ISSUE 1.2

MCS GUIDANCE DOCUMENT

Heat Pump Calculator User Guide

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1. INTRODUCTION

This is the User Guide for the MCS heat pump calculator. The calculator provides a method for carrying out the design calculations required by MIS 3005. The calculator is optional and installers may choose to use their own calculations as long as these comply with the requirements of MIS 3005.

2. SIMPLE STEPS FOR COMPLETING A HEAT LOSS CALCULATION

This section provides an overview of the steps required to complete a heat loss calculation using the MCS heat pump calculator.

Step 1: Select 'Enable Editing' and then 'Enable Content' if macros have been disabled. Begin by selecting the 'Design Details' tab. This is the page where you are required to enter generic information about the property and the heating/hot water requirements.

The cells of the calculator are coloured as follows:

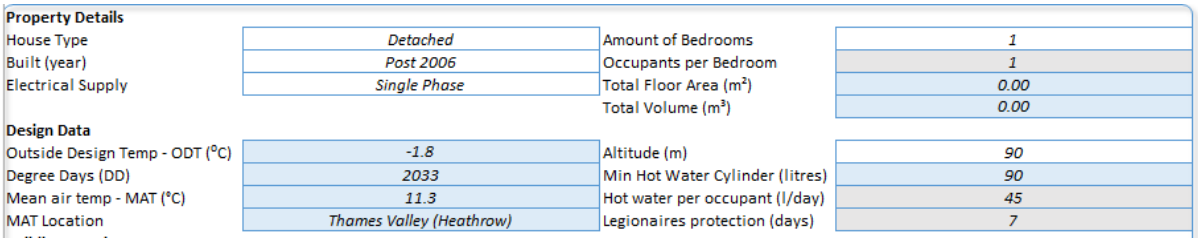
- White cells may be edited.
- Blue cells are automatically populated and cannot be edited.
- Grey cells are automatically populated but can be edited, if the designer wishes to.

Step 2: Complete 'Design Details' section with information about the site of the proposed installation. The site address postcode is a key input value as the postcode is used to automatically populate key values such as the external temperature.

Design Details

Project Referenece:		**MCS Designer:**	
Date:		**Company Name:**	
Customer Name:		**MCS No:**	
Site Address:		**Address:**	
Post Code:	***Input Required***	**Post Code:**	
Contact Nos.		**Contact Nos.**	
Email Address:		**Email Address:**	

Steps 3: Complete the 'Property Details' and 'Design Data' table. It is preferable to identify the property's exact altitude using an internet tool such as google maps. Alternatively, you can refer to the 'Design Tables' tab for altitude data by region.

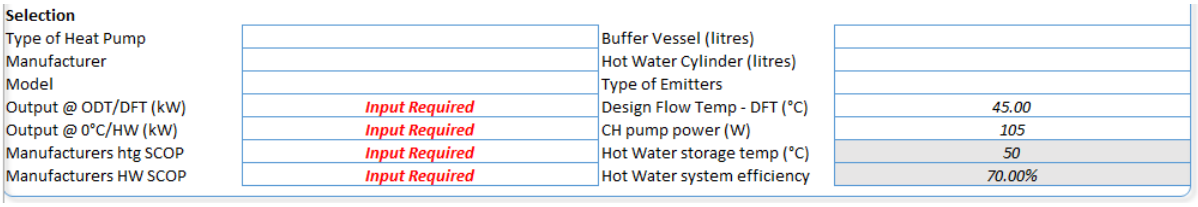


Property Details			
House Type	*Detached*	Amount of Bedrooms	*1*
Built (year)	*Post 2006*	Occupants per Bedroom	*1*
Electrical Supply	*Single Phase*	Total Floor Area (m^2)	*0.00*
		Total Volume (m^3)	*0.00*
Design Data			
Outside Design Temp - ODT (°C)	*-1.8*	Altitude (m)	*90*
Degree Days (DD)	*2033*	Min Hot Water Cylinder (litres)	*90*
Mean air temp - MAT (°C)	*11.3*	Hot water per occupant (l/day)	*45*
MAT Location	*Thames Valley (Heathrow)*	Legionaires protection (days)	*7*

Step 4: Complete the section on heat pump details.

Key inputs are:

- 'Output @ ODT/DFT (KW)' – Output of heat pump @ Outdoor Design Temperature and Design Flow Temperature
- 'Output @ 0°C/HW (KW)' – Output of heat pump @ 0°C outdoor temperature and maximum flow temperature for hot water production
- The 'Manufacturers htg SCOP' stands for the SCOP of the heat pump in heating mode
- The 'Manufacturers HW SCOP' stands for the SCOP of the heat pump in heating hot water mode
- CH stands for Central Heating



Selection			
Type of Heat Pump		Buffer Vessel (litres)	
Manufacturer		Hot Water Cylinder (litres)	
Model		Type of Emitters	
Output @ ODT/DFT (kW)	***Input Required***	Design Flow Temp - DFT (°C)	*45.00*
Output @ 0°C/HW (kW)	***Input Required***	CH pump power (W)	*105*
Manufacturers htg SCOP	***Input Required***	Hot Water storage temp (°C)	*50*
Manufacturers HW SCOP	***Input Required***	Hot Water system efficiency	*70.00%*

Step 5: Complete the estimated running costs by entering in the price per kilowatt hours for electric, gas, LPG and oil. Ideally you should check with the customer to obtain specific energy costs.

Estimated Running Costs			
Space Heating	£0.00	Ground Pump	£0.00
Hot Water from Heat Pump	£0.00	Electric (p/kWh)	£0.14
Hot Water from Immersion	£7.62	Gas (p/kWh)	£0.05
Total Running Costs	£7.62	LPG (p/kWh)	£0.52
Central Heating Pump	£0.00	Oil (p/kWh)	£0.61

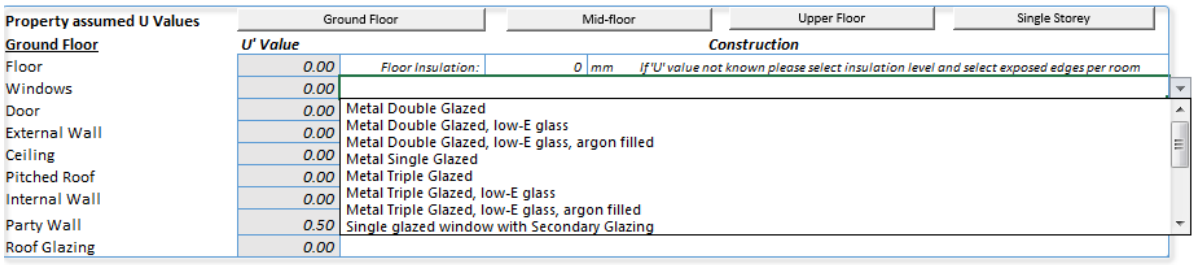
Step 6: Enter U-value information for materials on each floor of the property. You are only required to enter the U-values for the applicable floor types. Please note:

- 'Ground floor' assumes that the floor is an external surface and the roof connects to an internal (heated) space;
- 'Mid-floor' assumes that the floor and roof are connected to internal (heated) spaces;
- 'Upper floor' assumes that the roof is connected to an external (unheated) space;
- 'Single storey' assumes that both the ground and roof are connected to external (unheated) spaces.

Some examples are below:

- A standard detached house with a ground floor and 1st floor would only require the 'Ground Floor' and 'Upper Floor' tabs to be completed.
- A bungalow would typically only require the values for a 'single storey' building to be completed.

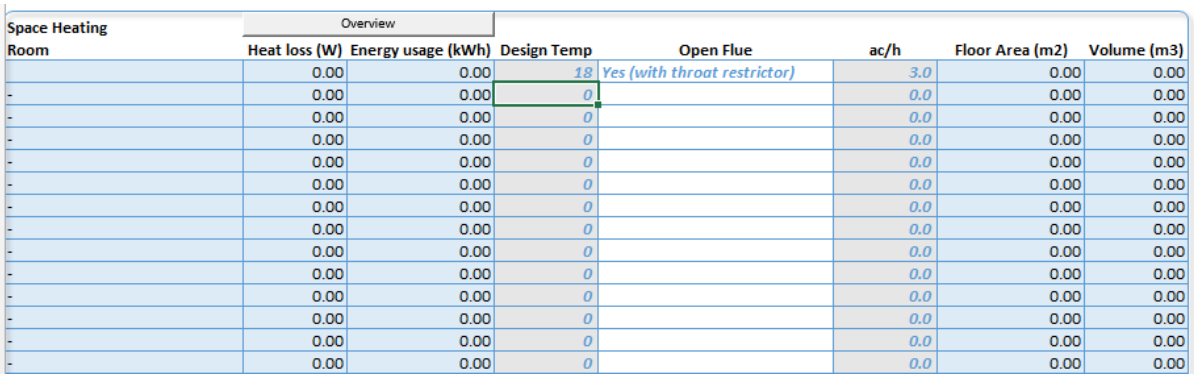
You can select the material types from a drop-down list, in which case the U-value will be provided automatically. If you have manually calculated the U-value or know the materials U-value then you can override the entry and enter the figure in the grey box.



Step 7: Leave the 'Design Details' tab and begin completing the room-by room tabs (up to 30 rooms). Please see Section 6 for further information on the room-by-room calculation tab.

Please note that the first 15 rooms are grouped together, with the remaining 15 found after the Compliance Certificate Guidance (CC Guidance) tab. *Tip – move room tabs into a group dependent on amount in building.*

Step 8: Return to the 'Design Details' tab and click on the 'Space heating - Overview' button. A list of all the rooms entered onto the room-by-room tabs will appear. These will appear in the order that they have been entered. The design temperature and air change per hour (ac/h) will appear and can be overridden by typing in an alternative value. At this stage you should also select whether an open flue is present in any of the rooms.



Step 9: Review the results by scrolling through the 'Design Details' tab. The Total Energy Usage (kWh/yr) cell will show the annual amount of energy required for space heating and hot water. This figure should be entered as the estimated annual generation figure on the MCS installation certificate. Other building requirement figures will appear in the section shown below.

Building Requirements			
Space Heating load (kW)	0.00	Annual Hot water heating demand (kWh/yr)	1528
Heat loss W/m²	0.00	Immersion Energy (kWh)	54
Space Heating (kWh/yr)	0	Total Energy Usage (kWh/yr)	1528

3. U-VALUE CALCULATOR

The U-value table contains a reference list of U-values which are sourced from the Cibse Domestic Heating Design Guide. If the fabric type is not available then you can use the calculator at the top of the page to calculate a more accurate U-value. In order to do this you will need to know the composition of the fabric type being calculated.

4. DESIGN TABLES

The Design table provide reference data which can be used in the heat loss calculation. Most of the values are used automatically based on the values that you enter whilst doing the main heat loss calculation i.e. entering a postcode will automatically reference the correct external temperature.

5. ROOM-BY-ROOM DESIGN TABS

Step 1: Begin by entering information about the room. You will need to select a room from the drop-down list. It is also possible to enter an alternative room name however you will need to manually select the room design temperature and air changes per hour. In the cell next to the room name, you can select a number from a list. This helps to identify where there are multiple rooms with the same name / designation. For example, you could have a Living Room 1 and Living Room 2.

It is important to correctly identify the building level as this will impact on the room heat losses e.g. if the level is single storey then the calculator will assume that the roof and floor are connected to external (unheated) spaces.

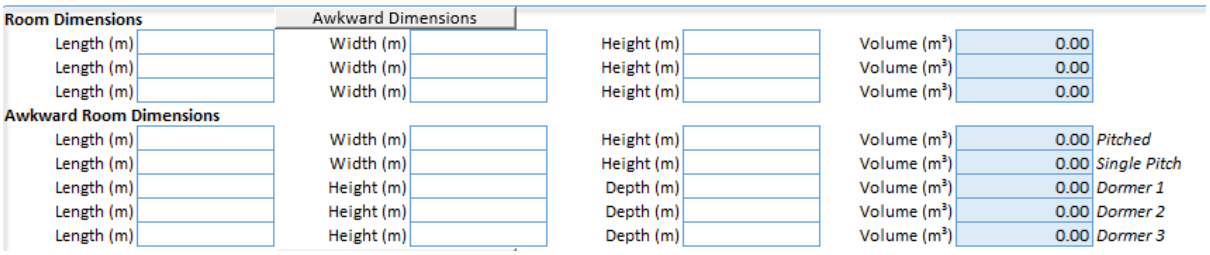
The software allows the designer to add an uplift for the following:

- **Thermal bridging.** If thermal bridging is present, then the designer can choose to enter an uplift factor.

- **Exposed location.** If the room has a wall which connects to an external surface which is particularly exposed, then the designer can choose to add a 10% uplift.
- **High ceiling.** The designer can add an additional uplift for rooms with a high ceiling, the tool provides guidance on the uplift to select based on the ceiling height.
- **Intermittent heating.** The MCS definition of intermittent heating is that the heating system has the ability to provide all the space heating requirement on the design day within a period of no more than 16 hours, without use of supplementary heaters. A standard uplift factor of 20% is specified. If not selected, it is assumed that the system will provide continuous heating which means that the heating system has the ability to provide all the space heating requirement on the design day within a period of no more than 24 hours (but taking more than 16 hours), without use of supplementary heaters.

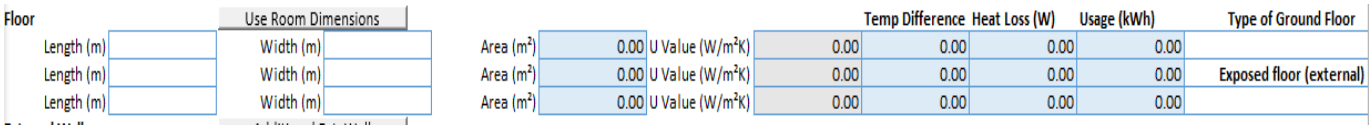
Room Information			Ventilation Heat Loss		Fabric	*Heat Loss (W)*	*Usage (kWh)*	*Additional heat loss*	*Addition*	*Heat Loss (W)*
Room			Air Changes a hour	0.00	Floor	0.00	0.00	Thermal Bridging (New Build >2006)	0.00%	0.00
Level			Air Change Factor (W/m³K)	0.33	Ext Wall	0.00	0.00	Exposed location	0.00%	0.00
Design Room Temp (°C)		0.00	Total Volume (m³)	0.00	Roof	0.00	0.00	High ceiling	0.00%	0.00
Outside Design Temp (°C)		-1.80	Heat loss (W)	0.00	Glazing	0.00	0.00	Intermittent heating	0.00%	0.00
Temp Difference (°C)		1.80	Estimated Energy usage (kWh)	0.00	Int./Party Wall	0.00	0.00		**Total Room Heat Loss (W)**	**0.00**
Degree Days		2033							**Total Room Energy Usage (kWh)**	**0.00**

Step 2: Enter the room dimensions. If the room is not a conventional square/rectangle then you can enter up to three different dimensions. An 'awkward dimensions' button is available, if selected a number of additional lines will be displayed which can be used to enter the additional dimensions. This button is to help calculate the volume of the room when it's not a cube. For example, if the room has a pitched roof then break the room into sections using the room dimensions section to calculate the cube volume and the pitched line to calculate the triangular prism on top.

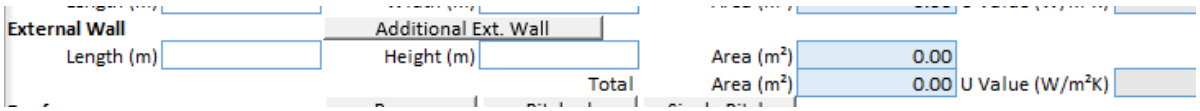


Room Dimensions	Awkward Dimensions				
Length (m)		Width (m)		Height (m)		Volume (m³)	0.00	
Length (m)		Width (m)		Height (m)		Volume (m³)	0.00	
Length (m)		Width (m)		Height (m)		Volume (m³)	0.00	
Awkward Room Dimensions								
Length (m)		Width (m)		Height (m)		Volume (m³)	0.00	*Pitched*
Length (m)		Width (m)		Height (m)		Volume (m³)	0.00	*Single Pitch*
Length (m)		Height (m)		Depth (m)		Volume (m³)	0.00	*Dormer 1*
Length (m)		Height (m)		Depth (m)		Volume (m³)	0.00	*Dormer 2*
Length (m)		Height (m)		Depth (m)		Volume (m³)	0.00	*Dormer 3*

Step 3: Enter the floor dimensions. You can either do this manually or click the box 'Use Room Dimensions'. You will also need to enter the 'Type of Ground Floor' and the 'Exposed Floor (external)', essentially the number of exposed floor edges.



Step 4: Enter the external wall dimensions. The U-values entered on the design details tab will be used unless the U-value figure is manually overwritten. Additional external walls can be added as required by clicking the 'Additional Ext Wall' button.



Step 5: Enter the dimensions for any windows and doors. The U-values entered on the design details tab will be used unless the U-value figure is manually overwritten. There are buttons which can be clicked to enter additional windows, doors or details of any roof glazing.

Step 6: Enter the dimensions of any internal walls. If you are entering an internal wall then you are also required to enter the temperature of the adjoining room. If the wall is a 'party wall' then you should select the button for this and enter the dimensions. As per the Domestic Heating Design Guide a temperature difference of 10°C is assumed for party walls.

6. MCS 020

This tab can be used to record the results of the sound power level calculations completed in accordance with MCS 020. This tab is only applicable to Air Source Heat Pumps.

7. GROUND LOOP SIZING TABS

This tab can be used to record information about the ground loop sizing calculations. It is applicable to Ground Source Heat Pumps. Check the manufacturer's website for details on the pipe sizing and antifreeze such as the 'Viscosity @ 0 °C'. For clarification, the calculation for Reynolds number is generated using the following data enter points on the GL Sizing tab: 13, 19, 24 and 26. It is based on the pipe diameter, brine flow rate, amount of loops and a look up table of results to calculate the internal diameter of the loops and velocity of the fluid.

8. HEAT EMITTER SIZING TABS

There are two tabs for entering / recording information relating to heat emitter design – the 'HP Rad Sizing' and 'UFH Guide' For clarification on the 'UFH Guide' tab, 'MWT @ DOT (°C)' in column E corresponds to Mean Water Temperature and not flow temperature.

9. GRAPHS

This tab provides information on the annual running costs and CO_2 emissions.

10. COMPLIANCE CERTIFICATE

A copy of the MCS compliance certificate is provided. Where possible any data calculated during the heat loss calculation is pre-populated. Additional data will need to be inputted manually to complete the compliance certificate. A value of N/A or 0 can be entered in fields which are not applicable. It can then be saved as a PDF document and uploaded to the MCS installation database. The 'CC Guidance' tab can be used as guidance on completion of the compliance certificate.