

Technical Note			TN-013
Test: Space heating test			Test no.: 1a to 1f
Assumption: Simulated space heat outputs			Assumption no: 006
Rev: 01	Date: 26/10/2020	Author: Josu Aurrekoetxea	Checked:

1. Introduction

Current space heating test includes 1kW, 2kW and 4kW tests representing low, medium and high demand conditions of a regular apartment. These conditions are considered typical in normal size apartments, however, some operators have observed in live systems an important drop in performance in some HIUs when the demand is smaller than 1kW, and therefore, it has been proposed to reduce the low demand to 0.5kW power.

This technical note will analyse the representativeness of the selected power values of the low demand and medium demand heating tests.

2. Consideration 1 oversizing of the plate heat exchanger (PHE)

During the design period, it is generally accepted that the PHE must be selected to meet the highest power conditions. Due to this consideration the district heating industry tends to oversize PHEs. However, while meeting the maximum demand conditions is necessary, it is also important that the PHE performs reasonably well at low demand conditions.

PHEs designed for sized for very high power could have very low turbulence when operating with much smaller flows. This could mean a low heat exchange due to the low turbulence, and as a consequence much higher flows on the primary with higher return temperatures. Therefore, it is relevant to test the PHE at the lowest expected power.

A test house briefly tested 2 different HIUs at 0.5kW conditions while doing their Besa test. The results weren't recorded but the results showed one of the HIUs performing similarly as at 1kW test while the other HIU had a significant jump in return temperature. This proves that the 0.5kW test would be relevant.

3. Consideration 2 low demand conditions

The lowest demand possible in a typical apartment set up is the living room radiator. This radiator is controlled directly by the room controller and therefore is the only one that doesn't include a TRV to close the radiator. The minimum demand will happen when all TRVs on the rest of the radiators are closed but the living room thermostat is still demanding heat.

These radiators' size depends on the size of the living room itself, and therefore, the power of the radiator will change from one apartment to the other, but typically it will be smaller than 1kW power.

It is possible to have lower than 1kW demand inside an apartment but to consider lower values for the test it will need to be analysed how often the apartments run with close to 0.5kW demands. In order to do that real apartment data was analysed looking for typical low demand conditions. Following snapshots belong to real apartments in London:





These graphs show that the typical minimum demand conditions are between 0.4 kW and 0.6kW approximately. They also show that the demand at around 0.5kW happen quite regularly during periods of the heating season.

4. Consideration 3: Test houses

Test houses consider 0.5 kW test a challenge because at that low power the test rig takes more time to achieve stable conditions and there is a risk of doing the test longer. However, if the power tolerance is increased to $\pm 0.1\text{kW}$ the test could be performed reasonably fast .

Since 0.5kW test replaces another heating test the change should not affect the cost of the test.

5. Consideration 4: medium power test

Since the results of 2kW and 4 kW tests are very similar on the tests published so far it is proposed to test 1kW as the medium power test and drop the 2kW test.

6. Consideration 5: maximum heating power of the HIU

A manufacturer raised the concern having 0.5kW heating test included. If a HIU is designed to cover high heating demands the result of a 0.5kW test will be considerably worse.

While this concern is true, it is considered that the purpose of the test is to show real operating conditions. Heating demands that require very high heating outputs only will be necessary for very big pent houses and refurbished listed buildings. The amount of this developments is marginal comparing with new build apartments.

7. Conclusions

Testing a PHE at its lowest operating conditions is relevant to see real performance. Real live information confirms that demands on the range of 0.5 kW happen regularly.

The test conditions are achievable on the test rigs but a bigger tolerance is required.

For medium power test is recommended to test 1kW test instead of 2kW.

8. Recommendation

It is recommended to change test 1a and 1d from 1kW to 0.5kW, tests 1b and 1e from 2kW to 1 kW, while tests 1c and 1f remain 4kW.