

INTRODUCTION

Wolf Steel Ltd. retained *OMNI* to perform U.S. Environmental Protection Agency (EPA) certification testing on the 2100 wood stove. The 2100 wood stove is a non-catalytic, freestanding, radiant-type room heater. The firebox is constructed of mild steel. Usable firebox volume was measured to be 1.5 cubic feet and the stove is vented through a 6-inch diameter flue collar located at the top of the unit.

The testing was performed at *OMNI*'s testing facility in Portland, Oregon. The altitude of the laboratory is 30 feet above sea level. The unit was received in good condition and logged in on November 10, 2008, then assigned and labeled with *OMNI* ID #1318. *OMNI* representative Ken Morgan conducted the certification testing and completed all testing by December 17, 2008. The EPA was notified of the testing dates in a letter dated December 11, 2008. A testing contract, including provisions for Random Compliance Audit (RCA) testing, has been signed by Cliff Lilley of Wolf Steel Ltd. and is on file at *OMNI*'s testing facility.

The 2100 wood stove was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standard of Performance for Residential Wood Heaters (Appendix A, Methods 28 and 5G). Particulate emissions were measured using a Method 5G sampling train consisting of two filters (front and back). The weighted average emissions of the four test runs included in the results indicate a particulate emission level of 3.9 grams per hour. Run #5, a fan confirmation test run, was performed and was not used in the weighted average emission results. Test runs were conducted in each of three burn rate categories (0.80-1.25 kg/hr, 1.25-1.90 kg/hr, and maximum). Emissions for each of their individual test runs did not exceed the cap. The 2100 results are within the emission limit of 7.5 grams per hour for non-catalytic affected facilities manufactured on or after July 1, 1990, or sold at retail on or after July 1, 1992.

The wood heater was sealed after completion of testing in compliance with the EPA regulation as follows:

- “DO NOT TAMPER” labels were placed on the door and on all other openings.
- Plastic material sealed with “DO NOT TAMPER” labels and tape was wrapped around the unit.
- The unit was sealed in a wood box constructed for the unit and secured with steel banding.
- “DO NOT TAMPER” labels were placed on all outer surfaces of the box.

This report is organized in accordance with the EPA-recommended outline and is summarized in the Table of Contents immediately preceding this report. The results in this report are limited to the item submitted.

Table 1.1 – Particulate Emissions

Run	Burn Rate (kg/hr dry)	Method 5G Emissions (g/hr)
1	0.93	4.01
2	1.07	4.21
3	3.11	3.58
4	1.68	3.48

Weighted particulate emission average of four test runs: 3.9 grams per hour.

Table 1.2 – Test Facility Conditions

Run	Room Temperature (°F)		Barometric Pressure (Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	68	77	30.50	30.41	<50	<50
2	80	66	29.94	29.63	<50	<50
3	66	65	30.05	30.06	<50	<50
4	66	65	30.36	30.30	<50	<50

Table 1.3.1 – Fuel Measurement and Crib Description Summary – PRETEST

Run	Pretest Fuel Weight (Starting weight in lbs)	Pretest Moisture (Dry basis - %)	Coal Bed Weight (lbs)
1	8.2	21.0	2.3
2	8.2	21.1	2.2
3	17.3	22.7	2.0
4	13.9	21.1	2.3

Table 1.3.2 – Fuel Measurement and Crib Description Summary – TEST

Run	Test Fuel Wet Basis (lbs)	Firebox Volume (ft ³)	Fuel Loading Density Wet Basis (lbs/ft ³)	Fuel Moisture Content Dry (%)	Piece Length (in)	2x4s Used	4x4s Used
1	9.4	1.5	6.27	19.4	17.5	4	0
2	9.4	1.5	6.27	19.6	17.5	4	0
3	9.8	1.5	6.53	22.3	17.5	4	0
4	9.7	1.5	6.47	20.7	17.5	4	0

Table 1.4 – Dilution Tunnel Gas Measurements and Sampling Data Summary

Run	Length of Test (min)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
1	230	12.97	144.7	83.7
2	200	14.10	153.5	85.5
3	70	13.32	131.5	146.4
4	130	12.62	136.9	97.2

Table 1.5 - Heater Operation Data (Average Temperature Data)

Run	Beginning Surface Temperature Average ^a	Ending Surface Temperature Average ^a	Surface Delta T ^b
1	349.6	273.8	76
2	352.2	273.8	78
3	505.2	443.2	62
4	375.0	329.2	46

a. All temperatures are in degrees F.
 b. Represents the difference between beginning and ending average surface temperatures.

Table 1.6 – Pretest Configuration

Run	Combustion Air (in)	Fuel Added	Fuel Removed	Time (min)
1	Open 0.3125"	8.2 lbs at start; no addition; coal bed 2.3 lbs	0.0	70
2	Open 0.375"	8.2 lbs at start; no addition; coal bed 2.2 lbs	0.5	80
3	Fully Open	17.3 lbs at start; no addition; coal bed 2.0 lbs	0.0	60
4	Open 0.78"	13.9 lbs at start; no addition; coal bed 2.3 lbs	0.0	110

Table 1.7 – Run Data

Run	Average Dry Burn Rate (kg/hr)	Initial (Induced) Draft (H ₂ O)	Primary Air Setting (in)	Run Time (min)	Average Draft (H ₂ O)
1	0.93	0	Open 0.3125"	230	-0.031
2	1.07	0	Open 0.375"	200	-0.036
3	3.11	0	Fully Open	70	-0.068
4	1.68	0	Open 0.78"	130	-0.049

Table 1.8 – Test Configurations

Run	Five-Minute Startup	Combustion Air
1	<p><u>Bypass</u>: N/A. <u>Fuel Loading</u>: Loaded by 55 seconds. <u>Door</u>: Closed at 60 seconds. <u>Primary Air</u>: Fully open for 5.0 minutes, then closed to test setting. <u>Other</u>: None. <u>Secondary</u>: Fixed. <u>Tertiary</u>: None. <u>Fan</u>: Off for first 30 minutes, on high for remainder of test.</p>	Open 0.3125"
2	<p><u>Bypass</u>: N/A. <u>Fuel Loading</u>: Loaded by 55 seconds. <u>Door</u>: Closed at 60 seconds. <u>Primary Air</u>: Fully open for 5.0 minutes, then closed to test setting. <u>Other</u>: None. <u>Secondary</u>: Fixed. <u>Tertiary</u>: None. <u>Fan</u>: Off for first 30 minutes, on high for remainder of test.</p>	Open 0.375"
3	<p><u>Bypass</u>: N/A. <u>Fuel Loading</u>: Loaded by 45 seconds. <u>Door</u>: Closed at 50 seconds. <u>Primary Air</u>: Fully open for duration of test. <u>Other</u>: None. <u>Secondary</u>: Fixed. <u>Tertiary</u>: None. <u>Fan</u>: On high for duration of test.</p>	Fully Open
4	<p><u>Bypass</u>: N/A. <u>Fuel Loading</u>: Loaded by 45 seconds. <u>Door</u>: Closed at 50 seconds. <u>Primary Air</u>: Fully open for 5.0 minutes, then closed to test setting. <u>Other</u>: None. <u>Secondary</u>: Fixed. <u>Tertiary</u>: None. <u>Fan</u>: On high for duration of test.</p>	Open 0.78"

Model: 2100
Wolf Steel Ltd.
9 Napoleon Road
Barrie, ON L4M 4Y8
CANADA

TEST RESULTS AND DISCUSSION

A total of five test runs were performed on the 2100 wood stove. Four test runs were conducted in the following categories and included in the weighted average emission level results: two in the 0.80 to 1.25 kg/hr dry category; one in the 1.25 to 1.90 kg/hr dry category; and one at maximum.

The weighted particulate emission level was measured to be **3.9 g/hr**.

The proportionality results for all four test runs were acceptable. Quality check results for each test run are presented in Section 2 of this report.