

# RCA TEST REPORT

**Intertek**

**REPORT NUMBER: 100962764PRT-001**  
**REPORT DATE: November 26, 2012**

**EVALUATION CENTER**  
Intertek Testing Services NA Inc.  
22887 NE Townsend Way  
Fairview Oregon 97024

**RENDERED TO**  
US Environmental Protection Agency  
1200 Pennsylvania Ave  
Washington, DC. 20460

**PRODUCT EVALUATED:**  
MODEL Grand View 230 SOLID FUEL ROOM HEATER

**Report of Testing Model Grand View 230 Wood Fuel Room Heater for compliance with the applicable requirements of the following criteria: EPA Method 28 "Certification and Auditing of Wood Heaters" and EPA Method 5G "Determination of Particulate Matter Emissions from Wood Heaters".**

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## **I. INTRODUCTION**

Intertek Testing Services NA (Intertek) has conducted testing for the US Environmental Protection Agency (EPA), on model Grand View 230 Solid Fuel Room Heater, in cooperation with a Random Compliance Audit conducted on Lennox Hearth Products. Tests were conducted to applicable performance requirements included in EPA Method 28 "Certification and auditing of wood heaters" and Method 5G "Determination of particulate matter emissions from wood heaters."

### **I.A PURPOSE OF TEST**

Tests were conducted to determine compliance with specification of a Random Compliance Audit ordered by the EPA. Results of this audit will be evaluated for compliance with U.S EPA requirements under 40 CFR 60 SUBPART AAA, NSPS for Residential Wood Heaters. This evaluation was conducted on November 12, 2012 through November 16, 2012.

### **I.B LABORATORY**

Tests on the Grand View 230 Solid Fuel Room Heater were conducted at Intertek testing Services Laboratory located in Portland Oregon. Laboratory elevation is 35 feet above sea level and is accredited by the U.S. EPA, Certificate Number 8. Tests were conducted by test Engineer Bruce Davis.

### **I.C DESCRIPTION OF UNIT**

Stove model Grand View 230 Solid Fuel Room Heater is constructed of carbon steel. Outer dimensions are 25.5-inches deep, 24.5-inches high, and 25-inches wide. The unit has a door located on the front with a viewing glass for loading the fuel.

(See product drawings.)

Any proprietary drawings or manufacturing methods are on file at Intertek in Portland Oregon

### **I.D REPORT ORGANIZATION**

This report includes summaries of all data necessary to determine compliance with the regulations. Raw data, calibration records, intermediate calculations, drawings, specifications and other supporting information are contained in appendices to this report.

## **II. SUMMARIZATION**

### **II.A PRETEST INFORMATION**

A sample was submitted to Intertek directly from the client. This sample was selected by an officer of the EPA. Selected test unit was received at Intertek in Portland Oregon on October 30, 2012 and was shipped via the client. Test unit was inspected upon receipt and found to be in good condition. Following manufacturer's instructions the unit was set up with out difficulty.

Following assembly, the unit was placed on the test stand and instrumented with thermocouples in specified locations. Prior to beginning emissions tests the unit was operated for a minimum of 10 hours at medium burn rate to break in the stove. The unit was found to be operating satisfactory during this break-in period conducted on November 1<sup>st</sup> and November 2<sup>nd</sup>, 2012. Fuel used for the break-in process was a combination of dimensional lumber and cordwood.

Following the pre-burn break-in process the unit was allowed to cool. The unit's chimney system and laboratory dilution tunnels were cleaned using standard wire brush chimney cleaning equipment. On November 12, 2012 the unit was set-up for testing.

### **II.B INFORMATION LOG**

#### **TEST STANDARD**

From November 12 through November 16, 2012, the unit was tested for EPA emissions.

#### **Deviation from Standard Method**

No deviations from the standards were performed, however, only the applicable sections from each standard were used during all testing.

### **II.C SUMMARY OF TEST RESULTS**

RUN #1 November 13, 2012 Air control set at full closed position, burn time was 250 minutes with a category 3 burn rate of 1.38 kg/hr. The door open for 4 minutes 30 seconds, and then closed. Combustion air control was open for 4 minutes 45 seconds, and then set to full closed by 5 minutes. Convection air fan was turned off at start of test and turned to low at 30 minutes.

RUN #2 November 14, 2012 Air control set at full closed position, burn time was 290 minutes with a category 2 burn rate of 1.15 kg/hr. The door open for 3 minutes 30 seconds, and then closed. Combustion air control was open for 4

minutes 45 seconds, and then set to full closed by 5 minutes. Convection air fan was turned off at start of test and turned to low at 30 minutes.

RUN #3 November 15, 2012 Air control set at full closed position, burn time was 270 minutes with a category 3 burn rate of 1.26 kg/hr. The door open for 75 seconds, and then closed. Combustion air control was open for 4 minutes 45 seconds, and then set to full closed by 5 minutes. Convection air fan was turned off at start of test and turned to low at 30 minutes.

RUN #4 November 15, 2012 Air control set at full open position, burn time was 140 minutes with a category 4 burn rate of 2.51 kg/hr. The door open for 75 seconds, and then closed. Combustion air control was fully open for entire test. Convection air fan was on high for entire test.

## II.D SUMMARY OF OTHER DATA

### EMISSIONS

Run Number	Test Date	Burn Rate (kg/hr)	Emission Rate (g/hr)	Adjusted Emission Rate (g/hr)
1	11/13/12	1.38	2.52	3.92
2	11/14/12	1.15	1.99	3.22
3	11/15/12	1.26	1.74	2.88
4	11/16/12	2.51	1.67	2.79

### WEIGHTED AVERAGE CALCULATION

Test No.	Burn Rate	(E) Average Emission Rate g/hr	Heat Output (Btu/hr)	Probability	(K) Weighting Factor	(KxE)
2	1.15	3.22	13,867	0.4900	0.5816	1.8728
3	1.26	2.88	15,193	0.5816	0.1886	0.5432
1	1.38	3.92	16,640	0.6786	0.3832	1.5021
4	2.51	2.79	30,266	0.9648	0.3214	0.8967
Totals:					1.4748	4.8148
Weighted average emission rate:						3.26

### TEST FACILITY CONDITIONS

Run	Room Temp. °F before	Room Temp °F after	Baro. Pres. In. Hg before	Baro. Pres. In. Hg after	R.H. % before	R.H. % after	Air Vel. Ft/min before	Air Vel. Ft/min after
1	70	73	30.03	30.01	45.1	44.9	<50	<50
2	73	71	30.11	30.09	41.5	42.3	<50	<50
3	72	70	30.04	30.04	47.6	46.5	<50	<50
4	73	72	29.76	29.76	43.5	43.7	<50	<50

### DILUTION TUNNEL FLOW RATE MEASUREMENTS AND SAMPLING DATA (5G-3)

Run No.	Burn Time (min)	Velocity (ft/sec)	Volumetric Flow Rate (dscf/min)	Total Temp. (°R)	Volume Sample		Particulate Catch (mg)	
					1	2	1	2
1	250	12.95	140.50	552	38.589	37.613	11.6	11.2
2	290	12.57	137.82	548	44.147	43.255	10.5	10.5
3	270	12.65	138.02	549	41.282	40.484	9.1	8.1
4	140	12.71	129.91	581	21.460	20.892	4.6	4.5

### DILUTION TUNNEL DUAL TRAIN PRECISION

Run No.	Sample Ratios		Total Emissions (g)		% Deviation	% Deviation of 7.5% of 7.5 grams*
	Train 1	Train 2	Train 1	Train 2		
1	910.252	933.888	10.559	10.460	0.0	0.41
2	905.312	923.975	9.506	9.702	0.01	0.73
3	902.716	920.519	8.215	7.456	0.04	3.09
4	847.483	870.544	3.898	3.917	0.00	0.15

\*= As described in Method 5G-3 section 16.2.5

### GENERAL SUMMARY OF RESULTS

Run No.	Burn Rate (kg/hr)	Change In Surface Temp (°F)	Initial Draft (in/H <sub>2</sub> O)	Run Time (min)	Average Draft (in/H <sub>2</sub> O)
1	1.38	42.0	-.02	250	-.043
2	1.15	71.4	-.03	290	-.043
3	1.26	60.4	-.03	270	-.048
4	2.51	33.0	-.06	140	-.07

### **III. PROCESS DESCRIPTION**

#### **III.A TEST SET-UP DESCRIPTON**

A standard 6" diameter single wall pipe and insulated chimney system was installed to 15' above floor level. The unit controls were set to the lowest setting during the test.

#### **III.B AIR SUPPLY SYSTEM**

Combustion air is controlled by a sliding damper operated by a lever on the left side of the appliance. Secondary air system has no user controls and works on a fixed opening. All gases exit through the 6" flue located at the top of the appliance.

### **IV. SAMPLING SYSTEMS**

#### **IV.A. SAMPLING LOCATIONS**

Particulate samples are collected from a dilution tunnel similar to example shown in figure 1. Dillution tunnel has two elbows and two mixing baffles in the system ahead of the sampling section. Sampling section is a continuous section of 6 inch diameter pipe straight over its entire length. Tunnel velocity pressure is determined by a standard Pitot tube located greater than 8 duct diameters from the beginning of the sampling section. The dry bulb thermocouple is located six inches downstream from the Pitot tube. Tunnel samplers are located at a point greater than two duct diameters from the end of this section.

Stack gas samples are collected from the steel chimney section 8 feet  $\pm$  6 inches above the scale platform. (See Figure 2.)

#### IV.A.(1) DILUTION TUNNEL

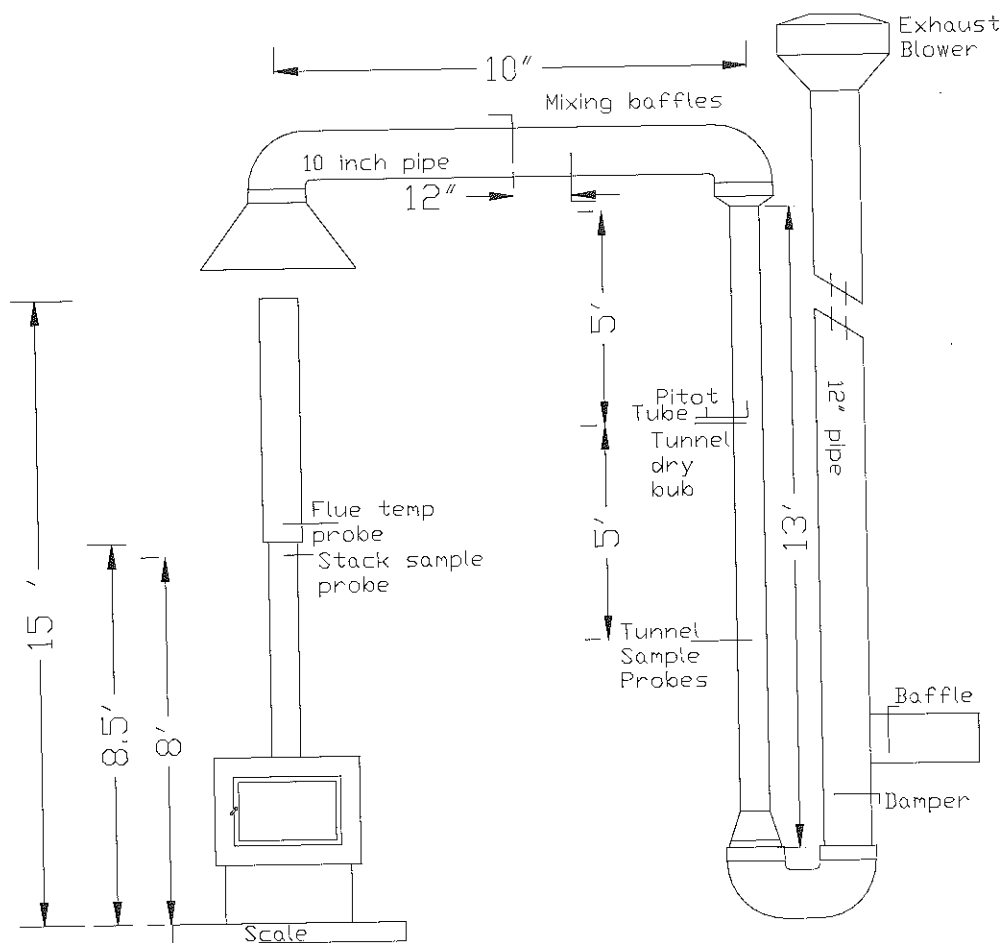
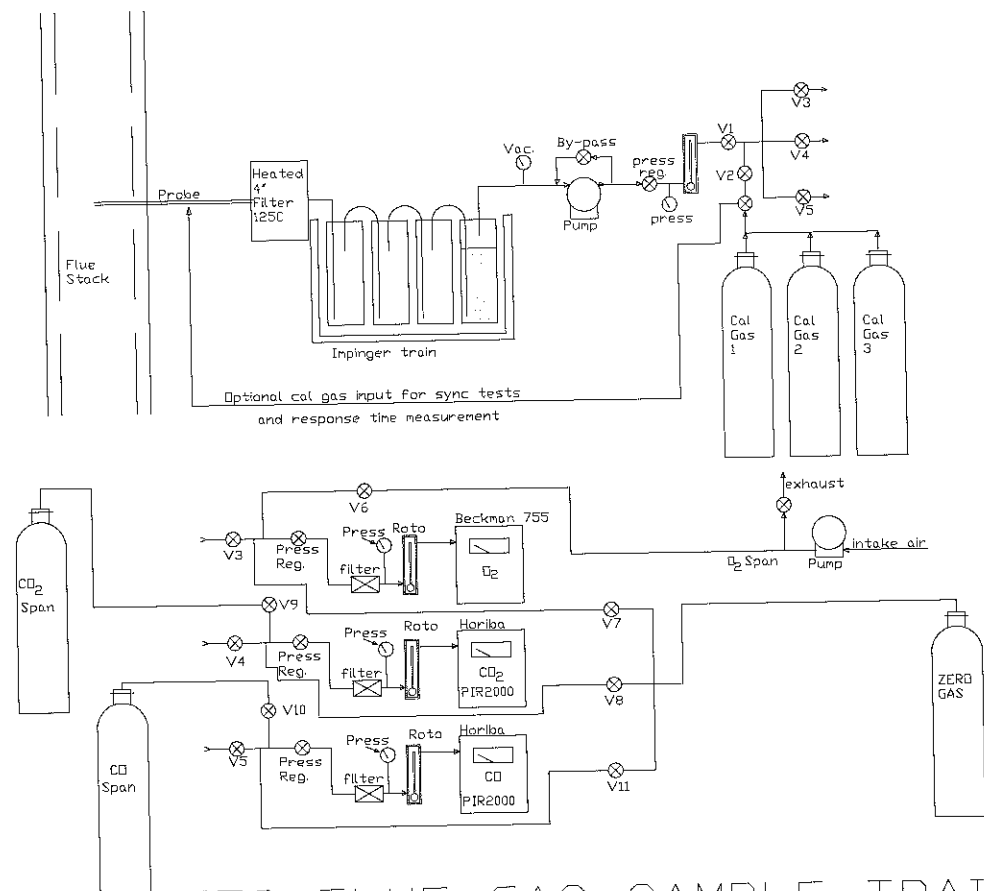


FIGURE 1

## IV.B. OPERATIONAL DRAWINGS

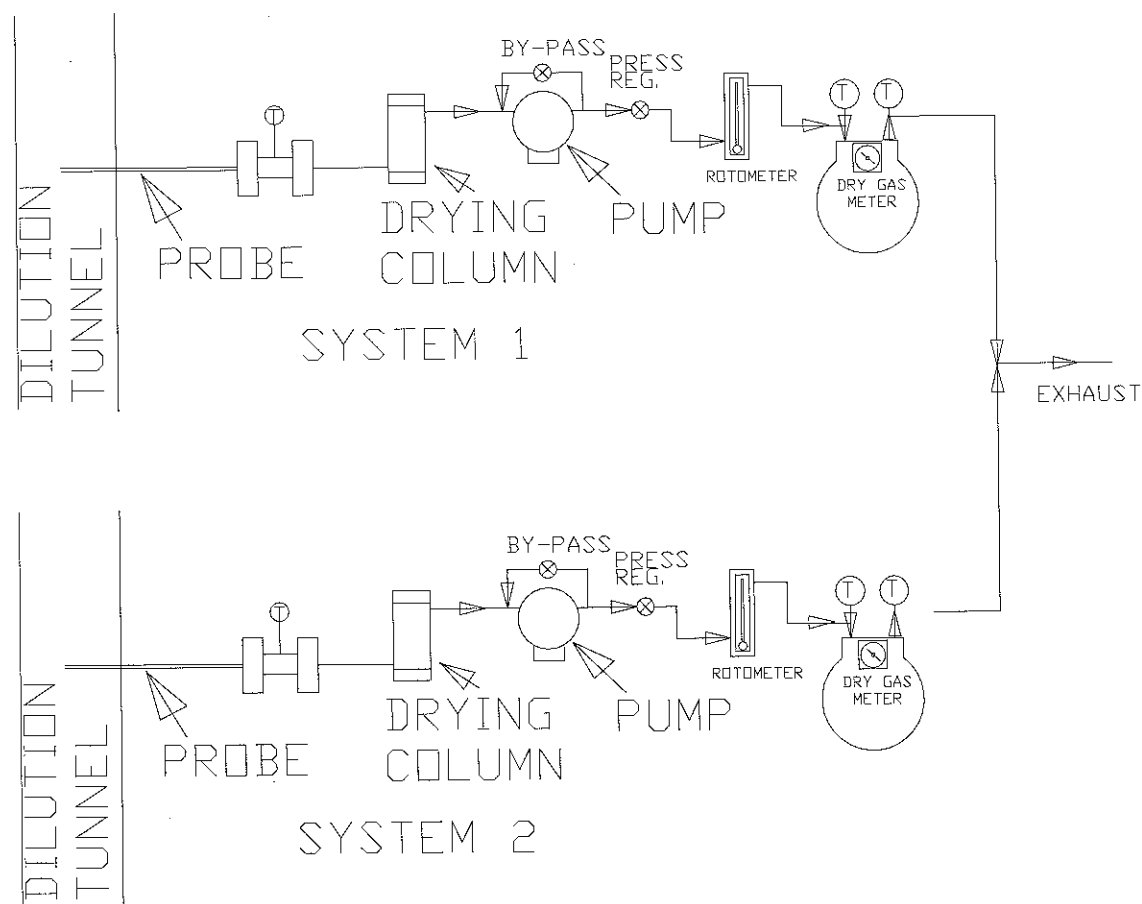
### IV.B.(1) STACK GAS SAMPLE TRAIN



ITS FLUE GAS SAMPLE TRAIN

FIGURE 2

#### IV.B.(2). DILUTION TUNNEL SAMPLE SYSTEMS



**Figure 3**

## **V. SAMPLING METHODS**

### **V.A. PARTICULATE SAMPLING**

Particulates were sampled in strict accordance with EPA Method 5G-3. This method uses two identical sampling systems with binder free, 47-mm diameter filters. The dryers used in the sample systems are filled with "Drierite" before each test series.

## **VI. QUALITY ASSURANCE**

### **VI.A. INSTRUMENT CALIBRATION**

#### **VI.A. (1). DRY GAS METERS**

At the conclusion of each test program the dry gas meters are checked against our standard dry gas meter. Three runs are made on each dry gas meter used during the test program. The average calibration factors obtained are then compared with the six-month calibration factor and, if within 5%, the six-month factor is used to calculate standard volumes. Results of this calibration are contained in Appendix D.

An integral part of the post test calibration procedure is a leak check of the pressure side by plugging the system exhaust and pressurizing the system to 10" W.C. The system is judged to be leak free if it retains the pressure for at least 10 minutes.

Standard dry gas meter is calibrated annually by an accredited calibration agency. With readings made to .001 ft<sup>3</sup>, the resolution is .1%, giving accuracy higher than the  $\pm 2\%$  required by the standard.

#### **VI.A.(2). STACK SAMPLE ROTAMETER**

A sample rate Rotameter was not used as part of the sampling system. This sample system utilized an orifice attached to outlets of the dry gas meters. Pressure drop across the orifice is monitored and maintained at a constant rate. A constant pressure drop across an orifice maintains a constant desired sample rate at the filters.

## **VI.B. TEST METHOD PROCEDURES**

### **VI.B.(1). LEAK CHECK PROCEDURES**

Before and after each test, each sample train is tested for leaks. Leakage rates are measured and must not exceed 0.02 CFM or 4% of the sampling rate. Leak checks are performed checking the entire sampling train, not just the dry gas meters. Pre-test leak checks are conducted with a vacuum of 10 inches of mercury. Vacuum is monitored during each test and the highest vacuum reached is then used for the post test vacuum value. If leakage limits are not met, the test run is rejected. During, these tests the vacuum was typically less than 2 inches of mercury. Thus, leakage rates reported are expected to be much higher than actual leakage during the tests.

### **VI.B.(2). TUNNEL VELOCITY/FLOW MEASUREMENT**

The tunnel velocity is calculated from a center point Pitot tube signal multiplied by an adjustment factor. This factor is determined by a traverse of the tunnel as prescribed in EPA Method 1. Final tunnel velocities and flow rates are calculated from EPA Method 2, Equation 6.9 and 6.10. (Tunnel cross sectional area is the average from both lines of traverse.)

Pitot tubes are cleaned before each test and leak checks are conducted after each test.

### **VI.B.(3). PM SAMPLING PROPORTIONALITY (5G-3)**

Proportionality was calculated in accordance with EPA Method 5G-3. The data and results are included in Appendix C.

## VII. CONCLUSION

These tests demonstrate that this unit is an affected facility under the definition given in the regulation. The weighted average emission rate of 3.26 g/hr meets the requirements of this standard.

### VII.A RESULTS AND OBSERVATIONS

The Model Grand View 230 Solid Fuel Room Heater has been found to be in compliance with the applicable performance and construction requirements of the following criteria: EPA Method 28 "Certification and auditing of wood heaters" and Method 5G Determination of particulate matter emissions from wood heaters."

#### INTERTEK TESTING SERVICES NA

Reported by:



Bruce Davis  
Test Engineer

Reviewed by:



Ken Morgan  
Reviewer

# **Appendix A**

## **K List Drawings**

## COUNTRY STOVES PS40 PI40 EPA INFO

[illegible]

[illegible]

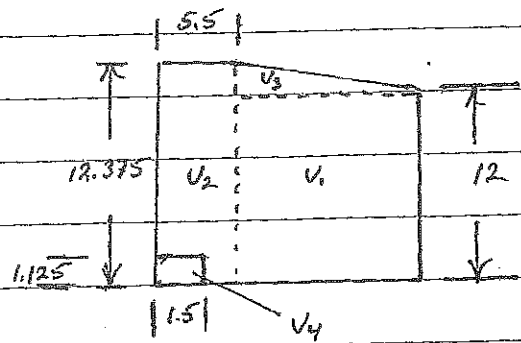
Lennox

6/8/11

Gravimetric 230

B. Davis

G100436227



$$V_1 = 12 \times 17 \times 13.25 = 1.56424$$

$$V_2 = 12.375 \times 17 \times 5.5 = 0.6696$$

$$V_3 = .375 \times 17 \times 13.25 = 0.02441$$

2

$$\text{sub} = 2.258$$

$$V_4 = 1.125 \times 17 \times 1.5 = 0.01660$$

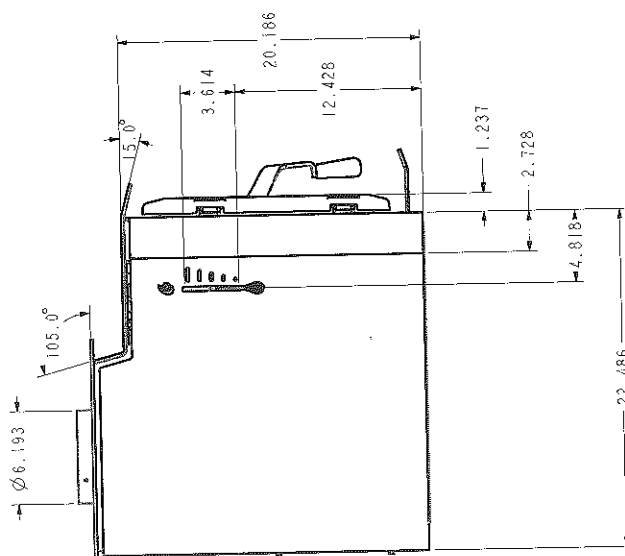
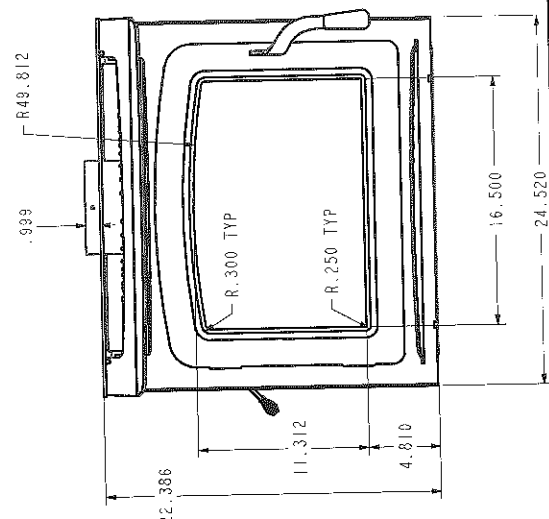
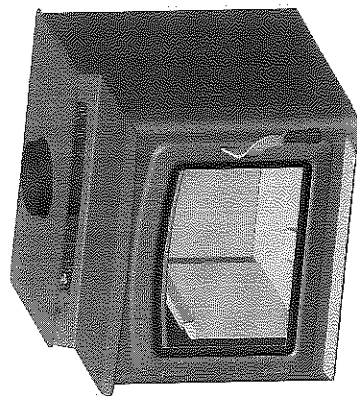
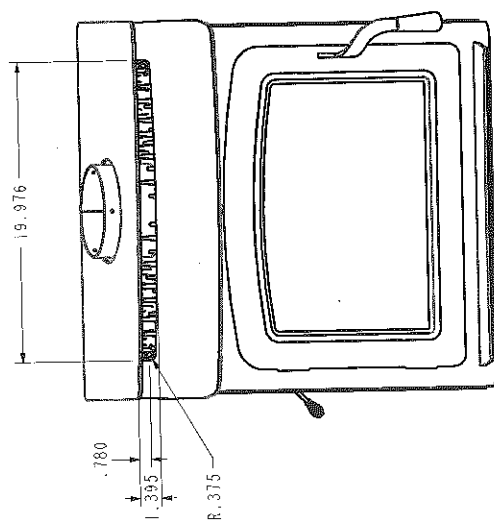
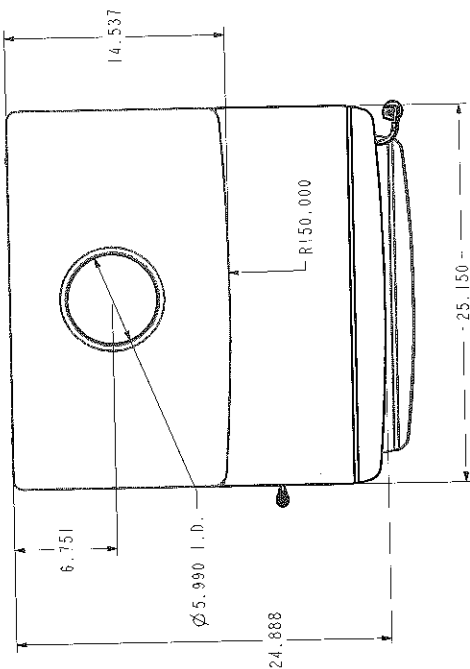
$$\text{Total} = 2.24 \text{ ft}^3$$

$$2.24 \times 7.16/\text{ft}^3 = 15.7$$

$$\text{Fuel load} \pm 10\% \quad 14.2 - 17.2 \text{ lbs.}$$

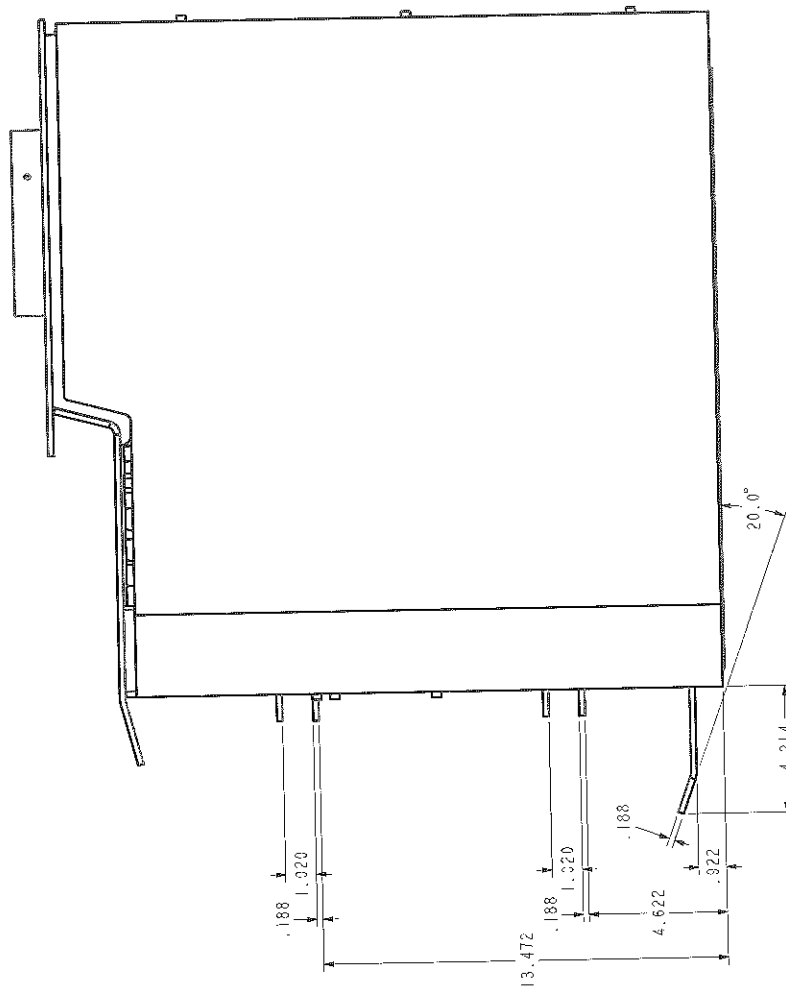
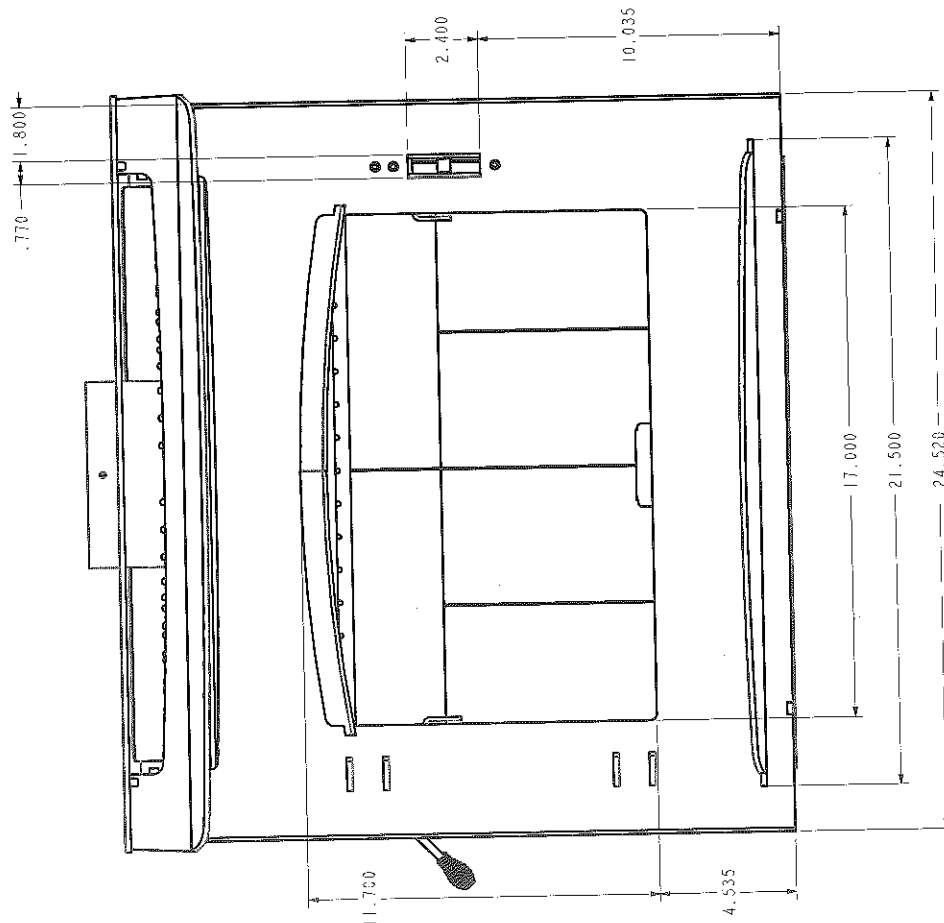
Note: A volume of 2.28 was calculated by a CAD program. This volume was used for certification tests.

PART NO: C1-16200-00






PART NAME: 6200 GRANDVIEW BODY				MATERIAL: STEEL			
TOLERANCES UNLESS OTHERWISE SPECIFIED:		DOW ST: LRS		DATE: 06-20-11		PROJ MODEL: 01-16200-00	
XX ± .1 XX ± .02		REV BY: REE		DATE: 7-9-11		SOW NO: 6200_BODY_EPA	
XX ± .005 ± .05		1502 14TH ST NW ALBUQUERQUE, NM 87102		DATE: 7-9-11		SCALE: 1 OF 10	
INCHES		COUNTRY TOVES		DATE: 7-9-11		REV: A	
STEE: B		1502 14TH ST NW ALBUQUERQUE, NM 87102		DATE: 7-9-11		REV: A	
COUNTRY TOVES		1502 14TH ST NW ALBUQUERQUE, NM 87102		DATE: 7-9-11		REV: A	
COUNTRY TOVES		1502 14TH ST NW ALBUQUERQUE, NM 87102		DATE: 7-9-11		REV: A	

01-16200-00

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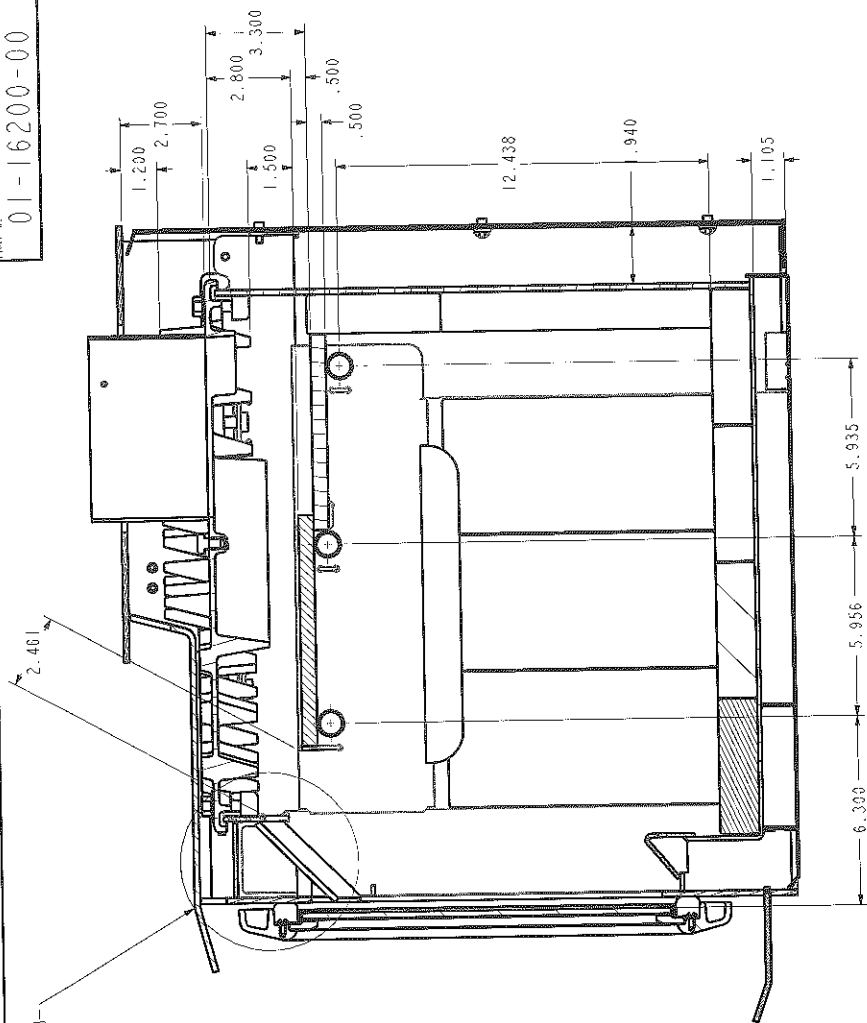
SECTION E-E

PART NAME: <b>GRANDVIEW OPENINGS</b>		MATERIAL: <b>STEEL</b>	
TOLERANCES UNLESS OTHERWISE SPECIFIED: A .1 .005 ± .025 XXX .1 .005 ± .025		DATE: 06-20-11 PROJE NO: 01-16200-00	
 <b>COUNTRY IRON WORKS</b> A LITTLE MORE, WORTH A LOT MORE 1502 I-49 (233) 735-1100		DATE: 7-9-11 DRAW NO: 6200-BODY-EPA	
CONSTRUCTION & FABRICATION TO COMPLY WITH THE SPECIFICATIONS OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.		DATE: _____ SHT: 3 OF 10 REV: A	
SIZE:  B			
			

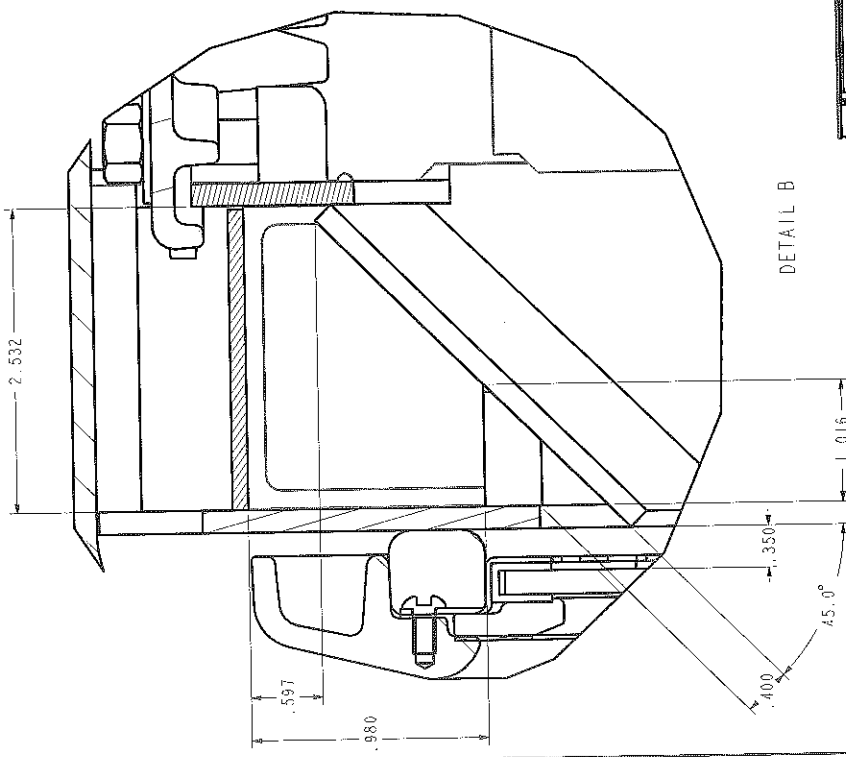


PART #:  
01-16200-00

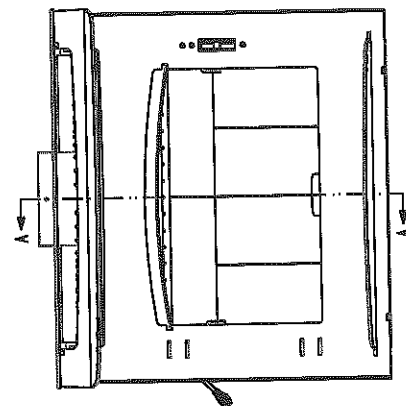
SEE DETAIL B-



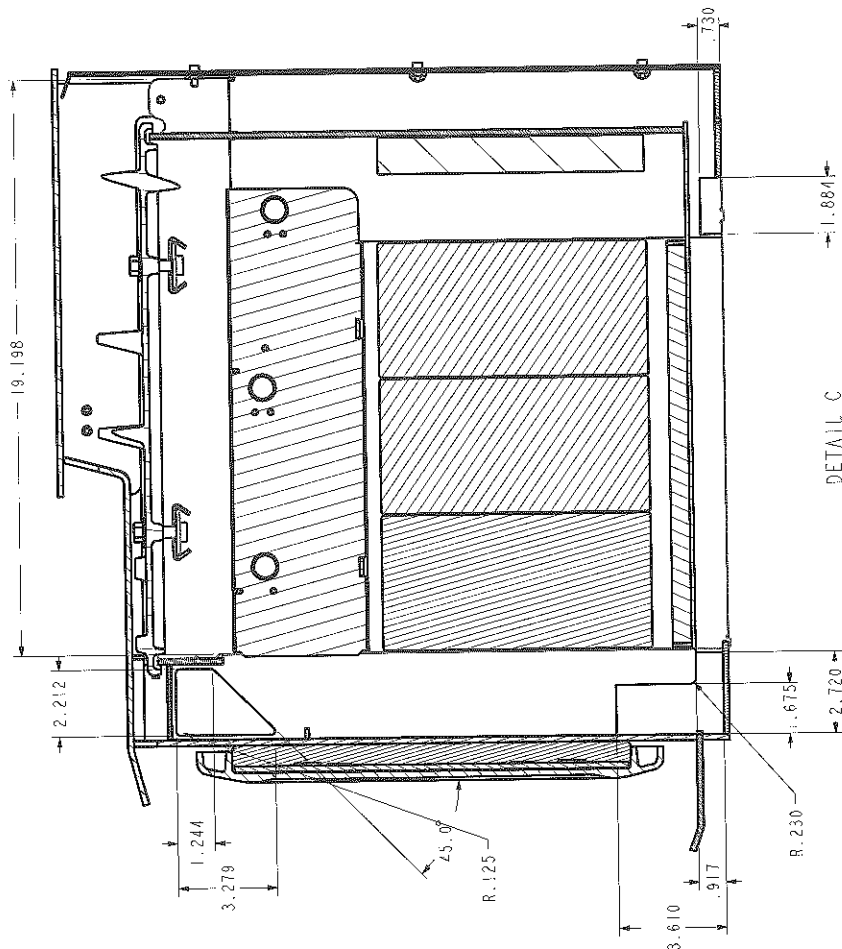
SECTION A-A



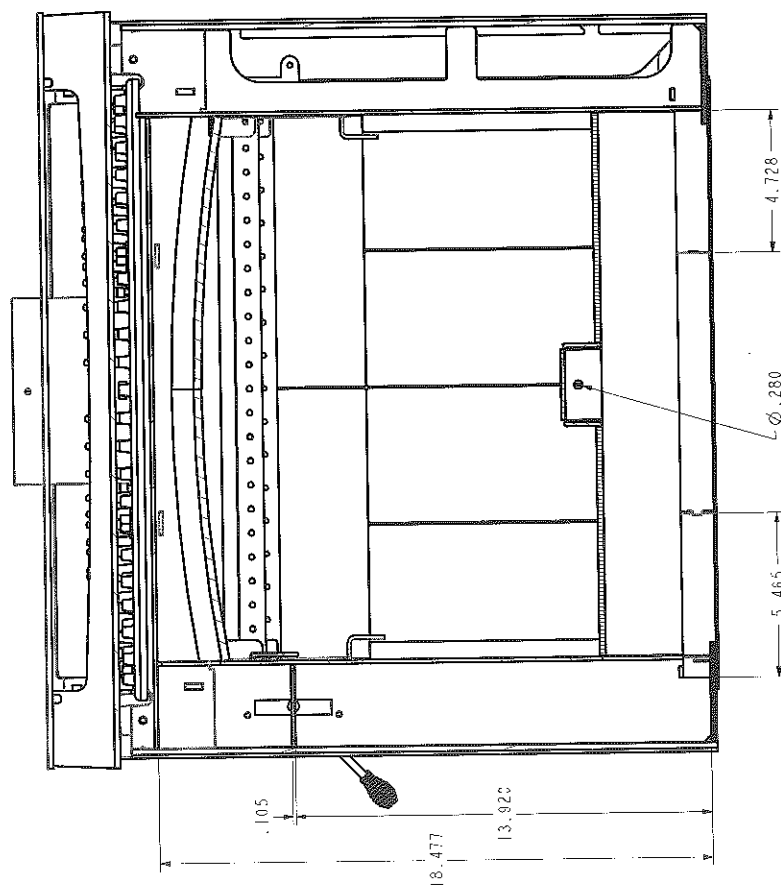
DETAIL B



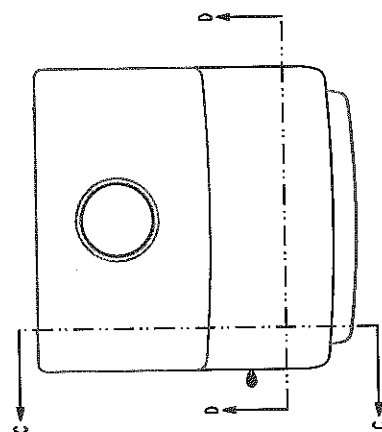
PART NAME: GRANDVIEW AIR CHANNELS		MATERIAL: STEEL	
TOLERANCES UNLESS OTHERWISE SPECIFIED: X ± .1 XX ± .025 XXX ± .005		DATE: 06-20-11	PROJ. MODEL: 01-16200-00
COUNTRY STOVES 1502 14TH ST NW PO BOX 98001 ALBUQUERQUE, NM 87108 (505) 755-1234 WWW.COUNTRYSTOVES.COM INC. NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.		DATE: 7-9-11	REV. BY: 6200_BODY_EPA
STYL: B		DATE: 7-9-11	SCALE: 5 OF 10
		DATE: 7-9-11	REV: A



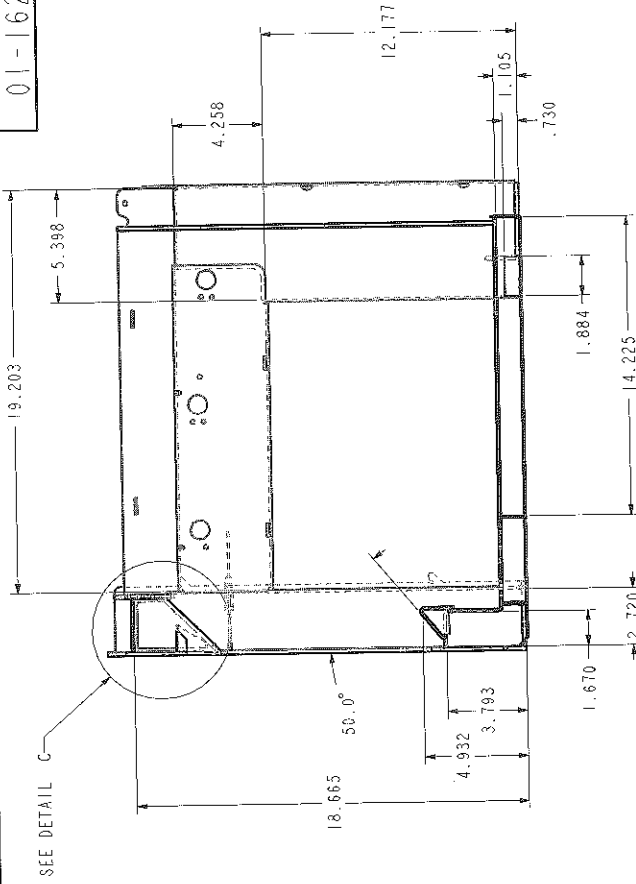
DETAIL C



DETAIL D

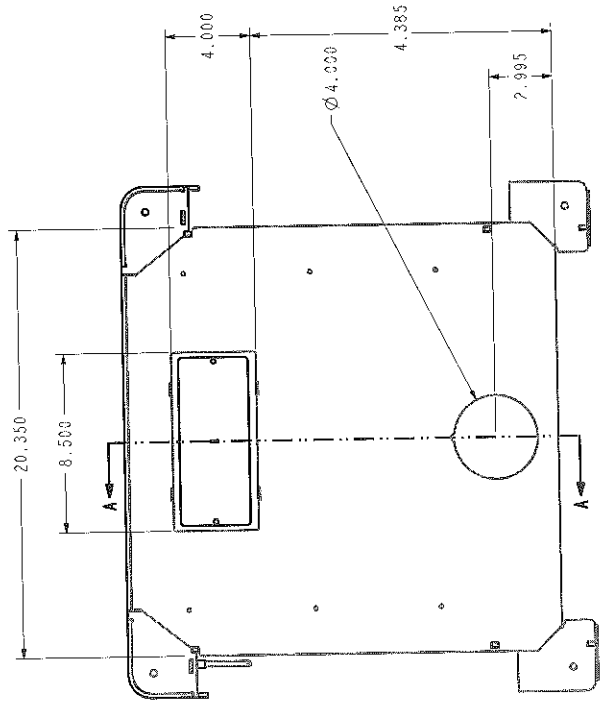
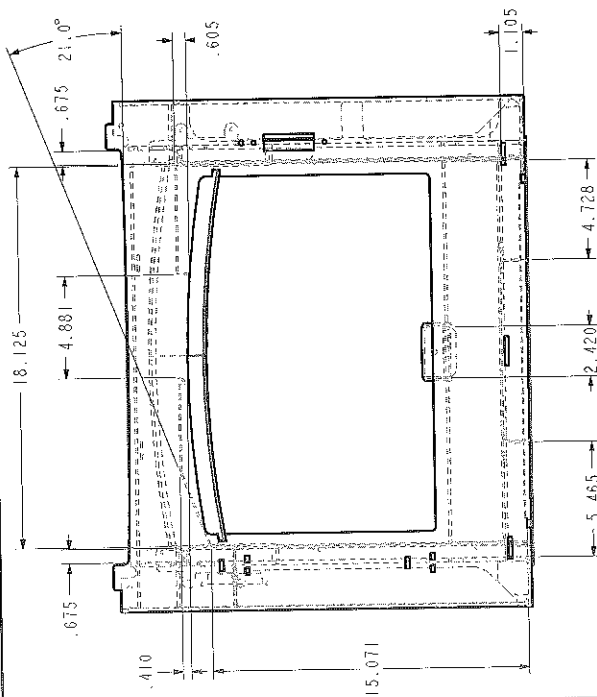
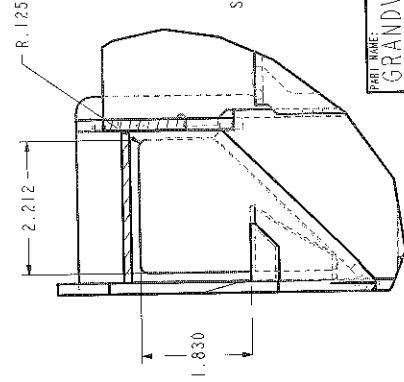
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PART NO.  
01-16200-00



SECTION A-A

DETAIL C  
SCALE 0.500

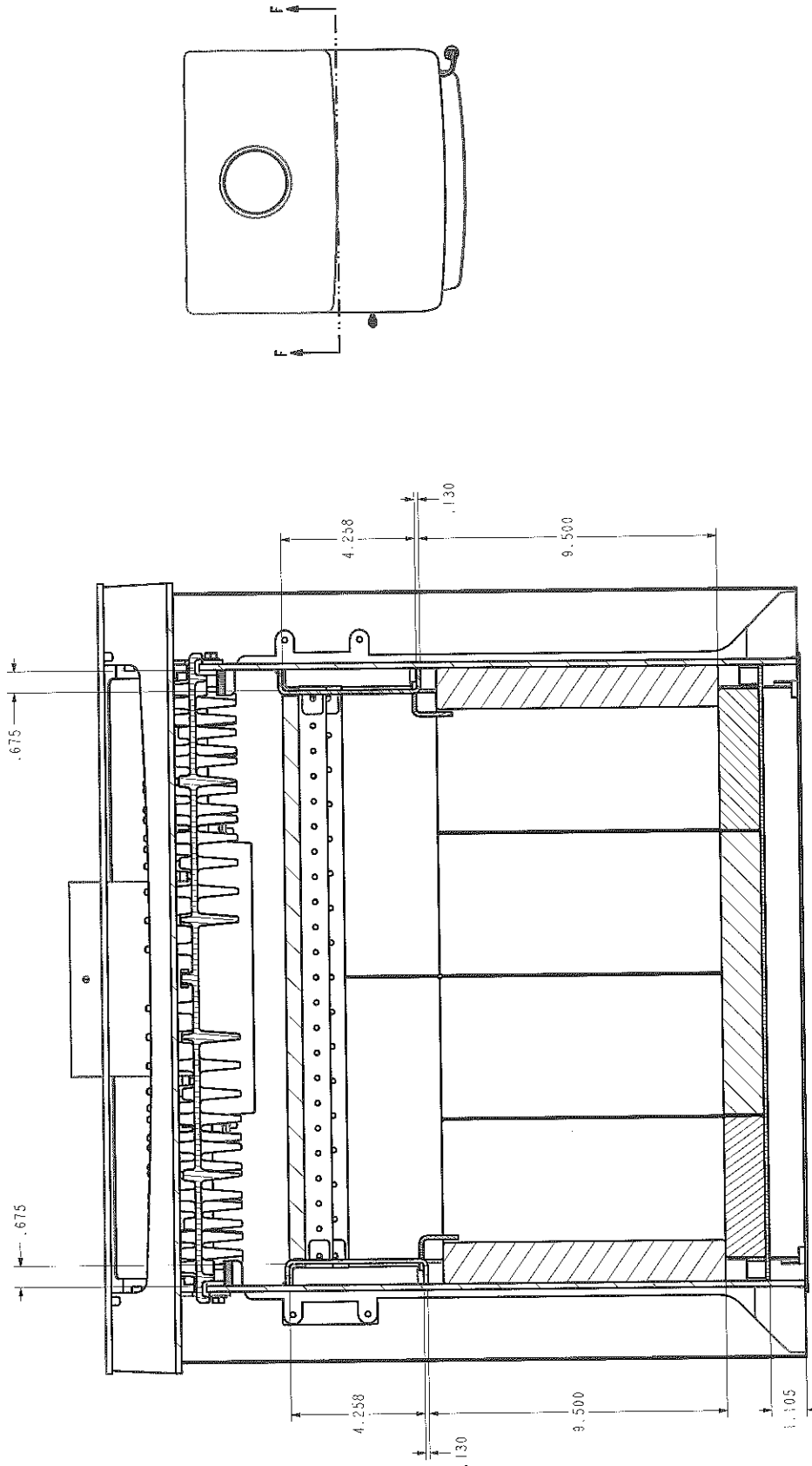


PART NAME: GRANDVIEW AIR CHANNELS		MATERIAL: STEEL	
DESIGN BY: LRS	DATE: 06-20-11	PROJECT NO.: 01-16200-00	
REV BY: REE	DATE: 7-9-11	6200-BODY-EPA	
SCALE: 1"=1'-0"	SCALE: 1"=1'-0"	SCALE: 1"=1'-0"	SCALE: 1"=1'-0"
SHEET: 7	OF: 10	A	

COUNTRY LOVES  
1502 14TH ST NW AUBURN, WA 98001  
(253) 735-1100  
WWW.COUNTRYLOVES.COM  
ATTENTION: DESIGN/SALES/INQ.

PART 1:

01-16200-00



PART NAME:

GRANDVIEW AIR CHANNELS

MATERIAL:

STEEL

TOLERANCES: UNLESS OTHERWISE SPECIFIED:

X ± .1 XX ± .025

XXX + .005 / - .010

FRACTIONS: 1/16, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1

DECIMALS: 1/10, 1/100, 1/1000

UNITS: INCHES

SIZE: B

COUNTRY TOVES

1502 14th Street, Wrentham, MA 01901

TELEPHONE: (508) 735-1100

FAX: (508) 735-1100

ELECTRIC: 1502 14th Street, Wrentham, MA 01901

TELEPHONE: (508) 735-1100

FAX: (508) 735-1100

DOW BY:

LRS

REV BY:

REE

DATE:

7-9-11

APP BY:

DATE:

SCALE:

8 of 10

DATE:

06-20-11

DATE:

7-9-11

DATE:

7-9-11

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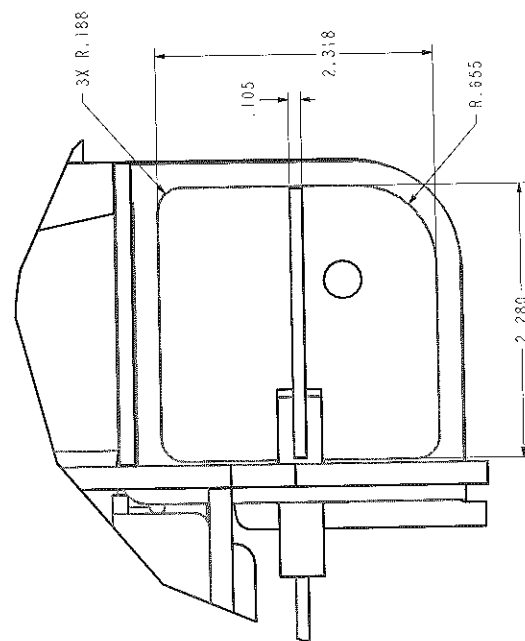
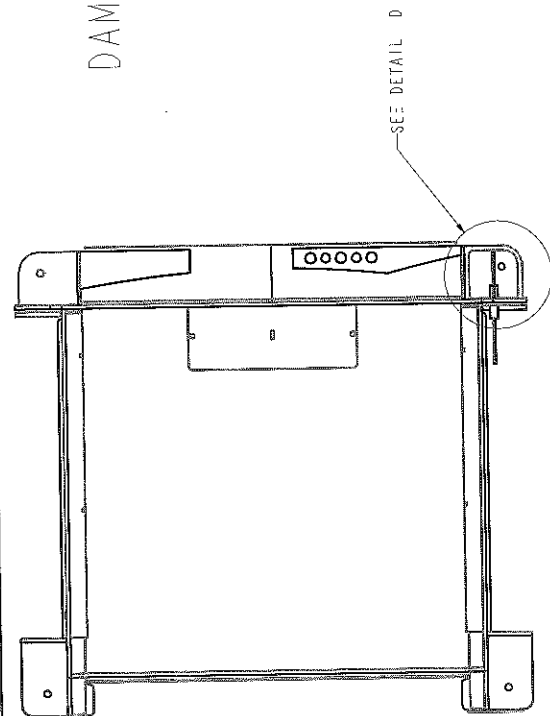
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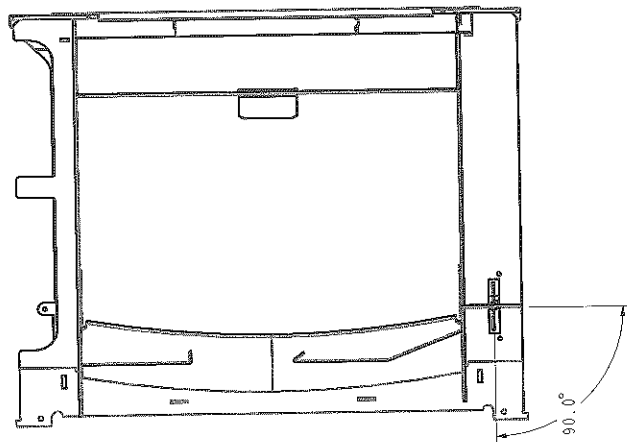
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# DAMPER FULL OPEN





DETAIL D

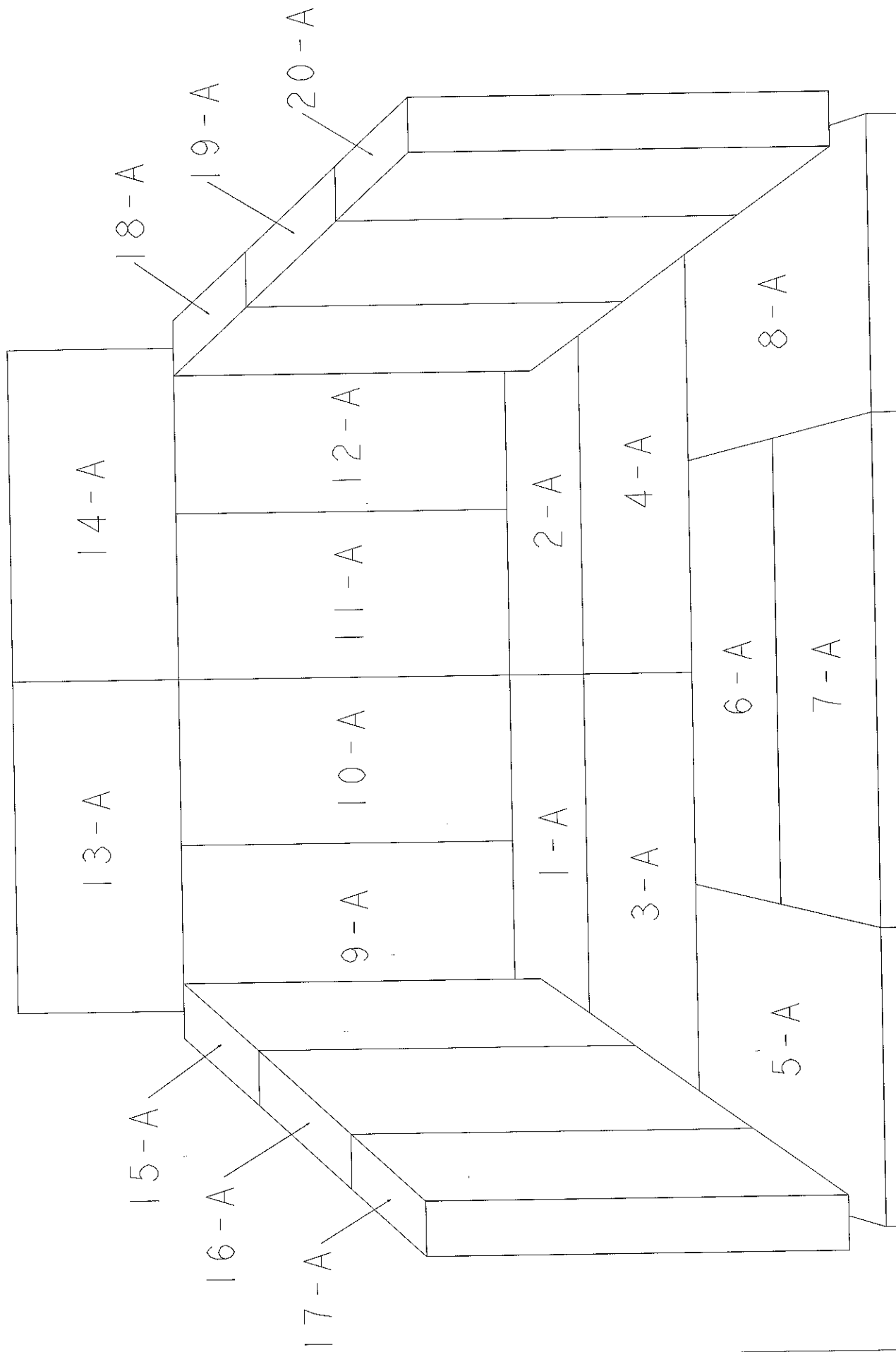


PART #:  
01-16200-00

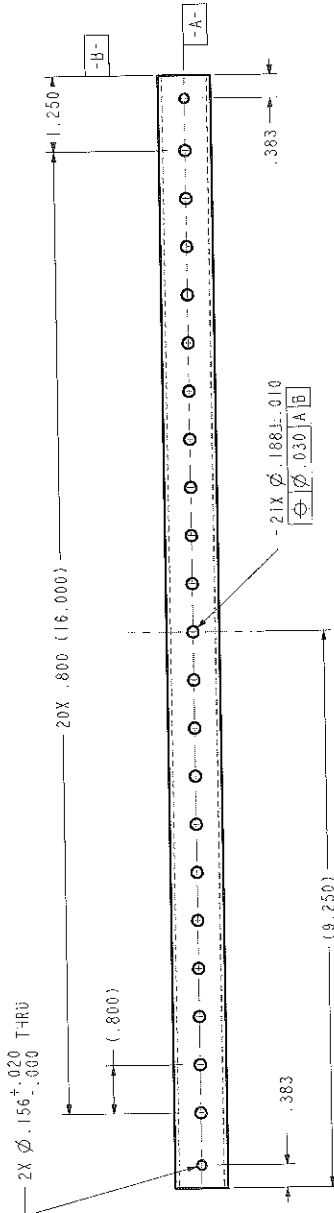
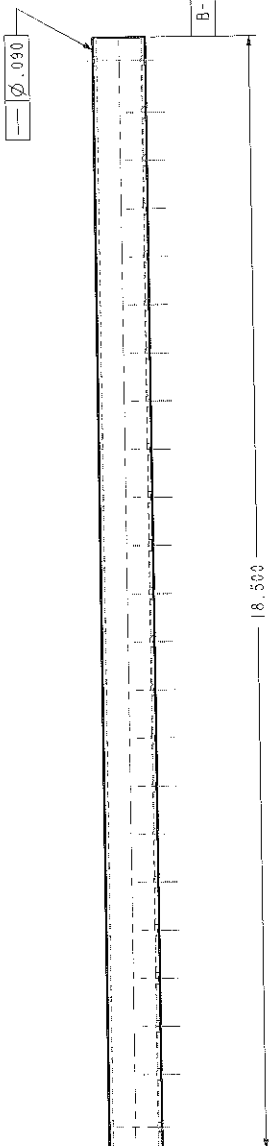
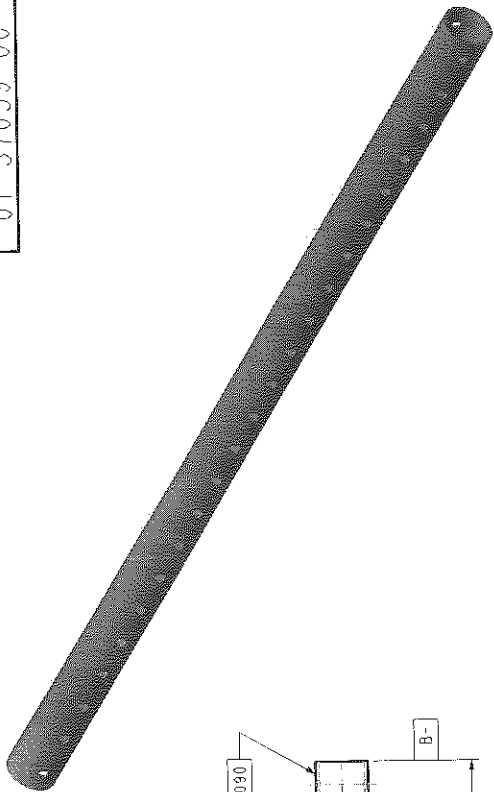
PART NAME: GRANDVIEW DAMPER OPEN		MATERIAL: STEEL	
TOLERANCES UNLESS OTHERWISE SPECIFIED: .X ± .1 .2XX ± .025 ANGLES ± .5°		DATE: 06-20-11	
DESIGNED BY: LRS		DATE: 06-20-11	
CHECKED BY: REE		DATE: 7-9-11	
APPROVED BY: [Signature]		DATE: 7-9-11	
SIZE: B		SCALE: 9 of 10	
COUNTRY TOVES 1562 147 (253) 735 - 1153 1562 147 (253) 735 - 1153 CONFIDENTIAL & PROPRIETARY TO COUNTRY TOVES, INC. NO PARTS OR SUBASSEMBLIES TO BE USED WITHOUT WRITTEN AUTHORIZATION FROM COUNTRY TOVES, INC.		01-16200-00	
6200_BODY_EPA		REV: 9 of 10	
A		A	

PART NAME:		GRANDVIEW FIRE BOX DIMENSIONS		MATERIALS: STEEL	
TOLERANCES UNLESS SPECIFIED:		 <b>COUNTRY OF ORIGIN</b> 1902 14TH AVENUE SUITE 100 DENVER, CO 80202 (303) 733-1100		DATE: 06-20-01 PROJE NO.: 16200-00 DWG #: 6200-BODY-EPA SCALE: 1" = 1'-0"	
X .001 ± X .005 ± XXX ± .005 ± HOLE ± .005 ± FINISH:		PART BT: LRS REV BT: 0 PART NO: 6200-BODY-EPA REV NO: 0 DATE: 7-9-11 SCALE: 1" = 1'-0"		DATE: 7-9-11 SCALE: 1" = 1'-0"	
 WARNING:		CONFIDENTIAL & PROPRIETARY TO COUNTRY OF ORIGIN. NO PARTS TO BE REPRODUCED OR USED IN ANY MANNER WITHOUT WRITTEN PERMISSION.		DATE: 7-9-11 SCALE: 1" = 1'-0"	

LETTER A BRICK IS FULL SIZE  
9" LONG x 4 1/2" WIDE x 1 5/16" THICK



PART #:  
01-37059-00

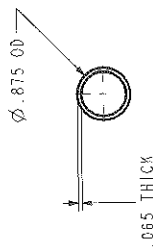
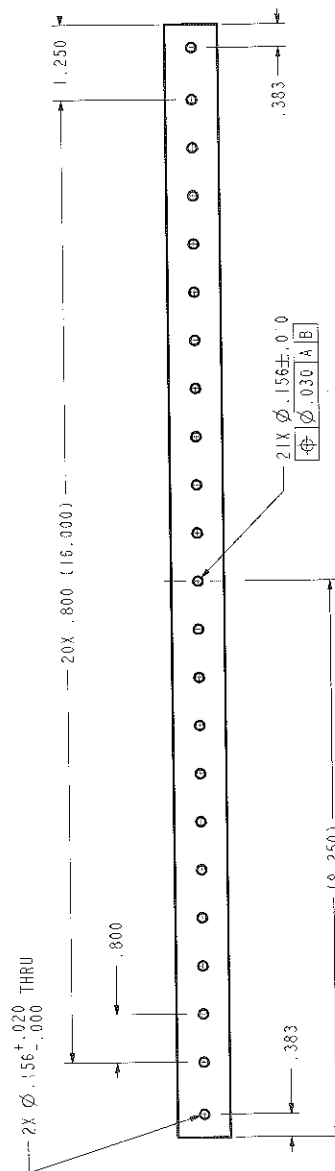
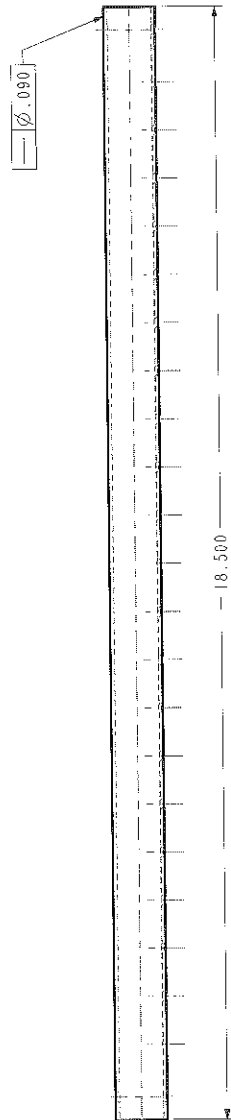
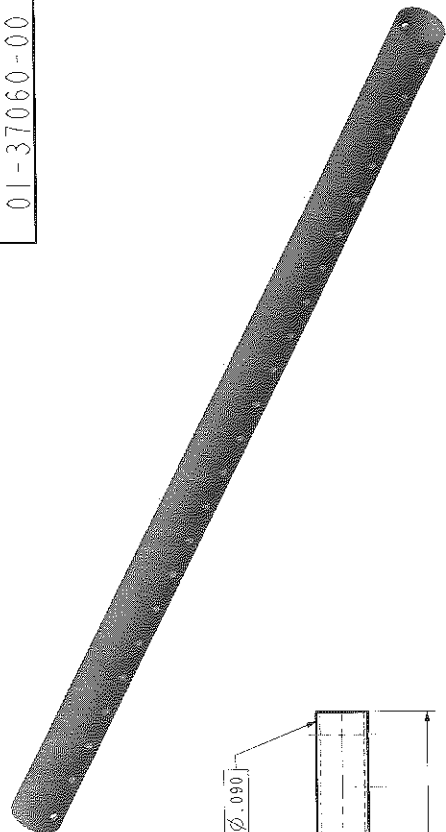


NOTES: DO NOT SCALE DRAWING!  
ONLY END HOLES ARE THRU HOLES  
DEBURR TUBE ENDS

PART NAME: SECONDARY TUBE, GRANDVIEW, FRONT		MATERIAL: T-304 STAINLESS	
TOLERANCES UNLESS OTHERWISE SPECIFIED: .X ± .1 .XX ± .025 .XXX ± .005		DATE: 11-1-10	
FINISH: CRZ		PROJ. NO.: 01-37059-00	
DESIGNER: REE		DATE: 5-4-11	
CHECKER: REE		PROJ. NO.: 01-37059-00	
SCALE: 1:2		SHEET: 1 of 1	
APPROVED: [Signature]		REV.:	

COUNTRY TOVES  
1502 14TH AVENUE, SUITE 1100  
DENVER, CO 80001  
CONFIDENTIAL & PROPRIETARY TO COUNTRY TOVES, INC.  
NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.

PART #:  
01-37060-00

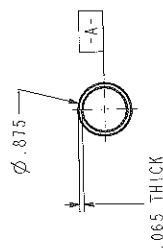
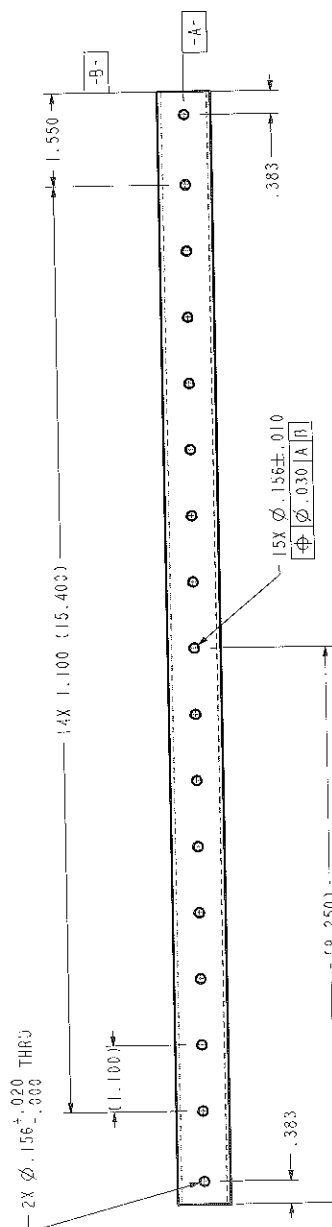
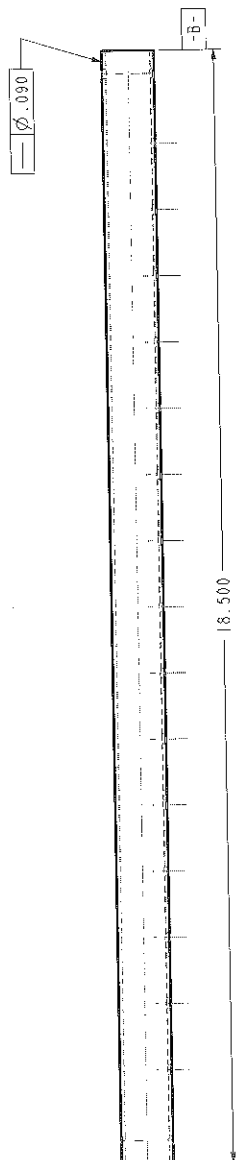
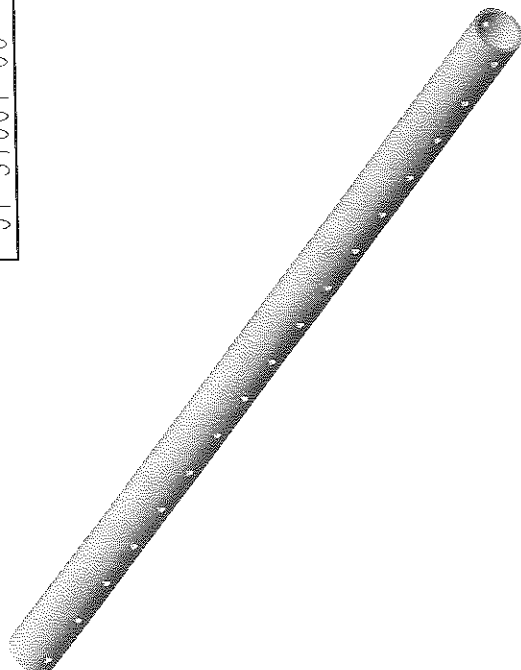


NOTES: DO NOT SCALE DRAWING!  
ONLY END HOLES ARE THRU HOLES  
DEBURR TUBE ENDS

PART NAME:	SECONDARY TUBE, GRANDVIEW, MID	MATERIAL:	T-304 STAINLESS
TOLERANCES UNLESS OTHERWISE SPECIFIED:		DATE:	5-4-11
.X $\pm$ .1 .XX $\pm$ .025		DRG BY:	RLE
.XXX $\pm$ .005 $\angle$ $\pm$ .5		REV BY:	
(INCHES)		DATE:	
SIZE:	B	SCALE:	1:2
1502 14TH ST NW, ALBUQUERQUE, NM 87102		SHR:	1 OF 1
CONFIDENTIAL AS SUPPLIED TO COMBUSTION SYSTEMS, INC. NOT TO BE REPRODUCED OR MANUFACTURED WITHOUT WRITTEN PERMISSION OF COMBUSTION SYSTEMS, INC.		REV:	

COUNTRY TUBES  
A LITTLE MORE WARRANTY  
1502 14TH ST NW, ALBUQUERQUE, NM 87102

01-37061-00



NOTES: DO NOT SCALE DRAWING!  
ONLY END HOLES ARE THRU HOLES  
DEBURR TUBE ENDS

[illegible]

# **Appendix B**

## **Operation Manual**

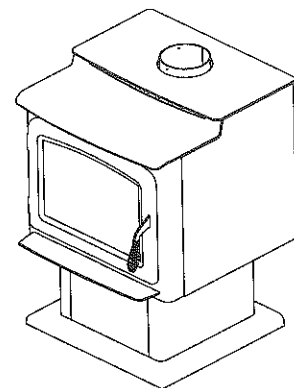


# INSTALLATION AND OPERATION MANUAL

## Free-Standing EPA Certified Wood-Burning Stoves

Save These Instructions  
For Future Reference

P/N 506031-01, Rev. D, 10/2012



Grandview GV230

## Wood-Burning Stoves Model Grandview™ GV230

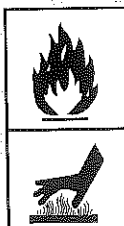
With Innovative Thermal Fin Technology (TFT™)

A French manual is available upon request. Order P/N 506223-28.

Ce manuel d'installation est disponible en français, simplement en faire la demande. Numéro de la pièce 506223-28.

This appliance must be properly installed and operated in order to prevent the possibility of a house fire. Please read this entire installation and operation manual before installing and using your wood stove. Failure to follow these instructions could result in property damage, bodily injury or even death.

Contact your local building or fire officials to obtain a permit and information on any installation requirements and inspection requirements in your area.



### ! WARNINGS

- **Hot! Do not touch!** The glass and surfaces of this appliance will be hot during operation and will retain heat for a while after shutting off the appliance. Severe burns may result.
- **Carefully supervise children in the same room as appliance.**

## CONGRATULATIONS!

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

Thank you for selecting a Lennox Hearth Products wood stove as the answer to your home supplemental heating needs.

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### USING THIS MANUAL

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

**PRODUCT IS SUBJECT TO CHANGE WITHOUT NOTICE**

## IMPORTANT SAFETY AND WARNING INFORMATION

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

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

## TESTING INFORMATION

This manual describes the installation and operation of the Grandview™ 230 non-catalytic wood heater. This heater meets the U.S. Environmental Protection Agency's emissions limits for wood heaters sold on or after July 1, 1990. This heater has been developed, tested and constructed in accordance with the requirements of UL 1482, ULC S627 and HUD standards and is listed by Intertek Testing Services, Portland, OR. It has been approved for residential, mobile home and alcove installations.

## DRAFT REQUIREMENTS

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

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

The appliance depends solely on the natural draft of the chimney system to draw combustion air into the unit. Draft is the force that moves air from the appliance up into the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors. Too much draft may cause excessive temperatures in the appliance (overfiring). Slow or inadequate draft equals poor combustion and possible smoking problems. The following are some conditions that may contribute to poor chimney draft:

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

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

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

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

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

Also see *Troubleshooting* on **Page 24**.

## SELECTING THE PROPER VENTING SYSTEM

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

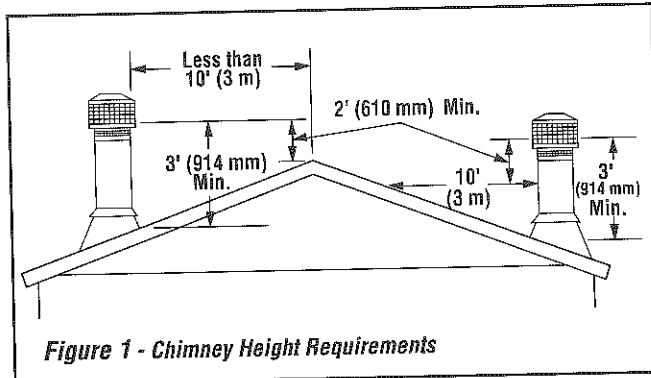
**American National Standards Institute ANSI/NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances - See Draft Section:** A chimney or vent shall be so designed and constructed to develop a flow sufficient to completely remove all flue and vent gases to the outside atmosphere.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

### Chimney Guidelines:

- This appliance requires approximately 12 feet minimum of "effective draw" provided by the venting system. As a rule of thumb, every 90 degree total direction change in the venting will result in a loss of approximately 5 feet of "effective draw." Example: If two 45 degree offsets are used, subtract 5 feet from the actual vertical vent height to determine your "effective draw." In this case if you had 14 feet of vertical vent, the effective draw would only be approximately 9 feet (14 ft. - 5 ft. = 9 ft.), therefore it may be necessary to add additional height to the venting system.
- Do not install an offset within the first two feet above the flue outlet on the appliance.
- In well insulated and weather tight homes, it may be difficult to establish a good draft up your chimney. The poor draft is caused by a shortage of air in the house. In this situation an Outside Air Kit may need to be installed (See *Negative Pressure Warning* on **Page 5** and *Outside Combustion Air* on **Page 15**).

## CHIMNEY HEIGHT REQUIREMENTS

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



**Figure 1 - Chimney Height Requirements**

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

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

## NEGATIVE PRESSURE WARNING

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

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

## CLEARANCES TO COMBUSTIBLES

**WARNING: BE ABSOLUTELY SURE THE DISTANCE BETWEEN THE HEATER AND THE SURFACE OF ANY COMBUSTIBLE CONSTRUCTION IS NOT LESS THAN SHOWN IN THE FIGURES ON PAGE 7.**

### Floor Protection

**USA** - The floor in front and under the heater must be protected with noncombustible material. The covering must extend 16" in front of the door opening of the heater and 8" to either side of the door opening.

**Canada** - The floor in front and under the heater must be protected with noncombustible material. The covering must extend 450 mm in front of the door opening of the heater and 200 mm to either side of the stove body and 200 mm to the rear or to the wall, whichever is smaller.

**USA and Canada** - A chimney connector / venting extends horizontally over the floor, protection must also cover the floor under the connector / venting and at least 2" (51 mm) to either side.

**Alcove Installations USA and Canada** - The floor protection must be a thermally rated non-combustible floor protector. See **Page 8** for details on determining acceptable floor protection materials or hearth pads for alcove installations.

### Alcove Installation

**Clearances** - In alcove installations, only 6" double wall connector pipe can be used (single wall or single wall pipe with shield is not allowed). Minimum alcove width between combustible materials is 52" (1321 mm). Maximum alcove depth is 48" (1219 mm). Minimum alcove height is 90" (2286 mm).

**Thermal Floor Protection** - Thermal floor protection is only required where the stove is installed into an alcove.

### Chimney and Connector

Minimum 6" diameter, minimum 24 MSG black steel connector pipe with UL103HT listed factory-built chimney suitable for use with solid fuels or masonry chimney. Horizontal connection not tested, refer to local building codes for installation. See installation instructions for details. Restrictions apply! Read instructions before installing.

Residential chimney systems must be from the same brands as listed for mobile homes but connector pipe may be double wall, single wall, or single wall with shield as listed.

This appliance may be vented into a code-approved masonry chimney with flue liner.

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

All of the stove connector pipe used must be of the same brand. The chimney that the stove pipe transitions into may be a different brand. Other than the transition of the stove pipe into the chimney, do not mix different brand vent components. Install all vent components per vent manufacturer's instructions.

The chimney connector shall not pass through an attic or roof space, closet or similar concealed space, or a floor, or ceiling. Where passage through a wall, or partition of combustible construction is desired, the installation shall conform to CAN/CSA-B365, Installation Code for Solid-Fuel-Burning Appliances and Equipment.

There must be an effective vapor barrier at the location where the chimney or other component penetrates to the exterior of the structure. Follow the vent manufacturer's detailed instructions.

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

Clearance dimensions are to flue collar. If a single wall connector pipe with shield is used, a 1 inch air space is needed between pipe and shield. Shield attaches to rear of stove pipe and must run from stove top to ceiling. Pipe shield shall be UL listed.

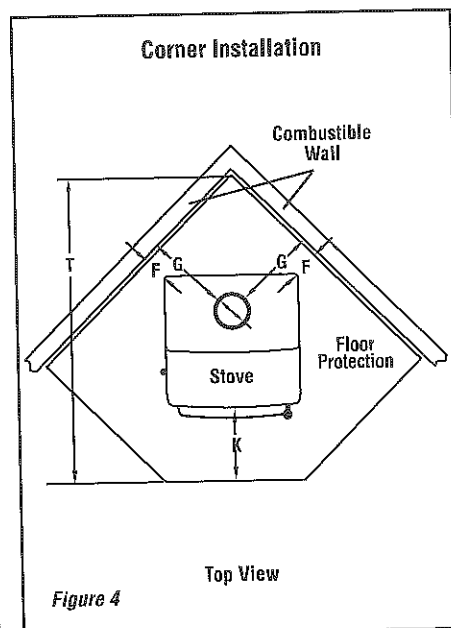
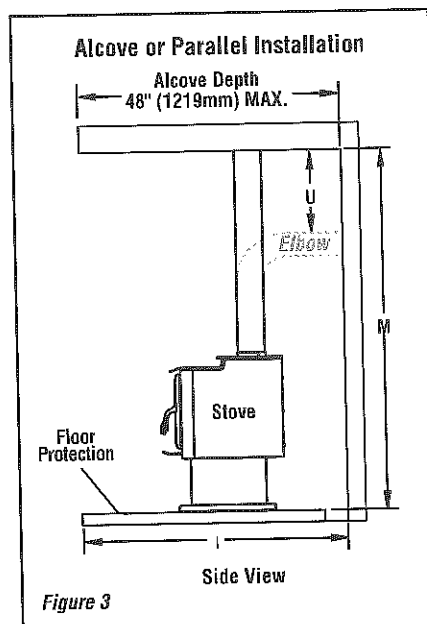
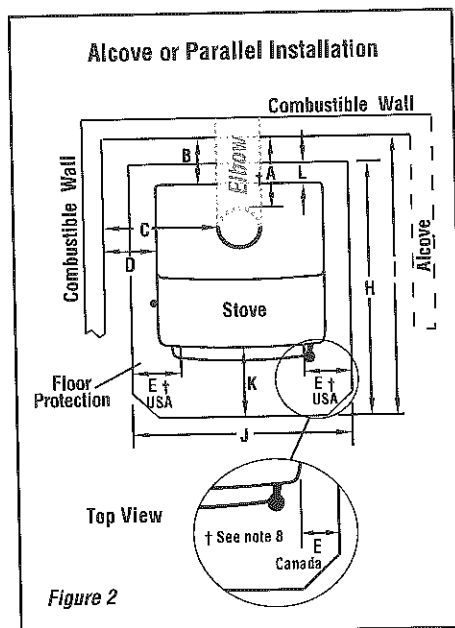
### Components Required For Installations

Legs OR Pedestal Assembly.

**Use all required components specified for this appliance. Do not substitute.**

**WARNING:** In the event that you remove the blower for any reason, make sure a cover plate (available from Lennox Hearth Products) is installed before using the heater. *Note: The cover plate is not necessary if a blower has never been installed because a knock-out will be in place to act as the cover.*

# INSTALLATION CLEARANCES - REFER TO FIGURES 2, 3 AND 4



## USA - inches (millimeters)



PIPE	INSTALLATION	A (3)	B (1)	C (3)	D (1)	E (8)	F (1,4)	G (3,4)	H (2)	I (6)	J (2)	K (7)	L (5)	M	T (6)	U
Single Wall	Residential-Vertical Vent	16 (406)	12-3/8 (314)	22 (559)	12-1/2 (318)	8 (200)	5-11/16 (145)	16 (406)	38-5/8 (981)	51 (1295)	33 (838)	16 (406)	0 (0)	84 (2134)	58-7/8 (1495)	N/A N/A
Single Wall	Residential-With Elbow	19 (483)	15-3/8 (391)	23 (584)	13-1/2 (343)	8 (200)	5-11/16 (145)	16 (406)	38-5/8 (981)	54 (1372)	33 (838)	16 (406)	0 (0)	84 (2134)	58-7/8 (1495)	19 N/A
Double Wall	Residential or Mobile Home-Vertical Vent	10 (254)	6-3/8 (162)	20 (508)	10-1/2 (267)	8 (200)	4-11/16 (119)	15 (381)	38-5/8 (981)	45 (1143)	33 (838)	16 (406)	0 (0)	84 (2134)	57-1/2 (1461)	N/A N/A
Double Wall	Residential or Mobile Home-With Elbow	10 (254)	6-3/8 (162)	21 (533)	11-1/2 (292)	8 (200)	4-11/16 (119)	15 (381)	38-5/8 (981)	45 (1143)	33 (838)	16 (406)	0 (0)	84 (2134)	57-1/2 (1461)	10 N/A
Double Wall	Alcove-Vertical Vent	13 (330)	9-3/8 (238)	22-1/2 (572)	13 (330)	8 (200)	N/A N/A	N/A N/A	38-5/8 (981)	48 (1219)	33 (838)	16 (406)	0 (0)	72 (1829)	N/A N/A	N/A N/A

## CANADA - inches (millimeters)



PIPE	INSTALLATION	A (3)	B (1)	C (3)	D (1)	E (8)	F (1,4)	G (3,4)	H (2)	I (6)	J (2)	K (7)	L (5)	M	T (6)	U
Single Wall	Residential-Vertical Vent	16 (406)	12-3/8 (314)	22 (559)	12-1/2 (318)	8 (200)	5-11/16 (145)	16 (406)	49 (1235)	53 (1346)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	58-7/8 (1495)	N/A N/A
Single Wall	Residential-With Elbow	19 (483)	15-3/8 (391)	23 (584)	13-1/2 (343)	8 (200)	5-11/16 (145)	16 (406)	49 (1235)	56 (1422)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	58-7/8 (1495)	19 (483)
Double Wall	Residential or Mobile Home-Vertical Vent	10 (254)	6-5/16 (160)	20 (508)	10-1/2 (267)	8 (200)	4-11/16 (119)	15 (381)	47 (1193)	47 (1193)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	57-1/2 (1461)	N/A N/A
Double Wall	Residential or Mobile Home-With Elbow	10 (254)	6-5/16 (160)	21 (533)	11-9/16 (293)	8 (200)	4-11/16 (119)	15 (381)	47 (1193)	47 (1193)	41-1/8 (1045)	18 (450)	8 (200)	84 (2134)	57-1/2 (1461)	10 (254)
Double Wall	Alcove-Vertical Vent	13 (330)	9-3/8 (238)	22-1/2 (572)	13-1/16 (331)	8 (200)	N/A N/A	N/A N/A	49 (1235)	50 (1270)	41-1/8 (1045)	18 (450)	8 (200)	72 (1829)	N/A N/A	N/A N/A

### Footnotes:

- These dimensions to the stove body are for reference only. Actual distances should be measured from the stove's flue collar.
- Minimum noncombustible hearth pad dimensions.
- Clearances to connector pipe shall be measured from the flue collar of the stove.
- Not applicable to alcove installations.

- In corner applications, when installed at minimum back wall clearances, the required floor protection is dimensioned off the back plane of the stove, therefore the floor protection required off the back corners (at a 45 degree angle) only needs to extend to the wall. This situation will only occur in CANADA installations.

- Reference dimension only, to assist in planning the installation.
- Measured from front of floor protection to the front of firebox.
- USA=8" (200mm) from door opening, Canada=8" (200mm) from sides and back of unit.

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

## ALCOVE INSTALLATIONS - FLOOR PROTECTION

When the Grandview™ 230 is installed in an Alcove, the floor protection must be a thermally rated non-combustible floor protector meeting or exceeding a thermal rating of  $k=.47$  or equivalent with a listed thickness of 1/2" (12.7 mm) minimum in the USA and Canada. The thermal protection must extend 16" in front of the heater and 8" to each side (measured from the door opening).

### Using Alternate Material As Floor Protection

The floor protection or alternate material used as a floor protector must be constructed of a durable noncombustible material having an equal or better thermal conductivity value (lower  $k$  value) of  $k=.47$  BTU/IN FT<sup>2</sup> HR °F or a thermal resistance that equals or exceeds  $r = 2.13$  HR °F FT<sup>2</sup> IN/BTU with a minimum thickness of 1/2". With these values, determine the minimum thickness of the alternate material required using the formula(s) and shown in **Table 1**.

**Note:** Any noncombustible material having a minimum thickness of 1/2" (12.7mm) whose  $k$  value is less than .47 or whose  $r$  value is more than 2.13 is acceptable. If the alternate material used has a higher  $k$  value or lower  $r$  value will require a greater thickness of the material used. In some cases, if the  $k$  value is less or the  $r$  value higher, a thinner material may be used.

### Methods of determining floor protection equivalents:

To determine the thickness required for the alternate material when either the " $k$ " value or " $r$ " value is known, use either the  **$k$  formula** or  **$r$  formula**.

**Example:** If Micore 160 Mineral Fiber Board is to be used for the floor protection, how thick must this material be?

$k_M$  =  $k$  value per inch of **alternate** material

$r_M$  =  $r$  value per inch of **alternate** material

$T_M$  = minimum thickness required for **alternate** material

$T_L$  = standard thickness of the **alternate** material

$k_L$  =  $k$  value per inch of **listed** material

$r_L$  =  $r$  value per inch of **listed** material

$T_L$  = minimum thickness of **listed** material

**Note:** An asterisk "\*" indicates, it is a value taken from **Table 1**.

### Using the $k$ formula:

#### $k$ formula:

Minimum thickness of alternate material ( $T_M$ )	=	$k$ -value (per Inch) of alternate material ( $k_M$ ) x $k$ -value (per inch) of listed material ( $k_L$ )	x	Specified min. thickness of listed material ( $T_L$ )
$T_M$ (inches)	=	$k_M$	x	$T_L$
		*.47		
$T_M$ (inches)	=	*.35	x	.50"
		*.47		
.312 (inches)=		.745	x	.50"

**Answer -** The minimum required thickness of the Micore 160 is .372" therefore round up to nearest standard thickness available which is 3/8" (.375")

### Using the $r$ formula:

Minimum thickness of alternate material	=	$r$ -value (per Inch) of listed material x $r$ -value (per inch) of alternate material	x	Specified min. thickness of listed material
$T_M$ (inches)	=	$r_L$	x	$T_L$
		$r_M$		
$T_M$ (inches)	=	*2.13	x	.50"
		*2.86		
.312 (inches)=		.745	x	.50"

**Answer -** The minimum required thickness of the Micore 160 is .372" therefore round up to nearest standard thickness available which is 3/8" (.375")

Listed Material			
	k (per inch)	r (per inch)	Listed Min. Thickness
Listed Material	.47 $k_L$	2.13 $r_L$	1/2" (.50") $T_L$
** Approved Alternate Materials for Floor/Hearth Protection			
Alternative Materials	Thermal Values		Minimum Thickness (rounded to nearest 1/8 inch)
	k (per inch) $k_M$	r (per inch) $r_M$	Min. Thickness $T_M$
Kaowool M Board	.47	2.13	.5" (1/2")
Micore 160™ U.S. Gypsum	.35	2.86	.37" (3/8")
Micore 300™ U.S. Gypsum	.46	2.17	.49" (1/2")
Durock™ Cement Board U.S. Gypsum	1.92	.52	2.04" (2-1/8")
Hardibacker™	1.95	.51	2.07" (2-1/8")
Hardibacker 500™	2.30	.43	2.45" (2-1/2")
Cultured Stone Hearth-stone™	2.82	.35	3" (3")
Wonderboard	3.23	.31	3.44" (3-1/2")
Super Firetemp M Johns-Manville	.61	1.64	.65" (3/4")
Super Firetemp L Johns-Manville	.54	1.85	.57" (5/8")
Face brick	9.00	.111	9.57" (9-5/8")
Common brick	5.00	.20	5.32" (5-3/8")
Cement mortar	5.00	.20	5.32" (5-3/8")
Ceramic tile	12.5	.08	13.30" (13-3/8")
Marble	~11	~.09	11.70" (11-3/4")

**Table 1 - USA AND CANADA REQUIREMENTS**

\*\* If the hearth extension material(s) that is intended to be used is NOT listed on Table 1, the material can still be used if the material(s) is non-combustible. However, the manufacturer of the material must provide either the listed  $k$ -value per inch or  $r$ -value per inch with listed thickness so that the minimum thickness required for the hearth can be calculated (per instructions here or as specified in the NFI Certification Manuals).

**Note:** Also see NFI (National Fireplace Institute) Certification Manuals showing other acceptable calculation methods and acceptable alternate materials which can be used.

## SPECIFICATIONS - GRANDVIEW™ 230

Product Reference Information			
Cat. No.	Description	Ship. Weight	Ship. Volume
H8338	Grandview 230 Wood-Burning Stove	385 lb.	20.09 cu. ft.

### Notes:

- Dimensions shown are approximations only (+/- 1/4")
- Diagrams, illustrations and photographs are not to scale – consult installation instructions. Product designs, materials, dimensions, specifications, colors and prices are subject to change or discontinuance without notice.
- Approved for residential, manufactured home, and alcove installations.
- Optional Kits Available:  
Door Trim Kit  
Blower  
Outside Air Kit  
Louvers  
Legs (choice of three styles)  
Pedestal  
Ash Drawer for legs or for pedestal

- ① Square-foot heating capacities and burn times are approximations only. Actual performance may vary depending upon home design and insulation, ceiling heights, climate, condition and type of wood used, appliance location, burn rate, accessories chosen, chimney installation and how the appliance is operated.

Specifications

Listing

Stove Pipe Diameter Single Wall or Double Wall	6" (152 mm)
Log Length	16" W x 18" D Max. (406mm W x 457mm D Max.)
Firebox	17" W x 19" D x 12-1/2" H Max. (432mm W x 483mm D x 318mm H Max.) Volume = 2.3 cu. ft.
Glass Viewing Area	16-1/2" W x 11-5/16" H (419mm W x 287mm H)
EPA Test Load: Cord Wood: ①	28,200 BTUs/hr. 76,000 BTUs/hr.
Maximum Burn Times ①	12 hours
Heating Capacity ①	1200 to 2200 sq. ft.
EPA Grams Per Hour	3.6 gr/hr
EPA Phase II and Washington State Approved	

The Grandview™ Model GV230 woodstove is safety listed with the following agency:

- Intertek, Tested to UL 1482, ULC S627



Dimensions

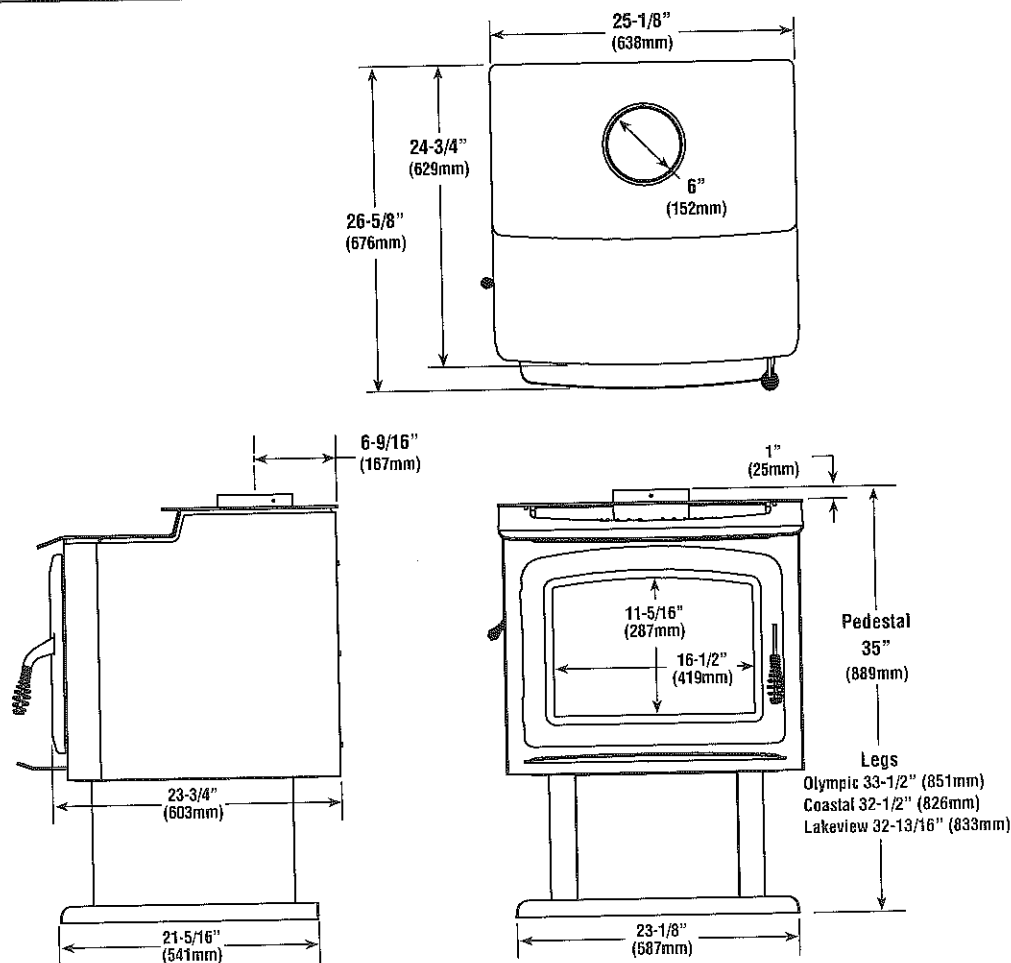
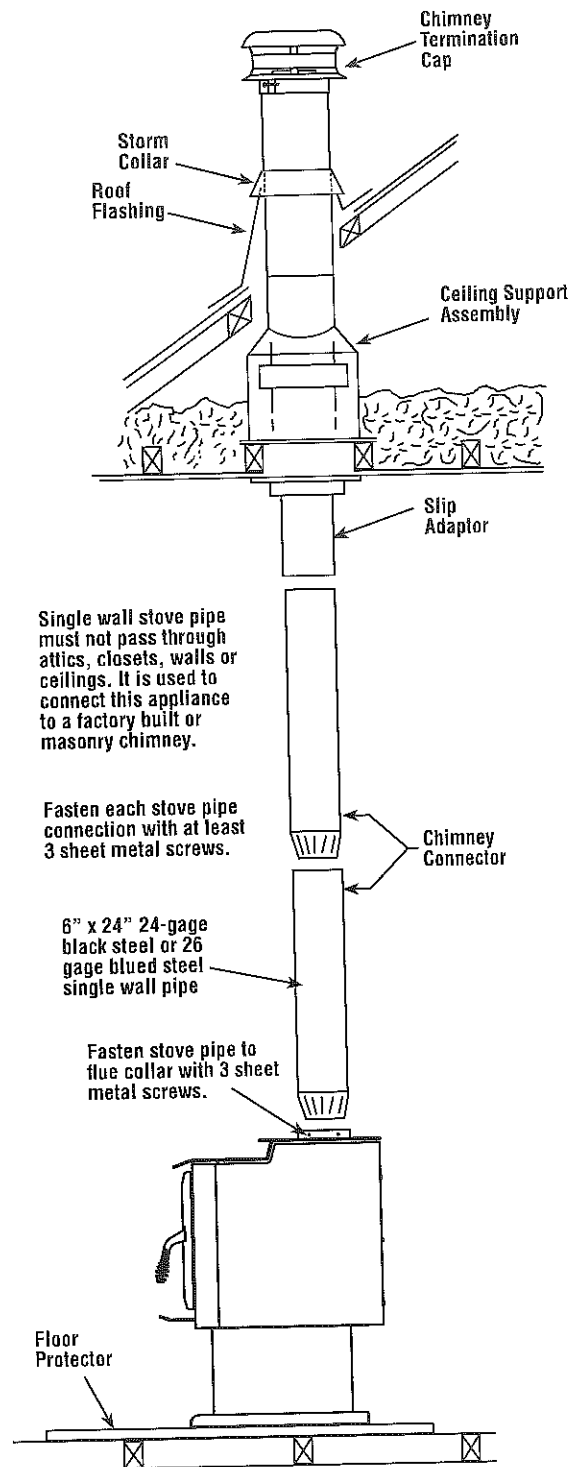


Figure 5

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

**Single Wall Pipe**  
Using 6" Diameter Single Wall Connector Pipe

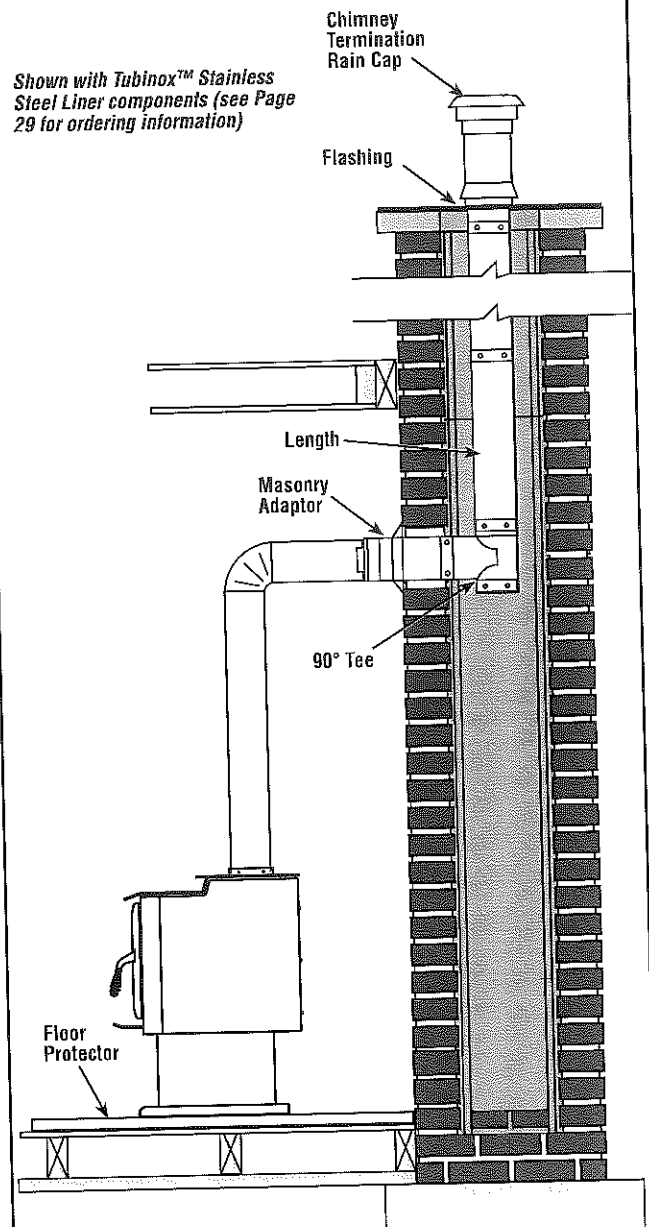
**INSTALL VENTING SYSTEM PER VENT MANUFACTURERS INSTRUCTIONS!**



**Figure 6 - Typical Installation**

**STAINLESS STEEL LINER**  
Using 6" Diameter Rigid Stainless Steel Liner

**INSTALL VENTING SYSTEM PER VENT MANUFACTURERS INSTRUCTIONS!**



**Figure 7 - Connected to a Masonry Chimney**

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

## CHIMNEY INSTALLATION

- Install chimney as per manufacturer's instructions. Some brands of pipe may require removal of the spacer ring in the flue collar.
- All horizontal runs of pipe should be as short as possible and are required by NFPA No. 211 to have an upward pitch or rise in the same direction the smoke travels of no less than 1/4" to the linear foot. The connector pipe must meet minimum clearances in any direction to walls or other combustible materials. It must attach to a listed double wall metal chimney at least 6" in diameter or to a masonry chimney with a flue passage of at least 48 square inches.
- It is required that a chimney connector pipe not extend further than the inner wall of the flue when it is connected to a masonry chimney and that it either be cemented to the masonry or be installed without cement in a thimble connected to the masonry wall. When the connector is inserted into a thimble, the joint must be tight enough so that it will not be dislodged in normal use. Install connector at no less than the minimum clearances from the ceiling when using a 90-degree elbow to pass through combustible constructions.
- Chimney connector pipes should never pass through a floor, ceiling, fire wall, partition, or combustible construction of any type unless certain precautions are taken. The best method is to use a listed thimble and a listed chimney in accordance with the manufacturer's directions. NFPA No. 211 gives approved methods for passing a flue pipe through combustible constructions (see *Page 12*).

### Manufactured Home Installations (ref. *Figure 8*)

This appliance is approved for installation into a manufactured (mobile) home.

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

All mobile home installations require an outside air kit (see *Page 28* for ordering information). The stove must be secured to the floor and grounded to the chassis of the mobile home (see *Page 14* for detailed instructions).

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

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

**Approved Chimney\*** - Your stove is approved for use with Class A, UL 103 HT (U.S.) / ULC-S629 (Canada) Listed Residential Type and Building Heating Appliance Chimney (HT chimney - 2100° Fahrenheit) and double wall connector pipe from **Security Chimneys™**.

Clearances to connector shall be measured from 6" flue collar. Restrictions apply! Read instructions before installing.

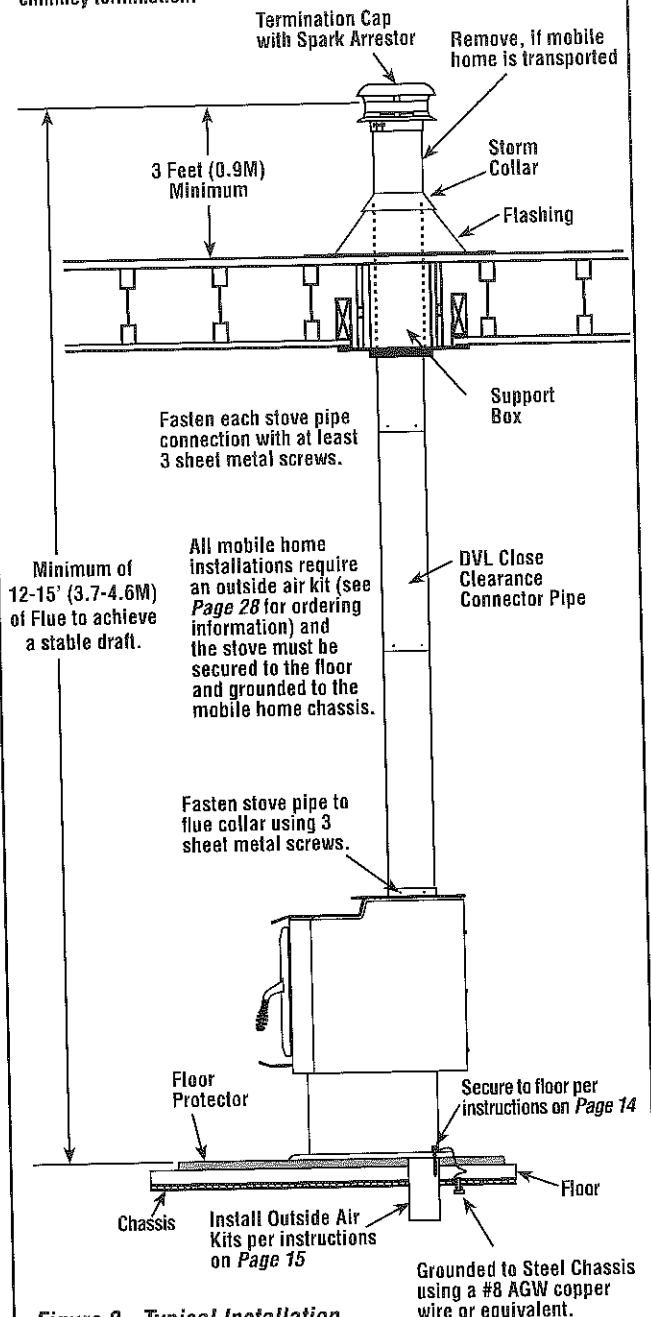
**YOUR CHIMNEY INSTALLATION MUST COMPLY WITH LOCAL BUILDING AND FIRE CODES.**

\* Other approved chimney brands are Jakes Evans/GSW, Dura-vent, Metal Fab, Ameri-Tec, Metalbestos and Industrial Chimney (ICC).

### Double Wall Pipe Using 6" Diameter Type L-Vent Connector Pipe Mobile (Manufactured) Home Installation Shown

#### INSTALL VENTING SYSTEM PER VENT MANUFACTURERS INSTRUCTIONS!

Mobile home installations require a spark arrestor at the chimney termination.



**Figure 8 - Typical Installation**

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

**Chimney Connector Systems and Clearances from Combustible Walls for Residential Heating Appliances (NFPA 211) Refer to Figure 9**

**System A.** Minimum 3.5 in. (90 mm) thick brick masonry wall framed into combustible wall with a minimum of 12 in. (305 mm) brick separation from clay liner to combustibles. Fireclay liner (ASTM C 315, Standard Specification for Clay Flue Linings, or equivalent), minimum 5/8 in. (16 mm) wall thickness, shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.

Clearance: 12 in. (305 mm)

**System B.** Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1 in. (25.4 mm) or more of insulation with a minimum 9 in. (229 mm) air space between the outer wall of the chimney length and combustibles.

The inner end of the chimney length shall be flush with the inside of the masonry chimney flue and shall be sealed to the flue and to the brick masonry penetration with non-water-soluble refractory cement. Supports shall be securely fastened to wall surfaces on all sides.

Fasteners between supports and the chimney length shall not penetrate the chimney liner.

Clearance: 9 in. (229 mm)

**System C.** Sheet steel chimney connector, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, with a ventilated thimble, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, having two 1 in. (25.4 mm) air channels, separated from combustibles by a minimum of 6 in. (152 mm) of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness.

Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

Clearance: 6 in. (152 mm)

**System D.** Solid-insulated, listed factory-built chimney length with an inside diameter 2 in. (51 mm) larger than the chimney connector and having 1 in. (25.4 mm) or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gauge [0.024 in. (0.61 mm)] thickness, with a minimum 2 in. (51 mm) air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12 in. (305 mm). Chimney section concentric with and spaced 1 in. (25.4 mm) away from connector by means of sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports of minimum 24 gauge [0.024 in. (0.61 mm)] thickness.

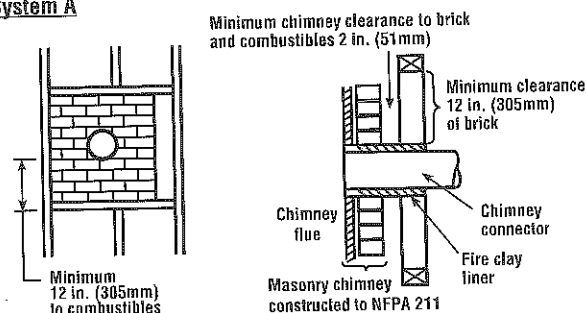
Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

Clearance: 2 in. (51 mm)

**Additional requirements:**

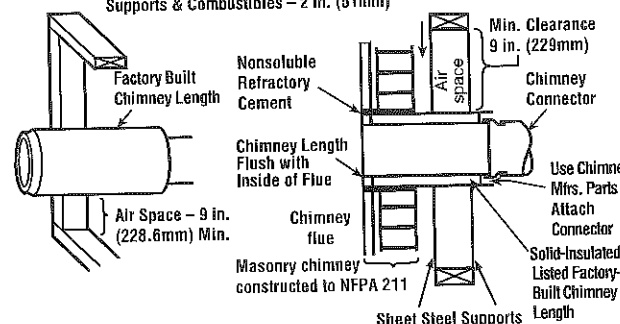
1. Insulation material used as part of wall pass-through system shall be of noncombustible material and shall have a thermal conductivity of 1.0 Btu-in./hr-ft<sup>2</sup> - °F (4.88 kg-cal/hr-m<sup>2</sup> - °C) or less.
2. All clearances and thicknesses are minimums; larger clearances and thicknesses shall be permitted.
3. Any material used to close up an opening for the connector shall be of noncombustible material.
4. A connector to a masonry chimney, except for System B, shall extend in one continuous piece through the wall pass-through system and the chimney wall to the inner face of the flue liner, but not beyond.

**System A**



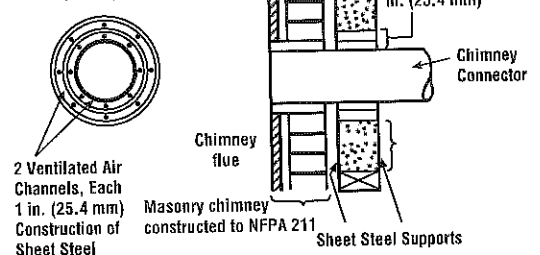
**System B**

Minimum Chimney Clearance from Masonry to Sheet Steel Supports & Combustibles - 2 in. (51 mm)



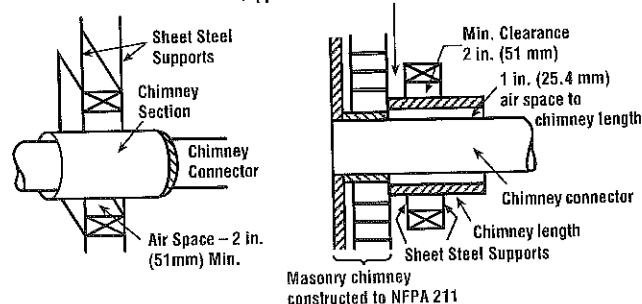
**System C**

Minimum chimney clearance to sheet steel supports and combustibles 2 in. (51 mm)



**System D**

Minimum chimney clearance to sheet steel supports and combustibles 2 in. (51 mm)



**Figure 9 - Chimney Connector Systems and Clearances from Combustible Walls**

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

## LEG INSTALLATION

### Residential and Mobile Homes

(Tieing down and grounding are required only in mobile homes)

Open all cartons, if any and remove the contents upon receipt and check for any damaged or missing parts. If there is hidden damage, notify your freight company or Lennox Hearth Products dealer immediately.

**CAUTION:** Wear gloves during installation in case of sharp edges on the stove.

### Leg Installation

1. Carefully place stove on it's back. Be careful not to scratch the stove, use a piece of cardboard or carpet to protect the back of the stove.
2. Using a 9/16" wrench or socket remove the bolt in each of the four corners along with the attached shipping brackets.
3. Remove legs from the packaging and using the bolts and washers that come with the legs install each leg in each corner with one bolt and one washer.
4. Before the legs are fully tightened down make sure that they are aligned correctly to match the front and side planes of the stove.
5. The stove can now be set up on the legs making sure that all baffle boards and bricks are set back in place. These items may have shifted when the stove was placed on it's back.
6. If it is necessary to level, secure, or ground your stove, use the holes in the bottom of the leg for those applications. To level the stove use leg leveling kit (P/N H8407) or leveling pads (P/N H7638). Level by adjusting the bolt or leveling pad down on each leg that is not in full contact with the hearth or surface below that the stove is located on.

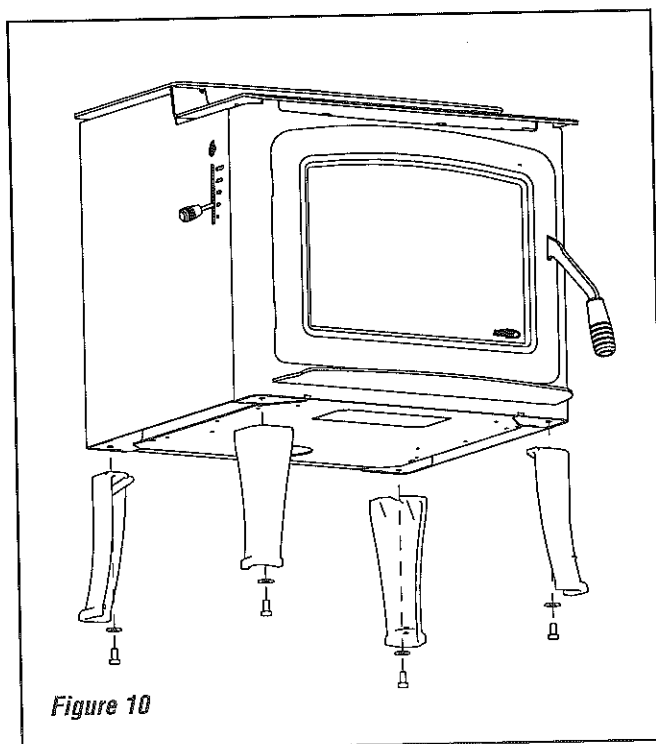


Figure 10

## PEDESTAL INSTALLATION

### Residential and Mobile Homes

(Tieing down and grounding are required only in mobile homes)

Open all cartons, if any and remove the contents upon receipt and check for any damaged or missing parts. If there is hidden damage, notify your freight company or Lennox Hearth Products dealer immediately.

**CAUTION:** Wear gloves during installation in case of sharp edges on the stove.

### Pedestal Installation

1. Remove the heater from the carton, if packaged, upon receipt and check for any damaged or missing parts.
2. Install the 10-24 screws included with the pedestal kit to the bottom of the stove as seen in **Figure 11**. You will need a 5/32" allen wrench to complete this.
3. Carefully place stove on it's back. Be careful not to scratch the stove, use a piece of cardboard or carpet to protect the back of the stove.
4. The pedestal will have key hole slots that line up with the screws that were placed in the bottom of the stove. Carefully install pedestal on the installed screws with the open end of the pedestal towards the rear of the stove.
5. Assuring that the pedestal is placed correctly in slots then tighten all six screws.
6. The stove can now be set up on the pedestal making sure that all baffle boards and bricks are set back in place. These items may have shifted when the stove was placed on it's back.
7. When installing a pedestal on this stove you **MUST** plug the one leg mounting bolt hole, located on the bottom of the stove in the front left corner, with the bolt that was used to mount the shipping legs. **FAILURE TO INSTALL THIS BOLT PROPERLY WILL RESULT IN REDUCED CONTROL OF THE STOVE'S COMBUSTION SYSTEM!**

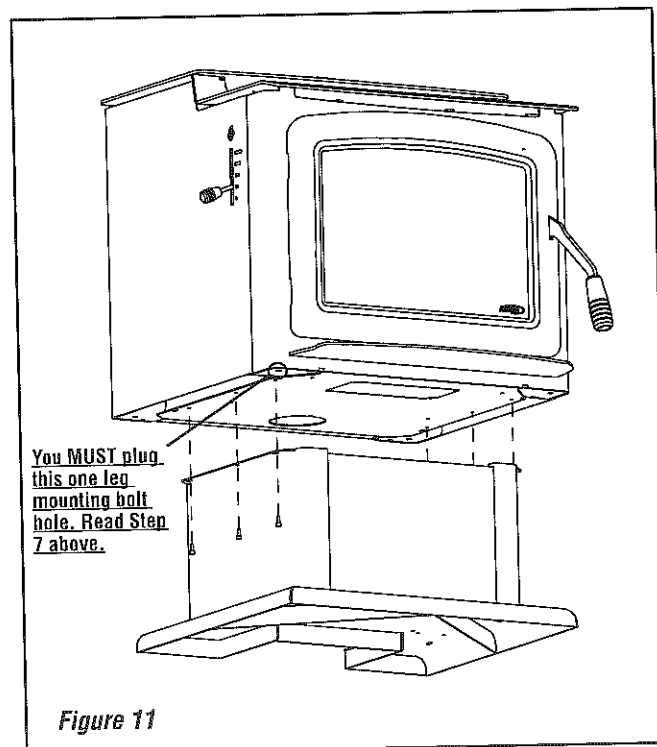


Figure 11

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

## ATTACHING STOVE TO MANUFACTURED HOME FLOOR

### Leg Tie Down Kits (Manufactured [mobile] Homes)

#### Order:

H7665 Leg Tie Down Kit, Coastal and Lakeview Legs

H5308 Leg Tie Down Kit, Olympic Legs

## ATTACHING STOVE TO MANUFACTURED HOME FLOOR

THE STOVE MUST BE ATTACHED TO THE FLOOR AT NO LESS THAN TWO POINTS

### Pedestal

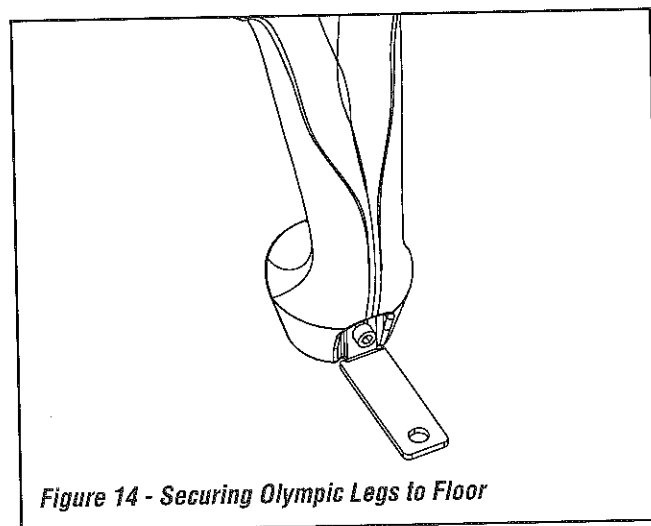
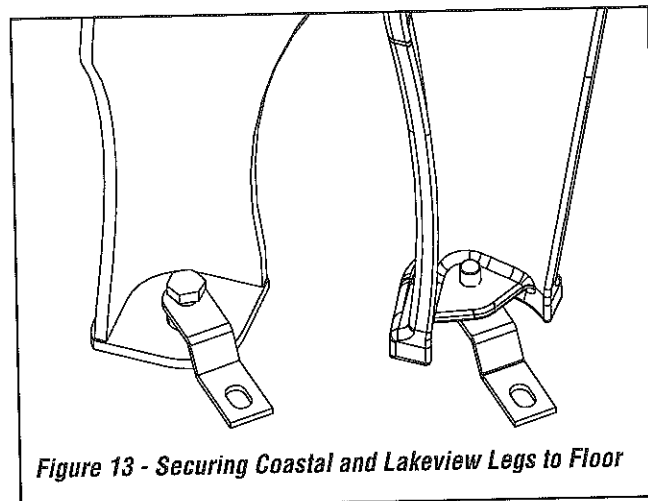
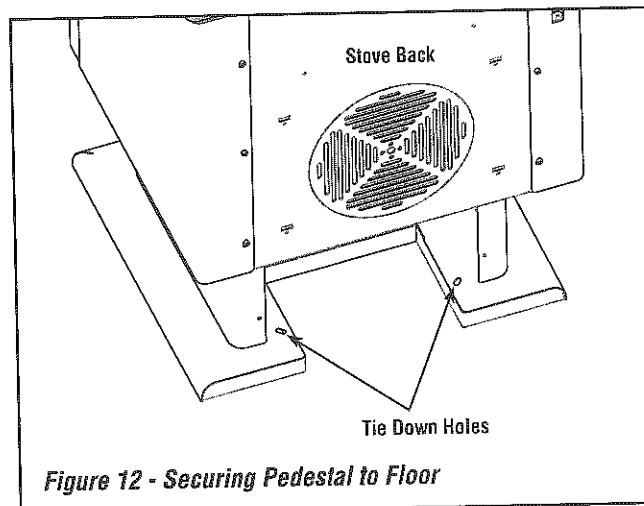
Locate the two holes on the back of the pedestal (*Figure 12*). Secure the pedestal to the floor using two field provided 1/4" screws.

### Lakeview and Coastal Legs

Connect the bolt down bracket to each leg using kit (P/N H7665) screw as shown in *Figure 13*. Secure the leg bracket to the floor using one field provided 1/4" bolt.

### Olympic Legs

Connect the bolt down bracket to each leg using kit (P/N H5308) screw as shown in *Figure 14*. Secure the leg bracket to the floor using one field provided 1/4" screw.



## OUTSIDE COMBUSTION AIR KIT INSTALLATION

### Outside Air Kits

#### Order:

- 1 ea. P/N UZIAD Outside Air Coupler Kit (connects outside air ducting, UZI, to stove)  
**AND**  
 1 ea. P/N UZI Outside Air Ducting Kit (includes 4" insulated flex x 10' long)

An outside air kit is required in Manufactured (mobile) Home installations. For residential installations, check with local authorities having jurisdiction in your area, it may be mandatory.

### Outside Air Kit Coupler

To install the outside air kit coupler onto the stove, line up the "V" notch in the coupler with the "V" notch in the open on the bottom of the stove. Push and twist so the rolled edge catches the bottom of the stove and continue turning full 360° to lock the coupler in place.

### Through the Wall Outside Air Kit Installation (refer to Figures 15, 16 and 17)

The outside air assembly may be installed according to the following requirements:

- Duct length should be kept to a minimum.
- The air intake register must not be installed more than ten (10) feet (3050 mm) above the base of the stove.
- The fresh air must come from outside the house. The air intake must not draw air from the attic, from the basement or garage.
- The air intake should be installed where it is not likely to be blocked by snow or exposed to extreme wind and away from automobile exhaust fumes, gas meters and other vents.
- The duct and register may be installed above or below floor level.

- Make a 4-1/4" (110 mm) hole in the outside wall of the house at the chosen location. From outside, place the outside air register in the hole (open side down) and fasten the register to the wall, with screws as shown (see Figure 17).
- Install the coupler onto the existing collar on stove (see Figure 15).
- Attach the duct to the coupler on stove (see Figure 16). Using the aluminium tape provided, wrap the tape around the joint between the flexible duct and the air inlet.

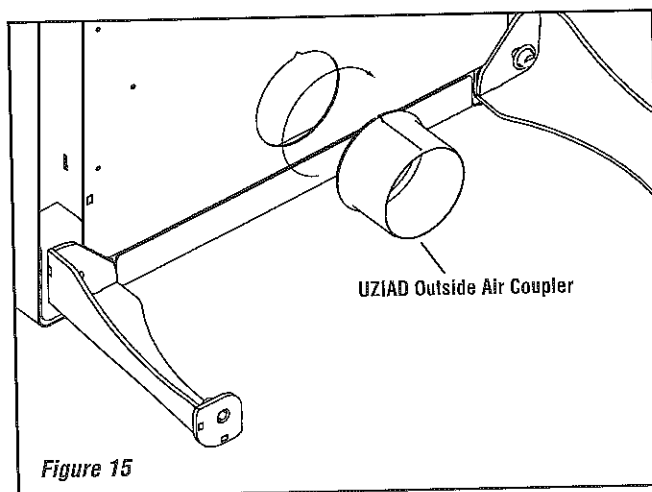


Figure 15

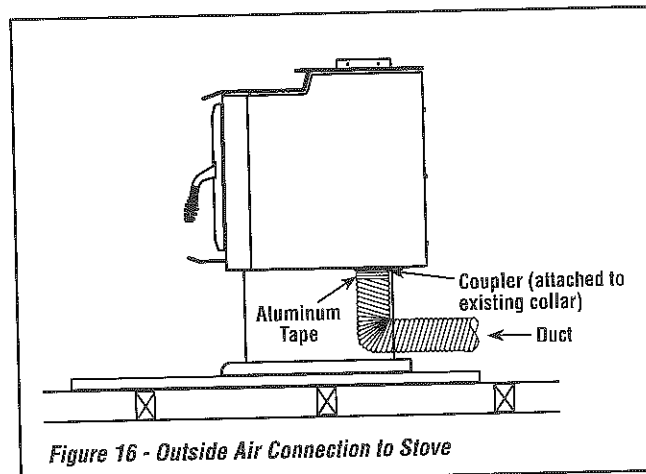


Figure 16 - Outside Air Connection to Stove

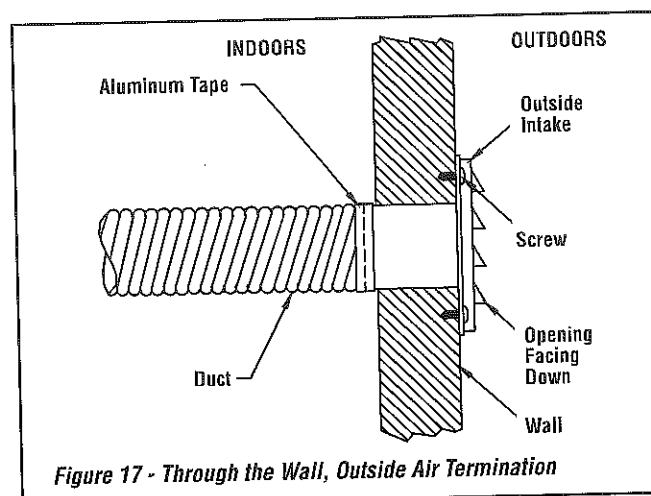


Figure 17 - Through the Wall, Outside Air Termination

### Manufactured Home Through the Floor Outside Air Kit Installation (refer to Figure 18)

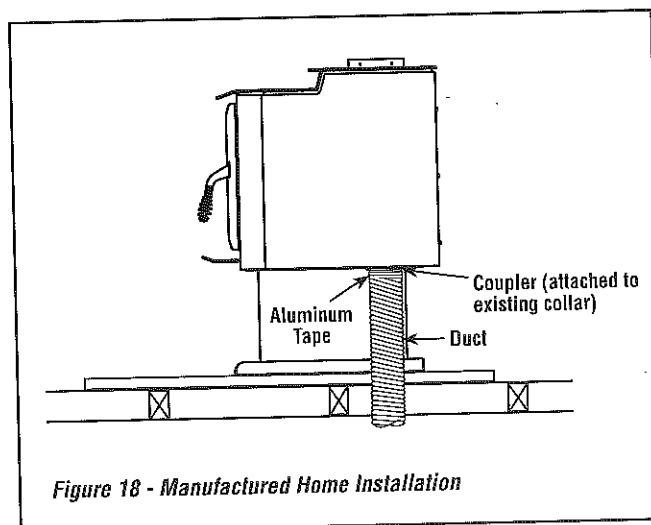


Figure 18 - Manufactured Home Installation

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

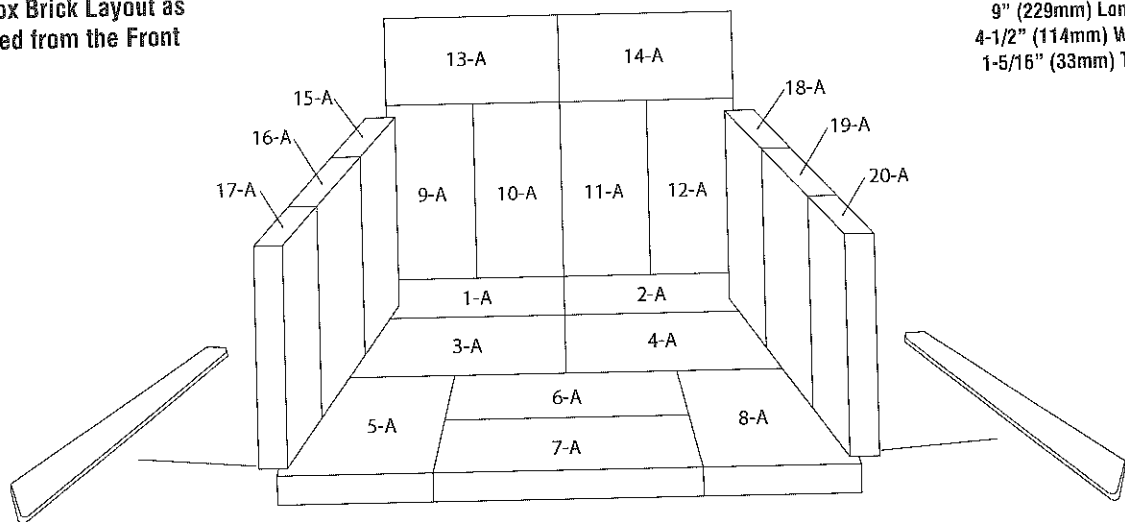
## BRICK AND BAFFLE INSTALLATION

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

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

1. Install firebox bottom brick spacers on both the left and right side of firebox. The brick spacers are located in the package with the manual. Assure that brick spacers are pushed to each side until they are in full contact with the firebox side on each side.
2. Install brick #1-20 in the numbered sequence shown in *Figure 19*.
3. Brick's 13 and 14 will be located between the steel firebox and rear baffle board (already installed).
4. Once all bricks are installed confirm that the already installed baffle boards are in there correct location and resting on the secondary burn tubes.

Firebox Brick Layout as Viewed from the Front



Letter A Brick Are Full Size  
9" (229mm) Long x  
4-1/2" (114mm) Wide x  
1-5/16" (33mm) Thick

Figure 19

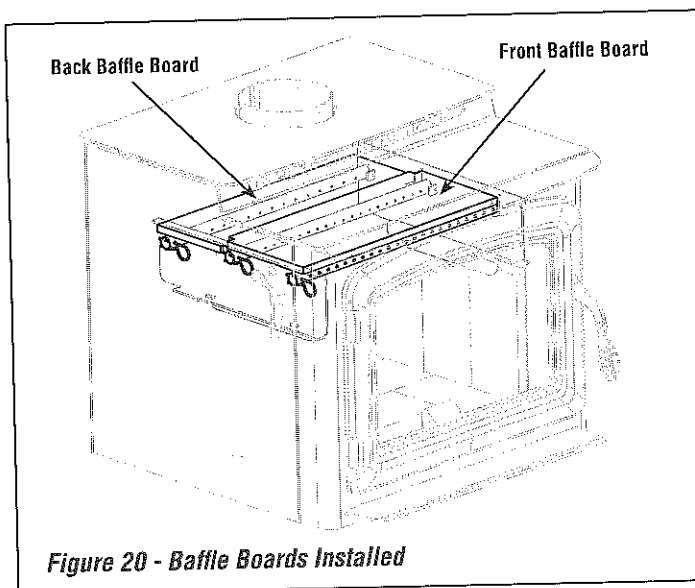


Figure 20 - Baffle Boards Installed

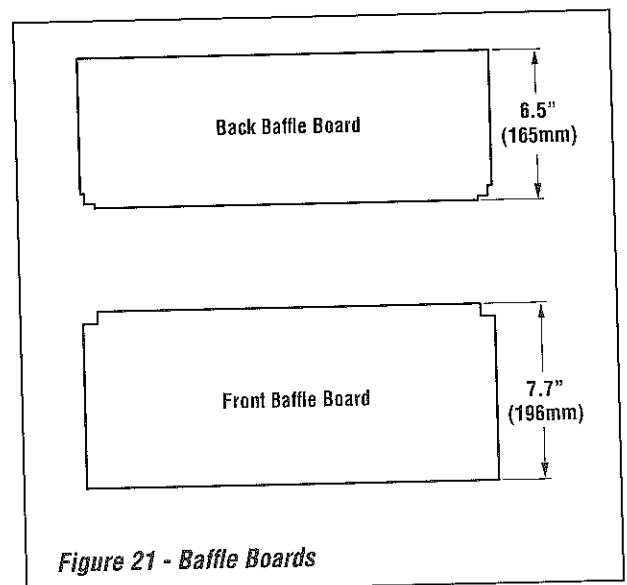
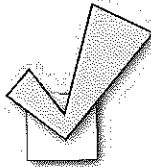


Figure 21 - Baffle Boards

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

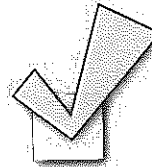
### FOR MOBILE HOME INSTALLS:

- ☐ Be sure the stove is properly grounded
- ☐ Be sure the stove is properly securely fastened to the floor
- ☐ Be sure the outside air vent is free of obstructions and has a mesh screen in place



### POST INSTALLATION CHECKS

- ☐ Check that all chimney pipe joints are secured and installed according to the manufacturers instruction.
- ☐ If used, make sure the outside air kit is properly installed and unobstructed.
- ☐ Make sure the legs or pedestal are securely fastened to the stove.
- ☐ Double check all stove clearances.
- ☐ Be sure bricks and baffle boards are properly installed.
- ☐ If plated accessories are used, be sure surfaces are clean prior to firing the stove.  
See Page 18



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

## PAINT CURING

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

Your new Grandview™ 230 is painted with a high temperature paint that cures during the first few firings. We recommend that you put your stove or fireplace insert through a regimen of three burns. The first two should last for 20 minutes each at 250 degrees (the stove or fireplace insert should be allowed to cool completely between each burn). The third should be a burn of at least 450 degrees F. for 45-60 minutes. The paint will become soft, gummy and emit non-toxic smoke during these burns. During these first burns, open the appliance door frequently to help prevent the door gasket from adhering to the appliance. After the stove or fireplace insert cools down for the third time, the paint will harden. **DO NOT BUILD A LARGE ROARING FIRE UNTIL THIS CURING EFFECT IS COMPLETE OR YOU MAY DAMAGE THE FINISH OF YOUR STOVE.** Spray can touch-ups should be done only with a high temperature stove paint (cat. no. H8159), available from all Lennox Hearth Products dealers.

## BURN-IN PERIOD

Please be patient with the heat output of your stove or fireplace insert for the first few weeks. The steel will go through a curing process that eliminates moisture, which is deep in the steel and firebrick. This moisture will reduce initial heat output of your stove or fireplace insert and may make it difficult to start. **(DO NOT OVERFIRE THE STOVE DURING THIS PROCESS. IF THE STOVE OR CHIMNEY BECOMES RED, REDUCE THE AMOUNT OF AIR ENTERING THE STOVE IMMEDIATELY).**

## OPERATING HINTS

1. Burn only dry, well-seasoned cord wood. In some states it is illegal to burn wet wood or anything other than clean, dry wood products.
2. Your stove or fireplace insert is designed to operate with the door closed! Operate only with the door shut tightly at all times except when loading wood and possibly on start up to establish a draft. Never leave the unit unattended while the front door is opened.
3. **DO NOT** contact or move the baffle boards while loading wood. Occasionally check the baffle to assure that the boards are in their correct location.

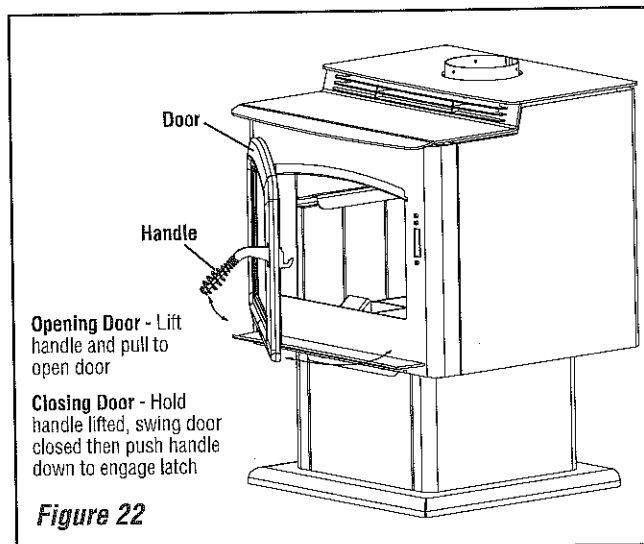
4. **CAUTION: THE DRAFT CONTROL MUST BE FULLY OPEN BEFORE OPENING THE DOOR TO AVOID POSSIBLE COMBUSTION FLASH!!** (Ignition of hot volatile gases as the door is opened).
5. Feeding excessive amounts of fuel to the stove or fireplace insert should be avoided. It is important to supply it with sufficient draft and fuel to maintain a moderately hot fire. If, during overnight burns, heavy creosote deposits develop inside your stove and on the door, the draft is set too low - review your burning habits!

## DOOR OPERATION

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

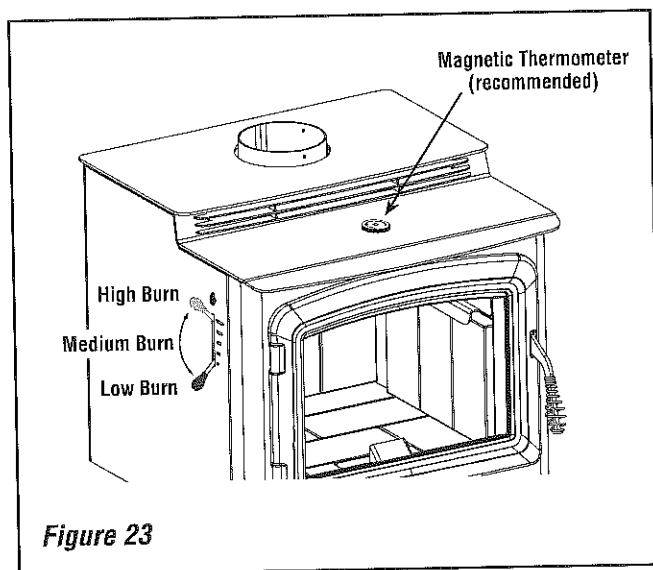
## ⚠ WARNING

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



## STARTING AND MAINTAINING A FIRE

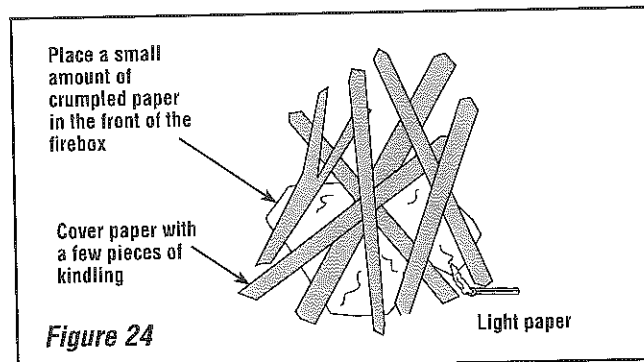
1. **NEVER USE FLAMMABLE LIQUIDS TO START OR REKINDLE A SOLID FUEL FIRE!!**
2. Fully open the primary draft control by placing draft control (wood handle located on left side of the stove) in the highest position. This control determines the amount of air entering the stove. Lowering this control reduces the burn rate of the stove. For your convenience, the control is marked with five positions to assist you in obtaining repeatable burn rates.
3. Place a small amount of crumpled paper in the front of the firebox and cover it with a few pieces of kindling.
4. Light the paper and allow sufficient time for the kindling to become fully engulfed in flames. You will now close the wood units front door. Your wood units front door may or may not need to be left slightly open during this start up process, this depends on the stove model and the amount of draft present.
5. When operating any wood burning appliance, it is important to become familiar with how the damper control affects heat output and the overall temperature of the appliance. A stove thermometer can be a helpful tool to help ensure you are not over-firing your appliance and it will also ensure you are burning fuel at a rate that is most efficient. Place a stove thermometer on the top of the appliance as shown in *Figure 23*. Monitor the temperature every 15 minutes or so until you become more familiar with your appliance. Close the damper all the way down if you begin to reach 500 degrees, as this is a sign that you are operating your appliance at too high a temperature.



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

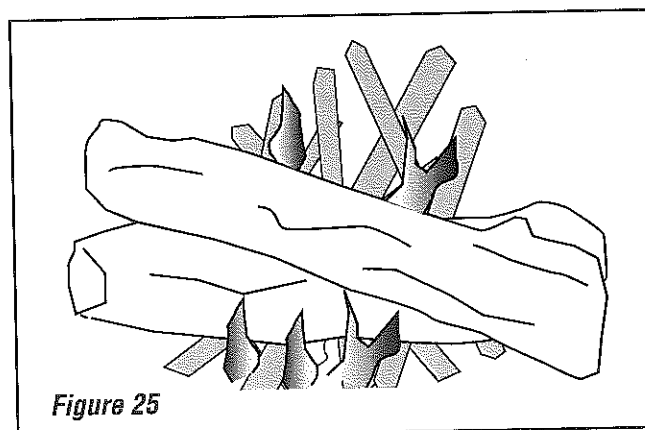
**CAUTION:** Do Not alter the adjustment range of the draft control for increased firing for any reason.

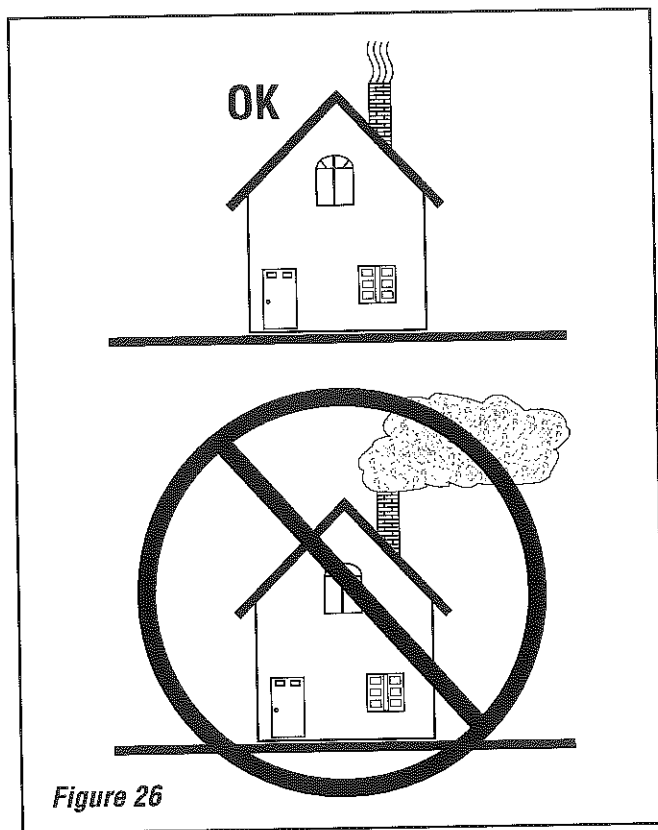
**Operate only with fuel door and ash drawer closed. Maintain all seals in good condition. Do not operate with broken glass.**



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

6. Once kindling is burning well, larger pieces of wood may be added, then the door should be fully closed if there was the need to keep it slightly open during start up.
7. For best results, use smaller pieces of wood to get the stove or fireplace insert temperature very high before loading larger wood for sustained burns. If necessary, crack the door to allow ignition of the fuel charge. Now you can add larger pieces of wood and after several minutes of high burn, set the left control for the desired heat output. Check the exhaust in about 15 to 20 minutes (see *Figure 26*). Large amounts of smoke indicate an improper burn setting (either too high or too low). Adjust and recheck in 5 to 10 minutes.





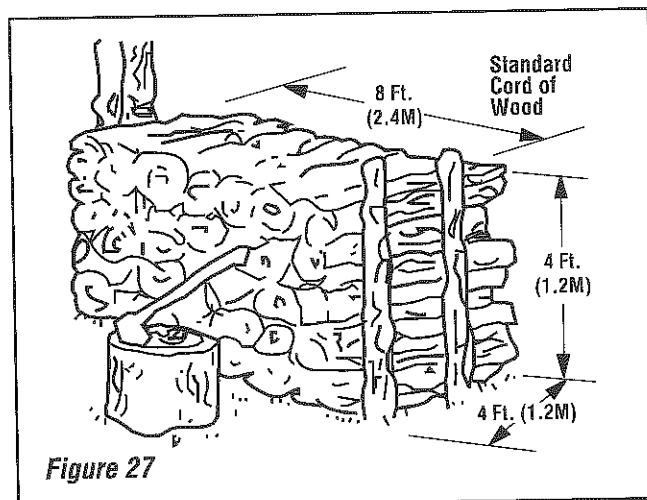
## FUEL

This appliance is designed and engineered to burn, dry, well-seasoned wood only.

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

Your stove will not operate at the level that it is meant to unless you use seasoned, dry wood. Do not burn driftwood or wood that has been in salt water, doing so will void your warranty. Do not burn incorrect fuels such as flammable liquids, grease, treated wood, coal, garbage, cardboard, solvents, or colored paper. Burning treated wood, garbage, solvents, or colored paper may result in the release of toxic fumes. This type of burning will also void your warranty.

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



**What does "Well-Seasoned" mean?**

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

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

### Seasoning Guide

Softwoods – 6 months to 18 months

Hardwoods – 12 months to 24 months

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

## GETTING THE MOST OUT OF YOUR STOVE

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

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

## MAXIMIZING YOUR STOVE'S OVERALL EFFICIENCY

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

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

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

1. Thoroughly preheat your stove before slowing the burn rate by closing the draft control.
2. When loading wood into a preheated stove or fireplace insert, allow a vigorous fire to build before lowering the draft control.
3. Operate your stove as much as possible in the low to medium burn ranges.
4. Do not lower the draft setting so low as to completely extinguish the flames in the firebox. Check for at least some small flames twenty minutes after setting the draft control.
5. Do not continually operate your stove or fireplace insert in the high (wide open) setting. This wastes wood by carrying a great deal of heat up the chimney and can damage your stove or fireplace insert and chimney.
6. Go outside and check your chimney. More than a very small amount of smoke indicates wasted heat, creosote build up and pollution (*see Figure 26*).

## ACHIEVING CLEAN, LONG BURNS

To achieve long burn times, after having thoroughly preheated the stove, load the firebox without blocking the small air opening found in the center front of the firebox. At this point, you may need to burn the stove with the draft open for a few minutes to ignite the wood. All Lennox Hearth Products stoves are EPA tested for emissions at low burn with the air control completely closed. Whether or not you should burn your stove with the air control completely closed will depend on the following factors:

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

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

## BLOWER OPERATION (OPTIONAL KIT)

### Blower Operation

The blower can be operated in either manual or automatic mode. When operated automatically, the blower will turn on when the stove is hot, and turn off when the stove is cool.

— **MANUAL OPERATION:** Flip blower mode switch to the manual position (up) and adjust blower speed dial to desired setting. To turn blower off, rotate blower speed dial counter clockwise until it clicks "off."

— **AUTO OPERATION:** Flip blower mode switch to auto position and turn blower speed dial clockwise until it clicks out of the "off" position. When the stove warms up (approx. 15-20 Mins), the blower will automatically turn on (adjust blower speed dial to desired speed setting). When the stove or insert cools down, the blower will automatically turn off.

### Blower Operation Guidelines

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

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



Figure 29 - Blower Controls

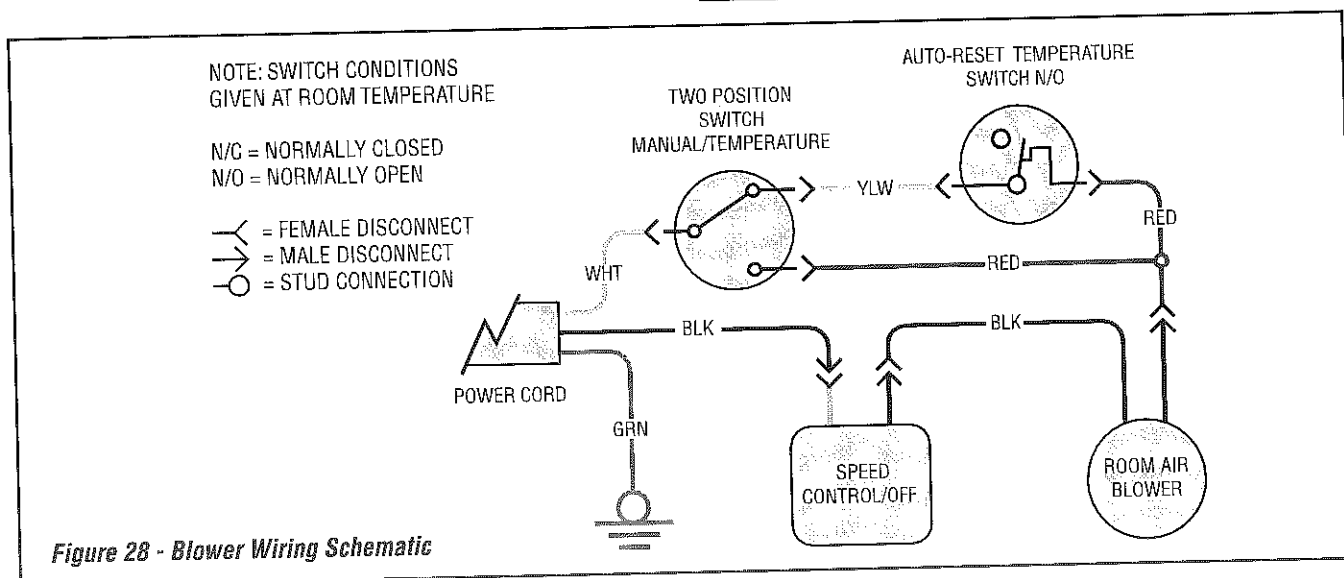
## ⚠ WARNINGS

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

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

**DANGER:** Disconnect power before servicing blower.

In the event that you remove the blower for any reason, make sure a cover plate (available from Lennox Hearth Products) is installed before using the heater. Excessive rear wall temperatures will result if the stove is burned without the cover plate. The cover plate is not necessary if a blower has never been installed because a knock-out will be in place to act as the cover.



NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

## DO'S AND DON'TS

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

## MAINTENANCE

### GLASS REPLACEMENT INSTRUCTIONS

(Refer to Figure 30)

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

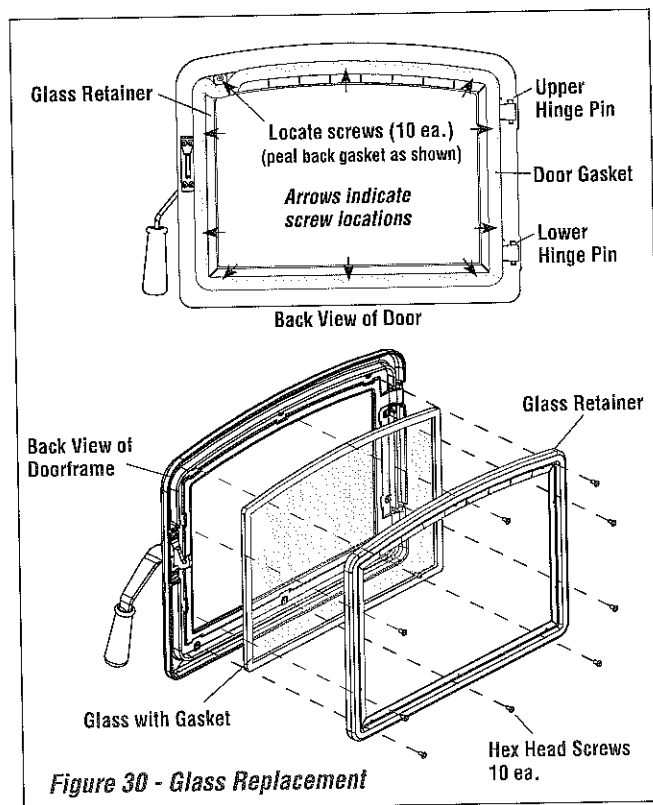


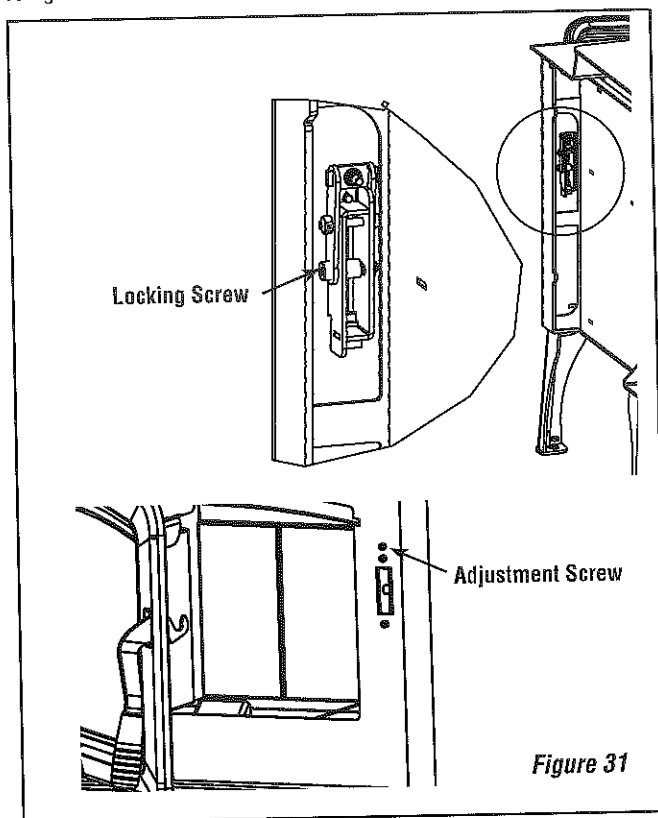
Figure 30 - Glass Replacement

NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

## MAINTENANCE

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

**DOOR LATCH:** Adjustment Instructions - Remove the right side heat shield by loosening the 3 screws located on the back of the stove. Using a "L" shaped 5/32" allen wrench, loosen the locking screw in the latch assembly as shown in **Figure 31**. With the locking screw loosened, adjust the top 5/32" allen screw (**Figure 31**) in the front of the stove to adjust the door tension. Turning the screw to the right will tighten the door, turning the screw to the left will loosen the door. When you loosen the door it will be easiest to pull the roller pin to the full forward position and make slight adjustments to tighten to the desired tension. Assure that the tension on the front door creates a good seal between the gasket on the front door and the firebox front. After adjusting the door tension, re-tighten the lock screw and replace the heat shield.



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

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

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

### GLASS CLEANING GUIDELINES

#### WARNING: DO NOT CLEAN GLASS WHEN APPLIANCE IS HOT!

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

- Ensure the stove is cold prior to cleaning glass.
- This appliance is designed to provide a flow of air over the inside of the glass, where along with high heat helps inhibit build-up on the glass. When build-up occurs, a commercial glass cleaner designed for stoves is recommended. Regular household glass cleaners will not clean creosote.

- Do not use abrasives such as steel pads, steel wool or oven cleaner as they will scratch the glass. Never scrape glass with a razor blade as this may pit the glass and make it impossible to clean in the future.
- Do not use chemical glass cleaners as they may damage the gaskets or painted surfaces.

### TIPS FOR KEEPING THE GLASS CLEAN

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

### CREOSOTE FORMATION AND NEED FOR REMOVAL

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire.

The chimney and chimney connector should be inspected at least once monthly during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated (1/8" [3 mm] or more), it should be removed to reduce the risk of a chimney fire.

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

### DISPOSAL OF ASHES

Ashes should be scooped out of a cool stove or fireplace insert with a small metal shovel. Ashes should be placed in a steel container with a tight fitting lid and moved outdoors immediately. Other waste shall not be placed in this container. The closed container of ashes should be placed on a non-combustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all the cinders have thoroughly cooled. Ashes can ignite up to 72 hours after removal from the appliance.

## CAUTION

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

## WARNINGS

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

## TROUBLESHOOTING

### Problem

### Solution

#### POOR DRAFT:

Extend chimney in length or have the chimney realigned to the proper size flue. Oversized chimneys normally have poor drafts. Remember, the stove or fireplace inserts' draft depends solely on the natural draft of the chimney (See Draft Requirements on **Page 4**). If your stove or fireplace insert is not drafting properly, your chimney is the problem. All stoves are thoroughly tested to ensure proper draft with the correct size chimney flue.

#### EXCESSIVE DRAFT:

With better chimneys being more common, excessive draft can be an issue. Alleviate excessive draft by slowing the burn rate of the stove or fireplace insert once it has reached proper operating temperature (See Maximizing Your Stoves Overall Efficiency on **Page 21**).

#### DIRTY GLASS:

- 1) Burn smaller, hotter fires and check to make sure you are not setting the draft down too far with the draft control.
- 2) Make sure your wood is well-seasoned and dry (not open to rain - see Creosote **[Page 24]** and Fuel **[Page 20]** sections).
- 3) See Poor Draft section (above) and Cleaning Glass on **Page 24**.

#### SMOKES WHEN DOOR IS OPEN:

- 1) If smoke is entering the room, check to make sure your baffle boards are properly installed.
- 2) Check the chimney for blockage due to creosote (see Chimney **[Page 6]** and Creosote **[Page 24]** sections).
- 3) Check draft (See POOR DRAFT section above).

#### WOOD BURNS TOO FAST:

- 1) The draft control must be closed further.
- 2) Add fuel at lower firebox temperatures.
- 3) Load wood side to side and reduce the flow of air under wood.
- 4) The door seal may need replacing, check for leakage.
- 5) See "Excessive Draft."

#### POOR HEAT OUTPUT:

- 1) Check your wood. Wet, moist, unseasoned wood will not produce heat.
- 2) Your stove or fireplace insert needs to be seasoned (moisture removed from the steel and brick). Continue to burn a fire. It normally takes from one to three weeks of burning to season your stove (See Burn-In procedures on **Page 18**).
- 3) See Excessive Draft section above.

#### PAINT GIVES OFF ODOR (smoke):

Paint is tempering-in. Burn only moderately hot for the first few days until paint is fully cured. Then burn a very hot fire to cure any paint that may not easily cure. Open windows or door to ventilate (See Burn-In Period on **Page 18**).

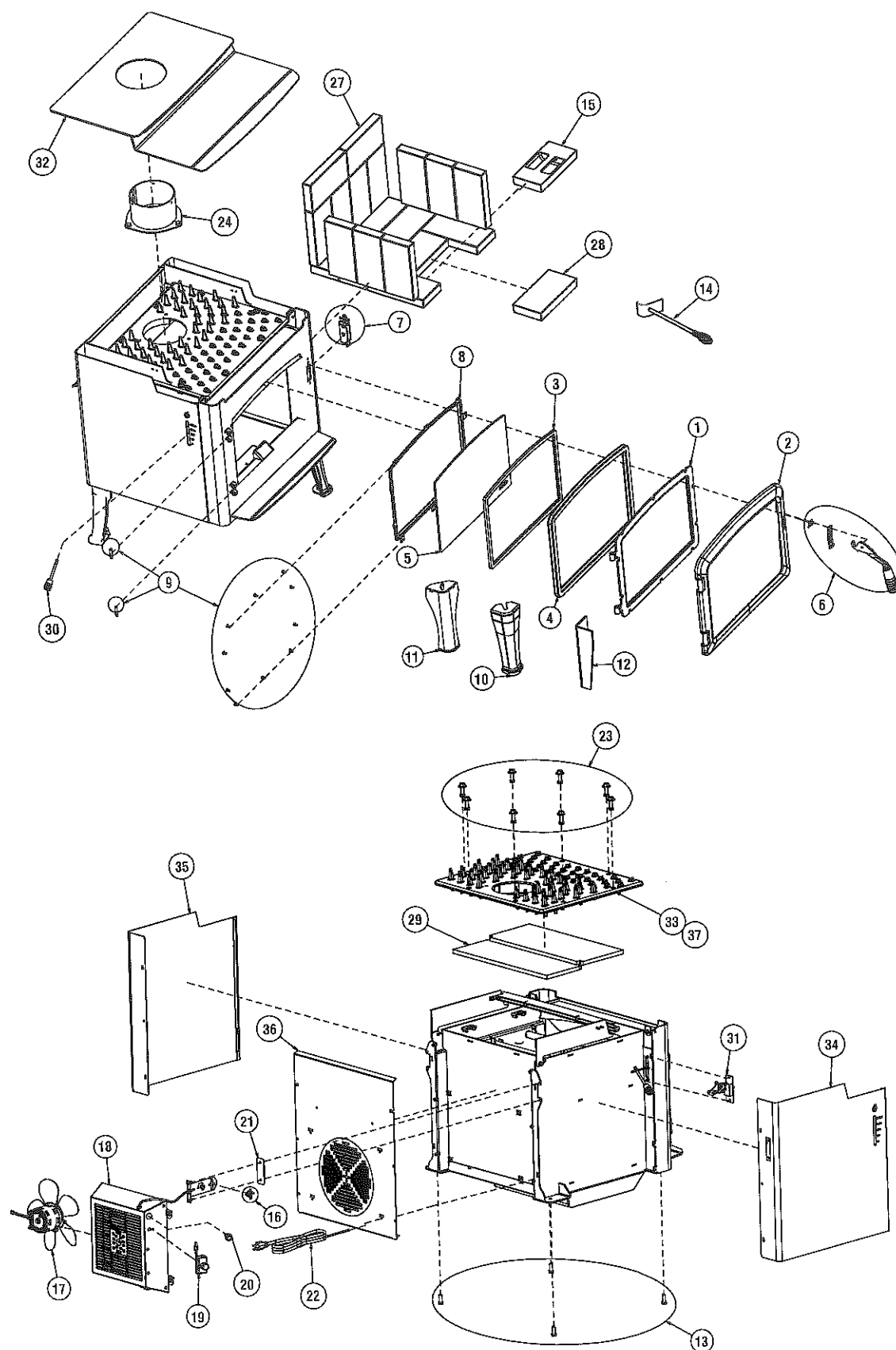
# **REPLACEMENT PARTS - MODEL GRANDVIEW™ 230**

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

FRONT DOOR PARTS LIST		
Item #	Cat. No	Description
1	H8365	Inner Door Frame, Cast Iron
2	H8366	Outer Door Frame, Cast Iron
3	H8380	Glass Gasket 1"
4	H5639	Door Gasket 7/8"
5	H8392	Ceramic Glass With Gasket
6	H8395	Door Handle Kit
7	H8397	Door Latch Assembly (4 button head screws and latch)
8	H8394	Glass, Retainer Kit
9	H8398	Door Hardware Kit (includes 2 pins, door roller and 10 button head screws and door set screw)
LEG PARTS		
10	H8383	Coastal Brushed Nickel Leg - single leg
10	H8384	Coastal, Nickel Leg - single leg
10	H8385	Coastal, Black Leg - single leg
11	H8386	Lakeview, Steel Black Leg - single leg
	H5619	Olympic, Brushed Nickel Cast Leg - single leg
	H5621	Olympic, Nickel Cast Leg - single leg
	H5669	Olympic, Black Cast Leg - single leg
	H8382	Leg, Hardware, Bolt, Kit
PEDESTAL PARTS		
14	H5564	Ash Plug Remover and Rake
15	H8381	Removable Ash Plug

BLOWER PARTS		
Item #	Cat. No	Description
16	H8374	Blower Snap Switch
17	H8375	Blower Blade
18	H8376	Blower Cover
19	H5742	Speed Control - High Temperature
20	H8066	Blower Rocker Switch
	H8399	Blower Opening Cover Plate
22	H5660	Blower Power Cord
MISCELLANEOUS PARTS		
	71052	Dry Graphite (apply to door handle bushing)
	H5633	Anti Seize, 2 Gram Pouch
23	H8387	Heat Exchanger Bolt Kit
	H8388	Flue Ring Bolt Kit
	H8389	Ash Drawer Hardware Kit
	H8390	Taplite Qty 8 (34055)
	H8391	Button Head Screw Qty 8 (34027)
FIREBOX PARTS		
	H8367	Secondary Tube Retainer Clips
	H8373	Replacement Secondary Air Tube Kit
27	H8378	Complete Firebrick Kit (20 bricks included)
28	H5612	Firebrick 4-1/2" X 9", Each
29	H8379	Baffle Board Kit
BODY PARTS		
30	H8393	Damper Rod
31	H8396	Damper Assembly
32	H8368	Stove Top Replacement
33	H8369	Cast Iron Heat Exchanger (hardware included)
35	H8370	Left Side Heat Shield (hardware included)
34	H8371	Right Side Heat Shield (hardware included)
36	H8372	Rear, Heat, Shield (hardware included)
37	H8377	Heat Exchanger Gasket

# REPLACEMENT PARTS - MODEL GRANDVIEW™ 230

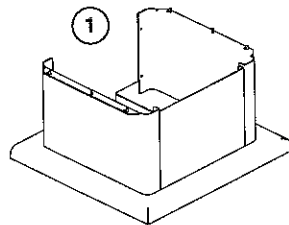
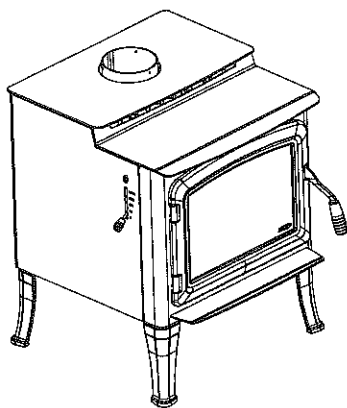


NOTE: DIAGRAMS & ILLUSTRATIONS ARE NOT TO SCALE.

# **ACCESSORIES - MODEL GRANDVIEW™ 230**

PEDESTAL (REQUIRED)			
Item #	Cat. No.	Model	Description
1	H8343	PED-GV	Pedestal, Black
OR LEGS (REQUIRED)			
2	H8339	LEG-COSTL-BLK	Coastal Legs, Black
2	H8340	LEG-COSTL-BRNKL	Coastal Legs, Brushed Nickel
2	H8341	LEG-COSTL-NKL	Coastal Legs, Nickel
3	H8342	LEG-LKVIEW-BLK	Lakeview Legs, Black
4	70000	LEG-OLY-B	Olympic Sculptured Black
4	70002	LEG-OLY-N	Olympic Sculptured Nickel
4	70008	LEG-OLY-BRN	Olympic Sculptured Brushed Nickel
ASH DRAWERS			
5	H8344	ASHDR-KIT-PED-GV	Pedestal, Ash Drawer Kit
6	H8345	ASHDR-KIT-LEG-GV	Leg, Ash Drawer Kit
LOUVERS			
7	H8348	LVP-GV230-BLK	Louvers, Black
7	H8349	LVR-GV230-BRNKL	Louvers, Brushed Nickel

DOOR TRIM			
Item #	Cat. No.	Model	Description
8	H8346	DRTRM-GV230-NKL	Door Trim, Nickel
8	H8347	DRTRM-GV230-BRNKL	Door Trim, Brushed Nickel
BLOWER			
9	H8350	BLWR-GV-700-SS	Blower
OUTSIDE AIR KITS			
10	UZIAD	UZIAD	Outside Air Coupler for Connection of UZI to Fireplace
11	UZI	UZI	Outside Air Kit (4" I.D. x 10 ft. long insulated flex)
COMMON ACCESSORIES			
12	H8159	TSPK-B	Touch-up Spray Paint Kit, Black
13	H7665	WP-LEGF-LBRKT	Leg Tie Down Kit, Coastal & Lakeview Legs, Mobile Homes
14	H5308	W-LEGF-LBRKT	Leg Tie Down Kit, Olympic Legs, Mobile Homes
15	H7638	BELLA-LLK	Leg Leveling Pads
----	H8407	W-LLK	Leg Leveling Bolt Kit



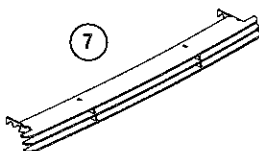
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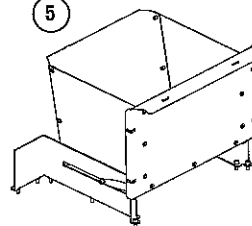
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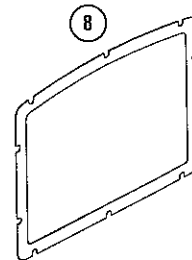
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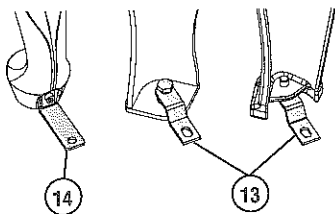
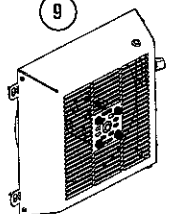
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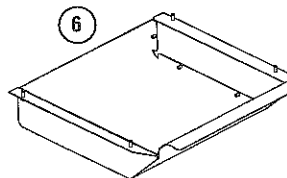
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# VENTING COMPONENTS - MODEL GRANDVIEW™ 230

## Security Chimneys™ Pipe

Tubinox Components 6" Rigid Stainless Steel Liner			
Cat. No.	Model	Description	Pc. / Container
6LL6	6LL6	LENGTH 6" X 6"	4
6LL12	6LL12	LENGTH 6" X 12"	4
6LL24	6LL24	LENGTH 6" X 24"	4
6LL36	6LL36	LENGTH 6" X 36"	4
6LL48	6LL48	LENGTH 6" X 48"	4
6L7A	6L7A	ADJUSTABLE LENGTH (7 to 11)	4
6LT	6LT	SPLIT BASE TEE	4
6LTCS	6LTCS	TEE CAP	10
6LTC	6LTC	TWIST LOCK TEE CAP	4
6LE30	6LE30	ELBOW 30 DEGREE	4
6LE45	6LE45	ELBOW 45 DEGREE	4
6LE90	6LE90	ELBOW 90 DEGREE	4
6LST	6LST	FLASHING	5
6LSTSS	6LSTSS	FLASHING STAINLESS	1
6LSA	6LSA	SUPPORT ASSEMBLY	5
6LSB	6LSB	INTERIOR SUPPORT	5
6LAAM	6LAAM	ADAPTOR FLEX PIPE (MALE)	4
6LAAF	6LAAF	ADAPTOR FLEX PIPE (FEMALE)	4
6LLFLEX	6LLFLEX	STAINLESS FLEXIBLE LENGTH (6"X60")	4
6LMA	6LMA	MASONRY ADAPTOR	1
6LLR5	6LLR5	REDUCER LENGTH (6"-5")	4
6LLW7	6LLW7	INCREASER LENGTH (6"-7")	4
6LCC	6LCC	DELUXE RAIN CAP	1
6LCS	6LCS	REGULAR RAIN CAP	1
6LRSMI	6LRSMI	ADJUSTABLE INSULATION WALL THIMBLE 6" - 12"	1

# Secure Black™ Single Wall Stove Pipe 6" SW Pipe and Accessories

Cat. No.	Model	Description	Pc. / Container
6SWL6	6SWL6	LENGTH 6" X 6"	100
6SWL12	6SWL12	LENGTH 6" X 12"	5
6SWL24	6SWL24	LENGTH 6" X 24"	10
6SWL36	6SWL36	LENGTH 6" X 36"	2
6SWL48	6SWL48	LENGTH 6" X 48"	5
6SWLT	6SWLT	TELESCOPIC LENGTH 6" (42"-66")	1
6SWLA	6SWLA	ADJUSTABLE LENGTH 6" (3"-9")	5
6SWMA	6SWMA	SINGLE WALL MASONRY ADAPTOR 6"	1
6SWT	6SWT	TEE 6" (TEE CAP INCLUDED)	2
6SWE45	6SWE45	ELBOW 45 DEGREE 6"	4
6SWE90	6SWE90	ELBOW 90 DEGREE 6"	4
6SWE90A	6SWE90A	SWIVEL 90 DEGREE ELBOW 6"	10
6UP	6UP	FLUE EXTENSION 6"	10
6SWAB	6SWAB	STOVE ADAPTOR 6"	8
6SWIN7	6SWIN7	INCREASER LENGTH (6"-7")	4
6SWIN8	6SWIN8	INCREASER LENGTH (6"-8")	4
6SWOA	6SWOA	OVAL TO ROUND ADAPTOR 6"	5
6SWLK	6SWLK	DAMPER UNIT 6"	4
6PB	6PB	DECORATIVE COLLAR 6" (ASHT)	25
6PF	6PF	TRIM COLLAR 6" (ASHT)	5

# Double Wall Black Stove Pipe 6" DL Pipe and Accessories

Cat. No.	Model	Description	Pc. / Container
6DL6	6DL6	LENGTH 6" X 6"	8
6DL12	6DL12	LENGTH 6" X 12"	4
6DL24	6DL24	LENGTH 6" X 24"	2
6DL36	6DL36	LENGTH 6" X 36"	2
6DL42A	6DL42A	TELESCOPIC LENGTH (42"-66")	1
6DL3A	6DL3A	ADJUSTABLE LENGTH (3"-9")	4
6DL36A	6DL36A	ADJUSTABLE LENGTH (3"-34")	2
6DT	6DT	TEE (TEE CAP INCLUDED)	4
6DE45	6DE45	ELBOW 45 DEGREE	4
6DE90	6DE90	ELBOW 90 DEGREE	4
6DMA	6DMA	MASONRY ADAPTOR	1
6UP	6UP	FLUE EXTENSION	10
6DAB	6DAB	STOVE ADAPTOR	8
6DLW7	6DLW7	INCREASER LENGTH (6"-7")	4
6DLW8	6DLW8	INCREASER LENGTH (6"-8")	4
6DLK	6DLK	DAMPER UNIT DL 6"	4
6DQDH	6DQDH	DECORATIVE COLLAR	25
6DQ	6DQ	TRIM COLLAR	10

# **VENTING COMPONENTS - MODEL GRANDVIEW™ 230**

Secure Temp® Factory-Built Chimney 6" Secure Temp ASHT and Secure Temp G-ASHT			
Cat. No.	Model	Description	Pc. / Container
Lengths and Fittings			
6L8	6L8	LENGTH 6" X 8"	1
6L12	6L12	LENGTH 6" X 12"	1
6L18	6L18	LENGTH 6" X 18"	1
6L24	6L24	LENGTH 6" X 24"	1
6L36	6L36	LENGTH 6" X 36"	1
6L48	6L48	LENGTH 6" X 48"	1
6LA	6LA	ADJUSTABLE LENGTH, 12"	1
6TI	6TI	INSULATED TEE (TCS INCLUDED)	1
6TCS	6TCS	INSULATED SS TEE CAP (INCLUDED WITH TI)	10
6TB	6TB	BASE TEE GALVANIZED (TC INCLUDED)	1
6TBS	6TBS	BASE TEE STAINLESS (TCS INCLUDED)	1
6TBD	6TBD	BASE TEE GALVANIZED DOUBLE (TC INCLUDED)	1
6TC	6TC	BASE TEE CAP GALVANIZED	10
6TCI	6TCI	INSULATED TEE CAP (USE WITH SME SUPPORT)	5
6TCP	6TCP	DRAIN TEE CAP (USE WITH SME SUPPORT)	5
6E15	6E15	INSULATED ELBOW 15 DEGREE	2
6E30	6E30	INSULATED ELBOW 30 DEGREE	1
Aluminum Zinc Coated Steel (Lengths and Fittings)			
6GL8	6GL8	LENGTH 6" X 8"	1
6GL12	6GL12	LENGTH 6" X 12"	1
6GL18	6GL18	LENGTH 6" X 18"	1
6GL24	6GL24	LENGTH 6" X 24"	1
6GL36	6GL36	LENGTH 6" X 36"	1
6GL48	6GL48	LENGTH 6" X 48"	1
6GLA	6GLA	ADJUSTABLE LENGTH, 12"	1
6GTI	6GTI	INSULATED TEE (TCS INCLUDED)	1
6TCS	6TCS	INSULATED SS TEE CAP (INCLUDED WITH GTI)	10
6GE15	6GE15	INSULATED ELBOW 15 DEGREE	2
6GE30	6GE30	INSULATED ELBOW ALUM-ZINC 30 DEGREE	1
Supports			
6UP	6UP	FLUE EXTENSION	10
PS	PS	SQUARE CATHEDRAL SUPPORT EXTENSION	1
6SSC	6SSC	SQUARE CATHEDRAL SUPPORT W/ COUPLER	1
6SSAC	6SSAC	ADJUSTABLE SQUARE CATHEDRAL SUPPORT w/COUPLER	1
6SFC	6SFC	FINISHING SUPPORT W/COUPLER	1

Cat. No.	Model	Description	Pc. / Container
Supports (continued)			
6SM	6SM	TEE SUPPORT	1
6SMA	6SMA	GALVALUME ADJUSTABLE TEE SUPPORT (2" TO 6")	5
SO	SO	OFFSET SUPPORT / WALL SUPPORT	10
ST	ST	ROOF SUPPORT	10
6SD	6SD	FLOOR SUPPORT	5
6SP	6SP	ANCHOR PLATE	10
Braces and Firestops			
6BF	6BF	FIRESTOP	10
6RSM30	6RSM30	ANGLED FIRESTOP - 30 DEGREE	
6RS	6RS	RADIATION SHIELD	5
6RSA2	6RSA2	2PC INSULATED ATTIC RADIATION SHIELD	1
6ARSA	6ARSA	ADJUSTABLE INSULATED ATTIC RADIATION SHIELD	1
6RSI	6RSI	INSULATED RADIATION SHIELD	1
6RSM	6RSM	INSULATED WALL THIMBLE	1
6RSMI30	6RSMI30	30-DEGREE RADIATION SHIELD	1
BS2	BS2	UNIVERSAL ROOF BRACE	1
BM	BM	UNIVERSAL WALL BAND	10
6BH	6BH	GUY WIRE BAND (WIRE NOT INCLUDED)	10
6FR	6FR	FLAT ROOF FLASHING	3
6FAR	6FAR	ADJUSTABLE ROOF FLASHING - 1/12- 7/12	3
6FARA	6FARA	ADJUSTABLE MALLEABLE ALUMINUM ROOF FLASHING 1/12 - 7/12	
6FBR	6FBR	ADJUSTABLE ROOF FLASHING - 8/12- 12/12	3
6FBRA	6FBRA	ADJUSTABLE MALLEABLE ALUMINUM ROOF FLASHING 8/12 - 12/12	
6FBBR	6FBBR	ADJUSTABLE ROOF FLASHING 12/12 - 21/12	3
6FPR	6FPR	PEAK ROOF FLASHING 1/12 -7/12	3
6FPBR	6FPBR	PEAK ROOF FLASHING 8/12 -12/12	3
6FC	6FC	STORM COLLAR	10
Chimney Termination			
6CC	6CC	RAIN CAP	1
PE	PE	UNIVERSAL SPARK ARRESTER BAND	10
Chimney Accessories			
6PF	6PF	DECORATIVE TRIM	5
6PB	6PB	DECORATIVE COLLAR	25
6PA	6PA	BLACK PIPE ADAPTOR	1
6PD	6PD	FINISHING CONE	1
Fireplace Components			
6EK-1	6EK-1	EXTERIOR KIT (INCLUDES 1 TI, 1 TCI, 1 SME, 1 RSM, 1 CC, 1 PB, 1 BM)	1
6IK	6IK	INTERIOR KIT (INCLUDES 1 SFC, 1 RSA2, 1CC)	1

## NOTES

## WARRANTY

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

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

## REPLACEMENT PARTS

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

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

When ordering repair parts, always give the following information:

1. The model number of the appliance.

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

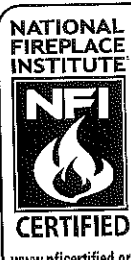
If you encounter any problems or have any questions concerning the installation or application of this system, please contact your dealer.

**LENNOX HEARTH PRODUCTS**  
1508 Elm Hill Pike, Suite 108  
Nashville, TN 37210  
visit us at [www.LennoxHearthProducts.com](http://www.LennoxHearthProducts.com)  
1-800-655-2008

## PRODUCT REFERENCE INFORMATION

We recommend that you record the following important information about your appliance. If you did not purchase your appliance directly from a Lennox Hearth Products dealer, then please call 1-800-655-2008 for the name and phone number of your nearest Lennox Hearth Products dealer who will answer your questions or address your concerns.

Your Appliance's Model Number \_\_\_\_\_  
Your Appliance's Serial Number \_\_\_\_\_  
The Date On Which Your Appliance Was Installed \_\_\_\_\_  
Your Dealer's Name \_\_\_\_\_



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



Nous recommandons que nos poêles à bois soient installés et que l'entretien soit effectué par des professionnels certifiés, aux États-Unis par le National Fireplace Institute® (NFI) et au Canada, par le Wood Energy Technical Training (WETT).



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

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**LENNOX**  
HEARTH PRODUCTS

## **Appendix C**

### **Sample Analysis**

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/13/12 Engineer: B. Davis Run #: 1 Sample Train #: A

Train assembled by: BD Balance Equipment #: 19683 Thermo/Hygro meter Equipment #: 19724

Audit weight Equipment #: 19684 (Balance audit mfr. std: 500 ± 0.72 mg)

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/14/12		1700	41.2	67	2467	5001	BD
11/19/12		0800	47.5	66	2465	5001	BD

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/14/12		1700	41.2	67	113.6590	5001	BD
11/19/12		0800	47.5	66	113.6591	5001	BD

**Front Filter, Rear Filter & Seal Set Weighing Record**  
 Filter #: 469, Front Filter Tare: 1180, Rear Filter Tare: 1186, Seal Set Tare: NA, D/T in desiccator: 11/13, Preliminary wt.: 2476

**Probe Weighing Record**  
 Probe #: 18, Tare wt.: 113.6574, Cleaned by: BD, D/T in desiccator: 11/13, Preliminary wt.: 113.6598

Date: 11/24/12

Engineer signature: BD

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/14/12 Engineer: B. Davis Run #: 1 Sample Train #: B

Train assembled by: BD Balance Equipment #: 19683 Thermo/Hygro meter Equipment #: 19724

Audit weight Equipment #: 19684 (Balance audit mfr. std:  $500 \pm 0.72$  mg)

Front Filter, Rear Filter & Seal Set Weighing Record		Filter # <sup>471</sup> <u>422</u> , Front Filter Tare: <u>118.1</u> , Rear Filter Tare: <u>119.8</u> , Seal Set Tare: <u>NA</u> , D/T in desiccator: <u>11/13</u> , Preliminary wt.: <u>242.5</u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
<u>11/14/12</u>	<u>1700</u>	<u>41.2</u>	<u>67</u>	<u>.2473</u>	<u>.5001</u>	<u>BL</u>
<u>11/19/12</u>	<u>0800</u>	<u>47.5</u>	<u>66</u>	<u>.2472</u>	<u>.5001</u>	<u>BL</u>

Probe Weighing Record		Probe # <u>20</u> , Tare wt.: <u>113.4721</u> , Cleaned by: <u>BD</u> , D/T in desiccator: <u>11/13</u> , Preliminary wt.: <u>113.4294</u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
<u>11/14/12</u>	<u>1700</u>	<u>41.2</u>	<u>67</u>	<u>113.4741</u>	<u>.5001</u>	<u>BL</u>
<u>11/19/12</u>	<u>0800</u>	<u>47.5</u>	<u>66</u>	<u>113.4740</u>	<u>.5001</u>	<u>BL</u>

Date: 11/20/12

Engineer signature: BD

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/14/12 Engineer: B. Davis Run #: 2 Sample Train #: A

Train assembled by: BD Balance Equipment #: 19683 Thermo/Hygro meter Equipment #: 1972Y

Audit weight Equipment #: 1968Y (Balance audit mfr. std: 500 ± 0.72 mg)

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/15/12		1720	43.7	68	.2472	.5001	BC
11/19/12		0800	47.5	66	.2471	.5001	BC

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/15/12		1720	43.7	68	126.5392	.5001	BC
11/19/12		0800	47.5	66	126.5392	.5001	BC

Date: 11/20/12

Engineer signature: BD

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/14/12 Engineer: B. Davis Run #: 2 Sample Train #: B

Train assembled by: BD Balance Equipment #: 19623 Thermo/Hygro meter Equipment #: 19724

Audit weight Equipment #: \_\_\_\_\_ (Balance audit mfr. std: 500 ± 0.72 mg)

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/15/12		1720	43.7	68	.2455	.5001	BL
11/19/12		0800	47.5	66	.2454	.5001	BL

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/15/12		1720	43.7	68	126.4884	.5001	BL
11/19/12		0800	47.5	66	126.4883	.5001	BL

**Front Filter, Rear Filter & Seal Set Weighing Record**

Filter #: 425, Front Filter Tare: .1187, Rear Filter Tare: .1127, Seal Set Tare: NA, D/T in desiccator: 11/14/12 Preliminary wt.: 245.8

**Probe Weighing Record**

Probe #: 23, Tare wt.: 126.4884, Cleaned by: BA, D/T in desiccator: 11/14/12 Preliminary wt.: 126.4892

Date: 11/20/12

Engineer signature: BD

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/15/12 Engineer: B. Davis Run #: 3 Sample Train #: A

Train assembled by: BA Balance Equipment #: 19683 Thermo/Hygro meter Equipment #: 19724

Audit weight Equipment #: 19684 (Balance audit mfr. std: 500 ± 0.72 mg)

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/16/12		1715	43.3	67	.2455	.5001	BL
11/19/12		0800	47.5	66	.2455	.5001	BL

Date		Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/16/12		1715	43.3	67	113.6515	.5001	BL
11/19/12		0800	47.5	66	113.6513	.5001	BL

Date: 11/20/12

Engineer signature: BD

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/15/12 Engineer: B. Davis Run #: 3 Sample Train #: B

Train assembled by: BA Balance Equipment #: 19683 Thermo/Hygro meter Equipment #: 19724

Audit weight Equipment #: 19684 (Balance audit mfr. std: 500 ± 0.72 mg)

Front Filter, Rear Filter & Seal Set Weighing Record		Filter #: <u>479</u> , Front Filter Tare: <u>.1192</u> , Rear Filter Tare: <u>.1190</u> , Seal Set Tare: <u>NA</u> , D/T in desiccator: <u>11/15/12</u> , Preliminary wt.: <u>      </u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/16/12	1715	43.3	67	.2450	.5001	BA
11/19/12	0800	47.5	66	.2452	.5001	BA

Probe Weighing Record		Probe #: <u>22</u> , Tare wt.: <u>.13.2694</u> , Cleaned by: <u>BA</u> , D/T in desiccator: <u>11/15/12</u> , Preliminary wt.: <u>      </u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
11/16/12	1715	43.3	67	113.7705	.5001	BA
11/19/12	0800	47.5	66	113.7805	.5001	BA

Date: 11/20/12

Engineer signature: BA

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/16/12 Engineer: B. Davis Run #: 4 Sample Train #: A

Train assembled by: BA Balance Equipment #: 19683 Thermo/Hygro meter Equipment #: 19724

Audit weight Equipment #: 19683 (Balance audit mfr. std: 500 ± 0.72 mg)

Front Filter, Rear Filter & Seal Set Weighing Record		Filter #: <u>481</u> <u>482</u> , Front Filter Tare: <u>.1176</u> , Rear Filter Tare: <u>.1194</u> , Seal Set Tare: <u>NA</u> , D/T in desiccator: <u>11/18</u> , Preliminary wt.: <u>0.810</u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
<u>11/19/12</u>	<u>0800</u>	<u>47.5</u>	<u>66</u>	<u>.2416</u>	<u>.5001</u>	<u>BA</u>
<u>11/20/12</u>	<u>1010</u>	<u>47.5</u>	<u>65</u>	<u>.2415</u>	<u>.5001</u>	<u>BA</u>

Probe Weighing Record		Probe # <u>12329</u> , Tare wt.: <u>124.7836</u> , Cleaned by: <u>BA</u> , D/T in desiccator: <u>11/18</u> , Preliminary wt.: <u> </u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
<u>11/19/12</u>	<u>0800</u>	<u>47.5</u>	<u>66</u>	<u>124.7847</u> <u>125.7320</u>	<u>.5001</u>	<u>BA</u>
<u>11/20/12</u>	<u>1010</u>	<u>47.5</u>	<u>65</u>	<u>124.7847</u>	<u>.5001</u>	<u>BA</u>

Date: 11/20/12

Engineer signature: B. Davis

**DILUTION TUNNEL WORKSHEET - METHOD 5G3**

Client: EPA Model: Grand View 230 Project #: G100962764 Sample ID #: PRT1211131110-001

Date: 11/16/12 Engineer: B. Davis Run #: 4 Sample Train #: 3

Train assembled by: BL Balance Equipment #: 19623 Thermo/Hygro meter Equipment #: 19724

Audit weight Equipment #: 19624 (Balance audit mfr. std: 500 ± 0.72 mg)

Front Filter, Rear Filter & Seal Set Weighing Record		Filter #: <u>483</u> , Front Filter Tare: <u>.1210</u> , Rear Filter Tare: <u>.1199</u> , Seal Set Tare: <u>.211</u> , D/T in desiccator: <u>11/14</u> Preliminary wt.: <u>0.25</u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
<u>11/19/12</u>	<u>0800</u>	<u>47.5</u>	<u>66</u>	<u>.2441</u>	<u>.5001</u>	<u>BL</u>
<u>11/20/12</u>	<u>1010</u>	<u>47.5</u>	<u>65</u>	<u>.2445</u>	<u>.5001</u>	<u>BL</u>

Probe Weighing Record		Probe #: <u>2933</u> , Tare wt.: <u>125.7319</u> , Cleaned by: <u>BL</u> , D/T in desiccator: <u>11/14</u> Preliminary wt.: <u> </u>				
Date	Time	R/H %	Temp. (F)	Weight (grams)	Audit (grams)	Initials
<u>11/19/12</u>	<u>0800</u>	<u>47.5</u>	<u>66</u>	<u>125.7326</u> <del>124.7317</del>	<u>.5001</u>	<u>BL</u>
<u>11/20/12</u>	<u>1010</u>	<u>47.5</u>	<u>65</u>	<u>125.7328</u>	<u>.5001</u>	<u>BL</u>

Date: 11/24/12

Engineer signature: B. Davis

Tares

Beaker □

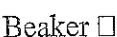

Filter ☐Probe ☒Seals ☐

Size 47 mm

Date and time in desiccator: 4-25-12 10:00 Thermol/Hygro meter ID# 8475

Balance equipment number: 19683 Engineer: X. Maphumbe

[illegible]

Filter ☐Probe Seals ☐

Size 47 mm

Balance equipment number: 19633 Engineer: K. May

Page 1 of 1

**Tares**

 Beaker ☐ Filter ☒ Probe ☐ Seals ☐ Size 47 mm

 Date and time in desiccator: 10-12-11 08:00 Thermol/Hygro meter ID# 8475

 Balance equipment number: 19683 Engineer: K. Meigad

ID #	Date: 10-13-11 Time: 08:10 R/H %: 13.0 T (F): 68 Initial: 16	Date: 10-13-11 Time: 15:00 R/H %: 18 T (F): 68 Initial: 16	Date: Time: R/H %: T (F): Initial:	Date: Time: R/H %: T (F): Initial:	Manufacture Model Run number
Balance Audit wt.	.5001	.5001			
465	.1194	.1195	- 0.1195		
466	.1200	.1199	-		
467	.1182	.1182	-		
468	.1190	.1189	-		
469	.1180	.1180	-		Lewnox RCA GU230 R- 1A
470	.1185	.1186	-		Lewnox RCA GU230 R- 1B
471	.1180	.1181	-		Lewnox RCA GU230 R- 1B
472	.1199	.1198	-		Lewnox RCA GU230 R- 1B
473	.1192	.1191	-		Lewnox RCA GU230 R- 2A
474	.1187	.1186	-		Lewnox RCA GU230 R- 2A
475	.1187	.1187	-		Lewnox RCA GU230 R- 2B
476	.1178	.1177	-		Lewnox RCA GU230 R- 2B
477	.1188	.1188	-		Lewnox RCA GU230 R- 3A
478	.1188	.1187	-		Lewnox RCA GU230 R- 3A
479	.1191	.1192	-		Lewnox RCA GU230 R- 3B
480	.1189	.1190	-		Lewnox RCA GU230 R- 3B
481	.1175	.1176	-		Lewnox RCA GU230 R- 4A
482	.1194	.1194	-		Lewnox RCA GU230 R- 4A
483	.1208	.1210	-		Lewnox RCA GU230 R- 4B
484	.1199	.1199	-		Lewnox RCA GU230 R- 4B
485	.1197	.1197	-		
486	.1200	.1201	-		
487	.1199	.1200	-		

# **Appendix D**

## **Calibrations**

### **Equipment Used:**

**Platform Scale: 19743**  
**10 pound audit weight: 20115**  
**Analytical Balance: 19683**  
**500 mg Audit Weight: 19684**  
**Relative Humidity: 19724**  
**Moisture Meter: 19701**  
**Barometer: 20177**  
**Calibration Dry Gas Meter: 19681**  
**Dwyer Microtector: 19673**  
**Thermocouple Readout: 19752**  
**Fuel Scale: 19710**

## Dry Gas Meter Verification

Equipment Number:	19741	Engineer:	B. Davis <i>B.D.</i>
Equipment Manufacture:	APEX	Calibration Date:	31-Oct-2012
Model:	XC-60-EP	Barometric Pressure:	29.55
Type of verification:	Post Test:	Six Month:	X
Standard Dry Gas Meter Equipment Number	19681	Dry Gas Meter Previous Calibration Factor	1
Standard Dry Gas Meter Calibration Factor	0.9975	Average Current Calibration Factor:	<b>0.9770</b>
Standard Dry Gas Meter Cal Due Date	3/22/2013	Deviation Previous to Current Factor:	2.30%
		Acceptable limit is 5%	

Calibration factor deviation from average  
Acceptable limit is .020      0.010

Trial Number	1	2	3
Pressure Drop	4.8	3	1.5
Reference Meter start	585.85	594.723	600.806
Reference Meter end	594.587	600.774	605.894
Dry Gas Meter start	0	0	0
Dry Gas Meter end	8.594	6.053	5.15
Reference Temperature	75	75	75
Dry Gas Meter Temperature	67	67	68
Total volume reference	8.737	6.051	5.088
Total volume Dry Gas Meter	8.594	6.053	5.15
Gas Meter calibration factor	<b>0.987</b>	<b>0.975</b>	<b>0.969</b>
Deviation from average	0.010	0.002	0.008

Intertek

# Dry Gas Meter Verification

Equipment Number: 19742 Engineer: B. Davis  
 Equipment Manufacture: APEX Calibration Date: 31-Oct-2012  
 Model: XC-60-EP Barometric Pressure: 30  
 Type of verification: Post Test: Six Month: X  
 Standard Dry Gas Meter Equipment Number 19681 Dry Gas Meter Previous Calibration Factor 1.001  
 Standard Dry Gas Meter Calibration Factor 0.9975 Average Current Calibration Factor: 0.9872  
 Standard Dry Gas Meter Cal Due Date 12/12/2011 Deviation Previous to Current Factor: 1.38%  
 Acceptable limit is 5%

Calibration factor deviation from average  
 Acceptable limit is .020 0.007

Trial Number	1	2	3
Pressure Drop	5.03	3	1
Reference Meter start	568.2	573.56	580.563
Reference Meter end	571.257	580.535	585.68
Dry Gas Meter start	0	0	0
Dry Gas Meter end	3.086	7.117	5.294
Reference Temperature	67	67	68
Dry Gas Meter Temperature	75	78	78
Total volume reference	3.057	6.975	5.117
Total volume Dry Gas Meter	3.086	7.117	5.294
Gas Meter calibration factor	<b>0.991</b>	<b>0.991</b>	<b>0.980</b>
Deviation from average	0.004	0.004	0.007

Intertek

## Dry Gas Meter Verification

Equipment Number: 19741      Engineer: B. Davis  
 Equipment Manufacture: APEX      Calibration Date: 20-Nov-2012  
 Model: XC-60-EP      Barometric Pressure: 29.50

Type of verification:      Post Test: X      Six Month: \_\_\_\_\_

Standard Dry Gas Meter Equipment Number 19681      Dry Gas Meter Previous Calibration 0.9914

Standard Dry Gas Meter Calibration Factor 0.9975      Calibration factor deviation from average 0.22%  
 Acceptable limit 2%

Standard Dry Gas Meter Cal Due Date 3/22/2013      Deviation Previous to Current Factor: 1.88%  
 Acceptable limit 5%, NA for six Month calibration

Trial Number      1      2      3  
 Current average calibration factor 1.010

Pressure Drop	3.00	3.00	3.00
Reference Meter start	609.38	616.927	622.537
Reference Meter end	616.927	622.537	627.671
Reference Temperature	64	64	64
Dry Gas Meter start	0	0	0
Dry Gas Meter end	7.499	5.622	5.156
Dry Gas Meter Temperature	73	75	76
Total volume reference	7.547	5.61	5.134
Total volume Dry Gas Meter	7.499	5.622	5.156
Gas Meter calibration factor	<b>1.014</b>	<b>1.009</b>	<b>1.008</b>
Deviation from average	0.003	0.002	0.002

**Intertek**

## Dry Gas Meter Verification

Equipment Number: 19742  
 Equipment Manufacture: APEX  
 Model: XC-60-EP

Engineer: B. Davis  
 Calibration Date: 20-Nov-2012  
 Barometric Pressure: 29.50

Type of verification: Post Test: X Six Month: \_\_\_\_\_

Standard Dry Gas Meter Equipment Number 19681 Dry Gas Meter Previous Calibration 0.9914

Standard Dry Gas Meter Calibration Factor 0.9975 Calibration factor deviation from average 0.38%  
 Acceptable limit 2%

Standard Dry Gas Meter Cal Due Date 3/22/2013 Deviation Previous to Current Factor: 0.43%  
 Acceptable limit 5%, NA for six Month calibration

Trial Number                      1                      2                      3  
 Current average calibration factor 0.987

Pressure Drop	3.00	3.00	3.00
Reference Meter start	627.726	633.19	644.49
Reference Meter end	633.19	644.49	649.917
Reference Temperature	64	65	64
Dry Gas Meter start	0	0	0
Dry Gas Meter end	5.522	11.601	5.587
Dry Gas Meter Temperature	71	76	76
Total volume reference	5.464	11.3	5.427
Total volume Dry Gas Meter	5.522	11.601	5.587
Gas Meter calibration factor	<b>0.993</b>	<b>0.985</b>	<b>0.984</b>
Deviation from average	0.006	0.002	0.003

**Intertek**

## Pressure Transducer and Thermocouple Calibration

### APEX XC-60-EP Meter Box

Calibration meter used was a Dwyer Microtector equipment number 19673. This meter was calibrated by an accredited laboratory just prior to this calibration.

Pressure was applied to a single point and then split into two lines using a tee to supply pressure simultaneously to the calibration meter and the device under test. Two pressure transducers are used in this device, one for delta P and one for delta H.

Temperature readout was calibrated using ice and boiling water, a second calibrated meter number 9045 was used as a reference.

November 1, 2012

Equipment Numbers	19742 0-3" range	19673 0-3" range	Difference
<b>Delta H (Inches H<sub>2</sub>O)</b>	-0.01	0	.01
	0.56	0.556	.04
	1.00	0.998	.02
	2.20	2.10	.10
	3.01	2.9	.11

Equipment Numbers	19742 0-2" range	19673 0-2" range	Difference
<b>Delta P (Inches H<sub>2</sub>O)</b>	0.00	0	0
	0.15	.15	0
	0.35	.35	0
	0.50	.50	0
	0.70	.70	0
	1.01	1.01	0

19742	Ice Water	Boiling Water	Reference Ice	Reference Boil
	33	213	33	214

*B. J. [Signature]*

## Pressure Transducer and Thermocouple Calibration

### APEX XC-60-EP Meter Box

Calibration meter used was a Dwyer Microtector equipment number 19673. This meter was calibrated by an accredited laboratory just prior to this calibration.

Pressure was applied to a single point and then split into two lines using a tee to supply pressure simultaneously to the calibration meter and the device under test. Two pressure transducers are used in this device, one for delta P and one for delta H.

Temperature readout was calibrated using ice and boiling water, a second calibrated meter number 9045 was used as a reference.

November 1, 2012

Equipment Numbers	19741 0-3" range	19673 0-3" range	Difference
Delta H (Inches H <sub>2</sub> O)	-0.01	0	.01
	0.508	.51	.002
	1.015	1.01	.005
	2.01	2.06	.004
	3.18	3.20	.002

Equipment Numbers	19741 0-1" range	19673 0-2" range	Difference
Delta P (Inches H <sub>2</sub> O)	0.0	0	0
	0.15	0.14	.01
	0.35	0.35	0
	0.50	0.50	0
	0.70	0.70	0
	0.995	1.00	.005

19741	Ice Water	Boiling Water	Reference Ice	Reference Boil
	33	213	33	214

*B. [Signature]*

## CERTIFICATE OF CALIBRATION

<b>CUSTOMER:</b>	INTERTEK TESTING FAIRVIEW OR	<b>CALIBRATION DATE:</b>	03/22/12
<b>PO NUMBER:</b>	ADMIN.6513000	<b>CALIBRATION DUE:</b>	03/22/13
<b>INST. MANUFACTURER:</b>	SENSUS	<b>PROCEDURE:</b>	NAVAIR 17-20MG-02
<b>INST. DESCRIPTION:</b>	P.D. METER	<b>CALIBRATION FLUID:</b>	AIR @ 14.7 PSIA 70 F
<b>MODEL NUMBER:</b>	S-275	<b>STANDARD(S) USED:</b>	A4, A24 DUE 02-2013
<b>SERIAL NUMBER:</b>	19199330	<b>NIST TRACE #'S:</b>	1219670781
<b>RATED UNCERTAINTY:</b>	+/- .5 % RD.	<b>AMBIENT CONDITIONS:</b>	765 mm HGA 38 % RH 72 F
<b>UNCERTAINTY GIVEN:</b>	+/- .194 % RD.	<b>CERTIFICATE FILE #:</b>	437261.12
<b>NOTES:</b>	AS RECEIVED WITHIN SPECS. REFERENCE CONDITIONS ARE: 760 mmHGA 70 F		

TEST POINT NUMBER	UUT INDICATED SCFM	DM.STD. ACTUAL SCFM	CORRECTION FACTOR
1	0.25666	0.256	0.99743
2	0.50031	0.499	0.99738
3	0.76291	0.761	0.99750
4	1.01489	1.012	0.99745
5	1.55681	1.553	0.99755
6	2.00274	1.998	0.99763
7	2.59928	2.593	0.99758
8	2.99895	2.992	0.99768
AVERAGE=			0.9975250

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 • 10572 Calle Lee #138 • Los Alamitos, CA 90720  
Phone (714) 827-1215 • Fax (714) 827-0823

This Calibration Certificate shall not be reproduced except, in full, without approval by DICK MUNN'S COMPANY. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Date:

3/22/12

Approved By:

*[Signature]*

Calibration Technician:

*[Signature]*

Page 1 of 1



Calibration  
Certificate No. 1750.01

Calibration complies with ISO/IEC  
17025, ANSI/NCSL Z540-1, and 9001



Cert. No.: 4198-4488314

### Traceable® Certificate of Calibration for Hand Held Barometer

Manufactured for and distributed by: VWR International, LLC, Radnor Corporate Center, Bldg 1, Ste 200, 100 Matsonford Road, Radnor, PA 19087  
**Instrument Identification:**

Model: 61161-398 S/N: 122400524 Manufacturer: Control Company

#### Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	8/15/12	1000302796
Digital Thermometer	41334977/41335007	9/14/12	4000-3893288

#### Certificate Information:

Technician: 57 Procedure: CAL-32 Cal Date: 7/17/12 Cal Due: 7/17/14  
Test Conditions: 25.5°C 43.0 %RH 1015 mBar

#### Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
mbar		N.A.		552.00	547	Y	544	560	1.20	>4:1
mbar		N.A.		750.20	747	Y	742	758	1.20	>4:1
mbar		N.A.		1,013.20	1,011	Y	1,005	1,021	1.20	>4:1
°C		N.A.		25.255	26.1	Y	24.3	26.3	0.161	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

*Nicol Rodriguez*  
Nicol Rodriguez, Quality Manager

*Wallace Berry*  
Wallace Berry, Technical Manager

#### Maintaining Accuracy:

In our opinion once calibrated your Hand Held Barometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Hand Held Barometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

#### Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA  
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.  
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2008-AQ-HOU-RvA.  
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).



**TRANSCAT<sup>®</sup> CALIBRATION  
SERVICES**



NVLAP LAB CODE  
200867-0

## CERTIFICATE OF CALIBRATION

Customer: INTERTEK  
22887 NE TOWNSEND WAY  
FAIRVIEW, OR 97024

Customer Nbr: 1-556813-000  
PO Nbr: USA20-0000208799  
Date Received: December 13, 2011

Cert/SO Nbr: 15-BN4EL-105-1  
Manufacturer: Dwyer Instruments Inc.  
Model Nbr: 1430

Date Completed: December 27, 2011  
Due Date: December 27, 2012

Description: Microtector  
Serial Nbr: E49U  
ID Nbr: 19673  
Unit Barcode: 901B0055114

Calibrated To: Manufacturer Specification  
Calibration Proc: 1-AC15388-2  
Item Received: In Tolerance  
Item Returned: In Tolerance

For calibration data, see Supplemental Report for SO Nbr 15-BN4EL-105-1

Transcat Calibration Laboratories have been audited and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the Lab Scope of Accreditation are indicated by the presence of the Accrediting Body's Logo and Certificate Number on this Certificate of Calibration. Any measurements on an accredited calibration not covered by that Lab Scope are listed in the notes section of the certificate. This report must not be used to claim product certification approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Transcat calibrations, as applicable, are performed in compliance with the requirements of ISO 9001:2008, ISO TS16949, ANSI/NCSL Z540-1994, and ISO 10012-1992. When specified contractually the requirements of 10CFR21, 10CFR50 App. B and NQA-1 are also covered.

Traceability includes no less than an unbroken chain of comparison realization of SI units, measurement uncertainty, documentation, competence, periodic recalibration, and measurement assurance. Transcat documents the traceability of measurements to the SI units through the National Institute of Standards and Technology (NIST) or the National Research Council of Canada (NRC), or other recognized national measurement institutes (NMI's) or international standard bodies, or to measurable conditions created in our laboratory, or accepted fundamental and/or natural physical constants, ratio type of calibration, or by comparison to consensus standards. The specific path of traceability for the reported measurement results is maintained at the Transcat facility and is available there for review.

Complete records of work performed are maintained by Transcat and are available for inspection. Laboratory standards used in the performance of this calibration are shown on the Supplemental Report.

The results in this report relate only to the item calibrated or tested and the determination of in or out of tolerance is specific to the model/serial no. referenced above based on the tolerances shown on the supplemental report; these tolerances are either the original equipment manufacturer's (OEM's) warranted specifications or the client's requested specifications.

The applied uncertainty is the uncertainty of the calibration process. The Test Uncertainty Ratio (TUR) is calculated as per NCSL International RP9, section 8.2. All calibrations have been performed using processes having a TUR of 4:1 or better, unless otherwise noted on the Supplemental Report. Uncertainties have been estimated at a 95 percent confidence level ( $k=2$ ). Calibration at a 4:1 TUR (or greater) provides reasonable confidence that the instrument is within the stated tolerances. For measuring instruments in order to consider the contribution to the uncertainty from reproducibility of the unit under test (UUT), add 0.6 of the UUT's least significant digit to the reported uncertainty. For mass calibrations, conventional mass referenced to 8.0 g/cm<sup>3</sup>.

Any number of factors can cause a unit to drift out of tolerance at any time following its calibration. Limitations on the uses of this instrument are detailed in the OEM's operating instructions.


### Notes:

#### Calibrated At:

2056 S. Alex Road  
West Carrollton, OH 45449  
By: Dave Highlands

#### Facility Responsible:

2056 S. Alex Road  
West Carrollton, OH 45449  
937-866-1033

 Digitally Signed On December 27, 2011



Digitally Signed By Sherry Caldarelli for

Date: December 27, 2011

Jim Beckner  
Lab Manager

### Revision 0

This certificate may not be reproduced except in full without the written approval of Transcat. Additional information if applicable may be included on separate reports.

F0013R22 8/12/2011

Certificate - Page 1 of 1



# SUPPLEMENTAL REPORT FOR 15-BN4EL-105-1

## CALIBRATION LAB DATA AS FOUND / AS LEFT

Service Order Nbr: 15-BN4EL-105-1

Description: Microtector

Serial: E49U

Customer: INTERTEK

Calibrated: 12/27/2011

Date Due: 12/27/2012

Service Type: R6

Mfg: Dwyer Instruments Inc.

Model: 1430

PO Nbr: USA20-0000208799

ID Nbr: 19673

Calibration Proc: 1-AC15388-2

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	$\frac{\Delta}{Y}$	Uncertainty ( $k=2; \pm$ )	TUR
Length Measure								
Linearity	0.2100in	$\pm(0.0002 \text{ in})$	0.2098	0.2102	0.2100 in			
	0.4200in	$\pm(0.0002 \text{ in})$	0.4198	0.4202	0.4200 in			
	0.6050in	$\pm(0.0002 \text{ in})$	0.6048	0.6052	0.6049 in			
	0.8150in	$\pm(0.0002 \text{ in})$	0.8148	0.8152	0.8150 in			
	1.0000in	$\pm(0.0002 \text{ in})$	0.9998	1.0002	1.0000 in			
Function Check								
Meter Deflection			P	P	P			

The reported uncertainty is the uncertainty of the calibration process. For measuring instruments add 0.6 of the least significant digit to the reported uncertainty to obtain the measurement uncertainty of the unit under test at the specific test point.

Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT



## SUPPLEMENTAL REPORT FOR 15-BN4EL-105-1

### CALIBRATION LAB DATA AS FOUND / AS LEFT

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	$\frac{Q}{P}$	Uncertainty (k=2; $\pm$ )	TUR
-------------	-----------	----------	-----------	------------	--------------------	---------------	---------------------------	-----

As Found and As Left Data recorded on 12/27/2011

Temperature: 68.2°F / 20.1°C      Relative Humidity: 31%

Temp/RH Assort: M1243

Asset

Manufacturer

Description

Cal Date

Due Date

Traceability Numbers

M1151

10-616-1

Gage Block Set, w/ 2 Optical Flats

2/9/2011

2/29/2012

15-2&M1151-1-3

The reported uncertainty is the uncertainty of the calibration process. For measuring instruments add 0.6 of the least significant digit to the reported uncertainty to obtain the measurement uncertainty of the unit under test at the specific test point.

Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT.

Omega TC Reader ID # 19752

EPA Emissions Booth # 1

Due for Calibration 3-8-2012

Date of calibration 4-24-2012

Used Omega Model CL23A Calibrator

Calibrated 2-23-12 Due: 2-23-2013

Calibration done by: Kreig Maplethorpe

*Kreig Maplethorpe*

1

**Calibration of Omega TC Reader Epa Booth # 1**

**Verified 9 of 12 channels Exceeding the minimum requirement of 10%**

Location	Refrence	Response
	0°F	3°F
	50°F	52°F
	100°F	102°F
Dillution	150°F	152°F
Tunnel	250°F	252°F
	350°F	352°F
	500°F	500°F
	750°F	752°F

Location	Refrence	Response
	0°F	1°F
	50°F	51°F
	100°F	101°F
Flue	150°F	151°F
Gases	250°F	251°F
	350°F	351°F
	500°F	501°F
	750°F	751°F

Location	Refrence	Response
	0°F	1°F
	50°F	51°F
	100°F	100°F
FB Top	150°F	151°F
	250°F	251°F
	350°F	351°F
	500°F	501°F
	750°F	751°F

Location	Refrence	Response
	0°F	2°F
	50°F	51°F
	100°F	101°F
FB	150°F	151°F
Bottom	250°F	251°F
	350°F	351°F
	500°F	501°F
	750°F	752°F

Omega TC Reader ID # 19752  
EPA Emissions Booth # 1  
Due for Calibration 3-8-2012  
Date of calibration 4-24-2012  
Used Omega Model CL23A Calibrator  
Calibrated 2-23-12 Due: 2-23-2013

Calibration done by: Kreig Maplethorpe

*Kreig Maplethorpe*

2

Location	Reference	Response
	0°F	1°F
	50°F	53°F
	100°F	103°F
FB Back	150°F	152°F
	250°F	252°F
	350°F	352°F
	500°F	502°F
	750°F	752°F

Location	Reference	Response
	0°F	2°F
	50°F	51°F
	100°F	101°F
FB Left	150°F	151°F
	250°F	251°F
	350°F	351°F
	500°F	501°F
	750°F	752°F

Location	Reference	Response
	0°F	1°F
	50°F	51°F
	100°F	101°F
FB Right	150°F	151°F
	250°F	251°F
	350°F	351°F
	500°F	501°F
	750°F	752°F

Location	Reference	Response
	0°F	1°F
	50°F	51°F
	100°F	101°F
Filter Train A	150°F	151°F
	250°F	251°F
	350°F	351°F
	500°F	501°F
	750°F	751°F

Omega TC Reader ID # 19752  
EPA Emissions Booth # 1  
Due for Calibration 3-8-2012  
Date of calibration 4-24-2012  
Used Omega Model CL23A Calibrator  
Calibrated 2-23-12 Due: 2-23-2013

Calibration done by: Kreig Maplethorpe

*Kreig Maplethorpe*

3

Location	Reference	Response
	0°F	1°F
	50°F	51°F
	100°F	101°F
Filter	150°F	151°F
Train B	250°F	251°F
	350°F	351°F
	500°F	501°F
	750°F	753°F



# QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS  
2340 SE 11<sup>TH</sup> Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293  
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



Intertek Testing Services NA, Inc -OR  
22887 NE Townsend Way  
Fairview, OR 97024

Report Number: INTT02R3G100038B121029

## **A2LA ACCREDITED** **CERTIFICATE OF CALIBRATION WITH DATA**

### INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Weightronics	3732	R3G100038B	19710	Warehouse
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.05	QC033	10/29/12	10/27/11	10/2013

### FUNCTIONAL CHECKS

SHIFT TEST		LINEARITY		REPEATABILITY		ENVIRONMENTAL CONDITIONS
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:	
50	0.05	HB44	HB44	50	0.05	
As-Found:		As-Found:		As-Found:		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	
As-Left:		As-Left:		As-Left:		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	<input type="checkbox"/> Good <input checked="" type="checkbox"/> Fair <input type="checkbox"/> Poor

### CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
250	249.95	249.95	0.064
150	150.00	150.00	0.064
100	100.00	100.00	0.031
50	50.00	50.00	0.031
25	25.00	25.00	0.031
10	10.00	10.00	0.031

### CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	12/17/11	12/2013	34XX

Permanent Information Concerning this Equipment:  
Indicator serial number: R3G100038

Comments/Information Concerning this Calibration

Report prepared/reviewed by: [Signature]

Date: 10/29/12

Technician: D. Thompson  
Signature: [Signature]

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

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1993.

Member: National Conference of Standards Laboratories and Weights & Measures



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(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



Calibration Services  
Certificate Number: 1550.01  
Laboratory code: 115953

Intertek Testing Services NA, Inc -OR  
22887 NE Townsend Way  
Fairview, OR 97024

Report Number: INTT02083047121029

### A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

#### INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Weigh-Tronix	WI125x1000	083047	19743	Warehouse
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.1	QC033	10/29/12	10/27/11	10/2013

#### FUNCTIONAL CHECKS

SHIFT TEST		LINEARITY		REPEATABILITY		ENVIRONMENTAL CONDITIONS
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:	
250	0.4	HB44	HB44	50	0.2	
As-Found:		As-Found:		As-Found:		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	
As-Left:		As-Left:		As-Left:		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	

<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Good	Fair	Poor

#### CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	1000.2	1000.2	0.12
500	500.0	500.0	0.08
300	300.0	300.0	0.08
200	200.0	200.0	0.08
100	100.0	100.0	0.05
50	50.0	50.0	0.05

#### CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	12/17/11	12/2013	34XX

#### Permanent Information Concerning this Equipment:

Indicator s/n 083047 Platform s/n 66190. Platform labelled 1000  
lb. x 0.2 lb.

#### Comments/Information Concerning this Calibration

Report prepared/reviewed by: Alk

Date: 10/29/12

Technician: D. Thompson

Signature: Alk

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

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

Member: National Conference of Standards Laboratories and Weights & Measures



NVLAP LAB CODE  
200886-0

## CERTIFICATE OF CALIBRATION

Customer: INTERTEK  
22887 NE TOWNSEND WAY  
FAIRVIEW, OR 97024

Customer Nbr: 1-556813-000  
PO Nbr:  
Date Received: April 05, 2012

Cert/SO Nbr: 2-BQ1C3-630002-1  
Manufacturer: Ohaus  
Model Nbr: AV264C

Date Completed: April 05, 2012  
Due Date: April 05, 2013

Description: Digital Balance  
Serial Nbr: 8031051017  
ID Nbr: 19683  
Unit Barcode: 402A0002607

Calibrated To: Manufacturer Specification  
Calibration Proc: 1-AC34283-0  
Item Received: In Tolerance  
Item Returned: In Tolerance

For calibration data, see Supplemental Report for SO Nbr 2-BQ1C3-630002-1

Transcat Calibration Laboratories have been audited and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the Lab's Scope of Accreditation are indicated by the presence of the Accrediting Body's Logo and Certificate Number on this Certificate of Calibration. Any measurements on an accredited calibration not covered by that Lab's Scope are listed in the notes section of the certificate. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Transcat calibrations, as applicable, are performed in compliance with the requirements of ISO 9001:2008, ISO TS16949, ANSI/NCCL Z540-1994, and ISO 10012:1992. When specified contractually, the requirements of 10CFR21, 10CFR50 App. B and NQA-1 are also covered.

Traceability includes no less than: An unbroken chain of comparison, realization of SI units, measurement uncertainty, documentation, competence, periodic recalibration, and measurement assurance. Transcat documents the traceability of measurements to the SI units through the National Institute of Standards and Technology (NIST) or the National Research Council of Canada (NRC), or other recognized national measurement institutes (NMI's) or international standard bodies, or to measurable conditions created in our laboratory, or accepted fundamental and/or natural physical constants, ratio type of calibration, or by comparison to consensus standards. The specific path of traceability for the reported measurement results is maintained at the Transcat facility and is available there for review.

Complete records of work performed are maintained by Transcat and are available for inspection. Laboratory standards used in the performance of this calibration are shown on the Supplemental Report.

The results in this report relate only to the item calibrated or tested, and the determination of in or out of tolerance is specific to the model/serial no. referenced above based on the tolerances shown on the supplemental report; these tolerances are either the original equipment manufacturer's (OEM's) warranted specifications or the client's requested specifications.


The applied uncertainty is the uncertainty of the calibration process. The Test Uncertainty Ratio (TUR) is calculated as per NCCL International RP-9, section 8.2. All calibrations have been performed using processes having a TUR of 4:1 or better, unless otherwise noted on the Supplemental Report. Uncertainties have been estimated at a 95 percent confidence level ( $k=2$ ). Calibration at a 4:1 TUR (or greater) provides reasonable confidence that the instrument is within the stated tolerances. For measuring instruments, in order to consider the contribution to the uncertainty from reproducibility of the unit under test (UUT), add 0.6 of the UUT's least significant digit to the reported uncertainty. For mass calibrations: Conventional mass referenced to 8.0 g/cm<sup>3</sup>.

Any number of factors can cause a unit to drift out of tolerance at any time following its calibration. Limitations on the uses of this instrument are detailed in the OEM's operating instructions.

Notes: TUR's of less than 1:1 approved by Bruce LeBlanc Qlty Mng'r 503-676-2311


Calibrated At:

22887 NE TOWNSEND WAY  
FAIRVIEW, OR 97024  
By: Drake Dunning

 Digitally Signed On April 05, 2012

Facility Responsible:

14058 SW Milton Ct  
Portland, OR 97224  
503-598-8700

  
Marc Jaso  
Lab Manager

**Revision 0**

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Certificate - Page 1 of 1

# CALIBRATION LAB DATA AS FOUND / AS LEFT

Service Order Nbr: 2-BQ1C3-630002-1

Description: Digital Balance

Serial: 8031051017

Customer: INTERTEK

Calibrated: 4/5/2012

Date Due: 4/5/2013

Service Type: N6

Mfg: Ohaus

Model: AV264C

PO Nbr:

ID Nbr: 19683

Calibration Proc: 1-AC34283-0

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	$\frac{Q}{n}$	Uncertainty ( $k=2; \pm$ )	TUR
Weight Measurement								
Linearity	10.0000g	$\pm(0.0003\text{ g})$	9.9997	10.0003	9.9999 g			
	50.0000g	$\pm(0.0003\text{ g})$	49.9997	50.0003	50.0000 g		1.200000e-004 g	2.5 : 1
	100.0000g	$\pm(0.0003\text{ g})$	99.9997	100.0003	100.0001 g		2.400000e-004 g	1.2 : 1
	150.0000g	$\pm(0.0003\text{ g})$	149.9997	150.0003	150.0000 g		5.000000e-004 g	0.6 : 1
	200.0000g	$\pm(0.0003\text{ g})$	199.9997	200.0003	200.0002 g		5.000000e-004 g	0.6 : 1
	260.0000g	$\pm(0.0003\text{ g})$	259.9997	260.0003	260.0002 g		1.200000e-003 g	0.2 : 1
Repeatability (Std. Deviation)		$\pm(0.0001\text{ g})$	-0.00010	0.00010	0.00008 g			

As Found and As Left Data recorded on 4/5/2012

Temperature: 68.0°F / 20.0°C

Relative Humidity: 41%

Temp/RH Asset: 179W

The reported uncertainty is the uncertainty of the calibration process. For measuring instruments, add 0.6 of the least significant digit to the reported uncertainty to obtain the measurement uncertainty of the unit under test at the specific test point.  
Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT.

# CALIBRATION LAB DATA AS FOUND / AS LEFT

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	0	Uncertainty (k=2; ±)	TUR
Asset	Manufacturer	Model	Description		Cal Date	Due Date	Traceability Numbers	
19-P014	Rice Lake Weighing Systems	1mg to 5kg	Weight Set, Class 1		4/13/2011	4/30/2012	05242-11	

Remarks:

TUR's of less than 1:1 approved by Bruce LeBlanc Qlty Mngr 503-676-2311

The reported uncertainty is the uncertainty of the calibration process. For measuring instruments, add 0.6 of the least significant digit to the reported uncertainty to obtain the measurement uncertainty of the unit under test at the specific test point.

Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT.



# TRANSCAT® CALIBRATION SERVICES

## Certificate of Compliance

It is hereby certified that this article has been tested for functionality. If the article has no testable function it has been inspected and is certified to be the article as described.

Customer: INTERTEK  
22887 NE TOWNSEND WAY  
FAIRVIEW, OR 97024

Customer Nbr: 1-556813-000  
PO Nbr: USA20-0000208799  
Date Received: December 09, 2011

Cert/SO Nbr: 2-BN24D-101-1  
Manufacturer: Troemner  
Model Nbr: Unknown (RM0101)

Date Completed: January 04, 2012  
Due Date: December 20, 2012

Description: Weight, Single 500 milligram Ultra Class  
Serial Nbr: 1000013130  
ID Nbr: 19684  
Unit Barcode: 900B0019546

For calibration data, see Supplemental Report for SO Nbr 2-BN24D-101-1

Transcat Calibration Laboratories have been audited and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the Lab Scope of Accreditation are indicated by the presence of the Accrediting Body's Logo and Certificate Number on this Certificate of Calibration. Any measurements on an accredited calibration not covered by that Lab Scope are listed in the notes section of the certificate. This report must not be used to claim product certification approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Transcat calibrations, as applicable, are performed in compliance with the requirements of ISO 9001:2008, ISO TS16949, ANSI/NCSL Z540-1994, and ISO 10012:1992. When specified contractually the requirements of 10CFR21, 10CFR50 App. B and NQA-1 are also covered.

Traceability includes no less than an unbroken chain of comparison realization of SI units, measurement uncertainty, documentation, competence, periodic recalibration, and measurement assurance. Transcat documents the traceability of measurements to the SI units through the National Institute of Standards and Technology (NIST) or the National Research Council of Canada (NRC), or other recognized national measurement institutes (NMI's) or international standard bodies, or to measurable conditions created in our laboratory, or accepted fundamental and/or natural physical constants, ratio type of calibration, or by comparison to consensus standards. The specific path of traceability for the reported measurement results is maintained at the Transcat facility and is available there for review.

Complete records of work performed are maintained by Transcat and are available for inspection. Laboratory standards used in the performance of this calibration are shown on the Supplemental Report.

The results in this report relate only to the item calibrated or tested, and the determination of in or out of tolerance is specific to the model/serial no. referenced above based on the tolerances shown on the supplemental report; these tolerances are either the original equipment manufacturer's (OEM's) warranted specifications or the client's requested specifications.

The applied uncertainty is the uncertainty of the calibration process. The Test Uncertainty Ratio (TUR) is calculated as per NCSL International RP9, section 8.2. All calibrations have been performed using processes having a TUR of 4:1 or better, unless otherwise noted on the Supplemental Report. Uncertainties have been estimated at a 95 percent confidence level ( $k=2$ ). Calibration at a 4:1 TUR (or greater) provides reasonable confidence that the instrument is within the stated tolerances. For measuring instruments in order to consider the contribution to the uncertainty from reproducibility of the unit under test (UUT), add 0.6 of the UUT's least significant digit to the reported uncertainty. For mass calibrations, conventional mass referenced to 8.0 g/cm<sup>3</sup>.

Any number of factors can cause a unit to drift out of tolerance at any time following its calibration. Limitations on the uses of this instrument are detailed in the OEM's operating instructions.

Notes: This unit was calibrated by Heusser Newweight 12/20/2011 (see attached doc# 10636-11). Documentation was reviewed per Transcat policy P0902.

Checked for compliance at:

14058 SW Milton Ct  
Portland, OR 97224  
By: Greg Guile

Digitally Signed On January 04, 2012

Facility Responsible:

14058 SW Milton Ct  
Portland, OR 97224  
503-598-8700



Digitally Signed By Marc Jaso for

Date: January 04, 2012

Tony Kutch  
Lab Manager

**Revision 0**

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F0013R22 8/12/2011

Certificate - Page 1 of 1



# SUPPLEMENTAL REPORT FOR 2-BN24D-101-1

## CALIBRATION LAB DATA AS FOUND / AS LEFT

Service Order Nbr: 2-BN24D-101-1

Description: Weight, Single 500 milligram Ultra Class

Serial: 1000013130

Customer: INTERTEK

Calibrated: 1/4/2012

Date Due: 12/20/2012

Service Type: V6

Mfg: Troemner

Model: Unknown (RM0101)

PO Nbr: USA20-0000208799

ID Nbr: 19684

Calibration Proc: 1-AC10001-2

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	Uncertainty (k=2; $\pm$ )	TUR
Function Check							
Documentation Verification			P	P	P		

As Found and As Left Data recorded on 1/4/2012

Temperature: 68.8°F / 20.4°C      Relative Humidity: 42%      Temp/RH Asset: 1015W

Asset      Manufacturer      Model      Description      Cal Date      Due Date      Traceability Numbers

### Remarks:

This unit was calibrated by Heusser Newweight 12/20/2011 (see attached doc# 10636-11). Documentation was reviewed per Transcat policy P0902.

# Heusser Neweigh, LLC Mass Certificate of Calibration

Issued to:

Transcat, Inc  
14058 SW Milton Court  
Portland, OR 97224

Heusser Neweigh Test Number:  
**10636-11**

Date of Calibration:  
20 December 2011

#### Order Information:

Purchase Order No.: 320281  
Date Received: 19 December 2011  
Submitted By: Paulette Rountree  
Next Calibration Due: December 2012

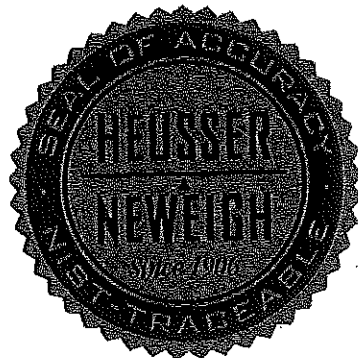
#### Description of the Mass Artifacts:

Manufacturer: Troemner  
Serial Number: 1000013130  
ID/Asset Number: 19684  
Accuracy Class: Ultra Class  
Description: 500 milligram weight

This is to certify that the information contained in this Certificate of Calibration is true and correct as of the date of calibration. This certificate of calibration shall not be reproduced except in full, without the written authorization of Heusser Neweigh.

  
Authorized Signature

*21 Dec 2011*  
Date of Issue



Calibration  
A2LA Certificate No.: 1823.01  
ISO/IEC 17025-2005  
ANSI/NCSL Z540-1-1994

Test # 10636-11  
Page: 1 of 4  
Date: 20 Dec 2011

HEUSSER NEWEIGH, LLC 1400 Willow Pass Court, Concord, California 94520 800.672.1440

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**Calibration Information:**

Metrologist 1: ALC  
Metrologist 2:  
Metrologist 3:

Test Method WP-310-2-2 (Rev.2010-1)

**Environmental Conditions:**

Temperature: 21.5 °C  
Pressure 1013.0 hPa  
Humidity: 45.0 %

**Reference Standards Used:****Mass Comparator Used:**

Cal ID #	Calibration Date	Calibration Due Date	Cal ID #	Model
56	14 December 2010	January 2012	18	Mettler a5

**As Found / As Left Data (unless reported in 'As Found' data) :**

Nominal Mass mg	ID	Assumed Density g/cm <sup>3</sup>	Conventional Mass mg	Correction mg	Estimated Uncertainty mg	Reference Standard ID	Comparator ID
500		7.95	499.9989	-0.0011	0.0010	56	18

**Comments:**

Test # 10636-11  
Page: 2 of 4  
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#### Pertinent Information:

The weights listed on this *Certificate of Calibration* have been compared to mass reference standards that are directly traceable to the National Institute of Standards and Technology (NIST). NIST # 822/275890 & NIST # 822/272103

The procedure used to calibrate the herein described weights and this *Certificate of Weight Calibration* meets the requirements and guidelines of ISO 17025:2005, ANCI/NCSL Z540-1-1994, ASTM E 817-97, or OIML R111, the Heusser Neweigh Quality Assurance Program (Revision 2007-1) and the purchase order referenced herein, if any.

The procedure used to disseminate an assigned value for each weight was performed through a series of intercomparisons between NIST traceable mass reference standards and the weights listed on this *Certificate of Calibration*.

Uncertainty has been calculated using the root-sum-square method to include both Type A components, assuming a normal distribution, and Type B components; with a coverage factor of  $k = 2$  to express the expanded uncertainty with an approximate 95% confidence level.

The calibration of the weights listed on this Mass Certificate of Calibration is based on an assumed apparent mass vs. material of density  $8.0 \text{ g/cm}^3$ , unless otherwise noted.

#### Definitions:

As Found Data—the conventional mass as it was received by Heusser Neweigh, after cleaning, but prior to adjustment or replacement.

As Left Data—the conventional mass after adjustment, repair, or replacement of the weight. The As Left data will equal the As Found data if there were no adjustment, repair, or replacement of the weight.

Calibration—the acts of determining the mass difference between a standard of known mass value and an "unknown" test weight or set of test weights, establishing the conventional mass value of the "unknown", and of determining a quantitative estimate of the uncertainty to be assigned to the stated conventional mass value of the "unknown".

Certificate of Calibration—a document that presents calibration results and other information relevant to a calibration, including the nominal mass values and corrections, together with a statement of the uncertainty of the values.

Class Tolerance—the maximum amount by which the conventional mass of the weight is allowed to deviate from the assigned nominal value, plus/minus the estimated uncertainty.

Conventional Mass—conventional value of the result of a weight at  $20^\circ\text{C}$ .

Correction—mass values are traditionally expressed by two numbers, one being the nominal mass of the weight, and the second being a correction. The mass of the weight is then the assigned nominal value plus the assigned correction. Positive corrections indicate that the weight embodies more mass than is indicated by the assigned nominal value.

Nominal Mass—the mass value as indicated on the weight.

Traceability—the property of the result of a measurement or the value of a standard whereby it can be related to national or international standards, through an unbroken chain of comparisons.

Uncertainty—in any measurement of mass, there are a number of sources of uncertainty. The uncertainty figure is an expression of the expanded overall uncertainty for the measurement, using two standard deviations as a limit to the effect of both random errors and systematic errors associated with the measurement process.

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APPENDIX 1: Troemner Tolerance Table

Nominal Mass	Troemner UltraClass								
kg	mg								
30	45								
25	37								
20	30								
10	15								
5	7								
4	4.5								
3	4.5								
2	3.0								
1	1.5								
g	mg								
500	0.7								
300	0.45								
200	0.30								
100	0.15								
50	0.07								
30	0.044								
20	0.044								
10	0.030								
5	0.020								
3	0.020								
2	0.020								
1	0.020								
mg	mg								
500	0.005								
300	0.005								
200	0.005								
100	0.005								
50	0.005								
30	0.005								
20	0.005								
10	0.005								
5	0.005								
3	0.005								
2	0.005								
1	0.005								

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# TRANSCAT<sup>®</sup> CALIBRATION SERVICES

## Certificate of Compliance

It is hereby certified that this article has been tested for functionality. If the article has no testable function it has been inspected and is certified to be the article as described.

Customer: INTERTEK  
2595 SOUTHWEST 153RD DRIVE  
BEAVERTON, OR 97006

Customer Nbr: 1-556813-000  
PO Nbr: USA20-0000202108  
Date Received: December 13, 2010

Cert/SO Nbr: 2-A94VT-88-1  
Manufacturer: Troemner  
Model Nbr: UNKNOWN (PM0104)

Date Completed: February 03, 2011  
Due Date: January 21, 2012

*One time cal only  
unless damaged.*

Part Nbr: Unknown (PM0104)  
Description: 10 Lb Weight, Single  
Serial Nbr: NONE  
ID Nbr: ~~NONE~~ *2015*  
Unit Barcode: 901B0008371

Transcat Calibration Laboratories have been audited and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the Labs Scope of Accreditation are indicated by the presence of the Accrediting Body's Logo and Certificate Number on this Certificate of Calibration. Any measurements on an accredited calibration not covered by that Labs Scope are noted below. This report must not be used to claim product certification, approval, or endorsement by NVLAP, A2LA, NIST, or any agency of the Federal Government.

Transcat calibrations, as applicable, are performed in compliance with the requirements of ISO 9001:2000, ISO TS16949, ANSI/NCCL Z340-1994, QS-9000 and ISO 10012:1992. When specified contractually the requirements of 10CFR21, 10CFR50 App. B and NQA-1 are also covered.

Transcat will maintain and document the traceability of all its standards to the National Institute of Standards and Technology (NIST) or the National Research Council of Canada (NRC), or to other recognized national or international standard bodies (NIMs), or to measurable conditions created in our laboratory, or accepted fundamental and/or natural physical constants, ratio type of calibration or by comparison to consensus standards. The specific path of traceability for the reported measurement results is maintained at the Transcat facility and is available there for review.

Complete records of work performed are maintained by Transcat and are available for inspection. Laboratory standards used in the performance of this calibration are shown below.

The results in this report relate only to the item calibrated or tested and the determination of in or out of tolerance is specific to the model/serial no. referenced above based on the manufacturer's published specifications.

All calibrations have been performed using processes having a test uncertainty ratio of four or more times greater than the unit calibrated unless otherwise noted on the Supplemental Report. Uncertainties have been estimated at a 95 percent confidence level ( $k=2$ ). Calibration at a 4:1 TUR provides reasonable confidence that the instrument is within the manufacturer's published specifications. Limitations on the uses of this instrument are detailed in the manufacturer's operating instructions. Any number of factors can cause a unit to drift out of tolerance at any time following its calibration. The reported uncertainty is the uncertainty of the calibration process. For measuring instruments add 0.6 of the least significant digit to the reported uncertainty to obtain the measurement uncertainty of the unit under test at the specific point. For mass calibrations conventional mass referenced to 8.0 g/cm<sup>3</sup>. For single sided tolerances no TUR will be provided.

Notes: This device was certified by Troemner on 21 Jan 2011, (see attached certificate 591491B), as reviewed by Transcat policy P0902R2.

Checked for compliance at:

14058 SW Milton Ct  
Portland, OR 97224  
By: Greg Guile

Digitally Signed On 2/3/2011

Facility Responsible:

14058 SW Milton Ct  
Portland, OR 97224  
503-598-8700

Reprinted on 02/08/2011

Digitally Signed By Drake Dunning for  
Date: 2/3/2011

Tony Kutch  
Lab Manager

Revision 0

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F0013R21 8/06/2009

Certificate - Page 1 of 1



# SUPPLEMENTAL REPORT FOR A94VT-88-1

## CALIBRATION LAB DATA AS FOUND / AS LEFT

Service Order Nbr: A94VT-88-1  
Description: 10 Lb Weight, Single  
Serial: NONE  
Customer: INTERTEK  
Calibrated: 2/3/2011  
Date Due: 1/21/2012  
Service Type: V9

Mfg: Troemner  
Model: UNKNOWN (PM0104)  
PO Nbr: USA20-0000202108  
ID Nbr: NONE  
Calibration Proc: 1-AC10001-1

Description	Setpoints	Accuracy	Low Limit	High Limit	As Found / As Left	Uncertainty (k=2; ±)	TUR
Function Check							
Documentation Verification							

As Found and As Left Data recorded on 2/3/2011

Temperature: 67.5°F / 19.7°C      Relative Humidity: 42%      Temp/RH Asset: 1013W

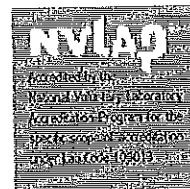
Asset	Manufacturer	Model	Description	Cal Date	Due Date	Traceability Numbers
None - 02	None - Only for Lab Use	NONE	Only for lab use	1/23/2009	1/23/2009	N/A

Remarks:

This device was certified by Troemner on 21 Jan 2011, (see attached certificate 591491B), as reviewed by Transcat policy P0902R2

The reported uncertainty is the uncertainty of the calibration process. For measuring instruments add 0.6 of the least significant digit to the reported uncertainty to obtain the measurement uncertainty of the unit under test at the specific test point.

Reported resolution of the UUT does not represent calibration uncertainty or accuracy of the UUT



# Calibration Certificate

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Weight

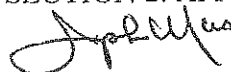
Certificate Number 591491B-1  
Date of Calibration 21-JAN-2011

## SECTION 1: NAME AND ADDRESS OF CUSTOMER

End user  
Transcat Inc  
14058 SW Milton Ct  
Portland OR 97224-8025

Client  
Transcat (Rochester)  
35 Vantage Point Drive  
Rochester NY 14624

## SECTION 2: APPROVED SIGNATORY

  
Joseph Moran, Metrology Manager

## SECTION 3: PERSON PERFORMING WORK

Daniel Foglio

## SECTION 4: CERTIFICATE INFORMATION

Description of Masses: Cast Iron

Accuracy Class : NIST 105-1 Class F  
Order Number : 304744  
Construction : Two Piece  
Material : Cast Iron

Date Received : 11-JAN-2011  
Date of Calibration : 21-JAN-2011  
Date of Issue : 21-JAN-2011  
Weight Range : 10 lb

## SECTION 5: ENVIRONMENTAL CONDITIONS DURING TEST

Temperature: 21.73°C

Pressure: 752.79 mm Hg

Relative Humidity: 45%

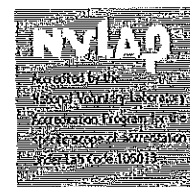
## SECTION 6: PERTINENT INFORMATION

The Weights listed on this calibration report have been compared to reference mass standards that are directly traceable to the National Institute of Standards and Technology under Test No. 822/272103-05.

Reference standards and balances used to perform the calibration are listed in Section 10.

The weights calibrated for this report have been calibrated in accordance with Troemner's calibration process. The calibration performed meets Level III criteria as described in the NIST/NVLAP Technical Guide 150-2.

This calibration also meets specifications as outlined in ISO 9001, ISO/IEC 17025, ANSI/NCSL Z540-1-1994, NRC Document 10CFR50 Appendix B, and applicable documents.



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Weight

Certificate Number 591491B-1  
Date of Calibration 21-JAN-2011

## NAME AND ADDRESS OF CUSTOMER

End user  
Transcat Inc  
14058 SW Milton Ct  
Portland OR 97224-8025

Client  
Transcat (Rochester)  
35 Vantage Point Drive  
Rochester NY 14624

## SECTION 7: TRUE MASS (MASS IN VACUUM) CALIBRATION DATA

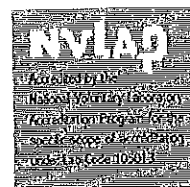
Nominal Mass Value	Serial Number	----- True Mass ----- As Found	----- As Left	Density <sup>1</sup> of Weight	Uncertainty (+ or -)
10 lb		4536.2786 g	4536.2786 g	7.2000 g/cm <sup>3</sup>	50.0 mg

<sup>1</sup> Density is assumed unless otherwise stated



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Weight

Certificate Number 591491B-1  
Date of Calibration 21-JAN-2011

## NAME AND ADDRESS OF CUSTOMER

End user  
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Portland OR 97224-8025

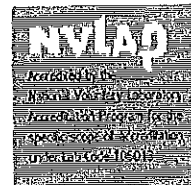
Client  
Transcat (Rochester)  
35 Vantage Point Drive  
Rochester NY 14624

## SECTION 8: MASS IN AIR CALIBRATION VALUE VS. REFERENCE DENSITY $8000 \text{ kg m}^{-3}$

Nominal Mass Value	Serial Number	---- Conventional Mass Value ----		Uncertainty (+ or -)	Tolerance (+ or -)
		As Found	As Left		
10 lb		4536.2030 g	4536.2030 g	50.0 mg	450.0000 mg



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Weight

Certificate Number 591491B-1  
Date of Calibration 21-JAN-2011

## NAME AND ADDRESS OF CUSTOMER

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14058 SW Milton Ct  
Portland OR 97224-8025

Client  
Transcat (Rochester)  
35 Vantage Point Drive  
Rochester NY 14624

## SECTION 9: MASS IN AIR CALIBRATION DATA VS. REFERENCE DENSITY $8000 \text{ kg m}^{-3}$

Nominal Mass Value	Serial Number	-- Conventional Mass Correction --		Uncertainty (+ or -)	Tolerance (+ or -)
		As Found	As Left		
10 lb		279.3 mg	279.3 mg	50.0 mg	450.0000 mg

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35 Vantage Point Drive  
Rochester NY 14624

## SECTION 10: CALIBRATION PROCEDURE DATA

Nominal Mass Value	Serial Number	Standard Set No.	Cal Due	Balance Used	Cal Due	Procedure Used
10 lb		S1104	02/28/11	XP64003L-A01	11/30/11	Multi A-B

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Weight

Certificate Number 591491B-1

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NAME AND ADDRESS OF CUSTOMER

End user

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14058 SW Milton Ct  
Portland OR 97224-8025

Client

Transcat (Rochester)  
35 Vantage Point Drive  
Rochester NY 14624

## SECTION 11: GENERAL INFORMATION

This calibration was performed in Troemner's High Precision Level I Mass Metrology Laboratory at 201 Wolf Drive, Thorofare, New Jersey 08086 unless otherwise noted on page one. The internal procedures used are CAL-CLASSI, CAL-MMAP, and NIST HB145.

## SECTION 12: DEFINITIONS AND TERMS

**MASS IN A VACUUM** - The mass of a weight as if it were measured in a vacuum. Also known as True Mass.

**MASS IN AIR** - The conventional value of the result of weighing in air, in accordance to International Recommendation OIML D 28. For a weight taken at 20° C, the conventional mass is the mass of a reference weight of a density of 8000 kg·m<sup>-3</sup> which it balances in air of a density of 1.2 kg·m<sup>-3</sup>.

**AS FOUND MASS IN A VACUUM** - The measured value of the mass(es) as they were received by Troemner.

**AS LEFT MASS IN A VACUUM** - The measured value of the mass(es) after they were adjusted, repaired or replaced when necessary. The As Found Mass in a Vacuum will equal the As Left Mass in a Vacuum if the mass(es) did not require adjustment, repair or replacement.

**NOMINAL MASS** - The mass value as marked on the weight.

**CORRECTION** - The difference between the mass value of a weight and its nominal value. A positive correction indicates that the mass value is greater than the nominal value by the amount of the correction.

**AS FOUND CONVENTIONAL MASS CORRECTION** - The conventional correction of the result, as it was received by Troemner, of weighing in air in accordance to International Recommendation D 28. For a weight taken at 20° C, the conventional mass is the mass of a reference weight of density 8000 kg·m<sup>-3</sup> which it balances in air density of 1.2 kg·m<sup>-3</sup>. If the customer requires cleaning prior to calibration, the after cleaning correction would be reported.

**AS LEFT CONVENTIONAL MASS CORRECTION** - The conventional correction of the result, after adjustment, repair, or replacement of weighing in air in accordance to International Recommendation D 28. For a weight taken at 20° C, the conventional mass is the mass of a reference weight of density 8000 kg·m<sup>-3</sup> which it balances in air density of 1.2 kg·m<sup>-3</sup>. The As Found will equal the As Left Conventional Mass Correction if the mass(es) did not require adjustment, repair or replacement.

*(continued on next page)*

# Calibration Certificate

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Weight

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### Client

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35 Vantage Point Drive  
Rochester NY 14624

## SECTION 12: DEFINITIONS AND TERMS (continued)

**UNCERTAINTY** - The standard deviation associated with the result of the measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurand. The uncertainty is calculated in accordance with NIST TechNote 1297 / UKAS M3003 using a coverage factor of  $k = 2$  ( $k = 2$  defines an interval having a level of confidence of approximately 95 percent). The uncertainty does not include possible effects of magnetism.

**TOLERANCE** - Defines the limits in which the correction value and the uncertainty must fall to meet the tolerance specification for the given Class.

**AS FOUND CONVENTIONAL MASS VALUE** - The measured value of the mass(es) as they were received by Troemner, of weighing in air in accordance to International Recommendation OIML D 28. For a weight taken at 20° C, the conventional mass is the mass of a reference weight of density 8000 kg·m<sup>-3</sup> which it balances in air density of 1.2 kg·m<sup>-3</sup>. If the customer requires cleaning prior to calibration, the after cleaning value would be reported. F denotes Out of Tolerance Weight.

**AS LEFT CONVENTIONAL MASS VALUE** - The measured value of the mass(es) after they were adjusted, repaired or replaced when necessary, of weighing in air in accordance to International Recommendation OIML D 28. For a weight taken at 20° C, the Conventional Mass is the mass of a reference weight of density 8000 kg·m<sup>-3</sup> which it balances in air density of 1.2 kg·m<sup>-3</sup>. The As Found will equal the As Left Conventional Mass Value if the mass(es) did not require adjustment, repair or replacement.

**ASTM E617-97** - Weights meet the tolerance specification for ASTM E617-97. Weights 2kg - 1g screened for magnetism using a Gaussmeter.

## SECTION 13: ADDENDUM

Weight(s) Pass Visual Inspection

## **Appendix E**

### **Sample Calculations**

## Equations and Sample Calculations - Method 5G

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.

BR	Dry burn rate, kg/hr
$m_p$	Total particulate matter collected, mg
$V_{m(std)}$	Volume of gas sampled corrected to standard conditions, dscf
$v_s$	Average dilution tunnel gas velocity, ft/sec
$C_s$	Particulate concentration, g/dscf
$Q_{sd}$	Average dilution tunnel gas flow rate, dscf/min
E	Particulate emission rate, lbs/hr
PR	Proportional rate variation, %

## Dry Burn Rate

Using equation 28-3:

$$BR = \frac{60 \times W_{wd}}{\theta} \times \frac{100 - \%M_w}{100}$$

Where,

- BR = Dry burn rate, lb/hr
- $W_{wd}$  = Mass of wood burned (wet basis) during test run, lb
- $\theta$  = Total time of test run, minutes
- $\%M_w$  = Average moisture content of test fuel charge, wet basis percent

Sample Calculation:

Dry basis moisture of fuel = 20.03%

Using the equation 28-2 for converting dry basis moisture to wet basis moisture,

$$\%M_w = \frac{20.03 \times 100}{20.03 + 100}$$

$$\%M_w = 16.69\%$$

The wet weight of the fuel charge was 7.8 pounds. Converting pounds to kilograms yields a weight of 3.538 kg. The run time for this run was 180 minutes. Therefore, the burn rate equation appears thus:

$$BR = \frac{60 \times 3.538 \times (100 - 16.69)}{180 \times 100}$$

$$BR = 0.98 \text{ kg/hr} = 2.17 \text{ lb/hr}$$

## Volume of Gas Sampled Corrected to Dry Standard Conditions

Using equation 5-1:

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

Where:

K	=	17.64 °R/in. Hg
T <sub>std</sub>	=	528 °R
P <sub>std</sub>	=	29.92 in. Hg
V <sub>m</sub>	=	Volume of gas sample measured at the dry gas meter, dcf
Y	=	Dry gas meter calibration factor, dimensionless
P <sub>b</sub>	=	Barometric pressure at the testing site, in. Hg
ΔH	=	Average pressure differential across the orifice meter, in. H <sub>2</sub> O
T <sub>m</sub>	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

$$V_{m(std)} = 98.434 \times 1.01 \times \left( \frac{528}{29.92} \right) \times \frac{30.03 + \frac{0.7}{13.6}}{532.5}$$

$$V_{m(std)} = 99.116 \text{ ft}^3$$

## Dilution Tunnel Gas Velocity

Using equations 2-7 and 2-6, calculated at each recorded interval:

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

$$M_s = M_d \times (1 - B_{ws}) + 18.0 \times B_{ws}$$

Where:

$v_s$  = Average dilution tunnel gas velocity, ft/sec

$k_p$  = Pitot tube constant:  $85.49 \frac{ft}{sec} \left[ \frac{(lb/lb-mole) \times (inches\ Hg)}{(^{\circ}R) \times (inches\ H_2O)} \right]^{\frac{1}{2}}$

$C_p$  = Pitot tube coefficient (0.99 for standard pitot tube; 0.84 may be used for S-type pitot tubes constructed according to Method 2 procedures), unitless

$\Delta P$  =  $\Delta P$  measured during the pre-test flow traverse of the dilution tunnel; the square root of the  $\Delta P$  values are averaged for this calculation, in.  $H_2O$

$P_b$  = Barometric pressure at test site, in. Hg

$P_g$  = Static Pressure of tunnel, in. Hg

$P_s$  = Absolute tunnel pressure,  $= P_b + P_g$

$M_s$  = Molecular weight of tunnel gas; assume  $M_d = 29$  lb/lb-mole (per method 5G)

$B_{ws}$  = Moisture content of dilution tunnel gas, ratio; assume 4% (per method 5G)

$T_s$  = Dilution tunnel temperature,  $^{\circ}R$ ; ( $^{\circ}R = ^{\circ}F + 460$ )

Sample calculation:

$$M_s = 29 \times (1 - 0.04) + 18.0 \times 0.04 = 28.56$$

$$v_s = 85.49 \times 0.99 \times \sqrt{0.0351} \times \sqrt{\frac{(548)}{(30.03 + \frac{-0.45}{13.6}) \times (28.56)}}$$

$$v_s = 12.69 \frac{ft}{sec}$$

## Particulate Concentration

Using equation 5G-2:

$$C_s = 0.001 \frac{g}{mg} \times \frac{m_n}{V_{m(std)}}$$

Where:

- $C_s$  = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscf
- $m_n$  = 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:

$$C_s = \frac{0.001 \times 16.2}{99.116}$$

$$C_s = 0.000163 \text{ g/dscf}$$

## Average Dilution Tunnel Gas Flow Rate

Using equation 2-8, calculated at each recorded interval:

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

Where:

$Q_{sd}$	=	Gas flow rate corrected to dry, standard conditions, dscf/hr
3600	=	Conversion from seconds to hours
$B_{ws}$	=	Moisture content of dilution tunnel gas, ratio; assume 4% (per method 5G)
$v_s$	=	Average dilution tunnel gas velocity, ft/sec
$A$	=	Cross sectional area of dilution tunnel, ft <sup>2</sup>
$T_{std}$	=	Standard absolute temperature, 538°R
$T_{s(avg)}$	=	Average absolute dilution tunnel temperature, °R, (°R = °F + 460)
$P_b$	=	Barometric pressure at test site, in. Hg
$P_g$	=	Dilution tunnel static pressure, in. Hg
$P_s$	=	Absolute dilution tunnel gas pressure, in Hg, (Hg = $P_b + P_g$ )
$P_{std}$	=	Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.04) \times 12.69 \times \frac{(\pi \times 3^2)}{144} \times \frac{528}{548} \times \frac{30.03 + \frac{-0.45}{13.6}}{29.92}$$

$$Q_{sd} = 8313.36 \text{ dscf/hr} = 138.56 \text{ dscf/min}$$

## Particulate Emission Rate

Using equation 5G-3 and 5G-4:

$$E = C_s \times Q_{sd}$$

$$E_{adj} = K_3 \times E^{0.83}$$

Where:

- $E$  = Particulate emission rate, g/hr
- $E_{adj}$  = Particulate emission rate, adjusted, g/hr
- $C_s$  = Concentration of particulate matter in the stack, corrected to dry, standard conditions, g/dscf
- $Q_{sd}$  = Average dilution tunnel gas flow rate, dscf/hr
- $K_3$  = Constant, 1.82 for metric units, 0.643 for English units

Sample calculation:

$$E = 0.000163 \times 8313.36$$

$$E = 1.36 \text{ g/hr}$$

$$E_{adj} = 1.82 \times 1.36^{0.83}$$

$$E = 2.35 \text{ g/hr}$$

## Proportional Rate Variation

Using equation 5H-9, calculated at each recorded interval:

$$PR = \frac{\theta \times (V_{mi} \times V_s \times T_m \times T_{si})}{10 \times (V_m \times V_{si} \times T_s \times T_{mi})} \times 100$$

Where:

PR	=	Percent proportional rate
$\theta$	=	Time of test, min
$S_i$	=	Measured tracer gas concentration for the "i <sup>th</sup> " interval, in this case, the inverse of the calculated flow in the stack based on CO <sub>2</sub> concentrations in the stack and in the dilution tunnel
$V_{mi(std)}$	=	Volume of gas sample measured by the dry gas meter during the "i <sup>th</sup> " 10 minute interval, dscf
$V_m$	=	Volume of gas sample as measured by dry gas meter, dscf
$V_{si}$	=	Average gas velocity in the dilution tunnel during each 10 minute interval, i, of the test run, m/sec
$V_s$	=	Average gas velocity in the dilution tunnel, m/sec
$T_{mi}$	=	Absolute average dry gas meter temperature during each 10 minute interval, i, of the test run, °R
$T_m$	=	Absolute average dry gas meter temperature, °R
$T_{si}$	=	Absolute average gas temperature in the dilution tunnel during each 10 minute interval, i, of the test run, °R
$T_s$	=	Absolute average gas temperature in the dilution tunnel, °R

Sample calculation (for the reading at 50 minutes into test run 1):

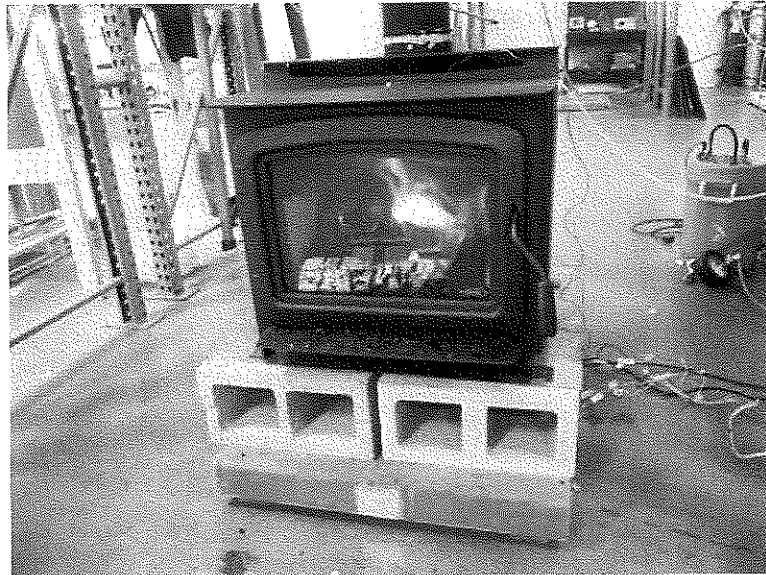
$$PR = \frac{180 \times 5.6 \times 12.69 \times 533 \times 552}{10 \times 98.434 \times 12.63 \times 548 \times 532} \times 100$$

$$PR = 103.8\%$$

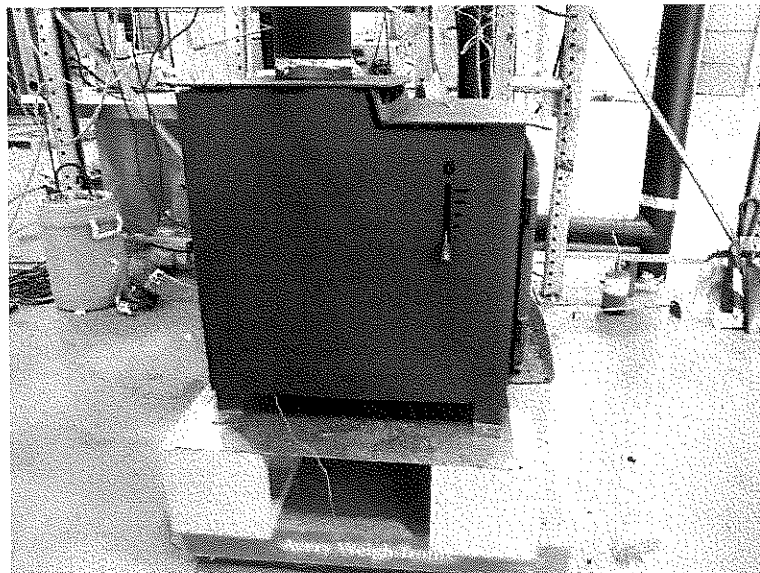
## **Appendix F**

### **Test Data**

**Lennox RCA Test Series  
Model Grand View 230  
Project Number G100962764**



GV 230 Front View



GV 230 Side View

## 8/27/2010

Nov. 13 through Nov 16, 2012

3=pellet

Totals:	1.4748	4.8148	0.00
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Weighted average emissions rate:	3.2647
Weighted Average OHE:	0.00

32

## TEST RESULTS EPA METHOD 5G-3

Project Number: G100926764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 13-Nov-12  
 Test Run Number: 1

Dry Burn-Rate, kg/hr:		1.38
Emission-Rate, g/hr:		2.52
Adjusted Emission-Rate, g/hr :		3.92
Duration of Test, Minutes		250
Dry Gas Meter Standardization		Train ATrain B
Dry Gas Meter Beginning Reading, ft³	0	0
Dry Gas Meter Ending Reading, ft³	40.056	38.638
Barometric Pressure Correction Factor	1.003	1.003
Dry Gas Meter Calibration Factors (y factors)	0.977	0.9872
Dry Gas Meter Temperature Factors	0.975	0.975
Dry Gas Meter Delta-H Correction Factors	1.008	1.007
Dry Gas Meter STD Volume Sampled, ft³	38.589	37.613
Dillution Tunnel Flow / Volume		
Standardized Tunnel Flow, dscfm	140.504	
Total Tunnel Volume, scf	35126.033	
Emission Caclulations	Train A	Train B
Sample Ratios (Total Tunnel Volume / Total Sample Volume)	910.252	933.888
Sample Particulate Mass, mg	11.6	11.2
Total Emissions, grams	10.559	10.460
Emission-Rate, g/hr	2.53	2.51
Adjusted Emission Rates, g/hr	3.94	3.91
Deviation, %	0.00	
For catalytic equipped appliances - if deviation from average emission rate is greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 4.1 g/hr.	0.01	
For non-catalytic appliances - if deviation from average emission rate ls greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 7.5 g/hr.	0.41%	
Operating Parameters	Train A	Train B
Max Filter Temperature, °F	76	77
Post-Test Leak Check, cfm @ in. Hg vac.	.006@6	.004@10
Average Firebox Surface Temperture delta-T, °F	42	
Maximum Ambient Temperture, °F	79	
Mimimum Ambient Temperature, °F	70	
Fuel Properties		
Wet Fuel Load Weight, lb.	15.25	
Dry-Basis Fuel Load Moisture Content, %	20.29	
Wet-Basis Fuel Load Moisture Content, %	16.87	
Coal Bed Range, lb.	3.10	3.80
Actual Coal Bed, Lb.	3.3	

Test Engineer: BTD

Date: 11/26/12

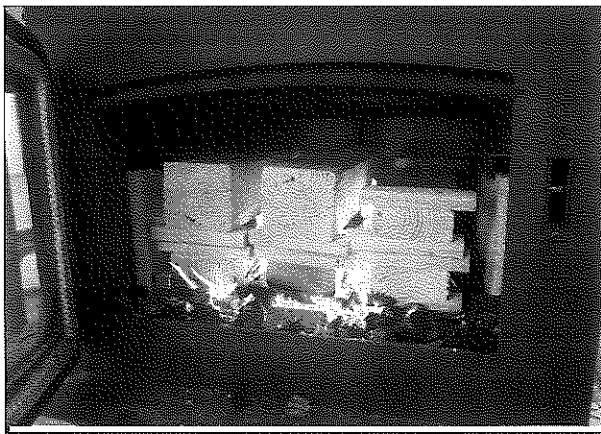
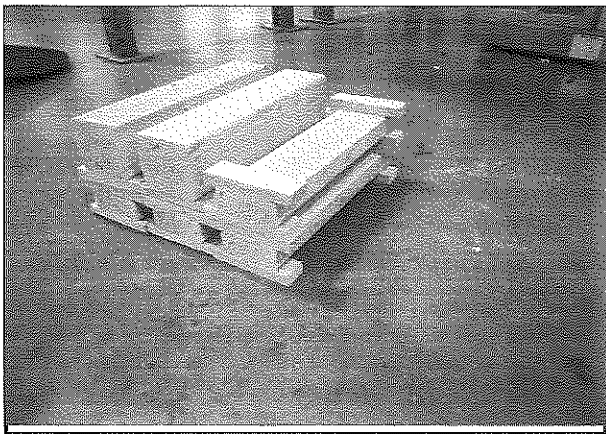


# Run Notes

## EPA Methods 28 and 5G-3

PROJECT / TEST INFORMATION	
Project Number:	G100926764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	13-Nov-12
Test Run Number:	1
Date tunnel cleaned:	11/12/2012
Purpose of Test	RCA

Appliance Information		
Appliance Type:	2	1 - Catalytic 2 - Non - Catalytic 3 - Pellet 4 - Hydronic
Firebox Volume, ft <sup>3</sup> :	2.28	N/A for pellet type
Convection Blower	2	1 - No Fan 2 - Fan Optional 3 - Fan Standard

[illegible]

Test Engineer: 302

Date: 11/26/12

Project Number:	G100926764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	13-Nov-12
Test Run Number:	1

Firebox Volume, ft <sup>3</sup> :	2.28
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Calibration Reference ID	
Set meter to Species 1	
Set Temperature to 70F	12% 12.0
Set pin setting to 444	22% 22.0

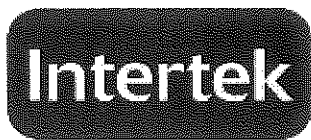
PRE-BURN FUEL PROPERTIES					
Eq. ID No.:		Time:	9:30	Temp., °F:	65
Piece No.	Length, In.	Weight, Lb.	Moisture, %, Dry Basis		
1	96.00	15.80	20.5	22.7	19.7
2	96.00		19.4	20.5	21.4
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total Weight		15.8	Average, %db		20.7

Allowable Fuel Load Range:	14.4	to	17.5
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TEST FUEL LOAD PROPERTIES						
Eq. ID No.:		Time:		Temp., °F:		
Piece No.	Length, In.	Weight, Lb.		Moisture, %, Dry Basis		
		2x4	4x4			
1	15.00		3.60	19.8	22.4	23.4
2	15.00		3.75	19.4	22.5	19.9
3	15.00	2.05		20.3	20.1	19.2
4	15.00	1.75		19.1	19.1	19.2
5	15.00	2.05		20.0	19.7	19.2
6	15.00	2.05		20.8	19.4	21.7
7						
8						
Totals		7.9	7.4			
% of Weight		52	48			
Total weight, wet, lb.		15.25		Average Moisture, dry		20.29
Total weight, dry, kg		5.75		Average Moisture, wet		16.87

Test Engineer: BD

Date: 11/26/12



Project Number:	G100926764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	13-Nov-12
Test Run Number:	1

EPA Method 28  
Pre Burn Data

Coal Bed Range	3.1	to	3.8
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Average Firebox Temp, °F	349.4
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Final Coal Bed Wt, lb	3.3
-----------------------	-----

[illegible]

Test Engineer: B. J.

Date: 11/22/22



TEST DATA  
EPA METHOD 5G-3

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID No: PRT1211131110-001  
Test Date: 13-Nov-12  
Test Run No: 1

Temperature Data

Firebox Temp Start	347.2
Firebox Temp End	305.2
Firebox Delta-T	42.0

Max Filter Temps	
Train A	Train B
76	77

Interval	10	Duration of Test, Min			250		Firebox Data 1			425		70		77	
Time		Temperature Data													
Interval	Duration	Room	Dilution Tunnel	Flue Gas	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Outlet	Train A Filter	Train B Filter	Train A DGM	Train B DGM	
0	0	70	80	186	247	339	288	430	432		70	70	72	72	
1	10	71	104	303	271	333	345	418	422		75	75	74	73	
2	20	71	100	332	347	331	339	389	406		74	74	75	74	
3	30	72	107	385	435	325	336	378	412		75	75	77	77	
4	40	73	112	437	534	322	309	385	431		76	76	78	78	
5	50	73	111	419	571	320	293	398	453		76	76	80	80	
6	60	76	111	422	604	318	302	411	474		76	77	81	82	
7	70	75	105	386	593	319	315	427	493		76	77	83	83	
8	80	75	102	359	550	322	324	442	493		76	77	84	84	
9	90	74	96	319	494	324	327	454	486		76	76	84	84	
10	100	76	95	292	431	326	326	459	477		75	76	84	84	
11	110	73	91	277	391	327	319	457	462		74	74	84	84	
12	120	72	88	256	367	325	316	459	451		73	73	84	83	
13	130	72	85	232	332	327	314	452	444		72	72	84	83	
14	140	71	83	221	305	325	309	442	437		72	72	83	82	
15	150	70	82	211	281	318	298	429	429		71	71	83	82	
16	160	70	81	209	270	313	295	424	426		70	70	82	82	
17	170	70	81	209	261	310	294	418	424		70	70	82	82	
18	180	71	82	206	256	303	296	413	422		70	70	82	82	
19	190	76	84	206	253	299	299	410	422		72	72	82	82	
20	200	71	84	201	246	291	299	405	417		71	71	82	82	
21	210	72	85	199	241	284	298	399	412		72	72	82	83	
22	220	79	89	199	239	276	296	396	408		73	73	82	83	
23	230	73	86	193	232	275	291	390	400		73	72	83	84	
24	240	76	83	190	226	275	284	386	390		75	74	83	84	
25	250	73	81	187	218	269	274	384	381		73	74	84	84	

Test Engineer: B. D.

Date: 11/26/12



TEST DATA  
EPA METHOD 5G-3

Gas Particulate Sampling Data

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 13-Nov-12  
Test Run Number: 1

Barometer, in. Hg	RH, %	Sample Box Correction (y) Factors	
Start	30.03	45.1	0.977
End	30.01	44.9	0.987

Leak Check, cfm @ in Hg	
Train A	Train B
.006@6	.004@10

Maximum Vacuum	
Train A	Train B
0.00	0.00

Duration of Test, Min		250											
Time	Particulate Sampling Data												
	Tunnel Delta-P	Train A Delta-H	Train B Delta-H	Flue Draft	Fuel Weight	Weight Loss	Train A Volume	Train B Volume	Train A Proportional Rate	Train B Proportional Rate	Train A Vacuum, In. Hg	Train B Vacuum, In. Hg	
0	0.048	3.00	3.00	-0.020	15.30	15.30	0.000	0.000	100.03	100.03	0.00	0.00	
10	0.048	3.04	3.03	-0.050	13.80	1.50	1.546	1.533	98.95	101.89	0.00	0.00	
20	0.048	3.03	3.01	-0.060	12.80	1.00	3.126	3.060	100.57	100.95	0.00	0.00	
30	0.048	3.03	3.01	-0.060	11.20	1.60	4.718	4.594	101.59	101.47	0.00	0.00	
40	0.048	3.03	3.01	-0.070	9.50	1.70	6.336	6.156	103.51	103.58	0.00	0.00	
50	0.048	3.04	3.01	-0.070	8.10	1.40	8.011	7.812	106.67	109.31	0.00	0.00	
60	0.048	3.04	3.02	-0.070	6.60	1.50	9.498	9.211	94.52	92.01	0.00	0.00	
70	0.048	3.06	3.03	-0.060	5.40	1.20	11.070	10.717	99.03	98.34	0.00	0.00	
80	0.048	3.07	3.05	-0.060	4.40	1.00	12.664	12.248	99.96	99.53	0.00	0.00	
90	0.048	3.08	3.04	-0.050	3.80	0.60	14.280	13.810	100.80	101.00	0.00	0.00	
100	0.048	3.08	3.08	-0.050	3.30	0.50	15.912	15.381	101.71	101.49	0.00	0.00	
110	0.048	3.06	3.07	-0.050	2.80	0.50	17.484	16.896	97.62	97.52	0.00	0.00	
120	0.048	3.08	3.09	-0.040	2.50	0.30	19.116	18.466	101.06	100.97	0.00	0.00	
130	0.048	3.09	3.07	-0.040	2.20	0.30	20.756	20.050	101.28	101.59	0.00	0.00	
140	0.048	3.09	3.06	-0.040	2.00	0.20	22.363	21.596	99.24	99.15	0.00	0.00	
150	0.048	3.11	3.08	-0.030	1.80	0.20	23.903	23.086	95.02	95.47	0.00	0.00	
160	0.048	3.11	3.07	-0.030	1.60	0.20	25.612	24.728	105.54	105.12	0.00	0.00	
170	0.048	3.12	3.06	-0.030	1.40	0.20	27.283	26.337	103.20	103.00	0.00	0.00	
180	0.048	3.07	3.07	-0.030	1.20	0.20	28.783	27.782	92.72	92.59	0.00	0.00	
190	0.048	3.08	3.09	-0.030	1.10	0.10	30.381	29.326	98.96	99.12	0.00	0.00	
200	0.048	3.09	3.08	-0.030	0.90	0.20	32.089	30.970	105.77	105.53	0.00	0.00	
210	0.048	3.09	3.07	-0.030	0.60	0.30	33.708	32.549	100.35	101.27	0.00	0.00	
220	0.048	3.10	3.08	-0.030	0.50	0.10	35.204	33.975	93.07	91.79	0.00	0.00	
230	0.048	3.10	3.05	-0.030	0.30	0.20	36.919	35.628	106.21	105.92	0.00	0.00	
240	0.048	3.09	3.05	-0.030	0.20	0.10	38.446	37.097	94.30	93.87	0.00	0.00	
250	0.048	3.09	3.06	-0.030	0.00	0.20	40.056	38.638	99.06	98.29	0.00	0.00	

Test Engineer: BD

Date: 11/26/12



# Dilution Tunnel Velocity Traverse EPA Method 5G-3

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 13-Nov-12  
Test Run Number: 1

	Dilution Tunnel		Square Root
	Delta P In. H2O	Temp, °F	
A1	0.0280	99	0.1673
A2	0.0360	99	0.1897
A3	0.0480	99	0.2191
A4	0.0360	99	0.1897
A Center	0.0480	99	0.2191
B1	0.0280	99	0.1673
B2	0.0420	99	0.2049
B3	0.0480	99	0.2191
B4	0.0280	99	0.1673
B Center	0.0480	99	0.2191
Averages	0.039	99	0.1906

Tunnel Diameter **6.000** inches

Tunnel Static **-0.430** in. H2O

Tunnel Area 0.19635 Ft<sup>2</sup>

Pitot Correction 0.8698 factor

Baro. Pressure 30.03

Pitot Factor **0.99** (0.99 for standard, 0.84 or Cal. For S-Type )

Initial Velocity 13.028 Ft/ Sec

Initial Flow **139.63** Ft<sup>3</sup>/min

Test Engineer: 

Date: 11/26/12



DILLUTION TUNNEL PARTICULATE CALCULATIONS  
EPA Method 5G-3

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 13-Nov-12  
Test Run Number: 1

Intertek Equipment No.'s \_\_\_\_\_

Sample Train - 1					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	469		118	
B - Rear Filter Catch	Filter	470		118.6	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			246.5	236.6	9.9
Probe & Filter Holder	Probe	18	113659.1	113657.4	1.7
			Total Particulate, mg		11.6

Sample Train - 2					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	471		118.1	
B - Rear Filter Catch	Filter	472		119.8	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			247.2	237.9	9.3
Probe & Filter Holder	Probe	20	113474.0	113472.1	1.9
			Total Particulate, mg		11.2

Test Engineer: B. J. [Signature]

Date: 11/29/12

## TEST RESULTS EPA METHOD 5G-3

Project Number: G100926764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 14-Nov-12  
 Test Run Number: 2

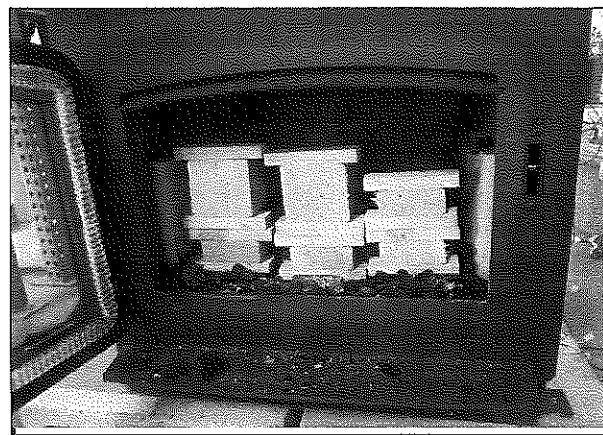
Dry Burn-Rate, kg/hr:		1.15
Emission-Rate, g/hr:		1.99
Adjusted Emission-Rate, g/hr :		3.22
Duration of Test, Minutes		290
<b>Dry Gas Meter Standardization</b>		
	Train A	Train B
Dry Gas Meter Beginning Reading, ft <sup>3</sup>	0	0
Dry Gas Meter Ending Reading, ft <sup>3</sup>	45.826	44.395
Barometric Pressure Correction Factor	1.006	1.006
Dry Gas Meter Calibration Factors (γ factors)	0.977	0.9872
Dry Gas Meter Temperature Factors	0.973	0.974
Dry Gas Meter Delta-H Correction Factors	1.007	1.007
Dry Gas Meter STD Volume Sampled, ft <sup>3</sup>	44.147	43.255
<b>Dilution Tunnel Flow / Volume</b>		
Standardized Tunnel Flow, dscfm		137.815
Total Tunnel Volume, scf		39966.393
<b>Emission Calculations</b>		
	Train A	Train B
Sample Ratios (Total Tunnel Volume / Total Sample Volume)	905.312	923.975
Sample Particulate Mass, mg	10.5	10.5
Total Emissions, grams	9.506	9.702
Emission-Rate, g/hr	1.97	2.01
Adjusted Emission Rates, g/hr	3.19	3.25
Deviation, %	0.01	
For catalytic equipped appliances - if deviation from average emission rate is greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 4.1 g/hr.	0.01	
For non-catalytic appliances - if deviation from average emission rate is greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 7.5 g/hr.	0.73%	
<b>Operating Parameters</b>		
	Train A	Train B
Max Filter Temperature, °F	77	77
Post-Test Leak Check, cfm @ in. Hg vac.	.01@12	.008@6
Average Firebox Surface Temperature delta-T, °F	71.4	
Maximum Ambient Temperature, °F	79	
Minimum Ambient Temperature, °F	71	
<b>Fuel Properties</b>		
Wet Fuel Load Weight, lb.	14.85	
Dry-Basis Fuel Load Moisture Content, %	21.58	
Wet-Basis Fuel Load Moisture Content, %	17.75	
Coal Bed Range, lb.	3.00	3.70
Actual Coal Bed, Lb.	3.3	

Test Engineer: B. D.

Date: 11/24/12



Appliance Information		
Appliance Type:	2	1 - Catalytic 2 - Non - Catalytic 3 - Pellet 4 - Hydronic
Firebox Volume, ft <sup>3</sup> :	2.28	N/A for pellet type
Convection Blower	2	1 - No Fan 2 - Fan Optional 3 - Fan Standard

[illegible]

Date: 11/26/12

Project Number:	G100926764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	14-Nov-12
Test Run Number:	2

Firebox Volume, ft <sup>3</sup> :	2.28
-----------------------------------	------

Calibration Reference ID	
Set meter to Species 1	
Set Temperature to 70F	12% 12.0
Set pin setting to 444	22% 22.0

PRE-BURN FUEL PROPERTIES					
Eq. ID No.:		Time:	10:10	Temp., °F:	65
Piece No.	Length, In.	Weight, Lb.	Moisture, %, Dry Basis		
1	96.00		23.8	24.2	22.8
2	96.00	15.55	19.4	19.2	20.3
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total Weight		15.6	Average, %db		21.6

Allowable Fuel Load Range:				14.4	to	17.5
TEST FUEL LOAD PROPERTIES						
Eq. ID No.:				Time:	10:10	Temp., °F: 65
Piece No.	Length, In.	Weight, Lb.		Moisture, %, Dry Basis		
		2x4	4x4			
1	15.00		3.60	21.3	19.9	22.5
2	15.00		3.70	21.5	20.0	21.3
3	15.00	1.95		22.7	19.9	22.6
4	15.00	1.95		23.5	22.8	22.6
5	15.00	1.75		20.1	18.6	19.9
6	15.00	1.90		23.9	22.8	22.5
7						
8						
Totals		7.6	7.3			
% of Weight		51	49			
Total weight, wet, lb.		14.85		Average Moisture, dry		21.58
Total weight, dry, kg		5.54		Average Moisture, wet		17.75

Test Engineer: BD

Date: 11/14/12



Project Number:	G100926764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	14-Nov-12
Test Run Number:	2

EPA Method 28  
Pre Burn Data

Coal Bed Range	3.0	to	3.7
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Average Firebox Temp, °F	347.8
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Final Coal Bed Wt, lb	3.3
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[illegible]

Test Engineer: [Signature]

Date: 11/11/2019



TEST DATA  
EPA METHOD 5G-3

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID No: PRT1211131110-001  
Test Date: 14-Nov-12  
Test Run No: 2

Temperature Data

Firebox Temp Start	344.8
Firebox Temp End	273.4
Firebox Delta-T	71.4

Max Filter Temps	
Train A	Train B
77	77

Interval	10	Duration of Test, Min			290									
Time		Temperature Data												
Interval	Duration	Room	Dillution Tunnel	Flue Gas	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Outlet	Train A Filter	Train B Filter	Train A DGM	Train B DGM
0	0	73	102	228	237	346	278	442	421		72	72	75	75
1	10	72	89	221	232	327	320	419	386		73	73	76	76
2	20	72	90	278	274	323	308	370	345		72	73	77	76
3	30	72	88	309	322	318	272	352	331		73	73	78	78
4	40	72	96	347	377	311	244	356	333		73	74	79	79
5	50	72	101	370	442	307	241	371	363		74	74	80	80
6	60	73	108	412	533	303	260	389	397		75	75	81	81
7	70	76	104	366	577	304	289	416	436		75	75	82	82
8	80	76	100	339	526	308	296	429	451		76	76	83	83
9	90	76	97	318	489	307	311	441	465		76	76	84	84
10	100	79	97	292	447	306	326	451	475		77	77	85	84
11	110	75	90	260	397	303	335	455	468		75	76	85	84
12	120	74	88	248	367	303	330	455	452		75	75	85	84
13	130	74	86	229	340	303	320	452	437		74	74	85	84
14	140	74	85	209	309	311	305	440	424		74	74	85	84
15	150	79	87	197	276	314	287	424	411		75	75	85	84
16	160	79	86	192	261	314	278	416	406		74	74	85	84
17	170	73	82	184	247	311	269	406	396		73	73	84	84
18	180	73	81	180	241	309	265	400	391		72	73	84	84
19	190	72	80	174	233	304	259	394	384		71	71	84	83
20	200	73	79	171	225	296	255	388	376		71	71	84	84
21	210	75	79	170	218	290	254	383	371		73	73	85	84
22	220	73	79	169	213	286	253	378	367		73	73	86	83
23	230	72	79	165	207	275	250	372	360		72	72	84	83
24	240	72	79	164	200	262	246	364	355		71	71	84	83
25	250	72	79	164	199	260	243	362	355		71	71	84	83
26	260	72	79	164	197	253	242	357	355		71	71	84	84
27	270	71	79	162	194	248	242	353	352		71	71	83	83
28	280	71	78	161	192	241	241	351	347		71	71	83	83
29	290	71	78	162	190	238	241	351	347		71	71	82	82

Test Engineer:                     

Date: 11/24/12

### Gas Particulate Sampling Data

Project Number: G100926764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 14-Nov-12  
 Test Run Number: 2

Barometer, In. Hg	RH, %	Sample Box Correction (y) Factors
Start 30.11	41.5	Meter Box (A) 0.977
End 30.09	42.3	Meter Box (B) 0.987

Leak Check, cfm @ in Hg
Train A
Train B
.01@12 .008@6

Maximum Vacuum
Train A
Train B
0.00 0.00

Duration of Test, Min			290										
Time	Particulate Sampling Data												
	Tunnel Delta-P	Train A Delta-H	Train B Delta-H	Flue Draft	Fuel Weight	Weight Loss	Train A Volume	Train B Volume	Train A Proportional Rate	Train B Proportional Rate	Train A Vacuum, In. Hg	Train B Vacuum, In. Hg	
0	0.048	3.00	3.00	-0.030	14.85	14.85	0.000	0.000	99.95	99.95	0.00	0.00	
10	0.048	3.01	3.02	-0.040	14.20	0.65	1.557	1.524	99.94	100.88	0.00	0.00	
20	0.048	3.01	3.00	-0.060	13.40	0.80	3.178	3.097	103.95	104.21	0.00	0.00	
30	0.048	3.00	2.97	-0.060	12.40	1.00	4.665	4.546	95.00	95.47	0.00	0.00	
40	0.048	2.99	2.99	-0.070	11.10	1.30	6.320	6.155	106.31	106.58	0.00	0.00	
50	0.048	2.98	2.97	-0.070	9.60	1.50	7.866	7.650	99.57	99.29	0.00	0.00	
60	0.048	2.98	2.97	-0.070	7.90	1.70	9.410	9.140	99.87	99.39	0.00	0.00	
70	0.048	2.97	2.97	-0.070	6.50	1.40	11.026	10.721	103.97	104.89	0.00	0.00	
80	0.048	2.98	3.00	-0.060	5.60	0.90	12.559	12.193	98.10	97.14	0.00	0.00	
90	0.048	2.98	3.01	-0.060	4.60	1.00	14.132	13.721	100.20	100.38	0.00	0.00	
100	0.048	2.98	2.97	-0.050	4.00	0.60	15.733	15.272	101.80	101.89	0.00	0.00	
110	0.048	3.00	3.00	-0.050	3.40	0.60	17.336	16.829	101.28	101.64	0.00	0.00	
120	0.048	2.99	3.01	-0.050	3.00	0.40	18.989	18.432	104.25	104.45	0.00	0.00	
130	0.048	2.98	3.00	-0.040	2.70	0.30	20.510	19.870	95.75	93.53	0.00	0.00	
140	0.048	2.99	3.01	-0.040	2.40	0.30	22.187	21.527	105.48	107.67	0.00	0.00	
150	0.048	3.00	3.00	-0.040	2.30	0.10	23.697	23.016	95.15	96.93	0.00	0.00	
160	0.048	2.99	3.01	-0.030	2.10	0.20	25.313	24.556	101.73	100.16	0.00	0.00	
170	0.048	2.99	3.00	-0.030	1.90	0.20	26.983	26.176	104.94	104.98	0.00	0.00	
180	0.048	3.01	2.99	-0.030	1.80	0.10	28.440	27.580	91.47	90.90	0.00	0.00	
190	0.048	2.98	3.02	-0.030	1.60	0.20	30.036	29.129	100.10	100.38	0.00	0.00	
200	0.048	2.96	3.02	-0.030	1.40	0.20	31.584	30.631	97.00	97.06	0.00	0.00	
210	0.048	3.02	3.00	-0.030	1.30	0.10	33.201	32.195	101.14	101.07	0.00	0.00	
220	0.048	3.02	3.00	-0.030	1.10	0.20	34.733	33.678	95.82	96.01	0.00	0.00	
230	0.048	3.00	2.99	-0.030	1.00	0.10	36.322	35.212	99.57	99.31	0.00	0.00	
240	0.048	3.00	3.00	-0.030	0.80	0.20	37.834	36.701	94.75	96.40	0.00	0.00	
250	0.048	3.00	3.02	-0.030	0.70	0.10	39.470	38.260	102.52	100.93	0.00	0.00	
260	0.048	3.00	3.02	-0.030	0.50	0.20	41.087	39.824	101.33	101.07	0.00	0.00	
270	0.048	3.01	3.00	-0.030	0.40	0.10	42.646	41.332	97.87	97.63	0.00	0.00	
280	0.048	3.01	3.02	-0.030	0.20	0.20	44.158	42.819	94.83	96.18	0.00	0.00	
290	0.048	3.01	3.00	-0.030	0.00	0.20	45.826	44.395	104.81	102.12	0.00	0.00	

Test Engineer:                     

Date: 11/24/12



## Dilution Tunnel Velocity Traverse EPA Method 5G-3

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 14-Nov-12  
Test Run Number: 2

	Dilution Tunnel		Square Root
	Delta P In. H2O	Temp, °F	
A1	0.0260	91	0.1612
A2	0.0340	91	0.1844
A3	0.0480	91	0.2191
A4	0.0320	91	0.1789
A Center	0.0480	91	0.2191
B1	0.0300	91	0.1732
B2	0.0380	91	0.1949
B3	0.0460	91	0.2145
B4	0.0260	91	0.1612
B Center	0.0480	91	0.2191
Averages	0.0376	91	0.1859

Tunnel Diameter **6.000** inches

Tunnel Static **-0.450** in. H2O

Tunnel Area 0.19635 Ft<sup>2</sup>

Pitot Correction 0.8487 factor

Baro. Pressure 30.11

Pitot Factor **0.99** (0.99 for standard, 0.84 or Cal. For S-Type )

Initial Velocity 12.603 Ft/ Sec

Initial Flow **137.40** Ft<sup>3</sup>/min

Test Engineer: BA

Date: 11/24/12

Project Number: G100926764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 14-Nov-12  
 Test Run Number: 2

Intertek Equipment No.'s \_\_\_\_\_

Sample Train - 1					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	473		119.1	
B - Rear Filter Catch	Filter	474		118.6	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			247.1	237.7	9.4
Probe & Filter Holder	Probe	19	126539.2	126538.1	1.1
			Total Particulate, mg		<b>10.5</b>

Sample Train - 2					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	475		118.7	
B - Rear Filter Catch	Filter	476		117.7	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			245.4	236.4	9
Probe & Filter Holder	Probe	23	126488.3	126486.8	1.5
			Total Particulate, mg		<b>10.5</b>

Test Engineer:         

Date: 11/26/12

## TEST RESULTS EPA METHOD 5G-3

Project Number: G100962764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 15-Nov-12  
 Test Run Number: 3

Dry Burn-Rate, kg/hr:		1.26
Emission-Rate, g/hr:		1.74
Adjusted Emission-Rate, g/hr :		2.88
Duration of Test, Minutes		270
<b>Dry Gas Meter Standardization</b>		
	Train A	Train B
Dry Gas Meter Beginning Reading, ft <sup>3</sup>	0	0
Dry Gas Meter Ending Reading, ft <sup>3</sup>	42.893	41.622
Barometric Pressure Correction Factor	1.004	1.004
Dry Gas Meter Calibration Factors (y factors)	0.977	0.9872
Dry Gas Meter Temperature Factors	0.974	0.974
Dry Gas Meter Delta-H Correction Factors	1.007	1.007
Dry Gas Meter STD Volume Sampled, ft <sup>3</sup>	41.282	40.484
<b>Dilution Tunnel Flow / Volume</b>		
Standardized Tunnel Flow, dscfm		138.022
Total Tunnel Volume, scf		37266.019
<b>Emission Calculations</b>		
	Train A	Train B
Sample Ratios (Total Tunnel Volume / Total Sample Volume)	902.716	920.519
Sample Particulate Mass, mg	9.1	8.1
Total Emissions, grams	8.215	7.456
Emission-Rate, g/hr	1.83	1.66
Adjusted Emission Rates, g/hr	3.00	2.77
Deviation, %	0.04	
For catalytic equipped appliances - if deviation from average emission rate is greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 4.1 g/hr.	0.06	
For non-catalytic appliances - if deviation from average emission rate is greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 7.5 g/hr.	3.09%	
<b>Operating Parameters</b>		
	Train A	Train B
Max Filter Temperature, °F	76	76
Post-Test Leak Check, cfm @ in. Hg vac.	.006@4	.008@5
Average Firebox Surface Temperature delta-T, °F	60.4	
Maximum Ambient Temperature, °F	78	
Minimum Ambient Temperature, °F	71	
<b>Fuel Properties</b>		
Wet Fuel Load Weight, lb.	15.15	
Dry-Basis Fuel Load Moisture Content, %	21.34	
Wet-Basis Fuel Load Moisture Content, %	17.59	
Coal Bed Range, lb.	3.10	3.70
Actual Coal Bed, Lb.	3.1	

Test Engineer: BOD

Date: 11/26/12

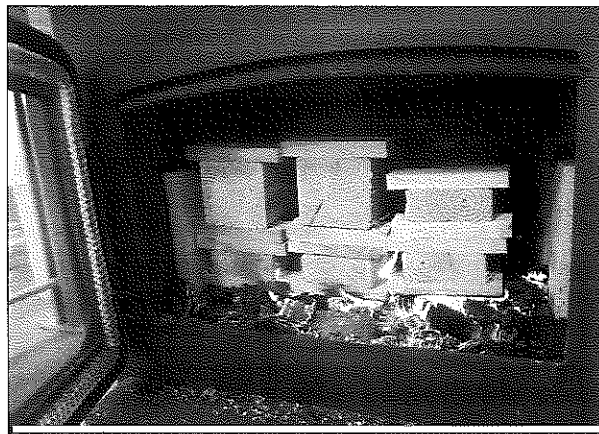
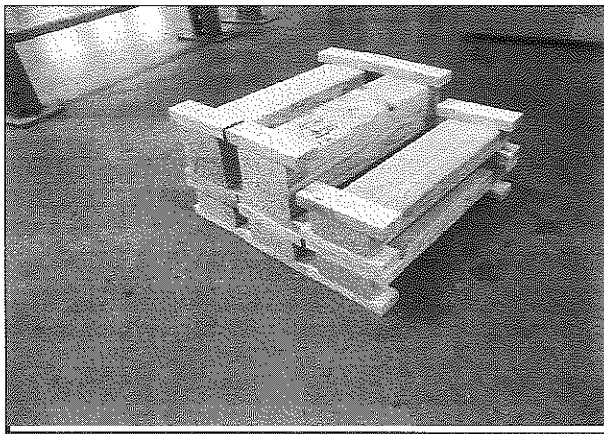


## Run Notes

### EPA Methods 28 and 5G-3

PROJECT / TEST INFORMATION	
Project Number:	G100962764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	15-Nov-12
Test Run Number:	3
Date tunnel cleaned:	11/12/2012
Purpose of Test	RCA

Appliance Information		
Appliance Type:	2	1 - Catalytic 2 - Non - Catalytic 3 - Pellet 4 - Hydronic
Firebox Volume, ft <sup>3</sup> :	2.28	N/A for pellet type
Convection Blower	2	1 - No Fan 2 - Fan Optional 3 - Fan Standard

[illegible]

Test Engineer: 30

Date: 11/2/2020

Project Number: G100962764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 15-Nov-12  
 Test Run Number: 3

Firebox Volume, ft<sup>3</sup>: 2.28

Calibration Reference ID	
Set meter to Species 1	
Set Temperature to 70F	12% 12.0
Set pin setting to 444	22% 22.0

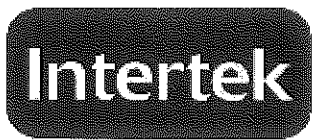
PRE-BURN FUEL PROPERTIES					
Eq. ID No.:		Time:	9:15	Temp., °F:	65
Piece No.	Length, In.	Weight, Lb.	Moisture, %, Dry Basis		
1	96.00	14.20	22.8	24.6	24.2
2	96.00		19.2	19.2	20.4
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total Weight		14.2	Average, %db		21.7

Allowable Fuel Load Range: 14.4 to 17.5

TEST FUEL LOAD PROPERTIES						
Eq. ID No.:		Time:	9:15	Temp., °F:	65	
Piece No.	Length, In.	Weight, Lb.		Moisture, %, Dry Basis		
		2x4	4x4			
1	14.50	3.65		19.8	21.4	21.4
2	14.50	3.70		20.9	19.3	22.7
3	14.50	2.05		21.1	19.8	21.5
4	14.50	1.70		24.5	21.2	24.8
5	14.50	2.05		20.5	19.5	21.7
6	14.50	2.00		21.5	21.4	21.2
7						
8						
Totals		7.8	7.4			
% of Weight		51	49			
Total weight, wet, lb.		15.15		Average Moisture, dry		21.34
Total weight, dry, kg		5.66		Average Moisture, wet		17.59

Test Engineer: BD

Date: 11/26/12



Project Number:	G100962764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	15-Nov-12
Test Run Number:	3

EPA Method 28  
Pre Burn Data

Coal Bed Range	3.1	to	3.7
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to

3

Average Firebox Temp, °F	366.2
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366.2

Final Coal Bed Wt, lb	3.1
-----------------------	-----

### 3.1

[illegible]

Test Engineer: B. S. S.

Date: 11/2/12

## TEST DATA EPA METHOD 5G-3

Project Number: G100962764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID No: PRT1211131110-001  
 Test Date: 15-Nov-12  
 Test Run No: 3

### Temperature Data

Firebox Temp Start	364
Firebox Temp End	303.6
Firebox Delta-T	60.4

Max Filter Temps	
Train A	Train B
76	76

Interval	10	Duration of Test, Min			Firebox Data 1					Data 2		75		75	
Time		Temperature Data													
Interval	Duration	Room	Dilution Tunnel	Flue Gas	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Outlet	Train A Filter	Train B Filter	Train A DGM	Train B DGM	
0	0	72	85	195	253	359	294	458	456		71	70	74	73	
1	10	72	90	221	265	351	337	428	420		71	70	75	74	
2	20	78	96	258	278	349	322	379	390		73	72	76	76	
3	30	73	100	327	345	334	306	368	380		72	71	78	78	
4	40	74	97	391	490	316	254	374	404		74	74	80	80	
5	50	74	106	409	562	298	256	390	436		76	76	81	81	
6	60	74	104	395	603	293	270	410	463		75	75	82	82	
7	70	73	100	353	562	289	287	428	486		74	75	83	83	
8	80	78	100	346	527	288	298	436	489		75	76	83	83	
9	90	73	94	317	479	286	303	449	483		73	74	83	83	
10	100	74	94	299	452	288	310	459	485		74	74	83	83	
11	110	76	94	276	429	291	317	462	480		74	74	83	83	
12	120	78	94	259	391	293	321	466	477		74	74	83	83	
13	130	75	88	230	345	306	321	455	464		74	75	84	84	
14	140	78	88	216	311	310	318	441	453		75	76	84	84	
15	150	74	84	204	292	320	312	430	442		74	74	84	84	
16	160	73	82	198	276	321	308	423	433		73	74	84	84	
17	170	72	81	192	261	314	302	414	425		72	72	84	84	
18	180	74	83	194	254	314	303	410	421		72	73	84	83	
19	190	73	82	192	247	307	308	403	419		71	71	83	83	
20	200	76	85	190	243	303	313	398	415		72	72	83	83	
21	210	74	85	186	238	301	310	393	410		73	73	83	83	
22	220	74	86	185	235	299	305	370	406		73	73	83	84	
23	230	74	83	181	230	297	299	386	402		73	73	84	84	
24	240	73	82	181	228	291	292	383	399		73	74	84	84	
25	250	72	78	179	226	281	286	377	397		73	73	84	84	
26	260	72	76	176	222	286	281	373	390		72	72	84	84	
27	270	71	79	172	215	282	271	366	384		70	71	83	83	

Test Engineer: BD

Date: 11/26/12

### Gas Particulate Sampling Data

Project Number: G100962764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 15-Nov-12  
 Test Run Number: 3

Barometer, In. Hg	RH, %	Sample Box Correction (y) Factors	
Start 30.04	47.6	Meter Box (A)	0.977
End 30.04	46.5	Meter Box (B)	0.987

Leak Check, cfm @ in Hg	
Train A	Train B
.006@4	.008@5

Maximum Vacuum	
Train A	Train B
0.00	0.00

Duration of Test, Min		Particulate Sampling Data											
Time	Tunnel Delta-P	Train A Delta-H	Train B Delta-H	Flue Draft	Fuel Weight	Weight Loss	Train A Volume	Train B Volume	Train A Proportional Rate	Train B Proportional Rate	Train A Vacuum, In. Hg	Train B Vacuum, In. Hg	
0	0.046	3.00	3.00	-0.030	15.20	15.20	0.000	0.000	100.01	100.01	0.00	0.00	
10	0.046	3.03	3.07	-0.050	14.50	0.70	1.617	1.580	103.27	104.17	0.00	0.00	
20	0.046	3.03	3.06	-0.060	13.60	0.90	3.268	3.191	105.82	106.40	0.00	0.00	
30	0.046	2.99	2.97	-0.070	12.50	1.10	4.748	4.642	94.84	95.82	0.00	0.00	
40	0.046	2.97	2.98	-0.080	10.60	1.90	6.413	6.245	106.02	105.18	0.00	0.00	
50	0.046	2.95	2.96	-0.080	9.00	1.60	7.891	7.685	94.69	95.07	0.00	0.00	
60	0.046	2.99	2.99	-0.070	7.40	1.60	9.530	9.270	104.63	104.26	0.00	0.00	
70	0.046	2.97	3.01	-0.070	6.20	1.20	11.133	10.826	101.78	101.80	0.00	0.00	
80	0.046	2.99	3.02	-0.070	5.30	0.90	12.750	12.390	102.67	102.33	0.00	0.00	
90	0.046	3.01	3.02	-0.060	4.40	0.90	14.260	13.879	95.36	96.90	0.00	0.00	
100	0.046	3.00	3.02	-0.060	3.70	0.70	15.998	15.538	109.76	107.96	0.00	0.00	
110	0.046	3.00	3.01	-0.060	3.10	0.60	17.498	17.027	94.73	96.90	0.00	0.00	
120	0.046	3.00	2.99	-0.050	2.80	0.30	19.047	18.494	97.82	95.47	0.00	0.00	
130	0.046	3.00	3.00	-0.040	2.50	0.30	20.603	20.003	97.55	97.49	0.00	0.00	
140	0.046	2.98	3.02	-0.040	2.30	0.20	22.145	21.492	96.67	96.19	0.00	0.00	
150	0.046	3.00	3.02	-0.040	2.10	0.20	23.771	23.077	101.57	102.02	0.00	0.00	
160	0.046	3.03	3.04	-0.040	1.90	0.20	25.352	24.613	98.58	98.69	0.00	0.00	
170	0.046	3.04	3.03	-0.040	1.70	0.20	26.963	26.175	100.35	100.26	0.00	0.00	
180	0.046	3.02	3.03	-0.040	1.50	0.20	28.544	27.710	98.67	98.89	0.00	0.00	
190	0.046	3.02	3.04	-0.040	1.30	0.20	30.143	29.263	99.88	99.96	0.00	0.00	
200	0.046	3.01	3.03	-0.040	1.10	0.20	31.838	30.905	106.17	105.98	0.00	0.00	
210	0.046	3.01	3.02	-0.030	1.00	0.10	33.416	32.441	98.84	99.14	0.00	0.00	
220	0.046	3.01	3.02	-0.030	0.80	0.20	35.002	33.975	99.43	98.92	0.00	0.00	
230	0.046	2.99	3.02	-0.030	0.60	0.20	36.603	35.528	99.91	99.87	0.00	0.00	
240	0.046	3.00	3.02	-0.030	0.40	0.20	38.149	37.028	96.39	96.37	0.00	0.00	
250	0.046	3.02	3.03	-0.030	0.30	0.10	39.718	38.551	97.47	97.49	0.00	0.00	
260	0.046	3.04	3.04	-0.030	0.20	0.10	41.291	40.084	97.53	97.95	0.00	0.00	
270	0.046	3.00	3.01	-0.030	0.00	0.20	42.893	41.622	99.79	98.72	0.00	0.00	

Test Engineer: B.D.

Date: 11/26/12



**Dilution Tunnel Velocity Traverse**  
**EPA Method 5G-3**

Project Number: G100962764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 15-Nov-12  
Test Run Number: 3

	Dilution Tunnel		Square Root
	Delta P In. H2O	Temp, °F	
A1	0.0280	96	0.1673
A2	0.0360	96	0.1897
A3	0.0460	96	0.2145
A4	0.0300	96	0.1732
A Center	0.0460	96	0.2145
B1	0.0280	96	0.1673
B2	0.0380	96	0.1949
B3	0.0480	96	0.2191
B4	0.0280	96	0.1673
B Center	0.0460	96	0.2145
Averages	0.0374	96	0.1867

Tunnel Diameter **6.000** inches

Tunnel Static **-0.440** in. H2O

Tunnel Area 0.19635 Ft<sup>2</sup>

Pitot Correction 0.8704 factor

Baro. Pressure 30.04

Pitot Factor **0.99** ( 0.99 for standard, 0.84 or Cal. For S-Type )

Initial Velocity 12.726 Ft/ Sec

Initial Flow **137.17** Ft<sup>3</sup>/min

Test Engineer: BD

Date: 11/14/12



DILLUTION TUNNEL PARTICULATE CALCULATIONS  
EPA Method 5G-3

Project Number: G100962764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 15-Nov-12  
Test Run Number: 3

Intertek Equipment No.'s \_\_\_\_\_

Sample Train - 1					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	477		118.8	
B - Rear Filter Catch	Filter	478		118.7	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			245.5	237.5	8
Probe & Filter Holder	Probe	16A	113651.3	113650.2	1.1
			Total Particulate, mg		9.1

Sample Train - 2					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	479		119.2	
B - Rear Filter Catch	Filter	480		119	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			245.2	238.2	7
Probe & Filter Holder	Probe	22	113770.5	113769.4	1.1
			Total Particulate, mg		8.1

Test Engineer: BD

Date: 11/26/12

Project Number: G100926764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 16-Nov-12  
 Test Run Number: 4

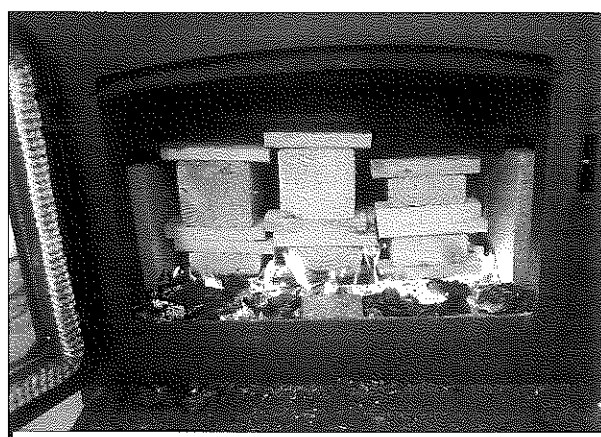
Dry Burn-Rate, kg/hr:		2.51
Emission-Rate, g/hr:		1.67
Adjusted Emission-Rate, g/hr :		2.79
Duration of Test, Minutes		140
<b>Dry Gas Meter Standardization</b>		
	Train A	Train B
Dry Gas Meter Beginning Reading, ft <sup>3</sup>	0	0
Dry Gas Meter Ending Reading, ft <sup>3</sup>	22.502	21.66
Barometric Pressure Correction Factor	0.995	0.995
Dry Gas Meter Calibration Factors (γ factors)	0.977	0.9872
Dry Gas Meter Temperature Factors	0.974	0.975
Dry Gas Meter Delta-H Correction Factors	1.008	1.007
Dry Gas Meter STD Volume Sampled, ft <sup>3</sup>	21.460	20.892
<b>Dilution Tunnel Flow / Volume</b>		
Standardized Tunnel Flow, dscfm	129.908	
Total Tunnel Volume, scf	18187.155	
<b>Emission Calculations</b>		
	Train A	Train B
Sample Ratios (Total Tunnel Volume / Total Sample Volume)	847.483	870.544
Sample Particulate Mass, mg	4.6	4.5
Total Emissions, grams	3.898	3.917
Emission-Rate, g/hr	1.67	1.68
Adjusted Emission Rates, g/hr	2.79	2.80
Deviation, %	0.00	
For catalytic equipped appliances - if deviation from average emission rate is greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 4.1 g/hr.	0.00	
For non-catalytic appliances - if deviation from average emission rate is greater than 7.5% due to low particulate catch, difference is not to exceed 7.5% compared to 7.5 g/hr.	0.15%	
<b>Operating Parameters</b>		
	Train A	Train B
Max Filter Temperature, °F	83	84
Post-Test Leak Check, cfm @ in. Hg vac.	0	0
Average Firebox Surface Temperature delta-T, °F	33	
Maximum Ambient Temperature, °F	79	
Minimum Ambient Temperature, °F	72	
<b>Fuel Properties</b>		
Wet Fuel Load Weight, lb.	15.75	
Dry-Basis Fuel Load Moisture Content, %	22.02	
Wet-Basis Fuel Load Moisture Content, %	18.05	
Coal Bed Range, lb.	3.20	3.90
Actual Coal Bed, Lb.	3.5	

Test Engineer: B.D.

Date: 11/26/12



Appliance Information		
Appliance Type:	2	1 - Catalytic 2 - Non - Catalytic 3 - Pellet 4 - Hydronic
Firebox Volume, ft <sup>3</sup> :	2.28	N/A for pellet type
Convection Blower	2	1 - No Fan 2 - Fan Optional 3 - Fan Standard

Date: 11/26/2019

Project Number:	G100926764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	16-Nov-12
Test Run Number:	4

Firebox Volume, ft <sup>3</sup> :	2.28
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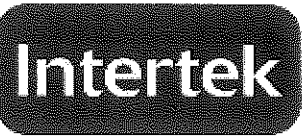
Calibration Reference ID	
Set meter to Species 1	
Set Temperature to 70F	12% 12.0
Set pin setting to 444	22% 22.0

PRE-BURN FUEL PROPERTIES					
Eq. ID No.:		Time:	10:15	Temp., °F:	65
Piece No.	Length, In.	Weight, Lb.	Moisture, %, Dry Basis		
1	96.00	16.85	19.2	20.6	21.4
2	96.00		25.3	24.8	24.8
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total Weight		16.9	Average, %db		22.7

Allowable Fuel Load Range:					
			14.4	to	17.5
TEST FUEL LOAD PROPERTIES					
Eq. ID No.:		Time:	10:15	Temp., °F:	65
Piece No.	Length, In.	Weight, Lb.		Moisture, %, Dry Basis	
		2x4	4x4		
1	15.00		3.90	22.3	22.5 21.4
2	15.00		4.10	22.5	23.5 24.5
3	15.00	2.10		25.3	23.2 23.5
4	15.00	1.80		19.1	19.1 19.6
5	15.00	1.85		21.5	21.3 21.0
6	15.00	2.00		21.6	22.0 22.5
7					
8					
Totals		7.8	8.0		
% of Weight		49	51		
Total weight, wet, lb.		15.75		Average Moisture, dry	22.02
Total weight, dry, kg		5.85		Average Moisture, wet	18.05

Test Engineer: BD

Date: 11/26/12



Project Number:	G100926764
Manufacturer:	Lennox
Model:	Grand View 230
Sample ID Number:	PRT1211131110-001
Test Date:	16-Nov-12
Test Run Number:	4

EPA Method 28  
Pre Burn Data

Coal Bed Range	3.2	to	3.9
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Average Firebox Temp, °F	341.6
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Final Coal Bed Wt, lb	3.5
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[illegible]

Test Engineer: [Signature]

Date: 1/24/2013

Project Number: G100926764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID No: PRT1211131110-001  
 Test Date: 16-Nov-12  
 Test Run No: 4

### Temperature Data

Firebox Temp Start	340.8
Firebox Temp End	307.8
Firebox Delta-T	33.0

Max Filter Temps	
Train A	Train B
83	84

Interval	10	Duration of Test, Min				140				Firebox Data 1				53%				56				54			
Time		Temperature Data																							
			Dillution Tunnel	Flue Gas	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Outlet	Train A Filter	Train B Filter	Train A DGM	Train B DGM											
Interval	Duration	Room																							
0	0	73	135	330	160	259	207	527	551		72	72	78	77											
1	10	73	142	554	182	252	194	490	515		76	76	78	78											
2	20	76	157	599	315	246	187	472	521		81	82	79	78											
3	30	76	157	599	346	247	188	476	541		83	84	80	79											
4	40	75	143	539	336	262	196	486	578		80	81	82	81											
5	50	75	126	459	264	266	204	498	585		77	79	83	82											
6	60	74	119	433	222	270	204	499	575		75	77	83	82											
7	70	79	120	433	212	257	207	510	566		76	77	83	82											
8	80	74	114	404	199	247	206	517	557		76	77	83	83											
9	90	73	106	379	189	245	212	512	549		76	77	83	83											
10	100	75	107	348	174	250	217	503	538		76	77	84	83											
11	110	75	103	331	163	250	221	496	529		76	76	84	84											
12	120	74	98	309	152	256	223	484	516		76	76	84	84											
13	130	73	95	295	143	252	218	473	501		75	75	84	84											
14	140	72	94	290	138	245	210	458	488		73	74	83	83											

Test Engineer: BD

Date: 11/24/12

### Gas Particulate Sampling Data

Project Number: G100926764  
 Manufacturer: Lennox  
 Model: Grand View 230  
 Sample ID Number: PRT1211131110-001  
 Test Date: 16-Nov-12  
 Test Run Number: 4

Barometer, In. Hg	RH, %	Sample Box Correction (γ) Factors	
Start	29.76	43.5	0.977
End	29.76	43.7	0.987

Leak Check, cfm @ in Hg	
Train A	Train B

Maximum Vacuum	
Train A	Train B
0.00	0.00

Duration of Test, Min		140		Particulate Sampling Data						0.00		0.00	
Time	Particulate Sampling Data												
	Tunnel Delta-P	Train A Delta-H	Train B Delta-H	Flue Draft	Fuel Weight	Weight Loss	Train A Volume	Train B Volume	Train A Proportional Rate	Train B Proportional Rate	Train A Vacuum, In. Hg	Train B Vacuum, In. Hg	
0	0.047	3.00	3.00	-0.060	15.80	15.80	0.000	0.000	99.87	99.87	0.00	0.00	
10	0.047	3.01	2.99	-0.090	13.70	2.10	1.644	1.588	104.94	105.21	0.00	0.00	
20	0.047	3.06	2.94	-0.090	11.00	2.70	3.185	3.075	99.40	99.74	0.00	0.00	
30	0.047	3.06	2.97	-0.090	8.40	2.60	4.746	4.560	100.50	99.42	0.00	0.00	
40	0.047	3.05	2.98	-0.090	6.50	1.90	6.351	6.095	101.78	101.22	0.00	0.00	
50	0.047	3.07	3.05	-0.080	5.20	1.30	7.970	7.640	101.02	100.24	0.00	0.00	
60	0.047	3.08	3.08	-0.070	4.10	1.10	9.550	9.170	98.00	98.68	0.00	0.00	
70	0.047	3.09	3.08	-0.070	3.10	1.00	11.270	10.830	106.77	107.15	0.00	0.00	
80	0.047	3.08	3.09	-0.070	2.30	0.80	12.809	12.310	95.04	94.86	0.00	0.00	
90	0.047	3.09	3.04	-0.070	1.70	0.60	14.357	13.804	94.93	95.09	0.00	0.00	
100	0.047	3.09	3.06	-0.060	1.10	0.60	15.885	15.293	93.61	94.86	0.00	0.00	
110	0.047	3.08	3.08	-0.060	0.80	0.30	17.648	16.983	107.63	107.08	0.00	0.00	
120	0.047	3.09	3.08	-0.050	0.50	0.30	19.300	18.575	100.40	100.43	0.00	0.00	
130	0.047	3.12	3.07	-0.050	0.30	0.20	20.868	20.093	95.04	95.50	0.00	0.00	
140	0.047	3.10	3.06	-0.050	0.00	0.30	22.502	21.660	99.13	98.67	0.00	0.00	

Test Engineer: BOD

Date: 11/26/12



# Dilution Tunnel Velocity Traverse EPA Method 5G-3

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 16-Nov-12  
Test Run Number: 4

	Dilution Tunnel		Square Root
	Delta P In. H2O	Temp, °F	
A1	0.0260	108	0.1612
A2	0.0320	108	0.1789
A3	0.0460	108	0.2145
A4	0.0360	107	0.1897
A Center	0.0480	109	0.2191
B1	0.0280	107	0.1673
B2	0.0320	107	0.1789
B3	0.0380	106	0.1949
B4	0.0280	106	0.1673
B Center	0.0460	107	0.2145
Averages	0.036	107.3	0.1816

Tunnel Diameter **6.000** inches

Tunnel Static **-0.430** in. H2O

Tunnel Area 0.19635 Ft<sup>2</sup>

Pitot Correction 0.8377 factor

Baro. Pressure 29.76

Pitot Factor **0.99** ( 0.99 for standard, 0.84 or Cal. For S-Type )

Initial Velocity 12.564 Ft/ Sec

Initial Flow **131.50** Ft<sup>3</sup>/min

Test Engineer: BD

Date: 11/26/12



DILLUTION TUNNEL PARTICULATE CALCULATIONS  
EPA Method 5G-3

Project Number: G100926764  
Manufacturer: Lennox  
Model: Grand View 230  
Sample ID Number: PRT1211131110-001  
Test Date: 16-Nov-12  
Test Run Number: 4

Intertek Equipment No.'s \_\_\_\_\_

Sample Train - 1					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	481		117.6	
B - Rear Filter Catch	Filter	482		119.4	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			241.5	237	4.5
Probe & Filter Holder	Probe	29	124784.7	124784.6	0.1
Total Particulate, mg					4.6

Sample Train - 2					
Sample Component	Component	ID Number	Weights		
			Final, mg	Tare, mg	Particulate, mg
A - Front Filter Catch	Filter	483		121	
B - Rear Filter Catch	Filter	484		119.9	
C - Seal Set	O-Ring				
Total, A+B+C-Tares			244.5	240.9	3.6
Probe & Filter Holder	Probe	33	125732.8	125731.9	0.9
Total Particulate, mg					4.5

Test Engineer: BD

Date: 11/26/12

