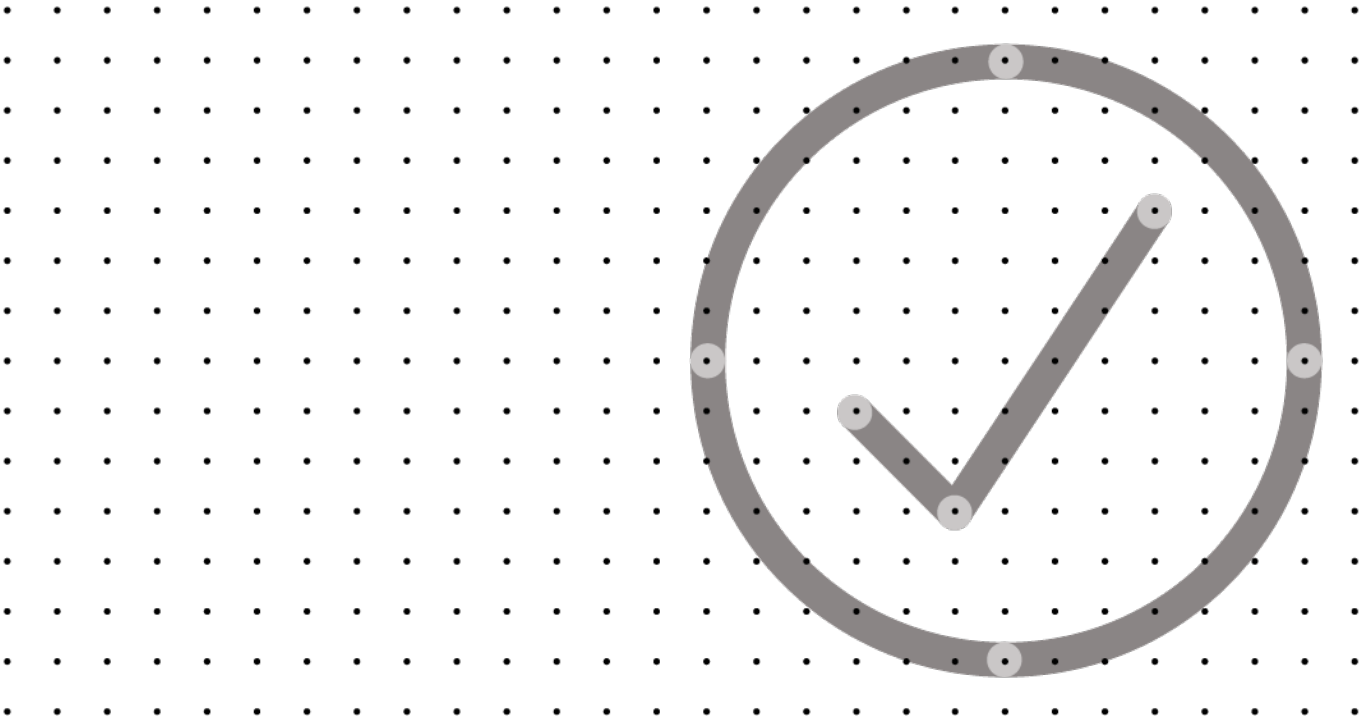**MCS 2025**

Heat Pump: Pre-Sale Information and System Performance Estimate Standard

To be used in conjunction with the MCS Customer Commitment

This Standard was prepared by the MCS Heat Pump Working Group.

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ABOUT MCS

MCS: Giving everyone confidence in home-grown energy

With energy costs constantly rising and climate change affecting us all – low-carbon technology has a bigger and bigger role to play in the future of UK energy. MCS is here to ensure it's a positive one.

MCS is the UK's quality mark for small-scale renewable energy technologies like solar PV, solar heating, heat pumps, biomass, and battery storage. We have two main roles – setting and maintaining standards, and providing consumer protection.

Our Standards define how certified renewable energy installations should be designed and installed using MCS certified products. They are a benchmark for quality developed in close consultation with industry through independent technical working groups.

The Standards are owned by The MCS Foundation (a charitable trust), but maintained and developed by MCS.

www.mcscertified.com

CHANGES TO STANDARDS

When MCS Standards are revised, the issue number is also revised to indicate the nature of the changes. This can either be a whole new issue or an amendment to the current issue. Details will be posted online, www.mcscertified.com

Technical or other significant changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

The issue number is given on the left of the decimal point, and the amendment number on the right. For example, issue 3.2 indicates that it is the third significant version of the document which has had two sets of minor amendments.

Users of this Standard should ensure that they are using the latest issue.

Amendments issued since publication

Issue No.	Amendment details	Date
1.0	First publication for MCS:2025 1.0	01/01/2025

FOREWORD

Compliance with this Standard is mandatory for MCS Contractors certified to MCS: 2025.

The purpose of this Standard is to specify best practice in achieving high-quality low carbon technology installations. Whilst it is not possible to ensure safety, this Standard provides requirements which should help mitigate potential safety risks associated with the design and installation of this technology.

This document contains references to other documents which may be either normative or informative. At the time of publication any editions of those documents, where indicated, were valid. However, as all documents are subject to revision, any users of this document should apply the most recent editions of those referenced documents (unless a dated version is specified).

NOTE:
This MCS Standard makes use of the terms 'must', 'shall' and 'should' when prescribing certain requirements and procedures. In the context of this document:

- the term 'must' identifies a requirement by law at the time of publication;
- the term 'shall' prescribes a requirement or procedure that is intended to be complied with in full and without deviation;
- the term 'should' prescribes a requirement or procedure that is intended to be complied with unless reasonable justification can be given.

Compliance with this MCS Standard does not in itself confer immunity from legal obligations.

1 SCOPE

This Standard describes the methods for calculating the amount of estimated renewable energy which might be delivered by a heat pump system during a typical year to deliver the annual heating demand. This document is to be used in conjunction with the MCS Customer Commitment. The format in which this shall be presented to the customer is also given along with the technical information to accompany the estimate.

Performance estimates enable customers to compare different systems. The use of this MCS standard for performance estimates brings a comparable and consistent methodology for different heat pump configurations.

The estimates are based on the best knowledge of MCS of heat pump applications.

This Standard and its associated requirements shall be complied with before a contract is awarded to the customer.

Note: Where site characteristics are unknown (e.g. where the contract may be signed when the property is pre-built), best assumptions shall be made.

2 METHOD

2.1 Site evaluation

Using a valid Energy Performance Certificate (EPC) identify:

(a) The property space heating demand (kWh/year); and

(b) The hot water demand (kWh/year); and

(c) The total property floorspace (m^2).

Notes:

A valid EPC is one which has not expired and where the given annual heat demand is not expected to change such as by, for example, an extension or refurbishment of the building, and where the heat pump is intended to supply that changed heat demand. Where no valid EPC exists on the public register, but it is possible to obtain one through a domestic energy assessment, then an EPC should be obtained and lodged. Neither the annual heat demand of the building nor the annual energy performance of the system are appropriate for sizing the system.

Where it is not possible to obtain a valid EPC refer to Appendix A of this Standard.

The total property floorspace is given in the EPC and is not the same as property footprint.

(d) Using the property postcode identify (lookup) in Appendix B, Table 1 the appropriate number of degree days and the outdoor low temperature.

(e) Calculate the property specific heat loss ($P_{specific}$) in W/K:

$$P_{specific} = \frac{1000 \times Q}{24 \times D}$$

Where:

- Q is the space heating demand (kWh/year) identified in paragraph (a); and
- D is the degree days per year identified in paragraph (d).

(f) Calculate the total heat loss (P_t) in W:

$$P_t = P_{specific} \times (d_i - d_o)$$

Where:

- $P_{specific}$ is the property specific heat loss as calculated in paragraph (e); and
- d_i is the design inside temperature of 21°C; and

- d_o is the outdoor low temperature identified in paragraph (d). Where this is a negative number then, mathematically, subtracting a negative number becomes addition.

(g) Calculate the specific heat loss in W/m^2 :

$$W/m^2 = P_t \div \text{Total property floorspace (m}^2)$$

Where:

- P_t is the total heat loss as calculated in paragraph (f).

2.2 Indicative heat pump capacity

Where a room-by-room heat loss has been undertaken to establish the size of the emitters and overall heat pump capacity then this step need not be undertaken.

(h) Estimate the heat pump capacity (in kW):

$$\text{Heat pump capacity} = P_t \div 1000$$

Where:

- P_t is the total heat loss as calculated in paragraph (f).

Note:

For hybrid installations, the space heating demand (kWh/year) obtained in paragraph (a) should be reduced by the proportion to be supplied by other heat sources, leaving the remainder to be supplied by the heat pump which should then be used to calculate $P_{specific}$ at paragraph (e), then calculate P_t at paragraph (f) and finally the heat pump capacity at paragraph (h).

The estimate of the heat pump capacity is indicative only and may change following the detailed heat loss assessment and system design.

2.3 Proposed emitters

(i) From the following four options, determine the best match for the emitters proposed to exist in the finished system:

- Existing radiators
- Mostly upgraded radiators
- Mostly underfloor
- Approximately 50% radiators and 50% underfloor.

(j) Decide upon the flow temperature. Where it is proposed to use existing radiators (i.e. no, or very few, radiators are to be replaced with larger variants) the default flow temperature of 60 °C shall be used unless a room-by-room heat loss calculation has been carried out which justifies a lower flow temperature.

2.4 Seasonal performance factor (SPF) and star rating

(k) Using the specific heat loss ($P_{specific}$) calculated in paragraph (e), select the correct specific heat loss band in column 1 in Appendix B, Table 2.

(l) Using the proposed flow temperature (or default 60 °C), lookup (read across) as follows:

   a. Where radiators:

      i.   The star rating from column 3
      ii. Any relevant notes from column 6 (Existing Radiators) or 7 (Mostly Upgraded Radiators).
      iii. If ground source heat pump the estimated SPF and any relevant notes from column 4
      iv. If air source heat pump the estimated SPF and any relevant notes from column 5.

   b. Where mostly underfloor:

      i.   The star rating from column 3
      ii. Any relevant notes for either Flooring on Screed from column 7, or Flooring on Chipboard on Aluminium from column 8, or Flooring on High Conductivity Panel on Aluminium from column 9
      iii. If ground source heat pump the estimated SPF and any relevant notes from column 4
      iv. If air source heat pump the estimated SPF and any relevant notes from column 5.

   c. Where approximately 50% radiators and 50% underfloor:

      i.   The star rating from column 3
      ii. Any relevant notes from column 6 or column 7.
      iii. If ground source heat pump the estimated SPF and any relevant notes from column 4
      iv. If air source heat pump the estimated SPF and any relevant notes from column 5
      v.   Any additional notes depending on the flow temperature to the underfloor from columns 8, 9 or 10.

Note: the flow temperature used to determine the estimated SPF in paragraphs iii. and iv. should be that for the radiators and not the underfloor. If those radiators are existing, then the default flow temperature of 60 °C shall be used unless a room-by-room heat loss calculation has been carried out which justifies a lower flow temperature to the radiators.

2.5   Calculating annual electricity consumption

(m) Calculate the annual electricity consumption for the space heating (kWh):

$$\text{Annual electricity consumption (space)} = \frac{Q}{SPF}$$

Where:

- Q is the space heating demand (kWh/year) identified in paragraph (a); and
- SPF is the estimate seasonal performance factor identified in paragraph (l).

(n) Calculate the annual electricity consumption for the hot water (kWh):

$$\text{Annual electricity consumption (water)} = \frac{W}{1.7}$$

Where:

- W is the hot water demand (kWh/year) identified in paragraph (b); and
- 1.7 is the performance factor when heating hot water only taken from SAP 2012 (Table 4a).

(o) Calculate the annual electricity consumption from an immersion heater to regularly pasteurise any hot water storage (kWh):

$$\text{Annual electricity consumption (immersion)} = \frac{F \times Vol \times 10 \times 4{,}200}{3{,}600{,}000}$$

Where:

- F is the frequency of pasteurisation. If pasteurisation can be provided by the heat pump (or not required at all) this can be Zero. Otherwise should be either 365 where daily or 52 where weekly
- Vol is the nominal size of the proposed hot water storage cylinder (litres)
- The factor of 10 assumes the immersion is used to raise the cylinder temperature 10°C from 50°C to 60°C.

(p) Calculate the total annual electricity consumption of the proposed system:

Annual electricity consumption (space)

+

Annual electricity consumption (water)

+

Annual electricity consumption (immersion)

(q) Convert the result of paragraph (p) into a high/low (+/- 10%) range:

a) Multiply the total annual electricity consumption by 0.9; and
b) Multiply the total annual electricity consumption by 1.1.

3 HYBRID SYSTEMS

For hybrid systems, where the heat pump is not intended to provide 100% of the demand (space heating or hot water), the calculations above shall be modified:

(r) Determine the proportion of the space heating demand and hot water demand identified in paragraphs (a) and (b) to be supplied by the boiler; and

(s) Lookup the boiler efficiency factor in Appendix B, Table 3;

(t) Calculate the energy consumption of the other source as the heat demand supplied, as found in paragraph (r), divided by the boiler efficiency from paragraph (s);

(u) Use the remainder from paragraph (r) (i.e. the proportion of the demand to be provided by the heat pump) in paragraphs (d) to (q) above;

(v) Calculate the total energy consumption of the hybrid system by combining the results from paragraph (t) with the results from paragraph (u).

4 PRE-SALE INFORMATION FOR HEAT PUMP SYSTEMS

As a minimum, the following technical information shall be communicated in writing to the customer before the point that the contract is awarded:

a) The results of the preceding calculation using the format given below along with the Key Information from Section 5.

Note: A Heat Pump System Performance Estimate (HPSPE) tool is published on the MCS website which can be used to undertake the calculations given in this Standard. It also produces an output table in the correct format along with additional (and optional) outputs such as the emitter star rating and a graph of likely system performance against flow temperature.

Additional estimates may be provided using an alternative methodology, including proprietary software packages, but:

- Such estimates shall clearly describe and justify the approach taken and factors used

- They shall not be given greater prominence than the standard MCS estimate

- They shall be accompanied by warning text stating that it should be treated with caution if it is significantly better than the result given by the standard method.

b) The proportion of the building's space heating and/or domestic hot water that is to be provided by the heat pump (excluding any heat supplied by a supplementary electric heater) taking into account the heat emitter circuit and flow temperature.

c) Manufacturer's datasheet for the proposed heat pump

d) Manufacturer's datasheet for the proposed hot water cylinder (if applicable)

e) Details of any subcontractors proposed to undertake installation

Heat pump system performance estimate

Your energy requirements

Energy required for heating		kWh
Demand to be supplied by the heat pump		kWh
Energy required for hot water		kWh
Demand to be supplied by the heat pump		kWh

Your property

Your postcode prefix		
Total property floorspace (not property footprint)		m²
Average watts per square metre *Note: W/m² is a measure of your property's thermal efficiency. 0-30W/m² is very low heat loss and 120-150W/m² is very high heat loss.*		W/m²

Proposed system

Heat pump capacity *Note: unless a full heat loss calculation has been undertaken, this figure is indicative only and may change.*		kW
Heat pump type (select one)	ASHP / GSHP / WSHP / SAHP	
Your system is proposed to provide (select one):	Space heat and hot water Space heating only Hybrid (Combining heat from a heat pump and a boiler)	
Your proposed heating system will be (select one):	Your existing radiators (none upgraded) Mostly (at least 50%) upgraded radiators Mostly underfloor Approx. 50% radiators and 50% underfloor	
The proposed flow temperature will be		°C

Performance

The seasonal performance factor is calculated to be:				
Estimate of energy consumption of the proposed heat pump (or combined system where Hybrid). *Note: you can convert these figures to approximate running costs.*	High estimate		Low estimate	
		kWh		kWh

Important Note: This is not a detailed system design. It offers a reasonable estimate of likely performance and a description of the likely design.

Details may change after the heat loss survey and design / This estimate is based on a full heat loss survey and design (delete as appropriate).

Applicable warning notes (from Table 2):

5 KEY INFORMATION

The heat demand of a building, and therefore the performance and running costs of heating systems, is difficult to predict with certainty due to the variables discussed here. These variables apply to all types of heating systems, although the efficiency of heat pumps is more sensitive to good system design and installation. For these reasons your estimate is given as guidance only and should not be considered as a guarantee.

Seasonal performance factor

Seasonal performance factor (SPF) is a measure of the operating performance of a heating system incorporating an electric heat pump over a season, typically a year. It is the ratio of heat delivered to the total electrical energy consumed by the unit over the same period. As a guide, a heat pump system achieving an SPF of 3 would have delivered 3 kWh of heat energy for every 1 kWh of electrical energy it consumed over a 'standard' annual cycle.

Energy performance certificate

An energy performance certificate (EPC) is produced in accordance with a methodology approved by the government. As with all such calculations, it relies on the accuracy of the information input. Some of this information, such as the insulation and air tightness properties of the building may have to be assumed and this can affect the final figures significantly leading to uncertainty especially with irregular or unusual buildings.

Identifying the uncertainties of energy predictions for heating systems

We have identified 3 key types of factor that can affect how much energy a heating system will consume and how much energy it will deliver into a home. These are 'Fixed', 'Variable' and 'Random'. Most factors are common to ALL heating systems regardless of the type (e.g oil, gas, solid fuel, heat pump etc.) although the degree of effect varies between different types of heating system as given in the following table.

The combined effect of these factors on energy consumption and the running costs makes overall predictions difficult however an accuracy ± 25-30% would not be unreasonable in many instances. Under some conditions even this could be exceeded (e.g. considerable opening of windows). Therefore it is advised that when making choices based on mainly financial criteria (e.g. payback based on capital cost verses net benefits such as fuel savings and financial incentives) this variability is taken into account as it could extend paybacks well beyond the period of any incentives received, intended occupancy, finance agreement etc.

Factor	Impact
'Fixed' which include:	
Equipment selection performance figures (SCoP) from ErP data	System efficiency
Energy assessment via the EPC (e.g. assumptions as to fabric construction and levels of insulation; the variation in knowledge and experience of Energy Assessors)	Energy required
'Variable' which are affected by the system design and include:	
Accuracy of sizing of heat pump - i.e. closeness of unit output selection (kW) to demand heat requirement (kW)	System efficiency
Design space and ambient (external) temperatures	Energy required
Design flow /return water temperatures, and weather compensation	System efficiency
Type of heat emitter (e.g. Under-floor; natural convector (e.g. 'radiator'), fan convector etc.)	System efficiency
'Random' which cannot be anticipated and include:	
User behaviour:	
• Room temperature settings	Energy required
• Hot water usage and temperature settings	Energy required
• Occupancy patterns/times	Energy required
• Changing the design HP flow temperatures	System efficiency
• Ventilation (i.e. opening windows)	Energy required
Annual climatic variations (i.e. warmer and colder years than average)	Energy required

Key:

The statement at the end of each item indicates the major factor affected as follows:

Energy required: The heat energy output requirement of the system which directly impacts on running costs. This requirement exists regardless of the heating system chosen as it is the heat required to keep the space comfortable. Opening windows or increasing room temperatures will demand more heat output, which means more energy input but this would NOT directly affect the efficiency. Thus increased energy demand does NOT automatically mean reduced efficiency.

System sfficiency: The efficiency of the system has been directly affected and will therefore demand more input energy to achieve the same heat output thus increasing running costs. However, increased energy input does NOT necessarily mean lower system efficiency (see above).

APPENDIX A

For all systems where the premises are not entitled to obtain a domestic EPC (e.g. non-domestic) or where it is not possible to use a SCoP (e.g. GAHP, SAHP), the means of estimating the annual energy performance shall be as follows:

a) Assess the annual heat load for the building (space heating and / or hot water) using any suitable performance calculation method. Such calculation method shall be clearly described and justified.

b) Multiply the result from a) by the proportion of the relevant heat load to be provided by the heat pump system.

c) For space heating, divide the result from b) by the default efficiency (expressed as a Seasonal Coefficient of Performance or Seasonal Primary Energy Ratio (SCoP or SPERh)) for heat pumps calculated using the data available on the MCS website (www.mcscertified.com). For water heating, divide the result from b) by the efficiency (expressed as a Seasonal Coefficient of Performance or Seasonal Primary Energy Ratio (SCoP or SPERh)) when the heat pump is operating at the flow temperature of the heat pump while providing water heating service.

d) For domestic hot water (SAHPs and HWHPs), the efficiency to be expressed as a Seasonal Performance Factor (SPF) shall be taken as the Coefficient of Performance (COP) (in accordance with the SEPEMO report: D2.5/D3.5 Position paper on heat pump SPF) obtained from the test results undertaken as part of the MCS 007 heat pump product certification scheme requirements for SAHPs and HWHPs.

e) Calculate the energy to be supplied by any supplementary heater by multiplying the result from a) by the proportion of the relevant heat load not supplied by the heat pump.

f) Add the result from c) to the result from d) to give the total energy required for the relevant heat load.

g) The results from e) for space heating and hot water are added together to give an overall energy requirement for the building for these heat loads

APPENDIX B – LOOKUP DATA

Postcode index for degree days and outdoor low temperature								
Post-codes AB-HG	Low Temps (°C)	Degree days	Post-codes HP-S	Low Temps (°C)	Degree days	Post-codes SA-ZE	Low Temps (°C)	Degree days
AB	-5.4	2668	HA	-3	2033	PO	-4.8	2224
AL	-3	2033	HD	-4.5	2307	PR	-4.5	2388
B	-5.1	2425	HG	-3.3	2307	RG	-4.6	2033
BA	-4.6	1835	HP	-3	2033	RH	-3	2033
BB	-4.5	2228	HR	-5.1	2425	RM	-3	2033
BD	-3.3	2307	HS	-5.6	1800	S	-3.3	2228
BH	-4.8	2224	HU	-3.3	2307	SA	-3.1	2161
BL	-4.5	2228	HX	-4.5	2228	SE	-3	2033
BN	-4.8	2224	IG	-3	2033	SG	-3	2033
BR	-3	2255	IM	-4.5	2228	SK	-4.5	2228
BS	-3.1	1835	IP	-4.6	2254	SL	-3	2033
BT	-3.2	2360	IV	-5.6	2668	SM	-3	2033
CA	-3.7	2388	JE	-4.8	1800	SN	-4.6	2425
CB	-3	2033	KA	-5.6	2494	SO	-4.8	2224
CF	-3.1	1835	KT	-3	2033	SP	-4.8	2224
CH	-4.5	2228	KW	-5.4	2668	SR	-3.7	2370
CM	-3	2033	KY	-5.4	2577	SS	-3	2033
CO	-4.6	2254	L	-4.5	2228	ST	-5.1	2228
CR	-3	2224	LA	-4.5	2388	SW	-3	2033
CT	-3	2255	LD	-3.1	2161	SY	-5.1	2161
CV	-5.1	2425	LE	-3.9	2425	TA	-1.5	1835
CW	-4.5	2228	LL	-4.5	2228	TD	-5.4	2483
DA	-3	2255	LN	-3.9	2307	TF	-5.1	2425
DD	-5.4	2577	LS	-3.3	2307	TN	-3	2255
DE	-3.9	2228	LU	-3	2033	TQ	-1.5	1858
DG	-5.6	2483	M	-4.5	2228	TR	-1.5	1858
DH	-3.7	2370	ME	-3	2033	TS	-3.7	2370
DL	-3.7	2388	MK	-4.6	2425	TW	-3	2203
DN	-3.3	2307	ML	-5.4	2494	UB	-3	2203
DT	-4.8	2224	N	-3	2033	W	-3	2203
DY	-5.1	2425	NE	-3.7	2370	WA	-4.5	2228
E	-3	2033	NG	-3.9	2254	WC	-3	2203
EC	-3	2033	NN	-3.9	2425	WD	-3	2203
EH	-5.4	2577	NP	-3.1	2425	WF	-3.3	2307
EN	-3	2255	NR	-4.6	2254	WN	-4.5	2228
EX	-1.5	1858	NW	-3	2033	WR	-5.1	2425
FK	-5.6	2577	OL	-4.5	2228	WS	-5.1	2425
FY	-4.5	2388	OX	-4.6	2425	WV	-5.1	2425
G	-5.6	2494	PA	-5.6	2494	YO	-3.3	2307
GL	-4.6	2425	PE	-4.6	2254	ZE	-5.4	2668
GU	-3	2033	PH	-5.6	2668			
GY	-4.8	1800	PL	-1.5	1858			

Table 1: Postcode Index for degree days and outdoor low temperatures

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Notes: To be Included in Consumer Template When Indicated
Property Specific Heat Loss Band	Flow Temperature °C	Star Rating	Estimated SPF for GSHP	Estimated SPF for ASHP	Radiators (Existing)	Radiators (Mostly Upgraded)	UFH: Flooring on Screed — Include Notes 8+10	UFH: Flooring on Chipboard on Aluminium — Include Notes 9+10	UFH: Flooring on High Conductivity Panel on Aluminium — Include Notes 9+10	
Specific Heat Loss <30 W/m²	Up to 35	★★★★★★	4.3	4.0	Note 1	✓	✓	Note 4	✓	**Note 1:** No change to existing radiators is unlikely to be viable – unless the current radiators are significantly over-sized for your existing fossil fuel boiler.
	36-40	★★★★★	4.1	3.8	Note 1	✓	✓	✓	✓	
	41-45	★★★★	3.7	3.4	Note 1	✓	✓	✓	✓	**Note 2:** Proposed system design is possible, but the size of standard emitters may be excessive. Speak to your installer about the emitter choices.
	46-50	★★★	3.4	3.1	Note 1	✓	✓	✓	✓	
	51-55	★★	3.1	2.8 and Note 5	✓	✓	✓	✓	✓	
	56-60	★	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	✓	✓	**Note 3:** Important: The system cannot operate as designed for Tile, wood or carpet on screed or where aluminium panels are used instead of screed. Fabric heat loss should be reduced and/or load sharing with other emitter types.
	61-65	No Stars	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 6	Note 6	
Specific Heat Loss 30-50 W/m²	Up to 35	★★★★★★	4.3	4.0	Note 1	✓	Note 4	Note 3	Note 4	
	36-40	★★★★★	4.1	3.8	Note 1	✓	✓	✓	✓	**Note 4:** The system can operate as designed for Tiles. For Wood and Carpet Floor Coverings, additional measures to improve property energy efficiency are likely to be needed (such as improved insulation or draught proofing).
	41-45	★★★★	3.7	3.4	Note 1	✓	✓	✓	✓	
	46-50	★★★	3.4	3.1	Note 1	✓	✓	✓	✓	
	51-55	★★	3.1	2.8 and Note 5	✓	✓	✓	✓	✓	**Note 5:** Forecast system efficiency is low and running costs may be high without system design changes.
	56-60	★	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	✓	✓	
	61-65	No Stars	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 6	Note 6	**Note 6:** Not suitable for UFH.
Specific Heat Loss 50-80 W/m²	Up to 35	★★★★★★	4.3	4.0	Note 1	✓	Note 3	Note 3	Note 3	
	36-40	★★★★★	4.1	3.8	Note 1	✓	Note 4	Note 4	Note 4	**Note 7:** Suitable for Tiles in Bathrooms/Ensuites Only
	41-45	★★★★	3.7	3.4	Note 1	✓	Note 4	Note 4	Note 4	
	46-50	★★★	3.4	3.1	Note 1	✓	✓	Note 4	✓	**Note 8:** Screed floors with UFH complies with BS1264 Type A construction laid on floor insulation – Default Pipe Spacing 200mm cc.
	51-55	★★	3.1	2.8 and Note 5	Note 1	✓	✓	✓	✓	
	56-60	★	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	✓	✓	
	61-65	No Stars	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 6	Note 6	**Note 9:** Dry Floor systems with UFH complies with BS1264 Type B Aluminium Plate construction laid with insulation underneath – Default Pipe Spacing 200mm cc.
Specific Heat Loss 80-100 W/m²	Up to 35	★★★★★★	4.3	4.0	Note 2	Note 2	Note 3	Note 3	Note 3	
	36-40	★★★★★	4.1	3.8	Note 1	✓	Note 3	Note 3	Note 3	**Note 10:** specialist UFH Designers can provide more accurate information for heating performance with different systems.
	41-45	★★★★	3.7	3.4	Note 1	✓	Note 4	Note 3	Note 4	
	46-50	★★★	3.4	3.1	Note 1	✓	Note 4	Note 4	Note 4	
	51-55	★★	3.1	2.8 and Note 5	Note 1	✓	✓	Note 4	✓	
	56-60	★	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	✓	✓	
	61-65	No Stars	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 6	Note 6	
Specific Heat Loss 100-120 W/m²	Up to 35	★★★★★★	4.3	4.0	Note 2	Note 2	Note 3	Note 3	Note 3	
	36-40	★★★★★	4.1	3.8	Note 2	Note 2	Note 3	Note 3	Note 3	
	41-45	★★★★	3.7	3.4	Note 2	Note 2	Note 7	Note 3	Note 7	
	46-50	★★★	3.4	3.1	Note 1	✓	Note 7	Note 7	Note 7	
	51-55	★★	3.1	2.8 and Note 5	Note 1	✓	Note 7	Note 7	Note 7	
	56-60	★	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 7	Note 7	
	61-65	No Stars	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 6	Note 6	
Specific Heat Loss 120-150 W/m²	Up to 35	★★★★★★	4.3	4.0	Note 2	Note 2	Note 3	Note 3	Note 3	
	36-40	★★★★★	4.1	3.8	Note 2	Note 2	Note 3	Note 3	Note 3	
	41-45	★★★★	3.7	3.4	Note 2	Note 2	Note 3	Note 3	Note 3	
	46-50	★★★	3.4	3.1	Note 1	✓	Note 3	Note 3	Note 3	
	51-55	★★	3.1	2.8 and Note 5	Note 1	✓	Note 7	Note 3	Note 3	
	56-60	★	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 7	Note 7	
	61-65	No Stars	2.8 and Note 5	2.5 and Note 5	✓	✓	Note 6	Note 6	Note 6	

Table 2: Heat emitter guide

Boiler efficiency factors	
Generation source	Factor
New boiler	0.93
Existing boiler pre-1994	0.82
Existing boiler 1994-2007	0.87
Existing boiler Post-2007	0.92

Table 3: Boiler efficiency factors

APPENDIX C – WORKED EXAMPLE

An existing property in rural Wales (postcode CF) has a total space heating demand (taken from a valid EPC) of 15,500kWh/year and hot water demand of 2,900kWh/year. An air source heat pump is proposed to provide 100% of the space heating and hot water demand. It is proposed to upgrade the radiators not able to provide the required output at a flow temperature of 50°C.

The calculations would be as follows:

    (a) Space heating demand = 15,500kWh

    (b) Hot water demand = 2,900kWh

    (c) Total property floorspace = 145m^2

    (d) Degree days = 1835 and outdoor low temperature -3.1°C

    (e) Property specific heat loss $P_{specific}$ =

$$\frac{1000 \times 15{,}500}{24 \times 1{,}835}$$

$$= 352 \text{ W/K}$$

    (f) Total heat loss P_t =

$$P_{specific} \times (di - do)$$

$$352 \times (21 - -3.1)$$

$$352 \times 24.1$$

$$= 8483\text{W}$$

    (g) Specific heat loss =

$$P_t \div \text{Total Property Floorspace (m}^2)$$

$$8483 \div 145\text{m}^2$$

$$= 59\text{W/m}^2$$

    (h) Indicative heat pump capacity =

$$P_t \div 1000$$

$$8483 \div 1000$$

$$= 8.5\text{kW}$$

    (i) Proposed emitters = mostly upgraded radiators

    (j) The proposed flow temperature is 50°C. The default of 60°C does not apply as not using existing radiators

    (k) Lookup row in Table 2 is the third from the top (between 50 and 80W/m^2)

    (l) Given the proposed flow temperature is 50°C so:

        a. Where mostly upgraded radiators

i. Star rating is "★ ★ ★" from column 3

ii. No note to select

iii. Not applicable as air source heat pump proposed

iv. SPF from column 5 is 3.1

(m) Annual electricity consumption (space) =

$$\frac{Q}{SPF}$$

$$\frac{15,500}{3.1}$$

= 5000kWh

(n) Annual electricity consumption (water) =

$$\frac{W}{1.7}$$

$$\frac{2,900}{1.7}$$

= 1705kWh

(o) Annual electricity consumption (immersion) for 200L cylinder and weekly pasteurisation =

$$\frac{Vol \times F \times 10 \times 4,200}{3,600,000}$$

$$\frac{200 \times 52 \times 10 \times 4,200}{3,600,000}$$

$$\frac{436800000}{3,600,000}$$

= 121kWh

(p) Calculate the total annual electricity consumption of the proposed system:

5000 + 1705 + 121 = 6826kWh

(q) Convert the result of paragraph (p) into a high/low (+/- 10%) range:

a. Multiply the total annual electricity consumption by 0.9 =

(a) 6826 x 90% = 6143kWh

b. Multiply the total annual electricity consumption by 1.1 =

(b) 6826 x 110% = 7508kWh