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# How heat pumps can achieve '55 °C peak temperature'

## Joint industry message in view of EEPLIANT 3 WP9 – Water heaters and Storage tanks

Our industry organisations, representing the heating, cooling, and household appliance sectors would like to outline that **the existing EN16147 standard referenced in the transitional method for space and water heaters should be used for testing heat pumps in EEPLIANT 3 Work Package 9 'Water heaters and Storage tanks'**.

In light of the reasons detailed below, our industries indeed consider that the answer to FAQ 40, as written in the 2015 Guidelines, remains valid – i.e. it is still allowed to reach the peak temperature Tp of 55 °C with the support of an electrical back-up heater. In other words, the new answer to FAQ 57 of the 2018 Guidelines should not be deemed in line with the Regulations (EU) No 811, 812, 813 and 814/2013.

This interpretation was confirmed by Ms Veerle Beelaerts, Policy Officer in DG ENER, Unit C4 'Energy Efficiency: Buildings and Products', at a meeting on 18 September 2018: it was not the intention of the European Commission (EC) to mention if an electrical back-up heater should be used or not in FAQ 57, nor did the EC want to retest all products. Given the impact of such change, Ms Beelaerts aimed to check whether a corrigendum to 2018 Guidelines for space and water heaters can be issued to go back to the previous FAQ 40. This was nevertheless not an EC priority then, given the other product groups that were pending approval / vote in end 2018.

We welcome the opportunity to discuss this matter further with you at your best convenience and provide further clarification in view of upcoming tests of heat pump water heaters in EEPLIANT 3 WP9 project.

### 2015 Guidelines for space and water heaters

In the 2015 Guidelines, the answer to **FAQ 40** read:

*Peak temperature (Tp) means the minimum water temperature, expressed in degrees Celsius, to be achieved during water draw-off, as specified in Annex III, table 1. The peak temperature Tp shall be calculated as a mean value over the water draw-offs with a minimum value as specified in the tapping cycles.*

*In cases where the peak temperature is not reached, the relevant standards need to correct the energy consumption of the water heater by assuming an additional electricity consumption in order to reach this temperature.*

In the 2015 version, it was thus clearly stated that it is not required to **physically** reach the peak temperature $T_p$ of 55 °C over a draw-off.

## Transitional method EC/2014/C207 for Lot 2

The 2015 guidelines are in line with the transitional method **EC/2014/C207** for Lot 2, which refers (in 4.5 f) to EN 16147:2011 with relations to the specific chapters 6.5.2 to 6.5.3.5.

The referred chapters of EN 16147:2011 clearly describe the virtual back up heating with the equation (3) here below:

For dish washing tapping, where a temperature difference $\Delta T_{desired}$ of 45 K is required, the required hot water temperature cannot always be achieved. During the tapping it is assumed that the missing temperature difference to the required value is produced by an additional electrical resistance heater during the tapping.

For that case the following additional equations are given:

$$Q_{EL-Tap} = \frac{1}{3600} \int_0^{t_{Tap}} c_p \cdot \rho(T) \cdot \dot{V}_{Tap} \cdot \left(\theta_{WC}(t) + \Delta T_{desired} - \theta_{WH}(t)\right) dt \quad (3)$$

NOTE 1 $Q_{EL-Tap}$ is set to zero, in case (3) gives a value below zero.

NOTE 2 Tapping will be stopped when $Q_{HP-Tap} + Q_{EL-Tap}$ is equal to the required energy for this tapping.

The overall energy recovery $Q_{TC}$ of the whole tapping cycle is:

$$Q_{HP-TC} = \sum_{i=1}^{n_{Tap}} Q_{HP-Tap_i} \qquad Q_{EL-TC} = \sum_{i=1}^{n_{Tap}} Q_{EL-Tap_i}$$

$$Q_{TC} = Q_{HP-TC} + Q_{EL-TC} \quad (4)$$

where

$n_{Tap}$ is the number of tappings during the tapping cycle;

$i$ is the index for the tapping.

The energy required for missing temperature difference is the calculated $Q_{EL-Tap}$ and not a measured value.

## Standard EN 16147:2017

To be in line with Lot 1 & 2 Ecodesign Regulations for Ecodesign and Labelling, including the associated Guidelines, **EN16147:2017** standard specifies, in clause 7.9.1:

*For draw-offs with a peak temperature $T_p$ of 55 °C, this temperature cannot always be achieved by the heat pump alone. During the draw-off it is then assumed that the missing temperature difference to the required $T_p$ is produced by an additional electrical resistance heater.*

## 2018 Guidelines for space heaters, water heaters and solid fuel boilers

In the new Guidelines 2018, the answer to **FAQ 57** (formerly FAQ 40) reads:

*Peak temperature (Tp) means the minimum water temperature, expressed in degrees Celsius, to be achieved during water draw-off, as specified in Annex III, table 1. The peak temperature Tp shall be calculated as a mean value over the water draw-offs with a minimum value as specified in the tapping cycles.*

*In cases where the peak temperature is not reached, additional the product cannot be declared under this tapping profile and needs to be tested under another tapping profile.*

As the first answer to the FAQ disappeared, it can be understood from the new Guidelines that assumed electrical back up is not allowed any more for reaching the peak temperature $T_p$ of 55 °C.

It is also indicated that, in case $T_p$ cannot be achieved, the load profile shall be lowered. However, changing the load profile will not allow, in most cases, a heat pump to reach $T_p$.

## Technical information

The maximum temperature that can be reached by the association of a heat pump generator and a water tank depends on the arrangement of the heat pump + water tank design, set temperature and load profile.

APPLiA, EHI, EHPA and EPEE therefore raised the following remarks on the new proposed answer to FAQ 57:

1. **Load profile**

   The larger the load profile is, the more numerous the draw-offs are and the more energy is taken out from the water tank. Thus, in some cases, reducing the load profile might allow the heat pump to reach the peak temperature (with or without back up heater).

2. **Heat pump + water tank design**

   The maximum water temperature that can be reached depends on the heat pump and associated water tank design (refrigerant type, control of the backup heater, volume of the tank, heat pump capacity, etc.). For example, heat pump combination heaters might be able to provide water at 55°C outlet temperature or more for space heating but cannot necessarily reach the required domestic hot water temperature $T_p$ inside the tank. This will require a much higher outlet temperature from the condenser of the heat pump for the heat transfer from heating water to the domestic hot water inside the tank.

3. **Set temperature**

   According to the EN16147 standard and previous FAQ answer, it is currently possible to set a domestic hot water temperature on the heat pump that is below 55°C and to still be compliant with the Ecodesign requirements and the standard requirement. Depending on the set temperature, it might be impossible to reach the peak temperature $T_p$ whatever the load profile is.

4. **EN 16147**

   The standard leaves the possibility to reach the peak temperature $T_p$ by using an assumed electrical resistance heater. This standard is the current reference, in line with the Ecodesign legislation.

5. **Transitional method EC/2014/C207**

   The revised FAQ is not in line with the transitional method for Lot 2 and therefore it is not in line with the existing legislation.

**About the Signatories**

**About APPLiA:** APPLiA represents the home appliance industry in Europe. Direct Members are Arçelik, Ariston Thermo Group, BSH Hausgeräte GmbH, Candy Group, Daikin Europe, De'Longhi, Dyson, AB Electrolux, Gorenje, Groupe Atlantic, LG Electronics Europe, Liebherr Hausgeräte, Miele & Cie. KG, Panasonic, Philips, Samsung, Groupe SEB, Smeg, Vestel, Vorwerk and Whirlpool Europe. APPLiA's member Associations cover the following countries: Austria, Baltics, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey and the United Kingdom. www.applia-europe.eu

**About EHI:** EHI, the association of the European Heating Industry, represents 90% of the European market for heat and hot water generation, heating controls and heat emitters, 80% of biomass central heating, as well as 75% of the hydronic heat pump and solar thermal markets. Our Members produce advanced technologies for heating in buildings, including: heating systems, burners, boilers, heat pumps, components and system integrators, radiators, surface heating & cooling and renewable energy systems. In doing so, we employ directly more than 160.000 people in Europe and invest more than 700 million euro a year in energy efficiency. www.ehi.eu

**About EHPA:** The European Heat Pump Association (EHPA) is a Brussels based industry association, which aims at promoting awareness and proper deployment of heat pump technology in the European market place for residential, commercial and industrial applications. EHPA provides technical and economic input to European, national and local authorities in legislative, regulatory and energy efficiency matters. All activities are aimed at overcoming market barriers and dissemination of information in order to speed up market development of heat pumps for heating, cooling and hot water production. EHPA coordinates quality initiatives: including the HP KEYMARK, a Quality label for heat pumps and Certification standards for heat pump installers. The association compiles the annual heat pump statistics and organizes a number of events, among them an annual heat pump conference. www.ehpa.org.

**About EPEE:** The European Partnership for Energy and the Environment (EPEE) represents the refrigeration, air-conditioning and heat pump industry in Europe. Founded in the year 2000, EPEE's membership is composed of 40 member companies, national and international associations.

EPEE member companies realize a turnover of over 30 billion Euros, employ more than 200,000 people in Europe and also create indirect employment through a vast network of small and medium-sized enterprises such as contractors who install, service and maintain equipment. EPEE member companies have manufacturing sites and research and development facilities across the EU, which innovate for the global market.

As an expert association, EPEE is supporting safe, environmentally and economically viable technologies with the objective of promoting a better understanding of the sector in the EU and contributing to the development of effective European policies. Please see our website (www.epeeglobal.org) for further information.