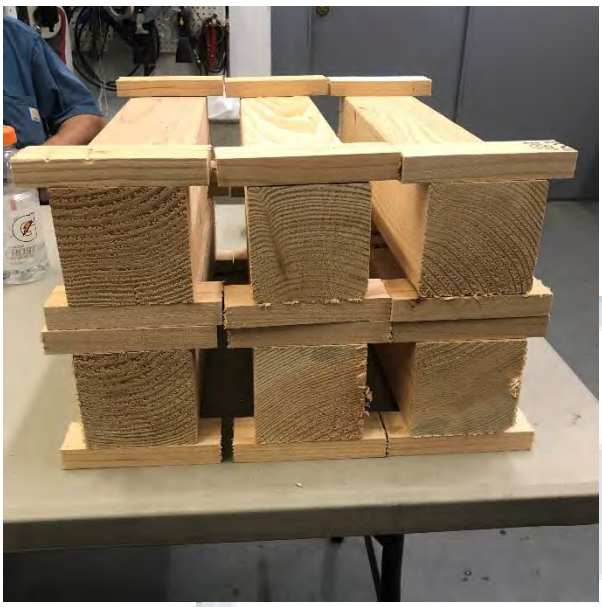
	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	13:25	13:33	13:30	7/31 - 7:52	7/31 - 7:56	7/31 - 7:54
CO_2	0.00	10.25	16.85	0.00	10.25	16.91
CO	0.00	2.54	4.41	0.00	2.52	4.33

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

Technician Signature: Date: 7/31/2019

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 3 Test Date: 7/30/2019



Test Fuel Side View

Test Fuel Iso View

Test Fuel Loaded in Stove

Air Setting

Technician Signature: Date: 7/31/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 4 Data Summary

Client:	Valley Comfort [Blaze King]
Model:	KE40
Job #:	19-509
Tracking #:	0032
Test Date:	7/31/2019

8/7/2019

Techician Signature Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

Burn Rate (kg/hr):	1.55

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	56.815	61.349	61.363	9.152
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.7			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	7915.3			
Average Gas Meter Temperature (°F)	76.7	100.4	99.6	88.1
Total Sample Volume (dscf)	53.509	55.471	55.807	10.344
Average Tunnel Temperature (°F)	102.8			
Total Time of Test (min)	398			
Total Particulate Catch (mg)	0.2	10.4	9.8	4.2
Particulate Concentration, dry-standard (g/dscf)	0.0000037	0.0001875	0.0001756	0.0004060
Total PM Emissions (g)	0.20	9.65	9.02	3.18
Particulate Emission Rate (g/hr)	0.03	1.45	1.36	3.18
Emissions Factor (g/kg)	-	0.94	0.88	-
Difference from Average Total Particulate Emissions (g)	-	0.31	0.31	-
Difference from Average Emissions Factor (g/kg)	-	0.03	0.03	-

Final Average Results	
Total Particulate Emissions (g)	9.34
Particulate Emission Rate (g/hr)	1.41
Emissions Factor (g/kg)	0.91
HHV Efficiency (%)	79.5%
LHV Efficiency (%)	85.9%
CO Emissions (g/min)	0.33

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	88.0	OK
Face Velocity	< 30 ft/min	8.4	OK
Leakage Rate	Less than 4% of average sample rate	0.003 cfm	OK
Ambient Temp	55-90 °F	Min: 72 / Max: 81	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	0.2	OK

B415.1 Efficiency Results

Manufacturer: Valley Comfort [Blaze King]
Model: KE40
Date: 07/31/19
Run: 4
Control #: 19-509
Test Duration: 398
Output Category: 3

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	79.5%	85.9%
Combustion Efficiency	99.3%	99.3%
Heat Transfer Efficiency	80.0%	86.5%

Output Rate (kJ/h)	24,352	23,101	**(Btu/h)**
Burn Rate (kg/h)	1.55	3.41	**(lb/h)**
Input (kJ/h)	30,633	29,059	**(Btu/h)**

Test Load Weight (dry kg)	10.26	22.61	**dry lb**
MC wet (%)	18.91		
MC dry (%)	23.32		
Particulate (g)	9.34		
CO (g)	131		
Test Duration (h)	6.63		

Emissions	Particulate	CO
g/MJ Output	0.06	0.81
g/kg Dry Fuel	0.91	12.78
g/h	1.41	19.76
g/min	0.02	0.33
lb/MM Btu Output	0.13	1.89

Air/Fuel Ratio (A/F)	12.30

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

WOODSTOVE FUEL DATA - ASTM E2780

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

Preburn Fuel Information

Size	Length (in)	Moisture Content (% DB)	Size	Length (in)	Moisture Content (% DB)
2x4	17.00	21.9	2x4	17.00	24.2
2x4	17.00	21.9	2x4	17.00	22.3
2x4	17.00	20.6	2x4	17.00	24.6
2x4	17.00	24.7	2x4	17.00	21.4
2x4	17.00	18.8	2x4	17.00	25.3
2x4	17.00	19.3	2x4	17.00	21.9
2x4	17.00	21.9			
2x4	17.00	23.8			
Total Fuel Weight (lbs):		25.16	Average Moisture (%DB):		22.3

Firebox Volume (ft^3):	4.35
Total 2x4 Crib Weight, with spacers (lbs):	0.00
Total 4x4 Crib Weight, with spacers (lbs):	27.88
Total Wet Fuel Weight, with spacers (lbs):	27.88

Coal Bed Range (20-25%):
Min (lbs): 5.58
Max (lbs): 6.97

Test Fuel Information

Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	17.75	4.30	23.2	24.8	23.3	3.47
4x4	17.75	3.96	20.1	24.9	20.3	3.25
4x4	17.75	4.36	25.8	22.2	23.8	3.52
4x4	17.75	4.32	24.4	23.2	22.3	3.50
4x4	17.75	3.94	24.6	22.4	23.8	3.19
4x4	17.75	4.34	23.0	24.5	23.2	3.51
					Total Dry Weight, no spacers (lbs):	20.45
					Total Dry Weight, with spacers (lbs):	22.70

Spacer Moisture Readings (%DB)

21.0	17.2	20.9	19.0	19.7	11.3		
24.6	16.8	21.9	19.5	23.8	15.1		
18.8	11.0	17.3	17.3	24.5	18.6		
10.7	10.2	16.9	23.8	19.8	16.6		

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft^3, DB)	27.1	OK
Loading Density	6.3 - 7.7 (lbs/ft^3, WB)	6.41	OK
2x4 Fuel Mix	35 - 65 % of total weight	N/A	N/A

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client:	Valley Comfort [Blaze King]	Job #:	19-509
Model:	KE40	Tracking #:	0032
Run #:	4	Technician:	SJB
Test Start Time:	8:11	Date:	7/31/2019

Total Sampling Time (min):	398
Recording Interval (min):	10
Meter Box γ Factor:	0.998 (A)
Meter Box γ Factor:	1.002 (B)
Meter Box γ Factor:	0.998 (Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	28.74	28.68	28.71
Relative Humidity (%)	12.4	10.3	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		56.815	ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	7/26/2019

Sample Train Post-Test Leak Checks

(A)	0.001	cfm @	-6	in. Hg
(B)	0.003	cfm @	-6	in. Hg
(Ambient)	0.000	cfm @	-15	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.020	101
2	0.034	101
3	0.044	101
4	0.030	101
5	0.028	101
6	0.040	101
7	0.038	101
8	0.024	101
Center	0.044	101

Static Pressure: -0.170 in. H_2O

Dilution Tunnel H_2O:	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	ft^2
V_{strav}:	12.67	ft/sec
V_{scent}:	14.62	ft/sec
F_p:	0.866	[ratio]
Initial Tunnel Flow:	129.6	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

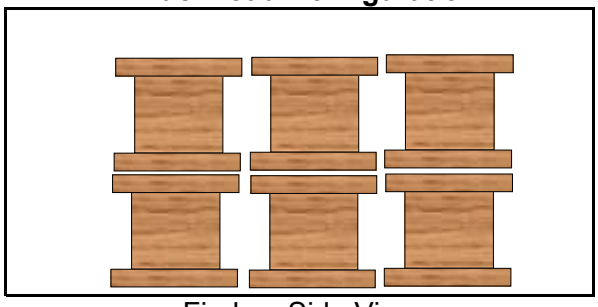
Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	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

Firebox Front



Firebox Back

Firebox Side View

WOODSTOVE PREBURN DATA - ASTM E2780

Client: Valley Comfort [Blaze Kir
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

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

			Temperatures (°F)							
Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H_2O)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	8.4	-0.040	613	534	322	658	404	506.2	427	74
10	7.6	-0.030	568	514	337	653	404	495.2	298	74
20	7.3	-0.020	514	485	322	590	403	462.8	267	75
30	7.0	-0.020	483	472	316	520	408	439.8	261	73
40	6.7	-0.020	469	474	317	484	419	432.6	262	74
50	6.4	-0.020	456	471	323	454	429	426.6	265	73
60	6.2	-0.020	432	451	307	441	433	412.8	256	72

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.044	0.07	84	1.26		27.9		94	257	79	73
10	1.504	0.150	0.044	0.96	84	1.6	100	26.6	-1.25	101	313	82	72
20	3.033	0.153	0.044	0.94	86	1.51	102	25.4	-1.19	103	331	83	74
30	4.559	0.153	0.044	1.10	88	2.97	101	24.2	-1.28	105	335	83	73
40	6.086	0.153	0.044	1.09	90	3.23	101	22.9	-1.28	107	345	84	73
50	7.627	0.154	0.044	0.99	92	2.97	102	21.5	-1.42	105	334	84	73
60	9.152	0.153	0.044	0.92	93	3.28	100	20.3	-1.12	105	333	84	73
70	10.723	0.157	0.044	1.09	95	3.12	103	19.1	-1.21	106	339	85	73
80	12.263	0.154	0.044	0.92	96	3.14	101	18.0	-1.14	105	341	85	74
90	13.809	0.155	0.044	1.04	97	1.15	101	16.9	-1.05	105	337	85	74
100	15.365	0.156	0.044	1.12	98	1.72	102	15.9	-1.05	105	333	85	74
110	16.912	0.155	0.044	0.91	99	3.18	101	14.8	-1.09	106	342	85	75
120	18.460	0.155	0.044	0.96	100	3.26	101	13.9	-0.88	105	331	85	75
130	20.012	0.155	0.044	0.96	100	1.47	101	13.0	-0.9	105	334	85	75
140	21.570	0.156	0.044	1.03	101	1.57	101	12.1	-0.91	104	333	85	76
150	23.116	0.155	0.044	1.04	101	1.66	101	11.1	-0.98	107	344	86	76
160	24.662	0.155	0.044	1.07	102	1.84	100	10.0	-1.11	108	345	86	77
170	26.199	0.154	0.044	1.02	102	2.9	100	9.0	-0.98	107	333	87	77
180	27.745	0.155	0.044	0.93	103	1.84	100	8.4	-0.64	103	308	87	77
190	29.292	0.155	0.044	1.10	103	3.3	100	7.9	-0.52	101	291	86	77
200	30.835	0.154	0.044	0.94	104	1.18	99	7.4	-0.5	101	287	86	77
210	32.373	0.154	0.044	1.01	104	1.49	99	6.9	-0.53	102	290	86	77
220	33.919	0.155	0.044	0.93	104	1.13	100	6.3	-0.57	102	297	86	77
230	35.458	0.154	0.044	1.01	104	1.45	99	5.7	-0.55	102	297	86	77
240	37.004	0.155	0.044	0.94	104	3.21	100	5.3	-0.47	102	286	86	77
250	38.543	0.154	0.044	1.06	104	3.25	99	4.8	-0.46	102	279	86	78
260	40.096	0.155	0.044	1.09	104	1.25	100	4.3	-0.48	102	282	86	78
270	41.634	0.154	0.044	1.05	104	1.16	99	3.9	-0.47	102	285	86	78
280	43.168	0.153	0.044	1.02	105	3.12	99	3.5	-0.4	102	276	86	78
290	44.713	0.155	0.044	0.93	105	3.07	99	3.1	-0.32	101	267	86	79
300	46.249	0.154	0.044	0.94	105	1.37	99	2.8	-0.29	101	260	86	79
310	47.795	0.155	0.044	1.09	105	3.26	99	2.6	-0.29	100	258	86	79

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	49.342	0.155	0.044	1.09	105	1.13	99	2.3	-0.25	100	257	87	79
330	50.888	0.155	0.044	1.08	105	2.79	99	2.0	-0.3	100	260	87	79
340	52.429	0.154	0.044	0.92	105	1.15	99	1.7	-0.3	101	259	87	79
350	53.966	0.154	0.044	1.12	106	1.81	99	1.4	-0.32	101	262	87	80
360	55.503	0.154	0.044	1.14	106	3.12	99	1.1	-0.33	101	257	87	80
370	57.044	0.154	0.044	1.11	106	2.46	99	0.8	-0.26	101	256	87	80
380	58.581	0.154	0.044	1.09	106	3.04	99	0.5	-0.25	101	254	87	80
390	60.120	0.154	0.044	1.03	106	1.16	99	0.3	-0.26	101	254	88	80
398	61.349	0.123	0.044	1.08	106	2.5	99	0.0	-0.28	101	255	88	81
Avg/Tot	61.349	0.153	0.044	1.00	100	2.22	100			103	298	86	76.7

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.00	81	1		79	-0.020	7.69	0.00
10	1.539	0.154	1.17	81	-4.84	103	82	-0.030	9.05	0.03
20	3.084	0.155	1.21	83	-0.87	103	82	-0.030	9.60	0.03
30	4.586	0.150	1.24	86	17.28	100	83	-0.030	9.78	0.02
40	6.101	0.152	1.13	88	-5.03	101	83	-0.030	12.69	1.84
50	7.620	0.152	1.14	90	11.57	100	83	-0.030	9.04	0.02
60	9.144	0.152	1.14	92	11.71	100	84	-0.030	10.41	0.02
70	10.670	0.153	1.11	94	9.87	100	84	-0.030	10.48	0.00
80	12.195	0.153	1.22	95	7.16	100	84	-0.030	10.36	0.02
90	13.724	0.153	1.15	96	-0.21	100	84	-0.030	10.40	0.00
100	15.252	0.153	1.19	97	4.56	100	85	-0.030	11.07	0.00
110	16.779	0.153	1.13	98	1.69	100	85	-0.030	10.50	0.00
120	18.310	0.153	1.07	99	-2.19	100	85	-0.030	10.02	0.00
130	19.844	0.153	1.14	100	8.69	100	85	-0.030	11.00	0.00
140	21.376	0.153	1.21	100	10.49	99	85	-0.030	10.91	0.04
150	22.921	0.155	1.22	101	0.3	100	85	-0.030	12.51	0.46
160	24.463	0.154	1.09	101	1.35	100	86	-0.030	11.76	0.75
170	26.008	0.155	1.16	102	7.19	100	87	-0.030	11.45	0.23
180	27.551	0.154	1.24	102	6.57	100	86	-0.030	9.73	0.02
190	29.091	0.154	1.20	102	7.06	99	86	-0.020	9.24	0.01
200	30.632	0.154	1.19	103	4.42	99	86	-0.020	9.48	0.00
210	32.177	0.155	1.15	103	1.02	100	85	-0.020	9.84	0.00
220	33.723	0.155	1.15	103	-0.53	100	86	-0.020	9.81	0.00
230	35.266	0.154	1.24	103	5.55	99	86	-0.020	9.52	0.01
240	36.809	0.154	1.15	104	-1.18	99	86	-0.020	9.40	0.01
250	38.353	0.154	1.10	104	6	99	86	-0.020	9.85	0.00
260	39.902	0.155	1.21	104	-1.48	100	86	-0.020	10.31	0.00
270	41.450	0.155	1.18	104	6.05	100	86	-0.020	10.16	0.00
280	42.998	0.155	1.23	104	-1.68	100	87	-0.020	9.66	0.00
290	44.547	0.155	1.12	105	5.39	99	86	-0.020	9.46	0.00
300	46.095	0.155	1.09	105	6.88	99	87	-0.020	9.05	0.01
310	47.649	0.155	1.24	105	3.87	100	87	-0.020	8.98	0.01

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	49.203	0.155	1.11	105	-1.81	100	87	-0.020	8.98	0.00
330	50.760	0.156	1.13	105	7	100	87	-0.020	9.35	0.01
340	52.316	0.156	1.16	105	4.31	100	87	-0.020	9.65	0.01
350	53.873	0.156	1.17	105	0.79	100	87	-0.020	9.25	0.00
360	55.431	0.156	1.20	105	0	100	87	-0.020	8.88	0.01
370	56.996	0.157	1.21	106	2.78	100	87	-0.020	8.67	0.01
380	58.551	0.156	1.11	106	6.05	100	87	-0.020	8.65	0.01
390	60.115	0.156	1.27	106	-0.36	100	88	-0.020	8.67	0.01
398	61.363	0.125	1.20	106	7.39	100	88	-0.020	8.94	0.01
Avg/Tot	61.363	0.153	1.14	100	3.75	100	85	-0.024	9.86	0.09

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

Stove ΔT: 0

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	432	450	306	440	433	412.2	740
10	362	385	232	438	438	371.0	854
20	331	358	225	465	437	363.2	890
30	328	355	230	494	435	368.4	935
40	337	359	233	513	435	375.4	971
50	366	377	229	538	435	389.0	947
60	362	373	238	546	429	389.6	994
70	370	381	235	567	424	395.4	1010
80	378	388	234	574	420	398.8	1034
90	378	390	244	580	414	401.2	1006
100	388	401	246	590	409	406.8	1027
110	404	410	245	594	405	411.6	1048
120	402	406	247	583	399	407.4	1027
130	398	405	251	593	391	407.6	1061
140	403	420	255	599	386	412.6	1031
150	419	418	266	604	381	417.6	1079
160	444	438	285	620	377	432.8	1095
170	440	477	294	617	376	440.8	1071
180	430	486	294	604	377	438.2	1009
190	422	471	284	563	377	423.4	945
200	414	462	280	533	378	413.4	920
210	411	461	281	521	380	410.8	927
220	410	465	283	523	382	412.6	949
230	411	466	285	521	386	413.8	934
240	414	468	287	509	390	413.6	896
250	419	467	291	495	396	413.6	860
260	435	465	303	487	403	418.6	861
270	446	472	309	489	412	425.6	864
280	448	478	309	482	421	427.6	843
290	449	479	309	471	429	427.4	805
300	451	473	310	461	437	426.4	784
310	453	466	302	449	440	422.0	770
320	453	459	299	443	441	419.0	765
330	457	452	300	441	440	418.0	768
340	460	448	305	438	441	418.4	766
350	463	448	309	432	445	419.4	753
360	466	448	308	429	449	420.0	751
370	463	438	294	429	455	415.8	750
380	457	430	291	427	464	413.8	752
390	452	426	292	422	471	412.6	738
398	450	426	293	417	476	412.4	738
Average	416	433	276	511	417	411	902

LAB SAMPLE DATA - ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 4

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	3556	116.8	116.8	121.0	4.2
Train A Filters - Remainder	3557	115.1	236.8	240.6	3.8
	3558	121.7			
Train A Probe	14A	116817.7	116817.7	116818.3	0.6
Train A O-Rings	14A	3364.2	3364.2	3366.0	1.8
Train B Filters	3559	116.1	231.4	238.5	7.1
	3560	115.3			
Train B Probe	14B	116771.5	116771.5	116772.0	0.5
Train B O-Rings	14B	3338.5	3338.5	3340.7	2.2
Background Filter	3561	123.2	123.2	123.4	0.2

Placed in Dessicator on:	8/5 - 8:00

Train A Filters - First Hour	121.2	8/6 16:03	121.0	8/7 16:02				
Train A Filters - Remainder	240.7	8/6 16:03	240.6	8/7 16:02				
Train A Probe	116818.4	8/6 16:03	116818.3	8/7 16:04				
Train A O-Rings	3366.0	8/6 16:03	3366.0	8/7 16:04				
Train B Filters	238.5	8/6 16:03	238.5	8/7 16:04				
Train B Probe	116772.0	8/6 16:04	116772.0	8/7 16:04				
Train B O-Rings	3340.6	8/6 16:04	3340.7	8/7 16:04				
Background Filter	123.4	8/6 16:04	123.4	8/7 16:04				

1st hour Sub-Total, mg:	4.2
Remainder Sub-Total, mg:	6.2
Train 1 Aggregate, mg:	**10.4**
Train 2 Aggregate, mg:	**9.8**
Ambient Aggregate, mg:	0.2

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 4 Test Date: 7/31/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Medium High Test Setting (50° Counterclockwise from fully open)
Targeted Burn Category: III

Preburn Notes

Time	Notes
-	Loaded 26.4 lbs of preburn, fan on high, bypass closed, burn down to target weight before turn down.
0 min	@8.3 lbs, turned air down to test setting, fan turned down to medium high.
45 min	@6.5 lbs, raked coal bed.
60 min	@6.1 lbs, zeroed scale in preparation of test fuel loading.

Test Notes

Test Burn Start Time: 8:11 Test Fuel Loaded by: 30 seconds
Door Closed: 40 seconds Air Control Set at: 0 seconds
Other Loading Notes: Bypass closed @ 0 sec

Time	Notes
0 min	Loaded test fuel load
60 min	Changed 1-hr filter
398 min	End of test

Test Burn End Time: 14:49

Flue Gas Concentration Measurement

Calibration Gas Values:
Span Gas CO_2 (%): 16.89 CO (%): 4.33
Mid Gas CO_2 (%): 10.07 CO (%): 2.53

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	7:52	7:56	7:54	18:28	18:31	18:30
CO_2	0.00	10.25	16.91	0.00	9.67	16.88
CO	0.00	2.52	4.33	0.00	2.48	4.33

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

Technician Signature: Date: 7/31/2019

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 4 Test Date: 7/31/2019

Test Fuel Side View

Test Fuel Iso View

Test Fuel Loaded in Stove

Air Setting

Technician Signature: _____ Date: 7/31/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 5 Data Summary

Client:	Valley Comfort [Blaze King]
Model:	KE40
Job #:	19-509
Tracking #:	0032
Test Date:	7/31/2019

8/7/2019

Techician Signature Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

Burn Rate (kg/hr):	1.05

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	0.000	90.140	89.314	9.154
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.6			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	7983.9			
Average Gas Meter Temperature (°F)	74.4	99.6	100.4	94.0
Total Sample Volume (dscf)	0.000	81.563	81.053	10.356
Average Tunnel Temperature (°F)	92.7			
Total Time of Test (min)	589			
Total Particulate Catch (mg)	0.0	6.5	7.2	2.5
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000797	0.0000888	0.0002414
Total PM Emissions (g)	0.00	6.25	6.96	1.93
Particulate Emission Rate (g/hr)	0.00	0.64	0.71	1.93
Emissions Factor (g/kg)	-	0.61	0.68	-
Difference from Average Total Particulate Emissions (g)	-	0.36	0.36	-
Difference from Average Emissions Factor (g/kg)	-	0.03	0.03	-

Final Average Results	
Total Particulate Emissions (g)	6.60
Particulate Emission Rate (g/hr)	0.67
Emissions Factor (g/kg)	0.64
HHV Efficiency (%)	82.0%
LHV Efficiency (%)	88.6%
CO Emissions (g/min)	0.10

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	8.3	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 71 / Max: 78	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	50.0	OK

B415.1 Efficiency Results

Manufacturer: Valley Comfort [Blaze King]
Model: KE40
Date: 07/31/19
Run: 5
Control #: 19-509
Test Duration: 589
Output Category: 2

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	82.0%	88.6%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	82.4%	89.1%

Output Rate (kJ/h)	17,009	16,134	**(Btu/h)**
Burn Rate (kg/h)	1.05	2.31	**(lb/h)**
Input (kJ/h)	20,737	19,671	**(Btu/h)**

Test Load Weight (dry kg)	10.28	22.65	**dry lb**
MC wet (%)	17.46		
MC dry (%)	21.16		
Particulate (g)	6.60		
CO (g)	61		
Test Duration (h)	9.82		

Emissions	Particulate	CO
g/MJ Output	0.04	0.37
g/kg Dry Fuel	0.64	5.95
g/h	0.67	6.23
g/min	0.01	0.10
lb/MM Btu Output	0.09	0.85

Air/Fuel Ratio (A/F)	14.42

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

WOODSTOVE FUEL DATA - ASTM E2780

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

Preburn Fuel Information					
Size	Length (in)	Moisture Content (% DB)	Size	Length (in)	Moisture Content (% DB)
2x4	17.00	20.0	2x4	17.00	19.5
2x4	17.00	24.7	2x4	17.00	23.8
2x4	17.00	22.0	2x4	17.00	20.1
2x4	17.00	23.0	2x4	17.00	21.7
2x4	17.00	24.5	2x4	17.00	22.2
2x4	17.00	21.5	2x4	17.00	20.1
2x4	17.00	22.4			
2x4	17.00	21.0			
Total Fuel Weight (lbs):		25.8	Average Moisture (%DB):		21.9

Firebox Volume (ft^3):	4.35
Total 2x4 Crib Weight, with spacers (lbs):	0.00
Total 4x4 Crib Weight, with spacers (lbs):	27.44
Total Wet Fuel Weight, with spacers (lbs):	27.44

Coal Bed Range (20-25%):
Min (lbs): 5.49
Max (lbs): 6.86

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	17.75	4.18	22.3	22.3	23.0	3.41
4x4	17.75	4.24	23.0	20.9	18.8	3.51
4x4	17.75	4.18	20.1	20.8	20.4	3.47
4x4	17.75	4.26	19.0	19.5	18.7	3.58
4x4	17.75	3.96	22.0	22.0	22.0	3.25
4x4	17.75	3.78	22.0	22.0	22.0	3.10
				Total Dry Weight, no spacers (lbs):		20.31
				Total Dry Weight, with spacers (lbs):		22.69

Spacer Moisture Readings (%DB)							
18.6	20.9	22.0					
13.6	16.3	18.2					
21.8	17.4	20.5					
12.0	24.8	24.2					
11.3	23.0	21.5					
17.3	23.5	23.3					
14.3	25.8	17.5					
16.3	23.7	17.3					

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft^3, DB)	26.9	OK
Loading Density	6.3 - 7.7 (lbs/ft^3, WB)	6.31	OK
2x4 Fuel Mix	35 - 65 % of total weight	N/A	N/A

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client:	Valley Comfort [Blaze King]	Job #:	19-509
Model:	KE40	Tracking #:	0032
Run #:	5	Technician:	SJB
Test Start Time:	18:56	Date:	7/31/2019

Total Sampling Time (min):	589
Recording Interval (min):	10

Meter Box γ Factor:	0.998	(A)
Meter Box γ Factor:	1.002	(B)
Meter Box γ Factor:	1.000	(Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	28.64	28.74	28.69
Relative Humidity (%)	9.2	15.4	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		0.000	ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	7/26/2019

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-5	in. Hg
(B)	0.000	cfm @	-5	in. Hg
(Ambient)	0.000	cfm @	0	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.020	101
2	0.034	101
3	0.044	101
4	0.030	101
5	0.028	101
6	0.040	101
7	0.038	101
8	0.024	101
Center	0.044	101

Static Pressure: -0.170 in. H_2O

Dilution Tunnel H_2O:	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	ft^2
V_{strav}:	12.69	ft/sec
V_{scent}:	14.65	ft/sec
F_p:	0.866	[ratio]
Initial Tunnel Flow:	129.5	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

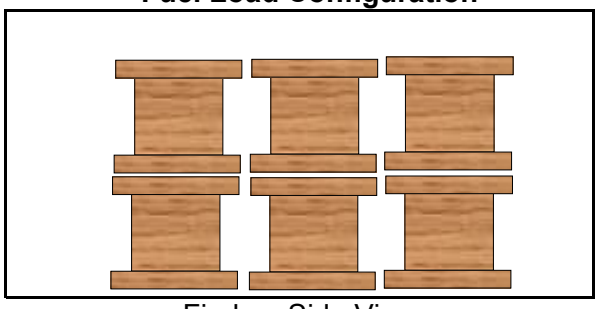
Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	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

Firebox Front



Firebox Back

Firebox Side View

WOODSTOVE PREBURN DATA - ASTM E2780

Client: Valley Comfort [Blaze Kir
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

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

			Temperatures (°F)							
Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H_2O)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	7.0	-0.030	599	564	437	695	423	543.6	320	83
10	6.9	-0.020	534	519	415	614	429	502.2	200	82
20	6.9	-0.020	472	466	380	519	426	452.6	172	82
30	7.0	-0.010	422	420	349	452	418	412.2	156	81
40	7.0	-0.010	381	383	323	404	409	380.0	145	80
50	7.0	-0.010	346	353	299	366	400	352.8	150	79
60	6.9	-0.010	318	332	276	354	387	333.4	168	78

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.044	-0.01	92	1.24		27.4		94	168	85	78
10	1.519	0.152	0.044	1.07	91	3.16	101	27.0	-0.46	96	191	86	78
20	3.053	0.153	0.044	1.08	92	3.22	102	26.5	-0.52	97	224	85	76
30	4.581	0.153	0.044	0.99	94	3.26	102	25.7	-0.8	100	253	85	76
40	6.103	0.152	0.044	1.05	95	2.14	101	24.8	-0.87	101	267	85	76
50	7.632	0.153	0.044	0.95	96	2.87	101	24.0	-0.78	101	251	84	76
60	9.154	0.152	0.044	0.93	98	2.84	100	23.2	-0.81	101	265	84	75
70	10.687	0.153	0.044	1.03	98	1.12	101	22.4	-0.79	100	265	84	75
80	12.218	0.153	0.044	1.09	99	1.52	101	21.5	-0.89	101	266	84	75
90	13.751	0.153	0.044	0.95	100	3.11	101	20.7	-0.83	100	266	84	75
100	15.280	0.153	0.044	0.96	100	3.23	100	19.9	-0.82	100	263	84	75
110	16.810	0.153	0.044	0.94	101	1.76	100	19.1	-0.77	99	259	84	75
120	18.341	0.153	0.044	0.95	101	1.47	100	18.4	-0.68	98	256	84	75
130	19.874	0.153	0.044	1.07	101	3.24	100	17.7	-0.68	98	254	83	75
140	21.405	0.153	0.044	1.00	101	1.28	100	17.1	-0.6	97	252	83	75
150	22.942	0.154	0.044	1.03	102	1.15	100	16.5	-0.64	97	249	83	75
160	24.470	0.153	0.044	1.03	101	3.19	100	15.9	-0.61	96	245	83	74
170	26.006	0.154	0.044	1.08	101	1.4	100	15.3	-0.57	96	245	83	74
180	27.532	0.153	0.044	1.04	101	2.93	100	14.7	-0.64	95	245	82	74
190	29.067	0.154	0.044	0.96	101	2.92	100	14.1	-0.62	95	247	82	73
200	30.599	0.153	0.044	1.07	101	2.13	100	13.4	-0.68	96	247	82	75
210	32.132	0.153	0.044	1.08	101	1.69	100	12.8	-0.62	97	238	83	77
220	33.659	0.153	0.044	0.89	102	2.95	100	12.2	-0.57	96	230	84	78
230	35.191	0.153	0.044	0.91	102	1.11	100	11.7	-0.5	95	226	85	78
240	36.711	0.152	0.044	0.99	102	1.33	99	11.1	-0.57	95	225	85	78
250	38.244	0.153	0.044	1.04	103	2.44	100	10.6	-0.48	93	224	84	75
260	39.772	0.153	0.044	0.90	103	1.53	99	10.0	-0.62	93	224	83	74
270	41.314	0.154	0.044	1.06	102	2.4	100	9.4	-0.6	92	223	82	74
280	42.854	0.154	0.044	1.07	102	1.19	100	8.9	-0.5	92	221	82	73
290	44.384	0.153	0.044	0.92	102	1.11	99	8.4	-0.54	91	218	81	73
300	45.918	0.153	0.044	1.07	101	2.28	100	8.0	-0.39	92	212	81	75
310	47.452	0.153	0.044	1.00	101	2.42	100	7.6	-0.43	92	206	82	76

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	48.982	0.153	0.044	1.04	101	1.31	99	7.2	-0.32	90	198	83	75
330	50.515	0.153	0.044	0.92	101	1.16	100	6.9	-0.38	89	193	81	74
340	52.050	0.154	0.044	1.07	101	2.5	100	6.6	-0.24	89	201	81	75
350	53.583	0.153	0.044	0.98	101	3	100	6.3	-0.35	90	205	82	76
360	55.110	0.153	0.044	0.95	101	2.94	99	5.9	-0.4	89	211	81	73
370	56.643	0.153	0.044	1.08	101	2.64	100	5.6	-0.28	90	211	81	74
380	58.173	0.153	0.044	0.96	101	3.16	100	5.3	-0.31	91	212	81	75
390	59.702	0.153	0.044	0.90	100	3.21	100	4.9	-0.4	89	211	81	73
400	61.232	0.153	0.044	0.93	100	2.91	100	4.7	-0.23	90	210	80	74
410	62.755	0.152	0.044	1.05	100	1.85	99	4.3	-0.38	89	210	81	72
420	64.286	0.153	0.044	1.07	100	3.14	100	4.1	-0.18	89	202	80	74
430	65.818	0.153	0.044	0.97	100	2.93	100	3.8	-0.3	88	199	80	72
440	67.356	0.154	0.044	0.91	100	3.14	100	3.6	-0.17	88	205	80	74
450	68.890	0.153	0.044	0.93	100	1.1	100	3.3	-0.31	88	204	80	72
460	70.421	0.153	0.044	1.00	99	1.13	100	3.1	-0.24	88	202	80	73
470	71.948	0.153	0.044	0.94	99	3.12	100	2.8	-0.27	89	200	80	74
480	73.480	0.153	0.044	0.94	99	3.11	100	2.5	-0.28	87	198	80	72
490	75.008	0.153	0.044	0.92	99	2.6	100	2.4	-0.1	89	202	80	73
500	76.536	0.153	0.044	0.99	99	1.52	100	2.1	-0.29	89	202	80	74
510	78.068	0.153	0.044	1.00	99	3.23	100	1.9	-0.2	87	203	79	73
520	79.594	0.153	0.044	0.98	99	3.13	99	1.7	-0.21	88	202	80	73
530	81.126	0.153	0.044	1.05	99	1.15	100	1.4	-0.28	87	201	79	71
540	82.658	0.153	0.044	0.95	99	2.09	100	1.2	-0.21	88	207	79	73
550	84.188	0.153	0.044	1.10	99	1.6	100	1.0	-0.27	87	205	79	72
560	85.709	0.152	0.044	0.92	98	3.1	99	0.7	-0.25	88	209	79	72
570	87.235	0.153	0.044	1.00	98	2.97	100	0.5	-0.24	88	207	79	73
580	88.758	0.152	0.044	1.08	98	2.22	99	0.3	-0.22	86	203	79	71
589	90.140	0.138	0.044	1.07	98	1.43	90	0.0	-0.25	88	205	79	73
Avg/Tot	90.140	0.153	0.044	0.98	100	2.28	100			93	222	82	74.4

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.00	90	1		84	-0.010	5.82	0.01
10	1.489	0.149	1.15	90	3.53	100	85	-0.020	5.02	0.01
20	3.006	0.152	1.09	91	17.6	102	84	-0.020	7.21	0.01
30	4.521	0.152	1.10	93	-5.22	102	84	-0.020	7.61	0.01
40	6.029	0.151	1.13	94	12.78	101	84	-0.020	8.11	0.01
50	7.538	0.151	1.17	96	-3.79	101	84	-0.020	7.24	0.00
60	9.055	0.152	1.06	97	0.64	101	84	-0.020	7.78	0.01
70	10.570	0.152	1.16	99	11.43	101	84	-0.020	7.87	0.00
80	12.083	0.151	1.18	100	11.11	101	84	-0.020	8.66	0.01
90	13.602	0.152	1.15	100	-1.81	101	83	-0.020	8.76	0.01
100	15.117	0.152	1.18	101	11.95	100	83	-0.020	8.86	0.00
110	16.635	0.152	1.06	101	11.84	101	83	-0.020	8.29	0.00
120	18.154	0.152	1.15	102	-2.3	100	83	-0.020	8.49	0.00
130	19.677	0.152	1.08	102	-4.12	101	83	-0.020	8.68	0.00
140	21.196	0.152	1.15	102	10.54	100	82	-0.020	8.30	0.00
150	22.710	0.151	1.08	102	-3.25	100	82	-0.020	8.50	0.00
160	24.232	0.152	1.13	102	10.45	100	82	-0.020	8.50	0.00
170	25.751	0.152	1.02	102	-4.52	100	82	-0.020	8.73	0.00
180	27.270	0.152	1.07	102	8.9	100	82	-0.020	8.69	0.00
190	28.782	0.151	1.18	102	2.37	100	81	-0.020	9.40	0.02
200	30.300	0.152	1.14	102	10.24	100	82	-0.020	9.66	0.15
210	31.825	0.153	1.13	102	1.52	101	83	-0.020	9.37	0.16
220	33.346	0.152	1.14	102	8.89	100	84	-0.020	9.11	0.12
230	34.863	0.152	1.03	103	-0.14	100	85	-0.020	9.48	0.15
240	36.371	0.151	1.18	103	-2.66	99	85	-0.020	9.81	0.18
250	37.888	0.152	1.09	103	3.84	100	84	-0.020	9.57	0.11
260	39.406	0.152	1.18	103	7.21	100	82	-0.020	9.81	0.29
270	40.930	0.152	1.12	103	-1.32	100	82	-0.020	9.87	0.53
280	42.450	0.152	1.14	103	-0.15	100	81	-0.020	9.88	0.50
290	43.973	0.152	1.17	103	4.29	100	81	-0.020	9.83	0.16
300	45.502	0.153	1.12	102	1.08	100	81	-0.020	9.75	0.13
310	47.025	0.152	1.12	102	10.65	100	82	-0.020	9.27	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	48.551	0.153	1.20	102	8.5	100	82	-0.020	8.47	0.00
330	50.076	0.153	1.17	102	-0.7	100	81	-0.020	8.63	0.00
340	51.598	0.152	1.18	102	8.69	100	81	-0.020	9.09	0.00
350	53.131	0.153	1.11	102	6.22	101	81	-0.020	9.19	0.00
360	54.654	0.152	1.06	102	9.15	100	81	-0.020	9.19	0.00
370	56.183	0.153	1.04	102	12.15	100	80	-0.020	9.31	0.00
380	57.704	0.152	1.13	102	-0.76	100	81	-0.020	9.13	0.00
390	59.236	0.153	1.16	102	8.19	100	81	-0.020	9.09	0.00
400	60.763	0.153	1.17	101	9.03	100	80	-0.020	9.13	0.00
410	62.283	0.152	1.14	101	-3.16	100	80	-0.020	8.36	0.00
420	63.792	0.151	1.09	101	-3.86	99	80	-0.020	8.06	0.00
430	65.305	0.151	1.06	101	0.51	99	80	-0.020	7.83	0.00
440	66.816	0.151	1.11	101	4.05	99	80	-0.020	7.99	0.00
450	68.326	0.151	1.20	101	10.7	99	80	-0.020	7.89	0.00
460	69.837	0.151	1.02	101	11.73	99	79	-0.020	7.96	0.00
470	71.346	0.151	1.10	101	7.96	99	80	-0.020	8.08	0.00
480	72.853	0.151	1.11	100	12.02	99	79	-0.020	7.96	0.00
490	74.360	0.151	1.05	100	9.64	99	79	-0.020	7.76	0.00
500	75.874	0.151	1.07	100	-2.47	100	80	-0.020	7.89	0.00
510	77.381	0.151	1.18	100	11.95	99	79	-0.020	8.10	0.00
520	78.899	0.152	1.15	100	-1.93	100	79	-0.020	7.94	0.00
530	80.413	0.151	1.20	100	6.59	99	79	-0.020	8.19	0.00
540	81.931	0.152	1.17	100	-0.9	100	79	-0.020	8.28	0.00
550	83.434	0.150	1.17	100	-0.71	99	78	-0.020	7.82	0.00
560	84.948	0.151	1.16	100	10.56	99	79	-0.020	7.61	0.00
570	86.454	0.151	1.06	100	11.94	99	79	-0.020	7.47	0.00
580	87.957	0.150	1.08	100	-2.32	99	78	-0.020	7.24	0.00
589	89.314	0.136	1.08	99	-0.96	89	79	-0.020	7.31	0.00
Avg/Tot	89.314	0.151	1.10	100	4.57	100	81	-0.020	8.45	0.04

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

Stove ΔT: 50

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	317	331	276	354	386	332.8	602
10	273	292	227	339	372	300.6	589
20	248	272	212	347	360	287.8	712
30	242	276	211	372	352	290.6	797
40	249	289	223	399	351	302.2	840
50	256	301	225	410	354	309.2	775
60	263	314	230	432	358	319.4	848
70	270	327	235	453	361	329.2	858
80	278	341	241	476	364	340.0	903
90	287	357	246	504	365	351.8	921
100	295	373	250	518	366	360.4	914
110	301	391	254	522	366	366.8	906
120	305	405	256	514	366	369.2	889
130	307	416	258	517	367	373.0	916
140	309	422	260	522	370	376.6	911
150	310	431	263	520	372	379.2	904
160	311	439	265	515	375	381.0	888
170	313	451	269	508	377	383.6	876
180	316	464	276	502	380	387.6	877
190	319	476	280	503	383	392.2	899
200	323	487	288	521	386	401.0	931
210	328	484	296	530	389	405.4	909
220	329	477	300	524	391	404.2	882
230	330	474	303	515	393	403.0	869
240	331	471	307	515	394	403.6	881
250	333	468	306	522	395	404.8	898
260	335	464	305	528	397	405.8	912
270	337	464	306	539	401	409.4	912
280	340	466	310	542	404	412.4	901
290	343	467	314	536	407	413.4	897
300	345	465	319	534	408	414.2	891
310	346	460	320	529	408	412.6	871
320	344	453	318	507	406	405.6	820
330	339	440	311	489	404	396.6	804
340	335	433	309	486	402	393.0	817
350	333	426	304	489	402	390.8	825
360	333	421	301	493	405	390.6	842
370	336	420	302	500	411	393.8	853
380	340	422	307	501	414	396.8	844
390	342	422	311	498	416	397.8	840
400	344	420	317	500	418	399.8	839
410	346	417	314	495	420	398.4	819
420	345	408	310	487	420	394.0	803
430	346	398	307	478	420	389.8	788
440	346	392	302	474	418	386.4	787
450	350	396	302	448	422	383.6	718
460	357	401	304	428	436	385.2	702
470	365	405	304	420	448	388.4	695

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

Stove ΔT: **50**

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	368	405	300	417	455	389.0	699
490	371	399	294	421	457	388.4	714
500	376	394	292	425	456	388.6	712
510	380	394	293	421	456	388.8	707
520	385	395	294	421	456	390.2	706
530	387	396	295	421	458	391.4	717
540	390	397	298	424	458	393.4	722
550	394	393	297	425	455	392.8	722
560	396	385	297	427	453	391.6	726
570	393	379	297	427	455	390.2	724
580	392	373	291	422	453	386.2	717
589	390	368	288	422	446	382.8	722
Average	332	406	285	472	404	380	816

LAB SAMPLE DATA - ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 5

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 7/31/2019

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	3562	121.1	121.1	123.6	2.5
Train A Filters - Remainder	3563	117.3	238.0	240.9	2.9
	3564	120.7			
Train A Probe	15A	117418.8	117418.8	117418.8	0.0
Train A O-Rings	15A	3568.1	3568.1	3569.2	1.1
Train B Filters	3565	115.0	238.8	244.5	5.7
	3566	123.8			
Train B Probe	15B	116905.3	116905.3	116905.7	0.4
Train B O-Rings	15B	3568.8	3568.8	3569.9	1.1
Background Filter			0.0	0.0	

Placed in Dessicator on:	8/5 - 8:00

Train A Filters - First Hour	123.7	8/6 16:07	123.6	8/7 16:10				
Train A Filters - Remainder	241.0	8/6 16:07	240.9	8/7 16:10				
Train A Probe	117419.0	8/6 16:07	117418.8	8/7 16:11				
Train A O-Rings	3569.0	8/6 16:07	3569.2	8/7 16:11				
Train B Filters	244.5	8/6 16:07	244.5	8/7 16:11				
Train B Probe	116905.7	8/6 16:07	116905.7	8/7 16:11				
Train B O-Rings	3569.9	8/6 16:07	3569.9	8/7 16:11				
Background Filter								

1st hour Sub-Total, mg:	2.5
Remainder Sub-Total, mg:	4.0
Train 1 Aggregate, mg:	**6.5**
Train 2 Aggregate, mg:	**7.2**
Ambient Aggregate, mg:	0.0

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 5 Test Date: 7/31/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Fan Confirmation Test Setting (72° Counterclockwise from fully open)
Targeted Burn Category: II – Fan Confirmation

Preburn Notes

Time	Notes
-	*FAN CONFIRMATION TEST - FAN OFF FOR DURATION OF TEST PERIOD*
-	Loaded 25.8 lbs of preburn, bypass closed, burn down to target weight before turn down.
0 min	@7.0 lbs, turned air down to test setting
45 min	@7.0 lbs, raked coal bed.
60 min	@6.9 lbs, zeroed scale in preparation of test fuel loading.

Test Notes

Test Burn Start Time: 18:56 Test Fuel Loaded by: 30 seconds
Door Closed: 40 seconds Air Control Set at: 0 seconds
Other Loading Notes: Bypass closed @ 0 sec

Time	Notes
-	*FAN CONFIRMATION TEST - FAN OFF FOR DURATION OF TEST PERIOD*
0 min	Loaded test fuel load
60 min	Changed 1-hr filter
589 min	End of test

Test Burn End Time: 4:45

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 16.89 CO (%): 4.33
Mid Gas CO_2 (%): 10.07 CO (%): 2.53

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	18:28	18:31	18:30	8/1 – 7:00	8/1 – 7:03	8/1 – 7:02
CO_2	0.00	9.67	16.88	0.00	10.24	16.59
CO	0.00	2.48	4.33	0.04	2.51	4.42

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

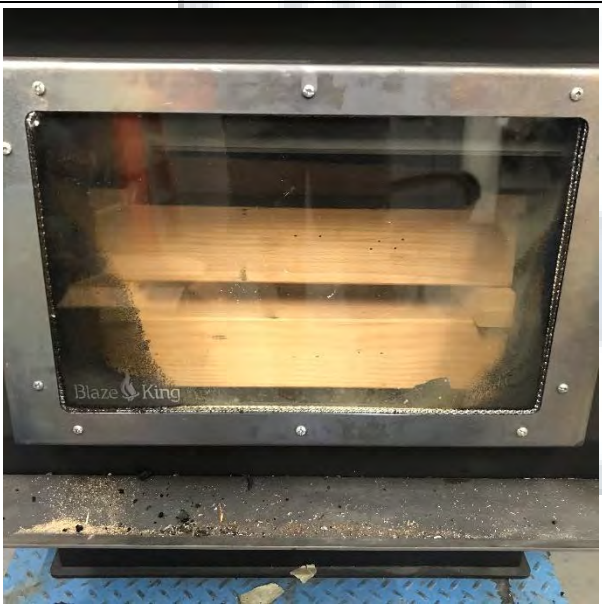
Technician Signature: _____ Date: 8/1/2019

ASTM E2780 Wood Heater Run Sheets

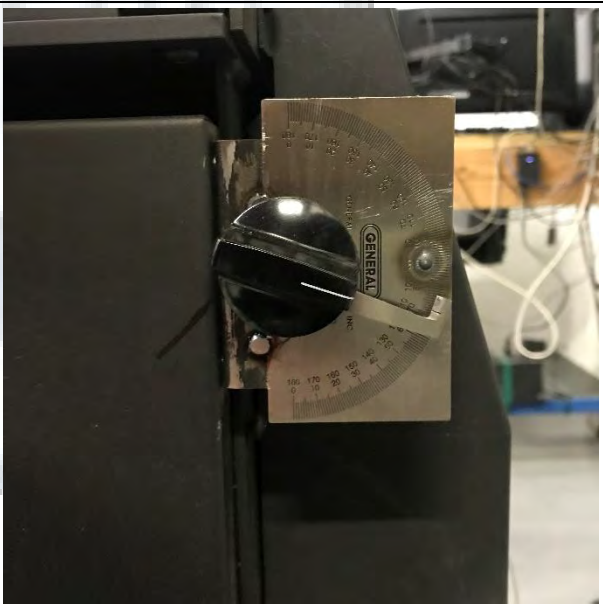
Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 5 Test Date: 7/31/2019

Test Fuel Side View

Test Fuel Iso View



Test Fuel Loaded in Stove



Air Setting

Technician Signature: Date: 8/1/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 6 Data Summary

Client:	Valley Comfort [Blaze King]
Model:	KE40
Job #:	19-509
Tracking #:	0032
Test Date:	8/1/2019

8/7/2019

Techician Signature Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 6

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

Burn Rate (kg/hr):	2.54

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	0.000	38.989	38.693	9.200
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.6			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	7596.1			
Average Gas Meter Temperature (°F)	77.4	100.5	99.0	92.1
Total Sample Volume (dscf)	0.000	35.302	35.283	10.422
Average Tunnel Temperature (°F)	121.4			
Total Time of Test (min)	249			
Total Particulate Catch (mg)	0.0	12.9	12.8	5.7
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0003654	0.0003628	0.0005469
Total PM Emissions (g)	0.00	11.52	11.44	4.15
Particulate Emission Rate (g/hr)	0.00	2.78	2.76	4.15
Emissions Factor (g/kg)	-	1.09	1.08	-
Difference from Average Total Particulate Emissions (g)	-	0.04	0.04	-
Difference from Average Emissions Factor (g/kg)	-	0.00	0.00	-

Final Average Results	
Total Particulate Emissions (g)	11.48
Particulate Emission Rate (g/hr)	2.77
Emissions Factor (g/kg)	1.09
HHV Efficiency (%)	75.4%
LHV Efficiency (%)	81.5%
CO Emissions (g/min)	1.92

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	90.0	OK
Face Velocity	< 30 ft/min	8.5	OK
Leakage Rate	Less than 4% of average sample rate	0.002 cfm	OK
Ambient Temp	55-90 °F	Min: 76 / Max: 79	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	76.0	OK

B415.1 Efficiency Results

Manufacturer: Valley Comfort [Blaze King]
Model: KE40
Date: 08/01/19
Run: 6
Control #: 19-509
Test Duration: 249
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.4%	81.5%
Combustion Efficiency	96.8%	96.8%
Heat Transfer Efficiency	77.9%	84.2%

Output Rate (kJ/h)	37,799	35,856	**(Btu/h)**
Burn Rate (kg/h)	2.53	5.58	**(lb/h)**
Input (kJ/h)	50,145	47,568	**(Btu/h)**

Test Load Weight (dry kg)	10.50	23.15	**dry lb**
MC wet (%)	18.65		
MC dry (%)	22.92		
Particulate (g)	11.48		
CO (g)	479		
Test Duration (h)	4.15		

Emissions	Particulate	CO
g/MJ Output	0.07	3.05
g/kg Dry Fuel	1.09	45.57
g/h	2.77	115.34
g/min	0.05	1.92
lb/MM Btu Output	0.17	7.09

Air/Fuel Ratio (A/F)	10.73

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

WOODSTOVE FUEL DATA - ASTM E2780

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 6

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

Preburn Fuel Information

Size	Length (in)	Moisture Content (% DB)	Size	Length (in)	Moisture Content (% DB)
2x4	17.00	21.7	2x4	17.00	19.9
2x4	17.00	21.7	2x4	17.00	21.0
2x4	17.00	24.5	2x4	17.00	24.4
2x4	17.00	23.8	2x4	17.00	22.1
2x4	17.00	24.9	2x4	17.00	19.2
2x4	17.00	24.9	2x4	17.00	23.1
2x4	17.00	18.9			
2x4	17.00	22.0			
Total Fuel Weight (lbs):		24.78	Average Moisture (%DB):		22.3

Firebox Volume (ft^3):	4.35
Total 2x4 Crib Weight, with spacers (lbs):	0.00
Total 4x4 Crib Weight, with spacers (lbs):	28.46
Total Wet Fuel Weight, with spacers (lbs):	28.46

Coal Bed Range (20-25%):
Min (lbs): 5.69
Max (lbs): 7.12

Test Fuel Information

Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	17.75	4.38	22.0	21.3	21.4	3.60
4x4	17.75	3.98	22.0	21.9	25.2	3.23
4x4	17.75	4.06	22.8	22.8	25.0	3.29
4x4	17.75	4.42	23.8	23.8	23.8	3.57
4x4	17.75	4.40	22.0	22.3	20.2	3.62
4x4	17.75	4.30	22.6	24.5	25.2	3.46
					Total Dry Weight, no spacers (lbs):	20.78
					Total Dry Weight, with spacers (lbs):	23.24

Spacer Moisture Readings (%DB)

12.5	20.3	24.2	20.4	15.1	24.6		
20.3	14.3	24.9	19.5	21.9	23.2		
24.2	21.4	17.2	13.4	13.3	21.9		
14.2	18.7	13.3	12.8	21.9	14.7		

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft^3, DB)	27.5	OK
Loading Density	6.3 - 7.7 (lbs/ft^3, WB)	6.54	OK
2x4 Fuel Mix	35 - 65 % of total weight	N/A	N/A

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client:	Valley Comfort [Blaze King]	Job #:	19-509
Model:	KE40	Tracking #:	0032
Run #:	6	Technician:	SJB
Test Start Time:	7:51	Date:	8/1/2019

Total Sampling Time (min):	249
Recording Interval (min):	10
Meter Box γ Factor:	0.998 (A)
Meter Box γ Factor:	1.002 (B)
Meter Box γ Factor:	1.000 (Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	28.76	28.75	28.76
Relative Humidity (%)	14.5	12.7	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		0.000	ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	7/26/2019

Sample Train Post-Test Leak Checks

(A)	0.001	cfm @	-6	in. Hg
(B)	0.002	cfm @	-6	in. Hg
(Ambient)	0.000	cfm @	0	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.024	127
2	0.034	127
3	0.026	127
4	0.020	127
5	0.024	127
6	0.040	127
7	0.046	127
8	0.030	127
Center	0.044	127

Static Pressure: -0.170 in. H_2O

Dilution Tunnel H_2O:	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	ft^2
V_{strav}:	12.63	ft/sec
V_{scent}:	14.95	ft/sec
F_p:	0.845	[ratio]
Initial Tunnel Flow:	123.1	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

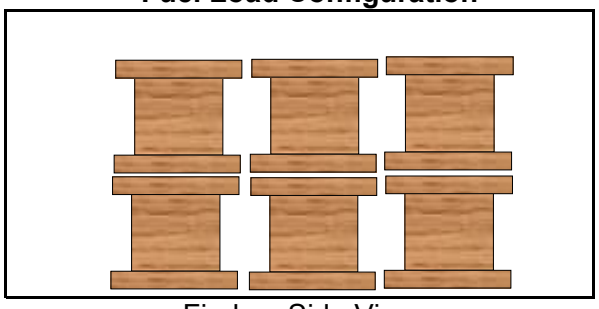
Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	22.9

Fuel Load Configuration

Firebox Front



Firebox Back

Firebox Side View

WOODSTOVE PREBURN DATA - ASTM E2780

Client: Valley Comfort [Blaze Kir
Model: KE40
Run #: 6

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

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

			Temperatures (°F)							
Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H_2O)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	26.0	-0.030	609	534	358	526	559	517.2	432	75
10	22.6	-0.040	507	452	264	551	556	466.0	482	73
20	19.4	-0.040	494	432	247	597	529	459.8	479	73
30	16.9	-0.040	508	438	251	640	507	468.8	473	74
40	14.4	-0.040	545	465	276	656	490	486.4	464	74
50	12.3	-0.040	583	495	308	655	478	503.8	452	75
60	10.3	-0.030	666	512	332	655	467	526.4	439	76
70	8.6	-0.040	721	522	342	652	451	537.6	428	76
80	7.1	-0.030	724	537	369	645	440	543.0	423	76

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 6

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.001		0.044	-0.02	87	1.24		28.5		162	492	76	76
10	1.492	0.149	0.044	0.99	88	1.49	98	25.4	-3.04	134	462	86	78
20	3.006	0.151	0.044	0.90	90	2.4	100	22.9	-2.51	133	464	86	77
30	4.512	0.151	0.044	0.96	92	2.74	99	20.7	-2.25	132	458	86	77
40	6.062	0.155	0.044	1.11	94	3.37	101	18.5	-2.19	130	449	86	78
50	7.637	0.158	0.044	1.17	96	3.19	102	16.6	-1.85	128	438	85	77
60	9.201	0.156	0.044	1.13	98	1.62	101	14.9	-1.68	126	433	85	78
70	10.776	0.158	0.044	1.08	99	1.22	101	13.4	-1.52	124	422	88	77
80	12.347	0.157	0.044	1.11	101	3.35	100	12.1	-1.3	122	417	90	77
90	13.921	0.157	0.044	1.15	102	2.08	100	11.0	-1.08	121	408	86	77
100	15.491	0.157	0.044	0.95	102	1.52	100	10.0	-1.03	120	398	82	77
110	17.065	0.157	0.044	1.07	103	1.42	100	9.0	-1.03	119	391	81	77
120	18.643	0.158	0.044	1.01	103	3.08	100	8.0	-0.97	119	387	80	77
130	20.222	0.158	0.044	1.00	104	3.22	100	7.1	-0.95	119	401	79	77
140	21.802	0.158	0.044	1.09	104	1.2	100	6.2	-0.84	118	386	79	77
150	23.376	0.157	0.044	0.98	104	3.32	100	5.5	-0.77	117	381	80	77
160	24.960	0.158	0.044	1.13	104	3.12	100	4.7	-0.73	117	385	80	77
170	26.534	0.157	0.044	1.01	104	1.93	100	3.8	-0.91	118	394	81	77
180	28.110	0.158	0.044	1.01	104	3.34	100	3.1	-0.74	117	373	82	78
190	29.682	0.157	0.044	1.09	105	2.98	99	2.4	-0.64	115	367	82	78
200	31.258	0.158	0.044	1.05	105	3.18	99	2.0	-0.45	113	344	83	79
210	32.836	0.158	0.044	1.00	105	1.44	99	1.6	-0.39	112	334	83	78
220	34.415	0.158	0.044	1.09	105	2.34	99	1.2	-0.42	111	327	83	78
230	35.994	0.158	0.044	1.00	105	2.97	99	0.8	-0.38	111	325	83	78
240	37.567	0.157	0.044	1.16	105	3.31	99	0.4	-0.42	110	315	83	78
249	38.989	0.142	0.044	0.96	105	1.38	89	0.0	-0.37	109	309	83	78
Avg/Tot	38.989	0.156	0.044	1.01	101	2.40	99			121	395	83	77.4

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 6

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.001		0.00	83	7		75	-0.040	7.72	0.30
10	1.484	0.148	1.16	84	1.69	99	85	-0.040	14.54	2.27
20	2.968	0.148	1.23	86	1.81	99	85	-0.040	14.35	1.03
30	4.506	0.154	1.20	89	2.77	102	84	-0.040	14.37	1.25
40	6.036	0.153	1.19	91	2.81	101	84	-0.040	14.04	0.51
50	7.568	0.153	1.11	94	2.97	100	84	-0.030	13.61	0.26
60	9.111	0.154	1.18	96	1.63	100	84	-0.030	13.53	0.41
70	10.684	0.157	1.16	97	2.64	102	84	-0.030	12.79	0.40
80	12.238	0.155	1.11	99	2.86	100	84	-0.030	10.03	0.01
90	13.789	0.155	1.13	100	1.48	100	84	-0.030	9.64	0.01
100	15.353	0.156	1.23	101	1.58	100	83	-0.030	10.96	0.00
110	16.915	0.156	1.07	102	1.31	100	83	-0.030	11.05	0.06
120	18.477	0.156	1.16	102	1.58	100	83	-0.030	11.24	0.06
130	20.046	0.157	1.26	102	2.39	100	83	-0.030	11.22	0.06
140	21.616	0.157	1.23	103	1.56	100	83	-0.030	10.77	0.05
150	23.180	0.156	1.19	103	2.71	100	83	-0.030	10.63	0.05
160	24.744	0.156	1.17	103	1.48	100	83	-0.030	11.02	0.04
170	26.307	0.156	1.23	104	1.6	99	83	-0.030	11.73	0.07
180	27.876	0.157	1.17	104	1.62	100	83	-0.030	11.36	0.00
190	29.441	0.157	1.21	104	2.46	99	83	-0.030	9.92	0.00
200	31.010	0.157	1.16	104	1.66	99	83	-0.030	9.28	0.03
210	32.586	0.158	1.24	104	2.05	100	83	-0.030	9.48	0.03
220	34.143	0.156	1.12	104	1.41	98	83	-0.030	9.19	0.00
230	35.716	0.157	1.20	105	1.93	99	83	-0.030	8.96	0.03
240	37.284	0.157	1.19	105	1.58	99	82	-0.030	8.90	0.03
249	38.693	0.141	1.24	105	3.02	89	82	-0.030	8.93	0.03
Avg/Tot	38.693	0.155	1.14	99	2.22	99	83	-0.032	11.13	0.27

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 6

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

Stove ΔT: 76

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	724	542	395	653	440	550.8	1069
10	579	484	264	633	448	481.6	1092
20	540	464	263	637	448	470.4	1137
30	545	465	271	642	447	474.0	1126
40	554	483	272	642	448	479.8	1124
50	557	490	275	645	449	483.2	1110
60	564	492	275	647	452	486.0	1111
70	572	500	277	640	457	489.2	1095
80	573	504	280	612	461	486.0	1045
90	557	489	271	580	454	470.2	1002
100	570	477	263	557	441	461.6	1021
110	596	485	270	544	439	466.8	992
120	611	495	276	534	441	471.4	992
130	622	508	286	543	438	479.4	1046
140	617	509	287	539	439	478.2	987
150	616	506	284	532	445	476.6	982
160	630	510	291	522	453	481.2	958
170	650	541	330	531	464	503.2	983
180	656	562	352	529	473	514.4	946
190	646	574	371	516	479	517.2	935
200	623	556	353	496	484	502.4	863
210	600	540	347	477	491	491.0	854
220	582	535	344	462	497	484.0	829
230	570	527	343	452	502	478.8	822
240	560	522	359	437	503	476.2	785
249	554	524	370	426	500	474.8	767
Average	595	511	307	555	461	486	988

LAB SAMPLE DATA - ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 6

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	3567	115.8	115.8	121.5	5.7
Train A Filters - Remainder	3568	115.6	237.3	241.0	3.7
	3569	121.7			
Train A Probe	1A	115630.6	115630.6	115631.9	1.3
Train A O-Rings	1A	3565.4	3565.4	3567.6	2.2
Train B Filters	3570	124.9	247.3	255.7	8.4
	3571	122.4			
Train B Probe	1B	115904.4	115904.4	115906.0	1.6
Train B O-Rings	1B	3554.1	3554.1	3556.9	2.8
Background Filter			0.0	0.0	

Placed in Dessicator on:	8/5 - 8:00

Train A Filters - First Hour	121.7	8/6 16:10	121.5	8/7 16:12				
Train A Filters - Remainder	241.0	8/6 16:10	241.0	8/7 16:12				
Train A Probe	115632.0	8/6 16:10	115631.9	8/7 16:12				
Train A O-Rings	3567.5	8/6 16:10	3567.6	8/7 16:12				
Train B Filters	255.7	8/6 16:10	255.7	8/7 16:12				
Train B Probe	115906.0	8/6 16:10	115906.0	8/7 16:12				
Train B O-Rings	3556.9	8/6 16:10	3556.9	8/7 16:13				
Background Filter								

1st hour Sub-Total, mg:	5.7
Remainder Sub-Total, mg:	7.2
Train 1 Aggregate, mg:	**12.9**
Train 2 Aggregate, mg:	**12.8**
Ambient Aggregate, mg:	0.0

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 6 Test Date: 8/1/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): High Fire Test Setting (fully open)
Targeted Burn Category: IV – Catalyst Equivalency Test

Preburn Notes

Time	Notes
0 min 80 min	Loaded 24.8 lbs of preburn on 1.6 lb kindling bed, bypass closed, fan on high. @7.1 lbs, zeroed scale in preparation of test fuel loading.

Test Notes

Test Burn Start Time: 7:51 Test Fuel Loaded by: 40 seconds
Door Closed: 45 seconds Air Control Set at: 0 seconds
Other Loading Notes: Bypass closed @ 0 sec

Time	Notes
0 min 60 min 249 min	Loaded test fuel load Changed 1-hr filter End of test

Test Burn End Time: 12:00

Flue Gas Concentration Measurement

Calibration Gas Values:
Span Gas CO_2 (%): 16.89 CO (%): 4.33
Mid Gas CO_2 (%): 10.07 CO (%): 2.53

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	7:16	7:20	7:18	16:29	16:31	16:33
CO_2	0.00	10.24	16.90	0.02	9.93	16.51
CO	0.00	2.51	4.33	0.03	2.41	4.14

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

Technician Signature: _____ Date: 8/1/2019

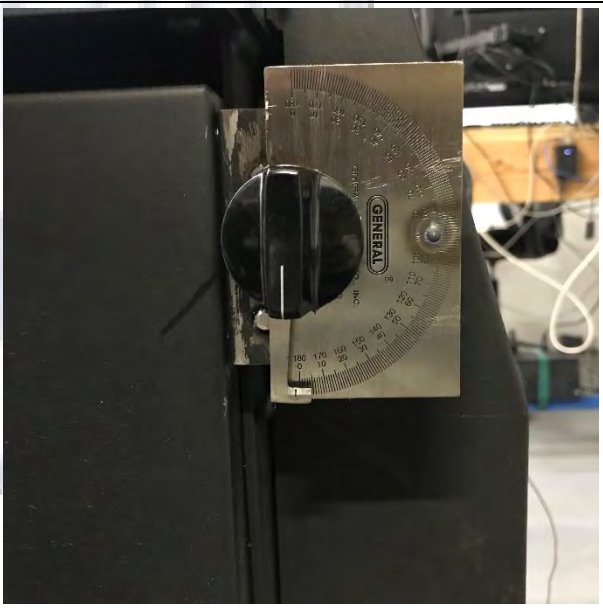
ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 6 Test Date: 8/1/2019

Test Fuel Side View

Test Fuel Iso View

Test Fuel Loaded in Stove



Air Setting

Technician Signature: Date: 8/1/2019

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515

Run 7 Data Summary

Client:	Valley Comfort [Blaze King]
Model:	KE40
Job #:	19-509
Tracking #:	0032
Test Date:	8/1/2019

8/7/2019

Techician Signature | Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

Burn Rate (kg/hr):	0.68

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	0.000	143.699	145.103	9.232
Average Gas Velocity in Dilution Tunnel (ft/sec)	12.2			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	7800.3			
Average Gas Meter Temperature (°F)	74.1	99.2	100.2	93.3
Total Sample Volume (dscf)	0.000	130.370	131.996	10.457
Average Tunnel Temperature (°F)	88.5			
Total Time of Test (min)	920			
Total Particulate Catch (mg)	0.0	4.6	4.3	1.2
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000353	0.0000326	0.0001148
Total PM Emissions (g)	0.00	4.22	3.90	0.90
Particulate Emission Rate (g/hr)	0.00	0.28	0.25	0.90
Emissions Factor (g/kg)	-	0.41	0.38	-
Difference from Average Total Particulate Emissions (g)	-	0.16	0.16	-
Difference from Average Emissions Factor (g/kg)	-	0.02	0.02	-

Final Average Results	
Total Particulate Emissions (g)	4.06
Particulate Emission Rate (g/hr)	0.26
Emissions Factor (g/kg)	0.39
HHV Efficiency (%)	84.0%
LHV Efficiency (%)	90.8%
CO Emissions (g/min)	0.02

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	84.0	OK
Face Velocity	< 30 ft/min	8.5	OK
Leakage Rate	Less than 4% of average sample rate	0.002 cfm	OK
Ambient Temp	55-90 °F	Min: 70 / Max: 78	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	43.0	OK

B415.1 Efficiency Results

Manufacturer: Valley Comfort [Blaze King]
Model: KE40
Date: 08/01/19
Run: 7
Control #: 19-509
Test Duration: 920
Output Category: 1

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	84.0%	90.8%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	84.4%	91.3%

Output Rate (kJ/h)	11,222	10,645	**(Btu/h)**
Burn Rate (kg/h)	0.67	1.49	**(lb/h)**
Input (kJ/h)	13,356	12,669	**(Btu/h)**

Test Load Weight (dry kg)	10.34	22.78	**dry lb**
MC wet (%)	17.33		
MC dry (%)	20.96		
Particulate (g)	4.06		
CO (g)	18		
Test Duration (h)	15.33		

Emissions	**Particulate**	**CO**
g/MJ Output	0.02	0.11
g/kg Dry Fuel	0.39	1.75
g/h	0.26	1.18
g/min	0.00	0.02
lb/MM Btu Output	0.05	0.24

Air/Fuel Ratio (A/F)	15.54

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

WOODSTOVE FUEL DATA - ASTM E2780

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

Preburn Fuel Information

Size	Length (in)	Moisture Content (% DB)	Size	Length (in)	Moisture Content (% DB)
2x4	17.00	24.7	2x4	17.00	22.0
2x4	17.00	22.3	2x4	17.00	24.3
2x4	17.00	24.4	2x4	17.00	23.8
2x4	17.00	21.1	2x4	17.00	19.3
2x4	17.00	21.4	2x4	17.00	22.0
2x4	17.00	22.1	2x4	17.00	23.1
2x4	17.00	24.5			
2x4	17.00	20.0			
Total Fuel Weight (lbs):		25.88	Average Moisture (%DB):		22.5

Firebox Volume (ft^3):	4.35
Total 2x4 Crib Weight, with spacers (lbs):	0.00
Total 4x4 Crib Weight, with spacers (lbs):	27.56
Total Wet Fuel Weight, with spacers (lbs):	27.56

Coal Bed Range (20-25%):
Min (lbs): 5.51
Max (lbs): 6.89

Test Fuel Information

Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	17.75	3.94	19.9	19.7	21.7	3.27
4x4	17.75	3.80	22.4	22.1	20.6	3.12
4x4	17.75	4.00	20.5	20.1	19.8	3.33
4x4	17.75	3.92	19.7	18.6	20.3	3.28
4x4	17.75	4.32	24.3	22.1	24.6	3.49
4x4	17.75	4.08	20.4	20.1	20.4	3.39
				Total Dry Weight, no spacers (lbs):		19.89
				Total Dry Weight, with spacers (lbs):		22.84

Spacer Moisture Readings (%DB)

15.9	19.9	15.5	19.3	20.9	20.5		
18.8	19.1	18.8	21.4	16.5	21.6		
13.8	20.7	16.4	18.8	15.5	15.0		
21.6	18.8	19.2	20.9	18.8	20.6		

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft^3, DB)	26.3	OK
Loading Density	6.3 - 7.7 (lbs/ft^3, WB)	6.34	OK
2x4 Fuel Mix	35 - 65 % of total weight	N/A	N/A

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client:	Valley Comfort [Blaze King]	Job #:	19-509
Model:	KE40	Tracking #:	0032
Run #:	7	Technician:	SJB
Test Start Time:	14:56	Date:	8/1/2019

Total Sampling Time (min):	920
Recording Interval (min):	10
Meter Box γ Factor:	0.998 (A)
Meter Box γ Factor:	1.002 (B)
Meter Box γ Factor:	1.000 (Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	28.70	28.78	28.74
Relative Humidity (%)	12.0	14.9	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:		0.000	ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	7/26/2019

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-6	in. Hg
(B)	0.002	cfm @	-6	in. Hg
(Ambient)	0.000	cfm @	0	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.022	92
2	0.036	92
3	0.026	92
4	0.022	92
5	0.024	92
6	0.042	92
7	0.042	92
8	0.030	92
Center	0.042	92

Static Pressure: -0.170 in. H_2O

Dilution Tunnel H_2O:	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	ft^2
V_{strav}:	12.23	ft/sec
V_{scent}:	14.18	ft/sec
F_p:	0.862	[ratio]
Initial Tunnel Flow:	127.0	scf/min

TEST FUEL PROPERTIES

Default Fuel Values

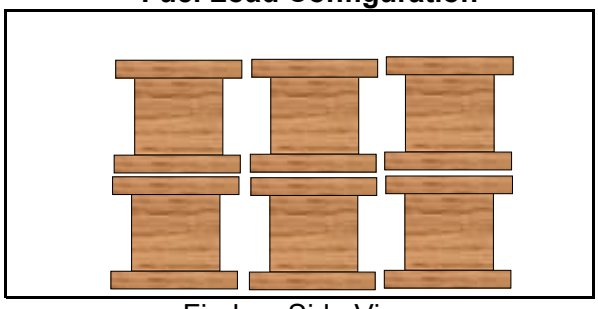
Fuel Type:	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	21.0

Fuel Load Configuration

Firebox Front



Firebox Back

Firebox Side View

WOODSTOVE PREBURN DATA - ASTM E2780

Client: Valley Comfort [Blaze Kir
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

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

			Temperatures (°F)							
Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H_2O)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Flue	Ambient
0	7.0	-0.030	634	575	367	623	452	530.2	378	83
10	6.8	-0.020	551	522	388	596	467	504.8	204	82
20	6.8	-0.020	478	464	359	521	458	456.0	172	81
30	6.8	-0.010	422	417	332	455	442	413.6	155	79
40	6.8	-0.010	380	380	310	409	426	381.0	144	79
50	6.8	-0.010	345	350	287	376	408	353.2	153	78
60	6.8	-0.010	314	321	262	342	390	325.8	132	78

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.042	0.02	92	1.23		27.6		91	132	82	78
10	1.528	0.153	0.042	0.93	91	1.16	100	27.2	-0.37	92	138	83	76
20	3.052	0.152	0.042	0.91	92	1.08	99	26.9	-0.34	93	164	83	76
30	4.583	0.153	0.042	0.99	93	3.08	100	26.2	-0.63	95	209	83	76
40	6.139	0.156	0.042	1.04	94	3.23	101	25.5	-0.73	96	222	83	75
50	7.686	0.155	0.042	1.12	95	3.13	101	24.7	-0.81	97	238	83	76
60	9.232	0.155	0.042	1.12	96	2.71	100	23.8	-0.85	98	245	83	76
70	10.811	0.158	0.042	1.02	97	2.99	102	23.1	-0.76	98	233	84	76
80	12.367	0.156	0.042	1.00	98	2.6	101	22.3	-0.79	98	233	84	75
90	13.924	0.156	0.042	0.94	99	3.09	100	21.6	-0.72	97	223	84	75
100	15.484	0.156	0.042	1.12	100	2.99	100	20.8	-0.78	97	229	83	76
110	17.044	0.156	0.042	1.13	100	1.24	100	20.1	-0.7	97	221	84	76
120	18.614	0.157	0.042	1.10	100	3.04	101	19.5	-0.63	96	214	83	76
130	20.179	0.157	0.042	1.00	101	1.69	100	18.8	-0.63	95	209	83	76
140	21.737	0.156	0.042	0.94	101	1.96	100	18.3	-0.55	95	196	84	77
150	23.309	0.157	0.042	1.05	101	2.87	101	17.9	-0.41	93	179	83	75
160	24.879	0.157	0.042	1.13	101	1.18	101	17.5	-0.35	93	170	83	76
170	26.443	0.156	0.042	1.12	102	3.14	100	17.2	-0.36	93	171	83	76
180	28.007	0.156	0.042	1.10	102	3.1	100	16.8	-0.36	93	175	83	76
190	29.573	0.157	0.042	0.95	102	1.18	100	16.4	-0.41	93	179	83	76
200	31.146	0.157	0.042	1.01	102	2.83	101	16.0	-0.41	93	183	83	76
210	32.713	0.157	0.042	0.99	102	3.11	100	15.5	-0.49	93	190	83	76
220	34.277	0.156	0.042	1.00	102	1.23	100	15.0	-0.5	94	186	83	76
230	35.840	0.156	0.042	1.04	102	1.13	100	14.6	-0.41	92	171	83	76
240	37.404	0.156	0.042	0.94	102	3.1	100	14.3	-0.32	92	161	82	76
250	38.970	0.157	0.042	0.96	102	1.86	100	14.0	-0.26	91	153	82	75
260	40.536	0.157	0.042	1.12	102	3.14	100	13.8	-0.23	91	155	81	75
270	42.102	0.157	0.042	1.11	102	1.24	100	13.5	-0.3	91	167	81	74
280	43.673	0.157	0.042	1.11	101	1.37	100	13.1	-0.4	91	182	81	74
290	45.242	0.157	0.042	0.95	101	3.09	100	12.6	-0.49	91	190	81	74
300	46.807	0.157	0.042	0.98	101	2.87	100	12.2	-0.41	91	178	81	74
310	48.374	0.157	0.042	1.05	101	3.12	100	11.9	-0.31	90	158	82	75

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
320	49.934	0.156	0.042	0.95	101	2.33	100	11.6	-0.22	89	146	81	74
330	51.510	0.158	0.042	1.03	101	2.87	101	11.5	-0.18	89	140	81	75
340	53.077	0.157	0.042	1.08	101	1.11	100	11.3	-0.16	89	144	81	74
350	54.655	0.158	0.042	0.98	101	1.91	101	11.1	-0.21	89	157	80	74
360	56.220	0.157	0.042	1.03	100	3.15	100	10.8	-0.24	89	166	80	74
370	57.781	0.156	0.042	0.96	100	1.32	100	10.6	-0.23	89	171	80	73
380	59.348	0.157	0.042	1.14	100	2.73	100	10.4	-0.24	89	172	80	73
390	60.915	0.157	0.042	1.11	100	2.97	100	10.1	-0.24	89	169	80	73
400	62.484	0.157	0.042	0.97	100	1.3	100	9.9	-0.22	88	167	80	73
410	64.049	0.157	0.042	0.98	100	1.63	100	9.7	-0.19	87	164	79	72
420	65.616	0.157	0.042	1.07	99	1.16	100	9.5	-0.2	87	160	79	72
430	67.184	0.157	0.042	1.08	99	2.91	100	9.3	-0.2	87	159	79	72
440	68.750	0.157	0.042	1.07	99	1.19	100	9.1	-0.18	87	160	79	74
450	70.320	0.157	0.042	1.06	99	2.9	100	9.0	-0.19	87	160	79	72
460	71.890	0.157	0.042	1.04	99	1.14	100	8.8	-0.17	87	164	79	72
470	73.465	0.158	0.042	1.02	98	3.13	101	8.6	-0.17	86	164	79	72
480	75.034	0.157	0.042	1.02	98	3.23	100	8.4	-0.18	86	162	78	71
490	76.598	0.156	0.042	1.13	98	2.92	100	8.3	-0.16	86	165	78	71
500	78.166	0.157	0.042	1.04	98	1.47	100	8.1	-0.16	86	165	78	71
510	79.734	0.157	0.042	0.98	98	1.7	100	7.9	-0.2	86	166	77	70
520	81.298	0.156	0.042	0.99	97	3.14	100	7.6	-0.28	86	179	77	70
530	82.863	0.157	0.042	0.99	97	1.44	100	7.4	-0.22	86	182	77	70
540	84.436	0.157	0.042	1.13	97	2.93	101	7.2	-0.22	86	181	77	72
550	86.006	0.157	0.042	1.03	97	1.82	101	7.0	-0.18	86	172	78	73
560	87.567	0.156	0.042	1.06	97	3.13	100	6.9	-0.16	86	171	79	74
570	89.128	0.156	0.042	1.12	98	1.75	100	6.7	-0.16	86	166	79	74
580	90.690	0.156	0.042	1.06	98	2.85	100	6.6	-0.12	86	166	80	74
590	92.249	0.156	0.042	0.98	98	3.16	100	6.3	-0.23	86	170	80	75
600	93.805	0.156	0.042	0.96	99	1.31	99	6.1	-0.22	86	179	80	75
610	95.361	0.156	0.042	1.01	99	3.08	99	5.9	-0.27	86	181	80	75
620	96.923	0.156	0.042	0.95	99	2.94	100	5.7	-0.2	86	180	80	75
630	98.482	0.156	0.042	0.97	99	2.91	100	5.5	-0.18	86	173	80	75

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
640	100.032	0.155	0.042	1.00	99	3.21	99	5.3	-0.16	85	169	80	75
650	101.594	0.156	0.042	1.08	100	3.1	100	5.2	-0.15	85	168	80	75
660	103.150	0.156	0.042	1.01	100	2.86	99	5.0	-0.17	85	163	80	75
670	104.712	0.156	0.042	1.12	100	1.99	100	4.8	-0.15	85	164	80	75
680	106.272	0.156	0.042	1.15	100	1.23	99	4.7	-0.18	85	165	80	75
690	107.829	0.156	0.042	1.15	100	3.2	99	4.4	-0.25	85	172	80	75
700	109.391	0.156	0.042	1.00	100	3.12	100	4.2	-0.23	86	177	80	75
710	110.951	0.156	0.042	1.13	100	1.37	99	4.0	-0.23	85	170	80	75
720	112.508	0.156	0.042	1.11	100	3.21	99	3.8	-0.17	85	165	80	75
730	114.061	0.155	0.042	1.15	100	2.97	99	3.6	-0.21	85	163	80	74
740	115.618	0.156	0.042	1.14	100	3.06	99	3.4	-0.22	84	163	79	71
750	117.185	0.157	0.042	0.98	99	1.3	100	3.1	-0.21	83	163	78	71
760	118.752	0.157	0.042	1.03	99	2.6	100	2.9	-0.2	83	164	78	72
770	120.308	0.156	0.042	1.14	99	3.21	99	2.7	-0.22	84	168	78	73
780	121.876	0.157	0.042	1.01	99	3.08	100	2.5	-0.26	84	171	79	74
790	123.430	0.155	0.042	1.12	99	2.95	99	2.2	-0.22	84	174	79	74
800	124.988	0.156	0.042	1.02	99	1.14	99	2.0	-0.26	85	177	79	74
810	126.553	0.157	0.042	1.08	99	1.26	100	1.8	-0.22	85	175	79	74
820	128.104	0.155	0.042	1.07	99	1.65	99	1.6	-0.16	84	169	79	74
830	129.672	0.157	0.042	0.94	99	1.09	100	1.4	-0.16	84	169	79	74
840	131.233	0.156	0.042	1.10	99	2.92	100	1.3	-0.15	84	171	79	74
850	132.795	0.156	0.042	0.96	99	3.1	100	1.1	-0.15	83	171	79	74
860	134.349	0.155	0.042	1.03	99	2.94	99	1.0	-0.15	84	172	79	73
870	135.903	0.155	0.042	1.10	99	3.1	99	0.8	-0.17	84	173	79	73
880	137.466	0.156	0.042	1.02	99	1.19	100	0.7	-0.17	84	178	78	73
890	139.025	0.156	0.042	1.11	99	1.1	99	0.5	-0.16	83	175	78	73
900	140.584	0.156	0.042	0.97	99	1.43	99	0.4	-0.14	84	175	78	73
910	142.142	0.156	0.042	1.13	99	2.97	99	0.2	-0.14	84	174	78	72
920	143.699	0.156	0.042	1.06	99	1.49	99	0.0	-0.21	84	171	78	72
Avg/Tot	143.699	0.156	0.042	1.03	99	2.32	100			88	175	80	74.1

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.00	89	1		82	-0.020	4.63	0.04
10	1.489	0.149	1.16	89	1.47	97	83	-0.010	5.59	0.01
20	2.983	0.149	1.18	90	2.31	97	82	-0.010	7.33	0.01
30	4.493	0.151	1.19	92	-3.96	98	82	-0.020	8.97	0.01
40	6.028	0.154	1.12	93	15.73	99	82	-0.020	8.59	0.00
50	7.569	0.154	1.21	95	15.16	99	83	-0.020	9.15	0.01
60	9.138	0.157	1.24	96	-4.62	101	83	-0.020	9.15	0.00
70	10.704	0.157	1.23	98	6.83	101	83	-0.020	8.52	0.00
80	12.275	0.157	1.18	99	16.25	101	83	-0.020	8.58	0.00
90	13.848	0.157	1.09	99	5.35	101	83	-0.020	8.71	0.00
100	15.418	0.157	1.24	100	-3.54	100	83	-0.020	9.59	0.00
110	16.990	0.157	1.24	101	-2.67	100	83	-0.020	8.78	0.01
120	18.559	0.157	1.18	101	14.8	100	83	-0.020	8.92	0.00
130	20.131	0.157	1.11	101	-3.55	100	83	-0.020	9.52	0.02
140	21.701	0.157	1.10	102	12.65	100	83	-0.020	8.79	0.05
150	23.276	0.158	1.25	102	12.61	100	83	-0.020	7.50	0.00
160	24.857	0.158	1.21	102	3.7	100	82	-0.010	7.39	0.00
170	26.436	0.158	1.18	102	5.66	100	82	-0.020	7.81	0.00
180	28.016	0.158	1.24	102	8.6	100	82	-0.010	8.61	0.01
190	29.593	0.158	1.17	103	-1.09	100	82	-0.020	8.79	0.01
200	31.175	0.158	1.17	103	-2.23	100	82	-0.020	9.14	0.01
210	32.749	0.157	1.26	103	-1.18	100	82	-0.020	9.98	0.00
220	34.330	0.158	1.17	103	12.47	100	82	-0.020	9.99	0.10
230	35.921	0.159	1.25	103	12.52	101	82	-0.010	8.94	0.01
240	37.500	0.158	1.14	103	12.09	100	82	-0.010	7.92	0.01
250	39.083	0.158	1.26	103	7.5	100	81	-0.010	7.34	0.00
260	40.662	0.158	1.16	103	12.1	100	81	-0.010	8.20	0.01
270	42.252	0.159	1.26	103	13.89	101	81	-0.010	9.14	0.01
280	43.832	0.158	1.20	103	11.18	100	80	-0.010	10.04	0.01
290	45.417	0.159	1.21	103	6.01	100	80	-0.020	10.34	0.10
300	47.008	0.159	1.22	102	10.45	101	80	-0.020	9.08	0.46
310	48.597	0.159	1.27	102	1.58	101	81	-0.010	8.00	0.11

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	50.180	0.158	1.25	102	8.77	100	81	-0.010	7.17	0.01
330	51.763	0.158	1.27	102	-1.57	100	80	-0.010	6.82	0.01
340	53.346	0.158	1.25	102	-1.78	100	80	-0.010	7.65	0.01
350	54.933	0.159	1.11	102	-2.15	100	80	-0.010	8.82	0.01
360	56.508	0.158	1.21	102	-0.42	100	80	-0.010	8.96	0.00
370	58.091	0.158	1.28	102	1.22	100	80	-0.010	9.06	0.00
380	59.671	0.158	1.20	102	9.26	100	79	-0.010	8.92	0.00
390	61.255	0.158	1.22	102	12.55	100	79	-0.010	8.95	0.00
400	62.844	0.159	1.22	101	2.95	101	79	-0.010	8.38	0.00
410	64.427	0.158	1.25	101	2.46	100	79	-0.010	8.15	0.01
420	66.020	0.159	1.23	101	0.48	101	78	-0.010	8.24	0.00
430	67.604	0.158	1.18	101	2.97	100	78	-0.010	7.61	0.00
440	69.185	0.158	1.27	101	0.01	100	78	-0.010	7.68	0.00
450	70.776	0.159	1.19	100	11.21	101	79	-0.010	7.47	0.00
460	72.361	0.159	1.22	100	7.86	100	78	-0.010	7.53	0.00
470	73.947	0.159	1.21	100	12.07	100	78	-0.010	7.44	0.00
480	75.527	0.158	1.23	100	-2.01	100	77	-0.010	7.20	0.00
490	77.113	0.159	1.19	100	-0.15	100	77	-0.010	7.10	0.00
500	78.693	0.158	1.16	100	5.04	100	77	-0.010	6.69	0.00
510	80.274	0.158	1.17	99	-0.41	100	77	-0.010	8.95	0.00
520	81.863	0.159	1.26	99	1.52	101	76	-0.010	8.66	0.00
530	83.445	0.158	1.30	99	5.72	100	76	-0.020	8.09	0.00
540	85.023	0.158	1.28	99	1.06	100	77	-0.010	7.50	0.00
550	86.604	0.158	1.20	99	1.2	100	78	-0.010	7.07	0.00
560	88.187	0.158	1.14	99	-0.38	100	79	-0.010	6.69	0.00
570	89.771	0.158	1.23	99	11	100	80	-0.010	6.38	0.00
580	91.348	0.158	1.10	99	10.51	100	80	-0.010	6.23	0.00
590	92.926	0.158	1.27	100	0.95	100	80	-0.010	8.30	0.00
600	94.502	0.158	1.23	100	8.97	100	80	-0.010	8.68	0.00
610	96.080	0.158	1.27	100	1.08	100	80	-0.010	8.61	0.00
620	97.668	0.159	1.29	100	0.2	100	80	-0.010	7.69	0.00
630	99.246	0.158	1.23	100	1.71	100	80	-0.010	7.21	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
640	100.832	0.159	1.23	101	5.37	100	80	-0.010	7.31	0.00
650	102.415	0.158	1.21	101	-0.97	100	80	-0.010	7.27	0.00
660	103.987	0.157	1.29	101	4.12	99	80	-0.010	7.28	0.00
670	105.572	0.159	1.32	101	1.06	100	80	-0.010	7.43	0.00
680	107.150	0.158	1.25	101	7.7	100	80	-0.010	7.68	0.00
690	108.730	0.158	1.27	101	1.09	100	80	-0.010	8.02	0.00
700	110.308	0.158	1.19	101	0.64	100	80	-0.010	8.32	0.00
710	111.893	0.158	1.25	101	8.1	100	80	-0.010	7.72	0.00
720	113.475	0.158	1.29	101	0.89	100	80	-0.010	7.71	0.00
730	115.057	0.158	1.24	101	-0.09	100	80	-0.010	8.10	0.00
740	116.642	0.158	1.29	101	2.05	100	79	-0.010	8.04	0.00
750	118.225	0.158	1.11	101	9.77	100	77	-0.010	8.32	0.00
760	119.804	0.158	1.26	100	1.4	100	77	-0.010	8.31	0.00
770	121.387	0.158	1.26	100	2.47	100	78	-0.010	8.23	0.00
780	122.972	0.158	1.26	100	9.29	100	79	-0.010	8.10	0.00
790	124.547	0.158	1.16	100	-0.5	99	79	-0.010	8.47	0.00
800	126.127	0.158	1.25	100	-1.3	100	79	-0.010	8.29	0.00
810	127.706	0.158	1.22	100	1.11	100	79	-0.010	7.68	0.00
820	129.291	0.158	1.17	100	-0.32	100	79	-0.010	7.04	0.00
830	130.878	0.159	1.24	100	-1.65	100	79	-0.010	6.55	0.00
840	132.460	0.158	1.28	100	7.33	100	79	-0.010	6.02	0.00
850	134.039	0.158	1.26	100	8.54	100	79	-0.010	6.08	0.00
860	135.618	0.158	1.15	100	1.18	100	79	-0.010	6.23	0.00
870	137.198	0.158	1.26	100	9.01	100	79	-0.010	6.50	0.00
880	138.786	0.159	1.13	100	-0.45	100	78	-0.010	6.31	0.00
890	140.367	0.158	1.28	100	0.51	100	78	-0.010	5.87	0.00
900	141.953	0.159	1.25	100	-0.47	100	78	-0.010	5.79	0.00
910	143.526	0.157	1.24	100	1.32	99	78	-0.010	5.28	0.00
920	145.103	0.158	1.19	99	4.58	100	78	-0.010	5.10	0.00
Avg/Tot	145.103	0.158	1.20	100	4.22	100	80	-0.012	7.87	0.01

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

Stove ΔT: 43

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	313	319	261	341	390	324.8	469
10	269	274	216	308	377	288.8	456
20	240	243	197	305	367	270.4	608
30	231	229	190	348	362	272.0	809
40	234	228	189	384	361	279.2	802
50	242	232	193	410	360	287.4	853
60	254	238	199	437	361	297.8	882
70	266	245	204	451	363	305.8	844
80	276	253	209	457	366	312.2	882
90	282	258	213	455	368	315.2	845
100	288	265	219	464	370	321.2	899
110	293	271	224	476	371	327.0	869
120	298	275	228	473	371	329.0	856
130	300	276	232	486	369	332.6	903
140	301	278	236	495	368	335.6	848
150	299	278	234	480	367	331.6	783
160	294	275	233	448	362	322.4	730
170	289	272	233	431	356	316.2	730
180	286	270	234	427	350	313.4	759
190	285	270	238	435	345	314.6	789
200	287	272	242	445	341	317.4	809
210	290	275	245	463	337	322.0	853
220	293	279	248	488	334	328.4	856
230	295	281	248	492	330	329.2	781
240	293	281	245	466	324	321.8	709
250	289	278	240	434	317	311.6	655
260	284	274	240	410	310	303.6	668
270	281	273	243	411	304	302.4	739
280	284	277	250	435	300	309.2	830
290	290	283	259	471	298	320.2	875
300	296	290	266	489	297	327.6	800
310	295	291	265	469	295	323.0	683
320	289	287	260	439	289	312.8	633
330	280	281	254	407	281	300.6	583
340	272	275	255	383	274	291.8	601
350	267	275	259	378	269	289.6	665
360	268	280	269	387	268	294.4	701
370	271	287	277	399	270	300.8	725
380	274	293	281	409	272	305.8	736
390	277	298	283	415	275	309.6	732
400	279	302	283	415	278	311.4	716
410	278	306	280	409	280	310.6	700
420	276	310	276	402	282	309.2	689
430	272	311	272	399	284	307.6	686
440	269	313	270	393	287	306.4	681
450	267	316	269	389	291	306.4	679
460	265	319	267	384	293	305.6	674
470	264	320	267	380	295	305.2	675

WOODSTOVE SURFACE TEMPERATURE DATA

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

Stove ΔT: 43

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	262	322	265	376	296	304.2	670
490	260	323	264	372	295	302.8	668
500	258	323	262	368	293	300.8	663
510	257	323	261	368	291	300.0	691
520	259	328	266	396	291	308.0	769
530	263	336	270	410	294	314.6	761
540	266	340	272	407	297	316.4	728
550	268	342	271	398	298	315.4	699
560	268	341	267	386	297	311.8	676
570	266	339	262	376	295	307.6	655
580	263	335	258	367	291	302.8	642
590	261	331	255	371	289	301.4	702
600	262	333	257	392	291	307.0	738
610	265	334	263	412	296	314.0	778
620	268	336	267	418	301	318.0	743
630	270	335	267	406	306	316.8	702
640	269	332	265	392	308	313.2	677
650	267	329	263	382	307	309.6	661
660	266	325	263	375	306	307.0	653
670	265	319	260	370	304	303.6	654
680	266	316	257	369	301	301.8	668
690	270	309	256	379	299	302.6	711
700	278	302	257	395	298	306.0	739
710	289	295	254	406	296	308.0	721
720	300	290	250	404	294	307.6	694
730	306	281	239	400	291	303.4	694
740	309	273	229	401	289	300.2	703
750	312	269	225	401	287	298.8	701
760	317	268	222	401	285	298.6	697
770	324	266	219	403	285	299.4	709
780	330	264	217	411	285	301.4	730
790	335	263	216	417	284	303.0	745
800	339	263	215	423	284	304.8	748
810	343	263	214	420	285	305.0	729
820	342	261	211	410	286	302.0	700
830	340	259	209	394	286	297.6	672
840	338	256	206	381	285	293.2	663
850	338	253	204	376	284	291.0	669
860	339	252	203	374	281	289.8	673
870	341	251	203	374	278	289.4	680
880	343	250	204	376	275	289.6	685
890	341	249	203	374	274	288.2	678
900	338	248	204	368	275	286.6	666
910	334	246	205	362	277	284.8	655
920	328	244	204	354	279	281.8	636
Average	287	287	242	407	308	306	721

LAB SAMPLE DATA - ASTM E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run #: 7

Job #: 19-509
Tracking #: 0032
Technician: SJB
Date: 8/1/2019

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	3572	121.7	121.7	122.9	1.2
Train A Filters - Remainder	3573	116.3	232.3	234.1	1.8
	3574	116.0			
Train A Probe	2A	116241.7	116241.7	116242.0	0.3
Train A O-Rings	2A	3551.4	3551.4	3552.7	1.3
Train B Filters	3576	124.6	240.7	243.5	2.8
	3576	116.1			
Train B Probe	2B	116331.6	116331.6	116331.7	0.1
Train B O-Rings	2B	3570.0	3570.0	3571.4	1.4
Background Filter			0.0	0.0	

Placed in Dessicator on:	8/5 - 8:00

Train A Filters - First Hour	123.1	8/6 16:11	122.9	8/7 16:14				
Train A Filters - Remainder	234.0	8/6 16:11	234.1	8/7 16:14				
Train A Probe	116242.1	8/6 16:12	116242.0	8/7 16:14				
Train A O-Rings	3552.6	8/6 16:12	3552.7	8/7 16:14				
Train B Filters	243.6	8/6 16:12	243.5	8/7 16:14				
Train B Probe	116331.7	8/6 16:12	116331.7	8/7 16:14				
Train B O-Rings	3571.3	8/6 16:12	3571.4	8/7 16:14				
Background Filter								

1st hour Sub-Total, mg:	1.2
Remainder Sub-Total, mg:	3.4
Train 1 Aggregate, mg:	**4.6**
Train 2 Aggregate, mg:	**4.3**
Ambient Aggregate, mg:	0.0

ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 7 Test Date: 8/1/2019

Wood Heater Run Notes

Test Control Settings

Primary Air Setting(s): Low Test Setting (88° Counterclockwise from fully open)
Targeted Burn Category: I

Preburn Notes

Time	Notes
-	Loaded 25.8 lbs of preburn, fan on high, bypass closed, burn down to target weight before turn down.
0 min	@6.9 lbs, turned air down to test setting, fan turned down to low.
45 min	@6.9 lbs, raked coal bed.
60 min	@6.8 lbs, zeroed scale in preparation of test fuel loading.

Test Notes

Test Burn Start Time: 14:56 Test Fuel Loaded by: 25 seconds
Door Closed: 30 seconds Air Control Set at: 0 seconds
Other Loading Notes: Bypass closed @ 0 sec

Time	Notes
0 min	Loaded test fuel load
60 min	Changed 1-hr filter
920 min	End of test

Test Burn End Time: 8/2 – 6:16

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 16.89 CO (%): 4.33
Mid Gas CO_2 (%): 10.07 CO (%): 2.53

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	16:40	16:45	16:43	8/2 – 6:55	8/2 – 6:58	8/2 – 7:00
CO_2	0.00	10.28	16.88	0.04	9.98	16.67
CO	0.00	2.53	4.33	0.00	2.47	4.24

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

Technician Signature: Date: 8/2/2019

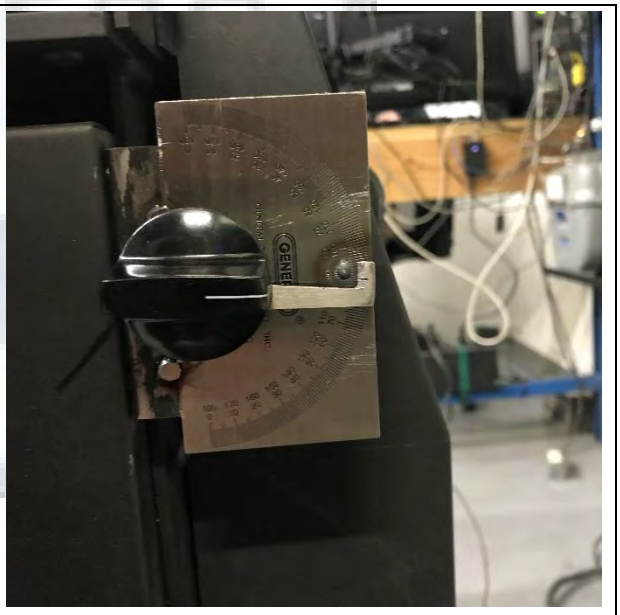
ASTM E2780 Wood Heater Run Sheets

Client: Valley Comfort Job Number: 19-509 Tracking #: 0032
`Model: KE40 Run Number: 7 Test Date: 8/1/2019

Test Fuel Side View

Test Fuel Iso View

Test Fuel Loaded in Stove



Air Setting

Technician Signature: Date: 8/2/2019

ASTM E2515 - Glass Filters

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
3541	121.8	121.8	–	–	SB	19-509	#1
3542	123.8	123.7	–	–	SB	↓	↓
3543	116.7	116.7	–	–	SB	↓	↓
3544	122.8	122.6	–	–	SB	↓	↓
3545	115.2	115.2	–	–	SB	↓	↓
3546	117.1	117.1	–	–	SB	19-509	#2
3547	114.4	114.3	–	–	SB	↓	↓
3548	121.8	122.0	–	–	SB	↓	↓
3549	123.8	124.0	–	–	SB	↓	↓
3550	115.8	115.6	–	–	SB	↓	↓
3551	121.7	121.8	–	–	SB	19-509	#3
3552	115.9	115.9	–	–	SB	↓	↓
3553	116.0	116.0	–	–	SB	↓	↓
3554	122.8	122.6	–	–	SB	↓	↓
3555	123.6	123.8	–	–	SB	↓	↓
3556	116.8	116.8	–	–	SB	19-509	#4
3557	115.1	115.1	–	–	SB	↓	↓
3558	121.8	121.7	–	–	SB	↓	↓

Weight 1 Date/Time:
7/22 - 7:30
Weight 2 Date/Time:
7/23 - 8:00
Weight 3 Date/Time:
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
3559	116.3	116.1	–	–	SB	19-509	#4
3560	115.5	115.3	–	–	SB	↓	↓
3561	123.4	123.0	123.2	–	SB	↓	↓
3562	121.0	121.1	–	–	SB	19-509	#5
3563	116.8	117.2	117.3	–	SB	↓	↓
3564	120.7	120.7	–	–	SB	↓	↓
3565	115.1	115.0	–	–	SB	↓	↓
3566	123.8	123.8	–	–	SB	↓	↓
3567	115.9	115.8	–	–	SB	19-509	#6
3568	115.7	115.6	–	–	SB	↓	↓
3569	121.5	121.7	–	–	SB	↓	↓
3570	124.8	124.9	–	–	SB	↓	↓
3571	122.3	122.4	–	–	SB	↓	↓
3572	121.6	121.7	–	–	SB	19-509	#7
3573	116.4	116.3	–	–	SB	↓	↓
3574	116.1	116.0	–	–	SB	↓	↓
3575	124.7	124.6	–	–	SB	↓	↓
3576	116.3	116.1	–	–	SB	↓	↓

Weight 1 Date/Time:
7/22 - 7:30
Weight 2 Date/Time:
7/23 - 8:00
Weight 3 Date/Time:
7/24 - 8:00
Weight 4 Date/Time:

ASTM E2515 - Probes

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
1A	115630.4	115630.6	-	-	SB	19-509	#6
1B	115908.2	115904.4	-	-	SB		
2A	116241.8	116241.7	-	-	SB	19-509	#4
2B	116331.8	116331.6	-	-	SB		
3A	116076.7	116078.8	-	-	SB		
3B	116341.4	116341.4	-	-	SB		
4A	116184.3	116184.2	-	-	SB		
4B	116366.9	116366.9	-	-	SB		
5A	116769.5	116769.4	-	-	SB		
5B	116877.5	116877.3	-	-	SB		

Weight 1 Date/Time:
7/22 - 7:00

Weight 2 Date/Time:
7/23 - 8:00

Weight 3 Date/Time:

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
6A							
6B							
7A							
7B							
8A							
8B							
9A							
9B							
10A							
10B							

Weight 1 Date/Time:

Weight 2 Date/Time:

Weight 3 Date/Time:

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
11A							
11B							
12A							
12B							
13A							
13B							
14A							
14B							
15A							
15B							

Weight 1 Date/Time:

Weight 2 Date/Time:

Weight 3 Date/Time:

Weight 4 Date/Time:

ASTM E2515 - Probes

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
1A	115630.0	115630.2	–	–	SB	18-449	#1
1B	115903.7	115903.8	–	–	SB		
2A	116240.5	116240.5	–	–	SB	18-449	#2
2B	116330.5	116330.6	–	–	SB		
3A	116078.1	116078.1	–	–	SB	18-449	#3
3B	116340.8	116340.9	–	–	SB		
4A	116183.6	116183.8	–	–	SB	19-480	#1
4B	116365.8	116366.0	–	–	SB		
5A	116769.1	116769.7	116769.1	116769.3	SB	19-480	#2
5B	116876.8	116877.2	116876.8	116876.9	SB		

Weight 1 Date/Time:
6/10 - 7:00

Weight 2 Date/Time:
6/11 - 7:45

Weight 3 Date/Time:
6/13 - 8:30

Weight 4 Date/Time:
6/14 - 7:30

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
6A	116544.8	116545.5	116545.3	–	SB	19-480	#3
6B	116117.9	116118.4	116118.4	–	SB		
7A	116740.8	116741.1	116741.2	–	SB	19-495	#1
7B	117289.4	117289.1	117289.0	–	SB	↓	↓
8A	116823.4	116824.4	116824.3	–	SB	19-496	#1
8B	116825.8	116826.3	116826.2	–	SB	↓	#1
9A	116714.4	116714.2	–	–	SB	19-496	#2
9B	117920.6	117920.1	117920.3	–	SB	↓	#2
10A	116820.7	116820.5	–	–	SB	19-496	#3
10B	117905.3	117905.2	–	–	SB	↓	#3

Weight 1 Date/Time:
6/13 - 8:30

Weight 2 Date/Time:
6/14 - 7:30

Weight 3 Date/Time:
6/17 - 7:00

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
11A	117035.5	117035.7	–	–	SB	19-509	#1
11B	117489.9	117489.9	–	–	SB	↓	#1
12A	116889.3	116889.1	–	–	SB	19-509	#2
12B	117957.1	117957.2	–	–	SB	19-509	#2
13A	117456.0	117455.8	–	–	SB	19-509	#3
13B	117054.7	117054.9	–	–	SB	19-509	#3
14A	116818.1	116817.8	116817.7	–	SB	19-509	#4
14B	116772.0	116771.7	116771.5	–	SB	19-509	#4
15A	117418.9	117418.8	–	–	SB	19-509	#5
15B	116905.2	116905.3	–	–	SB	19-509	#5

Weight 1 Date/Time:
7/22 - 7:00

Weight 2 Date/Time:
7/23 - 8:00

Weight 3 Date/Time:
7/24 - 8:00

Weight 4 Date/Time:

ASTM E2515 - O-Rings

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
1A	3562.7	3562.8	-	-	SB	18-449	#1
1B	3551.3	3551.3	-	-	SB		
2A	3548.4	3548.5	-	-	SB	18-449	#2
2B	3566.9	3567.1	-	-	SB		
3A	3575.6	3575.7	-	-	SB	18.449	#3
3B	3564.0	3564.2	-	-	SB		
4A	3588.4	3588.5	-	-	SB	19.480	#1
4B	3576.1	3576.3	-	-	SB		
5A	3530.2	3530.2	-	-	SB	19.480	#2
5B	3526.8	3526.9	-	-	SB		

Weight 1 Date/Time:
6/10 - 7:00

Weight 2 Date/Time:
6/11 - 7:45

Weight 3 Date/Time:

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
6A	3611.1	3611.2	-	-	SB	19-480	#3
6B	3387.9	3387.8	-	-	SB		
7A	3570.0	3570.1	-	-	SB	19-495	#1
7B	3518.8	3519.0	-	-	SB		
8A	3548.8	3549.0	-	-	SB	19-496	#1
8B	3582.2	3582.3	-	-	SB		
9A	3579.9	3580.1	-	-	SB	19-496	#2
9B	3522.5	3522.7	-	-	SB		
10A	3427.7	3427.9	-	-	SB	19.496	#3
10B	3568.4	3568.6	-	-	SB		

Weight 1 Date/Time:
6/10 - 7:00

Weight 2 Date/Time:
6/13 - 8:30

Weight 3 Date/Time:

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
11A	3421.6	3422.2	3422.3	-	SB	19-509	#1
11B	4232.2	4232.8	4232.8	-	SB		
12A	3393.9	3394.0	-	-	SB	19-509	#2
12B	3403.9	3404.1	-	-	SB		
13A	3358.8	3359.0	-	-	SB	19-509	#3
13B	3443.2	3443.6	3443.6	-	SB		
14A	3364.1	3364.2	-	-	SB	19-509	#4
14B	3338.3	3338.5	-	-	SB		
15A	3567.9	3568.1	-	-	SB	19-509	#5
15B	3568.3	3568.7	3568.8	-	SB		

Weight 1 Date/Time:
7/22 - 7:15

Weight 2 Date/Time:
7/24 - 8:00

Weight 3 Date/Time:
7/25 - 7:00

Weight 4 Date/Time:

ASTM E2515 - O-Rings

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
1A	3565.5	3565.4	—	—	SB	19-509	#C
1B	3553.9	3554.1	—	—	SB		
2A	3551.2	3551.4	—	—	SB	19-509	#7
2B	3569.8	3570.0	—	—	SB		
3A	3578.3	3578.5	—	—	SB		
3B	3566.7	~~3567.3~~ 3566.8	—		SB		
4A	3591.2	3591.3	—	—	SB		
4B	3578.6	3578.8	—	—	SB		
5A	3532.9	3533.1	—	—	SB		
5B	3529.3	3529.5	—	—	SB		

Weight 1 Date/Time:
7/22 - 7:15
Weight 2 Date/Time:
7/24 - 8:00
Weight 3 Date/Time:
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
6A							
6B							
7A							
7B							
8A							
8B							
9A							
9B							
10A							
10B							

Weight 1 Date/Time:
Weight 2 Date/Time:
Weight 3 Date/Time:
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weigth 3	Weight 4	Initial	Project	Run
11A							
11B							
12A							
12B							
13A							
13B							
14A							
14B							
15A							
15B							

Weight 1 Date/Time:
Weight 2 Date/Time:
Weight 3 Date/Time:
Weight 4 Date/Time:

July 16, 2019
Prepared by Aaron Saxton
Product Development, Blaze King Industries

Blaze King KE40 EPA Test Burn Instructions

The following literature shall be used as a guideline when operating a Blaze King KE40 during an EPA 5G Wood Heater Test.

** before starting any test run ensure unit is clean; use vacuum to remove any material left from previous burns and zero scale**

Kindling Load

- prepare 15lbs of Douglas Fir cordwood (kindling load)
- with the thermostat set to high and the bypass door open, light the fire
- leave the loading door cracked open until fire is well established
- once loading door is closed and combustor temperature begins to climb, close the bypass door (ensure bypass is latched shut), turn fan on to high
- once load has burned down to 1.5-2.0 lbs, open bypass door and then loading door and break down load into chunks of coal
- scoop out coals (as much as possible) and zero scale reading to eliminate any weight from moisture loss accumulated in unit/stack before fire is lit
- place coals back in unit and flatten to make an even coal bed; rake hotter coals to front of unit for better preburn light off.
- close loading door and bypass door and prepare to load preburn.

Preburn Load

- the preburn load consists of 3 layers of 14 pieces of 2x4 (5 pieces on the bottom, 5 pieces in the middle, and 4 pieces on top; all pieces evenly spaced). When ready to load preburn; open bypass door & loading door and place the bottom layer onto coal bed in a front to back orientation, then insert the middle layer in a side to side orientation, and finally insert the top layer in a front to back orientation. Close loading door & bypass door and ensure thermostat and fan are both set to high. Keep time loading door is open to a minimum.
- burn until following weights are reached for their respective turn down settings:
    - low burn = 7lbs
    - medium low burn = 7lbs
    - medium high burn = 5.8lbs
    - high burn = no turn down
    - **note: turn down weight is based on fuel load weight (variable)
- at turn down time, fan speed is also reduced respectively:
    - low burn = rheostat knob at lowest point
    - medium low burn = rheostat knob 1/3 open
    - medium high burn = rheostat knob 2/3 open
    - high burn = rheostat knob fully open

- With the exception of high burn (where the coal bed will be raked immediately before loading test fuel) at 15 minutes before test load time the coal bed must be raked. Leaving the bypass door closed, open the loading door and rake the hotter coals to towards the front of the firebox with a slight angle forward (helps prevent test load from rolling forward into door glass). Close loading door immediately after raking, keeping time loading door is open to a minimum. Once preburn has burned down to desired coal bed weight, prepare to load test fuel.

Test Load

- when ready to load; Leave thermostat knob at the test setting, turn fan off, leave bypass door closed, open loading door and load test fuel (six 4x4's) making sure to slightly angle the front two stacked 4x4's back into the stove to help prevent them from rolling forward into the door glass. Close loading door as soon as test fuel is loaded and turn the fan on to its respective burn category speed (as previously listed).

  It is important to keep loading time to less than 60 seconds to minimize the amount of room air that will flood the combustor. Turn the fan on to its respective burn category speed (as previously listed).

Low Burn Rate Justification

Completed by Ashnil Reddy
Product Development, Blaze King Ind.
December 14, 2016
Revised January 13, 2021

The two main components of a Blaze King thermostat are the damper blade and the bimetallic coil; they work in unison to produce a consistent heat output. The damper blade is controlled by a thermostat knob that is positioned accordingly based on desired heat output. The bimetallic coil regulates the flow of intake air by adjusting the damper blade angle based on its reaction with heat radiating off the appliance. As the fire loses intensity (appliance radiates less heat) the bimetallic coil contracts causing both the damper blade angle and the flow of intake air to increase which stokes the fire so the appliance can maintain the desired heat output. As the fire gains intensity (appliance radiates more heat) the bimetallic coil expands causing both the damper blade angle and the flow of intake air to decrease for the opposite effect.

When preforming a emission certification test run in the Low Burn rate category (<0.8kg/hr), Blaze King's target fuel consumption rate is 0.1lb of test fuel per 10 minute interval. To achieve this, the thermostat knob is positioned such that the damper blade is almost fully closed. If the blade is closed beyond this point, inadequate intake air would cause the burn to stall. This low burn rate is consistently achievable in a test lab environment given that external conditions are held constant. However, when burning in a real world environment, external conditions cannot be held constant which could yield a faster low burn rate given the same thermostat knob setting as used in the test lab environment.

A great example of a real world inconsistency that would affect the low burn rate is chimney draft. If the unit were installed with a chimney height of 20ft or greater, the increased draft associated with that chimney height could increase the velocity of intake air into the unit and result in a faster low burn rate given the same thermostat knob setting as used in the test lab. In this scenario, the operator would be able to turn the thermostat knob lower to account for the increased draft and maintain the same low burn rate that was achieved in the test lab environment. If the consumer were to turn the thermostat knob too low, the fire would stall due to inadequate intake air as previously mentioned. This proves that when the damper blade is closed within the thermostat, regardless of the thermostat knob position, the low burn rate achieved during emissions testing is no greater than the rate that an operator can achieve in real world use.

The following data set was obtained from a Blaze King PE32 in-house (unofficial) low burn run to show that when the thermostat knob is set to a position lower than what was used for the official low burn run, the fire stalls. The KE40 utilizes the same thermostat mechanism as the PE32 (manufacturer part #Z3032/Z3040) and thus this data supports the same conclusion, that the appliance was tested at the lowest possible burn rate achievable by a consumer.

Blaze King / Valley Comfort

Wood Heater Test Data - EPA Method 5G

Run:

Manufacturer: Blaze King
Model: PE32
Tracking No.:
Project No.: Low Burn - Invalid Run Stalled
Test Date: 02-Jul-18
Beginning Clock Time: 00:00
Recording Interval: 10 min.
Total Sampling Time: 890 min.
Burn Rate: N/A kg/hr

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP									"H2O
Initial Temp.									oF

Equipment Numbers: THERMOSTAT KNOB WAS CLOSED 80° FROM FULLY OPEN
NOTE: THERM KNOB WAS CLOSED 76° FROM FULLY OPEN FOR OFFICIAL EPA LOW BURN
TEST TERMINATED AT 890 MINS BECAUSE < .1 LB/MIN WEIGHT CHANGE FOR 30 MINUTES

PM Control Module: BK-06
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.56 lb/lb-mole
Dilution Tunnel H2O: 4.00 percent
Dilution Tunnel Static: -0.680 "H2O
Pitot Tube Cp: 0.99
Meter Box Y Factor: 0.988
Barometric Pressure: Begin Middle End Average 0.00 "Hg

Signature/Date:
Tunnel Velocity: #DIV/0! ft/sec.
Intial Tunnel Flow: #DIV/0! scfm
Average Tunnel Flow: #DIV/0! scfm
Tunnel Area: 0.196 ft2
Post-Test Leak Check: .008@6 cfm@"Hg
Fuel Moisture (dry basis 22.3 %
Total Particulate: mg
Filter Holder No.:

	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
Elapsed Time	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	1.000					#DIV/0!	#DIV/0!		20.78		252.89	386.58	200.39	221.34	219.33		256.1	223.14			69.78		382.99
10	1.000	0.00					#DIV/0!	#DIV/0!	20.71	-0.07	234.17	360.64	175.17	191.65	188.9		230.1	199.55			69.95		444.57
20	1.000	0.00						#DIV/0!	20.56	-0.15	231.32	347.64	158.76	170.75	168.45		215.4	185.54			69.39		495.28
30	1.000	0.00						#DIV/0!	20.3	-0.26	246.05	347.92	150.46	159.71	158.64		212.6	183.97			69.39		580.11
40	1.000	0.00					#DIV/0!	#DIV/0!	19.76	-0.54	279.84	354.64	146.54	162.68	160.83		220.9	195.46			69.16		679.73
50	1.000	0.00					#DIV/0!	#DIV/0!	19.11	-0.65	299.51	361.25	147.38	172.2	170.41		230.2	203.97			69.67		685.51
60	1	0.00					#DIV/0!	#DIV/0!	18.42	-0.69	314.3	362.65	147.49	180.55	177.08		236.4	213.44			69.05		709.6
70	1.000	0.00					#DIV/0!	#DIV/0!	17.68	-0.74	341.14	366.3	149.85	186.27	182.46		245.2	225.43			68.88		765.74
80	1.000	0.00					#DIV/0!	#DIV/0!	16.94	-0.74	369.88	371.34	151.58	196.3	192.26		256.3	237.98			69.67		785.91
90	1.000	0.00					#DIV/0!	#DIV/0!	16.4	-0.54	360.36	369.27	151.7	200.5	199.83		256.3	235.46			69.78		735.15
100	1.000	0.00					#DIV/0!	#DIV/0!	15.87	-0.53	372.35	367.81	152.03	201.9	204.7		259.8	237.82			69.84		806.59
110	1.000	0.00					#DIV/0!	#DIV/0!	15.43	-0.44	400.25	368.59	151.75	200.39	200.28		264.3	244.6			70.45		856.18
120	1	0.00					#DIV/0!	#DIV/0!	14.85	-0.58	428.6	366.35	153.38	201.84	199.15		269.9	252.55			70.45		874.27
130	1.000	0.00					#DIV/0!	#DIV/0!	14.38	-0.47	434.21	364	154.39	206.21	201.45		272.1	255.75			70.62		854.44
140	1.000	0.00					#DIV/0!	#DIV/0!	13.94	-0.44	426.31	363.38	156.24	208.74	204.37		271.8	254.96			70.28		835.5
150	1.000	0.00					#DIV/0!	#DIV/0!	13.49	-0.45	427.43	365.4	157.97	213.16	207.45		274.3	255.91			71.12		846.99
160	1.000	0.00					#DIV/0!	#DIV/0!	13.03	-0.46	437.34	369.94	160.61	218.04	211.54		279.5	258.83			71.4		863.18
170	1.000	0.00					#DIV/0!	#DIV/0!	12.61	-0.42	442.72	374.81	164.47	223.64	215.24		284.2	261.97			71.63		855.34
180	1	0.00					#DIV/0!	#DIV/0!	12.19	-0.42	440.2	377.22	167.44	228.52	218.43		286.4	262.25			71.96		841.94
190	1.000	0.00					#DIV/0!	#DIV/0!	11.81	-0.38	437.4	377.22	171.08	231.32	220.17		287.4	262.36			72.02		841.55
200	1.000	0.00					#DIV/0!	#DIV/0!	11.4	-0.41	438.41	375.88	174.28	234.51	222.18		289.1	263.7			72.41		843.23
210	1.000	0.00					#DIV/0!	#DIV/0!	11.03	-0.37	434.6	372.18	177.3	235.91	224.71		288.9	263.53			72.58		830.91
220	1.000	0.00					#DIV/0!	#DIV/0!	10.67	-0.36	433.14	368.09	181.39	237.26	224.65		288.9	263.31			72.92		833.2
230	1.000	0.00					#DIV/0!	#DIV/0!	10.28	-0.39	441.77	364.78	186.49	238.49	226.95		291.7	265.5			73.03		852.2
240	1	0.00					#DIV/0!	#DIV/0!	9.89	-0.39	448.33	361.93	191.53	239.11	229.36		294.1	267.79			73.2		844.35
250	1.000	0.00					#DIV/0!	#DIV/0!	9.57	-0.32	437.29	355.76	195.57	237.7	231.82		291.6	266.9			73.48		806.14
260	1.000	0.00					#DIV/0!	#DIV/0!	9.31	-0.26	412.07	346.52	199.27	238.71	231.32		285.6	261.97			73.65		758.23
270	1.000	0.00					#DIV/0!	#DIV/0!	9.1	-0.21	383.67	336.88	200.44	236.14	229.36		277.3	255.3			73.98		706.35
280	1.000	0.00					#DIV/0!	#DIV/0!	8.92	-0.18	356.04	326.68	200.5	231.93	226.83		268.4	247.4			74.21		665.56

Wood Heater Test Data - EPA Method 5G

Run:

Signature/Date:

Manufacturer:	Blaze King		
Model:	PE32		
Tracking No.:			
Project No.:	Low Burn - Invalid Run Stalled		
Test Date:	02-Jul-18		
Beginning Clock Time:	00:00		
Recording Interval:	10	min.	
Total Sampling Time:	890	min.	
Burn Rate:	N/A	kg/hr	

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP									"H2O
Initial Temp.									oF

Equipment Numbers: THERMOSTAT KNOB WAS CLOSED 80° FROM FULLY OPEN

NOTE: THERM KNOB WAS CLOSED 76° FROM FULLY OPEN FOR OFFICIAL EPA LOW BURN

TEST TERMINATED AT 890 MINS BECAUSE < .1 LB/MIN WEIGHT CHANGE FOR 30 MINUTES

PM Control Module:	BK-06		
Dilution Tunnel MW(dry):	29.00	lb/lb-mole	
Dilution Tunnel MW(wet):	28.56	lb/lb-mole	
Dilution Tunnel H2O:	4.00	percent	
Dilution Tunnel Static:	-0.680	"H2O	
Pitot Tube Cp:	0.99		
Meter Box Y Factor:	0.988		
Barometric Pressure:	Begin	Middle	End
			Average 0.00 "Hg

Tunnel Velocity:	#DIV/0!	ft/sec.
Intial Tunnel Flow:	#DIV/0!	scfm
Average Tunnel Flow:	#DIV/0!	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.008@6	cfm@"Hg
Fuel Moisture (dry basis	22.3	%
Total Particulate:		mg
Filter Holder No.:		

	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
Elapsed Time	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
290	1.000	0.00					#DIV/0!	#DIV/0!	8.75	-0.17	339.23	316.71	201.23	226.83	223.92		261.6	241.57			74.26		655.19
300	1	0.00					#DIV/0!	#DIV/0!	8.55	-0.2	336.43	307.01	204.09	222.86	222.63		258.6	240.17			74.37		672.56
310	1.000	0.00					#DIV/0!	#DIV/0!	8.33	-0.22	343.49	298.11	209.58	219.55	222.91		258.7	241.79			74.32		695.76
320	1.000	0.00					#DIV/0!	#DIV/0!	8.1	-0.23	353.24	290.21	213.33	217.25	226.11		260.0	243.87			74.54		716.21
330	1.000	0.00					#DIV/0!	#DIV/0!	7.84	-0.26	366.86	283.71	216.58	215.85	233.56		263.3	246.05			74.54		738.29
340	1.000	0.00					#DIV/0!	#DIV/0!	7.61	-0.23	372.01	278.94	218.82	215.29	240.62		265.1	247.62			74.82		740.58
350	1.000	0.00					#DIV/0!	#DIV/0!	7.38	-0.23	371.28	275.69	220.17	215.57	245.21		265.6	248.18			74.77		727.98
360	1	0.00					#DIV/0!	#DIV/0!	7.18	-0.2	359.4	273.79	219.66	215.63	248.85		263.5	246.05			75.05		695.25
370	1.000	0.00					#DIV/0!	#DIV/0!	7.03	-0.15	339.62	274.07	214.84	214.56	249.81		258.6	240.11			74.93		653.4
380	1.000	0.00					#DIV/0!	#DIV/0!	6.91	-0.12	323.54	276.42	209.13	212.83	249.69		254.3	233.5			74.93		633.62
390	1.000	0.00					#DIV/0!	#DIV/0!	6.76	-0.15	318.39	278.16	203.92	210.98	249.41		252.2	229.58			75.16		644.15
400	1.000	0.00					#DIV/0!	#DIV/0!	6.58	-0.18	326.29	279.84	200.44	210.36	251.26		253.6	229.3			75.27		681.64
410	1.000	0.00					#DIV/0!	#DIV/0!	6.37	-0.21	352.85	283.87	202.46	210.59	253.79		260.7	235.91			75.38		737
420	1	0.00					#DIV/0!	#DIV/0!	6.17	-0.2	357.61	288.69	205.49	213.27	259.61		264.9	241.18			75.44		722.82
430	1.000	0.00					#DIV/0!	#DIV/0!	6.01	-0.16	353.97	292.84	208.23	216.36	264.99		267.3	243.64			75.55		705.34
440	1.000	0.00					#DIV/0!	#DIV/0!	5.84	-0.17	345.9	295.42	208.23	217.81	267.79		267.0	243.2			75.61		684.22
450	1.000	0.00					#DIV/0!	#DIV/0!	5.71	-0.13	334.81	295.36	206.89	217.81	267.51		264.5	240.62			75.77		662.03
460	1.000	0.00					#DIV/0!	#DIV/0!	5.57	-0.14	325.67	293.79	203.75	216.41	264.32		260.8	237.03			75.89		645.22
470	1.000	0.00					#DIV/0!	#DIV/0!	5.47	-0.1	313.63	291.55	198.71	214.28	260.73		255.8	231.54			75.77		618.27
480	1	0.00					#DIV/0!	#DIV/0!	5.36	-0.11	303.54	288.36	193.89	210.53	256.42		250.5	225.55			75.83		609.64
490	1.000	0.00					#DIV/0!	#DIV/0!	5.23	-0.13	305	285.78	188.4	207.06	252.44		247.7	222.07			75.77		641.8
500	1.000	0.00					#DIV/0!	#DIV/0!	5.08	-0.15	307.86	287.18	187.67	205.49	251.04		247.8	221.85			75.83		637.93
510	1.000	0.00					#DIV/0!	#DIV/0!	4.98	-0.1	303.2	289.25	188.34	204.09	248.46		246.7	221.51			75.77		623.87
520	1.000	0.00					#DIV/0!	#DIV/0!	4.86	-0.12	297.43	289.25	187.05	202.01	243.53		243.9	219.83			75.77		619.28
530	1.000	0.00					#DIV/0!	#DIV/0!	4.74	-0.12	295.64	290.93	186.44	200.39	238.49		242.4	219.1			75.77		620.28
540	1	0.00					#DIV/0!	#DIV/0!	4.62	-0.12	293.4	293.68	184.53	199.15	233.22		240.8	217.76			75.55		617.76
550	1.000	0.00					#DIV/0!	#DIV/0!	4.49	-0.13	291.61	295.75	184.36	199.32	228.18		239.8	217.48			75.72		620.28
560	1.000	0.00					#DIV/0!	#DIV/0!	4.3	-0.19	303.88	298.16	184.92	202.01	223.64		242.5	221.34			75.55		668.25
570	1.000	0.00					#DIV/0!	#DIV/0!	4.09	-0.21	326.12	299.51	185.54	207.62	220.5		247.9	227.95			75.72		720.36

Wood Heater Test Data - EPA Method 5G

Signature/Date:

Run:

Manufacturer: Blaze King
Model: PE32
Tracking No.:
Project No.: Low Burn - Invalid Run Stalled
Test Date: 02-Jul-18
Beginning Clock Time: 00:00
Recording Interval: 10 min.
Total Sampling Time: 890 min.
Burn Rate: N/A kg/hr

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP									"H2O
Initial Temp.									oF

Equipment Numbers: THERMOSTAT KNOB WAS CLOSED 80° FROM FULLY OPEN
NOTE: THERM KNOB WAS CLOSED 76° FROM FULLY OPEN FOR OFFICIAL EPA LOW BURN
TEST TERMINATED AT 890 MINS BECAUSE < .1 LB/MIN WEIGHT CHANGE FOR 30 MINUTES

PM Control Module: BK-06
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.56 lb/lb-mole
Dilution Tunnel H2O: 4.00 percent
Dilution Tunnel Static: -0.680 "H2O
Pitot Tube Cp: 0.99
Meter Box Y Factor: 0.988
Barometric Pressure: Begin Middle End Average 0.00 "Hg

Tunnel Velocity: #DIV/0! ft/sec.
Intial Tunnel Flow: #DIV/0! scfm
Average Tunnel Flow: #DIV/0! scfm
Tunnel Area: 0.196 ft2
Post-Test Leak Check: .008@6 cfm@"Hg
Fuel Moisture (dry basis 22.3 %
Total Particulate: mg
Filter Holder No.:

	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
Elapsed Time	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
580	1.000	0.00					#DIV/0!	#DIV/0!	3.81	-0.28	359.24	301.97	187.72	216.75	220.11		257.2	237.48			75.27		789.44
590	1.000	0.00					#DIV/0!	#DIV/0!	3.5	-0.31	400.64	304.77	191.03	229.69	223.02		269.8	249.47			75.05		837.07
600	1	0.00					#DIV/0!	#DIV/0!	3.21	-0.29	415.04	305.89	194.45	243.03	226.11		276.9	256.19			75.44		815.72
610	1.000	0.00					#DIV/0!	#DIV/0!	2.98	-0.23	400.92	305.39	195.23	253.11	228.18		276.6	255.91			75.44		766.81
620	1.000	0.00					#DIV/0!	#DIV/0!	2.82	-0.16	374.25	302.81	193.5	260.96	227.23		271.8	251.1			75.44		707.92
630	1.000	0.00					#DIV/0!	#DIV/0!	2.7	-0.12	343.66	298.27	190.19	262.64	222.58		263.5	243.31			75.16		650.93
640	1.000	0.00					#DIV/0!	#DIV/0!	2.62	-0.08	320.41	292.61	184.98	261.52	217.08		255.3	235.24			75.1		621.29
650	1.000	0.00					#DIV/0!	#DIV/0!	2.5	-0.12	308.14	286.79	180.61	259.28	211.43		249.3	229.19			75.16		619.39
660	1	0.00					#DIV/0!	#DIV/0!	2.35	-0.15	292.78	281.97	179.1	263.87	209.02		245.3	226.33			74.77		578.77
670	1.000	0.00					#DIV/0!	#DIV/0!	2.2	-0.15	284.88	280.01	178.82	272.56	208.79		245.0	227.9			74.71		573.95
680	1.000	0.00					#DIV/0!	#DIV/0!	2.07	-0.13	280.46	279.17	179.71	276.7	208.4		244.9	230.76			74.37		556.69
690	1.000	0.00					#DIV/0!	#DIV/0!	1.94	-0.13	275.36	277.26	179.1	277.09	207.39		243.2	231.09			74.49		547.28
700	1.000	0.00					#DIV/0!	#DIV/0!	1.83	-0.11	270.93	274.63	176.91	274.91	206.83		240.8	227.95			74.15		539.26
710	1.000	0.00					#DIV/0!	#DIV/0!	1.73	-0.1	267.74	274.07	175.45	273.73	205.88		239.4	225.15			74.04		534.56
720	1	0.00					#DIV/0!	#DIV/0!	1.63	-0.1	268.52	273.4	172.65	266.22	203.47		236.9	222.97			73.98		550.97
730	1.000	0.00					#DIV/0!	#DIV/0!	1.53	-0.1	270.2	271.94	171.14	258.83	200.56		234.5	220.78			73.65		553.94
740	1.000	0.00					#DIV/0!	#DIV/0!	1.43	-0.1	268.97	270.31	169.35	253.28	199.15		232.2	218.82			73.59		552.26
750	1.000	0.00					#DIV/0!	#DIV/0!	1.32	-0.11	268.75	272.11	167.89	247.4	197.36		230.7	216.47			73.31		558.26
760	1.000	0.00					#DIV/0!	#DIV/0!	1.22	-0.1	266.95	273.45	166.38	242.75	195.74		229.1	214.68			73.2		554.95
770	1.000	0.00					#DIV/0!	#DIV/0!	1.12	-0.1	260.28	274.18	163.86	238.94	193.78		226.2	211.59			73.14		530.41
780	1	0.00					#DIV/0!	#DIV/0!	1.03	-0.09	259.22	275.36	160.61	232.72	189.74		223.5	208.12			72.69		550.47
790	1.000	0.00					#DIV/0!	#DIV/0!	0.93	-0.1	259.28	273.51	157.41	225.71	185.48		220.3	204.87			72.86		550.36
800	1.000	0.00					#DIV/0!	#DIV/0!	0.86	-0.07	253.95	272.11	154.11	219.94	181.67		216.4	200.39			72.58		532.6
810	1.000	0.00					#DIV/0!	#DIV/0!	0.82	-0.04	243.2	271.88	150.13	212.43	176.52		210.8	193.72			72.36		495.84
820	1.000	0.00					#DIV/0!	#DIV/0!	0.75	-0.07	230.59	268.8	145.14	204.65	170.92		204.0	186.44			72.08		473.6
830	1.000	0.00					#DIV/0!	#DIV/0!	0.72	-0.03	219.94	263.81	140.6	197.42	165.2		197.4	179.43			72.19		451.91
840	1	0.00					#DIV/0!	#DIV/0!	0.67	-0.05	210.47	257.82	136.46	190.75	159.43		191.0	172.99			71.96		432.24
850	1.000	0.00					#DIV/0!	#DIV/0!	0.64	-0.03	197.42	251.77	132.2	183.35	153.77		183.7	165.93			72.08		391.68
860	1.000	0.00					#DIV/0!	#DIV/0!	0.61	-0.03	172.2	245.32	128.05	174.5	147.83		173.6	154.72			71.74		279.22

Wood Heater Test Data - EPA Method 5G

Run:

Manufacturer:	Blaze King		
Model:	PE32		
Tracking No.:			
Project No.:	Low Burn - Invalid Run Stalled		
Test Date:	02-Jul-18		
Beginning Clock Time:	00:00		
Recording Interval:	10	min.	
Total Sampling Time:	890	min.	
Burn Rate:	N/A	kg/hr	

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP									"H2O
Initial Temp.									oF

Equipment Numbers: THERMOSTAT KNOB WAS CLOSED 80° FROM FULLY OPEN

NOTE: THERM KNOB WAS CLOSED 76° FROM FULLY OPEN FOR OFFICIAL EPA LOW BURN TEST TERMINATED AT 890 MINS BECAUSE < .1 LB/MIN WEIGHT CHANGE FOR 30 MINUTES

PM Control Module:	BK-06		
Dilution Tunnel MW(dry):	29.00	lb/lb-mole	
Dilution Tunnel MW(wet):	28.56	lb/lb-mole	
Dilution Tunnel H2O:	4.00	percent	
Dilution Tunnel Static:	-0.680	"H2O	
Pitot Tube Cp:	0.99		
Meter Box Y Factor:	0.988		

Barometric Pressure:	Begin	Middle	End	Average
				0.00 "Hg

Signature/Date:

Tunnel Velocity:	#DIV/0!	ft/sec.
Intial Tunnel Flow:	#DIV/0!	scfm
Average Tunnel Flow:	#DIV/0!	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.008@6	cfm@"Hg
Fuel Moisture (dry basis	22.3	%
Total Particulate:		mg
Filter Holder No.:		

	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
Elapsed Time	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
870	1.000	0.00					#DIV/0!	#DIV/0!	0.59	-0.02	156.01	238.04	123.46	164.92	141.39		164.8	145.08			71.63		248.18
880	1.000	0.00					#DIV/0!	#DIV/0!	0.59	0	145.08	229.52	119.25	156.07	135.62		157.1	137.13			71.29		226.78
890	1.000	0.00					#DIV/0!	#DIV/0!	0.59	0	136.4	219.55	115.11	147.77	129.73		149.7	130.35			71.4		210.31
Avg/Total	0.00	0.00	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!		-0.23	324.50	307.69	177.47	218.79	213.29		248.26	227.70			73.35		650.81

Sample Calculations – ASTM E2780 & E2515

Client: Valley Comfort [Blaze King]
Model: KE40
Run: 1

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

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

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

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

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

BR – Dry burn rate, kg/hr

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

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

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

m_n – Total particulate matter collected, mg

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

E_T – Total particulate emissions, g

PR - Proportional rate variation

PM_R – Particulate emissions for test run, g/hr

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

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

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

Where,

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

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

Sample Calculation:

FM_S = 20.7 %

M_{Swb} = 2.7 lbs

0.4536 = Conversion factor from lbs to kg

M_{Sdb} = [(2.7 x 0.4536) (100/(100 + 20.7)

M_{Sdb} = **1.02** kg

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

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

Where,

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

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

Sample Calculation (test fuel piece 1):

MC_{Pnwb} = 3.72

FM_{CPn} = 23.2

= 3.7 (100/(100+ 23.2)

= 3.0 lbs

Total dry crib weight, excluding spacers = 20.49 lbs

M_{Cdb} = **9.30** kg

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

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

Where,

V_C = Volume of fuel crib, ft^3

Sample calculation:

V_C = 1305 in^3

1728 = conversion from in^3 to ft^3

D_{Cdb} = 20.49 / 1305 * 1728

= **27.15** 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:

$$M_{FTAdb} = 1.022 + 9.30$$

$$= \mathbf{10.32} \text{ kg}$$

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

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

Where,

θ = Total length of test run, min

Sample Calculation:

M_{Bdb} = 10.32 kg
θ = 250 min

$$BR = \frac{60 \times 10.3}{250}$$

BR = **2.48** kg/hr

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

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

Where:

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

Sample calculation:

$$Fp = \frac{12.80}{11.94} = 1.072$$

$$V_s = 1.072 \times 85.49 \times 0.99 \times 0.167 \times \left(\frac{121.0 + 460}{\left(28.64 + \frac{-0.17}{13.6} \right) \times 28.78} \right)^{1/2}$$

V_s = **12.75** ft/s

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

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

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

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

Where:

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

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 12.75 \times 0.1963 \times \frac{528}{121.0 + 460} \times \frac{28.64 + \frac{-0.17}{13.6}}{29.92}$$

Q_{sd} = **7678.5** 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_2O
T_m	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 39.085 \times 0.998 \times \frac{\left(28.64 + \frac{1.02}{13.6}\right)}{(100.2 + 460)}$$

$V_{m(std)}$ = **35.270** dscf

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 38.650 \times 1.002 \times \frac{\left(28.64 + \frac{1.16}{13.6}\right)}{(98.1 + 460)}$$

$V_{m(std)}$ = **35.160** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 0.00 \times 1 \times \frac{\left(28.64 + \frac{0.00}{13.6}\right)}{(78.0 + 460)}$$

$V_{m(std)}$ = **0** 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 + 3.9 + 0.0

m_n = **3.9** mg

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

m_n = 0.7 + 5.5 + 1.6

m_n = **7.8** mg

Train A aggregate:

m_n = 3.9 + 7.8
m_n = **11.7** mg

Using equation for Train B:

m_n = 0.7 + 7.7 + 2.9

m_n = **11.3** 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:

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

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{11.7}{35.27}$$

C_s = **0.00033** g/dscf

For Train 2

$$C_s = 0.001 \times \frac{11.3}{35.16}$$

C_s = **0.00032** g/dscf

For Ambient Train

$$C_r = 0.001 \times \frac{0.0}{0}$$

C_r = **0** 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 = (0.000332 - 0) x 7678.5 x 250 /60

E_T = **10.61** g

For Train 2

E_T = (0.000321 - 0) x 7678.5 x 250 /60

E_T = **10.28** g

Average

E = **10.45** g

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

7.5% of the average =	**0.78**
Train 1 difference =	**0.17**
Train 2 difference =	**0.17**

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

θ = Total sampling time, min

θ_i = Length of recording interval, min

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

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

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

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

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

T_m = Absolute average dry gas meter temperature, ^oR

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

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

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

$$PR = \left(\frac{250 \times 1.472 \times 12.75 \times (127.0 + 460) \times (100.2 + 460)}{10 \times 39.085 \times 12.81 \times (121.0 + 460) \times (84.0 + 460)} \right) \times 100$$

PR = **97** %

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

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

Where,

E_T = Total particulate emissions, grams

θ = Total length of full integrated test run, min

Sample Calculation:

E_T (Dual train average) = 10.45 g

θ = 250 min

$$PM_R = 60 \times (10.45 / 250)$$

PM_R = **2.51** g/hr

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

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

Sample Calculation:

E_T (Dual train average) = 10.45 g

M_{Bdb} = 10.32 kg

PM_F = 10.45 / ####

PM_F = **1.01** g/kg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

OFFICE OF
COMPLIANCE

DEC 15 2016

Chris Neufeld
Vice President
Blaze King Industries, Inc.
146 A Street
Walla Walla, Washington 99362

RE: Blaze King Industries, Inc. (Blaze King) Request for Catalyst Suitable Replacement Procedures

Dear Mr. Neufeld:

This letter is in response to the February 3, 2016, Blaze King letter requesting the United States Environmental Protection Agency (EPA) implement a program to allow catalyst equipped wood heater manufacturers and suppliers to seek suitable replacement status during the life cycle of the product. As discussed below, replacement catalysts may be used if equivalency is properly demonstrated.

To have a catalyst deemed suitable for replacement, equivalency testing must be conducted by an EPA-approved test laboratory. Consistent with the 2015 Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces (Subpart AAA) (2015 Standards), the manufacturer must notify the EPA of the date that certification testing (catalyst equivalency testing) is scheduled to begin as stated in Section 60.534(g). This notice must be received by the EPA at least 30 days before the start of testing. EPA will consider the following steps to be adequate to demonstrate replacement catalyst equivalency:

1) The manufacturer uses the same test method as the original certification test was conducted. If the original certification test method is no longer valid, the manufacturer requests an alternative test method prior to testing.

2) The replacement catalyst is aged 50 hours prior to catalytic equivalency testing. The catalyst is tested in the same model or model line unit in which the original catalyst was tested.

3) Both a Category 1 run and Category 4 run are conducted by an EPA-approved test laboratory.

4) The new Category 1 run is compared to the original Category 1 run, and the new Category 4 run is compared to the original Category 4 run. The new runs are not more than 0.5 grams/hour greater than the original certification test results for each run. They are compared separately, with no averaging. In equation form:

Replacement catalyst category 1 ≤ (original catalyst category 1 + 0.5g/hr)

AND

Replacement catalyst category 4 ≤ (original catalyst category 4 + 0.5g/hr)

As noted in Section 60.533(k)(4)[1], the EPA Administrator must approve the change in the catalyst in advance, with proper documentation of the equivalency testing. This documentation consists of the original certification test report category 1 and 4 data and the new category 1 and 4 test data results. All demonstration test data must be sent to WoodHeaterReports@epa.gov within 60 days after the date of completing the test. EPA considers the catalyst equivalency testing to be a form of certification testing governed by the provisions in Section 60.534.

The EPA finds the request outside the scope of an applicability determination. The term "applicability determination" is limited to the Agency's formal decisions, issued in response to a non-hypothetical and site-specific request about the applicability of a specific rule to a specific facility. Therefore, the EPA considers this response to be a regulatory interpretation to a source request for clarification.[2]

This response has been prepared in consultation with the Office of Air Quality, Planning, and Standards, and the Office of General Counsel. If you have any questions, please contact Rafael Sanchez of my staff at 202-564-7028 or email at sanchez.rafael@epa.gov.

Sincerely,

Edward J. Messina, Director
Monitoring, Assistance, and Media Programs Division
Office of Compliance

[1] A change in the make, model or composition of a catalyst is presumed to affect particulate matter and carbon monoxide emissions and efficiency, unless the change has been requested by the heater manufacturer and has been approved in advance by the Administrator, based on test data that demonstrate that the replacement catalyst is equivalent to or better than the original catalyst in terms of particulate matter emission reduction.
[2] This regulatory interpretation updates EPA Applicability Determination WDS-138 (July 6, 1990).

cc: Amanda Aldridge, OAQPS
Adam Baumgart-Getz, OAQPS
Mike Toney, OAQPS
Scott Jordan, OGC
Sara Ayres, OC

KING KE40

SN - 28.

BLAZE KING CATALYST STOVE - POÊLE À BOIS CATALYTIQUE

ROOM HEATER, SOLID FUEL TYPE, ALSO FOR USE IN MOBILE HOMES. / APPAREIL APPROUVÉ DE TYPE CARBURANT SOLIDE, AUSSI ADAPTÉ POUR INSTALLER DANS UNE MAISON MOBILE.
SUITABLE FOR MOBILE-HOME INSTALLATION / CONCU POUR MAISONS MOBILES.
MODEL / MODÈLE: KE40
Tested to / Testé: UL 1482-2011(R2015) / ULC-S627-00 (R2016)
CERTIFIED IN BOTH UNITED STATES AND CANADA / CERTIFIÉ POUR LES ÉTATS-UNIS ET LE CANADA

PFS report#:F19-513

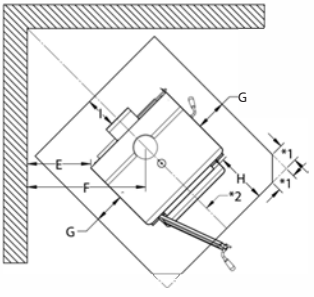
PREVENT HOUSE FIRES- Install and use only in accordance with Blaze King's installation and operation instructions. Contact local building or fire officials about restrictions a installation inspection in your area. The flue size is 8"
CHIMNEYS: DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE. Except for installation detailed below, use 8" listed factory built chimney suitable for use with solid fuels and conforming to, ULC629 in Canada or UL-103HT in the USA or a masonry residential type chimney.
Mobile home, residential close clearance, and residential alcove installations require a 8" listed double wall close clearance chimney connector, with matching listed factory built chimney suitable for use with solid fuels and conforming to, ULC629 in Canada or UL-103HT in the USA. Mobile Home installations are only allowed with a roof exit.
Do not install in a sleeping room. Passing through a wall or ceiling requires special methods: see instructions and local building codes.

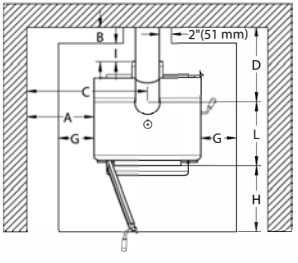
POUR PRÉVENIR UN INCENDIE - Installer et employer seulement selon le manuel d'installation de Blaze King. Contacter les autorités locales en bâtiments ou en matière de prévention d'incendies au sujet des normes d'inspection et d'installation dans votre secteur. La dimension des conduits de cheminée est de 8".
CHEMINÉE: NE PAS CONNECTER CETTE UNITÉ A UNE CONDUITE DE CHEMINÉE SERVANT UN AUTRE APPAREIL. Excepté pour les situations détaillées ci-dessous, employer une cheminée de 8" homologuée par le fabricant à des fins d'utilisation pour combustibles solides conformément à la norme ULC629 au Canada ou UL-103HT aux Etats-Unis ou employer une cheminée en maçonnerie de type résidentiel.
L'installation dans une maison mobile, en espace restreint ou dans des endroits à faible dégagement, requiert l'utilisation de connecteurs muraux à doubles parois et ayant une épaisseur 8" pour la cheminée. Ceux-ci doivent être homologués par le fabricant à des fins d'utilisation pour combustibles solides conformément à la norme ULC629 au Canada ou UL-103HT aux Etats-Unis. L'installation dans une maison mobile est permise seulement avec une sortie passant par le toit.
Ne pas installer dans une chambre à coucher. Passer à travers un mur ou un plafond requiert une méthode spécifique décrite dans les instructions et dans le code local du bâtiment.

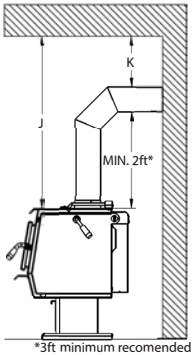
MINIMUM CLEARANCES TO COMBUSTIBLES (See owners manual for complete description of all requirements)
DÉGAGEMENTS MINIMUM AUX COMBUSTIBLES (voir les directives d'installation pour la description complète de toutes les conditions)

Residential Installations	A	B	C	D	E	F	J
Roof exit, parallel and corner. Sortie de toit, parallèle et coin.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125" * 410 mm	4" 102 mm	19.375" * 492 mm	48 1/8" 1223 mm
Wall exit, parallel and corner. Sortie de mur, parallèle et coin.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125" 410 mm	4" 102 mm	19.375" 492 mm	48 1/8" * 1223 mm
Alcove roof exit. Fan kit or rear shield required. Sortie de toit en alcôve. Kit de ventilateur et protection arrière requise.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125" 410 mm	N/A	N/A	48 1/8" 1223 mm
Mobile Home Installations							
Roof exit, parallel and corner. Fan kit or rear shield required. Outside air kit required. La sortie du toit, parallèle et en coin. Kit de ventilateur et protection arrière requise. Kit d'air extérieur requis.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125" 410 mm	4" 102 mm	19.375" 492 mm	48 1/8" 1223 mm

***Check with local codes and pipe manufacturers for pipe clearances. In Canada 18" clearances from single wall pipe is required.**
*** Vérifier avec le code du bâtiment local et avec le manufacturier de tuyaux pour les dégagements. Au Canada un dégagement de 18 po est exigé pour un tuyau à simple paroi.**







*3ft minimum recomended

G - 3" (77 mm) in U.S.A.
8" (203 mm) in Canada

H - 16" (406 mm) in U.S.A.
18" (456 mm) in Canada

I - 0" (0 mm) in U.S.A.
8" (203 mm) in Canada

K - 18" (456 mm) *

L - 17.375" (442 mm)

ALCOVE

min. width / min. largeur	**51"**
max. depth / max. profondeur	**49"**
min. height above stove / hauteur min. au-dessus du poêle	**48"**

Floor protection may be any non-combustible material or Listed Floor Protector, and must extend at least 18" (456 mm) in Canada or 16" (406 mm) in U.S.A., in front of the loading door opening; In USA minimum size is 34 1/4" x 43 1/8" (871 mm x 1095 mm).
In Canada, minimum size is 47" x 53 1/8" (1194 mm x 1349 mm)
US ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using crib wood. (E A test methods 28R/5G with an emission-rate of 1.1 g/hr). 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 operating instructions in the owner's manual, or if the catalytic element is deactivated or removed.
***ONLY OPERATE WITH DOORS CLOSED. Open door to feed fire ON Y. *DO NOT OBSTRUCT COMBUSTION AIR OPENINGS. Do not obstruct the space beneath the heater. For Use With Solid Wood Fuel Only - Do not burn other fuels, this may make the catalyst in the combustor inactive. The performance of the catalytic device or its durability has not been evaluated as part of the certification. Combustor part number: 15-1510-C2 or 115-1510-C2. Provide adequate outside air for combustion. *Replace with only ceramic glass, 5 mm. thickness. Unit must be installed with Blaze King Leg Kit Z1713, Classic Base Z4815, or Pedestal Kit Z2903 provided, attach as shown in the installation instructions.**

La protection de plancher peut être de n'importe quel matériel non combustible ou Protecteur de plancher approuvé, et doit se prolonger au moins de 18" (456 mm) au Canada ou 16" (406 mm) aux États-Unis devant la porte de chargement; Aux États-Unis, la taille minimum est de 34 1/4" x 43 1/8" (871 mm x 1095 mm)
Au Canada la taille minimum est de 47" x 53 1/8" (1194 mm x 1349 mm)
L'AGENCE DE PROTECTION ENVIRONNEMENTALE DES U.S. - Certifié conformément aux normes d'émission de particules 2020 , en utilisant du bois machiné (méthodes d'essai EPA 28R / 5G, ASTM E2515 et ASTM E2780, avec un taux d'émission de 1.1 g/hre). Cet appareil de chauffage au bois nécessite des inspections périodiques et des réparations pour un fonctionnement adéquat. Consulter le manuel du propriétaire pour plus d'informations. Il est contre les règlements fédéraux de faire fonctionner cet appareil de chauffage à l'encontre des instructions d'utilisation fournies dans le manuel du propriétaire, ou si l'élément catalytique est enlevé ou désactivé.
***Utiliser le uniquement avec les portes fermées. Ouvrir la porte pour alimenter le feu SEULEMENT. *Ne pas obstruer l'entrée d'air de combustion. Fournir l'apport d'air extérieur adéquat pour alimenter la combustion. Ne pas obstruer l'espace sous l'appareil. Utiliser uniquement avec des combustibles solides - ne pas brûler aucun autre combustible, ce qui peut rendre le catalyseur de la chambre à combustion inactif. La performance du catalyseur ou sa longévité n'a pas été évaluée dans le cadre de la certification. Numéro du catalyseur: 115-1510-C2 ou 115-1510-V3 *Employer seulement le verre en céramique d'une épaisseur de 5mm si le remplacement est nécessaire. L'appareil doit être installé avec le Blaze King kit de jambe Z1713, Base Classique Z4815, ou Piédestal Kit Z3903 fourni, attache comme indiqué dans les instructions d'installation.**

MANUFACTURED IN

☐ USA:
Blaze King Industries
146A Street
Walla Walla, WA.
99362

☐ CANADA:
Valley Comfort Systems
1290 Commercial Way
Penticton, B.C.
V2A 3H5

MANUFACTURE DATE

JAN ☐	**FEB ☐**	**MAR ☐**	**APR ☐**	**MAY ☐**	**JUN ☐**
JUL ☐	**AUG ☐**	**SEP ☐**	**OCT ☐**	**NOV ☐**	**DEC ☐**
2019 ☐	**2020 ☐**	**2021 ☐**	**2022 ☐**	**2023 ☐**	**2024 ☐**

KING KE40

SOLID FUEL CATALYTIC STOVE

KE40 Firebox with Z4886 Door and Z1713 Parlor Leg Kit

KE40 Firebox with Z4886 Door and Z4815 Classic Base Kit

KE40 Firebox with Z4886 Door and Z3903 Ultra Pedestal Kit

NATIONAL FIREPLACE INSTITUTE NFI CERTIFIED www.nficertified.org

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).

Wood Energy Technical Training

U.S. Environmental Protection Agency certified to comply with 2020 particulate emission standards using crib wood

PFS® C US

REPORT #:F19-513

Installer: Please complete the details on the back cover and leave this manual with the homeowner.
Homeowner: Please SAVE THESE INSTRUCTIONS for future reference.

The authority having jurisdiction (such a municipal building department, fire department, etc.) should be consulted before installation to determine the need to obtain a permit.

OPERATION & INSTALLATION MANUAL

Manufactured By

Valley Comfort Systems Inc., 1290 Commercial Way, Penticton, BC, V2A 3H5, Canada
In Canda: Phone 250-493-7444, Fax 250-493-5833
In USA: Phone 509-522-2730, Fax 509-522-1701
web: www.blazeking.com, email: info@blazeking.com

Pour la version française de nos manuels S.V.P. vous référez à notre site web: www.blazeking.com

180-KE40 v1.03 per PE32 revs

March 22, 2021

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⚠WARNING

- **THIS APPLIANCE IS HOT WHEN OPERATED AND CAN CAUSE SEVERE BURNS IF CONTACTED.**
  ANY CHANGES OR ALTERATIONS TO THIS APPLIANCE OR ITS CONTROLS CAN BE DANGEROUS AND IS PROHIBITED BY FEDERAL AND STATE LAWS.
- Do not operate appliance before reading and understanding operating instructions. Failure to operate appliance according to operating instructions could cause fire or injur .
- Before installing this appliance, contact the local building or fire authority and follow their guidelines
- This appliance must be installed by a qualified installe .
- Risk of burns. The appliance should be turned off and cooled before servicing
- Do not operate without fully assembling all components.
- Do not let the appliance become hot enough for any part to glow red.
- Do not install damaged, incomplete or substitute components.
- Risk of cuts and abrasions. Wear protective gloves and safety glasses during installation. Sheet metal edges may be sharp.
- Children and adults should be alerted to the hazards of high surface temperature and should stay away to avoid burns or clothing ignition.
- Young children should be carefully supervised when they are in the same room as the appliance. Toddlers, young children and others may be susceptible to accidental contact burns. A physical barrier is recommended if there are at risk individuals in the house. To restrict access to an appliance or appliance, install an adjustable safety gate to keep toddlers, young children and other at risk individuals out of the room and away from hot surfaces.
- Clothing or other flammable material should not be placed on or near the appliance. Objects placed in front of the appliance must be kept a minimum of 48” away from the front face of the appliance.
- Due to high temperatures, the appliance should be located out of traffic and away from furniture and draperie
- Ensure you have incorporated adequate safety measure to protect infants / toddlers from touching hot surfaces.
- Even after the appliance is out, all surfaces, including the glass and/or any attachment will remain hot for an extended period of time.
- Check with your local hearth specialty dealer for safety hearth guards to protect children from hot surfaces. These guards must be fastened to a wall and/or to the floo .
- Any safety guard removed for servicing must be replaced prior to operating the appliance.
- Under no circumstances should this appliance be modified
- This appliance must not be connected to a chimney flue pipe ser icing a separate solid fuel burning appliance.
- Do not operate the appliance with the glass door removed, cracked or broken. Replacement of the glass should be done by a licensed or qualified service person
- Do not strike or slam shut the appliance glass door.
- Operate only with the doors tightly closed.
- Appliance will over-fire if door is not shut and latched
- Only certified doors / optional fronts / and surrounds for inse ts with the unit are to be installed on the appliance.
- Keep the packaging material out of reach of children and dispose of the material in a safe manner. As with all plastic bags, these are not toys and should be kept away from children and infants.
- If the appliance is not properly installed, a house fire may re ult. Do not expose the appliance to the elements (rain, etc.) and keep the appliance dry at all times.
- The chimney must be sound and free of cracks and obstructions. Clean your chimney regularly as required.
- 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.
- Your appliance requires periodic maintenance and cleaning. Failure to maintain your appliance may lead to smoke spillage in your home.
- Higher efficiencies and lower emissions will generally result w n burning air dried seasoned woods, as compared to wet, green or freshly cut wood. Burning wet unseasoned wood can cause excessive creosote accumulation. When ignited it can cause a chimney fire that may result in a serious house fir
- The appliance is designed to burn seasoned wood only. Do not burn treated wood, coal, charcoal, colored paper, cardboard, solvents or garbage.
- Burn wood directly on the firebricks. Do not use a grate or ele ate the fire
- Do not store wood within appliance installation clearances or within the space required for re-fueling and ash removal.
- Ashes must be disposed in a metal container with a tight lid and placed on a non-combustible surface well away from the home or structure until completely cool.

CALIFORNIA PROPOSITION 65

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

SPECIFICATIONS

Model	King KE40(catalytic)
Height (w/ Z1713 Parlor Leg Kit)	36 1/2” (927 mm)
Height (w/ Z4815 Classic Base Kit)	32 5/8” (828 mm)
Height (w/ Z3903 Ultra Pedestal Kit)	38 3/8” (974 mm)
Width	31” (787 mm) (without removable bypass handle)
Depth	29 7/8” (758 mm) (without optional fan kit)
Flue collar	8” I.D.
Fire door opening	18 1/2” x 9 3/4” (470 mm x 247 mm)
Firebox depth	17 3/8” (441 mm) brick to brick, 21 1/2” (546 mm) brick to glass
Firebox width	22 3/4” (577 mm)
Firebox height	15 1/4” (387 mm)
Firebox capacity	4.35 cu. ft.
Recommended Fuel length	17” - 22” (432mm - 559mm)
Wood capacity (approximate):	White oak - 80 lbs. (36 kg)
	Fir - 55 lbs. (24 kg)
Construction	10 gauge & 1/4” firebox, brick line 16 gauge outer shields
Shipping Weight (Firebox only)	420 lbs. (190.5 kg)
Shipping Weight (Pedestal only)	50 lbs. (22.7 kg)
Shipping Weight (Base only)	30 lbs. (13.6 kg)
Shipping Weight (Legs only)	20 lbs. (9.1 kg)
Chimney recommendation (Minimum)	15’ from stove top to chimney cap: Insulated liner recommended

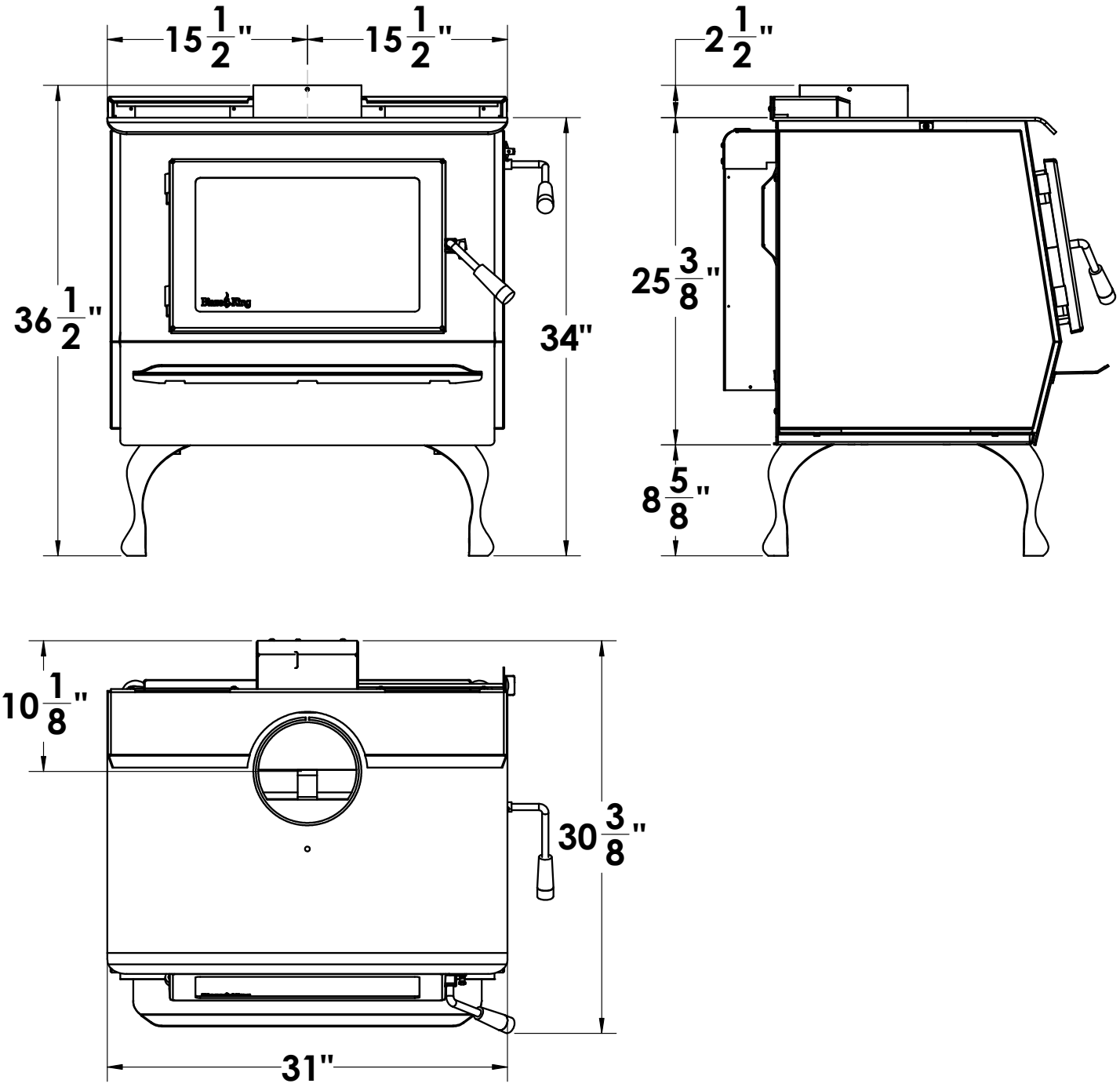
This unit was tested and listed UL 1482-2011(R2015) and ULC-S627-00 (R2016) by PFS testing laboratories.
This manual describes the installation and operation of the King KE40 catalytic equipped wood heater.
This heater is certified to comply with the 2020 U.S. Environmental Protection Agency’s particulate emission standards using crib wood. Under specific test conditions this heater has been shown to deliver heat at rates ranging from 11,690 to 34,985 Btu/hr.

EMISSIONS	CO Average(%)	g/hr
Low Burn	0.21	0.42
Med-low Burn	0.38	0.65
Med-high Burn	0.33	1.41
High Burn	1.44	2.51
EPA emission rate weighted average		**1.1 g/h**

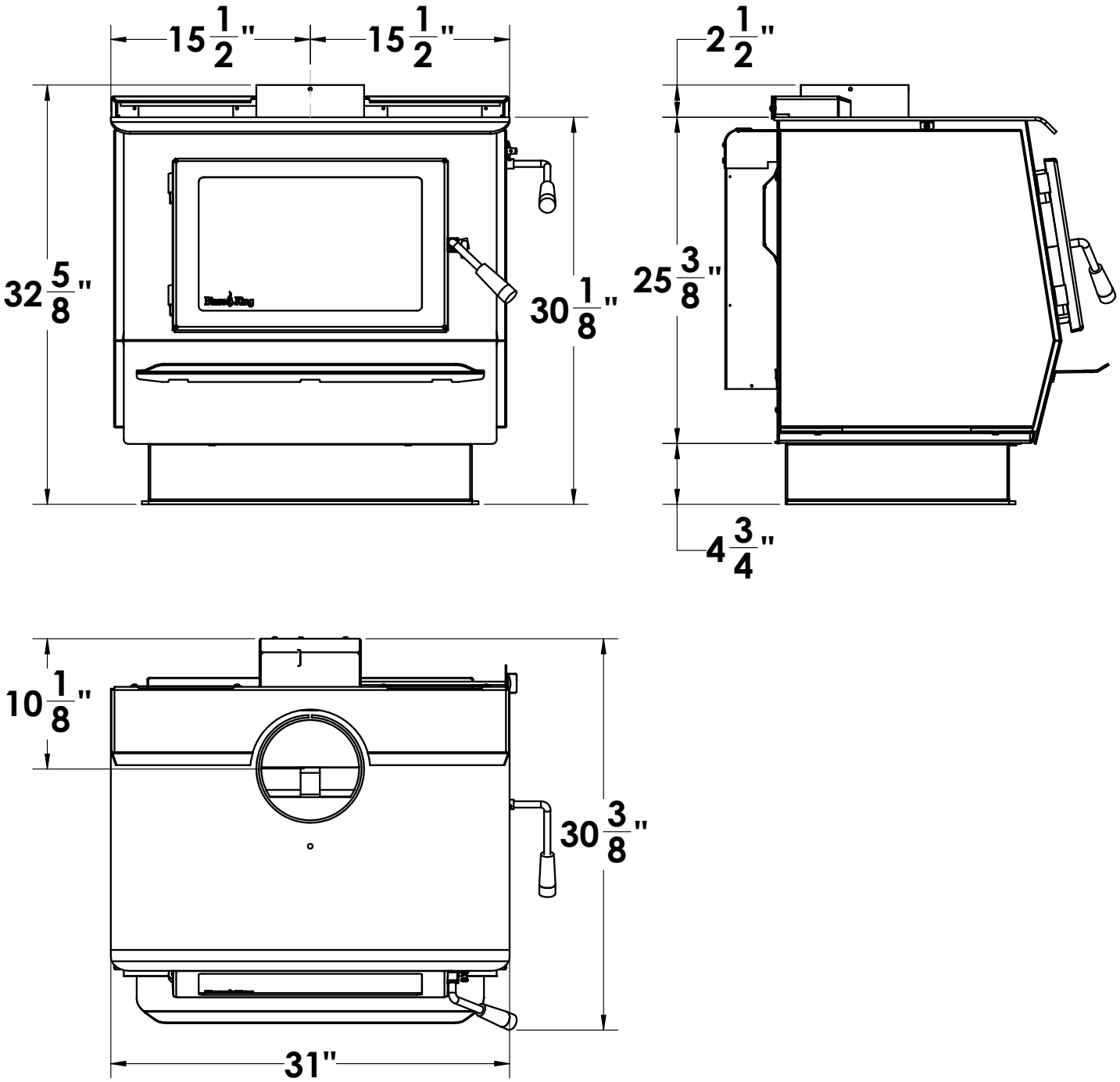
This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.
This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed.
The combustor supplied with this heater is a 115-1510-C2 or 115-1510-V3. Consult the catalytic combustor warranty also supplied with this wood heater. Warranty claims should be addressed to:

in Canada	**in USA**
Blaze King Industries / Valley Comfort Systems Warranty Department, 1290 Commercial Way Penticton, BC Canada V2A 3H5, Ph: 250-493-7444	Blaze King Industries Warranty Department, 146 A Street Walla Walla, Washington 99362, Ph: 509-522-2730

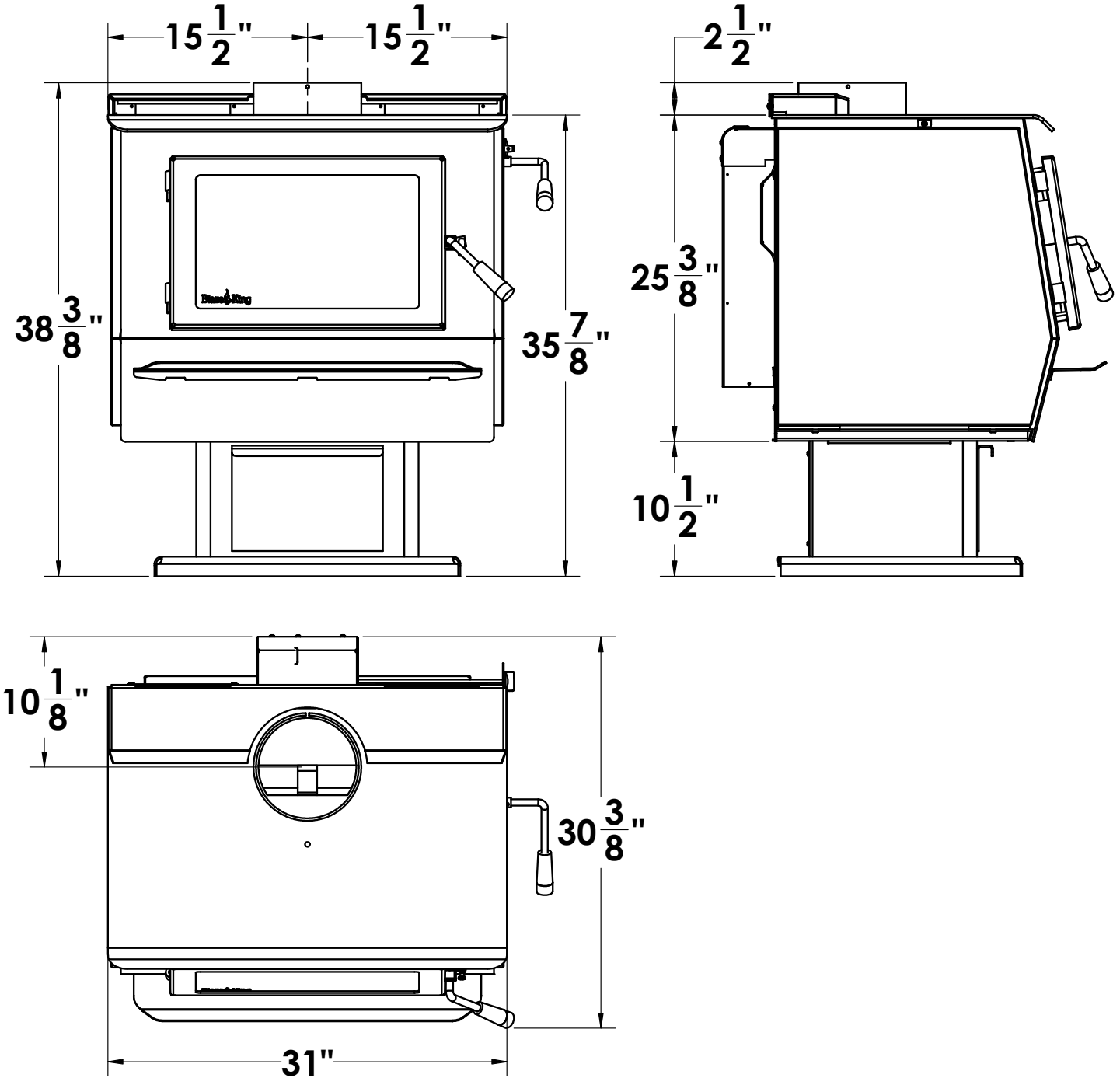
APPLIANCE DIMENSIONS - King KE40 with Door and Parlor Leg Kit



APPLIANCE DIMENSIONS - King KE40 with Door and Classic Base Kit



APPLIANCE DIMENSIONS - King KE40 with Door and Ultra Pedestal Kit



PFS report#:F19-513

KING KE40

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Mobile home, residential close clearance, and residential alcove installations require a 8" listed double wall close clearance chimney connector, with matching listed factory built chimney suitable for use with solid fuels and conforming to, ULC629 in Canada or UL-103HT in the USA. Mobile Home installations are only allowed with a roof exit.
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Mobile Home Installations Installations Maison Mobile							
Roof exit, parallel and corner. Fan kit or rear shield required. Outside air kit required. La sortie du toit, parallèle et en coin. Kit de ventilateur et protection arrière requise. Kit d'air extérieur requis.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125" 410 mm	4" 102 mm	19.375" 492 mm	48 1/8" 1223 mm

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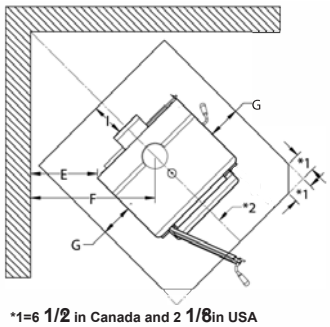

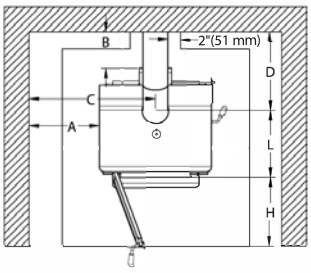

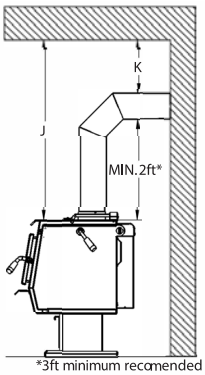

***1=6 1/2 in Canada and 2 1/8in USA**
***2=62 3/8in Canada and 60 3/8in USA**

G - 2" (51 mm) in U.S.A.
8" (203 mm) in Canada

H - 16" (406 mm) in U.S.A.
18" (456 mm) in Canada

I - 0" (0 mm) in U.S.A.
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min. width / min. largeur	51"
max. depth / max. profondeur	49"
min. height above stove / hauteur min. au-dessus du poêle	48"

Floor protection may be any non-combustible material or Listed Floor Protector, and must extend at least 18" (456 mm) in Canada or 16" (406 mm) in U.S.A., in front of the loading door opening; In USA minimum size is 35" x 43 1/8" (889 mm x 1096 mm).
In Canada, minimum size is 47" x 53 1/8" (1194 mm x 1350 mm)
US ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards u ing crib wood. (EPA test methods 28R/5G with an emission-rate of 1.1 g/hr). 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 operating instructions in the owner's manual, or if the catalytic element is deactivated or removed.
***ONLY OPERATE WITH DOORS CLOSED. Open door to feed fire ON Y. *DO NOT OBSTRUCT COMBUSTION AIR OPENINGS. Do not obstruct the space beneath the heater. For Use With Solid Wood Fuel Only - Do not burn other fuels, this may make the catalyst in the combustor inactive. The performance of the catalytic device or its durability has not been evaluated as part of the certification. Combustor part number: 115-1510-C2 or 115-1510-V3. Provide adequate outside air for combustion. *Replace with only ceramic glass, 5 mm. thickness. Unit must be installed with Blaze King Leg Kit Z1713, Classic Base Z4815, or Pedestal Kit Z2903 provided, attach as shown in the installation instructions.**

La protection de plancher peut être de n'importe quel matériel non combustible ou Protecteur de plancher approuvé, et doit se prolonger au moins de 18" (456 mm) au Canada ou 16" (406 mm) aux États-Unis devant la porte de chargement; Aux États-Unis, la taille minimum est de 35" x 43 1/8" (889 mm x 1096 mm)
Au Canada la taille minimum est de 47" x 53 1/8" (1194 mm x 1350 mm)
L'AGENCE DE PROTECTION ENVIRONNEMENTALE DES U.S. - Certifié conformément aux normes d'émission de articules 2020 , en utilisant du bois machiné (méthodes d'essai EPA 28R / 5G, ASTM E2515 et ASTM E2780, avec un taux d'émission de 1.1 g/hre). Cet appareil de chauffage au bois nécessite des inspections p riodiques et des réparations pour un fonctionnement adéquat. Consulter le manuel du propriétaire pour plus d'informations. Il est contre les règlements fédéraux de faire fonctionner cet appareil de chauffage à l'encontre des instructions d'utilisation fournies dans le manuel du propriétaire, ou si l'élément catalytique est enlevé ou désactivé.
***Utiliser le uniquement avec les portes fermées. Ouvrir la porte pour alimenter le feu SEULEMENT. *Ne pas obstruer l'entrée d'air de combustion. Fournir l'apport d'air extérieur adéquat pour alimenter la combustion. Ne pas obstruer l'espace sous l'appareil. Utiliser uniquement avec des combustibles solides - ne pas brûler aucun autre combustible, ce qui peut rendre le catalyseur de la chambre à combustion inactif. La performance du catalyseur ou sa longévité n'a pas été évaluée dans le cadre de la certification. Numéro du catalyseur: 115-1510-C2 ou 115-1510-V3 *Employer seulement le verre en céramique d'une épaisseur de 5mm si le remplacement est nécessaire. L'appareil doit être installé avec le Blaze King kit de pattes Z1713, Base Classique Z4815, ou Piédestal Kit Z3903 fourni, attache comme indiqué dans les instructions d'installation.**

MANUFACTURED IN

☐ USA:
Blaze King Industries
146A Street
Walla Walla, WA.
99362

☐ CANADA:
Valley Comfort Systems
1290 Commercial Way
Penticton, B.C.
V2A 3H5

MANUFACTURE DATE

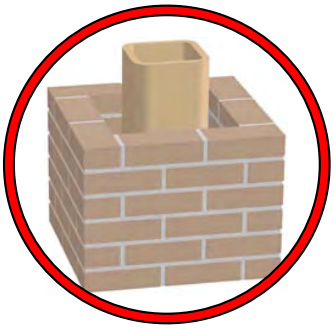
JAN ☐	FEB ☐	MAR ☐	APR ☐	MAY ☐	JUN ☐
JUL ☐	AUG ☐	SEP ☐	OCT ☐	NOV ☐	DEC ☐
2019 ☐	2020 ☐	2021 ☐	2022 ☐	2023 ☐	2024 ☐

170-0243 [05 20]

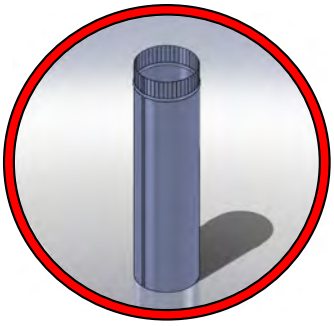
SAFETY PRECAUTIONS

IF THIS BLAZE KING APPLIANCE IS NOT PROPERLY INSTALLED OR OPERATED, 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.

PLEASE READ THIS ENTIRE MANUAL BEFORE YOU INSTALL AND USE YOUR NEW APPLIANCE. FAILURE TO FOLLOW INSTRUCTIONS MAY RESULT IN PROPERTY DAMAGE, BODILY INJURY, OR EVEN DEATH.



This appliance must be connected to a listed high temperature **(ULC629 IN CANADA OR UL-103HT IN THE USA)** residential type factory built solid fuel chimney or an approved masonry chimney with a flue line .
Chimney and chimney connector must be in good condition and kept clean.
NEVER vent the stove to other rooms of the building. Must be vented to the outside ONLY.
NEVER use a chimney or chimney connector smaller then the stove exhaust, unless approved by your local inspector.
NEVER vent the stove into a “Class B” gas vent chimney.
DO NOT CONNECT IN CONJUNCTION WITH ANY AIR DISTRIBUTION DUCTWORK UNLESS SPECIFICALLY APPROVED FOR SUCH INSTALLATIONS.



Inspect the chimney connector and chimney regularly during each burning season and clean when necessary.
DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.

NEVER intentionally start a chimney fire to clean the flu

When installed in a mobile home, this appliance must be bolted to the floor and provided with outside air.

WARNING: DO NOT INSTALL IN A SLEEPING ROOM
CAUTION: THE STRUCTURAL INTEGRITY OF THE MOBILE HOME FLOOR, WALL, AND CEILING/ROOF MUST BE MAINTAINED.

Check with local building official

If the Optional Fan Kit is installed, connect this unit to a properly grounded, 110-volt electrical outlet. Do not route the power cord in front of or under the appliance.

Do not make any changes or modifications to an existing masonry fireplace or chimney to install this appliance. Do not make any changes to the appliance to increase combustion air.

Never try to repair or replace any part of this appliance unless instructions are given in this manual. All other work must be done by a trained technician.

Do not place clothing or other flammable items on or near this appliance.

Allow the appliance to cool down before carrying out any maintenance or cleaning.

DO NOT OVER FIRE THIS HEATER. Attempts to achieve heat output rates that exceed heater design specifications can result in permanent damage to the heater and to the catalytic combustor. Over firing the appliance may cause a house fire. Never burn the appliance so hot that the appliance or chimney connector begins to glow.

Maintain the door and glass seal and keep them in good condition. A leaking door seal will shorten burn times and may harm the combustor.

Avoid placing wood against the glass when loading. Do not slam the door or strike the glass.

Do not use a grate or other device to elevate the fire off o the firebox flo . Burn the fire directly on the bricks.

Do not throw this manual away. This manual has important operating and maintenance instructions that you will need at a later time. Always follow the instructions in this manual.

Ashes should be placed in a steel container with a tightly fitting lid and moved outdoors immediately. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled. Other waste shall not be placed in this container.

It is required in some jurisdictions to install smoke and carbon monoxide detectors where heaters are installed. Install at least one smoke detector on each floor of your home to ensure your safety. It should be located away from the wood appliance and close to the sleeping areas. Locating a smoke detector too close to a wood appliance can cause the smoke detector alarm to sound if a puff of smoke is emitted while the wood appliance door is open during reloading. Follow the smoke detector manufacturers placement, installation, and maintenance instructions.

SAFETY PRECAUTIONS

This appliance is designed and approved for burning cord wood only. DO NOT burn garbage or flammable fluids such as gasoline, naphtha or engine oil; artificial or pap logs; gift wrappings; coal; lighter fluids; chemical cleaners; chemical starters; treated or painted wood; salt water driftwood or foil-backed paper such as gum wrappers or cigarette packages; lawn clippings or yard waste; materials containing rubber (including tires), plastic, asbestos; waste petroleum products, paints or paint thinners, or asphalt products; construction or demolition debris; railroad ties or pressure-treated wood; manure or animal remains; unseasoned wood or paper products, cardboard, plywood, or particleboard. 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 heat . Burning these materials may result in the release of toxic fumes or render the heater ineffective and cause smoke. Burn natural wood onl . It will void all warranties and safety listings and may damage the combustor.

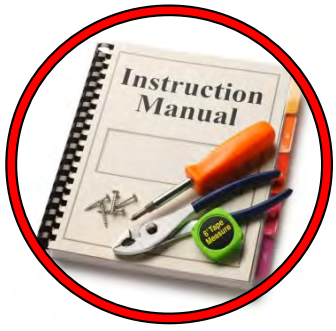
Never burn the appliance with the loading door open. Leaving the door cracked open may damage the combustor.

Never block free airflow through vents on this appliance.

Do not use chemicals or fluids to start the fire. Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or 'freshen up' a fire in this heate . Keep all such liquids well away from the heater while it is in use. Some fuels could generate carbon monoxide and are very dangerous.

HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY.
CONTACT MAY CAUSE SKIN BURNS.
Do not touch the appliance when it is hot and educate all children of the danger of a high temperature appliance. Young children should be supervised when they are in the same room as the appliance.

Keep furniture, curtains, wood, paper and other combustibles a minimum of 48in (1219mm) away from the front of the appliance. ALSO, DO NOT STORE COMBUSTIBLES UNDER THE APPLIANCE (WOOD, PAPER etc.).



This appliance must be properly installed to prevent the possibility of a house fire. The instructions must be strictly adhered to. Do not use makeshift methods or compromise in the installation.

Contact local building official to obtain a permit and information on any installation restriction or inspection requirements in your area. Notify your insurance company as well.

⚠WARNING

- **BEFORE INSTALLING THIS APPLIANCE, CONTACT THE LOCAL BUILDING OR FIRE OR OTHER AUTHORITY HAVING JURISDICTION AND FOLLOW THEIR GUIDELINES.**
- **THIS APPLIANCE MUST BE INSTALLED BY A QUALIFIED INSTALLER. FOLLOW THE INSTALLATION DIRECTIONS. DO NOT OPERATE WITHOUT FULLY ASSEMBLING ALL COMPONENTS.**
- **IF THIS APPLIANCE IS NOT PROPERLY INSTALLED, A HOUSE FIRE MAY RESULT.**
- **THIS APPLIANCE IS HOT WHEN OPERATED AND CAN CAUSE SEVERE BURNS IF CONTACTED. CHILDREN AND PETS MUST BE KEPT FROM TOUCHING THE APPLIANCE WHEN IT IS HOT.**
- **COMBUSTIBLE MATERIAL SUCH AS FIRE WOOD, WET CLOTHING, ETC. PLACED TOO CLOSE CAN CATCH FIRE. OBJECTS PLACED IN FRONT OF THE APPLIANCE MUST BE KEPT A MINIMUM OF 48”(1219 MM) FROM THE FRONT OF THE APPLIANCE.**

Blaze King grants no warranty, implied or stated, for the installation or maintenance of the appliance and assumes no responsibility of any consequential damage(s).

NATIONAL FIREPLACE INSTITUTE NFI CERTIFIED www.nficertified.org

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

Wood Energy Technical Training www.wettinc.ca

PARTS INCLUDED
1. Poker
2. Manual kit (w/ warranty cards, thermometer, bypass handle)

REQUIRED KIT (choose one)	
1. S.Z1713.BK Parlor Leg Kit	2. S.Z3903.BK Ultra Pedestal Kit
3. S.Z4815 Classic Base Kit	

OPTIONAL EQUIPMENT	
1. S.Z1714 Fan Kit	2. S.Z3820.BK Leg Ash Pan Kit
3. S.Z4710 Rear Shield	4. S.Z1726 / S.Z1726B Fresh Air Kit 4”/3”

FLOOR PROTECTION

If the stove sits on a combustible floo , a non-combustible shield must be used underneath the stove and extending 16” out from the front and 8” on either side of the fuel-loading door in the USA. In Canada a non-combustible shield must be used underneath the stove and extending 8” on either side and rear and 18” out in front of the loading door.

A non-combustible shield is also required underneath the chimney connector and extending at least 2” (50.8mm) on either side of the chimney connector.

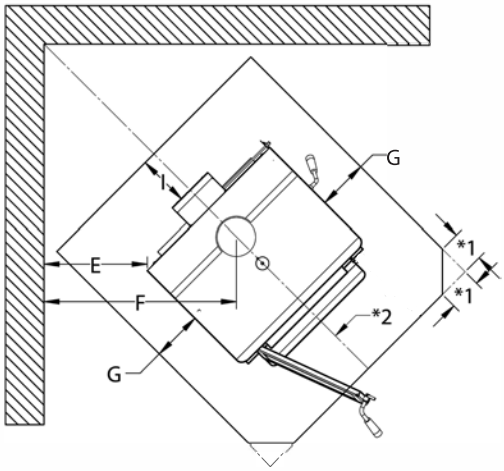
See the next page for minimum sizes depending on model. This floor protection is required to prevent sparks from falling onto the combustible floo . See CSA B365-M87. **This product does not require thermal hearth pad protection.**

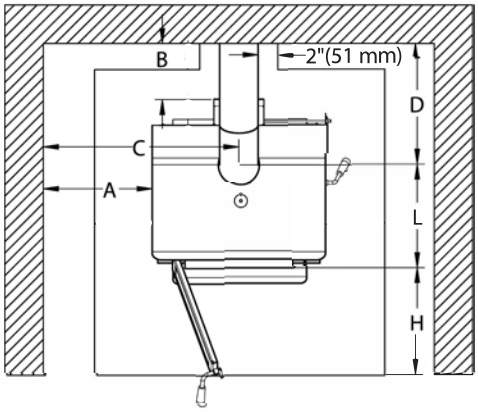
MINIMUM CLEARANCES

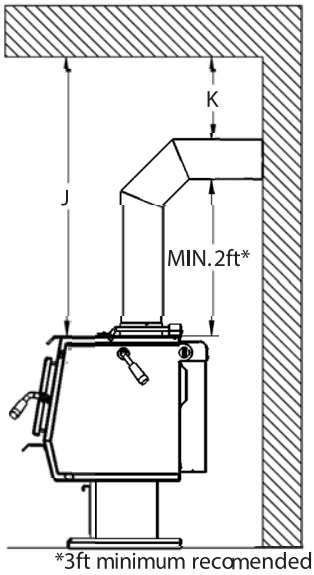
Residential Installations	A	B	C	D	E	F	J
Roof exit, parallel and corner.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125"* 410 mm	4" 102 mm	19.375"* 492 mm	48 1/8" 1223 mm
Wall exit, parallel and corner.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125"* 410 mm	4" 102 mm	19.375"* 492 mm	48 1/8"* 1223 mm
Alcove, roof exit. Fan kit or rear shield required.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125"* 410 mm	N/A	N/A	48 1/8" 1223 mm
Mobile Home Installation							
Roof exit, parallel and corner. Fan kit or rear shield required. Outside air kit required.	10" 254 mm	6" 153 mm	25.5" 648 mm	16.125"* 410 mm	4" 102 mm	19.375"* 492 mm	48 1/8" 1223 mm

*** Check with local codes and pipe manufacturer for pipe clearances. In Canada, 18" clearances from single wall pipe is required. Clearances may only be reduced by means approved by the regulatory authority**

*** Check with local codes and pipe manufacturer for pipe clearances. In Canada, 18" clearances from single wall pipe is required.**







***1=6 1/2" in Canada and 2 1/8" in USA**
***2=62 3/8" in Canada and 60 3/8" in USA**

G = 2" (51 mm) in USA 8" (203 mm) in Canada	H = 16" (406 mm) in USA 18" (456 mm) in Canada	I = 0" (0 mm) in USA 8" (203 mm) in Canada	K = 18" (456 mm) for single wall pipe in Canada

Ember protection shield (not required to have an insulation value)
is to be listed under UL 1618-2009 (type 1) and must have a minimum size of:
In USA: 35" x 43 1/8" (889 x 1096 mm)
In Canada: 47" x 53 1/8" (1194 x 1350 mm)
Min. Alcove minimum width 51", maximum depth 49", minimum height above stove top 48"
This stove must be installed in compliance with all local codes and regulations.

COMBUSTION AIR

Ensure adequate combustion air allowing for all other exhausting type appliances in the dwelling (range hoods, dryers, etc.). In air tight homes and modern constructions, careful considerations must be taken into account when using a wood burning appliance. Heat recovery ventilators (HRV) systems along with constant running fan motors in air handlers must be taken into account when balancing the system. Failure to do so may result in air starvation, smoke spillage and carbon monoxide threats. Consult a HVAC specialist for proper installation. Ensure adequate combustion air allowing for all other exhausting type appliances in the dwelling (range hoods, dryers, etc.). In airtight houses it is recommended to install a fresh air inlet into the room where the appliance is located, to prevent air starvation.

DRAFTING PERFORMANCE

Draft is the force which moves air into the appliance up through the chimney. The amount of draft created by your chimney depends upon length, offsets, insulating properties, obstructions (such as architectural design, trees), local geography and other factors.

External forces, such as outdoor temperature, wind, barometric pressure, topography, or factors inside the home (negative pressure from exhaust fans, chimneys, air infiltration, etc) may adversely affect draf

Too much draft may cause excessive temperatures in the appliance and may damage the heater. An uncontrollable burn or excessive temperature indicates excessive draft.

Inadequate draft may cause back puffing (spillage) into the room and plugging of the chimn , chimney cap or spark arrestor screen. Inadequate draft may cause smoke to leak into the room through appliance or chimney connector joints. Poor draft can also lead to poor heat production and the inability for the combustor to remain active in lower burn rate settings.

High efficiency appliances, such as your Blaze King stove, may require some fine tuning of your chimn system in order to maximize performance.

Blaze King cannot be responsible for external forces leading to less than optimal performance.

ROLE OF THE CHIMNEY

Without a proper installed chimney, this appliance will not burn correctly.

The role of the chimney is to pull the proper amount of air into the firebox for the purpose of complete combustion. Incomplete combustion will lead to more smoke and pollution of the outside air. A proper operating chimney will allow the user to enjoy peak performance at all burn operating levels from low to high. Blaze King therefore recommends vertical installations with a minimum length of 15’ from stove top to chimney cap. In all freestanding stove installations, use double wall stove pipe from the stove top to the ceiling support box. The use of double wall stove pipe does allow for reduced clearances, however most importantly, it helps to keep the chimney warm and improve draft.

For wall exits, the same suggestion applies. With the addition of the recommendation to use two 45 degree elbows rather than a single 90 degree elbow. The use of two 45 degree elbows will allow for both a smoother transition to the exterior chimney and will also shorten the horizontal run to the outside chimney. A minimum 36” rise is recommended prior to any elbows being used. When possible, outside chimney systems should be isolated from direct exposure to winter weather by building a chase around the chimney, observing all clearances as specified by the venting manufacture . Doing so will help to keep the chimney warmer and improve draft. (see ***RECOMMENDED FLUE HEIGHTS***)

VENTING SYSTEMS

The venting system consists of a chimney connector and a chimney. These get extremely hot during use. Temperatures inside the chimney may exceed 2000 degrees in the event of a creosote fire. To protect against the possibility of a house fire, the chimney connector and chimney must be properly installed and maintained. A listed thimble must be used when a connection is made through a combustible wall to a chimney. A chimney support package must be used when a connection is made through the ceiling to a listed prefabricated chimney. These accessories are absolutely necessary to provide safe clearances to combustible wall and ceiling material.

This stove may be connected to a lined masonry chimney or a listed factory built chimney suitable for use with solid fuels and conforming to, ULC629 in Canada or UL-103HT in the USA. Do not connect it to a chimney serving another appliance. To do so will affect the safe operation of both appliances, and will void the stove warranty. You must comply with the local authority having jurisdiction and/or in Canada, CSA installation standard B365-M87.

The chimney connector must be 8” diameter, 24 MSG Black/Blue steel. Do not use aluminum or galvanized steel. They cannot properly withstand the extreme temperatures of a wood fire. The chimney connector between the stove and the chimney should be as short and direct as possible.

The chimney connector must be attached to either an approved masonry chimney or one of the listed factory built chimneys suitable for use with solid wood fuel. All joints must be tight and fastened with sheet metal screws.

⚠WARNING

THE CHIMNEY CONNECTOR IS TO BE USED ONLY WITHIN THE ROOM, BETWEEN THE STOVE AND CEILING / WALL. NEVER USE A CHIMNEY CONNECTOR TO PASS THROUGH AN ATTIC OR ROOF SPACE, CLOSET OR SIMILAR CONCEALED SPACE, OR A FLOOR, OR CEILING. AN EFFECTIVE VAPOR BARRIER MUST BE MAINTAINED AT THE LOCATION WHERE THE CHIMNEY OR COMPONENT PENETRATES TO THE EXTERIOR OF THE STRUCTURE. ALWAYS MAINTAIN THE MINIMUM CLEARANCES TO COMBUSTIBLES AS REQUIRED BY THE APPLICABLE BUILDING CODES.

CONNECTION TO A METAL PREFABRICATED CHIMNEY

Refer to **"RECOMMENDED FLUE HEIGHTS"** chart for minimum flue height recommendations and ULC629 in Canada or UL-103HT in the USA for installation codes. When a metal prefabricated chimney is used, the manufacturer's installation instructions must be followed precisely. You must also purchase (from the same manufacturer) and install the ceiling support package or wall pass through and "T" section package, fire stops (when needed), insulation shield, roof flashing, chimney cap, etc. Maintain the proper clearance to the structure as recommended by the manufacturer. This clearance is usually a minimum of 2 inches, although it may vary by manufacturer or for certain components.

There are basically two methods of metal chimney installation. One method is to install the chimney inside the residence through the ceiling(s) and the roof. The other method is to install an exterior chimney that runs up the outside of the residence **(not recommended)**. If it is necessary to run the chimney outside, build an outside chase around the chimney.

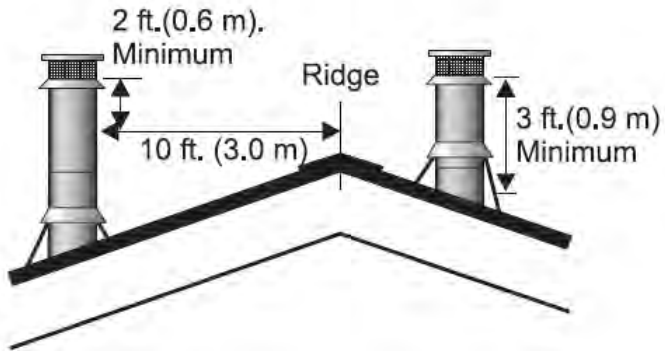
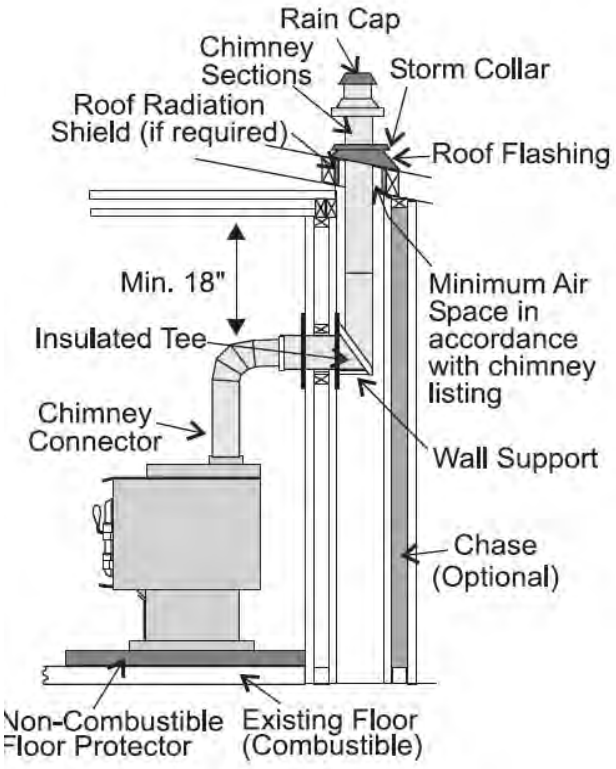
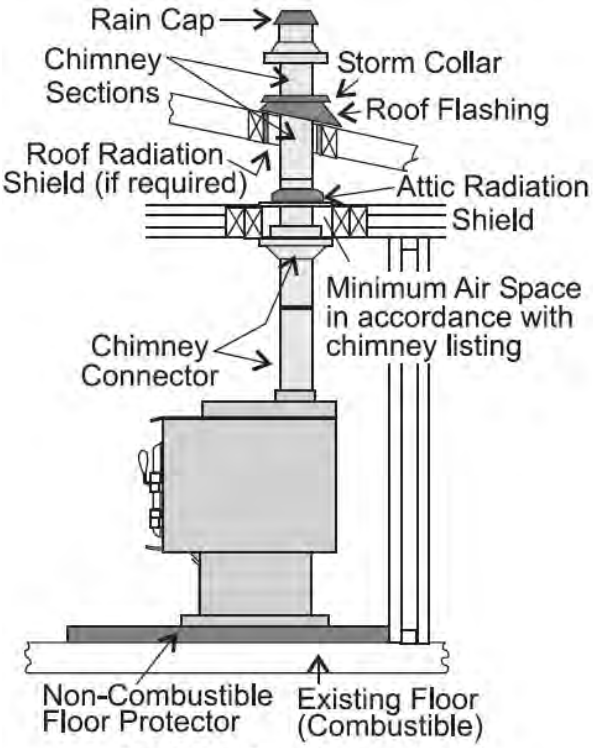


Fig. 1

The chimney must be the required height above the roof or other obstruction for safety and for proper draft operation. The requirement is that the chimney must be at least 3 feet higher than the highest point where it passes through the roof and at least 2 feet higher than the highest part of the roof or structure that is within 10 feet of the chimney, measured horizontally (**Fig. 1**). The height requirement is necessary in the interest of safety and does not necessarily assure proper flue draft. Use a minimum total system height of 15 feet, measured from the stove flue collar to the top of the chimne , not including the chimney cap.



Horizontal Installation



Standard Ceiling Installation

CONNECTION TO A MASONRY CHIMNEY

Masonry chimney***

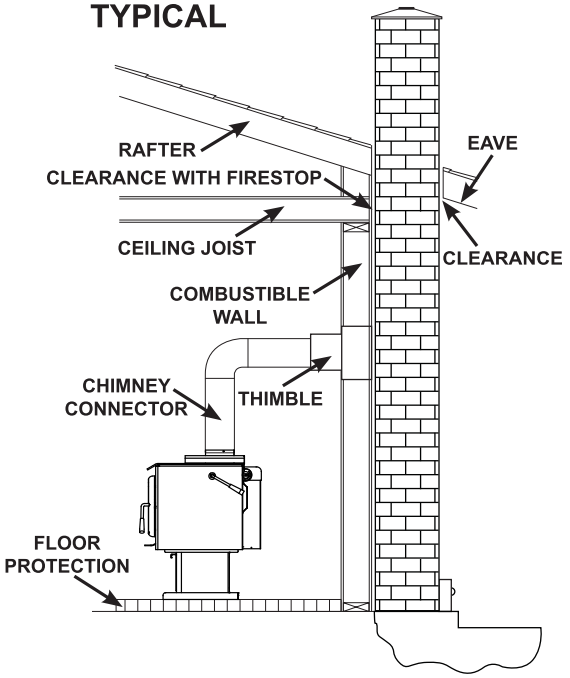
Ensure that a masonry chimney meets the minimum standards (NFPA) by having it inspected by a professional. Make sure there are no cracks, loose mortar or other signs of deterioration and blockage. Have the chimney cleaned before the stove is installed and operated. When connecting the stove through a combustible wall to a masonry chimney, special methods are needed.

In Canada, the wall cut away is to provide 18” clearance for the connector. The resulting space must remain empty. A flush mounted sheet metal cover may be used on one side only. If covers are to be used on both sides, each cover must be mounted on noncombustible spacers at least 1” clear of the wall.

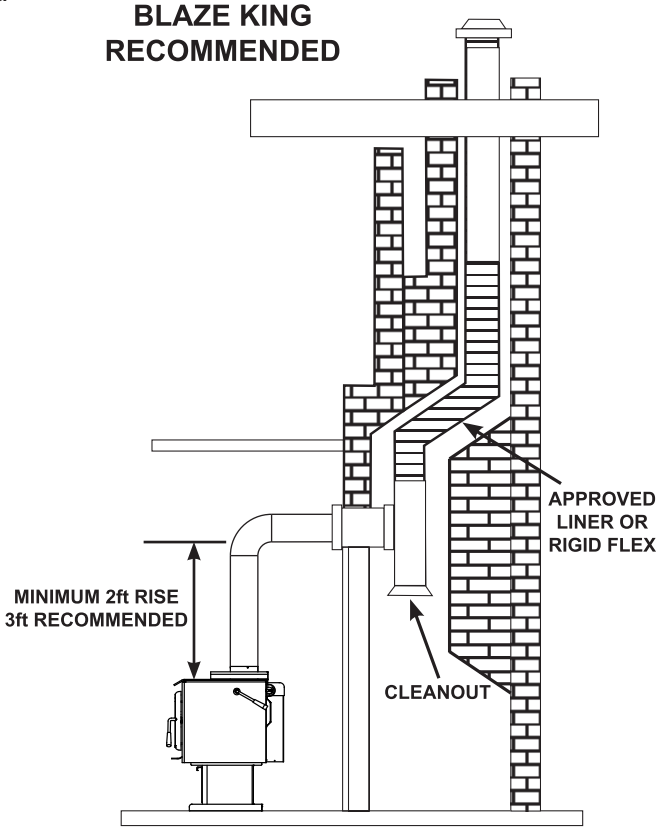
*****Blaze King recommends the use of a Stainless steel liner, preferably insulated, inside a masonry chimney. This is to maintain proper draft and overall better operation of the unit.**

Your local dealer or local jurisdiction can provide details of approved methods of passing a chimney connector through a combustible wall in your area. In USA, the National Fire Protection Association has minimum standards to comply with. In Canada , this type of installation must conform to CAN/CSA-B365, Installation Code for Solid Fuel Burning Appliances and Equipment.

TYPICAL



BLAZE KING RECOMMENDED



RECOMMENDED FLUE HEIGHTS

1. At sea level the minimum height is a 15 ft (4.6 m) straight run.
2. Add the following vertical height to the flue to compensate for
   45° elbow = 1.0 ft (.30 m)
   90° elbow = 2.0 ft (.61 m)
   "T" section= 3.0 ft (.91 m)
3. Each foot of horizontal run = 2 ft (.61 m) of vertical rise.

Example: One 90° elbow = 2ft (.61 m)
2ft Horizontal run = 4ft (1.2 m)
One base "T" = 3ft (.91 m)
Total height addition = 9ft (2.7 m) at sea level

MINIMUM RECOMMENDED FLUE HEIGHT				
ELEVATION ABOVE SEA LEVEL	**NUMBER OF ELBOWS**			
	0	**2 X 15°**	**2 X 30°**	**2 X 45°**
0 - 1000 ft 0 - 305 m	15 4.6 m	16 4.9 m	18 5.5 m	19 5.8 m
1000 - 2000 ft 305 - 610 m	15.5 4.7 m	16.5 5.0 m	18.5 5.6 m	19.5 5.9 m
2000 - 3000 ft 610 - 914 m	16 4.9 m	17 5.2 m	19 5.8 m	20 6.1 m
3000 - 4000 ft 914 - 1219 m	16.5 5.0 m	17.5 5.3 m	19.5 5.9 m	20.5 6.2 m
4000 - 5000 ft 1219 - 1524 m	17 5.2 m	18 5.5 m	20 6.1 m	21 6.4 m
5000 - 6000 ft 1524 - 1829 m	17.5 5.3 m	18.5 5.6 m	20.5 6.2 m	21.5 6.6 m
6000-7000 ft 1829 - 2134 m	18 5.5 m	19 5.8 m	21 6.4 m	22 6.7 m
7000 - 8000 ft 2134 - 2438 m	18.5 5.6 m	19.5 5.9 m	21.5 6.6 m	22.5 6.9 m
NOTE: No more than one offset (two elbows allowed). Two 45°elbows equal one 90° elbow				

Please note: These are only guidelines. Please refer to the section in the manual pertaining to draft. Every installation is unique and can be influenced by topographical and geographical phenomena
The use of a manometer and an understanding of pressure planes and the stack effect are imperative in planning and executing a successful installation.

MOBILE HOME (AND RESIDENTIAL ALCOVE INSTALLATIONS)

Requires outside air kit, and either rear shield OR fan kit. (See next page for kits and part numbers). The outside air kit is easiest to mount before the stove is installed. See instructions packed with each kit. **NOTE: UNDER NO CIRCUMSTANCES SHOULD THE FRESH AIR TUBE EVER BE INSTALLED HIGHER THAN THE BOTTOM OF THE APPLIANCE FIREBOX FLOOR.**

When a metal prefabricated chimney is used, the manufacturer's installation instructions must be followed precisely. You must also purchase (from the same manufacturer) and install the ceiling support package, fire stops (when needed), insulation shield, roof flashing, chimney cap, etc. Maintain the proper clearance to the structure as recommended by the manufacturer.

Chimney connector must be double wall close clearance type with either ULC629 or ULCS610 designation. Single wall pipe is not allowed in Mobile Homes or in Alcove Installations. Insulated chimney components must be a listed factory built chimney suitable for use with solid fuels and conforming to, ULC629 in Canada or UL-103HT in the USA. For Mobile home, the chimney needs to be removable to allow for transportation of the mobile home.

⚠WARNING

DO NOT INSTALL IN SLEEPING ROOM. THE STRUCTURAL INTEGRITY OF THE MOBILE HOME FLOOR, WALL AND CEILING / ROOF MUST BE MAINTAINED.

In mobile home installations, the stove must be securely fastened to the floor using the tie-downs provided in the Outside Air kit.

- For S.Z1713.BK Parlor Leg kit, use the S.ZR8039 Leg Anchor Kit to secure stove to the floo . (**Fig.3**)
- For S.Z3903.BK Ultra Pedestal Kit use #10 screws and washers through the two holes in the back angle support to secure the stove to the floo . (**Fig.4**)
- For S.Z4815 Classic Base Kit use #10 screws and shipping brackets (**Fig.2**) from the firebox crate to secure the stove to the floo . (**Fig.5**)

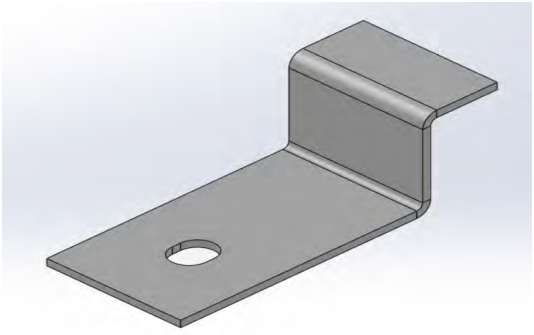


Fig. 2

Fig. 3

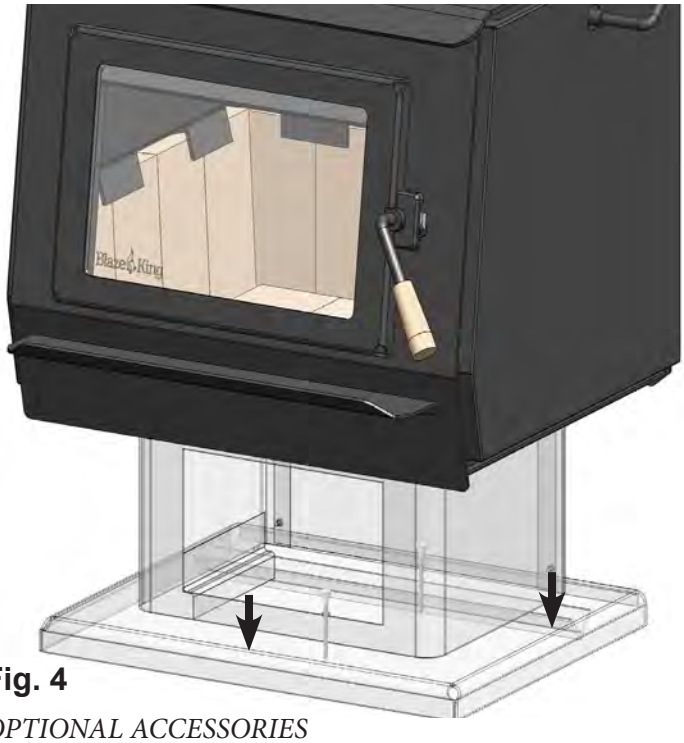


Fig. 4

Fig. 5

OPTIONAL ACCESSORIES

MOBILE HOMES — Requires Outside Air Kit (S.Z1726 / S.Z1726B), and either Fan Kit (S.Z1714) or Rear Shield (S.Z4710).

RESIDENTIAL ALCOVES — Requires either Fan Kit (S.Z1714) or Rear Shield (S.Z4710)

REAR SHIELD KIT (S.Z4710)

EITHER this Rear Shield or Fan Kit (S.Z1714) is REQUIRED FOR:

MOBILE HOMES and RESIDENTIAL ALCOVES

FAN KIT (S.Z1714)

EITHER this Fan Kit or Rear Shield (S.Z4710) is REQUIRED FOR:

MOBILE HOMES and RESIDENTIAL ALCOVES

NOTE: Fan Kit should be installed before the stove is placed into position

ELECTRICAL CONNECTION:

Your Blaze King fan kit is equipped with a three-prong (grounded) plug to decrease shock hazard. THIS PLUG SHOULD BE INSERTED DIRECTLY INTO A PROPERLY-GROUNDED, THREE-HOLE RECEPTACLE. DO NOT CUT OR REMOVE THE GROUNDING PRONG FROM THIS PLUG. Do not route the power cord in front or under the stove.

OUTSIDE AIR KIT (S.Z1726 / S.Z1726B)

REQUIRED FOR:

MOBILE HOMES

The outside air inlet hose is a flexible tube to bring outside air for combustion into the stove from outside the residence, through the wall or up through the floo . The flexible tube will allow some adjustment over or around floor joists or plumbing. DO NO CHANGE THE STRUCTURAL INTEGRITY OF THE FLOOR. This air hose must be kept open at all times to provide outside air for combustion.

PARLOR LEG KIT (S.Z1713.BK)

NOTE: EITHER S.Z1713.BK PARLOR LEG KIT, S.Z4815 CLASSIC BASE KIT, OR S.Z3903.BK ULTRA PEDESTAL KIT, MUST BE INSTALLED BEFORE STOVE CAN BE DUCTED AND READY FOR USE.

TOOLS NEEDED FOR INSTALLATION: 3/4” wrench or socket wrench

INSTALLATION

1. Lean stove rearwards to gain access to stove bottom. **NOTE: Use extreme caution when leaning the stove over to avoid injury or damage to the flooring or appliance. Place cardbaord inside the firebox to support bricks when leaning the stove**
2. Position each leg accordingly, use alignment holes in base, fasten to stove using the 1/2” bolts and washers supplied with the parlor leg kit. (**Fig. 5**)
3. Lift stove back to its upright position.
4. Adjust carriage bolts in order to level stove.

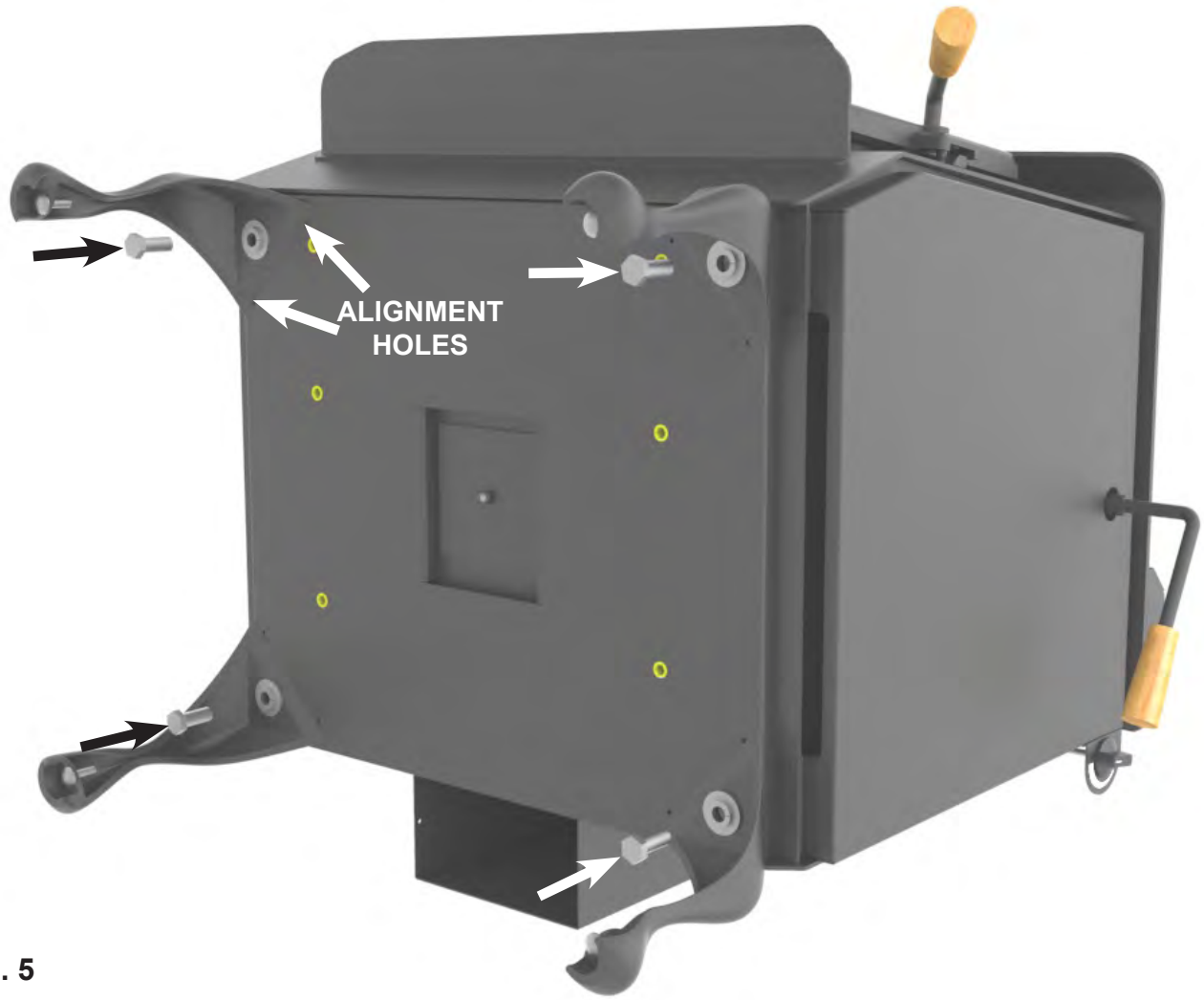


Fig. 5

CLASSIC BASE KIT (S.Z4815)

NOTE: EITHER S.Z1713.BK PARLOR LEG KIT, S.Z4815 CLASSIC BASE KIT, OR S.Z3903.BK ULTRA PEDESTAL KIT, MUST BE INSTALLED BEFORE STOVE CAN BE DUCTED AND READY FOR USE.

TOOLS NEEDED FOR INSTALLATION: 7/16” and 3/4” wrench or socket wrench

INSTALLATION

1. Lean stove rearwards to gain access to stove bottom. **NOTE: Use extreme caution when leaning the stove over to avoid injury or damage to the flooring or appliance. Place cardboard inside the firebox to support bricks when leaning the stove.**

2. There are two 1/2” x 1/2” long bolts supplied with the classic base kit, thread them as shown, leave approximately a 1/4” of thread showing. (**Fig. 6)**

3. Slide the classic base slots onto the bolts from the previous step. (**Fig. 7)**

4. There are two 1/4-20 x 1/2” bolts supplied with the classic base kit, tighten until snug. (**Fig. 8**)

5. Tighten the 1/2” x 1/2” bolts until snug.

6. Lift stove back to its upright position.

Fig. 6

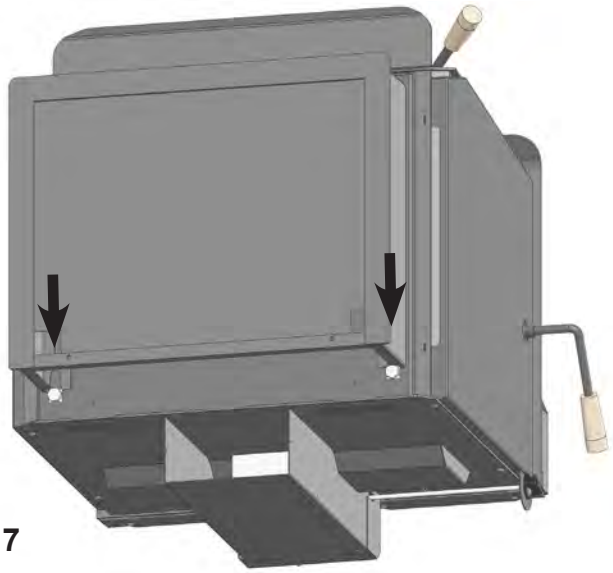


Fig. 7

Fig. 8

ULTRA PEDESTAL KIT (S.Z3903.BK)

NOTE: EITHER S.Z1713.BK PARLOR LEG KIT, S.Z4815 CLASSIC BASE KIT, OR S.Z3903.BK ULTRA PEDESTAL KIT, MUST BE INSTALLED BEFORE STOVE CAN BE DUCTED AND READY FOR USE.

TOOLS NEEDED FOR INSTALLATION: 7/16" wrench or socket wrench

INSTALLATION

1. Lean stove rearwards to gain access to stove bottom. **NOTE: Use extreme caution when leaning the stove over to avoid injury or damage to the flooring or appliance. Place cardbaord inside the firebox to support bricks when leaning the stove.**

2. Remove "ASH CHANNEL SEAL" by unscrewing the 1/4" nut. (**Fig. 8**)

3. Thread all four 1/4"-20 button head cap screws into the stove base until halfway in (included w/ Pedestal Kit). (**Fig. 9**)

4. Remove the ash drawer from the assembled pedestal. (Can also remove pedestal back panel if needed)

5. Utilizing the key holes on the top of the pedestal body, slide the pedestal into place by pushing it against the bottom of the stove and then pushing it towards the back of the stove (use the half turned in screws as guide pins) (**Fig. 10** the pedestal base is not shown for clarity)

6. Once the pedestal is in position, finish tightening the four screws into the stove bottom and lift stove into its upright position.

7. Insert the ash drawer into the pedestal front. (Reattach pedestal back panel if removed)

8. Remove the ash plug from the firebox and insert the ash plug supplied with the pedestal kit.

Fig. 8

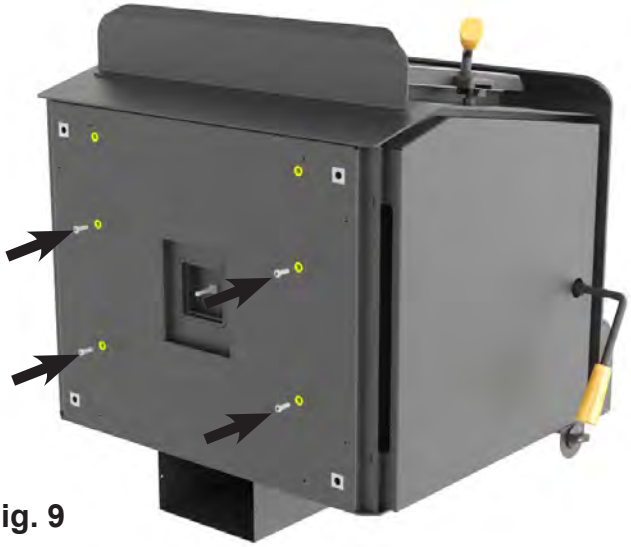


Fig. 9

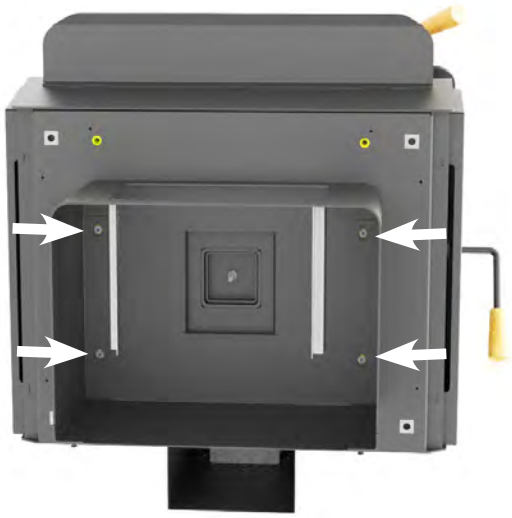


Fig. 10

PUSH PEDESTAL AGAINST FIREBOX BOTTOM, THEN TOWARDS FIREBOX BACK TO CORRECTLY POSITION IN KEY HOLES

DOOR INSTALLATION AND CHANGE-OUT

To install the door upon stove installation or to change it out, follow these steps:

WARNING: DOOR IS HEAVY, PLEASE HOLD FIRMLY.

INSTALLATION

1. Align bottom door hinge hole with bottom firebox hinge pin. **Fig. 11**)
2. Lower door onto bottom hinge pin, then align top door hinge hole with top firebox hinge pin
3. Lower door onto pins until door hinge surface contacts firebox hinge surface

NOTE: If your door has a gold or silver plating on it, please follow the instructions on the PLATED DOOR & TRIM CARE card found in the manual pack.

Fig. 11

YOUR FIRST FIRE!

The following pages contain information on the operation of the major components on your Blaze King appliance. Please take the time to read through this section as it will give you a better understanding of how your appliance works. This understanding will help you to operate your appliance at its optimum level thus extended its life while allowing you to get the highest efficiencies from your heat .

INTRODUCTION

All Blaze King free standing wood appliances are designed as radiant room space heaters. They have been designed and tested to be installed in insulated habitable rooms areas of your dwelling. The appliance has not been designed to be installed in a concrete uninsulated basement or in a shop/garage environment. Such applications may cause the thermostat to be unresponsive due the constant call for heat resulting in appliance being in a constant or over fire situation. Consequential damage from this type of operation will deem the warranty null and void.

All Blaze King wood appliances are designed to burn cord wood only. Dimensional timber off cuts, very low moisture content small diameter wood and pressed wood logs, when used in excess, may result in excessive internal firebox temperatures that can cause causing irreversible damage to the firebo s internal structure. Excessive temperatures can be caused by many small pieces of very low moisture content wood being used as a primary fuel source. This may be evident by warping or warped internal plates and retainers, possible cracking of the outer firebox and possibly premature failure of the catalytic combusto . All wood appliances should be cleaned out and inspected at the end of every burning season to identify if any internal components have been affected during the burning season. If problems are observed steps must be taken to identify and correct the problem before the subsequent burning season. Failure to do so will result in the warranty of the product being null and void.

EFFICIENCY

Efficiency was determined using the method outlined in B415.1-10 test method. It is represented by the Highe Heating Value (HHV) as the fuel used during testing contains between 19% - 25% water moisture included in the total calculated fuel weight. (Other test methods such as LHV or Low Heating Value, does not take the water moisture into account).

Annual Fuel Utilization Efficiency (AFUE) attempts to represent the actual, season long, average efficiency an appliance. HHV is the actual, calculated average efficiency obtained under test conditions. Using correctl seasoned wood is important when trying to gain efficien . The more seasoned (dry) the wood, the higher the efficiency (less energy wasted on eliminating moisture during combustion). Operating your Blaze King at lowe settings will result in higher efficiencies as the fuel will undergo a more complete combustion. For maximu efficien , the appliance should be installed in a location that provides adequate intake/combustion air as well as a location that will allow for the straightest run of optimal chimney length to establish necessary draft .

FAN OPERATION

Fans are an optional item for most Blaze King appliances. If fans are installed on your appliance, they should be turned off until the stove reaches normal operating temperatures. Approximately 30 minutes after a fire has been established within the appliance, the fan speed should match the thermostat control setting. (i.e. if your themrostat is set to a medium heat output then your fan should also be set at medium, low—low, high—high etc.). We recommend the use of fans on all of our wood appliances. The fan system recirculates room air over the hot surfaces of your appliance and helps spread this super heated air around your home.

SELECTING WOOD

⚠WARNING

- **THIS APPLIANCE IS DESIGNED TO BURN NATURAL WOOD ONLY. DO NOT BURN TREATED WOOD, COAL, CHARCOAL, COLORED PAPER, CARDBOARD, SOLVENTS OR GARBAGE.**
- **HIGHER EFFICIENCIES AND LOWER EMISSIONS WILL GENERALLY RESULT WHEN BURNING AIR DRIED SEASONED WOODS, AS COMPARED TO WET, GREEN OR FRESHLY CUT WOODS.**
- **BURNING WET UNSEASONED WOOD CAN CAUSE EXCESSIVE CREOSOTE ACCUMULATION. WHEN IGNITED IT CAN CAUSE A CHIMNEY FIRE THAT MAY RESULT IN A SERIOUS HOUSE FIRE.**

It takes a great deal of energy to evaporate the moisture contained in green or wet wood and that energy will not be heating your house. Green or wet wood will also greatly increase creosote issues. To ensure that your wood fuel has a moisture content of 20% or lower, only use seasoned wood that has been split, stacked, and protected from rain or snow for at least 24 months. Firewood should be split and stacked in a manner that allows for air flow to all areas

Never burn salt-water driftwood as it is very corrosive and will deteriorate the structure of the appliance. The burning of salt-water driftwood will void the warranty.

Both hardwood and softwood burn equally well in this appliance, but the more dense hardwood will weigh more per cord and burn a little slower and longer.

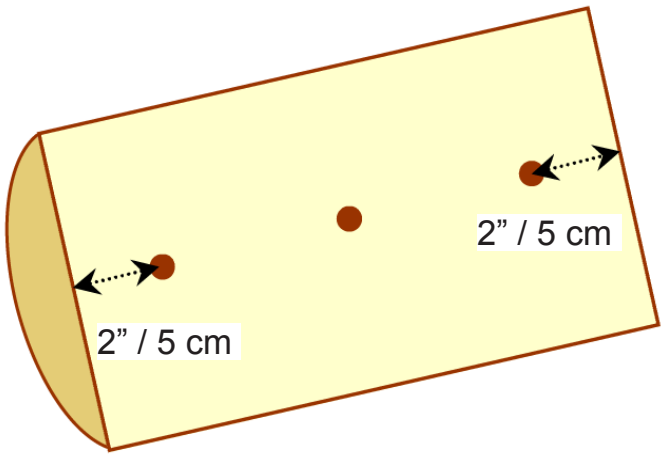
The only accurate way to determine wood moisture is to purchase a moisture meter.

⚠WARNING

- **NEVER START A FIRE UNLESS ALL BRICKS ARE CORRECTLY PLACED INSIDE THE FIREBOX. CHECK THE INSTALLATION INSTRUCTIONS CAREFULLY.**
- **ALWAYS OPEN THE BYPASS DOOR BEFORE OPENING THE LOADING DOOR.**
- **ONCE THE LOADING DOOR IS CLOSED, CLOSE THE BYPASS DOOR DIRECTLY AFTER THE CATALYTIC THERMOMETER NEEDLE IS IN THE ACTIVE ZONE.**

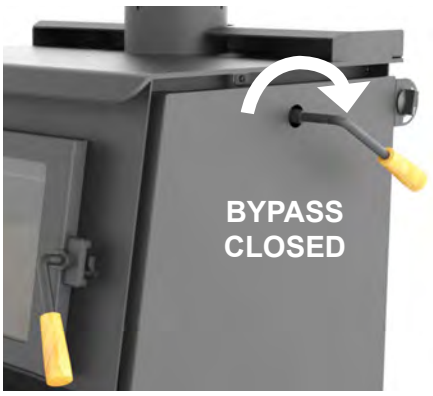
HOW TO USE MOISTURE METERS

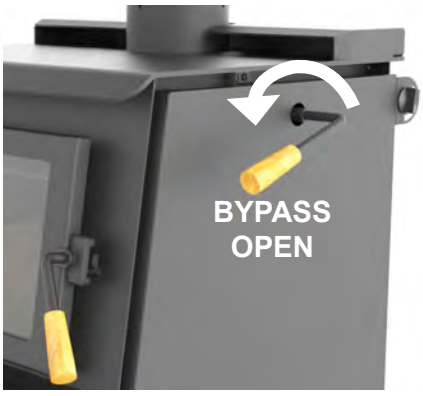
1. Take a random selection of around 3-4 logs per cubic yard or cubic meter.
2. Split each log down the middle.
3. In the center of log push pins of meter along grain - three measurements are taken on the freshly split surface: 2” or 5 cm in from each end of the log and in the middle of the split surface with sufficient contact (see figur
4. Do this to all the logs and take an average of the readings (this will be only an approximate indication but a good guide).

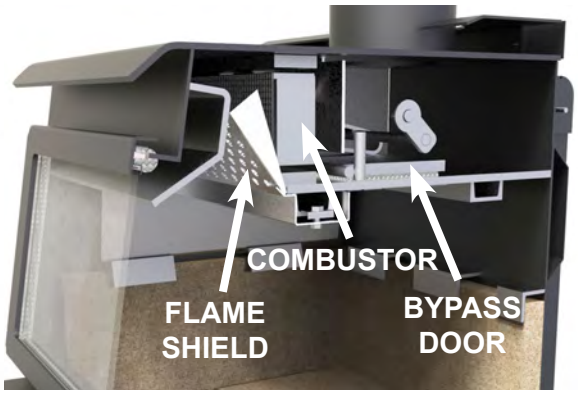


BYPASS DOOR

Your catalytic wood burning appliance is fitted with a bypass door which allows exhaust from the fire t temporarily bypass the catalytic combustor. The bypass door is located inside the dome of the firebox at the top of the appliance. It is a hinged, steel plate door and is controlled by the bypass handle located on the right side of the appliance. When the handle is pointing forward, the bypass door is open. To close the bypass door you must rotate the handle clockwise until it points to the rear of the appliance. To ensure the bypass door is fully closed, push down on the bypass handle until you hear a positive click. **NEVER OPEN THE LOADING DOOR WITHOUT OPENING THE BYPASS DOOR**







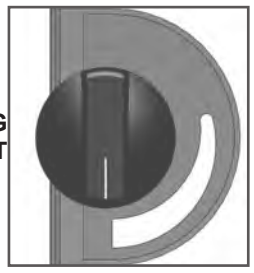
CATALYTIC THERMOMETER

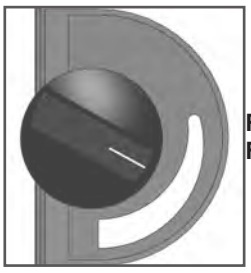
The catalytic thermometer is located on the top of the appliance. Its sole purpose is to indicate whether the combustor is ACTIVE or INACTIVE. It is important to ensure that the appliance is operated in the stove in the ACTIVE zone. When the thermometer reads INACTIVE it means that the combustor temperature is below 500F and is not producing a clean burn. For the most accurate reading, turn the fan off for approximately 5 minutes before reading the thermometer. For calibration instructions refer to “CATALYTIC THERMOMETER” in the “MAINTENANCE” section.

THERMOSTAT

The thermostat is located at the rear of the appliance and is controlled by the thermostat knob which is located at the upper right rear corner of the appliance. When the knob is positioned at the **HIGH** setting, the appliance will operate at its highest burn rate and deliver its maximum heat output. As the knob is rotated counter clockwise the burn rate will decrease along with heat output. Burn rate is greatly influenced by location, installation, and external environment, so you may find it necessary to reposition the knob until you find th ideal setting to suit your situation. Please note that all adjustments to the thermostat should be done gradually as too rapid a change may cause the thermostat to operate improperly. The thermostat is set at the factory. **DO NOT TAMPER WITH THE THERMOSTAT**, this will result in a malfunctioning thermostat.

**HIGH SETTING
MAXIMUM HEAT OUTPUT**





**ROTATE COUNTER CLOCKWISE
FOR REDUCED HEAT OUTPUT**

LIGHTING THE FIRE

NOTE: As you heat up the appliance for the first time, the paint will go through a curing process and will give off an odo . To minimize the inconvenience, burn the stove at a low temperature setting for several hours. It is advisable to open a door or window until the odor dissipates. You may also notice a change in color as the paint cures, this is normal and will appear uniform after subsequent firings

1. **DO NOT USE A GRATE. BUILD THE FIRE DIRECTLY ON THE BRICK IN THE BOTTOM OF THE STOVE.**
2. Position the thermostat to the **HIGH** setting and turn the fan (if fitted) **OFF**.
3. Open both the loading door and the bypass door (rotate the bypass handle forward).
4. Place 10 balls of non-glossy paper towards the front of the bottom of the firebox then stack 20 pieces of kindling on top of the paper in a crisscross fashion (leaving air gaps in between sticks).
5. Light the fire and allow it to get a good start while leaving the loading door cracked open (approximately 3 to 5 minutes). **DO NOT LEAVE THE STOVE UNATTENDED.**
6. Once the kindling is fully on fire, place two or three medium size logs onto the fire. Keeping the loadin door unlatched, allow the logs to catch fire (approximately 5 minutes). **DO NOT LEAVE THE STOVE UNATTENDED.**
7. Once the logs are burning, latch the loading door shut **BUT** keep the bypass door open. Leaving the loading door open after the wood load has caught fire may cause premature failure of the catalytic combustor.
8. When nearly all of the wood in the firebox is fully burning, finish loading the appliance. Lay the wood a far back in the stove as possible. Latch the loading door shut and observe the catalytic thermometer. Once the needle is in the **ACTIVE ZONE**, close the bypass door (rotate the bypass handle backwards).
9. Let the fire burn with the thermostat at the **HIGH** setting for 20-30 minutes or until the fire is well established. This ensures that the stove, catalyst, and wood load are all stabilized at optimum operating temperatures. The temperature in the stove and the gases entering the combustor must be raised to at least 500F (indicated by the thermometer needle in the **ACTIVE ZONE**) for catalytic activity to be initiated.
10. After 20-30 minutes or once the fire is well established, gradually turn the thermostat down to the desired heat output setting. Please note that if the thermostat is turned down too low too quickly, the fire may go out or the combustor may stop working, indicated by the thermometer needle falling into the **INACTIVE ZONE**. If this happens, simply thurn the thermostat back to a higher heat output setting to let the fire reestablish itself
11. If installed, turn the fan on after the initial warm up period of 20-30 minutes.

Probably the least understood requirement in maintaining a good fire is that of establishing a good base of coals or embers. A good bed of hot coals or embers will maintain a more even temperature as well as getting the new load of wood started easily. Put as much wood into the appliance as needed, practice will teach the amount of wood necessary to keep the fire going until the next reloading time. Don't be afraid to fill it completely if necessar . With the Blaze King thermostat, the wood will only burn at the rate set on the thermostat. Once the fire is established, the appliance should be left to complete the full burn cycle. This is evident by a) only coal bed (ember bed) remaining or b) the catalytic thermometer hovers just inside the active zone. Following this procedure will maximize the efficiency of the appliance as well as limit exhaust emission and smoke spillage.

RELOADING PROCEDURE

WHEN PREPARING TO RELOAD, IF THE NEEDLE ON THE CATALYTIC THERMOMETER IS STILL IN THE ACTIVE ZONE, FOLLOW THE PROCEDURE BELOW; IF THE NEEDLE HAS DROPPED INTO THE INACTIVE ZONE, REFER BACK TO THE "LIGHTING THE FIRE" PROCEDURE ON THE PREVIOUS PAGE.

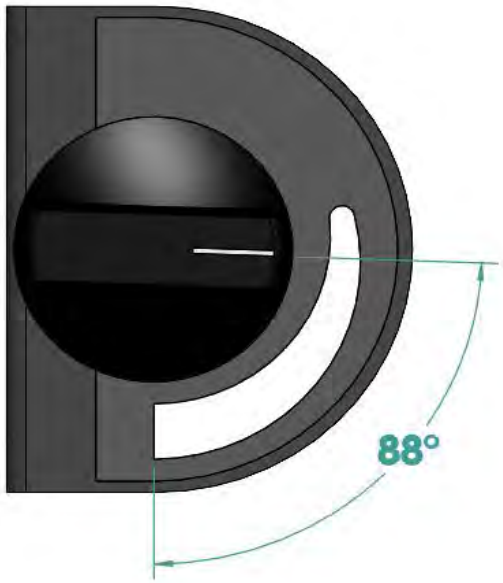
It is important to note that the catalytic thermometer is simply displaying the temperature of the catalytic combustor. It may be used as an aide when it comes to indentifying a reload point, but other factors such as lack of fuel in the firebox or dropping room temperatures should be used as well.

1. Have your next load of wood ready before beginning. Turn the thermostat to **HIGH**. Wait 2 minutes for the air flow to stabilize
2. To help minimize smoke spillage into the room, you may wish to open the bypass door and again wait 2 minutes for the air flow to stabilize.
3. Crack open the loading door to allow ambient room air to be introduced into the firebox, this may take a minute to stabilize
4. Slowly open the loading door and proceed to reload the firebox. If you experience excessive smoke spillage, slightly close the loading door to re-establish a draft through the chimney.
5. Once loaded, latch the loading door shut and (if opened) close the bypass door immediately. Let the fire burn on the HIGH thermostat setting for 20 to 30 minutes OR until the fire is very well established. At that point, turn the thermostat down to the desired setting. Keep in mind you may not see a large amount of flame activity in the lower thermostat setting. The thermometer needle will remain in the active zone indicating that the burn cycle is continuing.
6. Should you burn the stove on a very low setting for extended periods of time, you will begin to see creosote deposits forming on the glass door. To remove these deposits, simply run the stove on **HIGH** for approximately 30 minutes. The **HIGH** setting will burn off most of the deposit

Note: Our loading instructions are outlined in general terms due to the vast array of variables that arise with each installation. Such variables include type of wood fuel, chimney hieght and configuration, installation altitude, seasonal weather conditions, and the desired heat output required. Over time you will learn which settings are necessary to achieve optimal performance with your sepecific installation

OPTIMAL LOW BURN THERMOSTAT SETTING

Your Blaze King appliance was tested and certified in accordance to the New Source Performace Standards for Residential Wood Heaters. During this test series, the low burn rate of the unit was determined by setting the thermostat knob to a position that yeilded the lowest burn rate achievable. Considering that certification testing was conducting in a controlled labratory environment with the appliance connected to a 15ft tall chimney, you may find that your optimal low burn thermostat setting is either above of below the certification test setting based on your location, installation, and the external environment you are operating in. If you find that you are setting your thermostat beyond the test setting, please note that if the thermostat is turned down too low the fire may go out or the combustor may stop working which is indicated by the thermometer needle falling into the **INACTIVE ZONE**. If this happens, simply turn the thermostat back to a higher heat output setting and let the fire reestablish itself



OPTIMAL TESTED LOW BURN SETTING

WOOD BURNING IN THE SHOULDER SEASON

There are a few things to consider if you choose to light a fire during the spring or fall seasons when the outside temperature is milder, perhaps 55°F to 70°F (13°C to 21°C).

You may notice smoke spillage out of the loading door when it is opened during start up or reloading. This is caused by a lack of natural draft within the chimney system. The temperature difference between the chimney system and the outside air causes flue gasses to be drawn up and out of the chimne . Smaller temperature differences produce less draft in your chimney system than larger temperature differences This air movement, referred to as Stack Effect, is also influenced by air density and moisture differences To eliminate the smoke spilliage you may have to stoke the fire for longer than usual. Once the fire warms the chimney the draf will improve and spillage will be reduced. When operating the appliance on a lower thermostat setting, the resultant lower flue temperatures can cause your chimney system to cool down. This also decreases natural draft and spillage may occur.

General Rules for burning in the shoulder season:

- Run your appliance on **HIGH** for 30 minutes after start up and reloading before gradually turning the thermostat down to the desired heat output setting.
- The thermostat setting needs to be high enough to keep the catalytic thermometer in the active zone. If the thermometer will not stay in the active zone, turn the thermostat to a higher setting and then wait 15 minutes to confirm that the thermometer remains in the active zone. Repeat as required
- If your appliance is producing too much heat, try to reduce the volume of wood fuel loads rather than turning your thermostat down. It is good burning practice to build smaller, hotter fires on milder days in the spring and fall.

ICE - FORMATION AND PREVENTION

Most of what you see coming from the chimney of a properly operating catalytic appliance is water vapor. In extremely cold weather, and with some exterior chimneys, this vapor may freeze in the chimney to the point of actually blocking the chimney and extinguishing the fire. In such weathe , burn the appliance for 5 to 10 minutes with the thermostat set to **HIGH** to melt any possible ice build.

CATALYST MONITORING

⚠WARNING

DO NOT USE THE APPLIANCE WITHOUT A COMBUSTOR

It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly. A non-functioning combustor will result in a loss of heating efficien , and an increase in creosote and emissions. Following is a list of items that should be checked on a periodic basis:

- Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Actual removal of the combustor is not recommended unless more detailed inspection is warranted because of decreased performance. Refer to "CATALYTIC COMBUSTOR TROUBLESHOOTING" on next page.
- This catalytic heater is equipped with a temperature probe to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 500°F (indicated by the thermometer needle in the active zone), and often reach temperatures in excess of 1000°F. If catalyst temperatures fall below 500°F (indicated by the thermometer needle in the inactive zone), refer to next step and to "CATALYTIC COMBUSTOR, TESTING" below.
- You can get an indication of whether the catalyst is working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalyst light-off has been achieved, to the amount of smoke leaving the chimney when smoke is not routed through the combustor (bypass mode):
  - Light the appliance as per the lighting instructions (see "LIGHTING THE FIRE"). With smoke routed through the catalyst, go outside and observe the emissions leaving the chimney.
  - Open the bypass mechanism, wait approximately 15 minutes, and again observe the emissions leaving the chimney. Significantly more smoke will be seen when the exhaust is not routed through the combustor (bypass mode). Some smoke may be visible shortly after you start the fire and shortly after reloading the fire. Allow 20 to 30 minutes for the fire to stabilize before making observations

CATALYTIC COMBUSTOR, TESTING

Light the fire per the lighting instructions. After 1 hour of burning a well established fire, position the thermostat knob to a medium - low burn rate setting. Allow 5 minutes for the catalytic thermometer to reach equiliburm and observe the location of the indicator needle. A properly functioning combustor will have an active temperture greater than 500F and the thermometer will read in the ACTIVE zone. A "tired" or "dead" combustor will yield thermometer reading in the INACTIVE zone. Repeat this procedure for at least 3 burn cycles. If, after several burn cycles, the thermometer will not indicate an ACTIVE reading your combustor may require cleaning or replacement. If, after cleaning and reburning, your combustor is still not producing an ACTIVE reading you should contact your Blaze King dealer for a replacement combustor. Note - It is also possible that the catalytic thermometer itself may be functioning incorrectly. Before condemning the combustor, read CATALYTIC THERMOMETER in OPERATING INSTRUCTIONS.

CATALYTIC COMBUSTOR, CLEANING

Under certain conditions, ash particles may become attached to the face of the combustor. These may be seen while the combustor is in the glowing stage, or when the fire is out. Any deposit on the visible face of the combustor should be removed. Wait until the fire is out and the appliance is cold before performing any cleaning. Brushing the combustor with a soft bristle paint brush will remove some deposits. Passing a vacuum cleaner wand or brush near the face of the combustor will remove most deposits. (Hot ash in a vacuum cleaner bag will burn, may melt the vacuum or cause a house fire. Exercise caution and never clean the appliance when the appliance or ashes are hot.) Never scrape the combustor with any hard tool or brush. Never run pipe cleaner through the individual cells of the combustor. This is not needed, and may do more harm than good. Limit cleaning to the face of the combustor. **NOTE: Never remove a combustor without approved combustor gasket in hand as original gasket will fall apart when removed from** appliance. Remember to re-install the Flame Shield (the perforated plate) in same position it was found.
TIP: A hot fire will usually prove to be the best method of cleaning the combustor of deposits

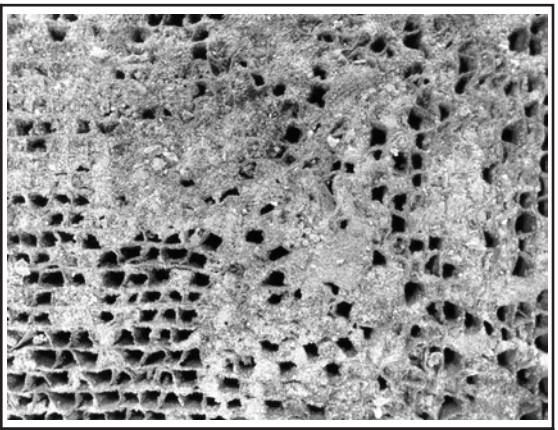
CATALYTIC COMBUSTOR, TROUBLESHOOTING

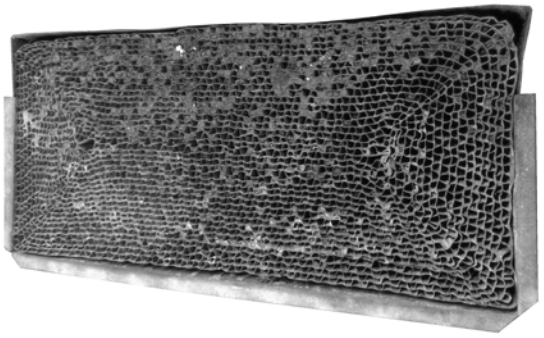
PROBLEM - CREOSOTE PLUGGING

Possible Cause: Burning materials that produce a lot of char and fly-ash
Solution: Do not burn materials such as garbage, gift wrap, or cardboard.

Possible Cause: Burning wet, pitchy woods or burning large loads of small diameter wood with the combustor in the operating position without the thermostat needle in the active zone.
Solution: Burn dry, seasoned wood, don't engage the bypass until the temperatures are high enough to initiate light-off (indicated by the thermostat needle in the active zone).

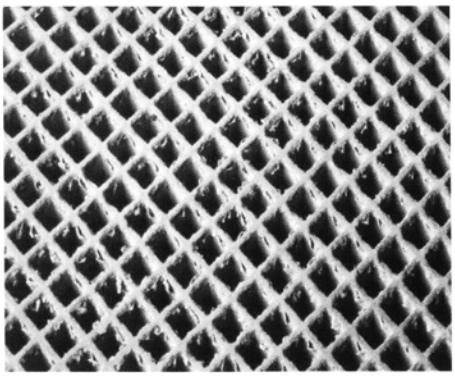
Possible Cause: Combustor not functioning. If proper burning procedures have been followed to no avail, the combustor is not functioning.
Solution: Replace the combustor with a genuine Blaze King combustor (failure to do so will void your warranty).





PROBLEM - CATALYST PEELING

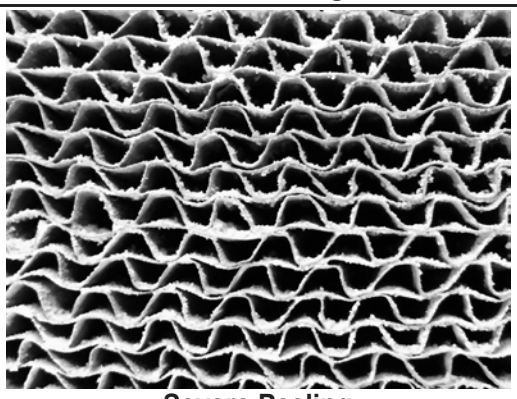
Possible Cause: Extreme temperatures (above 1800°F, or 1000°C.) at combustor surface can cause the catalysts to peel. Over firing and flame impingement on the combustor are primar causes. Minor peeling photo shows minor peeling that is normal and does not affect function. Severe peeling photo shows that are closed or plugged.
Solution: Avoid extreme temperatures and flame impingement If peeling is severe, remove and replace combustor.



Minor Peeling

PROBLEM - CATALYST DEACTIVATION

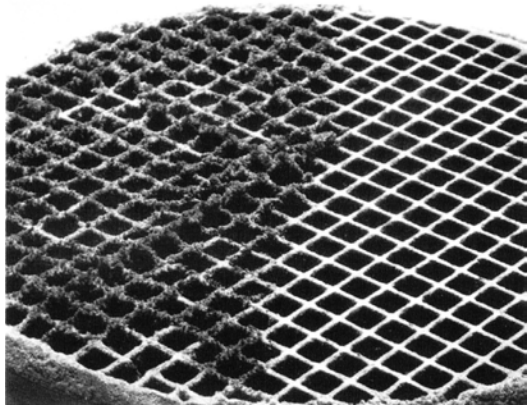
Possible Cause: Burning large quantities of trash, pressure-treated lumber, or painted woods.
Solution: Burn quality woods available in your area. If you decide the catalyst has been deactivated, replace combustor with a genuine Blaze King combustor (failure to do so will void your warranty).



Severe Peeling

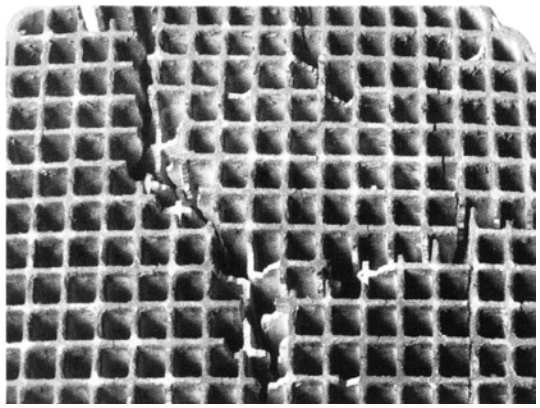
PROBLEM - CATALYST MASKING
(The catalyst is coated with a layer of fly-as or soot which prevents catalytic activity)

Possible Cause: Accumulation of fly-as
Solution: Brush cooled combustor with a soft-bristled brush or vacuum lightly at least once per burning season.



PROBLEM - THERMAL CRACKING

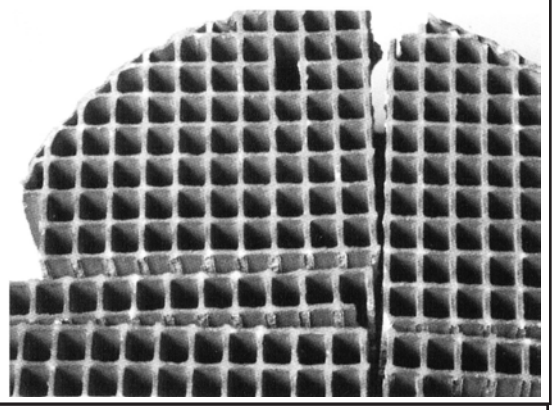
Possible Cause: Normal operation, as long as the combustor remains intact.
Solution: If cracking causes large pieces to fall out, replace the combustor.



PROBLEM - MECHANICAL CRACKING

Possible Cause: Mishandling, abuse, or operating without a properly gasket sealed combustor.
Solution: Handle with care

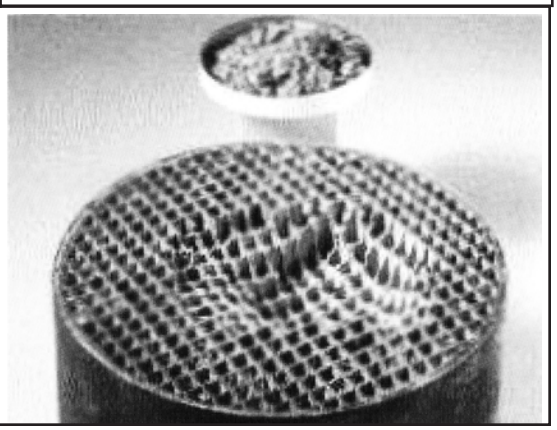
Possible Cause: Distortion of holding collar.
Solution: Combustor should be held firmly in its can. It should slide easily into and out of the holding collar of the stove. If severe cracking has resulted in loss of large chunks of combustor, replace combustor. Also replace any warped stove parts.



PROBLEM - CRUMBLING

Possible Cause: Air leaks
Solution: Inspect door gasket. (see ***MAINTENANCE***)

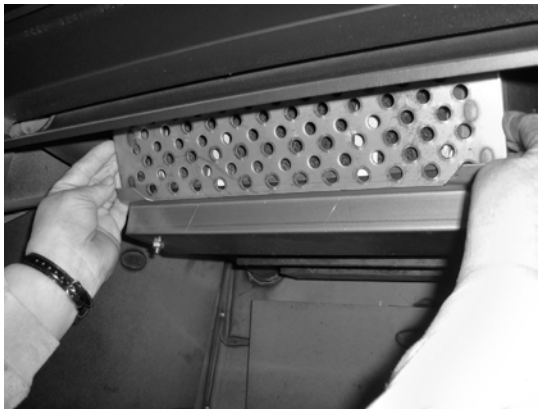
Possible Cause: High draft
Solution: Maintain draft to manufactured specifications



CATALYTIC COMBUSTOR, REPLACEMENT

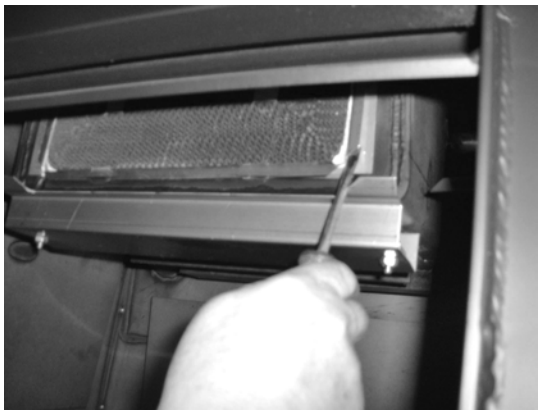
BLAZE KING RECOMMENDS YOUR DEALER PERFORM THIS TASK

The catalytic thermometer on top of the stove should read in the active zone after the stove has been in operation for several hours. If the thermometer's indicator needle does not stay in the active zone, even with a hot fire, over a 7-10 day period of regular use, the combustor may need replacement or cleaning (see ***CATALYST MONITORING***). If the combustor needs replacing then discontinue use of the appliance until the combustor is replaced. If the combustor must be examined or replaced contact your Blaze King dealer.

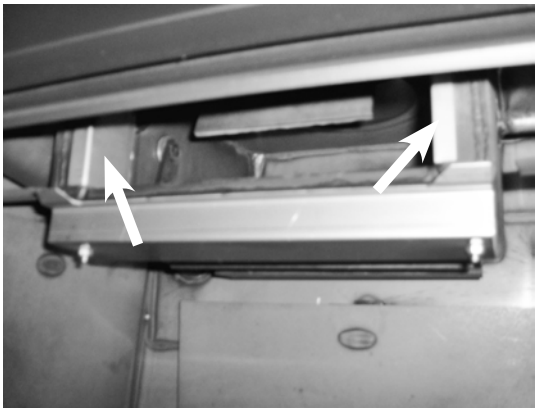


1. The removal of a Blaze King Catalytic combustor requires a small flat blade screwdriver or pocket knife. The stove fire must be out for at least 12 hours prior to the removal process. A combustor can reach 1400°F and hold high temperatures for several hours even after the fire is out. After waiting 12 hours, first remove the flame shield by simply lifting the shield off the t tabs at either side. Pay particular attention to orientation as there is a top and bottom edge to the flame shield

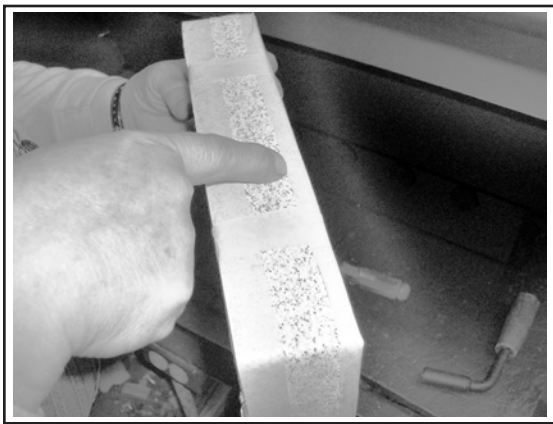
2. Once you remove the flame shield, you'll find the combust . The honeycomb combustor can be made of different materials such as cordierite, mulite or even stainless steel. They are all the same with regard to removal and caution should be taken so as to not drop or damage the combustor. If your combustor has never been cleaned according the manufacturers directions, you may wish to clean the combustor before replacing it with a new combustor. (see ***CATALYTIC COMBUSTOR CLEANING***)



3. The combustor has a metal tab across the bottom and on each side of the combustor. Using a flat blade screwdriver or pocket knife blade, slide the blade behind the metal tab and the heavy steel dome of the stove. The dome is the housing that surrounds the combustor. Apply slight pressure until the combustor begins to move forward, about 1/4". Repeat the process on the opposite end tab. By working back and forth the combustor will work free of the dome housing. It is normal for the gasket surrounding the metal band to fall apart during this process. New combustors are shipped with a new gasket.



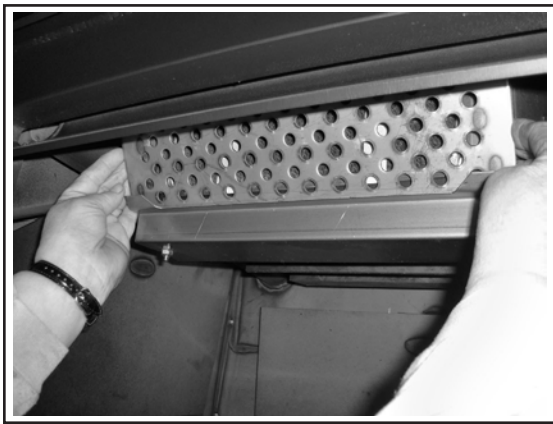
4. Now that the combustor has been removed you'll be able to see one stainless bypass retainer on each side. These can remain in place and do not need to be removed. These clips are not fixed in position and can fall into the firebox. Make sure they are in position before replacing the combustor. Using the same screwdriver or pocket knife, scrape any old gasket from the surface areas of the dome. The dome is the housing that surrounds the combustor. If you clean your existing combustor, you'll need to order replacement combustor gasket. It is always a good idea to have a spare combustor gasket on hand prior to performing any maintenance. If you purchase a new combustor a new gasket will already be applied to the combustor.



5. This new combustor already has the gasket installed. Note the 1" wide masking tape. This tape will help to keep the leading edge of the gasket from snagging during installation. If you've cleaned your combustor, wrap the combustor gasket as you see here and use the 1" masking tape around the perimeter front and rear. During the first fire the masking tape will burn off and t combustor gasket will swell providing a tight seal. It is this tight seal that improves efficiency and performance. You should never burn your stove without a combustor gasket installed.

6. Since the combustor is only 2" deep, there is ample room to lift the new combustor into place. **REMEMBER TO HAVE THE TAB ACROSS THE BOTTOM EDGE OF THE COMBUSTOR AS IT IS INSTALLED**. Slowly push the combustor in at the top apply even pressure to the left and right corners. This will allow for a better view of the bottom edge for the final fitting. **DO NOT FORCE THE COMBUSTOR INTO THE DOME. TAKE YOUR TIME AND WORK IT INTO PLACE SLOWLY.**

7. Once the combustor is installed completely so that all three tabs at touching the face of the dome, replace the flame shield. Note the flame shield sides are shaped like a triangle. The point of the triangle should face down when installed correctly. Never operate your stove without the flame shield in place. The flame shield will protect the face of the combustor against damages from wood when loading and other possible damages that can occur during the cleaning process.



8. The flame shield will rest on the two tabs located on the dome guard and lean slightly forward. Now that your combustor has been installed you can relight your stove. You will continue to receive excellent efficiency and clean burning for years to come. A few reminders, never burn anything other than dry, seasoned cordwood. Burning anything else may contaminate or ruin your new combustor. Also remember to keep your front loading door gasket seal properly adjusted. (see ***LOADING DOOR TENSION ADJUSTMENT***). Doing so will improve burn times and extend combustor life span.

The combustor supplied with this heater is either a 115-0556 or 115-0336-A-M metal combustor. Consult the catalytic combustor warranty also supplied with this wood heater. Warranty claims should be addressed to:

in Canada	in USA
Blaze King Industries / Valley Comfort Systems Warranty Department, 1290 Commercial Way Penticton, BC Canada V2A 3H5, Ph: 250-493-7444	Blaze King Industries Warranty Department, 146A Street Walla Walla, Washington 99362, Ph: 509-522-2730

RUN-AWAY OR CHIMNEY FIRE

⚠WARNING

A CHIMNEY FIRE CAN PERMANENTLY DAMAGE YOUR CHIMNEY SYSTEM. THIS DAMAGE CAN ONLY BE REPAIRED BY REPLACING THE DAMAGED COMPONENT PARTS. CHIMNEY FIRE DAMAGE IS NOT COVERED BY THE LIMITED WARRANTY.

CAUSES:

1. Using incorrect fuel, or small fuel pieces which would normally be used as kindling.
2. Leaving the door ajar too long and creating extreme temperatures as the air rushes in the open door.
3. Improperly installed or worn gaskets.
4. Creosote build up in the chimney.

SOLUTIONS:

1. Do not burn treated or processed wood, coal, charcoal, colored paper or cardboard.
2. Be careful not to over fire the appliance by leaving the door open too long after the initial start-up
3. Replace worn, dried out (inflexible) gaskets
4. Have your chimney cleaned regularly.

WHAT TO DO IF A RUN-AWAY OR CHIMNEY FIRE STARTS:

1. Close the draft fully (lowest position) by shutting off thermostat, and make sure firebox is closed tight .
2. Call the local fire department
3. Examine the chimney, attic and roof of the house, to see if any part has become hot enough to catch fire. If necessary spray with a fire extinguisher or water from a garden hos
4. Do not operate the appliance again until you are certain the chimney has not been damaged.

CREOSOTE FORMATION AND REMOVAL

When wood is burned slowly, it produces tar and other organic vapors which combine with expelled moisture to form creosote. These vapors condense in the relatively cooler chimney flue of a slow burning fire and whe ignited, make an extremely hot fire. Check your chimney for creosote and soot regularl , until a safe frequency for cleaning is established. The chimney connector and chimney should be inspected regularly during the heating season to determine if a creosote build up has occurred. Be aware that the hotter the fire, the less creosote is deposited.

If accumulation is excessive, clean the chimney. You may want to call a professional chimney sweep to clean it. Both the chimney and the appliance have to be cleaned at least once a year or as often as necessary.

Have a clearly understood plan to handle a chimney fire

CHIMNEY MAINTENANCE

The most efficient method to sweep the chimney is using a hard brush. Brush downwards so soot an creosote residues will come off the inner surface and fall to the bottom of the chimney where they can be removed easily.

The chimney must be checked regularly and if creosote has accumulated, it must be removed without delay. Cleaning on a regular basis should be sufficient during the coldest months. **ENSURE THE BYPASS DOOR IS OPEN PRIOR TO CLEANING THE CHIMNEY SO THE SOOT AND CREOSOTE FALLS INTO THE FIREBOX.**

Chimney / Flue Inspection:

1. The chimney should be inspected regularly during the heating season.
2. If possible, the chimney should be dismantled and cleaned.
3. The chimney should be inspected for possible damage.
4. If it is in good condition, put the chimney back in place; otherwise, it must be replaced.

FIRE EXTINGUISHERS AND SMOKE DETECTORS

All homes with a solid fuel burning appliance should have at least one fire extinguisher in a central location, known to all, and at least one smoke detector in the room containing the appliance. If it sounds an alarm, correct the cause but do not de-activate or relocate the smoke detector.

ASH REMOVAL

This appliance is required to be cleaned frequently because soot, creosote and ash may accumulate. Wait until the appliance is fully cooled off before the removal of ashes. **ALWAYS REMOVE THE ASH BUCKET IMMEDIATELY AFTER FILLING**. Ashes should be removed any time they come within one inch of the door opening. It is not necessary or advisable to completely remove all of the ashes when cleaning this appliance. Wood burns best in a bed of ashes 1/2” thick. Ashes should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a noncombustible floor or on the ground (outside), well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled. Other waste shall not be placed in this container.

⚠WARNING

NEVER STORE HOT ASHES IN A GARAGE OR BASEMENT. HOT ASHES WILL GENERATE CARBON MONOXIDE AND / OR FLAMMABLE GASES. THESE GASES MAY CAUSE SUFFOCATION AND POSSIBLE DEATH.

LOADING DOOR GASKET INSPECTION

Inspect the door gasket for physical deterioration, missing sections or obvious leakage. The appliance front should make a groove in the gasket material - one side of the groove (toward the inside) will often be dark or black, and the other side (toward the outside) should be light or white. Dark smudges on the outside of the groove may indicate an air leak. If the groove is very shallow or missing, or if there is a heavy ash or creosote deposit along the bottom edge of the gasket, it may need to be replaced. Frayed or broken gasket material, or a gasket that is hard and unyielding, will also indicate need for replacement. Any time a piece of gasket is missing or is broken anywhere, the entire gasket must be replaced.

To check the gasket further, wait until the appliance is cooled and insert a piece of paper (a dollar bill will work) into the door opening and close and latch the door. Obvious resistance should be felt when pulling the paper out Repeat this check several times around the perimeter of the door.

BYPASS DOOR GASKET INSPECTION

If you do not hear a positive click when closing your bypass door first try adjusting the tension, see number 9 below. If the seal is not tight after making the adjustment, the gasket may need to be replaced.

LOADING DOOR GASKET REPLACEMENT

BLAZE KING RECOMMENDS YOUR DEALER PERFORM THIS TASK

1. If the door gasket is to be replaced, be sure you have Blaze King 7/8” fiber glass gasket ready to re install, as well as high temperature adhesive. See your Blaze King dealer.
2. Be sure the fire is out and the stove has cooled down. The door should be removed by lifting up and out, off of the hinge pins. Then lay the door flat
3. With a pair of pliers, pull the old door gasket out of the channel and dispose of it.
4. Thoroughly clean out the channel so the new silicone adhesive will adhere and the gasket will fit smoothly.
5. Dry fit the new gasket first to ensure proper fit. Do not stretch or cut the gasket. Distribute the gask evenly around the frame.
6. Run a small bead of a high temperature silicone adhesive along the center of the channel. **DO NOT USE HOUSEHOLD SILICONE CAULKING**. High temperature silicone may be obtained from wood stove dealer.
7. Start the new gasket in the lower right corner. Do not stretch or cut the gasket. Distribute the gasket evenly around the frame.
8. Allow the adhesive to dry before closing the loading door. The loading door tension may need to be adjusted. (see ***LOADING DOOR TENSION ADJUSTMENT***)
9. Check the fit of the door gasket. Insert a narrow strip of paper into the door opening and close and latch the door. Obvious resistance should be felt when pulling the paper out. Repeat this check several times around the perimeter of the door. If no resistance is felt, adjust door latch catch. (see ***LOADING DOOR TENSION ADJUSTMENT***)
10. A tight sealing door extends the burn times & protects the combustor.

BYPASS DOOR GASKET REPLACEMENT

BLAZE KING RECOMMENDS YOUR DEALER PERFORM THIS TASK

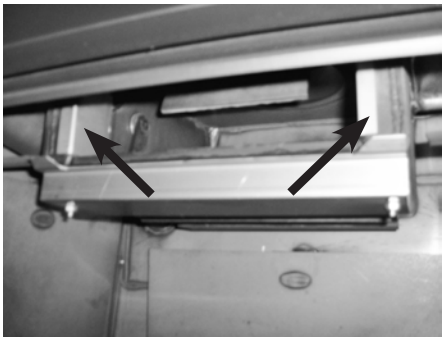
1. Will require THERMOSEAL® 1000SF high-temperature resistant cement and Blaze King 5/8" dense fiber glass gasket. See your Blaze King dealer. You will also require masking tape and combustor gasket as disassembly of the combustor will result in a damaged combustor gasket.
2. Be sure the fire is out and the stove has cooled down.
3. You will need to remove the liner from the collar of the stove, and have the ability to see straight down into the stove box through the collar.
4. Please follow steps in ***CATALYTIC COMBUSTOR, REPLACEMENT*** on how to remove your combustor.
5. After removing the combustor you will notice stainless bypass retainers on the left and right sides of the combustor opening. These tabs prevent the bypass door from popping out of its hinge holding pins during operation. Remove the stainless bypass retainers by pulling inwards. This will allow the bypass door to pop out of its hinge holding pins.
6. To remove the bypass door, move the bypass rod out of the way using the bypass handle on the side of the stove. Looking down through the collar, lift one end of the bypass door for clearance to turn inside the top assembly. Once the bypass plate is in this position, remove the plate through the combustor opening.

BYPASS DOOR REMOVAL THROUGH COMBUSTOR OPENING

7. Remove the old gasket and apply the THERMOSEAL® 1000SF high-temperature resistant cement along the door opening edge.
8. Place the gasket along the cement, and tap it in to seat it securely in the channel.
9. Replace bypass retainers.
10. Reverse method of removing bypass door to put it back in place.
11. Prior to reconnecting the liner, you will need to adjust the bypass ramp bolt. You must first loosen the retaining nut located under the head of the adjustment bolt. Then using a 7/16" box wrench, tighten the bolt until the bypass handle, when closed, has a slight cam-over feel. Do not over tighten.
12. Secure bolt adjustment by tightening the 7/16" nut against the ramp as seen in the photo to the left. Now work the bypass handle several times to make certain the bypass operation is smooth and working properly. When you are satisfied with the operation of the bypass, please lower the venting. Important: Apply high temp anti-seize lubricant to the under side of the bypass ramp where the rod contacts.
13. Please follow steps 5-8 on pages 30 & 31 to return the combustor into place. Please note that if the gasket of the combustor is damaged, it will have to be replaced.

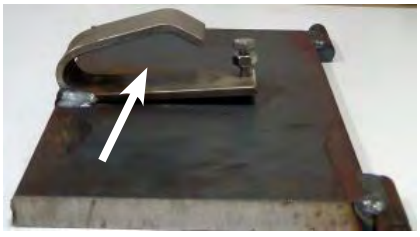
VIEW OF BYPASS DOOR AND CRANK THOUGH COLLAR

BYPASS RETAINERS



COMBUSTOR OPENING

BYPASS DOOR OPENING



APPLY LUBE TO THE UNDER SIDE OF THE BYPASS RAMP

DOOR GLASS GASKET INSPECTION

When the appliance is cold, hold the glass by placing the palm of each hand on either side of the glass. Press firmly and try to move the glass. If the glass moves the door glass retainers may need to be tightened or the door glass gasket may need to be replaced.

1. Inspect the door glass gasket. If the gasket is frayed or missing sections replace the gasket.
2. Inspect the glass retainers and ensure the screws holding the retainers in place are tight. Hand tighten plus 1/4 turn. Do not over tighten.

DOOR GLASS GASKET REPLACEMENT

BLAZE KING RECOMMENDS YOUR DEALER PERFORM THIS TASK

1. You will require Blaze King glass gasket and Blaze King door gasket. Please see your Blaze King dealer.
2. Remove the old glass gasket.
3. Starting at the corner opposite of the "Blaze King" logo, carefully wrap the gasket around the edges, pressing firmly onto the sides of the glass with the gasket centered on the edge. Finish the wrapping with a 1/2" overlap. Ensure the thickness of the gasket remains consistent and uniform.
4. Install glass with the "Blaze King" logo to the lower left corner of the door. Install the glass retainers with original fasteners. Ensure the glass is parallel to the frame and tighten the fasteners evenly.
5. Follow steps on "**LOADING DOOR GASKET REPLACEMENT"**.

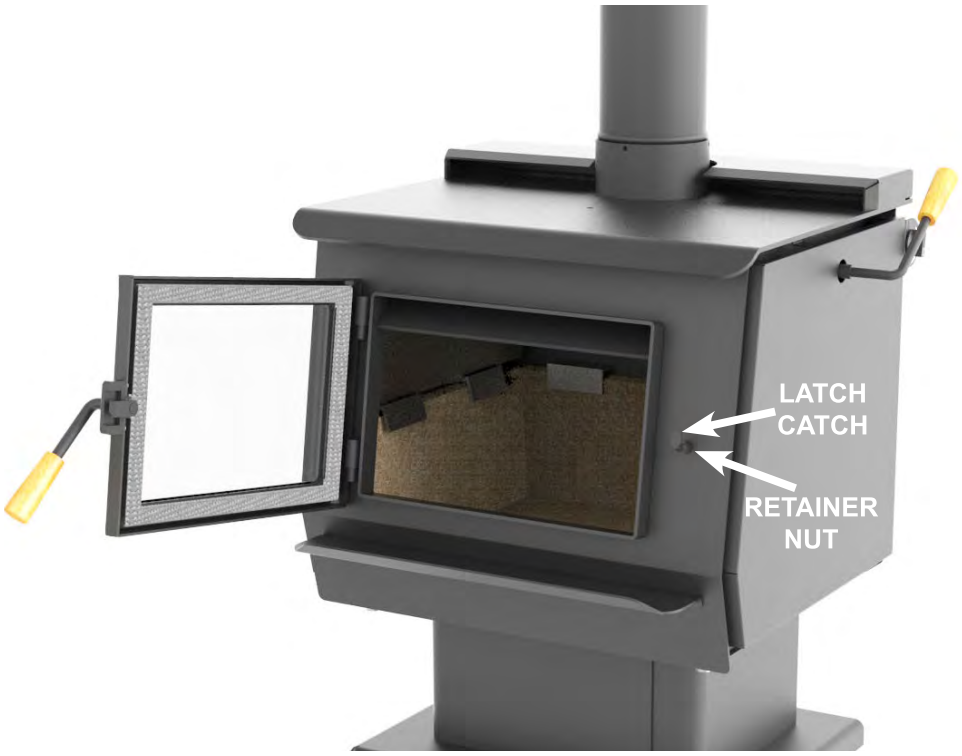
DOOR GLASS, CLEANING

The best way to keep the glass clean is to leave the appliance on high burn for a period of time after each reloading The moisture which is driven from a new load of wood contributes much of the creosote on the inside of the glass. Removing that moisture at the beginning of the burn cycle helps to keep the glass clean. Leaving the thermostat on a higher setting for 30 minutes to an hour before turning to low for an overnight burn will also help. Heavier deposits may require hand cleaning. Manual glass cleaning should be done when the appliance and glass are cool. **DO NOT CLEAN THE GLASS WHILE IT IS HOT**. **WARNING: Do not use abrasive cleaners to clean the glass**. Use a soft cloth. After using any cleaner, thoroughly rinse the glass with water to remove any deposits left by the cleaner. Failure to remove all traces of glass cleaner will result in the glass cleaner residue baking on. This residue may be very difficult to remov

LOADING DOOR TENSION ADJUSTMENT

To tighten the seal, use a 9/16" wrench to loosen retainer nut on the outside and tighten nut on inside firebox to move latch catch in (see figure beside). Secure retainer nut and (repeat) paper test. (see ***LOADING DOOR GASKET INSPECTION***)

Use penetrating oil if necessary to make turning easier.
DO NOT FORCE !!



⚠WARNING

DO NOT OPERATE THIS WOOD STOVE IF THE DOOR GASKET IS MISSING OR DAMAGED DANGEROUS OVER FIRING CAN OCCUR WHICH CAN DAMAGE THE APPLIANCE OR IGNITE CREOSOTE IN THE CHIMNEY, POSSIBLY CAUSING A HOUSE FIRE. IF ANY PART OF THE WOODSTOVE OR FLUE SYSTEM IS GLOWING THE STOVE IS BEING OVER FIRED.

OPTIONAL FAN ASSEMBLY

Routine maintenance of the OPTIONAL Fan Assembly on the back of the stove is not required. However, should it become necessary to replace an individual fan or rheostat, contact your local dealer.

CATALYTIC THERMOMETER

The combustor thermometer tells you what was happening 4-8 minutes ago, and remember, it is only an indication of the temperatures of the gasses after they pass through the combustor. The thermometer probe, the part that fits into the stove, must be cleaned at least once a yea . Lift it from the stove (be careful, it may be hot) and wipe or scrape it clean. At room temperature, away from the stove, the indicator should point near the bottom of the “Inactive” zone. If, after several years use, you find that the needle no longer points to the bottom of the “Inactive” zone when the thermometer has been at room temperature for 10 minutes or longer, it may need adjustment. Holding the probe with a pair of pliers, loosen the bolt on the top of the dial. Turn the dial to align the pointer with the bottom of the “Inactive” zone, then retighten the bolt.

NOTE: IF YOUR BLAZE KING IS EQUIPPED WITH FANS, TURN OFF FANS AND WAIT 10 MINUTES PRIOR TO READING CATALYTIC THERMOMETER INDICATOR. AIR MOVEMENT ACROSS THE TOP OF THE STOVE MAY PROVIDE FALSE READING.

THERMOSTAT

This wood heater thermostat 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. If the thermostat malfunctions contact your dealer for replacement by a qualified installe .

Your Blaze King is designed to allow a wide selection of heat output levels. If you begin to lose control of the amount of heat the stove is emitting, determine the cause early so that major problems may be avoided.
The six major needs of a well-controlled fire are

1. Knowledgeable operator.
2. Adequate air supply.
3. Firewood of good quality and proper size.
4. Catalytic combustor in good condition.
5. Clean chimney, properly sized and installed.
6. Door gasket tight and firm

Considering all of the above, number one is the most important for safe and efficient operation of any woodstove. Pleas study the operation instructions carefully. Consult your BLAZE KING dealer or call the Customer Service Department at Blaze King in the U.S.A. at 509-522-2730 or in Canada at 250-493-7444 if you have any questions not answered in this manual.

All of the six above mentioned needs are interrelated. A deficiency in any one will affect all of the others. If you encounte a problem, determine the source of the problem and then follow-up by checking the other needs as possible contributing factors.

PROBLEM: Chimney Fire	
CAUSE Act immediately regardless of cause	**SOLUTION** Turn the thermostat to lowest setting, check loading door to be sure it is tightly closed. **Call Fire Department.**
After the fire is out, have your chimney and flue connector inspected by a certified chimney sweep. A damaged masonry chimney should be repaired or rebuilt. A prefabricated chimney (factory built) that is damaged should be replaced. Any damage to the flue connector should be corrected before the system is used again. Possible causes of a chimney fire, and remedies for those causes, can be found further in this section: “Excessive Creosote Formation”, and “Spots of Creosote Accumulation in Chimney or Flue Connector”.	

PROBLEM: Not enough heat.	
CAUSE Green or wet wood. Not enough fuel in stove.	**SOLUTION** Use seasoned wood. Don’t be afraid to FULLY load the stove. A FULL load of wood won’t burn any hotter than the thermostat is set.
Obstruction in chimney or cap screen. Combustor plugged or coated.	Remove obstruction. See “COMBUSTOR, TESTING” See “COMBUSTOR, CLEANING”
Combustor not functioning.	See “COMBUSTOR, TESTING”. If needed, replace combustor, See”“COMBUSTOR, REPLACING”.
Thermostat set too low.	Raise thermostat setting.
Thermostat not operating properly.	Consult your Blaze King dealer.
Poor draft caused by an oversize flu	Measure draft with Manometer. See “CHIMNEY DRAFTS” Consult your Blaze King dealer or a chimney sweep.
Strong, gusting winds causing downdraft in chimney	Install wind-resistant chimney cap. Directional caps may not stay freely rotating. If you have a directional cap, check it frequently.
Tightly sealed house, inadequate air supply.	Slightly open a window, near the stove or install an outside air kit.
Reloading too much wood on top of too few coals.	Allow a larger bed of coals to build up.

PROBLEM: Too much heat.	
CAUSE	**SOLUTION**
By-Pass door left open.	Close the by-pass door.
Thermostat set too high.	Lower thermostat setting.
Loading door gasket leaking, admitting excess air into firebox	Replace door gasket and/or adjust door. See “GASKET INSPECTION”
Excessive draft in the chimney.	Measure draft with a Manometer. See “DRAFTS”. Consult your Blaze King dealer or a chimney sweep. Install a cap.
Thermostat not operating properly.	Consult your Blaze King dealer.
Wood is too small.	Use larger pieces.

PROBLEM: One or both fans will not run, or there is no adjustment for fan speed.	
CAUSE	**SOLUTION**
Fans mounted improperly.	Check that fan blade’s not touch edges of hole.
Fan speed control.	Consult your Blaze King dealer for replacement.

PROBLEM: Fans minimum speed too fast or maximum speed too slow.	
CAUSE	**SOLUTION**
Fan speed control out of adjustment.	Consult your Blaze King Dealer.

PROBLEM: Excessive creosote formation in chimney and chimney Connector.	
CAUSE	**SOLUTION**
By-pass door left open.	Close by-pass door.
By-pass door not sealing tightly.	Inspect by-pass door and seal for warping. Ash or creosote buildup may occur on door or seat. With stove cold scrape and vacuum area around by-pass. Be sure all mating steel surfaces are clean and smooth.
Improper operation.	Check thermostat setting and operating procedures. See “THERMOSTAT & OPTIMAL THERMOSTAT SETTING”
Wood too green or wet.	Use seasoned wood. Use a moisture meter to confirm
Catalytic combustor not operating properly.	Inspect the combustor. See “CATALYTIC COMBUSTOR, TESTING”
Poor draft caused by an oversize or short flue, etc	Measure draft with Manometer. See “DRAFTS”. Consult your Blaze King dealer or a chimney sweep.
Chimney too cold or poorly insulated.	Upgrade chimney system. Consult your Blaze King dealer or a chimney sweep.

PROBLEM: Catalytic combustor thermometer (on top of stove) does not go into "Active" zone, or does not stay there for long. (Fans must be in “off” position for 10 minutes prior to checking	
CAUSE	**SOLUTION**
Improper operation.	Check thermostat setting and operating procedures. See “THERMOSTAT & OPTIMAL THERMOSTAT SETTING”
Obstruction in chimney or cap.	Clean chimney, remove obstructions.
Faulty combustor thermometer.	Replace thermometer and Recheck combustor operating Temperature.
Wood too green or wet.	Use seasoned wood.

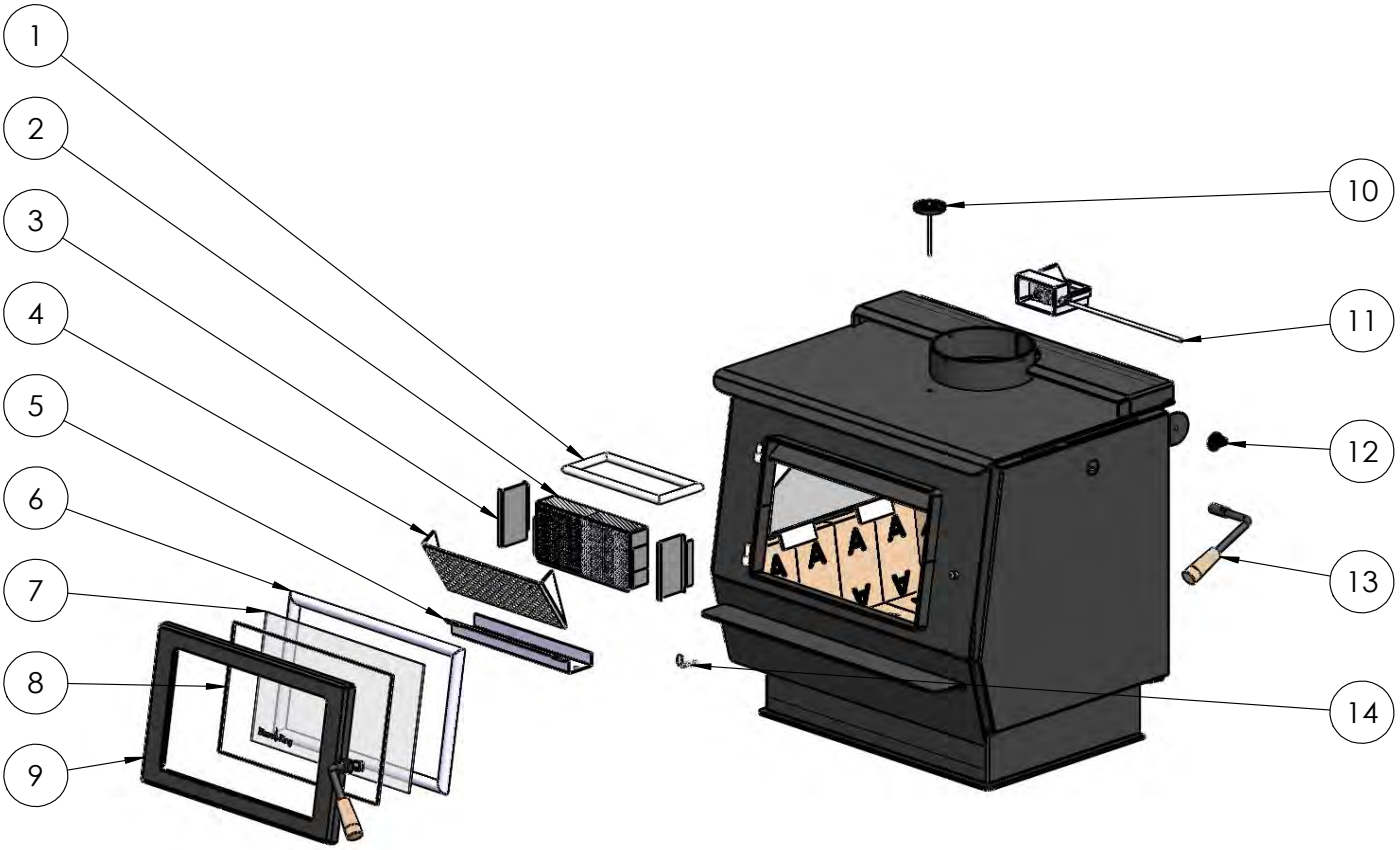
Combustor plugged or coated.	Clean combustor. See “CATALYTIC COMBUSTOR TESTING”
Combustor not functioning.	Check and test combustor. If needed replace combustor. See “CATALYTIC COMBUSTOR, REPLACING”
Thermostat not operating properly.	Consult your blaze King Dealer.
By-pass door leaking or not closing completely.	Inspect and clean area around by-pass doors. Adjust or replace gasket if necessary. Consult your Blaze King Dealer.

PROBLEM: Spots of creosote accumulation in chimney or chimney connector.	
CAUSE Air leaks in chimney or chimney connector.	**SOLUTION** Inspect chimney and / or chimney connector. Repair or replace as necessary. Check to be sure that the chimney connector is installed correctly.
CAUTION: a leaking chimney connector is a fire hazard and demands immediate attention	
Poor draft caused by an oversize flue, single wall pipe, to many elbows, etc.	Measure draft with Manometer. See “DRAFTS”. Consult your Blaze King dealer or a chimney sweep.

PROBLEM: Door glass quickly becomes coated with creosote.	
CAUSE Low thermostat setting or lowering the thermostat setting too far, too quickly.	**SOLUTION** Turn the thermostat to the warmest setting during the first 20-30 minutes or until the fire is well established after each reloading
Poor draft caused by an oversize or short flue, etc	Measure draft with Manometer. See “DRAFTS”. Consult your Blaze King dealer or a chimney sweep.
Obstruction in chimney or cap screen.	Remove obstruction. Clean chimney and/or cap screen.
Strong, gusting winds causing downdraft in chimney.	Install wind-resistant chimney cap.
Tightly sealed house, inadequate air supply.	Open a window, slightly, near the stove.
Burning poorly seasoned wet wood, or wood with high pitch content.	Use seasoned wood with low pitch content, such as some types of pine.

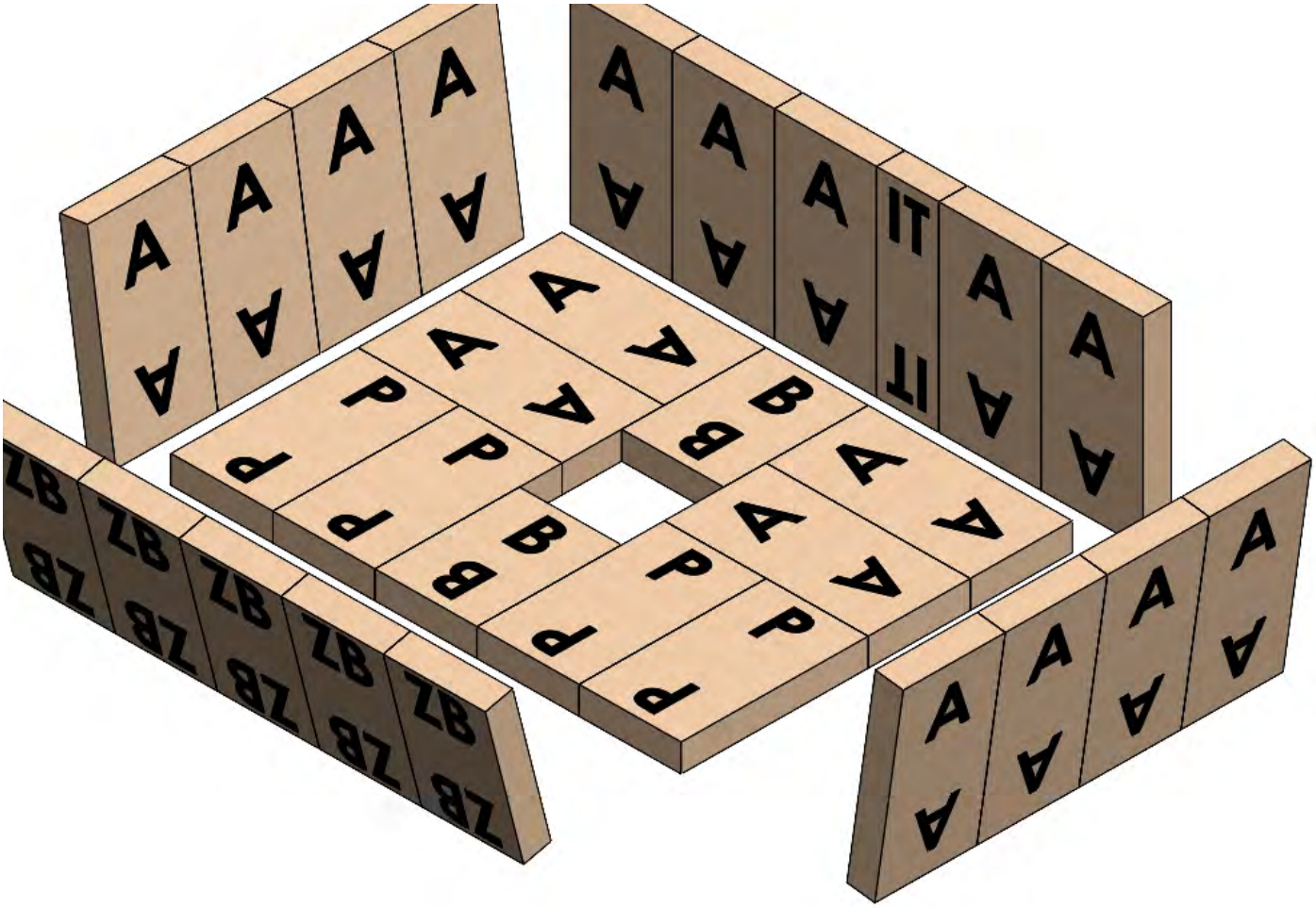
PROBLEM: The combustor temperature cannot be controlled. Turning the thermostat down often makes the combustor temperature go up.
CAUSE Turning the thermostat down, particularly in the first half of the burn cycle, causes the fire to emit more smoke, which i fuel for the combustor. The combustor temperature therefore climbs for up to several hours. This is normal, and is of no concern. As long as only the combustor temperature is elevated, there is nothing to worry about.

PROBLEM: Smoke spills from door opening when loading fuel	
CAUSE Spark arrestor screen on cap plugged.	**SOLUTION** Clean spark arrestor screen to bare metal wire.
Chimney too cold.	Make certain double wall stove pipe is used in installation.
Not enough vertical rise.	Make certain a minimum vertical rise of 36” is observed prior to elbows. Use two 45 elbows instead of 90 elbow.
Chimney not drafting.	Turn thermostat to highest setting, open bypass, leave loading door closed and wait 5-10 minutes to increase chimney or flue temperature.



No. exploded view	Part #	Description	QTY
1	155-0255-B	BYPASS GASKET 5/8” DENSE ROUND - 3 ft	1
2	S.CAT40	COMBUSTOR	1
3	S.Z4819	BYPASS RETAINER KIT	1
4	S.Z2430	FLAME SHIELD COMPLETE	1
5	S.Z4551	DOME GUARD REPLACEMENT KIT	1
6	155-0186	DOOR GASKET 7/8” ROUND - 6 ft	1
7	130-0243	GLASS CERAMIC 5MM	1
8	155-0254-AS	GLASS GASKET 1/8 x 3/4 301B W/PSA - 5 ft	1
9	S.Z4886	DOOR COMPLETE KE40 BLACK	1
10	120-0342-E	CAT THERMOMETER W/PAN 4” PROBE	1
11	S.Z3040	THERMOSTAT KE40	1
12	220-0102	KNOB BLK 1.50 X 75H (THERM)	1
13	S.Z2452.M	BYPASS HANDLE BLACK W/ MAPLE HANDLE	1
14	S.0693	LATCH CATCH	1

Brick Layout



Part #	QTY
A SIZE BRICK	17
B SIZE BRICK	2
P SIZE BRICK	4
IT SIZE BRICK	1
ZB SIZE BRICK	5

Z1714 Fan Kit Assembly

No. exploded view	Part #	Description	QTY
1	145-0136	RHEOSTAT WITH OFF (O/H/LOW)	1
2	220-0137	RHEOSTAT KNOB BLACK SILVER LINE	1
3	150-0175-C	FAN AXIAL SPIDER MOUNT	1

BLAZE KING WOOD LIMITED WARRANTY

Blaze King and Valley Comfort's respective brands extend the following warranty for wood fired appliances purchased from an authorized Blaze King / Valley Comfort dealer and installed in the United States of America or Canada. Warranty starts with date of purchase by the original owner (End User) except as noted for replacement parts.

Warranty Period		Components Covered	
Parts	Labor	Wood	
1 Year		X	All parts, materials and surface finishes (flaking and peeling) Subjec to Conditions, Exclusion, and Limitations listed.
2 Years		X	Fan assemblies and motors, thermal sensors, catalytic thermometer, bi-metallic thermostat assembly, door handle metal components.
5 Years	2 Years	X	Firebox & Heat Exchanger, Bypass Door Steel Components
6 Years		X	Catalyst Combustor (see Conditions, Exclusions, and Limitations)
1 Year		X	Other Replacement Parts
See Conditions, Exclusions, and Limitations			

Blaze King Wood Limited 5 Year Warranty

Blaze King is the manufacturer of the Blaze King line of heating products. At Blaze King, our commitment to the highest level of quality and customer service is the most important thing we do. Each Blaze King stove is built on a tradition of using only the finest materials and is backed by our limited warranty to the original purchase . With Blaze King, you're not just buying a stove; you're buying a company with years of unequalled performance and quality.

Limited Six (6) Year Warranty:
The CATALYTIC COMBUSTOR is under warranty by Blaze King for six (6) years from the date of original retail purchase. The purchaser shall pay the following share of the then current retail price for the combustor: The first three (3) years no charge, 4th year 60%; 5th year 70%, 6th year 80%. The Combustor must be returned to your dealer along with a completed COMBUSTOR FAILURE REPORT and original proof of purchase document.

Limited (5) Year Warranty:
Under this warranty, Blaze King covers the stove body and accessories against defects in materials and workmanship, for part repair or replacement for the first five (5) years *** to the original purchas . This Warranty covers: All Steel firebox components against defects in material and workmanship. Please see the exclusions and limitation section below as certain restrictions and exclusions apply this warranty.

Limited Two (2) Year Warranty:
Under this warranty, Blaze King covers, fan assemblies , modular thermostat and door handle steel components against defects in materials and workmanship, for part repair or replacement and limited labor for the first two (2) years to the original purchaser. Please see the exclusions and limitation section below as certain restrictions and exclusions apply to this warranty.

Limited One (1) Year Warranty:
Under this warranty, Blaze King covers all parts and materials against defects in materials and workmanship including exterior paint finishes, for part repair or replacement and limited labor for the first year to the original purchas . Please see the exclusions and limitation section below as certain restrictions and exclusions apply to this warranty.

How the Warranty Works

1. All warranties by the manufacturer are set herein and no claim shall be made against the manufacturer on any oral warranty or representation. All claims under this Limited Warranty must be made in writing by your dealer.
2. Any stove or part thereof that is repaired or replaced during the Limited Warranty period will be warranted under the terms of the Limited Warranty for a period not exceeding the remaining term of the original Limited Warranty or six (6) months, whichever is longer.
3. For any part or parts of this stove, which in our judgment show evidence of defects, Blaze King reserves the option to repair or to replace the defective part(s) through an accredited distributor or agent, provided the defective part is returned to the distributor or agent, transportation prepaid, if requested.
4. If you discover a problem that you think may be covered by the Limited Warranty, you MUST REPORT it to your Blaze King dealer WITHIN 30 DAYS from the date the problem was first detected, giving them proof of purchase and the date of purchase. The dealer will investigate the problem and work with Blaze King to determine whether the problem:
   a) Is covered by the Limited Warranty or
   b) Can be fixed in your home or does the product need to be returned to Blaze King for repai .
5. If Blaze King determines that the stove needs to be returned to Blaze King for repair, the customer has the responsibility and the expense of removing it from their home and shipping it to Blaze King. If the problem is covered by the Warranty, Blaze King will repair or replace the item at their discretion and the customer will be responsible for return shipping and re-installation in their home.
6. If the problem is not covered by the Limited Warranty, the customer will be responsible for all repair costs, as well as all storage, shipping and the cost of removing and re-installing the stove.
   If you are not satisfied with the service provided by the Blaze King deale , write to Blaze King at the address listed on the last page of the Owner's Manual. Include a copy of the original purchase invoice and a description of the problem.

Exclusions and Limitations:

1. This Warranty does not cover tarnish, discoloration or wear on the plated surfaces Painted finishes will change color after initial firing and will continue to change through the lifetime of the stove. This is normal occurrence for all high temperature coatings.
2. This Warranty does not cover gasket material or firebrick
3. Blaze King strongly recommends installation by a certified installe . Failure to comply may adversely affect coverage under the terms of this warranty. This Limited Warranty covers defects in materials and workmanship only if the product has been installed in accordance with local building and fire codes; in their absence refer to the owne 's manual. If the product is damaged or broken as a result of any alteration, wilful abuse, mishandling, accident, neglect, or misuse of the product, the Limited Warranty does not apply.
4. The stove must be operated and maintained at all times in accordance with the instructions in the Owner's Manual. If the unit shows signs of neglect or misuse, it is not covered under the terms of this Warranty policy. Performance problems due to operator error will not be covered by the Limited Warranty policy.
   Some minor expansion, contraction, or movement of certain parts and resulting noise, is normal and not a defect and, therefore, is not covered under this Limited Warranty.
5. Misuse includes over-firing. Over-firing can be identified later by warped plates and paint pigment being burnt o Over-firing this appliance can cause serious damage and will nullify the Limited arranty.
6. The Limited Warranty will cover glass thermal breakage only and will not cover misuse of the stove glass, including but not limited to:
   a) Glass that is struck, has surface contaminates or has had harsh or abrasive cleaners used on it.
   b) If the door is slammed or is closed while wood in the firebox is protruding out the stove opening thus striking the glass.
7. This warranty does not cover products made or provided by other manufacturers and used in conjunction with the operation of this stove without prior authorization from Blaze King The use of such products may nullify the Limited Warranty on this stove. If unsure as to the extent of this Limited Warranty, contact your authorized Blaze King dealer before installation.
8. Blaze King will not be responsible for inadequate performance caused by environmental conditions.
9. The Limited Warranty does not cover installation and operational related problems such as use of downdrafts or spillage caused by environmental conditions. Environmental conditions include but are not limited to nearby trees, buildings, roof tops, wind, hills, mountains, inadequate venting or ventilation, excessive offsets, negative air pressures or other influences caused by mechanical systems such as furnaces, fans, clothes dryers etc
10. The Limited Warranty does not cover damage caused by burning salt-saturated wood, corrosive driftwood, chemically treated wood or any fuel not recommended in the Owner's Manual (use cord wood only).
11. The Limited Warranty is void if:
    a) The stove has been operated in atmospheres contaminated by chlorine, fluorine or other damaging chemicals
    b) The stove is subject to submersion in water or prolonged periods of dampness or condensation.
    c) Any damage to the unit, combustion chamber or other components due to water, or weather damage which is the result of, but not limited to, improper chimney/venting installation.
    d) Salt air in coastal areas or high humidity can be corrosive to the finish; these environmental conditions can cause rusting. Damage caused by salt air or high humidity is not covered by the Limited Warranty.
12. Exclusions to the Limited Warranty include: injury, loss of use, damage, failure to function due to accident, negligence, misuse, improper installation, alteration or adjustment of the manufacturer's settings of components, lack of proper and regular maintenance, alteration, or act of God.
13. The Limited Warranty does not cover damage caused to the stove while in transit. If this occurs, do not operate the stove and contact your courier and/or dealer.
14. The Limited Warranty does not extend to or include paint, door or glass gaskets or firebricks damage caused by normal wear and tear, such as paint discoloration or chipping, worn or torn gaskets, chipped or cracked firebrick, etc
15. The Limited Warranty does not include damage to the unit caused by abuse, improper installation, or modification of the unit.
16. Damage to plated surfaces caused by fingerprints, scratches, melted items, or other external scores and residues left on the plated surfaces from the use of abrasive cleaners or polishes is not covered in this warranty.

17. Blaze King is free of liability for any damages caused by the stove, as well as inconvenience expenses and materials. The Limited Warranty does not cover incidental or consequential damages.
18. The Limited Warranty does not cover any loss or damage incurred by the use or removal of any component or apparatus to or from the Blaze King stove without the express written permission of Blaze King and bearing a Blaze King label of approval.
19. Any statement or representation of Blaze King Products and their performance contained in Blaze King advertising, packaging literature, or printed material is not part of the Limited Warranty.
20. The Limited Warranty is automatically voided if the stove's serial number has been removed or altered in any way. If the stove is used for commercial purposes, it is excluded from the Limited Warranty.
21. No dealer, distributor, or similar person has the authority to represent or warrant Blaze King Products beyond the terms contained within the Limited Warranty. Blaze King assumes no liability for such warranties or representations.
22. Blaze King will not cover the cost of the removal or re-installation of the stove, hearth, facing, mantels, venting or other components.
23. Labor to replace or repair items under this Limited Warranty will be covered per our warranty service fee reimbursement and labor rates are set per component schedule. Labor rates vary from location to location and as such total labor costs may not be covered. Please consult with your dealer or service technician for any additional charges such as travel time or additional labor charges that may apply.
24. For parts of the Blaze King woodstove or fireplace insert warranted beyond the first ye , the five year limited warranty will have the same obligations as described in this document, provided, however that the purchaser shall pay the following percentage of the then current retail cost of the repair or the replacement, according to the year after purchase in the which the defect is brought to the attention of Blaze King.*** During the 2nd year----purchaser pays 20%. 3rd year ----purchaser pays 40%. 4th year -----purchaser pays 60%. 5th year---- purchaser pays 80%.
25. If a defect or problem is determined by Blaze King to be non warrantable, Blaze King is not liable for travel costs for service work. In the event of in-home repair work, the customer will pay any in-home travel fees or service charges required by the Authorized Dealer.
26. At no time will Blaze King be liable for any consequential damages which exceed the purchase price of the unit. Blaze King has no obligation to enhance or modify any stove once manufactured (example: as a stove model evolves, field modifications or upgrades will not be performed)
27. This Limited Warranty is applicable only to the original purchaser and it is nontransferable.
28. This warranty only covers Blaze King Products that are purchased through an authorized Blaze King dealer.
29. If for any reason any section of the Limited Warranty is declared invalid, the balance of the warranty remains in effect and all other clauses shall remain in effect
30. The Limited Warranty is the only warranty supplied by Blaze King, the manufacturer of the stove. All other warranties, whether express or implied, are hereby expressly disclaimed and the purchaser's recourse is expressly limited to the Limited Warranty.
31. Blaze King and its employees or representatives will not assume any liability for damages, either directly or indirectly, caused by improper usage, operation, installation, servicing or maintenance of this stove.
32. Blaze King reserves the right to make changes without notice. Please complete and mail the warranty registration card and have the installer fill in the installation data sheet in the back of the manual for warranty and future reference
33. Blaze King is responsible for stocking parts for a maximum of seven (7) years after discontinuing the manufacture or incorporation of the item into its products. An exception to this would be if an OEM supplier is not able to supply a part.

NOTES

INSTALLER NOTES

Installer: Please complete the following information

Dealer Name & Address:_____

_____

Installer (print): _____

Installer (sign): _____

Phone #: _____

Date Installed:_____

Serial No.: _____

CORRELL'S SCALE SERVICE
INSTALLATION • SERVICE • REPAIR • RENTAL • LEASE • SALES

An R.B. Pugh Company LLC
Celebrating Over 40 Years of Sales and Service in the Columbia Basin

Certificate of Calibration

4300 RD. K N.E.
Moses Lake,
Washington 98837
Ph: (509) 765-7754
Fax: (509) 765-4941
rpugh@nctv.com

Customer: BLAZE KING
Address: 146 A.STREET
City, State Zip: WALLA WALLA, WASHINGTON 99362

Certificate ID: BK-2191906
ISO Number:
Date 6/19/2019

Indicator Mfg. Weigh-Tronix
Indicator Model WI125
Indicator Serial 073824
Test Interval 1 Year

Base Mfg. N/A
Base Model N/A
Base Serial N/A

Cal Date 6/19/2019
Due Date 6/19/2020
Procedure -

Scale ID BK-2
Scale Class III
Scale Status In Service

Scale Location LAB
Scale Range 0 - 1000 lb x 0.1 lb

EQUIPMENT CONDITIONS
[Working] Non-Working Clean Dirty Out of Level Out of Service

SHIFT TEST **Shift Test Result:** **[Pass]** Fail Adjust Not Applicable **Shift Weight:** 100.0 lb

Position
1 2
4 3

Position
1
4 2
3

All tolerances calculated in conformance with Handbook 44 Table 6.

LOAD TEST

Preliminary Load Test		
Test Wt.	**Reading**	**Error**
50.0 lb	50.0 lb	0.0 lb
100.0 lb	100.0 lb	0.0 lb
200.0 lb	200.0 lb	0.0 lb
300.0 lb	300.0 lb	0.0 lb
400.0 lb	400.0 lb	0.0 lb
500.0 lb	499.9 lb	-0.1 lb

In acceptance tolerance? **[Yes]** No N/A

Final Load Test		
Test Wt.	**Reading**	**Error**
50.0 lb	50.0 lb	0.0 lb
100.0 lb	100.0 lb	0.0 lb
200.0 lb	200.0 lb	0.0 lb
300.0 lb	300.0 lb	0.0 lb
400.0 lb	400.0 lb	0.0 lb
500.0 lb	500.0 lb	0.0 lb

In acceptance tolerance? **[Yes]** No N/A

TEST INFORMATION

Test Weight Classification: F
Traceability Certificate Number(s): I-5743 Cal Date: 10/5/2016 Recal Date: 10/5/2018
Standards Used: 50 LB 50 lb #1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Expanded Uncertainty: Available on Request or Reported on this Document
Test Location: **[Onsite]** Offsite
Overall Result: **[Pass]** Fail Adjust
Was the scale within customers required accuracy? **[Y]** N N/A
Environmental Conditions: **[Acceptable]** Unacceptable
Comments / Notes: TESTED SCALE LEFT AS SHOWN
Technician: Mike Pugh A0110
Certifying Technician: Technician Signature not found.

Scales were calibrated with certified test weights. Adjustments made to restore and/or maintain the accuracy of the scale conform to the tolerances established by the National Institute of Standards and Technology as specified in Handbook 44 Section 2.2, or Manufacturers Specifications. Best measurement of uncertainty calculated using a coverage factor of K=2. This provides confidence level of 95%. This certificate shall not be reproduced, except in full, with the written approval of the laboratory. Measurement uncertainty available on request.

CORRELL'S SCALE SERVICE
INSTALLATION • SERVICE • REPAIR • RENTAL • LEASE • SALES

An R.B. Pugh Company LLC
Celebrating Over 40 Years of Sales and Service in the Columbia Basin

Certificate of Calibration

4300 RD. K N.E.
Moses Lake,
Washington 98837
Ph: (509) 765-7754
Fax: (509) 765-4941
rpugh@nctv.com

Customer: BLAZE KING
Address: 146 A.STREET
City, State Zip: WALLA WALLA, WASHINGTON 99362

Certificate ID: BK-04191906
ISO Number:
Date 6/19/2019

Indicator Mfg. Adams
Indicator Model CFW-330A
Indicator Serial AE502030474
Test Interval 1 Year

Base Mfg. N/A
Base Model N/A
Base Serial N/A

Cal Date 6/19/2019
Due Date 6/19/2020
Procedure -

Scale ID BK-04
Scale Class III
Scale Status In Service

Scale Location Warehouse
Scale Range 0 - 330 lb x 0.02 lb

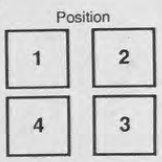
EQUIPMENT CONDITIONS

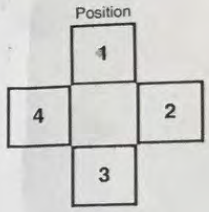
[Working] Non-Working Clean Dirty Out of Level Out of Service

SHIFT TEST **Shift Test Result:** **[Pass]** Fail Adjust Not Applicable **Shift Weight:** 25.00 lb

	As Found	
	Reading	**Error**
FRONT:	25.00 lb	0.00
CENTER:	25.00 lb	0.00
BACK:	25.00 lb	0.00

	As Left	
	Reading	**Error**
FRONT:	25.00 lb	0.00
CENTER:	25.00 lb	0.00
BACK:	25.00 lb	0.00





All tolerances calculated in conformance with Handbook 44 Table 6.

LOAD TEST

Preliminary Load Test		
Test Wt.	**Reading**	**Error**
10.00 lb	10.00 lb	0.00 lb
25.00 lb	25.00 lb	0.00 lb
50.00 lb	49.80 lb	-0.20 lb

In acceptance tolerance? Yes No **[N/A]**

Final Load Test		
Test Wt.	**Reading**	**Error**
10.00 lb	10.00 lb	0.00 lb
25.00 lb	25.00 lb	0.00 lb
50.00 lb	50.00 lb	0.00 lb

In acceptance tolerance? **[Yes]** No N/A

TEST INFORMATION

Test Weight Classification: F
Traceability Certificate Number(s): I-5538 Cal Date: 10/5/2016 Recal Date: 10/5/2018, I-5744 Cal Date: 10/5/2016 Recal Date: 10/5/2018
Standards Used: 1/16 - 2 1 lb #1; 25 LB 25 lb #1, 2
Expanded Uncertainty: Available on Request or Reported on this Document
Test Location: **[Onsite]** Offsite
Overall Result: **[Pass]** Fail Adjust
Was the scale within customers required accuracy? **[Y]** N N/A
Environmental Conditions: **[Acceptable]** Unacceptable
Comments / Notes: TESTED AND ADJUSTED SCALE LEFT AS SHOWN
Technician: Mike Pugh A0110
Certifying Technician: Technician Signature not found.

Scales were calibrated with certified test weights. Adjustments made to restore and/or maintain the accuracy of the scale conform to the tolerances established by the National Institute of Standards and Technology as specified in Handbook 44 Section 2.2, or Manufacturers Specifications. Best measurement of uncertainty calculated using a coverage factor of K=2. This provides confidence level of 95%. This certificate shall not be reproduced, except in full, with the written approval of the laboratory. Measurement uncertainty available on request.

Dry Gas Meter Calibration

Meter Manufacturer:	Apex
Model:	XC-50-DIR
Lab ID #:	129
Serial #:	1906005
Calibration Date:	7/23/2019
Calibration Expiration:	1/23/2020
Barometric Pressure:	29.99 in. Hg

Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/13/2020
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	N/A
γ Factor:	1.000
Allowable Deviation (±5%):	0.05
Actual Deviation:	0.00
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	142.099	149.680	147.972
Standard DGM Temperature (°F)	74.5	74.4	74.4
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)	5.156	5.446	5.386
DGM Temperature (°F)	92.0	92.0	92.0
DGM Pressure (in H_2O)	1.00	2.00	0.5
Time (min)	34.0	23.0	58.0
Net Volume for Standard DGM (ft^3)	5.018	5.286	5.226
Net Volume for DGM (ft^3)	5.156	5.446	5.386

Dry Gas Meter γ Factor	1.001	0.996	0.999
γ Factor Deviation From Average	1.001	0.996	0.999

Average Gas Meter γ Factor: 0.998

Calculations:

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

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is ±0.5%.

Dry Gas Meter Calibration

Meter Manufacturer:	Apex
Model:	XC-50-DIR
Lab ID #:	130
Serial #:	1906006
Calibration Date:	7/25/2019
Calibration Expiration:	1/25/2020
Barometric Pressure:	30.02 in. Hg

Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/13/2020
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	N/A
γ Factor:	1.000
Allowable Deviation (±5%):	0.05
Actual Deviation:	0.00
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	144.596	154.993	146.498
Standard DGM Temperature (°F)	72.0	72.0	72.0
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)	5.328	5.629	5.372
DGM Temperature (°F)	95.0	95.0	96.0
DGM Pressure (in H_2O)	1.04	1.99	0.6
Time (min)	35.0	25.0	54.0
Net Volume for Standard DGM (ft^3)	5.106	5.474	5.174
Net Volume for DGM (ft^3)	5.328	5.629	5.372

Dry Gas Meter γ Factor	0.995	1.007	1.003
γ Factor Deviation From Average	0.995	1.007	1.003

Average Gas Meter γ Factor: 1.002

Calculations:

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

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is ±0.5%.

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS

2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293

(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED

Calibration Services

Certificate Number 1550.01

Laboratory code: 115953

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

Material	Assumed Density	Range	Tolerance Class
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/cm^3).**

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

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

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 03/21/17

Signature David S. Thompson

Established 1974

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ACCREDITED

Calibration Services

Certificate Number: 1550.01

Laboratory code: 115953

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.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 03/21/17

Signature David S. Thompson

Established 1974

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

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/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16

Signature David S. Thompson

Established 1974

QUALITY CONTROL SERVICES

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ACCREDITED
CERTIFICATE #1550.01

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
Test Wt: 100 Tol: 0.0003
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

LINEARITY
Test Wt: 50 x 4 Tol: 0.0002
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

STANDARD DEVIATION
Test Wt: 100 Tol: 0.0001

1. 100.0001	5. 100.0002	9. 100.0001
2. 100.0001	6. 100.0001	10. 100.0001
3. 100.0001	7. 100.0001	Result
4. 100.0001	8. 100.0002	0.00004

ENVIRONMENTAL CONDITIONS
☐ Good ☑ Fair ☐ Poor
Temperature: 21.3°C

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 JC **Date:** 12/28/18 **Technician:** R.Kauble
Signature:

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation 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.

DICK MUNNS COMPANY
LIQUID & GAS FLOW CALIBRATION

ISO 17025 ACCREDITED
CL-122

CERTIFICATE OF CALIBRATION

CUSTOMER:	**PFS-TECO :** CLACKAMAS, OR	**CALIBRATION DATE:**	03/14/2019
PO NUMBER:	N/A	**CALIBRATION DUE:**	03/14/2020
INST. MANUFACTURER:	DWYER	**PROCEDURE:**	T.O.33K6-4-1769-1
INST. DESCRIPTION:	VELOMETER	**CALIBRATION FLUID:**	AIR @ 14.7 PSIA 70°F
MODEL NUMBER:	471	**RECEIVED CONDITION:**	WITHIN MFG. SPECS.
SERIAL NUMBER:	CP288559 (ID# 095)	**LEFT CONDITION:**	WITHIN MFG. SPECS.
RATED UNCERTAINTY:	SEE NOTES BELOW.	**AMBIENT CONDITIONS:**	762 mm HGA 43% RH 69°F
UNCERTAINTY GIVEN:	± .20% RD ; k=2	**CERTIFICATE FILE #:**	490265.2019

NOTES: ± 3% FS (0-500 / 0-1500) *** ± 4% F.S. (0-5000) ***± 5% F.S. (0-15000) *** ± 2 °F

NOTES CONT. : Q.MANUAL IM 1.5 REV 2017.1 DATED 7-18-2017

UUT INDICATED FT/MIN	DM.STD. ACTUAL FT/MIN	UUT INDICATED DEG. F	DM STD. ACTUAL DEG. F
64	65	0 TO 200°F	0 TO 200°F
110	112	43.4	43.5
206	210	69.0	68.9
498	509	99.4	99.2
503	505		
1049	1058		
1497	1514		
509	513		
3419	3460		
4992	5068		
5136	5235		
13928	14232		

STANDARDS USED:		
A220: 12" WIND TUNNEL 0 - 8000 FPM | CMC ± .203% RD | TRACE# 1520423238	DUE	05/23/2019
A24: HART SCIENTIFIC TEMP. STANDARD | ±.024 F | TRACE# 1520423238	DUE	03/07/2020

All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) used and the unit under test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the shown procedure number, in accordance with ISO 10012:2003, ISO 17025:2005, ANSI/NCSL-Z-540.3, and/or MIL-STD-45662A. Test methods: API2530-92 & ASME MFC-3M-1989.

Dick Munns Company • 11133 Winners Circle • Los Alamitos, CA 90720
Phone (714) 827-1215 • Fax (714) 827-0823

Date: 3/14/2019

Approved By:

Calibration Technician:

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 ± .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

PRAXAIR

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Tel: (323) 585-2154 Fax:(714) 542-6689
PGVPID: F22017

DocNumber: 000113538

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PXPKG TUALATIN OR H
10450 SW TUALATIN SHERWOOD
TUALATIN OR 97062

Praxair Order Number: 70334534
Customer P. O. Number:
Customer Reference Number:

Fill Date: 8/7/2017
Part Number: NI CD17CO8E-AS
Lot Number: 70086721902
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 1290 psig 99 cu. ft.

Certified Concentration:

Expiration Date: 8/11/2025			NIST Traceable Analytical Uncertainty:
Cylinder Number: CC700026			
4.33	%	CARBON MONOXIDE	± 0.5 %
16.89	%	CARBON DIOXIDE	± 0.3 %
16.97	%	OXYGEN	± 0.2 %
Balance		NITROGEN	

Certifcation 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:	4.32	Conc:	4.323
Z:	0	C:	4.32	R:	5	Conc:	4.323
UOM:	%			Mean Test Assay:			4.326 %

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 %

2. Component: CARBON DIOXIDE

Requested Concentration: 17 %
Certified Concentration: 16.89 %
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:	16.94	Conc:	16.887
R:	20.08	Z:	0	C:	16.95	Conc:	16.897
Z:	0	C:	16.94	R:	20.09	Conc:	16.887
UOM:	%			Mean Test Assay:			16.89 %

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 %

PRAXAIR
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DocNumber: 249902

Praxair Distribution, Inc.
5700 S. Alameda Street
Los Angeles CA 90058
Tel: 323-585-2154
Fax: 714-542-6689
PGVP ID: F22019

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PX/KG TUALATIN OR H
10450 SW TUALATIN SHERWOOD ROAD
TUALATIN OR 97062

Certificate Issuance Date: 04/18/2019
Praxair Order Number: 70935917
Part Number: NI CD10CO33E-AS

Fill Date: 04/05/2019
Lot Number: 70086909511
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

ProSpec EZ Cert

Expiration Date: / Cylinder Number:		NIST Traceable Expanded Uncertainty
	04/18/2027	
	CC167526	
10.07 %	Carbon dioxide	± 0.5 %
2.53 %	Carbon monoxide	± 0.6 %
10.50 %	Oxygen	± 0.4 %
Balance	Nitrogen	

Certification Information:

Certification Date: 04/18/2019 Term: 96 Months Expiration Date: 04/18/2027

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1.

Do Not Use this Standard if Pressure is less than 100 PSIG.

CO2 responses have been corrected for Oxygen IR Broadening effect. O2 responses have been corrected for CO2 interference.

Analytical Data:

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

1. **Component:** Carbon dioxide

Requested Concentration: 10 %
Certified Concentration: 10.07 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 04/15/2019

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

First Analysis Data:							Date 04/18/2019
Z: 0	R: 14.02	C: 10.06	Conc: 10.06
R: 14.02	Z: 0	C: 10.06	Conc: 10.06
Z: 0	C: 10.09	R: 14.04	Conc: 10.09
UOM: %			Mean Test Assay: 10.07 %

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

2. **Component:** Carbon monoxide

Requested Concentration: 2.5 %
Certified Concentration: 2.53 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 03/22/2019

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

First Analysis Data:							Date 04/18/2019
Z: 0	R: 2.48	C: 2.53	Conc: 2.53
R: 2.48	Z: 0	C: 2.53	Conc: 2.53
Z: 0	C: 2.54	R: 2.49	Conc: 2.54
UOM: %			Mean Test Assay: 2.53 %

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: 04/11/2019

Reference Standard: Type / Cylinder #: NTRM / DT0010384
Concentration / Uncertainty: 9.875 % ±0.4%
Expiration Date: 11/18/2022
Traceable to: SRM # / Sample # / Cylinder #: NTRM / 170701 / NTRM DT0010384
SRM Concentration / Uncertainty: 9.875% / ±0.040%
SRM Expiration Date: 11/18/2022

First Analysis Data:							Date 04/18/2019
Z: 0	R: 9.88	C: 10.51	Conc: 10.5
R: 9.89	Z: 0	C: 10.52	Conc: 10.51
Z: 0	C: 10.52	R: 9.89	Conc: 10.51
UOM: %			Mean Test Assay: 10.5 %

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

Analyzed By: Jose Vasquez

Certified By: Jenna Lockman

Verification of Standardization

of

Tape Measure

by

Advanced Calibration Technologies
28111 S.E. Wally Road
Boring, OR 97009
1-800-259-5058

ACCREDITED
Calibration
Cert# 1342.01

Customer:	PFS Teco, Inc	Street:	11785 Southeast Highway 212 Suite 305
City:	Clackamas State: OR	Zip:	97015 Location: In House
Machine Manufacturer:	Dewalt	Model:	16' Tape Measure
Capacity:	0.000 - 192.000 inches 0.125 Divisions	Serial #:	090
Calibration Cycle:	12 Months	Lab ID#:	#090
Previous Calibration Date:	January 2019	Calibration Procedure:	Ad-Tek SR
Equipment Used:	Gauge Blocks S/N: ADGB002	Action Recommended:	
If Other, Explain:			

Verification Data

Purpose:

This method provides instructions for checking the critical dimensions of the equipment.

Tolerance:

Equipment shall meet the dimensional tolerances specified in the applicable test method.

Procedure:

Verified using manufacturer's procedures.

Actual Dimensions (inches)	Unit Under Test As Found (inches)	Unit Under Test As Left (inches)	Difference (inches)
0.0000	0.000	0.000	0.000
0.1250	0.050	0.050	-0.075
0.2500	0.250	0.250	0.000
0.5000	0.500	0.500	0.000
0.7500	0.750	0.750	0.000
1.0000	1.000	1.000	0.000
3.0000	3.000	3.000	0.000
5.0000	5.000	5.000	0.000
7.0000	7.000	7.000	0.000
9.0000	9.000	9.000	0.000
12.0000	12.000	12.000	0.000

The overall condition of the device as found:	Within Specification
The overall condition of the device as left:	Within Specification
The measurement of uncertainty (MU) was calculated to be:	0.00060

File No: PFS-101666-0119D0120-AH-SR-090

Temperature: 72.1°F Humidity: 41.1%

The equipment used in the verification of this instrument has been calibrated and is NIST traceable.
The uncertainty of calibration was estimated at the 95% confidence level, coverage factor (k=2).

Remarks:

This certificate of verification is issued as a statement of fact that on the date of verification the above instrument had an accuracy as indicated and was calibrated to meet the requirements of the manufacturer's specifications. This certificate should not be construed or regarded as a guarantee or warranty of any kind that the instrument will retain the same percentage of accuracy as determined on the date when the verification was performed and reported. Ad-Tek, Inc. hereby expressly disclaims any and all liability for damage or loss by all parties arising or resulting from deterioration, obsolescence, malfunction, subsequent calibration performed by another agency or substandard performance of said instrument.

Service Technician: Alisa Houser Date of Service: January 16, 2019

Technical Manager: Nicole Ostrowski Date Next Due: January 2020

We sincerely appreciate your business and thank you for selecting Advanced Calibration Technologies, Inc. for servicing your equipment.
To reschedule, please call (800) 259-5058. Thank You.

J-2000

owner's manual

DELMHORST®
INSTRUMENT CO.

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