Fischer Storage Heater test

Final Report 57240/1

Carried out for
Fischer Future Heat UK

By Calum Maclean

12 September 2013

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Carried out for:

Fischer Future Heat UK
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Contract: **Final Report 57240/1**

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1 INTRODUCTION

This report details a test carried out on a Fischer Storage Heater, of nominal 2.2kW capacity. The test was requested by Keith Bastian of Fischer Future Heat UK and was conducted during July 2013.

The wireless receiver was replaced with an updated version on the radiator body by a representative of Fischer Future Heat UK before the tests were conducted.

2 OBJECTIVES

The objective of the test was to determine the total heat input over a 24 hour period into the Fischer Storage Heater while measuring the room temperature at various heights in the centre of the room while providing cooling loads to simulate outside temperature of 10^{o}C with an indoor temperature of 21^{o}C for 16 hours and a night set back simulation of outside temperature -1^{o}C with indoor temperature 16^{o}C for 8 hours.

2.1 ITEM SUPPLIED FOR TESTING

The appliance sent for testing was a Fischer Storage Heater. The heater had a nominal output of 2.2kW when on. The heater tested had a wireless receiver on the side at low level and a thermostat transmitter/sensor on the opposite wall. It consisted of an electrical heater within a fireclay structure encased in a steel fluted (finned) case. Nominal dimensions were 1300m x 610mm x 110mm.

3 INSTRUMENTATION

Table 1 The instrumentation used during the testing

Description	Identifier	Calibration due
Yokogawa WT110 power meter	116	12/Aug/2013
Seimens Magflo meter	203	19/Jun/2014
Agilent 34970A data-logger 1	Logger 6	18/Jun/2014
Agilent 34970A data-logger 2	Logger 7	
Platinum resistance thermometers	Channel nos: 11 to 18, 20, 21 to 25, 27 and 28	
Thermocouples	Channel nos: 1, 8 to 13, 16, 18 and 19	

4 SCOPE OF WORK AND TEST METHOD

The general methodology used was taken from the BSRIA generic test method for electrical and non-standard radiators. This incorporated principles and methods from BS EN 60675:1995 "Household electric direct acting room heaters. Methods for measuring performance"

The tests was carried out in a closed cuboid shape room measuring 3 m x 4 m x 4 m in height, with the floor raised by means of insulation slabs to give an internal floor-ceiling height of 2.5m as requested by the client.

The test room was constructed using 100 mm Urethane insulation with steel finish materials in a fabricated sheet form (manufacturers stated U-value of 0.19 W/m^2K). The test room was airtight enough to prevent any significant flow from or to the ambient air outside. The test room was within an existing larger environmental chamber, to minimise heat transfer through its surfaces.

A simulation was requested for daytime running at a cooling load simulating outside temperature of 10^oC with an indoor temperature of 21^oC and a night set back simulation of outside temperature -1^oC with indoor temperature 16^oC. Based on the chamber volumes and insulation values this equated to applied cooling loads in the test chamber of approximately 820W and 1350W respectively. 'Daytime' running period was 16hr, simulating a 6am-10pm period and 'night time' was a 8hr period simulating 10pm to 6am.

Temperature was controlled within both inner and outer chambers. Temperature in the outer chamber was maintained at 21ºC. Cooling within the test chamber was achieved by the application of water cooled panels in the chamber.

The test requested by the client was based on test clause 5 from BS EN 60675:1995. The test comprised of a 16 hour test period with the thermostat set to 21°C, then the thermostat set-point was changed to 16°C and the transition and subsequent steady state period data was recorded until an additional 8 hours had passed totalling 24 hours run time.

The thermostat was placed on the opposite wall as specified by the client at a height of 1.5m, the same height as the globe on the pole in the centre of the test chamber.

Prior to the tests a calibration was conducted to verify the heat loss through the room fabric (U value).

5 RESULTS

The results are split into 2 sections; the first is the average tables for the test sections and overall test and second the graphs of some of the important measured parameters.

Power consumption of the heater is shown as measured (average values over the period), maximum and minimum instantaneous values and total kWh over the test period.

5.1 DATA TABLES

Table 2 21°C set-point test data – 16 Hours

21 degrees set on radiator control				
	Units	Measured	Maximum	Minimum
Length of test	Hours	16.00	-	-
Globe temperature 1.5m	°C	21.02	21.15	20.91
Pole Temperature - 0.3m	°C	20.92	21.51	20.66
Pole Temperature - 0.5m	°C	21.13	21.91	20.91
Pole Temperature - 0.8m	°C	21.14	21.33	21.01
Pole Temperature - 1.1m	°C	21.42	21.71	21.15
Pole Temperature - 1.5m	°C	21.30	21.56	21.06
Pole Temperature - 2.0m	°C	21.49	22.48	21.18
Pole Temperature - 2.2m	°C	21.21	21.55	20.96
Power consumption of radiator	W	878	2496	0
Voltage supply to radiator when working	V	231	236	225
Total power input to radiator	Wh	14051	-	-
Water cooling	W	795	-	-

The thermal balance between applied cooling load and radiator output at steady state conditions was within 9.5%.

Table 3 16°C set-point test data – 8 Hours

16 degrees set on radiator control - all data				
	Units	Measured	Maximum	Minimum
Length of test	Hours	8.00	-	-
Globe temperature 1.5m	°C	16.21	20.99	14.04
Pole Temperature - 0.3m	°C	16.35	21.40	14.10
Pole Temperature - 0.5m	°C	16.26	21.30	14.15
Pole Temperature - 0.8m	°C	16.29	21.16	14.19
Pole Temperature - 1.1m	°C	16.72	21.51	14.52
Pole Temperature - 1.5m	°C	16.45	21.41	14.26
Pole Temperature - 2.0m	°C	16.55	21.44	13.62
Pole Temperature - 2.2m	°C	16.32	21.36	13.16
Power consumption of radiator	W	943	2480	0
Voltage supply to radiator when working	V	234	238	230
Total power input to radiator	Wh	7543	-	-
Water cooling	W	1320	-	-

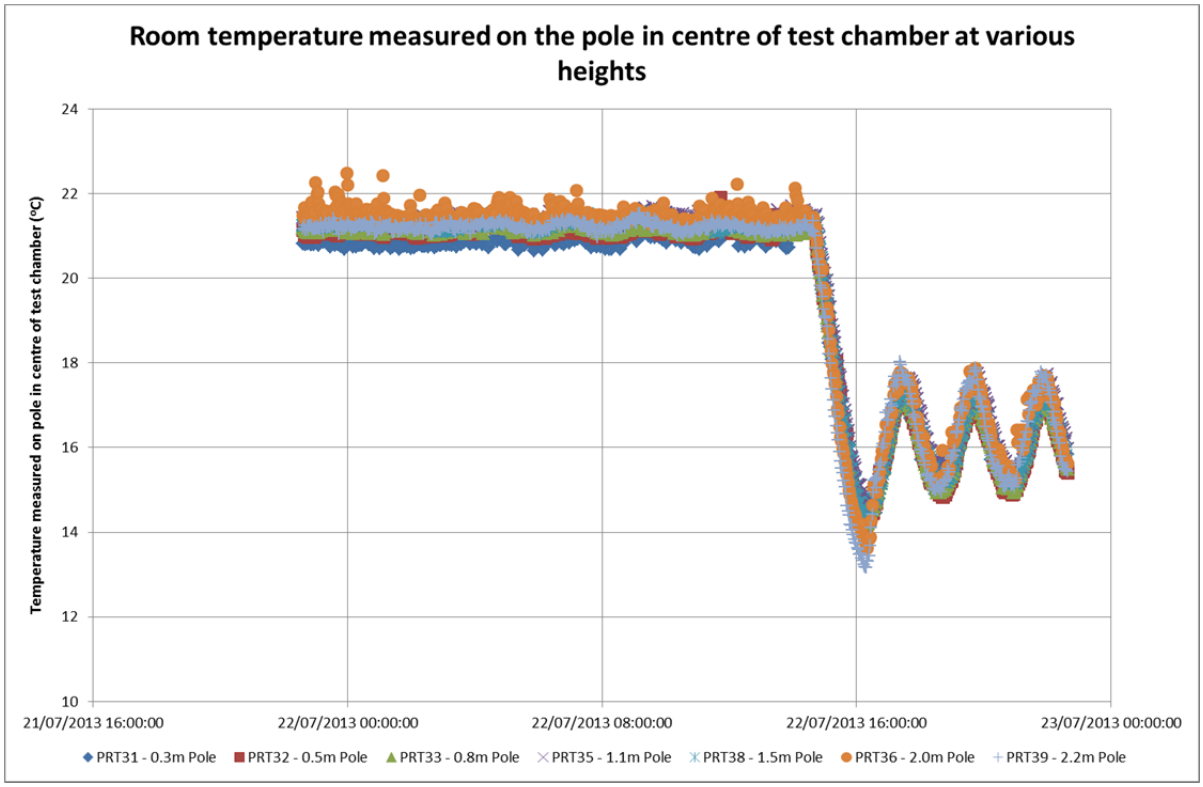
Table 4 16°C set-point test data – Steady state – 3 Hours

16 degrees set on radiator control - Steady state				
	Units	Measured	Maximum	Minimum
Length of test	Hours	3.07	-	-
Globe temperature 1.5m	°C	15.83	17.05	14.85
Pole Temperature - 0.3m	°C	16.10	17.35	14.96
Pole Temperature - 0.5m	°C	15.93	17.27	14.88
Pole Temperature - 0.8m	°C	16.00	17.29	14.94
Pole Temperature - 1.1m	°C	16.37	17.74	15.35
Pole Temperature - 1.5m	°C	16.11	17.28	15.16
Pole Temperature - 2.0m	°C	16.51	17.88	15.23
Pole Temperature - 2.2m	°C	16.35	17.87	15.06
Power consumption of radiator	W	1305	2433	0
Voltage supply to radiator when working	V	234	238	232
Total power input to radiator	Wh	4003	-	-
Water cooling	W	1367	-	-

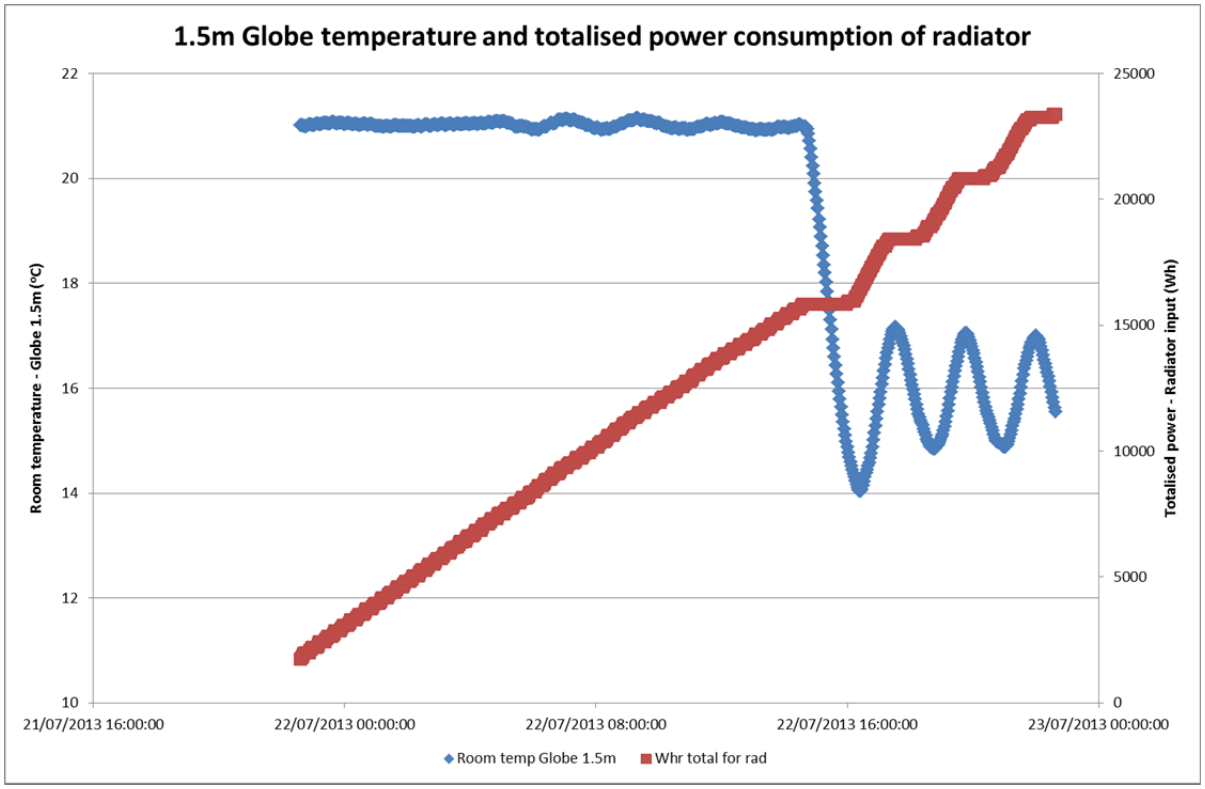
The thermal balance between applied cooling load and radiator output at steady sate conditions was within 5.5%.

6 GRAPHS

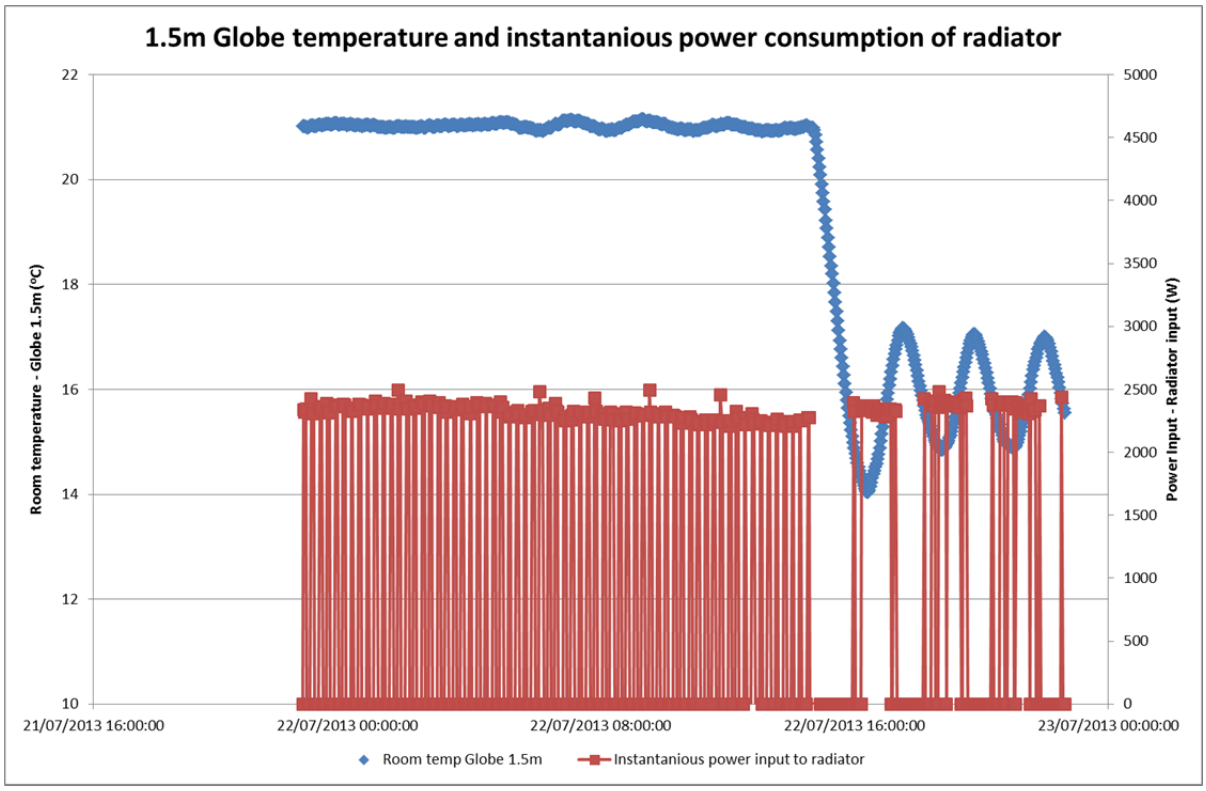
Graph showing temperature against time for various temperature probes in centre of test chamber



Graph showing the globe temperature and totalised power against time throughout the test



Graph showing the globe temperature and instantaneous power against time throughout the test



7 CONCLUSIONS

The Fischer Storage Heater held the chamber temperature, under the conditions tested, within a control band of +0.13°C and -0.10°C when set at 21°C on the thermostat and the average globe temperature was 21.02°C. These values are taken from the steady state period with the thermostat control temperature set to 21°C with a with simulated outside temperature of 10°C.

The Fischer Storage Heater held the chamber temperature, under the conditions tested, within a control band of +1.22°C and -0.97°C when set at 16°C on the thermostat and the average globe temperature was 15.83°C. These values are taken from the steady state period after the thermostat control temperature was set to 16°C with a simulated outside air temperature of -1°C.

The total power input to the Fischer Storage Heater during the 16 hour test period was 14.05kWh

The total power input to the Fischer Storage Heater during the full 24 hour test period was 21.59kWh.