

Dwelling Energy Assessment Procedure (DEAP)

Guidance Document

July 2021



DEAP Guidance Document

Dwelling Energy Assessment Procedure (DEAP) Guidance Document

July 2021

Sustainable Energy Authority of Ireland

SEAI is Ireland's national energy authority investing in, and delivering, appropriate, effective and sustainable solutions to help Ireland's transition to a clean energy future. We work with the public, businesses, communities and the Government to achieve this, through expertise, funding, educational programmes, policy advice, research and the development of new technologies.

SEAI is funded by the Government of Ireland through the Department of Communications, Climate Action and Environment.

© Sustainable Energy Authority of Ireland

Reproduction of the contents is permissible provided the source is acknowledged.

Contents

1. INTRODUCTION	9
1.1 Purpose of this document	9
1.2 BER Programme contact details	9
2. GENERAL GUIDANCE & PART L COMPLIANCE	10
2.1 When is a BER required	10
2.2 Access to BER data and sharing BER data	10
2.3 BER grade not as expected	11
2.4 Audit appeal examples and sample assessment errors	11
2.4.1 Appeal example: boiler interlock (audit finding upheld)	12
2.4.2 Appeal example: roof insulation (audit finding overturned)	13
2.4.3 Appeal example: solid fuel type (audit finding upheld)	14
2.4.4 Additional assessment error examples	15
2.5 Compliance with Part L and improving the BER grade	16
2.6 The National Administration System (NAS)	18
3. GENERAL GUIDANCE ON ACCEPTABLE EVIDENCE & SURVEYS	21
3.1 Survey: general information for new and existing dwellings	21
3.1.1 Survey tips	21
3.1.2 Survey order of priority	21
3.1.3 Signoff of construction drawings and specifications	22
3.1.4 Use of defaults in new dwelling assessments	23
3.1.5 Age of dwellings and extensions	23
3.1.6 Identifying an extension	23
3.1.7 Choosing the correct property address	23
3.1.8 Dwelling type classification	24
3.1.9 BER survey photograph quality	25
3.2 Acceptable evidence: general information	26
Guidance from Suppliers	27
3.3 Provisional assessments	27
3.3.1 Building Control and the requirement for a BER	28
3.3.2 Partially completed dwellings	28
3.4 Derelict dwellings	31
4. DIMENSIONS	32
4.1 Floor Areas	32
4.1.1 Good practice guidance when measuring floor areas	32
4.1.2 Floor area measurements in existing dwellings	33

4.1.3	<i>Case study: simple floor area calculation</i>	34
4.1.4	<i>Case study: floor area in detached house with internal garage</i>	35
4.1.5	<i>Split level dwellings</i>	36
4.1.6	<i>Floor areas and the requirement for BER</i>	40
4.2	Storey height.....	40
4.3	Ancillary room examples.....	43
4.3.1	<i>Mezzanine floor</i>	43
4.3.2	<i>Unheated basements</i>	44
4.3.3	<i>Heated basements</i>	45
4.3.4	<i>Conservatories</i>	48
4.3.5	<i>Porches / entrance lobbies</i>	49
5.	VENTILATION	51
5.1	Ventilation openings.....	51
5.1.1	<i>Chimneys in dwellings without secondary heaters</i>	51
5.1.2	<i>Common flue types on domestic heating appliances</i>	51
5.1.3	<i>Intermittent fans and passive vents</i>	52
5.2	Draught stripping.....	54
5.2.1	<i>Common Errors – Percentage draught stripping</i>	55
5.2.2	<i>Opening Types: examples</i>	56
5.2.3	<i>Identification of draught stripping</i>	59
5.3	Sheltered sides.....	60
5.4	Pressure testing for TGD L compliance and DEAP.....	61
5.4.1	<i>Building Regulation Part L 2019</i>	61
5.4.2	<i>Building Regulation Part L 2011</i>	62
5.4.3	<i>Air tightness report</i>	64
5.5	Mechanical ventilation.....	64
6.	FABRIC	67
6.1	Fabric defaults and non-defaults.....	67
6.1.1	<i>U-value defaults in existing dwellings</i>	67
6.1.2	<i>Non-default U-values in DEAP assessments</i>	67
6.1.3	<i>Documentary evidence for non-defaults where not accessible on site</i>	71
6.1.4	<i>Wall U-value substantiation examples</i>	71
6.1.5	<i>Semi-exposed walls in existing dwellings</i>	73
6.1.6	<i>Measuring roof insulation thickness</i>	73
6.1.7	<i>Room-in-roof approximation for existing dwellings</i>	75
6.2	Additional fabric examples.....	76

6.2.1	<i>Pitched roof U-value calculations</i>	76
6.2.2	<i>Wall insulation examples</i>	81
6.2.3	<i>Detailed case study # 1: data entry for walls, roofs and floors</i>	83
6.2.4	<i>Detailed case study #2: data entry for wall, roof and floor areas</i>	91
6.2.5	<i>Insulation upgrades in the Better Energy Homes grant programme</i>	95
6.3	Thermal mass	96
6.3.1	<i>Thermal mass: common issues</i>	96
6.4	TGD L fabric requirements for apartment walls.....	97
6.5	Thermal Bridging in DEAP	99
6.5.1	<i>What is a Thermal Bridge?</i>	99
6.5.2	<i>Heat Loss due to Thermal Bridges</i>	100
6.5.3	<i>Acceptable Construction Details (ACDs)</i>	100
6.5.4	<i>Junction Details not in the ACDs</i>	101
6.5.5	<i>Accounting for heat loss at junctions in DEAP</i>	102
6.5.6	<i>Example – All key junctions covered by a combination of ACDs and certified details</i>	104
6.5.7	<i>Summary of Thermal Bridging Scenarios</i>	112
7.	WINDOWS & DOORS	116
7.1	Window default data	116
7.1.1	<i>Windows defaults using DEAP Table S9</i>	117
7.1.2	<i>Windows defaults using DEAP Tables 6a and 6b</i>	118
7.2	Windows certified data.....	119
7.2.1	<i>Window sizes and certified window data:</i>	120
7.2.2	<i>Windows frame factor</i>	121
7.2.3	<i>New glazing retrofitted to an existing frame</i>	121
7.3	Window overshadowing	122
7.4	Skylights, solar tubes	123
7.5	Roof windows.....	125
7.5.4	<i>Perspex or plastic roofing</i>	126
7.6	Door entries in DEAP	126
7.6.1	<i>Number of doors</i>	126
7.6.2	<i>Solid wooden and PVC doors: U-values</i>	127
7.6.3	<i>Glazed doors – U-value</i>	127
8.	WATER HEATING	128
8.1	Common Shower Systems.....	128
8.1.1	<i>Vented hot water system</i>	128
8.1.2	<i>Unvented hot water system</i>	130

8.1.3	<i>Instantaneous electric shower</i>	132
8.1.4	<i>Power Showers</i>	134
8.1.5	<i>Shower heated by a Combi boiler or CPSU</i>	134
8.1.6	<i>Shower supplied by a Thermal Store</i>	134
8.2	Entering Default shower Data into DEAP 4.2	134
8.3	Entering Non-Default Shower Data into DEAP 4.2	135
8.3.1	<i>Waste Water Heat Recovery</i>	141
8.4	Baths	142
8.5	Low Water Usage	143
8.6	Hot water storage	143
8.6.1	<i>Hot water storage volume</i>	143
8.7	Water heating controls	147
8.8	Instantaneous electric water heaters	149
8.9	Combi-boilers	151
8.9.1	<i>Combi boiler: additional losses</i>	151
8.9.2	<i>Instantaneous combi Boilers - keep-hot facility</i>	152
8.9.3	<i>Further examples of combi boilers in DEAP</i>	153
9.	HEAT DISTRIBUTION & CONTROLS	157
9.1	Space heating controls	157
9.1.1	<i>Control category: common errors</i>	157
9.1.2	<i>Further control category examples</i>	159
9.2	Warm air heating system	162
10.	LIGHTING	163
10.1	Lighting Design Not Known	163
10.1.1	<i>Entry into DEAP 4.2</i>	163
10.2	Lighting Design Is Known	165
10.2.1	<i>Substantiating evidence required</i>	165
10.2.2	<i>Entry into DEAP 4.2</i>	165
11.	ENERGY REQUIREMENTS	168
11.1	Heating system efficiency	168
11.2	Room heaters and back boiler systems	172
11.2.1	<i>Identifying gas fired room heaters</i>	172
11.2.2	<i>Electric room-heaters in DEAP: direct and storage heaters</i>	173
11.2.3	<i>Electric storage heater controls</i>	175
11.3	Fuels	175
11.3.1	<i>Fuel type selection examples</i>	175

11.3.2	<i>Fuel cost comparison using DEAP</i>	177
11.3.3	<i>Efficiency data for solid fuel appliances</i>	178
11.4	Electricity in DEAP.....	178
11.4.1	<i>Accounting for updated electricity factors when carrying out Part L checks</i>	178
11.5	Group heating.....	179
12.	RENEWABLES & ENERGY SAVING DEVICES	183
12.1	Solar heating.....	183
12.1.1	<i>Solar space heating in individual heating systems</i>	183
12.1.2	<i>Solar space heating in group heating systems</i>	186
12.1.3	<i>Multiple solar collectors of different orientation</i>	188
12.2	On site renewable electricity generation	188
12.2.1	<i>Micro wind turbines in DEAP</i>	188
12.2.2	<i>Photovoltaics (PV) in DEAP</i>	189
12.3	Other energy saving devices	191
12.3.1	<i>Flue gas heat recovery systems (FGHRS)</i>	191
13.	HEAT PUMPS	193
13.1	Heat pump design flow temperature.....	194
13.1.1	<i>Designer/Installer Sign-off Sheet</i>	195
13.1.2	<i>Heating Design Sheet</i>	196
13.1.3	<i>Radiator Specification & Sizing</i>	201
13.1.4	<i>On-site checks</i>	204
13.1.5	<i>Checklist</i>	205
13.2	Heat Pump Examples	208
13.2.1	<i>Example 1: An air-to-water heat pump not compliant with Ecodesign/ Energy Labelling Directives. Listed on HARP.</i>	208
13.2.2	<i>Example 2: Air-to-water heat pump compliant with Ecodesign/ Energy Labelling Directive 214</i>	
13.2.3	<i>Example 3: Air-to-air heat pump compliant with Ecodesign/ Energy Labelling Directive</i>	220
13.2.4	<i>Example 4: Exhaust Air to water heat pump compliant with Ecodesign/ Energy Labelling Directive</i>	224
13.2.5	<i>Example 5: Air to water heat pump compliant with Ecodesign/ Energy Labelling Directive with backup heater</i>	225
13.3	Accounting for exhaust air heat pumps (EAHPs) in DEAP	228

Note on the information in this document

This document brings together articles from all published domestic BER technical bulletins. Most of the articles have been brought into this document unchanged. However, there are some changes, as outlined below.

Structure

The articles have been arranged by topic, so, for example, technical bulletin articles on Ventilation are in Section 5 of the this document, articles on windows and doors are in Section 7, and so on.

Note: where a technical bulletin article has previously been incorporated into the DEAP Manual, it is not included in this document.

Updated References

The following have all been updated,

- Screenshots of DEAP 3 have been updated to DEAP 4;
- References to previous revisions of TGD L have been updated, where appropriate;
- Links to external documents have been updated.

Changes to Text

- Section 3, on acceptable evidence and surveys, has been aligned with the current version of the DEAP Survey Guide (Version 4.0, published July 2020).
- Section 5.4, on 'Pressure testing for TGD L compliance and DEAP', has been updated to include TGD L 2019.
- Additional text has been added to Section 7.2.1 on the use of BFRC/WEP certificates.
- Section 13.1 on the use of Non-Default Flow Temperatures for heating systems has changed significantly. Changes include,
 - a new revision of the Designer/Installer sign-off document which is published along with this document;
 - changes to the checks Assessors are required to carry out.

The purpose of the changes is to simplify the role of the Assessor in this scenario, with the onus put on the Designer/Installer to provide the evidence required to support the use of a non-default flow temperature.

1. Introduction

The Dwelling Energy Assessment Procedure (DEAP) is a method for calculating energy consumption and associated carbon dioxide emissions for dwellings. It considers space heating, ventilation, water heating, and lighting in a dwelling. The Sustainable Energy Authority of Ireland publishes the DEAP software, which is used to perform the calculations, and associated guidance and procedural documents.

DEAP is used by registered BER Assessors to calculate the BER of new and existing dwellings and to demonstrate compliance with aspects of Part L of the Building Regulations.

1.1 Purpose of this document

The primary purpose of this document is to consolidate and replace guidance from several previous documents and resources including:

- DEAP Technical Bulletins
- DEAP Frequently Asked Questions (FAQs)
- Guidance issued at previous technical workshops run for BER Assessors.

The Technical Bulletins and FAQs are being retired on publication of this guidance document.





This document is organised based on different technical aspects of a DEAP assessment, e.g. ventilation, water heating, windows, fabric, dimensions, etc. This document is supplementary to the following core documents, all of which are available [here](#):

- DEAP Manual
- DEAP Survey Guide
- BER Assessor's Quality Assurance and Disciplinary Procedure
- BER Assessor's Code of Practice
- "DEAP Tools and information" and DEAP guidance videos [here](#).

This guidance document generally does not duplicate guidance published in these core documents. However, some of the guidance in those documents is repeated here for emphasis. Obsolete guidance is not included in this document.

1.2 BER Programme contact details

If you need to contact SEAI's BER Helpdesk, details are as follows:

<u>Registered BER Assessors</u>	<u>Other contacts</u>
 1890 252 738 / 01 248 6986	 1890 734 237 / 01 248 6985
 registered@ber.seai.ie	 info@ber.seai.ie

2. General Guidance & Part L compliance

This section covers high-level aspects of domestic BERs, such as when is a BER required, BER data access, Part L compliance and examples of the Quality Assurance process.

2.1 When is a BER required

All new and existing buildings, as identified in Irish Regulations [S.I. No. 243/2012 - European Union \(Energy Performance of Buildings\) Regulations 2012](#), for sale or rent require a BER. Additionally, new buildings require a BER before they are first occupied, even if not being sold or rented.

An existing dwelling is a dwelling which has previously been sold and/or occupied. Dwellings which have not previously been sold or occupied are to be specified as new dwellings in DEAP.

New dwellings being sold off plans and specifications, prior to construction, require a provisional BER. On completion, the new dwelling will require a “new-final” BER. BERs are required in some non-statutory cases also, for example, as per the [SEAI Better Energy Homes](#) programme. In all cases, published BERs must adhere to the DEAP Methodology and the guidance detailed in the core documents and supplementary guidance (including this Guidance Document) referenced in Section 1 above.

2.2 Access to BER data and sharing BER data

After a BER Assessor publishes a BER for a client, the client is entitled to access to the BER Certificate and the Advisory Report. In addition, [Statutory Instrument No. 243 of 2012](#), details that:

A data file or other extract from a register relating to a BER assessment for a particular building shall normally only be made available to—

- the relevant owner of the building, or an agent acting on behalf of the owner, via a BER assessor;

In other words, the client has a right to the DEAP output file capturing the parameters entered in the assessment should they wish to obtain it.

Section 10 of the [BER Assessor’s Code of Practice](#) details the obligations on BER Assessors in relation to BER data confidentiality and data protection. A BER Assessor is required to abide by the following confidentiality requirements:

- To keep confidential the identity of clients and BER records.
- To obtain in writing the consent of the client to hold discussions with third parties concerning BER assessments that he/she has been instructed to carry out, including discussions with architects, engineers, and prospective suppliers or suppliers of building materials, components or services.

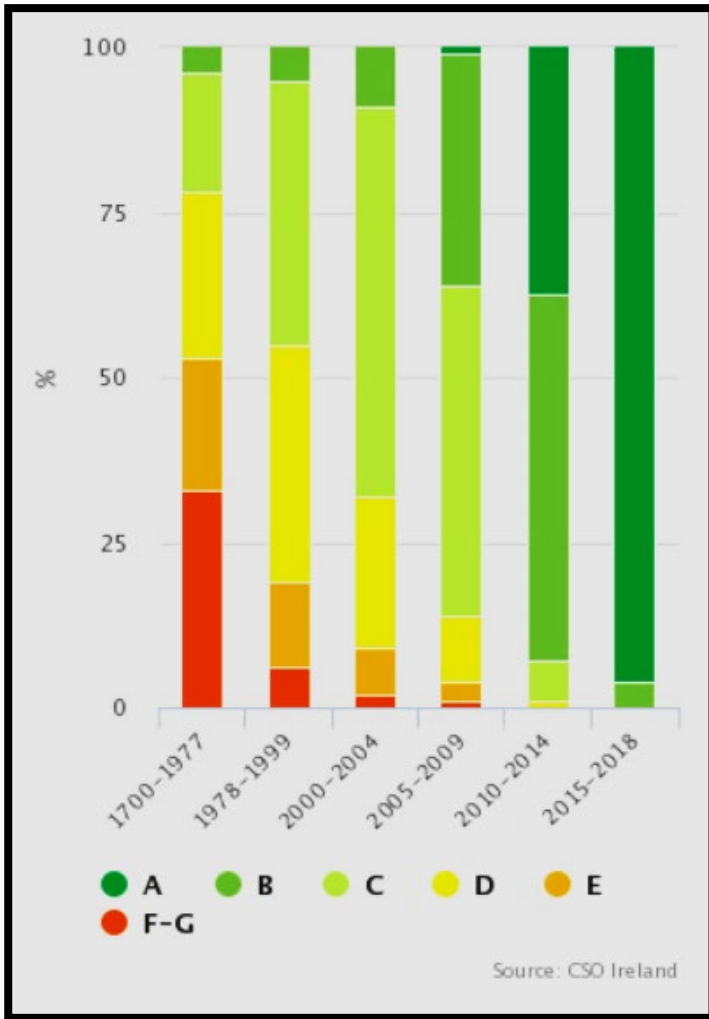
In relation to determining compliance with Part L of the Building Regulations, TGD L states that “Those involved in the design and construction of a building may be required by the relevant building control authority to provide such evidence as is necessary to establish that the requirements of the Regulations are being complied with.”

Consequently, a client may direct a BER Assessor to provide information to a Building Control Authority relating to the dwelling’s energy performance and/or relating to compliance with the Building Regulations. The [DHPCLG](#) details the powers of enforcement and inspection for Building Control Authorities.

2.3 BER grade not as expected

A dwelling designed to comply with Building Regulations 2011 TGD L would be expected to achieve an A3 Building Energy Rating. Dwellings designed to comply with earlier editions of the Building Regulations TGD L would not be expected to achieve better than an A3 rating. The national average BER grade is a D rating with variation depending on dwelling age, insulation, heating system efficiency, fuel, etc. The [Central Statistics Office](#) provide some analysis of BERs based on a number of parameters to help estimate a typical BER grade for the dwelling type/age. An example is shown in Figure 2.1.

Figure 2.1: BERs based on period of construction



If the BER achieved is better or worse than expected, it is possible that one or more errors have been made in the assessment. Errors must be corrected prior to publication of the assessment on NAS. A common cause of a BER assessment showing a better than expected energy rating for the dwelling is that the heating system has not been entered correctly in DEAP. All errors are taken into consideration by SEAI's Quality Assurance and Disciplinary Procedure (QADP) regardless of whether they improve or worsen the rating.

The National Administration System (NAS) and DEAP carry out basic checks on data entered to identify likely errors in data entered. The outcomes of these checks must be reviewed by BER Assessors prior to publication of BERs.

2.4 Audit appeal examples and sample assessment errors

This Guidance Document details a range of examples across various aspects of the DEAP Assessment. Some initial examples based on audit findings and appeals, presented at previous SEAI BER Technical Workshops are detailed in this section.

BER Assessors may appeal BER audit findings, setting out evidence or factors demonstrating that SEAI's preliminary decision resulting from an audit is incorrect. Appeals may result in the original audit decision being overturned with a revised audit report being issued if successful.

2.4.1 Appeal example: boiler interlock (audit finding upheld)

In the example below, the Assessor appealed the audit finding but the audit finding was **upheld**, i.e. the original audit outcome did not change:

Figure 2.2: Audit finding and appeal comment: Boiler interlock

Item	Energy requirements – space/water efficiency adjustment factor incorrect.
Comment	The efficiency adjustment factor for both space and water heating is incorrect. Based on a cylinder thermostat and room thermostats there is a boiler interlock present. Please refer to Section 9.3.9 (Boiler Interlock) of the DEAP Manual The impact of this error on the energy value is 5.92 kWh/m ² /yr
BER assessor comment	Section 9.3.9 of the DEAP Manual does not state that boiler interlock should have been selected. I don't see any reference as to why boiler interlock should have been included.

Figure 2.3: Audit appeal outcome: Boiler interlock

Heating system (Domestic Hot Water)

Primary Hot Water System

Hot Water Cylinder, Insulation and Controls

Heating system (Controls)

Heating Controls (tick all that apply)

Underfloor heating (UFH)

Pumps

Comments on water heating system

750x450mm

Appeal Outcome

The Non Compliance is Upheld

The assessor provided documentary evidence to support that a room thermostat and cylinder thermostat were present in the dwelling.

The auditor should have referred the assessor to Table S11 of the DEAP Manual where it states that boiler interlock is assumed to be present if a room thermostat and (for stored hot water systems) a cylinder thermostat.

The non compliance resulted in a change in energy use of 5.92 kWh/m²/yr.

Auditor correctly highlighted that a room thermostat and cylinder stat were present, which imply interlock in an existing dwelling

2.4.2 Appeal example: roof insulation (audit finding overturned)

In the existing dwelling assessment audit outcome in Figure 2.4, the auditor did not accept the calculations in Figure 2.5 on the basis that the insulation thermal conductivity was taken from DEAP Table 12b. The assessor contended that the non-default U-value as calculated was correct. The assessor had also provided useful photographs and Survey Form evidence supporting the presence, type and depth of attic insulation.

In this case, the audit finding was **overturned**, as the assessor provided adequate documentary evidence to support the presence of insulation and depth of insulation in the dwelling. The Assessor had also provided a correct U-value calculation showing derivation of the non-default U-value. The original audit should have accepted the non-default U-value calculation. The insulation conductivity was taken from Table 12b of the DEAP manual, which is allowed in existing dwellings.

Figure 2.4: Audit finding and appeal: Roof U-value

Item	Building elements - Roof U value Incorrect
Comment	Insufficient evidence provided by the assessor to support the non default U value calculation. No evidence to support the conductivity of the insulation materials. Default U value selected for building age. The impact of this error on the energy value is 92.02 kWh/m2/yr
BER assessor comment	2.3 U value defaults for existing dwellings as per Table S2 in the DEAP Manual assume insulation is not present. However actual U values must be calculated when the assessor has evidence of the particular construction and makeup of the exposed element (as per the DEAP Survey Guide)

Figure 2.5: Roof U-value calculation under review during audit and appeal

Element type: Roof - Pitched roof - insulated ceiling									
Calculation Method: I.S. EN ISO 6946									
Layer	d (mm)	λ layer	λ bridge	Fraction	Density	Sp. heat	R layer	R bridge	Description
							0.100		Rsi
1	12.5	0.210			700	1000	0.060		Plasterboard
2	150	0.044	0.130	0.0900	12	1030	3.409	1.154	Mineral wool quilt
3	150	0.044			12	1030	3.409		Mineral wool
4		R-value ⁴			1	1000	0.200		Roof space
							0.040		Rse
	<u>313 mm</u>						7.218		
⁴ Roof space - tiled roof, with felt or sarking boards									
Total resistance: Upper limit: 6.934 Lower limit: 6.708 Ratio: 1.034 Average: 6.821 m ² K/W									
U-value (uncorrected) 0.147									
<u>U-value corrections</u>									
Air gaps in layer 2 $\Delta U = 0.000$ (Level 0)									
Loft hatch $\Delta U = 0.003$ (Insulation thickness = 50 mm)									
Total ΔU 0.003									
U-value (corrected) 0.150									
U-value (rounded) 0.15 W/m²K									

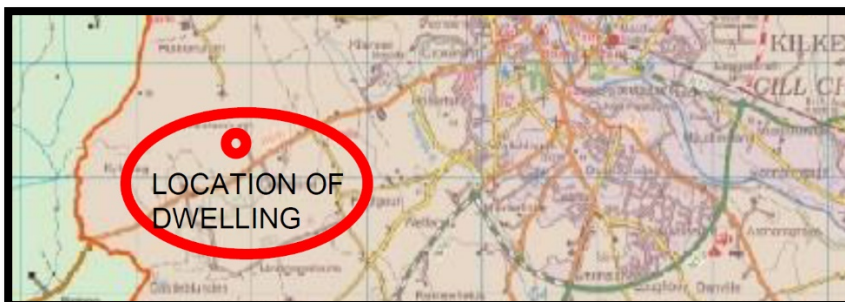
2.4.3 Appeal example: solid fuel type (audit finding upheld)

In the appeal example in Figure 2.6, the auditor deemed that the secondary heating fuel type was incorrect. The Assessor had selected fuel type “House Coal” despite the dwelling being in a smoke control area. The auditor detailed the guidance to be used in deriving the solid fuel type. The appeal was unsuccessful, and the audit finding was **upheld**.

Figure 2.6: Audit finding and appeal: Solid fuel type

Item 3	Energy Requirements – Fuel Type Incorrect. Incorrect secondary fuel type entered.
Comment	Secondary heating fuel incorrectly entered as 'Housecoal' for an open fire in a smoke control area. Select 'Manufactured Smokeless Fuel' when dwelling is in a 'smoke control area' and the appliance can burn multiple fuels. This property is located inside the Kilkenny city smoke control area. Refer to DEAP Manual Section 10.3.3. and Technical Bulletins October 2009, October 2012.
BER assessor comment	Dear Sir \ Madam, The property is located in the countryside, miles from Kilkenny City. See map attached with coordinates
Appeal Outcome	As a result of the appeal this non compliance has been upheld. The assessor's documentation regarding townland address, GPS co-ordinates and location of the property substantiates the same location as marked by the auditor on the DoE smoke control area map for Kilkenny. Smoke control areas (also called coal restricted areas) can be identified using the facility under http://maps.epa.ie or following guidance on the Department of Environment, Community and Local Government website

Figure 2.7: Auditor’s snapshot of Coal Restricted Area map



2.4.4 Additional assessment error examples

The following table details several errors identified in other audits.

Table 1: Additional sample assessment errors

Error type	Error Reason	Audit Comment
Thermal Bridging Factor Incorrect	Audit submission did not explicitly address the sign off points as per DEAP Appendix K: Thermal Bridging	No evidence provided to validate the use of a Thermal Bridging Factor of 0.08. See Appendix K DEAP Manual.
Wall U values Incorrect	Inadequate documentary evidence provided	A U-Value calculation has been provided for the heat loss walls. However, this is not considered valid on the following basis: <ul style="list-style-type: none"> • No sign off provided, • No confirmation of wall specification, • No confirmation of insulation manufacturer/type used, • No supporting NSAI certification
Renewable Contribution Incorrect	Wood stove included in error in the renewable and energy saving technologies section of DEAP	As per Appendix Q of the DEAP Manual, wood fuel systems have already been accounted for in the DEAP data file and therefore should not be entered here
Space/water heating efficiency incorrect	Incorrect main heating system efficiency entered	Incorrect default efficiency used for wood pellet boiler (Auto feed). Refer to Table 4a DEAP Manual
Intermittent fans incorrect	Incorrect number of intermittent fans entered	Extractor fan over cooker hob is not ducted through to outside air and should have been ignored. Incorrectly counted and entered in the data file
Efficiency adjustment factors incorrect	Assessor did not identify the room thermostat present	Room thermostat is 'built-in' within the programmer housing. The programmer as shown on the attachment has a programmable room thermostat as part of the one display unit located in the hall. Incorrectly entered 'No' instead of 'Yes' for 'boiler controlled by thermostat'. Efficiency adjustment factors corrected from '0.95' to '1' to reflect the presence of a cylinder thermostat and a room thermostat. Section 9.3.4 DEAP Manual refers

2.5 Compliance with Part L and improving the BER grade

Clients and homeowners can often ask how they can achieve an “A” rating in their new or existing dwelling, or how can they achieve compliance with the latest Energy and CO₂ performance requirements in Part L of the Building Regulations. There is no one specification that will guarantee that the “A” rating or Part L compliance is achieved as there are well over 50 parameters that can impact a BER and Part L assessment outcome.

For the purposes of Part L compliance, the calculated Energy Performance Coefficient (EPC) and Carbon Performance Coefficient (CPC) mustn't exceed the Maximum Permitted Energy Performance Coefficient (MPEPC) and the Maximum Permitted Carbon Performance Coefficient (MPCPC).

In the [2019 Technical Guidance Document \(TGD\) to Part L](#), the MPEPC is 0.3, meaning that the dwelling's calculated energy usage must be no more than 30% of the TGD L Appendix C reference dwelling EPC. Likewise, the dwelling's calculated CO₂ emissions must be no more than 35% (the MPCPC) of the TGD L 2019 Appendix C reference dwelling CPC. These are the values checked in DEAP.

A BER cert may be published for new dwellings regardless of whether the building meets Part L requirements. However, the BER assessor is required to notify their client in writing which elements of the dwelling design do not comply with Part L as calculated in DEAP.

The client or the dwelling designer may ask the BER assessor to help identify dwelling design changes to achieve Part L compliance in DEAP. It is always recommended to perform the DEAP calculation at early design stage prior to commencement as detailed in TGD L. This calculation should be kept under review and take account of changes to specification during construction e.g. heating system efficiency, window solar gain, thermal bridging details, MVHR specification changing after the original DEAP assessment is carried out.

Non-default performance as listed on relevant databases, third party certificates or CE marked literature should be used in preference to DEAP default values. See the guidance in the DEAP manual on “Accredited or certified data” under the “General Principles” section along with references to other relevant data sources and databases in the DEAP manual. For all DEAP entries, bear in mind the DEAP methodology requirements for valid supporting documentary evidence when carrying out a BER.

When seeking to achieve compliance with TGD L for dwellings it is worth reviewing the sample dwellings available from Department of Housing Planning and Local Government (DHPLG):

- [Technical Guidance Document \(TGD\) to Part L](#)
- [TGD L 2019 Regulatory Impact Analysis Document](#)

If still having difficulty identifying why the dwelling is not complying with Part L after reviewing the above sample dwellings, check through the following list to see potential areas for improvement. The following guidance is not exhaustive and is intended to help assessors identify how to achieve compliance by making improvements to the dwelling being assessed in several areas:

- Ventilation
 - For new dwellings, a permeability test result should be sought for entry in DEAP. For new-provisional ratings a value may be assumed as per Section 5.4 of this document.
For new-final ratings, permeability test results are produced in accordance with IS EN 9972:2015 (Supersedes IS EN 13829) by a person certified by an independent third party to carry out this work, e.g. National Standards Authority of Ireland certified or equivalent. Air pressure testing should be carried out on all dwellings on all development sites, as outlined in TGD L Section 1.3.4.4.
 - Open flues and chimneys contribute to ventilation heat losses in DEAP. System designers should minimise these losses using balanced or room-sealed flues or permanent dedicated combustion air supplies where possible (whilst adhering to all other relevant sections of Building Regulations e.g. see TGD J).
 - Background permanent ventilation for TGD F purposes will have reduced losses where controllable/closable vents are used (whilst adhering to all other relevant sections of Building Regulations). Combustion for Part J Heat Producing Appliances should be provided through permanent ventilation openings.
 - Non-default values for mechanical ventilation are taken from [SAP Appendix Q's Product Characteristics Database](#) and generally will result in lower calculated energy usage in DEAP than use of defaults.
 - The use of heat recovery systems can result in improved performance where non-default MVHR system parameters from SAP Appendix Q's Product Characteristics Database are used. Target increased efficiency and minimise Specific Fan Power when recommending a product from the Product Characteristics Database. When using heat recovery systems in your design, air tightness of the building has significant impact on the

CPC and EPC results obtained. Aim for higher levels of air tightness. The dwelling design must adhere to all other relevant sections of building regulations.

- **Building Elements**
 - While the dwelling must at least meet the minimum requirements in different sections of Part L (e.g. fabric requirements), the dwelling is more likely to achieve MPEPC/MPCPC compliance if the dwelling exceeds the requirements in different sections. For example, a dwelling with a wall U value of 0.12 W/m²K is more likely to meet MPEPC/MPCPC than a dwelling with a wall U-value of 0.18 W/m²K. The construction and depth of an external wall will change depending on the U-Value required, therefore it is important that the planned U-Value is specified in a DEAP calculation prior to commencement. The U-value required in a sloped roof may also influence the roof construction so again this should be specified in DEAP prior to commencement.
 - Aim for a thermal bridging factor of 0.08 (from Acceptable Construction Details) or lower. See DEAP Appendix K and Section 6.5 of this document.
 - Use certified U-values and solar transmittance values for windows. See DEAP Section 3.2 and Table 6b. Window orientation, glazing areas and locations can be optimised to capitalise on solar gain (e.g. minimise North facing windows and optimise South facing windows).
- **Water Heating**
 - Reduce the “temperature factor multiplier” for hot water storage following options in DEAP Table 2 (e.g. by having time and temperature control for an indirect cylinder).
 - Increased cylinder insulation will reduce the losses from the hot water cylinder (particularly factory fitted insulation).
 - Minimise the primary circuit losses e.g. if there is a boiler and cylinder, it is better to have all primary pipework between the boiler and cylinder insulated and ensure there is a cylinder thermostat.
 - A well-designed solar water heating system typically has a solar fraction of 50-60% - although this will depend on the needs of the client. Source non-default parameters for the solar collectors (e.g. using HARP). Use a cylinder with a larger dedicated solar storage volume to increase the yield from the solar collectors.
- **Lighting**
 - Aim to achieve 100% low energy lighting in the dwelling using low energy bulbs such as fluorescent, CFLs and LEDs.
- **Distribution System Losses and Gains**
 - Aim for a higher control category and lower temperature adjustment by having a high level of heating system controls. For example, a boiler heating system should at least have a programmer and two or more thermostats. TGD L outlines zoning and controls guidance for new dwellings.
 - Boiler systems should have boiler interlock to improve the efficiency adjustment factor. See DEAP Section 9.
 - Where there are central heating pumps, use pumps with an energy label showing low wattage and high efficiency. See the footnote to DEAP table 4f entitled “Note on use of non-default central heating pump electricity consumption”.
 - DEAP Table 4c, 4e and Section 9 discuss several other control options that may improve the dwelling’s EPC and CPC (e.g. delayed start thermostats and load/weather compensation).
- **Energy Requirements**
 - Source non-default values for space heating (main and secondary) and water heating. Check HARP and other certified sources for appropriately certified data.
 - The adjusted space and water heating efficiency can be optimised according to space heating emitter type, operating temperatures and system parameters, particularly for heat pumps. See DEAP Table 4 for details.
- **General**
 - Follow the DEAP methodology when checking the dwelling design for Part L compliance using DEAP. The dwelling must comply with all relevant facets of Building Regulations.
 - Default values are generally conservative. Use non-defaults supported by the appropriate evidence detailed in the DEAP manual and survey guide. For example, check HARP for heating systems, IAB for insulation thermal conductivities and so on. Non-default values in DEAP must always be supported by valid evidence from the correct database, accredited source, test data, etc. See the DEAP manual for guidance.
 - Investigate incremental improvements such as:

- Minimise fabric and ventilation losses
- Maximise solar, heat and light gains
- Improved air tightness
- Improved insulation levels
- Use better non-default values for HVAC efficiencies, U values etc.
- Optimise heating controls.
- It may be necessary to specify additional renewable systems subject to how the client and dwelling designer plan to achieve compliance.
- Review the DEAP results tab and see which section has the highest demand (e.g. water heating or space heating). Identify improvements to reduce that section as this is likely to yield the most significant improvement to EPC and CPC.

Training courses are available from 3rd parties to assist in achieving Part L compliance. SEAI is not involved in the delivery or development of these training courses.

Additional key references and databases:

- [HARP Database](#)
- [NSAI Air Tightness Testers Scheme](#)
- [NSAI Window Energy Performance Scheme](#)
- [NSAI Agrément Certificates](#)
- [NSAI Thermal Modellers Scheme](#)

2.6 The National Administration System (NAS)

Table 2: NAS Guidance

NAS issue	Guidance
BER certificates on the National Administration System	<p>The National Administration System (NAS) holds the BER certificate associated with the latest published version of each BER number’s assessment. In the cases where more than one rating is associated with a single BER number, only the most recent published rating’s certificate is available on NAS.</p> <p>The BER certificate should not be altered after it is downloaded from the NAS. Changes such as addition of the client or BER Assessor’s name should not be made to the certificate.</p>
NAS login	<p>In cases where an Assessor attempts to login to NAS and uses an incorrect password three times in succession, then their NAS account will become locked. The Assessor should then contact the BER Helpdesk to have the account unlocked, and, if required, the helpdesk can then assist in getting a new password.</p> <p>If an Assessor has lost their password, they should select the “Forgot Password?” option on the NAS login window. The Assessor is then required to enter their user name (Assessor number) and date of birth (dd/mm/yyyy format). A new password is then emailed automatically to the Assessor’s registered email address. This password is case-sensitive and can be copied and pasted into the NAS login window. Once logged in, the assessor can change to a new password if they wish to do so.</p> <p>In the case of any difficulties with passwords or login, assessors are advised to contact the BER Helpdesk for assistance.</p>
Updating published BERs on NAS	<p>Ratings published on the National Administration System (NAS) are generally displayed in descending order of BER Number. In certain circumstances, such as revision of published ratings, the new certificate assumes the same BER Certificate Number and therefore is listed along with the previously uploaded rating. Depending on the dates of the published ratings and the quantity of ratings uploaded by the Assessor, the revised rating may appear further down the list or on another page.</p> <p>To view the latest ratings uploaded, sort the visible ratings on NAS by Date “Processed/Issued” in descending order by clicking on the “Processed/Issued” column header. To alternate</p>

	<p>between “date descending” and “date ascending”, click on the “Processed/Issued” column header again. Similarly, the Assessor can sort BER Certificates by MPRN, County, Type, etc.</p> <p>Always take great care in uploading revised ratings as refunds cannot be issued after accepting the “Publish Rating Confirmation” screen.</p>
SEAI Substitute MPRN Facility	<p>The latest version RO11 form is available here: https://www.seai.ie/resources/forms/RO11 (Request for SEAI Property Reference Number)</p> <p>The BER Assessor should, from the outset, exhaust all avenues to obtain the relevant MPRN. The Assessor will need to confirm to the BER Helpdesk if the property has electric power and what lengths they’ve gone to obtain the MPRN. Please note the SEAI Property Reference Number is not to be used in instances where a builder/developer wants a BER certificate without registering the property with the ESB and seeking a MPRN. If the owner/vendor is a builder, or an agent acting on their behalf, they should be instructed to arrange for registration of the property for MPRN, at which stage the Assessor will be able to publish a BER rating.</p> <p>To prevent delays in generating the SEAI MPRN, the BER Assessor should make sure that all parts of the form have been completed in full and enclose a copy of all the relevant attachments and information.</p>
Sourcing the MPRN for the BER Assessment	<p>The MPRN is usually straightforward to source as it is printed on the electricity bill. This bill must be requested to the client by the BER assessor.</p> <p>In cases where a bill cannot be made available, the Assessor should provide the meter serial number when requesting an MPRN from ESNB (ESB Networks). In addition, when contacting ESNB to request the MPRN for the property, the BER Assessor must take steps to ensure that the MPRN sourced from ESNB is correct for the specific property. Clarifications must be sought from ESNB when there is an obvious mismatch in the property address, as the address may have been changed after the meter was installed and this may result in the wrong MPRN being sourced.</p> <p>Written evidence (letter / e-mail) of correspondence to ESNB (ESB Networks) must be provided when applying for a substitute MPRN to the BER Helpdesk and all records must be kept on file by the BER Assessor. The BER assessor must make all reasonable efforts to obtain a copy of the electricity bill for the property if the property has an electrical utility supply, and the MPRN must be primarily sourced from the electricity bill.</p> <p>The MPRN is not mandatory for provisional BER assessments</p> <p>If a “dummy” MPRN is used (SEAI Property Reference Number), a new BER Certificate will be required once the ESNB assigns an MPRN to the property and no refund will be awarded upon republication. There is a “shared MPRN” facility in DEAP and this should be used whenever the property has the same MPRN as another property</p> <p>The form RO11 referenced above must be filled in to request a “dummy” MPRN (SEAI Property Reference Number).</p>
BER Assessor company number on published BER certificate on NAS differs from the printed BER certificate	<p>A BER certificate contains the BER Assessor number and BER Assessor Company number assigned by SEAI. The contact details for BER Assessors are available by entering the relevant BER certificate number or MPRN on https://ndber.seai.ie/pass/ber/search.aspx</p> <p>In some circumstances the BER Assessor may retain the same Assessor number and the Assessor company number may change e.g. when a BER Assessor is no longer registered as an Individual but is now an Employee. The BER Assessor company number displayed on this website and on the NAS reflects the current company number assigned to a BER Assessor Company. The current BER certificate and related advisory report is held and may be viewed in electronic form on the NAS and may be produced in printed form from this record. The BER Assessor can provide their clients with a copy of the BER certificate.</p>

NAS MPRN utility	<p>A Meter Point Reference Number (MPRN) is a unique 11-digit number assigned to every single electricity connection and meter in the country. The MPRN can be found on the electricity bill for the dwelling. In the absence of electricity bills, the MPRN may be printed in the electricity meter box.</p> <p>Registered BER Assessors can validate the accuracy of an MPRN number using the MPRN Utility tab on NAS or in DEAP.</p>
BER is rejected on NAS	<p>A BER submission is rejected in NAS because errors have been identified by SEAI. The Assessor should review the errors, correct them and resubmit the rating.</p>
BER is classified as “repairable” on NAS	<p>A BER submission will be placed in the Repair Queue when the BER and/or MPRN number submitted is incompatible with a record already held on the National BER Register. Repairs can be found by clicking on the 'repairable' tab on NAS.</p> <p>If the Assessor can identify the error, the Assessor can discard the repair, and resubmit the rating after correcting it in DEAP and re-exporting and uploading the assessment again.</p> <p>If the Assessor is unable to identify an error and the numbers are correct, they can await final determination of the status of the rating by the BER Administrator.</p>

3. General Guidance on Acceptable Evidence & Surveys

This section outlines fundamental guidance for DEAP surveys and identifying acceptable evidence. It also includes guidance on the approach to Provisional BERs and partially completed dwellings.

3.1 Survey: general information for new and existing dwellings

BER assessments for both “Existing” and “New-Final” buildings require that BER Assessors carry out a full building survey before the BER is published. The Assessor must visit the premises to collect the data for the assessment. The BER Assessor may also review plans and specifications for new or existing buildings. Plans and specifications are particularly useful in providing supplementary information not available from the site survey.

Provisional ratings are carried out based on plans and specifications rather than using a site survey, although surveys can be carried out on partially completed new dwellings.

[The DEAP Survey Guide](#) provides extensive detail on the approach to domestic BER surveys, and, along with the DEAP manual, is the first port of call for technical guidance on the DEAP methodology. The following are the key points detailed in the Survey guide and are not repeated in detail in this DEAP Guidance Document:

- Contact the client in advance of the site visit to arrange access to the boiler house, etc.
- Collect as much evidence, photos, documentation and plans as possible during the survey and assessment.
- Always complete a [DEAP Survey Form](#) when carrying out the assessment. Assessors may use their own, customised Survey Form provided it collects at least the same data as the SEAI DEAP Survey Form. The Survey Form is designed to capture information towards every relevant DEAP entry for dwellings.
- The importance of equipment, documentation, sketches and drawings for carrying out an accurate survey.
- Step-by-step approach to internal, external and room-by-room survey.
- Section “Guidance on Supporting Evidence” showing extensive detail on evidence required for DEAP entries.

3.1.1 Survey tips

During the dwelling survey, Assessors should bear in mind the following tips to help expedite the survey process and reduce the likelihood of errors:

- Open doors to establish element lengths. This can reduce the number of measurements needed.
- Ask the homeowner for knowledge on works and extensions. Support this with evidence and data collection.
- Check with local/planning authorities for information on dwelling age (see below).
- Sense check dimensions – eliminate fundamental errors.
 - Do floor areas appear correct based on a walk around of the dwelling?
 - Do floor areas for different storeys make sense in relation to each other?
 - Allow for tolerances in DEAP Manual Appendix S.
 - Is there enough heat loss roof area to cover at least the largest floor area?
 - Double check survey form entries against sketches/plans. Do they match?
- Ensure that any equipment use during the survey is functioning correctly such as:
 - Bring spare batteries for any digital equipment such as laser measuring devices, electronic compass or data storage devices.
 - In establishing the orientation of dwelling, take several readings with a compass and ensure that there is no interference from any electrical devices or metal objects.

3.1.2 Survey order of priority

The DEAP Survey Guide Section 4 details that data from the site survey takes precedence. If site evidence isn't available, then evidence can be sourced from documentation. If site and documentary evidence are not available, then rely on DEAP defaults as a last option, bearing the following in mind:

- Defaults are usually, but not always the most pessimistic option, i.e. resulting in higher energy usage.
- Occasionally, a non-default results in higher energy usage.
- Non-defaults are always used if supporting evidence meeting requirements in the DEAP Methodology are available.
- If using defaults, keep on record your reasoning for using those defaults.

3.1.3 Signoff of construction drawings and specifications

Where plans and specifications are being used as substantiating evidence the following approach is required:

- Reports/drawings/specifications need to provide enough detail for the DEAP entry in question. Further detail on the level of information needed and other supporting documentation required is given in the DEAP Survey Guide, Section 4.
- Information gathered on site takes precedence, so if what is found on site contradicts the reports/drawings/specifications, the information gathered on site should be used.

New Build final and existing dwellings extensions

Reports of works or as-built drawings/specifications must be signed off by the person responsible for building regulation compliance sign-off. For example:

- Architect;
- Engineer;
- Assigned Certifier

Construction drawings/specifications signed off "As Built" by one of the parties above are deemed to be equivalent to "As Built" drawings/specifications.

For New Buildings/Extensions that "Opt Out" of building control and do not have an Architect, Engineer or Assigned Certifier for the project, non-default data must be supported by sufficient documentation in the form of invoices, photographs taken during construction, and drawings.

Receipts and invoices must be clearly related to the specific dwelling address and display the date the work was carried out or the date the product was supplied.

Quotations are not acceptable as supporting evidence.

New build provisional assessments

Design drawings/specifications for the proposed dwelling must be signed off by at least one of the following for the dwelling in question:

- Architect;
- Engineer;
- Developer/Builder/Contractor;
- BER Assessor's client.

Existing dwelling refurbishment

Renovation works often do not involve a design professional, so may not have a full set of plans or specifications documenting the works. Where available, reports/drawings/specifications signed off by the architect/assigned certifier/engineer can be used as substantiating evidence.

Where renovation works are supported by an SEAI grant, the Declaration of Works (DOW) signed-off by the Contractor can be used as substantiating evidence to support the thickness of insulation and area of insulation installed.

Alternatively, signed off reports, invoices or a signed letter head provided by the Contractor responsible for the works can be used as substantiating evidence.

Receipts and invoices (for retrofitted insulation, for example) must be clearly related to the specific dwelling address and display the date the work was carried out or the date the product was supplied.

Quotations are not acceptable as supporting evidence.

3.1.4 Use of defaults in new dwelling assessments

When performing a BER assessment on a dwelling that has not been previously sold or occupied, the dwelling is treated as a new dwelling in DEAP. Assessors may encounter dwellings considered to be “new” in this regard where there is a lack of availability of plans, U-values and other details. Approach these cases as follows:

- Make every effort to obtain plans and insulation details for the new dwelling where detail is not available from the survey. Defaults should only be relied upon when there is insufficient supporting evidence to use non-defaults.
- The Assessor may use DEAP defaults from Appendix S to determine any unavailable details despite having carried out the steps above.
- The dwelling is entered as a “new dwelling” in DEAP.
- Keep a record with the assessment detailing the reasons why defaults were chosen. This will help provide clarity if the assessment is audited by SEAI.
- The defaults in DEAP are conservative and could result in a failure of the TGD L compliance check. This should encourage clients to ensure that sufficient supporting evidence is provided to allow the use of non-default values.

3.1.5 Age of dwellings and extensions

The dwelling age is an essential data point, particularly as it is a basis for many values entered in DEAP when using defaults. When determining the age of the dwelling or extensions, preference is given to the use of legal documents such as commencement notices and planning notices. The following resources should be visited when investigating dwelling or extension age:

- Check with Local Authority or www.pleanala.ie
- <http://map.geohive.ie/mapviewer.html> shows maps from 2005, 2000, 1995

If legal documents are not available, use evidence from at least 2 of the following:

- Stylistic evidence - e.g. check for similar on Irish section of [Tabula](#) (Source: Energy Action)
- Plates on dwelling or development showing year of construction
- Age on electricity meter
- Year of glazing printed between panes or on concealed edge of frame. Open the window/door to check.
- Homeowner knowledge – retained in writing

If dwelling age evidence conflicts, err on the side of caution and choose the “older” option.

3.1.6 Identifying an extension

Identifying an extension in an existing dwelling may well make a significant improvement in the BER result for the dwelling. This is particularly the case where the extension was constructed more recently than the original dwelling and therefore will be assigned a more recent age band. Always use the age of the extension rather than original dwelling age when entering building elements included in the extension. There are several potential indicators as to the existence and area covered by the extension - this list is not exhaustive but is useful when seeking to identify an extension:

- Homeowner knowledge
- Different windows to the original dwelling
- Different roof type to the original dwelling
- Different radiators to the original dwelling
- Different room height to the original dwelling
- Different natural ventilation (such as background wall/window vents) to the original dwelling
- Change in rendering from the original dwelling
- The presence of two heating systems may indicate the existence of an extension.

3.1.7 Choosing the correct property address

It is critical that BER Assessors make every effort to ensure that they have the correct postal address for the dwelling being assessed. It is up to the Assessor to make sure that they publish the rating under an accurate postal address.

The address should allow for unique identification of the property in so far as possible, and in such a way that prospective purchasers or renters (or their agents) will be satisfied that the rating before them in fact relates to the property in question. This is a duty of care which Assessors owe to their clients. Any ambiguity in addresses should be eliminated or Assessors run the risk that a rating will be revoked and will thereafter need to be republished with a satisfactory address.

Assessors should confirm the postal address with the building owner. In addition, there are several tools available to assist Assessors in verifying the postal address, as outlined below.

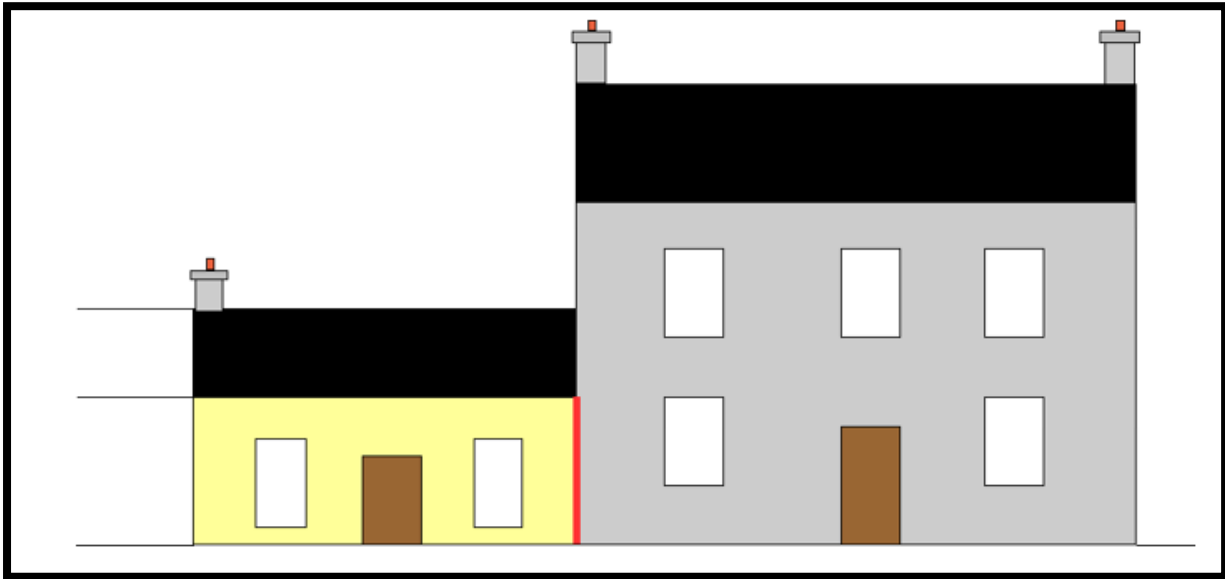
- **Eircode finder:** Source the Eircode of the property based on its location if unavailable from the client. Ensure to include the Eircode in the BER Assessment. This resource should also be used to verify the address if the Eircode is available.
- **Meter Point Reference Number (MPRN):** The Meter Point Reference Number (MPRN) is a unique reference allocated to the house by the ESB. It can be found on the household electricity bill. Through the NAS, Assessors are provided with access to the ESB's database of MPRNs to look up the MPRN address and to assist in ensuring that the rating is being published for the correct dwelling. The MPRN is generally reliable however there can be situations where there may be an issue with the address stored in the MPRN database. For example, in the case of new developments the address given to the ESB may have been the address used during the construction phase and may be out of date. If there are significant differences between the MPRN address and the postal address inserted in DEAP, the Assessor must publish the rating under the most accurate address. The address associated with the MPRN is as defined by ESB Networks.
- **Other Utility Bills:** Other utility bills, such as gas bills, can be another useful reference point.
- **An Post:** An Post provide an address verification service. The maximum number of searches allowed is 15 per day.
- **GeoDirectory:** The GeoDirectory is a database (a joint An Post and Ordnance Survey initiative) containing the address and map coordinates of over 1.7 Million addresses, every building in the Republic of Ireland. The database is updated by An Post postal workers, with official updates released on a quarterly basis. GeoDirectory offer services such as GeoAddress Locator which could be used to confirm dwelling addresses.
- **Phonebook:** The Eir phonebook can be helpful in confirming an address if you have the name of the owner and the county they reside in.

3.1.8 Dwelling type classification

The classification of a house as detached, semi-detached or terraced depends on how it adjoins the neighbouring buildings. A side is considered attached if more than half of its area adjoins a heated space. Otherwise it is not attached for the purposes of identifying dwelling type.

As an example, consider the BER assessment of the grey two-storey house below:

Figure 3.1 - Dwelling type: two storey house

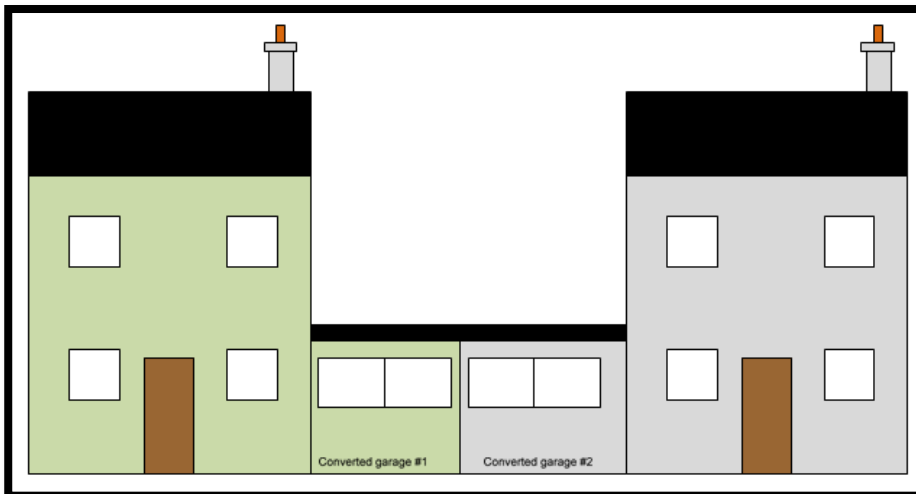


The grey two-storey house adjoins a single-storey house. The attic in the yellow single storey house is unheated. Less than half of that side of the grey two-storey house adjoins the heated space (yellow) so that side is unattached for the purposes of identifying the dwelling type. The other side of the grey two-storey house is unattached in this case, so the dwelling type is 'Detached'.

Even though the grey house is specified as 'Detached', it can still be assumed that there is no heat loss through the area of the party wall between the grey house and heated yellow spaces, (marked in red in the diagram). For the yellow single-storey house, both sides are fully adjoining heated spaces, so the dwelling type is 'Mid-terrace'.

In Figure 3.2, both houses were originally constructed with adjoining garages. Both garages were converted to habitable heated spaces and are less than half the height of the original dwellings. In addition, both houses were constructed as detached houses and should be entered as detached houses in DEAP.

Figure 3.2: Dwelling type: adjoining converted garages



3.1.9 BER survey photograph quality

As described in the DEAP Survey Guide, "BER Assessors should endeavour to gather as much data, photographs, sketches/plans and supporting evidence as possible (and indeed practicable) to increase the likelihood of an accurate survey and assessment which will stand up to auditing by SEAI". BER Audits have identified issues regarding the quality of photographs taken by Assessors. Recurring problems include:

- blurred photographs – due to camera movement

- underexposed photographs – particularly photos taken in attics & boiler houses when the flash has been used incorrectly
- poorly focused photographs – caused by not giving the camera time to focus, not having sufficient distance between camera and object, or, misuse of the camera’s macro function. This applies particularly to pictures of nameplates on boilers, heating appliances, etc.

If an Auditor cannot make a clear appraisal of a photograph for reasons such as the issues mentioned above, or for any other reason, then the Assessor may be liable to disciplinary sanction under the BER QA scheme. In some cases, BER Assessors may wish to compress photographs to a smaller file size as smaller documents are easier to transmit by email. This is acceptable provided the photograph remains clear.

To minimise the likelihood of any problems occurring, the Assessor is encouraged to read the camera’s manual to gain a full understanding of how the camera works, paying attention to the use of flash, macro and focus. The following simple tips should also be adhered to:

- hold the camera steady
- give the camera time to focus
- for close-up shots, the camera’s macro function may take several seconds to gain correct focus
- use the flash in poorly lit spaces (the camera’s auto-flash setting will do this automatically, generally with satisfactory results)
- when using the flash on an object several metres away try to ensure there are no objects in the foreground as this can affect the focus and/or over-expose the photograph
- check the photograph and if it is not of sufficient quality re-take the photograph.

3.2 Acceptable evidence: general information

The General Principles Section of the DEAP manual details acceptable sources of certified data.

The following are acceptable sources of certified data:

- Test certificates meeting the following criteria:
 - Clearly reference the actual product in question.
 - Relevant performance data must be shown (i.e. the performance data as required in the DEAP methodology, such as λ for insulation).
 - Must be in English or be accompanied by a certified English translation.
 - The relevant test performance standard must be stated on the test certificate.
 - The test laboratory must be accredited to test to that standard.
- “CE marked” literature meeting the following criteria
 - Clearly reference the actual product in question.
 - Relevant performance data must be shown.
 - Must be in English or be accompanied by a certified English translation.
 - The relevant test performance standard must be stated on the document.

Always retain evidence – including test certs – when carrying out a BER assessment

As outlined above, test certificates must be in English or accompanied by a certified English translation. Translated documents include:

- English translations from the accredited test house, OR
- English translations from a Professional Translator qualified in translation from the specified language to English. Such translators should be sourced via the “[Irish Translators and Interpreters Association](#)” (ITIA) search engine. International bodies such as the Institute of Translating and Interpreting (ITI) in the UK, or the International Federation of Translators, <http://www.fit-ift.org> are potential sources for suitable translators. Assessors are advised to consult with the BER Helpdesk if uncertain regarding the source of a translation.

Guidance from Suppliers

In some cases, heating system suppliers, insulation suppliers, etc., will issue DEAP guidance to BER Assessors. BER Assessors are responsible for ensuring that they follow the DEAP methodology as published in the DEAP manual, survey guide and associated BER Guidance published by SEAI. In any case where an Assessor is unsure of guidance received from a third party, the Assessor should contact the BER helpdesk with details of the guidance they are considering and specific queries they may have on this.

Each Assessor is entirely responsible for the content of each BER Assessment that they upload to the NAS, so it is in the Assessor's best interests to ensure that any information used in assessments is in compliance with the DEAP methodology.

3.3 Provisional assessments

A New Dwelling - Provisional BER can be carried out by BER Assessors based on design drawings and specifications of an uncompleted building provided that, on completion of the building in question, a New Dwelling - Final BER is carried out on the completed building.

The final BER on the dwelling, must be representative of the dwelling and DEAP methodology at the time of that final BER. The BER Assessor therefore must verify each item entered in the final BER. This includes the usual requirement of supporting evidence such as certified test reports, HARP listings, U-value calculations and so on. As an example, if the client specifies that a different boiler is being installed in the constructed dwelling than had been specified at the time of the provisional rating, then the final BER would have a different boiler (and associated efficiency) to the provisional rating.

The specification and drawings must be provided by the client or their representatives.

In cases where a BER Assessor has developed the specification or drawing, the documents must be signed off by the client confirming that the uncompleted building shall be built to the specifications and drawings produced by the Assessor. The specification and drawings must provide adequate information to support an entry.

In exceptional cases, there may be insufficient documentary evidence to support an entry. The assessor may then use the default values. The default should be based on the relevant guidance documents and the assessor should keep a record with the assessment detailing the reason for the default(s) chosen.

Table 3 has examples of acceptable and unacceptable documentation:

Table 3: Evidence for Provisional BER Assessments

Data Entry	Acceptable Supporting Documentation	Unacceptable Supporting Documentation
U-Value of Opaque Elements	<ul style="list-style-type: none"> Specification/ drawing detailing materials and thicknesses used in element construction, and U-Value Calculation to correct standards, and Agreement cert or other certified sources for thermal conductivity (use DEAP Table 12b if cert unavailable or specific make/model of insulation is not clear) 	Specification/ drawing stating U value of element is X.XX
Pressure Test Results	<ul style="list-style-type: none"> Can use non-default from tested "similar building" (a similar building has the same builder, same structure type, same dwelling type, same floor area) Default 0.25 ac/h if no Balanced Mechanical Ventilation (MV) proposed Default 0.15 ac/h if Balanced MV proposed See Section 5.4 in this document for more details 	Specification/ drawing stating Pressure Test shall achieve X m ³ /h/m ² with no other supporting data.

Thermal Bridging Factor	<p>Refer to DEAP manual Appendix K.</p> <p>For a provisional BER for a building that proposes to conform with Acceptable Construction Details (ACDs):</p> <ul style="list-style-type: none"> Assessor must provide the relevant drawings clearly showing the relevant details signed off by the developer/builder, site engineer or architect confirming that the uncompleted building shall be built to these details. See Section 6.5 in this document for more details 	Specification/ drawing stating the building will conform with ACDs with no details provided.
Heating System Efficiency	<ul style="list-style-type: none"> Specification/ drawing detailing proposed heating system Efficiency of Heating System based on HARP Database/ Certified Test Data/ Table 4a and 4b of the DEAP manual. Any calculations (e.g. heat pump) carried out to correct DEAP methodology 	Specification/ drawing stating that the heating efficiency shall be X%.

3.3.1 Building Control and the requirement for a BER

In some cases, it may not always be clear to a BER Assessor or their client if a BER is required for a dwelling. Under the regulations, the Building Control Authority (BCA) are responsible for ensuring that the BER requirement is met and the BER is provided by building owners to prospective buyers and tenants. As the BCA is responsible for enforcing the BER requirements in the market place, the BCA should be consulted when in doubt about the need for a BER for a building.

3.3.2 Partially completed dwellings

For this section, a partially complete dwelling is described as a dwelling where planning has been obtained, a commencement notice has been issued to the local authority and works have been undertaken on the dwelling. If a partially complete dwelling has not previously been sold or rented it is classified as 'New'. When being sold as is, these dwellings require a 'new provisional rating' when being offered for sale. A 'new final rating' is required when works are complete.

The dwelling can be assessed from plans and specifications along with site survey given that there is some work already done. Where there is insufficient information on site or from plans/specs, then DEAP defaults are applied. In applying DEAP defaults it is critical to determine the accurate age for the building and the version of TGD L that applies to the planning for the dwelling being assessed.

For Part L compliance checking, check the "transitional arrangements" sections of the different versions of [TGD L](#). This enables identification of the correct version of TGD L for the dwelling. The commencement notice can be obtained from the local authority and will help determine when works commenced on the dwelling. As most of this type of dwelling will have commenced in the last ten years planning details should be available online from the local authority.

A pessimistic default position is taken where plans/specs for the provisional rating and site survey do not indicate what heating system is installed or is to be installed. DEAP manual Section A3.4 gives guidance on dealing with missing or broken heating systems.

As specified in DEAP Manual Section 4.6 where a dwelling has no water heating system present (or specified in the case of a provisional rating), direct electric water heating is assumed to meet the hot water demand. In this case supplementary electric water heating is not specified as the main water heating is an electrical heat source. If there is no cylinder present, then hot water storage losses are not specified.

For new dwellings with no heating system specified or installed, assume that all heat is provided by electric heaters as per DEAP Manual Appendix A3.1. The new final rating will reflect the oil system and cylinder, etc., if that is installed once the dwelling is complete.

The example below shows a partially complete dwelling for which the BER Assessor can obtain some of the information on site. As there are no plans or specs available for the dwelling a pessimistic default position is taken where no information is available and a DEAP default can be applied.

Example:

A partially completed bungalow is being sold as is and a BER is required. From the information supplied - this dwelling is not complete and has not previously been sold or rented. Therefore, a new provisional rating is required. The Assessor determines that the house commenced construction in 2008 from the commencement notice dated January 2008. TGD L 2005 applies to the dwelling based on the transitional arrangements for TGD L 2008 as substantial work has been completed on the dwelling before 1st July 2009 (meaning that the structure of the external walls has been erected).

Key site survey details are as follows:

- A partially filled cavity wall and solid internal walls
- Solid ground floor with ground floor area = 131m² and perimeter = 51m
- Double glazed PVC windows with 16mm gap
- 100mm insulation in attic
- No plumbing has been completed in the dwelling
- No ventilation has been installed
- There is one chimney in the dwelling with a hearth capable of supporting an open fire¹
- There are 6 habitable rooms in the dwelling

¹ [TGD to Part J](#) of the Building Regulations defines the requirements for hearths in detail. The basic definition is that the hearth is a base intended to safely isolate a combustion appliance from people, combustible parts of the building fabric and soft furnishings.

DEAP Tab	Name of entry	Value	Comment
Building	No. of storeys	1	As determined on site
	Average room height	2.6m	As determined on site
	Living area	31.5m ²	Largest public room as determined on site
	Ground floor area	131m ²	As determined on site
	Floor	Ground floor, solid, U-value = 0.34W/m ² K	Default used as no details on floor spec. Perimeter and area as measured on site. Age band 2005 onwards
	Roofs	Pitched roof insulated on ceiling	100mm insulation as per site survey. Area as measured on site
	Walls	300mm cavity, U-value = 0.37W/m ² K	Default used for cavity wall, 2005 onwards as verified on site. Area as measured on site.
	Doors	Solid door, U-value = 3.0W/m ² K	As determined and measured on site
	Windows	2.2W/m ² K	Default from table S9 for 2004 or later double-glazed PVC window. Area, orientation and shading as determined on site.
	Thermal Mass Category of Dwelling	High	Based on Table 11 for this new dwelling. Use measurements on site
Ventilation	Number of chimneys	1	As determined on site
	Number of open flues	0	As determined on site
	Number of intermittent fans and passive vents	0	As determined on site
	Number of flueless combustion room heaters	0	As determined on site
	Is there a draught lobby on main entrance	No	As determined on site
	Percentage of windows and doors draught-stripped	90%	As determined on site. Attic hatch not draught-stripped
	Number of sides sheltered	0	As determined on site
Space Heating - Controls and Responsiveness	Temperature adjustment (°C)	0.3	Worst case for electric heaters assumed – no thermostatic control from Table 4e
	Heating system control category	2	For new dwellings that have no heating system specified, assume that electric heaters will provide all heat as per DEAP Manual Appendix A3.1. Control category from Table 4e for electric room heaters with no thermostatic control
	Heating system responsiveness	1	Electric room heaters, Table 4a
Space Heating – Pumps & Fans	Central heating pump	0	
	Boiler controlled by room Thermostat	No	
Space Heating –	Efficiency of main space heating system (%)	100	Electric Room Heaters assumed

Heat Sources	Efficiency adjustment factor for space heating	1.0	Value from Table 4c in the DEAP Manual or 1 if not applicable
	Fraction of heat from secondary/supplementary system	0.2	Taken from Table 7. Main heating system is electric room heaters. Secondary space heater is present in one habitable room (open fire) meaning the fraction of heat from secondary heating is 0.2.
	Secondary space heating system fuel	Solid Multi Fuel	Follow guidance in Section 10.3.3 of DEAP Manual
Water Heating – Options and Storage	Are there distribution losses?	No	No cylinder, sinks, taps or pipes installed.
	Are there storage losses?	No	No cylinder present.
	Is supplementary water heating used in summer?	No	Where a dwelling has no water heating system present, direct electric water heating is assumed to meet the hot water demand per DEAP Manual Section 4.6. In this case supplementary electric water heating is not specified as the main water heating is an electrical heat source
	Primary circuit loss type	None	As above
Water Heating – Heat Source	Efficiency of main water heating system (%)	100	Where a dwelling has no water heating system present, direct electric water heating is assumed to meet the hot water demand.
	Efficiency adjustment factor for water heating	1.0	Value from Table 4c or 1 if not applicable.
Lighting and internal gains	Percentage of low energy lighting	0	Worst case assumed as none installed.
Fuel data	Main space heating system	Electricity	For new dwellings that have no heating system specified, assume that electric heaters will provide all heat as per DEAP Manual Appendix A3.1.
	Secondary space heating system	Solid Multi Fuel	Follow guidance in Section 10.3.3 of DEAP Manual
	Main water heating system	Electricity	Where a dwelling has no water heating system present, direct electric water heating is assumed to meet the hot water demand per DEAP Manual Section 4.6. In this case supplementary electric water heating is not specified as the main water heating is an electrical heat source
	Supplementary water heating	None	

Table 4 – Example of data entry for partially-completed dwellings in DEAP

3.4 Derelict dwellings

There is no automatic exemption from the BER requirement for derelict buildings. A BER is produced where it is possible to do so and in accordance with the BER assessor Code of Practice.

In accordance with Section 7 of the Code of Practice, if a BER Assessor believes a building or any of its equipment is in such a condition as to make it unsafe or impractical to carry out an assessment, the BER Assessor may refuse to

carry out the assessment. In such circumstances, the BER Assessor shall return any fee received in respect of that proposed BER assessment.

4. Dimensions

This section has a range of examples and guidance to supplement the information provided in the DEAP Manual and Survey Guide. It sets out the correct approach to measurement, and to the inclusion or exclusion of a range of rooms and spaces in the dwelling.

4.1 Floor Areas

BER Assessors are required to record all dimensions on the site sketch (or architectural drawings verified on site) in accordance with the Code of Practice and the DEAP Survey Guide.

Incorrect floor areas can have a significant impact on the energy value calculated by DEAP and may lead to errors in the rating band stated on the BER certificate. Consequently, floor area errors can significantly impact error sizes identified during audit and result in penalty points being assigned to the Assessor.

When calculating the floor area(s) to be entered in the Building section of DEAP, the definitions in the DEAP Manual Section 1 must be followed.

4.1.1 Good practice guidance when measuring floor areas

The following steps are useful to increase the accuracy of floor area measurements:

- Measure key dimensions (width/length) twice as a cross check. As the measurements taken can significantly impact the floor area (and are often used to determine other heat loss areas such as walls and floors) it is worthwhile spending the extra time to make sure measurements are correct. Laser measurement devices can sometimes give an erroneous reading due to a bad reflection and it is easy to misread a tape measure.
- Where dwellings do not have a square or rectangular footprint, split the dwelling floor area into sections and measure each section. If parts of the dwelling were constructed at different times, the respective floor areas are entered in DEAP as separate heat loss building elements due to differing U-values (unless the different parts of the dwelling have identical constructional details and fall within the same age band). Ensure that sketch/plans define various parts of the dwelling clearly, with enough dimensions recorded to allow the accurate calculation of respective floor areas for input to DEAP using the appropriate age bands.
- If it is not possible to measure the entire width/length of parts of the dwelling with one measurement due to obstructions such as internal walls, measure the internal dimensions of rooms. Ensure internal wall thicknesses are also recorded and included in the overall dimension used to calculate the area(s). BER Assessors should always carry out a sense check to ensure that all measurements are accurate and are recorded correctly.
- A common error encountered during audits is the omission of the wall thickness between the two-storey main part of the dwelling and a single storey extension to the side/rear. The internal wall dividing the two storey and single storey part of the dwelling is often as thick as the main external walls. If an internal wall is omitted in the calculations, it can have a significant impact on the floor area calculated.
- After all inputs have been input to DEAP carry out a sense check on the floor areas entered:
 - Do the floor areas appear correct based on a walk around of the dwelling?
 - Do the floor areas for different storeys make sense in relation to each other compared to observations on site?
 - Is enough heat loss roof area entered in the building elements section to cover at least the largest floor area entered in the dimensions section? When carrying out this sense check bear in mind that insulated rafter roofs and roof light windows can cause differences between roof area and the largest floor area. Understand what these differences might be and allow for them in the sense check.

Bear in mind that there are always exceptions to these general checks, e.g.

- allowing for tolerances in DEAP Appendix S
- apartments without heat loss floors or roofs

- dwellings with non-standard geometry.

These basic sense checks are useful to identify fundamental errors with the DEAP inputs for typical house type geometries commonly encountered.

4.1.2 Floor area measurements in existing dwellings

DEAP Manual Section S4 allows for the following simplifications when calculating floor areas:

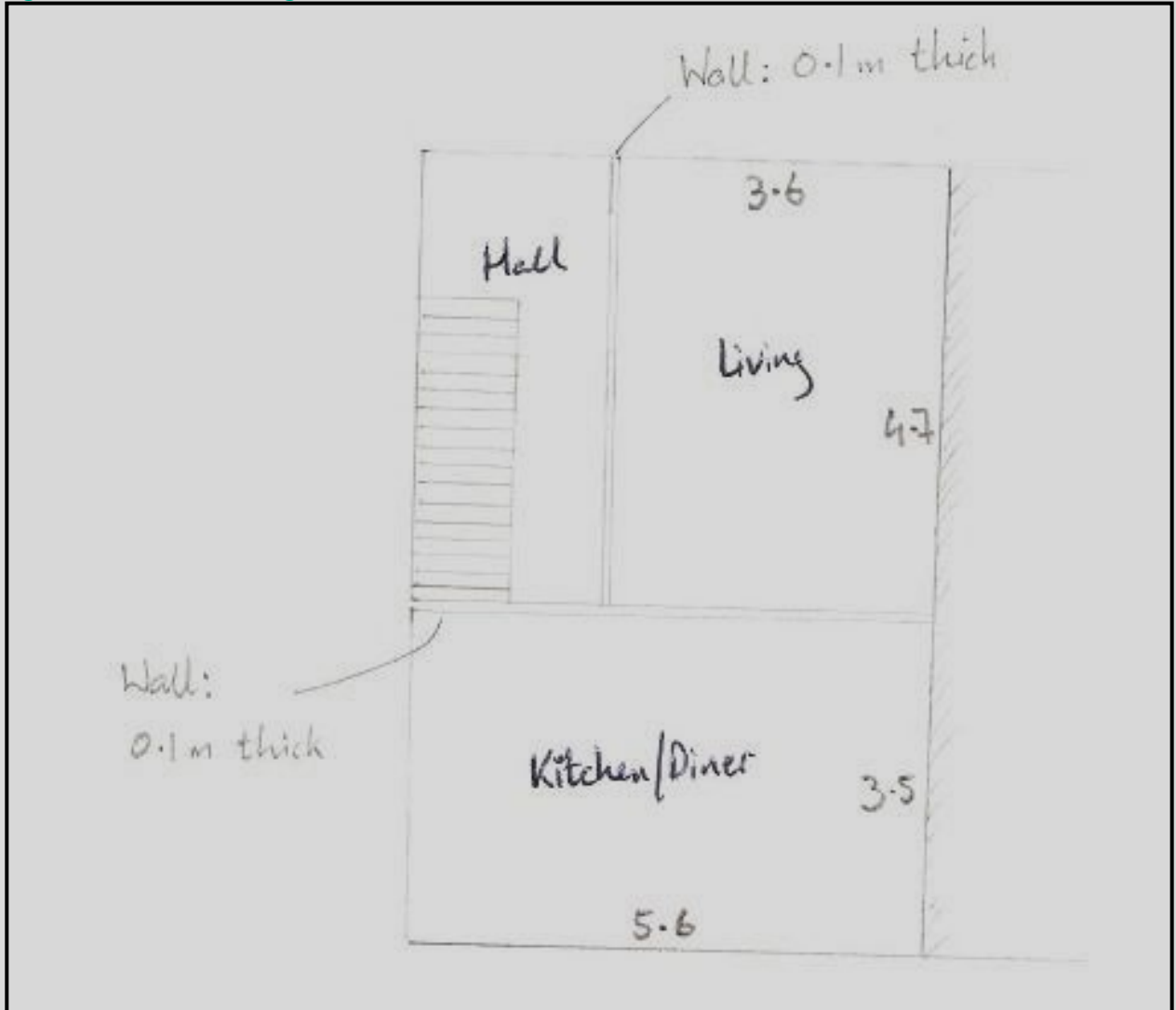
“Small bay windows, small porches, small door entrances or recesses, small chimney breasts, where they affect the total floor area by less than 10% overall, can all be ignored for the purposes of total floor area measurement. Bay windows, chimney breasts and other small areas within the living room area must be included in the living room area measurement.”

The simplifications apply only to the floor areas entered in DEAP. As defined in the DEAP Manual the simplification is not applied to the Living Area.

4.1.3 Case study: simple floor area calculation

The sketch in this example shows the ground floor plan of a semi-detached dwelling as extracted from BER survey notes. For simplicity, windows and doors have not been drawn, as they do not affect this calculation.

Figure 4.1 – Plan sketch of a ground floor



- The **internal** width of the house is the width of the kitchen/dining room: 5.6 m.
- The internal length of the house is $4.7 + 0.1 + 3.5 = 8.3$ m
- The ground floor area entered in the DEAP dimensions tab is: $5.6 \times 8.3 = 46.48 \text{ m}^2$.
- In this house the first-floor area is the same as the ground floor area: 46.48 m^2 .

Note that in calculating the length of the house, the thickness of the wall between the living room and the kitchen-dining room, 0.1 m, is included.

To determine the U-value (default or non-default) we must calculate the exposed perimeter of the ground floor. The ground floor is exposed on three sides (front, back and gable-end) but not on the side shared with the neighbouring house.

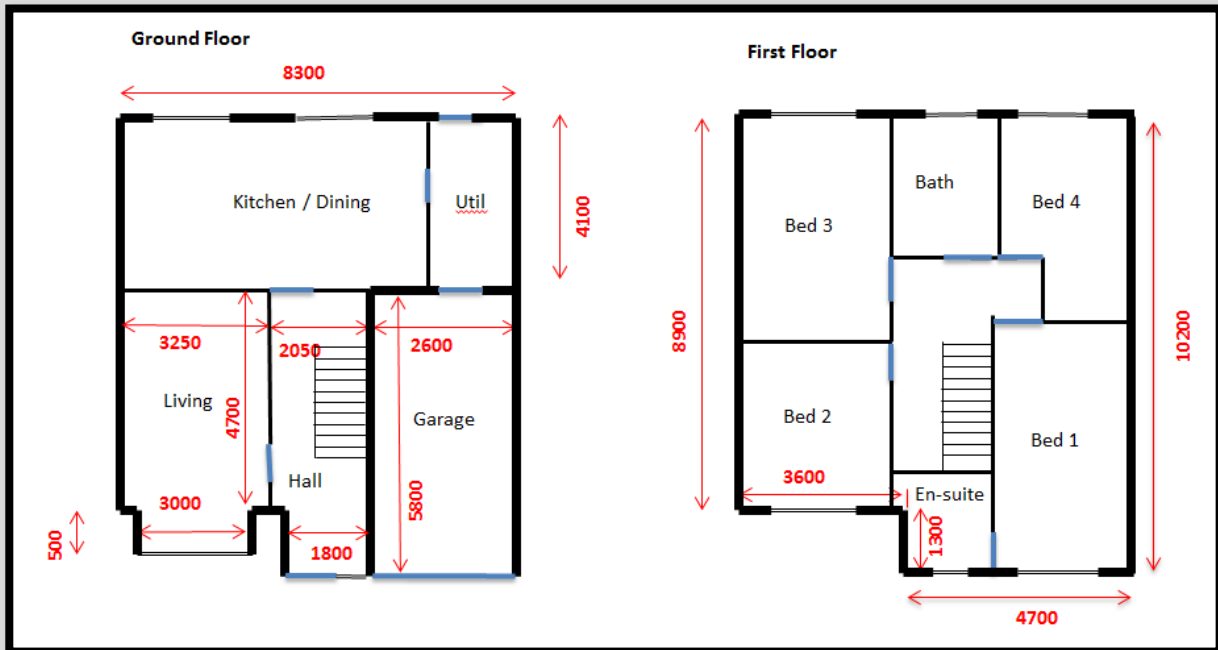
Therefore, the exposed perimeter is: $P = 5.6 + 8.3 + 5.6 = 19.5 \text{ m}$.

The storey height and area of each storey in the dwelling are recorded on the DEAP Survey Form.

4.1.4 Case study: floor area in detached house with internal garage

This example shows a two-storey dwelling with a garage on the ground floor.

Figure 4.2 – Ground floor and first floor plan



- All dimensions are internal measurements (mm)
- External wall and separating wall to garage 300mm width
- Internal partition walls 100mm width
- Unheated garage with well insulated separating wall. Therefore, the garage is not included in the floor area calculation. See Dimensions Section in DEAP manual guidance on garages.
- Utility room: This is included in the floor area calculation as it is directly accessible from the occupied area of the dwelling. See DEAP Manual Dimensions Section guidance on utility rooms.

Ground Floor Area

- $8.3\text{m} \times 4.1\text{m} = 34.03\text{m}^2$ (kitchen/diner/utility)
- $(3.25\text{m} + 0.1\text{m} + 2.05\text{m}) \times (4.7\text{m} + 0.1) = 25.92\text{m}^2$ (Main parts of living and hall)
- $0.5\text{m} \times 3.0\text{m} = 1.5\text{m}^2$ (living bay)
- $1.8\text{m} \times 1.3\text{m} = 2.34\text{m}^2$ (hall area near entrance)
- Total Ground Floor Area = 63.79m^2

First Floor Area

- $8.9\text{m} \times 8.3\text{m} = 73.87\text{m}^2$ (largest square section)
- $1.3\text{m} \times 4.7\text{m} = 6.11\text{m}^2$ (smaller rectangular section including part of ensuite / bed 1)
- Total First Floor Area = 79.98m^2

Notes:

- Always use internal dimensions ensuring the width of internal walls are included if a required dimension spans multiple rooms.
- The bay window area to the living room could be omitted for the ground floor area. However, the bay area was included in this example. See above guidance referencing small bay windows as per DEAP Section S4. Bay windows, chimney breasts and other small areas within the living room area must be included in the living room area measurement.

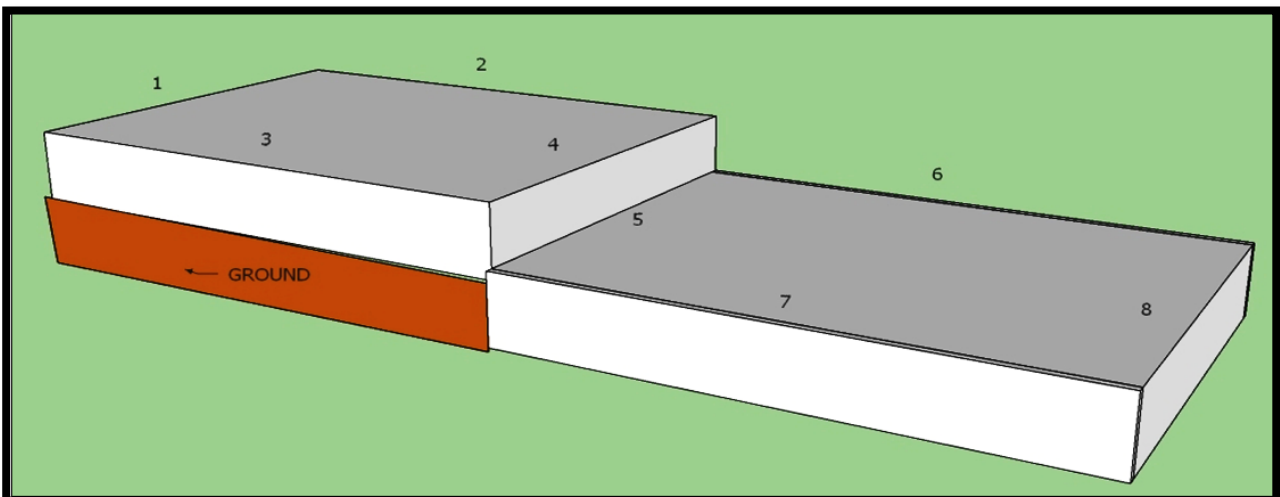
Examples of Quick Sense Checks

- In the example above, because the garage is excluded it would be expected that the first-floor area is greater than the ground floor area, based on visual inspection. Check to make sure it is as calculated. If it is not, re-examine the calculation and check for errors.
- A review of the plans suggests that the first-floor area is equal to the ground floor area plus the area of the garage and separating wall minus the bay area. The measurements are used in a cross check as follows: First Floor Area = $63.79\text{m}^2 + (2.9 \times 6.1)\text{m}^2 - 1.5\text{m}^2 = 79.98\text{m}^2$. Cross check confirms correct.
- After calculating the roof areas and entering them into DEAP, is the total roof area of the order of the first-floor area plus the bay area? If not, then recheck calculations noting this is a rough guide as insulated at rafter roof and roof lights can cause differences when carrying out this sense check.
- It may be difficult to get exact matches during cross checks due to variability in actual measurements taken on site. The cross checks should give close results. If the rough cross checks yield significant differences, then check the calculations again.

4.1.5 Split level dwellings

Figure 4.3 shows a basic layout of a split-level floor slab in an existing dwelling. The entire floor area of the dwelling is shown. Both floors bounded by perimeter "1234" and bounded by perimeter "5678" are solid and the entire dwelling is heated. There are steps down from floor "1234" to floor "5678".

Figure 4.3: Split level ground floor



The vertical section (bounded by "4,5") exposed to the exterior is entered as a wall in DEAP. For the floor "5678" and any of the wall exposed to external ground (bounded by "4,5"), refer to heated basements guidance in the Table S8 footnote in the DEAP manual. This is elaborated in Section 4.3.3 of this document. The method used depends on the average depth of the room below ground being less than 1.2m, or greater than (or equal to) 1.2m. Follow Section 4.3 in this document for the correct approach for the wall "4,5" and floor "5678" in both scenarios.

Regarding the exposed perimeter for the floor "5678", as stated on the footnote to Table S8 of the DEAP manual:

- For P/A ratio of the basement for default U-value calculation:
 - Perimeter is the basement floor perimeter (this is 5+6+7+8 in the diagram).
 - Area for P/A ratio calculation is the basement floor area.

The face of the step down is considered a wall exposed to the external ground and the base of that wall, "5" is included within the exposed perimeter calculation for the lower floor "5678".

For the upper solid floor "1234", as side 4 is adjacent to a heated room (i.e. the volume above floor "5678" is heated) then the exposed perimeter for the upper floor is 1+2+3.

Example

Take a simple example where a detached single storey dwelling has two rooms; a living room and a bedroom. The dwelling was built in 1985 and has a cavity wall construction and solid ground floor. There is a 0.3m step from the living area to the bedroom. Both rooms are heated. The area of openings in the dwelling is 12.5m². Default U-values are being used.

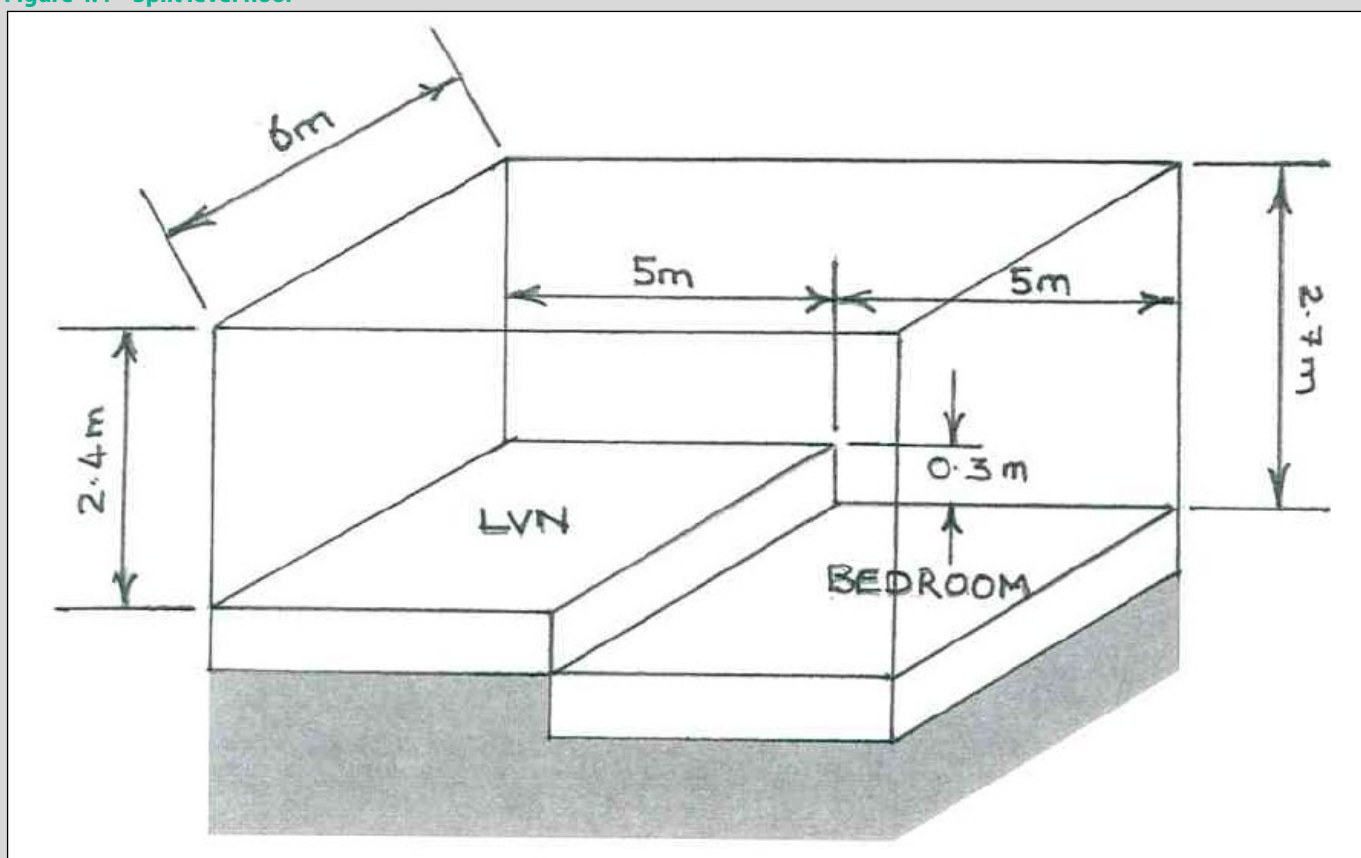
In cases where some of a basement's outer walls are below ground, and some are above ground, calculate the average basement depth below the external ground level. The average basement depth is weighted by the wall length.

The bedroom is partially below ground.

The floor slab and dimensions of the basement (bedroom) walls are shown in the diagram below:

- back wall adjoining living room= 6m wide * 2.7m high (0.3m below ground)
- front wall (to the right-hand side in the diagram) = 6m wide * 2.7m high (0m below ground)
- each side wall= 5m wide * 2.7m high (0m below ground)

Figure 4.4 – Split level floor



So, the depths below ground of the walls surrounding the **bedroom** are as follows. These are used in deriving average basement depth below ground.

- Back wall adjoining living room is 6m across with a depth of 0.3m below ground.
- The front wall (to the right-hand side of the diagram above) is 6m across and is 0m below ground.
- Each of the side walls are 5m across and are 0m below ground.

The following data entry applies for DEAP based on the average depth of the walls below ground:

$$\text{Average Basement Depth} = \frac{(6 \times 0.3) + (5 \times 0) + (5 \times 0) + (6 \times 0)}{6 + 6 + 5 + 5} = 0.082\text{m}$$

As the average basement depth below ground < 1.2m then:

- the basement floor is a solid ground floor for the purposes of determining its default U-value
- all basement walls are entered as walls in DEAP using the default wall U-values

Wall areas:

- Gross Wall Area = $(2.4*6) + (2.4*5*2) + (2.7*6) + (2.7*5*2) + (6*0.3) = 83.4\text{m}^2$
- Net Wall Area = $83.4 - 12.5 \text{ (opes)} = 70.9\text{m}^2$

This is entered in DEAP as follows:

Figure 4.5 – DEAP entry of wall data

The screenshot shows the 'Edit Wall' dialog box with the following fields and values:

Field	Value
Wall Type *	300mm Cavity
Age Band *	1983 - 1993
Description	Exposed Wall Area
Area [m ²] *	70.90
U-Value [W/m ² K] *	0.6
Include in compliance check	<input type="checkbox"/>
Wall is semi-exposed	<input type="checkbox"/>

Floor areas

- Floor area Living Room = $5*6 = 30\text{m}^2$
- Exposed Perimeter Living Room = $5+6+5 = 16\text{m}^2$
- Floor area Bedroom = $5*6 = 30\text{m}^2$
- Exposed Perimeter Bedroom = $5+6+5 +6 = 22\text{m}^3$

These areas are entered in DEAP as follows:

Figure 4.6 – DEAP entry of floor data – Living room

² Exposed perimeter of the living area section. This does not include the perimeter of the wall between the living room and bedroom as both rooms are within the heated section of the dwelling and this is not exposed to ground when viewed from the living room.

³ Exposed perimeter of the bedroom area section, the face of the step down is an exposed wall and so the base of that wall is included within the perimeter calculation.

Edit Floor ✕

<small>Floor Location *</small> Storey 1	<small>Floor Type *</small> Ground Floor - Solid	<small>Age Band *</small> 1983 - 1993
<small>Description</small> Living Room		<small>Area [m²] *</small> 30
<small>Exposed Perimeter [m] *</small> 16	<small>Wall area (exposed to ground) m²</small>	<small>U-Value [W/m²K] *</small> 0.64

Underfloor Heating
 Room in Roof

CANCEL
SAVE

Figure 4.7 – DEAP entry of floor data – Bedroom

Edit Floor ✕

<small>Floor Location *</small> Storey 1	<small>Floor Type *</small> Ground Floor - Solid	<small>Age Band *</small> 1983 - 1993
<small>Description</small> Bedroom		<small>Area [m²] *</small> 30
<small>Exposed Perimeter [m] *</small> 22	<small>Wall area (exposed to ground) m²</small>	<small>U-Value [W/m²K] *</small> 0.74

Underfloor Heating
 Room in Roof

CANCEL
SAVE

In accordance with DEAP Manual 'Dwelling Dimensions', **storey height** is the total height between the ceiling surface of a given storey and the ceiling surface of the storey below. For a single storey dwelling (including single storey apartments), or the lowest floor of a dwelling with more than one storey, the measurement should be from floor surface up to ceiling surface. In cases where the storey height varies in a single floor, the area weighted average storey height should be used.

$$\text{Average Storey Height} = \frac{(5 \times 6 \times 2.4) + (5 \times 6 \times 2.7)}{(10 \times 6)} = 2.55\text{m}$$

4.1.6 Floor areas and the requirement for BER

The [S.I. No. 243/2012 - European Union \(Energy Performance of Buildings\) Regulations 2012](#) regulation provides details on buildings for which a BER Certificate must be provided. While some buildings are exempt from the BER requirements (as detailed in S.I. 243), the owners of these buildings may choose to obtain a BER for the building on a voluntary basis. For example, a homeowner may choose to obtain a BER for an existing dwelling which is not for sale or rent.

S.I. 243 exempts several building types from the BER requirement including buildings which are “a standalone building with a total useful floor area of less than 50m²”. In other words, a detached dwelling with “useful floor area” of less than 50m² does not require a BER by S.I. 243.

In this context, “useful floor area” is space within the dwelling which can be occupied and serves a purpose within the dwelling. Areas which should be considered as potential “useful floor area” in the context of SI 243 include:

- All conservatories (including those excluded from the BER assessment as per DEAP section 3.3.3);
- All porches;
- All basements;
- All converted attics (accessible via fixed staircases);
- Heated garages;
- All habitable rooms;
- Other rooms (such as kitchens, utility room, hallways, landings, bathroom, cloakroom, ensuite accommodation and similar).

4.2 Storey height

Storey Height is defined in Section 1 of the DEAP manual as “the total height between the ceiling surface of a given storey and the ceiling surface of the storey below”. In some dwellings this height may vary across a single storey, e.g. if an extension of different ceiling height has been added. In cases such as this the area-weighted average storey height must be calculated.

Example 1

Take a two-storey detached house built in the 1940s to which a single storey ground floor extension was added in 2000. An Assessor carried out a BER survey of the dwelling and noted the following:

Ground Floor – Original Section: Area: 42m ² Floor-to-ceiling Height: 2.7m	Ground Floor - Extension Area: 16m ² Floor-to-ceiling Height: 2.4m
First Floor – Original Section Area: 42m ² First floor ceiling has flat and sloped sections – see below	Thickness of intermediate floor: Could not be measured.

The area-weighted average height of the ground floor, h_{AVE} , is calculated using the formula:

$$h_{AVE} = \frac{h_1 * A_1 + h_2 * A_2}{A_1 + A_2}$$

- h_1 = storey height of the original part of the ground floor = 2.7m,
- A_1 = the Area of the original part of the ground floor = 42m²,
- h_2 = storey height in the ground floor extension = 2.4m,
- A_2 = the Area of the ground floor extension = 16m².

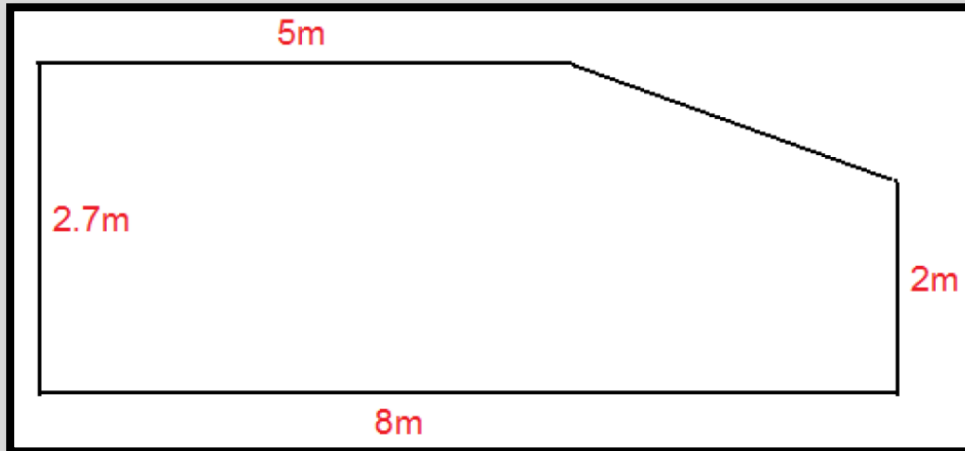
So, the average storey height of the ground floor is:

$$h_{AVE} = \frac{(2.7 * 42) + (2.4 * 16)}{(42 + 16)} = 2.62\text{m}$$

Example 2

Below is a cross section of the first floor drawn by an Assessor:

Figure 4.8 – Cross-section of the 1st floor



- The average height of the section with the flat ceiling is 2.7m
- The average height of the sloped section is $(2.7+2) / 2 = 2.35\text{m}$
- The average height of the whole storey is:

$$h_{1\text{st}} = \frac{(5 * 2.7) + ((8 - 5) * 2.35)}{8} = 2.57 \text{ m}$$

In this case the average is weighted by the width of the section rather than the area but either method would give the same result.

From the definition of storey height, we must remember to include the thickness of the intermediate floor. The Assessor noted that this could not be measured so the default value of 0.25m is used (from Section S4 of the DEAP manual). Thus, the average storey height of the first floor is:

$$h_{1\text{st}} = 2.57 + 0.25 = 2.82\text{m}$$

In cases where the Assessor first calculates the volume of the storey, the average height can also be derived by dividing the volume of the storey by the storey floor area.

A note on apartment storey heights: In a building containing two dwellings:

- a single storey apartment on the ground floor and
- a two-storey apartment above the ground floor apartment,

the height of the lower storey of apartment (b) is the measurement from its floor surface to its ceiling surface.

4.3 Ancillary room examples

4.3.1 Mezzanine floor

A “mezzanine” or internal balcony is typically an area of floor in a dwelling which overhangs the storey below. The mezzanine/balcony is accounted for under the Building section in DEAP. If the only area of floor at the level of the mezzanine is the mezzanine floor area itself, then the mezzanine can be entered as an additional storey in DEAP.

The average storey height for the mezzanine is the height between the ceiling surface under the mezzanine and the ceiling surface of the mezzanine.

The storey height for the storey below the mezzanine is weighted based on the following floor areas:

- The area below the mezzanine has height to the ceiling surface below the mezzanine.
- The remaining area is likely to extend in height to the same upper ceiling as that of the mezzanine.

Example:





A dwelling consisting of total ground floor area 125m², part of which is below a mezzanine of floor area 25m². The total storey height of the dwelling (from ground floor to upper ceiling) is 5m. The height from ground floor to the ceiling below the mezzanine is 2.5m. There are no other floor areas in this sample dwelling.

The storey height of the mezzanine is 2.5m (from the ceiling below the mezzanine to the upper ceiling). The ground storey height (weighted by area) is:

$$\frac{(2.5 * 25) + (5 * 100)}{125} = 4.5m$$

The DEAP entries for dimensions are as follows:

Figure 4.9 – Data entry for Mezzanine

FLOORS									
Number of Storeys		Number of Storeys *		Average Storey Height [m]		Storey 1 *		Storey 2 *	
Living area [m ²]		Living area [m ² *							
2		20		4.5		2.5			
Storey	Type	Description	U/F Heating	In Roof	Age Band	Exposed Perimeter [m]	Area [m ²]	U-Value [W/m ² K]	
1	Ground Floor - Solid	Ground floor	No	No	2000 - 2004	45.00	125.00	0.410	 
2	Non-Heat Loss Floor	Mezzanine	No	No	2000 - 2004		25.00	0.000	 
Total Floor area [m ²]			150.00						
Total Heat Loss Floor Area [m ²]			125.00						

Note that 2 storeys are entered in order to account for the mezzanine.

4.3.2 Unheated basements

An unheated basement is not considered part of the Total Floor Area of the dwelling in a BER assessment. The ground floor above the unheated basement is a heat loss area, i.e. the Assessor must account for heat lost from the dwelling down through the ground floor into the unheated basement.

In DEAP, the Assessor selects “Ground Floor – Above Unheated Basement” from the list of possible floor types. In cases where there is insufficient information to calculate the actual U-value of the heat loss ground floor above the unheated basement, the Assessor must use the defaults provided by DEAP.

Example:

The example below is of a floor above an unheated basement.

It was built in 1979 having an area of 56m² and an exposed perimeter of 22m.

Figure 4.10 – Floor above an unheated basement

The screenshot shows a software dialog box titled "Add Floor" with a close button (X) in the top right corner. The dialog contains the following fields and options:

Field	Value
Floor Location *	Storey 1
Floor Type *	Ground Floor – Above Unheated ...
Age Band *	1978 - 1982
Description	Ground floor of house, above unheated basement
Area [m ²] *	56
Exposed Perimeter [m] *	22
U-Value [W/m ² K] *	0.73

At the bottom of the dialog, there are two checkboxes: Underfloor Heating and Room in Roof. In the bottom right corner, there are two buttons: "CANCEL" and "SAVE".

4.3.3 Heated basements

If a basement is heated and consists of habitable rooms, then it is included in the Total Floor Area of the dwelling in the DEAP assessment. The ground floor above the heated basement is not a heat loss area as it is not above an unheated area. Heat is lost through the walls and floor of the basement as they are exposed, so the U-values of the basement walls and floor must be calculated and accounted for in DEAP.

The following cases may arise:

- Basement fully underground
- Basement partially underground

Example 1: Heated basement fully underground

If the basement floor and walls are fully underground then the Assessor selects, "Heated Basement – walls exposed to ground" when accounting for the heat loss areas of the basement under "Building elements – Floors" in DEAP. In this case the Assessor must provide:

- the floor area between the basement floor and the ground below (55m² in this example);
- the area of the basement wall exposed to ground (75m² in this example);
- the exposed perimeter of the **basement floor** (22m in this example);
- the Age Band of the basement.

DEAP then selects a default U-value which is overwritten by the Assessor when a non-default U-value is available.

Figure 4.11 – Heated basement: requires Floor Area, Exposed Perimeter and Wall area

Floor Location *	Floor Type *	Age Band *
Storey 1	Heated Basement - walls expose...	1994 - 1999

Description	Area [m ²] *
Basement walls and floor	55

Exposed Perimeter [m] *	Wall area (exposed to ground) m ²	U-Value [W/m ² K] *
22	75	0.38

Underfloor Heating Room in Roof

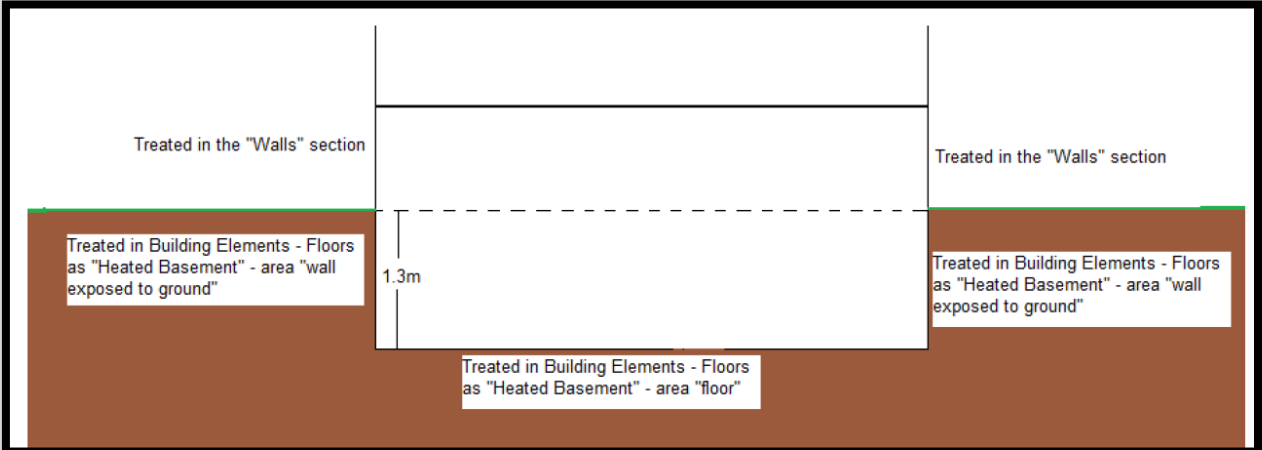
CANCEL SAVE

Example 2: Heated basement partially underground. Depth below ground $\geq 1.2\text{m}$

In cases where some of the basement's outer walls are below ground, and some are above ground, it is necessary to calculate the average basement depth. Average basement depth means the average depth of the internal basement floor level below the external ground level.

DEAP Appendix S details treatment of heated basements dependent on their depth below ground being either less than or greater than/equal to 1.2m. The figure below shows an example with a basement with average depth 1.3m:

Figure 4.12 – Average basement depth greater than 1.2m



Example 3: Heated basement partially underground. Depth below ground < 1.2m

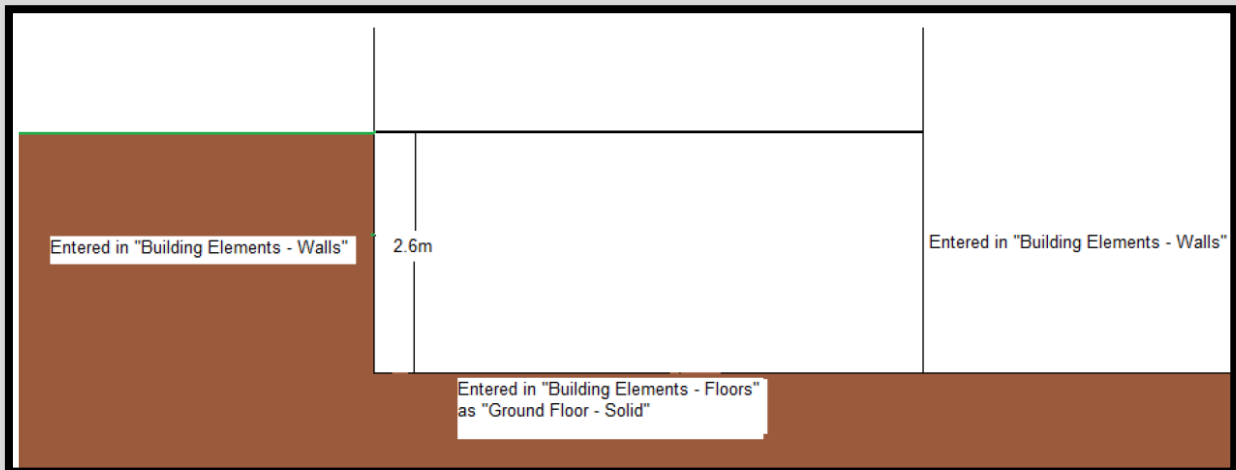
If the average basement depth is less than 1.2m then the basement floor is treated as a solid ground floor and the basement walls are treated as normal walls exposed to air under “Building Elements – Walls”.

As an example, consider a heated basement in a detached dwelling with floor area 7m x 10m. At the back of the house the external ground level is 2.6 metres above the basement floor. At the sides and front of the house the external ground level is at the basement floor level, i.e. the walls are above ground:

The dimensions of the basement walls are:

- back wall = 10m wide * 2.6m high (below ground)
- front wall = 10m wide * 2.6m high (above ground)
- each side wall = 7m wide * 2.6m high (above ground)

Figure 4.13 – Heated basement with depth less than 1.2m



The average of the basement depth is weighted by the wall length:

$$\text{Ave. Basement Depth} = \frac{(10 * 2.6) + (7 * 0) + (7 * 0) + (10 * 0)}{(7 + 10 + 7 + 10)} = 0.76\text{m}$$

This is less than 1.2m so

- the basement floor is treated like a standard solid ground floor, and,
 - the basement walls are treated as standard walls exposed to air,
- ...with the appropriate default U-values for that Age Band if defaults are being applied.

Example 4: Heated basements in semi-detached or terraced dwellings:

When surveying a semi-detached or mid-terrace dwelling with a heated basement, it may not be possible to examine the adjoining dwelling to establish whether a basement is present. It is likely that the adjoining house has a basement. Unless proven otherwise, the adjoining basement should be assumed to be unheated. If the adjoining basement is unheated or assumed to be unheated, then the basement party-wall is treated as a heat loss basement wall. If the adjoining basement is known to be heated, then there is no heat loss through the basement party-wall.

The party wall is always included in the average depth calculation for the heated basement, regardless of whether the adjoining basement is heated or unheated.

4.3.4 Conservatories

A conservatory is defined in DEAP as a room (or rooms) attached to a dwelling which has at least 75% of its roof and 50% of its external walls made of material that allows the transmission of light. The DEAP Manual, Section 3.3.3 details when to include a conservatory in the dwelling floor area:

- If the Building Regulations Part L 2008 or later applies.
- For existing / new dwellings prior to TGD L 2008, inclusion of a conservatory in the dwelling floor area depends on whether the conservatory is thermally separated from the dwelling.

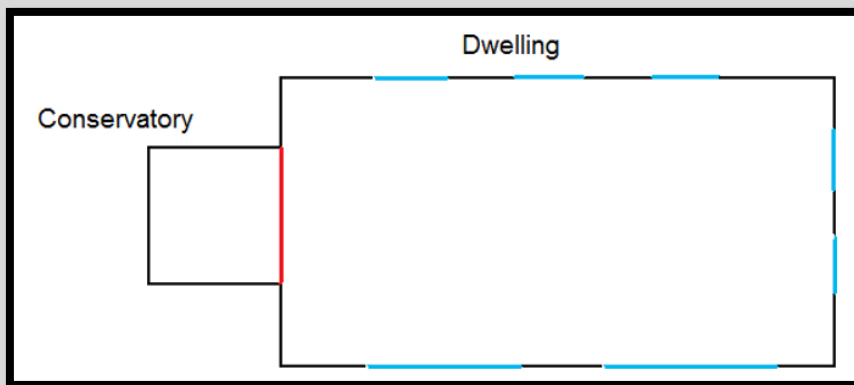
Example:

DEAP considers the conservatory thermally separated if both of the following are met:

- The walls, floors, windows and doors between it and the main dwelling must have U-values not more than 10% greater than corresponding exposed elements. For example, the U-value for a window between the heated and unheated space must not be more than 10% greater than exposed glazing elsewhere in the dwelling.
- It must be unheated or, if provided with a heating facility, must have provision for automatic temperature and on-off control independent of the heating provision in the main dwelling.

In the case shown below, the partition is a sliding glazed door. The door has 70% glazing so is treated as a window in DEAP. To test the first condition for thermal separation, the U-value of this sliding window (marked in red) is compared to the average U-value of the other windows in the house (marked in blue).

Figure 4.14 – Dwelling with conservatory



As an example, assume the sliding window is single-glazed with $U = 4.8 \text{ W/m}^2\text{K}$ and the other windows are double-glazed with $U = 2.6 \text{ W/m}^2\text{K}$. The limit for thermal separation is 10% greater than the U-value of the windows, i.e. $2.6 + 0.26 = 2.86 \text{ W/m}^2\text{K}$.

The U-value of the sliding window, $4.8 \text{ W/m}^2\text{K}$, is larger than this so the condition for thermal separation of the conservatory is not met. This means that heat will pass through the sliding window into the conservatory more easily than heat will flow out of the other windows. As a result, the conservatory will heat up to the same temperature as the rest of the house in which case it must be included in the dwelling floor area.

Now, if the single-glazed sliding window was replaced by a double-glazed sliding window with $U = 2 \text{ W/m}^2\text{K}$: The U-value of the sliding window is less than the limit for thermal separation in this example which is still $2.86 \text{ W/m}^2\text{K}$. This means that the new double-glazed sliding window acts as a sufficient barrier to the flow of heat from the house to the conservatory for the first condition for thermal separation to be satisfied.

Like the above, any walls in the partition between the dwelling and conservatory would be compared to other external dwelling walls. Likewise, doors in the partition between the dwelling and conservatory are compared to other external dwelling doors. The condition is met if the U-value of each of the partition elements is not 10% greater than the corresponding external elements elsewhere in the dwelling.

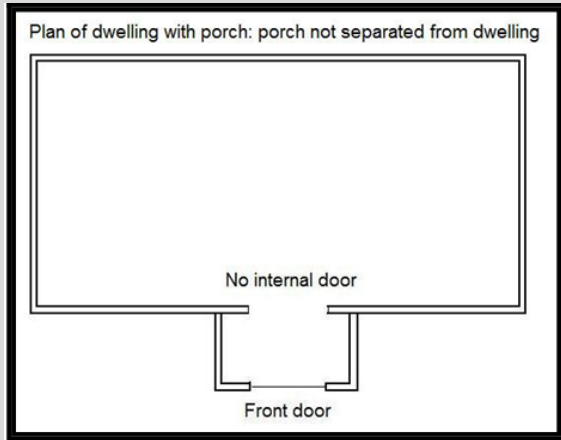
The DEAP Manual details a range of scenarios in which the second condition for thermal separation may or may not be met, based on heating controls and the presence of a fixed heating system.

4.3.5 Porches / entrance lobbies

The DEAP manual defines scenarios in which porches are included or excluded in dwelling floor area.

Example 1: Entrance lobby with no internal door

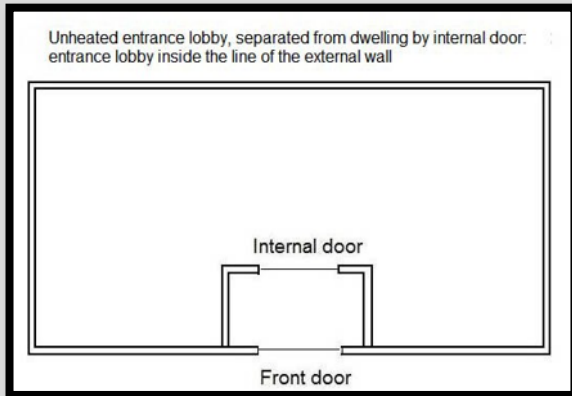
Figure 4.15 – Porch with no internal door



If a porch is not separated from the dwelling by an internal door, as shown in the following diagram, it is **included** in the total floor area of the BER assessment even if there are no fixed heating devices in the porch.

Example 2 : Unheated entrance lobby with internal door, within line of dwelling

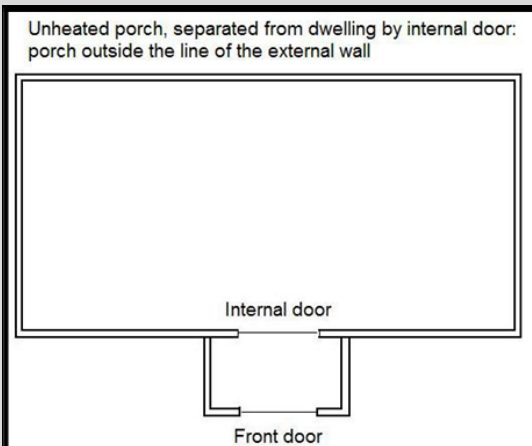
Figure 4.16 – Porch within line if dwelling and with an internal door



The entrance lobby is unheated and is separated from the rest of the dwelling by an internal door. This entrance lobby is, however, within the line of the building envelope. In DEAP this type of entrance lobby is always **included** in the assessment.

Example 3: Unheated entrance lobby with internal door, beyond line of dwelling

Figure 4.17 – Unheated porch outside line of dwelling, with an internal door

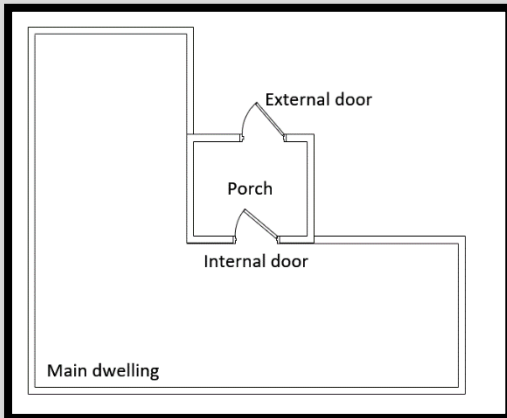


Here the porch is again unheated and separated from the dwelling by a door but this time the porch juts out beyond the line of the wall.

In this case the porch is always **excluded** from the assessment.

Example 4: Unheated entrance lobby with internal door, in a corner

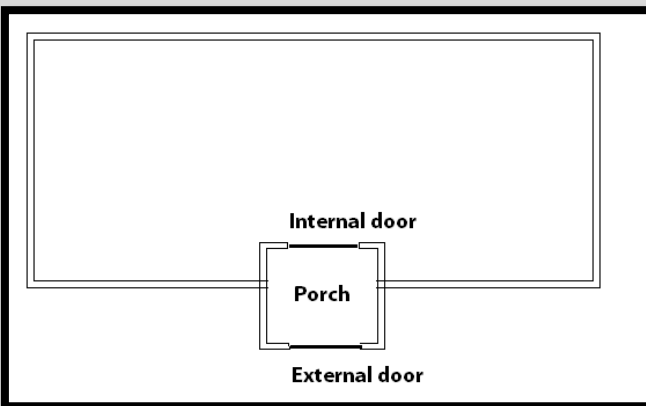
Figure 4.18 – Porch in a corner



In this case, the porch is in a “corner” of the dwelling, is unheated and is separated from the dwelling by a door. This entrance lobby is within the line of the building envelope. In DEAP this type of entrance lobby is **included** in the assessment.

Example 5: Unheated entrance lobby with internal door, partially within the line of the external wall

Figure 4.19 – Porch partially within line of external wall



In this case, as part of the porch is within the line of the building envelope, it is **included** in the assessment.

5. Ventilation

This section details a range of examples and guidance to supplement the ventilation sections in the DEAP Manual. It focusses on openings, draught stripping, sheltered sides, pressure testing and mechanical ventilation.

5.1 Ventilation openings

5.1.1 Chimneys in dwellings without secondary heaters

When a dwelling has a chimney or chimneys entered in DEAP, the dwelling will generally have secondary space heating entered in the DEAP assessment. This secondary space heater may or may not be the open fire associated with the chimney, subject to guidance in DEAP Appendix A. The following are sample scenarios where the open fire would not be considered as secondary heating:

- Another heat source is the secondary space heater (subject to guidance in DEAP Appendix A);
- The hearth below the chimney is not capable of supporting an open fire (the chimney is still counted in this case, but the actual fireplace cannot be used as a heat source);
- There are several open fireplaces in the dwelling and, based on guidance in Appendix A, these are chosen as the main space heating system.

Apart from these cases, it is likely that a dwelling with one or more chimneys would have an open fire selected as secondary space heating. In cases where the open fire is not considered the primary or secondary space heating system in DEAP, the chimney associated with the open fire will still contribute 40 m³/h to the ventilation of the dwelling in DEAP. For that reason, the chimney associated with an open fire must always be accounted for in the Ventilation section in DEAP unless the chimney is permanently blocked.

5.1.2 Common flue types on domestic heating appliances

An open flue is (usually) a vertical duct up to 200mm in diameter. It is considered as open because it takes the air required for combustion from the room in which the appliance is situated. Independent oil/gas boilers typically no longer use open flues although they can be seen on an old boiler (30+ years) in an existing dwelling.

Many modern stoves use an open flue. In the stove shown, combustion air is drawn into the stove from the room through a controllable vent. The combustion products – CO₂, water vapour, smoke particles and other gases – are removed through the vertical duct – the open flue – rising from the top of the stove. If the stove is in a fireplace, the flue will continue upwards through the chimney, but an open-flued stove can be located elsewhere in a dwelling with the flue passing up through the roof to expel the combustion products to the outside.

An open fire would normally have an associated chimney in DEAP. A chimney is specified if the open diameter of the flue is 200mm or more.

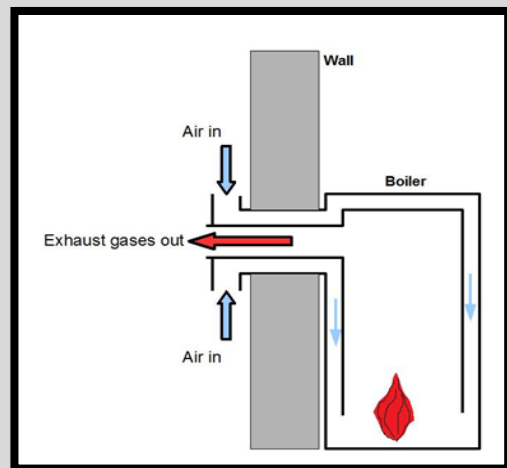


Modern boilers tend to have room-sealed flues. This means that the combustion air is taken from outside the dwelling (and the combustion products are expelled to outside the dwelling) so that the boiler is, in effect, sealed off from the air in the room in which it is located. This reduces the ventilation heat loss in the dwelling.

A balanced flue is an example of a room-sealed flue. In a balanced flue the intake and exhaust ducts are concentric as shown.

To ensure that there was a plentiful supply of air for combustion early balanced flues (from ca. 1980) tended to be quite large (up to 30 cm in diameter) with a rectangular cross-section. Modern balanced flues use a fan to ensure a continuous supply of combustion air. As a result, the diameter of the balanced flue in a modern boiler has reduced: it is usually less than 150 mm in diameter and the flue has a concentric circular cross-section as shown.

Balanced flues are increasingly common on stoves as they are necessary in houses with good air tightness levels and/or balanced whole house mechanical ventilation systems. In either situation, drawing air from the dwelling for combustion would impact on airtightness, so a balanced flue is used.



Note that permanent air supply vents in the same room as chimneys, open flues or fixed flueless appliances should not be counted in the DEAP ventilation section. The chimney, flue or fixed flueless appliance are reflected in the room by room survey. This air supply is accounted for when the chimney, flue or flueless appliance is entered in DEAP. However, intermittent fans and permanent air vents in the same room as a balanced or room sealed flued appliance must be accounted for as normal, subject to the rules in DEAP Manual Section 2.2.

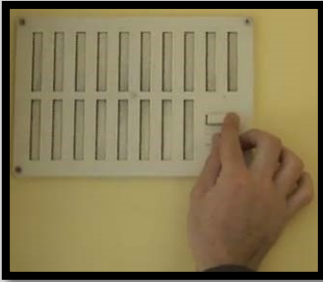
5.1.3 Intermittent fans and passive vents

DEAP Manual Section 2.2 details different types of intermittent fans and passive vents, including controllable vents to be excluded from the DEAP assessment. Several examples are shown below

Non-controllable wall vent (counted in DEAP subject to DEAP 2.2):



Controllable/closable wall vent (ignored in DEAP subject to DEAP 2.2):



Controllable/closable window vent (ignored in DEAP subject to DEAP 2.2):

Window vent closed:



Window vent open:



Some rooflight windows give the option of background ventilation through use of the opening handle. As this is closable it should not be counted as a background vent in DEAP:

Roof window vent open



Roof window vent closed



Permanent wall vents should also be ignored when located in a room containing chimneys, flues and fixed flueless gas fires. For example, in a dwelling with a flueless gas fire and associated permanent wall vents in the same room, the applicable ventilation rate is already calculated by DEAP.

Mechanical extractor fan (cooker hood) counted as an intermittent fan in DEAP:



Bathroom mechanical extractor exhaust counted as an intermittent fan in DEAP:



Audit example

- Assessor entered 7 intermittent fans and passive vents in DEAP.
- There were 2 permanent vents, 3 extract fans and 3 closable vents recorded on site.
- The permanent vent in the living area is accounted for by the chimney.
- The closable vents should not be recorded in DEAP.
- Therefore, the entry in DEAP should be 4 intermittent fans and passive vents in the dwelling.

5.2 Draught stripping

Where an air pressure test has not been carried out, typically in existing dwellings, uncontrolled air infiltration heat losses are estimated by the DEAP software based on,

- structure type,
- presence of a suspended wooden ground floor and
- the percentage of windows and doors draught stripped.

The screenshot in Figure 5.1 shows typical DEAP entries for a dwelling where air pressure testing has not been carried out.

Figure 5.1 – Attic hatches in DEAP

Number	Room	Type	Description
1		Attic Hatch - Draught Stripped	
1		Attic Hatch - Not Draught Stripped	

In DEAP 4, the draught stripping of the windows and doors in the dwelling is accounted for when entering the window and door information. DEAP 4 uses this data – and the information entered for attic hatches, as shown above – to calculate the percentage of draught stripping in the dwelling.

Figure 5.2 – Draught stripping of window openings

Common Errors – Percentage draught stripping

Errors typically identified during BER audits are as follows:

- **Error 1:** Draught stripping not adequately recorded in the site visit notes. To enable the calculation of draught stripping percentage, a record should be kept on an opening by opening basis. The DEAP Survey Form template provides a column to record the draught stripping status of openings and this can be used as the record. Other methods include recording the draught stripping next to each opening on the sketch/plan or using a bespoke list specifically for draught stripping.
- **Error 2:** Misinterpretation of the type of opening that should be considered for draught stripping:
 - Windows with no opening sections incorrectly included. As per the DEAP manual extract above, only windows with openable sections are considered. Windows without openable sections are not considered.
 - Loft hatches incorrectly omitted. Attic hatches are included in the draught stripping calculation. This can

have a significant impact on the energy value calculated by DEAP if there are multiple attic access points, e.g. in a room-in-roof type construction where there may be several access doors provided to crawl spaces. Attic hatches are entered directly into the Ventilation > Structural Air Tightness section of DEAP 4.



- **Error 3:** Entrance doors, e.g. front door and or back doors, not considered for draught stripping.

Entrance doors are included in the draught-stripping calculation.




5.2.2 Opening Types: examples


The images in the table below show typical openings found in dwellings. The total number of openable sections to be assessed for draught stripping is identified in each case.

Table 5 – Opening types: examples

Image	Description	Total number of openable sections considered for draught stripping.
	<p>uPVC double glazed door with side windows.</p>	<p>1</p>
	<p>uPVC double glazed window. Upper right and lower right sections are openable.</p>	<p>2</p>

	<p>Wood fully glazed door.</p>	<p>1</p>
	<p>uPVC patio doors. Both sides openable.</p>	<p>2</p>
	<p>Loft hatch with fold down ladder</p>	<p>1</p>

	<p>uPVC wrap around window. Openable sections to left and right sides.</p>	<p>2</p>
	<p>Wood single glazed window. Openable sections to top right and top left.</p>	<p>2</p>
	<p>Access door to crawl space (room-in-roof)</p>	<p>1</p>


	<p>Metal frame double glazed window. No openable sections.</p>	<p>0</p>
---	--	----------

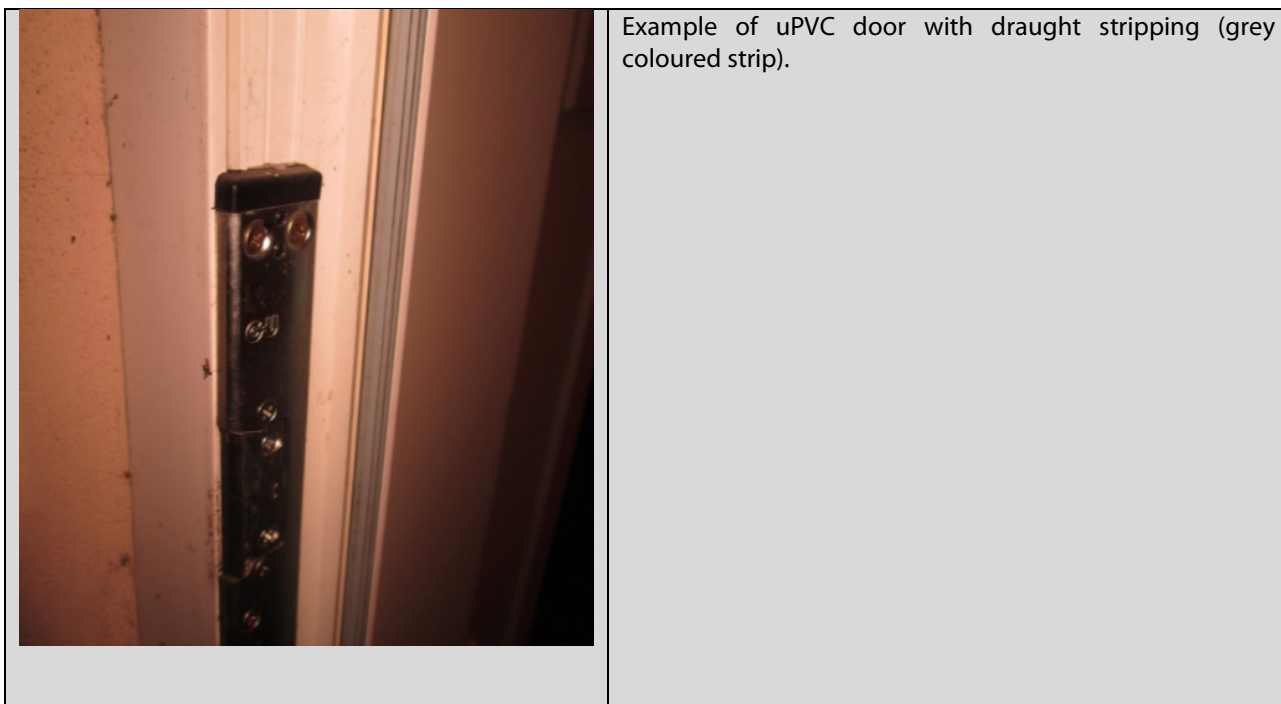
5.2.3 Identification of draught stripping

After the number of openable sections has been identified, a record must be made of whether the openable section is draught stripped or not.

Examples of openings with and without draught stripping are shown in the table below.

Table 6 – Draught-stripping: examples

	<p>Example of single glazed wood window without draught stripping.</p>
--	--

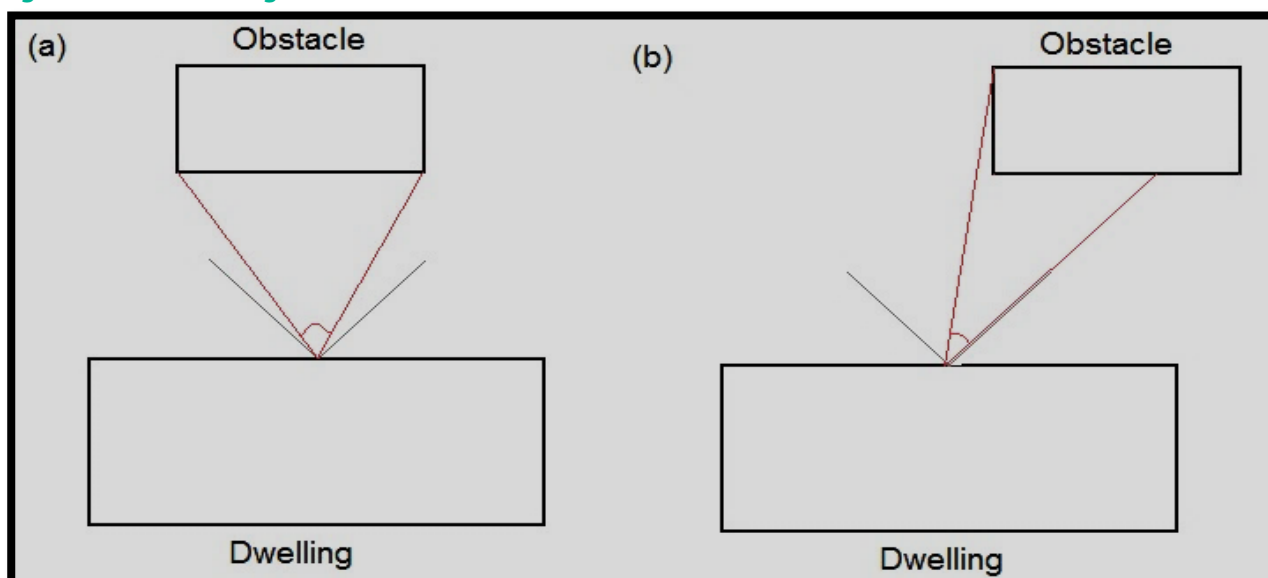


If an openable section is only partially draught stripped, it should be assigned as not draught stripped. An incomplete length of draught stripping would not create a seal to the openable section.

5.3 Sheltered sides

The DEAP Manual describes the conditions for deciding whether a side of a dwelling is sheltered by adjacent obstacles such as neighbouring buildings. It details how high, wide and near to the dwelling the obstacle(s) must be for that side to be sheltered. The guidance below focuses on the requirements of object width for sheltered sides. All objects in the following examples are assumed to meet the height and distance requirements for sheltered sides as detailed in the DEAP Manual. The importance of the position of the obstacle relative to the dwelling is highlighted in Figure 5.3. In the diagram, the red lines indicate the obstacle subtends to the midpoint of the side of the dwelling within the central 90°. Anything outside the grey lines is ignored.

Figure 5.3 – Shelter angle

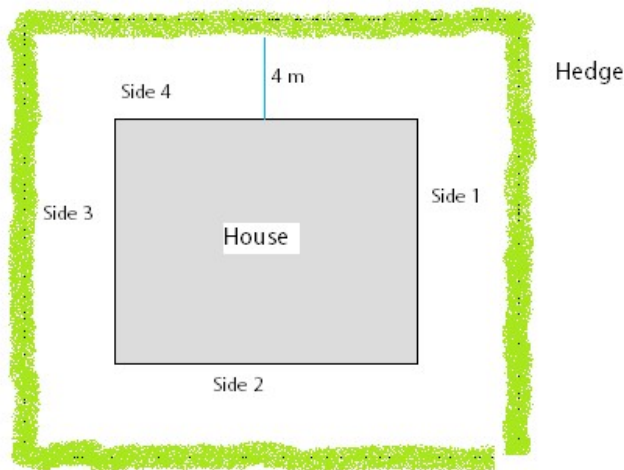


Two partially sheltered sides should be counted as one sheltered side. Architectural planting does not count as shelter unless it actually exists (even though shown as mature trees on drawings). If a tree of sufficient height and width is present it is considered as potentially sheltering the house, whether the tree has leaves or not.

Any party wall should be counted as a sheltered side once it meets the criteria above. The relevant base level for a sheltering obstacle starts at the base level of the dwelling being assessed. For example, a top floor apartment can only be sheltered by obstacles higher than the lowest floor of the apartment and obstacle height below that is ignored.

Obstacles can also be “combined” if they are close enough and wide enough but not tall enough. For example, consider a two-storey detached house with the upstairs ceiling at a height of 5.5 metres. The house is surrounded by a 3-metre tall hedge that is 4 metres from the house.

Figure 5.4 - Combining sheltered sides example



If two sides are taken together, the *combined* hedge height is 6 metres which is tall enough as it is greater than the dwelling height. So, sides 1 and 2 count as a single sheltered side, as do sides 3 and 4. In total the house has 2 sheltered sides in DEAP.

5.4 Pressure testing for TGD L compliance and DEAP

5.4.1 Building Regulation Part L 2019

Sections 1.3.4 and 1.5.4 of TGD L 2019 outline the requirements for air permeability pressure testing of new dwellings. Air pressure testing should be carried out on **all dwellings** on all development sites including single dwelling developments to show attainment of the backstop value of $5 \text{ m}^3/\text{hr}/\text{m}^2$.

The result of the air pressure test is divided by 20 to obtain the air changes per hour (ac/h) value to be entered in DEAP.

Individuals may, for example, demonstrate competence to carry out permeability tests on dwellings by being registered under the NSAI's Air Tightness Tester's Scheme. Additionally, individuals and organisations may demonstrate competence by being accredited to carry out tests to IS EN 9972:2015 (Supersedes IS EN 13829) by the Irish National Accreditation Board (INAB) or any other bodies capable of providing accreditation to ISO/IEC 17025.

Additional guidance on testing procedure is given in:

- Sections 2 to 4 of the BSRIA Guide “Airtightness testing for new dwellings”
- CIBSE Technical Manual TM 23 “Testing Buildings for Air leakage”
- ATTMA Technical standards

Air tightness test results for new-provisional BER assessments under Part L 2019

For provisional ratings, the dwelling won't be completed at the time of the BER assessment, so there will be no permeability test result available for the dwelling.

- Air pressure testing is required on all dwellings within the development
 - Non-default can be made via a permeability test for a similar building with all the following
 - Same builder/developer
 - Same structure type (timber frame / masonry / ICF)
 - Same dwelling type
 - Same floor area

Assessors should verify the pressure test result relate to building area and that the building elements are appropriate for the new building type.

- Default of 0.25ac/h may be used in DEAP for provisional dwellings without balanced mechanical ventilation proposed (CIBSE TM 23 best practice)
- Default of 0.15ac/h may be used in DEAP for provisional dwellings with balanced mechanical ventilation proposed

NB Any figures entered in the provisional BER **must be replaced** with an actual permeability test result for the dwelling (or development sample regime) when publishing the final BER for the dwelling.

5.4.2 Building Regulation Part L 2011

Section 1.5.4 of TGD L 2011 outlines the requirements for air permeability pressure testing of new dwellings. It details that air permeability testing does not need to be carried out on every single new dwelling, but must be tested in accordance with the sample regime defined in Table 4 of TGD L.

Table 7: TGD L 2011 extract

Table 4 Number of pressure tests per dwelling type	
Number of units	Number of tests
1 to 4	One test
Greater than 4, but equal to or less than 40	Two tests
Greater than 40, but equal to or less than 100	At least 5%
More than 100	
(a) where the first five tests achieve the design air permeability	At least 2% (for dwellings in excess of first 100 units)
(b) where one or more of first five tests do not achieve the design air permeability	At least 5% of units, until 5 successful consecutive tests are achieved, 2% thereafter

TGD L also details that a dwelling tested according to the sample regime in Table 4 of TGD L should achieve a permeability test result of 7m³/m²/hr.

If the permeability test is not carried out on the actual dwelling, or dwelling(s) of the same type, subject to the sample regime above, then "No" must be answered to "Has an air permeability test been carried out" when assessing the dwelling in DEAP. DEAP then assumes a default air leakage for the dwelling.

Key points:

- In the case of 2011 TGD L, the backstop is $7\text{m}^3/\text{m}^2/\text{hr}$.
- Where an Assessor has copies of pressure test results for building type, but not specific for the dwelling, which are greater than the backstop in TGD L and complying with minimum rate of testing in TGD L, the maximum air pressure test is used for the building type.
- Where an Assessor has copies of pressure tests for building type, but not specific for the dwelling, which are less than the backstop in TGD L and complying with minimum rate of testing in TGD L, they can use the backstop.
- Where an Assessor has copies of pressure test results specific for the dwelling, the pressure test results must be used.

Table 8 – Air pressure test examples

Scenario	TGD L conformance	DEAP: “Has an air permeability test been carried out?”	DEAP: “Adjusted result of air permeability test [ac/h]”
2 houses in a development with no permeability test carried out on any dwelling by the developer	No	No	n/a as these dwellings do not have a test result available.
2 houses in a development . They are not of the same type. Only one house has a permeability test result available and achieves $6\text{m}^3/(\text{h}\cdot\text{m}^2)$	Yes on one house. No on the other	Yes on one house. No on the other	Tested house has test result of $6\text{m}^3/(\text{h}\cdot\text{m}^2)$. Divide by 20 to get 0.3 ac/h on that house. n/a on the other house as no result available
2 houses in a development . They are of the same type. Only one house has a permeability test performed and achieves $6\text{m}^3/(\text{h}\cdot\text{m}^2)$	Yes to both	Yes to both	Tested house has test result of $6\text{m}^3/(\text{h}\cdot\text{m}^2)$. Divide by 20 to get 0.3 ac/h on that house. Other house has test results for same type and sample regime applies, results are below backstop so backstop of $7\text{m}^3/(\text{h}\cdot\text{m}^2)$ can be used. Divide by 20 to get 0.35 ac/h on that house.
9 houses in a development . They are of the same type. 2 houses have a permeability test performed and achieve: 1) $6\text{m}^3/(\text{h}\cdot\text{m}^2)$ 2) $10\text{m}^3/(\text{h}\cdot\text{m}^2)$	Yes to One No to Others – Remedial work should be carried out in compliance with regulations	Yes to all 9 houses	0.3 ac/h on the house which actually achieved $6\text{m}^3/(\text{h}\cdot\text{m}^2)$. 0.5 ac/h on the remaining 8 houses

Any test results used in the above scenario must be from accredited air tightness testers as discussed below. Otherwise, those results are not acceptable.

In general, for BER Assessments, SEAI encourages BER Assessors to use non-default certified test data wherever possible. This non-default data must be properly certified and substantiated. Where actual air permeability test results are identified in a BER assessment audit, SEAI may look for supporting evidence that the permeability test results are available and that the test was carried out by an individual or organisation competent to do so.

Individuals may, for example demonstrate competence to carry out permeability tests on dwellings by being registered under the [NSAI’s Air Tightness Tester’s Scheme](#). Additionally, individuals and organisations may demonstrate competence by being accredited to carry out tests to IS EN 9972:2015 (Supersedes IS EN 13829) by the Irish National Accreditation Board ([INAB](#)) or any other bodies capable of providing accreditation to ISO/IEC 17025.

For developments with three dwellings or less, the conditions outlined in TGD L 1.5.4.8 may be used to demonstrate air-tightness compliance to the Building Regulations requirements. In this case, if a dwelling of the same type was built by the same builder in the preceding 12 months and if that original dwelling achieved a permeability test result $\leq 7\text{m}^3/\text{m}^2/\text{hr}$, then the current dwelling would be deemed to be compliant to the Part L air permeability requirements. In this case, an air permeability test would not be required on the actual dwelling. In the BER assessment of the actual dwelling, the permeability test result is set to $7\text{m}^3/\text{m}^2/\text{hr}$ or 0.35ac/h in DEAP.

Additional guidance on testing procedure is given in:

- Sections 2 to 4 of the BSRIA Guide "[Airtightness testing for new dwellings](#)"
- CIBSE Technical Manual TM 23 "[Testing Buildings for Air leakage](#)"
- ATTMA [Technical standards](#)

Air tightness test results for new-provisional BER assessments under Part L 2011

For provisional ratings, the dwelling won't be completed at the time of the BER assessment, so there will be no permeability test result available for the dwelling.

- If air pressure testing is **not** proposed on all dwellings within the development
 - Default of 0.35 ac/h (adjusted permeability test result to be used in DEAP) for dwellings where pressure test is not proposed.
- If air pressure testing **is** proposed on all dwellings within the development
 - Non-default can be made via a permeability test for a similar building with all the following
 - Same builder/developer
 - Same structure type (timber frame / masonry / ICF)
 - Same dwelling type
 - Same floor area

Assessors should verify the pressure test result relate to building area and that the building elements are appropriate for the new building type.

- Default of 0.25ac/h may be used in DEAP for provisional dwellings without balanced mechanical ventilation proposed (CIBSE TM 23 best practice)
- Default of 0.15ac/h may be used in DEAP for provisional dwellings with balanced mechanical ventilation proposed

NB Any figures entered in the provisional BER **must be replaced** with an actual permeability test result for the dwelling (or development sample regime) when publishing the final BER for the dwelling.

5.4.3 Air tightness report

Relevant standards and minimum information required in air tightness test reports are detailed in TGD L Section 1.5.4. Also, as detailed in the DEAP Manual, the pressurisation test must be: "*completed in accordance with IS EN 13829 by an individual or organisation competent to do so (NSAI or INAB accreditation for example).*"

Note that the test standard IS EN 13829:2000 is now superseded by I.S. EN ISO 9972:2015. The list of NSAI accredited air tightness testers is [here](#).

Air tightness test equipment calibration expiry

If the air tightness test certificate shows the calibration due date of the air tightness test equipment, and if that date was expired at the time the test was carried out then either:

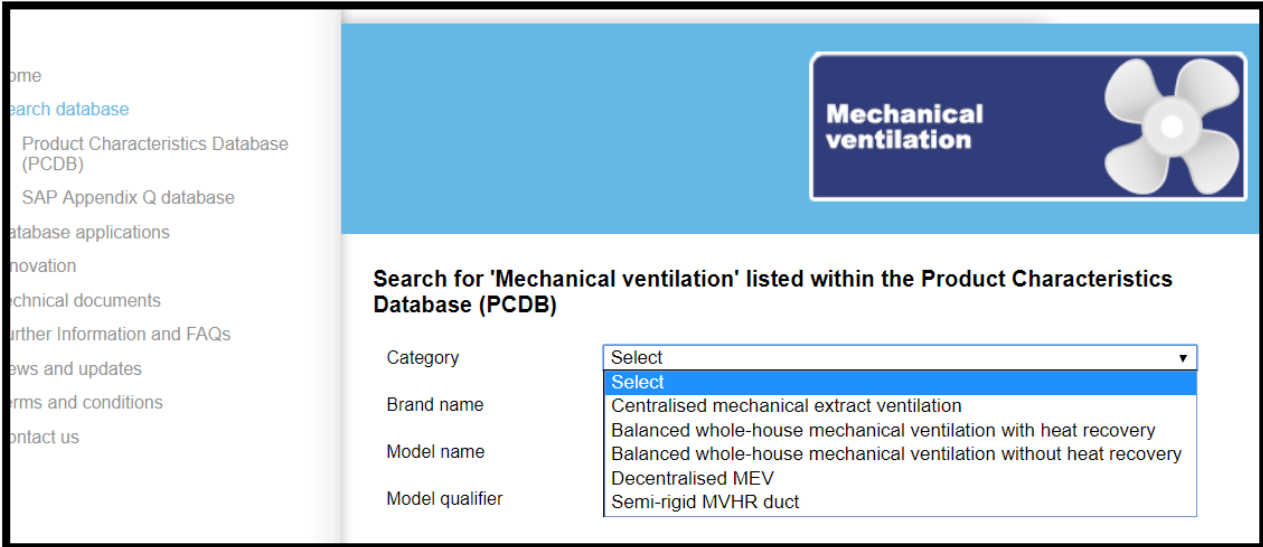
- a) A valid revised test must be provided, or
- b) Written clarification from an NSAI (or equivalent) accredited air tightness tester must be obtained and held on file by the BER Assessor as to the acceptability of the original result.

5.5 Mechanical ventilation

Non-default values for mechanical ventilation are taken from [SAP Appendix Q's Product Characteristics Database](#) (PCDB) and generally will result in lower calculated energy usage in DEAP than use of defaults. In addition, use of mechanical ventilation in a house with poor (or no) air tightness test results will likely result in an increase in energy usage due to increased air flow and extra electricity drawn by the ventilation fans.

When selecting a ventilation unit from the PCDB, first select the category (as shown in Figure 5.5), followed by brand, model and model qualifier for the unit being assessed.

Figure 5.5 - PCDB Ventilation selection



Then, identify the kitchen, and number of wet rooms with extract vents (n=3 in this case) as per Figure 5.6. Where ducting does not match the tested type, DEAP defaults must be used. Some semi-rigid ducting systems are “equivalent” to rigid ducting on the PCDB. Use data from the year applicable to the date of the supply/install of the MVHR system in the house being assessed. For example, systems up to and including 2011 use the 2009 data in this case. Systems from 2012 onwards use 2012 data. If the date of supply/install is unknown, assume the system is the same age as the dwelling. The “in-use” factors shown on the PCDB do not apply for DEAP.

Figure 5.6 - Sample MVHR unit on PCDB

Type	Index number	Status		
Centralised MEV and MVHR systems	500007	Normal		
Brand	Model name	Model qualifier		
Vent Axia	HRE 350			
System type	balanced whole-house mechanical ventilation with heat recovery			
Duct type	rigid			
Minimum duct size	125 mm diameter or 204 x 60 rectangular or larger			
Original manufacturer name	Vent Axia Ltd			
Current manufacturer name	Vent Axia Ltd			
K+n wet rooms	SFP (W/l/s) [2009]	Efficiency (%) [2009]	SFP (W/l/s) [2012]	Efficiency (%) [2012]
n = 1	0.94	89%	0.96	90%
n = 2	0.92	90%	0.96	90%
n = 3	0.89	89%	0.99	86%
n = 4	0.92	88%	-	-

Figure 5.7 - Entering data for the above unit in DEAP if installed in 2012 or later

	INFILTRATION DUE TO OPENINGS	STRUCTURAL AIR TIGHTNESS	VENTILATION METHOD
Method		Specific Fan Power [W/(l/s)]	Heat Exchanger Efficiency...
Balanced whole-house mechanical ventilation with heat recovery		0.99	86
Manufacturer	Model	How many wetrooms (including kitchen)? Is the ventilation ducting flexible/rigid/both?	
Vent Axia	HRE 350	Kitchen + 3 wetrooms. Rigid ducting.	
<input type="checkbox"/> External Uninsulated Ducting			

6. Fabric

This section focusses on relevant guidance and examples for planar fabric heat loss. It also discusses the approach to non-default thermal bridging entry in DEAP.

6.1 Fabric defaults and non-defaults

6.1.1 U-value defaults in existing dwellings

As per Table S2 in the DEAP manual, the default U-values for existing dwellings for dwellings constructed on or after 1978 (age band F onward) are based on Building Regulations made available from 1976 onwards. Defaults for age bands prior to this generally assume insulation is not present. However, non-default U-values must be calculated when the Assessor has evidence of the construction or makeup of the exposed element (as detailed in the DEAP Survey Guide). This is particularly important where:

- The actual U-value is less than the relevant default U-value.
- The actual U-value exceeds relevant default U-value. An example of this would be an uninsulated stud partition wall between a more recently constructed apartment and an unheated corridor. Rather than containing insulation, the partition may consist of plaster (internal and external), sheathing ply and air gaps between studs.

As can be seen from the tables of Appendix S in the DEAP manual, the dwelling age band can have a significant bearing on the default U-value. Consequently, it is important that the guidance in the DEAP Survey Guide is followed when determining the dwelling (or extension) age band.

It is preferable to use legal documents (e.g. commencement notice; planning notices):

- Check with Local Authority or www.pleanala.ie
- <http://map.geohive.ie/mapviewer.html> shows maps from 2005, 2000, 1995

If legal documents are not available, use evidence from at least 2 of:

- Stylistic evidence - e.g. check for similar on Irish section of Tabula: <http://webtool.building-typology.eu> ⁴
- Plates on dwelling or development showing year of construction
- Age on electricity meter
- Year of glazing printed between panes or on concealed edge of frame. Open the window/door to check.
- Homeowner knowledge – retain this in writing

If evidence conflicts, err on the side of caution by selecting the “older” option.

6.1.2 Non-default U-values in DEAP assessments

The DEAP manual (Section 3) and the DEAP Survey Guide detail how insulation in properties must be substantiated and how supporting U-values are calculated. Non-default U-value calculations must be carried out to the relevant standards to two decimal places and be based on thermal conductivities and thermal resistance values from appropriately accredited sources such as detailed in Section 3.2 or Agreement certificates.

If a third party such as an insulation installer or architect provides the BER Assessor with a U-value for a building element, the BER Assessor must ensure that any non-default U-value entered in a published BER assessment adheres to the rules set out in the DEAP methodology and associated guidance. Therefore, the Assessor must retain the non-default U-value calculation details with the BER records. A statement of the non-default U-value (without the substantiation required for U-value entry normally required in DEAP) from the installer detailing the non-default U-value is insufficient for the purposes of DEAP assessments.

⁴ Source: Energy Action Ltd.

When calculating the U-value for a building element retrofitted with insulation, ensure that the U-value calculation is based on guidance in the DEAP methodology. When calculating retrofitted building element U-values and using the U-value of the original building element as a starting point (such as per the footnote to Table S3 in the DEAP manual), the original building element U-value must be based on substantiated evidence as outlined in the DEAP methodology and DEAP survey guide, or else on DEAP Appendix S defaults.

The document [BR443](#) gives concise information on each relevant standard for U-value calculations. It is freely available online. BR443 also details requirements and relevant default values for corrections⁵ such as air gaps, emissivities and wall ties. See TGD L A2.1 for more details on corrections. Non-default values for these corrections must be sourced from certified data to relevant standards.

⁵ Note that corrections are not demonstrated in the simple examples in this section. Section 6 includes some examples with corrections in U-value calculations.

Example 1: drylining added to wall with non-default U-value calculations

A BER is required for an existing dwelling built in 1983. The walls have been retrofitted with drylining insulation. An architect's report is provided, detailing the original cavity wall makeup:

- 100mm concrete block inner leaf and 100mm concrete block outer leaf; Both "heavyweight"
- 100mm gap between inner and outer leaf partially-filled with 50mm of SD polystyrene insulation;
- 15mm external render;
- 5mm skim plaster internal finish.

Layer	Thickness (mm)	Thermal conductivity (W/mK)	Thermal Resistance (W/m ² K)
External Surface	-	-	0.04
Outer Render	15	1.00	.015
Outer block	100	1.33	0.075
Air Cavity	50	-	0.18
Insulation	50	0.038	1.316
Inner Block	100	1.33	0.075
Plaster	5	0.18	0.028
Internal Surface	-	-	0.13
Total Thermal Resistance (m ² K/W) =			1.859
Original Wall U-value (W/m ² K) =			0.54

The walls have been dry-lined with insulated plasterboard slabs:

- 50mm Phenolic foam (Certified thermal conductivity, $\lambda = 0.021$ W/mK);
- 12.5mm plasterboard.

Thermal Conductivity values for common building materials and insulation materials above are sourced from DEAP Table 12a and 12b as is allowed for in existing dwellings. The Total Thermal Resistance of the original wall is then used to calculate the final U-value of the wall after dry-lining addition:⁶

Layer	Thickness (mm)	Thermal conductivity (W/mK)	Thermal Resistance (m ² K/W)
Original Wall	As above	As above	1.859
Insulation	50	0.021	2.38
Plasterboard	12.5	0.25	0.05
Total Thermal Resistance (m ² K/W) =			4.289
Wall U-value (W/m ² K) =			0.23

⁶ As the assessor is not starting with a default U-value, and knows the thermal conductivity of the drylining, there is no need to use DEAP Table S3b

Example 2

A BER is required for an existing dwelling built in 1983 in which the walls have been retrofitted with drylining insulation (same dry-lining as the previous example). While the architect details that the drylining was added to the original wall, there is no additional information available on the original wall.

To calculate the U-value of the wall after dry-lining, the default U-value of the original wall is taken from Table S3. For a cavity wall built in 1983 (age band G) this is 0.6 W/m²K which is equivalent to a Thermal Resistance of 1.67m²K/W.⁷

Layer	Thickness (mm)	Thermal conductivity (W/mK)	Thermal Resistance (m ² K/W)
Original Wall	-	-	1.67
Insulation	50	0.021	2.38
Plasterboard	12.5	0.25	0.05
Total Thermal Resistance (m ² K/W) =			4.1
Wall U-value (W/m ² K) =			0.24

Plasterboard is not likely to have been used in buildings constructed before 1950. Therefore, for a building originally constructed prior to 1950 - where age band A, B, or C applies - if plasterboard is present then it is acceptable to assume that the plasterboard has been retrofitted.

On that basis the U value for "Plasterboard + 0mm Insulation" from Table S3b can be used.

For all other Age Bands, drylining cannot be assumed to be additional to a wall (even with 0mm insulation) unless there is proof that the drylining has been retrofitted.

Example 3

In this case, the homeowner claims that 50mm dry-lining insulation was retrofitted to the original cavity wall. The house was constructed in 1983 (age band G). No other evidence is available, and the assessor has insufficient access to determine the makeup of the wall and internal insulation.

In this case, the evidence doesn't support use of anything other than a default value from DEAP Table S3. The U-value of the wall in DEAP is 0.6.

⁷ While the assessor is starting with a default U-value, the thermal conductivity of the drylining is known, so there is no need to use DEAP Table S3b

6.1.3 Documentary evidence for non-defaults where not accessible on site

The following table outlines the documentation required for different parameters for New-final, New-provisional and Existing dwelling BERs, where those parameters are not accessible during the site survey.

Table 9: Supporting non-defaults using documentation

Item	New-final	New-provisional	Retrofit to existing
Insulation thickness	As-built drawings/specifications signed off by the person responsible for building regulation compliance sign-off, e.g.: <ul style="list-style-type: none"> • Architect; • Engineer; • Assigned Certifier 	Drawings/specifications signed off by one of, <ul style="list-style-type: none"> • developer • engineer • architect • client 	Invoices/ receipts (or DOW in uniform insulation thickness scenario) showing address
Conductivity of insulation	Agreement cert or other certified sources. NB Don't use DEAP table 12b unless all other avenues exhausted	Agreement cert or other certified sources preferable. Otherwise use DEAP table 12b	Agreement cert or other certified sources preferable. Otherwise use DEAP table 12b [†]
Construction of element	As built drawings or specification	Drawings or specifications	Not needed for default U-value. As built drawings/specifications needed to support non-default U-values [†]
Conductivity of element (e.g. Plaster, concrete)	CIBSE Guide A / DEAP table 12A	CIBSE Guide A/ DEAP table 12A	CIBSE /DEAP Table 12A acceptable if calculating full U-value
Area of element meeting non-default	Survey used to verify as built drawings or specification	Drawings or specifications	Invoices/ receipts (or DOW in uniform insulation thickness scenario) showing address

For further guidance on this see the [DEAP Survey Guide](#).

6.1.4 Wall U-value substantiation examples

The DEAP manual (Section 3) and Survey Guide detail how insulation properties are substantiated and how supporting U-values are calculated. Examples of inadequate substantiation of non-default U-values are given in Table

[†] U-value may be calculated for entire retrofitted element or add resistance of new insulation to the default resistance of original building element (See DEAP Table S3 footnote) **depending on level of availability of supporting evidence.**

10. The procedures for Existing and New Final BER assessments require that BER Assessors carry out a full building survey to collate and verify data for assessment before publishing the BER.

Table 10: U-value substantiation

Issue	Non-Compliance detail	Correct U-value detail
<p>The thermal conductivity value used to calculate the U-value of the retrofitted wall is not the same as the Agreement certificate value.</p>	<p>The insulation contractor certificate states a thermal conductivity of 0.033 W/mK and references NSAI certificate 06/0168. The NSAI cert states a thermal conductivity of 0.035 W/mK.</p>	<p>Either the NSAI cert number is incorrect or the incorrect thermal conductivity has been used in the U-value calculation. Considering no further evidence is presented the correct thermal conductivity of 0.035 W/mK from the NSAI certificate is used.</p>
<p>A U-value of 0.29 W/m²K has been entered in DEAP by the Assessor based on contractor input to the Declaration of Works form for cavity fill insulation under the Better Energy Homes Scheme.</p>	<p>No Assessor U-value calculation provided or evidence to specify the exact insulation type, thickness and certified evidence of thermal conductivity. A contractor's statement of U-value is not acceptable alone but must be accompanied by full calculations.</p>	<p>In the absence of acceptable documentary evidence, the U-value defaults to filled cavity value of 0.6 W/m²K (this reflects the construction age of the dwelling).</p>

6.1.5 Semi-exposed walls in existing dwellings

A semi-exposed wall is one that is adjacent to an unheated space. This affects the rate of heat loss through the wall – i.e. the U-value - a fact accounted for by adding an extra thermal resistance.

The way this adjustment is made depends on the source of the U-value of the wall:

- If the U-value of the semi-exposed wall is based on a default value for an exposed wall taken from DEAP Table S3, then the “Wall is semi-exposed” option in DEAP is selected for existing dwellings;
- If the U-value of the wall is a non-default value, i.e. a value calculated by the Assessor, then the adjustment must be calculated manually by the Assessor and the final value entered manually into DEAP. The Assessor must retain a record of the supporting calculation. In this case, the Ru value can be taken from DEAP Appendix S6.1 or from Tables A3/A4/A5 in TGD L. The Ru value is accounted for as detailed in DEAP Manual 3.3.
- Defaults can also be chosen for semi-exposed uninsulated walls between an apartment and an unheated corridor, stairway or commercial unit as per DEAP Table S3a.
- DEAP Manual 3.3.6 can be used to derive a more accurate Ru value based on areas of internal and external elements in the unheated space, the U-values of the unheated space’s external elements, and volume and air changes in the unheated space.

More detail on semi-exposed walls in existing apartment dwellings:

As stated in the DEAP manual: "In buildings incorporating flats, where corridors and stairwells are heated, walls between the flat and heated corridors/stairwells should be treated as non-heat loss walls (i.e. assuming the same temperature on either side of the walls). Otherwise these walls are treated as elements adjacent to an unheated space and their U-values should be calculated accordingly (see Section 3.3)."

In existing apartments with semi-exposed walls there are a number of options to choose from:

1. If using a non-default U value, calculate the U value of the wall in question and apply an Ru value based on TGD L 2011 Table A4. Do not tick the "wall is semi exposed option" in DEAP in this case as you are overwriting the default value with a non-default.
2. If using a default U value and using a default Ru value with one of the exposed wall types from DEAP table S3, tick "wall is semi exposed". DEAP will automatically apply a default Ru value to the exposed wall. *Note that Table S3 should only be used for walls between an apartment and unheated space when there is documentary evidence to support the presence of insulation.*
3. If using a default and the wall is semi-exposed uninsulated block, choose one of the walls from Table S3a in DEAP from the DEAP dropdown. This automatically applies a default Ru value to an uninsulated block wall between a dwelling and a corridor.

6.1.6 Measuring roof insulation thickness

When measuring the depth of attic roof insulation, for example glass fibre/mineral wool quilt or blown insulation, take care not to compress the insulation during measurement. As stated in the DEAP Survey Guide “Ensure insulation depth is established by taking the average of a number of measurements (including insulation levels on attic hatches).



Figure 6.1: Measuring roof insulation thickness

In certain cases, it will be necessary to enter the roof sections separately in DEAP as per the DEAP Survey Guide: "Different U-values (e.g. significantly different depths or materials) must be treated as separate roofs in DEAP"⁸. For example, the attic space may be insulated in a piecemeal fashion with different thicknesses in different sections and areas:

Figure 6.2 - Different attic insulation depths

	FLOORS	ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS
	Type		Description	Insulation Thickness [mm]	Age Band	Area [m ²]	U-Value [W/m ² K]
	Pitched Roof - Insulated on Ceiling		Insulated sections of Main roof		2005 -2009	95.00	0.400
	Pitched Roof - Insulated on Ceiling		Uninsulated sections of Main roof		2005 -2009	10.00	2.300
	Total Heat Loss Roof Area [m ²]			105.00	+ ADD ROOF		

For inaccessible sections of roof, the applicable default from Appendix S is applied if there is no other supporting evidence on the insulation type/thickness used. Where a default is applied to some sections and non-defaults to others, this is split into multiple roof sections in DEAP:

Figure 6.3 - Different attic insulation depths

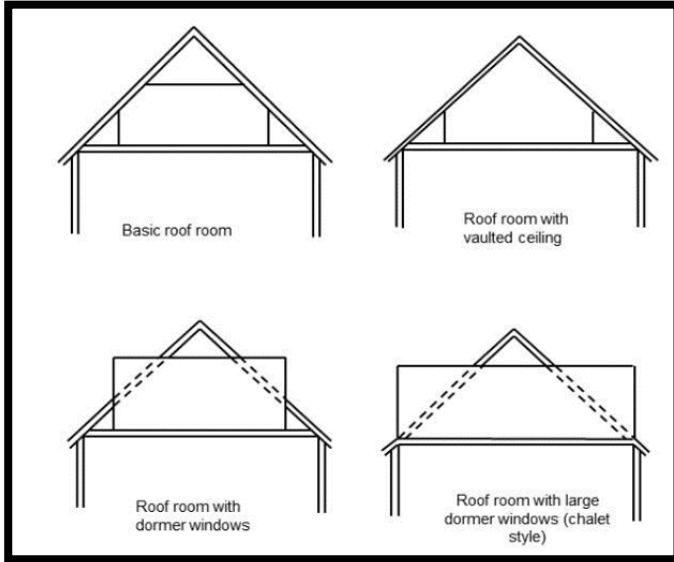
	FLOORS	ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS
	Type		Description	Insulation Thickness [mm]	Age Band	Area [m ²]	U-Value [W/m ² K]
	Flat Roof		New Extension		2005 -2009	9.30	0.250
	Flat Roof		Previous extension		1983 - 1993	6.70	0.490
	Pitched Roof - Insulated on Ceiling		Insulated sections of Main roof		1978 - 1982	95.00	0.400
	Pitched Roof - Insulated on Ceiling		Uninsulated sections of Main roof		1978 - 1982	10.00	2.300
	Total Heat Loss Roof Area [m ²]			121.00	+ ADD ROOF		

⁸ Bear in mind the tolerances allowed for in DEAP Appendix S4: "Where a specific floor, wall or roof area within a dwelling represents less than 10% of the respective total floor, wall, or roof area of the dwelling, then the differences in construction or U-value can be ignored, and the smaller area subsumed within the larger area."

6.1.7 Room-in-roof approximation for existing dwellings

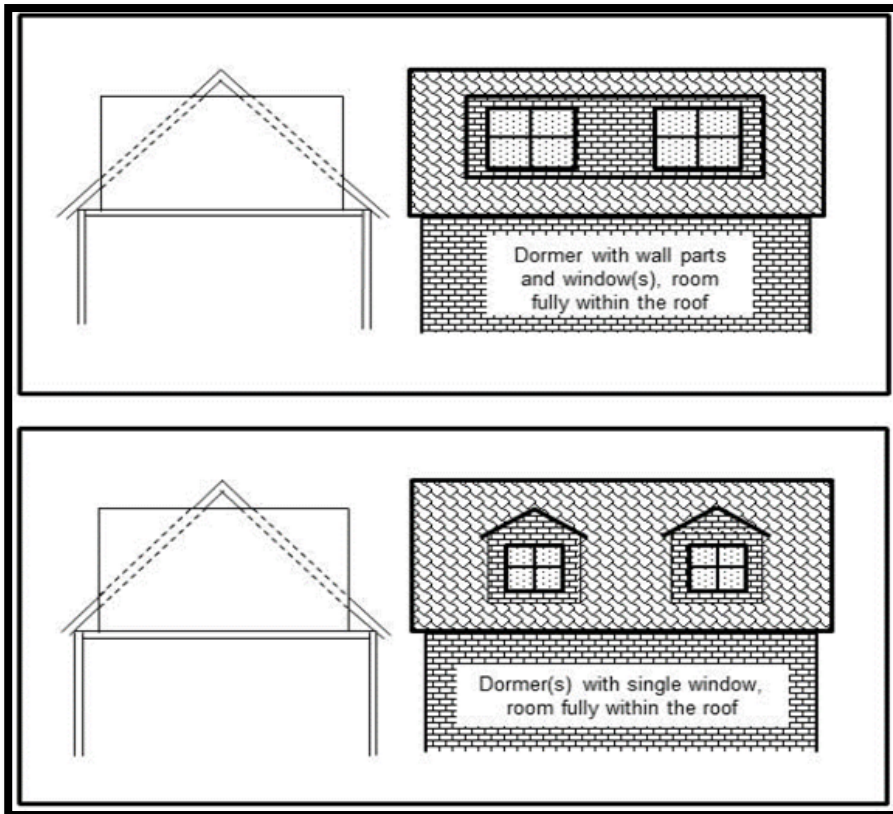
The DEAP Manual Appendix S details the approximation option for a room-in-roof in existing dwellings. This includes detail on the different measurement parameters and discusses scenarios in which the approximation is or is not allowable. The diagrams in Figure 6.4 are examples of room-in-roof for which the approximation can be used. The approximation is not allowable for new dwellings in DEAP.

Figure 6.4: Room-in-roof scenarios



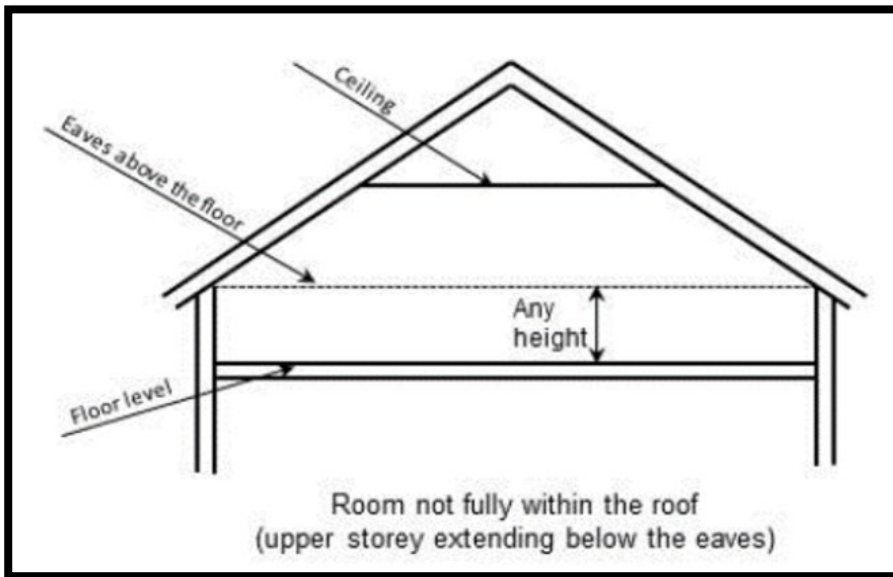
Where the room-in-roof has one or more dormer windows, the approximation can be used when the dormer structure includes a flat or pitched roof and wall parts as well as window(s), as shown below. This is valid if the room is fully contained within the roof and its floor is at eaves level or above as shown in Figure 6.5:

Figure 6.5: Room-in-roof scenarios: multiple dormer windows



Where the upper storey included in the total floor area has walls (other than gable walls) which are exposed, this is not a room-in-roof, and the room-in-roof approximation is not applicable. The walls and roofs of this upper storey are entered separately in DEAP. An example of such a scenario would be a "storey and a half" dwelling and is shown in Figure 6.6.

Figure 6.6: Room not fully within the roof



6.2 Additional fabric examples

This section covers a range of U-value calculation scenarios. Commercially available U-value calculators can be used to carry out these calculations provided they adhere to the relevant standards.

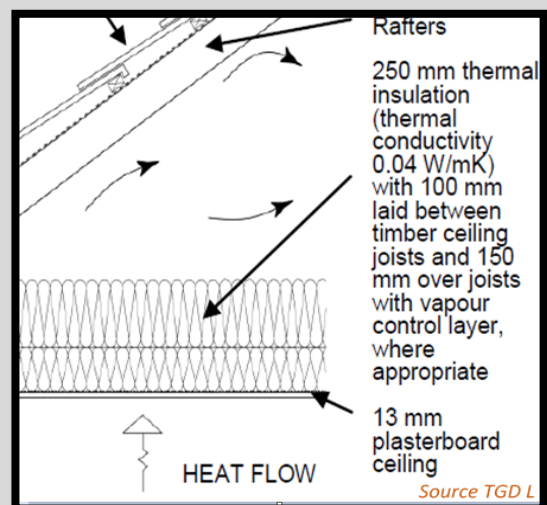
6.2.1 Pitched roof U-value calculations

Extensive detail on U-value calculations is provided in EN6946, Appendix A of TGD L and BR443. BR443 Section 8 (U-values for roofs) has a useful summary of the methods to be applied. The more common pitched roof scenarios are detailed below.

Example 1: Pitched roof, insulated at ceiling, ventilated attic

Insulation is first laid between the joists to completely fill the space between the joists. Another (continuous) layer of insulation is then laid over the joists. The joists act as a repeating thermal bridge through the first layer of insulation. Heat flows through the timber joists more easily than it flows through the insulation. In numerical terms, timber has a higher thermal conductivity than the insulation. A thermal bridge increases the rate of heat loss but in this case, it is an unavoidable consequence of the roof structure. The second layer of insulation is laid over the joists, so does not have thermal bridges.

To calculate the U-value of this type of roof – or any structure with one or more thermally-bridged layers - it is necessary to account for the different heat-paths through the structure. This is done using the Upper and Lower Resistance Method as described in detail in Example A3 of TGD L. In this method the upper and lower thermal resistances of the structure are calculated and averaged to obtain the U-value of the roof.



Source TGD L

The following notes are relevant to this calculation:

- The internal and external surface thermal resistances are shown in Section 4.1 of BRE 443 and EN6946.
- The ventilated roof space thermal resistance, $0.20\text{m}^2\text{K/W}$, is taken from TGD L and is based on EN6946.
- The thermal conductivity values of construction materials can be taken from Table 12a of the DEAP manual where certified data isn't available. For insulation materials, the values in Table 12b can be used for Existing and New-Provisional BER Assessments when certified data is not available. For New-Final BER Assessments, accredited test data must be used for insulation materials.
- The fractional area of thermal bridging can be calculated if the size and frequency of the timber joists are known. Otherwise default values from Table A2 of TGD L can be used. The default value for a flat ceiling, i.e. timber joists and insulation between the joists, is 9 % thermal bridging which is equivalent to a fractional area of 0.09.
- Sections 4.9 and 8 of BRE 443 discuss minor corrections due to air gaps and outlines when those corrections are required.

The U-value calculated by this method ($U = 0.16\text{ W/m}^2\text{K}$) is entered in DEAP along with the corresponding heat loss area, namely the area of the flat ceiling. The U-value calculation (using the BRE U-value calculator in this case) is shown below.

As an aside, the U-value of a flat roof structure with thermal bridging – insulation between timber joists – is calculated with the same method though without accounting for the ventilated roof space of the pitched roof.

**Timber lambda from Table 12a.
Timber fraction defaulted from TGD L
2017 Table A2**

Layer	Description	d (mm)	λ layer	λ bridge	fraction	R layer	R bridge
	Rsi					0.10	
1	Plasterboard (lambda table 12a)	13	0.250			0.052	
2	Wool/joists (wool lambda from cert)	100	0.040	0.130	0.0900	2.500	0.769
3 -->	Wool (lambda from cert)	150	0.040			3.750	
4	Roof space (incl tiles etc)			R 0.200		0.200	
	Rse					0.04	

Total thickness: 263 mm Resistance (upper/lower limit) 6.438 / 6.221

Air gaps: In layer number 2 Correction level: 0 $\Delta U = 0.0000$

Loft Hatch: Loft hatch present Insulation thickness: 100 $\Delta U = 0.0014$

Recessed Light Fittings: Fraction of area of roof with removed insulation: 0 $\Delta U = 0.0000$

U = 0.16 (0.159) I.S. EN ISO 6946

NB Round result to 2 decimal places

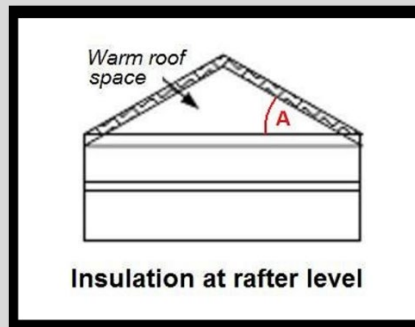
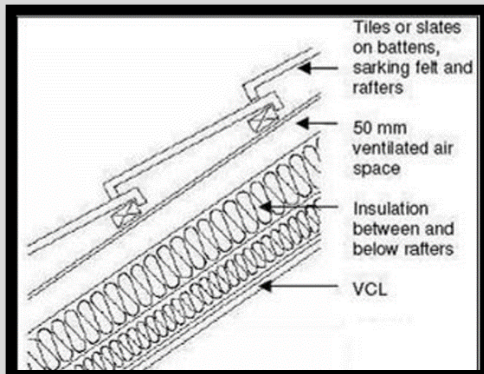
Insulation thickness measured on site

NB Relevant standard

Example 2: Pitched roof, insulated at rafter level, unventilated attic space with a flat ceiling

This example shows the calculation of the U-value of a pitched roof when the insulation is installed at rafter level. The attic is not accessible by a fixed staircase so is not included in the Total Floor Area in DEAP. In this example,

adapted from Appendix B of TGD L, the roof has 120 mm rafters with 120 mm phenolic foam insulation between the rafters and 50 mm of the same insulation below the rafters as shown in the close-up of the sloping section. The pitch of the roof is 30°. This is the angle 'A' in the diagram below.



The structure is like the previous example, with several uniform layers and a thermally-bridged layer so the Upper and Lower Resistance method is used. The Thermal Resistances are tabulated below:

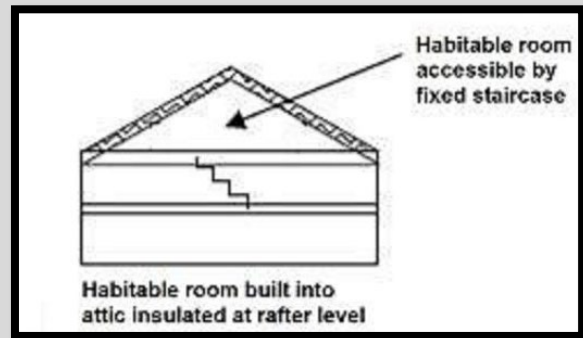
Layer	Thickness (m)	Thermal Conductivity (W/mK)	Thermal Resistance (m ² K/W)	Corrected Thermal Resistance (m ² K/W)
External Surface*	-	-	0.04	0.035
Insulation (between rafters) *	0.12	0.025	4.8	4.157
Timber Rafters*	0.12	0.13	0.92	0.799
Sloping Insulation (below rafters) *	0.05	0.025	2	1.732
Roof Space	-	-	0.16	0.16
Plasterboard	0.0125	0.25	0.05	0.05
Internal Surface	-	-	0.10	0.10

Although the form of the calculation is the same as the previous calculation there are crucial differences:

- Even though the insulation is located on the slope of the roof, the area of the flat ceiling is used for heat loss calculations in DEAP;
- The thermal resistance of each layer in the sloped section of the roof must be multiplied by the cosine of the pitch of the roof as detailed in BRE 443 Section 8 (Insulation at rafter level – flat ceiling). In the table above these layers are marked with an asterisk (*). In this example, the thermal resistance of these layers is multiplied by the Cos (30°) = 0.866 to give the Corrected Thermal Resistance in the last column of the table;
- Following guidance in BRE 443 the thermal resistance of the roof void between slope and ceiling is taken as 0.16 m²K/W;
- The default percentage of thermal bridging is again taken from Table A2 of TGD and has a value of 8%.
- The remainder of the calculation follows the method of upper and lower resistances to derive the total U-value.

Example 3: Pitched roof, insulated at rafter level, habitable attic space accessible by fixed staircase

This differs from Example 2, as the attic space is included in the assessment floor area. In this case the heat loss area to be entered in DEAP is the area of the sloping roof and the U-value calculation is for the sloping section. In this example, a roof structure like Example 2 above is used, namely, 120 mm rafters with 120 mm phenolic foam insulation between the rafters and 50 mm of phenolic foam insulation below the rafters. There is a plasterboard finish. The slope is a thermally bridged structure, so the U-value is calculated with the Upper and Lower Resistance method.



Layer	Thickness (m)	Thermal Conductivity (W/mK)	Thermal Resistance (m ² K/W)
External Surface	-	-	0.04
Insulation (between rafters)	0.12	0.025	4.8
Timber Rafters	0.12	0.13	0.92
Sloping Insulation (below rafters)	0.05	0.025	2
Plasterboard	0.0125	0.25	0.05
Internal Surface	-	-	0.10

The remainder of the calculation follows the method of the previous example with the Upper Resistance = 6.36 m²K/W and Lower Resistance = 5.78 m²K/W leading to a U-value of 0.16 W/m²K. The U-value is entered in DEAP along with the area of the sloping roof. There is no Cosine multiplier applied to the thermal resistances as the sloping area is the heat loss area in DEAP.

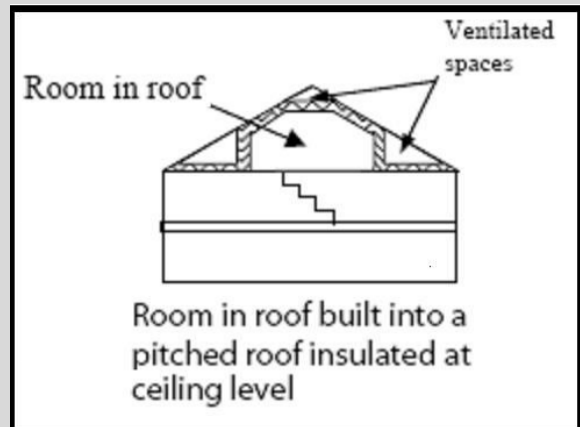
As before, the default percentage of thermal bridging is taken from Table A2 of TGD L and has a value for a sloped ceiling of 8%. BRE 443 section 4.8 provides further detail on accounting for ventilated air gaps where present in the sloping roof structure.

Example 4: Room-in-roof, insulation follows the shape of the room

There are two ways to calculate heat loss for a room-in-roof construction such as that shown in the diagram.

(i) Room-in-roof approximation

For Existing Dwellings, DEAP gives the option to automatically calculate the total exposed area and default U-value of the room-in-roof's heat loss surfaces. The area approximates the total area of the heat loss roof and wall sections of the room-in-roof as described in Appendix S of the DEAP manual and Section 6.1.7 above. The Assessor must account for the heat loss area of the ceiling of the storey below separately (ceiling below exposed to the ventilated⁹ crawl-spaces).



(ii) Manual calculation

In cases where the Assessor can identify the levels of insulation on the room-in-roof and there are varying levels of insulation (or in new dwellings), the Assessor must manually calculate the heat loss for each section of the room-in-roof. The area approximation referenced above is not used in this case.

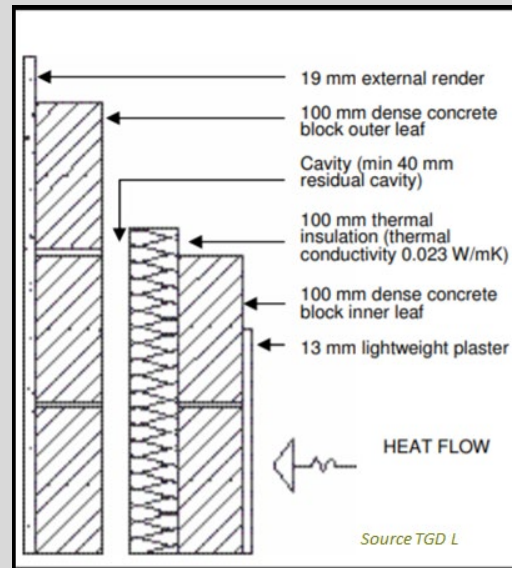
- Flat Ceiling Section of Room-in-roof: U-value calculated as per a standard pitched roof insulated at ceiling level as per Example 1 above and entered in DEAP along with the area of flat ceiling.
- Sloped Ceiling Section of Room-in-roof: U-value calculated as per a standard sloped ceiling, as described in Example 2 above and entered in DEAP along with the area of sloped ceiling.
- Knee Wall Section of Room-in-roof: U-value calculated as per a standard wall (e.g. use the Upper and Lower Resistance method for an insulated timber stud knee-wall). A thermal resistance of $R_u = 0.5$ is added to the knee-wall U-value as shown in Diagram A5 of TGD L. The U-value and the area of the knee walls are entered in DEAP (walls section).
- Semi-exposed Ceiling of Room Below: U-value calculated as per a standard roof (Upper and Lower Resistance method). A thermal resistance of $R_u = 0.5$ is added to the ceiling U-value as shown in Diagram A5 of TGD L 2011. The U-value and the area of the semi-exposed ceiling are entered in DEAP.

⁹ In cases where the crawl space behind the knee wall is unventilated, the BER Helpdesk can provide additional information for calculation of the U-values of the heat loss elements adjoining the crawl space.

6.2.2 Wall insulation examples

Example 1: U-value calculation for a wall: sourcing thermal conductivity

This example details the U-value calculation for a wall using the BRE U-value calculator. The sources of thermal conductivity on each row are also identified. The wall in question is based on a cavity wall from TGD L. U value corrections are also shown in the calculation below.



Layer	Description	d (mm)	λ layer	λ bridge	fraction	R layer
	Rsi					0.13
1	Plaster (Lambda DEAP 12a)	13	0.180			0.072
2	Conc. block (Lambda DEAP 12a)	100	1.330			0.075
3	Insulation (Lambda IAB cert)	100	0.023			4.348
4	Cavity unventilated	40	R 0.180			0.180
5	Conc. block (Lambda DEAP 12a)	100	1.330			0.075
6	Ext. render (Lambda DEAP 12a)	19	1.000			0.019
	Rse					0.04

Total thickness: 372 mm Resistance (upper/lower limit) 4.939

Air gaps: In layer number 3 Correction level 0 $\Delta U = 0.0000$

Wall ties: In layer number 3 Number per m² 5 Cross-section (mm²) 4 λ of wall ties 17 $\Delta U = 0.0021$

U = 0.20 (0.205) I.S. EN ISO 6946

NB Sources for Lambda are shown here (Thermal Conductivity)

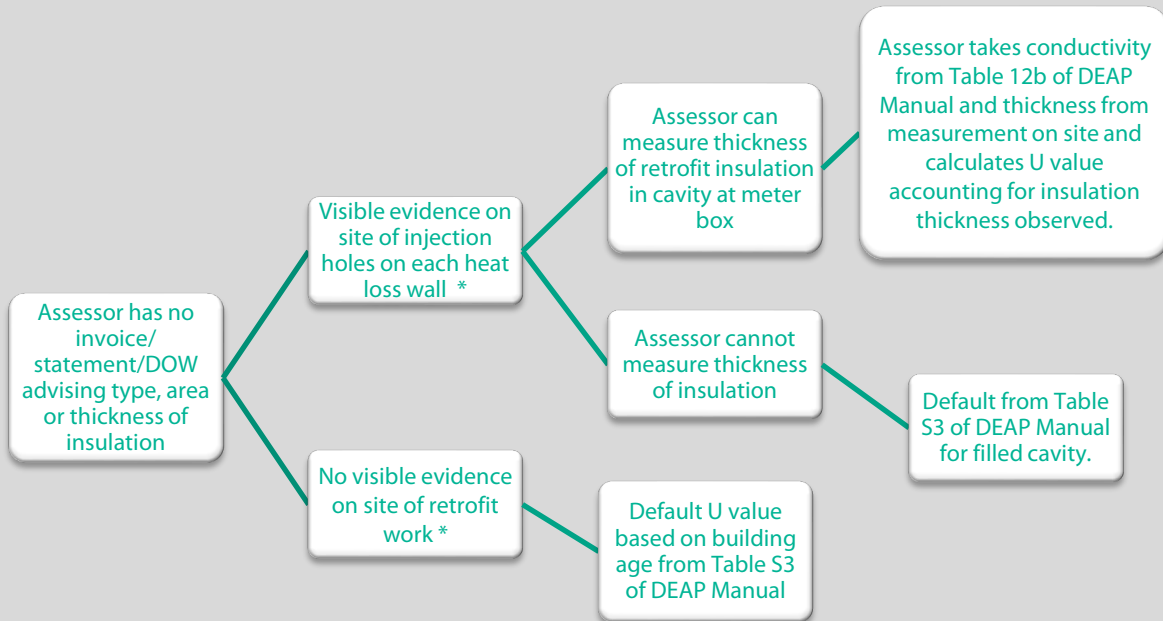
NB Round result to 2 decimal places

NB Relevant standard

NB Retain evidence supporting calculation (e.g. thickness, type, conductivity, calculation)

Example 2: Cavity wall retrofit insulation approach

This example details the decisions made in deriving the U-value for a cavity wall



* If a façade does not have evidence of injection holes, then there is no visible evidence on site of retrofit work for that façade and its U-value is defaulted.

6.2.3 Detailed case study # 1: data entry for walls, roofs and floors

This case study details wall and floor survey, associated calculations and DEAP data entry. The floor area for each level of the dwelling is needed to calculate both the **total floor area** and the **dwelling volume** in Building > Floors regardless of whether a dwelling's floor (or floors) loses heat. The assessment of a constructed dwelling also identifies and measures the **heat loss building elements**. Non-heat loss areas (e.g. party walls, a floor or a ceiling wholly above or below another dwelling, or walls backing onto a heated circulation space) are not heat loss elements in the DEAP Building tab. The calculations shown below, as well as sketches, photos, survey forms and all other calculations as related to a published BER must be kept on file by the Assessor as outlined in the Code of Practice.

The house being surveyed is a two-storey semi-detached house built in 1990. The main dwelling has an unheated garage. A cavity wall with partial fill insulation as built, extends around the main dwelling and the outside of the garage. The walls between the main dwelling and the garage are uninsulated solid walls. The floors of the main dwelling are suspended. The garage floor is solid. The external walls, internal walls on ground and first floor and the party wall are masonry walls with dense plaster. The dwelling has a flat ceiling insulated between the joists below a pitched roof.

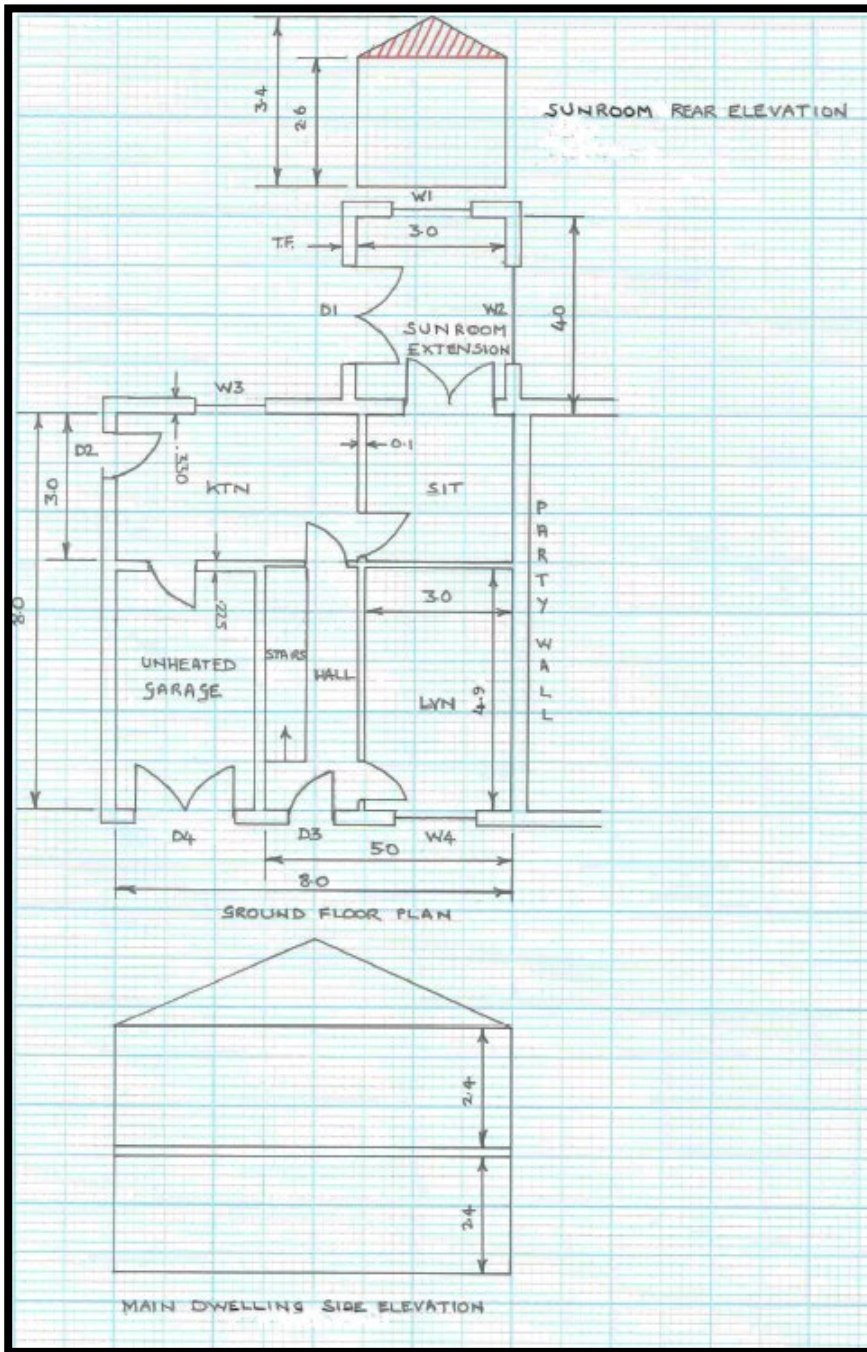
The extension to the rear was built in 2002. The extension age was determined from homeowner knowledge (retained in writing) and the date stamp on the glazing in the extension. The extension is a sunroom and has a vaulted ceiling insulated at rafter level, timber frame walls and a solid floor. There is a radiator with a TRV in the sunroom and it is heated from the main heating system. See survey form and sketch in Figure 6.7 and Figure 6.8.

Thermal mass calculations for this dwelling are detailed in Section 6.3 of this document.

Figure 6.7: Survey form for case study

Dwelling Type <input type="checkbox"/> detached house <input checked="" type="checkbox"/> semi detached house <input type="checkbox"/> end of terrace <input type="checkbox"/> mid terrace <input type="checkbox"/> ground floor apartment <input type="checkbox"/> mid floor apartment <input type="checkbox"/> top-floor apartment <input type="checkbox"/> basement apartment <input type="checkbox"/> maisonette <i>Pick dwelling type that is closest to actual dwelling type</i>	Age: Dwelling <input type="checkbox"/> pre 1900 <input type="checkbox"/> 1900 - 1929 <input type="checkbox"/> 1930 - 1949 <input type="checkbox"/> 1950 - 1966 <input type="checkbox"/> 1967 - 1977 <input type="checkbox"/> 1978 - 1982 <input checked="" type="checkbox"/> 1983 - 1993 <input type="checkbox"/> 1994 - 1999 <input type="checkbox"/> 2000 - 2004 <input type="checkbox"/> 2005 onwards	Age: Extension 1 <input type="checkbox"/> pre 1900 <input type="checkbox"/> 1900 - 1929 <input type="checkbox"/> 1930 - 1949 <input type="checkbox"/> 1950 - 1966 <input type="checkbox"/> 1967 - 1977 <input type="checkbox"/> 1978 - 1982 <input type="checkbox"/> 1983 - 1993 <input type="checkbox"/> 1994 - 1999 <input checked="" type="checkbox"/> 2000 - 2004 <input type="checkbox"/> 2005 onwards	Age: Extension 2 <input type="checkbox"/> pre 1900 <input type="checkbox"/> 1900 - 1929 <input type="checkbox"/> 1930 - 1949 <input type="checkbox"/> 1950 - 1966 <input type="checkbox"/> 1967 - 1977 <input type="checkbox"/> 1978 - 1982 <input type="checkbox"/> 1983 - 1993 <input type="checkbox"/> 1994 - 1999 <input type="checkbox"/> 2000 - 2004 <input type="checkbox"/> 2005 onwards <input type="checkbox"/> no extension 2	number of stories 2
Type of Rating <input type="checkbox"/> new-final dwelling <input checked="" type="checkbox"/> existing dwelling				Purpose of Rating <input type="checkbox"/> new: owner occupation <input checked="" type="checkbox"/> sale <input type="checkbox"/> private letting <input type="checkbox"/> social housing letting <input type="checkbox"/> grant support <input type="checkbox"/> other
Wall construction Main Wall* <input type="checkbox"/> stone wall thickness (mm) <input type="checkbox"/> <input type="checkbox"/> solid brick is wall semi exposed? <input type="checkbox"/> <input checked="" type="checkbox"/> cavity Wall Insulation <input checked="" type="checkbox"/> as built bead <input type="checkbox"/> <input type="checkbox"/> solid concrete <input type="checkbox"/> cavity fill EPS <input type="checkbox"/> <input type="checkbox"/> hollow block <input type="checkbox"/> external min fibre <input type="checkbox"/> <input type="checkbox"/> timber frame <input type="checkbox"/> internal dense <input type="checkbox"/> <input type="checkbox"/> other/unknown <input type="checkbox"/> insulation thickness if observable(mm) <input type="checkbox"/>	Roof Construction: Main Dwelling* <input checked="" type="checkbox"/> pitched - insulation btw joists Roof insulation <input type="checkbox"/> pitched - insulation in rafters thickness (mm) fibre <input checked="" type="checkbox"/> <input type="checkbox"/> flat - insulation integral warmcell <input type="checkbox"/> <input type="checkbox"/> room in roof 150 EPS <input type="checkbox"/> <input type="checkbox"/> no heat loss roof unknown dense <input type="checkbox"/> <input type="checkbox"/> other		Ground Floor Construction: Main Dwelling* <input type="checkbox"/> solid <input type="checkbox"/> no heat loss ground floor <input checked="" type="checkbox"/> suspended: sealed <input type="checkbox"/> unsealed <input type="checkbox"/> <input type="checkbox"/> above unheated basement <input type="checkbox"/> heated basement <input type="checkbox"/> other	
Wall construction Wall Type 2* <input type="checkbox"/> no wall type 2 wall thickness (mm) <input type="checkbox"/> <input type="checkbox"/> stone is wall semi exposed? <input type="checkbox"/> <input type="checkbox"/> solid brick Wall Insulation <input type="checkbox"/> cavity <input checked="" type="checkbox"/> as built bead <input type="checkbox"/> <input type="checkbox"/> solid concrete <input type="checkbox"/> cavity fill EPS <input type="checkbox"/> <input type="checkbox"/> hollow block <input type="checkbox"/> external min fibre <input type="checkbox"/> <input checked="" type="checkbox"/> timber frame <input type="checkbox"/> internal dense <input type="checkbox"/> <input type="checkbox"/> other/unknown Sunroom <input type="checkbox"/> insulation thickness if observable(mm) <input type="checkbox"/>		Roof Construction: Roof Type 2* <input type="checkbox"/> no heat loss roof type 2 Roof insulation <input type="checkbox"/> pitched - insulation btw joists thickness (mm) fibre <input type="checkbox"/> <input checked="" type="checkbox"/> pitched - insulation in rafters warmcell <input type="checkbox"/> <input type="checkbox"/> flat - insulation integral EPS <input type="checkbox"/> <input type="checkbox"/> room in roof unknown dense <input checked="" type="checkbox"/> <input type="checkbox"/> other		Ground Floor Construction: Floor Type 2* <input type="checkbox"/> no heat loss extension floor type 2 <input checked="" type="checkbox"/> solid <input type="checkbox"/> suspended: sealed <input type="checkbox"/> unsealed <input type="checkbox"/> <input type="checkbox"/> above unheated basement <input type="checkbox"/> other Garage
Wall construction Wall Type 3* <input type="checkbox"/> no wall type 3 wall thickness (mm) <input type="checkbox"/> <input type="checkbox"/> stone is wall semi exposed? <input type="checkbox"/> <input type="checkbox"/> solid brick Wall Insulation <input type="checkbox"/> cavity <input type="checkbox"/> as built bead <input type="checkbox"/> <input type="checkbox"/> solid concrete <input type="checkbox"/> cavity fill EPS <input type="checkbox"/> <input type="checkbox"/> hollow block <input type="checkbox"/> external min fibre <input type="checkbox"/> <input type="checkbox"/> timber frame <input type="checkbox"/> internal dense <input type="checkbox"/> <input type="checkbox"/> other/unknown <input type="checkbox"/> insulation thickness if observable(mm) <input type="checkbox"/>		Roof Construction: Roof Type 3* <input type="checkbox"/> no heat loss roof type 3 Roof insulation <input type="checkbox"/> pitched - insulation btw joists thickness (mm) fibre <input type="checkbox"/> <input type="checkbox"/> pitched - insulation in rafters warmcell <input type="checkbox"/> <input type="checkbox"/> flat - insulation integral EPS <input type="checkbox"/> <input type="checkbox"/> room in roof unknown dense <input type="checkbox"/> <input type="checkbox"/> other		Ground Floor Construction: Floor Type 3* <input type="checkbox"/> no heat loss extension floor type 3 <input checked="" type="checkbox"/> solid <input type="checkbox"/> suspended: sealed <input type="checkbox"/> unsealed <input type="checkbox"/> <input type="checkbox"/> above unheated basement <input type="checkbox"/> other Sunroom
Floor Insulation thickness (mm) <input type="checkbox"/> (only if any observed) min fibre <input type="checkbox"/> <input type="checkbox"/> none <input type="checkbox"/> unknown <input checked="" type="checkbox"/> dense <input type="checkbox"/>		Type of insulation (if any) EPS <input type="checkbox"/> min fibre <input type="checkbox"/> unknown <input checked="" type="checkbox"/> dense <input type="checkbox"/>		

Figure 6.8: Sketch for case study



Dwelling Dimensions: As per Section 1 of the DEAP manual, **dimensions**, refer to the inner surfaces of the elements bounding the dwelling. Thus, floor dimensions are obtained by measuring between the inner surfaces of the external or party walls, disregarding the presence of any internal walls. As there is no insulation between the dwelling and garage and the garage's external wall is insulated and has similar U-values to the external walls of the dwelling, the unheated garage is likely to reach the same or similar temperatures as the dwelling. Therefore, the garage is included in the dwelling floor area as it is not thermally separated.

The dwelling dimensions are calculated as follows:

1. Ground Floor
 - Main dwelling (8x8) = 64m² with ceiling height 2.4m
 - Extension (4¹⁰x3) = 12m² with average ceiling height 3m
 - Total ground floor = 76m² with average ceiling height 2.49m.
2. **First Floor** is the same area as the main dwelling ground floor of 64m² and has a ceiling height of (2.4+0.25) = 2.65m. The 0.25m floor thickness default is taken from Section S4 of the DEAP manual.

Floor Area: Section 1 of the DEAP Manual describes the areas of a dwelling which should and should not be accounted for under the dimensions tab in DEAP as part of the total dwelling floor area. It is critical that these areas are accounted for correctly in BER assessments. The floor area under the dimensions tab has a direct bearing on the BER result (expressed in kWh of primary energy per m² of floor area per year).

The calculations for the floors as detailed in the survey form are as follows:

1. Main Dwelling suspended floor (does not include garage floor): Figure 6.9:
 - Floor type = Ground Floor – Suspended;
 - Area (A) = (3x8) +(5x5) = 49m²;
 - Exposed perimeter (P)= 5(front)+3(side)+5(back)= 13m.
2. Main Dwelling solid-garage floor (included in floor area): Figure 6.10:
 - A = 5x3= 15m²;
 - P= 3+5= 8m.
3. Extension solid – Sunroom: Figure 6.11.
 - A= 4x3= 12m²
 - P= 4+3+4 (there is no extension on the neighbouring dwelling) = 11m.
4. Main dwelling 1st floor: Figure 6.12:
 - Floor type = Non Heat Loss Floor;
 - Area = 64m².

Using these calculations and the DEAP Survey Form, the DEAP entries are as shown below.

¹⁰ The extension is measured from the internal wall line of the original dwelling (4 meters in this case) as anything beyond that line would not be part of the dwelling floor/roof/wall area if the extension was not present.

Figure 6.9 - Main dwelling floor

Edit Floor ✕

Floor Location *	Floor Type *	Age Band *
Storey 1	Ground Floor - Suspended	1983 - 1993
Description		Area [m ²] *
Main dwelling		49
Exposed Perimeter [m] *	Wall area (exposed to ground) m ²	U-Value [W/m ² K] *
13		0.48

Underfloor Heating Room in Roof

CANCEL SAVE

Figure 6.10 - Garage floor

Add Floor ✕

Floor Location *	Floor Type *	Age Band *
Storey 1	Ground Floor - Solid	1983 - 1993
Description		Area [m ²] *
Main Dwelling - Garage		15
Exposed Perimeter [m] *	Wall area (exposed to ground) m ²	U-Value [W/m ² K] *
8		0.64

Underfloor Heating Room in Roof

CANCEL SAVE

Figure 6.11 - Sunroom floor

Add Floor

Floor Location *	Floor Type *	Age Band *
Storey 1	Ground Floor - Solid	2000 - 2004
Description		Area [m ²] *
Extension - sunroom		12
Exposed Perimeter [m] *	Wall area (exposed to ground) m ²	U-Value [W/m ² K] *
11		0.52

Underfloor Heating Room in Roof

CANCEL SAVE

Figure 6.12 – First floor

Edit Floor

Floor Location *	Floor Type *	Age Band *
Storey 2	Non-Heat Loss Floor	1983 - 1993
Description		Area [m ²] *
1st floor		64
Exposed Perimeter [m]	Wall area (exposed to ground) m ²	U-Value [W/m ² K]
		0

Floor will be used to calculate dwelling dimensions, not heat loss. All floors are included in the total floor area. Floors with U-Value 0W/m²K have no heat loss.

Underfloor Heating Room in Roof

CANCEL SAVE

Wall Area: There are two external wall types as identified on the survey sheet calculated as follows:

	Cavity Wall–Main Dwelling	Timber Frame-Extension
Gross Wall Area ¹¹ ¹²	$([8 + 8 + 8] \times [2.4 + 2.65]) -$ $([3 \times 2.6] + [0.5 \times 3 \times 0.8]) \text{ m}^2$ $= 24 * 5.05 - 7.8 - 1.2 = 112.2 \text{ m}^2$	$([4 + 4 + 3] \times 2.6) + (0.5 \times 3 \times 0.8)$ $= 11 * 2.6 + 1.2 = 29.8 \text{ m}^2$
Opes ¹³	18.9m ²	9.46m ²
Net Wall Area	93.3	20.34

The above areas are entered in DEAP as follows:

Figure 6.13 – Wall entry

FLOORS	ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS
Type	Description	Wall is semi-exposed	Include in compliance check	Age Band	Area [m ²]	U-Value [W/m ² K]
300mm Cavity	Main dwelling	No	No	1983 - 1993	93.30	0.600
Timber Frame	Sunroom Extension	No	No	2000 - 2004	20.34	0.550
Total Heat Loss Wall Area [m ²]		113.64		+ ADD WALL		

Roof Area: There are two roof types as identified on the survey sheet calculated:

- Pitched Roof - Insulated on Ceiling – Main Dwelling with 150mm insulation (8x8) = 64m²
- Pitched Roof - Insulated on Rafter - Sunroom Extension with insulation unknown, (1.7(slope)*2(no. of slopes) *4(length)) = 13.6m²

The above areas are entered in DEAP as follows:

¹¹ Cavity heat loss wall area is the total main dwelling wall area (party wall area is not included) minus the area of wall to the sunroom as the sunroom is within the dwelling envelope.

¹² Top of sunroom gable wall (triangle shaded in red in the sketch above).

¹³ Main dwelling opes have been calculated by the Assessor as 18.9m². Extension opes have been calculated by the Assessor as 9.46m².

Figure 6.14 – Roof entry

FLOORS	ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS
Type	Description	Insulation Thickness [mm]	Age Band	Area [m ²]	U-Value [W/m ² K]	
Pitched Roof - Insulated on Ceiling	Main dwelling		1983 - 1993	64.00	0.260	
Pitched Roof - Insulated on Rafter	Sunroom Extension		2000 - 2004	13.60	0.360	

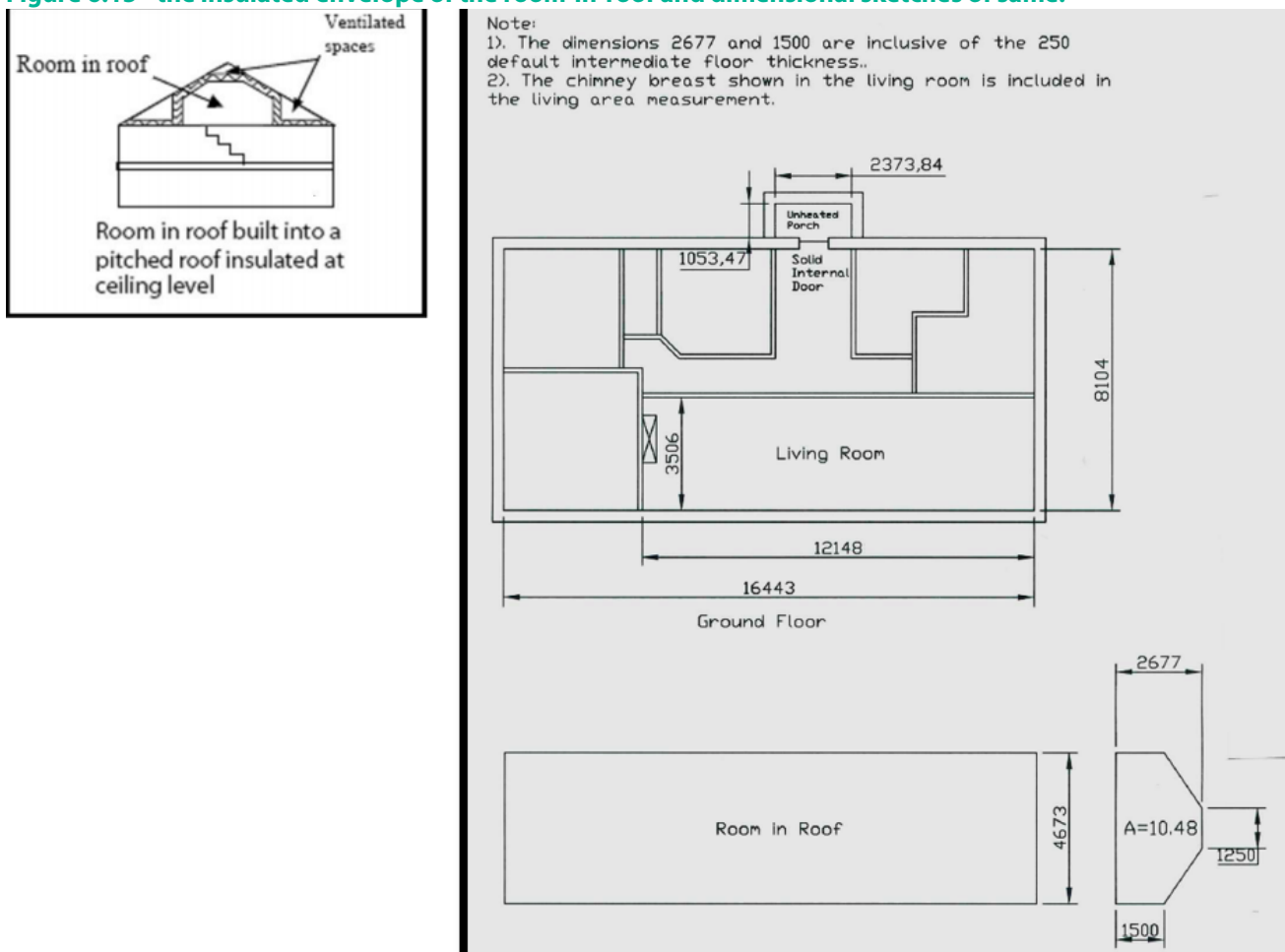
The corresponding dimensions are also captured in the DEAP Survey Form.

6.2.4 Detailed case study #2: data entry for wall, roof and floor areas

The house being assessed is a bungalow built in 1990. The room-in-roof was converted from an uninhabitable attic to a habitable space circa the year 2000 according to the homeowner, however there is no evidence on site to support this. The room-in-roof is accessible via a fixed staircase, is heated and contains two bedrooms. There is no access to the unheated spaces to the side or top of the room-in-roof. Other parameters of the dwelling are as follows:

- A 300mm cavity wall with partial fill insulation as built.
- The floors of the main dwelling are solid.
- The average storey height of the ground floor is 2.4m.
- The external window area on the ground floor is 20m² (this does not include the porch windows).
- There are 4 roof windows (double glazed, air filled 12mm gap) on the pitched roof insulated on rafter with a total area of 3.88m². These are located on the north facing roof.
- The porch at the entrance to the dwelling is unheated and there is a solid internal door between the porch and the main dwelling of area 1.85m².

Figure 6.15 - the insulated envelope of the room-in-roof and dimensional sketches of same.



Floor Area: Section 1 of the DEAP Manual describes which areas of a dwelling should and should not be accounted for in the total floor area. The porch above is protruding entirely from the line of the external wall of the dwelling, is unheated and there is a separating door to the dwelling. Therefore, it is not included in the dwelling measurements. This porch is not considered a draught lobby as it does not have a minimum depth of at least 1.2m and hence does not satisfy the criteria for a draught lobby specified in Section 2.4 of the DEAP Manual. The ground floor area dimensions are calculated as follows. Heat loss entries as per Figure 6.16.

- **Ground Floor:** $(16.443 * 8.104) = 133.25\text{m}^2$ with ceiling height 2.4m
- **Exposed Perimeter(P):** $= 16.443 + 8.104 + 16.443 + 8.104 = 49.094\text{m}$

Figure 6.16 - Heat loss floor entry

Add Floor		
Floor Location *	Floor Type *	Age Band *
Storey 1	Ground Floor - Solid	1983 - 1993
Description		Area [m ²] *
Main dwelling solid ground floor		133.25
Exposed Perimeter [m] *	Wall area (exposed to ground) m ²	U-Value [W/m ² K] *
49.09		0.57
<input type="checkbox"/> Underfloor Heating	<input type="checkbox"/> Room in Roof	
		CANCEL SAVE

As the room-in-roof is habitable and is accessed by a fixed staircase it is included in the dwelling floor area. For existing dwellings, DEAP gives the option to automatically calculate the total exposed area and default U-value of the room-in-roof's heat loss surfaces. The automatically calculated area approximates the total area "Arr" of the heat loss roof and wall sections of the room-in-roof as described in Appendix S6.2 of the DEAP manual. Account for the heat loss area "Crr" of the ceiling of the storey below separately (ceiling below exposed to the ventilated crawl-spaces). This room-in-roof approximation is used for the DEAP entries.





The dwelling dimensions are calculated as follows when using the room-in-roof approximation:

- First Floor / Room-in-roof floor area (Frr): $(16.443 * 4.673) = 76.84\text{m}^2$
- **Room-in-roof 'Average Storey Height':** $(10.48 * 16.443) / 76.84 = 2.24\text{m}$ ¹⁴. The 0.25m floor thickness default is taken from Section S4 of the DEAP manual and is already included in the room height, wall height and area measurements detailed on the drawing.
- **Living Area:** $(12.148 * 3.506) = 42.59\text{m}^2$

The floors entry is completed in DEAP as follows:

¹⁴ 10.48 is the cross-sectional area. The room volume is the cross-sectional area multiplied by the length of the room. Divide volume by Frr to get the average room height.

Figure 6.17 - Floor entry

FLOORS		ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS		
Number of Storeys		Number of Storeys *		Average Storey Height [m]		Storey 1 *	Storey 2 *		
Living area [m ²]		Living area [m ²] *				2.4	2.4		
Storey	Type	Description	U/F Heating	In Roof	Age Band	Exposed Perimeter [m]	Area [m ²]	U-Value [W/m ² K]	
1	Ground Floor - Solid		No	No	1983 - 1993	49.09	133.25	0.570	 
2	Non-Heat Loss Floor	Room-in-roof	No	Yes	1983 - 1993		76.84	0.000	 

Wall Area: The external wall has a partial fill cavity as built and its area is calculated as follows:

	Cavity Wall–Main Dwelling
Gross Wall Area	49.094(P) x 2.4(Ground floor height) m ² = 117.83 m ²
Opes	21.85m ² (Ground floor windows and doors)
Net Wall Area	95.98m ²

Note: The gable wall in the room-in-roof is included in the room-in-roof approximation Arr value and is not added separately under the cavity wall area. The area of wall semi-exposed to the porch is subsumed within the larger main dwelling wall area.

Note that, in accordance with DEAP manual Section S4, in a situation where a specific floor, wall or roof area within a dwelling represents less than 10% of the respective total floor, wall, or roof area of the dwelling, then the differences in construction or U-value can be ignored, and the smaller area subsumed within the larger area.

The wall area is entered in DEAP as follows:

Figure 6.18 – Wall entry

Edit Wall ✕

Wall Type *

300mm Cavity

Age Band *

1983 - 1993

Description

Main Dwelling - partial fill cavity wall, as built

Area [m²] *

95.98

Include in compliance check

Wall is semi-exposed

U-Value [W/m²K] *

0.6

CANCEL SAVE

Roof Area: The room-in-roof approximation is used for the roof data entry in DEAP in this assessment. To account for the room-in-roof in this existing dwelling using default U-values and the automated room-in-roof approximation in DEAP:

1. Take a room-in-roof with floor area F_{rr} , where F_{rr} is part of a ceiling of the storey below of area C_{rr} .
 $F_{rr} = 76.84\text{m}^2$
2. Determine the heat loss ceiling area of the storey below (not including the room-in-roof area)¹⁵. This is entered under "roofs" in building elements with area ($C_{rr} - F_{rr}$).

$C_{rr} - F_{rr} = 133.25(\text{ground floor area}) - 76.84 = 56.41\text{m}^2$

3. F_{rr} is entered under the dimensions tab in DEAP as a room-in-roof floor area, along with average height of the room-in-roof as shown above.
4. Under Building > Roofs, select "Room-in-roof insulated on side":
5. Use the default U-value listed on this tab (without using an "Ru" adjustment).
6. The automatically calculated area, A_{rr} , includes all heat loss walls and roof sections in the room-in-roof. Openings are not subtracted from A_{rr} as it is an approximate value. Windows in the room-in-roof must still be entered in the "windows" tab under the "building elements" section of the software.

There is no information other than the homeowner knowledge to substantiate the date the room-in-roof was converted. It is defaulted to the same age as the original dwelling.

The above areas are entered in DEAP as follows:

Figure 6.19 – Roof entry

FLOORS		ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS	
Type	Description	Insulation Thickness [mm]	Age Band	Area [m ²]	U-Value [W/m ² K]			
Pitched Roof - Insulated on Ceiling	Heat loss ceiling of ground floor ($C_{rr} - F_{rr}$)		1983 - 1993	56.41	0.490			
Room in Roof - Insulated on side	Room-in-roof (auto-calculation used)		1983 - 1993	155.57	0.490			
Total Heat Loss Roof Area [m ²]				211.98				+ ADD ROOF

Roof windows:

Windows in the room-in-roof are entered separately in DEAP and are not subtracted from the automatically calculated area as it is an approximation. There are only two possible orientations in DEAP for roof windows (North and Horizontal). The windows in this example are north facing. The U-value and solar transmittance are taken from Table 6a and Table 6b in this assessment.

See below for Roof Window DEAP entry:

¹⁵ The heat loss area of the storey below has a ventilated unheated space above it.

Figure 6.20 – Roof window

FLOORS		ROOFS		WALLS		ROOMS		DOORS		WINDOWS		GLOBAL FACTORS	
Count	Room	Type	Description	No. of opes	No. of opes draught-stripped	In roof	Over shading	Orientation	Area [m ²]	U-Value [W/m ² K]			
1		Double - Air - Wood/PVC - 6mm Gap	Roof windows	2	2	Yes	Very Little	North	3.88	3.100			

Solid Internal Door:

The solid internal front door is semi-exposed to the porch. A U value of **1.71W/m²K** is readily available from DEAP Manual Table 6a ‘Solid door between house and an unheated space (semi-exposed)’ for this door type. See below for Semi Exposed Door DEAP entry:

Figure 6.21 – Door entry

FLOORS		ROOFS		WALLS		ROOMS		DOORS		WINDOWS		GLOBAL FACTORS	
Count	Room	Type	Description	Draught Stripped	Area [m ²]	U-Value [W/m ² K]							
1		Solid semi-exposed door between house and unheated space	Solid internal front door	Yes	1.85	1.710							

6.2.5 Insulation upgrades in the Better Energy Homes grant programme

A BER certificate is required for dwellings retrofitted under the Better Energy Homes (BEH) scheme. This article deals with insulation upgrades under the BEH scheme and how they should be handled in a BER assessment. This article is relevant for wall and roof insulation upgrades under BEH particularly where the added insulation may not be directly identifiable, e.g. insulated rafter sections. Assessors must ensure that all efforts are made to obtain relevant information leading to calculated U-values rather than relying on defaults.

The U-value of walls with upgraded insulation must be calculated. There are two approaches available to the Assessor:

- The U-value is calculated in full using the thickness and thermal conductivity of each layer in the wall by the methods in EN ISO 6946.
- If this information is not available, then the default U-value of the original wall – taken from DEAP Table S3 – may be used as the starting point. Examples of such calculations are given in Section 6 of this document, and in DEAP Manual Table S3 (footnote).

Thermal Conductivity

If the Assessor is unable to identify the type of insulation by visual inspection, invoices and/or receipts from the Contractor should be used. The Assessor should check if the insulation product has an Irish Agreement Board (IAB) Certificate or other accredited test data (see Section 3.2 of this document) detailing the thermal conductivity. If certified thermal conductivity is not available, the most conservative appropriate default thermal conductivity value from DEAP Table 12b is used following guidance in DEAP Manual section 3.1.

Insulation Thickness

In the simplest case of insulation upgrade, the same thickness of insulation is added to all external heat-loss walls, e.g. 50 mm of cavity wall insulation added to the 4 external walls of a dwelling with no extensions. In this case the thickness of added insulation can be established using the Contractor’s Declaration of Works (DOW). The Contractor

is required to detail the average thickness of insulation before and after the grant works, enabling the Assessor to calculate the thickness of insulation added:

Figure 6.22 – Wall insulation DOW

(b) Measure Specification		
<i>(Please COMPLETE ALL of the following).</i>	Before Works	After Works
% Total Wall Area of Home Insulated	%	%*
(Average) Depth / Thickness of Insulation	mm	mm
(Average) Calculated U-Value for Wall	W/m ² K [^]	W/m ² K
Area of CAVITY WALL insulated by you		m ²

As an example, if the DOW states that there was 0mm of insulation before and 50mm of insulation after, then 50mm of insulation was added to the cavity.

More complex situations will arise. Take a dwelling with cavity walls built in 1940 with an extension (also with cavity walls) built in 2001. If the cavity width or insulation thickness of the original wall is different from that of the extension walls, then the “average thickness” specified in the DOW cannot be used in a BER assessment. In this case the Assessor should seek written clarification from the contractor for further detail from invoices/receipts for any section where wall insulation is not visible / accessible. Failing that, the filled cavity wall default in DEAP Table S3 provides a conservative value which may be used instead.

It is worth emphasising that the BEH Declaration of Works is not sufficient proof of insulation type or thermal conductivity. The Assessor must also retain a copy of all relevant invoice / receipts and any other documentation used to specify the type and thermal characteristics of the insulation.

If the Assessor has good reason to believe that the information provided by a Contractor is incorrect, he/she should contact SEAI. In cases where a BER assessor is being encouraged to misrepresent a BER, SEAI should be informed immediately in line with the [Whistle blower policy](#). A BER may still be published and must be in accordance with both the Code of Practice and DEAP methodology. The BER must represent identifiable information gathered on site where there is any conflict with Contractor information. Please see Section 4 of the DEAP Survey Guide: “The actual data observed on site takes precedence”.

All BER assessors are directed to notify SEAI immediately, in instances where they are invited to complete a BER Declaration of Works, and where the works surveyed are not in accordance with contractor’s declarations.

All BER Assessors should be assured that any such instances identified to SEAI will be treated in the utmost confidence and that their assistance will ultimately contribute to the improved professionalism and integrity of the scheme.

6.3 Thermal mass

Thermal mass of building elements must be recorded during the site survey. In the next section, some common errors relating to thermal mass are addressed.

6.3.1 Thermal mass: common issues

Several issues can arise when assessing Thermal Mass of a dwelling for a DEAP assessment, such as:

- **Error 1:** Element descriptions / thermal mass data inadequately recorded or not recorded during survey: The information required to identify the thermal mass category of an element must be recorded during the survey. This can be on the survey form, sketches and/or additional notes. As with all survey supporting documentation, ensure the records are clear, complete and transparent. While elements such as ground floors, walls and ceilings tend to be recorded during the site survey where the SEAI survey form is used, elements such as internal partitions and separating (party) walls are sometimes overlooked.
- **Error 2:** Building elements assigned the incorrect thermal mass categorisation, e.g. external wall categorised as light when it should be heavy based on site observations. Ensure elements are correctly categorised before assigning an overall thermal mass category using Table S10 or Table 11a for the dwelling.

- **Error 3:** Incorrect interpretation of the difference between separating walls and internal partitions. The key differences are identified below:
 - **Separating walls:** the walls between the dwelling in question and an adjoining heated or enclosed unheated space, e.g. garage in a house or corridor in an apartment block. Typically, a separating wall will be a party wall between the dwelling in question and an adjoining dwelling. For example, a semi-detached house will have a separating (party) wall. When using Table S10 and there is no separating wall, e.g. a detached house without adjoining garage, assume the separating wall has the same characteristics as the predominant external wall.
 - **Internal Partitions:** are the walls dividing the spaces internally within the dwelling. They are not heat loss walls. As stated above, it is common for these partitions to be overlooked when recording the dwelling characteristics during the site survey.
- **Error 4:** Both sides of internal partitions not accounted when using the Table 11 AmAf methodology. As both sides of internal partitions absorb/release heat to the dwelling, the area of both sides must be accounted when using the Table 11 methodology as per Section 7.3 of the DEAP Manual.
- **Error 5:** Openings not deducted from element areas when carrying out a Table 11 AmAf calculation. Windows and doors are categorised as light thermal mass when carrying out an AmAf calculation in accordance with Table 11a of the DEAP Manual. The area of thermally massive elements is therefore net of the area of windows and doors. Note that when dealing with internal partitions the opening area is deducted from both sides of the internal partition area calculation.

6.4 TGD L fabric requirements for apartment walls

As stated in Section 1.3.1.2 of Building Regulations TGD L:

“Unheated areas which are wholly or largely within the building structure, do not have permanent ventilation openings and are not otherwise subject to excessive air-infiltration or ventilation, e.g. common areas such as stairwells, corridors in buildings containing flats, may be considered as within the insulated fabric. In that case, if the external fabric of these areas is insulated to the same level as that achieved by equivalent adjacent external elements, no particular requirement for insulation between a heated dwelling and unheated areas would arise. It should be noted that heat losses to such unheated areas are taken into account by the DEAP methodology in the calculation of the dwelling EPC and CPC.”

Based on this guidance from TGD L, the elements between the dwelling and unheated space may be ignored for the purposes of meeting TGD L fabric requirements provided the external fabric of the corridor is insulated as described above.

In Section 1.3.1.2, “Equivalent adjacent elements” is taken to mean the external elements of the dwelling in question. E.g. if the external front wall of the apartment achieves a U-value of 0.21 W/m²K, then the “external fabric” of the unheated area (e.g. it’s external wall) would also be expected to have a U-value of 0.21 W/m²K for the unheated area to be considered “within the insulated fabric”.

DEAP allows the user to include or exclude a wall in the fabric compliance check depending on the approach being taken to fabric compliance in accordance with TGD L 1.3.1.2 above. If an Assessor is using this method as an alternative to meet the dwelling fabric requirements for a semi-exposed element, then they should keep a record of the method used with their BER assessment records (and within the comments entry field in the DEAP assessment). The records should indicate how Building Regulations fabric U-value requirements were met in accordance with Section 1.3.1.2 of Building Regulations TGD L for any relevant semi-exposed elements.

Note that Assessors will still need to ensure that all other heat loss elements of the dwelling meet the fabric requirements of TGD L using DEAP. Any non-conformance with TGD L must be communicated to the client.

BER Calculation:

All elements between the between the dwelling and unheated space are included in the DEAP assessment as heat loss elements for the purposes of calculating the BER, EPC and CPC. The appropriate Ru factors from Table A4 of TGD-L may be used for new dwellings, or from Section S6.1 in the DEAP manual section on existing dwellings. For clarity, this element should be entered as a separate line under building elements in DEAP.

6.5 Thermal Bridging in DEAP

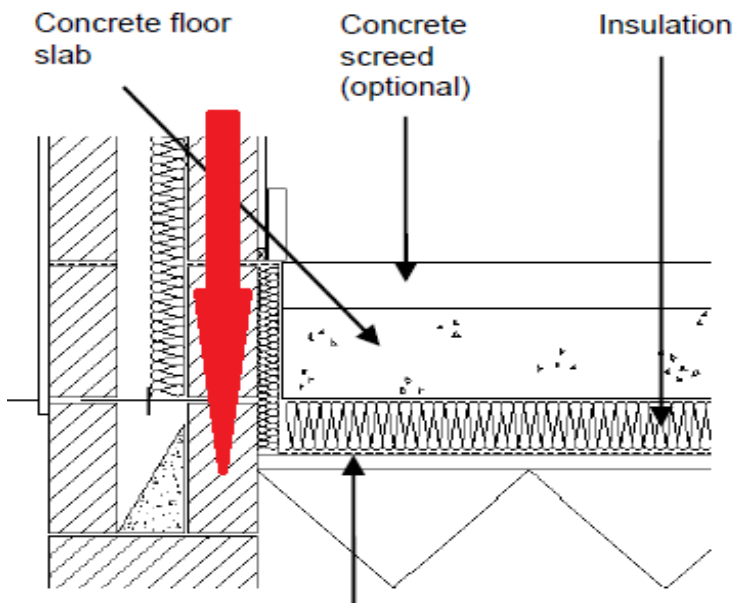
6.5.1 What is a Thermal Bridge?

Ideally, in order to minimise heat loss a dwelling would be completely enclosed in a continuous layer of insulation. In reality, there will be areas of the building fabric where it is impossible to maintain the continuity of insulation, particularly around doors and windows, and at the junctions between the building elements, e.g. the junction between the ground floor and the walls of the dwelling.

A **thermal bridge** occurs where there is a gap in insulation or a reduced level of insulation in the building fabric. This has a lower thermal resistance, which means it allows heat to escape more easily from the dwelling.

Figure 6.23 shows an example of a thermal bridge at the junction of a concrete slab ground floor with a masonry cavity wall. Because of the need to ensure structural stability, it is not possible to maintain a continuous layer of insulation across the junction.

Figure 6.23 - Section of the junction between a concrete ground floor and a masonry cavity wall



There is a gap between the floor insulation (under the slab) and the wall insulation (in the cavity). Heat will flow through this gap at a higher rate than through the floor or wall, both of which are well-insulated. This is the thermal bridge.

Measures can be taken to reduce the effect of the thermal bridge, e.g.

- The use of edge insulation around the perimeter of the floor;
- Bringing the wall insulation down below the top of the floor;
- The use of blocks of low thermal conductivity in the lower course(s) of the inner leaf of the cavity wall.

Section 1.3.3 of the TGD L requires that particular care must be taken to prevent excessive heat loss at these thermal bridges. Failure to do so could lead to problems with condensation and mould growth.

The rest of this section sets out,

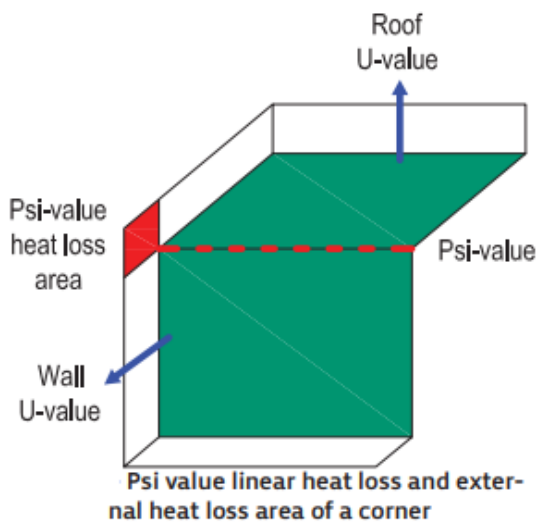
- How thermal bridging is accounted for in DEAP: the thermal bridging factor;
- The use of the Acceptable Construction Details and certified details to determine the thermal bridging factor;
- The documentary evidence required to support the use of a thermal bridging factor;
- An example of a non-default thermal bridging factor calculation, with examples of the supporting documentation required;
- The responsibilities of the BER Assessor in respect of the thermal bridging factor.

6.5.2 Heat Loss due to Thermal Bridges

In DEAP the heat loss through each building element - floor, wall, roof, window, door – depends on the **area** and the thermal transmittance (**U-value**) of that building element. However, while this accounts for the heat loss through those building elements, it does not account for heat loss at the *junctions* between those elements.

For example, in Figure 6.24, the wall area & wall U-value, and the roof area & roof U-value, account for the heat loss through the green sections. However, the heat loss through the junction of wall and roof, marked by the red dashed line, must also be accounted for.

Figure 6.24 - Heat loss at a wall-roof junction



This is described as a **linear thermal bridge** as the heat loss occurs along the line of the junction between wall and roof. In the same way that the rate of heat loss through a unit area of a building element is measured by its thermal transmittance (U-value), the rate of heat loss through a unit length of a linear thermal bridge is measured by its **linear thermal transmittance**. It is represented by the Greek letter Psi (Ψ) and so it is also known as the **Psi-value**. It is measured in units of W/mK.

In general, the Psi-value represents the additional heat flow through the linear thermal bridge over and above that through the adjoining plane elements. The Psi-value is calculated using numerical modelling in accordance with BR497 and BS EN ISO 10211:2017 and is dependent on a number of factors including:

- The geometry of the junction and DEAP measurement conventions.
- The level of insulation at the junction.

6.5.3 Acceptable Construction Details (ACDs)

In order to provide guidance on minimising heat loss through the thermal bridges in a dwelling, a set of junction details have been published for the most common construction methods used in Ireland. These are known as the Acceptable Construction Details (ACDs). For each junction in the ACDs the following is provided:

- A drawing of the junction detail;
- Construction requirements to achieve the necessary thermal performance;
- Requirements to ensure continuity of the air barrier;
- Options for the type of air barrier;
- The Psi-value of the junction detail – (also given in Tables D1 to D6 of TGD L).

These details are available to download from the Department of Housing, Planning and Local Government [website](#).

Figure 6.25 - A detail from the ACDs.

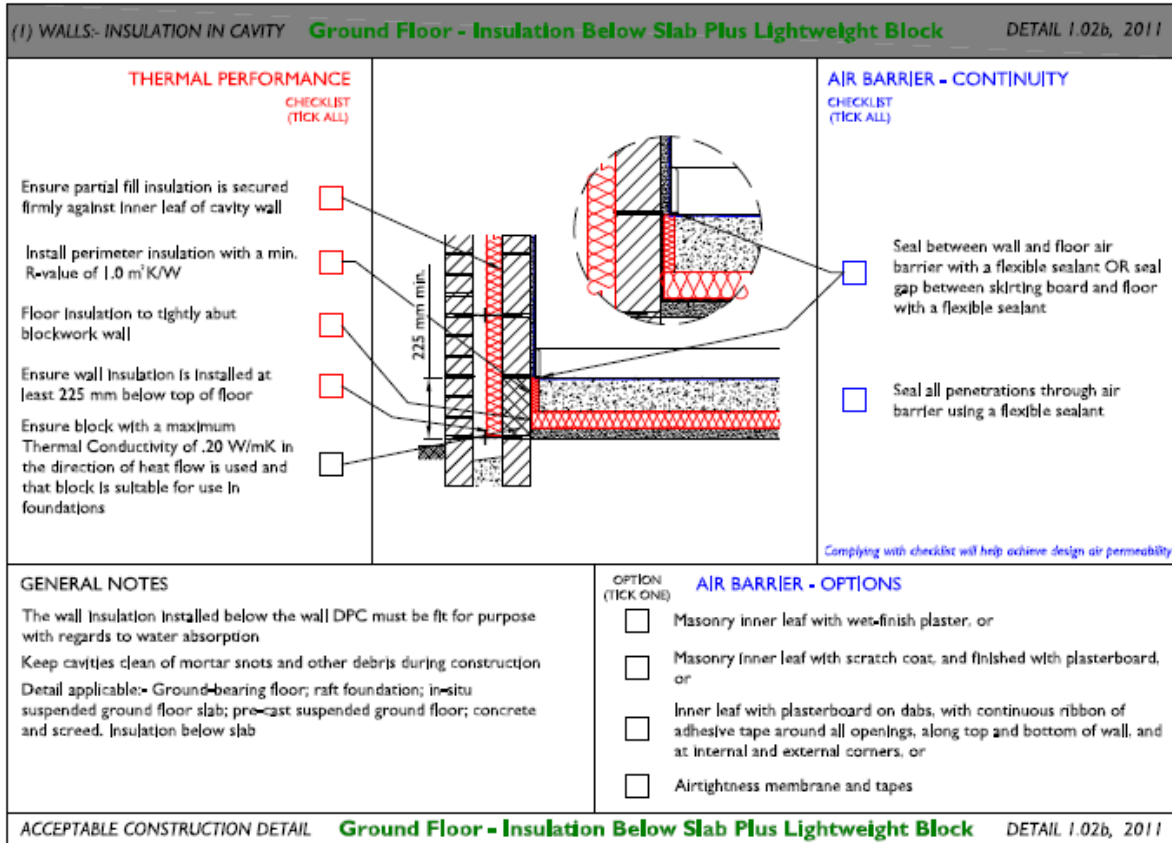


Figure 6.25 has an example of an ACD: Detail 1.02b for the junction of a Cavity Wall – Insulation in Cavity and a Ground Floor – Insulation below Slab plus Lightweight Block. Note the requirements that must be met, for example, “Install perimeter insulation with a min. R-value of 1.0 m²K/W” and “Ensure wall insulation is installed at least 225 mm below top of floor”.

For the purposes of the BER, if an ACD is being used, only the Thermal Performance checklist needs to be completed.

6.5.4 Junction Details not in the ACDs

The ACDs cover many common construction junction types, but they are not exhaustive. For example, the following features are typically not represented in the ACDs: cantilevered sections, non-standard window positions, façade bracketry (e.g. helping hand brackets).

As we will see in Section 6.5.5, where a non-default thermal bridging factor is to be used in DEAP, any key junctions not covered by ACDs need to be thermally modelled to determine the junction Psi-value. The Psi-value for non-ACD junctions can be taken from any of the following sources:

- A numerical model of the specific junction carried out and certified by an NSAI registered thermal modeller or equivalent. Details of the NSAI Thermal Modellers Scheme can be found [here](#). Many construction material manufacturers have developed their own library of certified details.
- NSAI Agrément certificates or equivalent – this approach is typically used for building systems rather than individual junction details.
- The BRE Certified Thermal Products Database, which can be found [here](#).

This is a database of Psi-values which have been independently assessed and certified by BRE.

BRE are a UKAS Accredited Certification Body. The calculated Psi-values provided by the BRE Certified Thermal Products Database are acceptable for use in DEAP and NEAP.

Please note: specifiers and constructors of these details should ensure that thermally approved details for the UK comply with all Parts of the Irish Building Regulations including Parts A-Structure, B-Fire, C-Site Preparation and Resistance to moisture, and D-Materials and Workmanship.

6.5.5 Accounting for heat loss at junctions in DEAP

In DEAP, the additional heat loss due to thermal bridging is accounted for by the Thermal Bridging Factor, also called the y-value, expressed in W/m^2K . DEAP multiplies this number by the total exposed surface area of the dwelling to give the heat loss due to thermal bridging from all key junctions in the dwelling. This section sets out the appropriate value to enter for the y-value, which depends on how thermal bridging has been addressed in the dwelling.

Note: The following types of junctions are considered key junctions where they include a heat loss plane element:

- Floor to wall (includes party walls)
- Wall to wall (corners & party walls)
- Roof to wall (includes party walls)
- Lintel above window/door
- Sill below window
- Window/door jamb

This list is not exhaustive. Any junction in the dwelling which has a relatively long length or a high rate of heat loss, or both, should be considered a key junction.

No information on junction details

Where no information is provided to the BER Assessor about the junction details, the default thermal bridging factor should be used: y-value = $0.15 W/m^2K$.

Even where this value is used, there is a responsibility to ensure junction design meets the TGD L requirements in relation to limiting risk of surface condensation, as set out in Appendix D of the TGD L. **This falls outside of BER assessments and is not considered here.**

All key junctions covered by ACDs

Where all of the key junctions in a dwelling are covered by details taken from the ACDs, there are two options for the thermal bridging factor:

Option 1: Use the thermal bridging factor, y-value = $0.08 W/m^2K$.

The use of this value is allowed for **new dwellings only**, where the dwelling has been designed and constructed in accordance with the acceptable construction details.

Documentary evidence is required to support the use of a y-value of $0.08 W/m^2K$ in a BER assessment.

The purpose of the supporting evidence is to show that:

- All junctions in the dwelling have been considered;
- All key junctions have been identified;
- Each key junction has been designed and built in accordance with the associated ACD.

For example, these requirements would be met by the following documentation:

- Construction Drawings showing **all** junctions in the dwelling.
- A schedule of junctions. This would,
 - List **all** junctions in the dwelling.
 - Identify all **key** junctions;
 - Reference the associated ACD for each key junction.
- A copy of the ACD for every key junction.

These documents should reference the dwelling being assessed and should be signed by the relevant person, i.e. one of,

- Developer,
- Builder,
- Architect,
- Engineer,
- Assigned certifier,

confirming that the key junctions identified were designed and built in accordance with the associated ACDs. (For New-Provisional ratings it is sufficient to confirm design only, as the dwelling has not yet been built.)

Option 2: Use a non-default thermal bridging factor.

Documentary evidence is required to support a non-default y-value.

The purpose of the supporting evidence is to show that:

- All junctions in the dwelling have been considered;
- All key junctions have been identified;
- Each key junction has been designed and built in accordance with the associated ACD;
- The non-default y-value has been calculated correctly.

For example, these requirements would be met by the following documentation:

- Construction Drawings showing **all** junctions in the dwelling.
- A schedule of junctions. This would,
 - List **all** junctions in the dwelling.
 - Identify all **key** junctions;
 - Reference the associated ACD for each key junction.
- A copy of the ACD for every key junction, as listed in the junction schedule.
- The calculation of the non-default y-value.

The calculation of the y-value requires the length of each key junction in the dwelling so this should be clearly set-out either in the drawings or the schedule.

These documents should reference the dwelling being assessed and should be signed by the relevant person, i.e. one of,

- Developer,
- Builder,
- Architect,
- Engineer,
- Assigned certifier,

confirming that the key junctions identified were designed and built in accordance with the associated ACDs. (For New-Provisional ratings it is sufficient to confirm design only, as the dwelling has not yet been built.)

The use of a calculated y-value is typically of benefit to projects. For the majority of dwellings, the calculated y-value will be below the default 0.08 W/m²K value for standard house types. This directly affects the overall energy performance of the dwelling.

Apartments will commonly have calculated y-values significantly above the 0.08 W/m²K value. This is not necessarily due to poor detailing of junctions but is mainly due to the DEAP measurement convention. For the purpose of *design-stage* assessments, it is recommended to use the 0.15 W/m²K default value for apartments. This allows a margin for error in the event that a y-value of 0.08 W/m²K is not achieved in the final construction.

SEAI have developed a Thermal Bridging Calculator which can be used to carry out y-value calculations. This is available to download from the SEAI website [here](#).

All junctions covered by a combination of ACDs and certified details

In this case a non-default y-value must be calculated.

Documentary evidence is required **to support a non-default y-value**. The purpose of the supporting evidence is to show that:

- All junctions in the dwelling have been considered;
- All key junctions have been identified;
- Each key junction has been designed and built in accordance with the associated ACD/certified detail;
- The non-default y-value has been calculated correctly.

For example, these requirements would be met by the following documentation:

- Construction Drawings showing **all** junctions in the dwelling.
- A schedule of junctions. This would,

- List **all** junctions in the dwelling.
- Identify all **key** junctions;
- Reference the associated ACD/certified detail for each key junction.
- A copy of the associated ACD/certified detail for every key junction, as listed in the junction schedule.
- The calculation of the non-default y-value.
 - The calculation of the y-value requires the length of each key junction in the dwelling so this should be clearly set-out either in the drawings or the schedule.

These documents should reference the dwelling being assessed and should be signed by the relevant person, i.e. one of,

- Developer,
- Builder,
- Architect,
- Engineer,
- Assigned certifier,

confirming that the key junctions identified were designed and built in accordance with the associated ACD/certified detail. (For New-Provisional ratings it is sufficient to confirm design only, as the dwelling has not yet been built.)

6.5.6 Example – All key junctions covered by a combination of ACDs and certified details

The dwelling in the following example is a 2-storey **semi-detached** house.

The details of the building fabric are set out in the following table:

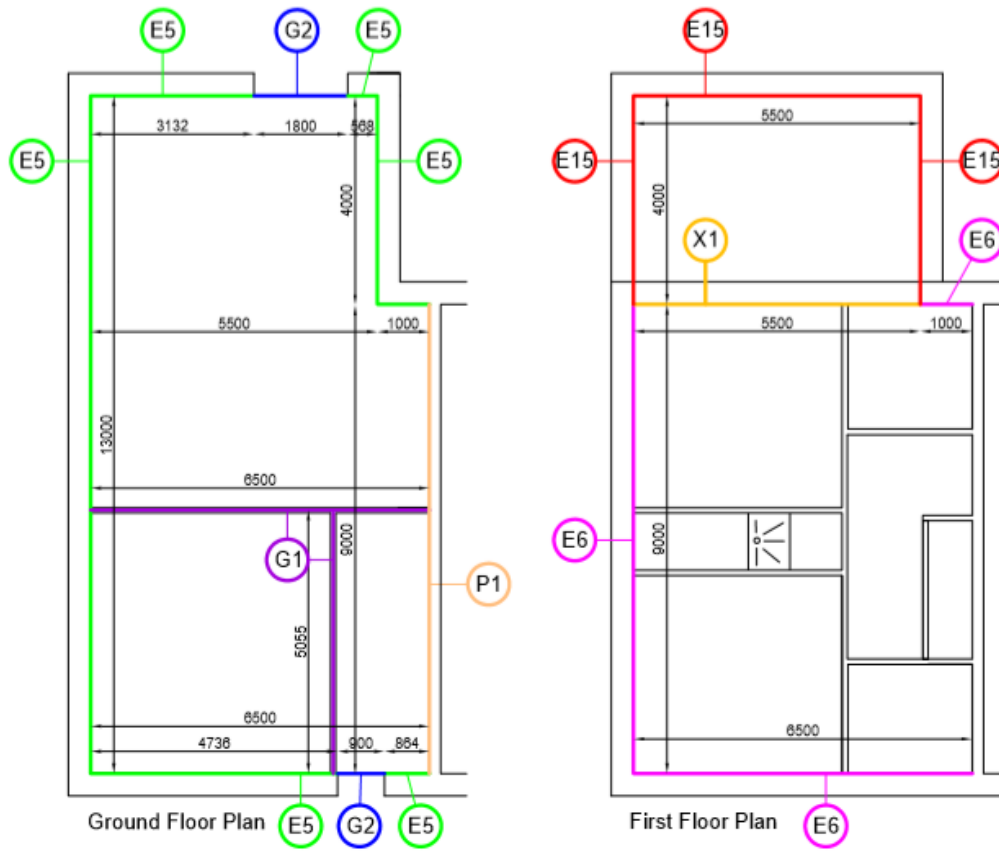
Table 12: Dwelling fabric for this example		
Element	Description	Calculated U-value
Wall Type 1	Cavity walls with partial fill insulated cavity	0.14
Ground Floor	Solid concrete floor with insulation below slab	0.14
Roof Type 1	Pitched roof, insulated at ceiling level	0.13
Roof Type 2	Flat roof	0.14
First Floor	Timber intermediate floor	-
Party Wall**	Solid masonry	-
Wall Type 2**	Solid masonry internal partition penetrating ground floor slab	-
Wall Type 3**	Timber stud partition	-
** While the heat loss through this plane element is typically not accounted for in DEAP, if this non-heat loss plane element adjoins another heat loss element, heat loss at the junction may need to be accounted for.		

Documentary evidence for BERs

In this example, the following evidence has been provided to substantiate a non-default y-value.

(a) Drawings with all junctions identified

Figure 6.26: Floor plans with all junctions identified



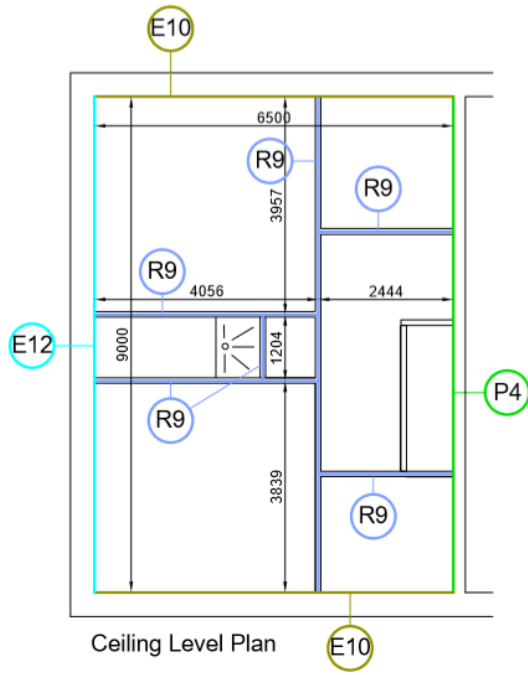
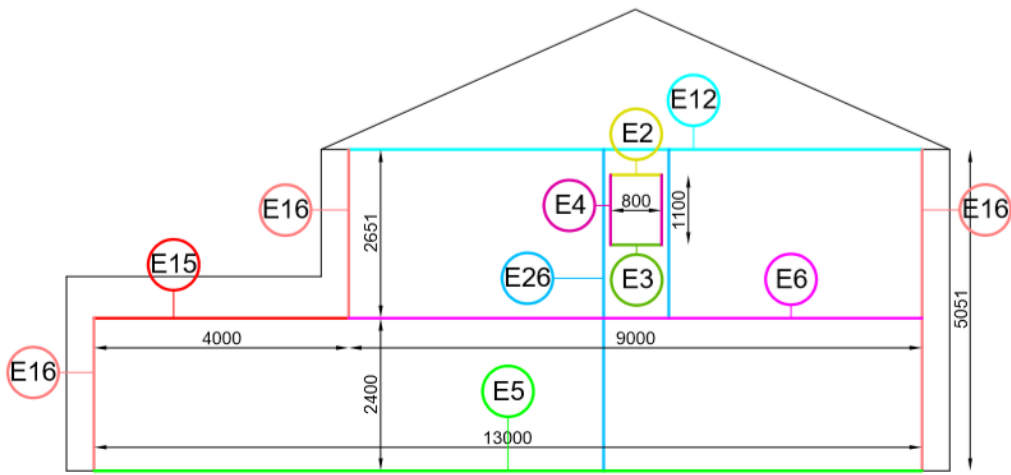


Figure 6.27: Elevations with all junctions identified





Side Elevation

Figure 6.26 and 6.27 provide an **example** of a set of plans and elevations with all the junctions identified and labelled. These drawings are usually prepared by the designer of the dwelling. The drawings should reference the dwelling being assessed. While this level of detail may not be available from the designer of the dwelling, at a minimum all key junctions must be identified.

(b) Schedule of all junctions identified in the drawings

In this example, a schedule of all junctions in the dwelling has been provided.

This schedule should contain the following information:

- A clear reference to the dwelling being assessed.
- A list of **all** of the junctions in the dwelling.

All junctions must be included in this list. The relevant person (Section 6.5.5) may consider a particular junction not to be a key junction, e.g. a door threshold, but must still include this junction here and explicitly state that it is not a key junction.

- For each junction that is considered to be a **key** junction, the associated ACD or certified detail must be identified. Note that all of the junction types listed in Section 6.5.5 are considered to be key junctions.

The schedule should be signed by the relevant person (developer/builder/architect/engineer/assigned certifier) confirming the junctions identified were designed and built in accordance with the associated ACDs and/or certified details.

Figure 6.28 is an example of a schedule of junctions for a dwelling.

Figure 6.28: Sample Schedule of Junctions

ABCD Architects Ltd., 50 The Street, Dublin | T: 01 111111 | E: abcd@abcdarchitects.ie

Contact details of person signing off on junctions → Dwelling Address: _____

Dwelling address → _____

Confirmation that dwelling has been designed (and built for final assessments) in accordance with associated ACD or certified detail → We confirm that this dwelling has been designed and built in accordance with the details listed below and as identified on the attached plans and elevations.]

Location	Junction Type	Junction Detail	
Ground Floor	E5	1.02b	Ground Floor – Insulation below slab plus lightweight block
	G2	Certified	Door Threshold
	G2	Certified	Door Threshold
	P1	G.05.01	Solid masonry separating wall through ground floor
First Floor	G1	G.05.02	Solid masonry (narrow) partition wall through ground floor
	E6	1.05	Intermediate floor within a dwelling
	X1	Certified	Flat roof to rear external wall (inverted)
Roof	E15	1.20	Flat Roof Parapet
	E10	1.09	Eaves – Unventilated Attic
	E12	1.15	Ventilated roof – attic floor level
Elevations	P4	G.01.2	Masonry separating wall (solid) – wall head - section
	R9	NKJ	Not a key junction – no thermal bridge
	E16	1.27.1	Corner
	E17	1.27.2	Inverted Corner
	E18	1.06.1	Masonry cavity separating wall (plan)
	E19	1.08	Stud partition wall
	E19	1.07	Masonry partition wall
	E4	1.25	Op e – jamb with proprietary cavity closer
	E2	1.23.2	Op e – pre-stressed concrete lintels – proprietary closer
	E3	1.26	Op e – concrete forward sill

List of all junctions in dwelling as identified on drawings →

Associated ACD or certified detail for each junction identified →

Date of confirmation → Confirmed by: _____ Date: _____

Signature of relevant person → Project Architect

(c) Copy of all ACDs / Certified Details

A copy of all ACDs and/or certified details referenced in the junction schedule should be provided. Each detail should be signed by the relevant person confirming the junction was designed and built (or designed for provisional ratings) in accordance with the relevant detail.

Where a Ψ -value is used which is calculated by a certified thermal modeller, the junction detail clearly referencing the certified ψ -value and thermal modeller name and registration details must be provided to the BER assessor

Where reports supporting the certified Ψ -value are not available in accordance with these requirements, this Ψ -value may not be used, and the γ -value reverts to a default 0.15W/m²K.

Figure 6.29 is an example of an ACD that has been appropriately completed and signed-off.

Note that,

- The checklist for Thermal Performance has been completed.
- It has been signed by the relevant person.
- The checklists for “Air Barrier – Continuity” and “Air Barrier – Options” have been completed in this example but these do not need to be completed in order to support the γ -value.

Figure 6.29: Sample Signed ACD

Thermal performance checklist completed

Air barrier continuity checklist completed

Signed by relevant person

Air barrier option selected

(1) WALLS- INSULATION IN CAVITY		Ope - Pre-stressed concrete lintels		DETAIL 1.23.1 + 1.23.2, 2011	
THERMAL PERFORMANCE CHECKLIST (TICK ALL) Ensure partial fill insulation is secured firmly against inner leaf of cavity wall <input checked="" type="checkbox"/> Continue insulation to width of the cavity <input checked="" type="checkbox"/> Install proprietary cavity closer with path of minimum thermal resistance through the closer of not less than 4.29 m ² K/W (manufacturers certified data) <input checked="" type="checkbox"/> Ensure all gaps around and between lintels are tightly packed with insulation <input checked="" type="checkbox"/>				AIR BARRIER - CONTINUITY CHECKLIST (TICK ALL) Seal all penetrations through air barrier using a flexible sealant <input checked="" type="checkbox"/> If forming the air barrier to the walls with a blockwork inner leaf or a scratch coat on blocks, install a flexible sealant between the cavity closer and blockwork wall <input checked="" type="checkbox"/> Apply flexible sealant to all interfaces between internal air barrier and window / door frame members <input checked="" type="checkbox"/>	
GENERAL NOTES Keep cavities clean of mortar spots and other debris during construction		AIR BARRIER - OPTIONS (OPTION (TICK ONE)) <input type="checkbox"/> Masonry inner leaf with wet-finish plaster, or <input type="checkbox"/> Masonry inner leaf with scratch coat, and finished with plasterboard, or <input type="checkbox"/> Inner leaf with plasterboard on dabs, with continuous ribbon of adhesive tape around all openings, along top and bottom of wall, and at internal and external corners, or <input checked="" type="checkbox"/> Airtightness membrane and tapes			
ACCEPTABLE CONSTRUCTION DETAIL		Ope - Pre-stressed concrete lintels		DETAIL 1.23.1 + 1.23.2, 2011	

John Murphy, (Site Engineer)

Complying with checklist will help achieve design air permeability

(d) Copy of non-default γ -value calculation.

The basic form of the calculation is as follows:

For each **key** junction in the dwelling:

- Measure the length of the junction, L;
- Identify the Ψ -value for the junction, either from the ACD documentation or from a thermal modelling report;
- Calculate the heat loss coefficient for the junction = $\Psi \times L$.

The Total Thermal Bridging Heat Loss Coefficient (H_{TB}) is the sum of the heat loss coefficients for all key junctions.

Finally, the Thermal Bridging Factor, γ = Total Thermal Bridging Heat Loss Coefficient/Total Exposed Area.

This is the value that is entered into DEAP.

Ψ -values for each junction detail in the ACDs are provided in Tables D1 - D6 of Appendix D of the TGD.

Figure 6.30 shows an excerpt from Table D1 with the data for Detail 1.02b highlighted.

Figure 6.30 - An excerpt from Table D1 with the data for Detail 1.02b highlighted

Table D1	Section 1 - Cavity Wall Insulation	Target U-values		
Junction detail Identifier 2011 Edition	Junction detail	U-value = 0.18 W/m ² K, 150mm full-fill or partial fill cavity ^{1,3} (roof U = 0.16) (floor U = 0.18)	U-value = 0.15 W/m ² K, 150mm full-fill or partial fill cavity and internal insulation ^{2,3} (roof U = 0.14) (floor U = 0.15)	U-value = 0.15 W/m ² K, 200mm full-fill or partial fill cavity ^{2,3} (roof U = 0.14) (floor U = 0.15)
		ψ-value (W/mK)	ψ-value (W/mK)	ψ-value (W/mK)
Section 1	Details			
1.01a	Ground Floor - Insulation above slab	0.170	0.072	0.196
1.01b	Ground Floor - Insulation above slab plus lightweight block	0.080	0.042	0.093
1.02a	Ground Floor - Insulation below slab	0.163	0.108	0.191
1.02b	Ground Floor - Insulation below slab plus lightweight block	0.070	0.061	0.083
1.03	Timber Suspended Ground Floor	0.219	0.102	0.227
1.04	Concrete Intermediate Floor within a dwelling	0.000	0.039	0.000

The highlighted section shows three Ψ-values which can be used for this junction, depending on the U-values of the elements involved and the location of the insulation.

Table 13 shows this in more detail:

Table 13 - Selecting the appropriate Psi-value for an ACD

Wall Type	Insulation	Target Wall U-value (W/m ² K)	Allowed Wall values U- (W/m ² K)	Target Floor value U- (W/m ² K)	Allowed Floor values U- (W/m ² K)	Psi-value
Cavity insulation		0.18	0.18	0.18	0.16 – 0.21	0.070
Cavity insulation and internal insulation		0.15	0.12 – 0.17	0.15	0.12 – 0.18	0.061
Cavity insulation		0.15	0.12 – 0.17	0.15	0.12 – 0.18	0.083

1) If the wall U-value or the floor U-value are not within one of the Allowed U-value ranges specified above (in Column 3 and Column 5 of Table 2), then an ACD Ψ-value **cannot be used**.

In such a case, there are three possible ways to proceed:

- The junction would have to be thermally modelled to get the correct Ψ-value, which would allow the calculation of a non-default y-value; or,
- If all key junctions were covered by ACDs, then y = 0.08 W/m²K could be used; or,
- Otherwise, the default thermal bridging factor, y = 0.15 W/m²K would have to be used.

2) An additional restriction is imposed in cases where the U-value of one flanking element is above its target U-value and the U-value of the other flanking element is below its target U-value, as follows:

Where two building elements have one U-value above its target while the other is below its target U-value, the aggregate percentage change from the respective target U-values in the table should not exceed 20% for the Ψ-value to be valid.

Taking the example of the wall-floor detail 1.02b again: let's take a case where the wall has a partially filled cavity giving a U-value of 0.16 W/m²K. The target U-value for this wall is 0.15 W/m²K, so the wall U-value is 6.67% above the target. Therefore, the floor U-value can't be more than 13.33% below the target floor U-value for this Ψ -value to be valid, i.e. if the floor U-value is below 0.13 W/m²K **then the Ψ -value cannot be used**.

Note that this restriction does not apply where both U-values are above their respective target U-values (but within the allowed ranges). Also, this restriction does not apply where both U-values are below their respective target U-values (but within the allowed ranges).

Table 14 has the details of the y-value calculation for this example dwelling.

Table 14: y-value calculation						
Location	Type	Junction Detail		Ψ (W/mK)	L (m)	Ψ * I (W/K)
Ground Floor	E5	1.02b	Ground Floor - Insulation below slab plus lightweight block	0.083	27.30	2.266
	G2	Certified	Door Threshold	0.054	1.80	0.098
	G2	Certified	Door Threshold	0.069	0.90	0.062
	P1	G.05.1	Solid masonry separating wall through ground floor	0.120	9.00	1.080
	G1	G.05.2	Solid masonry (narrow) partition wall through ground floor	0.150	11.56	1.733
First Floor	E6	1.05	Intermediate floor within a dwelling	-0.001	16.50	-0.017
	X1	Certified	Flat roof to rear external wall (inverted)	-0.063	5.50	-0.348
	E15	1.2	Flat Roof Parapet	0.206	13.50	2.781
Roof	E10	1.09	Eaves - Unventilated Attic	0.053	13.00	0.689
	E12	1.15	Ventilated Roof - Attic floor level	0.210	9.00	1.890
	P4	G.01.2	Masonry separating wall (solid) - wall head - section	0.229	9.00	2.061
	R9	NKJ	Not a key junction	0.000	23.20	0.000
Elevations	E16	1.27.1	Corner	0.035	12.50	0.438
	E17	1.27.2	Inverted Corner	-0.055	2.40	-0.132
	E18	1.06.1	Masonry Cavity Separating Wall (plan)	0.032	10.10	0.323
	E19	1.08	Stud Partition Wall	0.000	10.60	0.000
	E19	1.07	Masonry Partition Wall	0.000	4.80	0.000
	E4	1.25	Ope - Jamb with proprietary cavity closer	0.006	24.30	0.146
	E2	1.23.2	Ope - Pre-stressed concrete lintels-proprietary closer	0.006	12.20	0.073
	E3	1.26	Ope - concrete forward sill	0.019	9.50	0.181
Transmission Heat Loss Coefficient, H_{tb} (W/K)						13.324
Total Exposed Surface Area, ΣA_{exp} (m ²)						291.322
y-value (W/m²K)						0.046

The SEAI thermal bridging factor tool can also be used to calculate a y-value.

6.5.7 Summary of Thermal Bridging Scenarios

The following table summarises the means of deriving the y-value in different scenarios and supporting evidence in each case.

Table 15 – Summary of Thermal Bridging Scenarios

	y-value = 0.08 W/m ² K	Calculated y-value	y-value = 0.15 W/m ² K
Summary	ACDs met	Using ACD &/or certified Ψ -values	ACDs not met
Refer to	TGD L 2019 1.3.3.2 (i)	TGD L 2019 1.3.3.2(ii) & (iii)	TGD L 2019 1.3.3.2 (iv)
Step 1 Identify junctions	Identify junctions in dwelling	Identify junctions in dwelling	Junctions are not assessed for DEAP ¹ .
Step 2 Applicability of ACDs	All key junctions must be designed and built in accordance with ACDs	Identify applicable ACDs and/or certified details for all key junctions	N/A
Step 3 Ψ -values	Individual Ψ -values not required	Ψ -values are required for all key junctions, sourced from: - Tables D1-D6 (where ACDs are applicable) and/or - Calculated by registered thermal modeller or equivalent	N/A
Step 4 y-value for BER	No calculation required Default y-value = 0.08 W/m ² K (new dwellings only)	Calculation required Measure junction lengths and calculate y-value ²	No calculation required Default y-value = 0.15 W/m ² K
Step 5 Obtain & Check Documentary Evidence	- Signed-off drawings and schedule of all junctions as detailed above - ACDs signed off	- Signed-off drawings and schedule of all junctions as detailed above - ACDs signed off - Certified details where applicable	N/A
Notes:			
<ol style="list-style-type: none"> 1. There is a responsibility to ensure junction design meets the TGD L requirements in relation to limiting risk of surface condensation as set out in Appendix D of the TGD L. This falls outside of BER assessments and is not considered here. 2. Where a y-value is calculated by a third party, the BER assessor should check the calculation to ensure it is correct. 			

Figure 6.31 gives additional guidance on the process of accounting for Thermal Bridging in the form of a flowchart.

Table 16 looks at thermal bridging from the audit perspective.

It lists a number of scenarios that may arise and sets out the courses of action available to the Assessor.

Figure 6.31: Determining Thermal Bridging Factors & supporting documentation for DEAP

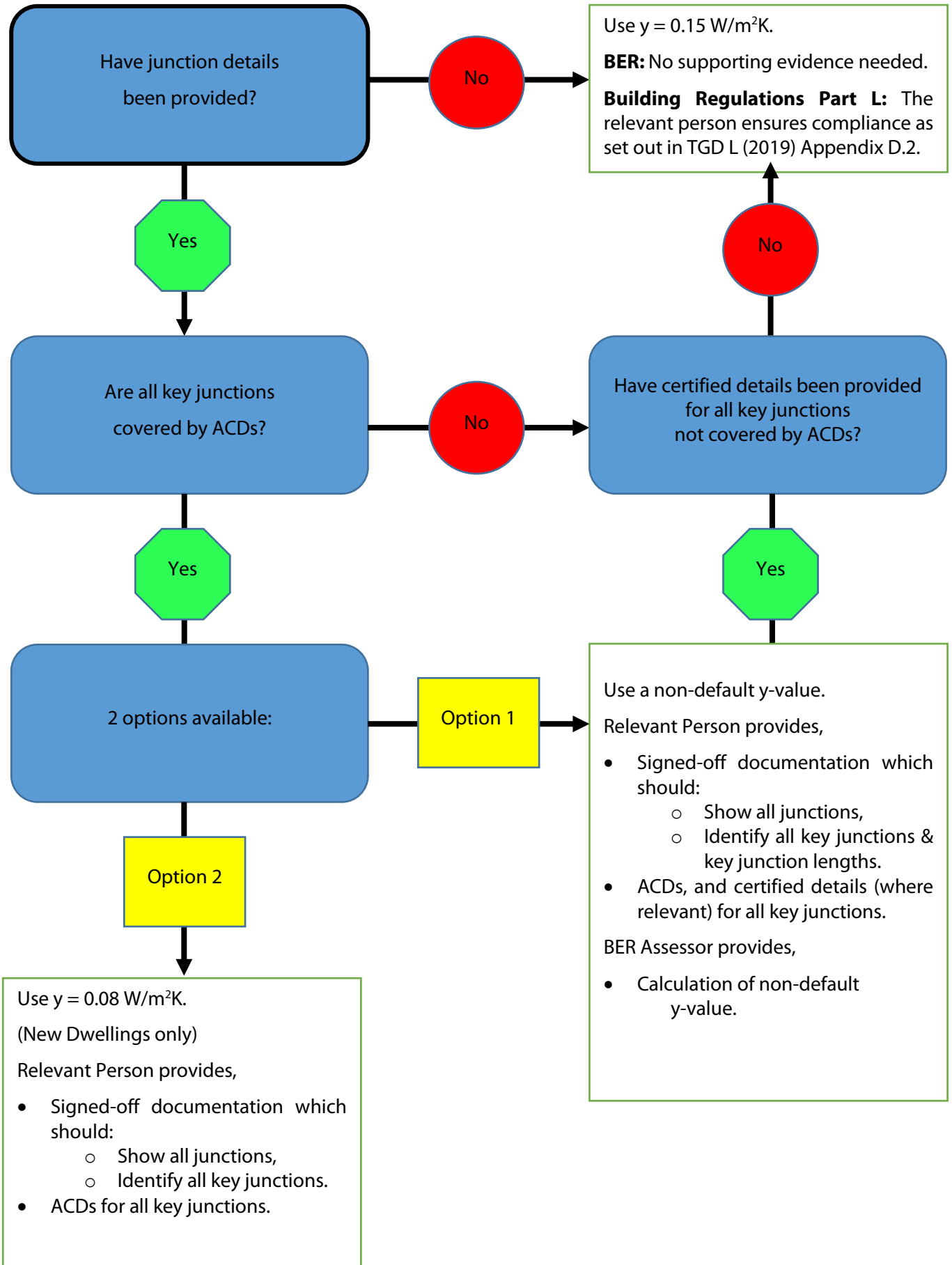


Table 16 – Different Thermal Bridging Scenarios and the Recommended Assessor Response

Scenario	Does this meet the BER requirements?	Assessor Recommended Action
All junctions are not identified in the documentation provided.	No: All junctions must be identified, even if they are not key junctions.	Request the missing information. If it is not provided then publish the BER with $y = 0.15 \text{ W/m}^2\text{K}$.
The relevant person has identified the floor-wall junction on the drawings but has stated in the schedule that it is not a key junction.	No: As stated in Section 1.5, the wall-floor junction is considered to be a key junction.	Request the missing information. If it is not provided then publish the BER with $y = 0.15 \text{ W/m}^2\text{K}$.
The relevant person has identified the door threshold on the drawings and schedule but has stated that it is not a key junction.	Yes: The door threshold is not listed in Section 1.5 as a key junction. The relevant person's statement that it is not a key junction is accepted.	Proceed as normal.
The relevant person has provided a set of bespoke detail drawings and stated that these details are equivalent to ACDs.	Yes: The relevant person's statement is accepted as long as for each detail the corresponding ACD is identified.	Proceed as normal.
The relevant person has provided a non-default y-value calculation. There is an error in the calculation.	No: The Assessor is responsible for the y-value entered into DEAP so any errors in the calculation are subject to audit.	Discuss with the relevant person how to correct the calculation. (i) Correct the calculation and use the result in DEAP, or, (ii) use the default $y = 0.15 \text{ W/m}^2\text{K}$ where the calculation cannot be substantiated
The relevant person has provided a full set of ACD documentation with the intention of using a non-default y-factor. This includes an ACD for the wall-floor junction. However, the U-values of the wall and floor do not fall in the allowed range for that detail, as set out in Appendix D of TGD L.	No: A non-default y-value calculation cannot be completed because a Psi-value for this junction has not been provided.	Suggest that the junction be thermally modelled, which would allow the calculation of a non-default y-value, or, Use the ACD default value, $y = 0.08 \text{ W/m}^2\text{K}$.

<p>One or more of the ACDs/certified details has not been provided.</p>	<p>No: The documentation is incomplete.</p>	<p>Request the missing information. If it is not provided then publish the BER with $\gamma = 0.15 \text{ W/m}^2\text{K}$.</p>
<p>The relevant person has provided a full set of ACD documentation but one of the details has an incomplete Thermal Performance checklist.</p>	<p>No: The documentation is incomplete.</p>	<p>Request the missing information. If it is not provided then publish the BER with $\gamma = 0.15 \text{ W/m}^2\text{K}$.</p>

7. Windows & Doors

This section details the approach to default data for windows and how to substantiate non-default data for windows and doors. It also discusses overshadowing, rooflights and entering doors in DEAP.

The primary references for windows and doors in the DEAP Manual are Section 3.2, Table 6 and Table S9. There are several key parameters to consider for windows and doors in DEAP assessments:

- Window / door U-value
 - Entered for the entire window/door (including frame)
 - Multiplied by area of window/door in DEAP to derive heat loss
 - Non-defaults must be supported by acceptable certified documentation. See Section 3 of this document.
 - Only use certified non-default U-value if certified non-default solar transmittance is available.
 - Several parameters can impact default selection (see later in this section).
- Window Solar Transmittance (g_{\perp})
 - See DEAP Manual Table 6b foot-notes.
 - Influences heat gains. Higher values can reduce space heat requirements in the heating season.
 - g_{\perp} factor for glazing at normal incidence.
 - If intending to use " g_{window} " it must be converted to g_{\perp} using the equation in DEAP Table 6b
 $g_{\perp} = g_{\text{window}} / [\text{Frame Factor} * 0.9]$
 - Relevant standard for non-default is I.S. EN 410
 - Non-defaults must be supported by acceptable certified documentation. See Section 3 of this document.
 - Only use certified non-default solar transmittance if certified non-default U-value available.
 - Several parameters can impact default selection (see later in this section).
- Other key factors for windows:
 - Light transmittance: **always defaulted** based on window type. Automatically selected by DEAP. No non-defaults permitted.
 - Frame factor: fraction of opening that is glazed.
 - Default from Table 6c based on frame material; or
 - Non-defaults permitted once representative of actual windows (from certified data).
 - Orientation and overshadowing (from survey).

7.1 Window default data

As always, non-defaults must be used for windows where possible and where supporting evidence is available. Where certified data is not available, see DEAP Section 3.2 on use of defaults:

For new dwellings (provisional or final assessment)¹⁶

- Default U-value taken from Table 6a
- Solar transmittance from Table 6b
- Use site observations and specs/plans to determine relevant parameters (e.g. triple glazing etc.)

For existing dwellings

- Table 6a and 6b can be used as per new dwellings or
- U-value and solar transmittance can be taken from DEAP Table S9
- Use site observations and specs/plans to determine relevant parameters (e.g. triple glazing etc.)

¹⁶ For new dwellings, specifications detailing the parameters for lookup in Table 6a / 6b are usually available (and some information will be available during survey of New-final dwellings). In exceptional circumstances (such as plans/specifications not available) Table S9 can be used as an alternative to Table 6a/6b for new dwellings.

7.1.1 Windows defaults using DEAP Table S9

Example 1: Double glazed installed before 2004 and using Table S9

Use one of the following depending on the frame type:

Glazing	Low E coating	Frame	Metal thermal break assumed	U-value (W/m ² K) (based on Table 6a)	Solar transmittance (based on Table 6b)	Comment
Double	No	Wood/PVC	n/a	3.1	.76	Air filled 6mm gap
Double	No	Metal	4mm	3.7	.76	air filled 6mm gap

Example 2: Double glazed installed between 2004 and 2009, using Table S9

Use one of the following depending on the frame type:

Glazing	Low E coating	Frame	Metal thermal break assumed	U-value (W/m ² K) (based on Table 6a)	Solar transmittance (based on Table 6b)	Comment
Double	Yes	Wood/PVC	n/a	2.2	.72	Air filled low E hard coat $\epsilon_n = .15$ 12mm gap
Double	Yes	Metal	4mm	2.7	.72	Air filled low E hard coat $\epsilon_n = .15$ 12mm gap

Example 3: Double glazed installed in 2010 or later, using Table S9

Use one of the following depending on the frame type:

Glazing	Low E Coating	Frame	Metal thermal break assumed	U-value (W/m ² K) (based on Table 6a)	Solar transmittance (based on Table 6b)	Comment
Double	Yes	Wood/PVC	n/a	2.0	.72	Argon-filled; low E, hard coat, $\epsilon_n = 0.15$; 12mm gap
Double	Yes	Metal	4mm	2.5	.72	Argon-filled; low E, hard coat, $\epsilon_n = 0.15$; 12mm gap

It is not acceptable to vary the filling / gap / coating values when using the Table S9 approach.

For example, if using Table S9 for a Double-Glazed window installed in 2014, you must assume the 12mm gap in Table S9, even though the gap identified on site could be larger than this.

The same filling / gap / coating parameters as above can be assumed for **Triple Glazing** based on being installed before 2004 or on/after 2004.

7.1.2 Windows defaults using DEAP Tables 6a and 6b

The DEAP Survey Guide states: “Representative photographs of the window, gap between glazing, manufacturer’s stamp can be used as supporting evidence when using defaults from DEAP Table 6.” This is elaborated below. There are examples of default selection using this method in Table 17 below.

When sourcing U-value and g_{\perp} from Table 6a and 6b, there are several properties to be considered:

- **Glazing type** (single, double, triple) and **frame type** (wood, PVC, metal) from survey / plans.
- **Insulating gas** (air, argon).
 - In the absence of information specifying the type of gas, assume the window is air filled.
 - The insulating gas type can be taken from manufacturer brochure/product literature.
- **Low emissivity coating** (hard coat, soft coat, no coat).
 - Assume no coat if unknown.
 - This parameter can be taken from manufacturer brochure/product literature.
 - If a coating is present and no further detail is available, assume hard coat with $\epsilon_n = 0.2$
- **Gap** between panes established by one of the following to select 6mm, 12mm or 16mm from 6a:
 - Manufacturer’s data (brochure or product literature).
 - Measure overall thickness and details of pane thickness from manufacturer literature.
 - If no pane thickness available, assume 4mm thick and measure overall thickness of the glazing or window to determine the gap.
 - Laser device with CE marking or meeting EU standards. Measures thickness of panes and gap(s).
 - If no info available and no measurement possible, assume 6mm gap between panes.
- Thermal break in metal framed windows can be established by one of:
 - Manufacturer’s data (brochure or product literature).
 - If no data available, if frame is noticeably colder than glass (on a cold day), then there is no break.
 - If there is a thermal break, but thickness is unknown, assume 4mm.
 - If in doubt about presence of thermal break, assume it is not present.

Gap between Panes	Option chosen in DEAP Table 6a
<12mm	6mm
>= 12mm ; <16mm	12mm
>=16mm	16mm

Table 17: Examples of defaults from DEAP Tables 6a and 6b

Scenario	Gas filling type and glass coating	Gap and thermal break.	DEAP results for U-value (6a) & g_{\perp} (6b)
1) Double glazed PVC Overall glazing thickness measured 16mm	No information on filling or coating available. Assume air filled with no coating	Assume 4mm panes. Gap is $16 - (4+4) = 8\text{mm}$. Select 6mm option from 6a. Thermal break n/a for PVC.	U-value = $3.1 \text{ W/m}^2\text{K}$ $g_{\perp} = 0.76$
2) Triple glazed wood frame. Overall thickness measured 36mm	No information on filling or coating available. Assume air filled with no coating	Assume 4mm panes so gap is $[36 - (4+4+4)]/2 = 12\text{mm}$. Select 12mm option in Table 6a Thermal break n/a for wood.	U-value = $2.1 \text{ W/m}^2\text{K}$ $g_{\perp} = 0.68$
3) Double glazed wood frame. Brochure states 18mm argon filled gap with hard Low-E coating.	Argon filled. Hard coated. Assume highest ϵ_n of 0.2	18mm gap present so select 16+mm option in DEAP 6a Thermal break n/a for wood.	U-value = $2.0 \text{ W/m}^2\text{K}$ $g_{\perp} = 0.72$

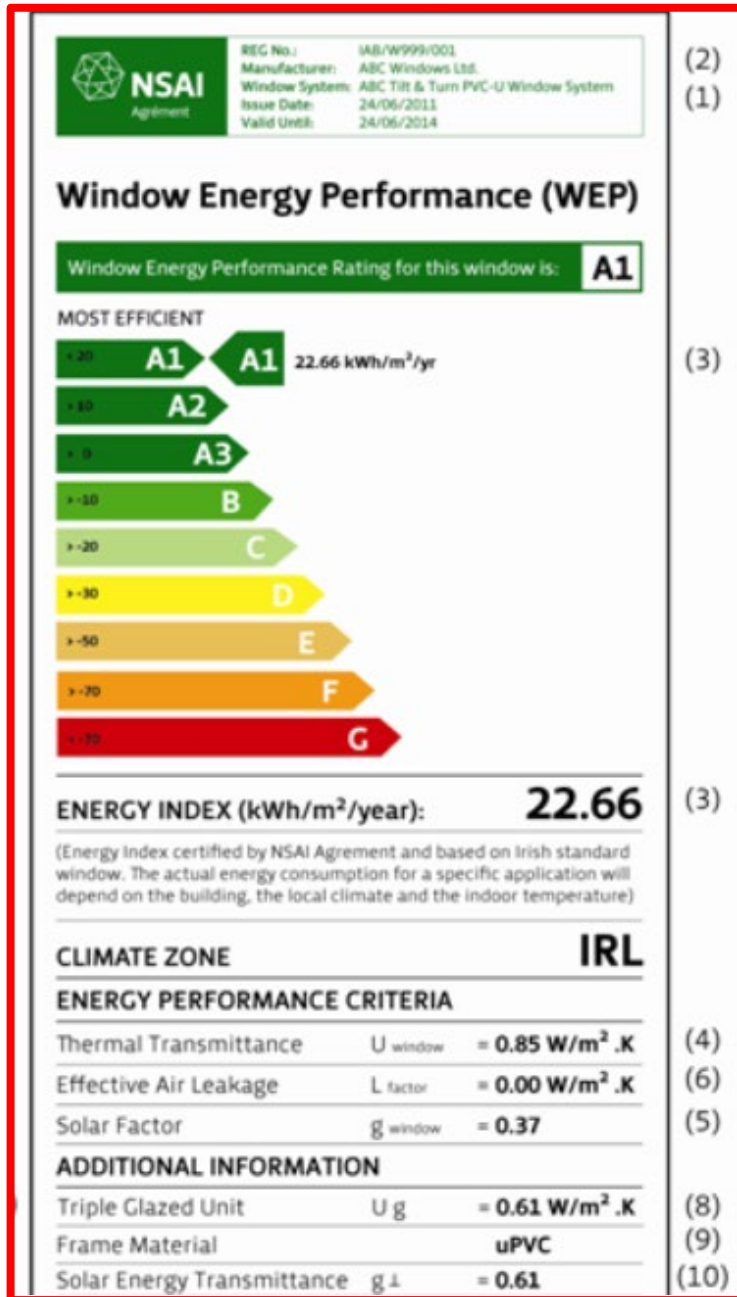
4) Double glazed metal frame. Frame not cold to touch compared to glass. Overall thickness measured 18mm	No information on filling or coating available. Assume air filled with no coating	Assume 4mm panes so gap is (18-(4+4)) = 10mm. Select 6mm option. Frame not colder than glass so break is present. Assume 4mm thermal break.	U-value = 3.7 W/m ² K g _L = 0.76
--	--	--	---

7.2 Windows certified data

As detailed in DEAP Manual Section 3.2, the preferred source of U-value data for windows, is a certified value measured according to IS EN ISO 12567-1 or a value calculated according to IS EN ISO 10077-1 or IS EN ISO 10077-2. A BER Assessor may perform this calculation provided it strictly adheres to the applicable standard and all non-default data is provided by an accredited source. When specifying a non-default U-value in DEAP, it must be accompanied by a non-default solar transmittance value calculated according to EN 410. If the non-default solar transmittance is not available, then default U-value **and** solar transmittance must be used.

Figure 7.1 shows an NSAI Window Energy Performance certificate:

Figure 7.1 – A WEP certificate



(2)
(1)
(3)
(3)
(3)
(4)
(6)
(5)
(8)
(9)
(10)

- Acceptable for use in DEAP
- Make and model shown at (1) and (2). Ensure these match window(s) being assessed. If in doubt, check with the supplier/manufacturer and retain their answer in writing.
- Ensure you have proof that this window make/model is installed in the dwelling being assessed. If it is not clear if the window being assessed matches the window system/type on the certificate, seek clarification from the supplier/manufacturer and retain their answer in writing.
- U-value for DEAP shown at (4) based on relevant standards
- g_∓ for DEAP shown at (10) based on relevant standards

BFRC certs are acceptable if relevant fields are shown. However, some BFRC certs don't show the U-value and g value required. Only use documents showing the relevant performance data. Verify the BFRC certificate number against the BFRC website www.bfrc.org.

Other certified data is acceptable subject to meeting requirements in Section 3.2 of this document for both U-value and solar transmittance. **BR443 Section 12 details the relevant standards for door U-value derivation.**

Overview of IS EN ISO 10077-1

EN 10077-1 is a simplified method for calculating the U value of a glazed unit. It relies on knowing (amongst other things) the following:

- Thermal transmittance values of the glazing
- Transmittance factors for the gas / air mix
- Transmittance factors for the frame material
- Linear transmittance of the frame (i.e. bridging)

The standard gives several defaults for these values. If these defaults are not used then certified proof is required for the respective transmittance values that will be used, as per IS EN ISO 12567-1.

7.2.1 Window sizes and certified window data:

It is common practice to establish, e.g. through calculation or WEP/BFRC certificates or other certified data, a standard U-value for a window of 1.48m x 1.23m with a central vertical divider, comprised of one opening section and one fixed section. If the standard sized window (1.48 high * 1.23 wide) is used to establish the U-value using one of the

standards above by testing or calculation as appropriate, then that U-value can be used for a window of the same type with different dimensions.

A WEP/BFRC certificate is also acceptable for use for a window of the same type with different configurations (e.g. more than one opening).

Table 18 – Standard testing sizes of window and doors

Window or door?	Actual window/door size	Size of standard window/door (metres)
Window	$\leq 2.3\text{m}^2$	1.48 (-25%) * 1.23 ($\pm 25\%$)
Window	$> 2.3\text{m}^2$	1.48 (+25%) * 2.18 ($\pm 25\%$)
Door	$\leq 3.6\text{m}^2$	1.23 ($\pm 25\%$) * 2.18 ($\pm 25\%$)
Door	$> 3.6\text{m}^2$	2.00 ($\pm 25\%$) * 2.18 ($\pm 25\%$)

In the case of larger doors or windows, Annex E of the standard I.S.EN 14351-1:2006 details other standard sizes for U-value derivation, as set out in Table 3.1.

Note that the standard allows for tolerances in the dimensions of the test window/door; these are shown in Table 3.1 in brackets, as a percentage of the target dimension.

Normally, a U-value measured/calculated for the smaller test size, i.e. 1.48 m * 1.23 m, can only be used for other sizes of the same type with an area less than 2.3m². However, where the U-value of the glazing, U_g , is less than 1.9 W/m²K, a U-value measured/calculated for the smaller test size can be used for all sizes of that window model.

7.2.2 Windows frame factor

- Non-default frame factor must be for the standard window, or,
- Derive area-weighted average frame factor for all windows in the dwelling, or,
- Use defaults from Table 6c.

7.2.3 New glazing retrofitted to an existing frame

When an Assessor encounters retrofitted / upgraded glass in an existing window frame, they may well need to resort to the default window U-values in DEAP, bearing in mind that the U-value entered is for the entire opening (glazing + frame). Non-default values are used where there is sufficiently evidenced information to carry out a calculation to IS EN ISO 10077-1. It is unlikely that IS EN ISO 10077-2 (detailed calculation) or IS EN ISO 12567-1 (measurement) would be feasible in this case. Also, to use a non-default U-value, an Assessor would require a certified solar transmittance value as outlined above.

If intending to carry out an IS EN ISO 10077-1 calculation, the defaults must be used for any non-certified data. In any calculations being carried out, in the case where a choice needs to be made on unknown parameters, the more pessimistic option must be chosen (i.e. chose the option yielding the higher window U-value).

It is unlikely that the assessor will have access to non-default information of the existing frame into which the new glass is being installed. If intending to carry out a U-value calculation rather than resorting to defaults for the entire window, use defaults for the frame provided in IS EN ISO 10077-1 and follow the approach in IS EN ISO 10077-1 to combine certified data for the glazing (if available) with defaults for the frame. Otherwise, a default for the entire window (including frame and glazing) from the DEAP manual must be used. Calculation of overall U value according to IS EN ISO 10077-1 can be carried out in U value calculators such as that published by BRE provided adequate certified non-default is available for the glazing at least.

When specifying a non-default window U-value in DEAP, a certified non-default solar transmittance value must accompany it.

7.3 Window overshadowing

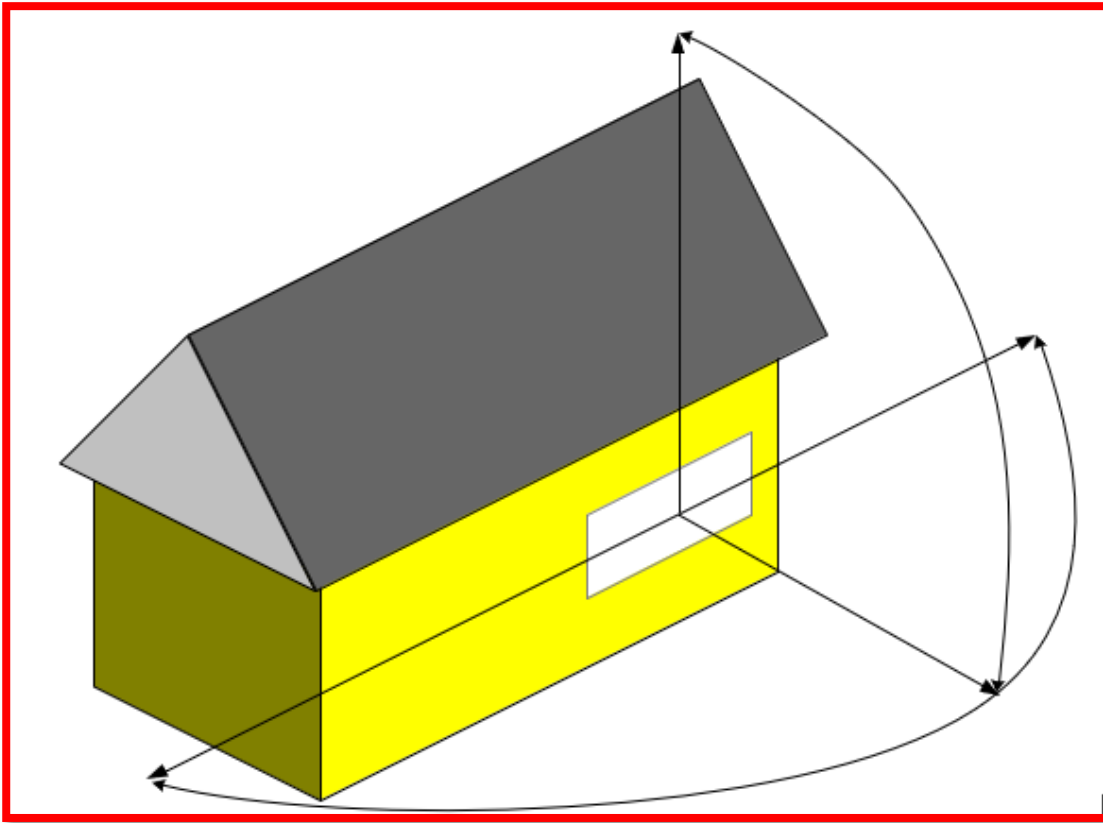
Assessors are required to select the appropriate overshadowing category from Table 6d of the DEAP manual for each window in the dwelling. Overshading of a window is an **estimate** of the sky which is blocked when viewed outwards from the centre point of the window in question. The skyline to be considered is in front of and above the window's centre point, as illustrated in the following diagram. Objects obscuring the skyline below or behind the window centre point should be ignored. Objects obscuring the skyline may be close to the window, such as balconies and window reveals, or far away from the window, such as landmasses and other buildings.

Alternatively, think of the entire surroundings of the window as being a sphere. The areas behind and below the window are not relevant for overshadowing estimation, so only the quarter sphere above and in front of the window should be considered, again as illustrated in Figure 7.2.

In borderline cases where the Assessor is unsure of the appropriate overshadowing category, then the more conservative option must be chosen. For example, if the overshadowing category lies between "Average" and "More than average", and the Assessor is unsure which one is applicable, then "More than average" is selected.

For sloping roof-windows and sloping solar PV/solar thermal collectors, the approach is like the above guidance on vertical windows. The area behind and/or below the sloping roof-window / solar PV / solar thermal collector is not relevant for overshadowing estimation. Only consider the sky upward from the horizontal plane and outward from the midpoint of the roof-window / collector when evaluating overshadowing. Solar PV and solar thermal overshadowing factors are detailed in DEAP Table H3.

Figure 7.2 - Window overshadowing



7.4 Skylights, solar tubes

In some types of room - e.g. north-facing rooms with external overshadowing, internal corridors in detached bungalows - it is difficult to achieve adequate daylight penetration using windows alone. In this case a rooflight extending to the ceiling below may be used to provide adequate natural lighting. In a dwelling with an uninhabited attic space the light must be transmitted from the rooflight to the ceiling of the living space with minimal losses. To do this a solar tube is installed. This is usually a metal cylinder with a highly reflective internal surface so that as much light as possible is conveyed to the interior of the dwelling as seen in the Figure 7.3.

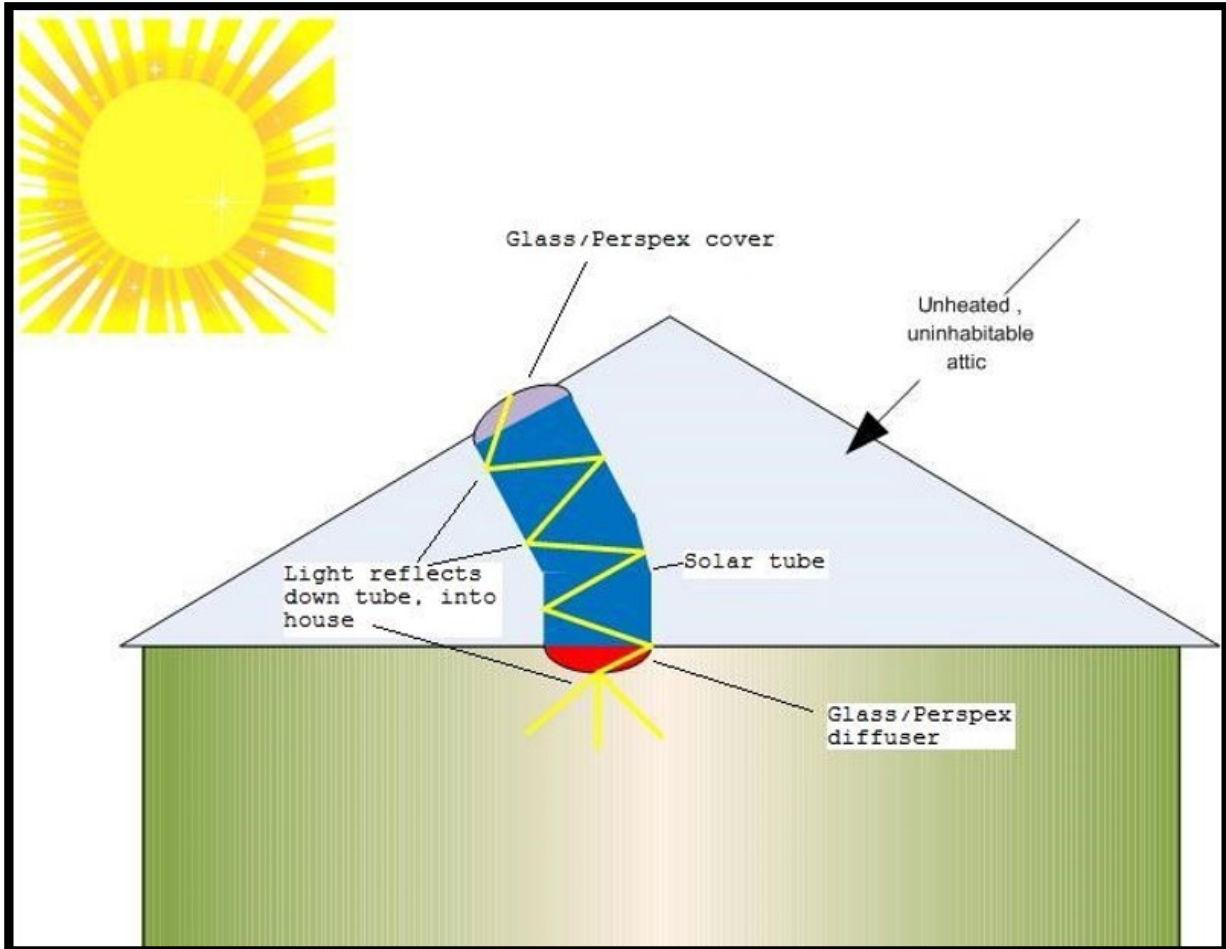
The skylight/solar-tube combination admits natural light to the dwelling so is treated as a window in DEAP. There is glazing/Perspex at the top of the tube to admit light and prevent moisture entering. Usually there is also a layer of glazing or Perspex at the bottom of the tube – the area marked in red in the diagram – which acts as a diffuser, spreading the light evenly through the room. In this case the rooflight is treated as being double-glazed, air-filled, with a gap $\geq 16\text{mm}$.

If there is no glazing/Perspex at the bottom of the tube then only the upper glazing (which could be single, double or triple glazed) is assumed. In addition, the walls of the solar tube are now considered to be part of the thermal envelope and so must be included as heat loss walls in DEAP. If the tube is cylindrical, the heat loss area of the tube is estimated from the length and diameter of the tube (for a tube with circular cross-section the opaque heat loss area = $\pi \cdot d \cdot l$, where 'd' is the diameter and 'l' the length of the tube).

Default U-values may be assumed unless the Assessor observes evidence to the contrary during the BER survey. In some cases, the tube may also be rectangular with plastered walls.

As always, detailed records of observations and calculations should be made and retained by the Assessor and comments relating to how the solar tube was treated are also recommended.

Figure 7.3: Solar tube



Example 1

A circular rooflight – diameter 50 cm - is connected to a solar tube – 1.3m in length - passing light through a Perspex diffuser into the central corridor of a detached bungalow built in 2002. How is this accounted for in DEAP?

- Window area = $\pi * r^2 = \pi * d^2 / 4 = \pi * (0.5)^2 / 4 = 0.20 \text{ m}^2$.
- Double-glazed, air-filled, gap $\geq 16\text{mm}$
- Table 6a gives a U-value = $2.7 \text{ W/m}^2\text{K}$. The "Roof window" option in DEAP should be selected.

Example 2

A rectangular rooflight opening with dimensions 1m * 0.5m - is connected via an elongated plastered rectangular section, 1.3m long, through an unheated attic passing light into the central corridor of a detached bungalow built in 2002. This elongated rooflight is open at the bottom and has a single glazed external surface. How is this accounted for in DEAP?

- Window area = 0.5m².
- Single-glazed – Table 6a gives a U-value = 4.8 W/m²K.
- The “Roof window” option in DEAP is selected.
- Heat loss wall area: i.e. area of plastered section between dwelling and unheated attic = 1.3 * (1+1+0.5+0.5) = 3.9 m².
- Wall U-value: built in 2002, default U-value from Table S3 = 0.55 W/m²K.
- The “Wall is semi-exposed” option is selected in DEAP as the attic is unheated.

7.5 Roof windows

A window is treated as a roof window if it is inclined at an angle of less than 70° from horizontal. Otherwise, treat it as a standard vertical window. This is defined in DEAP Table 1b. Roof windows are treated differently from vertical windows in 2 ways: orientation and U-value.

Orientation

For roof windows there are only two possible orientations in DEAP:

- North: when the roof window is oriented within 30° of North;
- Horizontal: for all other orientations.

Example 1:

During an attic conversion a window is built into the line of a roof having a pitch of 30°. The roof is oriented 15° West of North. What is the orientation of the window?

Answer: The pitch of the window is less than 70° so it is a roof window. The window is oriented within 30° of North so the orientation must be “North”.

Example 2:

A vertical dormer window faces 25° East of North. The pitch of the roof is 45°. How is the window treated in DEAP?

Answer: This dormer window is a vertical window in a pitched roof. It is treated as a vertical window, not a roof window. It is 25° from North, 20° from North-East so the appropriate orientation is “North-east”.

Example 3:

An existing dwelling has three roof windows in a south-facing roof with a pitch of 30°. How are the windows treated in DEAP?

Answer: The pitch of the windows is less than 70° so they are roof windows. The roof is *not* oriented within 30° of North so the orientation must be “Horizontal”.

U-value

DEAP adjusts the U-value of a roof window to account for the different direction of heat flow compared to a vertical window. Details of the adjustment are given in footnotes of DEAP Manual Table 6a. When adding a roof window in DEAP, select the “Roof Window” option. DEAP will automatically adjust the U-value. The adjustment applies to default or non-default U-values alike.

7.2.4 Perspex or plastic roofing

Perspex or plastic roofing is treated as glass when relying on defaults for solar transmittance and U-values. If there is more than a single layer (e.g. double or triple layers of Perspex) assume it is double or triple glazing air filled. Use the associated default U-values and solar transmittance for entry in DEAP as a roof window:



7.6 Door entries in DEAP

7.6.1 Number of doors

DEAP requires detail of the number of doors in the dwelling.

Example: A new dwelling with 2 identical external doors, one at the front and one at the rear.

For each door, area = 1.85m² and U-value = 3 W/m²K. In this case the door details can be entered in either of the following ways in DEAP: Note that in both cases the Total Heat Loss Door Area = 3.7m².

(i) Doors entered separately:

FLOORS	ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS	
Count	Room	Type	Description	Draught Stripped	Area [m ²]	U-Value [W/m ² K]	
1		Solid exposed door	Front door - solid wood	Yes	1.85	3.000	
1		Solid exposed door	Back door - solid wood	Yes	1.85	3.000	
Total Heat Loss Door Area [m ²]					3.70		+ ADD DOOR

(ii) Doors entered together:

FLOORS	ROOFS	WALLS	ROOMS	DOORS	WINDOWS	GLOBAL FACTORS	
Count	Room	Type	Description	Draught Stripped	Area [m ²]	U-Value [W/m ² K]	
2		Solid exposed door	Front and back doors - solid wood	Yes	1.85	3.000	
Total Heat Loss Door Area [m ²]					3.70		+ ADD DOOR

In DEAP 4, when entering a door, the draught-stripping is also specified:

7.6.2 Solid wooden and PVC doors: U-values

The default U-value for a solid wooden or PVC door is 3 W/m²K. A non-default door U-value may also be used once supported by the appropriate certification as outlined in Section 3.2 of DEAP and BR443 Section 12.

7.6.3 Glazed doors – U-value

In DEAP Section 6.2, a glazed door is one having between 30% and 60% glazing. The default U-value for a solid wood or PVC door is 3 W/m²K. Modern double and triple-glazing has a lower U-value, so the presence of glazing may lower the overall U-value of the door. If certified data is not available for the glazed door U-value, it can also be determined using the following formula:

$$U_{door} = \frac{(U_{glass} * \%_{glass}) + (U_{frame} * \%_{frame})}{100}$$

- U_{glass} is the U-value of the glazing, which may be taken from certified data or defaulted from DEAP Table 6a or S9;
- $\%_{glass}$ is the percentage of glazing in the door;
- U_{frame} is the U-value of the door frame which is taken to be 3 W/m²K;
- $\%_{frame}$ is the percentage of door frame.

Example A PVC door (area measured to be 1.9 m²) in an existing dwelling has a 0.8 m² of double-glazing, with a manufacturer’s date-stamped indicating an installation date of 2005. What is the adjusted U-value of the door?

- $U_{glass} = 2.2$ W/m²K - taken from Table S9,
- $\%_{glass} = 100 * 0.8 / 1.9 = 42.1\%$
- $U_{frame} = 3$ W/m²K, the default U-value for a PVC (or solid wooden) door,
- $\%_{frame} = 100 - 42.1 = 57.9\%$

$$U_{door} = \frac{(2.2 * 42.1) + (3 * 57.9)}{100} = 2.66 \text{ W/m}^2\text{K}$$

8. Water Heating

This section supplements the guidance in the DEAP Manual, focussing on,

- Changes to water heating methodology introduced in DEAP 4
- hot water storage,
- controls,
- combination water heaters (a.k.a. combi boilers)
- instantaneous water heaters.

8.1 Common Shower Systems

There are a number of types of shower system commonly used in Ireland. As these different systems use different amounts of hot water, BER Assessors will need to be able to identify them in order to account for them correctly in DEAP.

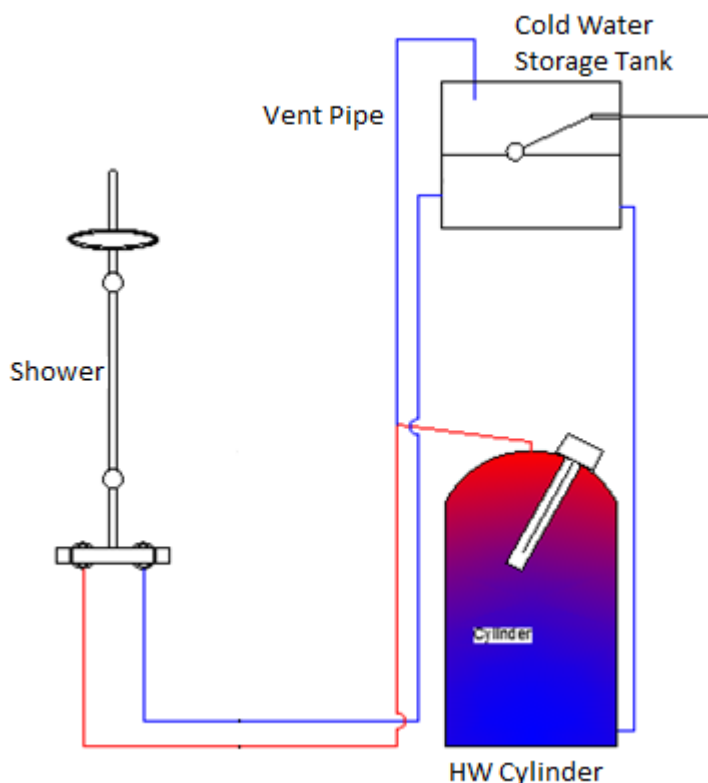
In this section we describe the most common systems, including key features that will help identify the system type in the BER survey.

8.1.1 Vented hot water system

This is the most common system in Irish homes. It is shown schematically in the Figure 8.1.

In this system the HW cylinder is heated by a boiler or heat pump or immersion, or a combination of these systems. It may also be heated by a solar thermal system.

Figure 8.1 - A schematic diagram of a Vented Hot Water system.



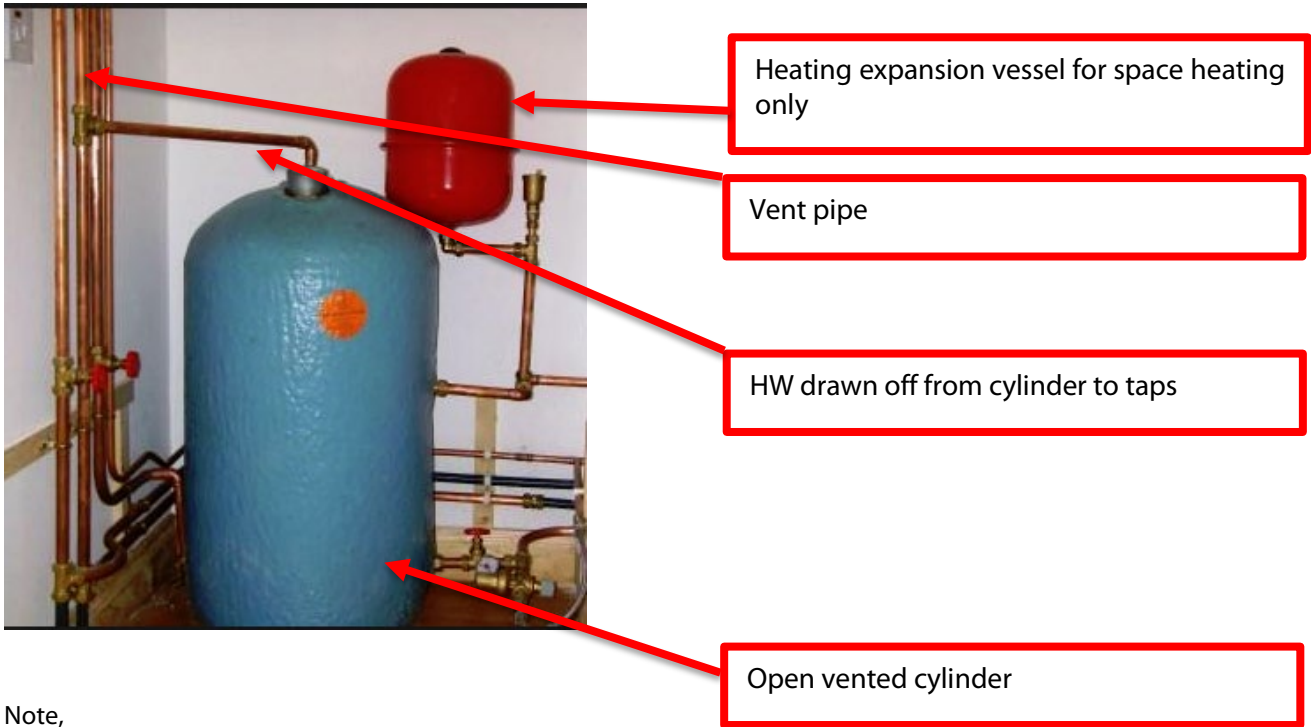
The key feature for identification is the Vent Pipe which rises from the pipework adjacent to the hot water cylinder and terminates over the cold water storage tank.

The key features for identification of the Vented HW system are as follows:

A Vent Pipe: Water is drawn from the cylinder through a horizontal pipe exiting at or near the top of the cylinder. In a vented system this pipe will connect to a vent pipe, which extends vertically upwards (Figure 8.2). The vent pipe is there to allow any excess hot water to drain off safely into the cold water tank and to let any trapped air escape.

The vent pipe terminates over the cold water storage tank (Figure 8.3).

Figure 8.2 - A photograph of a Vented Hot Water system.



Note,

- the HW Cylinder,
- the horizontal pipe through which hot water is drawn-off from the cylinder,
- the Vent Pipe which rises from the pipework adjacent to the hot water cylinder and terminates over the cold water storage tank.

Figure 3 - A vent pipe terminating over the cold water storage tank.



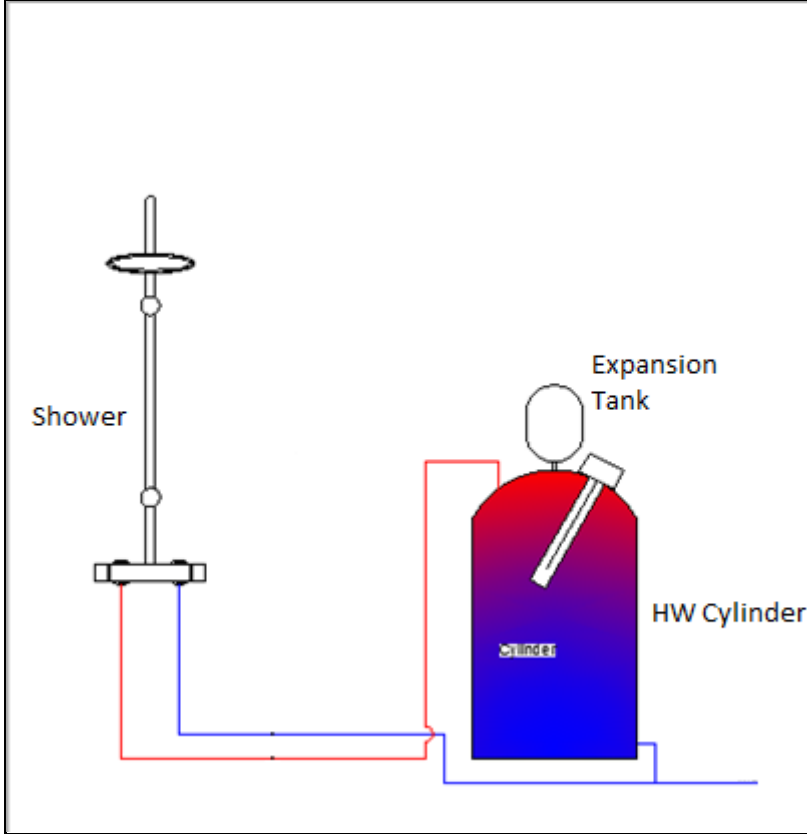
The presence of the vent pipe indicates that this is a vented system.

Hot Water Pump: The vented system can work with or without a pump. Assume the most conservative value, i.e. that there is a pump on the shower, unless you can show otherwise.

8.1.2 Unvented hot water system

The unvented hot water system is less common in Ireland than the vented system but it is seen in newer installations often in combination with newer technologies such as heat pumps. The unvented hot water system is shown schematically in Figure 8.4.

Figure 8.4 – A schematic diagram of an Unvented Hot Water system.



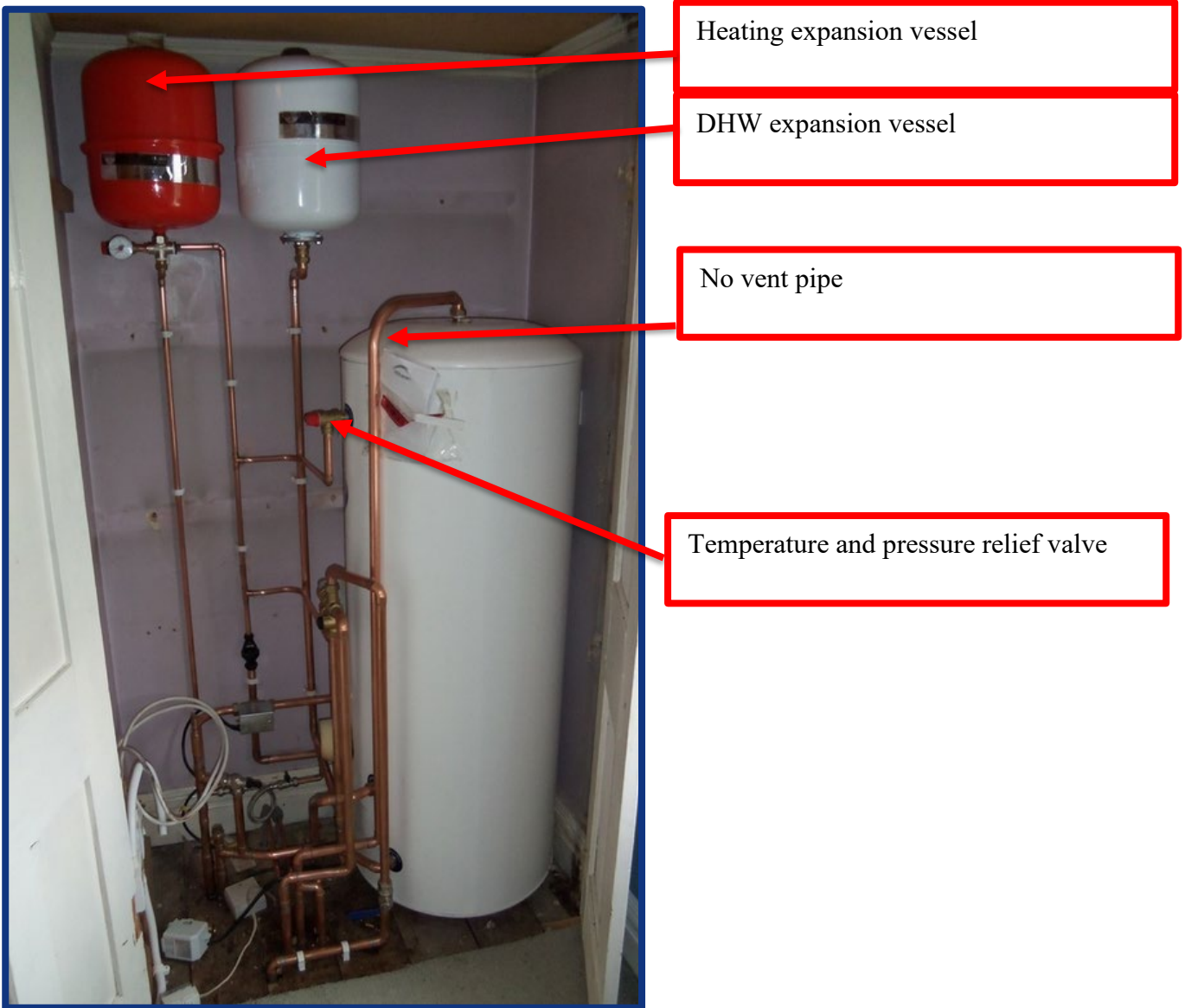
The key features for identification of the unvented HW system are as follows (see Figure 8.6):

- **No vent pipe:** As it is not a vented system there will not be a vent pipe rising to the cold water storage tank.
- **Expansion Vessels:** There should be an expansion vessel present to allow for the expansion of water as it heats. Expansion vessels on the space heating system are usually red whereas expansion vessels on unvented water heating systems would usually be blue or white, as in the picture below. However, it is best to double check which pipework the expansion vessel is connected to.

Figure 8.5 – Expansion vessels for unvented systems. The white and blue vessels are used on water heating systems whereas the red is used for space heating.



Figure 8.6 – An unvented hot water cylinder



- **Temperature and Pressure Relief Valve:** In order to prevent the water pressure from building to unsafe temperature and pressure levels, the system has a relief valve installed on the cylinder.

Figure 8.7 – A Relief Valve installed on a hot water cylinder.

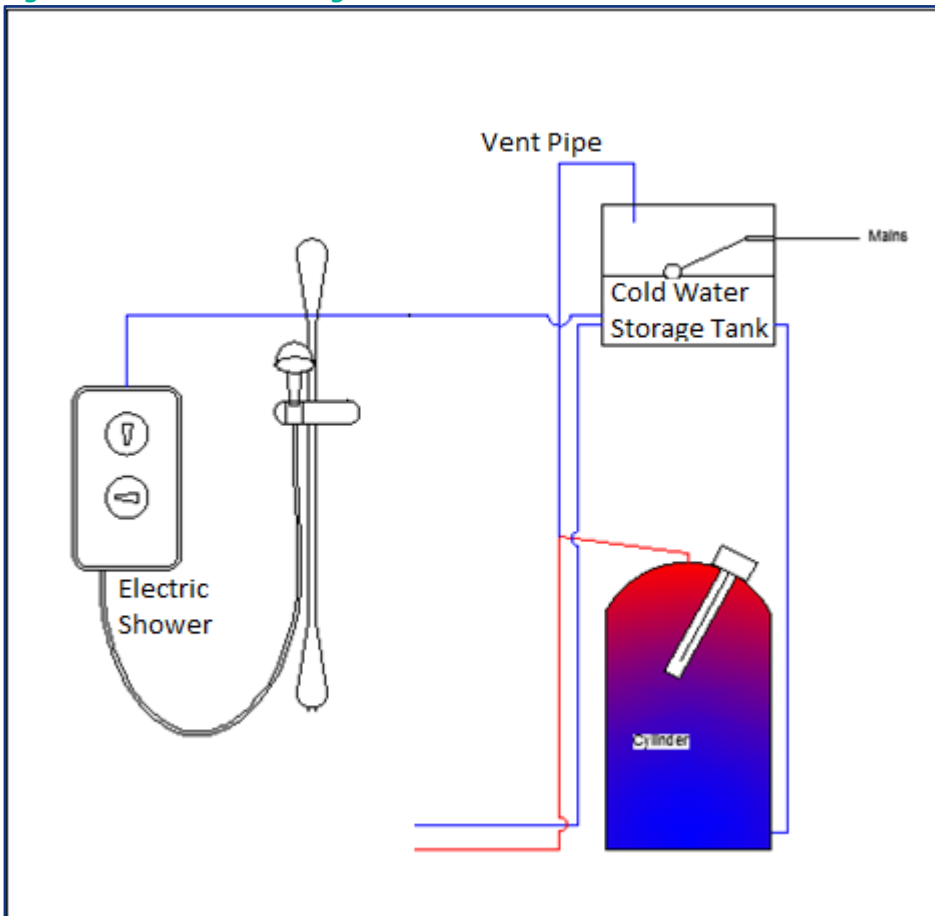


- An unvented system can operate with or without a cold water storage tank, so this is not generally a decisive factor in identifying the system type.

8.1.3 Instantaneous electric shower

An electric shower is a device which uses electrical power to heat *cold* water at the point-of-use, i.e. cold water is heated in the shower unit which is generally located on the shower wall. It does not draw water from a hot water cylinder. The electric shower system is shown schematically in Figure 8.8.

Figure 8.8 – A schematic diagram of an Electric Shower.



The key features for identification of the Electric Shower system are as follows:

- **Wall unit:** There will be a unit on the shower wall, with controls to adjust the temperature and flow-rate of the water. See Figure 8.9.

- **Single supply pipe:** An electric shower has a cold water supply only, i.e. it does not take hot water from the DHW cylinder (or from any other source). If the pipework is visible then there should only be one pipe supplying water to the unit.

Figure 8.9 – An electric shower.

The wall unit in which the water is heated.



- **Isolator Switch:** Because of the high power rating of electrical showers there will typically be an isolator unit present. It is often located on the ceiling and switched on using a pull-cord, or it can be located on a wall at the entrance to the bathroom/en-suite as shown in Figure 8.10.

Figure 8.10 – A wall-mounted isolator switch (left), and a ceiling-mounted isolator switch (right) for an electric shower.



8.1.4 Power Showers

A power shower is a unit that pumps hot and cold water to the shower. It does not heat the water. As such it is a mixer shower; it is not an electric shower.

It should be entered as a Mixer Shower – Vented hot water system + pump.

It can be difficult to distinguish between power showers and electric showers: if the pipework is visible,

- a power shower has 2 supply pipes (hot and cold),
- an electric shower only has one supply pipe (cold).

Otherwise the best approach is to look for a manual for the model installed, which are widely available online.

8.1.5 Shower heated by a Combi boiler or CPSU

A shower that gets its hot water from a Combi boiler or CPSU should be entered as a Mixer Shower supplied by an Unvented Hot Water system.

8.1.6 Shower supplied by a Thermal Store

A shower that receives its hot water from a thermal store rather than a cylinder should be entered as a Mixer Shower supplied by an Unvented Hot Water system.

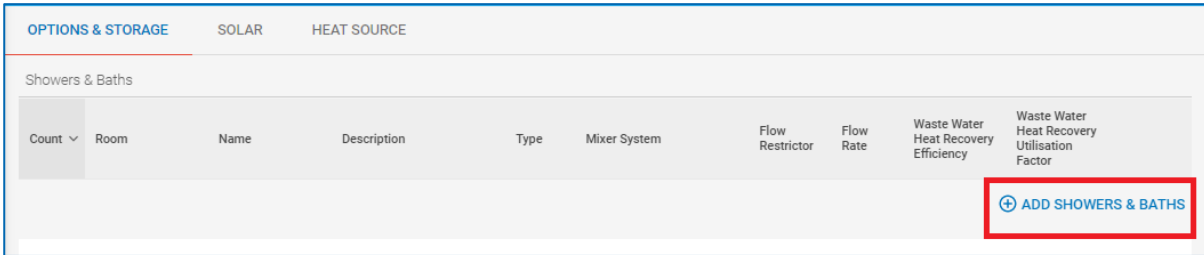
8.2 Entering Default shower Data into DEAP 4.2

In most BERs, particularly for existing dwellings, there is likely to be little or no information available on the showers in a dwelling. To simplify data entry for those cases, there are 4 default shower types available in the DEAP Library:

- Instantaneous electric shower,
- Mixer Shower – Vented hot water system,
- Mixer Shower – Vented hot water system + pump,
- Mixer Shower – Unvented hot water system.

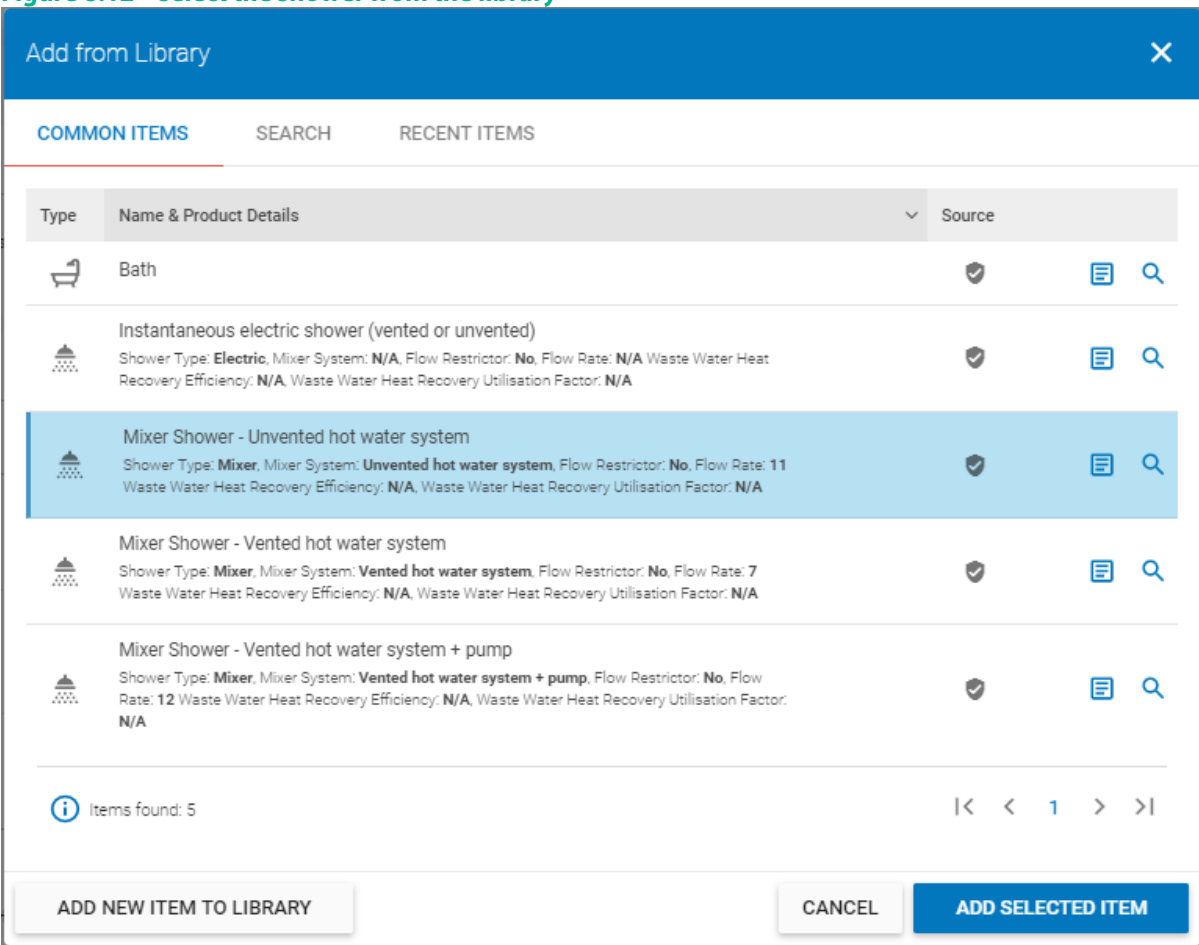
To add a shower, in Water Heating select the option to “Add Showers & Baths”:

Figure 8.11 – adding a shower



In the search screen that pops up select the appropriate line,

Figure 8.12 – select the shower from the library

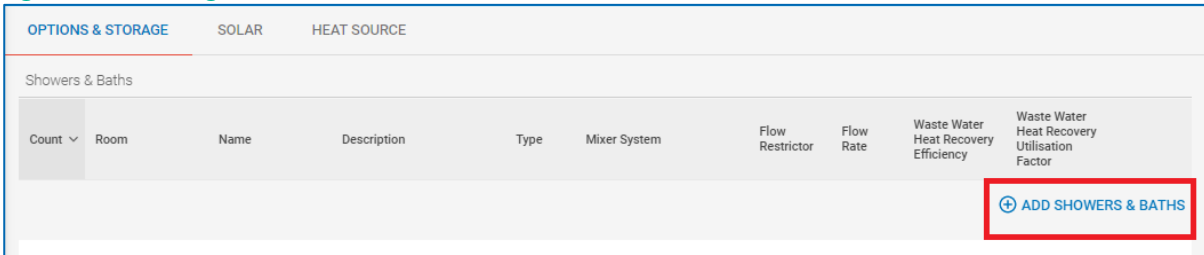


and click "Add Selected Item" to add it to the BER.

8.3 Entering Non-Default Shower Data into DEAP 4.2

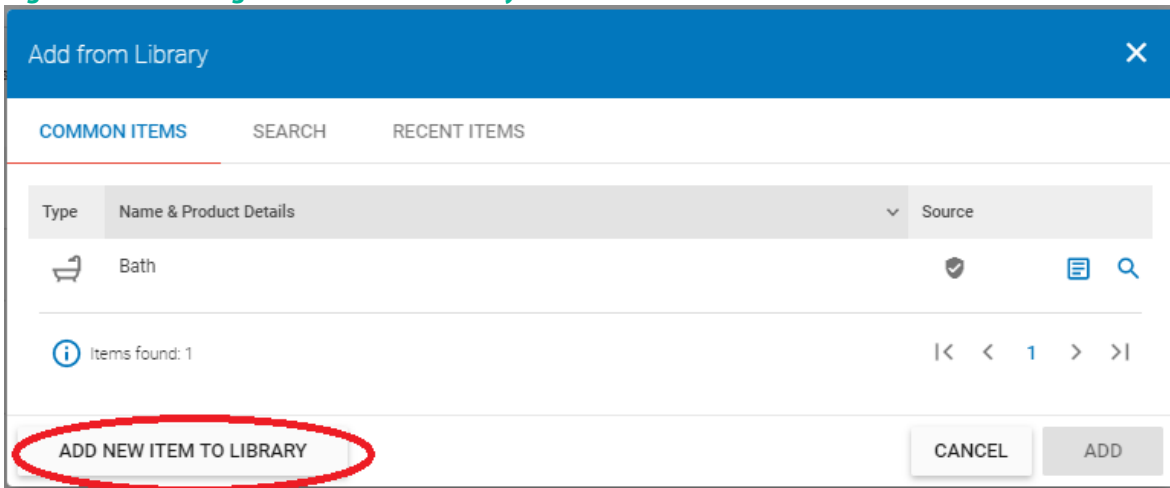
To add a shower, in Water Heating select the option to "Add Showers & Baths":

Figure 8.13 – adding a shower



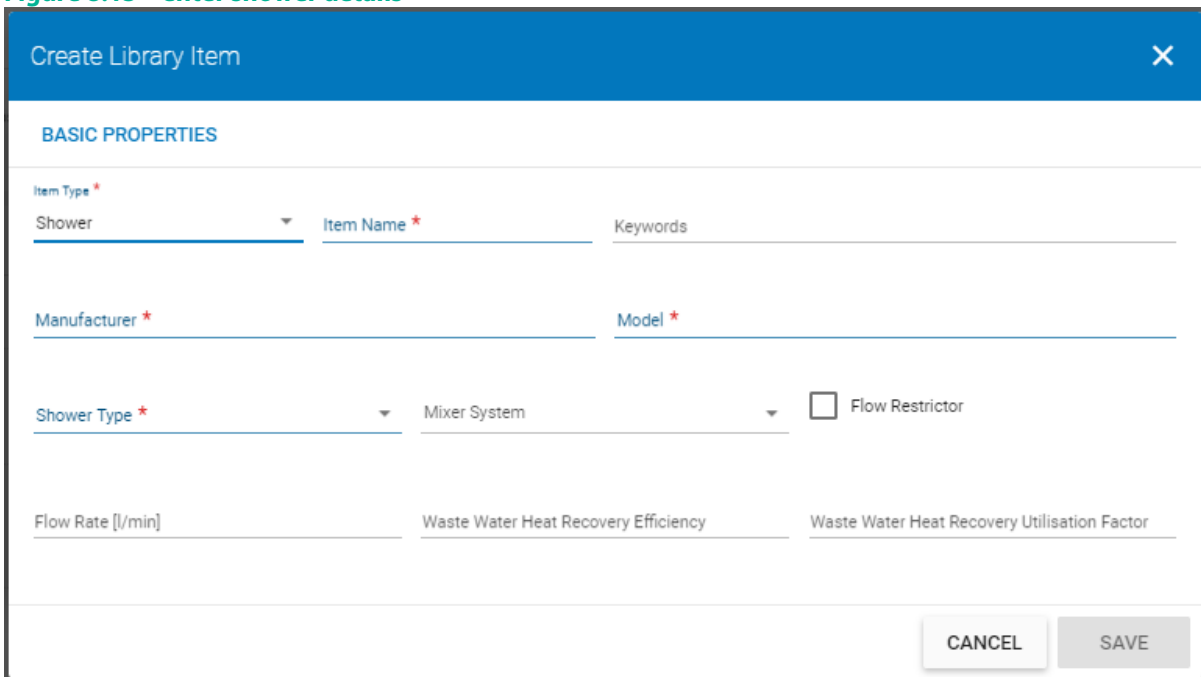
In the Search screen that pops up, to create a new shower select the option “Add New Item to Library”:

Figure 8.14 – adding a shower to the library



The data entry page for a shower is as follows:

Figure 8.15 – enter shower details



The following fields are text descriptions of the shower:

- Item Name – the name given to this shower in the DEAP Library,

- Manufacturer – the shower manufacturer,
- Model – the shower model.

Shower Type

There are 2 options in the dropdown:

- Electric – select this option for instantaneous electric showers;
- Mixer – select this option for all other shower types.

Note that for instantaneous electric showers no further information is required.

Mixer System

When you select ‘Mixer’ as the Shower Type you will need to select the Mixer System. There are 3 options to choose from based on the identification of the system as described in Section 1.1:

- Vented Hot Water System,
- Vented Hot Water System + Pump,
- Unvented Hot Water System.

Flow Rate

The flow rate is the amount of water flowing through a shower, measured in litres/minute.

When you choose a mixer type, DEAP will set a default Flow Rate for the shower, as follows:

Table 19 – Default flow rate for shower systems

Mixer System	Default Flow Rate (l/min)
Vented Hot Water System	7
Vented Hot Water System + Pump	12
Unvented Hot Water System	11

It is possible to enter a *non-default* flow rate for a shower as described later in this section.

Flow Restrictors

A Flow Restrictor is a device used to reduce the rate of water flow through a shower. In order to be considered in DEAP, a flow restrictor must be permanently fitted, i.e. cannot be removed without the use of tools. The European Water Label product database - see <http://www.europeanwaterlabel.eu/> - has a database of flow restrictors.

In DEAP, where a flow restrictor has been fitted permanently to a shower, the “Flow Restrictor” checkbox should be ticked. This sets the default Flow Rate to 6 litres/minute for all mixer types.

A non-default Flow Rate can be used when there is evidence to substantiate it, e.g. a technical data sheet with a CE-marking, or, where the product is listed on the European Water Label product database.

Figure 8.16 – Flow restrictor data

The screenshot shows a 'Create Library Item' dialog box with the following fields and values:

- Item Type:** Shower
- Item Name:** Test Shower #1
- Keywords:** Mixer shower
- Manufacturer:** Test Manufacturer
- Model:** Test Shower Model
- Shower Type:** Mixer
- Mixer System:** Vented hot water system
- Flow Restrictor:** (highlighted with a red box)
- Flow Rate [l/min]:** 6 (highlighted with a green box)
- Waste Water Heat Recovery Efficiency:** (empty)
- Waste Water Heat Recovery Utilisation Factor:** (empty)

Buttons: CANCEL, SAVE

Non-default Flow Rates

Where sufficient data is available it is possible to use a non-default flow rate for a shower.

The flow rate depends on the shower unit and on the pressure of the water supplied to the unit. So, in order to use a non-default flow rate for a shower, an Assessor would typically need the following,

- Shower data sheet – showing the flow rate across a range of pressures – and with;
 - A CE-marking;
 - Test standard - EN 1112:2008.
 - European Water Label product database - see <http://www.europeanwaterlabel.eu/>
- Pump datasheet – showing the water pressure the pump is capable of providing – and with,
 - A CE-marking;
 - Test standard - BS 5000-11:2008.
 - European Water Label product database - see <http://www.europeanwaterlabel.eu/>


Example


In a house where the following shower and pump installed:

Figure 8.17 – Shower system with non-default flow data

EUPHORIA SYSTEM 160
Shower system with thermostat
for wall mounting
MODEL # 27296000

*Pure Freude
an Wasser*

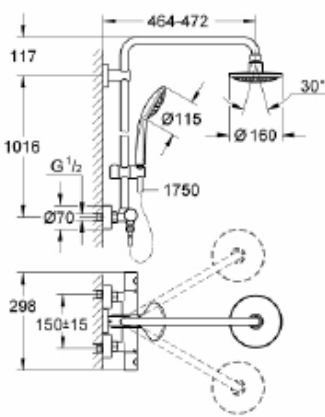




Product Description:
EUPHORIA SYSTEM 160
Shower system with thermostat for wall mounting

Standard Specification:
consisting of:
horizontal swivable 450 mm shower arm
exposed thermostat with Aquadimmer function
allows change between:
head shower Euphoria Cosmopolitan 160 (28 232 000)
spray pattern: Rain
with ball joint
rotation angle $\pm 15^\circ$
hand shower Euphoria 110 Mono (27 265 000)
adjustable in height with gliding element (12 140 000)
Silverflex shower hose 1750 mm (28 388)
minimum flow rate 7 l/min
GROHE DreamSpray perfect spray pattern
GROHE StarLight chrome finish
GROHE TurboStat compact cartridge with wax
thermoslement
SpeedClean anti-lime system
suitable for instantaneous heaters from 18 kW/h

Color:
 27296000 chrome



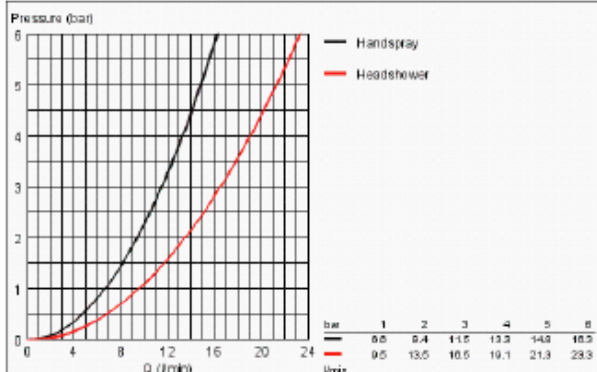
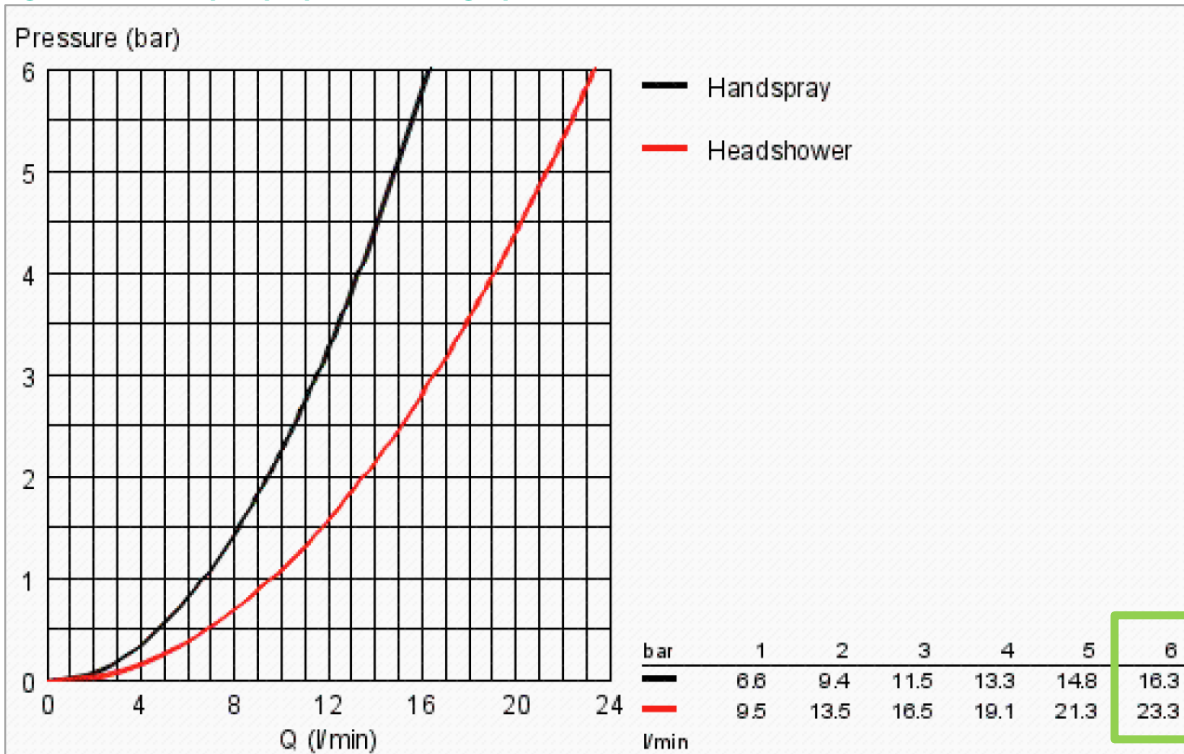


Figure 8.18 - The pump data plate – Maximum Pressure is 6 bar.



The pump brochure has the following graph of Flow vs. Pressure:

Figure 8.19 – The pump’s performance graph



At a pressure of 6 bar (the maximum pressure from the pump) the flow rate is 23.3 l/s.

In this case the shower has 2 outlets: a fixed shower head, and, a hand held shower head, which have different flow rates. In such scenarios the larger flow rate should be used.

This can be entered in DEAP 4.2 as follows:

Figure 8.20 – Entering the non-default flow rate

The screenshot shows the 'Create Library Item' form in DEAP 4.2. The form is titled 'Create Library Item' and has a close button (X) in the top right. Under the 'BASIC PROPERTIES' section, the following fields are visible: 'Item Type' (Shower), 'Item Name' (Thermo mixer shower), 'Keywords', 'Manufacturer' (Grohe), 'Model' (Euphoria System 160), 'Shower Type' (Mixer), 'Mixer System' (Vented hot water system + pump), and a checkbox for 'Flow Restrictor'. The 'Flow Rate (l/min)' field is highlighted with a red box and contains the value '23'. Below this are fields for 'Waste Water Heat Recovery Efficiency' and 'Waste Water Heat Recovery Utilisation Factor'. At the bottom right, there are 'CANCEL' and 'SAVE' buttons.

Note that the Flow Rate must be a whole number so 23.3 is rounded to 23 litres/min.

8.3.1 Waste Water Heat Recovery

A waste water heat recovery system uses a heat exchanger to recover heat from waste warm water as it flows through the waste plumbing system. It uses the recovered heat to pre-heat the cold water feed of a shower and a combi boiler or mains pressure hot water system (thermal store or unvented cylinder).

The energy recovered depends on the temperature of the cold water feed to the dwelling and type of systems that are installed.

WWHR systems are accounted for in DEAP 4.2 where they are linked to mixer showers, not for electric showers. There are three types of plumbing arrangements for WWHR systems:

- **System A:** output of the heat exchanger is fed to *both* the shower *and* the combi boiler or hot water system;
- **System B:** output of the heat exchanger is fed to the shower only;
- **System C:** output of the heat exchanger is fed to the combi boiler or hot water system but not to the shower.

To account for a WWHR system in DEAP 4.2 the following data is required:

- **Efficiency of WWHR:** this measures the efficiency of the heat recovery unit;
- **Utilisation Factor:** this takes account of shut-down and start-up losses. It is expressed as a factor between 0 and 1.

A WWHR system can only be entered in DEAP 4.2 if it is listed on the Product Characteristics Database (PCDB): <https://www.ncm-pcdb.org.uk/sap/index.jsp>

For each product listed on the PCDB, the data is given for each of the 3 possible system arrangements described: System A, System B, System C.

Example

For a New-Provisional BER, the specification, signed-off by the Architect, states that the shower in the main bathroom will use a Megaflo SHRU 60 WWHR system in a "System B" configuration. This system is listed on the PCDB:

Figure 8.21 – WWHR data from the PCDB

Type	Index number	Status
Waste water	080106	Normal
Brand	Model name	Model qualifier
Megaflo	SHRU 60	System B
Efficiency (%) [2009]	46.2	
Efficiency (%) [2012]	44.9	
Utilisation factor [2009]	0.968	
Utilisation factor [2012]	0.963	

which would be entered in DEAP 4.2 as follows, with the numbers rounded to 2 decimal places.

Figure 8.22 – Entering WWHR data

For a New Provisional or New Final BER, the presence of the WWHR system may be substantiated in a specification document signed-off by the architect, engineer, or assigned certifier for the dwelling.

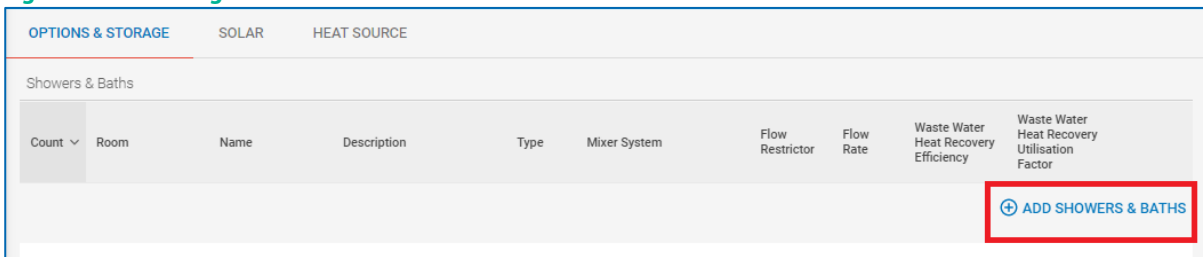
For an Existing BER, the presence of the WWHR system may be substantiated by invoices/receipts that clearly identify the system and dwelling address, or, a signed-off statement on headed-paper from the installer detailing the same.

8.4 Baths

In DEAP 4.2 each bath present in the dwelling should be accounted for.

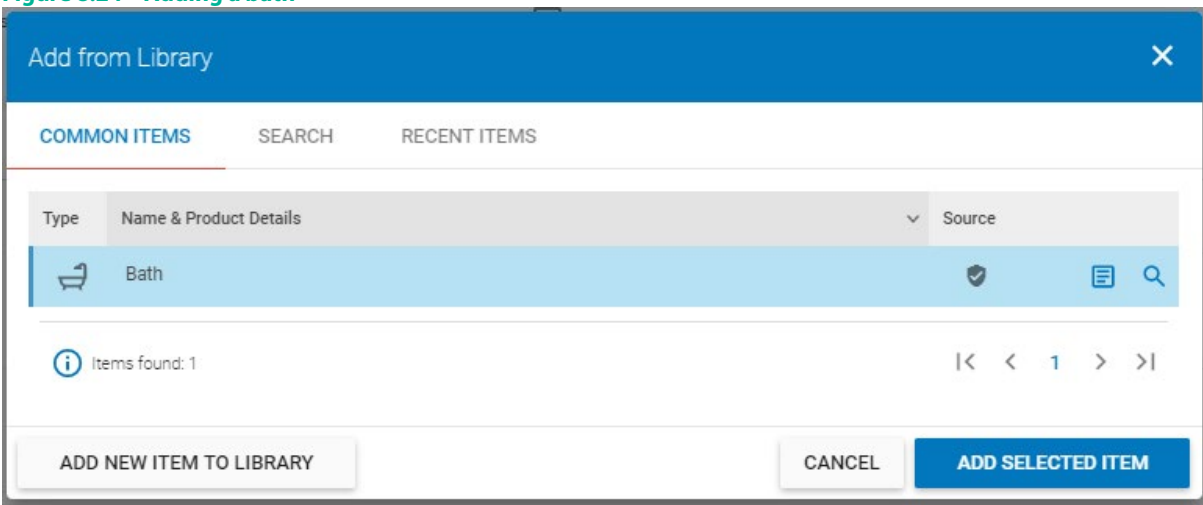
To add a bath, in Water Heating select the option to “Add Showers & Baths”:

Figure 8.23 – Adding a bath



In the Search screen that pops up, “Bath” is one of the “Common Items” listed.

Figure 8.24 – Adding a bath



Select it and click “Add Selected Item” to continue.

The bath will be added to the dwelling. No further information is required – DEAP will make the necessary adjustments in the background to account for the presence of the bath.

8.5 Low Water Usage

Hot Water Usage in DEAP is reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold). The Water Efficiency Calculation Tool (see <https://www.seai.ie/energy-in-business/ber-assessor-support/deap/>) is to be used to assess the water use within the dwelling.

Note that *this is an optional calculation* and does not have to be carried out as part of a BER for a dwelling.

8.6 Hot water storage

8.6.1 Hot water storage volume

The water cylinder volume is derived using DEAP Table 2a and the associated footnotes. In some cases, the cylinder or storage may be clearly much larger or much smaller than the values in Table 2a. In such instances, and in the absence of other information on labels or technical data based on relevant standards, the volume of a cylinder can be calculated by recording both the cylinder height and the diameter of the cylinder. The volume (which applies to hot water storage only) is then calculated as follows:

- $V = (\pi \times h \times d^2/4) / 1000$
Where:
 - d = diameter of the cylinder (cm)
 - h = height of the cylinder (cm)
 - pi = 3.142
 - V = volume of the cylinder (litres)
- When using the above formula, the average height should be estimated.

For Enclosed Water Heaters:

For rectangular storage units, the water heater volume is calculated by recording the height, width and depth of the unit if the heater is cuboid or the above formula if cylindrical. The cuboid volume is as follows:

- $V = h \times d \times w \times 1000$
Where:
 - d = depth of unit (m) minus the insulation thickness as appropriate.
 - h = height of unit (m) minus the insulation thickness as appropriate.
 - w = width of unit (m) minus the insulation thickness as appropriate
 - V = volume of the cylinder (litres)

Where multiple hot water cylinders are present in a dwelling the average insulation thickness is determined using the weighted volume of each cylinder.

Example 1: a dwelling has two cylinders heated by a boiler as follows:

- 70 litres with 50mm insulation
 - 80 litres with 20mm insulation
- The cylinder volume specified under "Water storage volume" is 150L

The insulation thickness specified in DEAP is $[(70 \times 50) + (80 \times 20)] / 150 = 5100 / 150 = 34\text{mm}$

For factory fitted insulation, the insulation thickness is measured at the pipe connections to the cylinder. If this is not feasible a needle or pin can be used to determine insulation thickness, ensuring, as always, that maximum care is taken, and no damage is done to the cylinder.

Example 2: The cylinder below has no label detailing the cylinder volume and is uninsulated.

It is necessary to obtain measurements on site to obtain the cylinder volume. The following measurements were obtained on site:

- Cylinder Total Height: 900mm
- Circumference: 1413mm



As per DEAP Table 2a note (b), the diameter of the cylinder can be obtained by dividing the circumference by pi (3.142). This gives a diameter of 450mm for the above cylinder. The volume of the cylinder in litres is then obtained by choosing the nearest height and diameter options from DEAP manual Table 2a. In this case the volume of the cylinder is 117 litres. Insulation thickness is not included in the height or diameter measurement.

Example 3: The dimensions of the cylinder below measured on site were as follows:

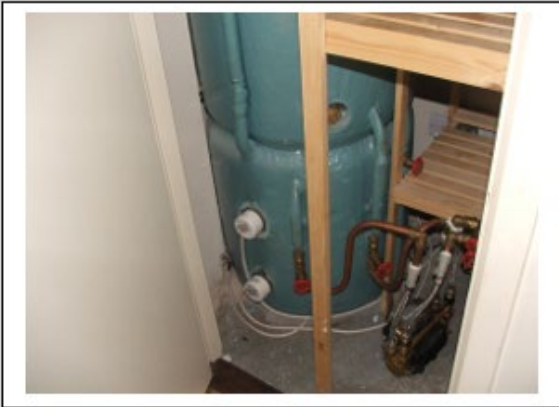
- Circumference: 1630mm. The diameter is therefore $1630/\pi = 518.8\text{mm}$
- Total height: 1120mm.



The insulation thickness could not be determined on site. The cylinder was installed in 2008 as proven by a receipt from the installer. A default insulation thickness from DEAP manual Table S11 of 35mm (factory applied insulation) is applied to the cylinder. The cylinder diameter without the insulation is $518.8\text{mm} - 70\text{mm} = 448.8\text{mm}$. The cylinder height without the insulation is $1120\text{mm} - 70\text{mm} = 1050\text{mm}$. From DEAP manual Table 2a, the nearest height and diameter options are a diameter of 450mm and a height of 1050mm giving a cylinder volume of 140 litres.

Example 4: The cylinder below is a dual cylinder as is often used in apartments.

The top half of the cylinder contains the cold-water storage tank in this case. The bottom half of the cylinder contains the hot water storage and is identifiable by the immersions.



We are only concerned with the hot water storage cylinder for storage losses in DEAP. We only measure the diameter and height of the bottom hot water storage to determine the hot water cylinder volume in this instance. The total diameter of the cylinder = 500mm. An insulation thickness of 25mm was determined. Therefore, the diameter of the cylinder without the insulation is 450mm. The total height of the hot water storage tank (bottom tank) was 700mm – 50mm (insulation thickness) = 650mm. From DEAP manual Table 2a, the nearest height and diameter options are a diameter of 450mm and a height of 675mm giving a cylinder volume of 84 litres.

Note for the examples above the hot water storage vessel volume may alternatively be determined from measured data according to BS 1566 or IS EN 12897. Cylinder standing losses may also be stated on an NSAI Agrément Certificate or equivalent.

The cylinder loss stated on labels / name-plates can be used where,

- the label has a CE-marking and states the relevant standard;
- or,
- the label has a reference to the relevant Ecodesign or Energy Labelling Directive.

In the event of a single cylinder with factory AND lagging insulation or two cylinders (one with factory, and one with lagging insulation), see Example 2 in Section 8 below.

8.7 Water heating controls

The DEAP Manual Table 2 details the “temperature factor unadjusted” and associated multiplier figures applied in DEAP based on water heating controls. Information required during site survey for selection of the factors is as follows where a hot water cylinder is heated by a boiler or heat pump:

- Presence of a cylinder thermostat
- Separate time control of the water heating

Other factors are considered for other storage types (e.g. thermal stores, combi boilers, CPSUs) as detailed in DEAP Table 2. The following examples show the effect of varying time and temperature control and the effect on the temperature factor and multiplier in DEAP.

<p>Example 1: No separate time control and no temperature control</p> <ul style="list-style-type: none">• Main space and water heating: Open fire with back boiler to radiators and cylinder• Controls: none• Values selected by DEAP:<ul style="list-style-type: none">○ Temperature factor: 0.6 for cylinder (indirect) as per table 2.○ Temperature factor multiplier: 1.3 (no timer or cylinder thermostat) <p>Note, if an immersion is the main water heater, the multiplier is always 1 as detailed in Table 2 of the DEAP manual.</p>
<p>Example 2: Separate time control only</p> <ul style="list-style-type: none">• Main water and space heating: Oil boiler heating radiators and cylinder• Controls: full programmer allowing the user to set separate times for space and for water heating. No thermostatic controls. See DEAP 9.3.3.• Values selected by DEAP:<ul style="list-style-type: none">○ Temperature factor: 0.6 for cylinder (indirect) as per table 2.○ Temperature factor multiplier: As there is no cylinder thermostat the multiplier 1.3 applies. As there is separate time control of water heating, the multiplier of 0.9 also applies. The multiplier entered in DEAP is therefore $1.3 \times 0.9 = 1.17$.
<p>Example 3: Temperature control only</p> <ul style="list-style-type: none">• Main space and water heating: Gas boiler• Controls: No time control. Has cylinder thermostat.• Values selected by DEAP:<ul style="list-style-type: none">○ Temperature factor: 0.6 for cylinder (indirect) as per Table 2○ Temperature factor multiplier: 1. Table 2 multipliers from notes a) and b) do not apply as there is no time control and there is separate temperature control.
<p>Example 4: Separate time and temperature control</p> <ul style="list-style-type: none">• Main space and water heating: Oil boiler• Controls: Programmer allowing the user to set separate times for space and for water heating. Cylinder thermostat present.• Values selected by DEAP:<ul style="list-style-type: none">○ Temperature factor: 0.6 for cylinder (indirect) as per Table 2.○ Temperature factor multiplier: As there is cylinder thermostat, the multiplier 1.3 does not apply. As there is separate control of water heating, the multiplier of 0.9 applies. The multiplier in DEAP is therefore 0.9. <p>Note that for such systems in existing dwellings, as per Table S11 of the DEAP Manual, Boiler Interlock is assumed present if there is a room thermostat and (for stored hot water systems) a cylinder thermostat. DEAP Section 9.3.9 provides further detail on boiler interlock.</p>

The following examples show systems with and without cylinder thermostats:

Example: Cylinder thermostat attached to the side of the cylinder



The cylinder thermostat is accounted for in DEAP if it provides the level of control outlined in DEAP 9.3.7. The following must be borne in mind:

1. Does it measure the temperature of the cylinder? (YES)
2. Does it switch on and off the water heating? (YES)
3. Can a single target temperature be set by the user? (YES)

Example: TRV with a sensing loom attached to side of the cylinder



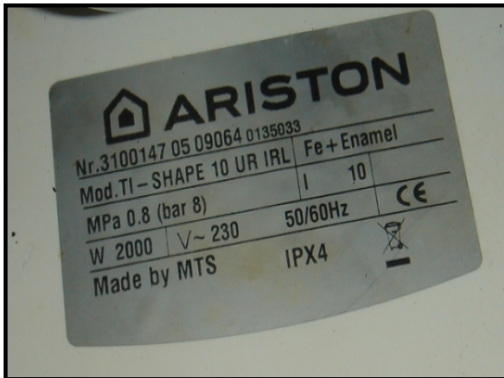
This is not counted as a cylinder thermostat in DEAP:

1. Does it measure the temperature of the cylinder? (YES)
2. Does it switch on and off the water heating?
(NO): The device is not wired back to a motorised valve, programmer or boiler. It merely closes off the flow through the cylinder coil.
3. Can a single target temperature be set by the user? (NO): The TRV doesn't show temperatures and does not allow the user to set a temperature (e.g. 60°C).

In other instances, the water temperature of the pipework rather than cylinder is being measured. Again, this does not count as a cylinder thermostat in DEAP as the cylinder temperature is not being measured.

8.8 Instantaneous electric water heaters

Figure 8.25: Instantaneous water heater data plate



An instantaneous electric water heater is a unit containing an electric heating element used to provide on-demand hot water, i.e. when the hot water tap is opened the electric element is switched on, thereby heating the cold water passing through it. These units are frequently located at the point of use, e.g. under the sink. They may contain a small insulated hot water store to be included in the water storage volume in the Water Heating section in DEAP. If a unit has a water store its volume may be detailed on a product data plate as shown in Figure.

In this case the volume is 10 litres. The data plate must have a CE-mark or reference to a national standard or equivalent to use the volume shown in DEAP. Where insulation thickness isn't detailed and can't be measured, the default thicknesses based on dwelling age band from DEAP Table S11 are used. The examples below show how these systems are treated in DEAP.

Example 1

Consider a one-bedroom apartment with hot water provided by three identical instantaneous electric water heaters: one for the bath, one for the bathroom sink, one for the kitchen sink. A CE-marked data plate on the instantaneous heaters states that each unit has a 10-litre hot water store insulated by 15mm of high density polyurethane foam. How is this treated in DEAP?

The hot water storage of each instantaneous heater must be accounted for in DEAP. The DEAP inputs are as follows:

- Water heating tab:
 - Are there Storage Losses: "Yes".
 - Water Storage Volume (for the three water heaters): $10 \times 3 = 30$ litres.
 - *Temperature Factor Unadjusted*: 0.6 - equivalent to a cylinder heated by an electric immersion *as per DEAP Table 2*.
 - Temperature Factor Multiplier: 1.
 - Insulation Type on Water Store: Factory Insulated.
 - Insulation Thickness [mm]: 15.
 - *Are there Distribution Losses*: "No" – If the heater is at the point of use, there are no distribution losses. If the heater is not at the point of use, e.g. a multi-point electric water heater providing hot water to taps in several different rooms, then there will be distribution losses.
 - Is supplementary electric water heating used in summer: "No".
 - *Primary Circuit Loss Type*: "Electric Immersion heater" – this is chosen when instantaneous electric heaters are the main water heating system.
- Energy Requirements tab:
 - Efficiency of main water heating system: 100%.
 - *Efficiency adjustment factor*: 1 (none of the values in DEAP Table 4c apply)
 - Main water heating system fuel: Electricity.

Example 2

A detached house has a regular oil boiler and a 110-litre hot water cylinder with a 25mm thick lagging jacket. The house has an extension with a WC with hot water provided by an instantaneous electric heater. A data sheet indicates that the instantaneous heater has an internal 15 litre hot water store with 10 mm of factory-fitted foam insulation. How do you deal with this in DEAP?

The cylinder and the instantaneous heater both store domestic hot water, so both will contribute to the storage loss. However, the main water heater is the oil boiler (provides more hot water and is cheaper to run). DEAP entries are as follows:

- *Storage Volume:* 110 + 15 = 125 litres.
- *Insulation Type & Thickness:* only one entry is permitted in DEAP so the weighted average of the two systems must be calculated considering the different storage capacity of each system; so,
 - *Insulation Type:* Factory Insulated.

- *Insulation Thickness* = $\frac{((25 \times 0.5 \times 110) + (10 \times 15))}{(110 + 15)} = 12.2 = 12 \text{ mm.}$

Lagging jacket insulation is half as effective as factory foam insulation. Therefore, the 25mm thickness of the cylinder lagging jacket is multiplied by 0.5 in the equation above. The equation shown provides an average factory insulation thickness weighted by volume.

- *Temperature Factor & Temperature Factor Multiplier:* these are calculated as normal for the main water heating system, i.e. the boiler & cylinder system.

8.9 Combi-boilers

A Combination Boiler, commonly known as a combi boiler, has the capability to provide domestic hot water directly and to provide space heating in the usual manner. In some cases, the combi boiler has an internal hot water store. In DEAP a combi boiler with an internal store capacity of less than 15 litres is classed as an instantaneous combi. A combi boiler with an internal store capacity of 15 to 70 litres is classed as a storage combi boiler.¹⁷ Dwellings with combi boilers are unlikely to have hot water storage installed other than storage which may be in the boiler. In addition, the combi boiler has separate connections for water and space heating. The HARP database categorises boilers as being combi or regular boilers. In addition, HARP provides information on any storage facility or keep-hot facility in the boiler. This information may also be available from product literature or websites.

When providing hot water, combi boilers operate in response to a demand from a tap or shower. By contrast, a regular boiler heats water stored in a hot water cylinder or thermal store for use later.

It takes a short amount of time for the water leaving the combi boiler to reach an adequate temperature. The energy required to meet the dwelling's hot water demand in DEAP does not take account of the energy used as the combi boiler output reaches an adequate temperature. In DEAP this extra energy input is called the additional loss for the combi boiler and is specified in DEAP Table 3a and the associated footnotes. The Assessor selects the combi boiler type from the list provided in DEAP:

- Instantaneous, without keep-hot facility
- Instantaneous, with keep-hot facility controlled by time clock
- Instantaneous, with keep-hot facility not controlled by time clock
- Storage combi boiler - store volume ≥ 55 litres
- Storage combi boiler - store volume $V < 55$ litres

8.9.1 Combi boiler: additional losses

The additional loss for a storage combi boiler depends on the volume, V , of the internal hot water store. An additional loss of zero applies if the volume is 55 litres or more (DEAP Table 3a). If the volume is less than 55 litres (but greater than 15 litres) the additional loss is calculated by the Assessor for entry in DEAP as follows:

$$\text{Additional Loss} = 600 - [(V-15) * 15]$$

Example

What is the Additional Loss of a combi with an internal hot water store having a capacity of 45 litres?

$V = 45$ litres. Substituting into the equation above gives additional loss as follows:

$$= 600 - [(45-15) * 15]$$

$$= 600 - [450]$$

$$= 150 \text{ kWh/y.}$$

Table 3a, note (a) applies to this category of storage combi boiler. Note (a) states that if the daily hot water usage is less than 100 litres/day, then the additional loss calculated above is multiplied by **(Daily Hot Water Usage)/100**.

In this example, if the daily hot water usage is 79 litres/day, the additional loss is corrected to:

$$= 150 * (79/100)$$

$$= 118.5 \text{ kWh/y.}$$

¹⁷ See DEAP Manual Appendix D for definitions of the combi boiler, instantaneous combi, storage combi and keep-hot facility. Storage > 70litres is a CPSU.

The daily hot water usage is displayed on the Water Heating tab in DEAP. If Note (a) applies the Assessor must make the adjustment to the additional loss. This adjustment is not required if the daily hot water usage ≥ 100 litres.

8.9.2 Instantaneous combi Boilers - keep-hot facility

Some instantaneous combi boilers maintain the water in the internal store above a set temperature even when there is no hot water demand and the boiler is not in use. This is called a keep-hot facility. It may operate by burning fuel or by heating an electrical element in the internal store. When an instantaneous combi boiler is selected from the list of combi boiler types it is also necessary to specify whether there is a keep-hot facility powered by electricity, using the second drop-down list:

Figure 8.26: Selecting the keep hot facility

Combi Boiler Type	Electric Keep-hot Facility Type	Additional Loss [kWh/y]	Keep-hot Consumption [kWh/y]
Instantaneous, with keep-hot facility controlled...	Electric keep-hot facility, controlled by time cl...	600	600

- If there is no keep hot facility present, then the “Electric keep hot facility type” entry is set to “None”.
 - An instantaneous combi with no keep-hot facility has an additional loss of 600 kWh/y but Note (a) applies in this case so the daily hot water usage is considered. *DEAP does this automatically*. The associated electricity consumption is zero as there is no keep-hot facility.
- If there is a keep hot facility present that operates by burning boiler fuel the “Electric keep hot facility type” entry is set to “None”.
 - In this case the additional loss is 600 kWh/y if the keep hot facility is controlled by a time-clock but 900 kWh/y if it is not controlled by a time-clock. The associated electricity consumption is zero. DEAP then attributes the keep-hot facility energy usage to the main water heating fuel type.
- If there is an *electric* keep hot facility present, then one of the following options is chosen:
 - Electric keep-hot facility, controlled by time clock: For an instantaneous combi boiler with an electric keep-hot facility controlled by a time-clock, the additional loss is 600 kWh/y and the electricity consumption is also 600 kWh/y (as defined in Table 4f).
 - Electric keep-hot facility, not controlled by time clock: For an instantaneous combi boiler with an electric keep-hot facility controlled by a time-clock, the additional loss is 900 kWh/y and the electricity consumption is also 900 kWh/y (as defined in Table 4f). As per the footnotes in DEAP Table 3a, if the power rating of the keep-hot facility without time clock is available from the HARP database, the additional loss is calculated by the user as:

$$\text{Loss} = 8.76 \times P \quad (\text{kWh/year})$$

where P is the power rating of the heater in Watts. The electricity consumption will have the same value as detailed in DEAP Table 4f (note f).

Table 20 – Losses for Combi-boiler Keep-Hot Facility

Keep hot Facility	Type	Time-Clock	Additional Loss (kWh/y)	Electricity Consumption (kWh/y)
No	NA	NA	600 ¹⁸	0
Yes	Boiler Fuel	No	900	0

¹⁸ * Table 3 Note (a) applies in this case if daily hot water usage < 100 litres.

Yes	Boiler Fuel	Yes	600	0
Yes	Electric	No	900 <i>or</i> (8.76 x P)	900 <i>or</i> (8.76 x P)
Yes	Electric	Yes	600	600

8.9.3 Further examples of combi boilers in DEAP

The examples below show population of DEAP fields for both instantaneous and storage combi boilers.

Example 1 – Instantaneous combi boiler

The screen shot below shows the HARP listing for an instantaneous combi boiler.

Trade name:	Immergas		
Model name:	Victrix 24kW -		
First Manufactured:	2006		
Last manufactured:	Current		
Efficiency band			
Seasonal efficiency(%):	90.6		
Efficiency category:	SEDBUK based on certified data	SAP equation used:	104
Output Power:	26 - 26 kW		
Main type:	Combi	Fuel:	Gas
Mounting:	Wall	Exposure:	Indoor only
	Condensing	Flue:	Room-sealed
Fan assistance:	Fan	Run Time Indicator:	True
Burner control:	Variable (Stepped or modulating)	Ignition:	No
Elec. power firing:	130W	not firing:	8 W
Store type:	NA	Store loss in test:	Unknown/Inapplicable
Separate store:		Store volume:	0 litres
Store insulation thickness:	0 mm	Store insulation type:	Unknown/Inapplicable
Store temperature:	NA/Unknown	Store heat loss:	NA/Unknown
"Keep-hot" facility:	NA	"Keep-hot" timer:	No Control
"Keep-hot" electric heater:	W		

Water storage losses are set to zero for instantaneous combi boilers. As they normally serve several outlets, they will have distribution losses. Where the combi boiler can supply domestic hot water separate to space heating, Supplementary electric water heating is set to 'No'.

There is no keep hot facility, as detailed in the HARP lookup above. Some instantaneous combi boilers will have a keep hot facility.

- 'Combi boiler type' = 'instantaneous without keep hot facility'
- 'Electric keep hot facility type' = 'None'.
- 'Primary circuit loss type' = 'Combi boiler'.

See DEAP entry below.

Primary Circuit Loss Type
 Combi boiler

Cylinder Thermostat
 Cylinder Heated by Boiler System having separate time control of DHW
 Is there a separate timer for heating the store
 Is store in an airing cupboard


Low water usage (less than 125 l/p/d)

Combi Boiler

Combi Boiler Type	Electric Keep-hot Facility Type	Additional Loss (kWh/y)	Keep-hot Consumption (kWh/y)
Instantaneous, without keep-hot facility	None	600	0

Example 2 – Storage combi boiler store volume <55litres.

The screen shot below shows the HARP listing combi boiler with store volume < 55 litres and > 15 litres. This volume implies that this is not an instantaneous combi boiler or CPSU – it is a storage combi boiler.

Manufacturer:	Immergas		
Trade name:	Immergas		
Model name:	Victrix Zeus 26 1 l -		
Model Identity no.:	0694BR0988		
First Manufactured:	2009		
Last manufactured:	Current		
Efficiency band			
Seasonal efficiency(%):	90.2		
Efficiency category:	Irish SEI Validated entry	SAP equation used:	106
Output Power:	23.6 - 23.6 kW		
Main type:	Combi	Fuel:	Gas
Mounting:	Wall	Exposure:	Indoor only
	Condensing	Flue:	Room-sealed
Fan assistance:	Fan	Run Time Indicator:	No details available
Burner control:	Variable (Stepped or modulating)	Ignition:	No
Elec. power firing:	135W	not firing:	8 W
Store type:	Secondary	Store loss in test:	Excluded
Separate store:		Store volume:	47.3 litres
Store insulation thickness:	18 mm	Store insulation type:	Polyurethane foam
Store temperature:	NA/Unknown	Store heat loss:	126 W
"Keep-hot" facility:	Unknown	"Keep-hot" timer:	NA/Unknown
"Keep-hot" electric heater:	W		

Water storage losses are set to 'Yes' for storage combi boilers. As they normally serve several outlets, they will have distribution losses. Where the combi boiler can supply domestic hot water separate to space heating, Supplementary electric water heating is set to 'No'. When the unit is located indoors, 'Yes' is selected for 'Is hot water storage indoors or in group heating scheme?'

The store type is secondary, the store insulation is polyurethane foam and the store insulation thickness is 18mm from the above listing. Using the Table 2 lookup in DEAP for temperature factor, the following detail is applied to the DEAP entry:

Storage Type	Storage Volume [l]	Heat Pump Type of D...	Temperature Factor Unadjusted
Storage combi boiler, s...	47		0.71
			Temperature Factor Multiplier
			1

The combi boiler type selected is Storage Combi boiler store volume <55litres. The store volume from HARP is 47.3 litres, rounded to 47 litres in DEAP.

As the volume is less than 55 litres (but greater than 15 litres) the additional loss is calculated by the Assessor for entry in DEAP as follows using DEAP Table 3a: Additional Loss = 600 – [(V-15) * 15]. This gives an Additional Loss of 120KWh/yr for the combi boiler. The Assessor enters this in DEAP.

As there is no keep hot facility in storage combi boilers, 'None' is selected for electric keep hot facility type. The associated electricity consumption automatically derived by DEAP is zero as there is no keep-hot facility. 'Combi boiler' is selected for the primary circuit loss type. See DEAP entry below.

Primary Circuit Loss Type			
Combi boiler			
<input type="checkbox"/>	Cylinder Thermostat	<input type="checkbox"/>	Cylinder Heated by Boiler System having separate time control of DHW
<input type="checkbox"/>	Is there a separate timer for heating the store		<input type="checkbox"/>
<input type="checkbox"/>	Is store in an airing cupboard		
<input type="checkbox"/>	Low water usage (less than 125 l/p/d)		
Combi Boiler			
Combi Boiler Type	Electric Keep-hot Facility Type	Additional Loss [kWh/yr]	Keep-hot Consumption [kWh/yr]
Storage combi boiler store volume < 55 litres	None	120	0

Note the Following:

- As per DEAP Section 4.2: For combi boilers, the storage loss factor is zero if the efficiency is taken from Table 4b. The loss is included for a storage combination boiler if its heating efficiency is based on certified data or is obtained from HARP, using the calculated hot water storage loss factor and volume on the 'Water Heating' tab and the temperature factor from Table 2. The insulation thickness and volume should be provided by the manufacturer or obtained from HARP.
- Always assume the more pessimistic option if information is not available.** For example, if unsure about 'keep hot' on an instantaneous combi boiler, select YES to keep hot. Where it is unclear if a storage combi boiler has a primary or secondary store, assume primary store present.
- Boiler interlock can be achieved for combi boilers by fitting a room thermostat.
- If there is a keep hot facility present that operates by burning boiler fuel the "Electric keep hot facility type" entry is set to "None".

9. Heat Distribution & Controls

This section supplements the DEAP Manual Guidance on heat distribution and controls for space heating.

9.1 Space heating controls

Controls can have a significant impact on the energy value calculated by DEAP. Table 4e of the DEAP manual defines the control category based on the type of controls installed in the dwelling. There are various groups of controls to select from based on the heating system type in Table 4e. Section 9.3 of the DEAP manual defines specific control types.

More recently, controls are provided via mobile Apps, enabling remote control of heating temperatures and scheduling. Determine the applicable level of control from the DEAP Manual Section 9.3 for these Apps when identifying the appropriate DEAP entries.

9.1.1 Control category: common errors

Insufficient Documentary Evidence

The retention of insufficient documentary evidence is often identified as a code of practice non-compliance issue. As stated in the DEAP Survey Guide Section 4 photographic evidence of heating controls is required:

Table 21 – Evidence for heating controls

DEAP software tab: "Space heating"		
Space heating: controls and responsiveness		
Data Entry Item	Guidance	Documentary Evidence Upload
Heating systems properties, emitter type and controls	<p>Follow guidance in the DEAP Manual.</p> <p>Representative photographs of heating system (e.g. radiators, underfloor, warm-air, electric storage heaters, air conditioning (ducted and non-ducted) system, etc.) and controls (such as TRVs, zone valves, room thermostats, cylinder thermostats, timers, and any other relevant controls) must be taken.</p> <p>Details must be recorded on the DEAP Survey Form.</p>	<ul style="list-style-type: none"> • Photographs of relevant heating controls; • Photographs of emitters (radiators, underfloor heating manifold, etc.); • Survey Form.

Always ensure that full, clear and transparent evidence is retained.

Control Category Value of "3" Entered in Error for Boiler Systems

One of the most common errors encountered during audit is the selection of control category 3 (time and temperature zone control) where site observations and/or the assessors survey notes do not support this category. As per the Section 9.3 definition in the DEAP Manual:

"In order to specify time and temperature zone control it must be possible to program the heating times of at least two space heating zones independently in addition to independent temperature controls. It is not necessary for these zones to correspond exactly with the zone division that defines the living area fraction (Section 7.2)".






There are two key requirements in the above definition:


1. Independent time control of at least 2 space heating zones
2. The ability to be able to set the temperature of each of the space heating zones

If only one of these requirements is met, time and temperature zone control cannot be selected in DEAP.

Some examples of typical programmers and timers in dwellings are shown below. The right-hand column of the table describes whether the controller(s) can provide time and temperature control when installed in conjunction with sufficient thermostatic control. Note that some other conditions (as described) may need to be met to constitute time and temperature control.

Table 22 – Examples of Programmers and Timers

Controller	Description	Capable of independent time control of 2 space heating zones?
	<p>Electronic programmer.</p> <p>1 channel for domestic hot water (left side controls).</p> <p>1 channel for space heating.</p>	<p>No. Only one channel is available for control of the space heating. If this is the only time programmer in the dwelling, then time and temperature zone control is not possible regardless of the number of thermostats present.</p>
	<p>Electronic programmer.</p> <p>1 channel for domestic hot water (right side control).</p> <p>2 channels for space heating (left and middle controls).</p>	<p>Yes. 2 channels are available for controlling time for space heating zones. Time and temperature zone control is possible.</p> <p>At least two room thermostats must be present in the dwelling in conjunction with this controller to specify time and temperature control in DEAP.</p>
	<p>1 x Programmable Thermostat.</p>	<p>No. These controllers are often identified as a standard programmer in error. They provide time and temperature control to a single zone. They are often characterised by a grille to the casing to allow air from the room to pass over a thermostat element. If unsure if the device is a programmable thermostat take the model number and attempt to identify the type through an on-line search. If this does not resolve the type contact the Helpdesk for advice.</p>
	<p>2 x Programmable Thermostats.</p>	<p>Yes. Same controller as above but there are two. It is therefore possible to control both the time and temperature of two zones independently. Time and temperature control can therefore be specified in DEAP. Additional thermostats are not required for time and temperature control as the thermostat is integrated with the programmers.</p>
	<p>1 x Mechanical Timeclock.</p>	<p>No. The timeclock provides time control but only has one channel and is therefore not capable of providing independent time control of two space heating zones.</p>

	<p>2 x Mechanical Timeclocks</p>	<p>Yes. Two channels are available for the time control of two space heating zones.</p> <p>Notes: The assessor must be sure that both timers are for the space heating zones, e.g. through labels or the presence of an additional controller that is clearly for control of the domestic hot water. Two mechanical time clocks could be for one space heating zone and domestic hot water.</p> <p>Two room thermostats must be present in conjunction with the timeclocks to specify time and temperature zone control.</p>
---	----------------------------------	---

9.1.2 Further control category examples

Information is required from site survey for correct selection of controls in DEAP:

- System/boiler type and emitter type.
- Type of control of space heating.
- Number of zones.
- Number of room thermostats.
- Number TRV's.

The following examples show the effect of varying time and temperature control on the DEAP entries. Full details are available in DEAP Table 4c and 4e in particular.

No time control of main space heating – A typical scenario would be when the main space heater is an open fire with back boiler to radiators. It can also be found in boiler systems controlled only by means of an on/off switch or by systems having a room thermostat only. This poor level of control is reflected in the control category of '1' and in some cases a temperature adjustment greater than '0'.

Individual Scheme Group Scheme

Heating System Properties Results

Heating system category Central heating systems with radiators or underfloor heating	Temperature Adjustment [C] 0.6
Sub Category Solid fuel boilers	Heating System Control Cate... 1
Heating System Open fire with back boiler to radiators	Heating System Responsiven... 3
Heat Emitter Type Radiators	Heating System Controls No time or thermostatic control of room ...

Wall or room thermostats are available in diverse types and styles, analogue and digital, examples of these are shown as follows:



If there are multiple space heating thermostats, then there are multiple space heating zones and each of these will need independent temperature and time control to apply a control category of '3' in a boiler system.

TRV's – All TRV's are counted in the Survey Form – Room by Room record. This determines whether they are accounted for in DEAP. A programmer is always needed for TRVs to be considered as control category '2'.

room in roof area (m ²)	perimeter/total ground floor (P/A) ratio			% draughtstripping	% low energy lights	Thermal mass							
<input type="text"/>	F type#1	F type#2	F type#3	<input type="text"/>	<input type="text"/>	external wall	light	med	heavy				
	<input type="text"/>	<input type="text"/>	<input type="text"/>			floor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
						separating walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
						internal walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Room by Room record						Overall thermal mass							
OPENING DATA					ROOM DATA								
ing dimensions	Glazing details	Frame	Gap	over shading	direction	Wall / roof type	Draught stripping y/n	Chimney or Flueless	Open Flues	Fans / vents	Rads with or w/o TRVs?	Number of Lights	Number of Low Energy Lights
H or m ²													

Group Heating Controls – for selection of the appropriate control category, observe and record the presence of the programmer, thermostats and TRVs. The programmer can be in the dwelling (e.g. apartment) or central to the group heating scheme (e.g. boiler room, corridor). As stated in Table 4e DEAP Group 3; under heating controls: *“(Programmer in group heating scheme may be inside dwelling or part of the group heating system)”*

Electric Heater Controls – Consider a small apartment with a storage heater and Automatic Charge Control in the living room and direct electric heating (with on/off control only) in each of the two bedrooms. There are no other habitable rooms. As per DEAP appendix A, the direct electric heaters heat most of the habitable rooms and are therefore the main heating system. The controls in DEAP are as follows:

< CONTROLS AND RESPONSIVENESS
PUMPS AND FANS
HEAT SOURCES
SUMMER IN

Individual Scheme
 Group Scheme

Heating System Properties

Heating system category

Room heaters ▼

Sub Category

Electric (direct acting) room heaters: ▼

Heating System

Panel, convector or radiant heaters ▼

Heating System Controls

No thermostatic control of room temperature ▼

Results

Temperature Adjustment [C]

0.3

Heating System Control Cate...

2

Heating System Responsiven...

1

If an appliance or system of appliances can provide the level of time control outlined in section 9.3.3 of the DEAP manual it should be considered as a programmer.

DEAP Section 9.3.1 defines a Room thermostat as follows: ‘A room thermostat senses the indoor air temperature and switches on or off the space heating. A single target temperature may be set by the user.’

An Appliance Thermostat (9.3.16) is located on the appliance and again, the user must be able to set a single target temperature.

The following photo shows an appliance dial graduated by ‘*’ to ‘Max’ on a direct electric heater:



This cannot be used to set a specific target temperature and therefore should not be regarded as a thermostat.

Alternatively, there may be product instructions or literature available for this appliance equating the graduations to temperatures measured in the room. We would advise Assessors to contact the relevant supplier/manufacturer for further details and to contact the Helpdesk if further assistance is needed.

9.2 Warm air heating system

Older warm air heating systems have their own distribution system but in more recent installations warm air systems are frequently combined with a Mechanical Ventilation system with Heat Recovery. For example, a boiler system may feed a heat exchanger at the mechanical ventilation inlet rather than feeding radiators. The heat recovery system data is entered in the ventilation tab in DEAP in the usual way. This caters for the ventilation aspect and the power consumption of the heat recovery system fans. It is possible to use non-defaults for the MVHR system as normal.

The boiler data is entered as normal, using the efficiency from HARP, for example.

In this scenario, "Warm Air Heating Or Fan Coil Radiators Present" is not selected in the 'Space Heating > Pumps And Fans' tab, because the warm air heating fan power is entered through the heat recovery system in the DEAP ventilation tab. As per DEAP table 4f note (d) the warm air heating fan power usage is that of the MVHR in this case.

The responsiveness category is 1 in this system type.

It should be assumed that a central heating pump is required to pump water from the boiler to the MVHR heat exchanger unless you can demonstrate otherwise.

10. Lighting

The method for calculating the energy required for lighting changed in DEAP 4.2. The new approach accounts for the bulbs present in a dwelling in greater detail and as a result additional information is entered in comparison to previous versions of DEAP. The information entered into DEAP 4.2 depends on whether the Lighting Design of the dwelling is known. In most cases the Lighting Design will not be known so that case will be dealt with first.

10.1 Lighting Design Not Known

In this case you should only enter **default** data for the light bulbs in the dwelling.

Non-default bulb data should not be used.

There are 5 default bulb types in the DEAP Library that must be used in this scenario:

- Default Linear fluorescent,
- Default LED/CFL,
- Default Halogen LV (low voltage),
- Default Halogen Lamp,
- Default Incandescent.

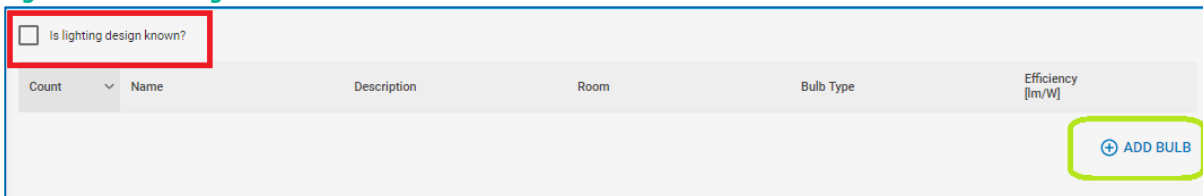
If no bulb is present assume Default Incandescent.

If it's not possible to distinguish between a Halogen and Halogen LV (low voltage) lamp, select Halogen.

10.1.1 Entry into DEAP 4.2

In the Lighting page of DEAP, "Is lighting design known?" is left unticked. On the right hand side of the page, select "Add bulb":

Figure 10.1 – Adding a bulb



This will allow you to add a default bulb from the DEAP Library.

In the DEAP Library a default bulb has been set up for each of the bulb types as can be seen in Figure 10.2. To add a bulb, select the relevant line in the list and then click "Add Selected Item":

Figure 10.2 – Adding a Default Bulb from the library

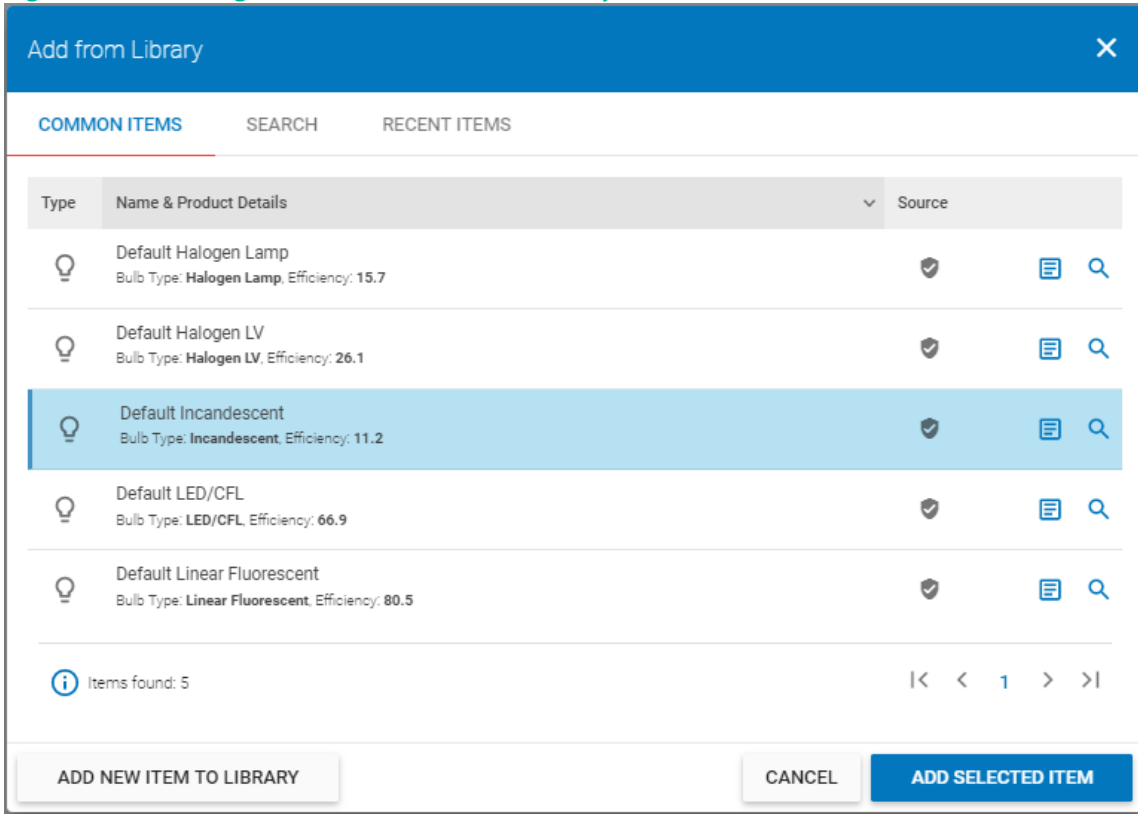
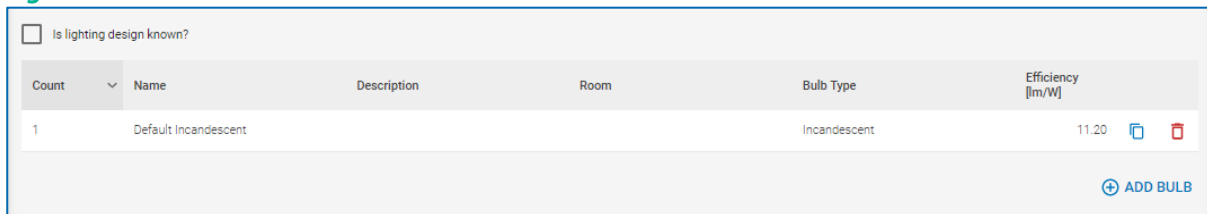


Figure 10.3 – The bulb has been added



In this example a Default Incandescent bulb has been selected and is then added to the dwelling. By default it is added with a Bulb Count = 1. If the number of incandescent bulbs in the house is not equal to 1 then this must be changed. To do this, click on the item to open the "Edit Bulb" page where you can change the number of bulbs.

In this example it has been changed to 5. Click “Save” to save the changes.

This process should be followed for all bulb types identified in the survey of the dwelling

10.2 Lighting Design Is Known

Where the lighting design is known a similar approach is taken but additional information is required.

10.2.1 Substantiating evidence required

The lighting design for a dwelling should include the following information:

- Lighting Plan: drawings for the dwelling indicating the location of all fixed light fittings.
- Lighting Schedule: this should document the bulb used in each of the fixed light fittings identified in the Lighting Plan.
- Supporting technical documentation: non-default data can only be used where there is supporting documentation indicating the Bulb Power (in Watts) and Bulb Efficiency (in Lumens /Watt). Documentation for bulb efficiency should meet the normal requirements of DEAP, i.e. it should be either,
 - Manufacturer’s documentation with a CE-marking and stating a relevant test standard, or,
 - Accredited test data, as defined in the DEAP Manual, referencing the relevant EN standards.

The above documentation should be signed-off by the Architect, Engineer or Assigned Certifier.

In a New Final BER survey, if it is clear that the information provided in the Lighting Design does not match the installed lighting, then for the purposes of the BER the lighting design is not known and the guidance in Section 2.1 should be followed.

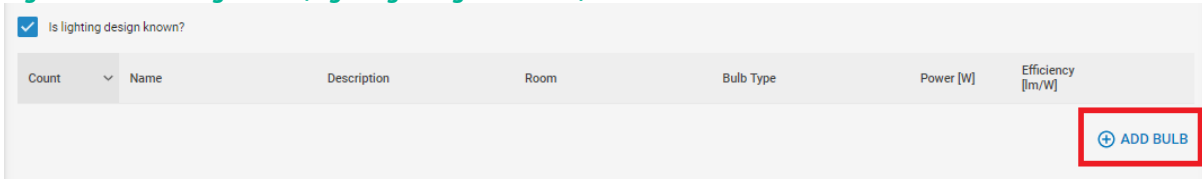
For example, in all of the following cases, the lighting design is considered to be invalid and default data should be used as per Section 2.1:

- The number of fixed light fittings specified in the lighting design is different from the number identified in the survey;
- Some of the fixed light fittings do not have bulbs installed;
- One or more of the bulbs does not match the lighting design, e.g. what was specified as CFL actually has an LED.

10.2.2 Entry into DEAP 4.2

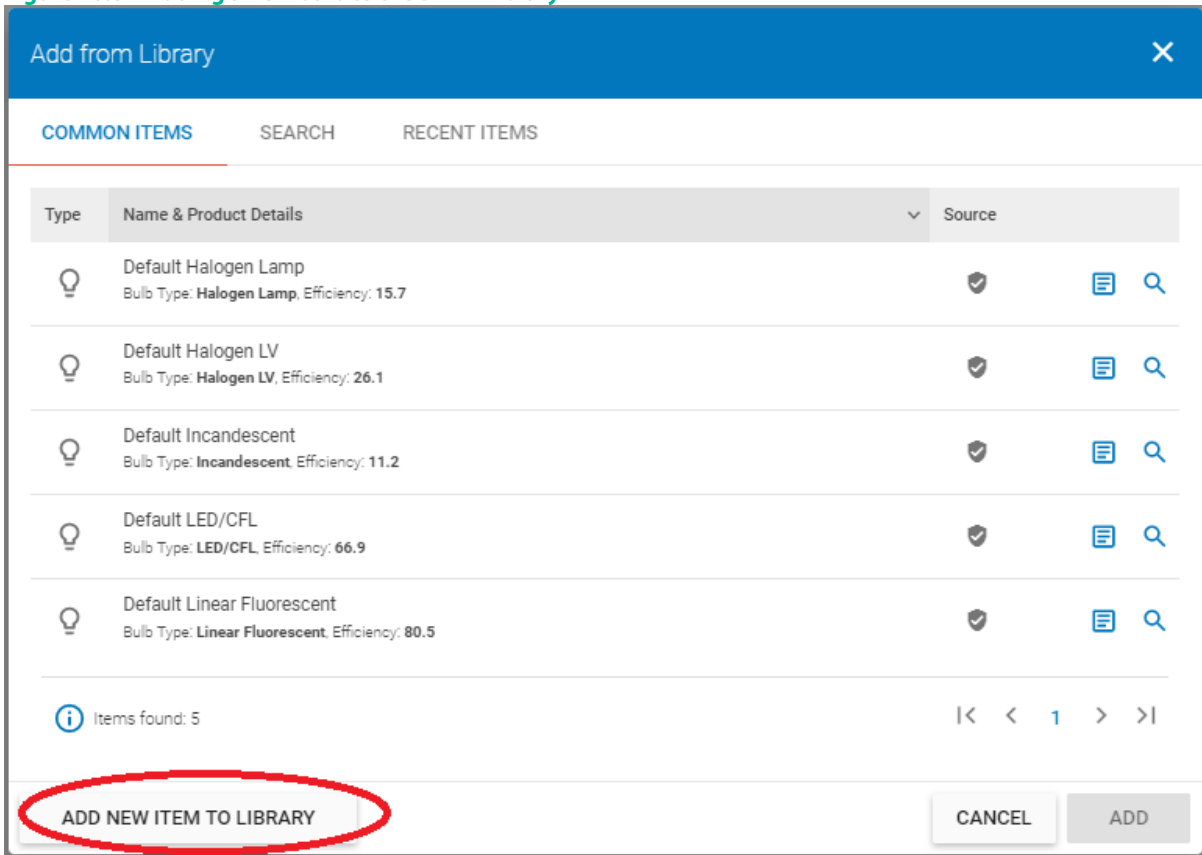
In the Lighting page of DEAP, “Is lighting design known?” is selected.

Figure 10.5 – Adding a Bulb (Lighting Design is known)



As before, to add a bulb select the “Add Bulb” option on the right hand side of the page.

Figure 10.6 – Adding a new bulb to the DEAP Library



Click “Add New Item to Library” to add a new bulb and then enter the data for the light bulb.

If you have previously added a bulb to the library, you will not have to add it again – you can just search for it in the Search tab. But, for the purposes of this exercise we will go through how to add a new bulb to the Library.

Figure 10.7 – Entering non-default bulb data

The screenshot shows a 'Create Library Item' dialog box with a blue header and a close button (X) in the top right. Below the header is a section titled 'BASIC PROPERTIES'. The form contains several fields:

Item Type *	Item Name *	Keywords
Bulb	X1	
Manufacturer *	Model *	
X1A	X1B	
Bulb Type *	Efficiency [lm/W] *	Power [W] *
LED/CFL	66.9	5

At the bottom right of the dialog box are two buttons: 'CANCEL' and 'SAVE'.

In order to add a bulb with non-default data you will need to specify,

- Bulb Efficiency (in lumens/Watt)
- Bulb Power (in Watts),

based on data from an appropriate source, as described in Section 3.2.

Click "Save" and then "Add Selected Item" to add this bulb to the dwelling.

As before, by default the bulb is added with a Bulb Count = 1.

If the number of these bulbs is not equal to 1 then this must be changed. To do this, click on the item to open the "Edit Bulb" page where you can change the number of bulbs.

11. Energy Requirements

This section supplements information in the DEAP Manual on Heating System Efficiency, room heaters, fuels and group heating systems.

11.1 Heating system efficiency

DEAP assumes that the dwelling has heating system(s) capable of heating the entire dwelling. Calculations are based on a main heating system and secondary heaters as described in DEAP Appendix A. This Appendix also covers whether secondary heating is to be specified in DEAP. The apportionment of heat supplied from the main and secondary systems is given in DEAP Table 7.

As detailed in DEAP Manual Section 9, gross seasonal boiler efficiency can be taken from any one of the following sources:

- [HARP database](#) - this is the preferred option;
- SEDBUK database - Please note SEDBUK boiler data is now located at the Products Characteristics Database (PCDB) [website](#). When referencing the boiler efficiency data from this website, the **SAP 2005** seasonal efficiency data must be used in DEAP;
- Certified test data. Follow guidance in Appendix D/J/E/G of the DEAP manual to convert to gross seasonal efficiency for use in DEAP;
- Defaults in Table 4a and Table 4b in the DEAP manual.

Example 1: Converting to Gross Efficiency

- Test certificate for wood fuel stove: net efficiency 77.2%.
- Stove warranty states that only wood fuel may be used in the appliance.
- Efficiency conversion factor for wood fuels is 0.91 (DEAP Manual Table E4)
- The efficiency used in DEAP is given by: Gross efficiency = $77.2 \times 0.91 = 70.25\%$.

Example 2: Using SEDBUK 2005 data

The screenshot below is a sample from the SEDBUK Products Characteristics Database.

Type	Index number	Status
Gas and oil fuel boiler	018136	Normal
Brand	Model name	Model qualifier
Fonderie Sime	MURELLE HE 70 R ErP	
Boiler ID*	8104981	
Fuel	mains gas	
SAP 2009/2012 annual efficiency (%)	89.0	
SAP winter seasonal efficiency (%)	90.0	
SAP summer seasonal efficiency (%)	79.3	
Comparative hot water efficiency (%)	57.9	
SAP 2005 seasonal efficiency (%)	90.1	

Efficiency used in DEAP from "SAP 2005 Seasonal Efficiency" = 90.1%

Where an appliance does not have the exact same name as an appliance on HARP/SEDBUK/certified data or the full name is not visible on the appliance, HARP/SEDBUK/certified data can be used if one of the following is available and **clearly** equates the appliance in the dwelling to a HARP/SEDBUK/certified data entry:

- Appliance installation manuals or instruction manuals;
- Statement on printed letterhead (in softcopy or hardcopy) from one of:
 - appliance manufacturer;
 - appliance supplier;
 - service engineer or maintenance firm.

The examples below deal with the correct identification of boiler efficiency based on the evidence available.

Example 3

Example 3.1:

The oil boiler recorded on site had no visible make or model number. There is no brochure or user manual available. It was determined that the house was built in 1997. As there is no further evidence available it is necessary to use the default efficiency from DEAP Manual Table 4b for a standard oil boiler 1985 to 1997 of 70%.



Example 3.2:



Manufacturer	Baxi UK		
Trade name	Baxi		
Model name	Solo 3 PFL System		
Model qualifier	50		
First Manufactured	2001		
Last manufactured	2006		
Efficiency band	D		
Seasonal efficiency	78.0		
Efficiency category	SEDBUK based on certified data	SAP equation used	101
Output Power	18.300 - 18.300 kW		
Main type	Regular	Fuel	GAS
Mounting	Wall	Exposure	Indoor only
	Non-condensing	Flue	Room-sealed
Fan assistance	Fan	Run Time Indicator	No
Burner control	On-off	Ignition	No
Elec. power firing	W	not firing	W
Store type	NA/Unknown	Store loss in test	NA/Unknown
Separate store	Internal hot water store	Store volume	0.00 litres
Store insulation thickness		Store insulation type	
Store temperature		Store heat loss	
"Keep-hot" facility	NA/Unknown	"Keep-hot" timer	NA/Unknown
"Keep-hot" electric heater	W		
Record last updated	2012/Mar/27 10:12	Primary Trade Association	

A Baxi Solo 3 PFL 50 Mains Gas boiler was identified on site on a data plate on the boiler's external casing. This gas boiler has an efficiency of 78% on the HARP database as shown.

Example 4

The main heating system in a semi-detached dwelling built in 1999 is a Sirus Radiant Combi gas boiler with automatic ignition. There is a condensate drain from the boiler indicating the type of boiler as a condensing boiler. The boiler has a flow and return pipe for space heating as well as a mains water inlet and DHW outlet as you would expect for a combi boiler. The boiler is fuelled by Mains Gas and is wall hung. The boiler provides all space heating to all habitable rooms as well as water heating. There is no detail available on the model type of the boiler. There is a two-channel programmer controlling both water and space heating. There are no fixed secondary heaters in place.

Sample image of condensate drain on a gas boiler



As there are no other details available on the type of gas boiler a default efficiency of 83% for "*condensing (including combi) boilers with automatic ignition*" is applied to the gas boiler (1998 or later) from DEAP Manual Table 4b.

The following data entry applies for DEAP:

Heating System	Heating System Type	Fuel Type
Main Space Heating System	Condensing Gas Combi Boiler	Mains Gas
Secondary Space Heating System	None	None
Main Water Heating System	Condensing Gas Combi Boiler	Mains Gas
Supplementary Water Heating System	None	None

As there are no fixed secondary heaters in place and all habitable rooms are heated by the main space heating system 'None' is selected for the Secondary Space Heating System. There is separate zoned time control (DHW separate from space heating). Therefore "None" is selected for Supplementary Electric Water Heating. See Section 4.6 of the DEAP manual for further guidance on Supplementary Water Heating.

Example 5:

A single storey dwelling built in 1930 located in Dublin has five habitable rooms with the following:

- 1 single burner dry heat range cooker in kitchen/diner with a discrete seating area.
- 1 open fire in living room
- 1 open fire in one bedroom
- 2 bedrooms not heated

There are no radiators in the house. There is no water heating system in the house.

Note: Single burner dry heat range cooker: DEAP Manual Appendix B Section 4.3 specifies this type as an appliance with a single burner that provides a cooking function. It is not included in DEAP calculations¹⁹. The kitchen/diner is therefore assumed to be unheated.

The DEAP methodology assumes that a good standard of heating is achieved throughout the dwelling. For dwellings in which the heating system is not capable of providing the standard, it is assumed that the additional heating is provided by electric heaters as detailed in DEAP Appendix A²⁰. For new dwellings that have no heating system specified, DEAP assumes that all heat is provided by electric heaters. See A2 and A3 in the DEAP manual for full details of how to assess an unheated, partly heated or fully heated dwelling.

In the case above, of the 5 habitable rooms, 40% are heated by an open fire room heater, 60% are unheated. As per DEAP Manual A3.2 – 'If the number of habitable rooms actually heated is more than 25% but not exceeding 50%, and there is one type of heater installed, this heating system is the primary and the (assumed) electric heaters are the secondary. Where there is more than one type of heater installed in this case, Sections A1 and A2 apply when identifying the primary and secondary space heating systems'.

The following data entry therefore applies for DEAP:

Heating System	Heating System Type	Fuel Type
Main Space Heating System	Open fire	Manufactured Smokeless Fuel
Secondary Space Heating System	Electric Room Heater (assumed)	Electricity
Main Water Heating System	Electricity	Electricity
Supplementary Water Heating System	None	None

Where a dwelling has no water heating system present, direct electric water heating is assumed to meet the hot water demand. In this case, supplementary electric water heating is not specified as the main water heating is an electrical heat source. If there is no cylinder present, then hot water storage losses are not specified.

11.2 Room heaters and back boiler systems

11.2.1 Identifying gas fired room heaters

There are several gas fuelled room-heaters in DEAP Table 4a to choose from when selecting the appropriate DEAP default efficiency. The following table gives guidance on identifying these heaters:

¹⁹ Ranges without a back boiler to space heating are not assumed to provide space heating in DEAP. In cases where a solid fuel range provides space or water heating (e.g. to radiators or cylinder), use the defaults for **ranges** rather than closed room heaters as detailed in DEAP Manual Table 4a 'Solid Fuel Boilers' when using defaults.

²⁰ For highly insulated inadequately heated small dwellings refer to DEAP Manual Section A3.3

Table 23 – Identifying room heaters

Appliance	Identifying features
<p>Gas fire, open flue, pre-1980 (open front), and,</p> <p>Gas fire, open flue, 1980 or later (open fronted), sitting proud of, and sealed to, fireplace opening</p>	<p>The differentiating factor between these two gas fires is their age. If in doubt about the age, choose the more conservative option (pre-1980). "Open flue" means the fire draws its combustion air from the room (as opposed to balanced flue). See Section 2.1 of the DEAP manual to differentiate between an open flue and a chimney. "Open front" means there is no glass front or enclosure separating its flames from the room. It does not have solid fuel effect flames. It would typically have a line of uniform blue flames.</p> <p>Typically, the flue outlet would be part of the heater.</p>
<p>Gas fire or wall heater, balanced flue</p>	<p>Balanced flue (or "room sealed") is defined in Section 2.1 of the DEAP manual: "A room heater is considered to be room sealed if it does not have any air exchange with the room in which it is situated". Both the air intake and air outlet of this heater are ducted to the external environment. The balanced flue intake and outlet may be in the form of a concentric flue (two pipes centred around a single point).</p>
<p>Gas fire, open flue (open fronted), sitting proud of, and sealed to, fireplace opening, with back boiler unit</p>	<p>This is the same as (1) above but has a back boiler.</p>
<p>Flush fitting Live Fuel Effect gas fire (open fronted), sealed to fireplace opening, with back boiler unit</p>	<p>This has flickering solid fuel effect flames rather than uniform blue flames in (1). The flue outlet is likely to be part of the heater. This type of heater has a back boiler.</p>
<p>Gas fire, closed front, fan assisted</p>	<p>This unit would usually be glass fronted. It does not have a balanced flue as described in (2). A fan draws air into the unit from the room or is used to send heat out into the room from the unit.</p>
<p>Condensing gas fire</p>	<p>This unit is likely to have a back boiler. If it is not clear whether the unit has a condenser or not, check for manufacturers detail or instruction manuals.</p>
<p>Flush fitting Live Fuel Effect gas fire (open fronted), sealed to fireplace opening</p>	<p>This unit has flickering solid fuel effect flames rather than uniform blue flames in (1). The flue outlet is likely to be part of the heater and there is no back boiler.</p>
<p>Flush fitting Live Fuel Effect gas fire (open fronted), fan assisted, sealed to fireplace opening</p>	<p>This has flickering solid fuel effect flames rather than uniform blue flames in (1). The flue outlet is likely to be part of the heater and there is no back boiler. A fan draws air into the unit from the room or is used to send heat out into the room.</p>
<p>Decorative Fuel Effect gas fire, open to chimney</p>	<p>This unit has flickering solid fuel effect flames rather than uniform blue lines and is open to the chimney. It would typically sit in the lower part of an existing fireplace, with the original chimney opening over it. The amount of air being drawn up through the chimney will be uncontrolled.</p>
<p>Gas fire, flueless</p>	<p>This unit does not have an open flue, chimney or balanced flue exhaust outlet. In this case there are likely to be 2 permanent vents in the room in which this fire is situated.</p>

11.2.2 Electric room-heaters in DEAP: direct and storage heaters

This section describes properties of different commonly found types of electric heating and how they are specified in DEAP assessments. Amongst these are storage heaters, direct electric heaters, and heaters which combine storage and direct heating.

Electric Storage Heaters: Old storage heaters consist of a thermally massive material – such as clay bricks or ceramic blocks within the heater – which can be heated by an embedded electrical element. The principle of operation is as follows: at night electricity is passed through the element thereby heating the thermal mass. This stored heat is slowly released during the following day.

Typically, they have two controls:

- an **Input** dial which controls the amount of electricity flowing into the storage heater during the night which in turn determines the amount of heat stored, and,
- an **Output** dial which controls the rate at which the heat is released the following day.

If the following day is likely to be cold, then the input dial is set high so that a lot of heat is stored overnight for use the following day. If heat is required throughout the day then the output dial is set low and the stored heat is released slowly. If heat is particularly required in the morning, then the output dial is set high and the stored heat is released quickly.

As they run on cheaper night-rate electricity, storage heaters are relatively cost-efficient to run. The main disadvantage is a lack of responsiveness. If the occupant feels cold during the day, he/she can't immediately switch the storage heater on. It only ever gives out heat that it has stored during the previous night. As a result, in DEAP old "large volume" storage heaters such as this have poor responsiveness as seen in the table below. Also, as outlined in DEAP Appendix A, if storage heating is the main heating system then a secondary system must be specified in DEAP.

Note that, in practice old storage heaters were usually sized to provide 90% of a dwelling's heating requirement with direct-acting electric heaters, portable or fixed, providing additional heat when required.

Direct-acting electric heaters: There are several types of direct-acting electric heater – convector heaters, radiant heaters, panel heaters – but they all operate on the same principle: when the occupant feels cold he/she can switch on a direct-acting electric heater and it will immediately generate heat to warm the room. They are often used as a back-up system to storage heating or may be used as the main heating system in some cases.

Modern direct-acting electric heaters may have sophisticated control systems with timers and thermostats controlling individual heaters giving excellent control and responsiveness in DEAP.

Integrated storage/direct-acting electric heaters: This is a storage heater (relying on stored heat generated during the previous night) and a direct-acting electric heater (which generates heat when it is switched on) contained in the same casing. The system is sized so that most of the heating load is provided by the storage heater at the cheaper night rate electricity. The system may be thermostatically controlled so that any shortfall is automatically provided by the direct-acting electric heater. Also, if the occupant feels cold he/she can manually switch on the direct-acting electric heater to get immediate heat.

If an integrated storage/direct-acting system is the main heating system in a dwelling, then a secondary system must be specified in accordance with the guidance in Appendix A of the DEAP manual. However, these integrated storage/direct-acting electric heaters are more responsive than most other types of storage heaters and this is reflected in the DEAP responsiveness category from Table 4a. Note that a dwelling with any of the systems described above may have a poor BER because of the high primary energy conversion factor of electricity.

The following table summarises the relevant DEAP inputs for these electric heaters. All are 100% efficient, with fuel type of "electricity". The efficiency adjustment factor in DEAP is "1". Full detail is available in DEAP Table 4a and Table 4e. The table does not include electric boilers or underfloor electric heating.

Table 24: Direct acting and storage electric heaters

System	Control Category	Responsiveness Category	Temperature Adjustment
Storage heaters	3	Ranges from 5 down to 2 depending on type of storage heater as outlined in DEAP Table 4a	0.3 or 0 depending on level of control as outlined in DEAP Table 4e, Group 4

Direct-acting electric Heaters	2 or 3 depending on level of control as outlined in DEAP Table 4e, Group 6	1	0.3 or 0 depending on level of control as outlined in DEAP Table 4e, Group 6
Integrated storage/direct acting electric heaters	3	2	0.3 or 0 depending on level of control as outlined in DEAP Table 4e, Group 4

11.2.3 Electric storage heater controls

DEAP Manual Section 9.3 outlines the different type of controls for electric storage heaters in DEAP assessments. There are three types of control that can be used with electric storage heaters - manual charge control, automatic charge control and CELECT-type control.

Manual: Manual controls are where the user controls the input and output of the Storage heater through the input and output dials. An input dial controls the amount of electricity flowing into the storage heater during the night, thereby determining the amount of heat stored. The user, using the output dial, sets the output from the storage heater manually, the output dial controls the rate at which heat is released.

Automatic Charge Control uses internal thermostat(s) or an external temperature sensor to control the charging of the heaters. Availability of electricity to the heaters may be controlled by the electricity supplier based on daily weather predictions. Automatic charge controls require the use of other remote thermostats throughout the dwelling or external to the dwelling to determine the charge amount.

CELECT-type control has electronic sensors throughout the dwelling linked to a central control device monitoring the individual room sensors and optimising the charging of all the storage heaters individually (and may select direct acting heaters in preference to storage heaters).

A select type control can control the heating times and specific zone temperatures throughout the dwelling. They require individual electronic sensors throughout the dwelling linked back to a central control device. These monitor the room temperatures and can optimise the charging of the individual storage heaters throughout the dwelling. The system can be zoned.

11.3 Fuels

11.3.1 Fuel type selection examples

Fuel type selection can have a significant bearing on the results calculated by DEAP, particularly when the fuel is electricity. The examples below show how to identify the fuel type in DEAP.

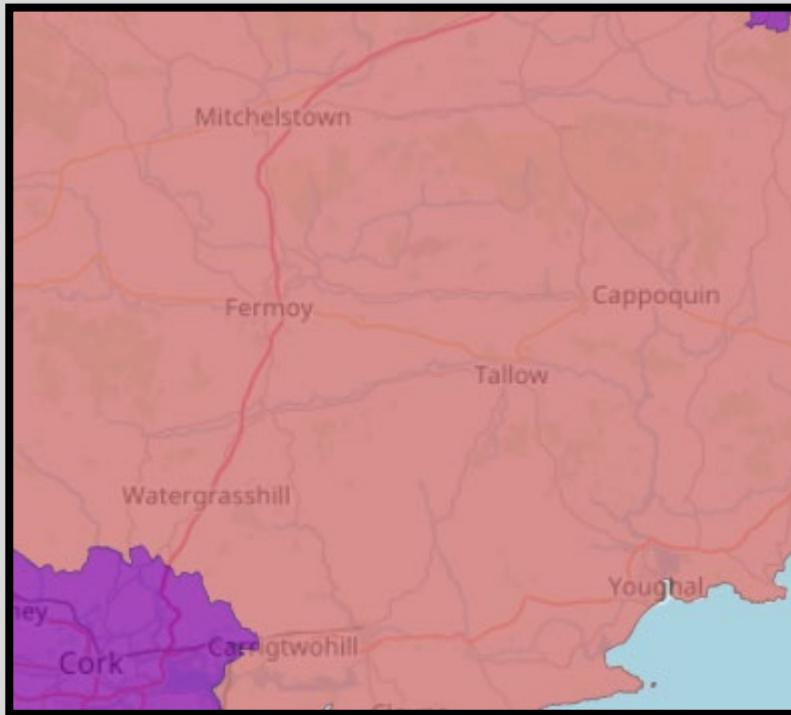
Example 1

A detached house located in Tallow, Co. Waterford has an oil boiler installed outside. There is a two-channel programmer controlling both water and space heating. The boiler provides space heating to all habitable rooms and water heating. A solid fuel stove is installed in the living room. There are no details visible to identify the type of stove.

The following approach applies for DEAP:

Heating System	Fuel Type
Main Space Heating System	Heating Oil
Secondary Space Heating System	Solid Multi Fuel
Main Water Heating System	Heating Oil
Supplementary Water Heating System	None

Tallow is not in a smoke control zone according to [Solid Fuel Regulations 2012-2020 \(arcgis.com\)](https://www.arcgis.com) :



By reference to Section 10.3.3 of the DEAP manual, as no details are available on the stove and the fuel type in the area is unknown, solid multi fuel is selected. There is separate zoned time control (DHW separate from space heating). Therefore "None" is selected for Supplementary Electric Water Heating. See Section 4.6 of the DEAP manual for further guidance on Supplementary Water Heating.

Example 2

A two-bedroom apartment in Dublin has electric panel heaters in the two bedrooms and a solid multi fuel stove in the living room. There are no more habitable rooms. As per DEAP Appendix A, the direct electric heaters heat most of the habitable rooms and are therefore the main heating system. The solid fuel stove is the secondary heating system. As Dublin is a smoke free zone, Manufactured Smokeless Fuel is selected as the Secondary Space Heating Fuel Type. An immersion heats all the DHW in a cylinder.

The following data entry applies for DEAP:

Heating System	Fuel Type
Main Space Heating System	Electricity
Secondary Space Heating System	Manufactured Smokeless Fuel
Main Water Heating System	Electricity
Supplementary Water Heating System	None

11.3.2 Fuel cost comparison using DEAP

The main and secondary space heating systems are identified based on DEAP Appendix A. In some cases, it may be necessary to make a cost-comparison between two or more heating systems to see which is the cheapest to run, as outlined in DEAP Manual Appendix A, Section A2.

This is done by calculating the BER for each main heating system in turn and noting the Delivered Energy in the DEAP Results tab. The Delivered Energy (in kWh) is multiplied by the fuel cost (in €/kWh) to give the annual cost of running the dwelling for each of the heating systems. The fuel cost data can be taken from the SEAI Domestic Fuel Cost Comparison file [here](#).

Example

A dwelling in a smokeless fuel area with three habitable rooms and two heat sources present: an open fire and a direct-acting electric heater. Each heater heats only one habitable room. Therefore, the cheapest to run is chosen as the main space heater.

The BER was first calculated with the open fire (efficiency = 30%) as the main heating system and the electric heater (efficiency = 100%) as secondary. Fuel costs in the example below are based on prices published in October 2011.

- **Main: Open Fire;**
Delivered Energy: 50301 @ 0.0463 €/kWh = €2328.94
 - **Secondary: Direct-acting Electric Heater;**
Delivered Energy: 1677 @ 0.1777 €/kWh = €298.00
- Total: = €2626.94**

The BER was then calculated with the electric heater as the main heating system and the open fire as secondary::

- **Main: Direct-acting Electric Heater**
Delivered Energy: 11264 @ 0.1777 €/kWh = €2001.61
 - **Secondary: Open Fire**
Delivered Energy: 4172 @ 0.0463 €/kWh = €193.16
- Total: = €2194.77**

When changing the main heating system above, it will typically also be necessary to make changes on the 'Space Heating > Controls And Responsiveness' tab to reflect a different level of control and responsiveness in the main heating system.

Each value is multiplied by the respective 'Unit Fuel Cost', taken from the 'Domestic Fuel Cost Comparison' file, to give the annual running cost.

In this case as the second option is cheaper to run, the electric heater is chosen as the main heating system and the open fire as the secondary system.

11.3.3 Efficiency data for solid fuel appliances

The following article details the approach to deriving the correct efficiency for solid fuel appliances based on fuel type and efficiency data available for the appliance based on DEAP Table 10.3.3

1) If the appliance fuel type as per DEAP 10.3.3 matches the test data fuel type then the gross efficiency is used if it is shown on the test certificate or on HARP.

Example 1:

- HARP listing for wood fuel stove: gross efficiency 73%.
- If the stove uses wood fuel in DEAP, then the efficiency is entered as 73% in DEAP.

2) If the appliance fuel type as per DEAP 10.3.3 matches the test certificate fuel type but the test certificate only shows the net efficiency then the net/gross conversion described in Appendix E must be applied (see Table E4).

Example 2:

- Test certificate for wood fuel stove: net efficiency 77.2%.
- If the stove uses wood fuel in practice then the efficiency used in DEAP is given by,
- Gross efficiency = $77.2 \times 0.91 = 70.25\%$.

3) If the appliance fuel type as per DEAP 10.3.3 is solid multifuel then the Assessor should consider the average efficiency from available solid fuel test data. This may be a single efficiency for a single fuel type or multiple efficiencies for multiple fuel types. The data could be from HARP or from other accredited sources. If the test data specifies gross efficiencies, such as on HARP, then the average of these can be used in DEAP. If the test data efficiencies are net, then these are averaged and the solid fuel net/gross conversion of 0.94 described in Appendix E must be applied.

Example 3:

- The fuel type of the stove in DEAP is solid multifuel.
- Test data for coal, anthracite and manufactured smokeless fuel are available specifying gross efficiencies of 75%, 76% and 72% respectively.
- The efficiency used in DEAP = $(75 + 76 + 72)/3 = 74.33\%$.

11.4 Electricity in DEAP

BER Assessor's and their clients may notice that dwellings primarily heated by direct or storage electricity will have higher primary energy calculated by DEAP (and hence a "worse" BER than might be expected). There are significant inefficiencies in thermal electricity production (in the generation and transmission of electricity) resulting in a high primary energy factor for electricity.

Also, the DEAP methodology cannot take account of the homeowner's choice of electricity supplier. As is stated in the DEAP manual, the calculation is an asset rating. This enables the consumer to make a fair comparison between a dwelling's energy performance and that of other dwellings. For example, if a potential purchaser/tenant of a dwelling were interested in buying/renting a house, the current occupier's behaviour (including choice of electricity supplier) is irrelevant. Changing electricity supplier does not involve any physical change to the dwelling asset.

The primary energy factor (primary energy required for each unit of delivered energy) and CO₂ factor (g/kWh delivered) for DEAP are periodically updated to reflect improvements to grid efficiency and increased renewables on the grid. The latest factors and derivation thereof are published [here](#). At the time of writing, the electricity factors were 2.08 (primary energy factor) and 0.409 kgCO₂/kWh delivered. These are automatically updated in DEAP each time the factors are recalculated by SEAI.

11.4.1 Accounting for updated electricity factors when carrying out Part L checks

The BER assessment must always be published using the latest factors discussed above and as automatically updated in DEAP. For the purposes of Part L compliance checking you may use the factors that applied at the date of application for planning permission or the latest published factors. The dates that new factors were published are

listed below. These factors can be changed under “DEAP 4 > View Assessment” if required. In all cases the current version of DEAP, published on www.seai.ie, must be used for Part L compliance checking and BER assessments.

Table 25: Historical electricity factors in DEAP

From	To	Electricity PEF	Electricity CO2 factor (kg/kWh)
14th June 2017	Present	2.08	.409
7 th Jan 2016	13th June 2017	2.19	.473
17 th Dec 2014	6 th Jan 2016	2.37	.522
11 th Dec 2013	16 th Dec 2014	2.45	.555
11 th Dec 2012	10 th Dec 2013	2.42	.524
1 st Dec 2011	10 th Dec 2012	2.58	.556
Pre 30 th Nov 2011	30 th Nov 2011	2.7	.643

11.5 Group heating

In group heating systems in DEAP, the "percentage of heat" entry for "heating systems 1/2/3" is the percentage of heat received by the dwelling from the group heating scheme boilers / heat pumps and is not reduced when CHP or secondary individual heating are present. This percentage of heat column only represents group heating appliances providing heat only (and not electricity). Therefore, it does not include the portion of heat from CHP plant (which also generates electricity) or secondary heating (which is not part of the group heating scheme - it is in the dwelling).

Examples and corresponding DEAP entries for group heating systems:

Example 1

A single boiler (90% efficient; mains gas fuel) in the group heating system. No other source of heat (from CHP or secondary heating) is present. The distribution loss factor for the group heating system is taken from the DEAP manual Table 9. The "Percentage of heat" is 100% for this boiler as it is the only group heating boiler present as shown in the following illustration:

The screenshot shows the DEAP software interface for configuring heat sources. The 'HEAT SOURCES' tab is active. The interface includes a sidebar with navigation icons and a main content area with the following elements:

- Navigation:** CONTROLS AND RESPONSIVENESS, PUMPS AND FANS, **HEAT SOURCES**, SUMMER INTERNAL TEMP.
- Heat Sources List:**
 - Fuel Type:** Mains Gas (Efficiency: 90.00, Percentage of heat: 100%)
 - Solar space heating system:** (Percentage of heat [%])
 - Total Percentage of Heat [%]:** 100 (with an 'ADD HEAT SOURCE' button)
- System Configuration:**
 - Primary System:** Distribution Loss Factor: 1.05
 - Secondary system:** Percentage of heat [%]
 - CHP:** System Type: None
 - Fraction of heat from CHP unit / recovered ...:** 0
 - Efficiency [%]:** (field)
 - Fuel Type:** (dropdown menu)
 - Electrical efficien...:** (field)
 - Heat efficiency:** (field)
- Additional Settings:**
 - Is charging based on heat consumed?
 - Fuel Type:** (dropdown menu)
 - Renewable PEF:** (field)
 - Non Renewable PEF:** (field)
 - CO₂ emission factor:** (field)

Example 2

Same as (1) above but with the addition of another boiler (92% efficient; oil) which supplies 40% of the heat from group heating boilers. Therefore, the mains gas boiler supplies 60% in the "percentage of heat" column and the oil boiler supplies 40% in the "percentage of heat" column.

CONTROLS AND RESPONSIVENESS		PUMPS AND FANS		HEAT SOURCES		SUMMER INTERNAL TEMP.	
	Fuel Type	Percentage of heat [%]	Efficiency				
	Heating Oil	40	92.00				
	Mains Gas	60	90.00				
	Solar space heating system		Percentage of heat [%]				
	Total Percentage of Heat [%]		100		ADD HEAT SOURCE		
	① Primary System	② Secondary system	CHP				
	Distribution Loss Factor	Percentage of heat [%]	System Type				
	1.05		None				
	Fraction of heat from CHP unit / recovered ...	Efficiency [%]	Fuel Type	Electrical efficien...	Heat efficiency		
	0						
<input checked="" type="checkbox"/>	Is charging based on heat consumed?	Fuel Type	Renewable PEF	Non Renewable PEF	CO ₂ emission factor		

Example 3

Same as (2) above but the dwelling itself also contains an open fire which is a fixed room heater. The "percentage of heat" column must **ALWAYS** total 100%, so the addition of the open fire (Secondary system) does not reduce the percentages of heat from "Heating System 1" or "Heating System 2". When the Percentage of Heat column does not total 100%, DEAP 4 flags this with a red warning sign.

Refer to Table 7 of the DEAP Manual for guidance on the fraction of heat supplied by secondary heating systems. Percentage of heat from secondary is therefore 10%:

CONTROLS AND RESPONSIVENESS		PUMPS AND FANS		HEAT SOURCES		SUMMER INTERNAL TEMP.	
	Fuel Type	Percentage of heat [%]	Efficiency				
	Heating Oil	40	92.00				
	Mains Gas	60	90.00				
	Solar space heating system		Percentage of heat [%]				
	Total Percentage of Heat [%]		100		ADD HEAT SOURCE		
	① Primary System	② Secondary system	CHP				
	Distribution Loss Factor	Percentage of heat [%]	System Type				
	1.05	10	None				
	Fraction of heat from CHP unit / recovered ...	Efficiency [%]	Fuel Type	Electrical efficien...	Heat efficiency		
	0	30					
<input checked="" type="checkbox"/>	Is charging based on heat consumed?	Fuel Type	Renewable PEF	Non Renewable PEF	CO ₂ emission factor		
		Solid Multi-Fuel					

Example 4

Same as (3) above but with a CHP system supplying a fraction of 0.2 of the heat. The percentages from the secondary system and heating systems 1 and 2 are not reduced when the CHP system is added as detailed above.

The screenshot shows the 'HEAT SOURCES' tab in a software interface. At the top, there are four tabs: 'CONTROLS AND RESPONSIVENESS', 'PUMPS AND FANS', 'HEAT SOURCES' (selected), and 'SUMMER INTERNAL TEMP.'. Below the tabs is a table of heat sources:

Fuel Type	Percentage of heat [%]	Efficiency
Heating Oil	40	92.00
Mains Gas	60	90.00
Solar space heating system	Percentage of heat [%]	
Total Percentage of Heat [%]		100

Below the table, there are three system configuration sections:

- Primary System:** Distribution Loss Factor: 1.05
- Secondary system:** Percentage of heat [%]: 10, Efficiency [%]: 30
- CHP:** System Type: Combined Heat and Power, Fuel Type: Mains Gas, Electrical efficien...: 0.32, Heat efficiency: 0.45

A red box highlights the 'Fraction of heat from CHP unit / recovered ...' field, which is set to 0.2. A green box highlights the CHP configuration section. At the bottom, there is a checkbox 'Is charging based on heat consumed?' which is checked, and a 'Fuel Type' dropdown set to 'Solid Multi-Fuel'.

Example 5

Finally, take a system the same as (4) above, but add a solar space heating system. It is determined using the methodology referenced in Section 12.1.2. Solar space heating system is 20% of the heat output from "heat-only" plant. Therefore, this is entered as per the following diagram, and each of the percentages from Heating system 1 and 2 are reduced by 20% of what they were prior to addition of solar heating. The Percentage of Heat column still must total 100%.

The screenshot shows the 'HEAT SOURCES' tab in a software interface, similar to Example 4 but with updated values. The table of heat sources is:

Fuel Type	Percentage of heat [%]	Efficiency
Heating Oil	32	92.00
Mains Gas	48	90.00
Solar space heating system	Percentage of heat [%]	
Total Percentage of Heat [%]		100

The 'Solar space heating system' row is highlighted with a red box, and its 'Percentage of heat [%]' value of 20 is also highlighted with a red box. The 'CHP' configuration section remains the same as in Example 4. The 'Fraction of heat from CHP unit / recovered ...' field is still 0.2. The 'Is charging based on heat consumed?' checkbox is checked, and the 'Fuel Type' is 'Solid Multi-Fuel'.

12. Renewables & Energy Saving Devices

This section provides guidance supplementing the DEAP Manual on several renewable and energy saving technologies. It focusses on solar water/space heating, heat pumps, photovoltaics, micro-wind turbines and energy saving devices (such as waste water heat recovery).

12.1 Solar heating

DEAP Manual Appendix H provides detailed guidance on solar water heating. The guidance below elaborates on this.

12.1.1 Solar space heating in individual heating systems

Solar space heating for individual heating systems is accounted for in DEAP using the method defined [here](#) (under “DEAP Tools and Information”).

Examples

A new dwelling has 15m² (gross area) of evacuated tube solar collectors providing some of the space and water heating demand. For simplicity, the data for the solar collector is taken from Table H1 of the DEAP manual, although data listed on HARP should be used if available for the collector product in question. The solar panels are south-facing at an angle of 30° with no overshadowing.

The hot water cylinder is a 1000 litre dual coil cylinder with a Dedicated Solar Storage Volume of 750 litres and 100 mm of factory-applied foam insulation.²¹

To carry out this calculation, follow the Solar Space Heating (individual systems) guidance and associated calculator at the link above. The first step is to calculate the amount of heat collected by the solar panels that will be used to reduce the *water* heating load. This is done by entering the information on the solar heating system into DEAP in the usual way.

²¹ Typically, solar space heating systems will have larger solar collector area to produce surplus heat for some of the space heating season above the hot water requirement. Therefore, they require larger storage systems. In solar space heating systems, the “hot water solar fraction” would usually be above 60% as calculated in the Water Heating section of DEAP.

Edit Solar Collector
✕

🔍 Product Details

Name	Evacuated tube
Manufacturer	Any
Model	Any
Zero Loss Collector Efficiency [η ₀]	0.6
Collector Heat Loss Coefficient [W/m ² ·K]	3

VIEW DETAILS IN LIBRARY

✎ Survey Details

Aperture Area of Collector [m ²]*	Dedicated Storage Volume [l]*
10.8	750
Annual Solar Radiation [kWh/m ²]*	Overshading Factor*
1074	1
<input checked="" type="checkbox"/> Cylinder Stat <input type="checkbox"/> Pump Solar Powered	
<input checked="" type="checkbox"/> Storage Contained within a combined Cylinder	

CANCEL
SAVE

DEAP calculates the Solar Hot Water Input, $Q_s = 2459$ kWh/year.

The next step is to calculate the amount of heat collected by the solar panels that will be used to reduce the *space* heating load. This is the surplus heat from the collectors during the heating season and is calculated by entering the following information into the Solar Space Heating spreadsheet.

- *Total Hot Water Heating Demand*: this value, in kWh/y, is copied from the Water Heating tab of DEAP.
- *Water Storage Volume*: in litres, copied from the Water Heating tab of DEAP. In this case it has a value of 1000 litres, as mentioned above.
- *Annual Space Heating Requirement*: in kWh/y, copied from the View Assessment > Gains/Losses section in DEAP.
- *Adjusted Efficiency of Main Heating System*: taken from the View Assessment > Energy section of DEAP. Note that this is the *adjusted* efficiency accounting for the effect of heating controls.

The next step depends on the type of solar space heating system. The Solar Space Heating spreadsheet covers two types:

- (1) Systems with a cylinder or thermal store for storing the solar heat for both water and space heating.
- (2) Systems with a cylinder for water heating only and with solar space heat supplied immediately to the heated space in the form of warm air.

In the calculation spreadsheet, select the appropriate system from the dropdown list and follow the final steps set out in (1) or (2) below:

Case 1: Systems with a cylinder for storing the solar heat for both water and space heating.

For this type of system, the details of the solar heating system are entered into the spreadsheet. The information is the same as that already entered in DEAP.

The spreadsheet then calculates the Space Heat Contribution – the renewable contribution to part L from the system - and the Delivered Space Heating Energy Saved which must be used to account for the system in DEAP.

Result			
Space heat contribution [kWh/y]	1186	If checking compliance with TGD L Renewables requirement, this is the renewable contribution.	
Delivered space heating energy saved [kWh/y]	1251	Enter this to DEAP "Renewable and energy-saving technologies" section as "Energy produced or saved".	

This data is entered in DEAP in the Energy requirements – Fuel Data tab as shown below:

The 'Primary energy conversion factor' and 'CO₂ emission factor' are for the main space heating fuel in the dwelling.

Case 2: Systems with a solar store for water heating only and with solar space heat supplied immediately to the heated space in the form of warm air.

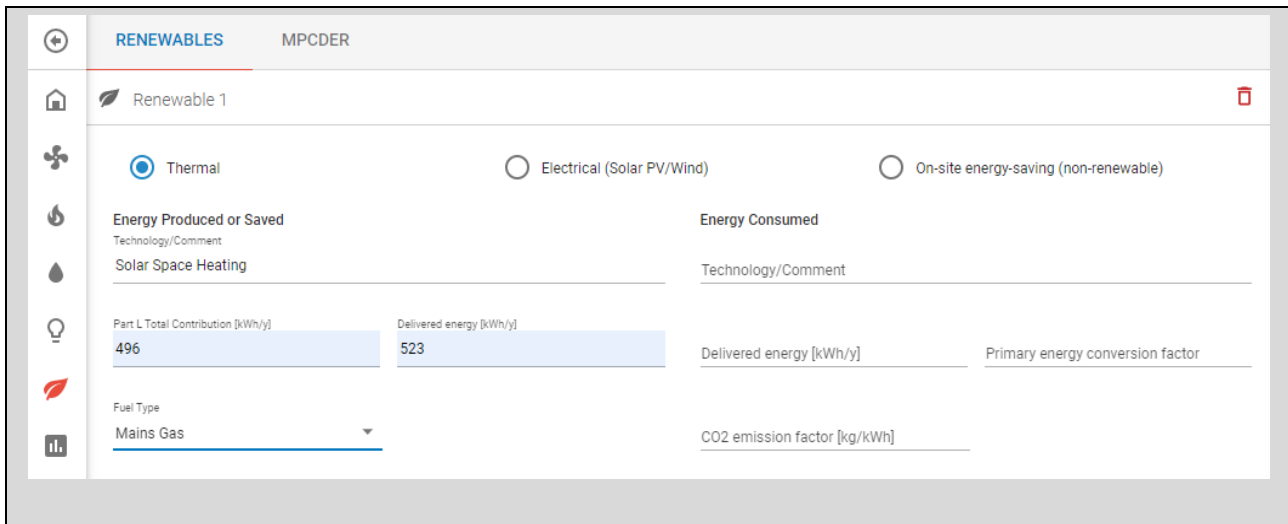
In this case the following data must also be entered in the "Immediate" worksheet of the Solar Space Heating spreadsheet:

- *Total Floor Area:* from the Building > Floors tab of DEAP.
- *Total Heat Loss:* from Results tab in the DEAP Survey.
- *Thermal Mass Category of Dwelling:* from the Building > Global Factors tab of DEAP.

As before, the spreadsheet calculates the Space Heat Contribution and Delivered Space Heating Energy Saved,

Result		
Space heat contribution [kWh/y]	496	If checking compliance with TGD L Renewables requirement, this is the renewable contribution.
Delivered space heating energy saved [kWh/y]	523	Enter this to DEAP "Renewable and energy-saving technologies" section as "Energy produced or saved".

which are entered into DEAP as shown in this diagram:



12.1.2 Solar space heating in group heating systems

Solar space heating for group heating systems is accounted for in DEAP using the method defined [here](#) (under “DEAP Tools and Information”).

A group solar space heating system is a group heating system (2 or more dwellings heated by the same heating system) in which some of the dwelling heating load is provided by an array of solar collectors, e.g. an apartment block with a boiler providing space heating and hot water to all the apartments and an array of solar collectors on the apartment building roof which also provides space heating and hot water to each apartment.

It is important to note in this case that the solar space heating system is part of the group scheme and not specific to an individual dwelling. As a result, the Assessor **does not need to enter data on the solar collectors in the Water Heating section of DEAP**. Instead, the spreadsheet is used to calculate the percentage contribution of the solar collectors to the total heat provided by the group heating scheme. The group solar space heating spreadsheet requires the following data:

Table 26 – Data required for solar space heating spreadsheet

Data Required	Value
Total Floor Area	From DEAP Building > Floors tab
Main Space Heating System: Delivered Energy	From DEAP View Assessment > Results tab
Main Water Heating System: Delivered Energy	From DEAP View Assessment > Results tab
Distribution Loss Factor	From DEAP Space Heating > Heat Sources tab (taken from DEAP Table 9)
Fraction of heat from CHP unit/recovered from Power Station	From DEAP Space Heating > Heat Sources tab
Total floor area of all dwellings served by the group heating scheme	Depends on the development in question.
Total aperture area of solar collectors in group heating scheme	From specification
Dedicated solar storage volume of group heating scheme	From specification
Zero loss collector efficiency of solar collectors	From certified test data or HARP database or DEAP Table H1




Collector heat loss coefficient	From certified test data or HARP database or DEAP Table H1
Annual solar radiation	DEAP Table H2
Overshading factor	DEAP Table H3

Example

The following example shows data for one apartment in a block of eight apartments (each apartment has a total floor area of 80 m²) with a group heating scheme (a gas boiler) and a group solar array on the apartment building roof. The array has a gross area of 100 m² which gives an aperture area of 72m² according to Table H2 - default values from Table H1 are used – and a dedicated solar storage of 5000 litres. The collectors are south-facing at a 30° tilt.

Take the following inputs from the DEAP calculation software completed as described in the instructions document			
Tab	Item	Value	
Dimensions	Total floor area [m ²]	80	
Results	'Main space heating system', 'Delivered energy [kWh/y]'	5298	
Results	'Main water heating system', 'Delivered energy [kWh/y]'	3849	
Energy requirements	Distribution loss factor [-]	1.05	
Energy requirements	Fraction of heat from CHP unit/recoverd from power station [-]	0	
Other inputs			
	Sum of floor areas of all dwellings served by the group heating scheme [m ²]	640	
	Proportion of collector area and storage volume allocated to this dwelling	0.125	
Inputs for solar system			
Complete the following inputs as described in Appendix H of the DEAP document i.e. in the same manner as for a solar water heating system serving a single dwelling.			
	Aperture area of solar collector - of group system [m ²]	72	Amount allocated to this dwelling 9.00
	Dedicated solar storage volume - of group system [litres]	5000	625
	Zero-loss collector efficiency, η_0 [-]	0.6	
	Collector heat loss coefficient, a_1 [W/m ² K]	3	
	Collector performance ratio, a_1/η_0 [W/m ² K]	5.00	
	Annual solar radiation [kWh/m ²] from Table H2	1074	
	Overshading factor [-] from Table H3	1	
Result			
	Solar contribution as percentage of heat output from heat-only plant (i.e. excluding CHP)		34% -

The last line, highlighted in blue, indicates that 34% of the heating provided by the group heating scheme thermal heating comes from the solar collectors. This information must be entered in DEAP for the group heating scheme's Space Heating section:

	CONTROLS AND RESPONSIVENESS	PUMPS AND FANS	HEAT SOURCES	SUMMER INTERNAL TEMP.
	Fuel Type	Percentage of heat [%]	Efficiency	
	Mains Gas		66	90.00  
	Solar space heating system	Percentage of heat [%]	34	
	Total Percentage of Heat [%]		100	 ADD HEAT SOURCE

In this case, “Renewable and Energy Saving Technologies” entries are not required in DEAP as the space and water heating derived from the group solar heating system is accounted for in full by this “34%” figure. In addition, DEAP uses this figure to calculate any applicable renewable energy contribution for Part L compliance checking.

The Assessor must follow DEAP Appendix A when identifying the main and secondary heating systems operating in conjunction with the solar space heating system or solar water heating system. A main space and water heating system and associated fuel must be specified for individual heating systems always. Likewise, for group heating, at least one fuelled thermal heating system must be specified along with the solar space heating system. The solar space heating will reduce the overall primary energy requirement of the dwelling and this is reflected in DEAP.

12.1.3 Multiple solar collectors of different orientation

The Annual Solar Radiation falling on a solar collector is taken from Table H2 of the DEAP manual. The values in this table must not be interpolated; instead, the nearest value in the table must be used: e.g. for a solar collector on a roof facing south with a pitch of 25° use the nearest value in the table which is for a south-facing roof with a pitch of 30°, i.e. a value of 1074 kWh/m².

The DEAP software assumes that all the solar collectors on a dwelling have the same orientation but this is not always the case. In this situation the correct value for the annual solar radiation must be calculated by an area-weighted average.

For example, consider a dwelling with:

- 2m² of collectors on a south-facing roof with a tilt of 30°, and,
- 1m² of collectors on an east-facing roof with a tilt of 60°.

According to DEAP Table H2 the collectors on the south-facing roof receive 1074 kWh/m² and the collectors on the east-facing roof receive 778 kWh/m².

$$\text{Average annual solar radiation} = \frac{(1074 \times 2) + (778 \times 1)}{(2 + 1)} = 975.33 \text{ kWh/m}^2$$

This value is entered for the “Annual Solar Radiation” in DEAP and the “Aperture Area of Solar Collector” is equal to the total area of the collectors which is 3m² in this case.

12.2 On site renewable electricity generation

12.2.1 Micro wind turbines in DEAP

DEAP Manual Appendix M2 gives a step by step approach to calculating the output from an onsite wind turbine for use in DEAP. Measured power data from the wind turbine may be used in a BER assessment only if the data covers a minimum of a continuous twelve-month period. This data may be in the form of printouts from (or photographs of) onsite metering equipment. As always, retain a copy of the supporting evidence with the BER when publishing a BER assessment. Where measured data is not available, the output power is calculated based on default factors, blade swept area, wind speed, surroundings (e.g. urban, rural, etc.) and the number of turbines installed.

The calculated or measured electrical energy generated is entered in the “Renewable and energy saving technologies” section in DEAP along with the current electricity factors for primary energy conversion and CO₂ emissions.

Example:

In the picture below, data for a wind turbine producing 1100kWh of electricity per year is entered in DEAP.

The screenshot shows the DEAP software interface for configuring a renewable energy source. The 'RENEWABLES' section is active, and 'MPCDER' is the selected category. Under 'Renewable 1', the 'Electrical (Solar PV/Wind)' option is selected. The 'Energy Produced or Saved' section shows 'Onsite wind turbine' with a 'Part L Total Contribution [kWh/y]' of 1100 and a 'Delivered energy [kWh/y]' of 1100. The 'Energy Consumed' section is empty. The 'Fuel Type' is set to 'Electricity'.

12.2.2 Photovoltaics (PV) in DEAP

DEAP Manual Appendix M1 details the approach to PV calculations in DEAP. The kWp (kilowatt peak) of the collector is defaulted to 0.06kWp per m² of installed collector as detailed in DEAP Appendix M1. However, always use certified / CE marked data to one of the following standards where possible:

- EN 61215/IEC 61215: Terrestrial Photovoltaic (PV) modules with Crystalline Solar Cells – Design Qualification and Type Approval
- EN 61646/IEC 61646: Thin-film terrestrial photovoltaic (PV) modules – Design Qualification and Type Approval

Example

A new dwelling is served by four PV collectors on a south facing roof at a slope of 30° slope with no overshadowing

- Annual solar radiation, “S” = 1074kWh
- Overshading factor “Zpv” = 1
- CE mark and standard IEC 61215 shown on datasheet so is acceptable for use in DEAP
- Nominal power from certified data of 250Wp (0.25kWp) at Standard Test Conditions (STC)
- 4 collectors =>
 - installed peak power = 4*0.25 =1kWp
- Electricity produced by PV module in kWh/yr for DEAP is 0.8 x kWp x S x Zpv =
 - 0.8*1*1074*1 = 859kWh/yr

Entered in DEAP under Part L contribution and Delivered energy (see overleaf).

Fuel Type is automatically set to ‘Electricity’.






ELECTRICAL DATA @ STC	
Nominal Power - P _{MPP} (Wp)	250
Watt Class Sorting - (W)	U/+5
Nominal Power Voltage - V _{MPP} (V)	30.2
Nominal Power Current - I _{MPP} (A)	8.30
Open Circuit Voltage - V _{OC} (V)	37.4
Short Circuit Current - I _{SC} (A)	8.86
Panel Efficiency (%)	15.2

Values at standard test conditions STC (airmass AM 1.5, irradiance 1000 W/m², cell temperature 25°C) at low irradiance of 200 W/m² (AM 1.5 and cell temperature 25°C) at xxx Wp. *Where xxx indicates the nominal power class (P_{MPP}) at STC indicated.

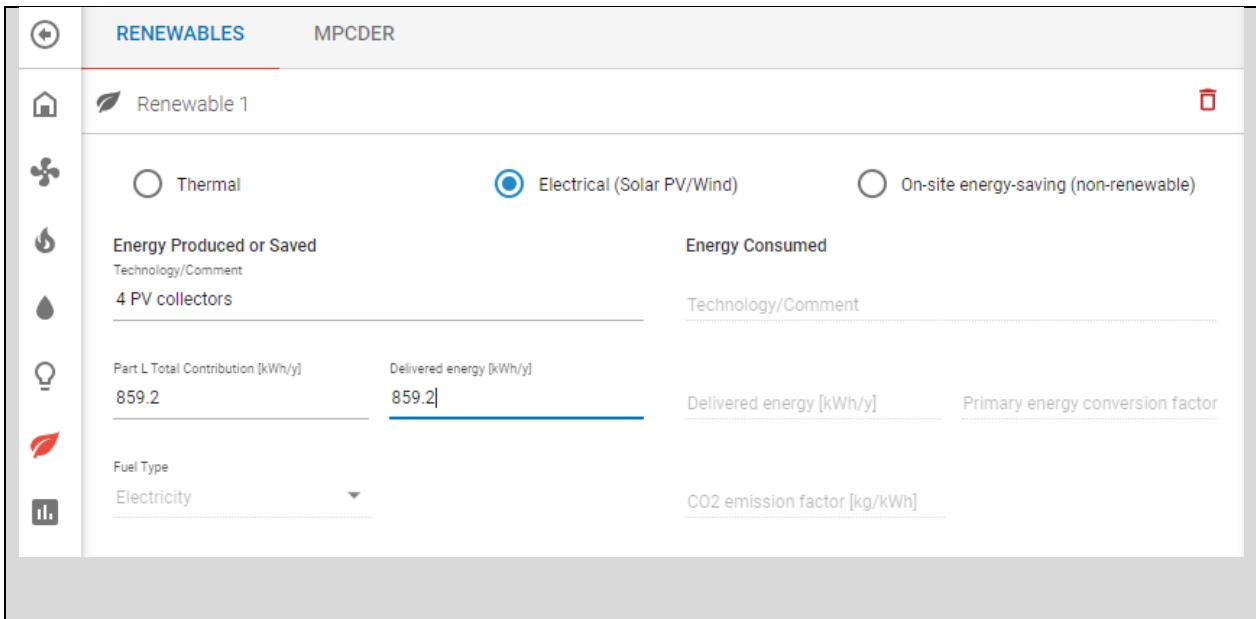
ELECTRICAL DATA @ NOCT	
Nominal Power - P _{MPP} (Wp)	183
Nominal Power Voltage - V _{MPP} (V)	27.8
Nominal Power Current - I _{MPP} (A)	6.58
Open Circuit Voltage - V _{OC} (V)	34.7
Short Circuit Current - I _{SC} (A)	7.11

Nominal operating cell temperature NOCT (800 W/m², AM 1.5, wind speed 1 m/s) at xxx Wp. *Where xxx indicates the nominal power class (P_{MPP}) at STC indicated.

CERTIFICATIONS

IEC 61215, IEC 61730 & UL 1703; MCS, IEC 62804 (PID), IEC 60068-2-68 (Blowing Sand), IEC 61701 (Salt Mist level 6), UNI 8457/9174 (Class A), ISO 11925-2 (Class E), ISO 9001: 2015, ISO 14001: 2004, OHSAS 18001: 2007



12.3 Other energy saving devices

The DEAP Methodology and software have evolved to cater for new and innovative technologies. If you are assessing a dwelling including an innovative technology not necessarily represented in DEAP, contact the BER Helpdesk by e-mail at registered@ber.seai.ie to ascertain the correct approach. In some cases, the technology may be catered for within the current DEAP methodology based on guidance from the BER Helpdesk. Otherwise:

- The technology may be considered for future inclusion in the DEAP methodology;
- The technology may be deemed inappropriate for inclusion in the DEAP methodology and should not be accounted for in BER assessments.

The “Renewable and Energy Saving Technologies” section in DEAP is discussed in DEAP Appendix Q, including a listing of technologies catered for therein.

12.3.1 Flue gas heat recovery systems (FGHRS)

A Flue Gas Heat Recovery System (FGHRS) is a mechanism to recover heat from a boiler’s exhaust gas, improving the efficiency of the boiler. The recovered heat can be used to pre-heat water entering the boiler. BRE provide a spreadsheet [here](#) for deriving the energy saved by these devices when registered on BRE’s products database.

When using the above spreadsheet, first select the installed FGHRS from the “Select FGHRS” tab -> “Index Number chosen). Then, under “Calculate savings” / “Worksheet data” select entries as follows:

Table 27 – FGHRS data entry

Data Required	Value
Fuel	LPG/Gas/Oil
Boiler Type	Regular/Combi
Condensing or Non-Condensing	Condensing or Non-Condensing
Total Dwelling Floor Area	From DEAP Building
Volume of Hot Water store	From DEAP Water Heating
Temperature Factor	From DEAP Water Heating “Temperature Factor Unadjusted” x “Temperature Factor Multiplier”
Water Storage heat loss for 1 month	From DEAP Water Heating “Storage Loss” (divided by 12 to give 1 month)

Primary Circuit Heat loss	From DEAP Water Heating "Primary Circuit Loss"
Combi Loss for 1 month	From DEAP Water Heating "Additional Loss for Combi Boiler" (divided by 12 to give approximately 1 month)
Contribution from Solar Water Heating	From DEAP Water Heating tab "Solar Hot Water Input"
Efficiency of space and water heating	From DEAP Space Heating > Heat Sources and DEAP Water Heating > Heat Sources (water heating efficiency repeated for each of the 12 months)
Energy Saved by WWHRS	Set to '0' in this instance.
Main heater fuel usage	From DEAP View Assessment > Gains and Losses: "Annual Space Heating Requirement" Divide by 8 to give an average value for each of the 8 months as an approximation
Fraction of heat from Secondary/Supplementary system	From DEAP Space Heating > Heat Sources tab
Electricity used by Keep-hot facility	From DEAP Water Heating

The spreadsheet uses this information to calculate the annual energy saved by the FGHRs in kWh. This number is input into the DEAP software in the Renewables section. The example below shows how the data for an FGHRs unit which saves 350kWh per annum is entered into DEAP:

The screenshot shows the DEAP software interface for a 'Renewable 1' entry. It features three radio buttons for energy source selection: 'Thermal' (unselected), 'Electrical (Solar PV/Wind)' (unselected), and 'On-site energy-saving (non-renewable)' (selected). The 'Energy Produced or Saved' section includes a text field for 'Technology/Comment' containing 'FGHRs', a 'Part L Total Contribution [kWh/y]' field with the value '0', and a 'Delivered energy [kWh/y]' field with the value '350'. The 'Energy Consumed' section includes a 'Technology/Comment' field with 'None', an empty 'Delivered energy [kWh/y]' field, and an empty 'Primary energy conversion factor' field. At the bottom, the 'Fuel Type' is set to 'Mains Gas' and the 'CO2 emission factor [kg/kWh]' field is empty.

Figure 12.1 – DEAP entry for a Flue Gas Heat Recovery System

13. Heat Pumps

The methodology for heat pumps in DEAP was updated in 2016 with full details now incorporated into the DEAP Manual.

The methodology is based on mandatory performance requirements for heat pumps across Europe under the Ecodesign (2009/125/EC) and Labelling (2010/30/EU) European directives. This update uses test data to standards I.S. EN 14825-2013 for space heating and I.S. EN 16147-2011 for water heating and derives seasonal performance data for entry in DEAP based on I.S. EN 15316-4-2-2008. The above directives are a legal requirement for heat pumps placed on the market from 26th September 2015. Where heat pumps are not required to comply with and do not comply with those directives, then the methodology uses EN14511 based data as detailed in the guidance document referenced below.

The full methodology is set out as follows and applies to all domestic BER assessments regardless of whether the heat pump complies with the above directives.

1. **Heat Pump Guidance.** This is detailed in DEAP manual Appendix G.
2. **Heat Pump Tool** This has been incorporated into DEAP 4. The calculation takes user entries from heat pump test data, heating system design data and DEAP heat demand calculations. It calculates the DEAP heat pump efficiencies and adjustment factors for space and water heating and the renewable energy contribution from the heat pump.
3. **Designer/Installer Sign Off Form** (Microsoft Excel format). This is filled out by the heating system designer or installer for the dwelling being assessed and is required by the BER assessor in completing the DEAP assessment where a heat pump is present in the dwelling. This form is retained by the BER Assessor alongside other supporting evidence for the BER.
Note: The Designer/Installer Sign Off form was updated in 2020 to allow for additional heat pump system types to be entered into DEAP. See below for further details.
4. **Heat Pump Examples.** The examples are listed in Section 13.2 to assist BER Assessors when carrying out assessments for dwellings fitted with heat pumps. The examples demonstrate how to enter the heat pump data into DEAP. The examples cover a range of heat pump types and scenarios detailing the designer input, and sourcing heat pump test data.

Key notes for the heat pump methodology:

- It is mandatory to use the heat pump guidance referenced above when assessing a dwelling with a heat pump system.
- Where Ecodesign data, EN 14825 or EN 16147 test data is available, it must be used.
- The Designer/ Installer sign off form is required for EN 14825/ EN 16147 methodology. However, in some cases, not all the required information will be available from the Designer/ Installer. In those cases, most information can be obtained from site visit and default values used elsewhere.
- 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.
- Heat pump Ecodesign performance figures must be for "Average climate conditions" when used in DEAP.
- As detailed in the Heat Pump Examples document: "The Ecodesign Directive requires that parameters must be provided for "Medium Temperature Applications" which is defined in the Ecodesign Directive as an indoor heat exchanger outlet temperature of 55°C and therefore relates to High Temperature test points in EN 14825".

- In cases where the manufacturer / supplier / other pre-populates the heat pump tool entries, the assessor is still responsible for ensuring DEAP (and heat pump) methodology is followed correctly and must still obtain the technical data sheets to verify data entered into DEAP.
- The following is a list that includes, but is not limited to, data that must be retained by the assessor for Heat Pump Assessments:
 - Signed copy of Designer/ Installer Sign Off sheet
 - Heat pump test performance documentation used in the calculation according to relevant standards/regulations/directives.
 - Any calculations demonstrating a lower design flow temperature for space heating where a non-default design flow temperature is specified in the heat pump calculation tool.
 - For Heat Pumps installed/on market after the 26th September 2015 where EN14511/ EN255 test data is used, documentary evidence must be retained justifying the heat pump’s lack of compliance with Ecodesign/ Energy Labelling Directives.

The methodology for heat pumps in DEAP was updated in 2020 to allow for the following heat pump system types to be included in BER assessments:

- **Low Temperature Heat Pumps:** These are Low Temperature “to-water” units as defined in the Ecodesign directive, which cannot deliver heating water at a temperature at or above 52°C.
- **Gas adsorption/absorption Heat Pumps (GAHP):** These heat pumps consume gas rather than electricity. The test data for these units is structured in the same way as electrical heat pumps but is based on different test standards detailed in the DEAP Heat Pump Methodology 2020 document.
- **Direct Exchange (DX) heat pumps:** These units circulate refrigerant rather than water through the ground loop. For the purposes of this calculator, they are similar to Brine /Water (B/W) units, although the source temperature is 4°C rather than 0°C.
- **Exhaust Air-to-Air heat pumps:** These are double duct systems using heat pump technology to source heat from extracted air to heat incoming fresh air. Like Exhaust Air-to-Water heat pumps, which are already facilitated in the DEAP software, the renewable energy contribution is adjusted as energy recovered from the dwelling via heat recovery is not considered renewable in line with the Renewables Directive (2018/2001).
- **Multiple Heat Pump Arrangements:** The heat pump calculator facilitates multiple heat pump configurations (up to three heat pumps, with means to separate space and water heating heat pumps). The combined efficiency of the three heat pumps may be entered as group heating or individual heat pumps, or combinations thereof. The user enters proportion of space heating and water heating from each heat pump as well as heat pump type information and associated test data for each unit.

A new heat pump calculator (Microsoft Excel format) has been developed for these heat pump types.

The new calculator and the accompanying guidance document,

- DEAP Heat Pump Calculator 2020,
- DEAP Heat Pump Methodology 2020,

are available for download [here](#) under “DEAP Heat Pump Methodology 2020”.

The calculator should only be used for the heat pump types listed. All other heat pump types can generally be entered directly into DEAP 4.

13.1 Heat pump design flow temperature

To calculate the space heating efficiency of the heat pump, the default design flow temperatures in Table 28 must be assumed unless there is sufficient documentary evidence available to support lower non-default flow temperatures.

Table 28 - Default flow temperatures for heat emitters

Heat Emitter Type	Default supply temperature
Radiators	55°C
Fan Coil Radiators	45°C

Underfloor Heating	35°C
--------------------	------

Where non-default flow temperatures are used to calculate the space heating efficiency of the heat pump, the following information is required and must be retained as documentary evidence:

- Designer/installer sign-off sheet;
- Heating design sheet;
- Radiator specifications, with additional calculations if necessary.

The following guidance sets out the documentary evidence required and the checks required to support non-default flow temperatures in BERs.

13.1.1 Designer/Installer Sign-off Sheet

For any heat pump to which Ecodesign, EN14825 or EN16147 applies, the Designer/Installer sign off sheet, or equivalent, must be completed and signed by the Designer/Installer of the heat pump system.

A new version of the designer/installer sign-off sheet has been developed by SEAI, which includes,

- A new Heating Design tab,
- A new Radiator Output Conversion tab,
- A checklist for BERs: this is provided to assist assessors in ensuring all supporting documentation is obtained and the required checks have been carried out to support BER inputs (where non-default flow temperatures are used to calculate the heat pump efficiency for space heating) & the heat pump grant process. While it is not mandatory to complete the checklist, it is advisable.
- A checklist for BER + heat pump grant applications: For the purpose of Better Energy Homes grants, the Registered Contractor must provide hardcopies of the Designer/Installer sign-off sheet to the homeowner. A copy must be submitted to SEAI by the homeowner along with the Declaration of Works.

This Designer/Installer sign-off sheet must be completed by the Designer/Installer in either hardcopy or softcopy format, and must be 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.

If the signed designer/installer sign-off sheet is not available, default values must be used for installation data, namely:

- Default flow temperature for the distribution system present, as per Table 28;
- No of Hours per Day Heat Pump has been designed to run = 8 hours;

Ecodesign/test data relating to the heat pump may still be used in this situation to calculate a non-default efficiency.

Additional guidance on the Designer/Installer sign-off sheet is given in Table 29.

Table 29: Designer/Installer Sign-off Sheet – additional notes

1. General Information	Notes
- includes dwelling details	
2. Purpose of installation	
- identifies if the heat pump is supplying space heating / domestic hot water / both	Confirm during site survey
3. Heat Pump Selection	
- Make, model and any model qualifier for the heat pump identified in the dwelling being assessed	Confirm during site survey
- Type of heat pump (e.g. A/W; B/W etc.)	

- Date of installation	Heat pumps installed after 26th September 2015 must comply with the Ecodesign and Energy Labelling Regulations
- Confirmation of compliance with the Ecodesign and Energy Labelling Regulations	
- Confirmation of test standards for the heat pump	
- Confirmation of hours of operation per day, (8, 16 or 24 hrs) closest to the number of hours of operation expected by the design. <i>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.</i>	
- Confirmation of any backup systems installed to supplement the heat pump including backup heater details and fuel type.	The main space heating backup heater is not the secondary heating. 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.
4. Heat Emitter Design	
- Heat emitters present in the dwelling	Confirm during site survey
- Heating controls within dwelling	Confirm during site survey
- Design flow temperature based on design conditions	Where this is a non-default flow temperature, the completed heating design sheet (or equivalent) must be obtained from the designer/installer
5. Domestic Hot Water	
- Confirmation of hot water temperature based on certified data	Check against certified data
- Confirmation of the type of store present	Confirm during site survey
- Confirmation of the 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.
6. Confirmation	
- Signoff and details of system designer/installer is required	

13.1.2 Heating Design Sheet

The SEAI Heating Design Sheet (or equivalent) must be filled out by the **Designer/Installer** where,

- non-default flow temperatures are used to calculate the efficiency of the heat pump, or,
- where an air distribution system is the primary heating source

The Heating Design sheet must reflect what is installed in the dwelling. It must be retained by the BER Assessor as documentary evidence for the BER.

The Heating Design Sheet contains the following information for each room in the dwelling:

- **Room heat loss** (in Watts) – This is the amount of heat lost from the room per second, at the specified internal temperature (i.e. the Design Room Temperature – see below) and the Design External Temperature, which is taken to be -3°C.
- **Type of emitter:** One of the following - Radiator, Fan Coil System, Underfloor, Air System.
- **Manufacturer & model/size:** Required for radiators and fan coil systems.
- **Single heat emitter output at ΔT_{design} & Number of emitters:** Required for radiators and fan coil systems. The single heat emitter output for a radiator or fan coil system should come from the manufacturer’s specification for the system. The output must be for the Temperature Difference (ΔT) specified for the room in question.
- **Total heat emitter output:** Required for radiators, fan coil systems, and air systems.
- **Design Room Temperature:** The target temperature in the room. This is based on room type and is taken from the CIBSE Domestic Heating Design Guide or an equivalent source.
- **Temperature Difference (ΔT_{design}):** Required for radiator and fan coil systems. This is the temperature difference between the water/air in the distribution system and the Design Room Temperature.
- **Underfloor Output (in W/m²):** The heat output of an underfloor heating system, where applicable.
- **Supply air temperature (°C) and Air Volume (litres/s):** The heat output of the air distribution system, where applicable.

The BER assessor must carry out a number of checks on the information provided in the heating design sheet:

For the use of a lower non-default flow temperature, the checks are as follows:

- Dwelling address of the heat pump installation has been provided.
- The design flow temperature and return temperature have been provided.
- For each room in the dwelling that is heated by the heating system, all the required heating design data has been provided.
- The total heat emitter output (Watts) is greater than the total heat loss (Watts).
- The HLI stated on the heating design sheet should be within 10% of the HLI calculated in DEAP, i.e.

$$0.9 * HLI_{\text{DEAP}} < HLI_{\text{DesignSheet}} < 1.1 * HLI_{\text{DEAP}}$$

- Where $HLI_{\text{DesignSheet}}$ is less than $(HLI_{\text{DEAP}} * 0.9)$ there is a risk that the heating system is undersized. In such a case, **the default flow temperature must be used.**
- Where $HLI_{\text{DesignSheet}}$ is more than 10% larger than HLI_{DEAP} , the BER Assessor must ask the Designer to confirm in writing that they followed the SR 50-4 standard for heat loss calculations and sizing, highlighting the risks of oversizing HP systems. If the Designer provides this confirmation then the non-default flow temperature can be used, as long as all other conditions are met. If the Designer does not provide this confirmation, then the default flow temperature must be used.
- The name and contact details of the Designer/Installer have been provided.

Where any of the evidence above is not made available, or where any conditions are not satisfied, a default flow temperature should be used.

Examples of a completed Heating Design Sheet are given in Figure 13.1 and Figure 13.2.

For the use of an air distribution system as the primary heating source, the checks are as follows:

- The supply air temperature for each room has been provided. Where greater than 27°C it should be supported by manufacturer's data.
- The air volume required meets the design specification for the heating system for provisional BERs or the commissioning sheet for Final BERs (i.e. the 'air volume provided by the system', as stated in the heating system design/commissioning sheet, must not be more than 10% lower than the 'air volume required' stated in the designer sheet).

Where this evidence is not available or does not meet the heating demand, the guidance in Appendix A of the DEAP manual should be followed.

Please note:

- **It is not the responsibility of the BER assessor to check the room heat loss calculations.**
It is the responsibility of the designer/installer of the system to carry out these calculations in accordance with the following:
 - S.R. 50-1:2021 Building services - Code of Practice - Part 1: Water based heating systems in dwellings;
 - S.R. 50-4:2021 Building services - Part 4: Heat pump systems in dwellings;

The following guidance may also be useful in addition to the above:

- SEAI Room heat loss and radiator sizing guidance.
- CIBSE Domestic Heating Design Guide
- Where an alternative to the Heating Design Sheet has been provided as documentary evidence, the same checks (items 1 – 10 above) must be carried out by the BER assessor.
- The SEAI Heating Design Sheet must be completed as part of the SEAI heat pump grant application process

Figure 13.2: Heating Design Sheet - Underfloor heating in one room and radiators in remainder of rooms

Heating Design Details										Notes		
Address of installation		1, Main Road, Ballyross, Co. Dublin.			2		45.00	Design Flow Temp °C				
Please specify below all details of the Heat distribution system as designed & installed							35.00	Return Temperature °C				
Room	Room Heat Loss [W]	Type of emitter	Manufacturer	Model /Size	Single heat emitter output at ΔT_{design} [W]	Number of emitters	Total heat emitters output [W]	Design Room Temp [°C]	ΔT_{design} for heat output	UF output [W/m ²]	Supply Air temperature [°C]	A
Kitchen	3	1100	Underfloor	Manuf	Model/size		1300	20		40		
Living room	1200	Radiator	Manuf	Model/size	750	2	1500	20	20			
WC	300	Radiator	Manuf	Model/size	450	1	450	18	22			
Hall	450	Radiator	Manuf	Model/size	450	1	450	18	22			
Bedroom	4	620	Radiator	Manuf	Model/size	750	1	750	18	22		
Bedroom 2	450	Radiator	Manuf	Model/size	450	1	450	18	22			
Bedroom 3	670	Radiator	Manuf	Model/size	750	1	750	18	22			
Bathroom	320	Radiator	Manuf	Model/size	450	1	450	18	22			
Total Heat Loss		5110	Watts	6		Total Output		6100	Watts			
Area of Dwelling		110	m ²									
HLI (Design)		1.94	W/K/m ²	7								
Heat pump output at design conditions		6	kW									
8		Full Name		Joe Murphy								
		Company Name		Acme Heat Pumps								
		Email		jm@acmehatpumps.ie								
		Date		05/02/2021								

Check the following has been provided:

1. Dwelling address of heat pump installation
2. Design Flow and Return temperatures
3. Where underfloor heating is specified, the room (or area) heat loss (W), total heat emitter output (W) and UF output (W/m²)
4. Where radiators/fan coil emitters are specified, the room heat loss (W), manufacturer, model, single heat emitter output (W), number of emitters, total heat emitter output (W), design room temp (°C) and ΔT for heat output
5. Where an air system is specified, the room heat loss (W), manufacturer, model, single heat emitter output (W), number of emitters, total heat emitter output (W), supply air temperature (°C) and air flow rate (l/sec). (Not shown in this example)
6. The total output (W) is greater than the total heat loss (W)
7. Check the HLI stated here is not less than 10% lower than Total Heat Loss per m² as calculated in DEAP
8. Heating design sheet has been completed by Designer/Installer and includes their name and contact details

13.1.3.2. Evidence Required for Radiators

The Assessor must perform an additional check to verify that the Designer/Installer has provided evidence to support the heat output for each radiator listed in the Heating Design sheet.

There are two possibilities:

(1) The radiator heat outputs listed in the manufacturer’s brochure match the radiator outputs listed in the design sheet.

Example 1

The Designer/Installer has supplied the Assessor with the radiator manufacturer’s brochure. It lists the heat output for different models and for different ΔT values.

Performance Data.

Model	Operation Mode	Heat Output (Watts)			
		ΔT_{10}	ΔT_{15}	ΔT_{20}	ΔT_{25}
ULOW 040	Static	74	126	184	247
	Comfort	125	197	272	350
	Boost	147	231	317	407
ULOW 060	Static	111	189	276	371
	Comfort	188	296	409	527
	Boost	220	345	475	609
ULOW 080	Static	148	252	368	494
	Comfort	250	394	545	702
	Boost	294	461	634	813

In the Heating Design sheet, for the radiator in the kitchen (see image below):

Room	Room Heat Loss [W]	Type of emitter	Manufacturer	Model /Size	Single heat emitter output at ΔT_{design} [W]	Number of emitters	Total heat emitters output [W]	Design Room Temp [°C]	ΔT_{design} for heat output
Kitchen	995	Radiator	Acme	Ulow 080 (Comfort)	545	2	1090	20	20

- The model corresponds to the model highlighted in the brochure;
- ΔT_{Design} corresponds to the value listed in the brochure ($\Delta T = 20$);
- The Heat Emitter Output at ΔT_{Design} equals the value stated in the brochure (545 Watts).

So, on that basis, the data provided for the radiator is acceptable.

Note that this check must be carried out for every radiator listed in the Heating Design sheet.

(2) The radiator heat outputs listed in the manufacturer’s brochure do not match the radiator outputs listed in the design sheet. In this case, the Designer/Installer must complete the Radiator Outputs sheet.

Example 2

In this example the Designer/Installer has provided a manufacturer’s brochure which gives the heat output for a range of models at $\Delta T = 50^\circ\text{C}$,

Nominal	Length	Double Convector		
Height	mm	Code	BTU/hr	Watts
500mm	400	Q22504CR	2295	672
	500	Q22505CR	2869	841
	600	Q22506CR	3442	1009
	700	Q22507CR	4016	1177
	800	Q22508CR	4590	1345
	900	Q22509CR	5164	1513
	1000	Q22510CR	5737	1681

as well as a table of correction factors (see below). These correction factors are used to calculate the heat output of the radiator at different ΔT values.

Correction Factors					
ΔT	Based on $\Delta T 50^{\circ}\text{C}$	ΔT	Based on $\Delta T 50^{\circ}\text{C}$	ΔT	Based on $\Delta T 50^{\circ}\text{C}$
10	0.131	24	0.396	38	0.707
11	0.148	25	0.417	39	0.731
12	0.165	26	0.438	40	0.754
13	0.182	27	0.459	41	0.778
14	0.200	28	0.481	42	0.802
15	0.219	29	0.503	43	0.826
16	0.237	30	0.524	44	0.851
17	0.256	31	0.547	45	0.875
18	0.275	32	0.569	46	0.897
19	0.295	33	0.592	47	0.925
20	0.314	34	0.614	48	0.948
21	0.334	35	0.637	49	0.975
22	0.355	36	0.660	50	1.000
23	0.375	37	0.684		

The Designer/Installer has completed the Radiator Output Conversion sheet using this data:



Room	ΔT_{design}	Radiator Make	Radiator Model or code	Radiator dimensions (width x height x depth)	Heat output (manufacturer)	ΔT (manufacturer)	Conversion factor	Heat output at ΔT_{design}
Kitchen	20	Acme	Q22509R	900 x 500	1513	50	0.314	475
Bedroom 1	22	Acme	Q22509R	900 x 500	1513	50	0.355	537
Bedroom 2	20	Acme	Q22509R	900 x 500	1513	50	0.314	475
Bedroom 3	22	Acme	Q22509R	900 x 500	1513	50	0.355	537
Bathroom	22	Acme	Q22509R	900 x 500	1513	50	0.355	537

The Heat Output and the Conversion Factor have been taken from the manufacturer's brochure.

For each radiator,

$$\text{Heat Output (at } \Delta T_{\text{Design}}) = \text{Conversion Factor} \times \text{Heat Output}$$

The Assessor must check that the values calculated (highlighted in the red box) match the values entered in the Heating Design sheet, as highlighted in the green box below.

Room	Room Heat Loss [W]	Type of emitter	Manufacturer	Model /Size	Single heat emitter output at ΔT_{design} [W]	Number of emitters	Total heat emitters output [W]	Design Room Temp [°C]	ΔT_{design} for heat output
Kitchen	900	Radiator	Acme	Q22509R	475	2	950	20	20
Bedroom 1	510	Radiator	Acme	Q22509R	537	1	537	18	22
Bedroom 2	450	Radiator	Acme	Q22509R	475	1	475	20	20
Bedroom 3	490	Radiator	Acme	Q22509R	537	1	537	18	22
Bathroom	320	Radiator	Acme	Q22509R	537	1	537	18	22

As in the previous example, the output of all radiators in the Heating Design sheet must be supported by the evidence outlined in this example.

Where the evidence is unavailable or incorrect for one or more radiators, the Assessor must use the default design flow temperature for the system.

NSAI SR 50-4 provides guidance in cases where the conversion factors are not made available by the manufacturer, the Designer/Installer.

Where **existing radiators are being retained in the dwelling**, the Designer/Installer can refer to the document '*Heat Emitter Supplement to the Domestic Heating Design Guide*' for heat outputs of typical radiators found in existing buildings.

13.1.4 On-site checks

It is advisable for assessors to obtain the completed designer/installer sign-off sheet and the heating design sheet prior to carrying out the dwelling survey.

Where it is intended to use a non-default design flow temperature to calculate the efficiency of the heat pump, the BER assessor must check the following during the site survey:

- Heat Emitter Type: Check that the installed heat emitter *in each room* matches the heat emitter type specified in the completed heating design sheet. For example, if the heating design sheet specifies a double-panel radiator in the living room, then check that this type of radiator has been installed in the living room.
- Radiator Size: Check that the radiators specified in the heating design sheet - and as described in the radiator technical data sheet - match those installed in the dwelling. The radiators installed in the dwelling should be within $\pm 50\text{mm}$ of the size specified in the heating design sheet.

The heating design sheet must reflect what is installed in the dwelling. If an assessor finds something different in the house, they should request the designer/installer to amend the documents to reflect the installation in the dwelling. If this is not done, defaults should be used to calculate the heat pump efficiency.

13.1.5 Checklist

Figure 13.5: Checklist for BERs with heat pump and non-default flow temperature (taken from Designer/Installer sign-off sheet)

BER Checklist

1.0 Designer/Installer sign-off sheet

- 1.1 Designer/Installer sign-off sheet has been completed and signed using one of the 3 methods:

Notes

Methods for signing:

1. Hardcopy signed by Designer/Installer, or
2. Softcopy format with an electronic signature from Designer/Installer, or
3. Softcopy format accompanied by email from designer/installer confirming that the data in the sign off sheet is correct.

2.0 Heating Design Sheet contains:

- 2.1 Dwelling address of heat pump installation.
- 2.2 The design flow & return temperatures.
- 2.3 Where radiators / fan coil emitters are specified, the room heat loss [W], manufacturer, model/size, single heat emitter output [W], number of emitters, total heat emitters output [W], design room temp. (°C) and ΔT for heat output.
- 2.4 Where underfloor heating is specified, the room (or area) heat loss [W], total heat emitter output [W] and UF output [W/m²].
- 2.5 Where an air system is specified, the room heat loss [W], manufacturer, model, single heat emitter output [W], number of emitters, total heat emitter output [W], supply air temperature [°C] and air flow rate l/s.
- 2.6 The total heat emitter output (W) is greater than total room heat loss (W).
- 2.7 The HLI stated on the heating design sheet, or equivalent, is not less than 10% lower than total heat loss per m² of dwelling (as calculated in DEAP).
- 2.8 Heat pump output at design conditions based on test data & design flow temp. provided for DEAP assessment
- 2.9 The name and contact details of the Designer/Installer.

PLEASE NOTE - To support the input of a heat pump in DEAP, the following is required: HP compliant with Ecodesign/Energy Labelling Directive:

1. Signed Designer/installer sign-off sheet;
2. Technical documentation outlining declared test data in accordance with EN 14825 and EN 16147;
3. Where non-default flow temperatures are used to calculate the SPF of the HP, all items on this checklist must also be provided

HP not compliant with Ecodesign/ Energy Labelling Directive:

- The SPF of the heat pump can be sourced from any of the following:
1. Harp Database
 2. Certified or CE marked data from accredited laboratory with test certificates to IS EN 14511-2, IS EN 255-2 or EN 15879;
 3. Use of DEAP Table 4a for heat pump efficiencies

3.0 Radiator Technical Data Sheets

- 3.1 For new radiators, the output of the radiators for the ΔT specified in the heating design sheet matches the manufacturer's stated output and/or
- 3.2 For existing radiators being retained, the output of the radiators for the ΔT specified in the heating design sheet matches the guidance for existing radiators contained within 'Heat Emitter Supplement to the Domestic Heating Design Guide'.
- 3.3 Where the ΔT as specified in the heating design sheet differs from the ΔT quoted in the manufacturer's technical data, the installed heat emitter meets the heat emitter output specified.

For guidance on how to estimate the heat output of existing radiators at the correct ΔT , please refer to the following documents:

- SEAI BER Technical Bulletin;
- MCS 021 Heat emitter guide for domestic heat pumps;
- 'Domestic Heating Design Guide' by CIBSE
- 'Heat emitter supplement to the Domestic Heating Design Guide' by the IDHEE.

4.0 Site Survey

- 4.1 Check that the type of heat emitter installed in each room matches the heat emitter type specified.
- 4.2 Check that the radiators as specified in the heating design sheet and as described in the radiator technical data sheet, match (approximately) those installed in the dwelling.
- 4.3 Check the air volume as specified in the heating design sheet meets the design specification or commissioning data sheet for the air system.

The heating design sheet must reflect what is installed in the dwelling. If an assessor finds something different in the house, the Designer/Installer needs to update the heating design sheet to reflect the installation in the dwelling. If this is not done, default flow temperatures must be used.

Figure 13.6: Checklist Heat Pump Grant and associated BER (taken from Designer/Installer sign-off sheet)

BER + Heat Pump Grant Checklist	
1.0 Designer/Installer sign-off sheet	Notes
1.1 Designer/Installer sign-off sheet has been completed and signed using one of the 3 methods:	<input type="checkbox"/>
2.0 Heating Design Sheet contains:	
2.1 Dwelling address of heat pump installation.	<input type="checkbox"/>
2.2 The design flow & return temperatures.	<input type="checkbox"/>
2.3 Where radiators / fan coil emitters are specified, the room heat loss [W], manufacturer, model/size, single heat emitter output [W], number of emitters, total heat emitters output [W], design room temp. (°C) and ΔT for heat output.	<input type="checkbox"/>
2.4 Where underfloor heating is specified, the room (or area) heat loss [W], total heat emitter output [W] and UF output [W/m ²].	<input type="checkbox"/>
2.5 Where an air system is specified, the room heat Loss [W], manufacturer, model, single heat emitter output [W], number of emitters, total heat emitters output [W], supply air temperature [°C] and air flow rate l/s.	<input type="checkbox"/>
2.6 The total heat emitter output (W) is greater than total room heat loss (W).	<input type="checkbox"/>
2.7 The HLI stated on the heating design sheet, or equivalent, is not less than 10% lower than total heat loss per m ² of dwelling (as calculated in DEAP).	<input type="checkbox"/>
2.8 Heat pump output at design conditions based on test data & design flow temp. provided for DEAP assessment.	<input type="checkbox"/>
2.9 The name and contact details of the Designer/Installer.	<input type="checkbox"/>
3.0 Radiator Technical Data Sheets	
3.1 For new radiators, the output of the radiators for the ΔT specified in the heating design sheet matches the manufacturer's stated output and/or	<input type="checkbox"/>
3.2 For existing radiators being retained, the output of the radiators for the ΔT specified in the heating design sheet matches the guidance for existing radiators contained within 'Heat Emitter Supplement to the Domestic Heating Design Guide'.	<input type="checkbox"/>
3.3 Where the ΔT as specified in the heating design sheet differs from the ΔT quoted in the manufacturer's technical data, the installed heat emitter meets the heat emitter output specified.	<input type="checkbox"/>
4.0 Site Survey	
4.1 Check that the type of heat emitter installed in each room matches the heat emitter type specified.	<input type="checkbox"/>
4.2 Check that the radiators as specified in the heating design sheet and as described in the radiator technical data sheet, match (approximately) those installed in the dwelling.	<input type="checkbox"/>
4.3 Check the air volume as specified in the heating design sheet meets the design specification or commissioning data sheet for the air system.	<input type="checkbox"/>

Methods for signing:

1. Hardcopy signed by Designer/Installer, or
2. Softcopy format with an electronic signature from Designer/Installer, or
3. Softcopy format accompanied by email from designer/installer confirming that the data in the sign off sheet is correct.

PLEASE NOTE - To support the input of a heat pump in DEAP, the following is required for HP compliant with Ecodesign/Energy Labelling Directive:

1. Designer/Installer sign-off sheet;
2. Technical documentation outlining declared test data in accordance with EN 14825 and EN 16147;
3. Where non-default flow temperatures are used to calculate the SPF of the HP, all items on this checklist must also be provided

In addition to the above, the Registered Contractor must provide the following to the homeowner for grant payment:

1. Signed-Off Declaration of Works;
2. Two hardcopies of the Designer/Installer sheet and Heating Design tab (no equivalent documents are accepted) and
3. Ecodesign datasheet for heat pump installed
4. The radiator heat output data must be verifiable through published datasheets. If this data is not widely available (e.g on internet), please submit the data source for the heat output.

For guidance on how to estimate the heat output of existing radiators at the correct ΔT, please refer to the following documents:

- SEAI BER Technical Bulletin;
- MCS 021 Heat emitter guide for domestic heat pumps;
- 'Domestic Heating Design Guide' by CIBSE
- 'Heat emitter supplement to the Domestic Heating Design Guide' by the IDHEE.

The heating design sheet must reflect what is installed in the dwelling. If an assessor finds something different in the house, the Designer/Installer needs to update the heating design sheet to reflect what is installed. If this is not done, default flow temperatures must be used.

13.2 Heat Pump Examples

13.2.1 Example 1: An air-to-water heat pump not compliant with Ecodesign/ Energy Labelling Directives. Listed on HARP.

Heat pump parameters

The first example is based on a heat pump installed in a dwelling prior to the 26th of September 2015.

Under the Ecodesign and Energy Label directives there is no mandatory requirement for the heat pump to comply with the directives. However the Assessor should check with the heat pump manufacturer/ supplier that the heat pump is not compliant, as the heat pump model may be available on the market post 26th September 2015 and therefore would need to be compliant with the directives. The Assessor has obtained contact details of the system designer or installer from the client.

In this case the Assessor has received a copy of the designer/ installer sign off sheet from the installer confirming that the heat pump is not compliant with the Ecodesign / Energy Labelling directives and has been tested to EN 14511. The installer also confirmed that the heat pump is available on the HARP Database.

Figure 13.7 - Heat Pump Selection from Designer/Installer Sign off Sheet

Manufacturer(s) of the installed heat pump(s)	Ensure this is exact product manufacturer name.	Model 123		
Model(s) of the installed heat pump(s)	Use exact product model, including model name, number, qualifier where present.			
Type(s) of Heat Pump (if separate heat pumps for space and water heating, tick all that apply)	Air to Water	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Brine to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust Air to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Air to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Brine to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Direct Exchange (DX)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust Air to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Space heating provided by low temperature heat pump?	Tick all that apply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is this a gas fired heat pump (GAHP)?	Tick all that apply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Date of Installation	Insert date system was installed (format DD/MM/YYYY)			
Is the Heat Pump(s) compliant with Ecodesign Directive	Tick where the answer is "yes"	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is the Heat Pump(s) compliant with Labelling Directive	Tick where the answer is "yes"	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Space Heating Test Standard	For each space heating heat pump, select Standard I.S. EN 14825 or I.S. EN 12309-6 or I.S. EN 13141 or I.S. EN 14511	I.S. EN 14511		
Water Heating Test Standard	For each water heating heat pump, select Standard I.S. EN 16147 or I.S. EN 13203-6 or I.S. EN 14511 or I.S. EN 255-3 or I.S. EN 14825/14511	I.S. EN 14511		
Is the heat pump listed on HARP	Select Yes or No	Yes		

Design details

The installer also confirmed the following as part of the sign off sheet:

Figure 13.8: Heat Emitter Design from Sign off Sheet

4. Heat Emitter Design	
Is there one or more radiators present	No
Is there one or more fan coil units present	No
Is there underfloor heating present	Yes
Is there warm air supply from the heat pump	No
Has a load / weather compensation been installed?	Yes
Provide details of zone, temperature and time control installed?	2 space and 1 water zones with time and temperature control on each
Temperature (°C) of the water leaving the heat pump system when supplying space heating based on full heating system design conditions and at the design external temperature? (Note this can not be greater than Max. temperature for individual heat pumps)	35

Figure 13.9: Hot Water System from Sign off Sheet

5. Hot Water System		Heat pump #1	Heat pump #2	Heat pump #3
Maximum flow temperature (°C) of the heat pump system while providing hot water (by heat pump only) based on certified data	<i>For up to three heat pumps: Input temperature in degrees celcius, please provide supporting documentation.</i>	55		
Type of DHW Store	<i>For up to three heat pumps: Input the type of store present, no store, integral store or separate store</i>	Separate Hot Water Storage		
Manufacturer(s) of the installed DHW Store (s)	<i>Ensure this is exact product manufacturer name.</i>	Acme		
Model(s) of the installed DHW Store(s)	<i>Use exact product model, including model name, number, qualifier where present.</i>	Model 123		
Is there an integral immersion or electric element present capable of providing hot water	<i>For up to three heat pumps: Select Yes or No</i>	Yes		

For existing dwellings, it may not always be possible to get a Designer/ Installer Sign off Sheet. In those circumstances, the Assessor should verify as much information as possible on site and follow the guidance set out in the DEAP Manual Appendix G and in this document.

Source of test data

For heat pumps that are not compliant with the Ecodesign/ Energy Labelling Directive, the Seasonal Performance Factor (SPF) can be sourced using the approach used in DEAP previously:

- HARP Database
- Certified or CE marked data from accredited laboratory with test certificates to IS EN 14511-2, IS EN 255-2 or EN 15879.
- Use of DEAP Table 4a defaults for heat pump efficiencies.

In this case the heat pump is listed on the HARP database as confirmed by the designer/ installer:

Entry in Heat Pump tool

Heat Pump Data

As with all heating systems in DEAP 4, information on the distribution system and controls is entered first in Space Heating > Controls and Responsiveness:

Figure 13.10 – Distribution system details for the heat pump

The screenshot shows a software interface with four tabs: 'CONTROLS AND RESPONSIVENESS', 'PUMPS AND FANS', 'HEAT SOURCES', and 'SUMMER INTERNAL TEMP.'. The 'CONTROLS AND RESPONSIVENESS' tab is active. It features two radio buttons: 'Individual Scheme' (selected) and 'Group Scheme'. Below this is a 'Heating System Properties' section with four dropdown menus: 'Heating system category' (Central heating systems with radiators or underfloor heating), 'Sub Category' (Heat pumps), 'Heating System' (Air-to-water heat pump (electric)), and 'Heat Emitter Type' (Underfloor heating, pipes in screed above insulation). A 'Heating System Controls' dropdown is set to 'Time and temperature zone control'. At the bottom left, there is an unchecked checkbox for 'Load or weather compensation'. On the right, a 'Results' panel displays: 'Temperature Adjustment (C)' as 0, 'Heating System Control Category' as 3, and 'Heating System Responsiveness Category' as 2.

In order to add the heating system, we will first add it as a new library item as follows:

Figure 13.11 – Adding the heat pump to the DEAP library

The screenshot shows a dialog box titled 'Add from Library' with a close button (X) in the top right. Below the title bar, it says 'Heat sources filtered to match heating system properties in the controls and responsiveness tab'. There are three tabs: 'COMMON ITEMS' (selected), 'SEARCH', and 'RECENT ITEMS'. The main area contains a table with the following data:

Type	Name & Product Details	Seasonal Efficiency (%)	Source
	Default heat pump - Air-to-water heat pump (electric) Manufacturer: Any, Model: Any, Type: Heat pumps, Air to Water, Space Heating Standard: Test standard not available, Water Heating Standard: N/A, Water Heating Seasonal Efficiency: N/A	250	
	Default heat pump - Gas-fired, air source Manufacturer: Any, Model: Any, Type: Heat pumps, Air to Water, Space Heating Standard: Test standard not available, Water Heating Standard: N/A, Water Heating Seasonal Efficiency: N/A	110	
	Default heat pump - Gas-fired, ground or water source Manufacturer: Any, Model: Any, Type: Heat pumps, Air to Water, Space Heating Standard: Test standard not available, Water Heating Standard: N/A, Water Heating Seasonal Efficiency: N/A	120	

At the bottom left, there is an information icon and the text 'Items found: 3'. At the bottom right, there are navigation arrows and the number '1'. At the very bottom, there are three buttons: 'ADD NEW ITEM TO LIBRARY' (highlighted with a red box), 'CANCEL', and 'ADD'.

Click "Add New Item to Library" which brings you to the Create Library Item screen:

Figure 13.12 – Data entry of basic properties for the heat pump

The screenshot shows a 'Create Library Item' dialog box with a blue header and a close button (X) in the top right. The main area is titled 'BASIC PROPERTIES' and contains several input fields and dropdown menus. The fields are arranged in a grid-like fashion. At the bottom right, there are 'CANCEL' and 'SAVE' buttons.

Field Label	Value
Item Type *	Heat Source
Item Name *	Acme 123 HP
Keywords	
Manufacturer *	Acme
Model *	123
Heating Source Type *	Heat pumps
Heat Pump Type *	Air to Water
Space Heating Standard	I.S. EN 14511
Water Heating Standard	I.S. EN 14511
Seasonal Space Heating Efficiency, η_{sp} [%] *	425
Water Heating Efficiency, η_{wh} [%] *	425
Temperature Control (Capacity Control)	
<input checked="" type="checkbox"/> Integrated Immersion	<input type="checkbox"/> Flow temperature $\geq [60/65]^{\circ}\text{C}$
TOL	WTOL

The details of the heat pump are entered as above, with an efficiency of 425% from the HARP listing.

Note that “Integrated Immersion” has been selected, as specified in the Designer/Installer Sign-Off.

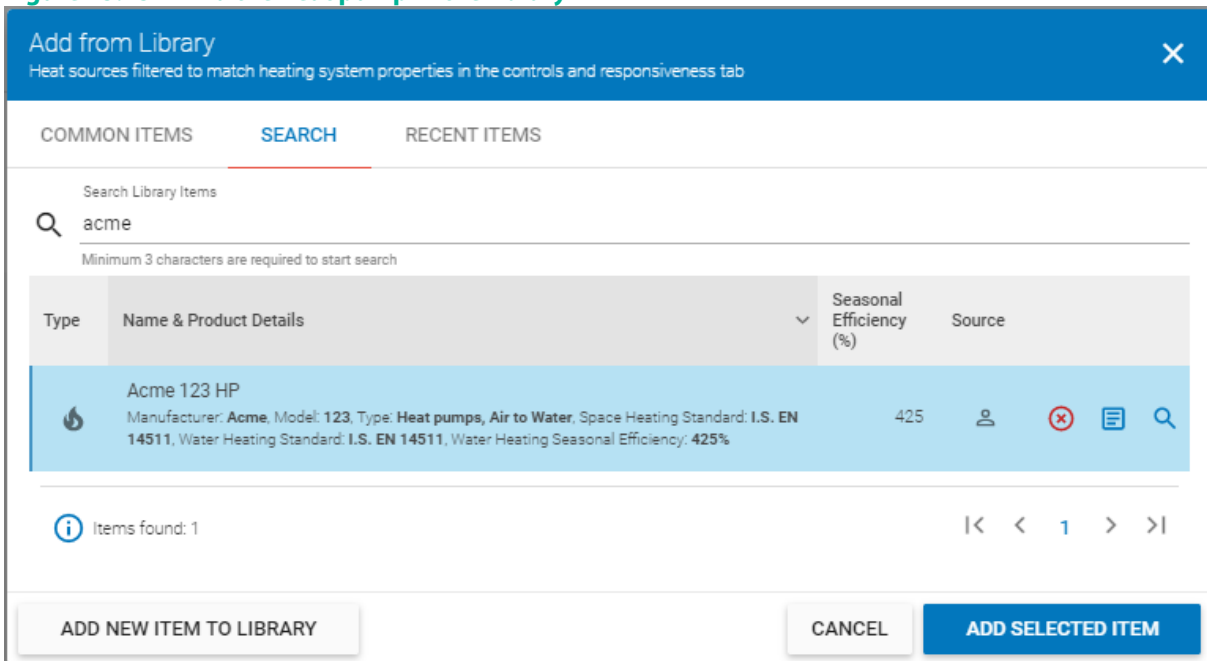
Also, a Flow Temperature $\geq [60/65]^{\circ}\text{C}$ has not been selected because the Designer/Installer Sign-Off specified a maximum flow temperature of 55°C .

Click “Save” to add it to the library.

It has been saved to the Library; the next step is to add it to the assessment.

Select “Add Heat Source” and use the Search tab to identify the system: in this case using the search term “Acme”.

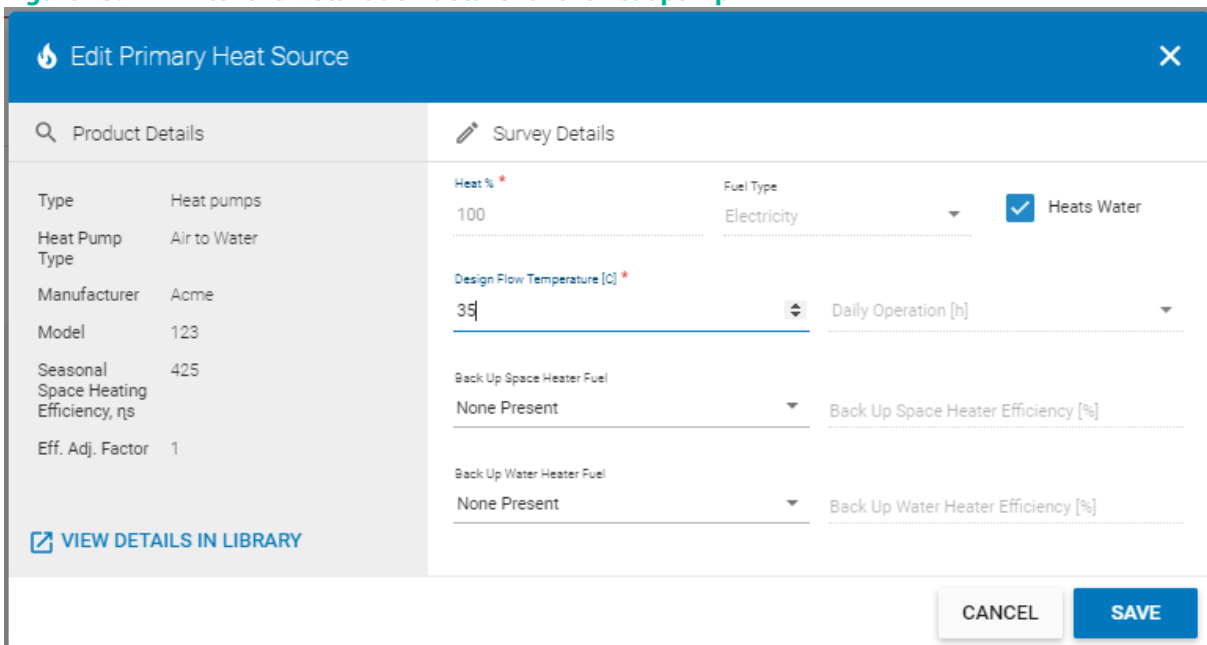
Figure 13.13 – Find the heat pump in the library



Select the item and click "Add Selected Item" to add it to the assessment.

Information on the installation now needs to be added.

Figure 13.14 – Enter the installation details for the heat pump



In this instance, "Heats Water" has been ticked because the heat pump heats both space and water.

A flow temperature of 35°C has been entered, the default for underfloor heating as specified in the Designer/Installer Sign-Off.

Click “Save” to proceed.

One more piece of information needs to be entered: we have specified that the system heats water but DEAP needs to know more.

Go to the Water Heating > Options and Storage tab and select the appropriate value for “Heat Pump Type of DHW”, which in this case is ‘Separate hot Water Storage’ as specified in the Designer/Installer Sign-Off.

Figure 13.15 – Entering the HP Type of DHW in Water Heating

The screenshot shows the 'Options & Storage' tab in the software. It includes sections for 'Showers & Baths', 'Options', and 'Storage'. In the 'Storage' section, the 'Heat Pump Type of DHW' dropdown menu is highlighted with a red box and set to 'Separate Hot Water Storage'. Other settings include 'Distribution Losses' and 'Storage Losses' checked, and 'Is hot water storage indoors or in group heating scheme?' checked.

If you go to Water Heating > Heat Source you will see that the heat pump has been added as the main water heating system. Also, note that the efficiency has been adjusted to account for the integral immersion.

Figure 13.16 – Find the heat pump in the library

Name	Manufacturer & Model	Seasonal Efficiency (η _{wh})	Efficiency Adj. Factor	Fuel Type	Daily Operation [h]	Heats space
Acme 123 HP	Acme, 123	161.90	1.00	Electricity		Yes

13.2.2 Example 2: Air-to-water heat pump compliant with Ecodesign/ Energy Labelling Directive

Heat pump parameters

The second example is based on the following:

Heat Pump installed in a dwelling after the 26th of September 2015 and compliant with the Ecodesign/ Energy Labelling Directives. It provides space and water heating.

The Ecodesign directive requires that technical data is made publicly available declaring the test data for the heat pump to EN 14825 and EN 16147.

The Assessor received the following details in the Designer/ Installer Sign off sheet.

Figure 13.17: Purpose of Installation from Sign off Sheet

2. Purpose of installation		Heat pump #1	Heat pump #2	Heat pump #3
Does the installation provide space heating?	<i>Tick applicable boxes</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does the installation provide water heating?	<i>Tick applicable boxes</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If heat pump(s) provide space and water heating, are they 2 separate heat pumps?	<i>Tick applicable boxes</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 13.18: Heat Pump Selection from Sign off Sheet

3. Heat pump selection		Heat pump #1	Heat pump #2	Heat pump #3
Manufacturer(s) of the installed heat pump(s)	<i>Ensure this is exact product manufacturer name.</i>	Acme		
Model(s) of the installed heat pump(s)	<i>Use exact product model, including model name, number, qualifier where present.</i>	ABC1		
Type(s) of Heat Pump (if separate heat pumps for space and water heating, tick all that apply)	Air to Water	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Brine to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust Air to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Air to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Brine to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Direct Exchange (DX)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust Air to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Space heating provided by low temperature heat pump?	<i>Tick all that apply</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is this a gas fired heat pump (GAHP)?	<i>Tick all that apply</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Date of Installation	<i>Insert date system was installed (format DD/MM/YYYY)</i>	20/09/2020		
Is the Heat Pump(s) compliant with Ecodesign Directive	<i>Tick where the answer is "yes"</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is the Heat Pump(s) compliant with Labelling Directive	<i>Tick where the answer is "yes"</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Space Heating Test Standard	<i>For each space heating heat pump, select Standard I.S. EN 14825 or I.S. EN 12309-6 or I.S. EN 13811 or I.S. EN 14511</i>	I.S. EN 14825		
Water Heating Test Standard	<i>For each water heating heat pump, select Standard I.S. EN 16147 or I.S. EN 13203-6 or I.S. EN 14511 or I.S. EN 255-3 or I.S. EN 14825/14511</i>	I.S. EN 16147		
Is the heat pump listed on HARP	<i>Select Yes or No</i>	No		
No of Hours per Day Heat Pump has been designed to run	<i>Select 8, 16 or 24 which best represents the design</i>	16		

Design details

The designer/ installer also confirmed the following as part of the sign off sheet; this was verified by the Assessor on site.

Firstly the assessor noted that the designer/ installer had advised that the heat pump was designed to meet the full space heating and hot water demand (Section 3 of the Designer Installer Sign Off Sheet). The assessor confirmed this on site as no backup heaters were installed. Note: The Backup heaters identified in Section 3 of the Designer Installer

Sign Off Sheet are heaters other than the heat pump itself, for example boilers. Backup water heaters which are part of the heat pump, i.e. integral immersions are identified in Section 5 of the Designer Installer Sign Off Sheet.

Figure 13.19 – Installation data from the Sign-off Sheet

% main space heat provided by each heat pump based on system design	Source percentage of heat from plant design details or operational records	100%		
Temperature (°C) of the water leaving the heat pump for Space Heating	Source temperature of heat from plant design details or operational records	45		
Is there a back up space heater present to supplement the Heat Pump?	See DEAP Manual Appendix G for definitions of backups to heat pumps	No		
Outline type of backup space heater and associated fuel	Enter backup heater type and fuel if present			
% main water heat provided by each heat pump based on system design	Source percentage of heat from plant design details or operational records	100%		
Temperature (°C) of the water leaving the heat pump for Hot Water Heating	Source temperature of heat from plant design details or operational records	55		
Is there a back up water heater present to supplement the Heat Pump?	See DEAP Manual Appendix G for definitions of backups to heat pumps	No		
Outline type of backup space heater and associated fuel	Enter backup heater type and fuel if present			

The dwelling is served by a combination of radiators and underfloor heating (taken from Section 4 of the Designer Installer Sign Off Sheet), with the design supply temperature being 45°C with the following controls.

Figure 13.20 – Heat Emitter Design section of the Sign-off Sheet

4. Heat Emitter Design		
Is there one or more radiators present	Yes	Select Yes or No
Is there one or more fan coil units present	No	Select Yes or No
Is there underfloor heating present	Yes	Select Yes or No
Is there warm air supply from the heat pump	No	Select Yes or No
Has a load / weather compensation been installed?	Yes	Select Yes or No
Provide details of zone, temperature and time control installed?	2 space and 1 water zones with time and temperature control on each	
Temperature (°C) of the water leaving the heat pump system when supplying space heating based on full heating system design conditions and at the design external temperature? (Note this can not be greater than Max. temperature for individual heat pumps)	45	Input temperature in degrees celcius

The heat pump was tested at a reference temperature of 55°C for water heating and had a separate hot water store (taken from Section 5 of the Designer Installer Sign Off Sheet).

Figure 13.21 – Heat Emitter Design section of the Sign-off Sheet

5. Hot Water System		Heat pump #1	Heat pump #2	Heat pump #3
Maximum flow temperature (°C) of the heat pump system while providing hot water (by heat pump only) based on certified data	For up to three heat pumps: Input temperature in degrees celcius, please provide supporting documentation.	55		
Type of DHW Store	For up to three heat pumps: Input the type of store present, no store, integral store or separate store	Separate Hot Water Storage		
Manufacturer(s) of the installed DHW Store (s)	Ensure this is exact product manufacturer name.	Acme		
Model(s) of the installed DHW Store(s)	Use exact product model, including model name, number, qualifier where present.	ABC1		
Is there an integral immersion or electric element present capable of providing hot water	For up to three heat pumps: Select Yes or No	Yes		

Source of test data

For heat pumps compliant with the Ecodesign directive, technical documentation outlining the declared test data must be made available to the public to comply with the directive.

Additional test data may be sourced that is in compliance with EN 14825 and EN 16147 from manufacturer's literature referencing the relevant regulations/ directives, CE marked data or accredited test data as detailed in the heat pump

guidance document. The following data is an excerpt from a publicly available technical data declaration in compliance with the Ecodesign directive referencing EN 14825 test data.

Figure 13.22 – Ecodesign data for the heat pump

Model: Acme ABC1					
Air-to-water heat pump: yes					
Water-to-water heat pump: no					
Brine-to-water heat pump: no					
Low-temperature heat pump: no					
Equipped with a supplementary heater: yes					
Heat pump combination heater: no					
Medium-temperature application.					
Average climate conditions.					
Item	Symbol	Value	Item	Symbol	Value
Rated heat output	P_{rated}	13.5	Seasonal space heating energy efficiency	η_p	125
Declared capacity for heating for part load at indoor temperature 20 °C and outdoor temperature T_j			Declared coefficient of performance or primary energy ratio for part load at indoor temperature 20 °C and outdoor temperature T_j		
$T_j = -7\text{ °C}$	P_{dh}	11.9	$T_j = -7\text{ °C}$	COP_d	1.83
$T_j = +2\text{ °C}$	P_{dh}	7.2	$T_j = +2\text{ °C}$	COP_d	3.18
$T_j = +7\text{ °C}$	P_{dh}	5.9	$T_j = +7\text{ °C}$	COP_d	4.27
$T_j = +12\text{ °C}$	P_{dh}	4.7	$T_j = +12\text{ °C}$	COP_d	6.32
$T_j =$ bivalent temperature	P_{dh}	11.9	$T_j =$ bivalent temperature	COP_d	1.83
$T_j =$ operation limit temperature	P_{dh}	9.3	$T_j =$ operation limit temperature	COP_d	1.7
			Operation limit temperature	TOL	-15
			HW operating limit temperature	WTOL	60
Other items			Rated air flow rate, outdoors		
Capacity control	Variable		8,400 m ³ /h		
Sound power level indoors/outdoors	L_{WA}	45/78			
Annual energy consumption	Q_{HE}	8541			
For heat pump combination heater			Water heating energy efficiency		
Declared load profile	IL		η_{wh}	99 %	
Daily electricity consumption	Q_{elec}	5,000			
Annual electricity consumption	AEC	1,109			
Volume of HW accounted for in test (litres)			200		
Standby Heat Loss (kWh/day)			1.9		

This data must be entered for the heat pump.

As in the previous example, to do this you must add the heat pump to the library.

In Space Heating > Controls and Responsiveness, enter the information on the heating distribution system and heating controls, as in Example 1.

Then in Space Heating > Heat Sources, click “Add Heat Source” and then “Add New Item to Library”.

Figure 13.23 – Data entry for the heat pump: Basic Properties

The screenshot shows a 'Create Library Item' dialog box with a blue header and a close button (X) in the top right. Below the header, there are two tabs: 'BASIC PROPERTIES' and 'HEAT PUMP TEST DATA'. The 'HEAT PUMP TEST DATA' tab is circled in red. The form contains the following fields:

Field Name	Value
Item Type *	Heat Source
Item Name *	Acme ABC1 HP
Manufacturer *	Acme
Model *	ABC1
Heating Source Type *	Heat pumps
Heat Pump Type *	Air to Water
Space Heating Standard	I.S. EN 14825
Water Heating Standard	I.S. EN 16147
Seasonal Space Heating Efficiency, η_{sp} [%] *	125
Water Heating Efficiency, η_{wh} [%] *	99
Temperature Control (Capacity Control) *	Variable Outlet
<input type="checkbox"/> Integrated Immersion	<input type="checkbox"/> Flow temperature $\geq [60 65]^{\circ}\text{C}$
TOL *	-15
WTOL *	60

At the bottom right, there are two buttons: 'CANCEL' and 'SAVE'.

This page contains some of the data from the Ecodesign data sheet.

Note the second tab called “Heat Pump Test Data” – circled in red – which is where the rest of the Ecodesign data will be entered.

Figure 13.24 – Data entry for the heat pump: Heat Pump Test Data

	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Source	A-7	A2	A7	A12	A-15
Sink	W52	W42	W36	W30	W55
Heating Capacity (kW)	11.9	7.2	5.9	4.7	9.3
Coefficient of Performance (kW/kW)	1.83	3.18	4.27	6.32	1.7

In the screenshot above we can see the space heating data (EN 14825) from the Ecodesign data sheet has been entered. Note that data must be entered for Test Condition - High (55°C).

Data from the other test conditions must be used *if available* but the High Temperature (55°C) is the only one that is required.

In this case, only the High Temperature data has been provided so that is all that is entered into DEAP 4.

Figure 13.25 – Data entry for the heat pump: Water Heating Test Data (IS EN 16147)

The water heating data (EN 16147) is entered in the lower half of the page

Click "Save" to add this item to the library and then add it to the assessment.

As in the previous example, data specific to the installation must now be entered:

Figure 13.26 – Data entry for the heat pump: Installation details

The screenshot shows a software interface for editing a primary heat source. It is divided into two main sections: 'Product Details' and 'Survey Details'.
Product Details:
 - Type: Heat pumps
 - Heat Pump Type: Air to Water
 - Manufacturer: Acme
 - Model: ABC1
 - Seasonal Space Heating Efficiency, η_s : 125
 - Note: This is the Ecodesign Seasonal Space Heating Efficiency, η_s . When the survey is completed, the efficiency will be updated to reflect the performance of the heat pump in this dwelling.
 - Eff. Adj. Factor: 1
 - A button labeled 'VIEW DETAILS IN LIBRARY' is at the bottom left.
Survey Details:
 - Heat %: 100
 - Fuel Type: Electricity (with a dropdown arrow)
 - Heats Water
 - Design Flow Temperature [C]: 45
 - Daily Operation [h]: 16 (with a dropdown arrow)
 - Back Up Space Heater Fuel: None Present (with a dropdown arrow)
 - Back Up Space Heater Efficiency [%]:
 - Back Up Water Heater Fuel: None Present (with a dropdown arrow)
 - Back Up Water Heater Efficiency [%]:
 - At the bottom right are 'CANCEL' and 'SAVE' buttons.

Click “Save” to add this item to the assessment and then make the necessary changes in Water Heating, as shown in Example 1.

Note: As only one set of test data is available (at 55°C) the tool bases the Efficiency on a flow temperature of 55°C irrespective of the actual flow temperature. Where more than one set of data is available, the tool will then adjust the efficiency based on the flow temperature using interpolation between the two sets of test points. **All sets of available valid test data must be used.**

The run hours can also impact on the results. For example if the heat pump was installed to operate 8 hours a day to meet internal environmental conditions - i.e. a timer on the heat pump only allows the heat pump to operate 3 hours in the morning and 5 hours in the evening – then the ability of the heat pump to meet demand will be reduced. In this instance that leads to a relatively poor space heating efficiency:

Figure 13.27 – Poor space heating efficiency

CONTROLS AND RESPONSIVENESS		PUMPS AND FANS		HEAT SOURCES			SUMMER INTERNAL TEMP.		
Type	Heat %	Name	Manufacturer & Model	Seasonal Efficiency (η_s)	Efficiency Adj. Factor	Fuel Type	Design Flow Temp. [C]	Daily Operation [h]	Heats water
Primary	100	Acme ABC1 HP	Acme, ABC1	284.73	1.00	Electricity	45	16	Yes

13.2.3 Example 3: Air-to-air heat pump compliant with Ecodesign/ Energy Labelling Directive

Heat pump parameters

The calculator caters for a number of heat pump types heating air rather than water: Air to Air, Brine to Air and Water to Air.

This example looks at how an Air to Air heat pump would be entered into the calculator and DEAP. Taking the details from Example 2, the air to water heat pump is replaced with an air to air heat pump. A similar methodology would be used for Brine to Air or Water to Air.

As an air to air heat pump, it is providing space heating only.

The designer/ installer sign off sheet has been updated as follows:

3. Heat pump selection		Heat pump #1	Heat pump #2	Heat pump #3
Manufacturer(s) of the installed heat pump(s)	<i>Ensure this is exact product manufacturer name.</i>	Acme		
Model(s) of the installed heat pump(s)	<i>Use exact product model, including model name, number, qualifier where present.</i>	A2A		
Type(s) of Heat Pump (if separate heat pumps for space and water heating, tick all that apply)	Air to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Brine to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust Air to Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Air to Air	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Brine to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Direct Exchange (DX)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust Air to Air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Space heating provided by low temperature heat pump?	<i>Tick all that apply</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is this a gas fired heat pump (GAHP)?	<i>Tick all that apply</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Date of Installation	<i>Insert date system was installed (format DD/MM/YYYY)</i>	20/09/2020		
Is the Heat Pump(s) compliant with Ecodesign Directive	<i>Tick where the answer is "yes"</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is the Heat Pump(s) compliant with Labelling Directive	<i>Tick where the answer is "yes"</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Space Heating Test Standard	<i>For each space heating heat pump, select Standard I.S. EN 14825 or I.S. EN 12309-6 or I.S. EN 13141 or I.S. EN 14811</i>	I.S. EN 14825		
Water Heating Test Standard	<i>For each water heating heat pump, select Standard I.S. EN 16147 or I.S. EN 13203-6 or I.S. EN 14811 or I.S. EN 255-3 or I.S. EN 14826/14811</i>			

Figure 13.28: Heat Pump Selection from Sign off sheet

Design details

The designer/ installer also confirmed the following as part of the sign off sheet; this was verified by the Assessor on site. Firstly that the heat pump was designed to meet the full space heating demand with no backup heaters installed (as per Section 3 of the Designer Installer Sign off sheet). Water heating is supplied by an alternate system rather than heat pump.

The dwelling is served by warm air supply; therefore the default supply temperature is 35°C:

Figure 13.29: Heat Emitter Design from Sign off sheet

4. Heat Emitter Design	
Is there one or more radiators present	No
Is there one or more fan coil units present	No
Is there underfloor heating present	No
Is there warm air supply from the heat pump	Yes
Has a load / weather compensation been installed?	No
Provide details of zone, temperature and time control installed?	2 space zones. Time control and temperature control in both zones.
Temperature (°C) of the water leaving the heat pump system when supplying space heating based on full heating system design conditions and at the design external temperature? (Note this can not be greater than Max. temperature for individual heat pumps)	35

Source of test data

Similar to Example 2, for heat pumps compliant with the Ecodesign directive, technical documentation outlining the test data declaration must be made available to the public to comply with the directive. Assessors can also source data from manufacturer publications referencing the relevant directives/ standards.

Data Entry

As in previous examples, you will first need to enter information on the distribution system and controls in Controls and Responsiveness,

Figure 13.30: Distribution system details

CONTROLS AND RESPONSIVENESS
PUMPS AND FANS
HEAT SOURCES
SUMMER INTERNAL TEMP.

Individual Scheme
 Group Scheme

⚙ Heating System Properties

Heating system category
Warm air systems

Sub Category
Heat pumps

Heating System
Air-to-air heat pump

Heating System Controls
Time and temperature zone control

📄 Results

Temperature Adjustment [C]
0

Heating System Control Category
3

Heating System Responsiveness C...
1

and then add the heat pump to the DEAP 4 library:

Note that in the Basic Properties page for the heat pump we have specified that the heat pump does not provide water heating (highlighted in red).

Also note that a default WTOL of 35°C is used for air-to-air heat pumps (circled in orange).

13.31: Heat Pump data entry: Basic Properties

Create Library Item

BASIC PROPERTIES HEAT PUMP TEST DATA

Item Type * Item Name *
Heat Source Acme A2A HP Keywords

Manufacturer * Model *
Acme A2A

Heating Source Type * Heat Pump Type *
Heat pumps Air to Air

Space Heating Standard * Water Heating Standard
I.S. EN 14825 Does not provide water heating

Seasonal Space Heating Efficiency, ηs [%] * Water Heating Efficiency, ηwh [%]
115

Temperature Control (Capacity Control) *
Variable Outlet

Integrated Immersion Flow temperature >= [60|65]*C

TOL * WTOL *
-10 35

CANCEL SAVE

In the Heat Pump Test Data page, the test data associated with EN 14825 is taken directly from the publicly available technical data declaration in compliance with the Ecodesign directive or directly from manufacturer literature referencing directives/ regulations or accredited/CE marked test data (as shown in Example 2).

For “to Air” heat pumps there is only one set of test conditions under EN 14825, namely the High Temperature – 55°C data, therefore no data is entered for Low, Medium and Very High Temperature test conditions.

Figure 13.32: Data entry: Heat Pump Test Data

Create Library Item
✕

BASIC PROPERTIES
HEAT PUMP TEST DATA

Heating System Test data: I.S. EN 14825

Test Condition - Low (35°C)

Test Condition - Medium (45°C)

Test Condition - High (55°C) *

	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Source	A-7	A2	A7	A12	A-10
Sink	A20	A20	A20	A20	A20
Heating Capacity (kW)	11.9	7.2	5.9	4.5	9.3
Coefficient of Performance (kW/kW)	1.89	3.18	4.27	6.32	1.7

Test Condition - Very High (65°C)

CANCEL
SAVE

Using a Design Flow Temperature = 35°C and Operating Hours = 16 hours, gives the efficiency as seen below:

Figure 13.33 – Calculated space heating efficiency

CONTROLS AND RESPONSIVENESS		PUMPS AND FANS		HEAT SOURCES		SUMMER INTERNAL TEMP.			
Type	Heat %	Name	Manufacturer & Model	Seasonal Efficiency (ηs)	Efficiency Adj. Factor	Fuel Type	Design Flow Temp. [C]	Daily Operation [h]	Heats water
Primary	100	Acme A2A HP	Acme, A2A	295.99	1.00	Electricity	35	16	No

Increasing the operating hours to 24 hours, would increase the efficiency of the system.

13.2.4 Example 4: Exhaust Air to water heat pump compliant with Ecodesign/ Energy Labelling Directive

The Exhaust Air to Water Heat Pump is similar to other “to Water” heat pumps, so the methodology is as per Example 2 with the following changes.

One key additional piece of information is required.

In Ventilation, the Ventilation Method is set to “Exhaust Air Heat Pump” and the specific fan power and flow rate of the system are entered, as shown below.

Figure 13.34 – EAHP entry in the Ventilation section

	INFILTRATION DUE TO OPENINGS	STRUCTURAL AIR TIGHTNESS	VENTILATION METHOD
Method		Specific Fan Power [W/(l/s)]	Exhaust Air Flow Rate [m ³ /h]
Exhaust Air Heat Pump		0.26	Heat Exchanger Efficiency [..] 240
Manufacturer	Model	How many wetrooms (including kitchen)? Is the ventilation ducting flexible/rigid/both?	
<input type="checkbox"/> External Uninsulated Ducting			

The air flow rate should be taken from the Ecodesign Technical Data Sheet for the heat pump.

Further details are given in Section 2.6 of the DEAP Manual.

13.2.5 Example 5: Air to water heat pump compliant with Ecodesign/ Energy Labelling Directive with backup heater.

Design Details

This example is based on Example 2 but with the addition of a backup heating system for space heating and water heating.

As per the Heat Pump Methodology guidance in DEAP Manual Appendix G, any system that is acting as a backup to the heat pump is considered part of the Main Heating system and is therefore not considered a secondary heater.

The backup must heat multiple rooms - like the heat pump - rather than be a single room heater (such as a typical secondary heater in DEAP).

In this case, the designer/ installer has confirmed that a backup heater is present in Section 3 of the Designer Installer Sign Off Sheet: a solid fuel stove with back boiler supplying space and water heating.

Figure 13.35: Heat pump installation details from Sign off sheet

% main space heat provided by each heat pump based on system design	Source percentage of heat from plant design details or operational records	100%		
Temperature (°C) of the water leaving the heat pump for Space Heating	Source temperature of heat from plant design details or operational records	35		
Is there a back up space heater present to supplement the Heat Pump?	See DEAP Manual Appendix G for definitions of backups to heat pumps	Yes		
Outline type of backup space heater and associated fuel	Enter backup heater type and fuel if present	Solid fuel stove with back boiler		
% main water heat provided by each heat pump based on system design	Source percentage of heat from plant design details or operational records	100%		
Temperature (°C) of the water leaving the heat pump for Hot Water Heating	Source temperature of heat from plant design details or operational records	55		
Is there a back up water heater present to supplement the Heat Pump?	See DEAP Manual Appendix G for definitions of backups to heat pumps	Yes		
Outline type of backup space heater and associated fuel	Enter backup heater type and fuel if present	Solid fuel stove with back boiler		

The heat pump is already in the library so we can search for it and select it,

Figure 13.36: Selecting the heat pump from the library

Add from Library
Heat sources filtered to match heating system properties in the controls and responsiveness tab

COMMON ITEMS **SEARCH** RECENT ITEMS

Search Library Items
Q acme
Minimum 3 characters are required to start search

Type	Name & Product Details	Seasonal Efficiency (%)	Source
	Acme 123 HP Manufacturer: Acme, Model: 123, Type: Heat pumps, Air to Water, Space Heating Standard: I.S. EN 14511, Water Heating Standard: I.S. EN 14511, Water Heating Seasonal Efficiency: 425%	425	
	Acme ABC1 HP Manufacturer: Acme, Model: ABC1, Type: Heat pumps, Air to Water, Space Heating Standard: I.S. EN 14825, Water Heating Standard: I.S. EN 16147, Water Heating Seasonal Efficiency: 99%	125	

Items found: 4 < 1 >

ADD NEW ITEM TO LIBRARY CANCEL **ADD SELECTED ITEM**

Then we need to enter the details specific to the installation; in this case that means specifying the backup heating for space heating and water heating:

Figure 13.37: Data entry for installation details

Edit Primary Heat Source

Product Details Survey Details

Type	Heat pumps	Heat % *	100	Fuel Type	Electricity	<input checked="" type="checkbox"/> Heats Water
Heat Pump Type	Air to Water	Design Flow Temperature [C] *	35	Daily Operation [h] *	16	
Manufacturer	Acme	Back Up Space Heater Fuel	Manufactured Smokeless Fuel	Back Up Space Heater Efficiency [%] *	65	
Model	ABC1	Back Up Water Heater Fuel	Manufactured Smokeless Fuel	Back Up Water Heater Efficiency [%] *	65	
Seasonal Space Heating Efficiency, ηs	125	<small>This is the Ecodesign Seasonal Space Heating Efficiency, ηs. When the survey is completed, the efficiency will be updated to reflect the performance of the heat pump in this dwelling.</small>				
Eff. Adj. Factor	1					

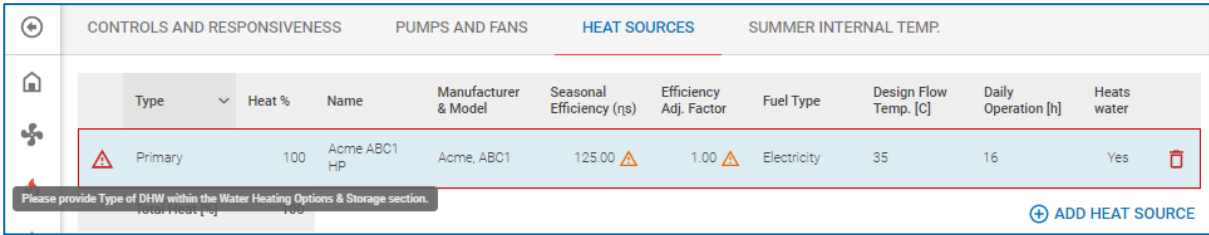
[VIEW DETAILS IN LIBRARY](#)

CANCEL **SAVE**

In this case there is no information provided for the stove with back boiler so the default efficiency from Table 4a is used.

Note that when the system has been added there are warning messages.

Figure 13.38: Warning messages in DEAP

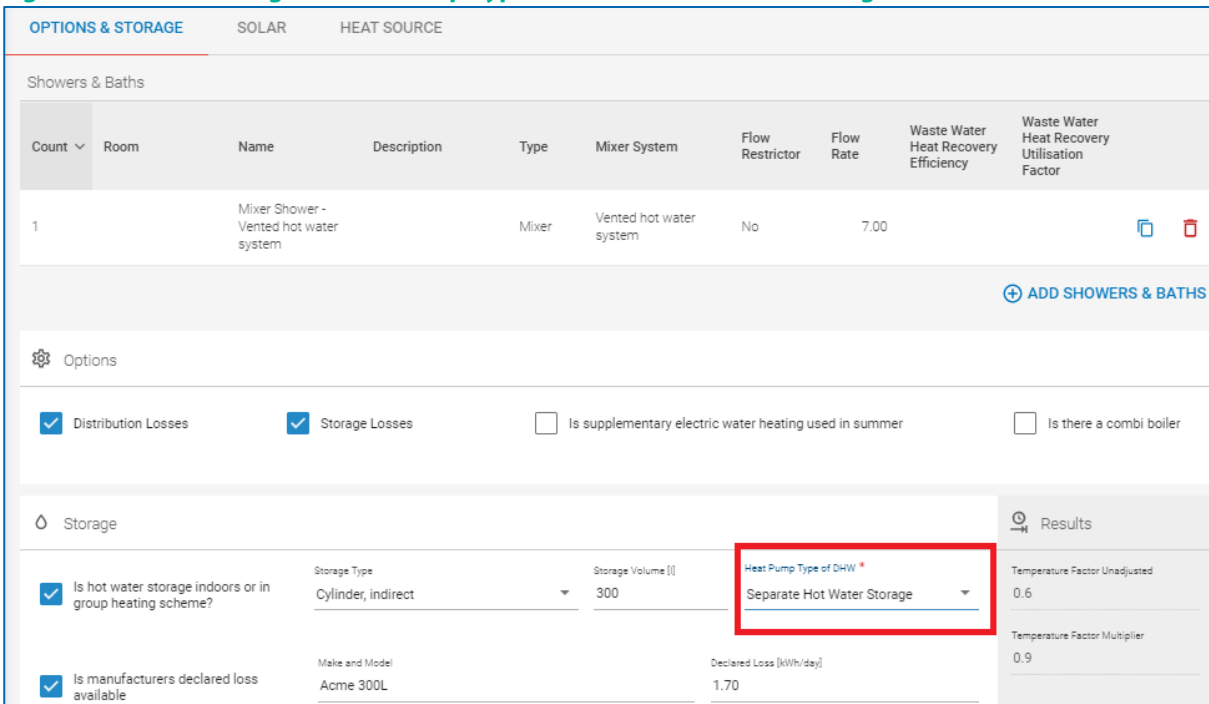


In particular, if you hover over the red triangle on the left-hand side you are advised as follows:

“Please provide Type of DHW within the Water Heating Options and Storage section”.

So, you need to go to ‘Water Heating > Options and Storage’ to select the ‘Heat Pump - Type of DHW’ as in the screenshot below where “Separate Hot Water Storage” has been chosen.

Figure 13.39 – Selecting the Heat Pump Type of DHW in the Water Heating section



13.3 Accounting for exhaust air heat pumps (EAHPs) in DEAP

The following steps are used for the treatment of EAHPs in DEAP calculation procedure for heat pumps that are not compliant with the Ecodesign and Energy Labelling Directives when applying an “uplift” to the Seasonal Performance Factor (i.e. heat pumps installed prior to September 2015 and without

EN 14825 / EN 16147 test data available).

Full guidance for treatment of heat pumps in DEAP is available in Appendix G of the DEAP Manual.

1. DEAP Ventilation Section:

Select the “Exhaust air heat pump” option. Provided the inlet air vents in the living spaces are each less than 3500 mm², a nil entry can be made in respect of this aspect of ventilation.

Apply a specific fan power (SFP) of 0.26 W/l/s as default. This is a weighted figure based on a zero figure during the heating season and a figure of 0.8 W/l/s for summertime operation. For seasonal fan power, use an alternative figure as per the SAP PCDB as referenced under Section 5.5 above.

2. DEAP Hot Water Section:

As per heat pump tool Select a heat storage tank with a standing loss that reflects the insulation specification of this component of the system. Where the EAHP is being cited as the main domestic hot water heating source, and is equipped with a direct auxiliary heating element, then the procedure set out in DEAP Appendix G (Equation G1) assuming a 50:50 allocation between the heat pump and direct electricity must be applied to the determination of efficiency.

3. DEAP Energy Requirements Section:

The efficiency (CoP or seasonal performance factor, SPF) to be used is either the default figure offered by DEAP Table 4a, or the average of the CoPs determined by independent testing to the European Standard EN 14511-2 by an accredited laboratory, for the three sets of conditions shown in the following table, i.e. the average of the efficiencies at

- 7°C outside air in – 45°C warm water out,

- 20°C exhaust air in – 45°C warm water out, and,
- 7°C outside air in – 35°C warm water out.

Rating conditions	Source heat exchanger (exhaust duct)		Sink heat exchanger (water storage vessel)	
	Inlet dry bulb temperature C	Inlet wet bulb temperature C	Inlet temperature C	Outlet temperature C
Outdoor air	7	6	40	45
Exhaust Air	20	12	40	45
Outdoor air (for floor heating or similar application)	7	6	30	35

4. System design info: System sizing check:

It is also recommended that a design heat loss and heat demand calculation be carried out for the dwelling based on a standard indoor – outdoor temperature difference, plus domestic hot water demand, with a check against the rated output of the EAHP under such conditions. It may in this context be appropriate to provide for a suitable plant capacity margin to enable heating up from cold following an extended period of absence.

5. Renewables Compliance

When using DEAP to evaluate a dwelling's compliance with the renewables requirement described under TGD L, the same method as outlined above is used with an alteration to the SPF in step (3). The three test points which should be used for renewables compliance checking for an Exhaust Air Heat Pump are A2/W35; A7/W35 and A7/W45.

The COPs from EN14511 at these test points are averaged to obtain the SPF when evaluating the renewables compliance of the dwelling. This SPF is in turn entered in DEAP to check if renewables compliance as per TGD L is achieved following steps 1-4 above. Where the BER Assessor carries out the renewables compliance check (for example on a new dwelling) they should inform their client regarding the result of the compliance check, and retain records relating to the compliance check with the assessment records. The BER is published using the SPF from step (3) above including the A20/W45 test point rather than the A2/W35 test point.

w: www.seai.ie

e: info@seai.ie

t: 01 8082100



Rialtas na hÉireann
Government of Ireland