HEAT PUMP AND ELECTRIC RESISTANCE HEATING GUIDE

Version 1

INTRODUCTION

These guides have been developed by BEAMA to help installers and contractors design and heat pump and electric heating systems, in accordance with the new Building Regulations (Part L) for new and existing dwellings in England, which come into force from the 15th June 2022.

It should be noted that the official guidance does not cover all circumstances and any proposed variation should be agreed with the relevant building control body.

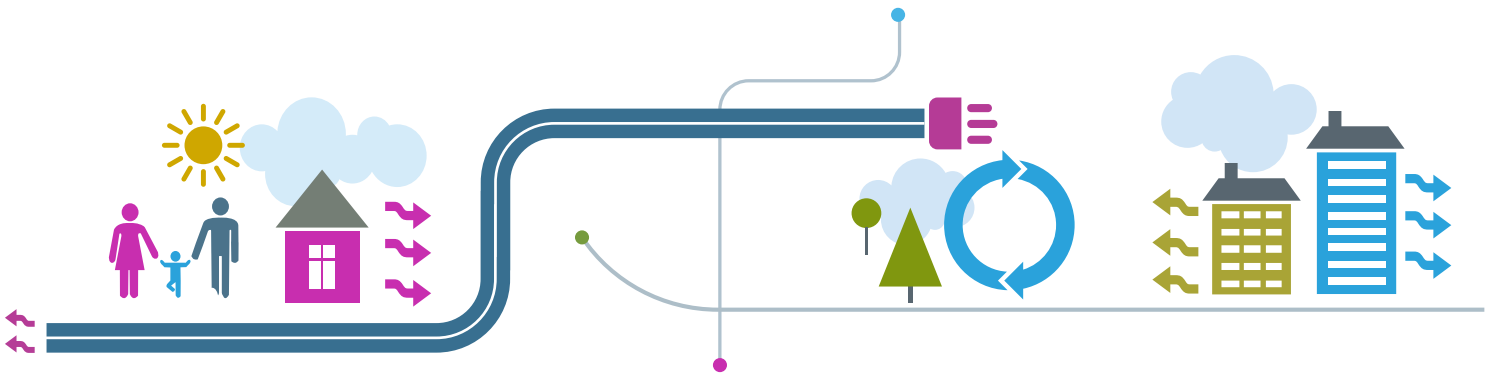
BEAMA is the UK trade association for manufacturers and providers of energy infrastructure technologies and systems.

This guide is a collaboration between the BEAMA Heat Pumps Group and Electric Heating and Hot Water Group.

The BEAMA Heat Pumps sector group members are:

The BEAMA Electric Heating and Hot Water Group Members are:

CONTENTS



1. GENERAL GUIDANCE – HEAT PUMPS

1.1 Sizing new and replacement space heating systems

The specification of space heating systems should be based on an appropriate heat loss calculation for the building, based on BS EN 12831-1 and CIBSE's Guide B1

Where a heat pump system is either newly installed or replacing a system in an existing building, including the heating appliance, emitters, and associated pipework, all parts of the system, including pipework and emitters, should be sized to allow the heat pump heating system to operate effectively, and in a manner that meets the heating needs of the building, at a maximum flow temperature of 55°C or lower. Systems should not be significantly oversized.

To maximise the efficiency of the Heat pump system, it would be preferable to design to a lower flow temperature than 55°C.

Where it is not feasible to install a system that can operate at this lower temperature (e.g., where there is insufficient space to fit larger radiators), the space heating system should be designed to the lowest design temperature possible that will still meet the heating needs of the building.

1.2 Sizing domestic hot water systems.

Domestic hot water systems should be sized for the anticipated domestic hot water demand of the dwelling, based on BS EN 12831-3 or the Chartered Institute of Plumbing and Heating Engineering's Plumbing Engineering Services Design Guide. Systems should not be significantly oversized. NOTE: For temperature limits to control legionella bacteria in domestic hot water systems, see Approved Document G.

1.3 Sizing heat pump heating systems

Air or ground source Heat pumps should be selected to meet the full space heating requirement at the design condition chosen for heat loss calculations. This selection should account for the space heating flow temperature assumed in the heat emitter circuit(s), and not assume any heat will be provided by supplementary electric heaters within the design external temperature range.

Reversible heat pump systems (i.e., those that provide both cooling and heating functions) should be designed such that they are optimised for heating rather than cooling.

2. CONTROLS

2.1 System controls and zoning

For wet heating systems in new dwellings with a floor area of 150m^2 or greater, a minimum of two independently controlled heating circuits should be provided.

System controls should be wired so that when there is no demand for space heating or hot water the heat pump and pump are switched off.

Domestic hot water circuits that are supplied from a hot water store should have both of the following:

a. Time control that is independent of space heating circuits.

b. Electronic temperature control.

Primary hot water circuits for domestic hot water or heating should have fully pumped circulation where this is compatible with the heat pump.

Wet heating systems should ensure a minimum flow of water to avoid short cycling. For space heating temperature control should be installed for the heat pump.

2.2 Thermostatic room controls

For heating systems in new dwellings, or when the heat pump is replacing a boiler in an existing dwelling, each room should be provided with thermostatic room controls (TRVs) These should be capable of being used to separately adapt the heating output in each room served by the heat pump. Where justified, heating may be controlled for each heating zone rather than individual rooms.

NOTE: There is no need to install TRVs in rooms/zones without heating in new or existing dwellings.

NOTE: Installing thermostatic room controls may not be technically feasible in some cases. These may include the following:

a. Dwellings with very low heat demand (e.g., less than 10W/m^2)

b. Dwellings with buffer zones for heat absorption or dissipation with high thermal mass.

It may be justified to control a heating zone rather than individual rooms in either of the following cases.

a. In single-storey open-plan dwellings in which the living area is greater than 70% of the total floor area. In such cases, the dwelling should be considered as a single heating zone.

b. Where two adjacent rooms have a similar function and heating requirements (e.g., kitchen and utility room). In such cases, the adjacent rooms should be considered as a single heating zone.

Exhaust air heat pump systems, which extract heat from the exhaust air of a dwelling, may not need to provide independent thermostatic control to individual rooms. Providing room/zone control on this type of system is unlikely to be economically and/or technically viable. However, other heat pump systems also in use in the same dwelling should be controlled using thermostatic room controls as described above.

2.3 Specific Heat pumps controls

The heat pump unit should include controls for all of the following, in addition to meeting the general requirements for heating and hot water systems in Section 1.

a. To control water pump operation (internal and external, as appropriate).

b. To control either of the following:

   i. For wet systems, water temperature.

   ii. For air systems, air temperature.

c. For air-to-water and air-to-air units, to control outdoor fan operation.

d. For air-to-water and air-to-air systems, to provide a defrost control for the external air-side heat exchanger.

e. For air-to-air systems, to control secondary heating (if fitted).

f. To protect against water flow failure.

g. To protect against high water temperature.

h. To protect against high refrigerant pressure.

i. For air-to-water and air-to-air units, to protect against air- flow failure.

The heat pump should have external controls that include both of the following.

a. Weather compensation or internal temperature control.

b. Timer or programmer for space heating.

The heating system controls should be connected so that when there is no demand for heat, no demand is placed on the system pump(s) and heat source.

For heat pump installations in which there are other heat sources available to the same building, each of these heat sources should be appropriately incorporated into a single control system.

3. HEAT PUMP AND UNDERFLOOR HEATING SYSTEMS

Underfloor heating systems used in conjunction with a heat pump should include the following:

a. Controls to adjust the operating temperature of the UFH system.

b. An automatic means of reducing the room temperature at night or when the room is unoccupied if the screed floor is greater than 65mm thick.

c. Have ground floors and those in contact with the outside of the house insulated to limit heat losses to less than 10W/m^2. The heat loss from the floor should be calculated using the sum of the thermal resistance of the floor finish and the underlying heated layer, multiplied by 10.

d. For underfloor heating systems intended for intermittent or cyclical operation and/or installed over unheated rooms should be separated from the structural floor by a layer of insulation with a thermal resistance of at least 1.25(m^2·K)/W.

e. The intermediate floor should have a layer of insulation to reduce downwards heat transmission with a thermal resistance of one of the following:

i. The performance in **c.**

ii. As specified in BS EN 1264-4, not less than 0.75(m^2·K)/W.

f. Distribution pipework which does not provide useful heat to a room should be insulated.

4. HEAT PUMP SITE LOCATION

Heat pumps should be located and installed subject to the manufacturer's guidance. With regard to air source heat pumps, this includes the consideration of factors that may adversely affect their performance, e.g., avoiding cold exhaust air recirculation and the removal of ice/ condensation from the outdoor coil during a defrost cycle.

Heat pumps should not be sited adjacent to bedrooms, nor should they be located on a solid base material that can readily transmit vibrations. Additionally, the location of the external fan and compressor should be selected to minimise disturbance to neighbours, while remaining in compliance with planning requirements.

The installation of anti-vibration instruments and flexible hose connections should be in accordance with the manufacturer's guidance to limit the effects of harmful vibrations on building structures.

5. COMMISSIONING

Before a new heat pump is installed, all central heating and primary hot water circuits should be thoroughly cleaned and flushed out. A suitable chemical inhibitor should be added to the primary heating circuit to protect against scale and corrosion.

The Heat pump and any dedicated ancillary products, e.g. integrated hot water cylinders, should be commissioned in accordance with both the manufacturer's instructions and the appropriate system design parameters.

Underfloor heating

If the heat pump is being used in conjunction with an underfloor heating system, then the underfloor system should be commissioned in accordance with BS EN 1264-4. If using a ground source heat pump the commissioning procedure for the ground array should be as follows.

a. **Ground arrays –** including header pipes and manifolds – should be flushed as one system to remove all debris and purged of air. Vertical, horizontal, and slinky ground arrays should be flushed in both directions. During this process, the heat pump (along with its accompanying pipework) should be isolated from the ground heat exchanger to avoid damage to the internal heat exchanger inside the heat pump.

b. **The heat pump –** along with its accompanying pipework – should be flushed and purged as a separate system while isolated from the ground array system.

c. Following the complete purging of micro air bubbles, a pressure test (in accordance with BS EN 805, section 11.3.3.4) should be conducted on all closed-loop ground source heat pump installations to prove the integrity of the systems. This test should be conducted on the entire system, which typically comprises the heat pump, header pipes, manifold, and all ground arrays.

b. **Antifreeze and biocide** should be added to ground heat exchangers as appropriate, in line with manufacturer's instructions.

Commissioning information provided to the dwelling owner should include details of the fluids used and their commissioned concentrations.

6. GENERAL GUIDANCE – ELECTRIC SPACE HEATING SYSTEMS

NOTE: Electric resistance heating is assumed to be 100% efficient at point-of -use, therefore no minimum efficiency is set for these types of system.

Electric heating systems should meet the guidance below to conform with requirements in Building Regulations 2010 Approved Document L Volume 1, 2021 edition 43L1(b), L2 However it should be noted that Regulation (EU) 2015 /1186(LOT 20) which eligible electric heating systems are obliged to conform to, already exceeds the minimum standards for most if not all the requirements below.

For electric storage heaters, both of the following should be met.

a. Automatic control of input charge should be provided.

b. The rate of heat release from the appliance should be adjustable, using an adjustable damper or other thermostatically controlled method.

For electric panel heaters or electric radiators that are either part of a new system or replacement components, time and temperature control should be provided to allow separate control for either of the following.

a. Each room.

b. Each appliance

For an electric warm air system that is either a new system or is a replacement component, both of the following should be provided.

a. A programmable room thermostat or a time switch and room thermostat.

b. Separately controllable heating zones that meet the guidance for thermostatic room controls in paragraphs 5.20 to 5.22 of the building regulations.

Specific standards for electric underfloor heating

Electric cables for underfloor heating should be installed within screeds as follows.

a. For direct electric systems, within screeds not exceeding 60mm in depth.

b. For off -peak energy storage systems, within screeds of at least 65mm in depth.

Where electric cable underfloor heating off -peak energy storage systems are used, both of the following should be met.

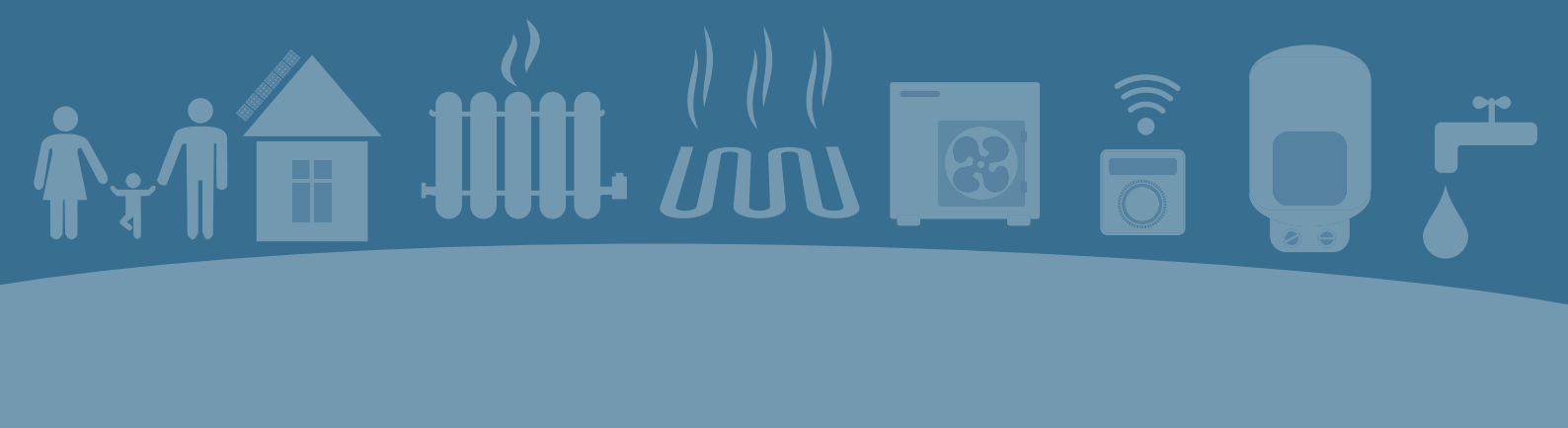
a. A minimum of 20% of the floor area of the dwelling should be heated with fast-response systems, such as panel heaters.

b. Controls should be installed which modify the input charge in response to both of the following.

    i. The room thermostat.

    ii. Floor temperature sensing.

Programmable room thermostats with an override feature should be provided for all direct electric zones of the electric underfloor heating system. Thermostats should have air and floor temperature-sensing capabilities which may be used individually or in combination.



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