Heat Pumps – Air/Ground/Water to Water Systems: Applicant Guidance

This guidance outlines the key supporting information required to make a high-quality application on various types of heat pumps.

Most heat pump solutions operate at lower flow temperatures than existing fossil fuel systems. These lower flow temperatures will generally be between **35-55°C** rather than the **70-80°C** for a traditional oil/gas boiler. Low temperature systems only work in sites that are adapted for these lower heating flow temperatures. Therefore, evidence needs to be provided to demonstrate the site will be suitable for the proposed heat pump system once all the works are complete. Aspects of the building that need to be checked to assess whether it will be suitable for low temperature heating are the building fabric and peak heat loss of the building, proposed heat emitters and heating pipework.

It is recommended that applicants also review the latest guidance from CIBSE titled *AM17: Heat pumps for large non-domestic buildings*, which details best practice in the design, installation, commissioning, operation, and maintenance of large heat pump systems.

'Whole Building' Approach

Follow the 'whole building' approach outlined in the guidance notes and show the proposed building fabric is suitable for your heat pump measure.

- To install an efficient and cost-effective low carbon heating system, the building heating demands should be minimised where possible.
- The building needs to have a reasonable level of insulation and air tightness so that it is possible to heat it sufficiently using low temperature hot water for heating.
- Please provide details of the existing building thermal envelope including areas and U-values i.e., floor, walls, roof, windows, and doors

Heating System Configuration

Heat pumps can be configured in a variety of ways, these are shown below.

- Standalone: A singular type of unit provides all the heating requirements for the building.
- Cascading Low Carbon System: The low carbon heating unit(s) work in sequence to meet the heating requirements of the building.
- Bivalent: The low carbon heating unit(s) work in parallel with another heating plant. This typically includes an electric boiler or retained non-end of life fossil fuel powered unit.

Sizing a New Heating System

The peak heat loss of the building needs to be calculated and to size the low carbon heating system, the applicant should demonstrate how they have followed best practice design principles.

- The proposed low carbon heating system must be sized correctly to ensure the heating and Domestic Hot Water (DHW) demands for the building are met. The size of the low carbon heating system should not exceed the size of the existing heating system (in terms of total output load).
- The submission of either yearly heat load profiles and/or peak heat loss calculations demonstrates that robust calculations have been completed to support the sizing approach taken.
- The peak heat load of the property needs to be calculated by measuring all the fabric and ventilation/infiltration heat losses for the coldest day of the year based on geographic location. As per CIBSE guides. **Please use 'Salix Heating Load tool v2' on the tools and resources page of our website to calculate this.**
- Using realistic air change rates to estimate ventilation losses.
- The calculation should account for the areas of the walls, floors, roof, windows and doors and their U-values.
- The peak kW rating of the heat pump is expected to match the peak kW heat loss of the building.
- The kW rating of the heat pump depends on the flow temperature it needs to supply and the lowest winter external air temperature. Ensure you are considering the air and flow temperatures on the manufacturers specification when sizing your heat pump.

Commented [CS1]: Is it worth mentioning the Salix peak heat loss tool here as a minimum requirement?

Domestic Hot Water (DHW)

Please specify how you propose to meet your DHW demand. This needs to be considered when sizing your heat pump if the heat pump is also providing DHW. If you are planning to use another method to provide your DHW then please provide details of this installation and the same level of supporting information as for your proposed heating system.

Survey of Existing Heat Emitters

A survey of existing heat emitters needs to be completed for any systems proposing lower flow temperatures than the existing system.

The lower flow temperatures of heat pumps require larger heat emitters than traditional boiler systems to allow the heating system to provide the set point temperature in the building. A survey needs to be completed to see whether existing heat emitters are large enough for the proposed flow temperature. If some or all the heat emitters are not large enough, then they will need to be replaced to allow the heating system to heat the building to the desired set point temperature.

Survey of Existing Pipework

A survey of existing pipework needs to be completed for any systems proposing higher flow rate than the existing system.

The pipework needs to be compatible with the new flow rates. Systems with lower temperature differences between the flow and return water temperature require higher flow rates to meet building heating demand. Heat pumps generally have a lower temperature difference between flow and return temperatures when compared to fossil fuel systems therefore need higher flow rates. If the old pipework is too small in diameter for the new flow rates required by the heat pump, then it needs to be replaced.

Distribution Network Operator (DNO)

It is important that your Distribution Network Operator (DNO) is contacted to ensure that you can connect your heat pump to their network within the PSDS timeline. This could resolve some problems in the future as part of the PSDS scheme:

- Example 1: You may find the DNO has too much demand for the local network already and therefore deny your request for permission to connect your heat pump to the network.
- Example 2: Your heat pump may not be compatible with the current grid connection.
- Example 3: There could be delays in obtaining approval for this causing the project timescale to be delayed.
- Example 4: There can be long lead times for electrical upgrades at the sites that require them.

You will need to provide the DNO with details of your installation and typical loading vs your maximum demand.

Table 1: Checklist for all types of air-to-air and air-to water heat pump applications

All Types of Heat Pump Applications Checklist	
1. Description of works: background information of existing heating system and if any infrastructure will remain that will be used by the heat pump.	☐
2. Schematics and drawings of existing and proposed system.	☐
3. Details of the building fabric measures indicating suitability for heat pump.	☐
4. Heat pump sizing calculations based on building peak heat loss.	☐
5. Explanation/evidence to check DHW demand will be met.	☐
6. Flow and return temperatures for new heat pump system.	☐
7. Explanation/evidence to check proposed pipework and pumps is suitable for required flow rate.	☐
8. Indicate heat emitters sized appropriately for the flow temperature.	☐
9. Details of current heat emitters.	☐
10. Details of proposed heat emitters.	☐

11. Specification for chosen heat pump to confirm the Seasonal Coefficient of Performance (SCOP) for given flow temperatures/operating conditions.	☐
12. Indicate initial contact with Distribution Network Operator (DNO) for heat pump installation to local electricity network (include timeframe in project plan).	☐

Table 2: Checklist for GSHP & WSHP heat pumps

GSHP & WSHP Checklist	
1. Details of source system design (boreholes, horizontal ground loop, closed or open loop water system). ➢ Ensure source system design specifications are matched to the heat pumps specifications. ➢ Ensure maximum power you can extract from your source system matches the peak heat demand of the site.	☐
2. GSHP – A Geological conditions survey or feasibility study.	☐
3. WSHP – A feasibility study and evidence of extraction permission for an open loop system.	☐
4. Indicate timeframe is sufficient to install source system in project plan. (For example, dig the trenches/drill the boreholes for the system).	☐