Technical Note			TN-029
Test: Keep Warm – Scaling Assessment			**Test no.:** 4
Assumption: During keep-warm test t12 shall not exceed 50oC if the keep-warm flow passes through the DHW heat exchanger.			**Assumption no:** 68
Rev: 03	**Date:** 22/11/2021	**Author:** Dmitriy Mostovoy	**Checked:** Steffan Cook (6th -1-2022)

1. Introduction

During the keep-warm test, heat flows down the primary and into the DHW heat exchanger (depending on design) preheating the DHW heat exchanger. Does the HIU exceed temperatures where scale formation on the DHW side of this heat exchanger could occur? Scale build-up will prevent efficient heat transfer and ultimately affect primary return temperatures and therefore network performance. Most of its life HIU will be operating in a keep-warm mode therefore it is paramount that HIUs reduce scaling during this function as much as possible.

T12 sensor measures the primary return temperature from the HIU and once the sensor reaches a certain value during the keep-warm test, it is assumed that the secondary DHW water in the plate heat exchanger has also reached this value.

Exceeding an agreed temperature and exposing heat exchangers to scaling risk should be taken very seriously even though there may be resistance and counterarguments from HIU manufacturers.

The purpose of the BESA HIU test regime is to reward R&D, improve heat networks and end-user comfort.

2. Considerations

Consideration 1

It is assumed that the DHW cold water input is not treated for scale prevention. Around 60% of the UK is classed as having hard or very hard water, with many areas exhibiting over 200mg of calcium carbonate per litre. Therefore scaling is a real risk.

Scale formation rate is a function of water temperature and is a non-linear process. The rate of limescale formation increases faster with increasing temperature. Various sources in practice use slightly different

graphs and formation rates, depending on factors such as water hardness levels and composition of the studied limescale.

Roughly the scaling rate in untreated water when it is heated leads to:

60C – heavy limescale formation.
55C – moderate scaling.
50C – scaling still occurs, but at significantly lower rate.

Consideration 2

In the new test regime DHW set temperature is 50C and it is expected that the keep-warm will operate below this temperature.

3. Conclusions

Scaling of the DHW heat exchanger is a real concern for performance, especially long-term performance. While the lower keepwarm set temperature below 50C is expected to help and to reduce the rate of scale formation it does not stop it entirely.

4. Recommendation

In line with the philosophy of gradually raising the bar for minimum standards, it is therefore proposed:

If T12 exceeds 55C during any point in the keep-warm test, then the HIU fails the overall test and cannot be “BESA Registered”.

If T12 exceeds 50C during the keep-warm test, the HIU receives a note identifying the scaling risk potential. The note will identify what percentage % (of time) during keepwarm cycling the HIU spends above 50C, and warns that the greater that percentage the greater will be the scaling risk.

5. Exclusions

It should be noted in the test regime and on any test reports that those HIUs which during the keep-warm function only pre-heat the pipework inside the HIU without directly heating the DHW plate heat exchanger are allowed to exceed the criteria without being penalised by having a “Fail” or “Note”. This is because the primary flow through the HIU does not heat the cold water in the DHW plate heat exchanger and therefore does not contribute to scaling formation. Nonetheless, the temperature monitoring as well as the keepwarm test itself is still required.