

# Integrating heat pumps

Hints & tips for architects  
& architectural technologists

January 2026



# Contents

<b>Scope</b>	<b>2</b>
<b>Introduction</b>	<b>3</b>
<b>Heat pump solution types</b>	<b>4</b>
<b>Design considerations</b>	<b>6</b>
<b>Principles</b>	<b>6</b>
<b>Workflow</b>	<b>7</b>
<b>Layout design</b>	<b>8</b>
<b>Specification</b>	<b>9</b>
<b>External design</b>	<b>10</b>
<b>Internal design</b>	<b>11</b>
<b>Annex: External guidance documents</b>	<b>12</b>

## Scope

This document is intended as a quick reference entry point to heat-pump-specific design considerations for architects and architectural technologists. The scope of the guide includes:

- Low-rise housing, meaning typically three storeys and below. Higher density typologies (flats) are not covered within this guide.
- Residential plots, as opposed to site-wide and infrastructure considerations, although references are made to the interface of the plot to the wider project where relevant.
- All sizes of new build development, from single home projects to large scale (multiple hundreds of homes) schemes.
- While the focus of the guidance will be developments in England, elements of the document may be useful to developers of schemes in other UK countries.
- Common heat pump technologies applicable to low rise homes. While references are made to other applicable heat pump technologies, this guide focuses on standalone, wet heating systems with outdoor units, which are expected to be most commonly used.
- The guide is primarily written with reference to English Building Regulations, and specifically anticipates Approved Document (AD) Part L 2025 (Future Homes Standard 2025) but will be relevant, at least in part, to regulations applying to other UK countries, e.g. Scottish Building Standards Technical Handbook, Scottish New Build Heat Standard. Homebuilders who have contributed to this guide have experience delivering homes across the UK.

# Introduction

***Integrating heat pumps: Hints & tips for architects & architectural technologists*** provides an accessible starting point for designers to help prompt thinking on common issues related to the design of low-rise new build homes with heat pumps.

**It aims to share best practice and lessons learned, in a digestible ‘hints and tips’ format, produced with extensive input from homebuilding professionals, including designers, developers and their heating and plumbing installers. By drawing from the experience of those who have already delivered heat pumps at scale, the guide aims to make sure key lessons are passed to the designers of future schemes.**

In using the guide, designers should be aware that:

- It is not intended as a substitute for a qualified technical team, or long form design and installation guidance from equipment manufacturers and trades. The designer is expected to refer to relevant external guidance, seek client input and engage with a qualified technical team to assist with making design decisions.
- Hints and tips should not be considered prescriptive. While this guide aims to represent best practice, there may be more than one correct design solution in a given situation.
- Design teams and installers should always refer to local authority requirements, building regulations, warranty provider requirements and manufacturer’s guidance.
- This document aims to capture important high-level considerations to assist the designer in making high quality design decisions, rather than providing detailed design guidance. Contextual references are also made to external long form guidance where relevant, while seeking to avoid unhelpful duplication.
- Note: diagrams/illustrations are only provided to aid explanation and are not necessarily complete or technically accurate.

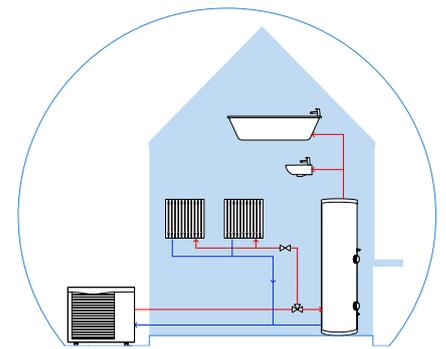
# Heat pump solution types

Heat pump technology applied to hot water and space heating has been available for a number of decades and there are numerous valid applications of the technology. Outlined below are the most common and emerging solution types, with considerations and application notes provided for each.

Monobloc ASHPs (Type A) are the most common system type used in lower density housing. However it is important to note that other solution types may be more appropriate depending on the specifics of the scheme. This guide focuses on homes using Type A systems, however many considerations will also be relevant to other solution types given here.

## A Air source heat pump (monobloc)

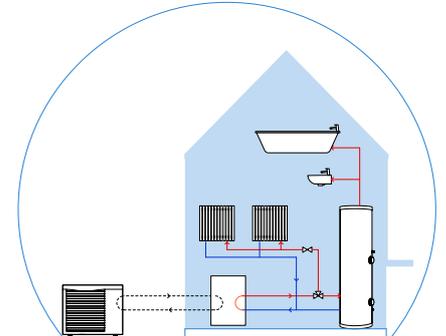
An Air Source Heat Pump (ASHP) absorbs heat from the outside air and raises the temperature of this absorbed heat to provide heating and hot water in the home via a refrigerant cycle. These units are referred to as “monobloc”. This means the air collector, refrigerant compressor, condenser and hydraulic components required for the heating circuit are all contained in one box. This box is placed outside the home in an open area. Two insulated pipes run into the home to provide space heating and to charge a cylinder to provide hot water.



- Heating circuit connects directly to heat pump (HP).
- Cylinder for domestic hot water (DHW).
- Radiators and/or underfloor heating (UFH).

## B Air source heat pump (split system)

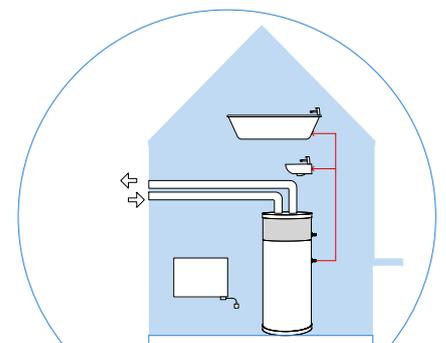
An ASHP Split System works in exactly the same way as the monobloc by absorbing heat from the outside air and raising the temperature of this absorbed heat to provide heating and hot water in the home. The difference with the split type is that the refrigerant circuit is separated into two parts or “split”. The air collector and refrigerant compressor are located in an “outdoor unit” and a separate “indoor unit” contains the condenser for the refrigerant and the hydraulic components required for the heating circuit.



- Refrigerant circuit between indoor unit and outdoor unit.
- Space needed for indoor unit and cylinder.
- Radiators and/or UFH.

## C Domestic hot water heat pump

An integrated Domestic Hot Water (DHW) heat pump works by absorbing heat from the outside air (or inside air in some cases) and raises the temperature of this absorbed heat to provide hot water in the home via a refrigerant cycle. They are usually contained in one unit which looks like a large hot water cylinder. This unit sits inside the home and has a ducting system to bring air to the collector and ASHP housed inside the unit. Heating is usually provided by a different means, for instance direct electric or radiant panels, which means these systems are typically best suited to apartments or small, well insulated houses.



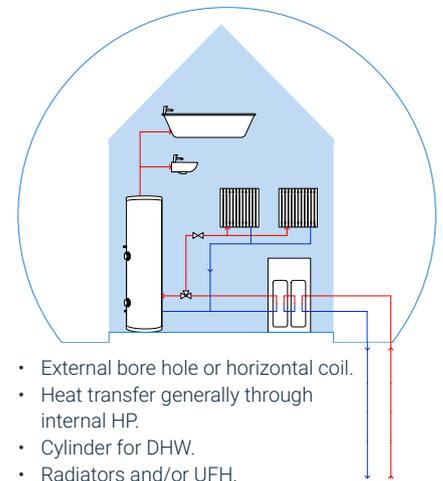
- Cylinder and HP combined in one package.
- Ducts needed for air intake and exhaust.
- Separate heating solution (often direct electric or radiant panel).

# Heat pump solution types continued

The following systems are less commonly used in low density housing, however they are seeing increased adoption in certain contexts.

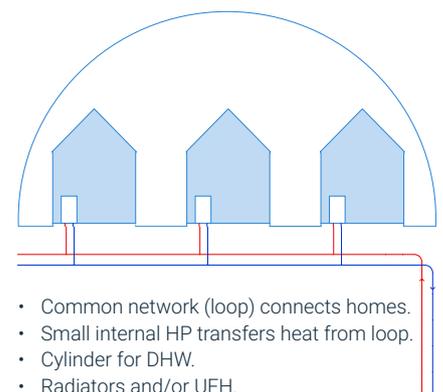
## D Ground source heat pump system for a single property

A Ground Source Heat Pump (GSHP) system uses stable underground temperatures to provide heating, hot water and sometimes cooling, to a single property. The system includes a ground loop pipe, usually in a vertical borehole, although horizontal 'slinky' coil designs are also possible. A thermal transfer fluid circulates in the pipe absorbing ground heat and delivers it to the indoor heat pump.



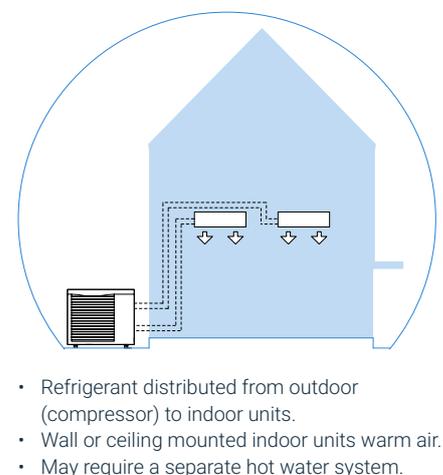
## E Shared ground loop (ambient loop) system with networked heat pumps

A shared ground loop, or ambient loop system, provides heating and cooling for multiple properties through a communal ground loop network, which circulates thermal transfer fluid at near-ambient temperatures. Each property connects to the loop with its own heat pump, allowing for independent, efficient operation. The system is most suited to denser developments, reducing land use and installation costs compared with boreholes dedicated to individual homes.



## F Air to air heat pump

An air to air heat pump is very similar to a split system. It usually has an outdoor unit housing the air collector but it may have multiple indoor units usually mounted on the wall. These units have a fan which blows warm air into the room to provide heating, but they can also provide cooling. The units are connected by small diameter refrigerant pipes which all run back to the main outdoor unit. Note: when using air to air systems, provision of hot water needs to be considered. Not all air to air systems can generate hot water, so another means may be required.



# Design considerations

Design considerations are split into sections corresponding broadly to overarching design principles and deliverables that the designer may be responsible for:

- **Principles** and **Workflow** provide general heat-pump-specific considerations outlining how the principles and design development process for heat pump schemes differ from the gas boiler approach. A typical workflow is given, emphasising the activities undertaken and information required at each stage.
- **Layout design** refers to considerations affecting the site plan in the context of the wider project plan/masterplan/environment where applicable.
- **Specification** refers to considerations affecting the architectural, building fabric, heating and plumbing, ventilation, and other relevant specifications.
- **External design** refers to considerations impacting the outside of the home.
- **Internal design** refers to considerations impacting the internal layout of the home.

## Principles

- 1 To meet Future Homes Standard, different and additional equipment will be required in the home, including in many cases a heat pump.
- 2 The design of homes with heat pumps requires specific design consideration. It is not a valid approach to 'shoehorn' heat pumps into gas boiler schemes designed to previous regulations. Designers should account for the unique requirements of heat pumps early in the layout and system design.
- 3 Heat pumps operate most efficiently when providing low-temperature, continuous heating. Systems therefore typically need larger heat emitters (such as radiators or underfloor heating) and well-designed building fabric to meet demand at lower temperatures. Heat pumps are less tolerant of poor thermal performance and suboptimal design than conventional boilers.
- 4 Opportunities exist for combining other renewable and energy saving technologies. The designer should consider whether spatial allowance should be made for optional enhancements, both as specification options and as future installs.
- 5 Clearly defined design responsibility is needed and up front coordination between disciplines, systems and packages. A single, coordinated design with a single point of design responsibility is best practice. The cost and impact of rework due to inappropriate design, for example incorrectly sized pipework, is extensive.
- 6 Education of the end user is essential, combined with intuitive controls. It is important to signal the differences in operating principles and expectations compared to a gas boiler.

# Workflow

Typical workflow illustration and considerations for the architect/designer and likely stakeholders/contributors are shown below. The developer/homebuilder/client should monitor design work and understand the design assumptions and specification 'placeholders', if adopted, in early iterations of the design process.

Note: project specifics and client requirements may vary the workflow or engagement needed.

<p><b>1 CONSIDER HEAT PUMPS IN SITE LAYOUTS</b></p> <p>Check relevant design guidance, design codes and other planning requirements.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/masterplanner</li> <li>Homebuilder/client</li> </ul>	<p><b>2 DETERMINE HEAT PUMP POSITION</b></p> <p>Check e.g. acoustic requirements for each plot, relevant design guidance, distance to openings etc.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/masterplanner</li> <li>HP subcontractor/supplier</li> <li>Heating system designer</li> </ul>	<p><b>3 REVIEW INTERNAL PLANS</b></p> <p>Allocate space for cylinder cupboard, UFH manifold, controls etc.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/masterplanner</li> <li>HP subcontractor/supplier</li> <li>Heating system designer</li> <li>Homebuilder/client</li> </ul>	<p><b>4 CONFIRM FABRIC SPECIFICATION</b></p> <p>Develop specification, source/develop thermal bridging junction details for design stage SAP/HEM.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/designer</li> <li>Energy assessor</li> <li>Homebuilder/client</li> </ul>
<p><b>5 RESOLVE MODELLING ASSUMPTIONS</b></p> <p>Review design stage equipment selection and assumptions in SAP/HEM. Revisit fabric specification if appropriate.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/designer</li> <li>Energy assessor</li> <li>HP subcontractor/supplier</li> <li>Heating system designer</li> <li>Homebuilder/client</li> </ul>	<p><b>6 CONFIRM INTERNAL PLANS</b></p> <p>Check plant spaces and service routes align with energy design and installation needs.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/designer</li> <li>Energy assessor</li> <li>HP subcontractor/supplier</li> <li>Heating system designer</li> </ul>	<p><b>7 REVIEW DETAILED DESIGN</b></p> <p>Ensure details meet performance, regulatory, and specification requirements.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Review requires input from the whole team including the client. Lead design responsibility should be established.</li> </ul>	<p><b>8 CHECK HEAT PUMP SUB-BASE DESIGN</b></p> <p>Establish security measures, condensate drain, refrigerant sump.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/designer</li> <li>Ground works engineer</li> <li>HP subcontractor/supplier</li> </ul>
<p><b>9 REVIEW THERMAL BRIDGE DETAILS</b></p> <p>Ensure continuous insulation and airtightness at all junctions, penetrations and fixings.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/designer</li> <li>Energy assessor</li> </ul>	<p><b>10 HEAT PUMP SYSTEM INSTALLATION</b></p> <p>Including commissioning, manufacturer registration, labelling, O&amp;M production and system handover.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Plumber</li> <li>Electrician</li> <li>HP subcontractor</li> <li>Homebuilder/client</li> <li>Heating system designer</li> </ul>	<p><b>11 SUBMIT AS-BUILT INFORMATION</b></p> <p>On completion, submit as-built information including commissioning sheets, photographic evidence and BREL report to the Building Control Body.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/designer</li> <li>Energy assessor</li> <li>Building Control Body</li> </ul>	<p><b>12 COMPLETION</b></p> <p>Compile handover pack including: Home Owner Guide sections, BREL report, warranty information.</p> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>Architect/designer</li> <li>Homebuilder/client</li> </ul>

## Architectural design information typically produced

### Early stage/initial design:

- Site layout with heat pump positions and access for inspection etc.
- Plans, sections, and elevations showing indicative layout for heat pump, cylinder, and associated equipment. Information should be sufficient for planning and initial SAP/HEM coordination.

### Detailed/final design:

- Final coordinated plans, sections, elevations and specification.
- Confirmed plant locations, service routes and ventilation openings.
- Final thermal bridging and construction details.
- Airtightness and ventilation strategy, to support compliance and performance evidence.

# Layout design

This section outlines layout design considerations relevant to the residential plots, not those relating to the wider development site.

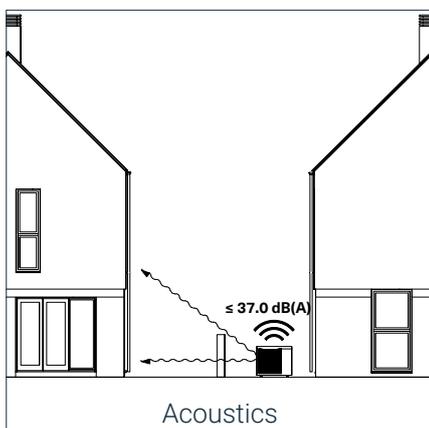
These considerations should be reviewed at an early stage of the design to ensure spatial compatibility.

The heat pump requirements should inform the design and should be captured in the preliminary planning layout.

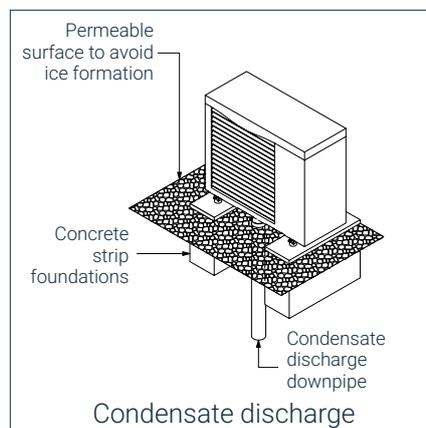


There may be specific acoustic and siting requirements set by planning. If not, the noise limits established by the Microgeneration Certification Scheme (MCS) should be applied.

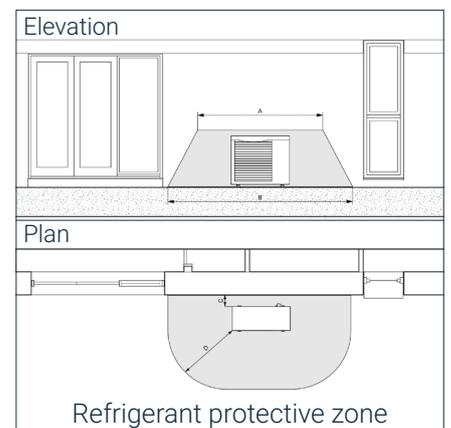
- 1 Consider heat pump external unit positioning in relation to the external elevation of the home and the incoming services route.
- 2 Understand planning restrictions and acoustic considerations when siting the external heat pump units (see *HPA Online technical resources* in Annex).
- 3 Consider potential pooling of escaped refrigerant. Ensure a safe protection zone in line with manufacturer requirements, considering windows and ventilation openings including air bricks.
- 4 Consider maintenance and accessibility and avoid locating the heat pump outside the curtilage of the home.
- 5 Allow for suitable sub-base and footings to support the external heat pump unit. Provide stable concrete foundation with a permeable surface and appropriate condensate drainage to avoid ice formation.
- 6 Ensure that the run length of the primary pipework between the heat pump and the cylinder cupboard is minimised, and within the heating design's specified range.



Acoustics  
Noise levels are assessed at neighbouring windows.



Condensate discharge  
A condensate discharge pipe usually drains to a sump or area of porous material.

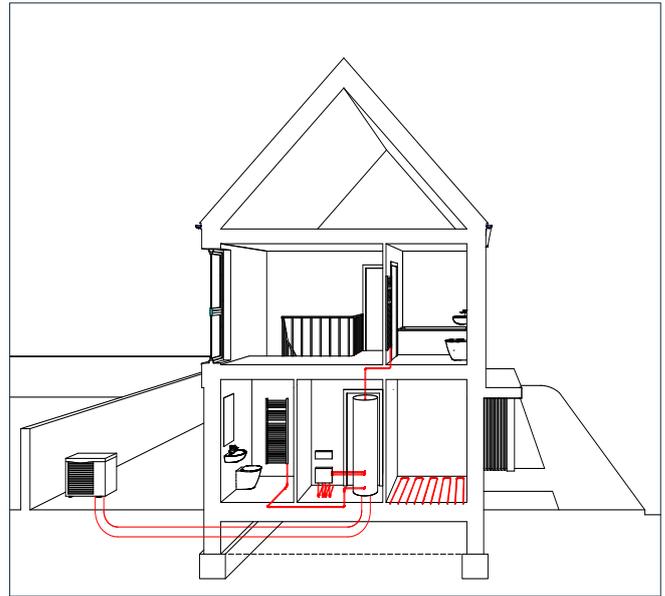


Refrigerant protective zone  
Protection zones for certain refrigerants (e.g. R290) may affect window and ventilation opening positions.

# Specification

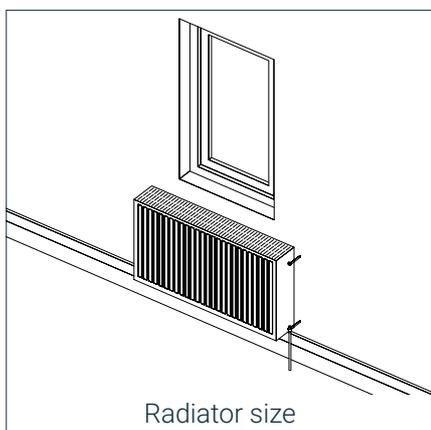
The heat pump system designer will need to make an accurate assessment of the building heat loss, considering external design temperatures, to avoid oversizing or undersizing the heat pump. Aspects that affect thermal performance: U-values, airtightness and thermal bridging therefore need to be carefully designed.

Be aware of the interaction of different parts of the Building Regulations (for instance ADs B, F and O). The spatial requirements within the home also need to be understood for equipment, pipework, radiators and access and maintenance.



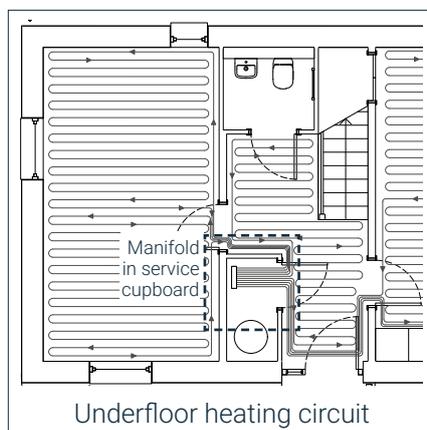
If the unit is sited remotely the lengths of insulated pipework should be minimised. The entry point needs to be coordinated with foundation and sub-structure.

- 1 Pay attention to specification of fabric insulation, pipework insulation and continuity of detailing/sealing around openings to ensure the required level of thermal performance.
- 2 Co-ordinate pipe diameter, floor construction, wall/partition construction, screed, floor coverings, manifold location and installation sequence with heating designer.
- 3 Confirm radiator sizes and pipe diameters with the heating designer at an early stage. Check the suitability of towel radiators.
- 4 Be aware of and provide access for secondary items including anti-freeze valves and isolation switches. Refer to manufacturer requirements for specifics.
- 5 Be aware of accompanying technologies such as PV, waste water heat recovery (WWHR), smart cylinders, and make spatial allowance for future enhancements and spec options where appropriate.
- 6 Co-ordinate specification with heating system designer and energy assessor to ensure good design and accuracy of design stage SAP/HEM.



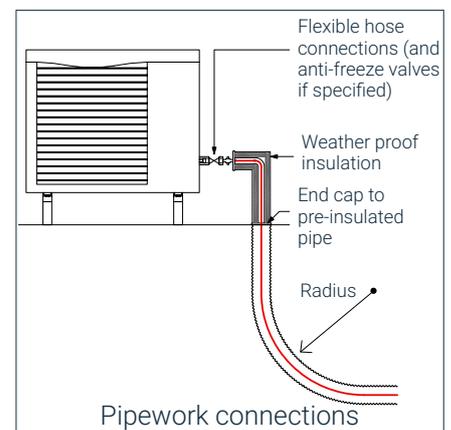
Radiator size

Radiators may be larger or deeper, with connection details for larger diameter pipework, e.g. 15mm.



Underfloor heating circuit

Co-ordinate with partition/wall layout and allocate space for manifold.



Pipework connections

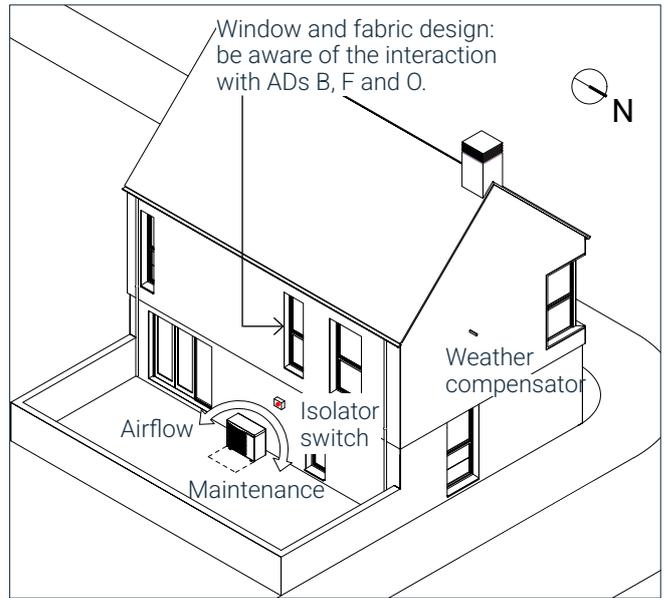
Be aware of minimum bend radius on pre-insulated pipework.

# External design

The heat pump needs to be fixed to a secure base/foundation with vibration isolating fixings following manufacturer recommendations.

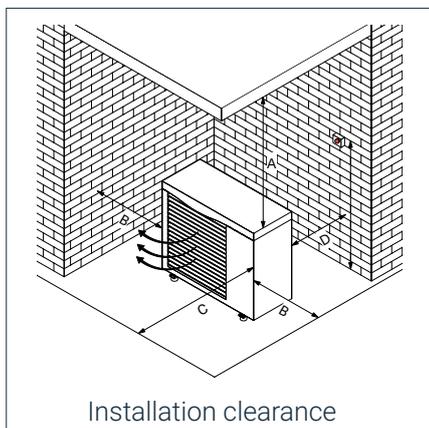
There are secondary items, for instance isolation valves and the weather compensator sensor that also need to be positioned.

The route of the pipework, the depth of trenching for pre-insulated pipework, and any interface with the foundation design or other services need to be considered.



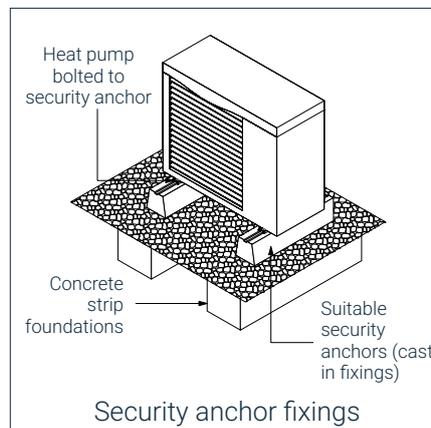
There are some essential requirements for positioning the external unit for acoustics, accessibility and to allow for good air flow. Secondary items should also be positioned carefully.

- 1 Where the ASHP external unit is located adjacent to the home, but not directly against a wall, ensure insulated pipework is supported using weather treated mild steel posts with proprietary trunking.
- 2 Where the external unit is not sited adjacent to the home, preformed insulated pipework will need to be laid within the ground.
- 3 The electrical isolator should be located near to ASHP Unit (on external wall – ideally fixed 1200mm from FGL but clear from any flammable refrigerant protective zone).
- 4 An outdoor weather compensator is required on all installations. This can be fitted in/on rear of unit, or otherwise remote location away from sunlight (e.g. on N or NW facing elevation). Always check manufacturer requirements.
- 5 Provide suitable base and anti-vibration mounts/proprietary fixings. Confirm the specification of the flexible hoses for the heating circuit and for the electrical termination.
- 6 Design a secure, ground-fixed anchoring point, as specified for the unit, to deter theft prior to occupation.



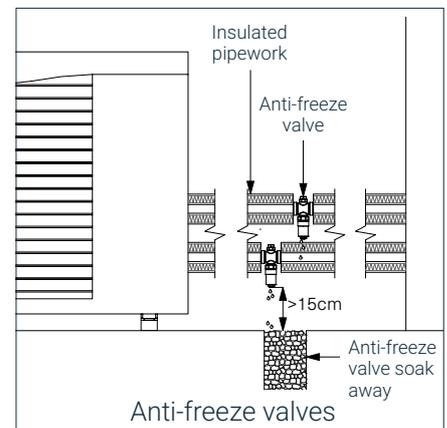
Installation clearance

The manufacturer guidance for clearance should be followed to achieve good airflow and space for inspections/maintenance.



Security anchor fixings

Incorporate a means to securely fix the heat pump to the base to mitigate theft. Use anchor fixings specified for the unit.



Anti-freeze valves

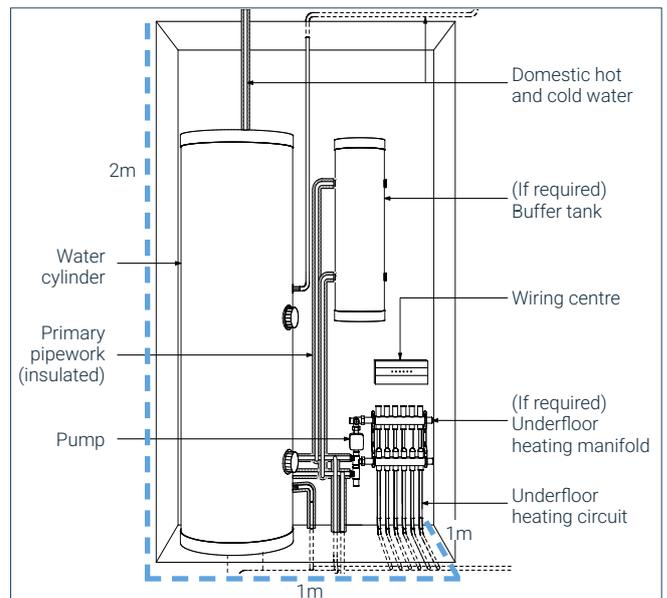
Where used as a permitted alternative to glycol dosing, install anti-freeze valves on external pipework and ensure area of porous material is directly below.

# Internal design

The designer needs to have a good appreciation of the spatial requirements for the equipment, pipework, controls and heat emitters. A sufficiently sized cylinder cupboard will be required within the thermal envelope of the home.

It is good practice to identify a position for pipework to run in a dedicated riser co-ordinated with the floor plans.

The ability to manoeuvre the cylinder into position on site should also be considered.



Although a small home will have a smaller cylinder it may require an additional volumizer or buffer tank for the heating circuit to increase the volume of water (thermal capacity) to reduce on-off 'cycling' of the heat pump.

- 1 The cylinder should be sited for rationalised flow and return pipework lengths. Manufacturer guidance should be consulted for specifics but in general primary pipework between the outdoor unit and the cylinder/distribution point should be kept below 10m. The primary pipework should be insulated both externally and internally.
- 2 Trade-offs exist when considering whether to locate the cylinder on the ground or first floor. Locating on the first floor may permit reduced pipework runs to heat emitters and hot water outlets. The weight of the cylinder must however be accounted for structurally and during install. Also consider whether drainage connections are required for condensate or venting.
- 3 The cylinder cupboard must be sized appropriately and is likely to need approx 1m x 1m plan area and sufficient height to allow for pipework connections and installation. Additional area may be required if accompanying technologies are installed in the cylinder cupboard. The door needs to be sized to allow the removal of the cylinder. A sturdy plywood pattress, or similar, is required in the cupboard to fix electrical equipment.
- 4 A pipework riser location should be shown and sized allowing for any boxing-in that may impact the floor layout. Floor joists may require trimming and kitchen worktops altered to allow for insulated pipework runs.
- 5 Radiator sizes may change with different flow temperatures typically ranging from 35 - 55°C. Co-ordination with heating system designer is required. Connection details may need to be reviewed to suit larger pipework diameters (e.g. 15mm).
- 6 Simple to use, intuitive controls are critical to ensuring the home occupier is able to operate the system efficiently. The heating system designer should factor the end user experience from the outset, enabling integration with other technologies, smart electricity tariffs and considering compatibility with smart home solutions.
- 7 Heating system ancillary components and communication protocols for thermostats, programmers etc., should be designed as one package by the heating system designer or a specialist and not compromised by procurement decisions. Heating zones, if required, should be carefully planned by the heating system designer. Generally, only homes over 150m<sup>2</sup> and those with underfloor heating require more than one heating zone.

# Annex: External guidance documents

The technical guidance landscape for heat pump system design continues to evolve and the Future Homes Hub aims to regularly review and host links to key guidance documents on the Knowledge Centre. Note that some publishers restrict access to non-members or charge for guidance.

The following resources provide a selection of further technical reading that may be relevant to architects designing for heat pumps.

**Access the Future Homes Hub Knowledge Centre**

## **Future Homes Hub**

### **[Householder guidance: Buying a new low energy home - heat pump edition](#)**

The Hub's Householder Guidance for heat pumps provides a good starting point describing the components of a low energy home, including heat pumps. While this targets the homeowner/buyer, designers may find this helpful as an introduction.

## **Microgeneration Certification Scheme**

### **[Heat Pump: Design Standard](#)**

MCS MIS-3005 is a technical design standard, elements of which are often referenced as design criteria and by third party guidance.

## **Chartered Institution of Building Services Engineers**

### **[Domestic Heating Design Guide](#)**

The CIBSE Domestic Heating Design Guide is a commonly referenced detailed technical guidance document intended predominantly for MEP/heating engineers. Architects may find this helpful to better understand technical fundamentals.



## **Passivhaus Trust**

### **[Air to water heat pumps: The basics of energy efficiency](#)**

This short Passivhaus Trust guidance document focusses on the principles of low energy design that should be applied early in the design process.

## **Heat Pump Association**

### **[Online technical resources](#)**

The HPA publishes numerous practical technical resources including guidance documents and webinars. Notable publications accessible here include their *"Heat Pump Commissioning Checklist & Service Record"* template and *"Field Assessment of Air Source Heat Pump Noise"* guidance.

## **Energy Saving Trust**

### **[Heat pumps: how they work, costs and savings](#)**

This online resource provides a basic overview of heat pump technology which may be useful for designers looking to familiarise with the technical fundamentals including benchmark performance and costs.

## Acknowledgements

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<b>Dani Putney</b>	Certsure	<b>Nick Houghton-Best</b>	Daikin
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<b>Jonathan Petts</b>	Telford Homes	<b>Richard Burley</b>	Vaillant Group
<b>Lee Tuffnell</b>	LABC	<b>Stephen Bielby</b>	Heat Pump Association
<b>Mark Barson</b>	Vaillant Group	<b>Tim Hartwell</b>	Miller Homes
<b>Mark Williams</b>	Clarion Housing Group		



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