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THERMAL CLEARANCE TESTING OF THE QUADRAFIRE MILLENIUM 3100 ACC SOLID FUEL APPLIANCE INSTALLED WITH A DEFAULT FLUE KIT

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By
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THERMAL CLEARANCE TESTING OF THE QUADRAFIRE MILLENIUM 3100 ACC SOLID FUEL APPLIANCE TESTED WITH A DEFUALT FLUE KIT

Report

The appliance and flue system were installed into a standard Clearance Test enclosure and tested in two positions in a manner conforming to joint Australian/New Zealand Standard 2918:2001, Appendix B. A minimum 970mm deep x 800mm wide x 6mm thick floor protector (cement fibre sheet) should be used under and in front of the appliance base when installing the appliance (see joint AS/NZS 2918:2001 3.3.2). The floor protector should extend 300mm in front of the appliance base. The Thermal conductivity of the floor protector is 0.8m².K/W for 4mm thick cement sheets.

The Quadrafire Millenium 3100ACC solid fuel appliance, when installed with a standard flue system, conforms to the requirements of joint AS/NZS 2918:2001, Appendix B, with respect to rear wall, side wall, floor and ceiling surface temperatures, when tested in the positions described in this report and using *Pinus radiata* firewood as the fuel type.

TEST POSITIONS

The appliance and flue combinations were tested at the following clearances:

Position A (Parallel)

175mm from rear wall to the edge of the appliance rear panel.
360mm from side wall to the edge of the appliance side panel.

Position B (Corner)

225mm from walls when measured from the rear corners of the appliance (45° to both walls).

Refer to Appendix 1 of this report for clearance diagrams.

Investigation: A. Reid

Report: S. Marland

Checked by: A. Reid

Signed: ..... Approved: .....

A. Reid
Technical Officer

S. Marland
Morwell Group Leader

1. INTRODUCTION

HRL Technology Pty Ltd was requested to assess the Quadrafire Millenium 3100ACC solid fuel burning appliance, in conjunction with a standard flue system. Clearance testing was performed according to joint AS/NZS 2918:2001, Appendix B.

This report provides details of the safety clearance tests performed at the Solid Fuel Heater Testing and Research Laboratory of HRL Technology Pty Ltd. The testing was conducted on July 11th 2012, by Mr A. Reid. The testing was commissioned by Hearth & Home Technologies and the test results remain the property of this company.

The appliance was tested using *Pinus radiata* as firewood. No testing was undertaken with coal or briquettes.

2. DETAILS OF APPLIANCE

The test results reported below apply only to the appliance/flue system tested. The details of the appliance given in this section include features which may affect safety clearances. Any change in the construction or design of this model of the appliance or flue could invalidate this report.

Appendix 2 gives test appliance construction details.

3. INSTALLATION OF THE APPLIANCE

The appliance/flue combination was installed in two test positions at clearances specified by the manufacturer after preliminary testing. Floor thermocouples were positioned according to joint AS/NZS 2918:2001, Appendix B.

3.1 Floor Protector

A floor protector was installed beneath and in front of the appliance. The floor protector (cement fibre or similar) must be installed so that its leading edge is a minimum of 300mm in front of the appliance base. The floor protector must be a minimum of 800mm wide x 970mm deep x 6mm thick. The floor protector consisted of 6mm thick cement fibre sheet with a thermal resistance value of 0.8m².K/W for 4mm thick cement sheets.

3.2 Flue System

The flue system used throughout testing was a Hawkwind default flue kit which was manufactured by SV Metals. This flue system has not been tested to joint AS/NZS 2918:2001, Appendix F by HRL Technology Pty Ltd. Appendix 3 shows details of the flue system.

The flue height was 4.6 ± 0.3 m from the floor protector.

4. CLEARANCES

4.1 Position A

The appliance was installed into the test enclosure with a rear wall clearance of 175mm and a side wall clearance of 360mm. Clearance measurements were taken from the appliance rear and side panels respectively (see Appendix 1).

4.2 Position B

The appliance was installed into the test enclosure in a corner position (45° to both side walls) with a clearance of 225mm to the side walls when measured from the appliance rear corners (see Appendix 1).

5. PROCEDURE

All clearance testing took place on July 11th 2012. The floor thermocouples were installed into positions as per joint AS/NZS 2918:2001, Appendix B. Other thermocouple positions were determined by monitoring surface temperatures during trial burn cycles. Hot sites were located with the aid of a Linear Laboratories C-600E infra-red pyrometer.

All thermocouple tips were stapled onto the test surfaces, with black tape over the first 100 mm to facilitate consistent and accurate recording of temperatures. Thermocouple positions are shown in Tables 1 and 2.

5.1 High Fire Test

The appliance was fully fired in accordance with Section B9.1 of the joint Standard. The level of fuel was maintained between 50-75% of the full volume level of the fuel chamber during the High Fire test.

The average fuel load for initiating the High Fire tests was 5.6kg with an average refuelling rate of 1.1kg/10 minutes.

During High Fire testing it was found that the highest surface temperatures caused through the operation of the appliance occurred when the primary air control was fully open.

5.2 Flash Fire Test

Immediately after the High Fire test was completed, sufficient embers were removed to bring the fire bed to a level of 15-25% of the fuel chamber volume. The appliance was then fired in accordance with Section B9.2 of the joint Standard. The average fuel load for initiating the Flash Fire tests was 3.7kg. Highest temperature rises were achieved by fully opening the primary air control and leaving the main door 10mm ajar from the door catch

5.3 Fuel

The appliance was fired using a standard firewood fuel of *Pinus radiata* with an average moisture content of 15.0%. Each firewood piece was 300mm x 100 mm x 40 mm.

6. RESULTS

6.1 Uncertainty of Measurement Statement

(a) The uncertainty of distance measurement for determining clearance distances was not greater than ± 2 mm.

(b) The uncertainty of temperature measurement during the entire test period was ± 2°C at the 95% confidence level.

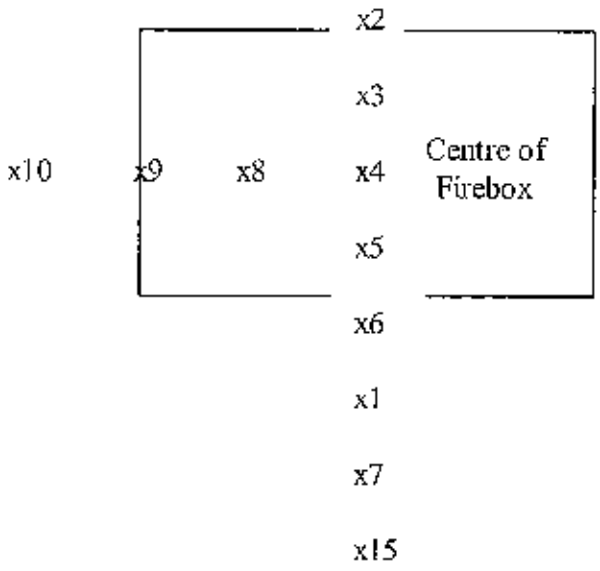
6.2 Test Enclosure Temperatures

Table 3 shows the ambient temperature range during testing. Tables 4 and 5 show the maximum temperature rise above ambient for each test surface.

7. CONCLUSION

The Quadrafire Millenium 3100ACC solid fuel burning appliance, when installed with a standard flue system, conforms to the requirements of Australian/New Zealand Standard 2918:2001, with respect to floor, ceiling, side wall and rear wall surface temperatures, when tested in the test positions described earlier in this report in accordance with Appendix B of the joint Standard.

Table 1: Position A



Thermocouple	/Channel No
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
15	15

Thermocouple	Channel No
11 Ceiling, inside wooden ceiling rim, to front of appliance	11
12 Ceiling, 25 mm from wooden ceiling rim, to front of appliance	12
13 Ceiling, inside wooden ceiling rim, to LHS of appliance	13
14 Ceiling, 25 mm from wooden ceiling rim, to LHS of appliance	14
16 Side wall, 925mm from corner, 740mm above floor	16
17 Side wall, 525mm from corner, 950mm above floor	17
18 Rear wall, 670mm from corner, 1025mm above floor	18
19 Rear wall, 530mm from corner, 1055mm above floor	19
20 Ambient temperature	20

Table 2: Position B

Thermocouple	Channel No
11 Ceiling, inside wooden ceiling rim, to RHS of appliance	11
12 Ceiling, 25 mm from wooden ceiling rim, to RHS of appliance	12
13 Ceiling, inside wooden ceiling rim, to LHS of appliance	13
14 Ceiling, 25 mm from wooden ceiling rim, to LHS of appliance	14
16 RHS wall, 700mm from corner, 990mm above floor	16
17 RHS wall, 545mm from corner, 1060mm above floor	17
18 LHS wall, 675mm from corner, 1050mm above floor	18
19 LHS wall, 530mm from corner, 1060mm above floor	19
20 Ambient temperature	20

Table 3: Ambient Temperature Range °C

Position	High Fire	Flash Fire
A	16.4 – 27.3	23.3 – 25.8
B	20.8 – 25.0	18.6 – 25.1

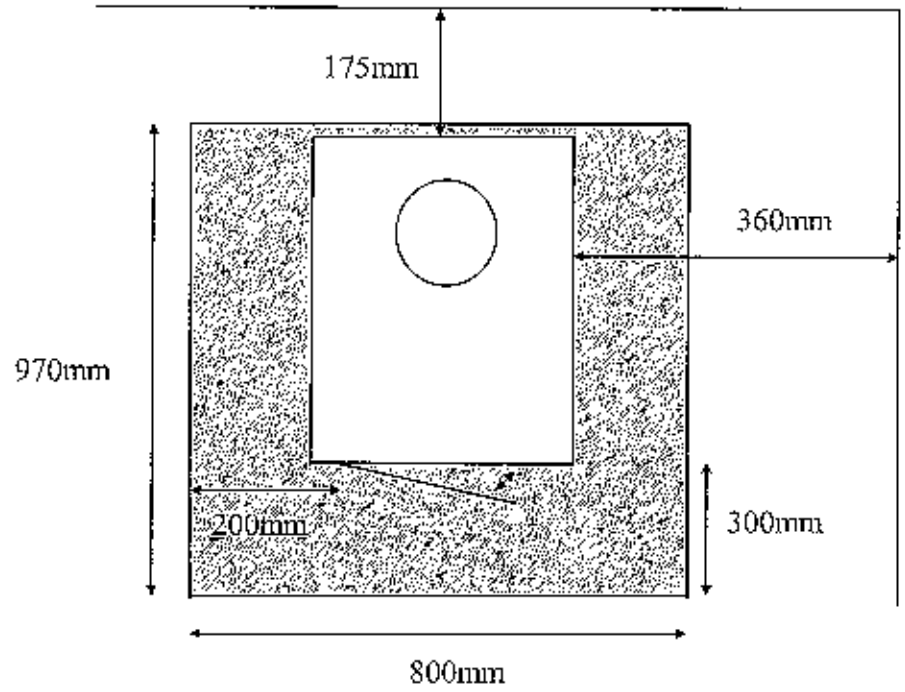
Table 4: Maximum Temperature Rise - Position A

Position	Thermocouple Number	High Fire Test (°C)	Thermocouple Number	Flash Fire Test (°C)
Floor	15	60.7	15	60.7
Ceiling	11	19.5	11	17.2
Rear Wall	19	60.7	18	42.9
Side Wall	17	53.3	17	42.8

Table 5: Maximum Temperature Rise - Position B

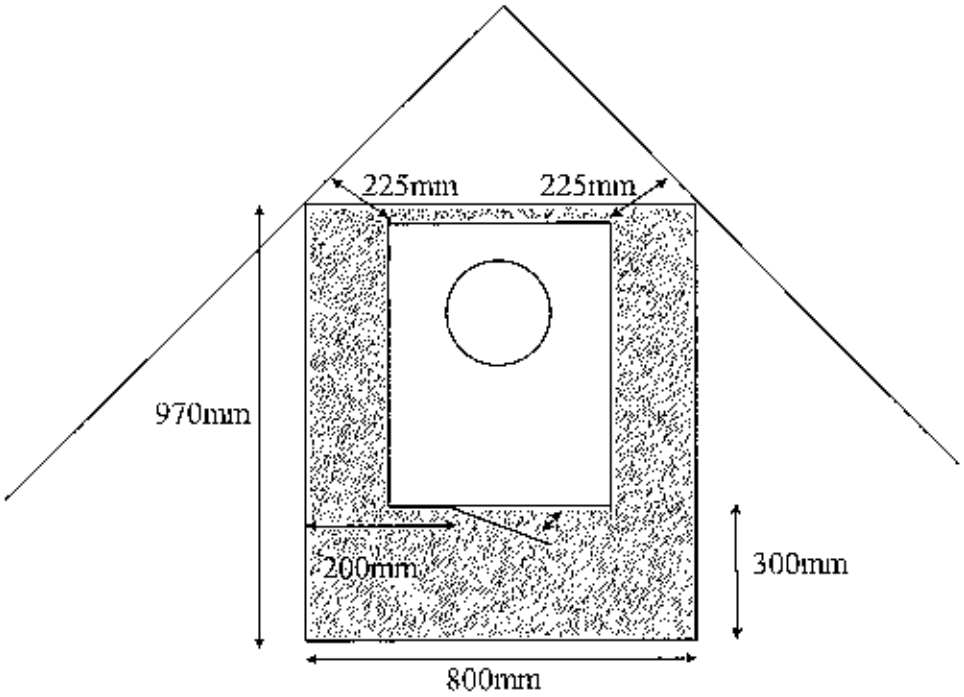
Position	Thermocouple Number	High Fire Test (°C)	Thermocouple Number	Flash Fire Test (°C)
Ceiling	11	18.5	11	16.3
RHS Wall	17	57.6	18	45.6
LHS Wall	18	57.3	18	46.2

APPENDIX 1:
MINIMUM CLEARANCES FOR THE QUADRAFIRE MILLENIUM 3100 ACC SOLID FUEL APPLIANCE INSTALLED WITH A DEFAULT FLUE KIT



Position A

The floor protector consisted of 6mm thick cement fibre sheet which had a thermal resistance of 0.8m².k/W.



Position B

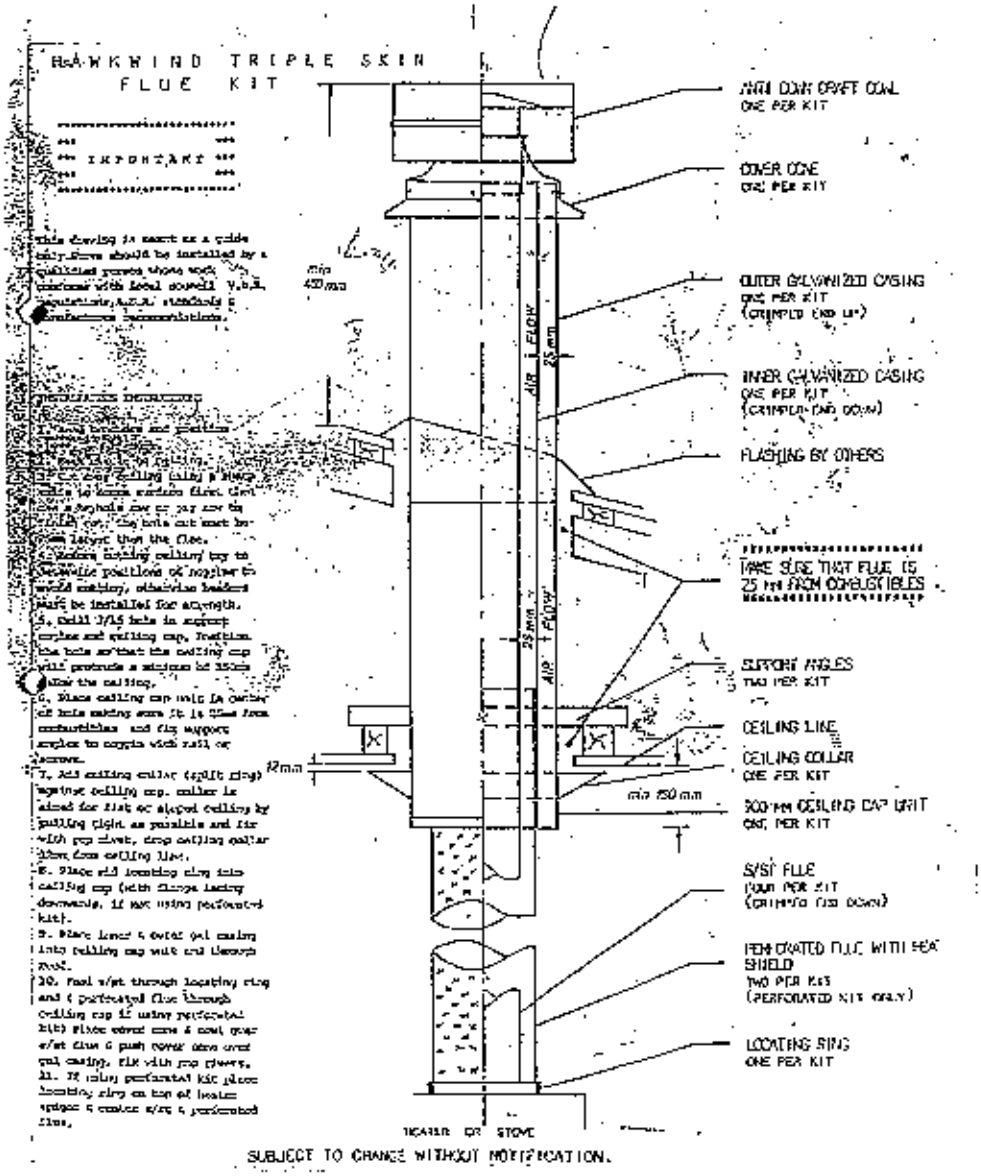
APPENDIX 2:
SOLID FUEL BURNING APPLIANCES CONSTRUCTION CHECKLIST

Appliance Model Name:	Quadra-fire 3100 ACC Series		
Manufacturer:	Home & Hearth Technologies		
Serial Number:	0071961421		
Overall Height (to top of top plate):	747mm		
Overall Width (not including top plate):	615mm		
Overall Depth (not including top plate):	670mm		
Top Plate Width:	635mm		
Top Plate Depth:	580mm		
Top Plate Thickness:	8mm		
Appliance Base:	*Height: 25mm*	*Width: 532mm*	*Depth:500mm*
Appliance Pedestal:	*Height:255mm*	*Width:462mm*	*Depth:405mm*
Firebox Description:	*Height:280mm*	*Width: 420mm*	*Depth:390mm*
Firebox Material Type/ Seam Fully Welded:	6mm Steel, fully welded		
Firebrick Size:	*Height*: 230/230mm *Thickness*: 32/32mm		*Width*: 112/74mm *No of*: 9/1
Main Door Opening:	*Height*: 278mm		*Width*: 396mm
Door: **Door Glass:**	*Height: 380mm* *Height: 275mm*	*Width:483mm* *Width:383mm*	*Depth: 25mm*
Primary Air Location:	Roof of firebox		
Dimension of Primary Air:	3 tubes with 21 holes @ 3mm + 1 tube with 31 holes @ 4.5mm		
Area of Primary (mm^2)	938.5mm^2		
Secondary/Tertiary Air Location:	Base of firebox front and rear		
Dimension of Secondary/Tertiary Air:	Front- 1 hole @ 8.5mm, Rear- 4 holes @ 8.5mm diameter		
Area of Secondary/Tertiary Air (mm^2):	283.75mm^2		
Flue Dimensions:	152mm OD		
Spigot Dimensions:	163mm OD		155mm ID
Spigot to Rear of Appliance:			88mm
Rear Internal to External Heat Shield:			50mm
Side Internal to External Heat Shield:			62mm
Heat Shield Material Type:	1.0mm sheetmetal		
Water Heater Fitted:			No
Fan Location/Speeds:	Rear of firebox, variable speed fan		
Catalytic Combustor:			No
Grate:			No
Diagrams:	Over the page		

*** Note the accuracy of measurements in Appendix 2 are ± 2% of the recorded value**

Signed: ..... **Date:** 17/7/12

APPENDIX 3:
HAWKWIND DEFAULT FLUE KIT



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