Enertek International

International Consultants in Product
Research, Design, Development
& Certification

BESA HIU Test Report

Indirect V2

Modules tested: 1, 2, 7, 8

Client: YGHP

Project Number: E4865 Report Issue: 1

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CONTENTS

List of Figures

List of Tables

1 EXECUTIVE SUMMARY

1.1.1 The Indirect V2 HIU underwent testing to the BESA Technical Standard for UK HIU Test Regime, V3-Rev001 September 2023. Modules 1, 2, 7, 8 were tested. Summary tables can be seen below, with further technical data shown in each respective test module chapter of this report. VWART calculations can be found within APPENDIX A.

Table 1 - Appliance Details and Modules Tested

Manufacturer:	YGHP
Model:	Indirect V2
Modules:	1, 2, 7, 8

Table 2 - Modules Tested Pass or Fail Summary

Module 1:	Pass
Module 2:	Pass
Module 7:	Pass
Module 8:	Pass

Table 3 - Modules 1 & 7 VWART Information

	VWART (°C)	Volume (m^3)
DHW	14	24.7
Standby	37	20.9
Space Heating	38	46.9

	VWART (°C)
Summer	25
Winter	32
Overall	28

Table 4 - Modules 2 & 8 VWART Information

	VWART (°C)	Volume (m^3)
DHW	21	41.4
Standby	41	37.4
Space Heating	37	71.5

	VWART (°C)
Summer	31
Winter	34
Overall	32

1.1.2 It should be noted that all VWART figures are to within ±2°C tolerance.

2 BRIEF

2.1.1 Enertek international Limited (EIL), were contracted to receive, install, and commission a production sample of the Indirect V2.

2.1.2 To perform the tasks required for assessing the efficiency of Domestic Hot Water (DHW) and Space Heating (SH) as per the BESA UK HIU BESA Technical Standard for UK HIU Test Regime, V3-Rev001 September 2023, a publicly available online test regime. This is here-on referred to as the Test Regime throughout this document.

2.1.3 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).

3 DEFINITIONS

3.1.1 The following definitions and abbreviations which have been used within this report can be found in Table 5 below.

Table 5 - Definitions and Abbreviations

Symbol	Description
t_{10}	Temperature, primary source
t_{11}	Temperature, primary side flow connection
t_{12}	Temperature, primary side return connection
t_{21}	Temperature, space heating system return connection
t_{22}	Temperature, space heating system flow connection
t_{31}	Temperature, cold water supply
t_{32}	Temperature, domestic hot water flow from HIU
t_{b1}	Temperature, primary side bypass flow (for non-keep warm configuration)
t_{b2}	Temperature, primary side bypass return (for non-keep warm configuration)
q_1	Volume flow, primary side
q_2	Volume flow, space heating system
q_3	Volume flow, domestic hot water
P_{11}	Static pressure, primary side flow connection
P_{12}	Static pressure, primary side return connection
P_{21}	Static pressure, space heating system return connection
P_{22}	Static pressure, space heating system flow connection
P_{31}	Static pressure, cold water supply
P_{32}	Static pressure, domestic hot water flow from HIU
dP_1	Differential pressure, primary system across HIU
dP_2	Differential pressure, space heating system across HIU
dP_3	Differential pressure, domestic hot water across HIU
Q_{DHW}	Estimated annual energy demand per year for hot water
Q_{SH}	Estimated annual energy demand per year for space heating
n_{DHW}	Number of DHW events per year

H_1	Arithmetic mean of primary side power recorded during test
H_3	Arithmetic mean of DHW power recorded during test
H_2	Arithmetic mean of space heating power recorded during test
h_{DHW}	Annual hours that HIU is producing DHW
h_{SH}	Annual hours that HIU is producing space heating
h_{KWM}	Annual hours that HIU is in keep warm mode
h_{NKWM}	Annual hours that HIU is in non-keep warm mode
V_{DHW}	Volume of primary water recorded during and post-DHW test
V_{SH}	Volume of primary water recorded during space heating tests
V_{KWM}	Volume of primary water recorded during keep warm test
V_{NKWM}	Volume of primary water recorded during non-keep warm test
$Prop_{Summer}$	Proportion of year HIU is operating in “summer” mode
$Prop_{Winter}$	Proportion of year HIU is operating in “winter” mode
$VWART_{DHW}$	DHW Volume Weighted Average Return Temperature
$VWART_{SH}$	Space Heating Volume Weighted Average Return Temperature
$VWART_{KWM}$	Keep Warm Volume Weighted Average Return Temperature
$VWART_{NKWM}$	Non-Keep Warm Volume Weighted Average Return Temperature
$VWART_{WINTER}$	Annual Volume Weighted Average Return Temperature for Heating Period
$VWART_{SUMMER}$	Annual Volume Weighted Average Return Temperature for Non-Heating Period
$VWART_{HIU}$	Total Annual Volume Weighted Average Return Temperature
$W_{thermal}$	Thermal energy use
$W_{electrical}$	Electrical energy use
SH_{PROP}	Annual heating period
NSH_{PROP}	Annual non-space heating period
TMV	Thermostatic mixing valve
TRV	Temperature regulating valve
UFH	Underfloor heating
DHW	Domestic hot water
HIU	Heat interface unit

DPCV	Differential pressure control valve
DRV	Double regulating valve
SH	Space heating
UKAS	United Kingdom Accreditation Service
EIL	Enertek International Limited

4 INTRODUCTION

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.

4.1.2 The HIU rig schematic is shown within Figure 1.

The HIU was commissioned in accordance with the technical manual / installation guide provided by YGHP. The location of which can be found within the references section of this report.

4.2 Appliance Details

4.2.1 Details of the HIU Indirect V2 appliance are given in Table 6. Photographs of the installed appliance are given in Figure 20, Figure 21 and Figure 22.

4.2.2 The UK declaration of conformity (CE or UKCA or equivalent) and water regulation 4 certificate can be found within APPENDIX C.

Table 6 - Appliance Details

Item	Description
Manufacturer	YGHP
Model	Indirect V2
Serial Number	202329065
Year of Manufacture	2023
DHW Priority	Yes
EUT Number	EUT 0659
Date Test Item Received	12/10/2023

4.3 Appliance Design Pressures and Temperatures

4.3.1 The maximum design pressures and temperatures of the Indirect V2 appliance for the primary side and the secondary side for both Space Heating and DHW are given in Table 7.

Table 7 - Appliance Design Pressures and Temperatures

Item	Pressure (bar)	Differential Pressure (bar)	Temperature (°C)
Primary Side	10	6	90
Secondary Side Space Heating	3	-	85
Secondary Side DHW	10	-	60

5 TEST METHOD

5.1 Test Regime

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

5.1.2 Testing was carried out in accordance with Test Module 1.

5.1.3 Testing was carried out in accordance with Test Module 2.

5.1.4 Testing was carried out in accordance with Test Module 7.

5.1.5 Testing was carried out in accordance with Test Module 8.

5.2 Measurement & Uncertainties

5.2.1 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.

5.2.2 The BESA uncertainties of measurement requirements are as follows:

- Differential Pressure, ± 1.0 kPa
- Temperature, ± 0.1 °C
- Volume Flow (≥ 0.06 l/s) ± 1.5 %
- Volume flow (< 0.06 l/s), ± 3.0 %

Note: the time constant for the temperature sensors is less than 1.5 s. The time constant for the differential pressure sensors is less than 5s.

5.2.3 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 shown within chapter 11.

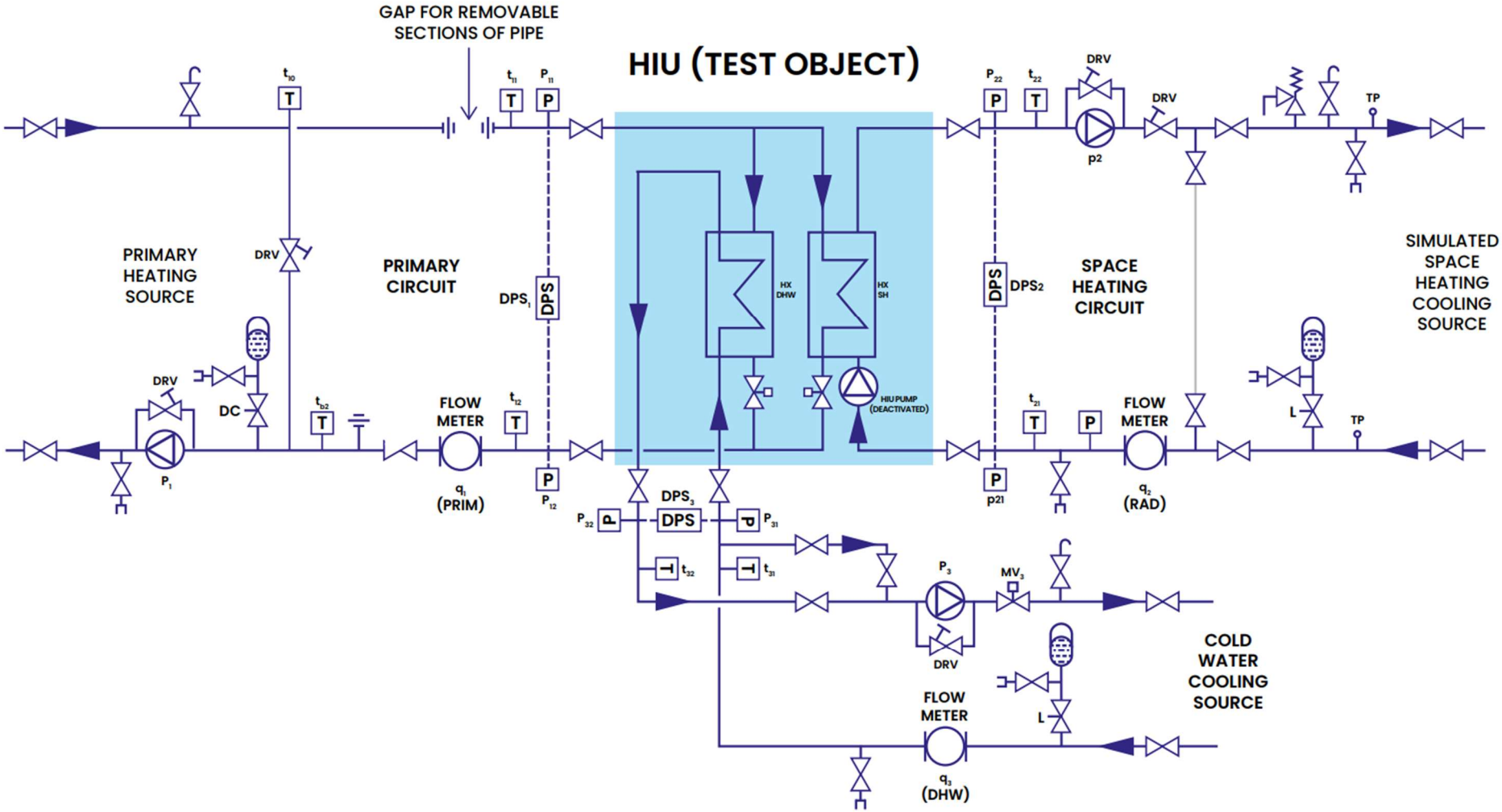

Figure 1 - EIL's HIU Test Rig schematic which is taken from Appendix B, Figure 4, of Technical Standard for UK HIU Test Regime Version 3: 2023

6 TEST MODULE 1 - SPACE HEATING, HIGH TEMPERATURE, DH70 INDIRECT

6.1 Test Module 1 Information

6.1.1 Objective: Perform static testing to investigate the performance characteristics of the HIU when indirectly meeting a space-heating load given a 55°C/35°C tertiary heating circuit and 70°C primary flow temperature.

6.1.2 The following set of tests are from test module 1 – space heating, high temperature, indirect heating module 1-DH70 indirect HM1-DH70C.

Table 8 - Module 1 Tests

Module 1 Tests	
01a	DH/70C, Space Heating Indirect 0.5 kW, 55/35°C tertiary, 50 kPa
01b	DH/70C, Space Heating Indirect 1 kW, 55/35°C tertiary, 200 kPa
01c	DH/70C, Space Heating Indirect 4 kW, 55/35°C tertiary, 50 kPa

6.2 Test Module 1 Results

6.2.1 Performance criteria results can be seen in Table 9, Test result data can be seen in Table 11 and key metrics can be found in Figure 2, Figure 3 and Figure 4. Best practice criteria can be found in table 10.

Table 9 - Module 1 Performance Criteria

Module 1 Tests Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
VWART (fail if the VWART is above 40°C)	Pass

Table 10 - Module 1 Best Practice

Module 1 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
VWART is below 37 °C	Not Achieved

Table 11 - Module 1 Test Results

Module 1 Test Results				
Parameter	**Symbol**	**01a (0.5kW)**	**01b (1kW)**	**01c (4kW)**
Temperature, primary side flow connection	t_{11} (°C)	70.4	69.7	69.8
Temperature, primary side return connection	t_{12} (°C)	38.1	38.3	38.6
Volume flow, primary side	q_1 (l/s)	0.0053	0.0094	0.031
Differential pressure, primary system across HIU	dP_1 (kPa)	53	201	51
Arithmetic mean of primary side power recorded during test	H_1 (W)	715.59	1231.66	4089.97
Temperature, space heating system return connection	t_{21} (°C)	35.5	34.8	35.3
Temperature, space heating system flow connection	t_{22} (°C)	54.7	55.5	54.7
Volume flow, space heating system	q_2 (l/s)	0.0061	0.011	0.048
Differential pressure, space heating system across HIU	dP_2 (kPa)	0.1	0.5	2
Arithmetic mean of space heating power during test	H_2 (W)	480.67	984.34	3952.51
Volume Weighted Avg. Return Temp	VWART (°C)	38	38	39
Total VWART (°C)		38		

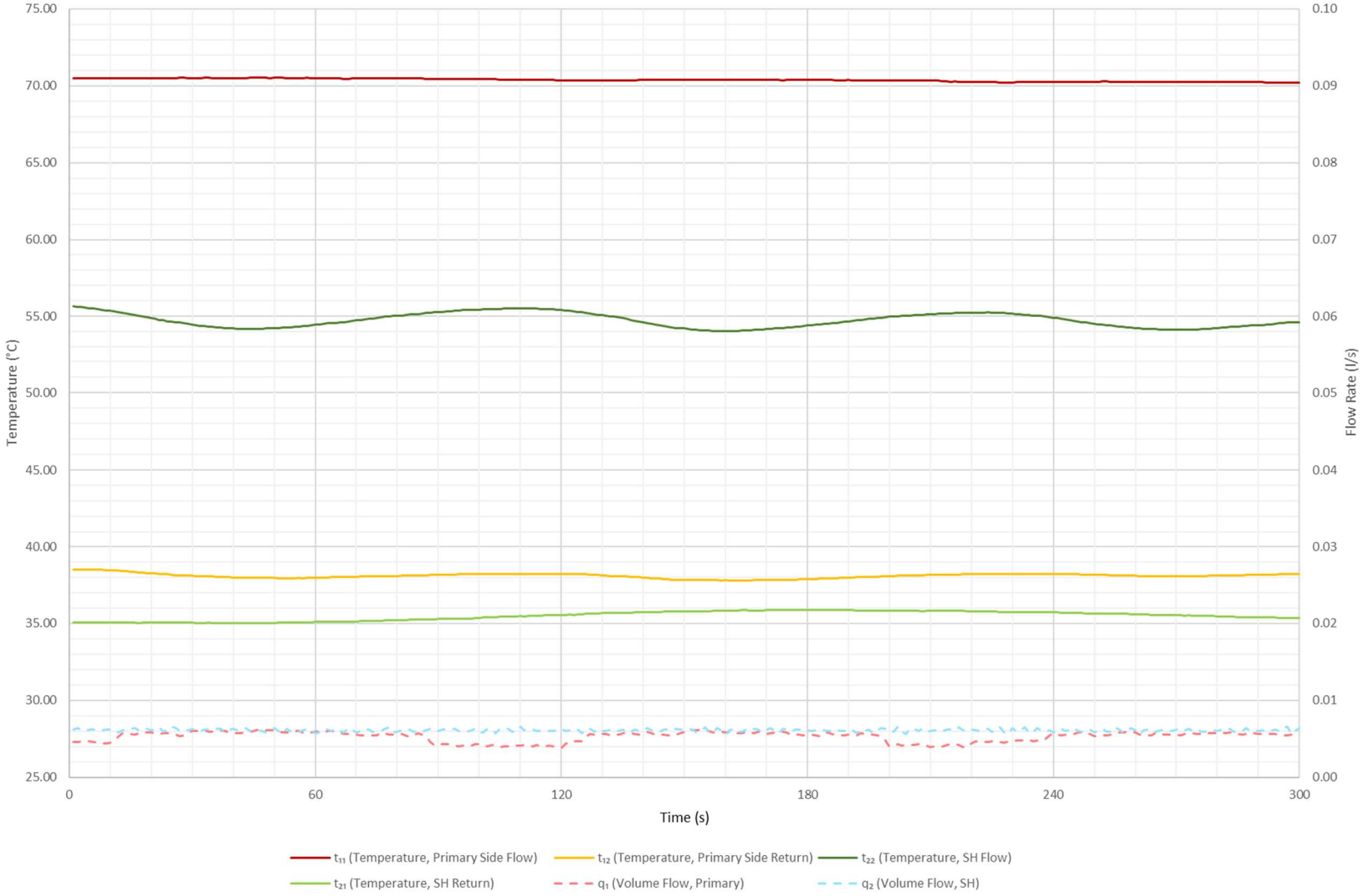

Figure 2 - Test 01a Key Metrics

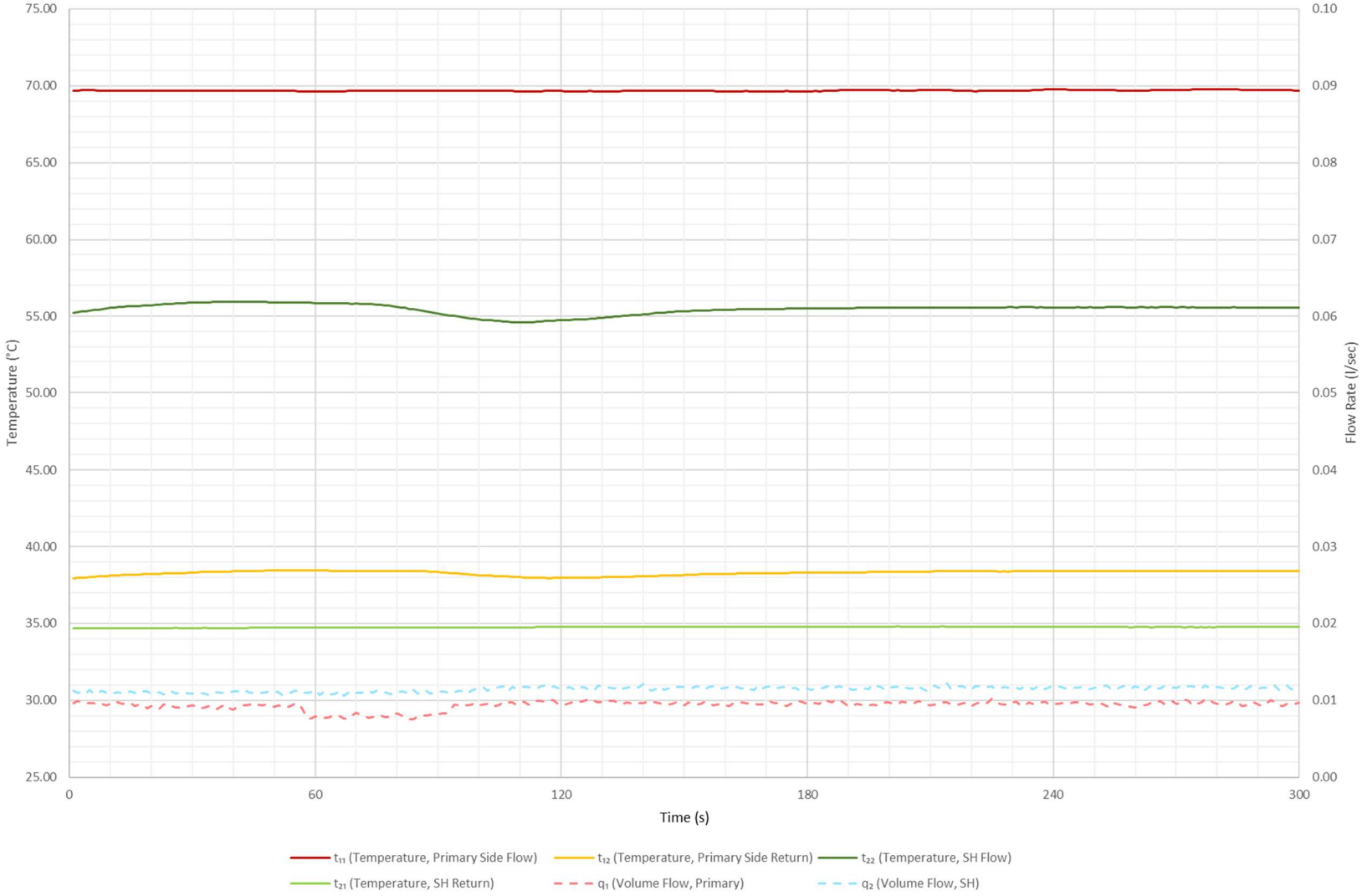

Figure 3 - Test 01b Key Metrics

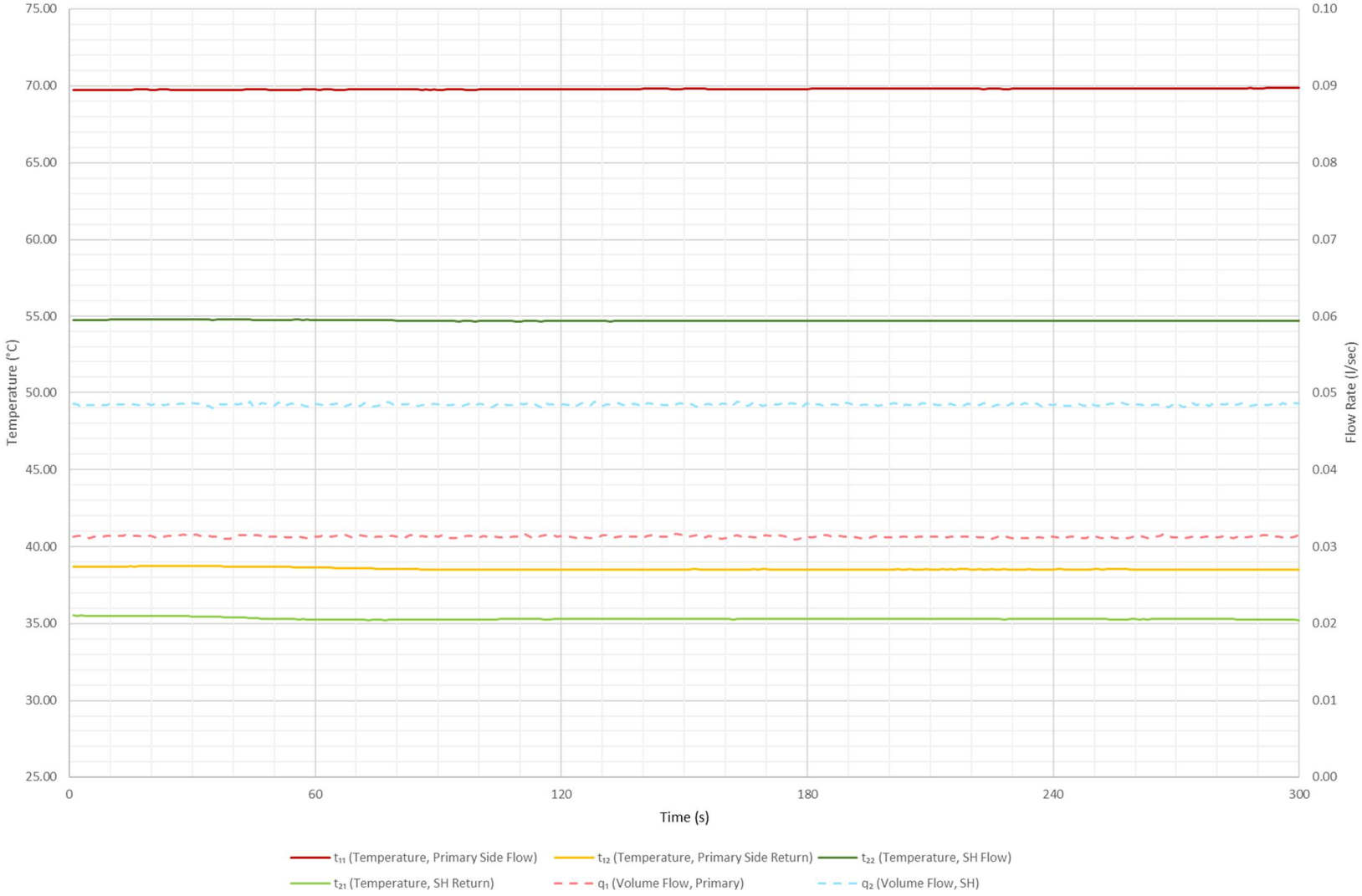

Figure 4 - Test 01c Key Metrics

7 TEST MODULE 2 - SPACE HEATING, LOW TEMPERATURE, DH55 INDIRECT

7.1 Test Module 2 Information

7.1.1 Objective: Perform static testing to investigate the performance characteristics of the HIU when indirectly meeting a space-heating load given a 45°C/35°C tertiary heating circuit and 55°C primary flow temperature.

7.1.2 The following set of tests are from test module 2 - Space Heating, Low Temperature, Indirect HEATING MODULE 2-DH55 Indirect HM2-DH55C

Table 12 - Module 2 Tests

Module 2 Tests	
01d	DH/55C, Space Heating Indirect 0.5 kW, 45/35°C tertiary, 50 kPa
01e	DH/55C, Space Heating Indirect 1 kW, 45/35°C tertiary, 200 kPa
01f	DH/55C, Space Heating Indirect 4 kW, 45/35°C tertiary, 50 kPa

7.2 Test Module 2 Results

7.2.1 Performance criteria results can be seen in Table 13, Test result data can be seen in Table 15 and key metrics can be found in Figure 5, Figure 6 and Figure 7. Best practice criteria can be found in table 14.

Table 13 - Module 2 Performance Criteria

Module 2 Tests Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
VWART (fail if the VWART is above 40°C)	Pass

Table 14 – Module 2 Best Practice

Module 2 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
VWART is below 37 °C	Achieved

Table 15 - Module 2 Test Results

Module 2 Test Results				
Parameter	**Symbol**	**01d (0.5kW)**	**01e (1kW)**	**01f (4kW)**
Temperature, primary side flow connection	t_{11} (°C)	55.0	54.7	54.8
Temperature, primary side return connection	t_{12} (°C)	37.1	36.0	37.4
Volume flow, primary side	q_1 (l/s)	0.0075	0.013	0.055
Differential pressure, primary system across HIU	dP_1 (kPa)	58	205	52
Arithmetic mean of primary side power recorded during test	H_1 (W)	564.86	986.26	4043.40
Temperature, space heating system return connection	t_{21} (°C)	34.6	35.0	35.5
Temperature, space heating system flow connection	t_{22} (°C)	44.9	44.5	44.7
Volume flow, space heating system	q_2 (l/s)	0.012	0.024	0.102
Differential pressure, space heating system across HIU	dP_2 (kPa)	0.3	2	5
Arithmetic mean of Space heating power during test	H_2 (W)	513.67	943.62	3965.22
Volume Weighted Avg. Return Temp	VWART (°C)	37	36	37
Total VWART (°C)		37		

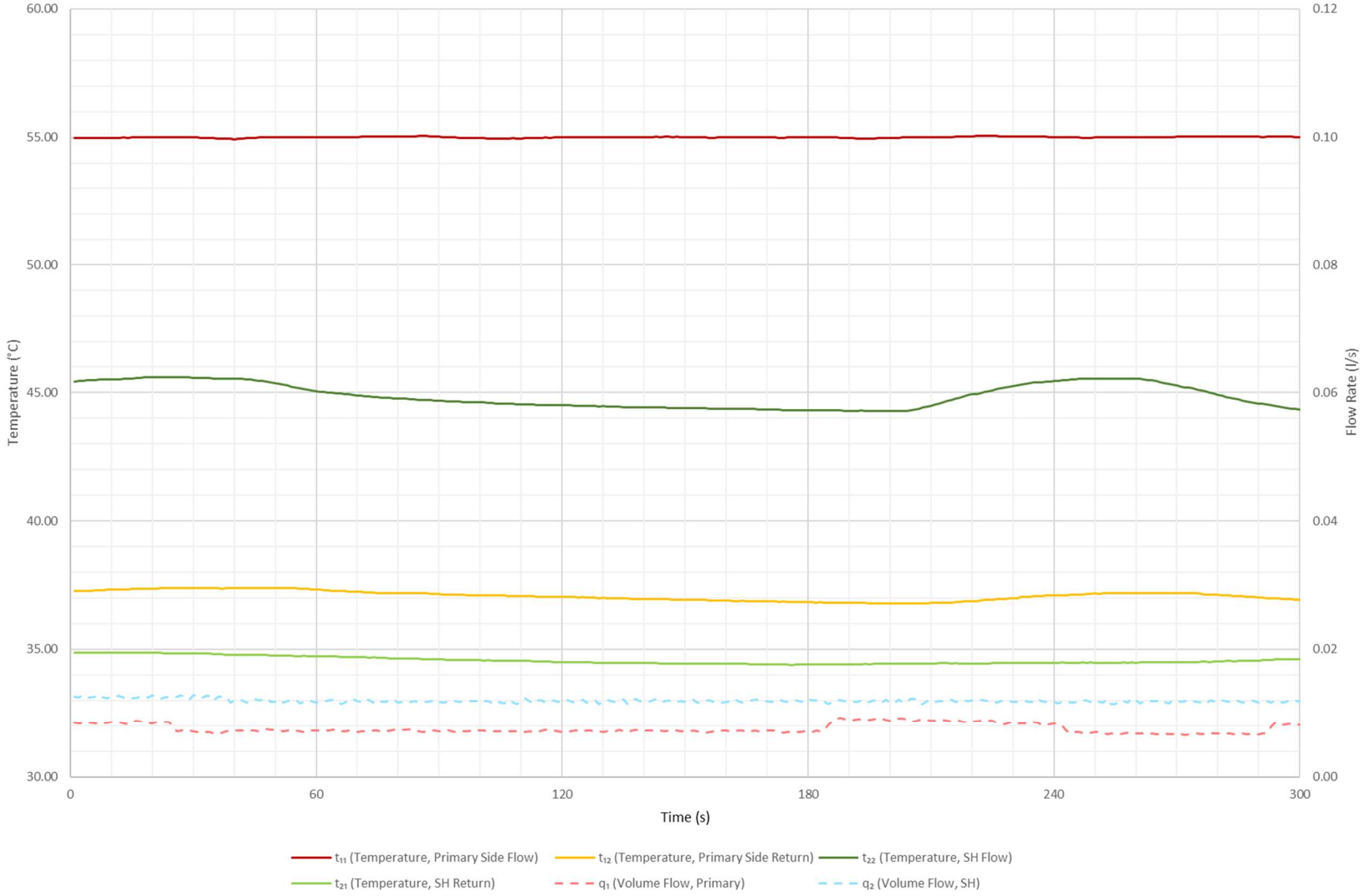

Figure 5 - Test 01d Key Metrics

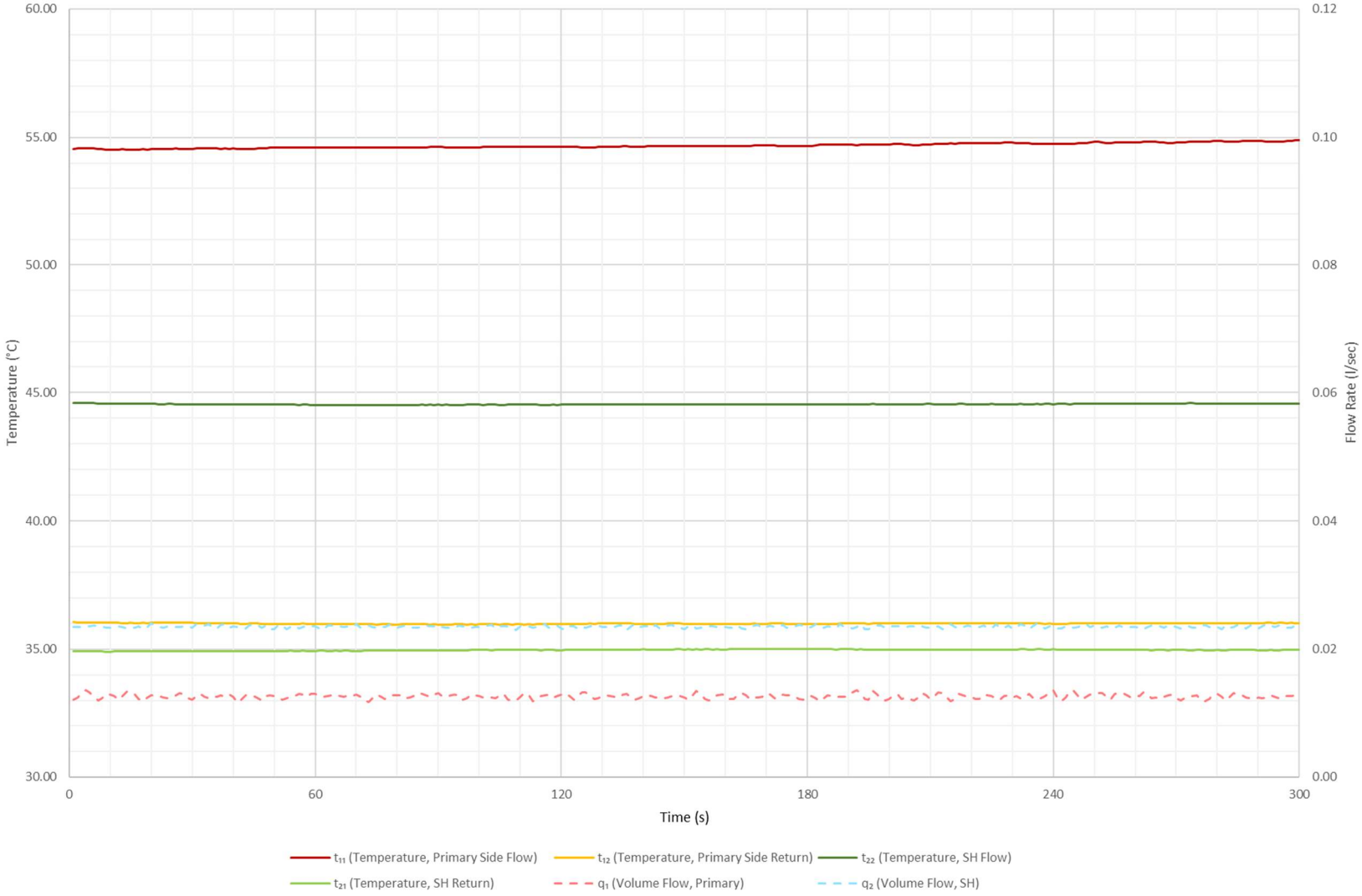

Figure 6 - Test 01e Key Metrics

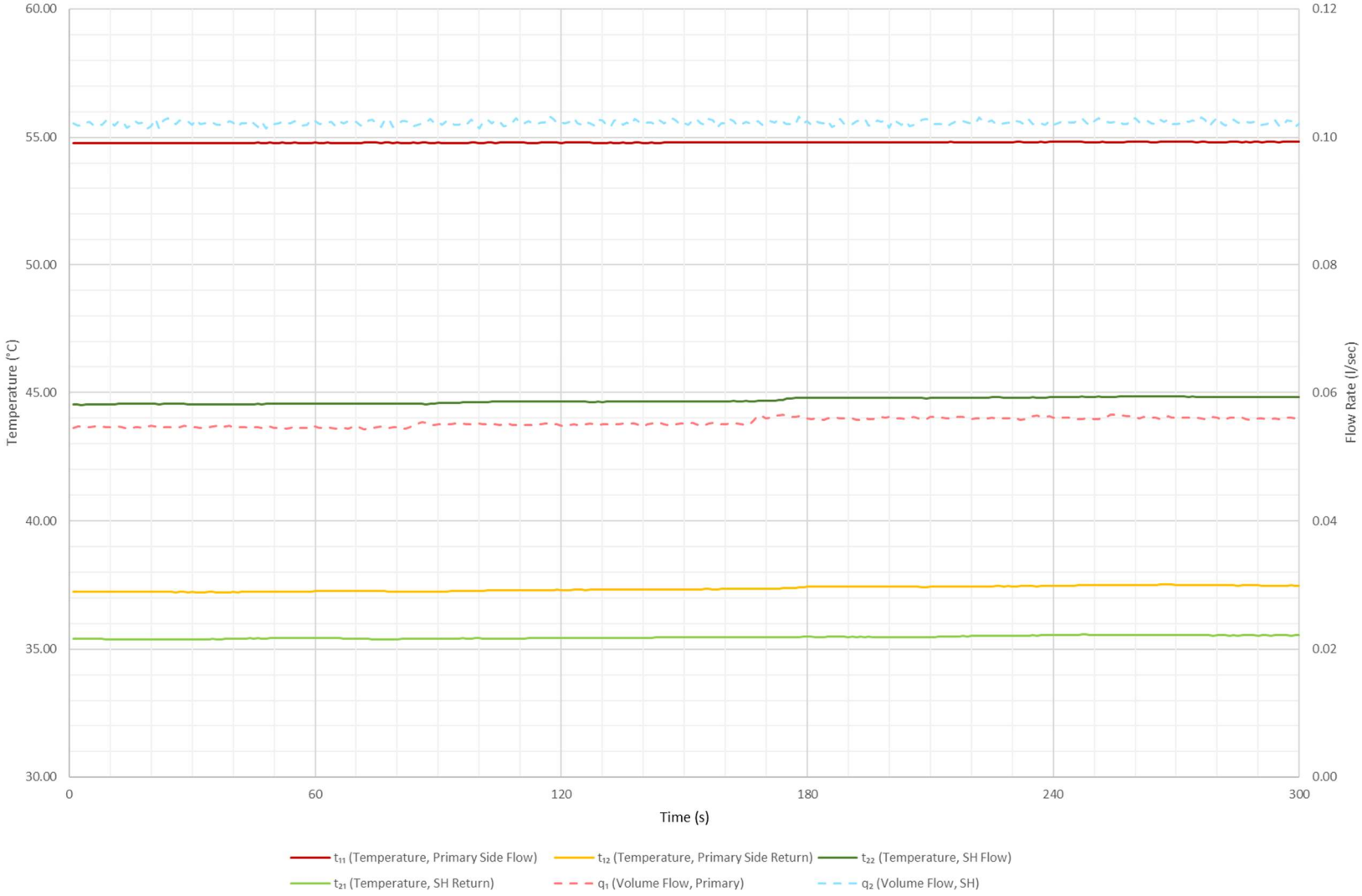

Figure 7 - Test 01f Key Metrics

8 TEST MODULE 7 – DHW, HIGH TEMPERATURE, DH70-KWARM

8.1 Test Module 7 Information

8.1.1 Objective: To explore the performance of the HIU under changing loads, as would be the case in practical operation. Key performance criteria are speed and consistency of DHW delivery to the customer; DHW staying at a safe temperature at all times and the volume weighted average return temperature when supplying space heating or DHW.

8.1.2 The following set of tests are from test module 7 – Domestic hot water, high temperature, keep warm hot water module 7-DH70-KWarm.

Table 16 - Module 7 Tests

Module 7 Tests	
11a	DH/70C, DHW only, 50°C DHW, Variable dP
12a	DH/70C, DHW Low Flow, 50°C DHW, 50kPa
12c	DH/70C, DHW Low Flow, 50°C DHW, 200kPa
13a	DH/70C, DHW Load Test, 50°C DHW
21a	DH/70C, DHW Keep Warm, 50°C DHW
22a	DH/70C, DHW Keep Warm Response Time, 50°C DHW

8.2 Test 11a Information

8.2.1 Objective: To investigate the performance of the HIU when delivering DHW, at a range of flow rates and differential pressures, given a 70°C primary flow temperature. The test investigates HIU operation in terms of DHW delivery and impacts on primary heat network return temperatures.

8.3 Test 11a Results

8.3.1 Performance criteria results can be seen in Table 18 Test result data can be seen in Table 17 and key metrics can be found in Figure 8. Best practice criteria can be found in table 19.

Table 17 - Module 7, Test 11a Results

Module 7 - Test 11a Results			
Parameter	**Symbol**	**Result**	
Maximum and minimum values of t_{32} when there is DHW flow	t_{32} (°C)	52.8	42.9
Number of consecutive seconds where t_{32} > 55°C	(s)	0	
Volume Weighted Avg. Return Temp	VWART (°C)	14	

Table 18 - Module 7, Test 11a Performance Criteria

Module 7 - Test 11a Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass
Fail if the VWART is above 22°C (to one decimal place)	Pass
Fail if the average DHW temperature (t_{32}) is not 50.0°C ±1°C (to one decimal place) for the final 150 seconds of each of the 180 second DHW flow periods	Pass
Fail if the DHW temperature (t_{32}) is not being maintained at 50.0°C ±3°C (to one decimal place) for >150 seconds of each of the DHW flow periods	Pass
Fail if the DHW temperature (t_{32}) drops below 45.0°C (to one decimal place) for more than 5 consecutive seconds, as this would impact resident comfort	Pass

Table 19 – Module 7 – Test 11 Best Practice

Module 7 – Test 11 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if the VWART is less than 17°C (to one decimal place)	Achieved
Best practice if the DHW temperature (t32) is being maintained at 50.0°C ±2°C throughout periods of DHW flow	Not Achieved
Best practice if the DHW temperature (t32) doesn't drop below 45.0°C (to one decimal place) for more than 2 consecutive seconds	Not Achieved

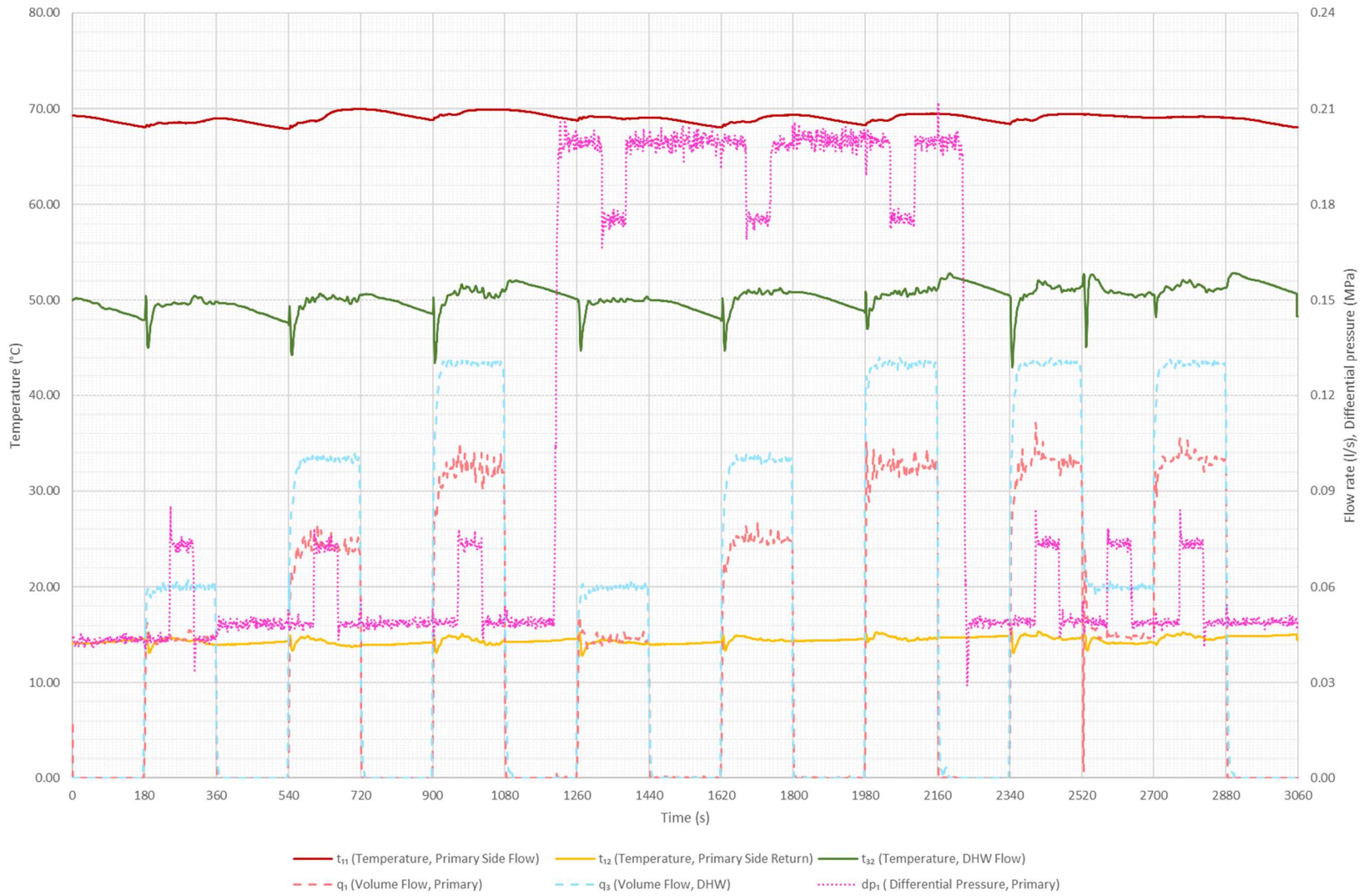

Figure 8 - Test 11a Key Metrics

8.4 Test 12a / 12c Information

8.4.1 Objective: To investigate the stability of DHW temperature at low flow rates. During operation, domestic hot water is sometimes drawn off at extremely low flow rates. Test 12 investigates the ability of the system to meet this condition by measuring the temperature at test point t_{32} at a flow rate of 0.02 l/s.

8.5 Test 12a / 12c Results

8.5.1 The HIU was able to deliver DHW at low flow rate above 45.0°C at the end of the 180 second period of low flow DHW.

8.5.2 The HIU was able to deliver stable DHW flow temperature (at t_{32}), defined as ability to maintain 50.0 ±3.0°C (1 decimal place) during the last 60 seconds of the test.

8.5.3 Performance criteria results can be seen in Table 21, Test result data can be seen in Table 20 and key metrics can be found in Figure 9 and Figure 10. Best practice criteria can be found in table 22.

Table 20 - Module 7, Test 12 Results

Module 7 - Test 12 Results					
Parameter	**Symbol**	**12a Result**		**12c Result**	
Maximum and minimum values of t_{32} when there is low DHW flow	t_{32} (°C)	58.7	48.5	55.0	51.0
Number of consecutive seconds where t_{32} > 55°C	(s)	48		2	

Table 21 - Module 7, Test 12 Performance Criteria

Module 7 - Test 12 Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass
Fail if DHW temperature (t_{32}) is not maintained at 50°C ±3°C (to one decimal place) for more than 60 seconds	Pass

Table 22 – Module 7 – Test 12 Best Practice

Module 7 – Test 12 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if DHW temperature (t32) is maintained at 50°C ±2°C (to one decimal place) throughout the test for both test 12a and 12c.	Not Achieved

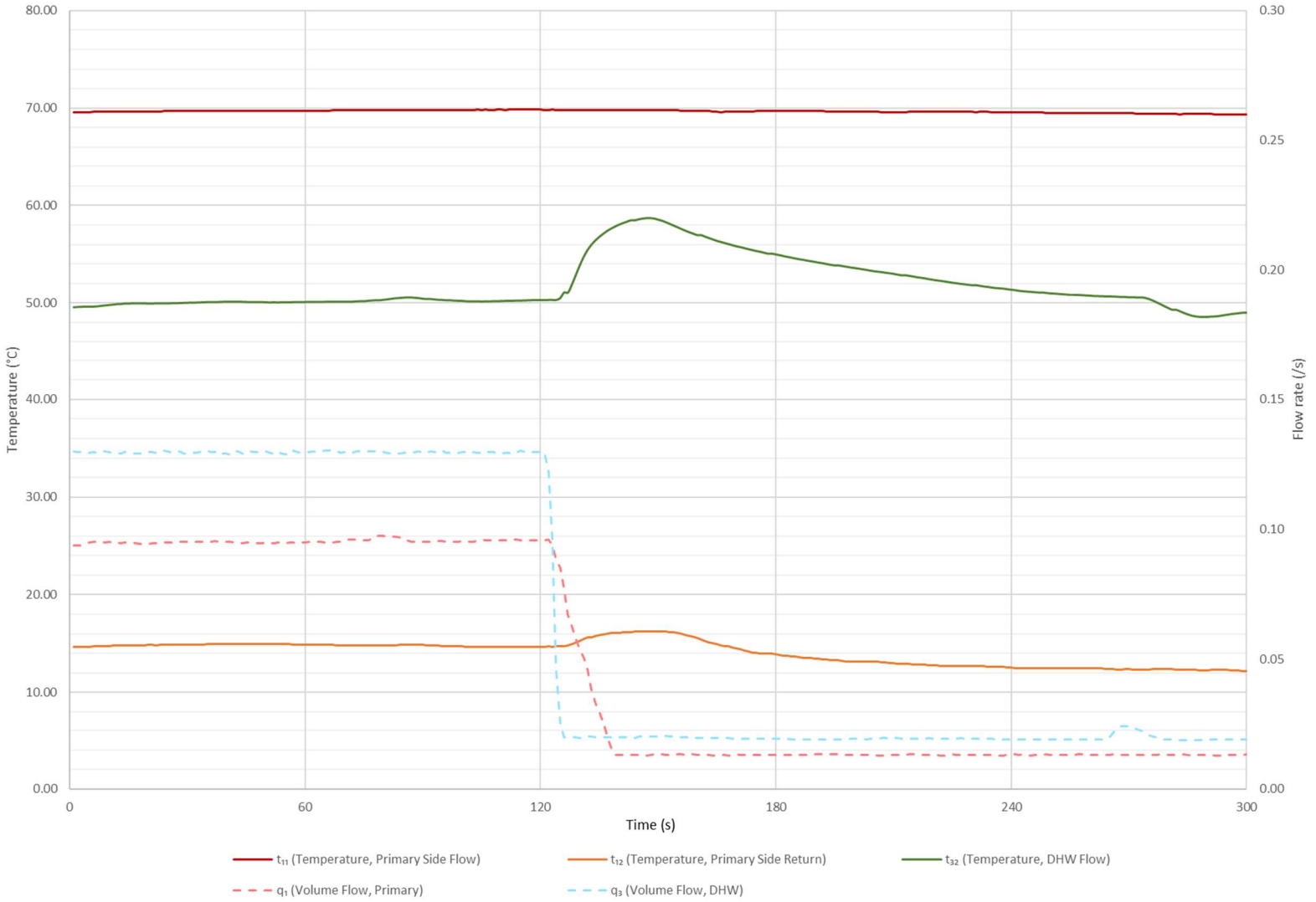

Figure 9 - Test 12a Key Metrics

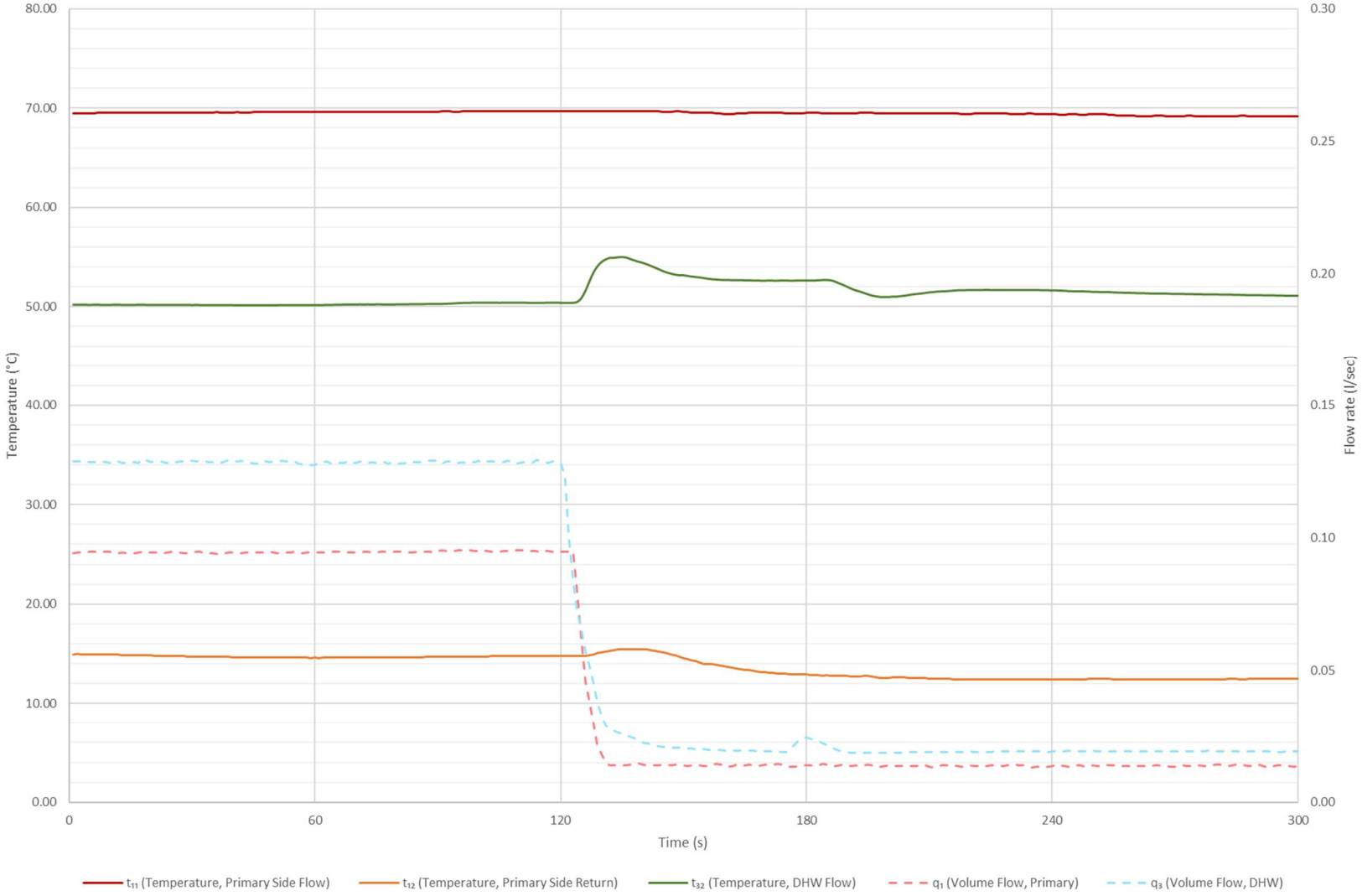

Figure 10 - Test 12c Key Metrics

8.6 Test 13a Information

8.6.1 Objective: To measure the maximum heat output (kW) and flow (l/sec) DHW output that can be delivered from the HIU. The HIU shall be set to deliver 50°C and the maximum DHW power output shall be measured with a flow step change and the peak value recorded when the DHW flow temperature is above 45°C.

8.7 Test 13a Results

8.7.1 The maximum DHW heat output was recorded as 53.71 kW, with a measured flow rate of 0.36 l/s, when producing minimum DHW at 45°C or above (Temperature achieved at final step 45.3 °C).

8.7.2 The recorded DHW line pressure drop across the HIU was 123.65 kPa.

8.7.3 The number of consecutive seconds where t_{32} > 55°C was 0 seconds.

8.7.4 Performance criteria results can be seen in Table 23, Test result data can be seen in Table 24 and key metrics can be found in Figure 11.

Table 23 - Module 7, Test 13 Performance Criteria

Module 7 - Test 13 Performance Criteria	
Performance Criteria, Fail if:	**PASS / FAIL**
Fail if DHW (at t_{32}) is less than 50°C ±1.0°C (to one decimal place) at 0.13 l/s flow rate, as the HIU must be able to produce DHW to the target temperature at a moderate load	Pass
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass

Table 24 - Module 7, Test 13a Results

Module 7 - Test 13a Results – Mean Average of Last 10 Seconds											
Parameter	**Symbol**	**0.15 l/s (25kW)**	**0.18 l/s (30kW)**	**0.21 l/s (35kW)**	**0.24 l/s (40kW)**	**0.27 l/s (45kW)**	**0.30 l/s (50kW)**	**0.33 l/s (55kW)**	**0.36 l/s (60kW)**	**0.39 l/s (65kW)**	**0.42 l/s (70kW)**
Temperature, primary side flow connection	t_{11} (°C)	70.3	70.3	70.3	70.3	70.3	70.2	70.3	70.3	70.3	N/A
Temperature, primary side return connection	t_{12} (°C)	14.3	14.7	15.1	15.3	15.8	16.4	16.0	16.0	15.4	N/A
Volume flow, primary side	q_1 (l/s)	0.104	0.125	0.145	0.167	0.190	0.211	0.229	0.240	0.244	N/A
Arithmetic mean of primary side power recorded during test	H_1 (kW)	24.68	29.50	34.09	39.05	43.74	47.87	51.68	53.71	55.04	N/A
Temperature, cold water supply	t_{31} (°C)	9.9	9.9	10.0	9.6	9.6	9.8	9.3	9.7	9.7	N/A
Temperature, domestic hot water flow from HIU	t_{32} (°C)	49.1	48.9	48.6	48.4	48.1	48.0	46.7	45.3	43.3	N/A
Volume flow, domestic hot water	q_3 (l/s)	0.150	0.180	0.210	0.240	0.270	0.300	0.331	0.361	0.391	N/A
Differential pressure, domestic hot water across HIU	dP_3 (kPa)	26	36	47	59	73	88	105	124	144	N/A
Arithmetic mean of DHW power recorded during test	H_3 (kW)	24.64	29.44	33.98	38.97	43.65	47.95	51.69	53.76	55.03	N/A

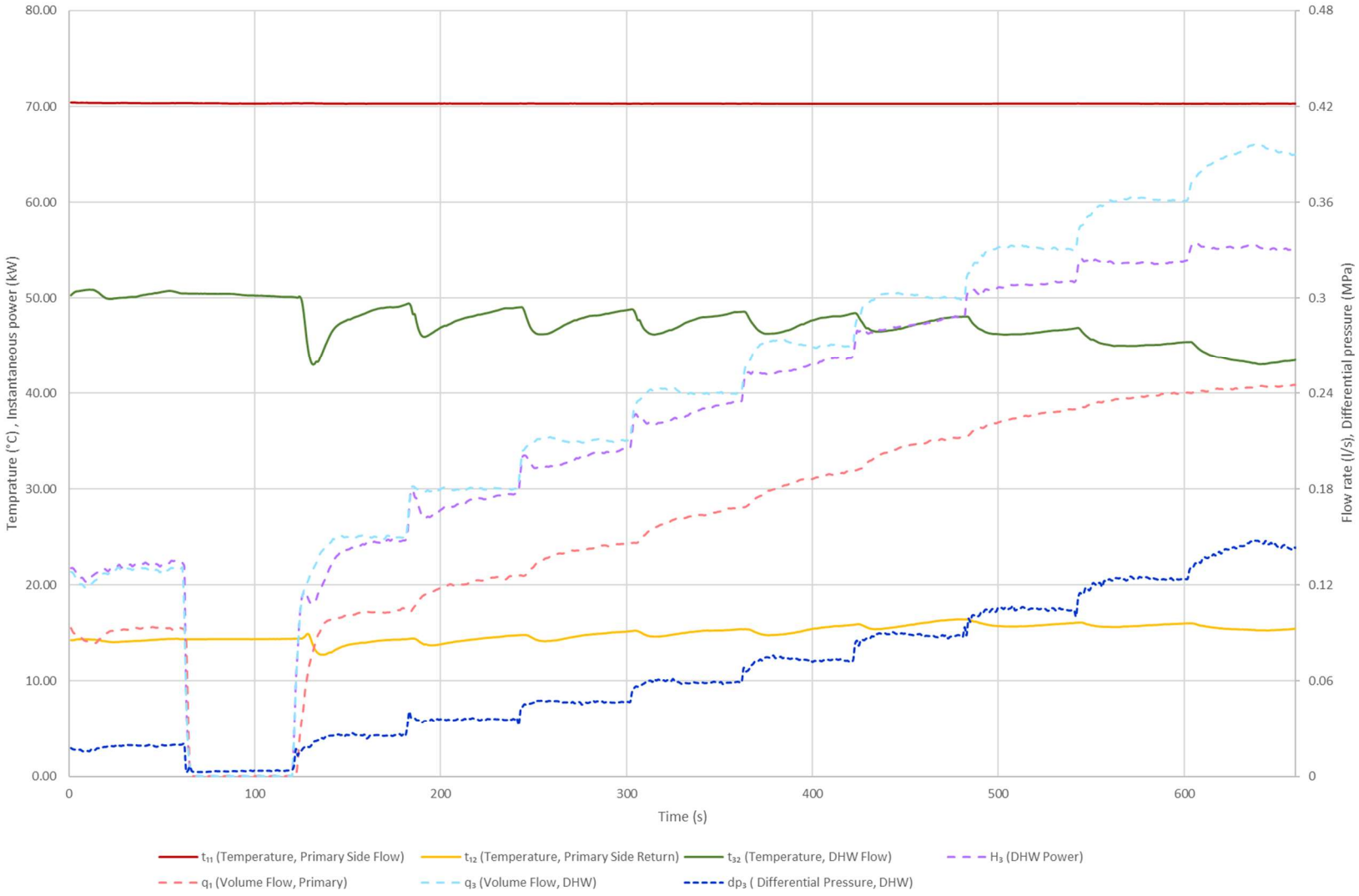

Figure 11 - Test 13a Key Metrics

8.8 Test 21a Information

8.8.1 Objective: To establish HIU performance during periods of no load, when operating in Keep Warm mode.

8.9 Test 21a Results

8.9.1 The Keep Warm operation is valid (based on Test 22a response time criteria).

8.9.2 The Keep Warm undergoes cycling (i.e. t_{11} varies by more than ±3 °C during the final 3 hours of the test).

8.9.3 Performance criteria results can be seen in Table 26, Test result data can be seen in Table 25 and key metrics can be found in Figure 12. Best practice criteria can be found in table 27.

Table 25 - Module 7, Test 21a Results

Module 7 - Test 21a Results		
Parameter	**Symbol**	**Result**
Mean average volume flow, primary side	q_1 (l/s)	0.0008
Mean average of primary side power recorded during test	H_1 (kW)	0.03
Mean average electrical energy use	$W_{electrical}$ (W)	1.82
Mean average thermal energy use	$W_{thermal}$ (W)	32.4
Overall energy loss per day	(kWh)	0.820
Overall keep warm volume weighted avg. return temp	VWART (°C)	37

Table 26 - Module 7, Test 21 Performance Criteria

Module 7 - Test 21 Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if VWART is above 44°C (to one decimal place)	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass
Fail if the primary supply temperature to the HIU (t_{11}) drops to below 39°C	Pass
Fail if the HIU overall energy losses are greater than 1.0 kWh/day (to three decimal places)	Pass
Fail if the Test 22a DHW temperature response time test fails (i.e. the HIU Keep Warm operation is not a valid Keep Warm)	Pass

Table 27 - Module 7 - Test 21 Best Practice

Module 7 – Test 21 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if VWART is below 38°C (to one decimal place)	Achieved
Best practice if HIU overall energy losses are less than 0.7 kWh/day (to three decimal places)	Not Achieved

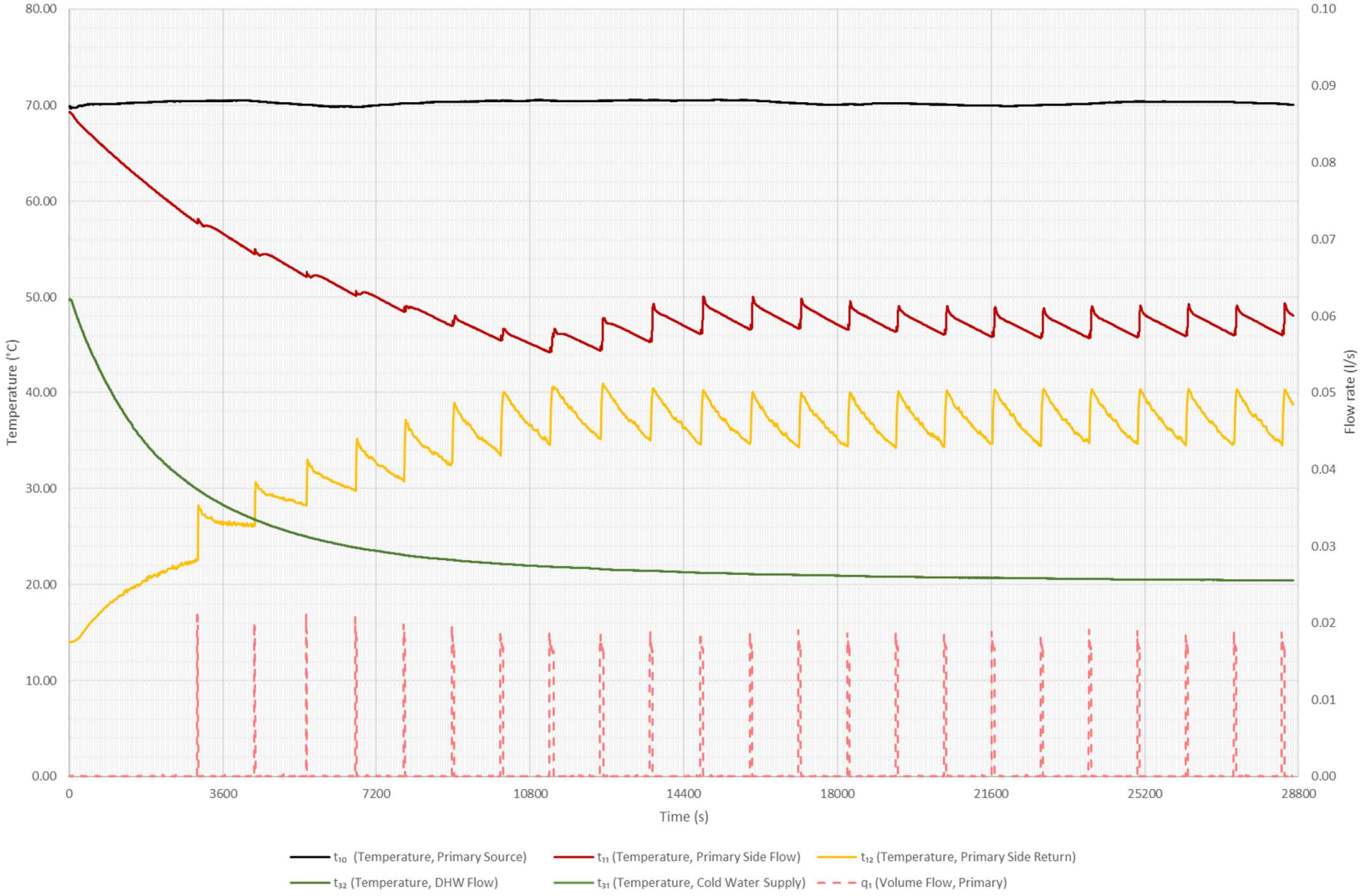

Figure 12 - Test 21a Key Metrics

8.10 Test 22a Information

8.10.1 Objective: To investigate DHW delivery time after a period of at least 8 hours Keep Warm only operation. This tests if the HIU can supply domestic hot water within an acceptable time of turning on the tap, which is a basic comfort requirement.

8.11 Test 22a Results

8.11.1 The Keep Warm operation is valid (based on response time criteria shown in Test 22 performance criteria).

8.11.2 Performance criteria results can be seen in Table 29, Test result data can be seen in Table 28 and key metrics can be found in Figure 13. Best practice criteria can be found in table 10.

Table 28 - Module 7, Test 22a Results

Module 7 - Test 22a Results		
Parameter	**Symbol**	**Result**
Time taken for t_{32} to reach 45.0°C and not subsequently drop below 42.0°C	(s)	14
Number of consecutive seconds where t_{32} > 55°C	(s)	0
Mean average volume flow, primary side	q_1 (l/s)	0.115

Table 29 - Module 7, Test 22 Performance Criteria

Module 7 - Test 22 Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if the DHW response time takes more than 15 seconds to reach 45.0°C (to one decimal place) at t_{32} while not dropping below 42.0°C (to one decimal place) thereafter	Pass
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass

Table 30 - Module 7 - Test 22 Best Practice

Module 7 – Test 22 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if DHW response time at t32 is less than 10 seconds	Not Achieved

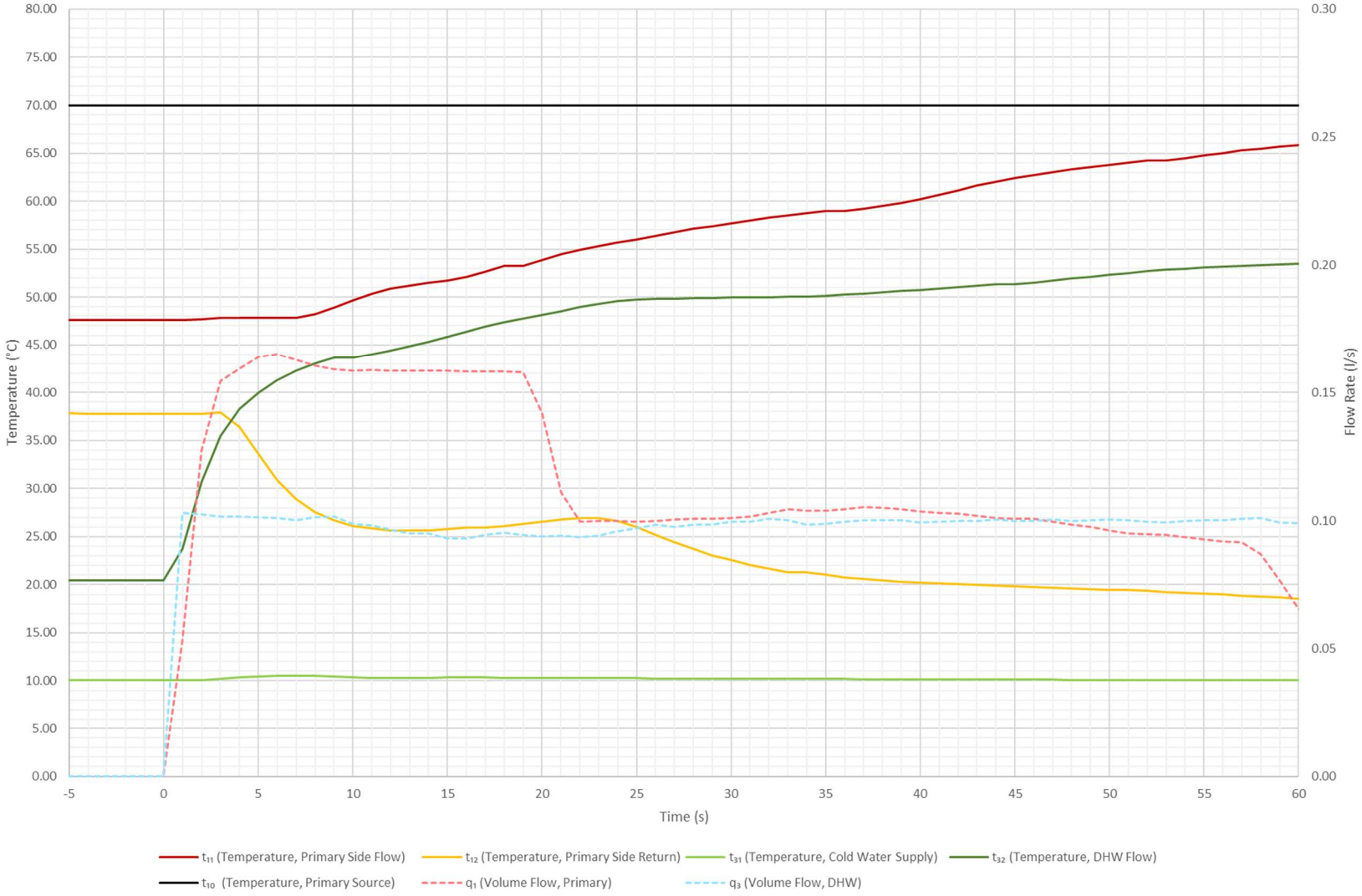

Figure 13 - Test 22a Key Metrics

9 TEST MODULE 8 – DHW, LOW TEMPERATURE, DH55-KWARM

9.1 Test Module 8 Information

9.1.1 Objective: To explore the performance of the HIU under changing loads, as would be the case in practical operation. Key performance criteria are speed and consistency of DHW delivery to the customer; DHW staying at a safe temperature at all times and the volume weighted average return temperature when supplying space heating or DHW.

9.1.2 The following set of tests are from test module 8 – Domestic Hot Water, Low Temperature, Keep Warm HOT WATER MODULE 8-DH55-KWarm.

Table 31 - Module 8 Tests

Module 8 Tests	
11b	DH/55C, DHW only, 50°C DHW, variable dP
12b	DH/55C, DHW Low Flow, 50°C DHW, 50kPa
12d	DH/55C, DHW Low Flow, 50°C DHW, 200kPa
13b	DH/55C, DHW Load Test, 50°C DHW
21b	DH/55C, DHW Keep Warm, 50°C DHW
22b	DH/55C, DHW Keep Warm Response Time, 50°C DHW

9.2 Test 11b Information

9.2.1 Objective: To investigate the performance of the HIU when delivering DHW, at a range of flow rates and differential pressures, given a 55°C primary flow temperature. The test investigates HIU operation in terms of DHW delivery and impacts on primary heat network return temperatures.

9.3 Test 11b Results

9.3.1 Performance criteria results can be seen in Table 33, Test result data can be seen in Table 32 and key metrics can be found in Figure 14. Best practice criteria can be found in table 34.

Table 32 - Module 8, Test 11b Results

Module 8 - Test 11b Results			
Parameter	**Symbol**	**Result**	
Maximum and minimum values of t_{32} when there is DHW flow	t_{32} (°C)	52.7	46.9
Number of consecutive seconds where t_{32} > 55°C	(s)	0	
Overall DHW Volume Weighted Avg. Return Temp	VWART (°C)	21.5	

Table 33 - Module 8, Test 11b Performance Criteria

Module 8 - Test 11b Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass
Fail if the VWART is above 27°C (to one decimal place)	Pass
Fail if the average DHW temperature (t_{32}) is not 50.0°C ±1°C (to one decimal place) for the final 150 seconds of each of the 180 second DHW flow periods	Pass
Fail if the DHW temperature (t_{32}) is not being maintained at 50.0°C ±3°C (to one decimal place) for >150 seconds of each of the DHW flow periods	Pass
Fail if the DHW temperature (t_{32}) drops below 45.0°C (to one decimal place) for more than 5 consecutive seconds, as this would impact resident comfort	Pass

Table 34 - Module 8 - Test 11 Best Practice

Module 8 – Test 11 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if the VWART is less than 20°C (to one decimal place)	Not Achieved
Best practice if the DHW temperature (t32) is being maintained at 50.0°C ±2°C throughout periods of DHW flow	Not Achieved
Best practice if the DHW temperature (t32) doesn't drop below 45.0°C (to one decimal place) for more than 2 consecutive seconds	Not Achieved

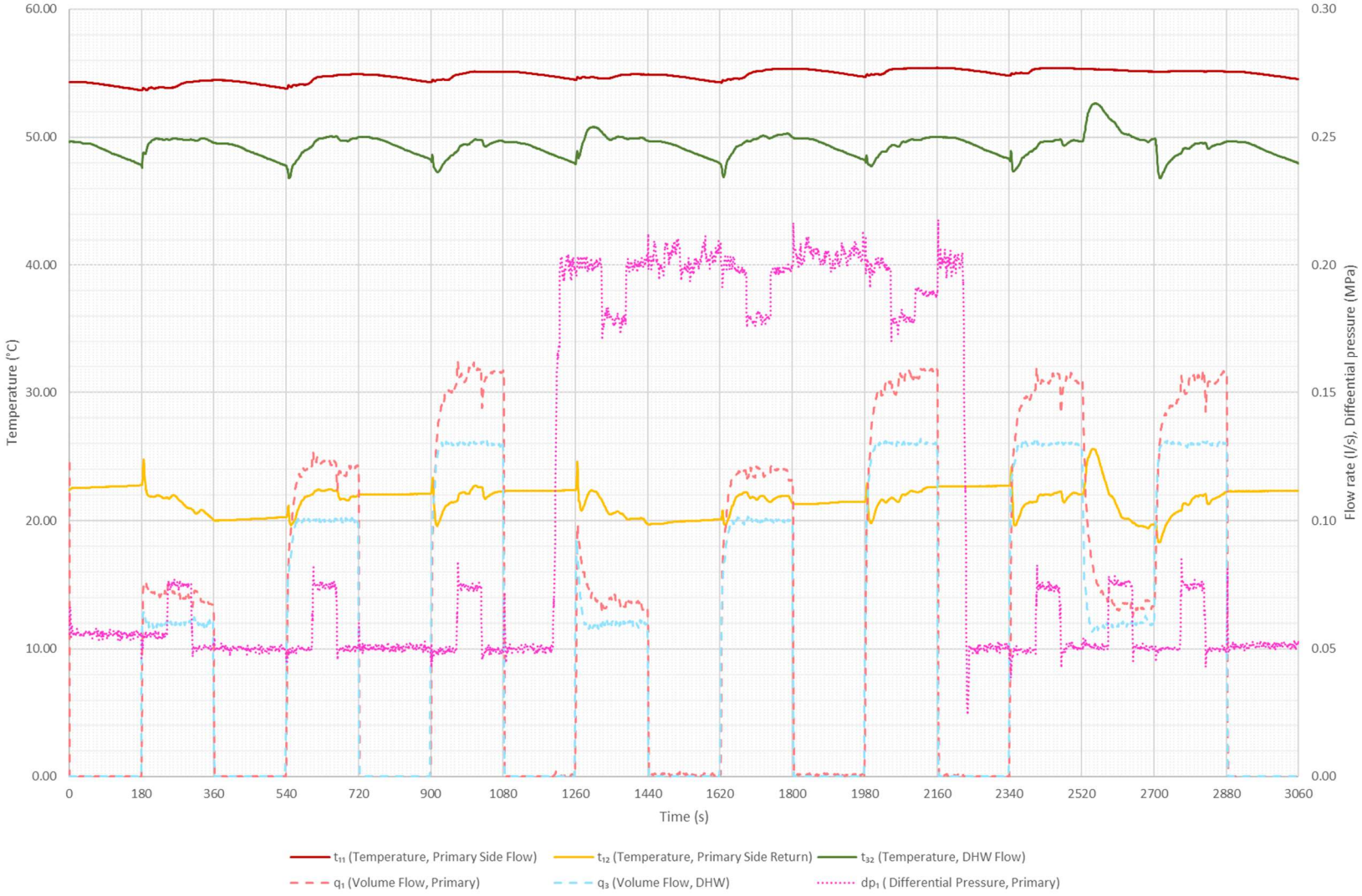

Figure 14 - Test 11b Key Metrics

9.4 Test 12b / 12d Information

9.4.1 Objective: To investigate the stability of DHW temperature at low flow rates. During operation, domestic hot water is sometimes drawn off at extremely low flow rates. Test 12 investigates the ability of the system to meet this condition by measuring the temperature at test point t_{32} at a flow rate of 0.02 l/s.

9.5 Test 12b / 12d Results

9.5.1 The HIU was able to deliver DHW at low flow rate above 45.0°C at the end of the 180 second period of low flow DHW.

9.5.2 The HIU was able to deliver stable DHW flow temperature (at t_{32}), defined as ability to maintain 50.0 ±3.0°C (1 decimal place) during the last 60 seconds of the test.

9.5.3 Performance criteria results can be seen in Table 36, Test result data can be seen in Table 35 and key metrics can be found in Figure 15 and Figure 16. Best practice criteria can be found in table 37.

Table 35 - Module 8, Test 12 Results

Module 8 - Test 12 Results					
Parameter	**Symbol**	**12b Result**		**12d Result**	
Maximum and minimum values of t_{32} when there is low DHW flow	t_{32} (°C)	52.3	49.0	53.0	50.4
Number of consecutive seconds where t_{32} > 55°C	(s)	0		0	

Table 36 - Module 8, Test 12 Performance Criteria

Module 8 - Test 12 Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass
Fail if DHW temperature (t_{32}) is not maintained at 50°C ±3°C (to one decimal place) for more than 60 seconds	Pass

Table 37 - Module 8 - Test 12 Best Practice

Module 8 – Test 12 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if DHW temperature (t32) is maintained at 50°C ±2°C (to one decimal place) throughout the test for both test 12b and 12d	Not Achieved

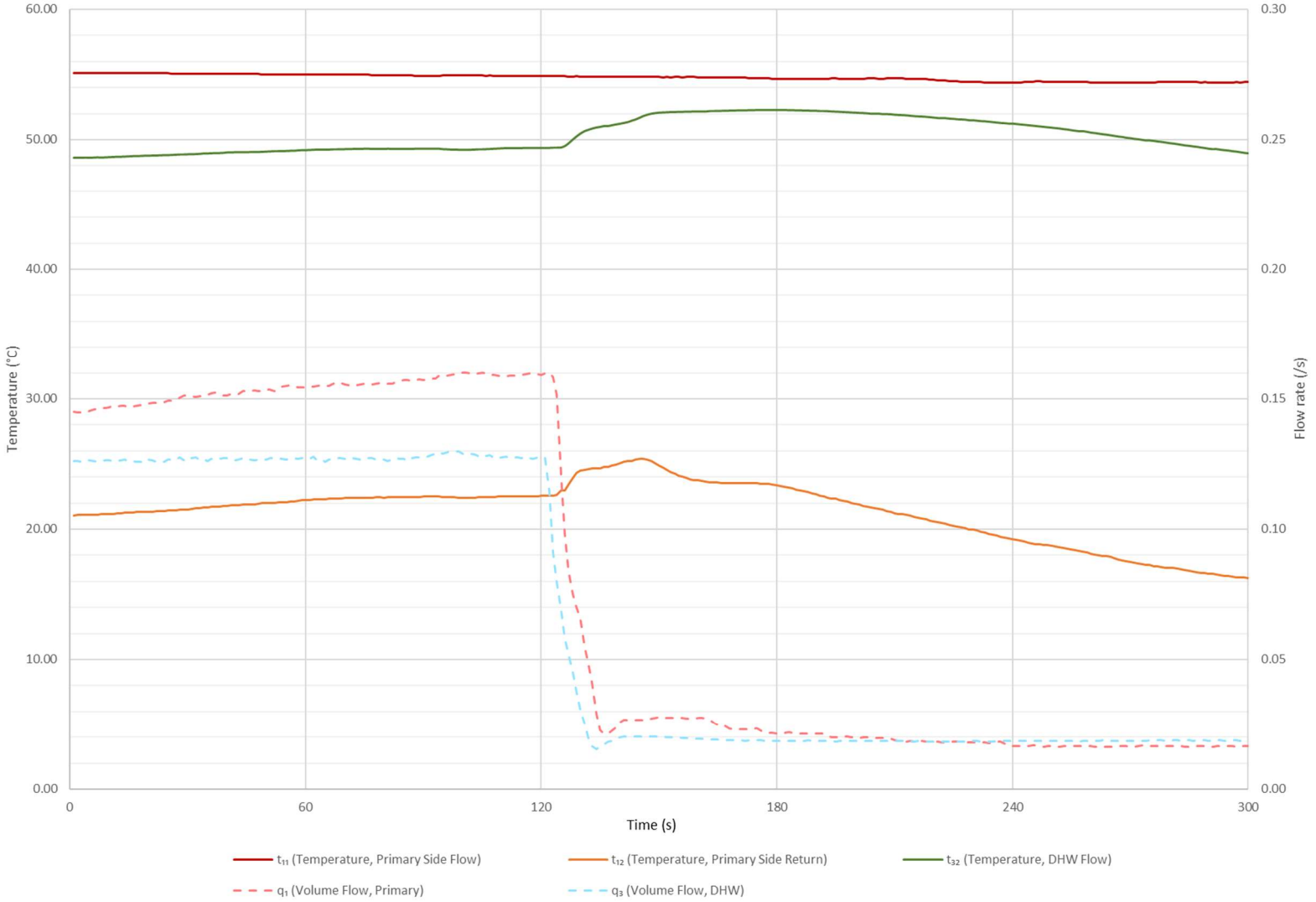

Figure 15 - Test 12b Key Metrics

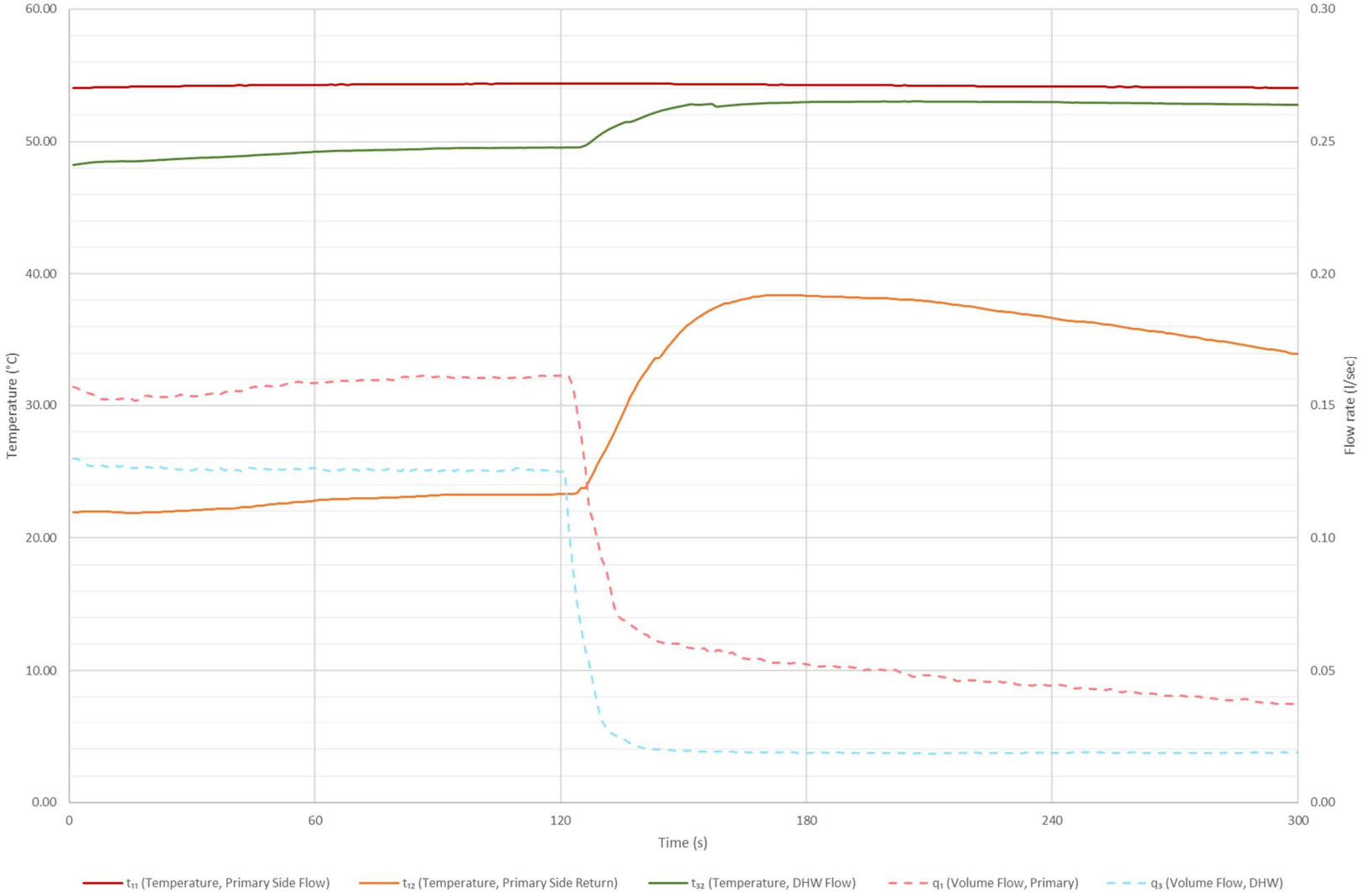

Figure 16 - Test 12d Key Metrics

9.6 Test 13b Information

9.6.1 Objective: To measure the maximum heat output (kW) and flow (l/sec) DHW output that can be delivered from the HIU. The HIU shall be set to deliver 50°C and the maximum DHW power output shall be measured with a flow step change and the peak value recorded when the DHW flow temperature is above 45°C.

9.7 Test 13b Results

9.7.1 The maximum DHW heat output was recorded as 36.99 kW, with a measured flow rate of 0.24 l/s, when producing minimum DHW at 45°C or above. (Temperature achieved at final step 46.2 °C).

9.7.2 The recorded DHW line pressure drop across the HIU was 59.05 kPa.

9.7.3 The number of consecutive seconds where t_{32} > 55°C was 0 seconds.

9.7.4 Performance criteria results can be seen in Table 38, Test result data can be seen in Table 39, key metrics can be found in Figure 17.

Table 38 - Module 8, Test 13 Performance Criteria

Module 8 - Test 13 Performance Criteria	
Performance Criteria, Fail if:	**PASS / FAIL**
Fail if DHW (at t_{32}) is less than 50°C ±1.0°C (to one decimal place) at 0.13 l/s flow rate, as the HIU must be able to produce DHW to the target temperature at a moderate load	Pass
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass

Table 39 - Module 8, Test 13b Results

Module 8 - Test 13b Results – Mean Average of Last 10 Seconds											
Parameter	**Symbol**	**0.15 l/s (25kW)**	**0.18 l/s (30kW)**	**0.21 l/s (35kW)**	**0.24 l/s (40kW)**	**0.27 l/s (45kW)**	**0.30 l/s (50kW)**	**0.33 l/s (55kW)**	**0.36 l/s (60kW)**	**0.39 l/s (65kW)**	**0.42 l/s (70kW)**
Temperature, primary side flow connection	t_{11} (°C)	55.4	55.4	55.3	55.2	54.9	N/A	N/A	N/A	N/A	N/A
Temperature, primary side return connection	t_{12} (°C)	20.6	20.5	20.3	20.5	19.9	N/A	N/A	N/A	N/A	N/A
Volume flow, primary side	q_1 (l/s)	0.166	0.195	0.225	0.255	0.270	N/A	N/A	N/A	N/A	N/A
Arithmetic mean of primary side power recorded during test	H_1 (kW)	24.25	28.53	32.97	36.99	39.53	N/A	N/A	N/A	N/A	N/A
Temperature, cold water supply	t_{31} (°C)	10.0	10.0	9.6	9.7	9.9	N/A	N/A	N/A	N/A	N/A
Temperature, domestic hot water flow from HIU	t_{32} (°C)	48.2	47.5	46.8	46.2	44.8	N/A	N/A	N/A	N/A	N/A
Volume flow, domestic hot water	q_3 (l/s)	0.150	0.180	0.210	0.240	0.270	N/A	N/A	N/A	N/A	N/A
Differential pressure, domestic hot water across HIU	dP_3 (kPa)	25	35	46	59	73	N/A	N/A	N/A	N/A	N/A
Arithmetic mean of DHW power recorded during test	H_3 (kW)	23.94	28.30	32.77	36.74	39.52	N/A	N/A	N/A	N/A	N/A

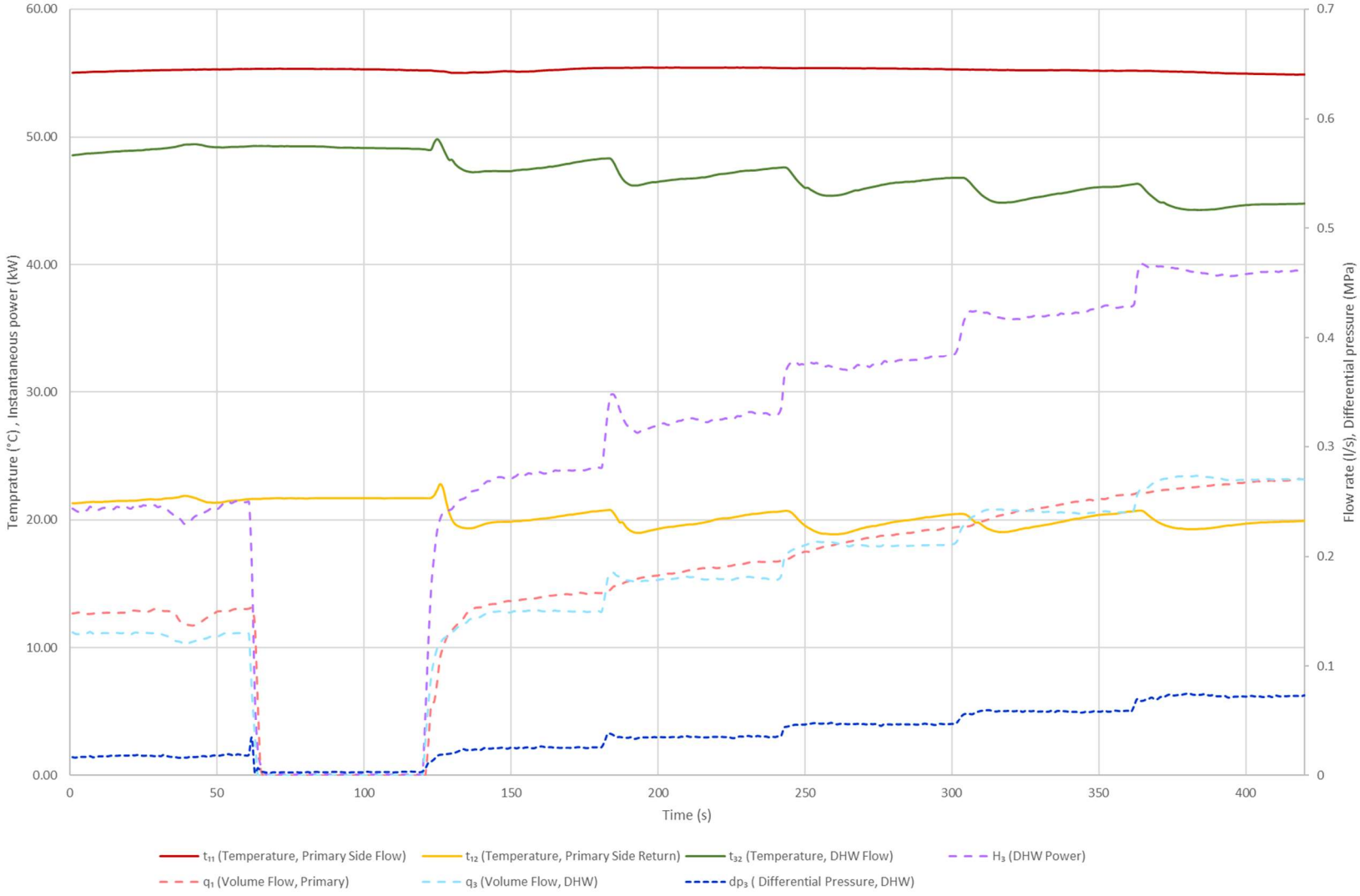

Figure 17 - Test 13b Key Metrics

9.8 Test 21b Information

9.8.1 Objective: To establish HIU performance during periods of no load, when operating in Keep Warm mode.

9.9 Test 21b Results

9.9.1 The Keep Warm operation is valid (based on Test 22b response time criteria).

9.9.2 The Keep Warm undergoes cycling (i.e. t_{11} varies by more than ±3 °C during the final 3 hours of the test).

9.9.3 Performance criteria results can be seen in Table 41, Test result data can be seen in Table 40 and key metrics can be found in Figure 18. Best practice criteria can be found in table 42.

Table 40 - Module 8, Test 21b Results

Module 8 - Test 21b Results		
Parameter	**Symbol**	**Result**
Mean average volume flow, primary side	q_1 (l/s)	0.0014
Mean average of primary side power recorded during test	H_1 (kW)	0.03
Mean average electrical energy use	$W_{electrical}$ (W)	1.85
Mean average thermal energy use	$W_{thermal}$ (W)	19.3
Overall energy loss per day	(kWh)	0.51
Overall Keep Warm Volume Weighted Avg. Return Temp	VWART (°C)	41

Table 41 - Module 8, Test 21 Performance Criteria

Module 8 - Test 21 Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if VWART is above 48°C (to one decimal place)	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass
Fail if the primary supply temperature to the HIU (t_{11}) drops to below 39°C	Pass
Fail if the HIU overall energy losses are greater than 1.0 kWh/day (to three decimal places)	Pass
Fail if the Test 22b DHW temperature response time test fails (i.e. the HIU Keep Warm operation is not a valid Keep Warm)	Pass

Table 42 - Module 8 - Test 21 Best Practice

Module 8 – Test 21 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if VWART is below 44°C (to one decimal place)	Achieved
Best practice if HIU overall energy losses are less than 0.7 kWh/day (to three decimal places)	Achieved

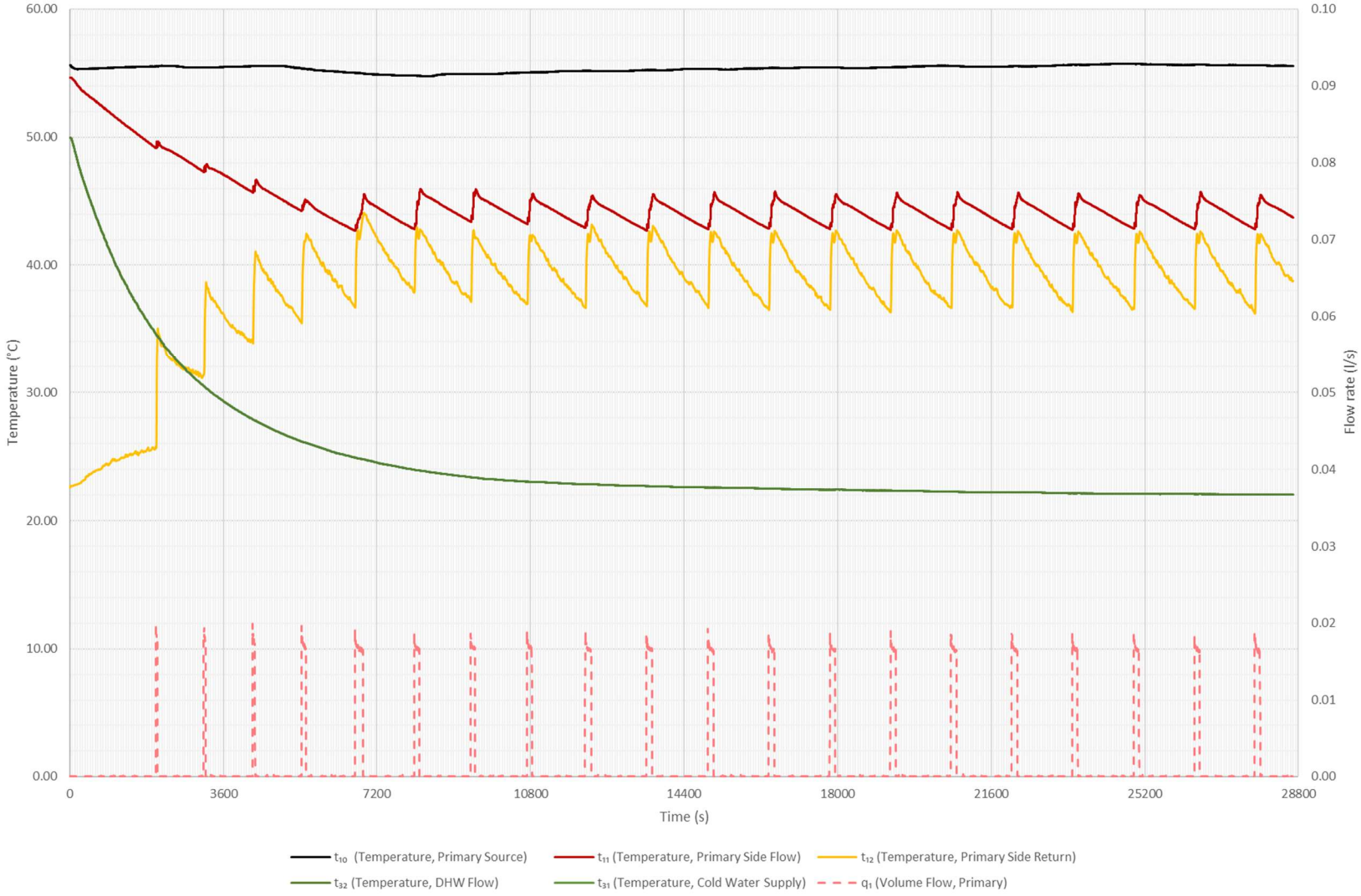

Figure 18 - Test 21b Key Metrics

9.10 Test 22b Information

9.10.1 Objective: To investigate DHW delivery time after a period of at least 8 hours Keep Warm only operation. This tests if the HIU can supply domestic hot water within an acceptable time of turning on the tap, which is a basic comfort requirement.

9.11 Test 22b Results

9.11.1 The Keep Warm operation is valid (based on response time criteria shown in Test 22 performance criteria).

9.11.2 Performance criteria results can be seen in Table 44, Test result data can be seen in Table 43 and key metrics can be found in Figure 19. Best practice criteria can be found in table 45.

Table 43 - Module 8, Test 22b Results

Module 8 - Test 22b Results		
Parameter	**Symbol**	**Result**
Time taken for t_{32} to reach 45.0°C and not subsequently drop below 42.0°C	(s)	15
Number of consecutive seconds where t_{32} > 55°C	(s)	0
Mean average volume flow, primary side	q_1 (l/s)	0.165

Table 44 - Module 8, Test 22 Performance Criteria

Module 8 - Test 22 Performance Criteria	
Performance Criteria, Fail if:	**PASS/FAIL**
Fail if the DHW response time takes more than 15 seconds to reach 45.0°C (to one decimal place) at t_{32} while not dropping below 42.0°C (to one decimal place) thereafter	Pass
Fail if DHW temperature (t_{32}) exceeds 60.0°C (to one decimal place) for more than 1 second, as this poses a scalding risk	Pass
Fail if primary return temperature (t_{12}) exceeds 55.0°C (to one decimal place) at any point, as this poses a scaling risk	Pass

Table 45 - Module 8 - Test 22 Best Practice

Module 8 – Test 21 – Best Practice Criteria	
Best Practice Criteria if:	**Best Practice**
Best practice if DHW response time at t32 is less than 10 seconds	Not Achieved

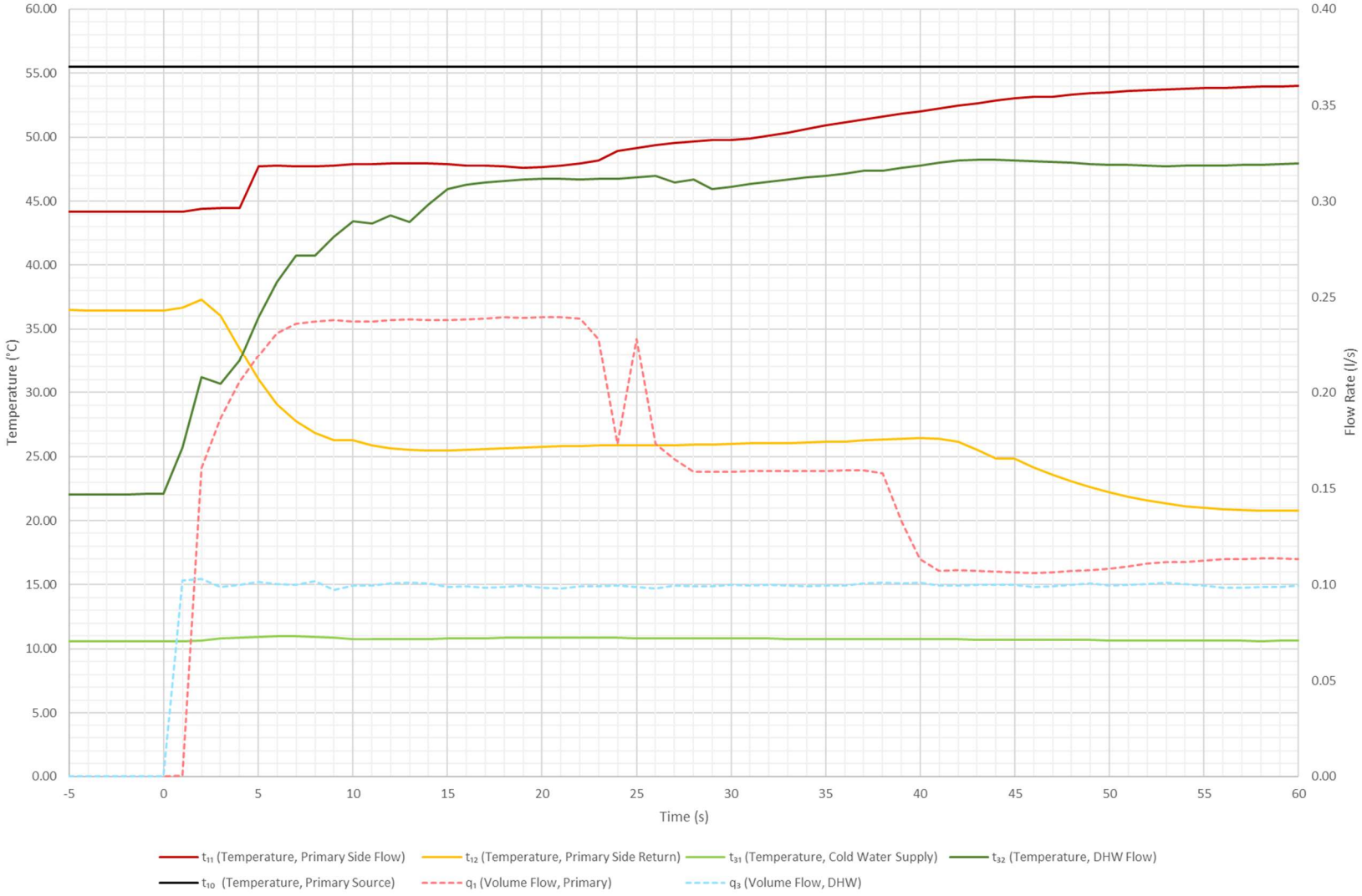

Figure 19 - Test 22b Key Metrics

10 CONCLUSIONS

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

10.1.1 The HIU has passed the requirements of the BESA UK HIU BESA Technical Standard for UK HIU Test Regime, V3-Rev001 September 2023.

11 EQUIPMENT AND INSTRUMENT LIST

EQUIPMENT NAME	ID NUMBER	CERTIFICATE NUMBER	MEASUREMENT UNCERTAINTY K=2	CALIBRATION DATE	CALIBRATION DUE
Cold Water Supply Probe	PRT 5002	CAL 000292	0.077 °C	27/04/2023	04/2024
DHW Outlet Probe	PRT 5003	CAL 000292	0.077 °C	27/04/2023	04/2024
Primary Inlet Probe	PRT 5004	CAL 000292	0.077 °C	27/04/2023	04/2024
Primary Return Probe	PRT 5005	CAL 000292	0.077 °C	27/04/2023	04/2024
SH Flow Probe	PRT 5006	CAL 000292	0.077 °C	27/04/2023	04/2024
SH Return Probe	PRT 5007	CAL 000292	0.077 °C	27/04/2023	04/2024
Primary Flow T[10]	PRT 5008	CAL 000292	0.077 °C	27/04/2023	04/2024
Flow Meter	FM 601	3953070009	0.006 l/sec	07/11/2022	04/2024
Flow Meter	FM 602	3953070011	0.0025 l/sec	09/11/2022	04/2024
Flow Meter	FM 603	3953070012	0.0046 l/sec	13/11/2022	04/2024
Flow Meter	FM 605	3953070010	0.001 l/sec	14/11/2022	04/2024
Pressure Transducer	PT 083	395307005	6.87 kPa	31/10/2022	04/2024
Pressure Transducer	PT 084	3953070003	8.33 kPa	18/10/2022	04/2024
Pressure Transducer	PT 085	3953070002	7.46 kPa	18/10/2022	04/2024
Pressure Transducer	PT 086	3953070004	7.23 kPa	18/10/2022	04/2024
Pressure Transducer	PT 087	3953070006	7.10 kPa	19/10/2022	04/2024
Pressure Transducer	PT 088	3953070007	6.54 kPa	19/10/2022	04/2024
Power Meter	PM 1022	3953070008	0.16 W	11/01/2023	01/2024
Pipe	PIPE 001	-	-	27/04/2024	04/2024

The reported expanded 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 BS EN ISO/IEC 17025:2017 requirements.

12 APPENDIX A

12.1 VWART Calculations for Modules 1 & 7

	VWART (°C)	Volume (m^3)
DHW	14	24.7
Standby	37	20.9
Space Heating	38	46.9

	VWART (°C)
Summer	25
Winter	32
Overall	28

	DHW Draw Test Results			Post DHW Draw (60 seconds)	
	Power (W)	Primary Flow (m^3/hr)	VWART (°C)	Primary Volume (m^3)	VWART (°C)
Low	9661	0.2	14	0.15	14
Medium	16291	0.3	15	0.02	14
High	21677	0.3	15	0.01	15

DHW Draw Volumes pa		
kWh pa	Hours	Volume pa (m^3)
729	75.46	11.6
297	18.23	4.7
444	20.48	7.0

Post DHW Draw Volumes pa	
Events pa	Volume pa (m^3)
10000	1.461
660	0.014
300	0.002

Standby Test Results	
Primary Flow (m^3/hr)	VWART (°C)
0.0028	37

Standby Volumes pa	
Hours	Volume pa (m^3)
7497	20.884

	Space Heating					
	Power (W)	Primary Flow (m^3/hr)	VWART (°C)	kWh pa	Hours	Volume pa (m^3)
0.5kW	481	0.019	38	98	204	3.88
1kW	984	0.034	38	787	800	26.94
4kW	3953	0.113	39	565	143	16.10

12.1.1 It should be noted that all VWART figures are to within ±2°C tolerance.

12.2 VWART Calculations for Modules 2 & 8

	VWART (°C)	Volume (m^3)
DHW	21	41.4
Standby	41	37.4
Space Heating	37	71.5

	VWART (°C)
Summer	31
Winter	34
Overall	32

	DHW Draw Test Results			Post DHW Draw (60 seconds)	
	Power (W)	Primary Flow (m^3/hr)	VWART (°C)	Primary Volume (m^3)	VWART (°C)
Low	9955	0.3	21	0.37	20
Medium	15890	0.4	22	0.11	22
High	20704	0.5	22	0.07	23

DHW Draw Volumes pa		
kWh pa	Hours	Volume pa (m^3)
729	73.23	18.3
297	18.69	7.8
444	21.45	11.5

Post DHW Draw Volumes pa	
Events pa	Volume pa (m^3)
10000	3.674
660	0.070
300	0.022

Standby Test Results	
Primary Flow (m^3/hr)	VWART (°C)
0.005	41

Standby Volumes pa	
Hours	Volume pa (m^3)
7478	37.381

	Space Heating					
	Power (W)	Primary Flow (m^3/hr)	VWART (°C)	kWh pa	Hours	Volume pa (m^3)
0.5kW	514	0.027	37	98	191	5.17
1kW	944	0.046	36	787	834	37.96
4kW	3965	0.199	37	565	142	28.40

12.2.1 It should be noted that all VWART figures are to within ±2°C tolerance.

13 APPENDIX B

13.1 Appliance Documentation

13.1.1 The details of the appliance documentation are given in Table 46 below.

Table 46 - Appliance Documentation

#	Component:	Document Submitted (Y/N):	Manufacturer and type:
1	Space Heating Heat Exchanger	Y	ZILMET ZB315 13 PLATES
2	Domestic Hot Water Heat Exchanger	Y	ZILMET ZA315 41 PLATES
3	Controller for Space Heating	Y	PACTROL 434300
4	Control Valve and Actuator for Space Heating	Y	FRESE PICV OPTIMA COMPACT DN15 AND FRESE FAST ACTING ACTUATOR STEPPER 5V
5	Space Heating Strainer	Y	NOVASFER 0,5 mm
6	Controller for Domestic Hot Water	Y	PACTROL 434300
7	Control Valve and Actuator for Domestic Hot Water	Y	FRESE PICV OPTIMA COMPACT DN15 AND FRESE FAST ACTING ACTUATOR STEPPER 5V
8	Temperature Sensors	Y	T&P NTC R25=10kΩ
9	Domestic Hot Water Isolating Valve	Y	NA
10	Primary Side Strainer	Y	NOVASFER 0,5 mm
11	Drain Valves	Y	NOVASFER ¼”
12	Vent Valves	Y	NOVASFER ¼”
13	Circulation Pump set with AAV & PRV	Y	GRUNDFOS UPM3 PWM 15-70
14	Heat Meter	Y	NA
15	Domestic Hot Water Flow Sensor	Y	SIKA VTY10
16	Pipes	Y	NOVASFER COPPER
17	Connections	Y	NOVASFER
18	Joints	Y	NOVASFER
19	Gaskets	Y	KLINGERSIL
20	Expansion Vessel	Y	ZILMET OEM-PRO 9L
21	Insulation	Y	TROCELLEN
22	Pressure Sensors	Y	HUBA 505
A1	‘O’ Ring	Y	EPDM70

A2	Operation Guide	Y	Manual (Commissioning guide included)
A3	Declaration of Conformity	Y	Supplied.
A4	Full Parameter List	Y	Supplied.
A5	Maximum Primary Static Operating Differential Pressure	Y	600 kPa
	Software Version	Y	V105-23
	Model Name and Type Number	Y	199P35007
	Serial Number	Y	202329065
	Any other components stated by manufacturer	N	

13.2 **Appliance Photographs**

Figure 20 - HIU with outer case fitted

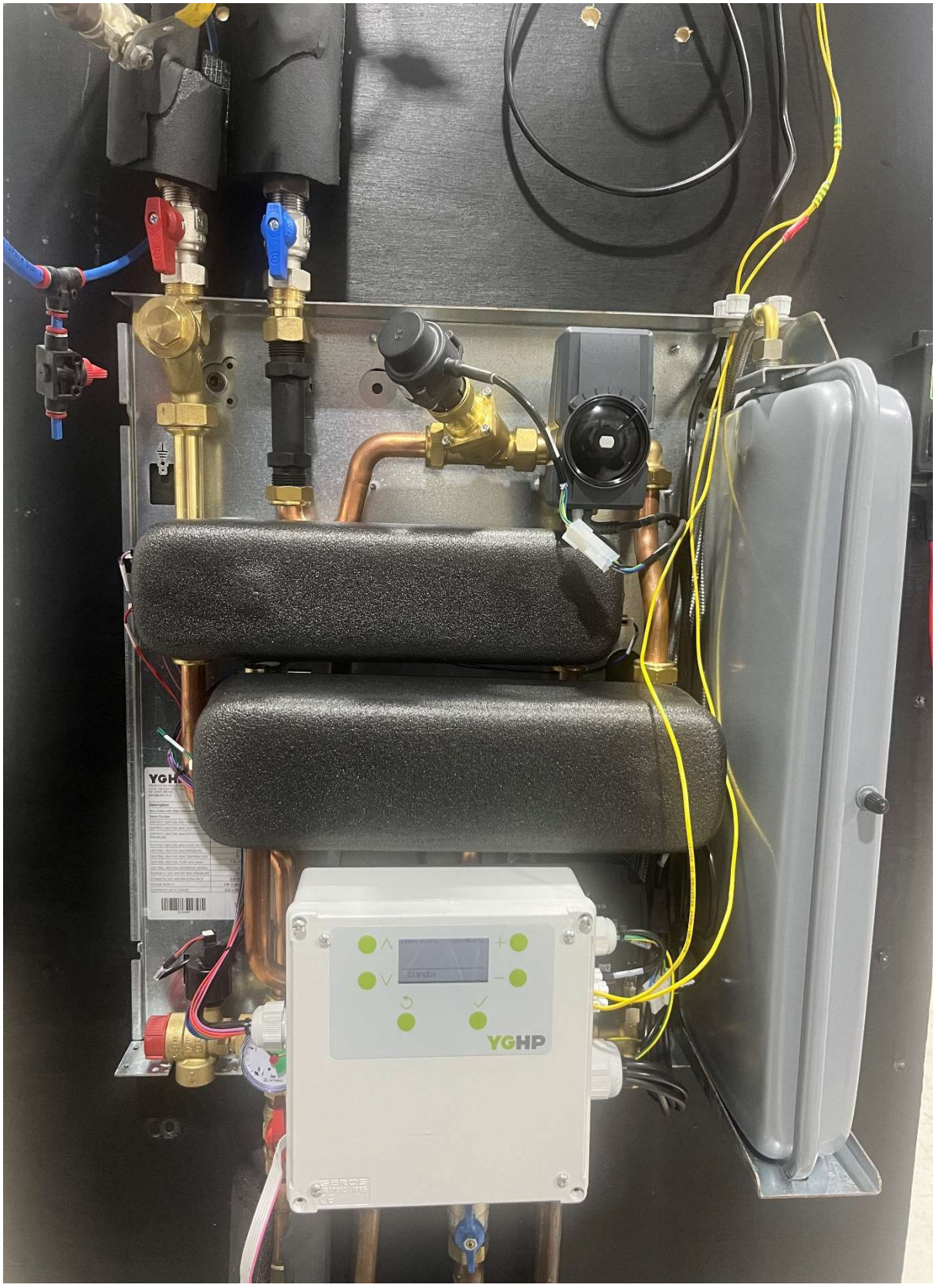

Figure 21 - HIU with outer case removed

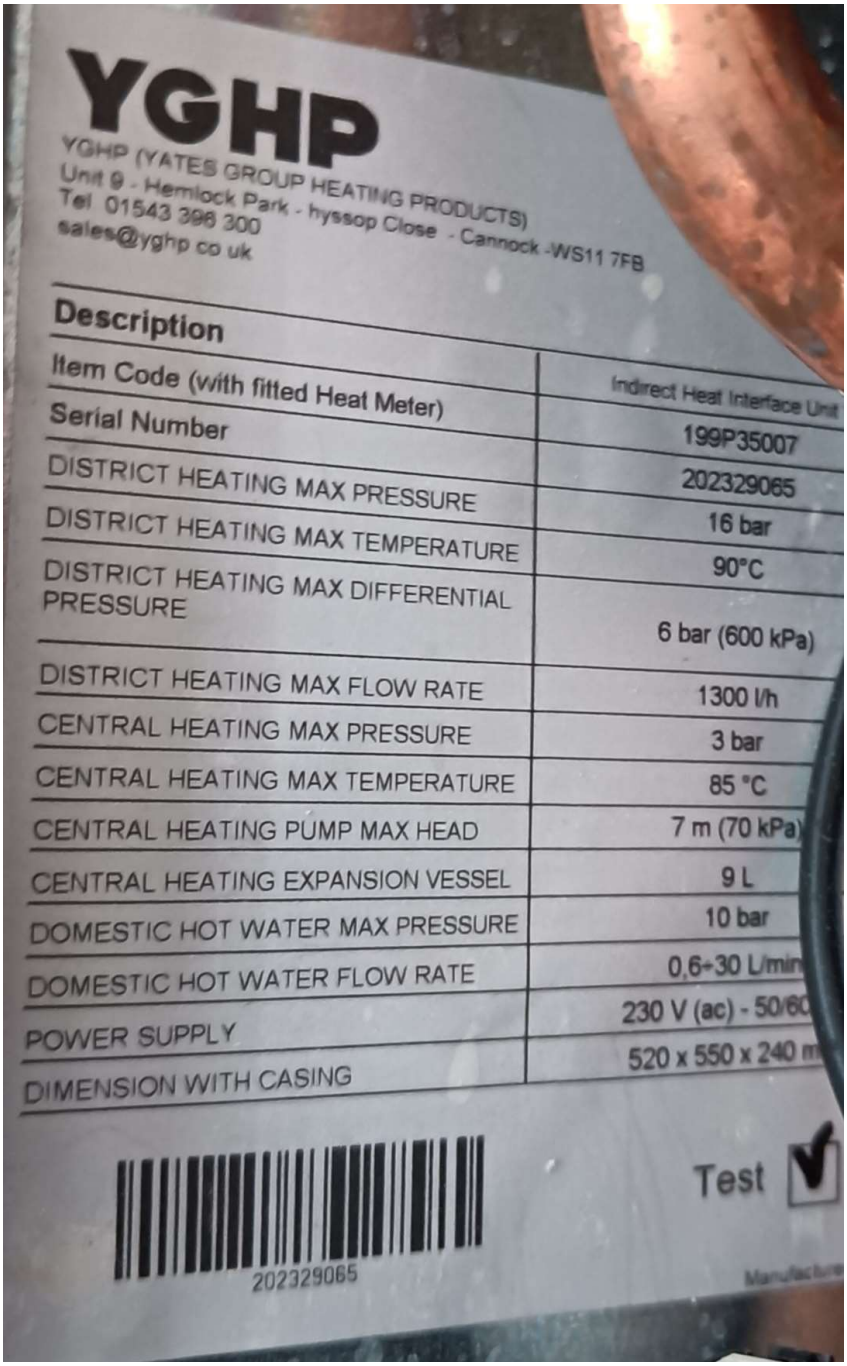

Figure 22 - Data Label

14 APPENDIX C

14.1 UK Declaration of Conformity

EMERSON
Climate Technologies

Supplier's Declaration of Conformity

In accordance with BS EN ISO/IEC 17050-1: 2010

No. 433600-2-17050-1:2010

Pactrol Controls Limited
Unit 3 The Three Sisters Enterprise Park
Antler Court,
Ashton-In-Makerfield
Wigan
WN4 8DU
United Kingdom

Tel: +44 (0) 1942 529240
Fax: +44 (0) 1942 529241

Object of the declaration:

Product Description	Pactrol Heating Interface Unit Control (HIU)
Product Number	433600 (Project reference X419)

The object of the declaration described above is in conformity with the requirements of the following directive(s):

2014/35/EU	**The Low Voltage Directive** and its amending directives

and has been designed and manufactured to the following specifications:

EN 60730-1:2016	Automatic electrical controls: General requirements.

Additional Information:

This declaration is not valid for controls with issue levels DEV1 to DEV4.

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above reference specifications. The unit complies with all the essential requirements of the Directives.

Authorised Signature:

Lee Washbourn
R&D Manager
Unit 3 The Three Sisters Enterprise Park
Antler Court,
Ashton-In-Makerfield
WN4 8DU

Issue Date:
21/06/18

PACTROL CONTROLS White Rodgers

A White-Rodgers Company
Reg. Office Unit 3, The Three Sisters Enterprise Park, Antler Court, Ashton-In-Makerfield, Wigan WN4 8DU
Registered in England No. 949364
VAT No. GB 151 9885 34

Figure 23 - UK declaration of conformity

14.2 Water Regulation 4 Certificate

Awaiting REG4 Certification, evidence supplied.

Figure 24 - Water regulation 4 certificate

15 BIBLIOGRAPHY

[1] *BESA (Building Engineering Services Association) UK HIU (Heat Interface Unit) Test regime Technical Specification*, V3-Rev001 September 2023

[2] *Technical Standard for UK HIU Test Regime - Space Heating, High Temperature, Indirect HEATING MODULE 1-DH70 Indirect*, Version 1: 2023

[3] *Technical Standard for UK HIU Test Regime - Space Heating, Low Temperature, Indirect HEATING MODULE 2-DH55 Indirect*, Version 1: 2023

[4] *Technical Standard for UK HIU Test Regime - Domestic Hot Water, High Temperature, Keep Warm HOT WATER MODULE 7-DH70-KWarm*, Version 1: 2023

[5] *Technical Standard for UK HIU Test Regime - Domestic Hot Water, Low Temperature, Keep Warm HOT WATER MODULE 8-DH55-KWarm*, Version 1: 2023

Report Issue No	Reason for Report Update
1	Original issue

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HHIC HEATING & HOTWATER INDUSTRY COUNCIL