DEAP Heat Pump Methodology

Q1 2016

Contents:

1 Introduction

This document details the methodology to be used for entry of heat pumps in the Dwelling Energy Assessment Procedure (DEAP) for space and water heating. The methodology as applied to heat pumps specified in DEAP v3.2.1 was revised following industry feedback and a public consultation on the DEAP heat pumps methodology in 2015.

The main points of note and objectives of the revised methodology are as follows and apply to all domestic BER assessments with heat pumps:

- The revised methodology provides more accurate treatment of heat pumps in DEAP assessments.
- Use of test results from standards aligned to the Energy Labelling[1] and Eco-design[2] Directives as applied to heat pumps. These directives are mandatory for products placed on the market from 26th September 2015.
- Where a heat pump is installed in a dwelling from 26th September 2015, BER Assessors must work on the basis that the heat pump make/model complies with the Energy Labeling and Eco design directives unless the manufacturer or supplier provides documentary evidence to support the reasoning for the product's non-compliance. This applies to:
    - All new-final and new-provisional domestic BER assessments.
    - All existing dwelling assessments with the heat pump installed after 26th September 2015.

  If the heat pump in these cases does not comply with the directives, and where insufficient supporting evidence has been provided to justify the lack of compliance with the mandatory directives, default efficiencies must be taken from Table 4a of the DEAP manual.
    - For heat pumps installed prior to 26th September 2015, that heat pump make/model may or may not comply with these directives.
- Where a heat pump make/model was installed before 26th September 2015 and does not comply with the directives applied, that heat pump can still be entered in DEAP using the methodology previously applied to heat pumps from DEAP v3.2.1 as elaborated in this document (Section 2). However, **where the make/model does comply with the directives, then the new approach detailed in Section 3 of this document must be applied in DEAP assessments.**
- For space heating, the new methodology based on the data available from the directives is incorporated using EN14825[3] test data for heat pumps and the calculation methodology for system efficiency is based on EN15316-4-2:2008[4].

[1] Directive 2010/30/EU on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products.

[2] Directive 2009/125/EC establishing a framework for the setting of Ecodesign requirements for energy-related products.

[3] I.S. EN 14825-2013 Air Conditioners Liquid Chilling Packages and Heat Pumps With Electrically Driven Compressors, for space heating and cooling – Testing and rating at part load conditions and calculation of seasonal performance

[4] I.S. EN 15316-4-2-2008 Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-2: Space heating generation systems, heat pump systems

- For water heating, the new methodology based on the data available from the directives is incorporated using EN16147[5] test data and the calculation methodology for system efficiency is based on EN15316-4-2:2008.
- The methodology includes:
    - This guidance document.
    - A calculator to derive the relevant DEAP entries for heat pumps.
    - A sheet for collecting relevant design details from the dwelling's heating system designer or installer.
    - A document detailing a number of example cases using the revised methodology.
- The calculator uses climate data for Dublin from Version 2.0 of ASHRAE's International Weather Files for Energy Calculations (IWEC2) as agreed with the Department of Environment, Community and Local Government (DECLG).
- SEAI will develop the Home-heating Appliance Register of Performance (HARP database) to facilitate listing of heat pumps complying with the directives on HARP and linking data held on HARP to the heat pumps calculation tool referenced above. For now, the tool accepts the directives based test data directly from the user, enabling completion of the DEAP assessment.
- The directives and associated regulations refer to different types of heat pumps, broadly categorised as providing space heating only, water heating only or combination heaters (providing space and water heating).
- Guidance in this document is specific to heat pump heating systems rather than other heating systems.
- **This document must be used in place of current guidance in the DEAP manual[6] for any dwellings with heat pumps installed to derive the relevant entries in DEAP for the heat pump. This document will be used as a basis for revised guidance relating to heat pumps in the DEAP manual at the next DEAP release, particularly Appendix G in the DEAP manual.**
- As per the BER Assessors Code of Practice, all data used in compiling the BER assessment must be retained on file by the BER Assessor. For heat pumps, this includes but is not limited to:
    - Heat pump test performance documentation used in the calculation according to relevant standards/regulations/directives.
    - The calculation of seasonal heat pump efficiencies for entry in DEAP using the heat pump calculation tool referenced in this document.
    - The designer/installer signoff sheet filled out for the dwelling being assessed as referenced in Section 1.2.
    - Any calculations demonstrating a lower design flow temperature for space heating other than the default values calculated by the heat pump calculation tool. This applies where a non-default design flow temperature is specified in the heat pump calculation tool.

[5] I.S. EN 16147-2011 Heat Pumps with Electrically Driven 16147:2011 Compressors – Testing and requirements for marking of domestic hot water units

[6] www.seai.ie/deap

The following diagram outlines the approach to use based on availability of Ecodesign data or associated test data where the heat pump is the main space and/or water heater in the dwelling:

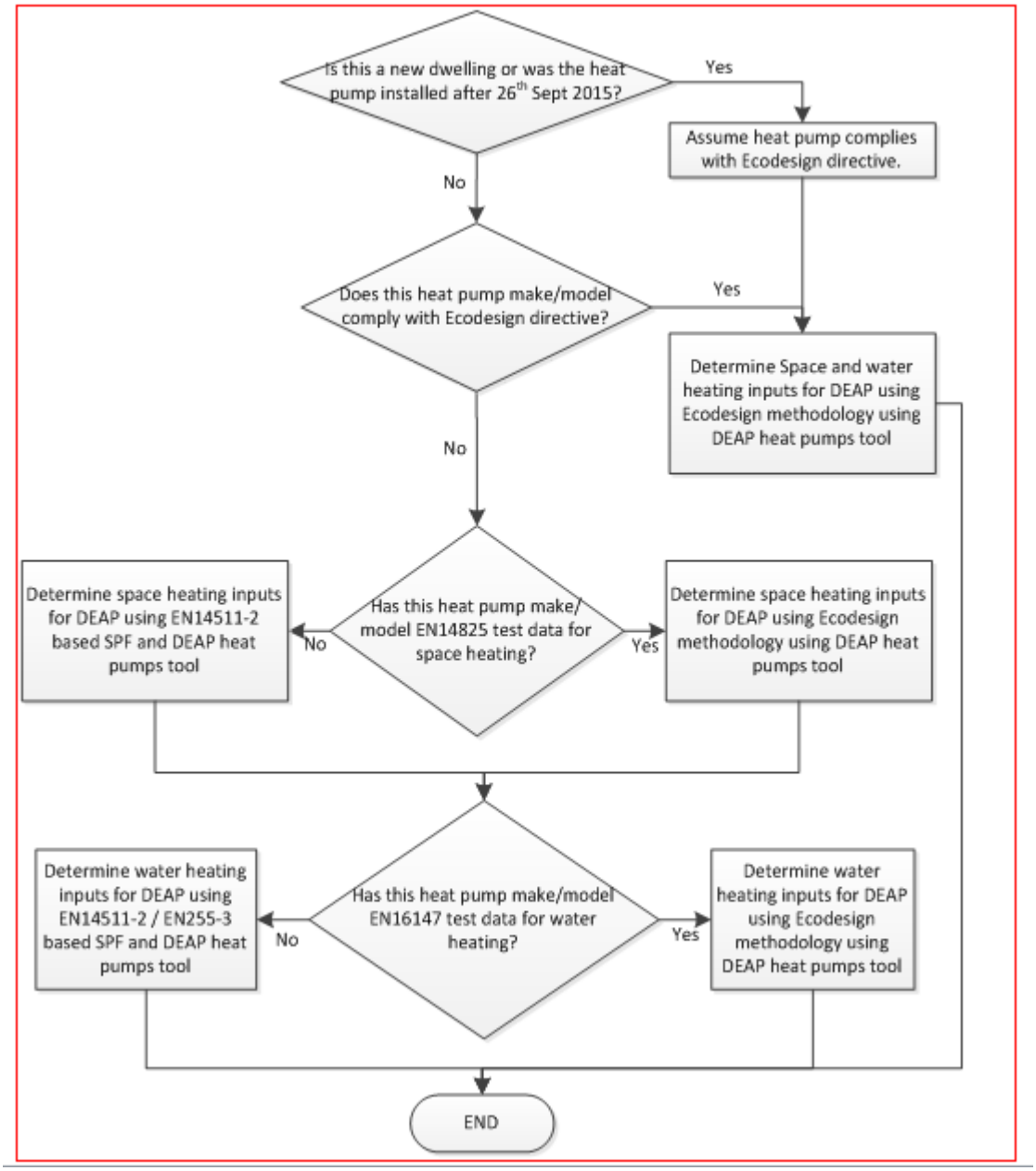

Figure 1: When to use Ecodesign methodology for heat pumps in DEAP

1.1 General guidance for the heat pump calculation tool

The heat pumps calculation tool has a number of tabs. **Only the "INPUT SHEET" tab is required for data entry and accessing results**. The other tabs automatically carry out the detail of the calculation based on the user inputs to the Input Sheet, the DEAP methodology, the relevant European standards and IWEC2 weather data.

The Input Sheet displays a number of fields. These are colour coded by user entries (yellow fields), constants (green fields), and calculated values (blue fields). Where fields are irrelevant for the calculation (e.g. EN14511-2 test data input is irrelevant for Ecodesign listed heat pump), the irrelevant fields are automatically coloured black by the calculator and are not used.

The RESULTS section at the end of the Input Sheet displays the DEAP entries for efficiency data, efficiency adjustment factors and Part L related data for entry under DEAP's Energy Requirements section.

There are a number of sections in the Input Sheet as follows:

- **General Information and Assessor Details**
  - Identify the dwelling and client / homeowner for the BER assessment.
  - Identify the BER Assessor name and number.
- **Building Data**
  - Enter the dwelling heat loss as calculated by DEAP for the dwelling being assessed. Sourced from DEAP -> Building Elements -> Heat Loss Results -> Total Heat Loss (W/K)
  - Details of Group Heating if applicable. Where the dwelling is heated by a group heating system, enter the following:
    - Floor area of dwelling from DEAP -> Dimensions -> Total Floor Area (m^2).
    - Proportion (%) of group heating provided by the heat pump. Derived as per DEAP Appendix C1.
    - Total floor area of buildings heated by the heat pump (m^2).
- **Heat Pump Data**
  - Enter the exact make, model and model qualifier for the heat pump identified in the dwelling being assessed.
  - Enter the type of heat pump (e.g. A/W; B/W etc.)
  - Identify the type of temperature control (capacity control) as identified in Ecodesign test data where applicable.
  - Specify whether the heat pump provides space heating, water heating or both and the standards to which the heat pump is tested.
  - Enter the Operation Limit Temperature (TOL – ^{O}C) and heating water operating limit temperature (WTOL - ^{O}C) taken from Ecodesign technical data where applicable.
- **Space Heating**
  - Enter the annual space heating demand from DEAP -> Distribution System Losses and Gains -> Annual Space Heating Requirements (kWh/y).
  - Specify if there is secondary space heating and CHP as per the entries under DEAP -> Energy Requirements -> Space Heating.
  - Constant value for design outdoor temperature based on CIBSE Guide A Section 2.

- Enter indoor design temperature from DEAP -> Net Space Heat Demand -> Required Mean Internal Temperature During Heating Hours [^{O}C].
- Identify each emitter type present in the dwelling.
- Enter design flow temperature (^{O}C). This is either sourced from the default calculated by the heat pump calculator or based on dwelling design data. If using design data rather than defaults, then, in line with DEAP Manual Table 4c footnote (e), the following details are required and must be retained by the BER Assessor:
    - The heat loss calculation carried out by the designer, which should be performed as detailed in "SR 50-1:2010 Code of practice for building services – Part 1: Domestic plumbing & heating" Section 7 (currently at draft stage). The assessor should compare this to the "Heat Loss Watts" calculated within the Heat Pump calculator based on -3°C external temperature and the internal design temperature taken from DEAP's Net Space Heat Demand tab. The designer/ installer's heat loss calculation is expected to be greater than or equal to the heat loss in the heat pump calculator.
    - Details of the design flow temperature to meet the design specification and associated heat loss per room.
    - The output specification of the heat emitter for each space for the design flow and return temperatures of the heating system and the air temperature of the room.
      For example the output of radiators are typically quoted at a delta T of 55°C based on a flow of 80°C, return of 70°C and a room temperature of 20°C. However radiator manufacturers will typically quote an adjustment factor that must be applied to the output for reduced delta temperatures. Documentary evidence must be retained showing the output of the heat emitter taking account of the adjustments.
- Select the number of running hours per day that the heat pump is in operation based on dwelling design data, 8, 16 or 24hrs. If not provided by the designer/installer, assume the default of 8 hours, as based on the DEAP heating schedule. The number of hours chosen should be based on the closest value to the design proposal. This is the number of hours during which the heat pump can be activated by thermostatic/load control devices to maintain the occupant's required thermal conditions in the dwelling according to the system designer/installer.
- Enter the Electricity Primary Energy factor sourced from DEAP's "Options" menu.
- Enter details of backup main space and water heating systems (if present), including fuel type, and efficiency. Backup efficiency data can be sourced from HARP, certified data or DEAP defaults. **The main space heating backup heater is not the secondary heating system**. It is any other system capable of heating multiple rooms in the dwelling and supplementing the heat pump, such as a backup boiler. If a system is considered as a heat pump backup, then it is not eligible to be considered as a secondary heating system in DEAP. The combination of a space heating heat pump and backup space heater are considered as the main space heater in DEAP. The combination of a water heating heat pump and backup water heater are considered as the main water heater in DEAP.

If the backup heater is a room heater with boiler, the methodology outlined in Section 9.2.4 of the DEAP Manual is followed. For gas fired room heaters, the back boiler is considered as a backup to the heat pump and the room heater is entered as a secondary heater. For oil and solid fuel room heater with back boiler, the combination of the boiler and room heater are considered as a backup heater and the room heater is not considered a secondary heater.

- Automatically calculated outputs from this section include flow and return related parameters, cut out hours and fuel related parameters for the backup systems.

- **Domestic Hot Water**
  - Enter the output from main water heater from DEAP -> Water Heating -> Output from main water heater [kWh/y].
  - Specify the volume of DHW storage as detailed in the DEAP -> Water Heating tab.
  - Select whether the heat pump has a separate hot water store, an integral hot water store or no hot water store. An integral store is defined as a store within the heat pump casing and is part of the heat pump. Therefore the reference hot water temperature from the heat pump test data is after/ downstream of the store.
  - **Determining maximum temperature achieved by the heat pump in DHW store/supply.**

    According to requirements of standards and guidelines[7] addressing Legionnaires Disease, DHW is required to be stored and supplied at a temperature of 60°C or more. The following rules apply when determining if this requirement is met for DEAP:
    - Where the DHW store is separate from the heat pump, in order to achieve a 60°C storage temperature the flow temperature from the heat pump must be at least 65°C. Otherwise, the heat pump is not assumed to be capable of heating the DHW store and supply to 60°C. This is based on an assumed temperature drop of 5°C from the heat pump to the DHW store as established in the UK's SAP Methodology.
    - Where there is no DHW store outside the heat pump (e.g. there is an internal store only or no hot water storage), the heat pump must be able to reach a flow temperature of at least 60°C. Otherwise, the heat pump is not assumed to be capable of heating the DHW store/supply to 60°C .
    - If it is not clear if the heat pump can heat the DHW store/supply to 60°C, then assume that it cannot.

[7] (a) The European Working Group for Legionella Infections Technical Guidelines for the Investigation, Control and Prevention of Travel Associated Legionnaires Disease (Design and construction) 2011
(b) The HSE Health Protection Surveillance Centre report National Guidelines for the Control of Legionellosis in Ireland 2009
(c) CIBSE Guide G – Public Health and Plumbing Engineering
(d) CIBSE TM 13 – Minimising the Risk of Legionnaires Disease
(e) UK Health and Safety Executive Legionnaires Disease Part 2: The control of legionella bacteria in hot and cold water systems.

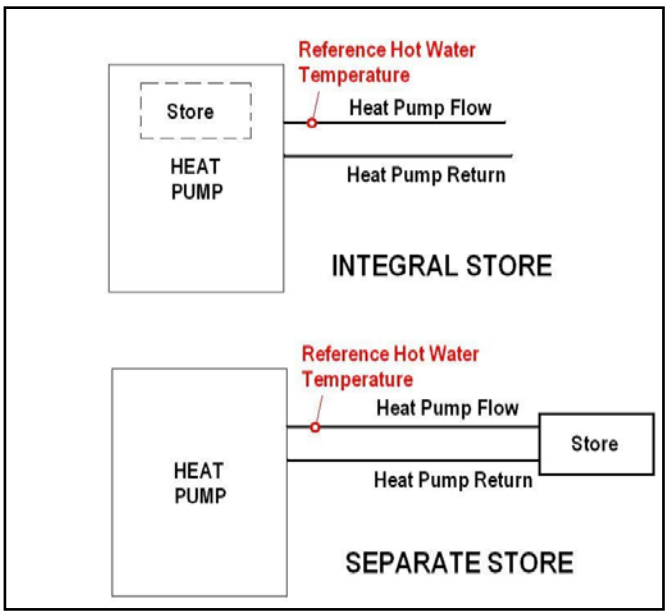

Figure 2: Identifying the store type

- The tool details the cold water inlet temperature (constant) and automatically calculates the required flow temperature to the hot water cylinder.

- **Product Performance Data**
  - Using the standards identified under the "Heat Pump Data" section above, the tool displays the required heat pump performance entries.
  - Sections 2 and 3 below provide further detail on the data required in this section for different standards.
- **Results**
  - The calculation tool automatically calculates efficiencies and efficiency adjustment factors for entry into DEAP -> Energy Requirements for space and water heating. The efficiencies calculated by the Heat Pump tool account for any requirement for back up heaters to supplement the heat pump to meet the heating demand, temperature requirements of the dwelling.
  - Depending on the presence of or requirement for backup heating, the calculator generates a figure for entry into DEAP -> Energy Requirements -> Fuel Data -> Renewable and energy saving technologies. Enter the value in the "Part L Total Contribution ". Set the "type" to "Renewable Thermal". Do not enter further information under the "Delivered Energy" column for this entry. This entry is only applicable for New-Final or New-Provisional BER assessments.

DEAP automatically checks conformance to a number of parameters for Part L of Building Regulations 2005, 2008 and 2011 as detailed in the DEAP manual.

1.2 Input from designer/installer

The following data is required from the system designer or installer for heat pumps to enable assessment of the heat pump in the DEAP heat pump calculation tool. **The BER Assessor will require that for any heat pump to which Ecodesign, EN14825 or EN16147 is applied (see Figure 1), a sign off sheet is completed and signed by the Designer/ Installer of the heat pump system**. The sheet may be provided by the Designer/Installer in hardcopy or softcopy format signed using one of the following methods:

- Hardcopy signed by the Designer/Installer, or
- Softcopy format with an electronic (e.g. scanned) signature from the Designer/Installer, or
- Softcopy format accompanied by an email from the designer/installer confirming that the data with the sign off sheet is correct.

SEAI has provided a template for this sheet to accompany the tool.

- **Section 1: General Information**
  - Identify the dwelling and client / homeowner for the BER assessment.
- **Section 2: Purpose of Installation**
  - Identify what the heat pump is supplying (Space Heating/ Domestic Hot Water/both)
- **Section 3: Heat Pump Selection**
  - Enter the exact make, model and any model qualifier for the heat pump identified in the dwelling being assessed.
  - Enter the type of heat pump (e.g. A/W; B/W etc.).
  - Enter the date of installation
  - Confirm compliance with the Ecodesign and Labelling Directive.
  - Confirm test standards for heat pumps.
  - Confirm hours of operation per day, (8, 16 or 24 hrs) closest to the number of hours operation expected by the design. This is the number of hours during which the heat pump can be activated by thermostatic/load control devices to maintain the occupant's required thermal conditions in the dwelling.
  - Confirm if backup systems have been installed to supplement the heat pump. Also detail backup heater details and fuel type.
- **Section 4: Heat Emitter Design**
  - Identify heat emitters present in the dwelling.
  - Identify controls within dwelling.
  - Confirm supply temperature based on design conditions.
- **Section 5: Domestic Hot Water**
  - Confirm hot water temperature based on certified data.
  - Confirm the type of store present.
  - Confirm presence of immersion/ electric element in the heat pump capable of providing domestic hot water. This must be specified even if this integral immersion is only installed as a backup to the heat pump.
- **Section 6: Confirmation**
  - Signoff and details of system designer/installer.

2 Heat pumps not compliant with Ecodesign/Energy Labeling Directives.

Where a heat pump make/model is not compliant with the Ecodesign and Energy Labeling directives and has no EN14825 / EN16147 test data, that heat pump is entered in DEAP following the guidance in this section. The approach taken in this case is aligned to the methodology for heat pumps in DEAP v3.2.1 with some elaboration to ensure more consistent application of the methodology. This section is used for space heating only where the heat pump make/model is not compliant with the Ecodesign and Energy Labeling Directives and does not have valid EN14825 test data. This section is used for water heating only where the make/model is not compliant with the Ecodesign and Energy Labeling directives and does not have valid EN16147 test data. Where the make/model is compliant with the directives and/or does have EN14825 and EN16147 data, then the approach for Heat Pumps compliant with Ecodesign and Energy Labeling Directive detailed in Section 3 **must** be applied in DEAP. See Figure 1 above.

For New Buildings or where the heat pump is installed after 26th September 2015, it is assumed that the heat pump is compliant with the Ecodesign and Energy Labeling directives as these are mandatory after the 26th September 2015. If such a heat pump is not compliant, the BER assessor must demonstrate, using confirmation from the heat pump manufacturer/supplier why the heat pump is not required to comply with the directives. Otherwise the BER Assessor must use heat pump efficiency defaults from Table 4a of the DEAP Manual for that heat pump.

Where a heat pump make/model was installed before 26th September 2015 and does not comply with the directives, that heat pump can still be entered in DEAP using the methodology previously applied to heat pumps from DEAP v3.2.1 as elaborated in this section. However, **where the make/model does comply with the directives, then the new approach detailed in Section 3 of this document must be applied in DEAP assessments.**

In all instances where the make/model of the heat pump is compliant with the Ecodesign and Energy Labeling Directive, the methodology outlined in Section 3 of this document must be followed.

If the heat pump is not required to comply with the Ecodesign directive, values from the HARP database are used where available if there is no data from Ecodesign technical data or its associated standards EN14825/EN16147 for the heat pump make/model in question. In this instance, if there is no SPF for the heat pump listed on HARP, then certified data from or endorsed by an accredited laboratory may be used to calculate the SPF. Accredited data requirements are detailed in the DEAP Manual section "Accredited or certified data". The calculation method requires test certificates from EN14511-2, IS EN 255-2 or EN 15879. Full details of this SPF calculation method as applicable to several types of heat pump are available in the HARP Heat Pump Database Submission Notes (Section 1.2).

2.1 Domestic Hot Water: Not Compliant with Ecodesign/ Energy Label Directive

If the heat pump is not required to comply with the Ecodesign and Energy Label Directives or has not been tested to I.S. EN 16147 then the following methodology is applied.

It is necessary to determine if the heat pump can meet all of the DHW demand where the directives do not apply. Where the heat pump can heat the DHW to the required temperature and does not have an integral immersion or integral electric element capable of providing hot water, then the heat pump is assumed to meet all of the DHW demand in DEAP and Section 2.1.3 below applies. If the heat pump has an integral immersion/element OR cannot heat the stored/supplied DHW to the required temperature, then Section 2.1.1 below applies:

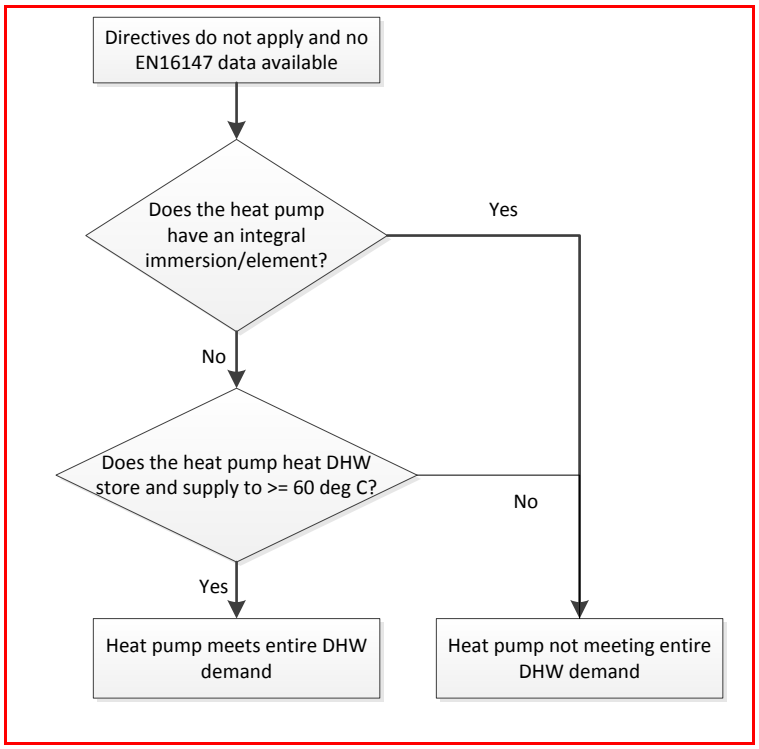

Figure 3: Does the heat pump meet the DHW demand?

Ability of Heat Pump to Meet Temperature:

- As detailed in Section 1.1, the temperature required by the Heat Pump to meet the DHW requirement is based on the type of installation.
- The maximum flow temperature output from the heat pump is taken from CE marked literature, CE marked data plates or accredited test data for the heat pump in question.

Identifying integral immersion/electric element for water heating

The following rules apply when identifying integral immersion/element for water heating in a heat pump:

- An immersion or water heating electric element is considered to be integral if it is within the heat pump unit and is capable of providing DHW. This would typically be part of the DHW circuit in the heat pump unit or part of a DHW store built into the unit.
- An integral immersion/element must be considered present regardless of whether it is used during normal operation or if it is only provided as a backup to the heat pump.
- An immersion/element is not considered to be integral if it is either absent or is only present in a DHW store physically separate from the heat pump unit.
- Evidence of presence or absence of an integral immersion is taken from product literature, test data, site evidence or a written statement from the system designer/installer for the heat pump make/model and dwelling being assessed.
- If it is not clear if there is an immersion/element integral to the heat pump DHW circuit, then assume that it is present.

All other entries related to controls etc. are as per DEAP V3.2.1 guidance.

2.1.1 DHW heated by heat pump not meeting all DHW demand

This section applies for heat pumps not required to comply with the Ecodesign or Energy Labelling directives or without EN16147 test data and there is an integral immersion/element in the heat pump or the heat pump cannot meet the required DHW temperatures detailed above. The water heating efficiency and water heating efficiency adjustment factor in DEAP are set out below and are automatically derived by the heat pump calculation tool.

Where the heat pump does not meet all of the DHW demand and EN14511-2/ EN255-2 or Table 4a default data is used as the basis for the DHW efficiency, the calculation tool assumes that 50% of DHW is heated by the heat pump and 50% by an immersion heater. The efficiency for water heating, entered as the "Efficiency of main water heater" in DEAP, is calculated as follows by the SEAI heat pump calculator:

$$\frac{100}{[50 \div SPF] + 0.50}$$

Equation 1

- SPF is the Seasonal Performance Factor of the heat pump entered by the user in the calculation tool as determined by one of the following methods and is entered in kW/kW units (e.g. 320% would be 3.2):
    - EN 14511-2 (from HARP or certified test data averaged from test points in DEAP Appendix G).
    - EN 255-2 (from HARP or certified test data test data averaged test points in DEAP Appendix G).
    - Table 4a default in DEAP Manual.

- The water heating efficiency adjustment factor for entry in DEAP is set to 1 by the calculation tool and entered in DEAP as the water heating efficiency adjustment factor.

2.1.2 DHW efficiency in DEAP based on EN 255-3

Where the heat pump has been tested to EN255-3 and this is used as the basis for the DHW efficiency, the calculation tool bases the proportion of domestic hot water provided by the heat pump on the "Reference Hot Water Temperature" from the EN 255-3 test certificate. The tool uses Equation 18 of EN 15316-4-2: 2008 to calculate the fraction of DHW provided by the backup heater. The efficiency for water heating is calculated based on the COP of the heat pump to EN 255-3 and the fraction of hot water provided by the backup heater (if present) and the corresponding efficiency of the backup heater. This is entered as the "Efficiency of main water heater" in DEAP and is calculated by the tool.

- COP (in kW/kW rather than as a percentage) is taken directly from EN255-3 certified data and entered by the user in the calculation tool.
- The Reference Hot Water Temperature (^{O}C) and Heating Capacity are entered in the tool. Where reference hot water temperature is unknown, default it to 40^{O}C.
- The tool calculates the overall efficiency based on the requirement for backup heater and this is entered into DEAP as the "Efficiency of Main Water Heating System".
- The water heating efficiency adjustment factor for entry in DEAP is set to 1 by the calculation tool and entered in DEAP as the water heating efficiency adjustment factor.

2.1.3 DHW heated by heat pump meeting all DHW demand

This section applies for heat pumps not required to comply with the Ecodesign or Energy Labelling Directive or EN16147 test data where there is no integral immersion/element in the heat pump and the heat pump meets the required DHW temperatures detailed above. The water heating efficiency and adjustment factor in DEAP are set out below.

Where the heat pump meets all of the DHW demand and EN14511-2 or EN255-2 are used as the basis for the DHW efficiency, it is assumed that all of the DHW is heated by the heat pump:

- SPF is the Seasonal Performance Factor of the heat pump entered by the user is determined from one of the following methods
    - EN 14511 -2 (from HARP or certified test data averaged from test points in DEAP Appendix G)
    - EN 255-2 (from HARP or certified test data averaged from test points in DEAP Appendix G)
- The heat pump calculation tool displays the efficiency adjustment factor as 0.7 which is entered into DEAP as the water heating efficiency adjustment factor.

2.1.4 DHW heated by immersion only

Where an immersion heater is used for heating all hot water, then the main water heater is specified as an immersion as per Table 4a.

2.2 Space heating: Not Compliant with Ecodesign/ Energy Label Directive

This section applies where the heat pump is used for space heating and is not required to comply with Ecodesign/ Energy Label Directives and does not have EN14825 test data.

The following guidance summarises how to identify the key entries related to the heat pump and emissions system.

- **Seasonal Performance Factor (SPF)**
  The SPF is entered as the space heating efficiency (DEAP Energy Requirements tab) where the heat pump is identified as the main space heater according to DEAP Appendix A. It is derived as detailed at the start of Section 2 above and is preferably taken from HARP, but may also be based on accredited test data (to EN14511-2 or EN255-2) or the defaults in DEAP Table 4a.
- **Efficiency Adjustment Factor**
  The efficiency adjustment factor for space heating is based on DEAP Table 4c (e) for heat pumps. The efficiency adjustment factor is automatically calculated based on data entered into the tool including the design flow temperature and controls.

All other entries related to controls etc. are as per DEAP V3.2.1 guidance.

3 Heat pumps compliant with Ecodesign and Energy Labeling or EN16147 / EN14825

Where a heat pump make/model is compliant with the Ecodesign and Energy Labeling Directive or has EN14825 / EN16147 test data, the associated test data and heat pump information must be entered in DEAP following the guidance in this section. This section is used for space heating where the heat pump is compliant with the Ecodesign and Energy Labeling Directive or has valid EN14825 test data. This section is used for water heating where the heat pump is compliant with the Ecodesign and Energy Labeling Directive or has valid EN16147 test data as applied to water heating.

Test data for Ecodesign/Labelling is based on EN14825 for space heating and on EN16147 for water heating. Test data will generally either be based on test certificates or technical data sheets which are required to be in declarations made publicly available under the Ecodesign Directive.

Technical Data declared by the manufacturer must clearly apply to the heat pump make/model/qualifier being assessed and include a reference to the Ecodesign directive and/or relevant standards. Alternatively, details of the heat pump's compliance with the directives must be provided in addition to the test result data. So, when using the Ecodesign based methodology, technical data being used for DEAP assessments must reference the Ecodesign directive and/or regulation 813/2013 for space heating. Water heating technical data must reference the Ecodesign directive and/or regulation 813/2013 and/or 814/2013. Alternatively, relevant performance data for the heat pump for space heating can be taken from accredited test data or CE marked data referencing EN14825. Relevant performance data for the heat pump for water heating can be taken from accredited test data or CE marked data referencing EN16147.

Ecodesign / EN 14825/ EN16147 test data is not yet facilitated on HARP – this will be implemented at a future date. Under the Ecodesign Directive the relevant technical information is required to be in declarations made publicly available under the directive and is referenced as Ecodesign data in the heat pump tool.

The heat pump tool calculates the renewable contribution based on the DEAP calculation and the renewable contribution from the heat pump only. The tool will calculate if an additional renewable contribution is required, allowing for efficiency changes due to use of a backup system and this is entered separately into DEAP under Energy Requirements -> Fuel Data –> Renewable Energy –> Part L total contribution. This entry is only applicable for New-Final or New-Provisional BER assessments.

The key references for regulations as applied to the directives are as follows. These detail the data that must be displayed on manufacturer literature, website declarations etc. for compliant devices.

- **811/2013** **"***supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device".*

- **812/2013** "*supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device*"**.**
- **813/2013** *"implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters. "*
- **814/2013** "*implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks"*
- **S.I. 454: 2013***: "EUROPEAN UNION (ECODESIGN REQUIREMENTS FOR CERTAIN ENERGY-RELATED PRODUCTS) (AMENDMENT) REGULATIONS 2013"*
- **2014/C 207/02: "***Commission communication in the framework of the implementation of Commission Regulation (EU) No 813/2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters…"*
- **2014/C 207/03: "***Commission communication in the framework of the implementation of Commission Regulation (EU) No 814/2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks…"*

The regulations above, coupled with the directives set out the full details of the directives and associated requirements. Specific to the heat pump methodology in this document, please bear in mind the following:

- The regulations clearly set out that the directives are mandatory for heat pumps placed on the market after 26th September 2015.
- Regulations 813/2013 and 814/2013 detail the technical parameters that must be declared on instruction manuals for installers and end users, as well as free access websites of manufacturers, their authorised representatives and importers. The technical parameters listed must be declared for space heating heat pumps, combination heat pumps and water heating heat pumps.
- The documents 2014/C 207/02 and 2014/C 207/03 detail the relevant standards as EN14825 for space heating and EN16147 for water heating.
- Where the BER Assessor is unable to obtain the relevant data to complete the entries for the heat pump calculator for an Ecodesign compliant heat pump, the Assessor should request the EN14825 and EN16147 test data as required from the heat pump manufacturer or supplier.
- If the data declared in publications from the manufacturer/supplier is unclear, the Assessor should contact the heat pump manufacturer or supplier directly for clarification.
- If uncertain whether the heat pump complies with Ecodesign, the Assessor should contact the heat pump manufacturer or supplier directly for clarification.

The BER Assessor may require additional test data to complete the calculation. Additional data can be sourced from the following:

- CE marked literature or accredited test certificates referencing EN 14825 for space heating.
- CE marked literature or accredited test certificates referencing EN 16147 for water heating.
- Manufacturer's literature referencing the relevant directives/regulations as detailed above.

3.1 Space heating: Compliant with Ecodesign/ Energy Label Directives or EN14825 data available.

If a heat pump has space heating test data available from Ecodesign Directive or EN14825, **that data must be used in the calculation tool to derive the space heating efficiency and associated efficiency adjustment factor for entry in DEAP**. The data entered is outlined as follows:

- Specify test conditions at which test data is available (Low temperature, medium temperature, high temperature, very high temperature). All sets of available valid test data must be used.
- The tool allows entry for a number of figures at different test points depending on the test conditions, the type of heat pump and whether the capacity control of the heat pump is variable or fixed outlet. These figures include the following and are taken from the Ecodesign or certified EN14825 data:
    - Heating capacity (kW), Coefficient of Performance (CoP) entered in kW/kW at 100%, 88%, 54%, 35% and 15% load.
    - Temperature operation limit (TOL - ^{O}C)
    - Heating Water operating limit temperature (WTOL - ^{O}C)

The calculator uses this data along with data identified earlier in this document to determine the space heating efficiency and efficiency adjustment factor based on the EN15316-4-2:2008 calculation methodology.

The tool determines the efficiency based on a number of factors:

- The ability of the heat pump to meet the heat demand within the dwelling.
- The efficiency of the heat pump based on climate data, operating hours and design flow temperatures within the dwelling.
- The backup heater, if applicable, is reflected in the overall heat pump efficiency for entry in DEAP.

3.2 DHW: Compliant with Ecodesign/ Energy Labeling Directive or EN16147 data available.

Where the heat pump has DHW test data available compliant with the Ecodesign/ Energy Labelling directives or EN16147, **that data must be used in the calculation tool to derive the water heating efficiency and associated efficiency adjustment factor for entry in DEAP**.

The required data from EN16147 test data or Ecodesign technical data or certified EN16147 data is as follows:

- Coefficient of Performance for domestic hot water (CoP) or the water heating energy efficiency (ηwh). The CoP is the term used in EN16147 test reports and is expressed in kW/kW, for example

2.5. The term ηwh is the water heating efficiency displayed on Ecodesign technical data and is expressed as a percentage, for example 100%.

- Reference hot water temperature (^{O}C). Where reference hot water temperature is unknown, default it to 40^{O}C.
- Heating capacity DHW (kW)
- Declared Load Profile
- Standby Heat Loss (kWh/day), set as 0 if unknown.
- Volume of DHW accounted for in test (L)

Where the volume of DHW accounted for in testing does not meet the requirements in the regulations for the Ecodesign directive (see references in Section 3 above), the calculator issues a warning for the assessor to seek revised test data to meet the Ecodesign requirements from the manufacturer/supplier.

Where the installed hot water storage in the dwelling doesn't meet the requirements in the regulations for the Ecodesign directive, the calculator advises the BER assessor that they must contact the client and designer/installer, advising that the installed hot water cylinder doesn't meet the requirements for the Ecodesign Directive and therefore the heat pump will not perform to the calculated efficiency. The BER Assessor is also advised to seek the correct data (e.g. revised tapping cycle data) in this instance.

In both of these instances, the assessor may still use the test data available, but must seek revised data as indicated from the supplier/manufacturer.

The calculator uses the test data along with data identified earlier in this document to determine the water heating efficiency and efficiency adjustment factor. The tool determines if and to what extent a backup water heater is required to meet the dwelling's water heat requirements. The impact of the backup heater is reflected in the overall heat pump efficiency for entry in DEAP.

4 Other heat pump system types

There are a number of heat pump types which may or may not have relevant Ecodesign, EN14825 or EN16147 data. Generally speaking, the guidance in Sections 1, 2 and 3 applies to these systems with additional information provided as follows.

4.1 Air to Air Heat Pumps

Air/air heat pumps heat air rather than wet heating system emitters such as radiators and underfloor heating. These systems typically source their heat from external air and do not provide DHW.

The heat pump calculation tool can accept Ecodesign based or HARP based data for these devices. The efficiency adjustment factor for this type of system is always "1".

4.2 Exhaust Air Heat Pumps (EAHP) and other heat pumps incorporating ventilation

EAHPs are considered as a mechanical extract ventilation and heat pump unit in DEAP. For EAHP units not required to comply with Ecodesign/Labelling directives, follow the guidance under the BER FAQ. This guidance allows for an uplift to be applied to the heat pump SPF, therefore reflecting the higher source temperature of the exhaust air. If calculating the renewable contribution from an EAHP for Part L compliance for a new dwelling, the lower SPF, without the exhaust air uplift must be used. HARP displays both the original and uplifted SPF for EAHP.

Where an EAHP is Ecodesign directive compliant then, in line with the guidance in the FAQ above for Part L and EAHPs: for Part L calculations for renewable energy contribution (TGD L 2008 section 1.2 or TGD L 2011 section 1.2), select "Air to Water" as the type of heat pump for an EAHP. For all other calculations (BER, TGD L MPEPC and TGD L MPCPC), select "Exhaust Air To Water".

Other systems combine heat recovery ventilation with heat pump technology. These are broken down into their individual ventilation and heat pump components and entered in DEAP within the rules of the DEAP methodology for each component. Enter the heat pump component as a heat pump following the guidance in this document. Enter the heat recovery ventilation system using data for MVHR's defaulted from DEAP under the "ventilation tab" or using non defaults from the Product Characteristic Database in the UK if available.

4.3 'Thermodynamic' Solar/Heat Pump systems

Thermodynamic solar/heat pump systems are treated the same as air/water heat pumps but use a flat plate solar collector (usually unglazed) instead of an outdoor fan as a means of collecting heat. These systems are treated as follows in DEAP:

- Enter the solar thermal collector following the guidance for solar collectors under DEAP Appendix H. Use Appendix H defaults if HARP or certified data is not available/applicable for the collector in

the thermodynamic heating system. As always, installation instructions in the test certificate on which the stated performance depends must be adhered to.

- Treat the heat pump component of the thermodynamic system as an air/water heat pump, following the guidance in this document for air/water heat pumps and using the heat pump calculation tool.

4.4 Group heating using heat pumps not required to comply with Ecodesign/Labelling directives

The DEAP Manual Appendix C3 details the approach for heat pumps in a group heating scheme. The calculation tool allows for heat pumps in group heating schemes by determining the proportion of the total group scheme occupied by the dwelling being assessed.

In particular, DEAP Appendix C3 says:

Separate efficiency adjustment factors may be applied in cases where the space and water heating circuits are clearly separate and the space heating circuit only uses low temperature emitters. The percentage of heat for space heating and that for water heating can be determined based on space and water heat delivered to the dwelling. The water heating efficiency and associated percentage of heat for water heating from the heat pump can then be entered separately from the space heating efficiency and percentage of heat for space heating.

For the space heating component of the heat pump, enter as "Heating System 1" in DEAP's group heating section. The space heating efficiency is the "Efficiency of Main Heating System * Efficiency Adjustment Factor (Main Heating)" as derived by the heat pump calculator.

For the water heating component of the heat pump, enter as "Heating System 2" in DEAP's group heating section. The water heating efficiency is the "Efficiency of Main Hot Water System * Efficiency Adjustment Factor (Main Hot water)" as derived by the heat pump calculator.

The "Percentage of heat" from each of the space and water heating components of the heat pump is the total percentage of heat from the heat pump weighted by each of the delivered energy for space heating and delivered energy for water heating from DEAP's results tab.

4.5 Direct Exchange and other types of heat pumps

There are some heat pump types not currently facilitated in the heat pump calculation tool (e.g. gas fired or direct Exchange heat pumps). These will be considered at a subsequent edition of the calculation tool and guidance.