# Space Heating with Radiators and Underfloor and Domestic Hot Water Production

Often while underfloor systems are used on lower floors the preferred choice for heating upstairs may well be radiators. Heat pumps can be used to heat buildings either with underfloor systems, with radiators or a mix of both. However if a mixture of both types of heating systems are used there are a number of considerations that need to be taken into account.

1. **The heat pump will need to run at a higher temperature.** Due to the lower surface area radiators need a higher flow temperature to provide heat into a room. This temperature (approx. 45°C) means that the heat pump runs less efficiently than if the heating distribution was purely underfloor.
2. **Underfloor pipe density.** Due to the lower flow temperatures, Kensa recommends that the pipe density is increased for all underfloor systems used with heat pumps. In systems with radiators, the 45°C flow temperature can be mixed down to 35°C by the use of mixing valves. It is important to remember that floor coverings acting as an insulating layer may require a higher flow temperature than 35°C for the underfloor system.
3. **Delay in heat output.** The underfloor mounted in screed acts as a large heat sink and absorbs most of the heat produced by the heat pump. This keeps the return temperature to the heat pump low and as heat pumps work on a flow temperature differential of approximately 5°C, the flow temperature is kept low. At low flow temperatures the radiators in the system will not provide heat and feel lukewarm until the underfloor is up to running temperature. This means that there is a delay between turning the heating system on and the radiators providing heat. This delay is more pronounced at initial start up but can also occur during normal running conditions.

**Facts at a glance:**

- Heating distribution systems

Heat pumps can work with underfloor systems, radiators or a mixture of both if various considerations are taken into account.

- Flow temperatures

If radiators are being used the heat will need to run at a higher flow temperature reducing the heat pumps efficiency.

- Heating delay

Due to the underfloor acting as a heat sink there will be a delay from turning the heating system on and the radiators providing heat.

- Zone valve

To avoid the bedrooms overheating at night while the underfloor is being charged using off-peak electricity, it is recommended that a zone valve is fitted on the radiator circuit.

- Buffer vessels

Buffer vessels are used to prevent short cycling of the heat pump. If approximately 25% of the heating zones are left open then there is no requirement for one.

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**Principle of Operation**

In the diagram (on page 3) the heat pump is set to produce a flow temperature of approximately 45°C. This flow temperature is circulated to the heating distribution system via a two connection buffer vessel (a buffer vessel is not required if a number of zones on the underfloor and radiators are left 'open' i.e. without control valves, however if close control of all zones is required a buffer vessel should be fitted). Zone valves are connected to the radiator and underfloor supplies and linked to a timeclock. This allows the radiator circuit to be isolated during the night, keeping the bedrooms cool, when off-peak electricity is being used to charge the underfloor screed. All radiators and underfloor manifolds should ideally be connected reverse return to equalise the pressure drops across the system. If this is not possible balancing valves should be used.

Radiator systems are quicker to respond than underfloor systems, however due to the low water content of the system it does mean that off-peak tariffs such as Economy 10 can not be effectively used.

When the DHW timeclock calls for production of DHW, the three-port valve diverts the flow from the heating distribution circuit into the indirect coil within the hot water cylinder. The temperature of the water from the heat pump is raised. When the DHW production time period ends, the three port valve switches back to the underfloor distribution and the temperature drops back to its space heating design temperature. The heat pump then reverts to space heating mode or switches off if no zones are calling for heat.

# Application (AIS)

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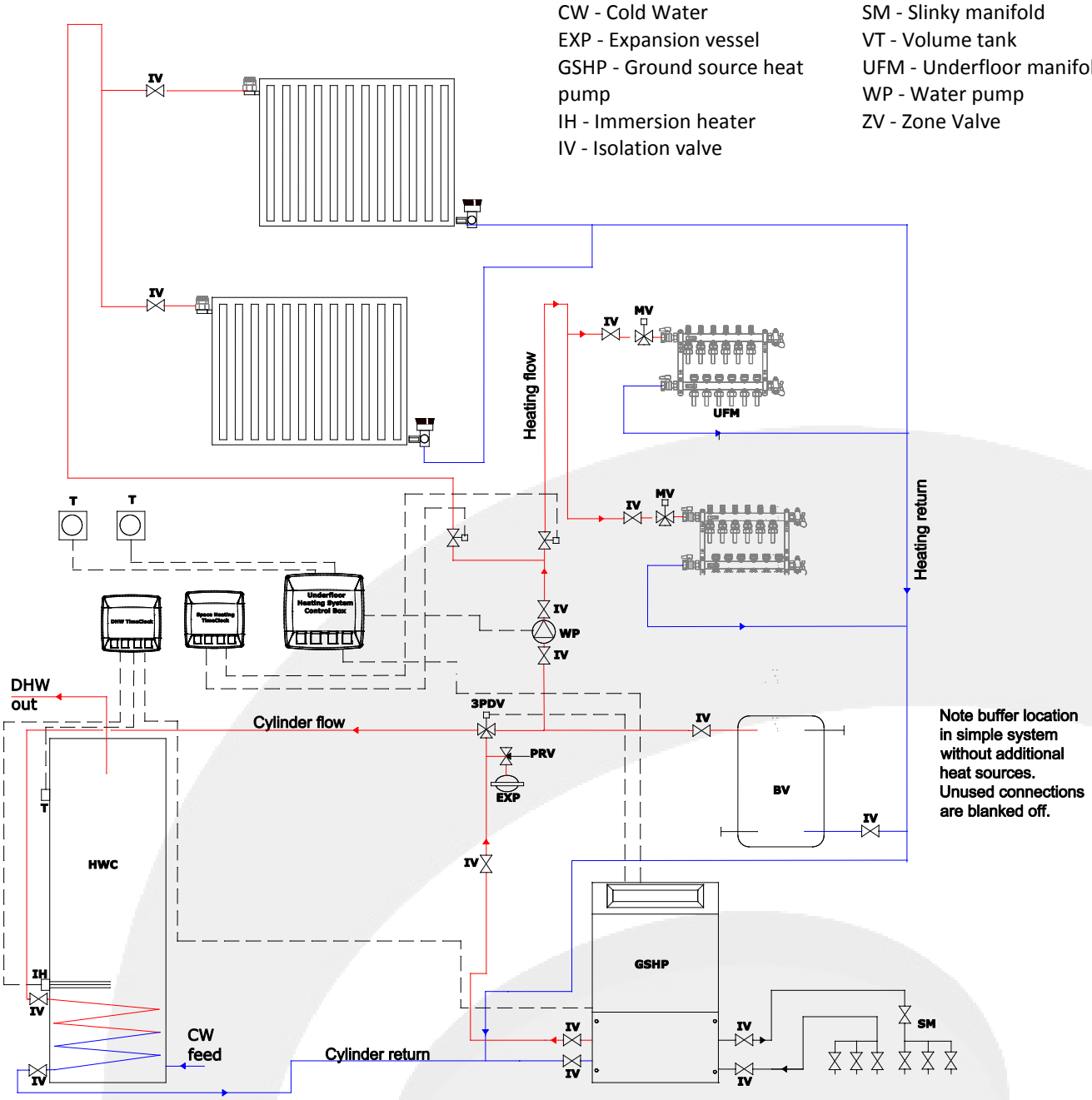
**Abbreviations**

3PDV - 3 port diverting valve
DHW - Domestic Hot Water
CW - Cold Water
EXP - Expansion vessel
GSHP - Ground source heat pump
IH - Immersion heater
IV - Isolation valve
MV - Mixing Valve
PRV - Pressure relief valve
SM - Slinky manifold
VT - Volume tank
UFM - Underfloor manifold
WP - Water pump
ZV - Zone Valve




Please note: The above drawing is a schematic only and additional valves and fittings maybe required.

Please note: Kensa supplies the ground source heat pump, slinky manifold and 3 port diverting valve. Kensa also supplies the horizontal ground arrays and antifreeze (not shown above).

The Buffer Vessel (BV) is an optional item and can be fitted to reduce short cycling of the heat pump. If 25% of the underfloor zones and radiators are left open this is not required.