

Sunamp



UniQ Heat Storage Batteries

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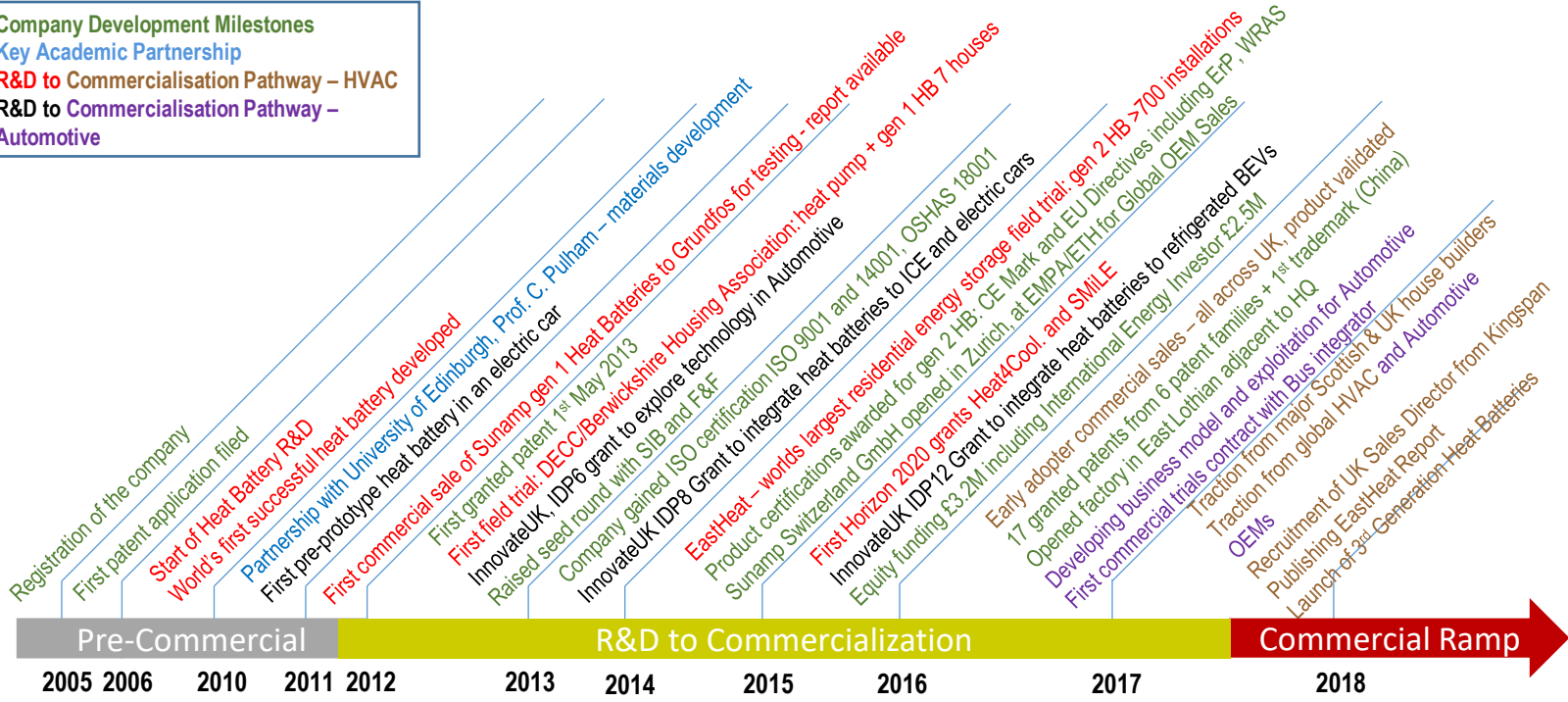
[@sunampltd](https://twitter.com/sunampltd)

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- Sunamp develop, design and manufacture heat batteries at our Headquarters and Factory in East Lothian, Scotland, UK
- We employ 80+ staff
- The most advanced PCM Heat Battery energy storage company in the world
- Global Business Development office in Zurich - inquiries from and partnerships with companies all over the world
- We have rolled out over 8000 heat batteries
- Proven in:
 - DECC Advanced Heat Storage SBRI (2013) – 7 homes with heat battery + heat pump for time-shifted, low-cost, low-carbon heating and hot water
 - EastHeat (2016) – 625 homes with heat batteries with PV and combi boilers or to deliver electric time-shifted space heating and hot water
 - Thousands of sales to home-owners, housebuilders and housing associations

Company History

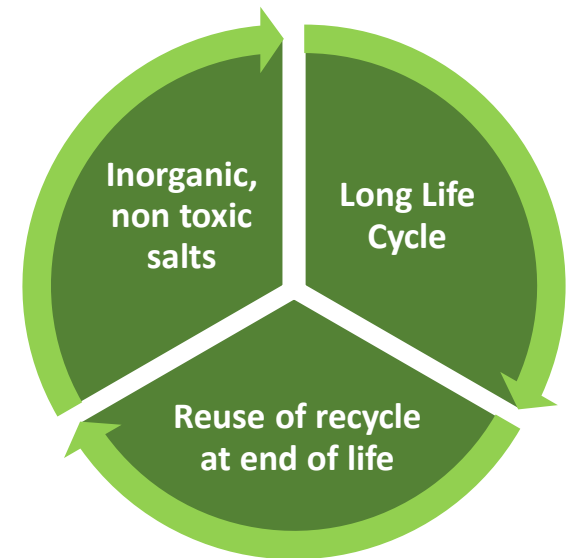
Company Development Milestones
 Key Academic Partnership
 R&D to Commercialisation Pathway – HVAC
 R&D to Commercialisation Pathway – Automotive



Phase Change Materials (PCMs) are substances that absorb and release thermal energy during the process of freezing and melting

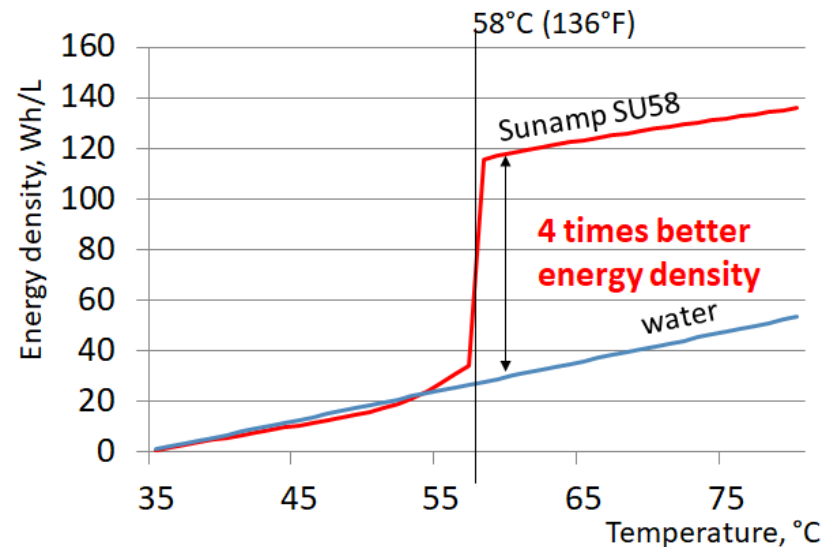
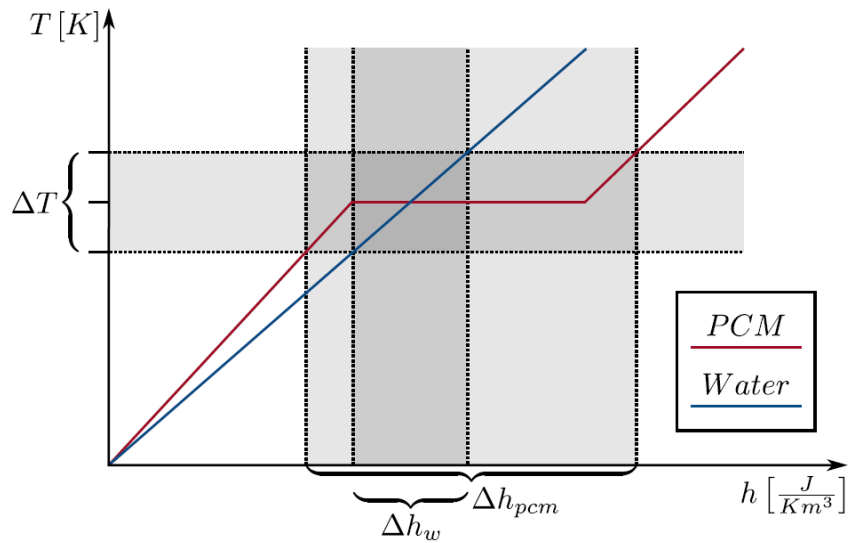
We use inorganic, Sodium Acetate based PCM material which is:

- Plentiful and easy to source
- Non toxic,
- Non flammable
- Long life: tested to 42,000 cycles with no degradation.
- A food grade material



Sodium Acetate is readily available and in common use in dishwasher tablets and as a flavouring for salt and vinegar crisps. We are able to fully re-use or re-cycle every component at end-of-life – either reformulated into new cells or as a de-icer for example

Phase Change Materials



The critical temperature of the PCM is in the temperature range denoted by ΔT . The latent and the specific heat (Δh_{pcm}) of the PCM in this range is therefore much higher than the specific heat of water (Δh_w).

What is a heat Battery?

A high-powered, high flow-rate heat exchanger is immersed in phase change material and encapsulated in a red moulded, polypropylene cell



The red cell is surrounded by non-flammable vacuum insulation panels. These offer superior insulation, in minimal space. As a result the *whole* range is ErP A or A+ with SAP benefits

Finished in a cuboid, white powder-coated aluminium case, which offers pipework knockouts on any face for very easy installation



Our new factory facility enables us to ramp up our current production quickly

Compact

Smaller than a slim dishwasher – can be floor mounted, fitted in a small kitchen unit, in a cupboard or in the garage. The technology enables it to store four times more energy than hot water tanks for a given volume of material, and this compact size could free up cupboard space where a traditional hot water tank would have been.

High power and high flow rates

High power heat exchanger inside so that the water is heated instantly at high power (up to 30kW) and high temperature before being blended via a thermostatic mixing valve to a selectable temperature. Delivers fast flowing hot water on-demand.

Modular

Cuboid and able to stack like Lego®

Minimal heat losses

2 to 4 times less heat loss than a traditional hot water tank – Saving money and reducing CO₂.

No Maintenance

Avoids the annual inspection and service which is required for unvented cylinders

Long Lasting

We have tested over 40,000 cycles of charging and discharging, the equivalent of over 50 years of daily use, without a single failure or degradation to the PCM.

Ease of installation

It does not need to comply with the requirements of Part G3 of the Building Regulations and therefore the pressure & temperature relief (P&T) valve and the associated discharge pipework are not required. This not only significantly reduces costs but also removes barriers in terms of where you can locate the battery within the property

Significantly Reduced Legionella risk

Legionella risk is significantly reduced as the heat battery does not store water directly, it stores energy and heats the water on demand.

Grid Balancing

By charging up in off-peak periods it not only reduces running costs, it also shifts load away from peak periods and helps reduce the strain on the electricity system.

Seasonal Performance Factor (SPF)

Reduced heat losses improves the SPF H4 compared to equivalent heat storage devices

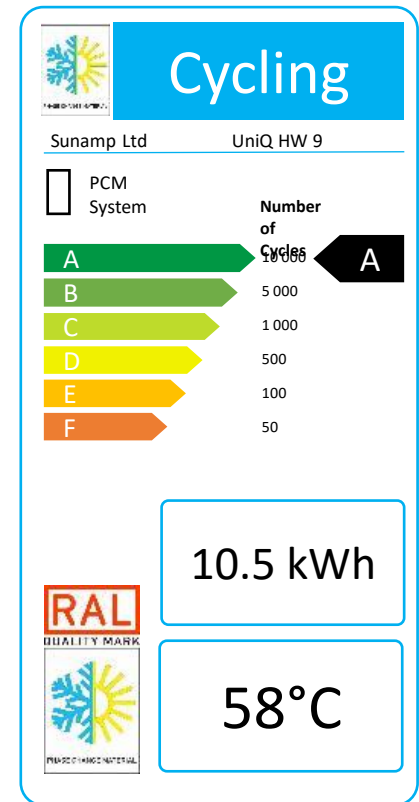
World's Best Performing, Certified Heat Battery



- The RAL Quality Association PCM has awarded Sunamp the **RAL Quality Mark** for its UniQ line of thermal batteries with the leading SU58 material.
- In independent testing conducted by ZAE Bayern, a prestigious German test lab, the PCM was successfully melted and solidified in a UniQ heat battery for 10,000 cycles.
- At the end of the test, no significant differences in stored thermal energy capacity were found between the cycled samples and an uncycled sample of the PCM. Sunamp's range of UniQ products earned the association's highest level of certification:

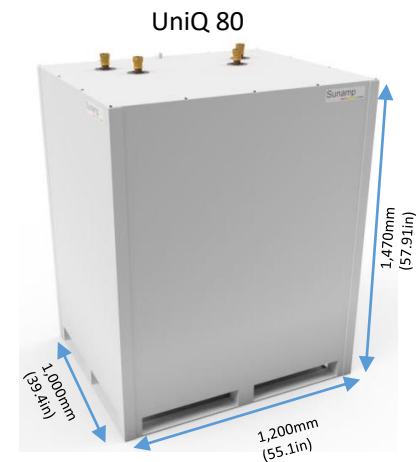
**Grade
A**

(The only product in the world to receive this level of certification)



PROPOSED LABEL

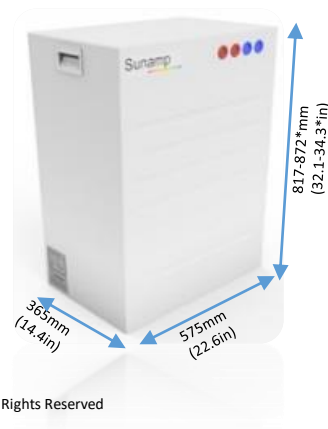
Modular, scalable, compact, efficient



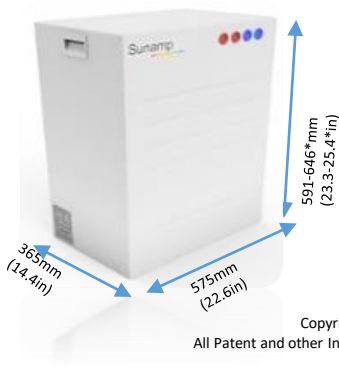
UniQ 12



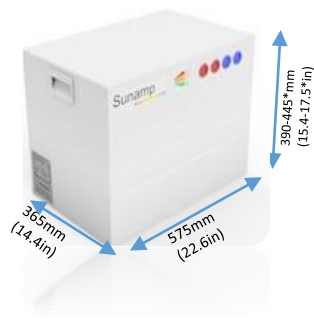
UniQ 9



UniQ 6



UniQ 3



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*height for models including stand-by electric heaters

Published Worldwide PCT Applications:
WO 2009/138771, WO 2011/058383, WO 2014/202974,
WO 2014/195691, WO 2014/191778, WO 2015/025175, WO 2017/221025

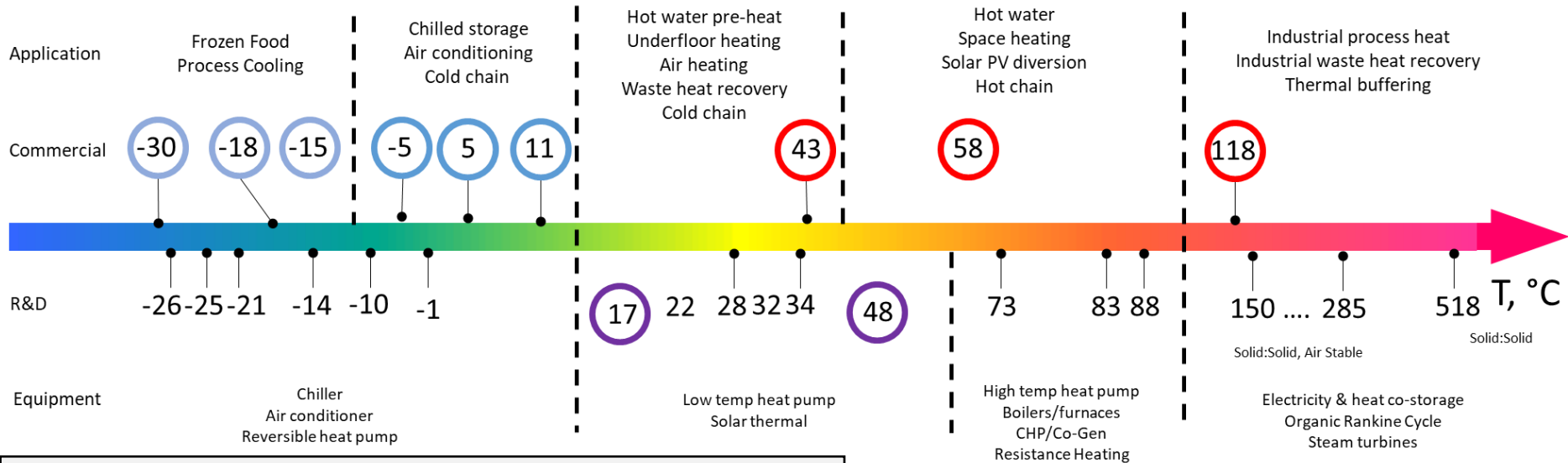
UniQ Range Technical Specification



		Size 3	Size 6	Size 9	Size 12	Size 80
Storage capacity –with PCM58	KWh	3.5	7.0	10.5	14.0	80-90
Equivalent hot water cylinder size	L	71	142	212	284	2800
V40, Volume of hot water available at 40°C	L	85	185	300	370	X
Heat loss rate	KWh/ 24h	0.449	0.649	0.738	0.809	3.0
ErP Rating class – Hot water storage vessel		A+	A+	A+	A+	N/A
Recommended maximum HW flow rate	L/min	6	15	20	25	X
Minimum water supply pressure at inlet heat battery	bar	1.00	1.50	1.50	1.50	X
Maximum working pressure	bar	10.0	10.0	10.0	10.0	16

Sunamp Cool & Heat Battery Range

Sunamp **Cool Batteries** and **Heat Batteries** can be filled with different PCMs to optimise each application

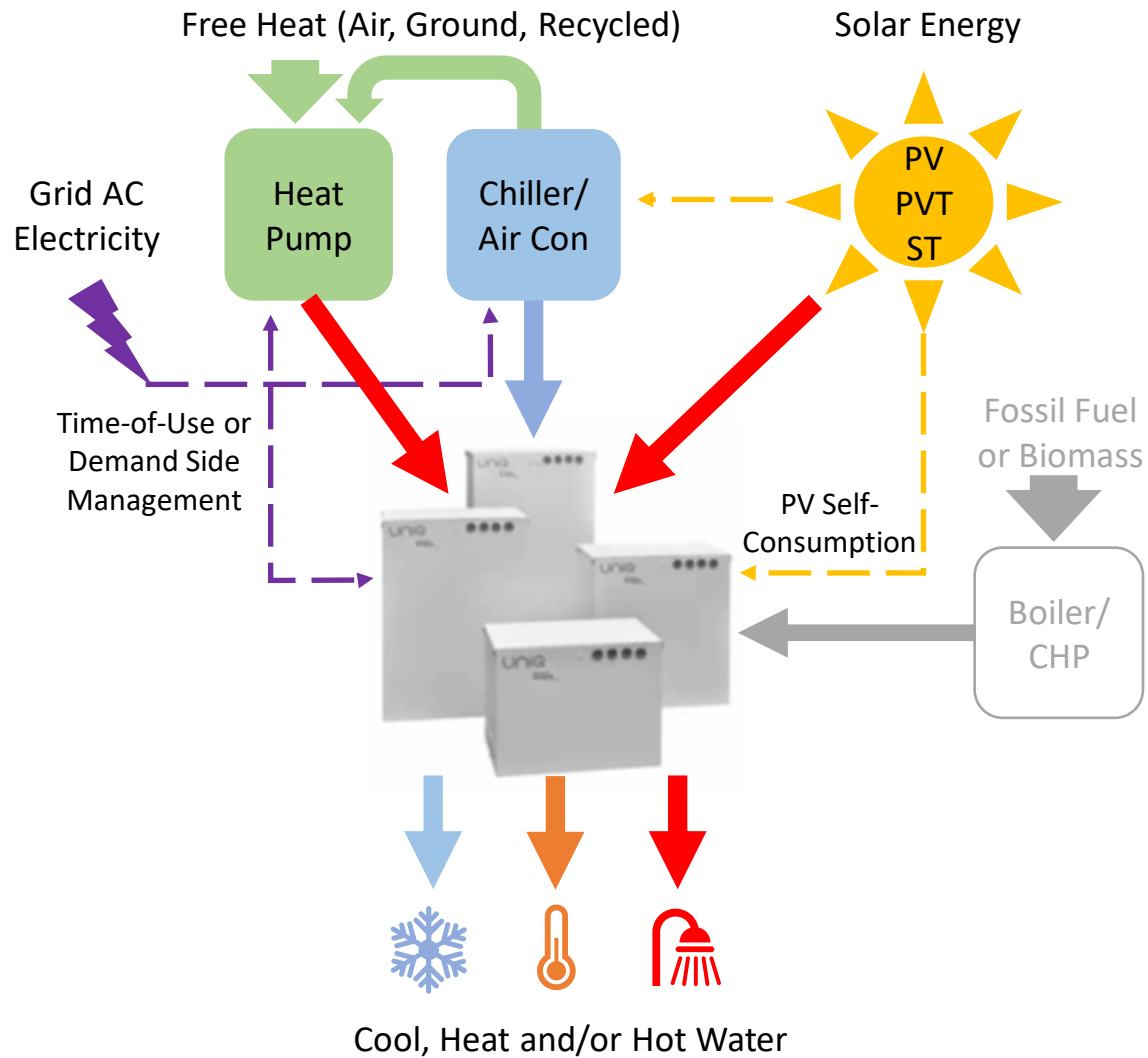


Materials		R&D Status	
Cooling	Heating		
		R&D active, material may enter market	32
		Accelerated development	

Sunamp's Phase Change Materials (PCMs) are internally developed, and generally inorganic, non-flammable materials. Values indicate phase change temperature.

Note: PCMs at different level of development and not all commercially available today.

The Product



Product Range - Applications

Sunamp has a full range of products for the home heating market, from stand-alone water heaters and energy stores to full-fledged heating solutions. Our products are compatible with world leading heating brands.

Domestic Hot Water

UniQ eHW Direct Cylinder Replacements

- Stand-alone electric hot water with minimum losses of space and energy
- No maintenance requirements
- Outstanding hot water performance

UniQ HW & HW+i Indirect Cylinder Replacements

- The hot water performance of a cylinder, at a fraction of the size
- No maintenance requirements
- Low heat losses

UniQ Heat & Cool Compact Thermal Stores

- Compact thermal storage for homes and businesses
- Allows time-shifting of heat demand and/or limitation of peak capacities
- Available at different temperature levels for cooling and heating

UniQ CPSU Direct Electric Combi

- Stand-alone electric space and water heating for small flats and highly insulated houses
- Enables the customer to benefit from day/night or variable tariffs

Combis

UniQ HTHP HP Performance Shifted

- Combination of heat batteries for hot water & space heating enables the use of low-cost day/night or variable tariffs
- A key enabler of heat pumps in retrofit, delivering „boiler-like“ performance
- Current compatibility:
 - Daikin Altherma HT
 - LG Therma V HT
 - Panasonic Aquarea HT Mono-bloc
- Future compatibility:
 - Daikin Altherma 3H HT
 - Vaillant aroTherm plus

UniQ eHW+iPV & HW+iPV PV-Ready

- Optimised PV self-consumption
- Compatible with a large range of boilers (e.g. Worcester-Bosch, Intergas, Daikin, etc.)

UniQ HW+iLTHP LT HP Cylinder Replacements

- Best in class heat generation meets best in class heat storage
- Current compatibility:
 - Daikin Altherma R32 range
 - Samsung R32 range

In Development: Heat Pump Water Heater

- The performance of a heat pump water heater, at half the size
- Precursor to further integration with heat pumps (showcase for direct condensation)

UniQ GSHP The Renewable Solution for High-Rise Buildings

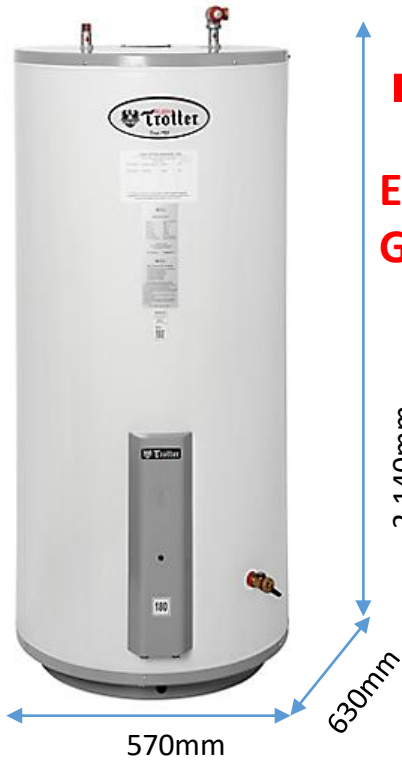
- Heat batteries in combination with GSHPs and a shared ground-loop allow removal of gas from tower blocks and terraced homes
- Current compatibility:
 - Kensa Heat Pumps

In Development: UniQ LTHP Package

- Time-shift for LTHPs
- Current compatibility: Mitsubishi Ecodan

Cylinders Vs Heat battery

Albin Trotter ATI E-305L



UniQ eHW 12

-71% in volume

Equal energy stored

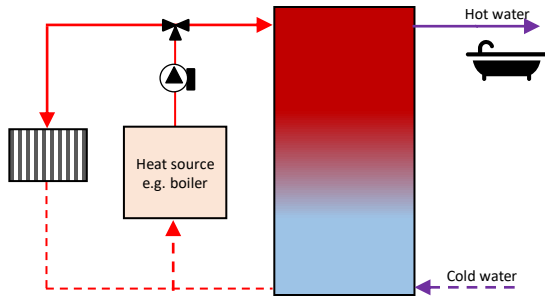
Greater amount of usable hot water.

UniQ 12

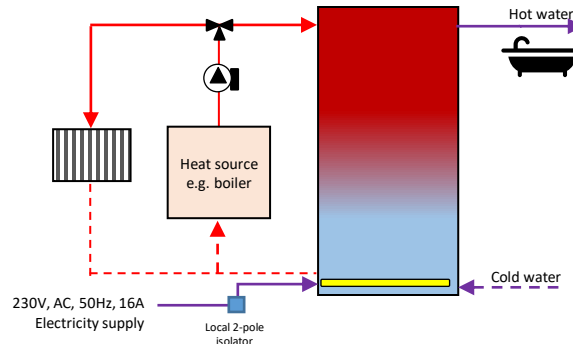


Cylinder vs Heat Battery replacement benefits – compact, safe, ERP A+ efficient (reduced heat loss)

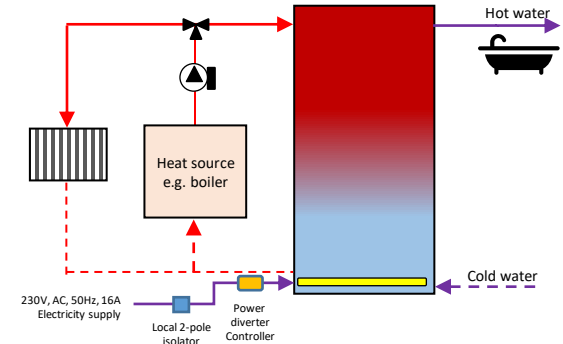
HW Batteries: External heat source



UniQ HW X heated by external heat source



UniQ HW X heated by external heat source and with standby electric heater



UniQ HW X heated by external heat source and solar PV

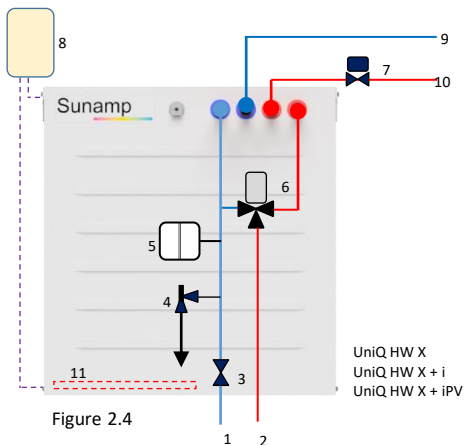
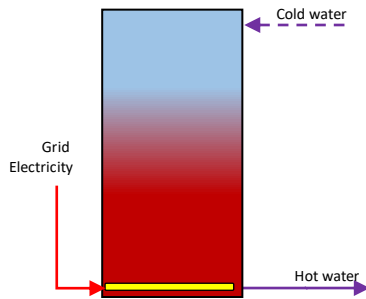


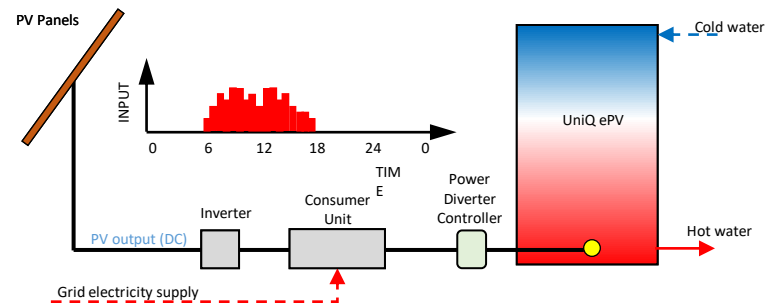
Figure 2.4

- 1 Mains cold water supply
- 2 Hot water supply
- 3 Cold water supply isolating valve
- 4 Cold water expansion relief valve (Portable water, setting: 6 – 10bar)
- 5 0.25 – 0.5L Potable water expansion vessel (Charge pressure: 2.0bar)
- 6 Thermostatic blending valve (Setting: 45 – 55°C)
- 7 Battery charging control valve – Primary heat source circuit
- 8 Heat battery controller
- 9 Boiler/Heat pump return
- 10 Boiler/Heat pump flow
- 11 Heating element (UniQ HW x + i & UniQ HW X +iPV model only)

HW Batteries: Grid Electricity



UniQ eHW X battery heated by grid electricity only



UniQ eHW X battery heated by grid electricity and solar PV

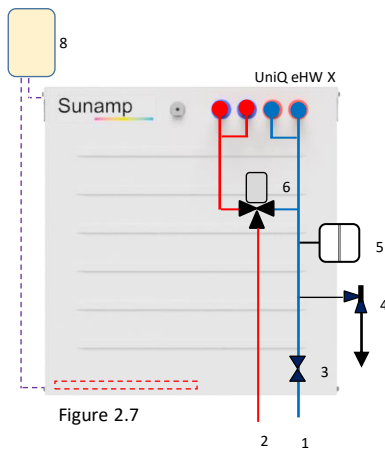
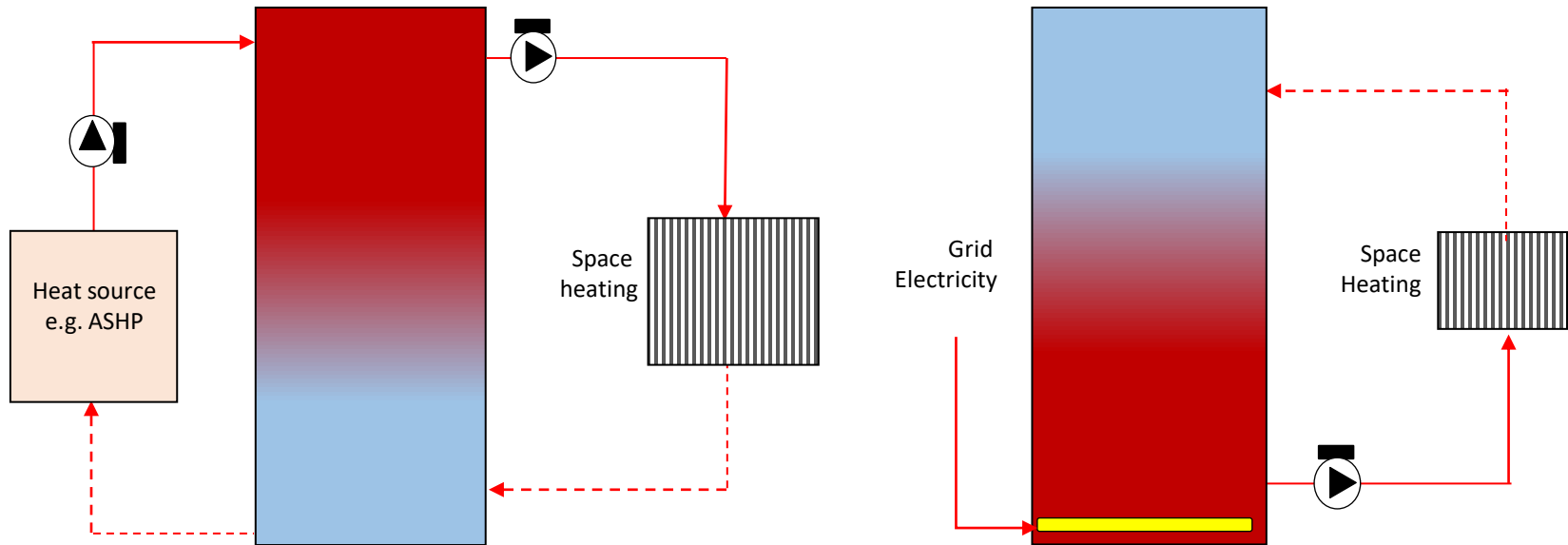


Figure 2.7

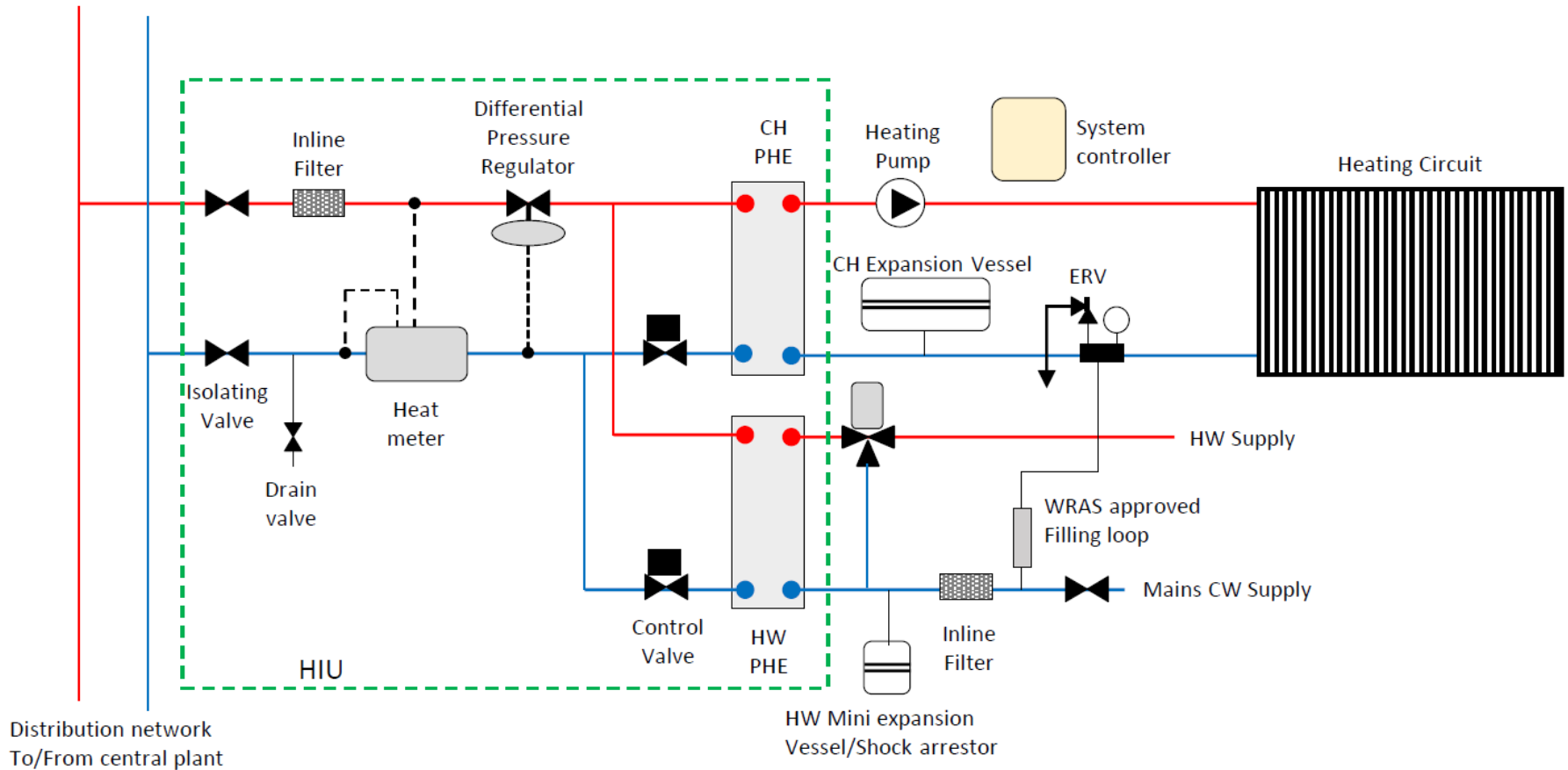
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- 7 Battery charging control valve – Primary heat source circuit
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Heat Batteries



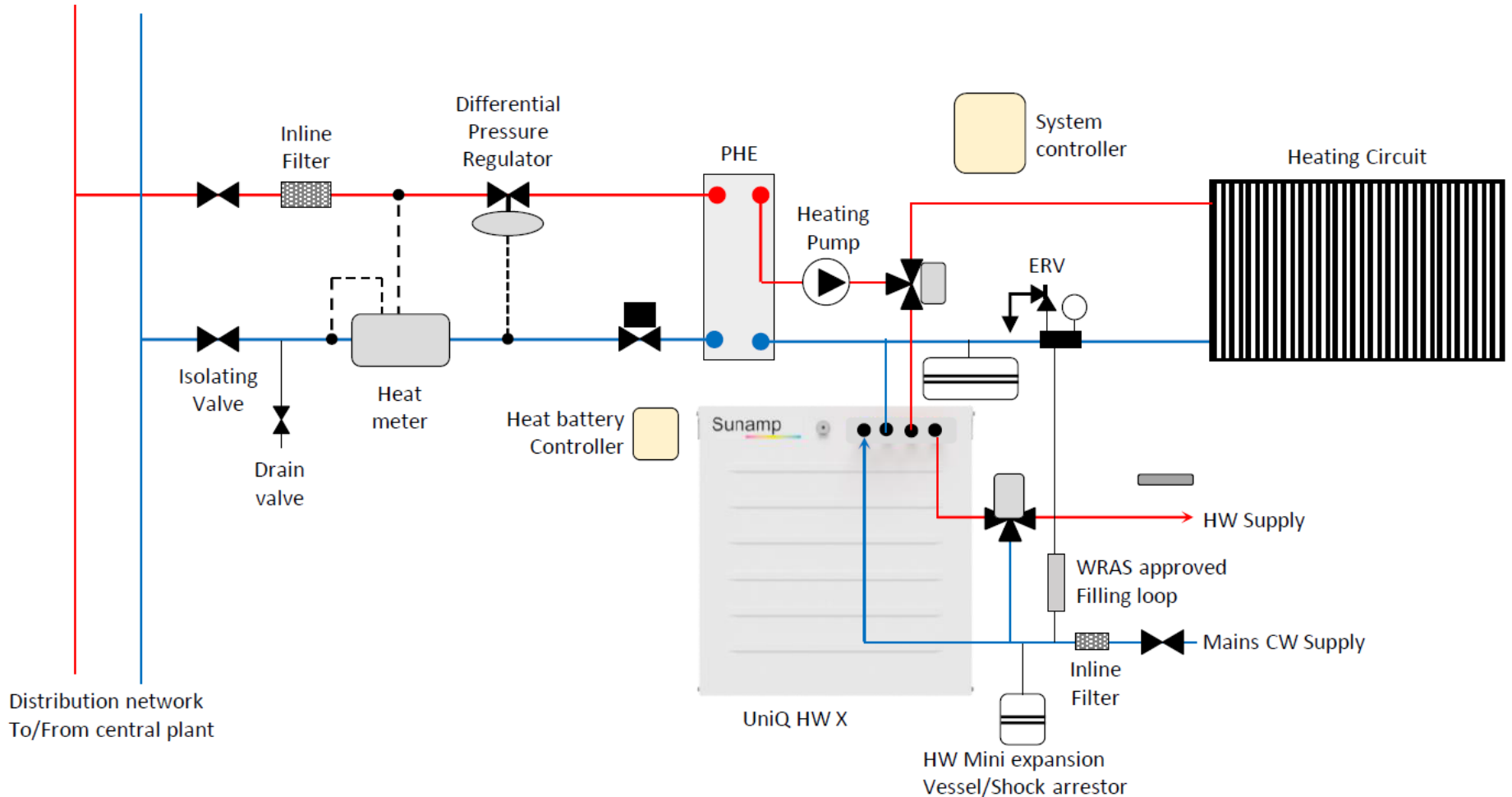
Typical Twin PHE based HIU

Figure 1: Typical heating system configuration with twin PHE based HIU



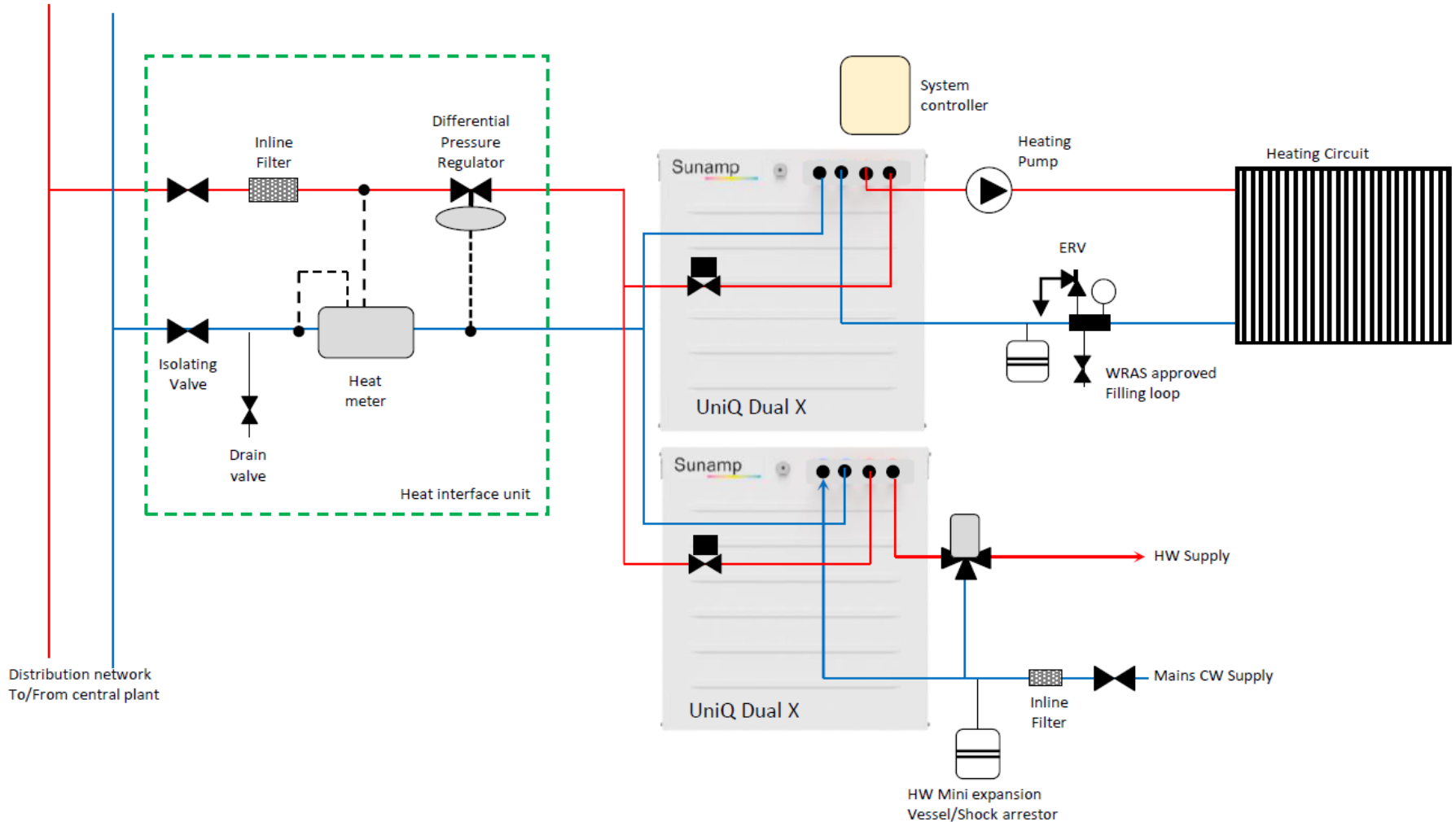
HIU – Sunamp Alternatives

Figure 2: Typical heating system configuration with single PHE HIU and Sunamp UniQ HW battery



HIU – Sunamp Alternatives

Figure 3: Typical communal heating system configuration with UniQ HW and CH heat batteries in apartment



Key design aspects

- This design provides full hydraulic separation of both heating and hot water circuits in an apartment from the central heat distribution network.
- The heat for hot water heating is stored in the heat battery, which heats the hot water instantaneously on demand.
- The heat for space heating for peak demands is stored in the central heating batteries and therefore provides rapid warmup of radiators and reduces the peak demand on the central plant.
- There is no need to size the network for peak heating and hot water demand and therefore depending upon the design of the central plant, there is scope for reducing the capacity of the central buffer vessels and the distribution network

Heat Pump Package Solutions

Package	1	2	3	4*
Heat Pump Type	Low Temperature	High Temperature	High Temperature	Low Temperature
Currently Approved Brands	Consult Sunamp	Consult Sunamp	Consult Sunamp	Consult Sunamp
Services Provided by UniQ Heat Batteries	Hot Water only (with electric boost when necessary)	Hot Water	Heating & Hot Water	Heating & Hot Water
Heat Delivery	Fan-assisted radiators / UFH	Radiators	Radiators	Fan-assisted radiators / UFH
Proposed PCM	HW: SU58	HW: SU58	Heating: SU58 HW: SU58	Heating: SU43 HW: SU58
Controls	Sunamp UniQ B30X ⁽²⁾	Sunamp UniQ B200	Sunamp UniQ HT Controller ⁽¹⁾	Sunamp UniQ LT Controller ⁽³⁾

(1) UniQ HT Controllers require customisation to suit heat pump model and system configuration

(2) UniQ B30X series – Different versions for different heat pumps

(3) UniQ LT Controller – Currently not serialised

*Note: This option is currently still in development

Low Temperature HP + Thermal Phase Change Storage 'UniQ HW 6 or 9' for Hot Water Only – [Consult Sunamp for heat pump brand compatibility](#)

Low temperature heat pumps using refrigerants such as R32 are capable of achieving $\sim 65^{\circ}\text{C}$ and provide a good match for UniQ HW +iLTHP heat batteries with PCM 58. In this scenario the heat pump runs at lower temperatures (and max efficiency) to directly supply central heating.

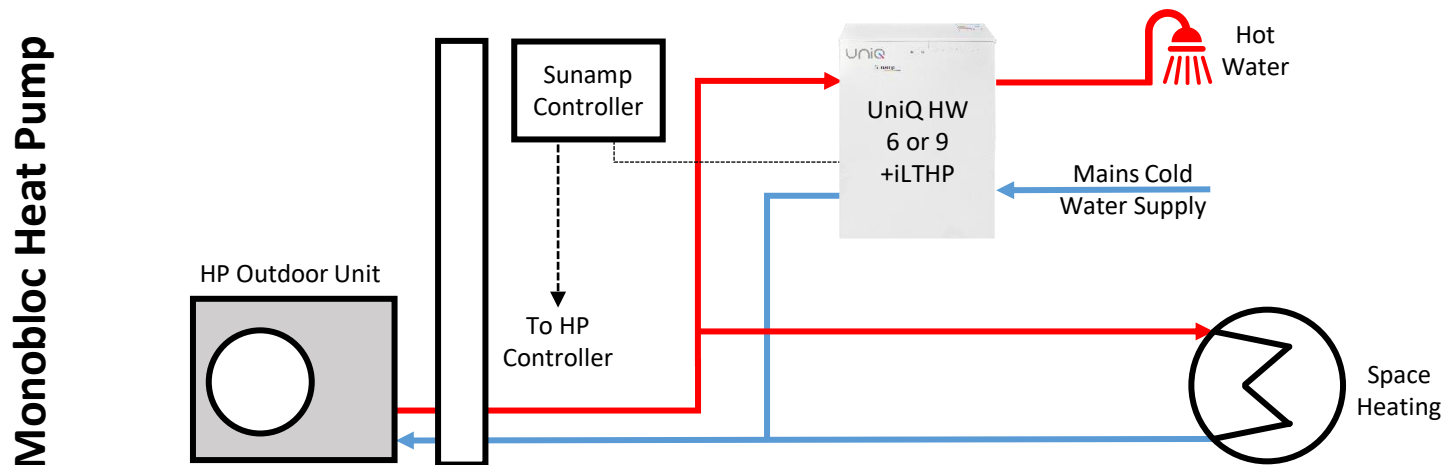
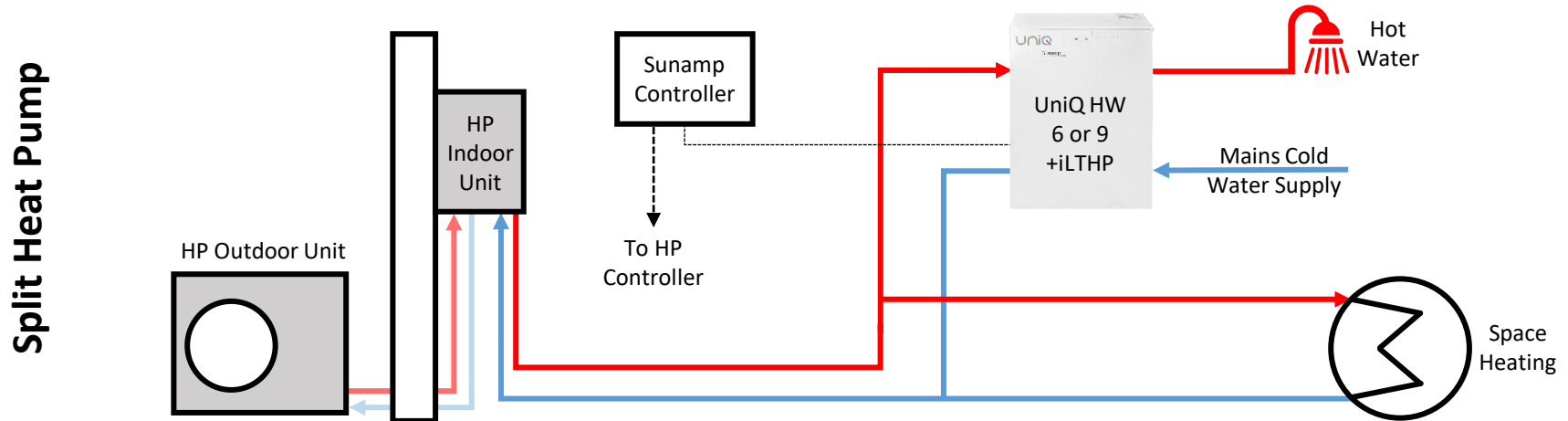
The heat pump would then run at a slightly higher temperature ($\sim 65^{\circ}\text{C}$) for short periods of time in order to charge the UniQ HW battery. Thus this combination provides maximum space savings and comfort with maximum performance.

- System Package consists of:
 - LT air-source heat pump
 - UniQ heat battery for hot water with top up electric heating element
 - On the rare occasion that the Low Temp ASHP cannot achieve 65°C the electric top up is automatically engaged. The heat pump continues to run and provide most of the energy with the electric element topping up a few degrees. The additional electrical energy required per year is roughly equivalent to the electricity needed to run anti-legionella cycles with a conventional cylinder. Note – heat batteries do not require anti-legionella cycles.
 - Sunamp controls package
- Design Specifications:
 - Hot Water Flow Temperature: $45\text{-}55^{\circ}\text{C}$ (selectable via TMV)
 - Central Heating Flow Temperature: Set by HP controller
 - Central Heating Delivery: Fan-assisted radiators/Fan-coils/Underfloor Heating

Package 1 - Schematic

Low Temperature HP + Thermal Phase Change Storage 'UniQ HW 6 or 9' for Hot Water Only –

Consult Sunamp for heat pump brand compatibility



Note: These schematics are for illustrative purpose only. Only air-source HPs are shown but the system configuration also applies to suitable ground-source heat pumps.

High Temperature HP + Thermal Phase Change Storage 'UniQ HW 6 or 9' for hot water supply only – [Consult Sunamp for heat pump brand compatibility](#)

When space is at a premium, the combination of a UniQ heat battery and a high temperature heat pump is the perfect fit.

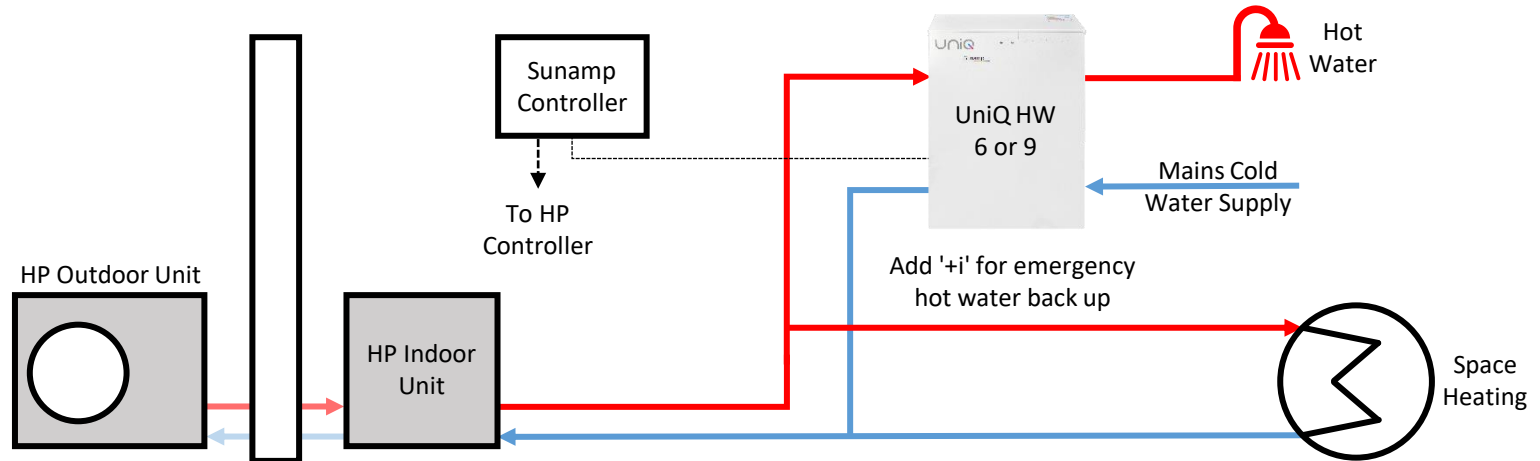
The ultra-compact heat battery combined with a heat pump directly supplying the heating allows for a minimum impact on useable space within the property. The very low heat losses of the heat battery mean that low cost electricity or PV can be used to reduce costs.

- System Package consists of:
 - HT air-source heat pump
 - UniQ heat battery for hot water
 - Sunamp controls package for hot water heating
 - There is an option to add a heating element via the '+i' option to provide emergency hot water back up when required (separate switch required)
- Design Specifications:
 - Hot Water Flow Temperature: 45-55°C (selectable via TMV)
 - Central Heating Flow Temperature: Set by HP controller
 - Central Heating Delivery: Traditional wet radiator system

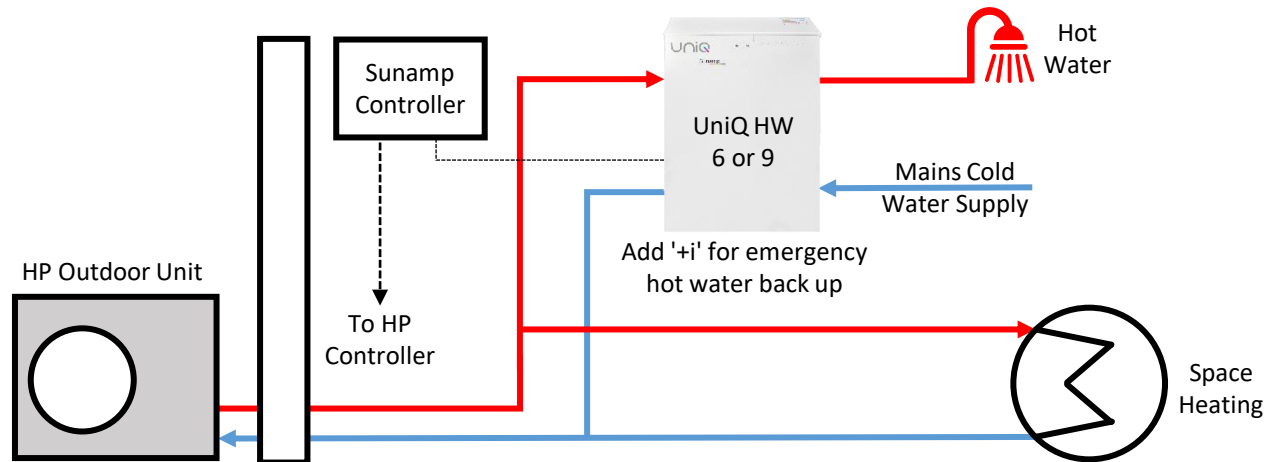
Package 2 - Schematic

High Temperature HP + Thermal Phase Change Storage 'UniQ HW 6 or 9' for hot water supply only – Consult Sunamp for heat pump brand compatibility

Dual-compressor split



Monobloc Heat Pump



Note: These schematics are for illustrative purpose only. Only air-source HPs are shown but the system configuration also applies to suitable ground-source heat pumps.

High Temperature HP + Thermal Phase Change Storage 'UniQ HW & UniQ HEAT' Batteries for Space Heating and Hot Water Time-Shift – **Consult Sunamp for heat pump brand compatibility**

Combining a high temperature heat pump with Sunamp's UniQ heat batteries for space heating and hot water time-shift allows consumers to benefit from low-cost electricity periods.

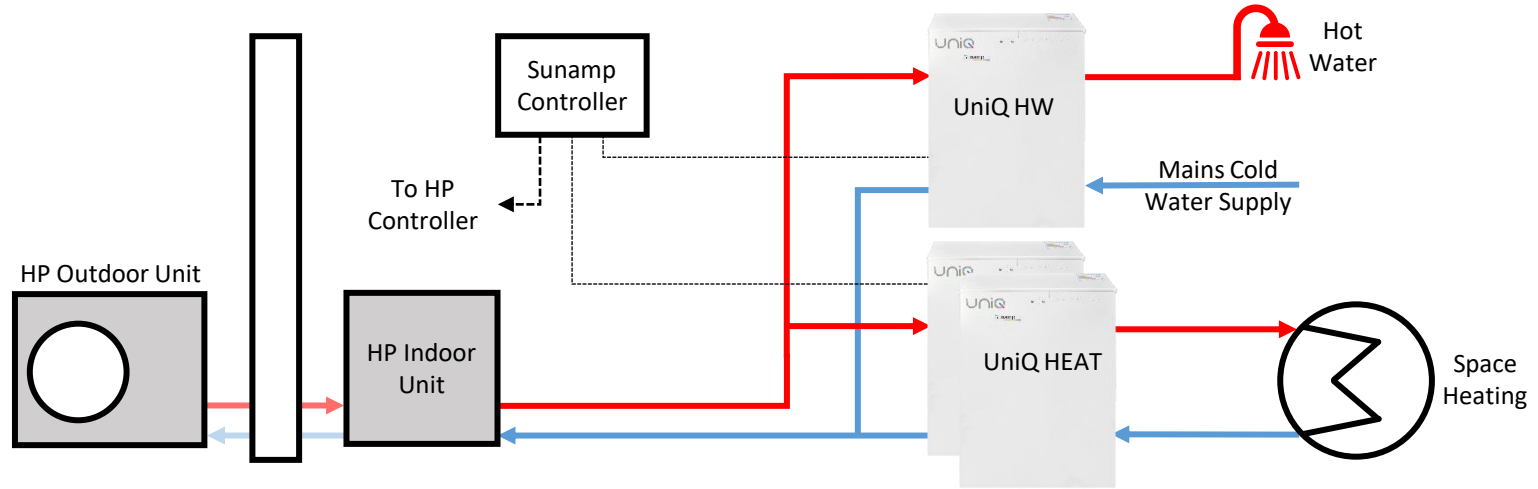
A further advantage of this system package are the flow temperatures (up to 55°C maximum). They mean that only a minimum of intervention is required on the heating system and allows end-users to operate more familiar on/off heating patterns.

- System Package consists of:
 - HT air-source heat pump (dual-compressor split or monobloc),
 - UniQ heat batteries for both space heating and hot water,
 - System hydraulics,
 - Sunamp controls package.
- Design Specifications:
 - Hot Water Flow Temperature: 45-55°C (selectable via TMV)
 - Central Heating Flow Temperature: 35-55°C (selectable via TMV – weather compensation possible)
 - Central Heating Delivery: Traditional wet radiator system sized for average radiator temperature of 50°C

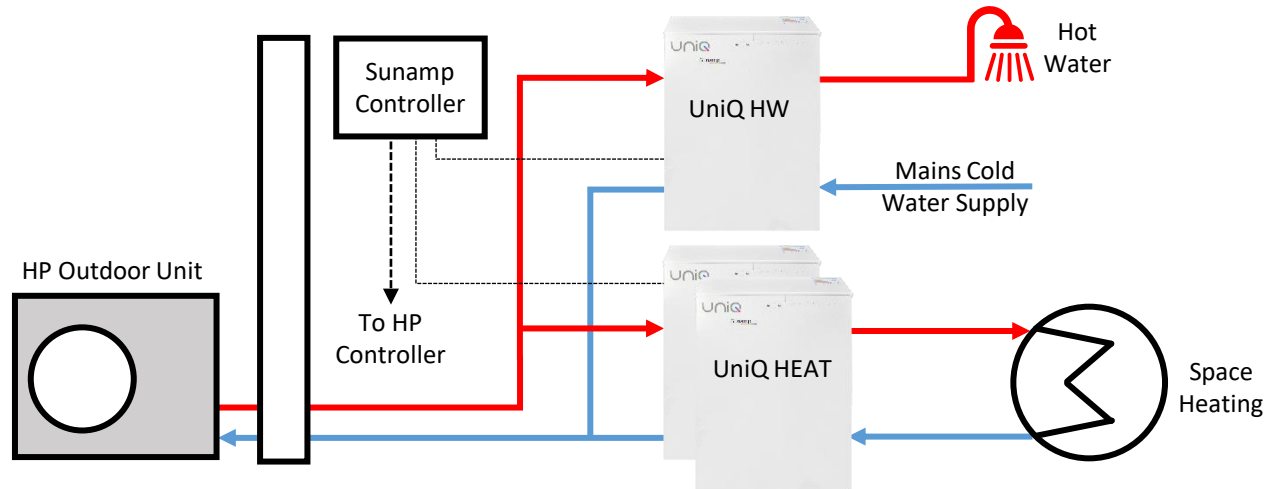
Package 3 - Schematic

High Temperature HP + Thermal Phase Change Storage 'UniQ HW & UniQ HEAT' Batteries for Space Heating and Hot Water Time-Shift – Consult Sunamp for heat pump brand compatibility

Dual-compressor split



Monobloc Heat Pump



Note: These schematics are for illustrative purpose only. Only air-source HPs are shown but the system configuration also applies to suitable ground-source heat pumps.

Low Temperature HP + UniQ PCM 43 & PCM 58 Heat Batteries for Space Heating and Hot Water Time-Shift (Currently being tested in lab – First field installations in Q1 2020)

Low temperature heat pumps not able to achieve $\sim 65^{\circ}\text{C}$ can be combined with Sunamp's UniQ heat batteries with PCM 43 & PCM 58 materials. Thus consumers benefit time-shift savings, while maintaining highest hot water comfort and keeping the benefits of low HP flow temperatures.

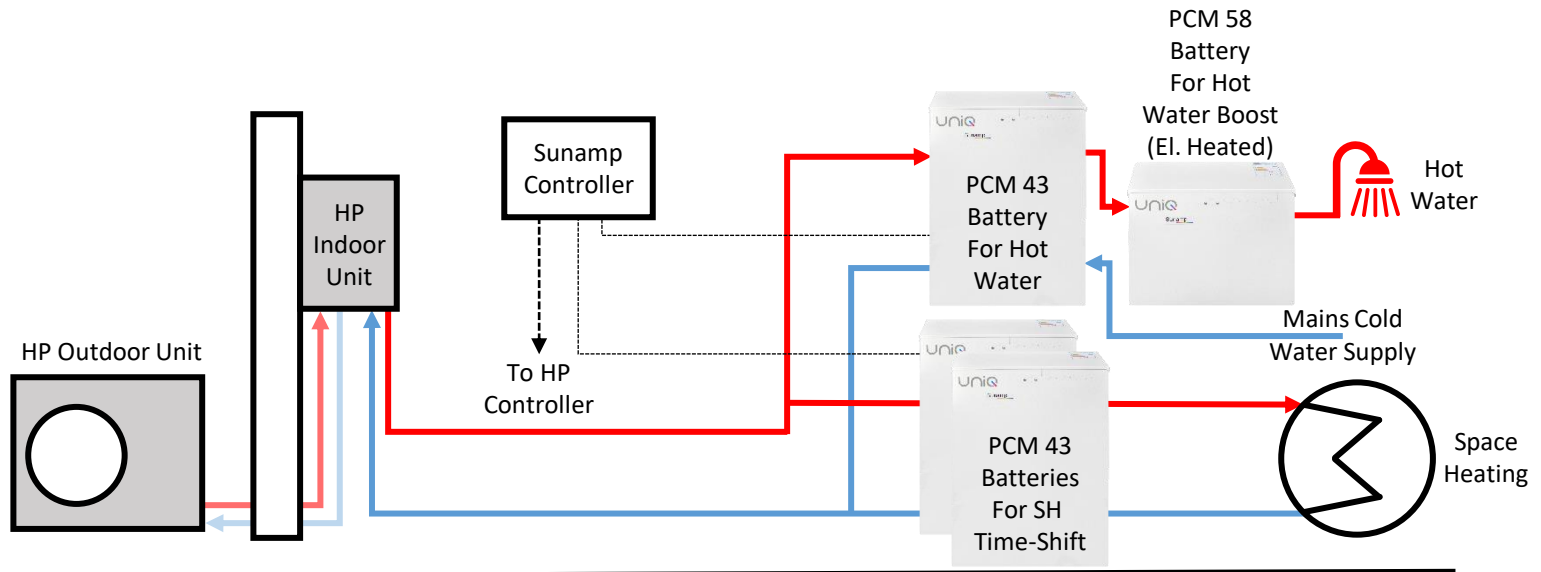
In this setup the heat pump provides energy at low temperatures and high efficiency to the space heating and hot water pre-heat batteries. To ensure hot water comfort an electrically heated UniQ heat battery then boosts the hot water temperatures.

- System Package consists of:
 - LT air-source heat pump
 - UniQ heat batteries with PCM 43 for space heating and hot water pre-heat time-shift
 - UniQ heat battery with PCM 58 as hot water booster.
 - Sunamp controls package for heating and hot water functions.
- Design Specifications:
 - Hot Water Flow Temperature: $45\text{-}55^{\circ}\text{C}$ (selectable via TMV)
 - Central Heating Flow Temperature: $25\text{-}37^{\circ}\text{C}$ (selectable via TMV – weather compensation possible)
 - Central Heating Delivery: Fan-assisted radiators/Fan-coils/Underfloor Heating

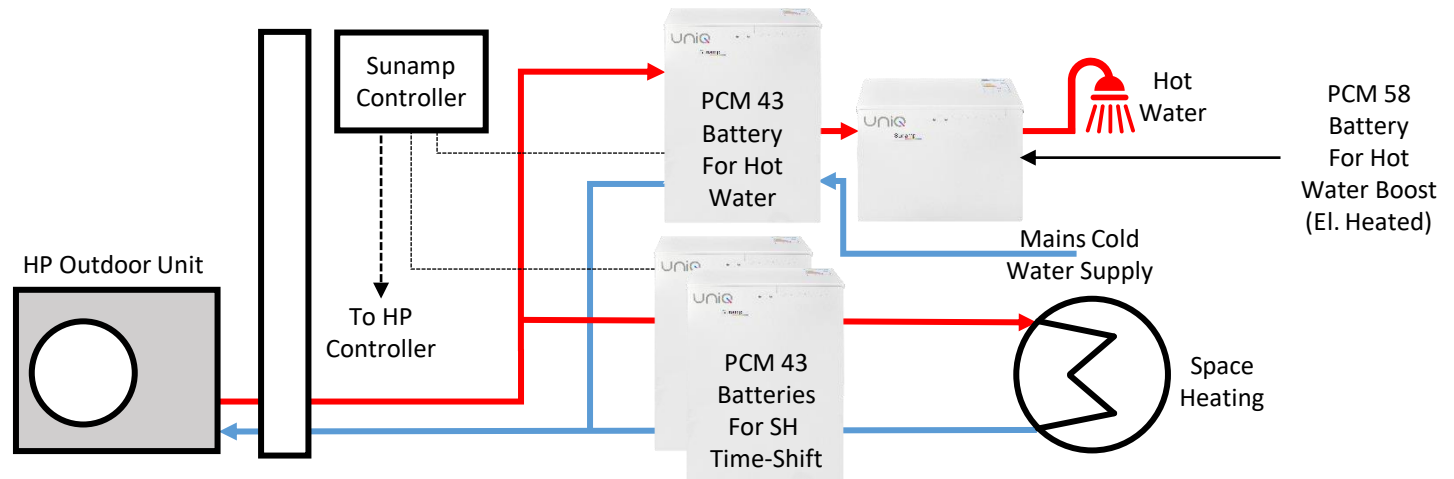
Package 4 - Schematic

Low Temperature HP + UniQ PCM 43 & PCM 58 Heat Batteries for Space Heating and Hot Water Time-Shift

Split Heat Pump



Monobloc Heat Pump



Note: These schematics are for illustrative purpose only. Only air-source HPs are shown but the system configuration also applies to suitable ground-source heat pumps.

Installations



- Communal Heating Systems
- Assisted Living Flats
- Large Luxury homes
- Social Housing
- High Rise Flats
- Modular Factory Fitted
- Village Halls
- Commercial CHP
- External Housing
 - Garages, out houses

8000+ Installations
Completed and Operational

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