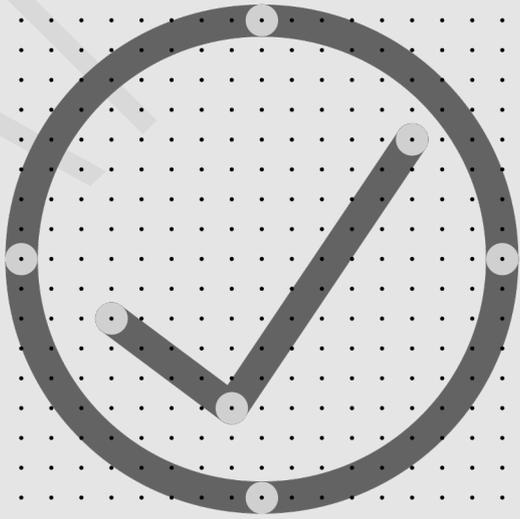


# Heat Pump Pre-sale information and performance calculation

.....  
To be used in conjunction with MIS 3005 (D & I)



This Standard was prepared by the MCS Working Group 6 ‘Heat Pumps’

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# ABOUT MCS

## Giving you confidence in home-grown energy

With energy costs constantly rising and climate change affecting us all, low-carbon technology has an ever increasing role to play in the future of UK energy.

We're here to ensure it's a positive one.

Working with industry we define, maintain and improve quality – certifying products and installers so people can have confidence in the low-carbon technology they invest in. From solar and wind, to heat pumps, biomass and battery storage, we want to inspire a new generation of home-grown energy, fit for the needs of every UK home and community.

### About

The Microgeneration Certification Scheme Service Company Ltd (MCSSCo Ltd) trades as MCS and is wholly owned by the non-profit MCS Charitable Foundation. Since 2007, MCS has become the recognised Standard for UK products and their installation in the small-scale renewables sector.

We create and maintain standards that allow for the certification of products, installers and their installations. Associated with these standards is the certification scheme, run on behalf of MCS by Certification Bodies who hold UKAS accreditation to ISO 17065.

MCS certifies low-carbon products and installations used to produce electricity and heat from renewable sources. It is a mark of quality. Membership of MCS demonstrates adherence to these recognised industry standards; highlighting quality, competency and compliance.

### Vision

To see MCS certified products and installations in every UK home and community.

### Mission

To give people confidence in low-carbon energy technology by defining, maintaining and improving quality.

### Values

1. We are expert – ensuring quality through robust technical knowledge
2. We are inspiring – helping to reshape energy in UK homes and communities
3. We are collaborative – working with industry and government to create positive change
4. We are principled – operating in a way that's clear, open and fair
5. We are determined – supporting the UK's drive towards a clean energy future

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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](http://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.

Issue No.	Amendment Details	Date
4.0	Major re-write including format and method.	XX/XX/2022

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# 1 SCOPE

This Standard describes the method to estimate the amount of renewable energy which might be delivered, along with the electricity consumed, by a heat pump heating system during a typical year. This document is to be used in conjunction with MIS 3005-D: The Heat Pump Standard (Design) and MIS 3005-I: The Heat Pump Standard (Installation). The format in which this shall be presented to the customer is also given along with the technical information to accompany the estimate.

A copy of this calculation shall be retained by the contractor for the minimum period defined within MCS001 and made available for audit.

## 2 METHOD

### 2.1 Site Evaluation

Obtain:

- (a) The property space heating demand (kWh/year); and
- (b) The hot water demand (kWh/year)

using:

- a valid energy performance certificate (EPC); or
- where the property is being newly built or renovated, a Standard Assessment Procedure (SAP 2012) calculation; or
- where it is not possible to obtain a valid EPC (or SAP assessment) an estimate of the annual space heating and hot water demands shall be made using a suitable method for the type of building. Such a method shall be clearly described and justified.

*Note: 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.*

- (c) Identify or calculate the total property floorspace (m<sup>2</sup>).

*Note: this requirement relates to the total floorspace not the property footprint. Total property floorspace is given in an EPC.*

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

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

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

Where:

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

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

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

Where:

- $P_{\text{specific}}$  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<sup>2</sup>:

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

Where:

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

## 2.2 Indicative Heat Pump Capacity

(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).

Notes:

*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*

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$P_{specific}$  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) 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 in paragraph (l), sub-paragraph a., unless a room-by-room heat loss calculation has been carried out which justifies a lower flow temperature. Add Note 1 from Appendix A, Table 2 as a warning note in the presentation to the consumer.

### 2.4 Seasonal Performance Factor (SPF) and Star Rating

- (k) Using the specific heat loss calculated in paragraph (g), select the correct specific heat loss band in Column 1 in Appendix A, Table 2.
- (l) Using the proposed flow temperature and lookup (read across) as follows:
- a. Where radiators:
- i. Any relevant notes from Column 3
  - ii. If ground source heat pump the estimated SPF and any relevant notes from Column 6
  - iii. If air source heat pump the estimated SPF and any relevant notes from Column 7
  - iv. The star rating from Column 8.
- b. Where mostly underfloor
- i. Any relevant notes for either wood on screed from Column 4 or tile on screed from Column 5
  - ii. If ground source heat pump the estimated SPF and any relevant notes from Column 6
  - iii. If air source heat pump the estimated SPF and any relevant notes from Column 7

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- iv. The star rating for either wood on screed from Column 9 or tile on screed from Column 10.
- c. Where approximately 50% radiators and 50% underfloor
- i. Any relevant notes from Column 3
  - ii. If ground source heat pump the estimated SPF and any relevant notes from Column 6
  - iii. If air source heat pump the estimated SPF and any relevant notes from Column 7
  - iv. The star rating from Column 8
  - v. Any additional notes depending on the flow temperature to the underfloor from Columns 8 or 9.

*Note: the flow temperature used to determine the estimated SPF in paragraphs i. and ii. 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):

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

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Where:

- Vol is the nominal size of the proposed hot water storage cylinder (litres)
- F is the frequency of pasteurisation and should be either 365 where daily or 52 where weekly
- 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:

$$\begin{aligned} & \textit{Annual electricity consumption (space)} \\ & \quad + \\ & \textit{Annual electricity consumption (water)} \\ & \quad + \\ & \textit{Annual electricity consumption (immersion)} \end{aligned}$$

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

- a. Multiply the total annual electricity consumption by 90%; and
- b. Multiply the total annual electricity consumption by 110%.

### 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 other heat source; and
- (s) Lookup the boiler efficiency factor in Appendix A, Table 3.
- (t) Calculate the energy consumption of the other source as the heat demand supplied divided by the boiler efficiency.
- (u) Use the remainder from paragraph (r) (i.e. the proportion of the demand to be provided by the heat pump) in paragraphs (m) 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 PRESENTATION FORMAT

The results of the preceding calculation shall be given to the customer using the format given below along with the Key Information from Section 5.

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.

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## 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)		m <sup>2</sup>
Average watts per square meter <i>Note: W/m<sup>2</sup> is a measure of your property's thermal efficiency. 0-30W/m<sup>2</sup> is very low heat loss and 120-150W/m<sup>2</sup> is very high heat loss.</i>		W/m <sup>2</sup>

### Proposed system (subject to design)

Heat pump capacity <i>Note: unless a full heat loss calculation has been undertaken, this figure is indicative only and may change.</i>		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 Approx. 50% radiators and 50% underfloor	

### Performance

Estimate of electricity consumption of the proposed heat pump (or combined system where Hybrid). <i>Note: you can convert these figures to approximate running costs.</i>	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.

### Applicable warning notes (from Table 2):

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## 5 KEY INFORMATION

**Predicting 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 insulating 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  $\pm 25-30\%$  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.

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Factor	Impact
<b>'Fixed'</b> 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
<b>'Variable'</b> 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
<b>'Random'</b> which cannot be anticipated and include:	
User behaviour:	
<ul style="list-style-type: none"> <li>Room temperature settings</li> </ul>	Energy Required
<ul style="list-style-type: none"> <li>Hot water usage and temperature settings</li> </ul>	Energy Required
<ul style="list-style-type: none"> <li>Occupancy patterns/times</li> </ul>	Energy Required
<ul style="list-style-type: none"> <li>Changing the design HP flow temperatures</li> </ul>	System Efficiency
<ul style="list-style-type: none"> <li>Ventilation (i.e. opening windows)</li> </ul>	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 Efficiency:** 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 – LOOKUP DATA

Postcode Index for Degree days and Outdoor Low Temperatures								
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	<b>Notes: To be included in Consumer Template When Indicated</b>
Specific Heat Loss Band	Flow Temp °C	Radiator Notes	Underfloor Heating Wood on Screed	Underfloor Heating Tile on Screed	Estimated SPF for GSHP	Estimated SPF for ASHP	Star Rating for Radiators or Combined Systems	Star Rating Mostly UFH Wood on Screed	Star Rating for Mostly UFH Tile on Screed	
Specific Heat Loss <30 W/m <sup>2</sup>	up to 35				4.3	3.6	★★★★★	★★★★★	★★★★★	<b>Note 1</b> (include only for proposals based on no or minimal radiator upgrades): No or minimal 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	3.4	★★★★★	★★★★★	★★★★★	
	41-45				3.7	3.0	★★★★★	★★★★★	★★★★★	
	46-50				3.4	2.7 and Note 5	★★★★	★★★★	★★★★	
	51-55	Note 1			3.1	2.4 and Note 5	★★★	★★★	★★★	
	56-60	Note 1			2.8 and Note 5	2.1 and Note 5	★	★	★	
61-65	Note 1			2.8 and Note 5	2.1 and Note 5	No Stars	No Stars	No Stars		
Specific Heat Loss 30 to 50 W/m <sup>2</sup>	up to 35				4.3	3.6	★★★★★	★★★★★	★★★★★	<b>Note 2:</b> Proposed system design is possible, but the size of standard emitters may be excessive. Speak to your installer about the emitter choices.
	36-40				4.1	3.4	★★★★★	★★★★★	★★★★★	
	41-45				3.7	3.0	★★★★★	★★★★★	★★★★★	
	46-50				3.4	2.7 and Note 5	★★★★	★★★★	★★★★	
	51-55	Note 1			3.1	2.4 and Note 5	★★★	★★★	★★★	
	56-60	Note 1			2.8 and Note 5	2.1 and Note 5	★	★	★	
61-65	Note 1			2.8 and Note 5	2.1 and Note 5	No Stars	No Stars	No Stars		
Specific Heat Loss 50 to 80 W/m <sup>2</sup>	up to 35		Note 3		4.3	3.6	★★★★★	Note: 3	★★★★★	<b>Note 3:</b> 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.
	36-40		Note 3		4.1	3.4	★★★★★	Note: 3	★★★★★	
	41-45				3.7	3.0	★★★★★	Note: 3	★★★★★	
	46-50				3.4	2.7 and Note 5	★★★★	Note: 3	★★★★	
	51-55	Note 1			3.1	2.4 and Note 5	★★★	Note: 3	★★★	
	56-60	Note 1			2.8 and Note 5	2.1 and Note 5	★	Note: 3	★	
61-65	Note 1			2.8 and Note 5	2.1 and Note 5	No Stars	Note: 3	No Stars		
Specific Heat Loss 80 to 100 W/m <sup>2</sup>	up to 35	Note 2	Note 3	Note 3	4.3	3.6	★★★★★	Note: 3	Note: 3	<b>Note 4:</b> The system can operate as designed for wood on screed but additional measures to improve property energy efficiency are likely to be needed (such as improved insulation or draught proofing).
	36-40		Note 3		4.1	3.4	★★★★★	Note: 3	★★★★★	
	41-45		Note 3		3.7	3.0	★★★★★	Note: 3	★★★★★	
	46-50		Note 4		3.4	2.7 and Note 5	★★★★	Note: 3	★★★★	
	51-55	Note 1	Note 4		3.1	2.4 and Note 5	★★★	Note: 3	★★★	
	56-60	Note 1	Note 4		2.8 and Note 5	2.1 and Note 5	★	Note: 3	★	
61-65	Note 1	Note 4		2.8 and Note 5	2.1 and Note 5	No Stars	Note: 3	No Stars		
Specific Heat Loss 100 to 120 W/m <sup>2</sup>	up to 35	Note 2	Note 3	Note 3	4.3	3.6	★★★★★	Note: 3	Note: 3	<b>Note 5:</b> Forecast system efficiency is low and running costs may be high without system design changes.
	36-40	Note 2	Note 3	Note 3	4.1	3.4	★★★★★	Note: 3	Note: 3	
	41-45	Note 2	Note 3	Note 3	3.7	3.0	★★★★★	Note: 3	Note: 3	
	46-50		Note 3	Note 3	3.4	2.7 and Note 5	★★★★	Note: 3	Note: 3	
	51-55	Note 1	Note 3	Note 3	3.1	2.4 and Note 5	★★★	Note: 3	Note: 3	
	56-60	Note 1	Note 3	Note 3	2.8 and Note 5	2.1 and Note 5	★	Note: 3	Note: 3	
61-65	Note 1	Note 3	Note 3	2.8 and Note 5	2.1 and Note 5	No Stars	Note: 3	Note: 3		
Specific Heat Loss 120 to 150 W/m <sup>2</sup>	up to 35	Note 2	Note 3	Note 3	4.3	3.6	★★★★★	Note: 3	Note: 3	
	36-40	Note 2	Note 3	Note 3	4.1	3.4	★★★★★	Note: 3	Note: 3	
	41-45	Note 2	Note 3	Note 3	3.7	3.0	★★★★★	Note: 3	Note: 3	
	46-50		Note 3	Note 3	3.4	2.7 and Note 5	★★★★	Note: 3	Note: 3	
	51-55	Note 1	Note 3	Note 3	3.1	2.4 and Note 5	★★★	Note: 3	Note: 3	
	56-60	Note 1	Note 3	Note 3	2.8 and Note 5	2.1 and Note 5	★	Note: 3	Note: 3	
61-65	Note 1	Note 3	Note 3	2.8 and Note 5	2.1 and Note 5	No Stars	Note: 3	Note: 3		

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

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## APPENDIX B – 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<sup>2</sup>

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

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

$$\frac{1000 \times 15500}{24 \times 1835}$$
$$352 \text{ W/K}$$

(f) Total heat loss  $P_t$  =

$$P_{\text{specific}} \times (d_i - d_o)$$
$$352 \times (21 + 3.1)$$
$$352 \times (24.1)$$
$$8483 \text{ W}$$

(g) Specific heat loss =

$$P_t \div \text{Total Property Floorspace (m}^2\text{)}$$
$$8483 \div 145 \text{ m}^2$$
$$59 \text{ W/m}^2$$

(h) Heat pump capacity =

$$\text{Heat pump capacity} = P_t \div 1000$$
$$\text{Heat pump capacity} = 8483 \div 1000$$
$$\text{Heat pump capacity} = 8.5 \text{ kW}$$

(i) Proposed emitters = mostly upgraded radiators

(j) Not applicable as not using existing radiators

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

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

a. Where radiators

i. No note to select

ii. Not applicable as air source heat pump proposed

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iii. SPF from Column 7 is 2.7 and Note 5

iv. Star rating is "☆☆☆"

(m) Annual electricity consumption (space) =

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

$$\text{Annual electricity consumption (space)} = \frac{15500}{2.7}$$

$$\text{Annual electricity consumption (space)} = 5740\text{kWh}$$

(n) Annual electricity consumption (water) =

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

$$\text{Annual electricity consumption (water)} = \frac{2,900}{1.7}$$

$$\text{Annual electricity consumption (water)} = 1705\text{kWh}$$

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

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

$$\text{Annual electricity consumption (immersion)} = \frac{200 \times 52 \times 10 \times 4,200}{3,600,000}$$

$$\text{Annual electricity consumption (immersion)} = \frac{43680000}{3,600,000}$$

$$\text{Annual electricity consumption (immersion)} = 121\text{kWh}$$

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

$$5740 + 1705 + 121 = 7566\text{kWh}$$

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

a. Multiply the total annual electricity consumption by 90% =

$$7566 \times 90\% = 6809\text{kWh}$$

b. Multiply the total annual electricity consumption by 110% =

$$(b) 7566 \times 110\% = 8322\text{kWh}$$

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