UNIQ HEAT BATTERIES REFERENCE MANUAL_V2.3

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Abstract

This is a quick reference guide for selecting the UniQ range of heat batteries for the required application. For designing a heating system based on UniQ heat batteries use main manual

Sunamp Ltd

CONTENTS

1. Introduction

The Sunamp *UniQ* range of advanced and compact heat batteries (i.e. heat stores) use the Phase Change Materials (PCMs) to store heat for producing hot water and for space heating in buildings. Sunamp heat batteries can be classified as primary thermal because the hot water is heated instantaneously on demand by transferring heat from the PCM to the mains water flowing through it, and they function like buffer vessels for space heating applications.

The pipe connections and the construction of a *UniQ* range of batteries are shown in figures 1 and 2 respectively. The phase change material (PCM) and the heat exchangers are housed in a sealed enclosure called '*The Cell*'. Although the Cell is sealed, the pressure inside the Cell is around the ambient atmospheric pressure i.e. about 1.0bar absolute and is fitted with an expansion relief valve. The Cell is insulated using highly efficient vacuum insulation panels. The outer case and hydraulic and electrical connections are designed so that multiple batteries can either be stacked or positioned side by side and then connected either in series or parallel.

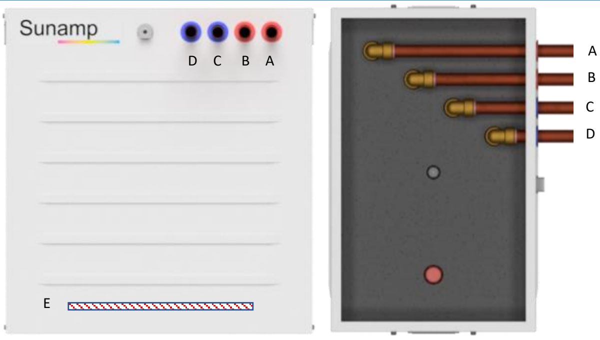


Figure 1: UniQ heat battery pipe connections – All models

A – D: High power hydronic circuit (22mm)
B – C: Low power hydronic circuit (22mm)
E: Electric heater – 'e' Series battteries only
F: Heater cable to controller – 'e' Series batteries only
G: Temperature sensors – All models

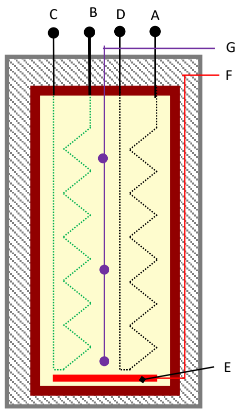


Figure 2: UniQ Heat battery construction

The *UniQ* range of heat batteries have two independent hydraulic circuits and either or both can be used for charging or discharging the heat batteries. The heat is transferred between the PCM and the high power (HPC) and the low power (LPC) hydronic circuits by means of an integrated heat exchanger inside the Cell.

The heat batteries are fitted with temperature sensors for measuring the charge state and for controlling their operation when connected to the Sunamp battery controller. All standard models of the *UniQ* range of heat batteries are supplied with PCM58 which has a phase transition temperature of 58°C.

The heat battery models covered by this document are listed in table 1.1. This document does not cover sizing, selection, configuration or design of the heating and hot water system in a building. It only covers installation and commissioning of the selected heat battery.

Table 1.1: UniQ Range of heat batteries

Generic range	Description	Models
UniQ HW	These heat batteries are heated by an external heat source (e.g. Gas boiler, Heat pump) and are designed for hot water heating only in buildings. Therefore, these batteries are direct replacement for vented and unvented Indirect hot water cylinders.	UniQ HW 3, UniQ HW 6, UniQ HW 9 And UniQ HW 12
UniQ HW+i	Same as the *'UniQ HW'* range but are fitted with a standby electric heater for heating the hot water when the main heat source fails.	UniQ HW 3+i, UniQ HW 6+i, UniQ HW 9+i & UniQ HW 12+i
UniQ HW+iPV	Same as the *'UniQ HW+i'* range but the AC power supply to the electric heater in the battery can be supplied from a PV system via an external PV power diverter controller. The rating of the PV system should not be greater than 2.5kWp.	UniQ HW 3+iPV, UniQ HW 6+iPV, UniQ HW 9+iPV & UniQ HW 12+iPV
UniQ eHW	These heat batteries are heated by internal electric heating elements only and therefore these heat batteries are equivalent to Direct vented or unvented hot water cylinders	UniQ eHW 3, UniQ eHW 6, UniQ eHW 9 & UniQ eHW 12
UniQ Dual	These heat batteries are designed to be heated by an external heat source (e.g. Gas boiler, Heat pump) and are suitable for storing heat for both space and hot water heating in the buildings. Therefore, these are direct replacement for integrated thermal stores.	UniQ Dual 3, UniQ Dual 6, UniQ Dual 9, UniQ Dual 12
UniQ eDual	These heat batteries are heated by integrated electric heaters and are designed for storing heat for both space and hot water heating only in buildings. Therefore, these are direct replacement for integrated electric thermal stores i.e. CPSU.	UniQ eDual 3, UniQ eDual 6, UniQ eDual 9, UniQ eDual 12

1.1. Advantages of *UniQ* Heat batteries

1.1.1. UniQ HW, UniQ eHW, UniQ Dual and UniQ eDual range

The main benefits of the *UniQ HW*, *UniQ eHW*, *UniQ Dual* and *UniQ eDual* heat batteries, compared with the traditional hot water cylinders and hot water only thermal stores are:

a) The heat is stored in the Phase Change Material and therefore the stored water content in the battery is less than 15 Litres and the hot water is heated instantaneously on demand. Therefore:
   - It does not need to comply with the Building Regulations, Part G3 requirements i.e. pressure & temperature relief (P&T) valve and the associated discharge pipework are not required.
   - The risks of legionella are significantly reduced.

b) Quicker and less costly installation.

c) No mandatory annual maintenance or inspection is required and therefore lower running costs.

d) Operational needs: Smaller space, typically 2 – 3 times smaller than the equivalent hot water cylinders and clean installation.

1.1.2. *UniQ Heat, UniQ eHeat, UniQ Dual and UniQ eDual* range

The main benefits of the *UniQ Heat* batteries (i.e. heat stores) compared with the hot water based thermal stores are:

a) The *UniQ Heat* batteries have low water content because over 90% of the heat is stored in the PCM and therefore, adding the *UniQ Heat* batteries to the heating system does not significantly increase the water content of the heating system. Therefore, in most installations, there is no need to increase either the size of expansion vessel or the required volume of water treatment chemicals.

b) Quicker and less costly installation because these heat batteries are supplied fully insulated and with a plug-in controller.

c) No mandatory annual maintenance or inspection is required and therefore lower running costs.

d) Operational needs e.g. smaller space, typically 2 – 3 times smaller than the equivalent hot water based thermal stores and clean installation.

2. Technical Specifications

The standard models of the Sunamp heat batteries are supplied with PCM58 and these heat batteries can be used with any heat source which can run at flow temperature greater than 65°C. The discharge temperature from these standard heat battery models will be between 52 and 55°C.

The overall dimensions and weights of the heat battery models in the *UniQ* range are listed in table 2.1 and their technical specification is listed in table 2.2. The pressure loss characteristics of the heat batteries are tabulated in tables 2.3a, 2.3b, 2.3d, 2.3e. The standard and optional equipment supplied with the heat batteries is listed in table 2.4.

Table 2.1. Overall dimensions and weights of UniQ heat battery range				
	Overall dimensions [mm]			Weight [1]
	Width	Depth	Height	[kg]
UniQ HW 3, UniQ Heat 3, UniQ Dual 3	365	575	410	55
UniQ HW 6, UniQ Heat 6, UniQ Dual 6	365	575	605	105
UniQ HW 9, UniQ Heat 9, UniQ Dual 9	365	575	815	155
UniQ HW 12, UniQ Heat 12, UniQ Dual 12	365	575	1,025	205
UniQ HW 3+i, UniQ HW 3+iPV, UniQ eHW 3, UniQ dPV 3	365	575	455	61
UniQ HW 6+i, UniQ HW 6+iPV, UniQ eHW 6, UniQ eDual 6	365	575	650	111
UniQ HW 9+i, UniQ HW 9+iPV, UniQ eHW 9, UniQ eDual 9	365	575	860	161
UniQ HW 12+i, UniQ HW 12+iPV, UniQ eHW 12	365	575	1,070	211
[1] The PCM in standard heat batteries has a phase transition temperature of 58°C				

Table 2.2: Technical specification of UniQ heat battery range					
		Size 3	Size 6	Size 9	Size 12
Storage capacity – Standard batteries with PCM58 [1]	[kWh]	3.5	7.0	10.5	14.0
Water content – Low power circuit (LPC) [3] Water content – High power circuit (HPC) [4]	[L] [L]	1.30 2.24	2.36 4.48	3.46 6.76	4.56 9.04
Equivalent hot water cylinder size [5]	[L]	71	142	212	284
V_{40}, Volume of hot water available at 40°C [6]	[L]	85	185	300	370
• Heat loss rate • Heat loss rate • ErP Rating class – Hot water storage vessel	[kWh/24h] [W] [-]	0.449 18.7 A⁺	0.649 27.0 A⁺	0.738 30.7 A⁺	0.809 33.7 A⁺
Recommended maximum HW flow rate	[L/min]	6	15	20	25
Minimum cold water supply pressure at inlet to the heat battery	[bar] [MPa]	1.00 0.10	1.50 0.15	1.50 0.15	1.50 0.15
Maximum working pressure: High power (HPC) and Low power (LPC) circuits	[bar] [MPa]	10.0 1.0	10.0 1.0	10.0 1.0	10.0 1.0
Pressure loss characteristics (See tables 2.3) ▪ K_V Value for the Low power circuit (LPC) ▪ K_V Value for the High power circuit (HPC)	 [-] [-]	 1.623 2.871	 1.255 2.356	 1.066 1.951	 0.963 1.451
Minimum heat source flow temperature [7]	[°C]	65	65	65	65
Maximum heat source flow temperature [8]	[°C]	85	85	85	85
Hot water outlet temperature at design flow rate [9]	[°C]	50 - 55	50 - 55	50 - 55	50 - 55
Heat battery controller • CC power supply rating at 230V, AC, 50Hz [10] • Electric heater supply rating at 230V, AC, 50Hz [11] • Standby power consumption – All models • Power rating of the heater at 230V, AC, 50Hz ('e' models only)	 [A] [A] [W] [W]	 6 16 7 2,800	 6 16 7 2,800	 6 16 7 2,800	 6 32 7 2,800

Notes – Table 2.2

1) *Batteries operating as hot water heaters. Charged to 75°C and then discharged using mains cold water at 10°C until the hot water outlet temperature dropped to 40°C.*
2) *Batteries operating as hot water heaters. Charged to 55°C and then discharged using mains cold water at 10°C until the hot water outlet temperature dropped to 40°C.*
3) *For UniQ HW and UniQ HW+I heat batteries, the low power circuit (LPC) is connected to external heat source e.g. a boiler.*
4) *For UniQ HW and UniQ HW+I heat batteries, the high power circuit (HPC) is connected to the mains cold water supply for producing hot water.*

5) *Calculated from the storage capacity of the heat battery and assuming that the hot water cylinder thermostat is set at 60°C, mains cold water inlet temperature is at 10°C and the stored energy utilisation factor of cylinder is 0.85.*
6) *Calculated from the storage capacity of the heat battery and assuming that the hot water outlet temperature is set at 40°C, mains cold water inlet temperature is at 10°C and the stored energy utilisation factor of cylinder is 0.95.*
7) *To fully charge the heat battery, the source flow temperature should be set so that it does not start to cycle on its internal thermostat and it should not be less than the value stated in table 4.2a. The battery will be fully charged when the battery return temperature is about 5°C less than the heat source flow temperature.*
8) *Maximum constant heat source flow temperature when charging the heat battery.*
9) *Recommended setting for the hot water thermostatic blending valve*
10) *Power supply to the heat battery/system controller via local 2-pole isolator*
11) *Power supply for the standby electric heater vial local 2-pole isolator – Only for UniQ HW+I type of heat batteries*

Table 2.3a: Pressure loss characteristic of UniQ size 3 batteries – All generic types							
Flow rate		Low power circuit (LPC)		High power circuit (HPC)		HPC & LPC Circuits in parallel	
[L/s]	[m³/h]	[bar]	[kPa]	[bar]	[kPa]	[bar]	[kPa]
0.10	0.360	0.049	4.920	0.016	1.572	0.006	0.640
0.20	0.720	0.197	19.680	0.063	6.289	0.026	2.560
0.30	1.080	0.443	44.280	0.142	14.151	0.058	5.760
0.40	1.440	0.787	78.721	0.252	25.157	0.102	10.240
0.50	1.800	1.230	123.001	0.393	39.308	0.160	16.000
0.60	2.160	1.771	177.121	0.566	56.603	0.230	23.040
0.70	2.520	2.411	241.082	0.770	77.043	0.314	31.360
0.80	2.880	3.149	314.882	1.006	100.628	0.410	40.960
0.90	3.240	3.985	398.523	1.274	127.357	0.518	51.840
1.00	3.600	4.920	492.003	1.572	157.231	0.640	64.000

Table 2.3b: Pressure loss characteristic of UniQ size 6 batteries – All generic types							
Flow rate		Low power circuit (LPC)		High power circuit (HPC)		HPC & LPC Circuits in parallel	
[L/s]	[m³/h]	[bar]	[kPa]	[bar]	[kPa]	[bar]	[kPa]
0.10	0.360	0.082	8.228	0.023	2.335	0.010	1.000
0.20	0.720	0.329	32.914	0.093	9.339	0.040	4.000
0.30	1.080	0.741	74.056	0.210	21.013	0.090	9.000
0.40	1.440	1.317	131.655	0.374	37.357	0.160	16.000
0.50	1.800	2.057	205.711	0.584	58.371	0.250	25.000
0.60	2.160	2.962	296.224	0.841	84.054	0.360	36.000
0.70	2.520	4.032	403.194	1.144	114.406	0.490	49.000
0.80	2.880	5.266	526.620	1.494	149.429	0.640	64.000
0.90	3.240	6.665	666.504	1.891	189.121	0.810	81.000
1.00	3.600	8.228	822.844	2.335	233.483	1.000	100.000

Table 2.3c: Pressure loss characteristic of UniQ size 9 batteries – All generic types							
		Low power circuit (LPC)		High power circuit (HPC)		HPC & LPC Circuits in parallel	
[L/s]	[m³/h]	[bar]	[kPa]	[bar]	[kPa]	[bar]	[kPa]
0.10	0.360	0.114	11.405	0.034	3.405	0.014	1.424
0.20	0.720	0.456	45.620	0.136	13.619	0.057	5.695
0.30	1.080	1.026	102.644	0.306	30.643	0.128	12.814
0.40	1.440	1.825	182.478	0.545	54.477	0.228	22.781
0.50	1.800	2.851	285.122	0.851	85.120	0.356	35.595
0.60	2.160	4.106	410.576	1.226	122.572	0.513	51.257
0.70	2.520	5.588	558.839	1.668	166.835	0.698	69.767
0.80	2.880	7.299	729.912	2.179	217.907	0.911	91.124
0.90	3.240	9.238	923.795	2.758	275.788	1.153	115.329
1.00	3.600	11.405	1,140.488	3.405	340.479	1.424	142.382

Table 2.3d: Pressure loss characteristic of UniQ Heat 12, UniQ HW 12, UniQ eHW 12, UniQ Dual 12 and UniQ eDual 12							
Flow rate		Low power circuit (LPC)		High power circuit (HPC)		HPC & LPC Circuits in parallel	
[L/s]	[m³/h]	[bar]	[kPa]	[bar]	[kPa]	[bar]	[kPa]
0.10	0.360	0.140	13.975	0.062	6.156	0.022	2.224
0.20	0.720	0.559	55.900	0.246	24.622	0.089	8.896
0.30	1.080	1.258	125.775	0.554	55.400	0.200	20.016
0.40	1.440	2.236	223.600	0.985	98.490	0.356	35.584
0.50	1.800	3.494	349.375	1.539	153.890	0.556	55.599
0.60	2.160	5.031	503.101	2.216	221.601	0.801	80.063
0.70	2.520	6.848	684.776	3.016	301.624	1.090	108.975
0.80	2.880	8.944	894.401	3.940	393.958	1.423	142.335
0.90	3.240	11.320	1,131.977	4.986	498.603	1.801	180.142
1.00	3.600	13.975	1,397.502	6.156	615.560	2.224	222.398

Table 2.4: Standard and optional equipment		
	UniQ HW 3, UniQ HW 6, UniQ HW 9, UniQ HW 12 UniQ Heat 3, UniQ Heat 6, UniQ Heat 9, UniQ Heat 12 UniQ Dual 3, UniQ Dual 6, UniQ Dual 9, UniQ Dual 12	UniQ eHW 3, UniQ eHW 6, UniQ eHW 9, UniQ eHW 12 UniQ HW 3+i, UniQ HW 6+i, UniQ HW 9+i, UniQ HW 12+i UniQ HW 3+iPV, UniQ HW 6+iPV, UniQ HW 9+iPV, UniQ HW 12+iPV
Standard equipment	a) Battery controller UniQ_SBC_03 b) Installation & commissioning manual c) Battery installation kit SA_BI_K01	a) Battery controller UniQ_SBC_01 or UniQ_SBC_02 b) Installation & commissioning manual c) Battery installation kit SA_BI_K01
Optional equipment	a) Hot water thermostatic blending valve	a) Hot water thermostatic blending valve

3. UniQ_SBC_B Series Controller

3.1. Description

The *UniQ_SBC_B* series controller is housed in a separate box and is supplied with each heat battery. The controller parameters can be changed on-site.

The variants of the control boxes available to match the different heat battery types as described below in table 3.1. All control boxes have the same outer case, although the number of wire entries and the internal wiring differ.

The controller inputs and outputs are listed in table 3.2. The default heat battery control set points are listed in table 3.3.

Warning:

live parts are accessible on the PCB and terminal strips. Connections and setup should be carried out by approved installer or competent personnel only.

Figure 3.1: UniQ SBC B Controller & heat battery package

Table 3.1: Heat battery controller selection

Controller type	Heat battery type	Control logic i.e. Program No (See section 3.2.2)	Wiring diagram	Comments
UniQ_SBC_B100	UniQ eHW UniQ eHeat UniQ eDual	Program No: 1	Figure 6.1	The controller UniQ SBC_B100 with logic program 1 selected is designed to control the operation of heat batteries heated by grid electricity only.
UniQ_SBC_B100	UniQ HW+i UniQ Dual+i	Program No: 2 Option 2: Off	Figure 6.2	The controller UniQ SBC_B100 with logic program 2 selected and with option 2 set to OFF is designed to control the operation of heat batteries which are mainly heated by external heat source e.g. boiler and have back up electric heater fitted which is connected to grid electricity only.
UniQ_SBC_B100	UniQ HW+iPV UniQ Dual+iPV	Program No: 2 Option 2: On	Figure 6.3	The controller UniQ SBC_B100 with logic program 2 selected and with option 2 set to ON is designed to control the operation of heat batteries which are mainly heated by external heat source e.g. boiler and the electric heater fitted which is connected to PV system via diverter controller.
UniQ_SBC_B200	UniQ HW UniQ Heat UniQ Dual	Program No: 3	Figure 6.4	The controller will only control an external heat source and should only be used with heat batteries which are NOT fitted with electric heating element
UniQ_SBC_B300	UniQ HW+LTHP	Program No:	Figure	The controller will control an external low temperature heat pump and an auxiliary heater to achieve proper melting of the cell.
UniQ_SBC_B400	UniQ CUPSU system	Program No:	Figure	This Controller is designed for managing the electric CPSU package consisting of 2 UniQ eDual heat batteries

Table 3.2: Controller inputs and outputs			
Inputs	PCB Pins	Reading	
Temperature sensor S1	J1.2 & J1.1	T1 / °C	Terminal marked T1 and 0V
Temperature sensor S2	J1.2 & J1.3	T2 / °C	Terminal marked T2 and 0V
Temperature sensor S3	J1.2 & J9-1	T3 / °C	
LINK 1	J1.8 & J1.6		Terminal marked FV and 0V
LINK 2	J1.8 & J1.7		Terminal marked FT and 0V
SW1 & SW2			Settings – see Controller Setup
Outputs	PCB Pins	Reading	
Heater control: Relay output - 1	J5-5 & J5-6	OR1. 0 or 1	
Boiler control: Relay output - 2	J5-1 & J5-2	OR2. 0 or 1	

Table 3: Control set points (°C)– Temperature sensors					
		UniQ_SBC_XX Controller type			
		_SBC_01	_SBC_02		_SBC_03
T_S1_ON	Bottom temperature sensor, TS1, heating demand on set point	65	45		45
T_S1_OFF	Bottom temperature sensor, TS1, heating demand off set point	77	65		65
T_S2_ON	Middle temperature sensor, TS2, heating demand on set point	55	55		55
T_S2_OFF	Middle temperature sensor, TS2, heating demand off set point	77	75		75
T_S3_ON	Top temperature sensor, TS3, heating demand on set point	45	65		65
T_S3_OFF	Top temperature sensor, TS3, heating demand off set point	75	77		77
T_S3_MAX_OFF	Maximum temperature permitted for sensor – Off limit, TS3 (Top)	85	85		85
T_S3_MAX_ON	Maximum temperature permitted for sensor - On, TS3 (Top)	80	80		80
T_S1_MAX_OFF	Maximum temperature permitted for sensor – Off limit, TS3 (Bottom)	85	85		85
T_S1_MAX_ON	Maximum temperature permitted for sensor - On, TS3 (Bottom)	80	80		80

3.2. Controller setup

3.2.1. Select options

Depending on the application, different options may be selected.

Holding switch, SW1, down will show the current setting on the 4 LEDs. Holding this switch down for longer than 5 seconds will cause the LEDs to cycle. Release the switch, SW1, when the correct pattern of LEDs is illuminated, and this choice will be stored. Refer to the Control Logic section for further explanation.

LED #	Option #	Option description Show/set by holding down SW1
D4	4	--
D3	3	Heat pump (65°C flow)
D2	2	PV input possible
D1	1	Charging demand level

3.2.2. Select program

One of 3 programs can be selected to match the application. Ensure that the correct program is chosen, or incorrect operation will result.

Holding switch, SW2, down will show the current setting on the 4 LEDs. Holding the switch down for longer than 5 seconds will cause the LEDs to cycle. Release the switch, SW2, when the correct LED is illuminated, and this choice will be stored.

LED #	Controller program Show/set by holding down SW2
D4	--
D3	Program 3
D2	Program 2
D1	Program 1

3.2.3. Indicators

LED #	Power on, normal operation	Temperature sensor fault	"Cold start" active
D4	Off	Flashing	Off
D3	Off	Flashing	Off
D2	Off	Flashing	Flashing
D1	Power on	On	On

LED D5: Boiler demand signal. The low current relay will be activated when this LED is illuminated.

LED D6: Heater demand signal. The high current contactor will be activated when this LED is illuminated.

3.3. Control logic

3.3.1. Program 1 (Electric storage water heater)

- *Heating from bottom to top*
- *Cooling from top to bottom*
- *Option 1 on: demand signal generated when battery is approx. 90% depleted*
- *Option 1 off: demand signal generated when battery is approx. 50% depleted*

3.3.2. Program 2 (Thermal store with electric heater)

- *Heating from top to bottom with boiler and from bottom to top with electric heater*
- *Cooling from bottom to top for both boiler and electric heating options*
- *Option 1 on: boiler demand signal generated when battery is approx. 90% depleted*
- *Option 1 off: boiler demand signal generated when battery is approx. 50% depleted*
- *Option 2 on: electrical input is from solar PV diverter. High current relay will be activated to allow input whenever possible.*
- *Option 2 off: electrical input is from "backup" heater switch*
- *Option 3 on: Heat pump mode – requires 65°C flow temperature*
- *Option 3 off: Boiler mode – requires 80°C flow temperature*

3.3.3. Program 3 (Thermal store heated by external heat source)

- *Heating from top to bottom*
- *Cooling from bottom to top*
- *Option 1 on: demand signal generated when battery is approx. 90% depleted*
- *Option 1 off: demand signal generated when battery is approx. 50% depleted*
- *Option 3 on: Heat pump mode – requires 65°C flow temperature*
- *Option 3 off: Boiler mode – requires 80°C flow temperature*

4. Design of cold and hot water supplies

4.1. General requirements

a) Minimum dynamic mains water supply pressure = 1.5bar
b) Maximum dynamic mains water supply pressure = 10.0bar
c) Minimum mains cold and hot water pipe sizes (Up to UniQ HW 9, UniQ Dual 9 models) = 22mm copper or equivalent
d) Minimum mains cold and hot water pipe sizes (Above UniQ HW 9, UniQ Dual 9 models) = 28mm copper or equivalent
e) Expansion vessel charge pressure (If fitted) = Incoming mains pressure (bar)

Note:

Although the heat batteries are designed for 10bar maximum working pressure, it is recommended that if the incoming mains pressure is greater than 5bar, a WRAS approved pressure regulator set at 5.0bar should be fitted for comfort of the occupants.

4.2. Water distribution network design

a) The water distribution network should be sized and designed to comply with the requirements of the relevant sections of:
b) BS EN 806-1:2000, BS EN 806-2:2005, BS EN 806-3:2012, BS EN 806-4:2010, BS EN 806-5:2012, Design, installation, testing and maintenance of services supplying water for domestic use within building and their curtilage
c) Domestic Building Services Compliance Guide 2013 edition incorporating 2018 amendments
d) The Water Supply (Water Fittings) Regulations i.e. WRAS

4.3. Hot water circuit expansion vessel sizing

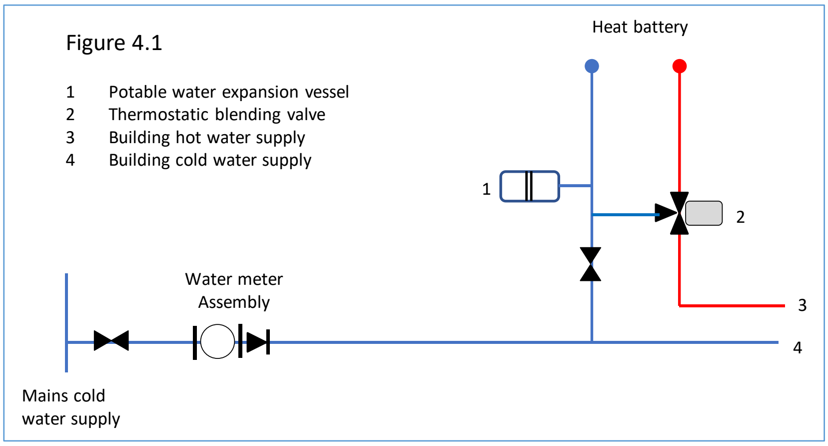
Unlike the vented and unvented cylinders, the hot water in the heat batteries is heated instantaneously on demand just like a gas combination boiler and the stored water content is very low (Less than 15 litres in most models – See technical specification section 4 in this manual). Therefore, the expansion vessel is not normally required.

However, the expansion vessel should be sized and fitted as shown schematically in figure 4.1 if the cold water mains coming into the building is fitted with a non-return valve which would prevent the water from the heat battery expanding back into the cold water mains during the heating phase.

[***Note:*** *Cold water supply into apartments and water meter assemblies are normally fitted with a non-return valve*].

Figure 4.1

1 Potable water expansion vessel
2 Thermostatic blending valve
3 Building hot water supply
4 Building cold water supply



The expansion vessel for the DHW heating batteries can be sized using equations 1 – 3.

$V_E = (V_{HB} \times E_C) / (1 - P_1/P_2)$ ----- [1]
$P_1 = P_I + 1.014$ ----- [2]
$P_2 = P_F + 1.014$ ----- [3]

Where

V_E = Total volume of the expansion vessel, [L]
V_{HB} = Water content of the heat battery circuit used for DHW heating - From technical data tables, [L]
E_C = Hot water expansion factor for standard heat batteries, E_C = 0.03
P_1 = Absolute initial expansion vessel charge pressure, [bar]
P_2 = Maximum absolute working pressure of the heat battery water circuit, [bar]
P_I = Initial expansion vessel charge pressure = CW mains pressure, [bar]
P_F = Maximum working pressure of heat battery water circuits = 10.0, [bar]

4.4. Hot water secondary circulation and trace heating

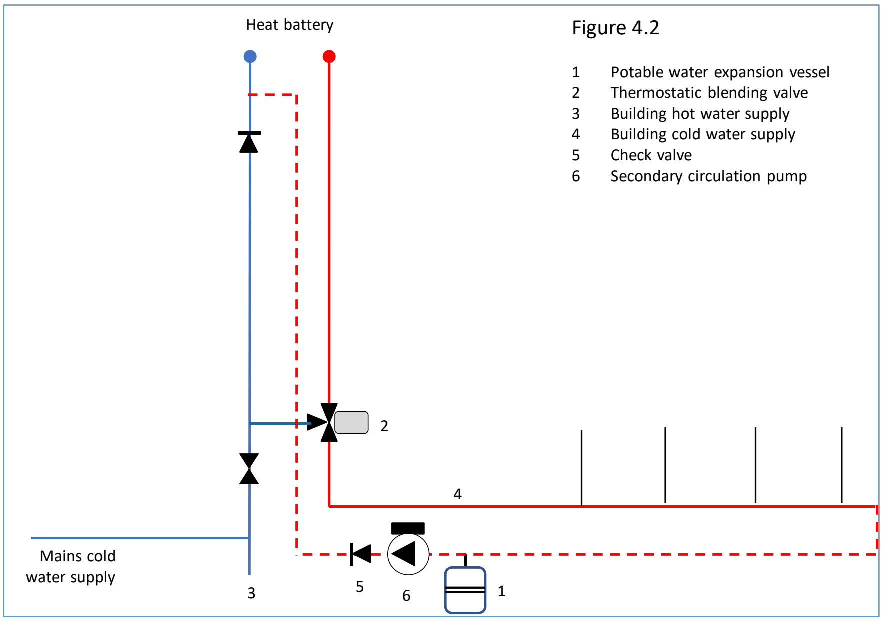
Secondary circulation or trace heating should be provided when the length of hot water pipe work and its water content becomes such that it would take an unreasonable length of time for hot water to reach the terminal fitting.

The Government guidance recommends that when opening a tap, or other outlet, the water should reach 50°C within 30 seconds.

The normal method for sizing the secondary circulation pipework is to calculate the heat loss from all the 'flow' and 'return' pipe circuits in the system. From this data, the flow rate required in each section to replace the heat loss in that section.

The Institute of Plumbing (IOP) guide states that as a *'rule of thumb'*, the return pipe size for the secondary circulation can be taken as two sizes below the flow pipe as first estimate for sizing the secondary return system.

The schematic diagram of secondary hot water circulation arrangement with Sunamp UniQ range of hot water batteries is shown in figure 4.2.



Notes:

a) All components in the secondary circulation loop (e.g. pump, expansion vessel, non-return valve) should have WRAS approval.

b) With PCM58 heat batteries, the hot water temperature in the secondary hot water circulation loop will be between 50 and 55°C.

4.5. Hard water areas

In hard water areas where mains water hardness can exceed 150 ppm Total Hardness, you must install a scale reducing device in the cold water supply to the heat batteries to reduce the rate of accumulation of limescale. The limescale can be controlled using one of the following devices:

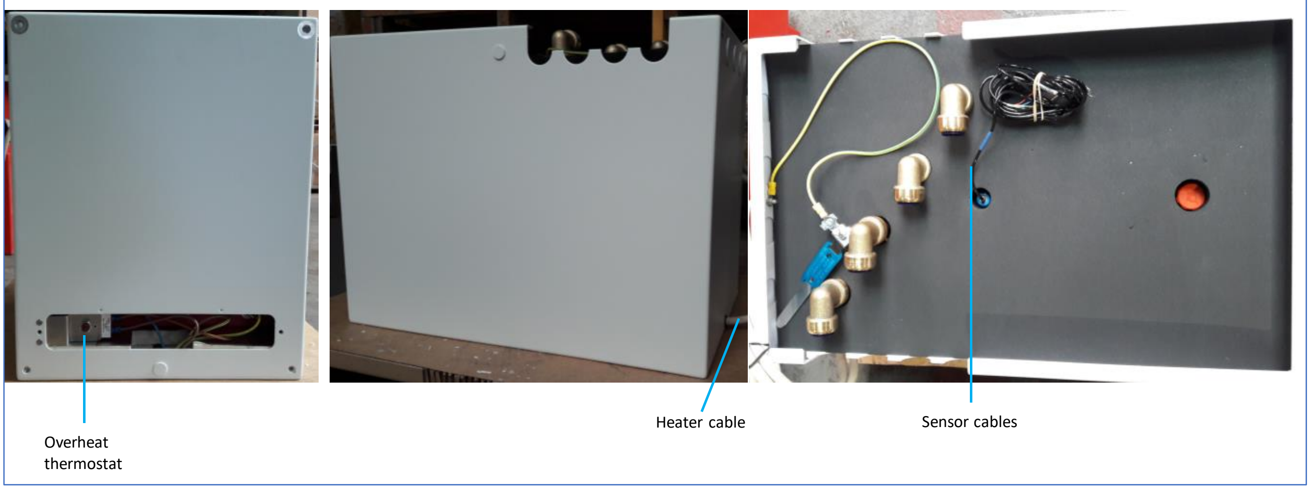
a) Chemical limescale inhibitors
b) Polyphosphate dosing
c) Electrolytic scale reducers
d) Water softeners

5. Installation Guide lines

5.1. General wiring recommendations

a) The heat batteries must be earthed. The wiring external to the heat batteries must be in accordance with the current I.E.E. (BS.7671) Wiring Regulations and any local regulations which apply. For IE reference should be made to the current ETCI rule for electrical installations.
b) The point of connection to the mains should be readily accessible and adjacent to the heat battery installation.
c) Control circuit mains wiring to the Sunamp controller should be 3 core PVC insulated cable, not less than 0.75 mm^2 (24 x 0.2mm), and to BS 6500 Table 16.
d) The mains wiring to the Sunamp controller for the nominal 3kW nominal electric heaters factory fitted in the heat batteries, should be 3 core PVC insulated cable, not less than 2.5 mm^2 (24 x 0.2mm), and to BS 6500 Table 16.
e) Connection must be made in a way that allows complete isolation of the electrical supply such as a double pole switch having a 3mm (1/8") contact separation in both poles. The means of isolation must be accessible to the user after installation.
f) All models of *UniQ* heat batteries are fitted with 3 temperature sensors as shown in figure 5.1. The *UniQ 'e'* models are also fitted with electric heating element as shown in figure 5.1.

Figure 5.1: UniQ direct electrically heated battery

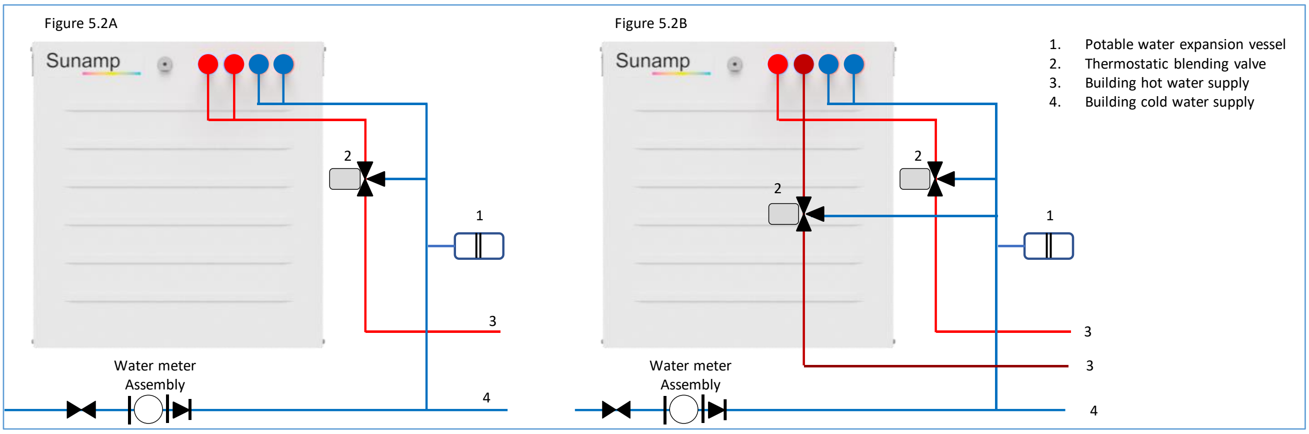


5.2. *UniQ eHW* batteries

5.2.1. Mains cold water and hot water supplies

The *UniQ eHW* batteries are designed for producing hot water in dwellings and are heated directly by electricity. Therefore, these heat batteries are equivalent to direct electrically heated hot water cylinders. The general requirements for designing hot water network are given in section 4 of this document.

a) Pipe connections – All model in this range: 22mm copper.
b) The *UniQ eHW* batteries are not suitable for tank fed hot water systems.
c) The *UniQ eHW* models are heated by integrated electric heaters and therefore are generally installed with high and low power circuits connected in parallel as shown in figure 5.2A. However larger sizes (above *UniQ eHW 6*) can be installed with two hot independent hot water circuits as shown in figure 5.2B.
d) For minimum and maximum working pressures see technical section and section 4.1.



5.2.2. Electricity supply and wiring

The *UniQ eHW* batteries are designed for installation with UniQ_SBC_01 controller. See section 6 for wiring information.

5.3. *UniQ HW*, *UniQ Heat & UniQ Dual* batteries

5.3.1. Mains cold water and hot water supplies

The *UniQ HW*, *UniQ Heat* and the *UniQ Dual* heat batteries are designed to be heated by an external heat source (e.g. boiler, heat pump). The *UniQ HW* batteries are designed for producing mains pressure hot water in buildings and therefore, these heat batteries are equivalent to indirect unvented hot water cylinders or hot water only thermal stores. The *UniQ Heat* batteries are designed for buffering heat for space heating in buildings and therefore these are equivalent to conventional buffer vessels. The *UniQ Dual* heat batteries are designed for buffering heat for both hot water heating and space heating and therefore these are equivalent to Integrated Thermal Stores. The general requirements for designing hot water network are given in section 4 of this document.

a) Pipe connections – All model in this range: 22mm copper.
b) The *UniQ HW* batteries are not suitable for tank fed hot water systems.
c) The hot water circuit should be connected to the high powered ports (D and A) and the heat source should be connected to the low power port (B and C) as shown schematically in figures 5.2A and 5.2B.
d) For minimum and maximum working pressures see section 4.1.

Heat source and heating circuit connections

A typical connection arrangement for the *UniQ Dual* is shown in figure 5.2B. When the mass flow rate in the heat source circuit is greater than the flow rate in the heating circuit, the difference will flow through the heat battery and charge it provided it is permitted to charge. When the mas flow rate in the heat source circuit is less than the mass flow rate in the heating circuit, the difference mass flow rate will flow from the heat battery to the heating circuit and the heat battery will discharge.

[***Note:*** *All heating system components are not shown in these figures*]

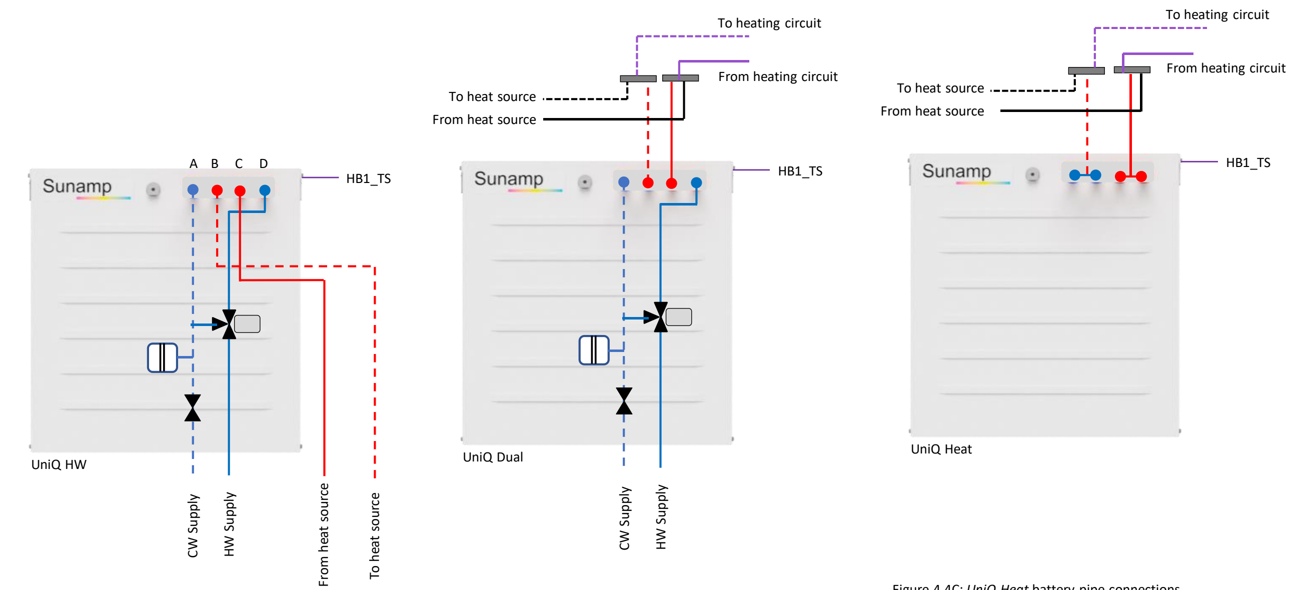


Figure 4.4A: *UniQ HW* battery pipe connections

Figure 4.4B: *UniQ Dual* battery pipe connections

Figure 4.4C: *UniQ Heat* battery pipe connections

A typical connection arrangement for the *UniQ Heat* configured as buffer vessel is shown in figure 5.2C. When the mass flow rate in the heat source is greater than the mass flow rate in the heating circuit, the difference will flow into the heat battery and charge it provided it is permitted to charge. When the mass flow rate in the heat source circuit is less than the mass flow rate to the heating circuit, the balance will flow from the heat battery circuit in to the heating circuit and the heat battery will discharge.

If hydraulic separation is required between the heat source and space heating circuits, then these circuits can be connected to low and high power circuits separately.

5.3.2. Electricity supply

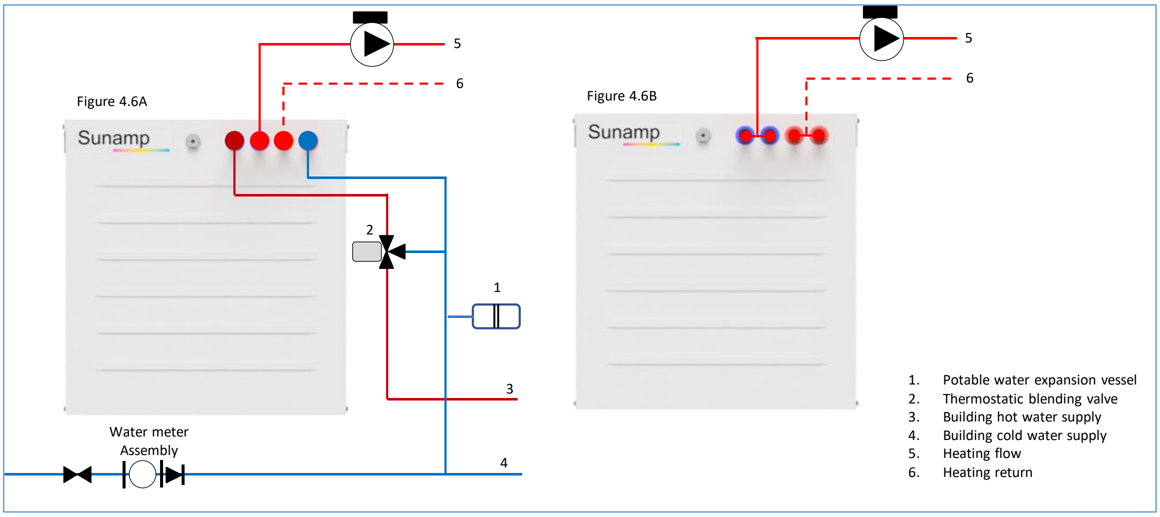
The *UniQ HW, UniQ Heat and UniQ Dual* heat batteries are supplied with a controller which manages the charging and provides the signal for controlling the external heat source. The wiring arrangements are described in section 6.2.

5.4. *UniQ eHeat & UniQ eDual* batteries

5.4.1. Mains cold water and hot water supplies

The *UniQ eDual* heat batteries are designed for storing heat which then can be used for producing hot water and for space heating in dwellings. These models are heated by internal electric heating elements. Therefore, these heat batteries are equivalent to hot water based electric thermal stores. The general requirements for designing hot water network are given in section 3 of this document.

a) Pipe connections – All model in this range: 22mm copper.
b) The *UniQ eDual* batteries are not suitable for tank fed hot water systems.
c) The hot water circuit should be connected to the high-powered ports (D and A) and the space heating load should be connected to the low power ports (B and C) as shown schematically in figure 4.6A.
d) For minimum and maximum working pressures see section 3.1.



5.4.2. Heating circuit connections

Typical connection arrangements for the *UniQ eDual* and the *UniQ eHeat* are shown in figures 4.6A and 4.6B respectively. The high and low powered ports connected in parallel for the *UniQ eHeat* batteries. [***Note:*** *These heat batteries should not be charged by an external heat source*]

5.4.3. Electricity supply

The *UniQ eHeat and UniQ eDual* heat batteries are supplied with a controller which manages the charging and discharging of the batteries. The wiring arrangements will depend upon the type of mains power supply for the heating elements. The wiring arrangement for these heat batteries is described in section 6.1.

5.5. *UniQ HW+iPV Heat & UniQ Dual* batteries

5.5.1. Mains cold water and hot water supplies

The *UniQ HW+i and UniQ HW+iPV* heat batteries are designed to be heated primarily by an external heat source (e.g. boiler, heat pump) and for producing mains pressure hot water heating in buildings. Therefore, these heat batteries are equivalent to indirect unvented hot water cylinders or hot water only thermal stores.

The *UniQ HW+i* models are fitted with standby electric heating elements to heat hot water when the main heat source fails.

The *UniQ HW+iPV* models are designed to use surplus PV power generation for hot water heating in conjunction with a PV power diverter controller with following restrictions:

- **a) The UniQ HW+iPV models cannot be used with heat pumps.**
- **b) The UniQ HW+iPV models cannot be used with installed PV capacity greater than 2.5kWp.**

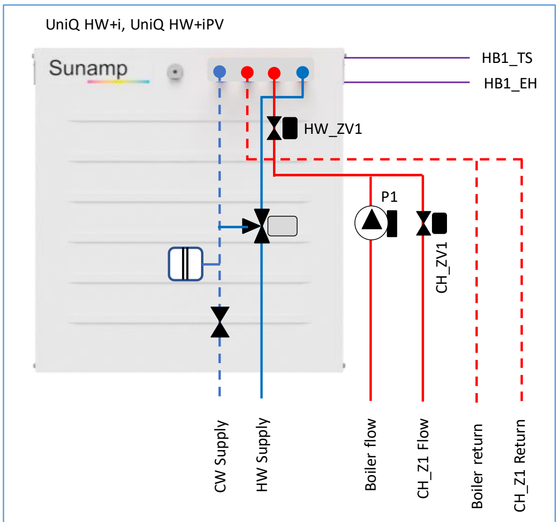


Figure 4.8: *UniQ HW+i, & UniQ HW+iPV* battery pipe connections

The general requirements for designing hot water network are given in section 3 of this document.

- a) Pipe connections – All model in this range: 22mm copper.
- b) The *UniQ HW* batteries are not suitable for tank fed hot water systems.

c) The hot water circuit should be connected to the high powered ports (D and A) and the heat source should be connected to the low power port (B and C) as shown schematically in figure 4.8.
d) For minimum and maximum working pressures see section 3.1.

5.5.2. Electricity supply

The *UniQ HW+i and UniQ HW+iPV* heat batteries are supplied with a controller which manages the charging and discharging of the batteries. These heat batteries require two independent power supplies and wiring diagrams are shown in section 6.3.

6. Electrical wiring

6.1. Heat batteries fitted with electric element

The heat battery will be supplied with a Uniq_SBC_B100 control box.

The schematics below include several different application examples. Please contact Sunamp if your application is not covered and you are not sure how to proceed.

Temperature sensors:

Unroll the 4-core sensor cable and run it through the grommet in the battery casing to the controller. Connect the sensor cables to the controller as shown in figure 6.1:

- Yellow cable: Terminal S0
- Blue cable: Terminal S1
- Red cable: Terminal S2
- Green cable: Terminal S3

Battery heater cable:

These batteries include pre-wired heating elements as shown in figure 5.1. Connect the heater cable to the controller as shown in figure 6.1:

- Brown (Live): Terminal 7 (Live)
- Blue (Neutral): Terminal 8 (Neutral)
- Green/Yellow (E): Terminal 9 (Earth)

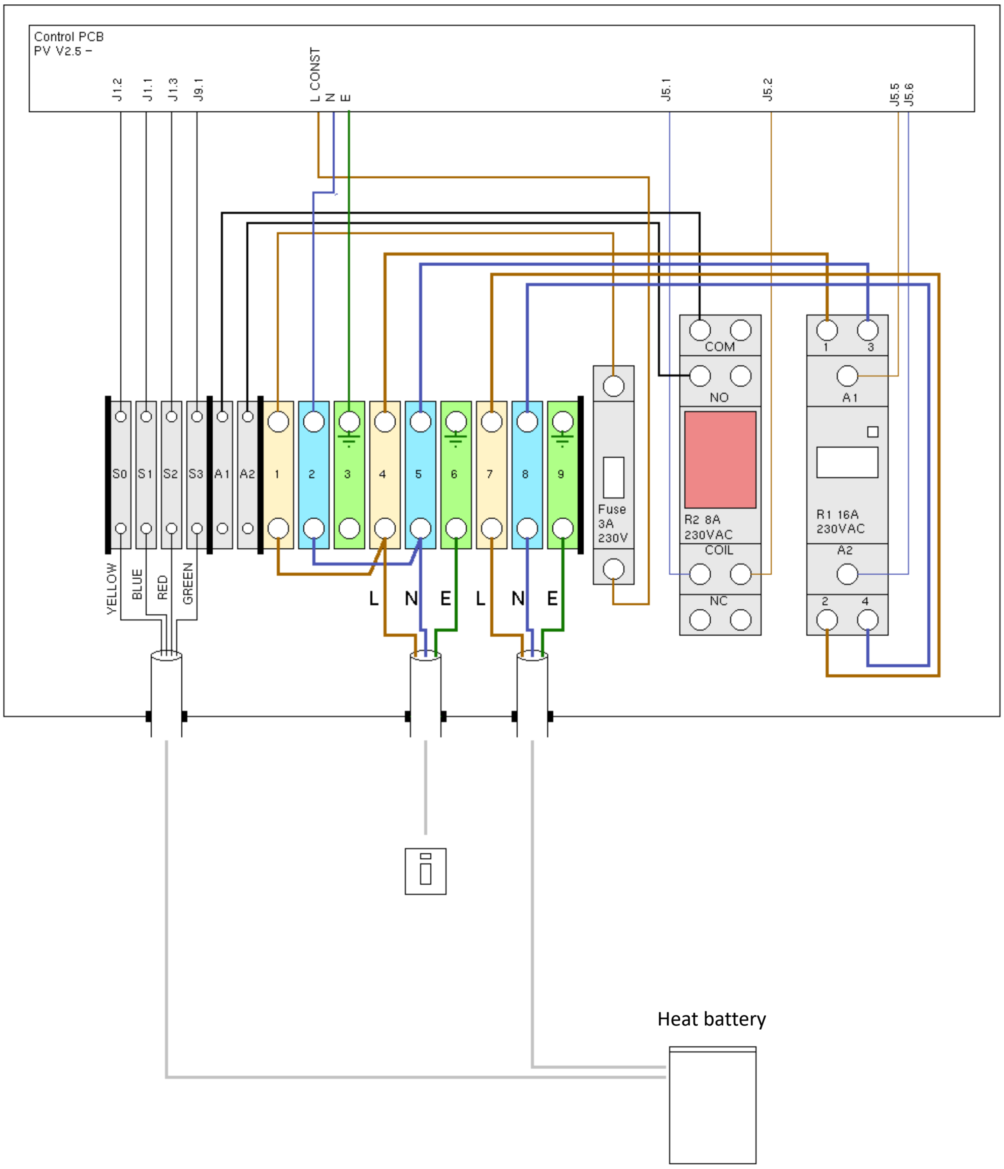
Mains supply – Electric storage water heater

Run and connect mains power supply cable (16A, minimum 2.5mm^2 CSA) from the local 2-pole isolator to the heat battery controller as shown in figure 6.1.

- Brown (Live): Terminal 4 and Terminal 1 (Live)
- Blue (Neutral): Terminal 5 and Terminal 2 (Neutral)
- Green/Yellow (Earth): Terminal 6 (Earth)

Set the controller program to type 1 for this application

Figure 6.1: Wiring for electric storage water heater applications



Mains supply – Heat batteries using external heat source and auxiliary electric element

Run and connect heater power supply cable (16A, minimum 2.5mm² CSA) from the local 2-pole isolator to the heat battery controller as shown in figure 6.2.

- Brown (Live): Terminal 4 (Live)
- Blue (Neutral): Terminal 5 (Neutral)
- Green/Yellow (Earth): Terminal 6 (Earth)

Run and connect control circuit power supply cable (6A, minimum 0x75mm² CSA) from the local 2 pole isolator to the controller as shown in figure 6.2

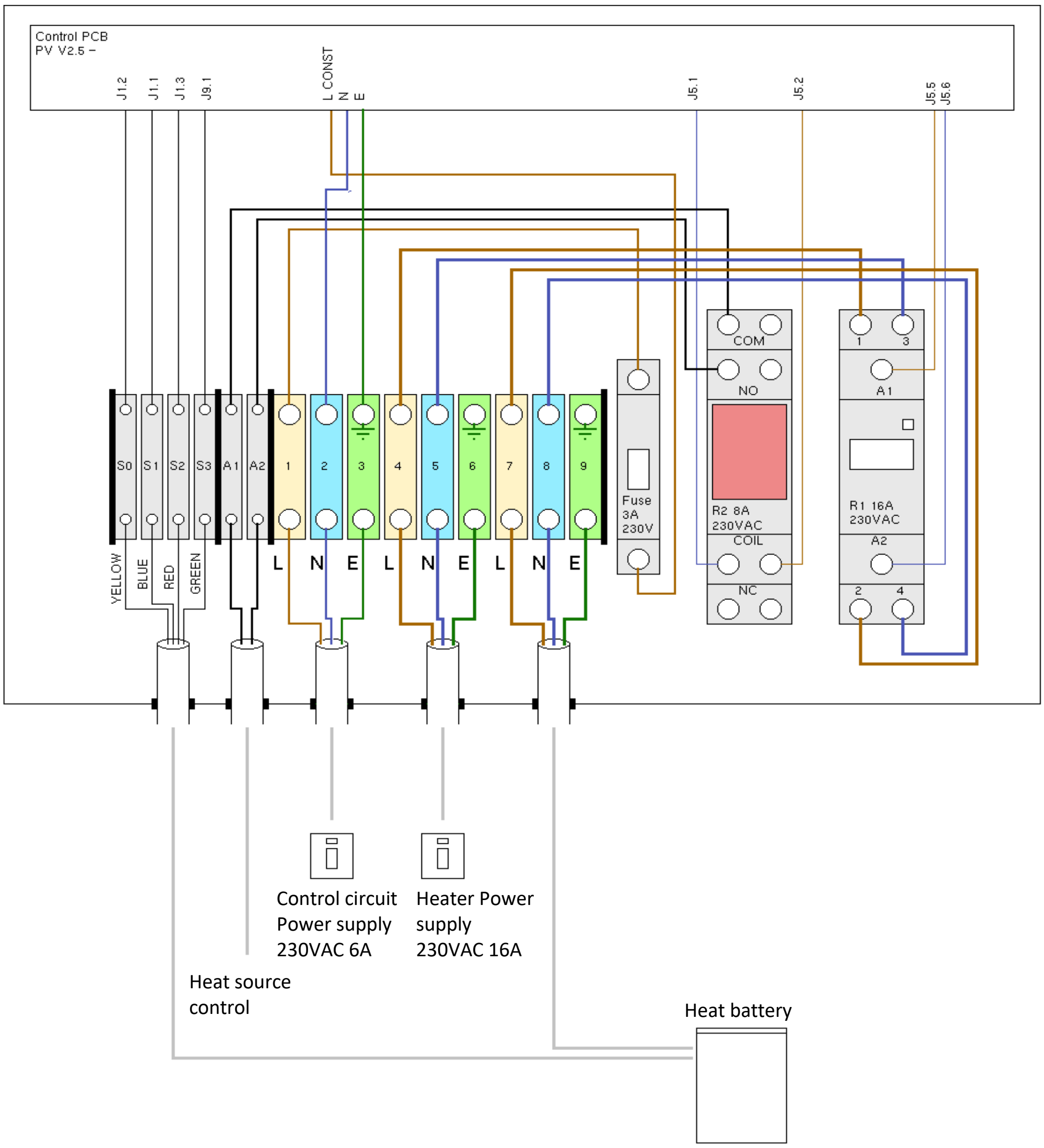
- Brown (Live): Terminal 1 (Live)
- Blue (Neutral): Terminal 2 (Neutral)
- Green/Yellow (Earth): Terminal 3 (Earth)

Set the controller program to type 2 for this application

Heat source control

The heat source control signal is available at terminals A1 & A2.

Figure 6.2: Wiring for heat batteries using external heat source and auxiliary electric element



Mains supply – Heat batteries with electrical input from solar diversion controller

Run and connect heater power supply cable (16A, minimum 2.5mm^2 CSA) from the solar diversion unit to the heat battery controller as shown in figure 6.3.

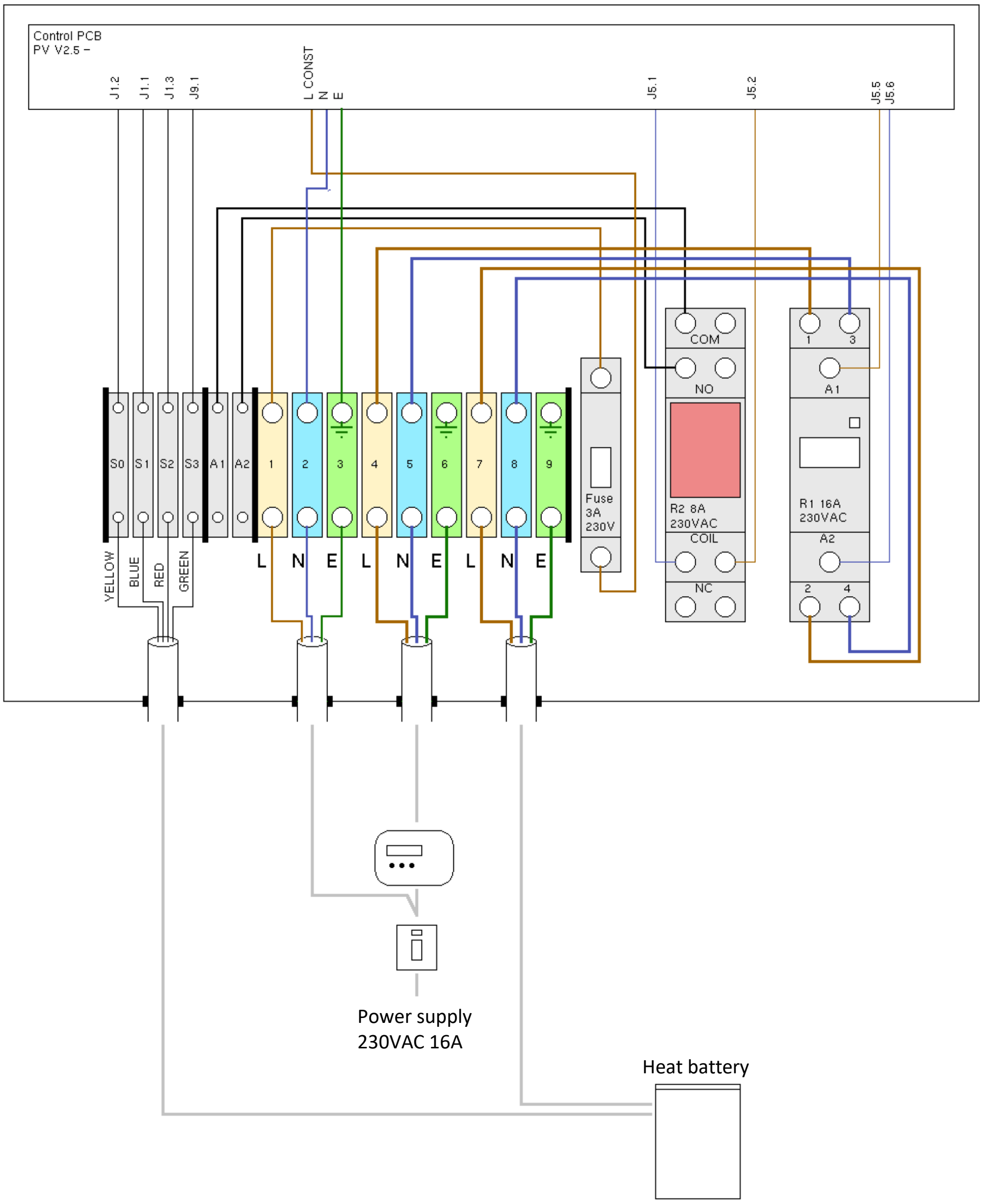
- Brown (Live): Terminal 4 (Live)
- Blue (Neutral): Terminal 5 (Neutral)
- Green/Yellow (Earth): Terminal 6 (Earth)

The control circuit power supply can be run from the same local isolator supplying the solar diversion unit.

A separate 6A supply should be used for the control circuit if there is a primary external heat source connected.

Set the controller program to type 1 for this application OR Type 2 if there is a primary external heat source connected

Figure 6.3: Wiring for heat batteries with solar diversion controller



6.2. Heat batteries not fitted with an electric element

The heat battery will be supplied with a Uniq_SBC_B200 control box.

Temperature sensors:

Unroll the 4-core sensor cable and run it through the grommet in the battery casing to the controller. Connect the sensor cables to the controller as shown in figure 6.4:

- Yellow cable: Terminal S0
- Blue cable: Terminal S1
- Red cable: Terminal S2
- Green cable: Terminal S3

Control circuit power supply

Run and connect control circuit power supply cable (6A, minimum 0x75mm^2 CSA) from the local 2 pole isolator to the controller as shown in figure 6.4

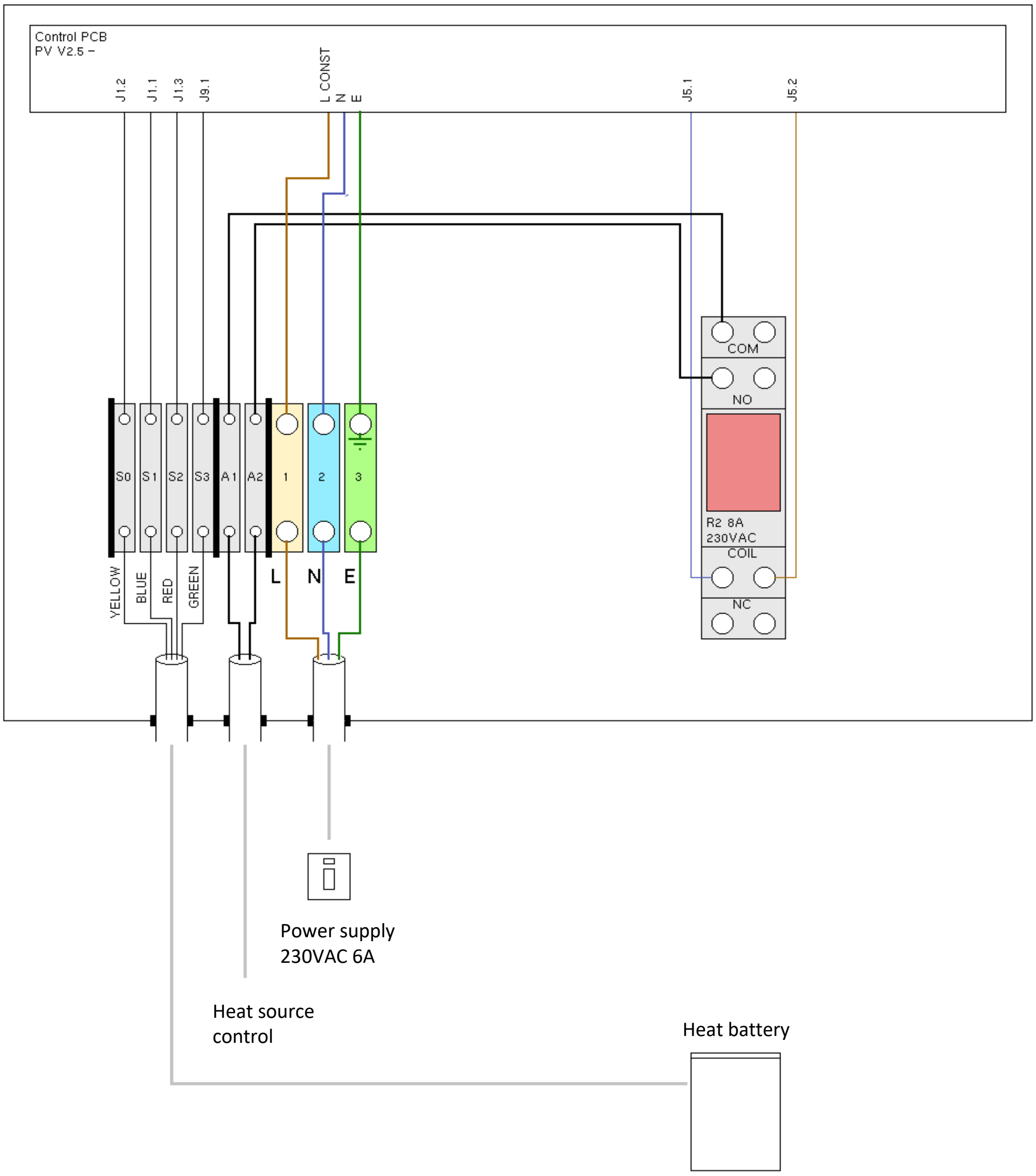
- Brown (Live): Terminal 1 (Live)
- Blue (Neutral): Terminal 2 (Neutral)
- Green/Yellow (Earth): Terminal 3 (Earth)

Set the controller program to type 3 for this application

Heat source control

The heat source control signal is available at terminals A1 & A2. When the charge state of the battery is below the pre-set level, the voltage free contacts will be closed and when the charge state of the heat battery is above the pre-set level, the volt free contacts will be opened.

Figure 6.4: Wiring for heat batteries without electric element



Appendix 1

Earlier controller hardware variants were available as per the table below, but have now been merged. Please refer to user manual version 2.2 if you have a version with the old naming convention.

UniQ_SBC_XX name (deprecated)	UniQ_SBC_BXXX (current)	
UniQ_SBC_01	UniQ_SBC_B100	
UniQ_SBC_01_PV	UniQ_SBC_B100	
UniQ_SBC_02	UniQ_SBC_B100	
UniQ_SBC_03	UniQ_SBC_B200	