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TESTING LABORATORY**

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**TEST REPORT      No. AHT-14-08-E**

CLIENT REFERENCE:

Order No. N/A

MANUFACTURER:

Schots Home Emporium  
400 Hoddle Street,  
Melbourne, Vic, 3068

APPLIANCE TESTED:

Vienna GL70

WORK REQUESTED:

Measure emissions, power output and  
efficiency to AS/NZS 4012:1999 and AS/NZS  
4013:1999 using hardwood fuel

TEST DATES:

03/06/2014 – 12/06/2014



25/08/2014

.....  
Signed by Authorised Person

.....  
Date of Issue

Tim Cannon



**NATA Accredited Laboratory    Number: 18755**

Accredited for compliance with ISO/IEC 17025.

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## 1. Introduction

Schots Home Emporium contracted Adelaide Heating Technology Test Laboratory to measure the emissions from the 'Vienna GL70' freestanding radiant wood burning heater appliance, manufactured in December 2013, in accordance with AS/NZS 4013:1999 and AS/NZS 4012:1999.

Detailed drawings of the appliance, operating instructions and installation instructions have been provided as supplementary documents to this report.

The fuel nominated was hardwood. The hardwood used in testing was selected to confirm with AS/NZS 4014.1:1999. The appliance is shown in Figure 1 (Appendix A).

## 2. Procedure

Adelaide Heating Technology laboratory's calorimeter room and emissions facility were used for testing the wood heater in accordance with AS/NZS 4012 and AS/NZS 4013. Refer to Appendix B for description of the calorimeter room and emissions facility, for details and specifications refer to the relevant standard.

Prior to the test series commencing, equipment was checked and/or calibrated as required.

A preburn leak test was carried out on the heater. The heater was then fitted with a flue and operated on high burn for a minimum of sixteen hours to fully cure paint, dry out bricks, etc. The leak test was repeated.

The firebox volume was then measured by the method described in AS/NZS 4012:1999. Fuel load was calculated from the firebox volume. Wood piece size, weight and number of fuel pieces making up the load were determined.

The heater was installed in the calorimeter room on platform scales and connected to the flue system in accordance with AS/NZS 4012. A 7 inch to 6 inch reducer was fitted to the heater flue spigot before being connected to the flue system.

The counter weight assembly for the up/down movement of the door was removed to reduce the overall weight of the appliance to less than 200kg which was the maximum allowable on the scales. The door still opened normally via a hinge assembly.

The heater was operated at three distinct primary air settings, adjusted via a bottom air control in the front of the ash pan beneath the firebox to give the required range of heat outputs:-

- **High**            Air control was fully open.
- **Low**             Air control was fully closed. After refuelling, door was closed in a secure manner to minimise any compromising of the door seals.
- **Medium**         Air control was open 2 mm.

For each air setting, a fire was lit in the appliance with paper and wood and a bed of embers built up. When the bed of embers was 24 to 26% of the single fuel load, a pre-burn cycle was commenced. The appliance was operated in such a way as to ensure that conditions at the beginning of the test cycle and the end were similar. For the low and medium setting, the air control was set fully open until the fuel mass dropped 20% of the single fuel load. At this point, the air control was set to the appropriate position to give the required burn rate.

At the end of the pre-burn test cycle, the appliance was operated for at least three valid cycles at each heater setting, and particulate emission samples collected during each test in accordance with AS/NZS 4013. Emission sample recovery is described in Appendix B.

Documentation provided with the appliance, in accordance with AS/NZS 4013 clause 8.2 has been provided as an additional documents with this report. These include detailed drawings of the appliance, installation instructions, and operating instructions.

### 3. Appliance Operating Conditions / Test Parameters

Condition	Comments	Condition	Comments
Appliance air flow test**	Pass	Hot Water Booster	No
Fire Box Volume	68.08 litres	Wood Ash Content	0.4% dry wood
Wood Type	Sugar Gum	Wood Density	0.883 kg/L dry wood
Wood Load	11.102 kg	Wood Calorific Value	17.87 MJ/kg dry wood
Number of Pieces	9	Wood Length	227mm
Fan	No	Method of Loading	Front to back

Post conditioning air flow rate = 0.512 m<sup>3</sup>/min

Post burn air flow rate = 0.527 m<sup>3</sup>/min

Variation in flow rate Post-burn to Post-Conditioning = 2.95%

## 4. Results

The results of performance test on the appliance by methods of AS/NZS 4012 and AS/NZS 4013:

### 4.1. Performance – Power

Air Setting	Cycle No.	Cycle Time (min)	Average Power (kW)	Wood Load (kg – wet)	Moisture (%)	Efficiency (%)	Burn Rate (kg/hr – dry wood)
High	1	92	19.4	11.001	12.30%	62.2%	6.4
High	2	90	18.5	11.106		57.3%	6.4
High	3	<u>90</u>	<u>18.9</u>	10.988		<u>59.1%</u>	<u>6.5</u>
	Average	91	18.9			59.5%	6.5
Medium	1	118	14.3	10.921	12.07%	59.2%	4.9
Medium	2	120	13.5	10.929	13.51%	57.4%	4.8
Medium	3	<u>118</u>	<u>14.3</u>	11.088	13.51%	<u>59.2%</u>	<u>4.9</u>
	Average	119	14.0			58.6%	4.9
Low	1	142	13.6	11.121	14.07%	67.7%	4.1
Low	2	128	13.9	11.108		62.4%	4.5
Low	3	<u>142</u>	<u>13.2</u>	11.142		<u>66.0%</u>	<u>4.1</u>
	Average	137	13.6			65.4%	4.2

The *Peak Power*<sup>1</sup> for the high setting was **21.3 kW**.

The uncertainty of measurement of power output at 5kW has been calculated and found to be less than ±5% at a 95% confidence level (coverage factor = 2).

<sup>1</sup>**Peak Power** is the average of the highest (peak) power levels recorded during each valid high burn test cycle.

## 4.2. Performance – Emissions

Test Date	Cycle Start Time	Air Setting	Cycle No.	Total Emissions (mg)	Ratio Dilution Tunnel / Sample	Emissions (g/cycle)	Emissions (g/kg dry wood)
9/10/2013	12:41	High	1	4.75	1144	5.44	0.56
	14:15	High	2	3.93	1106	4.34	0.45
	15:49	High	3	3.62	1107	4.00	<u>0.42</u>
		Average					0.48
4/11/2013	10:12	Medium	1	8.64	1118	9.66	1.01
	12:13	Medium	2	5.72	1107	6.34	0.67
	14:15	Medium	3	5.94	1128	6.70	<u>0.70</u>
		Average					0.79
31/10/2013	12:08	Low	1	5.58	1108	6.18	0.65
	14:30	Low	2	6.34	1089	6.90	0.72
	16:40	Low	3	6.98	1102	7.69	<u>0.80</u>
		Average					0.72

## 4.3. Summary – Schots Vienna GL70 (Hardwood)

Air Setting	Average Cycle Time (min)	Average Power Output (kW)	Average Efficiency (%)	Test Fuel Load Mass (kg – wet)	Emissions (g/kg – dry wood)
High	91	18.9	59.5%	10.979	0.48
Medium	119	14.0	58.6%	10.979	0.79
Low	137	<u>13.6</u>	<u>65.4%</u>	11.116	<u>0.72</u>
Average		15.5	61.1%		0.66

## 5. Conclusion

The appliance particulate emission factor established in testing is **0.7 g/kg** of dry wood.

**This appliance complies with AS/NZS 4013 (Section 7 Maximum Appliance Particulate Emissions Factor).**

The maximum average heat output was **18.9 kW** and the overall average efficiency was **61%** when tested in accordance with AS/NZS 4012.

## Appendix A – Figures / Photographs

Figure 1 – Photograph of appliance



Figure 2 – Photograph of fuel load



## Appendix B – Equipment / Method Description

### ***Calorimeter Room***

The Adelaide Heating Technology calorimeter room is an insulated room (internal dimensions 3200mm x 3400mm x 2400mm) integrated with test equipment and computer to provide a controlled environment and a facility for testing performance of domestic solid fuel burning appliances. Measurement of the change in temperature of air passing through the calorimeter room allows calculation of the power output, of the appliance on test, by taking into account the air flow rate and the calorimeter room calibration factors.

Temperature measurements are performed using thermocouples. Air flow measurements are performed using a pitot tube and differential pressure transducer. Air flow in and out of the room is controlled via variable speed drives operating two centrifugal fans. Air pressure in the room is maintained at atmospheric pressure for the duration of the test.

The heater is installed on platform scales linked to the test computer which measures and records the mass of fuel in the appliance during testing. The flue system incorporates an oil bath that isolates the weight of the heater from the rest of the flue.

The calorimeter room and associated equipment has been calibrated to account for deviations such as thermal losses through the calorimeter room walls. Measurement data collected is processed by the computer system and recorded every 2 minutes. (For details refer to AS/NZS 4012).

### ***Emissions Facility***

The emissions facility consists of calorimeter room, dilution tunnel, and sampling train. Appliance is operated in the calorimeter room, gases and particulates that exit the flue are admitted to the dilution tunnel where they are sampled. The sampling train collects a sample from the dilution tunnel and passes it through a double filter system to collect particulate emissions contained in the sample.

Measurements of relative flow rates in tunnel and sample train permit determination of volume ratio used for scaling of particulate emissions collected in sample to indicate total particulate emission of the appliance. The sampling train consists of sample probe, double filter assembly incorporating a thermocouple, gas dryer (desiccator), air sampler pump and dry gas meter.

Test equipment is integrated with a computer which processes and records the test data.

Emissions are only sampled during test cycles and not during fire lighting, conditioning burn or pre-test burn cycles. (For details refer to AS/NZS 4013).

### ***Sample Recovery***

The sample particulate emissions collected by the sampling train during a test are recovered at the completion of each test cycle. At completion of a test cycle, the filters are removed from the filter holders and placed in a desiccator to dry. The two dried filters are weighed before and after the test to establish weight of particulate emissions collected on the filters.

Condensed and entrapped emissions from the sample probe and first filter support are washed with acetone into a glass beaker. The acetone washing is dried to determine residual weight containing remaining emissions from sample.

Emissions weight in sample collected is determined by combining mass of emissions from the two filters with the acetone washing residual.

## Appendix C – Appliance Construction Checklist

Importer:		Schots Home Emporium				
Appliance Model Name:		Vienna GL70				
Serial Number:						
Water Heater fitted:		N/A	Catalytic Combustor:		N/A	
Fan Location and Speed:		N/A	Grate:		12 slots at 65 x 10mm each	
Overall Height (mm):	685	Overall Width (mm):	700	Overall Depth (mm):	470	
Fire Box Dimensions (mm):	Height:	410	Width:	535	Depth:	312
Fire Box Material/Thickness (mm):	Cast Iron / 6.0		Seam Fully Welded:		N/A – cast iron	
Fire Brick Size (mm):	N/A – cast iron					
Main Door Opening (mm):	Height:	415	Width:	560		
Door (mm):	Height:	520	Width:	700	Depth:	50
Door Glass (mm):	Height:	520	Width:	595		
Primary Air Opening:	Air control in ash pan – 6 x 16mm Ø holes		Closed:	Air control slid shut		
Secondary Air Opening:	N/A		Closed:	N/A		
Baffle Plate 1 (mm):	400(w) x 265(d) x 6 mm					
Spigot Size (mm):	186mm at the top & 176mm at the bottom					
Spigot Location from rear of appliance (mm):	160	From side of appliance (mm):	350			
Rear Heat Shield Air Gap (mm):	N/A		Side Heat Shield Air Gap (mm):	N/A		
Heat Shield Material/Thickness (mm):	N/A					