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Test Report

Date: 31st March 2005

TR/05/101

Project No. 2/33254

Aquademic Limited
PO Box 7226
Loughborough
LEICESTERSHIRE
LE11 3XB

Samples received	26/11/04
Evaluation commenced	19/12/04
Evaluation completed	31/03/05

Appliance Type

A gas fired instantaneous water heater
An electric water heater

Model Reference(s)

Chaffoteaux Brittany II T HP gas fired water heater
Triton Handwash T30i

Conclusion

Samples of the above products have been tested at the request of Aquademic Ltd to determine the effects of de-scaling the water circuit of these products with respect to improving their operational life and efficient operation.

Examining Engineer
(David Hartlebury)

Date:

Clearance by Authorising Officer:
(GD McKay)

Date:

Test Sample Designation

Sample No.	Description of Sample (Including Serial Number)
3284	Chaffoteaux Brittany II T HP: Serial number 795191813.03
3398	Triton Handwash T30i: Serial No. 00107760

Classification of Product(s) Evaluated – Chaffoteaux Brittany II T HP only

3.7.2.1 Gas Category:

Category	Destination Countries	Supply Pressure (mbar)
I_{2H}	GB	20

3.7.2.2 Type of flue system:

Flue Type	Maximum Length (mm)	Maximum Number of Bends
C_{11}	600	N/A

Test Sample Rating:

Chaffoteaux Brittany II T HP

Reference Gas	G20
Maximum **GROSS** heat Input (kW)	28.0
Maximum heat Output (kW)	21.0
Maximum setting pressure (mbar)	14.8
Injector size (mm)	1.08
Maximum water supply pressure (bar)	10
Minimum water supply pressure (bar)	1.0

Triton Handwash T30i

Reference data	
Maximum Electrical heat Input (kW)	3.0
Maximum water supply pressure (bar)	10
Minimum water supply pressure (bar)	1.0

Description of Test Sample

Figure 1: Triton Hand wash T30i

This is a standard electric sink water heater. The main problem with this heater is that inadequate water flow passes through it after a few months of operation. The spout outlet and the heater are scaled up such that the water flow sensor and the overheat temperature sensor stop the unit from operating.

Figure 2; Chaffateaux Brittany II T HP

This appliance will operate but the summer/winter water flow adjustment has seized up. Even with a high water supply pressure to the appliance only a small amount of water will pass through the unit. However the water flow is enough to cause the unit to operate at near full rate.

Test Programme

These appliances have been removed from the field after complaints by the end user. At the request of Aquademic Ltd., a scale and corrosion consultancy firm, some means of determining the amount of the restriction in the operation of these appliances both functionally and efficiency due to scaling of these appliances has been proposed. Once initial tests have been carried out on these units the samples were taken away and de-scaled using the appropriate chemical solutions. Once this de-scaling process has been carried out the appliances were re-tested to determine the improvement in efficiency and operation of the appliances.

The gas fired water heater was tested as near as possible to as specified in EN 26:1999 for appliance efficiency and time of heat up. These tests were carried out before and after de-scaling of the appliance.

The Triton Handwash T30i unit could not be tested in similar manner, as the scale build-up was impairing the operation of the unit. After initial testing of the electric water heater the second part of this determination programme was rejected and no further testing was carried out on this unit.

Performance test results

Before De-scaling

Chaffoteaux Brittany II T HP

As received: no flue kit & water flow adjuster stuck

CALCULATION OF BOILER THERMAL EFFICIENCY ***USING DRY GAS METER***

Version 1_3 - 08/04/03

TEST NUMBER			1	2	3
Test Gas Used			district	district	district
Gas Consumption	(V)	m^3	0.170	0.170	0.170
Time for Gas Consumption	(T_1)	s	265.27	266.30	265.47
Uncorrected Gas Rate		m^3/h	2.306	2.297	2.304
Meter Correction Factor	(k_2)		1	1	1
Atmospheric Pressure	(Pa)	mbar	1010.8	1010.8	1010.8
Meter Pressure	(Pg)	mbar	20.4	20.4	20.4
Meter Temperature	(tg)	°C	15.9	16.5	16.6
Gas Volume Correction Factor	(k_1)		1.015	1.013	1.012
Corrected Gas Rate		m^3/h	2.339	2.326	2.332
Test Gas NET CV	(H_i)	MJ/m^3	35.60	35.60	35.60
ACTUAL NET HEAT INPUT	(Q_i)	kW	23.2	23.0	23.1
Mass of Water Collected	(m_1)	kg	18.56	18.33	18.46
Mass of water after evaporation	(m_2)	kg	18.53	18.30	18.43
Corrected mass of water	(m)	kg	18.59	18.36	18.49
Time for collection of mass m_1	(T_2)	s	200.00	200.00	200.00
Average rig outlet temperature	(t_3)	°C	69.2	69.9	69.9
Average rig inlet temperature	(t_4)	°C	19.8	20.2	20.4
Average rig temperature rise		K	49.4	49.7	49.5
Rig loss at average water temp	(D_p)	kW	0.0	0.0	0.0
ACTUAL HEAT OUTPUT	(Q_o)	kW	19.2	19.1	19.2
NET FULL LOAD EFFICIENCY		%	83.0	82.9	83.1
Laboratory Ambient Temperature		°C	19.5	20.0	19.5
OVERALL AVERAGE NET EFFICIENCY		**%**	83.0		

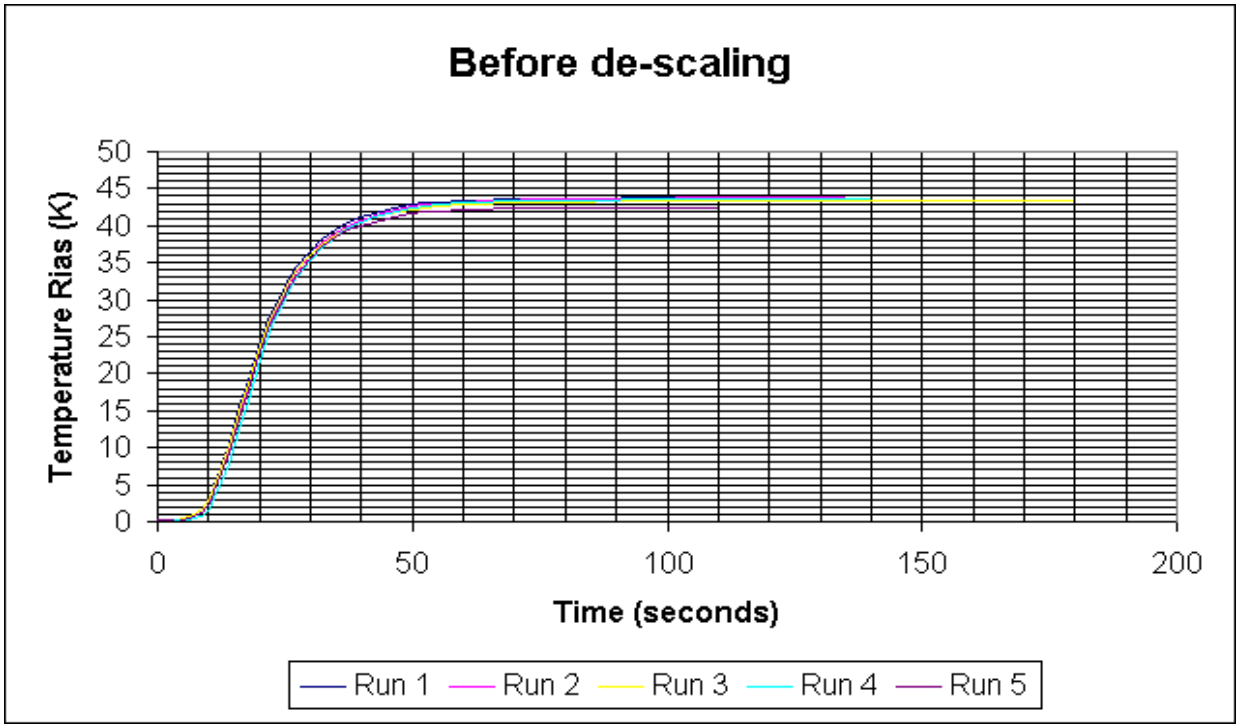
Heat input for heat up time results

As received: no flue kit & water flow adjuster stuck

CALCULATION OF APPLIANCE HEAT INPUT

Version 1_3 - 08/04/03 ***USING DRY GAS METER***

TEST NUMBER			1
Test Gas Used			District
Burner Pressure		mbar	
Boiler Flow Temperature	(t_2)	°C	65.8
Boiler Return Temperature	(t_1)	°C	22.4
Temperature Rise across Boiler		°C	43.4
Average Water Temperature		°C	44.1
Gas Consumption	(V)	m^3	0.100
Time for Gas Consumption	(T_1)	s	152.04
Uncorrected Gas Rate		m^3/h	2.368
Meter Correction Factor	(k_2)		0.982
Atmospheric Pressure	(Pa)	mbar	995.0
Meter Pressure	(Pg)	mbar	20.6
Meter Temperature	(tg)	°C	17.5
Saturated Vapour Pressure	(SVP)	mbar	19.9
Gas Volume Correction Factor	(k_1)		0.974
Corrected Gas Rate		m^3/h	2.265
Test Gas NET CV	(H_i)	MJ/m^3	35.84
ACTUAL NET HEAT INPUT	(Q_i)	kW	22.57



Time to heat up – 55 seconds average of five runs

After De-scaling

Chaffoteaux Brittany II T HP

De-scaled : no flue kit & water flow adjuster stuck

CALCULATION OF BOILER THERMAL EFFICIENCY USING WET GAS METER

Version 1_3 - 08/04/03

TEST NUMBER			1	2	3
Test Gas Used			District	District	District
Burner Pressure		mbar			
Gas Consumption	(V)	m^3	0.200	0.200	0.200
Time for Gas Consumption	(T_1)	s	306.31	305.71	305.81
Uncorrected Gas Rate		m^3/h	2.351	2.355	2.354
Meter Correction Factor	(k_2)		0.982	0.982	0.982
Atmospheric Pressure	(Pa)	mbar	1003.5	1003.5	1003.5
Meter Pressure	(Pg)	mbar	20.3	20.3	20.3
Meter Temperature	(tg)	°C	22.0	22.0	22.0
Saturated Vapour Pressure	(SVP)	mbar	26.2	26.2	26.2
Gas Volume Correction Factor	(k_1)		0.961	0.961	0.961
Corrected Gas Rate		m^3/h	2.219	2.223	2.222
Test Gas NET CV	(H_i)	MJ/m^3	35.31	35.31	35.31
ACTUAL NET HEAT INPUT	(Q_i)	kW	21.78	21.82	21.81

Mass of Water Collected	(m_1)	kg	21.80	21.58	21.72
Mass of water after evaporation	(m_2)	kg	21.77	21.51	21.67
Corrected mass of water	(m)	kg	21.83	21.65	21.77
Time for collection of mass m_1	(T_2)	s	200.00	200.00	200.00
Average rig outlet temperature	(t_3)	°C	59.8	59.9	60.0
Average rig inlet temperature	(t_4)	°C	17.4	17.4	17.5
Average rig temperature rise		K	42.4	42.5	42.5
Rig loss at average water temp	(D_p)	kW	0.0	0.0	0.0
ACTUAL HEAT OUTPUT	(Q_o)	kW	19.4	19.3	19.4
NET FULL LOAD EFFICIENCY		%	89.0	88.2	88.7
Laboratory Ambient Temperature		°C	25.1	25.1	25.1

OVERALL AVERAGE EFFICIENCY	**%**	88.6

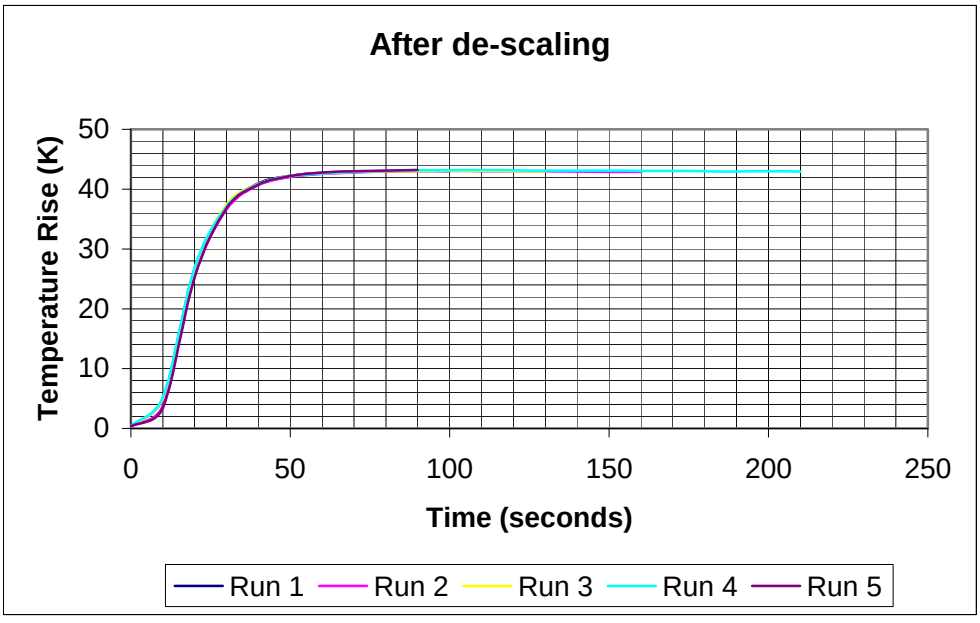
Heat input for heat up time results

De-scaled: no flue kit & water flow adjuster stuck

CALCULATION OF WATER HEATER HEAT INPUT

Version 1_3 - 08/04/03 ***USING WET GAS METER***

TEST NUMBER			1
Test Gas Used			District
Burner Pressure		mbar	
Boiler Flow Temperature	(t_2)	°C	57.2
Boiler Return Temperature	(t_1)	°C	14.3
Temperature Rise across Boiler		°C	42.9
Average Water Temperature		°C	35.8
Gas Consumption	(V)	m^3	0.100
Time for Gas Consumption	(T_1)	s	153.24
Uncorrected Gas Rate		m^3/h	2.349
Meter Correction Factor	(k_2)		0.982
Atmospheric Pressure	(Pa)	mbar	1003.5
Meter Pressure	(Pg)	mbar	20.3
Meter Temperature	(tg)	°C	22.0
Saturated Vapour Pressure	(SVP)	mbar	26.2
Gas Volume Correction Factor	(k_1)		0.961
Corrected Gas Rate		m^3/h	2.217
Test Gas NET CV	(H_i)	MJ/m^3	35.30
ACTUAL NET HEAT INPUT	(Q_i)	kW	21.76



Time to heat up – 47 seconds average of five runs

Triton Handwash T30i electric water heater

Test Method.

The test sample was found to have the spray nozzle totally blocked. For the tests being applied the nozzle was removed. Water flowed continually from the PRD outlet.

This was blanked off to give a maximum flow through the heater.

The water supply was kept at a constant pressure of 1.25 bar. The room ambient temperature was 17.6°C during the test

The applied supply voltage was 240V. This gave an input power of 2.94kW.

First test.

Heater water tap opened to obtained maximum flow.
After 33 seconds the control stat. went open circuit at a temperature of 70°C.

Flow of water to cut off 300 ml.

Second test.

Heater water tap opened to obtained maximum flow.
After 29 seconds the control stat went open circuit at a temperature of 70°C.

Flow of water to cut off 300 ml.

The heater water tap remained open. The control stat. closed after the temperature fell to 28.5°C, which was after 90 seconds from the start of the test.

The control stat. Again went open circuit after 110 seconds from start, at a temperature of 66.4°C.

The water flow for the 110 seconds duration was 900ml.

GENERAL COMMENTS ON TEST PROGRAMME

The two samples were supplied direct from the field. No flue system was supplied with the gas-fired appliance and the electrical sample had its water delivery spout fully blocked by scale.

The gas-fired water heater was tested with it's summer/winter water flow tap seized up and it was not possible to release this tap during any of the testing

The electrical test sample was so badly scaled that even after the water delivery spout was removed, and enough water now flowed through it to operate the water flow switch, the water flow was still too low and caused the overheat thermostat to shut down the appliance. It was decided that no further testing of this electrical appliance would be carried out.

The gas-fired water heater heat exchanger only was de-scaled. Only a small amount of scale was removed and the winter/summer switch was left in a seized up condition.

From the testing carried out on the gas-fired water heater the removal of scale appeared to:

1) Improved the steady state efficiency by around five to six percentage units;
2) Increased the water flow rate through the appliance
3) Reduced the time taken to heat the water from cold.

Instrumentation

Test Performed	Description	Instrument Number	Calibration Due Date
All tests	Druck pressure indicator	252.021	21/07/05
All tests	Stopwatch	9621.151	30.09.05
Efficiency tests	Weighing scales	605.041	07/06/05
Time to heat up tests before and after de-scaling and efficiency after de-scaling	Water inlet PRT	9307.638	06/01/05
Time to heat up tests before and after de-scaling and efficiency after de-scaling	Water outlet PRT	9307.650	06/09/05
Time to heat up tests before and after de-scaling and efficiency after de-scaling	Orion data logger	590.068	22/07/05
Efficiency before de-scaling	Dry gas meter	405.079	20/12/04
Efficiency before de-scaling	Gas temperature PRT	9307.623	06/01/05
Efficiency before de-scaling	Water outlet PRT	9307.624	06/01/05
Efficiency before de-scaling	Water inlet PRT	9307.626	06/01/05
Efficiency before de-scaling	Orion data logger	590.269	16/09/05
Efficiency after de-scaling	Wet gas meter	403.068	02/11/05
Efficiency after de-scaling	Wet gas meter thermometer	9306.056	31/10/05