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1 BRIEF

- 1.1.1 Enertek international Limited (EIL), were contracted to receive, install and commission a production sample, Hiper II on behalf of Intatec limited.
- 1.1.2 To carry out the work involved to evaluate the performance of Domestic Hot Water (DHW) and Space Heating (SH) in accordance with the BESA UK HIU Test regime Technical Specification, Rev-009 requirements, a publicly available online test regime. This is here-on referred to as the Test Regime throughout this document.
- 1.1.3 To provide a report detailing the tests carried out and generated results in accordance with the Test Regime criteria, including calculations for Volume Weighted Average Return Temperatures (VWART).

2 DEFINITIONS

2.1.1 The following definitions and abbreviations have been used within this report:

Symbol	Description	Unit
P_1	Power, Primary side	kW
P_2	Power, Space Heating side	kW
P_3	Power, Domestic Hot Water	kW
t_{11}	Temperature, Primary Side Supply Connection	°C
t_{12}	Temperature, Primary Side Return connection	°C
t_{21}	Temperature, Space Heating Side Return Connection	°C
t_{22}	Temperature, Space Heating System Supply Connection	°C
t_{31}	Temperature, Cold Water Supply	°C
t_{32}	Temperature, Domestic hot Water Output from HIU	°C
q_1	Volume Flow, Primary side	L/s
q_2	Volume Flow, Space heating side	L/s
q_3	Volume flow, Domestic hot water	L/s
Δp_1	Primary Pressure drop across entire HIU unit	kPa
Δp_2	Pressure Drop, Space heating system across HIU	kPa
Δp_3	Pressure Drop, Domestic Hot Water across HIU	kPa
$VWART_{DHW}$	DHW Volume Weighted Return Temperature	°C
$VWART_{SH}$	Space Heating Volume Weighted Return Temperature	°C
$VWART_{KWH}$	Keep Warm Volume Weighted Return Temperature	°C
$VWART_{HEAT}$	Annual Volume Weighted Return Temperature for Heating Period	°C
$VWART_{NONHEAT}$	Annual Volume Weighed Return Temperature for Non-Heating	°C
$VWART_{HIU}$	Total Annual Volume Weighted Return Temperature	°C
DHW	Domestic Hot Water	—
HIU	Heat Interface Unit	—
SH	Space Heating	—
TMV	Thermostatic mixing Valve	—

3 TEST OBJECT

3.1 Appliance Details

3.1.1 Details of the HIU Hiper II appliance are given in Table 3.1. Photograph of the installed appliance is given in Figure 8.2.

Table 3.1 – Appliance Details

Item	Description
Manufacturer	Intatec limited
Model	Hiper II
Serial number	300001
Year of manufacture	2019
DHW priority	Yes

3.2 Appliance Design Pressures

3.2.1 The maximum design pressures of the Hiper II appliance are given for the primary side and the secondary side for both Space Heating and DHW in Table 3.2.

Table 3.2 – Appliance Design Pressures

Item	Value	Unit
Primary Side	16	Bar
Secondary Side space Heating	3	Bar
Secondary Side DHW	10	Bar

3.3 Appliance Design Temperatures

3.3.1 The maximum design temperatures of the Hiper II appliance are given for the primary side and the secondary side for both Space Heating and DHW in Table 3.3

Table 3.3 – Appliance Design Temperatures

Item	Value	Unit
Primary Side	90	°C
Secondary Side space Heating	85	°C
Secondary Side DHW	65	°C

4 TEST METHOD

4.1 Installation of Appliance

4.1.1 The appliance was installed and commissioned (as received) and as defined in the product literature provided. Testing was carried out without further adjustment other than disabling the internal space heating pump and adjusting the setting of the SH and DHW set points through the user interface on the HIU controller to suit the conditions of the HIU test rig. The HIU rig schematic is given in Figure 4.1.

4.2 Test Regime

4.2.1 The testing described in this report was carried out in accordance with the BESA test regime¹. The Test Regime outlines a series of static and dynamic tests to determine the performance of a HIU's DHW and SH functions. The Regime outlines the test method including the reporting of the results, the performance requirements and the VWART calculations.

4.2.2 The setup of the BESA tests is reproduced in Table 4.1. The basis of reporting the performance of the HIU from the BESA Test Regime is reproduced in Table 4.2.

4.2.3 The Test Regime specifies the testing of two different test temperature packages. The first is the high temperature package, with a district primary supply of 70 °C and the second is the 'low temperature' package, with a district primary supply temperature of 60 °C.

4.2.4 As the Intatec limited, Hiper II is suitable for both high and low temperature operation, both test packages were carried out and results recorded within this report.

4.3 Measurement & Uncertainties

4.3.1 All measurements and uncertainties adhere to the requirements stipulated in the BESA Test Regime. All measurements were sampled at a rate of 1 Hz for all tests.

4.3.2 The BESA uncertainties of measurement requirements are as follows: Differential Pressure, ± 1 kPa; Temperature, ± 0.1 °C; Volume Flow, ± 1.5 %. Note: the time constant for the temperature sensors is less than 1.5 s.

4.3.3 EIL's reported uncertainty is based on a standard uncertainty by a coverage factor $K=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. The EIL equipment list and uncertainties are given in Table 8.3, Appendix B.

¹ UK HIU Test Regime Technical Specification, Rev-009 requirements, issued by the Building Engineering Services Association (BESA)

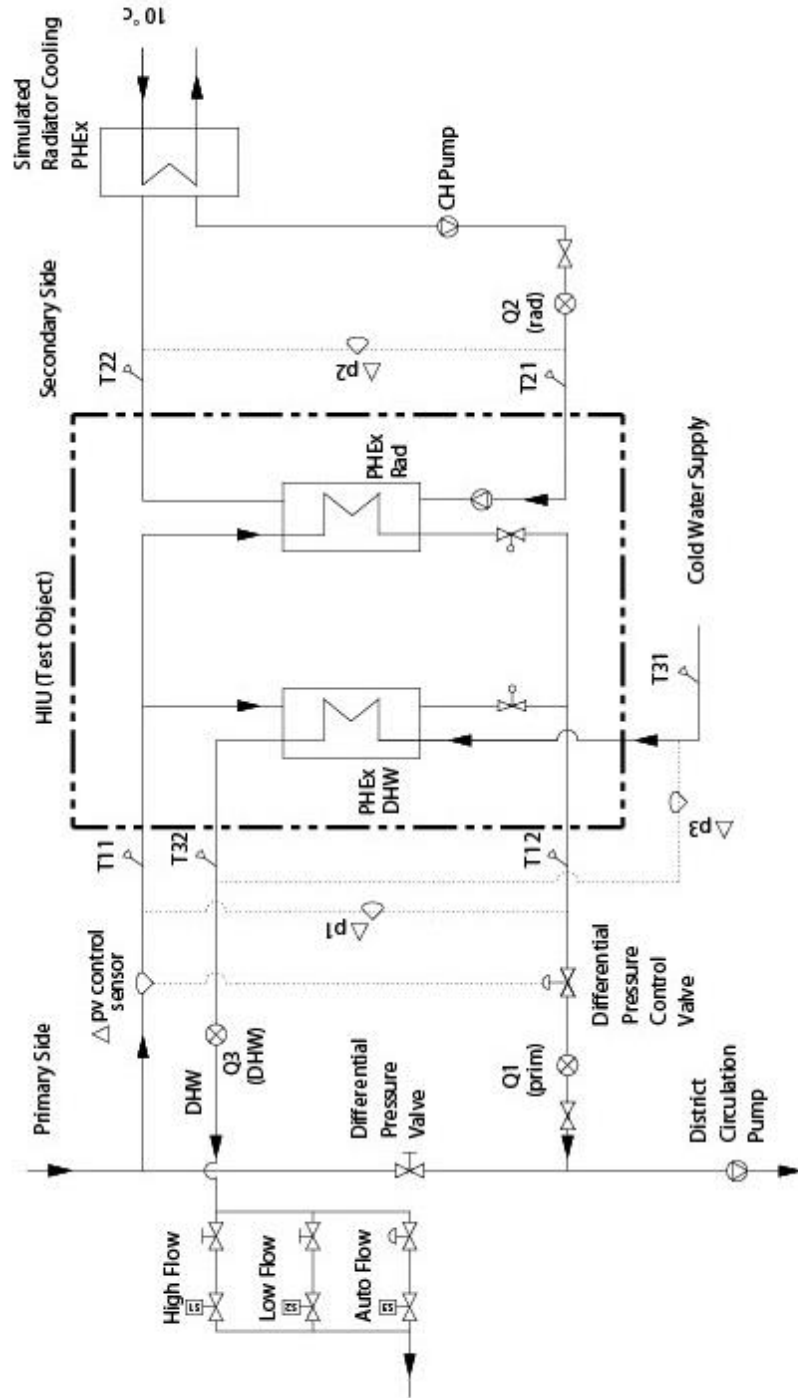


Figure 4.1 – EIL’s HIU Test Rig schematic

Table 4.1 – Setup of tests (Based on BESA Test Regime, Table 1: Test Schedule)

		<i>District Circuit</i>			<i>Domestic Hot Water</i>			<i>Space Heating</i>		
		Static Pressure	Differential Pressure	Flow Temperature	Temperature Set Point	Flow Rate	Heat Load	Flow Temperature	Return Temperature	Heat Load
<i>Symbol</i>		$[p_1]$	$[\Delta p_1]$	$[t_{11}]$	$[t_{32}]$	$[q_3]$	$[P_3]$	$[t_{22}]$	$[t_{21}]$	$[P_2]$
<i>Units</i>		$[kPa]$	$[kPa]$	$[^{\circ}C]$	$[^{\circ}C]$	$[Ls^{-1}]$	$[kW]$	$[^{\circ}C]$	$[^{\circ}C]$	$[kW]$
Static Tests										
0a	District Pressure Test	1.43 X Claimed Value	-	-	-	-	-	-	-	-
1a	1kW Space Heating	3.0	0.5	70	-	-	-	60	40	1
1b	2kW Space Heating	3.0	0.5	70	-	-	-	60	40	2
1c	4kW Space Heating	3.0	0.5	70	-	-	-	60	40	4
1d	1kW Space Heating	3.0	0.5	60	-	-	-	45	35	1
1e	2kW Space Heating	3.0	0.5	60	-	-	-	45	35	2
1f	4kW Space Heating	3.0	0.5	60	-	-	-	45	35	4
Dynamic Tests										
2a	Dynamic Tapping	3.0	0.5	70	55	See Test Profile	See Test Profile	-	-	-
2b	Dynamic Tapping	3.0	0.5	60	50			-	-	-
3a	Low Flow	3.0	0.5	70	55	0.02	Record Value.	-	-	-
3b	Low Flow	3.0	0.5	60	50	0.02	Record Value.	-	-	-
4a	Keep-warm	3.0	0.5	70	55	0.00	0	-	-	-
4b	Keep-warm	3.0	0.5	60	50	0.00	0	-	-	-
5a	DHW Response	3.0	0.5	70	55	0.13	Record Value.	-	-	-
5b	DHW Response	3.0	0.5	60	50	0.13	Record Value.	-	-	-

Table 4.2 – Test Reporting, [Adapted From BESA Test Regime, Table 5]

Test Designation		Reporting
0	District Pressure Test.	Pass/Fail as to whether HIU manages pressure test without leaks or damage.
1a	Space heating 1 kW, 60/40 °C secondary.	t_{11} – Primary flow temperature. t_{12} – Primary return temperature.
1b	Space heating 2 kW, 60/40 °C secondary.	Plot of key metrics over duration of test.
1c	Space heating 4 kW, 60/40 °C secondary.	Note: Outputs used as input data to ‘High Temperature’ Space Heating Volume Weighted Average Return Temperature calculation.
1d	Space heating 1 kW, 45/35 °C secondary.	t_{11} – Primary flow temperature. t_{12} – Primary return temperature.
1e	Space heating 2 kW, 45/35 °C secondary.	Plot of key metrics over duration of test.
1f	Space heating 4 kW, 45/35 °C secondary.	Note: Outputs used as input data to ‘Low Temperature’ Space Heating Volume Weighted Average Return Temperature calculation.
2a	DHW only, DH 70 °C flow; 55 °C DHW.	Pass/Fail on DHW (at t_{32}) exceeding 65.0 °C (to 1 decimal point) for more than 10 consecutive seconds. State the maximum and minimum DHW temperatures over the period of the test when there is a DHW flow. Assessment of scaling risk as per the criteria detailed in 2.26. Note: Outputs used as input data to ‘High Temperature’ Space Heating Volume Weighted Average Return Temperature calculation. Plot $t_{32}, t_{31}, q_3, t_{12}, q_1$
2b	DHW only, DH 60 °C flow; 50 °C DHW.	State the maximum and minimum DHW temperatures over the period of the test when there is a DHW flow. Note: Outputs used as input data to ‘Low Temperature’ Domestic Hot Water Volume Weighted Average Return Temperature calculation. Plot q_1, q_3, dp_1, dp_3
3a	Low flow DHW, DH 70 °C flow; 55 °C DHW.	Pass/Fail on DHW (at t_{32}) exceeding 65.0 °C (1 decimal place) for more than 10 consecutive seconds. Comment on ability to deliver DHW at low flow based on DHW temperature reaching at least 45.0 °C (1 decimal place) at the end of the 180 second period of low flow DHW. Comment on the ability to deliver stable DHW flow temperature (at t_{32}), defined as ability to maintain 55.0 +/- 3.0 °C (1 decimal place) during the last 60 seconds of the test. Maximum temperature achieved and +/-°C variance around 55.0 °C (1 decimal place) to be stated. Plot of key metrics for 60 seconds of 0.13 l/s flow and the subsequent 180 seconds of 0.02 l/s DHW flow. Assessment of scaling risk as per criteria detailed in 2.26.
3b	Low flow DHW, DH 60 °C flow; 50 °C DHW.	Comment on the ability to deliver DHW at low flow rate based on DHW temperature reaching at least 45 °C (1 decimal place) at the end of the 180 second period of low flow DHW. Comment on the ability to deliver stable DHW flow temperature (at t_{32}), defined as ability to maintain 50.0 +/-3°C (1 decimal place) to be stated. Maximum temperature achieved and +/-°C variance around 50.0°C (1 decimal place) to be stated. Plot of key metrics for 60 seconds of 0.13 l/s flow and the subsequent 180 seconds of 0.02 l/s DHW flow.

Test Designation		Reporting
4a	Keep-warm, DH 70 °C flow; 55 °C DHW.	<p>Assessment of whether valid keep-warm operation, based on 5a response time criteria: Pass/Fail.</p> <p>Comment on HIU keep-warm controls options.</p> <p>Assessment of scaling risk, based on duration of temperatures in excess of 55.0 °C (1 decimal place).</p> <p>State average heat load for the duration of the test.</p> <p>State the average primary flow rate for the duration of the test.</p> <p>Note: Outputs used as input data to 'High Temperature' Keep-warm Volume Weighted Average Return Temperature calculation.</p> <p>Plot of key metrics over duration of test.</p>
4b	Keep-warm, DH 60 °C flow; 50 °C DHW.	<p>Assessment of whether valid keep-warm operation, based on 5a response time criteria: Pass/Fail.</p> <p>Observation on the operation of the HIU during keep-warm. Comment on HIU keep-warm controls options.</p> <p>Assessment of scaling risk based on extent and duration of temperatures in excess of 55.0 °C (1 decimal place).</p> <p>State average heat load for the duration of the test.</p> <p>State the average primary flowrate for the duration of the test.</p> <p>Note: Outputs used as input data to 'Low Temperature' Keep-warm Volume Weighted Average Return Temperature calculation.</p> <p>Plot of key metrics over duration of test.</p>
5a	DHW response time, DH 70 °C flow; 55 °C DHW.	<p>Pass/Fail on DHW (at t_{32}) exceeding 65.0 °C (1 decimal place) for more than 10 consecutive seconds.</p> <p>State time to achieve 45.0 °C (1 decimal place) and not subsequently drop below 42.0 °C (1 decimal place).</p> <p>Plot t_{32}, t_{31}, t_{12}, q_1 over duration of test.</p>
5b	DHW response time, DH 60 °C flow; 50 °C DHW.	<p>State time to achieve a DHW temperature 45.0 °C (1 decimal place) and not subsequently drop below 42.0 °C (1 decimal place).</p> <p>Comment on stability of DHW temperature.</p> <p>Plot t_{32}, t_{31}, t_{12}, q_1 over duration of test.</p>

5 TEST RESULTS

5.1 Test 0 –Pressure Test

- 5.1.1 The appliance has passed the requirements of the static pressure test, Test 0 of the BESA Test Regime as:
- 5.1.2 There was No damage observed during the static pressure test, with the primary flow pressurised to 22.88 bar (1.43 times the rated value), and;
- 5.1.3 There were No leaks observed during the static pressure test, with the primary flow pressurised to 22.88 bar (1.43 times the rated value).

5.2 Test 1a to 1f – Space Heating 1-4 kW at 70 and 60 °C

- 5.2.1 The plot of the key metrics of Tests 1a-1f for the space heating 1 - 4 kW at both 70 and 60 °C are displayed in Figure 7.1 to Figure 7.6 respectively. See Table 5.1 for summarised test results including the average primary return temperature, t_{12} .

Table 5.1 - Test Results for Space Heating Tests 1a to 1f

Test	Description	Primary					Secondary				
		Flow Temperature [t_{11}] [°C]	Return Temperature [t_{12}] [°C]	Flow Rate [q_1] [Ls^{-1}]	Differential Pressure [Δp_1] [kPa]	Heat Load [P_1] [W]	Return Temperature [t_{21}] [°C]	Flow Temperature [t_{22}] [°C]	Flow Rate [q_2] [Ls^{-1}]	Differential Pressure [Δp_2] [kPa]	Heat Load [P_2] [W]
1a	- 1 kW Space Heating (DH 70 °C flow)	70.2	39.6	0.009	53.9	1178	39.8	60.2	0.012	- 0.8	1041
1b	- 2 kW Space Heating (DH 70 °C flow)	70.0	40.3	0.017	52.5	2134	40.0	60.1	0.024	0.0	2039
1c	- 4 kW Space Heating (DH 70 °C flow)	70.4	41.2	0.033	49.6	3996	40.2	60.1	0.048	2.3	4006
1d	- Space Heating 1 kW (DH 60 °C flow)	60.3	34.7	0.010	54.8	1094	34.9	45.3	0.024	- 0.5	1036
1e	- Space Heating 2 kW (DH 60 °C flow)	59.8	35.0	0.020	54.1	2085	35.0	45.4	0.047	2.0	2079
1f	- Space Heating 4 kW (DH 60 °C flow)	60.0	35.2	0.038	50.0	3971	34.9	45.2	0.095	10.0	4132

5.3 Test 2a – DHW Dynamic Tapping at 70 °C

- 5.3.1 The appliance has passed the requirements of the DHW only at 70 °C, Test 2a of the BESA Test Regime as:
- 5.3.2 The domestic hot water output temperature, t_{32} did not exceed 65 °C for more than 10 seconds.
- 5.3.3 The maximum and minimum temperatures of t_{32} were 63.40°C and 46.90°C respectively.
- 5.3.4 The plot of the key metrics of the duration of Test 2a is displayed in Figure 7.7, Appendix.

5.4 Test 2b – DHW Dynamic Tapping at 60 °C

- 5.4.1 The maximum and minimum temperatures of t_{32} were 54.52°C and 44.01°C respectively.
- 5.4.2 The plot of the key metrics of the duration of Test 2b is displayed in Figure 7.8, Appendix.

5.5 Test 3a – Low Flow DHW at 70 °C

- 5.5.1 The appliance did meet the requirements of the Low Flow test at 70 °C, Test 3a of the BESA Test Regime.
- 5.5.2 The HIU met the requirement of not exceeding 65 °C for more than 10 seconds in accordance with the test method. The HIU did provide stable flow temperatures of 55°C +/- 3°C for >60 seconds under the stated conditions.
- 5.5.3 The maximum and minimum temperatures of t_{32} were 58.14°C and 49.91°C respectively.
- 5.5.4 The plot of the key metrics of the duration of Test 3a is displayed in Figure 7.9, Appendix.

5.6 Test 3b – Low Flow DHW at 60 °C

- 5.6.1 The appliance met the requirements of the Low Flow test at 60 °C, Test 3b of the BESA Test Regime.
- 5.6.2 The HIU provided stable flow temperatures of 50°C +/- 3°C for >60 seconds under the stated conditions during a 1.2l/m DHW flow rate.
- 5.6.3 The appliance did maintain the DHW output temperature, t_{32} at 50 ± 3 °C during the last 60 seconds of the test.
- 5.6.4 The maximum and minimum temperatures of t_{32} were 52.19°C and 46.38°C respectively.
- 5.6.5 The plot of the key metrics of the duration of Test 3b is displayed in Figure 7.10, Appendix.

5.7 Test 4a – Keep-warm at 70 °C

- 5.7.1 The appliance has passed the requirements of the Keep-warm at 70 °C, Test 4a of the BESA Test Regime as:
- 5.7.2 This is a valid keep warm operation based on 5a response time criteria, see 5.9.3.

- 5.7.3 The appliance is not performing keep-warm cycling as the primary flow temperature, t_{11} does not vary by more than ± 3 °C during the final 3 hours of the test.
- 5.7.4 The average heat load on the primary side P_1 is 42 W.
- 5.7.5 The average primary flow q_1 over the 8 hour test was 3.3 l/hr.
- 5.7.6 The Keep-warm control was set to 39°C.
- 5.7.7 The plot of the key metrics of the duration of Test 4a is displayed in Figure 7.11, Appendix.

5.8 Test 4b – Keep-warm at 60 °C

- 5.8.1 The appliance has passed the requirements of the Keep-warm at 60 °C, Test 4b of the BESA Test Regime as:
- 5.8.2 This is a valid keep warm operation based on 5b response time criteria, see 5.10.1.
- 5.8.3 The appliance is not performing keep-warm cycling as the primary flow temperature, t_{11} does not vary by more than ± 3 °C during the final 3 hours of the test.
- 5.8.4 The average heat load on the primary side P_1 is 42 W.
- 5.8.5 The average primary flow q_1 over the 8 hour test was 4.5 l/hr.
- 5.8.6 The Keep-warm control was set to 39°C.
- 5.8.7 The plot of the key metrics of the duration of Test 4b is displayed in Figure 7.12, Appendix.

5.9 Test 5a – DHW Response Time at 70 °C

- 5.9.1 The appliance has passed the requirements of DHW Response Time at 70°C, Test 5a of the BESA Test Regime as:
- 5.9.2 The domestic hot water output temperature, t_{32} did not exceed 65 °C for more than 10 seconds.
- 5.9.3 The DHW response time for t_{32} to reach 45 °C (and not subsequently drop below 42 °C) was 13 seconds; therefore this is a valid keep warm.
- 5.9.4 The plot of the key metrics of the duration of Test 5a is displayed in Figure 7.13, Appendix.

5.10 Test 5b – DHW Response Time at 60 °C

- 5.10.1 The DHW response time for t_{32} to reach 45 °C (and not subsequently drop below 42 °C) was 15 seconds; therefore this is a valid keep warm.
- 5.10.2 The plot of the key metrics of the duration of Test 5b is displayed in Figure 7.14, Appendix.

5.11 Overall Scaling Risk Assessment

5.11.1 If any of the below factors occur then the risk of scaling of the DHW plate in hard water areas increases.

Table 5.2 - Overall Scaling Risk Assessment

<i>HIU has a TMV or TRV on the output of the DHW plate heat exchanger.</i>	No	
Test Designation	2a	3a
<i>t₃₂ above 60°C for more than 5 seconds</i>	No	No
<i>t₁₂ exceeds 55°C at any point of the test</i>	No	No
Test Designation	4a	4b
<i>t₁₂ exceeds 50°C at any time</i>	No	No

5.12 Test Summary

5.12.1 See Appendix for the summary of key metrics of all the tests described in this report.

5.13 VWART Calculations

5.13.1 The Volume Weighted Average Return Temperatures (VWART) have been calculated as stipulated in the BESA UK HIU Test Regime document. The calculated VWART values for both the high temperature and low temperature tests described in this report are given below in Table 5.3 and Table 5.4 respectively.

Table 5.3 – High Temperature VWART Calculations

Description	Symbol	Value	Unit
Annual Heating Period percentage	SH _{PROP}	7.1	%
Annual Non-Heating Period percentage	NSH _{PROP}	92.9	%
Space Heating Volume Weighted Return Temperature	VWART _{SH}	41	°C
DHW Volume Weighted Return Temperature	VWART _{DHW}	15	°C
Keep Warm Volume Weight return Temperature	VWART _{KWM}	38	°C
Annual Volume Weighted Return Temperature For Heating Period	VWART _{HEAT}	40	°C
Annual Volume Weighted Return Temperature For Non Heating	VWART _{NONHEAT}	27	°C
Total Annual Volume Weighted Return Temperature	VWART _{OVERALL}	28	°C

Table 5.4 – Low Temperature VWART Calculations

Description	Symbol	Value	Unit
Annual Heating Period percentage	SH _{PROP}	7.0	%
Annual Non-Heating Period percentage	NSH _{PROP}	93.0	%
Space Heating Volume Weighted Return Temperature	VWART _{SH}	35	°C
DHW Volume Weighted Return Temperature	VWART _{DHW}	16	°C
Keep Warm Volume Weight return Temperature	VWART _{KWM}	38	°C
Annual Volume Weighted Return Temperature For Heating Period	VWART _{HEAT}	35	°C
Annual Volume Weighted Return Temperature For Non Heating	VWART _{NONHEAT}	29	°C
Total Annual Volume Weighted Return Temperature	VWART _{OVERALL}	29	°C

6 CONCLUSIONS

6.1.1 The appliance has passed the performance requirements of the BESA HIU Test Regime.

All conclusions, opinions and interpretations indicated in this report are outside the scope of Enertek's UKAS accreditation.

7 APPENDIX A

7.1 Key Metric Plots

7.1.1 The graphical plots of the key metrics of the tests described in this report are given in this section.

GRAPHICAL PLOTS START ON NEXT PAGE

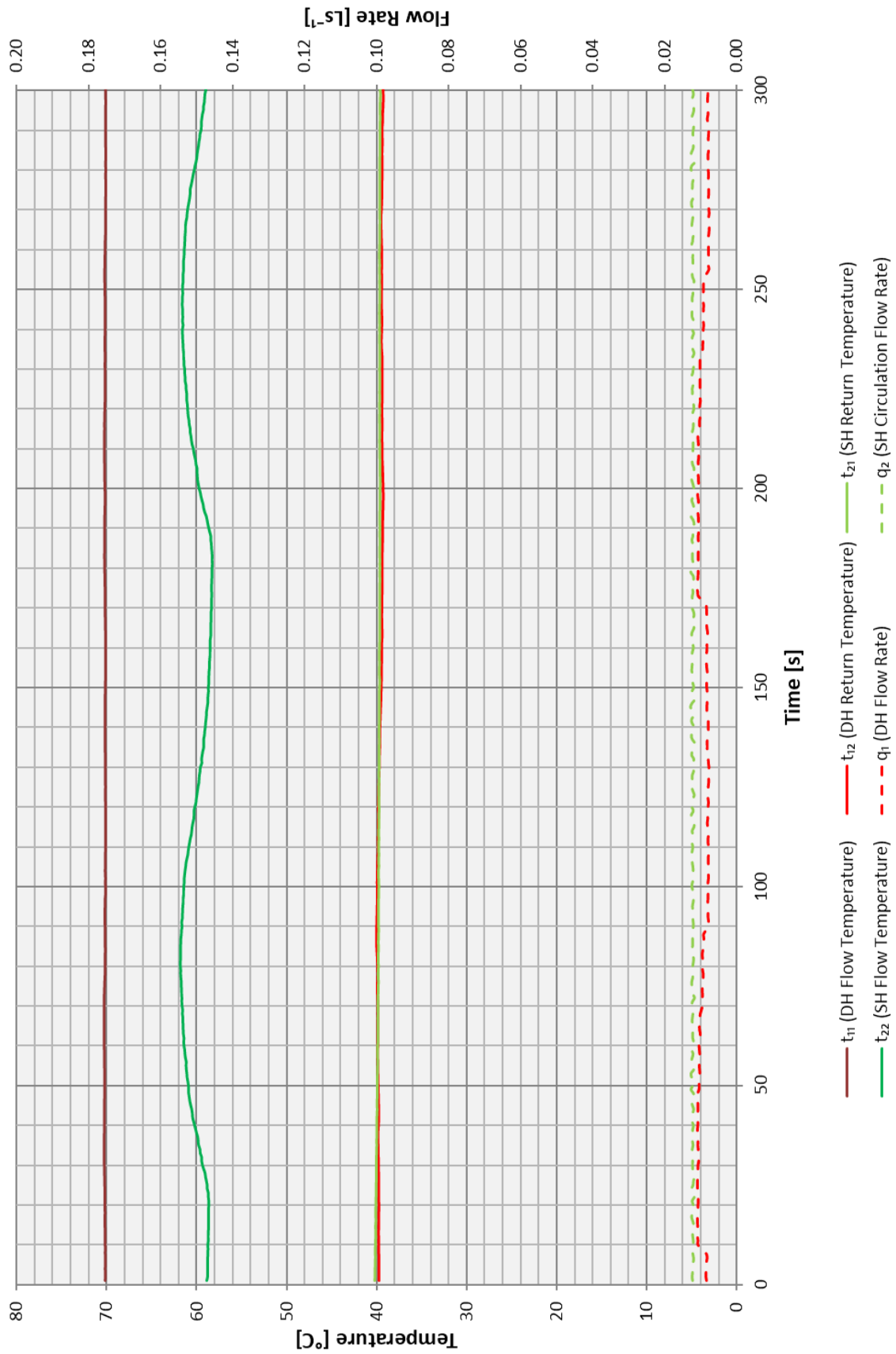


Figure 7.1 - Test 1a – Space Heating 1 kW at 70 °C

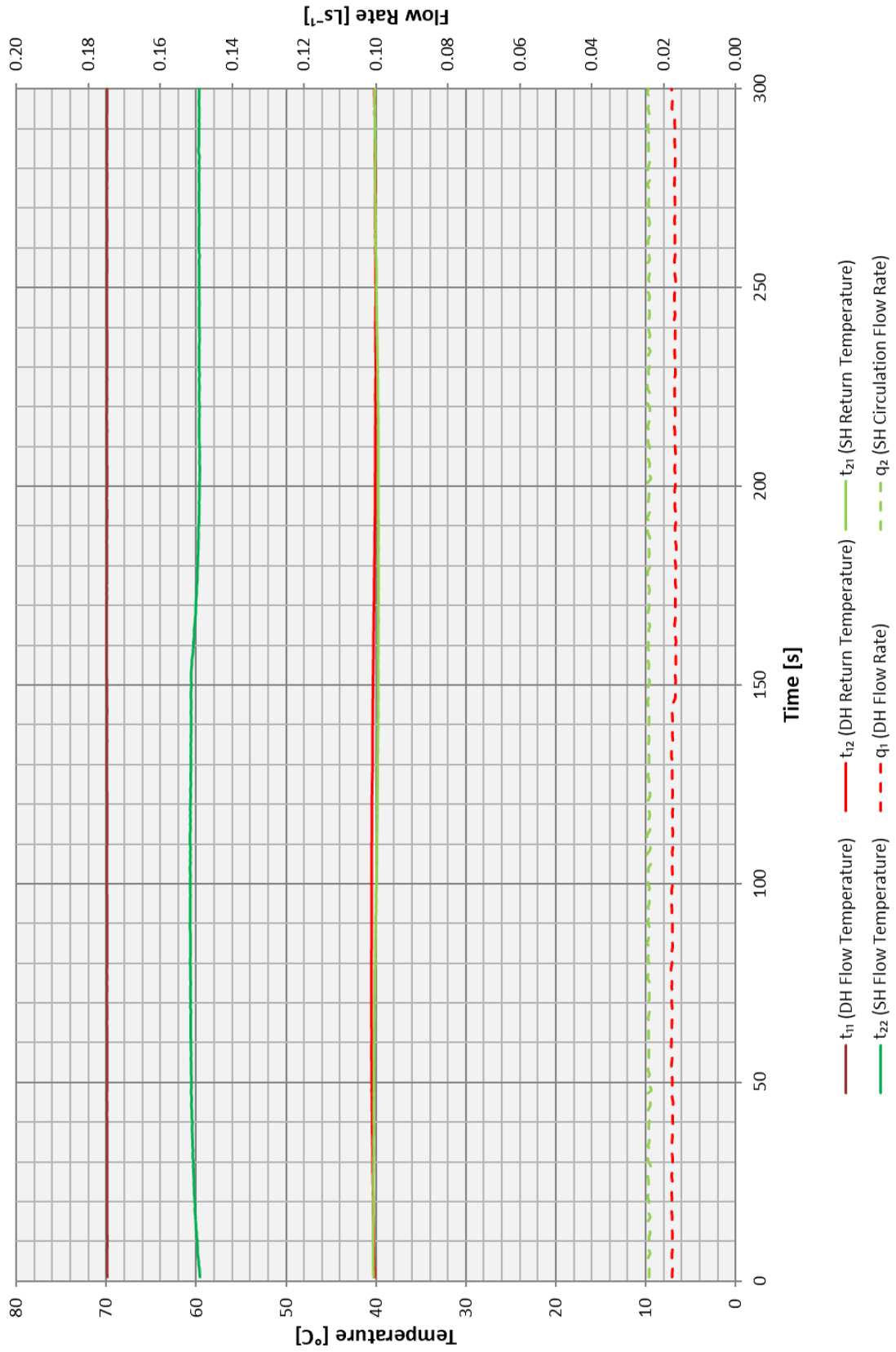


Figure 7.2 - Test 1b – Space Heating 2 kW at 70 °C

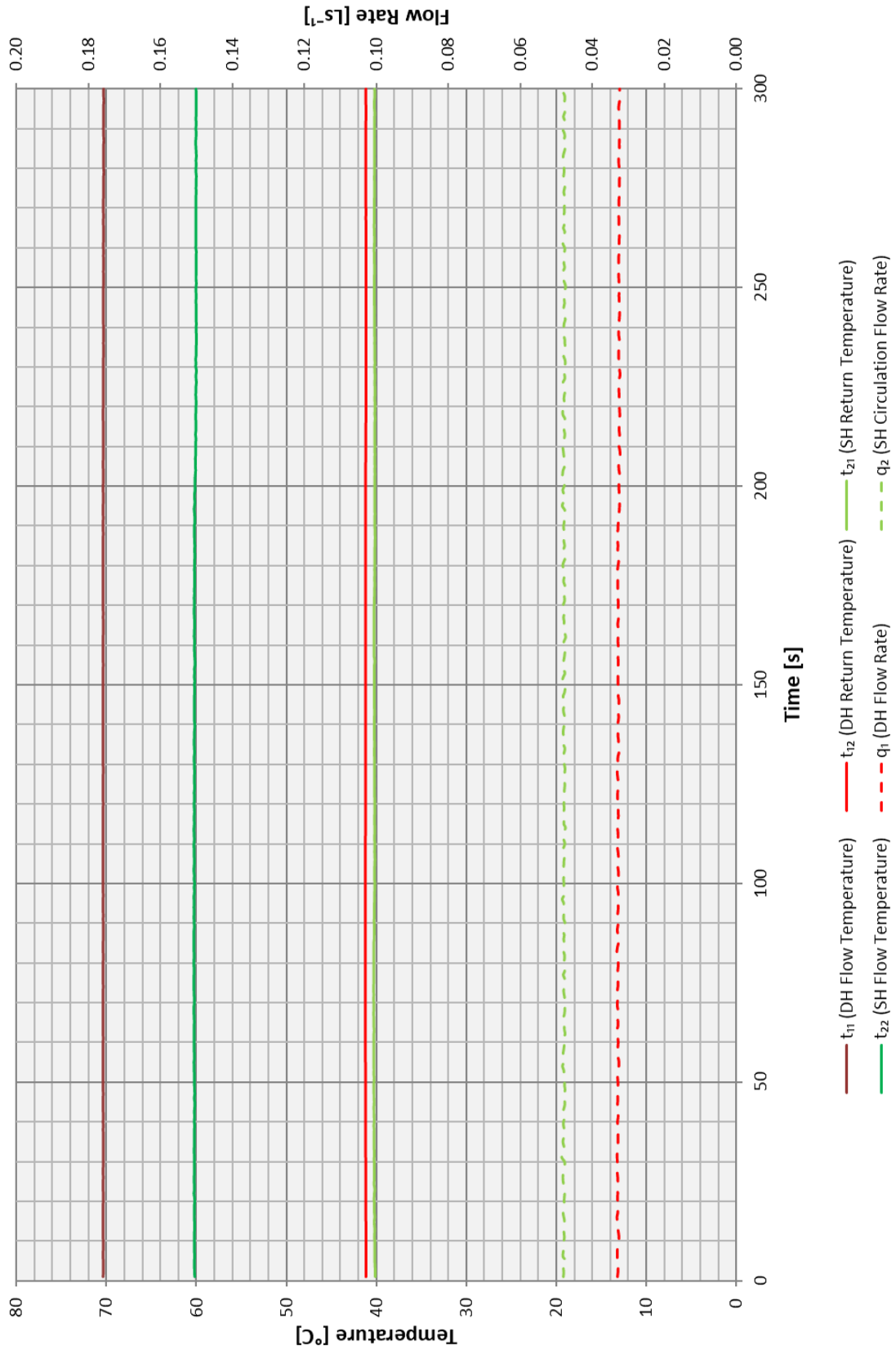


Figure 7.3 - Test 1c – Space Heating 4 kW at 70 °C

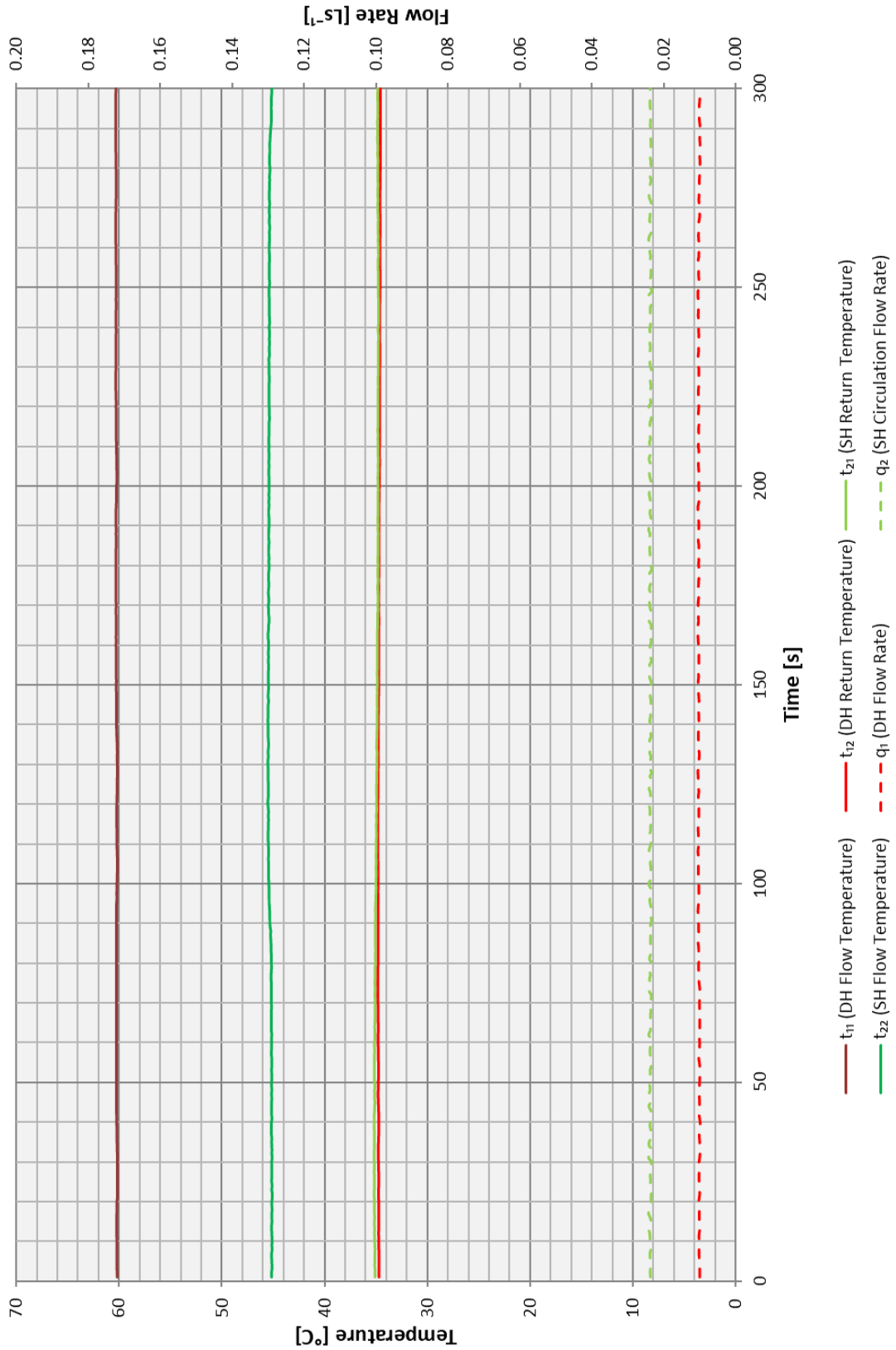


Figure 7.4 - Test 1d – Space Heating 1 kW at 60 °C

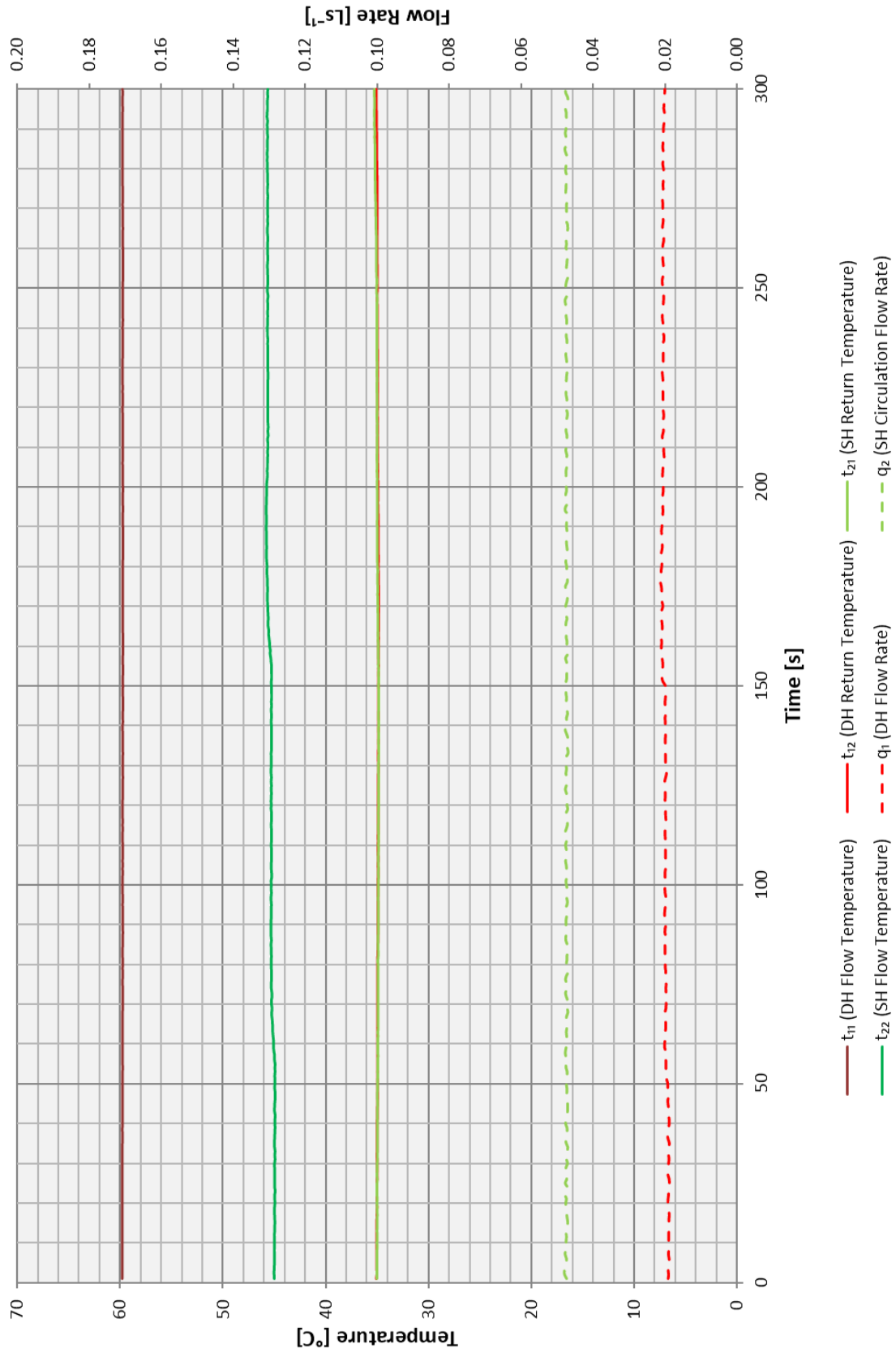


Figure 7.5 - Test 1e – Space Heating 2 kW at 60 °C

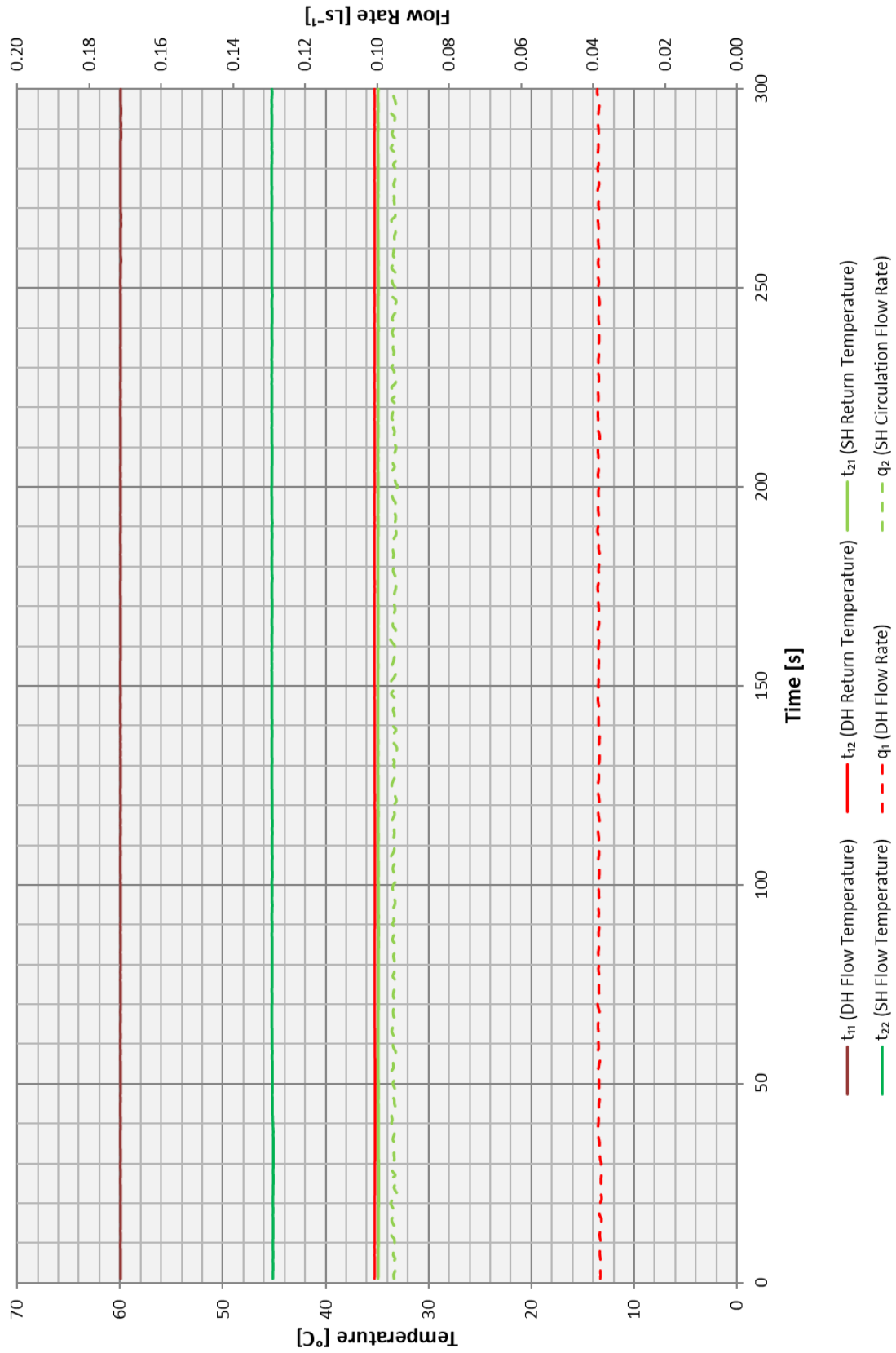


Figure 7.6 - Test 1f – Space Heating 4 kW at 60 °C

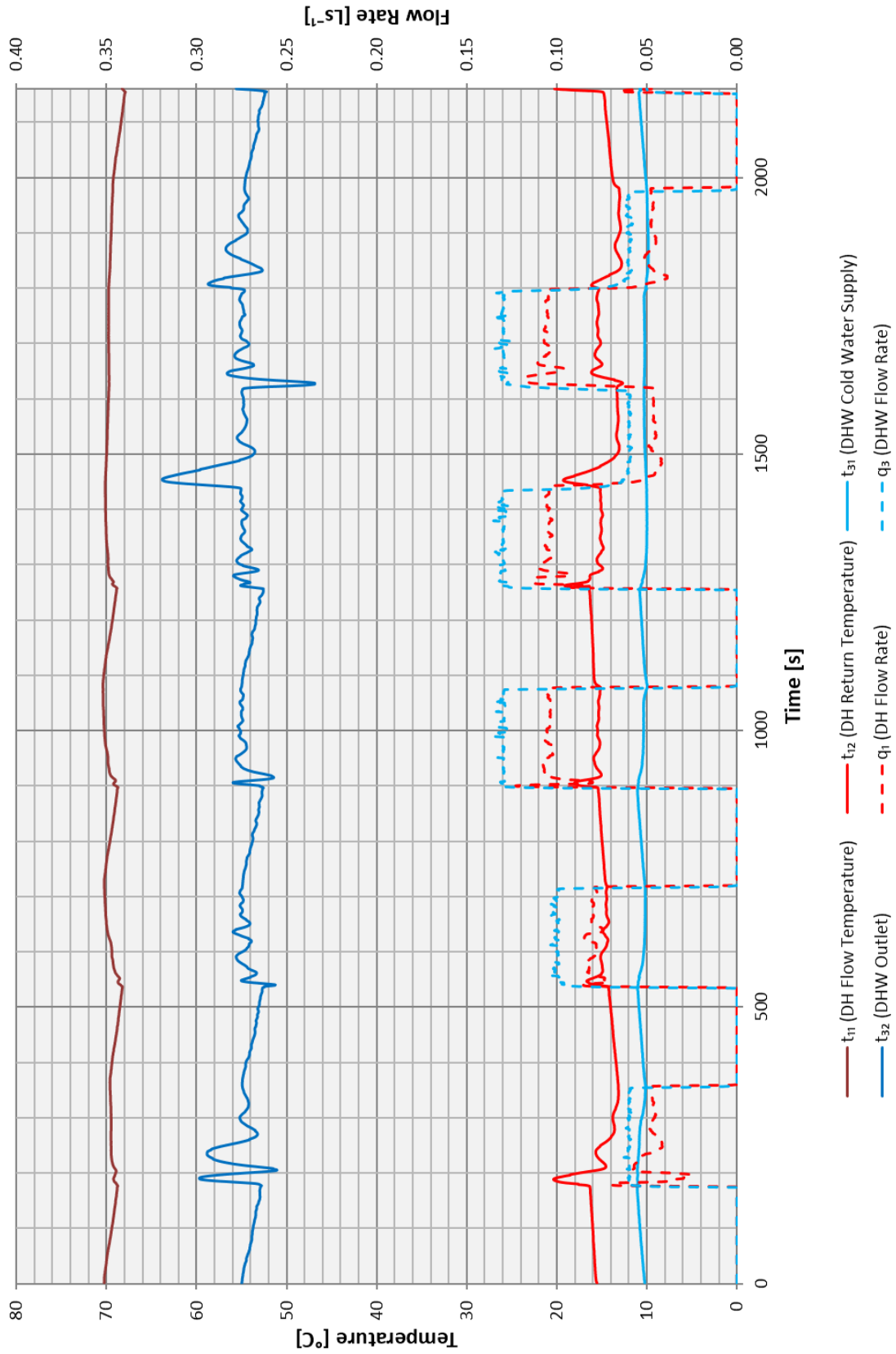


Figure 7.7 - Test 2a – DHW only at 70 °C

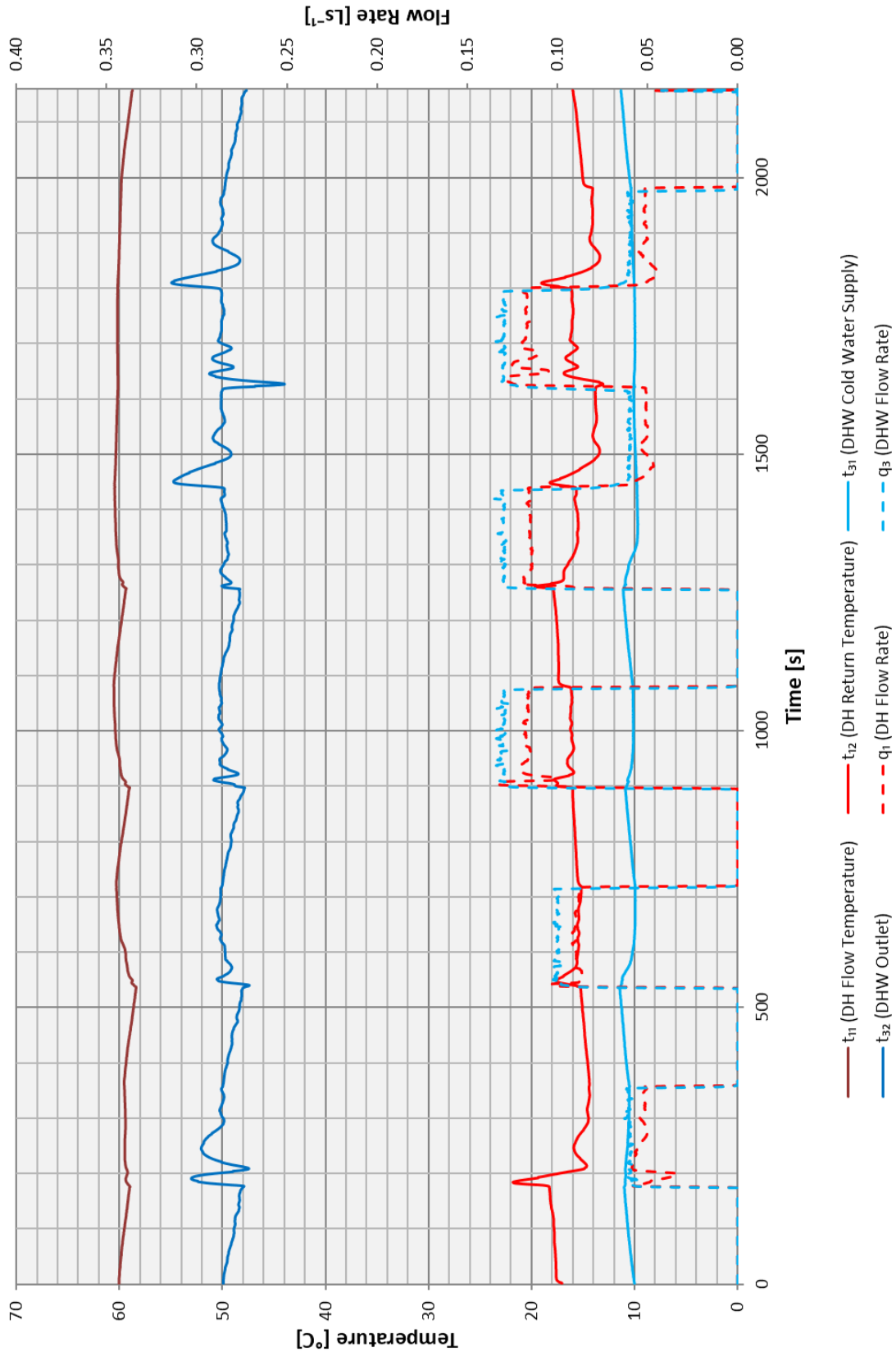


Figure 7.8 - Test 2b – DHW only at 60 °C

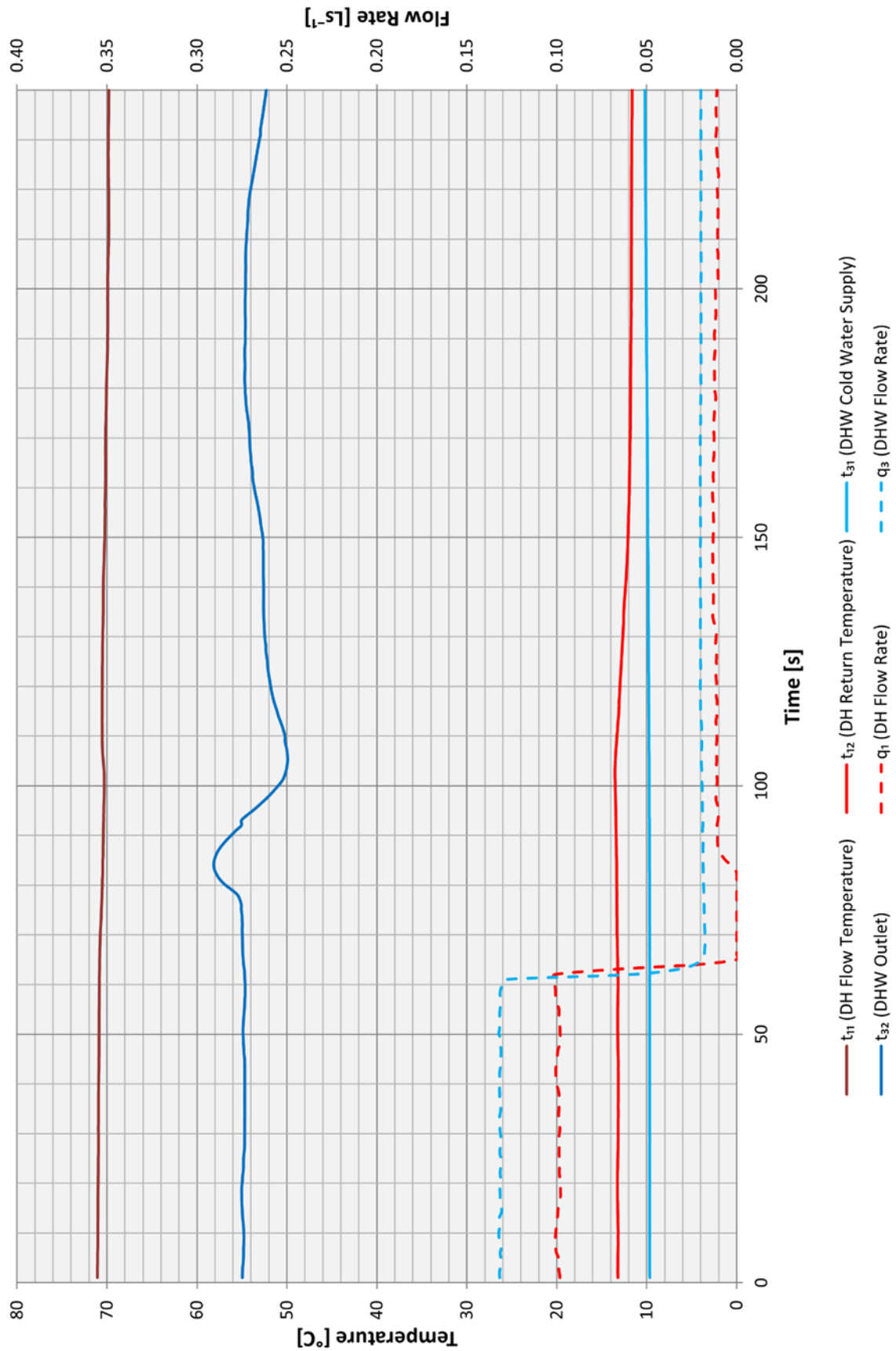


Figure 7.9 - Test 3a – Low Flow DHW at 70 °C

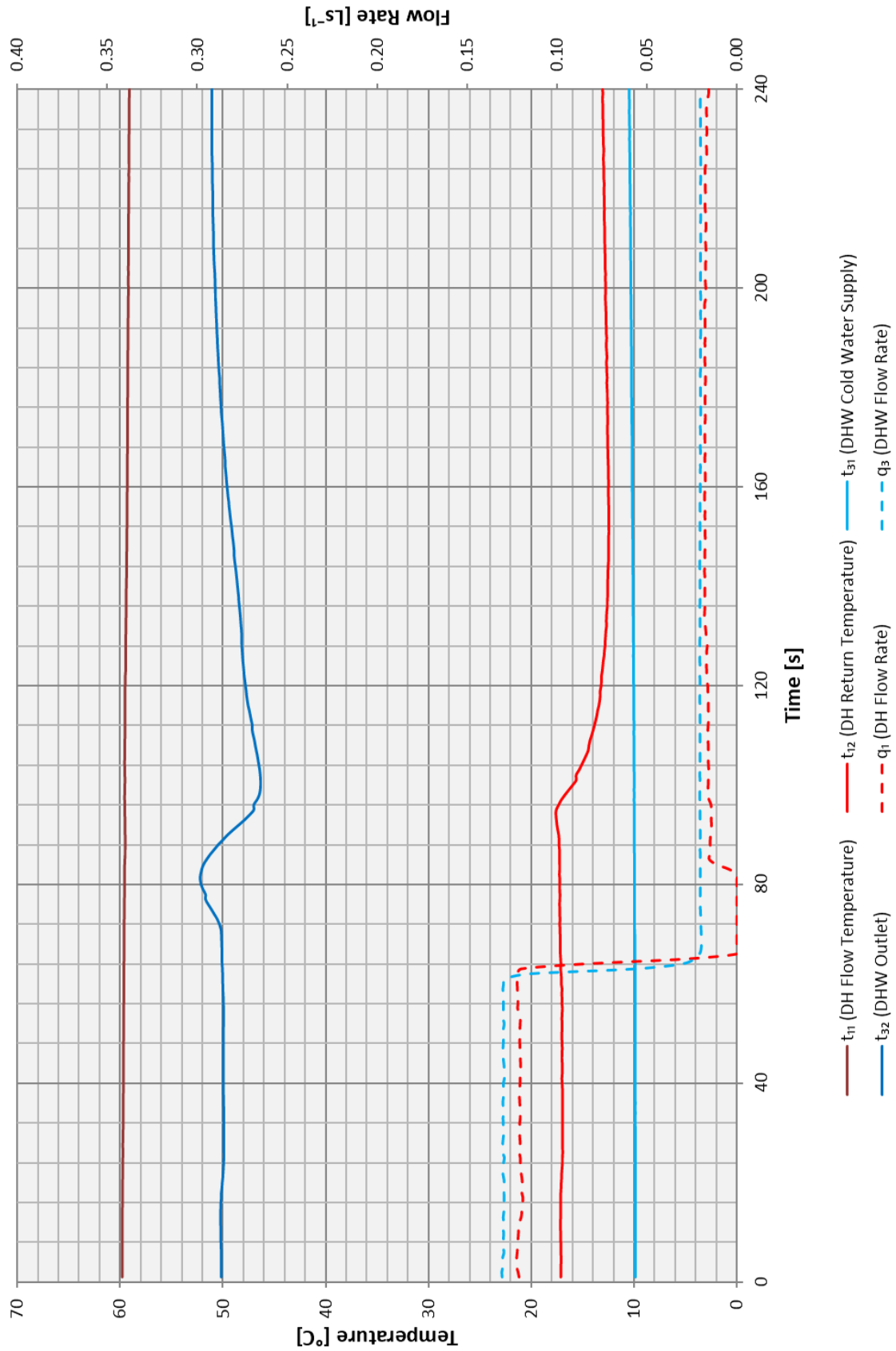


Figure 7.10 - Test 3b – Low Flow DHW at 60 °C

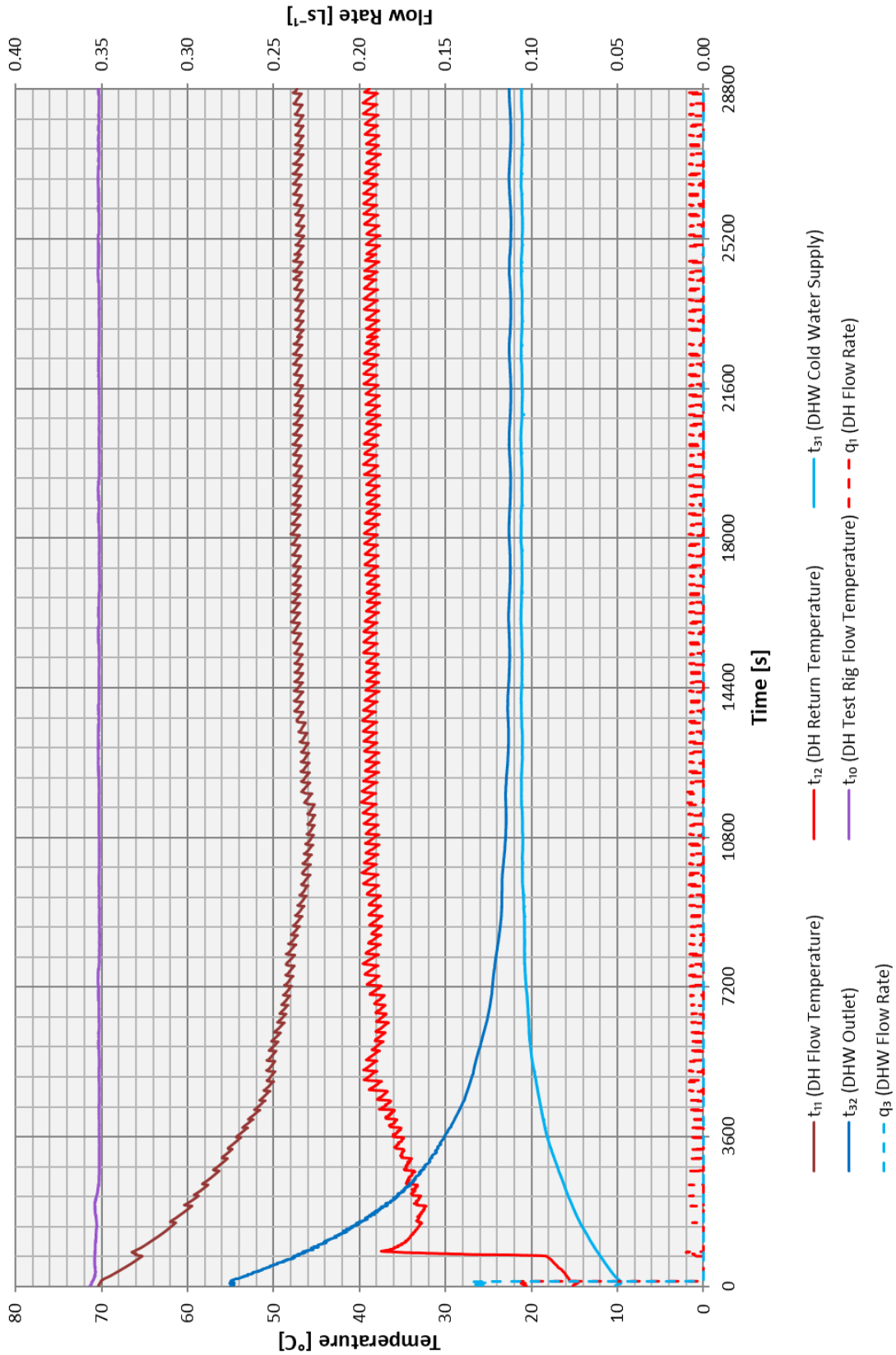


Figure 7.11 - Test 4a – Keep-warm at 70 °C

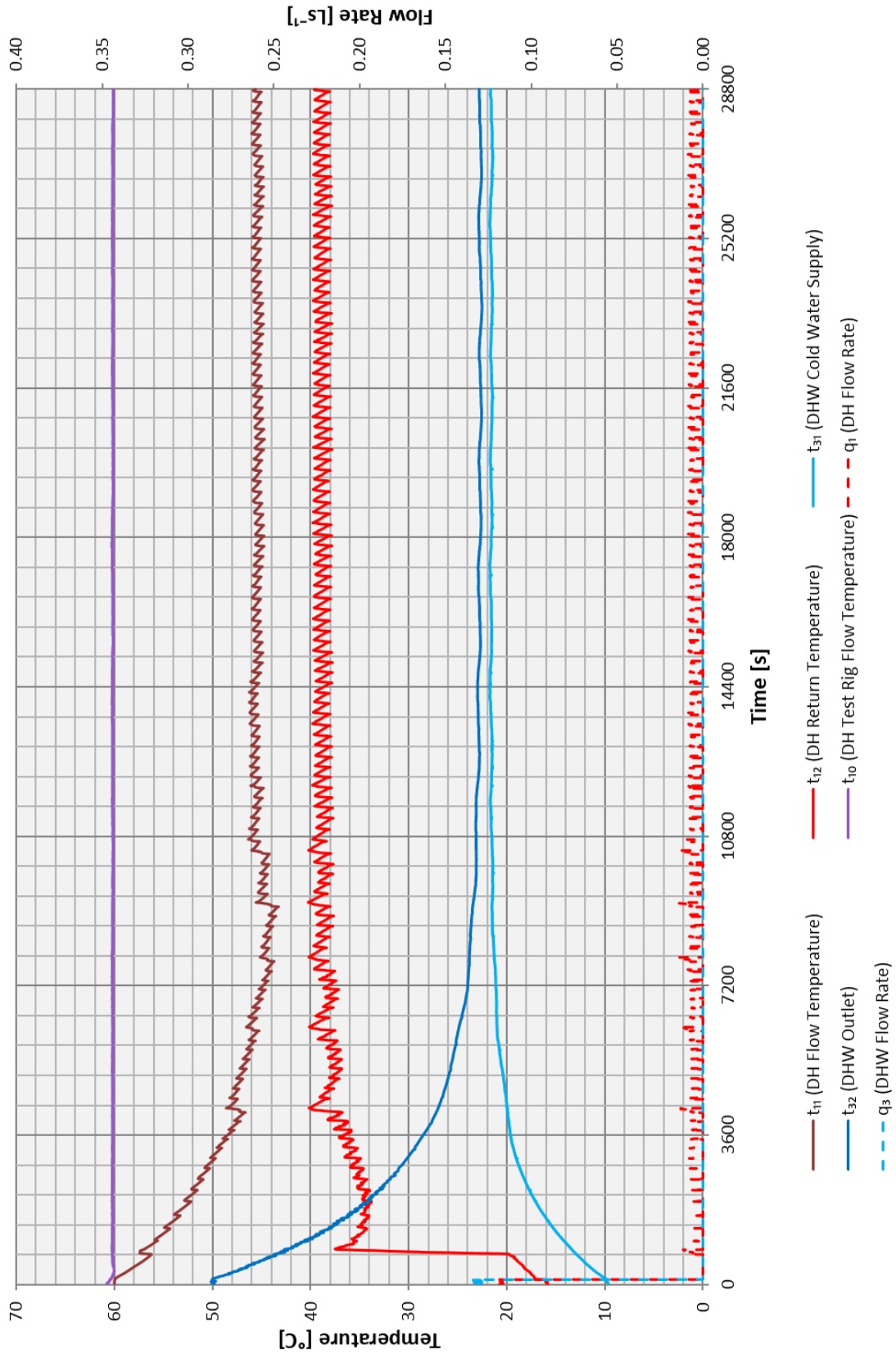


Figure 7.12 - Test 4b – Keep-warm at 60 °C

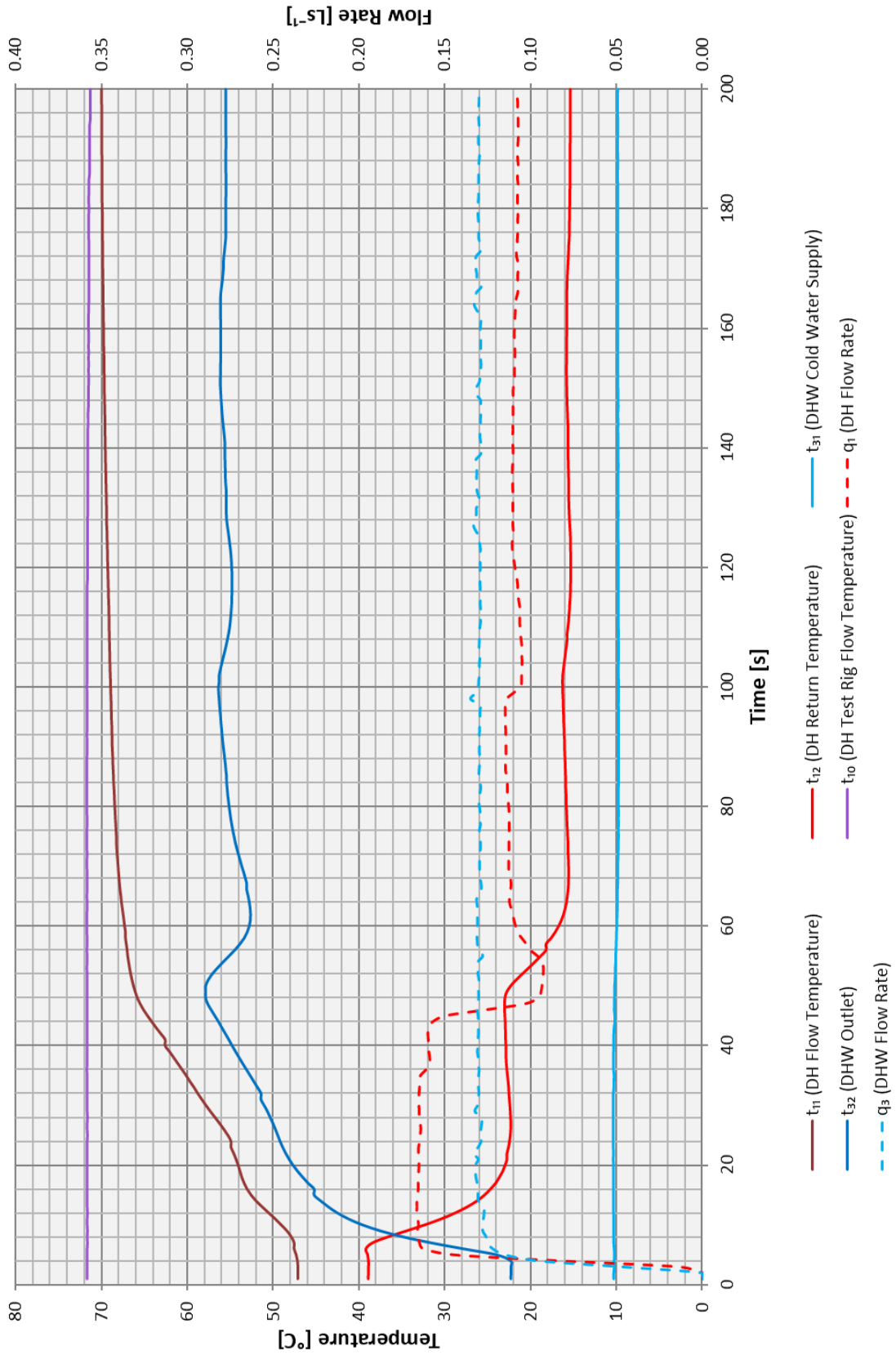


Figure 7.13 - Test 5a – DHW Response Time at 70 °C

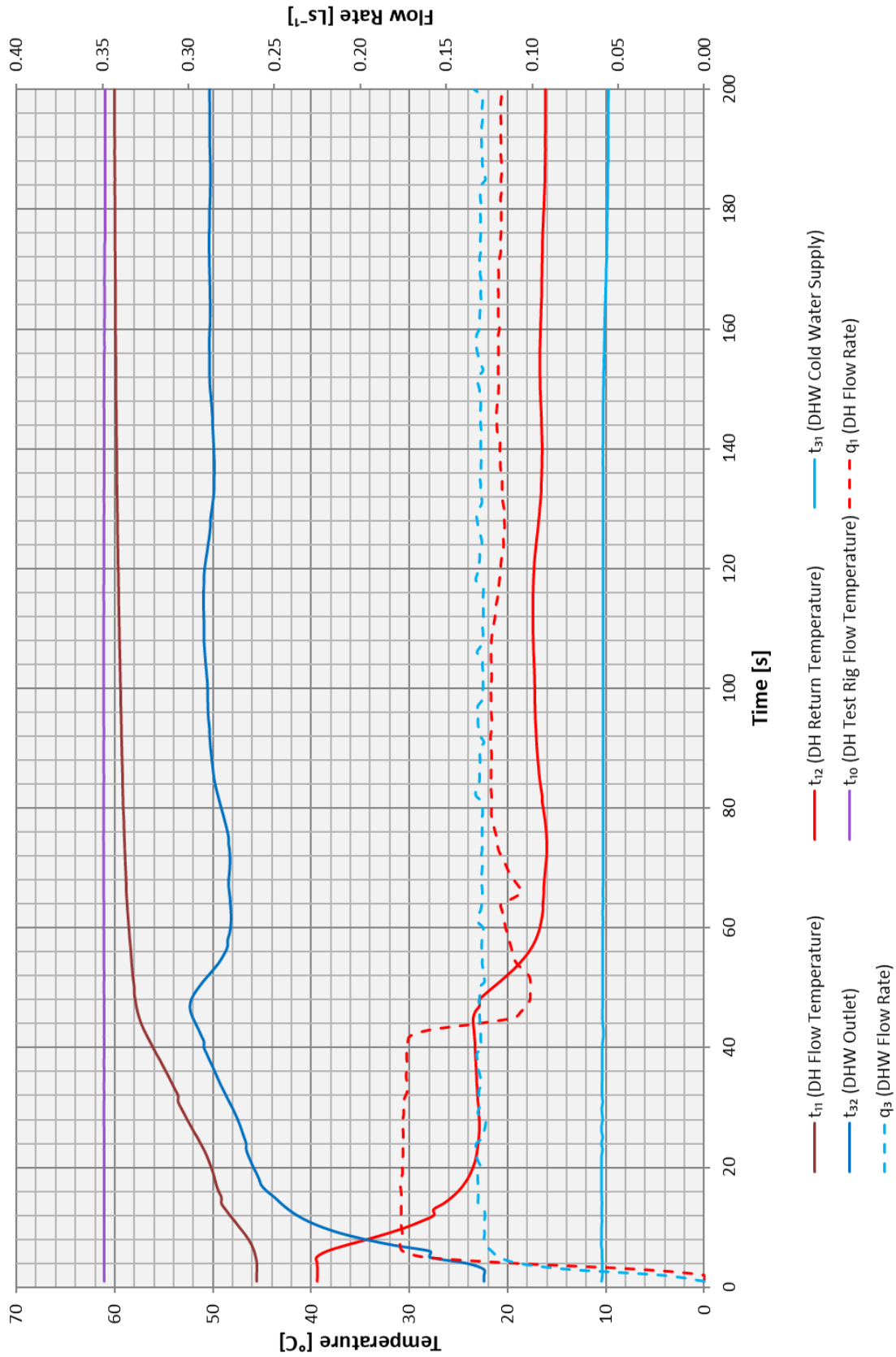


Figure 7.14 - Test 5b – DHW Response Time at 60 °C

Key Metric and VWARD Summary

7.1.2 The summary tables of the key metrics and VWARDS of the tests described in this report are given in this section.

SUMMARY TABLES START ON NEXT PAGE



High Temperature VVART Calculation for Hiper II HIU

Primary flow temperature: 70°C; DHW set point: 55°C; Space heating temperatures: 60°C/40°C
 Test carried out by Enertek International for HIGH Temperature BESA Tests
 Manufacturer: Intatec Limited; Model: Hiper II; Serial number: 300001; ;
 VVART calculation prepared by Ian Williamson of Enertek International on 25 November 2019

	VVART(°C)	Volume (m³)
DHW	15	22.4
Standby	38	26.3
Space Heating	41	43.7

Period	VVART(°C)	% Time
No Heating	27	93%
Heating	40	7%
Overall	28	

Table 7.1 - Key Metrics of High Temperature Package

DHW Draw test results		Post DHW Draw (60 seconds)	
Power (W)	Primary flow (ls)	VVART (°C)	VVART (°C)
Low	10654	0.047	15
Medium	18097	0.079	15
High	23446	0.103	16

Standby test results	
Primary flow (Ls ⁻¹)	VVART (°C)
0.001000	38

Space Heating test results		
Power (W)	Primary flow (Ls ⁻¹)	VVART (°C)
1kWp	1041	0.009
2kWp	2039	0.017
4kWp	4006	0.033

DHW Draw Volumes pa	
kWh pa	Hours
729	65.00
297	16.00
444	18.00

Standby Volumes pa	
Hours	Volume pa (m ³)
8,039	26.30

Post-DHW Draw Volumes pa		
Events pa	Average duration (secs)	Volume pa (m ³)
10000	30	-
660	75	-
300	145	-



Low Temperature VVART Calculation for Hiper II HIU

Primary flow temperature: 60°C, DHW set point: 50°C, Space heating temperatures: 45°C/35°C

Test carried out by Enertek International for HIGH Temperature BESA Tests

Manufacturer: Intatec Limited; Model: Hiper II; Serial number: 300001;

VVART calculation prepared by Ian Williamson of Enertek International on 25 November 2019

	VVART(°C)	Volume (m3)
DHW	16	27.8
Standby	38	35.0
Space Heating	35	49.9

	VVART(°C)	% Time
Period	29	93%
No Heating	35	7%
Overall	29	

Table 7.2 - Key Metrics of Low Temperature Package

	DHW Draw test results		Post DHW Draw (60 seconds)		DHW Draw Volumes pa		Post DHW Draw Volumes pa				
	Power (W)	Primary flow (ls)	VVART (°C)	Primary flow (m ³ /hr)	VVART (°C)	kWh pa	Hours	Volume pa (m ³)	Events pa	Average duration (secs)	Volume pa (m ³)
Low	9471	0.052	16	0.000	14	729	73.00	13.60	10000	30	-
Medium	16313	0.089	16	0.000	15	297	18.00	5.70	660	75	-
High	21145	0.115	16	0.000	17	444	21.00	8.50	300	145	-

Standby test results	
Primary flow (ls)	0.001000
VVART (°C)	38

Standby Volumes pa	
Hours	8.039
Volume pa (m ³)	36.00

Space Heating test results			
Power (W)	Primary flow (m ³ /hr)	VVART (°C)	
1kW/p	1036	0.010	35
2kW/p	2079	0.020	35
4kW/p	4132	0.038	35

Space Heating Volumes pa			
kWh pa	Hours	Volume pa (m ³)	
98	95.00	3.50	
787	379.00	27.50	
565	137.00	18.90	

8 APPENDIX B

8.1 Appliance Documentation

8.1.1 The details of the appliance documentation are given in Table 8.1 below.

Table 8.1 – Documentation Supplied

	Component:	Document Submitted (Y/N):	Manufacturer and type:
1	Space Heating Heat Exchanger	Y	Swep
2	Domestic Hot Water Heat Exchanger	Y	Swep
3	Controller for Space Heating	Y	Selco Inta
4	Control Valve and Actuator for Space Heating	Y	Frese Optima OEM Cartridge
5	Space Heating Strainer	N	N/A
6	Controller for Domestic Hot Water	Y	Selco Inta
7	Control Valve and Actuator for Domestic Hot Water	Y	Frese Fast Acting Actuator
8	Temperature Sensors	Y	Nordgas
9	Domestic Hot Water Isolating Valve	Y	Rbn and Wras 1304026 150142
10	Primary Side Strainer	Y	Installation Manual, PICV Inlet Block assembly
11	Drain Valves	Y	Rbm
12	Vent Valves	Y	Rbm
13	Circulation Pump set with AAV & PRV	Y	Grundfos UPM3
14	Heat Meter	Y	Ista Ultego III
15	Domestic Hot Water Flow Sensor	Y	Nordgas
16	Pipes	N	Copper
17	Connections	Y	Flat face with Gasket
18	Joints	N	N/A
19	Gaskets	Y	Tesnit
20	Expansion Vessel	Y	Zilmet
21	Insulation	N	N/A
22	Pressure Sensors	Y	Elbi
A2	Commissioning guide.	Y	Manufacturers operating manual
A3	Operation guides with a function description / description of operation and care instructions as suited to the intended user category.	Y	Manufacturers operating manual
A4	Declaration of Conformity for CE-marked HIUs.	N	
A5	Full parameter list for electrically controlled HIUs.	Y	Manufacturers operating manual
A6	Maximum primary static operating differential pressure.	16 bar	
A7	Deactivation procedure of the internal SH pump.	N/A	
	Model name and type number	HI Max Twin	
	Serial number	HMT191110001AA	

8.2 Appliance Components

8.2.1 Details of the main appliance components are given in Table 8.2.

Table 8.2 – Appliance Components details

Hiper II	
Appliance Serial Number	HMT191110001AA
Space Heating Heat Exchanger	SWEP
Domestic Hot Water Heat Exchanger	SWEP
Controller for Space Heating	Selco Inta
Control Valve & Actuator for Space Heating	Frese Optima OEM Cartridge
Controller for Domestic Hot Water	Selco Inta
Temperature Sensors	Nordgas
Domestic Hot Water Isolating valve	Rbn and Wras 1304026 150142
Primary Side Strainer	Installation Manual, PICV Inlet Block assembly
Circulation Pump	Grundfos UPM3
Heat Meter	Ista Ultego III
Domestic Hot Water Flow Sensor	Nordgas
Pipes	Copper
Connections	Flat face with Gasket
Gaskets	Tesnit
Expansion Vessel	Zilmet
Pressure Sensors	Elbi
Insulation	N/A

8.3 Appliance Photographs



Figure 8.1 – Photograph of Appliance [Case Fitted]



Figure 8.2 – Photograph of Appliance [Case Removed]



Figure 8-3 – Appliance Data Label

8.4 Calibrations and uncertainties

8.4.1 A list of equipment, their calibrations and uncertainties are given in Table 8.3 below.

Table 8.3 - EIL Equipment Calibration and Uncertainties

Equipment Name	ID Number	Calibration Certificate	Measurement Uncertainty $K=2$ $\frac{U}{\sqrt{20}}$	Units	Calibration Date	Calibration Due
Flow Meter [Primary Flow Rate]	FM 601	U92491-18	±0.0004	l/s	23-05-2018	23/05/2019
Flow Meter [DHW Flow Rate]	FM 602	U92511-18	±0.00305	l/s	24-05-2018	24/05/2019
Flow Meter [SH Flow Rate]	FM 603	U92467-18	±0.04871	l/s	22-05-2018	22/05/2019
Pressure Transducer [Primary Supply]	PT 086	K41132P	±6.82	kPa	22-05-2018	22/05/2019
Pressure Transducer [Primary Return]	PT 085	K41131P	±7.88	kPa	22-05-2018	22/05/2019
Pressure Transducer [DHW Output Pressure]	PT 083	K41129P	±7.73	kPa	22-05-2018	22/05/2019
Pressure Transducer [DHW Cold Water Supply]	PT 084	K41130P	±7.31	kPa	22-05-2018	22/05/2019
Pressure Transducer [SH Flow]	PT 087	K41127P	±7.26	kPa	22-05-2018	22/05/2019
Pressure Transducer [SH Return]	PT 088	K41128P	±7.30	kPa	22-05-2018	22/05/2019
PRT Probe [Primary Supply Temp]	PRT 4611	EIL 432360	±0.4	°C	16/05/2018	16/05/2019
PRT Probe [Primary Return Temp]	PRT 4612	EIL 432360	±0.4	°C	16/05/2018	16/05/2019
PRT Probe [DHW Output Temp]	PRT 4615	EIL 432360	±0.4	°C	16/05/2018	16/05/2019
PRT Probe [Cold Water Supply Temp]	PRT 4705	EIL 432360	±2.2	°C	16/05/2018	16/05/2019
PRT Probe [SH Supply Temp]	PRT 4613	EIL 432360	±0.4	°C	16/05/2018	16/05/2019
PRT Probe [SH Return Temp]	PRT 4608	EIL 433000	±0.5	°C	19/07/2018	19/07/2019
Pressure Transducer [Static Pressure Test]	PT 090	U100553-19	±50	kPa	21/11/2019	20/11/2020
Software	VERSION – LabVIEW, Version 5 , Service pack 1					

Report Issue No	Reason for Report Update
1	Original Issue
2	Test 3a Graph Added & Scaling risk assessment amended. SGB / JW
3	Test 3c removed from report, not needed as HIU passed test 3a.



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