
Foyer Supreme Inc.

**Model – Galaxy
EPA Certification Testing
Project # 019-S-014-1**

**Prepared by Dirigo Laboratories, Inc.
February 1, 2013**



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Affidavit:

All testing and associated procedures were conducted at Foyer Supreme, Inc. beginning 12/7/2012 and ending on 12/14/2012. Foyer Supreme, Inc. is located at 3594 Jarry East, Montreal, Quebec H1Z-2G4 - CANADA. All EPA protocols from Methods 1, 2, 3, 4, 5 and 28 were followed in the testing, sampling, analysis, and calibrations for these tests and all results are based on these methods. Particulate sampling was performed per EPA Method 5G sampling option 3 and ASTM E2515 *Standard Test Method for Determination of Particulate Matter Emissions Collected in a Dilution Tunnel*. Efficiency was calculated using CAN/CSA-B415.1-10 *Performance Testing of Solid-Fuel Burning Heating Appliances*.

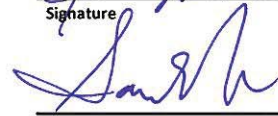
Dirigo Laboratories is accredited by the U.S. Environmental Protection Agency for the certification and auditing of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards For Residential Wood Heaters- Methods 28, 28A, 28 OWHH, 5G, 5H. Certificate Numbers 9 and 9M (mobile). See Appendix H for Certification.

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

John Steinert, President


Signature _____ Date 2/7/13

Gary Nelke CMfgE, Vice-President


Signature _____ Date 2/7/13

Ben Nelke, Technician


Signature _____ Date 2/7/13

Introduction:

Foyer Supreme, Inc.- located at 3594 Jarry East, Montreal, Quebec –CANADA, contracted with Dirigo Laboratories, Inc. to perform EPA certification testing on their Galaxy insert wood stove. Efficiency testing was also performed per CSA B-415.1-10 “Performance Testing of Solid-Fuel Burning Heating Appliances”. All testing was performed at the facilities of Foyer Supreme, Inc.

Wood heater Application Form:

Wood Heater Information Processing System Application Form		
	Application Type	
1.0	Administrative Information	
1.1	Wood Heater Model Name: Galaxy	
1.1a	Wood Heater Model Number: N/A	
1.1b	Wood Heater Certification Number (not applicable for initial certification)	
1.2	Wood Heater Type (catalytic, Non Catalytic, other): Non Catalytic	
1.3	Manufacturer Name: Foyer Supreme, Inc.	
1.3a	Manufacturer Street Address: 3594 Jarry East, Montreal,	
1.3b	Manufacturer State and Zip Code: Quebec H1Z-2G4 CANADA	
1.3c	Manufacturer Telephone Number: 514-593-4722	
1.3d	Manufacturer EIN 135028371	
1.4	Owner, Corporate Office or authorized representative to whom correspondence should be addressed. Emmanuel Marcakis	
1.4a	Designated Representative Name: Emmanuel Marcakis	
1.4b	Designated Representative Title: President	
1.4c	Designated Representative Mailing Address: 3594 Jarry East, Montreal, Quebec H1Z-2G4 CANADA	
1.4d	Designated Representative Telephone Number: 514-593-4722	
1.5	Annual Production Volume for this model for the next two years: Less than 2500 year	
2.0	Testing Information	
2.1	Name of Laboratory: Dirigo Laboratories, Inc.	
2.2	Test Notification Date: 9/20/2012	
2.3	Dates of Certification Tests: 12/10/2012 to 12/14/2012	
2.4	Test Method used for certification: Method 28 , Method 5G option 3, ASTM E2515	
2.5	Test Result Summary: See Report	Page 9
2.5.1	Test Result Grams/Hour: See Report	Page 9
2.5.2	Emission Rate Plot: See Report	Page 9
3.0	Test Report	
3.a1	Wood Heater Model Name: _____ Wood Heater Model Number: _____	Cover
3.a2	Testing Laboratory Name, Location and altitude	Page 3,4,8

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Wood Heater Information Processing System Application Form						
	<u>Laboratory Name</u>	<u>Location</u>	<u>Altitude</u>			
3.a3	Test Information date wood heater information received, data of tests, sampling method used, number of test runs				Page 9	
	<u>Date Received</u>	<u>Date of Tests</u>	<u>Sampling Method</u>	<u># Test Runs</u>		
	N/A	12/10/12 -12/14/13	5g-3	5		
3.a4	Identify any variations in the certification test from the published test methods				N/A	
3.b1	Table of Results (in order of increasing burn rate) test run number, burn rate, particulate emission rate, efficiency				Page9	
	<u>Run #</u>	<u>Burn Rate</u>	<u>Emission Rate</u>	<u>Heat Output</u>		<u>Efficiency</u>
3.b2	Summary of other data – Test facility conditions, surface temperature averages, catalyst temperature averages, pretest weights, test fuel charge weights, run times				Page 11	
3.b3	Discussion – specific test run problems and solutions				Page 8	
3.c1	Wood Heater Firebox Dimensions – volume, height, width				Page 11	
3.c2	Firebox Configuration – air supply locations and operation, air supply introduction location, refractory location, baffle and by-pass location, and operation (include line drawings and photographs)				Appendix D Page 13	
3.c3	Process Operation during test – air settings and adjustments, fuel bed adjustments, draft				Page 15	
3.c4	Test Fuel – Test fuel properties (moisture and temperature), test fuel crib description (include line drawings or photograph), test fuel charge density.				Page 16-17 Appendix F	
3.d1	Describe sampling location relative to wood heater (include drawing or photograph)				Page 18	
3.e1	Sampling Methods				Page 18	
3.e2	Analytical Methods				Page 19	
3.f1	Calibration procedures and results, certification procedures, sampling and analysis procedures				Appendix G	
3.f2	Test Method quality control procedures and results – leak checks, volume meter checks, stratification (velocity) checks, proportionality results.				Appendix G	
3.g1	Results and Sample Calculations				Appendix H	
3.g2	Raw Field Data				Appendix F	
3.g3	Sampling and Analytical Procedures				Appendix A	
3.g4	Analytical Data				Appendix F	
3.g5	Participants				Appendix B	
3.g6	Sampling and Operation Records				Appendix A	
3.g7	Additional Information				Appendix C	
4.0	Wood Heater Description					
4.1	Attach two photographs				Page 12	
4.2	Pursuant to Section 60.537c designate the permanent storage location of the tested wood heater, and the measures taken to seal the unit against tampering				Page 16	
4.3	Describe any special operation instruction that were provided to the laboratory.				N/A	

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Wood Heater Information Processing System Application Form		
4.4	Attached engineering drawings showing dimensions and material specifications for the following wood heater components and systems	Appendix D
4.4a1	Firebox dimensions	Page 11
4.4a2	Air Introduction System: Cross sectional area of inlets, outlets, and location and method of control	Page 10
4.4a3	Baffles: dimension and location	Appendix D
4.4a4	Refractory , insulation, dimension, location, and materials	Appendix D
4.4a5	Catalyst: Dimensions and location	N/A
4.4a6	Catalyst bypass mechanism and catalyst bypass gap tolerances: dimensions, cross sectional area and location	N/A
4.4a7	Flue Gas Exit: : Location and Exit	Page 10
4.4a8	Door and catalyst bypass gaskets: dimensions, fit and materials	Appendix D
4.4a9	Outer shielding and coverings: dimensions and location.	Appendix D
4.4a10	Fuel feed system (if applicable): fuel feed rate, auger motor design and power rating, and the angle of the auger to firebox	N/A
4.4a11	Forced air combustion system (if applicable): location and horsepower of blower motors and fan blade size	N/A
4.5	For each of the components or system listed above, identify any dimensions that you expect to have tolerances greater than +/-0.25” (or +/-5% for cross sectional areas) when all components are assembled and provide your manufacturing tolerances for these items. Attach documentation demonstrating that such tolerance variations do not adversely affect emissions.	N/A
4.6	If the tested wood heater has a firebox composed of material different from the material to be used in the manufacturer wood heaters (as provided for in Section 60.533(b)(3)(ii), describe these differences in the space below.	N/A
5.0	Catalyst Information	N/A
5.1	Catalyst Brand and model: Applied ceramics : Ceramic material	
5.2	Attach Catalyst Warranty: Within manual	N/A
5.3	Can the catalyst be visually inspected during normal heater operation or under typical installation conditions? Describe what the owner must do to make observation.	N/A
5.4	Describe catalyst installation and removal procedures (include descriptions, and illustrations prepared for use in owners manuals, if available.)	N/A
5.5	Describe location, size, and design of ports for monitoring catalyst temperature. Identify commercially available monitoring devices which are compatible.	N/A
5.6	If you want EPA to consider a proposed substitute for the catalyst identified in Section 5.1, please indicate below and submit evidence the you meet the tests described above.	N/A
6.0	Affirmations	
6.1	A representative wood heater for the model line in question has been tested in accordance with 40 CFR part 60, Section 60.534(a), and meets the applicable emission limits in 40 CFR Part 60, Section 60.532.	Yes
6.2	The results of all valid certification test runs are reported in this application and in the attached materials.	Yes
6.3	Wood Heaters manufactured under this certificate will be similar in all material and	Yes

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Wood Heater Information Processing System Application Form		
	dimensional respects, within tolerances of 40 CFR Part 60, Section 60.533(k)(2) and (3), to that wood heater tested for certification purposes.	
6.4	In-house parameter inspections and emission tests will be conducted and records will be maintained as described in 40 CFR Part 60, Section 60.533(o).	Yes
6.5	Labeling requirements described in 50 CFR Part 60, Section 60.536	Yes
6.6	For catalyst equipped wood heaters, warranty, inspection access and temperature port requirements as described in 40 CFR Part 60, Section 60.533 (c) , (d), and (m) will be adhered to.	N/A
6.7	I have read, understand and will comply with the requirements for reporting and record keeping set forth in 40 CFR Part 60, Section 60.537.	Yes
6.8	I have entered into a contract that satisfies the requirements of 40 CFR Part 60, Section 60.533(g) with the laboratory which conducted this certification	Yes
	The information contained in this application is true, complete, and correct to the best of my knowledge	Yes

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Technician Notes:

Prior to start of testing, the dilution tunnel was cleaned with a 6" steel brush.

Per Method 28 Section 8.1.1.3.1 - The unit could not be operated below 0.80 kg/hr, therefore, two category 2 tests were performed. See Table 1.

An over limits condition occurred during Run #3. Filter Temperatures went over the allowable limits during the test run. This was later determined to be a mechanical failure of the sensor probe. The probe was replaced and the run was thrown out.

The Galaxy insert utilizes a thermostatically controlled convection blower. All runs were performed with the blower set to the maximum setting.

Wood Heater Identification:

- Appliance Tested: *Foyer Supreme, Galaxy*
- Serial Number: *GY1000*
- Manufacturer: *Foyer Supreme, Inc.*
- Catalyst: *No*
- Heat exchange blower: *Integral*
- Type: *Wood Stove*
- Style: *Insert*
- Date Received: *N/A*
- Wood Heater Aging: *December 7, 2012 - 10 hrs.*
- Testing Period – Start: *Monday, December 10, 2012* Finish: *Friday, December 14, 2012*
- Test Location: *Foyer Supreme, Inc. 3594 Jarry East, Montreal, Quebec H1Z-2G4 CANADA*
- Elevation: *187 Feet above sea level*
- Test Technician(s): *Gary Nelke*

Results: Emissions

The overall weighted average emission rate based on the 4 certification runs is **3.5 g/hr**.

Results							
Category 2 0.8 to 1.0 Kg/hr		Category 2 .80 to 1.25 kg/hr (1.76 to 2.76 lbs/hr)		Category 3 1.25 to 1.90 kg/hr (2.76 to 4.19 lbs/hr)		Category 4 Maximum Burn Rate	
Date	12/11/2012	Date	12/10/2012	Date	12/12/2012	Date	9/13/2012
Run Number	2	Run Number	1	Run Number	5	Run Number	4
Emission Rate –g/Hr	2.4	Emission Rate g/Hr.	2.8	Emission Rate g/Hr.	6.6	Emission Rate g/Hr.	6.2
Burn Rate KG/hr	0.83	Burn Rate KG/hr	1.11	Burn Rate KG/hr	1.83	Burn Rate KG/hr	2.49
Overall Efficiency CSA B415 (HHV)	63.7%	Overall Efficiency CSA B415	63.7%	Overall Efficiency CSA B415	45.9%	Overall Efficiency CSA B415	57.8%
BTU (HHV)	13,352	BTU (HHV)	12,833	BTU (HHV)	15,713	BTU (HHV)	27,093

Table 1

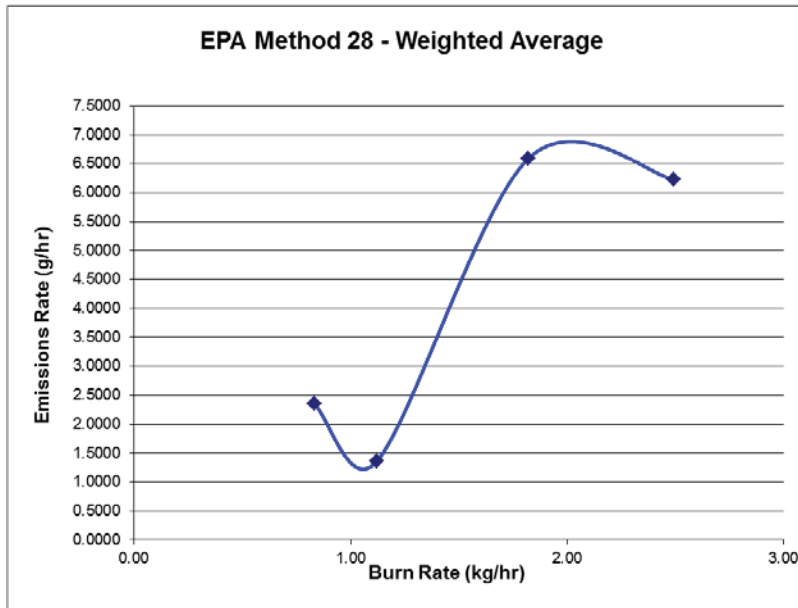


Table 2

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Results: Efficiency

Overall Weighted Average Efficiency using the Higher Heating Value is **58.0 %**.

EPA Method 28 - Weighted Average



Weighted Average: **58.04** % Overall HHV

Client: Supreme
 Model: Galaxy
 Tracking No.: 14
 Project No.: 019-s-014-1
 Test Dates: 12/10-12/13/2012

Signature/Date: *[Signature]* 2/1/13

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.83
Overall Efficiency %	63.1
Emissions Rate Cap (g/hr)	15
Weighting Factor	27.40%
Run Number	2

Burn Rate Category	2
Burn Rate (kg/hr-dry)	1.12
Overall Efficiency %	63.7
Emissions Rate Cap (g/hr)	15
Weighting Factor	37.00%
Run Number	1

Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.82
Overall Efficiency %	45.9
Emissions Rate Cap (g/hr)	18
Weighting Factor	28.50%
Run Number	5

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.49
Overall Efficiency %	57.8
Emissions Rate Cap (g/hr)	18
Weighting Factor	7.09%
Run Number	4

Figure 1: Overall Weighted Average Efficiency (HHV)

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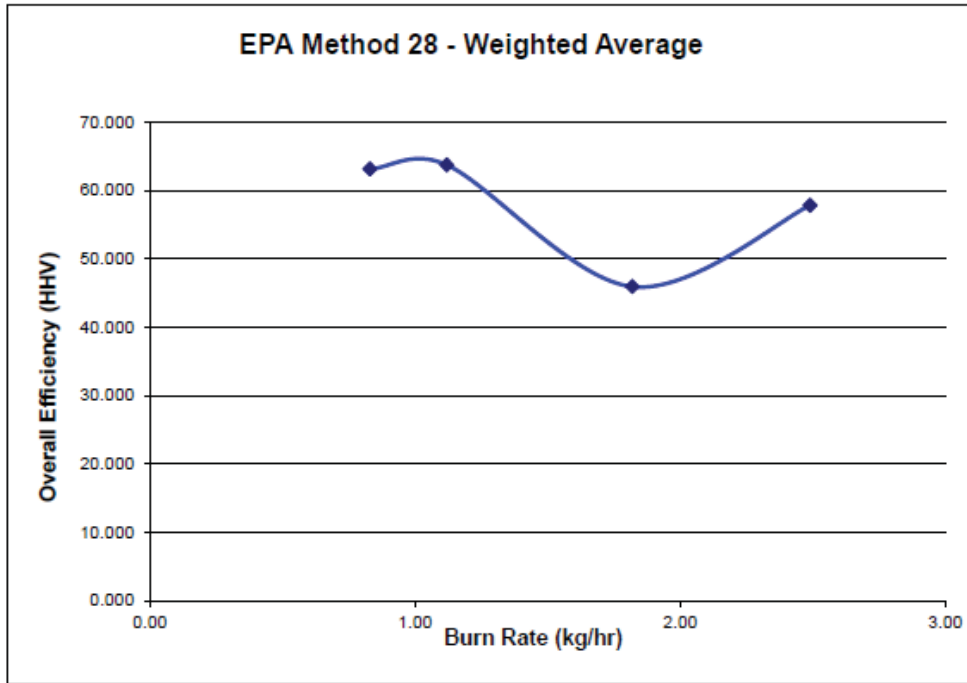


Table 3: Overall Weighted Avg. Efficiency

Test Condition Summary:

All testing conditions for runs 1,2,4,& 5 fell within allowable specifications of Method - 28. A summary of facility conditions, surface temperature averages, temperature averages, pre-test fuel weights, test fuel charge weights and run times is listed below in Table 4.

Runs	Ambient (Deg. F)		Relative Humidity (%)		Average Surface Temp. (Deg F.)		Barometric Pressure (In. Hg.)	Pre-Test Fuel End Wt. (Lbs.)	Test Fuel Charge Wt. (Lbs.)	Test Fuel Moisture (Dry Basis)	Run Time (Min.)
	Pre	Post	Pre	Post	Pre	Post					
1	68.5	67.5	83	84	278	320	29.8	4.2	21.2	20.3	430
2	70	68	85	85	347	348	30.11	3.86	21	20.7	570
4	72	71	70	71	628	683	30.04	4	20.9	20	190
5	71	73	72	72	523	516	30.11	3.86	21.1	21.4	260

Table 4: Test Condition Summary

Description:

Dimensions, firebox configuration, air supply locations, air introduction locations, and baffle locations of the wood heater are referenced below in Table 4 and Figures 2 through 5.

Heater Dimensions				
Height	Width	Depth	Firebox Volume	Weight
39"	31-7/16"	22-11/16"	3.09 Ft ³	220 Lbs

Table 5: Heater Dimensions



Figure 2: Front

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Figure 3: Firebox

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Process Operations:

The appliance was operated according to procedures as described in the Operations Manual – (see appendix I). Primary air supply settings, fuel bed adjustments, test fuel properties, test fuel configuration and loading density are as described below in Tables 6, and Figure 8. All draft measurements for all 5 runs were less than 1 ft³ per minute. See Appendix F for detailed run information.

	Burn Cat.	Primary Air Setting	Run Notes	
			Pre-Burn	Test Run
Run 1	2	Closed	Start w/15Lbs 9am recording start @ 10:15am w/5.45 lbs. Blower set to Max	Run Start @11.36am. Door open for < 1 minute at start. "Easy Light" mechanism set to max.
Run 2	2	Closed	Blower set to Max	Run Start @ 9:38. Door open for loading only. "Easy Light" mechanism set to max. Stirred coal bed at 8hr 40 Min. due to no weight change.
Run 3	N/A		Blower set to Max	Blown run, filter temps went over & mechanical failure – readout issues
Run 4	4	Full Open	Blower set to Max	"Easy Light" mechanism set to max.
Run 5	3	60 ⁰	Blower set to Max	"Easy Light" mechanism set to max.

Table 6:

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Figure 4: Primary Air Slide

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Figure 5: Air Flow Schematic (1)

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control

Figure 6 Air Flow Schematic (2)

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Test Fuel Properties:

All test fuel charges consisted of 6 pieces of 4" x 4"x 13.5" douglas fir dimensional lumber and were assembled per Method 28 specifications. Figures 6 and 7 detail the fuel charges. All fuel crib moisture content and temperatures were within allowable limits.



Figure 7: Fuel Load



Figure 8: Fuel Load

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Sampling Locations:

Sample ports are located 16.5 feet downstream from any disturbances and 1 foot upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 5.5 feet upstream from any disturbances. (See Figure 13 & 14)

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Figure 9: Sample Points

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Sampling Methods:

A dual filter dry sampling train system (5G sample option 3) was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per method 5G option 3 were followed. No alternate procedures were used.

Sampling and Analytical Procedures:

All sampling and analytical procedures used followed EPA Methods 1, 2, 3, 4, 5 and 28.

Analytical Methods Description:

All sample recovery and analysis procedures followed EPA Method 5 procedures. At the end of each test run, filters were removed from their housings, dessicated for 24 hours, and then weighed to a constant weight per Method 5 section 11.0.

Quality Control and Assurance Procedures and Results:

Calibration procedures and results were conducted per EPA Method 1 through 5 and Method 28. Calibration certificates and results can be found in Appendix F.

Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined in Method 5.

Upon completion of testing, the unit was sealed with metal strapping and labeled with the following seal:



Figure 10: Sealed unit

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Appendices:

Appendix A: Sampling and Analytical Procedures

All Sampling and Analytical Procedures were performed by Ben Nelke. All procedures used were directly from EPA Methods 1, 2, 3, 4, 5 and 28. No alternative procedures were used for this test series.

Appendix B: Participants

The following personnel were involved with the testing and producing of this report.

- John Steinert, President
- Gary Nelke CMfgE, Vice President
- Ben Nelke, Senior Technician

Appendix C: Updates

- There were no changes made to the appliance once testing commenced.