

Test Module 3

Space Heating, High Temperature, Direct, No Mix Down
HEATING MODULE 3–DH70 Direct No Mix Down

HM3–DH70C

Our Mission Statement: *“To improve the performance of residential HIUs across the UK.”*

Revision History

Revision number	Comments	Author	Approver	Date
VI-Rev001	Final version of test module for publication alongside the third edition of the Technical Standard for UK HIU Test Regime	Technical Committee	Steering Group	01/09/2023

1. INTRODUCTION

This document forms part of the UK Test Standard for Heat Interface Units that has been developed to assess the role and performance of HIUs in UK heat networks.

BESA Technical Standard for UK HIU Test Regime (2023) sets out the overall Test Standard requirements. In order to avoid having to repeat successful tests, the tests have been bundled into ‘modules’. This sub document covers MODULE 3 that comprises a series of tests, as set out below. Readers should refer to the main test document to understand how the tests and modules fit together within the overall Test Standard.

2. SCOPE

This document covers the tests required for registration under

MODULE 3, covering HIUs supplying Space Heating at High Temperature, Directly, No Mix Down.

The module code is:

HM3–DH70C – HEATING MODULE 3–DH70 Direct No Mix Down.

This module only applies to HIUs:

TYPE 2 HD/HWI

TYPE 6 HD

Pass/fail and best practice thresholds for these HIUs are shown below.

This module can be combined with DHW modules M7 or M9 for TYPE 2 HIUs.

3. TESTS TO BE CARRIED OUT

The following tests shall be carried out in this module.

M3.3.1 **Objective:** Perform static/steady state testing in order to investigate the performance characteristics of the HIU when meeting a specified space heating load.

M3.3.2 The primary differential pressure shall vary between 50 kPa and 200 kPa. The test rig shall control primary differential pressure to the set point $\pm 4\%$.

Note that in all plotting of graphs when reporting, dP will be converted into MPa to ensure that dP has

a similar magnitude to flow rate values (in l/s) and can therefore share the same axis, with temperature on a separate axis.

Note: The static tests data shall be recorded for a minimum of 300 seconds once HIU and test rig operation has stabilised. The results shall then be presented in table form derived from the mean average over the test period, as well as a plot of the key metrics for the same time period.

All tests shall include the following:

- M3.3.3 **Parameter recording** – there are several sensors across the test rig as well as instantaneous power values that shall be calculated from these sensor recordings. Only some of these will be required to be reported and plotted in graphs (see Reporting box at the end of the test module sections). However all sensors and calculated values shall be recorded for the duration of all tests and made available to the Technical Lead for analysis.
- M3.3.4 **Electrical consumption** – the maximum and average electrical consumption shall be measured throughout the test (in Watts $\pm 1\%$) along with the derived electrical losses. Electrical elements and other components not within the standard definition of a HIU shall be recorded in the HIU list of components and recorded as an extra line item of measured electrical consumption. The electrical consumption values will not be reported on but will be made available to the Technical Lead for analysis.

Tests 02a, 02b & 02c – Direct heating HIU, no mix down, space heating circuit capacity (High Primary Temperature)

02a	DH/70C, Space Heating Direct, No Mix Down 0.5 kW, 70/35°C tertiary
02b	DH/70C, Space Heating Direct, No Mix Down 1 kW, 70/35°C tertiary
02c	DH/70C, Space Heating Direct, No Mix Down 4 kW, 70/35°C tertiary

- M3.3.5 **Objective** – To perform static testing in order to investigate the performance characteristics of the HIU when directly meeting a space-heating load without temperature mix down (i.e. without a mix down valve), given a 70°C/35°C tertiary heating circuit and 70°C primary flow temperature.
- M3.3.6 **Scope** – this test includes HIUs that directly supply water from the primary heat network to the apartment heating circuit with no temperature control and no pump. The HIU shall have means of controlling the dP reaching the tertiary circuit, protecting it from the changes in primary dP.

These Direct HIUs without mix down but with High Primary Temperature are NOT APPLICABLE for new build situations that fall under the Building Regulations Part L requirement for radiators at 55°C. High temperature direct HIUs are only applicable for retrofit projects where existing high temperature radiators will remain. For example, projects with hot water cylinders being removed and replaced with direct HIUs without changes to radiators. They might also be used on projects with localised mixdown at an UFH manifold.

Note: This HIU type does not include temperature control, and therefore, the temperature measurements during the test are irrelevant for the performance of the HIU. Hence, the test goal is to monitor the dP control, and the impact of this on the HIU flow rate. The static test data shall be recorded for a minimum of 300 seconds once the HIU and test rig operation has stabilised. The test shall be performed with modulating dP on the primary side, while flow rate and tertiary dP is recorded.

M3.3.7 The test shall be performed at 70°C. The temperature shall be recorded but not reported.

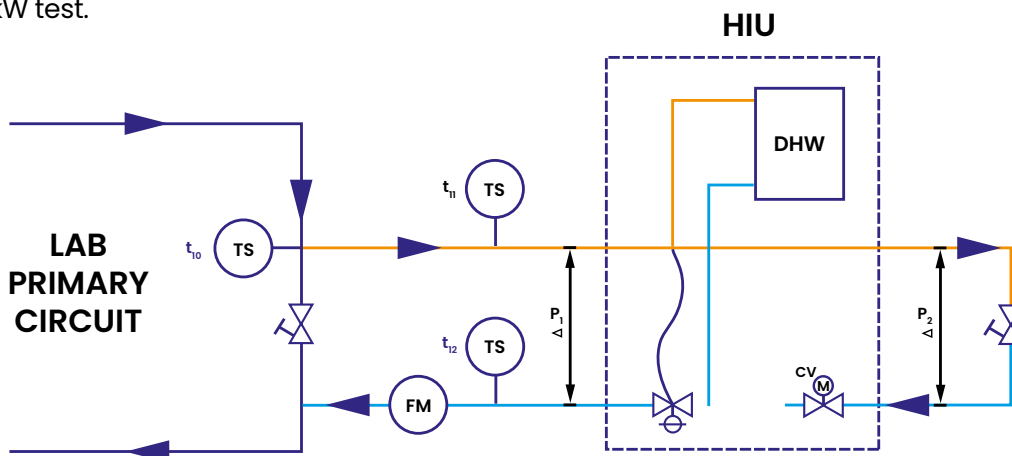
M3.3.8 This heating test represents the HIU performing at the following design conditions, shown in Table 1.

Test	kW	Primary flow temperature (°C)	Tertiary temperature profile (°C)	Flow rate (l/s)
02a	0.5	70	70/35	0.0034
02b	1	70	70/35	0.0068
02c	4	70	70/35	0.027

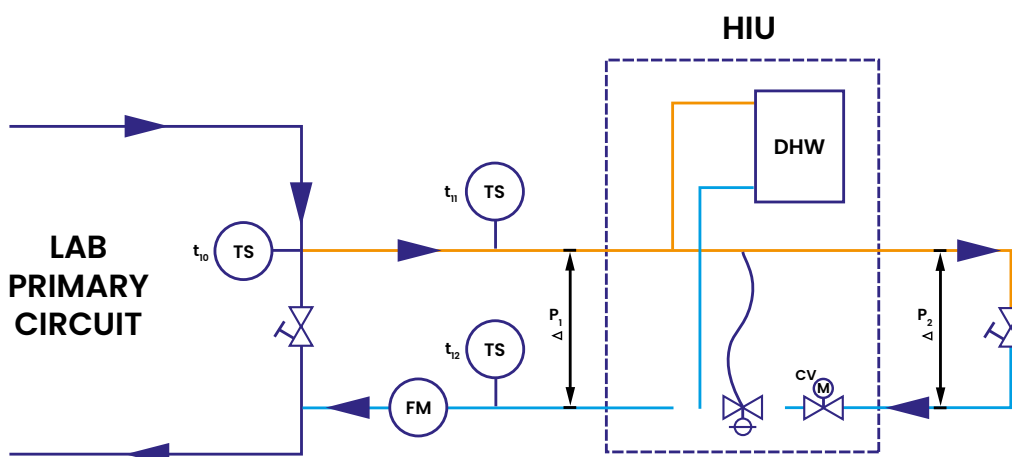
M3 Table 1 – Design conditions for tests 2a, 2b and 2c

M3.3.9 There are two types of direct HIU, depending on the dP control:

1. HIUs that include a **common dP control for DHW and heating** service on the primary (as shown in Figure 1). This HIU heating test is directly linked to a setting that affects DHW performance. Heating tests for this type of HIU shall be carried out with the same DPCV setting that is used on DHW tests. Therefore, once commissioned for one test, it shall not be modified for the remaining tests. These HIU dP settings shall be set in accordance with the manufacturer's instructions.
2. HIUs that include a **separate dP control for DHW and heating** (as shown in Figure 2). The heating DPCV setting in these HIUs does not affect DHW performance and their DHW and heating test modules are independent. Commissioning of the DPCV in these units is detailed in M3.3.10 as it will need to be carried out in tandem with commissioning the DRV at the start of the 4 kW test.



M3 Figure 1 – Direct heating HIU with common DHW and heating dP control and no heating mix down

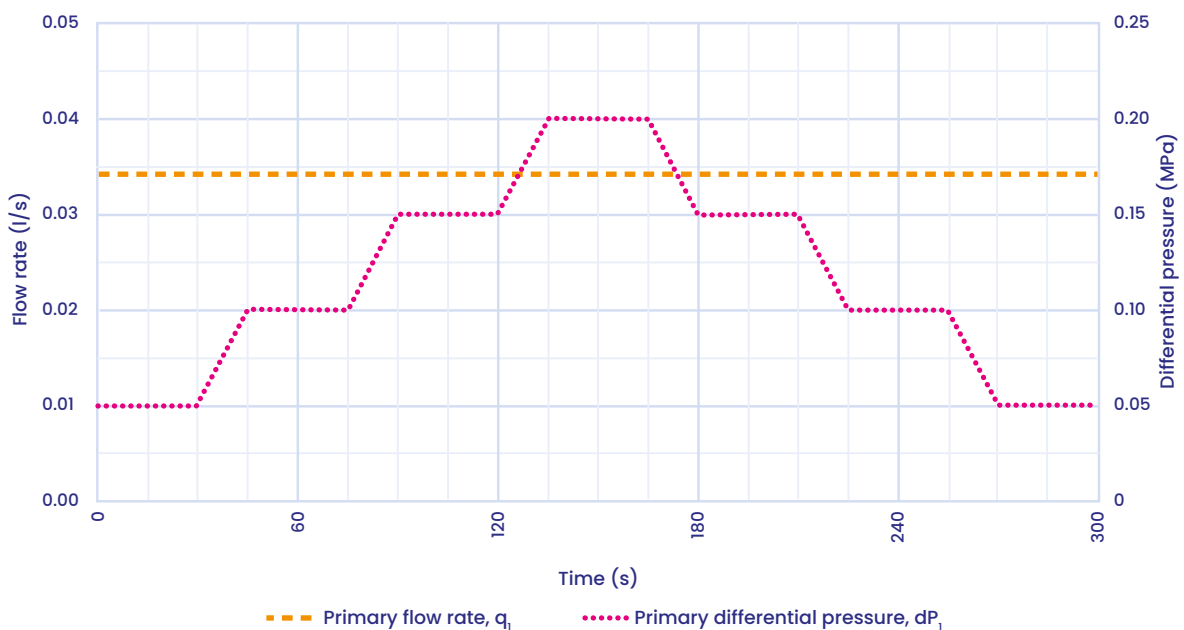


M3 Figure 2 – Direct heating HIU with independent heating dP control and no heating mix down

M3.3.10 The test rig shall include a DRV that shall simulate the pressure drop of the tertiary circuits. The commissioning of this shall be as follows, starting with the 4 kW heating test (test 02c) for both of the above configurations of HIU:

- For HIUs with a common DPCV, the DPCV shall be commissioned during the hot water tests and the DRV shall be adjusted to achieve the flow corresponding to a 4 kW demand (0.027 l/s), with 50 ± 2 kPa on the primary side. The DPCV shall not be touched during this. For HIUs with an independent heating DPCV, the DPCV shall be commissioned to achieve 20 kPa on the tertiary side, with 50 ± 2 kPa on the primary side. The test rig DRV should be adjusted at this condition to achieve the flow corresponding to a 4 kW demand (0.027 l/s). This process might follow some interactions between HIU DPCV commissioning and the test rig DRV commissioning. Once the conditions are achieved then the HIU DPCV shall not be touched again.
- Following the 4 kW test, the 1 kW (test 02b) and 0.5 kW (test 02a) tests shall follow, not necessarily in that order. Before each of these, the test rig DRV shall be commissioned to achieve the corresponding test flow rates (0.0068 l/s and 0.0034 l/s) with 50 ± 2 kPa on the primary side.

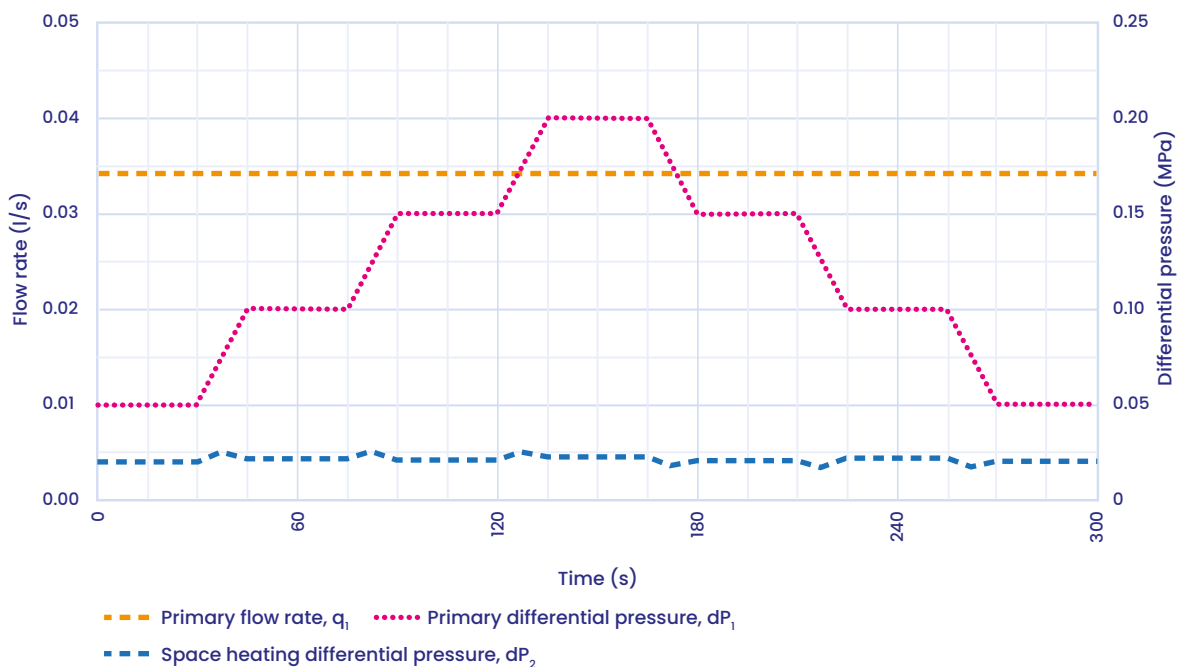
M3.3.11 Once the flow conditions are achieved with the test rig DRV, the test shall start with 50 kPa and shall increase in steps of 50 kPa up to 2 bar, and then drop back to 50 kPa in 50 kPa steps. Each step shall last 30 second at set-point, and the dP transition shall last 15 seconds, as per the profile shown in Figure 3.



M3 Figure 3 –Differential pressure test profile, also displaying primary flow rate (note that the primary flow rate shown is for demonstration purposes only as it displays the primary flow rate for Test 02c)

M3.3.12 Results shall be presented in two forms:

- A table including mean average values of q_2 , dP_2 over the duration of each test, plus maximum and minimum dP_2 . The table shall also show percentage values of the maximum dP_2 variation from initial setting, and the percentage deviation of the design q_2 flow values in Table 1.
- A graph over the duration of each test showing dP_1 , dP_2 , q_2 similar to the example profile in Figure 4.



M3 Figure 4 – Example test output profile (note that the primary flow rate shown is for demonstration purposes only as it displays the primary flow rate for Test 02c)

Pass/Fail Criteria

TEST 02 – Direct heating HIU, no mix down, static testing of space heating circuit capacity

Fail if the heating differential pressure, dP_2 , drops below 10 kPa or rises above 60 kPa (to one decimal place) at any point in the test.

4. TEST OUTPUTS

M3.4.1 A test report shall be prepared using the standardised BESA output template shown in the main test document. The test will provide the following outputs:

Reporting

TEST 02 – Indirect heating HIU static testing of space heating circuit capacity Report on the following values for each test:

A table including mean average values of q_2 , dP_2 over the duration of each test.

Maximum and minimum values of dP_2 .

Percentage values of the maximum dP_2 variation from initial setting, and the percentage deviation of the design q_2 flow values in Table 1.

Plot graph of following key metrics for each test:

dP_1 , dP_2 , q_2 over the duration of each test.

No part of this work or works may be translated, reprinted or reproduced, or utilised in any form either in whole or in part or by any means, including electronic, mechanical or other means, now known or invented in the future, including photocopying, recording or otherwise, or in any information storage and retrieval system, without the prior written permission of the Building Engineering Services Association, except in accordance with permitted uses and provisions of the Copyright, Designs and Patents Act 1988.

Neither the authors nor The Building Engineering Services Association accept any responsibility for loss occasioned to any person or business acting or refraining from acting as a result of material contained in this work.

First edition 2016, Second edition 2018, Third edition 2023.

©2023 BESA All rights reserved.