Bivalent Space Heating with Underfloor and DHW

Principle of Operation

Bivalent systems utilise a secondary boiler, which is designed to provide heat into the distribution system when the heat pump isn't sized for 100% of the peak load. They are generally found in retro-fit applications where insulation levels of the building are not sufficient and a heat pump cannot meet all off the heating load effectively.

Bivalent systems have to be carefully designed to avoid the return temperature of the heating circuit being too high. If this return temperature is above the in-built temperature set point at which the heat pump turns off, the heat pump will never actually turn on and the whole of the load will be taken by the secondary boiler, resulting in higher than expected energy bills and carbon emissions.

The simplest and most effective way to achieve the maximum efficiency for a bivalent heating system, while retaining the clients comfort, is to use 'either / or' control logic. Simply put *either* the heat pump *or* the secondary boiler operates, but not both together.

The system operates by use of an external temperature sensor (TS). This is set at to an external temperature above which the heating load is satisfied by the heat pump alone. If the external ambient temperature drops below this set point then the heat pump is switched off and the secondary boiler is switched on to supply heat into the heating distribution system. Due to the higher output temperature of the secondary boiler it is important that the boilers flow is mixed via a mixing valve (MV) with the return flow to lower the temperature to a suitable level for the heating distribution system.

Facts at a glance:

- Highest possible efficiency

Utilises the heat pump's high efficiency to produce the majority of space heating and uses two temperature set points (one for the underfloor and one for the DHW production) to produce the required heating at the highest efficiency as opposed to using in-built direct immersion heaters.

- 'Either / or' control logic

Control logic avoids the secondary boiler taking the whole heating load resulting in the heat pump never operating.

- Simple installation

Designed to simplify installation by removing the need for complicated control logic.

- Easily adjustable

The point at which the secondary boiler takes over from the heat pump can easily be adjusted by use of the outside temperature sensor.

- 50°C DHW flow temperature

Domestic hot water flow temperatures achieved at approximately 50°C using the heat pump alone.

- Propriety hot water tanks

The Kensa DHW system can link easily to any modern indirect DHW tank with a suitably sized in-direct coil.

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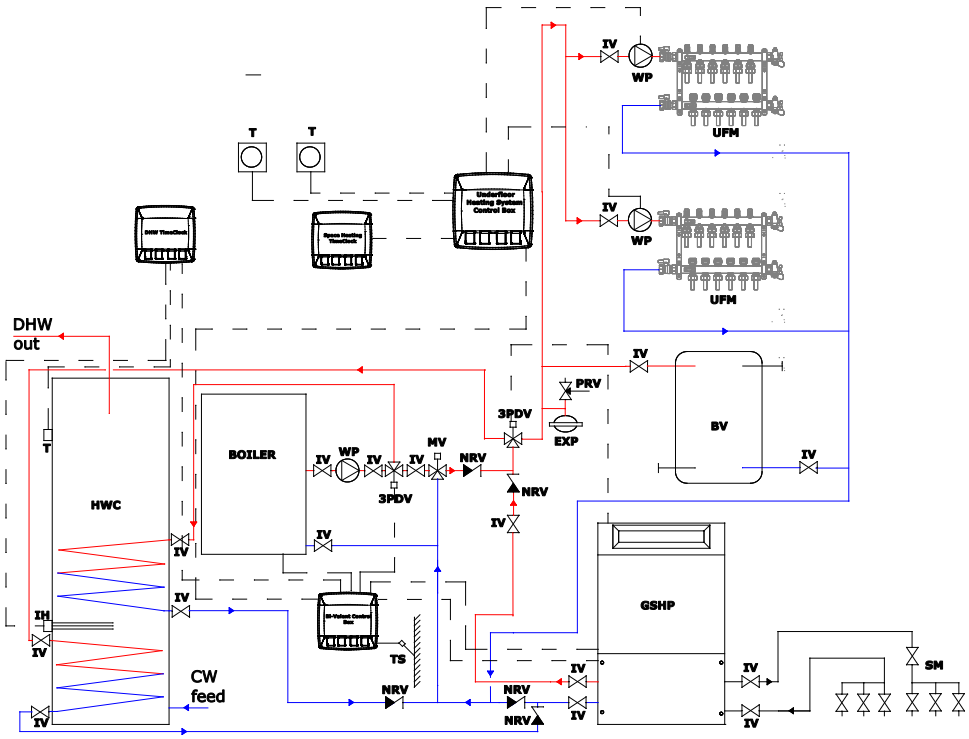
For production of DHW, the control logic should determine which appliance is currently operating. When the DHW timeclock calls, the corresponding three-port valve diverts the flow from the heating distribution circuit into the indirect coil within the hot water cylinder. If the heat pump is operating 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 heat pump reverts to space heating mode. The temperature drops back to its space heating design temperature or switches off if no zones are calling for heat.

The maximum DHW temperature that the heat pump can achieve will depend on the type of heat pump fitted and will be between 50-65C. If 65°C is required all year round, it is recommended that a high temperature heat pump (R134a) is fitted or if a standard temperature heat pump (R407C) is fitted an immersion heater is linked to a second channel on the DHW timeclock and this is programmed to operate for a period immediately following the DHW production. This means that the majority of the heating load for the DHW is produced using the heat pump, as opposed to using only the direct immersion heater.

If 50°C water is acceptable, then it is also recommended that the immersion heater is programmed to raise the temperature to 65°C at least once a week using the DHW timeclock. For single coil tanks it is advised that the boiler produces all of the DHW and the heat pump is dedicated to space heating only.

Abbreviations
3PDV - 3 Port diverting valve
BV - Buffer vessel
CW - Cold water
DHW - Domestic hot water
EXP - Expansion vessel
GSHP - Ground source heat pump
IH - Immersion heater
IV - Isolation valve
HWC - Hot water cylinder
MV - Mixing valve
NRV - Non return valve
PRV - Pressure relief valve
SM - Slinky manifold
T - Thermostat
TS - Temperature Sensor
UFM - Underfloor manifold



Please note: The above drawing is a schematic only and additional valves and fittings maybe required. 3 port valve orientation will depend on the manufacture of the valve. Kensa supplies the ground source heat pump and slinky manifold. 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 are left open this is not required.