



WE GIVE YOU THE POWER.....

- THE POWER TO SAVE.
- THE POWER TO CONTROL.
- THE POWER OF THE SUN.





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For technical help contact your distributor.

Distributor Details:

www.smarthotwater.co.nz

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INTRODUCTION

Forward

This installation guide is to be read in association with the “Smart-Cylinder Installation Guide” and SolaSmart-Plus V2 installation guide

Key Features

Evacuated Tube Collectors

Greater efficiency – Smart Hot Water control keeps booster use to an absolute minimum

Pump Station

Advanced Stagnation Control – the controller can pulse water to recover the solar loop from stagnation (see SolaSmart-Plus V2 installation guide)

Scope

Covers Smart-Cylinder model SS-DS (SS-SS, SS-NR)

Terminology

- **Smart-Cylinder** – The combination of a specially designed hot water cylinder and Senztek controller that uses advanced algorithms and user inputs to only use electricity to heat the water you need and no more, wasted heat is minimised. Also due to the highly flexible nature of the controller other cost saving (and environmentally friendly) options can be integrated including off-peak (night rate) power and other heat sources. You can now easily interact and control your once invisible hot water storage.
- **Advanced Topout** – An alternative to simple Topout (max tank temperature protection) that operates in 3 stages to delay the onset of collector stagnation and allow early recovery from stagnation once the tank has returned below the Topout temperature.
- **BioSafe®** – Automatic water monitoring and sterilisation developed by Senztek aimed primarily at protection from Legionella. Senztek is proud to have been first to market with this feature over 9 years ago.
- **Legionella** – Bacteria commonly found in soil and in low counts in water supplies. If allowed to multiply in warm water and inhaled (such as in a shower) dangerous lung infections can result.
- **Low Pressure** – Hot water pressure has traditionally been lower pressure. Specified as the equivalent of 6 metres water pressure.
- **Mains Pressure** – This is the same pressure as delivered by most cold water mains and is specified as 30 metres water pressure.
- **TSHWC** – Abbreviation for **The Smart Hot Water Company**

Example of an Solar installation

Vacuum Tube Collector panels (2x 10 tubes)



Collector manifold

Collector frame (where applicable)

Air Relief Valve

Solar heated water out

Collector (Roof) Sensor

Flow Meter + non return valve

Pump Station

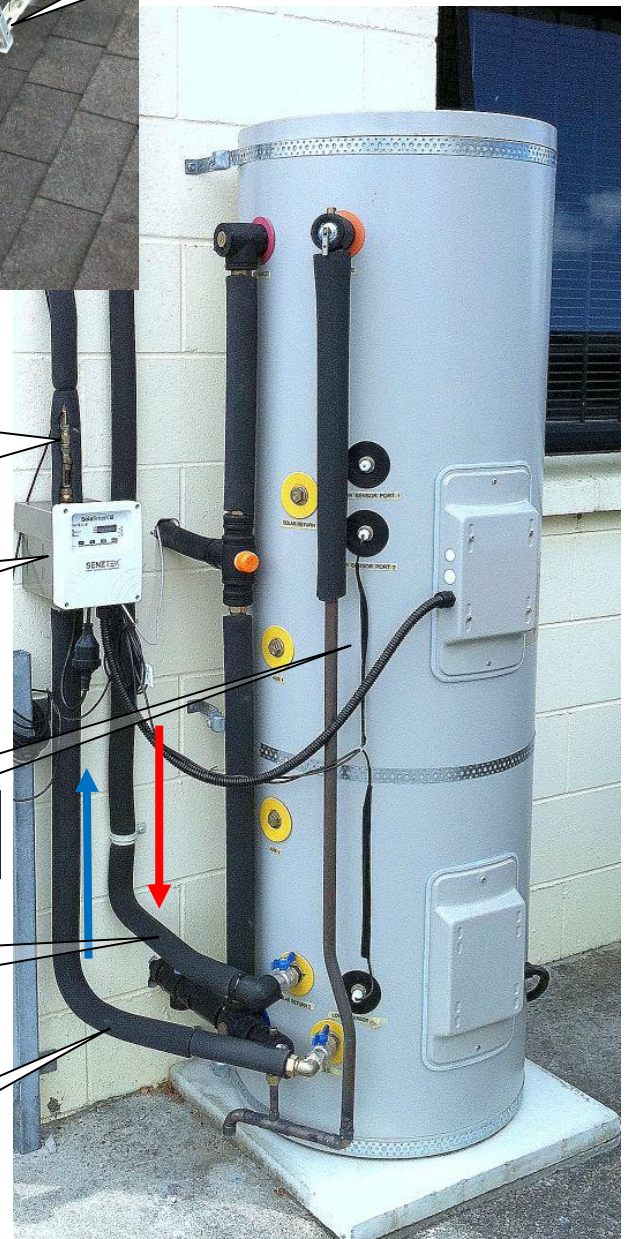


In home DisplaySmart

Smart Cylinder

Solar Return

Solar Out





SAFETY AND PRECAUTIONS

General Safety Precautions

This installation guide is for the installation of TSHWC Solar Hot Water upgrade to the Smart-Cylinder only

The complete installation to be checked at least annually for damage or malfunction.

All servicing must be carried out by an authorised service agent only.

Health and safety regulations now include fall arresting and roof anchoring methods for anybody working at height. Please comply with local regulations.

BioSafe®

To protect against dangerous infections by waterborne bacteria, primarily Legionella the Smart-Cylinder controller operates an automatic sterilisation regime according to AS 3498 (and AS/NZS 2712). As part of the regulations when BioSafe sterilisation is active the pump will run when the cylinder has heated to sterilisation temperatures to sterilise the solar loop as well. This will be displayed on the controller or DisplaySmart.

Regulatory Compliance

The entire Solar Smart installation needs to be installed according to local electrical wiring regulations and plumbing regulations by qualified personal

Water Quality

Water quality can vary in different locations and affect the performance, safe operation and lifespan of the hot water system.

If the water supply is not within the acceptable limits as indicated below, the hot water system should not be installed, and will not be covered by warranty from the manufacturer. A suitable solution is to implement a water pre-treatment process to bring the water quality to within acceptable limits to support the installation.

- Total Dissolved Solids < 600 ppm
- Electrical conductivity < 850us/cm
- Total hardness < 200 ppm
- Chloride < 250 ppm
- Magnesium < 10 ppm
- Sodium < 150 ppm
- Acidity/Alkalinity must be within the limits of pH 6.5 - 8.5

Do not install this system with a bore water supply

These products are not designed for use in, and should not be used for, applications which are in conjunction with items that are critical to any person's health (e.g. life support systems). These products are not designed for use in, and should not be used for, applications which are in conjunction with items that are critical to any person's health (e.g. life support systems).

In any critical installation, an independent fail-safe back-up system must always be implemented.

Steam

Steam is very dangerous and can cause serious burns

Solar Hot Water collectors heat by solar radiation, which is an uncontrolled heat source. Most of time the water is well below 100°C, the temperature at which water turns to steam (vapour phase change) at sea level pressure.

Under pressure this phase change occurs at higher temperatures, mains pressure is typically 160°C.

It is possible for the controller to prevent pumping when the cylinder is at maximum temperature to protect the cylinder. The collector will continue to heat, possibly to high temperatures, a condition known as stagnation.

Stagnation has been recorded as high as 220°C. A resultant dangerous hazard is a flash steam explosion: if the plumbing loop is suddenly de-pressurised to atmospheric pressure and the water is above 100°C then the water will suddenly expand and turn into steam, expanding 1700 times its original volume.

Never work on a solar loop in stagnation. If necessary force a pump operation with a brief manual override (see controller functionality). Observe 'Roof' temperature sensor reading below 90°C before attempting any work.

Power



The controller and pump must be supplied by 24hr (permanent) power to ensure frost protection and to minimise stagnation events.

All metal plumbing parts and components must be connected to electrical earth and be at earth potential; they must not 'float' electrically.

All power sources into the controller must be on the same phase

Lightening

If the system is installed in a lightening prone area it is recommended the collector and copper piping is directly connected using additional dedicated wiring, to an electrical earth stake. Check building regulations for local requirements.

Frost

The evacuated tube collectors are themselves frost tolerant but there is 1 litre of water in the manifold that can freeze and cause damage. To prevent this damage the controller (briefly) circulates the pump to replace the cold water with warm water. These evacuated collectors need much less warm water protection than flat plate collectors.

This installation manual is for a solar loop that uses potable water and is intended for low frost areas. High frost/freezing areas will need another solution, contact TSHWC to discuss solutions.

Warning

- Evacuated Collector tubes rapidly become very hot when exposed to sunlight. Beware if any are removed; the bulb might be very hot, do not touch the bulb. Wear gloves.
- Always wear safety gloves and eye protection when handling the collector or its glass components. The tubes are evacuated and can shatter explosively if broken.



INSTALLATION

High Temperature Plumbing

The solar loop can run at temperatures well over 100°C. Therefore all piping must be copper with copper or brass fittings. All TSHWC supplied parts are rated for these temperatures but any additional plumbing parts need to be so rated.

Do not use plastic pipe clips directly on the copper pipes.

Do not use plastic olives

All thermal pipe insulation must be able to withstand the solar loop temperatures and be UV rated.

Insulate Valves

All valves, hot water pipes and some unions need to be insulated to avoid high heat loss. TSHWC supplied valves and most unions have easy to install insulating 'boots'.

Roof Loading

TSHWC collectors (and optional) frame weigh less than the regulated 'live load' and as such is not required to have an engineer's report.

Each collector (and frame if being used) weighs no more than 45Kg for an area of 2.0m².

This arrangement yields a live roof loading of 0.22kPa and as such is less than the specified 0.25kPa in AS/NZS 1170.

Air Eliminator

It is possible for air or steam to form in a solar loop. It is important is vapour is removed or the pump may not be able to effectively move water around the loop or the collector sensor might read incorrectly or worst of all steam implosions in the piping or hot water cylinder

Flow Meter

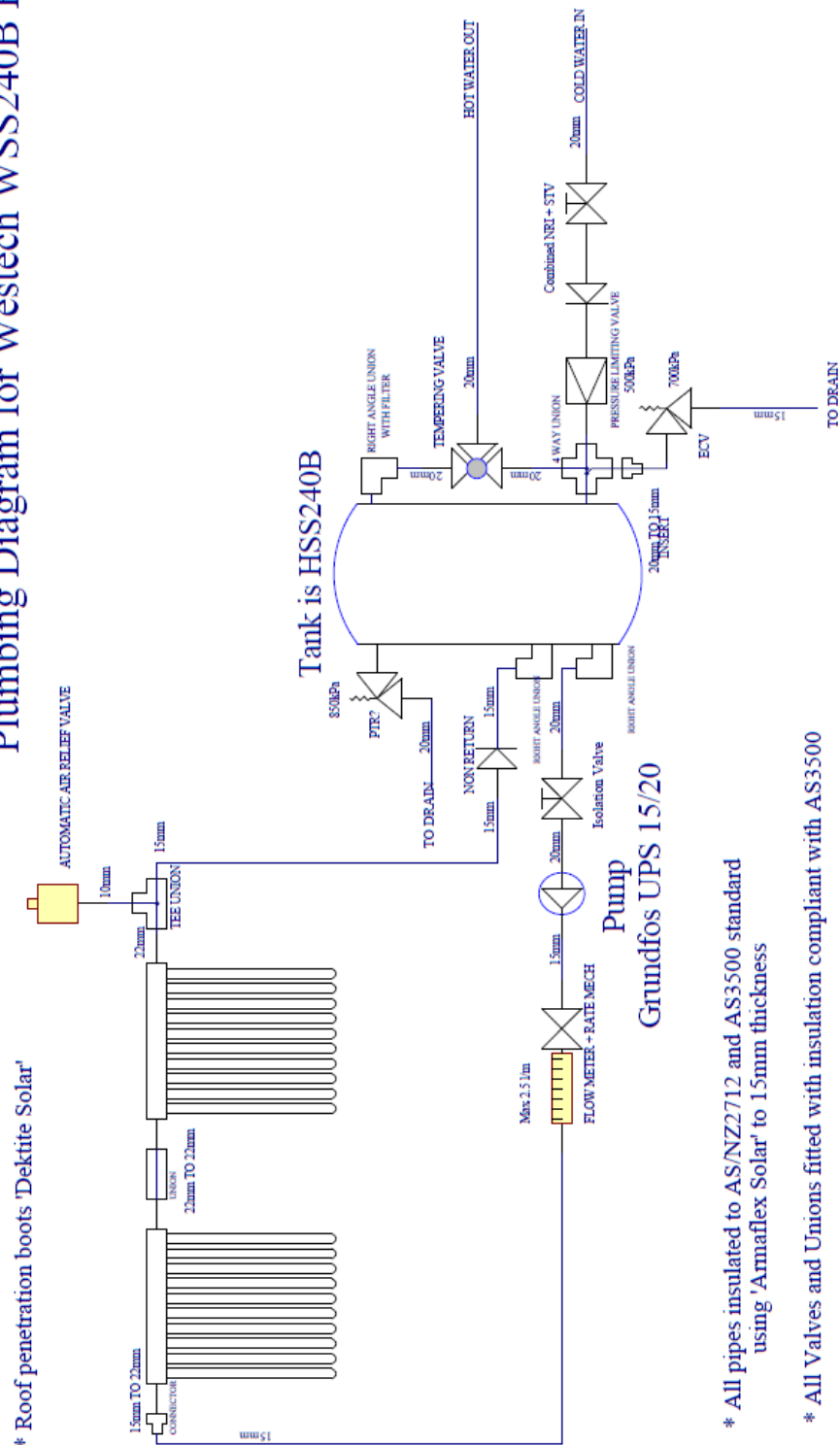
This meter the water flow rate in the solar loop. The flow rate can be adjusted by a turn screw on the flow meter. For a 2 collector (20 tube) system the flow rate should be around 0.8 ltrs/min, for 3 collectors 1.25 ltrs/min

Operation

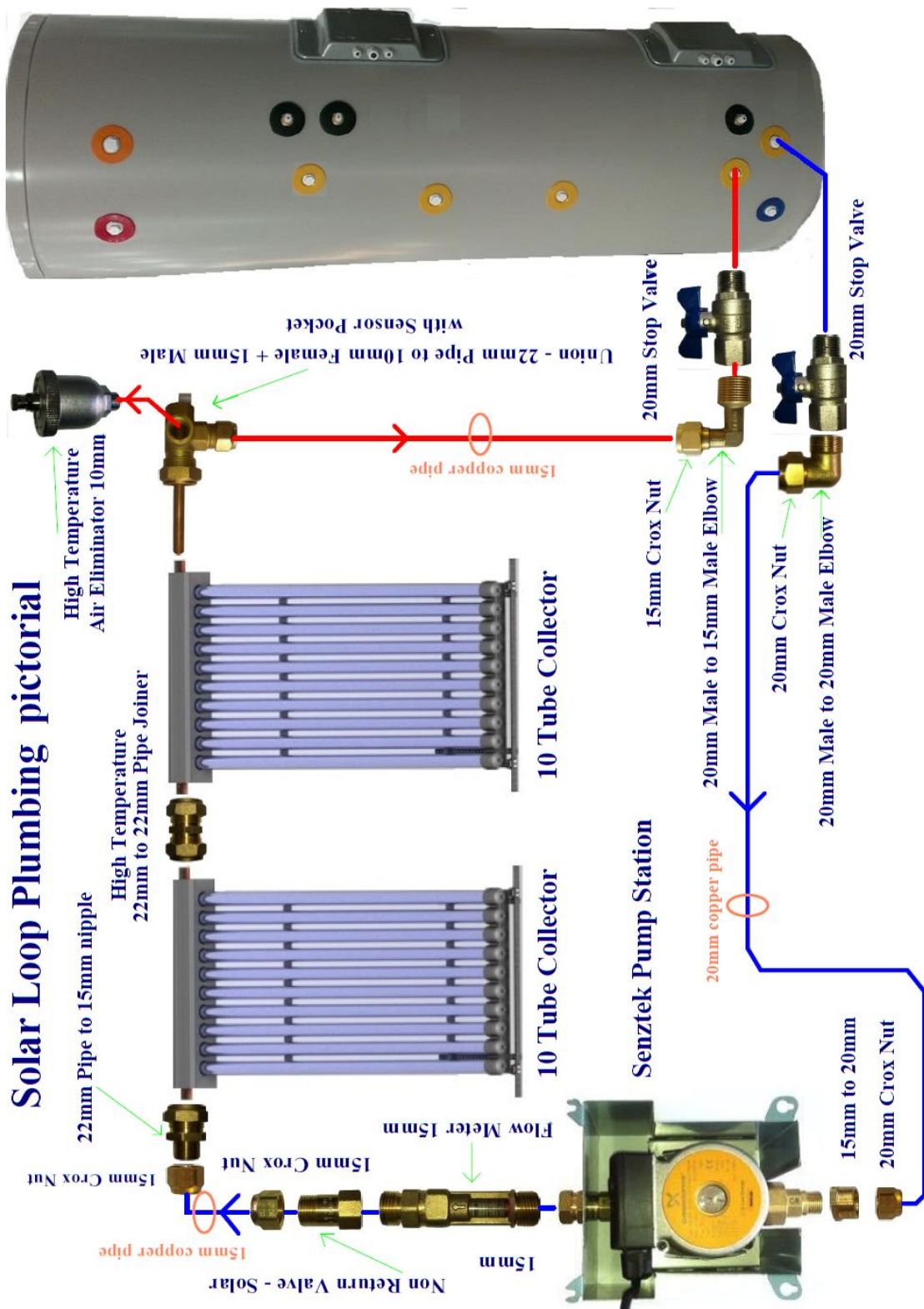
Solar Differential, See SolaSmart-Plus V2 installation manual for detailed explanation

Full Solar installation plumbing schematic

Plumbing Diagram for Westech WSS240B ET2



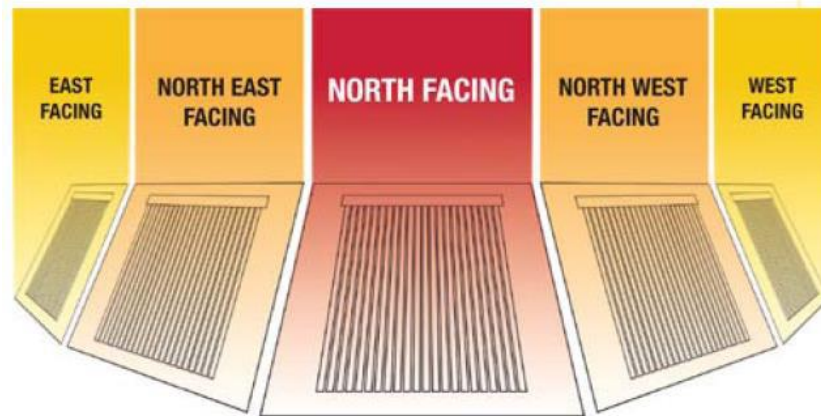
Pictorial Diagram of Plumbing Parts for Solar Loop



Collector Mounting

Collector Orientation

Facing due North is ideal but up to 90° either side of North is allowed. TSHWC strongly recommend a maximum of 45° off North



The vertical angle of the collector (or pitch) is ideally the same as the Latitude of the installation site. E.g. Auckland is 37° off the equator so this is the best average pitch angle. The further South, the higher the pitch.

However for enhanced Winter operation adding up to 20° to this will be a better balance of harvesting, helping to compensate for the lower solar orientation across the sky and shorter sunshine hours.

For aesthetic reasons many people are happy to lose a little efficiency in favour of a collector following the roof line. +/- 10° will lose about 10% efficiency but will fall off at a greater rate beyond this,

Pitch angle must be between 20° and 70°.

For heavy snow fall areas the collector should be mounted at 50° or greater to prevent excessive snow loading.

Collector Frame

If the Roof line is flat or does not support the desired pitch angle then a frame will need to be used.

Securing to the roof

Tiled Roof;

For flush mount on to a tiled roof use the pre-drilled straps provided with the collector.

Corrugated Roof (galvanised iron, colour steel etc)

**Securing to
Roof
continued..**

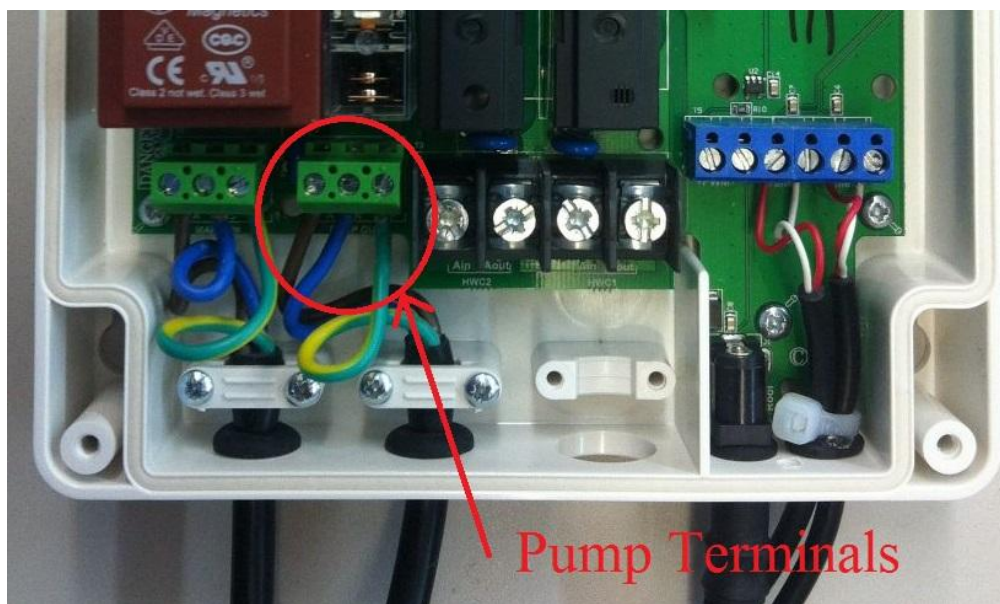
Frame installation

Electrical

Most Solar upgrade installations from a mains electrical point of view simply involve plugging the pump into the socket on the SolaSmart-Plus V2 controller.

If no socket is present then either fit a suitable socket or direct wire the pump into the 3 pin terminals marked “pump out”

A = Active (Phase) , N = Neutral, \perp = Earth



Note:

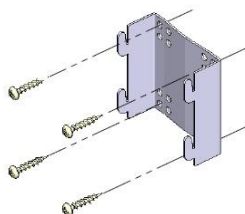
1. All metal plumbing parts and components of this installation must be at earth potential and connected to electrical earth. **Therefore the solar loop copper pipes must be connected to electrical earth**
2. If the solar pump/controller power supply is on a separate circuit to the hot water element/s then this is a dual supply installation. A warning label must be affixed at the controller and the electrical switch board warning that both circuits must be isolated before work is carried out.
3. **All power sources into the controller must be on the same phase**



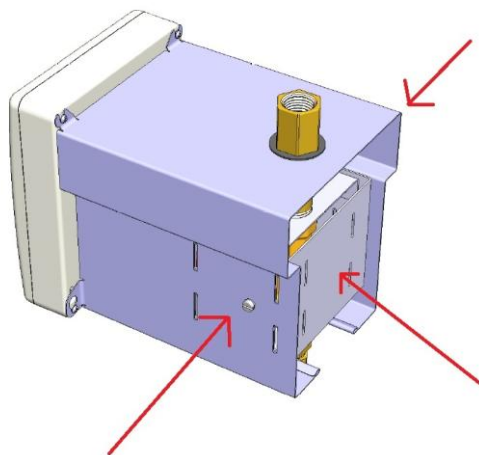
Installation Method

1. **Install the collector**
2. **Install the pump station**

Screw the separate mounting bracket to a suitable load bearing structure, enough to support the pump station weight.



Hang the pump station on the bracket; there are 3 orientations to choose from.



3. **Install the fittings**
4. **Install the piping + insulation**

Avoid sharp bends where possible in the solar loop

Be careful to fit pipe foam insulation before fixing pipe to wall, as much as possible.

Never use plastic pipe clips directly onto copper pipes in a solar loop. They can melt.

5. Install the roof sensor

The roof sensor mounts into the sensor pocket on the air eliminator/ collector brass union.

Coat the sensor in thermal paste and insert.

Use neutral cure silicon to seal the hole behind the sensor.

Water in the sensor pocket is a known problem, steam generation is a problem and also the sensors are not guaranteed to be water proof.



Hold cable in place where it exits the pocket with supplied holding clip (white plastic). Make sure cable cannot move in the wind etc, this is important as wire fatigue due to flexing is a known sensor failure issue. Attach sensor cable to outside of pipe insulation with cable ties



6. Flood the loop

7. Plug in pump to controller

8. Force water through

Press and hold down  and  to force the pump on. If you continue to press for 10 seconds the pump will stay on for 10 minutes. This is for commissioning.

Observe water flow through the flow meter, it should be around 1 – 2 litres (per minute) after a few minutes. If not adjust the screw on the flow meter to increase or decrease flow. If flow is still outside this range then it might be necessary to adjust the pump power settings.

Remove power from the pump (unplug).

There is a 3 way power lever on the black plastic pump cover.

To gain access to this lever: remove the controller or plastic cover off the pump station.

Move up or down as necessary.

9. Change controller for Solar operation (if necessary)

If the entire installation was setup for solar installation then the solar loop should be functional without intervention.



If this is an upgrade then the controller will need to be told there is a solar pump and Roof sensor to now manage.

There are two ways to achieve this.

1. Via the DisplaySmart-Touch screen.
 - a. Select the technical page
 - b. Press the maintenance icon
 - c. Enter the access code 1236 and press enter
 - d. First screen is Solar Enable/Disable
 - i. Press an up or down arrow to enable solar (note message in top right corner now warns that this new setting has not been saved)
 - ii. Press the save icon
 - iii. Unit is now Solar enabled.
 - iv.
 - e. If you wish to change the solar parameters from standard then you can continue through the rest of the set up screens and adjust then save accordingly. The SolaSmart-Plus V2 installation manual can explain the significance of each of these parameters.
2. If there is no DisplaySmart-Touch installed then the parameters will need to be adjusted on the controller. The SolaSmart-Plus V2 installation manual covers this. But in short, to enable solar on the controller.
 - a. Enter programming mode
 - b. First display will read $dF\bar{O}n$ (means Differential On temperature)
 - c. Press **ENTER**
 - d. Display will read - - - to indicate solar is disabled.
 - e. Press **+** or **-** to enter a valid Pump On temperature (usually 10°C)
 - f. Press **ENTER** to exit back to programming selection
 - g. Either continue on with the rest of the settings if you wish to have values other than standard (see installation manual) or press Enter to save the setting and exit to run mode.
3. Controller will now read the 'Roof' sensor temperature

10. Check installation




DISPLAY AND DIAGNOSTICS (WILL NOT DISPLAY IF DISPLAYSMART-TOUCH IS CONNECTED)

Introduction The Display is normally a scrolling display of 2 screens. Every 5 seconds the display scrolls to the next screen. (Does not appear if a DisplaySmart-Touch is installed)

Screen 1:
Roof °C Displays only if Solar option installed.

Screen 2:
Tank °C The dot next to the "TANK" will be lit up when the Upper Tank Temperature is on the display.

Screen 3:
Inlet °C The dot next to the "INLET" will be lit up when the Inlet (Lower Tank) Temperature is on the display.

Screen 4:
PWM Duty Cycle % **Note:** To view screens 4-6, press  This will activate advanced diagnostics mode for 10 minutes, after which time it will revert to the temperatures only.

Solar option display

Screen 5:
Time Time is shown in HH:MM format.

Screen 6:
Diagnostics Segment 1:
Solar Rule that is currently active (only active if Solar option is installed)

- = IDLE
F = Frost
d = Differential
t = TopOut (D1 Stage 1, D2 Stage 2 , D1 & D2 Stage 3)
b = Collector BioSafe
E = Error

Segment 2:
HWC Rule that is currently active

- = IDLE
r = Reheat
b = BioSafe
B = Boost
E = Error

Segment 3:
Active Element: L = Lower, U = Upper

Segment 4:
Active Tariff Band: 1 to 4

E.G. -rU2 = The solar pump is off, the tank is using an element to heat the tank (reheat) and that element is the upper It is time period 2.

The Smart-Cylinder is now fully installed and should be working.



See **‘Trouble Shooting’** section on pages 13-26 of this guide if the system is not working correctly.

Sensor Resistances

The table below has the correct resistance values of the sensors at different temperatures. The sensor must be removed from the Smart-Cylinder to measure these values correctly.

Follow the above procedure to remove a sensor.

Sensor Resistances		
Temperature	Resistance in kΩ	A ‘short’ circuit can be caused by the sensor wires being connected together. Check the wires are not partially cut and that moisture is not getting into the sensor causing corrosion.
0°C	27.25	
25°C	10.00	
50°C	4.162	
75°C	1.925	An ‘open’ circuit can be caused by the sensor wires being broken. Check the wires are not cut and that moisture is not getting into the sensor causing corrosion.
100°C	0.973	
Above 300°C or ‘shrt’ on display Sensor light Off	<.050	
Below -40°C or ‘oPn’ on display Sensor light Flashing	>200	

TROUBLE SHOOTING GUIDE

Symptom	Possible Cause	Solution
No operation, no lights (no DisplaySmart active)	⇒ No power ⇒ Power is interrupted to controller	⇒ Check mains supply ⇒ Check if load control (ripple control) by power co has removed power. ⇒ The controller will need a 24 hr power supply. It is possible to separately power the elements off a load shedding supply.
Sensor O.K. light out (Roof sensor also fault shows on DisplaySmart Touch home screen)	⇒ Roof sensor not detected. Broken sensor wire	⇒ Check Roof sensor wire. Plug in a spare Roof sensor to check controller is OK.
Pump does not come on yet sun is shining	⇒ Sensor not reading heating water properly ⇒ System in Topout	⇒ Check sensor mounting, thermal paste applied to sensor and inside pocket ⇒ Check indication if system is in Topout. It is normal to stop the pump once tank is at max temperature.
Pump runs too long	⇒ Flow ⇒ Settings	⇒
Pump runs at night	⇒ Reverse Thermo-siphoning	⇒
Hot water stored drops significantly at night, yet little or no draw off by user	⇒ Water leak ⇒ Tank is losing heat ⇒ Reverse Thermo-siphoning	⇒ Check for water leak; see if hot water pipe is hot/warm 2 metres from tank. ⇒ Install better insulation on hot water tank and fittings ⇒ Check one way valve is operating correctly, replace if faulty
	⇒	⇒
	⇒	⇒

Specifications Cylinder;

Characteristic	Electric boosted				Gas boosted	
	Mid mount element		Bi- mount element			
	240L	320L	240L	320L	240L	320L
Tank Material (inner vessel)	316AL Stainless Steel (1.6mm)					
Tank Material (Outer Vessel)	0.6mm Galvanised, Bond Coated™ mild steel					
Fittings	316AL Stainless Steel					
Diameter (mm)	540	600	540	600	540	600
Height (mm)	1720	1920	1720	1920	1720	1920
Tank capacity (L)	240L	320L	240L	320L	240L	320L
Net weight (kg)	62kg	72kg	62kg	72kg	62kg	72kg
Weight when full of water (kg)	302kg	392kg	302kg	392kg	302kg	392kg
Element rating (if installed)	2.4kW	2.4kW	2.4kW	2.4kW	n/a	n/a
Thermostat (if fitted)	Thermodisc 59T & 66T manual reset	Thermodisc 59T & 66T manual reset	Thermodisc 59T & 66T manual reset	Thermodisc 59T & 66T manual reset	n/a	n/a

Water Characteristic	Level	
Total dissolved solids	600 mg/litre or ppm	
Total hardness (as CaCO ₃)	200mg/litre or ppm	
Chlorides	300mg/litre or ppm	
Dissolves CO ₂	Gas	Electric
	18 mg/litre or ppm	Not applicable
pH Levels	5.5 – 9.5	
Saturation index (Langelier)	+0.4 to -1.0@65°C	

Power Supply to elements; 240 Vac +/- 10% 50 to 60 Hz

Safety Compliances:

Electrical	AS/NZ 60335.2.21:2002 Inc A1-3 AS/NZ 3820:2009 Ctick
Plumbing	WaterMark AS3498 AS/NZS 4020:2005 AS/NZ 2712: 2007



Controller;

Power Supply:

Supply Voltage	240 Vac +/- 10% 50 to 60 Hz
Quiescent power usage	3VA typical

Relay Outputs:

Pump: 10A max (240Vac) Resistive (element) ½ HP/375W (240Vac) Motor rating (0.4cos theta) max Minimum Load: 2watts @ 240Vac Zero Crossing contact closure / open Voltage from input switched through this output
2x HWC: 16A max @ 240Vac (3.6kW max) Resistive (element) 1.5 HP/1100W max (240Vac) Motor rating (0.4cos theta) Minimum Load: 2watts @ 240Vac to 110Vac or - 100mA at 60 Vdc or less Zero Crossing contact closure / open Isolated contacts

PWM Output: (Only for connection to an intelligent variable speed pump e.g. Grundfos Solar PM 15-85)

1kHz +/- 10% pulse repetition rate Max drive 5mA avg at 9-14 volts. Peak 1.5Amps Max 5 meter cable to pump
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Sensors:

PVC Sensors	-20 ~ +120°C tip 5.8mm diameter stainless steel -20 ~ +105°C cable, UV resistant
Teflon Sensor	-20 ~ +250°C peak tip, 5.8mm diameter stainless steel -20 ~ +180°C cable, UV resistant
Accuracy	+/-1°C @ 25°C

Real Time Clock:

Backup interval (no power)	14 days min (After 4 hour full charge cycle)
Accuracy	Max 30 sec per month drift

EMC and Safety Compliances:

Emissions	EN 55022-A, CTick
Immunity	EN 50082-1
Safety Compliance	AS/NZ 60950.1:2003, CTick AS/NZ 3820:2009 AS/NZ 2712: 2007

Continued on next page



SPECIFICATIONS, CONTINUED

General Specifications: (Unless otherwise stated in other input specifications)

Control Range	-40 ~ +299°C
Operating Temperature	0~60°C
Operating Humidity	5 ~ 85% RH. Non-Condensing
Enclosure Construction	Polycarbonate - Impact Resistant UL94 V-2 Non Burning, UV A & B Stabilized Water resistant to IP54
Dimensions	L = 167mm
(excluding glands and cables)	W = 142mm H = 40mm

Weight 1600grams
(Standard model + cables + sensors + packaging)

Note: Do not exceed these specification limits. Exceeding these limits can result in damage to the unit and voiding of the warrantee.

Product Liability. This information describes our products. It does not constitute guaranteed properties and is not intended to affirm the suitability of a product for a particular application. Due to ongoing research and development, designs, specifications, and documentation are subject to change without notification.

Regrettably, omissions and exceptions cannot be completely ruled out. No liability will be accepted for errors, omissions or amendments to this specification. Technical data are always specified by their average values and are based on Standard Calibration Units at 25°C, unless otherwise specified. Each product is subject to the 'Conditions of Sale'.